N84 15592

# NASA/MSFC NASTRAN AUXILIARY I/O ROUTINES

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## ABSTRACT

Since the initial installation of NASTRAN on the UNIVAC 1100/82 computer at the Marshall Space Flight Center (MSFC), a number of "local" codes have been incorporated as "user routines." This paper describes four of these codes and how interested users may obtain additional information.

## INTRODUCTION

The MAP elements supplied by COSMIC/NASTRAN contain the user subroutine names OUTPT4, DUMOD3, etc., along with corresponding dummy subroutines. Locally generated "user routines" are compiled and the relocatable elements are copied over the dummy relocatables for mapping into the COSMIC/NASTRAN system. Several local codes have been generated for the MSFC computer installations by BCSS and its predecessors and incorporated into NASTRAN in this manner.

The routines were written in the FORTRAN V language as used with standard COSMIC/NASTRAN. All of the appropriate links were mapped using the MAP elements supplied with the COSMIC/NASTRAN package.

The "user routines" are described in the following format: 1) purpose of routine or function, 2) installation of routine into standard COSMIC/NASTRAN, 3) example showing use of the routine. Note that the routine names used in the text differ from the DMAP "calling" names.

## BACKGROUND/REQUIREMENTS

OUTPT4 - This module was written to create FORTRAN-written, unformatted user tapes containing banded matrix data recovered from NASTRAN matrix data blocks as requested by the user via the OUTPUT4 DMAP instruction. The data is in a simple compact, convenient form and contains no special labeling codes.

INPTT4 - Companion module to OUPT4, reads matrix data blocks from OUTPT4 tapes.

DUMOD3 - This module was created to convert NASTRAN tabular data blocks into matrix data block format for convenience in manipulation and output, especially by OUTPT4. The element or gridpoint identification data is also recovered and output separately.

INPTT3 - This routine uses coding supplied by Rockwell International (RI) for reading matrix data in that company's customary format into NASTRAN matrix data blocks. The RI data is in a compact Fortran-formatted coded form, which appears to have quite widespread acceptance in the aerospace field.

PFDR - Print File Data Retrieval post processor originally written to extract OUTPT4 data from the NASTRAN print file, it is particularly useful when data output is required from more than one link execution as occurs frequently during substructure recovery procedures. In such cases, the normal output files are rewound after each link has been executed, thus ensuring that subsequent executions of the output modules will overwrite earlier ones. The print file is, of course, rewind inhibited. The program has now been generalized to extract all types of data. The user is required to provide header information to enable the program to find the data on the NASTRAN print file.

## IMPLEMENTATION

1. OUTPT4 - Outputs selected matrices to binary file INP1.

   A. Entry Point - OUTPT4; SUBROUTINE: WRTAPE

   B. NASTRAN Link: LINK14

   C. DMAP Calling Sequence: OUTPUT4 I1,I2,I3,I4,I5//V,N,P1/V,N,P2 $

   D. Input Data Blocks: Ii - Any matrix data block which the user desires to be written on NASTRAN file INP1. Purged data blocks are ignored. Up to five data blocks may be output.

   E. Output Data Blocks: None.

   F. Method: The OUTPT4 routine checks to determine whether the matrix data block is purged. If it is not, a call is made to subroutine WRTAPE, which writes each column of the matrix onto the user tape INP1. Parameters P1 and P2 provide controls corresponding to those in the standard OUTPT2 module (q.v.).

   G. Example: A comprehensive example of OUTPT4 and INPTT4 usage is provided as part of the description for the latter routine.

2. INPTT4 - reads matrix data from an OUTPT4 file assigned to INP2 into a specified matrix data block.

A. Entry Point: INPTT4.

B. NASTRAN Link: LINK2.

C. DMAP Calling Sequence:

```
INPUTT4     /MDB,,,,/V,N,P1/V,N,P2/V,N,P3 $
```

D. Input Data Blocks: None.

E. Output Data Blocks:

MDB - Matrix data block to be loaded with data from user file INP2.

F. Method: Retrieves one matrix from user file INP2 for each call to the routine. This file may be the INP1 file generated by the OUTPT4 routine or a similar user-written FORTRAN file. The required format for this file and usage of parameters P1, P2 and P3 are described in the OUTPUT4 documentation.

G. Examples: The use of both INPTT4 and OUTPT4 is illustrated in the DMAP ALTER sequence of Figure 1. Two matrices are read from a file previously created by OUTPT4 and subsequently printed using the MATPRN module (Figure 2). The OUTPT4 listing is shown in Figure 3.

H. Notes:

1. The primary use of this routine is to enable the user to obtain NASTRAN generated matrices in a FORTRAN binary format for subsequent use in user-written Fortran programs. Similarly formatted matrices created by NASTRAN OUTPT4 or by user-written Fortran programs can be read into NASTRAN data blocks by using the companion INPTT4 module.

2. The order of retrieval of matrix data blocks must be in the order which they were written.

3. Matrices output by OUTPT4 will be written on file INP1. This tape must be assigned as INP2 in subsequent NASTRAN runs when using INPTT4 to recover the matrices. Parameter usage is discussed in the user documentation.

DMAP ALTER SEQUENCE FOR INPTT4
AND OUTPT4

```
ID RI ORBITER
APP       DISPLACEMENT
SOL    1,0
DIAG 8
TIME 150
$
$       INPUTS KO,MO INTO KORB,MORB
ALTER 36
INPUTT4/KORB,,,,/C,N,193/C,N,193/C,N,2 $
CHKPNT KORB $
MATPRN KORB,,,,//  $
OUTPUT4 KORB,,,,//C,N,1/C,N,1 $
EXIT
ENDALTER
CEND
```

FIGURE 1

MATRIX AFTER INPTT4 EXECUTION

MATRIX NORE (GINO NAME 101 ) IS A REAL 193 COLUMN X 193 ROW RECTANG MATRIX.

COLUMN 1 ROWS 1 THRU 193

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.79086+05 | -1.07880+05 | -1.53271+03 | -6.38503+02 | 8.54546+03 | 6.40303+04 | -2.67360+03 | 8.84492+03 | -6.21386+04 | 2.73919+04 |
| -1.54768+06 | -4.70712+04 | 6.09942+04 | 1.53621+04 | -3.93861+04 | -1.17151+04 | -5.08813+02 | 1.47939+04 | 9.36227+03 | -4.84386+03 |
| 6.15556+03 | 2.68374+03 | 3.49066+03 | -1.63617+04 | 6.73577+03 | 1.33630+03 | 3.31632+04 | 2.17698+03 | -1.00348+03 | 3.26114+03 |
| -3.42670+03 | -2.19477+03 | -3.61942+03 | -[illegible].61748+03 | -2.68431+02 | 9.47095+02 | -9.34969+01 | 2.66353+01 | 1.12780+02 | -2.29765+03 |
| -7.60216+01 | -5.16667+02 | 7.57949+02 | 2.66266+01 | -1.72016+02 | -1.03655+03 | -1.54797+01 | 3.82732+02 | 7.39621+02 | -3.20177+01 |
| -1.57521+02 | -2.14741+03 | -1.23374+01 | -1.35438+02 | 9.99146+02 | -4.34526+00 | -5.69904+00 | -1.04996+03 | 3.69262+02 | -3.20291+02 |
| 1.15503+03 | 3.42164+02 | 5.19558+02 | 1.05538+03 | -5.76568+02 | -6.72748+02 | -1.96999+03 | -2.32856+02 | 1.57918+02 | -1.07910+03 |
| 2.15553+01 | -1.19422+02 | 1.16498+03 | 2.92930+01 | 1.90114+02 | 9.38117+02 | -6.81263+01 | -3.15512+02 | -1.60142+03 | -3.24143+01 |
| 1.41490+02 | -1.03464+03 | 2.48042+01 | -9.36665+01 | 1.04907+03 | 1.83796+01 | 8.69191+01 | 7.54985+02 | .44715+01 | -1.96645+02 |
| -1.18709+03 | -2.84461+01 | 1.12674+02 | -8.79756+02 | 3.72626+01 | -1.82561+02 | 8.50141+02 | 1.08713+01 | .56671+01 | 6.50838+02 |
| -3.90209+01 | -2.03712+02 | -6.93611+02 | -3.46946+01 | 1.78353+02 | -6.85045+02 | 3.10612+02 | -5.57702+02 | 5.46569+02 | 1.01666+02 |
| 5.64183+02 | 6.43029+02 | -2.82404+02 | -5.66990+02 | -7.06079+02 | -2.51645+02 | 5.30664+02 | -4.04849+02 | 1.36917+01 | 2.60741+02 |
| 2.19636+02 | 4.63965+00 | 1.44420+01 | 2.77059+01 | -4.56488-01 | -6.25733+01 | 1.36373+02 | -6.38554+01 | -4.11779+02 | -4.41472+02 |
| -6.52806+00 | -2.66957+01 | -1.17255+02 | 7.17144-01 | -4.74618+00 | 2.43588+01 | 4.71118+01 | -2.71173+02 | 4.20144+02 | 4.79257-02 |
| -5.69695+01 | 5.72646+01 | 7.65008+00 | 6.06184+01 | -2.88660+02 | 2.26952-01 | 1.95195+00 | -5.90909-01 | 2.10491+00 | 1.60561+01 |
| 4.76758+01 | -5.07263-02 | -2.04308+00 | 4.20695+01 | -9.82156+00 | 5.32595+01 | 2.61094+01 | -4.23244-01 | 1.41385+01 | 6.24920+01 |
| -5.14583-01 | 6.76566-01 | 1.68200+01 | -1.03797+00 | 7.23572+00 | 6.22935+00 | 8.08687-01 | -4.14914+00 | 1.73934+00 | 1.06025+00 |
| 1.37097+00 | 1.34269+01 | 2.49711+00 | 4.64631+00 | 6.24980+00 | 1.17787+00 | -8.20952-01 | 1.37658+00 | -2.37244-01 | -2.08880+00 |
| 2.96312+00 | -2.64142-01 | -4.91156+00 | -7.96025-01 | 3.13635+01 | 1.63129-01 | 2.70938+00 | -1.01071+02 | 1.52410+02 | -2.48704+02 |
| -9.06665-01 | 1.15397+01 | -3.46547+00 | | | | | | | |

COLUMN 2 ROWS 1 THRU 193

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| -1.07680+05 | 7.80277+04 | 3.78717+02 | 4.84821+01 | -2.72850+03 | -2.29513+04 | 4.10128+02 | -7.47900+03 | 5.99746+04 | -1.93296+04 |
| 1.25611+06 | 4.59847+04 | -7.19089+04 | -1.46343+04 | 3.32303+04 | 1.24812+04 | 5.92197+02 | -1.33631+04 | -8.51639+03 | 1.46401+03 |
| -2.19433+03 | -8.66012+02 | -3.31926+03 | 1.43461+04 | -6.19309+03 | -4.63644+02 | -1.17[illegible] | -1.12324+03 | 3.11155+02 | -1.17374+03 |
| 1.13243+03 | 1.96333+03 | 3.45384+03 | 4.98311+03 | 2.11648+02 | -7.16707+02 | 6.84461+00 | -2.91820+01 | -8.73917+01 | 2.10733+03 |
| 1.27005+01 | 2.45799+02 | -1.54587+02 | -4.74296+00 | 6.88539+01 | 2.70197+02 | 6.90104+01 | -3.21252+02 | -8.21585+02 | 2.85750+01 |
| 1.44660+02 | 1.99067+03 | 3.45443+00 | 5.31798+01 | -1.90102+02 | -2.94866-01 | -7.22724+00 | [illegible].68983+02 | -3.88881+02 | 2.15175+02 |
| -1.19341+03 | -7.54566+01 | -2.32562+02 | -2.17128+02 | 5.34791+02 | 6.00126+02 | 1.82614+03 | 5.85032+01 | -9.79095+01 | 3.02524+02 |
| -2.77598+01 | 7.64857+01 | -1.16145+03 | -4.15585+00 | -9.02279+01 | -2.03676+02 | 6.40158+01 | 2.80505+02 | 1.47875+01 | 6.51373+00 |
| -6.63792+01 | 3.26210+02 | -2.62652+01 | 7.14960+01 | -1.01601+03 | -2.47024+00 | -4.46580+01 | -1.75672+02 | 4.16296+01 | 1.74586+02 |
| 1.09045+03 | 7.44772+00 | -4.74208+01 | 2.89200+02 | -3.63576+01 | 1.53209+02 | -8.15345+02 | -7.88534-01 | -2.74319+01 | -1.61877+02 |
| 1.64905+01 | 1.80437+02 | 8.16692+02 | 1.04523+01 | -6.90073+01 | 2.33094+02 | -2.87133+02 | 4.79428+02 | -5.21938+02 | -2.43399+01 |
| -2.61672+02 | -1.69164+02 | 2.56902+02 | 5.12662+02 | 6.39723+02 | 8.73120+01 | -1.94494+02 | 1.43266+02 | -3.93256+00 | -1.11022+02 |
| -6.37532+01 | -1.31266+00 | -6.[illegible]650+00 | -7.51408+00 | 5.94258-01 | 5.81775+01 | -1.19143+02 | 5.68683+01 | 3.76033+02 | 3.92645+02 |
| 5.46702+00 | 3.10629+01 | 9.73273+01 | -1.03893-01 | 1.74398+00 | -6.15400+00 | -4.00566+01 | 2.46100+02 | -3.99636+02 | -2.89630-02 |
| 5.42260+01 | -5.16205+01 | -1.94243+00 | -1.81472+01 | 1.14181+02 | -7.37161-02 | -2.55942-01 | 7.36607-01 | -1.99816+02 | -1.65157+01 |
| -2.82206+01 | 2.16811-02 | -5.29304-01 | -1.44526+01 | 3.51927+00 | -1.93752+01 | -7.10170+00 | 8.03655-02 | -5.01926+00 | -1.94298+01 |
| 2.67359-01 | -4.73375-02 | -5.11472+00 | 4.35691-01 | -3.70056+00 | 1.29257+00 | -5.46232-01 | 2.47012+00 | 1.48973-01 | -2.81585-01 |
| -5.64612-02 | -4.67473+00 | -7.45290-01 | -1.99082+00 | -1.87545+00 | -1.00706+00 | 1.84796+00 | -9.70227-01 | 4.25375-01 | 1.17811+00 |
| 1.74965+00 | 3.97548-01 | 2.15048+00 | 4.09710-01 | -1.31423+01 | -6.94961-01 | -3.43634-01 | 4.78766+00 | 3.83699+01 | 6.42061+01 |

FIGURE 2

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# OUTPT4 MATRIX LISTING

```
MATRIX KCRB     UNPACKED AND WRITTEN ON TAPE.

GINO FILE NAME=  101
NO. COLS. = 193
NO. ROWS = 193
TY  = 2
FORM= 2

OPEN CORE LENGTH=  36594
GINO SYSTEM BUFFER= 1795
USABLE OPEN CORE=36799

COLUMN    1

 II=   1   N= 193
 .1790857108039+006  -.1070802100991+006  -.1532708640968+004  -.6165026951153+003   .7545464843010+004   .6403030360934+005
-.2673600845623+004   .8844920017724+004  -.6213861779810+005   .2739188383247+005  -.1547679524046+007  -.4707124617770+005
 .6099420679363+005   .1536206164633+005  -.3938612643212+005  -.1171509024528+005  -.5088128766001+003   .1479387001415+005
 .9362272126090+004  -.4843659214373+004   .6155562610045+004   .2463737834851+004   .2490677110229+004  -.1636165989186+005
 .6735770449507+004   .1336301318293+004   .3316316335123+005   .2176982854405+004  -.1003463916202+004   .3281135544283+004
-.3626002142587+004  -.2194766360603+004  -.3619421717613+004  -.5617481757276+004  -.7084305349123+003   .9470951048585+003
-.5349685550314+002   .2663534391763+002   .1127796933001+003  -.2297650245831+004  -.7602159498467+002  -.5166065282883+003
 .7575491185106+003   .2682656532985+002  -.1720181949317+003  -.1036549079198+004  -.7547968209903+002   .3027317573765+003
 .7396217176657+003  -.3201774781404+002  -.1575210126383+003  -.2147413179671+004  -.1233743098644+002  -.1354378013309+003
 .5991463670001+003  -.4345257456503+001  -.5699040378869+001  -.1049955249227+004   .3692623286508+003  -.3202911956276+003
 .1155033701661+004   .3421642870815+003   .5195578603696+003   .1055376044595+004  -.5765676611441+003  -.6727475970099+003
-.1969993662252+004  -.2326556279863+003   .1579162593593+003  -.1079104985216+004   .2155525231198+002  -.1194217003372+003
 .1164979081846+004   .2929297363163+002   .1901142676756+003   .9361173021657+003  -.6812629761895+002  -.3155117926546+003
-.1601417434624+004  -.3241932042641+002   .1414856985516+003  -.1034835752678+004   .2480421662040+002  -.5366651849072+002
 .1045066672165+004   .1837960574217+002   .8691912739453+002   .7549850252905+003  -.4447150924321+002  -.1966447772531+003
-.1187088729060+004  -.2844809614265+002   .1126235648311+003  -.8797578736642+003   .3772625827526+002  -.1825613965927+003
 .8501410943059+003   .1087127637355+002   .4566714262409+002   .6506377595386+003  -.3902093471358+002  -.2037119876633+003
-.8936108448005+003  -.3469464183141+002   .1783526738817+003  -.6850445847144+003   .3106118124679+003  -.5577020424492+003
 .5465690946355+003   .1016658121785+003   .5941833169289+003   .6430286811313+003  -.2024036722346+003  -.5689900583475+003
-.7660785959702+003  -.2516449911346+003   .5306638631900+003  -.4048493300542+003   .1369168729965+002   .2607409538874+003
 .2190380410756+003   .4639846643713+001   .1444196155122+002   .2770589858948+002  -.4564862078858+000  -.6257328791826+002
 .1363726856791+003  -.6385538818736+002  -.4117792304944+003  -.4414720702665+003  -.6528063642309+001  -.2669566232166+002
-.1172551697132+003   .7171436963886+000  -.4746179520887+001   .2438678525460+002   .4711177366701+002  -.2711727086186+003
 .4201440597444+003   .4792569061435-001  -.5896946657473+002   .5726457006672+002   .7850061358559+001   .6061842060605+002
-.2684595624857+003   .2269520454896+000   .1451950659934+001  -.5909092969711+000   .2104906544339+001   .1605611469048+002
 .4767560151427+002  -.5072626679920-001  -.2043084751106+001   .4786950657478+002  -.9821556386136+001   .5325953648363+002
 .2610939438697+002  -.4232443730466+000   .1413848393641+002   .6249197936927+002  -.5145811078370+000   .6765662240254+000
 .1681995507548+002  -.1037971864893+001   .7235715943354+001   .6729346150247+001   .8086865262964+000  -.4169139696497+001
 .1739339341986+001   .1060246369173+001   .1370916371773+001   .1342893082165+002   .2497107900626+001   .5646307378245+001
 .6249797704870+001   .1177865923166+001  -.8209519510192+000   .1376577604860+001  -.2372438215008+000  -.2088798443471+001
 .2463121222749+001  -.2641419138353+000  -.4911555850387+001  -.7960248661158+000   .3136351948590+002   .1631290323414+000
 .2704375489809+001  -.1010112529194+003   .1524097438662+003  -.2487043367031+003  -.9068651229227+000   .1153969372898+002
-.3465073142709+001

COLUMN    2

 II=   1   N= 193
-.1078802100991+006   .7802773625755+005   .3787167228733+003   .4848213354613+002  -.2728499669663+004  -.2295130713837+005
 .4101276314431+003  -.7478996330604+004   .5997463476713+005  -.1032958855025+005   .1258108212040+007   .4598469445369+005
-.7196865403632+005  -.1463434061053+005   .3373032622675+005   .1248118227817+005   .5921970300954+003  -.1336305178872+005
```

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FIGURE 3

3. DUMOD3

A. Entry Point: DUMOD3

B. NASTRAN Link: LINK7

C. DMAP Calling Sequence:

DUMMOD3 TDB,,,,,,,/MDB,,,,,,,/C,N,P1/C,N,0 $

D. Input Data Blocks:

TDB NASTRAN Table Data Block.

E. Output Data Blocks:

MDB NASTRAN Matrix Data Blocks.

F. Method: Converts tabular data blocks into matrix data block format. Up to eight data blocks may be converted. The tables are mapped into a P1 x 8 matrix and the grid point/element ID's into array LTLID which is listed and punched on cards.

G. Examples: The example illustrates how the SPCFORCE (OQG table) can be reformatted using the DMAP sequence shown in Figure 4. The LTLID array of gridpoint ID numbers is shown in Figure 5. Figure 6 shows the NASTRAN SPCFORCE output and Figure 7 shows the corresponding DUMOD3 matrix, IFLOAD, as output using OUTPT4.

DUMOD3 AND OUTPT4 DMAP INSTRUCTIONS

```
120  DUMMOD3   OQG,,,,,,,/IFLOAD,,,,,,,/C,N,100/C,N,0  $
121  CHKPNT    IFLOAD  $
122  OUTPUT4   IFLOAD,,,,//C,N,0/C,N,1  $
```

FIGURE 4

LTLID (ELEMENT/GRIDPOINT ID) ARRAY PRINTED AND PUNCHED BY DUMOD3

```
@XQT   *NASTRAN.LINK7

*** DIAG  8 MESSAGE -- TRAILER FOR DATA BLOCK IFLOAD    =        6      800       2       1     237    2962
      201        6       600        2        1
LUCKY YOU - MISSION ACCOMPLISHED

 LTLID ARRAY FOLLOWS
    50100    50200    50300    50400   200300   200700   201000   201300   201700   202100   205300   206000   206400

   207500   207600   207700   208000   208500   208800   209200   210500   211200   211300   211800   211900   213400

   213700   214100   214800   215900   217500   218200   219700   220100   220200   220500   220700   220800   220900

   221000   221200   221600   221700   222000   222200   222500   227900   228300   228700   229300   229400   230000

   260100   260200   260300   260400   260500   260600   260700   260800   260900   261000   262100   262200   300100

   300200   300300   300400   300500   300600   300700   300800   300900   301000   301100   301200   301300   301400

   301500
```

FIGURE 5

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

| POINT ID. | TYPE | T1 | T2 | T3 | R1 | R2 | R3 |
|---|---|---|---|---|---|---|---|
| 501 | G | -1.206804-05 | 1.199143-04 | 1.613958-04 | .0 | .0 | .0 |
| 502 | G | 4.743631-06 | -2.396741-04 | -1.591604-04 | .0 | .0 | .0 |
| 503 | G | 1.039475-05 | 1.796075-04 | 1.850083-04 | .0 | .0 | .0 |
| 504 | G | -4.584176-06 | -4.991144-05 | 1.962856-05 | .0 | .0 | .0 |
| 2003 | G | 6.776796-04 | -4.590919-03 | -2.676502-05 | .0 | .0 | .0 |
| 2007 | G | 8.541583-03 | -4.224124-03 | 3.366251-05 | .0 | .0 | .0 |
| 2010 | G | -2.066444-03 | -1.081322-02 | -3.450337-05 | .0 | .0 | .0 |
| 2013 | G | -8.890361-04 | -1.502390-02 | -7.701640-05 | .0 | .0 | .0 |
| 2017 | G | 3.489469-03 | 2.208480-02 | 3.170490-04 | .0 | .0 | .0 |
| 2021 | G | 1.604019-03 | -1.295724-03 | -6.565984-06 | .0 | .0 | .0 |
| 2053 | G | 4.066217-03 | -6.056302-03 | -3.244750-05 | .0 | .0 | .0 |
| 2060 | G | -2.663704-03 | 2.597022-02 | -1.893663-04 | .0 | .0 | .0 |
| 2064 | G | -5.511136-03 | 3.506613-02 | -6.132162-05 | .0 | .0 | .0 |
| 2075 | G | -2.132388-04 | -1.438704-02 | 1.652850-05 | .0 | .0 | .0 |
| 2076 | G | 6.916324-03 | 5.005876-03 | 3.090334-06 | .0 | .0 | .0 |
| 2077 | G | -1.588821-02 | -1.470724-02 | -1.176732-05 | .0 | .0 | .0 |
| 2080 | G | 1.702856-02 | -2.640372-03 | 2.055777-06 | .0 | .0 | .0 |
| 2085 | G | -7.705988-04 | 5.992521-03 | 4.369031-05 | .0 | .0 | .0 |
| 2088 | G | -6.792754-03 | -1.247024-02 | 6.748242-05 | .0 | .0 | .0 |
| 2092 | G | -5.295667-03 | -1.091623-02 | -1.549079-04 | .0 | .0 | .0 |
| 2105 | G | 3.217898-03 | 2.227146-03 | 3.284419-05 | .0 | .0 | .0 |
| 2112 | G | 2.620365-04 | -2.599823-02 | 8.186604-05 | .0 | .0 | .0 |
| 2113 | G | 3.677660-03 | 1.458527-02 | 4.641478-05 | .0 | .0 | .0 |
| 2118 | G | -4.814373-03 | -1.145327-02 | 1.504774-05 | .0 | .0 | .0 |
| 2119 | G | 3.294960-03 | 9.743377-03 | -4.582586-05 | .0 | .0 | .0 |
| 2134 | G | -6.645710-03 | 2.721332-02 | -3.786112-05 | .0 | .0 | .0 |
| 2137 | G | 5.345116-03 | 1.546585-02 | -5.719251-06 | .0 | .0 | .0 |
| 2141 | G | 5.601869-03 | 8.156471-03 | -1.156974-04 | .0 | .0 | .0 |
| 2148 | G | -4.004943-03 | -5.853392-03 | -3.789817-05 | .0 | .0 | .0 |
| 2159 | G | -1.881301-03 | -2.715342-02 | -4.199450-05 | .0 | .0 | .0 |
| 2175 | G | -4.314905-03 | 1.686265-02 | -3.387852-05 | .0 | .0 | .0 |
| 2182 | G | -1.063962-02 | -1.892261-02 | 1.339583-06 | .0 | .0 | .0 |
| 2197 | G | 6.898105-03 | -4.473658-03 | 5.992265-06 | .0 | .0 | .0 |
| 2201 | G | -1.200352-03 | -1.297658-02 | -6.877478-05 | .0 | .0 | .0 |
| 2202 | G | -1.789929-03 | -2.374511-03 | 5.776048-05 | .0 | .0 | .0 |
| 2205 | G | 1.422085-03 | 2.387991-03 | -3.556397-06 | .0 | .0 | .0 |
| 2207 | G | 4.545874-03 | -1.132318-02 | 3.139352-05 | .0 | .0 | .0 |
| 2208 | G | 4.005946-03 | 1.341997-02 | 3.141458-05 | .0 | .0 | .0 |
| 2209 | G | -3.969116-03 | 1.414541-02 | -6.278013-05 | .0 | .0 | .0 |
| 2210 | G | 5.832229-04 | 1.905805-02 | -2.440898-05 | .0 | .0 | .0 |
| 2212 | G | -1.365599-03 | -3.370628-02 | -1.837631-06 | .0 | .0 | .0 |
| 2216 | G | 4.266109-04 | -1.273158-02 | 1.448176-05 | .0 | .0 | .0 |
| 2217 | G | -6.719694-04 | -6.144261-03 | -2.363826-05 | .0 | .0 | .0 |
| 2220 | G | 3.261826-05 | 9.935439-03 | 2.497232-05 | .0 | .0 | .0 |
| 2222 | G | -2.091690-03 | 8.261646-03 | -2.359926-05 | .0 | .0 | .0 |

NASTRAN SFCFORCE OUTPUT LISTING
FIGURE 6

```
MATRIX IFLOAD   UNPACKED AND WRITTEN ON TAPE.

GINO FILE NAME=  101
NO. COLS. =    6
NO. ROWS = 800
TYPE= 1
FORM= 2

OPEN CORE LENGTH= 113066
GINO SYSTEM BUFFER= 1795
USABLE OPEN CORE=*****

COLUMN    1

II=    2    N= 628
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| -.12068036-04 | .11991427-03 | .16139576-03 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .47436311-05 | -.23967405-03 | -.15916036-03 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .10394751-04 | .17950747-03 | .16500830-03 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.45541763-05 | -.49911439-04 | .19628555-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .87767962-03 | -.45979189-02 | -.26705019-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .85415825-02 | -.42241237-02 | .33662506-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.20664438-02 | -.10813224-01 | -.34503365-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.86903608-03 | -.15023900-01 | -.77016397-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .34894688-02 | .22094805-01 | .31704697-03 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .16049189-02 | -.12957244-02 | -.65659036-05 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .40662169-02 | -.60563016-02 | -.32447500-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.26637043-02 | .25970218-01 | -.18936626-03 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.55111363-02 | .35056128-01 | -.61321673-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.21323083-03 | -.14357036-01 | .16528504-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .6[illegible]163244-02 | .50058757-02 | .30903344-05 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.15888205-01 | -.14707240-01 | -.11767316-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .17028559-01 | -.26473725-02 | .20552766-05 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.77059880-03 | .59925207-02 | .43690311-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.67927536-02 | -.12470242-01 | .67462472-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.52956668-02 | -.10916229-01 | -.15490788-03 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .32178978-02 | .22271459-02 | .32844188-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .26263655-03 | -.25998233-01 | .81866044-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .36776596-02 | .14595273-01 | .46414777-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.48143731-02 | -.11453275-01 | .15047738-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .32948604-02 | .97433770-02 | -.45825860-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.66457099-02 | .27213320-01 | -.37861124-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .53451161-02 | .15465854-01 | -.57192513-05 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .56018686-02 | .81564706-02 | -.11569742-03 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.46049429-02 | -.58533918-02 | -.37898167-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.1[illegible]813013-02 | -.27153418-01 | -.41994500-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.43149046-02 | .16862650-01 | -.33878517-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.10639619-01 | -.18922612-01 | .13395834-05 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .68981051-02 | -.44736578-02 | .59922645-05 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.12003521-02 | -.12976578-01 | -.68774775-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.17899293-02 | -.23745111-02 | .57760480-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .14228848-02 | .23679906-02 | -.35563966-05 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .45458743-02 | -.11323180-01 | .31393525-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .40059464-02 | .13419974-01 | .31414580-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| -.39691163-02 | .14145413-01 | -.62760133-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |
| .56322291-03 | .19058050-01 | -.24408977-04 | .00000000 | .00000000 | .00000000 | .00000000 | .00000000 |

FIGURE 7

OUTPT4 LISTING OF DUMOD3 MATRIX FORMATTED SPCFORCE TABLE

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4. INPTT3 - Reads matrix data from an RI-formatted file assigned to INPT into specified matrix data blocks.

A. Entry Point: INPTT3.

B. NASTRAN Link: LINK2

C. DMAP Calling Sequence:

```
INPUTT3    KO,MO,,,/KX,MX,,,/C,N,-1/C,N,0/C,N,0 $
```

D. Input Data Blocks: RI formatted matrices from file INPT.

E. Output Data Blocks: All NASTRAN matrix data blocks.

F. Method: Reads the matrices from an RI-formatted data file into NASTRAN matrix data blocks. Up to five matrices may be read.

G. Examples: Figure 8 shows the DMAP ALTER sequence required for loading two matrices into the Normal Modes Analysis Rigid Format and adding them into the mass and stiffness matrices. The diagnostic messages printed by NASTRAN to indicate successful completion of the INPUTT3 instruction are shown in Figure 9.

H. Notes: The file INPT must be assigned containing the RI-formatted data.

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INPUTT3 DMAP ALTER SEQUENCE

```
ID   RI ORBITER
APP       DISPLACEMENT
SOL       3,0
TIME 150
$
$            INPUTS KO, MO INTO KORB, MORB
ALTER 36
INPUTT3   KO,MO,,,/KORB,MORB,,,/C,N,-1/C,N,0/C,N,0  $
CHKPNT    KORB,MORB  $
$
$           FORMS KF1, MF1 AND ADDS KORB, MORB FORMING KFF, MFF
ALTER 71,72
EQUIV     KNN,KF1/SINGLE/MNN,MF1/SINGLE  $
CHKPNT    KF1,MF1  $
ALTER 74,75
SCE1      USET,KNN,MNN,,/KF1,KFS,,MF1,,  $
CHKPNT    KFS,KF1,MF1  $
ALTER 76
ADD5      KF1,KORB,,,/KFF  $
CHKPNT    KFF  $
ADD5      MF1,MORB,,,/MFF  $
CHKPNT    MFF  $
ENDALTER
CEND
```

FIGURE 8

NASTRAN MESSAGE TO DENOTE INPUTT3 MATRIX ENTRY

```
@XQT NASTRAN*NASTRAN.LINK2
 DATA BLOCK KO          FOUND WHILE SEARCHING FOR KORB
 MATRIX BLOCK KORB        IS OF SIZE  797 BY  797 AND TYPE      6

 *** DIAG  8 MESSAGE -- TRAILER FOR DATA BLOCK KORB       =         797        797
 DATA BLOCK MO          FOUND WHILE SEARCHING FOR MORB
 MATRIX BLOCK MORB        IS OF SIZE  797 BY  797 AND TYPE      6

 *** DIAG  8 MESSAGE -- TRAILER FOR DATA BLOCK MORB       =         797        797
```

FIGURE 9

5. PFDR - Print File Data Retrieval post processor

A. Method:

Repeated executions of OUTPUT4 and other output modules within a single NASTRAN run (especially in DMAP Looping) will cause previously written matrix data blocks on INP1 to be overwritten by subsequent calls to the output module. This being a system characteristic, the problem could not be resolved internally. The matrices were preserved in their entirety, however, when written by OUTPUT4 onto the NASTRAN print file. Hence, the print file is saved for subsequent input to a post-processor which extracts the matrices and writes them to a single file, which may be copied to tape for later processing. This approach enables the user to obtain the results of a number of output requests in a single run.

B. Input to PFDR:

The input to the post-processor is simply the NASTRAN printout file itself. This file can be obtained by the instruction @BRKPT PRINT$/FILENAME on the UNIVAC computer. This instruction simply diverts the symbolic print data to the previously assigned file FILENAME, which can then be read by PFDR.

C. The PFDR Post-Processor:

The NASTRAN print file is converted to ASCII code to enable it to be read by the post-processor. The data "key phrase" is input to the post-processor. If no "key" is given, the processor automatically defaults to OUTPUT4 data.

D. Output Data:

The output data will contain the OUTPT4 matrices or the particular data identified by the key phrase. This data is usually copied to tape for subsequent use. The data formats are described in the user documentation.

E. Implementation:

PFDR is currently not available on the MSFC IBM system.

F. Example: A sample runstream is shown in Figure 10.

## E. Examples

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PFDR SAMPLE RUNSTREAM

```
$
$          PRINT FILE DATA RETRIEVAL
$
@DELETE,C PRXXXX.
@DELETE,C OPXXXX.
@CAT,P PRXXXX,F/1/POS/200
@ASG,A PRXXXX.
@BRKPT PRINTS/PRXXXX
@XQT *NASTRAN.LINK1

(NASTRAN RUN)

@BRKPT PRINTS
@USE 31,OPXXXX.
@ED,UQ PRXXXX.
EXIT
@ASG,A C*NASTRAN.
@PRT,TC C*NASTRAN.
@XQT C*NASTRAN.X
@ED,UP OPXXXX.
EXIT
@ASG,TJ OP4TP,U9S,SAVE04 . PALIIFF
@COPY,GMC OPXXXX.,OP4TP.
@COPY,GMC OPXXXX.,OP4TP.
@FREE OP4TP.
@FREE PRXXXX.
@FREE OPXXXX.
@SYM PRXXXX.,,MHSP
@SYM OPXXXX.,,MHSP
```

KEY:

| | |
|---|---|
| PRXXXX | - FILE TO WHICH PRINTOUT IS DIVERTED |
| OPXXXX | - FILE TO WHICH EXTRACTED DATA IS WRITTEN |
| 31 | - ALTERNATE PRINT FILE DYNAMICALLY ATTACHED TO OPXXXX |
| C*NASTRAN.X | - EXECUTABLE ELEMENT OF PFDR |
| OP4TP | - TAPE TO WHICH OPXXXX IS COPIED |
| MHSP | - DENOTES PHYSICAL UNIT FOR PRINTER |

FIGURE 10

## SUMMARY

The MSFC COSMIC/NASTRAN Auxiliary I/O routines provide useful, additional capabilities for input and output of various matrices and tables between external files and NASTRAN. The PFDR print file post-processor allows the user to extract any type of data that is available from the NASTRAN print file. These routines are in frequent use on the MSFC UNIVAC 1100 and IBM systems.

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