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ᴀUTOMATED SHELL THEORY FOR ROTATING STRUCTURES (ASTROS)

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16. Abstract

A computer program for analyzing axisymmetric shells with inertial forces caused by rotation about the shell axis is developed by revising the STARS II shell program developed by the Grumman Aircraft Engineering Corporation. The basic capabilities of the STARS II program, such as the treatment of the branched shells, stiffened wall construction, and thermal gradients, are retained.

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DEFINITION OF SYMBOLS

Symbol	Definition
a	Semidiameter perpendicular to Z-axis in ellipsoid
b	Semidiameter parallel to Z-axis in ellipsoid
C	Stiffness eccentricity parameters; offset distance in ogive
$c\phi$	Cos ϕ
D	Bending stiffness parameters
E	Young's modulus (lb/in.^{2})
eq	Equivalent
F	Lineal force (lb/in.)
f	Position parameter for parabola; distributed loads in local coordinates
G	Shear modulus (lb/in.^{2})
h	Shell thickness; face sheet thickness; equivalent shell thickness
i	Index; beginning edge of shell segment; independent joint of kinematic link; subscript "inside"
j	Index; ending edge of shell segment; dependent joint of kinematic link
K	Extensional stiffness parameters
M	Bending moment on shell (in-lb/in.)
N	Membrane stress resultant (lb/in.)
$\overline{N}$	Assumed membrane stress resultant (lb/in.)

DEFINITION OF SYMBOLS (Continued)

Symbol	Definition
n	Index on harmonic
o	Subscript "outside"
Q	Transverse shear stress resultant (lb/in.)
R	Radius
r	Radius
s	Index of segment; coordinate in cylinder or cone
$s\phi$	Sin ϕ
T	Temperature
t	Core thickness in sandwich shell
w	Normal deflection, positive inward
X	Cartesian coordiate, $\theta = 0$ at X-axis
Y	Cartesian coordinate
Z	Cartesian coordinate coincides with axis of revolution
α	Angle between rotated coordinates
β	Ratio of semidiameter parallel to Z-axis in ellipsoid to semidiameter perpendicular to Z-axis
γ	Shear strain; nonlinear parameter; angle of inclination of kinematic link
Δ	Displacements in fixed or "global" coordinates
ζ	Normal coordinate, positive inward

DEFINITION OF SYMBOLS (Concluded)

Symbol	Definition
θ	Circumferential angular coordinate (rad)
Λ	Segment length parameter
λ	Shell parameter
ν	Poisson's ratio
ρ	Mass density (lb-sec^2/in.^{4})
σ	Normal stress (lb/in.^{2})
τ	Shear stress (lb/in.^{2})
ϕ	Meridional angular coordinate (rad)
Ω	Rotational displacement in "global" coordinates (rad)
ω	Rotational displacement (rad)
ω_0	Angular velocity (rad/sec)

AUTOMATED SHELL THEORY FOR ROTATING STRUCTURES (ASTROS)

SUMMARY

The ASTROS (Automated Shell Theory for ROtating Structures) program is a digital computer program that can analyze any disk or shell of revolution of arbitrary cross section under inertial loads caused by rotation about the shell axis and various static loads, including thermal gradients. The program output is the elastic stresses and deformations caused by the inertial and static loadings. This report contains all the information necessary for the application of this program.

INTRODUCTION

This program was developed because of a need for an easy-to-use and accurate computer program that is oriented directly toward solving for the stresses and deformations in rotating disks and shells of revolution such as those encountered in rocket engine turbomachinery. Several programs are already available for determining the stresses and deformations of rotating structures, but these are limited to disks and are based on the finite difference method. In using the finite difference method, the user must divide the structure into very small segments and determine values for each segment for use in the program. In the analysis of almost all geometric shapes, the input values must be approximated, especially for a variable-thickness structure; therefore, the results can be made more accurate only by dividing the structure into more and smaller segments for closer approximations. Thus, it was desirable to develop a program that could handle larger segments in the computer model to minimize the amount of input to the program and would have a larger program capability and more accurate results.

It was determined that the STARS II (Shell Theory Automated for Rotational Structures II) Computer Program developed by the Grumman Aircraft Engineering Corporation [1, 2, 3] already incorporated most of the necessary theory and programming for analyzing rotating structures, using a numerical integration approach. However, the STARS II Computer Program, although it can be used, was not directly oriented toward analyzing rotating structures, and a considerable amount of hand calculations to determine the inertial loads caused by rotation would have to be performed before inputting the data. Thus, by making modifications to the basic STARS II program and incorporating additional programming so that the inertial loads could be calculated internally and converted into static-load components, the ASTROS Computer Program was developed for rotating structures. Much of the information in the STARS II users' manual [2] is repeated in this report for completeness.

The ASTROS program has the capability of analyzing any disk or shell of revolution of arbitrary cross section under inertial loads caused by rotation and various static loads, including thermal gradients. The geometric shapes incorporated in the program are ellipsoidal, spherical, ogival, toroidal, conical, circular plate, cylindrical, and parabolic.

Four classifications of information are used as program input:

1. Geometry Data. The geometric description of each segment of the disk or shell of revolution.

2. Material Data. Thickness and material properties of the segment.

3. Topology Data. The manner in which all the segments are interconnected to form a structure.

4. Load Data. Temperature and loading data, both concentrated and distributed, and angular velocity.

The purpose of the program, as stated earlier, was to present an easy-to-use and accurate method for solving the stresses and deformations in rotating disks and shells of revolution. The program should not replace the engineer with a computer but instead should allow the computer to become the engineer's tool.

PROGRAM CAPABILITY

The use of an accurate shell theory to analyze rotating disks and shell structures involves complex mathematics and numerical techniques, which are nearly impossible to treat without the aid of automated procedures. On this basis, ASTROS was developed using the basic STARS II Computer Program [1, 2, 3], which is based upon the Love-Reissner first-order shell theory.

The program can analyze isotropic or orthotropic stiffened disks and shells of revolution, subjected to symmetric distributed loading or concentrated line loads, as well as thermal strains. Furthermore, a disk or shell with arbitrary boundary conditions, under loads which vary arbitrarily with position and under a temperature variation through the thickness, is tractable with this program. The rotating structure can consist of any of the following geometric shapes:

1. Ellipsoidal — spherical
2. Ogival — toroidal
3. Modified ellipsoidal shape
4. Conical — circular plate (disk)
5. Cylindrical
6. Parabolic

The rotating structure cross section can be a sheet, sandwich, or reinforced sheet or sandwich. The reinforcement can consist of rings and/or stringers or a waffle construction rotated 45 deg to the principal coordinates. The reinforcement material properties can also differ from those of the main shell.

The basic approach to the problem [1] is to cut the structure into several regions. These regions need to be singly connected and can have only line loads applied at their end points. There are no restrictions on geometry or on uniform or thermal loads. The regions are further subdivided into several segments, each being free to have its own geometric shape, provided that the shape falls into one of the categories just mentioned.

Stiffness matrices obtained for each segment are coupled by standard matrix methods to obtain region stiffnesses, which, after being reduced in size, are in turn coupled to form the total structure under analysis. The program can handle a structure composed of up to 24 segments in each of 19 regions arbitrarily connected to each other. There is a limitation on the size of a shell segment, which is a consequence of the demand that boundary disturbances be felt throughout the segment. This limitation is mathematically described as a length parameter in the next section, Input Information, under the heading, Calculation of Segment Length. This parameter, however, is not reliable near the apex of any shell shape ($\phi = 0$), and the segments needed in this region are actually much smaller than predicted by the parameter. A mathematical singularity occurs at the apex where r_0 (the radius of revolution) becomes zero. It is this singularity which prevents the length parameter from being meaningful near the apex. Furthermore, the point ($\phi = 0$) is not an acceptable input point of the program, although any point outside a circle of infinitesimal radius is satisfactory.

There is considerable latitude in what can be done within each segment. The thickness of any segment can be symmetrically tapered, and it can contain up to 14 points of discontinuity, provided that the segment centerline remains continuous and describable by a single geometry. A temperature distribution through the thickness can be specified at three points in a homogeneous shell and four points in a shell of rigid core sandwich construction. The distribution is considered to be linear between these points. Thus, it is possible to approximate temperature distributions other than linear distributions. In the event of physically discontinuous centerlines, a kinematic link is available for use in the analysis. The link relates displacements across the discontinuity. This link may be used between regions and between segments within a region.

The program is also capable of a nonlinear analysis. The analysis of this large deformation case is accomplished by use of iteration. Details of the nonlinear theory involved are presented in References 1 and 4, and the program utilization of this option is described in detail in the next section of this report, titled Input Information.

The output of the program is the amplitude of the displacements, stress resultants, and stresses at the inside and outside surfaces as a function of the radial coordinate, r_0. This output is printed out for each segment of the shell at intervals specified by the user of the program.

INPUT INFORMATION

The preceding section provides some insight into the capability of the ASTROS program and the potential it might have for future use. If the program is applied judiciously it can be an extremely powerful tool. The mechanics of applying it should be clearly understood. With this in mind, the remaining sections should be studied carefully.

The required input data may be subdivided into three main parts: geometric, topological (or coupling orientation), and joint data (degree-of-freedom description for each joint component). Each segment requires its own geometric configuration and numerical integration control.

The output consists of stiffness coefficients for each segment, and the actual symmetry of the coefficients is presented in a convenient form for a check on the accuracy of the integration through the segment. Region stiffnesses and their symmetry checks are also provided. Final stresses, displacements, and Huber-Von Mises-Hencky "effective stresses" are printed out for each segment at intervals along the segment as specified by the user of the program. The output will be further discussed in the next section, Output Information.

The full program capacity is described as follows.

Segments	24
Segment joints	25
Regions	19
Region joints	20
Number of points available per segment for specifying geometric or load data	30
Number of points available through the thickness for specifying temperature data	4
Geometries	ellipsoid, sphere, translated ellipsoid, modified ellipsoid, ogive, toroid, cone, annular plate, cylinder, and second-order parabola.
Wall cross-section options	single sheet, equal face sheet sandwich, unequal face sheet sandwich, eccentric reinforcement (rings, stringers or both), waffle reinforcement rotated 45 deg to coordinate axes.
Number of material property tables per submission	10
Number of points per material property table	10

Number of consecutive load conditions per submission	5 (except thermal or nonlinear = 1)
Orthotropy options	isotropic or orthotropic sheet, isotropic or orthotropic sandwich, isotropic or orthotropic sheet or sandwich reinforced by different property rings or different property stringers or both, isotropic or orthotropic sheet or sandwich reinforced by a different property waffle system rotated 45 deg to coordinate axes, other combinations obtained by redefining stiffness parameter formulas (see the subsection, Reinforced Shell Stiffness Formulas, in this section; also Reference 1.)

Figure 1 shows the detailed option flow chart for the program.

General Notes

Before discussing the specific input order, it would be advantageous to introduce some general guidelines in the area of idealizations and topology. In many computer programs there is such an abundance of numerical computations that minimizing numerical roundoff errors becomes as important as getting the final answers. In some cases the engineer can aid the program in this effort by using judicious idealizations. Such a possibility exists in the ASTROS program, since many internal operations are involved with building and inverting stiffness matrices. The object of the user, therefore, should be to help the computer by avoiding the creation of ill-conditioned matrices at any step [5]. Physically, the way to achieve this end is to have all the segment stiffness matrices of the same order of magnitude. This will, in turn, produce region stiffness matrices that are of similar orders of magnitude and minimize possible ill-conditioning in the total structure matrices. The user can help to achieve this end by sizing his segments in such a way that no short, stiff segment is contained alone in a region with all other long, flexible segments, or that no region comprised of all short, stiff segments exists in a structure whose other regions contain only long, flexible segments. No accurate measure can be given on the relative stiffness or flexibility of segments allowed, and thus the best check is to see if a structure is in equilibrium under the applied loading. The symmetry checks of segment and region stiffness matrices are useful for many reasons but will not necessarily alert a user to ill-conditioning.

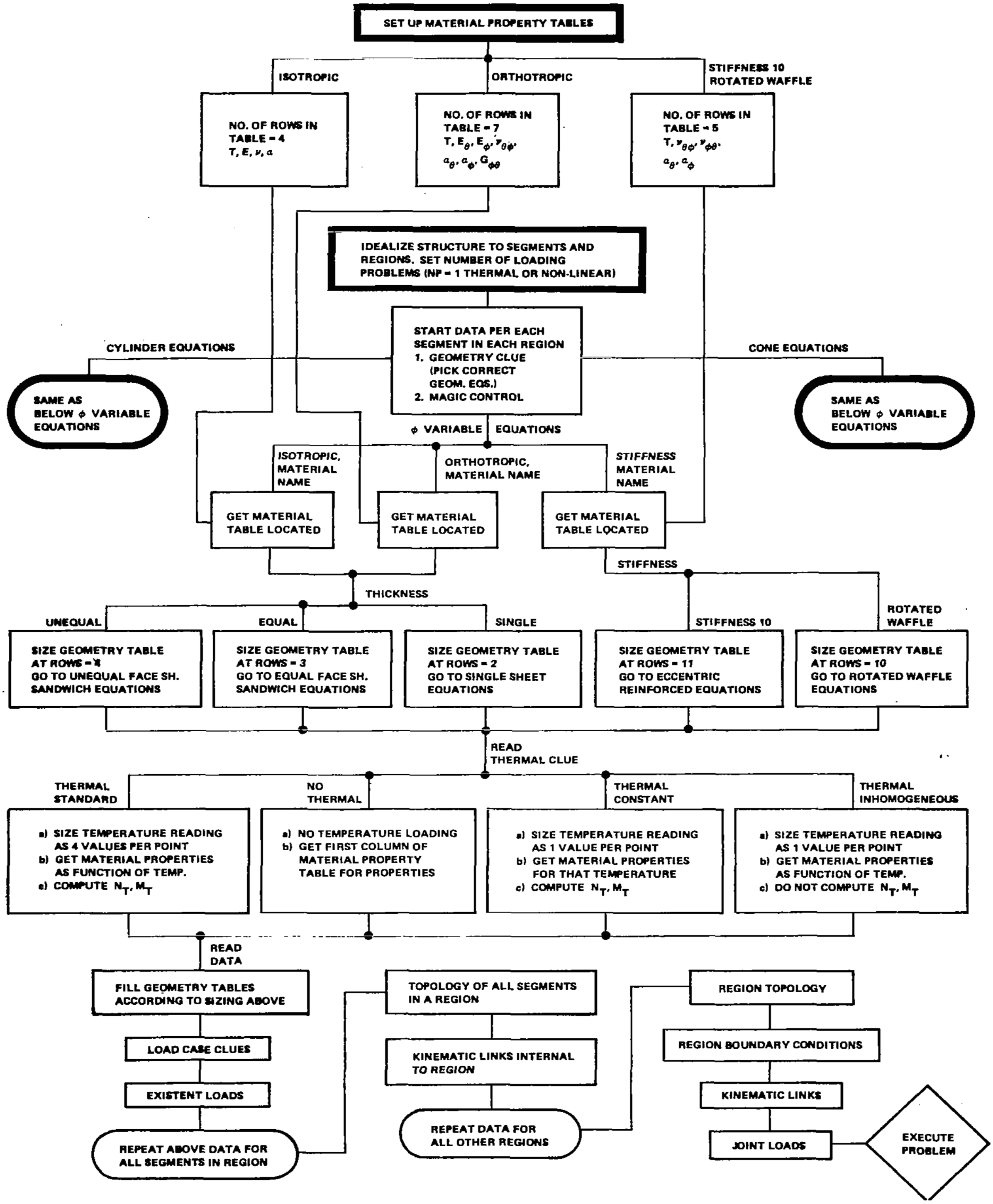


Figure 1. Program option flow chart.

In the use of regions, one other type of accident must be avoided. If, for instance, a structure were idealized using only one region and having both ends fixed, the problem could not be solved. This is because the program could not form a suitable boundary condition matrix for the structure. Thus, in the use of region idealizations, which are less physically meaningful to a user than pure segment idealizations, care should be taken so that all boundary conditions are not zeroed out.

Order of Input (See Figs. 1 and 2)

The order of the input data to the ASTROS program is outlined on the following pages.

GENERAL INTRODUCTORY CARDS	Column	Format
1. Title Card		
a. Alphameric title (submission description)	1-64	16A4
2. Program Control Card		
a. Number of regions to be coupled (Max. = 19)	1-2	I2
b. Total number of segments (Max. = 19 × 24 = 456)	3-5	I3
c. Number of Material Property Tables (Max. = 10)	6-7	I2
d. Harmonic value This value must be set equal to zero (0.) such that the loads will form an axisymmetric loading on the structure.	14-16	F3.1
e. Number of problems in this submission The user is able, in one submission, to analyze his structure under several independent loading conditions (max. = 5). The number of these loading conditions will determine the number of load clue cards which will be necessary per segment. If there is a thermal load or if the run is to be nonlinear, this number can only be unity (1).	17-18	I2

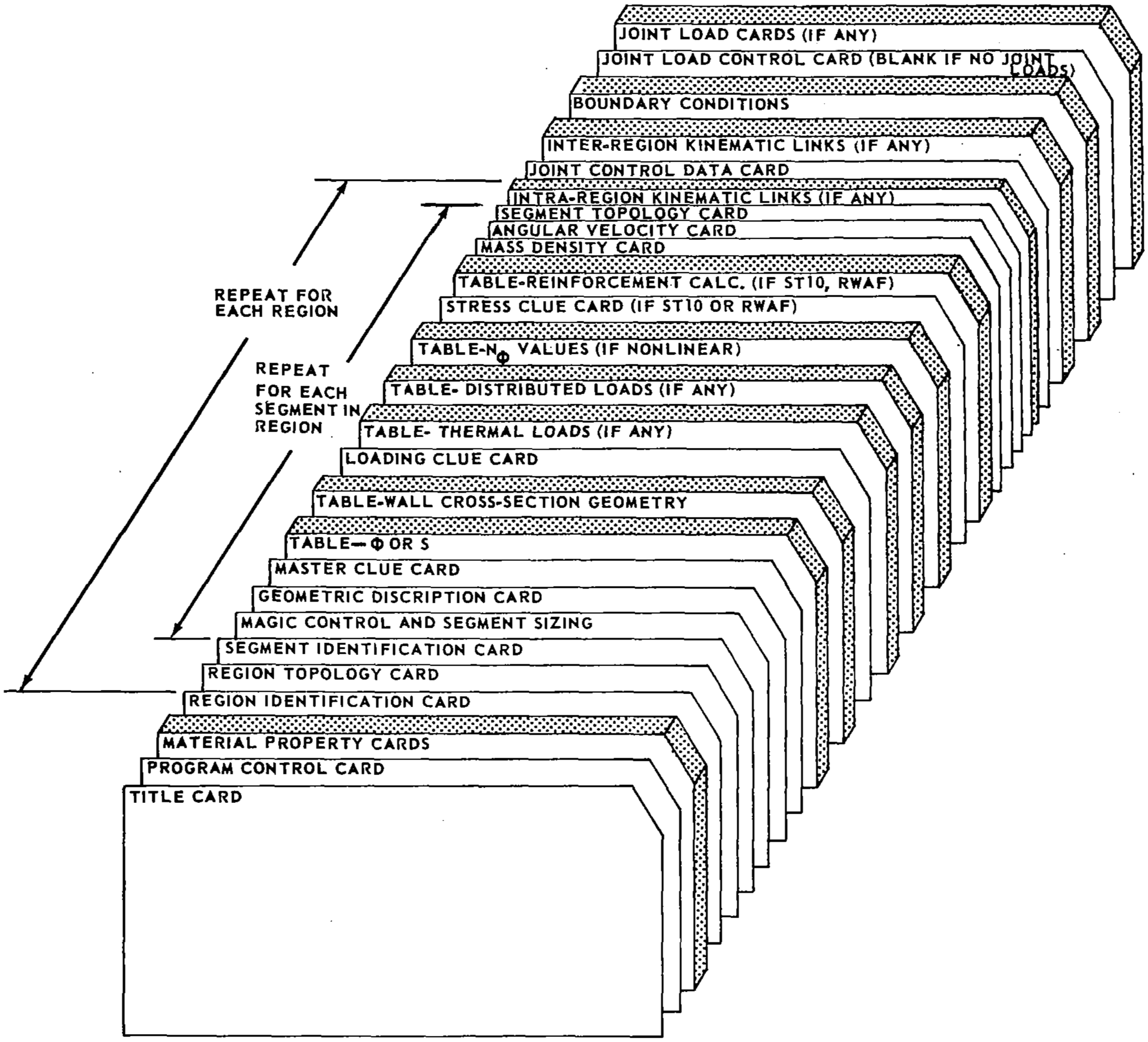


Figure 2. Data sequence.

GENERAL INTRODUCTORY CARDS (Concluded)	Column	Format
f. Coupling code (1) Coupling to occur, code = 1 (2) No coupling, code = 0 (or blank) If no coupling occurs, the program will give only individual stiffness matrix of each segment; if coupling occurs, the program will run to completion and give state of stress and deformation of the entire structure. Items 10 through 14 of the segment cards and the boundary condition cards of the regions are not included in an uncoupled run. In addition, the number of regions is one (1), and the total number of segments and the number of segments on the first region identification card must be the same. Also, the region introductory card (topology) is not included. Uncoupled runs present a way to size segments by use of stiffness symmetry checks, without a full execution of the problem.	19	I1

MATERIAL PROPERTY TABLES (max. = 10 sets)

As many sets of these cards are used (≤ 10) as there are different material property segments in the structure to be analyzed. These tables will be used to obtain the thermal variation of material properties if thermal loadings exist. Thus, the range of temperatures in this table should be greater than that of the thermal loads. If no thermal loads exist, the values given in the first column of this table will be used, and the rest of the table can be left blank. If there are thermal loads, the range of the table is to be considered as that between the second and tenth columns with the temperature values varying in ascending order.

1. Identification Card

	Column	Format
a. Material title (alphameric) Any name can be made up as long as it is consistently used on the segment cards to which it refers. The same name cannot appear on more than one (1) table.	1-4	A4

	Description	Column	Format
b.	Type of table One of several possible alphameric clues is written here. These clues serve to size the number of cards in the property table and define which properties belong on which card. The possible clues are: ISOT ORTH STIFF Their definitions are provided in item 2 below.	11-14	A4

2. Material Property Cards. The Material Property Cards are given below, depending upon which table type clue is used. If the table type clue is "ISOT" (isotropic table):

	Description	Format
a.	Temperature values (5 values per card; 2 cards). These are the temperatures at which the values of material properties will be given. The first value in the table must always be the room- or stress-free temperature, since the material properties in only the first column of the table will be used in an analysis involving no thermal load.	5E14.7
b.	Values of Young's modulus at the given temperatures. (5 values per card; 2 cards)	5E14.7
c.	Values of Poisson's ratio at the given temperatures. (5 values per card; 2 cards)	5E14.7
d.	Values of the thermal coefficient of expansion at the given temperatures. (5 values per card; 2 cards)	5E14.7

If the table type clue is "ORTH" (orthotropic table):

	Description	Format
a.	Temperature values (5 values per card; 2 cards). These are the temperatures at which the values of material properties will be given.	5E14.7
b.	Values of Young's modulus in the θ direction (E_θ) at the given temperatures. (5 values per card; 2 cards)	5E14.7

MATERIAL PROPERTY TABLES (max. = 10 sets) (Cont.)	Column	Format
c. Values of Young's modulus in the ϕ direction (E_{ϕ}) at the given temperatures. (5 values per card; 2 cards)		5E14.7
d. Values of the Poisson's ratio, $\nu_{\theta\phi}$, at the given temperatures. (5 values per card; 2 cards)		5E14.7
e. Values of the thermal coefficient of expansion in the θ direction (α_{θ}) at the given temperatures. (5 values per card; 2 cards)		5E14.7
f. Values of the thermal coefficient of expansion in the ϕ direction (α_{ϕ}) at the given temperatures. (5 values per card; 2 cards)		5E14.7
g. Values of the shear modulus, $G_{\phi\theta}$, at the given temperatures. (5 values per card; 2 cards)		5E14.7
If the table type is "STIF" (table to be used for reinforced shells):		
a-g. The values in these locations are the same as those above for the "ORTH" clue case and refer to the basic shell.		5E14.7
h. Values of ring Young's modulus (E_R) at the given temperatures. (5 values per card; 2 cards)		5E14.7
i. Values of stringer Young's modulus (E_S) at the given temperatures. (5 values per card; 2 cards)		5E14.7

MATERIAL PROPERTY TABLES (max. = 10 sets) (Concl.)	Column	Format
j. Values of ring thermal coefficient of expansion (α_R) at the given temperatures. (5 values per card; 2 cards)		5E14.7
k. Values of stringer thermal coefficient of expansion (α_s) at the given temperatures. (5 values per card; 2 cards)		5E14.7

Note: In a rotated waffle construction, items H and I and J and K, are respectively identical.

REGION INTRODUCTORY CARDS

These two cards are placed at the beginning of each region data information. Each region contains the following data set (Fig. 2): (1) two region introductory cards, (2) data cards for each segment within the region, and (3) kinematic link cards describing the kinematic links <u>within</u> the region, if any.

	Column	Format
1. Identification Card		
a. Number of segments within the region (≤ 24)	1-2	I2
b. Number of kinematic links between segments <u>within</u> the region.	3-4	I2
c. Any alphameric information (region description)	5-69	16A4
2. Topology Card (Coupling Orientation)		
a. Region number Number of the region under consideration.	1-5	I5
b. Joint (i) Joint associated with ith (beginning) end of the region (TIC).	6-10	I5
c. Joint (j) Joint associated with jth (ending) end of the region (STOP).	11-15	I5

There is no coordinate flow in regions, such as that shown for the segments in Figures 3 through 10. However, the start joint of a region must match with 1 in segment numbering, and the end joint must match with the highest segment joint number in the region (Fig. 11).

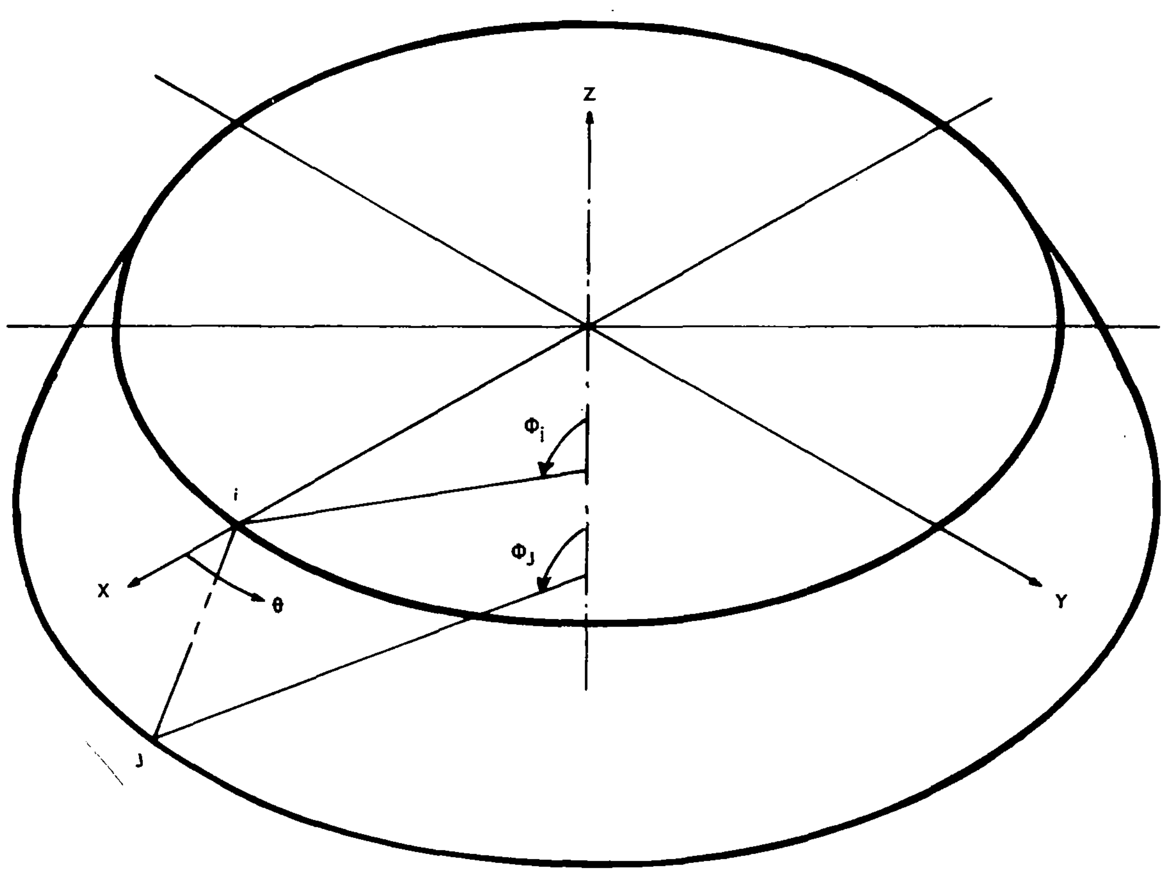


Figure 3. Typical shell segment.

SEGMENT CARDS

This sequence of cards is repeated for each segment within the region.

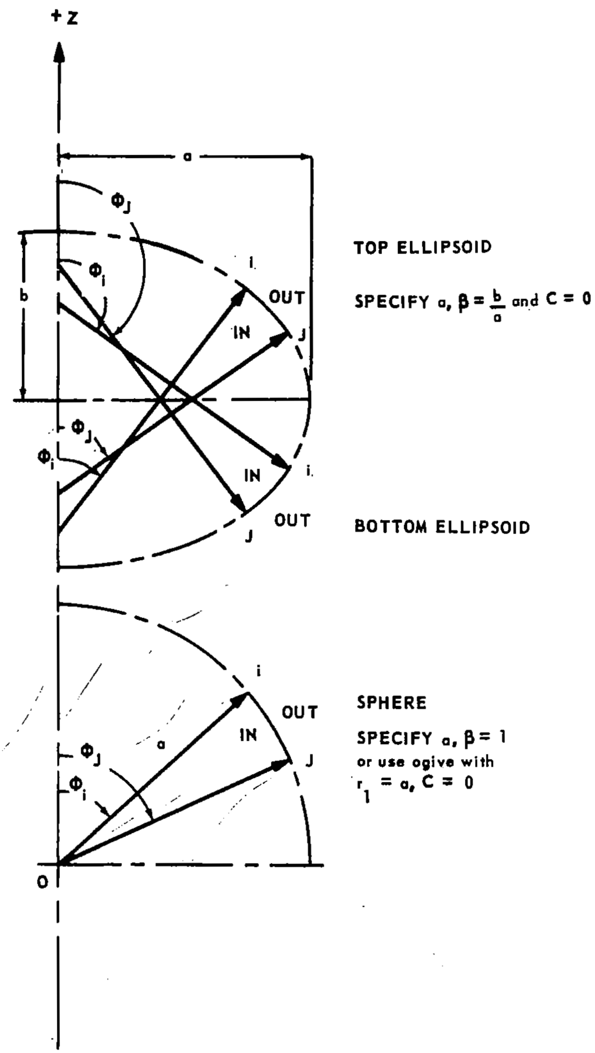


Figure 4. Ellipsoid.

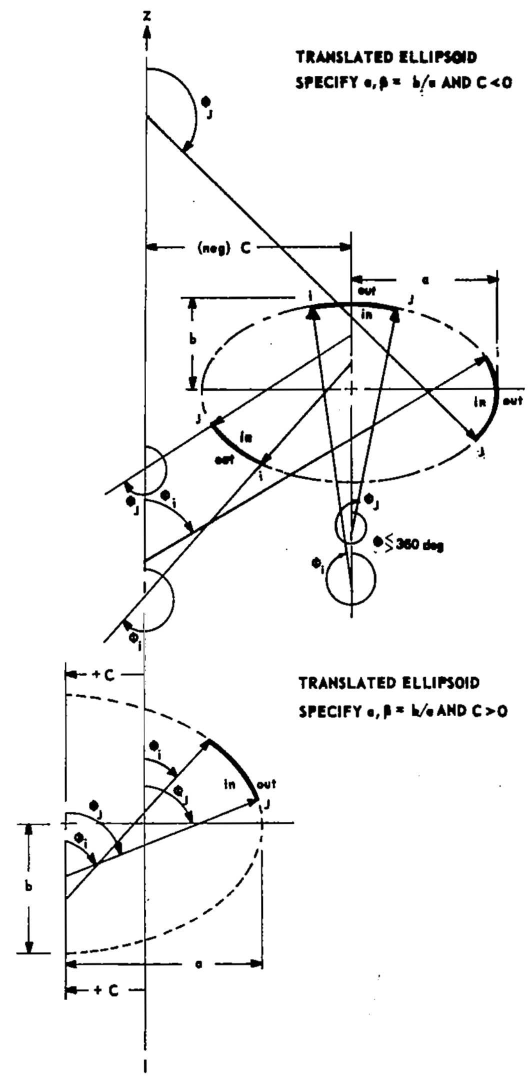


Figure 5. Translated ellipsoid.

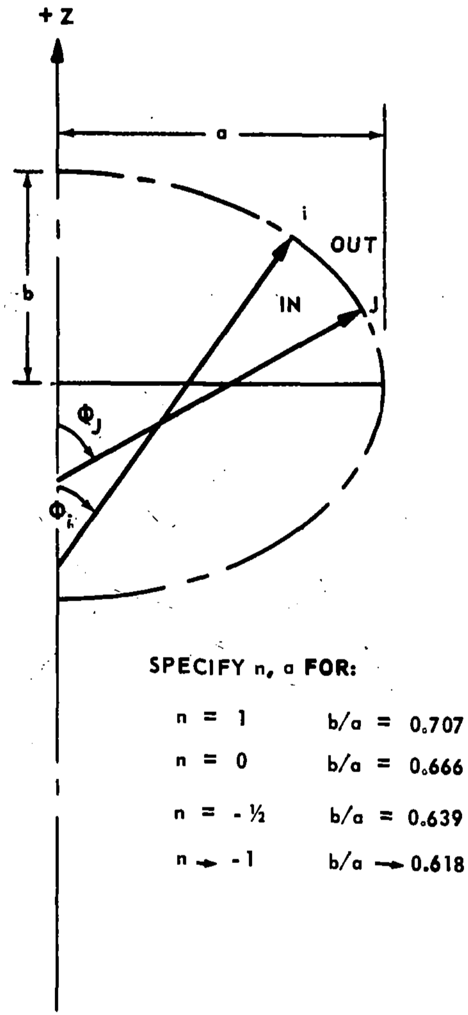


Figure 6. Modified ellipsoid.

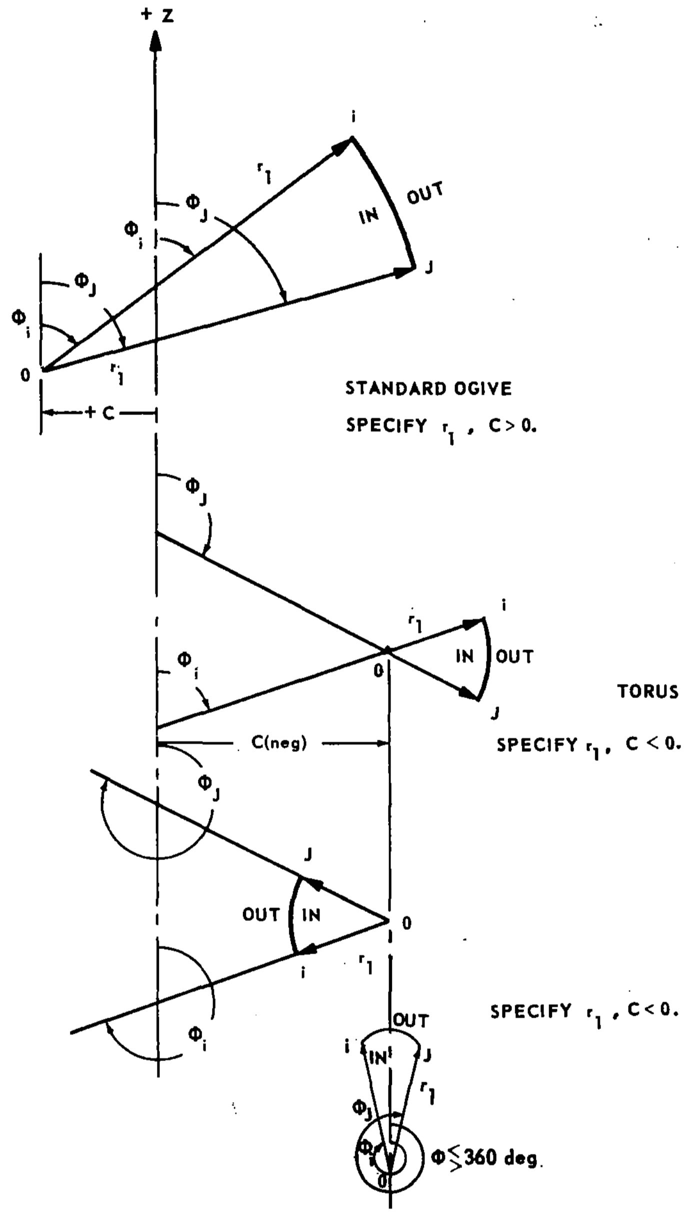


Figure 7. Ogive.

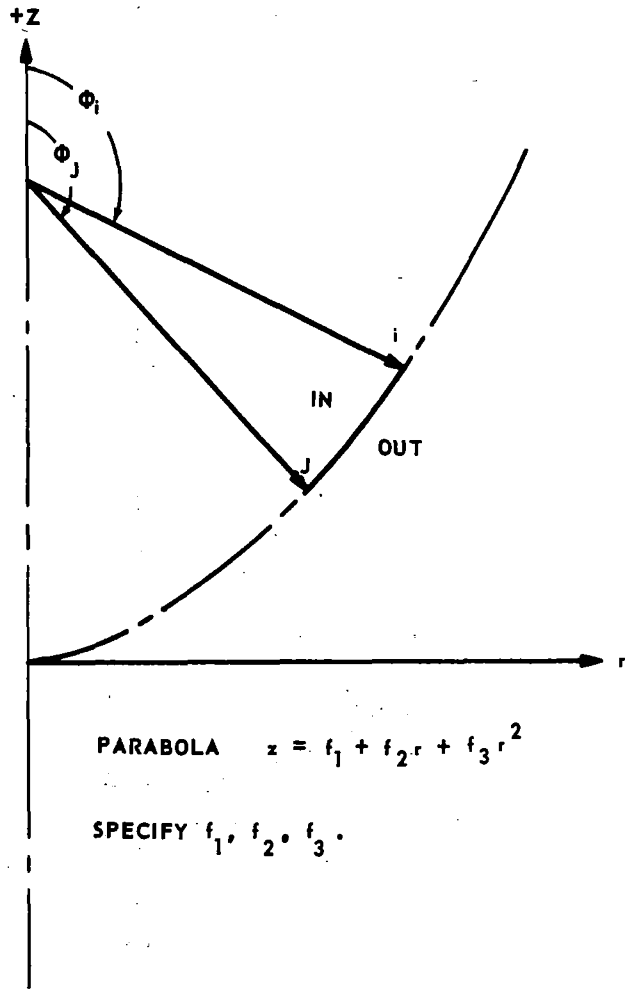


Figure 8. Paraboloid.

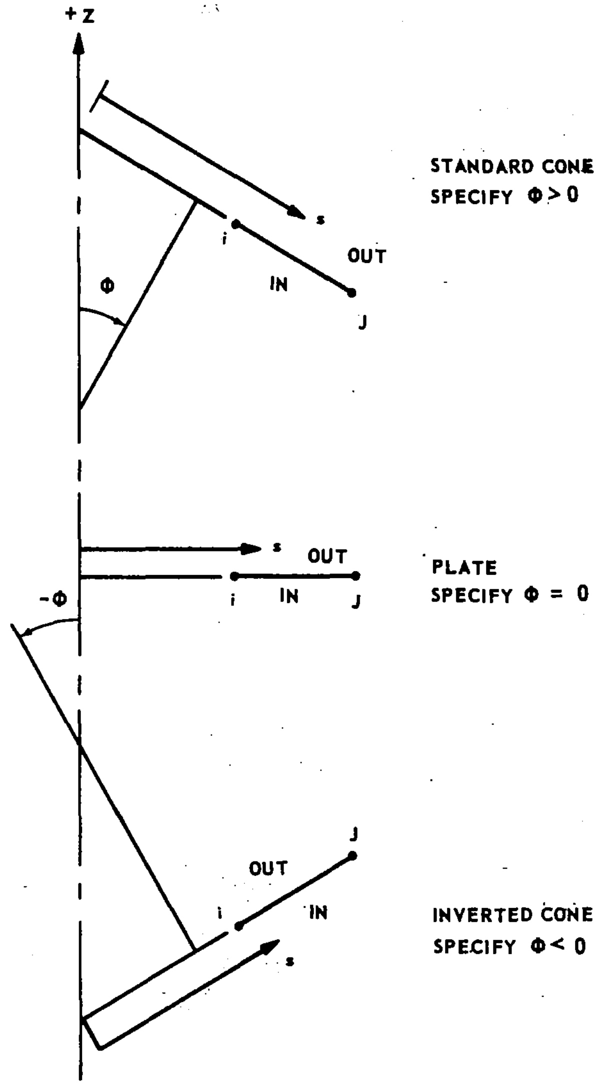


Figure 9. Cone.

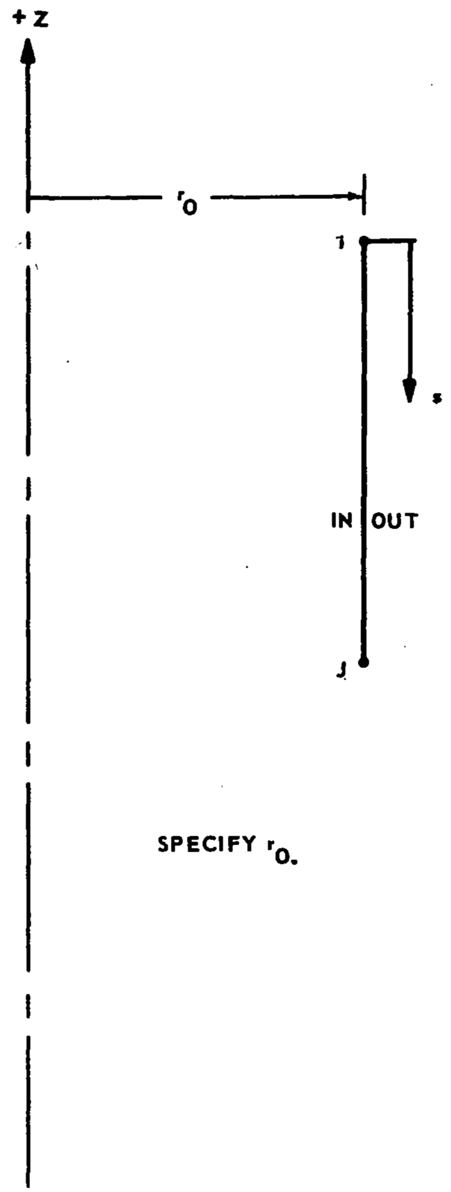


Figure 10. Cylinder.

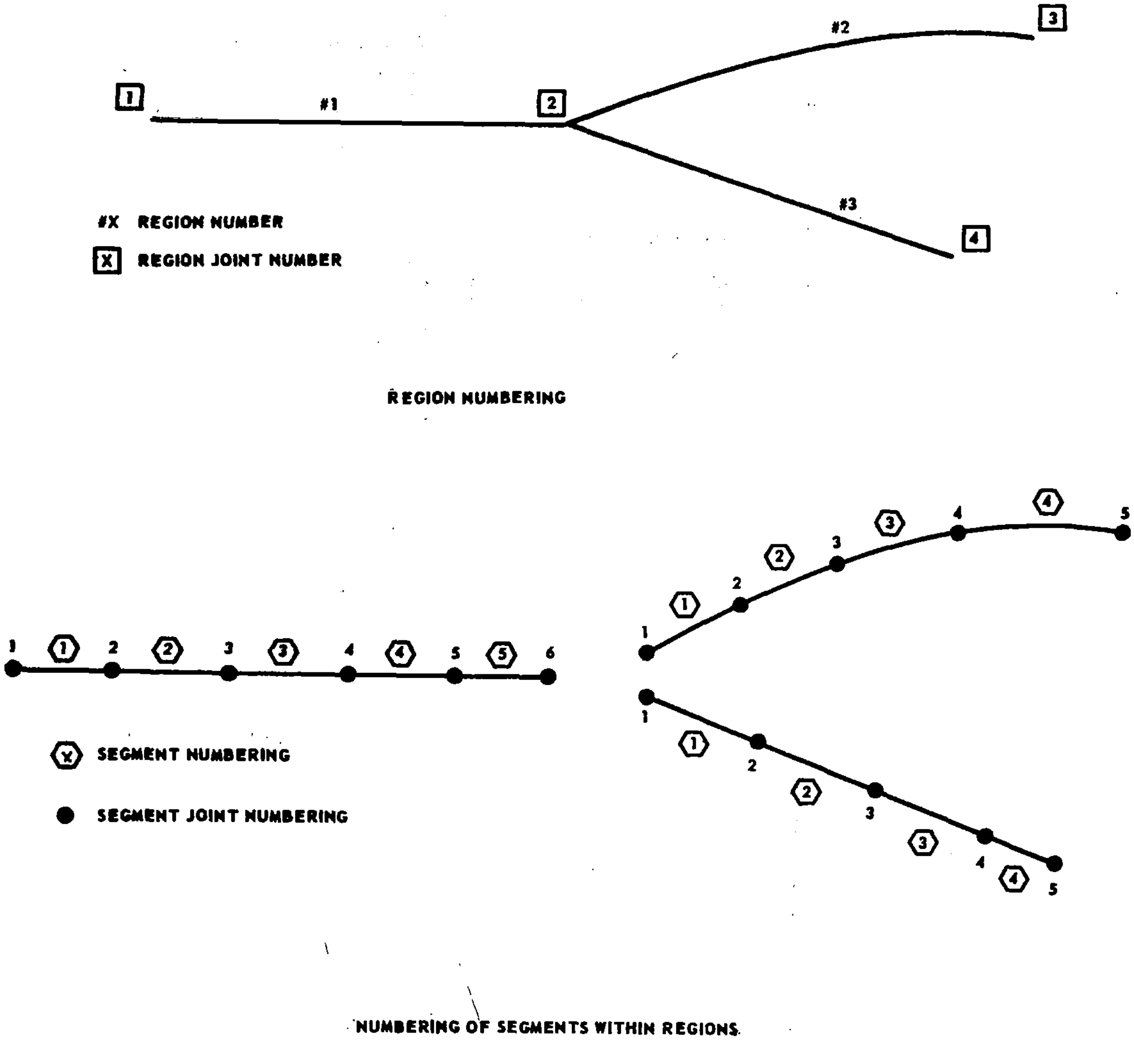


Figure 11. Topology schemes.

SEGMENT CARDS (Continued)		Column	Format
1. Identification Card			
a. Segment identification code		1-2	F2.0
(1) Ellipsoidal, translated ellipsoidal, or spherical segment,	code = 11		
(2) Modified ellipsoidal segment,	code = 12		
(3) Ogival — toroidal segment,	code = 13		

SEGMENT CARDS (Continued)

	Column	Format
(4) Paraboloid segment, code = 14		
(5) Conical — circular plate segment, code = 21. The plate is treated as a cone with zero angle.		
(6) Cylindrical segment, code = 31		
b. Any alphameric information (segment description)	3-66	16A4

2. "MAGIC" Control and Segment Sizing Card

	Column	Format
a. Initial value of ϕ in radians or s in inches (TIC)	1-14	E14.1
b. Final value of ϕ in radians or s in inches (STOP)	15-28	E14.1
c. Interval at which final answers are printed out (DTAU) The ϕ-coordinate is defined for all geometric shapes except the cylinder, cone, and plate, for which the s coordinate is used. Figures 3 through 10 describe these coordinates for each shape.	29-42	E14.1
d. Difference The value recommended depends upon the computer used. For the IBM 7094 it is 1.0 E-6; for the IBM 360-75 and the UNIVAC 1108 it is 1.0 E-4.	43-56	E14.1
e. Integration interval Recommended interval = 0.01 × segment length	57-70	E14.1
f. Delta For a fixed-step integration, delta = 0. This card controls the Runge-Kutta numerical integration scheme. The suggested values above yield accurate results for a fixed-step integration method.	71-72	F2.0

Calculation of Segment Length

There is a restriction on the length of the shell segments. Physically, the restriction demands that boundary distrubances at one edge be distinctly felt at the other edge. This is a consequence of using a matrix approach which requires the calculation of stiffness matrices for the segments. Since the stiffness matrices must be symmetric, the magnitude of each matrix element must be such that a computer roundoff error never becomes prominent. Limiting the segment length insures satisfaction of this criterion. This length is a function of both geometric shape and segment location within a specific geometry. One of the limiting factors is that the ratio of the radii of revolution at the initial and final points of a segment be greater than one-hundredth and less than one hundred. This requires smaller segments than will normally be predicted by formula in the area of an apex. In addition, note that $\phi = 0$ is not an acceptable input point.

For a cylinder, the segment length parameter,

$$\Lambda = (1 + \gamma)^{\frac{1}{2}} \beta \; \Delta s \quad ,$$

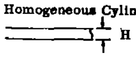
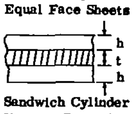
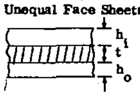
should be held to about 4.0. In this expression, γ is a nonlinear parameter. For homogeneous shells

$$\gamma = \left[3\left(1 - \nu^2\right)\right]^{\frac{1}{2}} \left(\frac{\overline{N}_\phi r_0}{EH^2}\right) \quad .$$

It is zero for a linear problem.

The rate of decay of a disturbance in the shell is measured by β. The meridional length is Δs.

The values of β^4 and Δs for various shell geometries are given below:

		For $\nu = 0.3$, $\Lambda \le 4$
Homogeneous Cylinder 	$\beta^4 = \frac{3(1-\nu^2)}{r_0^2 H^2}$	$\Delta s \le \frac{3.11 (r_0 H)^{\frac{1}{2}}}{(1+\gamma)^{\frac{1}{2}}}$
Sandwich Cylinder - Equal Face Sheets 	$\beta^4 = \frac{3(1-\nu^2)}{r_0^2(4h^2 + 6ht + 3t^2)}$	$\Delta s \le 3.11 \left[r_0^2(4h^2 + 6ht + 3t^2)\right]^{\frac{1}{4}}$
Sandwich Cylinder - Unequal Face Sheets 	$\beta^4 = \frac{3(1-\nu^2)}{(h_i + h_o)^4 + 12 h_i h_o t (h_i + h_o + t)} \left(\frac{h_i + h_o}{r_0}\right)^2$	$\Delta s \le 3.11 \left(\frac{r_0}{h_i + h_o}\right)^{\frac{1}{2}} \left[(h_i + h_o)^4 + 12 h_i h_o t (h_i + h_o + t)\right]^{\frac{1}{4}}$

Approximate formulas can be obtained for near-cylindrical regions of generally curved surfaces. The length parameter,

$$\Lambda = (1 + \gamma)^{\frac{1}{2}} \lambda \, \Delta\phi \quad ,$$

should be held to about 4.0. In this expression γ has the same definition as in the cylinder case.

The rate of decay of a disturbance in the shell is measured by λ. The angle intercepted by a meridional arc length Δs is $\Delta\phi = \Delta s / r_1$. The values of λ^4 and Δs for various shell geometries are given below:

		For $\nu = 0.3$, $\Lambda \leq 4$:
Homogeneous Construction	$\lambda^4 = 3(1 - \nu^2) \dfrac{r_1^4}{r_2^2 H^2}$	$\Delta s \leq \dfrac{3.11 (r_2 H)^{\frac{1}{2}}}{(1 + \gamma)^{\frac{1}{2}}}$
Sandwich Construction - Equal Face Sheets	$\lambda^4 = \dfrac{3(1 - \nu^2) r_1^4}{r_2^2 (4h^2 + 6ht + 3t^2)}$	$\Delta s \leq 3.11 \left[r_2^2 (4h^2 + 6ht + 3t^2) \right]^{\frac{1}{4}}$
Sandwich Construction - Unequal Face Sheets	$\lambda^4 = \dfrac{3(1 - \nu^2) r_1^4}{(h_i + h_o)^4 + 12 h_i h_o t (h_i + h_o + t)} \left(\dfrac{h_i + h_o}{r_2} \right)^2$	$\Delta s \leq 3.11 \left(\dfrac{r^2}{h_i + h_o} \right)^{\frac{1}{2}} \left[(h_i + h_o)^4 + 12 h_i h_o t (h_i + h_o + t) \right]^{\frac{1}{4}}$

The minimum allowable segment length is 1×10^{-3} (inches or radians).

SEGMENT CARDS (Continued)	Column	Format
3. Geometric Description Card		
a. Ellipsoid and sphere (Figs. 4 and 5)		
(1) Semiaxis perpendicular to Z-direction (a)	1-14	E14.1
(2) Ratio of semiaxis in the Z-direction (b) to (a), $\beta = \dfrac{b}{a}$	15-28	E14.1
(3) C = offset distance (±) (C = 0 if no offset)	29-42	E14.1
b. Modified ellipse shape (Fig. 6)		
(1) Axis ratio coefficient (n)	1-14	E14.1
(2) Semiaxis perpendicular to Z-direction (a)	15-28	E14.1

	Column	Format
c. Ogive (Fig. 7)		
(1) R_1 = radius	1-14	E14.1
(2) C = offset distance (±)	15-28	E14.1
d. Paraboloid (Fig. 8)		
(1) f_1 = position parameter	1-14	E14.1
(2) f_2 = shape parameter	15-28	E14.1
(3) f_3 = shape parameter	29-42	E14.1
e. Cone (Fig. 9)		
(1) Angle ϕ in radians (for flat plate, $\phi = 0$). Keep in mind that this ϕ is a constant for a given cone and should not be confused with the ϕ on the MAGIC Control and Segment Sizing Card.	1-14	E14.1
f. Cylinder (Fig. 10)		
(1) Radius	1-14	E14.1
4. Master Clue Card. This card contains a series of clues which determine the program and table locations to be used for the segment being described. For a master flow chart of clues and options in the program, see Figure 1.		
a. Material Table Type Clue This clue defines the type of material property table to be expected for the segment. This, as well as the following clue, determines the material properties that will be used in the structural analysis for the segment. Thus these two clues should match the two clues used on the identification card of the corresponding material property table. As mentioned before in this section under the category Material Property Tables, the three possibilities are: ISOT ORTH STIF	1-4	A4

	Column	Format
b. Material title This name should be the same as the name which appears on the material property table which contains the properties to be utilized for this segment.	11-14	A4
c. Sheet Clue (segment construction) This clue informs the program as to what kind of shell wall cross section to expect. If the shell is of single-sheet construction, the clue to be used is: <u>SING.</u> If the shell wall is an equal-size face sheet sandwich, the clue to be used is: <u>EQUA.</u> If the shell wall is a sandwich but the face sheets are not equal, the clue to be used is: <u>UNEQ</u>. Finally, if the shell is reinforced by rings, stringers, or a waffle, the clue to be used is: <u>BLAN.</u>	21-24	A4
d. Reinforcement Clue This clue describes the type of reinforcement that is present on the shell. If the shell is purely of single-sheet or equal or unequal-size face sheet honeycomb construction (no reinforcing), the clue to be used is: <u>THIC.</u> If the reinforcement consists of rings or stringers or both, located along the coordinate axes (θ and ϕ or s), then the clue to be used is: <u>ST10.</u> If the reinforcement consists of a waffle which is rotated 45 deg to the coordinate axes, then the clue to be used is: <u>RWAF.</u> If another shell cross section (for instance, some sort of layer combination) can be cast so as to have the same integrated Hooke's Laws as either of the reinforced cases (see Ref. 1, Appendix A), then the appropriate clue, ST10 or RWAF, can be used for its description. The formulas for the appropriate stiffnesses need only be changed (Ref. 1 and this section under the heading, Reinforced Shell Stiffness Formulas) so as to describe the new shape properly. The numbers based on these new	31-34	A4

formulas can be input in card set 6 as described in succeeding pages under item 6, Table of Wall Cross-Section Geometry, and this new cross section will be analyzed by the program.

e. Thermal Clue	41-44	A4

This clue describes the type of thermal problem which exists in the segment. The user is reminded that if there is a thermal loading on the structure, only one load problem may be run in the submission (see this section under the heading, Order of Input, and subheading, General Introductory Cards). If there is no thermal load on the segment, the clue to be used is NOTH. If the thermal loading on the segment is of a general, standard type, that is, if there is variation of temperature through the thickness as well as in the coordinate directions, the clue to be used is THST. If the thermal load is such that the variation is all in the coordinate directions and there is no thermal variation through the thickness, the clue to be used is THCN. The last clue concerns a shell which is inhomogeneous in the meridional direction. This is not really a thermal problem at all but merely a manipulation of the material property tables. If a structure has a wide variation in material properties in the meridional direction, without this last option one must take short segments of constant properties for analysis. With this option, however, the property variation is placed in the material property table and expressed on the segment as a function of temperature. No thermal loads are calculated, however, and the temperatures are used only to interpolate for material properties as integration is progressing along the segment. Thus, continual variation of properties in the meridional direction is accommodated. The clue for this option is THIN.

SEGMENT CARDS (Continued)

	Column	Format
f. Stress-free temperature The value of the temperature (usually room temperature) at which the segment has no thermal stresses or distortions induced is provided here. This is the temperature at which the shell was manufactured. If there is to be no thermal analysis, this value is not used and can be set to zero (0.0).	51-60	E10.1
g. Nonlinear Clue If the analysis is to be linear the clue is <u>LINE</u>. For a nonlinear analysis see Reference 1, Section 7, and use the clue <u>NPHI</u>.	61-64	A4
h. Table control — number of points in each of the following tables This can vary from 2 to 30, depending upon the shell geometry and loading. For a linearly varying geometry and/or loading only two input points would be required. These two points would be the end points. For more general loading and/or geometry a large number of points are required. In particular, each abrupt change is specified by two points. One should use as many points as necessary (up to 30) in order to completely describe the problem.	71-72	I2

5. Table of ϕ or s Values

	Column	Format
a. Initial, intermediate, and final values of ϕ or s. Each point requires 14 columns on a card, and thus there can be 5 values per card and up to 6 cards to make a total of up to 30 points.		5E14.7

In preparing input data for this card, one should always make the first table value slightly smaller than the initial value of ϕ or s specified under item 2a. The last value has to be slightly greater than the final value of ϕ or s given under item 2b. The table overlap is necessary to initialize the interpolation scheme. A suggested overlap value of 1×10^{-3} will insure good results. The minimum value of this overlap that can be used is 1×10^{-4}.

6. Table of Wall Cross-Section Geometry. The contents of these cards (up to six cards per item below) are dependent upon the clues registered on the Master Clue Card. If the shell to be described contains no reinforcing, the pertinent clue is item 4c, the Sheet Clue. For these cases the geometry is input and the stiffnesses are calculated internally by the program (Fig. 12). The input is presented below as a function of the Sheet Clue. If the Sheet Clue is SING (single sheet construction):

   a. Initial, intermediate, and final values of wall thickness (h_i) at points defined by table of ϕ or s values. — 5E14.7

If the Sheet Clue is EQUA (equal-size face sheet sandwich):

   a. Initial, intermediate, and final values of face sheet thickness (h_i) at points defined by table of ϕ or s values. — 5E14.7

   b. Initial, intermediate, and final values of core thickness (t) at points defined by table of ϕ or s values. — 5E14.7

If the Sheet Clue is UNEQ (unequal-size face sheet sandwich):

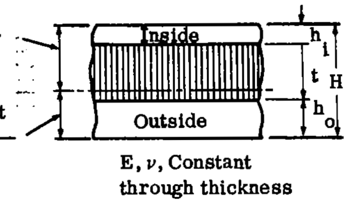
   a. Initial, intermediate, and final values of <u>inner</u> face sheet thickness (h_i) at points defined by table ϕ or s values. — 5E14.7

   b. Initial, intermediate, and final values of core thickness (t) at points defined by table of ϕ or s values. — 5E14.7

   c. Initial, intermediate, and final values of <u>outer</u> face sheet thickness (h_o) at points defined by table of ϕ or s values. — 5E14.7

$$\bar{\zeta}_{in} = \frac{h_i^2 + h_o^2 + 2h_ih_o + 2h_ot}{2(h_i + h_o)}$$

$$\bar{\zeta}_{out} = \frac{h_i^2 + h_o^2 + 2h_ih_o + 2h_it}{2(h_i + h_o)}$$



Configuration	Extensional Stiffnesses	Flexural Stiffnesses	Shear Stiffnesses
h_i Orthotropic	$K_{11} = \frac{E_\theta h_i}{1 - \nu_{\phi\theta}\nu_{\theta\phi}}$ $K_{22} = \frac{E_\phi h_i}{1 - \nu_{\phi\theta}\nu_{\theta\phi}}$	$D_{11} = \frac{E_\theta h_i^3}{12(1 - \nu_{\phi\theta}\nu_{\theta\phi})}$ $D_{22} = \frac{E_\phi h_i^3}{12(1 - \nu_{\phi\theta}\nu_{\theta\phi})}$	$K_{33} = G_{\phi\theta}h_i$ $D_{33} = \frac{G_{\phi\theta}h_i^3}{12}$
h_i, t, h_i Equal Face Sheets	$K_{11} = \frac{2E_\theta h_i}{1 - \nu_{\phi\theta}\nu_{\theta\phi}}$ $K_{22} = \frac{2E_\phi h_i}{1 - \nu_{\phi\theta}\nu_{\theta\phi}}$	$D_{11} = \frac{E_\theta h_i\left(4h_i^2 + 6h_it + 3t^2\right)}{6(1 - \nu_{\phi\theta}\nu_{\theta\phi})}$ $D_{22} = \frac{E_\phi h_i\left(4h_i^2 + 6h_it + 3t^2\right)}{6(1 - \nu_{\phi\theta}\nu_{\theta\phi})}$	$K_{33} = 2\,G_{\phi\theta}h_i$ $D_{33} = \frac{G_{\phi\theta}h_i\left(4h_i^2 + 6h_it + 3t^2\right)}{6}$
h_i, t, h_o Unequal Face Sheets	$K_{11} = \frac{E_\theta(h_i + h_o)}{1 - \nu_{\phi\theta}\nu_{\theta\phi}}$ $K_{22} = \frac{E_\phi(h_i + h_o)}{1 - \nu_{\phi\theta}\nu_{\theta\phi}}$	$D_{11} = E_\theta\left[\frac{(h_i + h_o)^4 + 12h_ih_ot(h_i + h_o + t)}{12(h_i + h_o)(1 - \nu_{\phi\theta}\nu_{\theta\phi})}\right]$ $D_{22} = E_\phi\left[\frac{(h_i + h_o)^4 + 12h_ih_ot(h_i + h_o + t)}{12(h_i + h_o)(1 - \nu_{\phi\theta}\nu_{\theta\phi})}\right]$	$K_{33} = G_{\phi\theta}(h_i + h_o)$ $D_{33} = G_{\phi\theta}\left[\frac{(h_i + h_o)^4 + 12h_ih_ot(h_i + h_o + t)}{12(h_i + h_o)}\right]$

Figure 12. Calculated shell section properties.

If the shell is reinforced, the Sheet Clue will be BLAN. In this case it is the following, or Reinforcement Clue (item 4d), which will determine the contents of card series 6. For the reinforcement cases the geometry can be complex and varied, since all types of reinforcing are to be included. Thus, rather than geometry, actual stiffness parameters will be input. Formulas for calculating these parameters are derived in Reference 1. They are presented for those and additional cases on the following pages. The reinforced shell input is presented below as a function of the Reinforcement Clue.

If the Reinforcement Clue is RWAF (waffle reinforcing rotated 45 deg to the coordinate axes):

	Column	Format
a. Initial, intermediate, and final values of the reinforced shell extensional stiffness in the θ direction (K_{11}) at points defined by table of ϕ or s values.		5E14.7
b. Initial, intermediate, and final values of the reinforced shell Poisson's ratio effective extensional stiffness (K_{12}) at points defined by table of ϕ or s values.		5E14.7
c. Initial, intermediate, and final values of the reinforced shell extensional stiffness in the ϕ direction (K_{22}) at points defined by table of ϕ or s values.		5E14.7
d. Initial, intermediate, and final values of the reinforced shell shear extensional stiffness (K_{33}) at points defined by table of ϕ or s values.		5E14.7
e. Initial, intermediate, and final values of the reinforced shell bending stiffness in the θ direction (D_{11}) at points defined by table of ϕ or s values.		5E14.7

SEGMENT CARDS (Continued)

	Column	Format
f. Initial, intermediate, and final values of the reinforced shell Poisson's ratio effective bending stiffness (D_{12}) at points defined by table of ϕ or s values.		5E14.7
g. Initial, intermediate, and final values of the reinforced shell bending stiffness in the ϕ direction (D_{22}) at points defined by table of ϕ or s values.		5E14.7
h. Initial, intermediate, and final values of the reinforced shell shear bending stiffness (D_{33}) at points defined by table of ϕ or s values.		5E14.7
i. Initial, intermediate, and final values of the reinforced shell waffle eccentricity parameter (C_{11}) at points defined by table of ϕ or s values.		5E14.7

If the Reinforcement Clue is ST10 (reinforcement consisting of rings or stringers or both):

a. through h. The items contained on these cards are identical to those described for the RWAF clue above.		8 sets of 5E14.7
i. Initial, intermediate, and final values of the reinforced shell ring eccentricity parameter (C_{11}) at points defined by table of ϕ or s values.		5E14.7
j. Initial, intermediate, and final values of the reinforced shell stringer eccentricity parameter (C_{22}) at points defined by table of ϕ or s values.		5E14.7

Reinforced Shell Stiffness Formulas

The formulas for the reinforced shell stiffnesses are given as follows.

1. Waffle Construction (RWAF Clue)

   a. Single sheet reinforced by rotated waffle:

$$K_{11} = \frac{E_\theta h}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_R A}{S} \qquad K_{22} = \frac{E_\phi h}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_R A}{S}$$

$$K_{12} = \frac{\nu_{\theta\phi} E_\theta h}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_R A}{S} \qquad K_{33} = G_{\phi\theta} h + \frac{E_R A}{S}$$

$$C_{11} = \frac{E_R AC}{S} \qquad D_{22} = \frac{-E_\phi h^3}{12(1-\nu_{\phi\theta}\nu_{\theta\phi})} - \frac{E_R I}{S}$$

$$D_{11} = \frac{-E_\theta h^3}{12(1-\nu_{\phi\theta}\nu_{\theta\phi})} - \frac{E_R I}{S} \qquad D_{33} = \frac{G_{\phi\theta} h^3}{12} + \frac{E_R I}{S}$$

$$D_{12} = \frac{-\nu_{\theta\phi} E_\theta h^3}{12(1-\nu_{\phi\theta}\nu_{\theta\phi})} - \frac{E_R I}{S}$$

b. Equal-size face sheet sandwich reinforced by rotated waffle:

$$K_{11} = \frac{2E_\theta h_i}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_R A}{S} \qquad K_{22} = \frac{2E_\phi h_i}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_R A}{S}$$

$$K_{12} = \frac{2\nu_{\theta\phi} E_\theta h_i}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_R A}{S} \qquad K_{33} = 2G_{\phi\theta} h_i + \frac{E_R A}{S}$$

$$C_{11} = \frac{E_R AC}{S} \qquad D_{22} = \frac{-E_\phi h_i\left(4h_i^2+6h_i t+3t^2\right)}{6(1-\nu_{\phi\theta}\nu_{\theta\phi})} - \frac{E_R I}{S}$$

$$D_{11} = \frac{-E_\theta h_i \left(4h_i^2 + 6h_i t + 3t^2\right)}{6(1-\nu_{\phi\theta}\nu_{\theta\phi})} - \frac{E_R I}{S}$$

$$D_{12} = \frac{-\nu_{\theta\phi} E_\theta h_i \left(4h_i^2 + 6h_i t + 3t^2\right)}{6(1-\nu_{\phi\theta}\nu_{\theta\phi})} - \frac{E_R I}{S}$$

$$D_{33} = \frac{G_{\phi\theta} h_i \left(4h_i^2 + 6h_i t + 3t^2\right)}{6} + \frac{E_R I}{S}$$

c. Unequal-size face sheet sandwich reinforced by rotated waffle:

$$K_{11} = \frac{E_\theta (h_i + h_o)}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_R A}{S} \qquad K_{22} = \frac{E_\phi (h_i + h_o)}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_R A}{S}$$

$$K_{12} = \frac{\nu_{\theta\phi} E_\theta (h_i + h_o)}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_R A}{S} \qquad K_{33} = G_{\phi\theta}(h_i + h_o) + \frac{E_R A}{S}$$

$$C_{11} = \frac{E_R A C}{S}$$

$$D_{11} = -E_\theta \left[\frac{(h_i + h_o)^4 + 12h_i h_o t(h_i + h_o + t)}{12(h_i + h_o)(1-\nu_{\phi\theta}\nu_{\theta\phi})}\right] - \frac{E_R I}{S}$$

$$D_{12} = -\nu_{\theta\phi} E_\theta \left[\frac{(h_i + h_o)^4 + 12h_i h_o t(h_i + h_o + t)}{12(h_i + h_o)(1-\nu_{\phi\theta}\nu_{\theta\phi})}\right] - \frac{E_R I}{S}$$

$$D_{22} = -E_\phi \left[\frac{(h_i + h_o)^4 + 12h_i h_o t(h_i + h_o + t)}{12(h_i + h_o)(1-\nu_{\phi\theta}\nu_{\theta\phi})}\right] - \frac{E_R I}{S}$$

$$D_{33} = G_{\phi\theta} \left[\frac{(h_i + h_o)^4 + 12h_ih_ot(h_i + h_o + t)}{12(h_i + h_o)} \right] + \frac{E_RI}{S}$$

where in the preceding presentation:

A = area of reinforcement

C = eccentricity of reinforcement (measured from the basic shell centroidal axis to the centroidal axis of the reinforcement — positive inward)

I = moment of inertia of reinforcement about basic shell centroidal axis

S = spacing of reinforcement

and the subscript R refers to reinforcement properties.

As can be seen from the changes in corresponding equations for the single sheet and sandwich basic constructions, any basic construction reinforced by a rotated waffle can be analyzed by the program by merely calculating its stiffnesses and adding to them the appropriate reinforcing stiffness terms. In addition, any other wall cross section which is not explicitly reinforced can be analyzed by this option if the integrated Hooke's laws of the cross section can be cast into the form of equations 4-10 in Reference 1, and the definitions of the stiffness parameters thus derived are used.

2. Ring — Stringer Reinforced Construction (ST10 Clue)

a. Single sheet reinforced by rings and/or stringers:

$$K_{11} = \frac{E_\theta h}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_{\theta_R}A_\theta}{S_\theta} \qquad K_{22} = \frac{E_\phi h}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_{\phi_R}A_\phi}{S_\phi}$$

$$K_{12} = \frac{\nu_{\theta\phi}E_\theta h}{1-\nu_{\phi\theta}\nu_{\theta\phi}} \qquad K_{33} = G_{\phi\theta}h$$

$$C_{11} = \frac{E_{\theta_R} C_\theta A_\theta}{S_\theta} \qquad C_{22} = \frac{E_{\phi_R} C_\phi A_\phi}{S_\phi}$$

$$D_{11} = \frac{-E_\theta h^3}{12(1-\nu_{\phi\theta}\nu_{\theta\phi})} - \frac{E_{\theta_R} I_\theta}{S_\theta} \qquad D_{22} = \frac{-E_\phi h^3}{12(1-\nu_{\phi\theta}\nu_{\theta\phi})} - \frac{E_{\phi_R} I_\phi}{S_\phi}$$

$$D_{12} = \frac{-\nu_{\theta\phi} E_\theta h^3}{12(1-\nu_{\phi\theta}\nu_{\theta\phi})} \qquad D_{33} = \frac{G_{\phi\theta} h^3}{12} + \frac{G_{\phi_R} J_\phi}{4S_\phi} + \frac{G_{\theta_R} J_\theta}{4S_\theta}$$

b. Equal-size face sheet sandwich reinforced by rings and/or stringers:

$$K_{11} = \frac{2E_\theta h_i}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_{\theta_R} A_\theta}{S_\theta}$$

$$K_{22} = \frac{2E_\phi h_i}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_{\phi_R} A_\phi}{S_\phi}$$

$$K_{12} = \frac{2\nu_{\theta\phi} E_\theta h_i}{1-\nu_{\phi\theta}\nu_{\theta\phi}}$$

$$K_{33} = 2G_{\phi\theta} h_i$$

$$C_{11} = \frac{E_{\theta_R} C_\theta A_\theta}{S_\theta}$$

$$C_{22} = \frac{E_{\phi_R} C_{\phi} A_{\phi}}{S_{\phi}}$$

$$D_{11} = \frac{-E_{\theta} h_i \left(4h_i^2 + 6h_i t + 3t^2\right)}{6(1-\nu_{\phi\theta}\nu_{\theta\phi})} - \frac{E_{\theta_R} I_{\theta}}{S_{\theta}}$$

$$D_{22} = \frac{-E_{\phi} h_i \left(4h_i^2 + 6h_i t + 3t^2\right)}{6(1-\nu_{\phi\theta}\nu_{\theta\phi})} - \frac{E_{\phi_R} I_{\phi}}{S_{\phi}}$$

$$D_{12} = \frac{-\nu_{\theta\phi} E_{\theta} h_i \left(4h_i^2 + 6h_i t + 3t^2\right)}{6(1-\nu_{\phi\theta}\nu_{\theta\phi})}$$

$$D_{33} = \frac{G_{\phi\theta} h_i \left(4h_i^2 + 6h_i t + 3t^2\right)}{6} + \frac{G_{\phi_R} J_{\phi}}{4S_{\phi}} + \frac{G_{\theta_R} J_{\theta}}{4S_{\theta}}$$

c. Unequal-size face sheet sandwich reinforced by rings and/or stringers:

$$K_{11} = \frac{E_{\theta}(h_i + h_o)}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_{\theta_R} A_{\theta}}{S_{\theta}}$$

$$K_{22} = \frac{E_{\phi}(h_i + h_o)}{1-\nu_{\phi\theta}\nu_{\theta\phi}} + \frac{E_{\phi_R} A_{\phi}}{S_{\phi}}$$

$$K_{12} = \frac{\nu_{\theta\phi} E_{\theta}(h_i + h_o)}{1-\nu_{\phi\theta}\nu_{\theta\phi}}$$

$$K_{33} = G_{\phi\theta}(h_i + h_o)$$

$$C_{11} = \frac{E_{\theta_R} C_\theta A_\theta}{S_\theta}$$

$$C_{22} = \frac{E_{\phi_R} C_\phi A_\phi}{S_\phi}$$

$$D_{11} = -E_\theta \left[\frac{(h_i + h_o)^4 + 12h_ih_ot(h_i + h_o + t)}{12(1-\nu_{\phi\theta}\nu_{\theta\phi})(h_i + h_o)} \right] - \frac{E_{\theta_R} I_\theta}{S_\theta}$$

$$D_{22} = -E_\phi \left[\frac{(h_i + h_o)^4\ 12h_ih_ot(h_i + h_o + t)}{12(1-\nu_{\phi\theta}\nu_{\theta\phi})(h_i + h_o)} \right] - \frac{E_{\phi_R} I_\phi}{S_\phi}$$

$$D_{12} = -\nu_{\theta\phi}E_\theta \left[\frac{(h_i + h_o)^4 + 12h_ih_ot(h_i + h_o + t)}{12(h_i + h_o)(1-\nu_{\phi\theta}\nu_{\theta\phi})} \right]$$

$$D_{33} = G_{\phi\theta} \left[\frac{(h_i + h_o)^4 + 12h_ih_ot(h_i + h_o + t)}{12(h_i + h_o)} \right] + \frac{G_{\phi_R} J_\phi}{4S_\phi} + \frac{G_{\theta_R} J_\theta}{4S_\theta}$$

where in the above presentation:

A = area of reinforcement

C = eccentricity of reinforcement (measured from the basic shell centroidal axis to the centroidal axis of the reinforcement — positive inward)

I = moment of inertia of reinforcement about basic shell centroidal axis

J = twist constant of reinforcement cross section

S = spacing of reinforcement

The subscripts θ or ϕ indicate coordinate directions, and the subscript R refers to reinforcement properties. With reference to reinforcement properties, ϕ refers to stringers and θ to rings.

The ST10 equations are somewhat approximate. First, since the reinforcement properties are "smeared," the equations will not be accurate where the reinforcement is widely spaced. Second, because of the first-order theory assumption that $M_{\phi\theta} = -M_{\theta\phi}$, the torsional constant is only approximate in cases where reinforcement properties GJ/S are not equal in the two coordinate directions. For an axisymmetric loading this approximation will have no effect unless a pure torsion load is applied.

As previously, changes in corresponding equations for the single sheet and sandwich basic constructions indicate that any basic construction with reinforcement can be analyzed by the program by calculating its basic stiffnesses and adding them to the appropriate reinforcing stiffness terms. Again, any other wall cross section which is not explicitly reinforced can be analyzed by this option if the integrated Hooke's laws of the cross section can be cast into the form of equations 4-1 in Reference 1, and the definitions of the stiffness parameters thus derived are used.

Both the ST10 and the RWAF equations are applicable to obtain accurate stress resultants for a reinforced shell structure. Stress calculations based upon "smeared" properties, however, are inaccurate and are not carried out by the program. The user, having the actual geometry and the stress resultants, can easily make this calculation (see Appendix A).

SEGMENT CARDS (Continued)	Column	Format
7. Loading Clue Card. The contents of this card are numerical clues which alert the programs to the types of loads that exist on the segment. If the clue indicates that some load does <u>not</u> exist, the appropriate cards in series 8 which would ordinarily contain the numerical values of this load are omitted from the		

	Column	Format
sequence. The series of cards 7 and 8 are repeated for the number of problems indicated on the Program Control Card (item e) up to a maximum of five. If three problems were being run, the following card sequence for that segment would be:		

Loading Clue Card for pattern one (card 7)
Load Values for pattern one (card 8)
Loading Clue Card for pattern two (card 7)
Load Values for pattern two (card 8)
Loading Clue Card for pattern three (card 7)
Load Values for pattern three (card 8)

The appropriate clues are as follows:

	Column	Format
a. Thermal Clue If there are no thermal loads (Item 4e is NOTH) the clue number is zero (0). If there is a standard thermal variation through the thickness (item 4e is THST), the clue number is four (4). If the temperature is constant through the thickness (item 4e is THCN) or if the in-homogeneous option is used (item 4e is THIN) the clue number is one (1). If a thermal loading <u>does</u> exist on the structure, then the stiffnesses matrix is thermal dependent, and only one loading problem may be run per submission (see Program Control Card, item e).	1	I1
b. Circumferential Load Clue (f_θ) If there are <u>no</u> circumferential loads, then the clue number is zero (0). If there are circumferential loads, then the clue number is one (1).	2	I1

SEGMENT CARDS (Continued)

	Column	Format
c. Meridional Load Clue (f_ϕ) The meridional load clue number <u>must</u> always be one (1) whether or not there are any meridional loads.	3	I1
d. Normal Load Clue (f_ζ) The normal load clue number <u>must</u> always be one (1) whether or not there are any normal loads.	4	I1
e. Circumferential Moment Load Clue (m_θ) The circumferential moment load clue number <u>must</u> always be one (1) whether or not there are any circumferential moment loads.	5	I1
f. Meridional Moment Load Clue (m_ϕ) If there are <u>no</u> meridional moment loads, then the clue number is zero (0). If there are meridional moment loads, then the clue number is one (1).	6	I1
g. Any alphameric information (load description)	7-70	16A4

8. Table of Applied Loads (see Figs. 13 through 15 for the sign convention). The appropriate card sequence is given as follows as a function of the Loading Clues on card 7. If the Thermal Clue is one (1):

	Column	Format
a. Initial, intermediate, and final values of the temperature of the shell at points defined by table of ϕ or s values. [These values will be used either for a thermal problem where there is no thermal variation through the thickness (Clue = THCN) or to calculate varying material properties along the shell for an inhomogeneous problem (Clue = THIN).]		5E14.7

If the Thermal Clue is four (4):

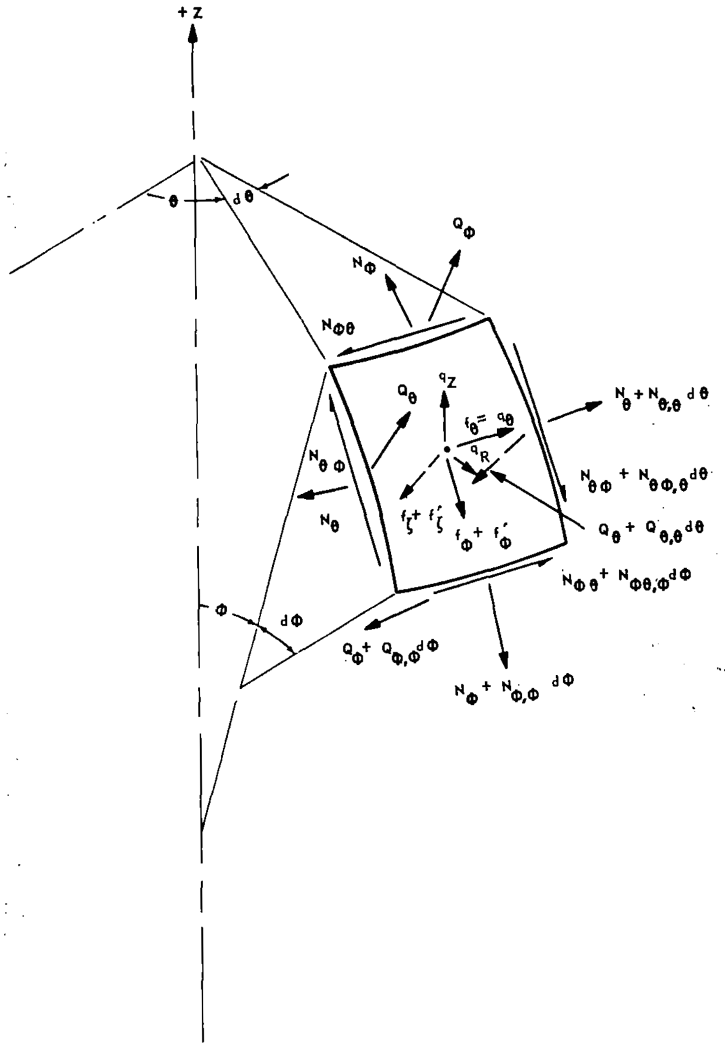


Figure 13. Forces on shell element.

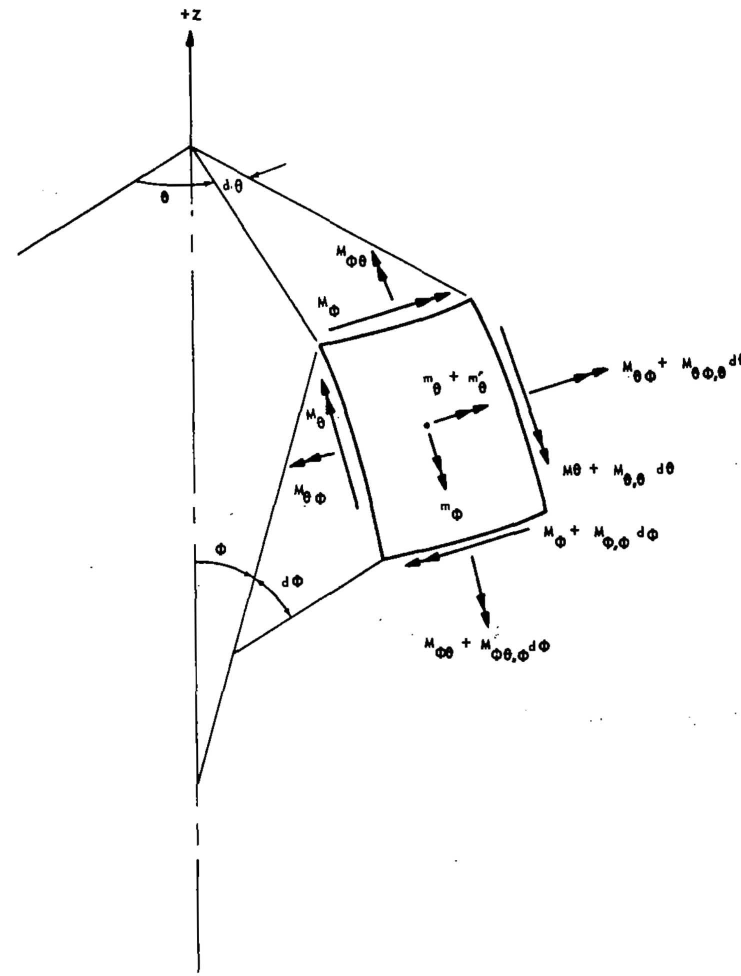


Figure 14. Moments on shell element.

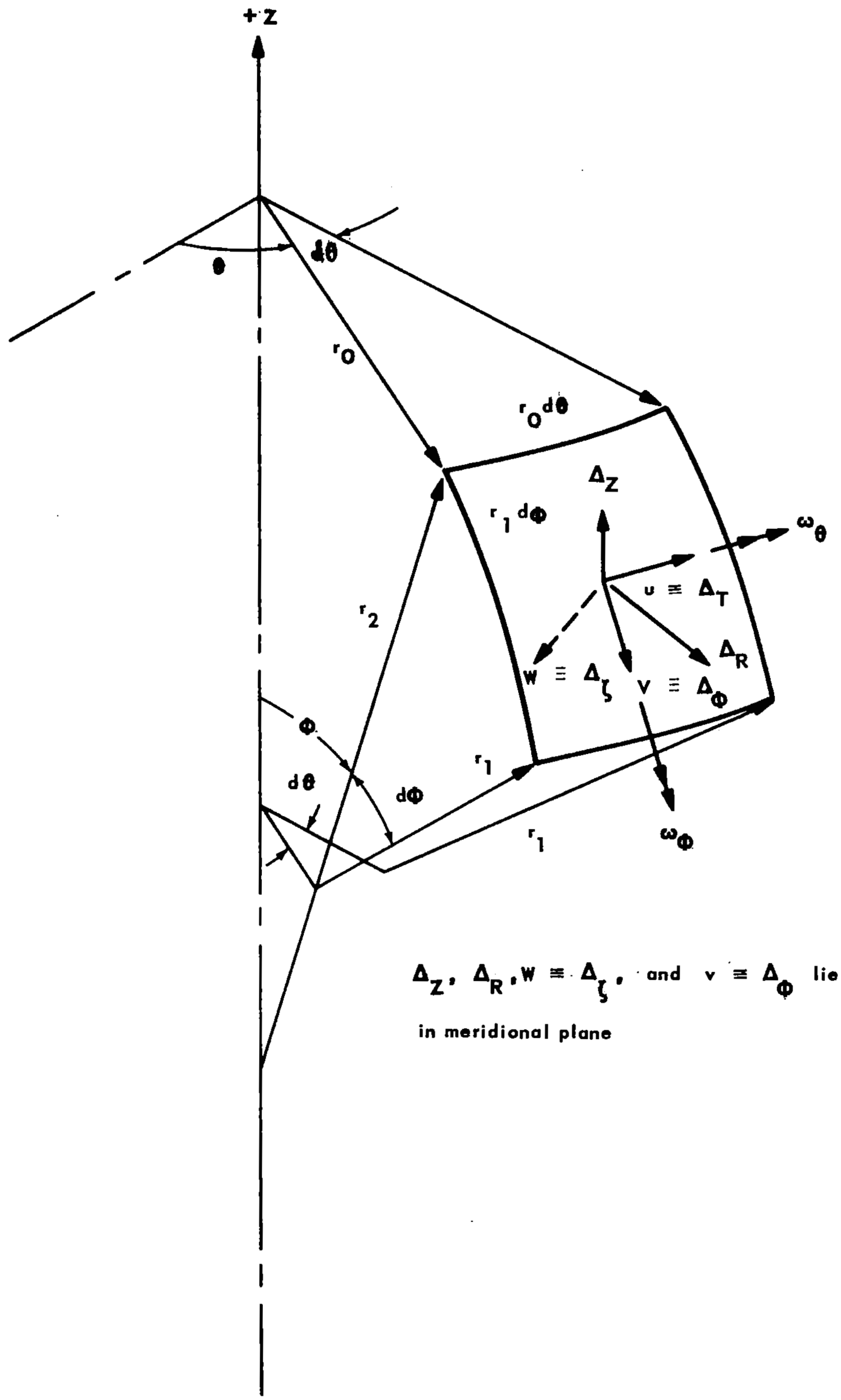
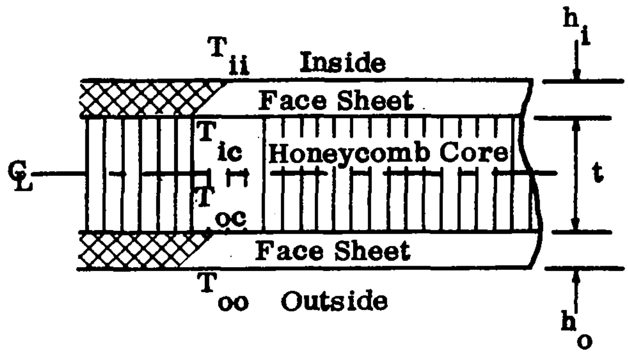


Figure 15. Shell element geometry and displacements.

	Column	Format
a. Initial, intermediate, and final values of the temperature T_{ii} at points defined by table of ϕ or s values. (The subscripts, nm, indicate temperature location; see the following sketch.)		5E14.7



	Column	Format
b. Initial, intermediate, and final values of the temperature T_{ic} at points defined by table of ϕ or s values.		5E14.7
c. Initial, intermediate, and final values of the temperature T_{oc} at points defined by table of ϕ or s values.		5E14.7
d. Initial, intermediate, and final values of the temperature T_{oo} at points defined by table of ϕ or s values.		5E14.7

If the Thermal Clue is zero (0), the above cards are omitted.

If the Circumferential Load Clue is one (1):

	Column	Format
e. Initial, intermediate, and final values of the circumferential loads f_θ at points defined by table of ϕ or s values. For a discussion of distributed loads, see Reference 6, Appendix A.		5E14.7

If the Circumferential Load Clue is zero (0), the cards in item e are omitted.

The Meridional Load Clue on card 7 is always one (1) whether or not there are any meridional loads. Thus, if there are no applied meridional loads on the segment, zero values must be used (or blank cards) according to the following format:

f. Initial, intermediate, and final values of the meridional loads f_ϕ at points defined by table of ϕ or s values. This card or cards cannot be omitted.		5E14.7

The Normal Load Clue from card 7 is always one (1) whether or not there are any normal loads. Thus, if there are no normal loads on the segment, zero values must be used (or blank cards) according to the following format:

g. Initial, intermediate, and final values of the normal loads f_ξ at points defined by table of ϕ or s values.		5E14.7

This card or cards cannot be omitted.

The Circumferential Moment Load Clue from card 7 is always one (1) whether or not there are any circumferential moment loads. Thus, if there are no circumferential moment loads on the segment, zero values must be used (or blank cards) according to the following format:

h. Initial, intermediate, and final values of the circumferential moment loads m_θ of points defined by table of ϕ or s values.		5E14.7

SEGMENT CARDS (Continued)

	Column	Format

This card or cards cannot be omitted.

If the Meridional Moment Load Clue is one (1):

i. Initial, intermediate, and final values of the meridional moment loads m_ϕ at points defined by table of ϕ or s values. — 5E14.7

If the Meridional Moment Load Clue is zero (0), cards i are omitted.

As noted, the load clue on card 7 for the meridional load, normal load, and circumferential moment load must always be one (1) even if these loads do not exist on the segment; thus, card 8 must include the numerical values of these loads using zeros or blank cards for any nonexisting applied loads. The reason for this is that the program internally calculates the inertial loads on the segment caused by rotation and breaks these loads down into the following three static component loads: meridional load, normal load, and circumferential moment load. The program then adds these loads to the external loads which have already been applied to the segment using cards 7 and 8. The program then stores these loads into the static load array; thus, the static load array for meridional loads, normal loads, and circumferential moment loads must always be open even if it means putting in zero values or blank cards for items f, g, and h on card 8.

	Column	Format

9. Table of Assumed Meridional Membrane Force $\bar{N}_\phi$ for Nonlinear Problems. If item 4g on the Master Clue Card is NPHI:

   a. Initial, intermediate, and final values of $\bar{N}_\phi$ at points defined by table of ϕ or s values. — 5E14.7

If Item 4g on the Master Clue Card is LINE, card sequence 9 is omitted. If the problem under consideration is nonlinear, the stiffness matrix depends upon $\bar{N}_\phi$, and only one loading problem may be run per submission (see Program Control Card, item e).

Nonlinear Analysis

The Rotating Structures Computer Program is capable of considering nonlinear effects using an iteration technique. The iteration technique, which is not automated, can be accidentally made to diverge. To insure convergence, care must be taken to satisfy the segment sizing parameters, since symmetry of the stiffness matrix for a nonlinear analysis is no longer a requirement. A nonlinear analysis would then use the following steps:

1. The first approximation to N is obtained from a linear solution, which may yield larger results than the actual nonlinear final value.

2. After the preliminary values are obtained, the structure segments should be resized in the areas where local nonlinear behavior is suspected, using the nonlinear sizing parameter (γ) previously described in this section of the report under the heading, Calculation of Segment Length.

3. If nonlinear effects are locally large, the value for $\bar{N}$ obtained from a linear solution (step 1) may dominate the loading terms in a nonlinear analysis and cause oscillations. To eliminate this possibility, the first $\bar{N}$ approximation should be lower than the value predicted by a linear analysis (90 to 50 percent, depending on the suspected magnitude of nonlinearity). If oscillations are encountered at <u>any</u> stage, they can be eliminated and a trend toward convergence reestablished by using smaller values of $\bar{N}$.

4. With this step the procedure is repeated. A nonlinear analysis is made, and the N output is compared with the barred (assumed) quantities. This procedure is carried out until convergence is reached.

SEGMENT CARDS (Continued)	Column	Format
10. Stress Clue Card. This card contains a series of clues used to identify the proper Hooke's law to be used for stress calculations.		
a. Meridional Stress Inner Edge Clue This clue informs the program as to what kind of construction exists at the meridional inner edge of the shell segment. If the construction is part of the basic shell, the clue is <u>SHEL.</u> If the construction is part of the rotated waffle reinforcement, the clue is <u>WAFF.</u> If the construction is part of a stringer, the clue is <u>STRI.</u>	1-4	A4

	Column	Format
b. Meridional Stress Outer Edge Clue This clue informs the program as to what kind of construction exists at the meridional outer edge of the shell segment. The same possibilities as in item a exist, and the possible clues again are: SHEL WAFF STRI	11-14	A4
c. Hoop Stress Inner Edge Clue This clue informs the program as to what kind of construction exists at the hoop inner edge of the shell segment. If the construction is part of the basic shell, the clue is SHEL. If the construction is part of the rotated waffle reinforcement, the clue is WAFF. If the construction is part of a ring, the clue is RING.	21-24	A4
d. Hoop Stress Outer Edge Clue This clue informs the program as to what kind of construction exists at the hoop outer edge of the shell segment. The same possibilities as in item c exist, and the possible clues again are: SHEL WAFF RING	31-34	A4
11. Reinforced Stress Calculation Table. The contents of these cards are dependent upon the Reinforcement Clue (item 4d). If this clue is THIC, the whole set of cards 10 and 11 is omitted. If the Reinforcement Clue is RWAF:		
a. Initial, intermediate, and final values of extreme inward distance to reinforcement edge at points defined by ϕ or s table. This is a signed ($\pm$) value, measured from the basic shell centroid to the extreme point of shell or reinforcement, positive inwards.		5E14.7

b.	Initial, intermediate, and final values of extreme outward distance to reinforcement edge at points defined by ϕ or s table. This is a signed ($\pm$) value, measured from the basic shell centroid to the extreme point of shell or reinforcement, positive inwards.	5E14.7
c.	Initial, intermediate, and final values of waffle reinforcement spacing at points defined by ϕ or s table.	5E14.7
d.	Initial, intermediate, and final values of waffle rib thickness at points defined by ϕ or s table.	5E14.7
e.	Initial, intermediate, and final values of inward or outward distance to waffle reinforcement centroid at points defined by ϕ or s table. This is a signed ($\pm$) value, measured from the basic shell centroid to the centroid of the waffle reinforcement, positive inward.	5E14.7
f.	Initial, intermediate, and final values of equivalent "smeared" thickness of the waffle reinforcement at points defined by ϕ or s table. [Note: "smeared" thickness refers to average thickness of stiffener per stiffener spacing ($\bar{t}$ = stiffener cross-sectional area/spacing).]	5E14.7
g.	Initial, intermediate, and final values of inner face sheet thickness (h_i) at points defined by ϕ or s table. (If single-sheet construction, items h and i must be included but can be replaced by blank cards.)	5E14.7
h.	Initial, intermediate, and final values of core thickness (t) at points defined by ϕ or s table.	5E14.7
i,	Initial, intermediate, and final values of outer face sheet thickness (h_o) at points defined by ϕ or s table. (If equal-size face sheet sandwich, this card still must be included and thus will be the same as card g.)	5E14.7

SEGMENT CARDS (Continued)

	Column	Format
If the Reinforcement Clue is ST10:		
a. Initial, intermediate, and final values of extreme inward θ distance to reinforcement edge at points defined by ϕ or s table. This is a signed (±) value, measured from the basic shell centroid to the extreme point of shell or ring, positive inwards.		5E14.7
b. Initial, intermediate, and final values of extreme outward θ distance to reinforcement edge at points defined by ϕ or s table. This is a signed (±) value, measured from the basic shell centroid to the extreme point of shell or ring, positive inwards.		5E14.7
c. Initial, intermediate, and final values of extreme inward ϕ distance to reinforcement edge at points defined by ϕ or s table. This is a signed (±) value, measured from the basic shell centroid to the extreme point of shell or stringer, positive inwards.		5E14.7
d. Initial, intermediate, and final values of extreme outward ϕ distance to reinforcement edge at points defined by ϕ or s table. This is a signed (±) value, measured from the basic shell centroid to the extreme point of shell or stringer, positive inwards.		5E14.7
e. Initial, intermediate, and final values of ring reinforcement spacing at points defined by ϕ or s table.		5E14.7
f. Initial, intermediate, and final values of stringer reinforcement spacing at points defined by ϕ or s table.		5E14.7
g. Initial, intermediate, and final values of ring thickness at points defined by ϕ or s table.		5E14.7

If the rings or stringers are other than a plate rib in shape (i.e., hat or "c" sections), the values in items g and h should be the largest-width dimension of the reinforcement construction.

h.	Initial, intermediate, and final values of stringer thickness at points defined by ϕ or s table.	5E14.7
i.	Initial, intermediate, and final values of inward or outward distance to ring reinforcement centroid at points defined by ϕ or s table. This is a signed (±) value, measured from the base shell centroid to the centroid of the ring reinforcement, positive inward.	5E14.7
j.	Initial, intermediate, and final values of equivalent smeared thickness of the ring reinforcement at points defined by ϕ or s table. [Note: "Smeared" thickness refers to average thickness of stiffener per stiffener spacing ($\bar{t}$ = stiffener cross-sectional area/spacing).]	5E14.7
k.	Initial, intermediate, and final values of inward or outward distance to stringer reinforcement centroid at points defined by ϕ or s table. This is a signed (±) value, measured from the base shell centroid to the centroid of the ring reinforcement, positive inward.	5E14.7
l.	Initial, intermediate, and final values of equivalent smeared thickness of the stringer reinforcement at points defined by ϕ or s table.	5E14.7

If the reinforcement is unidirectional (i.e., only rings or only stringers), the appropriate values in items e through l referring to the nonexistent reinforcement can be replaced by blank cards.

m.	Initial, intermediate, and final values of inner face sheet thickness (h_i) at points defined by ϕ or s table. (If single-sheet construction, items n and o must be included but can be replaced by blank cards.)	5E14.7

	Column	Format
n. Initial, intermediate, and final values of core thickness (t) at points defined by ϕ or s table.		5E14.7
o. Initial, intermediate, and final values of outer face sheet thickness (h_0) at points defined by ϕ or s table. (If equal-size face sheet sandwich, this card still must be included and thus will be the same as card m.)		5E14.7

12. Mass Density Card. The contents of this card are the numerical values of the mass densities of the shell segment and its reinforcements.

	Column	Format
a. Segment skin mass density This value is the mass density of the skin material whether it be of single-sheet (SING), equal-sheet (EQUA), or unequal-sheet (UNEQ) construction. If equal- or unequal-sheet sandwich construction, both face sheets must be of the same material.	1-14	E14.7
b. Segment core mass density This value is the mass density of the core material in a sandwich construction. Often the core material has such a small mass density compared with the skin that this value is taken as zero. If a value other than zero is used, it must be remembered that the basic shell centroid calculation must include the core material. (If single-sheet construction, this value is taken as zero.)	15-28	E14.7
c. Segment inner reinforcement mass density This value is the mass density of the reinforcement material used on the inside of the shell segment whether it be waffle construction (RWAF), ring, or stringer construction (ST10). If no inside reinforcement is used this value is taken as zero.	29-42	E14.7

SEGMENT CARDS (Continued)

		Column	Format
d.	Segment outside reinforcement mass density This value is the mass density of the reinforcement used on the <u>outside</u> of the shell segment whether it be waffle construction (RWAF), ring, or stringer construction (ST10). If no outside reinforcement is used this value is taken as zero.	43-56	E14.7

Note: The mass density value is calculated as follows:

$\rho = \gamma/g$ $\qquad \gamma = \text{lb/in.}^3$

$= \text{lb-sec}^2/\text{in.}^4$ $\qquad g = 386.4 \text{ in./sec}^2$

13. Angular Velocity Card. The contents of this card are the numerical values of the angular velocity of the segment.

		Column	Format
a.	This card contains the angular velocity values that correspond to the number of problems to be run. (See Program Control Card item 2e.)		5E14.7

14. Segment Topology Cards

		Column	Format
a.	Segment number Number of the segment under consideration.	1-5	I5
b.	Joint (i) Joint associated with ith end of the segment (TIC).	6-10	I5
c.	Joint (j) Joint associated with the jth end of the segment (STOP).	11-15	I5

Since within a region the segments are all singly connected, the segment joint numbers should be in adjacent numerical pairs. That is, if joint (j) is 6, joint (i) could only be 5 or 7. This is true only <u>within</u> a region. In addition, the initial joint of each region must be 1 in <u>segment</u> topology numbering, and the final joint of each region must be the last (highest) number in the <u>segment</u> topology numbering (Fig. 11). The coordinate ϕ or s increases from TIC to STOP, i to j. The user is again advised to see Figures 3 through 10.

INTRA-REGION KINEMATIC LINK CARDS	Column	Format
These cards, if any exist (Region Introductory Card, item 1b), are placed at the end of all the segment data for the region. They contain the following information:		
a. Joint (j) dependent joint	1-2	I2
b. Joint (i) independent joint For intra-region kinematic links these joints must be in consecutive decending order. That is, joint (j) should always be greater than joint (i) by one.	3-4	I2
c. Angle γ in radians (Fig. 16) Angle γ cannot equal o or π. The angle γ describes the orientation of the link; it is the inclination angle of the link from the vertical (Z-axis). The number of kinematic link cards must equal the number specified in item 1b of the Region Introductory Card.	5-19	E14.7

REGION JOINT CONTROL DATA CARDS

These cards are placed at the end of the data for all regions.

1. Joint Control Data Card

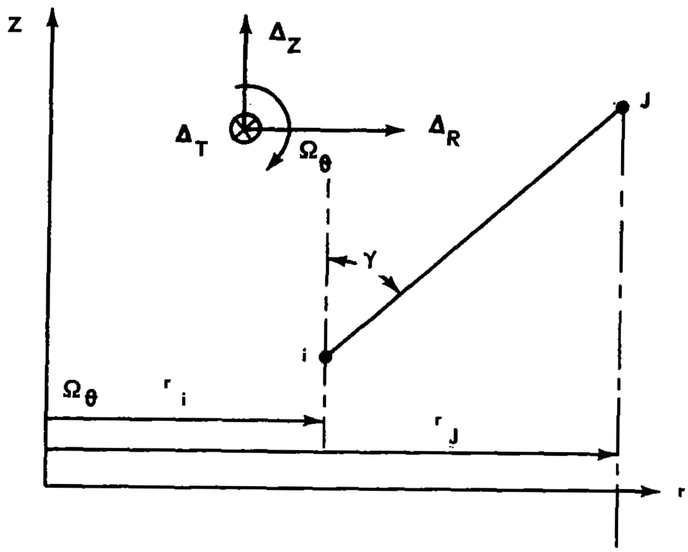
a. Number of region joints Total number of region joints for problem (max. = 20).	1-5	I5
b. Number of kinematic links Total number of kinematic links between regions for problem.	6-10	I5

	Column	Format
2. Kinematic Link Cards (inter-region)		
a. Joint (j) dependent joint	1-2	I2
b. Joint (i) independent joint	3-4	I2
For kinematic links between regions there are no restrictions upon joint numbering. If there is more than one inter-region kinematic link, the dependent joint (j) numbering, as they appear in the data deck, must be in an increasing order.		
c. Angle γ in radians (Fig. 16) Angle γ cannot equal 0 or π. The angle γ describes the orientation of the link; it is the inclination of angle of the link from the vertical (Z-axis). The number of kinematic link cards must equal the number specified in item 1b of the Joint Control Data Card.	5-19	E14.7
3. Boundary Condition Cards (joint data — one card per region joint)		
a. Joint number	1-2	I2
b. Joint component conditions on:		
(1) Δ_T	3-4	F2.0
(2) Δ_Z or Δ_N (Figs. 17 and 18)	5-6	F2.0
(3) Δ_R or Δ_Q	7-8	F2.0
(4) Ω_θ	9-10	F2.0

Four different codes are used to prescribe joint component conditions. They are:

(a) 0 = no displacement allowed.

(b) 1 = displacement allowed in the indicated direction.



$$
\begin{Bmatrix} \Delta_{T_J} \\ \Delta_{Z_J} \\ \Delta_{R_J} \\ \Omega_{\theta_J} \end{Bmatrix} = \left[\begin{array}{c|c|c|c} \frac{r_J}{r_i} & 0 & 0 & 0 \\ 0 & +1 & 0 & -(r_J - r_i) \\ 0 & 0 & +1 & (r_J - r_i) \cot \gamma \\ 0 & 0 & 0 & +1 \end{array} \right] \begin{Bmatrix} \Delta_{T_i} \\ \Delta_{Z_i} \\ \Delta_{R_i} \\ \Omega_{\theta_i} \end{Bmatrix}
$$

Figure 16. Kinematic link.

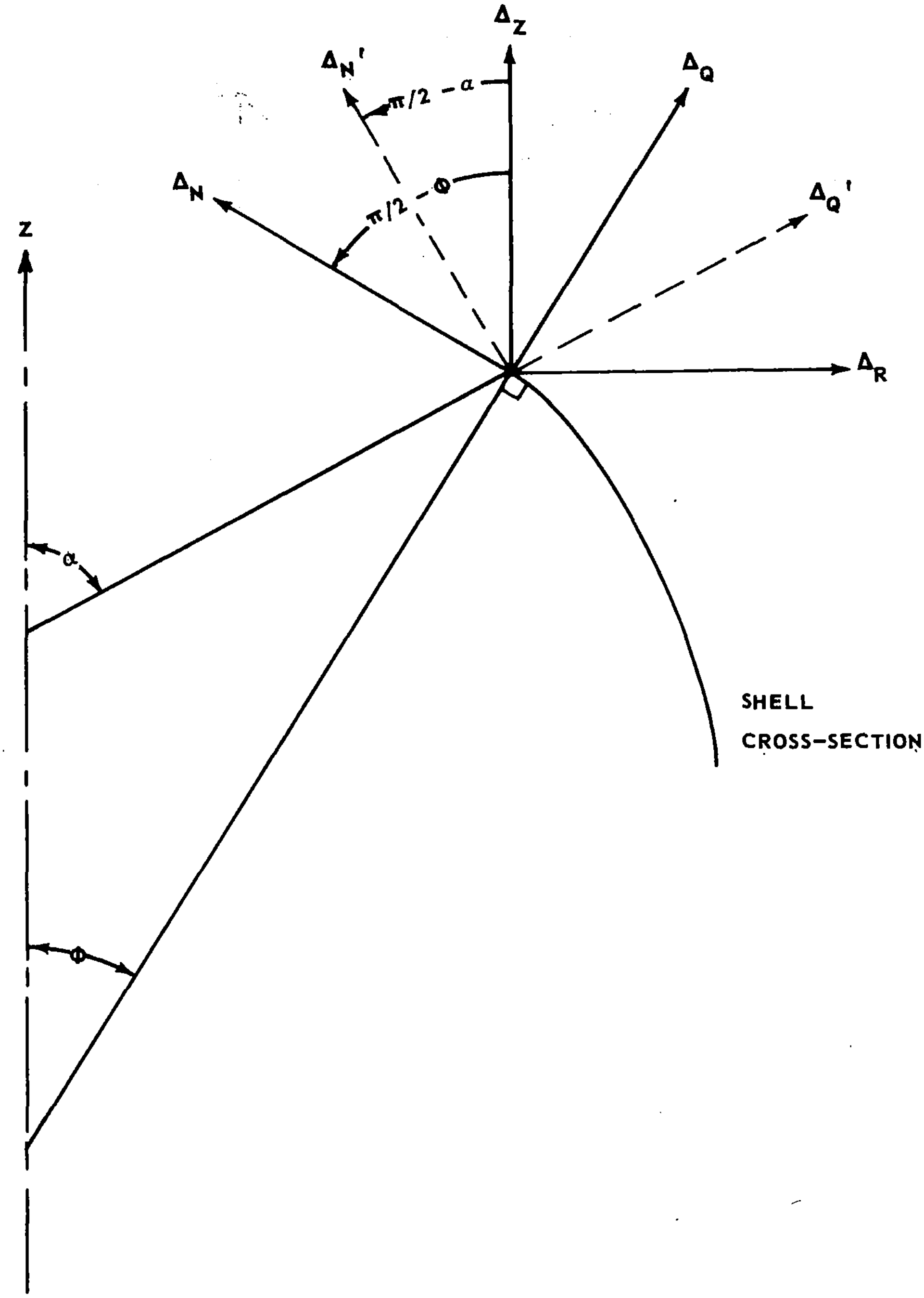
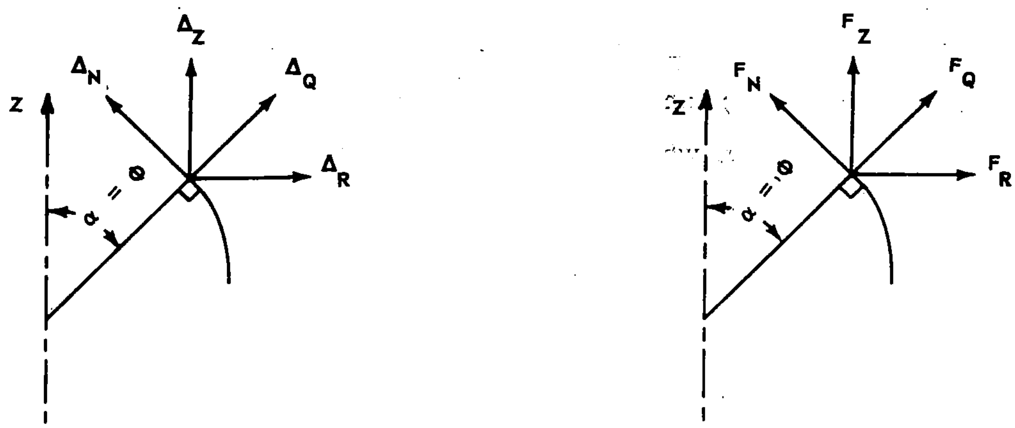


Figure 17. Description of general coordinate rotation $(\alpha \neq \phi)$.



$$\begin{array}{l c}
\text{ROTATION CODE} & \begin{array}{cccc} \quad 1 \quad & \quad 2 \quad & \quad 3 \quad & \quad 1 \quad \end{array} \\
\text{MATRIX} & \left\{\begin{matrix} \Delta_T \\ \Delta_Z \\ \Delta_R \\ \Omega_\theta \end{matrix}\right\} = \left[\begin{array}{c|c|c|c} +1 & 0 & 0 & 0 \\ 0 & \text{SIN } \alpha & \text{COS } \alpha & 0 \\ 0 & -\text{COS } \alpha & \text{SIN } \alpha & 0 \\ 0 & 0 & 0 & +1 \end{array}\right] \left\{\begin{matrix} \Delta_T \\ \Delta_N \\ \Delta_Q \\ \Omega_\theta \end{matrix}\right\}
\end{array}$$

$$\begin{array}{l c}
\text{ROTATION CODE} & \begin{array}{ccc} \quad 1 \quad & \quad 2 \quad 0 \quad & \quad 1 \quad \end{array} \\
\text{MATRIX} & \left\{\begin{matrix} \Delta_T \\ \Delta_Z \\ \Delta_R \\ \Omega_\theta \end{matrix}\right\} = \left[\begin{array}{c|c|c} +1 & 0 & 0 \\ 0 & \text{SIN } \alpha & 0 \\ 0 & -\text{COS } \alpha & 0 \\ 0 & 0 & +1 \end{array}\right] \left\{\begin{matrix} \Delta_T \\ \Delta_N \\ \Omega_\theta \end{matrix}\right\}
\end{array}$$

$$\begin{array}{l c}
\text{ROTATION CODE} & \begin{array}{ccc} \quad 1 \quad & \quad 0 \quad 3 \quad & \quad 1 \quad \end{array} \\
\text{MATRIX} & \left\{\begin{matrix} \Delta_T \\ \Delta_Z \\ \Delta_R \\ \Omega_\theta \end{matrix}\right\} = \left[\begin{array}{c|c|c} +1 & 0 & 0 \\ 0 & \text{COS } \alpha & 0 \\ 0 & \text{SIN } \alpha & 0 \\ 0 & 0 & +1 \end{array}\right] \left\{\begin{matrix} \Delta_T \\ \Delta_Q \\ \Omega_\theta \end{matrix}\right\}
\end{array}$$

Figure 18. Provision for local rotations.

(c) 2 = Δ_Z and Δ_R are rotated through an angle of $(\pi/2 - \alpha)$ and become Δ_N and Δ_Q, respectively, while a displacement is allowed in the Δ_N direction.

(d) 3 = Δ_Z and Δ_R rotated through an angle of $(\pi/2 - \alpha)$ and become Δ_N and Δ_Q, respectively, while a displacement is allowed in the Δ_Q direction.

When using rotation codes code 2 can exist only as Δ_Z coding; code 3 can exist only as Δ_R coding. Codes 0 and 1 can appear in either column 4 or column 6, in addition to columns 8 and 10. Thus, there are 12 possible boundary conditions when rotation codes are used ($\alpha = \phi$ for the following table). (See Figs. 17 and 18 for an explanation of codes 2 and 3).

	Free Edge (possible to apply shear and/ or membrane loads)	$\Delta_Q = 0$, Normal Support (possible to apply membrane load)	$\Delta_N = 0$, Membrane Support (possible to apply shear load)
Δ_T, Ω_θ Free	1, 2, 3, 1	1, 2, 0, 1	1, 0, 3, 1
Δ_T, Ω_θ Fixed	0, 2, 3, 0	0, 2, 0, 0	0, 0, 3, 0
Δ_T Fixed Ω_θ Free	0, 2, 3, 1	0, 2, 0, 1	0, 0, 3, 1
Δ_T Free Ω_θ Fixed	1, 2, 3, 0	1, 2, 0, 0	1, 0, 3, 0

	Column	Format
Notes: (1) To establish a datum for measuring displacement, free body motion must be eliminated from the structure; this should be accomplished by suitably applied boundary conditions, and (2) the ability of a dependent joint in a kinematic link to prescribe motion independently should be removed by setting all boundary conditions of that joint to zero (see the subsequent subsection, titled New Problem Cards).		
c. Angle α in radians	11-24	E14.1
To be used only in conjunction with a 2 or 3 code.		

Note: There must be as many Boundary Condition Cards as there are joints as indicated in item 1a of the Joint Control Data Card.

JOINT LOAD DATA CARDS

1. Load Control Data Card

	Column	Format
a. Number of joint loads	1-4	I4
Total number of joint loads in analysis. (Line loads can only be applied to region joints.)		
b. Any alphameric information (load description)	5-69	16A4

2. Joint Load Cards (as many as in item 1a above)

	Column	Format
a. Problem number	1-5	I5
Number of loading problem in which the line load exists. (See Program Control Card, item 2e.)		
b. Row identification	6-10	I5
The identification is the location of the degree of freedom at which the load is applied. This is obtained by counting the nonzero codes entered in the Boundary Conditions Cards, starting with		

JOINT LOAD DATA CARDS (Concluded) | Column | Format

Joint 1; T, Z, R, Ω_θ, Joint 2; T, Z, ... etc., and stopping at the joint and degree of freedom where the line load is to be applied. The location number of this degree of freedom is the information necessary.

c. Applied joint load | 11-24 | E14.7

The input is $2\pi r_0$ times the running load in lb/in. In the particular case of the axial axisymmetric load, this is simply the net force. For the sign convention, see Figures 13, 14, 15, 17, and 18.

3. Problem Termination Card

a. A blank card is required by the program only if there is no joint load data.

NEW PROBLEM CARDS

It may be necessary to repeat a problem with some different data. This may be accomplished in the following ways:

1. Loading Changes. With the present program five separate loading problems can be run simultaneously. This applies both to distributed and line loads.

2. Full Data Duplication. If it is desired to analyze a new structure, it is necessary to submit a complete new individual data deck. If several data decks are to be run with one submission, the decks must be stacked. The number of full data decks that can be stacked in one submission is limited only by time requirements.

It is hoped that the user is now able to use the ASTROS Computer Program to good advantage. It is a powerful tool, which will increase in value to the user as he uses it. One of the more complex areas of input is the description of topology, especially when involved with rotation codes and joint loads. An illustrative example of a Y-joint representation is therefore presented (see Fig. 19 for the structure and idealization). The idealized structure contains three regions and two kinematic links. The region joints

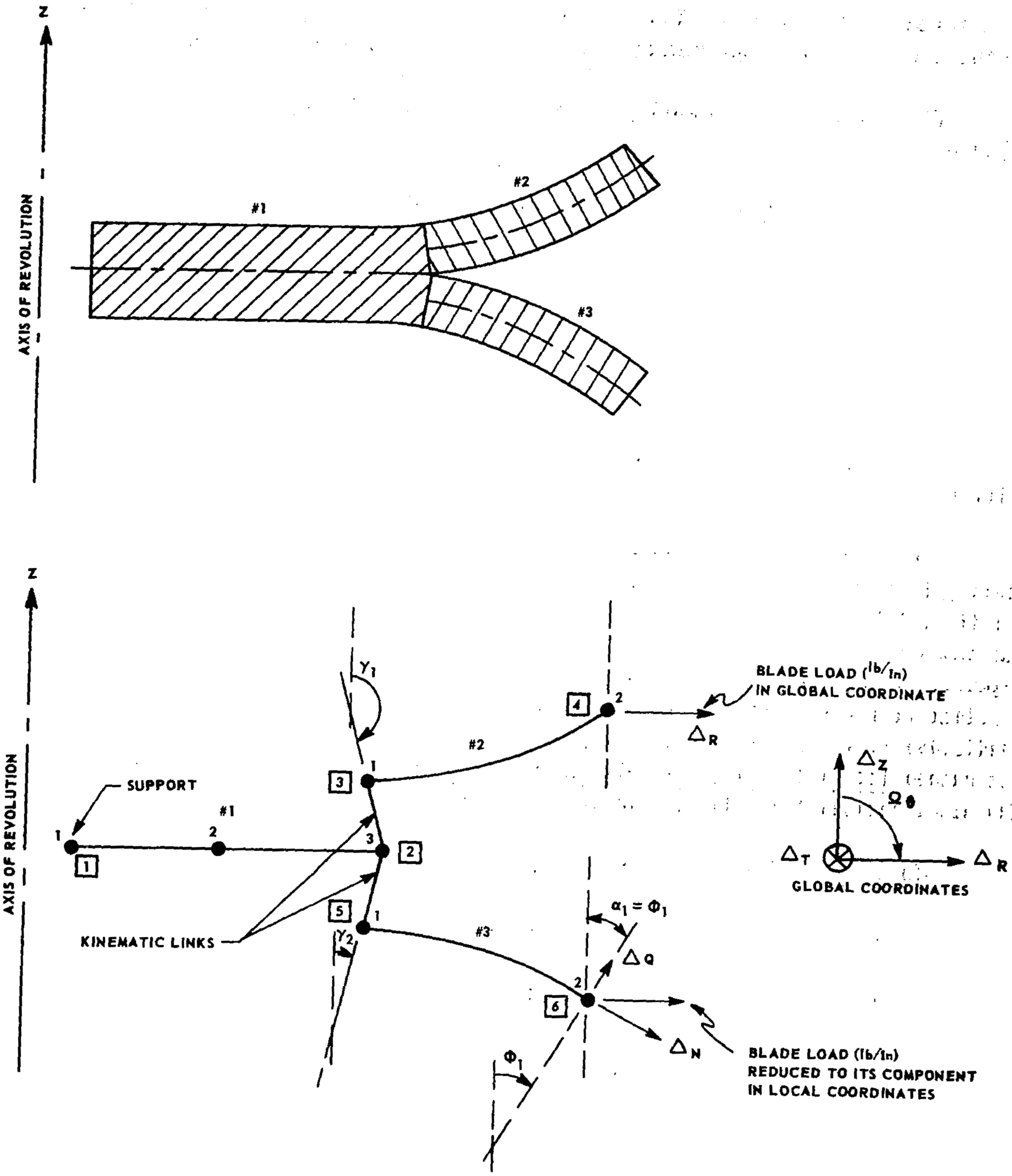


Figure 19. Y-joint and idealization.

are numbered from 1 to 6. Loads are applied (blade loads) to joints 4 and 6, and the structure is supported at joint 1. All regions must be coupled.

The second card in each region description (topology card) is as follows:

Region	Joint (i)	Joint (j)
1	1	2
2	3	4
3	5	6

The Joint Control Data Card would contain a 6 in column 5 and a 2 in column 10.

In this example, the restraint at joint 6 must be rotated from the fixed (global system) to a local system so that loads may be applied. In addition, joints 2 and 3 and 2 and 5 are to be coupled with kinematic links. Thus, the motions of joints 3 and 5 are dependent upon the motion of joint 2. This dependence will be insured by using two Kinematic Link Cards and setting the displacements of joints 3 and 5 equal to zero. It should be noted in this particular case that the motion of joints 3 and 5 is not being equated to zero, but rather the ability to prescribe motion independently is being removed. The data required for the Kinematic Link Cards have the following appearance:

Joint (j)	Joint (i)	Angle
3	2	γ_1
5	2	γ_2

Note: In a double link of the type shown in Figure 19, one joint must be consistently independent (joint 2 in this example).

The data required for the Boundary Condition Cards have the following appearance:

Joint	T	Z	R	θ	Angle
1	1	0	1	0	
2	1	1	1	1	
3	0	0	0	0	
4	1	1	1	1	
5	0	0	0	0	
6	1	2	3	1	α_1

The Load Control Data Card would contain a 3 in column 4.

The external loads (one load problem assumed) are applied to the structure through the Joint Load Cards which, in this example, would appear as:

Problem No.	Row	Load
1	9	$2\pi R_0 \times \Delta_R$ Load (lb/in.)
1	12	$2\pi R_0 \times \Delta_N$ Load (lb/in.)
1	13	$2\pi R_0 \times \Delta_Q$ Load (lb/in.)

In Appendix B, example problem 1 has been set up to determine the elastic stresses in a gas-turbine disk in a thermal environment. This problem serves as a typical example of rotating machinery problems.

In Appendix C, example problem 2 has been set up merely to show the complex geometries that the program can handle.

OUTPUT INFORMATION

The output of the ASTROS program is straightforward; however, a description is in order since the user should learn the signficance of the various checks that are provided. In addition, familiarity will be required with the possible error messages. It is important to point out that the output of the program will include a printout of the input data. This gives the user the opportunity to check whether the input data were correct. In the detailed description of the complete output which follows, the user should refer to the output of the problems in Appendix B as examples.

The title page of the output contains all the data from the General Introductory Cards, prominently placed, and needs no comment. The next page of the output contains the first region Identification Card in the center. The following output is then presented for each segment in this region (in order of appearance):

1. Contents of segment Identification Card

2. Contents of MAGIC Control and Segment Sizing Card

3. Contents of Geometric Description Card

4. Contents of Master Clue Card

5. The material property table used for the segment

6. Cross-section description table

7. Temperature load table (if any)

8. Distributed load tables (printed per problem)

9. Contents of Nonlinear Cards (if any)

10. Segment influence coefficients (MAGIC output)

11. Segment stiffness matrix

12. Stiffness matrix symmetry check

13. Segment load matrices

Item 12, the stiffness matrix symmetry check, is a check upon the validity of segment sizing and the accumulation of round-off error. For perfect symmetry to exist, it is necessary to have zeros above the main diagonal and zeros or ones below the diagonal. The amount of error induced by improper sizing or round-off is related to the amount that the off-diagonal terms in the lower triangle differ from unity. An attempt should be made to keep the upper limit on this difference at one percent (maximum number in lower triangle differ from unity. An attempt should be made to keep the upper limit on this difference at one percent (maximum number in lower triangle should be 0.1010. . . E 01).

As mentioned previously, items 1 through 13 are repeated for all the segments within region one. At this stage in the output, the topology of the segments within the region and the description of the intra-region kinematic links are presented. In the segment topology, the radius of revolution at every joint is also given. These should be checked at corresponding joints of adjacent segments to make sure that proper coupling has been specified.

At this point in the output the region matrices are presented. Given in order are the region stiffness matrix, the stiffness matrix symmetry check, and the region load matrices. Again the numerical round-off, evident in the symmetry check, should be kept to a maximum of one percent (0.1010. . . . E 01 in lower triangle). The output to this point, that is, sets of items 1 through 13, segment topology and links, and the region matrices, are now repeated as a group for each region within the structure. When this is completed, the region topology is presented. In this area, the appropriate radii of revolution are again provided for checks. The next items to be provided by the output are the descriptions of the inter-region kinematic links and the boundary conditions. At external points of the structure these are physical boundary conditions. At internal points they merely state the fact that no restraint exists and the joint in question is free to move. The last column in this set gives the angle α, which is zero unless a rotation code is indicated. It is important to refer to Figures 17 and 18 once more and point out that α represents a rotation of the coordinate system.

A variety of errors can be made in submitting input data. Certain errors may be detected and can be signaled by specially programmed error messages. The messages are mainly self-explanatory and are presented as follows.

IERROR = 8000

ONE OF THE MATERIAL PROPERTY TABLES CANNOT BE IDENTIFIED AS ISOT, ORTH, OR STIF.

IERROR = 8036

A MATERIAL PROPERTY TABLE NAME FOR A SEGMENT CANNOT BE FOUND IN THE TABLE LIST.

IERROR = 8086

THE TYPE OF GEOMETRY OF A SEGMENT CANNOT BE IDENTIFIED AS ONE HANDLED BY THE PROGRAM

IERROR = 8087

THE TYPE OF MATERIAL PROPERTY TABLE FOR A SEGMENT CANNOT BE IDENTIFIED AS ISOT, ORTH, OR STIF.

IERROR = 8089

THE WALL CONSTRUCTION OF A SEGMENT CANNOT BE IDENTIFIED AS SING, EQUA, UNEQ OR BLAN.

IERROR = 8090

THE TYPE OF TEMPERATURE INPUT FOR A SEGMENT CANNOT BE IDENTIFIED AS THST, NOTH, THCN, OR THIN.

IERROR = 8013

THE PROGRAM CANNOT DETERMINE WHETHER THE PROBLEM INPUT IS LINEAR OR NONLINEAR.

IERROR = 8009

THE PROGRAM CAN EXECUTE ONLY ONE NONLINEAR PROBLEM PER DATA DECK.

IERROR = 8031

THE LOAD INDICATOR CLUES CAN ONLY BE ZERO, BLANK, ONE OR FOUR.

IERROR = 8008

THE PROGRAM CAN EXECUTE ONLY ONE THERMAL LOAD PROBLEM PER DATA DECK.

IERROR = 8001

THE MAGIC CYCLE HAS GONE PAST STOP BY MORE THAN THE PERMITTED VALUE. CHECK TO SEE IF FIXED STEP SIZE IS TOO LARGE.

IERROR = 8003

THE FIRST ST TABLE VALUE (PHI OR S) SHOULD BE OVERLAPPED.

IERROR = 8006

THE LAST ST TABLE VALUE (PHI OR S) SHOULD BE OVERLAPPED.

IERROR = 8007

THE INTERPOLATED VALUE OF TEMPERATURE FOR THE MATERIAL PROPERTY TABLE IS LESS THAN THE SECOND TEMPERATURE VALUE.

IERROR = 8067

THE INTERPOLATED VALUE OF TEMPERATURE FOR THE MATERIAL PROPERTY TABLE IS GREATER THAN THE LAST VALUE OF TEMPERATURE.

IERROR = 8101

THE K11 STIFFNESS PARAMETER IS ZERO.

IERROR = 8102

THE K12 STIFFNESS PARAMETER IS ZERO.

IERROR = 8104

THE K22 STIFFNESS PARAMETER IS ZERO.

IERROR = 8105

THE K33 STIFFNESS PARAMETER IS ZERO.

IERROR = 8106

THE D11 STIFFNESS PARAMETER IS ZERO.

IERROR = 8107

THE D12 STIFFNESS PARAMETER IS ZERO.

IERROR = 8109

THE D22 STIFFNESS PARAMETER IS ZERO.

IERROR = 8110

THE D33 STIFFNESS PARAMETER IS ZERO.

IERROR = 8088

THE PROGRAM CANNOT DETERMINE WHETHER THE PROBLEM INPUT IS THIC, RWAF, OR ST10.

IERROR = 8120

THE Y2 BLOCK IN THE SEGMENT MAGIC OUTPUT IS SINGULAR.

IERROR = 8841

IN THE COMPUTATION OF THE REGION STIFFNESSES, THE K22 MATRIX WAS NOT POSITIVE DEFINITE.

IERROR = 8777

IN THE COMPUTATION OF THE REDUCED FLEXIBILITY MATRIX, THE REDUCED STIFFNESS MATRIX IS NOT POSITIVE DEFINITE.

IERROR = 8797

FOR KINEMATIC LINKS BETWEEN SEGMENTS, THE DEPENDENT JOINT NUMBER MUST BE GREATER THAN THE INDEPENDENT JOINT NUMBER.

IERROR = 8787

THE NUMBER OF POINTS IN ST TABLE MUST BE BETWEEN 2 AND 30.

IERROR = 8501

FOR NONLINEAR ANALYSIS, HARMONIC MUST BE ZERO.

All the above error messages will undoubtedly be caused by erroneous input data, including the ones on matrix singularity. Error 8120 will probably be caused by improper segment sizing. Error 8841 could be caused by bad segment sizing, bad segment topology, or bad intra-region links. Error 8777 could be caused by bad region topology, bad inter-region links, or improper boundary conditions. If the problem is correctly set up and idealized, only an unfortunately awkward geometric combination could cause matrices which are so ill-conditioned as to trip one of the singularity errors [5].

After having corrected any errors so that it is now possible for the program to run to completion, the problem solution can be discussed. The first item provided which represents the solution of the problem is the structure flexibility matrix. This matrix should also be checked for symmetry. After the reduced flexibility matrix, the applied line loads and the region end deflections are presented per problem. The deflection values are given for the region joints in numerical order, starting from joint 1.

Following this output, the program prints the internal load distribution results per segment. First, there is a reproduction of some input data previously discussed. Next, there appears a diagram which outlines the format of the tabulated results; see Table 1 for interpretation. Below that appear the numerical results for each point where a printout is called. They are printed out at a prescribed interval and per problem. Special cases can occur, depending upon meridional and wall cross-section geometries. Treating the block of numbers as a matrix:

1. The 1, 2 element will be zero for cylinders and cones.

2. The 3, 2 and 4, 2 elements will be the same for linear analyses.

3. The 6, 2 and 7, 2 elements will be zero for a nonsandwich construction or a sandwich construction with reinforcement.

4. The 6, 2 and 7, 2 and the 6, 6 and 7, 6 elements will be zero for any reinforced construction. The 6, 6 and 7, 6 stress calculations are not useful for design or failure criteria, since such criteria are material dependent. However, they are useful for comparison since they combine all stress components in a consistent manner characterized by a single number (see vol. I, p. 3-14, of Ref. 1).

TABLE 1. TABULATED OUTPUT INFORMATION[a]

1, 1	PHI (RAD OR IN) -----------	Φ or s at which calculations are made
2, 1	EPSILON THETA -----------	$\epsilon\theta$, circumferential strain (in./in.)
3, 1	U -----------------------	circumferential displacement (in.)
4, 1	V -----------------------	meridional displacement (in.)
5, 1	W -----------------------	normal displacement (in.)
6, 1	OMEGA THETA ------------	$\omega\theta$, circumferential rotational displacement (rad)
7, 1	OMEGA PHI --------------	$\omega\phi$, meridional rotational displacement (rad)
1, 2	DEGREE -----------------	Φ expressed in degrees
2, 2	EPSILON PHI -------------	$\epsilon\phi$, meridional strain (in./in.)
3, 2	Q PHI -------------------	$Q\phi$, meridional transverse shear stress resultant (lb/in.)
4, 2	J PHI -------------------	$J\phi$, effective meridional transverse shear stress resultant (lb/in.)
5, 2	Q THETA -----------------	$Q\theta$, circumferential transverse shear stress resultant (lb/in.)
6, 2	TAU ZETA PHI = Q/T -------	$\tau\zeta\phi = Q\phi/t$, meridional transverse shear stress (lb/in.^{2})
7, 2	TAU ZETA THETA = Q/T -----	$\tau\zeta\theta = Q\theta/t$, circumferential transverse shear stress (lb/in.^{2})
1, 3	PRINT INTERVAL ----------	interval at which answers are printed out
2, 3	GAMMA PHI THETA --------	$\gamma\phi\theta$, shear strain (in./in.)
3, 3	K PHI THETA -------------	$K\phi\theta$, specific twist (in./in.)
4, 3	N THETA -----------------	$N\theta$, circumferential force resultant (lb/in.)
5, 3	M THETA -----------------	$M\theta$, circumferential bending moment resultant (in.-lb/in.)
6, 3	SIGMA THETA IN-----------	$\sigma\theta$ in, circumferential stress on inside fiber (lb/in.^{2})
7, 3	SIGMA THETA OUT ---------	$\sigma\theta$ out, circumferential stress on outside fiber (lb/in.^{2})
1, 4	STEP --------------------	numerical integration step size
2, 4	K PHI -------------------	$K\phi$, meridional curvature (1/in.)
3, 4	J PHI STAR --------------	$*J\phi$, nonlinear effective transverse shear stress resultant (lb/in.)
4, 4	N PHI -------------------	$N\phi$, meridional force resultant (lb/in.)
5, 4	M PHI -------------------	$M\phi$, meridional bending moment resultant (in.-lb/in.)
6, 4	SIGMA PHI IN ------------	$\sigma\phi$ in, meridional stress on inside fiber (lb/in.^{2})
7, 4	SIGMA PHI OUT------------	$\sigma\phi$ out, meridional stress on outside fiber (lb/in.^{2})
1, 5	R ZERO ------------------	R0, radius of revolution about Z-axis
2, 5	K THETA -----------------	$K\theta$, circumferential curvature (1/in.)
3, 5	T PHI THETA -------------	$T\phi\theta$, effective in-plane shear stress resultant (lb/in.)
4, 5	N PHI THETA -------------	$N\phi\theta$, in-plane shear stress resultant (lb/in.)
5, 5	M PHI THETA -------------	$M\phi\theta$, twisting moment resultant (in.-lb/in.)
6, 5	TAU PHI THETA IN ---------	$\tau\phi\theta$, in, in-plane shear stress on inside fiber (lb/in.^{2})
7, 5	TAU PHI THETA OUT--------	$\tau\phi\theta$ out, in-plane shear stress on outside fiber (lb/in.^{2})
1, 6	NUMBER OF CYCLES--------	number of cycles
2, 6	N TEMPERATURE THETA ----	$NT\theta$, circumferential temperature force resultant (lb/in.)
3, 6	N TEMPERATURE PHI-------	$NT\phi$, meridional temperature force resultant (lb/in.)
4, 6	M TEMPERATURE THETA ----	$MT\theta$, circumferential temperature bending moment resultant (lb/in.)
5, 6	M TEMPERATURE PHI ------	$MT\phi$, meridional temperature bending moment resultant (lb/in.)
6, 6	SIGMA F IN --------------	σF in, Huber-von Mises-Hencky effective stress (lb/in.^{2})
7, 6	SIGMA F OUT -------------	σF out, Huber-von Mises-Hencky effective stress (lb/in.^{2})

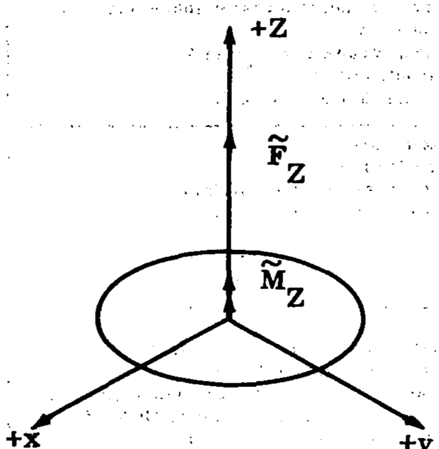
a. See Figures 13 through 15 for interpretation of the above table variables.

This completes the program output. The user is reminded to check the continuity of stress resultants across segment boundaries where applicable.

In utilizing the program, it is frequently necessary to relate applied edge loads to the net forces across a section. The relationship between forces in the fixed (global) coordinate system and any rotated coordinate system is given [1, 4, and 6] by the following relationship (Fig. 18):

$$\begin{Bmatrix} F_T \\ F_Z \\ F_R \\ M \end{Bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -s\phi & -c\phi & 0 \\ 0 & +c\phi & -s\phi & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{Bmatrix} F_T \\ F_N \\ F_Q \\ M \end{Bmatrix} . \qquad (1)$$

The relations between the net resultant external loads and the magnitudes of distributed edge loads are:



$$\begin{Bmatrix} \tilde{F}_Z \\ \tilde{M}_Z \end{Bmatrix} = 2\pi r_0 \begin{bmatrix} 0 & 1 & 0 & 0 \\ r_0 & 0 & 0 & 0 \end{bmatrix} \begin{Bmatrix} F_T \\ F_Z \\ F_R \\ M \end{Bmatrix} . \qquad (2)$$

It is frequently desirable to be able to calculate net forces at a cut section or a built-in edge directly from output values in order to check the equilibrium. The net forces in terms of the stress resultants (in local coordinates as they appear in the output) are:

$$
\begin{Bmatrix} \tilde{F}_Z\binom{i}{j} \\ \tilde{M}_Z\binom{i}{j} \end{Bmatrix} = \pm 2\pi r_0 \begin{bmatrix} 0 & +s\phi & +c\phi & 0 \\ -r_0 & 0 & 0 & 0 \end{bmatrix} \begin{Bmatrix} T_{\phi\theta}\binom{i}{j} \\ N_{\phi}\binom{i}{j} \\ J_{\phi}\binom{i}{j} \\ M_{\phi}\binom{i}{j} \end{Bmatrix} , \qquad (3)
$$

where the sign is chosen to correspond with the edge (i or j) on which the applied force is desired.

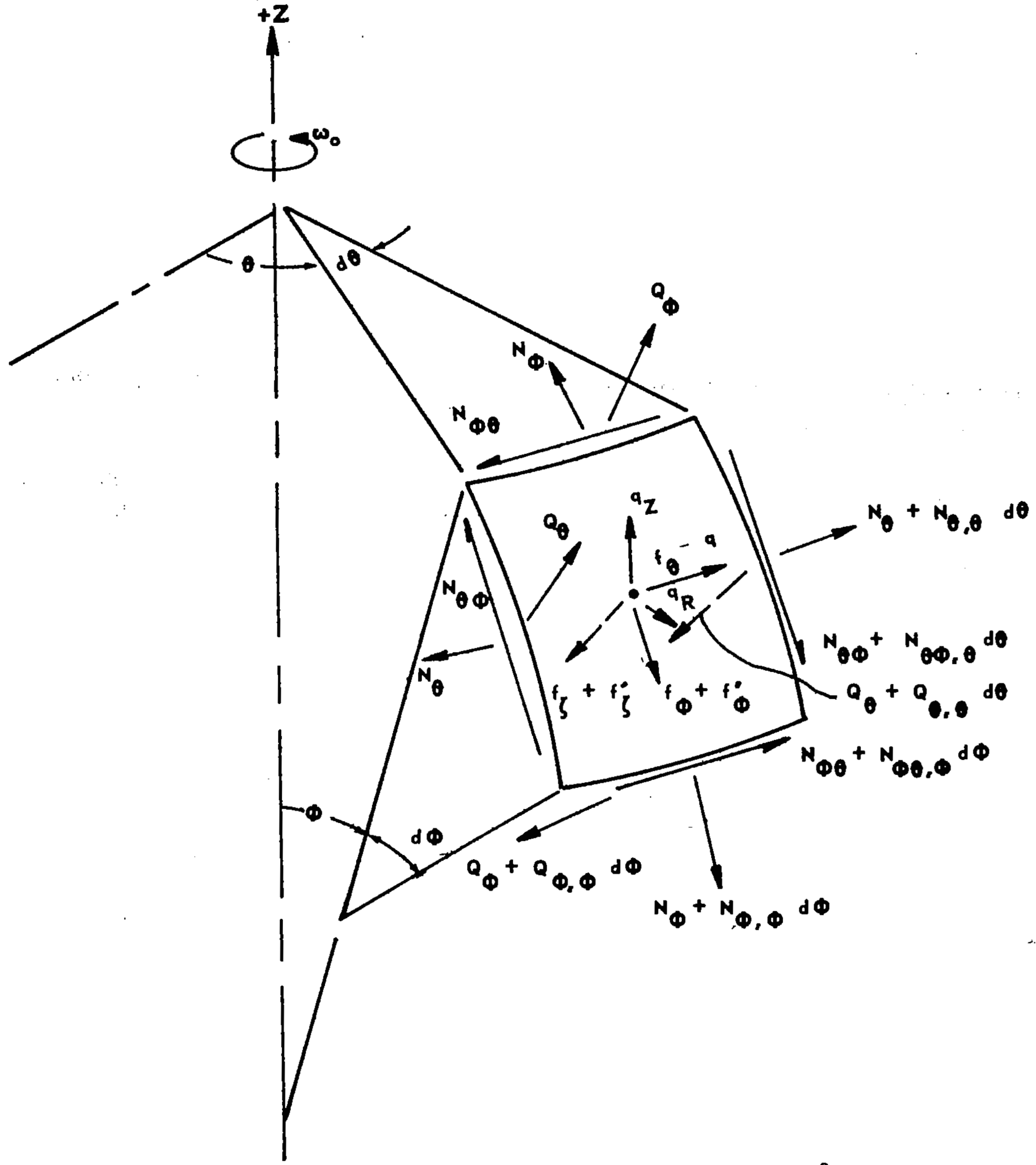
Equation (3) should be used to check the overall shell equilibrium for unfamiliar geometries because it is a good check on the solution to the problem.

THEORY

The ASTROS digital computer program is an automated procedure for the analysis of rotating structures constructed from thin shells of revolution, reinforced in various ways, and subjected to symmetric loads. The program can handle shells having multiple-connected joints, walls of sandwich construction, and thermal variations through the walls. The various shell geometries that can be handled by the program are ellipsoidal, spherical, ogival, paraboloidal, cylindrical, conical, or any selected special geometry.

For the general theory and derivations used by this program, refer to the STARS II Numerical Analysis of Shells [1]. The additional equations shown in this section express the inertial loads generated by rotation about the shell axis into equivalent static loads such that they can be used by the program as a static loading condition.

The equilibrium forces of a typical shell element are shown in Figures 20 and 21. The equilibrium equations corresponding to these forces have been changed from those listed in Reference 1 (equations 1-1b, 1-1c, and 1-1d). The changes were necessary because of the addition of the inertial forces. The new equilibrium equations are shown as follows.



Note: IL = Inertial Load due to rotation = mass × radius × ω_0^2 (perpendicular to axis of rotation).

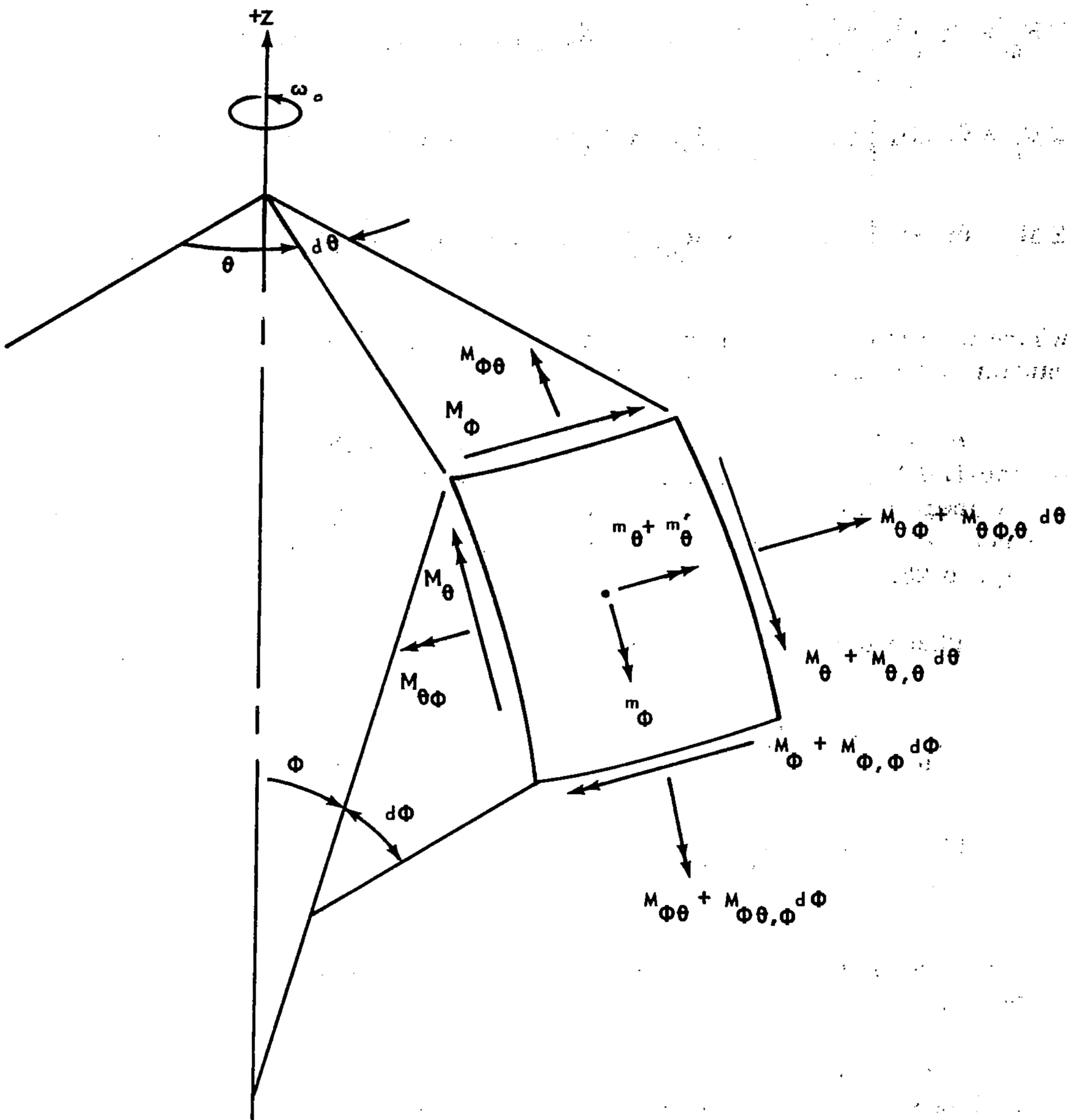
$$IL_\phi = (IL)\cos\phi \qquad\qquad IL_\zeta = (-IL)\sin\phi$$

$$= (\rho\omega_0^2\, r_0 \times h \times r_0 d\theta \times r_1 d\phi)\cos\phi \qquad\qquad = (-\rho\omega_0^2\, r_0 \times h \times r_0\, d\theta \times r_1 d\phi)\sin\phi$$

$$= r_1 r_0(\rho\omega_0^2\, r_0\, h\cos\phi\; d\theta\; d\phi) \qquad\qquad = -\,r_1 r_0(\rho\omega_0^2\, r_0\, h\sin\phi\; d\theta\; d\phi)$$

$$= r_1 r_0(f'_\phi\; d\theta\; d\phi) \qquad\qquad = -\,r_1 r_0(f'_\zeta\; d\theta\; d\phi)$$

Figure 20. Equilibrium forces.



Note: IM_{θ_n} = Inertial Moment due to eccentricity of n^{th} shell "layer" from reference surface.

$$IM_{\theta_n} = (-IL_n) \cos\phi\, \overline{y}_n$$

$$= (-\rho_n\, \omega_0^2\, r_0 \times h \times r_0\, d\theta \times r_1 d\phi) \cos\phi\, \overline{y}_n$$

$$= -r_1 r_0 (\rho_n\, \omega_0^2\, r_0\, h \cos\phi\, \overline{y}_n\, d\theta\, d\phi)$$

$$= -r_1 r_0 (m'_\theta\, d\theta\, d\phi)$$

Figure 21. Equilibrium moments.

$$\Sigma F_\phi = 0: \quad (N_\phi r_0)_{,\phi} + r_1 N_{\phi\theta,\theta} - N_\theta r_1 \cos\phi - r_0 Q_\phi = - r_1 r_0 (f_\phi + f'_\phi)$$

$$\Sigma F_\zeta = 0: \quad (Q_\phi r_0)_{,\phi} + r_1 Q_{\theta,\theta} + N_\theta r_1 \sin\phi + r_0 N_\phi = - r_1 r_0 (f_\zeta + f'_\zeta)$$

$$\Sigma M_\theta = 0: \quad -(M_\phi r_0)_{,\phi} - r_1 M_{\phi\theta,\theta} + M_\theta r_1 \cos\phi + r_0 r_1 Q_\phi = - r_1 r_0 (m_\theta + m'_\theta) \quad ,$$

where the prime (') quantities represent the contributions of the inertial loads caused by rotation about the Z-axis.

A sandwich shell segment with stiffeners is shown in Figure 22 with the inertial loads for each shell "layer" caused by rotation about the Z-axis. These inertial distributed loads can be represented by equivalent static forces per unit area and separated into normal and meridional components as shown in Figure 23.

These inertial distributed loads for any shell layer can be calculated as

$$f'_{\phi_n} = \rho\, \omega_0^2\, r_n\, h_n \cos\phi$$

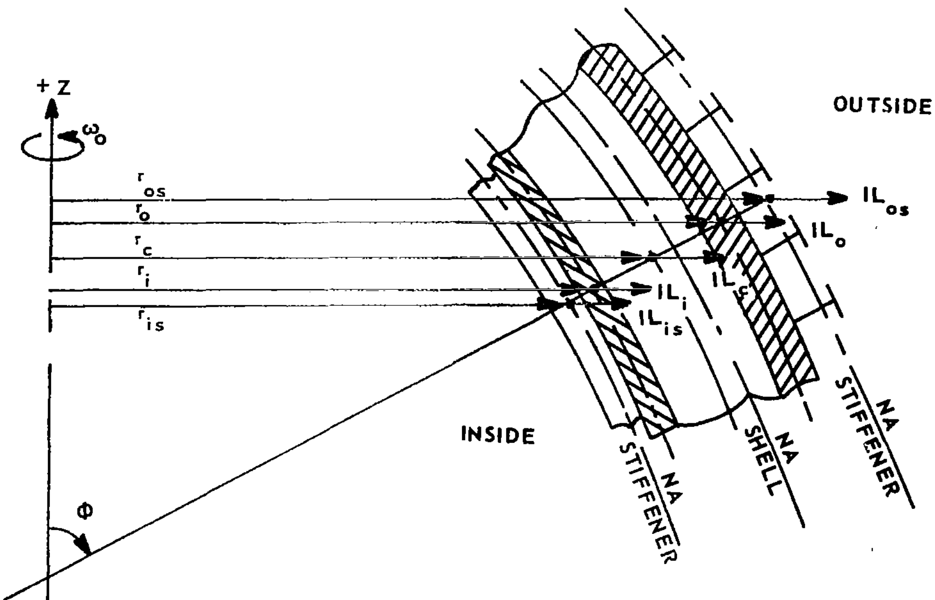
$$f'_{\zeta_n} = -\rho\, \omega_0^2\, r_n\, h_n \sin\phi$$

where the subscript n represents any desired layer (skin, core, or stiffener).

The static loads as shown in Figure 23 can be expressed at the neutral axis of the shell as seen in Figure 24, using the following expressions:

$$f'_{\phi_{total}} = \sum_n f'_{\phi_n} = f'_{\phi_{is}} + f'_{\phi_i} + f'_{\phi_c} + f'_{\phi_o} + f'_{\phi_{os}}$$

$$f'_{\zeta_{total}} = \sum_n f'_{\zeta_n} = f'_{\zeta_{is}} + f'_{\zeta_i} + f'_{\zeta_c} + f'_{\zeta_o} + f'_{\zeta_{os}}$$



IL_{is} = Inertial Load caused by inside stiffener

IL_i = Inertial Load caused by inside skin

IL_c = Inertial Load caused by core material

IL_o = Inertial Load caused by outside skin

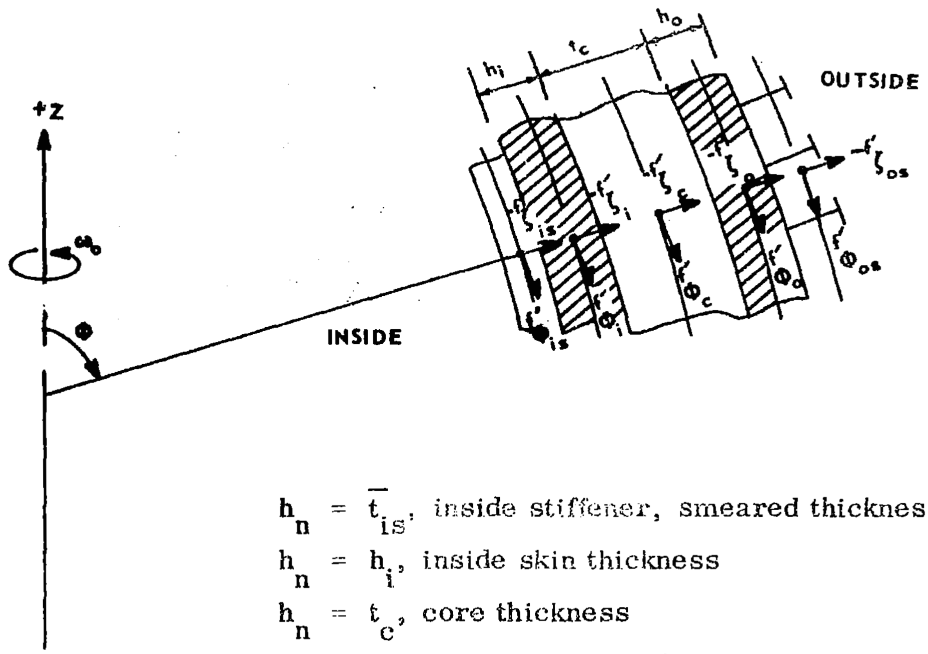
IL_{os} = Inertial Load caused by outside stiffener

Figure 22. Shell inertial distributed loads.

$$m'_{\theta\,total} = \sum_n m'_{\theta_n} = -f'_{\phi_{is}}\,\bar{y}_{is} - f'_{\phi_i}\,\bar{y}_i - f'_{\phi_c}\,\bar{y}_c - f'_{\phi_o}\,\bar{y}_o - f'_{\phi_{os}}\,\bar{y}_{os}$$

where the $\bar{y}$ is a signed value ($\pm$) measured from the basic shell centroidal axis to the centroid of the shell layer (positive inward).

Thus, the inertial distributed loads for any shell segment can be represented by equivalent static meridional, normal, and circumferential loads at the neutral axis of the shell as follows:



$h_n = \overline{t}_{is}$, inside stiffener, smeared thickness

$h_n = h_i$, inside skin thickness

$h_n = t_c$, core thickness

$h_n = h_o$, outside skin thickness

$h_n = \overline{t}_{os}$, outside stiffener, smeared thickness

$$\text{smeared thickness} = \left(\frac{\text{stiffener area}}{\text{stiffener spacing}}\right)$$

Figure 23. Shell equivalent static distributed loads.

$$f'_{\phi_{total}} = \left(\rho_{is}\,\omega_0^2\, r_{is}\,\overline{t}_{is} + \rho_i\,\omega_0^2\, r_i h_i + \rho_c\,\omega_0^2\, r_c t_c + \rho_o\,\omega_0^2\, r_o h_o + \rho_{os}\,\omega_0^2\, r_{os}\,\overline{t}_{os}\right)\cos\phi$$

$$f'_{\zeta_{total}} = \left(-\rho_{is}\,\omega_0^2\, r_{is}\,\overline{t}_{is} - \rho_i\,\omega_0^2\, r_i h_i - \rho_c\,\omega_0^2\, r_c t_c - \rho_o\,\omega_0^2\, r_o h_o - \rho_{os}\,\omega_0^2\, r_{os}\,\overline{t}_{os}\right)\sin\phi$$

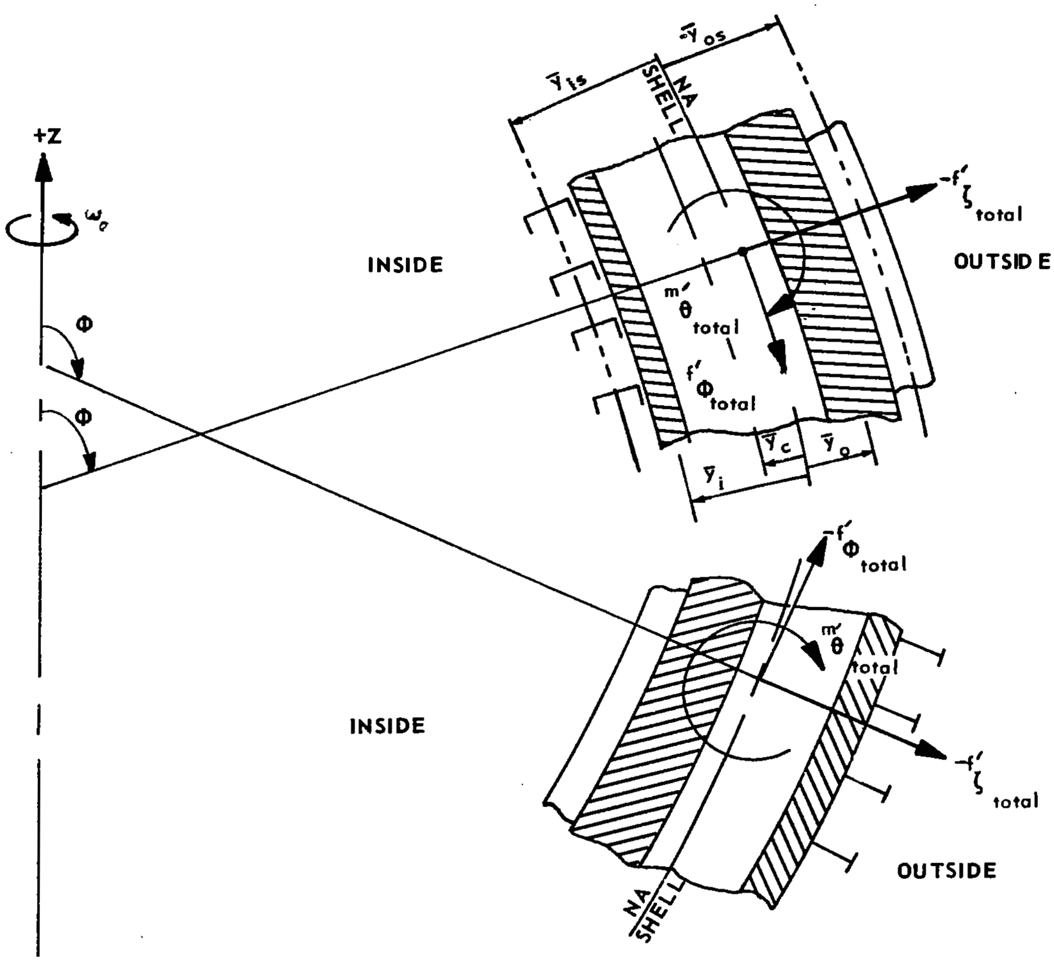


Figure 24. Equivalent static loads at the neutral axis of the shell.

$$m'_{\theta_{total}} = \Big(-\rho_{is}\,\omega_0^2\, r_{is}\,\overline{t}_{is}\,\overline{y}_{is} - \rho_i\,\omega_0^2\, r_i\, h_i\,\overline{y}_i - \rho_c\,\omega_0^2\, r_c\, t_c\,\overline{y}_c$$

$$-\rho_o\,\omega_0^2\, r_o\, h_o\,\overline{y}_o - \rho_{os}\,\omega_0^2\, r_{os}\,\overline{t}_{os}\,\overline{y}_{os}\Big)\cos\phi \quad .$$

The preceding logic was incorporated into the program as shown in Appendix D.

George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, Alabama 35812, February 17, 1971
976-40-00-00-00

APPENDIX A

STRESS CALCULATIONS FOR REINFORCED CASES

Several items must be noted when a stress analysis is performed upon a reinforced construction by use of the current program. Some of these items can be treated as rules, and some require engineering judgment. The rules to remember are:

1. The hoop and meridional stresses output in a waffle reinforcement are rotated 45 deg from the θ and ϕ coordinates and are actually in the waffle rib directions.

2. For a reinforced section, the in-plane shear stress is calculated for the meridional face only. This means that for a construction such as that shown in Figure A-1, $\tau_{\phi\theta}$ outer is calculated at point 1, and $\tau_{\phi\theta}$ inner is calculated at point 4.

Items requiring engineering consideration in the stress analysis are:

3. If a shell cross section contains materials of different properties, either actually or because of differential thermal loading, there is no guarantee that the stress at the extreme point is the most critical. The analyst should decide whether a check of stresses is necessary at each location where material properties change.

4. For a structure such as that shown in Figure A-1, the program will calculate direct stresses at points 1, 4, 3 and the bottom point below 3 and in-plane shear stresses at points 1 and 4. Whereas strain is linear from point 1 to point 4, there is a stress discontinuity at point 2. This will occur even if the material properties of the shell and ribs are the same, since the governing Hooke's laws differ [7]. The analyst must again decide whether the stresses at point 2 could be more critical than those at the extreme points.

Any additional stress calculations that the analyst decides to make on the basis of items 3 and 4 should always be made using the program strain and curvature output and Hooke's laws for the ring, stringer, or shell [7]. This can be done automatically in the program by providing the correct ζ distance (instead of the extreme) and by setting the stress clues for the appropriate Hooke's laws (segment card data sets 10 and 11).

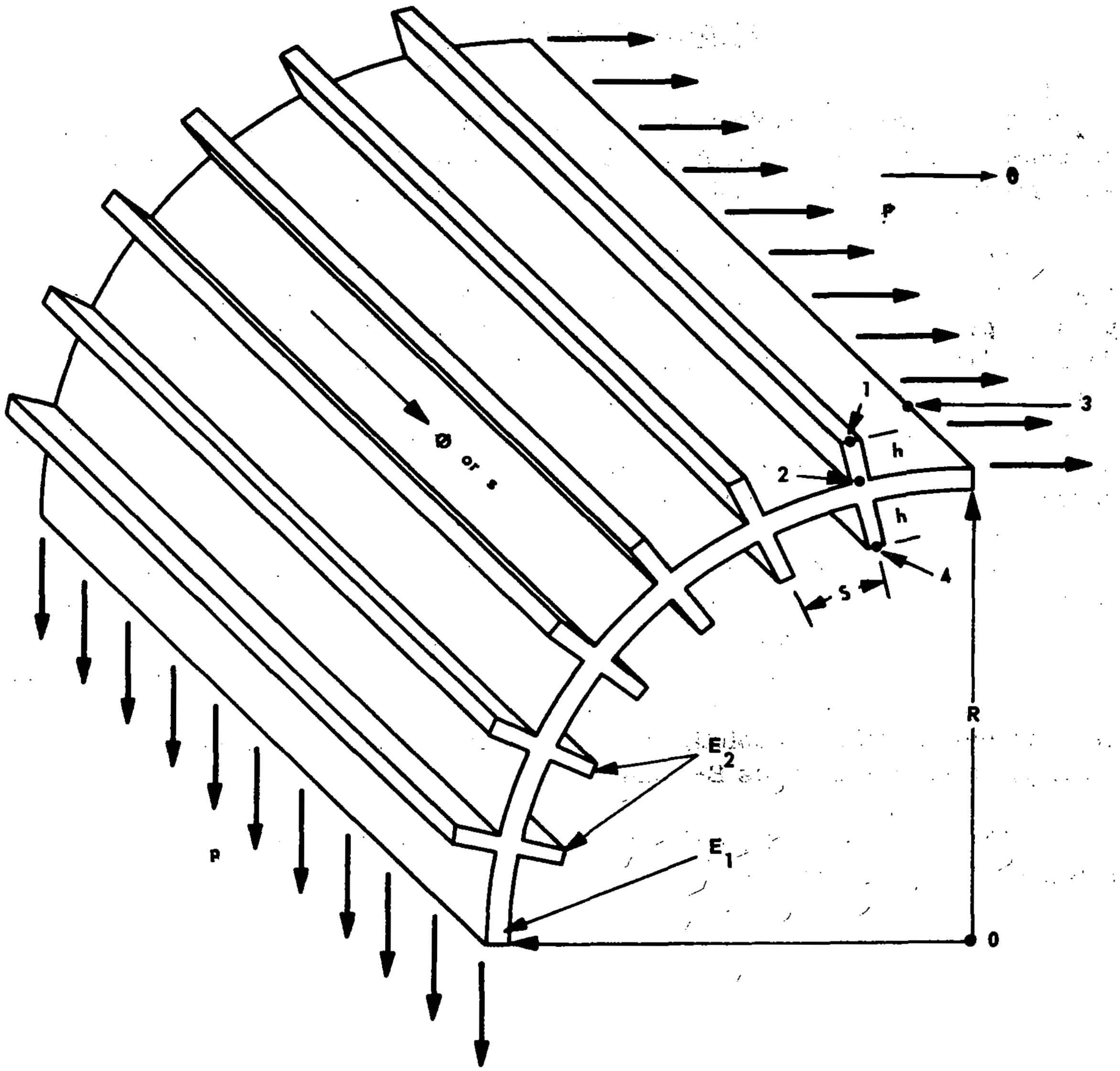


Figure A-1. Special stress case.

APPENDIX B

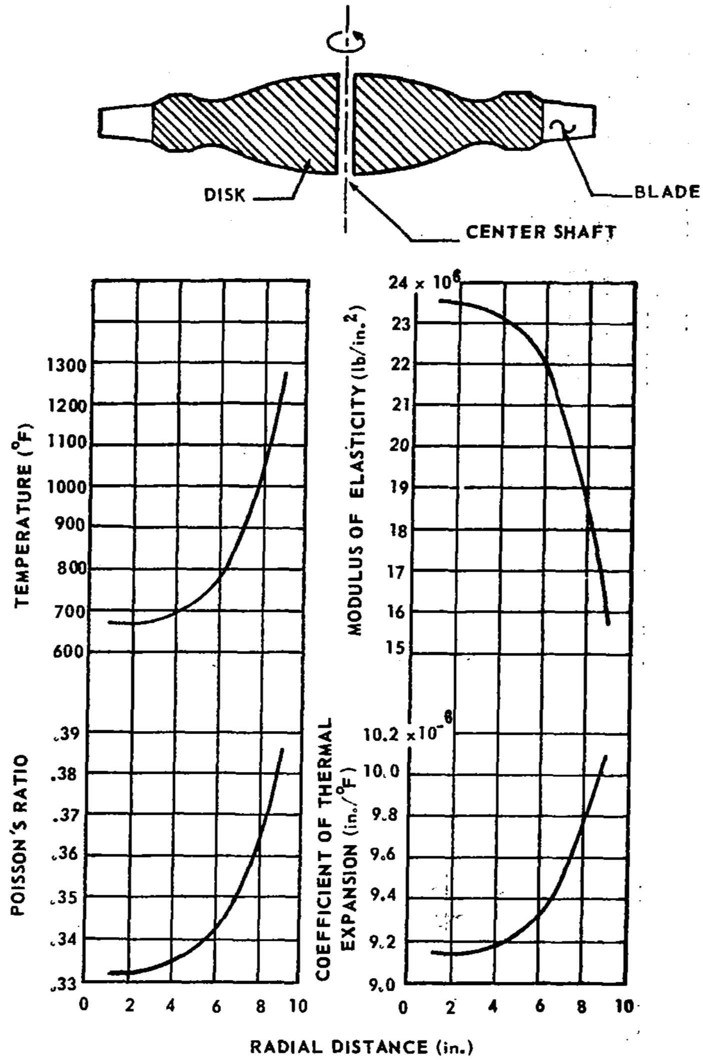
EXAMPLE PROBLEM 1

The following problem, taken from Reference 8, will serve as a good example on how to set up the ASTROS program for determining the elastic stresses in a gas-turbine disk in a thermal environment.

The disk has 50 turbine blades and is being rotated at 11 500 rpm. Figure B-1 shows the disk profile, temperature distribution, variation of the physical properties of the disk material as a function of the radius, mass density of the disk, turbine blade properties, and blade loading on the disk rim. Figure B-2 shows how the disk was idealized into various segment geometries with their temperatures and physical properties. Figure B-3 shows the segment joint numbering, segment numbers, and region joint numbering associated with the idealized problem.

In Figures B-4 and B-5 the results of the ASTROS program are compared with the results of the finite difference method of Reference 8. In this reference four independent solutions were calculated using 6, 10, 18, and 27 finite difference stations, respectively; as the number of stations was increased, the accuracy of the solution increased. The solution with 27 finite difference stations and the ASTROS solution with only eight segments correlate very closely, as seen in Figures B-4 and B-5.

The input data and format are shown in Table B-1, and the output solution is given in Table B-2.



Disk

γ disk = 0.26807 lb/in.^{3} ; g = 32.2 ft/sec^2 = 386.4 in./sec^2

ρ mass density = γ disk/g = 0.00069377 lb-sec^2/in.^{4}

Turbine Blade

WT = 0.4892 lb (weight of one blade) ; NB = 50 (number of blades)

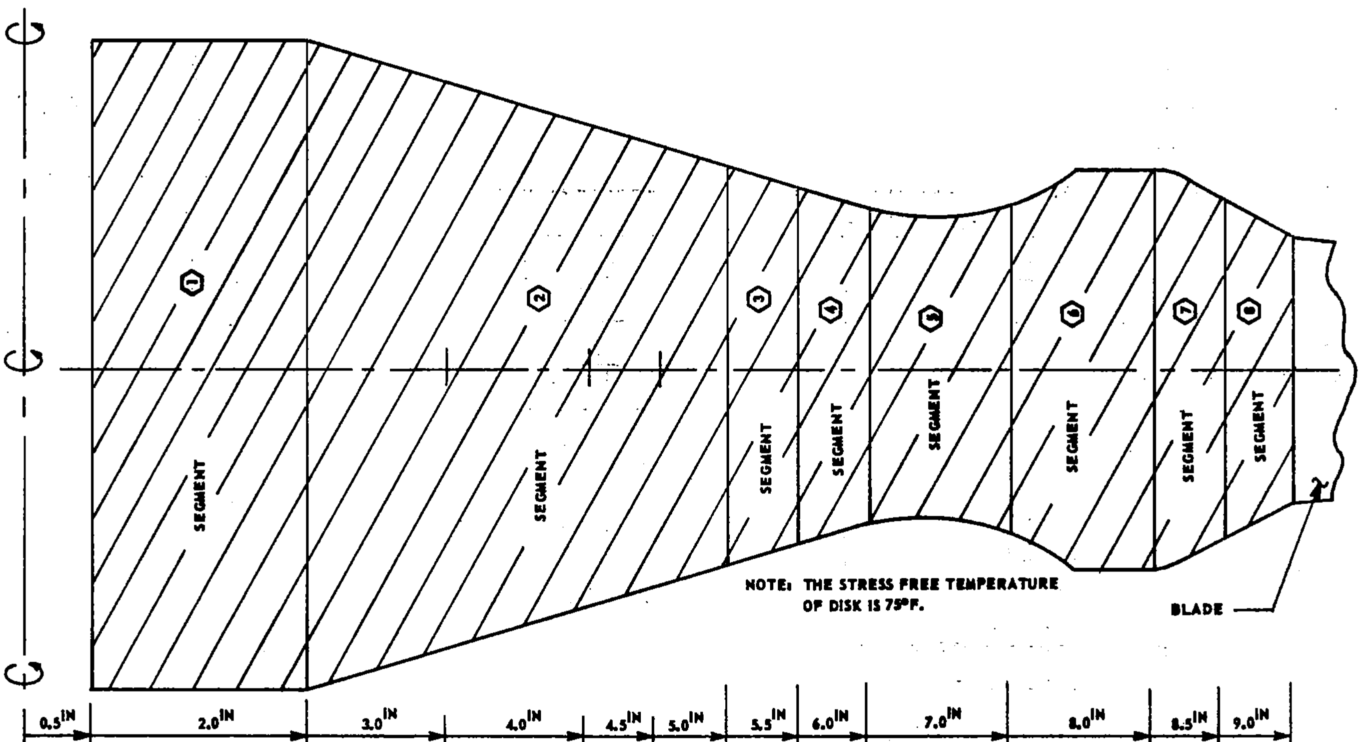
ω_0 = 11 500 rpm = 1204 rad/sec ; R_{cg} = 10 in. (radius to c.g. of blades)

Blade Loading on Disk Rim

$$BL = \frac{WT}{g} (NB)\ (R_{cg})\ (\omega^2)$$

$$= \frac{0.4892}{386.4} (50)\ (10)\ (1204)^2 = 917\ 639.9 \text{ lb}$$

Figure B-1. Disk profile, temperature distribution, and variation of physical properties of disk material as function of radius.



TEMPERATURE (°F)	675	675	682	698	713	732	759	793	895	1050	1152	1275
THICKNESS	4.375 IN	4.375 IN	3.840 IN	3.275 IN	2.97 IN	2.68 IN	2.372 IN	2.21 IN	2.155 IN	2.70 IN	2.38 IN	1.91 IN
POISSON'S RATIO	.333	.333	.333	.335	.336	.338	.340	.343	.352	.366	.375	.386
YOUNG'S MODULUS (E X 10^6)	23.5	23.5	23.4	23.2	23.0	22.8	22.4	22.0	20.7	18.7	17.4	15.8
COEF. THERMAL EXP. (α X 10^{-6})	9.149	9.149	9.159	9.185	9.207	9.239	9.281	9.337	9.499	9.748	9.913	10.109

Figure B-2. Problem 1 geometry.

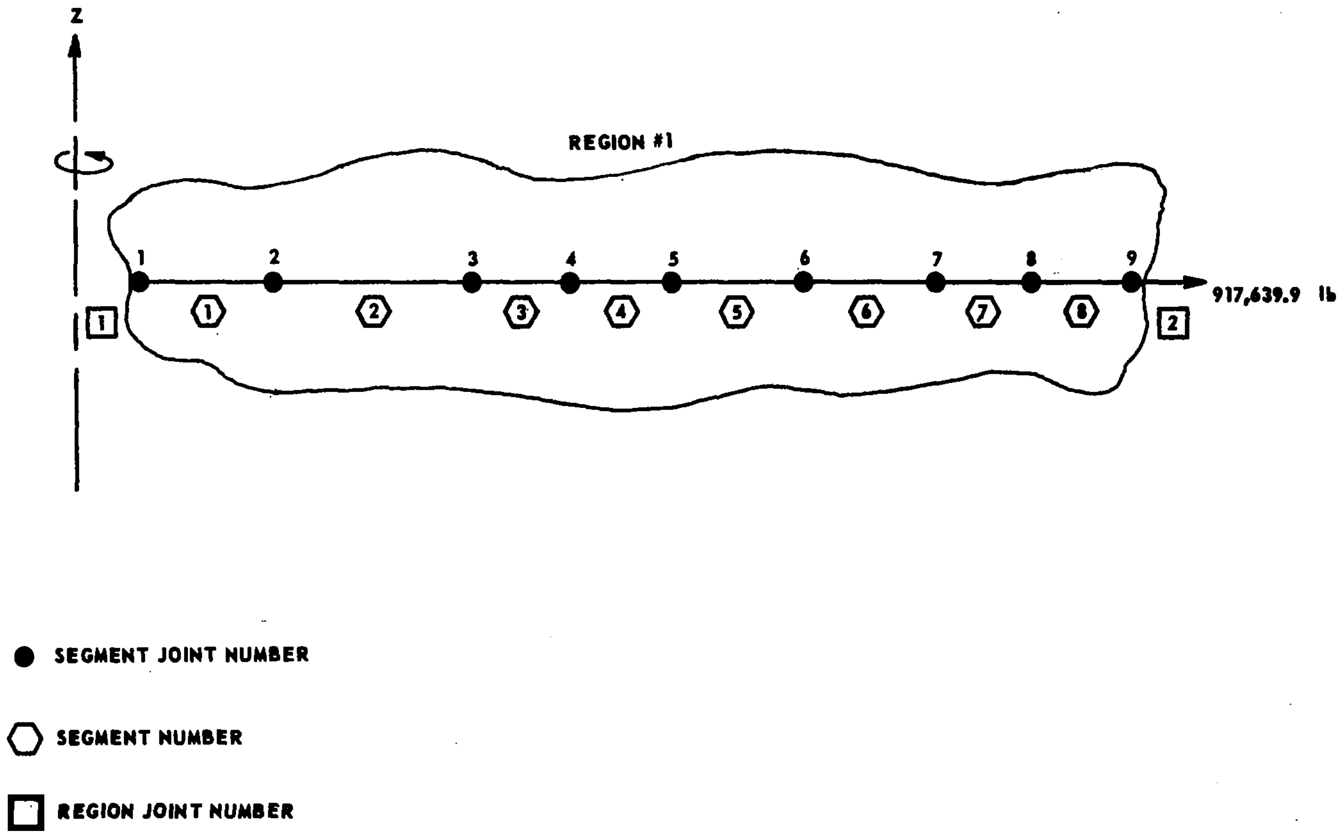


Figure B-3. Problem 1 idealization.

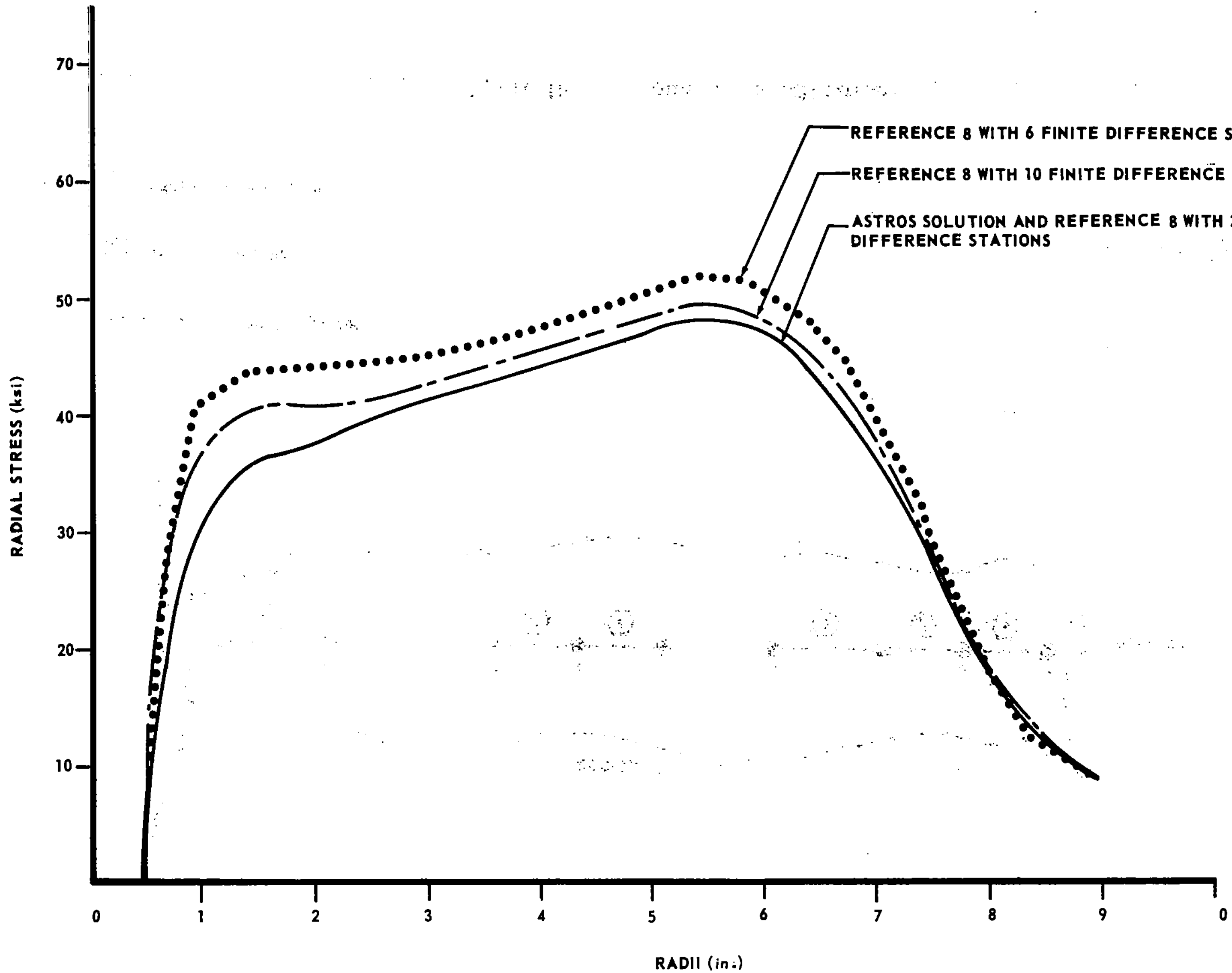


Figure B-4. Problem 1 radial stresses.

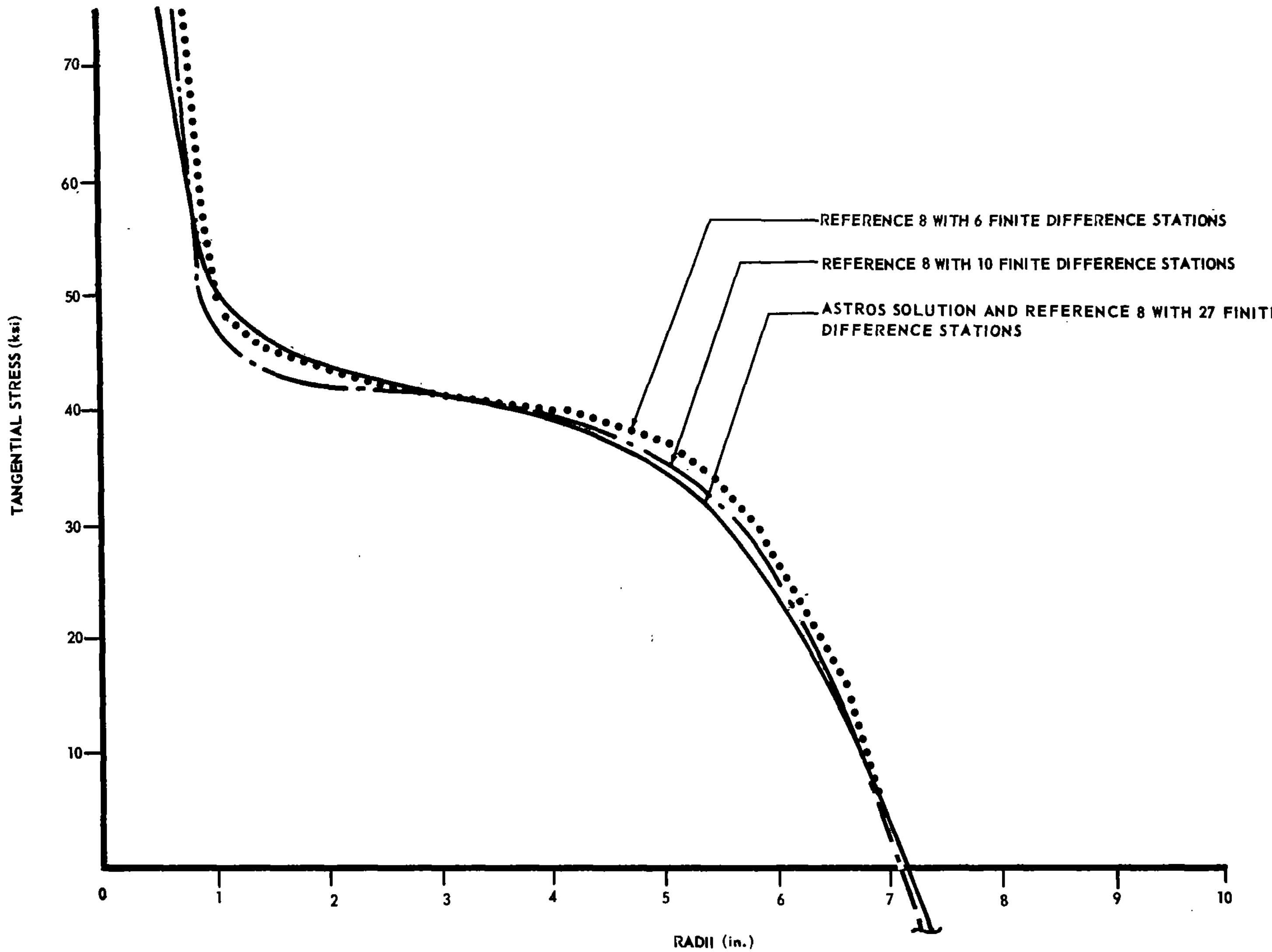


Figure B-5. Problem 1 tangential stresses.

TABLE B-1. FORTRAN CODING INPUT DATA FOR EXAMPLE PROBLEM 1

PROGRAM ____________ CODED BY ____________ FORTRAN CODING FORM DATE ________ PAGE ____ OF ____ IDENTIFICATION (73–80)

```
/// EXAMPLE PROBLEM 1 ///
 1  8 1  0.0     11
MATL      ISØT
+75.          +600.         +638.         +657.         +684.
+718.         +820.         +975.         +1077.        +1280.
23.5      E+0623.5      E+0623.0      E+0622.8      E+0622.4      E+06
22.0      E+0620.7      E+0618.7      E+0617.4      E+0615.8      E+06
.333          .333          .336          .338          .340
.343          .352          .366          .375          .386
9.149     E-069.149     E-069.207     E-069.239     E-069.289     E-06
9.337     E-069.499     E-069.748     E-069.913     E-0610.109    E-06
 8 REGION 1
    1    1    2
21 SEGMENT 1 OF REGION 1 (PLATE)
0.50          2.00          .125          1.0       E-06.015          0.
0.0
ISØT      MATL      SING      THIC      THCN      +75.      LINE       2
0.49          2.01
4.375         4.375
101110  TEMPERATURE LOADING ONLY
+675.         +675.
BLANK CARD
BLANK CARD
BLANK CARD
.00049377     0.0           0.0           0.0
```

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TABLE B-1. (Continued)

PROGRAM
CODED BY
DATE
PAGE OF
IDENTIFICATION

FORTRAN CODING FORM

```
1204.
    1     1    2
21 SEGMENT 2 OF REGION 1 (PLATE)
2.00          5.00          .125          1.0         E-06 .030         0.
0.0
ISØT     MATL      SING      THIC      THCN      +75.      LINE          5
1.99          3.0           4.0           4.5           5.01
4.375         3.84          3.275         2.97          2.68
101110  TEMPERATURE LOADING ONLY
+675.         +682.         +698.         +713.         +732.
BLANK CARD
BLANK CARD
BLANK CARD
.000693.77    0.0           0.0           0.0
1204.
    2     2    3
21 SEGMENT 3 ØF REGION 1 (PLATE)
5.00          5.50          .125          1.0         E-06 .005         10.
0.0
ISØT     MATL      SING      THIC      THCN      +75.      LINE          2
4.99          5.51
2.68          2.372
101110  TEMPERATURE LOADING ONLY
+732.         +759.
BLANK CARD
```

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TABLE B-1. (Continued)

PROGRAM
CODED BY

DATE
PAGE OF

IDENTIFICATION

FORTRAN CODING FORM

```
BLANK CARD
BLANK CARD
.00069377    0.0              0.0           0.0
1204.
    3    3    4
21 SEGMENT 4 OF REGION 1 (PLATE)
5.50         6.00            .125           1.0          E-06 .005          0.
0.0
ISOT     MATL     SING      THIC       THCN       +75       LINE         2
5.49         6.01
2.372        2.21
1011110  TEMPERATURE LOADING ONLY
+759.        +793.
BLANK CARD
BLANK CARD
BLANK CARD
.00069377    0.0              0.0           0.0
1204.
    4    4    5
21 SEGMENT 5 OF REGION 1 (PLATE)
6.00         7.00            .125           1.0          E-06 .01           0.
0.0
ISOT     MATL     SING      THIC       THCN       +75.      LINE         2
5.99         7.01
2.21         2.155
```

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TABLE B-1. (Continued)

PROGRAM ____________ DATE ________

CODED BY ____________ PAGE ____ OF ____

FORTRAN CODING FORM

```
101110  TEMPERATURE LOADING ONLY
+793.         +895.
BLANK CARD
BLANK CARD
.00069377     0.0           0.0           0.0
1204.
    5    5    6
21 SEGMENT 6 OF REGION 1 (PLATE)
7.00          8.00          .125          1.0       E-06 .01          0.
0.0
ISOT      MATL      SING      THIC      THCN      +75.      LINE       2
6.99          8.01
2.155         2.70
101110  TEMPERATURE LOADING ONLY
+895.         +1050.
BLANK CARD
BLANK CARD
BLANK CARD
.00069377     0.0           0.0           0.0
1204.
    6    6    7
21 SEGMENT 7 OF REGION 1 (PLATE)
8.00          8.50          .125          1.0       E-06 .005         0.
0.0
ISØT      MATL      SING      THIC      THCN      +75.      LINE       2
```

MSFC - Form 1610 (Rev July 1963)

TABLE B-1. (Continued)

PROGRAM ____________________ DATE ________
CODED BY ____________________ PAGE ___ OF ___ IDENTIFICATION

FORTRAN CODING FORM

```
7.99          8.51
2.70          2.38
101110  TEMPERATURE LOADING ONLY
+1050.        +1152.
BLANK CARD
BLANK CARD
BLANK CARD
.00069377     0.0           0.0           0.0
1204.
    7    7    8
21 SEGMENT 8 OF REGION 1 (PLATE)
8.50          9.00          .125          1.0        E-06 .005     0.
0.0
ISOT     MATL      SING      THIC      THCN      +75.      LINE      2
8.49          9.01
2.38          1.91
101110  TEMPERATURE LOADING ONLY
+1152.        +1275.
BLANK CARD
BLANK CARD
BLANK CARD
.00069377     0.0           0.0           0.0
1204.
    8    8    9
    2    0
```

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TABLE B-1. (Concluded)

PROGRAM ______ DATE ______

CODED BY ______ PAGE ___ OF ___

IDENTIFICATION 73–80

FORTRAN CODING FORM

1–5	6	7–72
1 1	0	1 1
2 1	1	1 1
1		TURBINE BLADE LOAD
1		6 +917639.9

MSFC - Form 1610 (Rev July 1963)

TABLE B-2. EXAMPLE PROBLEM 1

AUTOMATED SHELL THEORY FOR ROTATING STRUCTURES

(ASTROS)

DECK NUMBER 1

AS OF JULY 17, 1970

NUMBER OF SEGMENTS = 8 NUMBER OF REGIONS = 1 NUMBER OF MATERIAL PROPERTY TABLES USED = 1 NUMBER OF PROBLEMS = 1
THE GIVEN INPUT DATA INDICATES THAT THE SHELL SEGMENTS ARE TO BE COUPLED

/// EXAMPLE PROBLEM 1 ///

TABLE B-2. (Continued)

REGION NUMBER 1

THERE ARE 8 SEGMENTS AND 0 KINEMATIC LINKS WITHIN THIS REGION

TABLE B-2. (Continued)

SEGMENT NUMBER 1 SEGMENT CODE 21 SEGMENT 1 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.5000000+00	.2000000+01	.1250000+00	.1000000-03	.1500000-01	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.4990000+00	.2001000+01
.4375000+01	.4375000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.6750000+03	.6750000+03

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)

LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.4000002+01	.0000000	.0000000	.0000000
.0000000	.9242193+08	.0000000	.0000000	.0000000	.1488750+01	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.1474178+09	.0000000	.0000000	.1702928+01	.1488750+01
.6249993-01	.0000000	.0000000	.0000000	.2547338-07	.0000000	.0000000	.0000000
.0000000	.6903126+00	.0000000	.0000000	.0000000	.8414703-08	.0000000	.0000000
.0000000	.0000000	.2499999+00	.5415993+00	.0000000	.0000000	-.1506509-08	-.2581604-08
.0000000	.0000000	.0000000	.6903126+00	.0000000	.0000000	-.4300384-08	-.5275504-08
.0000000	-.2640623+06	.0000000	.0000000	.0000000	.6950833-02	.0000000	.0000000

TABLE B-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.4933141+09	.0000000	.0000000	.0000000	-.1233285+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.5254256+10	.1446736+03	-.2571206+10	.0000000	-.5254256+10	-.1502923+03	-.4283063+10
FORCR1	.0000000	.1446736+03	.5558184+09	-.7917221+02	.0000000	-.1502923+03	-.3733456+09	-.1318835+03
MOME 1	.0000000	-.2571207+10	-.7917221+02	.2144797+10	.0000000	.2571207+10	.7917221+02	.1500441+10
FORCT2	-.1233283+09	.0000000	.0000000	.0000000	.3083206+08	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.5254249+10	-.1502921+03	.2571203+10	.0000000	.5254249+10	.1300447+03	.4283058+10
FORCR2	.0000000	-.1502921+03	-.3733451+09	.7917210+02	.0000000	.1300447+03	.1030900+10	.1318833+03
MOME 2	.0000000	-.4283358+10	-.1318833+03	.1500439+10	.0000000	.4283058+10	.1318833+03	.5135720+10

SEGMENT SYMMETRY CHECK

.4933141+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.5254256+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.5558184+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.2144797+10	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.3083206+08	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.5254249+10	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1030900+10	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.5135720+10

SEGMENT LOAD MATRICES

.0000000
-.7990680-01
.2595063+07
.0000000
.0000000
.3228192+00
-.1048392+08
.0000000

TABLE B-2. (Continued)

SEGMENT NUMBER 2   SEGMENT CODE 21   SEGMENT 2 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.2000000+01	.5000000+01	.1250000+00	.1000000-03	.3000000-01	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT   MATL   SING   THIC   THCN   T FREE = .750+02 LINE   NUMBER OF TABLE COLUMNS = 5

MATERIAL PROPERTY TABLE USED

.75000+02	.66000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.1999000+01	.3600000+01	.4000000+01	.4500000+01	.5001000+01
.4375000+01	.3840000+01	.3275000+01	.2970000+01	.2680000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.6750000+03	.6820000+03	.6980000+03	.7130000+03	.7320000+03

PROBLEM 1   TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000	.0000000	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.2500001+01	.0000000	.0000000	.0000000
.0000000	.1760013+08	.0000000	.0000000	.0000000	.1168397+01	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.2150692+08	.0000000	.0000000	.3173603+01	.1389768+01
.1599999+00	.0000000	.0000000	.0000000	.6520011-07	.0000000	.0000000	.0000000
.0000000	.6995452+00	.0000000	.0000000	.0000000	.2371272-07	.0000000	.0000000
.0000000	.0000000	.3999999+00	.1468799+01	.0000000	.0000000	-.3047976-07	-.3588843-07
.0000000	.0000000	.0000000	.6670860+00	.0000000	.0000000	-.3014225-07	-.2450816-07
.0000000	-.2334007+06	.0000000	.5787550-03	.0000000	.1495757-01	-.1014975-10	-.1264768-10

TABLE B-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.4818387+09	.0000000	.0000000	.0000000	-.1927354+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.9200112+09	.9263058+01	-.1347215+10	.0000000	-.9200112+09	-.1201095+02	-.1131509+10
FORCR1	.0000000	.9263058+01	.6191829+09	-.4148324+02	.0000000	-.1201095+02	-.5299421+09	-.3484126+02
MOME 1	.0000000	-.1347215+10	-.4148324+02	.2685382+10	.0000000	.1347215+10	.4148324+02	.1144179+10
FORCT2	-.1927352+09	.0000000	.0000000	.0000000	.7709408+08	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.9200104+09	-.1201094+02	.1347214+10	.0000000	.9200104+09	-.2089313+00	.1131508+10
FORCR2	.0000000	-.1201094+02	-.5299416+09	.4148320+02	.0000000	-.2089310+00	.9267956+09	.3484123+02
MOME 2	.0000000	-.1131508+10	-.3484123+02	.1144178+10	.0000000	.1131508+10	.3484123+02	.2246734+10

SEGMENT SYMMETRY CHECK

.4818387+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.9200112+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.6191829+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.2685382+10	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.7709408+08	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.9200104+09	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000001+01	.9267956+09	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.2246734+10

SEGMENT LOAD MATRICES

.0000000
-.2490493+00
.7926648+07
.7973172-03
.0000000
.6576097+00
-.2119511+08
-.1250659-02

TABLE B-2. (Continued)

SEGMENT NUMBER 3 SEGMENT CODE 21 SEGMENT 3 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.5000000+01	.5500000+01	.1250000+00	.1000000-03	.5000000-02	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.4999000+01	.5501000+01
.2680000+01	.2372000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.7320000+03	.7590000+03

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1100000+01	.0000000	.0000000	.0000000
.0000000	.9510429+06	.0000000	.0000000	.0000000	.9717631+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.5093624+06	.0000000	.0000000	.4924864+00	.9721381+00
.8264463+00	.0000000	.0000000	.0000000	.2344003-07	.0000000	.0000000	.0000000
.0000000	.9430366+00	.0000000	.0000000	.0000000	.7693905-08	.0000000	.0000000
.0000000	.0000000	.9090909+00	.4625419+00	.0000000	.0000000	-.6035843-09	-.3803593-08
.0000000	.0000000	.0000000	.9427767+00	.0000000	.0000000	-.3460769-08	-.1455456-07
.0000000	-.3637279+05	.0000000	.9680471-04	.0000000	.4007726-02	-.1354942-12	-.6420283-12

TABLE B-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1474295+10	.0000000	.0000000	.0000000	-.1340268+10	.0000000	.0000000	.0000000
FORCZ1	.0000000	.1044306+12	.3093433+04	-.2729122+11	.0000000	-.1044306+12	-.3089883+04	-.2483142+11
FORCR1	.0000000	.3093433+04	.3967925+10	-.8403472+03	.0000000	-.3089883+04	-.4083222+10	-.7646054+03
MOME 1	.0000000	-.2729122+11	-.8403472+03	.9230452+10	.0000000	.2729122+11	.8403472+03	.4330787+10
FORCT2	-.1340268+10	.0000000	.0000000	.0000000	.1218425+10	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.1044306+12	-.3089882+04	.2729121+11	.0000000	.1044306+12	.3085187+04	.2483142+11
FORCR2	.0000000	-.3089882+04	-.4083222+10	.8403471+03	.0000000	.3085187+04	.4235690+10	.7646053+03
MOME 2	.0000000	-.2483141+11	-.7646052+03	.4330786+10	.0000000	.2483141+11	.7646052+03	.8142866+10

SEGMENT SYMMETRY CHECK

.1474295+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1044306+12	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.3967925+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.9230452+10	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1218425+10	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1044306+12	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.4235690+10	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.8142866+10

SEGMENT LOAD MATRICES

.0000000
-.5056841+00
.1636444+08
-.9173135-03
.0000000
.5632033+00
-.1823244+08
-.1481892-02

TABLE B-2. (Continued)

SEGMENT NUMBER 4 SEGMENT CODE 21 SEGMENT 4 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.5500000+01	.6000000+01	.1250000+00	.1000000-03	.5000000-02	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.5499000+01	.6601000+01
.2372000+01	.2210000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.7590000+03	.7930000+03

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1090909+01	.0000000	.0000000	.0000000
.0000000	.7081662+06	.0000000	.0000000	.0000000	.9735630+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.3107358+06	.0000000	.0000000	.4930028+00	.9737325+00
.8462778+00	.0000000	.0000000	.0000000	.2648596-07	.0000000	.0000000	.0000000
.0000000	.9478491+00	.0000000	.0000000	.0000000	.8647969-08	.0000000	.0000000
.0000000	.0000000	.9166667+00	.4657263+00	.0000000	.0000000	-.8234829-09	-.5064045-08
.0000000	.0000000	.0000000	.9477167+00	.0000000	.0000000	-.4829550-08	-.1981071-07
.0000000	-.3219036+05	.0000000	.9633194-04	.0000000	.4238461-02	-.1242107-12	-.9319351-12

TABLE B-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1423362+10	.0000000	.0000000	.0000000	-.1304749+10	.0000000	.0000000	.0000000
FORCZ1	.0000000	.8407043+11	.2468892+04	-.2149022+11	.0000000	-.8407043+11	-.2465639+04	-.2049510+11
FORCR1	.0000000	.2468892+04	.3890384+10	-.6617236+03	.0000000	-.2465639+04	-.3996027+10	-.6310820+03
MOME 1	.0000000	-.2149022+11	-.6617236+03	.7191929+10	.0000000	.2149022+11	.6617236+03	.3494603+10
FORCT2	-.1304748+10	.0000000	.0000000	.0000000	.1196019+10	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.8407042+11	-.2465639+04	.2149022+11	.0000000	.8407042+11	.2461453+04	.2049509+11
FORCR2	.0000000	-.2465639+04	-.3996027+10	.6617235+03	.0000000	.2461453+04	.4131961+10	.6310819+03
MOME 2	.0000000	-.2049510+11	-.6310819+03	.3494603+10	.0000000	.2049510+11	.6310819+03	.6799866+10

SEGMENT SYMMETRY CHECK

.1423362+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.8407043+11	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.3890384+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.7191929+10	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1196019+10	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.8407042+11	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.4131961+10	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.6799866+10

SEGMENT LOAD MATRICES

.0000000
-.5301794+00
.1693700+08
.5874287-03
.0000000
.5852875+00
-.1872670+08
.1596959-03

TABLE B-2. (Continued)

SEGMENT NUMBER 5   SEGMENT CODE 21   SEGMENT 5 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.6000000+01	.7000000+01	.1250000+00	.1000000-03	.1000000-01	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT   MATL   SING   THIC   THCN   T FREE = .750+02 LINE   NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.5999000+01	.7001000+01
.2210000+01	.2155000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.7930000+03	.8950000+03

PROBLEM 1   TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1166667+01	.0000000	.0000000	.0000000
.0000000	.9861482+06	.0000000	.0000000	.0000000	.9574140+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.3920416+06	.0000000	.0000000	.9763143+00	.9575986+00
.7346939+00	.0000000	.0000000	.0000000	.5633771-07	.0000000	.0000000	.0000000
.0000000	.9140641+00	.0000000	.0000000	.0000000	.1824765-07	.0000000	.0000000
.0000000	.0000000	.8571428+00	.8832505+00	.0000000	.0000000	-.7633865-08	-.2285153-07
.0000000	.0000000	.0000000	.9139224+00	.0000000	.0000000	-.2302034-07	-.4598497-07
.0000000	-.5708413+05	.0000000	.2047208-03	.0000000	.9096681-02	-.1604699-11	-.4251583-11

TABLE B-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.7806902+09	.0000000	.0000000	.0000000	-.6691630+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.9905847+10	.2441134+03	-.4922559+10	.0000000	-.9905847+10	-.2414043+03	-.4958925+10
FORCR1	.0000000	.2441134+03	.1977989+10	-.1515747+03	.0000000	-.2414043+03	-.2065971+10	-.1526945+03
MOME 1	.0000000	-.4922559+10	-.1515747+03	.3231243+10	.0000000	.4922559+10	.1515747+03	.1644448+10
FORCT2	-.6691629+09	.0000000	.0000000	.0000000	.5735682+09	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.9905845+10	-.2414043+03	.4922559+10	.0000000	.9905845+10	.2371797+03	.4958924+10
FORCR2	.0000000	-.2414043+03	-.2065970+10	.1515747+03	.0000000	.2371797+03	.2203167+10	.1526945+03
MOME 2	.0000000	-.4958924+10	-.1526945+03	.1644448+10	.0000000	.4958924+10	.1526945+03	.3356587+10

SEGMENT SYMMETRY CHECK

.7806902+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.9905847+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1977989+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.3231243+10	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.5735682+09	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.9905845+10	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.2203167+10	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.3356587+10

SEGMENT LOAD MATRICES

.0000000
-.5838733+00
.1879348+08
-.9077162-03
.0000000
.6996114+00
-.2255220+08
-.2690862-02

TABLE B-2. (Continued)

SEGMENT NUMBER 6 SEGMENT CODE 21 SEGMENT 6 OF REGION 1 (PLATE)

TTC	STOP	DTAU	DIFF	STEP	DELTA
.7000000+01	.8000000+01	.1250000+00	.1000000-03	.1000000-01	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.6999000+01	.8001000+01
.2155000+01	.2700000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.8950000+03	.1050000+04

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1142857+01	.0000000	.0000000	.0000000
.0000000	.7583642+06	.0000000	.0000000	.0000000	.9596543+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.3723958+06	.0000000	.0000000	.9778894+00	.9586767+00
.7656250+00	.0000000	.0000000	.0000000	.5668461-07	.0000000	.0000000	.0000000
.0000000	.9259448+00	.0000000	.0000000	.0000000	.1791612-07	.0000000	.0000000
.0000000	.0000000	.8750000+00	.8989075+00	.0000000	.0000000	-.6134774-08	-.1640306-07
.0000000	.0000000	.0000000	.9271588+00	.0000000	.0000000	-.2081466-07	-.3717965-07
.0000000	-.6434582+05	.0000000	.2641545-03	.0000000	.1109042-01	-.2019959-11	-.4481352-11

TABLE B-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.8867665+09	.0000000	.0000000	.0000000	-.7759207+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.1442839+11	.3717357+03	-.6365571+10	.0000000	-.1442839+11	-.3686860+03	-.8077593+10
FORCR1	.0000000	.3717357+03	.2355856+10	-.1960077+03	.0000000	-.3686860+03	-.2454900+10	-.2487241+03
MOME 1	.0000000	-.6365571+10	-.1960077+03	.3942469+10	.0000000	.6365571+10	.1960077+03	.2380736+10
FORCT2	-.7759206+09	.0000000	.0000000	.0000000	.6789305+09	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.1442839+11	-.3686859+03	.6365571+10	.0000000	.1442839+11	.3642848+03	.8077592+10
FORCR2	.0000000	-.3686859+03	-.2454900+10	.1960077+03	.0000000	.3642848+03	.2597831+10	.2487240+03
MOME 2	.0000000	-.8077592+10	-.2487240+03	.2380735+10	.0000000	.8077592+10	.2487240+03	.5775644+10

SEGMENT SYMMETRY CHECK

.8867665+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1442839+11	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.2355856+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.3942469+10	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.6789305+09	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1442839+11	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.2597831+10	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.5775644+10

SEGMENT LOAD MATRICES

```
 .0000000
-.8453890+00
 .2722588+08
-.2189279-02
 .0000000
 .9937913+00
-.3204541+08
-.3711562-02
```

TABLE B-2. (Continued)

SEGMENT NUMBER 7   SEGMENT CODE 21   SEGMENT 7 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.8000000+01	.8500000+01	.1250000+00	.1000000-03	.5000000-02	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT   MATL   SING   THIC   THCN   T FREE = .750+02 LINE   NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.7999000+01	.8501000+01
.2760000+01	.2380000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.1050000+04	.1152000+04

PROBLEM 1   TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)

LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1062500+01	.0000000	.0000000	.0000000
.0000000	.3129731+06	.0000000	.0000000	.0000000	.9791162+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.1694822+06	.0000000	.0000000	.4945968+00	.9792702+00
.8858131+00	.0000000	.0000000	.0000000	.3050527-07	.0000000	.0000000	.0000000
.0000000	.9642995+00	.0000000	.0000000	.0000000	.9537032-08	.0000000	.0000000
.0000000	.0000000	.9411764+00	.4761757+00	.0000000	.0000000	-.7414038-09	-.4730851-08
.0000000	.0000000	.0000000	.9641921+00	.0000000	.0000000	-.4193190-08	-.1786731-07
.0000000	-.3583143+05	.0000000	.1540614-03	.0000000	.6751045-02	-.2400838-12	-.1531677-11

TABLE B-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1750749+10	.0000000	.0000000	.0000000	-.1647764+10	.0000000	.0000000	.0000000
FORCZ1	.0000000	.1362741+12	.4037230+04	-.3608222+11	.0000000	-.1362741+12	-.4033841+04	-.3198148+11
FORCR1	.0000000	.4037230+04	.5160489+10	-.1111038+04	.0000000	-.4033841+04	-.5270558+10	-.9847690+03
MOME 1	.0000000	-.3608222+11	-.1111038+04	.1230868+11	.0000000	.3608222+11	.1111038+04	.5654690+10
FORCT2	-.1647761+10	.0000000	.0000000	.0000000	.1550834+10	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.1362739+12	-.4033835+04	.3608216+11	.0000000	.1362739+12	.4029848+04	.3198143+11
FORCR2	.0000000	-.4033835+04	-.5270550+10	.1111037+04	.0000000	.4029848+04	.5400038+10	.9847675+03
MOME 2	.0000000	-.3198143+11	-.9847675+03	.5654681+10	.0000000	.3198143+11	.9847675+03	.1038762+11

SEGMENT SYMMETRY CHECK

.1750749+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1362741+12	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.5160489+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1230868+11	.0000000	.0000000	.0000000	.0000000
.1000002+01	.1000000+01	.1000000+01	.1000000+01	.1550834+10	.0000000	.0000000	.0000000
.1000000+01	.1000002+01	.1000002+01	.1000002+01	.1000000+01	.1362739+12	.0000000	.0000000
.1000000+01	.1000002+01	.1000002+01	.1000002+01	.1000000+01	.1000000+01	.5400038+10	.0000000
.1000000+01	.1000002+01	.1000002+01	.1000002+01	.1000000+01	.1000000+01	.1000000+01	.1038762+11

SEGMENT LOAD MATRICES

.0000000
-.1111897+01
.3558177+08
-.1599975-05
.0000000
.1197738+01
-.3836955+08
.4292818-05

TABLE B-2. (Continued)

SEGMENT NUMBER 8 SEGMENT CODE 21 SEGMENT 8 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.8500000+01	.9000000+01	.1250000+00	.1000000-03	.5000000-02	1.

GEOMETRY INPUT VARIABLES

.0000000 .0000000 .0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.8499000+01	.9001000+01
.2380000+01	.1910000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.1152000+04	.1275000+04

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1058824+01	.0000000	.0000000	.0000000
.0000000	.2232738+06	.0000000	.0000000	.0000000	.9799038+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.8712303+05	.0000000	.0000000	.4948222+00	.9801667+00
.8919752+00	.0000000	.0000000	.0000000	.3843797-07	.0000000	.0000000	.0000000
.0000000	.9665272+00	.0000000	.0000000	.0000000	.1191038-07	.0000000	.0000000
.0000000	.0000000	.9444444+00	.4775688+00	.0000000	.0000000	-.1306875-08	-.8780926-08
.0000000	.0000000	.0000000	.9663758+00	.0000000	.0000000	-.7062710-08	-.3173576-07
.0000000	-.3092111+05	.0000000	.1261781-03	.0000000	.7616625-02	-.3852514-12	-.2527293-11

TABLE B-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1471167+10	.0000000	.0000000	.0000000	-.1389435+10	.0000000	.0000000	.0000000
FORCZ1	.0000000	.8250780+11	.2405270+04	-.2282897+11	.0000000	-.8250780+11	-.2402495+04	-.1836189+11
FORCR1	.0000000	.2405270+04	.4393964+10	-.7029463+03	.0000000	-.2402495+04	-.4484077+10	-.5653967+03
MOME 1	.0000000	-.2282897+11	-.7029463+03	.7966008+10	.0000000	.2282897+11	.7029463+03	.3397660+10
FORCT2	-.1389433+10	.0000000	.0000000	.0000000	.1312242+10	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.8250768+11	-.2402492+04	.2282894+11	.0000000	.8250768+11	.2399263+04	.1836187+11
FORCR2	.0000000	-.2402492+04	-.4484070+10	.7029453+03	.0000000	.2399263+04	.4588916+10	.5653959+03
MOME 2	.0000000	-.1836187+11	-.5653959+03	.3397655+10	.0000000	.1836187+11	.5653959+03	.5808328+10

SEGMENT SYMMETRY CHECK

.1471167+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.8250780+11	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.4393964+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.7966008+10	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.1312242+10	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.8250768+11	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.4588916+10	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.5808328+10

SEGMENT LOAD MATRICES

.0000000
-.1066270+01
.3415353+08
-.2080103-03
.0000000
.1144699+01
-.3670060+08
.4762191-03

TABLE B-2. (Continued)

INPUT DATA FOR SEGMENT COUPLING

REGION NUMBER 1 NUMBER OF SEGMENT JOINTS 9 NUMBER OF KINEMATIC LINKS 0

SEGMENT	JOINT(I)	JOINT(J)	RZERO(I)	RZERO(J)
1	1	2	.5000000+00	.2000000+01
2	2	3	.2000000+01	.5000000+01
3	3	4	.5000000+01	.5500000+01
4	4	5	.5500000+01	.6000000+01
5	5	6	.6000000+01	.7000000+01
6	6	7	.7000000+01	.8000000+01
7	7	8	.8000000+01	.8500000+01
8	8	9	.8500000+01	.8999988+01

REGION STIFFNESS MATRIX

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.4569051+09	.0000000	.0000000	.0000000	-.2538355+08	.0000000	.0000000	.0000000
FORCZ1	.0000000	.4537882+08	-.1276648+02	-.7011034+08	.0000000	-.4537982+08	.1274239+00	-.1295253+09
FORCR1	.0000000	-.1276648+02	.4599840+09	-.2158831+01	.0000000	.1274186+00	-.4951787+08	-.3988323+01
MOME 1	.0000000	-.7011027+08	-.2158828+01	.8271488+09	.0000000	.7011144+08	.2158856+01	.1692590+09
FORCT2	-.2538349+08	.0000000	.0000000	.0000000	.1410160+07	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.4537968+08	.1274185+00	.7011120+08	.0000000	.4537958+08	-.1426425+02	.1295235+09
FORCR2	.0000000	.1274238+00	-.4951773+08	.2158849+01	.0000000	-.1426425+02	.5086260+09	.3988251+01
MOME 2	.0000000	-.1295250+09	-.3988312+01	.1692586+09	.0000000	.1295235+09	.3988243+01	.6360958+09

REGION SYMMETRY CHECK

.4569051+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.4537882+08	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.4599848+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.8271488+09	.0000000	.0000000	.0000000	.0000000

TABLE B-2. (Continued)

.1000003+01	.1000000+01	.1000000+01	.1000000+01	.1410160+07	.0000000	.0000000	.0000000
.1000000+01	.1000003+01	.1000001+01	.1000003+01	.1000000+01	.4537958+08	.0000000	.0000000
.1000000+01	.1000001+01	.1000003+01	.1000004+01	.1000000+01	.1000000+01	.5086260+09	.0000000
.1000000+01	.1000003+01	.1000003+01	.1000003+01	.1000000+01	.1000000+01	.1000002+01	.6360958+09

REGION LOAD MATRIX

.0000000
-.5672103-01
.1599684+07
.6510312-02
.0000000
.1153038+01
-.3720380+08
-.1049101-01

TABLE B-2. (Continued)

INPUT DATA FOR REGION COUPLING

NUMBER OF REGION JOINTS 2   NUMBER OF KINEMATIC LINKS 0

REGION	JOINT(I)	JOINT(J)	RZERO(I)	RZERO(J)
1	1	2	.5000000+00	.8999988+01

BOUNDARY CONDITIONS

JOINT	DELTA T	DELTA Z	DELTA R	THETA	ANGLE ALPHA
1	1	0	1	1	.0000000
2	1	1	1	1	.0000000

TABLE B-2. (Continued)

THE REDUCED FLEXIBILITY MATRIX

ROW	COMN 1	COMN 2	COMN 3	COMN 4	COMN 5	COMN 6	COMN 7
1	-.1027706-03	.0000000	.0000000	-.1849920-02	.0000000	.0000000	.0000000
2	.0000000	.2197011-08	-.1072233-21	.0000000	.6106390-16	.2138925-09	.2243727-21
3	.0000000	-.1187532-21	.1398106-08	.0000000	-.2622244-08	-.8074393-16	.1619255-09
4	-.1849915-02	.0000000	.0000000	-.3329865-01	.0000000	.0000000	.0000000
5	.0000000	.6106370-16	-.2622233-08	.0000000	.5753401-07	.1716988-14	-.1101747-07
6	.0000000	.2138919-09	-.8074359-16	.0000000	.1716988-14	.1986905-08	-.3392489-15
7	.0000000	.2369921-21	.1619243-09	.0000000	-.1101747-07	-.3392489-15	.3772409-08

TABLE B-2. (Continued)

EXTERNAL LINE LOADS

PROBLEM NUMBER	POINT OF APPLICATION	APPLIED LOAD
1	6	.9176399+06

TABLE B-2. (Continued)

THE EXPANDED REGION JOINT DISPLACEMENT MATRIX (REGION END DEFLECTIONS)

JOINT	PROBLEM	DELTA T	DELTA Z	DELTA R	OMEGA-THETA
1	1	.0000000	.0000000	.4639367-02	-.6193084-10
2	1	.0000000	-.1081044-08	.7540150-01	-.1905722-09

TABLE B-2. (Continued)

```
                                        REGION NUMBER  1

                    THERE ARE  8 SEGMENTS AND  0 KINEMATIC LINKS WITHIN THIS REGION

       SEGMENT NUMBER  1     SEGMENT CODE 21      SEGMENT 1 OF REGION 1 (PLATE)

                          TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
  .4990000+00     .2001000+01
  .4375000+01     .4375000+01

                            TABLE ORDER PHI OR S VS. TEMPERATURE LOADS
  .6750000+03     .6750000+03

         PROBLEM  1     TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

  .0000000        .0000000
  .0000000        .0000000
  .0000000        .0000000
```

TABLE B-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.5000000+00	.0000000	.1250000+00	.1500000-01	.5000000+00	1
.9278733-02	.4302663-02	.0000000	.4203026-10	-.1238617-09	.8301592+06
.0000000	-.8994784-02	.0000000	-.8994784-02	.0000000	.8301592+06
.4639367-02	-.8994784-02	.3662699+06	-.1562500-01	.0000000	.0000000
-.1428547-09	.0000000	.1947671-01	.2468005-07	.0000000	.0000000
-.6193084-10	.0000000	.8371884+05	-.3571421-02	.0000000	.8371885+05
.0000000	.0000000	.8371883+05	-.3571436-02	.0000000	.8371883+05

PROBLEM NUMBER 1

.6349999+00	.0000000	.1250000+00	.1500000-01	.6349999+00	37
.8332997-02	.5245375-02	.0000000	.1593961-10	-.9172207-10	.8301592+06
.0000000	-.7082506-02	.0000000	-.7082506-02	.0000000	.8301592+06
.5291452-02	-.7082506-02	.2965435+06	.6927514+05	.0000000	.0000000
-.1509273-09	.0000000	.1533856-01	.2698453-02	.0000000	.0000000
-.5824350-10	.0000000	.6778137+05	.1583432+05	.0000000	.6141472+05
.0000000	.0000000	.6778137+05	.1583432+05	.0000000	.6141472+05

PROBLEM NUMBER 1

.7699997+00	.0000000	.1250000+00	.1500000-01	.7699997+00	73
.7838817-02	.5735810-02	.0000000	.3181837-11	-.7408585-10	.8301592+06
.0000000	-.5840768-02	.0000000	-.5840768-02	.0000000	.8301592+06
.6035887-02	-.5840768-02	.2600272+06	.1052327+06	.0000000	.0000000
-.1586902-09	.0000000	.1297379-01	.3902108-02	.0000000	.0000000
-.5704608-10	.0000000	.5943479+05	.2405319+05	.0000000	.5178276+05
.0000000	.0000000	.5943478+05	.2405319+05	.0000000	.5178275+05

PROBLEM NUMBER 1

.9049996+00	.0000000	.1250000+00	.1500000-01	.9049996+00	109
.7548200-02	.6021963-02	.0000000	-.3693631-11	-.6312206-10	.8301592+06
.0000000	-.4969493-02	.0000000	-.4969493-02	.0000000	.8301592+06
.6831118-02	-.4969493-02	.2384672+06	.1261266+06	.0000000	.0000000
-.1663864-09	.0000000	.1144004-01	.4462793-02	.0000000	.0000000
-.5712544-10	.0000000	.5450678+05	.2882893+05	.0000000	.4723054+05

TABLE B-2. (Continued)

.0000000	.0000000	.5450678+05	.2882893+05	.0000000	.4723054+05

PROBLEM NUMBER 1

.1039999+01	.0000000	.1250000+00	.1500000-01	.1039999+01	145
.7362627-02	.6202352-02	.0000000	-.7611846-11	-.5568504-10	.8301592+06
.0000000	-.4324414-02	.0000000	-.4324414-02	.0000000	.8301592+06
.7657129-02	-.4324414-02	.2246119+06	.1392083+06	.0000000	.0000000
-.1741455-09	.0000000	.1035470-01	.4710622-02	.0000000	.0000000
-.5791241-10	.0000000	.5133986+05	.3181904+05	.0000000	.4488482+05
.0000000	.0000000	.5133985+05	.3181904+05	.0000000	.4488482+05

PROBLEM NUMBER 1

.1174999+01	.0000000	.1250000+00	.1500000-01	.1174999+01	181
.7236658-02	.6322417-02	.0000000	-.9903152-11	-.5030499-10	.8301592+06
.0000000	-.3827566-02	.0000000	-.3827566-02	.0000000	.8301592+06
.8503069-02	-.3827566-02	.2151165+06	.1478226+06	.0000000	.0000000
-.1820409-09	.0000000	.9536789-02	.4793377-02	.0000000	.0000000
-.5910833-10	.0000000	.4916950+05	.3378803+05	.0000000	.4356524+05
.0000000	.0000000	.4916949+05	.3378803+05	.0000000	.4356523+05

PROBLEM NUMBER 1

.1309999+01	.0000000	.1250000+00	.1500000-01	.1309999+01	217
.7146974-02	.6405477-02	.0000000	-.1123911-10	-.4621659-10	.8301592+06
.0000000	-.3433122-02	.0000000	-.3433122-02	.0000000	.8301592+06
.9362531-02	-.3433122-02	.2082648+06	.1536860+06	.0000000	.0000000
-.1901154-09	.0000000	.8890808-02	.4784248-02	.0000000	.0000000
-.6054370-10	.0000000	.4760339+05	.3512822+05	.0000000	.4275339+05
.0000000	.0000000	.4760338+05	.3512822+05	.0000000	.4275338+05

PROBLEM NUMBER 1

.1444999+01	.0000000	.1250000+00	.1500000-01	.1444999+01	253
.7080609-02	.6464499-02	.0000000	-.1198617-10	-.4298730-10	.8301592+06
.0000000	-.3112381-02	.0000000	-.3112381-02	.0000000	.8301592+06
.1023147-01	-.3112381-02	.2031023+06	.1577527+06	.0000000	.0000000
-.1983939-09	.0000000	.8361986-02	.4722272-02	.0000000	.0000000
-.6211661-10	.0000000	.4642338+05	.3605776+05	.0000000	.4220627+05
.0000000	.0000000	.4642337+05	.3605776+05	.0000000	.4220626+05

PROBLEM NUMBER 1

.1579999+01	.0000000	.1250000+00	.1500000-01	.1579999+01	289
.7029886-02	.6507158-02	.0000000	-.1235666-10	-.4035644-10	.8301592+06
.0000000	-.2846449-02	.0000000	-.2846449-02	.0000000	.8301592+06

TABLE B-2. (Continued)

.1110721-01	-.2846449-02	.1990639+06	.1605878+06	.0000000	.0000000
-.2068902-09	.0000000	.7916802-02	.4629464-02	.0000000	.0000000
-.6376314-10	.0000000	.4550033+05	.3670579+05	.0000000	.4180274+05
.0000000	.0000000	.4550032+05	.3670579+05	.0000000	.4180274+05

PROBLEM NUMBER 1

.1714999+01	.0000000	.1250000+00	.1500000-01	.1714999+01	325
.6990026-02	.6538234-02	.0000000	-.1247963-10	-.3815853-10	.8301592+06
.0000000	-.2622385-02	.0000000	-.2622385-02	.0000000	.8301592+06
.1198789-01	-.2622385-02	.1957979+06	.1625432+06	.0000000	.0000000
-.2156113-09	.0000000	.7533632-02	.4518779-02	.0000000	.0000000
-.6544184-10	.0000000	.4475381+05	.3715273+05	.0000000	.4147895+05
.0000000	.0000000	.4475381+05	.3715273+05	.0000000	.4147894+05

PROBLEM NUMBER 1

.1849999+01	.0000000	.1250000+00	.1500000-01	.1849999+01	361
.6957927-02	.6560831-02	.0000000	-.1243661-10	-.3628392-10	.8301592+06
.0000000	-.2431021-02	.0000000	-.2431021-02	.0000000	.8301592+06
.1287216-01	-.2431021-02	.1930759+06	.1638472+06	.0000000	.0000000
-.2245597-09	.0000000	.7197904-02	.4398091-02	.0000000	.0000000
-.6712521-10	.0000000	.4413165+05	.3745078+05	.0000000	.4119950+05
.0000000	.0000000	.4413164+05	.3745078+05	.0000000	.4119949+05

PROBLEM NUMBER 1

.1984999+01	.0000000	.1250000+00	.1500000-01	.1984999+01	397
.6931503-02	.6577031-02	.0000000	-.1228074-10	-.3465729-10	.8301592+06
.0000000	-.2265687-02	.0000000	-.2265687-02	.0000000	.8301592+06
.1375902-01	-.2265687-02	.1907445+06	.1646532+06	.0000000	.0000000
-.2337345-09	.0000000	.6899439-02	.4272301-02	.0000000	.0000000
-.6879467-10	.0000000	.4359875+05	.3763501+05	.0000000	.4094393+05
.0000000	.0000000	.4359875+05	.3763501+05	.0000000	.4094393+05

PROBLEM NUMBER 1

.1999999+01	.0000000	.1250000+00	.1500000-01	.1999999+01	401
.6928851-02	.6578504-02	.0000000	-.1225812-10	-.3448938-10	.8301592+06
.0000000	-.2248695-02	.0000000	-.2248695-02	.0000000	.8301592+06
.1385769-01	-.2248695-02	.1905046+06	.1647169+06	.0000000	.0000000
-.2347678-09	.0000000	.6868236-02	.4258157-02	.0000000	.0000000
-.6897871-10	.0000000	.4354392+05	.3764959+05	.0000000	.4091642+05
.0000000	.0000000	.4354391+05	.3764958+05	.0000000	.4091642+05

TABLE B-2. (Continued)

SEGMENT NUMBER 2   SEGMENT CODE 21   SEGMENT 2 OF REGION I (PLATE)

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.1999000+01	.3600000+01	.4000000+01	.4500000+01	.5001000+01
.4375000+01	.3840000+01	.3275000+01	.2970000+01	.2680000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.6750000+03	.6820000+03	.6980000+03	.7130000+03	.7320000+03

PROBLEM 1   TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000	.0000000	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000

TABLE B-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.2000000+01	.0000000	.1250000+00	.3000000-01	.2000000+01	1
.6928846-02	.6578794-02	.0000000	-.1226708-10	-.3448936-10	.8300654+06
.0000000	-.2248704-02	.0000000	-.2248704-02	.0000000	.8300654+06
.1385769-01	-.2248704-02	.1904802+06	.1647175+06	.0000000	.0000000
-.2347678-09	.0000000	.6866229-02	.4258172-02	.0000000	.0000000
-.6897873-10	.0000000	.4354365+05	.3765430+05	.0000000	.4091809+05
.0000000	.0000000	.4354364+05	.3765430+05	.0000000	.4091809+05

PROBLEM NUMBER 1

.2150000+01	.0000000	.1250000+00	.3000000-01	.2150000+01	21
.6906323-02	.6632095-02	.0000000	-.1348848-10	-.3298266-10	.8159815+06
.0000000	-.2091817-02	.0000000	-.2091817-02	.0000000	.8159815+06
.1484859-01	-.2091817-02	.1848012+06	.1650035+06	.0000000	.0000000
-.2452574-09	.0000000	.6308241-02	.4145476-02	.0000000	.0000000
-.7091271-10	.0000000	.4303410+05	.3842388+05	.0000000	.4092421+05
.0000000	.0000000	.4303410+05	.3842387+05	.0000000	.4092421+05

PROBLEM NUMBER 1

.2300000+01	.0000000	.1250000+00	.3000000-01	.2300000+01	41
.6890009-02	.6679387-02	.0000000	-.1455469-10	-.3174676-10	.8018541+06
.0000000	-.1955395-02	.0000000	-.1955395-02	.0000000	.8018541+06
.1584702-01	-.1955395-02	.1796533+06	.1647427+06	.0000000	.0000000
-.2560502-09	.0000000	.5819281-02	.4018113-02	.0000000	.0000000
-.7301754-10	.0000000	.4263122+05	.3909297+05	.0000000	.4097682+05
.0000000	.0000000	.4263122+05	.3909296+05	.0000000	.4097682+05

PROBLEM NUMBER 1

.2450000+01	.0000000	.1250000+00	.3000000-01	.2450000+01	61
.6878443-02	.6722105-02	.0000000	-.1551427-10	-.3072401-10	.7876833+06
.0000000	-.1835676-02	.0000000	-.1835676-02	.0000000	.7876833+06
.1685218-01	-.1835676-02	.1749076+06	.1640586+06	.0000000	.0000000
-.2671702-09	.0000000	.5385867-02	.3882724-02	.0000000	.0000000
-.7527380-10	.0000000	.4230998+05	.3968562+05	.0000000	.4106075+05

TABLE B-2. (Continued)

.0000000	.0000000	.4230998+05	.3968562+05	.0000000	.4106075+05

PROBLEM NUMBER 1

.2599999+01	.0000000	.1250000+00	.3000000-01	.2599999+01	81
.6870569-02	.6761269-02	.0000000	-.1690288-10	-.2987243-10	.7734692+06
.0000000	-.1729772-02	.0000000	-.1729772-02	.0000000	.7734692+06
.1786348-01	-.1729772-02	.1704715+06	.1630407+06	.0000000	.0000000
-.2786392-09	.0000000	.4997990-02	.3743727-02	.0000000	.0000000
-.7766829-10	.0000000	.4205242+05	.4021936+05	.0000000	.4116651+05
.0000000	.0000000	.4205242+05	.4021936+05	.0000000	.4116651+05

PROBLEM NUMBER 1

.2749999+01	.0000000	.1250000+00	.3000000-01	.2749999+01	101
.6865613-02	.6797711-02	.0000000	-.1718078-10	-.2916025-10	.7592120+06
.0000000	-.1635421-02	.0000000	-.1635421-02	.0000000	.7592120+06
.1888043-01	-.1635421-02	.1662775+06	.1617550+06	.0000000	.0000000
-.2904772-09	.0000000	.4645032-02	.3595193-02	.0000000	.0000000
-.8019067-10	.0000000	.4184538+05	.4070726+05	.0000000	.4128808+05
.0000000	.0000000	.4184537+05	.4070725+05	.0000000	.4128808+05

PROBLEM NUMBER 1

.2899999+01	.0000000	.1250000+00	.3000000-01	.2899999+01	121
.6862995-02	.6831961-02	.0000000	-.1780682-10	-.2855676-10	.7449115+06
.0000000	-.1550830-02	.0000000	-.1550830-02	.0000000	.7449115+06
.1990268-01	-.1550830-02	.1622754+06	.1602516+06	.0000000	.0000000
-.3027014-09	.0000000	.4318190-02	.3432629-02	.0000000	.0000000
-.8281517-10	.0000000	.4167911+05	.4115932+05	.0000000	.4142166+05
.0000000	.0000000	.4167911+05	.4115932+05	.0000000	.4142166+05

PROBLEM NUMBER 1

.3049999+01	.0000000	.1250000+00	.3000000-01	.3049999+01	141
.6862335-02	.6871779-02	.0000000	-.4330926-10	-.2808421-10	.7307020+06
.0000000	-.1474560-02	.0000000	-.1474560-02	.0000000	.7307020+06
.2093012-01	-.1474560-02	.1579631+06	.1585654+06	.0000000	.2913486-02
-.3153263-09	.0000000	.2093841-02	.3269463-02	.0000000	.2913486-02
-.8565681-10	.0000000	.4144109+05	.4159910+05	.0000000	.4152032+05
.0000000	.0000000	.4144109+05	.4159909+05	.0000000	.4152031+05

PROBLEM NUMBER 1

.3199999+01	.0000000	.1250000+00	.3000000-01	.3199999+01	161
.6864008-02	.6923558-02	.0000000	-.1909314-10	-.2768129-10	.7167699+06
.0000000	-.1405440-02	.0000000	-.1405440-02	.0000000	.7167699+06

TABLE B-2. (Continued)

.2196482-01	-.1405440-02	.1529760+06	.1566835+06	.0000000	.0000000
-.3284247-09	.0000000	.3732212-02	.3113296-02	.0000000	.0000000
-.8858011-10	.0000000	.4104534+05	.4204010+05	.0000000	.4155165+05
.0000000	.0000000	.4104534+05	.4204010+05	.0000000	.4155165+05

PROBLEM NUMBER 1

.3349999+01	.0000000	.1250000+00	.3000000-01	.3349999+01	181
.6867785-02	.6972916-02	.0000000	-.1965747-10	-.2747047-10	.7028207+06
.0000000	-.1342510-02	.0000000	-.1342510-02	.0000000	.7028207+06
.2300707-01	-.1342510-02	.1482439+06	.1546312+06	.0000000	.0000000
-.3419149-09	.0000000	.3478026-02	.2953262-02	.0000000	.0000000
-.9202603-10	.0000000	.4070117+05	.4245484+05	.0000000	.4160573+05
.0000000	.0000000	.4070117+05	.4245484+05	.0000000	.4160573+05

PROBLEM NUMBER 1

.3499999+01	.0000000	.1250000+00	.3000000-01	.3499999+01	201
.6873325-02	.7020972-02	.0000000	.6190658-11	-.2696974-10	.6887582+06
.0000000	-.1284973-02	.0000000	-.1284973-02	.0000000	.6887582+06
.2405663-01	-.1284973-02	.1436899+06	.1524392+06	.0000000	-.2533060-02
-.3558651-09	.0000000	.4889135-02	.2816730-02	.0000000	-.2533060-02
-.9439405-10	.0000000	.4039069+05	.4285007+05	.0000000	.4167484+05
.0000000	.0000000	.4039069+05	.4285007+05	.0000000	.4167484+05

PROBLEM NUMBER 1

.3649998+01	.0000000	.1250000+00	.3000000-01	.3649998+01	221
.6880363-02	.7068037-02	.0000000	.6196599-11	-.2679145-10	.6745825+06
.0000000	-.1232166-02	.0000000	-.1232166-02	.0000000	.6745825+06
.2511331-01	-.1232166-02	.1392912+06	.1501320+06	.0000000	-.2412409-02
-.3702941-09	.0000000	.4585670-02	.2670625-02	.0000000	-.2412409-02
-.9778876-10	.0000000	.4010976+05	.4323143+05	.0000000	.4175820+05
.0000000	.0000000	.4010976+05	.4323143+05	.0000000	.4175820+05

PROBLEM NUMBER 1

.3799998+01	.0000000	.1250000+00	.3000000-01	.3799998+01	241
.6888688-02	.7114376-02	.0000000	-.2203658-10	-.2655506-10	.6602941+06
.0000000	-.1183528-02	.0000000	-.1183528-02	.0000000	.6602941+06
.2617700-01	-.1183528-02	.1350296+06	.1477300+06	.0000000	.0000000
-.3851598-09	.0000000	.2782594-02	.2539371-02	.0000000	.0000000
-.1009092-09	.0000000	.3985524+05	.4360388+05	.0000000	.4185565+05
.0000000	.0000000	.3985524+05	.4360387+05	.0000000	.4185565+05

PROBLEM NUMBER 1

TABLE B-2. (Continued)

.3949998+01	.0000000	.1250000+00	.3000000-01	.3949998+01	261
.6898130-02	.7160224-02	.0000000	-.2300336-10	-.2625041-10	.6458932+06
.0000000	-.1138584-02	.0000000	-.1138584-02	.0000000	.6458932+06
.2724760-01	-.1138584-02	.1308906+06	.1452502+06	.0000000	.0000000
-.4005627-09	.0000000	.2578365-02	.2416604-02	.0000000	.0000000
-.1036871-09	.0000000	.3962478+05	.4397189+05	.0000000	.4196753+05
.0000000	.0000000	.3962477+05	.4397189+05	.0000000	.4196753+05

PROBLEM NUMBER 1

.4099998+01	.0000000	.1250000+00	.3000000-01	.4099998+01	281
.6908827-02	.7228155-02	.0000000	-.2415303-10	-.2600339-10	.6316945+06
.0000000	-.1096928-02	.0000000	-.1096928-02	.0000000	.6316945+06
.2832618-01	-.1096928-02	.1257096+06	.1426939+06	.0000000	.0000000
-.4163946-09	.0000000	.2381469-02	.2296751-02	.0000000	.0000000
-.1066139-09	.0000000	.3911313+05	.4439758+05	.0000000	.4200540+05
.0000000	.0000000	.3911313+05	.4439758+05	.0000000	.4200540+05

PROBLEM NUMBER 1

.4249998+01	.0000000	.1250000+00	.3000000-01	.4249998+01	301
.6921484-02	.7306628-02	.0000000	-.5569362-10	-.2605757-10	.6174413+06
.0000000	-.1058213-02	.0000000	-.1058213-02	.0000000	.6174413+06
.2941629-01	-.1058213-02	.1201879+06	.1400362+06	.0000000	.1944116-02
-.4327334-09	.0000000	.9253243-03	.2166245-02	.0000000	.1944116-02
-.1107446-09	.0000000	.3849090+05	.4484743+05	.0000000	.4203122+05
.0000000	.0000000	.3849090+05	.4484743+05	.0000000	.4203122+05

PROBLEM NUMBER 1

.4399998+01	.0000000	.1250000+00	.3000000-01	.4399998+01	321
.6935945-02	.7384674-02	.0000000	-.5765840-10	-.2618938-10	.6029572+06
.0000000	-.1022138-02	.0000000	-.1022138-02	.0000000	.6029572+06
.3051814-01	-.1022138-02	.1149086+06	.1372958+06	.0000000	.1829817-02
-.4496287-09	.0000000	.8372158-03	.2039174-02	.0000000	.1829817-02
-.1152332-09	.0000000	.3791111+05	.4529718+05	.0000000	.4209300+05
.0000000	.0000000	.3791111+05	.4529718+05	.0000000	.4209300+05

PROBLEM NUMBER 1

.4549998+01	.0000000	.1250000+00	.3000000-01	.4549998+01	341
.6952050-02	.7467365-02	.0000000	-.6015849-10	-.2607210-10	.5888617+06
.0000000	-.9884410-03	.0000000	-.9884410-03	.0000000	.5888617+06
.3163181-01	-.9884410-03	.1096172+06	.1344905+06	.0000000	.1720745-02
-.4671705-09	.0000000	.7507690-03	.1936720-02	.0000000	.1720745-02
-.1186280-09	.0000000	.3727134+05	.4572858+05	.0000000	.4214132+05
.0000000	.0000000	.3727134+05	.4572858+05	.0000000	.4214131+05

TABLE B-2. (Continued)

PROBLEM NUMBER 1

.4699997+01	.0000000	.1250000+00	.3000000-01	.4699997+01	361
.6969969-02	.7559924-02	.0000000	-.2899286-10	-.2604126-10	.5757026+06
.0000000	-.9568950-03	.0000000	-.9568950-03	.0000000	.5757026+06
.3275883-01	-.9568950-03	.1040806+06	.1316185+06	.0000000	.0000000
-.4852177-09	.0000000	.1736623-02	.1830157-02	.0000000	.0000000
-.1223938-09	.0000000	.3646535+05	.4611344+05	.0000000	.4212634+05
.0000000	.0000000	.3646535+05	.4611344+05	.0000000	.4212634+05

PROBLEM NUMBER 1

.4849997+01	.0000000	.1250000+00	.3000000-01	.4849997+01	381
.6989655-02	.7653065-02	.0000000	-.2978094-10	-.2649371-10	.5622222+06
.0000000	-.9273003-03	.0000000	-.9273003-03	.0000000	.5622222+06
.3389981-01	-.9273003-03	.9877655+05	.1286909+06	.0000000	.0000000
-.5040578-09	.0000000	.1610660-02	.1705260-02	.0000000	.0000000
-.1284944-09	.0000000	.3569282+05	.4650234+05	.0000000	.4215027+05
.0000000	.0000000	.3569282+05	.4650234+05	.0000000	.4215027+05

PROBLEM NUMBER 1

.4999997+01	.0000000	.1250000+00	.3000000-01	.4999997+01	401
.7010956-02	.7746377-02	.0000000	-.6697316-10	-.2643394-10	.5484689+06
.0000000	-.8994812-03	.0000000	-.8994812-03	.0000000	.5484689+06
.3505476-01	-.8994812-03	.9372107+05	.1257237+06	.0000000	.1422818-02
-.5236396-09	.0000000	.5436118-03	.1599948-02	.0000000	.1422818-02
-.1321696-09	.0000000	.3496297+05	.4690168+05	.0000000	.4221794+05
.0000000	.0000000	.3496297+05	.4690168+05	.0000000	.4221794+05

TABLE B-2. (Continued)

```
        SEGMENT NUMBER  3     SEGMENT CODE 21      SEGMENT 3 OF REGION 1 (PLATE)

                                   TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
  .4999000+01     .5501000+01
  .2680000+01     .2372000+01

                                   TABLE ORDER PHI OR S VS. TEMPERATURE LOADS
  .7320000+03     .7590000+03

            PROBLEM  1     TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

  .0000000        .0000000
  .0000000        .0000000
  .0000000        .0000000
```

TABLE B-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.5000000+01	.0000000	.1250000+00	.5000000-02	.5000000+01	1
.7010953-02	.7748588-02	.0000000	.4602651-11	-.2643393-10	.5482871+06
.0000000	-.8995874-03	.0000000	-.8995874-03	.0000000	.5482871+06
.3505476-01	-.8995874-03	.9364081+05	.1257237+06	.0000000	-.1421515-02
-.5236396-09	.0000000	.2407552-02	.1599956-02	.0000000	-.1421515-02
-.1321697-09	.0000000	.3494860+05	.4692256+05	.0000000	.4222858+05
.0000000	.0000000	.3494860+05	.4692255+05	.0000000	.4222858+05

PROBLEM NUMBER 1

.5130000+01	.0000000	.1250000+00	.5000000-02	.5130000+01	105
.7031102-02	.7863570-02	.0000000	-.3253057-10	-.2661397-10	.5365709+06
.0000000	-.8767908-03	.0000000	-.8767908-03	.0000000	.5365709+06
.3606955-01	-.8767908-03	.8814462+05	.1231147+06	.0000000	.0000000
-.5410927-09	.0000000	.1366147-02	.1506120-02	.0000000	.0000000
-.1365296-09	.0000000	.3390666+05	.4735865+05	.0000000	.4226972+05
.0000000	.0000000	.3390666+05	.4735865+05	.0000000	.4226972+05

PROBLEM NUMBER 1

.5260000+01	.0000000	.1250000+00	.5000000-02	.5260000+01	209
.7053100-02	.7978891-02	.0000000	-.7223858-10	-.2671273-10	.5245435+06
.0000000	-.8551211-03	.0000000	-.8551211-03	.0000000	.5245435+06
.3709931-01	-.8551211-03	.8294323+05	.1204686+06	.0000000	.1252335-02
-.5591009-09	.0000000	.4407981-03	.1417234-02	.0000000	.1252335-02
-.1405090-09	.0000000	.3291575+05	.4780758+05	.0000000	.4237203+05
.0000000	.0000000	.3291575+05	.4780758+05	.0000000	.4237203+05

PROBLEM NUMBER 1

.5390000+01	.0000000	.1250000+00	.5000000-02	.5390000+01	313
.7076826-02	.8094866-02	.0000000	.3997051-11	-.2689276-10	.5122073+06
.0000000	-.8344967-03	.0000000	-.8344967-03	.0000000	.5122073+06
.3814409-01	-.8344967-03	.7802244+05	.1177981+06	.0000000	-.1171964-02
-.5776816-09	.0000000	.1928224-02	.1329394-02	.0000000	-.1171964-02
-.1449520-09	.0000000	.3197505+05	.4827585+05	.0000000	.4253632+05

TABLE B-2. (Continued)

.0000000	.0000000	.3197505+05	.4827585+05	.0000000	.4253632+05

PROBLEM NUMBER 1

.5500000+01	.0000000	.1250000+00	.5000000-02	.5500000+01	401
.7098175-02	.8193747-02	.0000000	-.7756683-10	-.2708973-10	.5015298+06
.0000000	-.8178067-03	.0000000	-.8178067-03	.0000000	.5015298+06
.3903996-01	-.8178067-03	.7406850+05	.1155278+06	.0000000	.1106142-02
-.5938610-09	.0000000	.3603482-03	.1256431-02	.0000000	.1106142-02
-.1489935-09	.0000000	.3121810+05	.4869221+05	.0000000	.4272496+05
.0000000	.0000000	.3121810+05	.4869220+05	.0000000	.4272496+05

TABLE B-2. (Continued)

```
            SEGMENT NUMBER  4     SEGMENT CODE 21     SEGMENT 4 OF REGION 1 (PLATE)

                                  TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
  .5499000+01      .6601000+01
  .2372000+01      .2210000+01

                                     TABLE ORDER PHI OR S VS. TEMPERATURE LOADS
  .7590000+03      .7930000+03

             PROBLEM  1     TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110
  .0000000         .0000000
  .0000000         .0000000
  .0000000         .0000000
```

TABLE B-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.5500000+01	.0000000	.1250000+00	.5000000-02	.5500000+01	1
.7098174-02	.8196372-02	.0000000	.3816599-11	-.2708976-10	.5014033+06
.0000000	-.8179031-03	.0000000	-.8179031-03	.0000000	.5014033+06
.3903996-01	-.8179031-03	.7398890+05	.1155278+06	.0000000	-.1105230-02
-.5938610-09	.0000000	.1804431-02	.1256466-02	.0000000	-.1105230-02
-.1489937-09	.0000000	.3119687+05	.4871145+05	.0000000	.4273646+05
.0000000	.0000000	.3119686+05	.4871144+05	.0000000	.4273646+05

PROBLEM NUMBER 1

.5630000+01	.0000000	.1250000+00	.5000000-02	.5630000+01	105
.7124832-02	.8308730-02	.0000000	-.3632511-10	-.2731690-10	.4975967+06
.0000000	-.7990173-03	.0000000	-.7990173-03	.0000000	.4975967+06
.4011280-01	-.7990173-03	.6908784+05	.1128212+06	.0000000	.0000000
-.6135271-09	.0000000	.1022461-02	.1172971-02	.0000000	.0000000
-.1537941-09	.0000000	.2965493+05	.4842682+05	.0000000	.4229040+05
.0000000	.0000000	.2965493+05	.4842682+05	.0000000	.4229040+05

PROBLEM NUMBER 1

.5760000+01	.0000000	.1250000+00	.5000000-02	.5760000+01	209
.7152809-02	.8420013-02	.0000000	-.7810599-10	-.2750765-10	.4935651+06
.0000000	-.7809839-03	.0000000	-.7809839-03	.0000000	.4935651+06
.4120018-01	-.7809839-03	.6438119+05	.1100811+06	.0000000	.1023125-02
-.6338167-09	.0000000	.2969247-03	.1092809-02	.0000000	.1023125-02
-.1584441-09	.0000000	.2814142+05	.4811714+05	.0000000	.4187021+05
.0000000	.0000000	.2814142+05	.4811714+05	.0000000	.4187020+05

PROBLEM NUMBER 1

.5890000+01	.0000000	.1250000+00	.5000000-02	.5890000+01	313
.7181997-02	.8530320-02	.0000000	-.3507563-10	-.2763954-10	.4893104+06
.0000000	-.7637466-03	.0000000	-.7637466-03	.0000000	.4893104+06
.4230196-01	-.7637466-03	.5986071+05	.1073150+06	.0000000	.0000000
-.6546951-09	.0000000	.9061224-03	.1016123-02	.0000000	.0000000
-.1627969-09	.0000000	.2665427+05	.4778431+05	.0000000	.4147450+05

TABLE B-2. (Continued)

.0000000	.0000000	.2665427+05	.4778431+05	.0000000	.4147450+05

PROBLEM NUMBER 1

.6000000+01	.0000000	.1250000+00	.5000000-02	.6000000+01	401
.7207567-02	.8622963-02	.0000000	-.3443044-10	-.2779359-10	.4855376+06
.0000000	-.7497445-03	.0000000	-.7497445-03	.0000000	.4855376+06
.4324540-01	-.7497445-03	.5617559+05	.1049591+06	.0000000	.0000000
-.6728342-09	.0000000	.8593552-03	.9524848-03	.0000000	.0000000
-.1667615-09	.0000000	.2541511+05	.4748589+05	.0000000	.4115797+05
.0000000	.0000000	.2541510+05	.4748588+05	.0000000	.4115796+05

TABLE B-2. (Continued)

```
            SEGMENT NUMBER  5     SEGMENT CODE 21       SEGMENT 5 OF REGION 1 (PLATE)

                                                 TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
    .5999000+01       .7001000+01
    .2210000+01       .2155000+01

                                                   TABLE ORDER PHI OR S VS. TEMPERATURE LOADS
    .7930000+03       .8950000+03

               PROBLEM  1     TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

    .0000000          .0000000
    .0000000          .0000000
    .0000000          .0000000
```

TABLE B-2. (Continued)

PHI (RAD, OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.6000000+01	.0000000	.1250000+00	.1000000-01	.6000000+01	1
.7207566-02	.8625900-02	.0000000	-.3445876-10	-.2779364-10	.4855444+06
.0000000	-.7495596-03	.0000000	-.7495596-03	.0000000	.4855444+06
.4324540-01	-.7495596-03	.5608824+05	.1049591+06	.0000000	.0000000
-.6728342-09	.0000000	.8590625-03	.9525301-03	.0000000	.0000000
-.1667619-09	.0000000	.2537993+05	.4749399+05	.0000000	.4116341+05
.0000000	.0000000	.2537992+05	.4749399+05	.0000000	.4116340+05

PROBLEM NUMBER 1

.6130000+01	.0000000	.1250000+00	.1000000-01	.6130000+01	53
.7239184-02	.8770716-02	.0000000	-.3174602-10	-.2790459-10	.4909130+06
.0000000	-.7336636-03	.0000000	-.7336636-03	.0000000	.4909130+06
.4437620-01	-.7336636-03	.4999260+05	.1021268+06	.0000000	.0000000
-.6948389-09	.0000000	.8277647-03	.8806411-03	.0000000	.0000000
-.1710551-09	.0000000	.2269493+05	.4636207+05	.0000000	.4015367+05
.0000000	.0000000	.2269492+05	.4636207+05	.0000000	.4015367+05

PROBLEM NUMBER 1

.6260000+01	.0000000	.1250000+00	.1000000-01	.6260000+01	105
.7272477-02	.8913726-02	.0000000	-.2911586-10	-.2795547-10	.4961401+06
.0000000	-.7184278-03	.0000000	-.7184278-03	.0000000	.4961401+06
.4552571-01	-.7184278-03	.4402880+05	.9921919+05	.0000000	.0000000
-.7173792-09	.0000000	.7964196-03	.8120960-03	.0000000	.0000000
-.1750013-09	.0000000	.2005252+05	.4518850+05	.0000000	.3921684+05
.0000000	.0000000	.2005252+05	.4518850+05	.0000000	.3921684+05

PROBLEM NUMBER 1

.6390000+01	.0000000	.1250000+00	.1000000-01	.6390000+01	157
.7307311-02	.9055407-02	.0000000	-.2656426-10	-.2795160-10	.5012086+06
.0000000	-.7038119-03	.0000000	-.7038119-03	.0000000	.5012086+06
.4669372-01	-.7038119-03	.3818440+05	.9624239+05	.0000000	.0000000
-.7404109-09	.0000000	.7650970-03	.7467060-03	.0000000	.0000000
-.1786107-09	.0000000	.1744745+05	.4397566+05	.0000000	.3835373+05

TABLE B-2. (Continued)

.0000000	.0000000	.1744745+05	.4397565+05	.0000000	.3835373+05

PROBLEM NUMBER 1

.6520000+01	.0000000	.1250000+00	.1000000-01	.6520000+01	209
.7343565-02	.9195483-02	.0000000	-.2412938-10	-.2785203-10	.5061327+06
.0000000	-.6897788-03	.0000000	-.6897788-03	.0000000	.5061327+06
.4788004-01	-.6897788-03	.3245972+05	.9320190+05	.0000000	.0000000
-.7638742-09	.0000000	.7333170-03	.6848985-03	.0000000	.0000000
-.1815952-09	.0000000	.1488021+05	.4272568+05	.0000000	.3756511+05
.0000000	.0000000	.1488021+05	.4272568+05	.0000000	.3756511+05

PROBLEM NUMBER 1

.6649999+01	.0000000	.1250000+00	.1000000-01	.6649999+01	261
.7381125-02	.9334616-02	.0000000	-.2175846-10	-.2770912-10	.5109125+06
.0000000	-.6762944-03	.0000000	-.6762944-03	.0000000	.5109125+06
.4908448-01	-.6762944-03	.2684941+05	.9010276+05	.0000000	.0000000
-.7877053-09	.0000000	.7018055-03	.6258753-03	.0000000	.0000000
-.1842656-09	.0000000	.1234872+05	.4144053+05	.0000000	.3685202+05
.0000000	.0000000	.1234872+05	.4144053+05	.0000000	.3685202+05

PROBLEM NUMBER 1

.6779999+01	.0000000	.1250000+00	.1000000-01	.6779999+01	313
.7419886-02	.9471068-02	.0000000	-.1940248-10	-.2757105-10	.5155474+06
.0000000	-.6633271-03	.0000000	-.6633271-03	.0000000	.5155474+06
.5030682-01	-.6633271-03	.2134843+05	.8694955+05	.0000000	.0000000
-.8118806-09	.0000000	.6711793-03	.5689343-03	.0000000	.0000000
-.1869317-09	.0000000	.9851014+04	.4012197+05	.0000000	.3621564+05
.0000000	.0000000	.9851012+04	.4012197+05	.0000000	.3621564+05

PROBLEM NUMBER 1

.6909999+01	.0000000	.1250000+00	.1000000-01	.6909999+01	365
.7459754-02	.9606692-02	.0000000	-.1714821-10	-.2735044-10	.5200369+06
.0000000	-.6508477-03	.0000000	-.6508477-03	.0000000	.5200369+06
.5154689-01	-.6508477-03	.1595227+05	.8374641+05	.0000000	.0000000
-.8363662-09	.0000000	.6403454-03	.5150913-03	.0000000	.0000000
-.1889915-09	.0000000	.7385329+04	.3877157+05	.0000000	.3565722+05
.0000000	.0000000	.7385328+04	.3877157+05	.0000000	.3565722+05

PROBLEM NUMBER 1

.6999999+01	.0000000	.1250000+00	.1000000-01	.6999999+01	401
.7487956-02	.9699772-02	.0000000	-.1556570-10	-.2723086-10	.5230595+06
.0000000	-.6424797-03	.0000000	-.6424797-03	.0000000	.5230595+06

TABLE B-2. (Continued)

.5241569-01	-.6424797-03	.1227568+05	.8150160+05	.0000000	.0000000
-.8534565-09	.0000000	.6198893-03	.4785881-03	.0000000	.0000000
-.1906160-09	.0000000	.5696228+04	.3781881+05	.0000000	.3531692+05
.0000000	.0000000	.5696227+04	.3781880+05	.0000000	.3531691+05

TABLE B-2. (Continued)

```
SEGMENT NUMBER  6     SEGMENT CODE 21     SEGMENT 6 OF REGION 1 (PLATE)

                              TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
  .6999000+01    .8001000+01
  .2155000+01    .2700000+01

                              TABLE ORDER PHI OR S VS. TEMPERATURE LOADS
  .8950000+03    .1050000+04

        PROBLEM  1    TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

  .0000000       .0000000
  .0000000       .0000000
  .0000000       .0000000
```

TABLE B-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.7000000+01	.0000000	.1250000+00	.1000000-01	.7000000+01	1
.7487955-02	.9703464-02	.0000000	-.6181677-10	-.2723086-10	.5232954+06
.0000000	-.6424798-03	.0000000	-.6424798-03	.0000000	.5232954+06
.5241569-01	-.6424798-03	.1215717+05	.8150159+05	.0000000	.8744135-03
-.8534565-09	.0000000	.5945043-04	.4786006-03	.0000000	.8744135-03
-.1906160-09	.0000000	.5639957+04	.3781022+05	.0000000	.3532951+05
.0000000	.0000000	.5639957+04	.3781022+05	.0000000	.3532951+05

PROBLEM NUMBER 1

.7130000+01	.0000000	.1250000+00	.1000000-01	.7130000+01	53
.7530027-02	.9887938-02	.0000000	-.1118028-10	-.2692316-10	.5498234+06
.0000000	-.6307656-03	.0000000	-.6307656-03	.0000000	.5498234+06
.5368909-01	-.6307656-03	.3029435+04	.7814903+05	.0000000	.0000000
-.8783099-09	.0000000	.6370187-03	.4298721-03	.0000000	.0000000
-.1919621-09	.0000000	.1360779+04	.3510340+05	.0000000	.3444318+05
.0000000	.0000000	.1360777+04	.3510340+05	.0000000	.3444318+05

PROBLEM NUMBER 1

.7260000+01	.0000000	.1250000+00	.1000000-01	.7260000+01	105
.7573925-02	.1007568-01	.0000000	-.7362029-11	-.2683043-10	.5766786+06
.0000000	-.6194709-03	.0000000	-.6194709-03	.0000000	.5766786+06
.5498669-01	-.6194709-03	-.6418419+04	.7461113+05	.0000000	.0000000
-.9034789-09	.0000000	.6588585-03	.3816188-03	.0000000	.0000000
-.1947889-09	.0000000	-.2794308+04	.3248254+05	.0000000	.3396601+05
.0000000	.0000000	-.2794310+04	.3248254+05	.0000000	.3396601+05

PROBLEM NUMBER 1

.7390000+01	.0000000	.1250000+00	.1000000-01	.7390000+01	157
.7619607-02	.1026636-01	.0000000	-.4727201-10	-.2635533-10	.6038302+06
.0000000	-.6085736-03	.0000000	-.6085736-03	.0000000	.6038302+06
.5630889-01	-.6085736-03	-.1616907+05	.7088616+05	.0000000	.1032341-02
-.9288336-09	.0000000	.2076191-04	.3421543-03	.0000000	.1032341-02
-.1947659-09	.0000000	-.6829108+04	.2993922+05	.0000000	.3387405+05

TABLE B-2. (Continued)

.0000000	.0000000	-.6829108+04	.2993921+05	.0000000	.3387405+05

PROBLEM NUMBER 1

.7520000+01	.0000000	.1250000+00	.1000000-01	.7520000+01	209
.7667030-02	.1045969-01	.0000000	-.2273799-11	-.2587370-10	.6312490+06
.0000000	-.5980530-03	.0000000	-.5980530-03	.0000000	.6312490+06
.5765606-01	-.5980530-03	-.2620608+05	.6697269+05	.0000000	.0000000
-.9541164-09	.0000000	.6964281-03	.3062791-03	.0000000	.0000000
-.1945702-09	.0000000	-.1074734+05	.2746608+05	.0000000	.3413324+05
.0000000	.0000000	-.1074734+05	.2746608+05	.0000000	.3413324+05

PROBLEM NUMBER 1

.7649999+01	.0000000	.1250000+00	.1000000-01	.7649999+01	261
.7716147-02	.1065546-01	.0000000	-.1527866-12	-.2566940-10	.6589829+06
.0000000	-.5878900-03	.0000000	-.5878900-03	.0000000	.6589829+06
.5902852-01	-.5878900-03	-.3653399+05	.6286934+05	.0000000	.0000000
-.9795474-09	.0000000	.7219943-03	.2692767-03	.0000000	.0000000
-.1963709-09	.0000000	-.1456067+05	.2505667+05	.0000000	.3470867+05
.0000000	.0000000	-.1456067+05	.2505666+05	.0000000	.3470867+05

PROBLEM NUMBER 1

.7779999+01	.0000000	.1250000+00	.1000000-01	.7779999+01	313
.7766912-02	.1085341-01	.0000000	-.3849555-10	-.2511900-10	.6869261+06
.0000000	-.5780667-03	.0000000	-.5780667-03	.0000000	.6869261+06
.6042657-01	-.5780667-03	-.4711803+05	.5857497+05	.0000000	.1197569-02
-.1005044-08	.0000000	-.1216564-04	.2418815-03	.0000000	.1197569-02
-.1954258-09	.0000000	-.1826425+05	.2270528+05	.0000000	.3555007+05
.0000000	.0000000	-.1826425+05	.2270528+05	.0000000	.3555007+05

PROBLEM NUMBER 1

.7909999+01	.0000000	.1250000+00	.1000000-01	.7909999+01	365
.7819279-02	.1105329-01	.0000000	.2411619-11	-.2461755-10	.7150451+06
.0000000	-.5685662-03	.0000000	-.5685662-03	.0000000	.7150451+06
.6185049-01	-.5685662-03	-.5794193+05	.5408880+05	.0000000	.0000000
-.1030384-08	.0000000	.7652968-03	.2171413-03	.0000000	.0000000
-.1947248-09	.0000000	-.2186073+05	.2040699+05	.0000000	.3661213+05
.0000000	.0000000	-.2186073+05	.2040699+05	.0000000	.3661213+05

PROBLEM NUMBER 1

.7999999+01	.0000000	.1250000+00	.1000000-01	.7999999+01	401
.7856445-02	.1119271-01	.0000000	.3097298-11	-.2430951-10	.7345969+06
.0000000	-.5621698-03	.0000000	-.5621698-03	.0000000	.7345969+06

TABLE B-2. (Continued)

.6285155-01	-.5621698-03	-.6556740+05	.5087034+05	.0000000	.0000000
-.1047898-08	.0000000	.7821968-03	.2013479-03	.0000000	.0000000
-.1944760-09	.0000000	-.2428912+05	.1884467+05	.0000000	.3745402+05
.0000000	.0000000	-.2428912+05	.1884467+05	.0000000	.3745402+05

TABLE B-2. (Continued)

SEGMENT NUMBER 7 SEGMENT CODE 21 SEGMENT 7 OF REGION 1 (PLATE)

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.7999000+01	.8501000+01
.2700000+01	.2380000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.1050000+04	.1152000+04

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

TABLE B-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.8000000+01	.0000000	.1250000+00	.5000000-02	.8000000+01	1
.7856444-02	.1119872-01	.0000000	.3078291-11	-.2430950-10	.7347326+06
.0000000	-.5644293-03	.0000000	-.5644293-03	.0000000	.7347326+06
.6285155-01	-.5644293-03	-.6573557+05	.5087543+05	.0000000	.0000000
-.1047898-08	.0000000	.7821717-03	.2019485-03	.0000000	.0000000
-.1944760-09	.0000000	-.2435226+05	.1884720+05	.0000000	.3751295+05
.0000000	.0000000	-.2435226+05	.1884720+05	.0000000	.3751295+05

PROBLEM NUMBER 1

.8129997+01	.0000000	.1250000+00	.5000000-02	.8129997+01	105
.7912745-02	.1155530-01	.0000000	.3007712-11	-.2387225-10	.7233813+06
.0000000	-.5554040-03	.0000000	-.5554040-03	.0000000	.7233813+06
.6433059-01	-.5554040-03	-.7448469+05	.4615935+05	.0000000	.0000000
-.1073154-08	.0000000	.6875911-03	.1796811-03	.0000000	.0000000
-.1940813-09	.0000000	-.2846734+05	.1764167+05	.0000000	.4029677+05
.0000000	.0000000	-.2846734+05	.1764167+05	.0000000	.4029677+05

PROBLEM NUMBER 1

.8259994+01	.0000000	.1250000+00	.5000000-02	.8259994+01	209
.7972626-02	.1187827-01	.0000000	.3053790-11	-.2344900-10	.7137615+06
.0000000	-.5466628-03	.0000000	-.5466628-03	.0000000	.7137615+06
.6585384-01	-.5466628-03	-.8215732+05	.4146193+05	.0000000	.0000000
-.1098359-08	.0000000	.6054730-03	.1567383-03	.0000000	.0000000
-.1936886-09	.0000000	-.3242673+05	.1636464+05	.0000000	.4301100+05
.0000000	.0000000	-.3242673+05	.1636464+05	.0000000	.4301100+05

PROBLEM NUMBER 1

.8389990+01	.0000000	.1250000+00	.5000000-02	.8389990+01	313
.8035622-02	.1219735-01	.0000000	.3222854-11	-.2303722-10	.7029907+06
.0000000	-.5381924-03	.0000000	-.5381924-03	.0000000	.7029907+06
.6741879-01	-.5381924-03	-.8894141+05	.3680145+05	.0000000	.0000000
-.1123513-08	.0000000	.5303649-03	.1332402-03	.0000000	.0000000
-.1932821-09	.0000000	-.3629131+05	.1501633+05	.0000000	.4568929+05

TABLE B-2. (Continued)

.0000000	.0000000	-.3629131+05	.1501632+05	.0000000	.4568929+05

PROBLEM NUMBER 1

.8499988+01	.0000000	.1250000+00	.5000000-02	.8499988+01	401
.8091214-02	.1246455-01	.0000000	.3484683-11	-.2269583-10	.6929638+06
.0000000	-.5312276-03	.0000000	-.5312276-03	.0000000	.6929638+06
.6877522-01	-.5312276-03	-.9401474+05	.3289857+05	.0000000	.0000000
-.1144754-08	.0000000	.4717943-03	.1129713-03	.0000000	.0000000
-.1929142-09	.0000000	-.3949129+05	.1381918+05	.0000000	.4791940+05
.0000000	.0000000	-.3949129+05	.1381918+05	.0000000	.4791940+05

TABLE B-2. (Continued)

```
SEGMENT NUMBER  8     SEGMENT CODE 21      SEGMENT 8 OF REGION 1 (PLATE)

                                    TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
   .8499000+01      .9001000+01
   .2380000+01      .1910000+01

                                      TABLE ORDER PHI OR S VS. TEMPERATURE LOADS
   .1152000+04      .1275000+04

            PROBLEM  1     TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
 LOAD IDENTIFICATION CLUES 101110

   .0000000         .0000000
   .0000000         .0000000
   .0000000         .0000000
```

TABLE B-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT
		PROBLEM NUMBER 1			
.8500000+01	.0000000	.1250000+00	.5000000-02	.8500000+01	1
.8091202-02	.1247198-01	.0000000	.3449915-11	-.2269586-10	.6927044+06
.0000000	-.5290801-03	.0000000	-.5290801-03	.0000000	.6927044+06
.6877522-01	-.5290801-03	-.9412161+05	.3289405+05	.0000000	.0000000
-.1144754-08	.0000000	.4710544-03	.1135031-03	.0000000	.0000000
-.1929148-09	.0000000	-.3956246+05	.1382647+05	.0000000	.4799342+05
.0000000	.0000000	-.3956246+05	.1382647+05	.0000000	.4799342+05
		PROBLEM NUMBER 1			
.8629997+01	.0000000	.1250000+00	.5000000-02	.8629997+01	105
.8160281-02	.1288098-01	.0000000	.3703051-11	-.2230048-10	.6705091+06
.0000000	-.5211102-03	.0000000	-.5211102-03	.0000000	.6705091+06
.7042320-01	-.5211102-03	-.9940624+05	.2836306+05	.0000000	.0000000
-.1169803-08	.0000000	.3877530-03	.8889113-04	.0000000	.0000000
-.1924531-09	.0000000	-.4403663+05	.1256474+05	.0000000	.5148210+05
.0000000	.0000000	-.4403663+05	.1256474+05	.0000000	.5148210+05
		PROBLEM NUMBER 1			
.8759994+01	.0000000	.1250000+00	.5000000-02	.8759994+01	209
.8233352-02	.1328619-01	.0000000	.4320643-11	-.2191055-10	.6464548+06
.0000000	-.5133768-03	.0000000	-.5133768-03	.0000000	.6464548+06
.7212411-01	-.5133768-03	-.1033060+06	.2395820+05	.0000000	.0000000
-.1194789-08	.0000000	.3140672-03	.6295651-04	.0000000	.0000000
-.1919363-09	.0000000	-.4837231+05	.1121826+05	.0000000	.5484872+05
.0000000	.0000000	-.4837231+05	.1121826+05	.0000000	.5484872+05
		PROBLEM NUMBER 1			
.8889990+01	.0000000	.1250000+00	.5000000-02	.8889990+01	313
.8310180-02	.1368717-01	.0000000	.5477701-11	-.2151931-10	.6206068+06
.0000000	-.5058696-03	.0000000	-.5058696-03	.0000000	.6206068+06
.7387742-01	-.5058696-03	-.1058867+06	.1970069+05	.0000000	.0000000
-.1219702-08	.0000000	.2489089-03	.3578545-04	.0000000	.0000000
-.1913065-09	.0000000	-.5257704+05	.9782193+04	.0000000	.5808920+05

TABLE B-2. (Concluded)

.0000000	.0000000	-.5257704+05	.9782193+04	.0000000	.5808920+05

PROBLEM NUMBER 1

.8999988+01	.0000000	.1250000+00	.5000000-02	.8999988+01	401
.8377956-02	.1402274-01	.0000000	.8167432-11	-.2117472-10	.5973844+06
.0000000	-.4996867-03	.0000000	-.4996867-03	.0000000	.5973844+06
.7540150-01	-.4996867-03	-.1070870+06	.1622760+05	.0000000	.0000000
-.1240708-08	.0000000	.1950633-03	-.1216354-09	.0000000	.0000000
-.1905722-09	.0000000	-.5603866+05	.8491911+04	.0000000	.6073154+05
.0000000	.0000000	-.5603866+05	.8491911+04	.0000000	.6073154+05

APPENDIX C

EXAMPLE PROBLEM 2

Example Problem 2 is an extension of Problem 1 in which two regions have been added. The additional regions are composed of various geometric shapes devised merely to show the complex geometries that the program can handle. The additional geometric shapes are constructed of equal and unequal face sheet thickness sandwich segments with some stringer and ring stiffeners. Figure C-1 shows the overall geometry of the problem, and Figures C-2, C-3, and C-4 show the individual region geometries. The segments which have stiffeners are shown in Figure C-5 and Figure C-6 with their respective stiffener geometries and parametric values shown. The resulting topology is shown in an idealization in Figure C-7, along with the kinematic link information. The kinematic links were included in this problem to demonstrate how to use them; both kinematic links could have been avoided if the centerlines of the joining segments had been made to coincide.

The input data and format are shown in Table C-1, and the output solution is given in Table C-2.

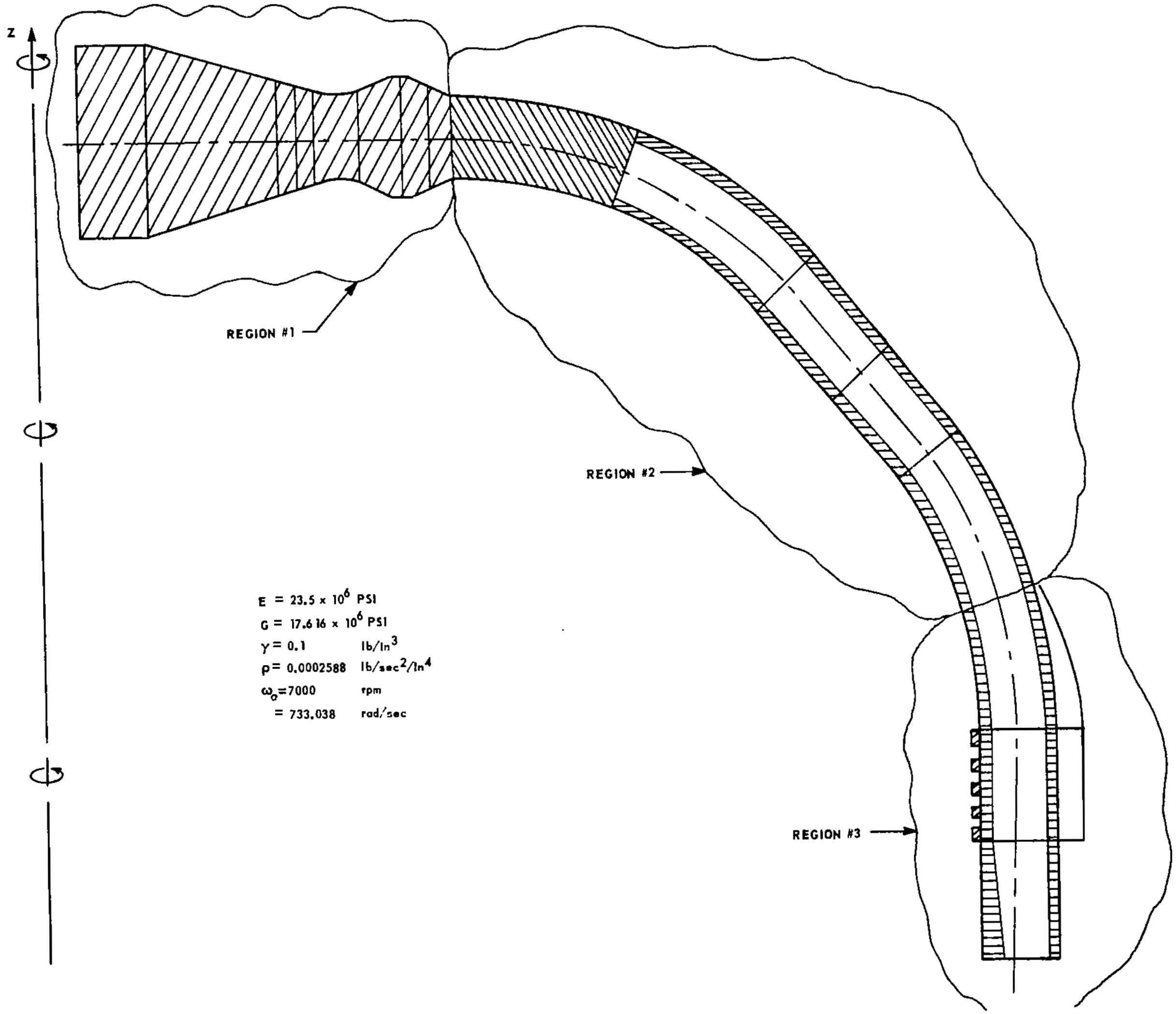
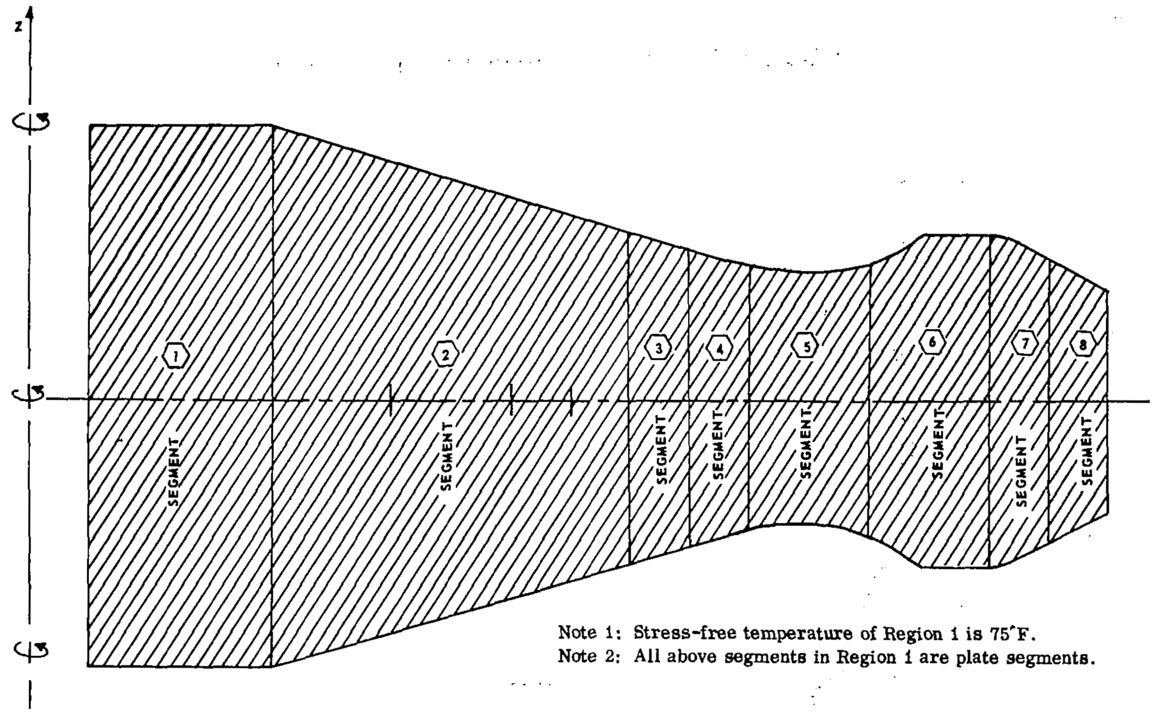


Figure C-1. Problem 2 overall geometry.



	0.5 in.	2.0 in.	3.0 in.	4.0 in.	4.5 in.	5.0 in.	5.5 in.	6.0 in.	7.0 in.	8.0 in.	8.5 in.	9.0 in.
Temperature (°F)	675	675	682	698	713	732	759	793	895	1050	1152	1275
Thickness (in.)	4.375	4.375	3.84	3.275	2.97	2.68	2.372	2.21	2.155	2.70	2.38	1.91
Poisson's Ratio	0.333	0.333	0.333	0.335	0.336	0.338	0.340	0.343	0.352	0.366	0.375	0.386
Young's Modulus ($E \times 10^6$)	23.5	23.5	23.4	23.2	23.0	22.8	22.4	22.0	20.7	18.7	17.4	15.8
Coef. Thermal Exp. ($\alpha \times 10^{-6}$)	9.149	9.149	9.159	9.185	9.207	9.239	9.281	9.337	9.499	9.748	9.913	10.109

Figure C-2. Problem 2, region 1, geometry.

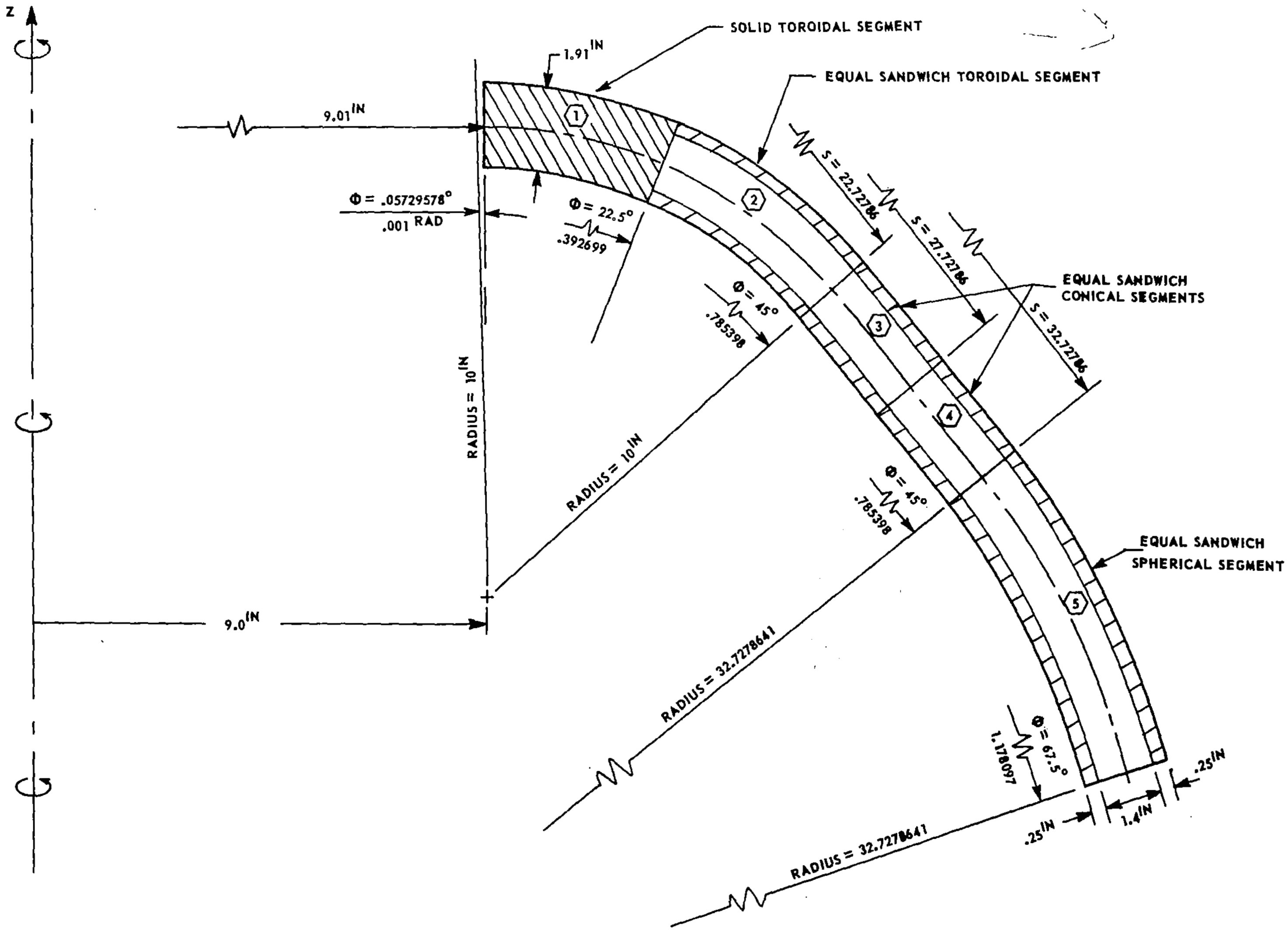


Figure C-3. Problem 2, region 2, geometry.

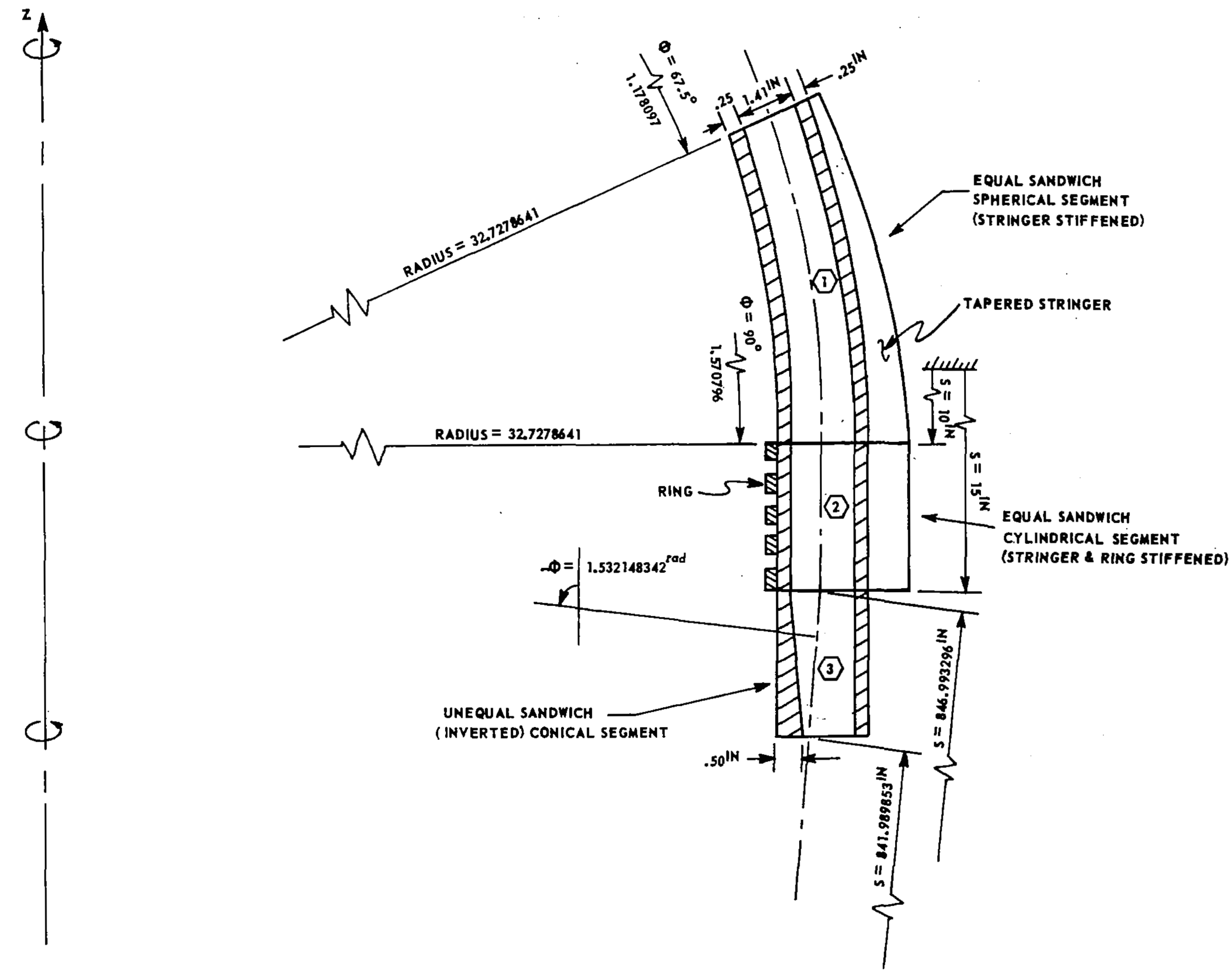
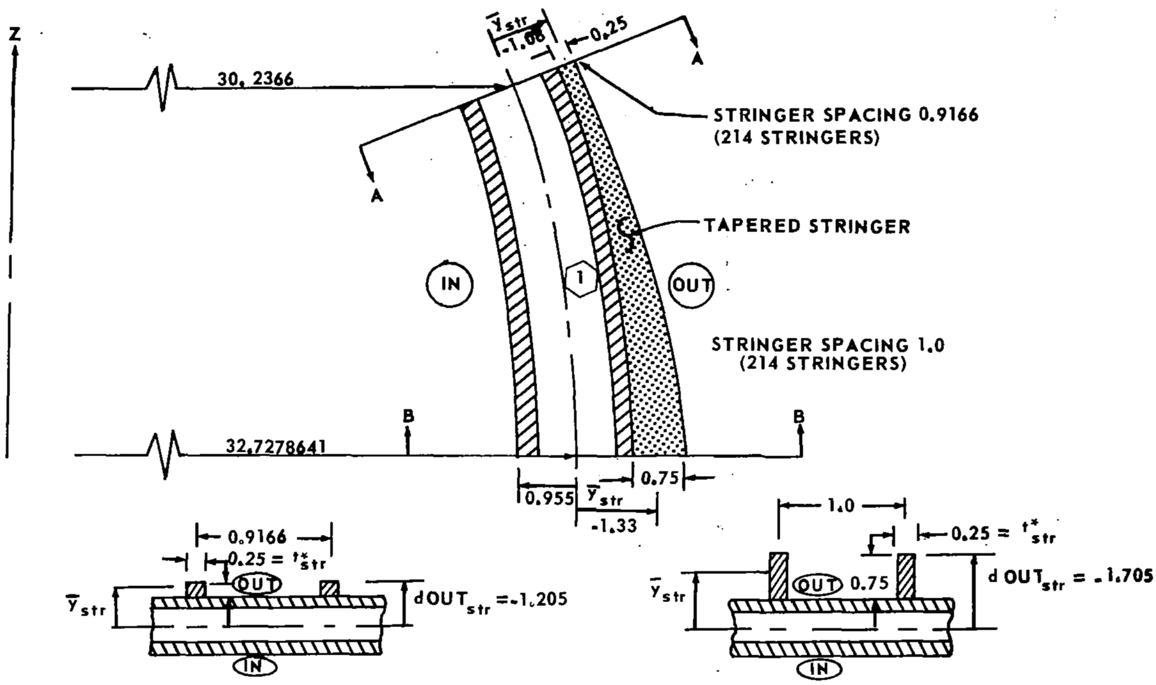


Figure C-4. Problem 2, region 3, geometry.



SECTION A-A

Segment Card 11 Calculations
(A) d in_{ring} = 0.955
(B) d out_{ring} = -0.955
(C) d in_{str} = 0.955
(D) d out_{str} = -1.205
(E) S_{ring} = 0.0
(F) S_{str} = 0.9166
(G) t^*_{ring} = 0.0
(H) t^*_{str} = 0.25
(I) $\bar{y}_{ring}$ = 0.0
(J) $\bar{t}_{ring}$ = 0.0
(K) $\bar{y}_{str}$ = -1.08
(L) $\bar{t}_{str}$ = 0.0682
(M) h_i = 0.25
(N) t = 1.41
(O) h_o = 0.25

Segment Card 6 Calculations
(A) K_{11} = 13.217 E06
(B) K_{12} = 4.401 E06
(C) K_{22} = 14.819 E06
(D) K_{33} = 8.808 E06
(E) D_{11} = -9.174 E06
(F) D_{12} = -3.055 E06
(G) D_{22} = -11.051 E06
(H) D_{33} = 6.116 E06
(I) C_{11} = 0.0
(J) C_{22} = -1.731 E06

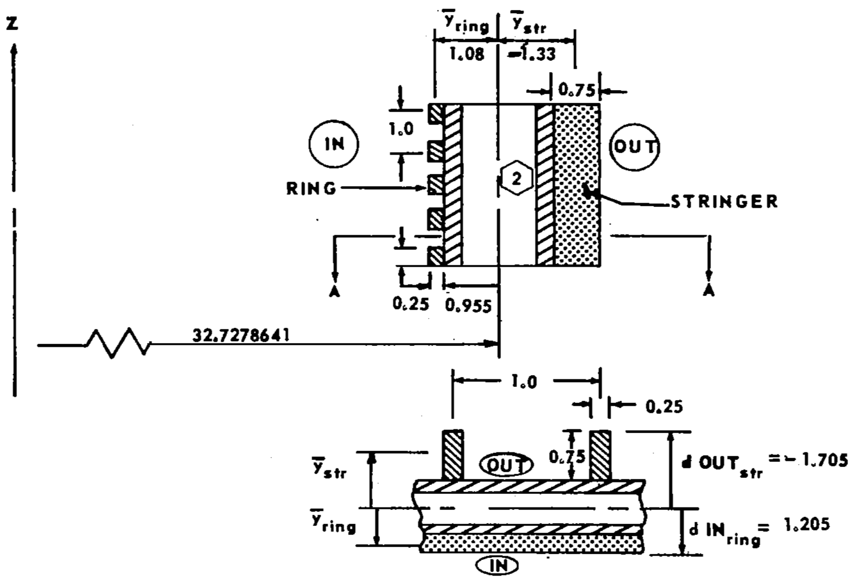
SECTION B-B

Segment Card 11 Calculations
(A) d in_{ring} = 0.955
(B) d out_{ring} = -0.955
(C) d in_{str} = 0.955
(D) d out_{str} = -1.705
(E) S_{ring} = 0.0
(F) S_{str} = 1.0
(G) t^*_{ring} = 0.0
(H) t^*_{str} = 0.25
(I) $\bar{y}_{ring}$ = 0.0
(J) $\bar{t}_{ring}$ = 0.0
(K) $\bar{y}_{str}$ = -1.33
(L) $\bar{t}_{str}$ = 0.1875
(M) h_i = 0.25
(N) t = 1.41
(O) h_o = 0.25

Segment Card 6 Calculations
(A) K_{11} = 13.217 E06
(B) K_{12} = 4.401 E06
(C) K_{22} = 17.623 E06
(D) K_{33} = 8.808 E06
(E) D_{11} = -9.174 E06
(F) D_{12} = -3.055 E06
(G) D_{22} = -17.175 E06
(H) D_{33} = 6.128 E06
(I) C_{11} = 0.0
(J) C_{22} = -5.860 E06

Note: All dimensions are in inches.

Figure C-5. Problem 2, segment 1, stiffness parameters.



SECTION A-A

Segment Card 11 Calculations
(A) d in_{ring} = 1.205
(B) d out_{ring} = -0.955
(C) d in_{str} = 0.955
(D) d out_{str} = -1.705
(E) S_{ring} = 1.0
(F) S_{str} = 1.0
(G) t^*_{ring} = 0.25
(H) t^*_{str} = 0.25
(I) $\bar{y}_{ring}$ = 1.08
(J) $\bar{t}_{ring}$ = 0.0625
(K) $\bar{y}_{str}$ = -1.33
(L) $\bar{t}_{str}$ = 0.1875
(M) h_i = 0.25
(N) t = 1.41
(O) h_o = 0.25

Segment Card 6 Calculations
(A) K_{11} = 14.686 E06
(B) K_{12} = 4.401 E06
(C) K_{22} = 17.623 E06
(D) K_{33} = 8.808 E06
(E) D_{11} = -11.051 E06
(F) D_{12} = -3.055 E06
(G) D_{22} = -17.175 E06
(H) D_{33} = 6.130 E06
(I) C_{11} = 1.586 E06
(J) C_{22} = -5.860 E06

Note: All dimensions are in inches.

Figure C-6. Problem 2, segment 2, stiffness parameters.

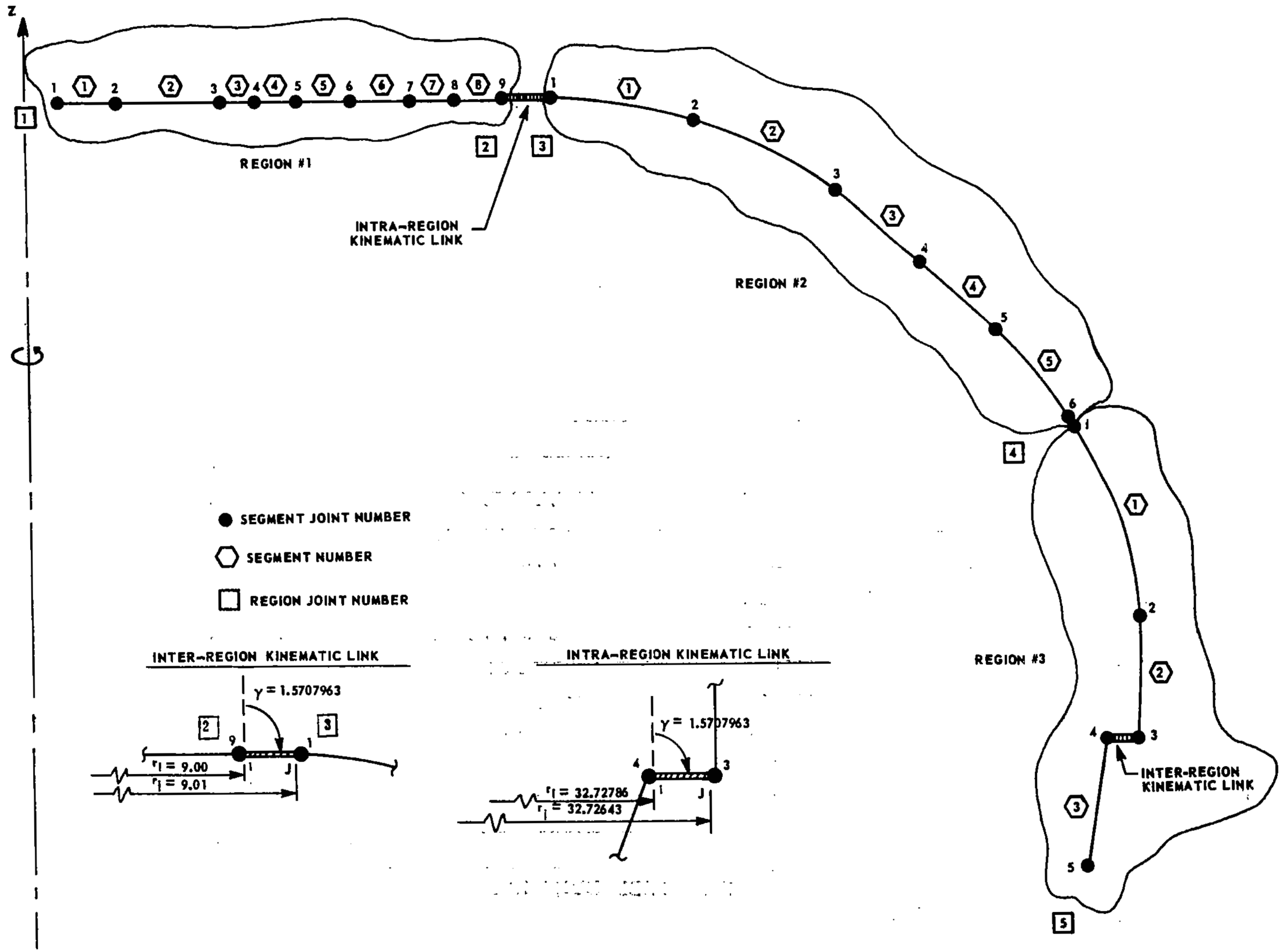


Figure C-7. Problem 2 idealization.

TABLE C-1. FORTRAN CODING INPUT DATA FOR EXAMPLE PROBLEM 2

PROGRAM ____________ DATE ________

CODED BY ____________ PAGE ___ OF ___

FORTRAN CODING FORM

IDENTIFICATION 73–80

```
/// EXAMPLE PROBLEM 2 ///
 3 16 2  0.0   11
MATL     ISOT
+75.          +600.          +638.          +657.          +684.
+718.         +820.          +975.          +1077.         +1280.
23.5     E+0623.5     E+0623.0     E+0622.8     E+0622.4     E+06
22.0     E+0620.7     E+0618.7     E+0617.4     E+0615.8     E+06
.333           .333           .336           .338           .340
.343           .352           .366           .375           .386
9.149    E+069.149    E+069.207    E+069.239    E+069.289    E+06
9.337    E+069.499    E+069.748    E+069.913    E+0610.109   E+06
PROP     STIF
+75.

23.5     E+06

23.5     E+06

.333

9.149    E-06

9.149    E-06

17.616   E+06
```

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TABLE C-1. (Continued)

PROGRAM ______________________ DATE __________ IDENTIFICATION

CODED BY ______________________ PAGE ____ OF ______

FORTRAN CODING FORM

```
23.5      E+06

23.5      E+06

9.149     E-06

9.149     E-06

 8 0  REGION  1
    1    1    2
21 SEGMENT 1 OF REGION 1 (PLATE)
0.5           2.0           .125          1.0       E-06 .015         0.
0.0
ISOT     MATL       SING      THIC      THCN      +.75.     LINE       2
0.49          2.0
4.375         4.375
101110
+675.         +675.
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0           0.0           0.0
733.038
    1    1    2
```

TABLE C-1. (Continued)

PROGRAM ____________ DATE ____________

CODED BY ____________ PAGE ____ OF ____ IDENTIFICATION 73 80

FORTRAN CODING FORM

```
21 SEGMENT 2 OF REGION 1 (PLATE)
2.0           5.0           .125          1.0           E-06 .030            0.
0.0
ISOT      MATL      SING      THIC      THCN      +75.      LINE      5
1.99          31.0          4.0           4.5           5.01
4.375         31.840        3.275         2.970         2.680
101110
+675.         +682.         +698.         +713.         +732.
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0           0.0           0.0
733.038
     2   2    3
21 SEGMENT 3 OF REGION 1 (PLATE)
5.00          5.50          .125          1.0           E-06 .005            0.
0.0
ISOT      MATL      SING      THIC      THCN      +75.      LINE      2
4.99          5.51
2.68          2.372
101110
+732.         +759.
BLANK CARD
BLANK CARD
BLANK CARD
```

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TABLE C-1. (Continued)

PROGRAM ______ CODED BY ______

FORTRAN CODING FORM

DATE ______ PAGE ___ OF ___ IDENTIFICATION

```
.0002588      0.0           0.0           0.0
733.038
    3      3    4
21 SEGMENT 4 OF REGION 1 (PLATE)
5.5           6.0           .125          1.0           E-06 .005          0.
0.0
ISOT        MATL      SING      THIC      THCN      +75.      LINE         2
5.49          6.0
2.372         2.210
101110
+759.         +793.
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0           0.0           0.0
733.038
    4      4    5
21 SEGMENT 5 OF REGION 1 (PLATE)
6.00          7.00          .125          1.0           E-06 .010          0.
0.0
ISOT        MATL      SING      THIC      THCN      +75.      LINE         2
5.99          7.01
2.210         2.155
101110
+793.         +895.
```

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TABLE C-1. (Continued)

PROGRAM ______________________ DATE ____________
CODED BY ______________________ PAGE ____ OF ____ IDENTIFICATION 73 80

FORTRAN CODING FORM

```
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0           0.0           0.0
733.038
    5    5    6
21 SEGMENT 6 OF REGION 1 (PLATE)
7.00          8.00          .125          1.0       E-06  010         0.
0.0
ISOT      MATL      SING      THIC      THCN      +75.      LINE       2
6.99          8.01
2.155         2.70
101110
+895.         +1050.
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0           0.0           0.0
733.038
    6    6    7
21 SEGMENT 7 OF REGION 1 (PLATE)
8.00          8.50          .125          1.0       E-06 .005         0.
0.0
ISOT      MATL      SING      THIC      THCN      +75.      LINE       2
7.99          8.51
```

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TABLE C-1. (Continued)

PROGRAM ____________ DATE ________
CODED BY ____________ PAGE ___ OF ___ IDENTIFICATION

FORTRAN CODING FORM

```
2.70          2.38
101110
+1050.        +1152.
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0           0.0           0.0
733.0388
    7    7    8
21 SEGMENT 8 OF REGION 1 (PLATE)
8.50          9.00          .125          1.0       E-06 .005          0.
0.0
ISOT      MATL      SING      THIC      THCN      +75.      LINE       2
8.49          9.01
2.38          1.91
101110
+1152.        +1275.
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0           0.0           0.0
733.0388
    8    8    9
  5.0 REGION 2
    2    3    4
```

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TABLE C-1. (Continued)

PROGRAM ____________ DATE ________
CODED BY ____________ PAGE ___ OF ___

FORTRAN CODING FORM

```
13 SEGMENT 1 OF REGION 2 (SOLID TOROIDAL)
0.00100       0.392699      .039         1.0       E-06 .0039169    0.
10.           -9.0
ISOT     MATL      SING      THIC      NOTH      +75.      LINE      2
0.00050       0.392800
1.91          1.91
001110
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0            0.0          0.0
733.038
    1    1    2
13 SEGMENT 2 OF REGION 2 (EQUA SANDWICH TOROIDAL)
0.392699      0.785398      .039         1.0       E-06 .0039269    0.
10.           -9.0
ISOT     MATL      EQUA      THIC      NOTH      +75.      LINE      2
0.3920        0.7855
.25           .25
1.41          1.41
001110
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0            0.0          0.0
```

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TABLE C-1. (Continued)

PROGRAM ____________ DATE ____________

CODED BY ____________ PAGE ____ OF ____

FORTRAN CODING FORM

IDENTIFICATION 73 80

```
733.038
    2     2    3
21 SEGMENT 3 OF REGION 2 (EQUA SANDWICH CONE)
22.72786      27.72786      .50            1.0      E-06 .05            0.
.785398
ISOT      MATL      EQUA      THIC      NOTH      +75.      LINE        2
22.710        27.74
.25            .25
1.41          1.41
001110
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0           0.0           0.0
733.038
    3     3    4
21 SEGMENT 4 OF REGION 2 (EQUA SANDWICH CONE)
27.72786      32.72786      .50            1.0      E-06 .05            0.
.785398
ISOT      MATL      EQUA      THIC      NOTH      +75.      LINE        2
27.71         32.74
.25            .25
1.41          1.41
001110
BLANK CARD
```

TABLE C-1. (Continued)

PROGRAM
CODED BY
DATE
PAGE OF
IDENTIFICATION

FORTRAN CODING FORM

```
BLANK CARD
BLANK CARD
.0002588      0.0           0.0           0.0
733.038
    4    4    5
11 SEGMENT 5 OF REGION 2 (EQUA SANDWICH SPHERICAL)
.785398       1.178097      .039          1.0       E-06 .00392699    0.
32.7278641    1.0
ISOT      MATL      EQUA      THIC      NOTH      +75.      LINE       2
.78520        1.1782
.25          .25
1.41          1.41
001110
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0           0.0           0.0
733.038
    5    5    6
 3. 1 REGION 3
    3    4    5
11 SEGMENT 1 OF REGION 3 (EQUA SANDWICH SPHERICAL)
1.178097      1.570796      .039          1.0       E-06 .00392699    0.
32.7278641    1.0
STIF      PROP      BLAN      ST10      NOTH      +75.      LINE       2
```

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TABLE C-1. (Continued)

PROGRAM ______________ DATE ______________

CODED BY ______________ PAGE ____ OF ______

IDENTIFICATION 73 – 80

FORTRAN CODING FORM

```
13.217    E+0613.217     E+06
```

```
1.178         1.5709
13.217    E+0613.217     E+06
4.401     E+064.401      E+06
14.819    E+0617.623     E+06
8.808     E+068.808      E+06
-9.174    E+06-9.174     E+06
-3.055    E+06-3.055     E+06
-11.051   E+06-17.175    E+06
6.116     E+066.128      E+06
0.0           0.0
-1.731    E+06-5.860     E+06
001110
BLANK CARD
BLANK CARD
BLANK CARD
SHEL      STRI      SHEL      SHEL
.955         .955
-.955        -.955
.955         .955
-1.205       -1.705
0.0           0.0
.9166         1.0
0.0           0.0
.25          .25
0.0           0.0
```

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TABLE C-1. (Continued)

PROGRAM
CODED BY

DATE
PAGE OF

IDENTIFICATION

FORTRAN CODING FORM

```
0.0           0.0
-1.08         -1.33
.0682         .1875
.25           .25
1.41          1.41
.25           .25
.0002588      0.0           0.0           .0002588
733.0388
    1    1    2
31 SEGMENT 2 OF REGION 3 (EQUA SANDWICH CYLINDER)
10.0          15.0           50           1.0       E-06 .05          0.
32.7278641
STIF      PROP      BLAN      ST10      NOTH      +75       LINE       2
9.09          15.01
14.686    E+0614.686    E+06
4.401     E+064.401     E+06
17.623    E+0617.623    E+06
8.808     E+068.808     E+06
-11.051   E+06-11.051   E+06
-3.055    E+06-3.055    E+06
-17.175   E+06-17.175   E+06
6.130     E+066.130     E+06
1.586     E+061.586     E+06
-5.860    E+06-5.860    E+06
001110
```

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TABLE C-1. (Continued)

PROGRAM ____________________ DATE ________ IDENTIFICATION (73–80)

CODED BY ____________________ PAGE ____ OF ____

FORTRAN CODING FORM

```
BLANK CARD
BLANK CARD
BLANK CARD
SHEL      STRI      RING      SHEL
1.205         1.205
-.955         -.955
.955          .955
-1.705        -1.705
1.0           1.0
1.0           1.0
.25           .25
.25           .25
1.08          1.08
.0625         .0625
-1.33         -1.33
.1875         .1875
.25           .25
1.41          1.41
.25           .25
.0002588      0.0           .0002588      .0002588
733.0388
    2    2    3
21 SEGMENT 3 OF REGION 3 (UNEQ SANDWICH INVERTED CONE)
841.989853    846.993296    .50       1.0       E-06 .05003443   10
-1.532148342
```

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TABLE C-1. (Concluded)

PROGRAM ____________ DATE ____________
CODED BY ____________ PAGE ___ OF ___ IDENTIFICATION 73 80

FORTRAN CODING FORM

```
ISOT      MATL      UNEQ      THIC      NOTH      +75.      LINE       2
841.988853    847.994296
.25           .25
1.16          1.41
.50           .25
001110
BLANK CARD
BLANK CARD
BLANK CARD
.0002588      0.0           0.0           0.0
733.0388
    3    5    4
 4 3 1.5707963
    5    1
 3 2 1.5707963
 1 1 0 1 0
 2 1 1 1 1
 3 0 0 0 0
 4 1 1 1 1
 5 1 1 1 1
BLANK CARD
```

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TABLE C-2. EXAMPLE PROBLEM 2

AUTOMATED SHELL THEORY FOR ROTATING STRUCTURES

(ASTROS)

DECK NUMBER 1

AS OF JULY 17, 1970

NUMBER OF SEGMENTS = 16 NUMBER OF REGIONS = 3 NUMBER OF MATERIAL PROPERTY TABLES USED = 2 NUMBER OF PROBLEMS = 1
THE GIVEN INBUT DATA INDICATES THAT THE SHELL SEGMENTS ARE TO BE COUPLED

/// EXAMPLE PROBLEM 2 ///

TABLE C-2. (Continued)

REGION NUMBER 1

THERE ARE 8 SEGMENTS AND 0 KINEMATIC LINKS WITHIN THIS REGION

TABLE C-2. (Continued)

SEGMENT NUMBER 1 SEGMENT CODE 21 SEGMENT 1 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.5000000+00	.2000000+01	.1250000+00	.1000000-03	.1500000-01	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.66000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.4990000+00	.2001000+01
.4375000+01	.4375000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.6750000+03	.6750000+03

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.4000002+01	.0000000	.0000000	.0000000
.0000000	.9242193+08	.0000000	.0000000	.0000000	.1488750+01	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.1474178+09	.0000000	.0000000	.1702928+01	.1488750+01
.6249993-01	.0000000	.0000000	.0000000	.2547338-07	.0000000	.0000000	.0000000
.0000000	.6903126+00	.0000000	.0000000	.0000000	.8414703-08	.0000000	.0000000
.0000000	.0000000	.2499999+00	.5415993+00	.0000000	.0000000	-.1506509-08	-.2581604-08
.0000000	.0000000	.0000000	.6903126+00	.0000000	.0000000	-.4300384-08	-.5275504-08
.0000000	-.2580540+06	.0000000	.0000000	.0000000	.6980744-02	.0000000	.0000000

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.4933141+09	.0000000	.0000000	.0000000	-.1233285+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.5254256+10	.1446736+03	-.2571206+10	.0000000	-.5254256+10	-.1502923+03	-.4283063+10
FORCR1	.0000000	.1446736+03	.5558184+09	-.7917221+02	.0000000	-.1502923+03	-.3733456+09	-.1318835+03
MOME 1	.0000000	-.2571207+10	-.7917221+02	.2144797+10	.0000000	.2571207+10	.7917221+02	.1500441+10
FORCT2	-.1233283+09	.0000000	.0000000	.0000000	.3083206+08	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.5254249+10	-.1502921+03	.2571203+10	.0000000	.5254249+10	.1300447+03	.4283058+10
FORCR2	.0000000	-.1502921+03	-.3733451+09	.7917210+02	.0000000	.1300447+03	.1030900+10	.1318833+03
MOME 2	.0000000	-.4283058+10	-.1318833+03	.1500439+10	.0000000	.4283058+10	.1318833+03	.5135720+10

SEGMENT SYMMETRY CHECK

.4933141+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.5254256+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.5558184+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.2144797+10	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.3083206+08	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.5254249+10	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1030900+10	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.5135720+10

SEGMENT LOAD MATRICES

.0000000
-.8025065-01
.2606230+07
.0000000
.0000000
.3214438+00
-.1043925+08
.0000000

TABLE C-2. (Continued)

SEGMENT NUMBER 2 SEGMENT CODE 21 SEGMENT 2 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.2000000+01	.5000000+01	.1250000+00	.1000000-03	.3000000-01	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 5

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.1999000+01	.3000000+01	.4000000+01	.4500000+01	.5001000+01
.4375000+01	.3840000+01	.3275000+01	.2970000+01	.2680000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.6750000+03	.6820000+03	.6980000+03	.7130000+03	.7320000+03

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 10111U

.0000000	.0000000	.0000000	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.2500001+01	.0000000	.0000000	.0000000
.0000000	.1760013+08	.0000000	.0000000	.0000000	.1168397+01	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.2150692+08	.0000000	.0000000	.3173603+01	.1389768+01
.1599999+00	.0000000	.0000000	.0000000	.6520011-07	.0000000	.0000000	.0000000
.0000000	.6995452+00	.0000000	.0000000	.0000000	.2371272-07	.0000000	.0000000
.0000000	.0000000	.3999999+00	.1468799+01	.0000000	.0000000	-.3047976-07	-.3588843-07
.0000000	.0000000	.0000000	.6670860+00	.0000000	.0000000	-.3014225-07	-.2450816-07
.0000000	-.2070670+06	.0000000	.8072036-04	.0000000	.1539960-01	-.1334402-11	-.1589566-11

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.4818387+09	.0000000	.0000000	.0000000	-.1927354+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.9200112+09	.9263058+01	-.1347215+10	.0000000	-.9200112+09	-.1201095+02	-.1131509+10
FORCR1	.0000000	.9263058+01	.6191829+09	-.4148324+02	.0000000	-.1201095+02	-.5299421+09	-.3484126+02
MOME 1	.0000000	-.1347215+10	-.4148324+02	.2685382+10	.0000000	.1347215+10	.4148324+02	.1144179+10
FORCT2	-.1927352+09	.0000000	.0000000	.0000000	.7709408+08	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.9200104+09	-.1201094+02	.1347214+10	.0000000	.9200104+09	-.2089313+00	.1131508+10
FORCR2	.0000000	-.1201094+02	-.5299416+09	.4148320+02	.0000000	-.2089310+00	.9267956+09	.3484123+02
MOME 2	.0000000	-.1131508+10	-.3484123+02	.1144178+10	.0000000	.1131508+10	.3484123+02	.2246734+10

SEGMENT SYMMETRY CHECK

.4818387+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000006+01	.9200112+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.6191829+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.2685382+10	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.7709408+08	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.9200104+09	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000001+01	.9267956+09	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.2246734+10

SEGMENT LOAD MATRICES

.0000000
-.2518601+00
.8160898+07
.2102056-04
.0000000
.6403481+00
-.2077748+08
-.4744597-03

TABLE C-2. (Continued)

SEGMENT NUMBER 3 SEGMENT CODE 21 SEGMENT 3 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.5000000+01	.5500000+01	.1250000+00	.1000000-03	.5000000-02	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23560+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.4999000+01	.5501000+01
.2680000+01	.2372000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.7320000+03	.7590000+03

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1100000+01	.0000000	.0000000	.0000000
.0000000	.9510429+06	.0000000	.0000000	.0000000	.9717631+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.5093624+06	.0000000	.0000000	.4924864+00	.9721331+00
.8264463+00	.0000000	.0000000	.0000000	.2344003-07	.0000000	.0000000	.0000000
.0000000	.9430366+00	.0000000	.0000000	.0000000	.7693905-08	.0000000	.0000000
.0000000	.0000000	.9090909+00	.4625419+00	.0000000	.0000000	-.6035843-09	-.3803593-08
.0000000	.0000000	.0000000	.9427767+00	.0000000	.0000000	-.3460769-08	-.1455456-07
.0000000	-.3079837+05	.0000000	.1374522-04	.0000000	.4030774-02	-.2892305-13	.3365627-13

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1474295+10	.0000000	.0000000	.0000000	-.1340268+10	.0000000	.0000000	.0000000
FORCZ1	.0000000	.1044306+12	.3093433+04	-.2729122+11	.0000000	-.1044306+12	-.3089883+04	-.2483142+11
FORCR1	.0000000	.3093433+04	.3967925+10	-.8403472+03	.0000000	-.3089883+04	-.4083222+10	-.7646054+03
MOME 1	.0000000	-.2729122+11	-.8403472+03	.9230452+10	.0000000	.2729122+11	.8403472+03	.4330787+10
FORCT2	-.1340268+10	.0000000	.0000000	.0000000	.1218425+10	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.1044306+12	-.3089882+04	.2729121+11	.0000000	.1044306+12	.3085187+04	.2483142+11
FORCR2	.0000000	-.3089882+04	-.4083222+10	.8403471+03	.0000000	.3085187+04	.4235690+10	.7646053+03
MOME 2	.0000000	-.2483141+11	-.7646052+03	.4330786+10	.0000000	.2483141+11	.7646052+03	.8142866+10

SEGMENT SYMMETRY CHECK

.1474295+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1044306+12	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.3967925+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.9230452+10	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1218425+10	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1044306+12	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.4235690+10	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.8142866+10

SEGMENT LOAD MATRICES

.0000000
-.5029329+00
.1645855+08
-.9351032-03
.0000000
.5546287+00
-.1813742+08
-.1467259-02

TABLE C-2. (Continued)

SEGMENT NUMBER 4 SEGMENT CODE 21 SEGMENT 4 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.5500000+01	.6000000+01	.1250000+00	.1000000-03	.5000000-02	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.5499000+01	.6001000+01
.2372000+01	.2210000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.7590000+03	.7930000+03

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1090909+01	.0000000	.0000000	.0000000
.0000000	.7081602+06	.0000000	.0000000	.0000000	.9735630+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.3107358+06	.0000000	.0000000	.4930028+00	.9737325+00
.8402778+00	.0000000	.0000000	.0000000	.2648596-07	.0000000	.0000000	.0000000
.0000000	.9478491+00	.0000000	.0000000	.0000000	.8647969-08	.0000000	.0000000
.0000000	.0000000	.9166667+00	.4657263+00	.0000000	.0000000	-.8234829-09	-.5064045-08
.0000000	.0000000	.0000000	.9477167+00	.0000000	.0000000	-.4829550-08	-.1981071-07
.0000000	-.2663534+05	.0000000	.1355853-04	.0000000	.4263795-02	.1844504-13	-.4680785-13

TABLE C-2. (Continued).

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1423362+10	.0000000	.0000000	.0000000	-.1304749+10	.0000000	.0000000	.0000000
FORCZ1	.0000000	.8407043+11	.2468892+04	-.2149022+11	.0000000	-.8407043+11	-.2465639+04	-.2049510+11
FORCR1	.0000000	.2468892+04	.3890384+10	-.6617236+03	.0000000	-.2465639+04	-.3996027+10	-.6310820+03
MOME 1	.0000000	-.2149022+11	-.6617236+03	.7191929+10	.0000000	.2149022+11	.6617236+03	.3494603+10
FORCT2	-.1304748+10	.0000000	.0000000	.0000000	.1196019+10	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.8407042+11	-.2465639+04	.2149022+11	.0000000	.8407042+11	.2461453+04	.2049509+11
FORCR2	.0000000	-.2465639+04	-.3996027+10	.6617235+03	.0000000	.2461453+04	.4131961+10	.6310819+03
MOME 2	.0000000	-.2049510+11	-.6310819+03	.3494603+10	.0000000	.2049510+11	.6310819+03	.6799866+10

SEGMENT SYMMETRY CHECK

.1423362+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.8407043+11	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.3890384+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.7191929+10	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1196019+10	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.8407042+11	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.4131961+10	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.6799866+10

SEGMENT LOAD MATRICES

.0000000
-.5271490+00
.1703824+08
.5599628-03
.0000000
.5759146+06
-.1862196+08
.1851756-03

TABLE C-2. (Continued)

SEGMENT NUMBER 5 SEGMENT CODE 21 SEGMENT 5 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.6000000+01	.7000000+01	.1250000+00	.1000000-03	.1000000-01	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.5999000+01	.7001000+01
.2210000+01	.2155000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.7930000+03	.8956000+03

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1166667+01	.0000000	.0000000	.0000000
.0000000	.9861482+06	.0000000	.0000000	.0000000	.9574140+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.3920416+06	.0000000	.0000000	.9763143+00	.9575986+00
.7346939+00	.0000000	.0000000	.0000000	.5633771-07	.0000000	.0000000	.0000000
.0000000	.9140641+00	.0000000	.0000000	.0000000	.1824765-07	.0000000	.0000000
.0000000	.0000000	.8571428+00	.8832505+00	.0000000	.0000000	-.7633865-08	-.2285153-07
.0000000	.0000000	.0000000	.9139224+00	.0000000	.0000000	-.2302034-07	-.4598497-07
.0000000	-.4532195+05	.0000000	.2945706-04	.0000000	.9210912-02	-.1944856-12	.7511938-13

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.7806902+09	.0000000	.0000000	.0000000	-.6691630+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.9905847+10	.2441134+03	-.4922559+10	.0000000	-.9905847+10	-.2414043+03	-.4958925+10
FORCR1	.0000000	.2441134+03	.1977989+10	-.1515747+03	.0000000	-.2414043+03	-.2065971+10	-.1526945+03
MOME 1	.0000000	-.4922559+10	-.1515747+03	.3231243+10	.0000000	.4922559+10	.1515747+03	.1644448+10
FORCT2	-.6691629+09	.0000000	.0000000	.0000000	.5735682+09	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.9905845+10	-.2414043+03	.4922559+10	.0000000	.9905845+10	.2371797+03	.4958924+10
FORCR2	.0000000	-.2414043+03	-.2065970+10	.1515747+03	.0000000	.2371797+03	.2203167+10	.1526945+03
MOME 2	.0000000	-.4958924+10	-.1526945+03	.1644448+10	.0000000	.4958924+10	.1526945+03	.3356587+10

SEGMENT SYMMETRY CHECK

.7806902+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.9905847+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1977989+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.3231243+10	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.5735682+09	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.9905845+10	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.2203167+10	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.3356587+10

SEGMENT LOAD MATRICES

.0000000
-.5836537+00
.1902947+08
-.1080897-02
.0000000
.6839449+00
-.2228654+08
-.2512173-02

TABLE C-2. (Continued)

SEGMENT NUMBER 6 SEGMENT CODE 21 SEGMENT 6 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.7000000+01	.8000000+01	.1250000+00	.1000000-03	.1000000-01	1.

GEOMETRY INPUT VARIABLES

.0000000 .0000000 .0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.6999000+01	.8001000+01
.2155000+01	.2700000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.8950000+03	.1050000+04

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1142857+01	.0000000	.0000000	.0000000
.0000000	.7583642+06	.0000000	.0000000	.0000000	.9596543+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.3723958+06	.0000000	.0000000	.9778894+00	.9586767+00
.7656250+00	.0000000	.0000000	.0000000	.5668401-07	.0000000	.0000000	.0000000
.0000000	.9259448+00	.0000000	.0000000	.0000000	.1791612-07	.0000000	.0000000
.0000000	.0000000	.8750000+00	.8989075+00	.0000000	.0000000	-.6134774-08	-.1640306-07
.0000000	.0000000	.0000000	.9271588+00	.0000000	.0000000	-.2081466-07	-.3717965-07
.0000000	-.4909121+05	.0000000	.3678332-04	.0000000	.1122366-01	-.6651711-12	-.7004234-12

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.8867665+09	.0000000	.0000000	.0000000	-.7759207+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.1442839+11	.3717357+03	-.6365571+10	.0000000	-.1442839+11	-.3686860+03	-.8077593+10
FORCR1	.0000000	.3717357+03	.2355856+10	-.1960077+03	.0000000	-.3686860+03	-.2454900+10	-.2487241+03
MOME 1	.0000000	-.6365571+10	-.1960077+03	.3942469+10	.0000000	.6365571+10	.1960077+03	.2380736+10
FORCT2	-.7759206+09	.0000000	.0000000	.0000000	.6789305+09	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.1442839+11	-.3686859+03	.6365571+10	.0000000	.1442839+11	.3642848+03	.8077592+10
FORCR2	.0000000	-.3686859+03	-.2454900+10	.1960077+03	.0000000	.3642848+03	.2597831+10	.2487240+03
MOME 2	.0000000	-.8077592+10	-.2487240+03	.2380735+10	.0000000	.8077592+10	.2487240+03	.5775644+10

SEGMENT SYMMETRY CHECK

.8867665+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1442839+11	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.2355856+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.3942469+10	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.6789305+09	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1442839+11	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.2597831+10	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.5775644+10

SEGMENT LOAD MATRICES

.0000000
-.8444673+00
.2755297+08
-.2566671-02
.0000000
.9698455+00
-.3162476+08
-.3176515-02

TABLE C-2. (Continued)

SEGMENT NUMBER 7 SEGMENT CODE 21 SEGMENT 7 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.8000000+01	.8500000+01	.1250000+00	.1000000-03	.5000000-02	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.7999000+01	.8501000+01
.2700000+01	.2380000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.1050000+04	.1152000+04

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1062500+01	.0000000	.0000000	.0000000
.0000000	.3129731+06	.0000000	.0000000	.0000000	.9791162+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.1694822+06	.0000000	.0000000	.4945968+00	.9792702+00
.8858131+00	.0000000	.0000000	.0000000	.3050527-07	.0000000	.0000000	.0000000
.0000000	.9642995+00	.0000000	.0000000	.0000000	.9537032-08	.0000000	.0000000
.0000000	.0000000	.9411764+00	.4761757+00	.0000000	.0000000	-.7414038-09	-.4730851-08
.0000000	.0000000	.0000000	.9641921+00	.0000000	.0000000	-.4193190-08	-.1786731-07
.0000000	-.2692191+05	.0000000	.2130309-04	.0000000	.6796483-02	-.3319798-13	-.2117951-12

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1750749+10	.0000000	.0000000	.0000000	-.1647764+10	.0000000	.0000000	.0000000
FORCZ1	.0000000	.1362741+12	.4037230+04	-.3608222+11	.0000000	-.1362741+12	-.4033841+04	-.3198148+11
FORCR1	.0000000	.4037230+04	.5160489+10	-.1111038+04	.0000000	-.4033841+04	-.5270558+10	-.9847690+03
MOME 1	.0000000	-.3608222+11	-.1111038+04	.1230868+11	.0000000	.3608222+11	.1111038+04	.5654690+10
FORCT2	-.1647761+10	.0000000	.0000000	.0000000	.1550834+10	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.1362739+12	-.4033835+04	.3608216+11	.0000000	.1362739+12	.4029848+04	.3198143+11
FORCR2	.0000000	-.4033835+04	-.5270550+10	.1111037+04	.0000000	.4029848+04	.5400038+10	.9847675+03
MOME 2	.0000000	-.3198143+11	-.9847675+03	.5654681+10	.0000000	.3198143+11	.9847675+03	.1038762+11

SEGMENT SYMMETRY CHECK

.1750749+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1362741+12	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.5160489+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1230868+11	.0000000	.0000000	.0000000	.0000000
.1000002+01	.1000000+01	.1000000+01	.1000000+01	.1550834+10	.0000000	.0000000	.0000000
.1000000+01	.1000002+01	.1000002+01	.1000002+01	.1000000+01	.1362739+12	.0000000	.0000000
.1000000+01	.1000002+01	.1000002+01	.1000002+01	.1000000+01	.1000000+01	.5400038+10	.0000000
.1000000+01	.1000002+01	.1000002+01	.1000002+01	.1000000+01	.1000000+01	.1000000+01	.1038762+11

SEGMENT LOAD MATRICES

.0000000
-.1165252+01
.3582126+08
-.2212435-06
.0000000
.1176623+01
-.3813909+08
.5935667-06

TABLE C-2. (Continued)

SEGMENT NUMBER 8 SEGMENT CODE 2; SEGMENT 8 OF REGION 1 (PLATE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.8500000+01	.9000000+01	.1250000+00	.1000000-03	.5000000-02	1.

GEOMETRY INPUT VARIABLES

.0000000	.0000000	.0000000

ISOT MATL SING THIC THCN T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.8499000+01	.9001000+01
.2380000+01	.1910000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.1152000+04	.1275000+04

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1058824+01	.0000000	.0000000	.0000000
.0000000	.2232738+06	.0000000	.0000000	.0000000	.9799038+00	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000
.0000000	.0000000	.0000000	-.8712303+05	.0000000	.0000000	.4948222+00	.9801667+00
.8919752+00	.0000000	.0000000	.0000000	.3843797-07	.0000000	.0000000	.0000000
.0000000	.9665272+00	.0000000	.0000000	.0000000	.1191038-07	.0000000	.0000000
.0000000	.0000000	.9444444+00	.4775688+00	.0000000	.0000000	-.1306875-08	-.8780926-08
.0000000	.0000000	.0000000	.9663758+00	.0000000	.0000000	-.7062710-08	-.3173576-07
.0000000	-.2293716+05	.0000000	.1744748-04	.0000000	.7669002-02	-.5327126-13	-.3494656-12

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1471167+10	.0000000	.0000000	.0000000	-.1389435+10	.0000000	.0000000	.0000000
FORCZ1	.0000000	.8250780+11	.2405270+04	-.2282897+11	.0000000	-.8250780+11	-.2402495+04	-.1836189+11
FORCR1	.0000000	.2405270+04	.4393964+10	-.7029463+03	.0000000	-.2402495+04	-.4484077+10	-.5653967+03
MOME 1	.0000000	-.2282897+11	-.7029463+03	.7966008+10	.0000000	.2282897+11	.7029463+03	.3397660+10
FORCT2	-.1389433+10	.0000000	.0000000	.0000000	.1312242+10	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.8250768+11	-.2402492+04	.2282894+11	.0000000	.8250768+11	.2399263+04	.1836187+11
FORCR2	.0000000	-.2402492+04	-.4484070+10	.7029453+03	.0000000	.2399263+04	.4588916+10	.5653959+03
MOME 2	.0000000	-.1836187+11	-.5653959+03	.3397655+10	.0000000	.1836187+11	.5653959+03	.5808328+10

SEGMENT SYMMETRY CHECK

.1471167+10	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.8250780+11	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.4393964+10	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.7966008+10	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.1312242+10	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.8250768+11	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.4588916+10	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.5808328+10

SEGMENT LOAD MATRICES

.0000000
-.1060904+01
.3438839+08
-.2876296-04
.0000000
.1125600+01
-.3648947+08
.6502032-04

TABLE C-2. (Continued)

INPUT DATA FOR SEGMENT COUPLING

REGION NUMBER 1   NUMBER OF SEGMENT JOINTS 9   NUMBER OF KINEMATIC LINKS 0

SEGMENT	JOINT(I)	JOINT(J)	RZERO(I)	RZERO(J)
1	1	2	.5000000+00	.2000000+01
2	2	3	.2000000+01	.5000000+01
3	3	4	.5000000+01	.5500000+01
4	4	5	.5500000+01	.6000000+01
5	5	6	.6000000+01	.7000000+01
6	6	7	.7000000+01	.8000000+01
7	7	8	.8000000+01	.8500000+01
8	8	9	.8500000+01	.8999988+01

REGION STIFFNESS MATRIX

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.4569051+09	.0000000	.0000000	.0000000	-.2538355+08	.0000000	.0000000	.0000000
FORCZ1	.0000000	.4537882+08	-.1276648+02	-.7011034+08	.0000000	-.4537982+08	.1274239+00	-.1295253+09
FORCR1	.0000000	-.1276648+02	.4599848+09	-.2158831+01	.0000000	.1274186+00	-.4951787+08	-.3988323+01
MOME 1	.0000000	-.7011027+08	-.2158828+01	.8271488+09	.0000000	.7011144+08	.2158856+01	.1692590+09
FORCT2	-.2538349+08	.0000000	.0000000	.0000000	.1410160+07	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.4537968+08	.1274185+00	.7011120+08	.0000000	.4537958+08	-.1426425+02	.1295235+09
FORCR2	.0000000	.1274238+00	-.4951773+08	.2158849+01	.0000000	-.1426425+02	.5086260+09	.3988251+01
MOME 2	.0000000	-.1295250+09	-.3988312+01	.1692586+09	.0000000	.1295235+09	.3988243+01	.6360958+09

REGION SYMMETRY CHECK

.4569051+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.4537882+08	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.4599848+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.8271488+09	.0000000	.0000000	.0000000	.0000000

TABLE C-2. (Continued)

.1000003+01	.1000000+01	.1000000+01	.1000000+01	.1410160+07	.0000000	.0000000	.0000000
.1000000+01	.1000003+01	.1000001+01	.1000003+01	.1000000+01	.4537958+08	.0000000	.0000000
.1000000+01	.1000001+01	.1000003+01	.1000004+01	.1000000+01	.1000000+01	.5086260+09	.0000000
.1000000+01	.1000003+01	.1000003+01	.1000003+01	.1000000+01	.1000000+01	.1000002+01	.6360958+09

REGION LOAD MATRIX

.0000000
-.5683865-01
.1812386+07
.9192774-03
.0000000
.1080885+01
-.3566942+08
-.1698312-02

TABLE C-2. (Continued)

REGION NUMBER 2

THERE ARE 5 SEGMENTS AND 0 KINEMATIC LINKS WITHIN THIS REGION

TABLE C-2. (Continued)

SEGMENT NUMBER 1 SEGMENT CODE 13 SEGMENT 1 OF REGION 2 (SOLID TOROIDAL)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.1000000-02	.3926990+00	.3900000-01	.1000000-03	.3916990-02	1.

GEOMETRY INPUT VARIABLES

.1000000+02	-.9000000+01	.0000000

ISOT MATL SING THIC NOTH T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.66000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.5000000-03	.3936990+00
.1910000+01	.1910000+01

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
.OAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.9652012+03	.0000000	.0000000	.0000000	.1423609+01	.0000000	.0000000	.0000000
.0000000	.1190158+07	-.4929794+06	-.6969033+06	.0000000	.8704523+00	-.3265188+00	.4747838-01
.0000000	-.1190133+04	.4929692+03	.6968986+03	.0000000	.3818131+00	.9242065+00	-.4747826-04
.0000000	-.2631215+06	.1089885+06	-.2831699+06	.0000000	.7536525+00	.3658080+01	.9401813+00
.4935527+00	.0000000	.0000000	.0000000	.1967355-06	.0000000	.0000000	.0000000
.0000000	.7660594+00	-.3165518+00	-.6197144+00	.0000000	.6711261-07	.4088875-07	.5373813-07
.0000000	.3209139+00	.6273815+00	.2865207+01	.0000000	-.4565376-07	-.5367868-06	-.3900636-06
.0000000	.3081178-01	-.1276265-01	.8210928+00	.0000000	-.6170812-07	-.4391769-06	-.2167581-06
.0000000	-.9633817+04	.3990457+04	.4887314+04	.0000000	-.3731355-03	-.1904944-03	-.3042701-03

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCY1	.4096482+09	.0000000	.0000000	.0000000	-.2877549+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.2380250+09	-.1176261+09	-.3989017+09	.0000000	-.2380250+09	.1392440+09	-.4001465+09
FORCR1	.0000000	-.1176261+09	.7882883+09	.2719413+08	.0000000	.1176261+09	-.8346019+09	-.1946061+09
MOME 1	.0000000	-.3989017+09	.2719412+08	.9564976+09	.0000000	.3989017+09	-.4212541+08	.5074005+09
FORCY2	-.2877543+09	.0000000	.0000000	.0000000	.2021856+09	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.2380250+09	.1176261+09	.3989016+09	.0000000	.2380250+09	-.1392440+09	.4001465+09
FORCR2	.0000000	.1392440+09	-.8346018+09	-.4212541+08	.0000000	-.1392440+09	.9941232+09	.2211145+09
MOME 2	.0000000	-.4001465+09	-.1946061+09	.5074005+09	.0000000	.4001465+09	.2211145+09	.1211202+10

SEGMENT SYMMETRY CHECK

.4096482+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.2380250+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.7882883+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.9564976+09	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.2021856+09	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.2380250+09	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.9941232+09	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1211202+10

SEGMENT LOAD MATRICES

.0000000
-.8022291+04
-.3235830+06
.1577122+05
.0000000
.8022276+04
-.4584894+06
-.9280760+05

TABLE C-2. (Continued)

SEGMENT NUMBER 2 SEGMENT CODE 13 SEGMENT 2 OF REGION 2 (EQUA SANDWICH TOROIDAL)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.3926990+00	.7853980+00	.3900000-01	.1000000-03	.3926990-02	1.

GEOMETRY INPUT VARIABLES

.1000000+02	-.9000000+01	.0000000

ISOT MATL EQUA THIC NOTH T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91990-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.3916990+00	.7863980+00
.2500000+00	.2500000+00
.1410000+01	.1410000+01

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)

LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.1406846+03	.0000000	.0000000	.0000000	.1252559+01	.0000000	.0000000	.0000000
.0000000	.1299398+06	-.1299396+06	-.2315395+06	.0000000	.8714949+00	-.3394969+00	.3156120-01
.0000000	-.5382275+05	.5382268+05	.9590670+05	.0000000	.4043817+00	.9059887+00	-.1307307-01
.0000000	-.1284210+06	.1284208+06	.5387290+05	.0000000	.8087115+00	.3687914+01	.9367999+00
.6372895+00	.0000000	.0000000	.0000000	.7887327-06	.0000000	.0000000	.0000000
.0000000	.8034216+00	-.3716755+00	-.7349019+00	.0000000	.2610393-06	.5379915-07	.1065315-06
.0000000	.3360969+00	.7067128+00	.3155775+01	.0000000	-.5905396-07	-.9662410-06	-.7104423-06
.0000000	.1927960-01	-.1927957-01	.8602226+00	.0000000	-.1133606-06	-.7663870-06	-.3828994-06
.0000000	-.2634521+04	.2634517+04	.4271312+04	.0000000	-.4555104-03	-.4554476-03	-.5512376-03

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1279876+09	.0000000	.0000000	.0000000	-.1021808+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.2106829+09	-.5864224+08	-.2820072+09	.0000000	-.2106830+09	.7418809+08	-.2528175+09
FORCR1	.0000000	-.5864223+08	.2481990+09	-.1385591+09	.0000000	.5864224+08	-.2601801+09	-.2184925+09
MOME 1	.0000000	-.2820072+09	-.1385591+09	.7845667+09	.0000000	.2820072+09	.1323428+09	.4072791+09
FORCT2	-.1021808+09	.0000000	.0000000	.0000000	.8158893+08	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.2106828+09	.5864221+08	.2820071+09	.0000000	.2106828+09	-.7418807+08	.2528173+09
FORCR2	.0000000	.7418805+08	-.2601799+09	.1323427+09	.0000000	-.7418807+08	.2945622+09	.2275089+09
MOME 2	.0000000	-.2528173+09	-.2184924+09	.4072789+09	.0000000	.2528174+09	.2275089+09	.9119600+09

SEGMENT SYMMETRY CHECK

.1279876+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.2106829+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.2481990+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.7845667+09	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.8158893+08	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.2106828+09	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.2945622+09	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.9119600+09

SEGMENT LOAD MATRICES

.0000000
-.3648935+04
-.1582270+06
.4286006+05
.0000000
.3649092+04
-.2030065+06
-.9144026+05

TABLE C-2. (Continued)

SEGMENT NUMBER 3 SEGMENT CODE 21 SEGMENT 3 OF REGION 2 (EQUA SANDWICH CONE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.2272786+02	.2772786+02	.5000000+00	.1000000-03	.5000000-01	1.

GEOMETRY INPUT VARIABLES

.7853980+00	.0000000	.0000000

ISOT MATL EQUA THIC NOTH T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.2272686+02	.2772886+02
.2500000+00	.2500000+00
.1410000+01	.1410000+01

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.3477442+02	.0000000	.0000000	.0000000	.1220288+01	.0000000	.0000000	.0000000
.0000000	.8392983+05	-.8392980+05	-.2229385+06	.0000000	.9538139+00	.5492453-01	.4228241-01
.0000000	-.8392980+05	.8392977+05	.2229385+06	.0000000	.4618610-01	.9450755+00	-.4228240-01
.0000000	-.1996769+06	.1996768+06	.2927780+06	.0000000	.1260413+00	.4810908+01	.9030881+00
.6717362+00	.0000000	.0000000	.0000000	.1031032-05	.0000000	.0000000	.0000000
.0000000	.8899362+00	-.7026035-01	-.1724805+00	.0000000	.3446819-06	.3971326-07	.3137892-07
.0000000	.4157552-01	.7781004+00	.4212019+01	.0000000	-.2887363-07	-.2051104-05	-.1190586-05
.0000000	.3465791-01	-.3465790-01	.8449191+00	.0000000	-.2325209-07	-.1272288-05	-.4907314-06
.0000000	-.4109637+04	.4109636+04	.9878769+04	.0000000	-.7802354-03	-.2247933-02	-.1780653-02

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1195127+09	.0000000	.0000000	.0000000	-.9793807+08	.0000000	.0000000	.0000000
FORCZ1	.0000000	.1972306+09	-.8825129+08	-.1740511+09	.0000000	-.1972306+09	.1078420+09	-.1740949+09
FORCR1	.0000000	-.8825129+08	.1854151+09	-.1667583+09	.0000000	.8825129+08	-.1932374+09	-.1830367+09
MOME 1	.0000000	-.1740511+09	-.1667583+09	.7701716+09	.0000000	.1740511+09	.1601127+09	.4073108+09
FORCT2	-.9793795+08	.0000000	.0000000	.0000000	.8026157+08	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.1972304+09	.8825119+08	.1740509+09	.0000000	.1972304+09	-.1078419+09	.1740947+09
FORCR2	.0000000	.1078419+09	-.1932371+09	.1601125+09	.0000000	-.1078419+09	.2242875+09	.1900443+09
MOME 2	.0000000	-.1740947+09	-.1830365+09	.4073104+09	.0000000	.1740947+09	.1900443+09	.8791366+09

SEGMENT SYMMETRY CHECK

.1195127+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1972306+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1854151+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.7701716+09	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.8026157+08	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1972304+09	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.2242875+09	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.8791366+09

SEGMENT LOAD MATRICES

.0000000
.3946858+03
-.3143466+06
.1869265+06
.0000000
-.3946655+03
-.3799289+06
-.2215530+06

TABLE C-2. (Continued)

SEGMENT NUMBER 4 SEGMENT CODE 21 SEGMENT 4 OF REGION 2 (EQUA SANDWICH CONE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.2772786+02	.3272786+02	.5000000+00	.1000000-03	.5000000-01	1.

GEOMETRY INPUT VARIABLES

.7853980+00	.0000000	.0000000

ISOT MATL EQUA THIC NOTH T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.2772686+02	.3272886+02
.2500000+00	.2500000+00
.1410000+01	.1410000+01

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.1706399+02	.0000000	.0000000	.0000000	.1180486+01	.0000000	.0000000	.0000000
.0000000	.5935800+05	-.5935798+05	-.1559730+06	.0000000	.9586859+00	.3792350-01	.2937645-01
.0000000	-.5935798+05	.5935796+05	.1559729+06	.0000000	.4131409-01	.9620765+00	-.2937644-01
.0000000	-.1422731+06	.1422731+06	.2067752+06	.0000000	.1102724+00	.4845401+01	.9231955+00
.7177067+00	.0000000	.0000000	.0000000	.1047001-05	.0000000	.0000000	.0000000
.0000000	.9055106+00	-.5828558-01	-.1430864+00	.0000000	.3497621-06	.3283319-07	.2600427-07
.0000000	.3006704-01	.8171579+00	.4337367+01	.0000000	-.2517290-07	-.2086872-05	-.1218034-05
.0000000	.2488849-01	-.2488848-01	.8733821+00	.0000000	-.2026003-07	-.1287307-05	-.4997650-06
.0000000	-.4976167+04	.4976165+04	.1203285+05	.0000000	-.9446155-03	-.2738900-02	-.2172484-02

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1388977+09	.0000000	.0000000	.0000000	-.1176615+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.2364096+09	-.1079542+09	-.2087061+09	.0000000	-.2364096+09	.1275332+09	-.2087384+09
FORCR1	.0000000	-.1079542+09	.2233004+09	-.2007313+09	.0000000	.1079542+09	-.2330732+09	-.2181138+09
MOME 1	.0000000	-.2087061+09	-.2007313+09	.9328858+09	.0000000	.2087061+09	.1951522+09	.4894702+09
FORCT2	-.1176613+09	.0000000	.0000000	.0000000	.9967404+08	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.2364093+09	.1079541+09	.2087058+09	.0000000	.2364093+09	-.1275330+09	.2087381+09
FORCR2	.0000000	.1275330+09	-.2330729+09	.1951520+09	.0000000	-.1275330+09	.2622431+09	.2239449+09
MOME 2	.0000000	-.2087381+09	-.2181135+09	.4894695+09	.0000000	.2087381+09	.2239449+09	.1041755+10

SEGMENT SYMMETRY CHECK

.1388977+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.2364096+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.2233004+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.9328858+09	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.9967404+08	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.2364093+09	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.2622431+09	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.1041755+10

SEGMENT LOAD MATRICES

.0000000
.4730536+03
-.4593188+06
.2721627+06
.0000000
-.4730374+03
-.5373009+04
-.3142689+06

TABLE C-2. (Continued)

SEGMENT NUMBER 5 SEGMENT CODE 11 SEGMENT 5 OF REGION 2 (EQUA SANDWICH SPHERICAL)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.7853980+00	.1178097+01	.3900000-01	.1000000-03	.3926990-02	1.

GEOMETRY INPUT VARIABLES

.3272786+02	.1000000+01	.0000000

ISOT MATL EQUA THIC NOTH T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.7843980+00	.1179097+01
.2500000+00	.2500000+00
.1410000+01	.1410000+01

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.2182274-14	.0000000	.0000000	.0000000	.1306564+01	.0000000	.0000000	.0000000
.0000000	.3676074+05	-.8874809+05	-.7105885+06	.0000000	.9770531+00	.8141506+00	.3550700+00
.0000000	-.3676066+05	.8874789+05	.7105877+06	.0000000	.3295097+00	-.2729534+00	-.3550697+00
.0000000	-.3050705+06	.7365027+06	.3252612+07	.0000000	.2734541+01	.8912039+01	-.2293149+00
.5857859+00	.0000000	.0000000	.0000000	.2475112-05	.0000000	.0000000	.0000000
.0000000	.7222736+00	-.3295097+00	-.2638321+01	.0000000	.1253288-05	.4214281-05	.1318328-05
.0000000	.7663602+00	-.4359392+00	.7025119+01	.0000000	-.3992970-05	-.3130674-04	-.6659526-05
.0000000	.1470753+00	-.3550697+00	-.3009716+00	.0000000	-.1318328-05	-.7334889-05	-.9020810-06
.0000000	-.6932839+04	.1673731+05	.1083631+06	.0000000	-.2073834-01	-.1552212+00	-.4946648-01

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.7675702+08	.0000000	.0000000	.0000000	-.5874725+08	.0000000	.0000000	.0000000
FORCZ1	.0000000	.1154831+09	-.6160592+08	-.9824541+08	.0000000	-.1154831+09	.8034103+08	.4333638+08
FORCR1	.0000000	-.6160592+08	.5751772+08	-.2081925+08	.0000000	.6160592+08	-.5119793+08	-.8109823+08
MOME 1	.0000000	-.9824541+08	-.2081924+08	.5045608+09	.0000000	.9824544+08	-.1620073+08	.1645219+09
FORCT2	-.5874718+08	.0000000	.0000000	.0000000	.4496313+08	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.1154830+09	.6160585+08	.9824532+08	.0000000	.1154830+09	-.8034096+08	-.4333636+08
FORCR2	.0000000	.8034093+08	-.5119787+08	-.1620070+08	.0000000	-.8034096+08	.8119120+08	.1251048+09
MOME 2	.0000000	.4333633+08	-.8109813+08	.1645217+09	.0000000	-.4333637+08	.1251048+09	.6130921+09

SEGMENT SYMMETRY CHECK

.7675702+08	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1154831+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.5751772+08	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.5045608+09	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.4496313+08	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1154830+09	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000002+01	.1000000+01	.1000000+01	.8119120+08	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.6130921+09

SEGMENT LOAD MATRICES

.0000000
.3323346+06
-.1915671+07
.2614827+07
.0000000
-.3323310+06
-.1940601+07
-.3802878+07

TABLE C-2. (Continued)

INPUT DATA FOR SEGMENT COUPLING

REGION NUMBER 2 NUMBER OF SEGMENT JOINTS 6 NUMBER OF KINEMATIC LINKS 0

SEGMENT	JOINT(I)	JOINT(J)	RZERO(I)	RZERO(J)
1	1	2	.9010000+01	.1282683+02
2	2	3	.1282683+02	.1607103+02
3	3	4	.1607103+02	.1960656+02
4	4	5	.1960656+02	.2314209+02
5	5	6	.2314209+02	.3023658+02

REGION STIFFNESS MATRIX

	DELTA Y1	DELTA Z1	DELTA R1	THETA 1	DELTA Y2	DELTA Z2	DELTA R2	THETA 2
FORCY1	.8057776+08	.0000000	.0000000	.0000000	-.2397511+08	.0000000	.0000000	.0000000
FORCZ1	.0000000	.1777802+08	-.1722842+08	-.5310264+08	.0000000	-.1777799+08	.1488061+08	.2254261+08
FORCR1	.0000000	-.1722842+08	.1171410+09	.1167244+08	.0000000	.1722839+08	-.1349092+08	-.1810184+08
MOME 1	.0000000	-.5310264+08	.1167244+08	.2974997+09	.0000000	.5310255+08	-.4565813+08	-.6577602+08
FORCY2	-.2397508+08	.0000000	.0000000	.0000000	.7149265+07	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.1777797+08	.1722837+08	.5310248+08	.0000000	.1777794+08	-.1488060+08	-.2254250+08
FORCR2	.0000000	.1488060+08	-.1349090+08	-.4565807+08	.0000000	-.1488060+08	.3304063+08	.9145404+08
MOME 2	.0000000	.2254248+08	-.1810182+08	-.6577593+08	.0000000	-.2254250+08	.9145404+08	.5103030+09

REGION SYMMETRY CHECK

.8057776+08	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1777802+08	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1171410+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.2974997+09	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.7149265+07	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1777794+08	.0000000	.0000000

TABLE C-2. (Continued)

.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.3304063+08	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.5103030+09

REGION LOAD MATRIX

.0000000
.9123067+06
-.1951142+07
-.1299966+07
.0000000
-.9123014+06
-.1956340+07
-.6331473+07

TABLE C-2. (Continued)

REGION NUMBER 3

THERE ARE 3 SEGMENTS AND 1 KINEMATIC LINKS WITHIN THIS REGION

TABLE C-2. (Continued)

SEGMENT NUMBER 1 SEGMENT CODE 11 SEGMENT 1 OF REGION 3 (EQUA SANDWICH SPHERICAL)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.1178097+01	.1570796+01	.3900000-01	.1000000-03	.3926990-02	1.

GEOMETRY INPUT VARIABLES

.3272786+02 .1000000+01 .0000000

STIF PROP BLAN STIO NOTH T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.23500+08	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.23500+08	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.33300+00	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.91490-05	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.91490-05	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.17616+08	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.23500+08	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.23500+08	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.91490-05	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.91490-05	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.1177097+01	.1571796+01
.1321700+08	.1321700+08
.4461000+07	.4401000+07
.1481900+08	.1762300+08
.8808000+07	.8808000+07
-.9174000+07	-.9174000+07
-.3055000+07	-.3055000+07
-.1105100+08	-.1717500+08
.6116000+07	.6128000+07
.0000000	.0000000
-.1731000+07	-.5860000+07

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)

LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

THE STRESS CLUES ARE SHEL STRI SHEL SHEL

TABLE C-2. (Continued)

TABLE ORDER PHI OR S VS. STRESS PROPERTIES

.9550000+00	.9550000+00
-.9550000+00	-.9550000+00
.9550000+00	.9550000+00
-.1205000+01	-.1705000+01
.0000000	.0000000
.9166000+00	.1000000+01
.0000000	.0000000
.2500000+00	.2500000+00
.0000000	.0000000
.0000000	.0000000
-.1080000+01	-.1330000+01
.6820000-01	.1875000+00
.2500000+00	.2500000+00
.1410000+01	.1410000+01
.2500000+00	.2500000+00

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.6148191-15	.0000000	.0000000	.0000000	.1082393+01	.0000000	.0000000	.0000000
.0000000	.5031667-01	-.3856146+05	-.3169426+06	.0000000	.9022262+00	.3711046-01	.1104803+00
.0000000	-.1214566+00	.9309508+05	.7651645+06	.0000000	.4349588+00	-.8958985-01	-.2667223+00
.0000000	-.1617939+01	.7739218+06	.3539868+07	.0000000	.3088158+01	.9354649+01	-.5167777-02
.8535523+00	.0000000	.0000000	.0000000	.1349475-05	.0000000	.0000000	.0000000
.0000000	.8535529+00	-.3995540+00	-.2933488+01	.0000000	.6416312-06	.1805250-05	.7102135-06
.0000000	.3535558+00	-.2624565+00	.8343439+01	.0000000	-.1777515-05	-.2377822-04	-.4825673-05
.0000000	.7299688-06	-.3179321+00	-.2085460+00	.0000000	-.9011230-06	-.5610643-05	-.6471590-06
.0000000	-.4065249-01	.2741536+05	.1949350+06	.0000000	-.5268912-02	-.1958651+00	-.5800281-01

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.1523817+09	.0000000	.0000000	.0000000	-.1407822+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.2288087+09	-.3603667+08	-.1575367+09	.0000000	-.2288088+09	.5858938+08	.1893489+09
FORCR1	.0000000	-.3603667+08	.3058566+08	-.7250598+08	.0000000	.3603666+08	-.1958118+08	-.1195834+09
MOME 1	.0000000	-.1575367+09	-.7250599+08	.8182484+09	.0000000	.1575368+09	.3533536+08	.2321412+09
FORCT2	-.1407822+09	.0000000	.0000000	.0000000	.1300657+09	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.2288086+09	.3603664+08	.1575367+09	.0000000	.2288087+09	-.5858939+08	-.1893488+09
FORCR2	.0000000	.5858935+08	-.1958117+08	.3533534+08	.0000000	-.5858939+08	.4004043+08	.1645317+09
MOME 2	.0000000	.1893488+09	-.1195833+09	.2321409+09	.0000000	-.1893488+09	.1645317+09	.1096511+10

SEGMENT SYMMETRY CHECK

.1523817+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.2288087+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.3058566+08	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.8182484+09	.0000000	.0000000	.0000000	.0000000
.1000001+01	.1000000+01	.1000000+01	.1000000+01	.1300657+09	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.2288087+09	.0000000	.0000000
.1000000+01	.1000001+01	.1000000+01	.1000001+01	.1000000+01	.1000000+01	.4004043+08	.0000000
.1000000+01	.1000000+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.1096511+10

SEGMENT LOAD MATRICES

.0000000
.7127381+06
-.3290778+07
.5713817+07
.0000000
-.7127281+06
-.3628082+07
-.7713126+07

TABLE C-2. (Continued)

SEGMENT NUMBER 2 SEGMENT CODE 31 SEGMENT 2 OF REGION 3 (EQUA SANDWICH CYLINDER)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.1000000+02	.1500000+02	.5000000+00	.1000000-03	.5000000-01	1.

GEOMETRY INPUT VARIABLES

.3272786+02	.0000000	.0000000

STIF PROP BLAN STIO NOTH T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.23500+08	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.23500+08	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.33300+00	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.91490-05	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.91490-05	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.17616+08	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.23500+08	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.23500+08	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.91490-05	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.91490-05	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.9999000+01	.1500100+02
.1468600+08	.1468600+08
.4401000+07	.4401000+07
.1762300+08	.1762300+08
.8808000+07	.8808000+07
-.1105100+08	-.1105100+08
-.3055000+07	-.3055000+07
-.1717500+08	-.1717500+08
.6130000+07	.6130000+07
.1586000+07	.1586000+07
-.5860000+07	-.5860000+07

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

THE STRESS CLUES ARE SHEL STRI RING SHEL

TABLE C-2. (Continued)

TABLE ORDER PHI OR S VS. STRESS PROPERTIES

.1205000+01	.1205000+01
-.9550000+00	-.9550000+00
.9550000+00	.9550000+00
-.1705000+01	-.1705000+01
.1000000+01	.1000000+01
.1000000+01	.1000000+01
.2500000+00	.2500000+00
.2500000+00	.2500000+00
.1080000+01	.1080000+01
.6250000-01	.6250000-01
-.1330000+01	-.1330000+01
.1875000+00	.1875000+00
.2500000+00	.2500000+00
.1410000+01	.1410000+01
.2500000+00	.2500000+00

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000	.1000000+01	.0000000	.0000000
.0000000	.0000000	.6097259+05	.1547831+06	.0000000	.4799274-01	.9422093+00	-.3148153-01
.0000000	.0000000	.1547831+06	.2594577+06	.0000000	.1138799+00	.4917690+01	.9422093+00
.1000000+01	.0000000	.0000000	.0000000	.5672971-06	.0000000	.0000000	.0000000
.0000000	.1000000+01	-.4799274-01	-.1138799+00	.0000000	.3122012-06	-.2562800-06	-.9571118-07
.0000000	.0000000	.9422093+00	.4917690+01	.0000000	.2562800-06	-.1357380-05	-.8097637-06
.0000000	.0000000	-.3148153-01	.9422093+00	.0000000	.9571118-07	-.8097637-06	-.3189844-06
.0000000	.0000000	.1691077+05	.4266092+05	.0000000	.1507393-02	-.5850766-02	-.4667708-02

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.3624824+09	.0000000	.0000000	.0000000	-.3624824+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.7247394+09	.1381532+08	-.2525290+09	.0000000	-.7247394+09	.1381531+08	.2525290+09
FORCR1	.0000000	.1381531+08	.3012762+09	-.7486607+09	.0000000	-.1381531+08	-.2942330+09	-.7427854+09
MOME 1	.0000000	-.2525290+09	-.7486607+09	.2583699+10	.0000000	.2525290+09	.7427854+09	.1165184+10
FORCT2	-.3624824+09	.0000000	.0000000	.0000000	.3624824+09	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.7247394+09	-.1381532+08	.2525290+09	.0000000	.7247394+09	-.1381531+08	-.2525290+09
FORCR2	.0000000	.1381532+08	-.2942330+09	.7427854+09	.0000000	-.1381532+08	.3012762+09	.7486607+09
MOME 2	.0000000	.2525290+09	-.7427854+09	.1165184+10	.0000000	-.2525290+09	.7486606+09	.2583698+10

SEGMENT SYMMETRY CHECK

.3624824+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.7247394+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.3012762+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.2583699+10	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.3624824+09	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000001+01	.1000000+01	.1000000+01	.7247394+09	.0000000	.0000000
.1000000+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.1000001+01	.3012762+09	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.2583698+10

SEGMENT LOAD MATRICES

.0000000
.5434072+04
-.1766442+07
.1473537+07
.0000000
-.5434072+04
-.1766442+07
-.1473537+07

TABLE C-2. (Continued)

SEGMENT NUMBER 3 SEGMENT CODE 21 SEGMENT 3 OF REGION 3 (UNEQ SANDWICH INVERTED CONE)

TIC	STOP	DTAU	DIFF	STEP	DELTA
.8419899+03	.8469933+03	.5000000+00	.1000000-03	.5003443-01	1.

GEOMETRY INPUT VARIABLES

-.1532148+01	.0000000	.0000000

ISOT MATL UNEQ THIC NOTH T FREE = .750+02 LINE NUMBER OF TABLE COLUMNS = 2

MATERIAL PROPERTY TABLE USED

.75000+02	.60000+03	.63800+03	.65700+03	.68400+03	.71800+03	.82000+03	.97500+03	.10770+04	.12800+04
.23500+08	.23500+08	.23000+08	.22800+08	.22400+08	.22000+08	.20700+08	.18700+08	.17400+08	.15800+08
.33300+00	.33300+00	.33600+00	.33800+00	.34000+00	.34300+00	.35200+00	.36600+00	.37500+00	.38600+00
.91490-05	.91490-05	.92070-05	.92390-05	.92890-05	.93370-05	.94990-05	.97480-05	.99130-05	.10109-04

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.8419889+03	.8469943+03
.2500000+00	.2500000+00
.1140000+01	.1410000+01
.5000000+00	.2500000+00

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

MATRIX X AND Y (TRANSPOSED) MAGIC OUTPUT

.2221334-01	.0000000	.0000000	.0000000	.1005946+01	.0000000	.0000000	.0000000
.0000000	.1020653+03	.2639582+04	.7087187+04	.0000000	.9980626+00	-.1549872-02	-.1250943-02
.0000000	.2639582+04	.6826405+05	.1832866+06	.0000000	-.5010474-01	.9599177+00	-.3235151-01
.0000000	.6180910+04	.1598488+06	.2864203+06	.0000000	-.1262799+00	.4959982+01	.9594646+00
.9882169+00	.0000000	.0000000	.0000000	.9167883-06	.0000000	.0000000	.0000000
.0000000	.9960576+00	.5081523-01	.1275272+00	.0000000	.3063561-06	-.2652590-07	-.2181851-07
.0000000	-.1174265-02	.9637242+00	.4946790+01	.0000000	.2554132-07	-.2040077-05	-.1256473-05
.0000000	-.9467460-03	-.2448445-01	.9634968+00	.0000000	.2010948-07	-.1199264-05	-.4884615-06
.0000000	-.5432608+03	-.1404964+05	-.3761709+05	.0000000	-.1781549-03	.8208856-02	.6630808-02

TABLE C-2. (Continued)

STIFFNESS COEFFICIENTS

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.2242905+09	.0000000	.0000000	.0000000	-.2229648+09	.0000000	.0000000	.0000000
FORCZ1	.0000000	.6670314+09	.9613391+06	-.3405085+08	.0000000	-.6670314+09	-.3497927+08	-.4957223+07
FORCR1	.0000000	.9613403+06	.2031657+09	.5089635+09	.0000000	-.9613407+06	-.1958983+09	.4801651+09
MOME 1	.0000000	-.3405085+08	.5089635+09	.1712492+10	.0000000	.3405085+08	-.5019569+09	.8168292+09
FORCT2	-.2229648+09	.0000000	.0000000	.0000000	.2216469+09	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.6670313+09	-.9613393+06	.3405084+08	.0000000	.6670313+09	.3497927+08	.4957222+07
FORCR2	.0000000	-.3497927+08	-.1958982+09	-.5019568+09	.0000000	.3497927+08	.2045027+09	-.4863198+09
MOME 2	.0000000	-.4957221+07	.4801650+09	.8168290+09	.0000000	.4957218+07	-.4863198+09	.1598615+10

SEGMENT SYMMETRY CHECK

.2242905+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.6670314+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000001+01	.2031657+09	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1712492+10	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.2216469+09	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000001+01	.1000000+01	.1000000+01	.6670313+09	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.2045027+09	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000001+01	.1000000+01	.1598615+10

SEGMENT LOAD MATRICES

.0000000
-.1075818+05
-.1578807+07
-.1285417+07
.0000000
.1075827+05
-.1325191+07
.1123206+07

TABLE C-2. (Continued)

INPUT DATA FOR SEGMENT COUPLING

REGION NUMBER 3 NUMBER OF SEGMENT JOINTS 5 NUMBER OF KINEMATIC LINKS 1

SEGMENT	JOINT(I)	JOINT(J)	RZERO(I)	RZERO(J)
1	1	2	.3023660+02	.3272786+02
2	2	3	.3272786+02	.3272786+02
3	5	4	.3253311+02	.3272693+02

SEGMENT LINKS

JOINT(J)	JOINT(I)	ANGLE OF ORIENTATION
4	3	.1570796+01

REGION STIFFNESS MATRIX

	DELTA T1	DELTA Z1	DELTA R1	THETA 1	DELTA T2	DELTA Z2	DELTA R2	THETA 2
FORCT1	.7831775+08	.0000000	.0000000	.0000000	-.7278953+08	.0000000	.0000000	.0000000
FORCZ1	.0000000	.1044628+09	-.7061061+07	-.1310964+09	.0000000	-.1044628+09	.9573364+07	.7047932+08
FORCR1	.0000000	-.7061059+07	.1895789+08	-.5549673+08	.0000000	.7061040+07	.1558040+07	-.7718804+07
MOME 1	.0000000	-.1310965+09	-.5549673+08	.6945209+09	.0000000	.1310965+09	-.8654069+07	-.1203993+08
FORCT2	-.7278949+08	.0000000	.0000000	.0000000	.6765150+08	.0000000	.0000000	.0000000
FORCZ2	.0000000	-.1044628+09	.7061037+07	.1310965+09	.0000000	.1044628+09	-.9573367+07	-.7047933+08
FORCR2	.0000000	.9573357+07	.1558039+07	-.8654063+07	.0000000	-.9573365+07	.2231026+08	.8035972+08
MOME 2	.0000000	.7047928+08	-.7718800+07	-.1203993+08	.0000000	-.7047932+08	.8035970+08	.6152934+09

REGION SYMMETRY CHECK

.7831775+08	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1044628+09	.0000000	.0000000	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1895789+08	.0000000	.0000000	.0000000	.0000000	.0000000

TABLE C-2. (Continued)

.1000000+01	.1000000+01	.1000000+01	.6945209+09	.0000000	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000003+01	.1000000+01	.6765150+08	.0000000	.0000000	.0000000
.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.1044628+09	.0000000	.0000000
.1000000+01	.1000001+01	.1000000+01	.1000001+01	.1000000+01	.1000000+01	.2231026+08	.0000000
.1000000+01	.1000001+01	.1000001+01	.1000000+01	.1000000+01	.1000000+01	.1000000+01	.6152939+09

REGION LOAD MATRIX

.0000000
.4961690+07
-.5120950+07
.1042452+08
.0000000
-.4961682+07
-.4947970+07
-.1460552+08

TABLE C-2. (Continued)

INPUT DATA FOR REGION COUPLING

NUMBER OF REGION JOINTS 5 NUMBER OF KINEMATIC LINKS 1

REGION	JOINT(I)	JOINT(J)	RZERO(I)	RZERO(J)
1	1	2	.5000000+00	.8999988+01
2	3	4	.9010000+01	.3023660+02
3	4	5	.3023660+02	.3253311+02

REGION LINKS

JOINT(J)	JOINT(I)	ANGLE OF ORIENTATION
3	2	.1570796+01

BOUNDARY CONDITIONS

JOINT	DELTA T	DELTA Z	DELTA R	THETA	ANGLE ALPHA
1	1	0	1	0	.0000000
2	1	1	1	1	.0000000
3	0	0	0	0	.0000000
4	1	1	1	1	.0000000
5	1	1	1	1	.0000000

TABLE C-2. (Continued)

THE REDUCED FLEXIBILITY MATRIX

ROW	COMN 1	COMN 2	COMN 3	COMN 4	COMN 5	COMN 6	COMN 7	COMN 8
1	.1956644-07	.0000000	.3128022-06	.0000000	.0000000	.0000000	.1050150-05	.0000000
2	.0000000	.2193306-08	.0000000	-.5026755-10	.1794772-09	.1761164-10	.0000000	-.2808423-09
3	.3128013-06	.0000000	.5630453-05	.0000000	.0000000	.0000000	.1890275-04	.0000000
4	.0000000	-.5026738-10	.0000000	.4226986-07	-.4669479-09	-.7088971-08	.0000000	.6380686-07
5	.0000000	.1794767-09	.0000000	-.4669481-09	.1667212-08	.1635991-09	.0000000	-.2608818-08
6	.0000000	.1761159-10	.0000000	-.7088971-08	.1635990-09	.2483677-08	.0000000	-.1463460-07
7	.1050146-05	.0000000	.1890273-04	.0000000	.0000000	.0000000	.6360077-04	.0000000
8	.0000000	-.2808411-09	.0000000	.6380678-07	-.2608815-08	-.1463458-07	.0000000	.1854626-06
9	.0000000	-.3608590-11	.0000000	-.2154485-09	-.3352127-10	.7549466-10	.0000000	.2106839-07
10	.0000000	-.6645046-12	.0000000	.1499462-10	-.6172779-11	-.5253774-11	.0000000	.1090871-08
11	.1129902-05	.0000000	.2033835-04	.0000000	.0000000	.0000000	.6843111-04	.0000000
12	.0000000	-.2797141-09	.0000000	.6380064-07	-.2598345-08	-.1463243-07	.0000000	.1826292-06
13	.0000000	.4205657-12	.0000000	.5560435-10	.3906764-11	-.1948211-10	.0000000	-.4010425-08
14	.0000000	.1588012-13	.0000000	-.1037103-10	.1475138-12	.3634496-11	.0000000	.4848767-09

ROW	COMN 9	COMN 10	COMN 11	COMN 12	COMN 13	COMN 14
1	.0000000	.0000000	.1129907-05	.0000000	.0000000	.0000000
2	-.3608589-11	-.6645049-12	.0000000	-.2797154-09	.4205969-12	.1587888-13
3	.0000000	.0000000	.2033839-04	.0000000	.0000000	.0000000
4	-.2154523-09	.1499402-10	.0000000	.6380074-07	.5559768-10	-.1037074-10
5	-.3352117-10	-.6172764-11	.0000000	-.2598350-08	.3907042-11	.1475023-12
6	.7549565-10	-.5253641-11	.0000000	-.1463245-07	-.1948062-10	.3634432-11
7	.0000000	.0000000	.6843114-04	.0000000	.0000000	.0000000
8	.2106838-07	.1090870-08	.0000000	.1826292-06	-.4010447-08	.4848779-09
9	.2605772-07	-.2629490-09	.0000000	.1973003-07	-.5858940-08	.9336438-09
10	-.2629489-09	.1004925-08	.0000000	-.2423038-09	.6178594-09	-.2170391-09
11	.0000000	.0000000	.7364312-04	.0000000	.0000000	.0000000
12	.1973001-07	-.2423051-09	.0000000	.1920498-06	-.4136650-08	.1862126-08
13	-.5858936-08	.6178594-09	.0000000	-.4136633-08	.8627735-07	-.1134403-07
14	.9336431-09	-.2170390-09	.0000000	.1862125-08	-.1134402-07	.3272039-08

TABLE C-2. (Continued)

THE EXPANDED REGION JOINT DISPLACEMENT MATRIX (REGION END DEFLECTIONS)

JOINT	PROBLEM	DELTA T	DELTA Z	DELTA R	OMEGA-THETA
1	1	.0000000	.0000000	.2467042-02	.0000000
2	1	.0000000	-.8319968-02	.5951767-01	.2914986-02
3	1	.0000000	-.8349154-02	.5951767-01	.2914986-02
4	1	.0000000	.1134515+00	.1814254+00	-.1195288-01
5	1	.0000000	.1875445+00	.2130359+00	.4445819-02

TABLE C-2. (Continued)

```
                                        REGION NUMBER  1

                     THERE ARE  8 SEGMENTS AND  0 KINEMATIC LINKS WITHIN THIS REGION

          SEGMENT NUMBER  1     SEGMENT CODE 21      SEGMENT 1 OF REGION 1 (PLATE)

                                  TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
  .4990000+00     .2001000+01
  .4375000+01     .4375000+01

                                    TABLE ORDER PHI OR S VS. TEMPERATURE LOADS
  .6750000+03     .6750000+03

            PROBLEM  1     TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

  .0000000        .0000000
  .0000000        .0000000
  .0000000        .0000000
```

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	W PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = W/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.5000000+00	.0000000	.1250000+00	.1500000-01	.5000000+00	1
.4934083-02	.5776947-02	.0000000	.1610949-03	.0000000	.8301592+06
.0000000	-.1927888+01	.0000000	-.1927888+01	.0000000	.8301592+06
.2467042-02	-.1927888+01	-.6204013+05	-.7031256-01	.0000000	.0000000
-.7596479-10	.0000000	-.9714391+04	-.2862787+05	.0000000	.0000000
.0000000	.0000000	-.1722576+05	-.8973978+04	.0000000	.1492232+05
.0000000	.0000000	-.1113544+05	.8973945+04	.0000000	.1744874+05

PROBLEM NUMBER 1

.6349999+00	.0000000	.1250000+00	.1500000-01	.6349999+00	37
.5094188-02	.5616425-02	.0000000	.1304881-03	.3060807-04	.8301592+06
.0000000	-.1518022+01	.0000000	-.1518022+01	.0000000	.8301592+06
.3234809-02	-.1518022+01	-.5027120+05	-.1183132+05	.0000000	.0000000
.1357819-05	.0000000	-.1330804+05	-.2503454+05	.0000000	.0000000
.1943612-04	.0000000	-.1566222+05	-.1055186+05	.0000000	.1383407+05
.0000000	.0000000	-.7318897+04	.5143260+04	.0000000	.1084723+05

PROBLEM NUMBER 1

.7699997+00	.0000000	.1250000+00	.1500000-01	.7699997+00	73
.5177682-02	.5532414-02	.0000000	.1145127-03	.4658451-04	.8301592+06
.0000000	-.1251875+01	.0000000	-.1251875+01	.0000000	.8301592+06
.3986814-02	-.1251875+01	-.4414508+05	-.1803463+05	.0000000	.0000000
.5115069-05	.0000000	-.1518383+05	-.2315900+05	.0000000	.0000000
.3587006-04	.0000000	-.1484997+05	-.1138184+05	.0000000	.1345540+05
.0000000	.0000000	-.5330638+04	.3137436+04	.0000000	.7415103+04

PROBLEM NUMBER 1

.9049996+00	.0000000	.1250000+00	.1500000-01	.9049996+00	109
.5226609-02	.5482870-02	.0000000	.1051364-03	.5596175-04	.8301592+06
.0000000	-.1065132+01	.0000000	-.1065132+01	.0000000	.8301592+06
.4730079-02	-.1065132+01	-.4056706+05	-.2170470+05	.0000000	.0000000
.1096903-04	.0000000	-.1628482+05	-.2205821+05	.0000000	.0000000
.5064536-04	.0000000	-.1437726+05	-.1187565+05	.0000000	.1330404+05

TABLE C-2. (Continued)

.0000000	.0000000	-.4167677+04	.1953500+04	.0000000	.5415464+04

PROBLEM NUMBER 1

.1039999+01	.0000000	.1250000+00	.1500000-01	.1039999+01	145
.5257672-02	.5451090-02	.0000000	.9916813-04	.6193076-04	.8301592+06
.0000000	-.9268692+00	.0000000	-.9268692+00	.0000000	.8301592+06
.5467976-02	-.9268692+00	-.3830774+05	-.2407093+05	.0000000	.0000000
.1874416-04	.0000000	-.1698566+05	-.2135755+05	.0000000	.0000000
.6440795-04	.0000000	-.1408054+05	-.1219686+05	.0000000	.1323959+05
.0000000	.0000000	-.3431568+04	.1193011+04	.0000000	.4158465+04

PROBLEM NUMBER 1

.1174999+01	.0000000	.1250000+00	.1500000-01	.1174999+01	181
.5278574-02	.5429372-02	.0000000	.9513619-04	.6596336-04	.8301592+06
.0000000	-.8203778+00	.0000000	-.8203778+00	.0000000	.8301592+06
.6202321-02	-.8203778+00	-.3680065+05	-.2570039+05	.0000000	.0000000
.2832951-04	.0000000	-.1745916+05	-.2088422+05	.0000000	.0000000
.7750691-04	.0000000	-.1388435+05	-.1242094+05	.0000000	.1321356+05
.0000000	.0000000	-.2938529+04	.6721876+03	.0000000	.3325963+04

PROBLEM NUMBER 1

.1309999+01	.0000000	.1250000+00	.1500000-01	.1309999+01	217
.5293269-02	.5413761-02	.0000000	.9228529-04	.6881485-04	.8301592+06
.0000000	-.7358350+00	.0000000	-.7358350+00	.0000000	.8301592+06
.6734179-02	-.7358350+00	-.3575300+05	-.2688406+05	.0000000	.0000000
.3965050-04	.0000000	-.1779397+05	-.2054954+05	.0000000	.0000000
.9014740-04	.0000000	-.1374998+05	-.1258658+05	.0000000	.1320677+05
.0000000	.0000000	-.2594249+04	.2967228+03	.0000000	.2754623+04

PROBLEM NUMBER 1

.1444999+01	.0000000	.1250000+00	.1500000-01	.1444999+01	253
.5303956-02	.5402060-02	.0000000	.9019549-04	.7090519-04	.8301592+06
.0000000	-.6670891+00	.0000000	-.6670891+00	.0000000	.8301592+06
.7664212-02	-.6670891+00	-.3500480+05	-.2778375+05	.0000000	.0000000
.5265453-04	.0000000	-.1803942+05	-.2030422+05	.0000000	.0000000
.1024579-03	.0000000	-.1365590+05	-.1271532+05	.0000000	.1321075+05
.0000000	.0000000	-.2346290+04	.1417782+02	.0000000	.2353411+04

PROBLEM NUMBER 1

.1579999+01	.0000000	.1250000+00	.1500000-01	.1579999+01	289
.5311935-02	.5392966-02	.0000000	.8861814-04	.7248303-04	.8301592+06
.0000000	-.6100910+00	.0000000	-.6100910+00	.0000000	.8301592+06

TABLE C-2. (Continued)

.8392852-02	-.6100710+00	-.3445964+05	-.2849525+05	.0000000	.0000000
.6730314-04	.0000000	-.1822470+05	-.2011906+05	.0000000	.0000000
.1145231-03	.0000000	-.1358937+05	-.1281991+05	.0000000	.1322145+05
.0000000	.0000000	-.2163603+04	-.2064929+03	.0000000	.2068103+04

PROBLEM NUMBER 1

.1714999+01	.0000000	.1250000+00	.1500000-01	.1714999+01	325
.5318017-02	.5385670-02	.0000000	.8739844-04	.7370317-04	.8301592+06
.0000000	-.5620663+00	.0000000	-.5620663+00	.0000000	.8301592+06
.9120393-02	-.5620663+00	-.3405787+05	-.2907821+05	.0000000	.0000000
.8356736-04	.0000000	-.1836798+05	-.1997588+05	.0000000	.0000000
.1264009-03	.0000000	-.1354246+05	-.1290828+05	.0000000	.1323677+05
.0000000	.0000000	-.2026858+04	-.3846203+03	.0000000	.1864542+04

PROBLEM NUMBER 1

.1849999+01	.0000000	.1250000+00	.1500000-01	.1849999+01	361
.5322728-02	.5379645-02	.0000000	.8693592-04	.7466611-04	.8301592+06
.0000000	-.5210506+00	.0000000	-.5210506+00	.0000000	.8301592+06
.9847039-02	-.5210506+00	-.3376080+05	-.2957134+05	.0000000	.0000000
.1014248-03	.0000000	-.1848106+05	-.1986290+05	.0000000	.0000000
.1381322-03	.0000000	-.1351000+05	-.1298558+05	.0000000	.1325557+05
.0000000	.0000000	-.1923507+04	-.5327511+03	.0000000	.1720161+04

PROBLEM NUMBER 1

.1984999+01	.0000000	.1250000+00	.1500000-01	.1984999+01	397
.5326421-02	.5374538-02	.0000000	.8566304-04	.7543938-04	.8301592+06
.0000000	-.4856139+00	.0000000	-.4856139+00	.0000000	.8301592+06
.1057294-01	-.4856139+00	-.3354239+05	-.3000065+05	.0000000	.0000000
.1208578-03	.0000000	-.1857187+05	-.1977219+05	.0000000	.0000000
.1497471-03	.0000000	-.1348854+05	-.1305527+05	.0000000	.1327721+05
.0000000	.0000000	-.1845119+04	-.6593165+03	.0000000	.1619459+04

PROBLEM NUMBER 1

.1999999+01	.0000000	.1250000+00	.1500000-01	.1999999+01	401
.5326780-02	.5374016-02	.0000000	.8558669-04	.7551577-04	.8301592+06
.0000000	-.4819718+00	.0000000	-.4819718+00	.0000000	.8301592+06
.1065355-01	-.4819718+00	-.3352214+05	-.3004525+05	.0000000	.0000000
.1231137-03	.0000000	-.1858084+05	-.1976322+05	.0000000	.0000000
.1510314-03	.0000000	-.1348673+05	-.1306265+05	.0000000	.1327977+05
.0000000	.0000000	-.1837678+04	-.6723205+03	.0000000	.1610456+04

TABLE C-2. (Continued)

SEGMENT NUMBER 2   SEGMENT CODE 21   SEGMENT 2 OF REGION 1 (PLATE)

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.1999000+01	.3000000+01	.4000000+01	.4500000+01	.5001000+01
.4375000+01	.3840000+01	.3275000+01	.2970000+01	.2680000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.6750000+03	.6820000+03	.6980000+03	.7130000+03	.7320000+03

PROBLEM 1   TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000	.0000000	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000
.0000000	.0000000	.0000000	.0000000	.0000000

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.2000000+01	.0000000	.1250000+00	.3000000-01	.2000000+01	1
.5326776-02	.5374085-02	.0000000	.8562798-04	.7551571-04	.8300654+06
.0000000	-.4756602+00	.0000000	-.4756602+00	.0000000	.8300654+06
.1065355-01	-.4756602+00	-.3352655+05	-.3004474+05	.0000000	.0000000
.1231137-03	.0000000	-.1857644+05	-.1976324+05	.0000000	.0000000
.1510314-03	.0000000	-.1348872+05	-.1306489+05	.0000000	.1328188+05
.0000000	.0000000	-.1839580+04	-.6715243+03	.0000000	.1612351+04

PROBLEM NUMBER 1

.2150000+01	.0000000	.1250000+00	.3000000-01	.2150000+01	21
.5330225-02	.5378299-02	.0000000	.9113198-04	.7641221-04	.8159815+06
.0000000	-.4424746+00	.0000000	-.4424746+00	.0000000	.8159815+06
.1145998-01	-.4424746+00	-.3395439+05	-.3048375+05	.0000000	.0000000
.1467522-03	.0000000	-.1802806+05	-.1966113+05	.0000000	.0000000
.1642862-03	.0000000	-.1377251+05	-.1349565+05	.0000000	.1363619+05
.0000000	.0000000	-.2041206+04	-.7016678+03	.0000000	.1796277+04

PROBLEM NUMBER 1

.2300000+01	.0000000	.1250000+00	.3000000-01	.2300000+01	41
.5333492-02	.5382299-02	.0000000	.9684737-04	.7755723-04	.8018541+06
.0000000	-.4136176+00	.0000000	-.4136176+00	.0000000	.8018541+06
.1226703-01	-.4136176+00	-.3436994+05	-.3091476+05	.0000000	.0000000
.1724415-03	.0000000	-.1751686+05	-.1953784+05	.0000000	.0000000
.1783816-03	.0000000	-.1407413+05	-.1393703+05	.0000000	.1400608+05
.0000000	.0000000	-.2237648+04	-.7349379+03	.0000000	.1975518+04

PROBLEM NUMBER 1

.2450000+01	.0000000	.1250000+00	.3000000-01	.2450000+01	61
.5336597-02	.5386050-02	.0000000	.1028412-03	.7892017-04	.7876833+06
.0000000	-.3882941+00	.0000000	-.3882941+00	.0000000	.7876833+06
.1307466-01	-.3882941+00	-.3477091+05	-.3133914+05	.0000000	.0000000
.2003105-03	.0000000	-.1703524+05	-.1939929+05	.0000000	.0000000
.1933544-03	.0000000	-.1439197+05	-.1439182+05	.0000000	.1439189+05

TABLE C-2. (Continued)

.0000000	.0000000	-.2430132+04	-.7699964+03	.0000000	.2151103+04

PROBLEM NUMBER 1

.2599999+01	.0000000	.1250000+00	.3000000-01	.2599999+01	81
.5339552-02	.5389521-02	.0000000	.1091752-03	.8048116-04	.7734692+06
.0000000	-.3658925+00	.0000000	-.3658925+00	.0000000	.7734692+06
.1388283-01	-.3658925+00	-.3515552+05	-.3175774+05	.0000000	.0000000
.2304940-03	.0000000	-.1657771+05	-.1924965+05	.0000000	.0000000
.2092510-03	.0000000	-.1472504+05	-.1486243+05	.0000000	.1479421+05
.0000000	.0000000	-.2619500+04	-.8057579+03	.0000000	.2323864+04

PROBLEM NUMBER 1

.2749999+01	.0000000	.1250000+00	.3000000-01	.2749999+01	101
.5342366-02	.5392684-02	.0000000	.1159093-03	.8222800-04	.7592120+06
.0000000	-.3459347+00	.0000000	-.3459347+00	.0000000	.7592120+06
.1469150-01	-.3459347+00	-.3552239+05	-.3217103+05	.0000000	.0000000
.2631347-03	.0000000	-.1614024+05	-.1909195+05	.0000000	.0000000
.2261269-03	.0000000	-.1507279+05	-.1535103+05	.0000000	.1521382+05
.0000000	.0000000	-.2806332+04	-.8412902+03	.0000000	.2494459+04

PROBLEM NUMBER 1

.2899999+01	.0000000	.1250000+00	.3000000-01	.2899999+01	121
.5345043-02	.5395512-02	.0000000	.1231041-03	.8415409-04	.7449115+06
.0000000	-.3280415+00	.0000000	-.3280415+00	.0000000	.7449115+06
.1550062-01	-.3280415+00	-.3587037+05	-.3257927+05	.0000000	.0000000
.2983843-03	.0000000	-.1571981+05	-.1892838+05	.0000000	.0000000
.2440468-03	.0000000	-.1543501+05	-.1585969+05	.0000000	.1565167+05
.0000000	.0000000	-.2991014+04	-.8757476+03	.0000000	.2663404+04

PROBLEM NUMBER 1

.3049999+01	.0000000	.1250000+00	.3000000-01	.3049999+01	141
.5347637-02	.5403793-02	.0000000	.1310550-03	.8625909-04	.7307020+06
.0000000	-.3119083+00	.0000000	-.3119083+00	.0000000	.7307020+06
.1631029-01	-.3119083+00	-.3657967+05	-.3298567+05	.0000000	.2913486-02
.3364048-03	.0000000	-.1530152+05	-.1876049+05	.0000000	.2913486-02
.2630901-03	.0000000	-.1591539+05	-.1640091+05	.0000000	.1616362+05
.0000000	.0000000	-.3277722+04	-.9064484+03	.0000000	.2931557+04

PROBLEM NUMBER 1

.3199999+01	.0000000	.1250000+00	.3000000-01	.3199999+01	161
.5350738-02	.5423184-02	.0000000	.1400864-03	.8856815-04	.7167699+06
.0000000	-.2972876+00	.0000000	-.2972876+00	.0000000	.7167699+06

TABLE C-2. (Continued)

.1712235-01	-.2972876+00	-.3793703+05	-.3342665+05	.0000000	.0000000
.3773759-03	.0000000	-.1487560+05	-.1858833+05	.0000000	.0000000
.2834180-03	.0000000	-.1660447+05	-.1699799+05	.0000000	.1680468+05
.0000000	.0000000	-.3753472+04	-.9395726+03	.0000000	.3383000+04

PROBLEM NUMBER 1

.3349999+01	.0000000	.1250000+00	.3000000-01	.3349999+01	181
.5354382-02	.5440871-02	.0000000	.1498471-03	.9109045-04	.7028207+06
.0000000	-.2839762+00	.0000000	-.2839762+00	.0000000	.7028207+06
.1793717-01	-.2839762+00	-.3915713+05	-.3390241+05	.0000000	.0000000
.4215004-03	.0000000	-.1446649+05	-.1841292+05	.0000000	.0000000
.3051529-03	.0000000	-.1729378+05	-.1763597+05	.0000000	.1746739+05
.0000000	.0000000	-.4207838+04	-.9802183+03	.0000000	.3813414+04

PROBLEM NUMBER 1

.3499999+01	.0000000	.1250000+00	.3000000-01	.3499999+01	201
.5358449-02	.5457491-02	.0000000	.1604687-03	.9383293-04	.6887582+06
.0000000	-.2718058+00	.0000000	-.2718058+00	.0000000	.6887582+06
.1875456-01	-.2718058+00	-.4027261+05	-.3440355+05	.0000000	-.2533060-02
.4689981-03	.0000000	-.1407081+05	-.1823530+05	.0000000	-.2533060-02
.3284151-03	.0000000	-.1799131+05	-.1831589+05	.0000000	.1815578+05
.0000000	.0000000	-.4649640+04	-.1025525+04	.0000000	.4231138+04

PROBLEM NUMBER 1

.3649998+01	.0000000	.1250000+00	.3000000-01	.3649998+01	221
.5362843-02	.5473090-02	.0000000	.1720651-03	.9680613-04	.6745825+06
.0000000	-.2606357+00	.0000000	-.2606357+00	.0000000	.6745825+06
.1957437-01	-.2606357+00	-.4129104+05	-.3492274+05	.0000000	-.2412409-02
.5201082-03	.0000000	-.1368729+05	-.1805628+05	.0000000	-.2412409-02
.3533422-03	.0000000	-.1869961+05	-.1903944+05	.0000000	.1887182+05
.0000000	.0000000	-.5080412+04	-.1072993+04	.0000000	.4637958+04

PROBLEM NUMBER 1

.3799998+01	.0000000	.1250000+00	.3000000-01	.3799998+01	241
.5367487-02	.5487693-02	.0000000	.1847659-03	.1000237-03	.6602941+06
.0000000	-.2503474+00	.0000000	-.2503474+00	.0000000	.6602941+06
.2039644-01	-.2503474+00	-.4221849+05	-.3545399+05	.0000000	.0000000
.5750918-03	.0000000	-.1331491+05	-.1787647+05	.0000000	.0000000
.3800899-03	.0000000	-.1942107+05	-.1980886+05	.0000000	.1961784+05
.0000000	.0000000	-.5501289+04	-.1120293+04	.0000000	.5035492+04

PROBLEM NUMBER 1

TABLE C-2. (Continued)

.3949998+01	.0000000	.1250000+00	.3000000-01	.3949998+01	261
.5372313-02	.5501309-02	.0000000	.1987195-03	.1035025-03	.6458932+06
.0000000	-.2408406+00	.0000000	-.2408406+00	.0000000	.6458932+06
.2122063-01	-.2408406+00	-.4305980+05	-.3599240+05	.0000000	.0000000
.6342350-03	.0000000	-.1295284+05	-.1769638+05	.0000000	.0000000
.4088346-03	.0000000	-.2015809+05	-.2062694+05	.0000000	.2039656+05
.0000000	.0000000	-.5913075+04	-.1165166+04	.0000000	.5425159+04

PROBLEM NUMBER 1

.4099998+01	.0000000	.1250000+00	.3000000-01	.4099998+01	281
.5377488-02	.5531989-02	.0000000	.2152904-03	.1072770-03	.6316945+06
.0000000	-.2320293+00	.0000000	-.2320293+00	.0000000	.6316945+06
.2204769-01	-.2320293+00	-.4476287+05	-.3654538+05	.0000000	.0000000
.6978539-03	.0000000	-.1257068+05	-.1751602+05	.0000000	.0000000
.4398354-03	.0000000	-.2122905+05	-.2154475+05	.0000000	.2138865+05
.0000000	.0000000	-.6625863+04	-.1196610+04	.0000000	.6115992+04

PROBLEM NUMBER 1

.4249998+01	.0000000	.1250000+00	.3000000-01	.4249998+01	301
.5383615-02	.5569839-02	.0000000	.2343560-03	.1114195-03	.6174413+06
.0000000	-.2238401+00	.0000000	-.2238401+00	.0000000	.6174413+06
.2288035-01	-.2238401+00	-.4673893+05	-.3714195+05	.0000000	.1944116-02
.7663208-03	.0000000	-.1218711+05	-.1733471+05	.0000000	.1944116-02
.4735328-03	.0000000	-.2246818+05	-.2256243+05	.0000000	.2251545+05
.0000000	.0000000	-.7468673+04	-.1227439+04	.0000000	.6936883+04

PROBLEM NUMBER 1

.4399998+01	.0000000	.1250000+00	.3000000-01	.4399998+01	321
.5390581-02	.5605704-02	.0000000	.2556730-03	.1159670-03	.6029572+06
.0000000	-.2162091+00	.0000000	-.2162091+00	.0000000	.6029572+06
.2371854-01	-.2162091+00	-.4850517+05	-.3777263+05	.0000000	.1829817-02
.8400649-03	.0000000	-.1181684+05	-.1715291+05	.0000000	.1829817-02
.5102547-03	.0000000	-.2372058+05	-.2366464+05	.0000000	.2369266+05
.0000000	.0000000	-.8285452+04	-.1259553+04	.0000000	.7732996+04

PROBLEM NUMBER 1

.4549998+01	.0000000	.1250000+00	.3000000-01	.4549998+01	341
.5398268-02	.5645220-02	.0000000	.2791509-03	.1209570-03	.5888617+06
.0000000	-.2090814+00	.0000000	-.2090814+00	.0000000	.5888617+06
.2456211-01	-.2090814+00	-.5034830+05	-.3842843+05	.0000000	.1720745-02
.9195664-03	.0000000	-.1146718+05	-.1697114+05	.0000000	.1720745-02
.5503541-03	.0000000	-.2507337+05	-.2483830+05	.0000000	.2495667+05
.0000000	.0000000	-.9164836+04	-.1294069+04	.0000000	.8591211+04

TABLE C-2. (Continued)

PROBLEM NUMBER 1

.4699997+01	.0000000	.1250000+00	.3000000-01	.4699997+01	361
.5406932-02	.5694074-02	.0000000	.3046028-03	.1264037-03	.5757026+06
.0000000	-.2024086+00	.0000000	-.2024086+00	.0000000	.5757026+06
.2541257-01	-.2024086+00	-.5252232+05	-.3911915+05	.0000000	.0000000
.1005352-02	.0000000	-.1114336+05	-.1679032+05	.0000000	.0000000
.5940970-03	.0000000	-.2660863+05	-.2607172+05	.0000000	.2634428+05
.0000000	.0000000	-.1019448+05	-.1339601+04	.0000000	.9595069+04

PROBLEM NUMBER 1

.4849997+01	.0000000	.1250000+00	.3000000-01	.4849997+01	381
.5416545-02	.5740975-02	.0000000	.3333084-03	.1323500-03	.5622222+06
.0000000	-.1961485+00	.0000000	-.1961485+00	.0000000	.5622222+06
.2627023-01	-.1961485+00	-.5446914+05	-.3984003+05	.0000000	.0000000
.1097998-02	.0000000	-.1082760+05	-.1661080+05	.0000000	.0000000
.6418971-03	.0000000	-.2816514+05	-.2740971+05	.0000000	.2779513+05
.0000000	.0000000	-.1119961+05	-.1382610+04	.0000000	.1057631+05

PROBLEM NUMBER 1

.4999997+01	.0000000	.1250000+00	.3000000-01	.4999997+01	401
.5426952-02	.5785509-02	.0000000	.3657557-03	.1388554-03	.5484689+06
.0000000	-.1902640+00	.0000000	-.1902640+00	.0000000	.5484689+06
.2713474-01	-.1902640+00	-.5618386+05	-.4058081+05	.0000000	.1422818-02
.1198150-02	.0000000	-.1052033+05	-.1643270+05	.0000000	.1422818-02
.6942764-03	.0000000	-.2974420+05	-.2886034+05	.0000000	.2931227+05
.0000000	.0000000	-.1217497+05	-.1417287+04	.0000000	.1153183+05

TABLE C-2. (Continued)

```
SEGMENT NUMBER  3     SEGMENT CODE 21      SEGMENT 3 OF REGION 1 (PLATE)

                                   TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
  .4999000+01     .5501000+01
  .2680000+01     .2372000+01

                                   TABLE ORDER PHI OR S VS. TEMPERATURE LOADS
  .7320000+03     .7590000+03

           PROBLEM  1    TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

  .0000000        .0000000
  .0000000        .0000000
  .0000000        .0000000
```

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.5000000+01	.0000000	.1250000+00	.5000000-02	.5000000+01	1
.5426948-02	.5786500-02	.0000000	.3663303-03	.1388553-03	.5482871+06
.0000000	.2274282+00	.0000000	.2274282+00	.0000000	.5482871+06
.2713474-01	.2274282+00	-.5621912+05	-.4058075+05	.0000000	-.1421515-02
.1198150-02	.0000000	-.1051374+05	-.1643281+05	.0000000	-.1421515-02
.6942764-03	.0000000	-.2976903+05	-.2887939+05	.0000000	.2933433+05
.0000000	.0000000	-.1219515+05	-.1411685+04	.0000000	.1155417+06

PROBLEM NUMBER 1

.5130000+01	.0000000	.1250000+00	.5000000-02	.5130000+01	105
.5436870-02	.5850015-02	.0000000	.4007938-03	.1450478-03	.5365709+06
.0000000	.2216649+00	.0000000	.2216649+00	.0000000	.5365709+06
.2789114-01	.2216649+00	-.5860173+05	-.4124644+05	.0000000	.0000000
.1291596-02	.0000000	-.1022883+05	-.1627916+05	.0000000	.0000000
.7440953-03	.0000000	-.3162383+05	-.3031942+05	.0000000	.3099222+05
.0000000	.0000000	-.1346092+05	-.1413182+04	.0000000	.1281291+05

PROBLEM NUMBER 1

.5260000+01	.0000000	.1250000+00	.5000000-02	.5260000+01	209
.5447839-02	.5910928-02	.0000000	.4396652-03	.1510391-03	.5245435+06
.0000000	.2161865+00	.0000000	.2161865+00	.0000000	.5245435+06
.2865563-01	.2161865+00	-.6070992+05	-.4193939+05	.0000000	.1252335-02
.1391821-02	.0000000	-.9952891+04	-.1612617+05	.0000000	.1252335-02
.7986736-03	.0000000	-.3349726+05	-.3188151+05	.0000000	.3271932+05
.0000000	.0000000	-.1468781+05	-.1405509+04	.0000000	.1403792+05

PROBLEM NUMBER 1

.5390000+01	.0000000	.1250000+00	.5000000-02	.5390000+01	313
.5459716-02	.5969180-02	.0000000	.4836871-03	.1593008-03	.5122073+06
.0000000	.2109724+00	.0000000	.2109724+00	.0000000	.5122073+06
.2942787-01	.2109724+00	-.6255589+05	-.4265074+05	.0000000	-.1171964-02
.1499484-02	.0000000	-.9685460+04	-.1597401+05	.0000000	-.1171964-02
.8586312-03	.0000000	-.3539668+05	-.3357620+05	.0000000	.3452246+05

TABLE C-2. (Continued)

.0000000	.6000000	-.1587646+05	-.1381933+04	.0000000	.1523258+05

PROBLEM NUMBER 1

.5500000+01	.0000000	.1250000+00	.5000000-02	.5500000+01	401
.5470381-02	.6016324-02	.0000000	.5256185-03	.1662001-03	.5015298+06
.0000000	.2067529+00	.0000000	.2067529+00	.0000000	.5015298+06
.3008709-01	.2067529+00	-.6392110+05	-.4326120+05	.0000000	.1106142-02
.1596942-02	.0000000	-.9465516+04	-.1584601+05	.0000000	.1106142-02
.9141006-03	.0000000	-.3703006+05	-.3512307+05	.0000000	.3611434+05
.0000000	.0000000	-.1685237+05	-.1344057+04	.0000000	.1622216+05

TABLE C-2. (Continued)

SEGMENT NUMBER 4   SEGMENT CODE 21   SEGMENT 4 OF REGION 1 (PLATE)

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.5499000+01	.6001000+01
.2372000+01	.2210000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.7590000+03	.7930000+03

PROBLEM 1   TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)

LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.5500000+01	.0000000	.1250000+00	.5000000-02	.5500000+01	1
.5470380-02	.6017707-02	.0000000	.5263508-03	.1662001-03	.5014033+06
.0000000	-.7642215-01	.0000000	-.7642215-01	.0000000	.5014033+06
.3008709-01	-.7642215-01	-.6396371+05	-.4326129+05	.0000000	-.1105230-02
.1596942-02	.0000000	-.9460749+04	-.1584616+05	.0000000	-.1105230-02
.9141007-03	.0000000	-.3706155+05	-.3514381+05	.0000000	.3614086+05
.0000000	.0000000	-.1687809+05	-.1337786+04	.0000000	.1625055+05

PROBLEM NUMBER 1

.5630000+01	.0000000	.1250000+00	.5000000-02	.5630000+01	105
.5484066-02	.6108100-02	.0000000	.5524137-03	.1748131-03	.4975967+06
.0000000	-.7465752-01	.0000000	-.7465752-01	.0000000	.4975967+06
.3087529-01	-.7465752-01	-.6706115+05	-.4400926+05	.0000000	.0000000
.1720295-02	.0000000	-.9388936+04	-.1569791+05	.0000000	.0000000
.9841980-03	.0000000	-.3916407+05	-.3624369+05	.0000000	.3778861+05
.0000000	.0000000	-.1840594+05	-.1536955+04	.0000000	.1768761+05

PROBLEM NUMBER 1

.5760000+01	.0000000	.1250000+00	.5000000-02	.5760000+01	209
.5499151-02	.6196464-02	.0000000	.5806367-03	.1836496-03	.4935651+06
.0000000	-.7297254-01	.0000000	-.7297254-01	.0000000	.4935651+06
.3167511-01	-.7297254-01	-.6994506+05	-.4479747+05	.0000000	.1023125-02
.1852986-02	.0000000	-.9310270+04	-.1555466+05	.0000000	.1023125-02
.1057822-02	.0000000	-.4124646+05	-.3741267+05	.0000000	.3946946+05
.0000000	.0000000	-.1990040+05	-.1749844+04	.0000000	.1908573+05

PROBLEM NUMBER 1

.5890000+01	.0000000	.1250000+00	.5000000-02	.5890000+01	313
.5515499-02	.6282854-02	.0000000	.6112106-03	.1927446-03	.4893104+06
.0000000	-.7136194-01	.0000000	-.7136194-01	.0000000	.4893104+06
.3248629-01	-.7136194-01	-.7262563+05	-.4561853+05	.0000000	.0000000
.1995494-02	.0000000	-.9225633+04	-.1541592+05	.0000000	.0000000
.1135265-02	.0000000	-.4331294+05	-.3865141+05	.0000000	.4118053+05

TABLE C-2. (Continued)

.0000000	.0000000	-.2136331+05	-.1973850+04	.0000000	.2044796+05

PROBLEM NUMBER 1

.6000000+01	.0000000	.1250000+00	.5000000-02	.6000000+01	401
.5530225-02	.6354443-02	.0000000	.6390756-03	.2006690-03	.4855376+06
.6000000	-.7005364-01	.0000000	-.7005364-01	.0000000	.4855376+06
.3318135-01	-.7005364-01	-.7474183+05	-.4633403+05	.0000000	.0000000
.2124126-02	.0000000	-.9149942+04	-.1530175+05	.0000000	.0000000
.1204014-02	.0000000	-.4505209+05	-.3975490+05	.0000000	.4265093+05
.0000000	.0000000	-.2257769+05	-.2170220+04	.0000000	.2157460+05

TABLE C-2. (Continued)

```
SEGMENT NUMBER  5     SEGMENT CODE 21     SEGMENT 5 OF REGION 1 (PLATE)

                    TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
 .5999000+01     .7001000+01
 .2210000+01     .2155000+01

                    TABLE ORDER PHI OR S VS. TEMPERATURE LOADS
 .7930000+03     .8950000+03

          PROBLEM  1     TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

 .0000000        .0000000
 .0000000        .0000000
 .0000000        .0000000
```

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = W/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.6000000+01	.0000000	.1250000+00	.1000000-01	.6000000+01	1
.5530225-02	.6356660-02	.0000000	.6395046-03	.2006690-03	.4855444+06
.0000000	-.1585864+00	.0000000	-.1585864+00	.0000000	.4855444+06
.3318135-01	-.1585864+00	-.7481005+05	-.4633395+05	.0000000	.0000000
.2124126-02	.0000000	-.9147862+04	-.1530183+05	.0000000	.0000000
.1204014-02	.0000000	-.4509003+05	-.3976498+05	.0000000	.4267740+05
.0000000	.0000000	-.2261305+05	-.2167237+04	.0000000	.2161109+05

PROBLEM NUMBER 1

.6130000+01	.0000000	.1250000+00	.1000000-01	.6130000+01	53
.5549433-02	.6514938-02	.0000000	.6419188-03	.2100001-03	.4909130+06
.0000000	-.1552233+00	.0000000	-.1552233+00	.0000000	.4909130+06
.3401862-01	-.1552233+00	-.8009996+05	-.4723362+05	.0000000	.0000000
.2286058-02	.0000000	-.9226935+04	-.1517220+05	.0000000	.0000000
.1287301-02	.0000000	-.4777183+05	-.4020301+05	.0000000	.4447312+05
.0000000	.0000000	-.2495345+05	-.2681879+04	.0000000	.2372646+05

PROBLEM NUMBER 1

.6260000+01	.0000000	.1250000+00	.1000000-01	.6260000+01	105
.5571111-02	.6671324-02	.0000000	.6448242-03	.2189990-03	.4961401+06
.0000000	-.1519998+00	.0000000	-.1519998+00	.0000000	.4961401+06
.3487515-01	-.1519998+00	-.8521021+05	-.4821327+05	.0000000	.0000000
.2458840-02	.0000000	-.9296758+04	-.1504950+05	.0000000	.0000000
.1370934-02	.0000000	-.5037860+05	-.4068830+05	.0000000	.4630034+05
.0000000	.0000000	-.2723786+05	-.3228310+04	.0000000	.2577578+05

PROBLEM NUMBER 1

.6390000+01	.0000000	.1250000+00	.1000000-01	.6390000+01	157
.5595072-02	.6826183-02	.0000000	.6482497-03	.2276962-03	.5012086+06
.0000000	-.1489074+00	.0000000	-.1489074+00	.0000000	.5012086+06
.3575251-01	-.1489074+00	-.9015243+05	-.4926461+05	.0000000	.0000000
.2642519-02	.0000000	-.9358118+04	-.1493312+05	.0000000	.0000000
.1454979-02	.0000000	-.5291580+05	-.4121683+05	.0000000	.4814444+05

TABLE C-2. (Continued)

.0000000	.0000000	-.2947019+05	-.3803740+04	.0000000	.2776443+05

PROBLEM NUMBER 1

.6520000+01	.0000000	.1250000+00	.1000000-01	.6520000+01	209
.5621149-02	.6979462-02	.0000000	.6521302-03	.2361194-03	.5061327+06
.0000000	-.1459384+00	.0000000	-.1459384+00	.0000000	.5061327+06
.3664989-01	-.1459384+00	-.9493233+05	-.5038022+05	.0000000	.0000000
.2837155-02	.0000000	-.9411703+04	-.1482253+05	.0000000	.0000000
.1539499-02	.0000000	-.5538614+05	-.4178502+05	.0000000	.4999301+05
.0000000	.0000000	-.3165176+05	-.4405453+04	.0000000	.2969506+05

PROBLEM NUMBER 1

.6649999+01	.0000000	.1250000+00	.1000000-01	.6649999+01	261
.5649189-02	.7131280-02	.0000000	.6564483-03	.2442935-03	.5109125+06
.0000000	-.1430855+00	.0000000	-.1430855+00	.0000000	.5109125+06
.3756710-01	-.1430855+00	-.9955768+05	-.5155335+05	.0000000	.0000000
.3042812-02	.0000000	-.9458149+04	-.1471723+05	.0000000	.0000000
.1624552-02	.0000000	-.5779325+05	-.4238961+05	.0000000	.5183730+05
.0000000	.0000000	-.3378493+05	-.5031762+04	.0000000	.3157123+05

PROBLEM NUMBER 1

.6779999+01	.0000000	.1250000+00	.1000000-01	.6779999+01	313
.5679051-02	.7281750-02	.0000000	.6611907-03	.2522410-03	.5155474+06
.0000000	-.1403420+00	.0000000	-.1403420+00	.0000000	.5155474+06
.3850396-01	-.1403420+00	-.1040356+06	-.5277795+05	.0000000	.0000000
.3259564-02	.0000000	-.9498032+04	-.1461681+05	.0000000	.0000000
.1710194-02	.0000000	-.6014046+05	-.4302767+05	.0000000	.5367077+05
.0000000	.0000000	-.3587186+05	-.5680001+04	.0000000	.3339612+05

PROBLEM NUMBER 1

.6909999+01	.0000000	.1250000+00	.1000000-01	.6909999+01	365
.5710609-02	.7430971-02	.0000000	.6663459-03	.2599825-03	.5200369+06
.0000000	-.1377017+00	.0000000	-.1377017+00	.0000000	.5200369+06
.3946030-01	-.1377017+00	-.1083726+06	-.5404851+05	.0000000	.0000000
.3487490-02	.0000000	-.9531875+04	-.1452085+05	.0000000	.0000000
.1796479-02	.0000000	-.6243074+05	-.4369653+05	.0000000	.5548853+05
.0000000	.0000000	-.3791449+05	-.6348495+04	.0000000	.3517260+05

PROBLEM NUMBER 1

.6999999+01	.0000000	.1250000+00	.1000000-01	.6999999+01	401
.5733388-02	.7533593-02	.0000000	.6701514-03	.2652315-03	.5230595+06
.0000000	-.1359312+00	.0000000	-.1359312+00	.0000000	.5230595+06

TABLE C-2. (Continued)

.4013371-01	-.1359312+00	-.1112956+06	-.5495242+05	.0000000	.0000000
.3651877-02	.0000000	-.9552017+04	-.1445685+05	.0000000	.0000000
.1856620-02	.0000000	-.6398440+05	-.4417636+05	.0000000	.5673585+05
.0000000	.0000000	-.3930358+05	-.6822263+04	.0000000	.3637547+05

TABLE C-2. (Continued)

SEGMENT NUMBER 6   SEGMENT CODE 21   SEGMENT 6 OF REGION 1 (PLATE)

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.6999000+01	.8601000+01
.2155000+01	.2700000+01

TABLE ORDER PHI OR S VS. TEMPERATURE LOADS

.8950000+03	.1650000+04

PROBLEM 1   TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.7000000+01	.0000000	.1250000+00	.1000000-01	.7000000+01	1
.5733388-02	.7537545-02	.0000000	.6697420-03	.2652314-03	.5232954+06
.0000000	-.9953933-01	.0000000	-.9953933-01	.0000000	.5232954+06
.4013371-01	-.9953933-01	-.1114217+06	-.5495239+05	.0000000	.8744135-03
.3651877-02	.0000000	-.9554617+04	-.1445692+05	.0000000	.8744135-03
.1856620-02	.0000000	-.6402892+05	-.4416218+05	.0000000	.5676570+05
.0000000	.0000000	-.3935258+05	-.6824847+04	.0000000	.3642292+05

PROBLEM NUMBER 1

.7130000+01	.0000000	.1250000+00	.1000000-01	.7130000+01	53
.5768894-02	.7823562-02	.0000000	.6003156-03	.2719593-03	.5498234+06
.0000000	-.9772445-01	.0000000	-.9772445-01	.0000000	.5498234+06
.4113222-01	-.9772445-01	-.1218125+06	-.5635377+05	.0000000	.0000000
.3898694-02	.0000000	-.1005151+05	-.1437206+05	.0000000	.0000000
.1939070-02	.0000000	-.6688479+05	-.4271218+05	.0000000	.5866097+05
.0000000	.0000000	-.4254797+05	-.7914402+04	.0000000	.3919471+05

PROBLEM NUMBER 1

.7260000+01	.0000000	.1250000+00	.1000000-01	.7260000+01	105
.5808226-02	.8106894-02	.0000000	.5397165-03	.2772843-03	.5766786+06
.0000000	-.9597456-01	.0000000	-.9597456-01	.0000000	.5766786+06
.4216772-01	-.9597456-01	-.1323635+06	-.5791171+05	.0000000	.0000000
.4155670-02	.0000000	-.1056209+05	-.1429926+05	.0000000	.0000000
.2013084-02	.0000000	-.6963690+05	-.4147371+05	.0000000	.6067344+05
.0000000	.0000000	-.4561408+05	-.8950933+04	.0000000	.4186257+05

PROBLEM NUMBER 1

.7390000+01	.0000000	.1250000+00	.1000000-01	.7390000+01	157
.5851138-02	.8387896-02	.0000000	.4866160-03	.2814237-03	.6038302+06
.0000000	-.9428624-01	.0000000	-.9428624-01	.0000000	.6038302+06
.4323991-01	-.9428624-01	-.1430589+06	-.5962147+05	.0000000	.1032341-02
.4421777-02	.0000000	-.1108526+05	-.1423811+05	.0000000	.1032341-02
.2079721-02	.0000000	-.7228648+05	-.4042068+05	.0000000	.6274789+05

TABLE C-2. (Continued)

.0000000	.0000000	-.4855718+05	-.9942321+04	.0000000	.4442835+05

PROBLEM NUMBER 1

.7520000+01	.0000000	.1250000+00	.1000000-01	.7520000+01	209
.5897406-02	.8666889-02	.0000000	.4399147-03	.2845587-03	.6312490+06
.0000000	-.9265629-01	.0000000	-.9265629-01	.0000000	.6312490+06
.4434849-01	-.9265629-01	-.1538840+06	-.6147836+05	.0000000	.0000000
.4696117-02	.0000000	-.1161991+05	-.1418823+05	.0000000	.0000000
.2139881-02	.0000000	-.7483521+05	-.3953064+05	.0000000	.6484363+05
.0000000	.0000000	-.5138309+05	-.1089498+05	.0000000	.4689461+05

PROBLEM NUMBER 1

.7649999+01	.0000000	.1250000+00	.1000000-01	.7649999+01	261
.5946830-02	.8944440-02	.0000000	.3986473-03	.2868409-03	.6589829+06
.0000000	-.9108174-01	.0000000	-.9108174-01	.0000000	.6589829+06
.4549324-01	-.9108174-01	-.1648528+06	-.6347806+05	.0000000	.0000000
.4977899-02	.0000000	-.1216554+05	-.1414922+05	.0000000	.0000000
.2194333-02	.0000000	-.7729678+05	-.3878431+05	.0000000	.6694112+05
.0000000	.0000000	-.5410782+05	-.1181423+05	.0000000	.4927464+05

PROBLEM NUMBER 1

.7779999+01	.0000000	.1250000+00	.1000000-01	.7779999+01	313
.5999227-02	.9220485-02	.0000000	.3621152-03	.2883978-03	.6869261+06
.0000000	-.8955981-01	.0000000	-.8955981-01	.0000000	.6869261+06
.4667398-01	-.8955981-01	-.1759242+06	-.6561630+05	.0000000	.1197569-02
.5266425-02	.0000000	-.1272067+05	-.1412071+05	.0000000	.1197569-02
.2243735-02	.0000000	-.7966116+05	-.3816496+05	.0000000	.6900869+05
.0000000	.0000000	-.5672499+05	-.1270444+05	.0000000	.5156034+05

PROBLEM NUMBER 1

.7909999+01	.0000000	.1250000+00	.1000000-01	.7909999+01	365
.6054427-02	.9495235-02	.0000000	.3296776-03	.2893376-03	.7150451+06
.0000000	-.8808790-01	.0000000	-.8808790-01	.0000000	.7150451+06
.4789051-01	-.8808790-01	-.1870831+06	-.6788867+05	.0000000	.0000000
.5561076-02	.0000000	-.1328423+05	-.1410233+05	.0000000	.0000000
.2288660-02	.0000000	-.8192967+05	-.3765790+05	.0000000	.7103020+05
.0000000	.0000000	-.5923830+05	-.1356910+05	.0000000	.5375394+05

PROBLEM NUMBER 1

.7999999+01	.0000000	.1250000+00	.1000000-01	.7999999+01	401
.6094203-02	.9684788-02	.0000000	.3093316-03	.2896754-03	.7345969+06
.0000000	-.8709691-01	.0000000	-.8709691-01	.0000000	.7345969+06

TABLE C-2. (Continued)

.4875362-01	-.8709691-01	-.1948519+06	-.6953812+05	.0000000	.0000000
.5768363-02	.0000000	-.1367876+05	-.1409535+05	.0000000	.0000000
.2317403-02	.0000000	-.8344471+05	-.3736585+05	.0000000	.7239644+05
.0000000	.0000000	-.6091914+05	-.1415426+05	.0000000	.5521974+05

TABLE C-2. (Continued)

```
SEGMENT NUMBER  7     SEGMENT CODE 21      SEGMENT 7 OF REGION 1 (PLATE)

                                 TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
  .7999000+01     .8501000+01
  .2700000+01     .2380000+01

                                   TABLE ORDER PHI OR S VS. TEMPERATURE LOADS
  .1050000+04     .1152000+04

          PROBLEM  1    TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

  .0000000        .0000000
  .0000000        .0000000
  .0000000        .0000000
```

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.8000000+01	.0000000	.1250000+00	.5000000-02	.8000000+01	1
.6094202-02	.9690267-02	.0000000	.3095674-03	.2896754-03	.7347326+06
.0000000	.1277703+02	.0000000	.1277703+02	.0000000	.7347326+06
.4875362-01	.1277703+02	-.1949996+06	-.6953410+05	.0000000	.0000000
.5768363-02	.0000000	-.1367750+05	-.1409892+05	.0000000	.0000000
.2317403-02	.0000000	-.8350167+05	-.3736899+05	.0000000	.7244720+05
.0000000	.0000000	-.6097662+05	-.1414992+05	.0000000	.5527707+05

PROBLEM NUMBER 1

.8129997+01	.0000000	.1250000+00	.5000000-02	.8129997+01	105
.6154076-02	.9985726-02	.0000000	.3569875-03	.2903647-03	.7233813+06
.0000000	.1257272+02	.0000000	.1257272+02	.0000000	.7233813+06
.5003262-01	.1257272+02	-.1988637+06	-.7195690+05	.0000000	.0000000
.6072370-02	.0000000	-.1282474+05	-.1408362+05	.0000000	.0000000
.2360664-02	.0000000	-.8724366+05	-.3984438+05	.0000000	.7564960+05
.0000000	.0000000	-.6476400+05	-.1515812+05	.0000000	.5867234+05

PROBLEM NUMBER 1

.8259994+01	.0000000	.1250000+00	.5000000-02	.8259994+01	209
.6216531-02	.1025738-01	.0000000	.4078547-03	.2918056-03	.7137615+06
.0000000	.1237485+02	.0000000	.1237485+02	.0000000	.7137615+06
.5134850-01	.1237485+02	-.2022589+06	-.7436042+05	.0000000	.0000000
.6382412-02	.0000000	-.1209143+05	-.1405633+05	.0000000	.0000000
.2410312-02	.0000000	-.9113139+05	-.4248760+05	.0000000	.7898210+05
.0000000	.0000000	-.6852805+05	-.1621113+05	.0000000	.6203206+05

PROBLEM NUMBER 1

.8389990+01	.0000000	.1250000+00	.5000000-02	.8389990+01	313
.6281206-02	.1052233-01	.0000000	.4656497-03	.2940418-03	.7029907+06
.0000000	.1218310+02	.0000000	.1218310+02	.0000000	.7029907+06
.5269926-01	.1218310+02	-.2048772+06	-.7673559+05	.0000000	.0000000
.6699357-02	.0000000	-.1142386+05	-.1401905+05	.0000000	.0000000
.2467008-02	.0000000	-.9500931+05	-.4531538+05	.0000000	.8230960+05

TABLE C-2. (Continued)

.0000000	.0000000	-.7218532+05	-.1730641+05	.0000000	.6527606+05

PROBLEM NUMBER 1

.8499988+01	.0000000	.1250000+00	.5000000-02	.8499988+01	401
.6337514-02	.1074106-01	.0000000	.5209743-03	.2966138-03	.6929638+06
.0000000	.1202544+02	.0000000	.1202544+02	.0000000	.6929638+06
.5386879-01	.1202544+02	-.2065049+06	-.7871504+05	.0000000	.0000000
.6973653-02	.0000000	-.1090572+05	-.1398074+05	.0000000	.0000000
.2521214-02	.0000000	-.9828885+05	-.4786562+05	.0000000	.8513025+05
.0000000	.0000000	-.7519747+05	-.1826354+05	.0000000	.6793284+05

TABLE C-2. (Continued)

```
SEGMENT NUMBER  8     SEGMENT CODE 21       SEGMENT 8 OF REGION 1 (PLATE)

                                   TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
   .8499000+01      .9001000+01
   .2380000+01      .1910000+01

                                     TABLE ORDER PHI OR S VS. TEMPERATURE LOADS
   .1152000+04      .1275000+04

                 PROBLEM  1     TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 101110

   .0000000         .0000000
   .0000000         .0000000
   .0000000         .0000000
```

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.8500000+01	.0000000	.1250000+00	.5000000-02	.8500000+01	1
.6337505-02	.1074651-01	.0000000	.5224740-03	.2966133-03	.6927044+06
.0000000	-.2596281+00	.0000000	-.2596281+00	.0000000	.6927044+06
.5386879-01	-.2596281+00	-.2065526+06	-.7871851+05	.0000000	.0000000
.6973653-02	.0000000	-.1089472+05	-.1378344+05	.0000000	.0000000
.2521213-02	.0000000	-.9837024+05	-.4771160+05	.0000000	.8520065+05
.0000000	.0000000	-.7527167+05	-.1826444+05	.0000000	.6800455+05

PROBLEM NUMBER 1

.8629997+01	.0000000	.1250000+00	.5000000-02	.8629997+01	105
.6406205-02	.1104693-01	.0000000	.6359590-03	.3008403-03	.6705091+06
.0000000	-.2557171+00	.0000000	-.2557171+00	.0000000	.6705091+06
.5528553-01	-.2557171+00	-.2046071+06	-.8100235+05	.0000000	.0000000
.7306129-02	.0000000	-.1007910+05	-.1393066+05	.0000000	.0000000
.2596251-02	.0000000	-.1033942+06	-.5228679+05	.0000000	.8954391+05
.0000000	.0000000	-.7965836+05	-.1948075+05	.0000000	.7192461+05

PROBLEM NUMBER 1

.8759994+01	.0000000	.1250000+00	.5000000-02	.8759994+01	209
.6477206-02	.1133085-01	.0000000	.7771451-03	.3068221-03	.6464548+06
.0000000	-.2519222+00	.0000000	-.2519222+00	.0000000	.6464548+06
.5674028-01	-.2519222+00	-.2054492+06	-.8320189+05	.0000000	.0000000
.7649391-02	.0000000	-.9365731+04	-.1386812+05	.0000000	.0000000
.2687760-02	.0000000	-.1085208+06	-.5720234+05	.0000000	.9402784+05
.0000000	.0000000	-.8387944+05	-.2071506+05	.0000000	.7567897+05

PROBLEM NUMBER 1

.8889990+01	.0000000	.1250000+00	.5000000-02	.8889990+01	313
.6550143-02	.1159528-01	.0000000	.9551736-03	.3149497-03	.6206068+06
.0000000	-.2482383+00	.0000000	-.2482383+00	.0000000	.6206068+06
.5823071-01	-.2482383+00	-.2031389+06	-.8530256+05	.0000000	.0000000
.8605838-02	.0000000	-.8743523+04	-.1379766+05	.0000000	.0000000
.2799900-02	.0000000	-.1138012+06	-.6276731+05	.0000000	.9872919+05

TABLE C-2. (Continued)

.0000000	.0000000	-.8793233+05	-.2194509+05	.0000000	.7927168+05

PROBLEM NUMBER 1

.8999988+01	.0000000	.1250000+00	.5000000-02	.8999988+01	401
.6613083-02	.1180099-01	.0000000	.1144044-02	.3238878-03	.5973844+06
.0000000	-.2452043+00	.0000000	-.2452043+00	.0000000	.5973844+06
.5951767-01	-.2452043+00	-.2003271+06	-.8699324+05	.0000000	.0000000
.8319966-02	.0000000	-.8280727+04	-.1373303+05	.0000000	.0000000
.2914987-02	.0000000	-.1184370+06	-.6808781+05	.0000000	.1029522+06
.0000000	.0000000	-.9122555+05	-.2295940+05	.0000000	.8218729+05

TABLE C-2. (Continued)

REGION NUMBER 2

THERE ARE 5 SEGMENTS AND 0 KINEMATIC LINKS WITHIN THIS REGION

SEGMENT NUMBER 1 SEGMENT CODE 13 SEGMENT 1 OF REGION 2 (SOLID TOROIDAL)

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.5000000-03	.3936990+00
.1910000+01	.1910000+01

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.1000000-02	.5729578-01	.3900000-01	.3916990-02	.9010000+01	1
.6605734-02	-.3921011-02	.0000000	.7860871-03	.3235277-03	.0000000
.0000000	.8684668+02	.0000000	.8684668+02	.0000000	.0000000
.5952599-01	.8684668+02	.2675618+06	-.8689650+05	.0000000	.0000000
.8289633-02	.0000000	-.8982668+04	-.1371771+05	.0000000	.0000000
.2914986-02	.0000000	.1253110+06	-.6805696+05	.0000000	.1698908+06
.0000000	.0000000	.1548585+06	-.2293414+05	.0000000	.1675072+06

PROBLEM NUMBER 1

.4016990-01	.2301566+01	.3900000-01	.3916990-02	.9401591+01	41
.6173383-02	-.3508191-02	.0000000	.7270090-03	.3415351-03	.0000000
.0000000	.2946966+04	.0000000	.2946966+04	.0000000	.0000000
.5837514-01	.2946966+04	.2526753+06	-.7332426+05	.0000000	.0000000
.7181966-02	.0000000	-.8957105+04	-.1290305+05	.0000000	.0000000
.3213566-02	.0000000	.1175591+06	-.5961121+05	.0000000	.1561457+06
.0000000	.0000000	.1470224+06	-.1716812+05	.0000000	.1563152+06

PROBLEM NUMBER 1

.7933980-01	.4545836+01	.3900000-01	.3916990-02	.9792566+01	81
.5786238-02	-.3143151-02	.0000000	.6123425-03	.3539781-03	.0000000
.0000000	.4881999+04	.0000000	.4881999+04	.0000000	.0000000
.5733609-01	.4881999+04	.2392677+06	-.6140420+05	.0000000	.0000000
.6227985-02	.0000000	-.8562052+04	-.1120683+05	.0000000	.0000000
.3477293-02	.0000000	.1111891+06	-.5058058+05	.0000000	.1433367+06
.0000000	.0000000	.1393530+06	-.1371702+05	.0000000	.1466933+06

PROBLEM NUMBER 1

.1185097+00	.6790106+01	.3900000-01	.3916990-02	.1018232+02	121
.5437095-02	-.2819474-02	.0000000	.4645143-03	.3597499-03	.0000000
.0000000	.6064473+04	.0000000	.6064473+04	.0000000	.0000000
.5639703-01	.6064473+04	.2270832+06	-.5093338+05	.0000000	.0000000
.5406238-02	.0000000	-.7895138+04	-.8967570+04	.0000000	.0000000
.3688966-02	.0000000	.1059067+06	-.4141558+05	.0000000	.1315966+06

TABLE C-2. (Continued)

.0000000	.0000000	.1318768+06	-.1191780+05	.0000000	.1382216+06

PROBLEM NUMBER 1

.1576796+00	.9034376+01	.3900000-01	.3916990-02	.1057027+02	161
.5120198-02	-.2531858-02	.0000000	.3010132-03	.3586981-03	.0000000
.0000000	.6636750+04	.0000000	.6636750+04	.0000000	.0000000
.5554752-01	.6636750+04	.2159203+06	-.4174096+05	.0000000	.0000000
.4690559-02	.0000000	-.7043400+04	-.6452901+04	.0000000	.0000000
.3839163-02	.0000000	.1014631+06	-.3246694+05	.0000000	.1210085+06
.0000000	.0000000	.1246315+06	-.1124087+05	.0000000	.1306152+06

PROBLEM NUMBER 1

.1968495+00	.1127865+02	.3900000-01	.3916990-02	.1095581+02	201
.4830990-02	-.2275908-02	.0000000	.1354061-03	.3512955-03	.0000000
.0000000	.6717170+04	.0000000	.6717170+04	.0000000	.0000000
.5477792-01	.6717170+04	.2056230+06	-.3368169+05	.0000000	.0000000
.4052719-02	.0000000	-.6083433+04	-.3873455+04	.0000000	.0000000
.3924517-02	.0000000	.9765065+05	-.2400503+05	.0000000	.1116064+06
.0000000	.0000000	.1176614+06	-.1126375+05	.0000000	.1236786+06

PROBLEM NUMBER 1

.2360194+00	.1352292+02	.3900000-01	.3916990-02	.1133834+02	241
.4565895-02	-.2047961-02	.0000000	-.2187652-04	.3384032-03	.0000000
.0000000	.6404686+04	.0000000	.6404686+04	.0000000	.0000000
.5407906-01	.6404686+04	.1960722+06	-.2663068+05	.0000000	.0000000
.3464492-02	.0000000	-.5081757+04	-.1393711+04	.0000000	.0000000
.3946338-02	.0000000	.9429767+05	-.1623499+05	.0000000	.1033758+06
.0000000	.0000000	.1110135+06	-.1165054+05	.0000000	.1172736+06

PROBLEM NUMBER 1

.2751893+00	.1576718+02	.3900000-01	.3916990-02	.1171729+02	281
.4322106-02	-.1844933-02	.0000000	-.1629262-03	.3210987-03	.0000000
.0000000	.5782414+04	.0000000	.5782414+04	.0000000	.0000000
.5344201-01	.5782414+04	.1871781+06	-.2047952+05	.0000000	.0000000
.2899253-02	.0000000	-.4095328+04	.8594509+03	.0000000	.0000000
.3909508-02	.0000000	.9126343+05	-.9308729+04	.0000000	.9625597+05
.0000000	.0000000	.1047345+06	-.1213579+05	.0000000	.1112998+06

PROBLEM NUMBER 1

.3143591+00	.1801145+02	.3900000-01	.3916990-02	.1209207+02	321
.4097412-02	-.1664205-02	.0000000	-.2818706-03	.3005537-03	.0000000
.0000000	.4920366+04	.0000000	.4920366+04	.0000000	.0000000

TABLE C-2. (Continued)

.5285795-01	.4920366+04	.1788730+06	-.1513315+05	.0000000	.0000000
.2333186-02	.0000000	-.3172137+04	.2789919+04	.0000000	.0000000
.3821595-02	.0000000	.8843359+05	-.3334559+04	.0000000	.9014714+05
.0000000	.0000000	.9886797+05	-.1251167+05	.0000000	.1056807+06

PROBLEM NUMBER 1

.3535290+00	.2025572+02	.3900000-01	.3916990-02	.1246211+02	361
.3890040-02	-.1503524-02	.0000000	-.3744854-03	.2779466-03	.0000000
.0000000	.3877604+04	.0000000	.3877604+04	.0000000	.0000000
.5231816-01	.3877604+04	.1711054+06	-.1050757+05	.0000000	.0000000
.1746193-02	.0000000	-.2351859+04	.4326839+04	.0000000	.0000000
.3492134-02	.0000000	.8571590+05	.1614969+04	.0000000	.8491993+05
.0000000	.0000000	.9345206+05	-.1261766+05	.0000000	.1003576+06

PROBLEM NUMBER 1

.3926989+00	.2249999+02	.3900000-01	.3916990-02	.1282683+02	401
.3698526-02	-.1360920-02	.0000000	-.4378819-03	.2544629-03	.0000000
.0000000	.2703963+04	.0000000	.2703963+04	.0000000	.0000000
.5181405-01	.2703963+04	.1638345+06	-.6528032+04	.0000000	.0000000
.1122534-02	.0000000	-.1666531+04	.5420125+04	.0000000	.0000000
.3532093-02	.0000000	.8303629+05	.5496617+04	.0000000	.8042897+05
.0000000	.0000000	.8851815+05	-.1233225+05	.0000000	.9528470+05

TABLE C-2. (Continued)

SEGMENT NUMBER 2   SEGMENT CODE 13   SEGMENT 2 OF REGION 2 (EQUA SANDWICH TOROIDAL)

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.3916990+00	.7863980+00
.2500000+00	.2500000+00
.1410000+01	.1410000+01

PROBLEM 1   TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.3926990+00	.2250000+02	.3900000-01	.3926990-02	.1282683+02	1
.3698525-02	-.1725576-02	.0000000	-.6755970-03	.2544027-03	.0000000
.0000000	.2703984+04	.0000000	.2703984+04	.0000000	.0000000
.5181405-01	.2703984+04	.4128384+05	-.6528003+04	.0000000	.0000000
.1122532-02	.0000000	-.2699504+03	.5420122+04	.0000000	.0000000
.3532042-02	.1917719+04	.8182486+05	.1858717+04	.0000000	.8091151+05
.0000000	.0000000	.8331052+05	-.2797073+05	.0000000	.1002659+06

PROBLEM NUMBER 1

.4319688+00	.2474999+02	.3900000-01	.3926990-02	.1318660+02	41
.3512041-02	-.1583313-02	.0000000	-.7604257-03	.2238105-03	.0000000
.0000000	.2521054+04	.0000000	.2521054+04	.0000000	.0000000
.5119572-01	.2521054+04	.3944544+05	-.5468598+04	.0000000	.0000000
.4327393-03	.0000000	.2697884+03	.6271699+04	.0000000	.0000000
.3249816-02	.1787982+04	.7963327+05	.6375874+04	.0000000	.7664449+05
.0000000	.0000000	.7814850+05	-.2825026+05	.0000000	.9546194+05

PROBLEM NUMBER 1

.4712387+00	.2699999+02	.3900000-01	.3926990-02	.1353990+02	81
.3341611-02	-.1456990-02	.0000000	-.8369026-03	.1931998-03	.0000000
.0000000	.2317928+04	.0000000	.2317928+04	.0000000	.0000000
.5060120-01	.2317928+04	.3774905+05	-.4549196+04	.0000000	.0000000
-.3504311-03	.0000000	.7841844+03	.7086721+04	.0000000	.0000000
.2935900-02	.1643920+04	.7765596+05	.1040236+05	.0000000	.7301268+05
.0000000	.0000000	.7334023+05	-.2859915+05	.0000000	.9107233+05

PROBLEM NUMBER 1

.5105085+00	.2924998+02	.3900060-01	.3926990-02	.1388621+02	121
.3186501-02	-.1345192-02	.0000000	-.9046614-03	.1629642-03	.0000000
.0000000	.2102530+04	.0000000	.2102530+04	.0000000	.0000000
.5002059-01	.2102530+04	.3619119+05	-.3754343+04	.0000000	.0000000
-.1239509-02	.0000000	.1268510+04	.7800627+04	.0000000	.0000000
.2593657-02	.1491156+04	.7687297+05	.1395655+05	.0000000	.6994690+05

TABLE C-2. (Continued)

.0000000	.0000000	.6089178+05	-.2877392+05	.0000000	.8707256+05

PROBLEM NUMBER 1

.5497783+00	.3149998+02	.3900000-01	.3926990-02	.1422498+02	161
.3046132-02	-.1246668-02	.0000000	-.9636065-03	.1334577-03	.0000000
.0000000	.1881315+04	.0000000	.1881315+04	.0000000	.0000000
.4944407-01	.1881315+04	.3476973+05	-.3070031+04	.0000000	.0000000
-.2245295-02	.0000000	.1719224+04	.8431457+04	.0000000	.0000000
.2226536-02	.1334266+04	.7427030+05	.1706105+05	.0000000	.6737973+05
.0000000	.0000000	.6480861+05	-.2934117+05	.0000000	.8344232+05

PROBLEM NUMBER 1

.5890481+00	.3374997+02	.3900000-01	.3926990-02	.1455570+02	201
.2920092-02	-.1160301-02	.0000000	-.1013851-02	.1049916-03	.0000000
.0000000	.1659448+04	.0000000	.1659448+04	.0000000	.0000000
.4886188-01	.1659448+04	.3348348+05	-.2483543+04	.0000000	.0000000
-.3376850-02	.0000000	.2133819+04	.8979300+04	.0000000	.0000000
.1837982-02	.1176913+04	.7283865+05	.1974154+05	.0000000	.6524761+05
.0000000	.0000000	.6109524+05	-.2967571+05	.0000000	.8016436+05

PROBLEM NUMBER 1

.6283179+00	.3599996+02	.3900000-01	.3926990-02	.1487786+02	241
.2807860-02	-.1085093-02	.0000000	-.1055665-02	.7783368-04	.0000000
.0000000	.1440958+04	.0000000	.1440958+04	.0000000	.0000000
.4826435-01	.1440958+04	.3233191+05	-.1983312+04	.0000000	.0000000
-.4641513-02	.0000000	.2510663+04	.9445816+04	.0000000	.0000000
.1431363-02	.1021956+04	.7157249+05	.2202573+05	.0000000	.6349266+05
.0000000	.0000000	.5775515+05	-.2995898+05	.0000000	.7722359+05

TABLE C-2. (Continued)

.4698525-01	.1025324+04	.3043260+05	-.1200503+04	.0000000	.0000000
-.7591203-02	.0000000	.3148106+04	.1014697+05	.0000000	.0000000
.5767192-03	.7271804+03	.6952794+05	.2552073+05	.0000000	.4091830+05
.0000000	.0000000	.5220246+05	-.3032274+05	.0000000	.7230135+05

PROBLEM NUMBER 1

.7461272+00	.4274794+02	.3900000-01	.3926990-02	.1578800+02	361
.2551897-02	-.9178610-03	.0000000	-.1134694-02	.6262766-05	.0000000
.0000000	.8316704+03	.0000000	.8316704+03	.0000000	.0000000
.4628506-01	.8316704+03	.2968519+05	-.8996973+03	.0000000	.0000000
-.9282796-02	.0000000	.3408579+04	.1038936+05	.0000000	.0000000
.1346499-03	.5898372+03	.6874789+05	.2678934+05	.0000000	.6002043+05
.0000000	.0000000	.4999089+05	-.3038813+05	.0000000	.7029692+05

PROBLEM NUMBER 1

.7853970+00	.4499993+02	.3900000-01	.3926990-02	.1607106+02	401
.2492669-02	-.8791352-03	.0000000	-.1147201-02	-.1379829-04	.0000000
.0000000	.6485651+03	.0000000	.6485651+03	.0000000	.0000000
.4553233-01	.6485661+03	.2907289+05	-.6485658+03	.0000000	.0000000
-.1112079-01	.0000000	.3630804+04	.1056537+05	.0000000	.0000000
-.3136059-03	.4599752+03	.6813678+05	.2777593+05	.0000000	.5934274+05
.0000000	.0000000	.4815478+05	-.3037020+05	.0000000	.6858354+05

TABLE C-2. (Continued)

.0000000	.0000000	.6889178+05	-.2897392+05	.0000000	.8707256+05

PROBLEM NUMBER 1

.5997783+00	.3149998+02	.3900000-01	.3926990-02	.1422498+02	161
.3846132-02	-.1246668-02	.0000000	-.9636065-03	.1334577-03	.0000000
.0000000	.1881315+04	.0000000	.1881315+04	.0000000	.0000000
.4944487-01	.1881315+04	.3476973+05	-.3070031+04	.0000000	.0000000
-.2245295-02	.0000000	.1719224+04	.8431457+04	.0000000	.0000000
.2226536-02	.1334266+04	.7427030+05	.1706105+05	.0000000	.6737973+05
.0000000	.0000000	.6480861+05	-.2934117+05	.0000000	.8344232+05

PROBLEM NUMBER 1

.5890481+00	.3374997+02	.3900000-01	.3926990-02	.1455570+02	201
.2920092-02	-.1160301-02	.0000000	-.1013851-02	.1049916-03	.0000000
.0000000	.1659948+04	.0000000	.1659948+04	.0000000	.0000000
.4886188-01	.1659948+04	.3348348+05	-.2483543+04	.0000000	.0000000
-.3376850-02	.0000000	.2133819+04	.8979300+04	.0000000	.0000000
.1837982-02	.1176913+04	.7283865+05	.1974154+05	.0000000	.6524761+05
.0000000	.0000000	.6107524+05	-.2967571+05	.0000000	.8016436+05

PROBLEM NUMBER 1

.6283179+00	.3599996+02	.3900000-01	.3926990-02	.1487785+02	241
.2807860-02	-.1085093-02	.0000000	-.1055665-02	.7783368-04	.0000000
.0000000	.1440958+04	.0000000	.1440958+04	.0000000	.0000000
.4826435-01	.1440958+04	.3233191+05	-.1983312+04	.0000000	.0000000
-.4641513-02	.0000000	.2510463+04	.9445816+04	.0000000	.0000000
.1431363-02	.1021956+04	.7157249+05	.2202573+05	.0000000	.6349266+05
.0000000	.0000000	.5775515+05	-.2995898+05	.0000000	.7722359+05

PROBLEM NUMBER 1

.6675876+00	.3824995+02	.3900000-01	.3926990-02	.1519073+02	281
.2709276-02	-.1020143-02	.0000000	-.1089432-02	.5220919-04	.0000000
.0000000	.1228871+04	.0000000	.1228871+04	.0000000	.0000000
.4764194-01	.1228871+04	.3131491+05	-.1558818+04	.0000000	.0000000
-.6049947-02	.0000000	.2848858+04	.9833828+04	.0000000	.0000000
.1009918-02	.8715396+03	.7046911+05	.2394242+05	.0000000	.6206395+05
.0000000	.0000000	.5479052+05	-.3017769+05	.0000000	.7460661+05

PROBLEM NUMBER 1

.7068574+00	.4049995+02	.3900000-01	.3926990-02	.1549497+02	321
.2624031-02	-.9646933-03	.0000000	-.1115608-02	.2830306-04	.0000000
.0000000	.1025324+04	.0000000	.1025324+04	.0000000	.0000000

TABLE C-2. (Continued)

.4698525-01	.1025324+04	.3043260+05	-.1200503+04	.0000000	.0000000
-.7591203-02	.0000000	.3148106+04	.1014697+05	.0000000	.0000000
.5767192-03	.7271804+03	.6952794+05	.2552073+05	.0000000	.6091830+05
.0000000	.0000000	.5220246+05	-.3032274+05	.0000000	.7230135+05

PROBLEM NUMBER 1

.7461272+00	.4274794+02	.3900000-01	.3926990-02	.1578800+02	361
.2551897-02	-.9178610-03	.0000000	-.1134694-02	.6262766-05	.0000000
.0000000	.8316704+03	.0000000	.8316704+03	.0000000	.0000000
.4628506-01	.8316704+03	.2968519+05	-.8996973+03	.0000000	.0000000
-.9282796-02	.0000000	.3408579+04	.1038936+05	.0000000	.0000000
.1346499-03	.5898372+03	.6874989+05	.2678934+05	.0000000	.6002043+05
.0000000	.0000000	.4999089+05	-.3038813+05	.0000000	.7029692+05

PROBLEM NUMBER 1

.7853970+00	.4499993+02	.3900000-01	.3926990-02	.1607106+02	401
.2492669-02	-.8791352-03	.0000000	-.1147201-02	-.1379829-04	.0000000
.0000000	.6485651+03	.0000000	.6485651+03	.0000000	.0000000
.4553233-01	.6485651+03	.2907289+05	-.6485658+03	.0000000	.0000000
-.1112079-01	.0000000	.3630804+04	.1056537+05	.0000000	.0000000
-.3136059-03	.4599752+03	.6813678+05	.2777593+05	.0000000	.5934274+05
.0000000	.0000000	.4815478+05	-.3037020+05	.0000000	.6858354+05

TABLE C-2. (Continued)

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SEGMENT NUMBER  3     SEGMENT CODE 21      SEGMENT 3 OF REGION 2 (EQUA SANDWICH CONE)

                                 TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
 .2272686+02     .2772886+02
 .2500000+00     .2500000+00
 .1410000+01     .1410000+01

             PROBLEM  1     TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

 .0000000        .0000000
 .0000000        .0000000
 .0000000        .0000000
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TABLE C-2. (Continued)

.4267160-01	-.4776105+03	.2849215+05	.4776359+03	.0000000	.0000000
-.2334250-01	.0000000	.4630765+04	.9312355+04	.0000000	.0000000
-.5088242-02	-.3387309+03	.6972689+05	.2658038+05	.0000000	.6095071+05
.0000000	.0000000	.4424170+05	-.2466983+05	.0000000	.6047614+05

PROBLEM NUMBER 1

.2767783+02	.0000000	.5000000+00	.5000000-01	.1957119+02	397
.2454308-02	-.7778959-03	.0000000	-.9094127-03	-.2023419-03	.0000000
.0000000	-.5205134+03	.0000000	-.5205134+03	.0000000	.0000000
.4164697-01	-.5205134+03	.2901146+05	.5205383+03	.0000000	.0000000
-.2628296-01	.0000000	.4633958+04	.8960071+04	.0000000	.0000000
-.5600384-02	-.3491585+03	.7077432+05	.2569679+05	.0000000	.6205366+05
.0000000	.0000000	.4527150+05	-.2361464+05	.0000000	.6063192+05

PROBLEM NUMBER 1

.2772783+02	.0000000	.5000000+00	.5000000-01	.1960654+02	401
.2458618-02	-.7790808-03	.0000000	-.9054255-03	-.2036133-03	.0000000
.0000000	-.5238233+03	.0000000	-.5238233+03	.0000000	.0000000
.4160804-01	-.5238233+03	.2906320+05	.5238481+03	.0000000	.0000000
-.2656412-01	.0000000	.4633441+04	.8927381+04	.0000000	.0000000
-.5445755-02	-.3715059+03	.7087640+05	.2561345+05	.0000000	.6216207+05
.0000000	.0000000	.4537642+05	-.2351806+05	.0000000	.6065710+05

TABLE C-2. (Continued)

SEGMENT NUMBER 4   SEGMENT CODE 21   SEGMENT 4 OF REGION 2   (EQUA SANDWICH CONE)

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.2772686+02	.3272886+02
.2500000+00	.2500000+00
.1410000+01	.1410000+01

PROBLEM 1   TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.2772786+02	.0000000	.5000000+00	.5000000-01	.1960656+02	1
.2458616-02	-.7790791-03	.0000000	-.9054341-03	-.2036132-03	.0000000
.0000000	-.5238351+03	.0000000	-.5238351+03	.0000000	.0000000
.4160804-01	-.5238351+03	.2906318+05	.5238597+03	.0000000	.0000000
-.2656412-01	.0000000	.4633467+04	.8927459+04	.0000000	.0000000
-.5645758-02	-.3715142+03	.7087642+05	.2561369+05	.0000000	.6216206+05
.0000000	.0000000	.4537630+05	-.2351825+05	.0000000	.6065714+05

PROBLEM NUMBER 1

.2827786+02	.0000000	.5000000+00	.5000000-01	.1999547+02	45
.2510078-02	-.7938953-03	.0000000	-.8612698-03	-.2168347-03	.0000000
.0000000	-.5545044+03	.0000000	-.5545044+03	.0000000	.0000000
.4117562-01	-.5545044+03	.2967807+05	.5545286+03	.0000000	.0000000
-.2980402-01	.0000000	.4619843+04	.8562729+04	.0000000	.0000000
-.6131622-02	-.3932655+03	.7206872+05	.2467139+05	.0000000	.6343928+05
.0000000	.0000000	.4664358+05	-.2245328+05	.0000000	.6104977+05

PROBLEM NUMBER 1

.2882785+02	.0000000	.5000000+00	.5000000-01	.2038437+02	89
.2568302-02	-.8116490-03	.0000000	-.8169041-03	-.2287065-03	.0000000
.0000000	-.5758474+03	.0000000	-.5758474+03	.0000000	.0000000
.4073421-01	-.5758474+03	.3036932+05	.5758712+03	.0000000	.0000000
-.3330444-01	.0000000	.4593224+04	.8192027+04	.0000000	.0000000
-.6593118-02	-.4084024+03	.7337795+05	.2369401+05	.0000000	.6486225+05
.0000000	.0000000	.4809931+05	-.2139052+05	.0000000	.6164388+05

PROBLEM NUMBER 1

.2937785+02	.0000000	.5000000+00	.5000000-01	.2077328+02	133
.2632401-02	-.8319738-03	.0000000	-.7727745-03	-.2393048-03	.0000000
.0000000	-.5893294+03	.0000000	-.5893294+03	.0000000	.0000000
.4028232-01	-.5893294+03	.3112697+05	.5893527+03	.0000000	.0000000
-.3705198-01	.0000000	.4555643+04	.7819602+04	.0000000	.0000000
-.7030260-02	-.4179641+03	.7478784+05	.2269615+05	.0000000	.6641682+05

TABLE C-2. (Continued)

.0000000	.0000000	.4971802+05	-.2033874+05	.0000000	.6242394+05

PROBLEM NUMBER 1

.2992785+02	.0000000	.5000000+00	.5000000-01	.2116219+02	177
.2701561-02	-.8545694-03	.0000000	-.7292375-03	-.2487075-03	.0000000
.0000000	-.5961321+03	.0000000	-.5961321+03	.0000000	.0000000
.3981862-01	-.5961321+03	.3194186+05	.5961550+03	.0000000	.0000000
-.4103330-01	.0000000	.4508906+04	.7448961+04	.0000000	.0000000
-.7443279-02	-.4227887+03	.7629102+05	.2168985+05	.0000000	.6808839+05
.0000000	.0000000	.5147642+05	-.1930523+05	.0000000	.6337412+05

PROBLEM NUMBER 1

.3047784+02	.0000000	.5000000+00	.5000000-01	.2155109+02	221
.2775040-02	-.8788975-03	.0000000	-.6865864-03	-.2569927-03	.0000000
.0000000	-.5971936+03	.0000000	-.5971936+03	.0000000	.0000000
.3934201-01	-.5971936+03	.3280559+05	.5972161+03	.0000000	.0000000
-.4523524-01	.0000000	.4454624+04	.7083032+04	.0000000	.0000000
-.7832584-02	-.4235416+03	.7786911+05	.2068504+05	.0000000	.6986232+05
.0000000	.0000000	.5335325+05	-.1829617+05	.0000000	.6447852+05

PROBLEM NUMBER 1

.3102784+02	.0000000	.5000000+00	.5000000-01	.2194000+02	265
.2852162-02	-.9048781-03	.0000000	-.6450652-03	-.2642379-03	.0000000
.0000000	-.5932429+03	.0000000	-.5932429+03	.0000000	.0000000
.3885154-01	-.5932429+03	.3371046+05	.5932650+03	.0000000	.0000000
-.4964490-01	.0000000	.4394253+04	.6724291+04	.0000000	.0000000
-.8198732-02	-.4207397+03	.7951272+05	.1968998+05	.0000000	.7172422+05
.0000000	.0000000	.5532911+05	-.1731692+05	.0000000	.6572150+05

PROBLEM NUMBER 1

.3157784+02	.0000000	.5000000+00	.5000000-01	.2232891+02	309
.2932313-02	-.9322051-03	.0000000	-.6048811-03	-.2705189-03	.0000000
.0000000	-.5848298+03	.0000000	-.5848298+03	.0000000	.0000000
.3834640-01	+.5848298+03	.3464943+05	.5848515+03	.0000000	.0000000
-.5424972-01	.0000000	.4329122+04	.6374870+04	.0000000	.0000000
-.8542401-02	-.4147729+03	.8121145+05	.1871164+05	.0000000	.7366020+05
.0000000	.0000000	.5738628+05	-.1637223+05	.0000000	.6708783+05

PROBLEM NUMBER 1

.3212783+02	.0000000	.5000000+00	.5000000-01	.2271781+02	353
.3014939-02	-.9606637-03	.0000000	-.5662152-03	-.2759096-03	.0000000
.0000000	-.5723517+03	.0000000	-.5723517+03	.0000000	.0000000

TABLE C-2. (Continued)

.3782691-01	-.5723517+03	.3561613+05	.5723731+03	.0000000	.0000000
-.5903756-01	.0000000	.4260463+04	.6036657+04	.0000000	.0000000
-.8864379-02	-.4059232+03	.8295591+05	.1775601+05	.0000000	.7565708+05
.0000000	.0000000	.5950861+05	-.1546651+05	.0000000	.6856295+05

PROBLEM NUMBER 1

.3267782+02	.0000000	.5000000+00	.5000000-01	.2310672+02	397
.3099539-02	-.9900671-03	.0000000	-.5292307-03	-.2804821-03	.0000000
.0000000	-.5560772+03	.0000000	-.5560772+03	.0000000	.0000000
.3728950-01	-.5560772+03	.3660476+05	.5560982+03	.0000000	.0000000
-.6399672-01	.0000000	.4189433+04	.5711366+04	.0000000	.0000000
-.9165596-02	-.3943810+03	.8473773+05	.1682834+05	.0000000	.7770251+05
.0000000	.0000000	.6168133+05	-.1460395+05	.0000000	.7013311+05

PROBLEM NUMBER 1

.3272782+02	.0000000	.5000000+00	.5000000-01	.2314207+02	401
.3107312-02	-.9927812-03	.0000000	-.5259571-03	-.2808597-03	.0000000
.0000000	-.5544158+03	.0000000	-.5544158+03	.0000000	.0000000
.3723993-01	-.5544158+03	.3669554+05	.5544367+03	.0000000	.0000000
-.6445566-01	.0000000	.4182897+04	.5682491+04	.0000000	.0000000
-.9191926-02	-.3932027+03	.8490130+05	.1674557+05	.0000000	.7789046+05
.0000000	.0000000	.6188088+05	-.1452782+05	.0000000	.7028012+05

TABLE C-2. (Continued)

```
SEGMENT NUMBER  5     SEGMENT CODE 11      SEGMENT 5 OF REGION 2   (EQUA SANDWICH SPHERICAL)

                                   TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
   .7843980+00     .1179097+01
   .2500000+00     .2500000+00
   .1410000+01     .1410000+01

              PROBLEM  1     TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

   .0000000        .0000000
   .0000000        .0000000
   .0000000        .0000000
```

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.7853980+00	.4499999+02	.3900000-01	.3926990-02	.2314209+02	1
.3107309-02	-.9927861-03	.0000000	-.5259620-03	-.2808595-03	.0000000
.0000000	-.5543912+03	.0000000	-.5543912+03	.0000000	.0000000
.3723993-01	-.5543912+03	.3669549+05	.5543733+03	.0000000	.0000000
-.6445666-01	.0000000	.4182910+04	.5682535+04	.0000000	.0000000
-.9191928-02	-.3931852+03	.8490123+05	.1674556+05	.0000000	.7789040+05
.0000000	.0000000	.6188074+05	-.1452807+05	.0000000	.7028014+05

PROBLEM NUMBER 1

.8246678+00	.4724998+02	.3900000-01	.3926990-02	.2403280+02	41
.3320753-02	-.1069198-02	.0000000	-.4495460-03	-.2773056-03	.0000000
.0000000	-.5234529+03	.0000000	-.5234529+03	.0000000	.0000000
.3311959-01	-.5234529+03	.3917997+05	.4838584+03	.0000000	.0000000
-.7806569-01	.0000000	.3916891+04	.4970720+04	.0000000	.0000000
-.9817945-02	-.3712432+03	.8913817+05	.1464581+05	.0000000	.8279259+05
.0000000	.0000000	.6758170+05	-.1271037+05	.0000000	.7475178+05

PROBLEM NUMBER 1

.8639375+00	.4949998+02	.3900000-01	.3926990-02	.2488645+02	81
.3558365-02	-.1153829-02	.0000000	-.3815271-03	-.2701265-03	.0000000
.0000000	-.4813410+03	.0000000	-.4813410+03	.0000000	.0000000
.2834940-01	-.4813410+03	.4194768+05	.4110889+03	.0000000	.0000000
-.9224499-01	.0000000	.3643267+04	.4324856+04	.0000000	.0000000
-.1035108-01	-.3413766+03	.9392066+05	.1272302+05	.0000000	.8824970+05
.0000000	.0000000	.7387067+05	-.1107867+05	.0000000	.7998691+05

PROBLEM NUMBER 1

.9032073+00	.5174997+02	.3900000-01	.3926990-02	.2570173+02	121
.3816577-02	-.1244707-02	.0000000	-.3218341-03	-.2602002-03	.0000000
.0000000	-.4394551+03	.0000000	-.4394551+03	.0000000	.0000000
.2290053-01	-.4394551+03	.4496014+05	.3464243+03	.0000000	.0000000
-.1068551+00	.0000000	.3369876+04	.3746975+04	.0000000	.0000000
-.1080222-01	-.3116703+03	.9919328+05	.1100352+05	.0000000	.9417488+05

TABLE C-2. (Continued)

.0000000	.0000000	.8064729+05	-.9617821+04	.0000000	.8586116+05

PROBLEM NUMBER 1

.9424771+00	.5399996+02	.3900000-01	.3926990-02	.2647738+02	161
.4092561-02	-.1340364-02	.0000000	-.2690251-03	-.2482197-03	.0000000
.0000000	-.4085353+03	.0000000	-.4085353+03	.0000000	.0000000
.1675155-01	-.4085353+03	.4818643+05	.2968050+03	.0000000	.0000000
-.1217701+00	.0000000	.3098670+04	.3225965+04	.0000000	.0000000
-.1118130-01	-.2897413+03	.1048996+06	.9470600+04	.0000000	.1004995+06
.0000000	.0000000	.8784615+05	-.8283380+04	.0000000	.9226713+05

PROBLEM NUMBER 1

.9817469+00	.5624995+02	.3900000-01	.3926990-02	.2721221+02	201
.4384064-02	-.1439725-02	.0000000	-.2203604-03	-.2346955-03	.0000000
.0000000	-.3989176+03	.0000000	-.3989176+03	.0000000	.0000000
.9887352-02	-.3989176+03	.5160150+05	.2665358+03	.0000000	.0000000
-.1368745+00	.0000000	.2825961+04	.2738254+04	.0000000	.0000000
-.1149553-01	-.2829203+03	.1109793+06	.8068013+04	.0000000	.1071733+06
.0000000	.0000000	.9542672+05	-.7001870+04	.0000000	.9911332+05

PROBLEM NUMBER 1

.1021017+01	.5849994+02	.3900000-01	.3926990-02	.2790507+02	241
.4689206-02	-.1541998-02	.0000000	-.1718357-03	-.2199679-03	.0000000
.0000000	-.4207083+03	.0000000	-.4207083+03	.0000000	.0000000
.2298431-02	-.4207083+03	.5518402+05	.2577988+03	.0000000	.0000000
-.1520592+00	.0000000	.2542643+04	.2248153+04	.0000000	.0000000
-.1174780-01	-.2983747+03	.1173647+06	.6701913+04	.0000000	.1141614+06
.0000000	.0000000	.1033714+06	-.5670718+04	.0000000	.1063202+06

PROBLEM NUMBER 1

.1060286+01	.6074992+02	.3900000-01	.3926990-02	.2855491+02	281
.5006242-02	-.1646575-02	.0000000	-.1181916-03	-.2042287-03	.0000000
.0000000	-.4838582+03	.0000000	-.4838582+03	.0000000	.0000000
-.6019570-02	-.4838582+03	.5891358+05	.2709628+03	.0000000	.0000000
-.1672148+00	.0000000	.2234407+04	.1708001+04	.0000000	.0000000
-.1193505-01	-.3431618+03	.1239756+06	.5241887+04	.0000000	.1214396+06
.0000000	.0000000	.1116787+06	-.4158035+04	.0000000	.1138147+06

PROBLEM NUMBER 1

.1099556+01	.6299991+02	.3900000-01	.3926990-02	.2916072+02	321
.5333269-02	-.1752919-02	.0000000	-.5291322-04	-.1875495-03	.0000000
.0000000	-.5981122+03	.0000000	-.5981122+03	.0000000	.0000000

TABLE C-2. (Continued)

-.1506584-01	-.5981122+03	.6276739+05	.3047434+03	.0000000	.0000000
-.1022230+00	.0000000	.1882011+04	.1058258+04	.0000000	.0000000
-.1204664-01	-.4241930+03	.1307136+06	.3521528+04	.0000000	.1289889+06
.0000000	.0000000	.1203560+06	-.2302555+04	.0000000	.1215236+06

PROBLEM NUMBER 1

.1138825+01	.6524989+02	.3900000-01	.3926990-02	.2972156+02	361
.5667886-02	-.1860448-02	.0000000	.3175716-04	-.1699176-03	.0000000
.0000000	-.7728127+03	.0000000	-.7728127+03	.0000000	.0000000
-.2483389-01	-.7728127+03	.6671630+05	.3562624+03	.0000000	.0000000
-.1969464+00	.0000000	.1461641+04	.2277222+03	.0000000	.0000000
-.1206277-01	-.5480941+03	.1374546+06	.1339155+04	.0000000	.1367900+06
.0000000	.0000000	.1294106+06	.8589459+02	.0000000	.1293676+06

PROBLEM NUMBER 1

.1178095+01	.6749988+02	.3900000-01	.3926990-02	.3023658+02	401
.6006805-02	-.1968405-02	.0000000	.1497765-03	-.1512801-03	.0000000
.0000000	-.1016531+04	.0000000	-.1016531+04	.0000000	.0000000
-.3531091-01	-.1016531+04	.7072017+05	.4210528+03	.0000000	.0000000
-.2112160+00	.0000000	.9454520+03	-.8659288+03	.0000000	.0000000
-.1195288-01	-.7209438+03	.1440420+06	-.1540699+04	.0000000	.1448185+06
.0000000	.0000000	.1388387+06	.3224910+04	.0000000	.1372647+06

TABLE C-2. (Continued)

REGION NUMBER 3

THERE ARE 3 SEGMENTS AND 1 KINEMATIC LINKS WITHIN THIS REGION

SEGMENT NUMBER 1 SEGMENT CODE 11 SEGMENT 1 OF REGION 3 (EQUA SANDWICH SPHERICAL)

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.1177097+01	.1571796+01
.1321700+08	.1321700+08
.4401000+07	.4401000+07
.1481900+08	.1762300+08
.8808000+07	.8808000+07
-.9174000+07	-.9174000+07
-.3055000+07	-.3055000+07
-.1105100+08	-.1717500+08
.6116000+07	.6128000+07
.0000000	.0000000
-.1731000+07	-.5860000+07

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.1178097+01	.6749999+02	.3900000-01	.3926990-02	.3023660+02	1
.6006807-02	-.1802073-02	.0000000	.4035911-03	-.1512793-03	.0000000
.0000000	-.1016523+04	.0000000	-.1016523+04	.0000000	.0000000
-.3531041-01	-.1016523+04	.7146105+05	.4210695+03	.0000000	.0000000
-.2112160+00	.0000000	.1548655+03	-.8659482+03	.0000000	.0000000
-.1195288-01	.0000000	.1433305+06	-.3677250+04	.0000000	.0000000
.0000000	.0000000	.1424782+06	-.3090802+05	.0000000	.0000000

PROBLEM NUMBER 1

.1217367+01	.6974997+02	.3900000-01	.3926990-02	.3070499+02	41
.6341403-02	-.1902191-02	.0000000	.5501651-03	-.1278099-03	.0000000
.0000000	-.9754248+03	.0000000	-.9754248+03	.0000000	.0000000
-.4625243-01	-.9754248+03	.7544278+05	.3598950+03	.0000000	.0000000
-.2246040+00	.0000000	-.5082264+03	-.1939141+04	.0000000	.0000000
-.1133835-01	.0000000	.1494686+06	-.7275529+04	.0000000	.0000000
.0000000	.0000000	.1522651+06	-.2846265+05	.0000000	.0000000

PROBLEM NUMBER 1

.1256636+01	.7199995+02	.3900000-01	.3926990-02	.3112604+02	81
.6656586-02	-.1998266-02	.0000000	.6827281-03	-.1046872-03	.0000000
.0000000	-.9358244+03	.0000000	-.9358244+03	.0000000	.0000000
-.5782083-01	-.9358244+03	.7918573+05	.3040794+03	.0000000	.0000000
-.2366430+00	.0000000	-.1125334+04	-.2945868+04	.0000000	.0000000
-.1054470-01	.0000000	.1552557+06	-.1058123+05	.0000000	.0000000
.0000000	.0000000	.1614480+06	-.2600949+05	.0000000	.0000000

PROBLEM NUMBER 1

.1295906+01	.7424994+02	.3900000-01	.3926990-02	.3149909+02	121
.6947047-02	-.2088394-02	.0000000	.8030504-03	-.8262974-04	.0000000
.0000000	-.8918518+03	.0000000	-.8918518+03	.0000000	.0000000
-.6995135-01	-.8918518+03	.8262809+05	.2615398+03	.0000000	.0000000
-.2470904+00	.0000000	-.1695274+04	-.3891790+04	.0000000	.0000000
-.9588666-02	.0000000	.1605714+06	-.1362943+05	.0000000	.0000000

TABLE C-2. (Continued)

.0000000	.0000000	.1699000+06	-.2349658+05	.0000000	.0000000

PROBLEM NUMBER 1

.1335175+01	.7649992+02	.3900000-01	.3926990-02	.3182358+02	161
.7208038-02	-.2170862-02	.0000000	.9117947-03	-.6224631-04	.0000000
.0000000	-.8363701+03	.0000000	-.8363701+03	.0000000	.0000000
-.8256835-01	-.8363701+03	.8571468+05	.2008062+03	.0000000	.0000000
-.2557267+00	.0000000	-.2214485+04	-.4774753+04	.0000000	.0000000
-.8485451-02	.0000000	.1653153+06	-.1642822+05	.0000000	.0000000
.0000000	.0000000	.1775009+06	-.2090467+05	.0000000	.0000000

PROBLEM NUMBER 1

.1374445+01	.7874990+02	.3900000-01	.3926990-02	.3209900+02	201
.7435303-02	-.2243984-02	.0000000	.1008645-02	-.4406442-04	.0000000
.0000000	-.7612116+03	.0000000	-.7612116+03	.0000000	.0000000
-.9558584-01	-.7612116+03	.8839662+05	.1514258+03	.0000000	.0000000
-.2623549+00	.0000000	-.2677162+04	-.5583356+04	.0000000	.0000000
-.7250036-02	.0000000	.1694055+06	-.1895810+05	.0000000	.0000000
.0000000	.0000000	.1841371+06	-.1824557+05	.0000000	.0000000

PROBLEM NUMBER 1

.1413715+01	.8099989+02	.3900000-01	.3926990-02	.3232492+02	241
.7625055-02	-.2305986-02	.0000000	.1092401-02	-.2854524-04	.0000000
.0000000	-.6574080+03	.0000000	-.6574080+03	.0000000	.0000000
-.1089083+00	-.6574080+03	.9063172+05	.1041344+03	.0000000	.0000000
-.2668014+00	.0000000	-.3075410+04	-.6295766+04	.0000000	.0000000
-.5898388-02	.0000000	.1727794+06	-.2117133+05	.0000000	.0000000
.0000000	.0000000	.1897025+06	-.1556175+05	.0000000	.0000000

PROBLEM NUMBER 1

.1452984+01	.8324987+02	.3900000-01	.3926990-02	.3250100+02	281
.7774018-02	-.2354925-02	.0000000	.1161058-02	-.1608812-04	.0000000
.0000000	-.5154328+03	.0000000	-.5154328+03	.0000000	.0000000
-.1224317+00	-.5154328+03	.9238517+05	.6101652+02	.0000000	.0000000
-.2689180+00	.0000000	-.3399439+04	-.6878772+04	.0000000	.0000000
-.4448544-02	.0000000	.1753943+06	-.2299146+05	.0000000	.0000000
.0000000	.0000000	.1941005+06	-.1292667+05	.0000000	.0000000

PROBLEM NUMBER 1

.1492254+01	.8549986+02	.3900000-01	.3926990-02	.3262697+02	321
.7879490-02	-.2388639-02	.0000000	.1211879-02	-.7025864-05	.0000000
.0000000	-.3254747+03	.0000000	-.3254747+03	.0000000	.0000000

TABLE C-2. (Continued)

-.1360437+00	-.3254747+03	.9363082+05	.2562612+02	.0000000	.0000000
-.2685861+00	.0000000	-.3637836+04	-.7287090+04	.0000000	.0000000
-.2921591-02	.0000000	.1772294+06	-.2431323+05	.0000000	.0000000
.0000000	.0000000	.1972474+06	-.1044569+05	.0000000	.0000000

PROBLEM NUMBER 1

.1531524+01	.8774984+02	.3900000-01	.3926990-02	.3270263+02	361
.7939465-02	-.2404727-02	.0000000	.1241468-02	-.1611881-05	.0000000
.0000000	-.7775740+02	.0000000	-.7775740+02	.0000000	.0000000
-.1496255+00	-.7775740+02	.9435271+05	.3065326+01	.0000000	.0000000
-.2657210+00	.0000000	-.3777898+04	-.7462962+04	.0000000	.0000000
-.1342569-02	.0000000	.1782876+06	-.2500295+05	.0000000	.0000000
.0000000	.0000000	.1990764+06	-.8256927+04	.0000000	.0000000

PROBLEM NUMBER 1

.1570793+01	.8999982+02	.3900000-01	.3926990-02	.3272786+02	401
.7952778-02	-.2400550-02	.0000000	.1245854-02	.2427563-10	.0000000
.0000000	.2370787+03	.0000000	.2370787+03	.0000000	.0000000
-.1630522+00	.2370787+03	.9454704+05	.9517432-02	.0000000	.0000000
-.2602779+00	.0000000	-.3806084+04	-.7336112+04	.0000000	.0000000
.2587384-03	.0000000	.1785987+06	-.2489965+05	.0000000	.0000000
.0000000	.0000000	.1995425+06	-.6531876+04	.0000000	.0000000

TABLE C-2. (Continued)

SEGMENT NUMBER 2 SEGMENT CODE 31 SEGMENT 2 OF REGION 3 (EQUA SANDWICH CYLINDER)

TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES

.9999000+01	.1500100+02
.1468600+08	.1468600+08
.4401000+07	.4401000+07
.1762300+08	.1762300+08
.8808000+07	.8808000+07
-.1105100+08	-.1105100+08
-.3055000+07	-.3055000+07
-.1717500+08	-.1717500+08
.6130000+07	.6130000+07
.1586000+07	.1586000+07
-.5860000+07	-.5860000+07

PROBLEM 1 TABLE ORDER PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

.0000000	.0000000
.0000000	.0000000
.0000000	.0000000

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	R ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT

PROBLEM NUMBER 1

.1000000+02	.0000000	.5000000+00	.5000000-01	.3272786+02	1
.7952790-02	-.2400423-02	.0000000	.1246148-02	.0000000	.0000000
.0000000	.2370779+03	.0000000	.2370779+03	.0000000	.0000000
-.1630522+00	.2370779+03	.1062304+06	.3051758-03	.0000000	.0000000
-.2602778+00	.0000000	.8806144+04	-.7336108+04	.0000000	.0000000
.2587435-03	.0000000	.1868906+06	-.2490358+05	.0000000	.0000000
.0000000	.0000000	.1995465+06	-.6479919+04	.0000000	.0000000

PROBLEM NUMBER 1

.1055000+02	.0000000	.5000000+00	.5000000-01	.3272786+02	45
.7942699-02	-.2394093-02	.0000000	.1234690-02	.0000000	.0000000
.0000000	.3439717+03	.0000000	.3439717+03	.0000000	.0000000
-.1643709+00	.3439717+03	.1061101+06	.3051758-03	.0000000	.0000000
-.2599476+00	.0000000	.8825143+04	-.7176412+04	.0000000	.0000000
.9412012-03	.0000000	.1866534+06	-.2453588+05	.0000000	.0000000
.0000000	.0000000	.1992391+06	-.6790252+04	.0000000	.0000000

PROBLEM NUMBER 1

.1110000+02	.0000000	.5000000+00	.5000000-01	.3272786+02	89
.7921199-02	-.2383248-02	.0000000	.1218223-02	.0000000	.0000000
.0000000	.4541315+03	.0000000	.4541315+03	.0000000	.0000000
-.1656849+00	.4541315+03	.1058421+06	.3051758-03	.0000000	.0000000
-.2592439+00	.0000000	.8841352+04	-.6957140+04	.0000000	.0000000
.1615984-02	.0000000	.1861482+06	-.2402282+05	.0000000	.0000000
.0000000	.0000000	.1986279+06	-.7195195+04	.0000000	.0000000

PROBLEM NUMBER 1

.1165000+02	.0000000	.5000000+00	.5000000-01	.3272786+02	133
.7888443-02	-.2367878-02	.0000000	.1196598-02	.0000000	.0000000
.0000000	.5700208+03	.0000000	.5700208+03	.0000000	.0000000
-.1669917+00	.5700208+03	.1054287+06	.3051758-03	.0000000	.0000000
-.2581719+00	.0000000	.8855463+04	-.6675817+04	.0000000	.0000000
.2280301-02	.0000000	.1853784+06	-.2335903+05	.0000000	.0000000

TABLE C-2. (Continued)

.0000000	.0000000	.1977157+06	-.7700413+04	.0000000	.0000000

PROBLEM NUMBER 1

.1220000+02	.0000000	.5000000+00	.5000000-01	.3272786+02	177
.7844632-02	-.2347954-02	.0000000	.1169586-02	.0000000	.0000000
.0000000	.6940582+03	.0000000	.6940582+03	.0000000	.0000000
-.1682887+00	.6940582+03	.1048729+06	.3051758-03	.0000000	.0000000
-.2567380+00	.0000000	.8868502+04	-.6328623+04	.0000000	.0000000
.2931255-02	.0000000	.1843488+06	-.2253620+05	.0000000	.0000000
.0000000	.0000000	.1965060+06	-.8314548+04	.0000000	.0000000

PROBLEM NUMBER 1

.1275000+02	.0000000	.5000000+00	.5000000-01	.3272786+02	221
.7790014-02	-.2323436-02	.0000000	.1136871-02	.0000000	.0000000
.0000000	.8286043+03	.0000000	.8286043+03	.0000000	.0000000
-.1695736+00	.8286043+03	.1041787+06	.3051758-03	.0000000	.0000000
-.2549505+00	.0000000	.8881821+04	-.5910426+04	.0000000	.0000000
.3565801-02	.0000000	.1830653+06	-.2154312+05	.0000000	.0000000
.0000000	.0000000	.1950032+06	-.9049168+04	.0000000	.0000000

PROBLEM NUMBER 1

.1330000+02	.0000000	.5000000+00	.5000000-01	.3272786+02	265
.7724893-02	-.2294269-02	.0000000	.1098063-02	.0000000	.0000000
.0000000	.9759482+03	.0000000	.9759482+03	.0000000	.0000000
-.1708437+00	.9759482+03	.1033507+06	.3051758-03	.0000000	.0000000
-.2528193+00	.0000000	.8897099+04	-.5414811+04	.0000000	.0000000
.4180697-02	.0000000	.1815350+06	-.2036578+05	.0000000	.0000000
.0000000	.0000000	.1932125+06	-.9918694+04	.0000000	.0000000

PROBLEM NUMBER 1

.1385000+02	.0000000	.5000000+00	.5000000-01	.3272786+02	309
.7649628-02	-.2260387-02	.0000000	.1052693-02	.0000000	.0000000
.0000000	.1138293+04	.0000000	.1138293+04	.0000000	.0000000
-.1720964+00	.1138293+04	.1023945+06	.3051758-03	.0000000	.0000000
-.2503560+00	.0000000	.8916334+04	-.4834132+04	.0000000	.0000000
.4772467-02	.0000000	.1797663+06	-.1898748+05	.0000000	.0000000
.0000000	.0000000	.1911401+06	-.1094032+05	.0000000	.0000000

PROBLEM NUMBER 1

.1440000+02	.0000000	.5000000+00	.5000000-01	.3272786+02	353
.7564639-02	-.2221714-02	.0000000	.1000221-02	.0000000	.0000000
.0000000	.1317739+04	.0000000	.1317739+04	.0000000	.0000000

TABLE C-2. (Continued)

-.1733292+00	.1317739+04	.1013165+06	.3051758-03	.0000000	.0000000
-.2475745+00	.0000000	.8941842+04	-.4159553+04	.0000000	.0000000
.5337357-02	.0000000	.1777690+06	-.1738891+05	.0000000	.0000000
.0000000	.0000000	.1887931+06	-.1213392+05	.0000000	.0000000

PROBLEM NUMBER 1

.1495000+02	.0000000	.5000000+00	.5000000-01	.3272786+02	397
.7470410-02	-.2178172-02	.0000000	.9400410-03	.0000000	.0000000
.0000000	.1516273+04	.0000000	.1516273+04	.0000000	.0000000
-.1745394+00	.1516273+04	.1001243+06	.3051758-03	.0000000	.0000000
-.2444906+00	.0000000	.8976246+04	-.3381118+04	.0000000	.0000000
.5871298-02	.0000000	.1755546+06	-.1554834+05	.0000000	.0000000
.0000000	.0000000	.1861799+06	-.1352194+05	.0000000	.0000000

PROBLEM NUMBER 1

.1500000+02	.0000000	.5000000+00	.5000000-01	.3272786+02	401
.7461405-02	-.2173969-02	.0000000	.9341651-03	.0000000	.0000000
.0000000	.1535333+04	.0000000	.1535333+04	.0000000	.0000000
-.1746482+00	.1535333+04	.1000106+06	.3051758-03	.0000000	.0000000
-.2441958+00	.0000000	.8979914+04	-.3304829+04	.0000000	.0000000
.5918153-02	.0000000	.1753430+06	-.1536821+05	.0000000	.0000000
.0000000	.0000000	.1859295+06	-.1365860+05	.0000000	.0000000

TABLE C-2. (Continued)

```
SEGMENT NUMBER  3     SEGMENT CODE 21      SEGMENT 3 OF REGION 3 (UNEQ SANDWICH INVERTED CONE)

                              TABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES
   .8417889+03      .8469943+03
   .2500000+00      .2500000+00
   .1160000+01      .1410000+01
   .5000000+00      .2500000+00

          PROBLEM  1    TABLE ORDER  PHI OR S VS. DISTRIBUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI)
LOAD IDENTIFICATION CLUES 001110

   .0000000         .0000000
   .0000000         .0000000
   .0000000         .0000000
```

TABLE C-2. (Continued)

PHI (RAD. OR IN.)	DEGREES	PRINT INTERVAL	STEP	K ZERO	NUMBER OF CYCLES
EPSILON THETA	EPSILON PHI	GAMMA PHI THETA	K PHI	K THETA	N TEMPERATURE THETA
U	Q PHI	K PHI THETA	J PHI STAR	T PHI THETA	N TEMPERATURE PHI
V	J PHI	N THETA	N PHI	N PHI THETA	M TEMPERATURE THETA
W	Q THETA	M THETA	M PHI	M PHI THETA	M TEMPERATURE PHI
OMEGA THETA	TAU ZETA PHI = Q/T	SIGMA THETA IN	SIGMA PHI IN	TAU PHI THETA IN	SIGMA F IN
OMEGA PHI	TAU ZETA THETA = Q/T	SIGMA THETA OUT	SIGMA PHI OUT	TAU PHI THETA OUT	SIGMA F OUT
		PROBLEM NUMBER 1			
.8419879+03	.0000000	.5000000+00	.5003443-01	.3253311+02	1
.6548280-02	-.2181974-02	.0000000	-.2418532-05	.7655459-05	.0000000
.0000000	.1029173+01	.0000000	.1029173+01	.0000000	.0000000
.1956358+00	.1029173+01	.1153965+06	-.2747925+02	.0000000	.0000000
.2056304+00	.0000000	-.7322175+02	-.1397461+01	.0000000	.0000000
.6445819-02	.8871804+00	.1536644+06	-.4087610+02	.0000000	.1536848+06
.0000000	.0000000	.1540102+06	-.3427614+02	.0000000	.1540273+06
		PROBLEM NUMBER 1			
.8424902+03	.0000000	.5000000+00	.5003443-01	.3255244+02	41
.6642077-02	-.2213079-02	.0000000	-.4332463-05	.7649111-05	.0000000
.0000000	.8819082+02	.0000000	.8819082+02	.0000000	.0000000
.1945363+00	.8819082+02	.1131501+06	-.2429249+02	.0000000	.0000000
.2088552+00	.0000000	-.6602216+02	.1899168+02	.0000000	.0000000
.6444301-02	.7442015+02	.1558908+06	.2023120+02	.0000000	.1558807+06
.0000000	.0000000	.1562041+06	-.6989659+02	.0000000	.1562391+06
		PROBLEM NUMBER 1			
.8429905+03	.0000000	.5000000+00	.5003443-01	.3257177+02	81
.6735707-02	-.2244081-02	.0000000	-.1085160-04	.7640318-05	.0000000
.0000000	.1944808+03	.0000000	.1944808+03	.0000000	.0000000
.1934212+00	.1944808+03	.1107911+06	-.2016611+02	.0000000	.0000000
.2120788+00	.0000000	-.4257280+02	.8783010+02	.0000000	.0000000
.6440715-02	.1607241+03	.1581595+06	.2188323+03	.0000000	.1580502+06
.0000000	.0000000	.1583628+06	-.2005492+03	.0000000	.1584631+06
		PROBLEM NUMBER 1			
.8434909+03	.0000000	.5000000+00	.5003443-01	.3259110+02	121
.6829122-02	-.2274959-02	.0000000	-.2296257-04	.7626057-05	.0000000
.0000000	.3182666+03	.0000000	.3182666+03	.0000000	.0000000
.1922907+00	.3182666+03	.1083188+06	-.1536323+02	.0000000	.0000000
.2152996+00	.0000000	.2148343+00	.2142613+03	.0000000	.0000000
.6432510-02	.2577019+03	.1604774+06	.5791611+03	.0000000	.1601886+06

TABLE C-2. (Continued)

.0000000	.0000000	.1604763+06	-.4518580+03	.0000000	.1607028+06

PROBLEM NUMBER 1

.8439912+03	.0000000	.5000000+00	.5003443-01	.3261094+02	161
.6922226-02	-.2305480-02	.0000000	-.4166324-04	.7602731-05	.0000000
.0000000	.4579078+03	.0000000	.4579078+03	.0000000	.0000000
.1911447+00	.4579078+03	.1057323+06	-.9947284+01	.0000000	.0000000
.2185145+00	.0000000	.6516194+02	.4066073+03	.0000000	.0000000
.6416638-02	.3634165+03	.1628496+06	.1122798+04	.0000000	.1622911+06
.0000000	.0000000	.1625330+06	-.8526793+03	.0000000	.1629418+06

PROBLEM NUMBER 1

.8444915+03	.0000000	.5000000+00	.5003443-01	.3262977+02	201
.7014879-02	-.2336196-02	.0000000	-.6779864-04	.7566145-05	.0000000
.0000000	.6117474+03	.0000000	.6117474+03	.0000000	.0000000
.1899835+00	.6117474+03	.1030300+06	-.3982350+01	.0000000	.0000000
.2217188+00	.0000000	.1548200+03	.6723624+03	.0000000	.0000000
.6389545-02	.4760488+03	.1652793+06	.1868814+04	.0000000	.1643529+06
.0000000	.0000000	.1645182+06	-.1436769+04	.0000000	.1652412+06

PROBLEM NUMBER 1

.8449919+03	.0000000	.5000000+00	.5003443-01	.3264910+02	241
.7106876-02	-.2366434-02	.0000000	-.1031105-03	.7511469-05	.0000000
.0000000	.7781045+03	.0000000	.7781045+03	.0000000	.0000000
.1888070+00	.7781045+03	.1002099+06	.2466587+01	.0000000	.0000000
.2249059+00	.0000000	.2714673+03	.1018184+04	.0000000	.0000000
.6347130-02	.5939786+03	.1677675+06	.2833960+04	.0000000	.1663686+06
.0000000	.0000000	.1664133+06	-.2245093+04	.0000000	.1675471+06

PROBLEM NUMBER 1

.8454922+03	.0000000	.5000000+00	.5003443-01	.3266843+02	281
.7197951-02	-.2396304-02	.0000000	-.1483077-03	.7433165-05	.0000000
.0000000	.9552676+03	.0000000	.9552676+03	.0000000	.0000000
.1876155+00	.9552676+03	.9726930+05	.9333336+01	.0000000	.0000000
.2280669+00	.0000000	.4171036+03	.1449880+04	.0000000	.0000000
.6284683-02	.7155685+03	.1703128+06	.4032938+04	.0000000	.1683326+06
.0000000	.0000000	.1681949+06	-.3329126+04	.0000000	.1698839+06

PROBLEM NUMBER 1

.8459925+03	.0000000	.5000000+00	.5003443-01	.3268776+02	321
.7287759-02	-.2425685-02	.0000000	-.2051707-03	.7324860-05	.0000000
.0000000	.1141488+04	.0000000	.1141488+04	.0000000	.0000000

TABLE C-2. (Concluded)

.1864091+00	.1141488+04	.9420550+05	.1655029+02	.0000000	.0000000
.2311906+00	.0000000	.5934438+03	.1972389+04	.0000000	.0000000
.6196777-02	.8393499+03	.1729117+06	.5478777+04	.0000000	.1702385+06
.0000000	.0000000	.1698324+06	-.4755723+04	.0000000	.1722595+06

PROBLEM NUMBER 1

.8464929+03	.0000000	.5000000+00	.5003443-01	.3270710+02	361
.7375865-02	-.2454430-02	.0000000	-.2757094-03	.7179143-05	.0000000
.0000000	.1334975+04	.0000000	.1334975+04	.0000000	.0000000
.1851882+00	.1334975+04	.9101532+05	.2404821+02	.0000000	.0000000
.2342627+00	.0000000	.8019108+03	.2589765+04	.0000000	.0000000
.6077094-02	.9639115+03	.1755582+06	.7183389+04	.0000000	.1720790+06
.0000000	.0000000	.1712857+06	-.6614562+04	.0000000	.1746869+06

PROBLEM NUMBER 1

.8469932+03	.0000000	.5000000+00	.5003443-01	.3272643+02	401
.7461732-02	-.2482354-02	.0000000	-.3626142-03	.6987251-05	.0000000
.0000000	.1533894+04	.0000000	.1533894+04	.0000000	.0000000
.1839531+00	.1533894+04	.8769542+05	.3175614+02	.0000000	.0000000
.2372654+00	.0000000	.1043626+04	.3305155+04	.0000000	.0000000
.5918154-02	.1087910+04	.1782436+06	.9158428+04	.0000000	.1738454+06
.0000000	.0000000	.1725005+06	-.9029964+04	.0000000	.1771882+06

APPENDIX D

SUBROUTINE LISTING

The MAIN control program (Table D-1) and subroutines RIEMAN (Table D-2) and LEBEGE (Table D-3) were the only subroutines that needed modification in the STARS II Computer Program. Therefore, the ASTROS Computer Program has the same program layout as in Reference 3 except for MAIN, RIEMAN, and LEBEGE. All other subroutines can be found in Reference 3.

TABLE D-1. MAIN CONTROL PROGRAM

```
                    COMMON STORY(16),TALE(16)

      COMMON STORY(16),TALE(16)
      COMMON XMAT(110,10),STD(10),NST(30),NKL(30),NXMAT(20),SAVTIC(900)
      COMMON SAVJTC(30),SAVSTP(30),JRTIC(30),JRSTOP(30)
      COMMON SADUS(60),RADUS(60)
      COMMON XN,NREG,NSEGTL,NMPT,MATPRP,TEFREE,NCUPLE,TIC,PHI,STOP
      COMMON NRGEND,NSYM,NRG,NRC,NSC,NIX,IERROR,RESTOP,RTICK,IOUT
      COMMON MAT,KGEOM,IGEOM,ITYPE,ISTTAB,THICK,KELVIN,G1
      COMMON IBEGIN,NPROB,NHARM,NSEG,NERROR,Q,NSMAX
      COMMON /NAM1/ STRGO(6),THERM(4),MATER(3),SEGTAB(3),FACE(4),EQUATE(
     13),STRESS(4)
      COMMON /LYCORR/ YCORR(144)
      INTEGER SAVJTC,SAVSTP
      INTEGER THICK,TYPE
      INTEGER SEGTAB
      INTEGER Q
    1 WRITE (6,12)
      REWIND 1
      REWIND 2
      REWIND 3
      REWIND 4
      REWIND 8
      REWIND 9
      REWIND 10
      REWIND 11
      REWIND 12
      NIX=0
      Q=5
      NHARM=1
      READ (5,13) (STORY(I),I=1,16)
      READ (5,14) NREG,NSMAX,NMPT,XN,NPROB,NCUPLE
      WRITE (6,15) NSMAX,NREG,NMPT,NPROB
      IF (NCUPLE.EQ.0) WRITE (6,16)
      IF (NCUPLE.EQ.1) WRITE (6,17)
      WRITE (6,18) (STORY(I),I=1,16)
      NROW=0
      KK=-1
      NSAVE=0
      DO 4 I=1,NMPT
      KK=KK+2
      NXMAT(KK)=NROW+1
      II=NROW+1
      READ (5,19) STD(I),TYPE
      NROW=11
      DO 2 L=1,3
      IF (TYPE.EQ.MATER(L)) GO TO 3
    2 CONTINUE
    3 CONTINUE
      IF (L.EQ.1) NROW=4
      IF (L.EQ.2) NROW=7
      N=0
```

TABLE D-1. (Continued)

```
      COMMON STORY(16),TALE(16)
      IF (NROW.EQ.4) N=1
      IF (NROW.EQ.11) N=1
      IF (NROW.EQ.7) N=1
      IF (N.NE.1) GO TO 10
      LLL=NSAVE+NROW
      READ (5,20) ((XMAT(M,J),J=1,10),M=II,LLL)
      NROW=NSAVE+NROW
      NXMAT(KK+1)=LLL
    4 NSAVE=NROW
      DO 7 NRC=1,NREG
      WRITE (6,12)
      READ (5,21) NST(NRC),NKL(NRC),(STORY(I),I=1,16)
      WRITE (6,22) NRC,NST(NRC),NKL(NRC)
      IF (NCUPLE.EQ.1) READ (5,23) IR,JRTIC(NRC),JRSTOP(NRC),STORY
      NSEG=NST(NRC)
    5 NSC=0
      IF (Q.EQ.1) WRITE (6,15) NSMAX,NREG,NMPT,NPROB,XN
    6 NSC=NSC+1
      WRITE (6,12)
      CALL RIEMAN
      IF (NIX.NE.0) GO TO 11
      CALL SEGMAT
      IF (NIX.NE.0) GO TO 11
      IF (NSC.LT.NSEG) GO TO 6
      NSC=0
      IF (NCUPLE.EQ.0) GO TO 8
      CALL REGMAT
      IF (NIX.LT.0) GO TO 11
      NIX=0
      REWIND 2
      REWIND 3
    7 CONTINUE
      IF (NCUPLE.EQ.1) GO TO 9
    8 READ (5,24) XN
      IF (Q.EQ.1) REWIND 1
      Q=1
      WRITE (6,12)
      GO TO 5
    9 CALL STRMAT
      IF (NIX.NE.0) GO TO 11
      CALL INITAL
      IF (NIX.NE.0) GO TO 11
      CALL LEBEGE
      GO TO 1
      CALL EXIT
   10 IERROR=8000
      NERROR=1
   11 CALL PDUMP
      CALL ETRAP
      STOP
```

```
                          COMMON STORY(16),TALE(16)
C
   12 FORMAT (1H1)
   13 FORMAT (16A4)
   14 FORMAT (I2,I3,I2,F9.6,I2,I1)
   15 FORMAT (1H ,////40X,46HAUTOMATED SHELL THEORY FOR ROTATING STRUCTU
     1RES///60X,8H(ASTROS)////57X,13HDECK NUMBER 1//54X,19HAS OF JULY 17
     2, 1970////8X,21HNUMBER OF SEGMENTS = I3,21H NUMBER OF REGIONS = ,I
     32,43H NUMBER OF MATERIAL PROPERTY TABLES USED = ,I2,22H NUMBER OF
     4PROBLEMS = ,I2)
   16 FORMAT (28X,76HTHE GIVEN INPUT DATA INDICATES THAT THE SHELL SEGME
     1NTS ARE NOT TO BE COUPLED//)
   17 FORMAT (30X,72HTHE GIVEN INPUT DATA INDICATES THAT THE SHELL SEGME
     1NTS ARE TO BE COUPLED//)
   18 FORMAT (///////////////////8X,16A4)
   19 FORMAT (A4,6X,A4,6X)
   20 FORMAT (5E14.7)
   21 FORMAT (2I2,16A4)
   22 FORMAT (///////////////////////////58X,13HREGION NUMBER,I3//35X,10HT
     1HERE ARE ,I2,14H SEGMENTS AND ,I2,35H KINEMATIC LINKS WITHIN THIS
     2REGION)
   23 FORMAT (3I5,16A4)
   24 FORMAT (7X,F9.6,3X)
      END
```

TABLE D-2. SUBROUTINE RIEMAN

```
                                SUBROUTINE RIEMAN
      SUBROUTINE RIEMAN
      COMMON STORY(16),TALE(16)
      COMMON XMAT(110,10),STD(10),NST(30),NKL(30),NXMAT(20),SAVTIC(900)
      COMMON SAVJTC(30),SAVSTP(30),JRTIC(30),JRSTOP(30)
      COMMON SADUS(60),RADUS(60)
      COMMON XN,NREG,NSEGTL,NMPT,MATPRP,TEFREE,NCUPLE,TIC,PHI,STOP
      COMMON NRGEND,NSYM,NRG,NRC,NSC,NIX,IERROR,RESTOP,RTICK,IOUT
      COMMON MAT,KGEOM,IGEOM,ITYPE,ISTTAB,THICK,KELVIN,G1
      COMMON IBEGIN,NPROB,NHARM,NSEG,NERROR,Q,NSMAX
      COMMON /LYCORR/ YCORR(144)
      COMMON /NAMI/ STRGO(6),THERM(4),MATEK(3),SEGTAB(3),FACE(4),EQUATE(
     13),STRESS(4)
      INTEGER SAVJTC,SAVSTP
      INTEGER SEGTAB
      INTEGER THICK,TYPE
      INTEGER Q
      EQUIVALENCE (XMTTH,XMTETH), (XMTPH,XMTEPH), (XNTTH,XNTETH), (XNTPH
     1,XNTEPH)
      EQUIVALENCE (XNPHI,XNPI)
      DIMENSION VAR(4)
      DIMENSION KLUE(4)
      DIMENSION IPROB(10), LST(61)
      DIMENSION YDEV(144), YICS(144), YNEW(144)
      DIMENSION TBDEL(144), FWDEL(144)
      DIMENSION ILAYR(10)
      DIMENSION ST(70,31), XLAYER(10)
      DIMENSION LMERD(5), LPRES(5), XPL(5), XMERD(5), XPRES(5)
      DIMENSION LMONT(5), XMONT(5)
      DIMENSION OMAGX(5)
      DOUBLE PRECISION YNEW,YPRED
      COMMON /EQUAZN/ YPRED(144),YDOT(144),YASAVE(144),YANTH,YAMTH,YAMPT
     1,YAJPH,S,SN,CS,SNSQ,CSSQ,TAN,SEC,CN,X1CS,X1SN,TN,X1RO,X1ROSQ,X1SNR
     2O,X1CSRO,CN1RO,SN1RO,CS1RO,X1R1,X1R2,CS1R1,CS1R2,SN1R1,X1R1SQ,R2SQ
     3,RO,BESQ,ROSQ,XNSQ,BETA,R1,R2,S1,R1DOT,XNTTH,XNTPH,XMTTH,XMTPH,XFT
     4HLD,XFPHLD,XFZELD,XMTHLD,XMPHLD,ETHET,EPHI,XGPT,ALPHTH,ALPHPH,XNUT
     5P,XNUPT,XC11,XC22,XD33,XD22,XD21,XD12,XK11,XK12,XK21,XK22,XK33,XD1
     61,M,I,XNL,XNPHI
      IOUT=0
      XNL=0.0
      IF (Q.EQ.1) GO TO 1
      READ (5,195) RGO,(STORY(I),I=1,16)
      WRITE (1) RGO,(STORY(I),I=1,16)
      READ (5,196) TIC,STOP,DTAU,DIFF,STEP,DELTA
      WRITE (1) TIC,STOP,DTAU,DIFF,STEP,DELTA
      READ (5,196) G1,G2,G3
      WRITE (1) G1,G2,G3
      READ (5,197) TYPE,HLAYR,SHEET,INTERP,RANKIN,TEFREE,ANALYS,NP
      IF (NP.LT.2.OR.NP.GT.30) GO TO 189
      WRITE (1) TYPE,HLAYR,SHEET,INTERP,RANKIN,TEFREE,ANALYS,NP
      GO TO 2
```

```
                          SUBROUTINE RIEMAN
    1 READ (1) RGO,(STORY(I),I=1,16)
      READ (1) TIC,STOP,DTAU,DIFF,STEP,DELTA
      READ (1) G1,G2,G3
      READ (1) TYPE,HLAYR,SHEET,INTERP,RANKIN,TEFREE,ANALYS,NP
    2 EPSIL=1.0E-05
      DIFF=1.0E-04
      ERR=1.0E-07
      I=RGO
      WRITE (6,198) NSC,I,(STORY(I),I=1,16),TIC,STOP,DTAU,DIFF,STEP,DELT
     1A
      WRITE (6,199) G1,G2,G3
      WRITE (6,200) TYPE,HLAYR,SHEET,INTERP,RANKIN,TEFREE,ANALYS,NP
C     MATERIAL PROPERTY IDENTIFICATION
      DO 4 I=1,NMPT
      IF (HLAYR-STD(I)) 4,3,4
    3 MAT=I
      GO TO 5
    4 CONTINUE
      GO TO 170
C     GEOMETRY IDENTIFICATION SEARCH
    5 DO 6 I=1,6
      IF (RGO-STRGO(I)) 6,7,6
    6 CONTINUE
      GO TO 171
    7 KGEOM=I
      DO 8 I=1,3
      IF (TYPE-MATER(I)) 8,9,8
    8 CONTINUE
      GO TO 172
    9 ITYPE=I
      DO 10 I=1,3
      IF (INTERP-SEGTAB(I)) 10,11,10
   10 CONTINUE
      GO TO 173
   11 ISTTAB=I
      DO 12 I=1,4
      IF (SHEET.EQ.FACE(I)) GO TO 13
   12 CONTINUE
      GO TO 174
   13 THICK=I
C     TEMPERATURE LOAD IDENTIFICATION
      DO 14 I=1,4
      IF (RANKIN.EQ.THERM(I)) GO TO 15
   14 CONTINUE
      GO TO 175
   15 KELVIN=I
C     LINEAR OR NONLINEAR ANALYSIS IDENTIFICATION
      DO 16 I=1,3
      IF (EQUATE(I).EQ.ANALYS) GO TO 17
   16 CONTINUE
```

TABLE D-2. (Continued)

SUBROUTINE RIEMAN

```
      GO TO 188
   17 IANLYZ=1
      IF (IANLYZ.NE.1.AND.NPROB.GT.1) GO TO 168
      IF (IANLYZ.NE.1) XNL=1.0
      IF (XNL.NE.0.0.AND.XN.NE.0.0) GO TO 190
      NROW=0
      NROW=THICK+1
      IF (ISTTAB.EQ.1) NROW=11
      IF (ISTTAB.EQ.3) NROW=10
      L=2*(MAT-1)+1
      II=NXMAT(L)
      III=NXMAT(L+1)
      WRITE (6,201) ((XMAT(I,J),J=1,10),I=II,III)
      WRITE (6,202)
      DO 20 I=1,NROW
      IF (Q.EQ.1) GO TO 18
      READ (5,203) (ST(I,J),J=1,NP)
      WRITE (1) (ST(I,J),J=1,NP)
      GO TO 19
   18 READ (1) (ST(I,J),J=1,NP)
   19 WRITE (6,204) (ST(I,J),J=1,NP)
   20 CONTINUE
      IF (NPROB.EQ.0) GO TO 39
      K=NROW+1
      JJ=1
      JJJ=6
      MM=1
      DO 36 NLC=1,NPROB
      JT=JJ
      JTT=JJJ
      L=0
      IF (Q.EQ.1) GO TO 21
      READ (5,205) (LST(J),J=JJ,JJJ),(TALE(I),I=1,16)
      WRITE (1) (LST(J),J=JJ,JJJ),(TALE(I),I=1,16)
      GO TO 22
   21 READ (1) (LST(J),J=JJ,JJJ),(TALE(I),I=1,16)
   22 CONTINUE
      IF (LST(JJ)) 169,24,23
   23 L=LST(JJ)
      IF (NLC.GT.1.AND.LST(JT).NE.0) GO TO 167
   24 JJ=JJ+1
   25 IF (LST(JJ)) 169,27,26
   26 L=L+1
   27 IF (JJ.EQ.JJJ) GO TO 28
      JJ=JJ+1
      GO TO 25
   28 IF (L.EQ.0) GO TO 35
      KK=K+L-1
      DO 30 M=K,KK
      IF (Q.EQ.1) GO TO 29
```

TABLE D-2. (Continued)

```
                         SUBROUTINE RIEMAN
      READ (5,203) (ST(M,J),J=1,NP)
      WRITE (1) (ST(M,J),J=1,NP)
      GO TO 30
   29 READ (1) (ST(M,J),J=1,NP)
   30 CONTINUE
      IF (NLC.GT.1.OR.LST(1).EQ.0) GO TO 32
      WRITE (6,206)
      KY=K
      KZ=K+LST(1)-1
      DO 31 N=KY,KZ
      WRITE (6,204) (ST(N,J),J=1,NP)
   31 CONTINUE
      K=KZ+1
   32 IF ((L-LST(JT)).EQ.0) GO TO 34
      WRITE (6,207) NLC
      WRITE (6,208) (LST(J),J=JT,JTT)
      DO 33 N=K,KK
      WRITE (6,204) (ST(N,J),J=1,NP)
   33 CONTINUE
   34 CONTINUE
   35 K=K+L-LST(JT)
      JJ=JJJ+1
      JJJ=JJ+5
   36 MM=MM+1
      IF (IANLYZ.EQ.1) GO TO 39
      KK=KK+1
      IF (L.EQ.0) KK=NROW+1
      IF (Q.EQ.1) GO TO 37
      READ (5,203) (ST(KK,J),J=1,NP)
      WRITE (1) (ST(KK,J),J=1,NP)
      GO TO 38
   37 READ (1) (ST(KK,J),J=1,NP)
   38 WRITE (6,209) (ST(KK,J),J=1,NP)
   39 IF (NCUPLE.EQ.0) GO TO 46
      IF (ISTTAB-2) 40,45,40
   40 READ (5,210) (VAR(I),I=1,4)
      WRITE (6,211) (VAR(I),I=1,4)
C     STRESS CLUES IDENTIFICATION
      I=0
   41 I=I+1
      DO 42 J=1,4
      IF (VAR(I).EQ.STRESS(J)) GO TO 43
   42 CONTINUE
      GO TO 191
   43 KLUE(I)=J
      IF (I.LT.4) GO TO 41
      WRITE (1) (KLUE(I),I=1,4)
      IF (IANLYZ.EQ.1.AND.L.EQ.0) KK=NROW
      K=KK+1
      KK=K+8
```

TABLE D-2. (Continued)

SUBROUTINE RIEMAN

```
      IF (ISTTAB.EQ.1) KK=K+14
      WRITE (6,212)
      DO 44 I=K,KK
      READ (5,203) (ST(I,J),J=1,NP)
      WRITE (6,204) (ST(I,J),J=1,NP)
   44 WRITE (1) (ST(I,J),J=1,NP)
   45 CONTINUE
      READ (5,213) PHO1,PHO2,PHO3,PHO4
      WRITE (1) PHO1,PHO2,PHO3,PHO4
      READ (5,213) (OMAGX(KJ),KJ=1,NPROB)
      WRITE (1) (OMAGX(KJ),KJ=1,NPROB)
      READ (5,214) IS,SAVJTC(IS),SAVSTP(IS),(STORY(I),I=1,16)
      ITIC=SAVJTC(IS)
      ISTOP=SAVSTP(IS)
      JTIC=JRTIC(NRC)
      JSTOP=JRSTOP(NRC)
   46 CONTINUE
      NEQNS=64+8*NPROB
      DO 47 I=1,NEQNS
   47 YICS(I)=0.0
      YICS(5)=1.0
      YICS(14)=1.0
      YICS(23)=1.0
      YICS(32)=1.0
      YICS(33)=1.0
      YICS(42)=1.0
      YICS(51)=1.0
      YICS(60)=1.0
      NCYC=0
      NSAVE=NROW
      IEND=0
      PRINT=TIC
      DTA=DTAU
      DTAU=0.0
      CALL SETUP (MAGIN,MAGOUT,TIC,STEP,NEQNS,DTAU,EPSIL,DELTA,ERR,TIME,
     1DTIME,YICS,YPRED,YCORR,YDOT,YNEW,YDEV,FWDEL,TBDEL)
      GO TO 49
   48 CALL MAGIC (MAGIN,MAGOUT,TIC,STEP,NEQNS,DTAU,EPSIL,DELTA,ERR,TIME,
     1DTIME,YICS,YPRED,YCORR,YDOT,YNEW,YDEV,FWDEL,TBDEL)
   49 IF (MAGOUT.LE.0) GO TO 57
      IF (TIME.GT.STOP) GO TO 51
      IF (TIME.LT.STOP) GO TO 52
   50 IEND=-1
      GO TO 53
   51 IF (TIME.LE.(STOP+DIFF)) GO TO 50
      GO TO 162
   52 IF ((STOP-DIFF).LE.TIME) GO TO 50
      IF ((TIME+DTIME).GT.STOP) GO TO 55
      IF (PRINT.GT.TIME) GO TO 54
      PRINT=TIME+DTA
```

SUBROUTINE RIEMAN

```
53 IF (IOUT.NE.0) GO TO 187
   IF (IEND.GT.0) GO TO 163
   IF (IEND.LT.0) GO TO 193
54 MAGIN=0
   GO TO 48
55 DTIME=STOP-TIME
   DELTA=0.0
   GO TO 53
56 NCYC=NCYC+1
   MAGIN=-1
   GO TO 48
57 LT=0
   JJ=NPROB*6
   DO 58 J=1,JJ
58 LT=LT+LST(J)
   NTOTAL=LT+NSAVE
   IF (XNL.EQ.1.0) NTOTAL=NTOTAL+1
   NCONT=NTOTAL
   IF (NCUPLE.EQ.0) GO TO 59
   IF (ISTTAB.EQ.1) NTOTAL=NTOTAL+15
   IF (ISTTAB.EQ.3) NTOTAL=NTOTAL+9
59 CONTINUE
   PHI=TIME
   ARG=PHI
   LL=NP+1
   DO 61 I=1,NP
   IF (ARG-ST(1,I)) 60,64,61
60 IF (I-1) 164,164,62
61 CONTINUE
   GO TO 165
62 DO 63 IK=2,NTOTAL
63 ST(IK,LL)=ST(IK,I-1)+(ST(IK,I)-ST(IK,I-1))*(ARG-ST(1,I-1))/(ST(1,I
  1)-ST(1,I-1))
   GO TO 66
64 DO 65 IK=2,NTOTAL
65 ST(IK,LL)=ST(IK,I)
66 CONTINUE
C     THE UPDATED INTERPOLATED VALUES OF THE MATERIAL PROPERTY COEFFIC
C     IENTS ARE FOUND IN THE XMAT TABLE AND STORED IN THE XLAYER ARRAY
   L=(MAT-1)*2+1
   II=NXMAT(L)
   III=NXMAT(L+1)
   M=1
   LL=NP+1
   GO TO (67,76,68,68), KELVIN
67 L=NROW+1
   TEMPAV=(ST(L,LL)+ST(L+1,LL)+ST(L+2,LL)+ST(L+3,LL))/4.0
   ARG=TEMPAV
   GO TO 69
68 ARG=ST(NROW+1,LL)
```

```
                         SUBROUTINE RIEMAN
 69 DO 71 I=2,10
    IF (ARG-XMAT(II,I)) 70,72,71
 70 IF (I-2) 166,166,74
 71 CONTINUE
    GO TO 176
 72 L=II+1
    DO 73 J=L,III
    XLAYER(M)=XMAT(J,I)
 73 M=M+1
    GO TO 78
 74 L=II+1
    DO 75 J=L,III
    XLAYER(M)=XMAT(J,I-1)+(XMAT(J,I)-XMAT(J,I-1))*(ARG-XMAT(II,I-1))/(
   1XMAT(II,I)-XMAT(II,I-1))
 75 M=M+1
    GO TO 78
 76 L=II+1
    DO 77 J=L,III
    XLAYER(M)=XMAT(J,1)
 77 M=M+1
 78 GO TO (79,80,81), ITYPE
 79 ETHET=XLAYER(1)
    XNUTP=XLAYER(2)
    ALPHTH=XLAYER(3)
    EPHI=ETHET
    XNUPT=XNUTP
    ALPHPH=ALPHTH
    XGPT=ETHET/(2.0*(1.0+XNUPT))
    GO TO 82
 80 ETHET=XLAYER(1)
    EPHI=XLAYER(2)
    XNUTP=XLAYER(3)
    ALPHTH=XLAYER(4)
    ALPHPH=XLAYER(5)
    XGPT=XLAYER(6)
    XNUPT=ETHET*XNUTP/EPHI
    GO TO 82
 81 ETHET=XLAYER(1)
    EPHI=XLAYER(2)
    XNUTP=XLAYER(3)
    ALPHTH=XLAYER(4)
    ALPHPH=XLAYER(5)
    XGPT=XLAYER(6)
    ER=XLAYER(7)
    ES=XLAYER(8)
    ALPHR=XLAYER(9)
    ALPHS=XLAYER(10)
    XNUPT=ETHET*XNUTP/EPHI
 82 CONTINUE
    GO TO (83,86,89,90,91,92), KGEOM
```

SUBROUTINE RIEMAN

```
C     GEOMETRY FOR ELLIPSE                                              C3510
   83 A=G1                                                              C3520
      BE=G2                                                             C3530
      BETA=BE                                                           C3540
      BESQ=BE**2                                                        C3550
      ASQ=A**2                                                          C3560
      SN=SIN(PHI)                                                       C3570
      CS=COS(PHI)                                                       C3580
      SNSQ=SN**2                                                        C3590
      CSSQ=CS**2                                                        C3600
      R2=A*SQRT(1.0/(SNSQ+BESQ*CSSQ))                                   C3610
      R2SQ=R2**2                                                        C3620
      R0=R2*SN                                                          C3630
      R1=R2*R2SQ*BESQ/ASQ                                               C3640
      BESQ=BE**2                                                        C3650
      R1DOT=0.0                                                         C3660
      IF (KGEOM.EQ.1.AND.BETA.NE.1.0) R1DOT=3.0*(R2*BETA/A)**2*(CS/SNSQ) C3670
     1*(R1*SN-R0)                                                       C3680
C     FOLLOWING EQUATIONS ARE FOR DISPLACED ELLIPSE                     C3690
      IF (SN.EQ.0.0) GO TO 84                                           C3700
      R2=R2-G3/SN                                                       C3710
      R0=R0-G3                                                          C3720
      GO TO 85                                                          C3730
   84 IF (G3.EQ.0.0) GO TO 85                                           C3740
      R2=1.0                                                            C3750
      R0=-G3                                                            C3760
   85 CONTINUE                                                          C3770
      GO TO 93                                                          C3780
C     GEOMETRY FOR OGIVE                                                C3790
   86 R1=G1                                                             C3800
      C=G2                                                              C3810
      SN=SIN(PHI)                                                       C3820
      CS=COS(PHI)                                                       C3830
      IF (SN.EQ.0.0) GO TO 87                                           C3840
      R2=R1-C/SN                                                        C3850
      GO TO 88                                                          C3860
   87 R2=1.0                                                            C3870
   88 R0=R1*SN-C                                                        C3880
      R1DOT=0.0                                                         C3890
      GO TO 93                                                          C3900
C     GEOMETRY FOR CONE                                                 C3910
   89 CS=COS(G1)                                                        C3920
      SN=SIN(G1)                                                        C3930
      S=PHI                                                             C3940
      SI=1.0/S                                                          C3950
      R2=CS*SN*PHI                                                      C3960
      R0=PHI*CS                                                         C3970
      R1DOT=0.0                                                         C3980
      GO TO 93                                                          C3990
C     GEOMETRY FOR CYLINDER                                             C4000
```

SUBROUTINE RIEMAN

```
   90 RO=G1
      RIDOT=0.0
      SN=1.0
      CS=1.0
      GO TO 93
C     MODIFIED  ELLIPSE
   91 XNEXP=G1
      A=G2
      XN1=1.0+XNEXP
      XN2=1.0/XN1
      XN3=XN1+1.0
      XN4=XN3+1.0
      XN5=XN4/XN1
      SN=SIN(PHI)
      CS=COS(PHI)
      R2=A*(2.0/(1.0+SN**XN1))**XN2
      R1=(A/2.0)*(R2/A)**XN3
      RO=R2*SN
      RIDOT=-XN3*A*(SN**XNEXP*CS/4.0)*(2.0/(1.0+SN**XN1))**XN5
      GO TO 93
C     PARABOLIC GEOMETRY
   92 SN=SIN(PHI)
      CS=COS(PHI)
      TAN=SN/CS
      SEC=1.0/CS
      F1=G1
      F2=G2
      F3=G3
      RO=-(F2+TAN)/(2.0*F3)
      R1=-SEC**3/(2.0*F3)
      R2=RO/SN
      RIDOT=-3.0*SEC**4*SN/(2.0*F3)
   93 TAN=SN/CS
C     THE FOLLOWING LOGIC DETERMINES ROTATIONAL INERTIAL LOADS AND
C     PUTS THEM INTO THE ST ARRAY AS STATIC LOADS
      LZAP=0
      DO 94 NNI=1,5
      LMERD(NNI)=0
      LPRES(NNI)=0
   94 LMONT(NNI)=0
   95 LZAP=LZAP+1
      GO TO (96,97,97,97,97), LZAP
   96 KNK=3
      MIM=1
      GO TO 98
   97 KNK=KNK+6
      MIM=MIM+1
   98 DO 99 NI=1,KNK
   99 LMERD(MIM)=LMERD(MIM)+LST(NI)
      LMERD(MIM)=LMERD(MIM)+NSAVE
```

TABLE D-2. (Continued)

```
                                SUBROUTINE RIEMAN
      LPRES(MIM)=LMERD(MIM)+1                                          C4510
      LMONT(MIM)=LMERD(MIM)+2                                          C4520
      IF (LZAP-NPROB) 95,100,100                                       C4530
  100 LL=NP+1                                                          C4540
C     IF THICK=4, THE ELEMENT IS STIFFENED WITH EITHER RWAF OR ST10    C4550
C     IF THICK=1,2 OR 3 THE ELEMENT HAS NO STIFFENER                   C4560
      IF (THICK.NE.4) GO TO 116                                        C4570
      YBARI=0.0                                                        C4580
      YBARO=0.0                                                        C4590
      TISZ=0.0                                                         C4600
      TOSZ=0.0                                                         C4610
C     IF ISTTAB=1, THE ELEMENT IS STIFFENED WITH STRINGERS AND/OR RINGS   C4620
C     IF ISTTAB=3, THE ELEMENT IS STIFFENED WITH 45 DEGREE WAFFEL (RWAF)  C4630
      IF (ISTTAB.EQ.1) GO TO 104                                       C4640
C     RWAF STIFFENED                                                   C4650
      TEST1=ST(NCONT+5,LL)                                             C4660
      IF (TEST1) 101,102,102                                           C4670
  101 YBARO=ST(NCONT+5,LL)                                             C4680
      TOSZ=ST(NCONT+6,LL)                                              C4690
      GO TO 103                                                        C4700
  102 YBARI=ST(NCONT+5,LL)                                             C4710
      TISZ=ST(NCONT+6,LL)                                              C4720
  103 HIZ=ST(NCONT+7,LL)                                               C4730
      TZ=ST(NCONT+8,LL)                                                C4740
      HOZ=ST(NCONT+9,LL)                                               C4750
      GO TO 111                                                        C4760
C     ST10 STIFFENED (STRINGERS AND/OR RINGS)                          C4770
  104 TEST1=ST(NCONT+9,LL)                                             C4780
      TEST2=ST(NCONT+11,LL)                                            C4790
      IF (TEST1) 105,107,106                                           C4800
  105 YBARO=ST(NCONT+9,LL)                                             C4810
      TOSZ=ST(NCONT+10,LL)                                             C4820
      GO TO 107                                                        C4830
  106 YBARI=ST(NCONT+9,LL)                                             C4840
      TISZ=ST(NCONT+10,LL)                                             C4850
  107 IF (TEST2) 108,110,109                                           C4860
  108 YBARO=ST(NCONT+11,LL)                                            C4870
      TOSZ=ST(NCONT+12,LL)                                             C4880
      GO TO 110                                                        C4890
  109 YBARI=ST(NCONT+11,LL)                                            C4900
      TISZ=ST(NCONT+12,LL)                                             C4910
  110 HIZ=ST(NCONT+13,LL)                                              C4920
      TZ=ST(NCONT+14,LL)                                               C4930
      HOZ=ST(NCONT+15,LL)                                              C4940
  111 GO TO (112,112,113,114,112,112), KGEOM                           C4950
  112 DIS=YBARI*SIN(3.1415926-PHI)                                     C4960
      DOS=ABS(YBARO)*SIN(3.1415926-PHI)                                C4970
      GO TO 115                                                        C4980
  113 DIS=YBARI*SIN(G1)                                                C4990
      DOS=ABS(YBARO)*SIN(G1)                                           C5000
```

SUBROUTINE RIEMAN

```
      GO TO 115
  114 DIS=YBARI
      DOS=ABS(YBARO)
  115 ROIS=RO-DIS
      ROOS=RO+DOS
      GO TO 121
C     NO STIFFENER ON SKIN ELEMENT
  116 TISZ=0.0
      TOSZ=0.0
      YBARI=0.0
      YBARO=0.0
      ROIS=0.0
      ROOS=0.0
      IF (THICK-2) 120,118,117
  117 HOZ=ST(4,LL)
      GO TO 119
  118 HOZ=ST(2,LL)
  119 TZ=ST(3,LL)
      HIZ=ST(2,LL)
      GO TO 121
  120 HIZ=ST(2,LL)
      TZ=0.0
      HOZ=0.0
  121 SSSI=(HIZ**2+HOZ**2+2.0*HIZ*HOZ+2.0*HOZ*TZ)/(2.0*HIZ+2.0*HOZ)
      SSSO=(HIZ**2+HOZ**2+2.0*HIZ*HOZ+2.0*HIZ*TZ)/(2.0*HIZ+2.0*HOZ)
      YBRI=-(HIZ/2.0)+SSSI
      YBRC=-(HIZ+TZ/2.0)+SSSI
      YBRO=(HOZ/2.0)-SSSO
      GO TO (122,122,123,124,122,122), KGEOM
C     ELLIPTICAL,SPHERICAL,MOD. ELLIPSE,OGIVAL,TOROIDAL,PARABOLOID
  122 ROI=RO-YBRI*SIN(3.1415926-PHI)
      ROC=RO-YBRC*SIN(3.1415926-PHI)
      ROO=RO-YBRO*SIN(3.1415926-PHI)
      GO TO 125
C     CONICAL, PLATE
  123 ROI=RO-YBRI*SIN(GI)
      ROC=RO-YBRC*SIN(GI)
      ROO=RO-YBRO*SIN(GI)
      GO TO 125
C     CYLINDER
  124 ROI=RO-YBRI
      ROC=RO-YBRC
      ROO=RO-YBRO
  125 DO 126 IJK=1,NPROB
      XPLI1=PHO1*OMAGX(IJK)**2*ROI*HIZ
      XPLO1=PHO1*OMAGX(IJK)**2*ROO*HOZ
      XPL2=PHO2*OMAGX(IJK)**2*ROC*TZ
      XPL3=PHO3*OMAGX(IJK)**2*ROIS*TISZ
      XPL4=PHO4*OMAGX(IJK)**2*ROOS*TOSZ
  126 XPL(IJK)=XPLI1+XPLO1+XPL2+XPL3+XPL4
```

SUBROUTINE RIEMAN

```
      GO TO (127,127,129,131,127,127), KGEOM
C     ELLIPTICAL,SPHERICAL,MODEFIED ELLIPSE,OGIVAL,TOROIDAL,PARABOLOID
  127 DO 128 KNI=1,NPROB
      XMERD(KNI)=-XPL(KNI)*COS(3.1415926-PHI)
      XPRES(KNI)=-XPL(KNI)*SIN(3.1415926-PHI)
      XMONT(KNI)=XPL3*COS(3.1415926-PHI)*YBARI+XPL4*COS(3.1415926-PHI)*Y
     1BARO
      XMONT(KNI)=XMONT(KNI)+XPLI1*COS(3.1415926-PHI)*YBRI+XPLO1*COS(3.14
     115926-PHI)*YBRO+XPL2*COS(3.1415926-PHI)*YBRC
      LKL=LMERD(KNI)
      ST(LKL,LL)=ST(LKL,LL)+XMERD(KNI)
      LKL=LPRES(KNI)
      ST(LKL,LL)=ST(LKL,LL)+XPRES(KNI)
      LKL=LMONT(KNI)
  128 ST(LKL,LL)=ST(LKL,LL)+XMONT(KNI)
      GO TO 133
C     CONICAL,PLATE
  129 DO 130 KNI=1,NPROB
      XMERD(KNI)=XPL(KNI)*COS(G1)
      XPRES(KNI)=-XPL(KNI)*SIN(G1)
      XMONT(KNI)=-XPL3*COS(G1)*YBARI-XPL4*COS(G1)*YBARO
      XMONT(KNI)=XMONT(KNI)-XPLI1*COS(G1)*YBRI-XPLO1*COS(G1)*YBRO-XPL2*C
     1OS(G1)*YBRC
      LKL=LMERD(KNI)
      ST(LKL,LL)=ST(LKL,LL)+XMERD(KNI)
      LKL=LPRES(KNI)
      ST(LKL,LL)=ST(LKL,LL)+XPRES(KNI)
      LKL=LMONT(KNI)
  130 ST(LKL,LL)=ST(LKL,LL)+XMONT(KNI)
      GO TO 133
C     CYLINDER
  131 DO 132 KNI=1,NPROB
      XMERD(KNI)=0.0
      XPRES(KNI)=-XPL(KNI)
      XMONT(KNI)=0.0
      LKL=LPRES(KNI)
  132 ST(LKL,LL)=ST(LKL,LL)+XPRES(KNI)
  133 CONTINUE
C
      IF (TIME.EQ.TIC) RTICK=RO
      IF (NCYC.GT.1.OR.NCUPLE.EQ.0) GO TO 134
      IF (TIME.EQ.TIC.AND.NSC.EQ.1) SADUS(JTIC)=RO
      IF (TIME.EQ.TIC) RADUS(ITIC)=RO
  134 CONTINUE
      ROSQ=RO**2
      XNSQ=XN**2
      CN=CS*SN
      XICS=1.0/CS
      TN=SN/CS
      XIRO=1.0/RO
```

```
                              SUBROUTINE RIEMAN
      XIROSQ=1.0/RO**2
      XICSRO=1.0/(CS*RO)
      CN1RO=CN/RO
      SN1RO=SN/RO
      CS1RO=CS/RO
      SNSQ=SN**2
      CSSQ=CS**2
      IF (KGEOM.EQ.4.OR.KGEOM.EQ.3) GO TO 135
      R1SQ=R1**2
      R2SQ=R2**2
      X1SN=1.0/SN
      X1SNRO=1.0/(SN*RO)
      X1R1=1.0/R1
      X1R2=1.0/R2
      CS1R1=CS/R1
      CS1R2=CS/R2
      SN1R1=SN/R1
      XIR1SQ=1.0/R1**2
  135 XNTTH=0.0
      XNTPH=0.0
      XMTTH=0.0
      XMTPH=0.0
      IF (ITYPE.EQ.3) GO TO 145
C     COMPUTATION OF K AND D FOR MATERIAL PROPETY INPUT
      GO TO (136,139,142), THICK
C     SINGLE SHEET
  136 HI=ST(2,LL)
      TEMP1=ETHET*HI
      TEMP2=TEMP1*HI**2
      TEMP3=(1.0-XNUPT*XNUTP)
      XK11=TEMP1/TEMP3
      XD11=TEMP2/(12.0*TEMP3)
      IF (ITYPE.EQ.2) GO TO 137
      XK22=XK11
      XD22=XD11
      GO TO 138
  137 TEMP1=EPHI*HI
      TEMP2=TEMP1*HI**2
      XK22=TEMP1/TEMP3
      XD22=TEMP2/(12.0*TEMP3)
  138 XK33=XGPT*HI
      XD33=XK33*HI**2/12.0
      GO TO 146
C     EQUAL  SHEETS
  139 HI=ST(2,LL)
      T=ST(3,LL)
      TEMP1=2.0*ETHET*HI
      TEMP2=HI*(4.0*HI**2+6.0*HI*T+3.0*T**2)
      TEMP3=(1.0-XNUPT*XNUTP)
      XK11=TEMP1/TEMP3
```

SUBROUTINE RIEMAN

```
      XD11=ETHET*TEMP2/(6.0*TEMP3)
      IF (ITYPE.EQ.2) GO TO 140
      XK22=XK11
      XD22=XD11
      GO TO 141
  140 TEMP1=2.0*EPHI*HI
      XK22=TEMP1/TEMP3
      XD22=EPHI*TEMP2/(6.0*TEMP3)
  141 XK33=2.0*XGPT*HI
      XD33=XK33*TEMP2/(12.0*HI)
      GO TO 146
C     UNEQUAL SHEETS
  142 HI=ST(2,LL)
      T=ST(3,LL)
      HO=ST(4,LL)
      TEMP1=HI+HO
      TEMP2=TEMP1**4+12.0*HI*HO*T*(TEMP1+T)
      TEMP3=(1.0-XNUPT*XNUTP)
      XK11=ETHET*TEMP1/TEMP3
      XD11=ETHET*TEMP2/(12.0*TEMP1*TEMP3)
      IF (ITYPE.EQ.2) GO TO 143
      XK22=XK11
      XD22=XD11
      GO TO 144
  143 XK22=EPHI*TEMP1/TEMP3
      XD22=EPHI*TEMP2/(12.0*TEMP1*TEMP3)
  144 XK33=XGPT*TEMP1
      XD33=XGPT*(TEMP2/(12.0*TEMP1))
      GO TO 146
C     RANKIN=THSTNO MEANS INTERPOLATE,COMPUTE NTEMP,MTEMP
C     RANKIN=NOTHRM MEANS DO NOT INTERPOLATE,DO NOT COMPUTE NTEMP,NTEMP
C     RANKIN=THCNST MEANS DO NOT INTERPOLATE,COMPUTE NTEMP,MTEMP
C     RANKIN=THINHO MEANS INTERPOLATE,BUT DO NOT COMPUTE NTEMP,MTEMP
  145 CONTINUE
      XK11=ST(2,LL)
      XK12=ST(3,LL)
      XK22=ST(4,LL)
      XK33=ST(5,LL)
      XD11=ST(6,LL)
      XD12=ST(7,LL)
      XD22=ST(8,LL)
      XD33=ST(9,LL)
      XC11=ST(10,LL)
      XC22=ST(11,LL)
      XK21=XK12
      XD21=XD12
  146 GO TO (147,154,148,154), KELVIN
  147 TII=ST(NROW+1,LL)
      TIK=ST(NROW+2,LL)
      TOK=ST(NROW+3,LL)
```

SUBROUTINE RIEMAN

```
      TOO=ST(NROW+4,LL)
      GO TO 149
  148 TII=ST(NROW+1,LL)
      TIK=TII
      TOK=TII
      TOO=TII
  149 CONTINUE
      TEMP1=ALPHTH+XNUTP*ALPHPH
      TEMP2=ALPHPH+XNUPT*ALPHTH
      TEMP3=1.0-XNUPT*XNUTP
      TEMP4=HI/4.0
      TEMP5=HI**2/24.0
      TEMP6=TII+TIK+TOK+TOO-4.0*TEFREE
      TEMP7=2.0*TII+TIK-TOK-2.0*TOO
      GO TO (150,151,152,153), THICK
  150 XNTTH=ETHET*TEMP1*TEMP4*TEMP6/TEMP3
      XNTPH=EPHI*TEMP2*TEMP4*TEMP6/TEMP3
      XMTTH=ETHET*TEMP1*TEMP5*TEMP7/TEMP3
      XMTPH=EPHI*TEMP2*TEMP5*TEMP7/TEMP3
      GO TO 154
  151 TI=T/2.0
      TEMP8=HI/2.0
      TEMP9=TII+TIK-TOK-TOO
      XNTTH=ETHET*TEMP1*TEMP8*TEMP6/TEMP3
      XNTPH=EPHI*TEMP2*TEMP8*TEMP6/TEMP3
      XMTTH=ETHET*TEMP1*TEMP8*(HI*TEMP7/3.0+TI*TEMP9)/TEMP3
      XMTPH=EPHI*TEMP2*TEMP8*(HI*TEMP7/3.0+TI*TEMP9)/TEMP3
      GO TO 154
  152 TI=(HO**2-HI**2+2.0*HO*T)/(2.0*(HI+HO))
      TO=(HI**2-HO**2+2.0*HI*T)/(2.0*(HI+HO))
      TEMP6=2.0*TII+TIK-3.0*TEFREE
      TEMP7=2.0*TOO+TOK-3.0*TEFREE
      TEMP8=TII+TIK-2.0*TEFREE
      TEMP9=TOK+TOO-2.0*TEFREE
      XNTTH=ETHET*TEMP1*0.5*(HI*TEMP8+HO*TEMP9)/TEMP3
      XNTPH=EPHI*TEMP2*0.5*(HI*TEMP8+HO*TEMP9)/TEMP3
      XMTTH=ETHET*TEMP1*0.5*(HI**2*TEMP6/3.0-HO**2*TEMP7/3.0+TI*HI*TEMP8
     1-TO*HO*TEMP9)/TEMP3
      XMTPH=EPHI*TEMP2*0.5*(HI**2*TEMP6/3.0-HO**2*TEMP7/3.0+TI*HI*TEMP8-
     1TO*HO*TEMP9)/TEMP3
      GO TO 154
  153 TEMP10=SQRT(-XK11*XD11)/SQRT(48.0)
      TEMP11=SQRT(-XK22*XD22)/SQRT(48.0)
      XNTTH=(XK11/4.0)*TEMP1*TEMP6
      XNTPH=(XK22/4.0)*TEMP2*TEMP6
      XMTTH=TEMP10*TEMP1*TEMP7
      XMTPH=TEMP11*TEMP2*TEMP7
C     COMPUTATION OF K AND D FOR K AND D INPUT
  154 LL=NP+1
      IF (XK11.EQ.0.0) GO TO 177
```

SUBROUTINE RIEMAN

```
      IF (ITYPE.EQ.3.AND.XK12.EQ.0.) GO TO 178
      IF (ITYPE.EQ.3.AND.XK21.EQ.0.) GO TO 179
      IF (XK22.EQ.0.0) GO TO 180
      IF (XK33.EQ.0.0) GO TO 181
      IF (XD11.EQ.0.0) GO TO 182
      IF (ITYPE.EQ.3.AND.XD12.EQ.0.) GO TO 183
      IF (ITYPE.EQ.3.AND.XD21.EQ.0.) GO TO 184
      IF (XD22.EQ.0.0) GO TO 185
      IF (XD33.EQ.0.0) GO TO 186
      NL=0
      XSAVE1=XNTTH
      XSAVE2=XNTPH
      XSAVE3=XMTTH
      XSAVE4=XMTPH
      XNTTH=0.0
      XNTPH=0.0
      XMTTH=0.0
      XMTPH=0.0
      XFTHLD=0.0
      XFPHLD=0.0
      XFZELD=0.0
      XMTHLD=0.0
      XMPHLD=0.0
      JF=8+NPROB
      K=NROW
C     ANALYS=LINE
C     ANALYS=OMTH
C     ANALYS=NPH
      XNPHI=0.0
      IJKLMN=NROW+LST(1)+LST(2)+LST(3)+LST(4)+LST(5)+LST(6)+1
      IF (XNL.NE.0.0) XNPHI=ST(IJKLMN,LL)
      DO 161 M=1,JF
      I=(M-1)*8+1
      IF (M.LT.9) GO TO 160
      XNTTH=XSAVE1
      XNTPH=XSAVE2
      XMTTH=XSAVE3
      XMTPH=XSAVE4
      NL=NL+1
      XFTHLD=0.0
      XFPHLD=0.0
      XFZELD=0.0
      XMTHLD=0.0
      XMPHLD=0.0
      IR=NL*6-5
      IF (LST(IR).NE.0) K=K+LST(IR)
      IF (LST(IR+1).EQ.0) GO TO 155
      K=K+1
      XFTHLD=ST(K,LL)
  155 IF (LST(IR+2).EQ.0) GO TO 156
```

SUBROUTINE RIEMAN

```
      K=K+1
      XFPHLD=ST(K,LL)
  156 IF (LST(IR+3).EQ.0) GO TO 157
      K=K+1
      XFZELD=ST(K,LL)
  157 IF (LST(IR+4).EQ.0) GO TO 158
      K=K+1
      XMTHLD=ST(K,LL)
  158 IF (LST(IR+5).EQ.0) GO TO 159
      K=K+1
      XMPHLD=ST(K,LL)
  159 CONTINUE
  160 CALL DIFFEQ
  161 CONTINUE
      GO TO 56
  162 IERROR=8001
      NERROR=11
      GO TO 192
  163 IERROR=8002
      NERROR=12
      GO TO 192
  164 IERROR=8003
      NERROR=13
      GO TO 192
  165 IERROR=8006
      NERROR=14
      GO TO 192
  166 IERROR=8007
      NERROR=15
      GO TO 192
  167 IERROR=8008
      NERROR=10
      GO TO 192
  168 IERROR=8009
      NERROR=8
      GO TO 192
  169 IERROR=8031
      NERROR=9
      GO TO 192
  170 IERROR=8036
      NERROR=2
      GO TO 192
  171 IERROR=8086
      NERROR=3
      GO TO 192
  172 IERROR=8087
      NERROR=4
      GO TO 192
  173 IERROR=8088
      NERROR=27
```

TABLE D-2. (Continued)

SUBROUTINE RIEMAN

```
      GO TO 192
  174 IERROR=8089
      NERROR=5
      GO TO 192
  175 IERROR=8090
      NERROR=6
      GO TO 192
  176 IERROR=8067
      NERROR=16
      GO TO 192
  177 IERROR=8101
      NERROR=17
      GO TO 192
  178 IERROR=8102
      NERROR=18
      GO TO 192
  179 IERROR=8103
      NERROR=19
      GO TO 192
  180 IERROR=8104
      NERROR=20
      GO TO 192
  181 IERROR=8105
      NERROR=21
      GO TO 192
  182 IERROR=8106
      NERROR=22
      GO TO 192
  183 IERROR=8107
      NERROR=23
      GO TO 192
  184 IERROR=8108
      NERROR=24
      GO TO 192
  185 IERROR=8109
      NERROR=25
      GO TO 192
  186 IERROR=8110
      NERROR=26
      GO TO 192
  187 IERROR=110
      NERROR=28
      GO TO 192
  188 IERROR=8013
      NERROR=7
      GO TO 192
  189 IERROR=8787
      NERROR=34
      GO TO 192
  190 IERROR=8501
```

TABLE D-2. (Concluded)

```
                         SUBROUTINE RIEMAN

      NERROR=35
      GO TO 192
  191 IERROR=8111
      NERROR=36
  192 NIX=1
      RETURN
  193 CONTINUE
      WRITE (6,215)
      WRITE (6,216) (YCORR(I),I=1,NEQNS)
      RESTOP=RO
      IF (NCUPLE.EQ.0) GO TO 194
      RADUS(ISTOP)=RO
      IF (NSC.LT.NSEG) GO TO 194
      SADUS(JSTOP)=RO
      IF (ITIC.GT.ISTOP) SADUS(JSTOP)=RADUS(ITIC)
  194 RETURN
C
  195 FORMAT (F2.0,16A4)
  196 FORMAT (5E14.1,F2.0)
  197 FORMAT (5(A4,6X),E10.1,A4,6X,I2)
  198 FORMAT (//13X,15HSEGMENT NUMBER ,I2,5X,13HSEGMENT CODE ,I2,5X,16A4
     1//22X,3HTIC,15X,4HSTOP,15X,4HDTAU,15X,4HDIFF,15X,4HSTEP,10X,5HDELT
     2A//16X,5(E14.7,5X),2X,F2.0)
  199 FORMAT (//54X,24HGEOMETRY INPUT VARIABLES,//38X,3(E14.7,5X))
  200 FORMAT (//12X5(A4,6X),9HT FREE = ,E10.3,2XA4,6X26HNUMBER OF TABLE
     1COLUMNS = ,I2)
  201 FORMAT (//51X,28HMATERIAL PROPERTY TABLE USED,//(10(1H ,E12.5)))
  202 FORMAT (//42X,47HTABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES,)
  203 FORMAT (5E14.7)
  204 FORMAT (1H ,8(E14.7,2X)/(3X,8(E14.7,2X)))
  205 FORMAT (6I1,16A4)
  206 FORMAT (//45X,42HTABLE ORDER PHI OR S VS. TEMPERATURE LOADS,)
  207 FORMAT (//16X,8HPROBLEM ,I2,5X,84HTABLE ORDER  PHI OR S VS. DISTRI
     1BUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI),)
  208 FORMAT (27H LOAD IDENTIFICATION CLUES ,6I1/)
  209 FORMAT (//47X,38HASSUMED NON-LINEAR VALUES VS. PHI OR S//(1H ,8(E1
     14.7,2X)))
  210 FORMAT (4(A4,6X))
  211 FORMAT (//34X,23HTHE STRESS CLUES ARE   ,4(A4,6X))
  212 FORMAT (//44X,43HTABLE ORDER  PHI OR S VS. STRESS PROPERTIES/)
  213 FORMAT (5E14.7)
  214 FORMAT (3I5,16A4)
  215 FORMAT (//46X,41HMATRIX X AND Y (TRANSPOSED)  MAGIC OUTPUT)
  216 FORMAT (8(2X,E14.7))
      END
```

TABLE D-3. SUBROUTINE LEBEGE

```
                              SUBROUTINE LEBEGE

      SUBROUTINE LEBEGE
      COMMON STORY(16),TALE(16)
      COMMON XMAT(110,10),STD(10),NST(30),NKL(30),NXMAT(20),SAVTIC(900)
      COMMON SAVJTC(30),SAVSTP(30),JRTIC(30),JRSTOP(30)
      COMMON SADUS(60),RADUS(60)
      COMMON XN,NREG,NSEGTL,NMPT,MATPRP,TEFREE,NCUPLE,TIC,PHI,STOP
      COMMON NRGEND,NSYM,NRG,NRC,NSC,NIX,IERROR,RESTOP,RTICK,IOUT
      COMMON MAT,KGEOM,IGEOM,ITYPE,ISTTAB,THICK,KELVIN,G1
      COMMON IBEGIN,NPROB,NHARM,NSEG,NERROR,Q,NSMAX
      COMMON /NAM1/ STRGO(6),THERM(4),MATER(3),SEGTAB(3),FACE(4),EQUATE(
     13),STRESS(4)
      INTEGER SAVJTC,SAVSTP
      INTEGER SEGTAB
      INTEGER THICK,TYPE
      INTEGER Q
      EQUIVALENCE (XMTTH,XMTETH), (XMTPH,XMTEPH), (XNTTH,XNTETH), (XNTPH
     1,XNTEPH)
      EQUIVALENCE (XNPHI,XNPI)
      DIMENSION IPROB(10), LST(61)
      DIMENSION YDEV(80), YICS(80), YNEW(80)
      DIMENSION TBDEL(80), FWDEL(80)
      DIMENSION YCORR(80)
      DIMENSION ILAYR(10)
      DIMENSION KLUE(4)
      DIMENSION ST(70,31), XLAYER(10)
      DIMENSION LMERD(5), LPRES(5), XPL(5), XMERD(5), XPRES(5)
      DIMENSION LMONT(5), XMONT(5)
      DIMENSION OMAGX(5)
      DOUBLE PRECISION YNEW,YPRED
      COMMON /LASTEQ/ YPRED(80),YDOT(80),YASAVE(80),YANTH,YAMTH,YAMPT,YA
     1NPT,YAOPH,YAQPH,YAQTH,YAJPH,S,SN,CS,SNSQ,CSSQ,TAN,SEC,CN,X1CS,X1SN
     2,TN,X1RO,X1ROSQ,X1SNRO,X1CSRO,CNIRO,SNIRO,CSIRO,XIR1,XIR2,CSIR1,CS
     3IR2,SNIR1,XIR1SQ,R2SQ,RO,BESQ,ROSQ,XNSQ,BETA,R1,R2,S1,R1DOT,R1SQ,X
     4NTTH,XNTPH,XMTTH,XMTPH,XFTHLD,XFPHLD,XFZELD,XMTHLD,XMPHLD,ETHET,EP
     5HI,XGPT,ALPHTH,ALPHPH,XNUTP,XNUPT,XC11,XC22,XD33,XD22,XD21,XD12,XK
     611,XK12,XK21,XK22,XK33,XD11,M,I,SITIN,SITOUT,SIPIN,SIPOUT,TPTIN,TP
     7TOUT,ZBRIN,ZBROUT,SCRIPA,SCRIPI,SIFIN,SIFOUT,TZEPH,TZETH,XNL,XNPHI
      REWIND 1
      KSC=0
      JAM=1
      JNSC=0
      DO 1 I=1,NREG
    1 KSC=KSC+NST(I)
      LSC=0
    2 LSC=LSC+1
      XNTTH=0.0
      XNTPH=0.0
      XMTTH=0.0
      XMTPH=0.0
      XNL=0.0
```

TABLE D-3. (Continued)

SUBROUTINE LEBEGE

```
      NSC=LSC
      JNSC=JNSC+1
      IF (JNSC.LE.NST(JAM)) GO TO 3
      JAM=JAM+1
      JNSC=1
    3 CONTINUE
      IOUT=1
      READ (1) RGO,(STORY(I),I=1,16)
      READ (1) TIC,STOP,DTAU,DIFF,STEP,DELTA
      READ (1) G1,G2,G3
      READ (1) TYPE,HLAYR,SHEET,INTERP,RANKIN,TEFREE,ANALYS,NP
      DIFF=1.0E-04
      EPSIL=1.0E-05
      ERR=1.0E-07
      I=RGO
      WRITE (6,186)
      IF (JNSC.EQ.1) WRITE (6,187) JAM,NST(JAM),NKL(JAM)
      WRITE (6,188) JNSC,I,(STORY(I),I=1,16)
C     MATERIAL PROPERTY IDENTIFICATION
      DO 5 I=1,NMPT
      IF (HLAYR-STD(I)) 5,4,5
    4 MAT=I
      GO TO 6
    5 CONTINUE
      GO TO 162
C     GEOMETRY IDENTIFICATION SEARCH
    6 DO 7 I=1,6
      IF (RGO-STRGO(I)) 7,8,7
    7 CONTINUE
      GO TO 163
    8 KGEOM=I
      IGEOM=0
      IF (KGEOM.EQ.1.OR.KGEOM.EQ.2.OR.KGEOM.EQ.5.OR.KGEOM.EQ.6) IGEOM=1
      IF (KGEOM.EQ.3) IGEOM=2
      IF (KGEOM.EQ.4) IGEOM=3
      DO 9 I=1,3
      IF (TYPE-MATER(I)) 9,10,9
    9 CONTINUE
      GO TO 164
   10 ITYPE=I
      DO 11 I=1,3
      IF (INTERP-SEGTAB(I)) 11,12,11
   11 CONTINUE
      GO TO 165
   12 ISTTAB=I
      DO 13 I=1,4
      IF (SHEET.EQ.FACE(I)) GO TO 14
   13 CONTINUE
      GO TO 166
   14 THICK=I
```

```
                            SUBROUTINE LEBEGE
C     TEMPERATURE LOAD IDENTIFICATION
      DO 15 I=1,4
      IF (RANKIN.EQ.THERM(I)) GO TO 16
   15 CONTINUE
      GO TO 167
   16 KELVIN=I
C     LINEAR OR NONLINEAR ANALYSIS IDENTIFICATION
      DO 17 I=1,3
      IF (EQUATE(I).EQ.ANALYS) GO TO 18
   17 CONTINUE
      GO TO 179
   18 IANLYZ=I
      IF (IANLYZ.NE.1.AND.NPROB.GT.1) GO TO 160
      IF (IANLYZ.NE.1) XNL=1.0
      IF (XNL.NE.0.0.AND.XN.NE.0.0) GO TO 180
      NROW=0
      NROW=THICK+1
      IF (ISTTAB.EQ.1) NROW=11
      IF (ISTTAB.EQ.3) NROW=10
      WRITE (6,189)
      DO 19 I=1,NROW
      READ (1) (ST(I,J),J=1,NP)
      WRITE (6,185) (ST(I,J),J=1,NP)
   19 CONTINUE
      K=NROW+1
      JJ=1
      JJJ=6
      MM=1
      DO 32 NLC=1,NPROB
      JT=JJ
      JTT=JJJ
      L=0
      READ (1) (LST(J),J=JJ,JJJ),(TALE(I),I=1,16)
      IF (LST(JJ)) 161,21,20
   20 L=LST(JJ)
      IF (NLC.GT.1.AND.LST(JT).NE.0) GO TO 159
   21 JJ=JJ+1
   22 IF (LST(JJ)) 161,24,23
   23 L=L+1
   24 IF (JJ.EQ.JJJ) GO TO 25
      JJ=JJ+1
      GO TO 22
   25 IF (L.EQ.0) GO TO 31
      KK=K+L-1
      DO 26 M=K,KK
      READ (1) (ST(M,J),J=1,NP)
   26 CONTINUE
      IF (NLC.GT.1.OR.LST(1).EQ.0) GO TO 28
      WRITE (6,190)
      KY=K
```

SUBROUTINE LFBEGE

```
      KZ=K+LST(1)-1                                                     P1510
      DO 27 N=KY,KZ                                                     P1520
      WRITE (6,165) (ST(N,J),J=1,NP)                                    P1530
   27 CONTINUE                                                          P1540
      K=KZ+1                                                            P1550
   28 IF ((L-LST(JT)).EQ.0) GO TO 30                                    P1560
      WRITE (6,191) NLC                                                 P1570
      WRITE (6,192) (LST(J),J=JT,JTT)                                   P1580
      DO 29 N=K,KK                                                      P1590
      WRITE (6,165) (ST(N,J),J=1,NP)                                    P1600
   29 CONTINUE                                                          P1610
   30 CONTINUE                                                          P1620
   31 K=K+L-LST(JT)                                                     P1630
      JJ=JJJ+1                                                          P1640
      JJJ=JJ+5                                                          P1650
   32 MM=MM+1                                                           P1660
      IF (IANLYZ.EQ.1) GO TO 33                                         P1670
      KK=KK+1                                                           P1680
      IF (L.EQ.0) KK=NROW+1                                             P1690
      READ (1) (ST(KK,J),J=1,NP)                                        P1700
      WRITE (6,193) (ST(KK,J),J=1,NP)                                   P1710
   33 CONTINUE                                                          P1720
      NSAVE=NROW                                                        P1730
      JJ=NPROB*6                                                        P1740
      LT=0                                                              P1750
      DO 34 J=1,JJ                                                      P1760
   34 LT=LT+LST(J)                                                      P1770
      NTOTAL=LT+NSAVE                                                   P1780
      IF (XML.EQ.1.0) NTOTAL=NTOTAL+1                                   P1790
      NCONT=NTOTAL                                                      P1800
      IF (ISITAF-2) 35,39,36                                            P1810
   35 IF (IANLYZ.EQ.1.AND.L.EQ.0) KK=NROW                               P1820
      K=KK+1                                                            P1825
      KK=KK+15                                                          P1830
      NTOTAL=NTOTAL+15                                                  P1840
      GO TO 37                                                          P1850
   36 IF (IANLYZ.EQ.1.AND.L.EQ.0) KK=NROW                               P1860
      K=KK+1                                                            P1865
      KK=KK+9                                                           P1870
      NTOTAL=NTOTAL+9                                                   P1880
   37 READ (1) (KLGE(I),I=1,4)                                          P1890
      DO 38 I=K,KK                                                      P1900
   38 READ (1) (ST(I,J),J=1,NP)                                         P1910
   39 CONTINUE                                                          P1920
      READ (1) PHO1,PHO2,PHO3,PHO4                                      P1930
      READ (1) (OMAGX(KJ),KJ=1,NPROB)                                   P1940
      NEQNS=6*NPROB                                                     P1950
      DO 40 I=1,NEQNS                                                   P1960
   40 YICS(I)=0.0                                                       P1970
      READ (4) (YICS(I),I=1,NEQNS)                                      P1980
      NCYC=0                                                            P1990
      NSAVE=NROW                                                        P2000
```

TABLE D-3. (Continued)

SUBROUTINE LEBEGE

```
      IEND=0
      PRINT=TIC
      DTA=DTAU
      DTAU=0.0
      CALL FIXEM (MAGIN,MAGOUT,TIC,STEP,NEQNS,DTAU,EPSIL,DELTA,ERR,TIME,
     1DTIME,YICS,YPRED,YCORR,YDOT,YNEW,YDEV,FWDEL,TBDEL)
      GO TO 42
   41 CALL WAND (MAGIN,MAGOUT,TIC,STEP,NEQNS,DTAU,EPSIL,DELTA,ERR,TIME,D
     1TIME,YICS,YPRED,YCORR,YDOT,YNEW,YDEV,FWDEL,TBDEL)
   42 IF (MAGOUT.LE.0) GO TO 51
      IF (TIME.GT.STOP) GO TO 44
      IF (TIME.LT.STOP) GO TO 45
   43 IEND=-1
      GO TO 46
   44 IF (TIME.LE.(STOP+DIFF)) GO TO 43
      GO TO 154
   45 IF ((STOP-DIFF).LE.TIME) GO TO 43
      IF ((TIME+DTIME).GT.STOP) GO TO 49
      IF (PRINT.GT.TIME) GO TO 48
      PRINT=TIME+DTA
   46 IF (IOUT.NE.0) GO TO 181
   47 IF (IEND.GT.0) GO TO 155
      IF (IEND.LT.0) GO TO 183
   48 MAGIN=0
      GO TO 41
   49 DTIME=STOP-TIME
      DELTA=0.0
      GO TO 46
   50 NCYC=NCYC+1
      MAGIN=-1
      GO TO 41
   51 PHI=TIME
      ARG=PHI
      LL=NP+1
      DO 53 I=1,NP
      IF (ARG-ST(1,I)) 52,56,53
   52 IF (I-1) 156,156,54
   53 CONTINUE
      GO TO 157
   54 DO 55 IK=2,NTOTAL
   55 ST(IK,LL)=ST(IK,I-1)+(ST(IK,I)-ST(IK,I-1))*(ARG-ST(1,I-1))/(ST(1,I
     1)-ST(1,I-1))
      GO TO 58
   56 DO 57 IK=2,NTOTAL
   57 ST(IK,LL)=ST(IK,I)
   58 CONTINUE
C     THE UPDATED INTERPOLATED VALUES OF THE MATERIAL PROPERTY COEFFIC
C     IENTS ARE FOUND IN THE XMAT TABLE AND STORED IN THE XLAYER ARRAY
      L=(MAT-1)*2+1
      II=NXMAT(L)
```

SUBROUTINE LEBEGE

```
      III=NXMAT(L+1)
      M=1
      LL=NP+1
      GO TO (59,68,60,60), KELVIN
   59 L=NROW+1
      TEMPAV=(ST(L,LL)+ST(L+1,LL)+ST(L+2,LL)+ST(L+3,LL))/4.0
      ARG=TEMPAV
      GO TO 61
   60 ARG=ST(NROW+1,LL)
   61 DO 63 I=2,10
      IF (ARG-XMAT(II,I)) 62,64,63
   62 IF (I-2) 158,158,66
   63 CONTINUE
      GO TO 168
   64 L=II+1
      DO 65 J=L,III
      XLAYER(M)=XMAT(J,I)
   65 M=M+1
      GO TO 70
   66 L=II+1
      DO 67 J=L,III
      XLAYER(M)=XMAT(J,I-1)+(XMAT(J,I)-XMAT(J,I-1))*(ARG-XMAT(II,I-1))/(
     1XMAT(II,I)-XMAT(II,I-1))
   67 M=M+1
      GO TO 70
   68 L=II+1
      DO 69 J=L,III
      XLAYER(M)=XMAT(J,1)
   69 M=M+1
   70 GO TO (71,72,73), ITYPE
   71 ETHET=XLAYER(1)
      XNUTP=XLAYER(2)
      ALPHTH=XLAYER(3)
      EPHI=ETHET
      XNUPT=XNUTP
      ALPHPH=ALPHTH
      XGPT=ETHET/(2.0*(1.0+XNUPT))
      GO TO 74
   72 ETHET=XLAYER(1)
      EPHI=XLAYER(2)
      XNUTP=XLAYER(3)
      ALPHTH=XLAYER(4)
      ALPHPH=XLAYER(5)
      XGPT=XLAYER(6)
      XNUPT=ETHET*XNUTP/EPHI
      GO TO 74
   73 ETHET=XLAYER(1)
      EPHI=XLAYER(2)
      XNUTP=XLAYER(3)
      ALPHTH=XLAYER(4)
```

TABLE D-3. (Continued)

```
                                SUBROUTINE LEBEGE
      ALPHPH=XLAYER(5)                                                  P3010
      XGPT=XLAYER(6)                                                    P3020
      ER=XLAYER(7)                                                      P3030
      ES=XLAYER(8)                                                      P3040
      ALPHR=XLAYER(9)                                                   P3050
      ALPHS=XLAYER(10)                                                  P3060
      XNUPT=ETHET*XNUTP/EPHI                                            P3070
   74 CONTINUE                                                          P3080
      GO TO (75,78,81,82,83,84), KGEOM                                  P3090
C     GEOMETRY FOR ELLIPSE                                              P3100
   75 A=G1                                                              P3110
      BE=G2                                                             P3120
      BETA=BE                                                           P3130
      BESQ=BE**2                                                        P3140
      ASQ=A**2                                                          P3150
      SN=SIN(PHI)                                                       P3160
      CS=COS(PHI)                                                       P3170
      SNSQ=SN**2                                                        P3180
      CSSQ=CS**2                                                        P3190
      R2=A*SQRT(1.0/(SNSQ+BESQ*CSSQ))                                   P3200
      R2SQ=R2**2                                                        P3210
      RO=R2*SN                                                          P3220
      R1=R2*R2SQ*BESQ/ASQ                                               P3230
      BESQ=BE**2                                                        P3240
      RIDOT=0.0                                                         P3250
      IF (KGEOM.EQ.1.AND.BETA.NE.1.0) RIDOT=3.0*(R2*BETA/A)**2*(CS/SNSQ)P3260
     1*(R1*SN-RO)                                                       P3270
C     FOLLOWING EQUATIONS ARE FOR DISPLACED ELLIPSE                     P3280
      IF (SN.EQ.0.0) GO TO 76                                           P3290
      R2=R2-G3/SN                                                       P3300
      RO=RO-G3                                                          P3310
      GO TO 77                                                          P3320
   76 IF (G3.EQ.0.0) GO TO 77                                           P3330
      R2=1.0                                                            P3340
      RO=-G3                                                            P3350
   77 CONTINUE                                                          P3360
      GO TO 85                                                          P3370
C     GEOMETRY FOR OGIVE                                                P3380
   78 R1=G1                                                             P3390
      C=G2                                                              P3400
      SN=SIN(PHI)                                                       P3410
      CS=COS(PHI)                                                       P3420
      IF (SN.EQ.0.0) GO TO 79                                           P3430
      R2=R1-C/SN                                                        P3440
      GO TO 80                                                          P3450
   79 R2=1.0                                                            P3460
   80 RO=R1*SN-C                                                        P3470
      RIDOT=0.0                                                         P3480
      GO TO 85                                                          P3490
C     GEOMETRY FOR CONE                                                 P3500
```

SUBROUTINE LEGEGE

```
   81 CS=COS(G1)
      SN=SIN(G1)
      S=PHI
      S1=1.0/S
      R2=CS*SN*PHI
      RO=PHI*CS
      RIDOT=0.0
      GO TO 85
C     GEOMETRY FOR CYLINDER
   82 RO=G1
      SN=1.0
      CS=1.0
      RIDOT=0.0
      GO TO 85
C     MODIFIED  ELLIPSE
   83 XNEXP=G1
      A=G2
      XN1=1.0+XNEXP
      XN2=1.0/XN1
      XN3=XN1+1.0
      XN4=XN3+1.0
      XN5=XN4/XN1
      SN=SIN(PHI)
      CS=COS(PHI)
      R2=A*(2.0/(1.0+SN**XN1))**XN2
      R1=(A/2.0)*(R2/A)**XN3
      RO=R2*SN
      RIDOT=-XN3*A*(SN**XNEXP*CS/4.0)*(2.0/(1.0+SN**XN1))**XN5
      GO TO 85
C     PARABOLIC GEOMETRY
   84 SN=SIN(PHI)
      CS=COS(PHI)
      TAN=SN/CS
      SEC=1.0/CS
      F1=G1
      F2=G2
      F3=G3
      RO=-(F2+TAN)/(2.0*F3)
      R1=-SEC**3/(2.0*F3)
      R2=RO/SN
      RIDOT=-3.0*SEC**4*SN/(2.0*F3)
   85 TAN=SN/CS
C     THE FOLLOWING LOGIC DETERMINES ROTATIONAL INERTIAL LOADS AND
C     PUTS THEM INTO THE ST ARRAY AS STATIC LOADS
      LZAP=0
      DO 86 NNI=1,5
      LMERD(NNI)=0
      LPRES(NNI)=0
   86 LMONT(NNI)=0
   87 LZAP=LZAP+1
```

TABLE D-3. (Continued)

SUBROUTINE LEBEGE

```
      GO TO (88,89,89,89,89), LZAP
   88 KNK=3
      MIM=1
      GO TO 90
   89 KNK=KNK+6
      MIM=MIM+1
   90 DO 91 NI=1,KNK
   91 LMERD(MIM)=LMERD(MIM)+LST(NI)
      LMERD(MIM)=LMERD(MIM)+NSAVE
      LPRES(MIM)=LMERD(MIM)+1
      LMONT(MIM)=LMERD(MIM)+2
      IF (LZAP-NPROB) 87,92,92
   92 LL=NP+1
C     IF THICK=4, THE ELEMENT IS STIFFENED WITH EITHER RWAF OR STIO
C     IF THICK=1,2 OR 3 THE ELEMENT HAS NO STIFFENER
      IF (THICK.NE.4) GO TO 108
      YBARI=0.0
      YBARO=0.0
      TISZ=0.0
      TOSZ=0.0
C     IF ISTTAB=1, THE ELEMENT IS STIFFENED WITH STRINGERS AND/OR RINGS
C     IF ISTTAB=3, THE ELEMENT IS STIFFENED WITH 45 DEGREE WAFFEL (RWAF)
      IF (ISTTAB.EQ.1) GO TO 96
C     RWAF STIFFENED
      TEST1=ST(NCONT+5,LL)
      IF (TEST1) 93,94,94
   93 YBARO=ST(NCONT+5,LL)
      TOSZ=ST(NCONT+6,LL)
      GO TO 95
   94 YBARI=ST(NCONT+5,LL)
      TISZ=ST(NCONT+6,LL)
   95 HIZ=ST(NCONT+7,LL)
      TZ=ST(NCONT+8,LL)
      HOZ=ST(NCONT+9,LL)
      GO TO 103
C     STIO STIFFENED (STRINGERS AND/OR RINGS)
   96 TEST1=ST(NCONT+9,LL)
      TEST2=ST(NCONT+11,LL)
      IF (TEST1) 97,99,98
   97 YBARO=ST(NCONT+9,LL)
      TOSZ=ST(NCONT+10,LL)
      GO TO 99
   98 YBARI=ST(NCONT+9,LL)
      TISZ=ST(NCONT+10,LL)
   99 IF (TEST2) 100,102,101
  100 YBARO=ST(NCONT+11,LL)
      TOSZ=ST(NCONT+12,LL)
      GO TO 102
  101 YBARI=ST(NCONT+11,LL)
      TISZ=ST(NCONT+12,LL)
```

SUBROUTINE LEBEGE

```
  102 HIZ=ST(NCONT+13,LL)
      TZ=ST(NCONT+14,LL)
      HOZ=ST(NCONT+15,LL)
  103 GO TO (104,104,105,106,104,104), KGEOM
  104 DIS=YBARI*SIN(3.1415926-PHI)
      DOS=ABS(YBARO)*SIN(3.1415926-PHI)
      GO TO 107
  105 DIS=YBARI*SIN(GI)
      DOS=ABS(YBARO)*SIN(GI)
      GO TO 107
  106 DIS=YBARI
      DOS=ABS(YBARO)
  107 ROIS=RO-DIS
      ROOS=RO+DOS
      GO TO 113
C     NO STIFFENER ON SKIN ELEMENT
  108 TISZ=0.0
      TOSZ=0.0
      YBARI=0.0
      YBARO=0.0
      ROIS=0.0
      ROOS=0.0
      IF (THICK-2) 112,110,109
  109 HOZ=ST(4,LL)
      GO TO 111
  110 HOZ=ST(2,LL)
  111 TZ=ST(3,LL)
      HIZ=ST(2,LL)
      GO TO 113
  112 HIZ=ST(2,LL)
      TZ=0.0
      HOZ=0.0
  113 SSSI=(HIZ**2+HOZ**2+2.0*HIZ*HOZ+2.0*HOZ*TZ)/(2.0*HIZ+2.0*HOZ)
      SSSO=(HIZ**2+HOZ**2+2.0*HIZ*HOZ+2.0*HIZ*TZ)/(2.0*HIZ+2.0*HOZ)
      YBRI=-(HIZ/2.0)+SSSI
      YBRC=-(HIZ+TZ/2.0)+SSSI
      YBRO=(HOZ/2.0)-SSSO
      GO TO (114,114,115,116,114,114), KGEOM
C     ELLIPTICAL,SPHERICAL,MOD. ELLIPSE,OGIVAL,TOROIDAL,PARABOLOID
  114 ROI=RO-YBRI*SIN(3.1415926-PHI)
      ROC=RO-YBRC*SIN(3.1415926-PHI)
      ROO=RO-YBRO*SIN(3.1415926-PHI)
      GO TO 117
C     CONICAL, PLATE
  115 ROI=RO-YBRI*SIN(GI)
      ROC=RO-YBRC*SIN(GI)
      ROO=RO-YBRO*SIN(GI)
      GO TO 117
C     CYLINDER
  116 ROI=RO-YBRI
```

TABLE D-3. (Continued)

SUBROUTINE LEBEGE

```
      ROC=RO-YBRC
      ROO=RO-YBRO
  117 DO 118 IJK=1,NPROB
      XPLI1=PHO1*OMAGX(IJK)**2*ROI*HIZ
      XPLO1=PHO1*OMAGX(IJK)**2*ROO*HOZ
      XPL2=PHO2*OMAGX(IJK)**2*ROC*TZ
      XPL3=PHO3*OMAGX(IJK)**2*ROIS*TISZ
      XPL4=PHO4*OMAGX(IJK)**2*ROOS*TOSZ
  118 XPL(IJK)=XPLI1+XPLO1+XPL2+XPL3+XPL4
      GO TO (119,119,121,123,119,119), KGEOM
C     ELLIPTICAL,SPHERICAL,MODEFIED ELLIPSE,OGIVAL,TOROIDAL,PARABOLOID
  119 DO 120 KNI=1,NPROB
      XMERD(KNI)=-XPL(KNI)*COS(3.1415926-PHI)
      XPRES(KNI)=-XPL(KNI)*SIN(3.1415926-PHI)
      XMONT(KNI)=XPL3*COS(3.1415926-PHI)*YBARI+XPL4*COS(3.1415926-PHI)*Y
     1BARO
      XMONT(KNI)=XMONT(KNI)+XPLI1*COS(3.1415926-PHI)*YBRI+XPLO1*COS(3.14
     115926-PHI)*YBRO+XPL2*COS(3.1415926-PHI)*YBRC
      LKL=LMERD(KNI)
      ST(LKL,LL)=ST(LKL,LL)+XMERD(KNI)
      LKL=LPRES(KNI)
      ST(LKL,LL)=ST(LKL,LL)+XPRES(KNI)
      LKL=LMONT(KNI)
  120 ST(LKL,LL)=ST(LKL,LL)+XMONT(KNI)
      GO TO 125
C     CONICAL,PLATE
  121 DO 122 KNI=1,NPROB
      XMERD(KNI)=XPL(KNI)*COS(GI)
      XPRES(KNI)=-XPL(KNI)*SIN(GI)
      XMONT(KNI)=-XPL3*COS(GI)*YBARI-XPL4*COS(GI)*YBARO
      XMONT(KNI)=XMONT(KNI)-XPLI1*COS(GI)*YBRI-XPLO1*COS(GI)*YBRO-XPL2*C
     1OS(GI)*YBRC
      LKL=LMERD(KNI)
      ST(LKL,LL)=ST(LKL,LL)+XMERD(KNI)
      LKL=LPRES(KNI)
      ST(LKL,LL)=ST(LKL,LL)+XPRES(KNI)
      LKL=LMONT(KNI)
  122 ST(LKL,LL)=ST(LKL,LL)+XMONT(KNI)
      GO TO 125
C     CYLINDER
  123 DO 124 KNI=1,NPROB
      XMERD(KNI)=0.0
      XPRES(KNI)=-XPL(KNI)
      XMONT(KNI)=0.0
      LKL=LPRES(KNI)
  124 ST(LKL,LL)=ST(LKL,LL)+XPRES(KNI)
  125 CONTINUE
C
      DEGRES=0.0
      IF (IGEOM.EQ.1) DEGRES=PHI*57.29579
```

```
                              SUBROUTINE LEBEGE
      ROSQ=RO**2
      XNSQ=XN**2
      CN=CS*SN
      X1CS=1.0/CS
      TN=SN/CS
      X1RO=1.0/RO
      X1ROSQ=1.0/RO**2
      X1CSRO=1.0/(CS*RO)
      CN1RO=CN/RO
      SN1RO=SN/RO
      CS1RO=CS/RO
      SNSQ=SN**2
      CSSQ=CS**2
      IF (KGEOM.EQ.4.OR.KGEOM.EQ.3) GO TO 126
      R1SQ=R1**2
      R2SQ=R2**2
      X1SN=1.0/SN
      X1SNRO=1.0/(SN*RO)
      X1R1=1.0/R1
      X1R2=1.0/R2
      CS1R1=CS/R1
      CS1R2=CS/R2
      SN1R1=SN/R1
      X1R1SQ=1.0/R1**2
  126 XNTTH=0.0
      XNTPH=0.0
      XMTTH=0.0
      XMTPH=0.0
      IF (ITYPE.EQ.3) GO TO 136
C     COMPUTATION OF K AND D FOR MATERIAL PROPETY INPUT
      GO TO (127,130,133), THICK
C     SINGLE SHEET
  127 HI=ST(2,LL)
      TEMP1=ETHET*HI
      TEMP2=TEMP1*HI**2
      TEMP3=(1.0-XNUPT*XNUTP)
      XK11=TEMP1/TEMP3
      XD11=TEMP2/(12.0*TEMP3)
      IF (ITYPE.EQ.2) GO TO 128
      XK22=XK11
      XD22=XD11
      GO TO 129
  128 TEMP1=EPHI*HI
      TEMP2=TEMP1*HI**2
      XK22=TEMP1/TEMP3
      XD22=TEMP2/(12.0*TEMP3)
  129 XK33=XGPT*HI
      XD33=XK33*HI**2/12.0
      GO TO 139
C     EQUAL  SHEETS
```

SUBROUTINE LEBEGE

```
 130 HI=ST(2,LL)
     T=ST(3,LL)
     TEMP1=2.0*ETHET*HI
     TEMP2=HI*(4.0*HI**2+6.0*HI*T+3.0*T**2)
     TEMP3=(1.0-XNUPT*XNUTP)
     XK11=TEMP1/TEMP3
     XD11=ETHET*TEMP2/(6.0*TEMP3)
     IF (ITYPE.EQ.2) GO TO 131
     XK22=XK11
     XD22=XD11
     GO TO 132
 131 TEMP1=2.0*EPHI*HI
     XK22=TEMP1/TEMP3
     XD22=EPHI*TEMP2/(6.0*TEMP3)
 132 XK33=2.0*XGPT*HI
     XD33=XK33*TEMP2/(12.0*HI)
     GO TO 139
C    UNEQUAL SHEETS
 133 HI=ST(2,LL)
     T=ST(3,LL)
     HO=ST(4,LL)
     TEMP1=HI+HO
     TEMP2=TEMP1**4+12.0*HI*HO*T*(TEMP1+T)
     TEMP3=(1.0-XNUPT*XNUTP)
     XK11=ETHET*TEMP1/TEMP3
     XD11=ETHET*TEMP2/(12.0*TEMP1*TEMP3)
     IF (ITYPE.EQ.2) GO TO 134
     XK22=XK11
     XD22=XD11
     GO TO 135
 134 XK22=EPHI*TEMP1/TEMP3
     XD22=EPHI*TEMP2/(12.0*TEMP1*TEMP3)
 135 XK33=XGPT*TEMP1
     XD33=XGPT*(TEMP2/(12.0*TEMP1))
     GO TO 139
C    RANKIN=THSTND MEANS INTERPOLATE,COMPUTE NTEMP,MTEMP
C    RANKIN=NOTHRM MEANS DO NOT INTERPOLATE,DO NOT COMPUTE NTEMP,NTEMP
C    RANKIN=THCNST MEANS DO NOT INTERPOLATE,COMPUTE NTEMP,MTEMP
C    RANKIN=THINHO MEANS INTERPOLATE,BUT DO NOT COMPUTE NTEMP,MTEMP
 136 CONTINUE
     XK11=ST(2,LL)
     XK12=ST(3,LL)
     XK22=ST(4,LL)
     XK33=ST(5,LL)
     XD11=ST(6,LL)
     XD12=ST(7,LL)
     XD22=ST(8,LL)
     XD33=ST(9,LL)
     XC11=ST(10,LL)
     XK21=XK12
```

SUBROUTINE LEBEGE

```
      XD21=XD12
      IF (ISTTAB-2) 137,139,138
  137 K=NTOTAL-14
      XC22=ST(11,LL)
      ZINTH=ST(K,LL)
      ZOUTTH=ST(K+1,LL)
      ZINPH=ST(K+2,LL)
      ZOUTPH=ST(K+3,LL)
      SR=ST(K+4,LL)
      SS=ST(K+5,LL)
      TR=ST(K+6,LL)
      TS=ST(K+7,LL)
      GO TO 139
  138 K=NTOTAL-8
      ZINTH=ST(K,LL)
      ZOUTTH=ST(K+1,LL)
      SR=ST(K+2,LL)
      TR=ST(K+3,LL)
      ZINPH=ZINTH
      ZOUTPH=ZOUTTH
  139 GO TO (140,147,141,147), KELVIN
  140 TII=ST(NROW+1,LL)
      TIK=ST(NROW+2,LL)
      TOK=ST(NROW+3,LL)
      TOO=ST(NROW+4,LL)
      GO TO 142
  141 TII=ST(NROW+1,LL)
      TIK=TII
      TOK=TII
      TOO=TII
  142 CONTINUE
      TEMP1=ALPHTH+XNUTP*ALPHPH
      TEMP2=ALPHPH+XNUPT*ALPHTH
      TEMP3=1.0-XNUPT*XNUTP
      TEMP4=HI/4.0
      TEMP5=HI**2/24.0
      TEMP6=TII+TIK+TOK+TOO-4.0*TEFREE
      TEMP7=2.0*TII+TIK-TOK-2.0*TOO
      GO TO (143,144,145,146), THICK
  143 CONTINUE
      IF (ITYPE.EQ.3) GO TO 146
      IF (THICK.EQ.2) GO TO 144
      IF (THICK.EQ.3) GO TO 145
      XNTTH=ETHET*TEMP1*TEMP4*TEMP6/TEMP3
      XNTPH=EPHI*TEMP2*TEMP4*TEMP6/TEMP3
      XMTTH=ETHET*TEMP1*TEMP5*TEMP7/TEMP3
      XMTPH=EPHI*TEMP2*TEMP5*TEMP7/TEMP3
      GO TO 147
  144 TI=T/2.0
      TEMP8=HI/2.0
```

SUBROUTINE LEBEGE

```
      TEMP9=TII+TIK-TOK-TOO
      XNTTH=ETHET*TEMP1*TEMP8*TEMP6/TEMP3
      XNTPH=EPHI*TEMP2*TEMP8*TEMP6/TEMP3
      XMTTH=ETHET*TEMP1*TEMP8*(HI*TEMP7/3.0+TI*TEMP9)/TEMP3
      XMTPH=EPHI*TEMP2*TEMP8*(HI*TEMP7/3.0+TI*TEMP9)/TEMP3
      GO TO 147
  145 TI=(HO**2-HI**2+2.0*HO*T)/(2.0*(HI+HO))
      TO=(HI**2-HO**2+2.0*HI*T)/(2.0*(HI+HO))
      TEMP6=2.0*TII+TIK-3.0*TEFREE
      TEMP7=2.0*TOO+TOK-3.0*TEFREE
      TEMP8=TII+TIK-2.0*TEFREE
      TEMP9=TOK+TOO-2.0*TEFREE
      XNTTH=ETHET*TEMP1*0.5*(HI*TEMP8+HO*TEMP9)/TEMP3
      XNTPH=EPHI*TEMP2*0.5*(HI*TEMP8+HO*TEMP9)/TEMP3
      XMTTH=ETHET*TEMP1*0.5*(HI**2*TEMP6/3.0-HO**2*TEMP7/3.0+TI*HI*TEMP8
     1-TO*HO*TEMP9)/TEMP3
      XMTPH=EPHI*TEMP2*0.5*(HI**2*TEMP6/3.0-HO**2*TEMP7/3.0+TI*HI*TEMP8-
     1TO*HO*TEMP9)/TEMP3
      GO TO 147
  146 TEMP10=SQRT(-XK11*XD11)/SQRT(48.0)
      TEMP11=SQRT(-XK22*XD22)/SQRT(48.0)
      XNTTH=(XK11/4.0)*TEMP1*TEMP6
      XNTPH=(XK22/4.0)*TEMP2*TEMP6
      XMTTH=TEMP10*TEMP1*TEMP7
      XMTPH=TEMP11*TEMP2*TEMP7
C     COMPUTATION OF K AND D FOR K AND D INPUT
  147 LL=NP+1
      IF (XK11.EQ.0.0) GO TO 169
      IF (ITYPE.EQ.3.AND.XK12.EQ.0.) GO TO 170
      IF (ITYPE.EQ.3.AND.XK21.EQ.0.) GO TO 171
      IF (XK22.EQ.0.0) GO TO 172
      IF (XK33.EQ.0.0) GO TO 173
      IF (XD11.EQ.0.0) GO TO 174
      IF (ITYPE.EQ.3.AND.XD12.EQ.0.) GO TO 175
      IF (ITYPE.EQ.3.AND.XD21.EQ.0.) GO TO 176
      IF (XD22.EQ.0.0) GO TO 177
      IF (XD33.EQ.0.0) GO TO 178
      NL=0
      XNPHI=0.0
      IJKLMN=NROW+LST(1)+LST(2)+LST(3)+LST(4)+LST(5)+LST(6)+1
      IF (XNL.NE.0.0) XNPHI=ST(IJKLMN,LL)
      JF=NPROB
      K=NROW
      DO 153 M=1,JF
      I=(M-1)*8+1
      NL=NL+1
      XFTHLD=0.0
      XFPHLD=0.0
      XFZELD=0.0
      XMTHLD=0.0
```

TABLE D-3. (Continued)

SUBROUTINE LEBEGE

```
      XMPHLD=0.0
      IR=NL*6-5
      IF (LST(IR).NE.0) K=K+LST(IR)
      IF (LST(IR+1).EQ.0) GO TO 148
      K=K+1
      XFTHLD=ST(K,LL)
  148 IF (LST(IR+2).EQ.0) GO TO 149
      K=K+1
      XFPHLD=ST(K,LL)
  149 IF (LST(IR+3).EQ.0) GO TO 150
      K=K+1
      XFZELD=ST(K,LL)
  150 IF (LST(IR+4).EQ.0) GO TO 151
      K=K+1
      XMTHLD=ST(K,LL)
  151 IF (LST(IR+5).EQ.0) GO TO 152
      K=K+1
      XMPHLD=ST(K,LL)
  152 CONTINUE
      CALL ODE
  153 CONTINUE
      GO TO 50
  154 IERROR=8001
      NERROR=11
      GO TO 182
  155 IERROR=8002
      NERROR=12
      GO TO 182
  156 IERROR=8003
      NERROR=13
      GO TO 182
  157 IERROR=8006
      NERROR=14
      GO TO 182
  158 IERROR=8007
      NERROR=15
      GO TO 182
  159 IERROR=8008
      NERROR=10
      GO TO 182
  160 IERROR=8009
      NERROR=8
      GO TO 182
  161 IERROR=8031
      NERROR=9
      GO TO 182
  162 IERROR=8036
      NERROR=2
      GO TO 182
  163 IERROR=8086
```

SUBROUTINE LEBEGE

```
      NERROR=3
      GO TO 182
  164 IERROR=8087
      NERROR=4
      GO TO 182
  165 IERROR=8088
      NERROR=27
      GO TO 182
  166 IERROR=8089
      NERROR=5
      GO TO 182
  167 IERROR=8090
      NERROR=6
      GO TO 182
  168 IERROR=8067
      NERROR=16
      GO TO 182
  169 IERROR=8101
      NERROR=17
      GO TO 182
  170 IERROR=8102
      NERROR=18
      GO TO 182
  171 IERROR=8103
      NERROR=19
      GO TO 182
  172 IERROR=8104
      NERROR=20
      GO TO 182
  173 IERROR=8105
      NERROR=21
      GO TO 182
  174 IERROR=8106
      NERROR=22
      GO TO 182
  175 IERROR=8107
      NERROR=23
      GO TO 182
  176 IERROR=8108
      NERROR=24
      GO TO 182
  177 IERROR=8109
      NERROR=25
      GO TO 182
  178 IERROR=8110
      NERROR=26
      GO TO 182
  179 IERROR=8013
      NERROR=7
      GO TO 182
```

SUBROUTINE LEBEGE

```
      IERROR=8797
      NERROR=34
      GO TO 182
  180 IERROR=8501
      NERROR=35
      GO TO 182
C     THE HUBER VON MISSES STRESS EQUATIONS
  181 CALL OUTPUT (KLUE,YCORR,ER,ES,ALPHR,ALPHS,ZINTH,ZOUTTH,ZINPH,ZOUTP
     1H,SR,SS,TR,TS,NCYC,TIME,DEGRES,DTA,STEP,HI,HO,T,TII,TOO)
      IF (NIX.EQ.1) GO TO 184
      GO TO 47
  182 NIX=1
      GO TO 184
  183 IF (LSC.LT.KSC) GO TO 2
  184 RETURN
C
  185 FORMAT (1H ,8(E14.7,2X)/(3X,8(E14.7,2X)))
  186 FORMAT (1H1)
  187 FORMAT (//58X,13HREGION NUMBER,I3//35X,10HTHERE ARE ,I2,14H SEGMEN
     1TS AND ,I2,35H KINEMATIC LINKS WITHIN THIS REGION)
  188 FORMAT (//13X,15HSEGMENT NUMBER ,I2,5X,13HSEGMENT CODE ,I2,5X,16A4
     1)
  189 FORMAT (//42X,47HTABLE ORDER PHI OR S VS. CROSSECTION PROPERTIES)
  190 FORMAT (//45X,42HTABLE ORDER PHI OR S VS. TEMPERATURE LOADS,)
  191 FORMAT (//16X,8HPROBLEM ,I2,5X,84HTABLE ORDER  PHI OR S VS. DISTRI
     1BUTED LOADS (F THETA, F PHI, F ZETA, M THETA, M PHI),)
  192 FORMAT (27H LOAD IDENTIFICATION CLUES ,6I1/)
  193 FORMAT (//47X,38HASSUMED NON-LINEAR VALUES VS. PHI OR S//(1H ,8(E1
     14.7,2X)))
      END
```

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