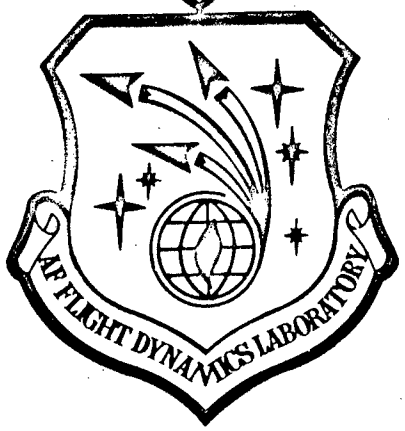
FBC 4462

AFFDL-TM-73-13-FBC

#30

AIR FORCE FLIGHT DYNAMICS LABORATORY
DIRECTOR OF LABORATORIES
AIR FORCE SYSTEMS COMMAND
WRIGHT PATTERSON AIR FORCE BASE OHIO



USER's INSTRUCTIONS FOR THE COMPUTER PROGRAM PLSTR
AS MODIFIED BY AFFDL/FBC

Prepared by

PLSTR

T. Muha

February 1973

COMPUTER PROGRAMS

FOREWORD

This work was conducted by Mr T. J. Muha, Exploratory Development Group, Advanced Composites Branch, at the Air Force Flight Dynamics Laboratory, under Project 4364, "Filamentary Composites Structures."

The manuscript was released by the author in February, 1973. This Technical Memorandum has been reviewed and is approved.

Philip A. Parmley

PHILIP A. PARMLEY
Chief, Advanced Composites Branch
Structures Division

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PART I

GENERAL INFORMATION

1.1 BACKGROUND

PLSTR was written by Dr R. S. Sandhu of the Ohio State University. The coding was based upon the earlier work by Professor Wilson of the University of California at Berkley, but modifications were made to improve the program's efficiency. The present version in use by AFFDL/FBC includes modifications by Mr T. J. Muha to account for orthotropic materials and to permit the output of either maximum and minimum stresses or strains.

1.2 PROGRAM DESCRIPTION

This program performs an elastic, plane stress, finite element, structural analysis. It can handle linearly varying thermal and pressure loads. At the present time it can handle quadrilateral and triangular elements, up to three thousand elements or grid points, up to twelve materials, up to eight temperature points for computing material properties of each material, and pressure acting on up to three hundred elements. The maximum semi-band width is fifty.

The analysis proceeds from

$$Ax = F, \tag{1}$$

where A is the stiffness matrix, x is the displacement matrix, and F is the force matrix.

Having determined the displacements from Equation (1), the strains are assumed to follow from

$$B\varepsilon = x, \tag{2}$$

where B is the matrix linking the strains and the displacements, and ε is the strain matrix.

Finally, taking the strains from Equation (2), the stresses are found from

$$\sigma = C\varepsilon, \tag{3}$$

where σ is the stress matrix and C is the material stiffness matrix. For isotropic materials, Equation (3) is Hooke's Law.

1.3 FUTURE WORK

As stated in Section 1.1, PLSTR has undergone a substantial modification since being received by AFFDL/FBC. Future modifications now being considered are using SPLINE interpolation functions to incorporate nonlinear material properties, a plane strain option, the ability to run multiple load cases, and a failure criterion for developing margins of safety.

PART II

INPUT INSTRUCTIONS

The input for PLSTR consists of eight logical cards. It must be noted that a logical card may consist of more than one physical card. For the remainder of this section, a logical card will be referred to simply as a card.

The eight input cards needed to run PLSTR are formatted as follows:

CARD 1: Title

Columns	Format	Variable	Explanation
1 - 80	8A10	HED	Any alphanumeric information necessary to identify the problem

CARD 2: Basic Information

Columns	Format	Variable	Explation
1 - 5	I5	NUMNP	Number of grid points
6 - 10	I5	NUMEL	Number of elements
11 - 15	I5	NUMMAT	Number of materials
16 - 20	I5	NUMPC	Number of pressure cards (See Card 7)
21 - 30	F10.2	ACELR	Acceleration in x-direction
31 - 40	F10.2	ACELZ	Acceleration in y-direction
41 - 50	F10.2	Q	Reference (stress-free) temperature

CARD 3 : Material Identification

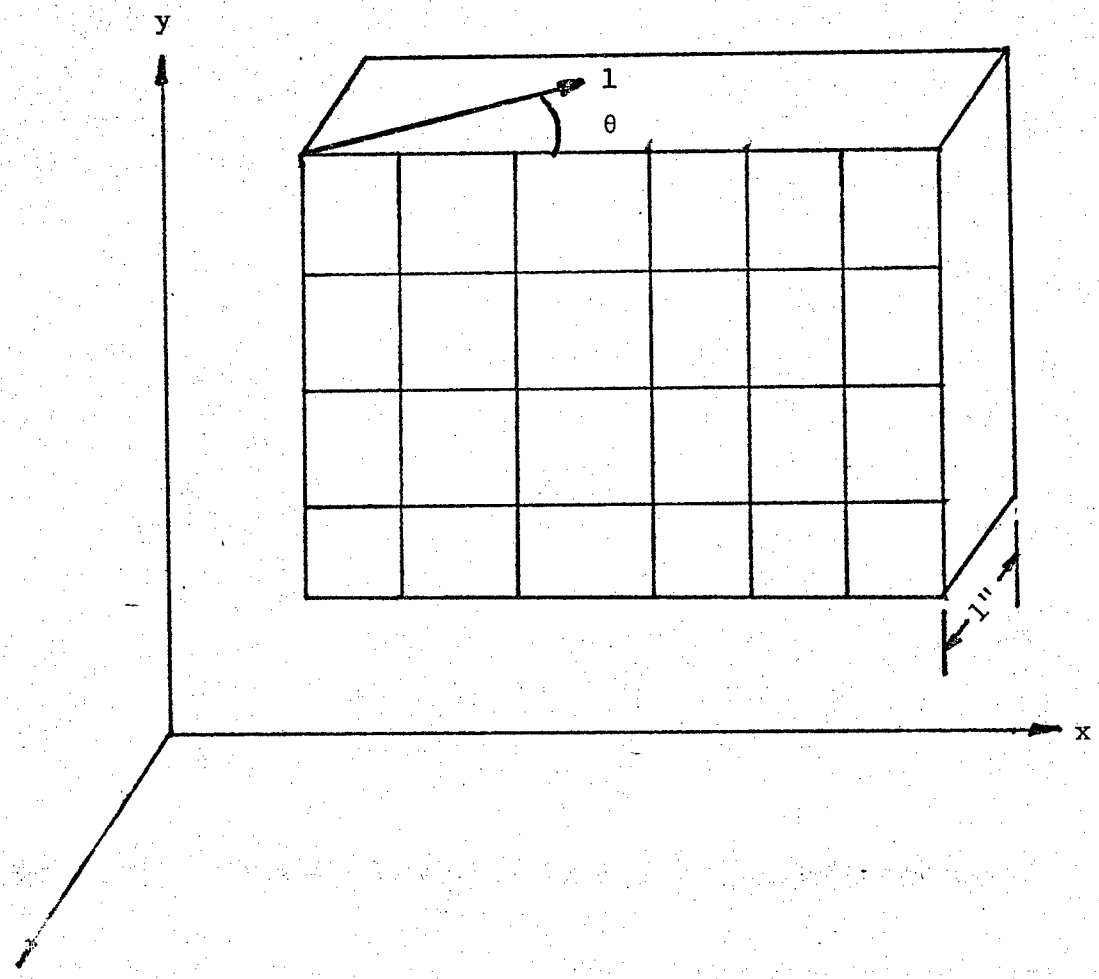
Columns	Format	Variable	Explanation
1 - 5	I5	MTYPE	Material Identification Number
6 - 10	I5	NTC(MTYPE)	Number of temperature cards for material MTYPE (see Card 4)

Columns	Format	Variable	Explanation
11 - 20	F10.0	RO(MTYPE)	Mass density for material MTYPE
21 - 25	I5	NORTHO(MTYPE)	Material type for material MTYPE 0, ISOTROPIC MATERIAL 1, orthotropic material

CARD 3A: Material Orientation (Orthotropic Materials Only)

Columns	Format	Variable	Explanation
1 - 10	F10.0	Angle , θ	Orientation angle of material longitudinal strength direction (fiber direction for dilamentary composites) in x-z plane

Figure 2-1. Grid Geometry



CARD 4A: Material Properties (Isotropic Materials Only)

Columns	Format	Variable	Explanation
1 - 10	F10.3	E(I,1,MTYPE)	Temperature I
11 - 20	F10.3	E(I,2,MTYPE)	Young's Modulus at temperature I
21 - 30	F10.3	E(I,3,MTYPE)	Poisson's Ratio at temperature I
31 - 40	F10.3	E(I,4,MTYPE)	Coefficient of thermal expansion at temperature I

NOTE: Repeat Card 4A for each temperature desired for material MTYPE, i.e., repeat NUMTC(MTYPE) times.

CARD 4B: Material Properties (Orthotropic Materials Only)

Columns	Format	Variable	Explanation
1-10	F10.0	TMAT(MTYPE,I)	Temperature I
11 - 20	F10.0	E11(MTYPE,I)	Longitudinal Young's modulus at temperature I
21 - 30	F10.0	E22(MTYPE,I)	Transverse Young's modulus at temperature I
31 - 40	F10.0	G12(MTYPE,I)	Shear modulus in the 1,2 plane at temperature I
41 - 50	F10.0	AMU12(MTYPE,I)	Poisson's Ratio, ν_{12}, at temperature I
51 - 60	F10.0	A1(MTYPE,I)	Longitudinal coefficient of thermal expansion at temperature I
61 - 70	F10.0	A2(MTYPE,I)	Transverse coefficient of thermal expansion at temperature I
71 - 80	F10.0	A12(MTYPE,I)	Shearing coefficient of thermal expansion, α_{12}, at temperature I

NOTE FOR A12(MTYPE,I) - At this time α_{12} has not been incorporated into the analysis; it has been included in the input with possible future inclusion in mind. For orthotropic materials $\alpha_{12} = 0$).

NOTE: Repeat Card 4B for each temperature desired for material MTYPE, i.e., repeat NUMTC(MTYPE) times.

Cards 3 and 4 are repeated NUMMAT times.

CARD 5: Grid Point Data

Columns	Format	Variable	Explanation
1 - 5	I5	N	Grid point number
6 - 10	F5.1	CODE(N)	Boundary condition flag for grid point N: 0, UR(N) and UZ(N) are x and y loads 1, UR(N) is x-displacement and UZ(N) is y-load 2, UR(N) is x-load and UZ(N) is y-displacement 3, UR(N) and UZ(N) are x and y displacements
11 - 20	F10.4	R(N)	X-coordinate of grid point N
21 - 30	F10.4	Z(N)	Y-coordinate of grid point N
31 - 40	F10.4	UR(N)	X-load or displacement of grid point N(See CODE(N) above)
41 - 50	F10.4	UZ(N)	Y-load or displacement of grid point N (See CODE(N) above)
51 - 60	F10.4	T(N)	Temperature of grid point N

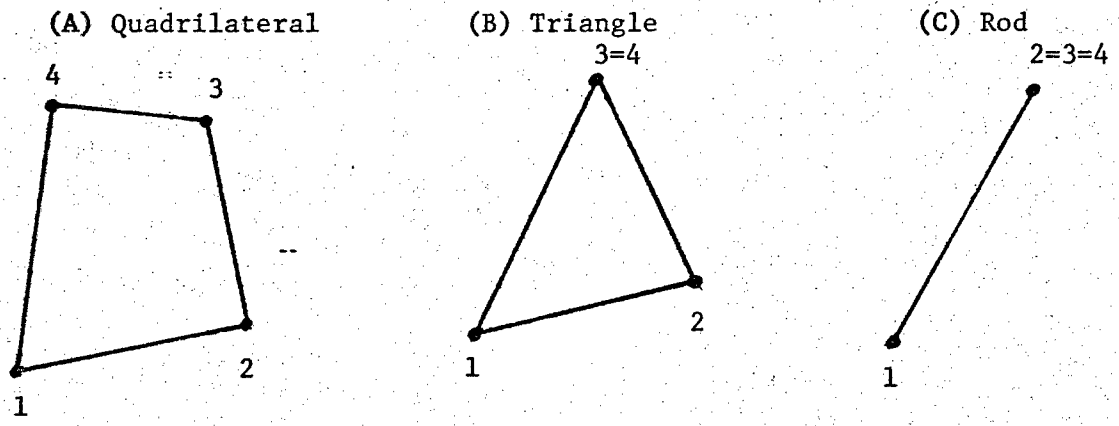
Card 5 is repeated to input the entire grid system. The repetition is performed either for every grid point or for those grid points required by the mesh generator within PLSTR (See Appendix A).

CARD 6: Element Data

Columns	Format	Variable	Explanation
1 - 5	I5	M	Element number
6 - 10	I5	IX(M,1)	First grid point for element M
11 - 15	I5	IX(M,2)	Second grid point for element M
16 - 20	I5	IX(M,3)	Third grid point for element M
21 - 25	I5	IX(M,4)	Fourth grid point for element M
26 - 30	I5	IX(M,5)	Material identification for element M

As for Card 5, Card 6 is repeated either for every element or for those elements required by PLSTR's mesh generator (See Appendix A). The sequencing of grid points for an element is counter clockwise as shown in Figure 2-2.

Figure 2-2 Element Grid Point Sequencing



NOTE: Four grid points must be input for each element type.

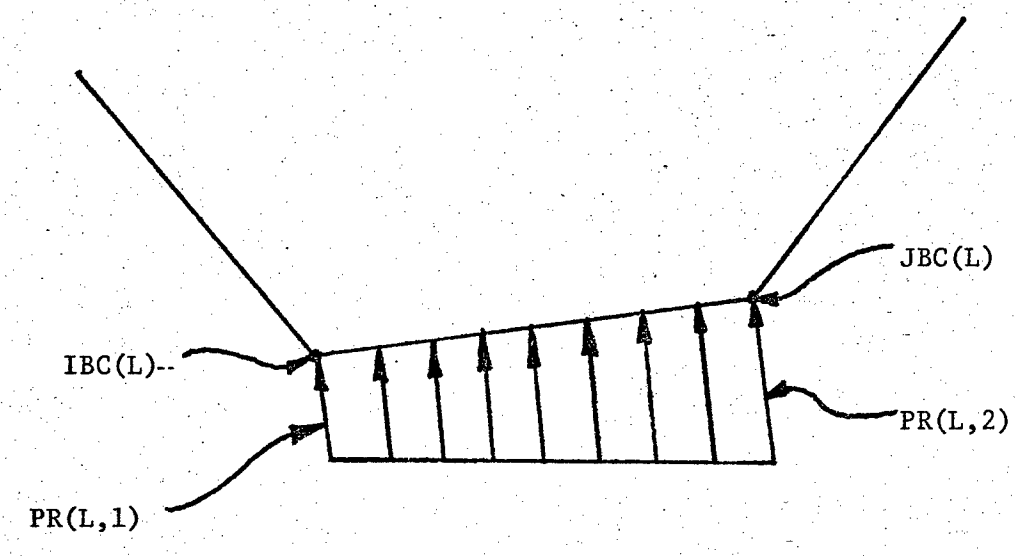
CARD 7: Pressure Data (If NUMPC is greater than zero)

Columns	Format	Variable	Explanation
1 - 5	I5	IBC(L)	First pressure grid point
6 - 10	I5	JBC(L)	Second pressure grid point
11 - 20	F10.3	PR(L,1)	Pressure acting at IBC
21 - 30	F10.3	PR(L,2)	Pressure acting at JBC

Card 7 is repeated NUMPC times (See Card 2). The grid points are sequenced in a counter clockwise manner as you proceed around the perimeter of the

grid (See Figure 2-3). A linear distribution is assumed along the element face.

Figure 2-3 Pressure Card Nomenclature



CARD 8: Output Selection

Columns	Format	Variable	Explanation
1 - 5	I5	NPRT	Stress-Strain output flag 0, print for each element El. No., x,y, x-stress, y-stress, xy-stress, max-stress, min-stress, and angle 1, print for each element El. No., x,y, x-stress, y-stress, xy-stress, x-strain, y-strain, and xy-strain

APPENDIX A

PLSTR MESH GENERATOR

The mesh generator in PLSTR is loacted between labeled statement 60 (Line 34) and labeled statement 190 (Line 68) of the main program (See Appendix B). This generation scheme is useful in reducing the required number of physical input cards when many orderly, similarly sized elements occur in the grid.

The impact on grid cards needed is that, if the N + 1 consecutive grid points, M to M + N, are evenly spaced the variable, CODE, for each of these points is zero, and no loads are applied only the grid points M and M + N need be entered. The generator will calculate

$$DX = \frac{X_{M+N} - X_M}{N}$$

and

$$DY = \frac{Y_{M+N} - Y_M}{N}$$

Then the mesh generator will assign

$$X_{M+1} = X_M + DX, \quad Y_{M+1} = Y_M + DY$$

$$X_{N+2} = X_{M+1} + DX, \quad Y_{M+2} = Y_{M+1} + DY$$

Temperature will be handled in the same manner, and CODE for all generated points will be set to zero.

The impact of the mesh generator on the number of element cards needed is similar to the impact on grid cards. If the N + 1 consecutive elements, M to M + N, have grid points progressing by ones, and the material is the same for all N + 1 elements, only the elements M and M + N need be entered. The mesh generator will assign

$$IX(J,K) = IX(J-1,K) + 1 \quad J = M+1,M+N;\ K=1,4$$

and

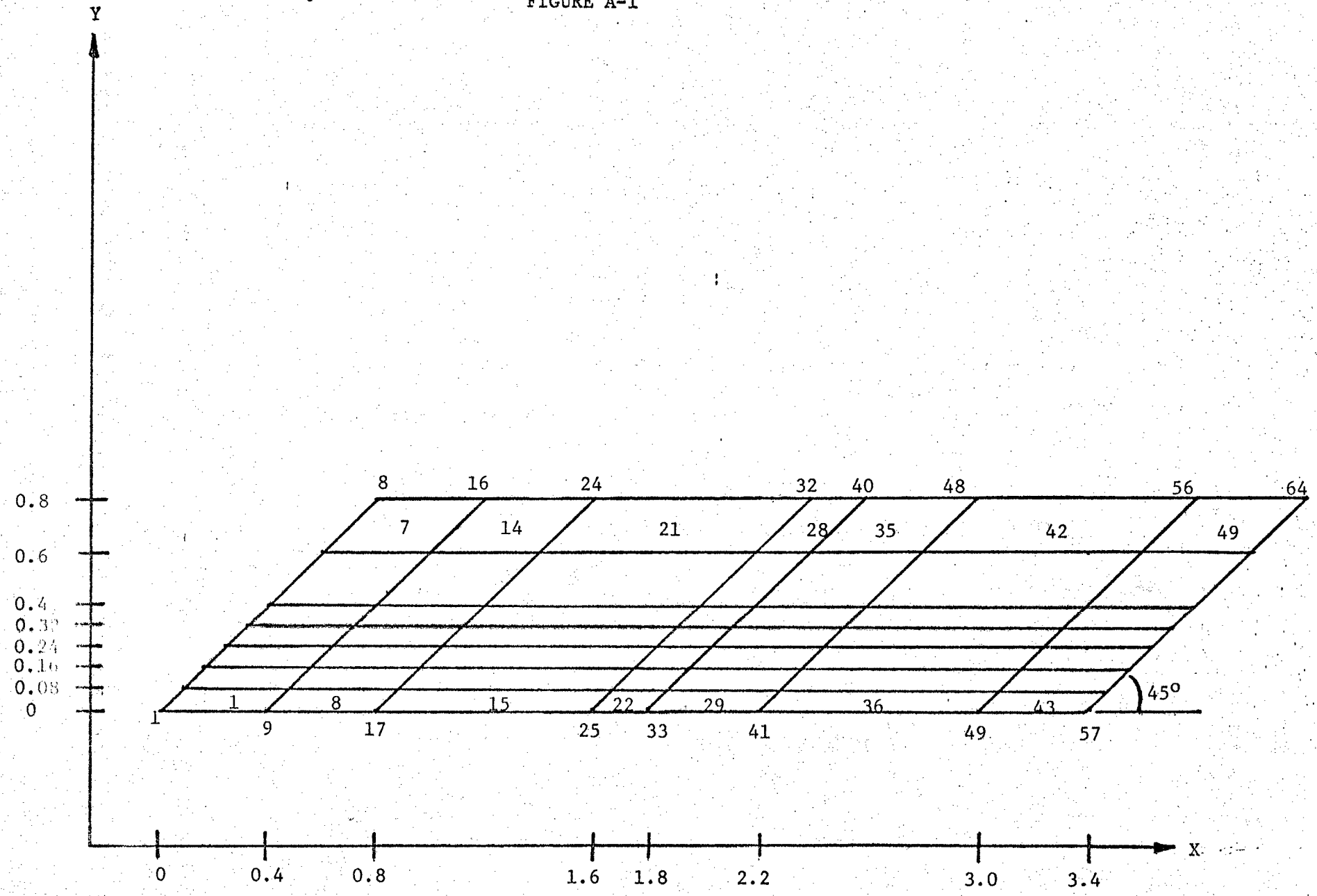
$$IX(J,5) = IX(M,5) \quad J = M+1,M+N-1$$

The following examples will illustrate the use and effect of the mesh generator.

EXAMPLE 1. Take a grid consisting of 64 grid points and 49 elements (See Figure A-1). In this problem, assume material 1 exists from Y = 0.0 to 0.32, and material 2 exists from Y = 0.32 to 0.8. Also assume that no points are constrained, i.e., CODE is zero everywhere. Without a mesh generator, 64 grid point cards and 49 element cards would be needed.

The grid points which must be input for this problem are 1,6,8,9,14, 16,17,22,24,25,30,32,33,38,40,41,46,48,49,54,56,57,62,64. Thus, only 24 grid points need be input instead of 64. The elements which must be input are 1,4,5,7,8,11,12,14,15,18,19,21,22,25,26,28,29,32,33,35,36,39,40,42,43, 46,47,49. Therefore, only 28 elements need be input instead of 49. In this problem, the mesh generator causes 61 fewer cards to be required.

FIGURE A-1


Y
0.8
0.6
0.4
0.32
0.24
0.16
0.08
0
8
16
24
32
40
48
56
64
7
14
21
28
35
42
49
1
8
15
22
29
36
43
45°
1
9
17
25
33
41
49
57
X
0
0.4
0.8
1.6
1.8
2.2
3.0
3.4

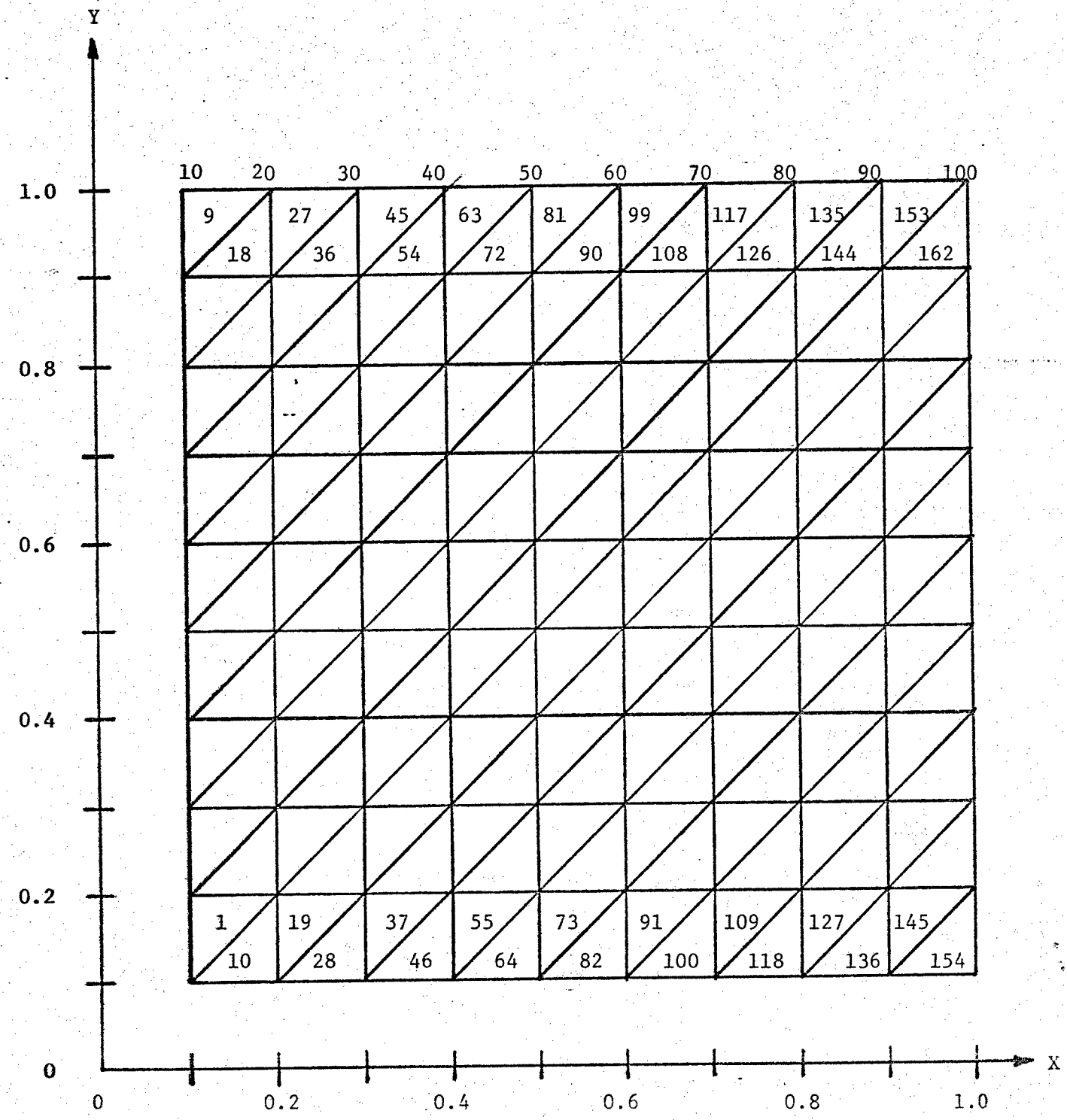
EXAMPLE 2. Take the same grid as in example 1. Assume, this time, that loads are applied at grid points 1 to 8, a zero x-displacement is imposed at grid points 57 to 64, and only one material is used.

The grid points which must be input for this problem are 1-8,9,14,16,17, 22,24,25,30,32,33,38,40,41,46,48,49,54,56,57-64. The elements which must be input are 1,7,8,14,15,21,22,28,29,35,36,42,43, and 49. Since only 34 grid points and 14 elements are input, 65 fewer data cards are required because of the mesh generator.

EXAMPLE 3. Take a grid consisting of 100 grid points and 162 elements (See Figure A-2). Assume one material, no loads, and no constraints. Without the mesh generator, 262 data cards would be required.

The grid points which must be input are 1, 10,11,20,21,30,31,40,41,50, 51,60,61,70,71,80,81,90,91, and 100. The elements which must be input are 1,9,10,18,19,27,28,36,37,45,46,54,55,63,64,72,73,81,82,90,91,99,100, 108,109,117,118,126,127,135,136,144,145,153,154, and 162. Thus, only 56 cards are required, instead of 262.

Figure A-2


Y
X
1.0
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1.0
10 20 30 40 50 60 70 80 90 100
9 18
27 36
45 54
63 72
81 90
99 108
117 126
135 144
153 162
1 10
19 28
37 46
55 64
73 82
91 100
109 118
127 136
145 154

APPENDIX B

PROGRAM LISTING

```
      PROGRAM PLSTR(INPUT,OUTPUT,PUNCH,TAPE1,TAPE2,TAPE5=INPUT,TAPE6=OUT
     1PUT)
C     ARBITRARY TWO DIMENSIONAL STRUCTURES
C     LINEAR PRESSURE BOUNDARY
C     PROGRAMMED BY R.S.SANDHU, THE OHIO STATE UNIVERSITY, COLUMBUS      MAIN
C     COMMON NUMNP,NUMEL,NUMMAT,NUMPC,ACELR,ACELZ,N,JOL,TEMP,MTYPE,Q,    MAIN
      COMMON HED(8),E(8,4,12),RO(12),NTC(8),R(3000),Z(3000),UR(3000),UZ(3000),
     1 HED(8),E(8,4,12),RO(12),NTC(8),R(3000),Z(3000),UR(3000),UZ(3000),
     2 CODE(3000),T(3000),IBC(300),JBC(300),PR(300,2)
      COMMON/ARG/C(3,3),S(10,10),SIG(6),P(8),ST(3,10),RR(5),ZZ(5),L4(4),
     1           EE(7),IX(3000,5),XC,YC
      COMMON/ORTHO/NORTHO(12),ANGLE(12),TH(12),S1(12),S2(12),S3(12),
     1             S4(12),S5(12),S6(12),S7(12),S8(12),E11(12,8),
     2             E22(12,8),G12(12,8),AMU12(12,8),A1(12,8),A2(12,8),
     3             A12(12,8),TMAT(12,8)
      COMMON/BANARG/MBAND,NUMBLK,B(200),A(200,100)
   30 READ  (5,1000) HED,NUMNP,NUMEL,NUMMAT,NUMPC,ACELR,ACELZ,Q          MAIN
      IF(EOF(5)) 123,31
   31 CONTINUE
      WRITE (6,2000) HED,NUMNP,NUMEL,NUMMAT,NUMPC,ACELR,ACELZ,Q          MAIN
                                                                         MAIN
   40 DO 50 M=1,NUMMAT
      READ(5,1001) MTYPE,NTC(MTYPE),RO(MTYPE),NORTHO(MTYPE)
      WRITE(6,2001) MTYPE,NTC(MTYPE),RO(MTYPE),NORTHO(MTYPE)
                                                                         MAIN
      NUMTC=NTC(MTYPE)
      NXN=NORTHO(MTYPE)
      IF(NXN.GT.0) GO TO 51
      READ(5,1002) ((E(I,J,MTYPE),J=1,4),I=1,NUMTC)
      WRITE(6,2002)((E(I,J,MTYPE),J=1,4),I=1,NUMTC)
      GO TO 50
   51 CALL ORTHOG(MTYPE,NUMTC)                                           MAIN
   50 CONTINUE                                                           MAIN
      WRITE (6,2003)
      L=1
      NL=1
   60 READ  (5,1003) N,CODE(N),R(N),Z(N),UR(N),UZ(N),T(N)                MAIN
      IF(N.EQ.1) GO TO 90                                                MAIN
      NL=L+1                                                             MAIN
      ZX=N-L                                                             MAIN
      DR=(R(N)-R(L))/ZX                                                  MAIN
      DZ=(Z(N)-Z(L))/ZX                                                  MAIN
      DT=(T(N)-T(L))/ZX                                                  MAIN
   70 L=L+1                                                              MAIN
      IF(N-L) 100,90,80                                                  MAIN
   80 CODE(L)=0.0                                                        MAIN
      R(L)=R(L-1)+DR                                                     MAIN
      Z(L)=Z(L-1)+DZ                                                     MAIN
      T(L)=T(L-1)+DT                                                     MAIN
      UR(L)=0.0                                                          MAIN
      UZ(L)=0.0                                                          MAIN
      GO TO 70                                                           MAIN
   90 WRITE (6,2004) (K,CODE(K),R(K),Z(K),UR(K),UZ(K),T(K),K=NL,N)       MAIN
      IF(NUMNP-N) 100,110,60                                             MAIN
  100 WRITE (6,2005) N                                                   MAIN
      CALL EXIT                                                          MAIN
  110 CONTINUE                                                           MAIN
      WRITE (6,2006)
```

```
      N=0                                                                MAIN
  130 READ (5,1004) M,(IX(M,I),I=1,5)                                    MAIN
  140 N=N+1                                                              MAIN
      IF (M-N) 170,170,150                                               MAIN
  150 IX(N,1)=IX(N-1,1)+1                                                MAIN
      IX(N,2)=IX(N-1,2)+1                                                MAIN
      IX(N,3)=IX(N-1,3)+1                                                MAIN
      IX(N,4)=IX(N-1,4)+1                                                MAIN
      IX(N,5)=IX(N-1,5)                                                  MAIN
  170 WRITE (6,2007) N,(IX(N,I),I=1,5)                                   MAIN
      IF (M-N) 180,180,140                                               MAIN
  180 IF (NUMEL-N) 190,190,130                                           MAIN
  190 CONTINUE                                                           MAIN
      IF (NUMPC) 290,310,290                                             MAIN
  290 WRITE (6,2008)                                                     MAIN
      DO 300 L=1,NUMPC                                                   MAIN
      READ(5,1005) IBC(L),JBC(L),PR(L,1),PR(L,2)                         MAIN
  300 WRITE(6,2009) IBC(L),JBC(L),PR(L,1),PR(L,2)                        MAIN
  310 CONTINUE                                                           MAIN
      READ (5,1006) NPRT                                                 MAIN
      J=0                                                                MAIN
      DO 340 N=1,NUMEL                                                   MAIN
      DO 340 I=1,4                                                       MAIN
      DO 325 L=1,4                                                       MAIN
      KK=IABS(IX(N,I)-IX(N,L))                                           MAIN
      IF (KK-J) 325,325,320                                              MAIN
  320 J=KK                                                               MAIN
  325 CONTINUE                                                           MAIN
  340 CONTINUE                                                           MAIN
      MBAND=2*J+2                                                        MAIN
  350 CALL STIFF                                                         MAIN
      CALL BANSOL                                                        MAIN
      WRITE (6,2010) (N,B(2*N-1),B(2*N),N=1,NUMNP)                       MAIN
      CALL STRESS(NPRT)
      DO 360 I=1,NUMNP
      J=2*I-1
      K=2*I
  360 CONTINUE
 1000 FORMAT (8A10/4I5,3F10.2)
 1001 FORMAT (2I5,F10.0,I5)                                              MAIN
 1002 FORMAT (4F10.3)
 1003 FORMAT (I5,F5.1,5F10.4)                                            MAIN
 1004 FORMAT (6I5)                                                       MAIN
 1005 FORMAT(2I5,2F10.3)
 1006 FORMAT (I5)
 2000 FORMAT (1H1,8A10/
     1 30H0 NUMBER OF NODAL POINTS------ I5 /
     2 30H0 NUMBER OF ELEMENTS---------- I5 /
     3 30H0 NUMBER OF DIFF. MATERIALS--- I3 /                            MAIN
     4 30H0 NUMBER OF PRESSURE CARDS---- I3 /                            MAIN
     5 30H0 X-ACCELERATION-------------- E12.4/                         MAIN
     6 30H0 Y-ACCELERATION-------------- E12.4/                         MAIN
     7 30H0 REFERENCE TEMPERATURE------- E12.4)                         MAIN
 2001 FORMAT (* MATERIAL NUMBER= *,I3,*, NUMBER OF TEMPERATURE CARDS= *,
     1       I3,*, MASS DENSITY= *,E12.4,*, NORTHO= *,I3)
```

```
      2002 FORMAT (15H0  TEMPERATURE 10X 5HE     9X 6HNU     10X 5HALPHA7     MAIN
     1(F15.2,3E15.5))                                                        MAIN
      2003 FORMAT (108H1NODAL POINT         TYPE  X ORDINATE  Y ORDINATE  X LOMAIN
     1AD OR DISPLACEMENT  Y LOAD OR DISPLACEMENT TEMPERATURE )               MAIN
  115 2004 FORMAT (I12,F12.2,2F12.5,2E24.7,F12.3)
      2005 FORMAT (26H0NODAL POINT CARD ERROR N= I5)                          MAIN
      2006 FORMAT (49h1ELEMENT NO.      I     J     K     L    MATERIAL  )   MAIN
      2007 FORMAT (1I13,4I6,1I12)                                             MAIN
      2008 FORMAT(29H0PRESSURE BOUNDARY CONDITIONS/40H     I     J    PRESSURMAIN
  120 1E I     PRESSURE J)                                                    MAIN
      2009 FORMAT(2I6,2F14.3)                                                 MAIN
      2010 FORMAT (12H1N.P. NUMBER 18X 2HUX 18X 2HUY / (1I12,2E20.7))         MAIN
      3000 FORMAT (2E20.7)
           GO TO 30 ;
  125  123 STOP
           END                                                                MAIN
```

SYMBOLIC REFERENCE MAP

ENTRY POINTS
5156 PLSTR

VARIABLES	SN	TYPE	RELOCATION							
312	A	REAL	ARRAY	BANARG	4	ACELR	REAL			/ /
5	ACELZ	REAL		/ /	644	AMU12	REAL	ARRAY	ORTHO	
14	ANGLE	REAL	ARRAY	ORTHO	1004	A1	REAL	ARRAY	ORTHO	
1304	A12	REAL	ARRAY	ORTHO	1144	A2	REAL	ARRAY	ORTHO	
2	B	REAL	ARRAY	BANARG	0	C	REAL	ARRAY	ARG	
30207	CODE	REAL	ARRAY	/ /	6060	DR	REAL			
6062	DT	REAL			6061	DZ	REAL			
23	E	REAL	ARRAY	/ /	247	EE	REAL	ARRAY	ARG	
204	E11	REAL	ARRAY	ORTHO	344	E22	REAL	ARRAY	ORTHO	
504	G12	REAL	ARRAY	ORTHO	13	HED	REAL	ARRAY	/ /	
6053	I	INTEGER			43767	IBC	INTEGER	ARRAY	/ /	
256	IX	INTEGER	ARRAY	ARG	6054	J	INTEGER			
44443	JBC	INTEGER	ARRAY	/ /	6063	K	INTEGER			
6065	KK	INTEGER			6055	L	INTEGER			
243	LM	INTEGER	ARRAY	ARG	6050	M	INTEGER			
0	MBAND	INTEGER		BANARG	11	MTYPE	INTEGER			/ /
6	N	INTEGER		/ /	6056	NL	INTEGER			
0	NORTHO	INTEGER	ARRAY	ORTHO	6064	NPRT	INTEGER			
637	NTC	INTEGER	ARRAY	/ /	1	NUMBLK	INTEGER			BANARG
1	NUMEL	INTEGER		/ /	2	NUMMAT	INTEGER			/ /
0	NUMNP	INTEGER		/ /	3	NUMPC	INTEGER			/ /
6051	NUMTC	INTEGER			6052	NXN	INTEGER			
163	P	REAL	ARRAY	ARG	45117	PR	REAL	ARRAY	/ /	
12	Q	REAL		/ /	647	R	REAL	ARRAY	/ /	
623	RO	REAL	ARRAY	/ /	231	RR	REAL	ARRAY	ARG	
11	S	REAL	ARRAY	ARG	155	SIG	REAL	ARRAY	ARG	
173	ST	REAL	ARRAY	ARG	44	S1	REAL	ARRAY	ORTHO	
60	S2	REAL	ARRAY	ORTHO	74	S3	REAL	ARRAY	ORTHO	
114	S4	REAL	ARRAY	ORTHO	124	S5	REAL	ARRAY	ORTHO	
140	S6	REAL	ARRAY	ORTHO	154	S7	REAL	ARRAY	ORTHO	
170	S8	REAL	ARRAY	ORTHO	36077	T	REAL	ARRAY	/ /	
15	TEMP	REAL		/ /	30	TH	REAL	ARRAY	ORTHO	
1444	TMAT	REAL	ARRAY	ORTHO	14427	UR	REAL	ARRAY	/ /	
22317	UZ	REAL	ARRAY	/ /	7	VOL	REAL		/ /	
35506	XC	REAL		ARG	35507	YC	REAL		ARG	
6537	Z	REAL	ARRAY	/ /	6057	ZX	REAL			
236	ZZ	REAL	ARRAY	ARG						

FILE NAMES	MODE								
0	INPUT		1023	OUTPUT		2046	PUNCH		3071 TAPE1
4114	TAPE2		0	TAPE5	FMT	1023	TAPE6	FMT	

EXTERNALS	TYPE	ARGS				
BANSOL		0	EOF	REAL	1	
EXIT		0	ORTHOG		2	
STIFF		0	STRESS		1	

INLINE FUNCTIONS TYPE ARGS
IABS INTEGER 1 INTRIN

STATEMENT LABELS

5151	30			0	31		INACTIVE	0	40		INACTIVE
5315	50			5313	51			5325	60		
5363	70			0	80		INACTIVE	5400	90		
5431	100			5440	110			5645	123		
5444	130			5461	140			0	150		INACTIVE
5474	170			0	180		INACTIVE	0	190		INACTIVE
0	290		INACTIVE	0	300			5554	310		
0	320		INACTIVE	5577	325			0	340		
0	350		INACTIVE	0	360			5660	1000	FMT	
5663	1001	FMT		5666	1002	FMT		5670	1003	FMT	
5673	1004	FMT		5675	1005	FMT		5700	1006	FMT	
5702	2000	FMT		5736	2001	FMT		5751	2002	FMT	
5761	2003	FMT		5776	2004	FMT		6003	2005	FMT	
6010	2006	FMT		6017	2007	FMT		6022	2008	FMT	
6033	2009	FMT		6036	2010	FMT		6044	3000	FMT	NO REFS

COMMON BLOCKS LENGTH
/ / 19623
ARG 15176
ORTHO 300
BANARG 20202

STATISTICS

PROGRAM LENGTH	7318	473
BUFFER LENGTH	51378	2655
COMMON LENGTH	166668	36278
BLANK COMMON	462478	19623

```
      SUBROUTINE STIFF                                                  STIF
      COMMON NUMNP,NUMEL,NUMMAT,NUMPC,ACELR,ACELZ,N,VOL,TEMP,MTYPE,J,   STIF
     1 HED(8),E(8,4,12),RO(12),NTC(8),R(3000),Z(3000),UR(3000),UZ(3000),
     2 CODE(3000),T(3000),IBC(300),JBC(300),PR(300,2)
      COMMON/ARG/C(3,3),S(10,10),SIG(6),P(8),ST(3,10),RR(5),ZZ(5),LM(4),
     1          EE(7),IX(3000,5),XC,YC
      COMMON/BANARG/MBAND,NUMBLK,B(200),A(200,100)
      REWIND 2                                                          STIF
      NB=50
      ND=2*NB                                                           STIF
      ND2=2*ND                                                          STIF
      STOP=0.0                                                          STIF
      NUMBLK=0                                                          STIF
      DO 50 N=1,ND2                                                     STIF
      B(N)=0.0                                                          STIF
      DO 50 M=1,ND                                                      STIF
   50 A(N,M)=0.0                                                        STIF
   60 NUMBLK=NUMBLK+1                                                   STIF
      NH=ND*(NUMBLK+1)                                                  STIF
      NM=NH-NB                                                          STIF
      NL=NM-NB+1                                                        STIF
      KSHIFT=2*NL-2                                                     STIF
      DO 210 N=1,NUMEL                                                  STIF
      IF (IX(N,5)) 210,210,65                                           STIF
   65 DO 80 I=1,4                                                       STIF
      IF (IX(N,I)-NL) 80,70,70                                          STIF
   70 IF (IX(N,I)-NM) 90,90,80                                          STIF
   80 CONTINUE                                                          STIF
      GO TO 210
   90 IF(IX(N,3)-IX(N,2)) 95,85,95
   85 CALL ONED
      IX(N,5)=-IX(N,5)
      MM=2
      GO TO 130
   95 CALL QUAD
      IX(N,5)=-IX(N,5)                                                  STIF
      IF(VOL) 100,100,110                                               STIF
  100 WRITE(6,2000) N                                                   STIF
      STOP=1.0                                                          STIF
  110 MM=4                                                              STIF
      IF(IX(N,3)-IX(N,4)) 130,120,130                                   STIF
  120 MM=3                                                              STIF
  130 DO 140 I=1,MM                                                     STIF
  140 LM(I)=2*IX(N,I)-2                                                 STIF
      DO 200 I=1,MM                                                     STIF
      DO 200 K=1,2                                                      STIF
      II=LM(I)+K-KSHIFT                                                 STIF
      KK=2*I-2+K                                                        STIF
      B(II)=B(II)+P(KK)                                                 STIF
      DO 200 J=1,MM                                                     STIF
      DO 200 L=1,2                                                      STIF
      JJ=LM(J)+L-II+1-KSHIFT                                            STIF
      LL=2*J-2+L                                                        STIF
      IF(JJ) 200,200,175                                                STIF
  175 IF(ND-JJ) 180,195,195
```

```
      180 WRITE (6,2001) N                                              STIF
          STOP=1.0                                                      STIF
          GO TO 210                                                     STIF
      195 A(II,JJ)=A(II,JJ)+S(KK,LL)                                    STIF
   60 200 CONTINUE                                                      STIF
      210 CONTINUE                                                      STIF
          DO 220 N=NL,NM                                                STIF
          IF(N-NUMNP) 215,215,220
      215 K=2*N-KSHIFT
   65     B(K)=B(K)+UZ(N)                                               STIF
          B(K-1)=B(K-1)+UR(N)
      220 CONTINUE
          IF(NUMPC) 225,310,225                                         STIF
      225 DO 300 L=1,NUMPC                                              STIF
   70     I=IBC(L)                                                      STIF
          J=JBC(L)                                                      STIF
          DR=Z(I)-Z(J)                                                  STIF
          DZ=R(J)-R(I)                                                  STIF
          PP2=(PR(L,2)+PR(L,1))/6.                                      STIF
   75     PP1=PP2+PR(L,1)/6.                                            STIF
          PP2=PP2+PR(L,2)/6.                                            STIF
          II=2*I-KSHIFT                                                 STIF
          JJ=2*J-KSHIFT                                                 STIF
          IF(II) 265,265,235                                            STIF
   80     235 IF(II-ND) 240,240,265                                     STIF
      240 B(II-1)=B(II-1)+PP1*DR                                        STIF
          B(II)=B(II)+PP1*DZ                                            STIF
      265 IF(JJ) 300,300,270                                            STIF
      270 IF(JJ-ND) 275,275,300                                         STIF
   85 275 B(JJ-1)=B(JJ-1)+PP2*DR                                        STIF
          B(JJ)=B(JJ)+PP2*DZ                                            STIF
      300 CONTINUE                                                      STIF
      310 DO 400 M=NL,NH                                                STIF
          IF (M-NUMNP) 315,315,400                                      STIF
   90 315 U=UR(M)                                                       STIF
          N=2*M-1-KSHIFT                                                STIF
          IF (CODE(M)) 390,400,316                                      STIF
      316 IF (CODE(M)-1.) 317,370,317                                   STIF
      317 IF (CODE(M)-2.) 318,390,318                                   STIF
   95 318 IF (CODE(M)-3.) 390,380,390                                   STIF
      370 CALL MODIFY(A,B,ND2,MBAND,N,U)                                STIF
          GO TO 400                                                     STIF
      380 CALL MODIFY(A,B,ND2,MBAND,N,U)                                STIF
      390 U=UZ(M)                                                       STIF
  100     N=N+1                                                         STIF
          CALL MODIFY(A,B,ND2,MBAND,N,U)                                STIF
      400 CONTINUE                                                      STIF
          WRITE (2) (B(N),(A(N,M),M=1,MBAND),N=1,ND)                    STIF
          DO 420 N=1,ND                                                 STIF
  105     K=N+ND                                                        STIF
          B(N)=B(K)                                                     STIF
          B(K)=0.0                                                      STIF
          DO 420 M=1,ND                                                 STIF
          A(N,M)=A(K,M)                                                 STIF
  110 420 A(K,M)=0.0                                                    STIF
```

```
      IF (NM-NUMNP) 60,480,480                                          STIF
  480 CONTINUE                                                          STIF
      IF(STOP) 490,500,490                                              STIF
  490 CALL EXIT                                                         STIF
  500 RETURN                                                            STIF
 2000 FORMAT (26H0NEGATIVE AREA ELEMENT NO. I4)                         STIF
 2001 FORMAT (29H0BAND WIDTH EXCEEDS ALLOWABLE I4)                      STIF
      END                                                               STIF
```

115

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SYMBOLIC REFERENCE MAP

ENTRY POINTS
1 STIFF

VARIABLES	SN	TYPE		RELOCATION						
312	A	REAL	ARRAY	BANARG	4	ACELR	REAL		/ /	
5	ACELZ	REAL		/ /	2	B	REAL	ARRAY	BANARG	
0	C	REAL	ARRAY	ARG	30207	CODE	REAL	ARRAY	/ /	
433	DR	REAL			434	DZ	REAL			
23	E	REAL	ARRAY	/ /	247	EE	REAL	ARRAY	ARG	
13	HED	REAL	ARRAY	/ /	422	I	INTEGER			
43707	IDC	INTEGER	ARRAY	/ /	425	II	INTEGER			
256	IX	INTEGER	ARRAY	ARG	427	J	INTEGER			
44443	JDC	INTEGER	ARRAY	/ /	431	JJ	INTEGER			
424	K	INTEGER			426	KK	INTEGER			
421	KSHIFT	INTEGER			430	L	INTEGER			
432	LL	INTEGER			243	LM	INTEGER	ARRAY	ARG	
415	M	INTEGER			0	MBAND	INTEGER		BANARG	
423	MM	INTEGER			11	MTYPE	INTEGER		/ /	
6	N	INTEGER		/ /	411	NB	INTEGER			
412	ND	INTEGER			413	ND2	INTEGER			
416	NH	INTEGER			420	NL	INTEGER			
417	NN	INTEGER			637	NTC	INTEGER	ARRAY	/ /	
1	NUMBLK	INTEGER		BANARG	1	NUMEL	INTEGER		/ /	
2	NUMMAT	INTEGER		/ /	0	NUMNP	INTEGER		/ /	
3	NUMPC	INTEGER		/ /	163	P	REAL	ARRAY	ARG	
436	PP1	REAL			435	PP2	REAL			
45117	PR	REAL	ARRAY	/ /	12	Q	REAL		/ /	
647	R	REAL	ARRAY	/ /	623	RO	REAL	ARRAY	/ /	
231	RR	REAL	ARRAY	ARG	11	S	REAL	ARRAY	ARG	
155	SIG	REAL	ARRAY	ARG	173	ST	REAL	ARRAY	ARG	
414	STOP	REAL			36077	T	REAL	ARRAY	/ /	
10	TEMP	REAL		/ /	437	U	REAL			
14427	UR	REAL	ARRAY	/ /	22317	UZ	REAL	ARRAY	/ /	
7	VOL	REAL		/ /	35506	XC	REAL		ARG	
35507	YC	REAL		ARG	65371	Z	REAL	ARRAY	/ /	
236	ZZ	REAL	ARRAY	ARG						

FILE NAMES MODE
TAPE2 UNFMT TAPE6 FMT

EXTERNALS	TYPE	ARGS		
EXIT		0	MODIFY	6
ONED		0	QUAD	0

STATEMENT LABELS

5	50		24	60			0	65	INACTIVE
0	70	INACTIVE	51	80			0	85	INACTIVE
53	90		63	95			0	100	INACTIVE
77	110		0	120	INACTIVE		104	130	
0	140		0	175	INACTIVE		0	180	INACTIVE
156	195		157	200			171	210	
0	215	INACTIVE	211	220			0	225	INACTIVE

STATEMENT LABELS

0	235	INACTIVE	0	240	INACTIVE	246	265		
0	270	INACTIVE	0	275	INACTIVE	256	300		
257	310		0	315	INACTIVE	0	316	INACTIVE	
0	317	INACTIVE	0	318	INACTIVE	302	370		
305	380		307	390		314	400		
0	420		0	480	INACTIVE	0	490	INACTIVE	
362	500		372	2000 FMT		377	2001 FMT		

COMMON BLOCKS	LENGTH
/ /	19623
ARG	15176
BANARG	20202

STATISTICS

PROGRAM LENGTH	4408	288
COMMON LENGTH	1050620	35378
BLANK COMMON	462478	19623

```
      SUBROUTINE ONED
      COMMON NUMNP,NUMEL,NUMMAT,NUMPC,ACELR,ACELZ,N,VOL,TEMP,MTYPE,J,    MAIN
     1 HED(8),E(8,4,12),RO(12),NTC(8),R(3000),Z(3000),UR(3000),UZ(3000),
     2 CODE(3000),T(3000),IBC(300),JBC(300),PR(300,2)
      COMMON/ARG/C(3,3),S(10,10),SIG(6),P(8),ST(3,10),RR(5),ZZ(5),LM(4),
     1          EE(7),IX(3000,5),XC,YC
      COMMON/BANARG/MBAND,NUMBLK,B(200),A(200,100)
C
      DO 100 I=1,8
      P(I)=0.0
      DO 100 J=1,8
  100 S(I,J)=0.0
      MTYPE=IX(N,5)
      I=IX(N,1)
      J=IX(N,2)
      DX=R(J)-R(I)
      DY=Z(J)-Z(I)
      XL=SQRT(DX**2+DY**2)
      COSA=DX/XL
      SINA=DY/XL
      COMM=E(1,2,MTYPE)*E(1,4,MTYPE)/XL
C
      S(1,1)=COSA*COSA*COMM
      S(1,2)=COSA*SINA*COMM
      S(1,3)=-S(1,1)
      S(1,4)=-S(1,2)
      S(2,1)=S(1,2)
      S(2,2)=SINA*SINA*COMM
      S(2,3)=-S(1,2)
      S(2,4)=-S(2,2)
      S(3,1)=S(1,3)
      S(3,2)=S(2,3)
      S(3,3)=S(1,1)
      S(3,4)=S(1,2)
      S(4,1)=S(1,4)
      S(4,2)=S(2,4)
      S(4,3)=S(3,4)
      S(4,4)=S(2,2)
C
      EP=C(1,3,MTYPE)/E(1,2,MTYPE)
      DX=DX*EP
      DY=DY*EP
      P(1)=S(1,1)*DX+S(1,2)*DY
      P(2)=S(2,1)*DX+S(2,2)*DY
      P(3)=-P(1)
      P(4)=-P(2)
C
      RETURN
C
      END
```

SYMBOLIC REFERENCE MAP

ENTRY POINTS
1 ONED

VARIABLES	SN	TYPE	RELOCATION							
312	A	REAL	ARRAY	BANARG	4	ACELR	REAL		/ /	
5	ACELZ	REAL		/ /	2	B	REAL	ARRAY	BANARG	
0	C	REAL	ARRAY	ARG	30207	CODE	REAL	ARRAY	/ /	
100	COMM	REAL			76	COSA	REAL			
73	DX	REAL			74	DY	REAL			
23	E	REAL	ARRAY	/ /	247	EE	REAL	ARRAY	ARG	
101	EP	REAL			13	HED	REAL	ARRAY	/ /	
71	I	INTEGER			43767	IBC	INTEGER	ARRAY	/ /	
256	IX	INTEGER	ARRAY	ARG	72	J	INTEGER			
44443	JBC	INTEGER	ARRAY	/ /	243	LM	INTEGER	ARRAY	ARG	
0	MBAND	INTEGER		BANARG	11	MTYPE	INTEGER		/ /	
6	N	INTEGER		/ /	637	NTC	INTEGER	ARRAY	/ /	
1	NUMBLK	INTEGER		BANARG	1	NUMEL	INTEGER		/ /	
2	NUMMAT	INTEGER		/ /	0	NUMNP	INTEGER		/ /	
3	NUMPC	INTEGER		/ /	163	P	REAL	ARRAY	ARG	
45117	PR	REAL	ARRAY	/ /	12	Q	REAL		/ /	
647	R	REAL	ARRAY	/ /	623	RO	REAL	ARRAY	/ /	
231	RR	REAL	ARRAY	ARG	11	S	REAL	ARRAY	ARG	
155	SIG	REAL	ARRAY	ARG	77	SINA	REAL			
173	ST	REAL	ARRAY	ARG	36077	T	REAL	ARRAY	/ /	
10	TEMP	REAL		/ /	14427	UR	REAL	ARRAY	/ /	
22317	UZ	REAL	ARRAY	/ /	7	VOL	REAL		/ /	
35506	XC	REAL		ARG	75	XL	REAL			
35507	YC	REAL		ARG	6537	Z	REAL	ARRAY	/ /	
236	ZZ	REAL	ARRAY	ARG						

EXTERNALS	TYPE	ARGS
SQRT	REAL	1 LIBRARY

STATEMENT LABELS
0 100

COMMON BLOCKS	LENGTH
/ /	19523
ARG	15176
BANARG	26202

STATISTICS

PROGRAM LENGTH	1028	66
COMMON LENGTH	105628	35378
BLANK COMMON	462478	19623

```
      SUBROUTINE QUAD                                                    QUAD
      COMMON NUMNP,NUMEL,NUMMAT,NUMPC,ACELR,ACELZ,N,VOL,TEMP,MTYPE,Q,    QUAD
     1 HED(8),E(8,4,12),RO(12),NTC(8),R(3000),Z(3000),UR(3000),UZ(3000),
     2 CODE(3000),T(3000),IBC(300),JBC(300),PR(300,2)
      COMMON/ARG/C(3,3),S(10,10),SIG(6),P(8),ST(3,10),RR(5),ZZ(5),LM(4),
     1          EE(7),IX(3000,5),XC,YC
      COMMON/ORTHO/NORTHO(12),ANGLE(12),TH(12),S1(12),S2(12),S3(12),
     1             S4(12),S5(12),S6(12),S7(12),S8(12),E11(12,8),
     2             E22(12,8),G12(12,8),AMU12(12,8),A1(12,8),A2(12,8),
     3             A12(12,8),TMAT(12,8)
      COMMON/BANARG/MBAND,NUMBLK,B(200),A(200,100)
      DIMENSION U(3),V(3)                                                QUAD
      I=IX(N,1)                                                          QUAD
      J=IX(N,2)                                                          QUAD
      K=IX(N,3)                                                          QUAD
      L=IX(N,4)                                                          QUAD
      MTYPE=IX(N,5)                                                      QUAD
      VOL=0.                                                             QUAD
      TEMP=(T(I)+T(J)+T(K)+T(L))/4.0                                     QUAD
      RATIO=0.0                                                          QUAD
      NUMTC=NTC(MTYPE)                                                   QUAD
      NXN=NORTHO(MTYPE)
      IF(NXN.GT.0) GO TO 111
      IF (NUMTC.EQ.1) GO TO 100                                          QUAD
      DO 50 M=2,NUMTC                                                    QUAD
      IF (E(M,1,MTYPE)-TEMP) 50,60,60                                    QUAD
   50 CONTINUE                                                           QUAD
   60 DEN=E(M,1,MTYPE)-E(M-1,1,MTYPE)                                    QUAD
      IF(DEN) 70,80,70                                                   QUAD
   70 RATIO=(TEMP-E(M-1,1,MTYPE))/DEN                                    QUAD
   80 DO 90 KK=1,3                                                       QUAD
   90 EE(KK)=E(M-1,KK+1,MTYPE)+RATIO*(E(M,KK+1,MTYPE)-E(M-1,KK+1,MTYPE))QUAD
      GO TO 110                                                          QUAD
  100 DO 105 KK=1,3                                                      QUAD
  105 EE(KK)=E(1,KK+1,MTYPE)                                             QUAD
  110 COMM=EE(1)/(1.-EE(2)**2)                                           QUAD
      GO TO 112
  111 CALL ELCON(MTYPE,NUMTC,TEMP)
      GO TO 113
  112 C(1,1)=COMM
      C(1,2)=COMM*EE(2)                                                  QUAD
      C(1,3)=0.                                                          QUAD
      C(2,1)=C(1,2)                                                      QUAD
      C(2,2)=C(1,1)                                                      QUAD
      C(2,3)=0.                                                          QUAD
      C(3,1)=0.                                                          QUAD
      C(3,2)=0.                                                          QUAD
      C(3,3)=.5*COMM*(1.-EE(2))                                          QUAD
  113 CONTINUE
  114 CONTINUE
      DO 130 J=1,10                                                      QUAD
      DO 120 I=1,3                                                       QUAD
  120 ST(I,J)=0.                                                         QUAD
      DO 130 I=1,10                                                      QUAD
  130 S(I,J)=0.
```

```
                      DO 140 I=1,4                                                  QUAD
                      NPP=IX(N,I)                                                   QUAD
                      RR(I)=R(NPP)                                                  QUAD
                  140 ZZ(I)=Z(NPP)                                                  QUAD
60                    IF(IX(N,3)-IX(N,4)) 145,150,145                               QUAD
                  145 XC=(RR(1)+RR(2)+RR(3)+RR(4))/4.                               QUAD
                      YC=(ZZ(1)+ZZ(2)+ZZ(3)+ZZ(4))/4.                              QUAD
                      RR(5)=XC                                                      QUAD
                      ZZ(5)=YC                                                      QUAD
65                    K=5                                                           QUAD
                      J=1                                                           QUAD
                      I=4                                                           QUAD
                      LM(3)=9                                                       QUAD
                      NT=4                                                          QUAD
70                    GO TO 160
                  150 NT=1                                                          QUAD
                      LM(3)=5                                                       QUAD
                      I=1                                                           QUAD
                      K=3                                                           QUAD
75                    J=2                                                           QUAD
                      XC=(RR(1)+RR(2)+RR(3))/3.                                     QUAD
                      YC=(ZZ(1)+ZZ(2)+ZZ(3))/3.                                     QUAD
                      RR(5)=RR(3)                                                   QUAD
                      ZZ(5)=ZZ(3)                                                   QUAD
80                160 DO 200 NN=1,NT                                                QUAD
                      LM(1)=2*I-1                                                   QUAD
                      LM(2)=2*J-1                                                   QUAD
                      U(1)=ZZ(J)-ZZ(K)                                              QUAD
                      U(2)=ZZ(K)-ZZ(I)                                              QUAD
85                    U(3)=ZZ(I)-ZZ(J)                                              QUAD
                      V(1)=RR(K)-RR(J)                                              QUAD
                      V(2)=RR(I)-RR(K)                                              QUAD
                      V(3)=RR(J)-RR(I)                                              QUAD
                      AREA=(RR(J)*U(2)+RR(I)*U(1)+RR(5)*U(3))/2.                    QUAD
90                    VOL=VOL+AREA                                                  QUAD
                      COMM=.25/AREA                                                 QUAD
                      XNT=NT                                                        QUAD
                      COM=2./XNT                                                    QUAD
                      COM=COM*COMM                                                  QUAD
95                    DO 180 L=1,3                                                  QUAD
                      II=LM(L)                                                      QUAD
                      ST(1,II)=ST(1,II)+U(L)*COM                                    QUAD
                      ST(2,II+1)=ST(2,II+1)+V(L)*COM                                QUAD
                      ST(3,II)=ST(3,II)+V(L)*COM                                    QUAD
100                   ST(3,II+1)=ST(3,II+1)+U(L)*COM                                QUAD
                      DO 180 M=1,3                                                  QUAD
                      JJ=LM(M)                                                      QUAD
                      S(II,JJ)=S(II,JJ)+(U(L)*C(1,1)*U(M)+V(L)*C(3,3)*V(M))*COMM    QUAD
                      S(II,JJ+1)=S(II,JJ+1)+(U(L)*C(1,2)*V(M)+V(L)*C(3,3)*U(M))*COMMQUAD
105                   S(II+1,JJ+1)=S(II+1,JJ+1)+(V(L)*C(1,1)*V(M)+U(L)*C(3,3)*U(M))*COMMQUAD
                      S(JJ+1,II)=S(II,JJ+1)                                         QUAD
                  180 CONTINUE                                                      QUAD
                      I=J                                                           QUAD
                      J=J+1                                                         QUAD
110               200 CONTINUE                                                      QUAD
```

```
      IF(IX(N,3)-IX(N,4)) 220,250,220                                   QUAD
  220 DO 240 I=1,2                                                      QUAD
      KK=10-I                                                           QUAD
      DO 240 K=1,KK                                                     QUAD
  115 CC=S(KK+1,K)/S(KK+1,KK+1)                                         QUAD
      DO 230 J=1,3                                                      QUAD
  230 ST(J,K)=ST(J,K)-CC*ST(J,KK+1)                                     QUAD
      DO 240 J=1,KK                                                     QUAD
  240 S(J,K)=S(J,K)-CC*S(J,KK+1)                                        QUAD
  120 250 CONTINUE                                                      QUAD
      DT=TEMP-Q                                                         QUAD
      IF(NXN.GT.0) GO TO 260
      DX=EE(3)*DT                                                       QUAD
      DY=EE(3)*DT                                                       QUAD
  125 GO TO 261
  260 DX=(EE(5)*((COS(TH(M)))**2)-EE(6)*((SIN(TH(M)))**2))*DT
      DY=(EE(5)*((SIN(TH(M)))**2)-EE(6)*((COS(TH(M)))**2))*DT
  261 SIG(1)=-C(1,1)*DX-C(1,2)*DY
      SIG(2)=-C(2,1)*DX-C(2,2)*DY                                       QUAD
  130 SIG(3)=0.                                                         QUAD
      DO 520 I=1,8                                                      QUAD
      P(I)=0.0                                                          QUAD
      DO 510 J=1,3                                                      QUAD
  510 P(I)=P(I)-ST(J,I)*SIG(J)                                          QUAD
  135 520 P(I)=P(I)*VOL                                                 QUAD
      MM=4                                                              QUAD
      IF(IX(N,3).EQ.IX(N,4)) MM=3                                       QUAD
      XMM=MM                                                            QUAD
      DY=VOL*ACELZ*RO(MTYPE)/XMM                                        QUAD
  140 DX=VOL*ACELR*RO(MTYPE)/XMM                                        QUAD
      DO 530 I=1,MM                                                     QUAD
      P(2*I)=P(2*I)+DY                                                  QUAD
  530 P(2*I-1)=P(2*I-1)+DX                                              QUAD
      RETURN                                                            QUAD
  145 END                                                               QUAD
```

SYMBOLIC REFERENCE MAP

ENTRY POINTS
1 QUAD

VARIABLES	SN	TYPE		RELOCATION					
312	A	REAL	ARRAY	BANARG	4	ACELR	REAL		/ /
5	ACELZ	REAL		/ /	644	AMU12	REAL	ARRAY	ORTHO
14	ANGLE	REAL	ARRAY	ORTHO	512	AREA	REAL		
1004	A1	REAL	ARRAY	ORTHO	1304	A12	REAL	ARRAY	ORTHO
1144	A2	REAL	ARRAY	ORTHO	2	B	REAL	ARRAY	BANARG
3	C	REAL	ARRAY	ARG	517	CC	REAL		
30207	CODE	REAL	ARRAY	/ /	514	COM	REAL		
506	COMM	REAL			504	DEN	REAL		
520	DT	REAL			521	DX	REAL		
522	DY	REAL			23	E	REAL	ARRAY	/ /
247	EE	REAL	ARRAY	ARG	204	E11	REAL	ARRAY	ORTHO
344	E22	REAL	ARRAY	ORTHO	504	G12	REAL	ARRAY	ORTHO
13	HED	REAL	ARRAY	/ /	474	I	INTEGER		
43767	IBC	INTEGER	ARRAY	/ /	515	II	INTEGER		
256	IX	INTEGER	ARRAY	ARG	475	J	INTEGER		
44443	JBC	INTEGER	ARRAY	/ /	516	JJ	INTEGER		
476	K	INTEGER			505	KK	INTEGER		
477	L	INTEGER			243	LM	INTEGER	ARRAY	ARG
503	M	INTEGER			0	MBAND	INTEGER		BANARG
523	MM	INTEGER			11	MTYPE	INTEGER		/ /
6	N	INTEGER		/ /	511	NN	INTEGER		
5	NORTHO	INTEGER	ARRAY	ORTHO	507	NPP	INTEGER		
510	NT	INTEGER			637	NTC	INTEGER	ARRAY	/ /
1	NUMBLK	INTEGER		BANARG	1	NUMEL	INTEGER		/ /
2	NUMMAT	INTEGER		/ /	0	NUMNP	INTEGER		/ /
3	NUMPC	INTEGER		/ /	501	NUMTC	INTEGER		
502	NXN	INTEGER			163	P	REAL	ARRAY	ARG
45117	PR	REAL	ARRAY	/ /	12	Q	REAL		/ /
647	R	REAL	ARRAY	/ /	500	RATIO	REAL		
623	RO	REAL	ARRAY	/ /	231	RR	REAL	ARRAY	ARG
11	S	REAL	ARRAY	ARG	155	SIG	REAL	ARRAY	ARG
173	ST	REAL	ARRAY	ARG	44	S1	REAL	ARRAY	ORTHO
60	S2	REAL	ARRAY	ORTHO	74	S3	REAL	ARRAY	ORTHO
110	S4	REAL	ARRAY	ORTHO	124	S5	REAL	ARRAY	ORTHO
140	S6	REAL	ARRAY	ORTHO	154	S7	REAL	ARRAY	ORTHO
170	S8	REAL	ARRAY	ORTHO	36077	T	REAL	ARRAY	/ /
10	TEMP	REAL		/ /	30	TH	REAL	ARRAY	ORTHO
1444	THAT	REAL	ARRAY	ORTHO	525	U	REAL	ARRAY	
14427	UR	REAL	ARRAY	/ /	22317	UZ	REAL	ARRAY	/ /
530	V	REAL	ARRAY		7	VOL	REAL		/ /
35506	XC	REAL		ARG	524	XMM	REAL		
513	XNT	REAL			35507	YC	REAL		ARG
6537	Z	REAL	ARRAY	/ /	236	ZZ	REAL	ARRAY	ARG

EXTERNALS	TYPE	ARGS			
BOB	REAL	1	LIBRARY	ELGON	3
SIN	REAL	1	LIBRARY		

STATEMENT LABELS

0	50		37	60		0	70
50	80		0	90		61	100
0	105		67	110		73	111
76	112		110	113		0	114
0	120		0	130		0	140
0	145	INACTIVE	161	150		176	160
0	180		0	200		0	220
0	230		0	240		363	250
372	260		412	261		0	510
0	520		0	530			

0	70	INACTIVE
61	100	
73	111	
0	114	INACTIVE
0	140	
176	160	
0	220	INACTIVE
363	250	
0	510	

COMMON BLOCKS LENGTH

/ /	19623
ARG	15176
ORTHO	900
BANARG	20202

STATISTICS

PROGRAM LENGTH	5338	347
COMMON LENGTH	103668	36278
BLANK COMMON	462478	19623

```
      SUBROUTINE STRESS(NPRT)
      COMMON NUMNP,NUMEL,NUMMAT,NUMPC,ACELR,ACELZ,N,VOL,TEMP,MTYPE,Q,    STRS
     1 HED(8),E(8,4,12),RO(12),NTC(8),R(3000),Z(3000),UR(3000),UZ(3000),
     2 CODE(3000),T(3000),IBC(300),JBC(300),PR(300,2)
     COMMON/ARG/C(3,3),S(10,10),SIG(6),P(8),ST(3,10),RR(5),ZZ(5),LM(4),
    1          EE(7),IX(3000,5),XC,YC
      COMMON/BANARG/MBAND,NUMBLK,B(200),A(200,100)
      MPRINT=0                                                          STRS
      DO 300 M=1,NUMEL                                                  STRS
     N=M                                                                STRS
      IX(N,5)=IABS(IX(N,5))                                             STRS
      MTYPE=IX(N,5)                                                     STRS
      DO 50 I=1,6
   50 SIG(I)=0.0
      IF(IX(N,3)-IX(N,2)) 90,60,90
   60 I=IX(N,1)
      J=IX(N,2)
      XC=(R(I)+R(J))/2.0
      YC=(Z(I)+Z(J))/2.0
      DX=R(J)-R(I)
      DY=Z(J)-Z(I)
      XL=SQRT(DX**2+DY**2)
      DU=B(2*J-1)-B(2*I-1)
      DV=B(2*J)-B(2*I)
      DL=DV*DY/XL+DU*DX/XL
      SIG(4)=E(1,4,MTYPE)*DL*E(1,2,MTYPE)/XL
      GO TO 200
   90 CALL QUAD
      MM=4                                                              STRS
      IF(IX(N,3)-IX(N,4)) 170,160,170                                   STRS
  160 MM=3                                                              STRS
  170 DO 180 I=1,3                                                      STRS
      RR(I)=0.                                                          STRS
      DO 180 J=1,MM                                                     STRS
      II=2*J                                                            STRS
      JJ=2*IX(N,J)                                                      STRS
  180 RR(I)=RR(I)+ST(I,II)*B(JJ)+ST(I,II-1)*B(JJ-1)                     STRS
      DO 190 I=1,3                                                      STRS
      DO 190 J=1,3                                                      STRS
  190 SIG(I)=SIG(I)+C(I,J)*RR(J)                                        STRS
      CC=(SIG(1)+SIG(2))/2.0                                            STRS
      BB=(SIG(1)-SIG(2))/2.                                             STRS
      CR=SQRT(BB**2+SIG(3)**2)
      SIG(4)=CC+CR                                                      STRS
      SIG(5)=CC-CR                                                      STRS
      SIG(6)=0.0                                                        STRS
      IF ((BB.EQ.0.0).AND.(SIG(3).EQ.0.0)) GO TO 200                    STRS
      SIG(6)=28.64*ATAN2(SIG(3),BB)
      IF(NPRT.EQ.1) GO TO 270
  200 IF(MPRINT) 250,220,250                                            STRS
  220 WRITE(6,2000)                                                     STRS
      MPRINT=50                                                         STRS
  250 MPRINT=MPRINT-1                                                   STRS
      WRITE (6,2001)  N,XC,YC,(SIG(I),I=1,6)                            STRS
      GO TO 300
```

```
      270 IF(MPRINT) 280,290,280
      290 WRITE(6,2003)
          MPRINT=50
      280 MPRINT=MPRINT-1
          WRITE(6,2004) N,XC,YC,(SIG(I),I=1,3),(RR(I),I=1,3)
      300 CONTINUE                                                    STRS
          RETURN                                                      STRS
     2000 FORMAT (7H1EL.NO.  7X 1HX  7X 1HY 4X 8HX-STRESS 4X 8HY-STRESS 3X  STRS
        1 9HXY-STRESS 2X 10HMAX-STRESS 2X 10HMIN-STRESS 7H  ANGLE )  STRS
     2001 FORMAT (I7,2F8.4,1P5E12.4,0P1F7.2)
     2002 FORMAT (I5,4F10.5)
     2003 FORMAT (7H1EL.NO. ,7X,1HX,7X,1HY,4X,8HX-STRESS,4X,8HY-STRESS,3X,
        1 9HXY-STRESS,2X,10H X-STRAIN ,2X,10H Y-STRAIN ,2X,10H XY-STRAIN)
     2004 FORMAT (I7,2F8.4,1P6E12.4)
          END                                                         STRS
```

SYMBOLIC REFERENCE MAP

ENTRY POINTS
2 STRESS

VARIABLES SN TYPE RELOCATION

312	A	REAL	ARRAY	BANARG	4	ACELR	REAL		/ /		
5	ACELZ	REAL		/ /	2	B	REAL	ARRAY	BANARG		
314	BB	REAL			0	C	REAL	ARRAY	ARG		
313	CC	REAL			30207	CODE	REAL	ARRAY	/ /		
315	CR	REAL			307	DL	REAL				
305	DU	REAL			306	DV	REAL				
302	DX	REAL			303	DY	REAL				
23	E	REAL	ARRAY	/ /	247	EE	REAL	ARRAY	ARG		
13	HED	REAL	ARRAY	/ /	300	I	INTEGER				
43767	IDC	INTEGER	ARRAY	/ /	311	II	INTEGER				
256	IX	INTEGER	ARRAY	ARG	301	J	INTEGER				
44443	JDC	INTEGER	ARRAY	/ /	312	JJ	INTEGER				
243	LM	INTEGER	ARRAY	ARG	277	M	INTEGER				
0	MBAND	INTEGER		BANARG	310	MM	INTEGER				
276	MPRINT	INTEGER			11	MTYPE	INTEGER		/ /		
6	N	INTEGER		/ /	0	NPRT	INTEGER		F.P.		
637	NTC	INTEGER	ARRAY	/ /	1	NUMBLK	INTEGER		BANARG		
1	NUMEL	INTEGER		/ /	2	NUMMAT	INTEGER		/ /		
0	NUMNP	INTEGER		/ /	3	NUMPC	INTEGER		/ /		
163	P	REAL	ARRAY	ARG	45117	PR	REAL	ARRAY	/ /		
12	Q	REAL		/ /	647	R	REAL	ARRAY	/ /		
623	RO	REAL	ARRAY	/ /	231	RR	REAL	ARRAY	ARG		
11	S	REAL	ARRAY	ARG	155	SIG	REAL	ARRAY	ARG		
173	ST	REAL	ARRAY	ARG	36077	T	REAL	ARRAY	/ /		
10	TEMP	REAL		/ /	14427	UR	REAL	ARRAY	/ /		
22317	UZ	REAL	ARRAY	/ /	7	VOL	REAL		/ /		
35506	XC	REAL		ARG	304	XL	REAL				
35507	YC	REAL		ARG	6537	Z	REAL	ARRAY	/ /		
236	ZZ	REAL	ARRAY	ARG							

FILE NAMES MODE
TAPE6 FMT

EXTERNALS TYPE ARGS
ATAN2 REAL 2 LIBRARY QUAD 0
SQRT REAL 1 LIBRARY

INLINE FUNCTIONS TYPE ARGS
IABS INTEGER 1 INTRIN

STATEMENT LABELS

0	50		0	60	INACTIVE	63	90		
0	160	INACTIVE	72	170		0	180		
0	190		157	200		0	220	INACTIVE	
164	250		202	270		207	280		
0	290	INACTIVE	226	300		232	2000	FMT	
245	2001	FMT	251	2002	FMT NO REFS	254	2003	FMT	
270	2004	FMT							

COMMON BLOCKS	LENGTH
/ /	19623
ARG	15176
BANARG	26202

STATISTICS

PROGRAM LENGTH	3208	208
COMMON LENGTH	165628	35378
BLANK COMMON	462478	19623

```
      SUBROUTINE MODIFY(A,B,NEQ,MBAND,N,U)                              MODI
      DIMENSION A(200,100),B(200)
      DO 250 M=2,MBAND                                                  MODI
      K=N-M+1                                                           MODI
      IF(K) 235,235,230                                                 MODI
230   B(K)=B(K)-A(K,M)*U                                                MODI
      A(K,M)=0.0                                                        MODI
235   K=N+M-1                                                           MODI
      IF(NEQ-K) 250,240,240                                             MODI
240   B(K)=B(K)-A(N,M)*U                                                MODI
      A(N,M)=0.0                                                        MODI
250   CONTINUE                                                          MODI
      A(N,1)=1.0                                                        MODI
      B(N)=U                                                            MODI
      RETURN                                                            MODI
      END
```

SYMBOLIC REFERENCE MAP

ENTRY POINTS
2 MODIFY

VARIABLES	SN	TYPE		RELOCATION						
0	A	REAL	ARRAY	F.P.	0	B	REAL	ARRAY	F.P.	
55	K	INTEGER			54	M	INTEGER			
0	MBAND	INTEGER		F.P.	0	N	INTEGER		F.P.	
0	NEQ	INTEGER		F.P.	0	U	REAL		F.P.	

STATEMENT LABELS
0 230 INACTIVE 34 235 0 240 INACTIVE
43 250

STATISTICS
PROGRAM LENGTH 773 63

```
      SUBROUTINE BANSOL                                                 BANS
      COMMON/BANARG/MBAND,NUMBLK,B(200),A(200,100)
      MM=MBAND
      NN=100                                                            BANS
      NL=NN+1                                                           BANS
      NH=NN+NN                                                          BANS
      REWIND 1                                                          BANS
      REWIND 2                                                          BANS
      NB=0                                                              BANS
      GO TO 150                                                         BANS
  100 NB=NB+1                                                           BANS
      DO 125 N=1,NN                                                     BANS
      NM=NN+N                                                           BANS
      B(N)=B(NM)                                                        BANS
      B(NM)=0.0                                                         BANS
      DO 125 M=1,MM                                                     BANS
      A(N,M)=A(NM,M)                                                    BANS
  125 A(NM,M)=0.0                                                       BANS
      IF (NUMBLK-NB) 150,200,150                                        BANS
  150 READ (2) (B(N),(A(N,M),M=1,MM),N=NL,NH)                           BANS
      IF (NB) 200,100,200                                               BANS
  200 DO 300 N=1,NN                                                     BANS
      IF (A(N,1)) 225,300,225                                           BANS
  225 B(N)=B(N)/A(N,1)                                                  BANS
      DO 275 L=2,MM                                                     BANS
      IF (A(N,L)) 230,275,230                                           BANS
  230 C=A(N,L)/A(N,1)                                                   BANS
      I=N+L-1                                                           BANS
      J=0                                                               BANS
      DO 250 K=L,MM                                                     BANS
      J=J+1                                                             BANS
  250 A(I,J)=A(I,J)-C*A(N,K)                                            BANS
      B(I)=B(I)-A(N,L)*B(N)                                             BANS
      A(N,L)=C                                                          BANS
  275 CONTINUE                                                          BANS
  300 CONTINUE                                                          BANS
      IF (NUMBLK-NB) 375,400,375                                        BANS
  375 WRITE (1) (B(N),(A(N,M),M=2,MM),N=1,NN)                           BANS
      GO TO 100                                                         BANS
  400 DO 450 M=1,NN                                                     BANS
      N=NN+1-M                                                          BANS
      DO 425 K=2,MM                                                     BANS
      L=N+K-1                                                           BANS
  425 B(N)=B(N)-A(N,K)*B(L)                                             BANS
      NM=N+NN                                                           BANS
      B(NM)=B(N)                                                        BANS
  450 A(NM,NB)=B(N)                                                     BANS
      NB=NB-1                                                           BANS
      IF (NB) 475,500,475                                               BANS
  475 BACKSPACE 1                                                       BANS
      READ (1) (B(N),(A(N,M),M=2,MM),N=1,NN)                            BANS
      BACKSPACE 1                                                       BANS
      GO TO 400                                                         BANS
  500 K=0                                                               BANS
      DO 600 N3=1,NUMBLK                                                BANS
```

```
                      DO 600 N=1,NN                                    BANS
                      NM=N+NN                                          BANS
                      K=K+1                                            BANS
                  600 B(K)=A(NM,NB)                                    BANS
60                    RETURN                                           BANS
                      END                                              BANS
```

SYMBOLIC REFERENCE MAP

ENTRY POINTS
1 BANSOL

VARIABLES	SN	TYPE		RELOCATION					
312	A	REAL	ARRAY	BANARG	2	B	REAL	ARRAY	BANARG
262	C	REAL			263	I	INTEGER		
264	J	INTEGER			265	K	INTEGER		
261	L	INTEGER			260	M	INTEGER		
0	MBAND	INTEGER		BANARG	251	MM	INTEGER		
256	N	INTEGER			255	NB	INTEGER		
254	NH	INTEGER			253	NL	INTEGER		
257	NM	INTEGER			252	NN	INTEGER		
1	NUMBLK	INTEGER		BANARG					

FILE NAMES	MODE		
TAPE1	UNFMT	TAPE2	UNFMT

STATEMENT LABELS

14	100	0	125		37	150	
61	200	0	225	INACTIVE	0	230	INACTIVE
0	250	122	275		125	300	
0	375	152	400		0	425	
0	450	0	475	INACTIVE	230	500	
0	600						

COMMON BLOCKS LENGTH
BANARG 20202

STATISTICS
PROGRAM LENGTH 2668 182
COMMON LENGTH 473528 20202

40

```
      SUBROUTINE ORTHOG(M,NUMTC)
C
      COMMON/ORTHO/NORTHO(12),ANGLE(12),TH(12),S1(12),S2(12),S3(12),
     1             S4(12),S5(12),S6(12),S7(12),S8(12),E11(12,8),
     2             E22(12,8),G12(12,8),AMU12(12,8),A1(12,8),A2(12,8),
     3             A12(12,8),TMAT(12,8)
C
      READ (5,1001) ANGLE(M)
      WRITE(6,2001) ANGLE(M)
      DO 1 I=1,NUMTC
      READ (5,1000) (TMAT(M,I),E11(M,I),E22(M,I),G12(M,I),AMU12(M,I),
     1               A1(M,I),A2(M,I),A12(M,I))
      WRITE(6,2000) (TMAT(M,I),E11(M,I),E22(M,I),G12(M,I),AMU12(M,I),
     1               A1(M,I),A2(M,I),A12(M,I))
    1 CONTINUE
      TH(M)=ANGLE(M)*3.1415926536/180.
      D=SIN(TH(M))
      F=COS(TH(M))
      S1(M)=F**4
      S2(M)=F**2*D**2
      S3(M)=F**3*D
      S4(M)=D**4
      S5(M)=F*D**3
      S6(M)=F**2
      S7(M)=D**2
      S8(M)=F*D
 1000 FORMAT (8F10.0)
 1001 FORMAT (F10.0)
 2000 FORMAT (3X,*TEMPERATURE*,7X,*E11*,12X,*E22*,12X,*G12*,11X,*AMU12*,
     1        9X,*ALPHA 1*,8X,*ALPHA 2*,8X,*ALPHA12*/8F15.4)
 2001 FORMAT (5X,*ANGLE= *,F5.2)
      RETURN
      END
```

SYMBOLIC REFERENCE MAP

ENTRY POINTS
2 ORTHOG

VARIABLES SN TYPE RELOCATION

644	AMU12	REAL	ARRAY	ORTHO	14	ANGLE	REAL	ARRAY	ORTHO
1004	A1	REAL	ARRAY	ORTHO	1304	A12	REAL	ARRAY	ORTHO
1144	A2	REAL	ARRAY	ORTHO	206	D	REAL		
234	E11	REAL	ARRAY	ORTHO	344	E22	REAL	ARRAY	ORTHO
267	F	REAL			504	G12	REAL	ARRAY	ORTHO
205	I	INTEGER			0	M	INTEGER		F.P.
0	NORTHO	INTEGER	ARRAY	ORTHO	0	NUMTC	INTEGER		F.P.
44	S1	REAL	ARRAY	ORTHO	60	S2	REAL	ARRAY	ORTHO
74	S3	REAL	ARRAY	ORTHO	110	S4	REAL	ARRAY	ORTHO
124	S5	REAL	ARRAY	ORTHO	140	S6	REAL	ARRAY	ORTHO
154	S7	REAL	ARRAY	ORTHO	170	S8	REAL	ARRAY	ORTHO
30	TH	REAL	ARRAY	ORTHO	1444	TMAT	REAL	ARRAY	ORTHO

FILE NAMES MODE
TAPE5 FMT TAPE6 FMT

EXTERNALS TYPE ARGS
COS REAL 1 LIBRARY SIN REAL 1 LIBRARY

STATEMENT LABELS
0 1 161 1000 FMT 163 1001 FMT
165 2000 FMT 177 2001 FMT

COMMON BLOCKS LENGTH
ORTHO 900

STATISTICS
PROGRAM LENGTH 2338 155
COMMON LENGTH 16048 900

```
      SUBROUTINE ELCON(M,NUMTC,TEMP)
C
      COMMON/ARG/C(3,3),S(10,10),SIG(6),P(8),ST(3,10),RR(5),ZZ(5),LM(4),
     1           EE(7),IX(3000,5),XC,YC
      COMMON/ORTHO/NORTHO(12),ANGLE(12),TH(12),S1(12),S2(12),S3(12),
     1             S4(12),S5(12),S6(12),S7(12),S8(12),E11(12,8),
     2             E22(12,8),G12(12,8),AMU12(12,8),A1(12,8),A2(12,8),
     3             A12(12,8),TMAT(12,8)
C
      RATIO=0.0
      IF(NUMTC.EQ.1) GO TO 100
      DO 1 I=2,NUMTC
      J=I-1
      SRT=TMAT(M,I)-TEMP
      IF(SRT.GE.0.0) GO TO 2
    1 CONTINUE
    2 DEN=TMAT(M,I)-TMAT(M,J)
      IF(DEN.EQ.0.0) GO TO 3
      RATIO=(TEMP-TMAT(M,J))/DEN
    3 EE(1)=E11(M,J)+RATIO*(E11(M,I)-E11(M,J))
      EE(2)=E22(M,J)+RATIO*(E22(M,I)-E22(M,J))
      EE(3)=G12(M,J)+RATIO*(G12(M,I)-G12(M,J))
      EE(4)=AMU12(M,J)+RATIO*(AMU12(M,I)-AMU12(M,J))
      AX=A1(M,I)-A1(M,J)
      AY=A2(M,I)-A2(M,J)
      AZ=A12(M,I)-A12(M,J)
      EE(5)=A1(M,J)+RATIO*AX
      EE(6)=A2(M,J)+RATIO*AY
      EE(7)=A12(M,J)+RATIO*AZ
      EE(5)=0.5*(EE(5)+A1(M,1))
      EE(6)=0.5*(EE(6)+A2(M,1))
      EE(7)=0.5*(EE(7)+A12(M,1))
      GO TO 110
  100 EE(1)=E11(M,1)
      EE(2)=E22(M,1)
      EE(3)=G12(M,1)
      EE(4)=AMU12(M,1)
      EE(5)=A1(M,1)
      EE(6)=A2(M,1)
      EE(7)=A12(M,1)
  110 UN=EE(4)*EE(2)/EE(1)
      UNU=1./(1.-UN*EE(4))
      C11=EE(1)*UNU
      C12=EE(2)*EE(4)*UNU
      C16=0.0
      C22=EE(2)*UNU
      C26=0.0
      C66=EE(3)*UNU
      C21=C12
      C61=C16
      C62=C26
      C(1,1)=S1(M)*C11+2.*S2(M)*C12+4.*S3(M)*C16+S4(M)*C22+4.*S5(M)*C26+
     1       4.*S2(M)*C66
      C(1,2)=S2(M)*C11+(S1(M)+S4(M))*C12+2.*(S5(M)-S3(M))*C16+S2(M)*C22+
     1       2.*(S3(M)-S5(M))*C26-4.*S2(M)*C66
```

```
      C(2,1)=C(1,2)
      C(1,3)=-S3(M)*C11+(S3(M)-S5(M))*C12+(S1(M)-3.*S2(M))*C16+S5(M)*C22
     1       +(3.*S2(M)-S4(M))*C26+2.*(S3(M)-S5(M))*C66
      C(3,1)=C(1,3)
60    C(2,2)=S4(M)*C11+2.*S2(M)*C12-4.*S5(M)*C16+S1(M)*C22-4.*S3(M)*C26+
     1       4.*S2(M)*C66
      C(2,3)=-S5(M)*C11+(S5(M)-S3(M))*C12+(3.*S2(M)-S4(M))*C16+S3(M)*C22
     1       +(S1(M)-3.*S2(M))*C26+(S5(M)-S3(M))*2.*C66
      C(3,2)=C(2,3)
65    C(3,3)=S2(M)*C11-2.*S2(M)*C12+2.*(S5(M)-S3(M))*C16+S2(M)*C22+
     1       2.*(S3(M)-S5(M))*C26+(S6(M)-S7(M))**2*C66
      RETURN
      END
```

SYMBOLIC REFERENCE MAP

ENTRY POINTS
2 ELCON

VARIABLES SN TYPE RELOCATION

644	A1U12	REAL	ARRAY	ORTHO	14	ANGLE	REAL	ARRAY	ORTHO	
355	AX	REAL			356	AY	REAL			
357	AZ	REAL			1004	A1	REAL	ARRAY	ORTHO	
1304	A12	REAL	ARRAY	ORTHO	1144	A2	REAL	ARRAY	ORTHO	
0	C	REAL	ARRAY	ARG	362	C11	REAL			
363	C12	REAL			364	C16	REAL			
370	C21	REAL			365	C22	REAL			
366	C26	REAL			371	C61	REAL			
372	C62	REAL			367	C66	REAL			
354	DEN	REAL			247	EE	REAL	ARRAY	ARG	
204	E11	REAL	ARRAY	ORTHO	344	E22	REAL	ARRAY	ORTHO	
504	G12	REAL	ARRAY	ORTHO	351	I	INTEGER			
256	IX	INTEGER	ARRAY	ARG	352	J	INTEGER			
243	LM	INTEGER	ARRAY	ARG	0	M	INTEGER		F.P.	
0	NORTHO	INTEGER	ARRAY	ORTHO	0	NUMTC	INTEGER		F.P.	
163	P	REAL	ARRAY	ARG	350	RATIO	REAL			
231	RR	REAL	ARRAY	ARG	11	S	REAL	ARRAY	ARG	
155	SIG	REAL	ARRAY	ARG	353	SRT	REAL			
173	ST	REAL	ARRAY	ARG	44	S1	REAL	ARRAY	ORTHO	
60	S2	REAL	ARRAY	ORTHO	74	S3	REAL	ARRAY	ORTHO	
114	S4	REAL	ARRAY	ORTHO	124	S5	REAL	ARRAY	ORTHO	
140	S6	REAL	ARRAY	ORTHO	154	S7	REAL	ARRAY	ORTHO	
170	S8	REAL	ARRAY	ORTHO	0	TEMP	REAL		F.P.	
30	TH	REAL	ARRAY	ORTHO	1444	TMAT	REAL	ARRAY	ORTHO	
360	UN	REAL			361	UNU	REAL			
35506	XC	REAL		ARG	35507	YC	REAL		ARG	
236	ZZ	REAL	ARRAY	ARG						

STATEMENT LABELS

0	1	26	2	44	3
156	100	171	110		

COMMON BLOCKS LENGTH

ARG	15176
ORTHO	900

STATISTICS

PROGRAM LENGTH	3733	251
COMMON LENGTH	373140	16076

```
CORE MAP  17.06.45.  NORMAL                    CONTROL                                  000100    176112    127643    046247
   ---TIME---LOAD MODE --L1--L2-----TYPE---------------USER---++---CALL-------------FWA LOAD--LWA LOAD--BLNK COMN--LENGTH--
   FWA LOADER  172767  FWA TABLES  167565
   -PROGRAM----ADDRESS-                                --LABELED---COMMON--
   PLSTR       116766                                              ARG       000100
                                                                   ORTHO     035610
                                                                   BANARG    037414
   STIFF       115056                                              ARG       000100
                                                                   BANARG    037414
   ONED        115516                                              ARG       000100
                                                                   BANARG    037414
   QUAD        115626                                              ARG       000100
                                                                   ORTHO     035610
                                                                   BANARG    037414
   STRESS      116353                                              ARG       000100
                                                                   BANARG    037414
   MODIFY      116673
   BANSOL      116772                                              BANARG    037414
   ORTHOG      117260                                              ORTHO     035610
   ELCON       117513                                              ARG       000100
                                                                   ORTHO     035610
   BACKSP$     120106
   IFENDF$     120436
   INPUTD$     120512
   INPUTC$     120773
   KODER$      121127
   KRAKER$     122542
   OUTPTD$     124321
   OUTPTC$     124600
   REWINM$     124674
   ATAN2E      124746
   SINCOSE     125047
   SQRTE       125124
   GETBA       125146
   SIO$        125165
   SYSTEM$     126632
   ----UNSATISFIED EXTERNALS-----                          REFERENCES
```

APPENDIX C

SAMPLE PROBLEM INPUT AND OUTPUT

Take a grid consisting of 64 grid points and 49 elements (See Figure A-1). Assume a distributed load through grid points 1-8 such that the eight respective point loads are 500, 1000, 1000, 1000,1000,1000, 1000, and 500 pounds. Assume also that grid points 57-64 are constrained in the x-direction. A constant pressure of 100 psi is applied to the lower surface. The temperature throughout the grid is $70^{\circ}F$, while the stress-free temperature of the structure is $0^{\circ}F$. The structure consists of two materials as follows:

Material 1 (isotropic) exists from y = 0.0 to y = 0.32 and has as properties

	0°	70°
E	10^6 psi	9×10^5 psi
ν	0.3	0.3
α	5×10^{-6} in/in/$^{\circ}F$	6×10^{-6} in/in/$^{\circ}F$

Material 2 (orthotropic) exists from y = 0.32 to y = 0.8 at an angle of 0° in the xz-plane and has as properties

	0°	70°
E_{11}	10^6	9×10^5
E_{22}	10^5	9×10^4
G_{12}	10^5	9.5×10^4
ν_{12}	0.25	0.25
α_{11}	5×10^{-6}	6×10^{-6}
α_{22}	5×10^{-5}	6×10^{-5}
α_{12}	0.0	0.0

The input and output for this problem is as follows:

SAMPLE INPUT

LISTING OF THE INPUT FOR PLSTR SAMPLE PROBLEM

DATA CARD NUMBER ONE

```
      1-10      11-20      21-30      31-40      41-50      51-60      61-70      71-80
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678
```

SAMPLE PROBLEM FOR PLSTR USER'S MANUAL. EXAMPLE FROM APPENDIX C.

DATA CARD NUMBER TWO

```
      1-10      11-20      21-30      31-40      41-50      51-60      61-70      71-80
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678
```

```
 64   49    2    7        0.0        0.0        0.0
```

DATA CARD NUMBER THREE

```
      1-10      11-20      21-30      31-40      41-50      51-60      61-70      71-80
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678
```

```
  1    2        0.1    0
```

DATA CARDS NUMBER FOUR

```
      1-10      11-20      21-30      31-40      41-50      51-60      61-70      71-80
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678
```

```
     0.0  1000000.        0.3  0.000005
    70.0   900000.        0.3  0.000006
```

DATA CARD NUMBER THREE

```
      1-10      11-20      21-30      31-40      41-50      51-60      61-70      71-80
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678
```

```
  2    2        0.1    1
```

DATA CARD NUMBER THREE-A

DATA CARD NUMBER FOUR

```
1-10      11-20      21-30      31-40      41-50      51-60      61-70      71-80
12345678901234567890123456789012345678901234567890123456789012345678901234567890
    0.0   1000000.    100000.    100000.      0.25  0.000005   0.00005       3.0
   70.0    900000.     90000.     95000.      0.25  0.000006   0.00006       0.0
```

DATA CARDS NUMBER FIVE

	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890
1	0.0	0.0	0.0	500.	0.0	70.0		
2	0.0	0.08	0.08	1000.	0.0	70.0		
3	0.0	0.16	0.16	1000.	0.0	70.0		
4	0.0	0.24	0.24	1000.	0.0	70.0		
5	0.0	0.32	0.32	1000.	0.0	70.0		
6	0.0	0.4	0.4	1000.	0.0	70.0		
7	0.0	0.6	0.6	1000.	0.0	70.0		
8	0.0	0.8	0.8	500.	0.0	70.0		
9	0.0	0.4	0.0	0.0	0.0	70.0		
14	0.0	0.8	0.4	0.0	0.0	70.0		
16	0.0	1.2	0.8	0.0	0.0	70.0		
17	0.0	0.8	0.0	0.0	0.0	70.0		
22	0.0	1.2	0.4	0.0	0.0	70.0		
24	0.0	1.6	0.8	0.0	0.0	70.0		
25	0.0	1.6	0.0	0.0	0.0	70.0		
30	0.0	2.0	0.4	0.0	0.0	70.0		
32	0.0	2.4	0.8	0.0	0.0	70.0		
33	0.0	1.8	0.0	0.0	0.0	70.0		
38	0.0	2.2	0.4	0.0	0.0	70.0		
40	0.0	2.6	0.8	0.0	0.0	70.0		
41	0.0	2.2	0.0	0.0	0.0	70.0		
46	0.0	2.6	0.4	0.0	0.0	70.0		
48	0.0	3.0	0.8	0.0	0.0	70.0		
49	0.0	3.0	0.0	0.0	0.0	70.0		
54	0.0	3.4	0.4	0.0	0.0	70.0		
56	0.0	3.8	0.8	0.0	0.0	70.0		
57	1.0	3.4	0.0	0.0	0.0	70.0		
58	1.0	3.48	0.08	0.0	0.0	70.0		
59	1.0	3.56	0.16	0.0	0.0	70.0		
60	1.0	3.64	0.24	0.0	0.0	70.0		
61	1.0	3.72	0.32	0.0	0.0	70.0		
62	1.0	3.8	0.4	0.0	0.0	70.0		
63	1.0	4.0	0.6	0.0	0.0	70.0		
64	1.0	4.2	0.8	0.0	0.0	70.0		

DATA CARDS NUMBER SIX

1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890
1 1	9 10	2 1					
4 4	12 13	5 1					
5 5	13 14	6 2					
7 7	15 16	8 2					
8 9	17 18	10 1					
11 12	20 21	13 1					
12 13	21 22	14 2					
14 15	23 24	16 2					
15 17	25 26	18 1					
18 20	28 29	21 1					
19 21	29 30	22 2					
21 23	31 32	24 2					
22 25	33 34	26 1					
25 28	36 37	29 1					
26 29	37 38	30 2					
28 31	39 40	32 2					
29 33	41 42	34 1					
32 36	44 45	37 1					
33 37	45 46	38 2					
35 39	47 48	40 2					
36 41	49 50	42 1					
39 44	52 53	45 1					
40 45	53 54	46 2					
42 47	55 56	48 2					
43 49	57 58	50 1					
46 52	60 61	53 1					
47 53	61 62	54 2					
49 55	63 64	56 2					

DATA CARDS NUMBER SEVEN

```
  1-10      11-20      21-30      31-40      41-50      51-60      61-70      71-80
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
    1    9       100.       100.
    9   17       100.       100.
   17   25       100.       100.
   25   33       100.       100.
   33   41       100.       100.
   41   49       100.       100.
   49   57       100.       100.
```

DATA CARD NUMBER EIGHT

```
  1-10      11-20      21-30      31-40      41-50      51-60      61-70      71-80
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
    1
```

SAMPLE OUTPUT

SAMPLE PROBLEM FOR PLSTR USER'S MANUAL. EXAMPLE FROM APPENDIX C.

NUMBER OF NODAL POINTS------ 64

NUMBER OF ELEMENTS---------- 49

NUMBER OF DIFF. MATERIALS--- 2

NUMBER OF PRESSURE CARDS---- 7

X-ACCELERATION------------- 0.

Y-ACCELERATION------------- 0.

REFERENCE TEMPERATURE------- 0.

MATERIAL NUMBER= 1, NUMBER OF TEMPERATURE CARDS= 2, MASS DENSITY= .1000E+00, NORTHO= 0

TEMPERATURE	E	NU	ALPHA
0.00	.1000E+07	.30000E+00	.50000E-05
70.00	.9000E+06	.30000E+00	.60000E-05

MATERIAL NUMBER= 2, NUMBER OF TEMPERATURE CARDS= 2, MASS DENSITY= .1000E+00, NORTHO= 1

ANGLE= 0.00

TEMPERATURE	E11	E22	G12	AMU12	ALPHA 1	ALPHA 2	ALPHA12
0.0000	1000000.0000	100000.0000	100000.0000	.2500	.0000	.0000	0.0000
TEMPERATURE	E11	E22	G12	AMU12	ALPHA 1	ALPHA 2	ALPHA12
70.0000	900000.0000	90000.0000	95000.0000	.2500	.0000	.0001	0.0000

NODAL POINT	TYPE	X ORDINATE	Y ORDINATE	X LOAD OR DISPLACEMENT	Y LOAD OR DISPLACEMENT	TEMPERATURE
1	0.00	0.00000	0.00000	.5000000E+03	0.	70.000
2	0.00	.08000	.08000	.1000000E+04	0.	70.000
3	0.00	.16000	.16000	.1000000E+04	0.	70.000
4	0.00	.24000	.24000	.1000000E+04	0.	70.000
5	0.00	.32000	.32000	.1000000E+04	0.	70.000
6	0.00	.40000	.40000	.1000000E+04	0.	70.000
7	0.00	.60000	.60000	.1000000E+04	0.	70.000
8	0.00	.80000	.80000	.5000000E+03	0.	70.000
9	0.00	.40000	0.00000	0.	0.	70.000
10	0.00	.48000	.08000	0.	0.	70.000
11	0.00	.56000	.16000	0.	0.	70.000
12	0.00	.64000	.24000	0.	0.	70.000
13	0.00	.72000	.32000	0.	0.	70.000
14	0.00	.80000	.40000	0.	0.	70.000
15	0.00	1.00000	.60000	0.	0.	70.000
16	0.00	1.20000	.80000	0.	0.	70.000
17	0.00	.80000	0.00000	0.	0.	70.000
18	0.00	.88000	.08000	0.	0.	70.000
19	0.00	.96000	.16000	0.	0.	70.000
20	0.00	1.04000	.24000	0.	0.	70.000
21	0.00	1.12000	.32000	0.	0.	70.000
22	0.00	1.20000	.40000	0.	0.	70.000
23	0.00	1.40000	.60000	0.	0.	70.000
24	0.00	1.60000	.80000	0.	0.	70.000
25	0.00	1.60000	0.00000	0.	0.	70.000
26	0.00	1.68000	.08000	0.	0.	70.000
27	0.00	1.76000	.16000	0.	0.	70.000
28	0.00	1.84000	.24000	0.	0.	70.000
29	0.00	1.92000	.32000	0.	0.	70.000
30	0.00	2.00000	.40000	0.	0.	70.000
31	0.00	2.20000	.60000	0.	0.	70.000
32	0.00	2.40000	.80000	0.	0.	70.000
33	0.00	1.80000	0.00000	0.	0.	70.000
34	0.00	1.88000	.08000	0.	0.	70.000
35	0.00	1.96000	.16000	0.	0.	70.000
36	0.00	2.04000	.24000	0.	0.	70.000
37	0.00	2.12000	.32000	0.	0.	70.000
38	0.00	2.20000	.40000	0.	0.	70.000
39	0.00	2.40000	.60000	0.	0.	70.000
40	0.00	2.60000	.80000	0.	0.	70.000
41	0.00	2.20000	0.00000	0.	0.	70.000
42	0.00	2.28000	.08000	0.	0.	70.000
43	0.00	2.36000	.16000	0.	0.	70.000
44	0.00	2.44000	.24000	0.	0.	70.000
45	0.00	2.52000	.32000	0.	0.	70.000
46	0.00	2.60000	.40000	0.	0.	70.000
47	0.00	2.80000	.60000	0.	0.	70.000
48	0.00	3.00000	.80000	0.	0.	70.000
49	0.00	3.60000	0.00000	0.	0.	70.000
50	0.00	3.08000	.08000	0.	0.	70.000
51	0.00	3.16000	.16000	0.	0.	70.000
52	0.00	3.24000	.24000	0.	0.	70.000
53	0.00	3.32000	.32000	0.	0.	70.000
54	0.00	3.40000	.40000	0.	0.	70.000
55	0.00	3.60000	.60000	0.	0.	70.000
56	0.00	3.80000	.80000	0.	0.	70.000
57	1.00	3.40000	0.00000	0.	0.	70.000

0.	1.00	4.20000	.80000	0.	0.	70.000

ELEMENT NO.	I	J	K	L	MATERIAL
1	1	9	10	2	1
2	2	10	11	3	1
3	3	11	12	4	1
4	4	12	13	5	1
5	5	13	14	6	2
6	6	14	15	7	2
7	7	15	16	8	2
8	9	17	18	10	1
9	10	18	19	11	1
10	11	19	20	12	1
11	12	20	21	13	1
12	13	21	22	14	2
13	14	22	23	15	2
14	15	23	24	16	2
15	17	25	26	18	1
16	18	26	27	19	1
17	19	27	28	20	1
18	20	28	29	21	1
19	21	29	30	22	2
20	22	30	31	23	2
21	23	31	32	24	2
22	25	33	34	26	1
23	26	34	35	27	1
24	27	35	36	28	1
25	28	36	37	29	1
26	29	37	38	30	2
27	30	38	39	31	2
28	31	39	40	32	2
29	33	41	42	34	1
30	34	42	43	35	1
31	35	43	44	36	1
32	36	44	45	37	1
33	37	45	46	38	2
34	38	46	47	39	2
35	39	47	48	40	2
36	41	49	50	42	1
37	42	50	51	43	1
38	43	51	52	44	1
39	44	52	53	45	1
40	45	53	54	46	2
41	46	54	55	47	2
42	47	55	56	48	2
43	49	57	58	50	1
44	50	58	59	51	1
45	51	59	60	52	1
46	52	60	61	53	1
47	53	61	62	54	2
48	54	62	63	55	2
49	55	63	64	56	2

PRESSURE BOUNDARY CONDITIONS

I	J	PRESSURE I	PRESSURE J
1	9	100.000	100.000
9	17	100.000	100.000
17	25	100.000	100.000
25	33	100.000	100.000
33	41	100.000	100.000

N.P. NUMBER	UX	UY
1	.8005524E-01	-.4741198E+10
2	.7005692E-01	-.4741198E+10
3	.5996794E-01	-.4741198E+10
4	.4973221E-01	-.4741198E+10
5	.3935337E-01	-.4741198E+10
6	.2741146E-01	-.4741198E+10
7	.1719335E-03	-.4741198E+10
8	-.2406125E-01	-.4741198E+10
9	.7505608E-01	-.4741198E+10
10	.6497383E-01	-.4741198E+10
11	.5474186E-01	-.4741198E+10
12	.4442501E-01	-.4741198E+10
13	.3397989E-01	-.4741198E+10
14	.2321611E-01	-.4741198E+10
15	-.2158265E-02	-.4741198E+10
16	-.2502768E-01	-.4741198E+10
17	.7029915E-01	-.4741198E+10
18	.6007014E-01	-.4741198E+10
19	.4981395E-01	-.4741198E+10
20	.3947735E-01	-.4741198E+10
21	.2917957E-01	-.4741198E+10
22	.1903391E-01	-.4741198E+10
23	-.4528999E-02	-.4741198E+10
24	-.2726316E-01	-.4741198E+10
25	.5901909E-01	-.4741198E+10
26	.4861879E-01	-.4741198E+10
27	.3814983E-01	-.4741198E+10
28	.2801385E-01	-.4741198E+10
29	.1821113E-01	-.4741198E+10
30	.1053541E-01	-.4741198E+10
31	-.7527217E-02	-.4741198E+10
32	-.2474789E-01	-.4741198E+10
33	.5647187E-01	-.4741198E+10
34	.4525560E-01	-.4741198E+10
35	.3514099E-01	-.4741198E+10
36	.2596411E-01	-.4741198E+10
37	.1631979E-01	-.4741198E+10
38	.8972649E-02	-.4741198E+10
39	-.7931471E-02	-.4741198E+10
40	-.2252197E-01	-.4741198E+10
41	.4686155E-01	-.4741198E+10
42	.3758430E-01	-.4741198E+10
43	.2842933E-01	-.4741198E+10
44	.1991567E-01	-.4741198E+10
45	.1227236E-01	-.4741198E+10
46	.5455494E-02	-.4741196E+10
47	-.7639836E-02	-.4741198E+10
48	-.1803589E-01	-.4741198E+10
49	.2306908E-01	-.4741198E+10
50	.1516914E-01	-.4741198E+10
51	.9215355E-02	-.4741198E+10
52	.4482269E-02	-.4741198E+10
53	.3875+9E-03	-.4741198E+10
54	-.3452301E-03	-.4741196E+10
55	-.3727913E-02	-.4741198E+10
56	-.7768631E-02	-.4741198E+10

-.4741198E+10

EL.NO.	X	Y	X-STRESS	Y-STRESS	XY-STRESS	X-STRAIN	Y-STRAIN	XY-STRAIN
1	.2400	.0400	-1.2280E+04	-1.8647E+03	-2.4297E+02	-1.2603E-02	2.4414E-03	-7.3193E-04
2	.3200	.1200	-1.2342E+04	-1.2242E+03	-6.1270E+02	-1.2885E-02	3.1738E-03	-1.7700E-03
3	.4000	.2000	-1.2909E+04	-2.2731E+03	-8.8736E+02	-1.3165E-02	2.1973E-03	-2.5635E-03
4	.4800	.2800	-1.2736E+04	-1.1208E+03	-1.2254E+03	-1.3351E-02	3.4180E-03	-3.5403E-03
5	.5600	.3600	-1.1263E+04	-6.0610E+02	-1.5170E+03	-1.1961E-02	2.4414E-04	-1.5869E-02
6	.7000	.5000	-7.9062E+03	-4.2361E+02	-7.3227E+02	-8.2821E-03	1.3428E-03	-7.6599E-03
7	.9000	.7000	-5.4349E+03	-4.4866E+02	-1.1670E+01	-5.4958E-03	3.6621E-04	-1.2207E-04
8	.6400	.0400	-1.2121E+04	-2.9157E+03	-2.2184E+02	-1.2076E-02	1.2207E-03	-6.4087E-04
9	.7200	.1200	-1.2635E+04	-2.0110E+03	-4.2255E+02	-1.2282E-02	2.1973E-03	-1.2207E-03
10	.8000	.2000	-1.2727E+04	-8.2001E+02	-5.7044E+02	-1.2337E-02	3.4180E-03	-1.6479E-03
11	.8800	.2800	-1.1577E+04	-7.7491E+02	-5.9157E+02	-1.2185E-02	3.4180E-03	-1.7090E-03
12	.9600	.3600	-1.0599E+04	-5.8950E+02	-3.5592E+02	-1.1228E-02	2.4414E-04	-3.7231E-03
13	1.1000	.5000	-7.9452E+03	-4.5724E+02	2.2756E+02	-8.3161E-03	9.7656E-04	2.3804E-03
14	1.3000	.7000	-4.6371E+03	-4.8440E+02	3.7343E+02	-4.6328E-03	-2.4414E-04	3.3063E-03
15	1.2400	.0400	-1.3685E+04	-1.7371E+03	-5.0178E+02	-1.4207E-02	3.0518E-03	-1.4496E-03
16	1.3200	.1200	-1.2768E+04	2.0539E+03	-5.1763E+02	-1.4451E-02	6.9580E-03	-1.4954E-03
17	1.4000	.2000	-1.2756E+04	2.2926E+03	7.9228E+01	-1.4460E-02	7.2021E-03	2.2888E-04
18	1.4800	.2800	-1.2307E+04	2.3619E+03	7.9228E+02	-1.4022E-02	7.0801E-03	2.2888E-03
19	1.5600	.3600	-1.1300E+04	-3.6683E+02	1.4310E+03	-1.2136E-02	2.9297E-03	1.4969E-02
20	1.7000	.5000	-8.0866E+03	-3.8119E+02	1.5462E+03	-7.1542E-03	1.5259E-03	1.5174E-02
21	1.9000	.7000	-7.3268E+02	-4.5820E+02	1.1290E+03	-3.0181E-04	-1.0376E-03	1.1810E-02
22	1.7400	.0400	-1.4214E+04	-1.7858E+03	-6.3383E+01	-1.4778E-02	3.1738E-03	-1.3311E-04
23	1.8200	.1200	-1.6512E+04	-5.9908E+03	3.4227E+03	-1.5930E-02	-7.3242E-04	9.8877E-03
24	1.9000	.2000	-1.5264E+04	-8.2531E+03	4.2255E+03	-1.3789E-02	-3.6621E-03	1.2207E-02
25	1.9800	.2800	-1.2666E+04	-5.9755E+03	4.4157E+03	-1.0995E-02	-2.1973E-03	1.2756E-02
26	2.0600	.3600	-8.5135E+03	-1.1306E+03	3.0399E+03	-8.7604E-03	-6.3477E-03	3.1799E-02
27	2.2000	.5000	-5.0497E+03	-6.5951E+02	2.4039E+03	-5.0426E-03	-2.0752E-03	2.5146E-02
28	2.4000	.7000	3.7964E+03	1.7688E+02	2.1005E+02	4.5541E-03	4.7607E-03	2.1973E-03
29	2.0400	.0400	-2.3062E+04	-1.0812E+04	3.6234E+03	-2.1601E-02	-3.9063E-03	1.0468E-02
30	2.1200	.1200	-1.9191E+04	-8.7720E+03	2.9262E+03	-1.7979E-02	-2.9297E-03	8.4534E-03
31	2.2000	.2000	-1.6134E+04	-6.5514E+03	2.5036E+03	-1.5378E-02	-1.4648E-03	7.2327E-03
32	2.2800	.2800	-1.2455E+04	-4.1145E+03	2.1128E+03	-1.2047E-02	0.	6.1035E-03
33	2.3600	.3600	-9.0769E+03	-8.8104E+02	1.3478E+03	-9.4557E-03	-3.4180E-03	1.4099E-02
34	2.5000	.5000	-4.0764E+03	-4.3446E+02	1.0561E+03	-4.6320E-03	4.8828E-04	1.1047E-02
35	2.7000	.7000	4.9206E+03	-3.9907E+02	5.2913E+01	5.9721E-03	-1.9541E-03	5.4932E-04
36	2.0400	.0400	-2.6442E+04	-2.9053E+02	-1.8751E+03	-2.6863E-02	8.9111E-03	-5.4169E-03
37	2.1200	.1200	-2.3990E+04	-6.5371E+02	6.1798E+02	-2.6018E-02	7.6904E-03	1.7853E-03
38	2.2000	.2000	-2.0434E+04	-1.8940E+03	1.9437E+03	-2.1653E-02	5.1270E-03	5.6152E-03
39	2.2800	.2800	-1.6125E+04	-1.2685E+03	2.4719E+03	-1.7077E-02	4.3945E-03	7.1411E-03
40	2.9000	.3600	-1.0459E+04	-6.4093E+02	2.3179E+03	-1.1058E-02	-3.6621E-04	2.4246E-02
41	3.1000	.5000	-1.5439E+03	-5.2784E+02	1.5156E+03	-1.1805E-03	-1.5869E-03	1.3854E-02
42	3.3000	.7000	7.5694E+03	-2.3966E+02	5.8348E+02	8.8620E-03	-9.1553E-04	6.1035E-03
43	3.2400	.0400	-4.2268E+04	3.8605E+03	1.4282E+04	-4.7832E-02	1.8799E-02	4.1260E-02
44	3.3200	.1200	-2.6122E+04	5.6281E+03	1.1705E+04	-3.0481E-02	1.5381E-02	3.3813E-02
45	3.4000	.2000	-1.3707E+04	6.9356E+03	9.1694E+03	-1.7122E-02	1.2695E-02	2.6489E-02
46	3.4800	.2800	-5.4372E+03	8.0391E+03	6.1964E+03	-6.0788E-03	1.0498E-02	1.7883E-02
47	3.5600	.3600	-3.0471E+02	3.2703E+02	3.0487E+03	-4.4405E-05	7.5684E-03	3.1891E-02
48	3.7000	.5000	4.3024E+03	2.6643E+02	2.0480E+03	5.0914E-03	5.6152E-03	2.1423E-02
49	3.9000	.7000	1.2673E+04	3.4306E+02	4.4053E+02	1.4371E-02	4.1504E-03	4.6082E-03

********** AUTOMATIC BULLETIN **********

USEFUL INFORMATION...

1) PERM. FILES FROM 1804, 28 JAN 73 LOADED AT 1759, 29 JAN 73.

2) SYSTEM 2794 WAS INTRODUCED ON 02 JAN 73.

3) A COMPLETE AUDIT IS PUT ON PERM FILE EVERY MORNING. IT CAN BE ATTACHED BY THE P.F. NAME (AUDIT,CY=4).

4) PLEASE REVIEW ALL YOUR PERMANENT FILES AND PURGE THOSE THAT ARE NOT ABSOLUTELY NECESSARY.

5) SOFTWARE TESTING... MONDAY THRU FRIDAY (0700-0800).

ANNOUNCEMENTS...

A) A 12 & 1/2 HOUR SCOPE COURSE WILL BE OFFERED ON FEB 26,29, MAR 2,7,9 FROM 0900 TO 1130 IN ROOM 101.

B) A 15 HOUR INTERMEDIATE FTN COURSE WILL BE OFFERED ON MAR 12,14,16,19,21,23 FROM 0900 TO 1130 IN ROOM 101.

C) TO REGISTER CONTACT TOM KELLER, ASD/DPCD, 56351/54442.

D) SOFTWARE PRODUCT TEST:

A LIVE TEST IN THE PRODUCTION ENVIRONMENT WILL BE CONDUCTED DURING THE PERIOD (7 FEB THRU 9 FEB 73).

THE FOLLOWING PRODUCTS WILL BE IN TEST MODE:

SIMSCRIPT 3.0

THE ABOVE PRODUCTS ARE OFFERED FOR TESTING AND MAY MALFUNCTION IN SOME CASES; THEREFORE PLEASE REPORT ANY PROBLEMS AS SOON AS POSSIBLE TO EXT. 56248 AND SAVE SUPPORTING DOCUMENTATION.

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 02/02/73  SCOPE 3.3 R2 CMR1    L279R2M    01/01/73
17.05.43.TJMT20J
17.05.43.TJM,T45,CM177000.D720633,MUHA,FBCB,55548
17.05.43.
17.05.44.FTN.
17.06.40.     28.917 CP SECONDS COMPILATION TIME
17.06.40.LGO.
17.06.45. MINIMUM FIELD LENGTH REQUIRED  176200
17.06.51.STOP
17.06.52.MAXIMUM MASS STORAGE  003450 PRUS
17.06.52.CP      031.332 SEC.
17.06.52.PP      015.568 SEC.
17.06.52.IO      014.085 SEC.
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