SORTED OUTPUT IN MSC/NASTRAN

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ABSTRACT

MSC/NASTRAN offers the capability to sort both forces and stresses. This capability will be demonstrated for static superelement output - DMAP1. Five sorting options exist. These options are: 1. SORT1 vs. SORT2 output, 2. selection of a specific stress or force to be sorted, 3. subcases to be sorted, 4. element set to be sorted, and 5. type of sort.

SORTED OUTPUT IN NASTRAN

TABLE OF CONTENTS

SORTED OUTPUT IN MSC/NASTRAN

SORTING CAPABILITIES

MSC/NASTRAN offers five options in sorting. These options are: 1.SORT1 vs. SORT2 output, 2. selection of a specific stress or force to be sorted, 3. subcases to be sorted, 4. element set to be sorted, and 5. type of sort. Static superelement output defaults to SORT1 output - stresses and forces are grouped by subcase; SORT2 groups the output by ELEMENT ID. Thus, sorted SORT1 presents maximum elements for a subcase; whereas SORT2 maximum subcases for an element. The user also chooses specific forces or stresses to be sorted. For example, one can even sort on the angle for principal stresses. In addition, both subcase and element-ID sets may be specified. Finally, the user will option for absolute or algebraic maxima;* the number of ordered stresses (or forces) to be output, and a cut-off level for output. With these sorting capabilities, one is able to tailor the static superelement output into many forms.

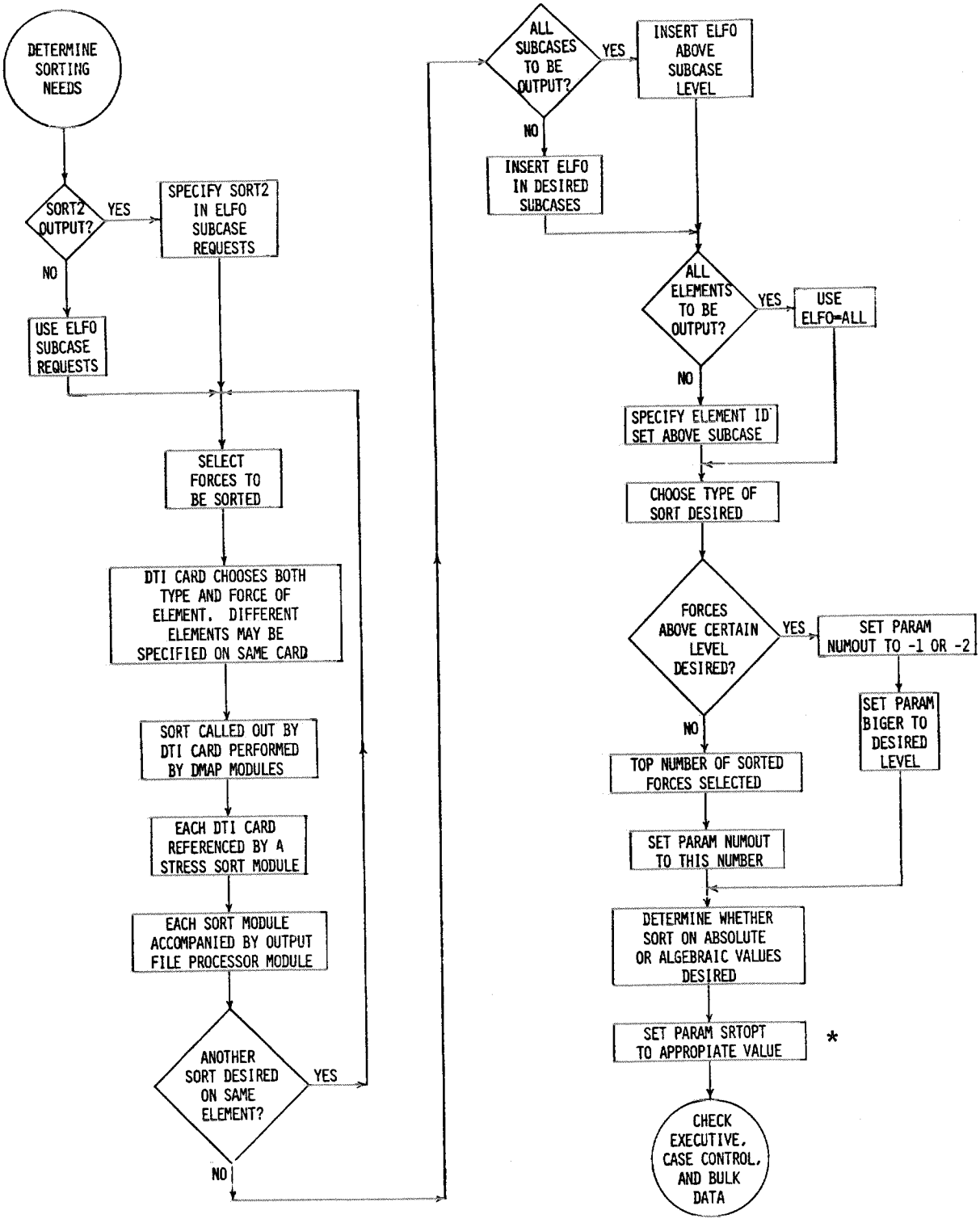
* At this time, version 60A contains an error in the coding that does not allow an algebraic sort.

SORTED OUTPUT IN MSC/NASTRAN

BASIC REQUIREMENTS

In order to execute a sort, the user adds commands to the executive control, case control, and bulk data. DMAP alters are inserted in the executive control deck; output requests in the case control; and, PARAM and DTI cards in the bulk data. For generality, I will discuss the requirements for the SORT2 option. DMAP modules for sorting and output replace existing modules in DMAP1. With this substitution, normal SORT2 output is sorted and output in the SORT2 format. Since sorted output is the same format as normal SORT2, the user simply inserts the same force and stress output requests in the case control. These output requests can control the subcases, element-ID's, and whether SORT1 or SORT2 is selected. The PARAM and DTI cards further specify the sorting: the forces or stresses to be sorted, the element types to be sorted, and the type of sort. Relationships between the sorting capabilities and the basic requirements are embodied by the following flowchart. The flowchart is for forces; stresses are nearly identical.

FLOWCHART FOR SORTED FORCE OUTPUT IN MSC/NASTRAN



* At this time, version 60A contains an error in the coding that does not allow an algebraic sort. The SRTOPT parameter is ineffective.

DMAP ALTERS

Typically, a DMAP ALTER for static superelement sortings consists of two modules, STRSORT and OFP, along with ALTER and ENDALTER directives. These four commands are inserted just before the CEND card as shown on the following page. This alter sorts forces in the SORT2 format.

Actual sorting is performed by the stress sort module, STRSORT. Either forces or stresses can be operated on with this module. Requesting SORT2 format results in an output element force table, OEF2, and an output element stress table, OES2. One inputs either of these tables into the stress sort module. Next, a reference to a DTI card directs the stress sort module to sort specific element types and forces in the output element force table. After sorting, the sorted table is output as another output element force table, OEF2X1. Note that the input force table, OEF2, is an output of a previous SORT2 module and must be specified by the same name for each STRSORT call; however, the INDTI's and OEF2X's are unique for each STRSORT call, with integers at the ends of these names. Four parameter initializations - NUMOUT, BIGER, SRTOPT, and SRTELTYP - make up the remainder of the stress sort module. These parameters are the same for each STRSORT. The $ sign ends the module call.

Module Name	Input Table	DTI Card	Sorted Output Table	Parameter Initializations
STRSORT	OEF2,	INDTI1 /	OEF2X1 /	V,Y,NUMOUT = -2/V,Y,BIGER = 0.0/ C,Y,SRTOPT = 0/C,Y,SRTELTYP = 0/ $

Output element force and stress tables are converted into SORT2 output through the output file processor, OFP. An output file processor accompanies each stress sort module. The sorted output table, OEF2X2, serves as input to this processor. The parameter specification, CARDNO, is the same for each OFP.

Module Name	Sorted Output Table from Corresponding STRSORT	Parameter Specification
OFP	OEF2X2,/ /	S,N,CARDNO $

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

```
ID HAMST,CTRFUS
APP DISPLACEMENT
TIME 5
DIAG 8
DIAG 14
DIAG 20
$ BEGINNING OF DMAP1
BEGIN $ STATIC ANALYSIS WITH MULTILEVEL - 27-JUL-1979 $
(SEE NASTRAN SOURCE PROGRAM COMPILATION FOR LISTING OF DMAP SEQUENCE)
END $
ALTER 658,658
STRSUKT  OEF2,INDTI1/OEF2X1/V,Y,NUMOUT=-2/V,Y,BIGER=0.0/
                              C,Y,SRTOPT=0/C,Y,SRTELTYP=0 $
OFP      OEF2X1,//S,N,CARDNO $
STRSUKT  OEF2,INDTI2/OEF2X2/V,Y,NUMOUT=-2/V,Y,BIGER=0.0/
                              C,Y,SRTOPT=0/C,Y,SRTELTYP=0 $
OFP      OEF2X2,//S,N,CARDNO $
ENDALTER
CEND
```

COMPLETE DMAP ALTER

DMAP ALTER IN EXECUTIVE CONTROL DECK

DMAP ALTERS (Cont'd)

To delete the existing OFP from DMAP1 and insert the STRSORT and OFP module, one uses the ALTER command. The number 658 repeated deletes statement 658 from DMAP1 and inserts any succeeding statements (up to the ENDALTER) at position 658.

Start of DMAP Alter	Number of Removed Statement	
ALTER	658,658	
{		All commands between the ALTER and ENDALTER are inserted at 658
}		
ENDALTER		
CEND		

This alteration of DMAP1 is shown on the next two pages. Note that DMAP1 is listed by DIAG14.

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

```
DMAP-DMAP INSTRUCTION
 NO.
617  OFP       OEP//S,N,CARDNO $
618  LABEL     NOMDATA $
619  COND      NOSTRENG,SESEF $
620  PARAM     //NE/NP/DMAPNO/3 $
621  COND      NOSTRENG,NP $
622  COND      NOSTRENG,NDUP $
623  DBFETCH   /XKJJ,,,,/V,Y,MODEL/PEID/1/DBSET3 $
624  PARAML    XKJJ//PRESENCE////NP $
625  COND      NOSTRENG,NP $
626  MPYAD     XKJJ,UGVS,/FG $
627  ADD       FG,UGVS/XG///1 $
628  MATGEN    ,/UG1/6/NOGSET/0/NOGSET $
629  MPYAD     XG,UG1,/SESEG/1 $
630  ADD       SESEG,TSE/SESEFG///2 $
631  MATPRN    SESEFG//$          STRAIN ENERGY FRACTION FOR NON-TIP
632  LABEL     NOSTRENG $
633  DBFETCH   /GPG,,,,/SOLID/SEID/1/DBSET3
634  PARAM     //SYSR/V,N,NP/56 $
635  PARAM     //EQ/V,N,NH/NP/0 $
636  EQUIV     FSILS,HSIL/NH/FBGPDTS,HBGPDT/NH $
637  COND      SKPPLTRN,NH $
638  PLTTRAN   FBGPDTS,FSILS/HBGPDT,HSIL/0/0 $
639  LABEL     SKPPLTRN $
640  VECPLOT   UGS,HBGPDT,FEQEXINS,FCSTMS,CASEDR,/QGSUM/V,Y,GRDPNT/0/1/
               SPCFORCE $
641  SDR2      CASEDR,FCSTMS,FMPT,FDIT,FEQEXINS,,FETT,FOLB1,HBGPDT,
               GPJ1,FQGS,FUGVS,FEST,XYCDBDR/
               OPG1,OQG1,OUGV1,OES1,OEF1,PUGV/AFP1/S,N,NP $
642  COND      MIKE9,FIXEDB
643  DBSTORE   PUGV//SOLID/SEID/DBSET2 $
644  LABEL     MIKE9 $
645  COND      LBLP2,NOGENL $
646  COND      LBLP2,NP $
647  EQUIV     OEF1,HOEF1/NH $
648  COND      NOSDRMT,NH $
649  DBFETCH   /KSLT,FQGE,FDLT,,/SOLID/0/1/DBSET3 $
650  SDRMT     FSILS,FUSET,FUGVS,OEF1,KSLT,FEST,FDIT,FQGE,FDLT,/HOEF1/
               C,Y,TABS/0 $
651  LABEL     NOSDRMT $
652  SDR3      OUGV1,OPG1,OQG1,HOEF1,OES1,/OUGV2,OPG2,OQG2,OEF2,OES2,/ $
653  COND      NODDRM1,NOLDRMM $
654  PARAM     //NOP/V,Y,NODDRMM=-1 $
655  DDRMM     CASECR,GOLV,GOLB,OUGV2,OQG2,OES2,OEF2,XYCDBDR/OUGV2Y,OQG2Y,
               OES2Y,OEF2Y,/$
656  EQUIV     OUGV2Y,OUGV2/ALWAYS/OQG2Y,OQG2/ALWAYS/OES2Y,OES2/ALWAYS/
               OEF2Y,OEF2/ALWAYS $
657  LABEL     NODDRM1 $
658  STRSORT   OEF2,INDTP/OEF2X1/V,Y,NUMOUT=-2/V,Y,BIGER=0.0/
                                   C,Y,SRTOPT=0/C,Y,SRTELTYP=0 $
658  CFP       OEF2X1,//S,N,CARDNO $
```

COMMANDS INSERTED AT 658 BY ALTER ON PAGE 6

LISTING OF DMAP1 BY DIAG 14

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

```
DMAP-DMAP INSTRUCTION
 NO.
  656  STRSORT  OEF2,INDTI2/OEF2X2/V,Y,NUMOUT=-2/V,Y,BIGER=0.0/

*** USER WARNING MESSAGE  42,
                          POSSIBLE ERROR IN DMAP INSTRUCTION STRSORT    INSTRUCTION NO. 658
 PARAMETER NAMED BIGER     ALREADY HAD VALUE ASSIGNED PREVIOUSLY
                           C,Y,SRTOPT=0/C,Y,SRTELTYP=0 $
  658  OFP      OEF2X2,//S,N,CARDNO $
  659  COND     LNOEDR,NOXYCDB $
  660  XYTRAN   XYCDBDR,OPG2,UQG2,OUGV2,OES2,OEF2/XYPLTT/APP/PSET/S,N,PFILE/
                S,N,CARDNO/S,N,NP $
  661  COND     LNOXYP,NP $
  662  XYPLOT   XYPLTT// $
  663  LABEL    LNOXYP $
  664  $                                                  *******  END  ********
  664  $       34      X       TOPSEDR                    ************************
  664  $*************************************************************************
  664  $
  664  $
  664  $*************************************************************************
  664  $       37      Z       SORT1   29 JUN 79          ************************
  664  $                                                  ******* START ********
  664  JUMP     LNOEDR $
  665  LABEL    LBLP2 $
  666  SDRX     CASEDR,OEF1,OES1,FGEOM2S,FGEOM3S,FEST,FCSTMS,FMP1,FDIT/
                OEF1X,OES1X/S,N,NP $
  667  EQUIV    OEF1,OEF1X/NP /OES1,OES1X/NP  $
  668  OFP      OUGV1,OPG1,UQG1,OEF1X//S,N,CARDNO $
  669  COND     LS1,S1 $
  670  STRSORT  OES1X,/OES1X1/V,Y,NUMOUT=-2/V,Y,BIGER=0.0/

*** USER WARNING MESSAGE  42,
                          POSSIBLE ERROR IN DMAP INSTRUCTION STRSORT    INSTRUCTION NO. 670
 PARAMETER NAMED BIGER     ALREADY HAD VALUE ASSIGNED PREVIOUSLY
                             C,Y,SRTOPT=0/C,Y,SRTELTYP=0 $
  671  OFP      OES1X1//S,N,CARDNO $
  672  LABEL    LS1 $
  673  COND     LS1G,CURV $
  674  PARAM    //NOP/V,Y,S1=0/V,Y,S1M=-1/V,Y,S1G=-1/ $
  675  CURV     OES1X,FMP1,FCSTMS,FEST,FSILS,FGPLS/OES1M,OES1G/C,Y,OUTOPT/
                C,Y,UG/C,Y,NINTPTS=10 $
  676  COND     LS1M,S1M $
  677  STRSORT  OES1M,/OES1M1/V,Y,NUMOUT/V,Y,BIGER $
  678  OFP      OES1M1//S,N,CARDNO $
  679  LABEL    LS1M $
  680  COND     LS1G,S1G $
  681  STRSORT  OES1G,/OES1G1/V,Y,NUMOUT/V,Y,BIGER $
  682  OFP      OES1G1//S,N,CARDNO $
  683  LABEL    LS1G $
  684  COND     NOXYPL,NOXYCDB $
  685  COND     NOXYPL,CURVPLOT $
  686  CURVPLOT EQUEXINS,FBGPDTS,FEDT,XYCDBDR,OPG1,UQG1,OUGV1,OES1G,/
```

COMMANDS INSERTED AT
658 BY ALTER ON PAGE 6

LISTING OF DMAP1 BY DIAG 14

SUBCASE REQUESTS

Output requests in the case control remain unchanged. As shown on the flowchart, output control consists of SORT1 vs. SORT2, subcases to be output, and element-ID output set. The following example selects the SORT2 option for certain subcases, with an element-ID set specified.

Element Force Output	Group all Subcases for Each Element		Element ID Set
ELFO	(SORT2)	=	100

EXAMPLE OF SUBCASE REQUESTS FOR SORTED OUTPUT

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

```
CARD
COUNT
 1      TITLE = HAHST CENTER FUSELAGE XF 110.25-161.00
 2      SUBTITLE = MODEL CANTILEVERED OFF XF 161.00
 3        MAXLINES = 300000
 4        SET 1 = 2,4,10,0
 5        SET 2 = 2,3,4,5,10,0
 6        SET 100 = 1370000 THRU 1380000
 7      SUBCASE 1
 8        LABEL = 1000 LB VERTICAL LOAD XF 110.25                    SE NO 2
 9        SUPER = 2,1
10        LOAD = 300
11        SPC = 20
12      ELFO(SORT2) = 100
13      SUBCASE 2
14        LABEL = 1000 LB VERTICAL LOAD XF 110.25                    SE NO 3
15        SUPER = 3,1
16        LOAD = 300
17        SPC = 20
18      ELFO(SORT2) = 100
19      SUBCASE 3
20        LABEL = 1000 LB VERTICAL LOAD XF 110.25                    SE NO 4
21        SUPER = 4,1
22      SUBCASE 4
23        LABEL = 1000 LB VERTICAL LOAD XF 110.25                    SE NO 5
24        SUPER = 5,1
25      SUBCASE 5
26        LABEL = 1000 LB VERTICAL LOAD XF 110.25                    SE NO 10
27        SUPER = 10,1
28      SUBCASE 6
29        LABEL = 1000 LB LATERAL LOAD XF 110.25                     SE NO 2
30        SUPER = 2,2
31        LOAD = 200
32        SPC = 20
33      ELFO(SORT2) = 100
34      SUBCASE 7
35        LABEL = 1000 LB LATERAL LOAD XF 110.25                     SE NO 3
36        SUPER = 3,2
37        LOAD = 201
38        SPC = 20
39      ELFO(SORT2) = 100
40      SUBCASE 8
41        LABEL = 1000 LB LATERAL LOAD XF 110.25                     SE NO 4
42        SUPER = 4,2
43      SUBCASE 9
44        LABEL = 1000 LB LATERAL LOAD XF 110.25                     SE NO 5
45        SUPER = 5,2
46      SUBCASE 10
47        LABEL = 1000 LB LATERAL LOAD XF 110.25                     SE NO 10
48        SUPER = 10,2
49      SUBCASE 11
50        LABEL = 10000 IN-LB VERTICAL BENDING MOMENT XF 110.25      SE NO 2
```

SORTED OUTPUT IN MSC/NASTRAN

BULK DATA

For determining a specified number of the top forces (or stresses) one requires two types of DTI cards and three PARAM cards. The flowchart explains the DTI functions - selecting both types and forces (or stresses) of element. PARAM's designate the type of sorting. If one desires to print forces above a certain level, then an additional PARAM card is required. This discussion centers on the next page's example: sorting a certain number of forces.

Two cards make-up each DTI specification. A header card simply denotes the existance of direct table input, DTI. This card contains the alphanumeric card name, INDTI1, and the header designation, Ø. The second card transmits the sorting information, element types and forces of that type to be sorted. This card also contains the alphanumeric name and a designation, 1. In specifying the sorting information, one places the element type first, then the specific force of that element. No limitations exist on the number of different elements that can be selected on one DTI card; however, one logical DTI card will recognize a designation of an element once, i.e. the user can select a particular element on a DTI card one time. To sort a different force on the same element insert a second DTI specification. Element-ID's for the DTI are in the MSC/NASTRAN APPLICATION MANUAL, pages 4.2 - 57, 58.

Specific forces and stresses for elements are shown in the USER'S MANUAL, VOL. II, Section 4.3. One provides direction for the STRSORT module through the DTI cards. In the stress sort module, NASTRAN passes through the output element force table, sorting on the designated forces. Since the module makes only one pass, we see that just one sort for an element type is effective. Another sort requires a second DTI card and STRSORT module.

Card Name	Alphanumeric Name Used by STRSORT	Header Card
DTI	INDTI1	Ø

Card Name	Name for STRSORT	Card With STRSORT information	TRIA3 element	Memb-force(y)	
DTI	INDTI1	1	74	3	(Card continued on next line)

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

CARD COUNT	. 1	.. 2	..	3	..	4	..	5	..	6	..	7	..	8	..	9	..	10 .
1-	DTI	INDTI1	0															
2-	DTI	INDTI1	1		74		3		33		6		34		-1		+DTI1	
3-	+DTI1	10	-1		11		-1		ENDREC									
4-	DTI	INDTI2	0															
5-	DTI	INDTI2	1		74		4		33		-1		34		-1		+DTI2	
6-	+DTI2	10	-1		11		-1		ENDREC									
7-	PARAM	DBSET1	8															
8-	PARAM	NODATA	-1															
9-	PARAM	NUMOUT	3															
10-	PARAM	SRTOPT	0															
	ENDDATA																	

TOTAL COUNT= 10

EXAMPLE OF BULK DATA REQUESTS FOR SORTED OUTPUT

BULK DATA (Cont'd)

	QUAD4 Element	Sort Bend-Moment(y)	BAR Element	Sort Nothing	
	33	6	34	-1	+DTI1

	Conrod Element	Sort Nothing	ELAS1 Element	Sort Nothing	Signifies End of Number One Card
+DTI1	1Ø	-1	11	-1	ENDREC

Note that the negative one specifies no sort. In addition, all output from this first STRSORT-DTI set will precede the second set for each superelement.

For the majority of sorts, the first three parameters listed below - NUMOUT, BIGER, and SRTOPT*- are sufficient. In this section's example, BIGER wasn't necessary. When DTI cards are specified, the SRTELTYP card is omitted. See the USER'S MANUAL, VOL. II, Page 3.1-26 for more information

* At this time, version 60A contains an error in the coding that renders SRTOPT ineffective.

Card Name	Parameter Name	Three Highest Magnitude Forces to be Output
PARAM	NUMOUT	3

Card Name	Parameter Name	Sort on Maximum Magnitude
PARAM	SRTOPT	0

EXAMPLE

Examples in the previous three sections are all derived from the same NASTRAN run. This run first listed the top three QUAD4 bend-moments(y) and TRIA3 membrane-forces(y), then the TRIA3 membrane-forces(xy). INDTI1 specifies the first two sorts; INDTI2, the third. NUMOUT and SRTOPT select the top three forces or moments by magnitude. Sorting by the first STRSORT module is directed by INDTI1. After determining the top three QUAD4 moments and TRIA3 y forces, this module transfers its output to the first OFP. Then, the second STRSORT selects the top three TRIA3 xy forces through INDTI2. Output from this module follows the first module's. In the case control, subcases 1, 2, 6, 7, 11 and 12 are chosen for sorting. Finally, all elements with ID's between 1370000 and 1380000 are to be sorted in the SORT2 format. On the next page is the QUAD4 bend-moment(y) sort for element 1371820.

1000 LB VERTICAL LOAD XF 110.25 SE NO 2
ELEMENT-ID = 1371820

F O R C E S I N Q U A D R I L A T E R A L E L E M E N T S (Q U A D 4)

	- MEMBRANE FORCES -			- BENDING MOMENTS -			- TRANSVERSE SHEAR FORCES -	
SUBCASE	FX	FY	FXY	MX	MY	MXY	QX	QY
0	-4.104234E+01	-3.580042E+02	1.400765E+01	-1.882649E-01	-4.093836E-01	9.359058E-02	8.237464E-02	-4.144327E-01
1	-6.891671E+00	-9.443706E+01	3.616907E+01	6.607900E-02	8.734238E-02	-1.114528E-01	-7.934056E-02	8.732944E-03
11	-7.087297E-01	-2.129928E+01	-1.360464E+01	2.812827E-02	6.156238E-02	-5.914179E-02	-2.578775E-02	3.079822E-02

EXAMPLE OF SORT2
OUTPUT FOR SORT ON
QUAD4 Y-MOMENT

APPENDIX-REDUCED OUTPUT

Generally, with sorted output each printed page contains very little information. This bulk may be considerably reduced by altering the NASTRAN output file. NASTRAN has the standard FORTRAN control characters in the first column: "1" signifies a new page to be started; "Ø", a double space. One can simply change all "1"'s in column one to blanks or zeroes, resulting in the output on the next page.

When merely determining maximums for each element, one may want to use a more sophisticated alteration. The second page following this one displays the result of changing output similar to that of the previous page's. Basically, this alteration takes the first page of output and leaves it unchanged; however, the succeeding ten pages are stripped down to only element-ID and the force output.

First locate the line with FORCES in it, then skip up five lines. (Note that the double space after the MODEL line is created with a zero in column one; double space after the ELEMENT-ID and FORCES lines are blank lines in the NASTRAN output file.) Next, three lines are deleted with the file pointer now at the ELEMENT line. The five lines after this ELEMENT line are removed, leaving the pointer at the force output line. A double space control character is then added to this line. Execute this sequence ten times, then start a new page. Thus, ten pages are reduced, then a new page is started.

As a final note, NASTRAN inserts blank pages and diagnostic messages between the different types of output, e.g. a QUAD4 sort vs. a TRIA3 or a QUAD4 membrane-force sort vs. a QUAD4 moment sort. One may find it desirable to retain these delimiters by searching through the output file. The user can specifically change only as many lines as necessary, leave the delimiters intact, then change only the next set of output, etc.

1000 LB VERTICAL LOAD XF 110.25 SE NO 2
ELEMENT-ID = 1371618

S T R E S S E S I N Q U A D R I L A T E R A L E L E M E N T S (Q U A D 4)

SUBCASE	FIBRE DISTANCE	STRESSES IN ELEMENT COORD SYSTEM NORMAL-X	NORMAL-Y	SHEAR-XY	PRINCIPAL STRESSES (ZERO SHEAR) ANGLE	MAJOR	MINOR	MAX SHEAR
6	3.150000E-02	-1.365163E+02	-2.991096E+03	4.041043E+02	7.9041	-8.041252E+01	-3.047200E+03	1.483394E+03
	-3.150000E-02	-5.937776E+02	-4.521482E+03	7.367871E+02	10.2824	-4.601144E+02	-4.655145E+03	2.097515E+03
1	3.150000E-02	-2.210833E+02	-2.791514E+03	5.748655E+02	12.0493	-9.837504E+01	-2.914222E+03	1.407924E+03
	-3.150000E-02	-1.928299E+02	-2.344440E+03	2.625444E+02	6.8573	-1.612569E+02	-2.376013E+03	1.107378E+03
11	3.150000E-02	-9.323409E+01	-1.054572E+03	-1.894502E+02	-10.7557	-5.724648E+01	-1.090560E+03	5.166566E+02
	-3.150000E-02	-4.483832E+01	-7.439558E+02	-3.548391E+02	-22.7148	1.037015E+02	-8.924955E+02	4.980985E+02

1000 LB VERTICAL LOAD XF 110.25 SE NO 2
ELEMENT-ID = 1371820

S T R E S S E S I N Q U A D R I L A T E R A L E L E M E N T S (Q U A D 4)

SUBCASE	FIBRE DISTANCE	STRESSES IN ELEMENT COORD SYSTEM NORMAL-X	NORMAL-Y	SHEAR-XY	PRINCIPAL STRESSES (ZERO SHEAR) ANGLE	MAJOR	MINOR	MAX SHEAR
6	3.150000E-02	-3.668626E+02	-5.063734E+03	8.086124E+01	.9860	-3.654709E+02	-5.065126E+03	2.349828E+03
	-3.150000E-02	-9.360687E+02	-6.301478E+03	3.638260E+02	3.8616	-9.115102E+02	-6.326036E+03	2.707263E+03
1	3.150000E-02	-2.092843E+02	-1.631038E+03	7.425972E+02	23.1251	1.078450E+02	-1.948167E+03	1.028006E+03
	-3.150000E-02	-9.498927E+00	-1.366964E+03	4.056273E+02	15.4318	1.024716E+02	-1.478935E+03	7.907032E+02
11	3.150000E-02	-5.377163E+01	-4.311788E+02	-1.265410E+02	-16.9225	-1.527118E+01	-4.696792E+02	2.272040E+02
	-3.150000E-02	3.127228E+01	-2.449887E+02	-3.053522E+02	-32.8298	2.282835E+02	-4.419999E+02	3.351417E+02

1000 LB VERTICAL LOAD XF 110.25 SE NO 2
ELEMENT-ID = 1372022

S T R E S S E S I N Q U A D R I L A T E R A L E L E M E N T S (Q U A D 4)

SUBCASE	FIBRE DISTANCE	STRESSES IN ELEMENT COORD SYSTEM NORMAL-X	NORMAL-Y	SHEAR-XY	PRINCIPAL STRESSES (ZERO SHEAR) ANGLE	MAJOR	MINOR	MAX SHEAR
6	3.150000E-02	-2.730197E+02	-5.432185E+03	-3.954526E+02	-4.3578	-2.428841E+02	-5.462321E+03	2.609718E+03
	-3.150000E-02	-1.071320E+03	-6.490949E+03	-1.713049E+02	-1.8086	-1.065911E+03	-6.496358E+03	2.715224E+03
1	3.150000E-02	-2.358053E+02	-8.316703E+02	6.511986E+02	32.7076	1.823791E+02	-1.249855E+03	7.161169E+02
	-3.150000E-02	1.042672E+02	-7.042142E+02	5.157274E+02	25.9549	3.553015E+02	-9.552484E+02	6.552749E+02
11	3.150000E-02	-6.937745E+01	-7.505056E+01	-1.305410E+02	-44.3776	5.835781E+01	-2.027858E+02	1.305718E+02
	-3.150000E-02	8.100911E+01	2.486774E+01	-2.508240E+02	-41.8072	3.053283E+02	-1.994514E+02	2.523898E+02

REDUCED OUTPUT-SIMPLE ALTERATION

OLT CAPTIVE FLIGHT CONDITION 3C00A019 SE NO 10
ELEMENT-ID = 347917

F O R C E S I N Q U A D R I L A T E R A L E L E M E N T S (Q U A D 4)

SUBCASE	- MEMBRANE FORCES - FX	FY	FXY	- BENDING MOMENTS - MX	MY	MXY	- TRANSVERSE SHEAR FORCES - QX	QY
10	-5.035906E+02	-1.295075E+02	3.271709E+02	8.267615E+00	2.021557E+00	1.753149E+00	-1.856710E+01	6.077458E+00
ELEMENT-ID = 348177								
10	3.571743E+03	-1.122753E+02	-1.042860E+02	-8.900819E+00	-5.113453E+00	4.649527E+00	-2.502266E+01	-2.698455E+00
ELEMENT-ID = 348183								
10	1.317E44E+03	2.197109E+02	1.382100E+03	-1.861927E+00	-1.708702E+00	3.363569E+00	-7.505699E+00	-5.063277E-01
ELEMENT-ID = 348381								
10	3.065446E+03	1.438441E+02	-1.060496E+02	-4.491856E+00	-7.953152E-01	1.907328E+00	3.266774E+01	-5.486095E-01
ELEMENT-ID = 348385								
10	-1.088791E+02	2.365378E-01	4.204699E+02	5.032897E+00	-7.608277E-02	-2.310906E+00	-2.513597E+01	-1.560837E-02
ELEMENT-ID = 348519								
10	-3.459971E+03	-3.113356E+02	1.005641E+03	4.852058E-01	8.823820E+00	8.025197E+00	-4.298017E+01	1.971959E+01
ELEMENT-ID = 350405								
10	3.219608E+02	-3.759910E+02	2.186922E+02	1.221334E+02	-5.795300E-09	8.894816E+01	-1.179299E+02	-3.725290E-06
ELEMENT-ID = 356769								
10	-3.667327E+02	1.493544E+03	-1.519526E+03	-2.967271E+01	-7.391897E+01	6.782942E+01	-1.487721E+02	1.444769E+01
ELEMENT-ID = 364959								
10	-1.919364E+03	-7.760097E+02	-5.428154E+02	-1.026015E+02	-1.116740E+01	-1.291409E+02	-5.154569E+01	3.627892E+01
ELEMENT-ID = 365961								
10	1.252529E+03	1.782721E+02	-1.295326E+03	-5.391577E+01	-1.334658E+01	-1.175828E+02	-2.363552E+01	-2.955213E+02
ELEMENT-ID = 366761								
10	9.136790E+01	1.676986E+02	-1.111615E+02	-6.225305E+00	-6.370083E+00	2.133008E+00	2.858740E+01	-2.134749E+01

APPENDIX-SORT1 SORTED OUTPUT

Except for the ALTER card, sorting in the SORT1 format is the same as in the SORT2 format. Steps 670 and 671 are specified on the ALTER card instead of step 658. These two steps are STRSORT and OFP modules that must be deleted from DMAP1. When SORT2 is called out in the output directives, DMAP1 will execute step 658, but not steps 670 and 671; with a SORT1 or, more commonly, no directive, step 658 is skipped and steps 670 and 671 performed. Besides changing the ALTER, one also omits all SORT2 specifications from the output directives. The following page shows the changed DMAP ALTER. The final page shows the effect on DMAP1 of this ALTER.

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

```
ID HAHS1,CTRFUS
APP DISPLACEMENT
TIME 5
DIAG 8
DIAG 14
DIAG 20
$ BEGINNING OF DMAP1
BEGIN $ STATIC ANALYSIS WITH MULTILEVEL - 27-JUL-1979 $
(SEE NASTRAN SOURCE PROGRAM COMPILATION FOR LISTING OF DMAP SEQUENCE)
END $
ALTER 670,671
STRSORT  OEF1X,INDTI1/OEF1X1/V,Y,NUMOUT=-2/V,Y,BIGER=0.0/
                          C,Y,SRTOPT=0/C,Y,SRTELTYP=0 $
OFP      OEF1X1,//S,N,CARDNO $
STRSORT  OEF1X,INDTI2/OEF1X2/V,Y,NUMOUT=-2/V,Y,BIGER=0.0/
                          C,Y,SRTOPT=0/C,Y,SRTELTYP=0 $
OFP      OEF1X2,//S,N,CARDNO $
ENDALTER
CEND
```

DMAP ALTER FOR SORT1 SORTED OUTPUT

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

```
DMAP-DMAP INSTRUCTION
 NO.
              S,N,CARDNO/S,N,NP $
 661  COND     LNOXYP,NP $
 662  XYPLOT   XYPLTT// $
 663  LABEL    LNOXYP $
 664  $                                          ******* END  ********
 664  $       34      X       TOPSEDR            ************************
 664  $*************************************************************************
 664  $
 664  $
 664  $*************************************************************************
 664  $       37      Z       SORT1   29 JUN 79  ************************
 664  $                                          ******* START ********
 664  JUMP     LNOEDR $
 665  LABEL    LBLP2 $
 666  SDRX     CASEDR,OEF1,OES1,FGEOM2S,FGEOM3S,FEST,FCSTMS,FMPT,FDIT/
              OEF1X,OES1X/S,N,NP $
 667  EQUIV    OEF1,OEF1X/NP /OES1,OES1X/NP  $
 668  OFP      OUGV1,OPG1,OQG1,OEF1X//S,N,CARDNO $
 669  COND     LS1,S1 $
 671  STRSORT  OEF1X,INDTI1/OEF1X1/V,Y,NUMOUT=-2/V,Y,BIGER=0.0/
                                  C,Y,SRTOPT=0/C,Y,SRTELTYP=0 $
 671  OFP      OEF1X1,//S,N,CARDNO $
 671  STRSORT  OEF1X,INDTI2/OEF1X2/V,Y,NUMOUT=-2/V,Y,BIGER=0.0/

*** USER WARNING MESSAGE  42,
                        POSSIBLE ERROR IN DMAP INSTRUCTION STRSORT    INSTRUCTION NO. 671
     PARAMETER NAMED BIGER     ALREADY HAD VALUE ASSIGNED PREVIOUSLY
                                  C,Y,SRTOPT=0/C,Y,SRTELTYP=0 $
 671  OFP      OFF1X2,//S,N,CARDNO $
 672  LABEL    LS1 $
 673  COND     LS1G,CURV $
 674  PARAM    //NOP/V,Y,S1=0/V,Y,S1M=-1/V,Y,S1G=-1/ $
 675  CURV     OFS1X,FMPT,FCSTMS,FEST,FSILS,FGPLS/OES1M,OES1G/C,Y,OUTOPT/
              C,Y,OG/C,Y,NINTPTS=10 $
 676  COND     LS1M,S1M $
 677  STRSORT  OFS1M,/OFS1M1/V,Y,NUMOUT/V,Y,BIGER $
 678  OFP      OFS1M1//S,N,CARDNO $
 679  LABEL    LS1M $
 680  COND     LS1G,S1G $
 681  STRSORT  OFS1G,/OFS1G1/V,Y,NUMOUT/V,Y,BIGER $
 682  OFP      OFS1G1//S,N,CARDNO $
 683  LABEL    LS1G $
 684  COND     NOXYPL,NOXYCDR $
 685  COND     NOXYPL,CURVPLOT $
 686  CURVPLOT EEQEXINS,FBGPDTS,FEDT,XYCDBDR,OPG1,OQG1,OUGV1,OES1G,/
              OPG2X,OQG2X,OUG2X,OES2X,/V,Y,DOPT=0 $
 687  XYTRAN   XYCDBDR,OPG2X,OQG2X,OUG2X,OES2X,/XYPLTS/SET1/PSET/
              S,N,PFILE/S,N,CARDNO/S,N,NP $
 688  COND     NOXYPL,NP $
 689  XYPLOT   XYPLTS// $
 690  LABEL    NOXYPL $
```


ALTERATION OF DMAP1 FOR SORT1 SORTED OUTPUT