NASA TECHNICAL MEMORANDUM

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NASA TM X-3504

NASTRAN THERMAL ANALYZER - THEORY AND APPLICATION INCLUDING A GUIDE TO MODELING ENGINEERING PROBLEMS

Volume II

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • WASHINGTON, D. C. • APRIL 1977

1. Report No. NASA TM X-3504	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Nastran Thermal Analyzer - Theory and Application Including a Guide to Modeling Engineering Problems, Vol. 2		5. Report Date April 1977
		6. Performing Organization Code 720
7. Author(s) Clifton E. Jackson, Jr.		8. Performing Organization Report No. TM X3504
9. Performing Organization Name and Address Goddard Space Flight Center Greenbelt, Maryland 20771		10. Work Unit No. 506-17-33
		11. Contract or Grant No.
		13. Type of Report and Period Covered Technical Memorandum
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20546		
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

The NASTRAN Thermal Analyzer ($\overline{\text{N}}$TA) is a new and unique general-purpose heat transfer computer program based on the finite element method. It is an integrated part of the NASTRAN system. To fill the needs of current and potential $\overline{\text{N}}$TA users who, in general, would neither be familiar with the underlying finite element theory nor have any prior experience in NASTRAN modeling, two volumes have been written to provide thermal engineers with a comprehensive and self-contained manual encompassing theory, application, and examples of modeling.

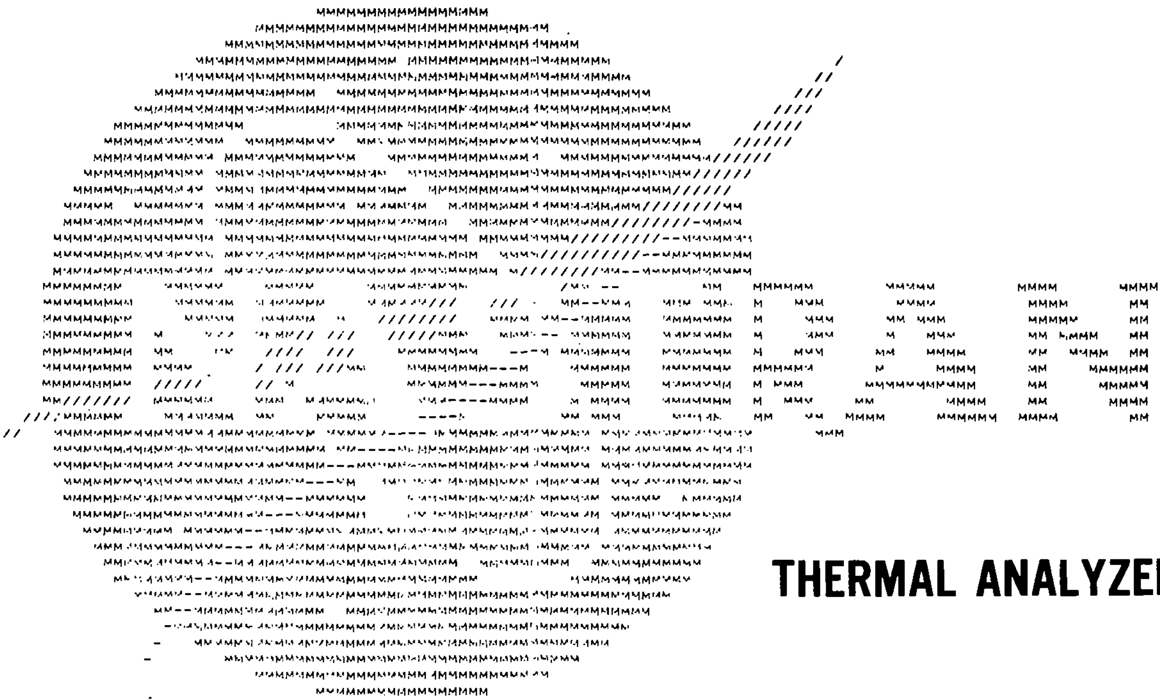
This volume, A Guide to the GSFC $\overline{\text{N}}$TA Sample Problem Library, is intended to instruct new $\overline{\text{N}}$TA users by example. A sample problem library containing 20 problems covers most facets of $\overline{\text{N}}$TA modeling, including radiative interchange, arbitrary nonlinear loads, transient temperature and steady-state structural plots, temperature-dependent conductivities, simulated multi-layer insulation, and constraint techniques, along with the demonstrated use of the major control options and important DMAP alters.

17. Key Words (Selected by Author(s)) General heat-transfer computer program, Finite element method, NASTRAN system	18. Distribution Statement Unclassified - Unlimited Cat. 34

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	549	$13.00

*For sale by the National Technical Information Service, Springfield, Virginia 22161.

All measurement values are expressed in the International System of Units (SI) in accordance with NASA Policy Directive 2220.4, paragraph 4.



THERMAL ANALYZER

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NASTRAN THERMAL ANALYZER

THEORY AND APPLICATION INCLUDING A GUIDE TO MODELING ENGINEERING PROBLEMS

Clifton E. Jackson, Jr.

I. INTRODUCTION

The purpose of this Sample Problem Library, in conjunction with Volume I of the NASTRAN Thermal Analyzer ($\overline{\text{N}}$TA) Manual, [1,2] is to demonstrate by example the flexibility and inherent simplicity which characterizes $\overline{\text{N}}$TA modeling.

In order to avoid unnecessary complexity, one basic sample problem is developed in both Linear Steady-State, Nonlinear Steady-State, and Transient formulations as Problems 1, 2, and 3, respectively. Seventeen subsequent problems are used to demonstrate specific modifications which can be made to model certain types of thermal couplings and/or modify the input and/or output required or produced by the program (Problems 12 and 19 vary from this philosophy, as will be noted). All of the changes made from a previous problem are documented at the end of each Bulk Data Deck, clearly indicating the new card or cards which were required to produce the desired modification and allowing the user to understand the level of effort involved.

The first problem will be discussed in detail on a card–by–card basis in order to delineate the basic structure of a $\overline{\text{N}}$TA problem, while Problems 2 through 20, which are primarily variants of Problem 1, will be reviewed so as to point out the changes which were made from a previous problem, the purpose of the alteration, and the resultant modification in the output.

Duplication of the data presented in Volume I of the $\overline{\text{N}}$TA manual and in the standard NASTRAN User's Manual[3] will be kept to a minimum, and references to relevant material in them will be supplied as necessary.

Appendices will contain the actual $\overline{\text{N}}$TA sample problem outputs, and in addition will provide compilations of different types of information useful both to readers of this guide and to NASTRAN thermal analysts in general. It is recommended that these appendices be read thoroughly, especially A, B, and C, as it is felt that the effective use of this manual and the $\overline{\text{N}}$TA will thereby be made considerably easier.

II. EXPLICATION OF THE NTA SAMPLE PROBLEMS

A. Physical Description of the Basic Problem

The physical situation chosen for modeling in these sample problems is a space radiating fin supported by rods and extending from a pipe in which a fixed temperature coolant is flowing, as is shown in figure 1.\ This configuration was chosen because it is easily grasped from a physical standpoint, yet is complex enough to allow a variety of thermal effects, such as convection, radiation, anisotropic heat conductivity, etc., to be meaningfully applied while the temperature distribution in the fin, and other thermal quantities, are being computed. The exact parameters and dimensions chosen are:

Constant Fluid Temperature in the Radiator Pipe: 300°C
Fin Material: Aluminum
Effective Convective Area from fluid to pipe: 0.0314 m^2 (pipe surface area along 0.1 m fin dimension)
Convective Film Coefficient from fluid to pipe: 200 W/m^2 - °C
Cross-Sectional Area of Support Rod: 0.001 m^2
Thickness of Radiating Fin: 0.01 m
Length and Width of Radiating Fin: 0.3 m and 0.1 m, respectively
External Thermal Input to Radiating Fin: 48 W (applied by a uniformly absorbed flux)
Emissivity of Radiating Fin (both top and bottom surfaces): 0.9
View Factors of Radiating Fin to Space (top and bottom): 1.0
Units used: meters, watts, degrees Celsius

B. Generation of the Linear Steady-State (LSS) Finite-Element Model*

1. GRID Points

In creating a finite-element model of the radiating fin problem described above, it is first necessary to select the locations where temperature solutions are desired and to identify them by creating a GRID point for each one. The location of the origin is arbitrary, and GRID points will usually be located at intervals around the boundary and on the surface of a 2-D structure (or internally to a 3-D structure). Their frequency, in general, varies directly with the nonlinearity of the proximate thermal gradients. For example, if a rod were being modeled with a fixed temperature at one end and a constant rate of heat loss at the other end, one GRID point at each end would be sufficient to model the linear gradient involved. However, if the bar were allowed to radiate energy along its length, the resulting nonlinear gradient down the rod might require 3 or more GRID points for accurate results to be obtained. There are no hard and fast rules which prescribe the number of GRID points that an analyst should use in any given situation, but the analyst should always be wary of areas in a model where large changes in temperature are exhibited between adjacent GRID

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*In the remainder of the text, when names of actual NASTRAN cards are used, they will be capitalized and underlined.

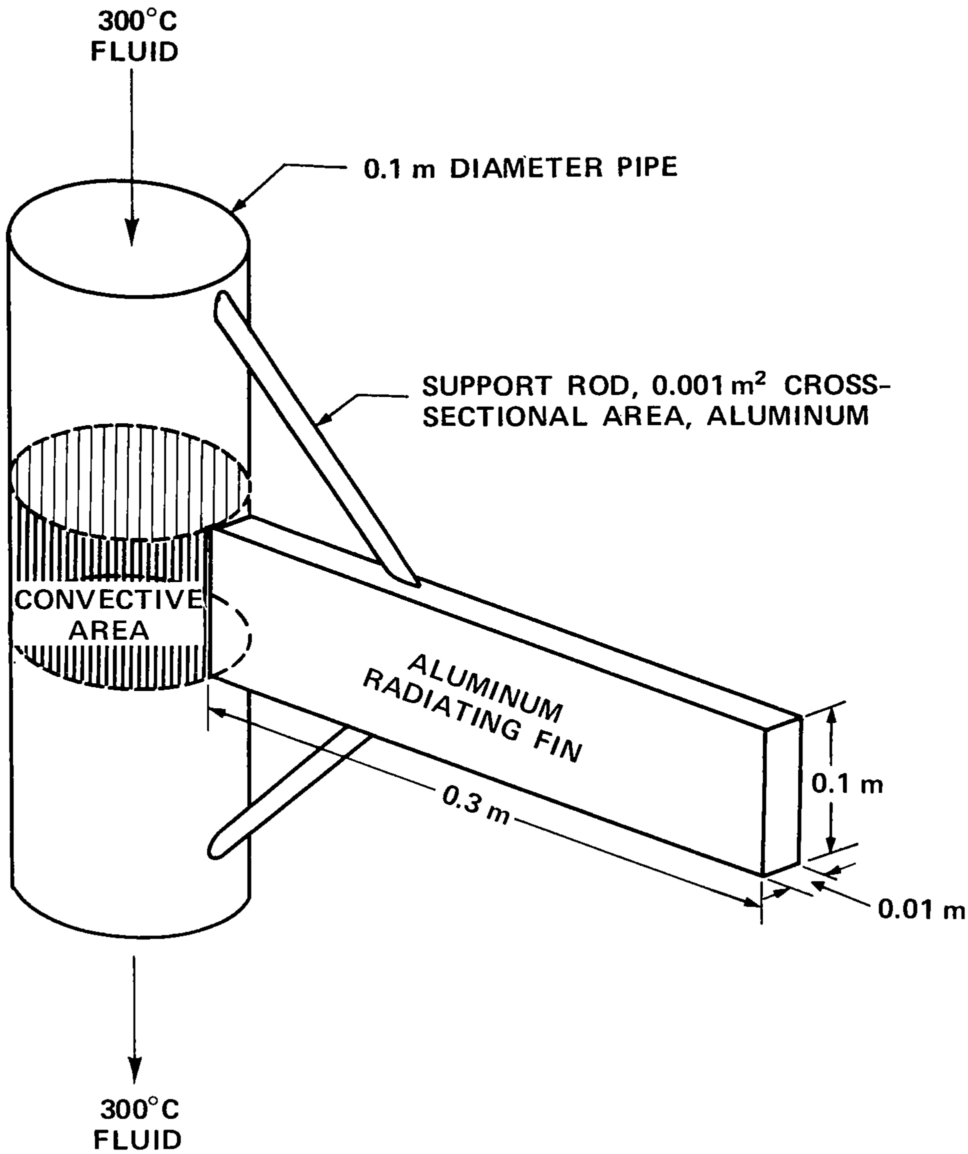


Figure 1. The Linear Steady-State (LSS) sample problem configuration.

points and be ready to add additional GRID points should convergence be slow in a non-linear steady-state (NLSS) run or if thermal oscillations occur during a transient run. The GRID points selected for this sample problem are shown in figure 2.

2. Heat Conduction Elements

Once the GRID point locations have been selected, it is necessary to use connection cards to form heat conduction elements which in conjunction with property cards and material cards, specify the conductive couplings between the GRID points.

Each connection card begins with the letter "C" and joins selected GRID points together to form a heat conduction element. All of these elements taken together are assembled into a matrix which specifies the conductive coupling between each GRID point in the model. For example, considering figure 2, if it is desired to connect the GRID points together to form three 2-D plates (elements 30, 40, and 50) and two 1-D rods (elements 10 and 20), CQUAD2 and CROD cards could be used as in figure 3 and the pictured plates and rods would be created (this is analogous to a "connect-the-dots" procedure). For most connection cards,

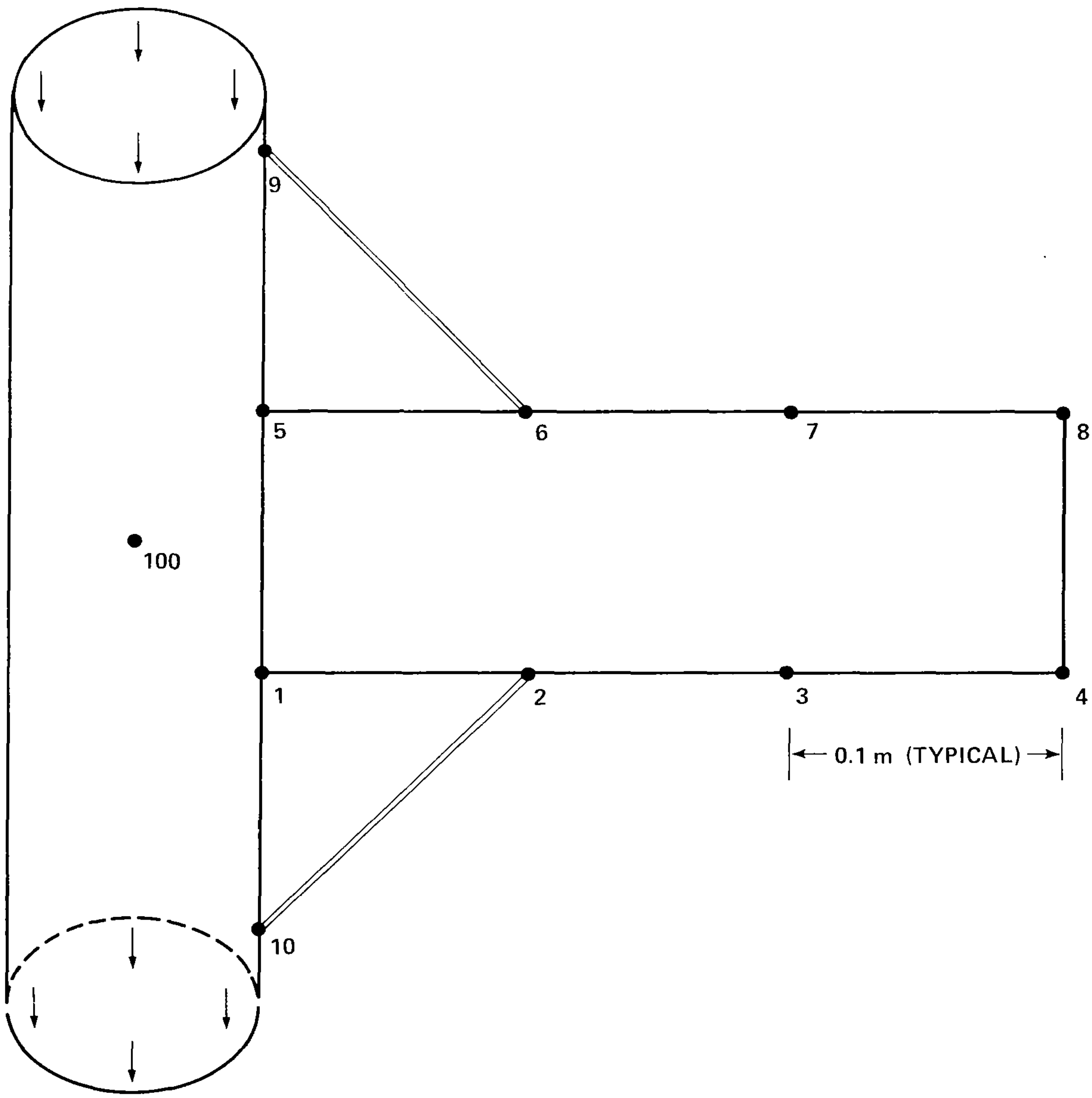
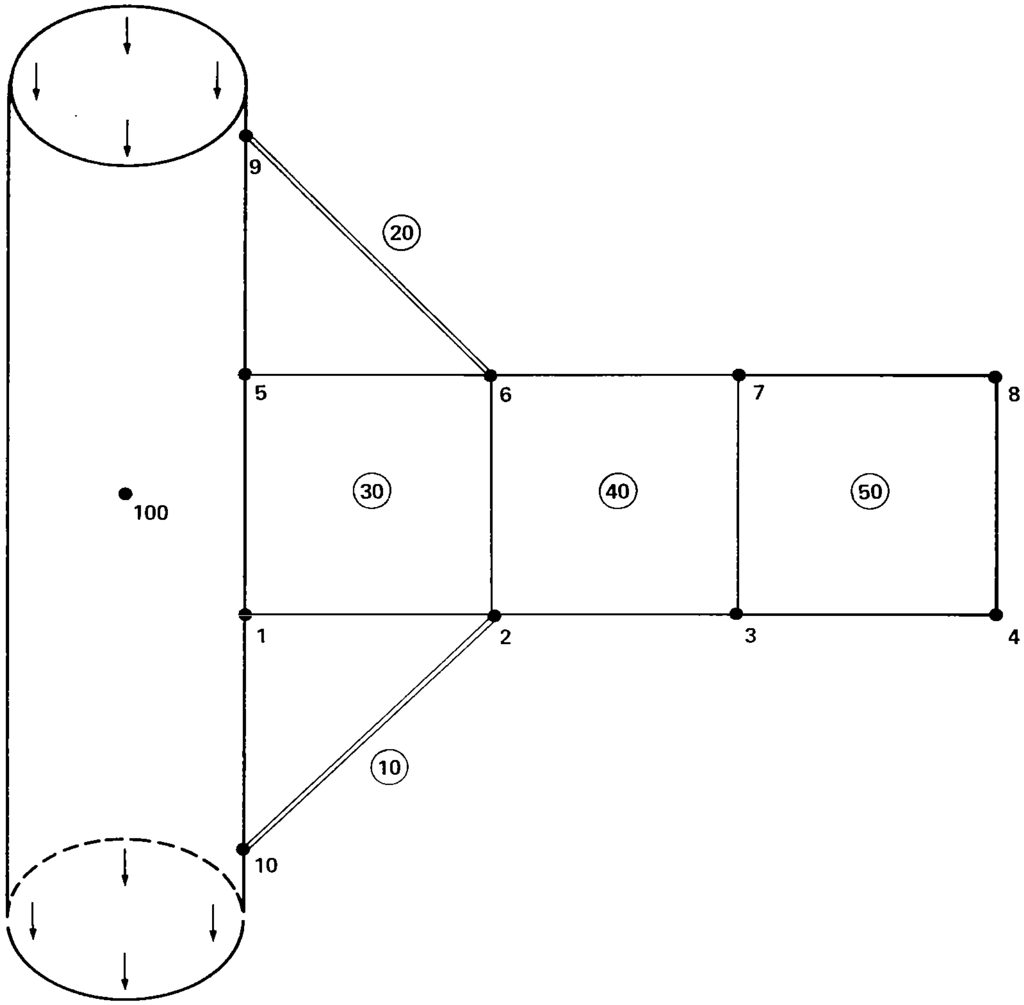


Figure 2. The LSS sample problem configuration with the GRID point locations designated.



				GRID POINTS				
ELEMENT CONNECTIONS	CROD	10	100	10	2			
	CROD	20	100	9	6			
	CQUAD2	30	200	1	2	6	5	
	CQUAD2	40	200	2	3	7	6	
	CQUAD2	50	200	3	4	8	7	
PROPERTIES	PROD	100	1000	{0.001}	CROSS SECTIONAL AREA			
	PQUAD2	200	1000	{0.01}	THICKNESS			
MATERIAL	{MAT4	1000	{200.}	{2.426 + 6}	THERMAL MASS PER UNIT VOLUME			
			THERMAL CONDUCTIVITY					

Figure 3. The LSS sample problem heat conduction elements and associated input cards.

it would also be necessary to reference a property card (all of which begin with the letter "P"), which would specify a thickness or cross-sectional area which applied to the referencing element, while in turn referencing a material card (all of which begin with the letter "M") which must be supplied to specify the relevant material properties, such as the thermal conductivity, for the element being defined. In figure 3, for example, the CQUAD2 cards reference a PQUAD2 card which in turn references a MAT4 card (the PQUAD2 card and the MAT4 card may be referenced any number of times by other CQUAD2 or PQUAD2 cards). A list of the heat conduction elements available for conductive heat transfer applications and a brief description of their capabilities and requirements are available in section 3.5.1(2) of Volume I of the $\overline{\text{N}}$TA Manual.

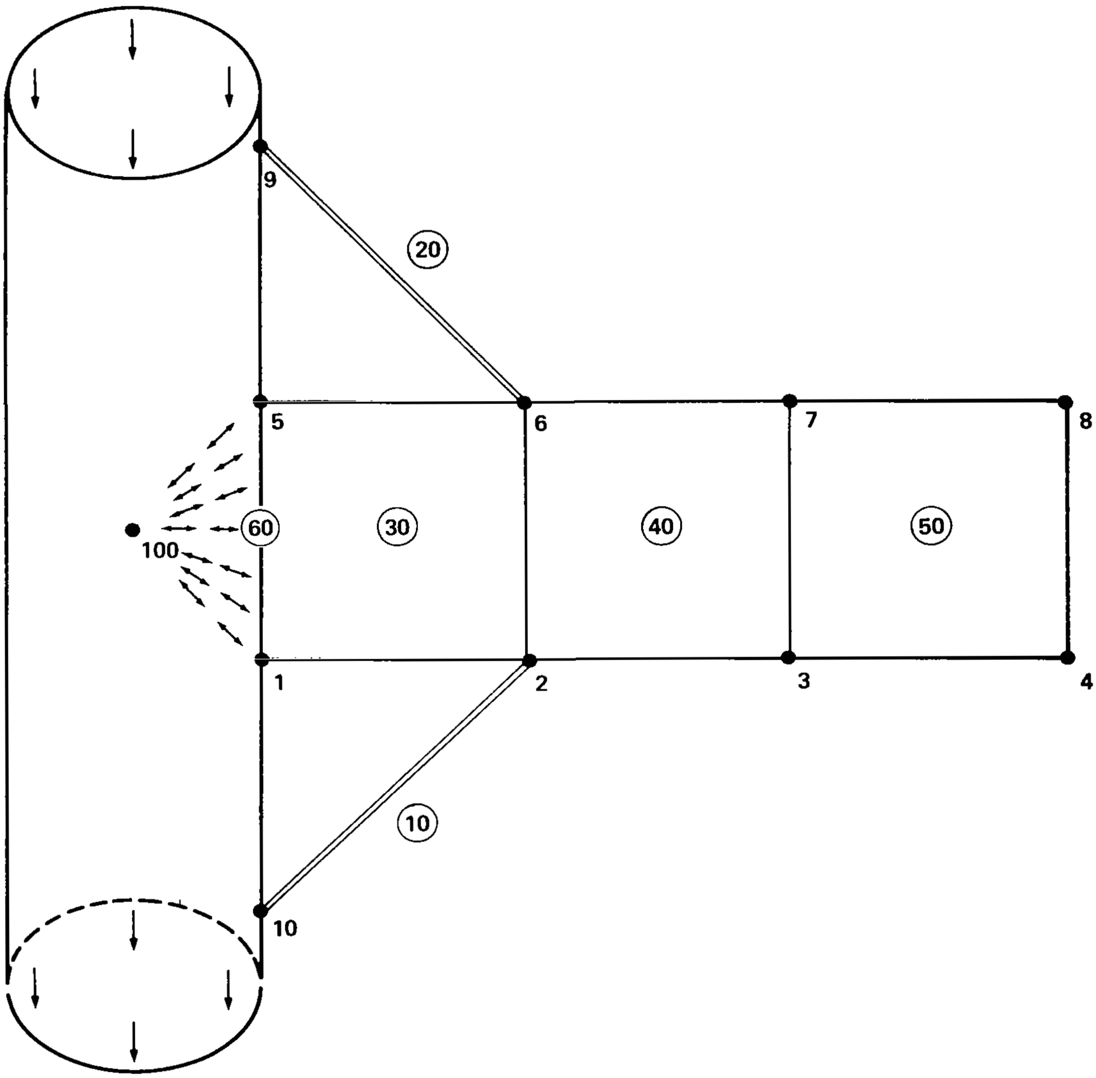
3. Boundary Surface Elements

Boundary surface elements are used to describe surface properties, such as convection or radiation, which must be modeled by the $\overline{\text{N}}$TA. All elements in NASTRAN are formed by connection cards, and the boundary surface elements are created by the use of the CHBDY card. It should be noted that the mnemonic CHBDY does not imply any geometric shape, as does, for example, CQUAD2 or CTRIA2; the CHBDY card may be used to represent circular, rectangular, triangular, arbitrary quadrilateral, elliptic cylindrical or general surface of revolution boundary configurations, as is discussed in section 3.5.1(3) of Volume I of the $\overline{\text{N}}$TA Manual. Figure 4 shows the location of the convective coupling between the fluid and the radiating fin, as defined by the CHBDY card and its associated PHBDY and MAT4 cards. The logic involved in this specification is perhaps the most complex in the $\overline{\text{N}}$TA, but verbally stated, what these cards define is a convective coupling of 200 W/ m^2 - °C between a rectangle 0.314 m wide extending from GRID point 1 to GRID point 5, and a fluid with a temperature corresponding to that of GRID point 100. The second card is a continuation of the CHBDY card, and field 3 of the CHBDY card references field 2 of the PHBDY card, and field 3 of the PHBDY card references field 2 of the MAT4 card. A PHBDY card and a MAT4 card must be referenced if a convective boundary condition is to be simulated. It may be seen that a MAT4 card referenced by a PHBDY card will define a different thermal parameter than a MAT4 card referenced by any other property cards associated with heat conduction elements (i.e., a convective film coefficient will be defined instead of a thermal conductivity).

4. Constraints

Two thermal constraints now need to be applied to complete the conductive/convective finite element model of the sample problem:

a. GRID point 100, the fluid point, must be fixed at 300°C with the use of an SPC (single point constraint) card, and



				GRID's		
CHBDY	60	{300	LINE	1 5		+CONVEC
+CONVEC	{100	100}		CONVECTIVE BOUNDARY GRID POINTS		
PHBDY	300	{3000	0.314}			
MAT4	3000	200.}				

WIDTH OF THE LINE ELEMENT

CONVECTIVE FILM COEFFICIENT "h"

Figure 4. The LSS sample problem convective boundary and associated input cards.

b. GRID points 9 and 10 will be specified to have temperatures equal to those of GRID points 5 and 1, respectively, as designated by the use of two MPC (multi-point constraint) cards.* This action is arbitrary and is done simply to demonstrate the MPC capability.

Figure 5 indicates where the MPC and SPC cards affect the model and lists the input cards involved. Details on MPC and SPC card definition may be found in section 3.5.1(4) of the associated N̄TA Manual.

5. Loads

In section II.A. of this guide it was stated that 48 watts were to be input to this radiating fin in the form of a uniformly absorbed flux. SLOAD cards, the simplest type of loading cards, were chosen for this example, and powers (in watts) were input to the GRID points as indicated in figure 6 by the SLOAD cards listed there. Figure 7 illustrates the reason for the apparently irregular manner in which the absorbed energy is applied to each GRID point. This phenomenon results from the fact that in determining the energy distribution, energy absorbed by the surface of an element equally proximate to two or more GRID points is divided equally between the competing GRID points, causing GRID points at the corners of an impinging flux to receive a smaller net applied load than points on the sides or at the center.

This concludes the initial description of the linear steady-state formulation of the basic sample problem which will be used to illustrate the N̄TA solution capabilities. As modifications are made to this problem, they will be defined and explained, but repetition of this basic problem and the N̄TA concepts involved in its solution will not be continued after the discussion of sample problem 1.

C. Discussion of the Sample Problems

As described in Volume I of the N̄TA Manual, section 3.2, every N̄TA problem is divided into three consecutively ordered segments, the Executive Deck, the Case Control Deck, and the Bulk Data Deck. In the following problem, reviews of each of these sections will be made separately, preceded by a statement of the intent of the problem and followed by a guide describing the output produced. Card types which are required in all runs will be double underlined, and repetition of card descriptions will be minimized by referencing problems to similar problems which have been previously discussed. The listings of the output associated with each sample problem may be found in appendix F.

In addition, a special feature that the user should remember when examining a Case Control Deck is that the N̄TA will check only the first four characters directly after and including the first non-blank character, if unique, to determine the card type. This would mean, for

*This is known as "equivalencing," and if the constrained GRID point has any kind of nonlinear load attached to it, it is the only type of MPC which may be used. See appendix C.

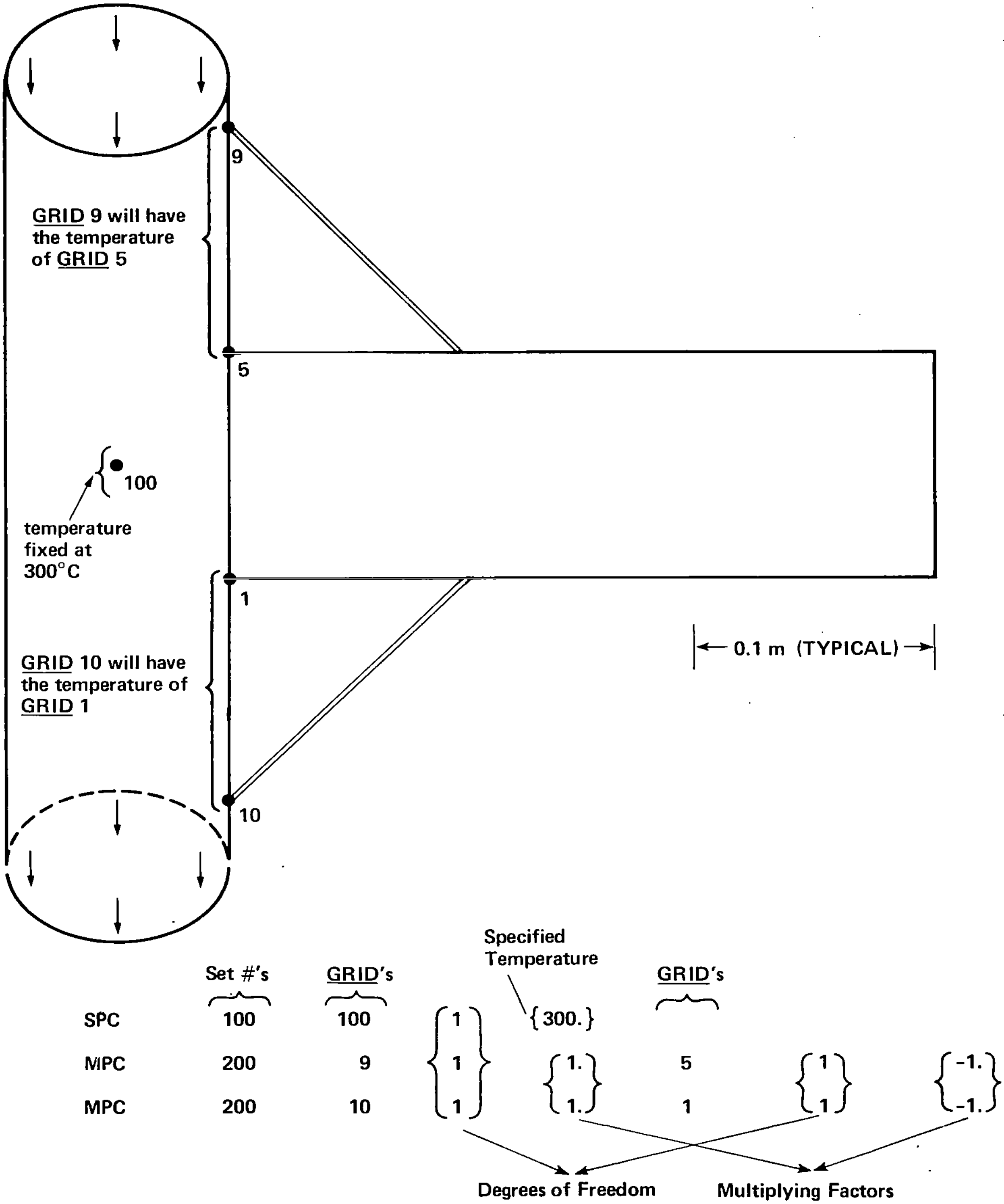
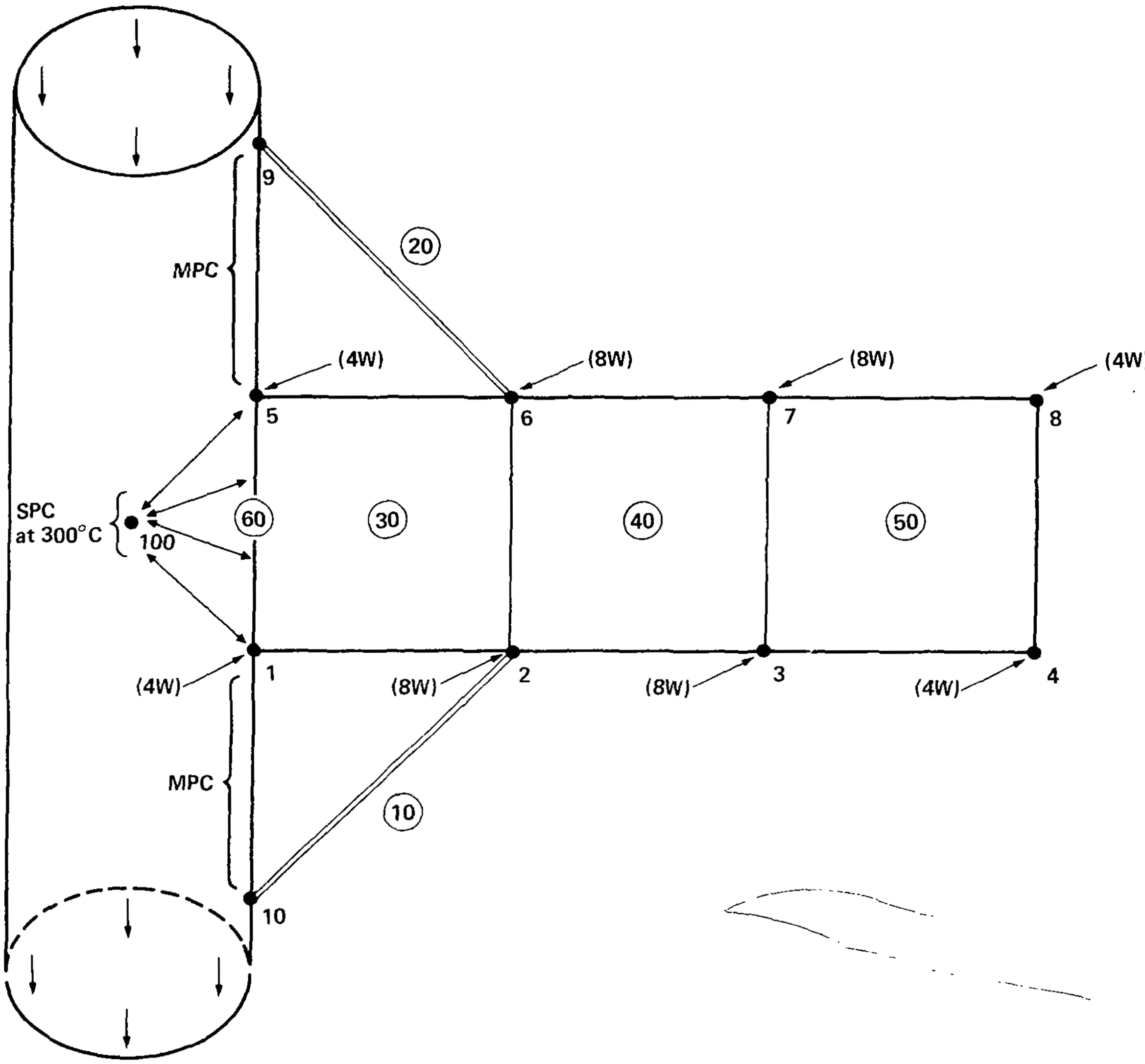
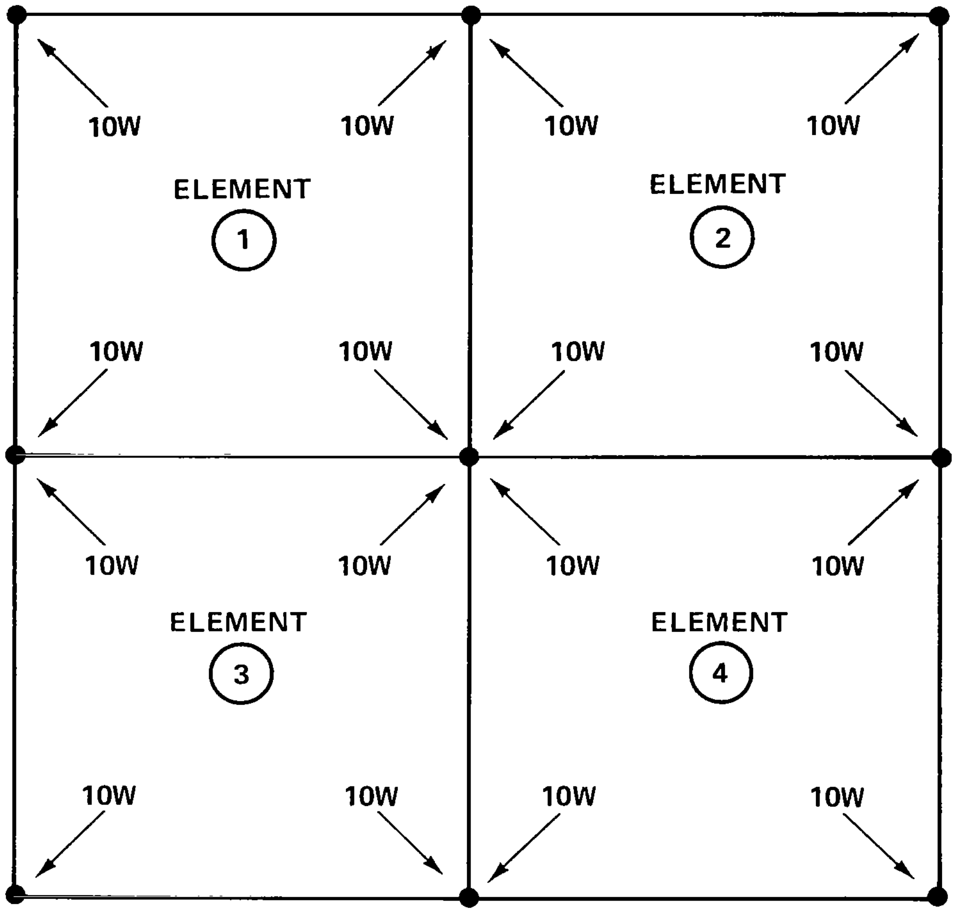


Figure 5. The LSS sample problem constrained points and associated input cards.



		GRID's	POWER (WATTS)	GRID's	POWER (WATTS)
SLOAD	300	1	4.	2	8.
SLOAD	300	3	8.	4	4.
SLOAD	300	5	4.	6	8.
SLOAD	300	7	8.	8	4.

Figure 6. The LSS sample problem applied loads and associated input cards. (Also summarizes the entire LSS analytical model)



Each element has an area of 1 m^2, and absorbs 40W/m^2. The absorbed energy is distributed to each GRID point composing an element based on its share of the element's area, which in this case means an equal distribution. Note that the center GRID point receives twice the energy of a side GRID point, which in turn receives twice the energy of a corner GRID point.

Figure 7. Sample distribution of a uniform absorbed flux to eligible GRID points.

example, that SPCFORCES = ALL would have the same effect as an SPCF = ALL request, a fact that would not at first be obvious. It should also be noted that in all $\overline{\text{N}}$TA decks BCD and EBCDIC characters may be used interchangeably for runs made on IBM machines, which means that "+", "=", "(", and ")" may be interchanged with "&", "#", "%", and "<", respectively. This is not true for the CDC and UNIVAC versions of $\overline{\text{N}}$TA, which require BCD code.

1. Sample Problem 1

a. Intent: This problem demonstrates the linear steady-state (LSS) solution of the basic sample problem described in sections II.A. and II.B.

b. Executive Control: The function of the Executive Control Deck is to define certain relatively problem-independent variables, which are required by N̄TA before execution may begin. The format of all cards in this section is free-field, meaning that there are no column restrictions for data entry, though input must start in column 1. Figure 8 displays the Executive Control Deck as used in Problem 1. The purpose of each card is as follows (see Volume I of the N̄TA Manual, section 3.3, for further details):

   i) The $ cards are comment cards and are used to explain cards which follow them.

   ii) The ID card provides information that will be used to label a restart tape if one is requested.

   iii) This TIME card indicates that a maximum of 10 cpu minutes may be consumed before the N̄TA will terminate execution.

   iv) This APP (abbreviation for "APProach") card indicates a heat transfer problem is to be solved.

   v) This SOL (abbreviation for "SOLution") card indicates that a linear steady-state (LSS) solution is desired.

   vi) The CEND card terminates the Executive Control Deck.

c. Case Control: The function of the Case Control Deck, which also employs a free-field format, is to select from the Bulk Data the input sets desired for this execution and to define the types and format of the output to be produced. The concept of "sets" as used in the N̄TA is quite simple and is best explained by example. Assume that you had defined several SPC cards in a Bulk Data Deck, some with a set ID 100 in field 2, and some with a 200 in field 2. Those with the 100 would be referred to as SPC set 100, and would be used in the problem solution only if a card saying SPC = 100 appeared in the Case Control Deck. The SPC set 200 cards would be treated as if they did not appear in the problem. Figure 9 displays the Case Control Deck as used in Problem 1, and the general purpose of each card is as follows (see Volume I of the N̄TA Manual, section 3.4, for further details):

   i) The TITLE card is used to specify a heading which will appear at the top left of each page of output (the default is all blanks).

   ii) The LINE card is used to specify the number of lines of data, not including headings, which will appear on each page (the default is 50).

NASTRAN EXECUTIVE CONTROL DECK ECHO

```
$
$**********************************************************************
$ START OF EXECUTIVE CONTROL ******************************************
$**********************************************************************
$
ID CLASS PROBLEM ONE. C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE LINEAR STEADY-STATE  SOLUTION ALGORITHM IS TO BE USED
$
SOL 1
CEND
```

Figure 8. LSS Executive Control Deck from sample problem 1.

CASE CONTROL DECK ECHO

```
CARD
COUNT
  1      $
  2      $*****************************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ************************************
  4      $*****************************************************************************************
  5      $
  6      TITLE = LINEAR STEADY-STATE PROBLEM
  7      $
  8      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
  9      $
 10      LINE = 51
 11      $
 12      $ REQUEST SORTED AND UNSORTED OUTPUT
 13      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 14      $
 15      ECHO = BOTH
 16      $
 17      $ SELECT THE SPC, MPC, AND LOAD SETS TO BE USED IN THIS SOLUTION
 18      $
 19      SPC = 100
 20      MPC = 200
 21      LOAD = 300
 22      $
 23      $  SELECT THE OUTPUT DESIRED (TEMPERATURES, LOADS, AND CONSTRAINT POWERS)
 24      $
 25      OUTPUT
 26      THERMAL=ALL
 27      OLOAD=ALL
 28      SPCF=ALL
 29      $
 30      $*****************************************************************************************
 31      $ END CASE CONTROL --- START BULK DATA *****************************************************
 32      $*****************************************************************************************
 33      $
 34      BEGIN BULK
```

Figure 9. LSS Case Control Deck from sample problem 1.

iii) The ECHO card is used to specify whether only the sorted Bulk Data listing, only the unsorted Bulk Data listing, or both sorted and unsorted Bulk Data listings should be printed (the default is to print the sorted Bulk Data only).

iv) The SPC card is used to specify the identification number for a set of single-point constraints which is present in the Bulk Data. The constraints will then be used to identify certain GRID points which are to be held at fixed temperatures.

v) The MPC card is used to specify the identification number for a set of multi-point constraints which is present in the Bulk Data. The constraints will then be used to identify certain GRID points whose temperatures are to be maintained in a fixed relationship during the problem solution.

vi) The LOAD card is used to specify the identification number for a set of load cards which is present in the Bulk Data. These load cards will specify powers and/or fluxes which are to be applied to the model during the problem solution.

vii) The OUTPUT card is used to separate the section of the Case Control which specifies boundary conditions and applied loads from the section of the Case Control which specifies the type of output which is desired.

viii) The THERMAL card is used to request a printout of the GRID point temperatures.

ix) The OLOAD card is used to request a printout of the linear GRID point applied loads.

x) The SPCF card is used to request a printout of the power required to sustain each single-point constrained GRID point at its specified temperature.

xi) The BEGIN BULK card indicates that the Case Control Deck is complete, and that all following cards will be Bulk Data.

d. Bulk Data: The purpose of the Bulk Data Deck, as displayed in unsorted form in figure 10, is to provide the finite-element description of the problem to be solved. All of the cards presented here have been discussed in some detail in section II.B. of this guide, and the following segment will essentially summarize the information presented there (see Volume I of the NTA Manual, section 3.5, for further details on the formatting and use of these cards).

i) The physical units employed must be consistent, but are otherwise completely arbitrary. The units which will be used in this sample problem, as indicated in the initial comment cards, are meters, watts, and degrees Celsius.

```
LINEAR STEADY - STATE PROBLEM                           NOVEMBER 23, 1975   NASTRAN 12/31/74   PAGE  3

                                        INPUT BULK DATA DECK ECHO
     1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10
$
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELCIUS ARE USED
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY
$
MAT4    1000    200                                                     ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200
$
$ DEFINE CONSTRAINTS
$
SPC     100     100     1       300
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$**************************************************************************
$ END OF BULK DATA ********************************************************
$**************************************************************************
$
ENDDATA
TOTAL COUNT = 61
*** USER INFORMATION 207, BULK DATA NOT SORTED. XSORT WILL RE-ORDER DECK.
```

Figure 10. LSS unsorted Bulk Data Deck from sample problem 1.

ii) The GRID cards are used to define the location of the solution points in the model. Each GRID point is given a unique identifying number along with x, y, and z coordinates* which fix its location in space. These GRID points will be joined together by N̄TA element connection cards to actually form the model. Often, when a GRID point is being referenced, the N̄TA requires that a degree-of-freedom be specified. The user should always specify "1". SCALAR and EXTRA points also exist, but are error prone in the N̄TA, of relatively little use, and will not be discussed here.

*It is possible to use cylidrical or spherical coordinates also-see Volume I of the N̄TA Manual, section 3.5.1(i).

iii) The CROD cards are a type of element connection card and are used to indicate that two GRID points are to be physically joined together by a thermally conducting rod. The properties of this rod, namely its cross-sectional area and its material composition will be defined respectively by $\overline{\mathrm{N}}$TA property and material cards.

iv) The CQUAD2 cards are an additional type of element connection card and are used to indicate that four different GRID points are to be physically joined together by a quadrilateral plate, with one GRID point being located at each corner. The properties of this plate, namely its thickness and its material composition, will be defined respectively by $\overline{\mathrm{N}}$TA property and material cards.

v) The PROD card is a type of property card and is used to define the cross-sectional area of the rods defined by the CROD cards which reference it. The material of which the rods are composed will be defined by a material card.

vi) The PQUAD2 card is a type of property card and is used to define the thickness of the quadrilateral plates defined by the CQUAD2 cards which reference it. The material of which the plates are composed will be defined by a material card.

vii) The MAT4 cards are a type of material card and are used to define the thermal conductivity of the material which composes any element connection cards which reference them through any property cards (i.e., CROD cards reference a PROD card which references a MAT4 card).

viii) The CHBDY card is a type of connection card and is used to define a surface area which will be participating in the thermal system either by transferring heat to other surface areas by convection and/or radiation, or by absorbing external thermal fluxes. This is the most complex of the commonly employed thermal connection card types and is discussed in detail in section 3.5.1(3) of Volume I of the $\overline{\mathrm{N}}$TA Manual.

ix) The PHBDY card is a type of property card and is used to specify the area (if necessary), emissivity (if necessary), absorbtivity (if necessary), and number of the material card which contains the convective film coefficient (if necessary). This is the most complex of the commonly employed thermal property card types, and is discussed in detail in section 3.5.1(3) of Volume I of the $\overline{\mathrm{N}}$TA Manual.

x) The MAT4 cards (see vii also) are a type of material card which, when referenced by a PHBDY card, will specify the convective film coefficient "h" (W/m^2-°C in this problem) which is to be used in calculating the heat exchange between the CHBDY card referencing the PHBDY card in question and the ambient points specified on the continuation portion of the CHBDY card itself.

xi) The SPC card is a type of constraint card which indicates that a selected GRID point is to remain at a specified temperature during the problem solution.

xii) The MPC cards are a type of constraint card which indicate that selected GRID points are to maintain a specified temperature relationship to other selected GRID points.

xiii) The SLOAD cards are a type of loading card which are used to apply fixed loads to selected GRID points.

xiv) The ENDDATA card indicates that the Bulk Data Deck is complete. Any input cards following an ENDDATA card (assuming that the ENDDATA card is in the Bulk Data) will be ignored.

e. Output Produced: Output for each of the 20 NTA Sample Problems may be found in appendix F. "User Information" and "User Warning" messages which appear in the output from the sample problems will not be discussed individually, but a description of them may be found in appendix B. All other output data following the Bulk Data listings will be discussed on a page-by-page basis (the page number is found in the upper right hand corner of most computer printout pages), with a minimum of repetition from previous problems. During all further discussions of the sample problems the reader will have to refer to appendix F to see the Executive Control, Case Control, and Bulk Data decks which are being discussed in addition to finding the output produced.

Page No.	Description
6	The output labeled "TEMPERATURE VECTOR" consists of a GRID-point-by-GRID-point listing of the solution temperatures for all of the GRID points in the model. Each row of output contains up to six temperatures, with the GRID point number of the first temperature in the row being specified at the far left of the row and the following GRID point numbers in each row increasing successively by a value of one (for example, GRID point eight has a temperature of 331.9°C). This output is produced by the "THERMAL=ALL" request in the Case Control Deck.
7	The output labeled "LOAD VECTOR" consists of a GRID-point-by-GRID-point listing of the loads applied to all of the GRID points in the model (with the exception that net loads of zero are not included). The correlation of applied loads with GRID point numbers is the same as has been described for the "TEMPERATURE VECTOR," and this "LOAD VECTOR" is produced by the "OLOAD=ALL" request in the Case Control Deck.

Page No.	Description
8	The output labeled "FORCES OF SINGLE-POINT CONSTRAINT" consists of a GRID-point-by-GRID-point listing of the non-zero thermal loads required to maintain the single-point constrained GRID points at their specified temperatures. The correlation of these internally determined thermal loads with GRID point numbers is the same as has been described for the "TEMPERATURE" and "LOAD" vectors, and these single-point constraint forces are requested by the "SPCF=ALL" request in the Case Control Deck.
unnumbered - first page after the "FORCES OF SINGLE POINT CONSTRAINT" output	This section of output is unlabeled, and is produced automatically for all $\overline{N}$TA runs which have enabled Fortran output unit 4 (see your local NASTRAN systems programmer for further information). Several useful pieces of information are supplied in this "Run Log:" 1) On line one, the $\overline{N}$TA computer core load point is defined; 2) On line two, the number of CPU and I/O seconds remaining to be used after the completion of the program load are given; 3) On most of the following lines, the total CPU seconds consumed, the total wall-clock seconds consumed, and the module presently being executed are listed; 4) At the end of each "LINK," generally a group of modules which perform a certain function, the total consumed I/O time is listed, and on the following line the amount of allocated core space which was not used by the preceding LINK is defined; 5) At the end of the "Run Log," the amount of core which was never used during the execution is listed. Obviously, this output would be useful in tuning a problem so that the minimum amount of required resources (time and core) could be requested. Also, in the case of an abend, it provides a trace up to the module where execution ceased. Further information may be requested to appear in the "Run Log" via the use of DIAG cards in the Executive Control, as is described in section 3.3 of Volume I of the $\overline{N}$TA Manual.

2. *Sample Problem 2**

a. Intent: This problem, which is based on Problem 1, adds radiative heat dissipation from the fin to space. The use of the nonlinear steady-state (NLSS) solution algorithm is therefore required and is demonstrated.

*During the discussions of the remaining problems it will be assumed that the reader realizes that more detailed descriptions of input cards may be found in the $\overline{N}$TA Manual.

b. Executive Control: Only minor changes were made from Problem 1:

   i) The ID card information was updated (changes to this card will be made in each new sample problem, but no further discussion of it will be made).

   ii) The SOL card was changed to request algorithm 3, which is the nonlinear steady-state solution method.

   iii) A DIAG 18 card has been included to force the convergence criteria to be printed out after each iteration.

c. Case Control: Only two changes were made from Problem 1:

   i) The TITLE card was updated (further changes to this card, which will occur in each new problem, will not be discussed).

   ii) The TEMP (MATERIAL) card is required for NLSS runs, and is used to reference a set of TEMP and/or TEMPD cards in the Bulk Data which define the estimated final steady-state temperature vector of the problem being solved. In order to avoid divergence, it is important that this guess vector be at least 80 percent of the true absolute steady-state temperature for each GRID point, though it should be realized that grossly high temperature guesses will drastically slow convergence. A tactic which has been successfully used in a variety of situations has been to obtain an initial solution while using a high temperature estimate, and then input this solution (which may be automatically punched as TEMP cards by the NTA–see Problem 11) as the temperature guess vector in a subsequent run.

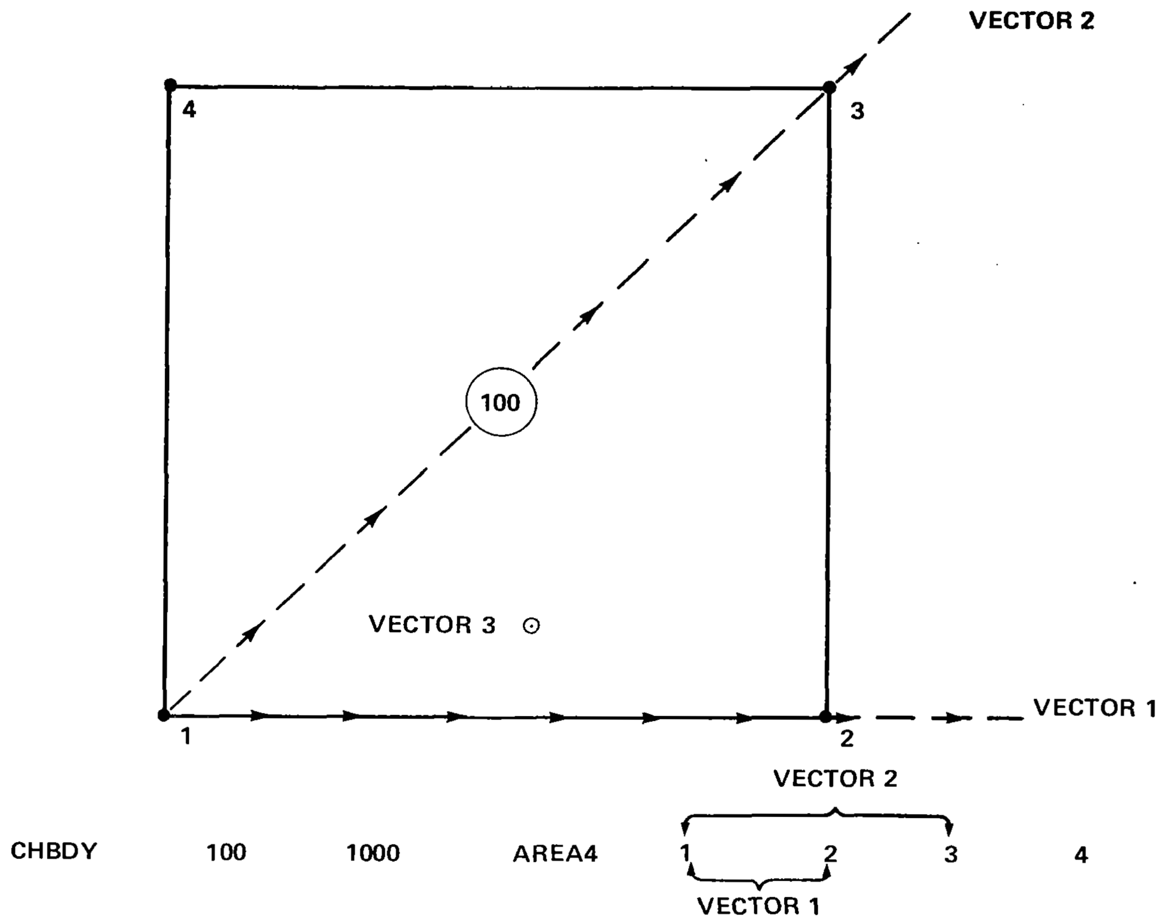
d. Bulk Data: All of the changes to the Bulk Data Deck which were made between Problems 1 and 2 are listed at the end of the unsorted Bulk Data echo.* Several new types of cards are seen there, and their uses are as follows:

   i) The SPC1 card is the type of single-point constraint card which should be used in NLSS problems.** It differs from the SPC card used in Problem 1 (which has been removed for Problem 2) in that no temperatures are actually specified on the SPC1 card, and only the ID numbers of the GRID points which are to be held at the temperatures specified for them by the TEMP(MATERIAL) set selected in the Case Control are entered.

   ii) The CHBDY cards are used to define the radiating boundary elements which cover both sides of the fin. It should be noted that CHBDY cards 200 and 500, 300 and 600, and 400 and 700 are identical except for a reversal in the ordering of the GRID points. As is shown in figure 11, this reversal changes

*This will be true for all of the problems except 12 and 19, in that a previous problem will be referenced and all Bulk Data changes will be listed at the end of the unsorted Bulk Data echo.

**Use of the SPC card has been known to produce incorrect answers; in addition, the TEMP(MATERIAL) set will override any temperatures specified on an SPC card.



VECTOR 1 (X) VECTOR 2 = VECTOR 3, whose direction defines the active side of the CHBDY element. In this case, it is the side facing the reader.

Figure 11. The right-hand rule as applied to a $\overline{\text{N}}$TA CHBDY AREA4 card.

the orientation of the normal vector formed by the cross-product of the lines between GRID points one and two and GRID points one and three (generally known as the "right-hand rule" vector). The direction of this normal is used in the $\overline{\text{N}}$TA only when a thermal flux vector from a QVECT card is being applied, though, as Problem 12 will illustrate, a special view factor determination program, VIEW, exists which also makes use of this orientation vector. Therefore, even though it will make no difference in most $\overline{\text{N}}$TA executions, it is good form to order the CHBDY GRID points such that the cross-product orientation vector will point in the direction in which the radiating surface is supposed to be looking. Defining the orientation vector for CHBDY POINT and LINE elements, where this cross-product is not available, is discussed on the CHBDY card Bulk Data description found in section 3.5.3 of Volume I of the NTA Manual.

iii) The PHBDY card, which is referenced by the six preceding CHBDY cards, defines the emissivity of these radiating surfaces as 0.90.

iv) The TEMP card, which has been selected for use by the TEMP(MATERIAL) card in the Case Control, defines a temperature guess of 300 degrees for GRID point 100. Whether this value is Celsius or Kelvin cannot be determined until the PARAM cards are examined.

v) The TEMPD card, which has also been selected for use by the TEMP-(MATERIAL) card in the Case Control, indicates that all GRID points which are not specifically supplied with temperature guesses via TEMP cards will have temperature guesses of 300 degrees. It should be noted that since both the TEMP and TEMPD cards specify the same temperature, the TEMP card could be omitted in this case without affecting the problem in any way.

vi) The PARAM TABS (Temperature ABSolute) card specifies a value (default= 0.0) which will be added to the temperature guesses and intermediate thermal solution vectors before the calculation of nonlinear loads due to radiation is made. In this case, if the Celsius/Kelvin system has been used in defining other material properties, the TABS value of 273.15 would indicate that the temperature guess vector and the results are and will be in degrees Celsius (the 273.15 value would be added to the temperatures guessed to convert them to the absolute Kelvin scale).

vii) The PARAM SIGMA card specifies the Stefan-Boltzmann constant (default=0.0) in the units which are being used in the particular problem being solved. In most NTA versions the omission of this card will result in no radiative interchange being included in the problem solution, and the user should verify the presence of this card to assure himself that his results do in fact include nonlinear radiative effects.

viii) The PARAM MAXIT (MAXimum ITerations) card specifies the maximum number of solution iterations (default=4) which will be allowed before execution will be automatically terminated.

ix) The PARAM EPSHT (EPSilon Heat Transfer) card specifies a value (default= 0.001) which will be used in determining whether the desired degree of convergence has been achieved, which would permit the solution iterations to cease without having reached the MAXIT value. The convergence criteria which are used are discussed in subsection e), where the output for this problem is examined.

x) The RADLST card is used to indicate which CHBDY cards are participating in the radiative interchange. In this case a 6 x 6 matrix is specified, with column one being associated with CHBDY card 200, etc.

xi) The RADMTX cards are used to define the area–times–view–factor values which will be entered into the square matrix specified by the RADLST card, and since this matrix is symmetric, only 1/2 of it need be entered. Although the format of this card type is given in section 3.5.3 of Volume I of the N̄TA Manual, a few additional comments are useful:

1) If the view factors supplied for an element sum to >1.001,* a fatal error will result in most versions (such as Levels 15.5.1, 15.5.2 and 15.5.3). If a version is used which does not make this error check, and view factors do sum to > 1.0, then the results are unpredictable.

2) If the view factors supplied for an element sum to <1.0, the N̄TA will automatically assume that the unaccounted for energy is lost to "space". Some versions (such as Levels 15.5.1, 15.5.2 and 15.5.3) will warn the user of this energy loss, but others may not, and the user should be aware of this potential invisible and infinite heat sink.

3) If a column is undefined by RADMTX cards, or is only partially defined, it will be filled out with zeros. However, note that no embedded blank fields are allowed.

In the light of these comments it can be seen that the radiation matrix in this problem will cause all of the energy radiated from the fin to be lost to the internal "space" node. In addition, since all of the terms in the RADMTX are zero, it could have been left out entirely and the same answers would have resulted due to the default option mentioned in comment #3 above.

*Since the RADMTX actually supplies area–times–view–factor values (AF values), the true criterion is that the AF sum for an element divided by that element's area be < 1.001.

e. Output Produced:

Page No.	Description
unnumbered – directly precedes page 7	This page of output is produced only if a DIAG 18 card is present in the Executive Control during a $\bar{N}$LSS run, and it lists three parameters which are used by the program to determine if solution iterations may be terminated (see section 2.6.2 of Volume I of the $\bar{N}$TA Manual for more detailed information):

i) EPSILON - P is the ratio of the change in the nonlinear load between the last two iterations to the nonlinear load calculated from the initial thermal guess vector.

ii) LAMDA – 1 is a weighted estimate of the lowest eigenvalue of the solution matrix.

iii) EPSILON – T is essentially a ratio of the sum of the changes in temperature from the previous iteration to the sum of the newest estimated temperatures.

The iteration algorithm will terminate under one of the following conditions:

i) EPSILON – T < EPSHT and EPSILON – P < 10 * EPSHT – Normal Convergence.

ii) EPSILON – T = 0. and EPSILON – P = any value – Maximum Convergence (essentially as good as Normal Convergence, but EPSILON - P was not satisfied, probably due to an inaccurate thermal guess vector).*

iii) LAMDA - 1 < 1 after the fourth iteration – Diverging Solution. To fix this, the user might try a higher thermal guess vector, examine the model for the unintended application of high thermal loads, and/or examine the RADMTX to verify that the view factors supplied do not sum to values greater than 1.001 for any element.

iv) If MAXIT is exceeded – termination due to Maximum Iterations.

v) If an internal algorithm which estimates the time required for an iteration indicates that not enough CPU time remains for the next iteration to be completed – termination due to Insufficient Time.

In this problem, termination is, as is shown, due to Normal Convergence. What is the best value to use for EPSHT? There is no one answer to this question, but commonly used values are 10^{-3} or 10^{-4}, and they have uniformly produced reliable results.

7, 8, 9 and the Run Log	This output is identical in form to that described in Problem 1. It should be noted that the modules being executed, as noted in the Run Log, are different from Problem 1 because the NLSS algorithm (SOL 3) is being used instead of the LSS algorithm (SOL 1).

*This convergence message is not available on all $\bar{N}$TA versions.

3. *Sample Problem 3*

a. Intent: This problem converts the NLSS model of Problem 2 to an identical non-linear transient problem, demonstrating the use of the transient solution algorithm (SOL 9).

b. Executive Control: The only change made from Problem 2 was on the SOL card, where algorithm 9, the nonlinear transient solution method, was selected instead of algorithm 3, the NLSS solution method.

c. Case Control: Several changes were made from Problem 2, as follows:

i) The LOAD card was changed to a DLOAD (Dynamic LOAD) card, which is required to request linear thermal loads during a transient execution. This card may reference only TLOAD1, TLOAD2, and DLOAD Bulk Data cards, which will, in turn, reference other linear load cards.

ii) The TSTEP (Time STEP) card is required to specify the identification number of the Bulk Data TSTEP card which will be used to define the integration time step size, the number of time steps to be solved, and the frequency with which the time steps will be printed out (i.e., every time step, or every other time step, or every third time step, etc.).

iii) The IC (Initial Condition) card is required to specify the set number of the TEMP and/or TEMPD cards which will be used to define the initial temperature of each GRID point in the model. This set number may be the same one referenced by the TEMP (MATERIAL) card, but in most cases a separate temperature vector will be specified.

iv) The SET card is optional, and is used here to define a group of GRID points which may be collectively referenced in later output requests.

v) The OLOAD card has been previously discussed, but its use here is slightly different in that it references a set number. The only requirement for the use of this option is that the set number selected be previously defined on a SET card in the Case Control, and the result will be that the requested output will be supplied only for the GRID points listed in the set. This option may be used for any of the various types of NTA output.

vi) The SPCF card is superfluous in this problem, as no SPC set is selected.

vii) Cards 54 through 69 supply the information required to produce printer plots of selected GRID point temperatures and thermal velocities (rate change of temperatures) as a function of time. The structure of this request is quite simple, in that it is initialized with an OUTPUT (XYOUT) card, followed by XTITLE and YTITLE cards to label the axes, and completed with an XYPAPLOT card which specifies the variable which is to be plotted against time along with the GRID points for which the plots will be generated. It should be noted that this group of cards must appear at the end of the Case Control Deck unless a structural plot packet is supplied (it may either precede or follow the transient plot request). Further detail on these printer plots may be found in section 4 of the NASTRAN User's Manual.

viii) It should be noted that the SPC request has been removed. The reason for this is that in SOL 9 any GRID point constrained by a SPC will remain fixed at zero degrees. This makes the SPC technique essentially useless in transient runs, and alternate methods for constraining GRID point temperatures will be discussed and applied in the Bulk Data Deck section of this problem.

ix) The TEMP (MATERIAL) card is optional for a transient solution, but its use should improve the stability of the solution. If the transient solution is to be oscillatory in nature, the guess vector selected should approximate the estimated average temperature of each GRID point.

d. Bulk Data: The following changes, listed at the end of the unsorted Bulk Data echo, were made to the Bulk Data to convert Problem 2 to Problem 3:

i) SPC and/or SPC1 cards may be used in SOL 9 only to constrain temperatures to zero degrees, and are therefore essentially useless. The standard transient method of constraining a GRID point is to first give it a large conductive coupling to a "ground" at absolute zero. A large load is then applied and effectively controls the temperature of the GRID point. This procedure is analagous to the well known linear stretching of a spring as governed by the relationship F = KX. In a thermal problem, the K is the magnitude of the conductive coupling to ground, the F is the magnitude of the applied load, and the X is the fixed temperature value. This sounds somewhat complicated, but a glance at the cards involved shows that it is not. A CELAS2 card is used to define a conductive coupling of $1. \times 10^5$ watts/°C between GRID point 100 and a thermal ground (an infinite heat sink at absolute zero). An SLOAD card (in conjunction with a TLOAD2 card, as will be discussed later) applies a load of $300. \times 10^5$ watts to GRID point 100. Therefore, by the equation stated above, the fixed temperature is $X = F/K = 300. \times 10^5$ (watts) / $1. \times 10^5$ (watts/°C) = 300° C. It should be emphasized that for this method to work, the conductive coupling to ground should be several orders of magnitude larger than the other real thermal conductances in the model. Also, a useful feature of this method is that if the load were made time-varying, the temperature of the constrained GRID point would vary proportionately.

ii) All linear SOL 9 loads, as was mentioned in the Case Control section of this problem, must be applied through TLOAD1, TLOAD2, and/or DLOAD Bulk Data cards. In this problem, a TLOAD2 card defines a unit multiplier which will operate from time = 0. to time = $1. \times 10^6$ and during this time will apply all load cards with a set ID of 300 (defined on field 3 of the TLOAD2 card). Both the old and new SLOAD cards in the problem have set ID's of 300 and will therefore be applied. In order to clarify this load application procedure further, figure 12 illustrates all of the possible logic paths which may be used successfully in SOL 9.

iii) The TSTEP card has been mentioned in the Case Control section, and in this problem specifies 31 time steps of 30 seconds each with a printout required for every time step.*

iv) An additional TEMPD card with a set ID of 600 defines the initial condition thermal vector as referenced by the IC card in the Case Control.

e. Output Produced

Page No.	Description
10	This page lists the total linear thermal load applied to GRID point 1 at each time step in the problem. This type of output, where a single GRID point is examined at all time steps is known as SORT2 output. It is possible to reverse this sorting and obtain information organized to display all GRID points at individual time steps, which is known as SORT1 output. This will be demonstrated in Problem 4.

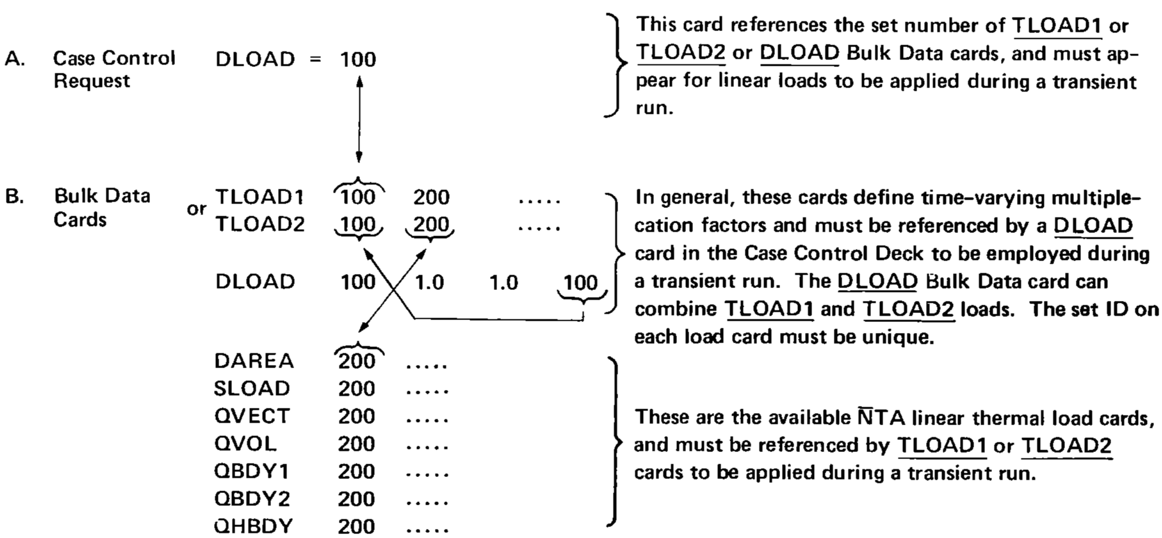


Figure 12. Applying linear transient loads.

*Either 31 or 45 integration steps will be used for all problems based on Problem 3, with the smaller number being chosen to allow each transient printer plot to fit on one page.

Page No.	Description
19	This output is identical to that on page 10, except that temperatures are listed instead of linear applied loads.
30 - 35	These pages contain data used in generating the transient temperature plots and are generally of little interest to the user.
36 - 39	These pages contain the plots mentioned above and are essentially self-explanatory. In the first plot, of temperatures, the symbols A, *, and 0 correspond to GRID points 100, 1, and 4. The following three plots separately graph the thermal velocities of GRID points 100, 1, and 4.
Run Log	This section indicates the modules being executed for SOL 9, along with other data as described in Problem 1. In future problems, the Run Log will only be discussed to point out modifications which have been made to the solution algorithms.

4. *Sample Problem 4*

a. Intent: This problem, which is based on Problem 3, demonstrates the use of a DMAP (Direct Matrix Abstraction Program) alter to produce SORT1 output in place of SORT2 output during a transient solution. In addition, the TSTEP card is modified to allow output only for every fifteenth time step, and a new DIAG card is included to provide a listing of the NASTRAN Source Program (often called a Rigid Format) which is executed, in this case SOL 9.

b. Executive Control:

i) A DIAG 14 card has been added to produce a listing of the DMAP Source Program being executed to solve this problem. This listing will be further discussed in the Output section.

ii) The four cards starting with ALTER 122 and ending with ENDALTER comprise an alter packet, and their purpose is to modify the Rigid Format which is called for execution by the SOL 9 card. The general topic of NASTRAN Source Program modification, generally known as "altering", is too complicated to be treated in a rigorous manner in this text. Fortunately, all that the casual user needs to realize is that the NTA is composed basically of groups of subprograms known as modules, and that the order in which these modules are selected for execution and the input supplied to them will determine what type of problem is solved. NASTRAN Source Programs, which consist of DMAP control statements (analagous to Fortran statements) specifying the modules to be executed, exist in three fixed forms (i.e., Rigid Formats) for heat transfer problems, and may be selected by specifying SOL 1 (LSS), SOL 3 (NLSS), or SOL 9 (Transient). Modifications to these Rigid Formats are possible but are often complex and always extremely error prone. However, certain useful alters have been developed and incorporated into simple and reliable packets that need only be inserted into the Executive Control Deck to produce the desired result.* The user must only remember to use the alter packet with the Rigid Format for which it was designed, and that should two or more alters be desired simultaneously, the lower numbered alters must directly precede the higher numbered alters with only one ENDALTER card appearing at the end of all of the alters.

In this problem, the alter packet shown will eliminate the SORT2 output and replace it with SORT1. For more detailed information on the uses of DMAP, see the NASTRAN User's Manual, section 5.

c. Case Control: No changes were made from Problem 3.

d. Bulk Data: Field five of the TSTEP card was changed from 1 to 15, which will cause the output to be produced only at every fifteenth time step.

e. Output Produced:

Page No.	Description
9-14	These pages list the DMAP statements which comprise Rigid Format 9. Note the three statements which are labeled 122. The first statement was part of the original rigid format, while the following two were input via the alter in the Case Control.
16 - 23	These pages list the SORT1 load and thermal vectors produced at every fifteenth time step.
30 - 33	These pages contain transient plots of every fifteenth time step only.
Run Log	Note that, in comparison with Problem 3, statement 122 is executed and statement 123 is not.

5. *Sample Problem 5*

a. Intent: This problem, which is based on Problem 4, demonstrates the generation of a structural plot of the NTA model as defined by the heat conduction elements.

b. Executive Control: Since structural plotting is done early in a NASTRAN execution, the existing alter packet from Problem 4 has been modified by the addition of an ALTER 20 and an EXIT $ card. These cards will cause NASTRAN to stop executing

*With the advent of Level 16, certain minor changes may have to be made to these alter packets.

after DMAP statement 20 is completed. Note that the previous alter could have been removed (except for the ENDALTER card) without affecting the results.

c. Case Control: A structural plot package has been added at the end of this deck. This is a general purpose request which will produce two plots (figure 13) of all of the geometrically defined heat conduction elements in the model. The first plot will have the GRID points labeled, while the second will have each element labeled. This plot package, if present, must directly precede the BEGIN BULK card, and will require that a seven-track tape be provided on unit PLT2 (consult your local NASTRAN Systems Programmer). The plot information will be placed on the tape, which then must be processed by a Stromberg-Carlson 4020 plotter to produce the plots on microfilm suitable for printing as desired. Complete plotter information (including more control cards and how to use other plotters) may be found in section 4 of the NASTRAN User's Manual.

d. Bulk Data: No changes were made from Problem 4.

e. Output Produced:

Page No.	Description
9	Note the insertion of the EXIT $ after the original DMAP instruction number 20.
16 - 19	Messages from the structure plotter indicating that two plots have been generated.
Run Log	Note that execution has ceased at DMAP statement 20 due to the alter.
figure 13	Structural plots printed from microfilm.

6. *Sample Problem 6*

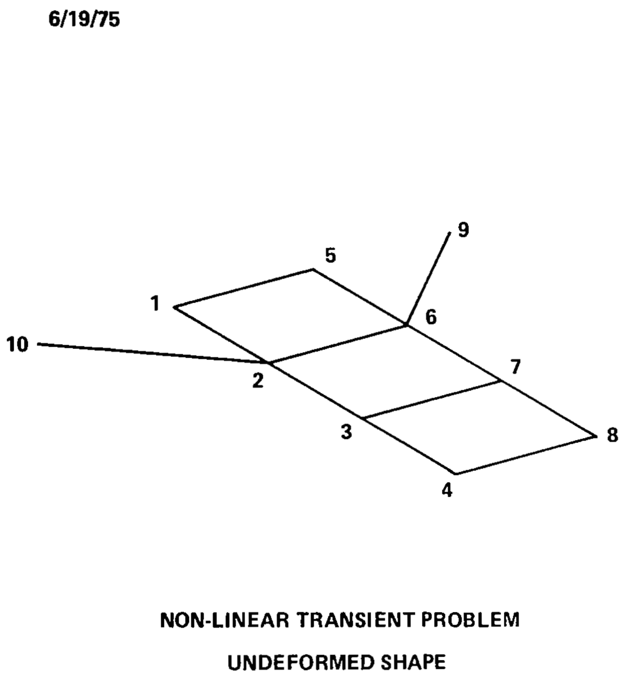
a. Intent: This NLSS problem is based on Problem 2 and demonstrates the modeling of thermal conductivity as a function of temperature.

b. Executive Control: No changes from Problem 2.

c. Case Control: No changes from Problem 2.

d. Bulk Data: Two new types of Bulk Data cards were introduced, MATT4 and TABLEM1. The MATT4 card defines in field two the ID of a MAT4 card which is to be made temperature dependent (in this case, MAT4 1000). Field three references a TABLEM1 card which will provide coefficients as a function of temperature which will be multiplied by the conductivity specified on MAT4 1000. For example, in this problem if an element's temperature were 300 degrees Celsius, then its conductivity would be (200)(1.25) = 250 W/m - °C.

e. Output Produced: No changes in the types of output requested were made from Problem 2. The answers are, of course, different and are consistent with a resultant increase in conductivity (i.e., the Single-Point Constraint Force at



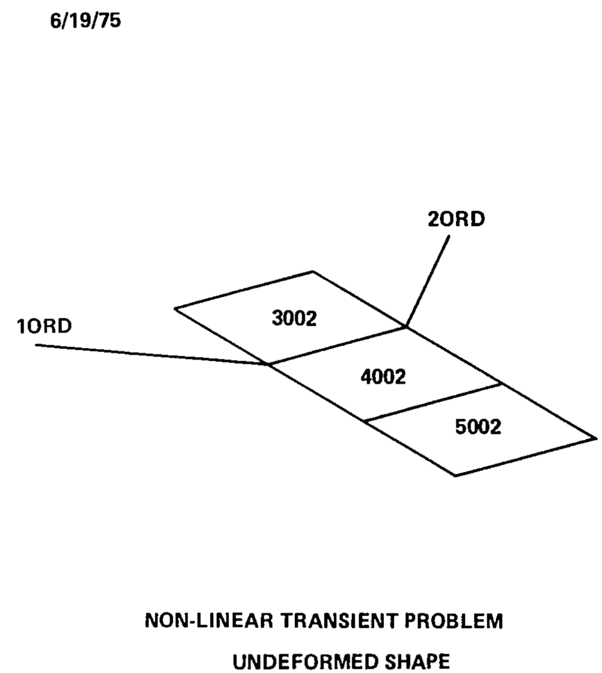


Figure 13. Computer-generated structure plots of the $\overline{\text{N}}$TA model.

GRID 100 increased because the increased conductivity drained more energy from this GRID point than was lost in Problem 2).

7. *Sample Problem 7*

a. Intent: This NLSS problem is based on Problem 2 and demonstrates the modeling of a convective coefficient which is a function of temperature.

b. Executive Control: No changes from Problem 2.

c. Case Control: No changes from Problem 2.

d. Bulk Data: The changes made here were identical to those made in Problem 6, with the exception that a different MAT4 card (one defining a convective film coefficient) was referenced by the MATT4 card.

e. Output Produced: The output format is identical to that of Problem 6.

8. *Sample Problem 8*

a. Intent: This NLSS problem is based on Problem 2 and demonstrates the modeling of anisotropic temperature-dependent thermal conductivity.

b. Executive Control: No changes from Problem 2.

c. Case Control: No changes from Problem 2.

d. Bulk Data: Two new types of Bulk Data cards were introduced, MAT5 and MATT5. They are analogous in function to MAT4 and MATT4 cards, respectively, except that they provide for the specification of anisotropic thermal conductivity (MAT5) and the independent variation of the conductivity components as a function of temperature (MATT5 with TABLEM1). A complete discussion of these card types in this manual would be excessively time consuming, so it will only be noted that the conductivity in the X-direction (along the fin axis) is defined to be identical to that of Problem 6, while the Y-direction conductivity (across the fin) is defined to be zero. See Volume I of the NTA Manual, section 3.5.3, for a detailed description of these new card types.

e. Output Produced: The output format, and the answers, are identical to those obtained in Problem 6. This is due to the fact that since there is no temperature gradient across the fin in this simple model, the reduction in the thermal conductivity in this direction to zero does not affect the results.

9. *Sample Problem 9*

a. Intent: This transient problem is based on Problem 3 and demonstrates the creation of a restart tape along with the punched card checkpoint dictionary required to make use of it. The procedure given is also applicable to SOL 1 or SOL 3 problems. The creation of a restart tape is useful in that it allows the user to reinitiate execution at the point of termination following an abend, or with a minimum of repetition following a small model change. Both of these features can save substantial amounts of computer time.

b. Executive Control: The only change made was the addition of a CHKPNT YES card, which specifies that a restart tape is to be prepared and that a checkpoint dictionary is to be punched to provide a description of the data files on the restart tape. These functions are completely automatic, with the user being required only to provide a tape on unit NPTP (New Problem TaPe) and to enable Fortran unit seven so that the checkpoint dictionary may be punched or directed to disk, tape, etc. Details on these procedures should be obtained from your local NASTRAN Systems Programmer.

c. Case Control: No changes were made, except for the removal of the OLOAD and XYPAPLOT output requests and a change from THERMAL = ALL to THERMAL = 5 to reduce printed output.

d. Bulk Data: No changes from Problem 3.

e. Output Produced:

Page No.	Description
2	This is a printed echo of the first card punched in the checkpoint dictionary.
11 - 13	These pages contain printed echoes of the checkpoint dictionary, interspersed with previously seen user warning and information messages. The exact format of these checkpoint cards is not of value to the user, and it is sufficient simply to realize that each card (except the REENTER cards which indicate DMAP statements at which execution could be reinitiated) defines the location on tape of a certain vector or matrix of information, often called a "data block". Further information on restart may be found in section 3.1 of the NASTRAN User's Manual.
14 - 22	This is a standard SORT2 transient thermal vector as requested in the Case Control Deck.
Cards punched on Fortran unit seven	These cards, not shown here, are identical to those listed on pages 2 and 9 - 11.

10. Sample Problem 10

a. Intent: This transient problem demonstrates the restart procedure using the restart tape and checkpoint dictionary produced in Problem 9.

b. Executive Control: Three changes were made from Problem 9:

i) A transient restart error was corrected by the inclusion of the 4 card alter packet beginning with ALTER 118, 119 and ending with ENDALTER. This packet is required for all transient restarts at Level 15.5.X, and may be required for Level 16.

ii) The checkpoint dictionary as punched in Problem 9 is inserted. The RESTART card will be used to verify that the proper tape has been mounted for the restart run, while the other cards will locate relevant data blocks on the restart tape. The restart tape must be mounted on unit OPTP (Old Problem TaPe).

iii) The CHKPNT card has been removed, though it is possible to make a restart tape during a run which is initiated by a restart tape (however, unit NPTP would have to be enabled in addition to unit OPTP).

c. Case Control: No changes from Problem 9.

d. Bulk Data: The Bulk Data input in this case consists of cards to be added to the listing on the restart tape and / cards which define cards to be removed from the listing on the restart tape. The / cards define, based on the sorted Bulk Data numbers of the cards on the restart tape, the number or numbers of cards to be deleted during the restart run. For example, in Problem 10, card #26 from Problem 9 is to be deleted. A glance back at Problem 9 shows that this is MAT4 1000, which is logical because a new MAT4 1000 card is being provided for this restart run. A restart run in which changes of any sort are made is termed a "modified" restart, as opposed to simply resuming execution after a system failure. An examination of the new sorted Bulk Data echo indicates that the new MAT4 1000 card has indeed replaced the one used in Problem 9.

e. Output Produced:

Page No.	Description
10	This list of modified cards is of little use to the user except as a reminder of the card types which have been changed for the restart run.
11 - 16	The NASTRAN DMAP Source Program used during the restart is automatically provided, and an asterisk is placed to the left of the instruction number of each DMAP statement scheduled to be executed.
Unnumbered Page between 16 and 17	In addition to standard User and Warning messages, a list of the data blocks obtained directly from the restart tape is provided. This list is of little use to the casual user.

Page No.	Description
17 - 25	The change in temperatures from Problem 9 may be observed, demonstrating the effect of the modification during the restart.

11. *Sample Problem 11*

a. Intent: Problem 11 is a transient run based on Problem 3 which demonstrates the application of arbitrary cyclical loads and the production of punched temperature cards.

b. Executive Control: The only change from Problem 3 was the addition of a four card alter packet which will cause the output from a THERMAL request in Case Control to be produced in SORT1 format. In addition all output requests, including THERMAL, will still be produced in SORT2 format. The reason for this alter is that NTA punched temperature cards are only produced correctly during a transient run when the SORT1 format is used, as will become apparent when the output is examined. No problem of this sort exists for punching TEMP cards during NLSS or LSS runs.

c. Case Control: Two changes were made from Problem 3:

   i) The DLOAD card now references set 800 instead of 300. This was done because several load sets have been combined in the Bulk Data as set 800 and must be referenced as such to be applied.

   ii) The THERMAL card now reads THERMAL (PUNCH), which will eliminate the printing of the thermal vector and will substitute the punching of temperature cards. It would also have been possible to request THERMAL (PRINT, PUNCH) to have obtained both types of output simultaneously.

d. Bulk Data: Several new card types are introduced here:

   i) The TLOAD1 card is similar to the previously seen TLOAD2 card except that a TABLED1 card (see below) is referenced in field 6 to provide a multiplying factor which varies as a function of time and will be multiplied by the loads defined by the set specified in field 3 of the TLOAD1 card. In addition, a DELAY set (see below) may be (and is) referenced in field 4 of the TLOAD1 card and specifies a time factor which is to be subtracted from the actual solution time before the TABLED1 card is consulted for the multiplying factor.

   ii) The TABLED1 card defines a multiplying factor versus time relationship which may be referenced by TLOAD1 cards. TABLED2, TABLED3, and/or TABLED4 cards may be used to perform a similar function.

   iii) The DELAY card specifies, on a GRID point basis, a time delay factor that may be used during the table look-up procedure described above. For example, if the solution time were at 1200 seconds, and a delay of 900 seconds had been specified for GRID point 2 via a DELAY card, the table look-up would locate the multiplying factor corresponding to a solution time of 300 seconds.

iv) The DLOAD card must be used if more than one TLOAD1 or TLOAD2 set is to be applied simultaneously. Scale factors are provided on the card and are set to 1.0 for a simple combination of load sets.

In summary, TLOAD2 300 applies loads during the entire solution to GRID points 1 - 8, 100; TLOAD1 700 to GRID points 1 - 8 from 0 to 450 seconds; and TLOAD1 710 to GRID points 1 - 8 from 900 to 1350 seconds.

e. Output Produced:

Page No.	Description
11 -19	Note the cyclic variation of the load vectors.
After the Run Log	This section contains temperature card images as requested by THERMAL (PUNCH). The punched output has deliberately been directed to the printer for presentation purposes. The SORT1 output runs through card 672, and the error in the SORT2 output which follows is easily seen (the program attempts to print a real number, the time, in an integer field).

12. Sample Problem 12

a. Intent: This problem is meant to demonstrate the capability which exists via the VIEW[4] program for generating view factors and RADMTX and RADLST cards directly from the CHBDY boundary element descriptions which are supplied to the NTA to define radiating surfaces. The Bulk Data from Problem 2 was used as input, with the only changes being the addition of a $VIEW* card to define VIEW parameters, the removal of CHBDY 60 which is not a radiating surface and the referencing of the $VIEW card from the CHBDY cards via an entry in field 9 of the CHBDY cards. Comment cards added to the Bulk Data may be seen in Problem 13, which is based on Problem 12. The RADMTX and RADLST cards produced are listed on the last page of output. Details on the operation and capabilities of the VIEW program may be found in the VIEW User's Manual[5] and the VIEW Programmer's Manual[6] obtainable, along with the program, from: COSMIC, Barrow Hall, University of Georgia, Athens, Georgia, 30601.

*This is the only card with a "$" in column 1 which is read as a data card by the VIEW program. All other "$" cards are considered to be comments and are ignored.

13. *Sample Problem 13*

a. Intent: This problem demonstrates a method of plotting CHBDY cards using a special MacNeal-Schwendler version of the $\overline{\text{N}}$TA (check with your local NASTRAN Systems programmer). This plotting capability has not been included in the standard $\overline{\text{N}}$TA version and therefore these boundary elements may not be plotted by them. In addition, this run, which is based on Problem 12, demonstrates that a Bulk Data Deck processed by VIEW can be immediately run on the $\overline{\text{N}}$TA.

b. Executive Control: The alter packet provided must be used to obtain the CHBDY plots. Also note that SOL 1 must be used.

c. Case Control: A structural plot package has been added at the end. It is identical to that used in Problem 5, except that HBDY has been specified on the SET card, so only CHBDY elements will be plotted.

d. Bulk Data: No changes were made from Problem 12, which was the VIEW run. Note the comment cards which were inserted for the VIEW run.

e. Output: The only output of note is the CHBDY plots, figure 14. Note that the element numbers are not clear because of overwriting due to coincident element positions.

14. *Sample Problem 14*

a. Intent: This problem demonstrates an alternate method which may be used to constrain a point to a fixed temperature during a transient run. In Problem 3 a large load was applied to a grounded GRID point to fix its temperature, but in this problem the load and grounding will be replaced with the application of a large thermal mass.

b. Executive Control: No changes were made from Problem 3.

c. Case Control: No changes were made from Problem 3, except to reduce the amount of output requested.

d. Bulk Data: The CELAS2 and SLOAD cards affecting GRID point 100 were removed by converting them to comment cards. CDAMP2 70 was added to apply a thermal mass of 5. x 10^8 Joules to GRID 100, a thermal mass much larger than that associated with the other GRID points in the problem. With an initial temperature of 300°C and this high thermal mass, GRID point 100 will tend to remain at 300°C during the solution.

e. Output Produced:

Page No.	Description
18	The temperature of GRID point 100 has remained very close to 300°C.

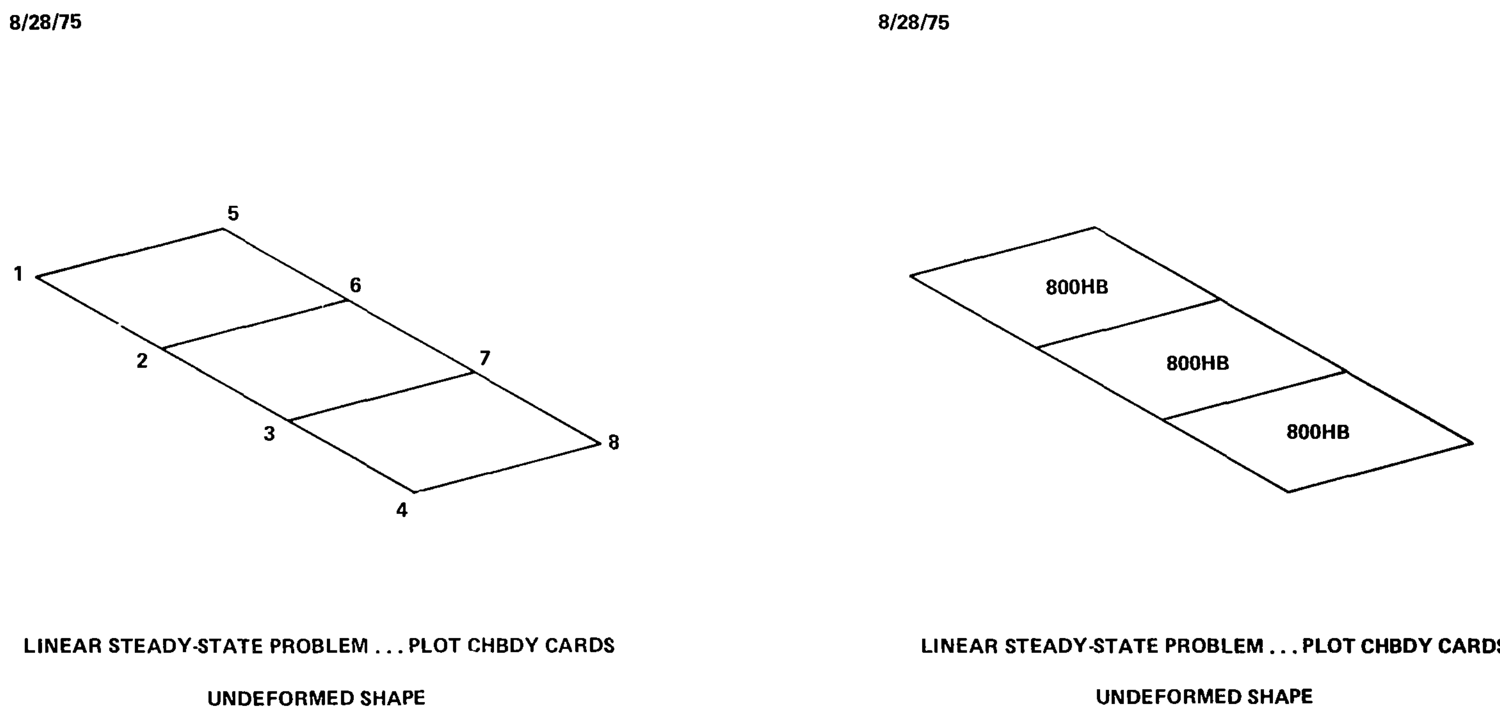


Figure 14. Computer-generated plots of the CHBDY boundary elements.

15. *Sample Problem 15*

a. Intent: This transient problem, which is based on Problem 3, demonstrates the reduction in the emissivity of a CHBDY element to simulate multilayer insulation on the radiating fin surfaces. This is an extremely simplified case which would be valid only for situations in which the multilayer insulation viewed space completely. In addition, it is assumed that the thermal load on the fin is internal to the blanket.

b. Executive Control: No changes from Problem 3.

c. Case Control: No changes from Problem 3, except for a reduction in the output requested.

d. Bulk Data: The only change made from Problem 3 was to reduce the emissivity specified on PHBDY 2000 from 0.9 to 0.02 (a commonly used value for the effective emissivity through a 5 - 10 layer aluminized mylar blanket).

e. Output Produced: No new types of output are produced, though the reader should notice that the temperatures are, as expected, warmer than those in Problem 3.

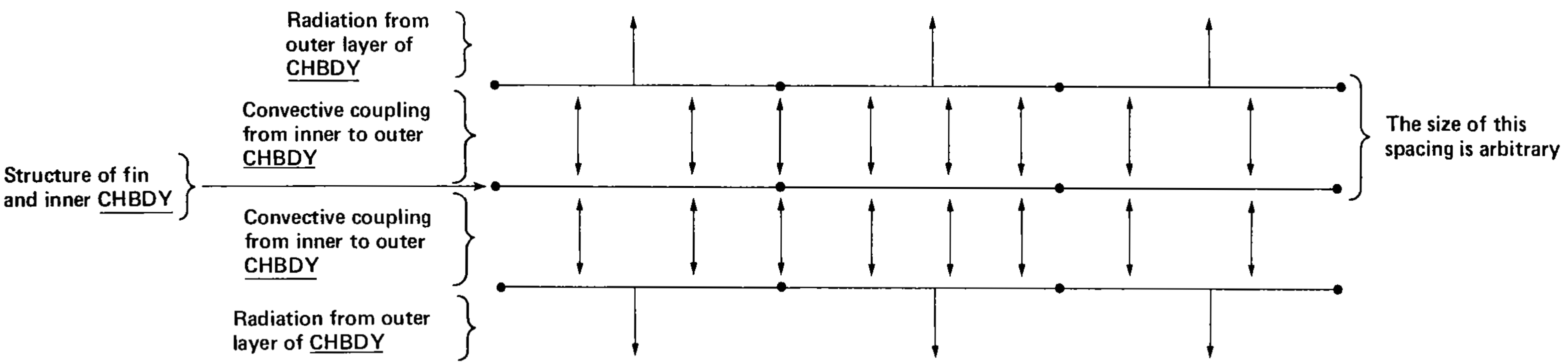
16. *Sample Problem 16*

a. Intent: This NLSS problem, adapted from Problem 2, demonstrates another method of simulating multilayer insulation. A second layer of CHBDY cards is placed on both sides of the fin, and a convective coupling simulating an effective conductance through the multilayer insulation is defined. The old layer of CHBDY cards is no longer allowed to radiate, and the new layer now radiates in its place. The surface properties defined on this outer radiating layer would be those of the outside of the multilayer insulation. See figure 15 for a diagram of this configuration. It should be noted that this method is much more flexible than that employed in Problem 15, in that the multilayer insulation may view any other surfaces, and no effective absorbtivity for externally applied flux need be calculated.

b. Executive Control: No changes from Problem 2.

c. Case Control: No changes from Problem 2.

d. Bulk Data: No new card types were input, but new GRID, CHBDY, PHBDY, and MAT4 cards define the outer radiating surface and the convective film coefficient (effective conductance) from the inner CHBDY cards to the outer CHBDY cards. In addition, the old RADLST card was removed by conversion to a comment card and replaced with a new RADLST card containing the outer layer CHBDY numbers. It is this change which transfers the radiative capability to the outer CHBDY layer.



(SIDE VIEW OF THE RADIATOR FIN)

Figure 15. Multilayer insulation modeled with an effective conductance.

e. Output Produced:

Page No.	Description
Directly precedes page 9	Note that the convergence is very slow. This may be due to a poor thermal guess vector, and Problem 17 will explore this possibility.
9	In the temperature vector, note that the outer insulation temperatures are predicted to be 37 – 39°C.
11	Note that the single-point constraint force is now negative, indicating that heat must be removed from GRID 100 to maintain it at its fixed temperature of 300°C.

17. *Sample Problem 17*

a. Intent: This problem is based on Problem 16 and demonstrates how an improved thermal guess vector can improve the convergence. In addition, the output produced by an ELFORCE request in Case Control is displayed and discussed.

b. Executive Control: No changes were made from Problem 16.

c. Case Control: An ELFORCE = ALL card was added to the output requests. This card is supposed to produce finite element temperature gradients and heat flows through all structural elements in the problem, in addition to an energy summary for each of the boundary (CHBDY) elements. The output produced was not completely correct, as will be discussed later.

d. Bulk Data: TEMP set 400, the thermal guess vector as used in Problem 16, was modified so that it became similar to the answers obtained in Problem 16.

e. Output Produced:

Page No.	Description
Directly precedes page 9	Note that the convergence is superior to that of Problem 16.
9	Note that the major differences in temperatures from Problem 16 are in the outer layer of the insulation.
12 – 14	For the CROD elements, the labeled gradients are actually ΔT and the labeled heat flows are $-K\Delta T$. For the CQUAD2 elements, the labeled gradients are correct and the labeled heat flows are actually heat fluxes. For the heat flow summary on the CHBDY elements, which is correct, a positive value indicates heat flowing into a surface and vice versa.

18. Sample Problem 18

a. Intent: This transient problem is based on Problem 3 and demonstrates the printing out of a NASTRAN Data Block via a DMAP alter, the use of the OTIME option to control output times, and the output produced by the ELFORCE request in a transient run.

b. Executive Control: DIAG 14 was added to provide a listing of the SOL 9 Rigid Format and a three card alter packet was added which will print out the HBGG matrix, the matrix which contains the thermal masses applied to each GRID point in the model. This method of printing out $\overline{\text{N}}$TA matrices is quite general and requires only that the user know the name of the matrix he wishes to print and the location where it is produced in the DMAP rigid format he has selected (the MATPRN request must, of course, follow the creation of the matrix to be printed). This information may be obtained from the NASTRAN Programmer's Manual[7] and the DMAP listings, and with a little practice any user can easily examine any matrix created by the $\overline{\text{N}}$TA.

c. Case Control: Several changes were made, including:

   i) Old output requests have been reduced.

   ii) An ELFORCE = ALL output request was inserted.

   iii) SET 1 was created to define a list of output times, and this set was selected by the OTIME (Output TIME) card.

d. Bulk Data: No changes were made from Problem 3.

e. Output Produced:

Page No.	Description
10	Note the insertion of the MATPRN (MATrix PRiNt) request in the SOL 9 Rigid Format (instruction #33)
15	This is the listing of the thermal mass matrix, HBGG. There are 11 GRID points in the problem and therefore 11 columns in the matrix, with the lowest numbered GRID point being assigned to column 1, etc. Note that this is a diagonal matrix since the $\overline{\text{N}}$TA uses the lumped mass rather than consistent mass formulation. See subsection 2.5.1(2) of Volume I of the $\overline{\text{N}}$TA Manual.
16	Note that the thermal vector is produced only for the time steps requested by the OTIME set selected in the Case Control. This feature may be used with SORT1 output as well as with SORT2.

Page No.	Description
25 - 36	The labeling of the output produced for structural elements by the ELFORCE request has the same errors that were noted in Problem 17. However, the boundary element (CHBDY) heat flow summary is not present in proper format or content, an error which has been fixed in Level 15.9.

19. *Sample Problem 19*

a. Intent: This transient problem is not based on any of the previous problems and is designed to demonstrate the capability of NTA to model problems via finite difference formulations (combined modes using finite difference and finite element techniques simultaneously are also feasible).

b. Executive Control: Standard transient control cards are used.

c. Case Control: Standard transient control cards are used.

d. Bulk Data: This problem models the temperature decay of two conductively coupled GRID points, one held at a fixed temperature and the other radiating and unconstrained.

   i) The GRID cards may or may not be given a precise location. Each GRID point may be considered as a finite difference "node".

   ii) Each GRID point has thermal mass attached to it through the use of CDAMP2 cards, as described in Problem 14.

   iii) GRID points are conductively coupled to one another through the use of CELAS2 cards. Field 3 specifies the coupling in the appropriate units (in this problem, W/°C), and fields 4 and 6 specify the GRID points which are to be coupled.

   iv) A CHBDY POINT boundary element is attached to GRID points which are to radiate, and an area and emissivity are specified on a PHBDY card. RADLST and RADMTX data are supplied as before.

   v) The remaining PARAM, TEMP, and TSTEP cards are as defined previously.

e. Output Produced:

Page No.	Description
5 - 6	A standard SORT2 transient thermal vector is produced. Note that GRID 1 is essentially held fixed at zero degrees Celsius due to its large thermal mass. Also note that the total thermal decay time is 4.5 seconds.

20. Sample Problem 20

a. Intent: This transient problem is based on Problem 3 and is used to demonstrate the use of transfer functions (TF cards) and arbitrary nonlinear loads (NOLINi (i = 1, 2, 3, 4) cards). These cards provide great flexibility and are of use in simulating active thermal control systems.

b. Executive Control: No changes were made from Problem 3.

c. Case Control: A NONLINEAR = 900 load request was added to apply all nonlinear loads with a set number of 900, and a TFL = 902 card selects the transfer function set, TF, which will be applied. Also, a NLLOAD card will produce a printout of the nonlinear loads applied. This would include radiative loads, which are removed from this problem in order to prevent them from obscuring the NOLINi nonlinear loads.

d. Bulk Data: Two new card types were introduced:

   i) The TF card allows the user to specify the temperature and/or $\partial T/\partial t$ of an unattached and unconstrained GRID point in terms of the temperature and/or $\partial T/\partial t$ of one or more independent GRID points in the model ($\partial^2 T/\partial t^2$) is, of course, not relevant to thermal problems). The TF card in this problem senses the temperature of GRID point 4 and sets the temperature of GRID point 904 equal to the negative of it. This action is purely arbitrary and is designed only to demonstrate the use of a transfer function.

   ii) NOLIN1 cards which, like all NOLINi cards, apply loads as a function of the temperature of a referenced GRID point or points, were chosen to apply the nonlinear loads. Loads are to be applied to GRID points 1 and 5 if the temperatures of GRID points 1 and 5, respectively, are less than 300°C. For example, if the temperature of GRID point 1 were 290°C, TABLED1 9004 would be consulted and a multiplying factor of 10 would be returned. This would be multiplied by a scale factor of 1, as specified on the NOLINi card, and a load of 10 watts would be applied to GRID point 1 in the next time step. It should be realized that this is not intended to be a carefully designed thermal control system, but is rather an example of the type of capability which the NTA possesses in this area.

e. Output Produced:

Page No.	Description
12 - 13	A listing of the nonlinear loads at each time step is provided.
25	Note that the temperature of GRID point 904 is the negative of that of GRID point 4, except for the initial condition.

III. REFERENCES

1. Lee, H. P., and J. B. Mason, "NASTRAN Thermal Analyzer: A General Purpose Finite-Element Heat Transfer Computer Program," The 2nd NASTRAN User's Colloquium, NASA TMX-2637, Sept. 1972, pp. 443-454.

2. Lee, H. P., "NASTRAN Thermal Analyzer: Theory and Application Including a Guide to Modeling Engineering Problems, Volume I - The NASTRAN Thermal Analyzer Manual," TR-R-470 NASA - Goddard Space Flight Center, June 1976.

3. McCormick, C. W. (Editor), "The NASTRAN User's Manual (Level 15)," NASA SP-222(01), With Level updates, June 1972, Washington, D. C.

4. Jackson, C. E., Jr. and E. F. Puccinelli, "View Factor Computer Program (VIEW)," NASA Tech Brief B75-10032, April 1975.

5. Puccinelli, E. F., "View Factor Computer Program (Program VIEW) User's Manual," X-324-73-272, Goddard Space Flight Center, July 1973.

6. Jackson, C. E., Jr., "Programmer's Manual for VIEW–A Modification of the RAVFAC View Factor Program for Use with the NASTRAN Thermal Analyzer on IBM-360 Series Computers," X-322-73-120, Goddard Space Flight Center, March 1973.

7. "The NASTRAN Programmer's Manual (Level 15)," NASA SP-223(01), with Level 15.5 updates, May 1973, Washington, D.C.

8. McKee, J., "Navy Structures Computer Program NEWSLETTER," No. 17, May 1975, pp. 5-9.

APPENDIX A

CROSS-REFERENCE OF THE $\bar{N}$TA SAMPLE PROBLEMS VS. THERMAL ANALYSIS FEATURES DEMONSTRATED

APPENDIX A

CROSS-REFERENCE OF THE $\overline{\text{N}}$TA SAMPLE PROBLEMS VS. THERMAL ANALYSIS FEATURES DEMONSTRATED

Thermal Analysis Feature	Sample Problem Number																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Linear Steady-State Run	√												√							
Nonlinear (radiation) Steady-State Run		√				√	√	√								√	√			
Nonlinear (radiation) Transient Run			√	√	√				√	√	√			√	√			√	√	√
DMAP Alter(s)				√	√					√	√		√					√		
Structure Plot					√															
Thermal Conductivity as F(T)						√														
Convective Film Coeff. as F(T)							√													
Anisotropic Thermal Conductivity as F(T)								√												
Generate a Restart Tape and a Checkpoint Deck									√											
Transient Printer Plots			√	√							√									
Reduce Transient Printout Frequency				√																
Define and Use a Set of GRID Points for Output			√	√					√	√	√			√	√			√		√
Only SORT1 Transient Output				√																
Produces Punched Output									√		√	√								
Execute a Modified Restart										√										
Produce Punched TEMP Cards During a Transient Run											√									
Mixed SORT1 and SORT2 Transient Output											√									
Cyclical Transient Loads											√									
Automatically Generate RADMTX & RADLST Cards using the VIEW Program												√								
Generate CHBDY Card Plots using a MacNeal-Schwendler $\overline{\text{N}}$TA Version													√							
Uses SPC Card(s)	√																			
Uses SPC1 Card(s)		√				√	√	√								√	√			
Transient Run Thermal Constraints			√	√					√	√	√			√	√			√	√	√
Uses MPC Card(s)	√	√	√	√		√	√	√	√	√	√			√	√	√	√	√		√
Multilayer Insulation															√	√	√			
Effect of a Modified Guess Vector																	√			
Gradient & Heat Flow Output																	√	√		
Printout of Thermal Mass Matrix																		√		
$\overline{\text{N}}$TA Finite Difference Modeling																			√	
Demonstrates Nonlinear Loads and Transfer Functions																				√
Demonstrates OTIME Option																		√		

APPENDIX B

INFORMATION AND WARNING MESSAGES PRESENT IN THE $\overline{N}$TA SAMPLE PROBLEMS

APPENDIX B

INFORMATION AND WARNING MESSAGES PRESENT IN THE N̄TA SAMPLE PROBLEMS

First Encountered in Sample Problem Number	Message	Description
1	User Information Message 3023	Informs the user about the bandwidth, the active rows and the active columns in the linear thermal stiffness (conductive) matrix.
1	User Information Message 3027	Informs the user as to the number of seconds which will be required to decompose the thermal stiffness matrix, and the type of matrix decomposition being used.
1	User Information Message 3035	Estimate of the solution error for a LSS problem—values less than 10^{-8} are generally acceptable (see section 2.6.1 of Volume I of the N̄TA Manual).
1	System Warning Message 3022	This message is incorrect and should be ignored.
1	User Information Message 207	This message is produced if the Bulk Data Deck is not alphabetically and numerically sorted.
2	User Information Message "Full Internal Space Node Available"	Informs the user that if the view factors do not sum to 1.0, energy will be lost to space.
2	User Information Message "6 Elements have a Total View Factor Less than 0.99"	Informs the user that 6 radiating elements have view factor sums of less than 0.99.

First Encountered in Sample Problem Number	Message	Description
2	System Warning Message 2169	These messages are normal and should be ignored.
2	User Information Message 3028	Informs the user of the bandwidth, active columns, and active rows in the upper triangular portion of the final thermal stiffness matrix for a radiation problem. The BBAR and CBAR values are the bandwidth and active columns, respectively, for the lower triangular portion of the matrix.
2	User Information Message 3086	Informs the user of the reason why solution iterations were terminated during a NLSS run.
3	User Warning Message 54	Informs the user that information supplied on a PARAM card was not required during the program solution.
3	User Warning Message 2077	This message indicates that a DMAP output Data Block has not been created. However, no error has occurred and the warning may be ignored.

APPENDIX C

COMMON $\overline{N}$TA USER ERRORS

APPENDIX C

COMMON N̄TA USER ERRORS

Inevitably, there are common mistakes that a new user is likely to make, and the purpose of this appendix is to provide a checklist of potential oversights that should be considered when an unsuccessful run is being debugged. N̄TA error messages vary from pinpoint problem solvers to obscure signposts, but in most cases the user will be able to use his error message and this appendix to quickly locate and correct common "new user" errors, significantly reducing the learning curve.

1. Do not use the GRDSET card.

2. Avoid the use of permanent SPCs specified on GRID cards and, in any case, never try to constrain any degree–of–freedom (DOF) other than 1.

3. Unless necessary, avoid the use of SPOINT and EPOINT cards – use GRID cards instead and specify 1 whenever a DOF is requested.

4. Whenever a temperature guess or initial condition is input, be certain that a temperature is defined for all of the GRID points in the problem. The easiest way to do this is to include a TEMPD card with each temperature set defined.

5. If a NLSS (SOL 3) problem is producing overflow messages while in subroutine SSGHT, verify that:

   a. The thermal guess vector is requested and is at least 80 percent of the true solution. Make certain that a large load is not inadvertently being applied, a situation which might cause the guess vector to be too low.

   b. The radiation matrix columns do not sum to produce view factors greater than 1.0.

   c. If MPCs are present, the problem does contain nonlinear loads (radiation or thermal conductivity as a function of temperature). The NTA presently has an error which will not permit linear problems with MPCs to be solved by the NLSS algorithm.

6. If nonlinear effects of any sort are applied to a GRID point, that point may only be constrained by an MPC if an equivalence is defined (i.e., one nonlinear GRID point temperature defined as equal to another GRID point temperature).

7. When transient loads are being applied many versions of the N̄TA (but not the GSFC Level 15.5.3 version) will require that a DAREA card be supplied for each load set referenced on a TLOAD1 or TLOAD2 card. This DAREA card most often is set up to simply define a zero load on an arbitrary GRID point (DAREA cards function analogously to SLOAD cards). If a version requires this card and it is not supplied, an abend will occur in module DPD and a message referring to a "missing table" will be produced.

8. When a transient restart is being executed, make certain that DMAP statements 118 and 119 (see Sample Problem 10) are forced to execute by inclusion in an Alter.

9. Always use SPC1 cards, not SPC cards, to constrain GRID points during a NLSS run. The use of SPC cards may work, but they have been known to cause an improper partitioning of the load vector which results in incorrect answers.

10. When radiative interchange is included in a problem be sure to define the Stephan - Boltzmann constant via a PARAM SIGMA card and, if the temperature input is not in absolute temperatures, the value which should be added to the temperatures before T^4 is calculated, via the PARAM TABS card.

11. If convection is desired from a CHBDY card, field 3 of the PHBDY card which is referenced by the CHBDY card must in turn reference a MAT4 card to provide the "h" value, the convective film coefficient.

12. Occasionally, the user may see one or more of his GRID points unexpectedly approach or reach a temperature of zero degrees. In this case verify that:

    a. If convection is used, GRID points are defined on the CHBDY continuation card. Otherwise, the CHBDY card will convect to zero degrees.

    b. If the problem is a transient, no SPC sets have been selected in the Case Control. Any GRID points constrained in this manner will remain at zero degrees.

    c. A CELASi (i = 1, 2, 3, 4) card is not inadvertently coupling a GRID point to "ground", which is always maintained at zero degrees.

13. If the "THRU" option is used to reference a range of card ID numbers, cards of the proper type and ID must exist for the entire range. For example, if "1000 THRU 1005" appears on a QVECT card referencing CHBDY cards, CHBDY cards with ID's of 1000, 1001, 1002, 1003, 1004, and 1005 must all be present in the Bulk Data or an error will result.

14. If an attempt is made to add thermal mass to a system via a convective film coefficient applied to a CHBDY card in a convection mode, 1/2 of the mass will be applied to the CHBDY element GRID points and 1/2 to the GRID points which are convected to. Often this is not what the user desires, and it may be preferable to add extra thermal mass to a system via CDAMP2 cards (see Sample Problems 14 and 19).

15. The use of the "OMIT" option for non-linear problems will produce incorrect answers. This problem is currently being fixed for the transient solution algorithm.

16. Attempts to employ temperature-dependent thermal conductivities and convective film coefficients simultaneously in a NLSS problem have resulted in failures due to instabilities. This problem is also currently being fixed.

17. The SUBCASE and REPCASE options are available only for LSS thermal runs, and their uses in SOL 3 or SOL 9 will produce unpredictable results. Inclusion of this capability is currently being implemented in SOL 3.

18. Excessive amounts of I/O time may be used in modules such as MPYAD if a barely sufficient core space is provided. If the user suspects this problem, he should increase the region request by 50 K decimal 8-bit bytes and look in the Run Log for any improvement.

19. CQDMEM1 cards are not properly handled for heat transfer in most Level 15.5 versions. CQUAD1 or CQUAD2 cards should be substituted if thermal runs are required.

20. Time-varying temperatures may be specified during transient runs by applying large time-varying loads to grounded GRID points (see the description of Problem 3).

21. The use of 7- or 8-digit GRID point numbers may result in a message indicating illegal bulk data on the GRID card in question.

APPENDIX D

HOW TO DOCUMENT A NASTRAN ERROR

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HOW TO DOCUMENT A NASTRAN ERROR

When a N̄TA user encounters an error which does not yield to his diligent and persistent investigation, he should:

1. Attempt to reduce the size of the problem to the minimum possible (preferably less than 50 cards) which still demonstrates the error. This is of great value in clarifying the source of the difficulty to the program analyst, but if impossible, proceed to step 2.

2. Run the erring problem with a DIAG 1, 8, 14, 15, 21, 22 card inserted in the Executive Control to produce invaluable diagnostic output for the program analyst.

3. If possible, generate a run with the minimum of changes required to produce a successful execution.

4. If an IBM machine is being used, the user should convert his final deck to BCD format. This is most easily done by assigning a temporary data set name to unit FT07F001 and punching the temporary data set in a post-NASTRAN job step (specify "COND = EVEN" if required). Any systems programmer can assist the user in this step.

5. Fill out an SPR (Software Problem Report) form (see the following page) as completely as possible.

6. Send the relevant input decks, output, and SPR to:

   NASTRAN Systems Management Office (NSMO)
   Mail Stop 253B
   Langley Research Center
   Hampton, Virginia 23665

In addition, the NASTRAN Thermal Analysis group at the Goddard Space Flight Center would be interested in hearing about thermal errors as they are encountered. We are not in a position to formally attend to program error fixes, but on an informal basis users may call or write to:

> Dr. H. P. Lee (or) C. E. Jackson, Jr.
> Code 322
> Goddard Space Flight Center
> Greenbelt, Maryland 20771
>
> Phone: 301-982-5275
> IDS Code 134

and we would be glad to provide all assistance possible.

NASTRAN SOFTWARE PROBLEM REPORT (SPR)

Date: ______________________

NSMO Use

SPR No. : ______________

Priority : ______________

Date Rec'd. : ______________

Date Assigned: ______________

Originator: ______________________________

Organization: ______________________________

Address: ______________________________

____

____

Phone No.: ______________________________

Materials Submitted:

( ) Output: _____ Runs

( ) Deck

( ) Plots

( ) Letter

( ) Dump

( ) Traceback

( ) Fix: ______________

( ) Program Listing

( ) Link Map Listing

( ) Other: ______________

Level: ______________________________

Computer: ______________________________

Rigid Format: ___,___ ☐ Disp ☐ Heat ☐ Aero

or ☐ DMAP ☐ Alters

Error Message: ______________________________

Module: ______________________________

Subroutine(s): ______________________________

____

____

____

____

Avoidance (if known): ______________________________

____

____

Estimate correction effort (if known): ________

____

____

Description: ____

____

____

____

____

____

____

____

NSMO Use

Level Fixed : ______________________________

Test Problem : ______________________________

Verified by NSMO : ______________________________

Rev 2/5/75

APPENDIX E

DANGERS IN THE USE OF NASTRAN NON-LINEAR LOADS IN STRUCTURAL TRANSIENT ANALYSES

APPENDIX E

DANGERS IN THE USE OF NASTRAN NON-LINEAR LOADS IN STRUCTURAL TRANSIENT ANALYSES

The following remarks appeared in the Navy Structures Computer Program NEWSLETTER[8], and are reproduced here to acquaint the new user with some of the difficulties encountered in transient analyses of structural problems employing non-linear loads. Problems involving radiative heat transfer should not be considered subject to these remarks, as the thermal stiffness (conductivity) matrix has been specially conditioned in these cases.

NONLINEAR TRANSIENT ANALYSIS

NASTRAN's nonlinear transient capability is mathematically straightforward and appears to be relatively simple to use. Unfortunately, this is not always true. Typically, NASTRAN's nonlinear capability is used to provide nonlinear boundary conditions for a large structural problem that is otherwise linear or to model a few nonlinear elastic or elastic-plastic elements in a problem which consists mostly of linear elements. Persons contemplating the use of NASTRAN's nonlinear capability for these types of problems may find the following observations helpful.

A major technical difficulty with NASTRAN's nonlinear capability arises from the fact that only one numerical integration algorithm is available for transient analysis involving coupled equations. This algorithm, known as the Newmark Beta Method, uses a fixed time step size which has been chosen by the user. Although this is an efficient algorithm for large systems of linear equations, it may be quite inefficient for problems with strong nonlinearities. Usually integration algorithms which automatically vary the time step size according to some convergence criterion, are better suited for nonlinear problems.

The use of nonlinear loads and the construction of nonlinear elements also requires a lot of manual "bookkeeping" as does the use of direct input matrices and transfer functions -- offering many opportunities for data errors. Automatic data checking is not effective in detecting these errors since the nonlinear features are pure mathematical abstractions with no direct physical ties.

A prudent approach to the use of NASTRAN's nonlinear features would include experimentation with small sample problems with known solutions. Such samples can be chosen to have the essential characteristics of the problem to be solved and will permit the user to become familiar with the required procedures and will provide some insight into the intricacies of the method (particularly the selection of appropriate time step size).

One source of instability is a time lag error, which occurs because the nonlinear loads are computed for n-th time step based on displacement values at the $(n-1)^{st}$ time step. The larger the time step the greater the deviation of the nonlinear load from the desired value. If the time step size does not change during the solution, the value of the displacements at the n-th time step can sometimes be estimated using the following formula:

$$U_n \approx \hat{U}_{n-1} = U_{n-1} + \alpha \dot{U}_{n-1} \Delta t + \beta \ddot{U}_{n-1} (\Delta t)^2$$

where $\hat{U}$ is introduced as a new independent variable for the nonlinear functions, $0 \leq \alpha \leq 1$, and $0 \leq \beta \leq 1$. This relationship can be defined using NASTRAN's direct input matrices or transfer functions. The $\ddot{U}$ term is seldom significant and is usually ignored. Values for α are best determined empirically. The choice, $\alpha=1$, seems to work well for short durations, but tends to cause instabilities when the integration is carried out for longer time periods.

Often the user will have a choice as to the duration of a nonlinear load. Because of the time lag error, the shorter the application of a nonlinear load the more stability the problem will exhibit. For example, in modeling a spring that "bottoms," shown in Figure 1-a, one could choose a nonlinear force, F(U), as shown in Figure 1-b (probably the most straightforward representation). Because the value of this loading function will be non-zero except when U is zero, there will be certain time lag errors added to the solution at each step of the problem. F(U) can be decomposed into the sum of a linear spring (dashed line) and a nonlinear load (solid line), as shown in Figure 1-c. Unless the loads are such that the spring is "bottomed" during most of the time history, the nonlinear force will be non-zero most of the time with the time-lag error accumulating as before. Figure 1-d also shows F(U) decomposed into a linear spring and a nonlinear load. In this case, when the spring is not "bottomed," the nonlinear load will be zero and the solution will have correspondingly less accumulated error.

A problem which seems to be related to the time lag error is an instability in the use of nonlinear loads which are dependent on velocities. An example which employs this technique is the model of a Coulomb damper given in the NASTRAN Theoretical Manual (p. 11.2-2, Dec. '72 Edition). Many people (MacNeal-Schwendler Corp., NSRDC, NASA-Goddard) have modified NASTRAN to reduce this instability by permitting nonlinear loads to be dependent directly on velocities computed by the backward difference formula

$$\dot{U}_n \approx \frac{1}{\Delta t} (U_n - U_{n-1})^*$$

This technique does improve stability, but the user should be cautioned that the velocities which are output by NASTRAN are computed by a central difference formula, $\dot{U}_n \approx \frac{1}{2\Delta t} (U_{n+1} - U_{n-1})$ and may differ significantly from those used to compute the nonlinear loads.

---

* In Navy-NASTRAN the dependent velocity is indicated by adding 10 to the component number (field 7) of the NOLINi cards (velocities of scalar points are indicated by the component number 10).

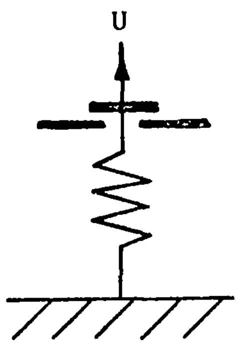


Figure 1-a

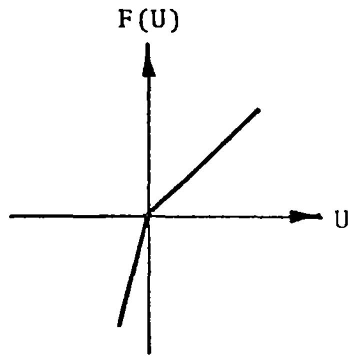


Figure 1-b

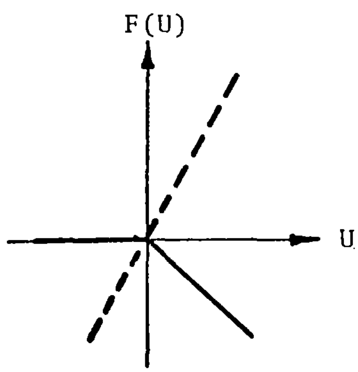


Figure 1-c

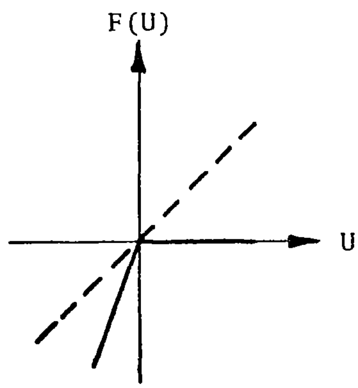


Figure 1-d

In attempting to model an elastic-plastic material following the example in the Theoretical Manual (p. 11.2-4) one encounters several problems. First, nonlinear loads which were direct functions of velocity are required to achieve a stable solution with a finite time step. Second, the model must be modified by adding a small mass, M_2, as shown in Figure 2-a, again for stability.

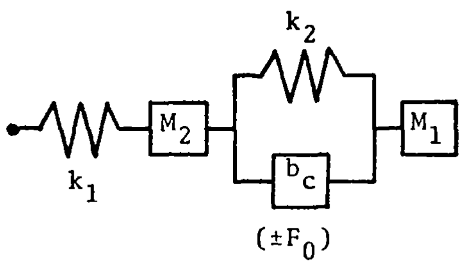


Figure 2-a

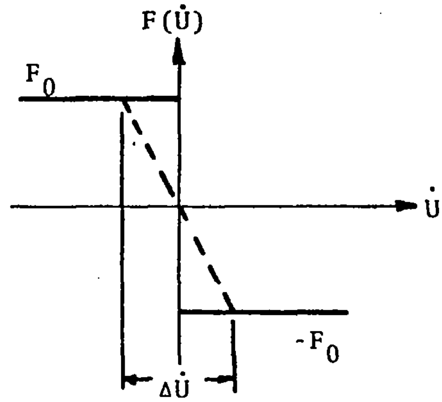


Figure 2-b

Without M_2, the system responds instantaneously to the nonlinear loads associated with the Coulomb damper, b_c. This in turn causes a sign change in the velocity which causes a nonlinear load of opposite sign to be applied at the next step. This configuration does not represent the desired model for finite size time steps. Since the mass M_2 is not part of the physical system being modeled it does introduce a further level of approximation and hence M_2 should be kept small with respect to the other masses in the model. However, the smaller the value of M_2 that is chosen the smaller the time step must be for a stable solution. Ideally the nonlinear loading function for the Coulomb damper would follow the solid line with a finite jump at U=0 shown in Figure 2-b. Again, for stability reasons, the ideal function should be replaced by a continuous function such as the dashed curve in the figure. However, the dashed portion of the curve has the effect of introducing a viscous damper in the system, hence a further approximation. This damping will decrease as $\Delta\dot{U}$ is made smaller, but correspondingly smaller time steps will be required for a convergent solution.

These observations have been made from the practical viewpoint of getting acceptable nonlinear solutions from NASTRAN. Obviously, many interesting theoretical questions arise which ought to be answered before a user could really feel comfortable with nonlinear functions and NASTRAN's integration algorithm. Persons contemplating a large effort involving nonlinear transient solutions should be aware of NASTRAN's current limitations. It may prove to be more economical to acquire an integration algorithm which is more amenable to nonlinear problems than to persist with the one now available in NASTRAN.

J. McKee

APPENDIX F

IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$***************************************************************************
$ START OF EXECUTIVE CONTROL ***********************************************
$***************************************************************************
$
ID CLASS PROBLEM ONE, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE LINEAR STEADY-STATE SOLUTION ALGORITHM IS TO BE USED
$
SOL 1
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $*************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL **************************
  4      $*************************************************************************
  5      $
  6      TITLE=     LINEAR STEADY-STATE PROBLEM
  7      $
  8      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
  9      $
 10      LINE=51
 11      $
 12      $ REQUEST SORTED AND UNSORTED OUTPUT
 13      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 14      $
 15      ECHO=BOTH
 16      $
 17      $ SELECT THE SPC, MPC, AND LOAD SETS TO BE USED IN THIS SOLUTION
 18      $
 19      SPC=100
 20      MPC=200
 21      LOAD=300
 22      $
 23      $ SELECT THE OUTPUT DESIRED (TEMPERATURES, LOADS, AND CONSTRAINT POWERS)
 24      $
 25      OUTPUT
 26      THERMAL=ALL
 27      OLOAD=ALL
 28      SPCF=ALL
 29      $
 30      $*************************************************************************
 31      $ END CASE CONTROL --- START BULK DATA ************************************
 32      $*************************************************************************
 33      $
 34      BEGIN BULK
```

INPUT BULK DATA DECK ECHO

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY
$
MAT4    1000    200.                                                    ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
SPC     100     100     1       300.
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
     1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
SLOAD   300     1       4.      2       8.
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*****************************************************************************
$ END OF BULK DATA ***********************************************************
$*****************************************************************************
$
ENDDATA
```

TOTAL COUNT= 61

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED.XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
1-	CHBDY	60	300	LINE	1	5				+CONVEC
2-	+CONVEC	100	100							
3-	CQUAD2	30	200	1	2	6	5			
4-	CQUAD2	40	200	2	3	7	6			
5-	CQUAD2	50	200	3	4	8	7			
6-	CROD	10	100	10	2					
7-	CROD	20	100	9	6					
8-	GRID	1		0.0	0.0	0.0				
9-	GRID	2		.1	0.0	0.0				
10-	GRID	3		.2	0.0	0.0				
11-	GRID	4		.3	0.0	0.0				
12-	GRID	5		0.0	.1	0.0				
13-	GRID	6		.1	.1	0.0				
14-	GRID	7		.2	.1	0.0				
15-	GRID	8		.3	.1	0.0				
16-	GRID	9		0.0	.2	0.0				
17-	GRID	10		0.0	-.1	0.0				
18-	GRID	100		-.05	.05	0.0				
19-	MAT4	1000	200.							ALUMINUM
20-	MAT4	3000	200.							
21-	MPC	200	9	1	1.	5	1	-1.		
22-	MPC	200	10	1	1.	1	1	-1.		
23-	PHBDY	300	3000	.314						
24-	PQUAD2	200	1000	.01						
25-	PROD	100	1000	.001						
26-	SLOAD	300	1	4.	2	8.				
27-	SLOAD	300	3	8.	4	4.				
28-	SLOAD	300	5	4.	6	8.				
29-	SLOAD	300	7	8.	8					
30-	SPC	100	100	1	300.					
	ENDDATA									

NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM

```
*** USER INFORMATION MESSAGE 3023.          B =      5
                                            C =      0
                                            R =      4

*** USER INFORMATION MESSAGE 3027. SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS        0  SECONDS.

*** USER INFORMATION MESSAGE 3035
```

```
FOR LOAD     1 EPSILON SUB E = -7.6553228E-16


*** SYSTEM WARNING MESSAGE 3022
    DATA BLOCK PLTPAR   IS REQUIRED AS INPUT AND IS NOT OUTPUT BY A PREVIOUS MODULE IN THE CURRENT DMAP ROUTE.
```

T E M P E R A T U R E   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	3.076433E 02	3.159275E 02	3.279275E 02	3.319275E 02	3.076433E 02	3.159275E 02
7	S	3.279275E 02	3.319275E 02	3.076433E 02	3.076433E 02		
100	S	3.000000E 02					

L O A D   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	4.000000E 00	8.000000E 00	8.000000E 00	4.000000E 00	4.000000E 00	8.000000E 00
7	S	8.000000E 00	4.000000E 00				

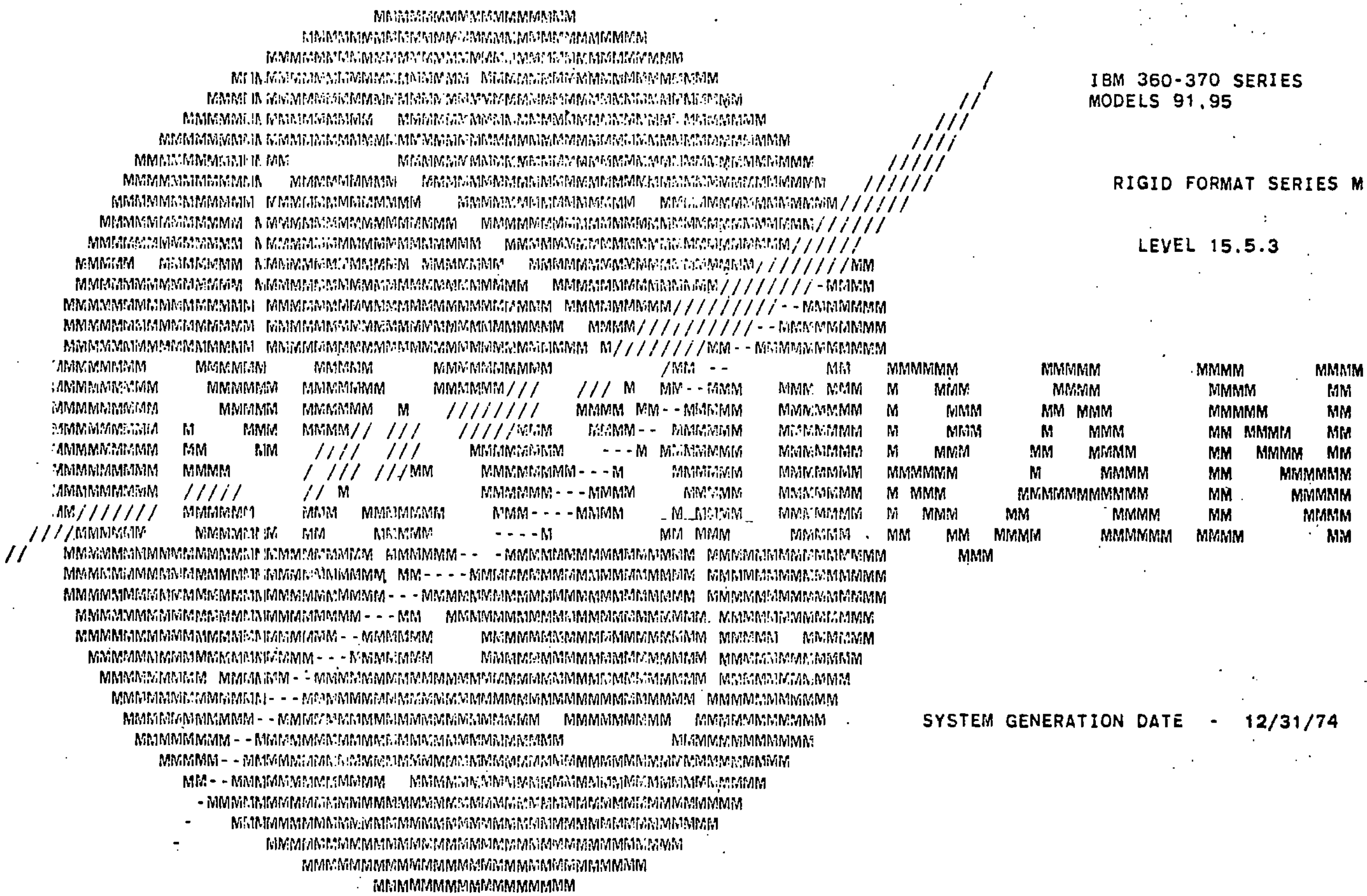
F O R C E S   O F   S I N G L E - P O I N T   C O N S T R A I N T

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
100	S	-4.799998E 01					

```
NASTRAN LOADED AT LOCATION 17CF20
TIME TO GO = 179 CPU SEC., 179 I/O SEC.
*     0 CPU-SEC.        0 ELAPSED-SEC.     SEM1   BEGN
*     0 CPU-SEC.        0 ELAPSED-SEC.     SEMT
*     0 CPU-SEC.        4 ELAPSED-SEC.     NAST
*     0 CPU-SEC.        4 ELAPSED-SEC.     GNFI
*     0 CPU-SEC.        4 ELAPSED-SEC.     XCSA
*     0 CPU-SEC.        7 ELAPSED-SEC.     IFP1
*     0 CPU-SEC.       11 ELAPSED-SEC.     XSOR
*     1 CPU-SEC.       17 ELAPSED-SEC.       DO   IFP
*     1 CPU-SEC.       33 ELAPSED-SEC.      END   IFP
*     1 CPU-SEC.       33 ELAPSED-SEC.     XGPI
*     3 CPU-SEC.       40 ELAPSED-SEC.     SEM1   END
*     3 CPU-SEC.       41 ELAPSED-SEC.     ----   LINKNS02 ---
=    19 I/O SEC.
LAST LINK DID NOT USE        0 BYTES OF OPEN CORE
*     3 CPU-SEC.       43 ELAPSED-SEC.     ----   LINK END ---
*     3 CPU-SEC.       43 ELAPSED-SEC.     XSFA
*     3 CPU-SEC.       45 ELAPSED-SEC.     XSFA
*     3 CPU-SEC.       45 ELAPSED-SEC.     4      GP1      BEGN
*     3 CPU-SEC.       51 ELAPSED-SEC.     4      GP1      END
*     3 CPU-SEC.       52 ELAPSED-SEC.     7      GP2      BEGN
*     3 CPU-SEC.       53 ELAPSED-SEC.     7      GP2      END
*     3 CPU-SEC.       54 ELAPSED-SEC.     9      PLTSET   BEGN
*     3 CPU-SEC.       55 ELAPSED-SEC.     9      PLTSET   END
*     3 CPU-SEC.       56 ELAPSED-SEC.     11     PRTMSG   BEGN
*     3 CPU-SEC.       57 ELAPSED-SEC.     11     PRTMSG   END
*     3 CPU-SEC.       57 ELAPSED-SEC.     12     SETVAL   BEGN
*     3 CPU-SEC.       57 ELAPSED-SEC.     12     SETVAL   END
*     3 CPU-SEC.       58 ELAPSED-SEC.     20     GP3      BEGN
*     3 CPU-SEC.       62 ELAPSED-SEC.     20     GP3      END
*     3 CPU-SEC.       64 ELAPSED-SEC.     22     PARAM    BEGN
*     3 CPU-SEC.       64 ELAPSED-SEC.     22     PARAM    END
*     3 CPU-SEC.       65 ELAPSED-SEC.     25     TA1      BEGN
*     4 CPU-SEC.       79 ELAPSED-SEC.     25     TA1      END
*     4 CPU-SEC.       80 ELAPSED-SEC.     27     PARAM    BEGN
*     4 CPU-SEC.       80 ELAPSED-SEC.     27     PARAM    END
*     4 CPU-SEC.       83 ELAPSED-SEC.     ----   LINKNS03 ---
=    47 I/O SEC.
LAST LINK DID NOT USE   41828 BYTES OF OPEN CORE
*     4 CPU-SEC.       86 ELAPSED-SEC.     ----   LINK END ---
*     4 CPU-SEC.       86 ELAPSED-SEC.     32     SMA1     BEGN
*     4 CPU-SEC.       90 ELAPSED-SEC.     32     SMA1     END
*     4 CPU-SEC.       94 ELAPSED-SEC.     50     PARAM    BEGN
*     4 CPU-SEC.       94 ELAPSED-SEC.     50     PARAM    END
*     4 CPU-SEC.       95 ELAPSED-SEC.     XSFA
*     4 CPU-SEC.       96 ELAPSED-SEC.     XSFA
*     4 CPU-SEC.       96 ELAPSED-SEC.     ----   LINKNS04 ---
=    54 I/O SEC.
LAST LINK DID NOT USE   23206 BYTES OF OPEN CORE
*     4 CPU-SEC.       98 ELAPSED-SEC.     ----   LINK END ---
*     4 CPU-SEC.       98 ELAPSED-SEC.     53     GP4      BEGN
*     4 CPU-SEC.      105 ELAPSED-SEC.     53     GP4      END
*     4 CPU-SEC.      106 ELAPSED-SEC.     56     PARAM    BEGN
*     4 CPU-SEC.      106 ELAPSED-SEC.     56     PARAM    END
*     4 CPU-SEC.      108 ELAPSED-SEC.     61     GPSP     BEGN
```

```
*     4 CPU-SEC.      108 ELAPSED-SEC.     61    GPSP     END
*     4 CPU-SEC.      108 ELAPSED-SEC.     ----  LINKNS14 ---
=    64 I/O SEC.
 LAST LINK DID NOT USE   76024 BYTES OF OPEN CORE
*     4 CPU-SEC.      110 ELAPSED-SEC.     ----  LINK END ---
*     4 CPU-SEC.      110 ELAPSED-SEC.     62    OFP      BEGN
*     4 CPU-SEC.      111 ELAPSED-SEC.     62    OFP      END
*     4 CPU-SEC.      112 ELAPSED-SEC.     ----  LINKNS04 ---
=    67 I/O SEC.
 LAST LINK DID NOT USE   74704 BYTES OF OPEN CORE
*     5 CPU-SEC.      114 ELAPSED-SEC.     ----  LINK END ---
*     5 CPU-SEC.      114 ELAPSED-SEC.     66    MCE1     BEGN
*     5 CPU-SEC.      119 ELAPSED-SEC.     66    MCE1     END
*     5 CPU-SEC.      120 ELAPSED-SEC.     68    MCE2     BEGN
*     5 CPU-SEC.      123 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     5 CPU-SEC.      125 ELAPSED-SEC.     MPYA  D
*     5 CPU-SEC.      125 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     5 CPU-SEC.      126 ELAPSED-SEC.     MPYA  D
*     5 CPU-SEC.      126 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     5 CPU-SEC.      127 ELAPSED-SEC.     MPYA  D
*     5 CPU-SEC.      127 ELAPSED-SEC.     68    MCE2     END
*     6 CPU-SEC.      129 ELAPSED-SEC.     74    SCE1     BEGN
*     6 CPU-SEC.      132 ELAPSED-SEC.     74    SCE1     END
*     6 CPU-SEC.      135 ELAPSED-SEC.     XSFA
*     6 CPU-SEC.      136 ELAPSED-SEC.     XSFA
*     6 CPU-SEC.      136 ELAPSED-SEC.     89    RBMG2    BEGN
*     6 CPU-SEC.      137 ELAPSED-SEC.     SDCO  MP
*     6 CPU-SEC.      138 ELAPSED-SEC.     SDCO  MP
*     6 CPU-SEC.      139 ELAPSED-SEC.     89    RBMG2    END
*     6 CPU-SEC.      140 ELAPSED-SEC.     ----  LINKNS05 ---
=    86 I/O SEC.
 LAST LINK DID NOT USE   68368 BYTES OF OPEN CORE
*     6 CPU-SEC.      143 ELAPSED-SEC.     ----  LINK END ---
*     6 CPU-SEC.      143 ELAPSED-SEC.     95    SSG1     BEGN
*     6 CPU-SEC.      151 ELAPSED-SEC.     95    SSG1     END
*     6 CPU-SEC.      155 ELAPSED-SEC.     100   SSG2     BEGN
*     6 CPU-SEC.      157 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     6 CPU-SEC.      160 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.      164 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     6 CPU-SEC.      165 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.      166 ELAPSED-SEC.     100   SSG2     END
*     6 CPU-SEC.      166 ELAPSED-SEC.     XSFA
*     6 CPU-SEC.      167 ELAPSED-SEC.     XSFA
*     6 CPU-SEC.      167 ELAPSED-SEC.     103   SSG3     BEGN
*     6 CPU-SEC.      167 ELAPSED-SEC.     FBS
*     6 CPU-SEC.      169 ELAPSED-SEC.     FBS
*     6 CPU-SEC.      169 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     7 CPU-SEC.      171 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.      173 ELAPSED-SEC.     103   SSG3     END
*     7 CPU-SEC.      174 ELAPSED-SEC.     XSFA
*     7 CPU-SEC.      175 ELAPSED-SEC.     XSFA
*     7 CPU-SEC.      175 ELAPSED-SEC.     ----  LINKNS12 ---
=   104 I/O SEC.
 LAST LINK DID NOT USE   24440 BYTES OF OPEN CORE
*     7 CPU-SEC.      177 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.      177 ELAPSED-SEC.     110   SDR1     BEGN
*     7 CPU-SEC.      181 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
```

```
 *      7 CPU-SEC.       182 ELAPSED-SEC.     MPYA  D
 *      7 CPU-SEC.       182 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
 *      7 CPU-SEC.       183 ELAPSED-SEC.     MPYA  D
 *      7 CPU-SEC.       185 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
 *      8 CPU-SEC.       186 ELAPSED-SEC.     MPYA  D
 *      8 CPU-SEC.       189 ELAPSED-SEC.     110   SDR1     END
 *      8 CPU-SEC.       191 ELAPSED-SEC.     XSFA
 *      8 CPU-SEC.       192 ELAPSED-SEC.     XSFA
 *      8 CPU-SEC.       192 ELAPSED-SEC.     ----  LINKNS13 ---
 =    116 I/O SEC.
  LAST LINK DID NOT USE   78108 BYTES OF OPEN CORE
 *      8 CPU-SEC.       196 ELAPSED-SEC.     ----  LINK END ---
 *      8 CPU-SEC.       196 ELAPSED-SEC.     119   SDR2     BEGN
 *      8 CPU-SEC.       200 ELAPSED-SEC.     119   SDR2     END
 *      8 CPU-SEC.       201 ELAPSED-SEC.     ----  LINKNS14 ---
 =    121 I/O SEC.
  LAST LINK DID NOT USE   25468 BYTES OF OPEN CORE
 *      8 CPU-SEC.       205 ELAPSED-SEC.     ----  LINK END ---
 *      8 CPU-SEC.       205 ELAPSED-SEC.     120   OFP      BEGN
 *      8 CPU-SEC.       207 ELAPSED-SEC.     120   OFP      END
 *      8 CPU-SEC.       207 ELAPSED-SEC.     139   EXIT     BEGN
 -------------------------------------------------------------------------------------------------------------
 =    124 I/O SEC.
  LAST LINK DID NOT USE   68004 BYTES OF OPEN CORE
  AMOUNT OF OPEN CORE NOT USED =    OK BYTES
```



IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*************************************************************************************
$ START OF EXECUTIVE CONTROL *********************************************************
$*************************************************************************************
$
ID CLASS PROBLEM TWO, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR STEADY-STATE SOLUTION ALGORITHM IS TO BE USED
$
SOL 3
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $*******************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ******************************
  4      $*******************************************************************************
  5      $
  6      TITLE=      NON-LINEAR STEADY-STATE PROBLEM
  7      $
  8      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
  9      $
 10      LINE=51
 11      $
 12      $ REQUEST SORTED AND UNSORTED OUTPUT
 13      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 14      $
 15      ECHO=BOTH
 16      $
 17      $ SELECT THE SPC, MPC, AND LOAD SETS TO BE USED IN THIS SOLUTION
 18      $
 19      SPC=100
 20      MPC=200
 21      LOAD=300
 22      $
 23      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 24      $
 25      TEMP(MATERIAL)=400
 26      $
 27      $ SELECT THE OUTPUT DESIRED (TEMPERATURES, LOADS, AND CONSTRAINT POWERS)
 28      $
 29      OUTPUT
 30      THERMAL=ALL
 31      OLOAD=ALL
 32      SPCF=ALL
 33      $
 34      $*******************************************************************************
 35      $ END CASE CONTROL --- START BULK DATA *****************************************
 36      $*******************************************************************************
 37      $
 38      BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY
$
MAT4    1000    200.                                                    ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      .       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$***************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                            .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

INPUT BULK DATA DECK ECHO

```
            .   1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
            $*******************************************************************************
            $ END OF BULK DATA *************************************************************
            $*******************************************************************************
            $
            ENDDATA
        TOTAL COUNT=   107
```

*** USER INFORMATION MESSAGE 207. BULK DATA NOT SORTED,XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
1-	CHBDY	60	300	LINE	1	5				+CONVEC
2-	+CONVEC	100	100							
3-	CHBDY	200	2000	AREA4	1	2	6	5		
4-	CHBDY	300	2000	AREA4	2	3	7	6		
5-	CHBDY	400	2000	AREA4	3	4	8	7		
6-	CHBDY	500	2000	AREA4	5	6	2	1		
7-	CHBDY	600	2000	AREA4	6	7	3	2		
8-	CHBDY	700	2000	AREA4	7	8	4	3		
9-	CQUAD2	30	200	1	2	6	5			
10-	CQUAD2	40	200	2	3	7	6			
11-	CQUAD2	50	200	3	4	8	7			
12-	CROD	10	100	10	2					
13-	CROD	20	100	9	6					
14-	GRID	1		0.0	0.0	0.0				
15-	GRID	2		.1	0.0	0.0				
16-	GRID	3		.2	0.0	0.0				
17-	GRID	4		.3	0.0	0.0				
18-	GRID	5		0.0	.1	0.0				
19-	GRID	6		.1	.1	0.0				
20-	GRID	7		.2	.1	0.0				
21-	GRID	8		.3	.1	0.0				
22-	GRID	9		0.0	.2	0.0				
23-	GRID	10		0.0	-.1	0.0				
24-	GRID	100		-.05	.05	0.0				
25-	MAT4	1000	200.							ALUMINUM
26-	MAT4	3000	200.							
27-	MPC	200	9	1	1.	5	1	-1.		
28-	MPC	200	10	1	1.	1	1	-1.		
29-	PARAM	EPSHT	.0001							
30-	PARAM	MAXIT	8							
31-	PARAM	SIGMA	5.685E-8							
32-	PARAM	TABS	273.15							
33-	PHBDY	300	3000	.314						
34-	PHBDY	2000			.90					
35-	PQUAD2	200	1000	.01						
36-	PROD	100	1000	.001						
37-	RADLST	200	300	400	500	600	700			
38-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
39-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
40-	RADMTX	3	0.0	0.0	0.0	0.0				
41-	RADMTX	4	0.0	0.0	0.0					
42-	RADMTX	5	0.0	0.0						
43-	RADMTX	6	0.0							
44-	SLOAD	300	1	4.	2	8.				
45-	SLOAD	300	3	8.	4	4.				
46-	SLOAD	300	5	4.	6	8.				
47-	SLOAD	300	7	8.	8	[illegible]				
48-	SPC1	100	1	100						
49-	TEMP	400	100	300.						
50-	TEMPD	400	300.							
	ENDDATA									

NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM

```
*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE     .   6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023,          B =      3
                                            C =      0
                                            R =      2

*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS       0  SECONDS.




*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          1

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          1

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HRFN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HRSN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          2

*** USER INFORMATION MESSAGE 3028,       B =     4     BBAR =     5
                                         C =     3     CBAR =     0
                                         R =     7

*** USER INFORMATION MESSAGE 3027, UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS       0 SECONDS.
```

D I A G   1 8   O U T P U T   F R O M   S S G H T

ITERATION	EPSILON-P	LAMEDA-1	EPSILON-T
1	7.890695E-02		
2	6.502289E-03	1.366183E 01	6.337976E-04
3	1.208152E-03	5.517917E 00	3.211591E-04
4	2.370754E-04	5.129703E 00	6.845902E-05

*** USER INFORMATION MESSAGE 3086, ENTERING SSGHT EXIT MODE BY REASON NUMBER 1 (NORMAL CONVERGENCE)

T E M P E R A T U R E   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	2.746404E 02	2.486993E 02	2.158606E 02	2.058354E 02	2.746404E 02	2.486993E 02
7	S	2.158606E 02	2.058354E 02	2.746404E 02	2.746404E 02		
100	S	3.000000E 02					

LOAD VECTOR

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	4.000000E 00	8.000000E 00	8.000000E 00	4.000000E 00	4.000000E 00	8.000000E 00
7	S	8.000000E 00	4.000000E 00				

F O R C E S   O F   S I N G L E - P O I N T   C O N S T R A I N T

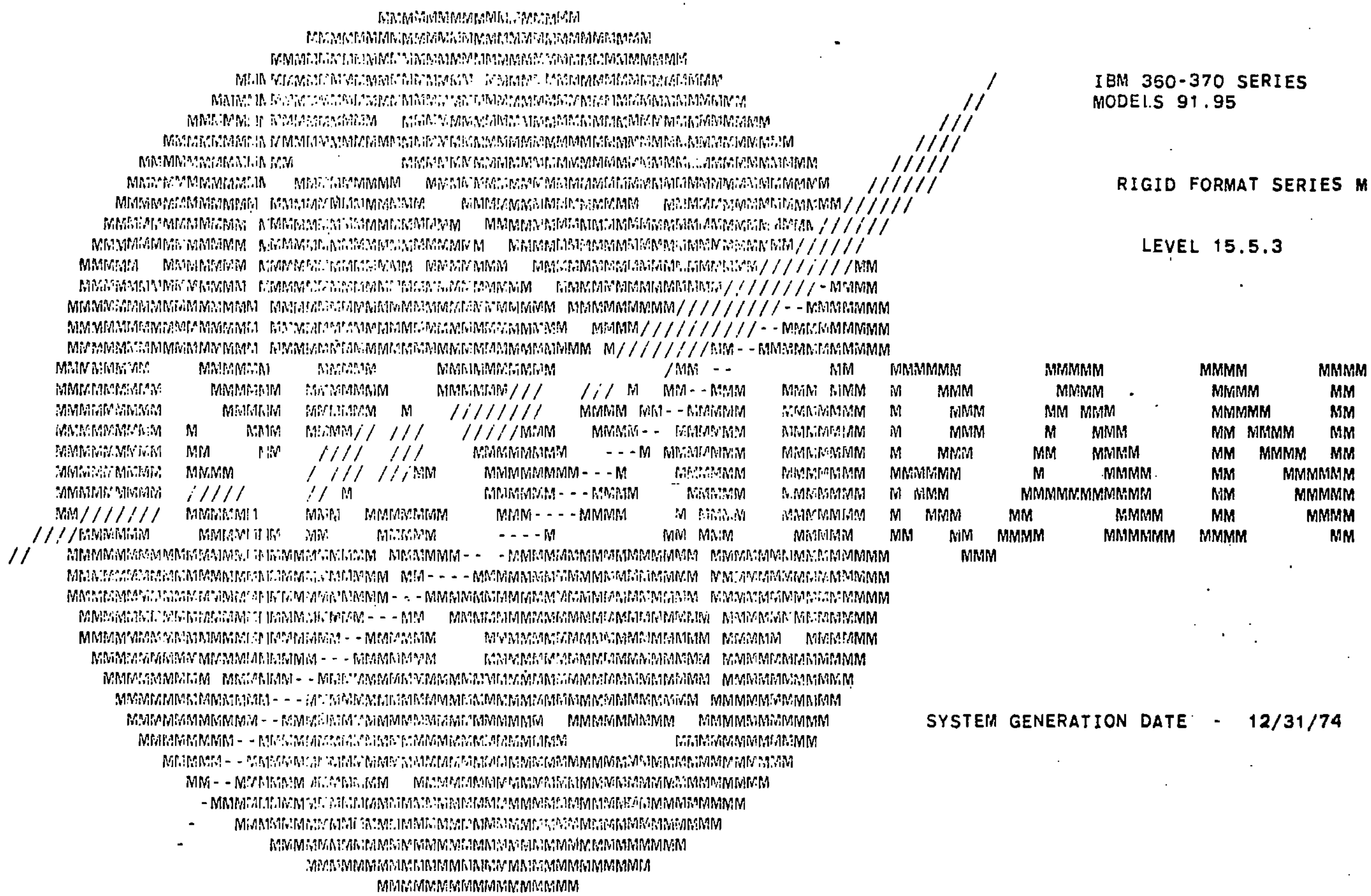
POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
100	S	1.592588E 02					

```
                                        - - - END OF JOB - - -

..................................................................................................................
..................................................................................................................
..................................................................................................................
..................................................................................................................
..................................................................................................................
 NASTRAN LOADED AT LOCATION 152720
 TIME TO GO =  59 CPU SEC., 239 I/O SEC.
*     0 CPU-SEC.         0 ELAPSED-SEC.     SEM1  BEGN
*     0 CPU-SEC.         0 ELAPSED-SEC.     SEMT
*     0 CPU-SEC.         3 ELAPSED-SEC.     NAST
*     0 CPU-SEC.         3 ELAPSED-SEC.     GNFI
*     0 CPU-SEC.         3 ELAPSED-SEC.     XCSA
*     1 CPU-SEC.         5 ELAPSED-SEC.     IFP1
*     1 CPU-SEC.         7 ELAPSED-SEC.     XSOR
*     1 CPU-SEC.        13 ELAPSED-SEC.       DO  IFP
*     2 CPU-SEC.        26 ELAPSED-SEC.      END  IFP
*     2 CPU-SEC.        26 ELAPSED-SEC.     XGPI
*     3 CPU-SEC.        31 ELAPSED-SEC.     SEM1  END
*     3 CPU-SEC.        31 ELAPSED-SEC.     ----  LINKNS02 ---
=    21 I/O SEC.
 LAST LINK DID NOT USE        0 BYTES OF OPEN CORE
*     3 CPU-SEC.        33 ELAPSED-SEC.     ----  LINK END ---
*     3 CPU-SEC.        33 ELAPSED-SEC.     XSFA
*     3 CPU-SEC.        34 ELAPSED-SEC.     XSFA
*     3 CPU-SEC.        34 ELAPSED-SEC.     2     GP1      BEGN
*     3 CPU-SEC.        41 ELAPSED-SEC.     2     GP1      END
*     3 CPU-SEC.        42 ELAPSED-SEC.     5     GP2      BEGN
*     3 CPU-SEC.        43 ELAPSED-SEC.     5     GP2      END
*     3 CPU-SEC.        43 ELAPSED-SEC.     7     PLTSET   BEGN
*     3 CPU-SEC.        44 ELAPSED-SEC.     7     PLTSET   END
*     3 CPU-SEC.        44 ELAPSED-SEC.     9     PRTMSG   BEGN
*     3 CPU-SEC.        45 ELAPSED-SEC.     9     PRTMSG   END
*     3 CPU-SEC.        45 ELAPSED-SEC.     10    SETVAL   BEGN
*     3 CPU-SEC.        45 ELAPSED-SEC.     10    SETVAL   END
*     3 CPU-SEC.        46 ELAPSED-SEC.     18    GP3      BEGN
*     4 CPU-SEC.        54 ELAPSED-SEC.     18    GP3      END
*     4 CPU-SEC.        55 ELAPSED-SEC.     20    TA1      BEGN
*     4 CPU-SEC.        66 ELAPSED-SEC.     20    TA1      END
*     4 CPU-SEC.        67 ELAPSED-SEC.     ----  LINKNS03 ---
=    51 I/O SEC.
 LAST LINK DID NOT USE    41928 BYTES OF OPEN CORE
*     4 CPU-SEC.        71 ELAPSED-SEC.     ----  LINK END ---
*     4 CPU-SEC.        71 ELAPSED-SEC.     24    SMA1     BEGN
*     4 CPU-SEC.        75 ELAPSED-SEC.     24    SMA1     END
*     4 CPU-SEC.        76 ELAPSED-SEC.     ----  LINKNS05 ---
=    56 I/O SEC.
 LAST LINK DID NOT USE    23308 BYTES OF OPEN CORE
*     4 CPU-SEC.        79 ELAPSED-SEC.     ----  LINK END ---
*     4 CPU-SEC.        79 ELAPSED-SEC.     27    RMG      BEGN
*     4 CPU-SEC.        83 ELAPSED-SEC.     SDCO  MP
*     4 CPU-SEC.        84 ELAPSED-SEC.     SDCO  MP
*     4 CPU-SEC.        85 ELAPSED-SEC.     FBS
*     4 CPU-SEC.        87 ELAPSED-SEC.     FBS
*     4 CPU-SEC.        88 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*     4 CPU-SEC.        89 ELAPSED-SEC.     MPYA  D
*     4 CPU-SEC.        89 ELAPSED-SEC.     TRAN  POSE
*     5 CPU-SEC.        91 ELAPSED-SEC.     TRAN  POSE
*     5 CPU-SEC.        91 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*     5 CPU-SEC.        92 ELAPSED-SEC.     MPYA  D
```

```
*     5 CPU-SEC.       94 ELAPSED-SEC.     27    RMG      END
*     5 CPU-SEC.       96 ELAPSED-SEC.     ----  LINKNS04 ---
=    72 I/O SEC.
 LAST LINK DID NOT USE   31560 BYTES OF OPEN CORE
*     5 CPU-SEC.       99 ELAPSED-SEC.     ----  LINK END ---
*     5 CPU-SEC.       99 ELAPSED-SEC.     32    GP4      BEGN
*     5 CPU-SEC.      107 ELAPSED-SEC.     32    GP4      END
*     5 CPU-SEC.      108 ELAPSED-SEC.     38    GPSP     BEGN
*     5 CPU-SEC.      109 ELAPSED-SEC.     38    GPSP     END
*     5 CPU-SEC.      109 ELAPSED-SEC.     ----  LINKNS14 ---
=    83 I/O SEC.
 LAST LINK DID NOT USE   76084 BYTES OF OPEN CORE
*     5 CPU-SEC.      114 ELAPSED-SEC.     ----  LINK END ---
*     5 CPU-SEC.      114 ELAPSED-SEC.     39    OFP      BEGN
*     5 CPU-SEC.      115 ELAPSED-SEC.     39    OFP      END
*     5 CPU-SEC.      117 ELAPSED-SEC.     ----  LINKNS04 ---
=    87 I/O SEC.
 LAST LINK DID NOT USE   74704 BYTES OF OPEN CORE
*     5 CPU-SEC.      120 ELAPSED-SEC.     ----  LINK END ---
*     5 CPU-SEC.      120 ELAPSED-SEC.     42    MCE1     BEGN
*     5 CPU-SEC.      124 ELAPSED-SEC.     42    MCE1     END
*     5 CPU-SEC.      124 ELAPSED-SEC.     44    MCE2     BEGN
*     5 CPU-SEC.      127 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*     6 CPU-SEC.      128 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.      128 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T ,NBR PASSES =   1,EST. TIME =      0.0
*     6 CPU-SEC.      129 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.      130 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T ,NBR PASSES =   1,EST. TIME =      0.0
*     6 CPU-SEC.      131 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.      134 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*     6 CPU-SEC.      135 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.      135 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T ,NBR PASSES =   1,EST. TIME =      0.0
*     7 CPU-SEC.      136 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.      136 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T ,NBR PASSES =   1,EST. TIME =      0.0
*     7 CPU-SEC.      138 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.      138 ELAPSED-SEC.     44    MCE2     END
*     7 CPU-SEC.      139 ELAPSED-SEC.     ----  LINKNS07 ---
=   106 I/O SEC.
 LAST LINK DID NOT USE   68372 BYTES OF OPEN CORE
*     7 CPU-SEC.      146 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.      146 ELAPSED-SEC.     50    VEC      BEGN
*     7 CPU-SEC.      147 ELAPSED-SEC.     50    VEC      END
*     7 CPU-SEC.      147 ELAPSED-SEC.     51    PARTN    BEGN
*     7 CPU-SEC.      150 ELAPSED-SEC.     51    PARTN    END
*     7 CPU-SEC.      150 ELAPSED-SEC.     52    PARTN    BEGN
*     7 CPU-SEC.      152 ELAPSED-SEC.     52    PARTN    END
*     7 CPU-SEC.      152 ELAPSED-SEC.     55    DECOMP   BEGN
*     7 CPU-SEC.      153 ELAPSED-SEC.     DECO  MP
*     7 CPU-SEC.      154 ELAPSED-SEC.     DECO  MP
*     7 CPU-SEC.      157 ELAPSED-SEC.     55    DECOMP   END
*     8 CPU-SEC.      158 ELAPSED-SEC.     XSFA
*     8 CPU-SEC.      159 ELAPSED-SEC.     XSFA
*     8 CPU-SEC.      159 ELAPSED-SEC.     ----  LINKNS05 ---
=   117 I/O SEC.
 LAST LINK DID NOT USE   59592 BYTES OF OPEN CORE
*     8 CPU-SEC.      161 ELAPSED-SEC.     ----  LINK END ---
*     8 CPU-SEC.      131 ELAPSED-SEC.     59    SSG1     BEGN
*     8 CPU-SEC.      167 ELAPSED-SEC.     59    SSG1     END
*     8 CPU-SEC.      168 ELAPSED-SEC.     63    SSG2     BEGN
```

```
*     8 CPU-SEC.      171 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =    1,EST. TIME =       0.0
*     8 CPU-SEC.      172 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.      175 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1,EST. TIME =       0.0
*     8 CPU-SEC.      176 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.      176 ELAPSED-SEC.     63    SSG2     END
*     8 CPU-SEC.      176 ELAPSED-SEC.     66    SSGHT    BEGN
*     9 CPU-SEC.      197 ELAPSED-SEC.     66    SSGHT    END
*     9 CPU-SEC.      198 ELAPSED-SEC.     ----  LINKNS08 ---
=   150 I/O SEC.
 LAST LINK DID NOT USE   24432 BYTES OF OPEN CORE
*     9 CPU-SEC.      205 ELAPSED-SEC.     ----  LINK END ---
*     9 CPU-SEC.      205 ELAPSED-SEC.     71    PLTTRAN BEGN
*     9 CPU-SEC.      207 ELAPSED-SEC.     71    PLTTRAN END
*     9 CPU-SEC.      208 ELAPSED-SEC.     ----  LINKNS13 ---
=   156 I/O SEC.
 LAST LINK DID NOT USE   73552 BYTES OF OPEN CORE
*     9 CPU-SEC.      214 ELAPSED-SEC.     ----  LINK END ---
*     9 CPU-SEC.      214 ELAPSED-SEC.     74    SDR2     BEGN
*     9 CPU-SEC.      218 ELAPSED-SEC.     74    SDR2     END
*     9 CPU-SEC.      218 ELAPSED-SEC.     ----  LINKNS14 ---
=   164 I/O SEC.
 LAST LINK DID NOT USE   25468 BYTES OF OPEN CORE
*     9 CPU-SEC.      226 ELAPSED-SEC.     ----  LINK END ---
*     9 CPU-SEC.      226 ELAPSED-SEC.     75    OFP      BEGN
*    10 CPU-SEC.      228 ELAPSED-SEC.     75    OFP      END
*    10 CPU-SEC.      228 ELAPSED-SEC.     ----  LINKNS13 ---
=   172 I/O SEC.
 LAST LINK DID NOT USE   68004 BYTES OF OPEN CORE
*    10 CPU-SEC.      238 ELAPSED-SEC.     ----  LINK END ---
*    10 CPU-SEC.      238 ELAPSED-SEC.     77    SDRHT    BEGN
*    10 CPU-SEC.      236 ELAPSED-SEC.     77    SDRHT    END
*    10 CPU-SEC.      238 ELAPSED-SEC.     ----  LINKNS14 ---
=   181 I/O SEC.
 LAST LINK DID NOT USE   39888 BYTES OF OPEN CORE
*    10 CPU-SEC.      254 ELAPSED-SEC.     ----  LINK END ---
*    10 CPU-SEC.      254 ELAPSED-SEC.     78    OFP      BEGN
*    10 CPU-SEC.      254 ELAPSED-SEC.     78    OFP      END
*    10 CPU-SEC.      256 ELAPSED-SEC.     92    EXIT     BEGN
----------------------------------------------------------------------------------------------------------------------
=   183 I/O SEC.
 LAST LINK DID NOT USE   74704 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =    OK BYTES
```



IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*******************************************************************************
$ START OF EXECUTIVE CONTROL ***************************************************
$*******************************************************************************
$
ID CLASS PROBLEM THREE, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR TRANSIENT SOLUTION ALGORITHM IS TO BE USED
$
SOL 9
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
$
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $*****************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL *****************************
  4      $*****************************************************************************
  5      $
  6      TITLE=      NON-LINEAR TRANSIENT PROBLEM
  7      $
  8      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
  9      $
 10      LINE=51
 11      $
 12      $ REQUEST SORTED AND UNSORTED OUTPUT
 13      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 14      $
 15      ECHO=BOTH
 16      $
 17      $ SELECT THE MPC AND LOAD SETS TO BE USED IN THIS SOLUTION
 18      $ NOTE THAT NO SPC SET IS SELECTED  AND THAT DLOAD HAS REPLACED LOAD.
 19      $
 20      MPC=200
 21      DLOAD=300
 22      $
 23      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 24      $ THE SELECTION OF THIS SET IS OPTIONAL FOR SOL 9, BUT SHOULD BE MADE IF
 25      $ THE FINAL TEMPERATURE IS SEVERAL HUNDRED DEGREES DIFFERENT FROM THE
 26      $ IC VECTOR, AND RADIATIVE INTERCHANGES ARE INCLUDED.
 27      $
 28      TEMP(MATERIAL)=400
 29      $
 30      $ SELECT THE STEP SIZE, NUMBER OF INCREMENTS, AND PRINTOUT FREQUENCY
 31      $
 32      TSTEP=500
 33      $
 34      $ SELECT THE TEMPERATURE SET DEFINING THE TEMPERATURE VECTOR AT T=0.
 35      $
 36      IC=600
 37      $
 38      $ SELECT OUTPUT DESIRED
 39      $
 40      OUTPUT
 41      THERMAL=ALL
 42      $
 43      $ DEFINE A GROUP OF GRID POINTS TO BE REFERENCED BY AN OUTPUT REQUEST
 44      $
 45      SET 5 = 1,2,3,4,5,6,7,8,100
 46      $
 47      $ REFERENCE A PREVIOUSLY DEFINED GROUP OF GRID POINTS
 48      $
 49      OLOAD=5
 50      $
 51      $ THE FOLLOWING CARDS REQUEST 4 FRAMES OF TRANSIENT PLOTS
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
52       $ THESE PLOTS WILL BE PRODUCED IMMEDIATELY ON THE PRINTER
53       $
54       OUTPUT(XYOUT)
55       XTITLE=TIME IN SECONDS
56       YTITLE= DEGREES CELSIUS GP(100,1,4)
57       $
58       $ 'DISP' MEANS THAT THE GRID POINT TEMPERATURE WILL BE PLOTTED VERSUS TIME
59       $ 'T1" IS REQUIRED (VESTIGIAL REMNANT FROM THE STRUCTURAL VERSION OF NASTRAN)
60       $ ALL OF THESE PLOTS WILL APPEAR ON ONE FRAME
61       $
62       XYPAPLOT DISP/100(T1),1(T1),4(T1)
63       XTITLE=TIME IN SECONDS
64       YTITLE= DEGREES CELSIUS PER SECOND GP(100,1,4)
65       $
66       $ 'VELO' MEANS THAT THE THERMAL VELOCITY WILL BE PLOTTED AS A FUNCTION OF TIME
67       $ THESE THREE PLOTS WILL APPEAR ON THREE DIFFERENT FRAMES
68       $
69       XYPAPLOT VELO/100(T1)/1(T1)/4(T1)
70       $
71       $*********************************************************************************
72       $ END CASE CONTROL --- START BULK DATA ****************************************
73       $*********************************************************************************
74       $
75       BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
    1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY AND THERMAL MASS
$
MAT4    1000    200.    2.426+6                                         ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
     1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*****************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
```

INPUT BULK DATA DECK ECHO

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED FOR THE TRANSIENT SOLUTION ----------
$ THEY CONVERT PROBLEM TWO TO PROBLEM THREE
$ NOTE THAT THE SPC1 SET WAS NOT SELECTED IN CASE CONTROL
$ NOTE THAT SPCF OUTPUT IS NOT REQUESTED IN TRANSIENT
$ NOTE THAT THERMAL MASS WAS ADDED TO 'MAT4' CARD 1000
$ NOTE THAT THE DIAG CARD IN THE EXECUTIVE CONTROL WAS IRRELEVANT
$ NOTE THAT THE LOAD REQUEST IN CASE CONTROL IS NOW A DLOAD REQUEST
$
$
$ TRANSIENT SINGLE POINT CONSTRAINT METHOD
$ CONSTRAIN GRID POINT 100 TO 300 DEGREES CELSIUS
$
CELAS2  300     1.+5    100     1
SLOAD   300     100     300.+5
$
$ DEFINES A CONSTANT LOAD SET APPLIED FROM T=0. TO T=1.+6 SECONDS
$
TLOAD2  300     300                             1.+6    0.      0.      +TL1
+TL1    0.      0.
$
$ DEFINES THE NUMBER OF INCREMENTS, THE STEP SIZE, AND THE PRINTOUT FREQUENCY
$ REFERENCED IN CASE CONTROL AS 'TSTEP'
$ EACH TIME STEP IS 30 SECONDS
$ 31 ITERATIONS SELECTED TO ALLOW THE PRINTER PLOT TO FIT ON ONE PAGE ...
$ 45 ITERATIONS ARE SELECTED IN ALL TRANSIENT PROBLEMS EXCEPT THREE AND ELEVEN
$
TSTEP   500     31      30.     1
$
$ DEFINES A TEMPERATURE VECTOR --- REFERENCED IN CASE CONTROL AS 'IC'
$
TEMPD   600     300.
$
$*******************************************************************************
$ END OF BULK DATA *************************************************************
$*******************************************************************************
$
ENDDATA
```

TOTAL COUNT= 140

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED,XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
1-	CELAS2	300	1.+5	100	1					
2-	CHBDY	60	300	LINE	1	5				+CONVEC
3-	+CONVEC	100	100							
4-	CHBDY	200	2000	AREA4	1	2	6	5		
5-	CHBDY	300	2000	AREA4	2	3	7	6		
6-	CHBDY	400	2000	AREA4	3	4	8	7		
7-	CHBDY	500	2000	AREA4	5	6	2	1		
8-	CHBDY	600	2000	AREA4	6	7	3	2		
9-	CHBDY	700	2000	AREA4	7	8	4	3		
10-	CQUAD2	30	200	1	2	6	5			
11-	CQUAD2	40	200	2	3	7	6			
12-	CQUAD2	50	200	3	4	8	7			
13-	CROD	10	100	10	2					
14-	CROD	20	100	9	6					
15-	GRID	1		0.0	0.0	0.0				
16-	GRID	2		.1	0.0	0.0				
17-	GRID	3		.2	0.0	0.0				
18-	GRID	4		.3	0.0	0.0				
19-	GRID	5		0.0	.1	0.0				
20-	GRID	6		.1	.1	0.0				
21-	GRID	7		.2	.1	0.0				
22-	GRID	8		.3	.1	0.0				
23-	GRID	9		0.0	.2	0.0				
24-	GRID	10		0.0	-.1	0.0				
25-	GRID	100		-.05	.05	0.0				
26-	MAT4	1000	200.	2.426+6						ALUMINUM
27-	MAT4	3000	200.							
28-	MPC	200	9	1	1.		1	-1.		
29-	MPC	200	10	1	1.	1	1	-1.		
30-	PARAM	EPSHT	.0001							
31-	PARAM	MAXIT	8							
32-	PARAM	SIGMA	5.685E-8							
33-	PARAM	TABS	273.15							
34-	PHBDY	300	3000	.314						
35-	PHBDY	2000			.90					
36-	PQUAD2	200	1000	.01						
37-	PROD	100	1000	.001						
38-	RADLST	200	300	400	500	600	700			
39-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
40-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
41-	RADMTX	3	0.0	0.0	0.0	0.0				
42-	RADMTX	4	0.0	0.0	0.0					
43-	RADMTX	5	0.0	0.0						
44-	RADMTX	6	0.0							
45-	SLOAD	300	1	4.	2	8.				
46-	SLOAD	300	3	8.	4	4.				
47-	SLOAD	300	5	4.	6	8.				
48-	SLOAD	300	7	8.	8	4.				
49-	SLOAD	300	100	300.+5						
50-	SPC1	100	1	100						
51-	TEMP	400	100	300.						

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
52-	TEMPD	400	300.							
53-	TEMPD	600	300.							
54-	TLOAD2	300	300			0.0	1.+6	0.0	0.0	+TL1
55-	+TL1	0.	0.							
56-	TSTEP	500	31	30.	1					
	ENDDATA									

```
      N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
   DMAP-DMAP INSTRUCTION
    NO.

*** USER WARNING MESSAGE  54,
    PARAMETER NAMED EPSHT     NOT REFERENCED

*** USER WARNING MESSAGE  54
    PARAMETER NAMED MAXIT     NOT REFERENCED

         **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**


*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE      .   6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023,          B =      3
                                            C =      0
                                            R =      2

*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS        0  SECONDS.


*** USER INFORMATION MESSAGE 3028,      B =      5      BBAR =     5
                                        C =      3      CBAR =     1
                                        R =      8

*** USER INFORMATION MESSAGE 3027, UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS      0 SECONDS
```

POINT-ID = 1

LOAD VECTOR

TIME	TYPE	VALUE
0.0	S	4.000000E 00
3.000000E 01	S	4.000000E 00
6.000000E 01	S	4.000000E 00
9.000000E 01	S	4.000000E 00
1.200000E 02	S	4.000000E 00
1.500000E 02	S	4.000000E 00
1.800000E 02	S	4.000000E 00
2.100000E 02	S	4.000000E 00
2.400000E 02	S	4.000000E 00
2.700000E 02	S	4.000000E 00
3.000000E 02	S	4.000000E 00
3.300000E 02	S	4.000000E 00
3.600000E 02	S	4.000000E 00
3.900000E 02	S	4.000000E 00
4.200000E 02	S	4.000000E 00
4.500000E 02	S	4.000000E 00
4.800000E 02	S	4.000000E 00
5.100000E 02	S	4.000000E 00
5.400000E 02	S	4.000000E 00
5.700000E 02	S	4.000000E 00
6.000000E 02	S	4.000000E 00
6.300000E 02	S	4.000000E 00
6.600000E 02	S	4.000000E 00
6.900000E 02	S	4.000000E 00
7.200000E 02	S	4.000000E 00
7.500000E 02	S	4.000000E 00
7.800000E 02	S	4.000000E 00
8.100000E 02	S	4.000000E 00
8.400000E 02	S	4.000000E 00
8.700000E 02	S	4.000000E 00
9.000000E 02	S	4.000000E 00
9.300000E 02	S	4.000000E 00

POINT-ID = 2

L O A D   V E C T O R

TIME	TYPE	VALUE
0.0	S	8.000000E 00
3.000000E 01	S	8.000000E 00
6.000000E 01	S	8.000000E 00
9.000000E 01	S	8.000000E 00
1.200000E 02	S	8.000000E 00
1.500000E 02	S	8.000000E 00
1.800000E 02	S	8.000000E 00
2.100000E 02	S	8.000000E 00
2.400000E 02	S	8.000000E 00
2.700000E 02	S	8.000000E 00
3.000000E 02	S	8.000000E 00
3.300000E 02	S	8.000000E 00
3.600000E 02	S	8.000000E 00
3.900000E 02	S	8.000000E 00
4.200000E 02	S	8.000000E 00
4.500000E 02	S	8.000000E 00
4.800000E 02	S	8.000000E 00
5.100000E 02	S	8.000000E 00
5.400000E 02	S	8.000000E 00
5.700000E 02	S	8.000000E 00
6.000000E 02	S	8.000000E 00
6.300000E 02	S	8.000000E 00
6.600000E 02	S	8.000000E 00
6.900000E 02	S	8.000000E 00
7.200000E 02	S	8.000000E 00
7.500000E 02	S	8.000000E 00
7.800000E 02	S	8.000000E 00
8.100000E 02	S	8.000000E 00
8.400000E 02	S	8.000000E 00
8.700000E 02	S	8.000000E 00
9.000000E 02	S	8.000000E 00
9.300000E 02	S	8.000000E 00

POINT-ID = 3

LOAD VECTOR

TIME	TYPE	VALUE
0.0	S	8.000000E 00
3.000000E 01	S	8.000000E 00
6.000000E 01	S	8.000000E 00
9.000000E 01	S	8.000000E 00
1.200000E 02	S	8.000000E 00
1.500000E 02	S	8.000000E 00
1.800000E 02	S	8.000000E 00
2.100000E 02	S	8.000000E 00
2.400000E 02	S	8.000000E 00
2.700000E 02	S	8.000000E 00
3.000000E 02	S	8.000000E 00
3.300000E 02	S	8.000000E 00
3.600000E 02	S	8.000000E 00
3.900000E 02	S	8.000000E 00
4.200000E 02	S	8.000000E 00
4.500000E 02	S	8.000000E 00
4.800000E 02	S	8.000000E 00
5.100000E 02	S	8.000000E 00
5.400000E 02	S	8.000000E 00
5.700000E 02	S	8.000000E 00
6.000000E 02	S	8.000000E 00
6.300000E 02	S	8.000000E 00
6.600000E 02	S	8.000000E 00
6.900000E 02	S	8.000000E 00
7.200000E 02	S	8.000000E 00
7.500000E 02	S	8.000000E 00
7.800000E 02	S	8.000000E 00
8.100000E 02	S	8.000000E 00
8.400000E 02	S	8.000000E 00
8.700000E 02	S	8.000000E 00
9.000000E 02	S	8.000000E 00
9.300000E 02	S	8.000000E 00

POINT-ID = 4

LOAD VECTOR

TIME	TYPE	VALUE
0.0	S	4.000000E 00
3.000000E 01	S	4.000000E 00
6.000000E 01	S	4.000000E 00
9.000000E 01	S	4.000000E 00
1.200000E 02	S	4.000000E 00
1.500000E 02	S	4.000000E 00
1.800000E 02	S	4.000000E 00
2.100000E 02	S	4.000000E 00
2.400000E 02	S	4.000000E 00
2.700000E 02	S	4.000000E 00
3.000000E 02	S	4.000000E 00
3.300000E 02	S	4.000000E 00
3.600000E 02	S	4.000000E 00
3.900000E 02	S	4.000000E 00
4.200000E 02	S	4.000000E 00
4.500000E 02	S	4.000000E 00
4.800000E 02	S	4.000000E 00
5.100000E 02	S	4.000000E 00
5.400000E 02	S	4.000000E 00
5.700000E 02	S	4.000000E 00
6.000000E 02	S	4.000000E 00
6.300000E 02	S	4.000000E 00
6.600000E 02	S	4.000000E 00
6.900000E 02	S	4.000000E 00
7.200000E 02	S	4.000000E 00
7.500000E 02	S	4.000000E 00
7.800000E 02	S	4.000000E 00
8.100000E 02	S	4.000000E 00
8.400000E 02	S	4.000000E 00
8.700000E 02	S	4.000000E 00
9.000000E 02	S	4.000000E 00
9.300000E 02	S	4.000000E 00

POINT-ID = 5

L O A D   V E C T O R

TIME	TYPE	VALUE
0.0	S	4.000000E 00
3.000000E 01	S	4.000000E 00
6.000000E 01	S	4.000000E 00
9.000000E 01	S	4.000000E 00
1.200000E 02	S	4.000000E 00
1.500000E 02	S	4.000000E 00
1.800000E 02	S	4.000000E 00
2.100000E 02	S	4.000000E 00
2.400000E 02	S	4.000000E 00
2.700000E 02	S	4.000000E 00
3.000000E 02	S	4.000000E 00
3.300000E 02	S	4.000000E 00
3.600000E 02	S	4.000000E 00
3.900000E 02	S	4.000000E 00
4.200000E 02	S	4.000000E 00
4.500000E 02	S	4.000000E 00
4.800000E 02	S	4.000000E 00
5.100000E 02	S	4.000000E 00
5.400000E 02	S	4.000000E 00
5.700000E 02	S	4.000000E 00
6.000000E 02	S	4.000000E 00
6.300000E 02	S	4.000000E 00
6.600000E 02	S	4.000000E 00
6.900000E 02	S	4.000000E 00
7.200000E 02	S	4.000000E 00
7.500000E 02	S	4.000000E 00
7.800000E 02	S	4.000000E 00
8.100000E 02	S	4.000000E 00
8.400000E 02	S	4.000000E 00
8.700000E 02	S	4.000000E 00
9.000000E 02	S	4.000000E 00
9.300000E 02	S	4.000000E 00

POINT-ID = 6

L O A D   V E C T O R

TIME	TYPE	VALUE
0.0	S	8.000000E 00
3.000000E 01	S	8.000000E 00
6.000000E 01	S	8.000000E 00
9.000000E 01	S	8.000000E 00
1.200000E 02	S	8.000000E 00
1.500000E 02	S	8.000000E 00
1.800000E 02	S	8.000000E 00
2.100000E 02	S	8.000000E 00
2.400000E 02	S	8.000000E 00
2.700000E 02	S	8.000000E 00
3.000000E 02	S	8.000000E 00
3.300000E 02	S	8.000000E 00
3.600000E 02	S	8.000000E 00
3.900000E 02	S	8.000000E 00
4.200000E 02	S	8.000000E 00
4.500000E 02	S	8.000000E 00
4.800000E 02	S	8.000000E 00
5.100000E 02	S	8.000000E 00
5.400000E 02	S	8.000000E 00
5.700000E 02	S	8.000000E 00
6.000000E 02	S	8.000000E 00
6.300000E 02	S	8.000000E 00
6.600000E 02	S	8.000000E 00
6.900000E 02	S	8.000000E 00
7.200000E 02	S	8.000000E 00
7.500000E 02	S	8.000000E 00
7.800000E 02	S	8.000000E 00
8.100000E 02	S	8.000000E 00
8.400000E 02	S	8.000000E 00
8.700000E 02	S	8.000000E 00
9.000000E 02	S	8.000000E 00
9.300000E 02	S	8.000000E 00

POINT-ID = 7

LOAD VECTOR

TIME	TYPE	VALUE
0.0	S	8.000000E 00
3.000000E 01	S	8.000000E 00
6.000000E 01	S	8.000000E 00
9.000000E 01	S	8.000000E 00
1.200000E 02	S	8.000000E 00
1.500000E 02	S	8.000000E 00
1.800000E 02	S	8.000000E 00
2.100000E 02	S	8.000000E 00
2.400000E 02	S	8.000000E 00
2.700000E 02	S	8.000000E 00
3.000000E 02	S	8.000000E 00
3.300000E 02	S	8.000000E 00
3.600000E 02	S	8.000000E 00
3.900000E 02	S	8.000000E 00
4.200000E 02	S	8.000000E 00
4.500000E 02	S	8.000000E 00
4.800000E 02	S	8.000000E 00
5.100000E 02	S	8.000000E 00
5.400000E 02	S	8.000000E 00
5.700000E 02	S	8.000000E 00
6.000000E 02	S	8.000000E 00
6.300000E 02	S	8.000000E 00
6.600000E 02	S	8.000000E 00
6.900000E 02	S	8.000000E 00
7.200000E 02	S	8.000000E 00
7.500000E 02	S	8.000000E 00
7.800000E 02	S	8.000000E 00
8.100000E 02	S	8.000000E 00
8.400000E 02	S	8.000000E 00
8.700000E 02	S	8.000000E 00
9.000000E 02	S	8.000000E 00
9.300000E 02	S	8.000000E 00

POINT-ID = 8

L O A D   V E C T O R

TIME	TYPE	VALUE
0.0	S	4.000000E 00
3.000000E 01	S	4.000000E 00
6.000000E 01	S	4.000000E 00
9.000000E 01	S	4.000000E 00
1.200000E 02	S	4.000000E 00
1.500000E 02	S	4.000000E 00
1.800000E 02	S	4.000000E 00
2.100000E 02	S	4.000000E 00
2.400000E 02	S	4.000000E 00
2.700000E 02	S	4.000000E 00
3.000000E 02	S	4.000000E 00
3.300000E 02	S	4.000000E 00
3.600000E 02	S	4.000000E 00
3.900000E 02	S	4.000000E 00
4.200000E 02	S	4.000000E 00
4.500000E 02	S	4.000000E 00
4.800000E 02	S	4.000000E 00
5.100000E 02	S	4.000000E 00
5.400000E 02	S	4.000000E 00
5.700000E 02	S	4.000000E 00
6.000000E 02	S	4.000000E 00
6.300000E 02	S	4.000000E 00
6.600000E 02	S	4.000000E 00
6.900000E 02	S	4.000000E 00
7.200000E 02	S	4.000000E 00
7.500000E 02	S	4.000000E 00
7.800000E 02	S	4.000000E 00
8.100000E 02	S	4.000000E 00
8.400000E 02	S	4.000000E 00
8.700000E 02	S	4.000000E 00
9.000000E 02	S	4.000000E 00
9.300000E 02	S	4.000000E 00

POINT-ID = 100

LOAD VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 07
3.000000E 01	S	3.000000E 07
6.000000E 01	S	3.000000E 07
9.000000E 01	S	3.000000E 07
1.200000E 02	S	3.000000E 07
1.500000E 02	S	3.000000E 07
1.800000E 02	S	3.000000E 07
2.100000E 02	S	3.000000E 07
2.400000E 02	S	3.000000E 07
2.700000E 02	S	3.000000E 07
3.000000E 02	S	3.000000E 07
3.300000E 02	S	3.000000E 07
3.600000E 02	S	3.000000E 07
3.900000E 02	S	3.000000E 07
4.200000E 02	S	3.000000E 07
4.500000E 02	S	3.000000E 07
4.800000E 02	S	3.000000E 07
5.100000E 02	S	3.000000E 07
5.400000E 02	S	3.000000E 07
5.700000E 02	S	3.000000E 07
6.000000E 02	S	3.000000E 07
6.300000E 02	S	3.000000E 07
6.600000E 02	S	3.000000E 07
6.900000E 02	S	3.000000E 07
7.200000E 02	S	3.000000E 07
7.500000E 02	S	3.000000E 07
7.800000E 02	S	3.000000E 07
8.100000E 02	S	3.000000E 07
8.400000E 02	S	3.000000E 07
8.700000E 02	S	3.000000E 07
9.000000E 02	S	3.000000E 07
9.300000E 02	S	3.000000E 07

POINT-ID = 1

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984949E 02
6.000000E 01	S	2.959980E 02
9.000000E 01	S	2.938445E 02
1.200000E 02	S	2.919236E 02
1.500000E 02	S	2.901902E 02
1.800000E 02	S	2.886216E 02
2.100000E 02	S	2.872031E 02
2.400000E 02	S	2.859224E 02
2.700000E 02	S	2.847678E 02
3.000000E 02	S	2.837285E 02
3.300000E 02	S	2.827942E 02
3.600000E 02	S	2.819548E 02
3.900000E 02	S	2.812014E 02
4.200000E 02	S	2.805254E 02
4.500000E 02	S	2.799189E 02
4.800000E 02	S	2.793750E 02
5.100000E 02	S	2.788872E 02
5.400000E 02	S	2.784500E 02
5.700000E 02	S	2.780579E 02
6.000000E 02	S	2.777063E 02
6.300000E 02	S	2.773909E 02
6.600000E 02	S	2.771079E 02
6.900000E 02	S	2.768542E 02
7.200000E 02	S	2.766267E 02
7.500000E 02	S	2.764224E 02
7.800000E 02	S	2.762390E 02
8.100000E 02	S	2.760745E 02
8.400000E 02	S	2.759270E 02
8.700000E 02	S	2.757944E 02
9.000000E 02	S	2.756755E 02
9.300000E 02	S	2.755686E 02

POINT-ID = 2

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.973813E 02
6.000000E 01	S	2.927502E 02
9.000000E 01	S	2.884094E 02
1.200000E 02	S	2.844219E 02
1.500000E 02	S	2.807952E 02
1.800000E 02	S	2.775146E 02
2.100000E 02	S	2.745569E 02
2.400000E 02	S	2.718955E 02
2.700000E 02	S	2.695042E 02
3.000000E 02	S	2.673574E 02
3.300000E 02	S	2.654314E 02
3.600000E 02	S	2.637039E 02
3.900000E 02	S	2.621553E 02
4.200000E 02	S	2.607668E 02
4.500000E 02	S	2.595225E 02
4.800000E 02	S	2.584070E 02
5.100000E 02	S	2.574070E 02
5.400000E 02	S	2.565105E 02
5.700000E 02	S	2.557069E 02
6.000000E 02	S	2.549862E 02
6.300000E 02	S	2.543399E 02
6.600000E 02	S	2.537601E 02
6.900000E 02	S	2.532400E 02
7.200000E 02	S	2.527734E 02
7.500000E 02	S	2.523547E 02
7.800000E 02	S	2.519789E 02
8.100000E 02	S	2.516416E 02
8.400000E 02	S	2.513388E 02
8.700000E 02	S	2.510670E 02
9.000000E 02	S	2.508229E 02
9.300000E 02	S	2.506038E 02

POINT-ID = 3

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.942329E 02
6.000000E 01	S	2.847380E 02
9.000000E 01	S	2.767437E 02
1.200000E 02	S	2.698711E 02
1.500000E 02	S	2.638923E 02
1.800000E 02	S	2.586531E 02
2.100000E 02	S	2.540391E 02
2.400000E 02	S	2.499607E 02
2.700000E 02	S	2.463457E 02
3.000000E 02	S	2.431346E 02
3.300000E 02	S	2.402768E 02
3.600000E 02	S	2.377296E 02
3.900000E 02	S	2.354565E 02
4.200000E 02	S	2.334258E 02
4.500000E 02	S	2.316098E 02
4.800000E 02	S	2.299850E 02
5.100000E 02	S	2.285301E 02
5.400000E 02	S	2.272267E 02
5.700000E 02	S	2.260584E 02
6.000000E 02	S	2.250109E 02
6.300000E 02	S	2.240714E 02
6.600000E 02	S	2.232284E 02
6.900000E 02	S	2.224718E 02
7.200000E 02	S	2.217928E 02
7.500000E 02	S	2.211832E 02
7.800000E 02	S	2.206357E 02
8.100000E 02	S	2.201442E 02
8.400000E 02	S	2.197027E 02
8.700000E 02	S	2.193061E 02
9.000000E 02	S	2.189498E 02
9.300000E 02	S	2.186298E 02

POINT-ID = 4

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.939604E 02
6.000000E 01	S	2.836946E 02
9.000000E 01	S	2.746729E 02
1.200000E 02	S	2.668035E 02
1.500000E 02	S	2.599419E 02
1.800000E 02	S	2.539440E 02
2.100000E 02	S	2.486829E 02
2.400000E 02	S	2.440520E 02
2.700000E 02	S	2.399628E 02
3.000000E 02	S	2.363418E 02
3.300000E 02	S	2.331275E 02
3.600000E 02	S	2.302688E 02
3.900000E 02	S	2.277216E 02
4.200000E 02	S	2.254489E 02
4.500000E 02	S	2.234185E 02
4.800000E 02	S	2.216028E 02
5.100000E 02	S	2.199780E 02
5.400000E 02	S	2.185226E 02
5.700000E 02	S	2.172187E 02
6.000000E 02	S	2.160496E 02
6.300000E 02	S	2.150009E 02
6.600000E 02	S	2.140601E 02
6.900000E 02	S	2.132157E 02
7.200000E 02	S	2.124576E 02
7.500000E 02	S	2.117771E 02
7.800000E 02	S	2.111658E 02
8.100000E 02	S	2.106167E 02
8.400000E 02	S	2.101239E 02
8.700000E 02	S	2.096810E 02
9.000000E 02	S	2.092829E 02
9.300000E 02	S	2.089254E 02

POINT-ID = 5

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984951E 02
6.000000E 01	S	2.959983E 02
9.000000E 01	S	2.938445E 02
1.200000E 02	S	2.919236E 02
1.500000E 02	S	2.901902E 02
1.800000E 02	S	2.886216E 02
2.100000E 02	S	2.872031E 02
2.400000E 02	S	2.859224E 02
2.700000E 02	S	2.847678E 02
3.000000E 02	S	2.837288E 02
3.300000E 02	S	2.827944E 02
3.600000E 02	S	2.819551E 02
3.900000E 02	S	2.812014E 02
4.200000E 02	S	2.805254E 02
4.500000E 02	S	2.799189E 02
4.800000E 02	S	2.793750E 02
5.100000E 02	S	2.788875E 02
5.400000E 02	S	2.784500E 02
5.700000E 02	S	2.780579E 02
6.000000E 02	S	2.777063E 02
6.300000E 02	S	2.773909E 02
6.600000E 02	S	2.771079E 02
6.900000E 02	S	2.768542E 02
7.200000E 02	S	2.766267E 02
7.500000E 02	S	2.764224E 02
7.800000E 02	S	2.762390E 02
8.100000E 02	S	2.760745E 02
8.400000E 02	S	2.759270E 02
8.700000E 02	S	2.757944E 02
9.000000E 02	S	2.756755E 02
9.300000E 02	S	2.755686E 02

POINT-ID = 6

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.973813E 02
6.000000E 01	S	2.927502E 02
9.000000E 01	S	2.884094E 02
1.200000E 02	S	2.844219E 02
1.500000E 02	S	2.807952E 02
1.800000E 02	S	2.775149E 02
2.100000E 02	S	2.745571E 02
2.400000E 02	S	2.718958E 02
2.700000E 02	S	2.695044E 02
3.000000E 02	S	2.673574E 02
3.300000E 02	S	2.654314E 02
3.600000E 02	S	2.637041E 02
3.900000E 02	S	2.621553E 02
4.200000E 02	S	2.607668E 02
4.500000E 02	S	2.595225E 02
4.800000E 02	S	2.584070E 02
5.100000E 02	S	2.574070E 02
5.400000E 02	S	2.565105E 02
5.700000E 02	S	2.557068E 02
6.000000E 02	S	2.549862E 02
6.300000E 02	S	2.543399E 02
6.600000E 02	S	2.537601E 02
6.900000E 02	S	2.532400E 02
7.200000E 02	S	2.527734E 02
7.500000E 02	S	2.523547E 02
7.800000E 02	S	2.519789E 02
8.100000E 02	S	2.516416E 02
8.400000E 02	S	2.513387E 02
8.700000E 02	S	2.510669E 02
9.000000E 02	S	2.508229E 02
9.300000E 02	S	2.506038E 02

POINT-ID = 7

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.942332E 02
6.000000E 01	S	2.847383E 02
9.000000E 01	S	2.767437E 02
1.200000E 02	S	2.698711E 02
1.500000E 02	S	2.638926E 02
1.800000E 02	S	2.586531E 02
2.100000E 02	S	2.540391E 02
2.400000E 02	S	2.499608E 02
2.700000E 02	S	2.463459E 02
3.000000E 02	S	2.431346E 02
3.300000E 02	S	2.402769E 02
3.600000E 02	S	2.377297E 02
3.900000E 02	S	2.354565E 02
4.200000E 02	S	2.334259E 02
4.500000E 02	S	2.316100E 02
4.800000E 02	S	2.299851E 02
5.100000E 02	S	2.285302E 02
5.400000E 02	S	2.272267E 02
5.700000E 02	S	2.260585E 02
6.000000E 02	S	2.250110E 02
6.300000E 02	S	2.240714E 02
6.600000E 02	S	2.232284E 02
6.900000E 02	S	2.224719E 02
7.200000E 02	S	2.217929E 02
7.500000E 02	S	2.211833E 02
7.800000E 02	S	2.206358E 02
8.100000E 02	S	2.201442E 02
8.400000E 02	S	2.197028E 02
8.700000E 02	S	2.193062E 02
9.000000E 02	S	2.189499E 02
9.300000E 02	S	2.186299E 02

POINT-ID = 8

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.939607E 02
6.000000E 01	S	2.836948E 02
9.000000E 01	S	2.746731E 02
1.200000E 02	S	2.668037E 02
1.500000E 02	S	2.599419E 02
1.800000E 02	S	2.539441E 02
2.100000E 02	S	2.486830E 02
2.400000E 02	S	2.440520E 02
2.700000E 02	S	2.399627E 02
3.000000E 02	S	2.363417E 02
3.300000E 02	S	2.331277E 02
3.600000E 02	S	2.302688E 02
3.900000E 02	S	2.277216E 02
4.200000E 02	S	2.254490E 02
4.500000E 02	S	2.234187E 02
4.800000E 02	S	2.216031E 02
5.100000E 02	S	2.199782E 02
5.400000E 02	S	2.185229E 02
5.700000E 02	S	2.172188E 02
6.000000E 02	S	2.160497E 02
6.300000E 02	S	2.150009E 02
6.600000E 02	S	2.140602E 02
6.900000E 02	S	2.132157E 02
7.200000E 02	S	2.124577E 02
7.500000E 02	S	2.117771E 02
7.800000E 02	S	2.111658E 02
8.100000E 02	S	2.106169E 02
8.400000E 02	S	2.101239E 02
8.700000E 02	S	2.096810E 02
9.000000E 02	S	2.092830E 02
9.300000E 02	S	2.089254E 02

POINT-ID = 9

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984951E 02
6.000000E 01	S	2.959983E 02
9.000000E 01	S	2.938445E 02
1.200000E 02	S	2.919236E 02
1.500000E 02	S	2.901902E 02
1.800000E 02	S	2.886216E 02
2.100000E 02	S	2.872031E 02
2.400000E 02	S	2.859224E 02
2.700000E 02	S	2.847678E 02
3.000000E 02	S	2.837288E 02
3.300000E 02	S	2.827944E 02
3.600000E 02	S	2.819551E 02
3.900000E 02	S	2.812014E 02
4.200000E 02	S	2.805254E 02
4.500000E 02	S	2.799189E 02
4.800000E 02	S	2.793750E 02
5.100000E 02	S	2.788875E 02
5.400000E 02	S	2.784500E 02
5.700000E 02	S	2.780579E 02
6.000000E 02	S	2.777063E 02
6.300000E 02	S	2.773909E 02
6.600000E 02	S	2.771079E 02
6.900000E 02	S	2.768542E 02
7.200000E 02	S	2.766267E 02
7.500000E 02	S	2.764224E 02
7.800000E 02	S	2.762390E 02
8.100000E 02	S	2.760745E 02
8.400000E 02	S	2.759270E 02
8.700000E 02	S	2.757944E 02
9.000000E 02	S	2.756755E 02
9.300000E 02	S	2.755686E 02

POINT-ID = 10

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984949E 02
6.000000E 01	S	2.959980E 02
9.000000E 01	S	2.938445E 02
1.200000E 02	S	2.919236E 02
1.500000E 02	S	2.901902E 02
1.800000E 02	S	2.886216E 02
2.100000E 02	S	2.872031E 02
2.400000E 02	S	2.859224E 02
2.700000E 02	S	2.847678E 02
3.000000E 02	S	2.837285E 02
3.300000E 02	S	2.827942E 02
3.600000E 02	S	2.819548E 02
3.900000E 02	S	2.812014E 02
4.200000E 02	S	2.805254E 02
4.500000E 02	S	2.799189E 02
4.800000E 02	S	2.793750E 02
5.100000E 02	S	2.788872E 02
5.400000E 02	S	2.784500E 02
5.700000E 02	S	2.780579E 02
6.000000E 02	S	2.777063E 02
6.300000E 02	S	2.773909E 02
6.600000E 02	S	2.771079E 02
6.900000E 02	S	2.768542E 02
7.200000E 02	S	2.766267E 02
7.500000E 02	S	2.764224E 02
7.800000E 02	S	2.762390E 02
8.100000E 02	S	2.760745E 02
8.400000E 02	S	2.759270E 02
8.700000E 02	S	2.757944E 02
9.000000E 02	S	2.756755E 02
9.300000E 02	S	2.755686E 02

POINT-ID = 100

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.999993E 02
6.000000E 01	S	2.999995E 02
9.000000E 01	S	2.999993E 02
1.200000E 02	S	2.999988E 02
1.500000E 02	S	2.999990E 02
1.800000E 02	S	2.999988E 02
2.100000E 02	S	2.999988E 02
2.400000E 02	S	2.999988E 02
2.700000E 02	S	2.999988E 02
3.000000E 02	S	2.999988E 02
3.300000E 02	S	2.999985E 02
3.600000E 02	S	2.999980E 02
3.900000E 02	S	2.999985E 02
4.200000E 02	S	2.999980E 02
4.500000E 02	S	2.999985E 02
4.800000E 02	S	2.999980E 02
5.100000E 02	S	2.999983E 02
5.400000E 02	S	2.999983E 02
5.700000E 02	S	2.999980E 02
6.000000E 02	S	2.999983E 02
6.300000E 02	S	2.999980E 02
6.600000E 02	S	2.999983E 02
6.900000E 02	S	2.999980E 02
7.200000E 02	S	2.999983E 02
7.500000E 02	S	2.999980E 02
7.800000E 02	S	2.999983E 02
8.100000E 02	S	2.999980E 02
8.400000E 02	S	2.999983E 02
8.700000E 02	S	2.999980E 02
9.000000E 02	S	2.999983E 02
9.300000E 02	S	2.999980E 02

```
                         X Y - O U T P U T   S U M M A R Y

SUBCASE          1
RESPONSE
DISPLACEMENT     CURVE         1( 3)

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS       ( X =  0.0           TO X =  0.9300000E 03 )

                          THE SMALLEST Y-VALUE =  0.2755686E 03 AT X =  0.9300000E 03

                          THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0           TO X =  0.9300000E 03 )

                          THE SMALLEST Y-VALUE =  0.2755686E 03 AT X =  0.9300000E 03

                          THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0

                                 E N D   O F   S U M M A R Y
```

```
                                 X Y - O U T P U T   S U M M A R Y

SUBCASE         1
RESPONSE
DISPLACEMENT    CUFVE         4( 3)

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGFEES CELSIUS GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS       ( X =  0.0          TO X =  0.9300000E 03 )

                         THE SMALLEST Y-VALUE =  0.2089254E 03 AT X =  0.9300000E 03

                         THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0          TO X =  0.9300000E 03 )

                         THE SMALLEST Y-VALUE =  0.2089254E 03 AT X =  0.9300000E 03

                         THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0


                                   E N D   O F   S U M M A R Y
```

X Y - O U T P U T   S U M M A R Y

```
SUBCASE          1
RESPONSE
DISPLACEMENT     CURVE       100( 3)

CURVE  TITLE = ,
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS       ( X =  0.0           TO X =  0.9300000E 03 )

                         THE SMALLEST Y-VALUE =  0.2999980E 03 AT X =  0.3600000E 03

                         THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0           TO X =  0.9300000E 03 )

                         THE SMALLEST Y-VALUE =  0.2999980E 03 AT X =  0.3600000E 03

                         THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0
```

E N D   O F   S U M M A R Y

```
                              X Y - O U T P U T   S U M M A R Y

SUBCASE          1
RESPONSE
VELOCITY         CURVE        100( 3)

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS PER SECOND GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS        ( X =  0.0            TO X =  0.9300000E 03 )

                        THE SMALLEST Y-VALUE = -0.2441405E-04 AT X =  0.0

                        THE LARGEST  Y-VALUE =  0.1627604E-04 AT X =  0.3600000E 03


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0            TO X =  0.9300000E 03 )

                        THE SMALLEST Y-VALUE = -0.2441405E-04 AT X =  0.0

                        THE LARGEST  Y-VALUE =  0.1627604E-04 AT X =  0.3600000E 03

                                E N D   O F   S U M M A R Y
```

```
                         X Y - O U T P U T   S U M M A R Y

SUBCASE         1
RESPONSE
VELOCITY        CURVE        1( 3)

XY-PAIRS WITHIN FRAME LIMITS WILL BE PLOTTED
PENSIZE =  1

THIS IS CURVE   1 OF WHOLE FRAME    1

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS PER SECOND GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS       ( X =  0.0           TO X =  0.9300000E 03 )

                          THE SMALLEST Y-VALUE = -0.8322752E-01 AT X =  0.3000000E 02

                          THE LARGEST  Y-VALUE = -0.3198242E-02 AT X =  0.9300000E 03


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0           TO X =  0.9300000E 03 )

                          THE SMALLEST Y-VALUE = -0.8322752E-01 AT X =  0.3000000E 02

                          THE LARGEST  Y-VALUE = -0.3198242E-02 AT X =  0.9300000E 03


                             E N D   O F   S U M M A R Y
```

X Y - O U T P U T   S U M M A R Y

```
SUBCASE          1
RESPONSE
VELOCITY         CURVE        4( 3)

XY-PAIRS WITHIN FRAME LIMITS WILL BE PLOTTED
PENSIZE =  1

THIS IS CURVE   1 OF WHOLE FRAME    2

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS PER SECOND GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

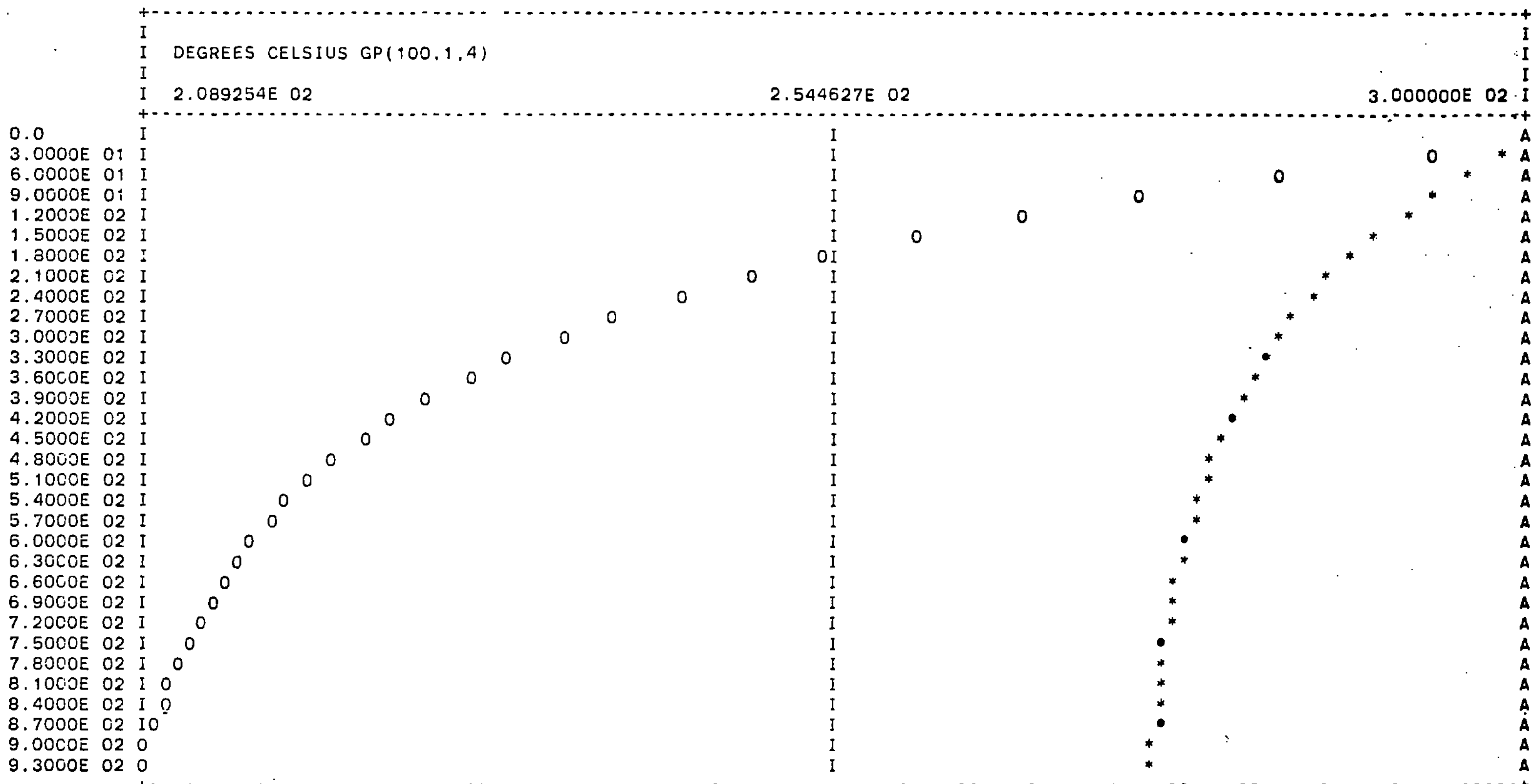
WITHIN THE FRAME X-LIMITS       ( X =  0.0           TO X =  0.9300000E 03 )
                         THE SMALLEST Y-VALUE = -0.3421956E 00 AT X =  0.3000000E 02
                         THE LARGEST  Y-VALUE = -0.1071116E-01 AT X =  0.9300000E 03


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0           TO X =  0.9300000E 03 )
                         THE SMALLEST Y-VALUE = -0.3421956E 00 AT X =  0.3000000E 02
                         THE LARGEST  Y-VALUE = -0.1071116E-01 AT X =  0.9300000E 03
```

E N D   O F   S U M M A R Y

F R A M E

X-AXIS TITLE = TIME IN SECONDS



```
                F      R      A      M      E

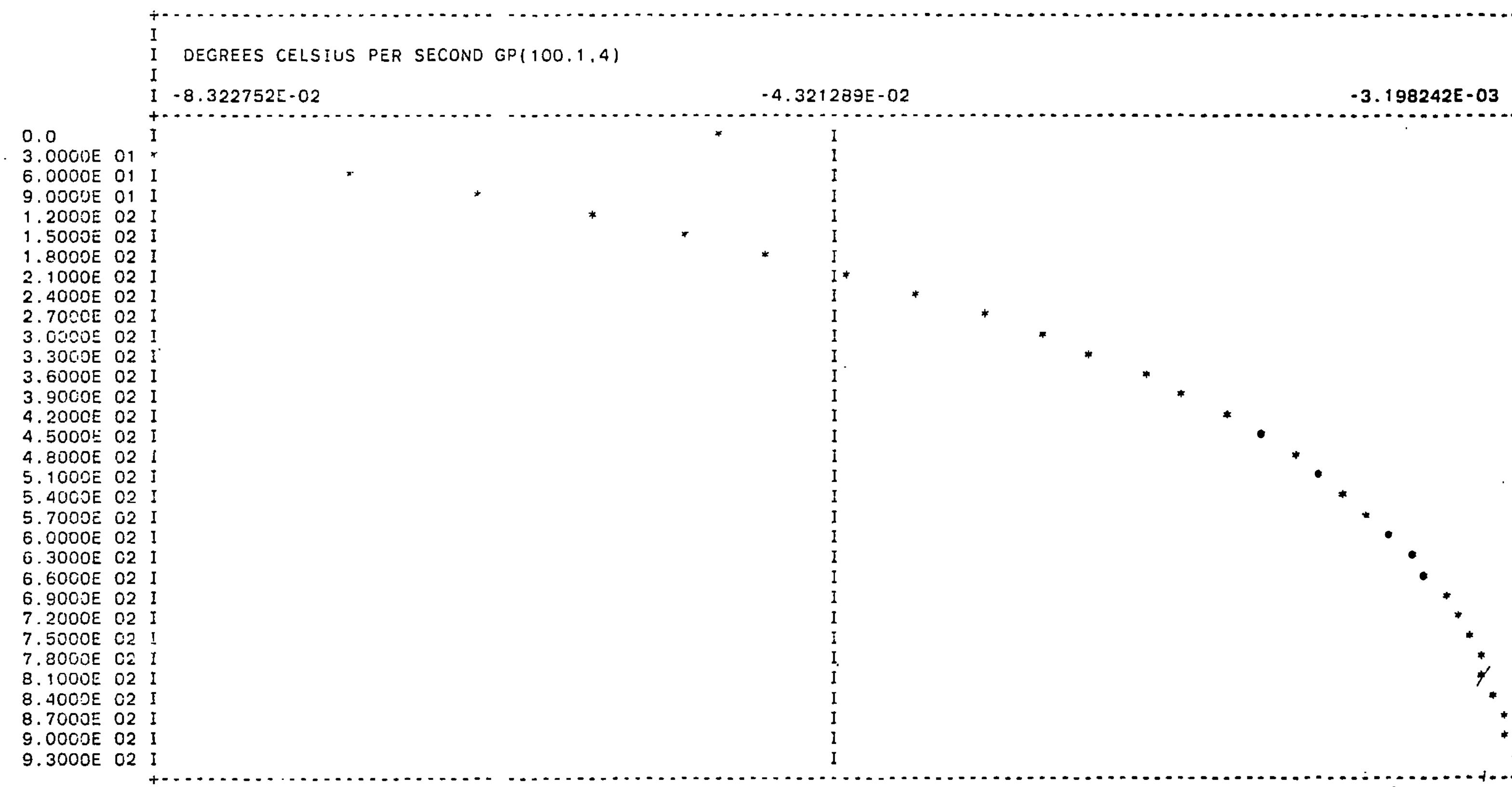
              ****   ****   ****   ****   ****
              *  *   *  *   *  *   *  *   *  *
              *  *   *  *   *  *   *  *   *  *
              *  *   *  *   *  *   *  *   *  *
              ****   ****   ****   ****   ****
```

X-AXIS TITLE = TIME IN SECONDS

```
           +---------------------------------------------------------------------------------------------------------------------+
           I                                                                                                                     I
           I  DEGREES CELSIUS PER SECOND GP(100.1.4)                                                                             I
           I                                                                                                                     I
           I -2.441405E-05                                      -4.069007E-06                                        1.627604E-05 I
           +---------------------------------------------------------------------------------------------------------------------+
0.0        *                                                          I                                                          I
3.0000E 01 I                                                          I                                  *                       I
6.0000E 01 I                                              *           I                                                          I
9.0000E 01 I                       *                                  I                                                          I
1.2000E 02 I                                                          I                                  *                       I
1.5000E 02 I                                              *           I                                                          I
1.8000E 02 I                                                          I           *                                              I
2.1000E 02 I                                                          I           *                                              I
2.4000E 02 I                                                          I           *                                              I
2.7000E 02 I                                                          I           *                                              I
3.0000E 02 I                                              *           I                                                          I
3.3000E 02 I                       *                                  I                                                          I
3.6000E 02 I                                                          I                                                          *
3.9000E 02 I                       *                                  I                                                          I
4.2000E 02 I                                                          I                                                          *
4.5000E 02 I                       *                                  I                                                          I
4.8000E 02 I                                                          I                                  *                       I
5.1000E 02 I                                                          I           *                                              I
5.4000E 02 I                                              *           I                                                          I
5.7000E 02 I                                                          I                                  *                       I
6.0000E 02 I                                              *           I                                                          I
6.3000E 02 I                                                          I                                  *                       I
6.6000E 02 I                                              *           I                                                          I
6.9000E 02 I                                                          I                                  *                       I
7.2000E 02 I                                              *           I                                                          I
7.5000E 02 I                                                          I                                  *                       I
7.8000E 02 I                                              *           I                                                          I
8.1000E 02 I                                                          I                                  *                       I
8.4000E 02 I                                              *           I                                                          I
8.7000E 02 I                                                          I                                  *                       I
9.0000E 02 I                                              *           I                                                          I
9.3000E 02 I                                                          I                                  *                       I
           +---------------------------------------------------------------------------------------------------------------------+
```

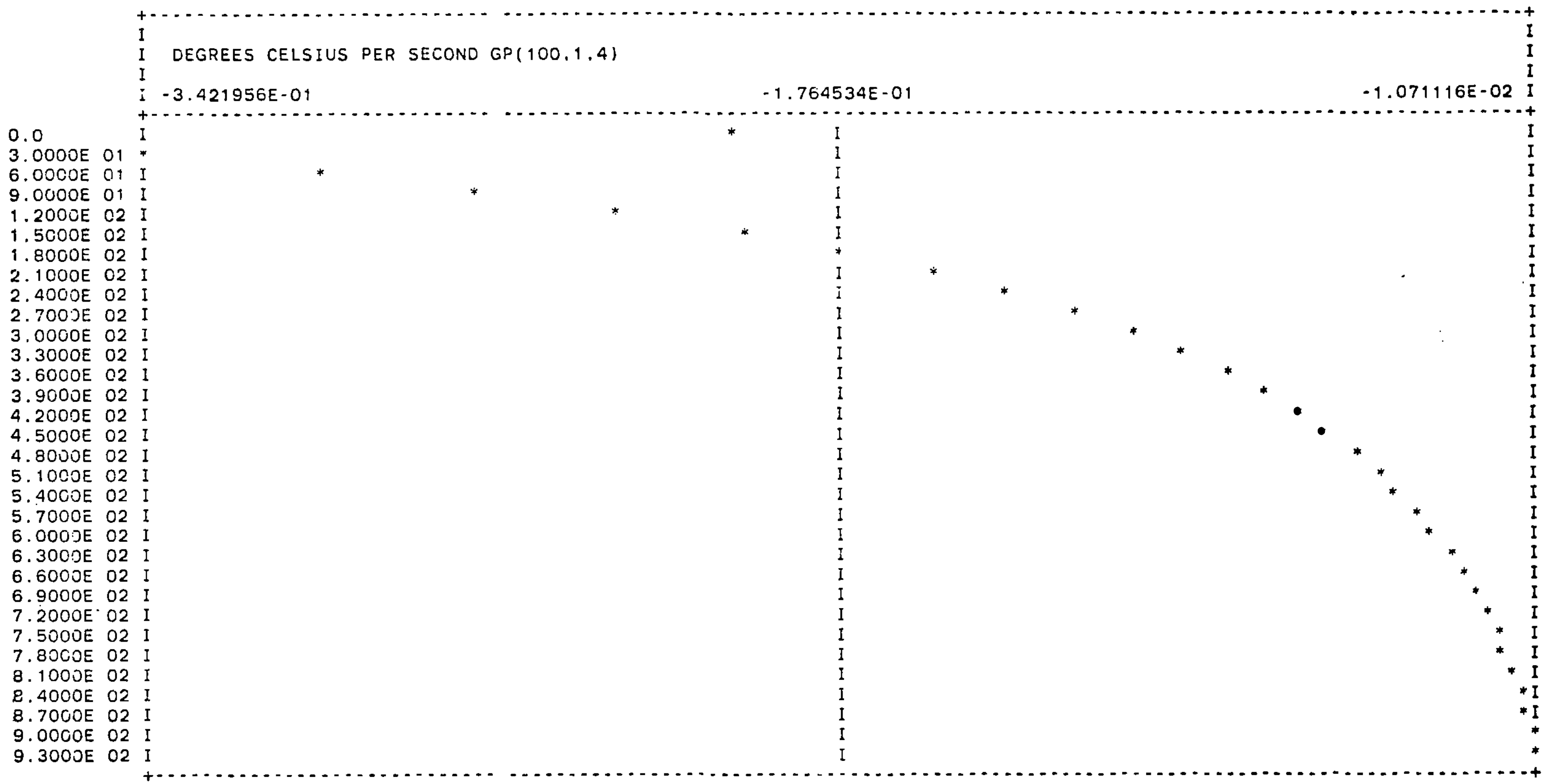
F R A M E

X-AXIS TITLE = TIME IN SECONDS



F R A M E

X-AXIS TITLE = TIME IN SECONDS



- - - END OF JOB - - -

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.......................................................................................................................................
 NASTRAN LOADED AT LOCATION 12CF20
 TIME TO GO =  59 CPU SEC., 299 I/O SEC.
*     0 CPU-SEC.        0 ELAPSED-SEC.     SEM1  BEGN
*     0 CPU-SEC.        0 ELAPSED-SEC.     SEMT
*     1 CPU-SEC.        7 ELAPSED-SEC.     NAST
*     1 CPU-SEC.        8 ELAPSED-SEC.     GNFI
*     1 CPU-SEC.        8 ELAPSED-SEC.     XCSA
*     1 CPU-SEC.        9 ELAPSED-SEC.     IFP1
*     1 CPU-SEC.       13 ELAPSED-SEC.     XSOR
*     2 CPU-SEC.       19 ELAPSED-SEC.       DO  IFP
*     3 CPU-SEC.       31 ELAPSED-SEC.      END  IFP
*     3 CPU-SEC.       31 ELAPSED-SEC.     XGPI
*     4 CPU-SEC.       37 ELAPSED-SEC.     SEM1  END
*     4 CPU-SEC.       37 ELAPSED-SEC.     ----  LINKNS02 ---
=    23 I/O SEC.
 LAST LINK DID NOT USE   40016 BYTES OF OPEN CORE
*     4 CPU-SEC.       39 ELAPSED-SEC.     ----  LINK END ---
*     4 CPU-SEC.       39 ELAPSED-SEC.     XSFA
*     5 CPU-SEC.       40 ELAPSED-SEC.     XSFA
*     5 CPU-SEC.       40 ELAPSED-SEC.     3     GP1     BEGN
*     5 CPU-SEC.       44 ELAPSED-SEC.     3     GP1     END
*     5 CPU-SEC.       45 ELAPSED-SEC.     8     GP2     BEGN
*     5 CPU-SEC.       46 ELAPSED-SEC.     8     GP2     END
*     5 CPU-SEC.       46 ELAPSED-SEC.     10    PLTSET  BEGN
*     5 CPU-SEC.       47 ELAPSED-SEC.     10    PLTSET  END
*     5 CPU-SEC.       47 ELAPSED-SEC.     12    PRTMSG  BEGN
*     5 CPU-SEC.       48 ELAPSED-SEC.     12    PRTMSG  END
*     5 CPU-SEC.       48 ELAPSED-SEC.     13    SETVAL  BEGN
*     5 CPU-SEC.       48 ELAPSED-SEC.     13    SETVAL  END
*     5 CPU-SEC.       49 ELAPSED-SEC.     21    GP3     BEGN
*     5 CPU-SEC.       55 ELAPSED-SEC.     21    GP3     END
*     5 CPU-SEC.       55 ELAPSED-SEC.     23    TA1     BEGN
*     5 CPU-SEC.       63 ELAPSED-SEC.     23    TA1     END
*     5 CPU-SEC.       64 ELAPSED-SEC.     ----  LINKNS03 ---
=    54 I/O SEC.
 LAST LINK DID NOT USE   62788 BYTES OF OPEN CORE
*     5 CPU-SEC.       67 ELAPSED-SEC.     ----  LINK END ---
*     5 CPU-SEC.       67 ELAPSED-SEC.     27    SMA1    BEGN
*     5 CPU-SEC.       70 ELAPSED-SEC.     27    SMA1    END
*     5 CPU-SEC.       70 ELAPSED-SEC.     30    SMA2    BEGN
*     6 CPU-SEC.       73 ELAPSED-SEC.     30    SMA2    END
*     6 CPU-SEC.       74 ELAPSED-SEC.     ----  LINKNS05 ---
=    62 I/O SEC.
 LAST LINK DID NOT USE   64268 BYTES OF OPEN CORE
*     6 CPU-SEC.       77 ELAPSED-SEC.     ----  LINK END - -
*     6 CPU-SEC.       77 ELAPSED-SEC.     35    RMG     BEGN
*     6 CPU-SEC.       80 ELAPSED-SEC.     SDCO  MP
*     6 CPU-SEC.       80 ELAPSED-SEC.     SDCO  MP
*     6 CPU-SEC.       81 ELAPSED-SEC.     FBS
*     6 CPU-SEC.       83 ELAPSED-SEC.     FBS
*     6 CPU-SEC.       84 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     6 CPU-SEC.       85 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.       86 ELAPSED-SEC.     TRAN  POSE
*     6 CPU-SEC.       87 ELAPSED-SEC.     TRAN  POSE
*     6 CPU-SEC.       87 ELAPSED-SEC.     MPYA  D
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                                                             METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
 *      6 CPU-SEC.        88 ELAPSED-SEC.      MPYA  D
 *      6 CPU-SEC.        91 ELAPSED-SEC.      35    RMG       END
 *      7 CPU-SEC.        92 ELAPSED-SEC.      ----  LINKNS04 ---
 =    78 I/O SEC.
 LAST LINK DID NOT USE   72520 BYTES OF OPEN CORE
 *      7 CPU-SEC.        96 ELAPSED-SEC.      ----  LINK END ---
 *      7 CPU-SEC.        96 ELAPSED-SEC.      40    GP4       BEGN
 *      7 CPU-SEC.        99 ELAPSED-SEC.      40    GP4       END
 *      7 CPU-SEC.       100 ELAPSED-SEC.      46    GPSP      BEGN
 *      7 CPU-SEC.       101 ELAPSED-SEC.      46    GPSP      END
 *      7 CPU-SEC.       101 ELAPSED-SEC.      ----  LINKNS14 ---
 =    86 I/O SEC.
 LAST LINK DID NOT USE  117044 BYTES OF OPEN CORE
 *      7 CPU-SEC.       105 ELAPSED-SEC.      ----  LINK END ---
 *      7 CPU-SEC.       105 ELAPSED-SEC.      47    OFP       BEGN
 *      7 CPU-SEC.       105 ELAPSED-SEC.      47    OFP       END
 *      7 CPU-SEC.       106 ELAPSED-SEC.      ----  LINKNS04 ---
 =    90 I/O SEC.
 LAST LINK DID NOT USE  115664 BYTES OF OPEN CORE
 *      7 CPU-SEC.       109 ELAPSED-SEC.      ----  LINK END ---
 *      7 CPU-SEC.       109 ELAPSED-SEC.      51    MCE1      BEGN
 *      7 CPU-SEC.       112 ELAPSED-SEC.      51    MCE1      END
 *      7 CPU-SEC.       113 ELAPSED-SEC.      53    MCE2      BEGN
 *      7 CPU-SEC.       116 ELAPSED-SEC.      MPYA  D
                                                     METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
 *      7 CPU-SEC.       117 ELAPSED-SEC.      MPYA  D
 *      8 CPU-SEC.       117 ELAPSED-SEC.      MPYA  D
                                                     METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
 *      8 CPU-SEC.       118 ELAPSED-SEC.      MPYA  D
 *      8 CPU-SEC.       118 ELAPSED-SEC.      MPYA  D
                                                     METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
 *      8 CPU-SEC.       120 ELAPSED-SEC.      MPYA  D
 *      8 CPU-SEC.       122 ELAPSED-SEC.      MPYA  D
                                                     METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
 *      9 CPU-SEC.       124 ELAPSED-SEC.      MPYA  D
 *      9 CPU-SEC.       124 ELAPSED-SEC.      MPYA  D
                                                     METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
 *      9 CPU-SEC.       126 ELAPSED-SEC.      MPYA  D
 *      9 CPU-SEC.       126 ELAPSED-SEC.      MPYA  D
                                                     METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
 *      9 CPU-SEC.       127 ELAPSED-SEC.      MPYA  D
 *      9 CPU-SEC.       129 ELAPSED-SEC.      MPYA  D
                                                     METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
 *      9 CPU-SEC.       131 ELAPSED-SEC.      MPYA  D
 *     10 CPU-SEC.       131 ELAPSED-SEC.      MPYA  D
                                                     METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
 *     10 CPU-SEC.       133 ELAPSED-SEC.      MPYA  D
 *     10 CPU-SEC.       133 ELAPSED-SEC.      MPYA  D
                                                     METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
 *     10 CPU-SEC.       134 ELAPSED-SEC.      MPYA  D
 *     10 CPU-SEC.       135 ELAPSED-SEC.      53    MCE2      END
 *     10 CPU-SEC.       137 ELAPSED-SEC.      XSFA
 *     10 CPU-SEC.       137 ELAPSED-SEC.      XSFA
 *     10 CPU-SEC.       137 ELAPSED-SEC.      ----  LINKNS06 ---
 =   112 I/O SEC.
 LAST LINK DID NOT USE  102132 BYTES OF OPEN CORE
 *     11 CPU-SEC.       139 ELAPSED-SEC.      ----  LINK END ---
 *     11 CPU-SEC.       139 ELAPSED-SEC.      75    DPD       BEGN
 *     11 CPU-SEC.       143 ELAPSED-SEC.      75    DPD       END
 *     11 CPU-SEC.       145 ELAPSED-SEC.      ----  LINKNS10 ---
 =   121 I/O SEC.
 LAST LINK DID NOT USE  116416 BYTES OF OPEN CORE
 *     11 CPU-SEC.       147 ELAPSED-SEC.      ----  LINK END ---
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*     11 CPU-SEC.       147 ELAPSED-SEC.     81     MTRXIN  BEGN
*     11 CPU-SEC.       148 ELAPSED-SEC.     81     MTRXIN  END
*     11 CPU-SEC.       148 ELAPSED-SEC.     83     PARAM   BEGN
*     11 CPU-SEC.       149 ELAPSED-SEC.     83     PARAM   END
*     11 CPU-SEC.       150 ELAPSED-SEC.     XSFA
*     11 CPU-SEC.       150 ELAPSED-SEC.     XSFA
*     11 CPU-SEC.       150 ELAPSED-SEC.     88     GKAD    BEGN
*     11 CPU-SEC.       152 ELAPSED-SEC.     88     GKAD    END
*     11 CPU-SEC.       153 ELAPSED-SEC.     ----   LINKNS05 ---
=   128 I/O SEC.
 LAST LINK DID NOT USE  117064 BYTES OF OPEN CORE
*     11 CPU-SEC.       155 ELAPSED-SEC.     ----   LINK END ---
*     11 CPU-SEC.       155 ELAPSED-SEC.     92     TRLG    BEGN
*     12 CPU-SEC.       162 ELAPSED-SEC.     MPYA   D
                                                    METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     12 CPU-SEC.       163 ELAPSED-SEC.     MPYA   D
*     12 CPU-SEC.       165 ELAPSED-SEC.     MPYA   D
                                                    METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     12 CPU-SEC.       166 ELAPSED-SEC.     MPYA   D
*     12 CPU-SEC.       166 ELAPSED-SEC.     MPYA   D
                                                    METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     12 CPU-SEC.       168 ELAPSED-SEC.     MPYA   D
*     13 CPU-SEC.       168 ELAPSED-SEC.     MPYA   D
                                                    METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     13 CPU-SEC.       169 ELAPSED-SEC.     MPYA   D
*     13 CPU-SEC.       169 ELAPSED-SEC.     92     TRLG    END
*     13 CPU-SEC.       170 ELAPSED-SEC.     ----   LINKNS11 ---
=   142 I/O SEC.
 LAST LINK DID NOT USE   58172 BYTES OF OPEN CORE
*     13 CPU-SEC.       173 ELAPSED-SEC.     ----   LINK END ---
*     13 CPU-SEC.       173 ELAPSED-SEC.     97     TRHT    BEGN
*     13 CPU-SEC.       175 ELAPSED-SEC.     DECO   MP
*     13 CPU-SEC.       176 ELAPSED-SEC.     DECO   MP
*     14 CPU-SEC.       209 ELAPSED-SEC.     97     TRHT    END
*     14 CPU-SEC.       209 ELAPSED-SEC.     ----   LINKNS12 ---
=   189 I/O SEC.
 LAST LINK DID NOT USE   69268 BYTES OF OPEN CORE
*     14 CPU-SEC.       215 ELAPSED-SEC.     ----   LINK END ---
*     14 CPU-SEC.       215 ELAPSED-SEC.     99     VDR     BEGN
*     14 CPU-SEC.       216 ELAPSED-SEC.     99     VDR     END
*     15 CPU-SEC.       217 ELAPSED-SEC.     111    PARAM   BEGN
*     15 CPU-SEC.       217 ELAPSED-SEC.     111    PARAM   END
*     15 CPU-SEC.       218 ELAPSED-SEC.     XSFA
*     15 CPU-SEC.       218 ELAPSED-SEC.     XSFA
*     15 CPU-SEC.       218 ELAPSED-SEC.     115    SDR1    BEGN
*     15 CPU-SEC.       219 ELAPSED-SEC.     MPYA   D
                                                    METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     15 CPU-SEC.       220 ELAPSED-SEC.     MPYA   D
*     15 CPU-SEC.       222 ELAPSED-SEC.     115    SDR1    END
*     15 CPU-SEC.       223 ELAPSED-SEC.     ----   LINKNS08 ---
=   196 I/O SEC.
 LAST LINK DID NOT USE  119104 BYTES OF OPEN CORE
*     15 CPU-SEC.       226 ELAPSED-SEC.     ----   LINK END ---
*     15 CPU-SEC.       226 ELAPSED-SEC.     118    PLTTRAN BEGN
*     15 CPU-SEC.       227 ELAPSED-SEC.     118    PLTTRAN END
*     15 CPU-SEC.       228 ELAPSED-SEC.     ----   LINKNS13 ---
=   200 I/O SEC.
 LAST LINK DID NOT USE  114512 BYTES OF OPEN CORE
*     16 CPU-SEC.       231 ELAPSED-SEC.     ----   LINK END ---
*     16 CPU-SEC.       231 ELAPSED-SEC.     120    SDR2    BEGN
*     16 CPU-SEC.       238 ELAPSED-SEC.     120    SDR2    END
*     16 CPU-SEC.       238 ELAPSED-SEC.     ----   LINKNS14 ---
=   208 I/O SEC.
 LAST LINK DID NOT USE   66428 BYTES OF OPEN CORE
```

```
*     16 CPU-SEC.      246 ELAPSED-SEC.     ----  LINK END ---
*     16 CPU-SEC.      246 ELAPSED-SEC.     121   SDR3     BEGN
*     16 CPU-SEC.      257 ELAPSED-SEC.     121   SDR3     END
*     16 CPU-SEC.      257 ELAPSED-SEC.     123   OFP      BEGN
*     17 CPU-SEC.      262 ELAPSED-SEC.     123   OFP      END
*     17 CPU-SEC.      262 ELAPSED-SEC.     130   XYTRAN   BEGN
*     20 CPU-SEC.      276 ELAPSED-SEC.     130   XYTRAN   END
*     20 CPU-SEC.      276 ELAPSED-SEC.     ----  LINKNS02 ---
=   225 I/O SEC.
 LAST LINK DID NOT USE        0 BYTES OF OPEN CORE
*     20 CPU-SEC.      291 ELAPSED-SEC.     ----  LINK END ---
*     20 CPU-SEC.      291 ELAPSED-SEC.     132   XYPLOT   BEGN
*     20 CPU-SEC.      292 ELAPSED-SEC.     132   XYPLOT   END
*     20 CPU-SEC.      292 ELAPSED-SEC.     138   EXIT     BEGN
----------------------------------------  ----------------------------------------------------------------------------------------
=   227 I/O SEC.
 LAST LINK DID NOT USE   97232 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =    OK BYTES
```

IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*****************************************************************************
$ START OF EXECUTIVE CONTROL ************************************************
$*****************************************************************************
$
ID CLASS PROBLEM FOUR, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR TRANSIENT SOLUTION ALGORITHM IS TO BE USED
$
SOL 9
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
$
$ REQUEST FOR DIAGNOSTIC PRINTOUT WHICH LISTS THE RIGID FORMAT BEING EXECUTED
$ (IN THIS CASE, SOL 9). THE INCLUSION OF THIS CARD IS OPTIONAL.
$
DIAG 14
$
$ THE RIGID FORMAT IS BEING ALTERED TO PROVIDE TRANSIENT OUTPUT
$ SORTED BY TIME STEP RATHER THAN BY GRID POINT. COMPARE THE OUTPUT WITH PROBLEM
$ 3 TO SEE THE DIFFERENCE. THIS ALTER PLUS THE DIAG 14 ADDITION ARE THE ONLY
$ CHANGES FROM PROBLEM 3 MADE IN EXECUTIVE CONTROL. THE ONLY OTHER
$ CHANGE WAS MADE TO THE TSTEP CARD IN THE BULK DATA.
$
ALTER 122
OFP HOPP1,HOQP1,HOUPV1,HOES1,HOEF1,//V,N,HCARDNO $
JUMP HP2
ENDALTER
CEND
```

```
                         C A S E   C O N T R O L   D E C K   E C H O
 CARD
 COUNT
   1      $
   2      $***************************************************************************
   3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ****************************
   4      $***************************************************************************
   5      $
   6      TITLE=   NON-LINEAR TRANSIENT PROBLEM ... SORT1 OUTPUT FORMAT
   7      $
   8      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
   9      $
  10      LINE=51
  11      $
  12      $ REQUEST SORTED AND UNSORTED OUTPUT
  13      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
  14      $
  15      ECHO=BOTH
  16      $
  17      $ SELECT THE MPC AND LOAD SETS TO BE USED IN THIS SOLUTION
  18      $ NOTE THAT NO SPC SET IS SELECTED, AND THAT DLOAD HAS REPLACED LOAD.
  19      $
  20      MPC=200
  21      DLOAD=300
  22      $
  23      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
  24      $ THE SELECTION OF THIS SET IS OPTIONAL FOR SOL 9, BUT SHOULD BE MADE IF
  25      $ THE FINAL TEMPERATURE IS SEVERAL HUNDRED DEGREES DIFFERENT FROM THE
  26      $ IC VECTOR, AND RADIATIVE INTERCHANGES ARE INCLUDED.
  27      $
  28      TEMP(MATERIAL)=400
  29      $
  30      $ SELECT THE STEP SIZE, NUMBER OF INCREMENTS, AND PRINTOUT FREQUENCY
  31      $
  32      TSTEP=500
  33      $
  34      $ SELECT THE TEMPERATURE SET DEFINING THE TEMPERATURE VECTOR AT T=0.
  35      $
  36      IC=600
  37      $
  38      $ SELECT OUTPUT DESIRED
  39      $
  40      OUTPUT
  41      THERMAL=ALL
  42      $
  43      $ DEFINE A GROUP OF GRID POINTS TO BE REFERENCED BY AN OUTPUT REQUEST
  44      $
  45      SET 5 = 1,2,3,4,5,6,7,8,100
  46      $
  47      $ REFERENCE A PREVIOUSLY DEFINED GROUP OF GRID POINTS
  48      $
  49      OLOAD=5
  50      $
  51      $ THE FOLLOWING CARDS REQUEST 4 FRAMES OF TRANSIENT PLOTS
```

```
                              C A S E   C O N T R O L   D E C K   E C H O
CARD
COUNT
52        $ THESE PLOTS WILL BE PRODUCED IMMEDIATELY ON THE PRINTER
53        $
54        OUTPUT(XYOUT)
55        XTITLE=TIME IN SECONDS
56        YTITLE= DEGREES CELSIUS GP(100,1,4)
57        $
58        $ 'DISP' MEANS THAT THE GRID POINT TEMPERATURE WILL BE PLOTTED VERSUS TIME
59        $ 'T1' IS REQUIRED (VESTIGIAL REMNANT FROM THE STRUCTURAL VERSION OF NASTRAN)
60        $ ALL OF THESE PLOTS WILL APPEAR ON ONE FRAME
61        $
62        XYPAPLOT DISP/100(T1),1(T1),4(T1)
63        XTITLE=TIME IN SECONDS
64        YTITLE= DEGREES CELSIUS PER SECOND GP(100,1,4)
65        $
66        $ 'VELO' MEANS THAT THE THERMAL VELOCITY WILL BE PLOTTED AS A FUNCTION OF TIME
67        $ THESE THREE PLOTS WILL APPEAR ON THREE DIFFERENT FRAMES
68        $
69        XYPAPLOT VELO/100(T1)/1(T1)/4(T1)
70        $
71        $*******************************************************************************
72        $ END CASE CONTROL --- START BULK DATA ****************************************
73        $*******************************************************************************
74        $
75        BEGIN BULK
```

```
                         I N P U T   B U L K   D A T A   D E C K   E C H O
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100              .05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY AND THERMAL MASS
$
MAT4    1000    200.    2.426+6                                         ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000     314
MAT4    3000    200
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

```
                    I N P U T   B U L K   D A T A   D E C K   E C H O

     1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

INPUT BULK DATA DECK ECHO

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED FOR THE TRANSIENT SOLUTION ----------
$ THEY CONVERT PROBLEM TWO TO PROBLEM THREE
$ NOTE THAT THE SPC1 SET WAS NOT SELECTED IN CASE CONTROL
$ NOTE THAT SPCF OUTPUT IS NOT REQUESTED IN TRANSIENT
$ NOTE THAT THERMAL MASS WAS ADDED TO 'MAT4' CARD 1000
$ NOTE THAT THE DIAG CARD IN THE EXECUTIVE CONTROL WAS IRRELEVANT
$ NOTE THAT THE LOAD REQUEST IN CASE CONTROL IS NOW A DLOAD REQUEST
$
$
$ TRANSIENT SINGLE POINT CONSTRAINT METHOD
$ CONSTRAIN GRID POINT 100 TO 300 DEGREES CELSIUS
$
CELAS2  300     1.+5    100     1
SLOAD   300     100     300.+5
$
$ DEFINES A CONSTANT LOAD SET APPLIED FROM T=0. TO T=1.+6 SECONDS
$
TLOAD2  300     300                             0.      1.+6    0.      0.      +TL1
+TL1    0.      0.
$
$ DEFINES THE NUMBER OF INCREMENTS, THE STEP SIZE, AND THE PRINTOUT FREQUENCY
$ REFERENCED IN CASE CONTROL AS 'TSTEP'
$ EACH TIME STEP IS 30 SECONDS
$
TSTEP   500     45      30.     15
$
$ DEFINES A TEMPERATURE VECTOR --- REFERENCED IN CASE CONTROL AS 'IC'
$
TEMPD   600     300.
$*******************************************************************************
$ THE FOLLOWING CHANGES WERE MADE TO CONVERT PROBLEM THREE TO PROBLEM FOUR
$ THE ONLY BULK DATA CARD WHICH WAS CHANGED WAS THE TSTEP CARD,
$ WHOSE FREQUENCY OF OUTPUT WAS CHANGED FROM EVERY STEP TO EVERY 15 STEPS.
$ THE ONLY OTHER CHANGES FROM PROBLEM THREE WERE IN EXECUTIVE CONTROL, WHERE
$ A NEW DIAG CARD AND AN ALTER WERE ADDED.
$
$*******************************************************************************
$ END OF BULK DATA *************************************************************
$*******************************************************************************
$
ENDDATA
```

TOTAL COUNT= 144

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED.XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 .
1-	CELAS2	300	1.+5	100	1					
2-	CHBDY	60	300	LINE	1	5				+CONVEC
3-	+CONVEC	100	100							
4-	CHBDY	200	2000	AREA4	1	2	6	5		
5-	CHBDY	300	2000	AREA4	2	3	7	6		
6-	CHBDY	400	2000	AREA4	3	4	8	7		
7-	CHBDY	500	2000	AREA4	5	6	2	1		
8-	CHBDY	600	2000	AREA4	6	.	3	2		
9-	CHBDY	700	2000	AREA4	7	8	4	3		
10-	CQUAD2	30	200	1	2	6	5			
11-	CQUAD2	40	200	2	3	7	6			
12-	CQUAD2	50	200	3	4	8	7			
13-	CROD	10	100	10	2					
14-	CROD	20	100	9	6					
15-	GRID	1		0.0	0.0	0.0				
16-	GRID	2		.1	0.0	0.0				
17-	GRID	3		.2	0.0	0.0				
18-	GRID	4		.3	0.0	0.0				
19-	GRID	5		0.0	.1	0.0				
20-	GRID	6		.1	.1	0.0				
21-	GRID	7		.2	.1	0.0				
22-	GRID	8		.3	.1	0.0				
23-	GRID	9		0.0	.2	0.0				
24-	GRID	10		0.0	-.1	0.0				
25-	GRID	100		-.05	.05	0.0				
26-	MAT4	1000	200.	2.426+6						ALUMINUM
27-	MAT4	3000	200.							
28-	MPC	200	9	1	1.	5	1	-1.		
29-	MPC	200	10	1	1.	1	1	-1.		
30-	PARAM	EPSHT	.0001							
31-	PARAM	MAXIT	8							
32-	PARAM	SIGMA	5.685E-8							
33-	PARAM	TABS	273.15							
34-	PHBDY	300	3000	.314						
35-	PHBDY	2000			.90					
36-	PQUAD2	200	1000	.01						
37-	PROD	100	1000	.001						
38-	RADLST	200	300	400	500	600	700			
39-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
40-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
41-	RADMTX	3	0.0	0.0	0.0	0.0				
42-	RADMTX	4	0.0	0.0	0.0					
43-	RADMTX	5	0.0	0.0						
44-	RADMTX	6	0.0							
45-	SLOAD	300	1	4.	2	8.				
46-	SLOAD	300	3	8.	4	4.				
47-	SLOAD	300	5	4.	6	8.				
48-	SLOAD	300	7	8.	8	4.				
49-	SLOAD	300	100	300.+5						
50-	SPC1	100	1	100						
51-	TEMP	400	100	300.						

```
                              S O R T E D   B U L K   D A T A   E C H O
CARD
COUNT        .   1   ..   2   ..   3   ..   4   ..   5   ..   6   ..   7   ..   8   ..   9   ..  10  .
  52-        TEMPD   400     300.
  53-        TEMPD   600     300.
  54-        TLOAD2  300     300                     0.0-    1.+6    0.0     0.0     +TL1
  55-        +TL1    0.      0.
  56-        TSTEP   500     45      30.     15
             ENDDATA
```

N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N

```
DMAP-DMAP INSTRUCTION
 NO.

  1  BEGIN     HEAT NO.9 TRANSIENT HEAT TRANSFER ANALYSIS $

  2  FILE      KGGX=TAPE/ KGG=TAPE $

  3  GP1       GEOM1,GEOM2,/HGPL,HEQEXIN,HGPDT,HCSTM,HBGPDT,HSIL/V,N,HLUSET/
               V,N,HALWAYS=-1/V,N,HNOGPDT $

  4  SAVE      HLUSET,HNOGPDT$

  5  PURGE     HUSET,HGM,HGO,HKAA,HBAA,HPSO,HKFS,HQP,HEST/HNOGPDT $

  6  CHKPNT    HGPL,HEQEXIN,HGPDT,HCSTM,HBGPDT,HSIL,HUSET,HGM,HGO,HKAA,HBAA,
               HPSO,HKFS,HQP,HEST $

  7  COND      HLBL5,HNOGPDT$

  8  GP2       GEOM2,HEQEXIN/HECT $

  9  CHKPNT    HECT $

 10  PLTSET    PCDB,HEQEXIN,HECT/HPLTSETX,HPLTPAR,HGPSETS,HELSETS/V,N,HNSIL/V,
               N,JUMPPLOT $

 11  SAVE      HNSIL,JUMPPLOT $

 12  PRTMSG    HPLTSETX//$

 13  SETVAL    //V,N,HPLTFLG/C,N,1/V,N,HPFILE/C,N,0 $

 14  SAVE      HPLTFLG,HPFILE $

 15  COND      HP1,JUMPPLOT$

 16  PLOT      HPLTPAR,HGPSETS,HELSETS,CASECC,HBGPDT,HEQEXIN,HSIL,,/HPLOTX1/
               V,N,HNSIL/V,N,HLUSET/V,N,JUMPPLOT/V,N,HPLTFLG/V,N,HPFILE $

 17  SAVE      JUMPPLOT,HPLTFLG,HPFILE $

 18  PRTMSG    HPLOTX1//$

 19  LABEL     HP1 $

 20  CHKPNT    HPLTPAR,HGPSETS,HELSETS $

 21  GP3       GEOM3,HEQEXIN,GEOM2/HSLT,HGPTT/C,N,123/C,N,123/C,N,123 $

 22  CHKPNT    HGPTT,HSLT $

 23  TA1,      ,HECT,EPT,HBGPDT,HSIL,HGPTT,HCSTM/HEST,,HGEI,HECPT,HGPCT/  V,N,
```

N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N

```
DMAP-DMAP INSTRUCTION
 NO.
               HLUSET/C.N.123/V.N.HNOSIMP=-1/C.N.0/C.N.123/C.N.123 $

 24  SAVE      HNOSIMP $

 25  CHKPNT    HEST.HECPT.HGPCT $

 26  COND      HLBL1.HNOSIMP$

 27  SMA1      HCSTM.MPT.HECPT.HGPCT.DIT/HKGGX..HGPST/C.N.123/C.N.123/V.N.
               HNNLK $

 28  SAVE      HNNLK $

 29  CHKPNT    HKGGX.HGPST $

 30  SMA2      HCSTM.MPT.HECPT.HGPCT.DIT/.HBGG/C.N.1.0/C.N.123/V.N.    HNOBGG=
               -1/C.N.-1 $

 31  SAVE      HNOBGG $

 32  PURGE     HBNN.HBFF.HBAA.HBGG/HNOBGG$

 33  CHKPNT    HBGG.HBNN.HBFF.HBAA $

 34  LABEL     HLBL1 $

 35  RMG       HEST.MATPOOL.HGPTT.HKGGX/HRGG.HQGE.HKGG/C.Y.TABS/C.Y.SIGMA=0.0/
               V.N.HNLR/V.N.HLUSET $

 36  SAVE      HNLR $

 37  EQUIV     HKGGX.HKGG/HNLR $

 38  PURGE     HRGG.HRNN.HRFF.HRAA.HRDD/HNLR $

 39  CHKPNT    HRGG.HRNN.HRFF.HRAA.HRDD.HKGG.HQGE $

 40  GP4       CASECC.GEOM4.HEQEXIN.HSIL.HGPDT/HRG..HUSET./V.N.HLUSET/V.N.
               HMPCF1=-1/V.N.HMPCF2=-1/V.N.HSINGLE=-1/V.N.HOMIT=-1/V.N.HREACT=
               -1/C.N.0/C.N.123/V.N.HNOSET=-1/V.N.HNOL/V.N.HNOA=-1 $

 41  SAVE      HMPCF1.HSINGLE.HOMIT.HNOSET.HREACT.HMPCF2.HNOL.HNOA $

 42  PURGE     HGM.HGMD/HMPCF1/HGO.HGOD/HOMIT/HKFS.HPSO.HQP/HSINGLE $

 43  EQUIV     HKGG.HKNN/HMPCF1/HRGG.HRNN/HMPCF1/HBGG.HBNN/HMPCF1 $

 44  CHKPNT    HGM.HRG.HGO.HKFS.HQP.HUSET.HGMD.HGOD.HPSO.HKNN.HRNN.HBNN $

 45  COND      HLBL2.HNOSIMP $
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

 46  GPSP      HGPL,HGPST,HUSET,HSIL/HOGPST $

 47  OFP       HOGPST,,,,,//V,N,HCARDNO $

 48  SAVE      HCARDNO $

 49  LABEL     HLBL2 $

 50  COND      HLBL3,HMPCF1 $

 51  MCE1      HUSET,HRG/HGM $

 52  CHKPNT    HGM $

 53  MCE2      HUSET,HGM,HKGG,HRGG,HBGG,/HKNN,HRNN,HBNN, $

 54  CHKPNT    HKNN,HRNN,HBNN $

 55  LABEL     HLBL3 $

 56  EQUIV     HKNN,HKFF/HSINGLE/HRNN,HRFF/HSINGLE/HBNN,HBFF/HSINGLE $

 57  CHKPNT    HKFF,HRFF,HBFF $

 58  COND      HLBL4,HSINGLE $

 59  SCE1      HUSET,HKNN,HRNN,HBNN,/HKFF,HKFS,,HRFF,HBFF, $

 60  CHKPNT    HKFS,HKFF,HRFF,HBFF $

 61  LABEL     HLBL4 $

 62  EQUIV     HKFF,HKAA/HOMIT/HRFF,HRAA/HOMIT/HBFF,HBAA/HOMIT $

 63  CHKPNT    HKAA,HRAA,HBAA $

 64  COND      HLBL5,HOMIT $

 65  SMP1      HUSET,HKFF,,,/HGO,HKAA,,,,,,,, $

 66  CHKPNT    HGO,HKAA $

 67  COND      HLBLR,HNLR $

 68  SMP2      HUSET,HGO,HRFF/HRAA $

 69  CHKPNT    HRAA $

 70  LABEL     HLBLR $

 71  COND      HLBL5,HNOBGG $
```

N A S T R A N S O U R C E P R O G R A M C O M P I L A T I O N

```
DMAP-DMAP INSTRUCTION
 NO.

 72  SMP2     HUSET,HGO,HBFF/HBAA $

 73  CHKPNT   HBAA $

 74  LABEL    HLBL5 $

 75  DPD      DYNAMICS,HGPL,HSIL,HUSET/HGPLD,HSILD,HUSETD,HTFPOOL,HDLT,,,
              HNLFT,HTRL,,HEQDYN/V,N,HLUSET/V,N,HLUSETD/C,N,123 /V,N,HNODLT/
              C,N,123/C,N,123/V,N,HNONLFT/V,N,HNOTRL/C,N,123/C,N,123/ V,N,
              HNOUE $

 76  SAVE     HLUSETD,HNODLT,HNONLFT,HNOTRL,HNOUE $

 77  COND     HERROR1,HNOTRL$

 78  EQUIV    HGO,HGOD/HNOUE/HGM,HGMD/HNOUE $

 79  PURGE    HPPO HPSO,HPDO,HPDT/HNODLT $

 80  CHKPNT   HUSETD,HEQDYN,HTFPOOL,HDLT,HTRL,HGOD,HGMD,HNLFT,HSILD,HGPLD,
              HPPO HPSO,HPDO,HPDT $

 81  MTRXIN   CASECC,MATPOOL,HEQDYN,,HTFPOOL/HK2PP,,HB2PP/V,N,HLUSETD/ V,N,
              HNOK2PP/C,N,123/V,N,HNOB2PP $

 82  SAVE     HNOK2PP,HNOB2PP $

 83  PARAM    //C,N,AND/V,N,HKDEKA/V,N,HNOUE/V,N,HNOK2PP $

 84  PURGE    HK2DD/HNOK2PP/HB2DD/HNOB2PP $

 85  EQUIV    HKAA,HKDD/HKDEKA/HB2PP,HB2DD/HNOA/HK2PP,HK2DD/HNOA/HRAA,HRDD/
              HNOUE $

 86  CHKPNT   HK2PP,HB2PP,HK2DD,HB2DD,HKDD,HRDD $

 87  COND     HLBL6,HNOGPDT $

 88  GKAD     HUSETD,HGM,HGO,HKAA,HBAA,HRAA,,HK2PP,,HB2PP/HKDD,HBDD, HRDD,
              HGMD,HGOD,HK2DD,HM2DD,HB2DD/C,N,TRANRESP/C,N,DISP/C,N, DIRECT/
              C,Y,HG=0.0/C,Y,HW3=0.0/C,Y,HW4=0.0/V,N,HNOK2PP/C,N,-1/   V,N,
              HNOB2PP/V,N,HNMPCF1/V,N,HSINGLE/V,N,HOMIT/V,N,HNOUE/ C,N,-1/V,N,
              HNOBGG/V,N,HNOSIMP/C,N,-1 $

 89  LABEL    HLBL6 $

 90  EQUIV    HK2DD,HKDD/HNOSIMP/HB2DD,HBDD/HNOGPDT $

 91  CHKPNT   HKDD,HBDD,HRDD,HGMD,HGOD $

 92  TRLG     CASECC,HUSETD,HDLT,HSLT,HBGPDT,HSIL,HCSTM,HTRL,DIT,HGMD,HGOD,,
```

```
   N A S T R A N   S O U R C E   P R O G R A M . C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.
              HEST/HPPO,HPSO,HPDO,HPDT,,HTOL/V,N,HNOSET/V,N,HPDEPDO $

 93  SAVE     HPDEPDO,HNOSET $

 94  EQUIV    HPPO,HPDO/HNOSET $

 95  EQUIV    HPDO,HPDT/HPDEPDO $

 96  CHKPNT   HPPO,HPDO,HPSO,HTOL,HPDT $

 97  TRHT     CASECC,HUSETD,HNLFT,DIT,HGPTT,HKDD,HBDD,HRDD,HPDT,HTRL/HUDVT,
              HPNLD/C,Y,BETA=.55/C,Y,TABS=0.0/V,N,HNLR/C,Y,RADLIN=-1 $

 98  CHKPNT   HUDVT,HPNLD $

 99  VDR      CASECC,HEQDYN,HUSETD,HUDVT,HTOL,XYCDB,HPNLD/HOUDV1,HOPNL1/  C,
              N,TRANRESP/C,N,DIRECT/C,N,0/V,N,HNOD/V,N,HNOP/C,N,0 $

100  SAVE     HNOD,HNOP $

101  CHKPNT   HOUDV1,HOPNL1 $

102  COND     HLBL7,HNOD $

103  SDR3     HOUDV1,HOPNL1,,,,/HOUDV2,HOPNL2,,,, $

104  OFP      HOUDV2,HOPNL2,,,,//V,N,HCARDNO $

105  SAVE     HCARDNO $

106  CHKPNT   HOPNL2,HOUDV2 $

110  LABEL    HLBL7 $

111  PARAM    //C,N,AND/V,N,HPJUMP/V,N,HNOP/V,N,JUMPPLOT $

112  COND     HLBL9,HPJUMP $

113  EQUIV    HUDVT,HUPV/HNOA $

114  COND     HLBL8,HNOA $

115  SDR1     HUSETD,,HUDVT,,,HGOD,HGMD,HPSO,HKFS,,/HUPV,,HQP/C,N,1/C,N,
              TRANSNT $

116  LABEL    HLBL8 $

117  CHKPNT   HUPV,HQP $

118  PLTTRAN  HBGPDT,HSIL/HBGPDP,HSIP/V,N,HLUSET/V,N,HLUSEP $
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

119  SAVE      HLUSEP $

120  SDR2      CASECC,HCSTM,MPT,DIT,HEQDYN,HSILD,,HTOL,HBGPDP,HPPO,HQP,HUPV,
               HEST,XYCDB/HOPP1,HOQP1,HOUPV1,HOES1,HOEF1 HPUGV /C,N,
               TRANRESP $

121  SDR3      HOPP1,HOQP1,HOUPV1,HOES1,HOEF1,/HOPP2,HOQP2,HOUPV2,HOES2,
               HOEF2, $

122  CHKPNT    HOPP2,HOQP2,HOUPV2,HOES2,HOEF2 $

122  OFP HOPP1,HOQP1,HOUPV1,HOES1,HOEF1,//V,N,HCARDNO $

122  JUMP HP2

123  OFP       HOPP2,HOQP2,HOUPV2,HOEF2,HOES2,//V,N,HCARDNO $

124  SAVE      HCARDNO $

125  COND      HP2,JUMPPLOT $

126  PLOT      HPLTPAR,HGPSETS,HELSETS,CASECC,HBGPDT,HEQEXIN,HSIP,,HPUGV/
               HPLOTX2/V,N,HNSIL/V,N,HLUSEP/V,N,JUMPPLOT/V,N,HPLTFLG/V,N,
               HPFILE $

127  SAVE      HPFILE $

128  PRTMSG    HPLOTX2// $

129  LABEL     HP2 $

130  XYTRAN    XYCDB,HOPP2,HOQP2,HOUPV2,HOES2,HOEF2/HXYPLTT/C,N,TRAN/C,N,PSET/
               V,N,HPFILE/V,N,HCARDNO $

131  SAVE      HPFILE,HCARDNO $

132  XYPLOT    HXYPLTT// $

133  LABEL     HLBL3 $

134  JUMP      FINIS $

135  LABEL     HERROR1 $

136  PRTPARM   //C,N,-1/C,N,HDIRTRDS

137  LABEL     FINIS$

138  END       $
```

```
        N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
    DMAP-DMAP INSTRUCTION
     NO.

*** USER WARNING MESSAGE  54.
     PARAMETER NAMED EPSHT     NOT REFERENCED

*** USER WARNING MESSAGE  54.
     PARAMETER NAMED MAXIT     NOT REFERENCED

          **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**



*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE         6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023,           B =      3
                                             C =      0
                                             R =      2

*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS        0  SECONDS.



*** USER INFORMATION MESSAGE 3028,      B =     5     BBAR =     5
                                        C =     3     CBAR =     1
                                        R =     8

*** USER INFORMATION MESSAGE 3027, UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS       0 SECONDS.
```

TIME = 0.0

L O A D   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	4.000000E 00	8.000000E 00	8.000000E 00	4.000000E 00	4.000000E 00	8.000000E 00
7	S	8.000000E 00	4.000000E 00				
100	S	3.000000E 07					

TIME = 4.500000E 02

L O A D   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	4.000000E 00	8.000000E 00	8.000000E 00	4.000000E 00	4.000000E 00	8.000000E 00
7	S	8.000000E 00	4.000000E 00				
100	S	3.000000E 07					

TIME = 9.0000000E 02

LOAD VECTOR

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	4.0000000E 00	8.0000000E 00	8.0000000E 00	4.0000000E 00	4.0000000E 00	8.0000000E 00
7	S	8.0000000E 00	4.0000000E 00				
100	S	3.0000000E 07					

TIME = 1.350000E 03

L O A D   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	4.000000E 00	8.000000E 00	8.000000E 00	4.000000E 00	4.000000E 00	8.000000E 00
7	S	8.000000E 00	4.000000E 00				
100	S	3.000000E 07					

TIME = 0.0

T E M P E R A T U R E   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	3.000000E 02	3.000000E 02	3.000000E 02	3.000000E 02	3.000000E 02	3.000000E 02
7	S	3.000000E 02	3.000000E 02	3.000000E 02	3.000000E 02		
100	S	3.000000E 02					

TIME = 4.500000E 02

T E M P E R A T U R E   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	2.799189E 02	2.595225E 02	2.316098E 02	2.234185E 02	2.799189E 02	2.595225E 02
7	S	2.316100E 02	2.234187E 02	2.799189E 02	2.799189E 02		
100	S	2.999985E 02					

TIME = 9.000000E 02

TEMPERATURE VECTOR

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	2.756755E 02	2.508229E 02	2.189498E 02	2.092829E 02	2.756755E 02	2.508229E 02
7	S	2.189439E 02	2.092830E 02	2.756755E 02	2.756755E 02		
100	S	2.999983E 02					

TIME = 1.350000E 03

T E M P E R A T U R E   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	2.748357E 02	2.490997E 02	2.164287E 02	2.064647E 02	2.748357E 02	2.490997E 02
7	S	2.164288E 02	2.064649E 02	2.748357E 02	2.748357E 02		
100	S	2.999980E 02					

```
                                X Y - O U T P U T   S U M M A R Y

SUBCASE          1
RESPONSE
DISPLACEMENT     CURVE          1( 3)


CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS GP(100.1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS       ( X =  0.0            TO X =  0.1350000E 04 )

                         THE SMALLEST Y-VALUE =  0.2748357E 03 AT X =  0.1350000E 04

                         THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0            TO X =  0.1350000E 04 )

                         THE SMALLEST Y-VALUE =  0.2748357E 03 AT X =  0.1350000E 04

                         THE LARGEST  Y-VALUE =  0.3000000E 03 A  X =  0.0

                                  E N D   O F   S U M M A R Y
```

X Y - O U T P U T   S U M M A R Y

```
SUBCASE          1
RESPONSE
DISPLACEMENT     CURVE          4( 3)

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS GP(100.1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS        ( X =  0.0            TO X =  0.1350000E 04 )

                         THE SMALLEST Y-VALUE =  0.2064647E 03 AT X =  0.1350000E 04

                         THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0            TO X =  0.1350000E 04 )

                         THE SMALLEST Y-VALUE =  0.2064647E 03 AT X =  0.1350000E 04

                         THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0
```

E N D   O F   S U M M A R Y

```
                         X Y - O U T P U T   S U M M A R Y

SUBCASE          1
RESPONSE
DISPLACEMENT     CURVE       100( 3)

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS CP(100,1,4)

THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS        ( X =  0.0            TO X =  0.1350000E 04 )

                          THE SMALLEST Y-VALUE =  0.2999980E 03 AT X =  0.1350000E 04

                          THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0

WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0            TO X =  0.1350000E 04 )

                          THE SMALLEST Y-VALUE =  0.2999980E 03 AT X =  0.1350000E 04

                          THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0

                              E N D   O F   S U M M A R Y
```

X Y - O U T P U T   S U M M A R Y

SUBCASE 1
RESPONSE
VELOCITY CURVE 100(3)

CURVE TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS PER SECOND GP(100.1.4)

THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS (X = 0.0 TO X = 0.1350000E 04)

THE SMALLEST Y-VALUE = -0.2441405E-04 AT X = 0.0

THE LARGEST Y-VALUE = 0.0 AT X = 0.1350000E 04

WITHIN THE X-LIMITS OF ALL DATA (X = 0.0 TO X = 0.1350000E 04)

THE SMALLEST Y-VALUE = -0.2441405E-04 AT X = 0.0

THE LARGEST Y-VALUE = 0.0 AT X = 0.1350000E 04

E N D   O F   S U M M A R Y

```
                         X Y - O U T P U T   S U M M A R Y

SUBCASE          1
RESPONSE
VELOCITY         CURVE         1( 3)

XY-PAIRS WITHIN FRAME LIMITS WILL BE PLOTTED
PENSIZE =  1

THIS IS CURVE   1 OF WHOLE FRAME    1

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS PER SECOND GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS       ( X =  0.0           TO X =  0.1350000E 04 )

                         THE SMALLEST Y-VALUE = -0.5017089E-01 AT X =  0.0

                         THE LARGEST  Y-VALUE = -0.7161456E-03 AT X =  0.1350000E 04


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0           TO X =  0.1350000E 04 )

                         THE SMALLEST Y-VALUE = -0.5017089E-01 AT X =  0.0

                         THE LARGEST  Y-VALUE = -0.7161456E-03 AT X =  0.1350000E 04

                              E N D   O F   S U M M A R Y
```

```
                                   X Y - O U T P U T   S U M M A R Y

SUBCASE         1
RESPONSE
VELOCITY        CURVE         4( 3)

XY-PAIRS WITHIN FRAME LIMITS WILL BE PLOTTED
PENSIZE =   1

THIS IS CURVE    1 OF WHOLE FRAME     2

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS PER SECOND GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS        ( X =  0.0            TO X =  0.1350000E 04 )
                         THE SMALLEST Y-VALUE = -0.2013183E 00 AT X =  0.0
                         THE LARGEST  Y-VALUE = -0.2401225E-02 AT X =  0.1350000E 04


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0            TO X =  0.1350000E 04 )
                         THE SMALLEST Y-VALUE = -0.2013183E 00 AT X =  0.0
                         THE LARGEST  Y-VALUE = -0.2401225E-02 AT X =  0.1350000E 04

                                    E N D   O F   S U M M A R Y
```

```
                                                 F     R     A     M     E

                                               ****  ****  ****  ****  ****
                                               *  *  *  *  *  *  *  *  *  *
                                               *  *  *  *  *  *  *  *  *  *
                                               *  *  *  *  *  *  *  *  *  *
                                               ****  ****  ****  ****  ****
```

X-AXIS TITLE = TIME IN SECONDS

```
              +----------------------------------------------------------------------------------------------------------------+
              I                                                                                                                I
              I  DEGREES CELSIUS GP(100,1,4)                                                                                   I
              I                                                                                                                I
              I  2.064647E 02                                      2.532323E 02                                   3.000000E 02 I
              +----------------------------------------------------------------------------------------------------------------+
0.0           I                                                    I                                                          A
4.5000E 02    I                 0                                  I                              *                           A
9.0000E 02    I  0                                                 I                         *                                A
1.3500E 03    0                                                    I                        *                                 A
              +----------------------------------------------------------------------------------------------------------------+
```

```
                                      F     R     A     M     E

                                    ****  ****  ****  ****  ****
                                    *  *  *  *  *  *  *  *  *  *
                                    *  *  *  *  *  *  *  *  *  *
                                    *  *  *  *  *  *  *  *  *  *
                                    ****  ****  ****  ****  ****
```

X-AXIS TITLE = TIME IN SECONDS

```
            +----------------------------------------------------------------------------------+
            I                                                                                  I
            I  DEGREES CELSIUS PER SECOND GP(100,1,4)                                          I
            I                                                                                  I
            I -2.441405E-05                        -1.220703E-05                        0.0    I
            +----------------------------------------------------------------------------------+
0.0         *                                        I                                         I
4.5000E 02  I                          *             I                                         I
9.0000E 02  I                                        I             *                           I
1.3500E 03  I                                        I                                         *
            +----------------------------------------------------------------------------------+
```

```
                                F   R   A   M   E

                              **** **** **** ****  **
                              *  * *  * *  * *  *   *
                              *  * *  * *  * *  *   *
                              *  * *  * *  * *  *   *
                              **** **** **** **** ****
```

X-AXIS TITLE = TIME IN SECONDS

```
           +------------------------------------------------------------------------------------------------------+
           I                                                                                                      I
           I  DEGREES CELSIUS PER SECOND GP(100,1,4)                                                              I
           I                                                                                                      I
           I -5.017089E-02                                    -2.544352E-02                         -7.161456E-04 I
           +------------------------------------------------------------------------------------------------------+
0.0        *                                                    I                                                 I
4.5000E 02 I                                                    I              *                                  I
9.0000E 02 I                                                    I                                          *      I
1.3500E 03 I                                                    I                                                 *
           +------------------------------------------------------------------------------------------------------+
```

```
 F    R    A    M    E

****  ****  ****  ****  ****
*  *  *  *  *  *  *  *     *
*  *  *  *  *  *  *  *    *
*  *  *  *  *  *  *  *   *
****  ****  ****  ****  ****
```

X-AXIS TITLE = TIME IN SECONDS

```
            +--------------------------------------------------------------------------------------------+
            I                                                                                            I
            I  DEGREES CELSIUS PER SECOND GP(100,1,4)                                                    I
            I                                                                                            I
            I -2.013183E-01                              -1.018598E-01                     -2.401225E-03 I
            +--------------------------------------------------------------------------------------------+
0.0         *                                              I                                             I
4.5000E 02  I                                              I                  *                          I
9.0000E 02  I                                              I                                      *      I
1.3500E 03  I                                              I                                             *
            +--------------------------------------------------------------------------------------------+
```

```
                                        - - - END OF JOB - - -

..........................................................................................
..........................................................................................
..........................................................................................
..........................................................................................
..........................................................................................
 NASTRAN LOADED AT LOCATION 12CF20
 TIME TO GO =   59 CPU SEC.,  239 I/O SEC.
*      0 CPU-SEC.          0 ELAPSED-SEC.      SEM1   BEGN
*      0 CPU-SEC.          0 ELAPSED-SEC.      SEMT
*      1 CPU-SEC.          3 ELAPSED-SEC.      NAST
*      1 CPU-SEC.          3 ELAPSED-SEC.      GNFI
*      1 CPU-SEC.          3 ELAPSED-SEC.      XCSA
*      1 CPU-SEC.          5 ELAPSED-SEC.      IFP1
*      1 CPU-SEC.          9 ELAPSED-SEC.      XSOR
*      2 CPU-SEC.         13 ELAPSED-SEC.        DO   IFP
*      3 CPU-SEC.         25 ELAPSED-SEC.       END   IFP
*      3 CPU-SEC.         25 ELAPSED-SEC.      XGPI
*      5 CPU-SEC.         32 ELAPSED-SEC.      SEM1   END
*      5 CPU-SEC.         33 ELAPSED-SEC.      ----   LINKNS02 ---
=     24 I/O SEC.
 LAST LINK DID NOT USE    40016 BYTES OF OPEN CORE
*      5 CPU-SEC.         35 ELAPSED-SEC.      ----   LINK END ---
*      5 CPU-SEC.         35 ELAPSED-SEC.      XSFA
*      5 CPU-SEC.         37 ELAPSED-SEC.      XSFA
*      5 CPU-SEC.         37 ELAPSED-SEC.      3      GP1      BEGN
*      5 CPU-SEC.         43 ELAPSED-SEC.      3      GP1      END
*      5 CPU-SEC.         47 ELAPSED-SEC.      8      GP2      BEGN
*      5 CPU-SEC.         47 ELAPSED-SEC.      8      GP2      END
*      5 CPU-SEC.         48 ELAPSED-SEC.      10     PLTSET   BEGN
*      5 CPU-SEC.         49 ELAPSED-SEC.      10     PLTSET   END
*      5 CPU-SEC.         50 ELAPSED-SEC.      12     PRTMSG   BEGN
*      5 CPU-SEC.         50 ELAPSED-SEC.      12     PRTMSG   END
*      5 CPU-SEC.         51 ELAPSED-SEC.      13     SETVAL   BEGN
*      5 CPU-SEC.         51 ELAPSED-SEC.      13     SETVAL   END
*      5 CPU-SEC.         53 ELAPSED-SEC.      21     GP3      BEGN
*      5 CPU-SEC.         64 ELAPSED-SEC.      21     GP3      END
*      5 CPU-SEC.         64 ELAPSED-SEC.      23     TA1      BEGN
*      6 CPU-SEC.         75 ELAPSED-SEC.      23     TA1      END
*      6 CPU-SEC.         77 ELAPSED-SEC.      ----   LINKNS03 ---
=     55 I/O SEC.
 LAST LINK DID NOT USE    82788 BYTES OF OPEN CORE
*      6 CPU-SEC.         81 ELAPSED-SEC.      ----   LINK END ---
*      6 CPU-SEC.         81 ELAPSED-SEC.      27     SMA1     BEGN
*      6 CPU-SEC.         85 ELAPSED-SEC.      27     SMA1     END
*      6 CPU-SEC.         86 ELAPSED-SEC.      30     SMA2     BEGN
*      6 CPU-SEC.         89 ELAPSED-SEC.      30     SMA2     END
*      6 CPU-SEC.         90 ELAPSED-SEC.      ----   LINKNS05 ---
=     63 I/O SEC.
 LAST LINK DID NOT USE    64268 BYTES OF OPEN CORE
*      6 CPU-SEC.         97 ELAPSED-SEC.      ----   LINK END ---
*      6 CPU-SEC.         97 ELAPSED-SEC.      35     RMG      BEGN
*      6 CPU-SEC.        101 ELAPSED-SEC.      SDCO   MP
*      6 CPU-SEC.        102 ELAPSED-SEC.      SDCO   MP
*      6 CPU-SEC.        103 ELAPSED-SEC.      FBS
*      6 CPU-SEC.        106 ELAPSED-SEC.      FBS
*      6 CPU-SEC.        107 ELAPSED-SEC.      MPYA   D
                                                      METHOD 2 NT.NBR PASSES =    1,EST. TIME =        0.0
*      7 CPU-SEC.        107 ELAPSED-SEC.      MPYA   D
*      7 CPU-SEC.        108 ELAPSED-SEC.      TRAN   POSE
*      7 CPU-SEC.        109 ELAPSED-SEC.      TRAN   POSE
*      7 CPU-SEC.        109 ELAPSED-SEC.      MPYA   D
```

```
                                                        METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     7 CPU-SEC.       110 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.       112 ELAPSED-SEC.     35    RMG      END
*     7 CPU-SEC.       113 ELAPSED-SEC.     ----  LINKNS04 ---
=    80 I/O SEC.
 LAST LINK DID NOT USE   72520 BYTES OF OPEN CORE
*     7 CPU-SEC.       118 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.       118 ELAPSED-SEC.     40    GP4      BEGN
*     7 CPU-SEC.       121 ELAPSED-SEC.     40    GP4      END
*     7 CPU-SEC.       123 ELAPSED-SEC.     46    GPSP     BEGN
*     7 CPU-SEC.       123 ELAPSED-SEC.     46    GPSP     END
*     7 CPU-SEC.       124 ELAPSED-SEC.     ----  LINKNS14 - -
=    88 I/O SEC.
 LAST LINK DID NOT USE  117044 BYTES OF OPEN CORE
*     7 CPU-SEC.       128 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.       128 ELAPSED-SEC.     47    OFP      BEGN
*     7 CPU-SEC.       128 ELAPSED-SEC.     47    OFP      END
*     7 CPU-SEC.       130 ELAPSED-SEC.     ----  LINKNS04 ---
=    91 I/O SEC.
 LAST LINK DID NOT USE  115664 BYTES OF OPEN CORE
*     8 CPU-SEC.       133 ELAPSED-SEC.     ----  LINK END ---
*     8 CPU-SEC.       133 ELAPSED-SEC.     51    MCE1     BEGN
*     8 CPU-SEC.       135 ELAPSED-SEC.     51    MCE1     END
*     8 CPU-SEC.       136 ELAPSED-SEC.     53    MCE2     BEGN
*     8 CPU-SEC.       139 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     8 CPU-SEC.       140 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.       140 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     8 CPU-SEC.       142 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.       142 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     9 CPU-SEC.       143 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.       145 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     9 CPU-SEC.       146 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.       146 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     9 CPU-SEC.       147 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.       147 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*    10 CPU-SEC.       149 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.       151 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*    10 CPU-SEC.       152 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.       152 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*    10 CPU-SEC.       153 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.       153 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*    11 CPU-SEC.       154 ELAPSED-SEC.     MPYA  D
*    11 CPU-SEC.       155 ELAPSED-SEC.     53    MCE2     END
*    11 CPU-SEC.       157 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.       158 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.       158 ELAPSED-SEC.     ----  LINKNS06 ---
=   113 I/O SEC.
 LAST LINK DID NOT USE  102132 BYTES OF OPEN CORE
*    11 CPU-SEC.       160 ELAPSED-SEC.     ----  LINK END ---
*    11 CPU-SEC.       160 ELAPSED-SEC.     75    DPD      BEGN
*    11 CPU-SEC.       164 ELAPSED-SEC.     75    DPD      END
*    11 CPU-SEC.       165 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.       166 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.       166 ELAPSED-SEC.     ----  LINKNS10 ---
=   122 I/O SEC.
```

```
 LAST LINK DID NOT USE  116416 BYTES OF OPEN CORE
*     11 CPU-SEC.      168 ELAPSED-SEC.      ----  LINK END ---
*     11 CPU-SEC.      168 ELAPSED-SEC.      81    MTRXIN  BEGN
*     11 CPU-SEC.      168 ELAPSED-SEC.      81    MTRXIN  END
*     11 CPU-SEC.      169 ELAPSED-SEC.      83    PARAM   BEGN
*     11 CPU-SEC.      169 ELAPSED-SEC.      83    PARAM   END
*     11 CPU-SEC.      170 ELAPSED-SEC.      XSFA
*     12 CPU-SEC.      171 ELAPSED-SEC.      XSFA
*     12 CPU-SEC.      171 ELAPSED-SEC.      88    GKAD    BEGN
*     12 CPU-SEC.      173 ELAPSED-SEC.      88    GKAD    END
*     12 CPU-SEC.      173 ELAPSED-SEC.      XSFA
*     12 CPU-SEC.      174 ELAPSED-SEC.      XSFA
*     12 CPU-SEC.      174 ELAPSED-SEC.      ----  LINKNS05 ---
=   128 I/O SEC.
 LAST LINK DID NOT USE  117064 BYTES OF OPEN CORE
*     12 CPU-SEC.      176 ELAPSED-SEC.      ----  LINK END ---
*     12 CPU-SEC.      176 ELAPSED-SEC.      92    TRLG    BEGN
*     12 CPU-SEC.      183 ELAPSED-SEC.      MPYA  D
                                                   METHOD 2 T .NBR PASSES =    1.EST. TIME =      0.0
*     12 CPU-SEC.      184 ELAPSED-SEC.      MPYA  D
*     12 CPU-SEC.      186 ELAPSED-SEC.      MPYA  D
                                                   METHOD 2 NT.NBR PASSES =    1.EST. TIME =      0.0
*     12 CPU-SEC.      187 ELAPSED-SEC.      MPYA  D
*     13 CPU-SEC.      187 ELAPSED-SEC.      MPYA  D
                                                   METHOD 2 NT.NBR PASSES =    1.EST. TIME =      0.0
*     13 CPU-SEC.      188 ELAPSED-SEC.      MPYA  D
*     13 CPU-SEC.      188 ELAPSED-SEC.      MPYA  D
                                                   METHOD 2 NT.NBR PASSES =    1.EST. TIME =      0.0
*     13 CPU-SEC.      189 ELAPSED-SEC.      MPYA  D
*     13 CPU-SEC.      189 ELAPSED-SEC.      92    TRLG    END
*     13 CPU-SEC.      190 ELAPSED-SEC.      ----  LINKNS11 ---
=   143 I/O SEC.
 LAST LINK DID NOT USE   58172 BYTES OF OPEN CORE
*     13 CPU-SEC.      193 ELAPSED-SEC.      ----  LINK END ---
*     13 CPU-SEC.      193 ELAPSED-SEC.      97    TRHT    BEGN
*     13 CPU-SEC.      195 ELAPSED-SEC.      DECO  MP
*     13 CPU-SEC.      196 ELAPSED-SEC.      DECO  MP
*     15 CPU-SEC.      241 ELAPSED-SEC.      97    TRHT    END
*     15 CPU-SEC.      241 ELAPSED-SEC.      ----  LINKNS12 ---
=   203 I/O SEC.
 LAST LINK DID NOT USE   69268 BYTES OF OPEN CORE
*     15 CPU-SEC.      245 ELAPSED-SEC.      ----  LINK END ---
*     15 CPU-SEC.      245 ELAPSED-SEC.      99    VDR     BEGN
*     15 CPU-SEC.      246 ELAPSED-SEC.      99    VDR     END
*     15 CPU-SEC.      247 ELAPSED-SEC.      111   PARAM   BEGN
*     15 CPU-SEC.      247 ELAPSED-SEC.      111   PARAM   END
*     15 CPU-SEC.      247 ELAPSED-SEC.      115   SDR1    BEGN
*     15 CPU-SEC.      248 ELAPSED-SEC.      MPYA  D
                                                   METHOD 2 NT.NBR PASSES =    1.EST. TIME =      0.0
*     15 CPU-SEC.      249 ELAPSED-SEC.      MPYA  D
*     15 CPU-SEC.      251 ELAPSED-SEC.      115   SDR1    END
*     16 CPU-SEC.      251 ELAPSED-SEC.      ----  LINKNS08 ---
=   213 I/O SEC.
 LAST LINK DID NOT USE  119112 BYTES OF OPEN CORE
*     16 CPU-SEC.      257 ELAPSED-SEC.      ----  LINK END ---
*     16 CPU-SEC.      257 ELAPSED-SEC.      118   PLTTRAN BEGN
*     16 CPU-SEC.      258 ELAPSED-SEC.      118   PLTTRAN END
*     16 CPU-SEC.      258 ELAPSED-SEC.      ----  LINKNS13 ---
=   219 I/O SEC.
 LAST LINK DID NOT USE  114512 BYTES OF OPEN CORE
*     16 CPU-SEC.      264 ELAPSED-SEC.      ----  LINK END ---
*     16 CPU-SEC.      264 ELAPSED-SEC.      120   SDR2    BEGN
*     16 CPU-SEC.      267 ELAPSED-SEC.      120   SDR2    END
*     16 CPU-SEC.      267 ELAPSED-SEC.      ----  LINKNS14 ---
```

```
=    228 I/O SEC.
 LAST LINK DID NOT USE    66428 BYTES OF OPEN CORE
*     16 CPU-SEC.        275 ELAPSED-SEC.       ----   LINK END ---
*     16 CPU-SEC.        275 ELAPSED-SEC.       121    SDR3     BEGN
*     16 CPU-SEC.        278 ELAPSED-SEC.       121    SDR3     END
*     16 CPU-SEC.        278 ELAPSED-SEC.       122    OFP      BEGN
*     17 CPU-SEC.        280 ELAPSED-SEC.       122    OFP      END
*     17 CPU-SEC.        280 ELAPSED-SEC.       130    XYTRAN   BEGN
*     19 CPU-SEC.        287 ELAPSED-SEC.       130    XYTRAN   END
*     19 CPU-SEC.        288 ELAPSED-SEC.       ----   LINKNS02 ---
=    246 I/O SEC.
 LAST LINK DID NOT USE         0 BYTES OF OPEN CORE
*     19 CPU-SEC.        297 ELAPSED-SEC.       ----   LINK END ---
*     19 CPU-SEC.        297 ELAPSED-SEC.       132    XYPLOT   BEGN
*     19 CPU-SEC.        298 ELAPSED-SEC.       132    XYPLOT   END
*     19 CPU-SEC.        298 ELAPSED-SEC.       138    EXIT     BEGN
---------------------------------------- ----------------------------------------------------------------------------------
=    247 I/O SEC.
 LAST LINK DID NOT USE    97232 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =    OK BYTES
```

IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$**************************************************************************
$ START OF EXECUTIVE CONTROL ***********************************************
$**************************************************************************
$
ID CLASS PROBLEM FIVE, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR TRANSIENT SOLUTION ALGORITHM IS TO BE USED
$
SOL 9
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
$
$ REQUEST FOR DIAGNOSTIC PRINTOUT WHICH LISTS THE RIGID FORMAT BEING EXECUTED
$ (IN THIS CASE, SOL 9). THE INCLUSION OF THIS CARD IS OPTIONAL.
$
DIAG 14
$
$ THE RIGID FORMAT IS BEING ALTERED TO CAUSE NASTRAN TO STOP PROCESSING
$ AFTER DMAP STATEMENT 20
$
ALTER 20
EXIT $
$
$ THE RIGID FORMAT IS BEING ALTERED TO PROVIDE TRANSIENT OUTPUT
$ SORTED BY TIME STEP RATHER THAN BY GRID POINT. COMPARE THE OUTPUT WITH PROBLEM
$ 3 TO SEE THE DIFFERENCE. THIS ALTER PLUS THE DIAG 14 ADDITION ARE THE ONLY
$ CHANGES FROM PROBLEM 3 MADE IN EXECUTIVE CONTROL. THE ONLY OTHER
$ CHANGE WAS MADE TO THE TSTEP CARD IN THE BULK DATA.
$
ALTER 122
OFP HOPP1,HOQP1,HOUPV1,HOES1,HOEF1,//V,N,HCARDNO $
JUMP HP2
ENDALTER
CEND
```

```
                                C A S E   C O N T R O L   D E C K   E C H O
CARD
COUNT
  1      $
  2      $*************************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ****************************
  4      $*************************************************************************************
  5      $
  6      TITLE=   NON-LINEAR TRANSIENT PROBLEM ... PRODUCE STRUCTURE PLOT
  7      $
  8      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
  9      $
 10      LINE=51
 11      $
 12      $ REQUEST SORTED AND UNSORTED OUTPUT
 13      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 14      $
 15      ECHO=BOTH
 16      $
 17      $ SELECT THE MPC AND LOAD SETS TO BE USED IN THIS SOLUTION
 18      $ NOTE THAT NO SPC SET IS SELECTED, AND THAT DLOAD HAS REPLACED LOAD.
 19      $
 20      MPC=200
 21      DLOAD=300
 22      $
 23      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 24      $ THE SELECTION OF THIS SET IS OPTIONAL FOR SOL 9, BUT SHOULD BE MADE IF
 25      $ THE FINAL TEMPERATURE IS SEVERAL HUNDRED DEGREES DIFFERENT FROM THE
 26      $ IC VECTOR, AND RADIATIVE INTERCHANGES ARE INCLUDED.
 27      $
 28      TEMP(MATERIAL)=400
 29      $
 30      $ SELECT THE STEP SIZE, NUMBER OF INCREMENTS, AND PRINTOUT FREQUENCY
 31      $
 32      TSTEP=500
 33      $
 34      $ SELECT THE TEMPERATURE SET DEFINING THE TEMPERATURE VECTOR AT T=0.
 35      $
 36      IC=600
 37      $
 38      $ SELECT OUTPUT DESIRED
 39      $
 40      OUTPUT
 41      THERMAL=ALL
 42      $
 43      $ DEFINE A GROUP OF GRID POINTS TO BE REFERENCED BY AN OUTPUT REQUEST
 44      $
 45      SET 5 = 1,2,3,4,5,6,7,8,100
 46      $
 47      $ REFERENCE A PREVIOUSLY DEFINED GROUP OF GRID POINTS
 48      $
 49      OLOAD=5
 50      $
 51      $ THE FOLLOWING CARDS REQUEST 4 FRAMES OF TRANSIENT PLOTS
```

```
                         C A S E   C O N T R O L   D E C K   E C H O
CARD
COUNT
 52      $ THESE PLOTS WILL BE PRODUCED IMMEDIATELY ON THE PRINTER
 53      $
 54      OUTPUT(XYOUT)
 55      XTITLE=TIME IN SECONDS
 56      YTITLE= DEGREES CELSIUS GP(100,1,4)
 57      $
 58      $ 'DISP' MEANS THAT THE GRID POINT TEMPERATURE WILL BE PLOTTED VERSUS TIME
 59      $ 'T1' IS REQUIRED (VESTIGIAL REMNANT FROM THE STRUCTURAL VERSION OF NASTRAN)
 60      $ ALL OF THESE PLOTS WILL APPEAR ON ONE FRAME
 61      $
 62      XYPAPLOT DISP/100(T1),1(T1),4(T1)
 63      XTITLE=TIME IN SECONDS
 64      YTITLE= DEGREES CELSIUS PER SECOND GP(100,1,4)
 65      $
 66      $ 'VELO' MEANS THAT THE THERMAL VELOCITY WILL BE PLOTTED AS A FUNCTION OF TIME
 67      $ THESE THREE PLOTS WILL APPEAR ON THREE DIFFERENT FRAMES
 68      $
 69      XYPAPLOT VELO/100(T1)/1(T1)/4(T1)
 70      $
 71      $ THE FOLLOWING SET OF CARDS WILL GENERATE A PLOT OF THE STRUCTURAL
 72      $ ELEMENTS IN THE PROBLEM BEING SOLVED. OUTPUT WILL BE PRODUCED FOR A
 73      $ SC 4020 PLOTTER. THIS PLOT PACKAGE MUST BE THE LAST SET OF CARDS BEFORE 'BEGIN
 74      $ BULK'. A SEVEN TRACK PLOT TAPE MUST BE PROVIDED.
 75      $
 76      OUTPUT(PLOT)
 77      SET 1 ALL
 78      FIND SET 1 ORIGIN 1 SCALE
 79      PLOT SET 1 ORIGIN 1 LABEL GRID POINTS
 80      PLOT SET 1 ORIGIN 1 LABEL ELEMENTS
 81      $
 82      $*******************************************************************************
 83      $ END CASE CONTROL --- START BULK DATA ******************************************
 84      $*******************************************************************************
 85      $
 86      BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY AND THERMAL MASS
$
MAT4    1000    200.    2.426+6                                         ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*****************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

INPUT BULK DATA DECK ECHO

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED FOR THE TRANSIENT SOLUTION ----------
$ THEY CONVERT PROBLEM TWO TO PROBLEM THREE
$ NOTE THAT THE SPC1 SET WAS NOT SELECTED IN CASE CONTROL
$ NOTE THAT SPCF OUTPUT IS NOT REQUESTED IN TRANSIENT
$ NOTE THAT THERMAL MASS WAS ADDED TO 'MAT4' CARD 1000
$ NOTE THAT THE DIAG CARD IN THE EXECUTIVE CONTROL WAS IRRELEVANT
$ NOTE THAT THE LOAD REQUEST IN CASE CONTROL IS NOW A DLOAD REQUEST
$
$
$ TRANSIENT SINGLE POINT CONSTRAINT METHOD
$ CONSTRAIN GRID POINT 100 TO 300 DEGREES CELSIUS
$
CELAS2  300     1.+5    100     1
SLOAD   300     100     300.+5
$
$ DEFINES A CONSTANT LOAD SET APPLIED FROM T=0. TO T=1.+6 SECONDS
$
TLOAD2  300     300                             0.      1.+6    0.      0.      +TL1
+TL1    0.      0.
$
$ DEFINES THE NUMBER OF INCREMENTS, THE STEP SIZE, AND THE PRINTOUT FREQUENCY
$ REFERENCED IN CASE CONTROL AS 'TSTEP'
$ EACH TIME STEP IS 30 SECONDS
$
TSTEP   500     45      30.     15
$
$ DEFINES A TEMPERATURE VECTOR --- REFERENCED IN CASE CONTROL AS 'IC'
$
TEMPD   600     300.
$*******************************************************************************
$ THE FOLLOWING CHANGES WERE MADE TO CONVERT PROBLEM THREE TO PROBLEM FOUR
$ THE ONLY BULK DATA CARD WHICH WAS CHANGED WAS THE TSTEP CARD.
$ WHOSE FREQUENCY OF OUTPUT WAS CHANGED FROM EVERY STEP TO EVERY 15 STEPS.
$ THE ONLY OTHER CHANGES FROM PROBLEM THREE WERE IN EXECUTIVE CONTROL, WHERE
$ A NEW DIAG CARD AND AN ALTER WERE ADDED.
$
$*******************************************************************************
$ THE FOLLOWING CHANGES WERE MADE TO CONVERT PROBELM FOUR TO PROBLEM FIVE
$ A PLOT TAPE WAS REQUESTED
$ AN ALTER WAS ADDED IN EXECUTIVE CONTROL
$ A PLOT PACKAGE WAS ADDED TO THE CASE CONTROL
$ NO CHANGES WERE MADE TO THE BULK DATA
$
$*******************************************************************************
$ END OF BULK DATA *************************************************************
$*******************************************************************************
$
ENDDATA
```

TOTAL COUNT= 151

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED.XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10
1-	CELAS2	300	1.+5	.00	1					
2-	CHBDY	60	300	LINE	1	5				+CONVEC
3-	+CONVEC	100	100							
4-	CHBDY	200	2000	AREA4	1	2	6	5		
5-	CHBDY	300	2000	AREA4	2	3	7	6		
6-	CHBDY	400	2000	AREA4	3	4	8	7		
7-	CHBDY	500	2000	AREA4	5	6	2	1		
8-	CHBDY	600	2000	AREA4	6	7	3	2		
9-	CHBDY	700	2000	AREA4	7	8	4	3		
10-	CQUAD2	30	200	1	2	6	5			
11-	CQUAD2	40	200	2	3	7	6			
12-	CQUAD2	50	200	3	4	8	7			
13-	CROD	10	100	10	2					
14-	CROD	20	100	9	6					
15-	GRID	1		0.0	0.0	0.0				
16-	GRID	2		.1	0.0	0.0				
17-	GRID	3		.2	0.0	0.0				
18-	GRID	4		.3	0.0	0.0				
19-	GRID	5		0.0	.1	0.0				
20-	GRID	6		.1	.1	0.0				
21-	GRID	7		.2	.1	0.0				
22-	GRID	8		.3	.1	0.0				
23-	GRID	9		0.0	.2	0.0				
24-	GRID	10		0.0	-.1	0.0				
25-	GRID	100		-.05	.05	0.0				
26-	MAT4	1000	200.	2.426+6						ALUMINUM
27-	MAT4	3000	200.							
28-	MPC	200	9	1	1.	5	1	-1.		
29-	MPC	200	10	1	1.	1	1	-1.		
30-	PARAM	EPSHT	.0001							
31-	PARAM	MAXIT	8							
32-	PARAM	SIGMA	5.685E-8							
33-	PARAM	TABS	273.15							
34-	PHBDY	300	3000	.314						
35-	PHBDY	2000			.90					
36-	PQUAD2	200	1000	.01						
37-	PROD	100	1000	.001						
38-	RADLST	200	300	400	500	600	700			
39-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
40-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
41-	RADMTX	3	0.0	0.0	0.0	0.0				
42-	RADMTX	4	0.0	0.0	0.0					
43-	RADMTX	5	0.0	0.0						
44-	RADMTX	6	0.0							
45-	SLOAD	300	1	4.	2	8.				
46-	SLOAD	300	3	8.	4	4.				
47-	SLOAD	300	5	4.	6	8.				
48-	SLOAD	300	7	8.	8	4.				
49-	SLOAD	300	100	300.+5						
50-	SPC1	100	1	100						
51-	TEMP	400	100	300.						

```
                                   S O R T E D   B U L K   D A T A   E C H O
CARD
COUNT         .   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
   52-        TEMPD   400     300.
   53-        TEMPD   600     300.
   54-        TLOAD2  300     300                     0.0     1.+6    0.0     0.0     +TL1
   55-        +TL1    0.      0.
   56-        TSTEP   500     45      30.     15
              ENDDATA
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

  1  BEGIN     HEAT NO.9 TRANSIENT HEAT TRANSFER ANALYSIS $

  2  FILE      KGGX=TAPE/ KGG=TAPE $

  3  GP1       GEOM1,GEOM2,/HGPL,HEQEXIN,HGPDT,HCSTM,HBGPDT,HSIL/V,N,HLUSET/
               V,N,HALWAYS=-1/V,N,HNOGPDT $

  4  SAVE      HLUSET,HNOGPDT$

  5  PURGE     HUSET,HGM,HGO,HKAA,HBAA,HPSO,HKFS,HQP,HEST/HNOGPDT $

  6  CHKPNT    HGPL,HEQEXIN,HGPDT,HCSTM,HBGPDT,HSIL,HUSET,HGM,HGO,HKAA,HBAA,
               HPSO,HKFS,HQP,HEST $

  7  COND      HLBL5,HNOGPDT$

  8  GP2       GEOM2,HEQEXIN/HECT $

  9  CHKPNT    HECT $

 10  PLTSET    PCDB,HEQEXIN,HECT/HPLTSETX,HPLTPAR,HGPSETS,HELSETS/V,N,HNSIL/V,
               N,JUMPPLOT $

 11  SAVE      HNSIL,JUMPPLOT $

 12  PRTMSG    HPLTSETX//$

 13  SETVAL    //V,N,HPLTFLG/C,N,1/V,N,HPFILE/C,N,0 $

 14  SAVE      HPLTFLG,HPFILE $

 15  COND      HP1,JUMPPLOT$

 16  PLOT      HPLTPAR,HGPSETS,HELSETS,CASECC,HBGPDT,HEQEXIN,HSIL,,/HPLOTX1/
               V,N,HNSIL/V,N,HLUSET/V,N,JUMPPLOT/V,N,HPLTFLG/V,N,HPFILE $

 17  SAVE      JUMPPLOT,HPLTFLG,HPFILE $

 18  PRTMSG    HPLOTX1//$

 19  LABEL     HP1 $

 20  CHKPNT    HPLTPAR,HGPSETS,HELSETS $

 20  EXIT $

 21  GP3       GEOM3,HEQEXIN,GEOM2/HSLT,HGPTT/C,N,123/C,N,123/C,N,123 $

 22  CHKPNT    HGPTT,HSLT $
```

N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N

```
DMAP-DMAP INSTRUCTION
 NO.

 23  TA1,      ,HECT,EPT,HBGPDT,HSIL,HGPTT,HCSTM/HEST,,HGEI,HECPT,HGPCT/  V,N,
               HLUSET/C,N,123/V,N,HNOSIMP=-1/C,N,0/C,N,123/C,N,123 $

 24  SAVE      HNOSIMP $

 25  CHKPNT    HEST,HECPT,HGPCT $

 26  COND      HLBL1,HNOSIMP$

 27  SMA1      HCSTM,MPT,HECPT,HGPCT,DIT/HKGGX,,HGPST/C,N,123/C,N,123/V,N,
               HNNLK $

 28  SAVE      HNNLK $

 29  CHKPNT    HKGGX,HGPST $

 30  SMA2      HCSTM,MPT,HECPT,HGPCT,DIT/,HBGG/C,N,1.0/C,N,123/V,N,    HNOBGG=
               -1/C,N,-1 $

 31  SAVE      HNOBGG $

 32  PURGE     HBNN,HBFF,HBAA,HBGG/HNOBGG$

 33  CHKPNT    HBGG,HBNN,HBFF,HBAA $

 34  LABEL     HLBL1 $

 35  RMG       HEST,MATPOOL,HGPTT,HKGGX/HRGG,HQGE,HKGG/C,Y,TABS/C,Y,SIGMA=0.0/
               V,N,HNLR/V,N,HLUSET $

 36  SAVE      HNLR $

 37  EQUIV     HKGGX,HKGG/HNLR $

 38  PURGE     HRGG,HRNN,HRFF,HRAA,HRDD/HNLR $

 39  CHKPNT    HRGG,HRNN,HRFF,HRAA,HRDD,HKGG,HQGE $

 40  GP4       CASECC,GEOM4,HEQEXIN,HSIL,HGPDT/HRG,,HUSET,/V,N,HLUSET/V,N,
               HMPCF1=-1/V,N,HMPCF2=-1/V,N,HSINGLE=-1/V,N,HOMIT=-1/V,N,HREACT=
               -1/C,N,0/C,N,123/V,N,HNOSET=-1/V,N,HNOL/V,N,HNOA=-1 $

 41  SAVE      HMPCF1,HSINGLE,HOMIT,HNOSET,HREACT,HMPCF2,HNOL,HNOA $

 42  PURGE     HGM,HGMD/HMPCF1/HGO,HGOD/HOMIT/HKFS,HPSO,HQP/HSINGLE $

 43  EQUIV     HKGG,HKNN/HMPCF1/HRGG,HRNN/HMPCF1/HBGG,HBNN/HMPCF1 $

 44  CHKPNT    HGM,HRG,HGO,HKFS,HQP,HUSET,HGMD,HGOD,HPSO,HKNN,HRNN,HBNN $

 45  COND      HLBL2,HNOSIMP $
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

 46  GPSP      HGPL,HGPST,HUSET,HSIL/HOGPST $

 47  OFP       HOGPST,,,,,//V,N,HCARDNO $

 48  SAVE      HCARDNO $

 49  LABEL     HLBL2 $

 50  COND      HLBL3,HMPCF1 $

 51  MCE1      HUSET,HRG/HGM $

 52  CHKPNT    HGM $

 53  MCE2      HUSET,HGM,HKGG,HRGG,HBGG,/HKNN,HRNN,HBNN, $

 54  CHKPNT    HKNN,HRNN,HBNN $

 55  LABEL     HLBL3 $

 56  EQUIV     HKNN,HKFF/HSINGLE/HRNN,HRFF/HSINGLE/HBNN,HBFF/HSINGLE $

 57  CHKPNT    HKFF,HRFF,HBFF $

 58  COND      HLBL4,HSINGLE $

 59  SCE1      HUSET,HKNN,HRNN,HBNN,/HKFF,HKFS,,HRFF,HBFF, $

 60  CHKPNT    HKFS,HKFF,HRFF,HBFF $

 61  LABEL     HLBL4 $

 62  EQUIV     HKFF,HKAA/HOMIT/HRFF,HRAA/HOMIT/HBFF,HBAA/HOMIT $

 63  CHKPNT    HKAA,HRAA,HBAA $

 64  COND      HLBL5,HOMIT $

 65  SMP1      HUSET,HKFF,,,/HGO,HKAA,,,,,,,, $

 66  CHKPNT    HGO,HKAA $

 67  COND      HLBLR,HNLR $

 68  SMP2      HUSET,HGO,HRFF/HRAA $

 69  CHKPNT    HRAA $

 70  LABEL     HLBLR $

 71  COND      HLBL5,HNOBGG $
```

N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N

```
DMAP-DMAP INSTRUCTION
 NO.

 72  SMP2     HUSET,HGO,HBFF/HBAA $

 73  CHKPNT   HBAA $

 74  LABEL    HLBL5 $

 75  DPD      DYNAMICS,HGPL,HSIL,HUSET/HGPLD,HSILD,HUSETD,HTFPOOL,DLT,,,
              HNLFT,HTRL,,HEQDYN/V,N,HLUSET/V,N,HLUSETD/C,N,123 /V,N,HNODLT/
              C,N,123/C,N,123/V,N,HNONLFT/V,N,HNOTRL/C,N,123/C,N,123/ V,N,
              HNOUE $

 76  SAVE     HLUSETD,HNODLT,HNONLFT,HNOTRL,HNOUE $

 77  COND     HERROR1,HNOTRL$

 78  EQUIV    HGO,HGOD/HNOUE/HGM,HGMD/HNOUE $

 79  PURGE    HPPO,HPSO,HPDO,HPDT/HNODLT $

 80  CHKPNT   HUSETD,HEQDYN,HTFPOOL,HDLT,HTRL,HGOD,HGMD,HNLFT,HSILD,HGPLD,
              HPPO,HPSO,HPDO,HPDT $

 81  MTRXIN   CASECC,MATPOOL,HEQDYN,,HTFPOOL/HK2PP,,HB2PP/V,N,HLUSETD/ V,N,
              HNOK2PP/C,N,123/V,N,HNOB2PP $

 82  SAVE     HNOK2PP,HNOB2PP $

 83  PARAM    //C,N,AND/V,N,HKDEKA/V,N,HNOUE/V,N,HNOK2PP $

 84  PURGE    HK2DD/HNOK2PP/HB2DD/HNOB2PP $

 85  EQUIV    HKAA,HKDD/HKDEKA/HB2PP,HB2DD/HNOA/HK2PP,HK2DD/HNOA/HRAA,HRDD/
              HNOUE $

 86  CHKPNT   HK2PP,HB2PP,HK2DD,HB2DD,HKDD,HRDD $

 87  COND     HLBL6,HNOGPDT $

 88  GKAD     HUSETD,HGM,HGO,HKAA,HBAA,HRAA,,HK2PP,,HB2PP/HKDD,HBDD, HRDD,
              HGMD,HGOD,HK2DD,HM2DD,HB2DD/C,N,TRANRESP/C,N,DISP/C,N, DIRECT/
              C,Y,HG=0.0/C,Y,HW3=0.0/C,Y,HW4=0.0/V,N,HNOK2PP/C,N,-1/   V,N,
              HNOB2PP/V,N,HMPCF1/V,N,HSINGLE/V,N,HOMIT/V,N,HNOUE/ C,N,-1/V,N,
              HNOBGG/V,N,HNOSIMP/C,N,-1 $

 89  LABEL    HLBL6 $

 90  EQUIV    HK2DD,HKDD/HNOSIMP/HB2DD,HBDD/HNOGPDT $

 91  CHKPNT   HKDD,HBDD,HRDD,HGMD,HGOD $

 92  TRLG     CASECC,HUSETD,HDLT,HSLT,HBGPDT,HSIL,HCSTM,HTRL,DIT,HGMD,HGOD,,
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.
                HEST/HPPO,HPSO,HPDO,HPDT,,HTOL/V,N,HNOSET/V,N,HPDEPDO $

 93  SAVE       HPDEPDO,HNOSET $

 94  EQUIV      HPPO,HPDO/HNOSET $

 95  EQUIV      HPDO,HPDT/HPDEPDO $

 96  CHKPNT     HPPO,HPDO,HPSO,HTOL,HPDT $

 97  TRHT       CASECC,HUSETD,HNLFT,DIT,HGPTT,HKDD,HBDD,HRDD,HPDT,HTRL/HUDVT,
                HPNLD/C,Y,BETA=.55/C,Y,TABS=0.0/V,N,HNLR/C,Y,RADLIN=-1 $

 93  CHKPNT     HUDVT,HPNLD $

 99  VDR        CASECC,HEQDYN,HUSETD,HUDVT,HTOL,XYCDB,HPNLD/HOUDV1,HOPNL1/  C,
                N,TRANRESP/C,N,DIRECT/C,N,0/V,N,HNOD/V,N,HNOP/C,N,0 $

100  SAVE       HNOD,HNOP $

101  CHKPNT     HOUDV1,HOPNL1 $

102  COND       HLBL7,HNOD $

103  SDR3       HOUDV1,HOPNL1,,,,/HOUDV2,HOPNL2,,,, $

104  OFP        HOUDV2,HOPNL2,,,,//V,N,HCARDNO $

105  SAVE       HCARDNO $

106  CHKPNT     HOPNL2,HOUDV2 $

110  LABEL      HLBL7 $

111  PARAM      //C,N,AND/V,N,HPJUMP/V,N,HNOP/V,N,JUMPPLOT $

112  COND       HLBL9,HPJUMP $

113  EQUIV      HUDVT,HUPV/HNOA $

114  COND       HLBL8,HNOA $

115  SDR1       HUSETD,,HUDVT,,,HGOD,HGMD,HPSO,HKFS,,/HUPV,,HQP/C,N,1/C,N,
                TRANSNT $

116  LABEL      HLBL8 $

117  CHKPNT     HUPV,HQP $

118  PLTTRAN    HBGPDT,HSIL/HBGPDP,HSIP/V,N,HLUSET/V,N,HLUSEP $
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

119  SAVE     HLUSEF $

120  SDR2     CASECC,HCSTM,MPT,DIT,HEQDYN,HSILD,,HTOL,HBGPDP,HPPO,HQP,HUPV,
              HEST,XYCDB/HOPP1,HOQP1,HOUPV1,HOES1,HOEF1,HPUGV /C,N,
              TRANRESP $

121  SDR3     HOPP1,HOQP1,HOUPV1,HOES1,HOEF1,/HOPP2,HOQP2,HOUPV2,HOES2,
              HOEF2, $

122  CHKPNT   HOPP2,HOQP2,HOUPV2,HOES2,HOEF2 $

122  OFP HOPP1,HOQP1,HOUPV1,HOES1,HOEF1,//V,N,HCARDNO $

122  JUMP HP2

123  OFP      HOPP2,HOQP2,HOUPV2,HOEF2,HOES2,//V,N,HCARDNO $

124  SAVE     HCARDNO $

125  COND     HP2,JUMPPLOT $

126  PLOT     HPLTPAR,HGPSETS,HELSETS,CASECC,HBGPDT,HEQEXIN,HSIP,,HPUGV/
              HPLOTX2/V,N,HNSIL/V,N,HLUSEP/V,N,JUMPPLOT/V,N,HPLTFLG/V,N,
              HPFILE $

127  SAVE     HPFILE $

128  PRTMSG   HPLOTX2// $

129  LABEL    HP2 $

130  XYTRAN   XYCDB,HOPP2,HOQP2,HOUPV2,HOES2,HOEF2/HXYPLTT/C,N,TRAN/C,N,PSET/
              V,N,HPFILE/V,N,HCARDNO $

131  SAVE     HPFILE,HCARDNO $

132  XYPLOT   HXYPLTT// $

133  LABEL    HLBL9 $

134  JUMP     FINIS $

135  LABEL    HERROR1 $

136  PRTPARM  //C,N,-1/C,N,HDIRTRD$

137  LABEL    FINIS$

138  END      $
```

```
        N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
    DMAP-DMAP INSTRUCTION
     NO.

*** USER WARNING MESSAGE  54,
     PARAMETER NAMED EPSHT    NOT REFERENCED

*** USER WARNING MESSAGE  54,
     PARAMETER NAMED MAXIT    NOT REFERENCED

          **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**
```

MESSAGES FROM THE PLOT MODULE

P L O T T E R   D A T A

THE FOLLOWING PLOTS ARE FOR AN SC 4020 PLOTTER

AN END-OF-FILE MARK FOLLOWS THE LAST PLOT

THE FOLLOWING PLOTS ARE REQUESTED ON PAPER ONLY

E N G I N E E R I N G   D A T A

ORTHOGRAPHIC PROJECTION
ROTATIONS (DEGREES) - GAMMA = 34.27, BETA = 23.17, ALPHA = 0.0 . AXES = +X,+Y,+Z, SYMMETRIC
SCALE (OBJECT-TO-PLOT SIZE) = 2.103726E 01

ORIGIN 1 - XO = -1.738504E 00, YO = -4.485910E 00 (INCHES)

MESSAGES FROM THE PLOT MODULE

PLOT 1 UNDEFORMED SHAPE

MESSAGES FROM THE PLOT MODULE

P L O T T E R   D A T A

THE FOLLOWING PLOTS ARE FOR AN SC 4020 PLOTTER

AN END-OF-FILE MARK FOLLOWS THE LAST PLOT

THE FOLLOWING PLOTS ARE REQUESTED ON PAPER ONLY

E N G I N E E R I N G   D A T A

```
ORTHOGRAPHIC PROJECTION
ROTATIONS (DEGREES) - GAMMA =  34.27, BETA =  23.17, ALPHA =   0.0 ,  AXES = +X,+Y,+Z, SYMMETRIC
SCALE (OBJECT-TO-PLOT SIZE) = 2.103726E 01

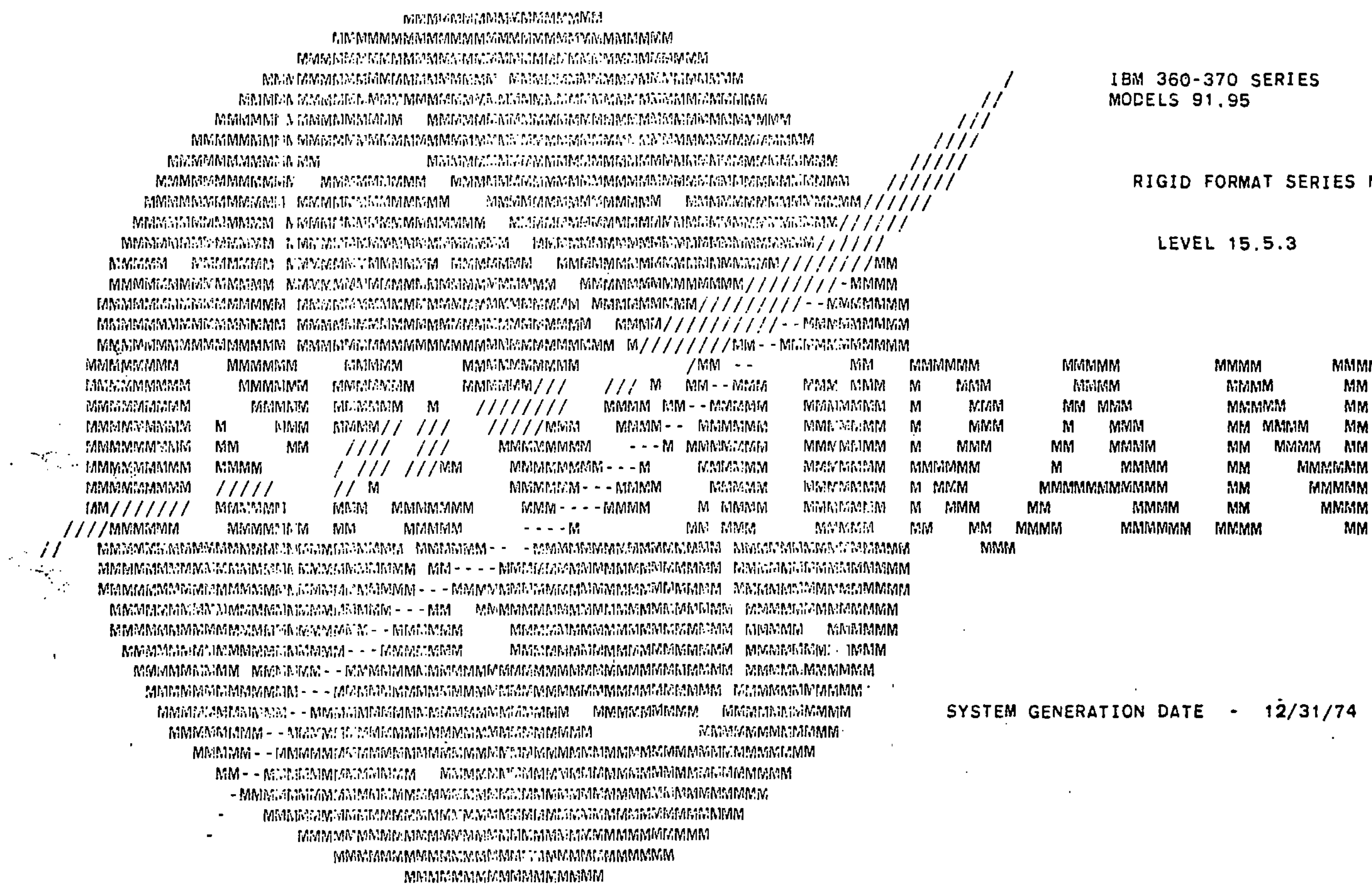
ORIGIN      1   -   XO = -1.738504E 00, YO = -4.485910E 00     (INCHES)
```

MESSAGES FROM THE PLOT MODULE

PLOT 2 UNDEFORMED SHAPE

```
                              - - - END OF JOB - - -

..........................................................................................
..........................................................................................
..........................................................................................
..........................................................................................
..........................................................................................
 NASTRAN LOADED AT LOCATION OFAF20
 TIME TO GO =   59 CPU SEC., 119 I/O SEC.
*      0 CPU-SEC.          0 ELAPSED-SEC.     SEM1  BEGN
*      0 CPU-SEC.          0 ELAPSED-SEC.     SEMT
*      0 CPU-SEC.          5 ELAPSED-SEC.     NAST
*      0 CPU-SEC.          5 ELAPSED-SEC.     GNFI
*      0 CPU-SEC.          5 ELAPSED-SEC.     XCSA
*      1 CPU-SEC.         14 ELAPSED-SEC.     IFP1
*      1 CPU-SEC.         19 ELAPSED-SEC.     XSOR
*      1 CPU-SEC.         26 ELAPSED-SEC.       DO  IFP
*      2 CPU-SEC.         37 ELAPSED-SEC.      END  IFP
*      2 CPU-SEC.         37 ELAPSED-SEC.     XGPI
*      4 CPU-SEC.         43 ELAPSED-SEC.     SEM1  END
*      4 CPU-SEC.         44 ELAPSED-SEC.     ----  LINKNS02 ---
*    25 I/O SEC.
 LAST LINK DID NOT USE    40016 BYTES OF OPEN CORE
*      4 CPU-SEC.         47 ELAPSED-SEC.     ----  LINK END ---
*      4 CPU-SEC.         47 ELAPSED-SEC.     XSFA
*      4 CPU-SEC.         48 ELAPSED-SEC.     XSFA
*      4 CPU-SEC.         48 ELAPSED-SEC.     3     GP1      BEGN
*      4 CPU-SEC.         60 ELAPSED-SEC.     3     GP1      END
*      4 CPU-SEC.         62 ELAPSED-SEC.     8     GP2      BEGN
*      4 CPU-SEC.         64 ELAPSED-SEC.     8     GP2      END
*      4 CPU-SEC.         65 ELAPSED-SEC.     10    PLTSET   BEGN
*      4 CPU-SEC.         75 ELAPSED-SEC.     10    PLTSET   END
*      4 CPU-SEC.         75 ELAPSED-SEC.     12    PRTMSG   BEGN
*      4 CPU-SEC.         76 ELAPSED-SEC.     12    PRTMSG   END
*      4 CPU-SEC.         76 ELAPSED-SEC.     13    SETVAL   BEGN
*      4 CPU-SEC.         76 ELAPSED-SEC.     13    SETVAL   END
*      4 CPU-SEC.         77 ELAPSED-SEC.     16    PLOT     BEGN
*      5 CPU-SEC.         86 ELAPSED-SEC.     16    PLOT     END
*      5 CPU-SEC.         87 ELAPSED-SEC.     18    PRTMSG   BEGN
*      5 CPU-SEC.         87 ELAPSED-SEC.     18    PRTMSG   END
*      5 CPU-SEC.         88 ELAPSED-SEC.     20    EXIT     BEGN
------------------------------------------------------------------------------------------
*    47 I/O SEC.
 LAST LINK DID NOT USE    68388 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =   39K BYTES
```



IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$**********************************************************************
$ START OF EXECUTIVE CONTROL *******************************************
$**********************************************************************
$
ID CLASS PROBLEM SIX, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR STEADY-STATE SOLUTION ALGORITHM IS TO BE USED
$
SOL 3
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $****************************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL *****************************
  4      $****************************************************************************************
  5      $
  6      TITLE=     NON-LINEAR STEADY-STATE PROBLEM ... K = F(T)
  7      $
  8      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
  9      $
 10      LINE=51
 11      $
 12      $ REQUEST SORTED AND UNSORTED OUTPUT
 13      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 14      $
 15      ECHO=BOTH
 16      $
 17      $ SELECT THE SPC, MPC, AND LOAD SETS TO BE USED IN THIS SOLUTION
 18      $
 19      SPC=100
 20      MPC=200
 21      LOAD=300
 22      $
 23      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 24      $
 25      TEMP(MATERIAL)=400
 26      $
 27      $ SELECT THE OUTPUT DESIRED (TEMPERATURES, LOADS, AND CONSTRAINT POWERS)
 28      $
 29      OUTPUT
 30      THERMAL=ALL
 31      OLOAD=ALL
 32      SPCF=ALL
 33      $
 34      $****************************************************************************************
 35      $ END CASE CONTROL --- START BULK DATA ***************************************
 36      $****************************************************************************************
 37      $
 38      BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM. METERS. WATTS. AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY
$
MAT4    1000    200.                                                    ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

INPUT BULK DATA DECK ECHO

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                            .90
$
$ ESTIMATE OF FINAL STEADY-STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

INPUT BULK DATA DECK ECHO

```
    .   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
    $*******************************************************************************
    $ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM TWO
    $ TO PROBLEM SIX. PROBLEM SIX HAS THE CONDUCTIVITY AS A FUNCTION
    $ OF TEMPERATURE.
    $
    $ MAKE THE CONDUCTIVITY OF MAT4 CARD 1000 TEMPERATURE DEPENDENT.
    $ AT A TEMPERATURE OF 200 C, THE CONDUCTIVITY WILL BE 200 WATTS/MT-C ...
    $ AT A TEMPERATURE OF 300 C, THE CONDUCTIVITY WILL BE 250 WATTS/MT-C ...
    $
    MATT4   1000    2000
    TABLEM1 2000                                                            +TM1
    +TM1    200.    1.      300.    1.25    ENDT
    $
    $*******************************************************************************
    $ END OF BULK DATA *************************************************************
    $*******************************************************************************
    $
    ENDDATA
TOTAL COUNT=  120
```

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED,XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
1-	CHBDY	60	300	LINE	1	5				+CONVEC
2-	+CONVEC	100	100							
3-	CHBDY	200	2000	AREA4	1	2	6	5		
4-	CHBDY	300	2000	AREA4	2	3	7	6		
5-	CHBDY	400	2000	AREA4	3	4	8	7		
6-	CHBDY	500	2000	AREA4	5	6	2	1		
7-	CHBDY	600	2000	AREA4	6	7	3	2		
8-	CHBDY	700	2000	AREA4	7	8	4	3		
9-	CQUAD2	30	200	1	2	6	5			
10-	CQUAD2	40	200	2	3	7	6			
11-	CQUAD2	50	200	3	4	8	7			
12-	CROD	10	100	10	2					
13-	CROD	20	100	9	6					
14-	GRID	1		0.0	0.0	0.0				
15-	GRID	2		.1	0.0	0.0				
16-	GRID	3		.2	0.0	0.0				
17-	GRID	4		.3	0.0	0.0				
18-	GRID	5		0.0	.1	0.0				
19-	GRID	6		.1	.1	0.0				
20-	GRID	7		.2	.1	0.0				
21-	GRID	8		.3	.1	0.0				
22-	GRID	9		0.0	.2	0.0				
23-	GRID	10		0.0	-.1	0.0				
24-	GRID	100		-.05	.05	0.0				
25-	MAT4	1000	200.							ALUMINUM
26-	MAT4	3000	200.							
27-	MATT4	1000	2000							
28-	MPC	200	9	1	1.	5	1	-1.		
29-	MPC	200	10	1	1.	.	1	-1.		
30-	PARAM	EPSHT	.0001							
31-	PARAM	MAXIT	8							
32-	PARAM	SIGMA	5.685E-8							
33-	PARAM	TABS	273.15							
34-	PHBDY	300	3000	.314						
35-	PHBDY	2000			.90					
36-	PQUAD2	200	1000	.01						
37-	PROD	100	1000	.001						
38-	RADLST	200	300	400	500	600	700			
39-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
40-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
41-	RADMTX	3	0.0	0.0	0.0	0.0				
42-	RADMTX	4	0.0	0.0	0.0					
43-	RADMTX	5	0.0	0.0						
44-	RADMTX	6	0.0							
45-	SLOAD	300	1	4.	2	8.				
46-	SLOAD	300	3	8.	4	4.				
47-	SLOAD	300	5	4.	6	8.				
48-	SLOAD	300	7	8.	8	4.				
49-	SPC1	100	1	100						
50-	TABLEM1	2000								+TM1
51-	+TM1	200.	1.	300.	1.25	ENDT				

```
                                S O R T E D   B U L K   D A T A   E C H O
          CARD
          COUNT       .  1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
            52-       TEMP    400     100     300.
            53-       TEMPD   400     300.
                      ENDDATA


      **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**



*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE      .   6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023,          B =      3
                                            C =      0
                                            R =      2

*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS         0  SECONDS.



*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          1

*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          2

*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          2

*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          1

*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HRFN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          2

*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HRSN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =          2

*** USER INFORMATION MESSAGE 3028,      B =     4     BBAR =     5
                                        C =     3     CBAR =     0
                                        R =     7

*** USER INFORMATION MESSAGE 3027, UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS        0 SECONDS.
```

D I A G   1 8   O U T P U T   F R O M   S S G H T

ITERATION	EPSILON-P	LAMBDA-1	EPSILON-T
1	7.890701E-02		
2	5.685221E-03	1.539461E 01	5.038404E-04
3	9.086095E-04	6.397292E 00	2.097907E-04
4	1.521550E-04	6.026622E 00	3.736917E-05

*** USER INFORMATION MESSAGE 3086, ENTERING SSGHT EXIT MODE BY REASON NUMBER 1 (NORMAL CONVERGENCE)

T E M P E R A T U R E   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	2.735178E 02	2.516375E 02	2.232828E 02	2.144910E 02	2.735178E 02	2.516375E 02
7	S	2.232828E 02	2.144910E 02	2.735178E 02	2.735178E 02		
100	S	3.000000E 02					

L O A D   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	4.000000E 00	8.000000E 00	8.000000E 00	4.000000E 00	4.000000E 00	8.000000E 00
7	S	8.000000E 00	4.000000E 00				

F O R C E S   O F   S I N G L E - P O I N T   C O N S T R A I N T

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
100	S	1.663081E 02					

```
................................................................................................................................................
................................................................................................................................................
................................................................................................................................................
................................................................................................................................................
................................................................................................................................................
NASTRAN LOADED AT LOCATION 120720
TIME TO GO =  59 CPU SEC., 239 I/O SEC.
*     0 CPU-SEC.        0 ELAPSED-SEC.    SEM1  BEGN
*     0 CPU-SEC.        0 ELAPSED-SEC.    SEMT
*     0 CPU-SEC.        3 ELAPSED-SEC.    NAST
*     0 CPU-SEC.        3 ELAPSED-SEC.    GNFI
*     0 CPU-SEC.        3 ELAPSED-SEC.    XCSA
*     1 CPU-SEC.        6 ELAPSED-SEC.    IFP1
*     1 CPU-SEC.        9 ELAPSED-SEC.    XSOR
*     1 CPU-SEC.       15 ELAPSED-SEC.      DO  IFP
*     2 CPU-SEC.       34 ELAPSED-SEC.     END  IFP
*     2 CPU-SEC.       34 ELAPSED-SEC.    XGPI
*     3 CPU-SEC.       40 ELAPSED-SEC.    SEM1  END
*     3 CPU-SEC.       41 ELAPSED-SEC.    ----  LINKNS02 ---
=    22 I/O SEC.
 LAST LINK DID NOT USE       0 BYTES OF OPEN CORE
*     3 CPU-SEC.       43 ELAPSED-SEC.    ----  LINK END ---
*     3 CPU-SEC.       44 ELAPSED-SEC.    XSFA
*     3 CPU-SEC.       45 ELAPSED-SEC.    XSFA
*     3 CPU-SEC.       45 ELAPSED-SEC.    2     GP1      BEGN
*     3 CPU-SEC.       53 ELAPSED-SEC.    2     GP1      END
*     3 CPU-SEC.       53 ELAPSED-SEC.    5     GP2      BEGN
*     3 CPU-SEC.       54 ELAPSED-SEC.    5     GP2      END
*     3 CPU-SEC.       55 ELAPSED-SEC.    7     PLTSET   BEGN
*     3 CPU-SEC.       56 ELAPSED-SEC.    7     PLTSET   END
*     3 CPU-SEC.       58 ELAPSED-SEC.    9     PRTMSG   BEGN
*     3 CPU-SEC.       58 ELAPSED-SEC.    9     PRTMSG   END
*     3 CPU-SEC.       59 ELAPSED-SEC.    10    SETVAL   BEGN
*     3 CPU-SEC.       59 ELAPSED-SEC.    10    SETVAL   END
*     3 CPU-SEC.       61 ELAPSED-SEC.    18    GP3      BEGN
*     4 CPU-SEC.       72 ELAPSED-SEC.    18    GP3      END
*     4 CPU-SEC.       73 ELAPSED-SEC.    20    TA1      BEGN
*     4 CPU-SEC.       88 ELAPSED-SEC.    20    TA1      END
*     4 CPU-SEC.       89 ELAPSED-SEC.    ----  LINKNS03 ---
=    52 I/O SEC.
 LAST LINK DID NOT USE   41628 BYTES OF OPEN CORE
*     4 CPU-SEC.       94 ELAPSED-SEC.    ----  LINK END ---
*     4 CPU-SEC.       94 ELAPSED-SEC.    24    SMA1     BEGN
*     4 CPU-SEC.       97 ELAPSED-SEC.    24    SMA1     END
*     4 CPU-SEC.       98 ELAPSED-SEC.    ----  LINKNS05 ---
=    57 I/O SEC.
 LAST LINK DID NOT USE   23308 BYTES OF OPEN CORE
*     4 CPU-SEC.      100 ELAPSED-SEC.    ----  LINK END ---
*     4 CPU-SEC.      100 ELAPSED-SEC.    27    RMG      BEGN
*     4 CPU-SEC.      103 ELAPSED-SEC.    SDCO  MP
*     4 CPU-SEC.      104 ELAPSED-SEC.    SDCO  MP
*     4 CPU-SEC.      105 ELAPSED-SEC.    FBS
*     4 CPU-SEC.      106 ELAPSED-SEC.    FBS
*     4 CPU-SEC.      107 ELAPSED-SEC.    MPYA  D
                                                METHOD 2 NT,NBR PASSES =    1,EST. TIME =      0.0
*     5 CPU-SEC.      108 ELAPSED-SEC.    MPYA  D
*     5 CPU-SEC.      108 ELAPSED-SEC.    TRAN  POSE
*     5 CPU-SEC.      109 ELAPSED-SEC.    TRAN  POSE
*     5 CPU-SEC.      109 ELAPSED-SEC.    MPYA  D
                                                METHOD 2 NT,NBR PASSES =    1,EST. TIME =      0.0
*     5 CPU-SEC.      110 ELAPSED-SEC.    MPYA  D
```

```
*      5 CPU-SEC.      113 ELAPSED-SEC.      27     RMG      END
*      5 CPU-SEC.      115 ELAPSED-SEC.      ----   LINKNS04 ---
=    73 I/O SEC.
 LAST LINK DID NOT USE   31560 BYTES OF OPEN CORE
*      5 CPU-SEC.      119 ELAPSED-SEC.      ----   LINK END ---
*      5 CPU-SEC.      119 ELAPSED-SEC.      32     GP4      BEGN
*      5 CPU-SEC.      125 ELAPSED-SEC.      32     GP4      END
*      5 CPU-SEC.      127 ELAPSED-SEC.      38     GPSP     BEGN
*      5 CPU-SEC.      127 ELAPSED-SEC.      38     GPSP     END
*      5 CPU-SEC.      128 ELAPSED-SEC.      ----   LINKNS14 ---
=    84 I/O SEC.
 LAST LINK DID NOT USE   76084 BYTES OF OPEN CORE
*      5 CPU-SEC.      132 ELAPSED-SEC.      ----   LINK END ---
*      5 CPU-SEC.      132 ELAPSED-SEC.      39     OFP      BEGN
*      5 CPU-SEC.      132 ELAPSED-SEC.      39     OFP      END
*      5 CPU-SEC.      133 ELAPSED-SEC.      ----   LINKNS04 ---
=    88 I/O SEC.
 LAST LINK DID NOT USE   74704 BYTES OF OPEN CORE
*      5 CPU-SEC.      136 ELAPSED-SEC.      ----   LINK END ---
*      5 CPU-SEC.      136 ELAPSED-SEC.      42     MCE1     BEGN
*      5 CPU-SEC.      139 ELAPSED-SEC.      42     MCE1     END
*      6 CPU-SEC.      139 ELAPSED-SEC.      44     MCE2     BEGN
*      6 CPU-SEC.      141 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*      6 CPU-SEC.      142 ELAPSED-SEC.      MPYA   D
*      6 CPU-SEC.      142 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*      6 CPU-SEC.      143 ELAPSED-SEC.      MPYA   D
*      6 CPU-SEC.      143 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*      6 CPU-SEC.      144 ELAPSED-SEC.      MPYA   D
*      6 CPU-SEC.      146 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*      7 CPU-SEC.      147 ELAPSED-SEC.      MPYA   D
*      7 CPU-SEC.      147 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*      7 CPU-SEC.      148 ELAPSED-SEC.      MPYA   D
*      7 CPU-SEC.      148 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*      7 CPU-SEC.      149 ELAPSED-SEC.      MPYA   D
*      7 CPU-SEC.      149 ELAPSED-SEC.      44     MCE2     END
*      7 CPU-SEC.      150 ELAPSED-SEC.      ----   LINKNS07 ---
=   107 I/O SEC.
 LAST LINK DID NOT USE   68372 BYTES OF OPEN CORE
*      7 CPU-SEC.      155 ELAPSED-SEC.      ----   LINK END ---
*      7 CPU-SEC.      155 ELAPSED-SEC.      50     VEC      BEGN
*      7 CPU-SEC.      156 ELAPSED-SEC.      50     VEC      END
*      7 CPU-SEC.      156 ELAPSED-SEC.      51     PARTN    BEGN
*      8 CPU-SEC.      158 ELAPSED-SEC.      51     PARTN    END
*      8 CPU-SEC.      158 ELAPSED-SEC.      XSFA
*      8 CPU-SEC.      159 ELAPSED-SEC.      XSFA
*      8 CPU-SEC.      159 ELAPSED-SEC.      52     PARTN    BEGN
*      8 CPU-SEC.      160 ELAPSED-SEC.      52     PARTN    END
*      8 CPU-SEC.      160 ELAPSED-SEC.      55     DECOMP   BEGN
*      8 CPU-SEC.      161 ELAPSED-SEC.      DECO   MP
*      8 CPU-SEC.      162 ELAPSED-SEC.      DECO   MP
*      8 CPU-SEC.      164 ELAPSED-SEC.      55     DECOMP   END
*      8 CPU-SEC.      165 ELAPSED-SEC.      ----   LINKNS05 ---
=   118 I/O SEC.
 LAST LINK DID NOT USE   59592 BYTES OF OPEN CORE
*      8 CPU-SEC.      167 ELAPSED-SEC.      ----   LINK END ---
*      8 CPU-SEC.      167 ELAPSED-SEC.      59     SSG1     BEGN
*      8 CPU-SEC.      171 ELAPSED-SEC.      59     SSG1     END
*      8 CPU-SEC.      172 ELAPSED-SEC.      63     SSG2     BEGN
```

```
*     8 CPU-SEC.      173 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     8 CPU-SEC.      174 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.      177 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     8 CPU-SEC.      178 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.      178 ELAPSED-SEC.     63    SSG2     END
*     9 CPU-SEC.      178 ELAPSED-SEC.     66    SSGHT    BEGN
*     9 CPU-SEC.      193 ELAPSED-SEC.     66    SSGHT    END
*     9 CPU-SEC.      194 ELAPSED-SEC.     ----  LINKNS08 ---
=   152 I/O SEC.
 LAST LINK DID NOT USE   24432 BYTES OF OPEN CORE
*     9 CPU-SEC.      200 ELAPSED-SEC.     ----  LINK END ---
*     9 CPU-SEC.      200 ELAPSED-SEC.     71    PLTTRAN BEGN
*     9 CPU-SEC.      201 ELAPSED-SEC.     71    PLTTRAN END
*     9 CPU-SEC.      201 ELAPSED-SEC.     ----  LINKNS13 ---
=   159 I/O SEC.
 LAST LINK DID NOT USE   73552 BYTES OF OPEN CORE
*     9 CPU-SEC.      207 ELAPSED-SEC.     ----  LINK END ---
*     9 CPU-SEC.      207 ELAPSED-SEC.     74    SDR2     BEGN
*     9 CPU-SEC.      210 ELAPSED-SEC.     74    SDR2     END
*     9 CPU-SEC.      210 ELAPSED-SEC.     ----  LINKNS14 ---
=   167 I/O SEC.
 LAST LINK DID NOT USE   25468 BYTES OF OPEN CORE
*    10 CPU-SEC.      216 ELAPSED-SEC.     ----  LINK END ---
*    10 CPU-SEC.      216 ELAPSED-SEC.     75    OFP      BEGN
*    10 CPU-SEC.      217 ELAPSED-SEC.     75    OFP      END
*    10 CPU-SEC.      218 ELAPSED-SEC.     ----  LINKNS13 ---
=   175 I/O SEC.
 LAST LINK DID NOT USE   68004 BYTES OF OPEN CORE
*    10 CPU-SEC.      225 ELAPSED-SEC.     ----  LINK END ---
*    10 CPU-SEC.      225 ELAPSED-SEC.     77    SDRHT    BEGN
*    10 CPU-SEC.      225 ELAPSED-SEC.     77    SDRHT    END
*    10 CPU-SEC.      225 ELAPSED-SEC.     ----  LINKNS14 ---
=   185 I/O SEC.
 LAST LINK DID NOT USE   39888 BYTES OF OPEN CORE
*    10 CPU-SEC.      235 ELAPSED-SEC.     ----  LINK END ---
*    10 CPU-SEC.      235 ELAPSED-SEC.     78    OFP      BEGN
*    10 CPU-SEC.      235 ELAPSED-SEC.     78    OFP      END
*    10 CPU-SEC.      236 ELAPSED-SEC.     92    EXIT     BEGN
------------------------------------------------------------------------------------------------------------------------------------
=   187 I/O SEC.
 LAST LINK DID NOT USE   74704 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =   OK BYTES
```

IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*********************************************************************************
$ START OF EXECUTIVE CONTROL *****************************************************
$*********************************************************************************
$
ID CLASS PROBLEM SEVEN, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR STEADY-STATE SOLUTION ALGORITHM IS TO BE USED
$
SOL 3
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $***********************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL *********************************
  4      $***********************************************************************************
  5      $
  6      TITLE=      NON-LINEAR STEADY-STATE PROBLEM ... H = F(T)
  7      $
  8      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
  9      $
 10      LINE=51
 11      $
 12      $ REQUEST SORTED AND UNSORTED OUTPUT
 13      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 14      $
 15      ECHO=BOTH
 16      $
 17      $ SELECT THE SPC, MPC, AND LOAD SETS TO BE USED IN THIS SOLUTION
 18      $
 19      SPC=100
 20      MPC=200
 21      LOAD=300
 22      $
 23      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 24      $
 25      TEMP(MATERIAL)=400
 26      $
 27      $ SELECT THE OUTPUT DESIRED (TEMPERATURES, LOADS, AND CONSTRAINT POWERS)
 28      $
 29      OUTPUT
 30      THERMAL=ALL
 31      OLOAD=ALL
 32      SPCF=ALL
 33      $
 34      $***********************************************************************************
 35      $ END CASE CONTROL --- START BULK DATA *********************************************
 36      $***********************************************************************************
 37      $
 38      BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY
$
MAT4    1000    200.                                                    ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

INPUT BULK DATA DECK ECHO

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

INPUT BULK DATA DECK ECHO

```
.   1  ..   2  ..   3  ..   4  ..   5  .    6  ..   7  ..   8  ..   9  ..  10  .
$*************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM TWO
$ TO PROBLEM SEVEN. PROBLEM SEVEN HAS THE CONVECTIVITY AS A FUNCTION
$ OF TEMPERATURE.
$
$ MAKE THE CONVECTIVITY OF MAT4 CARD 3000 TEMPERATURE DEPENDENT.
$ AT A TEMPERATURE OF 200 C. THE CONVECT 'ITY WILL BE 200 WATTS/MT-MT-C.
$ AT A TEMPERATURE OF 300 C. THE CONVECTIVITY WILL BE 250 WATTS/MT-MT-C.
$
MATT4   3000    2000
TABLEM1 2000                                                            +TM1
+TM1    200.    1.      300.    1.25    ENDT
$
$*************************************************************************
$ END OF BULK DATA *******************************************************
$*************************************************************************
$
ENDDATA
```

TOTAL COUNT= 120

*** USER INFORMATION MESSAGE 207. BULK DATA NOT SORTED.XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
1-	CHBDY	60	300	LINE	1	5				+CONVEC
2-	+CONVEC	100	100							
3-	CHBDY	200	2000	AREA4	1	2	6	5		
4-	CHBDY	300	2000	AREA4	2	3	7	6		
5-	CHBDY	400	2000	AREA4	3	4	8	7		
6-	CHBDY	500	2000	AREA4	5	6	2	1		
7-	CHBDY	600	2000	AREA4	6	7	3	2		
8-	CHBDY	700	2000	AREA4	7	8	4	3		
9-	CQUAD2	30	200	1	2	6	5			
10-	CQUAD2	40	200	2	3	7	6			
11-	CQUAD2	50	200	3	4	8	7			
12-	CROD	10	100	10	2					
13-	CROD	20	100	9	6					
14-	GRID	1		0.0	0.0	0.0				
15-	GRID	2		.1	0.0	0.0				
16-	GRID	3		.2	0.0	0.0				
17-	GRID	4		.3	0.0	0.0				
18-	GRID	5		0.0	.1	0.0				
19-	GRID	6		.1	.1	0.0				
20-	GRID	7		.2	1	0.0				
21-	GRID	8		.3	.1	0.0				
22-	GRID	9		0.0	.2	0.0				
23-	GRID	10		0.0	-.1	0.0				
24-	GRID	100		-.05	.05	0.0				
25-	MAT4	1000	200.							ALUMINUM
26-	MAT4	3000	200.							
27-	MATT4	3000	2000							
28-	MPC	200	9	1	1.	5	1	-1.		
29-	MPC	200	10	1	1.	1	1	-1.		
30-	PARAM	EPSHT	.0001							
31-	PARAM	MAXIT	8							
32-	PARAM	SIGMA	5.685E-8							
33-	PARAM	TABS	273.15							
34-	PHBDY	300	3000	.314						
35-	PHBDY	2000			.90					
36-	PQUAD2	200	1000	.01						
37-	PROD	100	1000	.001						
38-	RADLST	200	300	400	500	600	700			
39-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
40-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
41-	RADMTX	3	0.0	0.0	0.0	0.0				
42-	RADMTX	4	0.0	0.0	0.0					
43-	RADMTX	5	0.0	0.0						
44-	RADMTX	6	0.0							
45-	SLOAD	300	1	4.	2	8.				
46-	SLOAD	300	3	8.	4	4.				
47-	SLOAD	300	5	4.	6	8.				
48-	SLOAD	300	7	8.	8	[illegible]				
49-	SPC1	100	1	100						
50-	TABLEM1	2000								+TM1
51-	+TM1	200.	1.	300.	1.25	ENDT				

```
                                   S O R T E D   B U L K   D A T A   E C H O
 CARD
 COUNT        1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
   52-      TEMP    400     100     300.
   53-      TEMPD   400     300.
            ENDDATA


      **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**



*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE     .   6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023,         B =     3
                                           C =     0
                                           R =     2

*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS        0  SECONDS.



*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         1

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         1

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HRFN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HRSN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** USER INFORMATION MESSAGE 3028,     B =     4      BBAR =     5
                                       C =     3      CBAR =     0
                                       R =     7

*** USER INFORMATION MESSAGE 3027, UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS       0 SECONDS.
```

D I A G 1 8 O U T P U T F R O M S S G H T

ITERATION	EPSILON-P	LAMBDA-1	EPSILON-T
1	6.318074E-02		
2	5.190428E-03	1.240634E 01	6.380256E-04
3	9.369841E-04	5.662853E 00	2.751350E-04
4	1.789647E-04	5.290874E 00	5.648893E-05

*** USER INFORMATION MESSAGE 3086, ENTERING SSGHT EXIT MODE BY REASON NUMBER 1 (NORMAL CONVERGENCE)

T E M P E R A T U R E   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	2.786384E 02	2.519288E 02	2.181912E 02	2.079060E 02	2.786384E 02	2.519288E 02
7	S	2.181912E 02	2.079060E 02	2.786384E 02	2.786384E 02		
100	S	3.000000E 02					

L O A D   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	4.000000E 00	8.000000E 00	8.000000E 00	4.000000E 00	4.000000E 00	8.000000E 00
7	S	8.000000E 00	4.000000E 00				

F O R C E S   O F   S I N G L E - P O I N T   C O N S T R A I N T

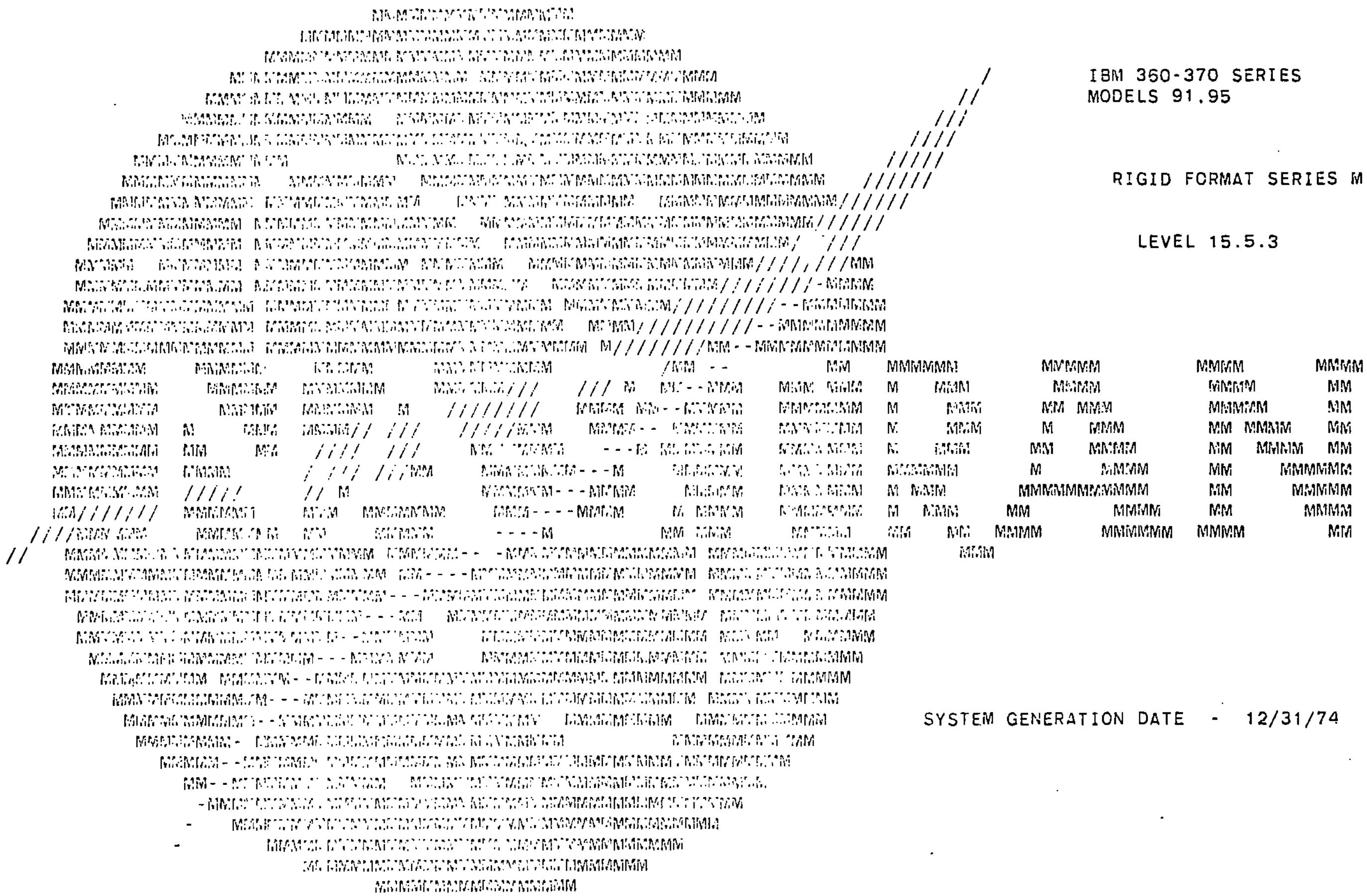
POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
100	S	1.641228E 02					

- - - END OF JOB - - -

```
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................
 NASTRAN LOADED AT LOCATION 0FAF20
 TIME TO GO =  59 CPU SEC., 239 I/O SEC.
*     0 CPU-SEC.         0 ELAPSED-SEC.     SEM1  BEGN
*     0 CPU-SEC.         0 ELAPSED-SEC.     SEMT
*     0 CPU-SEC.         2 ELAPSED-SEC.     NAST
*     0 CPU-SEC.         2 ELAPSED-SEC.     GNFI
*     0 CPU-SEC.         2 ELAPSED-SEC.     XCSA
*     0 CPU-SEC.         3 ELAPSED-SEC.     IFP1
*     0 CPU-SEC.         6 ELAPSED-SEC.     XSOR
*     1 CPU-SEC.        10 ELAPSED-SEC.       DO  IFP
*     1 CPU-SEC.        24 ELAPSED-SEC.      END  IFP
*     1 CPU-SEC.        24 ELAPSED-SEC.     XGPI
*     3 CPU-SEC.        30 ELAPSED-SEC.     SEM1  END
*     3 CPU-SEC.        30 ELAPSED-SEC.     ----  LINKNS02 ---
=    22 I/O SEC.
 LAST LINK DID NOT USE        0 BYTES OF OPEN CORE
*     3 CPU-SEC.        32 ELAPSED-SEC.     ----  LINK END ---
*     3 CPU-SEC.        32 ELAPSED-SEC.     XSFA
*     3 CPU-SEC.        33 ELAPSED-SEC.     XSFA
*     3 CPU-SEC.        33 ELAPSED-SEC.     2     GP1      BEGN
*     3 CPU-SEC.        38 ELAPSED-SEC.     2     GP1      END
*     3 CPU-SEC.        39 ELAPSED-SEC.     5     GP2      BEGN
*     3 CPU-SEC.        40 ELAPSED-SEC.     5     GP2      END
*     3 CPU-SEC.        40 ELAPSED-SEC.     7     PLTSET   BEGN
*     3 CPU-SEC.        41 ELAPSED-SEC.     7     PLTSET   END
*     3 CPU-SEC.        41 ELAPSED-SEC.     9     PRTMSG   BEGN
*     3 CPU-SEC.        42 ELAPSED-SEC.     9     PRTMSG   END
*     3 CPU-SEC.        42 ELAPSED-SEC.     10    SETVAL   BEGN
*     3 CPU-SEC.        42 ELAPSED-SEC.     10    SETVAL   END
*     3 CPU-SEC.        43 ELAPSED-SEC.     18    GP3      BEGN
*     3 CPU-SEC.        53 ELAPSED-SEC.     18    GP3      END
*     3 CPU-SEC.        53 ELAPSED-SEC.     20    TA1      BEGN
*     3 CPU-SEC.        62 ELAPSED-SEC.     20    TA1      END
*     3 CPU-SEC.        63 ELAPSED-SEC.     ----  LINKNS03 ---
=    52 I/O SEC.
 LAST LINK DID NOT USE    41828 BYTES OF OPEN CORE
*     4 CPU-SEC.        66 ELAPSED-SEC.     ----  LINK END ---
*     4 CPU-SEC.        66 ELAPSED-SEC.     24    SMA1     BEGN
*     4 CPU-SEC.        69 ELAPSED-SEC.     24    SMA1     END
*     4 CPU-SEC.        70 ELAPSED-SEC.     ----  LINKNS05 ---
=    57 I/O SEC.
 LAST LINK DID NOT USE    23308 BYTES OF OPEN CORE
*     4 CPU-SEC.        80 ELAPSED-SEC.     ----  LINK END ---
*     4 CPU-SEC.        80 ELAPSED-SEC.     27    RMG      BEGN
*     4 CPU-SEC.        84 ELAPSED-SEC.     SDCO  MP
*     4 CPU-SEC.        84 ELAPSED-SEC.     SDCO  MP
*     4 CPU-SEC.        86 ELAPSED-SEC.     FBS
*     4 CPU-SEC.        88 ELAPSED-SEC.     FBS
*     4 CPU-SEC.        89 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
*     4 CPU-SEC.        90 ELAPSED-SEC.     MPYA  D
*     4 CPU-SEC.        90 ELAPSED-SEC.     TRAN  POSE
*     4 CPU-SEC.        92 ELAPSED-SEC.     TRAN  POSE
*     4 CPU-SEC.        92 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
*     4 CPU-SEC.        94 ELAPSED-SEC.     MPYA  D
```

```
*     4 CPU-SEC.        96 ELAPSED-SEC.     27    RMG      END
*     4 CPU-SEC.        98 ELAPSED-SEC.     ----  LINKNS04 ---
=    73 I/O SEC.
 LAST LINK DID NOT USE   31560 BYTES OF OPEN CORE
*     4 CPU-SEC.       102 ELAPSED-SEC.     ----  LINK END ---
*     4 CPU-SEC.       102 ELAPSED-SEC.     32    GP4      BEGN
*     4 CPU-SEC.       107 ELAPSED-SEC.     32    GP4      END
*     5 CPU-SEC.       108 ELAPSED-SEC.     38    GPSP     BEGN
*     5 CPU-SEC.       109 ELAPSED-SEC.     38    GPSP     END
*     5 CPU-SEC.       109 ELAPSED-SEC.     ----  LINKNS14 ---
=    84 I/O SEC.
 LAST LINK DID NOT USE   76084 BYTES OF OPEN CORE
*     5 CPU-SEC.       113 ELAPSED-SEC.     ----  LINK END ---
*     5 CPU-SEC.       113 ELAPSED-SEC.     39    OFP      BEGN
*     5 CPU-SEC.       113 ELAPSED-SEC.     39    OFP      END
*     5 CPU-SEC.       115 ELAPSED-SEC.     ----  LINKNS04 ---
=    88 I/O SEC.
 LAST LINK DID NOT USE   74704 BYTES OF OPEN CORE
*     5 CPU-SEC.       117 ELAPSED-SEC.     ----  LINK END ---
*     5 CPU-SEC.       117 ELAPSED-SEC.     42    MCE1     BEGN
*     5 CPU-SEC.       120 ELAPSED-SEC.     42    MCE1     END
*     5 CPU-SEC.       120 ELAPSED-SEC.     44    MCE2     BEGN
*     5 CPU-SEC.       122 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*     5 CPU-SEC.       123 ELAPSED-SEC.     MPYA  D
*     5 CPU-SEC.       124 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*     5 CPU-SEC.       125 ELAPSED-SEC.     MPYA  D
*     5 CPU-SEC.       125 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*     6 CPU-SEC.       126 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.       128 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*     6 CPU-SEC.       129 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.       129 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*     6 CPU-SEC.       130 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.       130 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*     7 CPU-SEC.       132 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.       132 ELAPSED-SEC.     44    MCE2     END
*     7 CPU-SEC.       133 ELAPSED-SEC.     ----  LINKNS07 ---
=   107 I/O SEC.
 LAST LINK DID NOT USE   68372 BYTES OF OPEN CORE
*     7 CPU-SEC.       138 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.       138 ELAPSED-SEC.     50    VEC      BEGN
*     7 CPU-SEC.       138 ELAPSED-SEC.     50    VEC      END
*     7 CPU-SEC.       139 ELAPSED-SEC.     51    PARTN    BEGN
*     7 CPU-SEC.       141 ELAPSED-SEC.     51    PARTN    END
*     7 CPU-SEC.       141 ELAPSED-SEC.     XSFA
*     7 CPU-SEC.       142 ELAPSED-SEC.     XSFA
*     7 CPU-SEC.       142 ELAPSED-SEC.     52    PARTN    BEGN
*     7 CPU-SEC.       144 ELAPSED-SEC.     52    PARTN    END
*     7 CPU-SEC.       144 ELAPSED-SEC.     55    DECOMP   BEGN
*     7 CPU-SEC.       144 ELAPSED-SEC.     DECO  MP
*     7 CPU-SEC.       146 ELAPSED-SEC.     DECO  MP
*     7 CPU-SEC.       148 ELAPSED-SEC.     55    DECOMP   END
*     7 CPU-SEC.       149 ELAPSED-SEC.     ----  LINKNS05 ---
=   118 I/O SEC.
 LAST LINK DID NOT USE   59592 BYTES OF OPEN CORE
*     7 CPU-SEC.       151 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.       151 ELAPSED-SEC.     59    SSG1     BEGN
*     7 CPU-SEC.       155 ELAPSED-SEC.     59    SSG1     END
*     7 CPU-SEC.       157 ELAPSED-SEC.     63    SSG2     BEGN
```

```
*      7 CPU-SEC.       159 ELAPSED-SEC.     MPYA  D
                                                   METHOD 2 T ,NBR PASSES =   1,EST. TIME =      0.0
*      8 CPU-SEC.       160 ELAPSED-SEC.     MPYA  D
*      8 CPU-SEC.       162 ELAPSED-SEC.     MPYA  D
                                                   METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*      8 CPU-SEC.       163 ELAPSED-SEC.     MPYA  D
*      8 CPU-SEC.       163 ELAPSED-SEC.     63    SSG2     END
*      8 CPU-SEC.       163 ELAPSED-SEC.     66    SSGHT    BEGN
*      8 CPU-SEC.       182 ELAPSED-SEC.     66    SSGHT    END
*      8 CPU-SEC.       183 ELAPSED-SEC.     ----  LINKNS08 ---
=   154 I/O SEC.
 LAST LINK DID NOT USE   24408 BYTES OF OPEN CORE
*      8 CPU-SEC.       190 ELAPSED-SEC.     ----  LINK END - -
*      8 CPU-SEC.       190 ELAPSED-SEC.     71    PLTTRAN BEGN
*      8 CPU-SEC.       191 ELAPSED-SEC.     71    PLTTRAN END
*      8 CPU-SEC.       191 ELAPSED-SEC.     ----  LINKNS13 ---
=   160 I/O SEC.
 LAST LINK DID NOT USE   73552 BYTES OF OPEN CORE
*      9 CPU-SEC.       197 ELAPSED-SEC.     ----  LINK END ---
*      9 CPU-SEC.       197 ELAPSED-SEC.     74    SDR2     BEGN
*      9 CPU-SEC.       200 ELAPSED-SEC.     74    SDR2     END
*      9 CPU-SEC.       200 ELAPSED-SEC.     ----  LINKNS14 ---
=   169 I/O SEC.
 LAST LINK DID NOT USE   25468 BYTES OF OPEN CORE
*      9 CPU-SEC.       206 ELAPSED-SEC.     ----  LINK END ---
*      9 CPU-SEC.       206 ELAPSED-SEC.     75    OFP      BEGN
*      9 CPU-SEC.       213 ELAPSED-SEC.     75    OFP      END
*      9 CPU-SEC.       214 ELAPSED-SEC.     ----  LINKNS13 ---
=   177 I/O SEC.
 LAST LINK DID NOT USE   68004 BYTES OF OPEN CORE
*      9 CPU-SEC.       222 ELAPSED-SEC.     ----  LINK END ---
*      9 CPU-SEC.       222 ELAPSED-SEC.     77    SDRHT    BEGN
*      9 CPU-SEC.       223 ELAPSED-SEC.     77    SDRHT    END
*      9 CPU-SEC.       223 ELAPSED-SEC.     ----  LINKNS14 ---
=   186 I/O SEC.
 LAST LINK DID NOT USE   39888 BYTES OF OPEN CORE
*      9 CPU-SEC.       234 ELAPSED-SEC.     ----  LINK END ---
*      9 CPU-SEC.       234 ELAPSED-SEC.     78    OFP      BEGN
*      9 CPU-SEC.       235 ELAPSED-SEC.     78    OFP      END
*      9 CPU-SEC.       236 ELAPSED-SEC.     92    EXIT     BEGN
--------------------------------------------------------------------------------------------------------------------------------
=   189 I/O SEC.
 LAST LINK DID NOT USE   74704 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =    OK BYTES
```



IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*******************************************************************************
$ START OF EXECUTIVE CONTROL **************************************************
$*******************************************************************************
$
ID CLASS PROBLEM EIGHT, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR STEADY-STATE SOLUTION ALGORITHM IS TO BE USED
$
SOL 3
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
CEND
```

```
                         C A S E   C O N T R O L   D E C K   E C H O
CARD
COUNT
  1      $
  2      $*************************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ***********************************
  4      $*************************************************************************************
  5      $
  6      TITLE=      NON-LINEAR STEADY-STATE PROBLEM ... K = F(T) AND
  7      SUBTITLE=      K = ANISOTROPIC
  8      $
  9      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
 10      $
 11      LINE=51
 12      $
 13      $ REQUEST SORTED AND UNSORTED OUTPUT
 14      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 15      $
 16      ECHO=BOTH
 17      $
 18      $ SELECT THE SPC, MPC, AND LOAD SETS TO BE USED IN THIS SOLUTION
 19      $
 20      SPC=100
 21      MPC=200
 22      LOAD=300
 23      $
 24      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 25      $
 26      TEMP(MATERIAL)=400
 27      $
 28      $ SELECT THE OUTPUT DESIRED (TEMPERATURES, LOADS, AND CONSTRAINT POWERS)
 29      $
 30      OUTPUT
 31      THERMAL=ALL
 32      OLOAD=ALL
 33      SPCF=ALL
 34      $
 35      $*************************************************************************************
 36      $ END CASE CONTROL --- START BULK DATA ***********************************************
 37      $*************************************************************************************
 38      $
 39      BEGIN BULK
```

INPUT BULK DATA DECK ECHO

```
  1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY
$
$ MAT4 CARD REMOVED TO PERMIT ANISOTROPIC SPECIFICATION
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

INPUT BULK DATA DECK ECHO

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
 .   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$**************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM TWO
$ TO PROBLEM EIGHT. PROBLEM EIGHT HAS CONDUCTIVITY
$ AS A FUNCTION OF TEMPERATURE, AND THE CONDUCTIVITY IS ANISOTROPIC ALSO
$
$ THE FOLLOWING CARD REPLACES MAT4 CARD 1000 IN THE BULK DATA
$
MAT5    1000    200.                    200.
$
$ THE CARDS AFTER IT SPECIFY THE TEMPERATURE DEPENDENCE
$
MATT5   1000    5000                    6000
TABLEM1 5000                                                    +TM3
+TM3    200.    1.      300.    1.25    ENDT
TABLEM1 6000                                                    +TM4
+TM4    200.    0.      300.    0.      ENDT
$
$**************************************************************************
$ END OF BULK DATA ********************************************************
$**************************************************************************
$
ENDDATA
```

TOTAL COUNT= 124

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED.XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
1-	CHBDY	60	300	LINE	1	5				+CONVEC
2-	+CONVEC	100	100							
3-	CHBDY	200	2000	AREA4	1	2	6	5		
4-	CHBDY	300	2000	AREA4	2	3	7	6		
5-	CHBDY	400	2000	AREA4	3	4	8	7		
6-	CHBDY	500	2000	AREA4	5	6	2	1		
7-	CHBDY	600	2000	AREA4	6	7	3	2		
8-	CHBDY	700	2000	AREA4	7		4	3		
9-	CQUAD2	30	200	1	2	6	5			
10-	CQUAD2	40	200	2	3	7	6			
11-	CQUAD2	50	200	3	4	8	7			
12-	CROD	10	100	10	2					
13-	CROD	20	100	9	6					
14-	GRID	1		0.0	0.0	0.0				
15-	GRID	2		.1	0.0	0.0				
16-	GRID	3		.2	0.0	0.0				
17-	GRID	4		.3	0.0	0.0				
18-	GRID	5		0.0	.1	0.0				
19-	GRID	6		.1	.1	0.0				
20-	GRID	7		.2	.1	0.0				
21-	GRID	8		.3	.1	0.0				
22-	GRID	9		0.0	.2	0.0				
23-	GRID	10		0.0	-.1	0.0				
24-	GRID	100		-.05	.05	0.0				
25-	MAT4	3000	200.							
26-	MAT5	1000	200.			200.				
27-	MATT5	1000	5000			6000				
28-	MPC	200	9	1	1.	5	1	-1.		
29-	MPC	200	10	1	1.	1	1	-1.		
30-	PARAM	EPSHT	.0001							
31-	PARAM	MAXIT	8							
32-	PARAM	SIGMA	5.685E-8							
33-	PARAM	TABS	273.15							
34-	PHBDY	300	3000	.314						
35-	PHBDY	2000			.90					
36-	PQUAD2	200	1000	.01						
37-	PROD	100	1000	.001						
38-	RADLST	200	300	400	500	600	700			
39-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
40-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
41-	RADMTX	3	0.0	0.0	0.0	0.0				
42-	RADMTX	4	0.0	0.0	0.0					
43-	RADMTX	5	0.0	0.0						
44-	RADMTX	6	0.0							
45-	SLOAD	300	1	4.	2	8.				
46-	SLOAD	300	3	8.	4	4.				
47-	SLOAD	300	5	4.	6	8.				
48-	SLOAD	300	7	8.	8	4.				
49-	SPC1	100	1	100						
50-	TABLEM1	5000								+TM3
51-	+TM3	200.	1.	300.	1.25	ENDT				

```
                              S O R T E D   B U L K   D A T A   E C H O
   CARD
   COUNT        1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .
     52-        TABLEM1 6000                                                    +TM4
     53-        +TM4    200.    0.      300.    0.      ENDT
     54-        TEMP    400     100     300.
     55-        TEMPD   400     300.
                ENDDATA
```

```
**NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**



*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE        6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023,          B =      3
                                            C =      0
                                            R =      2

*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS        0  SECONDS.



*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         1

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         1

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HRFN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HRSN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** USER INFORMATION MESSAGE 3028,      B =      4      BBAR =     5
                                        C =      3      CBAR =     0
                                        R =      7
```

*** USER INFORMATION MESSAGE 3027. UNSYMMETRIC REAL   DECOMPOSITION TIME ESTIMATE IS   0 SECONDS.

D I A G   1 8   O U T P U T   F R O M   S S G H T

ITERATION	EPSILON-P	LAMBDA-1	EPSILON-T
1	7.890677E-02		
2	5.655109E-03	1.539461E 01	5.038404E-04
3	9.080866E-04	6.397274E 00	2.097920E-04
4	1.518862E-04	6.027384E 00	3.735893E-05

*** USER INFORMATION MESSAGE 3086, ENTERING SSGHT EXIT MODE BY REASON NUMBER 1 (NORMAL CONVERGENCE)

T E M P E R A T U R E   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	2.735178E 02	2.516375E 02	2.232829E 02	2.144910E 02	2.735178E 02	2.516375E 02
7	S	2.232829E 02	2.144910E 02	2.735178E 02	2.735178E 02		
100	S	3.000000E 02					

LOAD VECTOR

POINT ID.	TYPE.	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	4.000000E 00	8.000000E 00	8.000000E 00	4.000000E-00	4.000000E 00	8.000000E 00
7	S	8.000000E 00	4.000000E 00				

FORCES OF SINGLE-POINT CONSTRAINT

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
100	S	1.663081E 02					

```
                                        - - - END OF JOB - - -

..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................
 NASTRAN LOADED AT LOCATION CFAF20
 TIME TO GO =   59 CPU SEC., 239 I/O SEC.
*     0 CPU-SEC.          0 ELAPSED-SEC.     SEM1  BEGN
*     0 CPU-SEC.          0 ELAPSED-SEC.     SEMT
*     0 CPU-SEC.          2 ELAPSED-SEC.     NAST
*     0 CPU-SEC.          3 ELAPSED-SEC.     GNFI
*     0 CPU-SEC.          3 ELAPSED-SEC.     XCSA
*     0 CPU-SEC.          4 ELAPSED-SEC.     IFP1
*     0 CPU-SEC.          7 ELAPSED-SEC.     XSOR
*     1 CPU-SEC.         12 ELAPSED-SEC.       DO  IFP
*     1 CPU-SEC.         23 ELAPSED-SEC.      END  IFP
*     1 CPU-SEC.         23 ELAPSED-SEC.     XGPI
*     2 CPU-SEC.         28 ELAPSED-SEC.     SEM1  END
*     2 CPU-SEC.         29 ELAPSED-SEC.     ----  LINKNS02 ---
=    22 I/O SEC.
 LAST LINK DID NOT USE        0 BYTES OF OPEN CORE
*     3 CPU-SEC.         31 ELAPSED-SEC.     ----  LINK END ---
*     3 CPU-SEC.         31 ELAPSED-SEC.     XSFA
*     3 CPU-SEC.         32 ELAPSED-SEC.     XSFA
*     3 CPU-SEC.         32 ELAPSED-SEC.     2     GP1      BEGN
*     3 CPU-SEC.         35 ELAPSED-SEC.     2     GP1      END
*     3 CPU-SEC.         36 ELAPSED-SEC.     5     GP2      BEGN
*     3 CPU-SEC.         37 ELAPSED-SEC.     5     GP2      END
*     3 CPU-SEC.         37 ELAPSED-SEC.     7     PLTSET   BEGN
*     3 CPU-SEC.         37 ELAPSED-SEC.     7     PLTSET   END
*     3 CPU-SEC.         38 ELAPSED-SEC.     9     PRTMSG   BEGN
*     3 CPU-SEC.         38 ELAPSED-SEC.     9     PRTMSG   END
*     3 CPU-SEC.         38 ELAPSED-SEC.     10    SETVAL   BEGN
*     3 CPU-SEC.         38 ELAPSED-SEC.     10    SETVAL   END
*     3 CPU-SEC.         39 ELAPSED-SEC.     18    GP3      BEGN
*     3 CPU-SEC.         44 ELAPSED-SEC.     18    GP3      END
*     3 CPU-SEC.         44 ELAPSED-SEC.     20    TA1      BEGN
*     3 CPU-SEC.         52 ELAPSED-SEC.     20    TA1      END
*     3 CPU-SEC.         53 ELAPSED-SEC.     ----  LINKNS03 ---
=    52 I/O SEC.
 LAST LINK DID NOT USE    41828 BYTES OF OPEN CORE
*     3 CPU-SEC.         56 ELAPSED-SEC.     ----  LINK END ---
*     3 CPU-SEC.         56 ELAPSED-SEC.     24    SMA1     BEGN
*     4 CPU-SEC.         59 ELAPSED-SEC.     24    SMA1     END
*     4 CPU-SEC.         60 ELAPSED-SEC.     ----  LINKNS05 ---
=    57 I/O SEC.
 LAST LINK DID NOT USE    23308 BYTES OF OPEN CORE
*     4 CPU-SEC.         63 ELAPSED-SEC.     ----  LINK END ---
*     4 CPU-SEC.         63 ELAPSED-SEC.     27    RMG      BEGN
*     4 CPU-SEC.         65 ELAPSED-SEC.     SDCO  MP
*     4 CPU-SEC.         66 ELAPSED-SEC.     SDCO  MP
*     4 CPU-SEC.         67 ELAPSED-SEC.     FBS
*     4 CPU-SEC.         68 ELAPSED-SEC.     FBS
*     4 CPU-SEC.         69 ELAPSED-SEC.     MPYA  D
                                                   METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*     4 CPU-SEC.         70 ELAPSED-SEC.     MPYA  D
*     4 CPU-SEC.         70 ELAPSED-SEC.     TRAN  POSE
*     4 CPU-SEC.         71 ELAPSED-SEC.     TRAN  POSE
*     4 CPU-SEC.         71 ELAPSED-SEC.     MPYA  D
                                                   METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*     4 CPU-SEC.         72 ELAPSED-SEC.     MPYA  D
```

```
*     4 CPU-SEC.       74 ELAPSED-SEC.     27    RMG      END
*     4 CPU-SEC.       75 ELAPSED-SEC.     ----  LINKNS04 ---
=   73 I/O SEC.
 LAST LINK DID NOT USE   31560 BYTES OF OPEN CORE
*     4 CPU-SEC.       79 ELAPSED-SEC.     ----  LINK END ---
*     4 CPU-SEC.       79 ELAPSED-SEC.     32    GP4      BEGN
*     5 CPU-SEC.       85 ELAPSED-SEC.     32    GP4      END
*     5 CPU-SEC.       86 ELAPSED-SEC.     38    GPSP     BEGN
*     5 CPU-SEC.       86 ELAPSED-SEC.     38    GPSP     END
*     5 CPU-SEC.       87 ELAPSED-SEC.     ----  LINKNS14 ---
=   85 I/O SEC.
 LAST LINK DID NOT USE   76084 BYTES OF OPEN CORE
*     5 CPU-SEC.       91 ELAPSED-SEC.     ----  LINK END ---
*     5 CPU-SEC.       91 ELAPSED-SEC.     39    OFP      BEGN
*     5 CPU-SEC.       91 ELAPSED-SEC.     39    OFP      END
*     5 CPU-SEC.       92 ELAPSED-SEC.     ----  LINKNS04 ---
=   88 I/O SEC.
 LAST LINK DID NOT USE   74704 BYTES OF OPEN CORE
*     5 CPU-SEC.       96 ELAPSED-SEC.     ----  LINK END ---
*     5 CPU-SEC.       96 ELAPSED-SEC.     42    MCE1     BEGN
*     5 CPU-SEC.       99 ELAPSED-SEC.     42    MCE1     END
*     5 CPU-SEC.       99 ELAPSED-SEC.     44    MCE2     BEGN
*     5 CPU-SEC.      101 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1.EST. TIME =        0.0
*     5 CPU-SEC.      102 ELAPSED-SEC.     MPYA  D
*     5 CPU-SEC.      102 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =    1.EST. TIME =        0.0
*     5 CPU-SEC.      104 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.      104 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =    1.EST. TIME =        0.0
*     6 CPU-SEC.      105 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.      108 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1.EST. TIME =        0.0
*     6 CPU-SEC.      109 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.      109 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =    1.EST. TIME =        0.0
*     6 CPU-SEC.      110 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.      111 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =    1.EST. TIME =        0.0
*     6 CPU-SEC.      112 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.      113 ELAPSED-SEC.     44    MCE2     END
*     7 CPU-SEC.      114 ELAPSED-SEC.     ----  LINKNS07 ---
=  107 I/O SEC.
 LAST LINK DID NOT USE   68372 BYTES OF OPEN CORE
*     7 CPU-SEC.      119 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.      119 ELAPSED-SEC.     50    VEC      BEGN
*     7 CPU-SEC.      120 ELAPSED-SEC.     50    VEC      END
*     7 CPU-SEC.      120 ELAPSED-SEC.     51    PARTN    BEGN
*     7 CPU-SEC.      122 ELAPSED-SEC.     51    PARTN    END
*     7 CPU-SEC.      123 ELAPSED-SEC.     XSFA
*     7 CPU-SEC.      123 ELAPSED-SEC.     XSFA
*     7 CPU-SEC.      123 ELAPSED-SEC.     52    PARTN    BEGN
*     7 CPU-SEC.      124 ELAPSED-SEC.     52    PARTN    END
*     7 CPU-SEC.      125 ELAPSED-SEC.     55    DECOMP   BEGN
*     7 CPU-SEC.      125 ELAPSED-SEC.     DECO  MP
*     7 CPU-SEC.      127 ELAPSED-SEC.     DECO  MP
*     7 CPU-SEC.      129 ELAPSED-SEC.     55    DECOMP   END
*     7 CPU-SEC.      130 ELAPSED-SEC.     ----  LINKNS05 ---
=  119 I/O SEC.
 LAST LINK DID NOT USE   59592 BYTES OF OPEN CORE
*     7 CPU-SEC.      131 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.      131 ELAPSED-SEC.     59    SSG1     BEGN
*     7 CPU-SEC.      135 ELAPSED-SEC.     59    SSG1     END
*     7 CPU-SEC.      136 ELAPSED-SEC.     63    SSG2     BEGN
```

```
*     7 CPU-SEC.       137 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T  ,NBR PASSES =   1,EST. TIME =      0.0
*     7 CPU-SEC.       139 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.       141 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*     8 CPU-SEC.       142 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.       142 ELAPSED-SEC.     63    SSG2     END
*     8 CPU-SEC.       142 ELAPSED-SEC.     66    SSGHT    BEGN
*     8 CPU-SEC.       157 ELAPSED-SEC.     66    SSGHT    END
*     8 CPU-SEC.       157 ELAPSED-SEC.     ----  LINKNS08 ---
=   153 I/O SEC.
 LAST LINK DID NOT USE   24432 BYTES OF OPEN CORE
*     8 CPU-SEC.       164 ELAPSED-SEC.     ----  LINK END ---
*     8 CPU-SEC.       164 ELAPSED-SEC.     71    PLTTRAN BEGN
*     8 CPU-SEC.       165 ELAPSED-SEC.     71    PLTTRAN END
*     8 CPU-SEC.       166 ELAPSED-SEC.     ----  LINKNS13 ---
=   159 I/O SEC.
 LAST LINK DID NOT USE   73552 BYTES OF OPEN CORE
*     8 CPU-SEC.       171 ELAPSED-SEC.     ----  LINK END ---
*     8 CPU-SEC.       171 ELAPSED-SEC.     74    SDR2     BEGN
*     8 CPU-SEC.       174 ELAPSED-SEC.     74    SDR2     END
*     8 CPU-SEC.       175 ELAPSED-SEC.     ----  LINKNS14 ---
=   168 I/O SEC.
 LAST LINK DID NOT USE   25468 BYTES OF OPEN CORE
*     8 CPU-SEC.       181 ELAPSED-SEC.     ----  LINK END ---
*     8 CPU-SEC.       181 ELAPSED-SEC.     75    OFP      BEGN
*     8 CPU-SEC.       183 ELAPSED-SEC.     75    OFP      END
*     8 CPU-SEC.       183 ELAPSED-SEC.     ----  LINKNS13 ---
=   176 I/O SEC.
 LAST LINK DID NOT USE   68004 BYTES OF OPEN CORE
*     9 CPU-SEC.       191 ELAPSED-SEC.     ----  LINK END ---
*     9 CPU-SEC.       191 ELAPSED-SEC.     77    SDRHT    BEGN
*     9 CPU-SEC.       191 ELAPSED-SEC.     77    SDRHT    END
*     9 CPU-SEC.       191 ELAPSED-SEC.     ----  LINKNS14 ---
=   185 I/O SEC.
 LAST LINK DID NOT USE   39888 BYTES OF OPEN CORE
*     9 CPU-SEC.       202 ELAPSED-SEC.     ----  LINK END ---
*     9 CPU-SEC.       202 ELAPSED-SEC.     78    OFP      BEGN
*     9 CPU-SEC.       202 ELAPSED-SEC.     78    OFP      END
*     9 CPU-SEC.       203 ELAPSED-SEC.     92    EXIT     BEGN
----------------------------------------------------------------------------------------------------------------------------
=   183 I/O SEC.
 LAST LINK DID NOT USE   74704 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =    OK BYTES
```

IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*************************************************************************
$ START OF EXECUTIVE CONTROL *********************************************
$*************************************************************************
$
ID CLASS PROBLEM NINE, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR TRANSIENT SOLUTION ALGORITHM IS TO BE USED
$
SOL 9
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE_CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
$
$ A CHKPNT TAPE IS TO BE MADE TO ALLOW FOR LATER RESTARTS
$
CHKPNT YES
CEND
```

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

ECHO OF FIRST CARD IN CHECKPOINT DICTIONARY TO BE PUNCHED OUT FOR THIS PROBLEM

RESTART CLASS ,PROBLEM . 1/ 1/76, 27120.

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $********************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ******************************
  4      $********************************************************************************
  5      $
  6      TITLE=      NON-LINEAR TRANSIENT PROBLEM ... A RESTART TAPE WILL BE MADE
  7      $
  8      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
  9      $
 10      LINE=51
 11      $
 12      $ REQUEST SORTED AND UNSORTED OUTPUT
 13      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 14      $
 15      ECHO=BOTH
 16      $
 17      $ SELECT THE MPC AND LOAD SETS TO BE USED IN THIS SOLUTION
 18      $ NOTE THAT NO SPC SET IS SELECTED, AND THAT DLOAD HAS REPLACED LOAD.
 19      $
 20      MPC=200
 21      DLOAD=300
 22      $
 23      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 24      $ THE SELECTION OF THIS SET IS OPTIONAL FOR SOL 9, BUT SHOULD BE MADE IF
 25      $ THE FINAL TEMPERATURE IS SEVERAL HUNDRED DEGREES DIFFERENT FROM THE
 26      $ IC VECTOR, AND RADIATIVE INTERCHANGES ARE INCLUDED.
 27      $
 28      TEMP(MATERIAL)=400
 29      $
 30      $ SELECT THE STEP SIZE, NUMBER OF INCREMENTS, AND PRINTOUT FREQUENCY
 31      $
 32      TSTEP=500
 33      $
 34      $ SELECT THE TEMPERATURE SET DEFINING THE TEMPERATURE VECTOR AT T=0.
 35      $
 36      IC=600
 37      $
 38      $ SELECT OUTPUT DESIRED
 39      $
 40      OUTPUT
 41      $
 42      $ DEFINE A GROUP OF GRID POINTS TO BE REFERENCED BY AN OUTPUT REQUEST
 43      $
 44      SET 5 = 1,2,3,4,5,6,7,8,100
 45      $
 46      $ REFERENCE A PREVIOUSLY DEFINED GROUP OF GRID POINTS
 47      $
 48      THERMAL=5
 49      $
 50      $********************************************************************************
 51      $ END CASE CONTROL --- START BULK DATA *****************************************
```

```
                         C A S E   C O N T R O L   D E C K   E C H O
 CARD
 COUNT
 52      $*******************************************************************************
 53      $
 54      BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY AND THERMAL MASS
$
MAT4    1000    200.    2.426+6                                         ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1   ..   2   ..   3   ..   4   ..   5   ..   6   ..   7   ..   8   ..   9   ..  10   .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                            .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED FOR THE TRANSIENT SOLUTION ----------
$ THEY CONVERT PROBLEM TWO TO PROBLEM THREE    .
$ NOTE THAT THE SPC1 SET WAS NOT SELECTED IN CASE CONTROL
$ NOTE THAT SPCF OUTPUT IS NOT REQUESTED IN TRANSIENT
$ NOTE THAT THERMAL MASS WAS ADDED TO 'MAT4' CARD 1000
$ NOTE THAT THE DIAG CARD IN THE EXECUTI'E CONTROL WAS IRRELEVANT
$ NOTE THAT THE LOAD REQUEST IN CASE CONTROL IS NOW A DLOAD REQUEST
$
$
$ TRANSIENT SINGLE POINT CONSTRAINT METHOD
$ CONSTRAIN GRID POINT 100 TO 300 DEGREES CELSIUS
$
CELAS2  300     1.+5    100     1
SLOAD   300     100     300.+5
$
$ DEFINES A CONSTANT LOAD SET APPLIED FROM T=0. TO T=1.+6 SECONDS
$
TLOAD2  300     300                             0.      1.+6    0.      0.      +TL1
+TL1    0.      0.
$
$ DEFINES THE NUMBER OF INCREMENTS, THE STEP SIZE, AND THE PRINTOUT FREQUENCY
$ REFERENCED IN CASE CONTROL AS 'TSTEP'
$ EACH TIME STEP IS 30 SECONDS
$
TSTEP   500     45      30.     1
$
$ DEFINES A TEMPERATURE VECTOR --- REFERENCED IN CASE CONTROL AS 'IC'
$
TEMPD   600     300.
$
$*******************************************************************************
$ PROBLEM NINE DEMONSTRATES THE GENERATION OF A RESTART TAPE.
$ NO NEW BULK DATA CARDS WERE REQUIRED TO CONVERT PROBLEM THREE TO
$ PROBLEM NINE. THE ONLY CHANGES MADE WERE TO ACTIVATE UNITS
$ FT07F001 AND NPTP VIA THE JOB CONTROL LANGUAGE, AND TO ADD THE
$ 'CHKPNT YES' CARD TO THE EXECUTIVE CONTROL.
$ TO REDUCE THE OUTPUT VOLUME, THE ONLY OUTPUT REQUESTED IN THIS
$ RUN IS THERMAL=5
$*******************************************************************************
$ END OF BULK DATA ***************************************************************
$*******************************************************************************
$
ENDDATA
```

TOTAL COUNT= 146

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED,XSORT WILL RE-ORDER DECK.

S O R T E D B U L K D A T A E C H O

CARD COUNT	1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 .
1-	CELAS2	300	1.+5	100	1					
2-	CHBDY	60	300	LINE	1	5				+CONVEC
3-	+CONVEC	100	100							
4-	CHBDY	200	2000	AREA4	1	2	6	5		
5-	CHBDY	300	2000	AREA4	2	3	7	6		
6-	CHBDY	400	2000	AREA4	3	4	8	7		
7-	CHBDY	500	2000	AREA4	5	6	2	1		
8-	CHBDY	600	2000	AREA4	6	7	3	2		
9-	CHBDY	700	2000	AREA4	7	8	4	3		
10-	CQUAD2	30	200	1	2	6	5			
11-	CQUAD2	40	200	2	3	7	6			
12-	CQUAD2	50	200	3	4	8	7			
13-	CROD	10	100	10	2					
14-	CROD	20	100	9	6					
15-	GRID	1		0.0	0.0	0.0				
16-	GRID	2		.1	0.0	0.0				
17-	GRID	3		.2	0.0	0.0				
18-	GRID	4		.3	0.0	0.0				
19-	GRID	5		0.0	.1	0.0				
20-	GRID	6		.1	.1	0.0				
21-	GRID	7		.2	.1	0.0				
22-	GRID	8		.3	.1	0.0				
23-	GRID	9		0.0	.2	0.0				
24-	GRID	10		0.0	-.1	0.0				
25-	GRID	100		-.05	.05	0.0				
26-	MAT4	1000	200.	2.426+6						ALUMINUM
27-	MAT4	3000	200.							
28-	MPC	200	9	1	1.	5	1	-1.		
29-	MPC	200	10	1	1.	1	1	-1.		
30-	PARAM	EPSHT	.0001							
31-	PARAM	MAXIT	8							
32-	PARAM	SIGMA	5.685E-8							
33-	PARAM	TABS	273.15							
34-	PHBDY	300	3000	.314						
35-	PHBDY	2000			.90					
36-	PQUAD2	200	1000	.01						
37-	PROD	100	1000	.001						
38-	RADLST	200	300	400	500	600	700			
39-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
40-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
41-	RADMTX	3	0.0	0.0	0.0	0.0				
42-	RADMTX	4	0.0	0.0	0.0					
43-	RADMTX	5	0.0	0.0						
44-	RADMTX	6	0.0							
45-	SLOAD	300	1	4.	2	8.				
46-	SLOAD	300	3	8.	4	4.				
47-	SLOAD	300	5	4.	6	R.				
48-	SLOAD	300	7	8.	8	4.				
49-	SLOAD	300	100	300.+5						
50-	SPC1	100	1	100						
51-	TEMP	400	100	300.						

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 .
52-	TEMPD	400	300.							
53-	TEMPD	600	300.							
54-	TLOAD2	300	300			0.0	1.+6	0.0	0.0	+TL1
55-	+TL1	0.	0.							
56-	TSTEP	500	45	30.	1					
	ENDDATA									

```
       N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
   DMAP-DMAP INSTRUCTION
    NO.

*** USER WARNING MESSAGE  54.
    PARAMETER NAMED EPSHT    NOT REFERENCED

*** USER WARNING MESSAGE  54.
    PARAMETER NAMED MAXIT    NOT REFERENCED

         **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**
```

```
CONTINUATION OF CHECKPOINT DICTIONARY

 1,   XVPS     ,   FLAGS = 0,   REEL =  1,   FILE =      5


 2,   REENTER AT DMAP SEQUENCE NUMBER     7
 3,   HGPL     ,   FLAGS = 0,   REEL =  1,   FILE =      6
 4,   HEQEXIN  ,   FLAGS = 0,   REEL =  1,   FILE =      7
 5,   HGPDT    ,   FLAGS = 0,   REEL =  1,   FILE =      8
 6,   HBGPDT   ,   FLAGS = 0,   REEL =  1,   FILE =      9
 7,   HSIL     ,   FLAGS = 0,   REEL =  1,   FILE =     10
 8,   XVPS     ,   FLAGS = 0,   REEL =  1,   FILE =     11
 9,   HCSTM    ,   FLAGS = 0,   REEL =  0,   FILE =      0
10,   HUSET    ,   FLAGS = 0,   REEL =  0,   FILE =      0
11,   HGM      ,   FLAGS = 0,   REEL =  0,   FILE =      0
12,   HGO      ,   FLAGS = 0,   REEL =  0,   FILE =      0
13,   HKAA     ,   FLAGS = 0,   REEL =  0,   FILE =      0
14,   HBAA     ,   FLAGS = 0,   REEL =  0,   FILE =      0
15,   HPSO     ,   FLAGS = 0,   REEL =  0,   FILE =      0
16,   HKFS     ,   FLAGS = 0,   REEL =  0,   FILE =      0
17,   HOP      ,   FLAGS = 0,   REEL =  0,   FILE =      0
18,   HEST     ,   FLAGS = 0,   REEL =  0,   FILE =      0

19,   REENTER AT DMAP SEQUENCE NUMBER    10
20,   HECT     ,   FLAGS = 0,   REEL =  1,   FILE =     12
21,   XVPS     ,   FLAGS = 0,   REEL =  1,   FILE =     13
```

ADDITIONS TO CHECKPOINT DICTIONARY

```
22.  REENTER AT DMAP SEQUENCE NUMBER    21
23.  XVPS     ,  FLAGS = 0.   REEL =  1.   FILE =     14
24.  HPLTPAR  ,  FLAGS = 0.   REEL =  0.   FILE =      0
25.  HGPSETS  ,  FLAGS = 0.   REEL =  0.   FILE =      0
26.  HELSETS  ,  FLAGS = 0.   REEL =  0.   FILE =      0

27.  REENTER AT DMAP SEQUENCE NUMBER    23
28.  HGPTT    ,  FLAGS = 0.   REEL =  1.   FILE =     15
29.  HSLT     ,  FLAGS = 0.   REEL =  1.   FILE =     16
30.  XVPS     ,  FLAGS = 0.   REEL =  1.   FILE =     17

31.  REENTER AT DMAP SEQUENCE NUMBER    26
32.  HEST     ,  FLAGS = 0.   REEL =  1.   FILE =     18
33.  HECPT    ,  FLAGS = 0.   REEL =  1.   FILE =     19
34.  HGPCT    ,  FLAGS = 0.   REEL =  1.   FILE =     20
35.  XVPS     ,  FLAGS = 0.   REEL =  1.   FILE =     21


36.  REENTER AT DMAP SEQUENCE NUMBER    30
37.  HKGGX    ,  FLAGS = 0.   REEL =  1.   FILE =     22
38.  XVPS     ,  FLAGS = 0.   REEL =  1.   FILE =     23
39.  HGPST    ,  FLAGS = 0.   REEL =  0.   FILE =      0

40.  REENTER AT DMAP SEQUENCE NUMBER    34
41.  HBGG     ,  FLAGS = 0.   REEL =  1.   FILE =     24
42.  XVPS     ,  FLAGS = 0.   REEL =  1.   FILE =     25
43.  HBNN     ,  FLAGS = 0.   REEL =  0.   FILE =      0
44.  HBFF     ,  FLAGS = 0.   REEL =  0.   FILE =      0


*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE      ,   6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023,          B =      3
                                            C =      0
                                            R =      2

*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS        0  SECONDS.

45.  REENTER AT DMAP SEQUENCE NUMBER    40
46.  HRGG     ,  FLAGS = 0.   REEL =  1.   FILE =     26
47.  HKGG     ,  FLAGS = 0.   REEL =  1.   FILE =     27
48.  HQGE     ,  FLAGS = 0.   REEL =  1.   FILE =     28
49.  XVPS     ,  FLAGS = 0.   REEL =  1.   FILE =     29
50.  HRNN     ,  FLAGS = 0.   REEL =  0.   FILE =      0
51.  HRFF     ,  FLAGS = 0.   REEL =  0.   FILE =      0
52.  HRAA     ,  FLAGS = 0.   REEL =  0.   FILE =      0
53.  HRDD     ,  FLAGS = 0.   REEL =  0.   FILE =      0


54.  REENTER AT DMAP SEQUENCE NUMBER    45
```

```
 55.  HRG       ,  FLAGS = 0.  REEL =  1.  FILE =   30
 56.  HUSET     ,  FLAGS = 0.  REEL =  1.  FILE =   31
 57.  XVPS      ,  FLAGS = 0.  REEL =  1.  FILE =   32
 58.  HGMD      ,  FLAGS = 0.  REEL =  0.  FILE =    0
 59.  HGOD      ,  FLAGS = 0.  REEL =  0.  FILE =    0
 60.  HKNN      ,  FLAGS = 0.  REEL =  0.  FILE =    0


 61.  REENTER AT DMAP SEQUENCE NUMBER    53
 62.  HGM       ,  FLAGS = 0.  REEL =  1.  FILE =   33
 63.  XVPS      ,  FLAGS = 0.  REEL =  1.  FILE =   34

 64.  REENTER AT DMAP SEQUENCE NUMBER    55
 65.  HKNN      ,  FLAGS = 0.  REEL =  1.  FILE =   35
 66.  HRNN      ,  FLAGS = 0.  REEL =  1.  FILE =   36
 67.  HBNN      ,  FLAGS = 0.  REEL =  1.  FILE =   37
 68.  XVPS      ,  FLAGS = 0.  REEL =  1.  FILE =   38

 69.  REENTER AT DMAP SEQUENCE NUMBER    58.
 70.  HKNN      ,  FLAGS = 4.  REEL =  1.  FILE =   35
 71.  HKFF      ,  FLAGS = 4.  REEL =  1.  FILE =   35
 72.  HRNN      ,  FLAGS = 4.  REEL =  1.  FILE =   36
 73.  HRFF      ,  FLAGS = 4.  REEL =  1.  FILE =   36
 74.  HBNN      ,  FLAGS = 4.  REEL =  1.  FILE =   37
 75.  HBFF      ,  FLAGS = 4.  REEL =  1.  FILE =   37
 76.  XVPS      ,  FLAGS = 0.  REEL =  1.  FILE =   39

 77.  REENTER AT DMAP SEQUENCE NUMBER    64
 78.  HKAA      ,  FLAGS = 4.  REEL =  1.  FILE =   35
 79.  HRAA      ,  FLAGS = 4.  REEL =  1.  FILE =   36
 80.  HBAA      ,  FLAGS = 4.  REEL =  1.  FILE =   37
 81.  XVPS      ,  FLAGS = 0.  REEL =  1.  FILE =   40


 82.  REENTER AT DMAP SEQUENCE NUMBER    81
 83.  HUSETD    ,  FLAGS = 0.  REEL =  1.  FILE =   41
 84.  HEQDYN    ,  FLAGS = 0.  REEL =  1.  FILE =   42
 85.  HDLT      ,  FLAGS = 0.  REEL =  1.  FILE =   43
 86.  HTRL      ,  FLAGS = 0.  REEL =  1.  FILE =   44
 87.  HGM       ,  FLAGS = 4.  REEL =  1.  FILE =   33
 88.  HGMD      ,  FLAGS = 4.  REEL =  1.  FILE =   33
 89.  HSILD     ,  FLAGS = 0.  REEL =  1.  FILE =   45
 90.  HGPLD     ,  FLAGS = 0.  REEL =  1.  FILE =   46
 91.  XVPS      ,  FLAGS = 0.  REEL =  1.  FILE =   47
 92.  HTFPOOL   ,  FLAGS = 0.  REEL =  0.  FILE =    0
 93.  HNLFT     ,  FLAGS = 0.  REEL =  0.  FILE =    0
 94.  HPPO      ,  FLAGS = 0.  REEL =  0.  FILE =    0
 95.  HPDO      ,  FLAGS = 0.  REEL =  0.  FILE =    0
 96.  HPDT      ,  FLAGS = 0.  REEL =  0.  FILE =    0


 97.  REENTER AT DMAP SEQUENCE NUMBER    87
 98.  HKDD      ,  FLAGS = 4.  REEL =  1.  FILE =   35
 99.  HRDD      ,  FLAGS = 4.  REEL =  1.  FILE =   36
100.  XVPS      ,  FLAGS = 0.  REEL =  1.  FILE =   48
101.  HK2PP     ,  FLAGS = 0.  REEL =  0.  FILE =    0
102.  HB2PP     ,  FLAGS = 0.  REEL =  0.  FILE =    0
103.  HK2DD     ,  FLAGS = 0.  REEL =  0.  FILE =    0
104.  HB2DD     ,  FLAGS = 0.  REEL =  0.  FILE =    0
```

ADDITIONS TO CHECKPOINT DICTIONARY

```
      105,   REENTER AT DMAP SEQUENCE NUMBER     92
      106,   HBDD     ,   FLAGS = 0,   REEL =  1,   FILE =      49
      107,   XVPS     ,   FLAGS = 0,   REEL =  1,   FILE =      50


      108,   REENTER AT DMAP SEQUENCE NUMBER     97
      109,   HPPO     ,   FLAGS = 0,   REEL =  1,   FILE =      51
      110,   HPDO     ,   FLAGS = 4,   REEL =  1,   FILE =      52
      111,   HPDT     ,   FLAGS = 4,   REEL =  1,   FILE =      52
      112,   HTOL     ,   FLAGS = 0,   REEL =  1,   FILE =      53
      113,   XVPS     ,   FLAGS = 0,   REEL =  1,   FILE =      54


 *** USER INFORMATION MESSAGE 3028,     B =     5     BBAR =    5
                                        C =     3     CBAR =    1
                                        R =     8

 *** USER INFORMATION MESSAGE 3027, UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS      0 SECONDS.

      114,   REENTER AT DMAP SEQUENCE NUMBER     99
      115,   HUDVT    ,   FLAGS = 0,   REEL =  1,   FILE =      55
      116,   HPNLD    ,   FLAGS = 0,   REEL =  1,   FILE =      56
      117,   XVPS     ,   FLAGS = 0,   REEL =  1,   FILE =      57


      118,   REENTER AT DMAP SEQUENCE NUMBER    102
      119,   XVPS     ,   FLAGS = 0,   REEL =  1,   FILE =      58
      120,   HOUDV1   ,   FLAGS = 0,   REEL =  0,   FILE =       0
      121,   HOPNL1   ,   FLAGS = 0,   REEL =  0,   FILE =       0

      122,   REENTER AT DMAP SEQUENCE NUMBER    118
      123,   HUPV     ,   FLAGS = 0,   REEL =  1,   FILE =      59
      124,   XVPS     ,   FLAGS = 0,   REEL =  1,   FILE =      60




      125,   REENTER AT DMAP SEQUENCE NUMBER    123
      126,   HOUPV2   ,   FLAGS = 0,   REEL =  1,   FILE =      61
      127,   XVPS     ,   FLAGS = 0,   REEL =  1,   FILE =      62
      128,   HOPP2    ,   FLAGS = 0,   REEL =  0,   FILE =       0
      129,   HOQP2    ,   FLAGS = 0,   REEL =  0,   FILE =       0
      130,   HOES2    ,   FLAGS = 0,   REEL =  0,   FILE =       0
      131,   HOEF2    ,   FLAGS = 0,   REEL =  0,   FILE =       0
```

POINT-ID = 1

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984949E 02
6.000000E 01	S	2.959980E 02
9.000000E 01	S	2.938445E 02
1.200000E 02	S	2.919236E 02
1.500000E 02	S	2.901902E 02
1.800000E 02	S	2.886216E 02
2.100000E 02	S	2.872031E 02
2.400000E 02	S	2.859224E 02
2.700000E 02	S	2.847678E 02
3.000000E 02	S	2.837285E 02
3.300000E 02	S	2.827942E 02
3.600000E 02	S	2.819548E 02
3.900000E 02	S	2.812014E 02
4.200000E 02	S	2.805254E 02
4.500000E 02	S	2.799189E 02
4.800000E 02	S	2.793750E 02
5.100000E 02	S	2.788872E 02
5.400000E 02	S	2.784500E 02
5.700000E 02	S	2.780579E 02
6.000000E 02	S	2.777063E 02
6.300000E 02	S	2.773909E 02
6.600000E 02	S	2.771079E 02
6.900000E 02	S	2.768542E 02
7.200000E 02	S	2.766267E 02
7.500000E 02	S	2.764224E 02
7.800000E 02	S	2.762390E 02
8.100000E 02	S	2.760745E 02
8.400000E 02	S	2.759270E 02
8.700000E 02	S	2.757944E 02
9.000000E 02	S	2.756755E 02
9.300000E 02	S	2.755686E 02
9.600000E 02	S	2.754727E 02
9.900000E 02	S	2.753865E 02
1.020000E 03	S	2.753091E 02
1.050000E 03	S	2.752395E 02
1.080000E 03	S	2.751772E 02
1.110000E 03	S	2.751211E 02
1.140000E 03	S	2.750708E 02
1.170000E 03	S	2.750254E 02
1.200000E 03	S	2.749849E 02
1.230000E 03	S	2.749482E 02
1.260000E 03	S	2.749153E 02
1.290000E 03	S	2.748860E 02
1.320000E 03	S	2.748596E 02
1.350000E 03	S	2.748357E 02

POINT-ID = 2

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.973813E 02
6.000000E 01	S	2.927502E 02
9.000000E 01	S	2.884094E 02
1.200000E 02	S	2.844219E 02
1.500000E 02	S	2.807952E 02
1.800000E 02	S	2.775146E 02
2.100000E 02	S	2.745569E 02
2.400000E 02	S	2.718955E 02
2.700000E 02	S	2.695042E 02
3.000000E 02	S	2.673574E 02
3.300000E 02	S	2.654314E 02
3.600000E 02	S	2.637039E 02
3.900000E 02	S	2.621553E 02
4.200000E 02	S	2.607668E 02
4.500000E 02	S	2.595225E 02
4.800000E 02	S	2.584070E 02
5.100000E 02	S	2.574070E 02
5.400000E 02	S	2.565105E 02
5.700000E 02	S	2.557069E 02
6.000000E 02	S	2.549862E 02
6.300000E 02	S	2.543399E 02
6.600000E 02	S	2.537601E 02
6.900000E 02	S	2.532400E 02
7.200000E 02	S	2.527734E 02
7.500000E 02	S	2.523547E 02
7.800000E 02	S	2.519789E 02
8.100000E 02	S	2.516416E 02
8.400000E 02	S	2.513388E 02
8.700000E 02	S	2.510670E 02
9.000000E 02	S	2.508229E 02
9.300000E 02	S	2.506038E 02
9.600000E 02	S	2.504069E 02
9.900000E 02	S	2.502302E 02
1.020000E 03	S	2.500714E 02
1.050000E 03	S	2.499288E 02
1.080000E 03	S	2.498007E 02
1.110000E 03	S	2.496857E 02
1.140000E 03	S	2.495822E 02
1.170000E 03	S	2.494694E 02
1.200000E 03	S	2.494059E 02
1.230000E 03	S	2.493309E 02
1.260000E 03	S	2.492635E 02
1.290000E 03	S	2.492030E 02
1.320000E 03	S	2.491485E 02
1.350000E 03	S	2.490997E 02

POINT-ID = 3

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.942329E 02
6.000000E 01	S	2.847380E 02
9.000000E 01	S	2.767437E 02
1.200000E 02	S	2.698711E 02
1.500000E 02	S	2.638923E 02
1.800000E 02	S	2.586531E 02
2.100000E 02	S	2.540391E 02
2.400000E 02	S	2.499607E 02
2.700000E 02	S	2.463457E 02
3.000000E 02	S	2.431346E 02
3.300000E 02	S	2.402768E 02
3.600000E 02	S	2.377296E 02
3.900000E 02	S	2.354565E 02
4.200000E 02	S	2.334258E 02
4.500000E 02	S	2.316098E 02
4.800000E 02	S	2.299850E 02
5.100000E 02	S	2.285301E 02
5.400000E 02	S	2.272267E 02
5.700000E 02	S	2.260584E 02
6.000000E 02	S	2.250109E 02
6.300000E 02	S	2.240714E 02
6.600000E 02	S	2.232284E 02
6.900000E 02	S	2.224718E 02
7.200000E 02	S	2.217928E 02
7.500000E 02	S	2.211832E 02
7.800000E 02	S	2.206357E 02
8.100000E 02	S	2.201442E 02
8.400000E 02	S	2.197027E 02
8.700000E 02	S	2.193061E 02
9.000000E 02	S	2.189498E 02
9.300000E 02	S	2.186298E 02
9.600000E 02	S	2.183422E 02
9.900000E 02	S	2.180839E 02
1.020000E 03	S	2.178517E 02
1.050000E 03	S	2.176432E 02
1.080000E 03	S	2.174558E 02
1.110000E 03	S	2.172873E 02
1.140000E 03	S	2.171359E 02
1.170000E 03	S	2.169999E 02
1.200000E 03	S	2.168777E 02
1.230000E 03	S	2.167678E 02
1.260000E 03	S	2.166690E 02
1.290000E 03	S	2.165802E 02
1.320000E 03	S	2.165004E 02
1.350000E 03	S	2.164287E 02

POINT-ID = 4

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.939604E 02
6.000000E 01	S	2.836946E 02
9.000000E 01	S	2.746729E 02
1.200000E 02	S	2.668035E 02
1.500000E 02	S	2.599419E 02
1.800000E 02	S	2.539440E 02
2.100000E 02	S	2.486829E 02
2.400000E 02	S	2.440520E 02
2.700000E 02	S	2.399628E 02
3.000000E 02	S	2.363418E 02
3.300000E 02	S	2.331275E 02
3.600000E 02	S	2.302683E 02
3.900000E 02	S	2.277216E 02
4.200000E 02	S	2.254489E 02
4.500000E 02	S	2.234185E 02
4.800000E 02	S	2.216028E 02
5.100000E 02	S	2.199780E 02
5.400000E 02	S	2.185226E 02
5.700000E 02	S	2.172187E 02
6.000000E 02	S	2.160496E 02
6.300000E 02	S	2.150009E 02
6.600000E 02	S	2.140601E 02
6.900000E 02	S	2.132157E 02
7.200000E 02	S	2.124576E 02
7.500000E 02	S	2.117771E 02
7.800000E 02	S	2.111658E 02
8.100000E 02	S	2.106167E 02
8.400000E 02	S	2.101239E 02
8.700000E 02	S	2.096810E 02
9.000000E 02	S	2.092829E 02
9.300000E 02	S	2.089254E 02
9.600000E 02	S	2.086040E 02
9.900000E 02	S	2.083153E 02
1.020000E 03	S	2.080559E 02
1.050000E 03	S	2.078227E 02
1.080000E 03	S	2.076132E 02
1.110000E 03	S	2.074249E 02
1.140000E 03	S	2.072557E 02
1.170000E 03	S	2.071036E 02
1.200000E 03	S	2.069669E 02
1.230000E 03	S	2.068440E 02
1.260000E 03	S	2.067335E 02
1.290000E 03	S	2.066341E 02
1.320000E 03	S	2.065448E 02
1.350000E 03	S	2.064647E 02

POINT-ID = 5

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984951E 02
6.000000E 01	S	2.959983E 02
9.000000E 01	S	2.938445E 02
1.200000E 02	S	2.919236E 02
1.500000E 02	S	2.901902E 02
1.800000E 02	S	2.886216E 02
2.100000E 02	S	2.872031E 02
2.400000E 02	S	2.859224E 02
2.700000E 02	S	2.847678E 02
3.000000E 02	S	2.837288E 02
3.300000E 02	S	2.827944E 02
3.600000E 02	S	2.819551E 02
3.900000E 02	S	2.812014E 02
4.200000E 02	S	2.805254E 02
4.500000E 02	S	2.799189E 02
4.800000E 02	S	2.793750E 02
5.100000E 02	S	2.788875E 02
5.400000E 02	S	2.784500E 02
5.700000E 02	S	2.780579E 02
6.000000E 02	S	2.777063E 02
6.300000E 02	S	2.773909E 02
6.600000E 02	S	2.771079E 02
6.900000E 02	S	2.768542E 02
7.200000E 02	S	2.766267E 02
7.500000E 02	S	2.764224E 02
7.800000E 02	S	2.762390E 02
8.100000E 02	S	2.760745E 02
8.400000E 02	S	2.759270E 02
8.700000E 02	S	2.757944E 02
9.000000E 02	S	2.756755E 02
9.300000E 02	S	2.755686E 02
9.600000E 02	S	2.754727E 02
9.900000E 02	S	2.753865E 02
1.020000E 03	S	2.753091E 02
1.050000E 03	S	2.752397E 02
1.080000E 03	S	2.751772E 02
1.110000E 03	S	2.751211E 02
1.140000E 03	S	2.750708E 02
1.170000E 03	S	2.750256E 02
1.200000E 03	S	2.749849E 02
1.230000E 03	S	2.749485E 02
1.260000E 03	S	2.749155E 02
1.290000E 03	S	2.748860E 02
1.320000E 03	S	2.748596E 02
1.350000E 03	S	2.748357E 02

POINT-ID = 6

T E M P E R A T U R E V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.973813E 02
6.000000E 01	S	2.927502E 02
9.000000E 01	S	2.884094E 02
1.200000E 02	S	2.844219E 02
1.500000E 02	S	2.807952E 02
1.800000E 02	S	2.775149E 02
2.100000E 02	S	2.745571E 02
2.400000E 02	S	2.718958E 02
2.700000E 02	S	2.695044E 02
3.000000E 02	S	2.673574E 02
3.300000E 02	S	2.654314E 02
3.600000E 02	S	2.637041E 02
3.900000E 02	S	2.621553E 02
4.200000E 02	S	2.607668E 02
4.500000E 02	S	2.595225E 02
4.800000E 02	S	2.584070E 02
5.100000E 02	S	2.574070E 02
5.400000E 02	S	2.565105E 02
5.700000E 02	S	2.557068E 02
6.000000E 02	S	2.549862E 02
6.300000E 02	S	2.543399E 02
6.600000E 02	S	2.537601E 02
6.900000E 02	S	2.532400E 02
7.200000E 02	S	2.527734E 02
7.500000E 02	S	2.523547E 02
7.800000E 02	S	2.519789E 02
8.100000E 02	S	2.516416E 02
8.400000E 02	S	2.513387E 02
8.700000E 02	S	2.510669E 02
9.000000E 02	S	2.508229E 02
9.300000E 02	S	2.506038E 02
9.600000E 02	S	2.504069E 02
9.900000E 02	S	2.502302E 02
1.020000E 03	S	2.500714E 02
1.050000E 03	S	2.499288E 02
1.080000E 03	S	2.498007E 02
1.110000E 03	S	2.496857E 02
1.140000E 03	S	2.495822E 02
1.170000E 03	S	2.494894E 02
1.200000E 03	S	2.494059E 02
1.230000E 03	S	2.493309E 02
1.260000E 03	S	2.492635E 02
1.290000E 03	S	2.492030E 02
1.320000E 03	S	2.491486E 02
1.350000E 03	S	2.490997E 02

POINT-ID = 7

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.942332E 02
6.000000E 01	S	2.847383E 02
9.000000E 01	S	2.767437E 02
1.200000E 02	S	2.698711E 02
1.500000E 02	S	2.638926E 02
1.800000E 02	S	2.586531E 02
2.100000E 02	S	2.540391E 02
2.400000E 02	S	2.499608E 02
2.700000E 02	S	2.463459E 02
3.000000E 02	S	2.431346E 02
3.300000E 02	S	2.402769E 02
3.600000E 02	S	2.377297E 02
3.900000E 02	S	2.354565E 02
4.200000E 02	S	2.334259E 02
4.500000E 02	S	2.316100E 02
4.800000E 02	S	2.299851E 02
5.100000E 02	S	2.285302E 02
5.400000E 02	S	2.272267E 02
5.700000E 02	S	2.260585E 02
6.000000E 02	S	2.250110E 02
6.300000E 02	S	2.240714E 02
6.600000E 02	S	2.232284E 02
6.900000E 02	S	2.224719E 02
7.200000E 02	S	2.217929E 02
7.500000E 02	S	2.211833E 02
7.800000E 02	S	2.206358E 02
8.100000E 02	S	2.201442E 02
8.400000E 02	S	2.197028E 02
8.700000E 02	S	2.193062E 02
9.000000E 02	S	2.189499E 02
9.300000E 02	S	2.186299E 02
9.600000E 02	S	2.183423E 02
9.900000E 02	S	2.180840E 02
1.020000E 03	S	2.178519E 02
1.050000E 03	S	2.176433E 02
1.080000E 03	S	2.174559E 02
1.110000E 03	S	2.172874E 02
1.140000E 03	S	2.171360E 02
1.170000E 03	S	2.169999E 02
1.200000E 03	S	2.168777E 02
1.230000E 03	S	2.167678E 02
1.260000E 03	S	2.166691E 02
1.290000E 03	S	2.165803E 02
1.320000E 03	S	2.165004E 02
1.350000E 03	S	2.164288E 02

POINT-ID = 8

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.939607E 02
6.000000E 01	S	2.836948E 02
9.000000E 01	S	2.746731E 02
1.200000E 02	S	2.668037E 02
1.500000E 02	S	2.599419E 02
1.800000E 02	S	2.539441E 02
2.100000E 02	S	2.486830E 02
2.400000E 02	S	2.440520E 02
2.700000E 02	S	2.399627E 02
3.000000E 02	S	2.363417E 02
3.300000E 02	S	2.331277E 02
3.600000E 02	S	2.302688E 02
3.900000E 02	S	2.277216E 02
4.200000E 02	S	2.254490E 02
4.500000E 02	S	2.234187E 02
4.800000E 02	S	2.216031E 02
5.100000E 02	S	2.199782E 02
5.400000E 02	S	2.185229E 02
5.700000E 02	S	2.172188E 02
6.000000E 02	S	2.160497E 02
6.300000E 02	S	2.150009E 02
6.600000E 02	S	2.140602E 02
6.900000E 02	S	2.132157E 02
7.200000E 02	S	2.124577E 02
7.500000E 02	S	2.117771E 02
7.800000E 02	S	2.111658E 02
8.100000E 02	S	2.106169E 02
8.400000E 02	S	2.101239E 02
8.700000E 02	S	2.096810E 02
9.000000E 02	S	2.092830E 02
9.300000E 02	S	2.089254E 02
9.600000E 02	S	2.086041E 02
9.900000E 02	S	2.083153E 02
1.020000E 03	S	2.080560E 02
1.050000E 03	S	2.078228E 02
1.080000E 03	S	2.076133E 02
1.110000E 03	S	2.074250E 02
1.140000E 03	S	2.072557E 02
1.170000E 03	S	2.071037E 02
1.200000E 03	S	2.069669E 02
1.230000E 03	S	2.068440E 02
1.260000E 03	S	2.067335E 02
1.290000E 03	S	2.066342E 02
1.320000E 03	S	2.065450E 02
1.350000E 03	S	2.064649E 02

POINT-ID = 100

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.999993E 02
6.000000E 01	S	2.999995E 02
9.000000E 01	S	2.999993E 02
1.200000E 02	S	2.999988E 02
1.500000E 02	S	2.999990E 02
1.800000E 02	S	2.999988E 02
2.100000E 02	S	2.999988E 02
2.400000E 02	S	2.999988E 02
2.700000E 02	S	2.999988E 02
3.000000E 02	S	2.999988E 02
3.300000E 02	S	2.999985E 02
3.600000E 02	S	2.999980E 02
3.900000E 02	S	2.999985E 02
4.200000E 02	S	2.999980E 02
4.500000E 02	S	2.999985E 02
4.800000E 02	S	2.999980E 02
5.100000E 02	S	2.999983E 02
5.400000E 02	S	2.999983E 02
5.700000E 02	S	2.999980E 02
6.000000E 02	S	2.999983E 02
6.300000E 02	S	2.999980E 02
6.600000E 02	S	2.999983E 02
6.900000E 02	S	2.999980E 02
7.200000E 02	S	2.999983E 02
7.500000E 02	S	2.999980E 02
7.800000E 02	S	2.999983E 02
8.100000E 02	S	2.999980E 02
8.400000E 02	S	2.999983E 02
8.700000E 02	S	2.999980E 02
9.000000E 02	S	2.999983E 02
9.300000E 02	S	2.999980E 02
9.600000E 02	S	2.999983E 02
9.900000E 02	S	2.999980E 02
1.020000E 03	S	2.999980E 02
1.050000E 03	S	2.999980E 02
1.080000E 03	S	2.999980E 02
1.110000E 03	S	2.999980E 02
1.140000E 03	S	2.999980E 02
1.170000E 03	S	2.999980E 02
1.200000E 03	S	2.999980E 02
1.230000E 03	S	2.999980E 02
1.260000E 03	S	2.999980E 02
1.290000E 03	S	2.999980E 02
1.320000E 03	S	2.999980E 02
1.350000E 03	S	2.999980E 02

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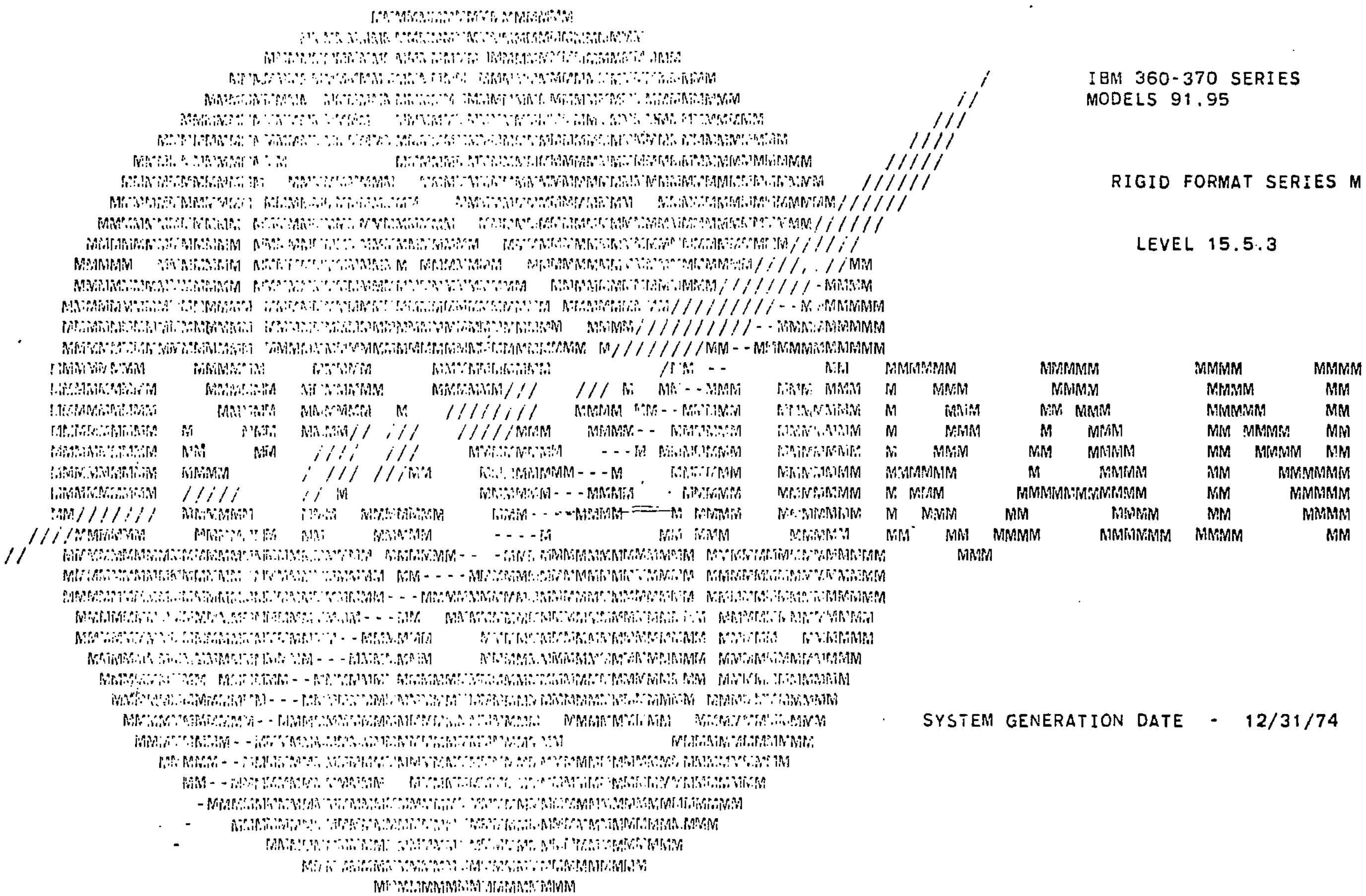
 NASTRAN LOADED AT LOCATION 16DF20
 TIME TO GO =   59 CPU SEC., 299 I/O SEC.
*      0 CPU-SEC.         0 ELAPSED-SEC.     SEM1   BEGN
*      0 CPU-SEC.         0 ELAPSED-SEC.     SEMT
*      1 CPU-SEC.         4 ELAPSED-SEC.     NAST
*      1 CPU-SEC.         4 ELAPSED-SEC.     GNFI
*      1 CPU-SEC.         4 ELAPSED-SEC.     XCSA
*      1 CPU-SEC.         7 ELAPSED-SEC.     IFP1
*      1 CPU-SEC.        10 ELAPSED-SEC.     XSOR
*      2 CPU-SEC.        15 ELAPSED-SEC.       DO   IFP
*      2 CPU-SEC.        27 ELAPSED-SEC.      END   IFP
*      2 CPU-SEC.        27 ELAPSED-SEC.     XGPI
*      4 CPU-SEC.        34 ELAPSED-SEC.     SEM1   END
*      4 CPU-SEC.        34 ELAPSED-SEC.     ----   LINKNS02 ---
=     24 I/O SEC.
 LAST LINK DID NOT USE   40016 BYTES OF OPEN CORE
*      4 CPU-SEC.        36 ELAPSED-SEC.     ----   LINK END ---
*      4 CPU-SEC.        36 ELAPSED-SEC.     XSFA
*      4 CPU-SEC.        37 ELAPSED-SEC.     XSFA
*      4 CPU-SEC.        37 ELAPSED-SEC.     3      GP1      BEGN
*      5 CPU-SEC.        43 ELAPSED-SEC.     3      GP1      END
*      5 CPU-SEC.        47 ELAPSED-SEC.     8      GP2      BEGN
*      5 CPU-SEC.        48 ELAPSED-SEC.     8      GP2      END
*      5 CPU-SEC.        50 ELAPSED-SEC.     10     PLTSET   BEGN
*      5 CPU-SEC.        51 ELAPSED-SEC.     10     PLTSET   END
*      5 CPU-SEC.        51 ELAPSED-SEC.     12     PRTMSG   BEGN
*      5 CPU-SEC.        52 ELAPSED-SEC.     12     PRTMSG   END
*      5 CPU-SEC.        52 ELAPSED-SEC.     13     SETVAL   BEGN
*      5 CPU-SEC.        52 ELAPSED-SEC.     13     SETVAL   END
*      5 CPU-SEC.        55 ELAPSED-SEC.     21     GP3      BEGN
*      5 CPU-SEC.        62 ELAPSED-SEC.     21     GP3      END
*      5 CPU-SEC.        64 ELAPSED-SEC.     23     TA1      BEGN
*      6 CPU-SEC.        75 ELAPSED-SEC.     23     TA1      END
*      6 CPU-SEC.        78 ELAPSED-SEC.     ----   LINKNS03 ---
=     62 I/O SEC.
 LAST LINK DID NOT USE   82788 BYTES OF OPEN CORE
*      6 CPU-SEC.        81 ELAPSED-SEC.     ----   LINK END ---
*      6 CPU-SEC.        81 ELAPSED-SEC.     27     SMA1     BEGN
*      6 CPU-SEC.        85 ELAPSED-SEC.     27     SMA1     END
*      6 CPU-SEC.        87 ELAPSED-SEC.     30     SMA2     BEGN
*      6 CPU-SEC.        90 ELAPSED-SEC.     30     SMA2     END
*      6 CPU-SEC.        93 ELAPSED-SEC.     ----   LINKNS05 ---
=     73 I/O SEC.
 LAST LINK DID NOT USE   64268 BYTES OF OPEN CORE
*      6 CPU-SEC.        96 ELAPSED-SEC.     ----   LINK END - -
*      6 CPU-SEC.        96 ELAPSED-SEC.     35     RMG      BEGN
*      6 CPU-SEC.        99 ELAPSED-SEC.     SDCO   MP
*      6 CPU-SEC.       100 ELAPSED-SEC.     SDCO   MP
*      6 CPU-SEC.       100 ELAPSED-SEC.     FBS
*      6 CPU-SEC.       102 ELAPSED-SEC.     FBS
*      6 CPU-SEC.       103 ELAPSED-SEC.     MPYA   D
                                                    METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*      7 CPU-SEC.       104 ELAPSED-SEC.     MPYA   D
*      7 CPU-SEC.       105 ELAPSED-SEC.     TRAN   POSE
*      7 CPU-SEC.       106 ELAPSED-SEC.     TRAN   POSE
*      7 CPU-SEC.       106 ELAPSED-SEC.     MPYA   D
```

```
                                           METHOD 2 NT,NBR PASSES =   1,EST. TIME =       0.0
*     7 CPU-SEC.      107 ELAPSED-SEC.    MPYA  D
*     7 CPU-SEC.      109 ELAPSED-SEC.    35    RMG      END
*     7 CPU-SEC.      113 ELAPSED-SEC.    ----  LINKNS04 ---
=    91 I/O SEC.
 LAST LINK DID NOT USE   72520 BYTES OF OPEN CORE
*     7 CPU-SEC.      118 ELAPSED-SEC.    ----  LINK END ---
*     7 CPU-SEC.      118 ELAPSED-SEC.    40    GP4      BEGN
*     7 CPU-SEC.      122 ELAPSED-SEC.    40    GP4      END
*     8 CPU-SEC.      126 ELAPSED-SEC.    46    GPSP     BEGN
*     8 CPU-SEC.      126 ELAPSED-SEC.    46    GPSP     END
*     8 CPU-SEC.      126 ELAPSED-SEC.    ----  LINKNS14 ---
=   101 I/O SEC.
 LAST LINK DID NOT USE  117044 BYTES OF OPEN CORE
*     8 CPU-SEC.      131 ELAPSED-SEC.    ----  LINK END ---
*     8 CPU-SEC.      131 ELAPSED-SEC.    47    OFP      BEGN
*     8 CPU-SEC.      131 ELAPSED-SEC.    47    OFP      END
*     8 CPU-SEC.      133 ELAPSED-SEC.    ----  LINKNS04 ---
=   104 I/O SEC.
 LAST LINK DID NOT USE  115664 BYTES OF OPEN CORE
*     8 CPU-SEC.      136 ELAPSED-SEC.    ----  LINK END ---
*     8 CPU-SEC.      136 ELAPSED-SEC.    51    MCE1     BEGN
*     8 CPU-SEC.      139 ELAPSED-SEC.    51    MCE1     END
*     8 CPU-SEC.      140 ELAPSED-SEC.    53    MCE2     BEGN
*     8 CPU-SEC.      142 ELAPSED-SEC.    MPYA  D
                                           METHOD 2 NT,NBR PASSES =   1,EST. TIME =       0.0
*     8 CPU-SEC.      144 ELAPSED-SEC.    MPYA  D
*     8 CPU-SEC.      144 ELAPSED-SEC.    MPYA  D-
                                           METHOD 2 T ,NBR PASSES =   1,EST. TIME =       0.0
*     8 CPU-SEC.      145 ELAPSED-SEC.    MPYA  D
*     9 CPU-SEC.      146 ELAPSED-SEC.    MPYA  D
                                           METHOD 2 T ,NBR PASSES =   1,EST. TIME =       0.0
*     9 CPU-SEC.      147 ELAPSED-SEC.    MPYA  D
*     9 CPU-SEC.      150 ELAPSED-SEC.    MPYA  D
                                           METHOD 2 NT,NBR PASSES =   1,EST. TIME =       0.0
*     9 CPU-SEC.      152 ELAPSED-SEC.    MPYA  D
*     9 CPU-SEC.      152 ELAPSED-SEC.    MPYA  D
                                           METHOD 2 T ,NBR PASSES =   1,EST. TIME =       0.0
*     9 CPU-SEC.      154 ELAPSED-SEC.    MPYA  D
*    10 CPU-SEC.      155 ELAPSED-SEC.    MPYA  D
                                           METHOD 2 T ,NBR PASSES =   1,EST. TIME =       0.0
*    10 CPU-SEC.      156 ELAPSED-SEC.    MPYA  D
*    10 CPU-SEC.      159 ELAPSED-SEC.    MPYA  D
                                           METHOD 2 NT,NBR PASSES =   1,EST. TIME =       0.0
*    10 CPU-SEC.      161 ELAPSED-SEC.    MPYA  D
*    10 CPU-SEC.      161 ELAPSED-SEC.    MPYA  D
                                           METHOD 2 T ,NBR PASSES =   1,EST. TIME =       0.0
*    10 CPU-SEC.      162 ELAPSED-SEC.    MPYA  D
*    10 CPU-SEC.      162 ELAPSED-SEC.    MPYA  D
                                           METHOD 2 T ,NBR PASSES =   1,EST. TIME =       0.0
*    11 CPU-SEC.      163 ELAPSED-SEC.    MPYA  D
*    11 CPU-SEC.      163 ELAPSED-SEC.    53    MCE2     END
*    11 CPU-SEC.      170 ELAPSED-SEC.    XSFA
*    11 CPU-SEC.      171 ELAPSED-SEC.    XSFA
*    11 CPU-SEC.      171 ELAPSED-SEC.    ----  LINKNS06 ---
=   131 I/O SEC.
 LAST LINK DID NOT USE  101876 BYTES OF OPEN CORE
*    11 CPU-SEC.      173 ELAPSED-SEC.    ----  LINK END ---
*    11 CPU-SEC.      173 ELAPSED-SEC.    75    DPD      BEGN
*    11 CPU-SEC.      177 ELAPSED-SEC.    75    DPD      END
*    11 CPU-SEC.      181 ELAPSED-SEC.    ----  LINKNS10 ---
=   143 I/O SEC.
 LAST LINK DID NOT USE  116420 BYTES OF OPEN CORE
*    12 CPU-SEC.      184 ELAPSED-SEC.    ----  LINK END ---
```

```
*    12 CPU-SEC.      184 ELAPSED-SEC.     81    MTRXIN  BEGN
*    12 CPU-SEC.      185 ELAPSED-SEC.     81    MTRXIN  END
*    12 CPU-SEC.      186 ELAPSED-SEC.     83    PARAM   BEGN
*    12 CPU-SEC.      186 ELAPSED-SEC.     83    PARAM   END
*    12 CPU-SEC.      188 ELAPSED-SEC.     XSFA
*    12 CPU-SEC.      188 ELAPSED-SEC.     XSFA
*    12 CPU-SEC.      188 ELAPSED-SEC.     88    GKAD    BEGN
*    12 CPU-SEC.      190 ELAPSED-SEC.     88    GKAD    END
*    12 CPU-SEC.      192 ELAPSED-SEC.     ----  LINKNS05 ---
=   151 I/O SEC.
 LAST LINK DID NOT USE  117060 BYTES OF OPEN CORE
*    12 CPU-SEC.      194 ELAPSED-SEC.     ----  LINK END ---
*    12 CPU-SEC.      194 ELAPSED-SEC.     92    TRLG    BEGN
*    12 CPU-SEC.      202 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1,EST. TIME =      0.0
*    12 CPU-SEC.      203 ELAPSED-SEC.     MPYA  D
*    13 CPU-SEC.      205 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*    13 CPU-SEC.      207 ELAPSED-SEC.     MPYA  D
*    13 CPU-SEC.      207 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*    13 CPU-SEC.      208 ELAPSED-SEC.     MPYA  D
*    13 CPU-SEC.      208 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*    13 CPU-SEC.      209 ELAPSED-SEC.     MPYA  D
*    13 CPU-SEC.      210 ELAPSED-SEC.     92    TRLG    END
*    14 CPU-SEC.      212 ELAPSED-SEC.     ----  LINKNS11 ---
=   167 I/O SEC.
 LAST LINK DID NOT USE   58176 BYTES OF OPEN CORE
*    14 CPU-SEC.      215 ELAPSED-SEC.     ----  LINK END ---
*    14 CPU-SEC.      215 ELAPSED-SEC.     97    TRHT    BEGN
*    14 CPU-SEC.      218 ELAPSED-SEC.     DECO  MP
*    14 CPU-SEC.      219 ELAPSED-SEC.     DECO  MP
*    16 CPU-SEC.      269 ELAPSED-SEC.     97    TRHT    END
*    16 CPU-SEC.      271 ELAPSED-SEC.     ----  LINKNS12 ---
=   228 I/O SEC.
 LAST LINK DID NOT USE   69268 BYTES OF OPEN CORE
*    16 CPU-SEC.      277 ELAPSED-SEC.     ----  LINK END ---
*    16 CPU-SEC.      277 ELAPSED-SEC.     99    VDR     BEGN
*    16 CPU-SEC.      280 ELAPSED-SEC.     99    VDR     END
*    16 CPU-SEC.      281 ELAPSED-SEC.     111   PARAM   BEGN
*    16 CPU-SEC.      281 ELAPSED-SEC.     111   PARAM   END
*    16 CPU-SEC.      282 ELAPSED-SEC.     XSFA
*    16 CPU-SEC.      282 ELAPSED-SEC.     XSFA
*    16 CPU-SEC.      282 ELAPSED-SEC.     115   SDR1    BEGN
*    16 CPU-SEC.      283 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.1
*    16 CPU-SEC.      284 ELAPSED-SEC.     MPYA  D
*    17 CPU-SEC.      287 ELAPSED-SEC.     115   SDR1    END
*    17 CPU-SEC.      289 ELAPSED-SEC.     ----  LINKNS08 ---
=   240 I/O SEC.
 LAST LINK DID NOT USE  119096 BYTES OF OPEN CORE
*    17 CPU-SEC.      293 ELAPSED-SEC.     ----  LINK END ---
*    17 CPU-SEC.      293 ELAPSED-SEC.     118   PLTTRAN BEGN
*    17 CPU-SEC.      294 ELAPSED-SEC.     118   PLTTRAN END
*    17 CPU-SEC.      294 ELAPSED-SEC.     ----  LINKNS13 ---
=   244 I/O SEC.
 LAST LINK DID NOT USE  114512 BYTES OF OPEN CORE
*    17 CPU-SEC.      297 ELAPSED-SEC.     ----  LINK END ---
*    17 CPU-SEC.      297 ELAPSED-SEC.     120   SDR2    BEGN
*    17 CPU-SEC.      299 ELAPSED-SEC.     120   SDR2    END
*    17 CPU-SEC.      300 ELAPSED-SEC.     ----  LINKNS14 ---
=   250 I/O SEC.
 LAST LINK DID NOT USE   66428 BYTES OF OPEN CORE
```

```
*     18 CPU-SEC.        304 ELAPSED-SEC.      ----  LINK END ---
*     18 CPU-SEC.        304 ELAPSED-SEC.      121   SDR3     BEGN
*     18 CPU-SEC.        308 ELAPSED-SEC.      121   SDR3     END
*     18 CPU-SEC.        310 ELAPSED-SEC.      123   OFP      BEGN
*     19 CPU-SEC.        312 ELAPSED-SEC.      123   OFP      END
*     19 CPU-SEC.        312 ELAPSED-SEC.      130   XYTRAN   BEGN
*     19 CPU-SEC.        312 ELAPSED-SEC.      130   XYTRAN   END
*     19 CPU-SEC.        313 ELAPSED-SEC.      ----  LINKNS02 ---
=   262 I/O SEC.
 LAST LINK DID NOT USE   11408 BYTES OF OPEN CORE
*     19 CPU-SEC.        319 ELAPSED-SEC.      ----  LINK END ---
*     19 CPU-SEC.        319 ELAPSED-SEC.      132   XYPLOT   BEGN
*     19 CPU-SEC.        320 ELAPSED-SEC.      132   XYPLOT   END
*     19 CPU-SEC.        320 ELAPSED-SEC.      138   EXIT     BEGN
--------------------------------------------------------------------------------------------------------------------------
=   263 I/O SEC.
 LAST LINK DID NOT USE   97232 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =  11K BYTES
```



IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*************************************************************************************
$ START OF EXECUTIVE CONTROL *********************************************************
$*************************************************************************************
$
ID CLASS PROBLEM TEN, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR TRANSIENT SOLUTION ALGORITHM IS TO BE USED
$
SOL 9
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
$
$ THE FOLLOWING ALTER IS NECESSARY FOR ALL TRANSIENT RESTARTS
$ USING THE HEAT TRANSFER OPTION ... IT IS USED TO CORRECT AN ERROR IN THE
$ RESTART TABLES
$
ALTER 118 119
PLTTRAN HBGPDT,HSIL/HBGPDP,HSIP/V,N,HLUSET/V,N,HLUSEP $
SAVE HLUSEP $
ENDALTER
$
$ ADD THE RESTART DICTIONARY WHICH WAS PUNCHED OUT BY PROBLEM
$ NUMBER NINE ... THIS IS REQUIRED TO RESTART A PROBLEM
$
RESTART  CLASS    ,PROBLEM  , 1/ 1/76,    27120,
          1,    XVPS      ,    FLAGS = 0,    REEL =  1,    FILE =      5
          2,    REENTER AT DMAP SEQUENCE NUMBER       7
          3,    HGPL      ,    FLAGS = 0,    REEL =  1,    FILE =      6
          4,    HEQEXIN   ,    FLAGS = 0,    REEL =  1,    FILE =      7
          5,    HGPDT     ,    FLAGS = 0,    REEL =  1,    FILE =      8
          6,    HBGPDT    ,    FLAGS = 0,    REEL =  1,    FILE =      9
          7,    HSIL      ,    FLAGS = 0,    REEL =  1,    FILE =     10
          8,    XVPS      ,    FLAGS = 0,    REEL =  1,    FILE =     11
          9,    HCSTM     ,    FLAGS = 0,    REEL =  0,    FILE =      0
         10,    HUSET     ,    FLAGS = 0,    REEL =  0,    FILE =      0
         11,    HGM       ,    FLAGS = 0,    REEL =  0,    FILE =      0
         12,    HGO       ,    FLAGS = 0,    REEL =  0,    FILE =      0
```

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
 13.  HKAA     .  FLAGS = 0.  REEL =  0.  FILE =     0
 14.  HSAA     .  FLAGS = 0.  REEL =  0.  FILE =     0
 15.  HPSO     .  FLAGS = 0.  REEL =  0.  FILE =     0
 16.  HKFS     .  FLAGS = 0.  REEL =  0.  FILE =     0
 17.  HOP      .  FLAGS = 0.  REEL =  0.  FILE =     0
 18.  HEST     .  FLAGS = 0.  REEL =  0.  FILE =     0
 19.  REENTER AT DMAP SEQUENCE NUMBER    10
 20.  HECT     .  FLAGS = 0.  REEL =  1.  FILE =    12
 21.  XVPS     .  FLAGS = 0.  REEL =  1.  FILE =    13
 22.  REENTER AT DMAP SEQUENCE NUMBER    21
 23.  XVPS     .  FLAGS = 0.  REEL =  1.  FILE =    14
 24.  HPLTPAR  .  FLAGS = 0.  REEL =  0.  FILE =     0
 25.  HGPSETS  .  FLAGS = 0.  REEL =  0.  FILE =     0
 26.  HELSETS  .  FLAGS = 0.  REEL =  0.  FILE =     0
 27.  REENTER AT DMAP SEQUENCE NUMBER    23
 28.  HGPTT    .  FLAGS = 0.  REEL =  1.  FILE =    15
 29.  HSLT     .  FLAGS = 0.  REEL =  1.  FILE =    16
 30.  XVPS     .  FLAGS = 0.  REEL =  1.  FILE =    17
 31.  REENTER AT DMAP SEQUENCE NUMBER    26
 32.  HEST     .  FLAGS = 0.  REEL =  1.  FILE =    18
 33.  HECPT    .  FLAGS = 0.  REEL =  1.  FILE =    19
 34.  HGPCT    .  FLAGS = 0.  REEL =  1.  FILE =    20
 35.  XVPS     .  FLAGS = 0.  REEL =  1.  FILE =    21
 36.  REENTER AT DMAP SEQUENCE NUMBER    30
 37.  HKGGX    .  FLAGS = 0.  REEL =  1.  FILE =    22
 38.  XVPS     .  FLAGS = 0.  REEL =  1.  FILE =    23
 39.  HGPST    .  FLAGS = 0.  REEL =  0.  FILE =     0
 40.  REENTER AT DMAP SEQUENCE NUMBER    34
 41.  HBGG     .  FLAGS = 0.  REEL =  1.  FILE =    24
 42.  XVPS     .  FLAGS = 0.  REEL =  1.  FILE =    25
 43.  HBNN     .  FLAGS = 0.  REEL =  0.  FILE =     0
 44.  HBFF     .  FLAGS = 0.  REEL =  0.  FILE =     0
 45.  REENTER AT DMAP SEQUENCE NUMBER    40
 46.  HRGG     .  FLAGS = 0.  REEL =  1.  FILE =    26
 47.  HKGG     .  FLAGS = 0.  REEL =  1.  FILE =    27
 48.  HQGE     .  FLAGS = 0.  REEL =  1.  FILE =    28
 49.  XVPS     .  FLAGS = 0.  REEL =  1.  FILE =    29
 50.  HRNN     .  FLAGS = 0.  REEL =  0.  FILE =     0
 51.  HRFF     .  FLAGS = 0.  REEL =  0.  FILE =     0
 52.  HRAA     .  FLAGS = 0.  REEL =  0.  FILE =     0
 53.  HRDD     .  FLAGS = 0.  REEL =  0.  FILE =     0
 54.  REENTER AT DMAP SEQUENCE NUMBER    45
 55.  HRG      .  FLAGS = 0.  REEL =  1.  FILE =    30
 56.  HUSET    .  FLAGS = 0.  REEL =  1.  FILE =    31
 57.  XVPS     .  FLAGS = 0.  REEL =  1.  FILE =    32
 58.  HGMD     .  FLAGS = 0.  REEL =  0.  FILE =     0
 59.  HGOD     .  FLAGS = 0.  REEL =  0.  FILE =     0
 60.  HKNN     .  FLAGS = 0.  REEL =  0.  FILE =     0
 61.  REENTER AT DMAP SEQUENCE NUMBER    53
 62.  HGM      .  FLAGS = 0.  REEL =  1.  FILE =    33
```

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
 63.  XVPS     .  FLAGS = 0.   REEL =  1.   FILE =    34
 64.  REENTER AT DMAP SEQUENCE NUMBER    55
 65.  HKNN     .  FLAGS = 0.   REEL =  1.   FILE =    35
 66.  HRNN     .  FLAGS = 0.   REEL =  1.   FILE =    36
 67.  HBNN     .  FLAGS = 0.   REEL =  1.   FILE =    37
 68.  XVPS     .  FLAGS = 0.   REEL =  1.   FILE =    38
 69.  REENTER AT DMAP SEQUENCE NUMBER    58
 70.  HKNN     .  FLAGS = 4.   REEL =  1.   FILE =    35
 71.  HKFF     .  FLAGS = 4.   REEL =  1.   FILE =    35
 72.  HRNN     .  FLAGS = 4.   REEL =  1.   FILE =    36
 73.  HRFF     .  FLAGS = 4.   REEL =  1.   FILE =    36
 74.  HBNN     .  FLAGS = 4.   REEL =  1.   FILE =    37
 75.  HBFF     .  FLAGS = 4.   REEL =  1.   FILE =    37
 76.  XVPS     .  FLAGS = 0.   REEL =  1.   FILE =    39
 77.  REENTER AT DMAP SEQUENCE NUMBER    64
 78.  HKAA     .  FLAGS = 4.   REEL =  1.   FILE =    35
 79.  HRAA     .  FLAGS = 4.   REEL =  1.   FILE =    36
 80.  HBAA     .  FLAGS = 4.   REEL =  1.   FILE =    37
 81.  XVPS     .  FLAGS = 0.   REEL =  1.   FILE =    40
 82.  REENTER AT DMAP SEQUENCE NUMBER    81
 83.  HUSETD   .  FLAGS = 0.   REEL =  1.   FILE =    41
 84.  HEQDYN   .  FLAGS = 0.   REEL =  1.   FILE =    42
 85.  HDLT     .  FLAGS = 0.   REEL =  1.   FILE =    43
 86.  HTRL     .  FLAGS = 0.   REEL =  1.   FILE =    44
 87.  HGM      .  FLAGS = 4.   REEL =  1.   FILE =    33
 88.  HGYD     .  FLAGS = 4.   REEL =  1.   FILE =    33
 89.  HSILD    .  FLAGS = 0.   REEL =  1.   FILE =    45
 90.  HGPLD    .  FLAGS = 0.   REEL =  1.   FILE =    46
 91.  XVPS     .  FLAGS = 0.   REEL =  1.   FILE =    47
 92.  HTFPOOL  .  FLAGS = 0.   REEL =  0.   FILE =     0
 93.  HNLFT    .  FLAGS = 0.   REEL =  0.   FILE =     0
 94.  HPPO     .  FLAGS = 0.   REEL =  0.   FILE =     0
 95.  HPDO     .  FLAGS = 0.   REEL =  0.   FILE =     0
 96.  HPDT     .  FLAGS = 0.   REEL =  0.   FILE =     0
 97.  REENTER AT DMAP SEQUENCE NUMBER    87
 98.  HKDD     .  FLAGS = 4.   REEL =  1.   FILE =    35
 99.  HRDD     .  FLAGS = 4.   REEL =  1.   FILE =    36
100.  XVPS     .  FLAGS = 0.   REEL =  1.   FILE =    48
101.  HK2PP    .  FLAGS = 0.   REEL =  0.   FILE =     0
102.  HB2PP    .  FLAGS = 0.   REEL =  0.   FILE =     0
103.  HK2DD    .  FLAGS = 0.   REEL =  0.   FILE =     0
104.  HB2DD    .  FLAGS = 0.   REEL =  0.   FILE =     0
105.  REENTER AT DMAP SEQUENCE NUMBER    92
106.  HBDD     .  FLAGS = 0.   REEL =  1.   FILE =    49
107.  XVPS     .  FLAGS = 0.   REEL =  1.   FILE =    50
108.  REENTER AT DMAP SEQUENCE NUMBER    97
109.  HPPO     .  FLAGS = 0.   REEL =  1.   FILE =    51
110.  HPDO     .  FLAGS = 4.   REEL =  1.   FILE =    52
111.  HPDT     .  FLAGS = 4.   REEL =  1.   FILE =    52
112.  HTOL     .  FLAGS = 0.   REEL =  1.   FILE =    53
```

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
          113.   XVPS     .   FLAGS = 0.   REEL =  1.   FILE =     54
          114.   REENTER AT DMAP SEQUENCE NUMBER     99
          115.   HUDVT    .   FLAGS = 0.   REEL =  1.   FILE =     55
          116.   HPNLD    .   FLAGS = 0.   REEL =  1.   FILE =     56
          117.   XVPS     .   FLAGS = 0.   REEL =  1.   FILE =     57
          118.   REENTER AT DMAP SEQUENCE NUMBER    102
          119.   XVPS     .   FLAGS = 0.   REEL =  1.   FILE =     58
          120.   HOUDV1   .   FLAGS = 0.   REEL =  0.   FILE =      0
          121.   HOPNL1   .   FLAGS = 0.   REEL =  0.   FILE =      0
          122.   REENTER AT DMAP SEQUENCE NUMBER    118
          123.   HUPV     .   FLAGS = 0.   REEL =  1.   FILE =     59
          124.   XVPS     .   FLAGS = 0.   REEL =  1.   FILE =     60
          125.   REENTER AT DMAP SEQUENCE NUMBER    123
          126.   HOUPV2   .   FLAGS = 0.   REEL =  1.   FILE =     61
          127.   XVPS     .   FLAGS = 0.   REEL =  1.   FILE =     62
          128.   HOPP2    .   FLAGS = 0.   REEL =  0.   FILE =      0
          129.   HOOP2    .   FLAGS = 0.   REEL =  0.   FILE =      0
          130.   HOES2    .   FLAGS = 0.   REEL =  0.   FILE =      0
          131.   HOEF2    .   FLAGS = 0.   REEL =  0.   FILE =      0
$ END OF CHECKPOINT DICTIONARY
CEND
```

```
                              C A S E   C O N T R O L   D E C K   E C H O
CARD
COUNT
  1      $
  2      $*************************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ************************************
  4      $*************************************************************************************
  5      $
  6      TITLE=      NON-LINEAR TRANSIENT PROBLEM
  7      SUBTITLE=      INPUT DATA OBTAINED FROM RESTART TAPE OF PROBLEM NINE
  8      $
  9      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
 10      $
 11      LINE=51
 12      $
 13      $ REQUEST SORTED AND UNSORTED OUTPUT
 14      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 15      $
 16      ECHO=BOTH
 17      $
 18      $ SELECT THE MPC AND LOAD SETS TO BE USED IN THIS SOLUTION
 19      $ NOTE THAT NO SPC SET IS SELECTED, AND THAT DLOAD HAS REPLACED LOAD.
 20      $
 21      MPC=200
 22      DLOAD=300
 23      $
 24      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 25      $ THE SELECTION OF THIS SET IS OPTIONAL FOR SOL 9, BUT SHOULD BE MADE IF
 26      $ THE FINAL TEMPERATURE IS SEVERAL HUNDRED DEGREES DIFFERENT FROM THE
 27      $ IC VECTOR, AND RADIATIVE INTERCHANGES ARE INCLUDED.
 28      $
 29      TEMP(MATERIAL)=400
 30      $
 31      $ SELECT THE STEP SIZE, NUMBER OF INCREMENTS, AND PRINTOUT FREQUENCY
 32      $
 33      TSTEP=500
 34      $
 35      $ SELECT THE TEMPERATURE SET DEFINING THE TEMPERATURE VECTOR AT T=0.
 36      $
 37      IC=600
 38      $
 39      $ SELECT OUTPUT DESIRED
 40      $
 41      OUTPUT
 42      $
 43      $ DEFINE A GROUP OF GRID POINTS TO BE REFERENCED BY AN OUTPUT REQUEST
 44      $
 45      SET 5 = 1,2,3,4,5,6,7,8,100
 46      $
 47      THERMAL=5
 48      $
 49      $*************************************************************************************
 50      $ END CASE CONTROL --- START BULK DATA ***********************************************
 51      $*************************************************************************************
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
52       $
53       BEGIN BULK
```

```
                    I N P U T   B U L K   D A T A   D E C K   E C H O

     1 ..  2 ..  3 ..  4 ..  5 ..  6 ..  7 ..  8 ..  9 ..  10 .
$
$****************************************************************************
$ PROBLEM 10 IS BEING RUN USING A RESTART TAPE MADE BY PROBLEM NINE.
$ NOTE THE ALTER IN THE EXECUTIVE CONTROL WHICH WAS ADDED TO
$ CORRECT A RESTART TABLE ERROR COMMON TO ALL TRANSIENT HEAT TRANSFER RESTARTS
$ THE CONDUCTIVITY OF MAT4 CARD 1000 IS BEING ALTERED TO DEMONSTRATE
$ THAT THE BULK DATA CAN BE MODIFIED DURING A RESTART.
$ IF NO MODIFICATIONS TO THE BULK DATA WERE DESIRED, THE 'BEGIN BULK'
$ CARD WOULD BE IMMEDIATELY FOLLOWED BY THE 'ENDDATA' CARD.
$
$ THE '/' CARD IS USED TO REMOVE THE OLD MAT4 CARD 1000 FROM THE BULK
$ DATA TO AVOID DUPLICATE INPUT.
$
/       26
$
$ THE NEW MAT4 CARD FOLLOWS
$
MAT4    1000    250.    2.426+6
$
$****************************************************************************
$ END OF BULK DATA **********************************************************
$****************************************************************************
$
ENDDATA

TOTAL COUNT=   24
```

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 .
1-	CELAS2	300	1.+5	100	1					
2-	CHBDY	60	300	LINE	1	5				+CONVEC
3-	+CONVEC	100	100							
4-	CHBDY	200	2000	AREA4	1	2	6	5		
5-	CHBDY	300	2000	AREA4	2	3	7	6		
6-	CHBDY	400	2000	AREA4	3	4	8	7		
7-	CHBDY	500	2000	AREA4	5	6	2	1		
8-	CHBDY	600	2000	AREA4	6	7	3	2		
9-	CHBDY	700	2000	AREA4	7	8	4	3		
10-	CQUAD2	30	200	1	2	6	5			
11-	CQUAD2	40	200	2	3	7	6			
12-	CQUAD2	50	200	3	4	8	7			
13-	CROD	10	100	10	2					
14-	CROD	20	100	9	6					
15-	GRID	1		0.0	0.0	0.0				
16-	GRID	2		.1	0.0	0.0				
17-	GRID	3		.2	0.0	0.0				
18-	GRID	4		.3	0.0	0.0				
19-	GRID	5		0.0	.1	0.0				
20-	GRID	6		.1	.1	0.0				
21-	GRID	7		.2	.1	0.0				
22-	GRID	8		.3	.1	0.0				
23-	GRID	9		0.0	.2	0.0				
24-	GRID	10		0.0	-.1	0.0				
25-	GRID	100		-.05	.05	0.0				
26-	MAT4	1000	250.	2.426+6						
27-	MAT4	3000	200.							
28-	MPC	200	9	1	1.	r.	1	-1.		
29-	MPC	200	10	1	1.	1	1	-1.		
30-	PARAM	EPSHT	.0001							
31-	PARAM	MAXIT	8							
32-	PARAM	SIGMA	5.665E-8							
33-	PARAM	TABS	273.15							
34-	PHBDY	300	3000	.314						
35-	PHBDY	2000			.90					
36-	PQUAD2	200	1000	.01						
37-	PROD	100	1000	.001						
38-	RADLST	200	300	400	500	600	700			
39-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
40-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
41-	RADMTX	3	0.0	0.0	0.0	0.0				
42-	RADMTX	4	0.0	0.0	0.0					
43-	RADMTX	5	0.0	0.0						
44-	RADMTX	6	0.0							
45-	SLOAD	300	1	4.	2	8.				
46-	SLOAD	300	3	8.	4	4.				
47-	SLOAD	300	5	4.	6	8.				
48-	SLOAD	300	7	8.	8	4.				
49-	SLOAD	300	100	300.+5						
50-	SPC1	100	1	100						
51-	TEMP	400	100	300.						

S O R T E D   B U L K   D A T A   E C H O

```
CARD
COUNT        .  1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10
  52-        TEMPD   400     300.
  53-        TEMPD   600     300.
  54-        TLOAD2  300     300                     0.0     1.+6    0.0     0.0     +TL1
  55-        +TL1    0.      0.
  56-        TSTEP   500     45      30.     1
             ENDDATA
```

LIST OF MODIFIED CARDS

MASK WORD	BIT POSITION	CARD NAME	PACKED BIT POSITION
1			
2			
3			
4			
5			
6			
7			
8			
	17	MAT4	8
9			
10			
11			
	17	POUT$	19
	31	NOLOOP$	25

```
        N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
 DMAP-DMAP INSTRUCTION
  NO.

*   1  BEGIN     HEAT NO.9 TRANSIENT HEAT TRANSFER ANALYSIS $

*   2  FILE      KGGX=TAPE/ KGG=TAPE $

    3  GP1       GEOM1,GEOM2,/HGPL,HEQEXIN,HGPDT,HCSTM,HBGPDT,HSIL/V,N,HLUSET/
                 V,N,HALWAYS=-1/V,N,HNOGPDT $

    4  SAVE      HLUSET,HNOGPDT$

    5  PURGE     HUSET,HGM,HGO,HKAA,HBAA,HPSO,HKFS,HQP,HEST/HNOGPDT $

    6  CHKPNT    HGPL,HEQEXIN,HGPDT,HCSTM,HBGPDT,HSIL,HUSET,HGM,HGO,HKAA,HBAA,
                 HPSO,HKFS,HQP,HEST $

    7  COND      HLBL5,HNOGPDT$

    8  GP2       GEOM2,HEQEXIN/HECT $

    9  CHKPNT    HECT $

   10  PLTSET    PCDB,HEQEXIN,HECT/HPLTSETX,HPLTPAR,HGPSETS,HELSETS/V,N,HNSIL/V,
                 N,JUMPPLOT $

   11  SAVE      HNSIL,JUMPPLOT $

   12  PRTMSG    HPLTSETX//$

   13  SETVAL    //V,N,HPLTFLG/C,N,1/V,N,HPFILE/C,N,0 $

   14  SAVE      HPLTFLG,HPFILE $

   15  COND      HP1,JUMPPLOT$

   16  PLOT      HPLTPAR,HGPSETS,HELSETS,CASECC,HBGPDT,HEQEXIN,HSIL,,/HPLOTX1/
                 V,N,HNSIL/V,N,HLUSET/V,N,JUMPPLOT/V,N,HPLTFLG/V,N,HPFILE $

   17  SAVE      JUMPPLOT,HPLTFLG,HPFILE $

   18  PRTMSG    HPLOTX1//$

   19  LABEL     HP1 $

   20  CHKPNT    HPLTPAR,HGPSETS,HELSETS $

   21  GP3       GEOM3,HEQEXIN,GEOM2/HSLT,HGPTT/C,N,123/C,N,123/C,N,123 $

   22  CHKPNT    HGPTT,HSLT $

   23  TA1,      ,HECT,EPT,HBGPDT,HSIL,HGPTT,HCSTM/HEST,,HGEI,HECPT,HGPCT/  V,N,
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.
                  HLUSET/C,N,123/V,N,HNOSIMP=-1/C,N,0/C,N,123/C,N,123 $

   24  SAVE       HNOSIMP $

   25  CHKPNT     HEST,HECPT,HGPCT $

*  26  COND       HLBL1,HNOSIMP$

*  27  SMA1       HCSTM,MPT,HECPT,HGPCT,DIT/HKGGX,,HGPST/C,N,123/C,N,123/V,N,
                  HNNLK $

*  28  SAVE       HNNLK $

   29  CHKPNT     HKGGX,HGPST $

*  30  SMA2       HCSTM,MPT,HECPT,HGPCT,DIT/,HBGG/C,N,1.0/C,N,123/V,N,    HNOBGG=
                  -1/C,N,-1 $

*  31  SAVE       HNOBGG $

*  32  PURGE      HBNN,HBFF,HBAA,HBGG/HNOBGG$

   33  CHKPNT     HBGG HBNN,HBFF,HBAA $

*  34  LABEL      HLBL1 $

*  35  RMG        HEST,MATPOOL,HGPTT,HKGGX/HRGG,HQGE,HKGG/C,Y,TABS/C,Y,SIGMA=0.0/
                  V,N,HNLR/V,N,HLUSET $

*  36  SAVE       HNLR $

*  37  EQUIV      HKGGX,HKGG/HNLR $

*  38  PURGE      HRGG,HRNN,HRFF,HRAA,HRDD/HNLR $

   39  CHKPNT     HRGG,HRNN,HRFF,HRAA,HRDD,HKGG,HQGE $

   40  GP4        CASECC,GEOM4,HEQEXIN,HSIL,HGPDT/HRG,,HUSET,/V,N,HLUSET/V,N,
                  HMPCF1=-1/V,N,HMPCF2=-1/V,N,HSINGLE=-1/V,N,HOMIT=-1/V,N,HREACT=
                  -1/C,N,0/C,N,123/V,N,HNOSET=-1/V,N,HNOL/V,N,HNOA=-1 $

   41  SAVE       HMPCF ,HSINGLE,HOMIT,HNOSET,HREACT,HMPCF2,HNOL,HNOA $

   42  PURGE      HGM,HGMD/HMPCF1/HGO,HGOD/HOMIT/HKFS,HPSO,HQP/HSINGLE $

*  43  EQUIV      HKGG,HKNN/HMPCF1/HRGG,HRNN/HMPCF1/HBGG,HBNN/HMPCF1 $

   44  CHKPNT     HGM,HRG,HGO,HKFS,HQP,HUSET,HGMD,HGOD,HPSO,HKNN,HRNN,HBNN $

*  45  COND       HLBL2,HNOSIMP $
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

*  46  GPSP     HGPL,HGPST,HUSET,HSIL/HOGPST $

*  47  OFP      HOGPST,,,,,//V,N,HCARDNO $

*  48  SAVE     HCARDNO $

*  49  LABEL    HLBL2 $

*  50  COND     HLBL3,HMPCF1 $

   51  MCE1     HUSET,HRG/HGM $

   52  CHKPNT   HGM $

*  53  MCE2     HUSET,HGM,HKGG,HRGG,HBGG,/HKNN,HRNN,HBNN, $

   54  CHKPNT   HKNN,HRNN,HBNN $

*  55  LABEL    HLBL3 $

*  56  EQUIV    HKNN,HKFF,HSINGLE/HRNN,HRFF/HSINGLE/HBNN,HBFF/HSINGLE $

   57  CHKPNT   HKFF,HRFF,HBFF $

*  58  COND     HLBL4,HSINGLE $

*  59  SCE1     HUSET,HKNN,HRNN,HBNN,/HKFF,HKFS,,HRFF,HBFF, $

   60  CHKPNT   HKFS,HKFF,HRFF,HBFF $

*  61  LABEL    HLBL4 $

*  62  EQUIV    HKFF,HKAA/HOMIT/HRFF,HRAA/HOMIT/HBFF,HBAA/HOMIT $

   63  CHKPNT   HKAA,HRAA,HBAA $

*  64  COND     HLBL5,HOMIT $

*  65  SMP1     HUSET,HKFF,,,/HGO,HKAA,,,,,,, $

   66  CHKPNT   HGO,HKAA $

*  67  COND     HLBLR,HNLR $

*  68  SMP2     HUSET,HGO,HRFF/HRAA $

   69  CHKPNT   HRAA $

*  70  LABEL    HLBLR $

*  71  COND     HLBL5,HNOBGG $
```

N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N

```
 DMAP-DMAP INSTRUCTION
  NO.

*  72  SMP2     HUSET,HGO,HBFF/HBAA $

   73  CHKPNT   HBAA $

*  74  LABEL    HLBL5 $

   75  DPD      DYNAMICS,HGPL,HSIL,HUSET/HGPLD,HSILD,HUSETD,HTFPOOL,HDLT,,,
                HNLFT,HTRL,,HEQDYN/V,N,HLUSET/V,N,HLUSETD/C,N,123 /V,N,HNODLT/
                C,N,123/C,N,123/V,N,HNONLFT/V,N,HNOTRL/C,N,123/C,N,123/ V,N,
                HNOUE $

   76  SAVE     HLUSETD,HNODLT,HNONLFT,HNOTRL,HNOUE $

   77  COND     HERROR1,HNOTRLS

   78  EQUIV    HGO,HGOD/HNOUE/HGM,HGMD/HNOUE $

   79  PURGE    HPPO,HPSO,HPDO,HPDT/HNODLT $

   80  CHKPNT   HUSETD,HEQDYN,HTFPOOL,HDLT,HTRL,HGOD,HGMD,HNLFT,HSILD,HGPLD,
                HPPO,HPSO,HPDO,HPDT $

   81  MTRXIN   CASECC,MATPOOL,HEQDYN,,HTFPOOL/HK2PP,,HB2PP/V,N,HLUSETD/ V,N,
                HNOK2PP/C,N,123/V,N,HNOB2PP $

   82  SAVE     HNOK2PP,HNOB2PP $

   83  PARAM    //C,N,AND/V,N,HKDEKA/V,N,HNOUE/V,N,HNOK2PP $

*  84  PURGE    HK2DD/HNOK2PP/HB2DD/HNOB2PP $

*  85  EQUIV    HKAA,HKDD/HKDEKA/HB2PP,HB2DD/HNOA/HK2PP,HK2DD/HNOA/HRAA,HRDD/
                HNOUE $

   86  CHKPNT   HK2PP,HB2PP,HK2DD,HB2DD,HKDD,HRDD $

*  87  COND     HLBL6,HNOGPDT $

*  88  GKAD     HUSETD,HGM,HGO,HKAA,HBAA,HRAA,,HK2PP,,HB2PP/HKDD,HBDD, HRDD,
                HGMD,HGOD,HK2DD,HM2DD,HB2DD/C,N,TRANRESP/C,N,DISP/C,N, DIRECT/
                C,Y,HG=0.0/C,Y,HW3=0.0/C,Y,HW4=0.0/V,N,HNOK2PP/C,N,-1/   V,N,
                HNOB2PP/V,N,HMPCF1/V,N,HSINGLE/V,N,HOMIT/V,N,HNOUE/ C,N,-1/V,N,
                HNOBGG/V,N,HNOSIMP/C,N,-1 $

*  89  LABEL    HLBL6 $

*  90  EQUIV    HK2DD,HKDD/HNOSIMP/HB2DD,HBDD/HNOGPDT $

   91  CHKPNT   HKDD,HBDD,HRDD,HGMD,HGOD $

*  92  TRLG     CASECC,HUSETD,HDLT,HSLT,HBGPDT,HSIL,HCSTM,HTRL,DIT,HGMD,HGOD,,
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
 DMAP-DMAP INSTRUCTION
  NO.
              HEST/HPPO.HPSO.HPDO.HPDT..HTOL/V.N.HNOSET/V.N.HPDEPDO $

*  93  SAVE    HPDEPDO.HNOSET $

*  94  EQUIV   HPPO.HPDO/HNOSET $

*  95  EQUIV   HPDO.HPDT/HPDEPDO $

   96  CHKPNT  HPPO.HPDO.HPSO.HTOL.HPDT $

*  97  TRHT    CASECC.HUSETD.HNLFT.DIT.HGPTT.HKDD.HBDD.HRDD.HPDT.HTRL/HUDVT.
               HPNLD/C.Y.BETA=.55/C.Y.TABS=0.0/V.N.HNLR/C.Y.RADLIN=-1 $

   98  CHKPNT  HUDVT.HPNLD $

*  99  VDR     CASECC.HEQDYN.HUSETD.HUDVT.HTOL.XYCDB.HPNLD/HOUDV1.HOPNL1/  C.
               N.TRANRESP/C.N.DIRECT/C.N.0/V.N.HNOD/V.N.HNOP/C.N.0 $

* 100  SAVE    HNOD.HNOP $

  101  CHKPNT  HOUDV1.HOPNL1 $

  102  COND    HLBL7.HNOD $

  103  SDR3    HOUDV1.HOPNL1..../HOUDV2.HOPNL2.... $

  104  OFP     HOUDV2.HOPNL2....//V.N.HCARDNO $

  105  SAVE    HCARDNO $

  106  CHKPNT  HOPNL2.HOUDV2 $

  110  LABEL   HLBL7 $

* 111  PARAM   //C.N.AND/V.N.HPJUMP/V.N.HNOP/V.N.JUMPPLOT $

* 112  COND    HLBL9.HPJUMP $

* 113  EQUIV   HUDVT.HUPV/HNOA $

* 114  COND    HLBL8.HNOA $

* 115  SDR1    HUSETD..HUDVT...HGOD.HGMD.HPSO.HKFS../HUPV..HQP/C.N.1/C.N.
               TRANSNT $

* 116  LABEL   HLBL8 $

  117  CHKPNT  HUPV.HQP $

* 119  PLTTRAN HBGPDT.HSIL/HBGPDP.HSIP/V.N.HLUSET/V.N.HLUSEP $
```

```
  N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

* 119  SAVE HLUSEP $

* 120  SDR2      CASECC,HCSTM,MPT,DIT,HEQDYN,HSILD,,HTOL,HBGPDP,HPPO,HQP,HUPV,
                 HEST,XYCDB/HOPP1,HOQP1,HOUPV1,HOES1,HOEF1,HPUGV /C,N,
                 TRANRESP $

* 121  SDR3      HOPP1,HOQP1,HOUPV1,HOES1,HOEF1,/HOPP2,HOQP2,HOUPV2,HOES2,
                 HOEF2, $

  122  CHKPNT    HOPP2,HOQP2,HOUPV2,HOES2,HOEF2 $

* 123  OFP       HOPP2,HOQP2,HOUPV2,HOEF2,HOES2,//V,N,HCARDNO $

* 124  SAVE      HCARDNO $

* 125  COND      HP2,JUMPPLOT $

* 126  PLOT      HPLTPAR,HGPSETS,HELSETS,CASECC,HBGPDT,HEQEXIN,HSIP,,HPUGV/
                 HPLOTX2/V,N,HNSIL/V,N,HLUSEP/V,N,JUMPPLOT/V,N,HPLTFLG/V,N,
                 HPFILE $

* 127  SAVE      HPFILE $

* 128  PRTMSG    HPLOTX2// $

* 129  LABEL     HP2 $

* 130  XYTRAN    XYCDB,HOPP2,HOQP2,HOUPV2,HOES2,HOEF2/HXYPLTT/C,N,TRAN/C,N,PSET/
                 V,N,HPFILE/V,N,HCARDNO $

* 131  SAVE      HPFILE,HCARDNO $

* 132  XYPLOT    HXYPLTT// $

* 133  LABEL     HLBL9 $

* 134  JUMP      FINIS $

* 135  LABEL     HERROR1 $

* 136  PRTPARM   //C,N,-1/C,N,HDIRTRD$

* 137  LABEL     FINIS$

* 138  END       $

*** USER WARNING MESSAGE  54,
  PARAMETER NAMED EPSHT     NOT REFERENCED

*** USER WARNING MESSAGE  54,
  PARAMETER NAMED MAXIT     NOT REFERENCED

*INDICATES INSTRUCTIONS TO BE EXECUTED FOR MODIFIED RESTART
```

THE FOLLOWING FILES WERE USED FROM OLD PROBLEM TAPE TO INITIATE RESTART

FILE NAME	REEL NO.	FILE NO.
HCSTM	(PURGED)	
HPLTPAR	(PURGED)	
HGPSETS	(PURGED)	
HELSETS	(PURGED)	
HNLFT	(PURGED)	
HK2PP	(PURGED)	
HB2PP	(PURGED)	
HGPL	1	6
HEQEXIN	1	7
HBGPDT	1	9
HSIL	1	10
HGPTT	1	15
HSLT	1	16
HEST	1	18
HECPT	1	19
HGPCT	1	20
HUSET	1	31
HGM	1	33
HGMD	1	33
HUSETD	1	41
HEQDYN	1	42
HDLT	1	43
HTRL	1	44
HSILD	1	45
XVPS	1	62

NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM

*** USER INFORMATION MESSAGE FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE . 6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023, B = 3
C = 0
R = 2

*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS 0 SECONDS.

*** USER INFORMATION MESSAGE 3028, B = 5 BBAR = 5
C = 3 CBAR = 1
R = 8

*** USER INFORMATION MESSAGE 3027, UNSYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS 0 SECONDS.

POINT-ID = 1

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984612E 02
6.000000E 01	S	2.958572E 02
9.000000E 01	S	2.935396E 02
1.200000E 02	S	2.914375E 02
1.500000E 02	S	2.895293E 02
1.800000E 02	S	2.878040E 02
2.100000E 02	S	2.862502E 02
2.400000E 02	S	2.848562E 02
2.700000E 02	S	2.836086E 02
3.000000E 02	S	2.824949E 02
3.300000E 02	S	2.815017E 02
3.600000E 02	S	2.806172E 02
3.900000E 02	S	2.798301E 02
4.200000E 02	S	2.791301E 02
4.500000E 02	S	2.785078E 02
4.800000E 02	S	2.779543E 02
5.100000E 02	S	2.774624E 02
5.400000E 02	S	2.770251E 02
5.700000E 02	S	2.766365E 02
6.000000E 02	S	2.762910E 02
6.300000E 02	S	2.759839E 02
6.600000E 02	S	2.757109E 02
6.900000E 02	S	2.754683E 02
7.200000E 02	S	2.752524E 02
7.500000E 02	S	2.750603E 02
7.800000E 02	S	2.748896E 02
8.100000E 02	S	2.747375E 02
8.400000E 02	S	2.746025E 02
8.700000E 02	S	2.744822E 02
9.000000E 02	S	2.743752E 02
9.300000E 02	S	2.742800E 02
9.600000E 02	S	2.741951E 02
9.900000E 02	S	2.741196E 02
1.020000E 03	S	2.740525E 02
1.050000E 03	S	2.739927E 02
1.080000E 03	S	2.739395E 02
1.110000E 03	S	2.738921E 02
1.140000E 03	S	2.738499E 02
1.170000E 03	S	2.738123E 02
1.200000E 03	S	2.737788E 02
1.230000E 03	S	2.737490E 02
1.260000E 03	S	2.737227E 02
1.290000E 03	S	2.736990E 02
1.320000E 03	S	2.736780E 02
1.350000E 03	S	2.736594E 02

POINT-ID = 2

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.973757E 02
6.000000E 01	S	2.927366E 02
9.000000E 01	S	2.884036E 02
1.200000E 02	S	2.844495E 02
1.500000E 02	S	2.808765E 02
1.800000E 02	S	2.776692E 02
2.100000E 02	S	2.747993E 02
2.400000E 02	S	2.722375E 02
2.700000E 02	S	2.699543E 02
3.000000E 02	S	2.679219E 02
3.300000E 02	S	2.661133E 02
3.600000E 02	S	2.645061E 02
3.900000E 02	S	2.630771E 02
4.200000E 02	S	2.618074E 02
4.500000E 02	S	2.606790E 02
4.800000E 02	S	2.596763E 02
5.100000E 02	S	2.587852E 02
5.400000E 02	S	2.579932E 02
5.700000E 02	S	2.572893E 02
6.000000E 02	S	2.566636E 02
6.300000E 02	S	2.561074E 02
6.600000E 02	S	2.556129E 02
6.900000E 02	S	2.551732E 02
7.200000E 02	S	2.547822E 02
7.500000E 02	S	2.544343E 02
7.800000E 02	S	2.541248E 02
8.100000E 02	S	2.538494E 02
8.400000E 02	S	2.536045E 02
8.700000E 02	S	2.533865E 02
9.000000E 02	S	2.531924E 02
9.300000E 02	S	2.530196E 02
9.600000E 02	S	2.528661E 02
9.900000E 02	S	2.527293E 02
1.020000E 03	S	2.526075E 02
1.050000E 03	S	2.524991E 02
1.080000E 03	S	2.524026E 02
1.110000E 03	S	2.523167E 02
1.140000E 03	S	2.522402E 02
1.170000E 03	S	2.521721E 02
1.200000E 03	S	2.521115E 02
1.230000E 03	S	2.520574E 02
1.260000E 03	S	2.520094E 02
1.290000E 03	S	2.519666E 02
1.320000E 03	S	2.519284E 02
1.350000E 03	S	2.518945E 02

POINT-ID = 3

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.943074E 02
6.000000E 01	S	2.850273E 02
9.000000E 01	S	2.773352E 02
1.200000E 02	S	2.707915E 02
1.500000E 02	S	2.651521E 02
1.800000E 02	S	2.602544E 02
2.100000E 02	S	2.559797E 02
2.400000E 02	S	2.522339E 02
2.700000E 02	S	2.489420E 02
3.000000E 02	S	2.460420E 02
3.300000E 02	S	2.434824E 02
3.600000E 02	S	2.412198E 02
3.900000E 02	S	2.392171E 02
4.200000E 02	S	2.374427E 02
4.500000E 02	S	2.358693E 02
4.800000E 02	S	2.344729E 02
5.100000E 02	S	2.332330E 02
5.400000E 02	S	2.321317E 02
5.700000E 02	S	2.311530E 02
6.000000E 02	S	2.302826E 02
6.300000E 02	S	2.295091E 02
6.600000E 02	S	2.288210E 02
6.900000E 02	S	2.282089E 02
7.200000E 02	S	2.276643E 02
7.500000E 02	S	2.271797E 02
7.800000E 02	S	2.267494E 02
8.100000E 02	S	2.263646E 02
8.400000E 02	S	2.260229E 02
8.700000E 02	S	2.257187E 02
9.000000E 02	S	2.254479E 02
9.300000E 02	S	2.252069E 02
9.600000E 02	S	2.249923E 02
9.900000E 02	S	2.248011E 02
1.020000E 03	S	2.246311E 02
1.050000E 03	S	2.244796E 02
1.080000E 03	S	2.243447E 02
1.110000E 03	S	2.242246E 02
1.140000E 03	S	2.241177E 02
1.170000E 03	S	2.240224E 02
1.200000E 03	S	2.239376E 02
1.230000E 03	S	2.238621E 02
1.260000E 03	S	2.237948E 02
1.290000E 03	S	2.237349E 02
1.320000E 03	S	2.236815E 02
1.350000E 03	S	2.236340E 02

POINT-ID = 4

T E M P E R A T U R E V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.909912E 02
6.000000E 01	S	2.818540E 02
9.000000E 01	S	2.740925E 02
1.200000E 02	S	2.675840E 02
1.500000E 02	S	2.611379E 02
1.800000E 02	S	2.555765E 02
2.100000E 02	S	2.507526E 02
2.400000E 02	S	2.461491E 02
2.700000E 02	S	2.425711E 02
3.000000E 02	S	2.386423E 02
3.300000E 02	S	2.359002E 02
3.600000E 02	S	2.342275E 02
3.900000E 02	S	2.324788E 02
4.200000E 02	S	2.311155E 02
4.500000E 02	S	2.290777E 02
4.800000E 02	S	2.270364E 02
5.100000E 02	S	2.254393E 02
5.400000E 02	S	2.240533E 02
5.700000E 02	S	2.231738E 02
6.000000E 02	S	2.222140E 02
6.300000E 02	S	2.213306E 02
6.600000E 02	S	2.205016E 02
6.900000E 02	S	2.199263E 02
7.200000E 02	S	2.193255E 02
7.500000E 02	S	2.187938E 02
7.800000E 02	S	2.183148E 02
8.100000E 02	S	2.178913E 02
8.400000E 02	S	2.175141E 02
8.700000E 02	S	2.171784E 02
9.000000E 02	S	2.168794E 02
9.300000E 02	S	2.166132E 02
9.600000E 02	S	2.163762E 02
9.900000E 02	S	2.161653E 02
1.020000E 03	S	2.159774E 02
1.050000E 03	S	2.158102E 02
1.080000E 03	S	2.156611E 02
1.110000E 03	S	2.155286E 02
1.140000E 03	S	2.154104E 02
1.170000E 03	S	2.153051E 02
1.200000E 03	S	2.152115E 02
1.230000E 03	S	2.151280E 02
1.260000E 03	S	2.150537E 02
1.290000E 03	S	2.149877E 02
1.320000E 03	S	2.149286E 02
1.350000E 03	S	2.148760E 02

POINT-ID = 5

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984612E 02
6.000000E 01	S	2.958572E 02
9.000000E 01	S	2.935396E 02
1.200000E 02	S	2.914375E 02
1.500000E 02	S	2.895293E 02
1.600000E 02	S	2.878040E 02
2.100000E 02	S	2.862502E 02
2.400000E 02	S	2.848562E 02
2.700000E 02	S	2.836086E 02
3.000000E 02	S	2.824949E 02
3.300000E 02	S	2.815017E 02
3.600000E 02	S	2.806172E 02
3.900000E 02	S	2.798301E 02
4.200000E 02	S	2.791301E 02
4.500000E 02	S	2.785078E 02
4.800000E 02	S	2.779543E 02
5.100000E 02	S	2.774624E 02
5.400000E 02	S	2.770251E 02
5.700000E 02	S	2.766365E 02
6.000000E 02	S	2.762910E 02
6.300000E 02	S	2.759839E 02
6.600000E 02	S	2.757109E 02
6.900000E 02	S	2.754683E 02
7.200000E 02	S	2.752524E 02
7.500000E 02	S	2.750603E 02
7.800000E 02	S	2.748896E 02
8.100000E 02	S	2.747375E 02
8.400000E 02	S	2.746025E 02
8.700000E 02	S	2.744822E 02
9.000000E 02	S	2.743752E 02
9.300000E 02	S	2.742800E 02
9.600000E 02	S	2.741951E 02
9.900000E 02	S	2.741196E 02
1.020000E 03	S	2.740525E 02
1.050000E 03	S	2.739927E 02
1.080000E 03	S	2.739395E 02
1.110000E 03	S	2.738921E 02
1.140000E 03	S	2.738499E 02
1.170000E 03	S	2.738123E 02
1.200000E 03	S	2.737788E 02
1.230000E 03	S	2.737490E 02
1.260000E 03	S	2.737227E 02
1.290000E 03	S	2.736990E 02
1.320000E 03	S	2.736780E 02
1.350000E 03	S	2.736594E 02

POINT-ID = 6

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.973757E 02
6.000000E 01	S	2.927366E 02
9.000000E 01	S	2.884036E 02
1.200000E 02	S	2.844485E 02
1.500000E 02	S	2.808765E 02
1.800000E 02	S	2.776692E 02
2.100000E 02	S	2.747993E 02
2.400000E 02	S	2.722375E 02
2.700000E 02	S	2.699543E 02
3.000000E 02	S	2.679219E 02
3.300000E 02	S	2.661138E 02
3.600000E 02	S	2.645061E 02
3.900000E 02	S	2.630771E 02
4.200000E 02	S	2.618074E 02
4.500000E 02	S	2.606790E 02
4.800000E 02	S	2.596763E 02
5.100000E 02	S	2.587852E 02
5.400000E 02	S	2.579932E 02
5.700000E 02	S	2.572893E 02
6.000000E 02	S	2.565636E 02
6.300000E 02	S	2.561074E 02
6.600000E 02	S	2.556130E 02
6.900000E 02	S	2.551732E 02
7.200000E 02	S	2.547822E 02
7.500000E 02	S	2.544342E 02
7.800000E 02	S	2.541248E 02
8.100000E 02	S	2.538494E 02
8.400000E 02	S	2.536045E 02
8.700000E 02	S	2.533865E 02
9.000000E 02	S	2.531924E 02
9.300000E 02	S	2.530193E 02
9.600000E 02	S	2.528661E 02
9.900000E 02	S	2.527293E 02
1.020000E 03	S	2.526075E 02
1.050000E 03	S	2.524991E 02
1.080000E 03	S	2.524026E 02
1.110000E 03	S	2.523167E 02
1.140000E 03	S	2.522402E 02
1.170000E 03	S	2.521721E 02
1.200000E 03	S	2.521115E 02
1.230000E 03	S	2.520575E 02
1.260000E 03	S	2.520094E 02
1.290000E 03	S	2.519666E 02
1.320000E 03	S	2.519285E 02
1.350000E 03	S	2.518945E 02

POINT-ID = 7

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.943074E 02
6.000000E 01	S	2.850273E 02
9.000000E 01	S	2.773354E 02
1.200000E 02	S	2.707917E 02
1.500000E 02	S	2.651521E 02
1.600000E 02	S	2.602546E 02
2.100000E 02	S	2.559797E 02
2.400000E 02	S	2.522340E 02
2.700000E 02	S	2.489421E 02
3.000000E 02	S	2.460421E 02
3.300000E 02	S	2.434825E 02
3.600000E 02	S	2.412199E 02
3.900000E 02	S	2.392172E 02
4.200000E 02	S	2.374428E 02
4.500000E 02	S	2.358694E 02
4.600000E 02	S	2.344730E 02
5.100000E 02	S	2.332332E 02
5.400000E 02	S	2.321318E 02
5.700000E 02	S	2.311530E 02
6.000000E 02	S	2.302829E 02
6.300000E 02	S	2.295092E 02
6.600000E 02	S	2.288211E 02
6.900000E 02	S	2.282090E 02
7.200000E 02	S	2.276644E 02
7.500000E 02	S	2.271798E 02
7.800000E 02	S	2.267486E 02
8.100000E 02	S	2.263647E 02
8.400000E 02	S	2.260229E 02
8.700000E 02	S	2.257188E 02
9.000000E 02	S	2.254480E 02
9.300000E 02	S	2.252070E 02
9.600000E 02	S	2.249923E 02
9.900000E 02	S	2.248012E 02
1.020000E 03	S	2.246311E 02
1.050000E 03	S	2.244797E 02
1.080000E 03	S	2.243448E 02
1.110000E 03	S	2.242247E 02
1.140000E 03	S	2.241178E 02
1.170000E 03	S	2.240224E 02
1.200000E 03	S	2.239377E 02
1.230000E 03	S	2.238622E 02
1.260000E 03	S	2.237949E 02
1.290000E 03	S	2.237350E 02
1.320000E 03	S	2.236816E 02
1.350000E 03	S	2.236341E 02

INPUT DATA OBTAINED FROM RESTART TAPE OF PROBLEM NINE

POINT-ID = 8

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.939912E 02
6.000000E 01	S	2.838540E 02
9.000000E 01	S	2.750923E 02
1.200000E 02	S	2.675642E 02
1.500000E 02	S	2.611382E 02
1.800000E 02	S	2.555765E 02
2.100000E 02	S	2.507527E 02
2.400000E 02	S	2.465491E 02
2.700000E 02	S	2.428712E 02
3.000000E 02	S	2.396424E 02
3.300000E 02	S	2.368002E 02
3.600000E 02	S	2.342928E 02
3.900000E 02	S	2.320738E 02
4.200000E 02	S	2.301155E 02
4.500000E 02	S	2.283778E 02
4.800000E 02	S	2.268365E 02
5.100000E 02	S	2.254665E 02
5.400000E 02	S	2.242534E 02
5.700000E 02	S	2.231738E 02
6.000000E 02	S	2.222141E 02
6.300000E 02	S	2.213607E 02
6.600000E 02	S	2.206017E 02
6.900000E 02	S	2.199264E 02
7.200000E 02	S	2.193255E 02
7.500000E 02	S	2.187908E 02
7.800000E 02	S	2.183149E 02
8.100000E 02	S	2.178912E 02
8.400000E 02	S	2.175141E 02
8.700000E 02	S	2.171784E 02
9.000000E 02	S	2.168794E 02
9.300000E 02	S	2.166133E 02
9.600000E 02	S	2.163763E 02
9.900000E 02	S	2.161653E 02
1.020000E 03	S	2.159774E 02
1.050000E 03	S	2.158101E 02
1.080000E 03	S	2.156612E 02
1.110000E 03	S	2.155285E 02
1.140000E 03	S	2.154104E 02
1.170000E 03	S	2.153052E 02
1.200000E 03	S	2.152114E 02
1.230000E 03	S	2.151281E 02
1.260000E 03	S	2.150538E 02
1.290000E 03	S	2.149876E 02
1.320000E 03	S	2.149286E 02
1.350000E 03	S	2.148761E 02

POINT-ID = 100

T E M P E R A T U R E V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.999993E 02
6.000000E 01	S	2.999995E 02
9.000000E 01	S	2.999993E 02
1.200000E 02	S	2.999988E 02
1.500000E 02	S	2.999990E 02
1.800000E 02	S	2.999988E 02
2.100000E 02	S	2.999988E 02
2.400000E 02	S	2.999983E 02
2.700000E 02	S	2.999988E 02
3.000000E 02	S	2.999985E 02
3.300000E 02	S	2.999980E 02
3.600000E 02	S	2.999985E 02
3.900000E 02	S	2.999980E 02
4.200000E 02	S	2.999983E 02
4.500000E 02	S	2.999983E 02
4.800000E 02	S	2.999980E 02
5.100000E 02	S	2.999983E 02
5.400000E 02	S	2.999980E 02
5.700000E 02	S	2.999983E 02
6.000000E 02	S	2.999980E 02
6.300000E 02	S	2.999983E 02
6.600000E 02	S	2.999980E 02
6.900000E 02	S	2.999983E 02
7.200000E 02	S	2.999980E 02
7.500000E 02	S	2.999980E 02
7.800000E 02	S	2.999980E 02
8.100000E 02	S	2.999980E 02
8.400000E 02	S	2.999980E 02
8.700000E 02	S	2.999980E 02
9.000000E 02	S	2.999980E 02
9.300000E 02	S	2.999980E 02
9.600000E 02	S	2.999980E 02
9.900000E 02	S	2.999980E 02
1.020000E 03	S	2.999980E 02
1.050000E 03	S	2.999980E 02
1.080000E 03	S	2.999980E 02
1.110000E 03	S	2.999980E 02
1.140000E 03	S	2.999980E 02
1.170000E 03	S	2.999980E 02
1.200000E 03	S	2.999980E 02
1.230000E 03	S	2.999980E 02
1.260000E 03	S	2.999980E 02
1.290000E 03	S	2.999980E 02
1.320000E 03	S	2.999980E 02
1.350000E 03	S	2.999980E 02

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                                         * * * END OF JOB * * *

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NASTRAN LOADED AT LOCATION OFAF20
TIME TO GO =   59 CPU SEC., 299 I/O SEC.
*      0 CPU-SEC.          0 ELAPSED-SEC.      SEM1  BEGN
*      0 CPU-SEC.          0 ELAPSED-SEC.      SEMT
*      0 CPU-SEC.          7 ELAPSED-SEC.      NAST
*      0 CPU-SEC.          7 ELAPSED-SEC.      GNFI
*      0 CPU-SEC.          7 ELAPSED-SEC.      XCSA
*      2 CPU-SEC.         14 ELAPSED-SEC.      IFP1
*      2 CPU-SEC.         20 ELAPSED-SEC.      XSOR
*      2 CPU-SEC.         31 ELAPSED-SEC.        DO  IFP
*      3 CPU-SEC.         53 ELAPSED-SEC.       END  IFP
*      3 CPU-SEC.         53 ELAPSED-SEC.      XGPI
*      5 CPU-SEC.         78 ELAPSED-SEC.      SEM1  END
*      5 CPU-SEC.         80 ELAPSED-SEC.      ----  LINKNS03 ---
=    29 I/O SEC.
 LAST LINK DID NOT USE    40016 BYTES OF OPEN CORE
*      5 CPU-SEC.         83 ELAPSED-SEC.      ----  LINK END ---
*      5 CPU-SEC.         84 ELAPSED-SEC.      XSFA
*      5 CPU-SEC.        100 ELAPSED-SEC.      XSFA
*      5 CPU-SEC.        100 ELAPSED-SEC.      27    SMA1     BEGN
*      6 CPU-SEC.        105 ELAPSED-SEC.      27    SMA1     END
*      6 CPU-SEC.        106 ELAPSED-SEC.      30    SMA2     BEGN
*      6 CPU-SEC.        113 ELAPSED-SEC.      30    SMA2     END
*      6 CPU-SEC.        115 ELAPSED-SEC.      ----  LINKNS05 ---
=    43 I/O SEC.
 LAST LINK DID NOT USE    64268 BYTES OF OPEN CORE
*      6 CPU-SEC.        119 ELAPSED-SEC.      ----  LINK END ---
*      6 CPU-SEC.        119 ELAPSED-SEC.      35    RMG      BEGN
*      6 CPU-SEC.        124 ELAPSED-SEC.      SDCO  MP
*      6 CPU-SEC.        125 ELAPSED-SEC.      SDCO  MP
*      6 CPU-SEC.        126 ELAPSED-SEC.      FBS
*      6 CPU-SEC.        129 ELAPSED-SEC.      FBS
*      6 CPU-SEC.        130 ELAPSED-SEC.      MPYA  D
                                                     METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*      6 CPU-SEC.        131 ELAPSED-SEC.      MPYA  D
*      6 CPU-SEC.        132 ELAPSED-SEC.      TRAN  POSE
*      6 CPU-SEC.        134 ELAPSED-SEC.      TRAN  POSE
*      6 CPU-SEC.        134 ELAPSED-SEC.      MPYA  D
                                                     METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*      6 CPU-SEC.        135 ELAPSED-SEC.      MPYA  D
*      7 CPU-SEC.        138 ELAPSED-SEC.      35    RMG      END
*      7 CPU-SEC.        141 ELAPSED-SEC.      ----  LINKNS04 ---
=    60 I/O SEC.
 LAST LINK DID NOT USE    72520 BYTES OF OPEN CORE
*      7 CPU-SEC.        147 ELAPSED-SEC.      ----  LINK END ---
*      7 CPU-SEC.        147 ELAPSED-SEC.      46    GPSP     BEGN
*      7 CPU-SEC.        147 ELAPSED-SEC.      46    GPSP     END
*      7 CPU-SEC.        147 ELAPSED-SEC.      ----  LINKNS14 ---
=    65 I/O SEC.
 LAST LINK DID NOT USE   138192 BYTES OF OPEN CORE
*      7 CPU-SEC.        154 ELAPSED-SEC.      ----  LINK END ---
*      7 CPU-SEC.        154 ELAPSED-SEC.      47    OFP      BEGN
*      7 CPU-SEC.        154 ELAPSED-SEC.      47    OFP      END
*      7 CPU-SEC.        156 ELAPSED-SEC.      ----  LINKNS04 ---
=    69 I/O SEC.
 LAST LINK DID NOT USE   115664 BYTES OF OPEN CORE
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*     7 CPU-SEC.      162 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.      162 ELAPSED-SEC.     53    MCE2    BEGN
*     7 CPU-SEC.      167 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     8 CPU-SEC.      169 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.      169 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     8 CPU-SEC.      172 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.      172 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     8 CPU-SEC.      176 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.      179 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     9 CPU-SEC.      180 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.      181 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     9 CPU-SEC.      183 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.      183 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     9 CPU-SEC.      185 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.      188 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*    10 CPU-SEC.      190 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.      191 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*    10 CPU-SEC.      192 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.      193 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*    10 CPU-SEC.      195 ELAPSED-SEC.     MPYA  D
*    11 CPU-SEC.      197 ELAPSED-SEC.     53    MCE2    END
*    11 CPU-SEC.      202 ELAPSED-SEC.     ----  LINKNS10 ---
=    91 I/O SEC.
 LAST LINK DID NOT USE  102132 BYTES OF OPEN CORE
*    11 CPU-SEC.      208 ELAPSED-SEC.     ----  LINK END ---
*    11 CPU-SEC.      208 ELAPSED-SEC.     88    GKAD    BEGN
*    11 CPU-SEC.      212 ELAPSED-SEC.     88    GKAD    END
*    11 CPU-SEC.      213 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.      218 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.      218 ELAPSED-SEC.     ----  LINKNS05 ---
=    96 I/O SEC.
 LAST LINK DID NOT USE  109852 BYTES OF OPEN CORE
*    11 CPU-SEC.      223 ELAPSED-SEC.     ----  LINK END ---
*    11 CPU-SEC.      223 ELAPSED-SEC.     92    TRLG    BEGN
*    11 CPU-SEC.      236 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*    11 CPU-SEC.      238 ELAPSED-SEC.     MPYA  D
*    12 CPU-SEC.      243 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*    12 CPU-SEC.      246 ELAPSED-SEC.     MPYA  D
*    12 CPU-SEC.      246 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*    12 CPU-SEC.      248 ELAPSED-SEC.     MPYA  D
*    12 CPU-SEC.      251 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*    12 CPU-SEC.      253 ELAPSED-SEC.     MPYA  D
*    12 CPU-SEC.      253 ELAPSED-SEC.     92    TRLG    END
*    12 CPU-SEC.      255 ELAPSED-SEC.     ----  LINKNS11 ---
=   110 I/O SEC.
 LAST LINK DID NOT USE   58172 BYTES OF OPEN CORE
*    13 CPU-SEC.      260 ELAPSED-SEC.     ----  LINK END ---
*    13 CPU-SEC.      260 ELAPSED-SEC.     97    TRHT    BEGN
*    13 CPU-SEC.      265 ELAPSED-SEC.     DECO  MP
*    13 CPU-SEC.      267 ELAPSED-SEC.     DECO  MP
*    15 CPU-SEC.      339 ELAPSED-SEC.     97    TRHT    END
```

```
*     15 CPU-SEC.       340 ELAPSED-SEC.      ----  LINKNS12 ---
=   170 I/O SEC.
 LAST LINK DID NOT USE   69268 BYTES OF OPEN CORE
*     15 CPU-SEC.       350 ELAPSED-SEC.      ----  LINK END ---
*     15 CPU-SEC.       350 ELAPSED-SEC.      99    VDR      BEGN
*     15 CPU-SEC.       355 ELAPSED-SEC.      99    VDR      END
*     15 CPU-SEC.       356 ELAPSED-SEC.      111   PARAM    BEGN
*     15 CPU-SEC.       356 ELAPSED-SEC.      111   PARAM    END
*     15 CPU-SEC.       357 ELAPSED-SEC.      115   SDR1     BEGN
*     15 CPU-SEC.       357 ELAPSED-SEC.      MPYA  D
                                                    METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.1
*     15 CPU-SEC.       359 ELAPSED-SEC.      MPYA  D
*     16 CPU-SEC.       365 ELAPSED-SEC.      115   SDR1     END
*     16 CPU-SEC.       366 ELAPSED-SEC.      ----  LINKNS08 ---
=   182 I/O SEC.
 LAST LINK DID NOT USE  119096 BYTES OF OPEN CORE
*     16 CPU-SEC.       379 ELAPSED-SEC.      ----  LINK END ---
*     16 CPU-SEC.       379 ELAPSED-SEC.      119   PLTTRAN BEGN
*     16 CPU-SEC.       381 ELAPSED-SEC.      119   PLTTRAN END
*     16 CPU-SEC.       382 ELAPSED-SEC.      XSFA
*     16 CPU-SEC.       382 ELAPSED-SEC.      XSFA
*     16 CPU-SEC.       382 ELAPSED-SEC.      ----  LINKNS13 ---
=   185 I/O SEC.
 LAST LINK DID NOT USE  107909 BYTES OF OPEN CORE
*     16 CPU-SEC.       384 ELAPSED-SEC.      ----  LINK END ---
*     16 CPU-SEC.       384 ELAPSED-SEC.      120   SDR2     BEGN
*     16 CPU-SEC.       387 ELAPSED-SEC.      120   SDR2     END
*     16 CPU-SEC.       388 ELAPSED-SEC.      ----  LINKNS14 ---
=   19[illegible] I/O SEC.
 LAST LINK DID NOT USE   66428 BYTES OF OPEN CORE
*     16 CPU-SEC.       394 ELAPSED-SEC.      ----  LINK END ---
*     16 CPU-SEC.       394 ELAPSED-SEC.      121   SDR3     BEGN
*     16 CPU-SEC.       398 ELAPSED-SEC.      121   SDR3     END
*     16 CPU-SEC.       398 ELAPSED-SEC.      123   OFP      BEGN
*     17 CPU-SEC.       402 ELAPSED-SEC.      123   OFP      END
*     17 CPU-SEC.       403 ELAPSED-SEC.      130   XYTRAN   BEGN
*     17 CPU-SEC.       403 ELAPSED-SEC.      130   XYTRAN   END
*     17 CPU-SEC.       403 ELAPSED-SEC.      ----  LINKNS02 ---
=   200 I/O SEC.
 LAST LINK DID NOT USE   11408 BYTES OF OPEN CORE
*     17 CPU-SEC.       410 ELAPSED-SEC.      ----  LINK END ---
*     17 CPU-SEC.       410 ELAPSED-SEC.      132   XYPLOT   BEGN
*     17 CPU-SEC.       410 ELAPSED-SEC.      132   XYPLOT   END
*     17 CPU-SEC.       411 ELAPSED-SEC.      138   EXIT     BEGN
--------------------------------------------------------------------------------------------------------------------
=   202 I/O SEC.
 LAST LINK DID NOT USE   97232 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =  11K BYTES
```

IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*********************************************************************************
$ START OF EXECUTIVE CONTROL *****************************************************
$*********************************************************************************
$
ID CLASS PROBLEM ELEVEN, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR TRANSIENT SOLUTION ALGORITHM IS TO BE USED
$
SOL 9
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
$
$ THE FOLLOWING ALTER IS REQUIRED TO CORRECTLY PUNCH OUT TEMPERATURE CARDS
$ DURING A TRANSIENT RUN
$
ALTER 120
OFP HOUPV1,,,,, // V,N,HCARDNO $
SAVE HCARDNO $
ENDALTER
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $***************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ****************************
  4      $***************************************************************************
  5      $
  6      TITLE=      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIED
  7      SUBTITLE=        AND TEMPERATURE CARDS PUNCHED.
  8      $
  9      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
 10      $
 11      LINE=51
 12      $
 13      $ REQUEST SORTED AND UNSORTED OUTPUT
 14      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 15      $
 16      ECHO=BOTH
 17      $
 18      $ SELECT THE MPC AND LOAD SETS TO BE USED IN THIS SOLUTION
 19      $ NOTE THAT NO SPC SET IS SELECTED, AND THAT DLOAD HAS REPLACED LOAD.
 20      $ THE DLOAD CARD NOW REFERENCES SET 800 FOR PROBLEM ELEVEN
 21      $ INSTEAD OF 300 AS IN PROBLEM THREE
 22      $
 23      MPC=200
 24      DLOAD=800
 25      $
 26      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 27      $ THE SELECTION OF THIS SET IS OPTIONAL FOR SOL 9, BUT SHOULD BE MADE IF
 28      $ THE FINAL TEMPERATURE IS SEVERAL HUNDRED DEGREES DIFFERENT FROM THE
 29      $ IC VECTOR  AND RADIATIVE INTERCHANGES ARE INCLUDED.
 30      $
 31      TEMP(MATERIAL)=400
 32      $
 33      $ SELECT THE STEP SIZE, NUMBER OF INCREMENTS, AND PRINTOUT FREQUENCY
 34      $
 35      TSTEP=500
 36      $
 37      $ SELECT THE TEMPERATURE SET DEFINING THE TEMPERATURE VECTOR AT T=0.
 38      $
 39      IC=600
 40      $
 41      $ SELECT OUTPUT DESIRED
 42      $
 43      OUTPUT
 44      $
 45      $ REQUEST PUNCHED THERMAL DATA
 46      $ THE PUNCH UNIT HAS BEEN DIRECTED TO THE PRINTER SO THAT THE PUNCHED
 47      $ DATA MAY BE VIEWED DIRECTLY.
 48      $ THE PUNCHED CARDS WILL BE FORMATTED CORRECTLY ONLY IF SORT1 OUTPUT
 49      $ IS USED. THE USER MAY EMPLOY THE ALTER PRESENT IN PROBLEM FOUR,
 50      $ WHICH WILL PROVIDE ALL OUTPUT IN SORT1 FORM, OR HE MAY USE THE ALTER AS IN
 51      $ THIS PROBLEM, WHICH WILL PRODUCE SORT2 THERMAL OUTPUT IN ADDITION TO
```

```
                         C A S E   C O N T R O L   D E C K   E C H O
CARD
COUNT
52      $ SORT1 FORMATTED THERMAL OUTPUT.
53      $
54      THERMAL(PUNCH)=ALL
55      $
56      $ DEFINE A GROUP OF GRID POINTS TO BE REFERENCED BY AN OUTPUT REQUEST
57      $
58      SET 5 = 1,2,3,4,5,6,7,8,100
59      $
60      $ REFERENCE A PREVIOUSLY DEFINED GROUP OF GRID POINTS
61      $
62      OLOAD=5
63      $
64      $ THE FOLLOWING CARDS REQUEST 4 FRAMES OF TRANSIENT PLOTS
65      $ THESE PLOTS WILL BE PRODUCED IMMEDIATELY ON THE PRINTER
66      $
67      OUTPUT(XYOUT)
68      XTITLE=TIME IN SECONDS
69      YTITLE= DEGREES CELSIUS GP(100,1,4)
70      $
71      $ 'DISP' MEANS THAT THE GRID POINT TEMPERATURE WILL BE PLOTTED VERSUS TIME
72      $ 'T1' IS REQUIRED (VESTIGIAL REMNANT FROM THE STRUCTURAL VERSION OF NASTRAN)
73      $ ALL OF THESE PLOTS WILL APPEAR ON ONE FRAME
74      $
75      XYPAPLOT DISP/100(T1),1(T1),4(T1)
76      XTITLE=TIME IN SECONDS
77      YTITLE= DEGREES CELSIUS PER SECOND GP(100,1,4)
78      $
79      $ 'VELO' MEANS THAT THE THERMAL VELOCITY WILL BE PLOTTED AS A FUNCTION OF TIME
80      $ THESE THREE PLOTS WILL APPEAR ON THREE DIFFERENT FRAMES
81      $
82      XYPAPLOT VELO/100(T1)/1(T1)/4(T1)
83      $
84      $*****************************************************************************
85      $ END CASE CONTROL --- START BULK DATA ****************************************
86      $*****************************************************************************
87      $
88      BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY AND THERMAL MASS
$
MAT4    1000    200.    2.426+6                                         ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$***************************** ***********************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                            90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

INPUT BULK DATA DECK ECHO

```
.   1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED FOR THE TRANSIENT SOLUTION ----------
$ THEY CONVERT PROBLEM TWO TO PROBLEM THREE
$ NOTE THAT THE SPC1 SET WAS NOT SELECTED IN CASE CONTROL
$ NOTE THAT SPCF OUTPUT IS NOT REQUESTED IN TRANSIENT
$ NOTE THAT THERMAL MASS WAS ADDED TO 'MAT4' CARD 1000
$ NOTE THAT THE DIAG CARD IN THE EXECUTIVE CONTROL WAS IRRELEVANT
$ NOTE THAT THE LOAD REQUEST IN CASE CONTROL IS NOW A DLOAD REQUEST
$
$
$ TRANSIENT SINGLE POINT CONSTRAINT METHOD
$ CONSTRAIN GRID POINT 100 TO 300 DEGREES CELSIUS
$
CELAS2  300     1.+5    100     1
SLOAD   300     100     300.+5
$
$ DEFINES A CONSTANT LOAD SET APPLIED FROM T=0. TO T=1.+6 SECONDS
$
TLOAD2  300     300                     0.      1.+6    0.      0.      +TL1
+TL1    0.      0.
$
$ DEFINES THE NUMBER OF INCREMENTS, THE STEP SIZE, AND THE PRINTOUT FREQUENCY
$ REFERENCED IN CASE CONTROL AS 'TSTEP'
$ EACH TIME STEP IS 30 SECONDS
$
TSTEP   500     31      30.     1
$
$ DEFINES A TEMPERATURE VECTOR --- REFER  ICED IN CASE CONTROL AS 'IC'
$
TEMPD   600     300.
$
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO THE DECK TO CONVERT
$ PROBLEM THREE TO PROBLEM ELEVEN. PROBLEM 11 DEMONSTRATES THE USE
$ OF TLOAD1, TABLED1, AND DELAY CARDS TO PRODUCE CYCLICAL LOADS.
$ ALSO, PUNCHED THERMAL DATA IS REQUESTED.
$ IN ADDITION, A DLOAD BULK DATA CARD IS USED TO COMBINE TLOAD1
$ AND TLOAD2 LOAD SETS.
$ THE ONLY CHANGES OTHER THAN BULK DATA ALTERATIONS WERE THE SELECTION
$ OF LOAD SET 800 IN THE CASE CONTROL INSTEAD OF 300. THE REQUEST
$ FOR THERMAL(PUNCH) INSTEAD OF SIMPLY THERMAL IN THE CASE CONTROL,
$ AND THE INCLUSION OF AN ALTER IN THE EXECUTIVE CONTROL.
$
$
$ REFERENCE THE LOAD, DELAY, AND TABLE CARDS WHICH WILL BE USED TO CREATE
$ LOAD SET 700
$
TLOAD1  700     300     701             703
TLOAD1  710     300     702             703
$
$ DEFINE THE TABLE WHICH IS REFERENCED BY THE TLOAD1 CARDS
```

```
                    I N P U T   B U L K   D A T A   D E C K   E C H O

.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10
$
TABLED1 703                                                           +TABD1
+TABD1  -1.     0.      -0.001  0.      0.      1.      450.    1.      +TABD2
+TABD2  450.001 0.      451.    0.      ENDT
$
$ DEFINE THE DELAY CARDS WHICH WILL BE USED DURING THE TABLE LOOKUP PROCEDURE
$
DELAY   701     100     1       1.+6
DELAY   702     100     1       1.+6    1       1       900.
DELAY   702     2       1       900.    3       1       900.
DELAY   702     4       1       900.    5       1       900.
DELAY   702     6       1       900.    7       1       900.
DELAY   702     8       1       900.
$
$ COMBINE THE TLOAD1 SETS (700 AND 710) AND THE TLOAD2 SET (300).
$ DLOAD SET 800 MUST BE REQUESTED IN CASE CONTROL TO APPLY THESE SETS
$ SIMULTANEOUSLY.
$
DLOAD   800     1.0     1.0     300     1.0     700     1.0     710
$
$*****************************************************************************
$ END OF BULK DATA ***********************************************************
$*****************************************************************************
$
ENDDATA

       TOTAL COUNT=  178


*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED,XSORT WILL RE-ORDER DECK.
```

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10
1-	CELAS2	300	1.+5	100	1					
2-	CHBDY	60	300	LINE	1	5				+CONVEC
3-	+CONVEC	100	100							
4-	CHBDY	200	2000	AREA4	1	2	6	5		
5-	CHBDY	300	2000	AREA4	2	3	7	6		
6-	CHBDY	400	2000	AREA4	3	4	8	7		
7-	CHBDY	500	2000	AREA4	5	6	2	1		
8-	CHBDY	600	2000	AREA4	6	7	3	2		
9-	CHBDY	700	2000	AREA4	7	8	4	3		
10-	CQUAD2	30	200	1	2	6	5			
11-	CQUAD2	40	200	2	3	7	6			
12-	CQUAD2	50	200	3	4	8	7			
13-	CROD	10	100	10	2					
14-	CROD	20	100	9	6					
15-	DELAY	701	100	1	1.+6					
16-	DELAY	702	2	1	900.	3	1	900.		
17-	DELAY	702	4	1	900.	5	1	900.		
18-	DELAY	702	6	1	900.	7	1	900.		
19-	DELAY	702	8	1	900.					
20-	DELAY	702	100	1	1.+6	1	1	900.		
21-	DLOAD	800	1.0	1.0	300	1.0	700	1.0	710	
22-	GRID	1		0.0	0.0	0.0				
23-	GRID	2		.1	0.0	0.0				
24-	GRID	3		.2	0.0	0.0				
25-	GRID	4		.3	0.0	0.0				
26-	GRID	5		0.0	.1	0.0				
27-	GRID	6		.1	.1	0.0				
28-	GRID	7		.2	.1	0.0				
29-	GRID	8		.3	.1	0.0				
30-	GRID	9		0.0	.2	0.0				
31-	GRID	10		0.0	-.1	0.0				
32-	GRID	100		-.05	.05	0.0				
33-	MAT4	1000	200.	2.426+6						ALUMINUM
34-	MAT4	3000	200.							
35-	MPC	200	9	1	1.	5	1	-1.		
36-	MPC	200	10	1	1.	1	1	-1.		
37-	PARAM	EPSHT	.0001							
38-	PARAM	MAXIT	8							
39-	PARAM	SIGMA	5.685E-8							
40-	PARAM	TABS	273.15							
41-	PHBDY	300	3000	314						
42-	PHBDY	2000			90					
43-	PQUAD2	200	1000	.01						
44-	PROD	100	1000	.001						
45-	RADLST	200	300	400	500	600	700			
46-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
47-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
48-	RADMTX	3	0.0	0.0	0.0	0.0				
49-	RADMTX	4	0.0	0.0	0.0					
50-	RADMTX	5	0.0	0.0						
51-	RADMTX	6	0.0							

```
                                   S O R T E D   B U L K   D A T A   E C H O
 CARD
 COUNT          .   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
   52-          SLOAD   300     1       4.      2       8.
   53-          SLOAD   300     3       8.      4       4.
   54-          SLOAD   300     5       4.      6       8.
   55-          SLOAD   300     7       8.      8       4.
   56-          SLOAD   300     100     300.+5
   57-          SPC1    100     1       100
   58-          TABLED1 703                                                             +TABD1
   59-          +TABD1  -1.     0.      -0.001  0.      0.      1.      450.    1.      +TABD2
   60-          +TABD2  450.001 0.      451.    0.      ENDT
   61-          TEMP    400     100     300.
   62-          TEMPD   400     300.
   63-          TEMPD   600     300.
   64-          TLOAD1  700     300     701             703
   65-          TLOAD1  710     300     702             703
   66-          TLOAD2  300     300                     0.0     1.+6    0.0     0.0     +TL1
   67-          +TL1    0.      0.
   68-          TSTEP   500     31      30.     1
                ENDDATA
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

*** USER WARNING MESSAGE  54,
     PARAMETER NAMED EPSHT     NOT REFERENCED

*** USER WARNING MESSAGE  54,
     PARAMETER NAMED MAXIT     NOT REFERENCED

          **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**

*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE         6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023,          B =      3
                                            C =      0
                                            R =      2

*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS        0  SECONDS.

*** USER INFORMATION MESSAGE 3028,      B =     5     BBAR =     5
                                        C =     3     CBAR =     1
                                        R =     8

*** USER INFORMATION MESSAGE 3027, UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS       0 SECONDS.
```

POINT-ID = 1

LOAD VECTOR

TIME	TYPE	VALUE
0.0	S	7.999998E 00
3.000000E 01	S	7.999998E 00
6.000000E 01	S	7.999998E 00
9.000000E 01	S	7.999998E 00
1.200000E 02	S	7.999998E 00
1.500000E 02	S	7.999998E 00
1.800000E 02	S	7.999998E 00
2.100000E 02	S	7.999998E 00
2.400000E 02	S	7.999998E 00
2.700000E 02	S	7.999998E 00
3.000000E 02	S	7.999998E 00
3.300000E 02	S	7.999998E 00
3.600000E 02	S	7.999998E 00
3.900000E 02	S	7.999998E 00
4.200000E 02	S	7.999998E 00
4.500000E 02	S	7.999998E 00
4.800000E 02	S	3.999999E 00
5.100000E 02	S	3.999999E 00
5.400000E 02	S	3.999999E 00
5.700000E 02	S	3.999999E 00
6.000000E 02	S	3.999999E 00
6.300000E 02	S	3.999999E 00
6.600000E 02	S	3.999999E 00
6.900000E 02	S	3.999999E 00
7.200000E 02	S	3.999999E 00
7.500000E 02	S	3.999999E 00
7.800000E 02	S	3.999999E 00
8.100000E 02	S	3.999999E 00
8.400000E 02	S	3.999999E 00
8.700000E 02	S	3.999999E 00
9.000000E 02	S	7.999998E 00
9.300000E 02	S	7.999998E 00

POINT-ID = 2

LOAD VECTOR

TIME	TYPE	VALUE
0.0	S	1.600000E 01
3.000000E 01	S	1.600000E 01
6.000000E 01	S	1.600000E 01
9.000000E 01	S	1.600000E 01
1.200000E 02	S	1.600000E 01
1.500000E 02	S	1.600000E 01
1.800000E 02	S	1.600000E 01
2.100000E 02	S	1.600000E 01
2.400000E 02	S	1.600000E 01
2.700000E 02	S	1.600000E 01
3.000000E 02	S	1.600000E 01
3.300000E 02	S	1.600000E 01
3.600000E 02	S	1.600000E 01
3.900000E 02	S	1.600000E 01
4.200000E 02	S	1.600000E 01
4.500000E 02	S	1.600000E 01
4.800000E 02	S	7.999999E 00
5.100000E 02	S	7.999999E 00
5.400000E 02	S	7.999999E 00
5.700000E 02	S	7.999999E 00
6.000000E 02	S	7.999999E 00
6.300000E 02	S	7.999999E 00
6.600000E 02	S	7.999999E 00
6.900000E 02	S	7.999999E 00
7.200000E 02	S	7.999999E 00
7.500000E 02	S	7.999999E 00
7.800000E 02	S	7.999999E 00
8.100000E 02	S	7.999999E 00
8.400000E 02	S	7.999999E 00
8.700000E 02	S	7.999999E 00
9.000000E 02	S	1.600000E 01
9.300000E 02	S	1.600000E 01

POINT-ID = 3

LOAD VECTOR

TIME	TYPE	VALUE
0.0	S	1.600000E 01
3.000000E 01	S	1.600000E 01
6.000000E 01	S	1.600000E 01
9.000000E 01	S	1.600000E 01
1.200000E 02	S	1.600000E 01
1.500000E 02	S	1.600000E 01
1.800000E 02	S	1.600000E 01
2.100000E 02	S	1.600000E 01
2.400000E 02	S	1.600000E 01
2.700000E 02	S	1.600000E 01
3.000000E 02	S	1.600000E 01
3.300000E 02	S	1.600000E 01
3.600000E 02	S	1.600000E 01
3.900000E 02	S	1.600000E 01
4.200000E 02	S	1.600000E 01
4.500000E 02	S	1.600000E 01
4.800000E 02	S	7.999999E 00
5.100000E 02	S	7.999999E 00
5.400000E 02	S	7.999999E 00
5.700000E 02	S	7.999999E 00
6.000000E 02	S	7.999999E 00
6.300000E 02	S	7.999999E 00
6.600000E 02	S	7.999999E 00
6.900000E 02	S	7.999999E 00
7.200000E 02	S	7.999999E 00
7.500000E 02	S	7.999999E 00
7.800000E 02	S	7.999999E 00
8.100000E 02	S	7.999999E 00
8.400000E 02	S	7.999999E 00
8.700000E 02	S	7.999999E 00
9.000000E 02	S	1.600000E 01
9.300000E 02	S	1.600000E 01

POINT-ID = 4

L O A D   V E C T O R

TIME	TYPE	VALUE
0.0	S	7.999998E 00
3.000000E 01	S	7.999998E 00
6.000000E 01	S	7.999998E 00
9.000000E 01	S	7.999998E 00
1.200000E 02	S	7.999998E 00
1.500000E 02	S	7.999998E 00
1.800000E 02	S	7.999998E 00
2.100000E 02	S	7.999998E 00
2.400000E 02	S	7.999998E 00
2.700000E 02	S	7.999998E 00
3.000000E 02	S	7.999998E 00
3.300000E 02	S	7.999998E 00
3.600000E 02	S	7.999998E 00
3.900000E 02	S	7.999998E 00
4.200000E 02	S	7.999998E 00
4.500000E 02	S	7.999998E 00
4.800000E 02	S	3.999999E 00
5.100000E 02	S	3.999999E 00
5.400000E 02	S	3.999999E 00
5.700000E 02	S	3.999999E 00
6.000000E 02	S	3.999999E 00
6.300000E 02	S	3.999999E 00
6.600000E 02	S	3.999999E 00
6.900000E 02	S	3.999999E 00
7.200000E 02	S	3.999999E 00
7.500000E 02	S	3.999999E 00
7.800000E 02	S	3.999999E 00
8.100000E 02	S	3.999999E 00
8.400000E 02	S	3.999999E 00
8.700000E 02	S	3.999999E 00
9.000000E 02	S	7.999998E 00
9.300000E 02	S	7.999998E 00

POINT-ID = 5

L O A D   V E C T O R

TIME	TYPE	VALUE
0.0	S	7.999998E 00
3.000000E 01	S	7.999998E 00
6.000000E 01	S	7.999998E 00
9.000000E 01	S	7.999998E 00
1.200000E 02	S	7.999998E 00
1.500000E 02	S	7.999998E 00
1.800000E 02	S	7.999998E 00
2.100000E 02	S	7.999998E 00
2.400000E 02	S	7.999998E 00
2.700000E 02	S	7.999998E 00
3.000000E 02	S	7.999998E 00
3.300000E 02	S	7.999998E 00
3.600000E 02	S	7.999998E 00
3.900000E 02	S	7.999998E 00
4.200000E 02	S	7.999998E 00
4.500000E 02	S	7.999998E 00
4.800000E 02	S	3.999999E 00
5.100000E 02	S	3.999999E 00
5.400000E 02	S	3.999999E 00
5.700000E 02	S	3.999999E 00
6.000000E 02	S	3.999999E 00
6.300000E 02	S	3.999999E 00
6.600000E 02	S	3.999999E 00
6.900000E 02	S	3.999999E 00
7.200000E 02	S	3.999999E 00
7.500000E 02	S	3.999999E 00
7.800000E 02	S	3.999999E 00
8.100000E 02	S	3.999999E 00
8.400000E 02	S	3.999999E 00
8.700000E 02	S	3.999999E 00
9.000000E 02	S	7.999998E 00
9.300000E 02	S	7.999998E 00

POINT-ID = 6

L O A D   V E C T O R

TIME	TYPE	VALUE
0.0	S	1.600000E 01
3.000000E 01	S	1.600000E 01
6.000000E 01	S	1.600000E 01
9.000000E 01	S	1.600000E 01
1.200000E 02	S	1.600000E 01
1.500000E 02	S	1.600000E 01
1.800000E 02	S	1.600000E 01
2.100000E 02	S	1.600000E 01
2.400000E 02	S	1.600000E 01
2.700000E 02	S	1.600000E 01
3.000000E 02	S	1.600000E 01
3.300000E 02	S	1.600000E 01
3.600000E 02	S	1.600000E 01
3.900000E 02	S	1.600000E 01
4.200000E 02	S	1.600000E 01
4.500000E 02	S	1.600000E 01
4.800000E 02	S	7.999999E 00
5.100000E 02	S	7.999999E 00
5.400000E 02	S	7.999999E 00
5.700000E 02	S	7.999999E 00
6.000000E 02	S	7.999999E 00
6.300000E 02	S	7.999999E 00
6.600000E 02	S	7.999999E 00
6.900000E 02	S	7.999999E 00
7.200000E 02	S	7.999999E 00
7.500000E 02	S	7.999999E 00
7.800000E 02	S	7.999999E 00
8.100000E 02	S	7.999999E 00
8.400000E 02	S	7.999999E 00
8.700000E 02	S	7.999999E 00
9.000000E 02	S	1.600000E 01
9.300000E 02	S	1.600000E 01

POINT-ID = 7

L O A D   V E C T O R

TIME	TYPE	VALUE
0.0	S	1.600000E 01
3.000000E 01	S	1.600000E 01
6.000000E 01	S	1.600000E 01
9.000000E 01	S	1.600000E 01
1.200000E 02	S	1.600000E 01
1.500000E 02	S	1.600000E 01
1.800000E 02	S	1.600000E 01
2.100000E 02	S	1.600000E 01
2.400000E 02	S	1.600000E 01
2.700000E 02	S	1.600000E 01
3.000000E 02	S	1.600000E 01
3.300000E 02	S	1.600000E 01
3.600000E 02	S	1.600000E 01
3.900000E 02	S	1.600000E 01
4.200000E 02	S	1.600000E 01
4.500000E 02	S	1.600000E 01
4.800000E 02	S	7.999999E 00
5.100000E 02	S	7.999999E 00
5.400000E 02	S	7.999999E 00
5.700000E 02	S	7.999999E 00
6.000000E 02	S	7.999999E 00
6.300000E 02	S	7.999999E 00
6.600000E 02	S	7.999999E 00
6.900000E 02	S	7.999999E 00
7.200000E 02	S	7.999999E 00
7.500000E 02	S	7.999999E 00
7.800000E 02	S	7.999999E 00
8.100000E 02	S	7.999999E 00
8.400000E 02	S	7.999999E 00
8.700000E 02	S	7.999999E 00
9.000000E 02	S	1.600000E 01
9.300000E 02	S	1.600000E 01

POINT-ID = 8

LOAD VECTOR

TIME	TYPE	VALUE
0.0	S	7.999998E 00
3.000000E 01	S	7.999998E 00
6.000000E 01	S	7.999998E 00
9.000000E 01	S	7.999998E 00
1.200000E 02	S	7.999998E 00
1.500000E 02	S	7.999998E 00
1.800000E 02	S	7.999998E 00
2.100000E 02	S	7.999998E 00
2.400000E 02	S	7.999998E 00
2.700000E 02	S	7.999998E 00
3.000000E 02	S	7.999998E 00
3.300000E 02	S	7.999998E 00
3.600000E 02	S	7.999998E 00
3.900000E 02	S	7.999998E 00
4.200000E 02	S	7.999998E 00
4.500000E 02	S	7.999998E 00
4.800000E 02	S	3.999999E 00
5.100000E 02	S	3.999999E 00
5.400000E 02	S	3.999999E 00
5.700000E 02	S	3.999999E 00
6.000000E 02	S	3.999999E 00
6.300000E 02	S	3.999999E 00
6.600000E 02	S	3.999999E 00
6.900000E 02	S	3.999999E 00
7.200000E 02	S	3.999999E 00
7.500000E 02	S	3.999999E 00
7.800000E 02	S	3.999999E 00
8.100000E 02	S	3.999999E 00
8.400000E 02	S	3.999999E 00
8.700000E 02	S	3.999999E 00
9.000000E 02	S	7.999998E 00
9.300000E 02	S	7.999998E 00

POINT-ID = 100

L O A D   V E C T O R

TIME	TYPE	VALUE
0.0	S	2.999998E 07
3.000000E 01	S	2.999998E 07
6.000000E 01	S	2.999998E 07
9.000000E 01	S	2.999998E 07
1.200000E 02	S	2.999998E 07
1.500000E 02	S	2.999998E 07
1.800000E 02	S	2.999998E 07
2.100000E 02	S	2.999998E 07
2.400000E 02	S	2.999998E 07
2.700000E 02	S	2.999998E 07
3.000000E 02	S	2.999998E 07
3.300000E 02	S	2.999998E 07
3.600000E 02	S	2.999998E 07
3.900000E 02	S	2.999998E 07
4.200000E 02	S	2.999998E 07
4.500000E 02	S	2.999998E 07
4.800000E 02	S	2.999998E 07
5.100000E 02	S	2.999998E 07
5.400000E 02	S	2.999998E 07
5.700000E 02	S	2.999998E 07
6.000000E 02	S	2.999998E 07
6.300000E 02	S	2.999998E 07
6.600000E 02	S	2.999998E 07
6.900000E 02	S	2.999998E 07
7.200000E 02	S	2.999998E 07
7.500000E 02	S	2.999998E 07
7.800000E 02	S	2.999998E 07
8.100000E 02	S	2.999998E 07
8.400000E 02	S	2.999998E 07
8.700000E 02	S	2.999998E 07
9.000000E 02	S	2.999998E 07
9.300000E 02	S	2.999998E 07

X Y - O U T P U T   S U M M A R Y

SUBCASE 1
RESPONSE
DISPLACEMENT CURVE 1(3)

CURVE TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS GP(100,1,4)

THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS (X = 0.0 TO X = 0.9300000E 03)

THE SMALLEST Y-VALUE = 0.2766606E 03 AT X = 0.8700000E 03

THE LARGEST Y-VALUE = 0.3000000E 03 AT X = 0.0

WITHIN THE X-LIMITS OF ALL DATA (X = 0.0 TO X = 0.9300000E 03)

THE SMALLEST Y-VALUE = 0.2766606E 03 AT X = 0.8700000E 03

THE LARGEST Y-VALUE = 0.3000000E 03 AT X = 0.0

E N D   O F   S U M M A R Y

X Y - O U T P U T   S U M M A R Y

```
SUBCASE          1
RESPONSE
DISPLACEMENT     CURVE        4( 3)

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS       ( X =  0.0            TO X =  0.9300000E 03 )
                         THE SMALLEST Y-VALUE =  0.2126197E 03 AT X =  0.8700000E 03
                         THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0

WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0            TO X =  0.9300000E 03 )
                         THE SMALLEST Y-VALUE =  0.2126197E 03 AT X =  0.8700000E 03
                         THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0
```

E N D   O F   S U M M A R Y

X Y - O U T P U T   S U M M A R Y

```
SUBCASE          1
RESPONSE
DISPLACEMENT    CURVE       100( 3)

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS       ( X =  0.0            TO X =  0.9300000E 03 )

                          THE SMALLEST Y-VALUE =  0.2999978E 03 AT X =  0.5100000E 03

                          THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0            TO X =  0.9300000E 03 )

                          THE SMALLEST Y-VALUE =  0.2999978E 03 AT X =  0.5100000E 03

                          THE LARGEST  Y-VALUE =  0.3000000E 03 AT X =  0.0
```

E N D   O F   S U M M A R Y

X Y - O U T P U T   S U M M A R Y

```
SUBCASE        1
RESPONSE
VELOCITY       CURVE      100( 3)

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS PER SECOND GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS      ( X =  0.0          TO X =  0.9300000E 03 )

                       THE SMALLEST Y-VALUE = -0.4069009E-04 AT X =  0.0

                       THE LARGEST  Y-VALUE =  0.3255208E-04 AT X =  0.3000000E 02


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0          TO X =  0.9300000E 03 )

                       THE SMALLEST Y-VALUE = -0.4069009E-04 AT X =  0.0

                       THE LARGEST  Y-VALUE =  0.3255208E-04 AT X =  0.3000000E 02
```

E N D   O F   S U M M A R Y

X Y - O U T P U T   S U M M A R Y

```
SUBCASE         1
RESPONSE
VELOCITY        CURVE        1( 3)

XY-PAIRS WITHIN FRAME LIMITS WILL BE PLOTTED
PENSIZE =  1

THIS IS CURVE   1 OF WHOLE FRAME    1

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS PER SECOND GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS       ( X =  0.0           TO X =  0.9300000E 03 )

                        THE SMALLEST Y-VALUE = -0.6912434E-01 AT X =  0.3000000E 02

                        THE LARGEST  Y-VALUE =  0.8007810E-02 AT X =  0.9000000E 03


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0           TO X =  0.9300000E 03 )

                        THE SMALLEST Y-VALUE = -0.6912434E-01 AT X =  0.3000000E 02

                        THE LARGEST  Y-VALUE =  0.8007810E-02 AT X =  0.9000000E 03
```

E N D   O F   S U M M A R Y

```
                          X Y - O U T P U T   S U M M A R Y

SUBCASE          1
RESPONSE
VELOCITY         CURVE        4( 3)

XY-PAIRS WITHIN FRAME LIMITS WILL BE PLOTTED
PENSIZE =  1

THIS IS CURVE    1 OF WHOLE FRAME    2

CURVE  TITLE =
X-AXIS TITLE =TIME IN SECONDS
Y-AXIS TITLE = DEGREES CELSIUS PER SECOND GP(100,1,4)


THE FOLLOWING INFORMATION IS FOR THE ABOVE DEFINED CURVE ONLY.

WITHIN THE FRAME X-LIMITS       ( X =  0.0           TO X =  0.9300000E 03 )

                         THE SMALLEST Y-VALUE = -0.2841634E 00 AT X =  0.3000000E 02

                         THE LARGEST  Y-VALUE =  0.3864440E-01 AT X =  0.9000000E 03


WITHIN THE X-LIMITS OF ALL DATA ( X =  0.0           TO X =  0.9300000E 03 )

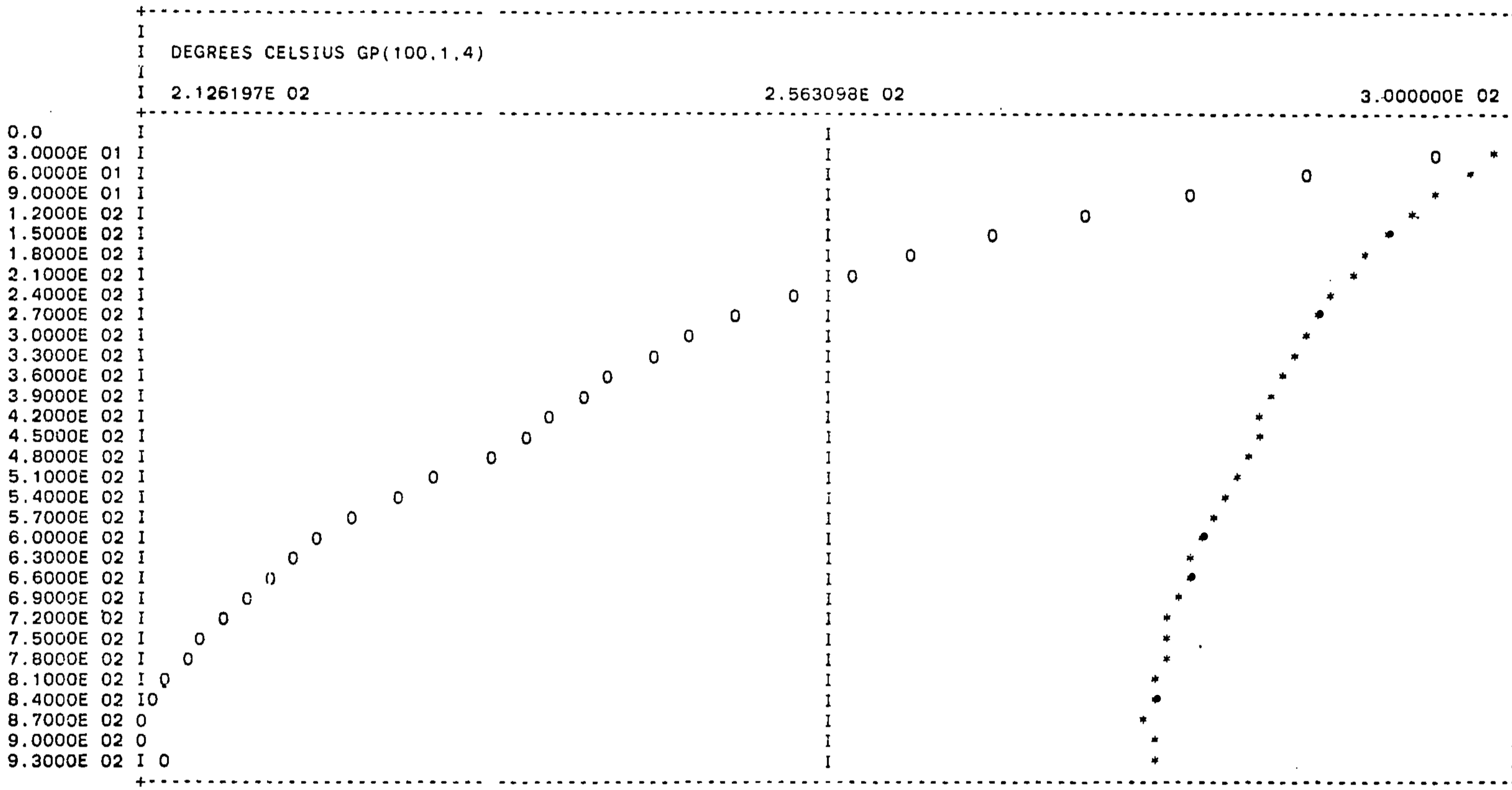
                         THE SMALLEST Y-VALUE = -0.2841634E 00 AT X =  0.3000000E 02

                         THE LARGEST  Y-VALUE =  0.3864440E-01 AT X =  0.9000000E 03

                              E N D   O F   S U M M A R Y
```

F R A M E

X-AXIS TITLE = TIME IN SECONDS



```
            F     R     A     M     E

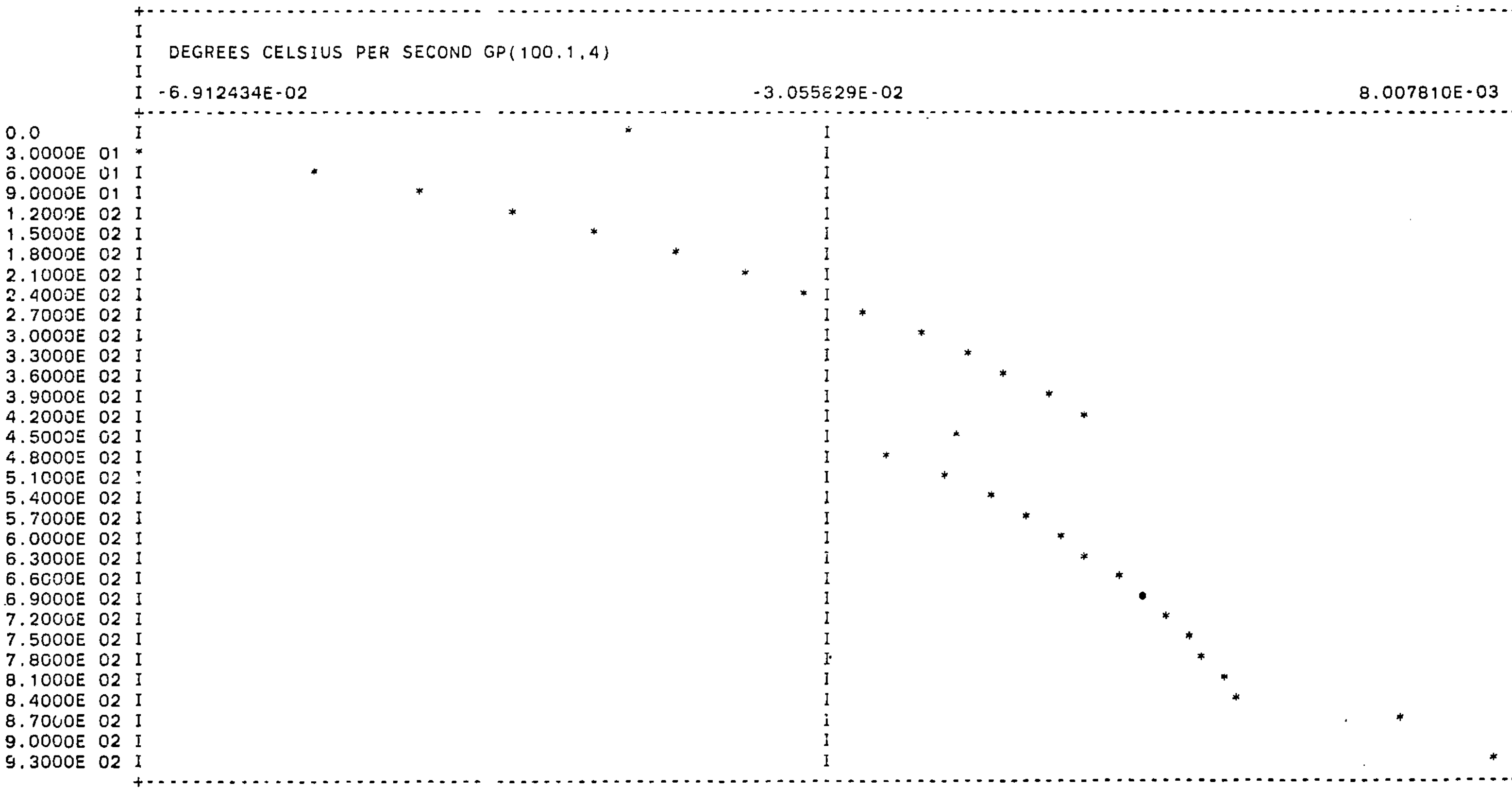
          ****  ****  ****  ****  ****
          *  *  *  *  *  *  *  *  *  *
          *  *  *  *  *  *  *  *  *  *
          *  *  *  *  *  *  *  *  *  *
          ****  ****  ****  ****  ****
```

X-AXIS TITLE = TIME IN SECONDS

```
           +--------------------------------------------------------------------------------------------------------+
           I                                                                                                        I
           I DEGREES CELSIUS PER SECOND GP(100,1,4)                                                                 I
           I                                                                                                        I
           I -4.069009E-05                                 -4.069007E-06                                3.255208E-05 I
           +--------------------------------------------------------------------------------------------------------+
0.0        *                                                   I                                                    I
3.0000E 01 I                                                   I                                                    *
6.0000E 01 I           *                                       I                                                    I
9.0000E 01 I                                                   I                                        *           I
1.2000E 02 *                                                   I                                                    I
1.5000E 02 I                                                   I                                                    *
1.8000E 02 I           *                                       I                                                    I
2.1000E 02 I                                                   I                                        *           I
2.4000E 02 I                      *                            I                                                    I
2.7000E 02 I                                                   I                                        *           I
3.0000E 02 I                      *                            I                                                    I
3.3000E 02 I                                                   I                             *                      I
3.6000E 02 I                                             *     I                                                    I
3.9000E 02 I                                                   I      *                                             I
4.2000E 02 I                                                   I      *                                             I
4.5000E 02 I                                                   I      *                                             I
4.8000E 02 I                      *                            I                                                    I
5.1000E 02 I                                                   I                                        *           I
5.4000E 02 I                      *                            I                                                    I
5.7000E 02 I                                                   I                             *                      I
6.0000E 02 I                                             *     I                                                    I
6.3000E 02 I                                                   I      *                                             I
6.6000E 02 I                                                   I      *                                             I
6.9000E 02 I                                                   I      *                                             I
7.2000E 02 I                                                   I      *                                             I
7.5000E 02 I                                                   I      *                                             I
7.8000E 02 I                                                   I      *                                             I
8.1000E 02 I                                                   I      *                                             I
8.4000E 02 I                                                   I      *                                             I
8.7000E 02 I                                                   I      *                                             I
9.0000E 02 I                                                   I      *                                             I
9.3000E 02 I                                                   I      *                                             I
           +--------------------------------------------------------------------------------------------------------+
```

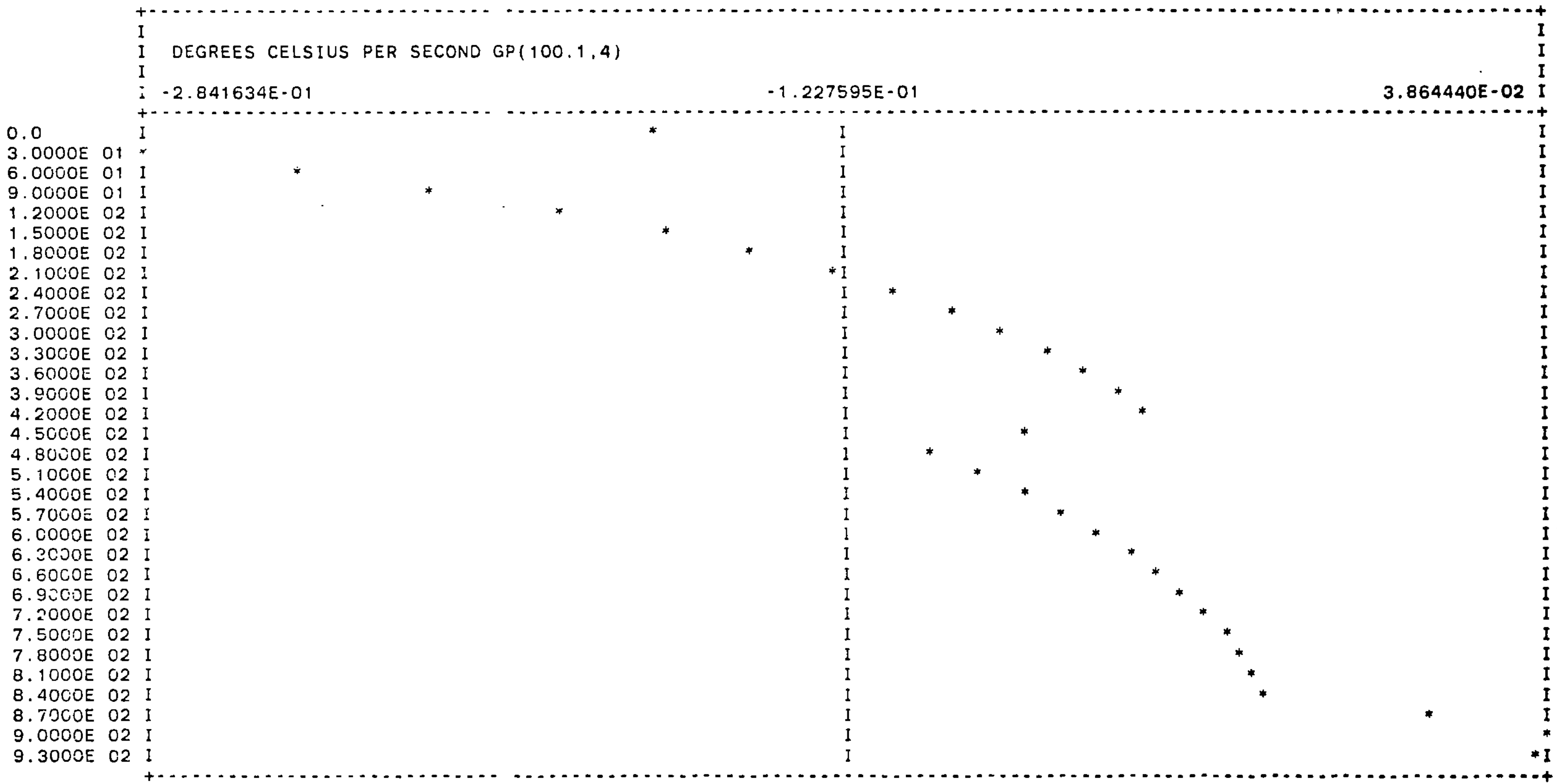
F R A M E

X-AXIS TITLE = TIME IN SECONDS



F R A M E

X-AXIS TITLE = TIME IN SECONDS



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NASTRAN LOADED AT LOCATION 1A2720
TIME TO GO = 599 CPU SEC., 599 I/O SEC.
*     0 CPU-SEC.        0 ELAPSED-SEC.     SEM1  BEGN
*     0 CPU-SEC.        0 ELAPSED-SEC.     SEMT
*     1 CPU-SEC.        4 ELAPSED-SEC.     NAST
*     1 CPU-SEC.        4 ELAPSED-SEC.     GNFI
*     1 CPU-SEC.        5 ELAPSED-SEC.     XCSA
*     1 CPU-SEC.        7 ELAPSED-SEC.     IFP1
*     1 CPU-SEC.       10 ELAPSED-SEC.     XSOR
*     2 CPU-SEC.       15 ELAPSED-SEC.       DO  IFP
*     3 CPU-SEC.       29 ELAPSED-SEC.      END  IFP
*     3 CPU-SEC.       29 ELAPSED-SEC.     XGPI
*     5 CPU-SEC.       34 ELAPSED-SEC.     SEM1  END
*     5 CPU-SEC.       35 ELAPSED-SEC.     ----  LINKNS02 ---
=    26 I/O SEC.
 LAST LINK DID NOT USE   40016 BYTES OF OPEN CORE
*     5 CPU-SEC.       37 ELAPSED-SEC.     ----  LINK END ---
*     5 CPU-SEC.       37 ELAPSED-SEC.     XSFA
*     5 CPU-SEC.       38 ELAPSED-SEC.     XSFA
*     5 CPU-SEC.       38 ELAPSED-SEC.     3     GP1       BEGN
*     5 CPU-SEC.       45 ELAPSED-SEC.     3     GP1       END
*     5 CPU-SEC.       47 ELAPSED-SEC.     8     GP2       BEGN
*     5 CPU-SEC.       46 ELAPSED-SEC.     8     GP2       END
*     5 CPU-SEC.       48 ELAPSED-SEC.     10    PLTSET    BEGN
*     5 CPU-SEC.       49 ELAPSED-SEC.     10    PLTSET    END
*     5 CPU-SEC.       50 ELAPSED-SEC.     12    PRTMSG    BEGN
*     5 CPU-SEC.       50 ELAPSED-SEC.     12    PRTMSG    END
*     5 CPU-SEC.       51 ELAPSED-SEC.     13    SETVAL    BEGN
*     5 CPU-SEC.       51 ELAPSED-SEC.     13    SETVAL    END
*     5 CPU-SEC.       52 ELAPSED-SEC.     21    GP3       BEGN
*     5 CPU-SEC.       59 ELAPSED-SEC.     21    GP3       END
*     5 CPU-SEC.       59 ELAPSED-SEC.     23    TA1       BEGN
*     6 CPU-SEC.       67 ELAPSED-SEC.     23    TA1       END
*     6 CPU-SEC.       68 ELAPSED-SEC.     ----  LINKNS03 ---
=    57 I/O SEC.
 LAST LINK DID NOT USE   82788 BYTES OF OPEN CORE
*     6 CPU-SEC.       71 ELAPSED-SEC.     ----  LINK END ---
*     6 CPU-SEC.       71 ELAPSED-SEC.     27    SMA1      BEGN
*     6 CPU-SEC.       74 ELAPSED-SEC.     27    SMA1      END
*     6 CPU-SEC.       74 ELAPSED-SEC.     30    SMA2      BEGN
*     6 CPU-SEC.       78 ELAPSED-SEC.     30    SMA2      END
*     6 CPU-SEC.       79 ELAPSED-SEC.     ----  LINKNS05 ---
=    65 I/O SEC.
 LAST LINK DID NOT USE   64268 BYTES OF OPEN CORE
*     6 CPU-SEC.       82 ELAPSED-SEC.     ----  LINK END ---
*     6 CPU-SEC.       82 ELAPSED-SEC.     35    RMG       BEGN
*     6 CPU-SEC.       86 ELAPSED-SEC.     SDCO  MP
*     6 CPU-SEC.       86 ELAPSED-SEC.     SDCO  MP
*     6 CPU-SEC.       87 ELAPSED-SEC.     FBS
*     6 CPU-SEC.       89 ELAPSED-SEC.     FBS
*     6 CPU-SEC.       90 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*     7 CPU-SEC.       91 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.       91 ELAPSED-SEC.     TRAN  POSE
*     7 CPU-SEC.       92 ELAPSED-SEC.     TRAN  POSE
*     7 CPU-SEC.       92 ELAPSED-SEC.     MPYA  D
```

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                                                            METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*     7 CPU-SEC.        93 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.        95 ELAPSED-SEC.     35    RMG       END
*     7 CPU-SEC.        97 ELAPSED-SEC.     ----  LINKNS04 ---
=    82 I/O SEC.
 LAST LINK DID NOT USE   72520 BYTES OF OPEN CORE
*     7 CPU-SEC.       101 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.       101 ELAPSED-SEC.     40    GP4       BEGN
*     7 CPU-SEC.       104 ELAPSED-SEC.     40    GP4       END
*     7 CPU-SEC.       106 ELAPSED-SEC.     46    GPSP      BEGN
*     7 CPU-SEC.       106 ELAPSED-SEC.     46    GPSP      END
*     7 CPU-SEC.       107 ELAPSED-SEC.     ----  LINKNS14 ---
=    90 I/O SEC.
 LAST LINK DID NOT USE  117044 BYTES OF OPEN CORE
*     7 CPU-SEC.       110 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.       110 ELAPSED-SEC.     47    OFP       BEGN
*     7 CPU-SEC.       111 ELAPSED-SEC.     47    OFP       END
*     7 CPU-SEC.       113 ELAPSED-SEC.     ----  LINKNS04 ---
=    93 I/O SEC.
 LAST LINK DID NOT USE  115664 BYTES OF OPEN CORE
*     8 CPU-SEC.       116 ELAPSED-SEC.     ----  LINK END ---
*     8 CPU-SEC.       116 ELAPSED-SEC.     51    MCE1      BEGN
*     8 CPU-SEC.       119 ELAPSED-SEC.     51    MCE1      END
*     8 CPU-SEC.       119 ELAPSED-SEC.     53    MCE2      BEGN
*     8 CPU-SEC.       121 ELAPSED-SEC.     MPYA  D
                                                            METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*     8 CPU-SEC.       123 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.       123 ELAPSED-SEC.     MPYA  D
                                                            METHOD 2 T ,NBR PASSES =   1,EST. TIME =      0.0
*     8 CPU-SEC.       124 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.       124 ELAPSED-SEC.     MPYA  D
                                                            METHOD 2 T ,NBR PASSES =   1,EST. TIME =      0.0
*     9 CPU-SEC.       126 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.       128 ELAPSED-SEC.     MPYA  D
                                                            METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*     9 CPU-SEC.       130 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.       130 ELAPSED-SEC.     MPYA  D
                                                            METHOD 2 T ,NBR PASSES =   1,EST. TIME =      0.0
*     9 CPU-SEC.       131 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.       131 ELAPSED-SEC.     MPYA  D
                                                            METHOD 2 T ,NBR PASSES =   1,EST. TIME =      0.0
*    10 CPU-SEC.       132 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.       134 ELAPSED-SEC.     MPYA  D
                                                            METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*    10 CPU-SEC.       136 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.       136 ELAPSED-SEC      MPYA  D
                                                            METHOD 2 T ,NBR PASSES =   1,EST. TIME =      0.0
*    10 CPU-SEC.       137 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.       138 ELAPSED-SEC.     MPYA  D
                                                            METHOD 2 T ,NBR PASSES =   1,EST. TIME =      0.0
*    10 CPU-SEC.       139 ELAPSED-SEC.     MPYA  D
*    11 CPU-SEC.       139 ELAPSED-SEC.     53    MCE2      END
*    11 CPU-SEC.       141 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.       142 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.       142 ELAPSED-SEC.     ----  LINKNS06 ---
=   116 I/O SEC.
 LAST LINK DID NOT USE  102132 BYTES OF OPEN CORE
*    11 CPU-SEC.       144 ELAPSED-SEC.     ----  LINK END ---
*    11 CPU-SEC.       144 ELAPSED-SEC.     75    DPD       BEGN
*    11 CPU-SEC.       152 ELAPSED-SEC.     75    DPD       END
*    11 CPU-SEC.       155 ELAPSED-SEC.     ----  LINKNS10 ---
=   126 I/O SEC.
 LAST LINK DID NOT USE  109192 BYTES OF OPEN CORE
*    11 CPU-SEC.       158 ELAPSED-SEC.     ----  LINK END ---
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*     11 CPU-SEC.       159 ELAPSED-SEC.      81    MTRXIN  BEGN
*     11 CPU-SEC.       159 ELAPSED-SEC.      81    MTRXIN  END
*     11 CPU-SEC.       160 ELAPSED-SEC.      83    PARAM   BEGN
*     11 CPU-SEC.       160 ELAPSED-SEC.      83    PARAM   END
*     11 CPU-SEC.       161 ELAPSED-SEC.      XSFA
*     11 CPU-SEC.       162 ELAPSED-SEC.      XSFA
*     11 CPU-SEC.       162 ELAPSED-SEC.      88    GKAD    BEGN
*     11 CPU-SEC.       165 ELAPSED-SEC.      88    GKAD    END
*     11 CPU-SEC.       165 ELAPSED-SEC.      XSFA
*     12 CPU-SEC.       167 ELAPSED-SEC.      XSFA
*     12 CPU-SEC.       167 ELAPSED-SEC.      ----  LINKNS05 ---
=   133 I/O SEC.
 LAST LINK DID NOT USE  109852 BYTES OF OPEN CORE
*     12 CPU-SEC.       168 ELAPSED-SEC.      ----  LINK END ---
*     12 CPU-SEC.       168 ELAPSED-SEC.      92    TRLG    BEGN
*     12 CPU-SEC.       178 ELAPSED-SEC.      MPYA  D
                                                    METHOD 2 T .NBR PASSES =   1,EST. TIME =      0.0
*     12 CPU-SEC.       179 ELAPSED-SEC.      MPYA  D
*     12 CPU-SEC.       180 ELAPSED-SEC.      MPYA  D
                                                    METHOD 2 NT.NBR PASSES =   1,EST. TIME =      0.0
*     12 CPU-SEC.       181 ELAPSED-SEC.      MPYA  D
*     13 CPU-SEC.       181 ELAPSED-SEC.      MPYA  D
                                                    METHOD 2 NT.NBR PASSES =   1,EST. TIME =      0.0
*     13 CPU-SEC.       182 ELAPSED-SEC.      MPYA  D
*     13 CPU-SEC.       183 ELAPSED-SEC.      MPYA  D
                                                    METHOD 2 NT.NBR PASSES =   1,EST. TIME =      0.0
*     13 CPU-SEC.       184 ELAPSED-SEC.      MPYA  D
*     13 CPU-SEC.       184 ELAPSED-SEC.      92    TRLG    END
*     13 CPU-SEC.       184 ELAPSED-SEC.      ----  LINKNS11  -
=   149 I/O SEC.
 LAST LINK DID NOT USE   58156 BYTES OF OPEN CORE
*     13 CPU-SEC.       187 ELAPSED-SEC.      ----  LINK END ---
*     13 CPU-SEC.       187 ELAPSED-SEC.      97    TRHT    BEGN
*     13 CPU-SEC.       190 ELAPSED-SEC.      DECO  MP
*     13 CPU-SEC.       192 ELAPSED-SEC.      DECO  MP
*     15 CPU-SEC.       222 ELAPSED-SEC.      97    TRHT    END
*     15 CPU-SEC.       223 ELAPSED-SEC.      ----  LINKNS12 ---
=   195 I/O SEC.
 LAST LINK DID NOT USE   69268 BYTES OF OPEN CORE
*     15 CPU-SEC.       228 ELAPSED-SEC.      ----  LINK END ---
*     15 CPU-SEC.       228 ELAPSED-SEC.      99    VDR     BEGN
*     15 CPU-SEC.       229 ELAPSED-SEC.      99    VDR     END
*     15 CPU-SEC.       229 ELAPSED-SEC.      111   PARAM   BEGN
*     15 CPU-SEC.       229 ELAPSED-SEC.      111   PARAM   END
*     15 CPU-SEC.       230 ELAPSED-SEC.      115   SDR1    BEGN
*     15 CPU-SEC.       230 ELAPSED-SEC.      MPYA  D
                                                    METHOD 2 NT.NBR PASSES =   1,EST. TIME =      0.0
*     15 CPU-SEC.       231 ELAPSED-SEC.      MPYA  D
*     16 CPU-SEC.       234 ELAPSED-SEC.      115   SDR1    END
*     16 CPU-SEC.       234 ELAPSED-SEC.      ----  LINKNS08 ---
=   205 I/O SEC.
 LAST LINK DID NOT USE  119104 BYTES OF OPEN CORE
*     16 CPU-SEC.       241 ELAPSED-SEC.      ----  LINK END ---
*     16 CPU-SEC.       241 ELAPSED-SEC.      118   PLTTRAN BEGN
*     16 CPU-SEC.       242 ELAPSED-SEC.      118   PLTTRAN END
*     16 CPU-SEC.       242 ELAPSED-SEC.      XSFA
*     16 CPU-SEC.       244 ELAPSED-SEC.      XSFA
*     16 CPU-SEC.       244 ELAPSED-SEC.      ----  LINKNS13 ---
=   208 I/O SEC.
 LAST LINK DID NOT USE  100596 BYTES OF OPEN CORE
*     16 CPU-SEC.       245 ELAPSED-SEC.      ----  LINK END ---
*     16 CPU-SEC.       245 ELAPSED-SEC.      120   SDR2    BEGN
*     16 CPU-SEC.       250 ELAPSED-SEC.      120   SDR2    END
*     16 CPU-SEC.       250 ELAPSED-SEC.      ----  LINKNS14 ---
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=   216 I/O SEC.
 LAST LINK DID NOT USE   66428 BYTES OF OPEN CORE
*     16 CPU-SEC.      254 ELAPSED-SEC.      ----  LINK END ---
*     16 CPU-SEC.      255 ELAPSED-SEC.      120   OFP      BEGN
*     17 CPU-SEC.      258 ELAPSED-SEC.      120   OFP      END
*     17 CPU-SEC.      258 ELAPSED-SEC.      121   SDR3     BEGN
*     17 CPU-SEC.      264 ELAPSED-SEC.      121   SDR3     END
*     17 CPU-SEC.      264 ELAPSED-SEC.      123   OFP      BEGN
*     18 CPU-SEC.      268 ELAPSED-SEC.      123   OFP      END
*     18 CPU-SEC.      269 ELAPSED-SEC.      130   XYTRAN   BEGN
*     20 CPU-SEC.      277 ELAPSED-SEC.      130   XYTRAN   END
*     20 CPU-SEC.      277 ELAPSED-SEC.      ----  LINKNS02 ---
=   235 I/O SEC.
 LAST LINK DID NOT USE       0 BYTES OF OPEN CORE
*     20 CPU-SEC.      285 ELAPSED-SEC.      ----  LINK END ---
*     20 CPU-SEC.      285 ELAPSED-SEC.      132   XYPLOT   BEGN
*     20 CPU-SEC.      285 ELAPSED-SEC.      132   XYPLOT   END
*     20 CPU-SEC.      285 ELAPSED-SEC.      138   EXIT     BEGN
------------------------------------------------------------------------------------------------------------------
=   236 I/O SEC.
 LAST LINK DID NOT USE   97232 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =    OK BYTES
```

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TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =           1
TIME =   0.0
TEMP*                  1                1    3.000000E 02
TEMP*                  1                2    3.000000E 02
TEMP*                  1                3    3.000000E 02
TEMP*                  1                4    3.000000E 02
TEMP*                  1                5    3.000000E 02
TEMP*                  1                6    3.000000E 02
TEMP*                  1                7    3.000000E 02
TEMP*                  1                8    3.000000E 02
TEMP*                  1                9    3.000000E 02
TEMP*                  1               10    3.000000E 02
TEMP*                  1              100    3.000000E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =           1
TIME =   0.3000000E 02
TEMP*                  1                1    2.987498E 02
TEMP*                  1                2    2.978250E 02
TEMP*                  1                3    2.952100E 02
TEMP*                  1                4    2.949839E 02
TEMP*                  1                5    2.987498E 02
TEMP*                  1                6    2.978252E 02
TEMP*                  1                7    2.952102E 02
TEMP*                  1                8    2.949839E 02
TEMP*                  1                9    2.987498E 02
TEMP*                  1               10    2.987498E 02
TEMP*                  1              100    2.999988E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =           1
TIME =   0.6000000E 02
TEMP*                  1                1    2.966760E 02
TEMP*                  1                2    2.939788E 02
TEMP*                  1                3    2.873252E 02
TEMP*                  1                4    2.864590E 02
TEMP*                  1                5    2.966760E 02
TEMP*                  1                6    2.939790E 02
TEMP*                  1                7    2.873254E 02
TEMP*                  1                8    2.864590E 02
TEMP*                  1                9    2.966760E 02
TEMP*                  1               10    2.966760E 02
TEMP*                  1              100    2.999998E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
```

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D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =            1
TIME =   0.9000000E 02
TEMP*                   1            1    2.948879E 02
TEMP*                   1            2    2.903755E 02
TEMP*                   1            3    2.806938E 02
TEMP*                   1            4    2.789768E 02
TEMP*                   1            5    2.948879E 02
TEMP*                   1            6    2.903755E 02
TEMP*                   1            7    2.806941E 02
TEMP*                   1            8    2.789768E 02
TEMP*                   1            9    2.948879E 02
TEMP*                   1           10    2.948879E 02
TEMP*                   1          100    2.999988E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =            1
TIME =   0.1200000E 03
TEMP*                   1            1    2.932939E 02
TEMP*                   1            2    2.870679E 02
TEMP*                   1            3    2.750024E 02
TEMP*                   1            4    2.724622E 02
TEMP*                   1            5    2.932939E 02
TEMP*                   1            6    2.870679E 02
TEMP*                   1            7    2.750024E 02
TEMP*                   1            8    2.724622E 02
TEMP*                   1            9    2.932939E 02
TEMP*                   1           10    2.932939E 02
TEMP*                   1          100    2.999995E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =            1
TIME =   0.1500000E 03
TEMP*                   1            1    2.918564E 02
TEMP*                   1            2    2.840625E 02
TEMP*                   1            3    2.700610E 02
TEMP*                   1            4    2.667942E 02
TEMP*                   1            5    2.918564E 02
TEMP*                   1            6    2.840625E 02
TEMP*                   1            7    2.700610E 02
TEMP*                   1            8    2.667939E 02
TEMP*                   1            9    2.918564E 02
TEMP*                   1           10    2.918564E 02
TEMP*                   1          100    2.999983E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
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```
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =               1
TIME =   0.1800000E 03
TEMP*                      1               1     2.905571E 02
TEMP*                      1               2     2.813474E 02
TEMP*                      1               3     2.657405E 02
TEMP*                      1               4     2.618516E 02
TEMP*                      1               5     2.905571E 02
TEMP*                      1               6     2.813474E 02
TEMP*                      1               7     2.657405E 02
TEMP*                      1               8     2.618516E 02
TEMP*                      1               9     2.905571E 02
TEMP*                      1              10     2.905571E 02
TEMP*                      1             100     2.999993E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =               1
TIME =   0.2100000E 03
TEMP*                      1               1     2.893835E 02
TEMP*                      1               2     2.789028E 02
TEMP*                      1               3     2.619446E 02
TEMP*                      1               4     2.575278E 02
TEMP*                      1               5     2.893835E 02
TEMP*                      1               6     2.789028E 02
TEMP*                      1               7     2.619446E 02
TEMP*                      1               8     2.575278E 02
TEMP*                      1               9     2.893835E 02
TEMP*                      1              10     2.893835E 02
TEMP*                      1             100     2.999983E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =               1
TIME =   0.2400000E 03
TEMP*                      1               1     2.883252E 02
TEMP*                      1               2     2.767068E 02
TEMP*                      1               3     2.585981E 02
TEMP*                      1               4     2.537332E 02
TEMP*                      1               5     2.883254E 02
TEMP*                      1               6     2.767068E 02
TEMP*                      1               7     2.585984E 02
TEMP*                      1               8     2.537332E 02
TEMP*                      1               9     2.883254E 02
TEMP*                      1              10     2.883252E 02
TEMP*                      1             100     2.999990E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.
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LABEL     =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =             1
TIME =   0.2700000E 03
TEMP*                    1              1     2.873728E 02
TEMP*                    1              2     2.747371E 02
TEMP*                    1              3     2.556405E 02
TEMP*                    1              4     2.503925E 02
TEMP*                    1              5     2.873730E 02
TEMP*                    1              6     2.747371E 02
TEMP*                    1              7     2.556406E 02
TEMP*                    1              8     2.503927E 02
TEMP*                    1              9     2.873730E 02
TEMP*                    1             10     2.873728E 02
TEMP*                    1            100     2.999983E 02
TITLE     =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.

LABEL     =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =             1
TIME =   0.3000000E 03
TEMP*                    1              1     2.865171E 02
TEMP*                    1              2     2.729722E 02
TEMP*                    1              3     2.530206E 02
TEMP*                    1              4     2.474437E 02
TEMP*                    1              5     2.865173E 02
TEMP*                    1              6     2.729724E 02
TEMP*                    1              7     2.530208E 02
TEMP*                    1              8     2.474438E 02
TEMP*                    1              9     2.865173E 02
TEMP*                    1             10     2.865171E 02
TEMP*                    1            100     2.999990E 02
TITLE     =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.

LABEL     =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =             1
TIME =   0.3300000E 03
TEMP*                    1              1     2.857493E 02
TEMP*                    1              2     2.713923E 02
TEMP*                    1              3     2.506960E 02
TEMP*                    1              4     2.448345E 02
TEMP*                    1              5     2.857495E 02
TEMP*                    1              6     2.713923E 02
TEMP*                    1              7     2.506961E 02
TEMP*                    1              8     2.448347E 02
TEMP*                    1              9     2.857495E 02
TEMP*                    1             10     2.857493E 02
TEMP*                    1            100     2.999983E 02
TITLE     =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.
```

```
LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =           1
TIME =   0.3600000E 03
TEMP*                  1                1     2.850610E 02
TEMP*                  1                2     2.699785E 02
TEMP*                  1                3     2.486305E 02
TEMP*                  1                4     2.425215E 02
TEMP*                  1                5     2.850613E 02
TEMP*                  1                6     2.699788E 02
TEMP*                  1                7     2.486305E 02
TEMP*                  1                8     2.425217E 02
TEMP*                  1                9     2.850613E 02
TEMP*                  1               10     2.850610E 02
TEMP*                  1              100     2.999988E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =           1
TIME =   0.3900000E 03
TEMP*                  1                1     2.844446E 02
TEMP*                  1                2     2.687141E 02
TEMP*                  1                3     2.467929E 02
TEMP*                  1                4     2.404678E 02
TEMP*                  1                5     2.844446E 02
TEMP*                  1                6     2.687141E 02
TEMP*                  1                7     2.467930E 02
TEMP*                  1                8     2.404677E 02
TEMP*                  1                9     2.844446E 02
TEMP*                  1               10     2.844446E 02
TEMP*                  1              100     2.999985E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =           1
TIME =   0.4200000E 03
TEMP*                  1                1     2.838926E 02
TEMP*                  1                2     2.675835E 02
TEMP*                  1                3     2.451565E 02
TEMP*                  1                4     2.386412E 02
TEMP*                  1                5     2.838926E 02
TEMP*                  1                6     2.675835E 02
TEMP*                  1                7     2.451566E 02
TEMP*                  1                8     2.386413E 02
TEMP*                  1                9     2.838926E 02
TEMP*                  1               10     2.838926E 02
TEMP*                  1              100     2.999985E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =
```

```
DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =              1
TIME =    0.4500000E 03
TEMP*                     1             1     2.833987E 02
TEMP*                     1             2     2.665725E 02
TEMP*                     1             3     2.436981E 02
TEMP*                     1             4     2.370152E 02
TEMP*                     1             5     2.833989E 02
TEMP*                     1             6     2.665728E 02
TEMP*                     1             7     2.436982E 02
TEMP*                     1             8     2.370153E 02
TEMP*                     1             9     2.833989E 02
TEMP*                     1            10     2.833987E 02
TEMP*                     1           100     2.999985E 02
TITLE     =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.

LABEL     =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =              1
TIME =    0.4800000E 03
TEMP*                     1             1     2.827021E 02
TEMP*                     1             2     2.652253E 02
TEMP*                     1             3     2.414202E 02
TEMP*                     1             4     2.345431E 02
TEMP*                     1             5     2.827021E 02
TEMP*                     1             6     2.652253E 02
TEMP*                     1             7     2.414203E 02
TEMP*                     1             8     2.345432E 02
TEMP*                     1             9     2.827021E 02
TEMP*                     1            10     2.827021E 02
TEMP*                     1           100     2.999985E 02
TITLE     =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.

LABEL     =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =              1
TIME =    0.5100000E 03
TEMP*                     1             1     2.818818E 02
TEMP*                     1             2     2.636260E 02
TEMP*                     1             3     2.386217E 02
TEMP*                     1             4     2.314749E 02
TEMP*                     1             5     2.818818E 02
TEMP*                     1             6     2.636262E 02
TEMP*                     1             7     2.386218E 02
TEMP*                     1             8     2.314751E 02
TEMP*                     1             9     2.818818E 02
TEMP*                     1            10     2.818818E 02
TEMP*                     1           100     2.999978E 02
TITLE     =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.

LABEL     =
```

```
DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
TIME =   0.5400000E 03
TEMP*                 1                1     2.811587E 02
TEMP*                 1                2     2.621531E 02
TEMP*                 1                3     2.361725E 02
TEMP*                 1                4     2.287193E 02
TEMP*                 1                5     2.811584E 02
TEMP*                 1                6     2.621531E 02
TEMP*                 1                7     2.361725E 02
TEMP*                 1                8     2.287193E 02
TEMP*                 1                9     2.811584E 02
TEMP*                 1               10     2.811587E 02
TEMP*                 1              100     2.999985E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
TIME =   0.5700000E 03
TEMP*                 1                1     2.805098E 02
TEMP*                 1                2     2.608113E 02
TEMP*                 1                3     2.340143E 02
TEMP*                 1                4     2.262701E 02
TEMP*                 1                5     2.805098E 02
TEMP*                 1                6     2.608113E 02
TEMP*                 1                7     2.340144E 02
TEMP*                 1                8     2.262702E 02
TEMP*                 1                9     2.805098E 02
TEMP*                 1               10     2.805098E 02
TEMP*                 1              100     2.999978E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
TIME =   0.6000000E 03
TEMP*                 1                1     2.799243E 02
TEMP*                 1                2     2.595952E 02
TEMP*                 1                3     2.321016E 02
TEMP*                 1                4     2.240963E 02
TEMP*                 1                5     2.799243E 02
TEMP*                 1                6     2.595952E 02
TEMP*                 1                7     2.321016E 02
TEMP*                 1                8     2.240964E 02
TEMP*                 1                9     2.799243E 02
TEMP*                 1               10     2.799243E 02
TEMP*                 1              100     2.999983E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
```

```
REAL OUTPUT
SUBCASE ID =          1
TIME =   0.6300000E 03
TEMP*                 1               1    2.793953E 02
TEMP*                 1               2    2.584961E 02
TEMP*                 1               3    2.304005E 02
TEMP*                 1               4    2.221654E 02
TEMP*                 1               5    2.793953E 02
TEMP*                 1               6    2.584961E 02
TEMP*                 1               7    2.304006E 02
TEMP*                 1               8    2.221655E 02
TEMP*                 1               9    2.793953E 02
TEMP*                 1              10    2.793953E 02
TEMP*                 1             100    2.999980E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
TIME =   0.6600000E 03
TEMP*                 1               1    2.789172E 02
TEMP*                 1               2    2.575046E 02
TEMP*                 1               3    2.288845E 02
TEMP*                 1               4    2.204482E 02
TEMP*                 1               5    2.789172E 02
TEMP*                 1               6    2.575046E 02
TEMP*                 1               7    2.288845E 02
TEMP*                 1               8    2.204483E 02
TEMP*                 1               9    2.789172E 02
TEMP*                 1              10    2.789172E 02
TEMP*                 1             100    2.999980E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
TIME =   0.6900000E 03
TEMP*                 1               1    2.784856E 02
TEMP*                 1               2    2.566111E 02
TEMP*                 1               3    2.275311E 02
TEMP*                 1               4    2.189187E 02
TEMP*                 1               5    2.784856E 02
TEMP*                 1               6    2.566111E 02
TEMP*                 1               7    2.275313E 02
TEMP*                 1               8    2.189188E 02
TEMP*                 1               9    2.784856E 02
TEMP*                 1              10    2.784856E 02
TEMP*                 1             100    2.999980E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
```

```
SUBCASE ID =          1
TIME =   0.7200000E 03
TEMP*                 1          1   2.780964E 02
TEMP*                 1          2   2.558067E 02
TEMP*                 1          3   2.263217E 02
TEMP*                 1          4   2.175545E 02
TEMP*                 1          5   2.780964E 02
TEMP*                 1          6   2.558067E 02
TEMP*                 1          7   2.263218E 02
TEMP*                 1          8   2.175546E 02
TEMP*                 1          9   2.780964E 02
TEMP*                 1         10   2.780964E 02
TEMP*                 1        100   2.999980E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
TIME =   0.7500000E 03
TEMP*                 1          1   2.777458E 02
TEMP*                 1          2   2.550829E 02
TEMP*                 1          3   2.252398E 02
TEMP*                 1          4   2.163365E 02
TEMP*                 1          5   2.777458E 02
TEMP*                 1          6   2.550830E 02
TEMP*                 1          7   2.252399E 02
TEMP*                 1          8   2.163364E 02
TEMP*                 1          9   2.777458E 02
TEMP*                 1         10   2.777458E 02
TEMP*                 1        100   2.999980E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
TIME =   0.7800000E 03
TEMP*                 1          1   2.774302E 02
TEMP*                 1          2   2.544321E 02
TEMP*                 1          3   2.242713E 02
TEMP*                 1          4   2.152476E 02
TEMP*                 1          5   2.774302E 02
TEMP*                 1          6   2.544321E 02
TEMP*                 1          7   2.242713E 02
TEMP*                 1          8   2.152476E 02
TEMP*                 1          9   2.774302E 02
TEMP*                 1         10   2.774302E 02
TEMP*                 1        100   2.999980E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
```

```
TIME =   0.8100000E 03
TEMP*                 1                1     2.771460E 02
TEMP*                 1                2     2.538469E 02
TEMP*                 1                3     2.234037E 02
TEMP*                 1                4     2.142735E 02
TEMP*                 1                5     2.771460E 02
TEMP*                 1                6     2.538469E 02
TEMP*                 1                7     2.234039E 02
TEMP*                 1                8     2.142735E 02
TEMP*                 1                9     2.771460E 02
TEMP*                 1               10     2.771460E 02
TEMP*                 1              100     2.999980E 02
TITLE     =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.

LABEL     =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
TIME =   0.8400000E 03
TEMP*                 1                1     2.768904E 02
TEMP*                 1                2     2.533208E 02
TEMP*                 1                3     2.226263E 02
TEMP*                 1                4     2.134011E 02
TEMP*                 1                5     2.768906E 02
TEMP*                 1                6     2.533209E 02
TEMP*                 1                7     2.226263E 02
TEMP*                 1                8     2.134012E 02
TEMP*                 1                9     2.768906E 02
TEMP*                 1               10     2.768904E 02
TEMP*                 1              100     2.999980E 02
TITLE     =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE .
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.

LABEL     =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
TIME =   0.8700000E 03
TEMP*                 1                1     2.766606E 02
TEMP*                 1                2     2.528482E 02
TEMP*                 1                3     2.219292E 02
TEMP*                 1                4     2.126197E 02
TEMP*                 1                5     2.766606E 02
TEMP*                 1                6     2.528482E 02
TEMP*                 1                7     2.219293E 02
TEMP*                 1                8     2.126198E 02
TEMP*                 1                9     2.766606E 02
TEMP*                 1               10     2.766606E 02
TEMP*                 1              100     2.999980E 02
TITLE     =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =         AND TEMPERATURE CARDS PUNCHED.

LABEL     =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
TIME =   0.9000000E 03
```

```
TEMP*              1              1   2.767090E 02
TEMP*              1              2   2.528671E 02
TEMP*              1              3   2.222810E 02
TEMP*              1              4   2.129424E 02
TEMP*              1              5   2.767090E 02
TEMP*              1              6   2.528671E 02
TEMP*              1              7   2.222812E 02
TEMP*              1              8   2.129426E 02
TEMP*              1              9   2.767090E 02
TEMP*              1             10   2.767090E 02
TEMP*              1            100   2.999980E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =               1
TIME =   0.9300000E 03
TEMP*              1              1   2.769492E 02
TEMP*              1              2   2.532791E 02
TEMP*              1              3   2.233669E 02
TEMP*              1              4   2.141017E 02
TEMP*              1              5   2.769492E 02
TEMP*              1              6   2.532792E 02
TEMP*              1              7   2.233670E 02
TEMP*              1              8   2.141018E 02
TEMP*              1              9   2.769492E 02
TEMP*              1             10   2.769492E 02
TEMP*              1            100   2.999980E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =               1
POINT ID =               1
TEMP*              1              0   3.000000E 02
TEMP*              1     1109262336   2.987498E 02
TEMP*              1     1111228416   2.966760E 02
TEMP*              1     1113194496   2.948879E 02
TEMP*              1     1115160576   2.932939E 02
TEMP*              1     1117126656   2.918564E 02
TEMP*              1     1119092736   2.905571E 02
TEMP*              1     1121058816   2.8[illegible]3835E 02
TEMP*              1     1123024896   2.883252E 02
TEMP*              1     1125179392   2.873728E 02
TEMP*              1     1125302272   2.865171E 02
TEMP*              1     1125425152   2.857493E 02
TEMP*              1     1125548032   2.850610E 02
TEMP*              1     1125670912   2.844446E 02
TEMP*              1     1125793792   2.838926E 02
TEMP*              1     1125916672   2.833987E 02
TEMP*              1     1126039552   2.827021E 02
TEMP*              1     1126162432   2.818818E 02
TEMP*              1     1126285312   2.811587E 02
TEMP*              1     1126408192   2.805098E 02
TEMP*              1     1126531072   2.799243E 02
TEMP*              1     1126653952   2.793953E 02
```

```
TEMP*              1       1126776832    2.789172E 02
TEMP*              1       1126899712    2.784856E 02
TEMP*              1       1127022592    2.780964E 02
TEMP*              1       1127145472    2.777458E 02
TEMP*              1       1127268352    2.774302E 02
TEMP*              1       1127391232    2.771460E 02
TEMP*              1       1127514112    2.768904E 02
TEMP*              1       1127636992    2.766606E 02
TEMP*              1       1127759872    2.767090E 02
TEMP*              1       1127882752    2.769492E 02
TITLE    =     NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =       1
POINT ID =      2
TEMP*              1                0    3.000000E 02
TEMP*              1       1109262336    2.978250E 02
TEMP*              1       1111228416    2.939788E 02
TEMP*              1       1113194496    2.903755E 02
TEMP*              1       1115160576    2.870679E 02
TEMP*              1       1117126656    2.840625E 02
TEMP*              1       1119092736    2.813474E 02
TEMP*              1       1121058816    2.789028E 02
TEMP*              1       1123024896    2.767068E 02
TEMP*              1       1125179392    2.747371E 02
TEMP*              1       1125302272    2.729722E 02
TEMP*              1       1125425152    2.713923E 02
TEMP*              1       1125548032    2.699785E 02
TEMP*              1       1125670912    2.687141E 02
TEMP*              1       1125793792    2.675835E 02
TEMP*              1       1125916672    2.665725E 02
TEMP*              1       1126039552    2.652253E 02
TEMP*              1       1126162432    2.636260E 02
TEMP*              1       1126285312    2.621531E 02
TEMP*              1       1126408192    2.608113E 02
TEMP*              1       1126531072    2.5[illegible]5952E 02
TEMP*              1       1126653952    2.584961E 02
TEMP*              1       1126776832    2.575046E 02
TEMP*              1       1126899712    2.566111E 02
TEMP*              1       1127022592    2.558067E 02
TEMP*              1       1127145472    2.550829E 02
TEMP*              1       1127268352    2.544321E 02
TEMP*              1       1127391232    2.538469E 02
TEMP*              1       1127514112    2.533208E 02
TEMP*              1       1127636992    2.528482E 02
TEMP*              1       1127759872    2.528671E 02
TEMP*              1       1127882752    2.532791E 02
TITLE    =     NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =       1
POINT ID =      3
TEMP*              1                0    3.000000E 02
TEMP*              1       1109262336    2.952100E 02
```

```
TEMP*                 1       1111228416    2.873252E 02
TEMP*                 1       1113194496    2.806938E 02
TEMP*                 1       1115160576    2.750024E 02
TEMP*                 1       1117126656    2.700610E 02
TEMP*                 1       1119092736    2.657405E 02
TEMP*                 1       1121058816    2.619446E 02
TEMP*                 1       1123024896    2.585981E 02
TEMP*                 1       1125179392    2.556405E 02
TEMP*                 1       1125302272    2.530206E 02
TEMP*                 1       1125425152    2.506960E 02
TEMP*                 1       1125548032    2.486305E 02
TEMP*                 1       1125670912    2.467929E 02
TEMP*                 1       1125793792    2.451565E 02
TEMP*                 1       1125916672    2.436981E 02
TEMP*                 1       1126039552    2.414202E 02
TEMP*                 1       1126162432    2.386217E 02
TEMP*                 1       1126285312    2.361725E 02
TEMP*                 1       1126408192    2.340143E 02
TEMP*                 1       1126531072    2.321016E 02
TEMP*                 1       1126653952    2.304005E 02
TEMP*                 1       1126776832    2.288845E 02
TEMP*                 1       1126899712    2.275311E 02
TEMP*                 1       1127022592    2.263217E 02
TEMP*                 1       1127145472    2.252398E 02
TEMP*                 1       1127268352    2.242713E 02
TEMP*                 1       1127391232    2.234037E 02
TEMP*                 1       1127514112    2.226263E 02
TEMP*                 1       1127636992    2.219292E 02
TEMP*                 1       1127759872    2.222810E 02
TEMP*                 1       1127882752    2.233669E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
POINT ID =          4
TEMP*                 1                0    3.000000E 02
TEMP*                 1       1109262336    2.949839E 02
TEMP*                 1       1111228416    2.864590E 02
TEMP*                 1       1113194496    2.789768E 02
TEMP*                 1       1115160576    2.724622E 02
TEMP*                 1       1117126656    2.667942E 02
TEMP*                 1       1119092736    2.618516E 02
TEMP*                 1       1121058816    2.575278E 02
TEMP*                 1       1123024896    2.537332E 02
TEMP*                 1       1125179392    2.503925E 02
TEMP*                 1       1125302272    2.474437E 02
TEMP*                 1       1125425152    2.448345E 02
TEMP*                 1       1125548032    2.425215E 02
TEMP*                 1       1125670912    2.404678E 02
TEMP*                 1       1125793792    2.386412E 02
TEMP*                 1       1125916672    2.370152E 02
TEMP*                 1       1126039552    2.345431E 02
TEMP*                 1       1126162432    2.314749E 02
TEMP*                 1       1126285312    2.287193E 02
TEMP*                 1       1126408192    2.262701E 02
TEMP*                 1       1126531072    2.240963E 02
TEMP*                 1       1126653952    2.221654E 02
TEMP*                 1       1126776832    2.204482E 02
TEMP*                 1       1126899712    2.189187E 02
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TEMP*          1     1127022592    2.175545E 02
TEMP*          1     1127145472    2.163365E 02
TEMP*          1     1127268352    2.152476E 02
TEMP*          1     1127391232    2.142735E 02
TEMP*          1     1127514112    2.134011E 02
TEMP*          1     1127636992    2.126197E 02
TEMP*          1     1127759872    2.129424E 02
TEMP*          1     1127882752    2.141017E 02
TITLE    =     NON-LINEAR TRANSIENT PROBLEM ... CYCLI[illegible]AL LOADS APPLIE
D
SUBTITLE =       AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =        1
POINT ID =        5
TEMP*          1              0    3.000000E 02
TEMP*          1     1109262336    2.987498E 02
TEMP*          1     1111228416    2.966760E 02
TEMP*          1     1113194496    2.948879E 02
TEMP*          1     1115160576    2.932939E 02
TEMP*          1     1117126656    2.918564E 02
TEMP*          1     1119092736    2.905571E 02
TEMP*          1     1121058816    2.8[illegible]3835E 02
TEMP*          1     1123024896    2.883254E 02
TEMP*          1     1125179392    2.873730E 02
TEMP*          1     1125302272    2.865173E 02
TEMP*          1     1125425152    2.857495E 02
TEMP*          1     1125548032    2.850613E 02
TEMP*          1     1125670912    2.844446E 02
TEMP*          1     1125793792    2.838926E 02
TEMP*          1     1125916672    2.833989E 02
TEMP*          1     1126039552    2.827021E 02
TEMP*          1     1126162432    2.818818E 02
TEMP*          1     1126285312    2.811584E 02
TEMP*          1     1126408192    2.805098E 02
TEMP*          1     1126531072    2.7[illegible]9243E 02
TEMP*          1     1126653952    2.7[illegible]3953E 02
TEMP*          1     1126776832    2.789172E 02
TEMP*          1     1126899712    2.784856E 02
TEMP*          1     1127022592    2.780964E 02
TEMP*          1     1127145472    2.777458E 02
TEMP*          1     1127268352    2.774302E 02
TEMP*          1     1127391232    2.771460E 02
TEMP*          1     1127514112    2.768906E 02
TEMP*          1     1127636992    2.766606E 02
TEMP*          1     1127759872    2.767090E 02
TEMP*          1     1127882752    2.769492E 02
TITLE    =     NON-LINEAR TRANSIENT PROBLEM ... CYCLI[illegible]AL LOADS APPLIE
D
SUBTITLE =       AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =        1
POINT ID =        6
TEMP*          1              0    3.000000E 02
TEMP*          1     1109262336    2.978252E 02
TEMP*          1     1111228416    2.939790E 02
TEMP*          1     1113194496    2.903755E 02
```

```
TEMP*              1      1115160576    2.870679E 02
TEMP*              1      1117126656    2.840625E 02
TEMP*              1      1119092736    2.813474E 02
TEMP*              1      1121058816    2.789028E 02
TEMP*              1      1123024896    2.767068E 02
TEMP*              1      1125179392    2.747371E 02
TEMP*              1      1125302272    2.729724E 02
TEMP*              1      1125425152    2.713923E 02
TEMP*              1      1125548032    2.699788E 02
TEMP*              1      1125670912    2.687141E 02
TEMP*              1      1125793792    2.675835E 02
TEMP*              1      1125916672    2.665728E 02
TEMP*              1      1126039552    2.652253E 02
TEMP*              1      1126162432    2.636262E 02
TEMP*              1      1126285312    2.621531E 02
TEMP*              1      1126408192    2.608113E 02
TEMP*              1      1126531072    2.595952E 02
TEMP*              1      1126653952    2.584961E 02
TEMP*              1      1126776832    2.575046E 02
TEMP*              1      1126899712    2.566111E 02
TEMP*              1      1127022592    2.558067E 02
TEMP*              1      1127145472    2.550830E 02
TEMP*              1      1127268352    2.544321E 02
TEMP*              1      1127391232    2.538469E 02
TEMP*              1      1127514112    2.533209E 02
TEMP*              1      1127636992    2.528482E 02
TEMP*              1      1127759872    2.528671E 02
TEMP*              1      1127882752    2.532792E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =       1
POINT ID =       7
TEMP*              1               0    3.000000E 02
TEMP*              1      1109262336    2.952102E 02
TEMP*              1      1111228416    2.873254E 02
TEMP*              1      1113194496    2.806941E 02
TEMP*              1      1115160576    2.750024E 02
TEMP*              1      1117126656    2.700610E 02
TEMP*              1      1119092736    2.657405E 02
TEMP*              1      1121058816    2.619446E 02
TEMP*              1      1123024896    2.585984E 02
TEMP*              1      1125179392    2.556406E 02
TEMP*              1      1125302272    2.530208E 02
TEMP*              1      1125425152    2.506961E 02
TEMP*              1      1125548032    2.486305E 02
TEMP*              1      1125670912    2.467930E 02
TEMP*              1      1125793792    2.451566E 02
TEMP*              1      1125916672    2.436982E 02
TEMP*              1      1126039552    2.414203E 02
TEMP*              1      1126162432    2.386218E 02
TEMP*              1      1126285312    2.361725E 02
TEMP*              1      1126408192    2.340144E 02
TEMP*              1      1126531072    2.321016E 02
TEMP*              1      1126653952    2.304006E 02
TEMP*              1      1126776832    2.288845E 02
TEMP*              1      1126899712    2.275313E 02
TEMP*              1      1127022592    2.263218E 02
TEMP*              1      1127145472    2.252399E 02
```

```
TEMP*                 1       1127268352    2.242713E 02
TEMP*                 1       1127391232    2.234039E 02
TEMP*                 1       1127514112    2.226263E 02
TEMP*                 1       1127636992    2.219293E 02
TEMP*                 1       1127759872    2.222812E 02
TEMP*                 1       1127882752    2.233670E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
POINT ID =          8
TEMP*                 1                0    3.000000E 02
TEMP*                 1       1109262336    2.949839E 02
TEMP*                 1       1111228416    2.864590E 02
TEMP*                 1       1113194496    2.789768E 02
TEMP*                 1       1115160576    2.724622E 02
TEMP*                 1       1117126656    2.667939E 02
TEMP*                 1       1119092736    2.618516E 02
TEMP*                 1       1121058816    2.575278E 02
TEMP*                 1       1123024896    2.537332E 02
TEMP*                 1       1125179392    2.503927E 02
TEMP*                 1       1125302272    2.474438E 02
TEMP*                 1       1125425152    2.448347E 02
TEMP*                 1       1125548032    2.425217E 02
TEMP*                 1       1125670912    2.404677E 02
TEMP*                 1       1125793792    2.386413E 02
TEMP*                 1       1125916672    2.370153E 02
TEMP*                 1       1126039552    2.345432E 02
TEMP*                 1       1126162432    2.314751E 02
TEMP*                 1       1126285312    2.287193E 02
TEMP*                 1       1126408192    2.262702E 02
TEMP*                 1       1126531072    2.240964E 02
TEMP*                 1       1126653952    2.221655E 02
TEMP*                 1       1126776832    2.204483E 02
TEMP*                 1       1126899712    2.189188E 02
TEMP*                 1       1127022592    2.175546E 02
TEMP*                 1       1127145472    2.163364E 02
TEMP*                 1       1127268352    2.152476E 02
TEMP*                 1       1127391232    2.142735E 02
TEMP*                 1       1127514112    2.134012E 02
TEMP*                 1       1127636992    2.126198E 02
TEMP*                 1       1127759872    2.129426E 02
TEMP*                 1       1127882752    2.141018E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =          1
POINT ID =          9
TEMP*                 1                0    3.000000E 02
TEMP*                 1       1109262336    2.987498E 02
TEMP*                 1       1111228416    2.966760E 02
TEMP*                 1       1113194496    2.948879E 02
TEMP*                 1       1115160576    2.932939E 02
TEMP*                 1       1117126656    2.918564E 02
```

```
TEMP*            1      1119092736    2.905571E 02
TEMP*            1      1121058816    2.893835E 02
TEMP*            1      1123024896    2.883254E 02
TEMP*            1      1125179392    2.873730E 02
TEMP*            1      1125302272    2.865173E 02
TEMP*            1      1125425152    2.857495E 02
TEMP*            1      1125548032    2.850613E 02
TEMP*            1      1125670912    2.844446E 02
TEMP*            1      1125793792    2.838926E 02
TEMP*            1      1125916672    2.833989E 02
TEMP*            1      1126039552    2.827021E 02
TEMP*            1      1126162432    2.818818E 02
TEMP*            1      1126285312    2.811584E 02
TEMP*            1      1126408192    2.805098E 02
TEMP*            1      1126531072    2.799243E 02
TEMP*            1      1126653952    2.793953E 02
TEMP*            1      1126776832    2.789172E 02
TEMP*            1      1126899712    2.784856E 02
TEMP*            1      1127022592    2.780964E 02
TEMP*            1      1127145472    2.777458E 02
TEMP*            1      1127268352    2.774302E 02
TEMP*            1      1127391232    2.771460E 02
TEMP*            1      1127514112    2.768906E 02
TEMP*            1      1127636992    2.766606E 02
TEMP*            1      1127759872    2.767090E 02
TEMP*            1      1127882752    2.769492E 02
TITLE    =    NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =     AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =     1
POINT ID =     10
TEMP*            1               0    3.000000E 02
TEMP*            1      1109262336    2.987498E 02
TEMP*            1      1111228416    2.966760E 02
TEMP*            1      1113194496    2.948879E 02
TEMP*            1      1115160576    2.932939E 02
TEMP*            1      1117126656    2.918564E 02
TEMP*            1      1119092736    2.905571E 02
TEMP*            1      1121058816    2.893835E 02
TEMP*            1      1123024896    2.883252E 02
TEMP*            1      1125179392    2.873728E 02
TEMP*            1      1125302272    2.865171E 02
TEMP*            1      1125425152    2.857493E 02
TEMP*            1      1125548032    2.850610E 02
TEMP*            1      1125670912    2.844446E 02
TEMP*            1      1125793792    2.838926E 02
TEMP*            1      1125916672    2.833987E 02
TEMP*            1      1126039552    2.827021E 02
TEMP*            1      1126162432    2.818818E 02
TEMP*            1      1126285312    2.811587E 02
TEMP*            1      1126408192    2.805098E 02
TEMP*            1      1126531072    2.799243E 02
TEMP*            1      1126653952    2.793953E 02
TEMP*            1      1126776832    2.789172E 02
TEMP*            1      1126899712    2.784856E 02
TEMP*            1      1127022592    2.780964E 02
TEMP*            1      1127145472    2.777458E 02
TEMP*            1      1127268352    2.774302E 02
TEMP*            1      1127391232    2.771460E 02
```

```
TEMP*                  1      1127514112    2.768904E 02
TEMP*                  1      1127636992    2.766606E 02
TEMP*                  1      1127759872    2.767090E 02
TEMP*                  1      1127882752    2.769492E 02
TITLE    =      NON-LINEAR TRANSIENT PROBLEM ... CYCLICAL LOADS APPLIE
D
SUBTITLE =        AND TEMPERATURE CARDS PUNCHED.

LABEL    =

DISPLACEMENTS
REAL OUTPUT
SUBCASE ID =           1
POINT ID =          100
TEMP*                  1               0    3.000000E 02
TEMP*                  1      1109262336    2.999988E 02
TEMP*                  1      1111228416    2.999998E 02
TEMP*                  1      1113194496    2.999988E 02
TEMP*                  1      1115160576    2.999995E 02
TEMP*                  1      1117126656    2.999983E 02
TEMP*                  1      1119092736    2.999993E 02
TEMP*                  1      1121058816    2.999983E 02
TEMP*                  1      1123024896    2.999990E 02
TEMP*                  1      1125179392    2.999983E 02
TEMP*                  1      1125302272    2.999990E 02
TEMP*                  1      1125425152    2.999983E 02
TEMP*                  1      1125548032    2.999988E 02
TEMP*                  1      1125670912    2.999985E 02
TEMP*                  1      1125793792    2.999985E 02
TEMP*                  1      1125916672    2.999985E 02
TEMP*                  1      1126039552    2.999985E 02
TEMP*                  1      1126162432    2.999978E 02
TEMP*                  1      1126285312    2.999985E 02
TEMP*                  1      1126408192    2.999978E 02
TEMP*                  1      1126531072    2.999983E 02
TEMP*                  1      1126653952    2.999980E 02
TEMP*                  1      1126776832    2.999980E 02
TEMP*                  1      1126899712    2.999980E 02
TEMP*                  1      1127022592    2.999980E 02
TEMP*                  1      1127145472    2.999980E 02
TEMP*                  1      1127268352    2.999980E 02
TEMP*                  1      1127391232    2.999980E 02
TEMP*                  1      1127514112    2.999980E 02
TEMP*                  1      1127636992    2.999980E 02
TEMP*                  1      1127759872    2.999980E 02
TEMP*                  1      1127882752    2.999980E 02
```

* * * END OF JOB * * *

```
NASTRAN LOADED AT LOCATION 10FA38
*      0 CPU-SEC       0 E-SEC        0 IO-CNT  SEM1   BEGN
*      0 CPU-SEC       0 E-SEC        0 IO-CNT  SEMT
*      1 CPU-SEC       3 E-SEC        0 IO-CNT  NAST
*      1 CPU-SEC       3 E-SEC        0 IO-CNT  GNFI
*      1 CPU-SEC       4 E-SEC        0 IO-CNT  XCSA
*      1 CPU-SEC       6 E-SEC        0 IO-CNT  IFP1
*      1 CPU-SEC      10 E-SEC        0 IO-CNT  XSOR
*      2 CPU-SEC      15 E-SEC        0 IO-CNT    DO   IFP
*      2 CPU-SEC      31 E-SEC        0 IO-CNT   END   IFP
*      2 CPU-SEC      31 E-SEC        0 IO-CNT  XGPI
*      4 CPU-SEC      39 E-SEC        0 IO-CNT  SEM1   END
*      5 CPU-SEC      40 E-SEC        0 IO-CNT  CORE   LEFT      48432
*      5 CPU-SEC      40 E-SEC        0 IO-CNT  LINK   BEGN      NS02
*      5 CPU-SEC      41 E-SEC        0 IO-CNT  ----   LINK END ---
*      5 CPU-SEC      42 E-SEC        0 IO-CNT  XSFA
*      5 CPU-SEC      43 E-SEC        0 IO-CNT  XSFA
*      5 CPU-SEC      43 E-SEC        0 IO-CNT  4      GP1       BEGN
*      5 CPU-SEC      50 E-SEC        0 IO-CNT  4      GP1       END
*      5 CPU-SEC      50 E-SEC        0 IO-CNT  7      GP2       BEGN
*      5 CPU-SEC      51 E-SEC        0 IO-CNT  7      GP2       END
*      5 CPU-SEC      52 E-SEC        0 IO-CNT  9      PLTHBDY   BEGN
*      5 CPU-SEC      56 E-SEC        0 IO-CNT  9      PLTHBDY   END
*      5 CPU-SEC      57 E-SEC        0 IO-CNT  9      PLTSET    BEGN
*      5 CPU-SEC      62 E-SEC        0 IO-CNT  9      PLTSET    END
*      5 CPU-SEC      63 E-SEC        0 IO-CNT  11     PRTMSG    BEGN
*      5 CPU-SEC      63 E-SEC        0 IO-CNT  11     PRTMSG    END
*      5 CPU-SEC      63 E-SEC        0 IO-CNT  12     SETVAL    BEGN
*      5 CPU-SEC      63 E-SEC        0 IO-CNT  12     SETVAL    END
*      5 CPU-SEC      64 E-SEC        0 IO-CNT  15     PLOT      BEGN
*      6 CPU-SEC      71 E-SEC        0 IO-CNT  15     PLOT      END
*      6 CPU-SEC      71 E-SEC        0 IO-CNT  17     PRTMSG    BEGN
*      6 CPU-SEC      72 E-SEC        0 IO-CNT  17     PRTMSG    END
*      6 CPU-SEC      72 E-SEC        0 IO-CNT  17     EXIT      BEGN
```

G O D D A R D   S P A C E   F L I G H T   C E N T E R   N A S A
* * * * * * *   * * * * *   * * * * * *   * * * * * *   * * * *

THE

```
V        V     I     EEEEEEE     W             W
V        V     I     E           W             W
 V      V      I     E            W           W
 V      V      I     E            W           W
  V    V       I     EEEE          W    W    W
  V    V       I     EEEE          W    W    W
   V  V        I     E              W  WWW  W
   V  V        I     E              W  WWW  W
    VV         I     E               WW   WW
    VV         I     EEEEEEF         WW   WW
```

PROGRAM

ED PUCCINELLI
REG MITCHELL
CLIFF JACKSON

VERSION TWO----AUGUST 22, 1974

DATE 1/ 1/76
TIME 8.04.04

****
* CASE 1 *
****

PROBLEM TITLE   GENERATE RADMTX AND RADLST CARDS ... PROBLEM TWELVE

CASE CONTROL CARD

COLUMNS	VARIABLE	VALUE	DESCRIPTION
9-16	IENDTM	1	ENTER CPU TIME USED ON JOB CARD (IN MINUTES--USE H FOR ONE-HALF MINUTE) DEFAULT IENDTM=100000 (SEE DOCUMENTATION).
17-24	NT	0	LE 0 -DO NOT COPY INPUT DATA ONTO TAPE (UNIT 2) FOR RESTART USE GT 0 -COPY INPUT DATA ONTO TAPE (UNIT 2) FOR RESTART USE
25-32	NVFCAL	0	GT 0 -VF CALCULATED USING FINITE DIFFERENCE METHOD LT 0 -VF CALCULATED USING CONTOUR INTEGRATION METHOD EQ 0 -PROGRAM SELECTS METHOD TO BE USED (SEE DOCUMENTATION)
33-40	NFE	0	LE 0 -MESH SIZE FOR EACH ELEMENT SPECIFIED ON INPUT DATA GT 0 -MESH SIZE SET TO 1 BY 1 FOR EACH ELEMENT. (OVERRIDES INPUT DATA)
41-48	NFS	0	GE 0 -SHADING CONSIDERED USING DATA FROM INPUT LT 0 -NEGLECT ALL SHADING
49-56	RMAX	0.0	MAXIMUM AREA/DISTANCE RATIO. DEFAULT RMAX = 0.1 (SEE DOCUMENTATION).

NASTRAN FORMATTED INPUT

SEMI-SORTED BULK DATA ECHO

1	2	3	4	5	6	7	8	9	10
********	********	********	********	********	********	********	********	********	********
CHBDY	200	2000	AREA4	1	2	6	5	10	
CHBDY	300	2000	AREA4	2	3	7	6	10	
CHBDY	400	2000	AREA4	3	4	8	7	10	
CHBDY	500	2000	AREA4	5	6	2	1	10	
CHBDY	600	2000	AREA4	6	7	3	2	10	
CHBDY	700	2000	AREA4	7	8	4	3	10	
GRID	1		0.	0.	0.				
GRID	2		.1	0.	0.				
GRID	3		.2	0.	0.				
GRID	4		.3	0.	0.				
GRID	5		0.	.1	0.				
GRID	6		.1	.1	0.				
GRID	7		.2	.1	0.				
GRID	8		.3	.1	0.				
GRID	9		0.	.2	0.				
GRID	10		0.	-.1	0.				
GRID	100		-.05	.05	0.				
PHBDY	300	3000	.314						
PHBDY	2000			.90					
SVIEW	10	0	0	3	3				

****

INPUT SUMMARY

NUMBERS OF COMPLETE LOGICAL CARD TYPES DETECTED

CHBDY = 6   CORD1 = 0   CORD2 = 0   GRDSET = 0   GRID = 11   PHBDY = 2   VIEW = 1

****

WARNING 33 ..... 103 LOGICAL CARD(S) DETECTED OF TYPE(S) NOT RECOGNIZED BY VIEW

```
                                   VIEW FACTORS
                                   ************

                                                                                           VF SUM FROM
ELEMENT     AREA          ELEM TO ELEM = VIEW FACTOR        ELEM TO ELEM = VIEW FACTOR       ELEMENT
.......     ....          ............   ...........        ............   ...........     ...........

    200   0.10000E-01*****************************************************************************************
                                                                                               0.0

    300   0.10000E-01*****************************************************************************************
                                                                                               0.0

    400   0.10000E-01*****************************************************************************************
                                                                                               0.0

    500   0.10000E-01*****************************************************************************************
                                                                                               0.0

    600   0.10000E-01*****************************************************************************************
                                                                                               0.0

    700   0.10000E-01*****************************************************************************************
                                                                                               0.0
```

PROGRAM SUMMARY FOR CASE 1
****

PROGRAM TERMINATED NORMALLY

CPU TIME(SECONDS)

PROCESSING OF INPUT DATA= 0
VIEW FACTOR COMPUTATIONS= 0

NUMBER OF VIEW FACTOR COMPUTATIONS

FINITE DIFFERENCE= 0
CONTOUR INTEGRAL= 0

REQUESTED CORE SPACE ALLOWS	THE INPUT DATA GENERATED
272 ELEMENTS	6 ELEMENTS
599 SUB-ELEMENTS	54 SUB-ELEMENTS
1232 SUB-ELEMENTS AFTER COMPRESSION	
816 GRID POINTS	11 GRID POINTS

53K BYTES OF CORE WERE NOT USED IN THIS CASE.

(55K ON ELEMENTS, 53K ON SUB-ELEMENTS AND 56K ON GRID POINTS.)

****
* END CASE 1 *
****

```
***********************
**** RUN COMPLETED ****
***********************
```

RADMTX	1.0	.0	.0	.0	.0	.0
RADMTX	2.0	.0	.0	.0	.0	
RADMTX	3.0	.0	.0	.0		
RADMTX	4.0	.0	.0			
RADMTX	5.0	.0				
RADMTX	6.0					
RADLST	200	300	400	500	600	700

N A S T R A N

MSC - 8

VERSION DEC 12, 1973

IBM 360-370 SERIES

MODELS 91,95

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*********************************************************************************
$ START OF EXECUTIVE CONTROL ******************************************************
$*********************************************************************************
$
ID CLASS PROBLEM THIRTEEN, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE LINEAR STEADY-STATE SOLUTION ALGORITHM IS TO BE USED
$
SOL 1
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
$
$ THE FOLLOWING ALTER IS REQUIRED TO GENERATE PLOTS USING A SPECIAL
$ VERSION OF NASTRAN WHICH IS REQUESTED BY THE JOB CONTROL STATEMENTS.
$
$-- VARIANCE ANALYSIS AND PLOT OF HBDY ELEMENTS --- 1 ------- 11/21/73 -00000010
$      APPROACH HEAT        SOL 1                                        00000020
$      MODULES                                                           00000030
$         PLTHBDY  MAKES HBDY ELEMENTS PLOTTABLE, CAN PRINT MESH DATA    00000040
$         VARIAN   COMPUTES DERIVATIVES EVERY LOOP, VARIANCES LAST LOOP  00000050
$      DATA CARDS                                                        00000060
$         1PARM    SELECT SIZE OF PARAMETER VARIATION (DEFAULT = 1.0)    00000070
$         1VARY    SPECIFY FUNCTIONAL DEPENDENCE OF INPUT UPON PARAMETERS00000080
$         VARIAN   SPECIFY DEVIATION OF PARAMETERS                       00000090
$         PARAM  DELTA  DENOMINATOR FOR DERIVATIVE (DEFAULT = 1.0)       00000100
$         PARAM  MESH   PRINT MESH DATA IF EQUAL YES  (DEFAULT = NO)     00000110
$      SYSTEM(62)       JRUN,  MUST BE SET FOR MANUAL MODE               00000120
$      DIAG 40  WILL PRINT MESSAGES ABOUT VARIED DATA CARDS              00000130
$ THE FIRST RUN (JRUN.EQ.0) MUST WRITE NPTP AND INPT TAPES               00000140
$ ADDITIONAL RUNS (JRUN.GE.1) MUST READ OPTP AND READ/WRITE INPT TAPES   00000150
ALTER 9,9                                                                00000160
PLTHBDY  GEOM2,ECT,EPT,SIL,EQEXIN,BGPDT/PECT,PSIL,PEQIN,PBGPDT/V,N,      00000170
         NHBDY/V,Y,MESH=NO $                                             00000180
SAVE     NHBDY $                                                         00000190
EQUIV    ECT,PECT/NHBDY/SIL,PSIL/NHBDY/EQEXIN,PEQIN/NHBDY/               00000200
         BGPDT,PBGPDT/NHBDY $                                            00000210
PLTSET   PCDB,PEQIN,PECT/PLTSETX,PLTPAR,GPSETS,ELSETS/V,N,NSIL/V,N,      00000220
```

NASTRAN EXECUTIVE CONTROL DECK ECHO

```
        JUMPPLOT $                                                      00000230
ALTER 15,15                                                             00000240
PLOT    PLTPAR,GPSETS,ELSETS,CASECC,PBGPDT,PEQIN,PSIL,,,,/PLOTX1/ V,N,  00000250
        NSIL/V,N,LUSET/V,N,JUMPPLOT/V,N,PLTFLG/V,N,PFILE $              00000260
ALTER 17
EXIT $
ENDALTER
$
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $*****************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ****************************
  4      $*****************************************************************************
  5      $
  6      TITLE=          LINEAR STEADY-STATE PROBLEM ... PLOT CHBDY CARDS
  7      $
  8      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT .NCLUDE HEADINGS AT TOP OF PAGE)
  9      $
 10      LINE=51
 11      $
 12      $ REQUEST SORTED AND UNSORTED OUTPUT
 13      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 14      $
 15      ECHO=BOTH
 16      $
 17      $ SELECT THE SPC, MPC, AND LOAD SETS TO BE USED IN THIS SOLUTION
 18      $
 19      SPC=100
 20      MPC=200
 21      LOAD=300
 22      $
 23      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 24      $
 25      TEMP(MATERIAL)=400
 26      $
 27      $ SELECT THE OUTPUT DESIRED (TEMPERATURES. LOADS, AND CONSTRAINT POWERS)
 28      $
 29      OUTPUT
 30      THERMAL=ALL
 31      OLOAD=ALL
 32      SPCF=ALL
 33      $
 34      $ THE FOLLOWING CARDS REQUEST THE CHBDY PLOT
 35      $
 36      OUTPUT(PLOT)
 37      SET 1 INCLUDE HBDY
 38      FIND SET 1 ORIGIN 1 SCALE
 39      PLOT SET 1 ORIGIN 1 LABEL GRID POINTS
 40      PLOT SET 1 ORIGIN 1 LABEL ELEMENTS
 41      $
 42      $*****************************************************************************
 43      $ END CASE CONTROL --- START BULK DATA ****************************************
 44      $*****************************************************************************
 45      $
 46      BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
    1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY
$
MAT4    1000    200.                                                    ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
$HBDY   60      300     LINE    1       5                               +CONVEC
$CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
     1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5       10
CHBDY   300     2000    AREA4   2       3       7       6       10
CHBDY   400     2000    AREA4   3       4       8       7       10
CHBDY   500     2000    AREA4   5       6       2       1       10
CHBDY   600     2000    AREA4   6       7       3       2       10
CHBDY   700     2000    AREA4   7       8       4       3       10
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
        .   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
        $*******************************************************************************
        $ THESE COMMENTS, WHICH DO NOT APPEAR IN THE VIEW RUN, APPLY TO CHANGES
        $ MADE FOR PROBLEM TWELVE.
        $ THE BULK DATA DECK FOR PROBLEM TWO WAS INPUT DIRECTLY TO THE VIEW PROGRAM
        $ WITH ONLY THREE CHANGES ... A $VIEW CARD WAS ADDED. CHBDY CARDS
        $ 200 THROUGH 700 WERE REFERENCED TO THIS VIEW CARD BY PUNCHING THE VIEW CARD
        $ NUMBER IN FIELD NINE, AND CHBDY CARD 60 AND ITS CONTINUATION CARD WERE
        $ REMOVED FROM THE DECK BY PLACING A $ IN COLUMN ONE OF EACH CARD.
        $ IT SHOULD BE NOTED THAT THE $VIEW CARD IS READ AS A COMMENT CARD BY NASTRAN,
        $ BUT IS READ AS A DATA CARD BY THE VIEW PROGRAM. ALL OTHER CARDS BEGINNING
        $ WITH A $ WHICH ARE FOUND IN THE VIEW PROGRAM ARE IGNORED.
        $ NO VIEW FACTOR COMPUTATIONS WERE DESIRED FOR CHBDY CARD 60.
        $ ALSO, UNIT SEVEN HAS BEEN DIRECTED TO THE PRINTER SO THE RADMTX AND RADLST
        $ CARDS PRODUCED MAY BE DIRECTLY VIEWED.
        $
        $VIEW   10      0       0       3       3
        $
        $*******************************************************************************
        $ CARDS ADDED TO CONVERT PROBLEM TWELVE TO PROBLEM THIRTEEN ... AN
        $ ALTER HAS BEEN ADDED IN THE EXECUTIVE CONTROL, SOL 1 HAS BEEN CHANGED TO
        $ SOL 3, PLOT REQUEST CARDS HAVE BEEN
        $ ADDED TO THE CASE CONTROL, AND A SPECIAL VERSION OF THE NASTRAN PROGRAM
        $ HAS BEEN REQUESTED IN THE JOB CONTROL STATEMENTS.
        $ ALSO NOTE THAT SOL 1 IS REQUESTED IN CASE CONTROL, AS THE ALTER
        $ IS DESIGNED FOR IT ... EXECUTION WILL TERMINATE AFTER THE PLOTS ARE PRODUCED.
        $
        $*******************************************************************************
        $ END OF BULK DATA *************************************************************
        $*******************************************************************************
        $
        ENDDATA
```

TOTAL COUNT= 133

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED,XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 .
1-	CHBDY	200	2000	AREA4	1	2	6	5	10	
2-	CHBDY	300	2000	AREA4	2	3	7	6	10	
3-	CHBDY	400	2000	AREA4	3	4	8	7	10	
4-	CHBDY	500	2000	AREA4	5	6	2	1	10	
5-	CHBDY	600	2000	AREA4	6	7	3	2	10	
6-	CHBDY	700	2000	AREA4	7	8	4	3	10	
7-	CQUAD2	30	200	1	2	6	5			
8-	CQUAD2	40	200	2	3	7	6			
9-	CQUAD2	50	200	3	4	8	7			
10-	CROD	10	100	10	2					
11-	CROD	20	100	9	6					
12-	GRID	1		0.0	0.0	0.0				
13-	GRID	2		.1	0.0	0.0				
14-	GRID	3		.2	0.0	0.0				
15-	GRID	4		.3	0.0	0.0				
16-	GRID	5		0.0	.1	0.0				
17-	GRID	6		.1	.1	0.0				
18-	GRID	7		.2	.1	0.0				
19-	GRID	8		.3	.1	0.0				
20-	GRID	9		0.0	.2	0.0				
21-	GRID	10		0.0	-.1	0.0				
22-	GRID	100		-.05	.05	0.0				
23-	MAT4	1000	200.							ALUMINUM
24-	MAT4	3000	200.							
25-	MPC	200	9	1	1.	5	1	-1.		
26-	MPC	200	10	1	1.	1	1	-1.		
27-	PARAM	EPSHT	.0001							
28-	PARAM	MAXIT	8							
29-	PARAM	SIGMA	5.685E-8							
30-	PARAM	TABS	273.15							
31-	PHBDY	300	3000	.314						
32-	PHBDY	2000			.90					
33-	PQUAD2	200	1000	.01						
34-	PROD	100	1000	.001						
35-	RADLST	200	300	400	500	600	700			
36-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
37-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
38-	RADMTX	3	0.0	0.0	0.0	0.0				
39-	RADMTX	4	0.0	0.0	0.0					
40-	RADMTX	5	0.0	0.0						
41-	RADMTX	6	0.0							
42-	SLOAD	300	1	4.	2	8.				
43-	SLOAD	300	3	8.	4	4.				
44-	SLOAD	300	5	4.	6	8.				
45-	SLOAD	300	7	8.	8	4.				
46-	SPC1	100	1	100						
47-	TEMP	400	100	300.						
48-	TEMPD	400	300.							
	ENDDATA									

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

*** USER WARNING MESSAGE  54,
    PARAMETER NAMED EPSHT    NOT REFERENCED

*** USER WARNING MESSAGE  54,
    PARAMETER NAMED MAXIT    NOT REFERENCED

*** USER WARNING MESSAGE  54,
    PARAMETER NAMED SIGMA    NOT REFERENCED

*** USER WARNING MESSAGE  54,
    PARAMETER NAMED TABS     NOT REFERENCED

      **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**
```

MESSAGES FROM THE PLOT MODULE

P L O T T E R   D A T A

THE FOLLOWING PLOTS ARE FOR AN SC 4020 PLOTTER

AN END-OF-FILE MARK FOLLOWS THE LAST PLOT

THE FOLLOWING PLOTS ARE REQUESTED ON PAPER ONLY

E N G I N E E R I N G   D A T A

ORTHOGRAPHIC PROJECTION
ROTATIONS (DEGREES) - GAMMA = 34.27, BETA = 23.17, ALPHA = 0.0 , AXES = +X,+Y,+Z, SYMMETRIC
SCALE (OBJECT-TO-PLOT SIZE) = 2.794795E 01

ORIGIN 1 - XO = -1.789886E-06, YO = -4.920804E 00 (INCHES)

MESSAGES FROM THE PLOT MODULE

PLOT 1 UNDEFORMED SHAPE

MESSAGES FROM THE PLOT MODULE

P L O T T E R   D A T A

THE FOLLOWING PLOTS ARE FOR AN SC 4020 PLOTTER

AN END-OF-FILE MARK FOLLOWS THE LAST PLOT

THE FOLLOWING PLOTS ARE REQUESTED ON PAPER ONLY

E N G I N E E R I N G   D A T A

ORTHOGRAPHIC PROJECTION
ROTATIONS (DEGREES) - GAMMA = 34.27, BETA = 23.17, ALPHA =   0.0 , AXES = +X,+Y,+Z, SYMMETRIC
SCALE (OBJECT-TO-PLOT SIZE) = 2.794795E 01

ORIGIN   1   -   XO = -1.789886E-06, YO = -4.920804E 00   (INCHES)

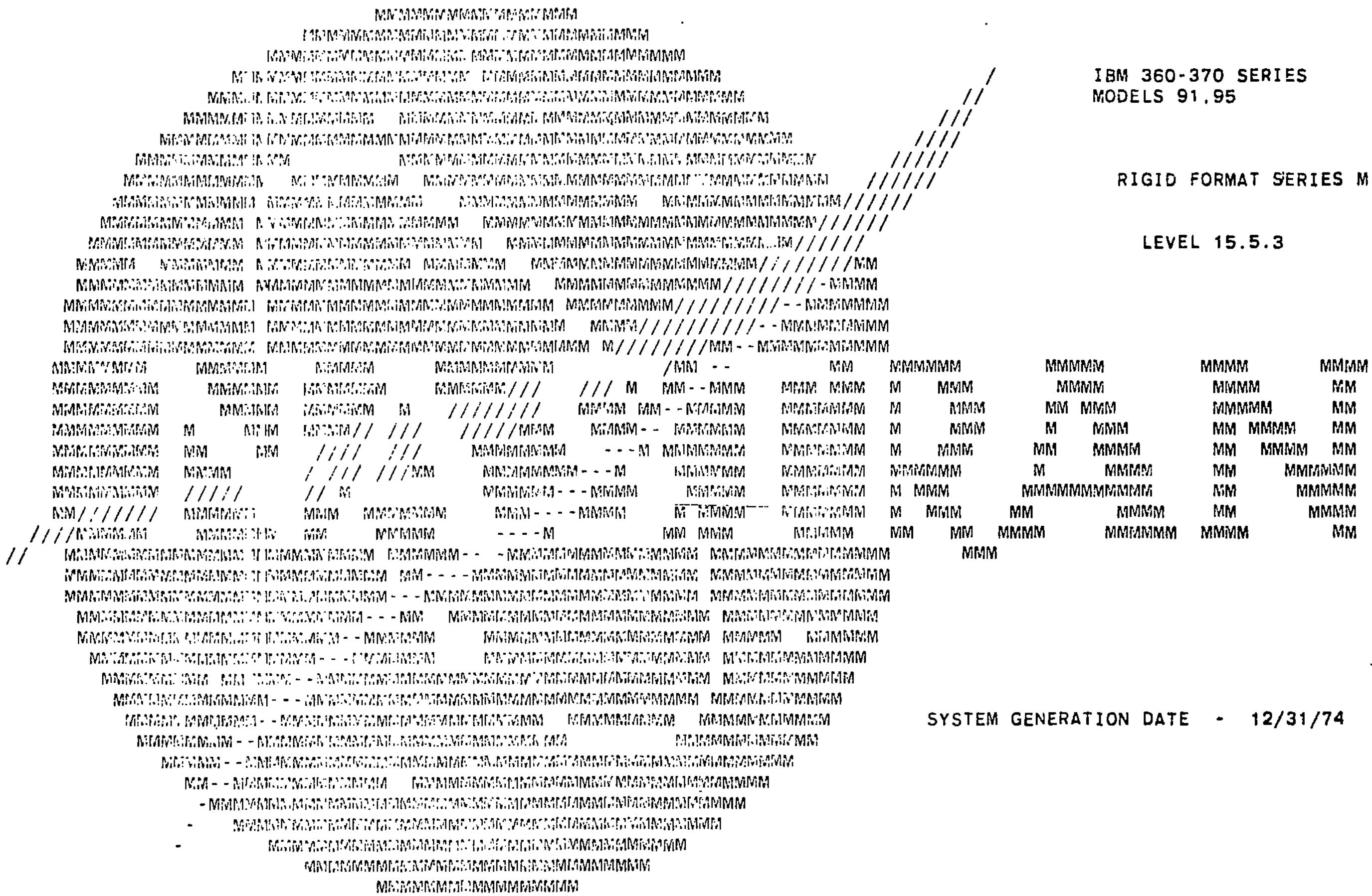
MESSAGES FROM THE PLCT MODULE

PLOT 2 UNDEFORMED SHAPE

IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3



SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*************************************************************************
$ START OF EXECUTIVE CONTROL *********************************************
$*************************************************************************
$
ID CLASS PROBLEM FOURTEEN, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR TRANSIENT SOLUTION ALGORITHM IS TO BE USED
$
SOL 9
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $*************************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ****************************
  4      $*************************************************************************************
  5      $
  6      TITLE=      NON-LINEAR TRANSIENT PROBLEM ... LARGE THERMAL MASS TO
  7      SUBTITLE=   CONSTRAIN A GRID POINT TO A FIXED TEMPERATURE
  8      $
  9      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
 10      $
 11      LINE=51
 12      $
 13      $ REQUEST SORTED AND UNSORTED OUTPUT
 14      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 15      $
 16      ECHO=BOTH
 17      $
 18      $ SELECT THE MPC AND LOAD SETS TO BE USED IN THIS SOLUTION
 19      $ NOTE THAT NO SPC SET IS SELECTED, AND THAT DLOAD HAS REPLACED LOAD.
 20      $
 21      MPC=200
 22      DLOAD=300
 23      $
 24      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 25      $ THE SELECTION OF THIS SET IS OPTIONAL FOR SOL 9, BUT SHOULD BE MADE IF
 26      $ THE FINAL TEMPERATURE IS SEVERAL HUNDRED DEGREES DIFFERENT FROM THE
 27      $ IC VECTOR, AND RADIATIVE INTERCHANGES APE INCLUDED.
 28      $
 29      TEMP(MATERIAL)=400
 30      $
 31      $ SELECT THE STEP SIZE, NUMBER OF INCREMENTS, AND PRINTOUT FREQUENCY
 32      $
 33      TSTEP=500
 34      $
 35      $ SELECT THE TEMPERATURE SET DEFINING THE TEMPERATURE VECTOR AT T=0.
 36      $
 37      IC=600
 38      $
 39      $ SELECT OUTPUT DESIRED
 40      $
 41      OUTPUT
 42      $
 43      $ DEFINE A GROUP OF GRID POINTS TO BE REFERENCED BY AN OUTPUT REQUEST
 44      $
 45      SET 5 = 1,2,3,4,5,6,7,8,100
 46      $
 47      $ REFERENCE A PREVIOUSLY DEFINED GROUP OF GRID POINTS
 48      $
 49      THERMAL=5
 50      $
 51      $*************************************************************************************
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
52      $ END CASE CONTROL --- START BULK DATA ****************************************
53      $***********************************************************************************
54      $
55      BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY AND THERMAL MASS
$
MAT4    1000    200.    2.426+6                                         ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
     1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       6.
SLOAD   300     7       8.      8       4.
$
$******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100             100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED FOR THE TRANSIENT SOLUTION ----------
$ THEY CONVERT PROBLEM TWO TO PROBLEM THREE
$ NOTE THAT THE SPC1 SET WAS NOT SELECTED IN CASE CONTROL
$ NOTE THAT SPCF OUTPUT IS NOT REQUESTED IN TRANSIENT
$ NOTE THAT THERMAL MASS WAS ADDED TO 'MAT4' CARD 1000
$ NOTE THAT THE DIAG CARD IN THE EXECUTIVE CONTROL WAS IRRELEVANT
$ NOTE THAT THE LOAD REQUEST IN CASE CONTROL IS NOW A DLOAD REQUEST
$
$
$ TRANSIENT SINGLE POINT CONSTRAINT METHOD
$ CONSTRAIN GRID POINT 100 TO 300 DEGREES CELSIUS
$
$ELAS2  300     1.+5    100     1
$LOAD   300     100     300.+5
$
$ DEFINES A CONSTANT LOAD SET APPLIED FROM T=0. TO T=1.+6 SECONDS
$
TLOAD2  300     300                             0.      1.+6    0.      0.      +TL1
+TL1    0.      0.
$
$ DEFINES THE NUMBER OF INCREMENTS, THE STEP SIZE  AND THE PRINTOUT FREQUENCY
$ REFERENCED IN CASE CONTROL AS 'TSTEP'
$ EACH TIME STEP IS 30 SECONDS
$
TSTEP   500     45      30.     1
$
$ DEFINES A TEMPERATURE VECTOR --- REFERENCED IN CASE CONTROL AS 'IC'
$
TEMPD   600     300.
$
$*******************************************************************************
$ TO CONVERT PROBLEM THREE TO PROBLEM FOURTEEN, A CELAS2 CARD AND AN SLOAD
$ CARD WERE REMOVED BY CONVERSION TO COMMENT CARDS (SEE ABOVE), AND
$ A CDAMP2 CARD HAS BEEN ADDED TO REPLACE THEM BY APPLYING A LARGE THERMAL MASS
$ TO GRID POINT 100 TO FIX ITS TEMPERATURE. THE VALUE OF THE THERMAL MASS
$ APPLIED IS ARBITRARY, BUT MUST BE MUCH LARGER THAN THAT APPLIED TO THE
$ OTHER GRID POINTS IN THE PROBLEM.
$ TO REDUCE THE OUTPUT VOLUME, THE ONLY OUTPUT REQUESTED IN THIS
$ RUN IS THERMAL=5
$
CDAMP2  70      5.E+8   100     1
$
$*******************************************************************************
$ END OF BULK DATA *************************************************************
$*******************************************************************************
$
ENDDATA
```

TOTAL COUNT= 150

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED.XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
1-	CDAMP2	70	5.E+8	100	1					
2-	CHBDY	60	300	LINE	1	5				+CONVEC
3-	+CONVEC	100	100							
4-	CHBDY	200	2000	AREA4	1	2	6	5		
5-	CHBDY	300	2000	AREA4	2	3	7	6		
6-	CHBDY	400	2000	AREA4	3	4	8	7		
7-	CHBDY	500	2000	AREA4	5	6	2	1		
8-	CHBDY	600	2000	AREA4	6	7	3	2		
9-	CHBDY	700	2000	AREA4	7	8	4	3		
10-	CQUAD2	30	200	1	2	6	5			
11-	CQUAD2	40	200	2	3	7	6			
12-	CQUAD2	50	200	3	4	8	7			
13-	CROD	10	100	10	2					
14-	CROD	20	100	9	5					
15-	GRID	1		0.0	0.0	0.0				
16-	GRID	2		.1	0.0	0.0				
17-	GRID	3		.2	0.0	0.0				
18-	GRID	4		.3	0.0	0.0				
19-	GRID	5		0.0	.1	0.0				
20-	GRID	6		.1	.1	0.0				
21-	GRID	7		.2	.1	0.0				
22-	GRID	8		.3	.1	0.0				
23-	GRID	9		0.0	.2	0.0				
24-	GRID	10		0.0	-.1	0.0				
25-	GRID	100		-.05	.05	0.0				
26-	MAT4	1000	200.	2.426+6						ALUMINUM
27-	MAT4	3000	200.							
28-	MPC	200	9	1	1.	.	1	-1.		
29-	MPC	200	10	1	1.	1	1	-1.		
30-	PARAM	EPSHT	.0001							
31-	PARAM	MAXIT	8							
32-	PARAM	SIGMA	5.685E-8							
33-	PARAM	TABS	273.15							
34-	PHBDY	300	3000	.314						
35-	PHBDY	2000			.90					
36-	PQUAD2	200	1000	.01						
37-	PROD	100	1000	.001						
38-	RADLST	200	300	400	500	600	700			
39-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
40-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
41-	RADMTX	3	0.0	0.0	0.0	0.0				
42-	RADMTX	4	0.0	0.0	0.0					
43-	RADMTX	5	0.0	0.0						
44-	RADMTX	6	0.0							
45-	SLOAD	300	1	4.	2	8.				
46-	SLOAD	300	3	8.	4	4.				
47-	SLOAD	300	5	4.	6	8.				
48-	SLOAD	300	7	8.	8	4.				
49-	SPC1	100	1	100						
50-	TEMP	400	100	300.						
51-	TEMPD	400	300.							

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 .
52-	TEMPD	600	300.							
53-	TLOAD2	300	300			0.0	1.+6	0.0	0.0	+TL1
54-	+TL1	0.	0.							
55-	TSTEP	500	45	30.	1					
	ENDDATA									

```
            N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
    DMAP-DMAP INSTRUCTION
     NO.

*** USER WARNING MESSAGE  54.
     PARAMETER NAMED EPSHT     NOT REFERENCED

*** USER WARNING MESSAGE  54.
     PARAMETER NAMED MAXIT     NOT REFERENCED

          **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**


*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE      ,   6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023,          B =      3
                                            C =      0
                                            R =      2

*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS        0  SECONDS.


*** USER INFORMATION MESSAGE 3028,      B =     5      BBAR =     5
                                        C =     3      CBAR =     1
                                        R =     8

*** USER INFORMATION MESSAGE 3027, UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS       0 SECONDS.
```

POINT-ID = 1

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984949E 02
6.000000E 01	S	2.959980E 02
9.000000E 01	S	2.938442E 02
1.200000E 02	S	2.919233E 02
1.500000E 02	S	2.901897E 02
1.800000E 02	S	2.886208E 02
2.100000E 02	S	2.872021E 02
2.400000E 02	S	2.859211E 02
2.700000E 02	S	2.847664E 02
3.000000E 02	S	2.837268E 02
3.300000E 02	S	2.827922E 02
3.600000E 02	S	2.819526E 02
3.900000E 02	S	2.811990E 02
4.200000E 02	S	2.805227E 02
4.500000E 02	S	2.799160E 02
4.800000E 02	S	2.793718E 02
5.100000E 02	S	2.788840E 02
5.400000E 02	S	2.784465E 02
5.700000E 02	S	2.780542E 02
6.000000E 02	S	2.777024E 02
6.300000E 02	S	2.773867E 02
6.600000E 02	S	2.771035E 02
6.900000E 02	S	2.768496E 02
7.200000E 02	S	2.766218E 02
7.500000E 02	S	2.764172E 02
7.800000E 02	S	2.762339E 02
8.100000E 02	S	2.760691E 02
8.400000E 02	S	2.759214E 02
8.700000E 02	S	2.757886E 02
9.000000E 02	S	2.756694E 02
9.300000E 02	S	2.755625E 02
9.600000E 02	S	2.754663E 02
9.900000E 02	S	2.753799E 02
1.020000E 03	S	2.753022E 02
1.050000E 03	S	2.752327E 02
1.080000E 03	S	2.751699E 02
1.110000E 03	S	2.751138E 02
1.140000E 03	S	2.750632E 02
1.170000E 03	S	2.750178E 02
1.200000E 03	S	2.749768E 02
1.230000E 03	S	2.749402E 02
1.260000E 03	S	2.749072E 02
1.290000E 03	S	2.748774E 02
1.320000E 03	S	2.748508E 02
1.350000E 03	S	2.748267E 02

POINT-ID = 2

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.973813E 02
6.000000E 01	S	2.927502E 02
9.000000E 01	S	2.884094E 02
1.200000E 02	S	2.844219E 02
1.500000E 02	S	2.807952E 02
1.800000E 02	S	2.775146E 02
2.100000E 02	S	2.745569E 02
2.400000E 02	S	2.718953E 02
2.700000E 02	S	2.695037E 02
3.000000E 02	S	2.673567E 02
3.300000E 02	S	2.654304E 02
3.600000E 02	S	2.637029E 02
3.900000E 02	S	2.621541E 02
4.200000E 02	S	2.607656E 02
4.500000E 02	S	2.595210E 02
4.800000E 02	S	2.584053E 02
5.100000E 02	S	2.574050E 02
5.400000E 02	S	2.565083E 02
5.700000E 02	S	2.557045E 02
6.000000E 02	S	2.549837E 02
6.300000E 02	S	2.543372E 02
6.600000E 02	S	2.537573E 02
6.900000E 02	S	2.532370E 02
7.200000E 02	S	2.527702E 02
7.500000E 02	S	2.523514E 02
7.800000E 02	S	2.519754E 02
8.100000E 02	S	2.516379E 02
8.400000E 02	S	2.513350E 02
8.700000E 02	S	2.510630E 02
9.000000E 02	S	2.508188E 02
9.300000E 02	S	2.505995E 02
9.600000E 02	S	2.504025E 02
9.900000E 02	S	2.502256E 02
1.020000E 03	S	2.500667E 02
1.050000E 03	S	2.499239E 02
1.080000E 03	S	2.497956E 02
1.110000E 03	S	2.496803E 02
1.140000E 03	S	2.495768E 02
1.170000E 03	S	2.494837E 02
1.200000E 03	S	2.494001E 02
1.230000E 03	S	2.493250E 02
1.260000E 03	S	2.492574E 02
1.290000E 03	S	2.491967E 02
1.320000E 03	S	2.491422E 02
1.350000E 03	S	2.490932E 02

POINT-ID = 3

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.942329E 02
6.000000E 01	S	2.847380E 02
9.000000E 01	S	2.767437E 02
1.200000E 02	S	2.698711E 02
1.500000E 02	S	2.638923E 02
1.800000E 02	S	2.586531E 02
2.100000E 02	S	2.540391E 02
2.400000E 02	S	2.499606E 02
2.700000E 02	S	2.463456E 02
3.000000E 02	S	2.431343E 02
3.300000E 02	S	2.402764E 02
3.600000E 02	S	2.377292E 02
3.900000E 02	S	2.354560E 02
4.200000E 02	S	2.334251E 02
4.500000E 02	S	2.316092E 02
4.800000E 02	S	2.299842E 02
5.100000E 02	S	2.285292E 02
5.400000E 02	S	2.272257E 02
5.700000E 02	S	2.260573E 02
6.000000E 02	S	2.250096E 02
6.300000E 02	S	2.240700E 02
6.600000E 02	S	2.232269E 02
6.900000E 02	S	2.224703E 02
7.200000E 02	S	2.217912E 02
7.500000E 02	S	2.211814E 02
7.800000E 02	S	2.206339E 02
8.100000E 02	S	2.201422E 02
8.400000E 02	S	2.197005E 02
8.700000E 02	S	2.193038E 02
9.000000E 02	S	2.189474E 02
9.300000E 02	S	2.186272E 02
9.600000E 02	S	2.183396E 02
9.900000E 02	S	2.180811E 02
1.020000E 03	S	2.178488E 02
1.050000E 03	S	2.176401E 02
1.080000E 03	S	2.174525E 02
1.110000E 03	S	2.172840E 02
1.140000E 03	S	2.171325E 02
1.170000E 03	S	2.169963E 02
1.200000E 03	S	2.168740E 02
1.230000E 03	S	2.167640E 02
1.260000E 03	S	2.166651E 02
1.290000E 03	S	2.165762E 02
1.320000E 03	S	2.164964E 02
1.350000E 03	S	2.164245E 02

POINT-ID = 4

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.939604E 02
6.000000E 01	S	2.836946E 02
9.000000E 01	S	2.746729E 02
1.200000E 02	S	2.668035E 02
1.500000E 02	S	2.599419E 02
1.800000E 02	S	2.539440E 02
2.100000E 02	S	2.486829E 02
2.400000E 02	S	2.440519E 02
2.700000E 02	S	2.399627E 02
3.000000E 02	S	2.363417E 02
3.300000E 02	S	2.331274E 02
3.600000E 02	S	2.302685E 02
3.900000E 02	S	2.277213E 02
4.200000E 02	S	2.254484E 02
4.500000E 02	S	2.234181E 02
4.800000E 02	S	2.216025E 02
5.100000E 02	S	2.199775E 02
5.400000E 02	S	2.185221E 02
5.700000E 02	S	2.172180E 02
6.000000E 02	S	2.160487E 02
6.300000E 02	S	2.150000E 02
6.600000E 02	S	2.140591E 02
6.900000E 02	S	2.132146E 02
7.200000E 02	S	2.124564E 02
7.500000E 02	S	2.117757E 02
7.800000E 02	S	2.111643E 02
8.100000E 02	S	2.106151E 02
8.400000E 02	S	2.101221E 02
8.700000E 02	S	2.096790E 02
9.000000E 02	S	2.092809E 02
9.300000E 02	S	2.089232E 02
9.600000E 02	S	2.086018E 02
9.900000E 02	S	2.083130E 02
1.020000E 03	S	2.080534E 02
1.050000E 03	S	2.078201E 02
1.080000E 03	S	2.076105E 02
1.110000E 03	S	2.074220E 02
1.140000E 03	S	2.072528E 02
1.170000E 03	S	2.071006E 02
1.200000E 03	S	2.069637E 02
1.230000E 03	S	2.068408E 02
1.260000E 03	S	2.067302E 02
1.290000E 03	S	2.066308E 02
1.320000E 03	S	2.065414E 02
1.350000E 03	S	2.064612E 02

POINT-ID = 5

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984951E 02
6.000000E 01	S	2.959920E 02
9.000000E 01	S	2.938442E 02
1.200000E 02	S	2.919233E 02
1.500000E 02	S	2.901897E 02
1.800000E 02	S	2.886208E 02
2.100000E 02	S	2.872021E 02
2.400000E 02	S	2.859211E 02
2.700000E 02	S	2.847661E 02
3.000000E 02	S	2.837266E 02
3.300000E 02	S	2.827920E 02
3.600000E 02	S	2.819524E 02
3.900000E 02	S	2.811987E 02
4.200000E 02	S	2.805225E 02
4.500000E 02	S	2.799160E 02
4.800000E 02	S	2.793718E 02
5.100000E 02	S	2.788840E 02
5.400000E 02	S	2.784465E 02
5.700000E 02	S	2.780542E 02
6.000000E 02	S	2.777021E 02
6.300000E 02	S	2.773867E 02
6.600000E 02	S	2.771035E 02
6.900000E 02	S	2.768496E 02
7.200000E 02	S	2.766218E 02
7.500000E 02	S	2.764175E 02
7.800000E 02	S	2.762339E 02
8.100000E 02	S	2.760691E 02
8.400000E 02	S	2.759214E 02
8.700000E 02	S	2.757886E 02
9.000000E 02	S	2.756694E 02
9.300000E 02	S	2.755625E 02
9.600000E 02	S	2.754663E 02
9.900000E 02	S	2.753799E 02
1.020000E 03	S	2.753022E 02
1.050000E 03	S	2.752327E 02
1.080000E 03	S	2.751699E 02
1.110000E 03	S	2.751138E 02
1.140000E 03	S	2.750632E 02
1.170000E 03	S	2.750178E 02
1.200000E 03	S	2.749771E 02
1.230000E 03	S	2.749402E 02
1.260000E 03	S	2.749072E 02
1.290000E 03	S	2.748774E 02
1.320000E 03	S	2.748508E 02
1.350000E 03	S	2.748267E 02

POINT-ID = 6

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.973813E 02
6.000000E 01	S	2.927502E 02
9.000000E 01	S	2.884094E 02
1.200000E 02	S	2.844219E 02
1.500000E 02	S	2.807952E 02
1.800000E 02	S	2.775146E 02
2.100000E 02	S	2.745569E 02
2.400000E 02	S	2.718953E 02
2.700000E 02	S	2.695037E 02
3.000000E 02	S	2.673567E 02
3.300000E 02	S	2.654304E 02
3.600000E 02	S	2.637029E 02
3.900000E 02	S	2.621541E 02
4.200000E 02	S	2.607656E 02
4.500000E 02	S	2.595210E 02
4.800000E 02	S	2.584053E 02
5.100000E 02	S	2.574050E 02
5.400000E 02	S	2.565083E 02
5.700000E 02	S	2.557045E 02
6.000000E 02	S	2.549837E 02
6.300000E 02	S	2.543372E 02
6.600000E 02	S	2.537573E 02
6.900000E 02	S	2.532370E 02
7.200000E 02	S	2.527702E 02
7.500000E 02	S	2.523513E 02
7.800000E 02	S	2.519755E 02
8.100000E 02	S	2.516380E 02
8.400000E 02	S	2.513350E 02
8.700000E 02	S	2.510630E 02
9.000000E 02	S	2.508188E 02
9.300000E 02	S	2.505995E 02
9.600000E 02	S	2.504025E 02
9.900000E 02	S	2.502256E 02
1.020000E 03	S	2.500667E 02
1.050000E 03	S	2.499239E 02
1.080000E 03	S	2.497956E 02
1.110000E 03	S	2.496803E 02
1.140000E 03	S	2.495768E 02
1.170000E 03	S	2.494838E 02
1.200000E 03	S	2.494001E 02
1.230000E 03	S	2.493250E 02
1.260000E 03	S	2.492575E 02
1.290000E 03	S	2.491968E 02
1.320000E 03	S	2.491422E 02
1.350000E 03.	S	2.490931E 02

POINT-ID = 7

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.942332E 02
6.000000E 01	S	2.847383E 02
9.000000E 01	S	2.767437E 02
1.200000E 02	S	2.698711E 02
1.500000E 02	S	2.608926E 02
1.800000E 02	S	2.586531E 02
2.100000E 02	S	2.540390E 02
2.400000E 02	S	2.499607E 02
2.700000E 02	S	2.463457E 02
3.000000E 02	S	2.431344E 02
3.300000E 02	S	2.402766E 02
3.600000E 02	S	2.377293E 02
3.900000E 02	S	2.354560E 02
4.200000E 02	S	2.334252E 02
4.500000E 02	S	2.316094E 02
4.800000E 02	S	2.299843E 02
5.100000E 02	S	2.285293E 02
5.400000E 02	S	2.272258E 02
5.700000E 02	S	2.260574E 02
6.000000E 02	S	2.250098E 02
6.300000E 02	S	2.240701E 02
6.600000E 02	S	2.232270E 02
6.900000E 02	S	2.224703E 02
7.200000E 02	S	2.217912E 02
7.500000E 02	S	2.211814E 02
7.800000E 02	S	2.206340E 02
8.100000E 02	S	2.201422E 02
8.400000E 02	S	2.197006E 02
8.700000E 02	S	2.193039E 02
9.000000E 02	S	2.189476E 02
9.300000E 02	S	2.186273E 02
9.600000E 02	S	2.183397E 02
9.900000E 02	S	2.180812E 02
1.020000E 03	S	2.178489E 02
1.050000E 03	S	2.176402E 02
1.080000E 03	S	2.174526E 02
1.110000E 03	S	2.172840E 02
1.140000E 03	S	2.171326E 02
1.170000E 03	S	2.169965E 02
1.200000E 03	S	2.168740E 02
1.230000E 03	S	2.167640E 02
1.260000E 03	S	2.166652E 02
1.290000E 03	S	2.165762E 02
1.320000E 03	S	2.164964E 02
1.350000E 03	S	2.164246E 02

POINT-ID = 8

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.939607E 02
6.000000E 01	S	2.836948E 02
9.000000E 01	S	2.746731E 02
1.200000E 02	S	2.668037E 02
1.500000E 02	S	2.599419E 02
1.800000E 02	S	2.539441E 02
2.100000E 02	S	2.486829E 02
2.400000E 02	S	2.440520E 02
2.700000E 02	S	2.399627E 02
3.000000E 02	S	2.363417E 02
3.300000E 02	S	2.331275E 02
3.600000E 02	S	2.302686E 02
3.900000E 02	S	2.277214E 02
4.200000E 02	S	2.254486E 02
4.500000E 02	S	2.234182E 02
4.800000E 02	S	2.216027E 02
5.100000E 02	S	2.199777E 02
5.400000E 02	S	2.185223E 02
5.700000E 02	S	2.172180E 02
6.000000E 02	S	2.160488E 02
6.300000E 02	S	2.150001E 02
6.600000E 02	S	2.140592E 02
6.900000E 02	S	2.132146E 02
7.200000E 02	S	2.124564E 02
7.500000E 02	S	2.117757E 02
7.800000E 02	S	2.111644E 02
8.100000E 02	S	2.106154E 02
8.400000E 02	S	2.101221E 02
8.700000E 02	S	2.096791E 02
9.000000E 02	S	2.092810E 02
9.300000E 02	S	2.089233E 02
9.600000E 02	S	2.086020E 02
9.900000E 02	S	2.083131E 02
1.020000E 03	S	2.080535E 02
1.050000E 03	S	2.078203E 02
1.080000E 03	S	2.076106E 02
1.110000E 03	S	2.074221E 02
1.140000E 03	S	2.072529E 02
1.170000E 03	S	2.071007E 02
1.200000E 03	S	2.069639E 02
1.230000E 03	S	2.068409E 02
1.260000E 03	S	2.067304E 02
1.290000E 03	S	2.066310E 02
1.320000E 03	S	2.065415E 02
1.350000E 03	S	2.064614E 02

POINT-ID = 100

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.999995E 02
6.000000E 01	S	2.999990E 02
9.000000E 01	S	2.999985E 02
1.200000E 02	S	2.999980E 02
1.500000E 02	S	2.999976E 02
1.800000E 02	S	2.999971E 02
2.100000E 02	S	2.999966E 02
2.400000E 02	S	2.999961E 02
2.700000E 02	S	2.999956E 02
3.000000E 02	S	2.999951E 02
3.300000E 02	S	2.999946E 02
3.600000E 02	S	2.999944E 02
3.900000E 02	S	2.999941E 02
4.200000E 02	S	2.999939E 02
4.500000E 02	S	2.999937E 02
4.800000E 02	S	2.999934E 02
5.100000E 02	S	2.999932E 02
5.400000E 02	S	2.999929E 02
5.700000E 02	S	2.999927E 02
6.000000E 02	S	2.999924E 02
6.300000E 02	S	2.999922E 02
6.600000E 02	S	2.999919E 02
6.900000E 02	S	2.999917E 02
7.200000E 02	S	2.999915E 02
7.500000E 02	S	2.999912E 02
7.800000E 02	S	2.999910E 02
8.100000E 02	S	2.999907E 02
8.400000E 02	S	2.999905E 02
8.700000E 02	S	2.999902E 02
9.000000E 02	S	2.999900E 02
9.300000E 02	S	2.999897E 02
9.600000E 02	S	2.999895E 02
9.900000E 02	S	2.999893E 02
1.020000E 03	S	2.999890E 02
1.050000E 03	S	2.999888E 02
1.080000E 03	S	2.999885E 02
1.110000E 03	S	2.999883E 02
1.140000E 03	S	2.999880E 02
1.170000E 03	S	2.999878E 02
1.200000E 03	S	2.999875E 02
1.230000E 03	S	2.999873E 02
1.260000E 03	S	2.999871E 02
1.290000E 03	S	2.999868E 02
1.320000E 03	S	2.999866E 02
1.350000E 03	S	2.999863E 02

```
                                          - - - END OF JOB - - -

....................................................................................................
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....................................................................................................
NASTRAN LOADED AT LOCATION 1B5F20
TIME TO GO =  59 CPU SEC., 298 I/O SEC.
*     0 CPU-SEC.        0 ELAPSED-SEC.     SEM1  BEGN
*     0 CPU-SEC.        0 ELAPSED-SEC.     SEMT
*     1 CPU-SEC.        5 ELAPSED-SEC.     NAST
*     1 CPU-SEC.        6 ELAPSED-SEC.     GNFI
*     1 CPU-SEC.        6 ELAPSED-SEC.     XCSA
*     1 CPU-SEC.        9 ELAPSED-SEC.     IFP1
*     1 CPU-SEC.       12 ELAPSED-SEC.     XSOR
*     2 CPU-SEC.       19 ELAPSED-SEC.       DO  IFP
*     2 CPU-SEC.       24 ELAPSED-SEC.      END  IFP
*     2 CPU-SEC.       34 ELAPSED-SEC.     XGPI
*     4 CPU-SEC.       42 ELAPSED-SEC.     SEM1  END
*     4 CPU-SEC.       42 ELAPSED-SEC.     ----  LINKNS02 ---
=    22 I/O SEC.
 LAST LINK DID NOT USE    40016 BYTES OF OPEN CORE
*     4 CPU-SEC.       44 ELAPSED-SEC.     ----  LINK END ---
*     4 CPU-SEC.       44 ELAPSED-SEC.     XSFA
*     4 CPU-SEC.       45 ELAPSED-SEC.     XSFA
*     4 CPU-SEC.       45 ELAPSED-SEC.     3     GP1      BEGN
*     4 CPU-SEC.       51 ELAPSED-SEC.     3     GP1      END
*     4 CPU-SEC.       53 ELAPSED-SEC.     8     GP2      BEGN
*     4 CPU-SEC.       54 ELAPSED-SEC.     8     GP2      END
*     4 CPU-SEC.       54 ELAPSED-SEC.     10    PLTSET   BEGN
*     5 CPU-SEC.       55 ELAPSED-SEC.     10    PLTSET   END
*     5 CPU-SEC.       56 ELAPSED-SEC.     12    PRTMSG   BEGN
*     5 CPU-SEC.       57 ELAPSED-SEC.     12    PRTMSG   END
*     5 CPU-SEC.       57 ELAPSED-SEC.     13    SETVAL   BEGN
*     5 CPU-SEC.       57 ELAPSED-SEC.     13    SETVAL   END
*     5 CPU-SEC.       58 ELAPSED-SEC.     21    GP3      BEGN
*     5 CPU-SEC.       65 ELAPSED-SEC.     21    GP3      END
*     5 CPU-SEC.       65 ELAPSED-SEC.     23    TA1      BEGN
*     5 CPU-SEC.       77 ELAPSED-SEC.     23    TA1      END
*     5 CPU-SEC.       79 ELAPSED-SEC.     ----  LINKNS03 ---
=    53 I/O SEC.
 LAST LINK DID NOT USE    82788 BYTES OF OPEN CORE
*     5 CPU-SEC.       82 ELAPSED-SEC.     ----  LINK END ---
*     5 CPU-SEC.       82 ELAPSED-SEC.     27    SMA1     BEGN
*     5 CPU-SEC.       86 ELAPSED-SEC.     27    SMA1     END
*     5 CPU-SEC.       87 ELAPSED-SEC.     30    SMA2     BEGN
*     5 CPU-SEC.       90 ELAPSED-SEC.     30    SMA2     END
*     5 CPU-SEC.       91 ELAPSED-SEC.     ----  LINKNS05 ---
=    61 I/O SEC.
 LAST LINK DID NOT USE    64268 BYTES OF OPEN CORE
*     6 CPU-SEC.       94 ELAPSED-SEC.     ----  LINK END ---
*     6 CPU-SEC.       94 ELAPSED-SEC.     35    RMG      BEGN
*     6 CPU-SEC.       98 ELAPSED-SEC.     SDCO  MP
*     6 CPU-SEC.       98 ELAPSED-SEC.     SDCO  MP
*     6 CPU-SEC.       99 ELAPSED-SEC.     FBS
*     6 CPU-SEC.      101 ELAPSED-SEC.     FBS
*     6 CPU-SEC.      101 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1,EST. TIME =       0.0
*     6 CPU-SEC.      102 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.      102 ELAPSED-SEC.     TRAN  POSE
*     6 CPU-SEC.      103 ELAPSED-SEC.     TRAN  POSE
*     6 CPU-SEC.      104 ELAPSED-SEC.     MPYA  D
```

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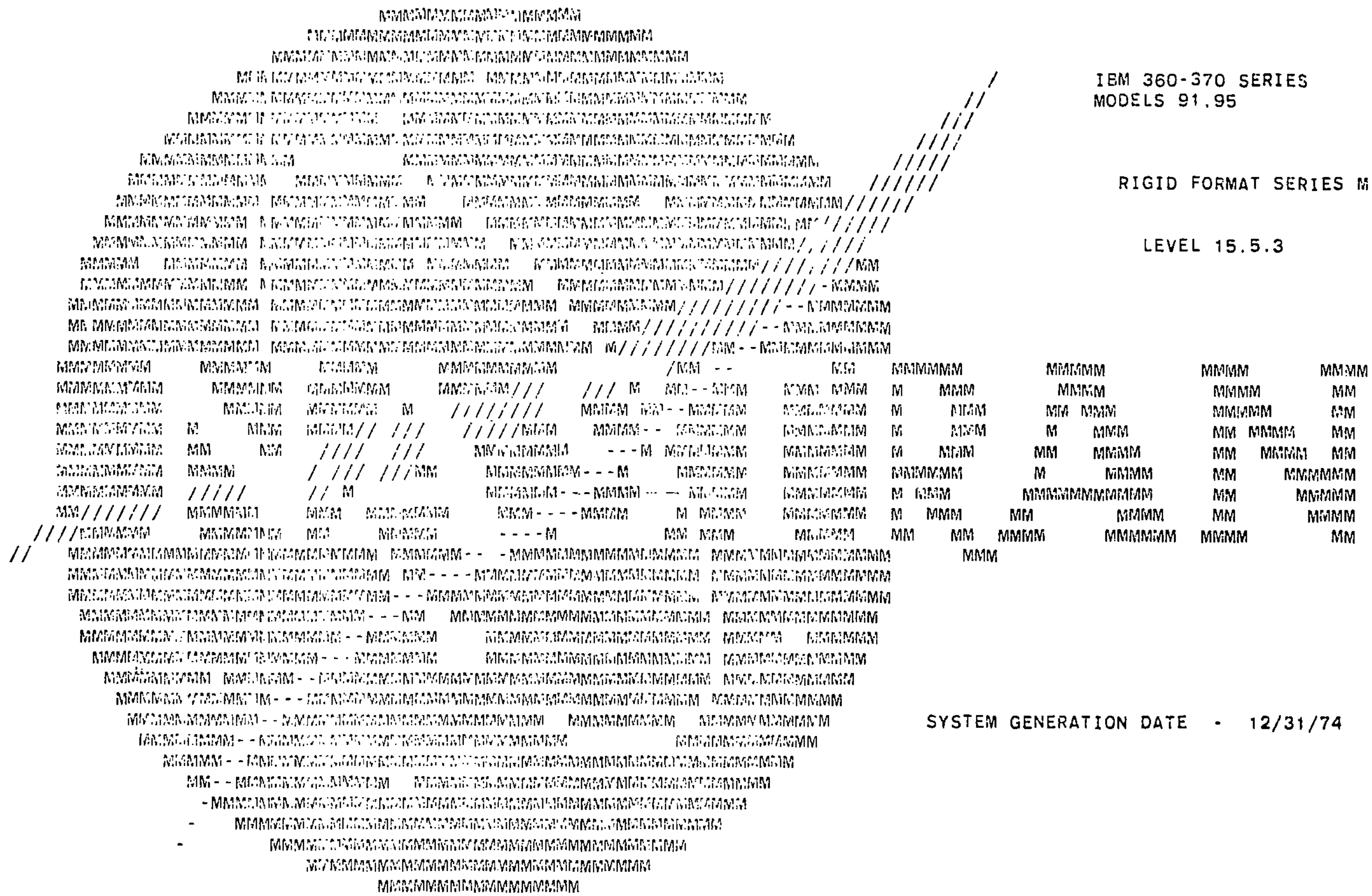
                                                    METHOD 2 NT.NBR PASSES =    1,EST. TIME =       0.0
*     6 CPU-SEC.       105 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.       106 ELAPSED-SEC.     35    RMG      END
*     7 CPU-SEC.       108 ELAPSED-SEC.     ----  LINKNS04 ---
=    77 I/O SEC.
 LAST LINK DID NOT USE   72520 BYTES OF OPEN CORE
*     7 CPU-SEC.       112 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.       112 ELAPSED-SEC.     40    GP4      BEGN
*     7 CPU-SEC.       115 ELAPSED-SEC.     40    GP4      END
*     7 CPU-SEC.       116 ELAPSED-SEC.     46    GPSP     BEGN
*     7 CPU-SEC.       117 ELAPSED-SEC.     46    GPSP     END
*     7 CPU-SEC.       117 ELAPSED-SEC.     ----  LINKNS14 ---
=    86 I/O SEC.
 LAST LINK DID NOT USE  117044 BYTES OF OPEN CORE
*     7 CPU-SEC.       121 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.       121 ELAPSED-SEC.     47    OFP      BEGN
*     7 CPU-SEC.       121 ELAPSED-SEC.     47    OFP      END
*     7 CPU-SEC.       123 ELAPSED-SEC.     ----  LINKNS04 ---
=    89 I/O SEC.
 LAST LINK DID NOT USE  115664 BYTES OF OPEN CORE
*     7 CPU-SEC.       126 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.       126 ELAPSED-SEC.     51    MCE1     BEGN
*     7 CPU-SEC.       129 ELAPSED-SEC.     51    MCE1     END
*     7 CPU-SEC.       129 ELAPSED-SEC.     53    MCE2     BEGN
*     7 CPU-SEC.       131 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 NT.NBR PASSES =    1,EST. TIME =       0.0
*     8 CPU-SEC.       132 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.       132 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 T .NBR PASSES =    1,EST. TIME =       0.0
*     8 CPU-SEC.       134 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.       134 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 T .NBR PASSES =    1,EST. TIME =       0.0
*     8 CPU-SEC.       135 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.       137 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 NT.NBR PASSES =    1,EST. TIME =       0.0
*     9 CPU-SEC.       139 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.       139 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 T .NBR PASSES =    1,EST. TIME =       0.0
*     9 CPU-SEC.       140 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.       140 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 T .NBR PASSES =    1,EST. TIME =       0.0
*     9 CPU-SEC.       142 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.       145 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 NT.NBR PASSES =    1,EST. TIME =       0.0
*    10 CPU-SEC.       146 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.       146 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 T .NBR PASSES =    1,EST. TIME =       0.0
*    10 CPU-SEC.       149 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.       150 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 T .NBR PASSES =    1,EST. TIME =       0.0
*    10 CPU-SEC.       151 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.       151 ELAPSED-SEC.     53    MCE2     END
*    10 CPU-SEC.       153 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.       154 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.       154 ELAPSED-SEC.     ----  LINKNS06 ---
=   111 I/O SEC.
 LAST LINK DID NOT USE  102132 BYTES OF OPEN CORE
*    11 CPU-SEC.       156 ELAPSED-SEC.     ----  LINK END ---
*    11 CPU-SEC.       156 ELAPSED-SEC.     75    DPD      BEGN
*    11 CPU-SEC.       162 ELAPSED-SEC.     75    DPD      END
*    11 CPU-SEC.       165 ELAPSED-SEC.     ----  LINKNS10 ---
=   120 I/O SEC.
 LAST LINK DID NOT USE  116416 BYTES OF OPEN CORE
*    11 CPU-SEC.       169 ELAPSED-SEC.     ----  LINK END ---
```

```
*    11 CPU-SEC.       169 ELAPSED-SEC.     81     MTRXIN   BEGN
*    11 CPU-SEC.       169 ELAPSED-SEC.     81     MTRXIN   END
*    11 CPU-SEC.       170 ELAPSED-SEC.     83     PARAM    BEGN
*    11 CPU-SEC.       170 ELAPSED-SEC.     83     PARAM    END
*    11 CPU-SEC.       171 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.       172 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.       172 ELAPSED-SEC.     88     GKAD     BEGN
*    11 CPU-SEC.       174 ELAPSED-SEC.     88     GKAD     END
*    11 CPU-SEC.       175 ELAPSED-SEC.     ----   LINKNS05 ---
=   127 I/O SEC.
 LAST LINK DID NOT USE  117064 BYTES OF OPEN CORE
*    11 CPU-SEC.       178 ELAPSED-SEC.     ----   LINK END ---
*    11 CPU-SEC.       178 ELAPSED-SEC.     92     TRLG     BEGN
*    12 CPU-SEC.       188 ELAPSED-SEC.     MPYA   D
                                                   METHOD 2 T .NBR PASSES =   1,EST. TIME =      0.0
*    12 CPU-SEC.       189 ELAPSED-SEC.     MPYA   D
*    12 CPU-SEC.       190 ELAPSED-SEC.     MPYA   D
                                                   METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*    12 CPU-SEC.       191 ELAPSED-SEC.     MPYA   D
*    12 CPU-SEC.       191 ELAPSED-SEC.     MPYA   D
                                                   METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*    12 CPU-SEC.       192 ELAPSED-SEC.     MPYA   D
*    12 CPU-SEC.       193 ELAPSED-SEC.     MPYA   D
                                                   METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.0
*    13 CPU-SEC.       194 ELAPSED-SEC.     MPYA   D
*    13 CPU-SEC.       194 ELAPSED-SEC.     92     TRLG     END
*    13 CPU-SEC.       195 ELAPSED-SEC.     ----   LINKNS11 ---
=   142 I/O SEC.
 LAST LINK DID NOT USE   58180 BYTES OF OPEN CORE
*    13 CPU-SEC.       197 ELAPSED-SEC.     ----   LINK END ---
*    13 CPU-SEC.       197 ELAPSED-SEC.     97     TRHT     BEGN
*    13 CPU-SEC.       200 ELAPSED-SEC.     DECO   MP
*    13 CPU-SEC.       201 ELAPSED-SEC.     DECO   MP
*    15 CPU-SEC.       261 ELAPSED-SEC.     97     TRHT     END
*    15 CPU-SEC.       261 ELAPSED-SEC.     ----   LINKNS12 ---
=   202 I/O SEC.
 LAST LINK DID NOT USE   69268 BYTES OF OPEN CORE
*    15 CPU-SEC.       267 ELAPSED-SEC.     ----   LINK END ---
*    15 CPU-SEC.       267 ELAPSED-SEC.     99     VDR      BEGN
*    15 CPU-SEC.       269 ELAPSED-SEC.     99     VDR      END
*    15 CPU-SEC.       269 ELAPSED-SEC.     111    PARAM    BEGN
*    15 CPU-SEC.       270 ELAPSED-SEC.     111    PARAM    END
*    15 CPU-SEC.       270 ELAPSED-SEC.     XSFA
*    15 CPU-SEC.       271 ELAPSED-SEC.     XSFA
*    15 CPU-SEC.       271 ELAPSED-SEC.     115    SDR1     BEGN
*    15 CPU-SEC.       271 ELAPSED-SEC.     MPYA   D
                                                   METHOD 2 NT,NBR PASSES =   1,EST. TIME =      0.1
*    15 CPU-SEC.       272 ELAPSED-SEC.     MPYA   D
*    16 CPU-SEC.       275 ELAPSED-SEC.     115    SDR1     END
*    16 CPU-SEC.       275 ELAPSED-SEC.     ----   LINKNS08 ---
=   212 I/O SEC.
 LAST LINK DID NOT USE  119096 BYTES OF OPEN CORE
*    16 CPU-SEC.       279 ELAPSED-SEC.     ----   LINK END ---
*    16 CPU-SEC.       279 ELAPSED-SEC.     118    PLTTRAN BEGN
*    16 CPU-SEC.       282 ELAPSED-SEC.     118    PLTTRAN END
*    16 CPU-SEC.       283 ELAPSED-SEC.     ----   LINKNS13 ---
=   216 I/O SEC.
 LAST LINK DID NOT USE  114512 BYTES OF OPEN CORE
*    16 CPU-SEC.       286 ELAPSED-SEC.     ----   LINK END ---
*    16 CPU-SEC.       286 ELAPSED-SEC.     120    SDR2     BEGN
*    16 CPU-SEC.       288 ELAPSED-SEC.     120    SDR2     END
*    16 CPU-SEC.       288 ELAPSED-SEC.     ----   LINKNS14 ---
=   222 I/O SEC.
 LAST LINK DID NOT USE   66428 BYTES OF OPEN CORE
```

```
*    17 CPU-SEC.       298 ELAPSED-SEC.      ----  LINK END ---
*    17 CPU-SEC.       298 ELAPSED-SEC.      121   SDR3     BEGN
*    17 CPU-SEC.       303 ELAPSED-SEC.      121   SDR3     END
*    17 CPU-SEC.       303 ELAPSED-SEC.      123   OFP      BEGN
*    18 CPU-SEC.       334 ELAPSED-SEC.      123   OFP      END
*    18 CPU-SEC.       335 ELAPSED-SEC.      130   XYTRAN   BEGN
*    18 CPU-SEC.       335 ELAPSED-SEC.      130   XYTRAN   END
*    18 CPU-SEC.       335 ELAPSED-SEC.      ----  LINKNS02 ---
=   232 I/O SEC.
 LAST LINK DID NOT USE    11408 BYTES OF OPEN CORE
*    18 CPU-SEC.       348 ELAPSED-SEC.      ----  LINK END ---
*    18 CPU-SEC.       348 ELAPSED-SEC.      132   XYPLOT   BEGN
*    18 CPU-SEC.       348 ELAPSED-SEC.      132   XYPLOT   END
*    18 CPU-SEC.       349 ELAPSED-SEC.      138   EXIT     BEGN
---------------------------------------------------------------------------------------------------------------------------
=   234 I/O SEC.
 LAST LINK DID NOT USE    97232 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =   11K BYTES
```



IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*************************************************************************************
$ START OF EXECUTIVE CONTROL *********************************************************
$*************************************************************************************
$
ID CLASS PROBLEM FIFTEEN, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR TRANSIENT SOLUTION ALGORITHM IS TO BE USED
$
SOL 9
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
CEND
```

```
                              C A S E    C O N T R O L    D E C K    E C H O
CARD
COUNT
  1        $
  2        $*******************************************************************************
  3        $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ******************************
  4        $*******************************************************************************
  5        $
  6        TITLE=      NON-LINEAR TRANSIENT ... MULTILAYER INSULATION BY EFFECTIVE E
  7        $
  8        $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
  9        $
 10        LINE=51
 11        $
 12        $ REQUEST SORTED AND UNSORTED OUTPUT
 13        $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 14        $
 15        ECHO=BOTH
 16        $
 17        $ SELECT THE MPC AND LOAD SETS TO BE USED IN THIS SOLUTION
 18        $ NOTE THAT NO SPC SET IS SELECTED, AND THAT DLOAD HAS REPLACED LOAD.
 19        $
 20        MPC=200
 21        DLOAD=300
 22        $
 23        $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 24        $ THE SELECTION OF THIS SET IS OPTIONAL FOR SOL 9, BUT SHOULD BE MADE IF
 25        $ THE FINAL TEMPERATURE IS SEVERAL HUNDRED DEGREES DIFFERENT FROM THE
 26        $ IC VECTOR, AND RADIATIVE INTERCHANGES ARE INCLUDED.
 27        $
 28        TEMP(MATERIAL)=400
 29        $
 30        $ SELECT THE STEP SIZE, NUMBER OF INCREMENTS, AND PRINTOUT FREQUENCY
 31        $
 32        TSTEP=500
 33        $
 34        $ SELECT THE TEMPERATURE SET DEFINING THE TEMPERATURE VECTOR AT T=0.
 35        $
 36        IC=600
 37        $
 38        $ SELECT OUTPUT DESIRED
 39        $
 40        OUTPUT
 41        $
 42        $ DEFINE A GROUP OF GRID POINTS TO BE REFERENCED BY AN OUTPUT REQUEST
 43        $
 44        SET 5 = 1,2,3,4,5,6,7,8,100
 45        $
 46        $ REFERENCE A PREVIOUSLY DEFINED GROUP OF GRID POINTS
 47        $
 48        THERMAL=5
 49        $
 50        $*******************************************************************************
 51        $ END CASE CONTROL --- START BULK DATA *****************************************
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
52      $********************************************************************************
53      $
54      BEGIN BULK
```

INPUT BULK DATA DECK ECHO

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY AND THERMAL MASS
$
MAT4    1000    200.    2.426+6                                         ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.              1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

```
                    I N P U T   B U L K   D A T A   D E C K   E C H O

    1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    .02
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

```
                         I N P U T   B U L K   D A T A   D E C K   E C H O

                 .   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
                $*******************************************************************************
                $ THE FOLLOWING BULK DATA CARDS WERE ADDED FOR THE TRANSIENT SOLUTION ----------
                $ THEY CONVERT PROBLEM TWO TO PROBLEM THREE
                $ NOTE THAT THE SPC1 SET WAS NOT SELECTED IN CASE CONTROL
                $ NOTE THAT SPCF OUTPUT IS NOT REQUESTED IN TRANSIENT
                $ NOTE THAT THERMAL MASS WAS ADDED TO 'MAT4' CARD 1000
                $ NOTE THAT THE DIAG CARD IN THE EXECUTIVE CONTROL WAS IRRELEVANT
                $ NOTE THAT THE LOAD REQUEST IN CASE CONTROL IS NOW A DLOAD REQUEST
                $
                $
                $ TRANSIENT SINGLE POINT CONSTRAINT METHOD
                $ CONSTRAIN GRID POINT 100 TO 300 DEGREES CELSIUS
                $
                CELAS2  300     1.+5    100     1
                SLOAD   300     100     300.+5
                $
                $ DEFINES A CONSTANT LOAD SET APPLIED FROM T=0. TO T=1.+6 SECONDS
                $
                TLOAD2  300     300                     0.      1.+6    0.      0.      +TL1
                +TL1    0.      0.
                $
                $ DEFINES THE NUMBER OF INCREMENTS, THE STEP SIZE, AND THE PRINTOUT FREQUENCY
                $ REFERENCED IN CASE CONTROL AS 'TSTEP'
                $ EACH TIME STEP IS 30 SECONDS
                $
                TSTEP   500     45      30.     1
                $
                $ DEFINES A TEMPERATURE VECTOR --- REFERENCED IN CASE CONTROL AS 'IC'
                $
                TEMPD   600     300.
                $
                $*******************************************************************************
                $ PROBLEM FIFTEEN WAS DERIVED DIRECTLY FROM PROBLEM THREE.
                $ PROBLEM FIFTEEN SIMULATES A BLANKET OF MULTILAYER INSULATION BEING PLACED
                $ ON BOTH SIDES OF THE RADIATING FIN. NO BULK DATA CARDS WERE ADDED, BUT
                $ THE EMISSIVITY OF PHBDY CARD 2000 WAS CHANGED FROM .9 TO AN EFFECTIVE
                $ EMISSIVITY OF .02. THIS WAS AN ARBITRARILY SELECTED VALUE WHICH IS OFTEN USED
                $ FOR 5 TO 10 LAYER BLANKETS ... THE DETERMINATION OF THE PROPER VALUE
                $ IS AN ANALYTICAL JOB WHICH IS BEYOND THE SCOPE OF THIS DOCUMENT.
                $ TO REDUCE THE OUTPUT VOLUME, THE ONLY OUTPUT REQUESTED IN THIS
                $ RUN IS THERMAL=5
                $
                $*******************************************************************************
                $ END OF BULK DATA *************************************************************
                $*******************************************************************************
                $
                ENDDATA
            TOTAL COUNT=   149

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED,XSORT WILL RE-ORDER DECK.
```

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 .
1-	CELAS2	300	1.+5	100	1					
2-	CHBDY	60	300	LINE	1	5				+CONVEC
3-	+CONVEC	100	100							
4-	CHBDY	200	2000	AREA4	1	2	6	5		
5-	CHBDY	300	2000	AREA4	2	3	7	6		
6-	CHBDY	400	2000	AREA4	3	4	8	7		
7-	CHBDY	500	2000	AREA4	5	6	2	1		
8-	CHBDY	600	2000	AREA4	6	7	3	2		
9-	CHBDY	700	2000	AREA4	7	8	4	3		
10-	CQUAD2	30	200	1	2	6	5			
11-	CQUAD2	40	200	2	3	7	6			
12-	CQUAD2	50	200	3	4	8	7			
13-	CROD	10	100	10	2					
14-	CROD	20	100	9	6					
15-	GRID	1		0.0	0.0	0.0				
16-	GRID	2		.1	0.0	0.0				
17-	GRID	3		.2	0.0	0.0				
18-	GRID	4		.3	0.0	0.0				
19-	GRID	5		0.0	.1	0.0				
20-	GRID	6		.1	.1	0.0				
21-	GRID	7		.2	.1	0.0				
22-	GRID	8		.3	.1	0.0				
23-	GRID	9		0.0	.2	0.0				
24-	GRID	10		0.0	-.1	0.0				
25-	GRID	100		-.05	.05	0.0				
26-	MAT4	1000	200.	2.426+6						ALUMINUM
27-	MAT4	3000	200.							
28-	MPC	200	9	1	1.	5	1	-1.		
29-	MPC	200	10	1	1.	1	1	-1.		
30-	PARAM	EPSHT	.0001							
31-	PARAM	MAXIT	8							
32-	PARAM	SIGMA	5.685E-8							
33-	PARAM	TABS	273.15							
34-	PHBDY	300	3000	.314						
35-	PHBDY	2000			.02					
36-	PQUAD2	200	1000	.01						
37-	PROD	100	1000	.001						
38-	RADLST	200	300	400	500	600	700			
39-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
40-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
41-	RADMTX	3	0.0	0.0	0.0	0.0				
42-	RADMTX	4	0.0	0.0	0.0					
43-	RADMTX	5	0.0	0.0						
44-	RADMTX	6	0.0							
45-	SLOAD	300	1	4.	2	8.				
46-	SLOAD	300	3	8.	4	4.				
47-	SLOAD	300	5	4.	6	8.				
48-	SLOAD	300	7	8.	8	4.				
49-	SLOAD	300	100	300.+5						
50-	SPC1	100	1	100						
51-	TEMP	400	100	300.						

```
                                       S O R T E D   B U L K   D A T A   E C H O
CARD
COUNT         .   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
  52-         TEMPD   400     300.
  53-         TEMPD   600     300.
  54-         TLOAD2  300     300                             0.0     1.+6    0.0     0.0     +TL1
  55-         +TL1    0.      0.
  56-         TSTEP   500     45      30.     1
              ENDDATA
```

```
        N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
    DMAP-DMAP INSTRUCTION
     NO.

*** USER WARNING MESSAGE  54,
     PARAMETER NAMED EPSHT     NOT REFERENCED

*** USER WARNING MESSAGE  54,
     PARAMETER NAMED MAXIT     NOT REFERENCED

          **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**




*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE         6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023.            B =      3
                                              C =      0
                                              R =      2

*** USER INFORMATION MESSAGE 3027. SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS        0  SECONDS.




*** USER INFORMATION MESSAGE 3028.       B =     5     BBAR =     5
                                         C =     3     CBAR =     1
                                         R =     8

*** USER INFORMATION MESSAGE 3027. UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS       0 SECONDS.
```

POINT-ID = 1

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	3.002195E 02
6.000000E 01	S	3.005920E 02
9.000000E 01	S	3.009275E 02
1.200000E 02	S	3.012410E 02
1.500000E 02	S	3.015374E 02
1.800000E 02	S	3.018186E 02
2.100000E 02	S	3.020854E 02
2.400000E 02	S	3.023384E 02
2.700000E 02	S	3.025776E 02
3.000000E 02	S	3.028037E 02
3.300000E 02	S	3.030168E 02
3.600000E 02	S	3.032180E 02
3.900000E 02	S	3.034072E 02
4.200000E 02	S	3.035854E 02
4.500000E 02	S	3.037529E 02
4.800000E 02	S	3.039106E 02
5.100000E 02	S	3.040586E 02
5.400000E 02	S	3.041978E 02
5.700000E 02	S	3.043284E 02
6.000000E 02	S	3.044509E 02
6.300000E 02	S	3.045662E 02
6.600000E 02	S	3.046743E 02
6.900000E 02	S	3.047759E 02
7.200000E 02	S	3.048711E 02
7.500000E 02	S	3.049604E 02
7.800000E 02	S	3.050442E 02
8.100000E 02	S	3.051228E 02
8.400000E 02	S	3.051968E 02
8.700000E 02	S	3.052661E 02
9.000000E 02	S	3.053311E 02
9.300000E 02	S	3.053921E 02
9.600000E 02	S	3.054492E 02
9.900000E 02	S	3.055029E 02
1.020000E 03	S	3.055532E 02
1.050000E 03	S	3.056006E 02
1.080000E 03	S	3.056450E 02
1.110000E 03	S	3.056865E 02
1.140000E 03	S	3.057256E 02
1.170000E 03	S	3.057622E 02
1.200000E 03	S	3.057965E 02
1.230000E 03	S	3.058289E 02
1.260000E 03	S	3.058591E 02
1.290000E 03	S	3.058875E 02
1.320000E 03	S	3.059141E 02
1.350000E 03	S	3.059390E 02

POINT-ID = 2

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	3.003853E 02
6.000000E 01	S	3.010850E 02
9.000000E 01	S	3.017725E 02
1.200000E 02	S	3.024348E 02
1.500000E 02	S	3.030674E 02
1.800000E 02	S	3.033685E 02
2.100000E 02	S	3.042378E 02
2.400000E 02	S	3.047759E 02
2.700000E 02	S	3.052837E 02
3.000000E 02	S	3.057625E 02
3.300000E 02	S	3.062136E 02
3.600000E 02	S	3.066382E 02
3.900000E 02	S	3.070376E 02
4.200000E 02	S	3.074131E 02
4.500000E 02	S	3.077659E 02
4.800000E 02	S	3.080974E 02
5.100000E 02	S	3.084087E 02
5.400000E 02	S	3.087012E 02
5.700000E 02	S	3.089756E 02
6.000000E 02	S	3.092334E 02
6.300000E 02	S	3.094753E 02
6.600000E 02	S	3.097024E 02
6.900000E 02	S	3.099155E 02
7.200000E 02	S	3.101155E 02
7.500000E 02	S	3.103030E 02
7.800000E 02	S	3.104790E 02
8.100000E 02	S	3.106443E 02
8.400000E 02	S	3.107993E 02
8.700000E 02	S	3.109446E 02
9.000000E 02	S	3.110811E 02
9.300000E 02	S	3.112090E 02
9.600000E 02	S	3.113291E 02
9.900000E 02	S	3.114417E 02
1.020000E 03	S	3.115474E 02
1.050000E 03	S	3.116465E 02
1.080000E 03	S	3.117395E 02
1.110000E 03	S	3.118269E 02
1.140000E 03	S	3.119087E 02
1.170000E 03	S	3.119854E 02
1.200000E 03	S	3.120574E 02
1.230000E 03	S	3.121250E 02
1.260000E 03	S	3.121885E 02
1.290000E 03	S	3.122480E 02
1.320000E 03	S	3.123040E 02
1.350000E 03	S	3.123562E 02

POINT-ID = 3

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	3.008613E 02
6.000000E 01	S	3.023389E 02
9.000000E 01	S	3.036787E 02
1.200000E 02	S	3.049131E 02
1.500000E 02	S	3.060588E 02
1.800000E 02	S	3.071262E 02
2.100000E 02	S	3.081226E 02
2.400000E 02	S	3.090537E 02
2.700000E 02	S	3.099248E 02
3.000000E 02	S	3.107400E 02
3.300000E 02	S	3.115034E 02
3.600000E 02	S	3.122185E 02
3.900000E 02	S	3.128884E 02
4.200000E 02	S	3.135164E 02
4.500000E 02	S	3.141047E 02
4.800000E 02	S	3.146565E 02
5.100000E 02	S	3.151738E 02
5.400000E 02	S	3.156589E 02
5.700000E 02	S	3.161138E 02
6.000000E 02	S	3.165403E 02
6.300000E 02	S	3.169404E 02
6.600000E 02	S	3.173157E 02
6.900000E 02	S	3.176677E 02
7.200000E 02	S	3.179978E 02
7.500000E 02	S	3.183076E 02
7.800000E 02	S	3.185981E 02
8.100000E 02	S	3.188706E 02
8.400000E 02	S	3.191262E 02
8.700000E 02	S	3.193660E 02
9.000000E 02	S	3.195908E 02
9.300000E 02	S	3.198018E 02
9.600000E 02	S	3.199998E 02
9.900000E 02	S	3.201855E 02
1.020000E 03	S	3.203596E 02
1.050000E 03	S	3.205229E 02
1.080000E 03	S	3.206763E 02
1.110000E 03	S	3.208201E 02
1.140000E 03	S	3.209548E 02
1.170000E 03	S	3.210813E 02
1.200000E 03	S	3.212000E 02
1.230000E 03	S	3.213113E 02
1.260000E 03	S	3.214160E 02
1.290000E 03	S	3.215139E 02
1.320000E 03	S	3.216057E 02
1.350000E 03	S	3.216919E 02

POINT-ID = 4

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	3.009070E 02
6.000000E 01	S	3.025188E 02
9.000000E 01	S	3.040464E 02
1.200000E 02	S	3.054761E 02
1.500000E 02	S	3.068083E 02
1.800000E 02	S	3.080496E 02
2.100000E 02	S	3.092061E 02
2.400000E 02	S	3.102847E 02
2.700000E 02	S	3.112913E 02
3.000000E 02	S	3.122317E 02
3.300000E 02	S	3.131108E 02
3.600000E 02	S	3.139333E 02
3.900000E 02	S	3.147029E 02
4.200000E 02	S	3.154236E 02
4.500000E 02	S	3.160986E 02
4.800000E 02	S	3.167310E 02
5.100000E 02	S	3.173235E 02
5.400000E 02	S	3.178789E 02
5.700000E 02	S	3.183997E 02
6.000000E 02	S	3.188877E 02
6.300000E 02	S	3.193455E 02
6.600000E 02	S	3.197749E 02
6.900000E 02	S	3.201775E 02
7.200000E 02	S	3.205552E 02
7.500000E 02	S	3.209092E 02
7.800000E 02	S	3.212417E 02
8.100000E 02	S	3.215530E 02
8.400000E 02	S	3.218450E 02
8.700000E 02	S	3.221191E 02
9.000000E 02	S	3.223762E 02
9.300000E 02	S	3.226174E 02
9.600000E 02	S	3.228438E 02
9.900000E 02	S	3.230559E 02
1.020000E 03	S	3.232551E 02
1.050000E 03	S	3.234419E 02
1.080000E 03	S	3.236169E 02
1.110000E 03	S	3.237813E 02
1.140000E 03	S	3.239355E 02
1.170000E 03	S	3.240801E 02
1.200000E 03	S	3.242158E 02
1.230000E 03	S	3.243430E 02
1.260000E 03	S	3.244624E 02
1.290000E 03	S	3.245742E 02
1.320000E 03	S	3.246794E 02
1.350000E 03	S	3.247781E 02

POINT-ID = 5

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	3.002195E 02
6.000000E 01	S	3.005918E 02
9.000000E 01	S	3.009272E 02
1.200000E 02	S	3.012407E 02
1.500000E 02	S	3.015371E 02
1.800000E 02	S	3.018184E 02
2.100000E 02	S	3.020854E 02
2.400000E 02	S	3.023384E 02
2.700000E 02	S	3.025776E 02
3.000000E 02	S	3.028035E 02
3.300000E 02	S	3.030168E 02
3.600000E 02	S	3.032178E 02
3.900000E 02	S	3.034072E 02
4.200000E 02	S	3.035854E 02
4.500000E 02	S	3.037529E 02
4.800000E 02	S	3.039104E 02
5.100000E 02	S	3.040583E 02
5.400000E 02	S	3.041975E 02
5.700000E 02	S	3.043281E 02
6.000000E 02	S	3.044507E 02
6.300000E 02	S	3.045659E 02
6.600000E 02	S	3.046741E 02
6.900000E 02	S	3.047756E 02
7.200000E 02	S	3.048708E 02
7.500000E 02	S	3.049602E 02
7.800000E 02	S	3.050442E 02
8.100000E 02	S	3.051228E 02
8.400000E 02	S	3.051968E 02
8.700000E 02	S	3.052661E 02
9.000000E 02	S	3.053311E 02
9.300000E 02	S	3.053921E 02
9.600000E 02	S	3.054492E 02
9.900000E 02	S	3.055029E 02
1.020000E 03	S	3.055532E 02
1.050000E 03	S	3.056006E 02
1.080000E 03	S	3.056448E 02
1.110000E 03	S	3.056865E 02
1.140000E 03	S	3.057256E 02
1.170000E 03	S	3.057622E 02
1.200000E 03	S	3.057966E 02
1.230000E 03	S	3.058289E 02
1.260000E 03	S	3.058591E 02
1.290000E 03	S	3.058875E 02
1.320000E 03	S	3.059141E 02
1.350000E 03	S	3.059390E 02

POINT-ID = 6

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	3.003653E 02
6.000000E 01	S	3.010850E 02
9.000000E 01	S	3.017725E 02
1.200000E 02	S	3.024348E 02
1.500000E 02	S	3.030674E 02
1.800000E 02	S	3.036682E 02
2.100000E 02	S	3.042375E 02
2.400000E 02	S	3.047756E 02
2.700000E 02	S	3.052837E 02
3.000000E 02	S	3.057625E 02
3.300000E 02	S	3.062136E 02
3.600000E 02	S	3.066382E 02
3.900000E 02	S	3.070376E 02
4.200000E 02	S	3.074131E 02
4.500000E 02	S	3.077659E 02
4.800000E 02	S	3.080974E 02
5.100000E 02	S	3.084087E 02
5.400000E 02	S	3.087012E 02
5.700000E 02	S	3.089756E 02
6.000000E 02	S	3.092332E 02
6.300000E 02	S	3.094751E 02
6.600000E 02	S	3.097021E 02
6.900000E 02	S	3.099153E 02
7.200000E 02	S	3.101152E 02
7.500000E 02	S	3.103030E 02
7.800000E 02	S	3.104790E 02
8.100000E 02	S	3.106443E 02
8.400000E 02	S	3.107993E 02
8.700000E 02	S	3.109448E 02
9.000000E 02	S	3.110811E 02
9.300000E 02	S	3.112090E 02
9.600000E 02	S	3.113291E 02
9.900000E 02	S	3.114419E 02
1.020000E 03	S	3.115476E 02
1.050000E 03	S	3.116467E 02
1.080000E 03	S	3.117397E 02
1.110000E 03	S	3.118269E 02
1.140000E 03	S	3.119087E 02
1.170000E 03	S	3.119856E 02
1.200000E 03	S	3.120576E 02
1.230000E 03	S	3.121252E 02
1.260000E 03	S	3.121885E 02
1.290000E 03	S	3.122480E 02
1.320000E 03	S	3.123040E 02
1.350000E 03	S	3.123564E 02

POINT-ID = 7

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	3.008613E 02
6.000000E 01	S	3.023389E 02
9.000000E 01	S	3.036787E 02
1.200000E 02	S	3.049131E 02
1.500000E 02	S	3.060588E 02
1.800000E 02	S	3.071262E 02
2.100000E 02	S	3.081226E 02
2.400000E 02	S	3.090537E 02
2.700000E 02	S	3.099248E 02
3.000000E 02	S	3.107400E 02
3.300000E 02	S	3.115034E 02
3.600000E 02	S	3.122185E 02
3.900000E 02	S	3.128884E 02
4.200000E 02	S	3.135164E 02
4.500000E 02	S	3.141047E 02
4.800000E 02	S	3.146565E 02
5.100000E 02	S	3.151738E 02
5.400000E 02	S	3.156589E 02
5.700000E 02	S	3.161138E 02
6.000000E 02	S	3.165403E 02
6.300000E 02	S	3.169404E 02
6.600000E 02	S	3.173157E 02
6.900000E 02	S	3.176677E 02
7.200000E 02	S	3.179980E 02
7.500000E 02	S	3.183076E 02
7.800000E 02	S	3.185981E 02
8.100000E 02	S	3.188706E 02
8.400000E 02	S	3.191262E 02
8.700000E 02	S	3.193660E 02
9.000000E 02	S	3.195908E 02
9.300000E 02	S	3.198018E 02
9.600000E 02	S	3.199998E 02
9.900000E 02	S	3.201855E 02
1.020000E 03	S	3.203596E 02
1.050000E 03	S	3.205229E 02
1.080000E 03	S	3.206763E 02
1.110000E 03	S	3.208201E 02
1.140000E 03	S	3.209551E 02
1.170000E 03	S	3.210815E 02
1.200000E 03	S	3.212002E 02
1.230000E 03	S	3.213115E 02
1.260000E 03	S	3.214160E 02
1.290000E 03	S	3.215139E 02
1.320000E 03	S	3.216060E 02
1.350000E 03	S	3.216921E 02

POINT-ID = 8

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	3.009072E 02
6.000000E 01	S	3.025188E 02
9.000000E 01	S	3.040464E 02
1.200000E 02	S	3.054761E 02
1.500000E 02	S	3.065086E 02
1.800000E 02	S	3.080498E 02
2.100000E 02	S	3.092061E 02
2.400000E 02	S	3.102847E 02
2.700000E 02	S	3.112913E 02
3.000000E 02	S	3.122317E 02
3.300000E 02	S	3.131108E 02
3.600000E 02	S	3.139331E 02
3.900000E 02	S	3.147029E 02
4.200000E 02	S	3.154236E 02
4.500000E 02	S	3.160936E 02
4.800000E 02	S	3.167310E 02
5.100000E 02	S	3.173235E 02
5.400000E 02	S	3.178789E 02
5.700000E 02	S	3.183997E 02
6.000000E 02	S	3.188879E 02
6.300000E 02	S	3.193455E 02
6.600000E 02	S	3.197749E 02
6.900000E 02	S	3.201775E 02
7.200000E 02	S	3.205552E 02
7.500000E 02	S	3.209094E 02
7.800000E 02	S	3.212415E 02
8.100000E 02	S	3.215530E 02
8.400000E 02	S	3.218452E 02
8.700000E 02	S	3.221191E 02
9.000000E 02	S	3.223762E 02
9.300000E 02	S	3.226174E 02
9.600000E 02	S	3.228438E 02
9.900000E 02	S	3.230562E 02
1.020000E 03	S	3.232551E 02
1.050000E 03	S	3.234419E 02
1.080000E 03	S	3.236172E 02
1.110000E 03	S	3.237815E 02
1.140000E 03	S	3.239355E 02
1.170000E 03	S	3.240801E 02
1.200000E 03	S	3.242158E 02
1.230000E 03	S	3.243430E 02
1.260000E 03	S	3.244624E 02
1.290000E 03	S	3.245745E 02
1.320000E 03	S	3.246794E 02
1.350000E 03	S	3.247781E 02

POINT-ID = 100

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.999993E 02
6.000000E 01	S	3.000000E 02
9.000000E 01	S	2.999993E 02
1.200000E 02	S	3.000000E 02
1.500000E 02	S	2.999993E 02
1.800000E 02	S	3.000000E 02
2.100000E 02	S	2.999995E 02
2.400000E 02	S	2.999998E 02
2.700000E 02	S	2.999995E 02
3.000000E 02	S	2.999998E 02
3.300000E 02	S	2.999998E 02
3.600000E 02	S	2.999998E 02
3.900000E 02	S	2.999998E 02
4.200000E 02	S	2.999998E 02
4.500000E 02	S	2.999998E 02
4.800000E 02	S	2.999998E 02
5.100000E 02	S	2.999998E 02
5.400000E 02	S	2.999998E 02
5.700000E 02	S	2.999998E 02
6.000000E 02	S	2.999998E 02
6.300000E 02	S	2.999998E 02
6.600000E 02	S	2.999998E 02
6.900000E 02	S	2.999998E 02
7.200000E 02	S	2.999998E 02
7.500000E 02	S	2.999998E 02
7.800000E 02	S	2.999998E 02
8.100000E 02	S	2.999998E 02
8.400000E 02	S	2.999998E 02
8.700000E 02	S	2.999998E 02
9.000000E 02	S	2.999998E 02
9.300000E 02	S	2.999998E 02
9.600000E 02	S	2.999998E 02
9.900000E 02	S	2.999998E 02
1.020000E 03	S	2.999998E 02
1.050000E 03	S	2.999998E 02
1.080000E 03	S	2.999998E 02
1.110000E 03	S	2.999998E 02
1.140000E 03	S	2.999998E 02
1.170000E 03	S	2.999998E 02
1.200000E 03	S	3.000005E 02
1.230000E 03	S	2.999998E 02
1.260000E 03	S	3.000005E 02
1.290000E 03	S	2.999998E 02
1.320000E 03	S	3.000005E 02
1.350000E 03	S	2.999998E 02

- - - END OF JOB - - -

```
NASTRAN LOADED AT LOCATION 0FAF20
TIME TO GO =  59 CPU SEC., 298 I/O SEC.
*      0 CPU-SEC.         0 ELAPSED-SEC.     SEM1  BEGN
*      0 CPU-SEC.         0 ELAPSED-SEC.     SEMT
*      0 CPU-SEC.         3 ELAPSED-SEC.     NAST
*      0 CPU-SEC.         3 ELAPSED-SEC.     GNFI
*      0 CPU-SEC.         3 ELAPSED-SEC.     XCSA
*      0 CPU-SEC.         4 ELAPSED-SEC.     IFP1
*      1 CPU-SEC.         7 ELAPSED-SEC.     XSOR
*      1 CPU-SEC.        12 ELAPSED-SEC.       DO  IFP
*      2 CPU-SEC.        24 ELAPSED-SEC.      END  IFP
*      2 CPU-SEC.        24 ELAPSED-SEC.     XGPI
*      4 CPU-SEC.        30 ELAPSED-SEC.     SEM1  END
*      4 CPU-SEC.        31 ELAPSED-SEC.     ----  LINKNS02 ---
=    22 I/O SEC.
 LAST LINK DID NOT USE   40016 BYTES OF OPEN CORE
*      4 CPU-SEC.        33 ELAPSED-SEC.     ----  LINK END ---
*      4 CPU-SEC.        33 ELAPSED-SEC.     XSFA
*      4 CPU-SEC.        34 ELAPSED-SEC.     XSFA
*      4 CPU-SEC.        34 ELAPSED-SEC.     3     GP1       BEGN
*      4 CPU-SEC.        39 ELAPSED-SEC.     3     GP1       END
*      4 CPU-SEC.        41 ELAPSED-SEC.     8     GP2       BEGN
*      4 CPU-SEC.        41 ELAPSED-SEC.     8     GP2       END
*      4 CPU-SEC.        42 ELAPSED-SEC.     10    PLTSET    BEGN
*      4 CPU-SEC.        42 ELAPSED-SEC.     10    PLTSET    END
*      4 CPU-SEC.        43 ELAPSED-SEC.     12    PRTMSG    BEGN
*      4 CPU-SEC.        43 ELAPSED-SEC.     12    PRTMSG    END
*      4 CPU-SEC.        44 ELAPSED-SEC.     13    SETVAL    BEGN
*      4 CPU-SEC.        44 ELAPSED-SEC.     13    SETVAL    END
*      4 CPU-SEC.        45 ELAPSED-SEC.     21    GP3       BEGN
*      4 CPU-SEC.        51 ELAPSED-SEC.     21    GP3       END
*      4 CPU-SEC.        52 ELAPSED-SEC.     23    TA1       BEGN
*      5 CPU-SEC.        63 ELAPSED-SEC.     23    TA1       END
*      5 CPU-SEC.        64 ELAPSED-SEC.     ----  LINKNS03 ---
=    53 I/O SEC.
 LAST LINK DID NOT USE   82788 BYTES OF OPEN CORE
*      5 CPU-SEC.        66 ELAPSED-SEC.     ----  LINK END ---
*      5 CPU-SEC.        68 ELAPSED-SEC.     27    SMA1      BEGN
*      5 CPU-SEC.        71 ELAPSED-SEC.     27    SMA1      END
*      5 CPU-SEC.        72 ELAPSED-SEC.     30    SMA2      BEGN
*      5 CPU-SEC.        74 ELAPSED-SEC.     30    SMA2      END
*      5 CPU-SEC.        75 ELAPSED-SEC.     ----  LINKNS05 ---
=    61 I/O SEC.
 LAST LINK DID NOT USE   64268 BYTES OF OPEN CORE
*      5 CPU-SEC.        79 ELAPSED-SEC.     ----  LINK END ---
*      5 CPU-SEC.        79 ELAPSED-SEC.     35    RMG       BEGN
*      5 CPU-SEC.        82 ELAPSED-SEC.     SDCO  MP
*      5 CPU-SEC.        83 ELAPSED-SEC.     SDCO  MP
*      5 CPU-SEC.        84 ELAPSED-SEC.     FBS
*      5 CPU-SEC.        86 ELAPSED-SEC.     FBS
*      5 CPU-SEC.        86 ELAPSED-SEC.     MPYA  D
                                                   METHOD 2 NT.NBR PASSES =    1,EST. TIME =      0.0
*      5 CPU-SEC.        88 ELAPSED-SEC.     MPYA  D
*      6 CPU-SEC.        88 ELAPSED-SEC.     TRAN  POSE
*      6 CPU-SEC.        90 ELAPSED-SEC.     TRAN  POSE
*      6 CPU-SEC.        90 ELAPSED-SEC.     MPYA  D
```

```
                                                   METHOD 2 NT.NBR PASSES =    1.EST. TIME =        0.0
*      6 CPU-SEC.       91 ELAPSED-SEC.     MPYA  D
*      6 CPU-SEC.       93 ELAPSED-SEC.     35    RMG       END
*      5 CPU-SEC.       95 ELAPSED-SEC.     ----  LINKNS04 ---
=    77 I/O SEC.
 LAST LINK DID NOT USE   72520 BYTES OF OPEN CORE
*      6 CPU-SEC.      100 ELAPSED-SEC.     ----  LINK END ---
*      6 CPU-SEC.      100 ELAPSED-SEC.     40    GP4       BEGN
*      6 CPU-SEC.      103 ELAPSED-SEC.     40    GP4       END
*      6 CPU-SEC.      105 ELAPSED-SEC.     46    GPSP      BEGN
*      6 CPU-SEC.      105 ELAPSED-SEC.     46    GPSP      END
*      6 CPU-SEC.      105 ELAPSED-SEC.     ----  LINKNS14 ---
=    85 I/O SEC.
 LAST LINK DID NOT USE  117044 BYTES OF OPEN CORE
*      6 CPU-SEC.      110 ELAPSED-SEC.     ----  LINK END ---
*      6 CPU-SEC.      110 ELAPSED-SEC.     47    OFP       BEGN
*      6 CPU-SEC.      111 ELAPSED-SEC.     47    OFP       END
*      6 CPU-SEC.      113 ELAPSED-SEC.     ----  LINKNS04 ---
=    89 I/O SEC.
 LAST LINK DID NOT USE  115664 BYTES OF OPEN CORE
*      6 CPU-SEC.      116 ELAPSED-SEC.     ----  LINK END ---
*      6 CPU-SEC.      116 ELAPSED-SEC.     51    MCE1      BEGN
*      6 CPU-SEC.      119 ELAPSED-SEC.     51    MCE1      END
*      6 CPU-SEC.      119 ELAPSED-SEC.     53    MCE2      BEGN
*      6 CPU-SEC.      122 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT.NBR PASSES =    1.EST. TIME =        0.0
*      7 CPU-SEC.      124 ELAPSED-SEC.     MPYA  D
*      7 CPU-SEC.      124 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =    1.EST. TIME =        0.0
*      7 CPU-SEC.      125 ELAPSED-SEC.     MPYA  D
*      7 CPU-SEC.      126 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =    1.EST. TIME =        0.0
*      7 CPU-SEC.      128 ELAPSED-SEC.     MPYA  D
*      8 CPU-SEC.      131 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT.NBR PASSES =    1.EST. TIME =        0.0
*      8 CPU-SEC.      132 ELAPSED-SEC.     MPYA  D
*      8 CPU-SEC.      133 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =    1.EST. TIME =        0.0
*      8 CPU-SEC.      134 ELAPSED-SEC.     MPYA  D
*      8 CPU-SEC.      134 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =    1.EST. TIME =        0.0
*      8 CPU-SEC.      136 ELAPSED-SEC.     MPYA  D
*      9 CPU-SEC.      139 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT.NBR PASSES =    1.EST. TIME =        0.0
*      9 CPU-SEC.      141 ELAPSED-SEC.     MPYA  D
*      9 CPU-SEC.      141 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =    1.EST. TIME =        0.0
*      9 CPU-SEC.      143 ELAPSED-SEC.     MPYA  D
*      9 CPU-SEC.      143 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =    1.EST. TIME =        0.0
*      9 CPU-SEC.      145 ELAPSED-SEC.     MPYA  D
*      9 CPU-SEC.      146 ELAPSED-SEC.     53    MCE2      END
*     10 CPU-SEC.      149 ELAPSED-SEC.     XSFA
*     10 CPU-SEC.      150 ELAPSED-SEC.     XSFA
*     10 CPU-SEC.      150 ELAPSED-SEC.     ----  LINKNS06 ---
=   111 I/O SEC.
 LAST LINK DID NOT USE  102132 BYTES OF OPEN CORE
*     10 CPU-SEC.      152 ELAPSED-SEC.     ----  LINK END ---
*     10 CPU-SEC.      152 ELAPSED-SEC.     75    DPD       BEGN
*     10 CPU-SEC.      157 ELAPSED-SEC.     75    DPD       END
*     10 CPU-SEC.      160 ELAPSED-SEC.     ----  LINKNS10 ---
=   120 I/O SEC.
 LAST LINK DID NOT USE  116416 BYTES OF OPEN CORE
*     10 CPU-SEC.      163 ELAPSED-SEC.     ----  LINK END ---
```

```
*    10 CPU-SEC.      163 ELAPSED-SEC.     81    MTRXIN  BEGN
*    10 CPU-SEC.      164 ELAPSED-SEC.     81    MTRXIN  END
*    10 CPU-SEC.      165 ELAPSED-SEC.     83    PARAM   BEGN
*    10 CPU-SEC.      165 ELAPSED-SEC.     83    PARAM   END
*    10 CPU-SEC.      168 ELAPSED-SEC.     XSFA
*    10 CPU-SEC.      169 ELAPSED-SEC.     XSFA
*    10 CPU-SEC.      169 ELAPSED-SEC.     88    GKAD    BEGN
*    10 CPU-SEC.      172 ELAPSED-SEC.     88    GKAD    END
*    10 CPU-SEC.      172 ELAPSED-SEC.     ----  LINKNS05 ---
=   127 I/O SEC.
 LAST LINK DID NOT USE  117064 BYTES OF OPEN CORE
*    10 CPU-SEC.      175 ELAPSED-SEC.     ----  LINK END ---
*    10 CPU-SEC.      175 ELAPSED-SEC.     92    TRLG    BEGN
*    11 CPU-SEC.      184 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASS-3 =   1.EST. TIME =      0.0
*    11 CPU-SEC.      186 ELAPSED-SEC.     MPYA  D
*    11 CPU-SEC.      188 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*    11 CPU-SEC.      189 ELAPSED-SEC.     MPYA  D
*    11 CPU-SEC.      189 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*    11 CPU-SEC.      191 ELAPSED-SEC.     MPYA  D
*    11 CPU-SEC.      191 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*    12 CPU-SEC.      193 ELAPSED-SEC.     MPYA  D
*    12 CPU-SEC.      193 ELAPSED-SEC.     92    TRLG    END
*    12 CPU-SEC.      194 ELAPSED-SEC.     ----  LINKNS11 ---
=   142 I/O SEC.
 LAST LINK DID NOT USE   58172 BYTES OF OPEN CORE
*    12 CPU-SEC.      199 ELAPSED-SEC.     ----  LINK END ---
*    12 CPU-SEC.      199 ELAPSED-SEC.     97    TRHT    BEGN
*    12 CPU-SEC.      202 ELAPSED-SEC.     DECO  MP
*    12 CPU-SEC.      203 ELAPSED-SEC.     DECO  MP
*    13 CPU-SEC.      254 ELAPSED-SEC.     97    TRHT    END
*    13 CPU-SEC.      255 ELAPSED-SEC.     ----  LINKNS12 ---
=   202 I/O SEC.
 LAST LINK DID NOT USE   69268 BYTES OF OPEN CORE
*    14 CPU-SEC.      264 ELAPSED-SEC.     ----  LINK END ---
*    14 CPU-SEC.      264 ELAPSED-SEC.     99    VDR     BEGN
*    14 CPU-SEC.      268 ELAPSED-SEC.     99    VDR     END
*    14 CPU-SEC.      269 ELAPSED-SEC.     111   PARAM   BEGN
*    14 CPU-SEC.      269 ELAPSED-SEC.     111   PARAM   END
*    14 CPU-SEC.      270 ELAPSED-SEC.     XSFA
*    14 CPU-SEC.      271 ELAPSED-SEC.     XSFA
*    14 CPU-SEC.      271 ELAPSED-SEC.     115   SDR1    BEGN
*    14 CPU-SEC.      271 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.1
*    14 CPU-SEC.      273 ELAPSED-SEC.     MPYA  D
*    14 CPU-SEC.      277 ELAPSED-SEC.     115   SDR1    END
*    14 CPU-SEC.      277 ELAPSED-SEC.     ----  LINKNS08 ---
=   212 I/O SEC.
 LAST LINK DID NOT USE  119096 BYTES OF OPEN CORE
*    15 CPU-SEC.      282 ELAPSED-SEC.     ----  LINK END ---
*    15 CPU-SEC.      282 ELAPSED-SEC.     118   PLTTRAN BEGN
*    15 CPU-SEC       283 ELAPSED-SEC.     118   PLTTRAN END
*    15 CPU-SEC.      283 ELAPSED-SEC.     ----  LINKNS13 ---
=   216 I/O SEC.
 LAST LINK DID NOT USE  114512 BYTES OF OPEN CORE
*    15 CPU-SEC.      287 ELAPSED-SEC.     ----  LINK END ---
*    15 CPU-SEC.      287 ELAPSED-SEC.     120   SDR2    BEGN
*    15 CPU-SEC.      293 ELAPSED-SEC.     120   SDR2    END
*    15 CPU-SEC.      293 ELAPSED-SEC.     ----  LINKNS14 ---
=   222 I/O SEC.
 LAST LINK DID NOT USE   66428 BYTES OF OPEN CORE
```

```
*    15 CPU-SEC.      300 ELAPSED-SEC.     ----  LINK END ---
*    15 CPU-SEC.      300 ELAPSED-SEC.     121   SDR3     BEGN
*    15 CPU-SEC.      304 ELAPSED-SEC.     121   SDR3     END
*    15 CPU-SEC.      305 ELAPSED-SEC.     123   OFP      BEGN
*    16 CPU-SEC.      308 ELAPSED-SEC.     123   OFP      END
*    16 CPU-SEC.      308 ELAPSED-SEC.     130   XYTRAN   BEGN
*    16 CPU-SEC.      308 ELAPSED-SEC.     130   XYTRAN   END
*    16 CPU-SEC.      309 ELAPSED-SEC.     ----  LINKNS02 ---
=   232 I/O SEC.
 LAST LINK DID NOT USE   11408 BYTES OF OPEN CORE
*    16 CPU-SEC.      318 ELAPSED-SEC.     ----  LINK END ---
*    16 CPU-SEC.      318 ELAPSED-SEC.     132   XYPLOT   BEGN
*    16 CPU-SEC.      318 ELAPSED-SEC.     132   XYPLOT   END
*    16 CPU-SEC.      318 ELAPSED-SEC.     138   EXIT     BEGN
-------------------------------------------------------------------------------------------------------------------------------
=   234 I/O SEC.
 LAST LINK DID NOT USE   97232 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =  11K BYTES
```

IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$**************************************************************************
$ START OF EXECUTIVE CONTROL *********************************************
$**************************************************************************
$
ID CLASS PROBLEM SIXTEEN, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR STEADY-STATE SOLUTION ALGORITHM IS TO BE USED
$
SOL 3
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $*******************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ******************************
  4      $*******************************************************************************
  5      $
  6      TITLE=      NON-LINEAR STEADY-STATE PROBLEM ... CONVECTIVE MULTILAYER INSULATION
  7      $
  8      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
  9      $
 10      LINE=51
 11      $
 12      $ REQUEST SORTED AND UNSORTED OUTPUT
 13      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 14      $
 15      ECHO=BOTH
 16      $
 17      $ SELECT THE SPC, MPC, AND LOAD SETS TO BE USED IN THIS SOLUTION
 18      $
 19      SPC=100
 20      MPC=200
 21      LOAD=300
 22      $
 23      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 24      $
 25      TEMP(MATERIAL)=400
 26      $
 27      $ SELECT THE OUTPUT DESIRED (TEMPERATURES, LOADS, AND CONSTRAINT POWERS)
 28      $
 29      OUTPUT
 30      THERMAL=ALL
 31      OLOAD=ALL
 32      SPCF=ALL
 33      $
 34      $*******************************************************************************
 35      $ END CASE CONTROL --- START BULK DATA *****************************************
 36      $*******************************************************************************
 37      $
 38      BEGIN BULK
```

I N P U T` B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR TH'CKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY
$
MAT4    1000    200.                                                    ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

INPUT BULK DATA DECK ECHO

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$***********************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
SADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WILL CONVERT PROBLEM TWO TO PROBLEM SIXTEEN.
$ PROBLEM SIXTEEN ADDS MULTILAYER INSULATION TO BOTH SIDES OF THE RADIATING FIN.
$ AND DOES THIS BY SIMULATING AN EFFECTIVE CONVECTIVITY FROM THE FIN TO THE
$ RADIATING SURFACES WHICH IS DEPENDENT ON THE THICKNESS OF THE MULTILAYER
$ INSULATION.
$ NOTE THAT THE RADLST BULK DATA CARD HAS BEEN REPLACED.
$ ALSO NOTE THAT THE THERMAL GUESS VECTOR HAS NOT BEEN CHANGED, THOUGH IT IS
$ NO LONGER AS ACCURATE AS IT WAS IN PROBLEM TWO.
$ AS LONG AS THE TEMPERATURE GUESSES ARE GREATER THAN 80 PERCENT OF THE FINAL
$ SOLUTION AT EACH POINT, THEN CONVERGENCE WILL OCCUR.
$
$
$ THE FOLLOWING GRID POINTS AND CHBDY CARDS DEFINE THE NEW RADIATING SURFACES.
$ NOTE THAT CONVECTION IS SPECIFIED.
$
GRID    11              0.      0.      0.
GRID    12              .1      0.      0.
GRID    13              .2      0.      0.
GRID    14              .3      0.      0.
GRID    15              0.      .1      0.
GRID    16              .1      .1      0.
GRID    17              .2      .1      0.
GRID    18              .3      .1      0.
GRID    21              0.      0.      0.
GRID    22              .1      0.      0.
GRID    23              .2      0.      0.
GRID    24              .3      0.      0.
GRID    25              0.      .1      0.
GRID    26              .1      .1      0.
GRID    27              .2      .1      0.
GRID    28              .3      .1      0.
CHBDY   1200    2001    AREA4   11      12      16      15              +MULT1
+MULT1  1       2       6       5
CHBDY   1300    2001    AREA4   12      13      17      16              +MULT2
+MULT2  2       3       7       6
CHBDY   1400    2001    AREA4   13      14      18      17              +MULT3
+MULT3  3       4       8       7
CHBDY   2500    2001    AREA4   25      26      22      21              +MULT10
+MULT10 5       6       2       1
CHBDY   2600    2001    AREA4   26      27      23      22              +MULT11
+MULT11 6       7       3       2
CHBDY   2700    2001    AREA4   27      28      24      23              +MULT12
+MULT12 7       8       4       3
$
$ DEFINE THE EMISSIVITY AND CONVECTIVE COEFFICIENT.
$
PHBDY   2001    2002            .9
MAT4    2002    1.
$
$ REPLACE THE OLD RADLST CARD WHICH WAS REMOVED FROM THE ORIGINAL BULK DATA.
```

INPUT BULK DATA DECK ECHO

```
      .   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
      $ THIS IS REQUIRED TO FORCE THE RADIATIVE LOSSES TO COME FROM THE OUTSIDE OF
      $ THE MULTILAYER INSULATION.
      $
      RADLST  1200    1300    1400    2500    2600    2700
      $
      $*******************************************************************************
      $ END OF BULK DATA ********************************************************************
      $*******************************************************************************
      $
      ENDDATA
TOTAL COUNT=  163
```

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED.XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
1-	CHBDY	60	300	LINE	1	5				+CONVEC
2-	+CONVEC	100	100							
3-	CHBDY	200	2000	AREA4	1	2	6	5		
4-	CHBDY	300	2000	AREA4	2	3	7	6		
5-	CHBDY	400	2000	AREA4	3	4	8	7		
6-	CHBDY	500	2000	AREA4	5	6	2	1		
7-	CHBDY	600	2000	AREA4	6	7	3	2		
8-	CHBDY	700	2000	AREA4	7	8	4	3		
9-	CHBDY	1200	2001	AREA4	11	12	16	15		+MULT1
10-	+MULT1	1	2	6	5					
11-	CHBDY	1300	2001	AREA4	12	13	17	16		+MULT2
12-	+MULT2	2	3	7	6					
13-	CHBDY	1400	2001	AREA4	13	14	18	17		+MULT3
14-	+MULT3	3	4	8	7					
15-	CHBDY	2500	2001	AREA4	25	26	22	21		+MULT10
16-	+MULT10	5	6	2	1					
17-	CHBDY	2600	2001	AREA4	26	27	23	22		+MULT11
18-	+MULT11	6	7	3	2					
19-	CHBDY	2700	2001	AREA4	27	28	24	23		+MULT12
20-	+MULT12	7	8	4	3					
21-	CQUAD2	30	200	1	2	6	5			
22-	CQUAD2	40	200	2	3	7	6			
23-	CQUAD2	50	200	3	4	8	7			
24-	CROD	10	100	10	2					
25-	CROD	20	100	9	6					
26-	GRID	1		0.0	0.0	0.0				
27-	GRID	2		.1	0.0	0.0				
28-	GRID	3		.2	0.0	0.0				
29-	GRID	4		.3	0.0	0.0				
30-	GRID	5		0.0	.1	0.0				
31-	GRID	6		.1	.1	0.0				
32-	GRID	7		.2	.1	0.0				
33-	GRID	8		.3	.1	0.0				
34-	GRID	9		0.0	.2	0.0				
35-	GRID	10		0.0	-.1	0.0				
36-	GRID	11		0.0	0.0	0.0				
37-	GRID	12		.1	0.0	0.0				
38-	GRID	13		.2	0.0	0.0				
39-	GRID	14		.3	0.0	0.0				
40-	GRID	15		0.0	.1	0.0				
41-	GRID	16		.1	.1	0.0				
42-	GRID	17		.2	.1	0.0				
43-	GRID	18		.3	.1	0.0				
44-	GRID	21		0.0	0.0	0.0				
45-	GRID	22		.1	0.0	0.0				
46-	GRID	23		.2	0.0	0.0				
47-	GRID	24		.3	0.0	0.0				
48-	GRID	25		0.0	.1	0.0				
49-	GRID	26		.1	.1	0.0				
50-	GRID	27		.2	.1	0.0				
51-	GRID	28		.3	.1	0.0				

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
52-	GRID	100		-.05	.05	0.0				
53-	MAT4	1000	200.							ALUMINUM
54-	MAT4	2002	1.							
55-	MAT4	3000	200.							
56-	MPC	200	9	1	1.	5	1	-1.		
57-	MPC	200	10	1	1.	1	1	-1.		
58-	PARAM	EPSHT	.0001							
59-	PARAM	MAXIT	8							
60-	PARAM	SIGMA	5.685E-8							
61-	PARAM	TABS	273.15							
62-	PHBDY	300	3000	.314						
63-	PHBDY	2000			.90					
64-	PHBDY	2001	2002		.9					
65-	PQUAD2	200	1000	.01						
66-	PROD	100	1000	.001						
67-	RADLST	1200	1300	1400	2500	2600	2700			
68-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
69-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
70-	RADMTX	3	0.0	0.0	0.0	0.0				
71-	RADMTX	4	0.0	0.0	0.0					
72-	RADMTX	5	0.0	0.0						
73-	RADMTX	6	0.0							
74-	SLOAD	300	1	4.	2	8.				
75-	SLOAD	300	3	8.	4	4.				
76-	SLOAD	300	5	4.	6	8.				
77-	SLOAD	300	7	8.	8	4.				
78-	SPC1	100	1	100						
79-	TEMP	400	100	300.						
80-	TEMPD	400	300.							
	ENDDATA									

NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM

```
*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE         6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023.          B =     3
                                            C =     0
                                            R =     2

*** USER INFORMATION MESSAGE 3027. SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS        0  SECONDS.
```

```
*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         1

*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         1

*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HRFN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169. THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB PARTITION HRSN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** USER INFORMATION MESSAGE 3028.      B =   12     BBAR =   13
                                        C =   11     CBAR =    8
                                        R =   23

*** USER INFORMATION MESSAGE 3027. UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS      0 SECONDS.
```

D I A G 1 8 O U T P U T F R O M S S G H T

ITERATION	EPSILON-P	LAMBDA-1	EPSILON-T
1	6.660479E-02		
2	1.958826E-02	2.047697E 00	1.811909E-02
3	1.194168E-02	1.640297E 00	1.448234E-02
4	8.270945E-03	1.443648E 00	1.186501E-02
5	6.107680E-03	1.354246E 00	9.136528E-03
6	4.689548E-03	1.302464E 00	6.925561E-03
7	3.696208E-03	1.263666E 00	5.232777E-03
8	2.968196E-03	1.245798E 00	3.942985E-03

*** USER INFORMATION MESSAGE 3086, ENTERING SSGHT EXIT MODE BY REASON NUMBER 2 (MAXIMUM ITERATIONS)

T E M P E R A T U R E   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	3.050085E 02	3.104246E 02	3.182302E 02	3.208242E 02	3.050085E 02	3.104246E 02
7	S	3.182302E 02	3.208242E 02	3.050085E 02	3.050085E 02	3.701466E 01	3.779317E 01
13	S	3.861156E 01	3.885472E 01	3.701454E 01	3.779312E 01	3.861209E 01	3.885464E 01
21	S	3.701447E 01	3.779398E 01	3.861153E 01	3.885516E 01	3.701344E 01	3.779346E 01
27	S	3.861099E 01	3.885524E 01				
100	S	3.000000E 02					

LOAD VECTOR

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	4.000000E 00	8.000000E 00	8.000000E 00	4.000000E 00	4.000000E 00	8.000000E 00
7	S	8.000000E 00	4.000000E 00				

FORCES OF SINGLE-POINT CONSTRAINT

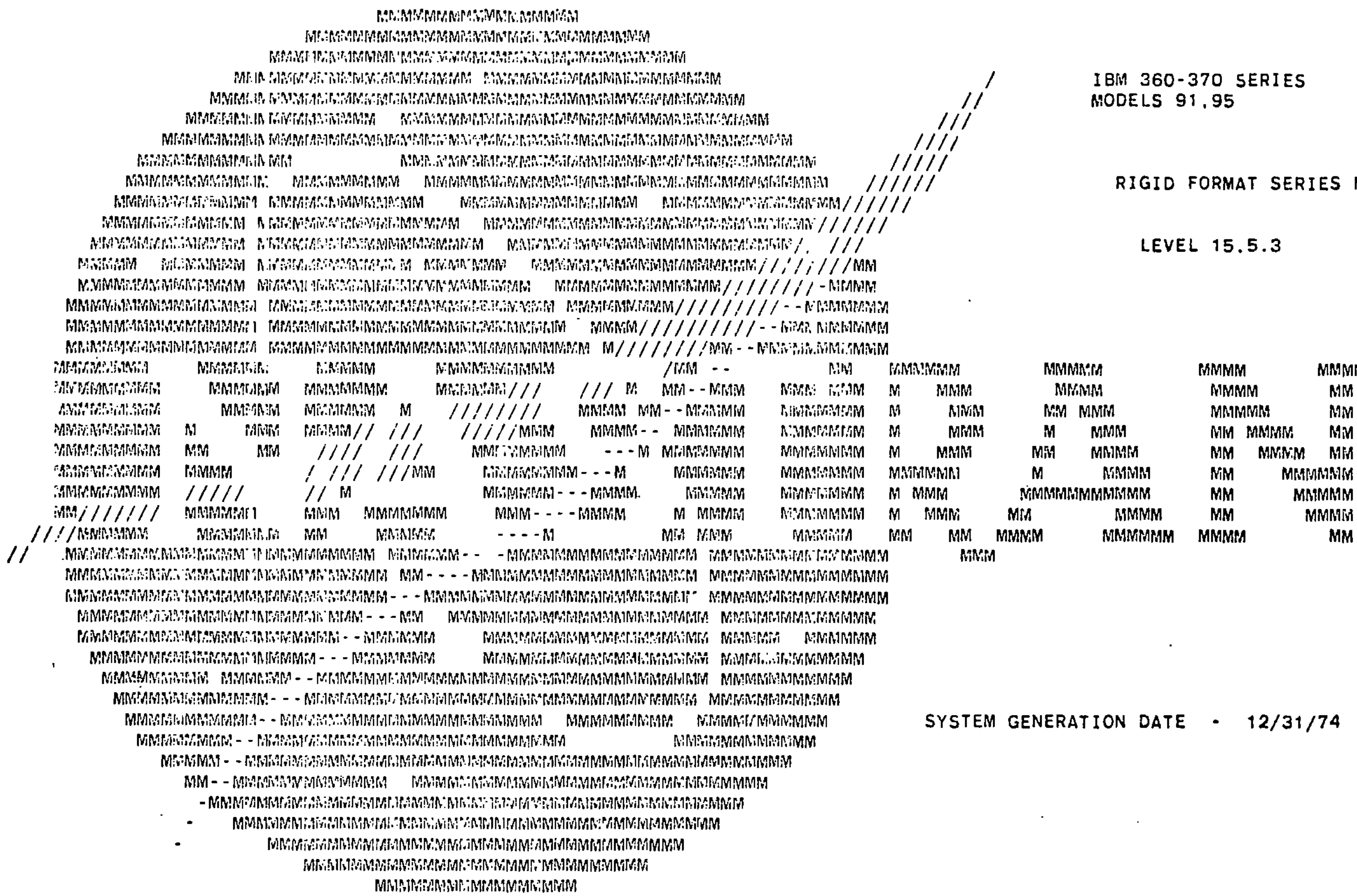
POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
100	S	-3.145313E 01					

- - - END OF JOB - - -

```
.............................................................................................................................
.............................................................................................................................
.............................................................................................................................
.............................................................................................................................
.............................................................................................................................
 NASTRAN LOADED AT LOCATION 218720
 TIME TO GO =   59 CPU SEC., 238 I/O SEC.
*      0 CPU-SEC.          0 ELAPSED-SEC.     SEM1  BEGN
*      0 CPU-SEC.          0 ELAPSED-SEC.     SEMT
*      1 CPU-SEC.          4 ELAPSED-SEC.     NAST
*      1 CPU-SEC.          4 ELAPSED-SEC.     GNFI
*      1 CPU-SEC.          4 ELAPSED-SEC.     XCSA
*      1 CPU-SEC.          6 ELAPSED-SEC.     IFP1
*      1 CPU-SEC.          9 ELAPSED-SEC.     XSOR
*      2 CPU-SEC.         14 ELAPSED-SEC.       DO  IFP
*      2 CPU-SEC.         24 ELAPSED-SEC.      END  IFP
*      2 CPU-SEC.         24 ELAPSED-SEC.     XGPI
*      3 CPU-SEC.         28 ELAPSED-SEC.     SEM1  END
*      3 CPU-SEC.         29 ELAPSED-SEC.     ----  LINKNS02 ---
=     21 I/O SEC.
 LAST LINK DID NOT USE        0 BYTES OF OPEN CORE
*      4 CPU-SEC.         31 ELAPSED-SEC.     ----  LINK END ---
*      4 CPU-SEC.         31 ELAPSED-SEC.     XSFA
*      4 CPU-SEC.         32 ELAPSED-SEC.     XSFA
*      4 CPU-SEC.         32 ELAPSED-SEC.     2     GP1       BEGN
*      4 CPU-SEC.         37 ELAPSED-SEC.     2     GP1       END
*      4 CPU-SEC.         38 ELAPSED-SEC.     5     GP2       BEGN
*      4 CPU-SEC.         39 ELAPSED-SEC.     5     GP2       END
*      4 CPU-SEC.         40 ELAPSED-SEC.     7     PLTSET    BEGN
*      4 CPU-SEC.         40 ELAPSED-SEC.     7     PLTSET    END
*      4 CPU-SEC.         41 ELAPSED-SEC.     9     PRTMSG    BEGN
*      4 CPU-SEC.         41 ELAPSED-SEC.     9     PRTMSG    END
*      4 CPU-SEC.         42 ELAPSED-SEC.     10    SETVAL    BEGN
*      4 CPU-SEC.         42 ELAPSED-SEC.     10    SETVAL    END
*      4 CPU-SEC.         43 ELAPSED-SEC.     18    GP3       BEGN
*      4 CPU-SEC.         52 ELAPSED-SEC.     18    GP3       END
*      4 CPU-SEC.         53 ELAPSED-SEC.     20    TA1       BEGN
*      5 CPU-SEC.         61 ELAPSED-SEC.     20    TA1       END
*      5 CPU-SEC.         62 ELAPSED-SEC.     ----  LINKNS03 ---
=     51 I/O SEC.
 LAST LINK DID NOT USE    41828 BYTES OF OPEN CORE
*      5 CPU-SEC.         65 ELAPSED-SEC.     ----  LINK END ---
*      5 CPU-SEC.         65 ELAPSED-SEC.     24    SMA1      BEGN
*      5 CPU-SEC.         69 ELAPSED-SEC.     24    SMA1      END
*      5 CPU-SEC.         69 ELAPSED-SEC.     ----  LINKNS05 ---
=     57 I/O SEC.
 LAST LINK DID NOT USE    23308 BYTES OF OPEN CORE
*      5 CPU-SEC.         73 ELAPSED-SEC.     ----  LINK END ---
*      5 CPU-SEC.         73 ELAPSED-SEC.     27    RMG       BEGN
*      5 CPU-SEC.         76 ELAPSED-SEC.     SDCO  MP
*      5 CPU-SEC.         77 ELAPSED-SEC.     SDCO  MP
*      5 CPU-SEC.         78 ELAPSED-SEC.     FBS
*      5 CPU-SEC.         80 ELAPSED-SEC.     FBS
*      5 CPU-SEC.         82 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*      5 CPU-SEC.         83 ELAPSED-SEC.     MPYA  D
*      5 CPU-SEC.         83 ELAPSED-SEC.     TRAN  POSE
*      5 CPU-SEC.         85 ELAPSED-SEC.     TRAN  POSE
*      5 CPU-SEC.         85 ELAPSED-SEC.     MPYA  D
                                                    METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*      6 CPU-SEC.         86 ELAPSED-SEC.     MPYA  D
```

```
*     6 CPU-SEC.       86 ELAPSED-SEC.     27     RMG      END
*     6 CPU-SEC.       90 ELAPSED-SEC.     ----   LINKNS04 ---
=    72 I/O SEC.
 LAST LINK DID NOT USE   31560 BYTES OF OPEN CORE
*     6 CPU-SEC.       93 ELAPSED-SEC.     ----   LINK END ---
*     6 CPU-SEC.       93 ELAPSED-SEC.     32     GP4      BEGN
*     6 CPU-SEC.       99 ELAPSED-SEC.     32     GP4      END
*     6 CPU-SEC.      101 ELAPSED-SEC.     38     GPSP     BEGN
*     6 CPU-SEC.      102 ELAPSED-SEC.     38     GPSP     END
*     6 CPU-SEC.      102 ELAPSED-SEC.     ----   LINKNS14 ---
=    84 I/O SEC.
 LAST LINK DID NOT USE   76084 BYTES OF OPEN CORE
*     6 CPU-SEC.      105 ELAPSED-SEC.     ----   LINK END ---
*     6 CPU-SEC.      105 ELAPSED-SEC.     39     OFP      BEGN
*     6 CPU-SEC.      106 ELAPSED-SEC.     39     OFP      END
*     6 CPU-SEC.      107 ELAPSED-SEC.     ----   LINKNS04 ---
=    87 I/O SEC.
 LAST LINK DID NOT USE   74704 BYTES OF OPEN CORE
*     6 CPU-SEC.      110 ELAPSED-SEC.     ----   LINK END ---
*     6 CPU-SEC.      110 ELAPSED-SEC.     42     MCE1     BEGN
*     6 CPU-SEC.      114 ELAPSED-SEC.     42     MCE1     END
*     7 CPU-SEC.      115 ELAPSED-SEC.     44     MCE2     BEGN
*     7 CPU-SEC.      117 ELAPSED-SEC.     MPYA   D
                                                  METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*     7 CPU-SEC.      118 ELAPSED-SEC.     MPYA   D
*     7 CPU-SEC.      119 ELAPSED-SEC.     MPYA   D
                                                  METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*     7 CPU-SEC.      120 ELAPSED-SEC.     MPYA   D
*     7 CPU-SEC.      120 ELAPSED-SEC.     MPYA   D
                                                  METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*     7 CPU-SEC.      122 ELAPSED-SEC.     MPYA   D
*     7 CPU-SEC.      124 ELAPSED-SEC.     MPYA   D
                                                  METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*     8 CPU-SEC.      125 ELAPSED-SEC.     MPYA   D
*     8 CPU-SEC.      126 ELAPSED-SEC.     MPYA   D
                                                  METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*     8 CPU-SEC.      127 ELAPSED-SEC.     MPYA   D
*     8 CPU-SEC.      127 ELAPSED-SEC.     MPYA   D
                                                  METHOD 2 T ,NBR PASSES =    1,EST. TIME =       0.0
*     8 CPU-SEC.      129 ELAPSED-SEC.     MPYA   D
*     8 CPU-SEC.      129 ELAPSED-SEC.     44     MCE2     END
*     8 CPU-SEC.      131 ELAPSED-SEC.     ----   LINKNS07 ---
=   106 I/O SEC.
 LAST LINK DID NOT USE   68244 BYTES OF OPEN CORE
*     8 CPU-SEC.      139 ELAPSED-SEC.     ----   LINK END ---
*     8 CPU-SEC.      139 ELAPSED-SEC.     50     VEC      BEGN
*     8 CPU-SEC.      140 ELAPSED-SEC.     50     VEC      END
*     8 CPU-SEC.      141 ELAPSED-SEC.     51     PARTN    BEGN
*     8 CPU-SEC.      144 ELAPSED-SEC.     51     PARTN    END
*     8 CPU-SEC.      144 ELAPSED-SEC.     52     PARTN    BEGN
*     9 CPU-SEC.      146 ELAPSED-SEC.     52     PARTN    END
*     9 CPU-SEC.      146 ELAPSED-SEC.     55     DECOMP   BEGN
*     9 CPU-SEC.      147 ELAPSED-SEC.     DECO   MP
*     9 CPU-SEC.      149 ELAPSED-SEC.     DECO   MP
*     9 CPU-SEC.      153 ELAPSED-SEC.     55     DECOMP   END
*     9 CPU-SEC.      156 ELAPSED-SEC.     XSFA
*     9 CPU-SEC.      157 ELAPSED-SEC.     XSFA
*     9 CPU-SEC.      157 ELAPSED-SEC.     ----   LINKNS05 ---
=   118 I/O SEC.
 LAST LINK DID NOT USE   59592 BYTES OF OPEN CORE
*     9 CPU-SEC.      160 ELAPSED-SEC.     ----   LINK END ---
*     9 CPU-SEC.      160 ELAPSED-SEC.     59     SSG1     BEGN
*     9 CPU-SEC.      166 ELAPSED-SEC.     59     SSG1     END
*     9 CPU-SEC.      167 ELAPSED-SEC.     63     SSG2     BEGN
```

```
*      9 CPU-SEC.       169 ELAPSED-SEC.     MPYA  D
                                                   METHOD 2 T ,NBR PASSES =   1.EST. TIME =      0.0
*      9 CPU-SEC.       171 ELAPSED-SEC.     MPYA  D
*      9 CPU-SEC.       174 ELAPSED-SEC.     MPYA  D
                                                   METHOD 2 NT,NBR PASSES =   1.EST. TIME =      0.0
*     10 CPU-SEC.       175 ELAPSED-SEC.     MPYA  D
*     10 CPU-SEC.       175 ELAPSED-SEC.     63    SSG2     END
*     10 CPU-SEC.       176 ELAPSED-SEC.     66    SSGHT    BEGN
*     11 CPU-SEC.       213 ELAPSED-SEC.     66    SSGHT    END
*     11 CPU-SEC.       214 ELAPSED-SEC.     ----  LINKNS08 ---
=   163 I/O SEC.
 LAST LINK DID NOT USE   24308 BYTES OF OPEN CORE
*     11 CPU-SEC.       223 ELAPSED-SEC.     ----  LINK END ---
*     11 CPU-SEC.       223 ELAPSED-SEC.     71    PLTTRAN BEGN
*     11 CPU-SEC.       225 ELAPSED-SEC.     71    PLTTRAN END
*     11 CPU-SEC.       226 ELAPSED-SEC.     ----  LINKNS13 ---
=   168 I/O SEC.
 LAST LINK DID NOT USE   73552 BYTES OF OPEN CORE
*     11 CPU-SEC.       232 ELAPSED-SEC.     ----  LINK END ---
*     11 CPU-SEC.       232 ELAPSED-SEC.     74    SDR2     BEGN
*     11 CPU-SEC.       236 ELAPSED-SEC.     74    SDR2     END
*     11 CPU-SEC.       237 ELAPSED-SEC.     ----  LINKNS14 ---
=   177 I/O SEC.
 LAST LINK DID NOT USE   25468 BYTES OF OPEN CORE
*     11 CPU-SEC.       245 ELAPSED-SEC.     ----  LINK END ---
*     11 CPU-SEC.       245 ELAPSED-SEC.     75    OFP      BEGN
*     11 CPU-SEC.       248 ELAPSED-SEC.     75    OFP      END
*     11 CPU-SEC.       249 ELAPSED-SEC.     ----  LINKNS13 ---
=   185 I/O SEC.
 LAST LINK DID NOT USE   68004 BYTES OF OPEN CORE
*     12 CPU-SEC.       261 ELAPSED-SEC.     ----  LINK END ---
*     12 CPU-SEC.       261 ELAPSED-SEC.     77    SDRHT    BEGN
*     12 CPU-SEC.       261 ELAPSED-SEC.     77    SDRHT    END
*     12 CPU-SEC.       262 ELAPSED-SEC.     ----  LINKNS14 ---
=   193 I/O SEC.
 LAST LINK DID NOT USE   39888 BYTES OF OPEN CORE
*     12 CPU-SEC.       278 ELAPSED-SEC.     ----  LINK END ---
*     12 CPU-SEC.       278 ELAPSED-SEC.     78    OFP      BEGN
*     12 CPU-SEC.       278 ELAPSED-SEC.     78    OFP      END
*     12 CPU-SEC.       280 ELAPSED-SEC.     92    EXIT     BEGN
----------------------------------------------------------------------------------------------------------
=   195 I/O SEC.
 LAST LINK DID NOT USE   74704 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =    OK BYTES
```



IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$****************************************************************************
$ START OF EXECUTIVE CONTROL ****************************************************
$****************************************************************************
$
ID CLASS PROBLEM SEVENTEEN, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR STEADY-STATE SOLUTION ALGORITHM IS TO BE USED
$
SOL 3
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $*******************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ******************************
  4      $*******************************************************************************
  5      $
  6      TITLE= NLSS PROBLEM ... SAME AS PROBLEM SIXTEEN, BUT WITH A BETTER GUESS VECTOR
  7      SUBTITLE=  AND AN ELFORCE OUTPUT REQUEST.
  8      $
  9      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
 10      $
 11      LINE=51
 12      $
 13      $ REQUEST SORTED AND UNSORTED OUTPUT
 14      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 15      $
 16      ECHO=BOTH
 17      $
 18      $ SELECT THE SPC, MPC, AND LOAD SETS TO BE USED IN THIS SOLUTION
 19      $
 20      SPC=100
 21      MPC=200
 22      LOAD=300
 23      $
 24      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 25      $
 26      TEMP(MATERIAL)=400
 27      $
 28      $ SELECT THE OUTPUT DESIRED(TEMPERATURES, LOADS, CONSTRAINT FORCES, AND
 29      $ GRADIENTS AND HEAT FLOWS)
 30      $
 31      OUTPUT
 32      THERMAL=ALL
 33      OLOAD=ALL
 34      SPCF=ALL
 35      $
 36      $ REQUEST ELEMENT GRADIENT AND HEAT FLOW OUTPUT
 37      $
 38      ELFORCE=ALL
 39      $
 40      $*******************************************************************************
 41      $ END CASE CONTROL --- START BULK DATA *****************************************
 42      $*******************************************************************************
 43      $
 44      BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ...   9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY
$
MAT4    1000    200.                                                    ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

INPUT BULK DATA DECK ECHO

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*****************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
SEMP    400     100     300.
SEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
SADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WILL CONVERT PROBLEM TWO TO PROBLEM SIXTEEN.
$ PROBLEM SIXTEEN ADDS MULTILAYER INSULATION TO BOTH SIDES OF THE RADIATING FIN.
$ AND DOES THIS BY SIMULATING AN EFFECTIVE CONVECTIVITY FROM THE FIN TO THE
$ RADIATING SURFACES WHICH IS DEPENDENT ON THE THICKNESS OF THE MULTILAYER
$ INSULATION.
$ NOTE THAT THE RADLST BULK DATA CARD HAS BEEN REPLACED.
$ ALSO NOTE THAT THE THERMAL GUESS VECTOR HAS NOT BEEN CHANGED. THOUGH IT IS
$ NO LONGER AS ACCURATE AS IT WAS IN PROBLEM TWO.
$ AS LONG AS THE TEMPERATURE GUESSES ARE GREATER THAN 80 PERCENT OF THE FINAL
$ SOLUTION AT EACH POINT. THEN CONVERGENCE WILL OCCUR.
$
$
$ THE FOLLOWING GRID POINTS AND CHBDY CARDS DEFINE THE NEW RADIATING SURFACES.
$ NOTE THAT CONVECTION IS SPECIFIED.
$
GRID    11              0.      0.      0.
GRID    12              .1      0.      0.
GRID    13              .2      0.      0.
GRID    14              .3      0.      0.
GRID    15              0.      .1      0.
GRID    16              .1      .1      0.
GRID    17              .2      .1      0.
GRID    18              .3      .1      0.
GRID    21              0.      0.      0.
GRID    22              .1      0.      0.
GRID    23              .2      0.      0.
GRID    24              .3      0.      0.
GRID    25              0.      .1      0.
GRID    26              .1      .1      0.
GRID    27              .2      .1      0.
GRID    28              .3      .1      0.
CHBDY   1200    2001    AREA4   11      12      16      15              +MULT1
+MULT1  1       2       6       5
CHBDY   1300    2001    AREA4   12      13      17      16              +MULT2
+MULT2  2       3       7       6
CHBDY   1400    2001    AREA4   13      14      18      17              +MULT3
+MULT3  3       4       8       7
CHBDY   2500    2001    AREA4   25      26      22      21              +MULT10
+MULT10 5       6       2       1
CHBDY   2600    2001    AREA4   26      27      23      22              +MULT11
+MULT11 6       7       3       2
CHBDY   2700    2001    AREA4   27      28      24      23              +MULT12
+MULT12 7       8       4       3
$
$ DEFINE THE EMISSIVITY AND CONVECTIVE COEFFICIENT
$
PHBDY   2001    2002            9
MAT4    2002    1.
$
$ REPLACE THE OLD RADLST CARD WHICH WAS REMOVED FROM THE ORIGINAL BULK DATA.
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$ THIS IS REQUIRED TO FORCE THE RADIATIVE LOSSES TO COME FROM THE OUTSIDE OF
$ THE MULTILAYER INSULATION.
$
RADLST  1200    1300    1400    2500    2600    2700
$********************************************************************************
$ CONVERT PROBLEM SIXTEEN TO PROBLEM SEVENTEEN BY CHANGING THE THERMAL
$ GUESS VECTOR. THE ONLY CHANGE TO THE PREVIOUS BULK DATA HAS BEEN THE
$ CONVERSION OF THE OLD GUESS VECTOR TO COMMENT CARDS.
$ THE ONLY OTHER CHANGE WAS THE ADDITION OF AN ELFORCE=ALL OUTPUT REQUEST
$
TEMP    400     1       330.    2       330.    3       330.
TEMP    400     4       330.    5       330.    6       330.
TEMP    400     7       330.    8       330.    9       330.
TEMP    400     10      330.    100     300.
TEMPD   400     70.
$
$********************************************************************************
$ END OF BULK DATA ***************************************************************
$********************************************************************************
$
ENDDATA
```

TOTAL COUNT= 174

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED.XSORT WILL RE-ORDER DECK.

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 .
1-	CHBDY	60	300	LINE	1	5				+CONVEC
2-	+CONVEC	100	100							
3-	CHBDY	200	2000	AREA4	1	2	6	5		
4-	CHBDY	300	2000	AREA4	2	3	7	6		
5-	CHBDY	400	2000	AREA4	3	4	8	7		
6-	CHBDY	500	2000	AREA4	5	6	2	1		
7-	CHBDY	600	2000	AREA4	6	7	3	2		
8-	CHBDY	700	2000	AREA4	7	8	4	3		
9-	CHBDY	1200	2001	AREA4	11	12	16	15		+MULT1
10-	+MULT1	1	2	6	5					
11-	CHBDY	1300	2001	AREA4	12	13	17	16		+MULT2
12-	+MULT2	2	3	7	6					
13-	CHBDY	1400	2001	AREA4	13	14	18	17		+MULT3
14-	+MULT3	3	4	8	7					
15-	CHBDY	2500	2001	AREA4	25	26	22	21		+MULT10
16-	+MULT10	5	6	2	1					
17-	CHBDY	2600	2001	AREA4	26	27	23	22		+MULT11
18-	+MULT11	6	7	3	2					
19-	CHBDY	2700	2001	AREA4	27	28	24	23		+MULT12
20-	+MULT12	7	8	4	3					
21-	CQUAD2	30	200	1	2	6	5			
22-	CQUAD2	40	200	2	3	7	6			
23-	CQUAD2	50	200	3	4	8	7			
24-	CROD	10	100	10	2					
25-	CROD	20	100	9	6					
26-	GRID	1		0.0	0.0	0.0				
27-	GRID	2		.1	0.0	0.0				
28-	GRID	3		.2	0.0	0.0				
29-	GRID	4		.3	0.0	0.0				
30-	GRID	5		0.0	.1	0.0				
31-	GRID	6		.1	.1	0.0				
32-	GRID	7		.2	.1	0.0				
33-	GRID	8		.3	.1	0.0				
34-	GRID	9		0.0	.2	0.0				
35-	GRID	10		0.0	-.1	0.0				
36-	GRID	11		0.0	0.0	0.0				
37-	GRID	12		.1	0.0	0.0				
38-	GRID	13		.2	0.0	0.0				
39-	GRID	14		.3	0.0	0.0				
40-	GRID	15		0.0	.1	0.0				
41-	GRID	16		.1	.1	0.0				
42-	GRID	17		.2	.1	0.0				
43-	GRID	18		.3	.1	0.0				
44-	GRID	21		0.0	0.0	0.0				
45-	GRID	22		.1	0.0	0.0				
46-	GRID	23		.2	0.0	0.0				
47-	GRID	24		.3	0.0	0.0				
48-	GRID	25		0.0	.1	0.0				
49-	GRID	26		.1	.1	0.0				
50-	GRID	27		.2	.1	0.0				
51-	GRID	28		.3	.1	0.0				

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 .
52-	GRID	100		-.05	.05	0.0				
53-	MAT4	1000	200.							ALUMINUM
54-	MAT4	2002	1.							
55-	MAT4	3000	200.							
56-	MPC	200	9	1	1.	5	1	-1.		
57-	MPC	200	10	1	1.	1	1	-1.		
58-	PARAM	EPSHT	.0001							
59-	PARAM	MAXIT	8							
60-	PARAM	SIGMA	5.685E-8							
61-	PARAM	TABS	273.15							
62-	PHBDY	300	3000	.314						
63-	PHBDY	2000			.90					
64-	PHBDY	2001	2002		.9					
65-	PQUAD2	200	1000	.01						
66-	PROD	100	1000	.001						
67-	RADLST	1200	1300	1400	2500	2600	2700			
68-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
69-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
70-	RADMTX	3	0.0	0.0	0.0	0.0				
71-	RADMTX	4	0.0	0.0	0.0					
72-	RADMTX	5	0.0	0.0						
73-	RADMTX	6	0.0							
74-	SLOAD	300	1	4.	2	8.				
75-	SLOAD	300	3	8.	4	4.				
76-	SLOAD	300	5	4.	6	8.				
77-	SLOAD	300	7	8.	8	4.				
78-	SPC1	100	1	100						
79-	TEMP	400	1	330.	2	330.	3	330.		
80-	TEMP	400	4	330.	5	330.	6	330.		
81-	TEMP	400	7	330.	8	330.	9	330.		
82-	TEMP	400	10	330.	100	300.				
83-	TEMPD	400	70.							
	ENDDATA									

NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM

*** USER INFORMATION MESSAGE FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE . 6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99

*** USER INFORMATION MESSAGE 3023, B = 3
C = 0
R = 2

*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS 0 SECONDS.

```
*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         1

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSF
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKFS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HKSS
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         1

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HRFN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** SYSTEM WARNING MESSAGE 2169, THE FORM PARAMETER AS GIVEN TO THE PARTITIONING MODULE FOR SUB-PARTITION HRSN
HAS NOT BEEN SET OR IS OF ILLEGAL VALUE.  IT HAS BEEN RESET =         2

*** USER INFORMATION MESSAGE 3028,      B =   12      BBAR =   13
                                        C =   11      CBAR =    8
                                        R =   23

*** USER INFORMATION MESSAGE 3027, UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS       0 SECONDS.
```

```
D I A G   1 8   O U T P U T   F R O M   S S G H T

ITERATION    EPSILON-P          LAMBDA-1           EPSILON-T
==================================================================
    1       9.723890E-02
    2       9.781306E-04      8.867649E 02      1.027934E-07

*** USER INFORMATION MESSAGE 3086, ENTERING SSGHT EXIT MODE BY REASON NUMBER  1 ( NORMAL CONVERGENCE )
```

T E M P E R A T U R E   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	3.047539E 02	3.098955E 02	3.173071E 02	3.197708E 02	3.047539E 02	3.098955E 02
7	S	3.173071E 02	3.197708E 02	3.047539E 02	3.047539E 02	9.320056E 00	1.032129E 01
13	S	1.144310E 01	1.175737E 01	9.320256E 00	1.032132E 01	1.144313E 01	1.175758E 01
21	S	9.320257E 00	1.032132E 01	1.144313E 01	1.175758E 01	9.320056E 00	1.032129E 01
27	S	1.144310E 01	1.175737E 01				
100	S	3.000000E 02					

L O A D   V E C T O R

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
1	S	4.000000E 00	8.000000E 00	8.000000E 00	4.000000E 00	4.000000E 00	8.000000E 00
7	S	8.000000E 00	4.000000E 00				

NLSS PROBLEM ... SAME AS PROBLEM SIXTEEN, BUT WITH A BETTER GUESS JANUARY 1, 1976 NASTRAN 12/31/74 PAGE 11
AND AN ELFORCE OUTPUT REQUEST.

F O R C E S   O F   S I N G L E - P O I N T   C O N S T R A I N T

POINT ID.	TYPE	ID VALUE	ID+1 VALUE	ID+2 VALUE	ID+3 VALUE	ID+4 VALUE	ID+5 VALUE
100	S	-2.985400E 01					

F I N I T E   E L E M E N T   T E M P E R A T U R E   G R A D I E N T S   A N D   H E A T   F L O W S

ELEMENT-ID	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
10	ROD	5.141602E 00			-1.028320E 03		
20	ROD	5.141602E 00			-1.028320E 03		

F I N I T E   E L E M E N T   T E M P E R A T U R E   G R A D I E N T S   A N D   H E A T   F L O W S

ELEMENT-ID	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
30	QUAD2	5.141602E 01	0.0		-1.028320E 04	0.0	
40	QUAD2	7.411621E 01	0.0		-1.482324E 04	0.0	
50	QUAD2	2.463623E 01	0.0		-4.927246E 03	0.0	

H E A T   F L O W   I N T O   H B D Y   E L E M E N T S   (CHBDY)

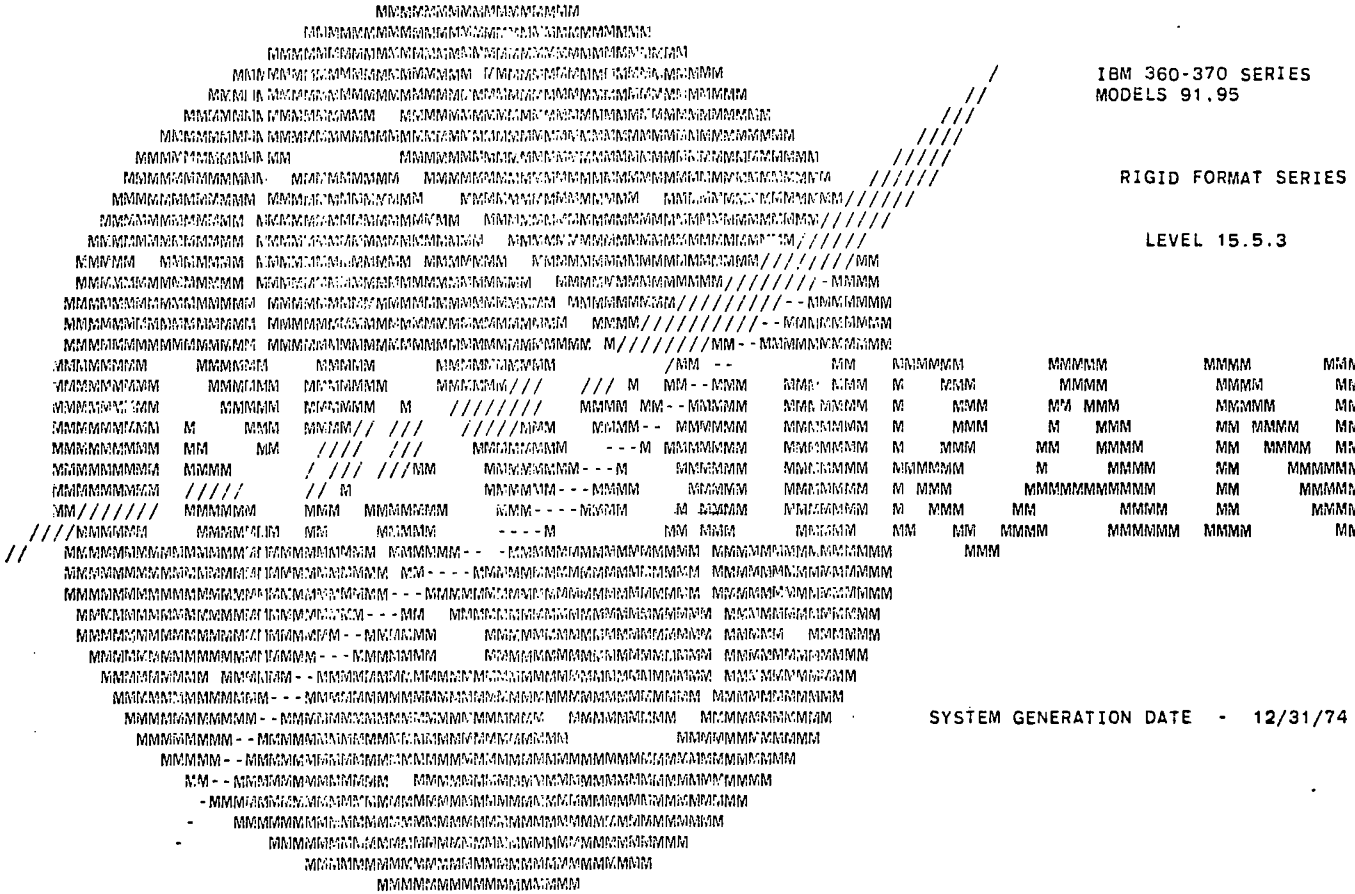
ELEMENT-ID	APPLIED-LOAD	CONVECTION	RADIATION	TOTAL
60	0.0	-2.985451E 01	0.0	-2.985451E 01
200	0.0	0.0	0.0	0.0
300	0.0	0.0	0.0	0.0
400	0.0	0.0	0.0	0.0
500	0.0	0.0	0.0	0.0
600	0.0	0.0	0.0	0.0
700	0.0	0.0	0.0	0.0
1200	0.0	2.975034E 00	-3.280534E 00	-3.055000E-01
1300	0.0	3.027185E 00	-3.330055E 00	-3.028698E-01
1400	0.0	3.069382E 00	-3.363784E 00	-2.944021E-01
2500	0.0	2.975034E 00	-3.280534E 00	-3.055000E-01
2600	0.0	3.027185E 00	-3.330055E 00	-3.028698E-01
2700	0.0	3.069382E 00	-3.363783E 00	-2.944012E-01

```
- - - END OF JOB - - -

...........................................................................................................................
...........................................................................................................................
...........................................................................................................................
...........................................................................................................................
...........................................................................................................................
 NASTRAN LOADED AT LOCATION 0FAF20
 TIME TO GO =   59 CPU SEC., 238 I/O SEC.
*      0 CPU-SEC.         0 ELAPSED-SEC.     SEM1  BEGN
*      0 CPU-SEC.         0 ELAPSED-SEC.     SEMT
*      0 CPU-SEC.         2 ELAPSED-SEC.     NAST
*      0 CPU-SEC.         3 ELAPSED-SEC.     GNFI
*      0 CPU-SEC.         3 ELAPSED-SEC.     XCSA
*      1 CPU-SEC.         3 ELAPSED-SEC.     IFP1
*      1 CPU-SEC.         5 ELAPSED-SEC.     XSOR
*      1 CPU-SEC.        10 ELAPSED-SEC.       DO  IFP
*      2 CPU-SEC.        23 ELAPSED-SEC.      END  IFP
*      2 CPU-SEC.        23 ELAPSED-SEC.     XGPI
*      3 CPU-SEC.        27 ELAPSED-SEC.     SEM1  END
*      3 CPU-SEC.        27 ELAPSED-SEC.     ----  LINKNS02 ---
=     21 I/O SEC.
 LAST LINK DID NOT USE        0 BYTES OF OPEN CORE
*      3 CPU-SEC.        29 ELAPSED-SEC.     ----  LINK END ---
*      3 CPU-SEC.        29 ELAPSED-SEC.     XSFA
*      3 CPU-SEC.        30 ELAPSED-SEC.     XSFA
*      3 CPU-SEC.        30 ELAPSED-SEC.     2     GP1      BEGN
*      3 CPU-SEC.        34 ELAPSED-SEC.     2     GP1      END
*      3 CPU-SEC.        35 ELAPSED-SEC.     5     GP2      BEGN
*      3 CPU-SEC.        36 ELAPSED-SEC.     5     GP2      END
*      3 CPU-SEC.        36 ELAPSED-SEC.     7     PLTSET   BEGN
*      3 CPU-SEC.        36 ELAPSED-SEC.     7     PLTSET   END
*      4 CPU-SEC.        37 ELAPSED-SEC.     9     PRTMSG   BEGN
*      4 CPU-SEC.        37 ELAPSED-SEC.     9     PRTMSG   END
*      4 CPU-SEC.        37 ELAPSED-SEC.     10    SETVAL   BEGN
*      4 CPU-SEC.        37 ELAPSED-SEC.     10    SETVAL   END
*      4 CPU-SEC.        39 ELAPSED-SEC.     18    GP3      BEGN
*      4 CPU-SEC.        44 ELAPSED-SEC.     18    GP3      END
*      4 CPU-SEC.        44 ELAPSED-SEC.     20    TA1      BEGN
*      4 CPU-SEC.        51 ELAPSED-SEC.     20    TA1      END
*      4 CPU-SEC.        52 ELAPSED-SEC.     ----  LINKNS03 ---
=     51 I/O SEC.
 LAST LINK DID NOT USE    41828 BYTES OF OPEN CORE
*      4 CPU-SEC.        55 ELAPSED-SEC.     ----  LINK END ---
*      4 CPU-SEC.        55 ELAPSED-SEC.     24    SMA1     BEGN
*      4 CPU-SEC.        59 ELAPSED-SEC.     24    SMA1     END
*      4 CPU-SEC.        59 ELAPSED-SEC.     ----  LINKNS05 ---
=     57 I/O SEC.
 LAST LINK DID NOT USE    23308 BYTES OF OPEN CORE
*      4 CPU-SEC.        62 ELAPSED-SEC.     ----  LINK END ---
*      4 CPU-SEC.        62 ELAPSED-SEC.     27    RMG      BEGN
*      4 CPU-SEC.        65 ELAPSED-SEC.     SDCO  MP
*      4 CPU-SEC.        66 ELAPSED-SEC.     SDCO  MP
*      4 CPU-SEC.        67 ELAPSED-SEC.     FBS
*      5 CPU-SEC.        69 ELAPSED-SEC.     FBS
*      5 CPU-SEC.        69 ELAPSED-SEC.     MPYA  D
                                                   METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*      5 CPU-SEC.        70 ELAPSED-SEC.     MPYA  D
*      5 CPU-SEC.        70 ELAPSED-SEC.     TRAN  POSE
*      5 CPU-SEC.        72 ELAPSED-SEC.     TRAN  POSE
*      5 CPU-SEC.        72 ELAPSED-SEC.     MPYA  D
                                                   METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*      5 CPU-SEC.        73 ELAPSED-SEC.     MPYA  D
```

```
*     5 CPU-SEC.        75 ELAPSED-SEC.      27     RMG       END
*     5 CPU-SEC.        76 ELAPSED-SEC.      ----   LINKNS04 ---
=    72 I/O SEC.
 LAST LINK DID NOT USE    31560 BYTES OF OPEN CORE
*     5 CPU-SEC.        80 ELAPSED-SEC.      ----   LINK END ---
*     5 CPU-SEC.        80 ELAPSED-SEC.      32     GP4       BEGN
*     5 CPU-SEC.        85 ELAPSED-SEC.      32     GP4       END
*     5 CPU-SEC.        86 ELAPSED-SEC.      38     GPSP      BEGN
*     5 CPU-SEC.        87 ELAPSED-SEC.      38     GPSP      END
*     5 CPU-SEC.        87 ELAPSED-SEC.      ----   LINKNS14 ---
=    84 I/O SEC.
 LAST LINK DID NOT USE    76084 BYTES OF OPEN CORE
*     5 CPU-SEC.        91 ELAPSED-SEC.      ----   LINK END ---
*     5 CPU-SEC.        91 ELAPSED-SEC.      39     OFP       BEGN
*     5 CPU-SEC.        92 ELAPSED-SEC.      39     OFP       END
*     6 CPU-SEC.        93 ELAPSED-SEC.      ----   LINKNS04 ---
=    88 I/O SEC.
 LAST LINK DID NOT USE    74704 BYTES OF OPEN CORE
*     6 CPU-SEC.        96 ELAPSED-SEC.      ----   LINK END ---
*     6 CPU-SEC.        96 ELAPSED-SEC.      42     MCE1      BEGN
*     6 CPU-SEC.        99 ELAPSED-SEC.      42     MCE1      END
*     6 CPU-SEC.        99 ELAPSED-SEC.      44     MCE2      BEGN
*     6 CPU-SEC.       101 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
*     6 CPU-SEC.       102 ELAPSED-SEC.      MPYA   D
*     6 CPU-SEC.       103 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
*     6 CPU-SEC.       104 ELAPSED-SEC.      MPYA   D
*     6 CPU-SEC.       105 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
*     7 CPU-SEC.       106 ELAPSED-SEC.      MPYA   D
*     7 CPU-SEC.       108 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
*     7 CPU-SEC.       110 ELAPSED-SEC.      MPYA   D
*     7 CPU-SEC.       110 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
*     7 CPU-SEC.       111 ELAPSED-SEC.      MPYA   D
*     7 CPU-SEC.       111 ELAPSED-SEC.      MPYA   D
                                                    METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
*     7 CPU-SEC.       112 ELAPSED-SEC.      MPYA   D
*     7 CPU-SEC.       112 ELAPSED-SEC.      44     MCE2      END
*     7 CPU-SEC.       114 ELAPSED-SEC.      ----   LINKNS07 ---
=   106 I/O SEC.
 LAST LINK DID NOT USE    68244 BYTES OF OPEN CORE
*     8 CPU-SEC.       119 ELAPSED-SEC.      ----   LINK END ---
*     8 CPU-SEC.       119 ELAPSED-SEC.      50     VEC       BEGN
*     8 CPU-SEC.       119 ELAPSED-SEC.      50     VEC       END
*     8 CPU-SEC.       120 ELAPSED-SEC.      51     PARTN     BEGN
*     8 CPU-SEC.       122 ELAPSED-SEC.      51     PARTN     END
*     8 CPU-SEC.       122 ELAPSED-SEC.      52     PARTN     BEGN
*     8 CPU-SEC.       123 ELAPSED-SEC.      52     PARTN     END
*     8 CPU-SEC.       123 ELAPSED-SEC.      55     DECOMP    BEGN
*     8 CPU-SEC.       124 ELAPSED-SEC.      DECO   MP
*     8 CPU-SEC.       125 ELAPSED-SEC.      DECO   MP
*     8 CPU-SEC.       128 ELAPSED-SEC.      55     DECOMP    END
*     8 CPU-SEC.       129 ELAPSED-SEC.      XSFA
*     8 CPU-SEC.       130 ELAPSED-SEC.      XSFA
*     8 CPU-SEC.       130 ELAPSED-SEC.      ----   LINKNS05 ---
=   118 I/O SEC.
 LAST LINK DID NOT USE    59592 BYTES OF OPEN CORE
*     8 CPU-SEC.       131 ELAPSED-SEC.      ----   LINK END ---
*     8 CPU-SEC.       131 ELAPSED-SEC.      59     SSG1      BEGN
*     8 CPU-SEC.       136 ELAPSED-SEC.      59     SSG1      END
*     8 CPU-SEC.       137 ELAPSED-SEC.      63     SSG2      BEGN
```

```
*     8 CPU-SEC.       139 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 T .NBR PASSES =   1.EST. TIME *      0.0
*     8 CPU-SEC.       141 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.       143 ELAPSED-SEC.     MPYA  D
                                                  METHOD 2 NT.NBR PASSES =   1.EST. TIME *      0.0
*     9 CPU-SEC.       144 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.       144 ELAPSED-SEC.     63    SSG2    END
*     9 CPU-SEC.       145 ELAPSED-SEC.     66    SSGHT   BEGN
*     9 CPU-SEC.       155 ELAPSED-SEC.     66    SSGHT   END
*     9 CPU-SEC.       156 ELAPSED-SEC.     ----  LINKNS08 ---
=   145 I/O SEC.
 LAST LINK DID NOT USE   24368 BYTES OF OPEN CORE
*     9 CPU-SEC.       165 ELAPSED-SEC.     ----  LINK END - -
*     9 CPU-SEC.       165 ELAPSED-SEC.     71    PLTTRAN BEGN
*     9 CPU-SEC.       166 ELAPSED-SEC.     71    PLTTRAN END
*     9 CPU-SEC.       167 ELAPSED-SEC.     ----  LINKNS13 ---
=   151 I/O SEC.
 LAST LINK DID NOT USE   73552 BYTES OF OPEN CORE
*     9 CPU-SEC.       173 ELAPSED-SEC.     ----  LINK END ---
*     9 CPU-SEC.       173 ELAPSED-SEC.     74    SDR2    BEGN
*     9 CPU-SEC.       178 ELAPSED-SEC.     74    SDR2    END
*     9 CPU-SEC.       179 ELAPSED-SEC.     ----  LINKNS14 ---
=   161 I/O SEC.
 LAST LINK DID NOT USE   25464 BYTES OF OPEN CORE
*    10 CPU-SEC.       184 ELAPSED-SEC.     ----  LINK END ---
*    10 CPU-SEC.       184 ELAPSED-SEC.     75    OFP     BEGN
*    10 CPU-SEC.       185 ELAPSED-SEC.     75    OFP     END
*    10 CPU-SEC.       186 ELAPSED-SEC.     ----  LINKNS13 ---
=   168 I/O SEC.
 LAST LINK DID NOT USE   68004 BYTES OF OPEN CORE
*    10 CPU-SEC.       193 ELAPSED-SEC.     ----  LINK END ---
*    10 CPU-SEC.       193 ELAPSED-SEC.     77    SDRHT   BEGN
*    10 CPU-SEC.       194 ELAPSED-SEC.     77    SDRHT   END
*    10 CPU-SEC.       195 ELAPSED-SEC.     ----  LINKNS14 ---
=   179 I/O SEC.
 LAST LINK DID NOT USE   25440 BYTES OF OPEN CORE
*    10 CPU-SEC.       204 ELAPSED-SEC.     ----  LINK END ---
*    10 CPU-SEC.       204 ELAPSED-SEC.     78    OFP     BEGN
*    10 CPU-SEC.       204 ELAPSED-SEC.     78    OFP     END
*    10 CPU-SEC.       206 ELAPSED-SEC.     92    EXIT    BEGN
------------------------------------------ ----------------------------------------------------------------------------------------
=   182 I/O SEC.
 LAST LINK DID NOT USE   68004 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =    OK BYTES
```



IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$*****************************************************************************
$ START OF EXECUTIVE CONTROL *************************************************
$*****************************************************************************
$
ID CLASS PROBLEM EIGHTEEN, C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB.
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR TRANSIENT SOLUTION ALGORITHM IS TO BE USED
$
SOL 9
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
$
$ ACTIVATES THE DIAGNOSTIC WHICH PRINTS OUT THE DMAP CONTROL CARDS FOR THE
$ RIGID FORMAT SELECTED ABOVE (SOL 9)
$
DIAG 14
$
$ ADD ADDITIONAL DMAP CONTROL CARDS TO PRINT OUT THE THERMAL MASS MATRIX.HBGG
$
ALTER 33
MATPRN HBGG,,,, // $
ENDALTER
$
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
        $
        $*****************************************************************************
        $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ****************************
        $*****************************************************************************
        $
        TITLE=   NON-LINEAR TRANSIENT PROBLEM ... DEMONSTRATE MATPRN, OTIME, AND ELFORCE
        $
        $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
        $
        LINE=51
        $
        $ REQUEST SORTED AND UNSORTED OUTPUT
        $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
        $
        ECHO=BOTH
        $
        $ SELECT THE MPC AND LOAD SETS TO BE USED IN THIS SOLUTION
        $ NOTE THAT NO SPC SET IS SELECTED, AND THAT DLOAD HAS REPLACED LOAD.
        $
        MPC=200
        DLOAD=300
        $
        $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
        $ THE SELECTION OF THIS SET IS OPTIONAL FOR SOL 9, BUT SHOULD BE MADE IF
        $ THE FINAL TEMPERATURE IS SEVERAL HUNDRED DEGREES DIFFERENT FROM THE
        $ IC VECTOR, AND RADIATIVE INTERCHANGES ARE INCLUDED.
        $
        TEMP(MATERIAL)=400
        $
        $ SELECT THE STEP SIZE, NUMBER OF INCREMENTS, AND PRINTOUT FREQUENCY
        $
        TSTEP=500
        $
        $ SELECT THE TEMPERATURE SET DEFINING THE TEMPERATURE VECTOR AT T=0.
        $
        IC=600
        $
        $ SELECT THE OUTPUT DESIRED (TEMPERATURES AND GRADIENTS AND HEAT FLOWS)
        $
        OUTPUT
        $
        $ DEFINE THE TIMES AT WHICH OUTPUT IS DESIRED ... THE NEAREST AVAILABLE SOLUTION
        $ TIMES TO THOSE TIMES LISTED BELOW WILL BE SELECTED FOR OUTPUT.
        $
        SET 1 = 0. , 30. , 60. , 600. , 1200. , 1800.
        $
        $ SELECT THE OTIME SET
        $
        OTIME = 1
        $
        $ DEFINE A GROUP OF GRID POINTS TO BE REFERENCED BY AN OUTPUT REQUEST
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
52        $
53        SET 5 = 1,2,3,4,5,6,7,8,100
54        $
55        $ REFERENCE A PREVIOUSLY DEFINED GROUP OF GRID POINTS
56        $
57        THERMAL=5
58        $
59        $ REQUEST ELEMENT GRADIENT AND HEAT FLOW OUTPUT
60        $
61        ELFORCE=ALL
62        $
63        $*****************************************************************************
64        $ END CASE CONTROL --- START BULK DATA *******************************************
65        $*****************************************************************************
66        $
67        BEGIN BULK
```

I N P U T B U L K D A T A D E C K E C H O

```
    1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY AND THERMAL MASS
$
MAT4    1000    200.    2.426+6                                         ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
    1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  .. 10  .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
TEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   TABS    273.15
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
RADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

```
                    I N P U T   B U L K   D A T A   D E C K   E C H O

    1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
$*************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED FOR THE TRANSIENT SOLUTION ----------
$ THEY CONVERT PROBLEM TWO TO PROBLEM THREE
$ NOTE THAT THE SPC1 SET WAS NOT SELECTED IN CASE CONTROL
$ NOTE THAT SPCF OUTPUT IS NOT REQUESTED IN TRANSIENT
$ NOTE THAT THERMAL MASS WAS ADDED TO 'MAT4' CARD 1000
$ NOTE THAT THE DIAG CARD IN THE EXECUTIVE CONTROL WAS IRRELEVANT
$ NOTE THAT THE LOAD REQUEST IN CASE CONTROL IS NOW A DLOAD REQUEST
$
$
$ TRANSIENT SINGLE POINT CONSTRAINT METHOD
$ CONSTRAIN GRID POINT 100 TO 300 DEGREES CELSIUS
$
CELAS2  300     1.+5    100     1
SLOAD   300     100     300.+5
$
$ DEFINES A CONSTANT LOAD SET APPLIED FROM T=0. TO T=1.+6 SECONDS
$
TLOAD2  300     300                     0.      1.+6    0.      0.      +TL1
+TL1    0.      0.
$
$ DEFINES THE NUMBER OF INCREMENTS, THE STEP SIZE, AND THE PRINTOUT FREQUENCY
$ REFERENCED IN CASE CONTROL AS 'TSTEP'
$ EACH TIME STEP IS 30 SECONDS
$
TSTEP   500     45      30.     1
$
$ DEFINES A TEMPERATURE VECTOR --- REFERENCED IN CASE CONTROL AS 'IC'
$
TEMPD   600     300.
$
$*************************************************************************
$ NO NEW BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM THREE TO PROBLEM
$ EIGHTEEN. A DIAGNOSTIC REQUEST AND A DMAP ALTER WERE ADDED TO THE EXEC CONTROL
$ AND AN OTIME SET WAS DEFINED AND SELECTED IN THE CASE CONTROL.
$ TO REDUCE THE OUTPUT VOLUME, THE ONLY OUTPUT REQUESTED IN THIS
$ RUN IS THERMAL=5 AND ELFORCE=ALL.
$*************************************************************************
$ END OF BULK DATA ********************************************************
$*************************************************************************
$
ENDDATA

TOTAL COUNT=  144

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED.XSORT WILL RE-ORDER DECK.
```

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
1-	CELAS2	300	1.+5	100	1					
2-	CHBDY	60	300	LINE	1	5				+CONVEC
3-	+CONVEC	100	100							
4-	CHBDY	200	2000	AREA4	1	2	6	5		
5-	CHBDY	300	2000	AREA4	2	3	7	6		
6-	CHBDY	400	2000	AREA4	3	4	8	7		
7-	CHBDY	500	2000	AREA4	5	6	2	1		
8-	CHBDY	600	2000	AREA4	6	7	3	2		
9-	CHBDY	700	2000	AREA4	7	8	4	3		
10-	CQUAD2	30	200	1	2	6	5			
11-	CQUAD2	40	200	2	3	7	6			
12-	CQUAD2	50	200	3	4	8	7			
13-	CROD	10	100	10	2					
14-	CROD	20	100	9	6					
15-	GRID	1		0.0	0.0	0.0				
16-	GRID	2		.1	0.0	0.0				
17-	GRID	3		.2	0.0	0.0				
18-	GRID	4		.3	0.0	0.0				
19-	GRID	5		0.0	.1	0.0				
20-	GRID	6		.1	.1	0.0				
21-	GRID	7		.2	.1	0.0				
22-	GRID	8		.3	.1	0.0				
23-	GRID	9		0.0	.2	0.0				
24-	GRID	10		0.0	-.1	0.0				
25-	GRID	100		-.05	.05	0.0				
26-	MAT4	1000	200.	2.426+6						ALUMINUM
27-	MAT4	3000	200.							
28-	MPC	200	9	1	1.		1	-1.		
29-	MPC	200	10	1	1.	1	1	-1.		
30-	PARAM	EPSHT	.0001							
31-	PARAM	MAXIT	8							
32-	PARAM	SIGMA	5.685E-8							
33-	PARAM	TABS	273.15							
34-	PHBDY	300	3000	.314						
35-	PHBDY	2000			.90					
36-	PQUAD2	200	1000	.01						
37-	PROD	100	1000	.001						
38-	RADLST	200	300	400	500	600	700			
39-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
40-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
41-	RADMTX	3	0.0	0.0	0.0	0.0				
42-	RADMTX	4	0.0	0.0	0.0					
43-	RADMTX	5	0.0	0.0						
44-	RADMTX	6	0.0							
45-	SLOAD	300	1	4.	2	8.				
46-	SLOAD	300	3	8.	4	4.				
47-	SLOAD	300	5	4.	6	8.				
48-	SLOAD	300	7	8.	8	4.				
49-	SLOAD	300	100	300.+5						
50-	SPC1	100	1	100						
51-	TEMP	400	100	300.						

S O R T E D   B U L K   D A T A   E C H O

```
CARD
COUNT          1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
  52-        TEMPD   400      300.
  53-        TEMPD   600      300.
  54-        TLOAD2  300      300                        0.0      1.+6     0.0      0.0      +TL1
  55-        +TL1    0.       0.
  56-        TSTEP   500      45       30.      1
             ENDDATA
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

  1  BEGIN    HEAT NO.9 TRANSIENT HEAT TRANSFER ANALYSIS $

  2  FILE     KGGX=TAPE/ KGG=TAPE $

  3  GP1      GEOM1,GEOM2,/HGPL,HEQEXIN,HGPDT,HCSTM,HBGPDT,HSIL/V,N,HLUSET/
              V,N,HALWAYS=-1/V,N,HNOGPDT $

  4  SAVE     HLUSET,HNOGPDT$

  5  PURGE    HUSET,HGM,HGO,HKAA,HBAA,HPSO,HKFS,HQP,HEST/HNOGPDT $

  6  CHKPNT   HGPL,HEQEXIN,HGPDT,HCSTM,HBGPDT,HSIL,HUSET,HGM,HGO,HKAA,HBAA,
              HPSO,HKFS,HQP,HEST $

  7  COND     HLBL5,HNOGPDT$

  8  GP2      GEOM2,HEQEXIN/HECT $

  9  CHKPNT   HECT $

 10  PLTSET   PCDB,HEQEXIN,HECT/HPLTSETX,HPLTPAR,HGPSETS,HELSETS/V,N,HNSIL/V,
              N,JUMPPLOT $

 11  SAVE     HNSIL,JUMPPLOT $

 12  PRTMSG   HPLTSETX//$

 13  SETVAL   //V,N,HPLTFLG/C,N,1/V,N,HPFILE/C,N,0 $

 14  SAVE     HPLTFLG,HPFILE $

 15  COND     HP1,JUMPPLOT$

 16  PLOT     HPLTPAR,HGPSETS,HELSETS,CASECC,HBGPDT,HEQEXIN,HSIL,,/HPLOTX1/
              V,N,HNSIL/V,N,HLUSET/V,N,JUMPPLOT/V,N,HPLTFLG/V,N,HPFILE $

 17  SAVE     JUMPPLOT,HPLTFLG,HPFILE $

 18  PRTMSG   HPLOTX1//$

 19  LABEL    HP1 $

 20  CHKPNT   HPLTPAR,HGPSETS,HELSETS $

 21  GP3      GEOM3,HEQEXIN,GEOM2/HSLT,HGPTT/C,N,123/C,N,123/C,N,123 $

 22  CHKPNT   HGPTT,HSLT $

 23  TA1,     ,HECT,EPT,HBGPDT,HSIL,HGPTT,HCSTM/HEST,,HGEI,HECPT,HGPCT/  V,N,
```

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.
                 HLUSET/C,N,123/V,N,HNOSIMP=-1/C,N,0/C,N,123/C,N,123 $

 24  SAVE        HNOSIMP $

 25  CHKPNT      HEST,HECPT,HGPCT $

 26  COND        HLBL1,HNOSIMP$

 27  SMA1        HCSTM,MPT,HECPT,HGPCT,DIT/HKGGX,,HGPST/C,N,123/C,N,123/V,N,
                 HNNLK $

 28  SAVE        HNNLK $

 29  CHKPNT      HKGGX,HGPST $

 30  SMA2        HCSTM,MPT,HECPT,HGPCT,DIT/,HBGG/C,N,1.0/C,N,123/V,N,   HNOBGG=
                 -1/C,N,-1 $

 31  SAVE        HNOBGG $

 32  PURGE       HBNN,HBFF,HBAA,HBGG/HNOBGG$

 33  CHKPNT      HBGG,HBNN,HBFF,HBAA $

 33  MATPRN HBGG,,,, // $

 34  LABEL       HLBL1 $

 35  RMG         HEST,MATPOOL,HGPTT,HKGGX/HRGG,HQGE,HKGG/C,Y,TABS/C,Y,SIGMA=0.0/
                 V,N,HNLR/V,N,HLUSET $

 36  SAVE        HNLR $

 37  EQUIV       HKGGX,HKGG/HNLR $

 38  PURGE       HRGG,HRNN,HRFF,HRAA,HRDD/HNLR $

 39  CHKPNT      HRGG,HRNN,HRFF,HRAA,HRDD,HKGG,HQGE $

 40  GP4         CASECC,GEOM4,HEQEXIN,HSIL,HGPDT/HRG,,HUSET,/V,N,HLUSET/V,N,
                 HMPCF1=-1/V,N,HMPCF2=-1/V,N,HSINGLE=-1/V,N,HOMIT=-1/V,N,HREACT=
                 -1/C,N,0/C,N,123/V,N,HNOSET=-1/V,N,HNOL/V,N,HNOA=-1 $

 41  SAVE        HMPCF1,HSINGLE,HOMIT,HNOSET,HREACT,HMPCF2,HNOL,HNOA $

 42  PURGE       HGM,HGMD/HMPCF1/HGO,HGOD/HOMIT/HKFS,HPSO,HQP/HSINGLE $

 43  EQUIV       HKGG,HKNN/HMPCF1/HRGG,HRNN/HMPCF1/HBGG,HBNN/HMPCF1 $

 44  CHKPNT      HGM,HRG,HGO,HKFS,HQP,HUSET,HGMD,HGOD,HPSO,HKNN,HRNN,HBNN $
```

N A S T R A N S O U R C E P R O G R A M C O M P I L A T I O N

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DMAP-DMAP INSTRUCTION
 NO.

 45  COND     HLBL2,HNOSIMP $
 46  GPSP     HGPL,HGPST,HUSET,HSIL/HOGPST $
 47  OFP      HOGPST,,,,,//V,N,HCARDNO $
 48  SAVE     HCARDNO $
 49  LABEL    HLBL2 $
 50  COND     HLBL3,HMPCF1 $
 51  MCE1     HUSET,HRG/HGM $
 52  CHKPNT   HGM $
 53  MCE2     HUSET,HGM,HKGG,HRGG,HBGG,/HKNN,HRNN,HBNN, $
 54  CHKPNT   HKNN,HRNN,HBNN $
 55  LABEL    HLBL3 $
 56  EQUIV    HKNN,HKFF/HSINGLE/HRNN,HRFF/HSINGLE/HBNN,HBFF/HSINGLE $
 57  CHKPNT   HKFF,HRFF,HBFF $
 58  COND     HLBL4,HSINGLE $
 59  SCE1     HUSET,HKNN,HRNN,HBNN,/HKFF,HKFS,,HRFF,HBFF, $
 60  CHKPNT   HKFS,HKFF,HRFF,HBFF $
 61  LABEL    HLBL4 $
 62  EQUIV    HKFF,HKAA/HOMIT/HRFF,HRAA/HOMIT/HBFF,HBAA/HOMIT $
 63  CHKPNT   HKAA,HRAA,HBAA $
 64  COND     HLBL5,HOMIT $
 65  SMP1     HUSET,HKFF,,,/HGO,HKAA,,,,,,, $
 66  CHKPNT   HGO,HKAA $
 67  COND     HLBLR,HNLR $
 68  SMP2     HUSET,HGO,HRFF/HRAA $
 69  CHKPNT   HRAA $
 70  LABEL    HLBLR $
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   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTICN
 NO.

 71  COND      HLBL5,HNOBGG $

 72  SMP2      HUSET,HGO,HBFF/HBAA $

 73  CHKPNT    HBAA $

 74  LABEL     HLBL5 $

 75  DPD         DYNAMICS,HGPL,HSIL,HUSET/HGPLD,HSILD,HUSETD,HTFPOOL,HDLT,,,
               HNLFT,HTRL,,HEQDYN/V,N,HLUSET/V,N,HLUSETD/C,N,123 /V,N,HNODLT/
               C,N,123/C,N,123/V,N,HNONLFT/V,N,HNOTRL/C,N,123/C,N,123/ V,N,
               HNOUE $

 76  SAVE      HLUSETD,HNODLT,HNONLFT,HNOTRL,HNOUE $

 77  COND      HERROR1,HNOTRL$

 78  EQUIV     HGO,HGOD/HNOUE/HGM,HGMD/HNOUE $

 79  PURGE     HPPO,HPSO,HPDO,HPDT/HNODLT $

 80  CHKPNT    HUSETD,HEQDYN,HTFPOOL,HDLT,HTRL,HGOD,HGMD,HNLFT,HSILD,HGPLD,
               HPPO,HPSO,HPDO,HPDT $

 81  MTRXIN    CASECC,MATPOOL,HEQDYN,,HTFPOOL/HK2PP,,HB2PP/V,N,HLUSETD/ V,N,
               HNOK2PP/C,N,123/V,N,HNOB2PP $

 82  SAVE      HNOK2PP,HNOB2PP $

 83  PARAM     //C,N,AND/V,N,HKDEKA/V,N,HNOUE/V,N,HNOK2PP $

 84  PURGE     HK2DD/HNOK2PP/HB2DD/HNOB2PP $

 85  EQUIV     HKAA,HKDD/HKDEKA/HB2PP,HB2DD/HNOA/HK2PP,HK2DD/HNOA/HRAA,HRDD/
               HNOUE $

 86  CHKPNT    HK2PP,HB2PP,HK2DD,HB2DD,HKDD,HRDD $

 87  COND      HLBL6,HNOGPDT $

 88  GKAD      HUSETD,HGM,HGO,HKAA,HBAA,HRAA,,HK2PP,,HB2PP/HKDD,HBDD, HRDD,
               HGMD,HGOD,HK2DD,HM2DD,HB2DD/C,N,TRANRESP/C,N,DISP/C,N, DIRECT/
               C,Y,HG=0.0/C,Y,HW3=0.0/C,Y,HW4=0.0/V,N,HNOK2PP/C,N,-1/    V,N,
               HNOB2PP/V,N,HMPCF1/V,N,HSINGLE/V,N,HOMIT/V,N,HNOUE/ C,N,-1/V,N,
               HNOBGG/V,N,HNOSIMP/C,N,-1 $

 89  LABEL     HLBL6 $

 90  EQUIV     HK2DD,HKDD/HNOSIMP/HB2DD,HBDD/HNOGPDT $

 91  CHKPNT    HKDD,HBDD,HRDD,HGMD,HGOD $
```

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   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

  92  TRLG      CASECC,HUSETD,HDLT,HSLT,HBGPDT,HSIL,HCSTM,HTRL,DIT,HGMD,HGOD,,
                HEST/HPPO,HPSO,HPDO,HPDT,,HTOL/V,N,HNOSET/V,N,HPDEPDO $

  93  SAVE      HPDEPDO,HNOSET $

  94  EQUIV     HPPO,HPDO/HNOSET $

  95  EQUIV     HPDO,HPDT/HPDEPDO $

  96  CHKPNT    HPPO,HPDO,HPSO,HTOL,HPDT $

  97  TRHT      CASECC,HUSETD,HNLFT,DIT,HGPTT,HKDD,HBDD,HRDD,HPDT,HTRL/HUDVT,
                HPNLD/C,Y,BETA=.55/C,Y,TABS=0.0/V,N,HNLR/C,Y,RADLIN=-1 $

  98  CHKPNT    HUDVT,HPNLD $

  99  VDR       CASECC,HEQDYN,HUSETD,HUDVT,HTOL,XYCDB,HPNLD/HOUDV1,HOPNL1/  C,
                N,TRANRESP/C,N,DIRECT/C,N,0/V,N,HNOD/V,N,HNOP/C,N,0 $

 100  SAVE      HNOD,HNOP $

 101  CHKPNT    HOUDV1,HOPNL1 $

 102  COND      HLBL7,HNOD $

 103  SDR3      HOUDV1,HOPNL1,,,,/HOUDV2,HOPNL2,,,, $

 104  OFP       HOUDV2,HOPNL2,,,,//V,N,HCARDNO $

 105  SAVE      HCARDNO $

 106  CHKPNT    HOPNL2,HOUDV2 $

 110  LABEL     HLBL7 $

 111  PARAM     //C,N,AND/V,N,HPJUMP/V,N,HNOP/V,N,JUMPPLOT $

 112  COND      HLBL9 HPJUMP $

 113  EQUIV     HUDVT HUPV/HNOA $

 114  COND      HLBL3 HNOA $

 115  SDR1      HUSETD,,HUDVT,,,HGOD,HGMD,HPSO,HKFS,,/HUPV,,HQP/C,N,1/C,N,
                TRANSNT $

 116  LABEL     HLBL3 $

 117  CHKPNT    HUPV,HQP $

 118  PLTTRAN   HBGPDT,HSIL/HBGPDP,HSIP/V,N,HLUSET/V,N,HLUSEP $
```

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   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

119  SAVE      HLUSEP $

120  SDR2      CASECC,HCSTM,MPT,DIT,HEQDYN,HSILD,,HTOL,HBGPDP,HPPO,HQP,HUPV,
               HEST,XYCDB/HOPP1,HOQP1,HOUPV1,HOES1,HOEF1,HPUGV /C,N,
               TRANRESP $

121  SDR3      HOPP1,HOQP1,HOUPV1,HOES1,HOEF1,/HOPP2,HOQP2,HOUPV2,HOES2,
               HOEF2, $

122  CHKPNT    HOPP2,HOQP2,HOUPV2,HOES2,HOEF2 $

123  OFP       HOPP2,HOQP2,HOUPV2,HOEF2,HOES2,//V,N,HCARDNO $

124  SAVE      HCARDNO $

125  COND      HP2,JUMPPLOT $

126  PLOT      HPLTPAR,HGPSETS,HELSETS,CASECC,HBGPDT,HEQEXIN,HSIP,,HPUGV/
               HPLOTX2/V,N,HNSIL/V,N,HLUSEP/V,N,JUMPPLOT/V,N,HPLTFLG/V,N,
               HPFILE $

127  SAVE      HPFILE $

128  PRTMSG    HPLOTX2// $

129  LABEL     HP2 $

130  XYTRAN    XYCDB,HOPP2,HOQP2,HOUPV2,HOES2,HOEF2/HXYPLTT/C,N,TRAN/C,N,PSET/
               V,N,HPFILE/V,N,HCARDNO $

131  SAVE      HPFILE,HCARDNO $

132  XYPLOT    HXYPLTT// $

133  LABEL     HLBL9 $

134  JUMP      FINIS $

135  LABEL     HERROR1 $

136  PRTPARM   //C,N -1/C,N,HDIRTRD$

137  LABEL     FINIS$

138  END       $

*** USER WARNING MESSAGE  54,
     PARAMETER NAMED EPSHT     NOT REFERENCED

*** USER WARNING MESSAGE  54,
     PARAMETER NAMED MAXIT     NOT REFERENCED

          **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**
```

```
MATRIX HBGG     (GINO NAME 101 ) IS A REAL        11 COLUMN X     11 ROW SYMETRIC MATRIX.

COLUMN      1       ROWS      1 THRU      1     ---------------------------------------------------
 6.06499E 01
COLUMN      2       ROWS      2 THRU      2     ---------------------------------------------------
 2.92844E 02
COLUMN      3       ROWS      3 THRU      3     ---------------------------------------------------
 1.21300E 02
COLUMN      4       ROWS      4 THRU      4     ---------------------------------------------------
 6.06499E 01
COLUMN      5       ROWS      5 THRU      5     ---------------------------------------------------
 6.06499E 01
COLUMN      6       ROWS      6 THRU      6     ---------------------------------------------------
 2.92844E 02
COLUMN      7       ROWS      7 THRU      7     ---------------------------------------------------
 1.21300E 02
COLUMN      8       ROWS      8 THRU      8     ---------------------------------------------------
 6.06499E 01
COLUMN      9       ROWS      9 THRU      9     ---------------------------------------------------
 1.71544E 02
COLUMN     10       ROWS     10 THRU     10     ---------------------------------------------------
 1.71544E 02
COLUMNS      11 THRU      11 ARE NULL.
THE NUMBER OF NON-ZERO WORDS IN THE LONGEST RECORD =       2
THE DENSITY OF THIS MATRIX IS   8.26 PERCENT.


*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE
*** USER INFORMATION MESSAGE     .   6 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99
*** USER INFORMATION MESSAGE 3023,          B =      3
                                            C =      0
                                            R =      2
*** USER INFORMATION MESSAGE 3027, SYMMETRIC REAL DECOMPOSITION TIME ESTIMATE IS        0  SECONDS.
```

```
*** USER INFORMATION MESSAGE 3028.      B =     5      BBAR =     5
                                        C =     3      CBAR =     1
                                        R =     8

*** USER INFORMATION MESSAGE 3027. UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS       0 SECONDS.
```

POINT-ID = 1

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984949E 02
6.000000E 01	S	2.959980E 02
6.000000E 02	S	2.777063E 02
1.200000E 03	S	2.749849E 02

POINT-ID = 2

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.973813E 02
6.000000E 01	S	2.927502E 02
6.000000E 02	S	2.549862E 02
1.200000E 03	S	2.494059E 02

POINT-ID = 3

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.942329E 02
6.000000E 01	S	2.847380E 02
6.000000E 02	S	2.250109E 02
1.200000E 03	S	2.168777E 02

POINT-ID = 4

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.939604E 02
6.000000E 01	S	2.836946E 02
6.000000E 02	S	2.160496E 02
1.200000E 03	S	2.069669E 02

POINT-ID = 5

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.984951E 02
6.000000E 01	S	2.959963E 02
6.000000E 02	S	2.777063E 02
1.200000E 03	S	2.749849E 02

POINT-ID = 6

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.973813E 02
6.000000E 01	S	2.927502E 02
6.000000E 02	S	2.549862E 02
1.200000E 03	S	2.494059E 02

POINT-ID = 7

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.942332E 02
6.000000E 01	S	2.847383E 02
6.000000E 02	S	2.250110E 02
1.200000E 03	S	2.168777E 02

POINT-ID = 8

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.939607E 02
6.000000E 01	S	2.836948E 02
6.000000E 02	S	2.160497E 02
1.200000E 03	S	2.069669E 02

POINT-ID = 100

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
3.000000E 01	S	2.999993E 02
6.000000E 01	S	2.999995E 02
6.000000E 02	S	2.999983E 02
1.200000E 03	S	2.999980E 02

ELEMENT-ID = 10

F I N I T E   E L E M E N T   T E M P E R A T U R E   G R A D I E N T S   A N D   H E A T   F L O W S

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	ROD	0.0			0.0		
3.000000E 01	ROD	-1.113525E 00			2.227051E 02		
6.000000E 01	ROD	-3.247803E 00			6.495605E 02		
6.000000E 02	ROD	-2.272011E 01			4.544020E 03		
1.200000E 03	ROD	-2.557899E 01			5.115797E 03		

ELEMENT-ID = 20

F I N I T E   E L E M E N T   T E M P E R A T U R E   G R A D I E N T S   A N D   H E A T   F L O W S

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	ROD	0.0			0.0		
3.000000E 01	ROD	-1.113770E 00			2.227539E 02		
6.000000E 01	ROD	-3.248047E 00			6.496094E 02		
6.000000E 02	ROD	-2.272011E 01			4.544020E 03		
1.200000E 03	ROD	-2.557898E 01			5.115793E 03		

ELEMENT-ID = 30

F I N I T E   E L E M E N T   T E M P E R A T U R E   G R A D I E N T S   A N D   H E A T   F L O W S

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	QUAD2	0.0	0.0		0.0	0.0	
3.000000E 01	QUAD2	-1.113647E 01	1.220703E-03		2.227295E 03	-2.441406E-01	
6.000000E 01	QUAD2	-3.247925E 01	1.220703E-03		6.495848E 03	-2.441406E-01	
6.000000E 02	QUAD2	-2.272012E 02	0.0		4.544023E 04	0.0	
1.200000E 03	QUAD2	-2.557900E 02	0.0		5.115801E 04	0.0	

ELEMENT-ID = 40

F I N I T E   E L E M E N T   T E M P E R A T U R E   G R A D I E N T S   A N D   H E A T   F L O W S

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	QUAD2	0.0	0.0		0.0	0.0	
3.000000E 01	QUAD2	-3.148315E 01	1.220703E-03		6.296629E 03	-2.441406E-01	
6.000000E 01	QUAD2	-8.012085E 01	1.220703E-03		1.602417E 04	-2.441406E-01	
6.000000E 02	QUAD2	-2.997527E 02	4.882813E-04		5.995054E 04	-9.765625E-02	
1.200000E 03	QUAD2	-3.252820E 02	0.0		6.505639E 04	0.0	

ELEMENT-ID = 50

F I N I T E   E L E M E N T   T E M P E R A T U R E   G R A D I E N T S   A N D   H E A T   F L O W S

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	QUAD2	0.0	0.0		0.0	0.0	
3.000000E 01	QUAD2	-2.724609E 00	2.441406E-03		5.449219E 02	-4.882813E-01	
6.000000E 01	QUAD2	-1.043457E 01	2.441406E-03		2.086914E 03	-4.882813E-01	
6.000000E 02	QUAD2	-8.961304E 01	7.324219E-04		1.792261E 04	-1.464844E-01	
1.200000E 03	QUAD2	-9.910791E 01	0.0		1.982158E 04	0.0	

ELEMENT-ID = 60

F I N I T E   E L E M E N T   T E M P E R A T U R E   G R A D I E N T S   A N D   H E A T   F L O W S

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	HBDY	0.0			0.0		
3.000000E 01	HBDY	-1.504395E 00			9.447591E 00		
6.000000E 01	HBDY	-4.001465E 00			2.512918E 01		
6.000000E 02	HBDY	-2.229199E 01			1.399936E 02		
1.200000E 03	HBDY	-2.501318E 01			1.570827E 02		

ELEMENT-ID = 200

F I N I T E   E L E M E N T   T E M P E R A T U R E   G R A D I E N T S   A N D   H E A T   F L O W S

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	HBDY	0.0			0.0		
3.000000E 01	HBDY	0.0			0.0		
6.000000E 01	HBDY	0.0			0.0		
6.000000E 02	HBDY	0.0			0.0		
1.200000E 03	HBDY	0.0			0.0		

ELEMENT-ID = 300

F I N I T E   E L E M E N T   T E M P E R A T U R E   G R A D I E N T S   A N D   H E A T   F L O W S

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	HBDY	0.0			0.0		
3.000000E 01	HBDY	0.0			0.0		
6.000000E 01	HBDY	0.0			0.0		
6.000000E 02	HBDY	0.0			0.0		
1.200000E 03	HBDY	0.0			0.0		

ELEMENT-ID = 400

FINITE ELEMENT TEMPERATURE GRADIENTS AND HEAT FLOWS

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	HBDY	0.0			0.0		
3.000000E 01	HBDY	0.0			0.0		
6.000000E 01	HBDY	0.0			0.0		
6.000000E 02	HBDY	0.0			0.0		
1.200000E 03	HBDY	0.0			0.0		

ELEMENT-ID = 500

F I N I T E E L E M E N T T E M P E R A T U R E G R A D I E N T S A N D H E A T F L O W S

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	HBDY	0.0			0.0		
3.000000E 01	HBDY	0.0			0.0		
6.000000E 01	HBDY	0.0			0.0		
6.000000E 02	HBDY	0.0			0.0		
1.200000E 03	HBDY	0.0			0.0		

ELEMENT-ID = 600

F I N I T E   E L E M E N T   T E M P E R A T U R E   G R A D I E N T S   A N D   H E A T   F L O W S

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	HBDY	0.0			0.0		
3.000000E 01	HBDY	0.0			0.0		
6.000000E 01	HBDY	0.0			0.0		
6.000000E 02	HBDY	0.0			0.0		
1.200000E 03	HBDY	0.0			0.0		

ELEMENT-ID = 700

F I N I T E E L E M E N T T E M P E R A T U R E G R A D I E N T S A N D H E A T F L O W S

TIME	EL-TYPE	X-GRADIENT	Y-GRADIENT	Z-GRADIENT	X-FLOW	Y-FLOW	Z-FLOW
0.0	HBDY	0.0			0.0		
3.000000E 01	HBDY	0.0			0.0		
6.000000E 01	HBDY	0.0			0.0		
6.000000E 02	HBDY	0.0			0.0		
1.200000E 03	HBDY	0.0			0.0		

- - - END OF JOB - - -

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 NASTRAN LOADED AT LOCATION 1F2F20
 TIME TO GO =  59 CPU SEC., 298 I/O SEC.
*      0 CPU-SEC.        0 ELAPSED-SEC.     SEM1  BEGN
*      0 CPU-SEC.        0 ELAPSED-SEC.     SEMT
*      1 CPU-SEC.        2 ELAPSED-SEC.     NAST
*      1 CPU-SEC.        2 ELAPSED-SEC.     GNFI
*      1 CPU-SEC.        3 ELAPSED-SEC      XCSA
*      1 CPU-SEC.        4 ELAPSED-SEC.     IFP1
*      1 CPU-SEC.        7 ELAPSED-SEC.     XSOR
*      2 CPU-SEC.       11 ELAPSED-SEC.       DO  IFP
*      2 CPU-SEC.       26 ELAPSED-SEC.      END  IFP
*      2 CPU-SEC.       26 ELAPSED-SEC.     XGPI
*      4 CPU-SEC.       31 ELAPSED-SEC.     SEM1  END
*      4 CPU-SEC.       31 ELAPSED-SEC.     ----  LINKNS02 ---
*     23 I/O SEC.
 LAST LINK DID NOT USE   40016 BYTES OF OPEN CORE
*      4 CPU-SEC.       33 ELAPSED-SEC.     ----  LINK END ---
*      4 CPU-SEC.       33 ELAPSED-SEC.     XSFA
*      5 CPU-SEC.       34 ELAPSED-SEC.     XSFA
*      5 CPU-SEC.       34 ELAPSED-SEC.     3     GP1      BEGN
*      5 CPU-SEC.       39 ELAPSED-SEC.     3     GP1      END
*      5 CPU-SEC.       42 ELAPSED-SEC.     8     GP2      BEGN
*      5 CPU-SEC.       42 ELAPSED-SEC.     8     GP2      END
*      5 CPU-SEC.       42 ELAPSED-SEC.     10    PLTSET   BEGN
*      5 CPU-SEC.       43 ELAPSED-SEC.     10    PLTSET   END
*      5 CPU-SEC.       44 ELAPSED-SEC.     12    PRTMSG   BEGN
*      5 CPU-SEC.       44 ELAPSED-SEC.     12    PRTMSG   END
*      5 CPU-SEC.       44 ELAPSED-SEC.     13    SETVAL   BEGN
*      5 CPU-SEC.       44 ELAPSED-SEC.     13    SETVAL   END
*      5 CPU-SEC.       45 ELAPSED-SEC.     21    GP3      BEGN
*      5 CPU-SEC.       54 ELAPSED-SEC.     21    GP3      END
*      5 CPU-SEC.       55 ELAPSED-SEC.     23    TA1      BEGN
*      5 CPU-SEC.       64 ELAPSED-SEC.     23    TA1      END
*      5 CPU-SEC.       64 ELAPSED-SEC.     ----  LINKNS03 ---
*     54 I/O SEC.
 LAST LINK DID NOT USE   82788 BYTES OF OPEN CORE
*      5 CPU-SEC.       68 ELAPSED-SEC.     ----  LINK END ---
*      5 CPU-SEC.       68 ELAPSED-SEC.     27    SMA1     BEGN
*      6 CPU-SEC.       72 ELAPSED-SEC.     27    SMA1     END
*      6 CPU-SEC.       73 ELAPSED-SEC.     30    SMA2     BEGN
*      6 CPU-SEC.       76 ELAPSED-SEC.     30    SMA2     END
*      6 CPU-SEC.       78 ELAPSED-SEC.     ----  LINKNS08 ---
*     62 I/O SEC.
 LAST LINK DID NOT USE   64268 BYTES OF OPEN CORE
*      6 CPU-SEC.       81 ELAPSED-SEC.     ----  LINK END ---
*      6 CPU-SEC.       81 ELAPSED-SEC.     33    MATPRN   BEGN
*      6 CPU-SEC.       82 ELAPSED-SEC.     33    MATPRN   END
*      6 CPU-SEC.       82 ELAPSED-SEC.     ----  LINKNS05 ---
*     65 I/O SEC.
 LAST LINK DID NOT USE  136144 BYTES OF OPEN CORE
*      6 CPU-SEC.       85 ELAPSED-SEC.     ----  LINK END ---
*      6 CPU-SEC.       85 ELAPSED-SEC.     35    RMG      BEGN
*      6 CPU-SEC.       88 ELAPSED-SEC.     SDCO  MP
*      6 CPU-SEC.       88 ELAPSED-SEC.     SDCO  MP
*      6 CPU-SEC.       89 ELAPSED-SEC.     FBS
*      6 CPU-SEC.       90 ELAPSED-SEC.     FBS
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*     6 CPU-SEC.       91 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     6 CPU-SEC.       92 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.       92 ELAPSED-SEC.     TRAN  POSE
*     6 CPU-SEC.       93 ELAPSED-SEC.     TRAN  POSE
*     6 CPU-SEC.       93 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     7 CPU-SEC.       94 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.       97 ELAPSED-SEC.     35    RMG       END
*     7 CPU-SEC.       98 ELAPSED-SEC.     ----  LINKNS04 ---
=    81 I/O SEC.
 LAST LINK DID NOT USE   72520 BYTES OF OPEN CORE
*     7 CPU-SEC.      103 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.      103 ELAPSED-SEC.     40    GP4       BEGN
*     7 CPU-SEC.      107 ELAPSED-SEC.     40    GP4       END
*     7 CPU-SEC.      108 ELAPSED-SEC.     46    GPSP      BEGN
*     7 CPU-SEC.      109 ELAPSED-SEC.     46    GPSP      END
*     7 CPU-SEC.      110 ELAPSED-SEC.     ----  LINKNS14 ---
=    89 I/O SEC.
 LAST LINK DID NOT USE  117044 BYTES OF OPEN CORE
*     7 CPU-SEC.      114 ELAPSED-SEC.     ----  LINK END ---
*     7 CPU-SEC.      114 ELAPSED-SEC.     47    OFP       BEGN
*     7 CPU-SEC.      114 ELAPSED-SEC.     47    OFP       END
*     7 CPU-SEC.      119 ELAPSED-SEC.     ----  LINKNS04 ---
=    93 I/O SEC.
 LAST LINK DID NOT USE  115664 BYTES OF OPEN CORE
*     7 CPU-SEC.      136 ELAPSED-SEC.     ----  LINK END ---
*     8 CPU-SEC.      136 ELAPSED-SEC.     51    MCE1      BEGN
*     8 CPU-SEC.      138 ELAPSED-SEC.     51    MCE1      END
*     8 CPU-SEC.      139 ELAPSED-SEC.     53    MCE2      BEGN
*     8 CPU-SEC.      141 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     8 CPU-SEC.      143 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.      143 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSFS =   1.EST. TIME =      0.0
*     8 CPU-SEC.      144 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.      144 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     8 CPU-SEC.      145 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.      147 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*     9 CPU-SEC.      155 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.      158 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*     9 CPU-SEC.      159 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.      159 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*    10 CPU-SEC.      161 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.      163 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =   1.EST. TIME =      0.0
*    10 CPU-SEC.      165 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.      165 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*    10 CPU-SEC.      166 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.      166 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =   1.EST. TIME =      0.0
*    11 CPU-SEC.      167 ELAPSED-SEC.     MPYA  D
*    11 CPU-SEC.      167 ELAPSED-SEC.     53    MCE2      END
*    11 CPU-SEC.      169 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.      171 ELAPSED-SEC.     XSFA
*    11 CPU-SEC.      171 ELAPSED-SEC.     ----  LINKNS06 ---
=   115 I/O SEC.
 LAST LINK DID NOT USE  102132 BYTES OF OPEN CORE
*    11 CPU-SEC.      173 ELAPSED-SEC.     ----  LINK END ---
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*    11 CPU-SEC.      173 ELAPSED-SEC.     75    DPD      BEGN
*    11 CPU-SEC.      178 ELAPSED-SEC.     75    DPD      END
*    11 CPU-SEC.      180 ELAPSED-SEC.     ----  LINKNS10 ---
=   124 I/O SEC.
 LAST LINK DID NOT USE  116416 BYTES OF OPEN CORE
*    11 CPU-SEC.      183 ELAPSED-SEC.     ----  LINK END ---
*    11 CPU-SEC.      183 ELAPSED-SEC.     81    MTRXIN   BEGN
*    11 CPU-SEC.      184 ELAPSED-SEC.     81    MTRXIN   END
*    11 CPU-SEC.      184 ELAPSED-SEC.     83    PARAM    BEGN
*    11 CPU-SEC.      184 ELAPSED-SEC.     83    PARAM    END
*    11 CPU-SEC.      185 ELAPSED-SEC.     XSFA
*    12 CPU-SEC.      187 ELAPSED-SEC.     XSFA
*    12 CPU-SEC.      187 ELAPSED-SEC.     88    GKAD     BEGN
*    12 CPU-SEC.      189 ELAPSED-SEC.     88    GKAD     END
*    12 CPU-SEC.      190 ELAPSED-SEC.     ----  LINKNS05 ---
=   130 I/O SEC.
 LAST LINK DID NOT USE  117064 BYTES OF OPEN CORE
*    12 CPU-SEC.      192 ELAPSED-SEC.     ----  LINK END ---
*    12 CPU-SEC.      192 ELAPSED-SEC.     92    TRLG     BEGN
*    12 CPU-SEC.      200 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =    1,EST. TIME =        0.0
*    12 CPU-SEC.      201 ELAPSED-SEC.     MPYA  D
*    12 CPU-SEC.      203 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1,EST. TIME =        0.0
*    12 CPU-SEC.      203 ELAPSED-SEC      MPYA  D
*    12 CPU-SEC.      204 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1,EST. TIME =        0.0
*    13 CPU-SEC.      205 ELAPSED-SEC.     MPYA  D
*    13 CPU-SEC.      205 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1,EST. TIME =        0.0
*    13 CPU-SEC.      205 ELAPSED-SEC.     MPYA  D
*    13 CPU-SEC.      206 ELAPSED-SEC.     92    TRLG     END
*    13 CPU-SEC.      206 ELAPSED-SEC.     ----  LINKNS11 ---
=   145 I/O SEC.
 LAST LINK DID NOT USE   58172 BYTES OF OPEN CORE
*    13 CPU-SEC.      210 ELAPSED-SEC.     ----  LINK END ---
*    13 CPU-SEC.      210 ELAPSED-SEC.     97    TRHT     BEGN
*    13 CPU-SEC.      214 ELAPSED-SEC.     DECO  MP
*    13 CPU-SEC.      215 ELAPSED-SEC.     DECO  MP
*    15 CPU-SEC.      283 ELAPSED-SEC.     97    TRHT     END
*    15 CPU-SEC.      283 ELAPSED-SEC.     ----  LINKNS12 ---
=   205 I/O SEC.
 LAST LINK DID NOT USE   69268 BYTES OF OPEN CORE
*    16 CPU-SEC.      293 ELAPSED-SEC.     ----  LINK END ---
*    16 CPU-SEC.      293 ELAPSED-SEC.     99    VDR      BEGN
*    16 CPU-SEC.      300 ELAPSED-SEC.     99    VDR      END
*    16 CPU-SEC.      300 ELAPSED-SEC.     111   PARAM    BEGN
*    16 CPU-SEC.      300 ELAPSED-SEC.     111   PARAM    END
*    16 CPU-SEC.      302 ELAPSED-SEC.     XSFA
*    16 CPU-SEC.      303 ELAPSED-SEC.     XSFA
*    16 CPU-SEC.      303 ELAPSED-SEC.     115   SDR1     BEGN
*    16 CPU-SEC.      303 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1,EST. TIME =        0.1
*    16 CPU-SEC.      305 ELAPSED-SEC.     MPYA  D
*    17 CPU-SEC.      310 ELAPSED-SEC.     115   SDR1     END
*    17 CPU-SEC.      310 ELAPSED-SEC.     ----  LINKNS08 ---
=   216 I/O SEC.
 LAST LINK DID NOT USE  119096 BYTES OF OPEN CORE
*    17 CPU-SEC.      316 ELAPSED-SEC.     ----- LINK END ---
*    17 CPU-SEC.      316 ELAPSED-SEC.     118   PLTTRAN BEGN
*    17 CPU-SEC.      317 ELAPSED-SEC.     118   PLTTRAN END
*    17 CPU-SEC.      318 ELAPSED-SEC.     ----  LINKNS13 ---
=   219 I/O SEC.
 LAST LINK DID NOT USE  114512 BYTES OF OPEN CORE
```

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*    17 CPU-SEC.      323 ELAPSED-SEC.     ----  LINK END ---
*    17 CPU-SEC.      323 ELAPSED-SEC.     120   SDR2     BEGN
*    17 CPU-SEC.      332 ELAPSED-SEC.     120   SDR2     END
*    17 CPU-SEC.      332 ELAPSED-SEC.     ----  LINKNS14 ---
=   227 I/O SEC.
 LAST LINK DID NOT USE   66424 BYTES OF OPEN CORE
*    17 CPU-SEC.      338 ELAPSED-SEC.     ----  LINK END ---
*    17 CPU-SEC.      338 ELAPSED-SEC.     121   SDR3     BEGN
*    18 CPU-SEC.      348 ELAPSED-SEC.     121   SDR3     END
*    18 CPU-SEC.      348 ELAPSED-SEC.     123   OFP      BEGN
*    18 CPU-SEC.      350 ELAPSED-SEC.     123   OFP      END
*    18 CPU-SEC.      351 ELAPSED-SEC.     130   XYTRAN   BEGN
*    18 CPU-SEC.      351 ELAPSED-SEC.     130   XYTRAN   END
*    18 CPU-SEC.      351 ELAPSED-SEC.     ----  LINKNS02 ---
=   239 I/O SEC.
 LAST LINK DID NOT USE   12720 BYTES OF OPEN CORE
*    18 CPU-SEC.      362 ELAPSED-SEC.     ----  LINK END ---
*    18 CPU-SEC.      362 ELAPSED-SEC.     132   XYPLOT   BEGN
*    18 CPU-SEC.      363 ELAPSED-SEC.     132   XYPLOT   END
*    18 CPU-SEC.      363 ELAPSED-SEC.     138   EXIT     BEGN
--------------------------------------------------------------------------------------------------------------------
=   241 I/O SEC.
 LAST LINK DID NOT USE   97232 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =  12K BYTES
```

IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3

SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$*****************************************************************************
$ START OF EXECUTIVE CONTROL *************************************************
$*****************************************************************************
$
$
$ THIS PROBLEM IS NOT BASED ON ANY OF THE PRECEDING PROBLEMS.
$ ITS PURPOSE IS TO DEMONSTRATE THAT THE NASTRAN THERMAL ANALYZER MAY BE USED
$ TO SOLVE PROBLEMS WHICH ARE DEFINED IN A FINITE DIFFERENCE FORM.
$ NOTE THAT THE TWO GRID POINTS ARE NOT LOCATED IN ANY SPECIFIC POSITION
$ IN SPACE ... ALSO, NO MATERIAL PROPERTIES ARE REQUIRED. AND
$                   COMMENT CARDS WHICH HAVE APPEARED IN THE PREVIOUS
$ EIGHTEEN PROBLEMS HAVE BEEN REMOVED SO THEY WILL NOT OBSCURE NEW COMMENTS
$ RELEVANT TO THIS PROBLEM.
$
$
ID CLASS PROBLEM NINETEEN, C.E. JACKSON
TIME 10
APP HEAT
SOL 9
CEND
```

```
                          C A S E   C O N T R O L   D E C K   E C H O
CARD
COUNT
  1      $
  2      $********************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ******************************
  4      $********************************************************************************
  5      $
  6      TITLE= FINITE DIFFERENCE USE OF THE NASTRAN THERMAL ANALYZER
  7      LINE=51
  8      ECHO=BOTH
  9      IC=100
 10      TEMP(MATERIAL)=101
 11      TSTEP=500
 12      OUTPUT
 13      THERMAL=ALL
 14      $
 15      $********************************************************************************
 16      $ END CASE CONTROL --- START BULK DATA *****************************************
 17      $********************************************************************************
 18      $
 19      BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
$
$ UNITS USED ARE METERS, WATTS, AND DEGREES CELSIUS
$
$
$ NOTE THAT NO LOCATION IS SPECIFIED
$
GRID    1
GRID    2
$
$ APPLY THERMAL MASS TO GRID POINTS ONE AND TWO
$ THE TEMPERATURE OF GRID POINT 1 IS EFFECTIVELY FIXED DUE TO ITS
$ LARGE THERMAL MASS.
$ GRID POINT 2 POSSESSES A THERMAL MASS OF 100 JOULES PER DEGREE CELSIUS.
$
CDAMP2  300     1.E+8   1       1
CDAMP2  301     1000.   2       1
$
$ CONDUCTIVELY COUPLE GRID POINTS ONE AND TWO
$ THE COUPLING WILL BE 5 WATTS PER DEGREE CELSIUS
$
CELAS2  400     5       1       1       2       1
$
$ THE FOLLOWING CARDS HAVE BEEN PREVIOUSLY DISCUSSED
$
CHBDY   200     201     POINT   2
PHBDY   201             10.     .6
RADLST  200
RADMTX  1       6.
PARAM   SIGMA   5.685E-8
PARAM   TABS    273.15
TEMP    100     1       0.      2       300.
TEMP    101     1       0.      2       -50.
TSTEP   500     45      .1      1
$
$************************************************************************
$ END OF BULK DATA ******************************************************
$************************************************************************
$
ENDDATA
```

TOTAL COUNT=   39

*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED,XSORT WILL RE-ORDER DECK.

```
                                   S O R T E D   B U L K   D A T A   E C H O
 CARD
 COUNT        .  1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10  .
    1-        CDAMP2  300     1.E+8   1       1
    2-        CDAMP2  301     1000.   2       1
    3-        CELAS2  400     5.      1       1       2       1
    4-        CHBDY   200     201     POINT   2
    5-        GRID    1
    6-        GRID    2
    7-        PARAM   SIGMA   5.685E-8
    8-        PARAM   TABS    273.15
    9-        PHBDY   201             10.     .6
   10-        RADLST  200
   11-        RADMTX  1       6.
   12-        TEMP    100     1       0.0     2       300.
   13-        TEMP    101     1       0.0     2       -50.
   14-        TSTEP   500     45      .1      1
              ENDDATA

      **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**


*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE

*** USER INFORMATION MESSAGE      1 ELEMENTS HAVE A TOTAL VIEW FACTOR (FA/A) LESS THAN 0.99
```

POINT-ID = 1

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	0.0
9.999996E-02	S	8.218437E-07
1.999999E-01	S	2.310435E-06
2.999999E-01	S	3.788811E-06
3.999999E-01	S	5.257123E-06
4.999998E-01	S	6.715506E-06
5.999998E-01	S	8.164096E-06
6.999997E-01	S	9.603024E-06
7.999997E-01	S	1.103241E-05
8.999997E-01	S	1.245239E-05
9.999996E-01	S	1.386307E-05
1.099999E 00	S	1.526458E-05
1.199999E 00	S	1.665702E-05
1.299998E 00	S	1.804052E-05
1.399998E 00	S	1.941517E-05
1.499997E 00	S	2.078110E-05
1.599997E 00	S	2.213840E-05
1.699996E 00	S	2.348718E-05
1.799995E 00	S	2.482755E-05
1.899995E 00	S	2.615960E-05
1.999994E 00	S	2.748343E-05
2.099994E 00	S	2.879913E-05
2.199993E 00	S	3.010679E-05
2.299993E 00	S	3.140653E-05
2.399992E 00	S	3.269840E-05
2.499991E 00	S	3.398251E-05
2.599991E 00	S	3.525894E-05
2.699990E 00	S	3.652778E-05
2.799990E 00	S	3.778913E-05
2.899989E 00	S	3.904304E-05
2.999989E 00	S	4.028960E-05
3.099988E 00	S	4.152890E-05
3.199987E 00	S	4.276101E-05
3.299987E 00	S	4.398599E-05
3.399986E 00	S	4.520392E-05
3.499986E 00	S	4.641491E-05
3.599985E 00	S	4.761899E-05
3.699985E 00	S	4.881625E-05
3.799984E 00	S	5.000674E-05
3.899983E 00	S	5.119054E-05
3.999983E 00	S	5.236772E-05
4.099982E 00	S	5.353833E-05
4.199982E 00	S	5.470245E-05
4.299981E 00	S	5.586015E-05
4.399981E 00	S	5.701146E-05
4.499980E 00	S	5.815648E-05

POINT-ID = 2

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
9.999996E-02	S	2.988525E 02
1.999999E-01	S	2.967905E 02
2.999999E-01	S	2.947634E 02
3.999999E-01	S	2.927634E 02
4.999998E-01	S	2.907905E 02
5.999998E-01	S	2.888438E 02
6.999997E-01	S	2.869226E 02
7.999997E-01	S	2.850264E 02
8.999997E-01	S	2.831545E 02
9.999996E-01	S	2.813066E 02
1.099999E 00	S	2.794819E 02
1.199999E 00	S	2.776802E 02
1.299998E 00	S	2.759009E 02
1.399998E 00	S	2.741433E 02
1.499997E 00	S	2.724072E 02
1.599997E 00	S	2.706921E 02
1.699996E 00	S	2.689976E 02
1.799995E 00	S	2.673230E 02
1.699995E 00	S	2.656680E 02
1.999994E 00	S	2.640325E 02
2.099994E 00	S	2.624158E 02
2.199993E 00	S	2.608176E 02
2.299993E 00	S	2.592375E 02
2.399992E 00	S	2.576753E 02
2.499991E 00	S	2.561306E 02
2.599991E 00	S	2.546031E 02
2.699990E 00	S	2.530924E 02
2.799990E 00	S	2.515980E 02
2.699989E 00	S	2.501199E 02
2.999989E 00	S	2.486575E 02
3.099988E 00	S	2.472108E 02
3.199987E 00	S	2.457793E 02
3.299987E 00	S	2.443627E 02
3.399986E 00	S	2.429608E 02
3.499986E 00	S	2.415735E 02
3.599985E 00	S	2.402004E 02
3.699985E 00	S	2.388411E 02
3.799984E 00	S	2.374956E 02
3.699983E 00	S	2.361636E 02
3.999983E 00	S	2.348447E 02
4.099982E 00	S	2.335388E 02
4.199982E 00	S	2.322458E 02
4.299981E 00	S	2.309653E 02
4.399981E 00	S	2.296971E 02
4.499980E 00	S	2.284411E 02

- - - END OF JOB - - -

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 NASTRAN LOADED AT LOCATION 177720
 TIME TO GO =   59 CPU SEC., 238 I/O SEC.
*      0 CPU-SEC.         0 ELAPSED-SEC.     SEM1  BEGN
*      0 CPU-SEC.         0 ELAPSED-SEC.     SEMT
*      0 CPU-SEC.         3 ELAPSED-SEC.     NAST
*      0 CPU-SEC.         4 ELAPSED-SEC.     GNFI
*      0 CPU-SEC.         4 ELAPSED-SEC.     XCSA
*      0 CPU-SEC.         6 ELAPSED-SEC.     IFP1
*      0 CPU-SEC.         8 ELAPSED-SEC.     XSOR
*      0 CPU-SEC.        11 ELAPSED-SEC.       DO  IFP
*      1 CPU-SEC.        24 ELAPSED-SEC.      END  IFP
*      1 CPU-SEC.        24 ELAPSED-SEC.     XGPI
*      2 CPU-SEC.        29 ELAPSED-SEC.     SEM1  END
*      2 CPU-SEC.        29 ELAPSED-SEC.     ----  LINKNS02 ---
=     17 I/O SEC.
  LAST LINK DID NOT USE    40016 BYTES OF OPEN CORE
*      3 CPU-SEC.        32 ELAPSED-SEC.     ----  LINK END ---
*      3 CPU-SEC.        32 ELAPSED-SEC.     XSFA
*      3 CPU-SEC.        33 ELAPSED-SEC.     XSFA
*      3 CPU-SEC.        33 ELAPSED-SEC.     3     GP1       BEGN
*      3 CPU-SEC.        41 ELAPSED-SEC.     3     GP1       END
*      3 CPU-SEC.        42 ELAPSED-SEC.     8     GP2       BEGN
*      3 CPU-SEC.        44 ELAPSED-SEC.     8     GP2       END
*      3 CPU-SEC.        45 ELAPSED-SEC.     10    PLTSET    BEGN
*      3 CPU-SEC.        46 ELAPSED-SEC.     10    PLTSET    END
*      3 CPU-SEC.        46 ELAPSED-SEC.     12    PRTMSG    BEGN
*      3 CPU-SEC.        47 ELAPSED-SEC.     12    PRTMSG    END
*      3 CPU-SEC.        47 ELAPSED-SEC.     13    SETVAL    BEGN
*      3 CPU-SEC.        47 ELAPSED-SEC.     13    SETVAL    END
*      3 CPU-SEC.        48 ELAPSED-SEC.     21    GP3       BEGN
*      3 CPU-SEC.        56 ELAPSED-SEC.     21    GP3       END
*      3 CPU-SEC.        57 ELAPSED-SEC.     23    TA1       BEGN
*      4 CPU-SEC.        64 ELAPSED-SEC.     23    TA1       END
*      4 CPU-SEC.        65 ELAPSED-SEC.     ----  LINKNS03 ---
=     47 I/O SEC.
  LAST LINK DID NOT USE    82788 BYTES OF OPEN CORE
*      4 CPU-SEC.        69 ELAPSED-SEC.     ----  LINK END ---
*      4 CPU-SEC.        69 ELAPSED-SEC.     27    SMA1      BEGN
*      4 CPU-SEC.        71 ELAPSED-SEC.     27    SMA1      END
*      4 CPU-SEC.        71 ELAPSED-SEC.     30    SMA2      BEGN
*      4 CPU-SEC.        73 ELAPSED-SEC.     30    SMA2      END
*      4 CPU-SEC.        74 ELAPSED-SEC.     ----  LINKNS05 ---
=     54 I/O SEC.
  LAST LINK DID NOT USE    71500 BYTES OF OPEN CORE
*      4 CPU-SEC.        80 ELAPSED-SEC.     ----  LINK END ---
*      4 CPU-SEC.        80 ELAPSED-SEC.     35    RMG       BEGN
*      4 CPU-SEC.        86 ELAPSED-SEC.     FBS
*      4 CPU-SEC.        88 ELAPSED-SEC.     FBS
*      4 CPU-SEC.        90 ELAPSED-SEC.     MPYA  D
                                                   METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*      4 CPU-SEC.        91 ELAPSED-SEC.     MPYA  D
*      4 CPU-SEC.        91 ELAPSED-SEC.     TRAN  POSE
*      4 CPU-SEC.        92 ELAPSED-SEC.     TRAN  POSE
*      4 CPU-SEC.        92 ELAPSED-SEC.     MPYA  D
                                                   METHOD 2 NT,NBR PASSES =    1,EST. TIME =       0.0
*      5 CPU-SEC.        93 ELAPSED-SEC.     MPYA  D
```

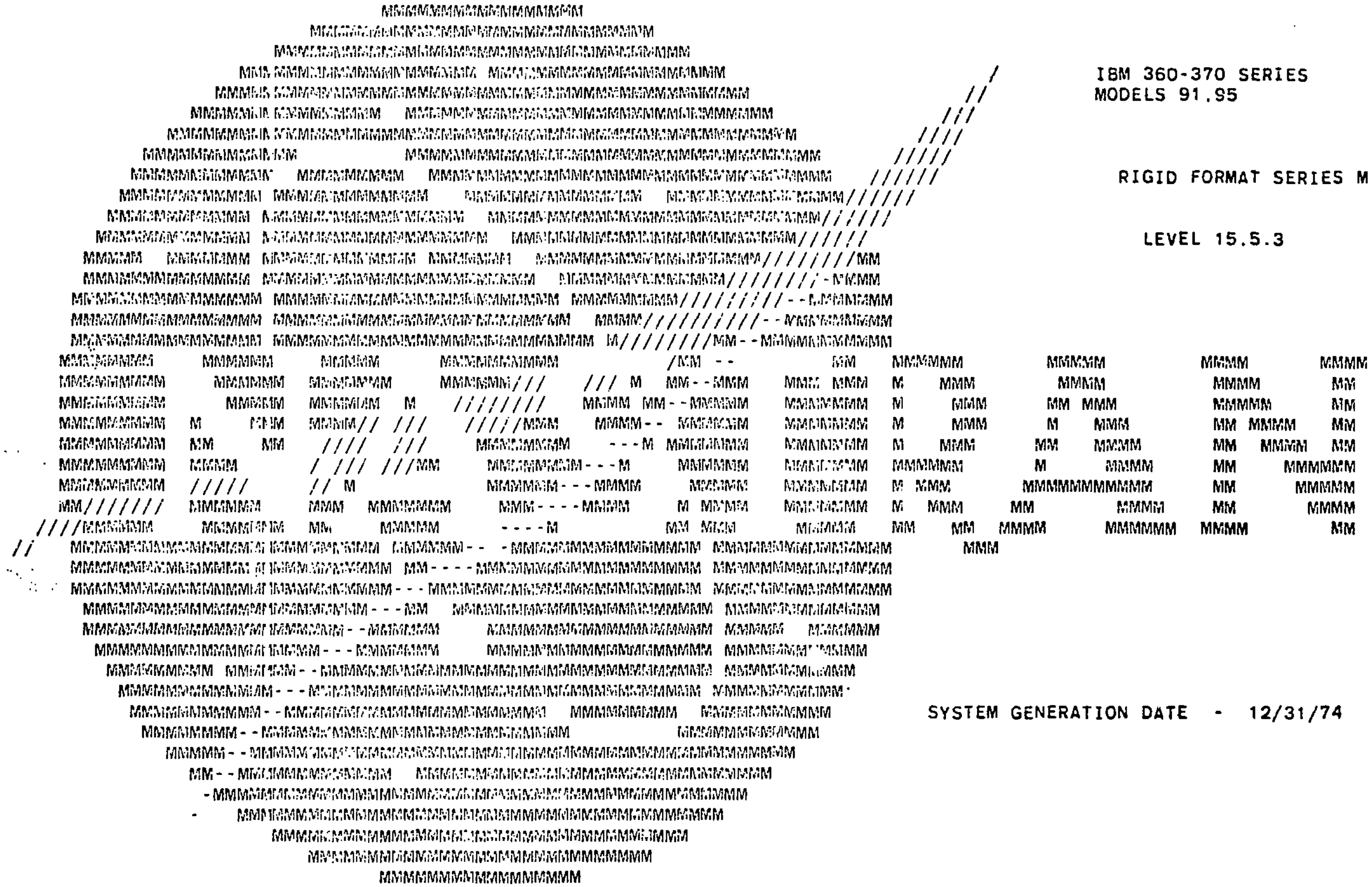
```
*      5 CPU-SEC.        96 ELAPSED-SEC.     35     RMG      END
*      5 CPU-SEC.        98 ELAPSED-SEC.     ----   LINKNS04 ---
=    69 I/O SEC.
 LAST LINK DID NOT USE   72544 BYTES OF OPEN CORE
*      5 CPU-SEC.       104 ELAPSED-SEC.     ----   LINK END ---
*      5 CPU-SEC.       104 ELAPSED-SEC.     40     GP4      BEGN
*      5 CPU-SEC.       107 ELAPSED-SEC.     40     GP4      END
*      5 CPU-SEC.       109 ELAPSED-SEC.     46     GPSP     BEGN
*      5 CPU-SEC.       109 ELAPSED-SEC.     46     GPSP     END
*      5 CPU-SEC.       110 ELAPSED-SEC.     ----   LINKNS14 ---
=    77 I/O SEC.
 LAST LINK DID NOT USE  124268 BYTES OF OPEN CORE
*      5 CPU-SEC.       118 ELAPSED-SEC.     ----   LINK END ---
*      5 CPU-SEC.       118 ELAPSED-SEC.     47     OFP      BEGN
*      5 CPU-SEC.       119 ELAPSED-SEC.     47     OFP      END
*      5 CPU-SEC.       123 ELAPSED-SEC.     XSFA
*      5 CPU-SEC.       123 ELAPSED-SEC.     XSFA
*      5 CPU-SEC.       123 ELAPSED-SEC.     ----   LINKNS06 ---
=    82 I/O SEC.
 LAST LINK DID NOT USE  115664 BYTES OF OPEN CORE
*      6 CPU-SEC.       125 ELAPSED-SEC.     ----   LINK END ---
*      6 CPU-SEC.       125 ELAPSED-SEC.     75     DPD      BEGN
*      6 CPU-SEC.       133 ELAPSED-SEC.     75     DPD      END
*      6 CPU-SEC.       135 ELAPSED-SEC.     ----   LINKNS10 ---
=    90 I/O SEC.
 LAST LINK DID NOT USE  116416 BYTES OF OPEN CORE
*      6 CPU-SEC.       139 ELAPSED-SEC.     ----   LINK END ---
*      6 CPU-SEC.       139 ELAPSED-SEC.     81     MTRXIN   BEGN
*      6 CPU-SEC.       140 ELAPSED-SEC.     81     MTRXIN   END
*      6 CPU-SEC.       140 ELAPSED-SEC.     83     PARAM    BEGN
*      6 CPU-SEC.       140 ELAPSED-SEC.     83     PARAM    END
*      6 CPU-SEC.       141 ELAPSED-SEC.     88     GKAD     BEGN
*      6 CPU-SEC.       144 ELAPSED-SEC.     88     GKAD     END
*      6 CPU-SEC.       144 ELAPSED-SEC.     XSFA
*      6 CPU-SEC.       145 ELAPSED-SEC.     XSFA
*      6 CPU-SEC.       145 ELAPSED-SEC.     ----   LINKNS05 ---
=    97 I/O SEC
 LAST LINK DID NOT USE  117064 BYTES OF OPEN CORE
*      6 CPU-SEC.       148 ELAPSED-SEC.     ----   LINK END ---
*      6 CPU-SEC.       148 ELAPSED-SEC.     92     TRLG     BEGN
*      6 CPU-SEC.       151 ELAPSED-SEC.     92     TRLG     END
*      6 CPU-SEC.       152 ELAPSED-SEC.     ----   LINKNS11 ---
=    99 I/O SEC.
 LAST LINK DID NOT USE   79760 BYTES OF OPEN CORE
*      7 CPU-SEC.       154 ELAPSED-SEC.     ----   LINK END ---
*      7 CPU-SEC.       154 ELAPSED-SEC.     97     TRHT     BEGN
*      8 CPU-SEC.       218 ELAPSED-SEC.     97     TRHT     END
*      8 CPU-SEC.       218 ELAPSED-SEC.     ----   LINKNS12 ---
=   156 I/O SEC.
 LAST LINK DID NOT USE   69268 BYTES OF OPEN CORE
*      8 CPU-SEC.       223 ELAPSED-SEC.     ----   LINK END ---
*      8 CPU-SEC.       223 ELAPSED-SEC.     99     VDR      BEGN
*      8 CPU-SEC.       228 ELAPSED-SEC.     99     VDR      END
*      8 CPU-SEC.       228 ELAPSED-SEC.     111    PARAM    BEGN
*      8 CPU-SEC.       228 ELAPSED-SEC.     111    PARAM    END
*      8 CPU-SEC.       229 ELAPSED-SEC.     ----   LINKNS08 ---
=   164 I/O SEC.
 LAST LINK DID NOT USE  119112 BYTES OF OPEN CORE
*      8 CPU-SEC.       235 ELAPSED-SEC.     ----   LINK END ---
*      8 CPU-SEC.       235 ELAPSED-SEC.     118    PLTTRAN BEGN
*      8 CPU-SEC.       237 ELAPSED-SEC.     118    PLTTRAN END
*      8 CPU-SEC.       237 ELAPSED-SEC.     XSFA
*      8 CPU-SEC.       238 ELAPSED-SEC.     XSFA
*      8 CPU-SEC.       238 ELAPSED-SEC.     ----   LINKNS13 ---
```

```
=    163 I/O SEC.
 LAST LINK DID NOT USE  107808 BYTES OF OPEN CORE
*      8 CPU-SEC.      240 ELAPSED-SEC.      ----   LINK END ---
*      8 CPU-SEC.      240 ELAPSED-SEC.      120    SDR2     BEGN
*      9 CPU-SEC.      242 ELAPSED-SEC.      120    SDR2     END
*      9 CPU-SEC.      242 ELAPSED-SEC.      ----   LINKNS14 ---
=    171 I/O SEC.
 LAST LINK DID NOT USE   66128 BYTES OF OPEN CORE
*      9 CPU-SEC.      248 ELAPSED-SEC.      ----   LINK END ---
*      9 CPU-SEC.      248 ELAPSED-SEC.      121    SDR3     BEGN
*      9 CPU-SEC.      253 ELAPSED-SEC.      121    SDR3     END
*      9 CPU-SEC.      253 ELAPSED-SEC.      123    OFP      BEGN
*      9 CPU-SEC.      255 ELAPSED-SEC.      123    OFP      END
*      9 CPU-SEC.      255 ELAPSED-SEC.      130    XYTRAN   BEGN
*      9 CPU-SEC.      255 ELAPSED-SEC.      130    XYTRAN   END
*      9 CPU-SEC.      255 ELAPSED-SEC.      ----   LINKNS02 ---
=    179 I/O SEC.
 LAST LINK DID NOT USE   44048 BYTES OF OPEN CORE
*      9 CPU-SEC.      263 ELAPSED-SEC.      ----   LINK END ---
*      9 CPU-SEC.      263 ELAPSED-SEC.      132    XYPLOT   BEGN
*      9 CPU-SEC.      263 ELAPSED-SEC.      132    XYPLOT   END
*      9 CPU-SEC.      263 ELAPSED-SEC.      138    EXIT     BEGN
----------------------------------------------------------------------------------------------------------------
=    181 I/O SEC.
 LAST LINK DID NOT USE   97232 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =   39K BYTES
```

IBM 360-370 SERIES
MODELS 91,95

RIGID FORMAT SERIES M

LEVEL 15.5.3



SYSTEM GENERATION DATE - 12/31/74

N A S T R A N   E X E C U T I V E   C O N T R O L   D E C K   E C H O

```
$
$***************************************************************************************************
$ START OF EXECUTIVE CONTROL ****************************************************************
$***************************************************************************************************
$
ID CLASS PROBLEM TWENTY  C.E. JACKSON
$
$ MAXIMUM CPU TIME ALLOWED FOR THE JOB
$
TIME 10
$
$ THE THERMAL ANALYZER PORTION OF NASTRAN IS TO BE USED
$
APP HEAT
$
$ THE NON-LINEAR TRANSIENT SOLUTION ALGORITHM IS TO BE USED
$
SOL 9
$
$ REQUEST FOR DIAGNOSTIC WHICH PRINTS OUT CONVERGENCE CRITERIA
$ PRODUCES OUTPUT ONLY FOR SOL 3
$
DIAG 18
$
CEND
```

C A S E   C O N T R O L   D E C K   E C H O

```
CARD
COUNT
  1      $
  2      $*************************************************************************
  3      $ END OF EXECUTIVE CONTROL --- START CASE CONTROL ****************************
  4      $*************************************************************************
  5      $
  6      TITLE=     NON-LINEAR TRANSIENT PROBLEM ...
  7      SUBTITLE=       TRANSFER FUNCTION AND ARBITRARY NON-LINEAR LOADS
  8      $
  9      $ SPECIFY 51 LINES OF DATA PER PAGE (DOES NOT INCLUDE HEADINGS AT TOP OF PAGE)
 10      $
 11      LINE=51
 12      $
 13      $ REQUEST SORTED AND UNSORTED OUTPUT
 14      $ IF THIS CARD IS OMITTED, ONLY THE SORTED BULK DATA WILL APPEAR
 15      $
 16      ECHO=BOTH
 17      $
 18      $ SELECT THE MPC AND LOAD SETS TO BE USED IN THIS SOLUTION
 19      $ NOTE THAT NO SPC SET IS SELECTED, AND THAT DLOAD HAS REPLACED LOAD.
 20      $
 21      MPC=200
 22      DLOAD=300
 23      $
 24      $ SELECT THE SET NUMBER OF THE NOLIN CARDS TO BE USED IN THIS PROBLEM
 25      $
 26      NONLINEAR=900
 27      $
 28      $ SELECT THE SET NUMBER OF THE TF CARDS TO BE USED IN THIS SOLUTION
 29      $
 30      TFL=902
 31      $
 32      $ SELECT THE TEMPERATURE SET WHICH IS AN ESTIMATE OF THE FINAL SOLUTION VECTOR
 33      $ THE SELECTION OF THIS SET IS OPTIONAL FOR SOL 9, BUT SHOULD BE MADE IF
 34      $ THE FINAL TEMPERATURE IS SEVERAL HUNDRED DEGREES DIFFERENT FROM THE
 35      $ IC VECTOR, AND RADIATIVE INTERCHANGES ARE INCLUDED.
 36      $
 37      TEMP(MATERIAL)=400
 38      $
 39      $ SELECT THE STEP SIZE, NUMBER OF INCREMENTS, AND PRINTOUT FREQUENCY
 40      $
 41      TSTEP=500
 42      $
 43      $ SELECT THE TEMPERATURE SET DEFINING THE TEMPERATURE VECTOR AT T=0.
 44      $
 45      IC=600
 46      $
 47      $ SELECT OUTPUT DESIRED
 48      $
 49      OUTPUT
 50      THERMAL=ALL
 51      $
```

```
                         C A S E   C O N T R O L   D E C K   E C H O
CARD
COUNT
52       $ DEFINE A SET OF GRID POINTS, AND REQUEST OUTPUT OF THE NON-LINEAR LOADS
53       $ APPLIED THERE (THIS WILL INCLUDE RADIATIVE LOADS IF THEY ARE PRESENT).
54       $
55       SET 6 = 1,5
56       NLLOAD=6
57       $
58       $*******************************************************************************
59       $ END CASE CONTROL --- START BULK DATA *****************************************
60       $*******************************************************************************
61       $
62       BEGIN BULK
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
.   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$
$ UNITS MUST BE CONSISTENT
$ IN THIS PROBLEM, METERS, WATTS, AND DEGREES CELSIUS ARE USED
$
$
$ DEFINE GRID POINTS
$
GRID    1               0.      0.      0.
GRID    2               .1      0.      0.
GRID    3               .2      0.      0.
GRID    4               .3      0.      0.
GRID    5               0.      .1      0.
GRID    6               .1      .1      0.
GRID    7               .2      .1      0.
GRID    8               .3      .1      0.
GRID    9               0.      .2      0.
GRID    10              0.      -.1     0.
GRID    100             -.05    .05     0.
$
$ CONNECT GRID POINTS
$
CROD    10      100     10      2
CROD    20      100     9       6
CQUAD2  30      200     1       2       6       5
CQUAD2  40      200     2       3       7       6
CQUAD2  50      200     3       4       8       7
$
$ DEFINE CROSS-SECTIONAL AREAS AND/OR THICKNESSES
$
PROD    100     1000    .001
PQUAD2  200     1000    .01
$
$ DEFINE MATERIAL THERMAL CONDUCTIVITY AND THERMAL MASS
$
MAT4    1000    200.    2.426+6                                         ALUMINUM
$
$ DEFINE CONVECTIVE AREA AND CONVECTIVE COEFFICIENT 'H'
$
CHBDY   60      300     LINE    1       5                               +CONVEC
+CONVEC 100     100
PHBDY   300     3000    .314
MAT4    3000    200.
$
$ DEFINE CONSTRAINTS
$
MPC     200     9       1       1.      5       1       -1.
MPC     200     10      1       1.      1       1       -1.
$
$ DEFINE APPLIED LOADS
$
SLOAD   300     1       4.      2       8.
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
  1  ..  2  ..  3  ..  4  ..  5  ..  6  ..  7  ..  8  ..  9  ..  10 .
SLOAD   300     3       8.      4       4.
SLOAD   300     5       4.      6       8.
SLOAD   300     7       8.      8       4.
$
$*****************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED TO CONVERT PROBLEM ONE TO
$ PROBLEM TWO. THE ONLY BULK DATA CARD REMOVED FROM THE PREVIOUS SOLUTION WAS
$ THE SPC CARD
$
$
$ THIS SPC1 CARD REPLACES THE SPC CARD REMOVED FROM ABOVE
$
SPC1    100     1       100
$
$ RADIATION BOUNDARY ELEMENTS
$
CHBDY   200     2000    AREA4   1       2       6       5
CHBDY   300     2000    AREA4   2       3       7       6
CHBDY   400     2000    AREA4   3       4       8       7
CHBDY   500     2000    AREA4   5       6       2       1
CHBDY   600     2000    AREA4   6       7       3       2
CHBDY   700     2000    AREA4   7       8       4       3
$
$ EMISSIVITY OF RADIATING ELEMENT
$
PHBDY   2000                    .90
$
$ ESTIMATE OF FINAL STEADY STATE SOLUTION VECTOR --- REFERENCED
$ BY TEMP(MATERIAL) IN CASE CONTROL
$
SEMP    400     100     300.
TEMPD   400     300.
$
$ PARAMETERS CONTROLLING RADIATION LOADING AND THE ITERATION LOOPING
$
PARAM   SIGMA   5.685E-8
PARAM   MAXIT   8
PARAM   TABS    273.15
PARAM   EPSHT   .0001
$
$ DEFINITION OF THE RADIATION MATRIX
$ ALL OF THE RADIATION GOES TO SPACE
$
SADLST  200     300     400     500     600     700
RADMTX  1       0.      0.      0.      0.      0.      0.
RADMTX  2       0.      0.      0.      0.      0.
RADMTX  3       0.      0.      0.
RADMTX  4       0.      0.      0.
RADMTX  5       0.      0.
RADMTX  6       0.
$
```

I N P U T   B U L K   D A T A   D E C K   E C H O

```
    1 ..  2 ..  3 ..  4 ..  5 ..  6 ..  7 ..  8 ..  9 ..  10 .
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE ADDED FOR THE TRANSIENT SOLUTION ----------
$ THEY CONVERT PROBLEM TWO TO PROBLEM THREE
$ NOTE THAT THE SPC1 SET WAS NOT SELECTED IN CASE CONTROL
$ NOTE THAT SPCF OUTPUT IS NOT REQUESTED IN TRANSIENT
$ NOTE THAT THERMAL MASS WAS ADDED TO 'MAT4' CARD 1000
$ NOTE THAT THE DIAG CARD IN THE EXECUTIVE CONTROL WAS IRRELEVANT
$ NOTE THAT THE LOAD REQUEST IN CASE CONTROL IS NOW A DLOAD REQUEST
$
$
$ TRANSIENT SINGLE POINT CONSTRAINT METHOD
$ CONSTRAIN GRID POINT 100 TO 300 DEGREES CELSIUS
$
CELAS2  300     1.+5    100     1
SLOAD   300     100     300.+5
$
$ DEFINES A CONSTANT LOAD SET APPLIED FROM T=0. TO T=1.+6 SECONDS
$
TLOAD2  300     300                     0.      1.+6    0.      0.      +TL1
+TL1    0.      0.
$
$ DEFINES THE NUMBER OF INCREMENTS, THE STEP SIZE, AND THE PRINTOUT FREQUENCY
$ REFERENCED IN CASE CONTROL AS 'TSTEP'
$ EACH TIME STEP IS 30 SECONDS
$
$STEP   500     45      30.     1
$
$ DEFINES A TEMPERATURE VECTOR --- REFERENCED IN CASE CONTROL AS 'IC'
$
TEMPD   600     300.
$
$*******************************************************************************
$ THE FOLLOWING BULK DATA CARDS WERE USED TO CONVERT PROBLEM THREE TO
$ PROBLEM 20. GRID POINT 904 HAS ITS TEMPERATURE CONTROLLED BY A TRANSFER
$ FUNCTION. TEMPERATURE DEPENDENT NON-LINEAR LOADS
$ ARE APPLIED TO GRID POINTS 1 AND 5 RESPECTIVELY.
$ THE ONLY OTHER CHANGES MADE WERE THE ADDITION OF A NONLINEAR AND A
$ NLLOAD REQUEST TO THE CASE CONTROL, A REDUCTION IN THE TSTEP
$ TIME INCREMENTS TO 1 SECOND EACH(THE OLD TSTEP CARD WAS MADE INTO A COMMENT),
$ THE REMOVAL OF THE LINEAR LOAD OUTPUT REQUEST (OLOAD=ALL) FROM CASE CONTROL,
$ THE REMOVAL OF THE PRINTER PLOT OUTPUT PACKAGE FROM CASE CONTROL,
$ THE REMOVAL OF THE RADLST CARD TO ELIMINATE ANY RADIATIVE EFFECTS (WHICH
$ WOULD OBSCURE THE NON-LINEAR LOADS APPLIED BY THE NOLIN CARDS), AND THE
$ CHANGE OF THE BASE TEMPERATURE OF THE FIN TO 200 DEGREES C (TO ENSURE THAT
$ THE FIN WOULD COOL OFF FROM ITS INITIAL TEMPERATURE EVEN THOUGH THE RADIATIVE
$ HEAT LOSSES HAD BEEN REMOVED).
$
$ EACH TIME STEP IS ONE SECOND
$
TSTEP   500     45      1.      1
$
```

```
                         I N P U T   B U L K   D A T A   D E C K   E C H O

 .   1  ..   2  ..   3  ..   4  ..   5  ..   6  ..   7  ..   8  ..   9  ..  10  .
$ CHANGES MADE TO ALTER THE BASE TEMPERATURE OF THE FIN TO 200 C.
$ PREVIOUS SLOAD AND TEMP CARDS WERE CONVERTED TO COMMENTS.
$
SLOAD   300     100     200.+5
TEMP    400     100     200.
TEMP    600     100     200.
$
$ APPLY NON-LINEAR LOADS AS A FUNCTION O. TEMPERATURE
$
NOLIN1  900     1       1       1.      1       1       9004
NOLIN1  900     5       1       .5      5       1       9004
TABLED1 9004                                                    +TAB1
+TAB1   270.    30.     300.    0.      301.    0.      ENDT
$
$ DEFINE A NEW GRID POINT (904) AND CONSTRAIN ITS TEMPERATURE TO THE
$ NEGATIVE OF THE TEMPERATURE OF GRID POINT 4 BY USING A TRANSFER FUNCTION.
$
GRID    904
TF      902     904     1       1.      0.      0.              +TF1
+TF1    4       1       1       0.      0.
$
$*************************************************************************
$ END OF BULK DATA *******************************************************
$*************************************************************************
ENDDATA
       TOTAL COUNT=  178
```

```
*** USER INFORMATION MESSAGE 207, BULK DATA NOT SORTED,XSORT WILL RE-ORDER DECK.
```

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	1	2	3	4	5	6	7	8	9	10
1-	CELAS2	300	1 +5	100	1					
2-	CHBDY	60	300	LINE	1	5				+CONVEC
3-	+CONVEC	100	100							
4-	CHBDY	200	2000	AREA4	1	2	6	5		
5-	CHBDY	300	2000	AREA4	2	3	7	6		
6-	CHBDY	400	2000	AREA4	3	4	8	7		
7-	CHBDY	500	2000	AREA4	5	6	2	1		
8-	CHBDY	600	2000	AREA4	6	7	3	2		
9-	CHBDY	700	2000	AREA4	7	8	4	3		
10-	CQUAD2	30	200	1	2	6	5			
11-	CQUAD2	40	200	2	3	7	6			
12-	CQUAD2	50	200	3	4	8	7			
13-	CROD	10	100	10	2					
14-	CROD	20	100	9	6					
15-	GRID	1		0.0	0.0	0.0				
16-	GRID	2		.1	0.0	0.0				
17-	GRID	3		.2	0.0	0.0				
18-	GRID	4		.3	0.0	0.0				
19-	GRID	5		0.0	.1	0.0				
20-	GRID	6		.1	.1	0.0				
21-	GRID	7		.2	.1	0.0				
22-	GRID	8		.3	.1	0.0				
23-	GRID	9		0.0	.2	0.0				
24-	GRID	10		0.0	-.1	0.0				
25-	GRID	100		-.05	.05	0.0				
26-	GRID	904								
27-	MAT4	1000	200.	2.426+6						ALUMINUM
28-	MAT4	3000	200.							
29-	MPC	200	9	1	1.	5	1	-1.		
30-	MPC	200	10	1	1.	1	1	-1.		
31-	NOLIN1	900	1	1	1.	1	1	9004		
32-	NOLIN1	900	5	1	.5	5	1	9004		
33-	PARAM	EPSHT	.0001							
34-	PARAM	MAXIT	8							
35-	PARAM	SIGMA	5.685E-8							
36-	PARAM	TABS	273.15							
37-	PHBDY	300	3000	.314						
38-	PHBDY	2000			.90					
39-	PQUAD2	200	1000	.01						
40-	PROD	100	1000	.001						
41-	RADMTX	1	0.0	0.0	0.0	0.0	0.0	0.0		
42-	RADMTX	2	0.0	0.0	0.0	0.0	0.0			
43-	RADMTX	3	0.0	0.0	0.0	0.0				
44-	RADMTX	4	0.0	0.0	0.0					
45-	RADMTX	5	0.0	0.0						
46-	RADMTX	6	0.0							
47-	SLOAD	300	1	4.	2	8.				
48-	SLOAD	300	3	8.	4	[illegible]				
49-	SLOAD	300	5	4.	6	8.				
50-	SLOAD	300	7	8.	8	4.				
51-	SLOAD	300	100	200.+5						

S O R T E D   B U L K   D A T A   E C H O

CARD COUNT	. 1 ..	2 ..	3 ..	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 .
52-	SPC1	100	1	100						
53-	TABLED1	9004								+TAB1
54-	+TAB1	270.	30.	300.	0.	301.	0.	ENDT		
55-	TEMP	400	100	200.						
56-	TEMP	600	100	200.						
57-	TEMPD	400	300.							
58-	TEMPD	600	300.							
59-	TF	902	904	1	1.	0.0	0.0			+TF1
60-	+TF1	4	1	1.	0.	0.				
61-	TLOAD2	300	300			0.0	1.+6	0.0	0.0	+TL1
62-	+TL1	0.	0.							
63-	TSTEP	500	45	1.	1					
	ENDDATA									

```
   N A S T R A N   S O U R C E   P R O G R A M   C O M P I L A T I O N
DMAP-DMAP INSTRUCTION
 NO.

*** USER WARNING MESSAGE  54.
     PARAMETER NAMED EPSHT    NOT REFERENCED

*** USER WARNING MESSAGE  54.
     PARAMETER NAMED MAXIT    NOT REFERENCED

          **NO ERRORS FOUND - EXECUTE NASTRAN PROGRAM**
```

```
*** USER WARNING MESSAGE 2015. EITHER NO ELEMENTS CONNECT
   INTERNAL GRID POINT       12    OR IT IS CONNECTED TO A RIGID ELEMENT OR A GENERAL ELEMENT.


*** USER INFORMATION MESSAGE   FULL INTERNAL SPACE NODE AVAILABLE


*** USER INFORMATION MESSAGE 3028,      B =     5      BBAR =    4
                                        C =     2      CBAR =    2
                                        R =     8

*** USER INFORMATION MESSAGE 3027, UNSYMMETRIC  REAL   DECOMPOSITION TIME ESTIMATE IS       0 SECONDS.
```

POINT-ID = 1

N O N - L I N E A R - F O R C E   V E C T O R

TIME	TYPE	VALUE
0.0	S	0.0
1.000000E 00	S	7.255859E-01
2.000000E 00	S	2.022461E 00
3.000000E 00	S	3.281738E 00
4.000000E 00	S	4.505859E 00
5.000000E 00	S	5.696045E 00
6.000000E 00	S	6.853516E 00
7.000000E 00	S	7.979004E 00
8.000000E 00	S	9.073975E 00
9.000000E 00	S	1.013843E 01
1.000000E 01	S	1.117407E 01
1.100000E 01	S	1.218164E 01
1.200000E 01	S	1.316162E 01
1.300000E 01	S	1 411548E 01
1.400000E 01	S	1.504346E 01
1.500000E 01	S	1.594653E 01
1.600000E 01	S	1.682568E 01
1.700000E 01	S	1.769066E 01
1.800000E 01	S	1.851294E 01
1.900000E 01	S	1.932373E 01
2.000000E 01	S	2.011255E 01
2.100000E 01	S	2.088062E 01
2.200000E 01	S	2.162866E 01
2.300000E 01	S	2.235718E 01
2.400000E 01	S	2.306689E 01
2.500000E 01	S	2.375830E 01
2.600000E 01	S	2.443188E 01
2.700000E 01	S	2.508838E 01
2.800000E 01	S	2.572803E 01
2.900000E 01	S	2.635156E 01
3.000000E 01	S	2.695947E 01
3.100000E 01	S	2.755200E 01
3.200000E 01	S	2.812988E 01
3.300000E 01	S	2.869336E 01
3.400000E 01	S	2.924292E 01
3.500000E 01	S	2.977881E 01
3.600000E 01	S	3.030176E 01
3.700000E 01	S	3.081177E 01
3.800000E 01	S	3.130957E 01
3.900000E 01	S	3.179541E 01
4.000000E 01	S	3.226953E 01
4.100000E 01	S	3.273242E 01
4.200000E 01	S	3.318433E 01
4.300000E 01	S	3.362549E 01
4.400000E 01	S	3.405640E 01
4.500000E 01	S	3.447729E 01

POINT-ID = 5

N O N - L I N E A R - F O R C E   V E C T O R

TIME	TYPE	VALUE
0.0	S	0.0
1.000000E 00	S	3.629150E-01
2.000000E 00	S	1.012572E 00
3.000000E 00	S	1.645141E 00
4.000000E 00	S	2.261352E 00
5.000000E 00	S	2.861693E 00
6.000000E 00	S	3.446898E 00
7.000000E 00	S	4.017211E 00
8.000000E 00	S	4.572997E 00
9.000000E 00	S	5.114623E 00
1.000000E 01	S	5.642577E 00
1.100000E 01	S	6.157470E 00
1.200000E 01	S	6.659301E 00
1.300000E 01	S	7.148925E 00
1.400000E 01	S	7.626220E 00
1.500000E 01	S	8.091795E 00
1.600000E 01	S	8.545530E 00
1.700000E 01	S	8.988279E 00
1.800000E 01	S	9.420042E 00
1.900000E 01	S	9.841307E 00
2.000000E 01	S	1.025220E 01
2.100000E 01	S	1.065332E 01
2.200000E 01	S	1.104468E 01
2.300000E 01	S	1.142663E 01
2.400000E 01	S	1.179956E 01
2.500000E 01	S	1.216357E 01
2.600000E 01	S	1.251904E 01
2.700000E 01	S	1.286609E 01
2.800000E 01	S	1.320508E 01
2.900000E 01	S	1.353613E 01
3.000000E 01	S	1.385950E 01
3.100000E 01	S	1.417541E 01
3.200000E 01	S	1.448413E 01
3.300000E 01	S	1.478576E 01
3.400000E 01	S	1.508056E 01
3.500000E 01	S	1.536877E 01
3.600000E 01	S	1.565039E 01
3.700000E 01	S	1.592578E 01
3.800000E 01	S	1.619493E 01
3.900000E 01	S	1.645824E 01
4.000000E 01	S	1.671568E 01
4.100000E 01	S	1.696751E 01
4.200000E 01	S	1.721385E 01
4.300000E 01	S	1.745494E 01
4.400000E 01	S	1.769078E 01
4.500000E 01	S	1.792162E 01

POINT-ID =   1

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
1.000000E 00	S	2.992744E 02
2.000000E 00	S	2.979775E 02
3.000000E 00	S	2.967183E 02
4.000000E 00	S	2.954941E 02
5.000000E 00	S	2.943040E 02
6.000000E 00	S	2.931465E 02
7.000000E 00	S	2.920210E 02
8.000000E 00	S	2.909260E 02
9.000000E 00	S	2.898616E 02
1.000000E 01	S	2.888259E 02
1.100000E 01	S	2.878184E 02
1.200000E 01	S	2.868384E 02
1.300000E 01	S	2.858845E 02
1.400000E 01	S	2.849565E 02
1.500000E 01	S	2.840535E 02
1.600000E 01	S	2.831743E 02
1.700000E 01	S	2.823193E 02
1.800000E 01	S	2.814871E 02
1.900000E 01	S	2.806763E 02
2.000000E 01	S	2.798875E 02
2.100000E 01	S	2.791194E 02
2.200000E 01	S	2.783713E 02
2.300000E 01	S	2.776428E 02
2.400000E 01	S	2.769331E 02
2.500000E 01	S	2.762417E 02
2.600000E 01	S	2.755681E 02
2.700000E 01	S	2.749116E 02
2.800000E 01	S	2.742720E 02
2.900000E 01	S	2.736484E 02
3.000000E 01	S	2.730405E 02
3.100000E 01	S	2.724480E 02
3.200000E 01	S	2.718701E 02
3.300000E 01	S	2.713066E 02
3.400000E 01	S	2.707571E 02
3.500000E 01	S	2.702212E 02
3.600000E 01	S	2.696982E 02
3.700000E 01	S	2.691882E 02
3.800000E 01	S	2.686904E 02
3.900000E 01	S	2.682046E 02
4.000000E 01	S	2.677305E 02
4.100000E 01	S	2.672676E 02
4.200000E 01	S	2.668157E 02
4.300000E 01	S	2.663745E 02
4.400000E 01	S	2.659436E 02
4.500000E 01	S	2.655227E 02

POINT-ID = 2

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
1.000000E 00	S	3.000107E 02
2.000000E 00	S	3.000254E 02
3.000000E 00	S	3.000295E 02
4.000000E 00	S	3.000237E 02
5.000000E 00	S	3.000083E 02
6.000000E 00	S	2.999639E 02
7.000000E 00	S	2.999502E 02
8.000000E 00	S	2.999087E 02
9.000000E 00	S	2.998584E 02
1.000000E 01	S	2.998003E 02
1.100000E 01	S	2.997349E 02
1.200000E 01	S	2.996621E 02
1.300000E 01	S	2.995825E 02
1.400000E 01	S	2.994961E 02
1.500000E 01	S	2.994036E 02
1.600000E 01	S	2.993052E 02
1.700000E 01	S	2.992007E 02
1.800000E 01	S	2.990908E 02
1.900000E 01	S	2.989756E 02
2.000000E 01	S	2.988555E 02
2.100000E 01	S	2.987307E 02
2.200000E 01	S	2.986008E 02
2.300000E 01	S	2.984668E 02
2.400000E 01	S	2.983289E 02
2.500000E 01	S	2.981865E 02
2.600000E 01	S	2.980405E 02
2.700000E 01	S	2.978911E 02
2.800000E 01	S	2.977378E 02
2.900000E 01	S	2.975813E 02
3.000000E 01	S	2.974216E 02
3.100000E 01	S	2.972590E 02
3.200000E 01	S	2.970935E 02
3.300000E 01	S	2.969253E 02
3.400000E 01	S	2.967546E 02
3.500000E 01	S	2.965818E 02
3.600000E 01	S	2.964065E 02
3.700000E 01	S	2.962289E 02
3.800000E 01	S	2.960493E 02
3.900000E 01	S	2.958677E 02
4.000000E 01	S	2.956843E 02
4.100000E 01	S	2.954995E 02
4.200000E 01	S	2.953132E 02
4.300000E 01	S	2.951252E 02
4.400000E 01	S	2.949360E 02
4.500000E 01	S	2.947454E 02

POINT-ID = 3

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
1.000000E 00	S	3.000359E 02
2.000000E 00	S	3.001013E 02
3.000000E 00	S	3.001660E 02
4.000000E 00	S	3.002302E 02
5.000000E 00	S	3.002939E 02
6.000000E 00	S	3.003569E 02
7.000000E 00	S	3.004192E 02
8.000000E 00	S	3.004807E 02
9.000000E 00	S	3.005413E 02
1.000000E 01	S	3.006008E 02
1.100000E 01	S	3.006594E 02
1.200000E 01	S	3.007170E 02
1.300000E 01	S	3.007737E 02
1.400000E 01	S	3.008293E 02
1.500000E 01	S	3.008838E 02
1.600000E 01	S	3.009370E 02
1.700000E 01	S	3.009893E 02
1.800000E 01	S	3.010403E 02
1.900000E 01	S	3.010901E 02
2.000000E 01	S	3.011387E 02
2.100000E 01	S	3.011860E 02
2.200000E 01	S	3.012319E 02
2.300000E 01	S	3.012766E 02
2.400000E 01	S	3.013198E 02
2.500000E 01	S	3.013618E 02
2.600000E 01	S	3.014023E 02
2.700000E 01	S	3.014414E 02
2.800000E 01	S	3.014792E 02
2.900000E 01	S	3.015156E 02
3.000000E 01	S	3.015505E 02
3.100000E 01	S	3.015842E 02
3.200000E 01	S	3.016165E 02
3.300000E 01	S	3.016472E 02
3.400000E 01	S	3.016765E 02
3.500000E 01	S	3.017043E 02
3.600000E 01	S	3.017310E 02
3.700000E 01	S	3.017561E 02
3.800000E 01	S	3.017798E 02
3.900000E 01	S	3.018020E 02
4.000000E 01	S	3.018228E 02
4.100000E 01	S	3.018423E 02
4.200000E 01	S	3.018604E 02
4.300000E 01	S	3.018770E 02
4.400000E 01	S	3.018923E 02
4.500000E 01	S	3.019063E 02

POINT-ID = 4

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
1.000000E 00	S	3.000359E 02
2.000000E 00	S	3.001016E 02
3.000000E 00	S	3.001672E 02
4.000000E 00	S	3.002327E 02
5.000000E 00	S	3.002981E 02
6.000000E 00	S	3.003635E 02
7.000000E 00	S	3.004290E 02
8.000000E 00	S	3.004944E 02
9.000000E 00	S	3.005596E 02
1.000000E 01	S	3.006248E 02
1.100000E 01	S	3.006899E 02
1.200000E 01	S	3.007549E 02
1.300000E 01	S	3.008198E 02
1.400000E 01	S	3.008845E 02
1.500000E 01	S	3.009492E 02
1.600000E 01	S	3.010137E 02
1.700000E 01	S	3.010779E 02
1.800000E 01	S	3.011418E 02
1.900000E 01	S	3.012056E 02
2.000000E 01	S	3.012690E 02
2.100000E 01	S	3.013323E 02
2.200000E 01	S	3.013953E 02
2.300000E 01	S	3.014580E 02
2.400000E 01	S	3.015205E 02
2.500000E 01	S	3.015825E 02
2.600000E 01	S	3.016440E 02
2.700000E 01	S	3.017056E 02
2.800000E 01	S	3.017666E 02
2.900000E 01	S	3.018271E 02
3.000000E 01	S	3.018875E 02
3.100000E 01	S	3.019473E 02
3.200000E 01	S	3.020066E 02
3.300000E 01	S	3.020654E 02
3.400000E 01	S	3.021236E 02
3.500000E 01	S	3.021816E 02
3.600000E 01	S	3.022390E 02
3.700000E 01	S	3.022959E 02
3.800000E 01	S	3.023523E 02
3.900000E 01	S	3.024082E 02
4.000000E 01	S	3.024634E 02
4.100000E 01	S	3.025181E 02
4.200000E 01	S	3.025723E 02
4.300000E 01	S	3.026257E 02
4.400000E 01	S	3.026787E 02
4.500000E 01	S	3.027310E 02

POINT-ID = 5

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
1.000000E 00	S	2.992742E 02
2.000000E 00	S	2.979749E 02
3.000000E 00	S	2.967097E 02
4.000000E 00	S	2.954773E 02
5.000000E 00	S	2.942766E 02
6.000000E 00	S	2.931062E 02
7.000000E 00	S	2.919656E 02
8.000000E 00	S	2.908540E 02
9.000000E 00	S	2.897708E 02
1.000000E 01	S	2.887148E 02
1.100000E 01	S	2.876851E 02
1.200000E 01	S	2.866814E 02
1.300000E 01	S	2.857021E 02
1.400000E 01	S	2.847476E 02
1.500000E 01	S	2.838164E 02
1.600000E 01	S	2.829089E 02
1.700000E 01	S	2.820234E 02
1.800000E 01	S	2.811599E 02
1.900000E 01	S	2.803174E 02
2.000000E 01	S	2.794956E 02
2.100000E 01	S	2.786934E 02
2.200000E 01	S	2.779106E 02
2.300000E 01	S	2.771467E 02
2.400000E 01	S	2.764009E 02
2.500000E 01	S	2.756729E 02
2.600000E 01	S	2.749619E 02
2.700000E 01	S	2.742678E 02
2.800000E 01	S	2.735898E 02
2.900000E 01	S	2.729277E 02
3.000000E 01	S	2.722810E 02
3.100000E 01	S	2.716492E 02
3.200000E 01	S	2.710317E 02
3.300000E 01	S	2.704285E 02
3.400000E 01	S	2.698389E 02
3.500000E 01	S	2.692625E 02
3.600000E 01	S	2.686992E 02
3.700000E 01	S	2.681484E 02
3.800000E 01	S	2.676101E 02
3.900000E 01	S	2.670835E 02
4.000000E 01	S	2.665686E 02
4.100000E 01	S	2.660649E 02
4.200000E 01	S	2.655723E 02
4.300000E 01	S	2.650901E 02
4.400000E 01	S	2.646184E 02
4.500000E 01	S	2.641567E 02

POINT-ID = C

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
1.000000E 00	S	3.000107E 02
2.000000E 00	S	3.000251E 02
3.000000E 00	S	3.000291E 02
4.000000E 00	S	3.000232E 02
5.000000E 00	S	3.000076E 02
6.000000E 00	S	2.999827E 02
7.000000E 00	S	2.999487E 02
8.000000E 00	S	2.999065E 02
9.000000E 00	S	2.998557E 02
1.000000E 01	S	2.997969E 02
1.100000E 01	S	2.997302E 02
1.200000E 01	S	2.996565E 02
1.300000E 01	S	2.995759E 02
1.400000E 01	S	2.994885E 02
1.500000E 01	S	2.993943E 02
1.600000E 01	S	2.992942E 02
1.700000E 01	S	2.991880E 02
1.800000E 01	S	2.990762E 02
1.900000E 01	S	2.989587E 02
2.000000E 01	S	2.988359E 02
2.100000E 01	S	2.987080E 02
2.200000E 01	S	2.985754E 02
2.300000E 01	S	2.984382E 02
2.400000E 01	S	2.982966E 02
2.500000E 01	S	2.981506E 02
2.600000E 01	S	2.980007E 02
2.700000E 01	S	2.978472E 02
2.800000E 01	S	2.976899E 02
2.900000E 01	S	2.975288E 02
3.000000E 01	S	2.973645E 02
3.100000E 01	S	2.971970E 02
3.200000E 01	S	2.970266E 02
3.300000E 01	S	2.968533E 02
3.400000E 01	S	2.966770E 02
3.500000E 01	S	2.964985E 02
3.600000E 01	S	2.963176E 02
3.700000E 01	S	2.961343E 02
3.800000E 01	S	2.959485E 02
3.900000E 01	S	2.957605E 02
4.000000E 01	S	2.955708E 02
4.100000E 01	S	2.953794E 02
4.200000E 01	S	2.951863E 02
4.300000E 01	S	2.949912E 02
4.400000E 01	S	2.947947E 02
4.500000E 01	S	2.945967E 02

POINT-ID = 7

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
1.000000E 00	S	3.000359E 02
2.000000E 00	S	3.001011E 02
3.000000E 00	S	3.001658E 02
4.000000E 00	S	3.002300E 02
5.000000E 00	S	3.002937E 02
6.000000E 00	S	3.003567E 02
7.000000E 00	S	3.004189E 02
8.000000E 00	S	3.004805E 02
9.000000E 00	S	3.005410E 02
1.000000E 01	S	3.006006E 02
1.100000E 01	S	3.006594E 02
1.200000E 01	S	3.007170E 02
1.300000E 01	S	3.007737E 02
1.400000E 01	S	3.008293E 02
1.500000E 01	S	3.008838E 02
1.600000E 01	S	3.009370E 02
1.700000E 01	S	3.009893E 02
1.800000E 01	S	3.010403E 02
1.900000E 01	S	3.010898E 02
2.000000E 01	S	3.011382E 02
2.100000E 01	S	3.011853E 02
2.200000E 01	S	3.012310E 02
2.300000E 01	S	3.012754E 02
2.400000E 01	S	3.013184E 02
2.500000E 01	S	3.013601E 02
2.600000E 01	S	3.014004E 02
2.700000E 01	S	3.014392E 02
2.800000E 01	S	3.014768E 02
2.900000E 01	S	3.015129E 02
3.000000E 01	S	3.015476E 02
3.100000E 01	S	3.015808E 02
3.200000E 01	S	3.016128E 02
3.300000E 01	S	3.016433E 02
3.400000E 01	S	3.016724E 02
3.500000E 01	S	3.016997E 02
3.600000E 01	S	3.017258E 02
3.700000E 01	S	3.017505E 02
3.800000E 01	S	3.017737E 02
3.900000E 01	S	3.017954E 02
4.000000E 01	S	3.018157E 02
4.100000E 01	S	3.018345E 02
4.200000E 01	S	3.018521E 02
4.300000E 01	S	3.018682E 02
4.400000E 01	S	3.018828E 02
4.500000E 01	S	3.018960E 02

POINT-ID = 8

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
1.000000E 00	S	3.000361E 02
2.000000E 00	S	3.001018E 02
3.000000E 00	S	3.001675E 02
4.000000E 00	S	3.002332E 02
5.000000E 00	S	3.002988E 02
6.000000E 00	S	3.003645E 02
7.000000E 00	S	3.004299E 02
8.000000E 00	S	3.004954E 02
9.000000E 00	S	3.005608E 02
1.000000E 01	S	3.006260E 02
1.100000E 01	S	3.006912E 02
1.200000E 01	S	3.007563E 02
1.300000E 01	S	3.008213E 02
1.400000E 01	S	3.008862E 02
1.500000E 01	S	3.009509E 02
1.600000E 01	S	3.010154E 02
1.700000E 01	S	3.010796E 02
1.800000E 01	S	3.011438E 02
1.900000E 01	S	3.012078E 02
2.000000E 01	S	3.012712E 02
2.100000E 01	S	3.013347E 02
2.200000E 01	S	3.013977E 02
2.300000E 01	S	3.014604E 02
2.400000E 01	S	3.015229E 02
2.500000E 01	S	3.015852E 02
2.600000E 01	S	3.016470E 02
2.700000E 01	S	3.017083E 02
2.800000E 01	S	3.017693E 02
2.900000E 01	S	3.018298E 02
3.000000E 01	S	3.019899E 02
3.100000E 01	S	3.019497E 02
3.200000E 01	S	3.020090E 02
3.300000E 01	S	3.020679E 02
3.400000E 01	S	3.021262E 02
3.500000E 01	S	3.021841E 02
3.600000E 01	S	3.022415E 02
3.700000E 01	S	3.022983E 02
3.800000E 01	S	3.023547E 02
3.900000E 01	S	3.024106E 02
4.000000E 01	S	3.024658E 02
4.100000E 01	S	3.025203E 02
4.200000E 01	S	3.025742E 02
4.300000E 01	S	3.026277E 02
4.400000E 01	S	3.026804E 02
4.500000E 01	S	3.027327E 02

POINT-ID = 9

T E M P E R A T U R E   V E C T O R

TIME	TYPE	VALUE
0.0	S	3.000000E 02
1.000000E 00	S	2.992742E 02
2.000000E 00	S	2.979749E 02
3.000000E 00	S	2.967097E 02
4.000000E 00	S	2.954773E 02
5.000000E 00	S	2.942766E 02
6.000000E 00	S	2.931062E 02
7.000000E 00	S	2.919656E 02
8.000000E 00	S	2.908540E 02
9.000000E 00	S	2.897708E 02
1.000000E 01	S	2.887148E 02
1.100000E 01	S	2.876851E 02
1.200000E 01	S	2.866814E 02
1.300000E 01	S	2.857021E 02
1.400000E 01	S	2.847476E 02
1.500000E 01	S	2.838164E 02
1.600000E 01	S	2.829089E 02
1.700000E 01	S	2.820234E 02
1.800000E 01	S	2.811599E 02
1.900000E 01	S	2.803174E 02
2.000000E 01	S	2.794956E 02
2.100000E 01	S	2.786934E 02
2.200000E 01	S	2.779106E 02
2.300000E 01	S	2.771467E 02
2.400000E 01	S	2.764009E 02
2.500000E 01	S	2.756729E 02
2.600000E 01	S	2.749619E 02
2.700000E 01	S	2.742678E 02
2.800000E 01	S	2.735898E 02
2.900000E 01	S	2.729277E 02
3.000000E 01	S	2.722810E 02
3.100000E 01	S	2.716492E 02
3.200000E 01	S	2.710317E 02
3.300000E 01	S	2.704285E 02
3.400000E 01	S	2.698389E 02
3.500000E 01	S	2.692625E 02
3.600000E 01	S	2.686992E 02
3.700000E 01	S	2.681484E 02
3.800000E 01	S	2.676101E 02
3.900000E 01	S	2.670835E 02
4.000000E 01	S	2.665686E 02
4.100000E 01	S	2.660649E 02
4.200000E 01	S	2.655723E 02
4.300000E 01	S	2.650901E 02
4.400000E 01	S	2.646184E 02
4.500000E 01	S	2.641567E 02

POINT-ID = 10

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
1.000000E 00	S	2.992744E 02
2.000000E 00	S	2.979775E 02
3.000000E 00	S	2.967183E 02
4.000000E 00	S	2.954941E 02
5.000000E 00	S	2.943040E 02
6.000000E 00	S	2.931465E 02
7.000000E 00	S	2.920210E 02
8.000000E 00	S	2.909200E 02
9.000000E 00	S	2.898616E 02
1.000000E 01	S	2.888259E 02
1.100000E 01	S	2.878184E 02
1.200000E 01	S	2.868384E 02
1.300000E 01	S	2.858845E 02
1.400000E 01	S	2.849565E 02
1.500000E 01	S	2.840535E 02
1.600000E 01	S	2.831743E 02
1.700000E 01	S	2.823193E 02
1.800000E 01	S	2.814871E 02
1.900000E 01	S	2.806763E 02
2.000000E 01	S	2.798875E 02
2.100000E 01	S	2.791194E 02
2.200000E 01	S	2.783713E 02
2.300000E 01	S	2.776428E 02
2.400000E 01	S	2.769331E 02
2.500000E 01	S	2.762417E 02
2.600000E 01	S	2.755681E 02
2.700000E 01	S	2.749116E 02
2.800000E 01	S	2.742720E 02
2.900000E 01	S	2.736484E 02
3.000000E 01	S	2.730405E 02
3.100000E 01	S	2.724480E 02
3.200000E 01	S	2.718701E 02
3.300000E 01	S	2.713066E 02
3.400000E 01	S	2.707571E 02
3.500000E 01	S	2.702212E 02
3.600000E 01	S	2.696982E 02
3.700000E 01	S	2.691882E 02
3.800000E 01	S	2.686904E 02
3.900000E 01	S	2.682046E 02
4.000000E 01	S	2.677305E 02
4.100000E 01	S	2.672676E 02
4.200000E 01	S	2.668157E 02
4.300000E 01	S	2.663745E 02
4.400000E 01	S	2.659436E 02
4.500000E 01	S	2.655227E 02

POINT-ID = 100

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	2.000000E 02
1.000000E 00	S	2.000055E 02
2.000000E 00	S	2.000062E 02
3.000000E 00	S	2.000056E 02
4.000000E 00	S	2.000060E 02
5.000000E 00	S	2.000056E 02
6.000000E 00	S	2.000052E 02
7.000000E 00	S	2.000054E 02
8.000000E 00	S	2.000052E 02
9.000000E 00	S	2.000053E 02
1.000000E 01	S	2.000052E 02
1.100000E 01	S	2.000052E 02
1.200000E 01	S	2.000051E 02
1.300000E 01	S	2.000051E 02
1.400000E 01	S	2.000051E 02
1.500000E 01	S	2.000051E 02
1.600000E 01	S	2.000050E 02
1.700000E 01	S	2.000047E 02
1.800000E 01	S	2.000046E 02
1.900000E 01	S	2.000046E 02
2.000000E 01	S	2.000046E 02
2.100000E 01	S	2.000046E 02
2.200000E 01	S	2.000045E 02
2.300000E 01	S	2.000045E 02
2.400000E 01	S	2.000044E 02
2.500000E 01	S	2.000045E 02
2.600000E 01	S	2.000044E 02
2.700000E 01	S	2.000044E 02
2.800000E 01	S	2.000044E 02
2.900000E 01	S	2.000044E 02
3.000000E 01	S	2.000043E 02
3.100000E 01	S	2.000043E 02
3.200000E 01	S	2.000040E 02
3.300000E 01	S	2.000042E 02
3.400000E 01	S	2.000037E 02
3.500000E 01	S	2.000041E 02
3.600000E 01	S	2.000038E 02
3.700000E 01	S	2.000040E 02
3.800000E 01	S	2.000038E 02
3.900000E 01	S	2.000039E 02
4.000000E 01	S	2.000038E 02
4.100000E 01	S	2.000039E 02
4.200000E 01	S	2.000038E 02
4.300000E 01	S	2.000038E 02
4.400000E 01	S	2.000038E 02
4.500000E 01	S	2.000038E 02

POINT-ID = 904

TEMPERATURE VECTOR

TIME	TYPE	VALUE
0.0	S	3.000000E 02
1.000000E 00	S	-3.000359E 02
2.000000E 00	S	-3.001013E 02
3.000000E 00	S	-3.001672E 02
4.000000E 00	S	-3.002327E 02
5.000000E 00	S	-3.002981E 02
6.000000E 00	S	-3.003635E 02
7.000000E 00	S	-3.004290E 02
8.000000E 00	S	-3.004944E 02
9.000000E 00	S	-3.005596E 02
1.000000E 01	S	-3.006248E 02
1.100000E 01	S	-3.006899E 02
1.200000E 01	S	-3.007549E 02
1.300000E 01	S	-3.008198E 02
1.400000E 01	S	-3.008845E 02
1.500000E 01	S	-3.009492E 02
1.600000E 01	S	-3.010137E 02
1.700000E 01	S	-3.010779E 02
1.800000E 01	S	-3.011418E 02
1.900000E 01	S	-3.012056E 02
2.000000E 01	S	-3.012693E 02
2.100000E 01	S	-3.013323E 02
2.200000E 01	S	-3.013953E 02
2.300000E 01	S	-3.014580E 02
2.400000E 01	S	-3.015205E 02
2.500000E 01	S	-3.015825E 02
2.600000E 01	S	-3.016443E 02
2.700000E 01	S	-3.017053E 02
2.800000E 01	S	-3.017668E 02
2.900000E 01	S	-3.018269E 02
3.000000E 01	S	-3.018875E 02
3.100000E 01	S	-3.019473E 02
3.200000E 01	S	-3.020066E 02
3.300000E 01	S	-3.020654E 02
3.400000E 01	S	-3.021238E 02
3.500000E 01	S	-3.021816E 02
3.600000E 01	S	-3.022390E 02
3.700000E 01	S	-3.022959E 02
3.800000E 01	S	-3.023523E 02
3.900000E 01	S	-3.024082E 02
4.000000E 01	S	-3.024634E 02
4.100000E 01	S	-3.025181E 02
4.200000E 01	S	-3.025723E 02
4.300000E 01	S	-3.026257E 02
4.400000E 01	S	-3.026787E 02
4.500000E 01	S	-3.027310E 02

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 NASTRAN LOADED AT LOCATION OFAF20
 TIME TO GO = 299 CPU SEC., 298 I/O SEC.
*      0 CPU-SEC.        0 ELAPSED-SEC.     SEM1  BEGN
*      0 CPU-SEC.        0 ELAPSED-SEC.     SEMT
*      0 CPU-SEC.        2 ELAPSED-SEC.     NAST
*      0 CPU-SEC.        3 ELAPSED-SEC.     GNFI
*      0 CPU-SEC.        3 ELAPSED-SEC.     XCSA
*      0 CPU-SEC.        4 ELAPSED-SEC.     IFP1
*      1 CPU-SEC.        6 ELAPSED-SEC.     XSOR
*      1 CPU-SEC.       11 ELAPSED-SEC.       DO  IFP
*      2 CPU-SEC.       24 ELAPSED-SEC.      END  IFP
*      2 CPU-SEC.       24 ELAPSED-SEC.     XGPI
*      4 CPU-SEC.       30 ELAPSED-SEC.     SEM1  END
*      4 CPU-SEC.       30 ELAPSED-SEC.     ----  LINKNS02 ---
=    24 I/O SEC.
 LAST LINK DID NOT USE   40016 BYTES OF OPEN CORE
*      4 CPU-SEC.       32 ELAPSED-SEC.     ----  LINK END ---
*      4 CPU-SEC.       32 ELAPSED-SEC.     XSFA
*      4 CPU-SEC.       33 ELAPSED-SEC.     XSFA
*      4 CPU-SEC.       33 ELAPSED-SEC.     3     GP1       BEGN
*      4 CPU-SEC.       37 ELAPSED-SEC.     3     GP1       END
*      4 CPU-SEC.       39 ELAPSED-SEC.     8     GP2       BEGN
*      4 CPU-SEC.       40 ELAPSED-SEC.     8     GP2       END
*      4 CPU-SEC.       40 ELAPSED-SEC.     10    PLTSET    BEGN
*      4 CPU-SEC.       41 ELAPSED-SEC.     10    PLTSET    END
*      4 CPU-SEC.       41 ELAPSED-SEC.     12    PRTMSG    BEGN
*      4 CPU-SEC.       42 ELAPSED-SEC.     12    PRTMSG    END
*      4 CPU-SEC.       42 ELAPSED-SEC.     13    SETVAL    BEGN
*      4 CPU-SEC.       42 ELAPSED-SEC.     13    SETVAL    END
*      4 CPU-SEC.       43 ELAPSED-SEC.     21    GP3       BEGN
*      4 CPU-SEC.       51 ELAPSED-SEC.     21    GP3       END
*      4 CPU-SEC.       51 ELAPSED-SEC.     23    TA1       BEGN
*      4 CPU-SEC.       59 ELAPSED-SEC.     23    TA1       END
*      4 CPU-SEC.       60 ELAPSED-SEC.     ----  LINKNS03 ---
=    56 I/O SEC.
 LAST LINK DID NOT USE   82788 BYTES OF OPEN CORE
*      5 CPU-SEC.       63 ELAPSED-SEC.     ----  LINK END ---
*      5 CPU-SEC.       63 ELAPSED-SEC.     27    SMA1      BEGN
*      5 CPU-SEC.       66 ELAPSED-SEC.     27    SMA1      END
*      5 CPU-SEC.       67 ELAPSED-SEC.     30    SMA2      BEGN
*      5 CPU-SEC.       70 ELAPSED-SEC.     30    SMA2      END
*      5 CPU-SEC.       71 ELAPSED-SEC.     ----  LINKNS05 ---
=    64 I/O SEC.
 LAST LINK DID NOT USE   64268 BYTES OF OPEN CORE
*      5 CPU-SEC.       74 ELAPSED-SEC.     ----  LINK END ---
*      5 CPU-SEC.       74 ELAPSED-SEC.     35    RMG       BEGN
*      5 CPU-SEC.       74 ELAPSED-SEC.     35    RMG       END
*      5 CPU-SEC.       75 ELAPSED-SEC.     XSFA
*      5 CPU-SEC.       76 ELAPSED-SEC.     XSFA
*      5 CPU-SEC.       76 ELAPSED-SEC.     ----  LINKNS04 ---
=    68 I/O SEC.
 LAST LINK DID NOT USE   86980 BYTES OF OPEN CORE
*      5 CPU-SEC.       78 ELAPSED-SEC.     ----  LINK END ---
*      5 CPU-SEC.       78 ELAPSED-SEC.     40    GP4       BEGN
*      5 CPU-SEC.       81 ELAPSED-SEC.     40    GP4       END
*      5 CPU-SEC.       82 ELAPSED-SEC.     46    GPSP      BEGN
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*     5 CPU-SEC.       83 ELAPSED-SEC.     46    GPSP     END
*     5 CPU-SEC.       83 ELAPSED-SEC.     ----  LINKNS14 ---
=    75 I/O SEC.
 LAST LINK DID NOT USE  117044 BYTES OF OPEN CORE
*     6 CPU-SEC.       85 ELAPSED-SEC.     ----  LINK END ---
*     6 CPU-SEC.       85 ELAPSED-SEC.     47    OFP      BEGN
*     6 CPU-SEC.       86 ELAPSED-SEC.     47    OFP      END
*     6 CPU-SEC.       87 ELAPSED-SEC.     ----  LINKNS04 ---
=    73 I/O SEC.
 LAST LINK DID NOT USE  115664 BYTES OF OPEN CORE
*     6 CPU-SEC.       89 ELAPSED-SEC.     ----  LINK END ---
*     6 CPU-SEC.       89 ELAPSED-SEC.     51    MCE1     BEGN
*     6 CPU-SEC.       91 ELAPSED-SEC.     51    MCE1     END
*     6 CPU-SEC.       91 ELAPSED-SEC.     53    MCE2     BEGN
*     6 CPU-SEC.       93 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
*     6 CPU-SEC.       95 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.       96 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
*     6 CPU-SEC.       97 ELAPSED-SEC.     MPYA  D
*     6 CPU-SEC.       98 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
*     7 CPU-SEC.      100 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.      103 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
*     7 CPU-SEC.      104 ELAPSED-SEC.     MPYA  D
*     7 CPU-SEC.      105 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
*     7 CPU-SEC.      106 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.      106 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
*     8 CPU-SEC.      108 ELAPSED-SEC.     MPYA  D
*     8 CPU-SEC.      108 ELAPSED-SEC.     53    MCE2     END
*     8 CPU-SEC.      112 ELAPSED-SEC.     XSFA
*     8 CPU-SEC.      112 ELAPSED-SEC.     XSFA
*     8 CPU-SEC.      113 ELAPSED-SEC.     ----  LINKNS06 ---
=    95 I/O SEC.
 LAST LINK DID NOT USE  109332 BYTES OF OPEN CORE
*     8 CPU-SEC.      115 ELAPSED-SEC.     ----  LINK END ---
*     8 CPU-SEC.      115 ELAPSED-SEC.     75    DPD      BEGN
*     8 CPU-SEC.      123 ELAPSED-SEC.     75    DPD      END
*     8 CPU-SEC.      125 ELAPSED-SEC.     ----  LINKNS10 ---
=   106 I/O SEC.
 LAST LINK DID NOT USE  116416 BYTES OF OPEN CORE
*     9 CPU-SEC.      128 ELAPSED-SEC.     ----  LINK END ---
*     9 CPU-SEC.      128 ELAPSED-SEC.     81    MTRXIN   BEGN
*     9 CPU-SEC.      130 ELAPSED-SEC.     81    MTRXIN   END
*     9 CPU-SEC.      130 ELAPSED-SEC.     83    PARAM    BEGN
*     9 CPU-SEC.      131 ELAPSED-SEC.     83    PARAM    END
*     9 CPU-SEC.      132 ELAPSED-SEC.     88    GKAD     BEGN
*     9 CPU-SEC.      135 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
*     9 CPU-SEC.      136 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.      137 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
*     9 CPU-SEC.      138 ELAPSED-SEC.     MPYA  D
*     9 CPU-SEC.      139 ELAPSED-SEC.     MPYA  D
                                                 METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
*    10 CPU-SEC.      140 ELAPSED-SEC.     MPYA  D
*    10 CPU-SEC.      144 ELAPSED-SEC.     88    GKAD     END
*    10 CPU-SEC.      144 ELAPSED-SEC.     XSFA
*    10 CPU-SEC.      145 ELAPSED-SEC.     XSFA
*    10 CPU-SEC.      145 ELAPSED-SEC.     ----  LINKNS05 ---
=   119 I/O SEC.
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 LAST LINK DID NOT USE  102660 BYTES OF OPEN CORE
*     10 CPU-SEC.       147 ELAPSED-SEC.      ----  LINK END ---
*     10 CPU-SEC.       147 ELAPSED-SEC.      92    TRLG     BEGN
*     10 CPU-SEC.       154 ELAPSED-SEC.      MPYA  D
                                                    METHOD 2 T .NBR PASSES =    1.EST. TIME =       0.0
*     10 CPU-SEC.       155 ELAPSED-SEC.      MPYA  D
*     10 CPU-SEC.       157 ELAPSED-SEC.      MPYA  D
                                                    METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
*     11 CPU-SEC.       158 ELAPSED-SEC.      MPYA  D
*     11 CPU-SEC.       158 ELAPSED-SEC.      MPYA  D
                                                    METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
*     11 CPU-SEC.       159 ELAPSED-SEC.      MPYA  D
*     11 CPU-SEC.       160 ELAPSED-SEC.      MPYA  D
                                                    METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.0
*     11 CPU-SEC.       161 ELAPSED-SEC.      MPYA  D
*     11 CPU-SEC.       161 ELAPSED-SEC.      92    TRLG     END
*     11 CPU-SEC.       162 ELAPSED-SEC.      XSFA
*     11 CPU-SEC.       162 ELAPSED-SEC.      XSFA
*     11 CPU-SEC.       162 ELAPSED-SEC.      ----  LINKNS11 ---
=   133 I/O SEC.
 LAST LINK DID NOT USE   58196 BYTES OF OPEN CORE
*     11 CPU-SEC.       164 ELAPSED-SEC.      ----  LINK END ---
*     11 CPU-SEC.       164 ELAPSED-SEC.      97    TRHT     BEGN
*     11 CPU-SEC.       166 ELAPSED-SEC.      DECO  MP
*     11 CPU-SEC.       167 ELAPSED-SEC.      DECO  MP
*     13 CPU-SEC.       198 ELAPSED-SEC.      97    TRHT     END
*     13 CPU-SEC.       199 ELAPSED-SEC.      ----  LINKNS12 ---
=   181 I/O SEC.
 LAST LINK DID NOT USE   61768 BYTES OF OPEN CORE
*     13 CPU-SEC.       202 ELAPSED-SEC.      ----  LINK END ---
*     13 CPU-SEC.       202 ELAPSED-SEC.      99    VDR      BEGN
*     13 CPU-SEC.       205 ELAPSED-SEC.      99    VDR      END
*     13 CPU-SEC.       206 ELAPSED-SEC.      ----  LINKNS14 ---
=   187 I/O SEC.
 LAST LINK DID NOT USE  119112 BYTES OF OPEN CORE
*     13 CPU-SEC.       209 ELAPSED-SEC.      ----  LINK END ---
*     13 CPU-SEC.       209 ELAPSED-SEC.      103   SDR3     BEGN
*     13 CPU-SEC.       212 ELAPSED-SEC.      103   SDR3     END
*     13 CPU-SEC.       212 ELAPSED-SEC.      104   OFP      BEGN
*     13 CPU-SEC.       213 ELAPSED-SEC.      104   OFP      END
*     13 CPU-SEC.       214 ELAPSED-SEC.      111   PARAM    BEGN
*     13 CPU-SEC.       214 ELAPSED-SEC.      111   PARAM    END
*     13 CPU-SEC.       214 ELAPSED-SEC.      ----  LINKNS12 ---
=   194 I/O SEC.
 LAST LINK DID NOT USE   44048 BYTES OF OPEN CORE
*     13 CPU-SEC.       218 ELAPSED-SEC.      ----  LINK END ---
*     13 CPU-SEC.       218 ELAPSED-SEC.      115   SDR1     BEGN
*     13 CPU-SEC.       218 ELAPSED-SEC.      MPYA  D
                                                    METHOD 2 NT.NBR PASSES =    1.EST. TIME =       0.1
*     14 CPU-SEC.       219 ELAPSED-SEC.      MPYA  D
*     14 CPU-SEC.       223 ELAPSED-SEC.      115   SDR1     END
*     14 CPU-SEC.       223 ELAPSED-SEC.      ----  LINKNS08 ---
=   203 I/O SEC.
 LAST LINK DID NOT USE  125752 BYTES OF OPEN CORE
*     14 CPU-SEC.       229 ELAPSED-SEC.      ----  LINK END ---
*     14 CPU-SEC.       229 ELAPSED-SEC.      118   PLTTRAN BEGN
*     14 CPU-SEC.       230 ELAPSED-SEC.      118   PLTTRAN END
*     14 CPU-SEC.       230 ELAPSED-SEC.      ----  LINKNS13 ---
=   208 I/O SEC.
 LAST LINK DID NOT USE  114512 BYTES OF OPEN CORE
*     14 CPU-SEC.       235 ELAPSED-SEC.      ----  LINK END ---
*     14 CPU-SEC.       235 ELAPSED-SEC.      120   SDR2     BEGN
*     14 CPU-SEC.       238 ELAPSED-SEC.      120   SDR2     END
*     14 CPU-SEC.       238 ELAPSED-SEC.      ----  LINKNS14 ---
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=   217 I/O SEC.
 LAST LINK DID NOT USE   66128 BYTES OF OPEN CORE
*    15 CPU-SEC.      245 ELAPSED-SEC.     ----  LINK END ---
*    15 CPU-SEC.      245 ELAPSED-SEC.     121   SDR3    BEGN
*    15 CPU-SEC.      249 ELAPSED-SEC.     121   SDR3    END
*    15 CPU-SEC.      249 ELAPSED-SEC.     123   OFP     BEGN
*    15 CPU-SEC.      253 ELAPSED-SEC.     123   OFP     END
*    15 CPU-SEC.      253 ELAPSED-SEC.     130   XYTRAN  BEGN
*    15 CPU-SEC.      253 ELAPSED-SEC.     130   XYTRAN  END
*    15 CPU-SEC.      253 ELAPSED-SEC.     ----  LINKNS02 ---
=   230 I/O SEC.
 LAST LINK DID NOT USE    8132 BYTES OF OPEN CORE
*    16 CPU-SEC.      262 ELAPSED-SEC.     ----  LINK END ---
*    16 CPU-SEC.      262 ELAPSED-SEC.     132   XYPLOT  BEGN
*    16 CPU-SEC.      263 ELAPSED-SEC.     132   XYPLOT  END
*    16 CPU-SEC.      263 ELAPSED-SEC.     138   EXIT    BEGN
----------------------------------------------------------------------------------------------------------------------------
=   231 I/O SEC.
 LAST LINK DID NOT USE   97232 BYTES OF OPEN CORE
 AMOUNT OF OPEN CORE NOT USED =    7K BYTES
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NASA-Langley, 1977

National Aeronautics and Space Administration
WASHINGTON, D. C. 20546

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