Structural Engineering Report No. 93

FEPARCS5 — A FINITE ELEMENT PROGRAM FOR THE ANALYSIS OF AXISYMMETRIC REINFORCED CONCRETE STRUCTURES — USER'S MANUAL —

by

ALAA E. ELWI

and

DAVID W. MURRAY

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University of Alberta

Department of Civil Engineering

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-User's Manual -

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NOTATION

dA : an element of area

$d\vec{b}_1, d\vec{b}_2$: elements of vectors forming sides of element of area.

E_o : initial Young's modulus

f_{cb} : biaxial compressive strength

f_{cu} : uniaxial compressive strength

f_{tu} : uniaxial tensile strength

G_o : initial shear modulus

p_n : pressure intensity in the positive direction of normal to a surface

p_r : pressure intensity component in global r direction

p_t : pressure intensity in the positive direction of tangent to a surface

p_2 : pressure intensity component in global z direction

r : horizontal coordinate or horizontal radius

u : displacement in the horizontal direction

v : displacement in the vertical direction

z : vertical coordinate

α : coefficient of thermal expansion, or angle of inclination of tangent to surface to the horizontal

α_c : ratio of biaxial compressive strength to uniaxial compressive strength (f_{cb}/f_{cu})

α_t : ratio of uniaxial tensile strength to uniaxial compressive strength (f_{tu}/f_{cu})

γ	:	specific weight
ε	:	strain
ε_{cu}	:	strain corresponding to uniaxial compressive strength
θ	:	angle of inclination of a reinforcing layer to the horizontal axis
λ_r	:	convergence tolerance for displacements
λ_p	:	convergence tolerance for loads
μ	:	nondimensional local coordinate of a finite element
ν_o	:	initial Poisson's ratio
ξ	:	nondimensional local coordinate of a finite element
ξ_1, ξ_2	:	nondimensionalized mean normal stresses in compression
ρ_1, ρ_2	:	nondimensionalized mean shear stresses at nondimensionalized mean normal stresses ξ_1 and ξ_2, respectively.
σ	:	denotes stresses

CHAPTER ONE

INTRODUCTION

1.1 Background to Program

This report is intended as documentation for program FEPARCS5. Program FEPARCS5 has been written in the course of research carried out by the authors to develop a sophisticated capability to analyse plane and axisymmetric, reinforced and/or prestressed concrete structures (Elwi and Murray, 1980). The objectives of the study were

(a) to develop a three dimensional nonlinear elastic constitutive relation for concrete (Elwi and Murray, 1979 and 1980).

(b) to formulate a finite element model capable of representing plane or axisymmetric behavior of reinforced and prestressed concrete structures.

(c) to develop a nonlinear finite element program for analysis of such structures and to incorporate the constitutive relation and the finite element model in the program.

This technology has been developed as an alternative to an elastic plastic capability developed by Murray et al. (1978) as part of a research program sponsored by the Atomic Energy Control Board of Canada and carried out at The University of Alberta to investigate the effects of overpressure on the behavior of Gentilly-2 type secondary containment structures which house CANDU nuclear reactors (Epstein and Murray, 1967, Murray, Rohardt and Simmonds, 1977, Murray, et al., 1978, and Chitnuyanondh et al., 1979).

1.2 Organization of Report

Chapter Two contains a general description of program FEPARCS5 in terms of the finite element model, the constitutive relations, the numerical solution strategy, the loads and the input and output. In Chapter Three the flow of operations and the structure of the program are presented. Appendix A contains the user's manual for the program. Appendix B describes the file structure. The execution commands for the various stages of the analysis are described in Appendix C. Appendix D contains a full listing of the program. A sample problem is described in Appendix E together with the input file and a sample output of the preprocessing phase and one of the advanced load steps.

CHAPTER TWO

GENERAL DESCRIPTION OF FEPARCS5

2.1 Introduction

Program FEPARCS5 is a finite element FORTRAN code for static analysis of axisymmetric or plane, reinforced and/or prestressed concrete structures. Although the program can handle linear problems it is designed for problems with nonlinear material response. In this chapter the finite element model is briefly described, the constitutive relations are outlined, the numerical solution strategy is discussed, the various types of loads are defined and the input and output are described. Much of the material in this chapter is based on Chapter Four of Elwi and Murray (1980).

2.2 Finite Element Model

Program FEPARCS5 is based on the finite element model described by Elwi and Murray (1980). This model is based on incremental variational principles assuming small displacements, negligible rotations and infinitesimal strains. The fundamental concept behind the model is to use the rectangular isoparametric element shown in Fig. 2.1 to represent the concrete continua (Zienkiewicz, 1971) and to superimpose identical elements in which integration is carried only along one or more layers to represent the reinforcing basis and prestressing tendons in a smearing fashion as shown in Fig. 2.3.

Two types of reinforcing elements have been developed and incorporated in program FEPARCS5; a meridional element to represent layers of reinforcement strained in plane r-z, and a circumferential element to represent circumferential reinforcement. Strains in both elements are compatible with the parent element representing the concrete. These strains are based on linear, quadratic or cubic displacement functions according to the degree of polynomial used in the parent element.

2.3 Constitutive Relations

The constitutive relation proposed by Elwi and Murray (1979) and (1980) is used to represent behavior of axisymmetric or plane concrete continua. The relation is based on the equivalent uniaxial strain concept introduced by Darwin and Pecknold (1974) and the ultimate strength surface proposed by Willam and Warnke (1975). In the modified relation, a unique nonlinear characterization of Poisson's ratio is introduced and post failure conditions are imposed on the ultimate strength surface to improve the determination of the stress-equivalent uniaxial strain relation parameters. For steel a simple one dimensional elastic plastic constitutive relation is adopted.

2.4 Numerical Solution Strategy

Program FEPARCS5 uses a tangent stiffness approach, or alternatively, the initial load method as solution strategies. In the first method a new stiffness matrix is evaluated at the beginning of each load increment based on the current material properties. The stiffness matrix is then re-evaluated every few iterates until convergence is obtained. In the second method, the stiffness matrix is evaluated at any specified point in the analysis, triangularized and stored. It is then used as a constant mapping in all subsequent load steps. In any case, assembly and triangularization of the stiffness matrix, reduction of the load vector and back substitution are governed by an equation solving package of the skyline type (Bathe and Wilson, 1976, and Elwi and Murray, 1977).

Convergence is based on displacement and/or load variation. The tolerances are set by the user at the beginning of every load step. In order to aid convergence an optional under (over) relaxation factor is provided. Drift of the solution is minimized by implementing the strain subincrement method (Elwi and Murray, 1980) and by tracing the stress point in every iteration from the last converged position rather than from the previous iteration.

2.5 Loads

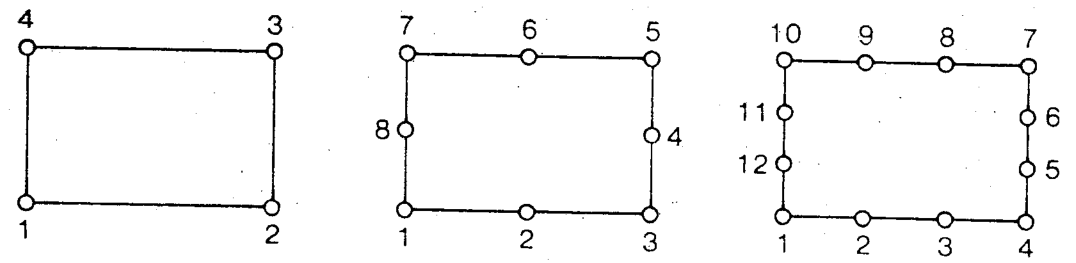
Program FEPARCS5 can handle several types of loads. Each type is stored in a separate array. These arrays are combined to form a load increment by applying load factors specified by the user at the beginning of every load step. Dead loads are a combination of gravity, hydrostatic and concentrated nodal loads. Two separate arrays are provided for live concentrated nodal loads and for thermal loads. The latter are calculated from the initial material properties and a user specified temperature distribution. Normal and tangential surface tractions are input as nodal pressure intensities. Each is integrated to form work equivalent nodal loads and stored in two additional arrays.

Post tensioning is simulated by applying a ficticious thermal distribution to the prestressing tendons to induce strains equivalent to the required tension. The corresponding stresses are then integrated over the prestressing layers forming a prestressing load vector. This load vector is then reversed and applied to the structure exclusive of the prestressing tendons. When convergence is obtained a set of self equilibrating stresses equivalent to a post tensioning state will exist in the structure.

2.6 Input and Output

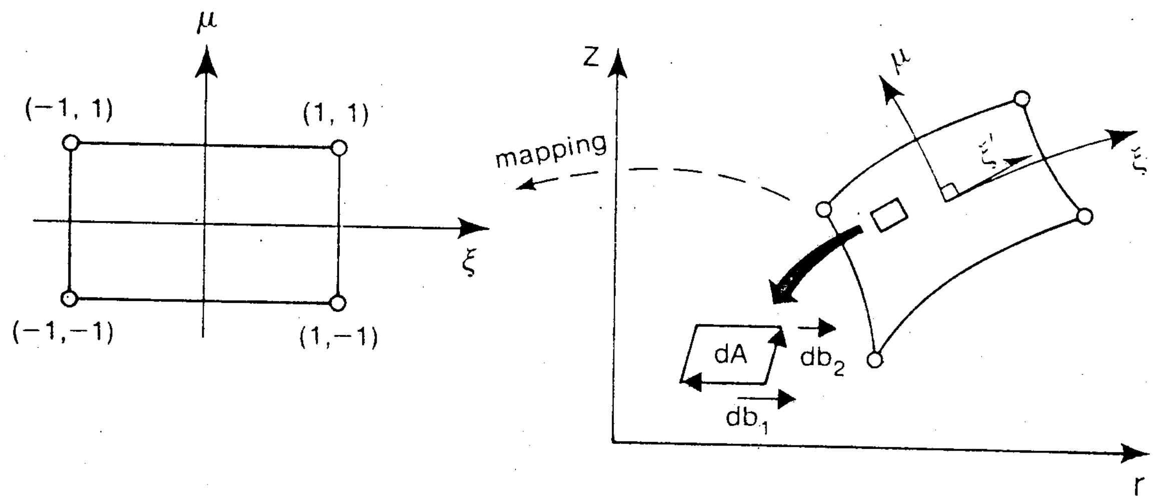
Program FEPARCS5 is executed in several stages. The first stage is called the "problem preparation phase" or the "preprocessing phase". The input to this phase is composed of control parameters, material properties, nodal geometry, boundary conditions, solid element information, reinforcing and prestressing layer information, concentrated dead and live nodal loads, normal and tangential surface tractions in the form of nodal pressure intensity distributions, hydrostatic pressure information, nodal thermal distributions, and finally surface specification for surface tractions. The output of this phase is composed of an echo check of input data as well as the completely generated data set, if required.

The second stage of execution is the solution or production phase which is run as many times as there are load steps. Each load step is initiated by reading a line describing the load factors, the convergence tolerances, as well as other control parameters. The output of any load step is composed of nodal displacements, stresses for the solid elements at the Gaussian integration points, and stresses and strains for the reinforcing and prestressing layers at the Gaussian points.



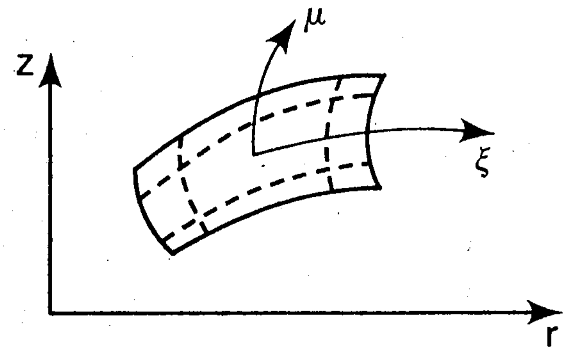
(a) Linear (b) Quadratic (c) Cubic

Fig. 2.1 Finite Element Model

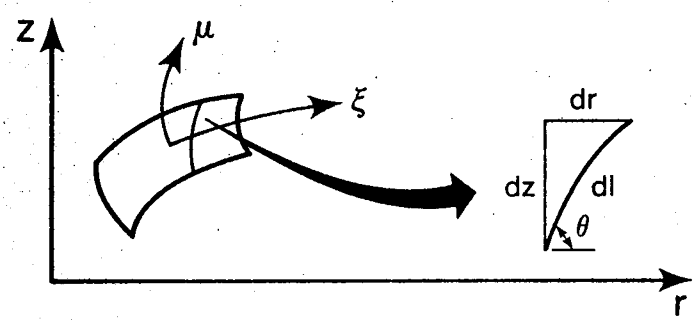


(a) Normalized Co-ordinates (b) The Element of Area

Fig. 2.2 Local Coordinate System

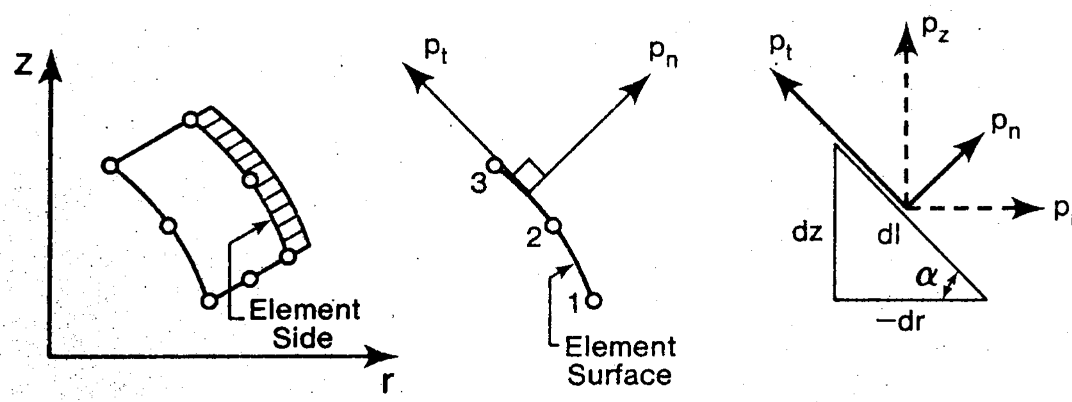


(a) Reinforcing Layers



(b) The Element of Length

Fig. 2.3 Reinforcing Layers



(a) Surface Tractions (b) Element Surface (c) Components

Fig. 2.4 Surface Tractions

CHAPTER THREE

STRUCTURE OF FEPARCS5

3.1 Flow of Operations

As mentioned in Section 2.6 program FEPARCS5 is executed in two main phases. The first phase is a problem preparation or pre-processing phase. This phase is executed on several stages. In the first stage the program reads the control parameters and calculates the required sizes of the different common blocks. The user can then adjust the size of active storage in the main segment. In the second stage the program reads and generates the structure and load data for checking purposes without carrying out any detailed calculations. The final stage is a complete preprocessing run in which the program generates all data, calculates and stores the element shape functions and derivatives at all integration points, forms the skyline of the structure stiffness matrix, initializes the stresses, strains and material properties at all integration points and finally forms the basic load vectors for all load types.

If requested, an initial stiffness matrix can be formulated, triangularized and stored out of core for use in the production phase. This stage is called "the initial load method preparation phase".

The production phase is the second phase of execution and is repeated for every load step. The size of the load step is controlled by the user who specifies the load factors according to which the basic load vectors are to be mixed in order to form a load increment vector.

Additionally, the user specifies the number of strain subincrements, the tolerances on convergence, the relaxation factor and the number of iterates after which the stiffness matrix is to be re-evaluated. If the last parameter is greater than the maximum number of iterates, the program automatically uses the initial load method as a solution strategy. Otherwise, the modified tangent stiffness approach is used.

Having read the load step specifications and formed the load increment vector accordingly, the program formulates and triangularizes the stiffness matrix if the tangent stiffness approach is used, or reads a stored triangularized stiffness matrix if the initial load approach is used. The program then solves for an increment of displacement and updates the total displacement vector. The stresses and material properties are then updated. If the problem is linear, the program prints the results and stops. If the problem is nonlinear, the stresses are integrated to form an equilibrating load vector which is subtracted from the total load vector to obtain the unbalanced load vector. If convergence is obtained, results are printed, and current stresses, material properties, loads and displacements are stored as unformated records on files. The load step is considered ended and the program stops. If convergence has not been obtained, the unbalanced load vector is used to obtain a further displacement increment and the steps are repeated.

When numerical difficulties such as an ill conditioned stiffness matrix, or oscillatory convergence occur, execution is automatically halted and the current stresses, strains and displacements are printed for the user's consideration. Figs. 3.1 and 3.2 show the flow charts of the preprocessing phase and the production phase. The initial load method preparation phase forms the last step of Fig. 3.1.

3.2 Structure of Program

Program FEPARCS5 is arranged in four distinct levels. The uppermost level is the MAIN segment. This segment is composed of parts; each of which controls a particular execution phase. Each part of MAIN calls a number of major routines which form the second level of the program. Each major routine controls the execution of one task, such as, reading the data (subroutine DATA), and formulating the stiffness matrix (Subroutine STIF), etc., by calling a number of routines which form the third level. Third level routines are designed to handle small and specialized portions of the task of the second level calling routine. The fourth level contains routines of general nature called many times by different higher order routines. This level contains the data managing package, the material routines, and other routines.

In addition to the levels described above, the program calls four MTS system routines which can be replaced. These are READ and WRITE for reading and writing unformatted records to sequential files, and NOTE and POINT which control the read and write pointers of sequential files. In the future these four routines will be replaced by routines of general FORTRAN nature. A fifth routine (VCMLT) is written in IBM ASSEMBLER language. Other than these exceptions, the rest of the program is written in FORTRAN IV language.

Figs. 3.3 to 3.5 show the structure of the different phases of the program. The functions of the major second level routines shown in Figs. 3.3 to 3.5 are summarized at the heading of each routine in the listing of Appendix D.

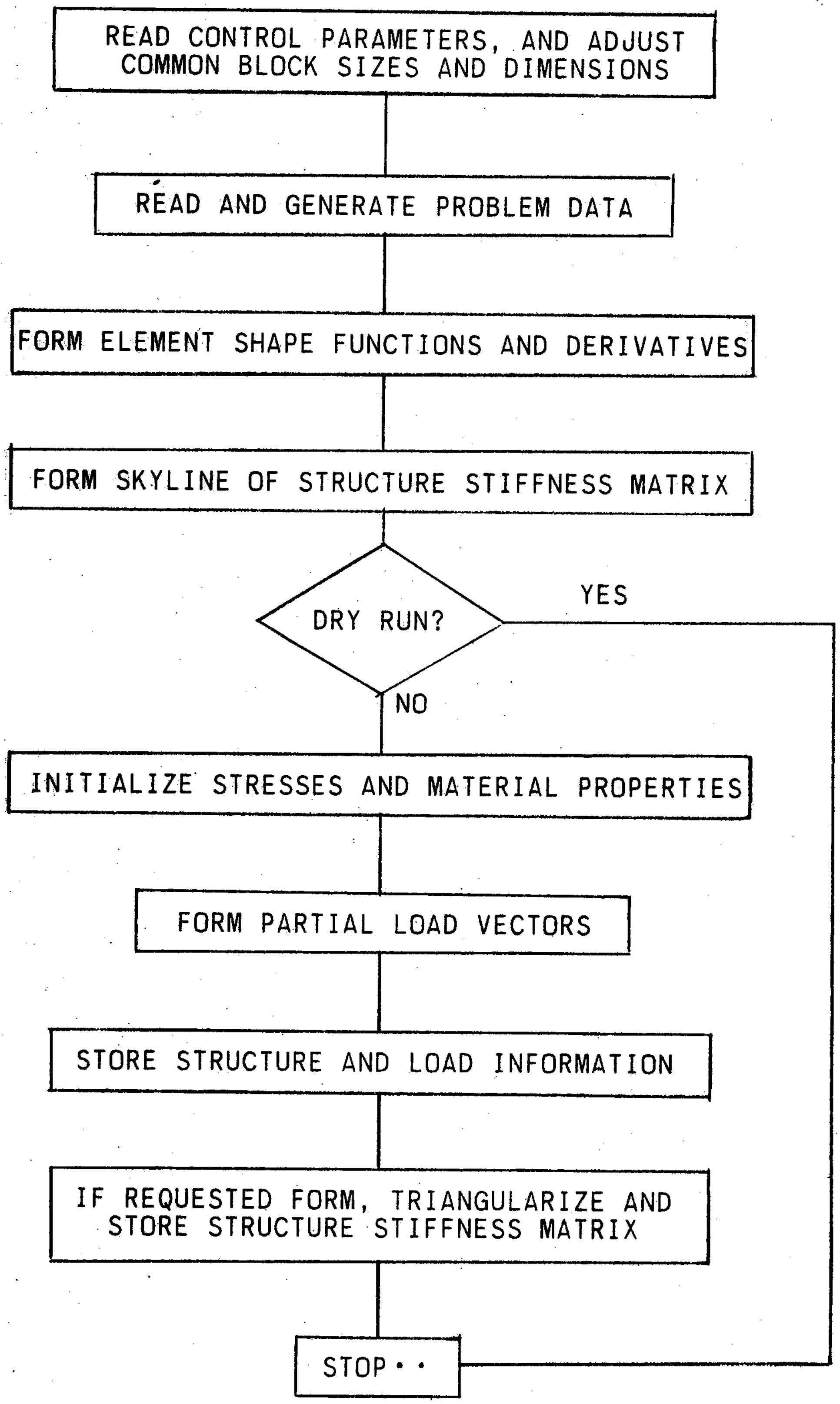


Fig. 3.1 Flow Chart of the Preprocessing Phase of FEPARCS5

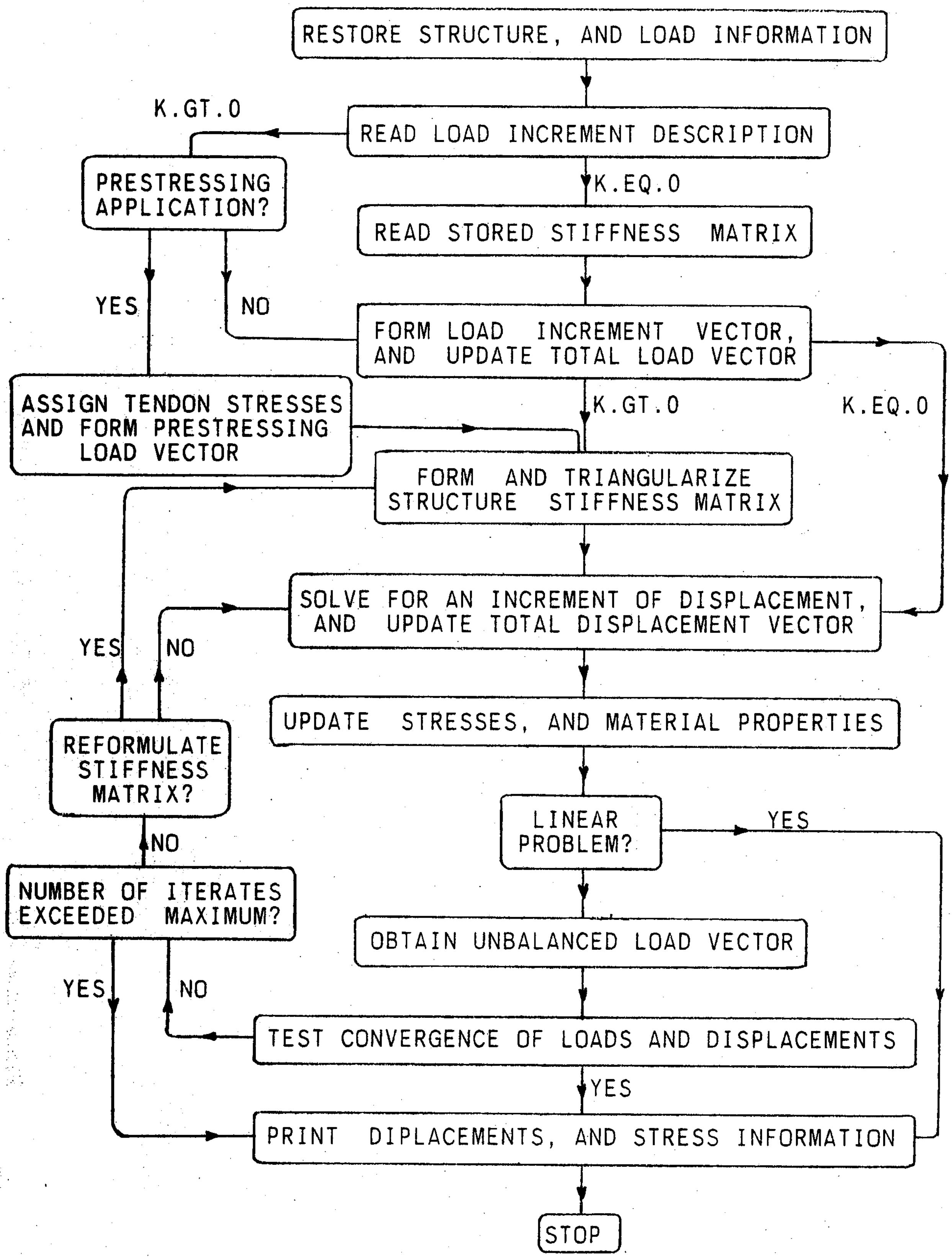


Fig. 3.2 Flow Chart of the Production Phase of FEPARCS5

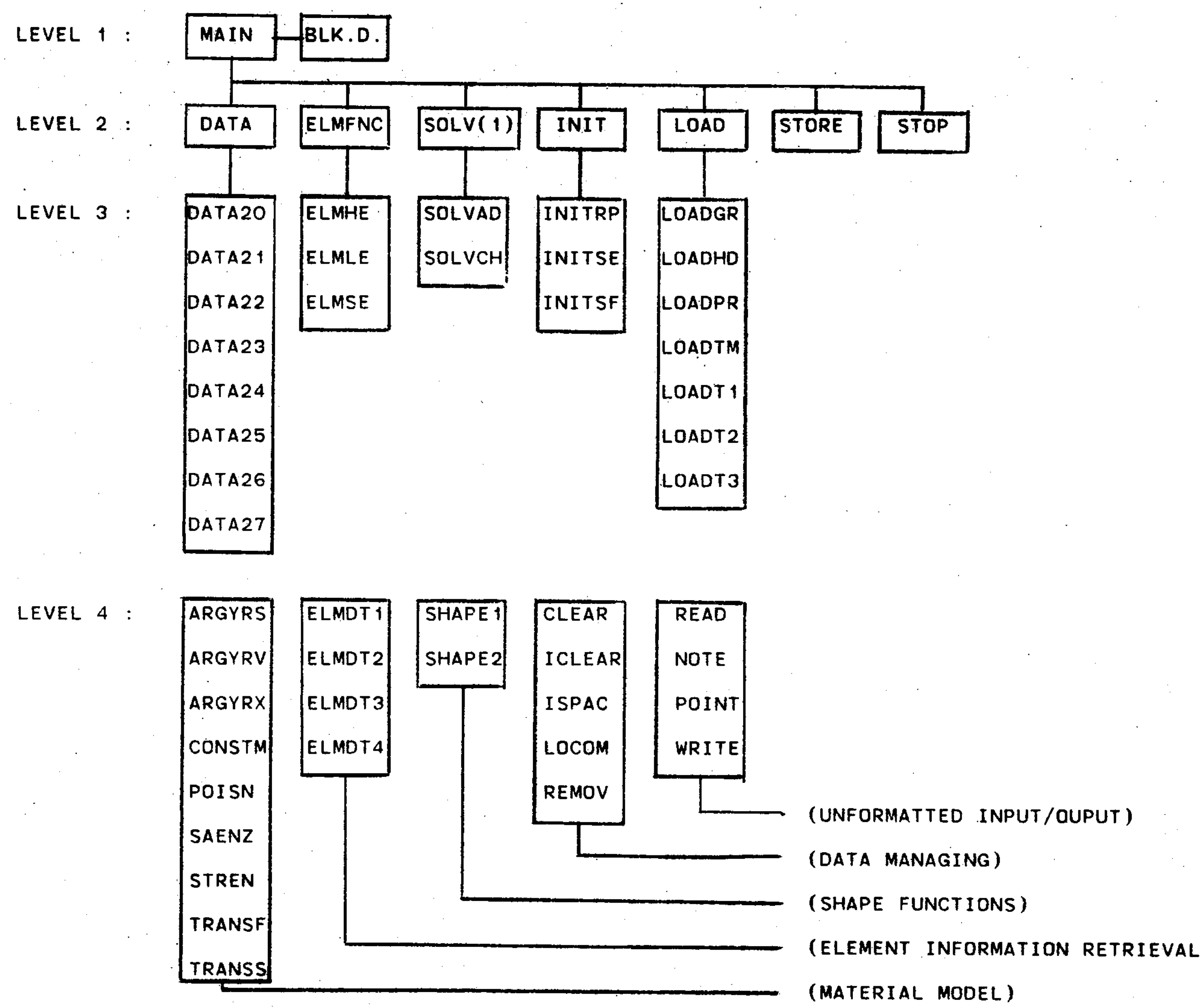


Fig. 3.3 Structure of the Preprocessing Page

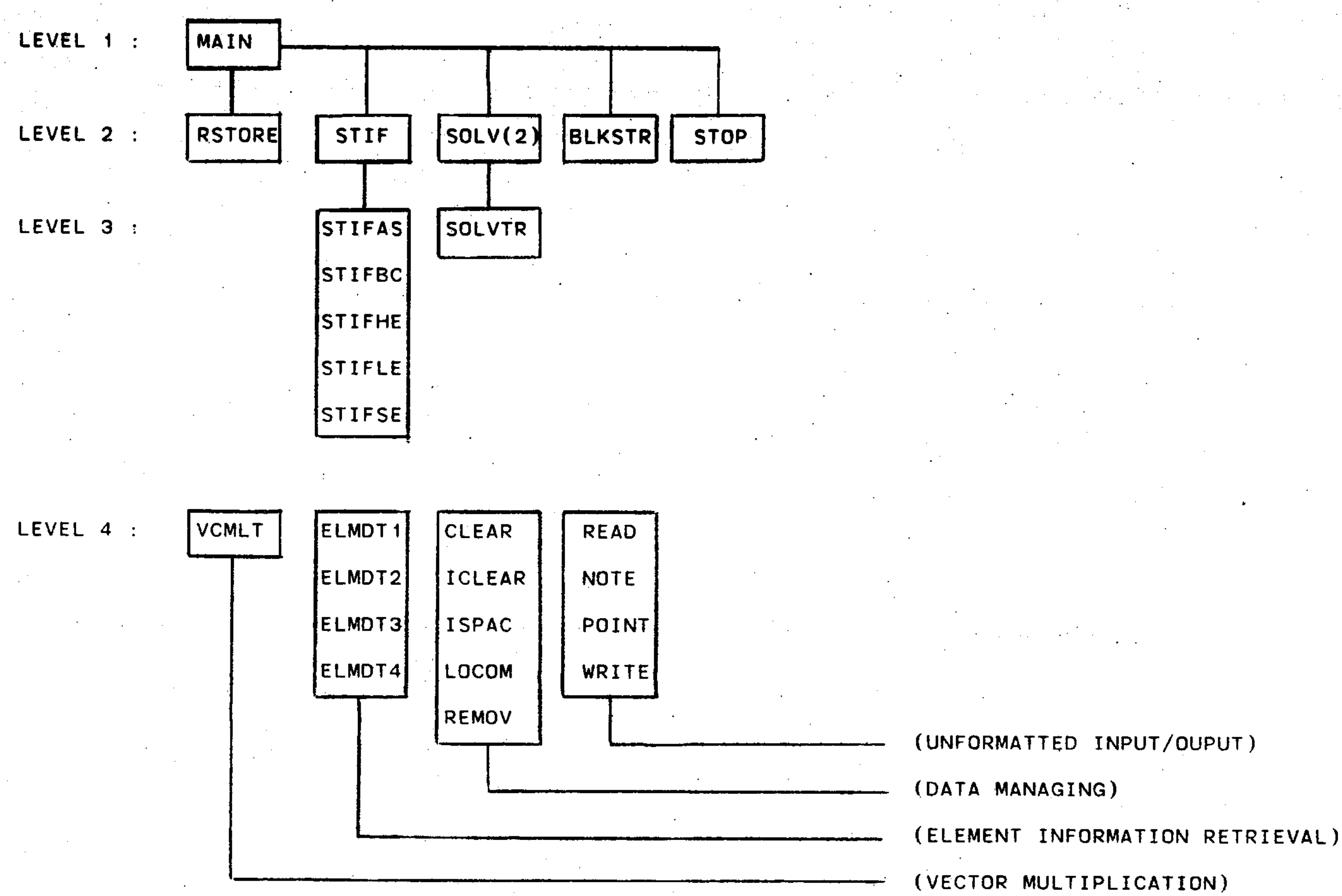


Fig. 3.4 Structure of the Initial Load Method Preparation Phase

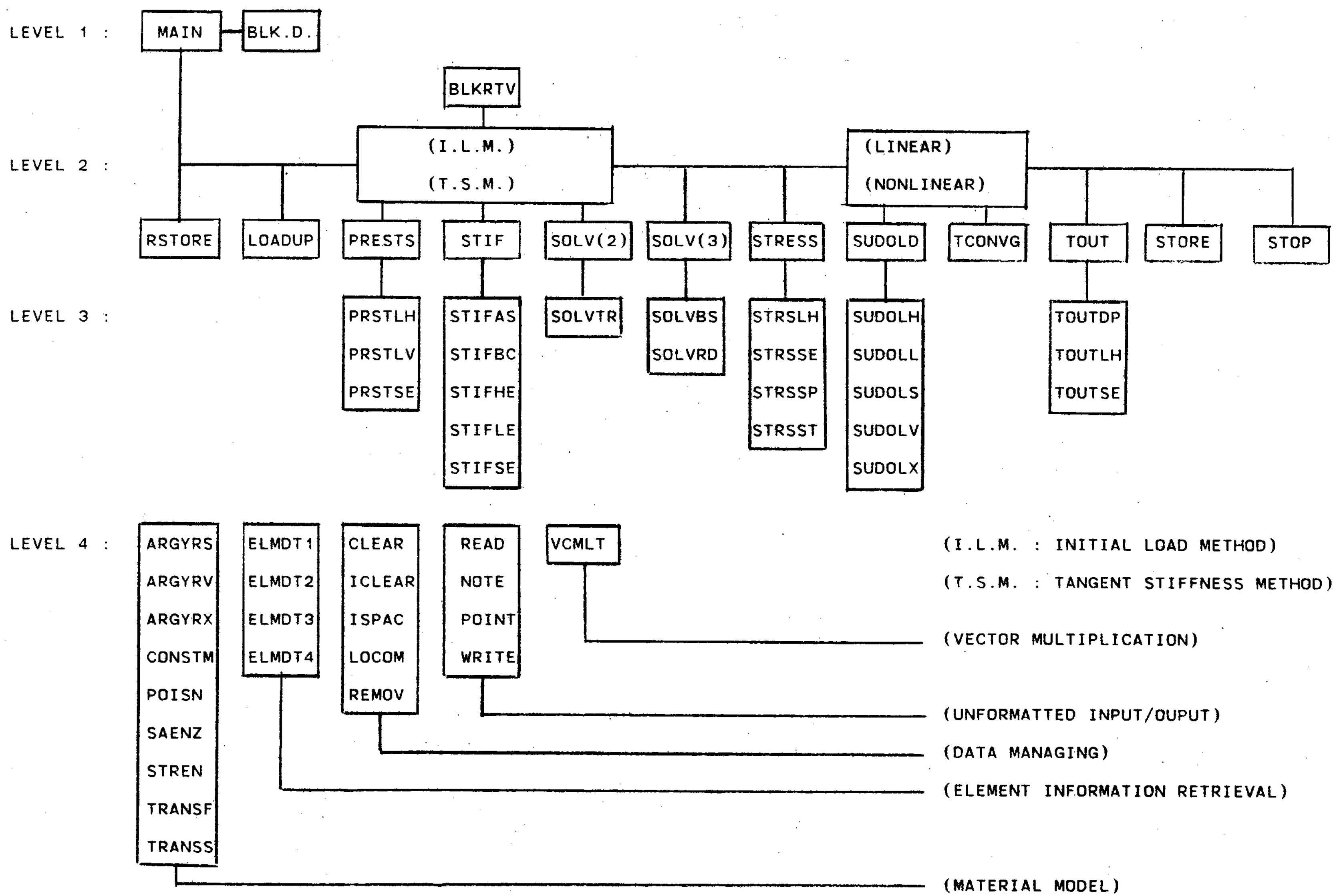


Fig. 3.5 Structure of the Production Phase

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APPENDIX A

USER'S MANUAL OF FEPARCS5

1. PREPROCESSING PHASE INITIATION CARD (I4)

One card which contains the following entry

4
IPHASE

IPHASE: -1

2. HEADING CARD (20A4)

One card which contains a title for the problem.

3. CONTROL CARD (20I4)

One card which contains the major control parameters entered as follows:

4	8	12	16	20	24	28	32	36	40
IECHO	ISTYP	IMTYP	IDRUN	ILNGR	IHOPR	ILNGP	IHOPP	ICNLD	ITEMP

44	48	52	56	60	64	68	72	76	80
IDSLD	ISTRS	IGRLD	NMNOD	NMELM	NMEBE	NCMAT	NSMAT	NMPAR	NITRT

IECHO : request for complete data output (0 = no and 1 = yes)

ISTYP : type of structure (0 = plane stress, 1 = axisymmetric)

IMTYP : type of problem (0 = linear, 1 = nonlinear)

IDRUN : flag for dry run (0 = no, 1 = yes, 2 = partial dry run in which only the first three cards are read. (see Appendix C.)

ILNGR : flag for longitudinal reinforcement

IHOPR : flag for hoop reinforcement

ILNGP : flag for longitudinal prestressing

IHOPP : flag for hoop prestressing

} (0 = without, 1 = with)

ICNLD : flag for concentrated nodal loads (0 = none, 1 = deadload and live load, 10 = prescribed displacement, 11 = dead and live loads and prescribed displacements)

ITEMP : flag for temperature distributions (0 = none, 1 = a distribution for prestressing purposes, and 2 = two distributions, the second is for temperature loading purposes.)

IDSLD : flag for surface tractions (0 = none, 10 = normal and tangential 1 = hydrostatic, 11 = normal, tangential and hydrostatic)

ISTRS : flag for initial stresses (0 = without, and 1 = with)

IGRLD : flag for gravity loads (0 = without, and 1 = with)

NMNOD : total number of nodes

NMELM : total number of solid elements

NMEBE : total number of external boundary elements

NCMAT : total number of materials for solid elements

NSMAT : total number of materials for reinforcing and prestressing elements

NMPAR : maximum number of parameters for any material

NITRT : maximum number of iterations per load step

4. MATERIAL CARDS

This group of cards consists of a number of cards for each material type, first the solid element materials, and then the reinforcing and prestressing element materials. For detailed definitions and further details of the constitutive relation, Elwi and Murray (1980) should be consulted.

4.1 Identification Card (2I4)

4	8
N	NMP(N)

N : material identification number

NMP(N) : number of material parameters to be read

4.2 Material Parameter Cards (10F8.0)

4.2a Solid Element

Two card for linear materials or three cards for nonlinear materials. It must be noted that in the material model used herein, the principal axes of orthotropy are assumed such that axis 1 coincides with local direction ξ^1 shown in Fig. 2.2 and axis 2 coincides with local direction μ and axis 3 coincides with circumferential direction.

8	16	24	32	40	48	56	64	72	80
EMDI(1)	EMDI(2)	EMDI(3)	EMDI(4)	PRTI(1)	PRTI(2)	PRTI(3)	TECI(1)	TECI(2)	TECI(3)

8	16	24	32	40	48	56	64	72	80
SW	FCU	AC	AT	SI1	ROI	SI2	R02	ECU	BC

8	16	24	32	40
BT	ETA1	LAM1	ETA2	LAM2

EMDI(1) :
EMDI(2) : Young's modulii for material directions ξ^1, μ and θ respectively,
EMDI(3) : E_{oi}, i = 1, 2, 3

EMDI(4) : Shear modulus for plane ξ^1-μ, G_{012}

PRTI(1) :
PRTI(2) : Poisson's Ratios for material directions ξ^1, μ and θ respectively,
PRTI(3) : ν_{oi}, i = 1, 2, 3

TECI(1) : Thermal expansion coefficients for material directions ξ^1, μ,
TECI(2) : and θ respectively, α_i, i = 1, 2, 3
TECI(3) :

SW : specific weight of the material, γ

(This is the end of input for a linear material)

FCU : uniaxial compressive strength of material, f_{cu}

AC : normalized biaxial compressive strength, α_c (f_{cb}/f_{cu})

AT : normalized uniaxial tensile strength, α_t (f_{tu}/f_{cu})

SI1 : minor meridian of failure surface hydrostatic parameter, ξ_1.

RO1 : minor meridian of failure surface deviatoric parameter, ρ_1.

SI2 : major meridian of failure surface hydrostatic parameter, ξ_1.

RO2 : major meridian of failure surface deviatoric parameter, ρ_2.

ECU : strain corresponding to FCU, ε_{cu}.

BC : strain parameter corresponding to AC.

BT : strain parameter corresponding to AT.

ETA1 : strain parameter corresponding SI1.

LAM1 : strain parameter corresponding to RO1.

ETA2 : strain parameter corresponding to SI2.

LAM2 : strain parameter corresponding to RO2.

In the absence of other information, the following values are suggested for normal concrete.

SI1 = 13.75		RO1 = 0.0
SI2 = 3.75		RO2 = 0.0
ETA1 = 22.5		LAM1 = 0.0
ETA2 = 22.5		LAM2 = 0.0

4.2b Reinforcing and Prestressing Element

A minimum of three and a maximum of 17 parameters on one or two cards.

8	16	24	32					
SS(1)	SN(1)			SS(i)	SN(i)			TC

The first (NMP(N)-1) parameters describe the stress strain curve point by point starting from the first nonzero point. A maximum of eight points other than the origin are allowed. The last parameter is the thermal expansion coefficient for this material.

SS(i) : stress at point i, σ.

SN(i) : strain at point i, ε.

TC : thermal expansion coefficient, α.

5. NODAL GEOMETRY CARDS

Program FEPARCS5 reads and generates nodal coordinates using a Cartesian and/or any number of polar coordinate systems. The Cartesian coordinate system is the global coordinate system of the problem. The polar coordinate system(s) must be assigned center(s) referenced to the global coordinate system. Interpolation of nodal coordinates is linear along a straight line in Cartesian coordinates. In polar coordinates interpolation is linear along an arc.

The nodal geometry cards can be divided into any number of groups. Each group describes a portion of the structure using the global Cartesian system or any one polar coordinate system. Hence, a group must consist of a group control card, a center specification card in case the group uses a polar coordinate system, and any number of nodal coordinate cards.

5.1 Group Control Card (2I4)

One card which contains the following entries.

4	8
NCARDS	ISPHER

NCARDS : number of nodal coordinate data cards in this group.

ISPHER : if other than 0 the group uses a polar coordinate system.

5.2 Center Specification Card (2F12.0)

This card is omitted if ISPHER = 0 on the group control card.

12	24
XC	YC

XC : r-coordinate of center of polar coordinate system.

YC : z-coordinate of center of polar coordinate system.

5.3 Nodal Coordinate Cards (I4, 2F12.0, I4)

One card per node unless automatic nodal generation is initiated to a total number of NCARDS cards.

4	16	28	32
N	XCORD	YCORD	INC

N : number of node

XCORD : r-coordinate or radius of nodal point.

YCORD : z-coordinate or angle included between the radius and z-global axis in degrees.

INC : if non-zero, automatic generation is initiated between the node on the preceding card and the node on this card. Generated nodes will have numbers (NOLD + INC*K), where NOLD is the node on the preceding card and K is a positive integer which varies from 1 to ((N-NOLD)/INC-1). If automatic generation is used in polar coordinate systems, radii and angles of generated points are interpolated linearly between nodes N and NOLD. In the Cartesian coordinate system, all generated nodes will lie on the straight line joining points N and NOLD at equal distances.

5.4 Termination Card

One blank card at the end of all nodal geometry cards.

6. EXTERNAL BOUNDARY ELEMENTS

External boundary elements in program FEPARCS5 are of the spring type. These springs may have any orientation in the r-z plane. In the case of axisymmetric structures these elements are entered with stiffness per unit width along the circumference.

6.1 Control Card (I4)

One card which contains the following entry:

4
NCARDS

NCARDS: number of external boundary element cards to follow.

6.2 Element Specification Card (3I4, 4F12.0)

One card per element unless automatic generation is used to a total of NCARDS cards.

4	8	12	24	36	48	60
N	NPEBE	INC	XPEBE	YPEBE	PDEBE	STEBE

N : identification number of external boundary element

NPEBE : identification number of node to which the element is attached.

INC : if nonzero automatic generation is initiated between element on the preceding card and this element. Generated elements will have numbers (NOLD+K*INC), where NOLD is the number of element on the preceding card and K is a positive integer. The elements will be attached to nodes with numbers linearly interpolated between the nodes of element N and NOLD and the generated elements will have the properties of the element on the card initiating the generation.

XPEBE : r-projection of a unit vector along element.

YPEBE : z-projection of a unit vector along element.

PDEBE : prescribed displacement of node in the direction of a unit vector along element.

STEBE : spring stiffness of element per unit width if other than 10^{20} unit force/unit displacement/unit width.

7. SOLID ELEMENT CARDS

Program FEPARCS5 uses isoparametric elements of the linear, quadratic and cubic types together with a variety of Gaussian integration rules.

7.1 Control Card (I4)

One card which contains the following entry

4
NCARDS

NCARDS : number of solid element specification cards of Type 7.2 to follow.

7.2 Element Specification Cards (18I4, F8.0)

One card per element unless automatic generation is used to a total of NCARDS cards.

4	8	12	16	20	24	72	80
N	NDELM	NGELM	ICLSE	MATSE	INC	NPELM(I),I=1,12	ORNSE

N : identification number of element

NDELM : order of element (1=linear, 2=quadratic and 3=cubic)

NGELM : a two digit number which gives the order of Gaussian integration required. The first digit is the order of integration in the local μ direction which may be 1, 2 or 3. The second digit is the order of integration in the ξ local direction which may be 1, 2, 3, 5, or 7.

ICLSE : if (0), the element is a prototype of a class of solid elements. In this case, its shape functions and derivatives will be evaluated and stored on file '1'. If (i), the element will be considered to have the same geometric properties as element number (i) which must be a prototype element. This classification scheme is restricted to geometric properties in the global r-z system only.

MATSE : material type identification number.

INC : if nonzero, automatic generation is initiated. Generated elements will have numbers (NOLD+K*INC), where NOLD is the element number on the preceding card, and K is a positive integer which varies from (1) to ((N-NOLD)/INC-1). The generated elements will have the properties specified on this card. The nodes will be interpolated linearly between element number NOLD and element number N.

NPELM : Array of the identification numbers of nodes of the element starting at a corner and proceeding in a counterclockwise manner around the element. The order of node specification in this array defines the local nondimensional coordinate system (ξ,μ). The initial nodes define the ξ direction, while the μ direction will make a counterclockwise angle with the ξ direction.

ORNSE : Orientation of the E_2 material axis measured in a counterclockwise direction from the global z-axis.

8. LONGITUDINAL REINFORCING ELEMENT CARDS

This group of cards is omitted if the flag ILNGR described in Section 3 equals zero.

8.1 Control Card (I4)

One card which contains the number of pairs of cards to be read in Section 8.2.

8.2 Element Specification Cards

Two cards per element, unless automatic generation is used. The first card is of format (5I4). The second is of format (8F8.0).

4	8	12	16	20
N	NL	IC	NM	INC

8	16	24	32	40	48	56	64
A1	P1	A2	P2	A3	P3	A4	P4

N : number of solid element which contains this element.

NL : number of last layer in this element (see Section 8.3).

IC : if zero, this element is a prototype of a class of longitudinal reinforcing elements, and its shape functions and derivatives will be computed and stored on file 1. If (i), this element belongs to the class described by element number (i), which must be a prototype element.

NM : material type identification number.

INC : if nonzero, automatic data generation is initiated. Generated elements will have numbers (NOD+K*INC), where NOLD is the element number on the preceding card, and K is a positive integer ranging from (1) to ((N-NOLD)/INC-1). The generated elements will have the properties on this card.

Al to A4: areas of layers per unit width. A solid element can accept four longitudinal reinforcing layers. The first two lie in the μ local direction. The last two lie in the ξ local direction.

Pl to P4: nondimensional position of layer with respect to center of element. Pl and P2 are ξ coordinates indicating the distances from the μ axis to layers Al and A2. P3 and P4 are μ coordinates indicating the distances from the ξ axis to layers A3 and A4.

8.3 Example

For the elements shown in Fig. A.1, the sequence of cards described in Sections 8.1 and 8.2 is written as follows.

```
4
1     1     0     1     0
    1.0        -0.5          0.0   0.0   0.0   0.0   0.0   0.0
2     1     0     1     0
    1.0         0.5          0.0   0.0   0.0   0.0   0.0   0.0
3     3     0     1
    1.0        -0.5          0.0   0.0   1.0  -0.5   0.0   0.0
4     4     0     1
    0.0         0.0          0.0   0.0   1.0  -0.5   1.0   0.5
```

9. CIRCUMFERENTIAL REINFORCING ELEMENT CARDS

This group of cards is omitted if the flag IHOPR described in Section 3 equals zero.

9.1 Control Card (I4)

One card which contains the number of pairs of cards to be read in Section 9.2.

9.2 Element Specification Cards

Two cards per element, unless automatic generation is used. The first card is of format (5I4). The second is of format (8F8.0).

4	8	12	16	20
N	NL	IC	NM	INC

8	16	24	32	40	48	56	64
A1	P1	A2	P2	A3	P3	A4	P4

N : number of solid element which contains this element.

NL : number of last layer in this element (see Section 8.3)

IC : if zero, this element is a prototype of a class of circumferential reinforcing elements, and its shape functions and derivatives will be computed and stored on file 1. If (i), this element belongs to the class described by element number (i) which must be a prototype element.

NM : material type identification number.

INC : if nonzero, automatic data generation is initiated. Generated elements will have numbers (NOLD+K*INC), where NOLD is the element number on the preceding card, and K is a positive integer ranging from (1) to ((N-NOLD)/INC-1). The generated elements will have the properties on the card initiating the generation.

A1 to A4: areas of layers per unit length. A solid element can accept four circumferential reinforcing layers. The first two lie in the μ local direction. The last two lie in the ξ local direction.

P1 to P4: nondimensional position of layer with respect to center of element. P1 and P2 are ξ coordinates indicating the distances from the μ axis to layers A1 and A2. P3 and P4 are μ coordinates indicating the distances from the ξ axis to layers A3 and A4.

10. LONGITUDINAL PRESTRESSING ELEMENT CARDS

This group of cards is omitted if the flag ILNGP described in Section 3 equals zero.

10.1 Control Card (I4)

One card which contains the number of pairs of cards to be read in Section 10.2.

10.2 Element Specification Cards

Two cards per element, unless automatic generation is used. The first card is of format (5I4). The second is of format (8F8.0).

4	8	12	16	20
4	NL	IC	NM	INC

8	16	24	32	40	48	56	64
A1	P1	A2	P2	A3	P3	A4	P4

N : number of solid element which contains this element.

NL : number of last layer in this element (see Section 8.3)

IC : if zero, this element is a prototype of a class of longitudinal prestressing elements, and its shape functions and derivatives will be computed and stored on file 1. If (i), this element belongs to the class described by element number (i) which must be a prototype element.

NM : material type identification number.

INC : if nonzero, automatic data generation is initiated. Generated elements will have numbers (NOLD+K*INC), where NOLD is the element number on the preceding card and K is a positive integer ranging from (1) to ((N-NOLD)/INC-1). The generated elements will have the properties on the card initiating the generation.

A1 to A4: areas of layers per unit width. A solid element can accept four longitudinal prestressing layers. The first two lie in the μ local direction. The last two lie in the ξ local direction.

P1 to P4: nondimensional position of layer with respect to center of element. P1 and P2 are ξ coordinates indicating the distances from the μ axis to layers A1 and A2. P3 and P4 are μ coordinates indicating the distances from the ξ axis to layers A3 and A4.

11. CIRCUMFERENTIAL PRESTRESSING ELEMENT CARDS

This group of cards is omitted if the flag IHOPP described in Section 3 equals zero.

11.1 Control Card (I4)

One card which contains the number of pairs of cards to be read in Section 11.2.

11.2 Element Specification Cards

Two cards per element unless automatic generation is used. The first card is of format (5I4). The second is of format (8F8.0).

4	8	12	16	20
N	NL	IC	NM	INC

8	16	24	32	40	48	56	64
A1	P1	A2	P2	A3	P3	A4	P4

N : number of solid element which contains this element.

NL : number of last layer in this element (see Section 8.3).

IC : if zero, this element is a prototype of a class of circumferential prestressing elements, and its shape functions and derivatives will be computed and stored on file 1. If (i), this element belongs to the class described by element number (i) which must be a prototype element.

NM : material type identification number.

INC : if nonzero, automatic data generation is initiated. Generated elements will have numbers (NOLD+K*INC), where NOLD is the element number on the preceding card, and K is a positive integer ranging from (1) to ((N-NOLD)/INC-1). The generated elements will have the properties on the card initiating the generation.

A1 to A4: areas of layers per unit length. A solid element can accept four circumferential prestressing layers. The first two lie in the μ local direction. The last two lie in the ξ local direction.

P1 to P4: nondimensional position of layer with respect to center of element. P1 and P2 are ξ coordinates indicating the distances from the μ axis to layers A1 and A2. P3 and P4 are μ coordinates indicating the distances from the ξ axis to layers A3 and A4.

12. LOAD DATA

Program FEPARCS5 can accept a variety of load types; concentrated loads (dead and/or live), hydrostatic surface pressure (dead), normal and/or tangential surface pressure (live), gravity loads (dead), prestressing loads, and temperature loads.

12.1 Concentrated Load Cards

This group of cards describes the live and dead concentrated nodal loads. The entire group of cards must be omitted if flag ICNLD described in Section 3 equals zero, or 10.

12.1.1 Control Card (I4)

One card which contains the following entry.

4
NCARDS

NCARDS : The number of concentrated load specification cards to follow.

12.1.2 Concentrated Load Spedification Cards (I4, F12.0)

One card per node at which a dead and/or live nonzero load is applied.

4	16	28	40	52
N	FDX	FDY	FLX	FLY

N : node identification number

FDX : r-component of dead load/unit width

FDY : z-component of dead load/unit width

FLX : r-component of live load/unit width

FLY : z-component of live load/unit width

12.2 Nodal Pressure Intensity Cards

This group describes the nodal normal and tangential pressure intensities which make up surface traction. The group is omitted if the flag IDSLD described in Section 3 equals zero or 1.

12.2.1 Control Card (I4)

One card which contains the number of cards of type 12.2.2 to be read.

12.2.2 Pressure Specification Card (2I4, 2F12.0)

One card per node of surfaces where pressure is applied, unless automatic data generation is used.

4	8	20	32
N	INC	PNORM	PTANG

N : node number

INC : if nonzero, automatic data generation is initiated. Pressure intensities are generated at nodes with numbers (NOLD+K*INC), where NOLD is the node number on the preceeding card, and K is a positive integer. The pressure intensities are interpolated linearly.

PNORM : pressure intensity at node N normal to surface (see Section 12.6)

PTANG : pressure intensity at node N tangential to surface (see Section 12.6).

12.3 Prestressing Nodal Temperature Distribution Cards

This group of cards describes a thermal distribution for the purpose of prestressing the tendons. If the flag ITEMP described in Section 3 is equal to zero, this group is to be omitted. If ITEMP=2, and there are no tendons, a blank card should be inserted to bypass this section.

12.3.1 Control Card (I4)

One card which contains the following entry.

4
NCARDS

NCARDS : The number of nodal temperature specification cards to follow.

12.3.2 Nodal Temperature Specification Cards (2I4, F12.0)

One card per node, unless automatic data generation is used to a total of NCARDS cards.

4	8	20
N	INC	TEMPV

N : node identification number

INC : if nonzero, temperature values are generated at nodes with numbers (NOLD+K*INC), where NOLD is the node identification number on the preceding card, and K is a positive integer which varies between (1) and ((N-NOLD)/INC-1). Generated temperature values will be interpolated linearly between nodes N and NOLD.

TEMPV : temperature value.

12.4 Nodal Temperature Distribution Cards

This group describes the thermal load on the structure in the form of a temperature distribution. The group is omitted, if the flag ITEMP described in Section 3 equals zero or (1).

12.4.1 Control Card (I4)

One card which contains the number of cards of type 12.4.2 to be read.

12.4.2 Nodal Temperature Specification Cards (2I4, F12.0)

One card per node, unless automatic data generation is initiated.

4	8	20
N	INC	TEMPV

N : node number

INC : if nonzero, automatic data generation is intiated. Temperature values are generated at nodes with numbers (NOLD+K*INC), where NOLD is the node number on the preceding card, and K is a positive integer. These values are interpolated linearly.

TEMPV : temperature at node N.

12.5 Nodal Hydrostatic Pressure Intensity Cards

This group of cards describes a hydrostatic pressure distribution. The entire group is omitted, if the flag IDSLD described in Section 3 equals 0 or 10.

12.5.1 Control Card (I4, 2F12.0)

One card which contains the following entries

4	16	28
NCARDS	HO	SWLIQ

NCARDS : The number of submerged node specification cards to follow.

HO : level of zero hydrostatic pressure

SWLIQ : specific weight of liquid.

12.5.2 Submerged Node Specification Cards (2I4)

One card per submerged node on exposed surface, unless automatic generation is used to a total of NCARDS cards.

4	8
N	INC

N : node identification number

INC : if nonzero, hydrostatic pressure intensities will be generated on nodes between NOLD and N, where NOLD is the node number on the preceeding card. The nodes at which generation takes place are those with numbers (NOLD+K*INC), where K is a positive integer which ranges from (1) to ((N-NOLD)/INC-1).

12.6 Surface Definition Cards (7I4)

One card per element surface exposed to surface traction, as described in Section 12.2, unless automatic generation is used. This group is terminated with a blank card. The group is omitted, if the flag IDSLD in Section 3 is 0 or 1.

4	8	12	16	20	24	28
NR	NI	NG	N1	N2	N3	N4

NR : number of nodes on surface (two, three, or four for linear, quadratic or cubic elements respectively). A surface is a group of nodes which form one side of a solid element.

NI : number of surfaces to be generated between the surface defined on the previous card and this card.

NG : order of Gaussian integration

N1 to N4: Node identification numbers which define the surface. The order of specification of the nodes defines the positive normal to the surface. The positive normal to an element surface is the normal which points to the righthandside, when the nodes which define the surface are traversed in the order they are specified. The positive direction of a tangent to the surface makes a 90° counterclockwise angle with the positive normal described above, as shown in Fig. 2.4 (i.e., the positive tangent points in the direction in which this curve is being traversed).

12.7 Submerged Surface Definition Cards (7I4)

One card per element surface exposed to hydrostatic pressure, unless automatic generation is used. This group of cards is terminated with a blank card.

4	8	12	16	20	24	28
NR	NI	NG	N1	N2	N3	N4

NR : number of nodes on surface (2, 3 or 4 for linear, quadratic or cubic elements). If zero, this group is terminated.

NI : number of surfaces to be generated between the surface defined on the previous card and this card.

NG : order of Gaussian integration (1, 2 or 3).

N1 to N4: identification numbers of nodes which define the surface. The order of specification of those nodes defines the positive direction of pressure with respect to the surface as described in Section 12.6.

13. INITIAL LOAD METHOD PREPARATION CARD

One blank card.

14. LOAD STEP SPECIFICATION CARDS (4I4, 9F6.0)

One card per load step which contains the following entries.

4	8	12	16	22	28	34	40	46	52	58	64	70
ISTEP	IPRST	NI	KI	RX	TU	TP	CD	CL	CT	CPN	CPT	CPD

ISTEP : load increment number

IPRST : if (1), this increment is a prestensioning step. Otherwise it should be zero.

NI : number of strain subincrements

KI : number of iterates allowed before re-evaluation of structure stiffness matrix.

RX : a relaxation factor.

TU : tolerance for convergence of displacements, λ_r

TP : tolerance for convergence of loads, λ_p

CD : load factor for increment of dead loads

CL : load factor for increment of live concentrated nodal loads

CT : load factor for temperature gradient loads

CPN : load factor for normal surface pressure

CPT : load factor for tangential surface pressure

CPD : load factor for prescribed displacements

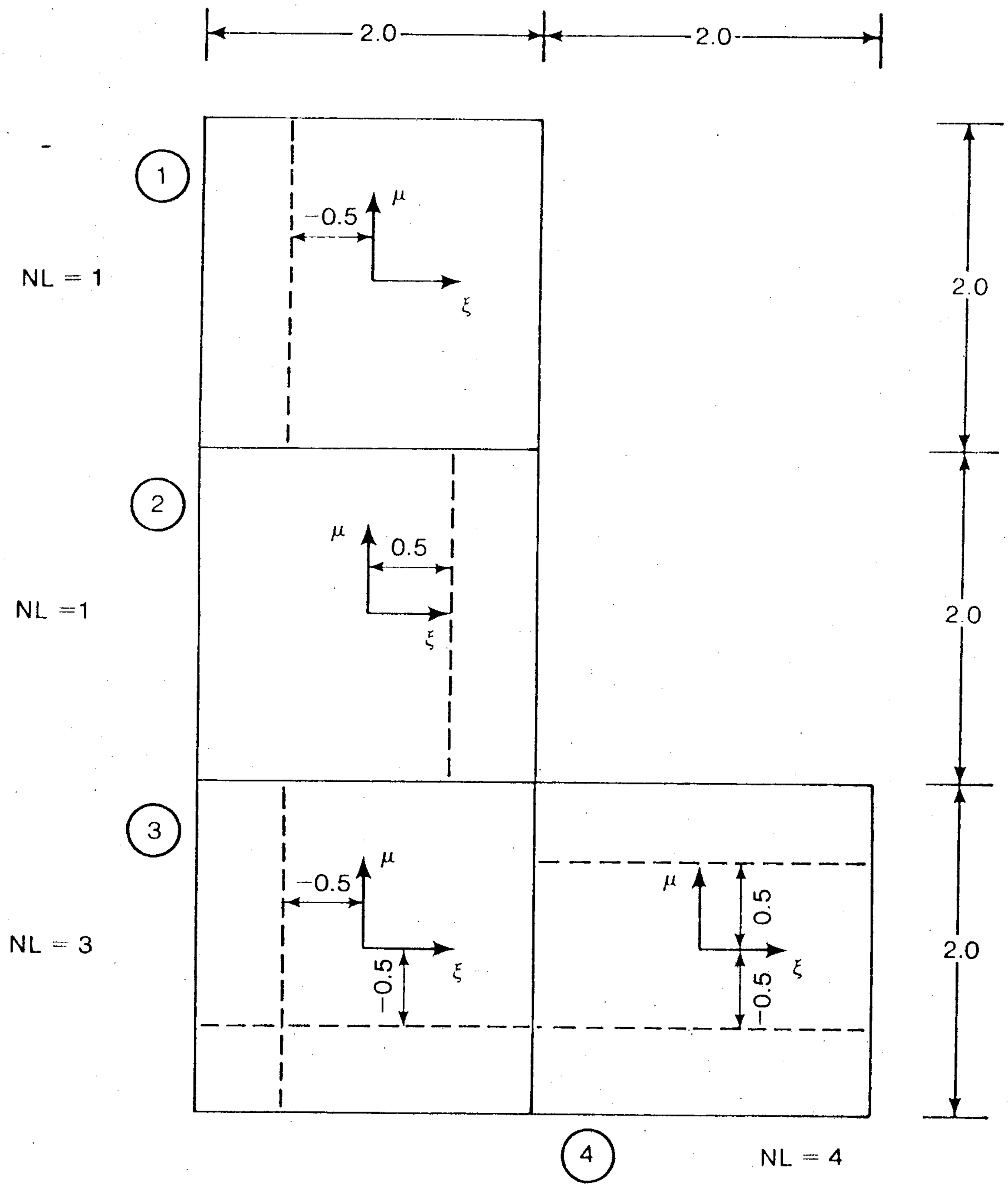


Fig. A.1 Example on Description of Reinforcing Layers

APPENDIX B

FILE DESCRIPTION

For input and output of printed data and results the program uses a number of line files. Interim and long term storage of unformatted information is done in sequential files. MTS system routines NOTE and Point control sequential files. Routine NOTE keeps track of the position of the write pointer and routine POINT positions the read pointer at the beginning of a particular record. The files used by the program are briefly described in the following. The sizes required for sequential files are stated in bytes. For the U. of A. MTS virtual memory system, 1 page = 4096 bytes.

File U1

Function: contains shape functions and derivatives evaluated at all integration points of prototype elements.

Type : sequential

Size : 336 bytes per integration point

Files U2 and U3

Function: contains stresses, strains and material properties at all integration points. Files U2 and U3 are assigned alternatively to channels 2 and 3. Channel 2 acts as input channel and the file assigned to it should contain information at the end of the previous load step. Channel 3 acts as output channel and the file assigned to it receives the information at the end of the current load step. This file can then act as input file for the next load step.

Type : sequential

Size : 440 bytes per integration point for solid elements and 80 bytes per integration point for reinforcing and prestressing layers.

<u>File U4</u>

Function: contains total loads and total displacements.

Type : sequential

Size : 32 bytes per nodal point

<u>File U5</u>

Function: contains input cards described in Sections 1 to 12 of Appendix A.

Type : line

<u>File U5'</u>

Function: initiates the stiffness matrix preparation phase in case the initial load method is to be used. This file contains one blank line as described in Section 13 of Appendix A.

Type : line

<u>File U5''</u>

Function: contains the load step control cards described in Section 14 of Appendix A. Each line initiates a load step.

Type : line

File U6

Function: receives output for printing

Type : line

File U7

Function: contains structure information and the basic load vectors.

Type : sequential

Size : enough to store common blocks AAA, BBB, III, and JJJ.

File U8

Function: contains a triangularized stiffness matrix for use in the initial load method.

Type : sequential

Size : enough to store common block CCC.

File U9

Function: temporary file used in the post-tensioning stage only.

Type : sequential

Size : identical to files U2 or U3.

Files U10, U11, U12 and U13

Function: receive printing output for the meridional reinforcing, circumferential reinforcing, meridional prestressing and circumferential prestressing layers.

Type : line

Program FEPARCS5 itself is stored in two separate files; OBJMAIN and OBJFEPARCS5. The former contains the compiled form of the main segment, while the latter contains the compiled form of the rest of the program.

APPENDIX C

EXECUTION OF FEPARCS5

Execution of program FEPARCS5 is carried out in several stages designed to carry out specific tasks. The results of each stage are used as input for the next stage. Those results can be stored on tape for future reference and to allow for restarting the analysis at any given point. This considerable flexibility calls for judiciousness on the part of the user. In the following, the different stages of execution are briefly described. The files required for the run commands are defined in Appendix B.

<u>The Partial Dry Run</u> (IDRUN=2)

In this initial stage the control parameters described in Sections 1, 2 and 3 of Appendix A are read and the required sizes of common blocks AAA, BBB, III, and JJJ are calculated. The user must then make sure that the sizes of those common blocks defined if MAIN are adequate. The run command may be written as

```
$run OBJMAIN+OBJFEPARCS5   5=U5   6=U6
```

This run is distinguished by IDRUN=2 on the control card.

<u>The Dry Run</u> (Data Check Run) (IDRUN=1)

In this run the program reads, generates and prints the structure and load data described in Sections 1 to 12 of Appendix A. The Jaccobian determinants at all integration points are calculated to assist in debugging the data. In this run, the program also calculates the size of the array required to store the skyline structure stiffness matrix. The user must then check the data, and must make sure that the size of common block CCC which is used to store the stiffness matrix is adequate. The run command may be stated as.

$run OBJMAIN+OBJFEPARCS5 1=U1 5=U5 6=U6

This run is distinguished by IDRUN=1 on the control card.

The Data Preprocessing Run (IDRUN=0)

In this stage the program reads, generates and prints the corrected data. The shape functions and derivatives are calculated at the integration points of the prototype elements. The skyline of the structure stiffness matrix is formed. The stresses, strains and material properties are initialized at all integration points. All basic load vectors are formed. Finally, the program stores all processed information on sequential files. The run command may be described as

$run OBJMAIN+OBJFEPARCS5 1=U1 2=U3 3=U2 4=U4 5=U5 6=U6 7=U7

It must be noted that if there is a state of initial stresses the user wishes to assign to the structure it should be contained in file U2 and must be assigned to channel 3 as shown above.

The Initial Load Method Preparation Run

In this run the program formulates, triangularizes and stores a structure stiffness matrix for use as a constant mapping in the initital load method. The program obtains the necessary information from previously stored files. The execution command may be written as follows.

$run OBJMAIN+OBJFEPARCS5 1=U1 2=U2 4=U4 5=U5' 6=U6(last+1)
7=U7 8=U8

The Pretensioning Run

The pretensioning stage is considered a load step and must be the first load step if it is to be performed. In this run the pretensioning equivalent loads are calculated and applied to the structure as described in Section 2.5. The execution command can be written as

```
$run OBJMAIN+OBJFEPARCS    1=U1  2=U2  3=U3  4=U4  5=U5''(1)
                           6=U6  7=U7  9=U9  10=U10  11=U11
                           12=U12  13=U13
```

The Production Run

Each load step is carried out separately in one run. If the run is successful the user should store the output files assigned to channels 3 and 4 on tape for future reference in case a rerun is required or more information other than those printed out is needed. The file assigned to channel 2 is an input file and should contain the stresses, strains and material properties at all integration points at the end of the preceeding load step. The file assigned to channel 3 is an output file for this information at the end of the current load step, and therefore, serves as an input file in the next load step where it should be assigned to channel 2. An example of two successive load steps is as follows,

```
$run OBJMAIN+OBJFEPARCS5  1=U1  2=U2  3=U3  4=U4  5=U5''(i)  6=U6  7=U7
                          [8=U8]  10=U10  11=U11  12=U12  13=U13

$print U6, U10, U11, U12 and U13

$empty U6, U10, U11, U12 and U13

$store U3 and U4 on tape
```

```
$run OBJMAIN+OBJFEPARCS5  1=U1  2=U3  3=U2  4=U4  5=U5''(i+1)  6=U6  7=U7
                          [8=U8]  10=U10  11=U11  12=U12  13=U13
```

In this sequence i denotes an odd numbered load step. For the MTS file handling system the statement 5=U5"(i) sets the read pointer for logical unit 5 to line i of file U5". Channel 8 is optional and is to be used only when the initial load approach is used as a solution strategy. In this case the initial load preparation run must have been carried out beforehand.

APPENDIX D

LISTING OF FEPARCS5

```
C                           PROGRAM FEPARCS5
C                           ****************
C
C     A FINITE ELEMENT PROGRAM FOR NONLINEAR ANALYSIS OF PLANE
C     OR AXISYMMETRIC-REINFORCED AND/OR PRESTRESSED CONCRETE
C     STRUCTURES.
C
C     WRITTEN BY:     A.E.ELWI, AND D.W.MURRAY
C                     UNIVERSITY OF ALBERTA,
C                     EDMONTON, ALBERTA,
C                     1979
C
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /AAA/ AAA(2453)
      COMMON /BBB/ BBB(5373)
      COMMON /CCC/ CCC(8178)
      COMMON /III/ III(2467)
      COMMON /JJJ/ JJJ(275)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /DATA1/ CD,CL,CT,CPN,CPT,CP,EP,TU,TP,RX,IS,MI,NI,KI
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      EQUIVALENCE (IDRUN,ITRAT)
C     ***********************************************************
C
      CALL TIME(0,0)
C     READ PHASE CONTROL PARAMETERS
      READ(IN,1000) ISTEP,IPRST,NI,KI,RX,TU,TP,CD,CL,CT,CPN,CPT,
     *             CP
      IF(ISTEP) 100,300,400
C
C     ***********************************************************
C
C                     PROBLEM PREPARATION PHASE
C
C     ***********************************************************
C
C     READ PROBLEM DATA  * * * * * * * * * * * * * * * * * * * *
100   CALL DATA
      CALL TIME(3,3)
C
C     FORMULATE ELEMENT SHAPE FUNCTIONS AND DERIVATIVES* * * * *
      CALL ELMFNC
      CALL TIME(3,3)
C
C     FORM COLUMN HEIGHTS AND ADDRESSING ARRAYS* * * * * * * * *
      CALL SOLV(1)
      CALL TIME(3,3)
      IF(IDRUN.EQ.1) GO TO 200
C
C     INITIALISE STRESSES AND MATERIAL PROPERTIES* * * * * * * *
      CALL INIT
```

```
      CALL TIME(3,3)
C
C     FORM INCREMENTAL LOAD VECTOR * * * * * * * * * * * * * * *
      CALL LOAD
      CALL TIME(3,3)
C
C     STORE VARIABLES, ARRAYS AND POINTERS ON FILE * * * * * * *
      CALL STORE (0)
      CALL TIME(3,3)
C
200   STOP
C
C     **********************************************************
C
C             STIFFNESS FORMATION AND TRIANGULARIZATION
C
C     **********************************************************
C
C
C     RESTORE VARIABLES, ARRAYS AND POINTERS FROM FILE * * * * *
300   CALL RSTORE
      IPRST = 0
      CALL TIME(3,3)
C
C     FORM STRUCTURE STIFFNESS MATRIX  * * * * * * * * * * * * *
      CALL STIF (INS)
      CALL TIME(3,3)
C
C     TRIANGULARIZE STRUCTURE STIFFNESS MATRIX * * * * * * * * *
      CALL SOLV (2)
      CALL TIME(3,3)
C
C     STORE TRIANGULARIZED STIFFNESS MATRIX ON FILE 8 * * * * *
      REWIND 8
      CALL BLKSTR (CCC(1),NSTIF,8)
C
      STOP
C
C     **********************************************************
C
C                    SOLUTION AND OUTPUT PHASE
C
C     **********************************************************
C
400   IXS = INS
C
C     RESTORE VARIABLES, ARRAYS AND POINTERS FROM FILE * * * * *
      CALL RSTORE
      IECHO=IPRST
      CALL TIME(3,3)
C
C     UPDATE LOAD VECTOR AND INITIALIZE PSUEDO-LOAD VECTOR * * *
      CALL LOADUP (ISTEP)
      CALL TIME(3,3)
```

```
C
C     PRESTRESS STRUCTURE  * * * * * * * * * * * * * * * * * *
      IF(IPRST.EQ.0) GO TO 500
      IOS = 9
      CALL PRESTS
      INS = 9
      IOS = 3
      CALL TIME(3,3)
C
C     FORM STURCTURE STIFFNESS MATRIX  * * * * * * * * * * * * *
500   IF(KI.NE.0) GO TO 600
      KI = NITRT + 1
      REWIND 8
      CALL BLKRTV (CCC(1),NSTIF,8)
      GO TO 700
600   CALL STIF (IXS)
      CALL TIME(3,3)
C
C     TRIANGULARIZE STIFFNESS MATRIX * * * * * * * * * * * * * *
      CALL SOLV(2)
      CALL TIME(3,3)
C
C     SOLVE FOR AND ACCUMULATE AN INCREMENT OF DISPLACEMENT  * *
700   CALL SOLV(3)
      CALL TIME(3,3)
C
C     UPDATE STRESSES AND MATERIAL PROPERTIES  * * * * * * * * *
      CALL STRESS
      CALL TIME(3,3)
C
C     CHECK IF PROBLEM IS LINEAR * * * * * * * * * * * * * * * *
      IF(IMTYP.EQ.0) GO TO 800
C
C     FORM PSUEDO-LOAD VECTOR  * * * * * * * * * * * * * * * * *
      CALL SUDOLD
      CALL TIME(3,3)
C
C     TEST CONVERGENCE * * * * * * * * * * * * * * * * * * * * *
      CALL TCONVG (K)
      CALL TIME(3,3)
      IF(K.EQ.0.OR.K.EQ.4) GO TO 800
      IF(K.EQ.2) GO TO 700
      IXS = IOS
      GO TO 600
C
C     PRINT OUT DISPLACEMENTS AND STRESSES * * * * * * * * * * *
800   CALL TOUT
      CALL TIME(3,3)
      IF(K.EQ.4) GO TO 900
C
C     STORE VARIABLES, ARRAYS AND POINTERS ON FILE * * * * * * *
      CALL STORE (1)
      CALL TIME(3,3)
C
```

```
900   STOP
C
1000  FORMAT(4I4,9F6.0)
C
      END
C
```

```
      BLOCK DATA
C
C     THIS SEGMENT INITIALISES SOME VARIABLES AND ARRAY ELEMETS
C     AS WELL AS TOLERANCE LIMITS.                        FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      REAL*8 NMS
      COMMON /DATA1/ CD,CL,CT,CPN,CPT,EP,TU,TP,RX,OV,IS,MI,NI,KI
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      COMMON /DIMCOM/NMS(5,30),L1,L2,L3,L4,L5,MX,IP(5,31),ICM(5)
      COMMON /POINTR/ LLL(68)
      COMMON /TOLER/ PT,FNUO,FNPO,KDIV
      COMMON /DATA2/ EPSY,EDBR
C
      DATA EPSY/0.0012/,EDBR/.06/
      DATA EP/1.D-3/,MI/50/
      DATA L1,L2,L3,L4,L5,MX/5*0,30/,IP(1,1),IP(2,1),IP(3,1),
     *     IP(4,1),IP(5,1)/5*1/
      DATA IN/5/,IO/6/,INS/2/,IST/7/,IOS/3/,ILD/4/
      DATA LLL/68*0/
```

```
      SUBROUTINE DATA
C
C     THIS SEGMENT CONTROLS DATA INPUT AND GENERATION.  FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /III/ III(1)
      COMMON /AAA/ AAA(1)
      COMMON /BBB/ BBB(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
C     READ PROBLEM CONTROL VARIABLES
      CALL DATA20
C
C     READ MATERIAL PARAMETERS
      K1 = ISPAC(3HEMP,(NCMAT+NSMAT)*NMPAR,3)
      J17 = ISPAC(3HNMP,(NCMAT+NSMAT),2)
      CALL DATA21 (BBB(1),III(J17))
C
C     READ AND GENERATE NODAL GEOMETRY, EXTERNAL BOUNDARY
C     ELEMENTS AND SOLID ELEMENT DATA.
      I1 = ISPAC(5HXCORD,NMNOD,1)
      I2 = ISPAC(5HYCORD,NMNOD,1)
      I3 = ISPAC(5HXPEBE,NMEBE,1)
      I4 = ISPAC(5HYPEBE,NMEBE,1)
      I5 = ISPAC(5HPDEBE,NMEBE,1)
      I6 = ISPAC(5HSTEBE,NMEBE,1)
      I7 = ISPAC(5HORNSE,NMELM,1)
      J1 = ISPAC(5HNPEBE,NMEBE,2)
      J2 = ISPAC(5HNDELM,NMELM,2)
      J3 = ISPAC(5HNGELM,NMELM,2)
      J4 = ISPAC(5HICLSE,NMELM,2)
      J5 = ISPAC(5HMATSE,NMELM,2)
      J6 = ISPAC(5HNPELM,NMELM*12,2)
      CALL DATA22(AAA(I1),AAA(I2),AAA(I3),AAA(I4),AAA(I5),AAA(I6)
     *           ,AAA(I7),III(J1),III(J2),III(J3),III(J4),III(J5)
     *           ,III(J6),0)
C
C     READ AND GENERATE LONGITUDINAL REINFORCEMENT ELEMENT DATA
      IF(ILNGR.EQ.0) GO TO 100
      J7 = ISPAC(5HNMLLR,NMELM,2)
      J8 = ISPAC(5HICLLR,NMELM,2)
      J18= ISPAC(5HMATLR,NMELM,2)
      I8 = ISPAC(5HARELR,4*NMELM,1)
      I9 = ISPAC(5HPOSLR,4*NMELM,1)
      CALL DATA23 (III(J7),III(J8),III(J18),AAA(I8),AAA(I9),1,0)
C
C     READ AND GENERATE HOOP REINFORCEMENT ELEMENT DATA
100   IF(IHOPR.EQ.0) GO TO 200
```

```
      J9  = ISPAC(5HNMLHR,NMELM,2)
      J10 = ISPAC(5HICLHR,NMELM,2)
      J19 = ISPAC(5HMATHR,NMELM,2)
      I10 = ISPAC(5HAREHR,4*NMELM,1)
      I11 = ISPAC(5HPOSHR,4*NMELM,1)
      CALL DATA23 (III(J9),III(J10),III(J19),AAA(I10),AAA(I11),2
     *            ,0)
C
C     READ AND GENERATE LONGITUDINAL PRESTRESSING ELEMENT DATA
200   IF(ILNGP.EQ.0) GO TO 300
      J11 = ISPAC(5HNMLLP,NMELM,2)
      J12 = ISPAC(5HICLLP,NMELM,2)
      J20 = ISPAC(5HMATLP,NMELM,2)
      I12 = ISPAC(5HARELP,4*NMELM,1)
      I13 = ISPAC(5HPOSLP,4*NMELM,1)
      CALL DATA23 (III(J11),III(J12),III(J20),AAA(I12),AAA(I13),
     *            3,0)
C
C     READ AND GENERATE HOOP PRESTRESSING ELEMENT DATA
300   IF(IHOPP.EQ.0) GO TO 400
      J13 = ISPAC(5HNMLHP,NMELM,2)
      J14 = ISPAC(5HICLHP,NMELM,2)
      J21 = ISPAC(5HMATHP,NMELM,2)
      I14 = ISPAC(5HAREHP,4*NMELM,1)
      I15 = ISPAC(5HPOSHP,4*NMELM,1)
      CALL DATA23 (III(J13),III(J14),III(J21),AAA(I14),AAA(I15),
     *            4,0)
C
C     READ CONCENTRATED NODAL LOADS
400   IF(IGRLD+ICNLD.EQ.0.AND.(IDSLD.EQ.0.OR.IDSLD.EQ.10))
     *                                                     GO TO 500
      K2 = ISPAC(2HFD,2*NMNOD,3)
      IF(ICNLD.EQ.0) GO TO 500
      K3 = ISPAC(2HFL,2*NMNOD,3)
      CALL DATA24 (BBB(K2),BBB(K3),AAA(I1))
C
C     READ AND GENERATE NODAL PRESSURE INTENSITIES
500   IF(IDSLD.LT.10) GO TO 600
      K4 = ISPAC(5HPNORM,NMNOD,3)
      K5 = ISPAC(5HPTANG,NMNOD,3)
      CALL DATA25 (BBB(K4),BBB(K5),0)
C
C     READ AND GENERATE NODAL TEMPRATURE VALUES
600   IF(ITEMP.EQ.0) GO TO 700
      K6 = ISPAC(5HTEMPV,NMNOD*ITEMP,3)
      CALL DATA26 (BBB(K6),0)
C
C     READ AND GENERATE NODAL HYDROSTATIC PRESSURE INTENSITIES.
700   IF(IDSLD.EQ.0.OR.IDSLD.EQ.10) GO TO 800
      K15 = ISPAC(5HPHYDR,NMNOD,3)
      CALL DATA27 (BBB(K15),AAA(I2),NMNOD,0)
C
C     PRINT THE COMPLETED DATA SET
800   IF(IECHO.EQ.0) GO TO 1500
```

```
      CALL DATA22(AAA(I1),AAA(I2),AAA(I3),AAA(I4),AAA(I5),AAA(I6)
     *           ,AAA(I7),III(J1),III(J2),III(J3),III(J4),III(J5)
     *           ,III(J6),1)
      IF(ILNGR.EQ.0) GO TO 900
      CALL DATA23 (III(J7),III(J8),III(J18),AAA(I8),AAA(I9),1,1)
900   IF(IHOPR.EQ.0) GO TO 1000
      CALL DATA23 (III(J9),III(J10),III(J19),AAA(I10),AAA(I11),2
     *            ,1)
1000  IF(ILNGP.EQ.0) GO TO 1100
      CALL DATA23 (III(J11),III(J12),III(J20),AAA(I12),AAA(I13),
     *             3,1)
1100  IF(IHOPP.EQ.0) GO TO 1200
      CALL DATA23 (III(J13),III(J14),III(J21),AAA(I14),AAA(I15),
     *             4,1)
1200  IF(IDSLD.LT.10) GO TO 1300
      CALL DATA25 (BBB(K4),BBB(K5),1)
1300  IF(ITEMP.EQ.0) GO TO 1400
      CALL DATA26 (BBB(K6),1)
1400  IF(IDSLD.EQ.0.OR.IDSLD.EQ.10) GO TO 1500
      CALL DATA27 (BBB(K15),AAA(I2),NMNOD,2)
1500  RETURN
      END
C
```

```
      SUBROUTINE DATA20
C
C     THIS SEGMENT READS THE PROBLEM CONTROL VARIABLES. FEPARCS5
C     ***********************************************************
      REAL*8 NMS
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      COMMON /DIMCOM/NMS(5,30),L1,L2,L3,L4,L5,MX,IP(5,31),ICM(5)
      DIMENSION HED(20)
C
      READ(IN,1000) HED
      WRITE(IO,2000) HED
C
      READ(IN,1100) IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,ILNGP,
     *              IHOPP,ICNLD,ITEMP,IDSLD,ISTRS,IGRLD,NMNOD,
     *              NMELM,NMEBE,NCMAT,NSMAT,NMPAR,NITRT
      WRITE(IO,2100) IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,ILNGP,
     *               IHOPP,ICNLD,ITEMP,IDSLD,IGRLD,ISTRS
      WRITE(IO,2200) NMNOD,NMELM,NMEBE,NCMAT,NSMAT,NMPAR,NITRT
C
C     CALCULATE COMMON BLOCK SIZES
      ICM(1) = 2*NMNOD + 4*NMEBE + NMELM*(1+8*(ILNGR+IHOPR+ILNGP
     *                 + IHOPP)) + 18*(NCMAT+NSMAT)
      ICM(2) = NMEBE + NMELM*(16 + 3*(ILNGR+IHOPR+ILNGP+IHOPP))
     *               + NCMAT + NSMAT + 4*NMNOD + 1
      IDL = 0
      ILL = ICNLD
      ISL = 0
      IHL = 0
      IF(IDSLD.EQ.1.OR.IDSLD.EQ.11) IHL = 1
      IF(IDSLD.GE.10) ISL = 1
      IF(IHL.EQ.1.OR.IGRLD.EQ.1.OR.ICNLD.EQ.1) IDL = 1
      ICM(3) = NMPAR*(NCMAT+NSMAT) + NMNOD*(10+6*ISL+4*ITEMP+IHL
     *                                     +4*(IDL+ILL))
      ICM(4) = 5*NMELM
      WRITE(IO,2300) (ICM(I),I=1,4)
      IF(IDRUN.EQ.2) STOP
C
      RETURN
C
C   FORMAT STATEMENTS
C   *****************
1000  FORMAT(20A4)
1100  FORMAT(20I4)
2000  FORMAT('1',20A4)
2100  FORMAT(//,'PROBLEM CONTROL VARIABLES'/,25(1H*)//,
     *'ECHO CHECK FLAG                                         =',I5/,
     *'AXISYMMETRY FLAG                                        =',I5/,
     *'NONLINEAR LOADING FLAG                                  =',I5/,
     *'DRY RUN FLAG                                            =',I5/,
     *'LONGITUDINAL REINFORCEMENT FLAG                         =',I5/,
     *'HOOP REINFORCEMENT FLAG                                 =',I5/,
```

```
     *'LONGITUDINAL PRESTRESSING FLAG                              =',I5/,
     *'HOOP PRESTRESSING FLAG                                      =',I5/,
     *'CONCENTRATED LOADS FLAG                                     =',I5/,
     *'TEMPRATURE LOADS FLAG                                       =',I5/,
     *'DISTRIBUTED SURFACE LOADS FLAG                              =',I5/,
     *'GRAVITY LOAD FLAG                                           =',I5/,
     *'INITIAL STRESSES FLAG                                       =',I5)
2200  FORMAT(//
     *'NUMBER OF NODAL POINTS                                      =',I5/,
     *'NUMBER OF ELEMENTS                                          =',I5/,
     *'NUMBER OF EXTERNAL BOUNDARY ELEMENTS                        =',I5/,
     *'NUMBER OF SOLID ELEMENT MATERIAL TYPES                      =',I5/,
     *'NUMBER OF REINFORCING ELEMENT MATERRIAL TYPES               =',I5/,
     *'MAXIMUM NUMBER OF MATERIAL PARAMETERS                       =',I5/,
     *'NUMBER OF ITERATIONS PER LOAD STEP                          =',I5)
2300  FORMAT(////'COMMON BLOCK SIZES'/,18('*')//,
     *       'AAA =',I10/,'III =',I10/,'BBB =',I10/,'JJJ =',I10)
C
      END
C
```

```
      SUBROUTINE DATA21 (EMP,NMP)
C
C     THIS SEGMENT READS MATERIAL PARAMETERS FOR SOLID ELEMENTS,
C     REINFORCING ELEMENTS AND PRESTRESSING TENDONS.    FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION EMP(NMPAR,1),NMP(1)
C
      N2 = NCMAT + NSMAT
      CALL CLEAR (EMP(1,1),N2*NMPAR)
C
      DO 100 N=1,N2
      READ(IN,1000) I,NMP(I)
      NP = NMP(I)
      READ(IN,1100) (EMP(K,I),K=1,NP)
100   CONTINUE
C
      WRITE(IO,2000) (N,N=1,N2)
      DO 200 N=1,NMPAR
      WRITE(IO,2100) (EMP(N,I),I=1,N2)
200   CONTINUE
C
      RETURN
C
C     FORMAT STATEMENTS
1000  FORMAT(2I4)
1100  FORMAT(10F8.0)
2000  FORMAT('1','MATERIAL PARAMETERS'/,19('*')//,'MAT. NO.',
     *       10I12//)
2100  FORMAT(8X,10D12.4)
C
      END
C
```

```
      SUBROUTINE DATA22    (XCORD,YCORD,XPEBE,YPEBE,PDEBE,STEBE,
     *                      ORNSE,NPEBE,NDELM,NGELM,ICLSE,MATSE,
     *                      NPELM,NECHO)
C
C     THIS SEGMENT READS AND GENERATES THE STRUCTURE DESCRIPTION
C     DATA.                                                  FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION XCORD(1),YCORD(1),XPEBE(1),YPEBE(1),PDEBE(1),
     *          STEBE(1),ORNSE(1),NPEBE(1),NDELM(1),NGELM(1),
     *          ICLSE(1),MATSE(1),NPELM(12,1),MINC(12)
      IF(NECHO.EQ.1) GO TO 800
C
C     READ NODAL GEOMETRY
      NERROR = 1
      WRITE(IO,2000)
      WRITE(IO,2100)
50    READ(IN,1300) NCARDS,ISPHER
      IF(NCARDS.EQ.0) GO TO 300
      IF(ISPHER.EQ.1) READ(IN,1100) X1,Y1
      DO 250 I=1,NCARDS
      READ (IN,1000) N,XCORD(N),YCORD(N),INC
      WRITE(IO,2200) N,XCORD(N),YCORD(N),INC
      IF(INC.EQ.0) GO TO 150
      NINT = (N-NOLD)/INC
      RN   = DABS(DFLOAT(NINT))
      IF(RN.LT.DFLOAT(N-NOLD)/DFLOAT(INC)-1.D-3) GO TO 999
      DX = (XCORD(N) - RAD)/RN
      DY = (YCORD(N) - THE)/RN
      L  = N
      M  = NINT - 1
      DO 100 J=1,M
      LL        = L - INC
      XCORD(LL) = XCORD(L) - DX
      YCORD(LL) = YCORD(L) - DY
100   L         = LL
150   RAD = XCORD(N)
      THE = YCORD(N)
      IF(ISPHER.EQ.0) GO TO 250
      IF(INC.EQ.0) NINT = 1
      L = N + INC
      DO 200 J=1,NINT
      LL = L -INC
      TH = YCORD(LL)*3.141592654D0/1.8D2
      X  = XCORD(LL)*DSIN(TH) + X1
      Y  = XCORD(LL)*DCOS(TH) + Y1
      XCORD(LL) = X
      YCORD(LL) = Y
200   L         = LL
250   NOLD      = N
```

```
      GO TO 50
C
C     READ AND GENERATE EXTERNAL BOUNDARY ELEMENT DATA
300   WRITE(IO,2300)
      WRITE(IO,2400)
      NERROR = 2
      READ(IN,1300) NCARDS
      IF(NCARDS.EQ.0) GO TO 500
      DO 400 J=1,NCARDS
      READ (IN,1200) N,NPEBE(N),INC,XPEBE(N),YPEBE(N),PDEBE(N),
     *               STEBE(N)
      IF(STEBE(N).EQ.0.D0) STEBE(N) = 1.D20
      WRITE(IO,2500) N,NPEBE(N),INC,XPEBE(N),YPEBE(N),PDEBE(N),
     *               STEBE(N)
      IF(INC.EQ.0) GO TO 400
      N1 = N - 1
      NO = NOLD + 1
      L  = NPEBE(NOLD)
      DO 350 I=NO,N1
      NPEBE(I) = L + INC
      XPEBE(I) = XPEBE(N)
      YPEBE(I) = YPEBE(N)
      PDEBE(I) = PDEBE(N)
      STEBE(I) = STEBE(N)
350   L        = NPEBE(I)
      IF(L.NE.(NPEBE(N)-INC)) GO TO 999
400   NOLD = N
C
C     MODIFY BOUNDARY CONDITIONS FOR AXISYMMETRIC PROBLEMS
      IF(ISTYP.EQ.0) GO TO 500
      DO 450 M=1,NMEBE
      N = NPEBE(M)
450   STEBE(M) = STEBE(M)*(XCORD(N) + 1.D0)
C
C     READ AND GENERATE SOLID ELEMENT DATA
500   WRITE(IO,2600)
      WRITE(IO,2700)
      NERROR = 3
      READ (IN,1300) NCARDS
      DO 700 J=1,NCARDS
      READ(IN,1300)  N,NDELM(N),NGELM(N),ICLSE(N),MATSE(N),INC,
     *              (NPELM(I,N),I=1,12),ORNSE(N)
      WRITE(IO,2800) N,NDELM(N),NGELM(N),ICLSE(N),MATSE(N),INC,
     *              (NPELM(I,N),I=1,12),ORNSE(N)
      IF(INC.EQ.0) GO TO 700
      NINC = (N-NOLD)/INC
      DO 550 I=1,12
550   MINC(I) = (NPELM(I,N) - NPELM(I,NOLD))/NINC
      NINC = NINC - 1
      L    = NOLD
      DO 650 I=1,NINC
      LL       = L + INC
      NDELM(LL) = NDELM(N)
      NGELM(LL) = NGELM(N)
```

```
      ICLSE(LL) = ICLSE(N)
      MATSE(LL) = MATSE(N)
      ORNSE(LL) = ORNSE(N)
      DO 600 K=1,12
600   NPELM(K,LL) = NPELM(K,L) + MINC(K)
650   L     = LL
700   NOLD = N
C
      RETURN
C
C     PRINTOUT COMPLETED DATA
800   INC = 0
      WRITE(IO,2900)
      WRITE(IO,2100)
      WRITE(IO,2200) (N,XCORD(N),YCORD(N),INC,N=1,NMNOD)
      WRITE(IO,3000)
      WRITE(IO,2400)
      WRITE(IO,2500) (N,NPEBE(N),INC,XPEBE(N),YPEBE(N),PDEBE(N),
     *                STEBE(N),N=1,NMEBE)
      WRITE(IO,3100)
      WRITE(IO,2700)
      WRITE(IO,2800) (N,NDELM(N),NGELM(N),ICLSE(N),MATSE(N),INC,
     *               (NPELM(I,N),I=1,12),ORNSE(N),N=1,NMELM)
C
      RETURN
C
999   WRITE(IO,1999) NERROR,N,NOLD,INC
      STOP
C
C     FORMAT STATEMENTS
1000  FORMAT(I4,2F12.0,I4)
1100  FORMAT(2F12.0)
1200  FORMAT(3I4,4F12.0)
1300  FORMAT(18I4,F8.0)
1999  FORMAT(//'PROGRAM DATA22 HAS DETECTED DATA ERROR',4I5)
2000  FORMAT('1','NODAL GEOMETRY AS INPUT'/,23(1H*)//)
2100  FORMAT(4X,'N',5X,'XCORD',10X,'YCORD',7X,'INC'//)
2200  FORMAT(I5,2D15.6,I5)
2300  FORMAT(////,'BOUDARY ELEMENTS AS INPUT'/,26(1H*)//)
2400  FORMAT('NO.BE NODE  INC',4X,'X.PROJ.',8X,'Y.PROJ.',8X,
     *       'PRS.DSP.',7X,'STIFF.'//)
2500  FORMAT(3I5,4D15.6)
2600  FORMAT(////,'SOLID ELEMENT DATA AS INPUT'/,27(1H*)//)
2700  FORMAT('NO.SE.   DEG GAUSS CLASS NO.MAT  INC   NP1   NP2',
     *       '   NP3   NP4   NP5   NP6   NP7   NP8   NP9  NP10',
     *       '  NP11  NP12 M.AXES ORN.'//)
2800  FORMAT(18I6,F12.4)
2900  FORMAT('1','COMPLETE NODAL GEOMETRY'/,23(1H*)//)
3000  FORMAT('1','COMPLETE BOUNDARY ELEMENTS'/,26(1H*)//)
3100  FORMAT('1','COMPLETE SOLID ELEMENT DATA'/,27(1H*)//)
C
      END
C
```

```
      SUBROUTINE DATA23    (NMLYR,ICLAS,MATRE,AREA,POSN,J,NECHO)
C
C     THIS SEGMENT READS THE REINFORCING AND/OR PRESTRESSING
C     ELEMENT DATA.                                          FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION NMLYR(1),ICLAS(1),AREA(4,1),POSN(4,1),MATRE(1)
C
      IF(NECHO.EQ.1) GO TO 500
C
      CALL ICLEAR(NMLYR(1),3*NMELM)
      CALL  CLEAR(AREA(1,1),4*NMELM)
      CALL  CLEAR(POSN(1,1),4*NMELM)
C
      IF(J.EQ.1) WRITE(IO,2000)
      IF(J.EQ.2) WRITE(IO,2100)
      IF(J.EQ.3) WRITE(IO,2200)
      IF(J.EQ.4) WRITE(IO,2300)
      WRITE(IO,2400)
      READ (IN,1000) NCARDS
C
      DO 400 M=1,NCARDS
      READ(IN,1000) N,NMLYR(N),ICLAS(N),MATRE(N),INC,
     *              (AREA(I,N),POSN(I,N),I=1,4)
      IF(INC.EQ.0) GO TO300
      NINC = (N-NOLD)/INC - 1
      L    = NOLD
      DO 200 K =1,NINC
      LL     = L + INC
      NMLYR(LL) = NMLYR(N)
      ICLAS(LL) = ICLAS(N)
      MATRE(LL) = MATRE(N)
      DO 100 I=1,4
      AREA(I,LL)= AREA(I,N)
100   POSN(I,LL)= POSN(I,N)
200   L         = LL
300   WRITE(IO,2900) N,NMLYR(N),ICLAS(N),MATRE(N),INC,
     *               (AREA(I,N),POSN(I,N),I=1,4)
400   NOLD = N
C
      RETURN
C
500   INC = 0
      IF(J.EQ.1) WRITE(IO,2500)
      IF(J.EQ.2) WRITE(IO,2600)
      IF(J.EQ.3) WRITE(IO,2700)
      IF(J.EQ.4) WRITE(IO,2800)
      WRITE(IO,2400)
      WRITE(IO,2900)(N,NMLYR(N),ICLAS(N),MATRE(N),INC,
     *              (AREA(I,N),POSN(I,N),I=1,4),N=1,NMELM)
```

```
C
      RETURN
C
C   FORMAT STATEMENTS*******************************************
1000  FORMAT(5I4/8F8.0)
2000  FORMAT(//'LONGITUDINAL REINFORCEMENT AS INPUT'//)
2100  FORMAT(//'HOOP REINFORCEMENT AS INPUT'//)
2200  FORMAT(//'PRESTRESSING LONGITUDINAL TENDONS AS INPUT'//)
2300  FORMAT(//'PRESTRESSING HOOP TENDONS AS INPUT'//)
2400  FORMAT('     N  NML  ICL  NMT  INC',10X,'A1',8X,'POS.',10X,
     *'A2',8X,'POS.',10X,'A3',8X,'POS.',10X,'A4',8X,'POS.'//)
2500  FORMAT('1','COMPLETE LONG. REINF. DATA'//)
2600  FORMAT('1','COMPLETE HOOP REINF. DATA'//)
2700  FORMAT('1','COMPLETE LONG. PRESTRESSING TENDON DATA'//)
2800  FORMAT('1','COMPLETE HOOP PRESTRESSING TENDON DATA'//)
2900  FORMAT(5I5,8D12.4)
C
      END
C
```

```
      SUBROUTINE DATA24 (FD,FL,XCORD)
C
C     THIS SEGMENT READS CONCENTRATED NODAL LOADS.       FEPARCS5
C     ***************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION FD(1),FL(1),XCORD(1)
C
      CALL CLEAR (FD(1),2*NMNOD)
      CALL CLEAR (FL(1),2*NMNOD)
      READ (IN,1000) NCARDS
      IF(NCARDS.EQ.0) GO TO 200
      WRITE(IO,2000)
C
      DO 100 I=1,NCARDS
      READ(IN,1000) N,FDX,FDY,FLX,FLY
      WRITE(IO,2100) N,FDX,FDY,FLX,FLY
      N2 = N*2
      N1 = N2 - 1
      XN = 1.D0 + DFLOAT(ISTYP)*(XCORD(N)-1.D0)
      FD(N1) = FDX*XN
      FD(N2) = FDY*XN
      FL(N1) = FLX*XN
      FL(N2) = FLY*XN
100   CONTINUE
C
200   RETURN
C
C     FORMAT STATEMENTS
1000  FORMAT(I4,4F12.0)
2000  FORMAT('1','LOADS',/4('*')//,'CONCENTRATED NODAL LOADS'/,
     *       24('*')//,4X,'N   X-DEAD L.      Y-DEAD L.',
     *       '         X-LIVE L.      Y-LIVE L.'//)
2100  FORMAT(I5,4D15.6)
C
      END
C
```

```
      SUBROUTINE DATA25 (PNORM,PTANG,NECHO)
C
C     THIS SEGMENT READS AND GENERATES NORMAL AND TANGENTIAL
C     NODAL PRESSURE INTENSITIES.                          FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION PNORM(1),PTANG(1)
      IF(NECHO.EQ.1) GO TO 300
      CALL CLEAR (PNORM(1),NMNOD)
      CALL CLEAR (PTANG(1),NMNOD)
      READ(IN,1000) NCARDS
      WRITE(IO,2000)
      WRITE(IO,2100)
      DO 200 I=1,NCARDS
      READ(IN,1000) N,INC,PNORM(N),PTANG(N)
      WRITE(IO,2200)N,INC,PNORM(N),PTANG(N)
      IF(INC.EQ.0) GO TO 200
      NINT = (N-NOLD)/INC
      RN = DFLOAT(NINT)
      IF(RN.LT.DFLOAT(N-NOLD)/DFLOAT(INC)-1.D-3) GO TO 998
      DNORM = (PNORM(N) - PNORM(NOLD))/RN
      DTANG = (PTANG(N) - PTANG(NOLD))/RN
      M = NINT - 1
      L = NOLD
      DO 100 J=1,M
      LL = L + INC
      PNORM(LL) = PNORM(L) + DNORM
      PTANG(LL) = PTANG(L) + DTANG
100   L = LL
200   NOLD = N
      RETURN
C
300   INC = 0
      WRITE(IO,2300)
      WRITE(IO,2100)
      WRITE(IO,2200) (N,INC,PNORM(N),PTANG(N),N=1,NMNOD)
      RETURN
C
998   WRITE(IO,999) N,INC,NOLD
999   FORMAT('PROG. DATA25 HAS DETECTED PRESSURE DATA ERROR',3I5)
      STOP
C
C     FORMAT STATEMENTS
1000  FORMAT(2I4,2F12.0)
2000  FORMAT(//'NODAL PRESSURE INTENSITY INPUT',/30('*')//)
2100  FORMAT(4X,'N  INC    NORM.P.I.       TANG.P.I.'//)
2200  FORMAT(2I5,2D15.6)
2300  FORMAT('1','COMPLETE NODAL PRESSURE INTENSITY DATA',
     *       /38('*')//)
      END
```

```
      SUBROUTINE DATA26 (TEMPV,NECHO)
C
C     THIS SEGMENT READS AND GENERATES NODAL TEMPRATURE VALUES.
C                                                        FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION TEMPV(NMNOD,1)
      IF(NECHO.EQ.1) GO TO 400
      CALL CLEAR (TEMPV(1,1),NMNOD*ITEMP)
      DO 300 LT=1,ITEMP
      READ(IN,1000) NCARDS
      IF(NCARDS.EQ.0) GO TO 300
      WRITE(IO,2000) LT
      WRITE(IO,2100)
      DO 200 I=1,NCARDS
      READ(IN,1000) N,INC,TEMPV(N,LT)
      WRITE(IO,2200)N,INC,TEMPV(N,LT)
      IF(INC.EQ.0) GO TO 200
      NINT = (N-NOLD)/INC
      RN = DFLOAT(NINT)
      IF(RN.LT.DFLOAT(N-NOLD)/DFLOAT(INC)-1.D-3) GO TO 998
      DTEMP = (TEMPV(N,LT)-TEMPV(NOLD,LT))/RN
      M = NINT - 1
      L = NOLD
      DO 100 J=1,M
      LL = L + INC
      TEMPV(LL,LT) = TEMPV(L,LT) + DTEMP
100   L = LL
200   NOLD = N
300   CONTINUE
      RETURN
400   WRITE(IO,2300)
      WRITE(IO,2400)
      DO 500 N=1,NMNOD
500   WRITE(IO,2500) N,(TEMPV(N,LT),LT=1,ITEMP)
      RETURN
C
998   WRITE(IO,999)N,INC,NOLD
999   FORMAT('PROG.DATA26 HAS DETECTED TEMP.DATA ERROR' ,3I5)
      STOP
C
C     FORMAT STATEMENTS
1000  FORMAT(2I4,F12.0)
2000  FORMAT(//'NODAL TEMPRATURE VALUES INPUT',I5/,29('*')//)
2100  FORMAT(4X,'N  INC    TEMP.V.'//)
2200  FORMAT(2I5,D15.6)
2300  FORMAT('1','COMPLETE NODAL TEMPRATURE DATA'/,30('*')//)
2400  FORMAT('     N    PRST.V.      TEMP.V.'//)
2500  FORMAT(I5,2D15.6)
      END
```

```
      SUBROUTINE DATA27 (PHYDR,YCORD,NMNOD,NECHO)
C
C     THIS SEGMENT ASSIGNS HYDROSTATIC PRESSURE INTENSITIES TO
C     SURFACE NODES.                                          FEPARCS5
C     **************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION PHYDR(1),YCORD(1)
C
      IF(NECHO.NE.0) GO TO 300
      CALL CLEAR (PHYDR(1),NMNOD)
      READ(IN,1000) NCARDS,HO,SWLIQ
      WRITE(IO,2000)
      WRITE(IO,2100)
C
      DO 200 I=1,NCARDS
      READ(IN,1100) N,INC
      PHYDR(N) = (HO-YCORD(N))*SWLIQ
      WRITE(IO,2200) N,INC,PHYDR(N)
      IF(INC.EQ.0) GO TO 200
      NINT = (N-NOLD)/INC
      RN = DFLOAT(NINT)
      IF(RN.LT.DFLOAT(N-NOLD)/DFLOAT(INC)-1.D-3) GO TO 998
      DPHYDR = (PHYDR(N) - PHYDR(NOLD))/RN
      M = NINT - 1
      L = NOLD
      DO 100 J=1,M
      LL = L + INC
      PHYDR(LL) = PHYDR(L) + DPHYDR
100   L = LL
200   NOLD = N
      RETURN
C
300   INC = 0
      WRITE(IO,2300)
      WRITE(IO,2100)
      WRITE(IO,2200) (N,INC,PHYDR(N),N=1,NMNOD)
      RETURN
C
998   WRITE(IO,999) N,NOLD,INC
999   FORMAT('PROGRAM DATA27 HAS DETECTED HYDROSTATIC PRESSURE',
     *       ' DATA ERROR',3I5)
      STOP
C
C     FORMAT STATAMENTS
1000  FORMAT(I4,2F12.0)
1100  FORMAT(2I4,F12.0)
2000  FORMAT(//'HYDROSTATIC NODAL PRESSURE INPUT'/,32('*')//)
2100  FORMAT('     N  INC    HYD.PRES.V.'//)
2200  FORMAT(2I5,D15.6)
2300  FORMAT('1','COMPLETE HYDROSTATIC PRES. DATA'/,31('*')//)
C
      END
C
```

```
      SUBROUTINE    ELMFNC
C
C     THIS SEGMENT CONTROLS EVALUATION OF SHAPE FUNCTIONS AND
C     DERIVATIVES FOR DIFFERENT TYPES OF ELEMENTS.      FEPARCS5
C     ************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /III/ III(1)
      COMMON /JJJ/ JJJ(1)
      COMMON /AAA/ AAA(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
      DIMENSION XEL(12),YEL(12)
C
      REWIND 1
      L1 = ISPAC(5HINF11,NMELM,4)
      L2 = ISPAC(5HINF12,NMELM*ILNGR,4)
      L3 = ISPAC(5HINF13,NMELM*IHOPR,4)
      L4 = ISPAC(5HINF14,NMELM*ILNGP,4)
      L5 = ISPAC(5HINF15,NMELM*IHOPP,4)
      DO 1000 ME = 1,NMELM
      CALL ELMDT4 (ME,IC,NS,NGL,NG,III(J2),III(J3),III(J4))
      CALL ELMDT1 (ME,NS,XEL(1),YEL(1),III(J6),AAA(I1),AAA(I2))
      ME1 = ME - 1
C
C     FORM AND STORE SHAPE FUNCTIONS AND DERIVATIVES FOR SOLID
C     ELEMENT
      IF(IC.EQ.0) GO TO 100
      GO TO 200
100   III(J4+ME1) = ME
      CALL ELMSE (ME,NS,NGL,NG,XEL(1),YEL(1),JJJ(L1))
C
C     FORM AND STORE SHAPE FUNCTIONS AND DERIVATIVES FOR LONGIT
C     UDINAL REINFORCING ELEMENT.
200   IF(ILNGR.EQ.0) GO TO 400
      NL = III(J7+ME1)
      IF(NL.EQ.0) GO TO 400
      IC = III(J8+ME1)
      IF(IC.EQ.0) GO TO 300
      GO TO 400
300   III(J8-1+ME) = ME
      CALL ELMLE (ME,NL,NS,NG,XEL(1),YEL(1),AAA(I8),AAA(I9),
     *            JJJ(L2))
C
C     FORM AND STORE SHAPE FUNCTIONS AND DERIVATIVES FOR HOOP
C     REINFORCING ELEMENT.
400   IF(IHOPR.EQ.0) GO TO 600
      NL = III(J9+ME1)
      IF(NL.EQ.0) GO TO 600
```

```
      IC = III(J10+ME1)
      IF(IC.EQ.0) GO TO 500
      GO TO 600
500   III(J10+ME1) = ME
      CALL ELMHE (ME,NL,NS,NG,XEL(1),YEL(1),AAA(I10),AAA(I11)
     *            ,JJJ(L3))
C
C     FORM AND STORE SHAPE FUNCTIONS AND DERIVATIVES FOR LONGIT
C     UDINAL PRESTRESSING ELEMENT.
600   IF(ILNGP.EQ.0) GO TO 800
      NL = III(J11+ME1)
      IF(NL.EQ.0) GO TO 800
      IC = III(J12+ME1)
      IF(IC.EQ.0) GO TO 700
      GO TO 800
700   III(J12+ME1) = ME
      CALL ELMLE (ME,NL,NS,NG,XEL(1),YEL(1),AAA(I12),AAA(I13)
     *            ,JJJ(L4))
C
C     FORM AND STORE SHAPE FUNCTIONS AND DERIVATIVES FOR HOOP
C     PRESTRESSING ELEMENT.
800   IF(IHOPP.EQ.0) GO TO 1000
      NL = III(J13+ME1)
      IF(NL.EQ.0) GO TO 1000
      IC = III(J14+ME1)
      IF(IC.EQ.0) GO TO 900
      GO TO 1000
900   III(J14+ME1) = ME
      CALL ELMHE (ME,NL,NS,NG,XEL(1),YEL(1),AAA(I14),AAA(I15)
     *            ,JJJ(L5))
C
1000  CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE ELMHE(ME,NL,NS,NG,XEL,YEL,AREHE,POSHE,INF1I)
C
C     THIS SEGMENT FORMS AND STORES SHAPE FUNCTIONS AND DERIVAT
C     IVES FOR HOOP REINFORCING(PRESTRESSING) ELEMENT.  FEPARCS5
C     ******************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN/288/
      DIMENSION XEL(1),YEL(1),AREHE(4,1),POSHE(4,1),INF1I(1),INF
     *          O(4),G(36),XGAUS(3,3),WGAUS(3,3),PHI(12),PHIX(12
     *          ),PHIY(12)
      EQUIVALENCE (PHI(1),G(1)),(PHIX(1),G(13)),(PHIY(1),G(25))
      DATA XGAUS/3*0.D0,-5.7735026919D-1,5.7735026919D-1,0.D0,
     *           -7.7459666924D-1,0.D0,7.7459666924D-1/,
     *     WGAUS/2.D0,2*0.D0,2*1.D0,0.D0,5.5555555556D-1,
     *           8.8888888889D-1,5.5555555556D-1/
      CALL NOTE(1,INFO)
      INF1I(ME) = INFO(2)
C
C   LOOP OVER THE ELEMENT HOOPS
      DO 500 MHP=1,NL
      AB = AREHE(MHP,ME)
      WRITE(1) AB
      IF(AB.LT.1.D-10) GO TO 500
      XI = POSHE(MHP,ME)
C
C     LOOP OVER GAUSS POINTS
      DO 400 JG=1,NG
      ZI = XGAUS(JG,NG)
      WG = WGAUS(JG,NG)
      IF(MHP.GT.2) GO TO 100
      CALL SHAPE2(XI,ZI,0,NS/4,PHI(1),PHIX(1),PHIY(1))
      GO TO 200
100   CALL SHAPE2(ZI,XI,0,NS/4,PHI(1),PHIX(1),PHIY(1))
200   T11 = 0.D0
      T12 = 0.D0
      T21 = 0.D0
      T22 = 0.D0
      XG  = 0.D0
      YG  = 0.D0
      DO 300 I=1,NS
      T11 = T11 + PHIX(I)*XEL(I)
      T12 = T12 + PHIX(I)*YEL(I)
      T21 = T21 + PHIY(I)*XEL(I)
      T22 = T22 + PHIY(I)*YEL(I)
      XG  = XG  + PHI(I)*XEL(I)
300   YG  = YG  + PHI(I)*YEL(I)
      GACOB = DSQRT(T21**2+T22**2)
      IF(MHP.GT.2) GACOB = DSQRT(T11**2+T12**2)
      W = GACOB*WG*AB
      WRITE(1) XG,YG,XEL(1),YEL(1),W
400   CALL WRITE(G(1),LEN,0,LNUM,1)
500   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE ELMLE(ME,NL,NS,NG,XEL,YEL,ARELE,POSLE,INF1I)
C
C     THIS SEGMENT FORMS AND STORES SHAPE FUNCTIONS AND DERIVAT
C     IVES FOR LONGITUDINAL REINFORCING(PRESTRESSING) ELEMENT.
C                                                       FEPARCS5
C     ****************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN/288/
      DIMENSION XEL(1),YEL(1),ARELE(4,1),POSLE(4,1),INF1I(1),INF
     *          O(4),Q(36),XGAUS(3,3),WGAUS(3,3),PHI(12),PHIX(12
     *          ),PHIY(12),SG(24)
      EQUIVALENCE (PHI(1),Q(1)),(SG(1),Q(13))
      DATA XGAUS/3*0.D0,-5.7735026919D-1,5.7735026919D-1,0.D0,
     *           -7.7459666924D-1,0.D0,7.7459666924D-1/,
     *     WGAUS/2.D0,2*0.D0,2*1.D0,0.D0,5.5555555556D-1,
     *           8.8888888889D-1,5.5555555556D-1/
      CALL NOTE(1,INFO)
      INF1I(ME) = INFO(2)
C
C     LOOP OVER  THE ELEMENT BARS
      DO 900 MRB=1,NL
      AB = ARELE(MRB,ME)
      WRITE(1) AB
      IF(AB.LT.1.D-10) GO TO 900
      XI = POSLE(MRB,ME)
C
C     LOOP OVER GAUSS POINTS
      DO 800 JG=1,NG
      ZI = XGAUS(JG,NG)
      WG = WGAUS(JG,NG)
      IF(MRB.GT.2) GO TO 100
      CALL SHAPE2(XI,ZI,0,NS/4,PHI(1),PHIX(1),PHIY(1))
      GO TO 200
100   CALL SHAPE2(ZI,XI,0,NS/4,PHI(1),PHIX(1),PHIY(1))
200   T11 = 0.D0
      T12 = 0.D0
      T21 = 0.D0
      T22 = 0.D0
      XG  = 0.D0
      YG  = 0.D0
C
      DO 300 I=1,NS
      T11 = T11 + PHIX(I)*XEL(I)
      T12 = T12 + PHIX(I)*YEL(I)
      T21 = T21 + PHIY(I)*XEL(I)
      T22 = T22 + PHIY(I)*YEL(I)
      XG  = XG  + PHI(I)*XEL(I)
300   YG  = YG  + PHI(I)*YEL(I)
C
      IF(MRB.GT.2) GO TO 400
      GACOB = T21**2 + T22**2
      SI    = T21/GACOB
      CO    = T22/GACOB
      GO TO 500
```

```
400   GACOB = T11**2 + T12**2
      SI    = T11/GACOB
      CO    = T12/GACOB
500   W     =WG*AB*DSQRT(GACOB)
      DO 700 I=1,NS
      I2 = I*2
      I1 = I2 - 1
      IF(MRB.GT.2) GO TO 600
      SG(I1) = PHIY(I)*SI
      SG(I2) = PHIY(I)*CO
      GO TO 700
600   SG(I1) = PHIX(I)*SI
      SG(I2) = PHIX(I)*CO
700   CONTINUE
C
C     WRITE GAUSS POINT INFORMATION ON FILE(1).
      WRITE(1) XG,YG,XEL(1),YEL(1),W
      CALL WRITE(Q(1),LEN,0,LNUM,1)
800   CONTINUE
900   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE ELMSE (ME,NS,NGL,NG,XEL,YEL,INF11)
C
C     THIS SEGMENT FORMS AND STORES SHAPE FUNCTIONS AND DERIVAT
C     IVES FOR SOLID ELEMENT.                             FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION XEL(1),YEL(1),PHI(12),PHIX(12),PHIY(12),INFO(4),
     *          INF11(1),XGAUS(7,5),WGAUS(7,5),G(36)
      EQUIVALENCE (PHI(1),G(1)),(PHIX(1),G(13)),(PHIY(1),G(25))
      DATA XGAUS/7*0.D0,-5.7735026919D-1,5.7735026919D-1,5*0.D0,
     *           -7.7459666924D-1,0.D0,7.7459666924D-1,4*0.D0,
     *           -1.D0,-.65465370708D0,0.D0,.65465370708D0,1.D0,
     *           2*0.D0,-1.D0,-.83022389628D0,-.46884879347D0,
     *           0.D0,.46884879347D0,.83022389628D0,1.D0/,
     *     WGAUS/2.D0,6*0.D0,2*1.D0,5*0.D0,5.5555555556D-1,
     *           8.8888888889D-1,5.5555555556D-1,4*0.D0,.1D0,
     *           .54444444444D0,.71111111111D0,.54444444444D0,
     *           .1D0,2*0.D0,.47619047619D-1,.27682604736D0,
     *           .43174538121D0,.48761904762D0,.43174538121D0,
     *           .27682604736D0,.47619047619D-1/
C
      CALL NOTE(1,INFO)
      INF11(ME) = INFO(2)
      LEN= 288
      YY = YEL(1)
      XX = XEL(1)
      NGX = NGL
      IF(NGL.EQ.5) NGX = 4
      IF(NGL.EQ.7) NGX = 5
C
C     LOOP OVER GAUSSIAN POINTS
      DO 900 JG = 1,NG
      ETA = XGAUS(JG,NG)
      WG  = WGAUS(JG,NG)
      DO 900 IG = 1,NGL
      XI = XGAUS(IG,NGX)
      CALL SHAPE2(XI,ETA,0,NS/4,PHI(1),PHIX(1),PHIY(1))
C
C     FORM JACOBIAN FOR GAUSS POINT; IG,JG
      T11 = 0.D0
      T12 = 0.D0
      T21 = 0.D0
      T22 = 0.D0
      XG  = 0.D0
      YG  = 0.D0
C
      DO 100 I=1,NS
      T11 = T11 + PHIX(I)*XEL(I)
      T12 = T12 + PHIX(I)*YEL(I)
      T21 = T21 + PHIY(I)*XEL(I)
      T22 = T22 + PHIY(I)*YEL(I)
      XG  = XG + PHI(I)*XEL(I)
```

```
100   YG   = YG + PHI(I)*YEL(I)
      ANGLE = DATAN2(-T21,T22)
C
C     INVERT JACOBIAN
      GACOB = (T11*T22-T12*T21)
      IF(GACOB.GE.0.D0)  GO TO 300
      WRITE(IO,3000) ME,IG,JG
      GO TO 900
300   GI=1.D0/GACOB
      R11 =  GI*T22
      R12 = -GI*T12
      R21 = -GI*T21
      R22 =  GI*T11
C
C     FORM SHAPE FUNCTION DERIVATIVES WITH RESPECT TO GLOBAL
C     COORDINATES.
400   DO 800 J=1,NS
      T1 = R11*PHIX(J) + R12*PHIY(J)
      T2 = R21*PHIX(J) + R22*PHIY(J)
      PHIX(J) = T1
800   PHIY(J) = T2
C
      W = GACOB*WG*WGAUS(IG,NGX)
C
C     WRITE(INVARIENT GAUSS POINT INFORMATION ON FILE(1).
      WRITE(1) XG,YG,XX,YY,ANGLE,W
      CALL WRITE(G(1),LEN,0,LNUM,1)
C
900   CONTINUE
C
      RETURN
C
3000  FORMAT(//' JACOBIAN DETERMINANT IS LESS THAN 0 FOR ELEMENT'
     *,I4/' AT GAUSS POINT (',I1,',',I1,')')
C
      END
C
```

```
      SUBROUTINE      INIT
C
C     THIS SEGMENT CONTROLS INITIALIZATION OF STRESSES, EQUIVAL
C     ENT UNIAXIAL STRAINS AND MATERIAL PROPERTIES.     FEPARCS5
C     ************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /III/ III(1)
      COMMON /JJJ/ JJJ(1)
      COMMON /AAA/ AAA(1)
      COMMON /BBB/ BBB(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION XEL(12),YEL(12)
C
      REWIND INS
      REWIND IOS
      I16 = ISPAC(4HSTSS,9*(NCMAT+NSMAT),1)
      I17 = ISPAC(4HSTNS,9*(NCMAT+NSMAT),1)
C
C     INITIALIZE FAILURE SURFACES
      CALL INITSF (BBB(K1),III(J17),AAA(I16),AAA(I17))
C
C     LOOP OVER ALL ELEMENTS
      DO 400 ME = 1,NMELM
      CALL ELMDT4 (ME,IC,NS,NGL,NG,III(J2),III(J3),III(J4))
      CALL ELMDT1 (ME,NS,XEL(1),YEL(1),III(J6),AAA(I1),AAA(I2))
      XL = XEL(1)
      YL = YEL(1)
      ME1 = ME - 1
C
C     INITIALIZE STRESSES, STRAINS AND MATERIAL PROPERTIES FOR
C     SOLID ELEMENT
      CALL INITSE (ME,IC,NGL,NG,XL,YL,III(J5),AAA(I7),AAA(I16),
     *             AAA(I17),BBB(K1),III(J17),JJJ(L1))
C
C     INITIALIZE STRESSES, STRAINS AND MATERIAL PROPERTIES FOR
C     LONGITUDINAL REINFORCING ELEMENT.
      IF(ILNGR.EQ.0) GO TO 100
      NL = III(J7+ME1)
      IF(NL.EQ.0) GO TO 100
      IC = III(J8+ME1)
      CALL INITRP (ME,IC,NG,XL,YL,NL,BBB(K1),III(J17),III(J18),
     *             JJJ(L2),AAA(I16),AAA(I17))
C
C     INITIALIZE STRESSES, STRAINS AND MATERIAL PROPERTIES FOR
C     HOOP REINFORCING ELEMENT
100   IF(IHOPR.EQ.0) GO TO 200
```

```
      NL = III(J9+ME1)
      IF(NL.EQ.0) GO TO 200
      IC = III(J10+ME1)
      CALL INITRP (ME,IC,NG,XL,YL,NL,BBB(K1),III(J17),III(J19),
     *             JJJ(L3),AAA(I16),AAA(I17))
C
C     INITIALIZE STRESSES, STRAINS AND MATERIAL PROPERTIES FOR
C     LONGITUDINAL PRESTRESSING ELEMENT
200   IF(ILNGP.EQ.0) GO TO 300
      NL = III(J11+ME1)
      IF(NL.EQ.0) GO TO 300
      IC = III(J12+ME1)
      CALL INITRP(ME,IC,NG,XL,YL,NL,BBB(K1),III(J17),III(J20),
     *             JJJ(L4),AAA(I16),AAA(I17))
C
C     INITIALIZE STRESSES, STRAINS AND MATERIAL PROPERTIES FOR
C     HOOP PRESTRESSING ELEMENT
300   IF(IHOPP.EQ.0) GO TO 400
      NL = III(J13+ME1)
      IF(NL.EQ.0) GO TO 400
      IC = III(J14+ME1)
      CALL INITRP(ME,IC,NG,XL,YL,NL,BBB(K1),III(J17),III(J21),
     *             JJJ(L5),AAA(I16),AAA(I17))
400   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE INITSE    (ME,IC,NGL,NG,XL,YL,MATSE,ORNSE,STSS,
     *                      STNS,EMP,NMP,INF11)
C
C     THIS SEGMENT INITIALIZES STRESSES, EQUIVALENT UNIAXIAL
C     STRAINS AND MATERIAL PROPERTIES FOR SOLID ELEMENT.FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1/440/,LEN2
      COMMON /DATA2/ EPSY,EDBR
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      DIMENSION SIGT(4),SIGL(4),SIGP(3),EPSQ(4),EPSC(4),SIGC(4),
     *          EMDC(4),PRTC(3),EMDI(4),PRTI(3),TECI(3),
     *          IBRK(4),SIGD(4),EPSD(4),SIGQ(4),CM(4,4),INFO(4),
     *          STSS(9,1),STNS(9,1),INF11(1),MATSE(1),ORNSE(1),
     *          P(55),Q(36),EMP(NMPAR,1),NMP(1)
      EQUIVALENCE (SIGT(1),P(1)),(SIGL(1),P(5)),(SIGP(1),P(9)),
     *          (EPSQ(1),P(12)),(EPSC(1),P(16)),(SIGC(1),P(20)),
     *          (EMDC(1),P(24)),(PRTC(1),P(28)),(TECI(1),P(31)),
     *          (CM(1,1),P(34)),(GAMA,P(50)),(XG,P(51)),(YG,P(52
     *          )),(ZETA,P(53)),(IBRK(1),P(54))
      INFO(1) = INF11(IC)
      CALL POINT (1,INFO,1)
      NM    = MATSE(ME)
      LS    = NMP(NM)
      ORNS  = ORNSE(ME)*3.1415926536D0/1.8D2
      IF(LS.LE.11) GO TO 50
      FCU   = EMP(12,NM)
      ECU   = EMP(19,NM)
      FTU   = -FCU*EMP(14,NM)
      ETU   = -ECU*EMP(21,NM)
50    DO 100 I=1,3
      EMDI(I) = EMP(I,NM)
      PRTI(I) = EMP(I+4,NM)
100   TECI(I) = EMP(I+7,NM)
      EMDI(4) = EMP(4,NM)
C
C     LOOP OVER GAUSSIAN POINTS
      DO 900  JG=1,NG
      DO 900  IG=1,NGL
      CALL CLEAR(P(1),53)
      CALL ICLEAR(IBRK(1),4)
      READ (1) XG1,YG1,XX,YY,ANGLE,W
      CALL READ (Q(1),LEN2,0,LNUM,1)
      IF(ISTYP.EQ.0) IBRK(3) = 2
C
C     READ INITIAL CONDITIONS IF ANY
      IF(ISTRS.EQ.0) GO TO 150
      CALL READ (P(1),LEN1,0,LNUM,INS)
C
C     INITIALIZE ELASTIC MODULII AND POISSON'S RATIOS
150   DO 200 I=1,3
```

```
      EMDC(I) = EMDI(I)
200   PRTC(I) = PRTI(I)
      EMDC(4) = EMDI(4)
      IF(LS.LE.11) GO TO 700
      IF(ISTRS.EQ.0) GO TO 700
C
C     OBTAIN STRENGTH AND DEFORMATION PARAMETERS
      CALL STREN (SIGL(1),STSS(1,NM),STNS(1,NM),FCU,FTU,ECU,ETU,
     *            SIGC(1),EPSC(1))
C
C     INITIALIZE EQUIVALENT UNIAXIAL STRAINS
      DO 300 I=1,4
      SIGD(I) = SIGL(I)
      IF(IBRK(I) .NE.1) GO TO 300
      EPSQ(I) = EPSC(I)
      SIGD(I) = SIGL(I) - SIGC(I)
      EMDC(I) = -EDBR*SIGC(I)/EPSC(I)
300   CONTINUE
C
400   II = 0
      DO 500 I=1,4
      IF(IBRK(I).EQ.2) GO TO 500
      IF(DABS(SIGC(I)).LT.1.D-6) GO TO 500
      EPSQ(I) = EPSQ(I) + SIGD(I)/EMDC(I)
      CALL SAENZ (SIGQ(I),EPSQ(I),SIGC(I),EPSC(I),EMDC(I),
     *            EMDI(I),IBRK(I),I,ISTYP)
      SIGD(I) = SIGL(I) - SIGQ(I)
      IF(DABS(SIGD(I)).GT.1.D-1) II = 1
500   CONTINUE
      IF(II.EQ.1) GO TO 400
C
C     OBTAIN POISSON'S RATIOS
      DO 600 I=1,3
      PRTC(I) = POISN(PRTI(I),EPSQ(I),EPSC(I))
600   CONTINUE
C
C     FORM CONSTITUTIVE MATRIX
700   CALL CONSTM(EMDC(1),PRTC(1),CM(1,1))
      ZETA = ANGLE + ORNS
      XG = XG1 + XL - XX
      YG = YG1 + YL - YY
      CALL WRITE (P(1),LEN1,0,LNUM,IOS)
C
900   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE INITRP (ME,IC,NG,XL,YL,NL,EMP,NMP,MATRE,INF1I,
     *                   STSS,STNS)
C
C     THIS SEGMENT INITIALIZES STRESSES, STRAINS AND MATERIAL
C     PROPERTIES FOR REINFORCING(PRESTRESSING) ELEMENT. FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1,LEN2/80/
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      DIMENSION STSS(9,1),STNS(9,1),EMP(NMPAR,1),P(10),INF1I(1),
     *          INFO(4),Q(36),NMP(1),MATRE(1)
      EQUIVALENCE (SIGT,P(1)),(EPST,P(2)),(YI,P(3)),(YC,P(4)),
     *            (SIGP,P(5)),(EPSP,P(6)),(TC,P(7)),(XG,P(8)),
     *            (YG,P(9)),(IBRK,P(10))
      INFO(1) = INF1I(IC)
      CALL POINT (1,INFO,1)
      NM = MATRE(ME)
      LS = NMP(NM)
      KS = (LS-1)/2 + 1
C
C     LOOP OVER ELEMENT LAYERS
      DO 500 MRB=1,NL
      READ (1) AREA
      IF(AREA.LT.1.D-10) GO TO 500
C
C     LOOP OVER GAUSSIAN POINTS
      DO 400 JG=1,NG
      K = 2
      SIGE = 0.D0
      IBRK = 0
      CALL CLEAR (P(1),9)
      READ (1) XG1,YG1,XX,YY,W
      CALL READ (Q(1),LEN1,0,LNUM,1)
      IF(ISTRS.EQ.0) GO TO 200
      CALL READ (P(1),LEN2,0,LNUM,INS)
      IF(IBRK.EQ.1) GO TO 300
      SIGE = SIGT
      IF(DABS(SIGT).LT.SIGP) SIGE = SIGP*DSIGN(1.D0,SIGT)
      DO 100 I=2,KS
      K = I
      IF(DABS(SIGE).GT.STSS(I,NM)) GO TO 100
      GO TO 200
100   CONTINUE
C
200   YC   = (STSS(K,NM)-STSS(K-1,NM))/(STNS(K,NM)-STNS(K-1,NM))
      YI   = (STSS(2,NM)-STSS(1,NM))/(STNS(2,NM)-STNS(1,NM))
      TC   = EMP(LS,NM)
      EPST = DSIGN(1.D0,SIGT)*(STNS(K-1,NM)+(DABS(SIGE)-STSS(K-1
     *       ,NM))/YC)
      EPSP = EPST - SIGE/YI
      IF(DABS(SIGT).LT.SIGP) EPST = EPSP + SIGT/YI
```

```
      SIGP = DABS(SIGE)
      XG = XG1 + XL - XX
      YG = YG1 + YL - YY
300   CALL WRITE(P(1),LEN2,0,LNUM,IOS)
400   CONTINUE
500   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE INITSF (EMP,NMP,STSS,STNS)
C
C     THIS SEGMENT CALCULATES  CONTROL PARAMETERS FOR STRENGTH
C     AND CORRESPONDING EQUIVALENT UNIAXIAL STRAIN SURFACES.
C                                                         FEPARCS5
C     *****************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      DIMENSION EMP(NMPAR,1),STSS(9,1),STNS(9,1),NMP(1)
C
C     SOLID ELEMENT MATERIAL STRENGTH AND DEFORMATION SURFACES'
C     PARAMETERS.
      DO 100 I=1,NCMAT
      IF(NMP(I).LE.11) GO TO 100
      CALL ARGYRS(EMP(13,I),STSS(1,I))
      CALL ARGYRS(EMP(20,I),STNS(1,I))
100   CONTINUE
C
C     REINFORCING AND PRESTRESSING ELEMENT MATERIAL PARAMETERS
      IF(NSMAT.EQ.0) GO TO 500
      N1 = NCMAT + 1
      N2 = NCMAT + NSMAT
      DO 300 N= N1,N2
      STSS(1,N) =0.D0
      STNS(1,N) = 0.D0
      LS = NMP(N)
      KS = (LS-1)/2 + 1
      DO 200 I=2,KS
      I2 = (I-1)*2
      I1 = I2 -1
      STSS(I,N) = EMP(I1,N)
      STNS(I,N) = EMP(I2,N)
200   CONTINUE
300   CONTINUE
C
500   RETURN
C
      END
C
```

```
      SUBROUTINE LOAD
C
C     THIS SEGMENT CONTROLS CONVERSION OF NODAL PRESSURE INTENS
C     ITIES, NODAL TEMPRATURES AND GRAVITY LOADS INTO WORK EQUI
C     VALENT NODAL FORCES.                               FEPARCS5
C     ***************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /III/ III(1)
      COMMON /JJJ/ JJJ(1)
      COMMON /AAA/ AAA(1)
      COMMON /BBB/ BBB(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION NOD(4),INC(4),NOLD(4),BTCAN(288),XEL(12),YEL(12)
      ND = 2*NMNOD
C
C     CONVERT SPECIFIC WEIGHT AND/OR TEMP.DISTRIBUTION INTO WORK
C     EQUIVALENT NODAL FORCES.
      IF(IGRLD.EQ.0.AND.ITEMP.LE.1) GO TO 500
      IF(ITEMP.LE.1) GO TO 100
      REWIND IOS
      K7 = ISPAC(2HFT,ND,3)
      CALL CLEAR (BBB(K7),ND)
      K17= ISPAC(5HTEMPI,NMNOD,3)
C
C     LOOP OVER ALL ELEMENTS
100   DO 450 ME=1,NMELM
      CALL ELMDT4 (ME,IC,NS,NGL,NG,III(J2),III(J3),III(J4))
      ME1 = ME - 1
      IF(IGRLD.EQ.0) GO TO 200
      CALL ELMDT1 (ME,NS,XEL(1),YEL(1),III(J6),AAA(I1),AAA(I2))
      XL = XEL(1)
      CALL LOADGR (ME,NS,NGL,NG,IC,ISTYP,NMPAR,XL,III(J5),III(J6
     *             ),JJJ(L1),BBB(K1),BBB(K2))
C
200   IF(ITEMP.LE.1) GO TO 450
      CALL LOADT1 (IC,ME,NS,NGL,NG,JJJ(L1),BTCAN(1),ISTYP)
C
      IF(ILNGR.EQ.0) GO TO 250
      NL = III(J7+ME1)
      IF(NL.EQ.0) GO TO 250
      IC = III(J8+ME1)
      CALL LOADT2 (IC,NS,NG,NL,ISTYP,JJJ(L2),BTCAN(1))
C
250   IF(IHOPR.EQ.0) GO TO 300
      NL = III(J9+ME1)
      IF(NL.EQ.0) GO TO 300
```

```
      IC = III(J10+ME1)
      CALL LOADT3 (IC,NS,NG,NL,JJJ(L3),BTCAN(1))
C
300   IF(ILNGP.EQ.0) GO TO 350
      NL = III(J11+ME1)
      IF(NL.EQ.0) GO TO 350
      IC  = III(J12+ME1)
      CALL LOADT2 (IC,NS,NG,NL,ISTYP,JJJ(L4),BTCAN(1))
C
350   IF(IHOPP.EQ.0) GO TO 400
      NL = III(J13+ME1)
      IF(NL.EQ.0) GO TO 400
      IC  = III(J14+ME1)
      CALL LOADT3 (IC,NS,NG,NL,JJJ(L5),BTCAN(1))
C
400   CALL LOADTM   (ME,NS,III(J6),BBB(K7),BBB(K6),BTCAN(1))
450   CONTINUE
C
C     CONVERT NODAL PRESSURE INTENSITIES INTO WORK EQUIVALENT
C     NODAL FORCES AND UPDATE LOAD VECTOR
500   IF(IDSLD.LT.10) GO TO 750
      K8 = ISPAC(3HFPN,ND,3)
      K9 = ISPAC(3HFPT,ND,3)
      CALL CLEAR (BBB(K8),4*NMNOD)
      CALL ICLEAR(NOLD(1),4)
550   READ(IN,1300) NR,NI,NG,(NOD(I),I=1,4)
      IF(NR.EQ.0) GO TO 750
      DO 600 I=1,NR
600   INC(I) = (NOD(I) - NOLD(I))/NI
      DO 700 I=1,NI
      DO 650 J=1,NR
650   NOLD(J) = NOLD(J) + INC(J)
      CALL LOADPR (NR,NG,ISTYP,NOLD(1),AAA(I1),AAA(I2),BBB(K4),
     *             BBB(K5),BBB(K8),BBB(K9))
700   CONTINUE
      GO TO 550
C
C     CONVERT NODAL HYDROSTATIC PRESSURE INTENSITIES INTO WORK
C     EQUIVALENT NODAL FORCES.
750   IF(IDSLD.EQ.0.OR.IDSLD.EQ.10) GO TO 975
      CALL ICLEAR (NOLD(1),4)
800   READ(IN,1300) NR,NI,NG,(NOD(I),I=1,4)
      IF(NR.EQ.0) GO TO 1000
      DO 850 I=1,NR
850   INC(I) = (NOD(I) - NOLD(I))/NI
      DO 950 I=1,NI
      DO 900 J=1,NR
900   NOLD(J) = NOLD(J) + INC(J)
      CALL LOADHD (NR,NG,ISTYP,NOLD(1),AAA(I1),AAA(I2),BBB(K15),
     *             BBB(K2))
950   CONTINUE
      GO TO 800
C
C     CONVERT PRESCRIBED NODAL DISPLACEMENTS INTO CONCENTRATED
```

```
C     NODAL FORCES
975   IF(ICNLD.LT.10) GO TO 1000
      K16 = ISPAC(3HFPD,ND,3)
      CALL LOADPD (ND,NMEBE,ISTYP,AAA(I1),AAA(I3),AAA(I4),AAA(I5)
     *             ,AAA(I6),BBB(K16),III(J1))
C
C     INITIALIZE TOTAL LOAD, TOTAL DISPLACEMENT AND TOTAL PSUEDO
C     LOAD VECTORS.
1000  K10 = ISPAC(2HDQ,ND,3)
      K14 = ISPAC(2HDU,ND,3)
      K13 = ISPAC(2HQT,ND,3)
      K11 = ISPAC(2HPT,ND,3)
      K12 = ISPAC(2HUT,ND,3)
      IF(ISTRS.EQ.0) GO TO 1100
      REWIND ILD
      CALL READ (BBB(K11),LEN,0,LNUM,ILD)
      CALL CLEAR (BBB(K12),ND)
      GO TO 1200
1100  CALL CLEAR (BBB(K11),2*ND)
C
1200  IF(ITEMP.GT.0) ITEMP = ITEMP - 1
      RETURN
C
1300  FORMAT(7I4)
C
      END
C
```

```
      SUBROUTINE LOADGR   (ME,NS,NGL,NG,IC,ISTYP,NMPAR,XL,MATSE,
     *                      NPELM,INF11,EMPROP,FD)
C
C     THIS SEGMENT CALCULATES GRAVITY LOADS OF SOLID ELEMENTS
C     AND ADDS THEM TO LOAD VECTOR.                          FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN
      DIMENSION NPELM(12,1),INF11(1),EMPROP(NMPAR,1),Q(36),FD(1)
     *         ,MATSE(1),PHI(12),INFO(4),ELOAD(12)
      EQUIVALENCE (PHI(1),Q(1))
C
      NM = MATSE(ME)
      SW = EMPROP(11,NM)
      INFO(1) = INF11(IC)
      CALL POINT (1,INFO,1)
      CALL CLEAR (ELOAD(1),12)
C
      DO 200 JG=1,NG
      DO 200 IG=1,NGL
      READ(1) XG,YG,XX,YY,ANGLE,W
      CALL READ(Q(1),LEN,0,LNUM,1)
      XG = XG + XL - XX
      IF(ISTYP.EQ.1) W = W*XG
      WT = W*SW
      DO 100 J=1,NS
100   ELOAD(J) = ELOAD(J) + WT*PHI(J)
C
200   CONTINUE
C
      DO 300 J=1,NS
      ND = 2*NPELM(J,ME)
      FD(ND) = FD(ND) - ELOAD(J)
300   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE LOADHD  (NR,NG,ISTYP,NOLD,XCORD,YCORD,PHYDR,FD)
C
C     THIS SEGEMNT CALCULATES NODAL FORCES EQUIVALENT TO HYDROS
C     TATIC SURAFCE PRESSURE INTENSITIES.                FEPARCS5
C     ***************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION XCORD(1),YCORD(1),WGAUS(3,3),PHYDR(1),XGAUS(3,3)
     *           ,NOLD(4),XEL(4),YEL(4),PHI(4),PHIY(4),FD(1)
      DATA XGAUS/3*0.D0,-5.7735026919D-1,5.7735026919D-1,0.D0,
     *           -7.7459666924D-1,0.D0,7.7459666924D-1/,
     *     WGAUS/2.D0,2*0.D0,2*1.D0,0.D0,5.5555555556D-1,
     *           8.8888888889D-1,5.5555555556D-1/
      NDEG = NR - 1
      DO 100 I=1,NR
      NODE = NOLD(I)
      XEL(I) = XCORD(NODE)
100   YEL(I) = YCORD(NODE)
      DO 500 IG=1,NG
      ETA = XGAUS(IG,NG)
      WG  = WGAUS(IG,NG)
      CALL SHAPE1(ETA,NDEG,PHI(1),PHIY(1))
      T11 = 0.D0
      T22 = 0.D0
      XG  = 0.D0
      PXN = 0.D0
      PYN = 0.D0
      DO 200 I =1,NR
      T11 = T11 + PHIY(I)*YEL(I)
      T22 = T22 + PHIY(I)*XEL(I)
200   XG  = XG  + PHI(I)*XEL(I)
      IF(ISTYP.EQ.1) WG = WG*XG
      DO 300 J=1,NR
      NODE = NOLD(J)
      PHJ = PHI(J)
      PXN = PXN + PHJ*PHYDR(NODE)*T11
300   PYN = PYN - PHJ*PHYDR(NODE)*T22
C
      DO 400 J=1,NR
      NODE     =  NOLD(J)
      PP       = PHI(J)*WG
      N2       = NODE*2
      N1       = N2 - 1
      FD(N1)   = FD(N1) + PP*PXN
400   FD(N2)   = FD(N2) + PP*PYN
500   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE LOADPD (ND,NMEBE,ISTYP,XCORD,XPEBE,YPEBE,PDEBE,
     *                   STEBE,FPD,NPEBE)
C
C     THIS SEGMENT CONVERTS PRESCRIBED NODAL DISPLACEMENTS INTO
C     CONCENTRATED NODAL FORCES
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION XCORD(1),XPEBE(1),YPEBE(1),PDEBE(1),STEBE(1),
     *          NPEBE(1),FPD(1)
C
      R = 1.D0
      CALL CLEAR (FPD(1),ND)
C
C     LOOP OVER ALL EXTERNAL BOUNDARY ELEMENTS
      DO 100 I=1,NMEBE
      N  =NPEBE(I)
      N2 = 2*N
      N1 = N2 - 1
      IF( ISTYP.EQ.1) R = XCORD(N)
      FPD(N1) = XPEBE(I)*STEBE(I)*PDEBE(I)*R
      FPD(N2) = YPEBE(I)*STEBE(I)*PDEBE(I)*R
100   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE LOADPR     (NR,NG,ISTYP,NOLD,XCORD,YCORD,PNORM,
     *                        PTANG,FPN,FPT)
C
C     THIS SEGMENT CALCULATES NODAL FORCES EQUIVALENT TO NORMAL
C     AND TANGENTIAL NODAL PRESSURE INTENSITIES.         FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION XCORD(1),YCORD(1),WGAUS(3,3) ,PNORM(1),PTANG(1),
     *          NOLD(4),XEL(4),YEL(4),PHI(4),PHIY(4),XGAUS(3,3),
     *          FPN(1),FPT(1)
      DATA XGAUS/3*0.D0,-5.7735026919D-1,5.7735026919D-1,0.D0,
     *           -7.7459666924D-1,0.D0,7.7459666924D-1/,
     *     WGAUS/2.D0,2*0.D0,2*1.D0,0.D0,5.5555555556D-1,
     *           8.8888888889D-1,5.5555555556D-1/
      NDEG = NR - 1
      DO 100 I=1,NR
      NODE = NOLD(I)
      XEL(I) = XCORD(NODE)
100   YEL(I) = YCORD(NODE)
      DO 500 IG=1,NG
      ETA = XGAUS(IG,NG)
      WG  = WGAUS(IG,NG)
      CALL SHAPE1(ETA,NDEG,PHI(1),PHIY(1))
      T11 = 0.D0
      T22 = 0.D0
      XG  = 0.D0
      PXN = 0.D0
      PYN = 0.D0
      PXT = 0.D0
      PYT = 0.D0
      DO 200 I =1,NR
      T11 = T11 + PHIY(I)*YEL(I)
      T22 = T22 + PHIY(I)*XEL(I)
200   XG  = XG  + PHI(I)*XEL(I)
      IF(ISTYP.EQ.1) WG = WG*XG
      DO 300 J=1,NR
      NODE = NOLD(J)
      PHJ = PHI(J)
      PXN = PXN + PHJ*PNORM(NODE)*T11
      PYN = PYN - PHJ*PNORM(NODE)*T22
      PXT = PXT + PHJ*PTANG(NODE)*T22
300   PYT = PYT + PHJ*PTANG(NODE)*T11
      DO 400 J=1,NR
      NODE    =  NOLD(J)
      PP      = PHI(J)*WG
      N2      = NODE*2
      N1      = N2 - 1
      FPN(N1) = FPN(N1) + PP*PXN
      FPN(N2) = FPN(N2) + PP*PYN
      FPT(N1) = FPT(N1) + PP*PXT
400   FPT(N2) = FPT(N2) + PP*PYT
500   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE LOADT1 (IC,ME,NS,NGL,NG,INF11,BTCAN,ISTYP)
C
C     THIS SEGMENT EVALUATES BT-C-ALPHA-N MATRIX FOR SOLID ELEM
C     ENT.                                                    FEPARCS5
C     ****************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1,LEN2
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION INF11(1),BTCAN(12,1),CAN(4,12),PHI(12),PHIY(12),
     *          PHIX(12),INFO(4),P(55),Q(36),TECC(4),TECI(3),
     *          CM(4,4),TECL(4)
      EQUIVALENCE (TECI(1),P(31)),(PHI(1),Q(1)),(PHIX(1),Q(13)),
     *            (CM(1,1),P(34)),(XG,P(51)),(PHIY(1),Q(25))
C
      INFO(1) = INF11(IC)
      CALL POINT(1,INFO,1)
      CALL CLEAR (BTCAN(1,1),288)
C
C     LOOP OVER GAUSSIAN POINTS
      DO 500 JG=1,NG
      DO 500 IG=1,NGL
      READ (1) XG1,YG1,XX,YY,ANGLE,W
      CALL READ(Q(1),LEN1,0,LNUM,1)
      CALL READ(P(1),LEN2,0,LNUM,IOS)
      IF(ISTYP.EQ.1) W = W*XG
      DO 200 I=1,3
      C = 0.D0
      DO 100 J=1,3
100   C = C + CM(J,I)*TECI(J)
200   TECL(I) = C
      CALL TRANSS (TECL(1),TECC(1),-ZETA)
C
C     FORM THE C-ALPHA-N MATRIX AT THE GAUSSIAN POINTS
      DO 300 J=1,NS
      PHJ     = PHI(J)
      DO 300 I=1,4
300   CAN(I,J) = TECC(I)*PHJ
C
C     FORM AND ACCUMULATE CONTRIBUTIONS TO BT-C-A-N MATRIX
      DO 400 I=1,NS
      I2 = 2*I
      I1 = I2 - 1
      PX = W*PHIX(I)
      PY = W*PHIY(I)
      PZ = W*PHI(I)/XG
      DO 400 J=1,NS
      BTCAN(J,I1)=PX*CAN(1,J)+PZ*CAN(3,J)+PY*CAN(4,J)+BTCAN(J,I1)
      BTCAN(J,I2)=PY*CAN(2,J)+PX*CAN(4,J)+BTCAN(J,I2)
400   CONTINUE
500   CONTINUE
C
      RETURN
C
      END
```

```
      SUBROUTINE LOADT2   (IC,NS,NG,NL,ISTYP,INF1I,BTCAN)
C
C     THIS SEGMENT EVALUATES BT-C-ALPHA-N MATRIX FOR LONGITUDIN
C     AL REINFORCING(PRESTRESSING) ELEMENTS.            FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1,LEN2
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION P(10),Q(36),PHI(12),SG(24),INF1I(1),BTCAN(12,1),
     *          INFO(4)
      EQUIVALENCE (YM,P(4)),(TX,P(7)),(XG,P(8)),(PHI(1),Q(1)),
     *            (SG(1),Q(13))
      INFO(1) = INF1I(IC)
      CALL POINT (1,INFO,1)
C
C     LOOP OVER ELEMENT LAYERS
      DO 400 MRB=1,NL
      READ(1) AREA
      IF(AREA.LT.1.D-10) GO TO 400
C
C     LOOP OVER GAUSSIAN POINTS
      DO 300 JG = 1,NG
      READ (1) XG1,YG1,XX,YY,W
      CALL READ(Q(1),LEN1,0,LNUM,1)
      CALL READ (P(1),LEN2,0,LNUM,IOS)
      W  = W*YM*TX
      IF(ISTYP.EQ.1) W = W*XG
C
C     FORM BT-E-A-N MATRIX
      DO 200 I=1,NS
      I2 = 2*I
      I1 = I2 -1
      P1 = W*SG(I1)
      P2 = W*SG(I2)
      DO 200 J=1,NS
      BTCAN(J,I1) = P1*PHI(J) + BTCAN(J,I1)
      BTCAN(J,I2) = P2*PHI(J) + BTCAN(J,I2)
200   CONTINUE
300   CONTINUE
400   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE LOADT3   (IC,NS,NG,NL,INF1I,BTCAN)
C
C     THIS SEGMENT EVALUATES BT-C-ALPHA-N MATRIX FOR HOOP REINF
C     ORCING(PRESTRESSING) ELEMENTS.                        FEPARCS5
C     ******************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1,LEN2
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION P(10),Q(36),PHI(12),INFO(4),INF1I(1),BTCAN(12,1)
      EQUIVALENCE (YM,P(4)),(TX,P(7)),(XG,P(8)),(PHI(1),Q(1))
      INFO(1) = INF1I(IC)
C
      CALL POINT (1,INFO,1)
C
C     LOOP OVER ELEMENT LAYERS
      DO 400 MRB=1,NL
      READ(1) AREA
      IF(AREA.LT.1.D-10) GO TO 400
C
C     LOOP OVER GAUSSIAN POINTS
      DO 300 JG = 1,NG
      READ(1) XG1,YG1,XX,YY,W
      CALL READ(Q(1),LEN1,0,LNUM,1)
      CALL READ (P(1),LEN2,0,LNUM,IOS)
C
C     FORM BT-E-A-N MATRIX
      PT = YM*TX*W
      DO 200 I=1,NS
      I1 = I*2 - 1
      PTPHI = PT*PHI(I)
      DO 200 J=1,NS
      BTCAN(J,I1) = BTCAN(J,I1) + PTPHI*PHI(J)
200   CONTINUE
300   CONTINUE
400   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE LOADTM (ME,NS,NPELM,FT,TEMPV,BTCAN)
C
C     THIS SEGMENT CALCULATES WORK EQUIVALENT TEMPRATURE LOADS
C     AND ADDS THEM TO LOAD VECTOR.                          FEPARCS5
C     ******************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION NPELM(12,1),TEMPV(1),BTCAN(12,1),TEL(12),TLD(24)
     *          ,FT(1)
C
      DO 100 I=1,NS
      NODE = NPELM(I,ME)
      TEL(I) = TEMPV(NODE)
100   CONTINUE
C
      ND = NS*2
      DO 300 I=1,ND
      CC = 0.D0
      DO 200 J=1,NS
200   CC = CC + TEL(J)*BTCAN(J,I)
300   TLD(I) = CC
C
      DO 400 I=1,NS
      NODE = NPELM(I,ME)
      I2   = I*2
      I1   = I2 - 1
      N2 = NODE*2
      N1 = N2 - 1
      FT(N1) = FT(N1) + TLD(I1)
      FT(N2) = FT(N2) + TLD(I2)
400   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE    LOADUP(ISTEP)
C
C     THIS SEGMENT UPDATES TOTAL LOAD VECTOR, AND INITIALIZES
C     PSUEDO-LOAD INCREMENT AND DISPLACEMENT VECTORS.   FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IPRST,ISTYP,IMTYP,ITRAT,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /BBB/ BBB(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
      COMMON /DATA1/ CD,CL,CT,CPN,CPT,CP,EP,TU,TP,RX,IS,MI,NI,KI
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      COMMON /TOLER/ PT,FNUO,FNPO,KDIV
      ITRAT = 0
      ND    = 2*NMNOD
      WRITE(IO,1600) ISTEP,IPRST,NI,KI,RX,TU,TP,CD,CL,CT,CPN,CPT
     *              ,CP
      IF(IMTYP.NE.0) WRITE(IO,1700)
C
C     INITIALIZE LOAD INCREMENT AND TOTAL DISPLACEMENT INCREMENT
      CALL CLEAR (BBB(K10),2*ND)
      IF(IPRST.EQ.1) GO TO 1500
C
C     FORM LOAD INCREMENT VECTOR
C     DEAD LOADS(GRAVITY, CONCENTRATED AND/OR HYDROSTATIC)
      IF(DABS(CD).LT.1.D-6) GO TO 200
      DO 100 I=1,ND
100   BBB(K10+I-1) = CD*BBB(K2+I-1)
C
C     LIVE LOADS(CONCENTRATED)
200   IF(DABS(CL).LT.1.D-6) GO TO 400
      DO 300 I=1,ND
300   BBB(K10+I-1) = BBB(K10+I-1) + CL*BBB(K3+I-1)
C
C     NORMAL SURFACE PRESSURE
400   IF(DABS(CPN).LT.1.D-6) GO TO 600
      DO 500 I=1,ND
500   BBB(K10+I-1) = BBB(K10+I-1) + CPN*BBB(K8+I-1)
C
C     TANGENTIAL SURFACE PRESSURES
600   IF(DABS(CPT).LT.1.D-6) GO TO 800
      DO 700 I=1,ND
700   BBB(K10+I-1) = BBB(K10+I-1) + CPT*BBB(K9+I-1)
C
C     TEMPRATURE LOADS
800   IF(DABS(CT).LT.1.D-6) GO TO 1100
      DO 900 I=1,ND
900   BBB(K10+I-1) = BBB(K10+I-1) + CT*BBB(K7+I-1)
      DO 1000 I=1,NMNOD
```

```
1000  BBB(K17+I-1) = CT*BBB(K6+NMNOD+I-1)
C
C     PRESCRIBED NODAL DISPLACEMENTS
1100  IF(ICNLD.LT.10) GO TO 1300
      DO 1200 I=1,ND
1200  BBB(K10+I-1) = BBB(K10+I-1) + CP*BBB(K16+I-1)
C
C     UPDATE TOTAL LOAD VECTOR
1300  DO 1400 I=1,ND
1400  BBB(K11+I-1) = BBB(K11+I-1) + BBB(K10+I-1)
      CALL VCMLT (BBB(K11),BBB(K11),PT,ND)
C
1500  RETURN
C
C     FORMAT STATEMENTS
1600  FORMAT('1',/,51X,28('*'),//,51X,'OUTPUT OF LOAD STEP NO.',
     *       I5,//,51X,28('*')///,'   IP   NI   KI',5X,'RX',11X,
     *       'TU',11X,'TP',11X,'CD',11X,'CL',11X,'CT',
     *       10X,'CPN',10X,'CPT',10X,'CPD'//,3I5,9D13.6//)
1700  FORMAT('ITRATE NO.      FNU',12X,'FNP',9X,'PT/UT'/)
C
      END
C
```

```
      SUBROUTINE   PRESTS
C
C     THIS SEGMENT CONTROLS THE PRESTRESSING PROCESS.   FEPARCS5
C     ****************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IPRST,ISTYP,IMTYP,ITRAT,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /III/ III(1)
      COMMON /JJJ/ JJJ(1)
      COMMON /AAA/ AAA(1)
      COMMON /BBB/ BBB(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
      COMMON /TOLER/ PT,FNUO,FNPO,KDIV
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION PRSLD(24),TEL(12)
C
      REWIND INS
      REWIND IOS
C
C     LOOP OVER ALL ELEMENTS
      DO 500 ME=1,NMELM
      CALL ELMDT4 (ME,IC,NS,NGL,NG,III(J2),III(J3),III(J4))
      CALL ELMDT3 (ME,NS,III(J6),BBB(K6),TEL(1))
      ME1 = ME - 1
      CALL CLEAR (PRSLD(1),NS*2)
C
C     BYPASS SOLID ELEMENT INFORMATION
      CALL PRSTSE (ME,IC,NGL,NG,JJJ(L1))
C
C     BYPASS LONGITUDINAL REINFORCING ELEMENT INFORMATION
      IF(ILNGR.EQ.0) GO TO 100
      NL = III(J7+ME1)
      IF(NL.EQ.0) GO TO 100
      IC = III(J8+ME1)
      NM = III(J18+ME1)
      LS = III(J17+NM-1)
      CALL PRSTLH (IC,NG,NS,NL,0,0,LS,NM,ISTYP,TEL(1),JJJ(L2),
     *             AAA(I16),AAA(I17),PRSLD(1))
C
C     BYPASS HOOP REINFORCING ELEMENT INFORMATION
100   IF(IHOPR.EQ.0) GO TO 200
      NL = III(J9+ME1)
      IF(NL.EQ.0) GO TO 200
      IC = III(J10+ME1)
      NM = III(J19+ME1)
      LS = III(J17+NM-1)
      CALL PRSTLH (IC,NG,NS,NL,1,0,LS,NM,ISTYP,TEL(1),JJJ(L3),
     *             AAA(I16),AAA(I17),PRSLD(1))
C
```

```
C     PRESTRESS LONG. TENDONS AND OBTAIN CORRESPONDING LOADS
200   IF(ILNGP.EQ.0) GO TO 300
      NL = III(J11+ME1)
      IF(NL.EQ.0) GO TO 300
      IC = III(J12+ME1)
      NM = III(J20+ME1)
      LS = III(J17+NM-1)
      CALL PRSTLH (IC,NG,NS,NL,0,1,LS,NM,ISTYP,TEL(1),JJJ(L4),
     *             AAA(I16),AAA(I17),PRSLD(1))
C
C     PRESTRESS HOOP TENDONS AND OBTAIN CORRESPONDING LOADS.
300   IF(IHOPP.EQ.0) GO TO 400
      NL = III(J13+ME1)
      IF(NL.EQ.0) GO TO 400
      IC = III(J14+ME1)
      NM = III(J21+ME1)
      LS = III(J17+NM-1)
      CALL PRSTLH (IC,NG,NS,NL,1,1,LS,NM,ISTYP,TEL(1),JJJ(L5),
     *             AAA(I16),AAA(I17),PRSLD(1))
C
C     FORM ICREMENT OF LOAD VECTOR
400   CALL PRSTLV (ME,NS,PRSLD(1),BBB(K10),III(J6))
500   CONTINUE
C
C     FORM TOTAL LOAD VECTOR
      ND = NMNOD*2
      DO 600 I=1,ND
      KC10 = K10 + I - 1
      BBB(KC10) = -BBB(KC10)
600   BBB(K11+I-1) = BBB(KC10)
      CALL VCMLT (BBB(K11),BBB(K11),PT,ND)
C
      RETURN
C
      END
C
```

```
      SUBROUTINE PRSTLH(IC,NG,NS,NL,IH,IP,LS,NM,ISTYP,TEL,INF1I,
     *                  STSS,STNS,PRSLD)
C
C     THIS SEGEMNT PRESTRESSES LOGITUDINAL OR HOOP TENDONS AND
C     CALCULATES THE CORRESPONDING LOADS.                      FEPARCS5
C     *********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1,LEN2,LEN3
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION Q(36),PHI(12),SG(24),INF1I(1),TEL(1),PRSLD(1),
     *          P(10),STSS(9,1),STNS(9,1),INFO(4)
      EQUIVALENCE (SIGT,P(1)),(EPST,P(2)),(YI,P(3)),(YC,P(4)),
     *            (SIGP,P(5)),(EPSP,P(6)),(TC,P(7)),(XG,P(8)),
     *            (PHI(1),Q(1)),(SG(1),Q(13))
      ND = NS*2
      KS = (LS-1)/2 + 1
      INFO(1) = INF1I(IC)
      CALL POINT(1,INFO,1)
C
C     LOOP OVER ELEMENT LAYERS
      DO 700 MRB=1,NL
      READ(1) AREA
      IF(AREA.LT.1.D-10) GO TO 700
C
C     LOOPPOVER GAUSSIAN POINTS
      DO 600 JG=1,NG
      T    = 0.D0
      READ (1) XG1,YG1,XX,YY,W
      CALL READ (Q(1),LEN1,0,LNUM,1)
      CALL READ(P(1),LEN2,0,LNUM,INS)
C
C     PRESTRESS TENDON AT GAUSSIAN POINT
      IF(IP.EQ.0) GO TO 500
      DO 100 J=1,NS
100   T = T + PHI(J)*TEL(J)
      EPST = EPST - T*TC
      CALL STRSST (EPST,EPSP,SIGT,SIGP,YC,YI,KS,STSS(1,NM),STNS(
     *             1,NM))
C
C     FORM CORRESPONDING LOAD VECTOR
      W = W*SIGT
      IF(IH.EQ.0) GO TO 300
      DO 200 I=1,NS
      I1 = I*2 - 1
200   PRSLD(I1) = PRSLD(I1) + PHI(I)*W
      GO TO 500
300   IF(ISTYP.EQ.1) W = W*XG
      DO 400 I=1,ND
400   PRSLD(I) = PRSLD(I) + SG(I)*W
500   CALL WRITE(P(1),LEN2,0,LNUM,IOS)
600   CONTINUE
700   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE PRSTSE (ME,IC,NGL,NG,INF11)
C
C     THIS SEGMNT BYPASSES SOLID ELEMENT INFORMATON AS PART OF
C     THE PRESTRESSING PROCESS.                             FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1,LEN2
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION INFO(4),INF11(1),Q(36),P(55)
C
      INFO(1) = INF11(IC)
      CALL POINT (1,INFO,1)
C
      DO 200 JG=1,NG
      DO 200 IG=1,NGL
      READ(1) XG,YG,XX,YY,ANGLE,W
      CALL READ(Q(1),LEN1,0,LNUM,1)
      CALL READ(P(1),LEN2,0,LNUM,INS)
      CALL WRITE(P(1),LEN2,0,LNUM,IOS)
200   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE PRSTLV (ME,NS,PRSLD,DP,NPELM)
C
C     THIS SEGMENT FORMS THE PRESTRESSING LOAD INCREMENT VECTOR.
C                                                           FEPARCS5
C     ***************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION PRSLD(1),DP(1),NPELM(12,1)
C
      DO 100 I=1,NS
      NODE = NPELM(I,ME)
      N2 = NODE*2
      N1 = N2 - 1
      I2 = I*2
      I1 = I2 - 1
      DP(N1) = DP(N1) + PRSLD(I1)
      DP(N2) = DP(N2) + PRSLD(I2)
100   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE STIF (IXS)
C
C     THIS SEGEMNT CONTROLS FORMULATION OF ELEMENT STIFFNESS AND
C     STRESS MATRICES, AS WELL AS ASSEMBLY OF STRUCTURE STIFFNE
C     SS MATRIX.                                          FEPARCS5
C     ****************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IPRST,ISTYP,IMTYP,ITRAT,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /III/ III(1)
      COMMON /JJJ/ JJJ(1)
      COMMON /BBB/ BBB(1)
      COMMON /CCC/ CCC(1)
      COMMON /AAA/ AAA(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
      DIMENSION STIFF(576)
C
      REWIND IXS
      CALL CLEAR(CCC(1),NSTIF)
C
C     LOOP OVER ALL ELEMENTS
      DO 500 ME=1,NMELM
      CALL ELMDT4 (ME,IC,NS,NGL,NG,III(J2),III(J3),III(J4))
      ME1 = ME - 1
C
C     FORM ELEMENT STIFFNESS FOR SOLID ELEMENT
      CALL STIFSE (IC,NS,NGL,NG,ISTYP,IXS,JJJ(L1),STIFF(1))
C
C     FORM ELEMENT STIFFNESS FOR LONGITUDINAL REINFORCING ELEM.
      IF(ILNGR.EQ.0) GO TO 100
      NL = III(J7+ME1)
      IF(NL.EQ.0) GO TO 100
      IC = III(J8+ME1)
      CALL STIFLE (IC,NS,NG,NL,ISTYP,IXS,0,JJJ(L2),STIFF(1))
C
C     FORM ELEMENT STIFFNESS FOR HOOP REINFORCING ELEMENT
100   IF(IHOPR.EQ.0) GO TO 200
      NL = III(J9+ME1)
      IF(NL.EQ.0) GO TO 200
      IC = III(J10+ME1)
      CALL STIFHE (IC,NS,NG,NL,IXS,0,JJJ(L3),STIFF(1))
C
C     FORM ELEMENT STIFFNESS FOR LONGITUDINAL PRESTRESSING ELEM.
200   IF(ILNGP.EQ.0) GO TO 300
      NL = III(J11+ME1)
      IF(NL.EQ.0) GO TO 300
      IC = III(J12+ME1)
      CALL STIFLE (IC,NS,NG,NL,ISTYP,IXS,IPRST,JJJ(L4),STIFF(1))
C
```

```
C     FORM ELEMENT STIFFNESS FOR HOOP PRESTRESSING ELEMENT
300   IF(IHOPP.EQ.0) GO TO 400
      NL = III(J13+ME1)
      IF(NL.EQ.0) GO TO 400
      IC = III(J14+ME1)
      CALL STIFHE (IC,NS,NG,NL,IXS,IPRST,JJJ(L5),STIFF(1))
C
C     ASSEMBLE ELEMENT STIFNESS INTO STRUCTURE STIFFNESS MATRIX
400   CALL STIFAS (ME,NS,III(J6),III(J15),CCC(1),STIFF(1))
C
500   CONTINUE
C
C     ADD BOUNDARY CONDITIONS TO STRUCTURE STIFFNESS MATRIX
      CALL STIFBC (NMEBE,III(J1),III(J15),AAA(I3),AAA(I4),AAA(I6
     *            ),CCC(1))
C
      RETURN
C
      END
C
```

```
      SUBROUTINE STIFAS (ME,NS,NPELM,MAXA,A,STIFF)
C
C     THIS SEGMENT ASSEMBLES STRUCTURE STIFFNESS MATRIX.FEPARCS5
C     ****************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION NPELM(12,1),MAXA(1),A(1),STVEC(300),STIFF(24,1),
     *          LM(24)
C
      ND = NS*2
C
C     SPREAD LOWER HALF OF STIFNESS MATRIX INTO A VECTOR
      L = 0
      DO 100 I=1,ND
      DO 100 J=I,ND
      L = L  +  1
100   STVEC(L) = STIFF(J,I)
C
      DO 200 I=1,NS
      I2 = 2*I
      LM(I2)   = 2*NPELM(I,ME)
      LM(I2-1) = LM(I2) - 1
200   CONTINUE
C
C     ASSEMBLE ELEMENT STIFFNESS VECTOR INTO STRUCTURE
C     STIFFNESS MATRIX USING SKYLINE STORAGE ADDRESSES.
      NDL = 0
      DO 400 L=1,ND
      LL = LM(L)
      ML = MAXA(LL)
      KS = L
      DO 300 N=1,ND
      NN = LM(N)
      LN = LL - NN
      IF(LN.LT.0) GO TO 300
      KK  = ML +LN
      KSS = KS
      IF(N.GE.L) KSS = N + NDL
      A(KK) = A(KK) + STVEC(KSS)
300   KS  = KS + ND - N
400   NDL = NDL + ND - L
C
      RETURN
C
      END
C
```

```
      SUBROUTINE STIFBC   (NMEBE,NPEBE,MAXA,XPEBE,YPEBE,STEBE,A)
C
C     THIS SEGMENT ADDS BOUNDARY CONDITIONS TO STRUCTURE STIFFN
C     ESS MATRIX IN THE FORM OF HIGH STIFFNESS SPRINGS. FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION NPEBE(1),MAXA(1),STEBE(1),A(1),XPEBE(1),YPEBE(1)
C
      DO 200 M=1,NMEBE
      N   = NPEBE(M)
      N2  = 2*N
      N1  = N2 - 1
      CO  = XPEBE(M)
      SI  = YPEBE(M)
      BS  = STEBE(M)
      K22 = MAXA(N2)
      K12 = K22 + 1
      K11 = MAXA(N1)
      A(K22) = A(K22) + BS*SI*SI
      A(K11) = A(K11) + BS*CO*CO
      A(K12) = A(K12) + BS*CO*SI
200   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE STIFHE (IC,NS,NG,NL,IXS,IPRST,INF1I,STIFF)
C
C     THIS SEGMENT EVALUATES STIFFNESS AND STRESS MATRICES FOR
C     HOOP REINFORCING(PRESTRESSING) ELEMENT.             FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN,LEN1,LEN2,LEN3
      DIMENSION PHI(12),Q(36),INFO(4),STIFF(24,1),P(10),INF1I(1)
      EQUIVALENCE (YM,P(4)),(XG,P(8)),(PHI(1),Q(1))
C
      ND      = 2*NS
      INFO(1) = INF1I(IC)
      CALL POINT (1,INFO,1)
C
C     LOOP OVER ELEMENT LAYERS
      DO 400 MRB=1,NL
      READ(1) AREA
      IF(AREA.LT.1.D-10) GO TO 400
C
C     LOOP OVER GAUSSIAN POINTS
      DO 300 JG = 1,NG
      READ(1) XG1,YG1,XX,YY,W
      CALL READ (Q(1),LEN1,0,LNUM,1)
      CALL READ (P(1),LEN2,0,LNUM,IXS)
      IF(IPRST.EQ.1) GO TO 300
C
C     FORM LOWER HALF OF STIFFNESS MATRIX.
      S = YM*W/XG
      DO 200 I=1,NS
      I1 = 2*I-1
      PPHI = S*PHI(I)
      DO 200 J=I,NS
      J1 = 2*J-1
      STIFF(J1,I1) = PHI(J)*PPHI + STIFF(J1,I1)
200   CONTINUE
300   CONTINUE
400   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE STIFLE(IC,NS,NG,NL,ISTYP,IXS,IPRST,INF1I,STIFF)
C
C     THIS SEGMENT EVALUATES STIFFNESS AND STRESS MATRICES FOR
C     LONGITUDINAL REINFORCING(PRESTRESSING) ELEMENT.    FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN,LEN1,LEN2,LEN3
      DIMENSION PHI(12),SG(24),STIFF(24,1),Q(36),INFO(4),INF1I(1)
     *          ,P(10)
      EQUIVALENCE(YM,P(4)),(XG,P(8)),(PHI(1),Q(1)),(SG(1),Q(13))
      ND       = 2*NS
      INFO(1) = INF1I(IC)
      CALL POINT (1,INFO,1)
C
C     LOOP OVER ELEMENT LAYERS
      DO 400 MRB=1,NL
      READ(1) AREA
      IF(AREA.LT.1.D-10) GO TO 400
C
C     LOOP OVER GAUSSIAN POINTS
      DO 300 JG = 1,NG
      READ(1) XG1,YG1,XX,YY,W
      CALL READ (Q(1),LEN1,0,LNUM,1)
      CALL READ (P(1),LEN2,0,LNUM,IXS)
      IF(IPRST.EQ.1) GO TO 300
      W  = W*YM
      IF(ISTYP.EQ.1) W = W*XG
C
C     FORM LOWER HALF OF STIFFNESS MATRIX.
      DO 200 I=1,NS
      I2 =  I*2
      I1 = I2 - 1
      P1 = SG(I1)*W
      P2 = SG(I2)*W
      DO 200 J=I,NS
      J2 = 2*J
      J1 = J2-1
      STIFF(J1,I1) = P1*SG(J1) + STIFF(J1,I1)
      STIFF(J1,I2) = P2*SG(J1) + STIFF(J1,I2)
      STIFF(J2,I1) = P1*SG(J2) + STIFF(J2,I1)
200   STIFF(J2,I2) = P2*SG(J2) + STIFF(J2,I2)
300   CONTINUE
400   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE STIFSE (IC,NS,NGL,NG,ISTYP,IXS,INF11,ST)
C
C     THIS SEGMENT EVALUATES STIFFNESS AND STRESS MATRICES FOR
C     SOLID ELEMENT.                                        FEPARCS5
C     *******************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN,LEN1,LEN2,LEN3
      DIMENSION PHI(12),PHIX(12),PHIY(12),Q(36),INFO(4),SG(4,24)
     *          ,ST(24,1),CM(4,4),INF11(1),P(55)
      EQUIVALENCE (CM(1,1),P(34)),(PHI(1),Q(1)),(PHIX(1),Q(13)),
     *            (PHIY(1),Q(25)),(XG,P(51)),(ZETA,P(53))
C
      ND    = 2*NS
      INFO(1) = INF11(IC)
      CALL POINT(1,INFO,1)
      CALL CLEAR (ST(1,1),576)
C
C     LOOP OVER GAUSSIAN POINTS
      DO 400 JG=1,NG
      DO 400 IG=1,NGL
C
      READ (1) XG1,YG1,XX,YY,ANGLE,W
      CALL READ (Q(1),LEN1,0,LNUM,1)
      CALL READ(P(1),LEN3,0,LNUM,IXS)
      CALL TRANSF (CM(1,1),-ZETA,ISTYP)
      IF(ISTYP.EQ.1) W = W*XG
C
C     FORM C-B MATRIX FOR GAUSS POINT
      DO 100 J=1,NS
      J2 = 2*J
      J1 = J2-1
      PX = PHIX(J)
      PY = PHIY(J)
      PZ = PHI(J)/XG
      SG(1,J1) = CM(1,1)*PX + CM(1,3)*PZ + CM(1,4)*PY
      SG(2,J1) = CM(2,1)*PX + CM(2,3)*PZ + CM(2,4)*PY
      SG(3,J1) = CM(3,1)*PX + CM(3,3)*PZ + CM(3,4)*PY
      SG(4,J1) = CM(4,1)*PX + CM(4,3)*PZ + CM(4,4)*PY
C
      SG(1,J2) = CM(1,2)*PY + CM(1,4)*PX
      SG(2,J2) = CM(2,2)*PY + CM(2,4)*PX
      SG(3,J2) = CM(3,2)*PY + CM(3,4)*PX
      SG(4,J2) = CM(4,2)*PY + CM(4,4)*PX
100   CONTINUE
C
C     FORM LOWER HALF OF ELEMENT STIFFNESS(SUMMATION OF BT-C-B)
      DO 300 I=1,NS
      I2 = 2*I
      I1 = I2-1
      PX = W*PHIX(I)
      PY = W*PHIY(I)
      PZ = W*PHI(I)/XG
      DO 300 J = I,NS
      J2 = 2*J
```

```
      J1 = J2-1
      ST(J1,I1) = ST(J1,I1)+SG(1,J1)*PX+SG(3,J1)*PZ+SG(4,J1)*PY
      ST(J2,I1) = ST(J2,I1)+SG(1,J2)*PX+SG(3,J2)*PZ+SG(4,J2)*PY
      ST(J1,I2) = ST(J1,I2)+SG(2,J1)*PY+SG(4,J1)*PX
      ST(J2,I2) = ST(J2,I2)+SG(2,J2)*PY+SG(4,J2)*PX
300   CONTINUE
C
400   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE STRESS
C
C     THIS SEGMENT CONTROLS EVALUATION OF STRESSES AND UPDATING
C     OF STRAINS AND MATERIAL PROPERTIES.                  FEAPRCS3
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IPRST,ISTYP,IMTYP,ITRAT,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /III/ III(1)
      COMMON /JJJ/ JJJ(1)
      COMMON /AAA/ AAA(1)
      COMMON /BBB/ BBB(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION DEL(24),TEL(12)
C
      REWIND INS
      REWIND IOS
C
C     LOOP OVER ALL ELEMENTS
      DO 500 ME=1,NMELM
      CALL ELMDT4 (ME,IC,NS,NGL,NG,III(J2),III(J3),III(J4))
      CALL ELMDT2 (ME,NS,DEL(1),III(J6),BBB(K14))
      ME1 = ME - 1
      IF(ITEMP.EQ.0) GO TO 100
      CALL CLEAR (TEL(1),12)
      CALL ELMDT3 (ME,NS,III(J6),BBB(K17),TEL(1))
C
C     UPDATE STRESSES AND MATERIAL PROPERTIES FOR SOLID ELEMENT
100   NM = III(J5+ME1)
      LS = III(J17+NM-1)
      CALL STRSSE (ME,IC,NS,NGL,NG,NM,LS,DEL(1),TEL(1),JJJ(L1),
     *             BBB(K1),AAA(I16),AAA(I17))
C
C     UPDATE STRESSES AND MATERIAL PROPERTIES FOR LONGITUDINAL
C     REINFORCING ELEMENT
      IF(ILNGR.EQ.0) GO TO 200
      NL = III(J7+ME1)
      IF(NL.EQ.0) GO TO 200
      IC = III(J8+ME1)
      NM = III(J18+ME1)
      LS = III(J17+NM-1)
      CALL STRSLH (IC,NS,NG,NL,0,LS,NM,DEL(1),TEL(1),JJJ(L2),
     *             AAA(I16),AAA(I17),0,ITEMP)
C
C     UPDATE STRESSES AND MATERIAL PROPERTIES FOR HOOP
C     REINFORCING ELEMENT
200   IF(IHOPR.EQ.0) GO TO 300
      NL = III(J9+ME1)
```

```
      IF(NL.EQ.0) GO TO 300
      IC = III(J10+ME1)
      NM = III(J19+ME1)
      LS = III(J17+NM-1)
      CALL STRSLH (IC,NS,NG,NL,1,LS,NM,DEL(1),TEL(1),JJJ(L3),
     *             AAA(I16),AAA(I17),0,ITEMP)
C
C     UPDATE STRESSES AND MATERIAL PROPERTIES FOR LONGITUDINAL
C     PRESTRESSING ELEMENT
300   IF(ILNGP.EQ.0) GO TO 400
      NL = III(J11+ME1)
      IF(NL.EQ.0) GO TO 400
      IC = III(J12+ME1)
      NM = III(J20+ME1)
      LS = III(J17+NM-1)
      CALL STRSLH (IC,NS,NG,NL,0,LS,NM,DEL(1),TEL(1),JJJ(L4),
     *             AAA(I16),AAA(I17),IPRST,ITEMP)
C
C     UPDATE STRESSES AND MATERIAL PROPERTIES FOR HOOP
C     PRESTRESSING ELEMENT
400   IF(IHOPP.EQ.0) GO TO 500
      NL = III(J13+ME1)
      IF(NL.EQ.0) GO TO 500
      IC = III(J14+ME1)
      NM = III(J21+ME1)
      LS = III(J17+NM-1)
      CALL STRSLH (IC,NS,NG,NL,1,LS,NM,DEL(1),TEL(1),JJJ(L5),
     *             AAA(I16),AAA(I17),IPRST,ITEMP)
C
500   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE STRSLH (IC,NS,NG,NL,IH,LS,NM,DEL,TEL,INF1I,STSS
     *                   ,STNS,IPRST,ITEMP)
C
C     THIS SEGMENT CALCULATES STRESSES AND UPDATES STRAINS AND
C     MATERIAL PROPERTIES FOR LONGITUDINAL(HOOP)ELEMENT.FEPARCS5
C     ****************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1,LEN2,LEN3
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION Q(36),PHI(12),SG(24),INF1I(1),DEL(1),
     *          TEL(1),P(10),STSS(9,1),STNS(9,1),INFO(4)
      EQUIVALENCE (SIGT,P(1)),(EPST,P(2)),(YI,P(3)),(YC,P(4)),
     *            (SIGP,P(5)),(EPSP,P(6)),(TC,P(7)),(XG,P(8)),
     *            (PHI(1),Q(1)),(SG(1),Q(13))
      KS = (LS-1)/2 + 1
      INFO(1) = INF1I(IC)
      CALL POINT(1,INFO,1)
C
C     LOOPPOVER ELEMENT LAYERS
      DO 900 MRB=1,NL
      READ(1) AREA
      IF(AREA.LT.1.D-10) GO TO 900
C
C     LOOPPOVER GAUSSIAN POINTS
      DO 800 JG=1,NG
      READ (1) XG1,YG1,XX,YY,W
      CALL READ (Q(1),LEN1,0,LNUM,1)
      CALL READ(P(1),LEN2,0,LNUM,INS)
      IF(IPRST.EQ.1) GO TO 700
      IF(IH.EQ.1) GO TO 200
C
C     OBTAIN STRAIN INCREMENT FOR LONGITUDINAL ELEMENT
      DO 100 J=1,NS
      J2 = 2*J
      J1 = J2 - 1
100   EPST = EPST + SG(J1)*DEL(J1) + SG(J2)*DEL(J2)
      GO TO 400
C
C    OBTAIN STRAIN INCREMENT FOR HOOP ELEMENT
200   DO 300 J=1,NS
300   EPST = EPST + PHI(J)*DEL(J*2-1)/XG
400   IF(ITEMP.EQ.0) GO TO 600
      T = 0.D0
      DO 500 I=1,NS
500   T = T + PHI(J)*TEL(J)
      EPST = EPST - T*TC
C
600   CALL STRSST (EPST,EPSP,SIGT,SIGP,YC,YI,KS,STSS(1,NM),STNS(
     *              1,NM))
700   CALL WRITE(P(1),LEN2,0,LNUM,IOS)
800   CONTINUE
900   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE STRSSE (ME,IC,NS,NGL,NG,NM,LS,DEL,TEL,INF11,EMP
     *                  ,STSS,STNS)
C
C     THIS SEGMENT LOOPS OVER STRAIN SUBINCREMENTS TO CALCULATE
C     AND ACCUMULATE INCREMENTS OF EQU. U. STRAINS AND TO UPDATE
C     STRESSES ANDMATERIAL PROPERTIES FOR SOLID ELEMENT.FEPARCS5
C     ***************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1,LEN2,LEN3
      COMMON /PROBCV/ NSTIF,IPRST,ISTYP,IMTYP,ITRAT,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      COMMON /DATA1/ CD,CL,CT,CPN,CPT,CP,EP,TU,TP,RX,IS,MI,NI,KI
      DIMENSION SIGT(4),SIGL(4),SIGP(3),SIGC(4),EPSQ(4),EPSL(4),
     *          EPSC(4),EMDC(4),EMDI(4),PRTC(3),PRTI(3),SIGD(4),
     *          EPSI(4),TECI(3),IBRK(4),SIGQ(4),CM(4,4),INFO(4),
     *          INF11(1),DEL(1),TEL(1),PHIY(12),PHIX(12),PHI(12)
     *          ,P(55),Q(36),STSS(9,1),STNS(9,1),EMP(NMPAR,1)
      EQUIVALENCE (SIGT(1),P(1)),(SIGL(1),P(5)),(SIGP(1),P(9)),
     *         (EPSQ(1),P(12)),(EPSC(1),P(16)),(SIGC(1),P(20)),
     *         (EMDC(1),P(24)),(PRTC(1),P(28)),(TECI(1),P(31)),
     *         (CM(1,1),P(34)),(GAMA,P(50)),(XG,P(51)),(YG,P(52)
     *         ),(ZETA,P(53)),(IBRK(1),P(54)),(PHI(1),Q(1)),
     *         (PHIX(1),Q(13)),(PHIY(1),Q(25))
      NSINC = NI
      IF(LS.LE.11) NSINC = 1
      INFO(1) = INF11(IC)
      CALL POINT(1,INFO,1)
      IF(LS.LE.11) GO TO 150
      FCU = EMP(12,NM)
      ECU = EMP(19,NM)
      FTU = -FCU*EMP(14,NM)
      ETU = -ECU*EMP(21,NM)
      DO 100 I=1,3
      EMDI(I) = EMP(I,NM)
  100 PRTI(I) = EMP(I+4,NM)
      EMDI(4) = EMP(4,NM)
C
C     LOOP OVER GAUSSIAN POINTS
  150 DO 900 JG=1,NG
      DO 900 IG=1,NGL
C
      READ (1) XG1,YG1,XX,YY,ANGLE,W
      CALL READ (Q(1),LEN1,0,LNUM,1)
      CALL READ (P(1),LEN2,0,LNUM,INS)
C
C     CALCULATE TOTAL STAIN INCREMENT AND SUBINCREMENT
      CALL CLEAR (EPSI(1),4)
      DO 200 J=1,NS
      VJ = DEL(2*J)
      UJ = DEL(2*J-1)
      EPSI(1) = EPSI(1) + PHIX(J)*UJ
      EPSI(2) = EPSI(2) + PHIY(J)*VJ
```

```
      EPSI(3) = EPSI(3) + PHI(J)*UJ*DFLOAT(ISTYP)/XG
200   EPSI(4) = EPSI(4) + PHIY(J)*UJ + PHIX(J)*VJ
      IF(ITEMP.EQ.0) GO TO 350
      T = 0.D0
      DO 250 I=1,NS
250   T = T + PHI(I)*TEL(I)
      DO 300 I=1,3
300   EPSI(I) = EPSI(I) - T*TECI(I)
C
350   DO 400 I=1,4
400   EPSI(I) = EPSI(I)/DFLOAT(NSINC)
C
C     TRANSFORM STRAIN SUBINCREMENT INTO LOCAL COORDINATE SYSTEM
      CALL TRANSS (EPSI(1),EPSL(1),ZETA)
C
C     LOOP OVER STARIN SUBINCREMENTS
      DO 800 N=1,NSINC
C
C     UPDATE LOCAL STRESSES
      DO 500 I=1,4
      SIGQ(I)   = SIGL(I)
      DO 450 J=1,4
450   SIGL(I)    = SIGL(I) + CM(J,I)*EPSL(J)
500   CONTINUE
C
C     CHECK IF MTERIAL IS LINEAR
      IF(LS.LE.11) GO TO 800
C
C     MATERIAL IS NONLINEAR
C     UPDATE EQUIVALENT UNIAXIAL STARINS
      DO 550 I=1,4
      IF(IBRK(I).EQ.2) GO TO 550
      IF(SIGQ(I)*SIGL(I).LT.0.D0) EMDC(I) = EMDI(I)
      EPSQ(I) = EPSQ(I) + (SIGL(I) - SIGQ(I))/EMDC(I)
      IF(EPSQ(I)*SIGL(I).LT.0.D0) EPSQ(I) = SIGL(I)/EMDC(I)
550   CONTINUE
C
C     UPDATE STRENGTH AND DEFORMATION PARAMETERS
      CALL STREN(SIGL(1),SIGL(1),STSS(1,NM),SIGC(1),FCU,FCU,FTU)
      CALL STREN(SIGL(1),EPSQ(1),STNS(1,NM),EPSC(1),FCU,ECU,ETU)
C
C     CHECK FOR LOCKING
      DO 600 I=1,4
      IF(IBRK(I).EQ.2) GO TO 600
      IF(DABS(SIGC(I)).GT.DABS(EMDI(I)*EPSC(I))) EPSC(I)=SIGC(I)
     *                                                   /EMDI(I)
600   CONTINUE
C
C     UPDATE STRESSES AND MATERIAL PROPERTIES
      DO 650 I=1,4
      IF(IBRK(I).EQ.2) GO TO 650
      CALL SAENZ (SIGL(I),EPSQ(I),SIGC(I),EPSC(I),EMDC(I),
     *            EMDI(I),IBRK(I),I,ISTYP)
650   CONTINUE
```

```
      DO 700 I=1,3
700   PRTC(I) = POISN (PRTI(I),EPSQ(I),EPSC(I))
C
C     FORM CONSTITUTIVE MATRIX
      CALL CONSTM(EMDC(1),PRTC(1),CM(1,1))
800   CONTINUE
C
C     TRANSFORM LOCAL STRESSES INTO GLOBAL COORDINATE SYSTEM AND
C     OBTAIN PRINCIPAL STRESSES.
      CALL TRANSS (SIGL(1),SIGT(1),-ZETA)
      CALL STRSSP (SIGL(1),SIGP(1),GAMA)
C
C     WRITE UPDATED INFORMATION ON FILE.
      CALL WRITE (P(1),LEN2,0,LNUM,IOS)
C
900   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE STRSSP (SIGL,SIGP,GAMA)
C
C     THIS SEGMENT CALCULATES PRINCIPAL STRESSES.          FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION SIGL(1),SIGP(1)
C
      SIGM = (SIGL(1) + SIGL(2))/2.D0
      SIGN = (SIGL(1) - SIGL(2))/2.D0
      RADS = DSQRT(SIGN**2 + SIGL(4)**2)
      SIGP(1) = SIGM + RADS
      SIGP(2) = SIGM - RADS
      SIGP(3) = SIGL(3)
      IF(SIGL(4).EQ.0.D0.AND.SIGN.EQ.0.D0) GO TO 100
      GAMA = DATAN2(SIGL(4),SIGN)/2.D0
      GO TO 200
100   GAMA = 0.D0
C
200   RETURN
C
      END
C
```

```
      SUBROUTINE STRSST (EPST,EPSP,SIGT,SIGP,YC,YI,KS,STSS,STNS)
C
C     THIS SEGMENT UPDATES STRESS AND MATERIAL PROPERTIES FOR
C     REINFORCING STEEL OR PRESTRESSING TENDONS.         FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION STSS(1),STNS(1)
C
C     CHECK FOR UNLOADING
      EPSE = EPST - EPSP
      SIGE = EPSE*YI
      IF(DABS(SIGE).LT.DABS(SIGP)) GO TO 300
C
C     OBTAIN NEW STRESS POINT AND TANGENT MODULUS
      DO 100 I=2,KS
      J    = I
      EPSD = DABS(EPST) - STNS(I)
      IF(EPSD.LT.0.D0) GO TO 200
100   CONTINUE
C
C     STRAIN HAS EXCEEDED MAXIMUM ALLOWED.**BREAK**
      SIGT = 0.D0
      SIGP = 0.D0
      YC   = 0.D0
      RETURN
C
200   YC   = (STSS(J)-STSS(J-1))/(STNS(J)-STNS(J-1))
      SIGT =  STSS(J-1)*DSIGN(1.D0,EPST)
     *      + YC*(EPST-STNS(J-1)*DSIGN(1.D0,EPST))
      EPSP = EPST - SIGT/YI
      SIGP = DABS(SIGT)
      RETURN
C
C     UNLOADING IS VERIFIED
300   SIGT = SIGE
      YC = YI
      RETURN
C
      END
C
```

```
      SUBROUTINE   SUDOLD
C
C     THIS SEGMENT CONTROLS FORMATION OF PSUEDO-LOAD VECTOR FROM
C     THE CURRENT STRESS CONDITION.                         FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IPRST,ISTYP,IMTYP,ITRAT,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /III/ III(1)
      COMMON /JJJ/ JJJ(1)
      COMMON /AAA/ AAA(1)
      COMMON /BBB/ BBB(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION PSDLD(24)
C
      REWIND IOS
      CALL CLEAR (BBB(K13),2*NMNOD)
C
C     LOOP OVER ALL ELEMENTS
      DO 500 ME=1,NMELM
      CALL ELMDT4 (ME,IC,NS,NGL,NG,III(J2),III(J3),III(J4))
      ME1 = ME - 1
      CALL CLEAR (PSDLD(1),NS*2)
C
C     OBTAIN PSUEDO-LOADS OF SOLID ELEMENT STRESSES
      CALL SUDOLS (ME,IC,NS,NGL,NG,ISTYP,JJJ(L1),PSDLD(1),IOS)
C
C     OBTAIN PSUEDO-LOADS OF LONG. REINF.ELEMENT STRESSES
      IF(ILNGR.EQ.0) GO TO 100
      NL = III(J7+ME1)
      IF(NL.EQ.0) GO TO 100
      IC = III(J8+ME1)
      CALL SUDOLL (IC,NG,NS,NL,ISTYP,0,JJJ(L2),PSDLD(1),IOS)
C
C     OBTAIN PSUEDO-LOADS OF HOOP REINF.ELEMENT STRESSES
100   IF(IHOPR.EQ.0) GO TO 200
      NL = III(J9+ME1)
      IF(NL.EQ.0) GO TO 200
      IC = III(J10+ME1)
      CALL SUDOLH (IC,NG,NS,NL,0,JJJ(L3),PSDLD(1),IOS)
C
C     OBTAIN PSUEDO-LOADS OF LONG. PREST. ELEMENT STRESSES
200   IF(ILNGP.EQ.0) GO TO 300
      NL = III(J11+ME1)
      IF(NL.EQ.0) GO TO 300
      IC = III(J12+ME1)
      CALL SUDOLL (IC,NG,NS,NL,ISTYP,IPRST,JJJ(L4),PSDLD(1),IOS)
C
```

```
C      OBTAIN PSUEDO-LOADS OF HOOP PREST. ELEMENT STRESSES.
300    IF(IHOPP.EQ.0) GO TO 400
       NL = III(J13+ME1)
       IF(NL.EQ.0) GO TO 400
       IC = III(J14+ME1)
       CALL SUDOLH (IC,NG,NS,NL,IPRST,JJJ(L5),PSDLD(1),IOS)
C
C      FORM PSUEDO-LOAD VECTOR(QT)
400    CALL SUDOLV (ME,NS,PSDLD(1),BBB(K13),III(J6))
500    CONTINUE
C
C      SUBTRACT  BOUNDARY REACTIONS FROM PSUEDO-LOAD VECTOR
       CALL SUDOLX (NMEBE,III(J1),AAA(I3),AAA(I4),AAA(I6),BBB(K12
     *             ),BBB(K13))
C
       RETURN
C
       END
C
```

```
      SUBROUTINE SUDOLH (IC,NG,NS,NL,IPRST,INF1I,PSDLD,IOS)
C
C     THIS SEGMENT CALCULATES AND ACCUMULATES WORK EQUIVALENT
C     PSUEDO-LOADS FOR A HOOP REINFORCING(PRESTRESSING) ELEMENT.
C                                                       FEPARCS5
C     ****************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1,LEN2
      DIMENSION INFO(4),INF1I(1),PSDLD(1),PHI(12),Q(36),P(10)
      EQUIVALENCE (PHI(1),Q(1)),(SIGT,P(1)),(XG,P(8))
C
      INFO(1) = INF1I(IC)
      CALL POINT (1,INFO,1)
C
C     LOOP OVER ELEMENT LAYERS
      DO 300 MRB=1,NL
      READ (1) AREA
      IF(AREA.LT.1.D-10) GO TO 300
C
C     LOOP OVER GAUSSIAN POINTS
      DO 200 JG=1,NG
      READ(1) XG1,YG1,XX,YY,W
      CALL READ (Q(1),LEN1,0,LNUM,1)
      CALL READ (P(1),LEN2,0,LNUM,IOS)
      IF(IPRST.EQ.1) GO TO 200
      W = W*SIGT
C
      DO 100 I=1,NS
      I2 = 2*I
      I1 = I2 - 1
      PSDLD(I1) = PSDLD(I1) + PHI(I)*W
100   CONTINUE
200   CONTINUE
300   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE SUDOLL(IC,NG,NS,NL,ISTYP,IPRST,INF1I,PSDLD,IOS)
C
C     THIS SEGMENT CALCULATES AND ACCUMULATES WORK EQUIVALENT
C     PSUEDO-LOADS OF A LONGITUDINAL REINFORCING(PRESTRESSING)
C     ELEMNT.                                                 FEPARCS5
C     *********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1,LEN2
      DIMENSION INFO(4),INF1I(1),PSDLD(1),PHI(12),SG(24),Q(36),
     *          P(10)
      EQUIVALENCE (PHI(1),Q(1)),(SG(1),Q(13)),(SIGT,P(1)),
     *            (XG,P(8))
C
      ND = NS*2
      INFO(1) = INF1I(IC)
      CALL POINT (1,INFO,1)
C
C     LOOP OVER ELEMNT LAYERS
      DO 300 MRB=1,NL
      READ (1) AREA
      IF(AREA.LT.1.D-10) GO TO 300
C
C     LOOP OVER GAUSSIAN POINTS
      DO 200 JG=1,NG
      READ (1) XG1,YG1,XX,YY,W
      CALL READ(Q(1),LEN1,0,LNUM,1)
      CALL READ(P(1),LEN2,0,LNUM,IOS)
      IF(IPRST.EQ.1) GO TO 200
      W = W*SIGT
      IF(ISTYP.EQ.1) W = W*XG
C
      DO 100 I=1,ND
      PSDLD(I) = PSDLD(I) + SG(I)*W
100   CONTINUE
200   CONTINUE
300   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE SUDOLS  (ME,IC,NS,NGL,NG,ISTYP,INF11,PSDLD,IOS)
C
C     THIS SEGMENT CALCULATES AND ACCUMULATES WORK EQUIVALENT
C     PSUEDO-LOADS FOR A SOLID ELEMENT.                     FEPARCS5
C     *************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN1,LEN2
      DIMENSION INFO(4),INF11(1),Q(36),PHI(12),PHIX(12),PSDLD(1)
     *          ,PHIY(12),P(55)
      EQUIVALENCE (PHI(1),Q(1)),(PHIX(1),Q(13)),(PHIY(1),Q(25)),
     *            (SIGT1,P(1)),(SIGT2,P(2)),(SIGT3,P(3)),(SIGT4,
     *            P(4)),(XG,P(51))
C
      INFO(1) = INF11(IC)
      CALL POINT (1,INFO,1)
C
C     LOOP OVER GAUSSIAN POINTS
      DO 200 JG=1,NG
      DO 200 IG=1,NGL
      READ (1) XG,YG,XX,YY,ANGLE,W
      CALL READ (Q(1),LEN1,0,LNUM,1)
      CALL READ (P(1),LEN2,0,LNUM,IOS)
      IF(ISTYP.EQ.1) W=W*XG
C
      DO 100 I=1,NS
      I2 = I*2
      I1 = I2 - 1
      PX = PHIX(I)*W
      PY = PHIY(I)*W
      PZ = PHI(I)/XG*W
      PSDLD(I1) = PSDLD(I1) + PX*SIGT1 + PZ*SIGT3 + PY*SIGT4
      PSDLD(I2) = PSDLD(I2) + PY*SIGT2 + PX*SIGT4
100   CONTINUE
C
200   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE SUDOLV (ME,NS,PSDLD,QT,NPELM)
C
C     THIS SEGMENT FORMS THE PSUEDO-LOAD VECTOR.           FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION PSDLD(1),QT(1),NPELM(12,1)
C
      DO 100 I=1,NS
      NODE = NPELM(I,ME)
      N2 = NODE*2
      N1 = N2 - 1
      I2 = I*2
      I1 = I2 - 1
      QT(N1) = QT(N1) + PSDLD(I1)
      QT(N2) = QT(N2) + PSDLD(I2)
100   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE SUDOLX    (NMEBE,NPEBE,XPEBE,YPEBE,STEBE,UT,QT)
C
C     THIS SEGMENT SUBTRACTS EXTERNAL BOUNDARY REACTIONS FROM
C     TOTAL PSUEDO-LOAD VECTOR.                             FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION NPEBE(1),UT(1),QT(1),XPEBE(1),YPEBE(1),STEBE(1)
C
C     LOOP OVER ALL EXTERNAL BOUDARY ELEMENTS
      DO 100 M=1,NMEBE
      N  = NPEBE(M)
      N2 = N*2
      N1 = N2 - 1
      C2 = XPEBE(M)**2
      S2 = YPEBE(M)**2
      CS = XPEBE(M)*YPEBE(M)
C
      QT(N1) = QT(N1) + STEBE(M)*(C2*UT(N1) + CS*UT(N2))
      QT(N2) = QT(N2) + STEBE(M)*(CS*UT(N1) + S2*UT(N2))
100   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE TCONVG  (K)
C
C     THIS SEGMENT TESTS CONVERGENCE OF THE DISPLACEMENTS AND/OR
C     THE PSUEDOLOADS, USING FIRST NORMS.                    FEPARCS5
C     ***************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IPRST,ISTYP,IMTYP,ITRAT,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /BBB/ BBB(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
      COMMON /DATA1/ CD,CL,CT,CPN,CPT,CP,EP,TU,TP,RX,IS,MI,NI,KI
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      COMMON /TOLER/ PT,FNUO,FNPO,KDIV
      K     = 2
      ND    = NMNOD*2
      ITRAT = ITRAT + 1
      CALL VCMLT (BBB(K10),BBB(K10),DU,ND)
      CALL VCMLT (BBB(K12),BBB(K12),UT,ND)
      DO 100 I=1,ND
100   BBB(K10+I-1) = BBB(K11+I-1) - BBB(K13+I-1)
      CALL VCMLT (BBB(K10),BBB(K10),DP,ND)
      FNU = DU/UT
      FNP = DP/PT
      OV  = DSQRT(PT/UT)
      IF(DABS(FNU).GT.DABS(FNUO).AND.DABS(FNP).GT.DABS(FNPO))
     *   KDIV = KDIV + 1
      RN = DFLOAT(ITRAT/KI)
      IF(RN.GT.DFLOAT(ITRAT)/DFLOAT(KI)-1.D-4) K = 1
      IF(FNU.LT.TU.AND.DABS(FNP).LT.TP) K = 0
      WRITE(IO,1200) ITRAT,FNU,FNP,OV
C
      IF(K.EQ.0) GO TO 300
      FNUO = FNU
      FNPO = FNP
      IF(KDIV.GT.4) K = 4
      IF(ITRAT.LE.NITRT) GO TO 400
      WRITE(IO,1000) NITRT
      K = 4
C
300   IF(IPRST.EQ.1) CALL CLEAR (BBB(K11),2*ND)
C
400   RETURN
1000  FORMAT(///,'NUMBER OF ITERATIONS HAS EXEEDED',I5)
1200  FORMAT(I10,3D15.6)
      END
C
```

```
      SUBROUTINE TOUT
C
C     THIS SEGMENT CONTROLS OUTPUT OF NODAL DISPLACEMENTS AND
C     ELEMENT STRESSES AT THE GAUSS POINTS.                 FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IPRST,ISTYP,IMTYP,ITRAT,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /III/ III(1)
      COMMON /AAA/ AAA(1)
      COMMON /BBB/ BBB(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
C
      REWIND IOS
C
C     OUTPUT NODAL DISPLACEMENTS
      CALL TOUTDP (NMNOD,IO,BBB(K12),BBB(K14))
C
C     LOOP OVER ALL ELEMENTS TO OUTPUT STRESSES
      WRITE(IO,1100)
      IF(ILNGR.EQ.0) GO TO 100
      WRITE(10,1300)
      WRITE(10,1200)
100   IF(IHOPR.EQ.0) GO TO 200
      WRITE(11,1400)
      WRITE(11,1200)
200   IF(ILNGP.EQ.0) GO TO 300
      WRITE(12,1500)
      WRITE(12,1200)
300   IF(IHOPP.EQ.0) GO TO 400
      WRITE(13,1600)
      WRITE(13,1200)
C
400   DO 800 ME=1,NMELM
      ME1 = ME - 1
C
C     OUTPUT SOLID ELEMENT STRESSES
      CALL TOUTSE (ME,NG,III(J3))
C
C     OUTPUT LONGITUDINAL REINFORCING ELEMENT STRESSES
      IF(ILNGR.EQ.0) GO TO 500
      NL = III(J7+ME1)
      IF(NL.EQ.0) GO TO 500
      CALL TOUTLH (ME,NG,NL,10,AAA(I8))
C
C     OUTPUT HOOP REINFORCING ELEMENT STRESSES
500   IF(IHOPR.EQ.0) GO TO 600
      NL = III(J9+ME1)
```

```
      IF(NL.EQ.0) GO TO 600
      CALL TOUTLH (ME,NG,NL,11,AAA(I10))
C
C     OUTPUT LONGITUDINAL PRESTRESSING ELEMENT STRESSES
600   IF(ILNGP.EQ.0) GO TO 700
      NL = III(J11+ME1)
      IF(NL.EQ.0) GO TO 700
      CALL TOUTLH (ME,NG,NL,12,AAA(I12))
C
C     OUTPUT HOOP PRESTRESSING ELEMENT STRESSES
700   IF(IHOPP.EQ.0) GO TO 800
      NL = III(J13+ME1)
      IF(NL.EQ.0) GO TO 800
      CALL TOUTLH (ME,NG,NL,13,AAA(I14))
C
800   CONTINUE
C
      RETURN
C
C     FORMAT STATEMENTS
1100  FORMAT('1','STRESS STATE AT THE GAUSS POINTS FOR SOLID ',
     *        'ELEMENTS',/,51('*')//,' ELEMENT   GAUSS   ',
     *        'COORDINATES',14X,'GLOBAL STRESSES',10X,'LOCAL ',
     *        'STRESSES',12X,'PRINCIPAL STRESSES      CRACKING ',
     *        'FLAGES'//)
1200  FORMAT('  ME  NL  JG',5X,'XG',10X,'YG',10X,'SIGT',10X,
     *        'EPST'//)
1300  FORMAT('1','STRESSES AT THE GAUSS POINTS FOR LONG. REINF',
     *        'ORCING ELEMENTS',/,59('*')//)
1400  FORMAT('1','STRESSES AT THE GAUSS POINTS FOR HOOP REINF',
     *        ' ELEMENTS',/,52('*')//)
1500  FORMAT('1','STRESSES AT THE GAUSS POINTS FOR LONG. PREST',
     *        'RESSING ELEMENTS',/,60('*')//)
1600  FORMAT('1','STRESSES AT THE GAUSS POINTS FOR HOOP PREST',
     *        'RESSING ELEMENTS',/,59('*')//)
C
      END
C
```

```
      SUBROUTINE TOUTDP (NMNOD,IO,UT,DU)
C
C     THIS SEGMENT PRINTS OUT NODAL DISPLACEMENTS.        FEPARCS5
C     ****************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION UT(1),DU(1)
C
      WRITE(IO,1000)
      DO 200 N=1,NMNOD
      N2 = N*2
      N1 = N2 - 1
      WRITE(IO,1100) N,UT(N1),UT(N2),DU(N1),DU(N2)
200   CONTINUE
C
      RETURN
C
1000  FORMAT('1','NODAL DISPLACEMENTS'/,19('*')//,
     *       '      N',7X,'U',14X,'V',13X,'DU',13X,'DV'//)
1100  FORMAT(I5,4D15.6)
C
      END
C
```

```
      SUBROUTINE TOUTLH (ME,NG,NL,IO1,AREA)
C
C     THIS  SEGMENT OUTPUTS STRESSES AT THE GAUSS POINTS FOR THE
C     LONGITUDINAL(HOOP) ELEMENTS.                          FEPARCS5
C     ****************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION P(10),AREA(4,1)
C
C     LOOP OVER ELEMENT LAYERS
      DO 200 MRB=1,NL
      IF(AREA(MRB,ME).LT.1.D-10) GO TO 200
C
C     LOOP OVER GAUSS POINTS
      DO 100 JG=1,NG
      CALL READ (P(1),LEN,0,LNUM,IOS)
      WRITE(IO1,1000) ME,MRB,JG,P(8),P(9),P(1),P(2)
100   CONTINUE
200   CONTINUE
C
      WRITE(IO1,1100)
C
       RETURN
C
1000  FORMAT(3I4,2D12.4,2D14.6)
1100  FORMAT(' ')
C
      END
C
```

```
      SUBROUTINE TOUTSE (ME,NG,NGELM)
C
C     THIS SEGMENT OUTPUTS THE STRESS STATE AT THE GAUSS POINTS
C     IN THE GLOBAL AS WELL AS THE PRINCIPAL DIRECTIONS FOR THE
C     SOLID ELEMENT.                                            FEPARCS5
C     *********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION P(55),IBRK(4),NGELM(1)
      EQUIVALENCE (IBRK(1),P(54))
C
      NGL = NGELM(ME)
      NG  = NGL/10
      NGL = NGL - NG*10
      DO 100 JG=1,NG
      DO 100 IG=1,NGL
      CALL READ (P(1),LEN,0,LNUM,IOS)
      ZETA = P(53)*1.8D2/3.1415926536D0
      GAMA = P(50)*1.8D2/3.1415926536D0
      WRITE(IO,1000) ME,IG,P(51),P(1),P(5),P(9),IBRK(1)
      WRITE(IO,1100) JG,P(52),P(2),P(6),P(10),IBRK(2)
      WRITE(IO,1200) ZETA,P(4),P(8),P(11),IBRK(3)
      WRITE(IO,1300) GAMA,IBRK(4)
100   CONTINUE
C
      WRITE(IO,1400)
C
      RETURN
C
1000  FORMAT(I5,'   IG   =',I2,'   XG   = ',D15.6,'   SIGR  =',
     *       D15.6,'   SIGXI  =',D15.6,'   SIG1  =',D15.6,
     *       '    IXI      =',I3)
1100  FORMAT(8X,'JG   =',I2,'   YG   = ',D15.6,'   SIGZ  =',
     *       D15.6,'   SIGETA =',D15.6,'   SIG2  =',D15.6,
     *       '    IETA     =',I3)
1200  FORMAT(19X,'ZETA = ',D15.6,'   SIGRZ =',D15.6,
     *       '    SIGXIET=',D15.6,'   SIGTH =',D15.6,
     *       '    ITHETA  =',I3)
1300  FORMAT(92X,'   GAMA  =',D15.6,'   IXIETA  =',I3/)
1400  FORMAT(' ')
C
      END
C
```

```
      SUBROUTINE   SOLV  (K)
C
C     THIS SEGMENY FORMS COLUMN HEIGHTS AND ADDRESSING ARRAYS
C     FOR STRUCTURE STIFFNESS MATRIX, TRIANGULARIZESZES STIFFNE
C     SS MATRIX, REDUCES R.H.S. AND BACKSUBSTITUTES FOR NODAL
C     DISPLACEMENTS.                                        FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROBCV/ NSTIF,IECHO,ISTYP,IMTYP,IDRUN,ILNGR,IHOPR,
     *                ILNGP,IHOPP,IDSLD,ISTRS,IGRLD,NMNOD,NMELM,
     *                NMEBE,NCMAT,NSMAT,NMPAR,ITEMP,ICNLD,NITRT
      COMMON /III/ III(1)
      COMMON /BBB/ BBB(1)
      COMMON /CCC/ CCC(1)
      COMMON /POINTR/
     *I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,I11,I12,I13,I14,I15,I16,I17,
     *J1,J2,J3,J4,J5,J6,J7,J8,J9,J10,J11,J12,J13,J14,J15,J16,J17,
     *K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,
     *L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11,L12,L13,J18,J19,J20,J21
      COMMON /DATA1/ CD,CL,CT,CPN,CPT,CP,EP,TU,TP,RX,IS,MI,NI,KI
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      GO TO (100,300,400) ,K
100   J15 = ISPAC(4HMAXA,(2*NMNOD+1),2)
      J16 = ISPAC(3HMHT,2*NMNOD,2)
      CALL ICLEAR(III(J16),2*NMNOD)
C
C     FORM COLUMN HEIGHTS ARRAY
      DO 200 ME=1,NMELM
      NS = III(J2+ME-1)*4
      CALL SOLVCH (12,NS,2*NS,2,ME,III(J16),III(J6))
200   CONTINUE
C
C     FORM DIAGONAL ELEMENTS ADDRESSING ARRAY
      CALL SOLVAD (III(J15),III(J16),NMNOD,2,NSTIF)
      WRITE(IO,1000) NSTIF
      RETURN
C
C     TRIANGULARIZE STIFFNESS MATRIX
300   CALL SOLVTR (CCC(1),III(J15),2*NMNOD,IO)
      RETURN
C
C     REDUCE R.H.S. AND BACKSUBSTITUTE FROM THE TRIANGULARIZED
C     STIFFNESS AMTRIX FOR THE CORRESPONDING NODAL DISPLACEMENTS.
400   ND = 2*NMNOD
      CALL SOLVRD (CCC(1),BBB(K10),III(J15),ND)
      CALL SOLVBS (BBB(K10),CCC(1),III(J15),ND)
      DO 500 I=1,ND
      II = I - 1
      BBB(K12+II) = BBB(K12+II) + BBB(K10+II)*RX
500   BBB(K14+II) = BBB(K14+II) + BBB(K10+II)*RX
      RETURN
1000  FORMAT(//,40(1H*)//,'SIZE OF STIFNESS MATRIX =',I8//,
     *40(1H*))
      END
```

```
      SUBROUTINE SOLVAD (MAXA,MHT,NN,ID,NWA)
C
C     THIS SUBROUTINE CALCULATES  THE ADDRESSES  OF THE DIAGONAL
C     ELEMENTS  AND LENGTH OF A  STIFFNESS MATRIX UPPER TRIANGLE
C     STORED COLUMN-WISE UNDER A SKYLINE.                 FEPARCS4
C     ***********************************************************
      DIMENSION MAXA(1),MHT(1)
C
      NEQ = NN*ID
      NM  = NEQ + 1
C
      MAXA(1) = 1
C
      IF(NEQ.EQ.1) GO TO 30
      DO 20 I=1,NEQ
      MAXA(I+1) = MAXA(I) + MHT(I) + 1
20    CONTINUE
C
      NWA = MAXA(NM) - 1
      GO TO 40
C
30    NWA = 1
40    RETURN
C
      END
C
```

```
      SUBROUTINE SOLVCH (NB,NODES,ND,ID,ME,MHT,NP)
C
C     THIS SUBROUTINE IS CALLED PER ELEMENT, OR PER SUBSTRUCTURE
C     TO FORM AND UPDATE THE COLUMN HEIGHT ARRAY(MHT).  FEPARCS4
C*********************************************************************
      DIMENSION MHT(1),NP(NB,1),LM(24)
C
      DO 100 I=1,NODES
      II = I*ID + 1
      N  = NP(I,ME)*ID + 1
      DO 100 J=1,ID
      JJ = II - J
100   LM(JJ) = N - J
C
      LS = 10000
C
      DO 200 I=1,ND
      IF(LM(I).GE.LS) GO TO 200
      LS = LM(I)
200   CONTINUE
C
      DO 300 I=1,ND
      II = LM(I)
      MB = II - LS
      IF(MB.GT.MHT(II)) MHT(II) = MB
300   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE SOLVTR (A,MAXA,NEQ,IO)
C
C     THIS SEGMENT TRIANGULARIZES A STIFFNESS MATRIX STORED
C     COLUMNWISE UNDER A SKYLINE.                         FEPARCS4
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION A(1),MAXA(1)
C
      DO  1000 N=1,NEQ
      KN = MAXA(N)
      KL = KN + 1
      KU = MAXA(N+1) - 1
      KH = KU - KL
      IF(KH) 900,500,100
100   K  = N - KH
      IC = 0
      KLT= KU
      DO 400 J=1,KH
      IC = IC + 1
      KLT= KLT - 1
      KI = MAXA(K)
      ND = MAXA(K+1) - KI - 1
      IF(ND.LE.0) GO TO 400
      KK = IC
      IF(KK.GT.ND) KK = ND
      CALL VCMLT(A(KI+1),A(KLT+1),C,KK)
      A(KLT) = A(KLT) - C
400   K  = K + 1
C
500   K  = N
      C  = 0.D0
      DO 600 KK = KL,KU
      K  = K - 1
      KI = MAXA(K)
      D  = A(KK)/A(KI)
      C  = C + D*A(KK)
      A(KK) = D
600   CONTINUE
      A(KN) = A(KN) - C
900   IF(A(KN)) 950,950,1000
950   WRITE(IO,3000) N,A(KN)
      CALL TOUT
      STOP
1000  CONTINUE
C
      RETURN
C
3000  FORMAT('ZERO OR NEGATIVE ELEMENT ON MAIN DIAGONAL NO.',I4,
     *D15.6)
C
      END
C
```

```
      SUBROUTINE SOLVRD (A,B,MAXA,NEQ)
C
C     THIS SEGMENT REDUCES A LOAD VECTOR USING A TRIANGULARIZED
C     SKYLINED STIFFNESS MATRIX.                          FEPARCS4
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION A(1),B(1),MAXA(1)
C
      DO 300 N=1,NEQ
      KN = MAXA(N)
      KL = KN + 1
      KU = MAXA(N+1) - 1
      KH = KU - KL
      IF(KH) 300,100,100
C
100   K = N
      E = 0.D0
      DO 200 KK=KL,KU
      K = K - 1
      E = E + A(KK)*B(K)
200   CONTINUE
C
      B(N) = B(N) - E
C
300   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE SOLVBS (B,A,MAXA,NEQ)
C
C     THIS SEGMENT BACKSUBSTITUTES FROM  TRANGULARIZED STIFFNESS
C     MATRIX INTO VECTOR OF REDUCED  INCREMENT OF PSUEDO-LOAD TO
C     OBTAIN CORRESPONDING INCREMENT OF DISPLACEMENT.    FEPARCS4
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION A(1),B(1),MAXA(1)
C
      N  = NEQ
C
      DO 100 I=1,NEQ
      K = MAXA(I)
100   B(I) = B(I)/A(K)
C
      DO 600 L=2,NEQ
      KL = MAXA(N) + 1
      KU = MAXA(N+1) - 1
      IF(KU.LT.KL) GO TO 600
      IF(B(N).EQ.0.D0) GO TO 600
      K  = N
      C  = B(N)
      DO 400 KK=KL,KU
      K = K - 1
400   B(K) = B(K) - A(KK)*C
600   N  = N - 1
C
      RETURN
C
      END
C
```

```
C         ROUTINE VCMLT
C
C         THIS SEGMENT CARRIES OUT A VECTOR PRODUCT IN ASSEMBLER.
C*****************************************************************
VCMLT     CSECT
          USING VCMLT,12
          STM   14,12,12(13)
          LR    12,15
          LA    11,SAVE
          ST    11,8(0,13)
          ST    13,4(0,11)
          LR    13,11
*
          L     2,0(1)
          L     4,4(1)
          L     5,8(1)
          L     3,12(1)
          L     3,0(3)
          SLL   3,3
          LA    8,8
          LR    9,3
          SR    9,8
          SR    7,7
          SDR   0,0
*
RET       LD    4,0(2,7)
          MD    4,0(4,7)
          ADR   0,4
          BXLE  7,8,RET
          STD   0,0(5)
          L     13,4(0,13)
          LM    14,12,12(13)
          SR    15,15
          BR    14
SAVE      DS    18F
          END
C
```

```
      SUBROUTINE ARGYRS (X,C)
C
C     THIS SEGMENT CALCULATES THE CONTROL PARAMETERS OF THE
C     FIVE-CONSTANT ARGYRES FAILURE SURFACE.              FEPARCS5
C     *****************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION X(6),C(9)
      DATA C1,C2,C3,C4,C5,C6,C7/1.D0,2.D0,3.D0,4.D0,9.D0,
     *1.095445115D0,.3651483716D0/
C
      AC = X(1)
      AT = X(2)
      SI1 = X(3)
      RO1 = X(4)
      SI2 = X(5)
      RO2 = X(6)
      A2 = (C6*SI1*(AT-AC) - C6*AC*AT + RO1*(C2*AC+AT))/
     *     ((C2*AC+AT)*(SI1-AC*C2/C3)*(SI1+AT*C1/C3))
      A1 = A2*(C2*AC-AT)/C3 + C6*(AT-AC)/(C2*AC+AT)
      A0 = AC*A1*C2/C3 - A2*AC*AC*C4/C5 + C7*AC
C
      S0 = (-A1 -DSQRT(A1*A1 - C4*A0*A2))/C2/A2
C
      B2 = (RO2*(S0+C1/C3) - C7*(S0+SI2))/
     *     ((SI2+S0)*(SI2-C1/C3)*(S0+C1/C3))
      B1 = (SI2+C1/C3)*B2 + (C6-C3*RO2)/(C3*SI2-C1)
      B0 = -S0*B1 - S0*S0*B2
C
      RI = (-(B1-A1) + DSQRT((B1-A1)**2 - C4*(B2-A2)*(B0-A0)))/
     *     (B2-A2)/C2
      RM = -SI2
C
      IF(A2.GT.0.D0.OR.
     *   A1.GT.0.D0.OR.
     *   A0.LE.0.D0.OR.
     *   B2.GT.0.D0.OR.
     *   B1.GT.0.D0.OR.
     *   B0.LE.0.D0)       GO TO 999
      C(1) = A2
      C(2) = A1
      C(3) = A0
      C(4) = B2
      C(5) = B1
      C(6) = B0
      C(7) = S0 - 1.D-6
      C(8) = RI
      C(9) = RM + 1.D-6
C
      RETURN
C
999   WRITE(6,1999) (X(I),I = 1,6),(C(I),I = 1,8)
1999  FORMAT(///,'ERROR...CONVEXITY'//,6D15.6//,8D15.6)
      STOP
      END
```

```
      SUBROUTINE ARGYRV (XA,DVG,HVG,CTH,XH,XD)
C
C     THIS SEGMENT CALCULATES A CONTROL POINT IN PRINCIPAL STRE
C     SS(STRAIN) SPACE ON A FAILURE SURFACE.              FEPARCS5
C     ********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /DATA1/ CD,CL,CT,CPN,CPT,CP,EP,TU,TP,RX,IS,MI,NI,KI
      COMMON /FILES/ IN,IO,INS,IOS,IST,ILD
      DIMENSION XA(1)
C
      XB = 1.D0
      CTH2 = 4.D0*CTH*CTH
      IF(DABS(HVG).GT.1.D-6) GO TO 100
      XD = 0.D0
      XH = 0.D0
      IF(DVG.LT.1.D-6) GO TO 1000
      XD = ARGYRX(XH,CTH,CTH2,XA(1))
      GO TO 1000
100   IF(DVG.GT.1.D-6) GO TO 200
      XD = 0.D0
      XH = XA(7)
      IF(HVG.LT.0.D0) XH = XA(9)
      GO TO 1000
C
200   XH = HVG*XB
      XD = DVG*XB
      IF(XH.GT.XA(9)) GO TO 300
      XD = XD*XA(9)/XH
      XH = XA(9)
      GO TO 400
300   IF(XH.LT.XA(7)) GO TO 400
      XD = XD*XA(7)/XH
      XH = XA(7)
400   Y1 = XD - ARGYRX(XH,CTH,CTH2,XA(1))
      IF(Y1.GE.0.D0) GO TO 500
      XB  = XB*2.D0
      Y2  = Y1
      XD2 = XD
      XH2 = XH
      GO TO 200
C
500   IF(XB.GT.1.D0) GO TO 600
550   XB  = XB/2.D0
      Y2  = Y1
      XD2 = XD
      XH2 = XH
      XH  = HVG*XB
      XD  = DVG*XB
      Y1  = XD - ARGYRX(XH,CTH,CTH2,XA(1))
      IF(Y1.GE.0.D0) GO TO 550
C
600   XH1 = XH
      XD1 = XD
      K = 0
```

```
      P = -1.D6
700   IF(DABS(Y1-Y2).LT.1.D-6) GO TO 1000
      XH = (Y1*XH2-Y2*XH1)/(Y1-Y2)
      XD = XD1*XH/XH1
      TEST = DABS(XD-P)/XD
      IF(TEST.LT.EP) GO TO 1000
      Y3 = XD - ARGYRX(XH,CTH,CTH2,XA(1))
      P = XD
      IF(Y1*Y3.GT.0.D0) GO TO 800
      XH2 = XH
      XD2 = XD
      Y2  = Y3
      GO TO 900
800   XH1 = XH
      XD1 = XD
      Y1  = Y3
900   K   = K + 1
      IF(K.LE.MI) GO TO 700
      WRITE(IO,2000) MI,HVG,DVG,XH,XD
      STOP
C
1000  RETURN
C
2000  FORMAT('MAX. ITER. NO. IS EXCEEDED',I3,4D15.6)
C
      END
C
```

```
      FUNCTION ARGYRX (XH,CTH,CTH2,XA)
C
C     THIS SEGMENT OBTAINS AN AVERAGE SHEAR STRESS POINT ON THE
C     ELLEPTIC TRACE OF THE 5-PARAMETER ARGYRIS SURFACE,CORRESP
C     ONDING TO A HYDROSTATIC STRESS XH AND AN ANGLE OF SIMILAR
C     ITY CTH.                                          FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION XA(1)
C
      R1 = XA(3) + (XA(2) + XA(1)*XH)*XH
      R2 = XA(6) + (XA(5) + XA(4)*XH)*XH
      IF(XH.LT.XA(8)) R1 = R2
      R3 = R2*R2 - R1*R1
      R4 = 2.D0*R1 - R2
      R5 = R3*CTH2 + (5.D0*R1 - 4.D0*R2)*R1
C
      R  = R2*(2.D0*R3*CTH + R4*DSQRT(DABS(R5)))/
     *        (R3*CTH2 + R4*R4)
      ARGYRX = R
C
      RETURN
C
      END
C
```

```
      SUBROUTINE CONSTM (EMDC,PRTC,CM)
C
C     THIS SEGMENT PREPARES AN AXISYMMETRIC CONSTITUTIVE MATRIX
C     FOR AN ORTHOTROPIC 3-D MATERIAL.                    FEPARCS5
C     *********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION EMDC(1),PRTC(1),CM(4,1)
C
C     FORM MATERIAL STIFFNESS MATRIX
      P23 = DSQRT(PRTC(2)*PRTC(3))
      P13 = DSQRT(PRTC(1)*PRTC(3))
      P21 = DSQRT(PRTC(2)*PRTC(1))
      Y12 = DSQRT(DABS(EMDC(1)*EMDC(2)))
      Y23 = DSQRT(DABS(EMDC(2)*EMDC(3)))
      Y31 = DSQRT(DABS(EMDC(3)*EMDC(1)))
      PHI = 1.D0 - P23*P23 - P13*P13 - P21*P21 - 2.D0*P21*P23*P13
C
      CM(1,1) = EMDC(1)*(1.D0-P23*P23)/PHI
      CM(1,2) = Y12*(P23*P13+P21)/PHI
      CM(1,3) = Y31*(P23*P21+P13)/PHI
      CM(2,1) = CM(1,2)
      CM(2,2) = EMDC(2)*(1.D0-P13*P13)/PHI
      CM(2,3) = Y23*(P21*P13+P23)/PHI
      CM(3,1) = CM(1,3)
      CM(3,2) = CM(2,3)
      CM(3,3) = EMDC(3)*(1.D0-P21*P21)/PHI
      DO 100 I=1,3
      CM(I,4) = 0.D0
100   CM(4,I) = 0.D0
      CM(4,4) = EMDC(4)
C
500   RETURN
C
      END
C
```

```
      SUBROUTINE ORDER (SIGP,SIGD)
C
C     THIS SEGMENT REARRANGES THE PRINCIPAL STRESS VECTOR IN
C     ASCENDING ORDER OF MAGNITUDE.                             FEPARCS5
C     *************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION SIGP(3),SIGD(3)
C
      SMIN = SIGP(1)
      SMAX = SIGP(1)
      IMIN = 1
      IMAX = 1
      DO 100 I=2,3
      IF(SMIN.GT.SIGP(I)) IMIN = I
      IF(SMAX.LT.SIGP(I)) IMAX = I
      SMIN = SIGP(IMIN)
100   SMAX = SIGP(IMAX)
C
      SIGD(1) = SMIN
      SIGD(3) = SMAX
C
      DO 200 I=1,3
      IF(IMIN.EQ.I.OR.IMAX.EQ.I) GO TO 200
      K = I
      GO TO 300
200   CONTINUE
300   SIGD(2) = SIGP(K)
C
      RETURN
C
      END
C
```

```
      FUNCTION  POISN (PRTI,EPSQ,EPSC)
C
C     THIS SEGMENT CALCULATES POISSON'S RATIO AS A FUNCTION OF
C     CURRENT EQUIVALENT UNIAXIAL STRAIN.                     FEPARCS5
C     *************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
C
      IF(DABS(EPSC).LT.1.D-12) GO TO 400
      EE     = EPSQ/EPSC
      IF(EPSQ.GT.0.D0) GO TO 100
      PRTC   = PRTI*(1.D0+1.3763*EE-5.36D0*EE**2+8.586D0*EE**3)
      IF(PRTC.LT.PRTI) PRTC = PRTI
      IF(PRTC.GT.0.49D0) PRTC = 0.49D0
      GO TO 400
C
100   IF(EE.GT.0.5D0) GO TO 200
      PRTC = PRTI
      GO TO 400
C
200   IF(EE.GT.1.D0) GO TO 300
      PRTC = PRTI*2.D0*(1.D0 - EE)
      GO TO 400
C
300   PRTC = 0.D0
C
400   POISN = PRTC
C
      RETURN
C
      END
C
```

```
      SUBROUTINE SAENZ (SIGQ,EPSQ,SIGC,EPSC,EMDC,EMDI,IBRK,I,IT)
C
C     THIS SEGMENT CALCULATES STRESS AND YOUNG'S MODULUS AS FUN
C     CTIONS OF CURRENT EQUIVALENT UNIAXIAL STRAIN AND CURRENT
C     MATERIAL PROPERTIES.                                FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /DATA2/ EPSY,EDBR
      IF(DABS(SIGC).LT.1.D-6.OR.DABS(EPSC).LT.1.D-12) GO TO 800
      IBRK = 0
      EE = EPSQ/EPSC
      ES = SIGC/EPSC
      RE = EMDI/ES
      IF(EE.GT.1.D0) GO TO 200
C
C     SAENZ THREE PARAMETER EQUATION UP TO PEAK
      AA    = 1.D0 + (RE - 2.D0)*EE + EE*EE
      SIGQ  = EMDI*EPSQ/AA
      EMDC  = EMDI*(1.D0 - EE*EE)/(AA*AA)
      GO TO 800
C
C     PIECEWISE LINEAR DEGRADING CURVE BEYOND PEAK
200   IBRK = 1
      IF(I+IT.EQ.5) GO TO 500
      AY   = DFLOAT(IDINT(EPSY/DABS(EPSC)))
      AX   = AY + 1.D0
      IF(EPSQ.LT.0.D0) AX = 2.D0
      IF(EE.GT.AX) GO TO 300
      EMDC = -EDBR*ES
      SIGQ = SIGC*(1.D0 - EDBR*(EE - 1.D0))
      IF(SIGQ*SIGC.LE.0.D0) GO TO 400
      GO TO 800
300   IF(EPSQ.LT.0.D0) GO TO 400
      BS   = 1.D0 - EDBR*AY
      IF(BS.LE.0.D0) GO TO 400
      ED   = EDBR/1.D2
      AZ   = BS/ED + AX
      IF(EE.GT.AZ) GO TO 400
      SIGQ = SIGC*ED*(AZ - EE)
      EMDC = -ED*ES
      GO TO 800
C
C     CONCRETE HAS COMPLETELY DETERIORATED
400   SIGQ  = 0.D0
      EMDC  = 0.D0
      IBRK  = 2
      GO TO 800
C
C     SHEAR STRESS STRAIN CURVE
500   SIGQ = SIGC*(1.D0 - EDBR*(EE - 1.D0)/1.D1)
      EMDC = -EDBR*ES/1.D1
C
800   RETURN
      END
```

```
      SUBROUTINE STREN (SOTN,SOTO,STSP,SOTC,XCU,SCU,STU)
C
C     THIS SEGMENT CALCULATES  MAXIMUM STRESSES CORRESPONDING TO
C     A GIVEN STATE OF STRESS, OR THE CORRESPONDING EQUIVALENT
C     UNIAXIAL STRAINS.                                    FEPARCS5
C     (SOT = SECOND ORDER TENSOR)
C     ****************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION SOTF(3),SOTO(1),SOTN(1),SOTP(3),STSP(1),SOTC(1),
     *          SOTQ(3),CS(3)
C
C     OBTAIN PRINCIPAL STRESSES
      CALL STRSSP (SOTN(1),SOTP(1),GAMA)
      CALL STRSSP (SOTO(1),SOTQ(1),GAMA)
      SN = DSQRT(SOTP(1)**2+SOTP(2)**2+SOTP(3)**2)
      SO = DSQRT(SOTQ(1)**2+SOTQ(2)**2+SOTQ(3)**2)
C
C     CHECK FAILURE MODE
      K = 1
      DO 100 I=1,3
100   IF(SOTP(I).GE.0.D0) K = K + 1
      IF(K.LE.2) GO TO 300
C
C     TENSION-TENSION-(TENSION/COMPRESSION)
      DO 200 I=1,3
      IF(SOTP(I).GT.0.D0) SOTF(I) = STU
200   IF(SOTP(I).LE.0.D0) SOTF(I) = SCU
      GO TO 800
C
C     COMPRESSION-COMPRESSION-(TENSION/COMPRESSION)
C     OBTAIN MEAN NORMAL STRESS(HVG), MEAN SHEAR STRESS(DVG),
C     AND COSINE ANGLE OF SIMILARITY(CTH).
300   CALL ORDER (SOTP(1),SOTF(1))
      SDV = (SOTF(1)-SOTF(2))**2+(SOTF(2)-SOTF(3))**2+(SOTF(3)
     *       -SOTF(1))**2
      DVG = DSQRT(SDV/15.D0)/DABS(XCU)
      HVG = -(SOTF(1) + SOTF(2) + SOTF(3))/3.D0/XCU
      CTH = 1.D0
      IF(SDV.LT.1.D-12) GO TO 400
      CTH = -(SOTF(1) + SOTF(2)-2.D0*SOTF(3))/DSQRT(SDV*2.D0)
400   DO 500 I=1,3
500   CS(I) = SOTP(I)/SN
C
C     FIND MAGNITUDE(SD) OF FAILURE VECTOR
      CALL ARGYRV(STSP(1),DVG,HVG,CTH,HS,DS)
      SD = DSQRT(HS*HS*3.D0  +  DS*DS*5.D0)*DABS(SCU)
      DO 600 I=1,3
600   SOTF(I) = CS(I)*SD
      IF(K.EQ.1) GO TO 800
C
C     COMPRESSION-COMPRESSION-TENSION
      DO 700 I=1,3
700   IF(SOTF(I).LT.0.D0.AND.SOTF(I).GT.SCU) SOTF(I) = SCU
C
```

```
800    SD = DSQRT(SOTF(1)**2+SOTF(2)**2+SOTF(3)**2)
       SQ = SD/SO
       DO 900 I=1,3
       SOTC(I) = SOTO(I)*SQ
900    IF(SOTC(I).GT.STU) SOTC(I) = STU
C
       SOTC(4) = DSQRT(SD**2-((SOTF(1)+SOTF(2)+SOTF(3))/3.D0)**2)
      *         *DSIGN(1.D0,SOTO(4))
       RETURN
C
       END
C
```

```
      SUBROUTINE TRANSF (CM,GAMA,ISTYP)
C
C     THIS SEGMENT TRANSFORMS MATERIAL STIFFNESS MATRIX AND THE
C     RMAL PROPERTIES VECTOR INTO GLOBAL COORDINATES.   FEPARCS5
C     *****************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION CM(4,4),TR(4,4),CT(4,4)
C
C     FORM TRANSFORMATION MATRIX
      CO = DCOS(GAMA)
      SI = DSIN(GAMA)
      CO2 = CO*CO
      SI2 = SI*SI
      CS  = CO*SI
      TR(1,1) = CO2
      TR(1,2) = SI2
      TR(1,4) = CS
      TR(2,1) = SI2
      TR(2,2) = CO2
      TR(2,4) =-CS
      TR(4,1) =-2.D0*CS
      TR(4,2) = 2.D0*CS
      TR(4,4) = CO2 - SI2
      DO 100 I=1,4
      TR(I,3) = 0.D0
100   TR(3,I) = 0.D0
      IF(ISTYP.EQ.1) TR(3,3) = 1.D0
C
C     TRANSFORM STIFFNESS MATRIX
      DO 300 I=1,4
      DO 300 J=1,4
      C       = 0.D0
      DO 200 K=1,4
200   C       = C + CM(K,J)*TR(K,I)
300   CT(J,I) = C
      DO 500 I=1,4
      DO 500 J=1,4
      C       = 0.D0
      DO 400 K=1,4
400   C       = C + TR(K,J)*CT(K,I)
500   CM(J,I) = C
C
900   RETURN
C
      END
C
```

```
      SUBROUTINE TRANSS (SIGO,SIGR,GAMA)
C
C     THIS SEGMENT TRANSFORMS CURRENT PRINCIPAL STRESSES INTO
C     GLOBAL COORDINATES.                                    FEPARCS5
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION SIGO(1),SIGR(1)
C
      SIGM = (SIGO(1) + SIGO(2))/2.D0
      SIGN = (SIGO(1) - SIGO(2))/2.D0
      CO   = DCOS(2.D0*GAMA)
      SI   = DSIN(2.D0*GAMA)
C
      SIGR(1) = SIGM + SIGN*CO + SIGO(4)*SI
      SIGR(2) = SIGM - SIGN*CO - SIGO(4)*SI
      SIGR(3) = SIGO(3)
      SIGR(4) = SIGO(4)*CO - SIGN*SI
C
      RETURN
C
      END
C
```

```
      SUBROUTINE ELMDT1 (ME,NS,XEL,YEL,NPELM,XCORD,YCORD)
C
C     THIS SEGMENT LOCATES SOME ELEMENT VARIABLES.      FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION XEL(1),YEL(1),YCORD(1),NPELM(12,1),XCORD(1)
C
      DO 100 I=1,NS
      NODE = NPELM(I,ME)
      XEL(I) = XCORD(NODE)
      YEL(I) = YCORD(NODE)
100   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE ELMDT2 (ME,NS,DEL,NPELM,DQ)
C
C     THIS SEGMENT OBTAINS ELEMENT MATERIAL INFORMATION AND NOD
C     AL DISPLACEMENTS.                                        FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION NPELM(12,1),DQ(1),DEL(1)
C
      DO 100 I=1,NS
      NODE = NPELM(I,ME)
      ND   = NODE*2
      I2 = 2*I
      I1 = I2 - 1
      DEL(I1) = DQ(ND-1)
      DEL(I2) = DQ(ND)
100   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE ELMDT3 (ME,NS,NPELM,TEMPI,TEL)
C
C     THIS SEGMENT OBTAINS ELEMENT NODAL TEMPRATURE.    FEPARCS5
C     *****************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION NPELM(12,1),TEMPI(1),TEL(1)
C
      DO 100 I=1,NS
      NODE = NPELM(I,ME)
      TEL(I) = TEMPI(NODE)
100   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE ELMDT4 (ME,IC,NS,NGL,NG,NDELM,NGELM,ICLSE)
C
C     THIS SEGMENT IDENTIFEIES THE INTEGRATION SCHEME.  FEPARCS5
C     ****************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION NDELM(1),NGELM(1),ICLSE(1)
C
      IC   = ICLSE(ME)
      NS   = NDELM(ME)*4
C
      NGL  = NGELM(ME)
      NG   = NGL/10
      NGL  = NGL - NG*10
C
      RETURN
C
      END
C
```

```
      SUBROUTINE SHAPE1 (ETA,NDEG,PHI,PHIY)
C
C     THIS SUBROUTINE COMPUTES ONE DIMENSIONAL SHAPE FUNCTIONS
C     AND DERIVATIVES.                                        FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION PHI(1),PHIY(1), ICORD(4,3)
      DATA ICORD/-1,1,2*0,-1,0,1,0,-3,-1,1,3/
C
      GO TO (100,300,600),NDEG
C
C     LINEAR SHAPE FUNCTIONS AND DERUVATIVES
100   K = 0
      DO 200 LJ = 1,2
      J  =  ICORD(LJ,1)
      RJ = DFLOAT(J)
      K  =  K+1
      PHI(K)  = .5D0*(1.D0+RJ*ETA)
      PHIY(K) = .5D0*RJ
200   CONTINUE
      RETURN
C
C     QUADRATIC SHAPE FUNCTIONS AND DERIVATIVES
300   K  =  0
      ETA2  = ETA**2
      DO 500 LJ = 1,3
      J  =  ICORD(LJ,2)
      JA =  IABS(J)
      RJ = DFLOAT(J)
      IF(JA.NE.1) GO TO 400
C
C     END POINTS
      K  =  K+1
      PHI(K)  = .5D0*ETA*RJ*(1.D0+ETA*RJ)
      PHIY(K) = .5D0*RJ*(1.D0+2.D0*ETA*RJ)
      GO TO 500
C
C     MID.SIDE POINT
400   K  =  K+1
      PHI(K)  = 1.D0 - ETA2
      PHIY(K) = -2.D0*ETA
500   CONTINUE
      RETURN
C
C     QUBIC SHAPE FUNCTIONS AND DERIVATIVES
600   K = 0
      ETA2  =  ETA**2
      C16  = 1.D0/1.6D1
      C916 = 9.D0*C16
      DO 800 LJ = 1,4
      J  =  ICORD(LJ,3)
      JA = (IABS(J)+1)/3
      RJ =  DFLOAT(J)/3.D0
      IF(JA.NE.1) GO TO 700
```

```
C
C     END POINTS
      K  =  K+1
      PHI(K)  =  C16*(9.D0*ETA2-1.D0)*(1.D0+RJ*ETA)
      PHIY(K) =  C16*(1.8D1*ETA-RJ+2.7D1*RJ*ETA2)
      GO TO 800
C
C     SIDE POINTS
700   K  =  K+1
      PHI(K)  = C916*(1.D0+9.D0*RJ*ETA)*(1.D0-ETA2)
      PHIY(K) = C916*(9.D0*RJ-2.D0*ETA-2.7D1*RJ*ETA2)
800   CONTINUE
      RETURN
      END
C
```

```
      SUBROUTINE SHAPE2 (XI,ETA,NSR,NDEG,PHI,PHIX,PHIY)
C
C     THIS SEGMENT FORMS THE SHAPE FUNCTION AND DERIVATIVES WITH
C     REPECT TO NONDIMENSIONAL COORDINATES, AT THE GAUSS POINT
C     SPECIFIED BY(XI,ETA).                                  FEPARCS5
C     **************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION PHI(1),PHIX(1),PHIY(1), ICORD(4,3),NPORD(12,3)
      DATA ICORD/-1,1,2*0,-1,0,1,0,-3,-1,1,3/
     *     ,NPORD/1,4,2,3,8*0,1,8,7,2,6,3,4,5,4*0,
     *           1,12,11,10,2,9,3,8,4,5,6,7/
C
      GO TO (100,400,700), NDEG
C
C     SHAPE FUNCTIONS AND DERIVATIVES FOR LINEAR DISPLACEMENT
100   K = 0
      DO 200 LI = 1,2
      I = ICORD(LI,1)
      RI = DFLOAT(I)
      DO 200 LJ = 1,2
      J = ICORD(LJ,1)
      RJ = DFLOAT(J)
      K = K+1
      N = NPORD(K,1)
      X1 = (1.D0+RI*XI)
      Y1 = (1.D0+RJ*ETA)
      PHI(N) = 2.5D-1*X1*Y1
      IF(NSR.EQ.1) GO TO 200
      PHIX(N) = 2.5D-1*RI*Y1
      PHIY(N) = 2.5D-1*RJ*X1
200   CONTINUE
      RETURN
C
C     SHAPE FUNCTIONS AND THEIR DERIVATIVES FOR QUADRATIC DISPL
C     ACEMENTS.
400   K = 0
      XI2 = XI**2
      ETA2 = ETA**2
      DO 600 LI = 1,3
      I = ICORD(LI,2)
      IA = IABS(I)
      RI = DFLOAT(I)
      DO 600 LJ = 1,3
      J = ICORD(LJ,2)
      JA = IABS(J)
      RJ = DFLOAT(J)
      IF(IA.NE.1.OR.JA.NE.1) GO TO 500
C
C     CORNER POINTS
      K = K+1
      N = NPORD(K,2)
      X1 = 1.D0+RI*XI
      Y1 = 1.D0+RJ*ETA
      PHI(N) = 2.5D-1*X1*Y1*(X1+Y1-3.D0)
```

```
      IF(NSR.EQ.1) GO TO 600
      PHIX(N) = 2.5D-1*Y1*(2.D0*X1+Y1-3.D0)*RI
      PHIY(N) = 2.5D-1*X1*(2.D0*Y1+X1-3.D0)*RJ
      GO TO 600
C
C     AT INTERIOR POINTS ON SIDES
500   IF(IA.EQ.0.AND.JA.EQ.0) GO TO 600
      K = K+1
      N = NPORD(K,2)
      IF(IA.EQ.0) GO TO 550
      X1 = 1.D0+RI*XI
      Y1 = 1.D0-ETA2
      PHI(N) = .5D0*X1*Y1
      IF(NSR.EQ.1)GO TO 600
      PHIX(N) = .5D0*RI*Y1
      PHIY(N) = -ETA*X1
      GO TO 600
C
550   X1 = 1.D0-XI2
      Y1 = 1.D0+RJ*ETA
      PHI(N) = .5D0*X1*Y1
      IF(NSR.EQ.1) GO TO 600
      PHIX(N) = -XI*Y1
      PHIY(N) = .5D0*RJ*X1
C
600   CONTINUE
      RETURN
C
C     SHAPE FUNCTIONS AND THEIR DERIVATIVES FOR CUBIC DISPLACEM
C     ENTS
700   K = 0
      XI2 = XI**2
      ETA2 = ETA**2
      C32 = 1.D0/3.2D1
      C932 = 9.D0/3.2D1
      DO 900 LI = 1,4
      I = ICORD(LI,3)
      IA = (IABS(I)+1)/3
      RI = DFLOAT(I)/3.D0
      DO 900 LJ = 1,4
      J = ICORD(LJ,3)
      JA = (IABS(J)+1)/3
      RJ = DFLOAT(J)/3.D0
      IF(IA.NE.1.OR.JA.NE.1) GO TO 750
C
C     CORNER POINTS
      K = K+1
      N = NPORD(K,3)
      X1 = 1.D0+RI*XI
      Y1 = 1.D0+RJ*ETA
      XY = 9.D0*(ETA2+XI2)-1.D1
      PHI(N) = C32*X1*Y1*XY
      IF(NSR.EQ.1) GO TO 900
      PHIX(N) = C32*Y1*(RI*XY+1.8D1*XI*X1)
```

```
      PHIY(N) = C32*X1*(RJ*XY+1.8D1*ETA*Y1)
      GO TO 900
C
C     AT INTERIOR POINTS ON SIDES
750   IF(IA.EQ.0.AND.JA.EQ.0)  GO TO 900
      K = K+1
      N = NPORD(K,3)
      IF(IA.NE.1)  GO TO 800
      X1 = 1.D0+RI*XI
      Y1 = 1.D0-ETA2
      Y2 = 1.D0+9.D0*RJ*ETA
      PHI(N) = C932*Y1*X1*Y2
      IF(NSR.EQ.1) GO TO 900
      PHIX(N) = C932*Y1*Y2*RI
      PHIY(N) = C932*X1*(9.D0*RJ*Y1-2.D0*ETA*Y2)
      GO TO 900
C
800   X1 = 1.D0-XI2
      Y1 = 1.D0+RJ*ETA
      X2 = 1.D0+9.D0*RI*XI
      PHI(N) = C932*X1*Y1*X2
      IF(NSR.EQ.1) GO TO 900
      PHIX(N) = C932*Y1*(9.D0*RI*X1-2.D0*XI*X2)
      PHIY(N) = C932*RJ*X1*X2
C
900   CONTINUE
C
      RETURN
      END
C
```

```
      FUNCTION ISPAC(NAME,LENGTH,K)
C
C   A SIMPLE MANAGER WHICH WORKS WITH 5 FIXED LENGTH COMMON BLO
C   CKS, A 5-COLUMN NAME DIRECTORY AND POINTER DIRECTORY.
C******************************************************************
      REAL*8 NAMES,NAME
      COMMON /DIMCOM/ NAMES(5,30),LAST1,LAST2,LAST3,LAST4,LAST5,
     *MAXDIM,IPT(5,31),ICOM(5)
C
C   CHECK IF NAME ALREADY EXISTS.
      ISPACE = LOCOM(NAME,K)
      IF(ISPACE.EQ.0) GO TO 10
      GO TO 100
C
C   ENTER NEW NAME IN DIRECTORY.
10    GO TO (20,30,40,50,60),K
20    LAST1 = LAST1 + 1
      LAST  = LAST1
      GO TO 70
30    LAST2 = LAST2 + 1
      LAST  = LAST2
      GO TO 70
40    LAST3 = LAST3 + 1
      LAST  = LAST3
      GO TO 70
50    LAST4 = LAST4 + 1
      LAST  = LAST4
      GO TO 70
60    LAST5 = LAST5 + 1
      LAST  = LAST5
C
70     IF(LAST.GT.MAXDIM) GO TO 200
      NAMES(K,LAST) = NAME
      ISPACE = IPT(K,LAST)
      IPT(K,LAST+1) = ISPACE + LENGTH
      IF((IPT(K,LAST+1)-1).GT.ICOM(K)) GO TO 300
      ISPAC = ISPACE
C
      RETURN
C
C   EXITS RESULTING FROM DIAGNOSED ERRORS
100   WRITE(6,1000) NAME
1000  FORMAT(22H***NAME ALREADY EXISTS,10X,A8)
      GO TO 400
200   WRITE(6,2000) NAME,K
2000  FORMAT(17H***TABLE OVERFLOW ,10X,A8,I4)
      GO TO 400
300   WRITE(6,3000) NAME,K,IPT(K,LAST),LENGTH
3000  FORMAT(23H***COMMON AREA OVERFLOW ,A8,3I4)
400   CALL EXIT
C
      END
C
```

```
      FUNCTION LOCOM(NAME,K)
C
C   LOCATES INDEX OF A GIVEN NAME IN NAMES DIRECTORY.
C*******************************************************************
      REAL*8 NAME,NAMES
      COMMON /DIMCOM/ NAMES(5,30),LAST1,LAST2,LAST3,LAST4,LAST5,
     *MAXDIM,IPT(5,31),ICOM(5)
C
      GO TO (10,20,30,40,50),K
10    LAST = LAST1
      GO TO 60
20    LAST = LAST2
      GO TO 60
30    LAST = LAST3
      GO TO 60
40    LAST = LAST4
      GO TO 60
50    LAST = LAST5
C
60    IF(LAST.EQ.0) GO TO 200
      DO 100 M=1,LAST
      IF(NAMES(K,M).NE.NAME) GO TO 100
      LOCOM = M
      RETURN
100   CONTINUE
200   LOCOM = 0
C
      RETURN
C
      END
C
```

```
      SUBROUTINE REMOV (NAME,K)
C
C   REMOVES NAME, IF IT IS THE LAST VARIABLE IN COLUMN K, IN
C   DIRECTORY, AND UPDATES POINTERS ACCORDINGLY.
C*****************************************************************
      REAL*8 NAME,NAMES
      COMMON /DIMCOM/ NAMES(5,30),LAST1,LAST2,LAST3,LAST4,LAST5,
     *MAXDIM,IPT(5,31),ICOM(5)
C
      GO TO (10,20,30,40,50),K
10    LAST = LAST1
      GO TO 60
20    LAST = LAST2
      GO TO 60
30    LAST = LAST3
      GO TO 60
40    LAST = LAST4
      GO TO 60
50    LAST = LAST5
C
60    IF(NAMES(K,LAST).NE.NAME)  GO TO 150
C
C   LAST VARIABLE IN DIRECTORY COLUMN K IS NAME;  REMOVE IT.
      IPT(K,LAST+1) = 0
      NAMES(K,LAST) = 0
      GO TO (70,80,90,100,110),K
70    LAST1 = LAST1 - 1
      GO TO 120
80    LAST2 = LAST2 - 1
      GO TO 120
90    LAST3 = LAST3 - 1
      GO TO 120
100   LAST4 = LAST4 - 1
      GO TO 120
110   LAST5 = LAST5 - 1
C
120   RETURN
C
150   WRITE(6,1500) NAME,NAMES(K,LAST)
1500  FORMAT(37H***NAME IS NOT LAST VARIABLE IN NAMES  ,2A8)
      CALL EXIT
C
      END
C
```

```
      SUBROUTINE REMOV2 (K)
C
C     INITIALISES COLUMN K IN NAMES AND IPT, AND LASTK
C*****************************************************************
      REAL*8 NAME,NAMES
      COMMON /DIMCOM/ NAMES(5,30),LAST1,LAST2,LAST3,LAST4,LAST5,
     *MAXDIM,IPT(5,31),ICOM(5)
C
      GO TO (10,20,30,40,50),K
10    LAST = LAST1
      LAST1=0
      GO TO 60
20    LAST = LAST2
      LAST2=0
      GO TO 60
30    LAST = LAST3
      LAST3=0
      GO TO 60
40    LAST = LAST4
      LAST4=0
      GO TO 60
50    LAST = LAST5
      LAST5=0
C
60    LASTN = LAST + 1
      DO 100 J=2,LASTN
      J1 = J - 1
      NAMES(K,J1) = 0
      IPT(K,J)    = 0
100   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE CLEAR (A,LEN)
C
C     THIS SEGMENT CLEARS A DOUBLE PRESC. ARRAY OF LENGTH LEN.
C     **********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION A(LEN)
C
      DO 100 I=1,LEN
      A(I) = 0.D0
100   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE ICLEAR (J,LEN)
C
C     THIS SEGMENT CLEARS AN INTEGER ARRAY OF LENGTH LEN.
C     ************************************************************
      DIMENSION J(LEN)
C
      DO 100 I=1,LEN
      J(I) = 0
100   CONTINUE
C
      RETURN
C
      END
C
```

```
      SUBROUTINE BLKSTR (A,LENGTH,IOF)
C
C     THIS SEGMENT BLOCKS AND STORES A REAL*8 ARRAY ON FILE.
C                                                           FEPARCS5
C     ************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN
      DIMENSION A(1)
C
      NBLK = LENGTH/4000
      IF(NBLK.EQ.0) GO TO 200
      DO 100 K=1,NBLK
      LEN = 32000
      NOE = 4000*(K-1) + 1
100   CALL WRITE (A(NOE),LEN,0,LNUM,IOF)
200   LEN = (LENGTH - 4000*NBLK)*8
      NOE = 4000*NBLK + 1
      CALL WRITE (A(NOE),LEN,0,LNUM,IOF)
C
      RETURN
C
      END
C
```

```
      SUBROUTINE BLKRTV (A,LENGTH,INF)
C
C     THIS SEGMENT BLOCKS AND RETRIEVES A REAL*8 ARRAY FROM FILE.
C                                                            FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN
      DIMENSION A(1)
C
      NBLK = LENGTH/4000
      IF(NBLK.EQ.0) GO TO 200
      DO 100 K=1,NBLK
      NOE = 4000*(K-1) + 1
100   CALL READ (A(NOE),LEN,0,LNUM,INF)
200   NOE = 4000*NBLK + 1
      CALL READ (A(NOE),LEN,0,LNUM,INF)
C
      RETURN
C
      END
C
```

```
      SUBROUTINE STORE (K)
C
C     THIS SEGMENT STORES VARIABLES, ARRAYS AND POINTERS ON FILE
C     AT THE END OF A LOAD STEP.                           FEPARCS5
C     ************************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      REAL*8 NMS
      INTEGER*2 LEN
      COMMON /AAA/ AAA(1)
      COMMON /III/ III(1)
      COMMON /BBB/ BBB(1)
      COMMON /JJJ/ JJJ(1)
      COMMON /PROBCV/ KKK(21)
      COMMON /POINTR/ LLL(68)
      COMMON /FILES / IN,IO,INS,IOS,IST,ILD
      COMMON /DIMCOM/ NMS(150),L1,L2,L3,L4,L5,MX,IPT(155),ICM(5)
C
      IF(K.EQ.1) GO TO 100
      REWIND IST
C
      LEN = 4*21
      CALL WRITE (KKK(1),LEN,0,LNUM,IST)
      LEN = 4*68
      CALL WRITE (LLL(1),LEN,0,LNUM,IST)
      LNT = ICM(1)
      WRITE (IST) LNT
      CALL BLKSTR (AAA(1),LNT,IST)
      LEN = ICM(2)*4
      CALL WRITE (III(1),LEN,0,LNUM,IST)
      LNT = (LLL(44)-1)
      WRITE (IST) LNT
      CALL BLKSTR (BBB(1),LNT,IST)
      LEN = ICM(4)*4
      CALL WRITE (JJJ(1),LEN,0,LNUM,IST)
C
100   REWIND ILD
      LNT = 2*(LLL(46)-LLL(45))
      WRITE (ILD) LNT
      CALL BLKSTR (BBB(LLL(45)),LNT,ILD)
C
      RETURN
C
      END
C
```

```
      SUBROUTINE RSTORE
C
C     THIS SEGEMNT RESTORES VARIABLES, ARRAYS AND POINTERS FROM
C     FILE AT THE BEGINNING OF A LOAD STEP.                  FEPARCS5
C     ***********************************************************
      IMPLICIT REAL*8(A-H,O-Z)
      INTEGER*2 LEN
      COMMON /AAA/ AAA(1)
      COMMON /III/ III(1)
      COMMON /BBB/ BBB(1)
      COMMON /JJJ/ JJJ(1)
      COMMON /FILES / IN,IO,INS,IOS,IST,ILD
      COMMON /PROBCV/ KKK(21)
      COMMON /POINTR/ LLL(68)
C
      REWIND ILD
      REWIND IST
C
      CALL READ (KKK(1),LEN,0,LNUM,IST)
      CALL READ (LLL(1),LEN,0,LNUM,IST)
      READ (IST) LNT
      CALL BLKRTV (AAA(1),LNT,IST)
      CALL READ (III(1),LEN,0,LNUM,IST)
      READ (IST) LNT
      CALL BLKRTV (BBB(1),LNT,IST)
      CALL READ (JJJ(1),LEN,0,LNUM,IST)
      READ (ILD) LNT
      CALL BLKRTV (BBB(LLL(45)),LNT,ILD)
C
      RETURN
C
      END
```

APPENDIX E

EXAMPLE PROBLEM

As part of the research program mentioned in Chapter 1, a reinforced and prestressed concrete test structure composed of a dome, a ring beam, a cylinder and a massive base was built and tested to destruction under increasing internal pressure at the I.F. Morrison Structural Laboratory, University of Alberta in 1978. A finite element model of the test structure was analyzed by Elwi and Murray (1980) using FEPARCS5. The results of the analysis were compared with the test results and with the results of an elastic plastic analysis carried out by Murray, et al. (1978) using a modified version of program BOSOR5.

Figs. E.1 to E.4 show the layout and the details of reinforcing and prestressing of the test structure. Figs. E.5 to E.9 show the details of the finite element model. The finite element mesh shown in Fig. E.5 is controlled by the locations of the prestressing tendons, the shape of the ring beam and the anticipated stress gradients at the juncture of the ring beam and the cylinder wall. The details of the mesh at the ring beam, the boundary elements and the locations of the reinforcing and prestressing layers are shown in Figs. E.6 to E.8 respectively. Fig. E.9 shows the local coordinate directions of the finite element mesh. Those directions are governed by the description of the element connectivity in Section 1.7.2 of Appendix A. The order of Gaussian integration rule is 2x2 for the solid elements and a two point rule is automatically assumed for each reinforcing or prestressing layer within a solid element.

The dome prestressing layers have been transformed from the actual orthogonal geodetic mesh shown in Fig. E.2 into an equivalent circumferential meridional mesh (Elwi and Murray, 1980). The stress strain curves for the different kinds of rebars and prestressing tendons are shown in Figs. E.10 and E.11. The prestressing tendons are assigned thermal properties corresponding to the required level of prestressing. There are three levels of prestressing; 137.5 ksi in the circumferential tendons in the cylinder wall and the ring beam, 90.0 ksi in the vertical tendons in the cylinder wall and 113.1 ksi in the dome tendons. The first two levels are induced in 0.5"ϕ tendons. Therefore, two different material types with two different thermal expansion coefficients are defined to simulate those tendons. The dome prestressing tendons are 0.62"ϕ tendons and these have a different thermal expansion coefficient.

Two different types of concrete are used in the body of the model. Normal cast in place concrete is used in the lower half of the cylinder wall and in the ring beam and the dome. Gunite concrete is used in the upper half of the cylinder wall. The properties of those two types of concrete are shown in Tables E.1.a and E.1.b.

The model is subjected to a variety of loads. The pretensioning equivalent loads are applied in the first load step. Friction losses in the dome are simulated by meridional tangential tractions on the middle surface. Hydrostatic pressure is simulated by a normal pressure distribution on the inside surface. Those two types of loads are added to the gravity load to form the second load step. A normal pressure distribution of 1.0 psi on the inside surface is used to form a load vector which is factored to apply internal pressure in all subsequent load steps.

Ultimate Strength Surface Parameters		Equivalent Uniaxial Strain Surface Para.		Initial Elastic Moduli	
f_{cu}	-5680.0	ε_{cu}	-0.00217	E_{01}	$3.1 * 10^7$
α_c	1.2	α_c	1.3	E_{02}	$3.1 * 10^7$
α_t	0.032	α_t	.055	E_{03}	$3.1 * 10^7$
ξ_1	13.75	ξ_1	22.5	G_{012}	$1.3 * 10^7$
ρ_1	0.0	ρ_1	0.0	ν_{01}	0.2
ξ_2	3.75	ξ_2	22.5	ν_{02}	0.2
ρ_2	0.0	ρ_2	0.0	ν_{03}	0.2

(a) Material No. 1 (Normal Concrete)

Ultimate Strength Surface		Equivalent Uniaxial Strain Surface		Initial Elastic Moduli	
f_{cu}	-3540.0	ε_{cu}	-0.00238	E_{01}	$1.8 * 10^7$
α_c	1.2	α_c	1.3	E_{02}	$1.8 * 10^7$
α_t	.048	α_t	0.05	E_{03}	$1.8 * 10^7$
ξ_1	13.75	ξ_1	27.5	G_{012}	$0.75 * 10^7$
ρ_1	0.0	ρ_1	0.0	ν_{01}	0.2
ξ_2	3.75	ξ_2	22.5	ν_{02}	0.2
ρ_2	0.0	ρ_2	0.0	ν_{03}	0.2

(b) Material No. 2 (Gunite)

Table E.1 Concrete Material Properties of Test Structure

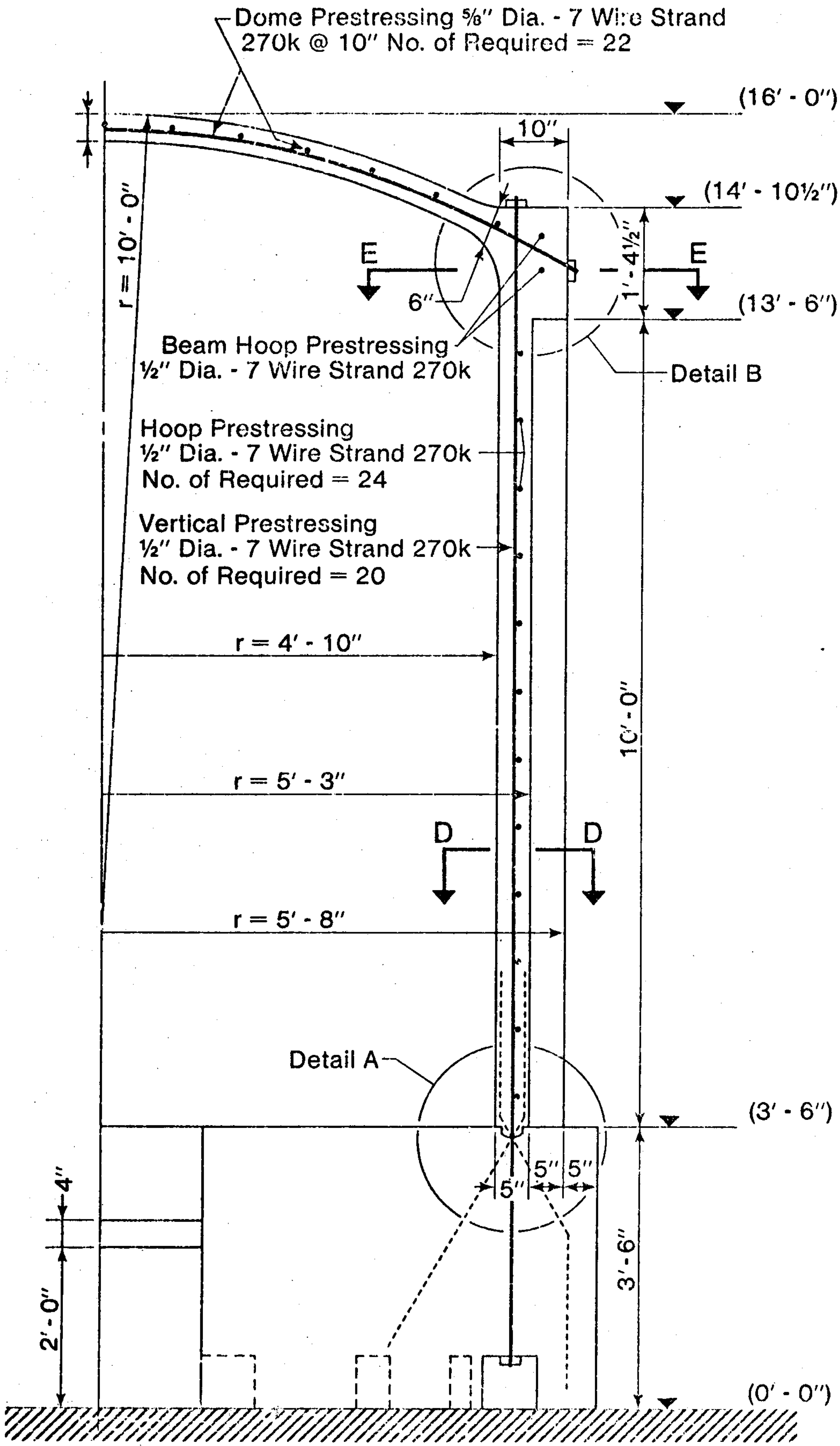


Fig. E.1 Elevation of Test Structure

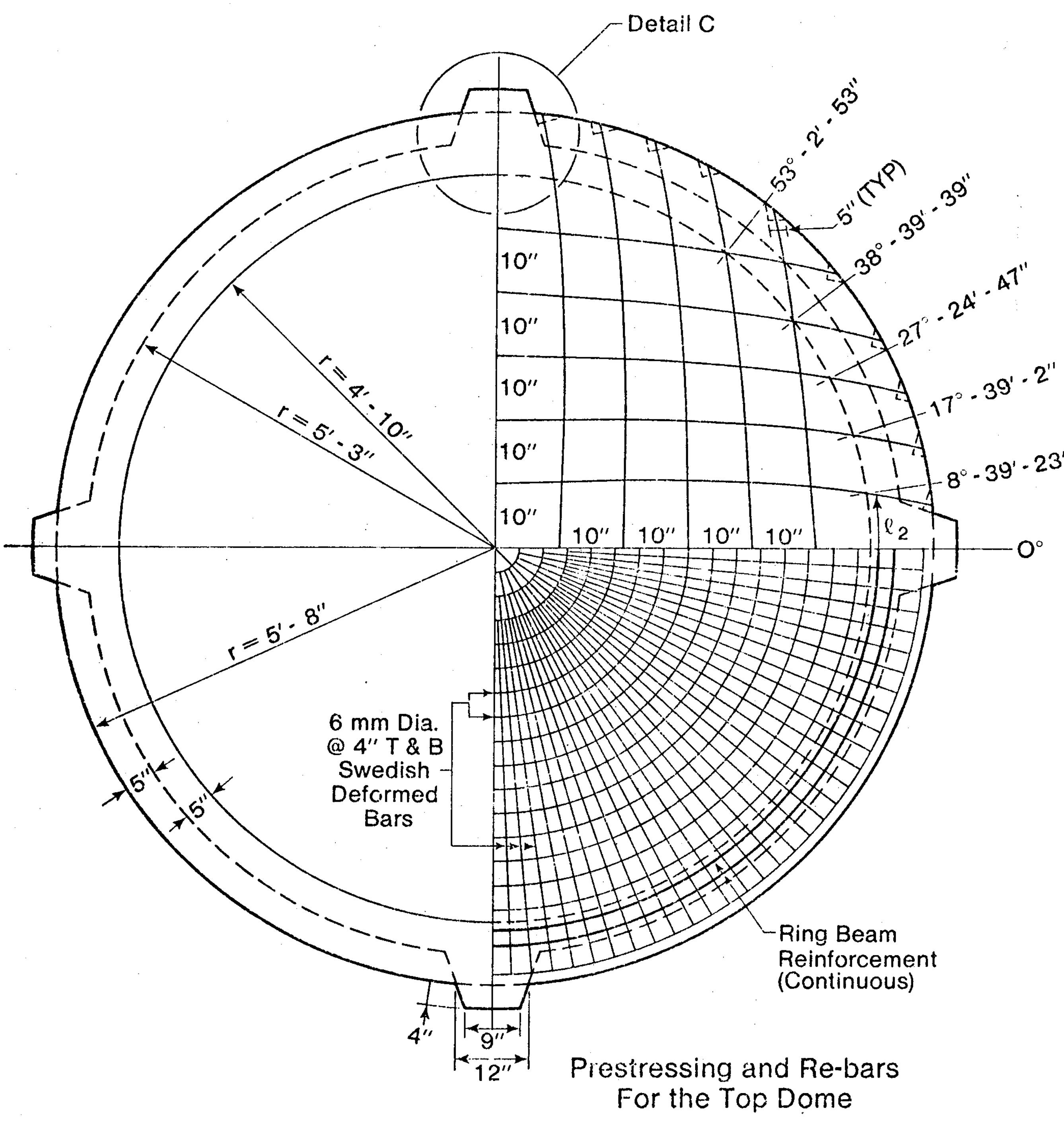


Fig. E.2 Prestressing Tendons and Reinforcing Layers for the Dome of the Test Structure

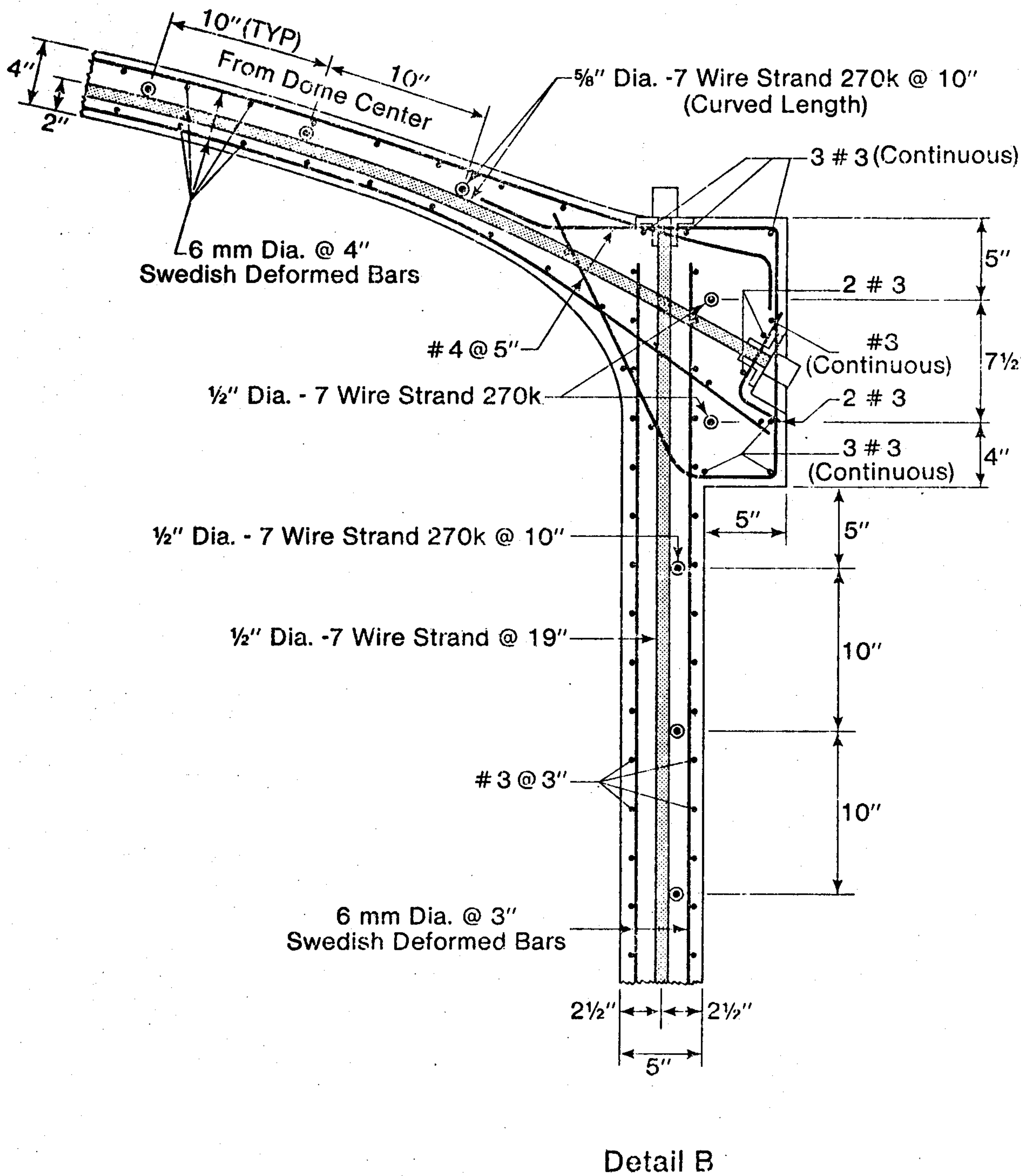


Fig. E.3 Detail of Ring Beam of Test Structure

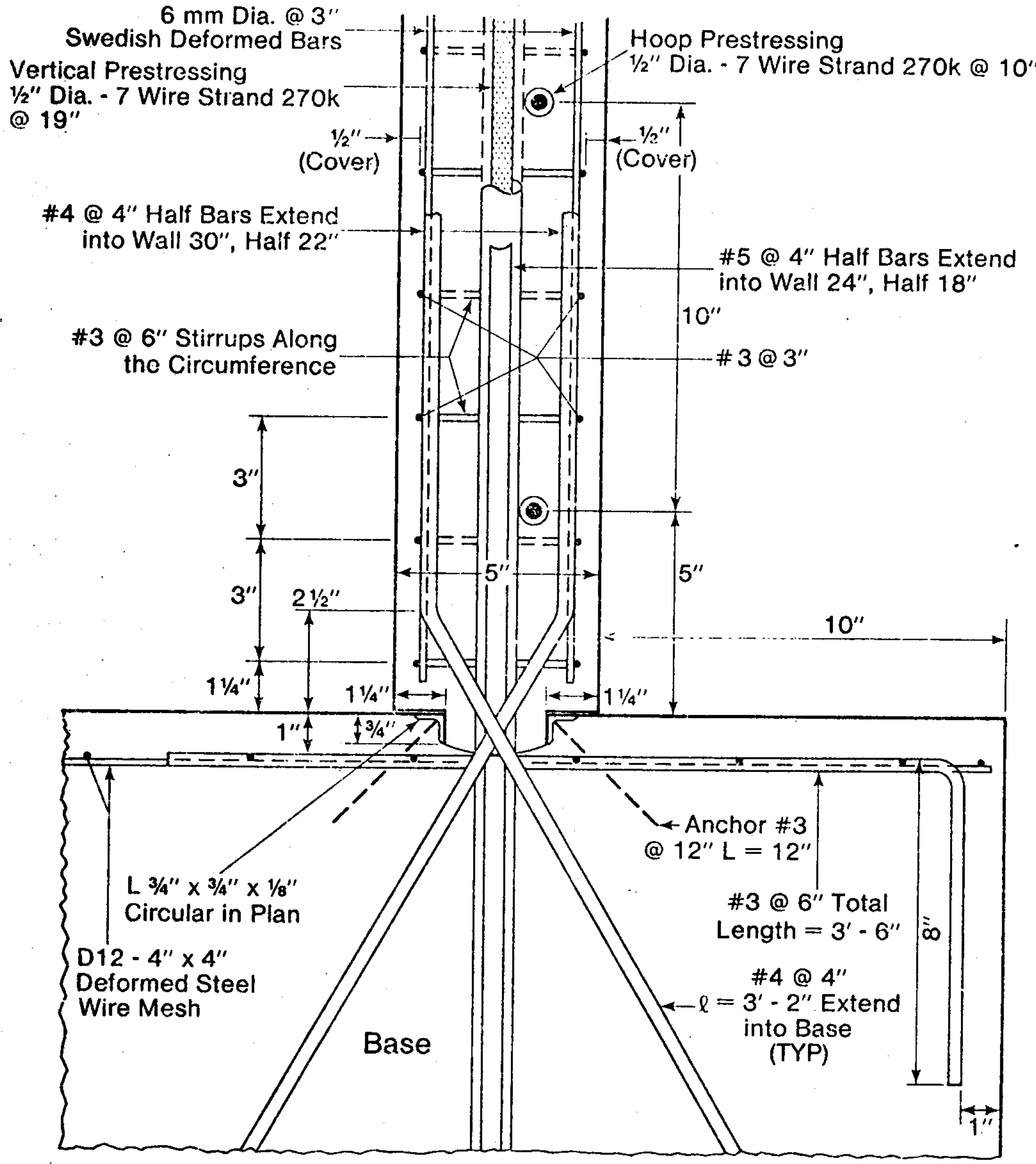


Fig. E.4 Detail of Cylinder Wall Base Connection of Test Structure

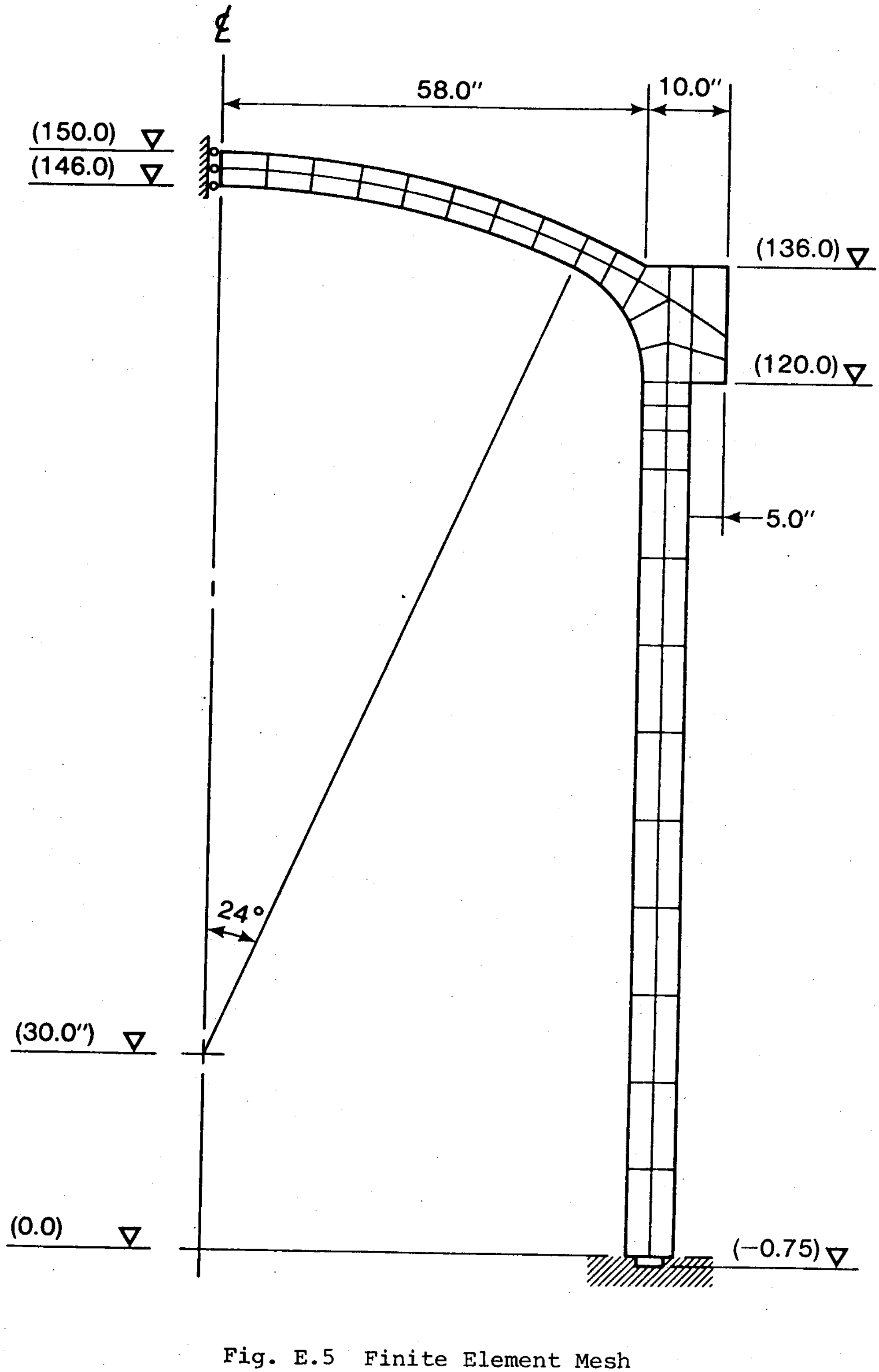
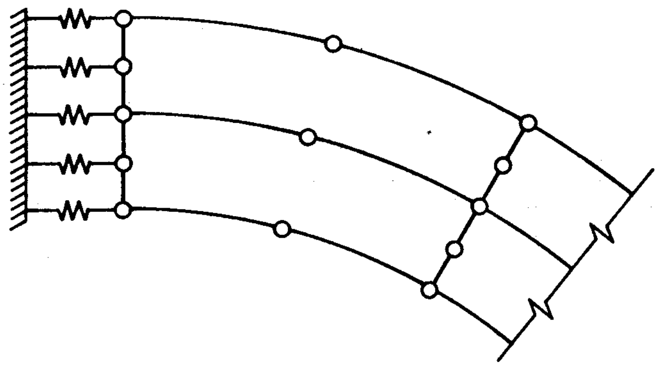


Fig. E.5 Finite Element Mesh



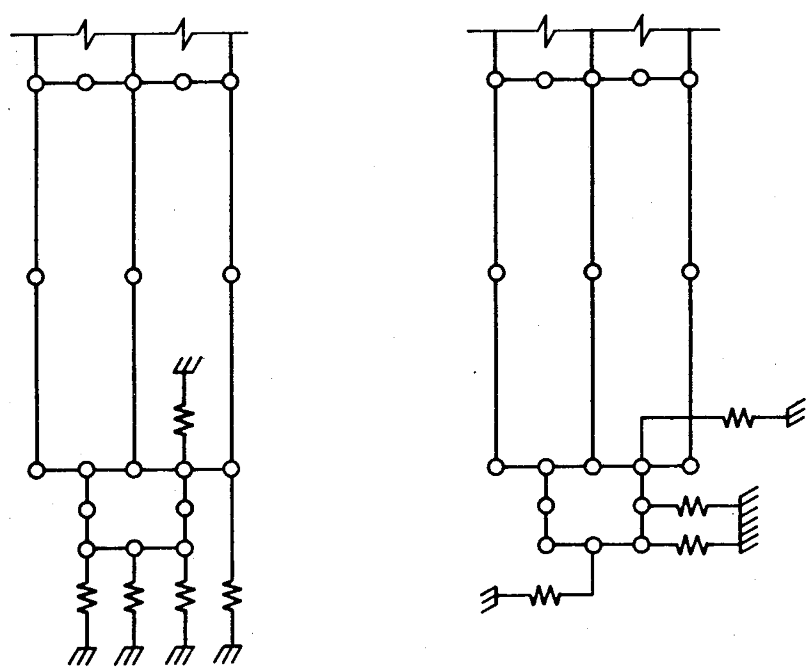


Fig. E.6 Boundary Condition Simulation

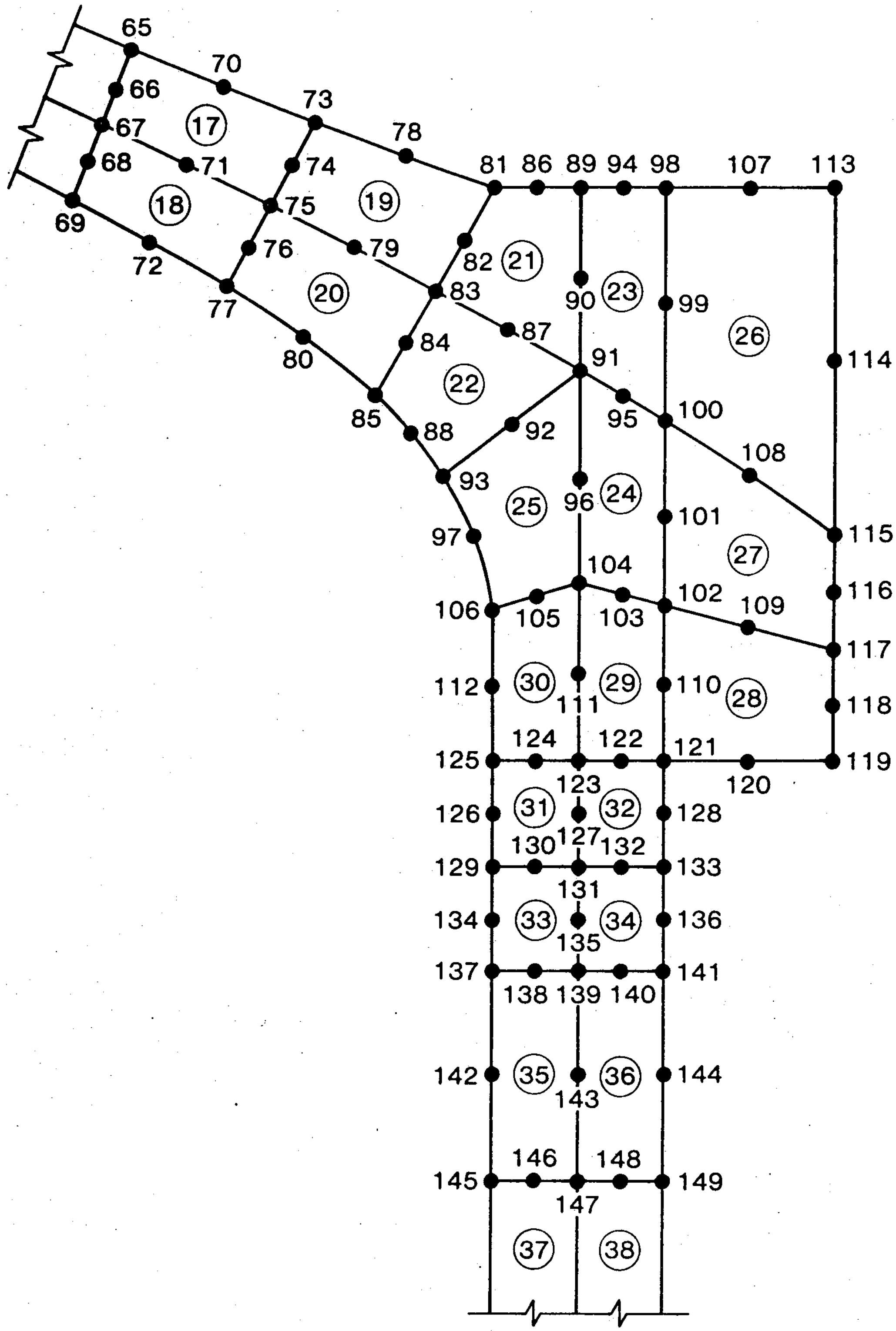


Fig. E.7 Detail of Finite Element Model of Ring Beam Area

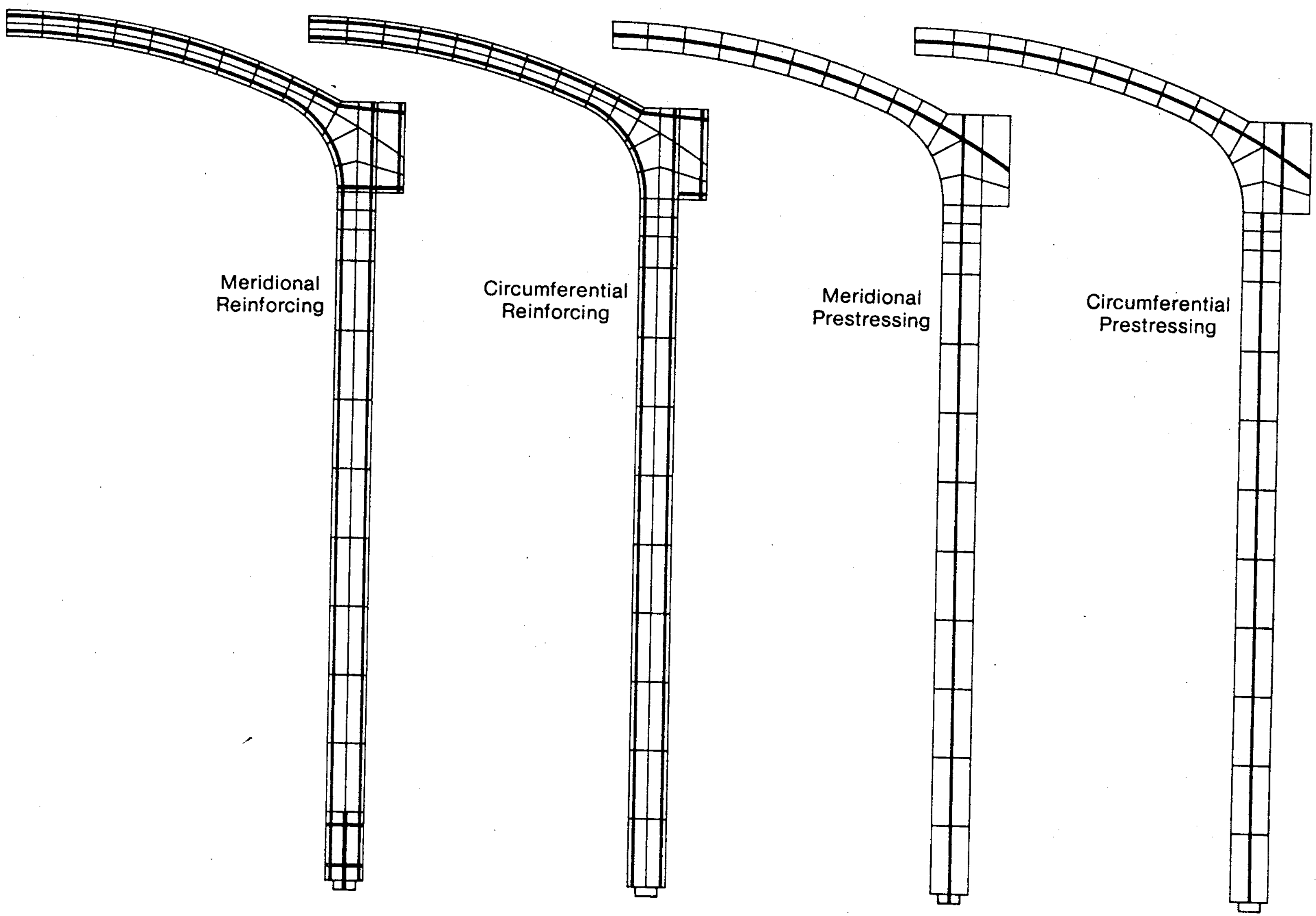


Fig. E.8 Reinforcing and Prestressing Layers of Finite Element Model

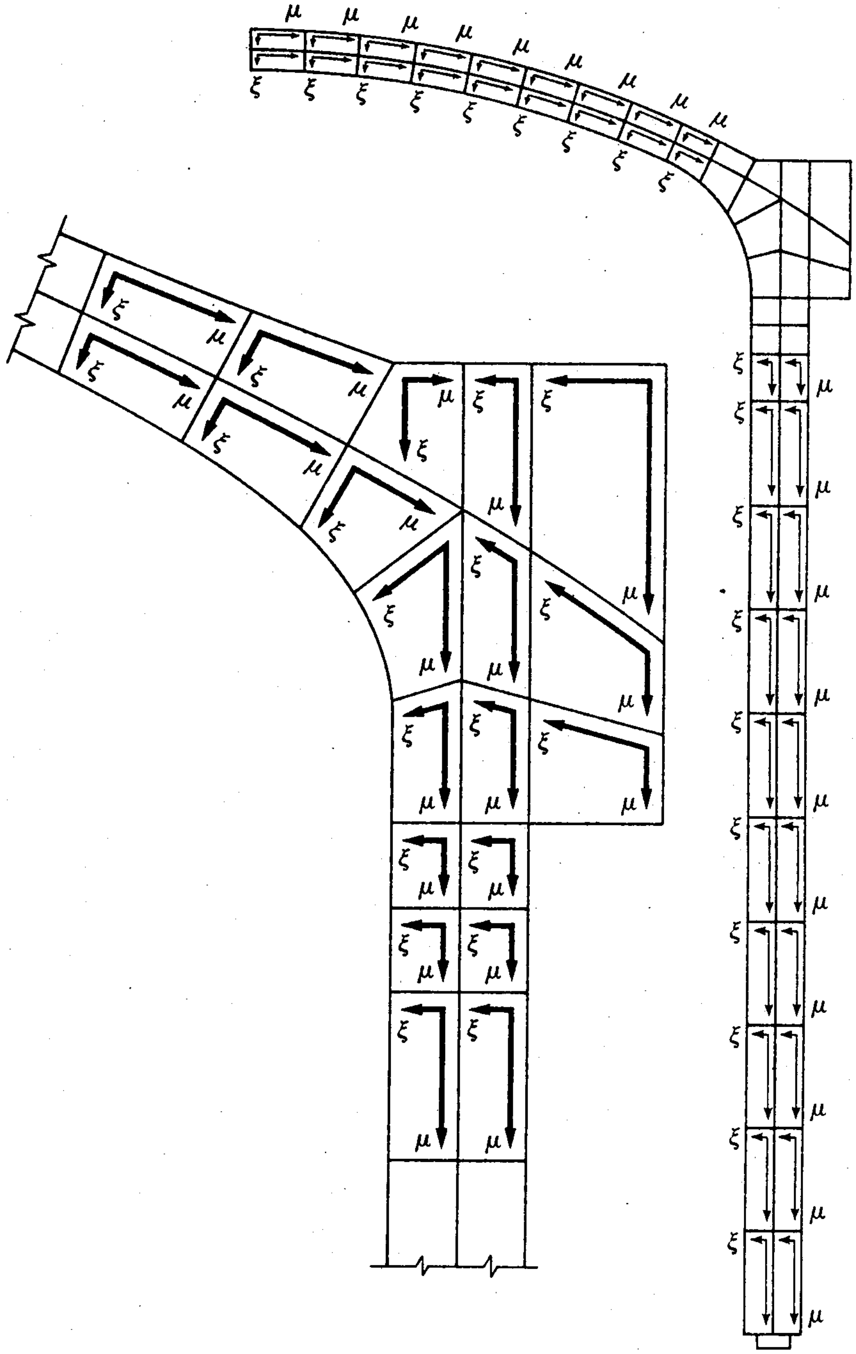
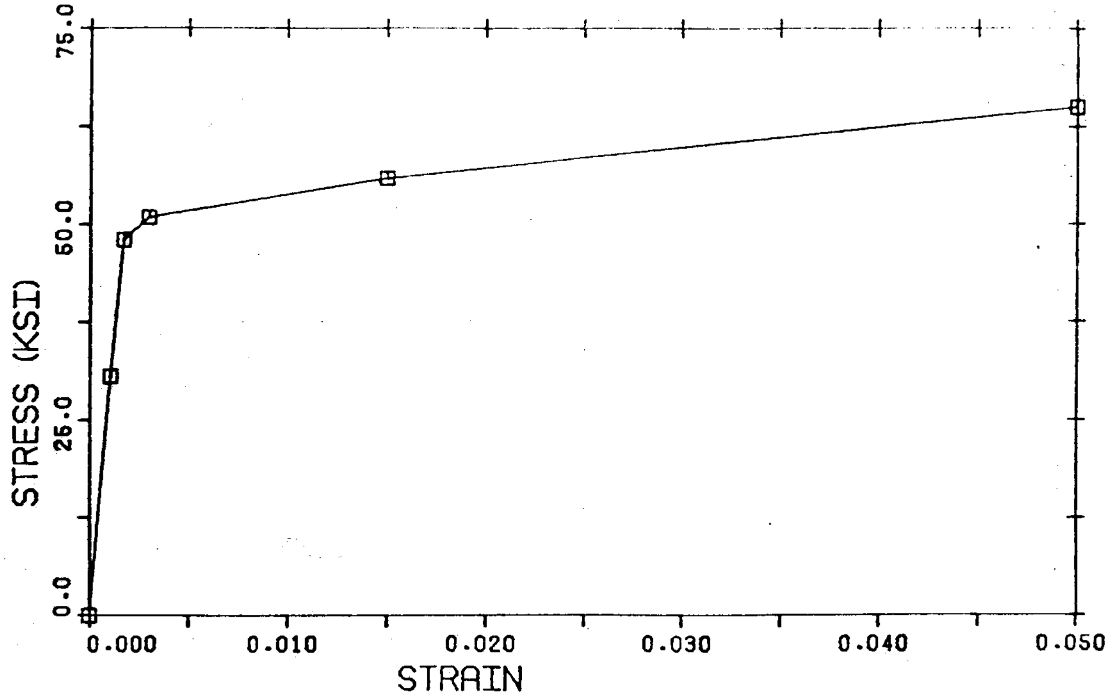
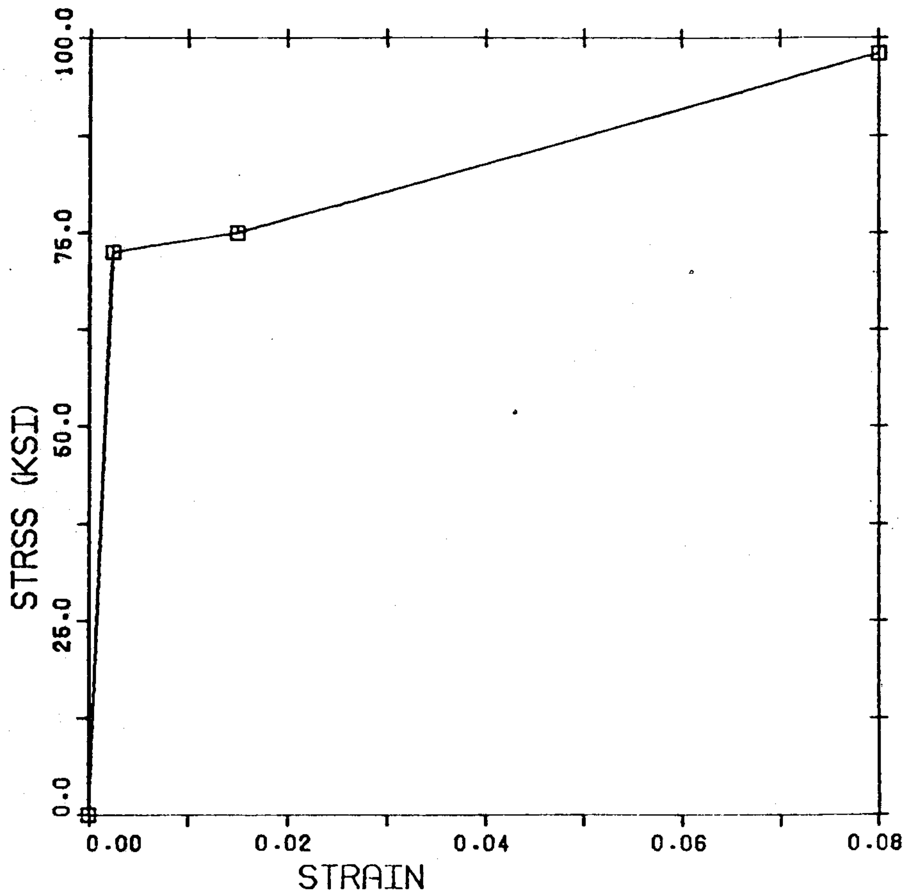


Fig. E.9 Local Coordinate Directions of Finite Element Mesh

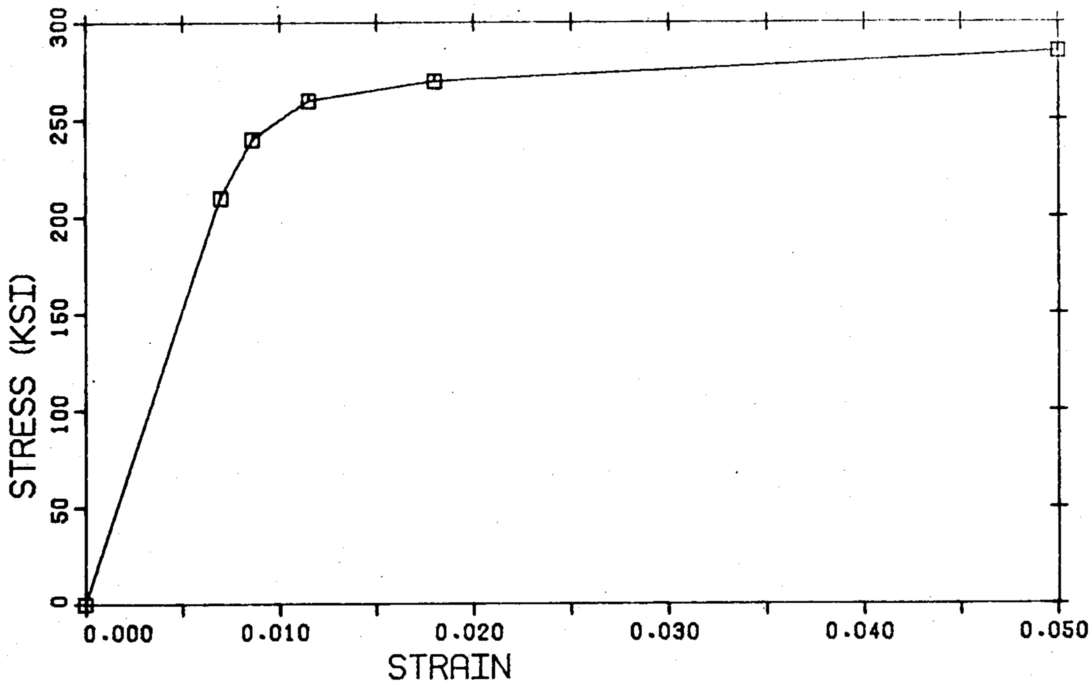


(a) #3 Rebar

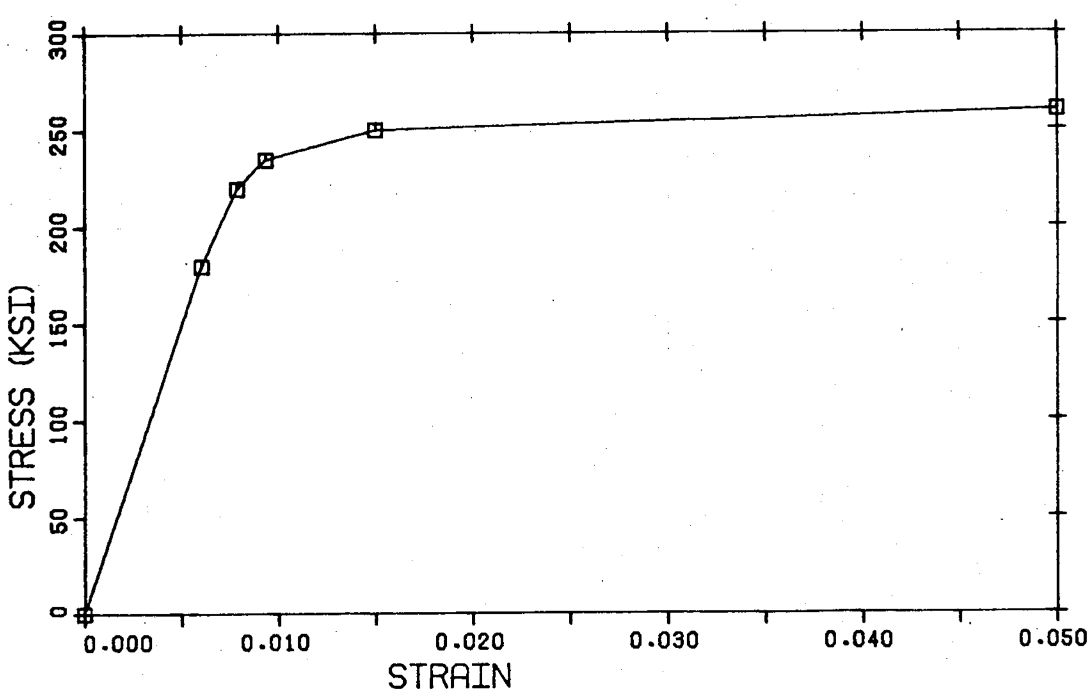


(b) 6 mm ϕ Wire

Fig. E.10 Stress Strain Curves for Rebars



(a) 0.5" ϕ Strands



(b) 0.62" ϕ Strands

Fig. E.11 Stress Strain Curves for Tendons

Input to the Preprocessing Run

(File U5)

```
     -1
SECONDARY CONTAINMENT STRUCTURE MODEL-JUNE 1979-FEPARCS5
     1   1   0   1   1   1   1   1   0   1  11   0   1 226  55  15   2   5  25  30
     1  11
     3.1D6   3.1D6   3.1D6   1.3D6     0.2      0.2      0.2
      0.D0
     2  11
     1.8D6   1.8D6   1.8D6   .75D6     0.2      0.2      0.2
      0.D0
     3  11
   3.06D4 1.04D-3  4.8D4 1.71D-3  5.09D4   3.D-2  5.59D4  1.5D-2   6.5D4   5.D-2
      0.D0
     4   7
   7.25D4 2.38D-3  7.5D4  1.5D-2   9.8D4   8.D-2    0.D0
     5  11
    2.1D5 6.93D-3  2.4D5 8.58D-3   2.6D5 1.15D-2   2.7D5  1.8D-2  2.85D5   5.D-2
 .4544D-2
     6  11
    2.1D5 6.93D-3  2.4D5 8.58D-3   2.6D5 1.15D-2   2.7D5  1.8D-2  2.85D5   5.D-2
  .297D-2
     7  11
    1.8D5 6.01D-3  2.2D5 7.85D-3  2.35D5 9.33D-3   2.5D5  1.5D-1   2.6D5   5.D-2
 .3735D-2
    16   1
      0.0     30.0
     1    120.0000      0.0000   0
    65    120.0000     24.0000   8
     2    119.0000      0.0000   0
    66    119.0000     24.0000   8
     3    118.0000      0.0000   0
    67    118.0000     24.0000   8
     4    117.0000      0.0000   0
    68    117.0000     24.0000   8
     5    116.0000      0.0000   0
    69    116.0000     24.0000   8
     6    120.0000      1.5000   0
    62    120.0000     22.5000   8
     7    118.0000      1.5000   0
    63    118.0000     22.5000   8
     8    116.0000      1.5000   0
    64    116.0000     22.5000   8
    68
    70     51.1063    138.8441   0
    71     50.1316    136.8215   0
    72     49.1287    134.7390   0
    73     53.4042    138.0627   0
    75     52.2483    135.8022   1
    77     51.0409    133.4420   1
    78     55.7021    137.2814   0
    79     54.3444    134.7411   0
    80     52.8831    132.0070   0
    81     58.0000    136.5000   0
    83     56.4189    133.6384   1
    85     54.6216    130.3830   1
    86     59.2500    136.5000   0
    87     58.4710    132.4946   0
    88     55.5530    129.3810   0
    89     60.5000    136.5000   0
    91     60.5000    131.3102   1
    93     56.2644    128.3790   1
```

Control Card

Material Cards

Nodal Geometry Cards

```
    94    61.7500   136.5000  0
    95    61.7548   130.5502  0
    96    60.5000   128.4827  0
    97    57.3400   125.9395  0
    98    63.0000   136.5000  0
   100    63.0000   129.7748  1
   102    63.0000   124.8874  1
   104    60.5000   125.6551  1
   106    58.0000   123.5000  1
   107    65.5000   136.5000  0
   108    65.5213   128.1375  0
   109    65.5000   124.0528  0
   110    63.0000   122.4437  0
   111    60.5000   122.8276  0
   112    58.0000   121.7500  0
   113    68.0000   136.5000  0
   115    68.0000   126.4365  1
   119    68.0000   120.0000  1
   121    63.0000   120.0000  1
   125    58.0000   120.0000  1
   126    58.0000   118.5000  0
   128    63.0000   118.5000  1
   129    58.0000   117.0000  0
   133    63.0000   117.0000  1
   134    58.0000   115.5000  0
   136    63.0000   115.5000  1
   137    58.0000   114.0000  0
   141    63.0000   114.0000  1
   142    58.0000   111.0000  0
   144    63.0000   111.0000  1
   145    58.0000   108.0000  0
   217    58.0000     0.0000  8
   146    59.2500   108.0000  0
   218    59.2500     0.0000  8
   147    60.5000   108.0000  0
   219    60.5000     0.0000  8
   148    61.7500   108.0000  0
   220    61.7500     0.0000  8
   149    63.0000   108.0000  0
   221    63.0000     0.0000  8
   150    58.0000   102.0000  0
   214    58.0000     6.0000  8
   151    60.5000   102.0000  0
   215    60.5000     6.0000  8
   152    63.0000   102.0000  0
   216    63.0000     6.0000  8
   222    59.2500    -0.3750  0
   223    61.7500    -0.3750  0
   224    59.2500    -0.7500  0
   226    61.7500    -0.7500  1

    11
     1    1   0       1.0                         1.D20          Boundary Element Cards
     2    2   0       1.0                         4.D20
     3    3   0       1.0                         8.D20
     4    4   0       1.0                         4.D20
     5    5   0       1.0                         1.D20
     6  224   0                 1.0
     8  226   1                 1.0
     9  217   0                 1.D0
```

```
 10 221   0               1.DO
 11 222   0         1.0
 15 226   1         1.0                                          Solid Element Cards
 27
  1   2  22   0   1   0   1   2   3   7  11  10   9   6
 21   2  22   0   1   2  81  82  83  87  91  90  89  86
  2   2  22   0   1   0   3   4   5   8  13  12  11   7
 22   2  22   0   1   2  83  84  85  88  93  92  91  87
 23   2  22   0   1   0  98  94  89  90  91  95 100  99
 24   2  22   0   1   0 100  95  91  96 104 103 102 101
 25   2  22   0   1   0  91  92  93  97 106 105 104  96
 26   2  22   0   1   0 113 107  98  99 100 108 115 114
 27   2  22   0   1   0 115 108 100 101 102 109 117 116
 28   2  22   0   1   0 117 109 102 110 121 120 119 118
 29   2  22   0   1   0 102 103 104 111 123 122 121 110
 30   2  22   0   1   0 104 105 106 112 125 124 123 111
 31   2  22   0   2   0 123 124 125 126 129 130 131 127
 32   2  22  31   2   0 121 122 123 127 131 132 133 128
 33   2  22  31   2   0 131 130 129 134 137 138 139 135
 34   2  22  31   2   0 133 132 131 135 139 140 141 136
 35   2  22   0   2   0 139 138 137 142 145 146 147 143
 36   2  22  35   2   0 141 140 139 143 147 148 149 144
 37   2  22   0   2   0 147 146 145 150 153 154 155 151
 43   2  22  37   2   2 171 170 169 174 177 178 179 175
 38   2  22  37   2   0 149 148 147 151 155 156 157 152
 44   2  22  37   2   2 173 172 171 175 179 180 181 176
 45   2  22  37   1   0 179 178 177 182 185 186 187 183
 53   2  22  37   1   2 211 210 209 214 217 218 219 215
 46   2  22  37   1   0 181 180 179 183 187 188 189 184
 54   2  22  37   1   2 213 212 211 215 219 220 221 216
 55   2  22   0   1   0 220 219 218 222 224 225 226 223     Longitudinal Reinforcing
 45                                                          Layer Cards
  1   1   0   4   0
  0.018  -0.350
  2   1   0   4   0
  0.018   0.350
  3   1   0   4
  0.018  -0.350
  4   1   0   4   0
  0.018   0.350
  5   1   0   4   0
  0.022  -0.350
  6   1   0   4   0
  0.022   0.350
  7   1   0   4
  0.029  -0.350
  8   1   0   4   0
  0.029   0.350
  9   1   0   4   0
  0.022  -0.350
 10   1   0   4
  0.022   0.350
 11   1   0   4   0
  0.018  -0.350
 12   1   0   4   0
  0.018   0.350
 13   1   0   4
  0.016  -0.350
 14   1   0   4
  0.016   0.350
```

```
0.014   -0.350
16   1   0   4
0.014    0.350
17   1   0   4
0.023   -0.350
18   1   0   4   0
0.023    0.350
19   1   0   4
0.031   -0.350
20   1   0   4
0.031    0.350
21   1   0   3
0.040   -0.350
22   1   0   3
0.040    0.350
23   3   0   3
0.0186  -0.350                  0.040  -0.350
24   1   0   3
0.0186  -0.350
25   1   0   3
0.040    0.350
26   3   0   3
0.040   -0.800                  0.040  -0.350
27   1   0   3
0.040   -0.800
28   3   0   3
0.040   -0.800                  0.040   0.720
29   3   0   4
0.0186  -0.350                  0.040   0.800
30   3   0   4
0.040    0.350                  0.040   0.800
31   1   0   4
0.0186   0.350
33   1   31   4
0.0186  -0.350
32   1   0   4
0.0186   0.350
34   1   32   4
0.0186  -0.350
35   1   0   4
0.0186   0.350
37   1   0   4
0.0186   0.350
49   1   37   4   2
0.0186   0.350
36   1   0   4   0
0.0186  -0.350
38   1   0   4
0.0186  -0.350
50   1   38   4   2
0.0186  -0.350
51   1   0   3
0.042    0.350
52   1   0   3
0.042   -0.350
53   4   0   3
0.050    0.350   0.078   -1.0   0.037   0.500   0.037   -0.500
54   4   0   3
0.050   -0.350                  0.037   0.500   0.037   -0.500
55   1   0   3
```

```
241   55      1     0     3
242    0.180        0.0
243   24                                                             Circumferential Reinforcing Layer Cards
244    1      1     0     4
245    0.011  -0.146
246   19      1     0     4     2
247    0.011  -0.146
248    2      1     0     4
249    0.011   0.146
250   20      1     0     4     2
251    0.011   0.146
252   35      1     0     3
253    0.037   0.450
254   37      1     0     3
255    0.037   0.450
256   53      1    37     3     2
257    0.037   0.450
258   36      1     0     3
259    0.037  -0.450
260   38      1     0     3
261    0.037  -0.450
262   54      1    38     3     2
263    0.037  -0.450
264   21      1     0     3
265    0.014  -0.146
266   22      3     0     3
267    0.014   0.247
268   23      3     0     3
269    0.037  -0.450                       0.014   -0.367
270   24      1     0     3
271    0.037  -0.450
272   25      1     0     3
273    0.029   0.349
274   26      3     0     3
275                        0.028  -0.400   0.014   -0.588
276   27      2     0     3
277                        0.028  -0.400
278   28      3     0     3
279                        0.028  -0.400   0.014    0.588
280   29      1     0     3
281    0.037  -0.450
282   30      1     0     3
283    0.037   0.450
284   31      1     0     3
285    0.037   0.450
286   32      1     0     3
287    0.037  -0.450
288   33      1     0     3
289    0.037   0.450
290   34      1     0     3
291    0.037  -0.450                                                 Longitudinal Prestressing Layer Cards
292   18
293    1      1     0     7
294    0.0239  1.0000
295   11      1     0     7     2
296    0.0239  1.0000
297   13      1     0     7
298    0.0237  1.0000
299   15      1     0     7
300    0.0235  1.0000
```

Circumferential Prestressing Layer Cards

```
17      1     0    7
0.0233   1.0000
19      1     0    7
0.0232   1.0000
21      1     0    7
0.0230   1.0000
24      3     0    7
                                0.0228 -1.0000
26      3     0    7
                                0.0226  1.0000
23      1     0    6
0.00805  1.0000
25      1     0    6
0.00805 -1.0000
30      1     0    6
0.00805 -1.0000
31      1     0    6
0.00805 -1.0000
33      1    31    6
0.00805 -1.0000
35      1     0    6
0.00805 -1.0000
37      1     0    6
0.00805 -1.0000
53      1    37    6    2
0.00805 -1.0000
55      1     0    6
0.00805        0.0
21
2       1     0    7
0.0200  -1.0000
4       1     0    7
0.0222  -1.0000
6       1     0    7
0.0267  -1.0000
8       1     0    7
0.0281  -1.0000
10      1     0    7
0.0285  -1.0000
12      1     0    7
0.0288  -1.0000
14      1     0    7
0.0290  -1.0000
16      1     0    7
0.0295  -1.0000
18      1     0    7
0.0296  -1.0000
20      1     0    7
0.0204  -1.0000
22      1     0    7
0.0144  -1.0000
24      3     0    7
                                0.0111 -1.0000
26      3     0    7
                                0.0088  1.0000
23      1     0    5
0.0153  -1.0000
27      1     0    5
0.0153   1.0000
29      1     0    5
```

361	0.0153		-1.0000					
362	32	1	0	5				
363	0.0153		1.0000					
364	34	1	32	5				
365	0.0153		1.0000					
366	36	1	0	5				
367	0.0153		1.0000					
368	38	1	0	5				
369	0.0153		1.0000					
370	54	1	38	5	2			Normal and Tangential Surface Traction Cards
371	0.0153		1.0000					
372	19							
373	5	0		1.0				
374	93	8		1.0				
375	8	0		1.0				
376	88	8		1.0				
377	97	0		1.0				
378	106	0		1.0				
379	112	0		1.0				
380	125	0		1.0				
381	126	0		1.0				
382	214	8		1.0				
383	129	0		1.0				
384	217	8		1.0				
385	3	0		0.0			5.0	
386	91	8		0.0			5.0	
387	7	0		0.0			5.0	
388	95	8		0.0			5.0	
389	100	0		0.0			5.0	
390	108	0		0.0			5.0	Prestressing Thermal Distribution Cards
391	115	0		0.0			5.0	
392	2							
393	1	0	-1.0					
394	226	1	-1.0					Hydrostatic Pressure Description Cards
395	12		146.0			.0362		
396	5	0						
397	93	8						
398	8	0						
399	88	8						
400	97	0						
401	106	0						
402	112	0						
403	125	0						
404	126	0						
405	214	8						
406	129	0						
407	217	8						Surface Definition for Normal and Tangential Traction
408	3	1	2	13	8	5		
409	3	10	2	93	88	85		
410	3	1	2	106	97	93		
411	3	1	2	125	112	106		
412	3	1	2	129	126	125		
413	3	1	2	137	134	129		
414	3	10	2	217	214	209		
415	3	1	2	3	7	11		
416	3	10	2	83	87	91		
417	3	1	2	91	95	100		
418	3	1	2	100	108	115		
419								Surface Definition for Hydrostatic Pressure
420	3	1	2	13	8	5		

```
    421       3  10   2  93  88  85
    422       3   1   2 106  97  93
    423       3   1   2 125 112 106
    424       3   1   2 129 126 125
    425       3   1   2 137 134 129
    426       3  10   2 217 214 209
    427
  END OF FILE
```

Input to the Pretensioning and Production Runs

(File U5'')

1	1	10	3	0.5	.001	.005	0.0	0.0	0.0	0.0	0.0
2	0	5	3	0.50	.001	.003	1.0	0.0	0.0	0.0	1.0
3	0	5	3	0.5	.001	.003	0.0	0.0	0.0	20.0	0.0
4	0	5	3	0.50	.001	.001	0.0	0.0	0.0	20.0	0.0
5	0	5	0	0.50	.001	.001	0.0	0.0	0.0	10.0	0.0
6	0	5	0	1.0	.001	.003	0.0	0.0	0.0	10.0	0.0
7	0	5	0	1.0	.001	.005	0.0	0.0	0.0	10.0	0.0
8	0	5	0	1.0	.001	.005	0.0	0.0	0.0	5.0	0.0
9	0	5	0	1.0	.001	.007	0.0	0.0	0.0	5.0	0.0
10	0	5	0	1.0	.001	.007	0.0	0.0	0.0	5.0	0.0
11	0	5	0	1.0	.001	.008	0.0	0.0	0.0	5.0	0.0
12	0	5	0	1.0	.001	.008	0.0	0.0	0.0	5.0	0.0
13	0	5	0	1.0	.001	.008	0.0	0.0	0.0	5.0	0.0
14	0	5	0	1.0	.001	.008	0.0	0.0	0.0	5.0	0.0
15	0	5	0	1.0	.001	.008	0.0	0.0	0.0	5.0	0.0
16	0	5	0	1.0	.001	.008	0.0	0.0	0.0	5.0	0.0
17	0	5	0	1.0	.001	.008	0.0	0.0	0.0	2.5	0.0
18	0	5	0	1.0	.001	.009	0.0	0.0	0.0	2.5	0.0
19	0	5	0	1.0	.001	.010	0.0	0.0	0.0	2.5	0.0
20	0	5	0	1.0	.001	.010	0.0	0.0	0.0	2.5	0.0
21	0	5	0	1.0	.001	.012	0.0	0.0	0.0	2.5	0.0
22	0	5	0	1.0	.001	.012	0.0	0.0	0.0	2.5	0.0
23	0	5	0	1.0	.001	.013	0.0	0.0	0.0	2.5	0.0
24	0	5	0	1.0	.001	.015	0.0	0.0	0.0	2.5	0.0
25	0	5	0	1.0	.001	.017	0.0	0.0	0.0	2.5	0.0
26	0	5	0	1.0	.001	.017	0.0	0.0	0.0	2.5	0.0

C

Output of the Preprocessing Run

```
SECONDARY CONTAINMENT STRUCTURE MODEL-JUNE 1979-FEPARCS5

PROBLEM CONTROL VARIABLES
*************************

ECHO CHECK FLAG                                       =    0
AXISYMMETRY FLAG                                      =    1
NONLINEAR LOADING FLAG                                =    0
DRY RUN FLAG                                          =    0
LONGITUDINAL REINFORCEMENT FLAG                       =    1
HOOP REINFORCEMENT FLAG                               =    1
LONGITUDINAL PRESTRESSING FLAG                        =    1
HOOP PRESTRESSING FLAG                                =    1
CONCENTRATED LOADS FLAG                               =    0
TEMPRATURE LOADS FLAG                                 =    1
DISTRIBUTED SURFACE LOADS FLAG                        =   11
GRAVITY LOAD FLAG                                     =    1
INITIAL STRESSES FLAG                                 =    0

NUMBER OF NODAL POINTS                                =  226
NUMBER OF ELEMENTS                                    =   55
NUMBER OF EXTERNAL BOUNDARY ELEMENTS                  =   15
NUMBER OF SOLID ELEMENT MATERIAL TYPES                =    2
NUMBER OF REINFORCING ELEMENT MATERRIAL TYPES         =    5
MAXIMUM NUMBER OF MATERIAL PARAMETERS                 =   25
NUMBER OF ITERATIONS PER LOAD STEP                    =   30

COMMON BLOCK SIZES
*****************

AAA =     2453
III =     2467
BBB =     5373
JJJ =      275
```

MATERIAL PARAMETERS
****

MAT. NO. 1	2	3	4	5	6	7
0.3100E+07	0.1800E+07	0.3060E+05	0.7250E+05	0.2100E+06	0.2100E+06	0.1800E+06
0.3100E+07	0.1800E+07	0.1040E-02	0.2380E-02	0.6930E-02	0.6930E-02	0.6010E-02
0.3100E+07	0.1800E+07	0.4800E+05	0.7500E+05	0.2400E+06	0.2400E+06	0.2200E+06
0.1300E+07	0.7500E+06	0.1710E-02	0.1500E-01	0.8580E-02	0.8580E-02	0.7850E-02
0.2000E+00	0.2000E+00	0.5090E+05	0.9800E+05	0.2600E+06	0.2600E+06	0.2350E+06
0.2000E+00	0.2000E+00	0.3000E-01	0.8000E-01	0.1150E-01	0.1150E-01	0.9330E-02
0.2000E+00	0.2000E+00	0.5590E+05	0.0	0.2700E+06	0.2700E+06	0.2500E+06
0.0	0.0	0.1500E-01	0.0	0.1800E-01	0.1800E-01	0.1500E+00
0.0	0.0	0.6500E+05	0.0	0.2850E+06	0.2850E+06	0.2600E+06
0.0	0.0	0.5000E-01	0.0	0.5000E-01	0.5000E-01	0.5000E-01
0.0	0.0	0.0	0.0	0.4544E-02	0.2970E-02	0.3735E-02
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

NODAL GEOMETRY AS INPUT
****

N	XCORD	YCORD	INC
1	0.120000E+03	0.0	0
65	0.120000E+03	0.240000E+02	8
2	0.119000E+03	0.0	0
66	0.119000E+03	0.240000E+02	8
3	0.118000E+03	0.0	0
67	0.118000E+03	0.240000E+02	8
4	0.117000E+03	0.0	0
68	0.117000E+03	0.240000E+02	8
5	0.116000E+03	0.0	0
69	0.116000E+03	0.240000E+02	8
6	0.120000E+03	0.150000E+01	0
62	0.120000E+03	0.225000E+02	8
7	0.118000E+03	0.150000E+01	0
63	0.118000E+03	0.225000E+02	8
8	0.116000E+03	0.150000E+01	0
64	0.116000E+03	0.225000E+02	8
70	0.511063E+02	0.138844E+03	0
71	0.501316E+02	0.136822E+03	0
72	0.491287E+02	0.134739E+03	0
73	0.534042E+02	0.138063E+03	0
75	0.522483E+02	0.135802E+03	1
77	0.510409E+02	0.133442E+03	1
78	0.557021E+02	0.137281E+03	0
79	0.543444E+02	0.134741E+03	0
80	0.528831E+02	0.132007E+03	0
81	0.580000E+02	0.136500E+03	0
83	0.564189E+02	0.133638E+03	1
85	0.546216E+02	0.130383E+03	1
86	0.592500E+02	0.136500E+03	0
87	0.584710E+02	0.132495E+03	0
88	0.555530E+02	0.129381E+03	0
89	0.605000E+02	0.136500E+03	0
91	0.605000E+02	0.131310E+03	1
93	0.562644E+02	0.128379E+03	1
94	0.617500E+02	0.136500E+03	0
95	0.617548E+02	0.130550E+03	0
96	0.605000E+02	0.128483E+03	0
97	0.573400E+02	0.125939E+03	0
98	0.630000E+02	0.136500E+03	0
100	0.630000E+02	0.129775E+03	1
102	0.630000E+02	0.124887E+03	1
104	0.605000E+02	0.125655E+03	1
106	0.580000E+02	0.123500E+03	1
107	0.655000E+02	0.136500E+03	0
108	0.655213E+02	0.128137E+03	0
109	0.655000E+02	0.124053E+03	0
110	0.630000E+02	0.122444E+03	0
111	0.605000E+02	0.122828E+03	0
112	0.580000E+02	0.121750E+03	0
113	0.680000E+02	0.136500E+03	0
115	0.680000E+02	0.126436E+03	1
119	0.680000E+02	0.120000E+03	1
121	0.630000E+02	0.120000E+03	1

125	0.580000E+02	0.120000E+03	1
126	0.580000E+02	0.118500E+03	0
128	0.630000E+02	0.118500E+03	1
129	0.580000E+02	0.117000E+03	0
133	0.630000E+02	0.117000E+03	1
134	0.580000E+02	0.115500E+03	0
136	0.630000E+02	0.115500E+03	1
137	0.580000E+02	0.114000E+03	0
141	0.630000E+02	0.114000E+03	1
142	0.580000E+02	0.111000E+03	0
144	0.630000E+02	0.111000E+03	1
145	0.580000E+02	0.108000E+03	0
217	0.580000E+02	0.0	8
146	0.592500E+02	0.108000E+03	0
218	0.592500E+02	0.0	8
147	0.605000E+02	0.108000E+03	0
219	0.605000E+02	0.0	8
148	0.617500E+02	0.108000E+03	0
220	0.617500E+02	0.0	8
149	0.630000E+02	0.108000E+03	0
221	0.630000E+02	0.0	8
150	0.580000E+02	0.102000E+03	0
214	0.580000E+02	0.600000E+01	8
151	0.605000E+02	0.102000E+03	0
215	0.605000E+02	0.600000E+01	8
152	0.630000E+02	0.102000E+03	0
216	0.630000E+02	0.600000E+01	8
222	0.592500E+02	-0.375000E+00	0
223	0.617500E+02	-0.375000E+00	0
224	0.592500E+02	-0.750000E+00	0
226	0.617500E+02	-0.750000E+00	1

BOUDARY ELEMENTS AS INPUT
****

NO.BE	NODE	INC	X.PROJ.	Y.PROJ.	PRS.DSP.	STIFF.
1	1	0	0.100000E+01	0.0	0.0	0.100000E+21
2	2	0	0.100000E+01	0.0	0.0	0.400000E+21
3	3	0	0.100000E+01	0.0	0.0	0.800000E+21
4	4	0	0.100000E+01	0.0	0.0	0.400000E+21
5	5	0	0.100000E+01	0.0	0.0	0.100000E+21
6	224	0	0.0	0.100000E+01	0.0	0.100000E+21
8	226	1	0.0	0.100000E+01	0.0	0.100000E+21
9	217	0	0.0	0.100000E+01	0.0	0.100000E+21
10	221	0	0.0	0.100000E+01	0.0	0.100000E+21
11	222	0	0.100000E+01	0.0	0.0	0.100000E+21
15	226	1	0.100000E+01	0.0	0.0	0.100000E+21

SOLID ELEMENT DATA AS INPUT
****

NO.SE.	DEG	GAUSS	CLASS	NO.MAT	INC	NP1	NP2	NP3	NP4	NP5	NP6	NP7	NP8	NP9	NP10	NP11	NP12	M.AXES ORN.
1	2	22	0	1	0	1	2	3	7	11	10	9	6	0	0	0	0	0.0
21	2	22	0	1	2	81	82	83	87	91	90	89	86	0	0	0	0	0.0
2	2	22	0	1	0	3	4	5	8	13	12	11	7	0	0	0	0	0.0
22	2	22	0	1	2	83	84	85	88	93	92	91	87	0	0	0	0	0.0
23	2	22	0	1	0	98	94	89	90	91	95	100	99	0	0	0	0	0.0
24	2	22	0	1	0	100	95	91	96	104	103	102	101	0	0	0	0	0.0
25	2	22	0	1	0	91	92	93	97	106	105	104	96	0	0	0	0	0.0
26	2	22	0	1	0	113	107	98	99	100	108	115	114	0	0	0	0	0.0
27	2	22	0	1	0	115	108	100	101	102	109	117	116	0	0	0	0	0.0
28	2	22	0	1	0	117	109	102	110	121	120	119	118	0	0	0	0	0.0
29	2	22	0	1	0	102	103	104	111	123	122	121	110	0	0	0	0	0.0
30	2	22	0	1	0	104	105	106	112	125	124	123	111	0	0	0	0	0.0
31	2	22	0	2	0	123	124	125	126	129	130	131	127	0	0	0	0	0.0
32	2	22	31	2	0	121	122	123	127	131	132	133	128	0	0	0	0	0.0
33	2	22	31	2	0	131	130	129	134	137	138	139	135	0	0	0	0	0.0
34	2	22	31	2	0	133	132	131	135	139	140	141	136	0	0	0	0	0.0
35	2	22	0	2	0	139	138	137	142	145	146	147	143	0	0	0	0	0.0
36	2	22	35	2	0	141	140	139	143	147	148	149	144	0	0	0	0	0.0
37	2	22	0	2	0	147	146	145	150	153	154	155	151	0	0	0	0	0.0
43	2	22	37	2	2	171	170	169	174	177	178	179	175	0	0	0	0	0.0
38	2	22	37	2	0	149	148	147	151	155	156	157	152	0	0	0	0	0.0
44	2	22	37	2	2	173	172	171	175	179	180	181	176	0	0	0	0	0.0
45	2	22	37	1	0	179	178	177	182	185	186	187	183	0	0	0	0	0.0
53	2	22	37	1	2	211	210	209	214	217	218	219	215	0	0	0	0	0.0
46	2	22	37	1	0	181	180	179	183	187	188	189	184	0	0	0	0	0.0
54	2	22	37	1	2	213	212	211	215	219	220	221	216	0	0	0	0	0.0
55	2	22	0	1	0	220	219	218	222	224	225	226	223	0	0	0	0	0.0

LONGITUDINAL REINFORCEMENT AS INPUT

N	NML	ICL	NMT	INC	A1	POS.	A2	POS.	A3	POS.	A4	POS.
1	1	0	4	0	0.1800E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0	4	0	0.1800E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
3	1	0	4	0	0.1800E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0	4	0	0.1800E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
5	1	0	4	0	0.2200E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
6	1	0	4	0	0.2200E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
7	1	0	4	0	0.2900E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
8	1	0	4	0	0.2900E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
9	1	0	4	0	0.2200E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
10	1	0	4	0	0.2200E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
11	1	0	4	0	0.1800E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
12	1	0	4	0	0.1800E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
13	1	0	4	0	0.1600E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
14	1	0	4	0	0.1600E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
15	1	0	4	0	0.1400E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
16	1	0	4	0	0.1400E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
17	1	0	4	0	0.2300E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
18	1	0	4	0	0.2300E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
19	1	0	4	0	0.3100E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
20	1	0	4	0	0.3100E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
21	1	0	3	0	0.4000E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0

22	1	0	3	0	0.4000E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
23	3	0	3	0	0.1860E-01	-0.3500E+00	0.0	0.0	0.4000E-01	-0.3500E+00	0.0	0.0
24	1	0	3	0	0.1860E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
25	1	0	3	0	0.4000E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
26	3	0	3	0	0.4000E-01	-0.8000E+00	0.0	0.0	0.4000E-01	-0.3500E+00	0.0	0.0
27	1	0	3	0	0.4000E-01	-0.8000E+00	0.0	0.0	0.0	0.0	0.0	0.0
28	3	0	3	0	0.4000E-01	-0.8000E+00	0.0	0.0	0.4000E-01	0.7200E+00	0.0	0.0
29	3	0	4	0	0.1860E-01	-0.3500E+00	0.0	0.0	0.4000E-01	0.8000E+00	0.0	0.0
30	3	0	4	0	0.4000E-01	0.3500E+00	0.0	0.0	0.4000E-01	0.8000E+00	0.0	0.0
31	1	0	4	0	0.1860E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
33	1	31	4	0	0.1860E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
32	1	0	4	0	0.1860E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
34	1	32	4	0	0.1860E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
35	1	0	4	0	0.1860E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
37	1	0	4	0	0.1860E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
49	1	37	4	2	0.1860E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
36	1	0	4	0	0.1860E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
38	1	0	4	0	0.1860E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
50	1	38	4	2	0.1860E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
51	1	0	3	0	0.4200E-01	0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
52	1	0	3	0	0.4200E-01	-0.3500E+00	0.0	0.0	0.0	0.0	0.0	0.0
53	4	0	3	0	0.5000E-01	0.3500E+00	0.7800E-01	-0.1000E+01	0.3700E-01	0.5000E+00	0.3700E-01	-0.5000E+00
54	4	0	3	0	0.5000E-01	-0.3500E+00	0.0	0.0	0.3700E-01	0.5000E+00	0.3700E-01	-0.5000E+00
55	1	0	3	0	0.1800E+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0

HOOP REINFORCEMENT AS INPUT

N	NML	ICL	NMT	INC	A1	POS.	A2	POS.	A3	POS.	A4	POS.
1	1	0	4	0	0.1100E-01	-0.1460E+00	0.0	0.0	0.0	0.0	0.0	0.0
19	1	0	4	2	0.1100E-01	-0.1460E+00	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0	4	0	0.1100E-01	0.1460E+00	0.0	0.0	0.0	0.0	0.0	0.0
20	1	0	4	2	0.1100E-01	0.1460E+00	0.0	0.0	0.0	0.0	0.0	0.0
35	1	0	3	0	0.3700E-01	0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
37	1	0	3	0	0.3700E-01	0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
53	1	37	3	2	0.3700E-01	0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
36	1	0	3	0	0.3700E-01	-0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
38	1	0	3	0	0.3700E-01	-0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
54	1	38	3	2	0.3700E-01	-0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
21	1	0	3	0	0.1400E-01	-0.1460E+00	0.0	0.0	0.0	0.0	0.0	0.0
22	3	0	3	0	0.1400E-01	0.2470E+00	0.0	0.0	0.0	0.0	0.0	0.0
23	3	0	3	0	0.3700E-01	-0.4500E+00	0.0	0.0	0.1400E-01	-0.3670E+00	0.0	0.0
24	1	0	3	0	0.3700E-01	-0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
25	1	0	3	0	0.2900E-01	0.3490E+00	0.0	0.0	0.0	0.0	0.0	0.0
26	3	0	3	0	0.0	0.0	0.2800E-01	-0.4000E+00	0.1400E-01	-0.5880E+00	0.0	0.0
27	2	0	3	0	0.0	0.0	0.2800E-01	-0.4000E+00	0.0	0.0	0.0	0.0
28	3	0	3	0	0.0	0.0	0.2800E-01	-0.4000E+00	0.1400E-01	0.5880E+00	0.0	0.0
29	1	0	3	0	0.3700E-01	-0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
30	1	0	3	0	0.3700E-01	0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
31	1	0	3	0	0.3700E-01	0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
32	1	0	3	0	0.3700E-01	-0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
33	1	0	3	0	0.3700E-01	0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0
34	1	0	3	0	0.3700E-01	-0.4500E+00	0.0	0.0	0.0	0.0	0.0	0.0

PRESTRESSING LONGITUDINAL TENDONS AS INPUT

N	NML	ICL	NMT	INC	A1	POS.	A2	POS.	A3	POS.	A4	POS.
1	1	0	7	0	0.2390E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
11	1	0	7	2	0.2390E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
13	1	0	7	0	0.2370E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
15	1	0	7	0	0.2350E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
17	1	0	7	0	0.2330E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
19	1	0	7	0	0.2320E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
21	1	0	7	0	0.2300E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
24	3	0	7	0	0.0	0.0	0.0	0.0	0.2280E-01	-0.1000E+01	0.0	0.0
26	3	0	7	0	0.0	0.0	0.0	0.0	0.2260E-01	0.1000E+01	0.0	0.0
23	1	0	6	0	0.8050E-02	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
25	1	0	6	0	0.8050E-02	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
30	1	0	6	0	0.8050E-02	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
31	1	0	6	0	0.8050E-02	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
33	1	31	6	0	0.8050E-02	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
35	1	0	6	0	0.8050E-02	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
37	1	0	6	0	0.8050E-02	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
53	1	37	6	2	0.8050E-02	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
55	1	0	6	0	0.8050E-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PRESTRESSING HOOP TENDONS AS INPUT

N	NML	ICL	NMT	INC	A1	POS.	A2	POS.	A3	POS.	A4	POS.
2	1	0	7	0	0.2000E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0	7	0	0.2220E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
6	1	0	7	0	0.2670E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
8	1	0	7	0	0.2810E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
10	1	0	7	0	0.2850E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
12	1	0	7	0	0.2880E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
14	1	0	7	0	0.2900E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
16	1	0	7	0	0.2950E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
18	1	0	7	0	0.2960E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
20	1	0	7	0	0.2040E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
22	1	0	7	0	0.1440E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
24	3	0	7	0	0.0	0.0	0.0	0.0	0.1110E-01	-0.1000E+01	0.0	0.0
26	3	0	7	0	0.0	0.0	0.0	0.0	0.8800E-02	0.1000E+01	0.0	0.0
23	1	0	5	0	0.1530E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
27	1	0	5	0	0.1530E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
29	1	0	5	0	0.1530E-01	-0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
32	1	0	5	0	0.1530E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
34	1	32	5	0	0.1530E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
36	1	0	5	0	0.1530E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
38	1	0	5	0	0.1530E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0
54	1	38	5	2	0.1530E-01	0.1000E+01	0.0	0.0	0.0	0.0	0.0	0.0

NODAL PRESSURE INTENSITY INPUT
****

N	INC	NORM.P.I.	TANG.P.I.

5	0	0.100000E+01	0.0
93	8	0.100000E+01	0.0
8	0	0.100000E+01	0.0
88	8	0.100000E+01	0.0
97	0	0.100000E+01	0.0
106	0	0.100000E+01	0.0
112	0	0.100000E+01	0.0
125	0	0.100000E+01	0.0
126	0	0.100000E+01	0.0
214	8	0.100000E+01	0.0
129	0	0.100000E+01	0.0
217	8	0.100000E+01	0.0
3	0	0.0	0.500000E+01
91	8	0.0	0.500000E+01
7	0	0.0	0.500000E+01
95	8	0.0	0.500000E+01
100	0	0.0	0.500000E+01
108	0	0.0	0.500000E+01
115	0	0.0	0.500000E+01

NODAL TEMPRATURE VALUES INPUT 1
****

N	INC	TEMP.V.
1	0	-0.100000E+01
226	1	-0.100000E+01

HYDROSTATIC NODAL PRESSURE INPUT
****

N	INC	HYD.PRES.V.
5	0	0.0
93	8	0.637880E+00
8	0	0.143896E-02
88	8	0.601608E+00
97	0	0.726190E+00
106	0	0.814500E+00
112	0	0.877850E+00
125	0	0.941200E+00
126	0	0.995500E+00
214	8	0.506800E+01
129	0	0.104980E+01
217	8	0.528520E+01

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SIZE OF STIFNESS MATRIX = 8178

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Output of Load Step No. 4 Run

(Internal pressure increment is 20.0 psi. Total pressure at end of run is 40.0 psi).

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OUTPUT OF LOAD STEP NO. 4

****

IP	NI	KI	RX	TU	TP	CD	CL	CT	CPN	CPT	CPD
0	5	3	0.500000E+00	0.100000E-02	0.100000E-02	0.0	0.0	0.0	0.200000E+02	0.0	0.0

ITRATE NO.	FNU	FNP	PT/UT
1	0.622191E+00	0.340793E+00	0.400663E+06
2	0.903584E-01	0.154582E+00	0.340555E+06
3	0.179432E-01	0.524610E-01	0.317781E+06
4	0.409201E-02	0.174307E-01	0.307631E+06
5	0.100181E-02	0.622012E-02	0.302769E+06
6	0.256222E-03	0.245259E-02	0.300349E+06
7	0.677059E-04	0.105502E-02	0.299115E+06
8	0.184186E-04	0.481076E-03	0.298474E+06

NODAL DISPLACEMENTS
****

N	U	V	DU	DV
1	0.942976E-18	0.335002E-01	0.103610E-18	0.187726E-01
2	-0.466896E-18	0.335921E-01	0.343821E-19	0.188202E-01
3	0.823327E-18	0.336788E-01	0.315570E-20	0.188639E-01
4	-0.546583E-18	0.337600E-01	0.843953E-20	0.189038E-01
5	0.960524E-18	0.338359E-01	0.590207E-19	0.189402E-01
6	0.580384E-03	0.334204E-01	0.304412E-03	0.187220E-01
7	0.470501E-03	0.335965E-01	0.234618E-03	0.188128E-01
8	0.361908E-03	0.337514E-01	0.168543E-03	0.188885E-01
9	0.113914E-02	0.331640E-01	0.596848E-03	0.185632E-01
10	0.102811E-02	0.332575E-01	0.527997E-03	0.186125E-01
11	0.916811E-03	0.333458E-01	0.458623E-03	0.186584E-01
12	0.804698E-03	0.334288E-01	0.390625E-03	0.187003E-01
13	0.696829E-03	0.335052E-01	0.324130E-03	0.187380E-01
14	0.167836E-02	0.327245E-01	0.878329E-03	0.182952E-01
15	0.133629E-02	0.329178E-01	0.668522E-03	0.183979E-01
16	0.995508E-03	0.330870E-01	0.462151E-03	0.184842E-01
17	0.219556E-02	0.320822E-01	0.114626E-02	0.179091E-01
18	0.195662E-02	0.321917E-01	0.100209E-02	0.179683E-01
19	0.171616E-02	0.322949E-01	0.857075E-03	0.180237E-01
20	0.147917E-02	0.323908E-01	0.715497E-03	0.180742E-01
21	0.124724E-02	0.324787E-01	0.576099E-03	0.181199E-01
22	0.266312E-02	0.312184E-01	0.138571E-02	0.173974E-01
23	0.204308E-02	0.314566E-01	0.101682E-02	0.175274E-01
24	0.142920E-02	0.316655E-01	0.653955E-03	0.176388E-01
25	0.308205E-02	0.301132E-01	0.159685E-02	0.167521E-01
26	0.269335E-02	0.302529E-01	0.136884E-02	0.168292E-01
27	0.230250E-02	0.303863E-01	0.113978E-02	0.169024E-01
28	0.191718E-02	0.305099E-01	0.915304E-03	0.169696E-01
29	0.153730E-02	0.306239E-01	0.693204E-03	0.170313E-01
30	0.341116E-02	0.287506E-01	0.175803E-02	0.159671E-01
31	0.247396E-02	0.290635E-01	0.121533E-02	0.161403E-01
32	0.154717E-02	0.293448E-01	0.681127E-03	0.162940E-01
33	0.364508E-02	0.271223E-01	0.186664E-02	0.150405E-01
34	0.309528E-02	0.273082E-01	0.155181E-02	0.151436E-01
35	0.254950E-02	0.274858E-01	0.123927E-02	0.152419E-01
36	0.200009E-02	0.276556E-01	0.926638E-03	0.153353E-01
37	0.145697E-02	0.278148E-01	0.616833E-03	0.154229E-01
38	0.377917E-02	0.252204E-01	0.192052E-02	0.139704E-01
39	0.251619E-02	0.256407E-01	0.120537E-02	0.142035E-01
40	0.126371E-02	0.260312E-01	0.498824E-03	0.144181E-01
41	0.376358E-02	0.230613E-01	0.189415E-02	0.127678E-01
42	0.305725E-02	0.233064E-01	0.149781E-02	0.129032E-01
43	0.235908E-02	0.235420E-01	0.110590E-02	0.130334E-01
44	0.165662E-02	0.237707E-01	0.713568E-03	0.131591E-01
45	0.954017E-03	0.239922E-01	0.320637E-03	0.132810E-01
46	0.359119E-02	0.206760E-01	0.178399E-02	0.114506E-01
47	0.206702E-02	0.212114E-01	0.935958E-03	0.117458E-01
48	0.544319E-03	0.217302E-01	0.912424E-04	0.120300E-01
49	0.323092E-02	0.181320E-01	0.157488E-02	0.100566E-01
50	0.243185E-02	0.184285E-01	0.113342E-02	0.102192E-01
51	0.164580E-02	0.187152E-01	0.698745E-03	0.103763E-01
52	0.850858E-03	0.189984E-01	0.260918E-03	0.105311E-01
53	0.446297E-04	0.192829E-01	-0.183565E-03	0.106868E-01
54	0.268821E-02	0.155236E-01	0.126976E-02	0.863602E-02

55	0.110574E-02	0.161240E-01	0.400718E-03	0.896439E-02
56	-0.500742E-03	0.167386E-01	-0.480122E-03	0.929895E-02
57	0.196859E-02	0.129840E-01	0.873233E-03	0.726101E-02
58	0.121783E-02	0.132865E-01	0.463130E-03	0.742528E-02
59	0.488742E-03	0.135772E-01	0.640264E-04	0.758328E-02
60	-0.254948E-03	0.138685E-01	-0.341819E-03	0.774140E-02
61	-0.103870E-02	0.141823E-01	-0.770178E-03	0.791221E-02
62	0.110891E-02	0.107017E-01	0.404624E-03	0.602980E-02
63	-0.144057E-03	0.112124E-01	-0.278249E-03	0.630729E-02
64	-0.146338E-02	0.117820E-01	-0.997491E-03	0.661569E-02
65	0.199393E-03	0.888140E-02	-0.864195E-04	0.505054E-02
66	-0.261282E-03	0.907994E-02	-0.337547E-03	0.515784E-02
67	-0.705655E-03	0.926861E-02	-0.581039E-03	0.526015E-02
68	-0.115895E-02	0.945262E-02	-0.828002E-03	0.535929E-02
69	-0.166619E-02	0.967664E-02	-0.110614E-02	0.548161E-02
70	-0.327259E-03	0.789262E-02	-0.368664E-03	0.451776E-02
71	-0.101388E-02	0.820123E-02	-0.746071E-03	0.468641E-02
72	-0.175825E-02	0.854821E-02	-0.115501E-02	0.487553E-02
73	-0.765289E-03	0.726173E-02	-0.600461E-03	0.417603E-02
74	-0.987518E-03	0.736684E-02	-0.725282E-03	0.423413E-02
75	-0.121549E-02	0.747447E-02	-0.854691E-03	0.429441E-02
76	-0.146430E-02	0.758049E-02	-0.992510E-03	0.435167E-02
77	-0.172952E-02	0.769931E-02	-0.114159E-02	0.441748E-02
78	-0.110012E-02	0.694091E-02	-0.777786E-03	0.399705E-02
79	-0.133070E-02	0.703076E-02	-0.916997E-03	0.405218E-02
80	-0.158330E-02	0.711659E-02	-0.106554E-02	0.410215E-02
81	-0.135546E-02	0.684418E-02	-0.911205E-03	0.393863E-02
82	-0.133251E-02	0.682597E-02	-0.907189E-03	0.393202E-02
83	-0.135144E-02	0.683254E-02	-0.928240E-03	0.394051E-02
84	-0.135981E-02	0.681480E-02	-0.941352E-03	0.393407E-02
85	-0.133153E-02	0.675883E-02	-0.934852E-03	0.390676E-02
86	-0.145676E-02	0.690470E-02	-0.961952E-03	0.396488E-02
87	-0.127847E-02	0.682794E-02	-0.892872E-03	0.392715E-02
88	-0.113521E-02	0.660256E-02	-0.836807E-03	0.381858E-02
89	-0.154030E-02	0.699884E-02	-0.100282E-02	0.400839E-02
90	-0.133478E-02	0.697207E-02	-0.910641E-03	0.399186E-02
91	-0.113461E-02	0.696676E-02	-0.823036E-03	0.398581E-02
92	-0.108630E-02	0.676118E-02	-0.807561E-03	0.388660E-02
93	-0.942568E-03	0.648048E-02	-0.742759E-03	0.374733E-02
94	-0.159854E-02	0.714515E-02	-0.103183E-02	0.407636E-02
95	-0.103660E-02	0.711015E-02	-0.774114E-03	0.405347E-02
96	-0.817792E-03	0.692704E-02	-0.669151E-03	0.396167E-02
97	-0.352589E-03	0.633491E-02	-0.441409E-03	0.366555E-02
98	-0.163928E-02	0.730519E-02	-0.105189E-02	0.415263E-02
99	-0.126912E-02	0.728421E-02	-0.878275E-03	0.413837E-02
100	-0.933755E-03	0.728070E-02	-0.722511E-03	0.413505E-02
101	-0.576423E-03	0.727201E-02	-0.545270E-03	0.412699E-02
102	-0.112899E-03	0.726854E-02	-0.315563E-03	0.412204E-02
103	-0.205908E-03	0.703021E-02	-0.363099E-03	0.400481E-02
104	-0.292540E-03	0.681571E-02	-0.407564E-03	0.390009E-02
105	-0.619501E-04	0.651088E-02	-0.294141E-03	0.374635E-02
106	0.242526E-03	0.609754E-02	-0.142309E-03	0.353482E-02
107	-0.163488E-02	0.764954E-02	-0.104722E-02	0.431653E-02
108	-0.665203E-03	0.768292E-02	-0.585787E-03	0.432875E-02
109	0.108316E-03	0.774415E-02	-0.202025E-03	0.435612E-02
110	0.480352E-03	0.726735E-02	-0.185260E-04	0.411729E-02
111	0.373675E-03	0.666226E-02	-0.739844E-04	0.381565E-02
112	0.778560E-03	0.581694E-02	0.129395E-03	0.338737E-02
113	-0.161089E-02	0.791664E-02	-0.103305E-02	0.444167E-02
114	-0.107779E-02	0.798009E-02	-0.783305E-03	0.447252E-02

115	-0.355586E-03	0.815585E-02	-0.427030E-03	0.455811E-02
116	-0.418711E-04	0.821311E-02	-0.273811E-03	0.458834E-02
117	0.302629E-03	0.825916E-02	-0.102885E-03	0.461201E-02
118	0.683706E-03	0.827187E-02	0.877595E-04	0.461713E-02
119	0.978429E-03	0.825714E-02	0.233707E-03	0.460825E-02
120	0.104217E-02	0.779714E-02	0.265000E-03	0.438021E-02
121	0.115089E-02	0.727954E-02	0.319224E-03	0.411902E-02
122	0.121920E-02	0.689734E-02	0.353242E-03	0.392559E-02
123	0.129368E-02	0.648167E-02	0.390469E-03	0.371630E-02
124	0.135217E-02	0.605220E-02	0.419391E-03	0.350067E-02
125	0.141303E-02	0.557199E-02	0.449288E-03	0.325928E-02
126	0.212924E-02	0.524878E-02	0.810902E-03	0.309003E-02
127	0.196199E-02	0.632594E-02	0.727684E-03	0.363170E-02
128	0.189246E-02	0.738602E-02	0.692859E-03	0.416527E-02
129	0.290297E-02	0.497136E-02	0.120061E-02	0.294451E-02
130	0.282320E-02	0.561134E-02	0.116094E-02	0.326628E-02
131	0.276663E-02	0.619519E-02	0.113289E-02	0.355937E-02
132	0.270768E-02	0.676435E-02	0.110337E-02	0.384525E-02
133	0.267642E-02	0.741506E-02	0.108742E-02	0.417233E-02
134	0.374338E-02	0.476491E-02	0.162285E-02	0.283515E-02
135	0.359686E-02	0.606016E-02	0.155017E-02	0.348501E-02
136	0.351484E-02	0.734768E-02	0.150881E-02	0.413063E-02
137	0.459224E-02	0.460518E-02	0.204853E-02	0.274937E-02
138	0.451842E-02	0.528788E-02	0.201207E-02	0.309143E-02
139	0.445150E-02	0.593354E-02	0.197881E-02	0.341501E-02
140	0.439604E-02	0.657016E-02	0.195091E-02	0.373335E-02
141	0.434558E-02	0.723117E-02	0.192536E-02	0.406388E-02
142	0.626027E-02	0.440052E-02	0.288271E-02	0.263548E-02
143	0.611260E-02	0.568186E-02	0.280953E-02	0.327491E-02
144	0.598065E-02	0.695260E-02	0.274306E-02	0.390914E-02
145	0.778238E-02	0.429753E-02	0.364078E-02	0.257234E-02
146	0.770781E-02	0.487952E-02	0.360412E-02	0.286161E-02
147	0.763176E-02	0.545051E-02	0.356647E-02	0.314541E-02
148	0.755753E-02	0.601749E-02	0.352925E-02	0.342717E-02
149	0.748184E-02	0.659186E-02	0.349108E-02	0.371262E-02
150	0.101561E-01	0.422643E-02	0.481378E-02	0.251308E-02
151	0.998749E-02	0.502053E-02	0.473046E-02	0.290257E-02
152	0.981204E-02	0.580915E-02	0.464255E-02	0.328943E-02
153	0.116128E-01	0.418750E-02	0.551956E-02	0.246821E-02
154	0.115209E-01	0.440325E-02	0.547441E-02	0.257087E-02
155	0.114290E-01	0.462532E-02	0.542901E-02	0.267686E-02
156	0.113391E-01	0.484541E-02	0.538421E-02	0.278186E-02
157	0.112485E-01	0.505681E-02	0.533880E-02	0.288241E-02
158	0.123010E-01	0.407268E-02	0.583689E-02	0.238309E-02
159	0.121065E-01	0.424462E-02	0.574099E-02	0.245794E-02
160	0.119192E-01	0.441675E-02	0.564786E-02	0.253303E-02
161	0.124494E-01	0.388565E-02	0.588426E-02	0.225951E-02
162	0.123479E-01	0.387818E-02	0.583453E-02	0.225069E-02
163	0.122515E-01	0.387327E-02	0.578721E-02	0.224329E-02
164	0.121612E-01	0.386611E-02	0.574245E-02	0.223477E-02
165	0.120751E-01	0.385705E-02	0.569969E-02	0.222521E-02
166	0.122327E-01	0.365409E-02	0.575452E-02	0.211134E-02
167	0.120322E-01	0.349608E-02	0.565598E-02	0.202526E-02
168	0.118482E-01	0.334170E-02	0.556514E-02	0.194108E-02
169	0.116902E-01	0.339117E-02	0.547040E-02	0.194589E-02
170	0.115926E-01	0.325331E-02	0.542281E-02	0.187555E-02
171	0.115006E-01	0.311607E-02	0.537795E-02	0.180557E-02
172	0.114178E-01	0.297963E-02	0.533716E-02	0.173601E-02
173	0.113398E-01	0.284220E-02	0.529872E-02	0.166592E-02
174	0.108854E-01	0.309434E-02	0.506826E-02	0.176301E-02

175	0.106886E-01	0.272144E-02	0.497182E-02	0.157848E-02
176	0.105144E-01	0.235072E-02	0.488600E-02	0.139502E-02
177	0.988625E-02	0.269262E-02	0.457704E-02	0.153111E-02
178	0.979432E-02	0.249304E-02	0.453274E-02	0.143311E-02
179	0.971107E-02	0.230677E-02	0.449253E-02	0.134144E-02
180	0.964595E-02	0.213064E-02	0.446051E-02	0.125500E-02
181	0.958840E-02	0.194869E-02	0.443204E-02	0.116606E-02
182	0.903996E-02	0.239729E-02	0.416056E-02	0.136508E-02
183	0.890812E-02	0.212021E-02	0.409711E-02	0.122748E-02
184	0.879461E-02	0.184293E-02	0.404230E-02	0.108972E-02
185	0.854132E-02	0.207216E-02	0.390857E-02	0.118548E-02
186	0.845663E-02	0.199647E-02	0.386811E-02	0.114616E-02
187	0.838053E-02	0.191522E-02	0.383165E-02	0.110425E-02
188	0.832662E-02	0.183639E-02	0.380519E-02	0.106360E-02
189	0.828044E-02	0.176169E-02	0.378233E-02	0.102482E-02
190	0.826742E-02	0.179208E-02	0.376201E-02	0.102604E-02
191	0.814397E-02	0.170490E-02	0.370266E-02	0.978266E-03
192	0.802834E-02	0.161920E-02	0.364713E-02	0.931271E-03
193	0.811366E-02	0.158926E-02	0.367463E-02	0.901470E-03
194	0.803697E-02	0.154160E-02	0.363818E-02	0.876526E-03
195	0.796407E-02	0.149254E-02	0.360353E-02	0.851039E-03
196	0.791425E-02	0.144281E-02	0.357921E-02	0.825222E-03
197	0.786782E-02	0.139696E-02	0.355649E-02	0.801255E-03
198	0.778100E-02	0.148479E-02	0.350999E-02	0.820747E-03
199	0.767477E-02	0.127622E-02	0.345870E-02	0.721675E-03
200	0.754770E-02	0.106879E-02	0.339828E-02	0.623105E-03
201	0.710256E-02	0.146604E-02	0.319420E-02	0.778304E-03
202	0.703361E-02	0.126769E-02	0.316142E-02	0.687327E-03
203	0.696354E-02	0.105046E-02	0.312825E-02	0.587698E-03
204	0.692057E-02	0.839950E-03	0.310715E-02	0.491577E-03
205	0.687557E-02	0.643298E-03	0.308520E-02	0.401376E-03
206	0.575219E-02	0.150847E-02	0.258057E-02	0.765037E-03
207	0.566996E-02	0.833009E-03	0.254057E-02	0.460383E-03
208	0.555612E-02	0.154921E-03	0.248660E-02	0.153742E-03
209	0.384489E-02	0.146279E-02	0.172338E-02	0.713309E-03
210	0.377762E-02	0.981860E-03	0.169123E-02	0.496106E-03
211	0.370736E-02	0.571788E-03	0.165773E-02	0.311787E-03
212	0.368535E-02	0.165299E-03	0.164573E-02	0.129564E-03
213	0.366252E-02	-0.278994E-03	0.163353E-02	-0.682880E-04
214	0.151776E-02	0.107310E-02	0.678796E-03	0.509130E-03
215	0.148075E-02	0.314505E-03	0.660932E-03	0.169843E-03
216	0.143195E-02	-0.435424E-03	0.637830E-03	-0.165425E-03
217	0.223796E-03	0.183130E-17	0.104839E-03	0.412478E-17
218	0.103817E-03	0.861408E-04	0.486145E-04	0.426125E-04
219	0.251819E-04	0.283286E-04	0.111854E-04	0.152672E-04
220	0.410649E-04	0.420750E-05	0.158508E-04	0.596795E-05
221	0.878066E-04	-0.392442E-18	0.339744E-04	-0.153972E-17
222	0.103498E-17	0.433755E-04	0.202430E-17	0.214107E-04
223	0.511665E-18	0.112221E-05	0.132689E-17	0.252326E-05
224	-0.413263E-18	0.245091E-18	-0.810631E-18	0.588137E-18
225	0.196259E-18	0.848420E-17	0.440285E-18	0.242944E-17
226	-0.379630E-18	0.137468E-18	-0.768612E-18	0.107150E-18

STRESS STATE AT THE GAUSS POINTS FOR SOLID ELEMENTS
****

ELEMENT	GAUSS	COORDINATES		GLOBAL STRESSES		LOCAL STRESSES		PRINCIPAL STRESSES		CRACKING FLAGES	
1	IG = 1	XG =	0.132323E+01	SIGR =	0.127939E+03	SIGXI =	-0.831808E+01	SIG1 =	0.131507E+03	IXI =	0
	JG = 1	YG =	0.149570E+03	SIGZ =	-0.784132E+01	SIGETA =	0.128416E+03	SIG2 =	-0.114088E+02	IETA =	0
		ZETA =	-0.906340E+02	SIGRZ =	-0.222963E+02	SIGXIET=	0.207885E+02	SIGTH =	0.136033E+03	ITHETA =	0
								GAMA =	0.815435E+02	IXIETA =	0
1	IG = 2	XG =	0.131045E+01	SIGR =	0.568422E+02	SIGXI =	-0.274935E+02	SIG1 =	0.675284E+02	IXI =	0
	JG = 1	YG =	0.148415E+03	SIGZ =	-0.268012E+02	SIGETA =	0.575345E+02	SIG2 =	-0.374874E+02	IETA =	0
		ZETA =	-0.906340E+02	SIGRZ =	-0.317494E+02	SIGXIET=	0.308162E+02	SIGTH =	0.782742E+02	ITHETA =	0
								GAMA =	0.720318E+02	IXIETA =	0
1	IG = 1	XG =	0.493640E+01	SIGR =	0.793417E+02	SIGXI =	0.162405E+01	SIG1 =	0.828372E+02	IXI =	0
	JG = 2	YG =	0.149475E+03	SIGZ =	0.287295E+01	SIGETA =	0.805906E+02	SIG2 =	-0.622582E+00	IETA =	0
		ZETA =	-0.923660E+02	SIGRZ =	-0.167188E+02	SIGXIET=	0.135076E+02	SIGTH =	0.988600E+02	ITHETA =	0
								GAMA =	0.805568E+02	IXIETA =	0
1	IG = 2	XG =	0.488873E+01	SIGR =	-0.898856E+02	SIGXI =	-0.106436E+02	SIG1 =	0.695060E+01	IXI =	0
	JG = 2	YG =	0.148322E+03	SIGZ =	-0.742506E+01	SIGETA =	-0.866671E+02	SIG2 =	-0.104261E+03	IETA =	0
		ZETA =	-0.923660E+02	SIGRZ =	-0.373106E+02	SIGXIET=	0.405848E+02	SIGTH =	-0.208746E+02	ITHETA =	0
								GAMA =	0.234375E+02	IXIETA =	0
2	IG = 1	XG =	0.130110E+01	SIGR =	-0.514060E+02	SIGXI =	-0.723734E+02	SIG1 =	-0.288321E+02	IXI =	0
	JG = 1	YG =	0.147570E+03	SIGZ =	-0.730754E+02	SIGETA =	-0.521079E+02	SIG2 =	-0.956492E+02	IETA =	0
		ZETA =	-0.906340E+02	SIGRZ =	0.316029E+02	SIGXIET=	-0.318349E+02	SIGTH =	-0.304812E+02	ITHETA =	0
								GAMA =	-0.538279E+02	IXIETA =	0
2	IG = 2	XG =	0.128832E+01	SIGR =	-0.246282E+03	SIGXI =	-0.509088E+02	SIG1 =	-0.478710E+02	IXI =	0
	JG = 1	YG =	0.146416E+03	SIGZ =	-0.514769E+02	SIGETA =	-0.246850E+03	SIG2 =	-0.249887E+03	IETA =	0
		ZETA =	-0.906340E+02	SIGRZ =	0.267478E+02	SIGXIET=	-0.245858E+02	SIGTH =	-0.240267E+03	ITHETA =	0
								GAMA =	-0.704378E+01	IXIETA =	0
2	IG = 1	XG =	0.485383E+01	SIGR =	-0.195278E+03	SIGXI =	-0.534631E+02	SIG1 =	-0.430153E+02	IXI =	0
	JG = 2	YG =	0.147477E+03	SIGZ =	-0.570396E+02	SIGETA =	-0.198854E+03	SIG2 =	-0.209302E+03	IETA =	0
		ZETA =	-0.923660E+02	SIGRZ =	0.462101E+02	SIGXIET=	-0.403506E+02	SIGTH =	-0.128491E+03	ITHETA =	0
								GAMA =	-0.145165E+02	IXIETA =	0
2	IG = 2	XG =	0.480617E+01	SIGR =	-0.278529E+03	SIGXI =	-0.370843E+02	SIG1 =	-0.363166E+02	IXI =	0
	JG = 2	YG =	0.146323E+03	SIGZ =	-0.386268E+02	SIGETA =	-0.280072E+03	SIG2 =	-0.280839E+03	IETA =	0
		ZETA =	-0.923660E+02	SIGRZ =	0.236550E+02	SIGXIET=	-0.136790E+02	SIGTH =	-0.267891E+03	ITHETA =	0
								GAMA =	-0.321195E+01	IXIETA =	0
3	IG = 1	XG =	0.757923E+01	SIGR =	0.341009E+02	SIGXI =	0.229312E+00	SIG1 =	0.351378E+02	IXI =	0
	JG = 1	YG =	0.149337E+03	SIGZ =	0.850073E+00	SIGETA =	0.347217E+02	SIG2 =	-0.186846E+00	IETA =	0
		ZETA =	-0.936340E+02	SIGRZ =	-0.596269E+01	SIGXIET=	0.381149E+01	SIGTH =	0.640720E+02	ITHETA =	0
								GAMA =	0.837688E+02	IXIETA =	0
3	IG = 2	XG =	0.750604E+01	SIGR =	-0.860165E+02	SIGXI =	0.887675E+01	SIG1 =	0.131839E+02	IXI =	0
	JG = 1	YG =	0.148185E+03	SIGZ =	0.110901E+02	SIGETA =	-0.838031E+02	SIG2 =	-0.881103E+02	IETA =	0
		ZETA =	-0.936340E+02	SIGRZ =	-0.144120E+02	SIGXIET=	0.204387E+02	SIGTH =	-0.573992E+02	ITHETA =	0
								GAMA =	0.119002E+02	IXIETA =	0
3	IG = 1	XG =	0.111825E+02	SIGR =	0.142831E+02	SIGXI =	-0.306022E+01	SIG1 =	0.152408E+02	IXI =	0
	JG = 2	YG =	0.149053E+03	SIGZ =	-0.244021E+01	SIGETA =	0.149031E+02	SIG2 =	-0.339788E+01	IETA =	0

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                  ZETA =   -0.953660E+02  SIGRZ =  -0.411492E+01  SIGXIET=   0.248587E+01  SIGTH =   0.243494E+02  ITHETA  =  0
                                                                                            GAMA  =   0.822647E+02  IXIETA  =  0

 3   IG   = 2    XG   =    0.110745E+02  SIGR  =  -0.108674E+03  SIGXI  =  -0.177496E+01  SIG1  =  -0.804035E+00  IXI     =  0
     JG   = 2    YG   =    0.147904E+03  SIGZ  =  -0.804235E+00  SIGETA =  -0.107704E+03  SIG2  =  -0.108675E+03  IETA    =  0
                 ZETA =   -0.953660E+02  SIGRZ =  -0.146817E+00  SIGXIET=   0.101878E+02  SIGTH =  -0.990702E+02  ITHETA  =  0
                                                                                            GAMA  =   0.544399E+01  IXIETA  =  0

 4   IG   = 1    XG   =    0.745246E+01  SIGR  =  -0.189518E+03  SIGXI  =  -0.359255E+02  SIG1  =  -0.343342E+02  IXI     =  0
     JG   = 1    YG   =    0.147341E+03  SIGZ  =  -0.385579E+02  SIGETA =  -0.192150E+03  SIG2  =  -0.193742E+03  IETA    =  0
                 ZETA =   -0.936340E+02  SIGRZ =   0.256017E+02  SIGXIET=  -0.158470E+02  SIGTH =  -0.163629E+03  ITHETA  =  0
                                                                                            GAMA  =  -0.573409E+01  IXIETA  =  0

 4   IG   = 2    XG   =    0.737927E+01  SIGR  =  -0.319492E+03  SIGXI  =  -0.427418E+02  SIG1  =  -0.427265E+02  IXI     =  0
     JG   = 1    YG   =    0.146189E+03  SIGZ  =  -0.441196E+02  SIGETA =  -0.320869E+03  SIG2  =  -0.320885E+03  IETA    =  0
                 ZETA =   -0.936340E+02  SIGRZ =   0.196353E+02  SIGXIET=  -0.205885E+01  SIGTH =  -0.298540E+03  ITHETA  =  0
                                                                                            GAMA  =  -0.424103E+00  IXIETA  =  0

 4   IG   = 1    XG   =    0.109955E+02  SIGR  =  -0.205790E+03  SIGXI  =  -0.457552E+02  SIG1  =  -0.457537E+02  IXI     =  0
     JG   = 2    YG   =    0.147062E+03  SIGZ  =  -0.470754E+02  SIGETA =  -0.207110E+03  SIG2  =  -0.207111E+03  IETA    =  0
                 ZETA =   -0.953660E+02  SIGRZ =   0.145436E+02  SIGXIET=   0.488382E+00  SIGTH =  -0.201546E+03  ITHETA  =  0
                                                                                            GAMA  =   0.173418E+00  IXIETA  =  0

 4   IG   = 2    XG   =    0.108875E+02  SIGR  =  -0.318289E+03  SIGXI  =  -0.451764E+02  SIG1  =  -0.451641E+02  IXI     =  0
     JG   = 2    YG   =    0.145912E+03  SIGZ  =  -0.472397E+02  SIGETA =  -0.320352E+03  SIG2  =  -0.320364E+03  IETA    =  0
                 ZETA =   -0.953660E+02  SIGRZ =   0.238096E+02  SIGXIET=   0.184368E+01  SIGTH =  -0.327662E+03  ITHETA  =  0
                                                                                            GAMA  =   0.383860E+00  IXIETA  =  0

 5   IG   = 1    XG   =    0.138144E+02  SIGR  =   0.310554E+01  SIGXI  =   0.245158E+01  SIG1  =   0.673111E+01  IXI     =  0
     JG   = 1    YG   =    0.148777E+03  SIGZ  =   0.326707E+01  SIGETA =   0.392103E+01  SIG2  =  -0.358498E+00  IETA    =  0
                 ZETA =   -0.966340E+02  SIGRZ =  -0.354388E+01  SIGXIET=   0.346782E+01  SIGTH =  -0.130439E+01  ITHETA  =  0
                                                                                            GAMA  =   0.509812E+02  IXIETA  =  0

 5   IG   = 2    XG   =    0.136811E+02  SIGR  =  -0.109235E+03  SIGXI  =   0.410839E+01  SIG1  =   0.415912E+01  IXI     =  0
     JG   = 1    YG   =    0.147630E+03  SIGZ  =   0.313547E+01  SIGETA =  -0.110208E+03  SIG2  =  -0.110259E+03  IETA    =  0
                 ZETA =   -0.966340E+02  SIGRZ =   0.107738E+02  SIGXIET=   0.240863E+01  SIGTH =  -0.122235E+03  ITHETA  =  0
                                                                                            GAMA  =   0.120650E+01  IXIETA  =  0

 5   IG   = 1    XG   =    0.173979E+02  SIGR  =  -0.760104E+01  SIGXI  =  -0.727019E+00  SIG1  =  -0.595235E+00  IXI     =  0
     JG   = 2    YG   =    0.148305E+03  SIGZ  =  -0.595734E+00  SIGETA =  -0.746975E+01  SIG2  =  -0.760154E+01  IETA    =  0
                 ZETA =   -0.983660E+02  SIGRZ =   0.590868E-01  SIGXIET=   0.951814E+00  SIGTH =  -0.391601E+02  ITHETA  =  0
                                                                                            GAMA  =   0.788279E+01  IXIETA  =  0

 5   IG   = 2    XG   =    0.172299E+02  SIGR  =  -0.102102E+03  SIGXI  =   0.137627E+01  SIG1  =   0.138057E+01  IXI     =  0
     JG   = 2    YG   =    0.147163E+03  SIGZ  =  -0.105997E+01  SIGETA =  -0.104538E+03  SIG2  =  -0.104543E+03  IETA    =  0
                 ZETA =   -0.983660E+02  SIGRZ =   0.158919E+02  SIGXIET=  -0.674289E+00  SIGTH =  -0.152818E+03  ITHETA  =  0
                                                                                            GAMA  =  -0.364745E+00  IXIETA  =  0

 6   IG   = 1    XG   =    0.135834E+02  SIGR  =  -0.200335E+03  SIGXI  =  -0.446341E+02  SIG1  =  -0.439040E+02  IXI     =  0
     JG   = 1    YG   =    0.146790E+03  SIGZ  =  -0.442573E+02  SIGETA =  -0.199959E+03  SIG2  =  -0.200689E+03  IETA    =  0
                 ZETA =   -0.966340E+02  SIGRZ =   0.743476E+01  SIGXIET=   0.106741E+02  SIGTH =  -0.222027E+03  ITHETA  =  0
                                                                                            GAMA  =   0.391292E+01  IXIETA  =  0

 6   IG   = 2    XG   =    0.134500E+02  SIGR  =  -0.303381E+03  SIGXI  =  -0.392383E+02  SIG1  =  -0.392230E+02  IXI     =  0
     JG   = 1    YG   =    0.145643E+03  SIGZ  =  -0.423411E+02  SIGETA =  -0.306484E+03  SIG2  =  -0.306499E+03  IETA    =  0
                 ZETA =   -0.966340E+02  SIGRZ =   0.286993E+02  SIGXIET=   0.202191E+01  SIGTH =  -0.341791E+03  ITHETA  =  0
                                                                                            GAMA  =   0.433453E+00  IXIETA  =  0
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6  IG  = 1  XG   =  0.171069E+02  SIGR  = -0.185372E+03  SIGXI  = -0.463055E+02  SIG1  = -0.450094E+02  IXI    = 0
   JG  = 2  YG   =  0.146326E+03  SIGZ  = -0.453594E+02  SIGETA = -0.184426E+03  SIG2  = -0.185722E+03  IETA   = 0
            ZETA = -0.983660E+02  SIGRZ =  0.700888E+01  SIGXIET=  0.134424E+02  SIGTH = -0.247622E+03  ITHETA = 0
                                                                                 GAMA  =  0.550738E+01  IXIETA = 0
6  IG  = 2  XG   =  0.169389E+02  SIGR  = -0.287533E+03  SIGXI  = -0.433077E+02  SIG1  = -0.431955E+02  IXI    = 0
   JG  = 2  YG   =  0.145184E+03  SIGZ  = -0.470375E+02  SIGETA = -0.291263E+03  SIG2  = -0.291375E+03  IETA   = 0
            ZETA = -0.983660E+02  SIGRZ =  0.306390E+02  SIGXIET=  0.527704E+01  SIGTH = -0.363746E+03  ITHETA = 0
                                                                                 GAMA  =  0.121865E+01  IXIETA = 0

7  IG  = 1  XG   =  0.200118E+02  SIGR  = -0.139408E+02  SIGXI  =  0.118865E+01  SIG1  =  0.142310E+01  IXI    = 0
   JG  = 1  YG   =  0.147891E+03  SIGZ  =  0.139274E+01  SIGETA = -0.137367E+02  SIG2  = -0.139711E+02  IETA   = 0
            ZETA = -0.996340E+02  SIGRZ =  0.682944E+00  SIGXIET=  0.188524E+01  SIGTH = -0.662152E+02  ITHETA = 0
                                                                                 GAMA  =  0.708879E+01  IXIETA = 0
7  IG  = 2  XG   =  0.198186E+02  SIGR  = -0.102576E+03  SIGXI  =  0.248747E+01  SIG1  =  0.249053E+01  IXI    = 0
   JG  = 1  YG   =  0.146753E+03  SIGZ  = -0.345062E+00  SIGETA = -0.105409E+03  SIG2  = -0.105412E+03  IETA   = 0
            ZETA = -0.996340E+02  SIGRZ =  0.172605E+02  SIGXIET=  0.573791E+00  SIGTH = -0.175630E+03  ITHETA = 0
                                                                                 GAMA  =  0.304687E+00  IXIETA = 0
7  IG  = 1  XG   =  0.235657E+02  SIGR  = -0.289230E+02  SIGXI  =  0.416066E+00  SIG1  =  0.593489E+00  IXI    = 0
   JG  = 2  YG   =  0.147232E+03  SIGZ  =  0.154622E+00  SIGETA = -0.291845E+02  SIG2  = -0.293619E+02  IETA   = 0
            ZETA = -0.101366E+03  SIGRZ =  0.359914E+01  SIGXIET=  0.229854E+01  SIGTH = -0.107720E+03  ITHETA = 0
                                                                                 GAMA  =  0.441388E+01  IXIETA = 0
7  IG  = 2  XG   =  0.233381E+02  SIGR  = -0.104535E+03  SIGXI  =  0.259225E+01  SIG1  =  0.259825E+01  IXI    = 0
   JG  = 2  YG   =  0.146100E+03  SIGZ  = -0.140812E+01  SIGETA = -0.108535E+03  SIG2  = -0.108541E+03  IETA   = 0
            ZETA = -0.101366E+03  SIGRZ =  0.207175E+02  SIGXIET=  0.816969E+00  SIGTH = -0.209963E+03  ITHETA = 0
                                                                                 GAMA  =  0.421188E+00  IXIETA = 0

8  IG  = 1  XG   =  0.196771E+02  SIGR  = -0.178482E+03  SIGXI  = -0.468315E+02  SIG1  = -0.454348E+02  IXI    = 0
   JG  = 1  YG   =  0.145919E+03  SIGZ  = -0.460113E+02  SIGETA = -0.177662E+03  SIG2  = -0.179059E+03  IETA   = 0
            ZETA = -0.996340E+02  SIGRZ =  0.875786E+01  SIGXIET=  0.135896E+02  SIGTH = -0.266971E+03  ITHETA = 0
                                                                                 GAMA  =  0.586793E+01  IXIETA = 0
8  IG  = 2  XG   =  0.194839E+02  SIGR  = -0.266454E+03  SIGXI  = -0.417970E+02  SIG1  = -0.417290E+02  IXI    = 0
   JG  = 1  YG   =  0.144781E+03  SIGZ  = -0.469284E+02  SIGETA = -0.271585E+03  SIG2  = -0.271653E+03  IETA   = 0
            ZETA = -0.996340E+02  SIGRZ =  0.341823E+02  SIGXIET=  0.395261E+01  SIGTH = -0.377185E+03  ITHETA = 0
                                                                                 GAMA  =  0.985164E+00  IXIETA = 0
8  IG  = 1  XG   =  0.231715E+02  SIGR  = -0.172782E+03  SIGXI  = -0.462093E+02  SIG1  = -0.446122E+02  IXI    = 0
   JG  = 2  YG   =  0.145271E+03  SIGZ  = -0.455857E+02  SIGETA = -0.172159E+03  SIG2  = -0.173756E+03  IETA   = 0
            ZETA = -0.101366E+03  SIGRZ =  0.111706E+02  SIGXIET=  0.142729E+02  SIGTH = -0.296190E+03  ITHETA = 0
                                                                                 GAMA  =  0.638504E+01  IXIETA = 0
8  IG  = 2  XG   =  0.229440E+02  SIGR  = -0.253503E+03  SIGXI  = -0.418385E+02  SIG1  = -0.417025E+02  IXI    = 0
   JG  = 2  YG   =  0.144139E+03  SIGZ  = -0.482015E+02  SIGETA = -0.259866E+03  SIG2  = -0.260003E+03  IETA   = 0
            ZETA = -0.101366E+03  SIGRZ =  0.371013E+02  SIGXIET=  0.544717E+01  SIGTH = -0.400893E+03  ITHETA = 0
                                                                                 GAMA  =  0.143028E+01  IXIETA = 0

9  IG  = 1  XG   =  0.261543E+02  SIGR  = -0.426295E+02  SIGXI  =  0.152236E+01  SIG1  =  0.169055E+01  IXI    = 0
   JG  = 1  YG   =  0.146682E+03  SIGZ  =  0.541491E+00  SIGETA = -0.436103E+02  SIG2  = -0.437785E+02  IETA   = 0
            ZETA = -0.102634E+03  SIGRZ =  0.713627E+01  SIGXIET=  0.276033E+01  SIGTH = -0.140014E+03  ITHETA = 0
                                                                                 GAMA  =  0.348691E+01  IXIETA = 0
9  IG  = 2  XG   =  0.259018E+02  SIGR  = -0.112384E+03  SIGXI  =  0.271225E+01  SIG1  =  0.286018E+01  IXI    = 0
```

```
      JG   = 1   YG   =   0.145555E+03  SIGZ  =  -0.118847E+01  SIGETA =  -0.116285E+03  SIG2  =  -0.116433E+03  IETA    =  0
                 ZETA =  -0.102634E+03  SIGRZ =   0.216005E+02  SIGXIET=   0.419822E+01  SIGTH =  -0.237842E+03  ITHETA  =  0
                                                                                       GAMA  =   0.201805E+01  IXIETA  =  0

  9   IG   = 1   XG   =   0.296689E+02  SIGR  =  -0.716217E+02  SIGXI  =   0.355234E+00  SIG1  =   0.694612E+00  IXI     =  0
      JG   = 2   YG   =   0.145838E+03  SIGZ  =  -0.179133E+01  SIGETA =  -0.737683E+02  SIG2  =  -0.741077E+02  IETA    =  0
                 ZETA =  -0.104366E+03  SIGRZ =   0.134080E+02  SIGXIET=   0.502703E+01  SIGTH =  -0.189925E+03  ITHETA  =  0
                                                                                       GAMA  =   0.386221E+01  IXIETA  =  0

  9   IG   = 2   XG   =   0.293824E+02  SIGR  =  -0.124471E+03  SIGXI  =   0.330614E+01  SIG1  =   0.377700E+01  IXI     =  0
      JG   = 2   YG   =   0.144720E+03  SIGZ  =  -0.102861E+01  SIGETA =  -0.128806E+03  SIG2  =  -0.129276E+03  IETA    =  0
                 ZETA =  -0.104366E+03  SIGRZ =   0.248256E+02  SIGXIET=   0.790118E+01  SIGTH =  -0.279140E+03  ITHETA  =  0
                                                                                       GAMA  =   0.341048E+01  IXIETA  =  0


 10   IG   = 1   XG   =   0.257169E+02  SIGR  =  -0.175606E+03  SIGXI  =  -0.473709E+02  SIG1  =  -0.454135E+02  IXI     =  0
      JG   = 1   YG   =   0.144730E+03  SIGZ  =  -0.466763E+02  SIGETA =  -0.174911E+03  SIG2  =  -0.176869E+03  IETA    =  0
                 ZETA =  -0.102634E+03  SIGRZ =   0.128226E+02  SIGXIET=   0.159212E+02  SIGTH =  -0.320993E+03  ITHETA  =  0
                                                                                       GAMA  =   0.700911E+01  IXIETA  =  0

 10   IG   = 2   XG   =   0.254643E+02  SIGR  =  -0.249538E+03  SIGXI  =  -0.427786E+02  SIG1  =  -0.426795E+02  IXI     =  0
      JG   = 1   YG   =   0.143604E+03  SIGZ  =  -0.510961E+02  SIGETA =  -0.257855E+03  SIG2  =  -0.257954E+03  IETA    =  0
                 ZETA =  -0.102634E+03  SIGRZ =   0.417259E+02  SIGXIET=   0.461911E+01  SIGTH =  -0.421708E+03  ITHETA  =  0
                                                                                       GAMA  =   0.122976E+01  IXIETA  =  0

 10   IG   = 1   XG   =   0.291726E+02  SIGR  =  -0.175541E+03  SIGXI  =  -0.452087E+02  SIG1  =  -0.428551E+02  IXI     =  0
      JG   = 2   YG   =   0.143901E+03  SIGZ  =  -0.447227E+02  SIGETA =  -0.175055E+03  SIG2  =  -0.177408E+03  IETA    =  0
                 ZETA =  -0.104366E+03  SIGRZ =   0.157419E+02  SIGXIET=   0.176393E+02  SIGTH =  -0.356047E+03  ITHETA  =  0
                                                                                       GAMA  =   0.760004E+01  IXIETA  =  0

 10   IG   = 2   XG   =   0.288861E+02  SIGR  =  -0.233558E+03  SIGXI  =  -0.414836E+02  SIG1  =  -0.412351E+02  IXI     =  0
      JG   = 2   YG   =   0.142782E+03  SIGZ  =  -0.504604E+02  SIGETA =  -0.242534E+03  SIG2  =  -0.242783E+03  IETA    =  0
                 ZETA =  -0.104366E+03  SIGRZ =   0.421217E+02  SIGXIET=   0.707304E+01  SIGTH =  -0.449359E+03  ITHETA  =  0
                                                                                       GAMA  =   0.201237E+01  IXIETA  =  0


 11   IG   = 1   XG   =   0.322251E+02  SIGR  =  -0.100025E+03  SIGXI  =   0.235253E+01  SIG1  =   0.265900E+01  IXI     =  0
      JG   = 1   YG   =   0.145153E+03  SIGZ  =  -0.245261E+01  SIGETA =  -0.104830E+03  SIG2  =  -0.105137E+03  IETA    =  0
                 ZETA =  -0.105634E+03  SIGRZ =   0.229103E+02  SIGXIET=   0.573953E+01  SIGTH =  -0.229731E+03  ITHETA  =  0
                                                                                       GAMA  =   0.305648E+01  IXIETA  =  0

 11   IG   = 2   XG   =   0.319140E+02  SIGR  =  -0.137148E+03  SIGXI  =   0.403853E+01  SIG1  =   0.522831E+01  IXI     =  0
      JG   = 1   YG   =   0.144041E+03  SIGZ  =   0.359779E+00  SIGETA =  -0.140827E+03  SIG2  =  -0.142017E+03  IETA    =  0
                 ZETA =  -0.105634E+03  SIGRZ =   0.263280E+02  SIGXIET=   0.131823E+02  SIGTH =  -0.311559E+03  ITHETA  =  0
                                                                                       GAMA  =   0.515730E+01  IXIETA  =  0

 11   IG   = 1   XG   =   0.356907E+02  SIGR  =  -0.150415E+03  SIGXI  =   0.871331E+00  SIG1  =   0.150221E+01  IXI     =  0
      JG   = 2   YG   =   0.144127E+03  SIGZ  =  -0.763226E+01  SIGETA =  -0.158919E+03  SIG2  =  -0.159550E+03  IETA    =  0
                 ZETA =  -0.107366E+03  SIGRZ =   0.372516E+02  SIGXIET=   0.100601E+02  SIGTH =  -0.289602E+03  ITHETA  =  0
                                                                                       GAMA  =   0.358837E+01  IXIETA  =  0

 11   IG   = 2   XG   =   0.353461E+02  SIGR  =  -0.160815E+03  SIGXI  =   0.314001E+01  SIG1  =   0.484817E+01  IXI     =  0
      JG   = 2   YG   =   0.143025E+03  SIGZ  =  -0.220493E+01  SIGETA =  -0.166160E+03  SIG2  =  -0.167868E+03  IETA    =  0
                 ZETA =  -0.107366E+03  SIGRZ =   0.341824E+02  SIGXIET=   0.170912E+02  SIGTH =  -0.359285E+03  ITHETA  =  0
                                                                                       GAMA  =   0.570740E+01  IXIETA  =  0


 12   IG   = 1   XG   =   0.316862E+02  SIGR  =  -0.177455E+03  SIGXI  =  -0.473406E+02  SIG1  =  -0.436311E+02  IXI     =  0
      JG   = 1   YG   =   0.143227E+03  SIGZ  =  -0.451621E+02  SIGETA =  -0.175276E+03  SIG2  =  -0.178986E+03  IETA    =  0
                 ZETA =  -0.105634E+03  SIGRZ =   0.143135E+02  SIGXIET=   0.220983E+02  SIGTH =  -0.383881E+03  ITHETA  =  0
```

```
                                                                                                 GAMA   =   0.952899E+01   IXIETA  =  0
12  IG  = 2  XG   =   0.313750E+02  SIGR  =  -0.221748E+03  SIGXI  =  -0.430333E+02   SIG1   =  -0.427561E+02   IXI     =  0
    JG  = 1  YG   =   0.142115E+03  SIGZ  =  -0.529783E+02  SIGETA =  -0.231693E+03   SIG2   =  -0.231971E+03   IETA    =  0
             ZETA =  -0.105634E+03  SIGRZ =   0.427750E+02  SIGXIET=   0.723743E+01   SIGTH  =  -0.471252E+03   ITHETA  =  0
                                                                                      GAMA   =   0.219370E+01   IXIETA  =  0
12  IG  = 1  XG   =   0.350938E+02  SIGR  =  -0.178470E+03  SIGXI  =  -0.441294E+02   SIG1   =  -0.383995E+02   IXI     =  0
    JG  = 2  YG   =   0.142218E+03  SIGZ  =  -0.398232E+02  SIGETA =  -0.174164E+03   SIG2   =  -0.179894E+03   IETA    =  0
             ZETA =  -0.107366E+03  SIGRZ =   0.141213E+02  SIGXIET=   0.278911E+02   SIGTH  =  -0.420821E+03   ITHETA  =  0
                                                                                      GAMA   =   0.116092E+02   IXIETA  =  0
12  IG  = 2  XG   =   0.347491E+02  SIGR  =  -0.189903E+03  SIGXI  =  -0.401604E+02   SIG1   =  -0.392382E+02   IXI     =  0
    JG  = 2  YG   =   0.141116E+03  SIGZ  =  -0.472609E+02  SIGETA =  -0.197003E+03   SIG2   =  -0.197926E+03   IETA    =  0
             ZETA =  -0.107366E+03  SIGRZ =   0.347669E+02  SIGXIET=   0.120621E+02   SIGTH  =  -0.495359E+03   ITHETA  =  0
                                                                                      GAMA   =   0.437209E+01   IXIETA  =  0

13  IG  = 1  XG   =   0.382076E+02  SIGR  =  -0.196806E+03  SIGXI  =   0.406571E+01   SIG1   =   0.450477E+01   IXI     =  0
    JG  = 1  YG   =   0.143309E+03  SIGZ  =  -0.121826E+02  SIGETA =  -0.213054E+03   SIG2   =  -0.213493E+03   IETA    =  0
             ZETA =  -0.108634E+03  SIGRZ =   0.579599E+02  SIGXIET=   0.977354E+01   SIGTH  =  -0.336685E+03   ITHETA  =  0
                                                                                      GAMA   =   0.257221E+01   IXIETA  =  0
13  IG  = 2  XG   =   0.378387E+02  SIGR  =  -0.172989E+03  SIGXI  =   0.614603E+01   SIG1   =   0.970140E+01   IXI     =  0
    JG  = 1  YG   =   0.142215E+03  SIGZ  =   0.310784E+01  SIGETA =  -0.176028E+03   SIG2   =  -0.179583E+03   IETA    =  0
             ZETA =  -0.108634E+03  SIGRZ =   0.347071E+02  SIGXIET=   0.256970E+02   SIGTH  =  -0.392038E+03   ITHETA  =  0
                                                                                      GAMA   =   0.787728E+01   IXIETA  =  0
13  IG  = 1  XG   =   0.416147E+02  SIGR  =  -0.278097E+03  SIGXI  =  -0.216812E+01   SIG1   =  -0.140794E+01   IXI     =  0
    JG  = 2  YG   =   0.142102E+03  SIGZ  =  -0.289166E+02  SIGETA =  -0.304845E+03   SIG2   =  -0.305605E+03   IETA    =  0
             ZETA =  -0.110366E+03  SIGRZ =   0.872430E+02  SIGXIET=   0.151877E+02   SIGTH  =  -0.406029E+03   ITHETA  =  0
                                                                                      GAMA   =   0.286539E+01   IXIETA  =  0
13  IG  = 2  XG   =   0.412129E+02  SIGR  =  -0.209388E+03  SIGXI  =   0.528211E+01   SIG1   =   0.108046E+02   IXI     =  0
    JG  = 2  YG   =   0.141020E+03  SIGZ  =   0.179360E+01  SIGETA =  -0.212877E+03   SIG2   =  -0.218399E+03   IETA    =  0
             ZETA =  -0.110366E+03  SIGRZ =   0.445439E+02  SIGXIET=   0.351465E+02   SIGTH  =  -0.439835E+03   ITHETA  =  0
                                                                                      GAMA   =   0.892972E+01   IXIETA  =  0

14  IG  = 1  XG   =   0.375686E+02  SIGR  =  -0.169171E+03  SIGXI  =  -0.476434E+02   SIG1   =  -0.365780E+02   IXI     =  0
    JG  = 1  YG   =   0.141414E+03  SIGZ  =  -0.367166E+02  SIGETA =  -0.158244E+03   SIG2   =  -0.169310E+03   IETA    =  0
             ZETA =  -0.108634E+03  SIGRZ =   0.428703E+01  SIGXIET=   0.366918E+02   SIGTH  =  -0.445616E+03   ITHETA  =  0
                                                                                      GAMA   =   0.167821E+02   IXIETA  =  0
14  IG  = 2  XG   =   0.371996E+02  SIGR  =  -0.160229E+03  SIGXI  =  -0.435940E+02   SIG1   =  -0.423840E+02   IXI     =  0
    JG  = 1  YG   =   0.140320E+03  SIGZ  =  -0.486323E+02  SIGETA =  -0.165267E+03   SIG2   =  -0.166477E+03   IETA    =  0
             ZETA =  -0.108634E+03  SIGRZ =   0.271352E+02  SIGXIET=   0.121937E+02   SIGTH  =  -0.511702E+03   ITHETA  =  0
                                                                                      GAMA   =   0.566693E+01   IXIETA  =  0
14  IG  = 1  XG   =   0.409187E+02  SIGR  =  -0.166640E+03  SIGXI  =  -0.410091E+02   SIG1   =  -0.253763E+02   IXI     =  0
    JG  = 2  YG   =   0.140227E+03  SIGZ  =  -0.254142E+02  SIGETA =  -0.151045E+03   SIG2   =  -0.166678E+03   IETA    =  0
             ZETA =  -0.110366E+03  SIGRZ =   0.231363E+01  SIGXIET=   0.443233E+02   SIGTH  =  -0.476004E+03   ITHETA  =  0
                                                                                      GAMA   =   0.194277E+02   IXIETA  =  0
14  IG  = 2  XG   =   0.405168E+02  SIGR  =  -0.998849E+02  SIGXI  =  -0.410485E+02   SIG1   =  -0.359654E+02   IXI     =  0
    JG  = 2  YG   =   0.139145E+03  SIGZ  =  -0.362824E+02  SIGETA =  -0.951188E+02   SIG2   =  -0.100202E+03   IETA    =  0
             ZETA =  -0.110366E+03  SIGRZ =   0.450109E+01  SIGXIET=   0.173402E+02   SIGTH  =  -0.521202E+03   ITHETA  =  0
                                                                                      GAMA   =   0.163380E+02   IXIETA  =  0
```

```
15  IG  = 1  XG   =  0.440854E+02  SIGR  = -0.348607E+03  SIGXI  =  0.694396E+01  SIG1 =  0.745013E+01  IXI    = 0
    JG  = 1  YG   =  0.141154E+03  SIGZ  = -0.376886E+02  SIGETA = -0.393239E+03  SIG2 = -0.393745E+03  IETA   = 0
             ZETA = -0.111634E+03  SIGRZ =  0.126775E+03  SIGXIET=  0.142414E+02  SIGTH = -0.457262E+03 ITHETA = 0
                                                                                  GAMA =  0.203556E+01  IXIETA = 0

15  IG  = 2  XG   =  0.436597E+02  SIGR  = -0.228230E+03  SIGXI  =  0.928318E+01  SIG1 =  0.170040E+02  IXI    = 0
    JG  = 1  YG   =  0.140081E+03  SIGZ  =  0.662422E+01  SIGETA = -0.230889E+03  SIG2 = -0.238610E+03  IETA   = 0
             ZETA = -0.111634E+03  SIGRZ =  0.504527E+02  SIGXIET=  0.437486E+02  SIGTH = -0.469763E+03 ITHETA = 0
                                                                                  GAMA =  0.100086E+02  IXIETA = 0

15  IG  = 1  XG   =  0.474247E+02  SIGR  = -0.465599E+03  SIGXI  = -0.143181E+01  SIG1 =  0.560109E-01  IXI    = 0
    JG  = 2  YG   =  0.139771E+03  SIGZ  = -0.638505E+02  SIGETA = -0.528018E+03  SIG2 = -0.529505E+03  IETA   = 0
             ZETA = -0.113366E+03  SIGRZ =  0.172506E+03  SIGXIET=  0.280299E+02  SIGTH = -0.527617E+03 ITHETA = 0
                                                                                  GAMA =  0.303838E+01  IXIETA = 0

15  IG  = 2  XG   =  0.469667E+02  SIGR  = -0.274693E+03  SIGXI  = -0.362558E+00  SIG1 =  0.711916E+01  IXI    = 0
    JG  = 2  YG   =  0.138711E+03  SIGZ  = -0.111397E+02  SIGETA = -0.285470E+03  SIG2 = -0.292952E+03  IETA   = 0
             ZETA = -0.113366E+03  SIGRZ =  0.717327E+02  SIGXIET=  0.467875E+02  SIGTH = -0.510205E+03 ITHETA = 0
                                                                                  GAMA =  0.908516E+01  IXIETA = 0


16  IG  = 1  XG   =  0.433481E+02  SIGR  = -0.157396E+03  SIGXI  = -0.451655E+02  SIG1 = -0.177436E+02  IXI    = 0
    JG  = 1  YG   =  0.139295E+03  SIGZ  = -0.186394E+02  SIGETA = -0.130869E+03  SIG2 = -0.158291E+03  IETA   = 0
             ZETA = -0.111634E+03  SIGRZ = -0.111847E+02  SIGXIET=  0.556967E+02  SIGTH = -0.493828E+03 ITHETA = 0
                                                                                  GAMA =  0.262130E+02  IXIETA = 0

16  IG  = 2  XG   =  0.429223E+02  SIGR  = -0.451809E+02  SIGXI  = -0.414781E+02  SIG1 = -0.130138E+02  IXI    = 0
    JG  = 1  YG   =  0.138222E+03  SIGZ  = -0.251943E+02  SIGETA = -0.288971E+02  SIG2 = -0.573614E+02  IETA   = 0
             ZETA = -0.111634E+03  SIGRZ = -0.197942E+02  SIGXIET=  0.212628E+02  SIGTH = -0.520832E+03 ITHETA = 0
                                                                                  GAMA =  0.532403E+02  IXIETA = 0

16  IG  = 1  XG   =  0.466315E+02  SIGR  = -0.144890E+03  SIGXI  = -0.415778E+02  SIG1 = -0.586106E+01  IXI    = 0
    JG  = 2  YG   =  0.137935E+03  SIGZ  = -0.786646E+01  SIGETA = -0.111178E+03  SIG2 = -0.146895E+03  IETA   = 0
             ZETA = -0.113366E+03  SIGRZ = -0.166976E+02  SIGXIET=  0.613318E+02  SIGTH = -0.506553E+03 ITHETA = 0
                                                                                  GAMA =  0.302145E+02  IXIETA = 0

16  IG  = 2  XG   =  0.461735E+02  SIGR  =  0.526879E+02  SIGXI  = -0.364573E+02  SIG1 =  0.104358E+03  IXI    = 0
    JG  = 2  YG   =  0.136875E+03  SIGZ  =  0.790347E+01  SIGETA =  0.970486E+02  SIG2 = -0.437667E+02  IETA   = 0
             ZETA = -0.113366E+03  SIGRZ = -0.705962E+02  SIGXIET=  0.320824E+02  SIGTH = -0.498020E+03 ITHETA = 0
                                                                                  GAMA =  0.771652E+02  IXIETA = 0


17  IG  = 1  XG   =  0.495938E+02  SIGR  = -0.493968E+03  SIGXI  =  0.342304E+01  SIG1 =  0.343148E+01  IXI    = 0
    JG  = 1  YG   =  0.138893E+03  SIGZ  = -0.637159E+02  SIGETA = -0.561106E+03  SIG2 = -0.561115E+03  IETA   = 0
             ZETA = -0.109953E+03  SIGRZ =  0.182754E+03  SIGXIET= -0.218254E+01  SIGTH = -0.552608E+03 ITHETA = 0
                                                                                  GAMA = -0.221508E+00  IXIETA = 0

17  IG  = 2  XG   =  0.490862E+02  SIGR  = -0.269626E+03  SIGXI  =  0.611823E+01  SIG1 =  0.104055E+02  IXI    = 0
    JG  = 1  YG   =  0.137793E+03  SIGZ  = -0.139445E+02  SIGETA = -0.289689E+03  SIG2 = -0.293976E+03  IETA   = 0
             ZETA = -0.113246E+03  SIGRZ =  0.825757E+02  SIGXIET=  0.358690E+02  SIGTH = -0.520021E+03 ITHETA = 0
                                                                                  GAMA =  0.681598E+01  IXIETA = 0

17  IG  = 1  XG   =  0.522054E+02  SIGR  = -0.482694E+03  SIGXI  = -0.148103E+02  SIG1 = -0.145776E+02  IXI    = 0
    JG  = 2  YG   =  0.137938E+03  SIGZ  = -0.701857E+02  SIGETA = -0.538070E+03  SIG2 = -0.538302E+03  IETA   = 0
             ZETA = -0.110225E+03  SIGRZ =  0.161342E+03  SIGXIET=  0.110376E+02  SIGTH = -0.561023E+03 ITHETA = 0
                                                                                  GAMA =  0.120788E+01  IXIETA = 0

17  IG  = 2  XG   =  0.515837E+02  SIGR  = -0.258273E+03  SIGXI  =  0.104629E+02  SIG1 =  0.126332E+02  IXI    = 0
    JG  = 2  YG   =  0.136694E+03  SIGZ  = -0.211107E+02  SIGETA = -0.289846E+03  SIG2 = -0.292016E+03  IETA   = 0
             ZETA = -0.114281E+03  SIGRZ =  0.956107E+02  SIGXIET=  0.256218E+02  SIGTH = -0.520032E+03 ITHETA = 0
```

```
                                                                                    GAMA  =  0.484174E+01  IXIETA = 0

18  IG = 1  XG   =  0.487120E+02  SIGR  = -0.129834E+03  SIGXI  = -0.440016E+02  SIG1  = -0.911844E+01  IXI    = 0
    JG = 1  YG   =  0.136982E+03  SIGZ  = -0.105528E+02  SIGETA = -0.963848E+02  SIG2  = -0.131268E+03  IETA   = 0
            ZETA = -0.116082E+03  SIGRZ = -0.131586E+02  SIGXIET=  0.551736E+02  SIGTH = -0.508090E+03  ITHETA = 0
                                                                                 GAMA  =  0.323029E+02  IXIETA = 0

18  IG = 2  XG   =  0.481972E+02  SIGR  =  0.935690E+02  SIGXI  = -0.410020E+02  SIG1  =  0.161886E+03  IXI    = 0
    JG = 1  YG   =  0.135867E+03  SIGZ  =  0.258884E+02  SIGETA =  0.160459E+03  SIG2  = -0.424285E+02  IETA   = 0
            ZETA = -0.120534E+03  SIGRZ = -0.963894E+02  SIGXIET=  0.170123E+02  SIGTH = -0.481652E+03  ITHETA = 0
                                                                                 GAMA  =  0.852069E+02  IXIETA = 0

18  IG = 1  XG   =  0.511196E+02  SIGR  = -0.117059E+03  SIGXI  = -0.308553E+02  SIG1  = -0.126484E+02  IXI    = 0
    JG = 2  YG   =  0.135765E+03  SIGZ  = -0.129202E+02  SIGETA = -0.991242E+02  SIG2  = -0.117331E+03  IETA   = 0
            ZETA = -0.117569E+03  SIGRZ =  0.532768E+01  SIGXIET=  0.396795E+02  SIGTH = -0.501400E+03  ITHETA = 0
                                                                                 GAMA  =  0.246480E+02  IXIETA = 0

18  IG = 2  XG   =  0.504735E+02  SIGR  =  0.102999E+03  SIGXI  = -0.445434E+02  SIG1  =  0.188972E+03  IXI    = 0
    JG = 2  YG   =  0.134471E+03  SIGZ  =  0.398294E+02  SIGETA =  0.187372E+03  SIG2  = -0.461438E+02  IETA   = 0
            ZETA = -0.122475E+03  SIGRZ = -0.113236E+03  SIGXIET=  0.193321E+02  SIGTH = -0.464664E+03  ITHETA = 0
                                                                                 GAMA  =  0.852674E+02  IXIETA = 0

19  IG = 1  XG   =  0.541137E+02  SIGR  = -0.440969E+03  SIGXI  =  0.109941E+02  SIG1  =  0.110141E+02  IXI    = 0
    JG = 1  YG   =  0.137231E+03  SIGZ  = -0.492650E+02  SIGETA = -0.501228E+03  SIG2  = -0.501248E+03  IETA   = 0
            ZETA = -0.110420E+03  SIGRZ =  0.165061E+03  SIGXIET=  0.320089E+01  SIGTH = -0.549071E+03  ITHETA = 0
                                                                                 GAMA  =  0.358024E+00  IXIETA = 0

19  IG = 2  XG   =  0.533986E+02  SIGR  = -0.247681E+03  SIGXI  =  0.115856E+02  SIG1  =  0.139691E+02  IXI    = 0
    JG = 1  YG   =  0.135860E+03  SIGZ  = -0.202564E+02  SIGETA = -0.279523E+03  SIG2  = -0.281906E+03  IETA   = 0
            ZETA = -0.115033E+03  SIGRZ =  0.946315E+02  SIGXIET=  0.264487E+02  SIGTH = -0.512901E+03  ITHETA = 0
                                                                                 GAMA  =  0.514944E+01  IXIETA = 0

19  IG = 1  XG   =  0.567152E+02  SIGR  = -0.430598E+03  SIGXI  =  0.109181E+02  SIG1  =  0.117893E+02  IXI    = 0
    JG = 2  YG   =  0.136255E+03  SIGZ  = -0.364677E+02  SIGETA = -0.477984E+03  SIG2  = -0.478855E+03  IETA   = 0
            ZETA = -0.110692E+03  SIGRZ =  0.146111E+03  SIGXIET=  0.206565E+02  SIGTH = -0.539997E+03  ITHETA = 0
                                                                                 GAMA  =  0.241505E+01  IXIETA = 0

19  IG = 2  XG   =  0.558584E+02  SIGR  = -0.250808E+03  SIGXI  = -0.435225E+02  SIG1  = -0.410358E+02  IXI    = 0
    JG = 2  YG   =  0.134684E+03  SIGZ  = -0.694459E+02  SIGETA = -0.276732E+03  SIG2  = -0.279218E+03  IETA   = 0
            ZETA = -0.116069E+03  SIGRZ =  0.771988E+02  SIGXIET=  0.242097E+02  SIGTH = -0.511585E+03  ITHETA = 0
                                                                                 GAMA  =  0.586463E+01  IXIETA = 0

20  IG = 1  XG   =  0.528611E+02  SIGR  = -0.122062E+03  SIGXI  = -0.360224E+02  SIG1  = -0.194379E+02  IXI    = 0
    JG = 1  YG   =  0.134830E+03  SIGZ  = -0.203630E+02  SIGETA = -0.106402E+03  SIG2  = -0.122987E+03  IETA   = 0
            ZETA = -0.119014E+03  SIGRZ =  0.974362E+01  SIGXIET=  0.379770E+02  SIGTH = -0.495221E+03  ITHETA = 0
                                                                                 GAMA  =  0.235907E+02  IXIETA = 0

20  IG = 2  XG   =  0.521079E+02  SIGR  =  0.957316E+02  SIGXI  = -0.358559E+02  SIG1  =  0.193115E+03  IXI    = 0
    JG = 1  YG   =  0.133387E+03  SIGZ  =  0.595844E+02  SIGETA =  0.191172E+03  SIG2  = -0.377989E+02  IETA   = 0
            ZETA = -0.125234E+03  SIGRZ = -0.114034E+03  SIGXIET=  0.210922E+02  SIGTH = -0.447584E+03  ITHETA = 0
                                                                                 GAMA  =  0.847369E+02  IXIETA = 0

20  IG = 1  XG   =  0.551971E+02  SIGR  = -0.118504E+03  SIGXI  = -0.477570E+02  SIG1  = -0.398352E+02  IXI    = 0
    JG = 2  YG   =  0.133472E+03  SIGZ  = -0.442739E+02  SIGETA = -0.115020E+03  SIG2  = -0.122942E+03  IETA   = 0
            ZETA = -0.121346E+03  SIGRZ =  0.186865E+02  SIGXIET=  0.244051E+02  SIGTH = -0.482252E+03  ITHETA = 0
                                                                                 GAMA  =  0.179834E+02  IXIETA = 0
```

```
20  IG  = 2  XG   =  0.542472E+02  SIGR  =  0.781708E+02  SIGXI  = -0.250176E+02  SIG1 =  0.189935E+03  IXI    = 0
    JG  = 2  YG   =  0.131730E+03  SIGZ  =  0.846718E+02  SIGETA =  0.187860E+03  SIG2 = -0.270925E+02  IETA   = 0
             ZETA = -0.130247E+03  SIGRZ = -0.108465E+03  SIGXIET=  0.211188E+02  SIGTH = -0.420926E+03 ITHETA = 0
                                                                                  GAMA =  0.843888E+02  IXIETA = 0

21  IG  = 1  XG   =  0.582664E+02  SIGR  = -0.415353E+03  SIGXI  = -0.524619E+02  SIG1 = -0.516779E+02  IXI    = 0
    JG  = 1  YG   =  0.135794E+03  SIGZ  = -0.687814E+02  SIGETA = -0.431673E+03  SIG2 = -0.432457E+03  IETA   = 0
             ZETA = -0.996351E+02  SIGRZ =  0.788678E+02  SIGXIET= -0.172606E+02  SIGTH = -0.538869E+03 ITHETA = 0
                                                                                  GAMA = -0.260078E+01  IXIETA = 0
21  IG  = 2  XG   =  0.575509E+02  SIGR  = -0.213841E+03  SIGXI  = -0.488344E+02  SIG1 = -0.488290E+02  IXI    = 0
    JG  = 1  YG   =  0.133866E+03  SIGZ  = -0.854580E+02  SIGETA = -0.250465E+03  SIG2 = -0.250470E+03  IETA   = 0
             ZETA = -0.115524E+03  SIGRZ =  0.777447E+02  SIGXIET=  0.104573E+01  SIGTH = -0.495719E+03 ITHETA = 0
                                                                                  GAMA =  0.297148E+00  IXIETA = 0
21  IG  = 1  XG   =  0.599027E+02  SIGR  = -0.355201E+03  SIGXI  = -0.250660E+03  SIG1 = -0.215700E+03  IXI    = 0
    JG  = 2  YG   =  0.135510E+03  SIGZ  = -0.230982E+03  SIGETA = -0.335523E+03  SIG2 = -0.370483E+03  IETA   = 0
             ZETA = -0.100062E+03  SIGRZ = -0.461719E+02  SIGXIET=  0.647227E+02  SIGTH = -0.552298E+03 ITHETA = 0
                                                                                  GAMA =  0.283758E+02  IXIETA = 0
21  IG  = 2  XG   =  0.597142E+02  SIGR  = -0.143613E+03  SIGXI  =  0.662425E+01  SIG1 =  0.222859E+02  IXI    = 0
    JG  = 2  YG   =  0.132806E+03  SIGZ  = -0.966285E+02  SIGETA = -0.246866E+03  SIG2 = -0.262527E+03  IETA   = 0
             ZETA = -0.116690E+03  SIGRZ =  0.140455E+03  SIGXIET= -0.649257E+02  SIGTH = -0.463332E+03 ITHETA = 0
                                                                                  GAMA = -0.135620E+02  IXIETA = 0

22  IG  = 1  XG   =  0.568142E+02  SIGR  = -0.121580E+03  SIGXI  = -0.527776E+02  SIG1 = -0.513362E+02  IXI    = 0
    JG  = 1  YG   =  0.132484E+03  SIGZ  = -0.651034E+02  SIGETA = -0.133906E+03  SIG2 = -0.135348E+03  IETA   = 0
             ZETA = -0.121406E+03  SIGRZ =  0.310977E+02  SIGXIET=  0.109094E+02  SIGTH = -0.471862E+03 ITHETA = 0
                                                                                  GAMA =  0.752652E+01  IXIETA = 0
22  IG  = 2  XG   =  0.555169E+02  SIGR  =  0.594326E+02  SIGXI  = -0.544188E+02  SIG1 =  0.166579E+03  IXI    = 0
    JG  = 1  YG   =  0.130636E+03  SIGZ  =  0.521395E+02  SIGETA =  0.165991E+03  SIG2 = -0.550067E+02  IETA   = 0
             ZETA = -0.131104E+03  SIGRZ = -0.110733E+03  SIGXIET=  0.113993E+02  SIGTH = -0.412350E+03 ITHETA = 0
                                                                                  GAMA =  0.870472E+02  IXIETA = 0
22  IG  = 1  XG   =  0.588729E+02  SIGR  = -0.894155E+02  SIGXI  =  0.188022E+02  SIG1 =  0.261823E+02  IXI    = 0
    JG  = 2  YG   =  0.131179E+03  SIGZ  = -0.804204E+02  SIGETA = -0.188638E+03  SIG2 = -0.196018E+03  IETA   = 0
             ZETA = -0.123339E+03  SIGRZ =  0.111009E+03  SIGXIET= -0.398170E+02  SIGTH = -0.444688E+03 ITHETA = 0
                                                                                  GAMA = -0.105006E+02  IXIETA = 0
22  IG  = 2  XG   =  0.567629E+02  SIGR  =  0.287211E+02  SIGXI  = -0.309665E+02  SIG1 =  0.143750E+03  IXI    = 0
    JG  = 2  YG   =  0.129439E+03  SIGZ  =  0.815607E+02  SIGETA =  0.141248E+03  SIG2 = -0.334681E+02  IETA   = 0
             ZETA = -0.136850E+03  SIGRZ = -0.845786E+02  SIGXIET=  0.209059E+02  SIGTH = -0.391335E+03 ITHETA = 0
                                                                                  GAMA =  0.831766E+02  IXIETA = 0

23  IG  = 1  XG   =  0.624724E+02  SIGR  = -0.165525E+03  SIGXI  = -0.165402E+03  SIG1 = -0.435112E+02  IXI    = 0
    JG  = 1  YG   =  0.135148E+03  SIGZ  = -0.168058E+03  SIGETA = -0.168181E+03  SIG2 = -0.290072E+03  IETA   = 0
             ZETA = -0.179971E+03  SIGRZ =  0.123274E+03  SIGXIET=  0.123272E+03  SIGTH = -0.485409E+03 ITHETA = 0
                                                                                  GAMA =  0.446771E+02  IXIETA = 0
23  IG  = 2  XG   =  0.610290E+02  SIGR  = -0.267073E+03  SIGXI  = -0.266816E+03  SIG1 = -0.244686E+02  IXI    = 0
    JG  = 1  YG   =  0.135336E+03  SIGZ  = -0.226071E+03  SIGETA = -0.226328E+03  SIG2 = -0.468676E+03  IETA   = 0
             ZETA = -0.179967E+03  SIGRZ =  0.221156E+03  SIGXIET=  0.221179E+03  SIGTH = -0.527273E+03 ITHETA = 0
                                                                                  GAMA =  0.476148E+02  IXIETA = 0
23  IG  = 1  XG   =  0.624742E+02  SIGR  = -0.148003E+03  SIGXI  = -0.147806E+03  SIG1 =  0.114801E+03  IXI    = 0
    JG  = 2  YG   =  0.131456E+03  SIGZ  = -0.324245E+02  SIGETA = -0.326214E+02  SIG2 = -0.295228E+03  IETA   = 0
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                ZETA =  -0.179971E+03  SIGRZ =   0.196701E+03  SIGXIET=   0.196759E+03  SIGTH =  -0.423239E+03  ITHETA  = 0
                                                                                        GAMA  =   0.531575E+02  IXIETA  = 0

 23  IG  = 2    XG   =   0.610308E+02  SIGR  =  -0.126432E+03  SIGXI  =  -0.126249E+03  SIG1  =   0.283088E+02  IXI     = 0
     JG  = 2    YG   =   0.132155E+03  SIGZ  =  -0.131223E+03  SIGETA =  -0.131406E+03  SIG2  =  -0.285964E+03  IETA    = 0
                ZETA =  -0.179967E+03  SIGRZ =   0.157118E+03  SIGXIET=   0.157115E+03  SIGTH =  -0.452385E+03  ITHETA  = 0
                                                                                        GAMA  =   0.445299E+02  IXIETA  = 0

 24  IG  = 1    XG   =   0.624742E+02  SIGR  =  -0.177540E+03  SIGXI  =  -0.177792E+03  SIG1  =   0.603603E+02  IXI     = 0
     JG  = 1    YG   =   0.129036E+03  SIGZ  =  -0.105576E+03  SIGETA =  -0.105325E+03  SIG2  =  -0.343477E+03  IETA    = 0
                ZETA =   0.179964E+03  SIGRZ =   0.198687E+03  SIGXIET=   0.198641E+03  SIGTH =  -0.429507E+03  ITHETA. = 0
                                                                                        GAMA  =   0.501687E+02  IXIETA  = 0

 24  IG  = 2    XG   =   0.610308E+02  SIGR  =  -0.107452E+03  SIGXI  =  -0.107616E+03  SIG1  =   0.551879E+02  IXI     = 0
     JG  = 1    YG   =   0.129829E+03  SIGZ  =  -0.674487E+02  SIGETA =  -0.672843E+02  SIG2  =  -0.230088E+03  IETA    = 0
                ZETA =   0.179967E+03  SIGRZ =   0.141229E+03  SIGXIET=   0.141205E+03  SIGTH =  -0.420888E+03  ITHETA  = 0
                                                                                        GAMA  =   0.490638E+02  IXIETA  = 0

 24  IG  = 1    XG   =   0.624724E+02  SIGR  =  -0.210988E+03  SIGXI  =  -0.210978E+03  SIG1  =  -0.236705E+02  IXI     = 0
     JG  = 2    YG   =   0.126118E+03  SIGZ  =  -0.239863E+02  SIGETA =  -0.239961E+02  SIG2  =  -0.211304E+03  IETA    = 0
                ZETA =   0.179964E+03  SIGRZ =  -0.769168E+01  SIGXIET=  -0.781006E+01  SIGTH =  -0.388636E+03  ITHETA  = 0
                                                                                        GAMA  =  -0.876123E+02  IXIETA  = 0

 24  IG  = 2    XG   =   0.610290E+02  SIGR  =  -0.132008E+03  SIGXI  =  -0.132041E+03  SIG1  =   0.248518E+02  IXI     = 0
     JG  = 2    YG   =   0.126655E+03  SIGZ  =   0.196892E+02  SIGETA =   0.197223E+02  SIG2  =  -0.137170E+03  IETA    = 0
                ZETA =   0.179967E+03  SIGRZ =   0.284571E+02  SIGXIET=   0.283688E+02  SIGTH =  -0.377567E+03  ITHETA  = 0
                                                                                        GAMA  =   0.797507E+02  IXIETA  = 0

 25  IG  = 1    XG   =   0.597117E+02  SIGR  =  -0.742587E+02  SIGXI  =  -0.596933E+02  SIG1  =   0.354137E+02  IXI     = 0
     JG  = 1    YG   =   0.129530E+03  SIGZ  =  -0.290889E+02  SIGETA =  -0.436543E+02  SIG2  =  -0.138761E+03  IETA    = 0
                ZETA =  -0.175126E+03  SIGRZ =   0.841080E+02  SIGXIET=   0.867175E+02  SIGTH =  -0.412494E+03  ITHETA  = 0
                                                                                        GAMA  =   0.476418E+02  IXIETA  = 0

 25  IG  = 2    XG   =   0.575580E+02  SIGR  =   0.917071E+01  SIGXI  =  -0.626607E+01  SIG1  =   0.154633E+03  IXI     = 0
     JG  = 1    YG   =   0.127933E+03  SIGZ  =   0.139143E+03  SIGETA =   0.154580E+03  SIG2  =  -0.631886E+01  IETA    = 0
                ZETA =  -0.160890E+03  SIGRZ =  -0.474673E+02  SIGXIET=   0.291445E+01  SIGTH =  -0.362207E+03  ITHETA  = 0
                                                                                        GAMA  =   0.889623E+02  IXIETA  = 0

 25  IG  = 1    XG   =   0.599235E+02  SIGR  =  -0.842069E+02  SIGXI  =  -0.840326E+02  SIG1  =   0.594541E+02  IXI     = 0
     JG  = 2    YG   =   0.126360E+03  SIGZ  =   0.594349E+02  SIGETA =   0.592606E+02  SIG2  =  -0.842262E+02  IETA    = 0
                ZETA =  -0.177233E+03  SIGRZ =  -0.166327E+01  SIGXIET=   0.526982E+01  SIGTH =  -0.362176E+03  ITHETA  = 0
                                                                                        GAMA  =   0.878967E+02  IXIETA  = 0

 25  IG  = 2    XG   =   0.583483E+02  SIGR  =  -0.227758E+02  SIGXI  =  -0.397823E+02  SIG1  =   0.212361E+03  IXI     = 0
     JG  = 2    YG   =   0.125021E+03  SIGZ  =   0.193709E+03  SIGETA =   0.210715E+03  SIG2  =  -0.414286E+02  IETA    = 0
                ZETA =  -0.168890E+03  SIGRZ =  -0.662265E+02  SIGXIET=  -0.203739E+02  SIGTH =  -0.313027E+03  ITHETA  = 0
                                                                                        GAMA  =  -0.853804E+02  IXIETA  = 0

 26  IG  = 1    XG   =   0.669464E+02  SIGR  =   0.211925E+02  SIGXI  =   0.211146E+02  SIG1  =   0.427387E+02  IXI     = 0
     JG  = 1    YG   =   0.134527E+03  SIGZ  =   0.123462E+02  SIGETA =   0.124241E+02  SIG2  =  -0.920000E+01  IETA    = 0
                ZETA =  -0.179913E+03  SIGRZ =  -0.255899E+02  SIGXIET=  -0.256032E+02  SIGTH =  -0.375596E+03  ITHETA  = 0
                                                                                        GAMA  =  -0.401839E+02  IXIETA  = 0

 26  IG  = 2    XG   =   0.640596E+02  SIGR  =  -0.591449E+02  SIGXI  =  -0.587601E+02  SIG1  =   0.551255E+02  IXI     = 0
     JG  = 1    YG   =   0.134934E+03  SIGZ  =  -0.330260E+02  SIGETA =  -0.334107E+02  SIG2  =  -0.147296E+03  IETA    = 0
                ZETA =  -0.179890E+03  SIGRZ =   0.100365E+03  SIGXIET=   0.100414E+03  SIGTH =  -0.424548E+03  ITHETA  = 0
                                                                                        GAMA  =   0.485970E+02  IXIETA  = 0
```

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26   IG  = 1   XG   =   0.669546E+02   SIGR  =  -0.168979E+03   SIGXI  =  -0.168024E+03   SIG1  =   0.368775E+02   IXI    =  0
     JG  = 2   YG   =   0.129136E+03   SIGZ  =  -0.442108E+03   SIGETA =  -0.443063E+03   SIG2  =  -0.647964E+03   IETA   =  0
               ZETA =  -0.179913E+03   SIGRZ =   0.314010E+03   SIGXIET=   0.313593E+03   SIGTH =  -0.474798E+03   ITHETA =  0
                                                                                          GAMA  =   0.331606E+02   IXIETA =  0

26   IG  = 2   XG   =   0.640678E+02   SIGR  =  -0.151382E+03   SIGXI  =  -0.150629E+03   SIG1  =   0.766918E+02   IXI    =  0
     JG  = 2   YG   =   0.130656E+03   SIGZ  =  -0.921572E+02   SIGETA =  -0.929096E+02   SIG2  =  -0.320231E+03   IETA   =  0
               ZETA =  -0.179890E+03   SIGRZ =   0.196240E+03   SIGXIET=   0.196352E+03   SIGTH =  -0.422508E+03   ITHETA =  0
                                                                                          GAMA  =   0.491807E+02   IXIETA =  0

27   IG  = 1   XG   =   0.669546E+02   SIGR  =  -0.745622E+03   SIGXI  =  -0.745983E+03   SIG1  =  -0.445535E+02   IXI    =  0
     JG  = 1   YG   =   0.126404E+03   SIGZ  =  -0.477215E+02   SIGETA =  -0.473599E+02   SIG2  =  -0.748790E+03   IETA   =  0
               ZETA =   0.179774E+03   SIGRZ =   0.471272E+02   SIGXIET=   0.443670E+02   SIGTH =  -0.492825E+03   ITHETA =  0
                                                                                          GAMA  =   0.863807E+02   IXIETA =  0

27   IG  = 2   XG   =   0.640678E+02   SIGR  =  -0.215198E+03   SIGXI  =  -0.216269E+03   SIG1  =   0.179144E+02   IXI    =  0
     JG  = 1   YG   =   0.128128E+03   SIGZ  =  -0.108812E+03   SIGETA =  -0.107742E+03   SIG2  =  -0.341924E+03   IETA   =  0
               ZETA =   0.179821E+03   SIGRZ =   0.171876E+03   SIGXIET=   0.171541E+03   SIGTH =  -0.423690E+03   ITHETA =  0
                                                                                          GAMA  =   0.537768E+02   IXIETA =  0

27   IG  = 1   XG   =   0.669464E+02   SIGR  =  -0.555338E+02   SIGXI  =  -0.554882E+02   SIG1  =  -0.262381E+02   IXI    =  0
     JG  = 2   YG   =   0.124330E+03   SIGZ  =  -0.273529E+02   SIGETA =  -0.273985E+02   SIG2  =  -0.566486E+02   IETA   =  0
               ZETA =   0.179774E+03   SIGRZ =  -0.571487E+01   SIGXIET=  -0.582609E+01   SIGTH =  -0.309785E+03   ITHETA =  0
                                                                                          GAMA  =  -0.787351E+02   IXIETA =  0

27   IG  = 2   XG   =   0.640596E+02   SIGR  =  -0.154234E+03   SIGXI  =  -0.154127E+03   SIG1  =  -0.545722E+02   IXI    =  0
     JG  = 2   YG   =   0.125497E+03   SIGZ  =  -0.575207E+02   SIGETA =  -0.576284E+02   SIG2  =  -0.157183E+03   IETA   =  0
               ZETA =   0.179821E+03   SIGRZ =  -0.171421E+02   SIGXIET=  -0.174432E+02   SIGTH =  -0.368444E+03   ITHETA =  0
                                                                                          GAMA  =  -0.800619E+02   IXIETA =  0

28   IG  = 1   XG   =   0.669434E+02   SIGR  =   0.615911E+02   SIGXI  =   0.615911E+02   SIG1  =   0.625026E+02   IXI    =  0
     JG  = 1   YG   =   0.122816E+03   SIGZ  =  -0.272622E+01   SIGETA =  -0.272622E+01   SIG2  =  -0.363768E+01   IETA   =  0
               ZETA =  -0.180000E+03   SIGRZ =  -0.771060E+01   SIGXIET=  -0.771060E+01   SIGTH =  -0.253489E+03   ITHETA =  0
                                                                                          GAMA  =  -0.674156E+01   IXIETA =  0

28   IG  = 2   XG   =   0.640566E+02   SIGR  =  -0.102897E+03   SIGXI  =  -0.102897E+03   SIG1  =  -0.557719E+02   IXI    =  0
     JG  = 1   YG   =   0.123576E+03   SIGZ  =  -0.634514E+02   SIGETA =  -0.634514E+02   SIG2  =  -0.110576E+03   IETA   =  0
               ZETA =  -0.180000E+03   SIGRZ =  -0.190235E+02   SIGXIET=  -0.190235E+02   SIGTH =  -0.326159E+03   ITHETA =  0
                                                                                          GAMA  =  -0.680169E+02   IXIETA =  0

28   IG  = 1   XG   =   0.669434E+02   SIGR  =  -0.941013E+00   SIGXI  =  -0.941013E+00   SIG1  =   0.135110E+02   IXI    =  0
     JG  = 2   YG   =   0.120755E+03   SIGZ  =  -0.681802E+01   SIGETA =  -0.681802E+01   SIG2  =  -0.212700E+02   IETA   =  0
               ZETA =   0.180000E+03   SIGRZ =   0.171404E+02   SIGXIET=   0.171404E+02   SIGTH =  -0.231663E+03   ITHETA =  0
                                                                                          GAMA  =   0.401360E+02   IXIETA =  0

28   IG  = 2   XG   =   0.640566E+02   SIGR  =   0.271579E+02   SIGXI  =   0.271579E+02   SIG1  =   0.343522E+02   IXI    =  0
     JG  = 2   YG   =   0.120958E+03   SIGZ  =  -0.272985E+02   SIGETA =  -0.272985E+02   SIG2  =  -0.344929E+02   IETA   =  0
               ZETA =   0.180000E+03   SIGRZ =  -0.210603E+02   SIGXIET=  -0.210603E+02   SIGTH =  -0.246946E+03   ITHETA =  0
                                                                                          GAMA  =  -0.188605E+02   IXIETA =  0

29   IG  = 1   XG   =   0.624717E+02   SIGR  =  -0.299751E+02   SIGXI  =  -0.299751E+02   SIG1  =   0.626362E+01   IXI    =  0
     JG  = 1   YG   =   0.123983E+03   SIGZ  =  -0.801597E+01   SIGETA =  -0.801597E+01   SIG2  =  -0.442547E+02   IETA   =  0
               ZETA =  -0.180000E+03   SIGRZ =  -0.227480E+02   SIGXIET=  -0.227480E+02   SIGTH =  -0.314254E+03   ITHETA =  0
                                                                                          GAMA  =  -0.578823E+02   IXIETA =  0

29   IG  = 2   XG   =   0.610283E+02   SIGR  =  -0.444076E+02   SIGXI  =  -0.444076E+02   SIG1  =   0.452155E+02   IXI    =  0
```

```
         JG   = 1   YG   =     0.124332E+03   SIGZ  =   0.219706E+02   SIGETA =   0.219706E+02   SIG2  =  -0.676524E+02   IETA    =  0
                    ZETA =    -0.180000E+03   SIGRZ =  -0.456429E+02   SIGXIET=  -0.456429E+02   SIGTH =  -0.324771E+03   ITHETA  =  0
                                                                                                GAMA  =  -0.630113E+02   IXIETA  =  0

   29    IG   = 1   XG   =     0.624717E+02   SIGR  =  -0.326794E+02   SIGXI  =  -0.326794E+02   SIG1  =   0.263149E+02   IXI     =  0
         JG   = 2   YG   =     0.121067E+03   SIGZ  =  -0.157059E+01   SIGETA =  -0.157059E+01   SIG2  =  -0.605648E+02   IETA    =  0
                    ZETA =     0.180000E+03   SIGRZ =  -0.405596E+02   SIGXIET=  -0.405596E+02   SIGTH =  -0.263723E+03   ITHETA  =  0
                                                                                                GAMA  =  -0.554908E+02   IXIETA  =  0

   29    IG   = 2   XG   =     0.610283E+02   SIGR  =  -0.311246E+02   SIGXI  =  -0.311246E+02   SIG1  =   0.704893E+02   IXI     =  0
         JG   = 2   YG   =     0.121161E+03   SIGZ  =   0.466842E+02   SIGETA =   0.466842E+02   SIG2  =  -0.549297E+02   IETA    =  0
                    ZETA =     0.180000E+03   SIGRZ =  -0.491826E+02   SIGXIET=  -0.491826E+02   SIGTH =  -0.261940E+03   ITHETA  =  0
                                                                                                GAMA  =  -0.641724E+02   IXIETA  =  0

   30    IG   = 1   XG   =     0.599717E+02   SIGR  =  -0.911380E+01   SIGXI  =  -0.911380E+01   SIG1  =   0.104286E+03   IXI     =  0
         JG   = 1   YG   =     0.124101E+03   SIGZ  =   0.773649E+02   SIGETA =   0.773649E+02   SIG2  =  -0.360350E+02   IETA    =  0
                    ZETA =    -0.180000E+03   SIGRZ =  -0.552527E+02   SIGXIET=  -0.552527E+02   SIGTH =  -0.308857E+03   ITHETA  =  0
                                                                                                GAMA  =  -0.640229E+02   IXIETA  =  0

   30    IG   = 2   XG   =     0.585283E+02   SIGR  =  -0.212547E+02   SIGXI  =  -0.212547E+02   SIG1  =   0.178185E+03   IXI     =  0
         JG   = 1   YG   =     0.123120E+03   SIGZ  =   0.172316E+03   SIGETA =   0.172316E+03   SIG2  =  -0.271236E+02   IETA    =  0
                    ZETA =    -0.180000E+03   SIGRZ =  -0.342124E+02   SIGXIET=  -0.342124E+02   SIGTH =  -0.283135E+03   ITHETA  =  0
                                                                                                GAMA  =  -0.802661E+02   IXIETA  =  0

   30    IG   = 1   XG   =     0.599717E+02   SIGR  =  -0.410152E+02   SIGXI  =  -0.410152E+02   SIG1  =   0.964376E+02   IXI     =  0
         JG   = 2   YG   =     0.121099E+03   SIGZ  =   0.777217E+02   SIGETA =   0.777217E+02   SIG2  =  -0.597311E+02   IETA    =  0
                    ZETA =     0.180000E+03   SIGRZ =  -0.507204E+02   SIGXIET=  -0.507204E+02   SIGTH =  -0.261289E+03   ITHETA  =  0
                                                                                                GAMA  =  -0.697458E+02   IXIETA  =  0

   30    IG   = 2   XG   =     0.585283E+02   SIGR  =  -0.490880E+02   SIGXI  =  -0.490880E+02   SIG1  =   0.105862E+03   IXI     =  0
         JG   = 2   YG   =     0.120836E+03   SIGZ  =   0.104851E+03   SIGETA =   0.104851E+03   SIG2  =  -0.500991E+02   IETA    =  0
                    ZETA =     0.180000E+03   SIGRZ =  -0.125170E+02   SIGXIET=  -0.125170E+02   SIGTH =  -0.258690E+03   ITHETA  =  0
                                                                                                GAMA  =  -0.853816E+02   IXIETA  =  0

   31    IG   = 1   XG   =     0.599717E+02   SIGR  =  -0.372953E+02   SIGXI  =  -0.372953E+02   SIG1  =   0.665601E+02   IXI     =  0
         JG   = 1   YG   =     0.119366E+03   SIGZ  =   0.553589E+02   SIGETA =   0.553589E+02   SIG2  =  -0.484964E+02   IETA    =  0
                    ZETA =    -0.180000E+03   SIGRZ =  -0.341072E+02   SIGXIET=  -0.341072E+02   SIGTH =  -0.132816E+03   ITHETA  =  0
                                                                                                GAMA  =  -0.718193E+02   IXIETA  =  0

   31    IG   = 2   XG   =     0.585283E+02   SIGR  =  -0.304768E+02   SIGXI  =  -0.304768E+02   SIG1  =   0.876663E+02   IXI     =  0
         JG   = 1   YG   =     0.119366E+03   SIGZ  =   0.847154E+02   SIGETA =   0.847154E+02   SIG2  =  -0.334276E+02   IETA    =  0
                    ZETA =    -0.180000E+03   SIGRZ =  -0.186713E+02   SIGXIET=  -0.186713E+02   SIGTH =  -0.128408E+03   ITHETA  =  0
                                                                                                GAMA  =  -0.810192E+02   IXIETA  =  0

   31    IG   = 1   XG   =     0.599717E+02   SIGR  =  -0.419795E+02   SIGXI  =  -0.419795E+02   SIG1  =   0.558448E+02   IXI     =  0
         JG   = 2   YG   =     0.117634E+03   SIGZ  =   0.459089E+02   SIGETA =   0.459089E+02   SIG2  =  -0.519154E+02   IETA    =  0
                    ZETA =     0.180000E+03   SIGRZ =  -0.311765E+02   SIGXIET=  -0.311765E+02   SIGTH =  -0.115319E+03   ITHETA  =  0
                                                                                                GAMA  =  -0.723230E+02   IXIETA  =  0

   31    IG   = 2   XG   =     0.585283E+02   SIGR  =  -0.436022E+02   SIGXI  =  -0.436022E+02   SIG1  =   0.525796E+02   IXI     =  0
         JG   = 2   YG   =     0.117634E+03   SIGZ  =   0.515079E+02   SIGETA =   0.515079E+02   SIG2  =  -0.446739E+02   IETA    =  0
                    ZETA =     0.180000E+03   SIGRZ =  -0.101526E+02   SIGXIET=  -0.101526E+02   SIGTH =  -0.116664E+03   ITHETA  =  0
                                                                                                GAMA  =  -0.839744E+02   IXIETA  =  0

   32    IG   = 1   XG   =     0.624717E+02   SIGR  =  -0.112153E+02   SIGXI  =  -0.112153E+02   SIG1  =   0.241250E+02   IXI     =  0
         JG   = 1   YG   =     0.119366E+03   SIGZ  =   0.602935E+01   SIGETA =   0.602935E+01   SIG2  =  -0.293110E+02   IETA    =  0
                    ZETA =    -0.180000E+03   SIGRZ =  -0.252885E+02   SIGXIET=  -0.252885E+02   SIGTH =  -0.131801E+03   ITHETA  =  0
```

```
                                                                          GAMA  =  -0.544136E+02   IXIETA  =  0

32  IG  = 2  XG   =   0.610283E+02  SIGR  = -0.508744E+01  SIGXI  = -0.508744E+01  SIG1  =   0.565813E+02   IXI     =  0
    JG  = 1  YG   =   0.119366E+03  SIGZ  =  0.432109E+02  SIGETA =  0.432109E+02  SIG2  =  -0.184578E+02   IETA    =  0
             ZETA =  -0.180000E+03  SIGRZ = -0.287147E+02  SIGXIET= -0.287147E+02  SIGTH =  -0.126534E+03   ITHETA  =  0
                                                                          GAMA  =  -0.650320E+02   IXIETA  =  0

32  IG  = 1  XG   =   0.624717E+02  SIGR  = -0.781876E+00  SIGXI  = -0.781876E+00  SIG1  =   0.467502E+02   IXI     =  0
    JG  = 2  YG   =   0.117634E+03  SIGZ  =  0.441709E+02  SIGETA =  0.441709E+02  SIG2  =  -0.336117E+01   IETA    =  0
             ZETA =   0.180000E+03  SIGRZ = -0.110724E+02  SIGXIET= -0.110724E+02  SIGTH =  -0.102709E+03   ITHETA  =  0
                                                                          GAMA  =  -0.768870E+02   IXIETA  =  0

32  IG  = 2  XG   =   0.610283E+02  SIGR  = -0.951074E+00  SIGXI  = -0.951074E+00  SIG1  =   0.679829E+02   IXI     =  0
    JG  = 2  YG   =   0.117634E+03  SIGZ  =  0.535089E+02  SIGETA =  0.535089E+02  SIG2  =  -0.154251E+02   IETA    =  0
             ZETA =   0.180000E+03  SIGRZ = -0.315872E+02  SIGXIET= -0.315872E+02  SIGTH =  -0.103747E+03   ITHETA  =  0
                                                                          GAMA  =  -0.653816E+02   IXIETA  =  0

33  IG  = 1  XG   =   0.599717E+02  SIGR  = -0.370958E+02  SIGXI  = -0.370958E+02  SIG1  =   0.500490E+02   IXI     =  0
    JG  = 1  YG   =   0.116366E+03  SIGZ  =  0.433427E+02  SIGETA =  0.433427E+02  SIG2  =  -0.438021E+02   IETA    =  0
             ZETA =  -0.180000E+03  SIGRZ = -0.241747E+02  SIGXIET= -0.241747E+02  SIGTH =  -0.998504E+02   ITHETA  =  0
                                                                          GAMA  =  -0.744955E+02   IXIETA  =  0

33  IG  = 2  XG   =   0.585283E+02  SIGR  = -0.416951E+02  SIGXI  = -0.416951E+02  SIG1  =   0.330983E+02   IXI     =  0
    JG  = 1  YG   =   0.116366E+03  SIGZ  =  0.317403E+02  SIGETA =  0.317403E+02  SIG2  =  -0.430531E+02   IETA    =  0
             ZETA =  -0.180000E+03  SIGRZ = -0.100781E+02  SIGXIET= -0.100781E+02  SIGTH =  -0.104932E+03   ITHETA  =  0
                                                                          GAMA  =  -0.823258E+02   IXIETA  =  0

33  IG  = 1  XG   =   0.599717E+02  SIGR  = -0.398555E+02  SIGXI  = -0.398555E+02  SIG1  =   0.398544E+02   IXI     =  0
    JG  = 2  YG   =   0.114634E+03  SIGZ  =  0.359827E+02  SIGETA =  0.359827E+02  SIG2  =  -0.437272E+02   IETA    =  0
             ZETA =   0.180000E+03  SIGRZ = -0.175674E+02  SIGXIET= -0.175674E+02  SIGTH =  -0.821567E+02   ITHETA  =  0
                                                                          GAMA  =  -0.775712E+02   IXIETA  =  0

33  IG  = 2  XG   =   0.585283E+02  SIGR  = -0.413019E+02  SIGXI  = -0.413019E+02  SIG1  =   0.129273E+02   IXI     =  0
    JG  = 2  YG   =   0.114634E+03  SIGZ  =  0.121803E+02  SIGETA =  0.121803E+02  SIG2  =  -0.420490E+02   IETA    =  0
             ZETA =   0.180000E+03  SIGRZ = -0.636494E+01  SIGXIET= -0.636494E+01  SIGTH =  -0.885149E+02   ITHETA  =  0
                                                                          GAMA  =  -0.833058E+02   IXIETA  =  0

34  IG  = 1  XG   =   0.624717E+02  SIGR  =  0.116525E+01  SIGXI  =  0.116525E+01  SIG1  =   0.694258E+02   IXI     =  0
    JG  = 1  YG   =   0.116366E+03  SIGZ  =  0.683044E+02  SIGETA =  0.683044E+02  SIG2  =   0.437977E-01   IETA    =  0
             ZETA =  -0.180000E+03  SIGRZ = -0.874933E+01  SIGXIET= -0.874933E+01  SIGTH =  -0.832416E+02   ITHETA  =  0
                                                                          GAMA  =  -0.826959E+02   IXIETA  =  0

34  IG  = 2  XG   =   0.610283E+02  SIGR  = -0.268308E+01  SIGXI  = -0.268308E+01  SIG1  =   0.643894E+02   IXI     =  0
    JG  = 1  YG   =   0.116366E+03  SIGZ  =  0.542295E+02  SIGETA =  0.542295E+02  SIG2  =  -0.128430E+02   IETA    =  0
             ZETA =  -0.180000E+03  SIGRZ = -0.261046E+02  SIGXIET= -0.261046E+02  SIGTH =  -0.892237E+02   ITHETA  =  0
                                                                          GAMA  =  -0.687340E+02   IXIETA  =  0

34  IG  = 1  XG   =   0.624717E+02  SIGR  =  0.305522E+01  SIGXI  =  0.305522E+01  SIG1  =   0.936477E+02   IXI     =  0
    JG  = 2  YG   =   0.114634E+03  SIGZ  =  0.930507E+02  SIGETA =  0.930507E+02  SIG2  =   0.245825E+01   IETA    =  0
             ZETA =   0.180000E+03  SIGRZ = -0.735400E+01  SIGXIET= -0.735400E+01  SIGTH =  -0.591783E+02   ITHETA  =  0
                                                                          GAMA  =  -0.853591E+02   IXIETA  =  0

34  IG  = 2  XG   =   0.610283E+02  SIGR  = -0.322690E+00  SIGXI  = -0.322690E+00  SIG1  =   0.657720E+02   IXI     =  0
    JG  = 2  YG   =   0.114634E+03  SIGZ  =  0.599201E+02  SIGETA =  0.599201E+02  SIG2  =  -0.617455E+01   IETA    =  0
             ZETA =   0.180000E+03  SIGRZ = -0.196666E+02  SIGXIET= -0.196666E+02  SIGTH =  -0.683063E+02   ITHETA  =  0
                                                                          GAMA  =  -0.734295E+02   IXIETA  =  0
```

```
35  IG  = 1  XG   =   0.599717E+02  SIGR  = -0.400229E+02  SIGXI  = -0.400229E+02  SIG1  =  0.364064E+02  IXI    = 0
    JG  = 1  YG   =   0.112732E+03  SIGZ  =  0.347675E+02  SIGETA =  0.347675E+02  SIG2  = -0.416618E+02  IETA   = 0
             ZETA =  -0.180000E+03  SIGRZ = -0.111922E+02  SIGXIET= -0.111922E+02  SIGTH = -0.620002E+02  ITHETA = 0
                                                                                   GAMA  = -0.816689E+02  IXIETA = 0

35  IG  = 2  XG   =   0.585283E+02  SIGR  = -0.417541E+02  SIGXI  = -0.417541E+02  SIG1  = -0.219262E+01  IXI    = 0
    JG  = 1  YG   =   0.112732E+03  SIGZ  = -0.269653E+01  SIGETA = -0.269653E+01  SIG2  = -0.422580E+02  IETA   = 0
             ZETA =  -0.180000E+03  SIGRZ = -0.446493E+01  SIGXIET= -0.446493E+01  SIGTH = -0.705818E+02  ITHETA = 0
                                                                                   GAMA  = -0.835608E+02  IXIETA = 0

35  IG  = 1  XG   =   0.599717E+02  SIGR  = -0.399672E+02  SIGXI  = -0.399672E+02  SIG1  =  0.298815E+02  IXI    = 0
    JG  = 2  YG   =   0.109268E+03  SIGZ  =  0.296511E+02  SIGETA =  0.296511E+02  SIG2  = -0.401975E+02  IETA   = 0
             ZETA =   0.180000E+03  SIGRZ = -0.401112E+01  SIGXIET= -0.401112E+01  SIGTH = -0.305038E+02  ITHETA = 0
                                                                                   GAMA  = -0.867133E+02  IXIETA = 0

35  IG  = 2  XG   =   0.585283E+02  SIGR  = -0.414777E+02  SIGXI  = -0.414777E+02  SIG1  = -0.161593E+02  IXI    = 0
    JG  = 2  YG   =   0.109268E+03  SIGZ  = -0.162412E+02  SIGETA = -0.162412E+02  SIG2  = -0.415596E+02  IETA   = 0
             ZETA =   0.180000E+03  SIGRZ = -0.143994E+01  SIGXIET= -0.143994E+01  SIGTH = -0.398219E+02  ITHETA = 0
                                                                                   GAMA  = -0.867449E+02  IXIETA = 0

36  IG  = 1  XG   =   0.624717E+02  SIGR  = -0.101739E+01  SIGXI  = -0.101739E+01  SIG1  =  0.991903E+02  IXI    = 0
    JG  = 1  YG   =   0.112732E+03  SIGZ  =  0.988216E+02  SIGETA =  0.988216E+02  SIG2  = -0.138609E+01  IETA   = 0
             ZETA =  -0.180000E+03  SIGRZ = -0.607839E+01  SIGXIET= -0.607839E+01  SIGTH = -0.394957E+02  ITHETA = 0
                                                                                   GAMA  = -0.865288E+02  IXIETA = 0

36  IG  = 2  XG   =   0.610283E+02  SIGR  = -0.122196E+01  SIGXI  = -0.122196E+01  SIG1  =  0.694659E+02  IXI    = 0
    JG  = 1  YG   =   0.112732E+03  SIGZ  =  0.672754E+02  SIGETA =  0.672754E+02  SIG2  = -0.341245E+01  IETA   = 0
             ZETA =  -0.180000E+03  SIGRZ = -0.124435E+02  SIGXIET= -0.124435E+02  SIGTH = -0.470279E+02  ITHETA = 0
                                                                                   GAMA  = -0.800163E+02  IXIETA = 0

36  IG  = 1  XG   =   0.624717E+02  SIGR  = -0.304260E+00  SIGXI  = -0.304260E+00  SIG1  =  0.117047E+03  IXI    = 0
    JG  = 2  YG   =   0.109268E+03  SIGZ  =  0.117024E+03  SIGETA =  0.117024E+03  SIG2  = -0.327543E+00  IETA   = 0
             ZETA =   0.180000E+03  SIGRZ = -0.165294E+01  SIGXIET= -0.165294E+01  SIGTH = -0.482009E+01  ITHETA = 0
                                                                                   GAMA  = -0.891930E+02  IXIETA = 0

36  IG  = 2  XG   =   0.610283E+02  SIGR  = -0.196788E+01  SIGXI  = -0.196788E+01  SIG1  =  0.706448E+02  IXI    = 0
    JG  = 2  YG   =   0.109268E+03  SIGZ  =  0.704359E+02  SIGETA =  0.704359E+02  SIG2  = -0.217684E+01  IETA   = 0
             ZETA =   0.180000E+03  SIGRZ = -0.389533E+01  SIGXIET= -0.389533E+01  SIGTH = -0.147125E+02  ITHETA = 0
                                                                                   GAMA  = -0.869293E+02  IXIETA = 0

37  IG  = 1  XG   =   0.599717E+02  SIGR  = -0.395357E+02  SIGXI  = -0.395357E+02  SIG1  =  0.301869E+02  IXI    = 0
    JG  = 1  YG   =   0.105464E+03  SIGZ  =  0.301541E+02  SIGETA =  0.301541E+02  SIG2  = -0.395686E+02  IETA   = 0
             ZETA =  -0.180000E+03  SIGRZ =  0.151433E+01  SIGXIET=  0.151433E+01  SIGTH = -0.241864E+01  ITHETA = 0
                                                                                   GAMA  =  0.887558E+02  IXIETA = 0

37  IG  = 2  XG   =   0.585283E+02  SIGR  = -0.414580E+02  SIGXI  = -0.414580E+02  SIG1  = -0.162526E+02  IXI    = 0
    JG  = 1  YG   =   0.105464E+03  SIGZ  = -0.162627E+02  SIGETA = -0.162627E+02  SIG2  = -0.414681E+02  IETA   = 0
             ZETA =  -0.180000E+03  SIGRZ =  0.505630E+00  SIGXIET=  0.505630E+00  SIGTH = -0.111002E+02  ITHETA = 0
                                                                                   GAMA  =  0.888508E+02  IXIETA = 0

37  IG  = 1  XG   =   0.599717E+02  SIGR  = -0.390107E+02  SIGXI  = -0.390107E+02  SIG1  =  0.354814E+02  IXI    = 0
    JG  = 2  YG   =   0.985359E+02  SIGZ  =  0.350653E+02  SIGETA =  0.350653E+02  SIG2  = -0.394268E+02  IETA   = 0
             ZETA =   0.180000E+03  SIGRZ =  0.556764E+01  SIGXIET=  0.556764E+01  SIGTH =  0.311872E+02  ITHETA = 0
                                                                                   GAMA  =  0.857256E+02  IXIETA = 0

37  IG  = 2  XG   =   0.585283E+02  SIGR  = -0.414443E+02  SIGXI  = -0.414443E+02  SIG1  = -0.582050E+00  IXI    = 0
    JG  = 2  YG   =   0.985359E+02  SIGZ  = -0.747466E+00  SIGETA = -0.747466E+00  SIG2  = -0.416097E+02  IETA   = 0
             ZETA =   0.180000E+03  SIGRZ =  0.259986E+01  SIGXIET=  0.259986E+01  SIGTH =  0.255431E+02  ITHETA = 0
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                                                                                GAMA  =   0.863595E+02   IXIETA  =  0

38   IG  = 1   XG    =   0.624717E+02   SIGR  =  -0.319946E+00   SIGXI   =  -0.319946E+00   SIG1  =   0.117988E+03   IXI     =  0
     JG  = 1   YG    =   0.105464E+03   SIGZ  =   0.117983E+03   SIGETA  =   0.117983E+03   SIG2  =  -0.324687E+00   IETA    =  0
               ZETA  =  -0.180000E+03   SIGRZ =   0.748925E+00   SIGXIET=    0.748925E+00   SIGTH =   0.219245E+02   ITHETA  =  0
                                                                                            GAMA  =   0.896373E+02   IXIETA  =  0

38   IG  = 2   XG    =   0.610283E+02   SIGR  =  -0.190732E+01   SIGXI   =  -0.190732E+01   SIG1  =   0.723511E+02   IXI     =  0
     JG  = 1   YG    =   0.105464E+03   SIGZ  =   0.723256E+02   SIGETA  =   0.723256E+02   SIG2  =  -0.193274E+01   IETA    =  0
               ZETA  =  -0.180000E+03   SIGRZ =   0.137400E+01   SIGXIET=    0.137400E+01   SIGTH =   0.129966E+02   ITHETA  =  0
                                                                                            GAMA  =   0.889400E+02   IXIETA  =  0

38   IG  = 1   XG    =   0.624717E+02   SIGR  =  -0.260026E+00   SIGXI   =  -0.260026E+00   SIG1  =   0.105457E+03   IXI     =  0
     JG  = 2   YG    =   0.985359E+02   SIGZ  =   0.105410E+03   SIGETA  =   0.105410E+03   SIG2  =  -0.306332E+00   IETA    =  0
               ZETA  =   0.180000E+03   SIGRZ =   0.221254E+01   SIGXIET=    0.221254E+01   SIGTH =   0.504236E+02   ITHETA  =  0
                                                                                            GAMA  =   0.888010E+02   IXIETA  =  0

38   IG  = 2   XG    =   0.610283E+02   SIGR  =  -0.220200E+01   SIGXI   =  -0.220200E+01   SIG1  =   0.699090E+02   IXI     =  0
     JG  = 2   YG    =   0.985359E+02   SIGZ  =   0.695035E+02   SIGETA  =   0.695035E+02   SIG2  =  -0.260747E+01   IETA    =  0
               ZETA  =   0.180000E+03   SIGRZ =   0.540728E+01   SIGXIET=    0.540728E+01   SIGTH =   0.442156E+02   ITHETA  =  0
                                                                                            GAMA  =   0.857117E+02   IXIETA  =  0


39   IG  = 1   XG    =   0.599717E+02   SIGR  =  -0.397276E+02   SIGXI   =  -0.397276E+02   SIG1  =   0.403303E+02   IXI     =  0
     JG  = 1   YG    =   0.934641E+02   SIGZ  =   0.399723E+02   SIGETA  =   0.399723E+02   SIG2  =  -0.400856E+02   IETA    =  0
               ZETA  =  -0.180000E+03   SIGRZ =   0.535338E+01   SIGXIET=    0.535338E+01   SIGTH =   0.424781E+02   ITHETA  =  0
                                                                                            GAMA  =   0.861744E+02   IXIETA  =  0

39   IG  = 2   XG    =   0.585283E+02   SIGR  =  -0.414693E+02   SIGXI   =  -0.414693E+02   SIG1  =   0.168644E+02   IXI     =  0
     JG  = 1   YG    =   0.934641E+02   SIGZ  =   0.168247E+02   SIGETA  =   0.168247E+02   SIG2  =  -0.415090E+02   IETA    =  0
               ZETA  =  -0.180000E+03   SIGRZ =   0.152127E+01   SIGXIET=    0.152127E+01   SIGTH =   0.398910E+02   ITHETA  =  0
                                                                                            GAMA  =   0.885061E+02   IXIETA  =  0

39   IG  = 1   XG    =   0.599717E+02   SIGR  =  -0.388038E+02   SIGXI   =  -0.388038E+02   SIG1  =   0.448888E+02   IXI     =  0
     JG  = 2   YG    =   0.865359E+02   SIGZ  =   0.447455E+02   SIGETA  =   0.447455E+02   SIG2  =  -0.389472E+02   IETA    =  0
               ZETA  =   0.180000E+03   SIGRZ =   0.346370E+01   SIGXIET=    0.346370E+01   SIGTH =   0.491684E+02   ITHETA  =  0
                                                                                            GAMA  =   0.876301E+02   IXIETA  =  0

39   IG  = 2   XG    =   0.585283E+02   SIGR  =  -0.409282E+02   SIGXI   =  -0.409282E+02   SIG1  =   0.343506E+02   IXI     =  0
     JG  = 2   YG    =   0.865359E+02   SIGZ  =   0.343097E+02   SIGETA  =   0.343097E+02   SIG2  =  -0.409691E+02   IETA    =  0
               ZETA  =   0.180000E+03   SIGRZ =   0.175578E+01   SIGXIET=    0.175578E+01   SIGTH =   0.492604E+02   ITHETA  =  0
                                                                                            GAMA  =   0.886639E+02   IXIETA  =  0


40   IG  = 1   XG    =   0.624717E+02   SIGR  =  -0.912901E+00   SIGXI   =  -0.912901E+00   SIG1  =   0.887199E+02   IXI     =  0
     JG  = 1   YG    =   0.934641E+02   SIGZ  =   0.886827E+02   SIGETA  =   0.886827E+02   SIG2  =  -0.950085E+00   IETA    =  0
               ZETA  =  -0.180000E+03   SIGRZ =   0.182562E+01   SIGXIET=    0.182562E+01   SIGTH =   0.569474E+02   ITHETA  =  0
                                                                                            GAMA  =   0.888332E+02   IXIETA  =  0

40   IG  = 2   XG    =   0.610283E+02   SIGR  =  -0.179151E+01   SIGXI   =  -0.179151E+01   SIG1  =   0.667031E+02   IXI     =  0
     JG  = 1   YG    =   0.934641E+02   SIGZ  =   0.662635E+02   SIGETA  =   0.662635E+02   SIG2  =  -0.223109E+01   IETA    =  0
               ZETA  =  -0.180000E+03   SIGRZ =   0.548716E+01   SIGXIET=    0.548716E+01   SIGTH =   0.538801E+02   ITHETA  =  0
                                                                                            GAMA  =   0.854198E+02   IXIETA  =  0

40   IG  = 1   XG    =   0.624717E+02   SIGR  =  -0.488024E+00   SIGXI   =  -0.488024E+00   SIG1  =   0.728549E+02   IXI     =  0
     JG  = 2   YG    =   0.865359E+02   SIGZ  =   0.728369E+02   SIGETA  =   0.728369E+02   SIG2  =  -0.506031E+00   IETA    =  0
               ZETA  =   0.130000E+03   SIGRZ =   0.114921E+01   SIGXIET=    0.114921E+01   SIGTH =   0.592130E+02   ITHETA  =  0
                                                                                            GAMA  =   0.891023E+02   IXIETA  =  0
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40   IG  = 2   XG   =   0.610283E+02   SIGR  =  -0.196295E+01   SIGXI  =  -0.196295E+01   SIG1  =   0.619952E+02   IXI     = 0
     JG  = 2   YG   =   0.865359E+02   SIGZ  =   0.618401E+02   SIGETA =   0.618401E+02   SIG2  =  -0.211806E+01   IETA    = 0
               ZETA =   0.180000E+03   SIGRZ =   0.314973E+01   SIGXIET=   0.314973E+01   SIGTH =   0.584025E+02   ITHETA  = 0
                                                                                          GAMA  =   0.871807E+02   IXIETA  = 0

41   IG  = 1   XG   =   0.599717E+02   SIGR  =  -0.399421E+02   SIGXI  =  -0.399421E+02   SIG1  =   0.472254E+02   IXI     = 0
     JG  = 1   YG   =   0.814641E+02   SIGZ  =   0.471831E+02   SIGETA =   0.471831E+02   SIG2  =  -0.399844E+02   IETA    = 0
               ZETA =  -0.180000E+03   SIGRZ =   0.192036E+01   SIGXIET=   0.192036E+01   SIGTH =   0.489541E+02   ITHETA  = 0
                                                                                          GAMA  =   0.887379E+02   IXIETA  = 0

41   IG  = 2   XG   =   0.585283E+02   SIGR  =  -0.424779E+02   SIGXI  =  -0.424779E+02   SIG1  =   0.414920E+02   IXI     = 0
     JG  = 1   YG   =   0.814641E+02   SIGZ  =   0.414917E+02   SIGETA =   0.414917E+02   SIG2  =  -0.424782E+02   IETA    = 0
               ZETA =  -0.180000E+03   SIGRZ =   0.149813E+00   SIGXIET=   0.149813E+00   SIGTH =   0.499591E+02   ITHETA  = 0
                                                                                          GAMA  =   0.898978E+02   IXIETA  = 0

41   IG  = 1   XG   =   0.599717E+02   SIGR  =  -0.383905E+02   SIGXI  =  -0.383905E+02   SIG1  =   0.482278E+02   IXI     = 0
     JG  = 2   YG   =   0.745359E+02   SIGZ  =   0.482258E+02   SIGETA =   0.482258E+02   SIG2  =  -0.383925E+02   IETA    = 0
               ZETA =   0.180000E+03   SIGRZ =   0.419759E+00   SIGXIET=   0.419759E+00   SIGTH =   0.474328E+02   ITHETA  = 0
                                                                                          GAMA  =   0.897223E+02   IXIETA  = 0

41   IG  = 2   XG   =   0.585283E+02   SIGR  =  -0.406267E+02   SIGXI  =  -0.406267E+02   SIG1  =   0.469622E+02   IXI     = 0
     JG  = 2   YG   =   0.745359E+02   SIGZ  =   0.469441E+02   SIGETA =   0.469441E+02   SIG2  =  -0.406448E+02   IETA    = 0
               ZETA =   0.180000E+03   SIGRZ =   0.126007E+01   SIGXIET=   0.126007E+01   SIGTH =   0.492981E+02   ITHETA  = 0
                                                                                          GAMA  =   0.891758E+02   IXIETA  = 0

42   IG  = 1   XG   =   0.624717E+02   SIGR  =  -0.807662E+00   SIGXI  =  -0.807662E+00   SIG1  =   0.651115E+02   IXI     = 0
     JG  = 1   YG   =   0.814641E+02   SIGZ  =   0.650962E+02   SIGETA =   0.650962E+02   SIG2  =  -0.822886E+00   IETA    = 0
               ZETA =  -0.180000E+03   SIGRZ =   0.100177E+01   SIGXIET=   0.100177E+01   SIGTH =   0.571545E+02   ITHETA  = 0
                                                                                          GAMA  =   0.891293E+02   IXIETA  = 0

42   IG  = 2   XG   =   0.610283E+02   SIGR  =  -0.229155E+01   SIGXI  =  -0.229155E+01   SIG1  =   0.603636E+02   IXI     = 0
     JG  = 1   YG   =   0.814641E+02   SIGZ  =   0.602875E+02   SIGETA =   0.602875E+02   SIG2  =  -0.236760E+01   IETA    = 0
               ZETA =  -0.180000E+03   SIGRZ =   0.218294E+01   SIGXIET=   0.218294E+01   SIGTH =   0.575481E+02   ITHETA  = 0
                                                                                          GAMA  =   0.880046E+02   IXIETA  = 0

42   IG  = 1   XG   =   0.624717E+02   SIGR  =  -0.760657E-01   SIGXI  =  -0.760657E-01   SIG1  =   0.605168E+02   IXI     = 0
     JG  = 2   YG   =   0.745359E+02   SIGZ  =   0.605158E+02   SIGETA =   0.605158E+02   SIG2  =  -0.771151E-01   IETA    = 0
               ZETA =   0.180000E+03   SIGRZ =  -0.252160E+00   SIGXIET=  -0.252160E+00   SIGTH =   0.544944E+02   ITHETA  = 0
                                                                                          GAMA  =  -0.897616E+02   IXIETA  = 0

42   IG  = 2   XG   =   0.610283E+02   SIGR  =  -0.164422E+01   SIGXI  =  -0.164422E+01   SIG1  =   0.584943E+02   IXI     = 0
     JG  = 2   YG   =   0.745359E+02   SIGZ  =   0.584909E+02   SIGETA =   0.584909E+02   SIG2  =  -0.164759E+01   IETA    = 0
               ZETA =   0.180000E+03   SIGRZ =   0.450107E+00   SIGXIET=   0.450107E+00   SIGTH =   0.553403E+02   ITHETA  = 0
                                                                                          GAMA  =   0.895712E+02   IXIETA  = 0

43   IG  = 1   XG   =   0.599717E+02   SIGR  =  -0.410883E+02   SIGXI  =  -0.410883E+02   SIG1  =   0.486534E+02   IXI     = 0
     JG  = 1   YG   =   0.694641E+02   SIGZ  =   0.486501E+02   SIGETA =   0.486501E+02   SIG2  =  -0.410916E+02   IETA    = 0
               ZETA =  -0.180000E+03   SIGRZ =   0.544887E+00   SIGXIET=   0.544887E+00   SIGTH =   0.446787E+02   ITHETA  = 0
                                                                                          GAMA  =   0.896521E+02   IXIETA  = 0

43   IG  = 2   XG   =   0.585283E+02   SIGR  =  -0.436637E+02   SIGXI  =  -0.436637E+02   SIG1  =   0.474063E+02   IXI     = 0
     JG  = 1   YG   =   0.694641E+02   SIGZ  =   0.473969E+02   SIGETA =   0.473969E+02   SIG2  =  -0.436731E+02   IETA    = 0
               ZETA =  -0.180000E+03   SIGRZ =  -0.922623E+00   SIGXIET=  -0.922623E+00   SIGTH =   0.464842E+02   ITHETA  = 0
                                                                                          GAMA  =  -0.894196E+02   IXIETA  = 0

43   IG  = 1   XG   =   0.599717E+02   SIGR  =  -0.377351E+02   SIGXI  =  -0.377351E+02   SIG1  =   0.497666E+02   IXI     = 0
     JG  = 2   YG   =   0.625359E+02   SIGZ  =   0.497472E+02   SIGETA =   0.497472E+02   SIG2  =  -0.377545E+02   IETA    = 0
```

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                  ZETA =     0.180000E+03   SIGRZ =   0.130362E+01   SIGXIET=   0.130362E+01   SIGTH =   0.423140E+02   ITHETA  =  0
                                                                                               GAMA  =   0.891465E+02   IXIETA  =  0

 43   IG   = 2    XG   =     0.585283E+02   SIGR  =  -0.400585E+02   SIGXI  =  -0.400585E+02   SIG1  =   0.503024E+02   IXI     =  0
      JG   = 2    YG   =     0.625359E+02   SIGZ  =   0.502884E+02   SIGETA =   0.502884E+02   SIG2  =  -0.400725E+02   IETA    =  0
                  ZETA =     0.180000E+03   SIGRZ =   0.112447E+01   SIGXIET=   0.112447E+01   SIGTH =   0.443615E+02   ITHETA  =  0
                                                                                               GAMA  =   0.892870E+02   IXIETA  =  0

 44   IG   = 1    XG   =     0.624717E+02   SIGR  =  -0.131145E+01   SIGXI  =  -0.131145E+01   SIG1  =   0.591191E+02   IXI     =  0
      JG   = 1    YG   =     0.694641E+02   SIGZ  =   0.591107E+02   SIGETA =   0.591107E+02   SIG2  =  -0.131988E+01   IETA    =  0
                  ZETA =    -0.180000E+03   SIGRZ =   0.713593E+00   SIGXIET=   0.713593E+00   SIGTH =   0.517205E+02   ITHETA  =  0
                                                                                               GAMA  =   0.893235E+02   IXIETA  =  0

 44   IG   = 2    XG   =     0.610283E+02   SIGR  =  -0.292773E+01   SIGXI  =  -0.292773E+01   SIG1  =   0.583551E+02   IXI     =  0
      JG   = 1    YG   =     0.694641E+02   SIGZ  =   0.583456E+02   SIGETA =   0.583456E+02   SIG2  =  -0.293716E+01   IETA    =  0
                  ZETA =    -0.180000E+03   SIGRZ =   0.759928E+00   SIGXIET=   0.759928E+00   SIGTH =   0.527692E+02   ITHETA  =  0
                                                                                               GAMA  =   0.892895E+02   IXIETA  =  0

 44   IG   = 1    XG   =     0.624717E+02   SIGR  =   0.260810E+00   SIGXI  =   0.260810E+00   SIG1  =   0.555638E+02   IXI     =  0
      JG   = 2    YG   =     0.625359E+02   SIGZ  =   0.555635E+02   SIGETA =   0.555635E+02   SIG2  =   0.260540E+00   IETA    =  0
                  ZETA =     0.180000E+03   SIGRZ =   0.122230E+00   SIGXIET=   0.122230E+00   SIGTH =   0.483210E+02   ITHETA  =  0
                                                                                               GAMA  =   0.898734E+02   IXIETA  =  0

 44   IG   = 2    XG   =     0.610283E+02   SIGR  =  -0.911599E+00   SIGXI  =  -0.911599E+00   SIG1  =   0.575336E+02   IXI     =  0
      JG   = 2    YG   =     0.625359E+02   SIGZ  =   0.575194E+02   SIGETA =   0.575194E+02   SIG2  =  -0.925849E+00   IETA    =  0
                  ZETA =     0.180000E+03   SIGRZ =   0.912599E+00   SIGXIET=   0.912599E+00   SIGTH =   0.498638E+02   ITHETA  =  0
                                                                                               GAMA  =   0.891054E+02   IXIETA  =  0

 45   IG   = 1    XG   =     0.599717E+02   SIGR  =  -0.416509E+02   SIGXI  =  -0.416509E+02   SIG1  =   0.540024E+02   IXI     =  0
      JG   = 1    YG   =     0.574641E+02   SIGZ  =   0.539860E+02   SIGETA =   0.539860E+02   SIG2  =  -0.416673E+02   IETA    =  0
                  ZETA =    -0.180000E+03   SIGRZ =   0.125091E+01   SIGXIET=   0.125091E+01   SIGTH =   0.674748E+02   ITHETA  =  0
                                                                                               GAMA  =   0.892508E+02   IXIETA  =  0

 45   IG   = 2    XG   =     0.585283E+02   SIGR  =  -0.444997E+02   SIGXI  =  -0.444997E+02   SIG1  =   0.601445E+02   IXI     =  0
      JG   = 1    YG   =     0.574641E+02   SIGZ  =   0.601414E+02   SIGETA =   0.601414E+02   SIG2  =  -0.445028E+02   IETA    =  0
                  ZETA =    -0.180000E+03   SIGRZ =   0.567329E+00   SIGXIET=   0.567329E+00   SIGTH =   0.714256E+02   ITHETA  =  0
                                                                                               GAMA  =   0.896894E+02   IXIETA  =  0

 45   IG   = 1    XG   =     0.599717E+02   SIGR  =  -0.379140E+02   SIGXI  =  -0.379140E+02   SIG1  =   0.549136E+02   IXI     =  0
      JG   = 2    YG   =     0.505359E+02   SIGZ  =   0.549131E+02   SIGETA =   0.549131E+02   SIG2  =  -0.379144E+02   IETA    =  0
                  ZETA =     0.180000E+03   SIGRZ =  -0.201920E+00   SIGXIET=  -0.201920E+00   SIGTH =   0.659744E+02   ITHETA  =  0
                                                                                               GAMA  =  -0.898754E+02   IXIETA  =  0

 45   IG   = 2    XG   =     0.585283E+02   SIGR  =  -0.406771E+02   SIGXI  =  -0.406771E+02   SIG1  =   0.601900E+02   IXI     =  0
      JG   = 2    YG   =     0.505359E+02   SIGZ  =   0.601677E+02   SIGETA =   0.601677E+02   SIG2  =  -0.406993E+02   IETA    =  0
                  ZETA =     0.180000E+03   SIGRZ =  -0.149707E+01   SIGXIET=  -0.149707E+01   SIGTH =   0.696031E+02   ITHETA  =  0
                                                                                               GAMA  =  -0.891497E+02   IXIETA  =  0

 46   IG   = 1    XG   =     0.624717E+02   SIGR  =  -0.157695E+01   SIGXI  =  -0.157695E+01   SIG1  =   0.567110E+02   IXI     =  0
      JG   = 1    YG   =     0.574641E+02   SIGZ  =   0.567091E+02   SIGETA =   0.567091E+02   SIG2  =  -0.157886E+01   IETA    =  0
                  ZETA =    -0.180000E+03   SIGRZ =   0.333746E+00   SIGXIET=   0.333746E+00   SIGTH =   0.719492E+02   ITHETA  =  0
                                                                                               GAMA  =   0.896719E+02   IXIETA  =  0

 46   IG   = 2    XG   =     0.610283E+02   SIGR  =  -0.375909E+01   SIGXI  =  -0.375909E+01   SIG1  =   0.600519E+02   IXI     =  0
      JG   = 1    YG   =     0.574641E+02   SIGZ  =   0.600447E+02   SIGETA =   0.600447E+02   SIG2  =  -0.376626E+01   IETA    =  0
                  ZETA =    -0.180000E+03   SIGRZ =   0.676311E+00   SIGXIET=   0.676311E+00   SIGTH =   0.743059E+02   ITHETA  =  0
                                                                                               GAMA  =   0.893928E+02   IXIETA  =  0
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46  IG  = 1  XG   =  0.624717E+02  SIGR  =  0.206117E+00  SIGXI  =  0.206117E+00  SIG1  =  0.550730E+02  IXI    = 0
    JG  = 2  YG   =  0.505359E+02  SIGZ  =  0.550727E+02  SIGETA =  0.550727E+02  SIG2  =  0.205831E+00  IETA   = 0
             ZETA =  0.180000E+03  SIGRZ =  0.125394E+00  SIGXIET=  0.125394E+00  SIGTH =  0.697568E+02  ITHETA = 0
                                                                                  GAMA  =  0.898691E+02  IXIETA = 0
46  IG  = 2  XG   =  0.610283E+02  SIGR  = -0.144180E+01  SIGXI  = -0.144180E+01  SIG1  =  0.603080E+02  IXI    = 0
    JG  = 2  YG   =  0.505359E+02  SIGZ  =  0.603077E+02  SIGETA =  0.603077E+02  SIG2  = -0.144214E+01  IETA   = 0
             ZETA =  0.180000E+03  SIGRZ = -0.144673E+00  SIGXIET= -0.144673E+00  SIGTH =  0.724865E+02  ITHETA = 0
                                                                                  GAMA  = -0.898658E+02  IXIETA = 0

47  IG  = 1  XG   =  0.599717E+02  SIGR  = -0.410225E+02  SIGXI  = -0.410225E+02  SIG1  =  0.542707E+02  IXI    = 0
    JG  = 1  YG   =  0.454641E+02  SIGZ  =  0.542311E+02  SIGETA =  0.542311E+02  SIG2  = -0.410621E+02  IETA   = 0
             ZETA = -0.180000E+03  SIGRZ = -0.194214E+01  SIGXIET= -0.194214E+01  SIGTH =  0.654242E+02  ITHETA = 0
                                                                                  GAMA  = -0.888324E+02  IXIETA = 0
47  IG  = 2  XG   =  0.585283E+02  SIGR  = -0.438729E+02  SIGXI  = -0.438729E+02  SIG1  =  0.567890E+02  IXI    = 0
    JG  = 1  YG   =  0.454641E+02  SIGZ  =  0.567793E+02  SIGETA =  0.567793E+02  SIG2  = -0.438825E+02  IETA   = 0
             ZETA = -0.180000E+03  SIGRZ =  0.986457E+00  SIGXIET=  0.986457E+00  SIGTH =  0.685630E+02  ITHETA = 0
                                                                                  GAMA  =  0.894385E+02  IXIETA = 0
47  IG  = 1  XG   =  0.599717E+02  SIGR  = -0.394927E+02  SIGXI  = -0.394927E+02  SIG1  =  0.521207E+02  IXI    = 0
    JG  = 2  YG   =  0.385359E+02  SIGZ  =  0.521043E+02  SIGETA =  0.521043E+02  SIG2  = -0.395091E+02  IETA   = 0
             ZETA =  0.180000E+03  SIGRZ = -0.122516E+01  SIGXIET= -0.122516E+01  SIGTH =  0.664783E+02  ITHETA = 0
                                                                                  GAMA  = -0.892338E+02  IXIETA = 0
47  IG  = 2  XG   =  0.585283E+02  SIGR  = -0.421001E+02  SIGXI  = -0.421001E+02  SIG1  =  0.507801E+02  IXI    = 0
    JG  = 2  YG   =  0.385359E+02  SIGZ  =  0.507404E+02  SIGETA =  0.507404E+02  SIG2  = -0.421398E+02  IETA   = 0
             ZETA =  0.180000E+03  SIGRZ = -0.191872E+01  SIGXIET= -0.191872E+01  SIGTH =  0.688547E+02  ITHETA = 0
                                                                                  GAMA  = -0.888165E+02  IXIETA = 0

48  IG  = 1  XG   =  0.624717E+02  SIGR  = -0.149611E+01  SIGXI  = -0.149611E+01  SIG1  =  0.579153E+02  IXI    = 0
    JG  = 1  YG   =  0.454641E+02  SIGZ  =  0.579065E+02  SIGETA =  0.579065E+02  SIG2  = -0.150491E+01  IETA   = 0
             ZETA = -0.180000E+03  SIGRZ = -0.723217E+00  SIGXIET= -0.723217E+00  SIGTH =  0.700924E+02  ITHETA = 0
                                                                                  GAMA  = -0.893026E+02  IXIETA = 0
48  IG  = 2  XG   =  0.610283E+02  SIGR  = -0.324167E+01  SIGXI  = -0.324167E+01  SIG1  =  0.611046E+02  IXI    = 0
    JG  = 1  YG   =  0.454641E+02  SIGZ  =  0.610620E+02  SIGETA =  0.610620E+02  SIG2  = -0.328425E+01  IETA   = 0
             ZETA = -0.180000E+03  SIGRZ = -0.165513E+01  SIGXIET= -0.165513E+01  SIGTH =  0.724398E+02  ITHETA = 0
                                                                                  GAMA  = -0.885265E+02  IXIETA = 0
48  IG  = 1  XG   =  0.624717E+02  SIGR  = -0.472348E-01  SIGXI  = -0.472348E-01  SIG1  =  0.644879E+02  IXI    = 0
    JG  = 2  YG   =  0.385359E+02  SIGZ  =  0.644781E+02  SIGETA =  0.644781E+02  SIG2  = -0.570299E-01  IETA   = 0
             ZETA =  0.180000E+03  SIGRZ = -0.795065E+00  SIGXIET= -0.795065E+00  SIGTH =  0.728444E+02  ITHETA = 0
                                                                                  GAMA  = -0.892942E+02  IXIETA = 0
48  IG  = 2  XG   =  0.610283E+02  SIGR  = -0.209589E+01  SIGXI  = -0.209589E+01  SIG1  =  0.622599E+02  IXI    = 0
    JG  = 2  YG   =  0.385359E+02  SIGZ  =  0.622396E+02  SIGETA =  0.622396E+02  SIG2  = -0.211616E+01  IETA   = 0
             ZETA =  0.180000E+03  SIGRZ = -0.114216E+01  SIGXIET= -0.114216E+01  SIGTH =  0.740776E+02  ITHETA = 0
                                                                                  GAMA  = -0.889832E+02  IXIETA = 0

49  IG  = 1  XG   =  0.599717E+02  SIGR  = -0.402449E+02  SIGXI  = -0.402449E+02  SIG1  =  0.506323E+02  IXI    = 0
    JG  = 1  YG   =  0.334641E+02  SIGZ  =  0.505712E+02  SIGETA =  0.505712E+02  SIG2  = -0.403060E+02  IETA   = 0
             ZETA = -0.180000E+03  SIGRZ = -0.235739E+01  SIGXIET= -0.235739E+01  SIGTH =  0.668882E+02  ITHETA = 0
                                                                                  GAMA  = -0.885141E+02  IXIETA = 0
49  IG  = 2  XG   =  0.585283E+02  SIGR  = -0.432748E+02  SIGXI  = -0.432748E+02  SIG1  =  0.439793E+02  IXI    = 0
```

```
     JG   = 1   YG    =   0.334641E+02  SIGZ  =  0.439787E+02  SIGETA =  0.439787E+02  SIG2  = -0.432754E+02  IETA   = 0
                ZETA  =  -0.180000E+03  SIGRZ = -0.224093E+00  SIGXIET= -0.224093E+00  SIGTH =  0.681584E+02  ITHETA = 0
                                                                                       GAMA  = -0.898528E+02  IXIETA = 0

49   IG   = 1   XG    =   0.599717E+02  SIGR  = -0.399148E+02  SIGXI  = -0.399148E+02  SIG1  =  0.478670E+02  IXI    = 0
     JG   = 2   YG    =   0.265359E+02  SIGZ  =  0.477691E+02  SIGETA =  0.477691E+02  SIG2  = -0.400127E+02  IETA   = 0
                ZETA  =   0.180000E+03  SIGRZ = -0.293115E+01  SIGXIET= -0.293115E+01  SIGTH =  0.638806E+02  ITHETA = 0
                                                                                       GAMA  = -0.880875E+02  IXIETA = 0

49   IG   = 2   XG    =   0.585283E+02  SIGR  = -0.432087E+02  SIGXI  = -0.432087E+02  SIG1  =  0.355088E+02  IXI    = 0
     JG   = 2   YG    =   0.265359E+02  SIGZ  =  0.355087E+02  SIGETA =  0.355087E+02  SIG2  = -0.432088E+02  IETA   = 0
                ZETA  =   0.180000E+03  SIGRZ = -0.858533E-01  SIGXIET= -0.858533E-01  SIGTH =  0.638517E+02  ITHETA = 0
                                                                                       GAMA  = -0.899375E+02  IXIETA = 0

50   IG   = 1   XG    =   0.624717E+02  SIGR  = -0.140831E+01  SIGXI  = -0.140831E+01  SIG1  =  0.701654E+02  IXI    = 0
     JG   = 1   YG    =   0.334641E+02  SIGZ  =  0.701589E+02  SIGETA =  0.701589E+02  SIG2  = -0.141473E+01  IETA   = 0
                ZETA  =  -0.180000E+03  SIGRZ = -0.677537E+00  SIGXIET= -0.677537E+00  SIGTH =  0.744662E+02  ITHETA = 0
                                                                                       GAMA  = -0.894576E+02  IXIETA = 0

50   IG   = 2   XG    =   0.610283E+02  SIGR  = -0.334826E+01  SIGXI  = -0.334826E+01  SIG1  =  0.644655E+02  IXI    = 0
     JG   = 1   YG    =   0.334641E+02  SIGZ  =  0.643590E+02  SIGETA =  0.643590E+02  SIG2  = -0.345474E+01  IETA   = 0
                ZETA  =  -0.180000E+03  SIGRZ = -0.268714E+01  SIGXIET= -0.268714E+01  SIGTH =  0.750823E+02  ITHETA = 0
                                                                                       GAMA  = -0.877308E+02  IXIETA = 0

50   IG   = 1   XG    =   0.624717E+02  SIGR  = -0.301326E+00  SIGXI  = -0.301326E+00  SIG1  =  0.785333E+02  IXI    = 0
     JG   = 2   YG    =   0.265359E+02  SIGZ  =  0.785307E+02  SIGETA =  0.785307E+02  SIG2  = -0.303933E+00  IETA   = 0
                ZETA  =   0.180000E+03  SIGRZ = -0.453341E+00  SIGXIET= -0.453341E+00  SIGTH =  0.739794E+02  ITHETA = 0
                                                                                       GAMA  = -0.896705E+02  IXIETA = 0

50   IG   = 2   XG    =   0.610283E+02  SIGR  = -0.224120E+01  SIGXI  = -0.224120E+01  SIG1  =  0.662430E+02  IXI    = 0
     JG   = 2   YG    =   0.265359E+02  SIGZ  =  0.661946E+02  SIGETA =  0.661946E+02  SIG2  = -0.228968E+01  IETA   = 0
                ZETA  =   0.180000E+03  SIGRZ = -0.182205E+01  SIGXIET= -0.182205E+01  SIGTH =  0.732243E+02  ITHETA = 0
                                                                                       GAMA  = -0.884760E+02  IXIETA = 0

51   IG   = 1   XG    =   0.599717E+02  SIGR  = -0.405619E+02  SIGXI  = -0.405619E+02  SIG1  =  0.439204E+02  IXI    = 0
     JG   = 1   YG    =   0.214641E+02  SIGZ  =  0.439161E+02  SIGETA =  0.439161E+02  SIG2  = -0.405662E+02  IETA   = 0
                ZETA  =  -0.180000E+03  SIGRZ = -0.601690E+00  SIGXIET= -0.601690E+00  SIGTH =  0.573695E+02  ITHETA = 0
                                                                                       GAMA  = -0.895919E+02  IXIETA = 0

51   IG   = 2   XG    =   0.585283E+02  SIGR  = -0.436909E+02  SIGXI  = -0.436909E+02  SIG1  =  0.282701E+02  IXI    = 0
     JG   = 1   YG    =   0.214641E+02  SIGZ  =  0.282626E+02  SIGETA =  0.282626E+02  SIG2  = -0.436984E+02  IETA   = 0
                ZETA  =  -0.180000E+03  SIGRZ =  0.733562E+00  SIGXIET=  0.733562E+00  SIGTH =  0.565090E+02  ITHETA = 0
                                                                                       GAMA  =  0.894160E+02  IXIETA = 0

51   IG   = 1   XG    =   0.599717E+02  SIGR  = -0.432506E+02  SIGXI  = -0.432506E+02  SIG1  =  0.459447E+02  IXI    = 0
     JG   = 2   YG    =   0.145359E+02  SIGZ  =  0.452509E+02  SIGETA =  0.452509E+02  SIG2  = -0.439443E+02  IETA   = 0
                ZETA  =   0.180000E+03  SIGRZ =  0.786652E+01  SIGXIET=  0.786652E+01  SIGTH =  0.419647E+02  ITHETA = 0
                                                                                       GAMA  =  0.849599E+02  IXIETA = 0

51   IG   = 2   XG    =   0.585283E+02  SIGR  = -0.443496E+02  SIGXI  = -0.443496E+02  SIG1  =  0.316334E+02  IXI    = 0
     JG   = 2   YG    =   0.145359E+02  SIGZ  =  0.312578E+02  SIGETA =  0.312578E+02  SIG2  = -0.447252E+02  IETA   = 0
                ZETA  =   0.180000E+03  SIGRZ = -0.534217E+01  SIGXIET= -0.534217E+01  SIGTH =  0.414459E+02  ITHETA = 0
                                                                                       GAMA  = -0.859783E+02  IXIETA = 0

52   IG   = 1   XG    =   0.624717E+02  SIGR  = -0.895234E+00  SIGXI  = -0.895234E+00  SIG1  =  0.785600E+02  IXI    = 0
     JG   = 1   YG    =   0.214641E+02  SIGZ  =  0.785557E+02  SIGETA =  0.785557E+02  SIG2  = -0.899518E+00  IETA   = 0
                ZETA  =  -0.180000E+03  SIGRZ = -0.583425E+00  SIGXIET= -0.583425E+00  SIGTH =  0.685136E+02  ITHETA = 0
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                                                                                  GAMA   = -0.895793E+02   IXIETA  =  0
52   IG  = 2   XG   =  0.610283E+02   SIGR  = -0.347144E+01   SIGXI  = -0.347144E+01   SIG1   =  0.622377E+02   IXI     =  0
     JG  = 1   YG   =  0.214641E+02   SIGZ  =  0.621745E+02   SIGETA =  0.621745E+02   SIG2   = -0.353467E+01   IETA    =  0
               ZETA = -0.180000E+03   SIGRZ = -0.203827E+01   SIGXIET= -0.203827E+01   SIGTH  =  0.666794E+02   ITHETA  =  0
                                                                                  GAMA   = -0.882233E+02   IXIETA  =  0
52   IG  = 1   XG   =  0.624717E+02   SIGR  = -0.798182E+00   SIGXI  = -0.798182E+00   SIG1   =  0.721234E+02   IXI     =  0
     JG  = 2   YG   =  0.145359E+02   SIGZ  =  0.721174E+02   SIGETA =  0.721174E+02   SIG2   = -0.804274E+00   IETA    =  0
               ZETA =  0.180000E+03   SIGRZ =  0.666474E+00   SIGXIET=  0.666474E+00   SIGTH  =  0.528469E+02   ITHETA  =  0
                                                                                  GAMA   =  0.894764E+02   IXIETA  =  0
52   IG  = 2   XG   =  0.610283E+02   SIGR  = -0.247990E+01   SIGXI  = -0.247990E+01   SIG1   =  0.624227E+02   IXI     =  0
     JG  = 2   YG   =  0.145359E+02   SIGZ  =  0.618491E+02   SIGETA =  0.618491E+02   SIG2   = -0.305348E+01   IETA    =  0
               ZETA =  0.180000E+03   SIGRZ =  0.610142E+01   SIGXIET=  0.610142E+01   SIGTH  =  0.519729E+02   ITHETA  =  0
                                                                                  GAMA   =  0.846295E+02   IXIETA  =  0

53   IG  = 1   XG   =  0.599717E+02   SIGR  = -0.348301E+02   SIGXI  = -0.348301E+02   SIG1   =  0.403699E+02   IXI     =  0
     JG  = 1   YG   =  0.946410E+01   SIGZ  =  0.397437E+02   SIGETA =  0.397437E+02   SIG2   = -0.354563E+02   IETA    =  0
               ZETA = -0.180000E+03   SIGRZ =  0.686220E+01   SIGXIET=  0.686220E+01   SIGTH  =  0.255137E+02   ITHETA  =  0
                                                                                  GAMA   =  0.847860E+02   IXIETA  =  0
53   IG  = 2   XG   =  0.585283E+02   SIGR  = -0.377689E+02   SIGXI  = -0.377689E+02   SIG1   =  0.423336E+02   IXI     =  0
     JG  = 1   YG   =  0.946410E+01   SIGZ  =  0.421005E+02   SIGETA =  0.421005E+02   SIG2   = -0.380020E+02   IETA    =  0
               ZETA = -0.180000E+03   SIGRZ =  0.432080E+01   SIGXIET=  0.432080E+01   SIGTH  =  0.272294E+02   ITHETA  =  0
                                                                                  GAMA   =  0.869124E+02   IXIETA  =  0
53   IG  = 1   XG   =  0.599717E+02   SIGR  = -0.327690E+02   SIGXI  = -0.327690E+02   SIG1   =  0.549355E+02   IXI     =  0
     JG  = 2   YG   =  0.253590E+01   SIGZ  =  0.546123E+02   SIGETA =  0.546123E+02   SIG2   = -0.330923E+02   IETA    =  0
               ZETA =  0.180000E+03   SIGRZ =  0.532468E+01   SIGXIET=  0.532468E+01   SIGTH  =  0.968326E+01   ITHETA  =  0
                                                                                  GAMA   =  0.865257E+02   IXIETA  =  0
53   IG  = 2   XG   =  0.585283E+02   SIGR  = -0.427191E+02   SIGXI  = -0.427191E+02   SIG1   =  0.104424E+03   IXI     =  0
     JG  = 2   YG   =  0.253590E+01   SIGZ  =  0.992366E+02   SIGETA =  0.992366E+02   SIG2   = -0.479065E+02   IETA    =  0
               ZETA =  0.180000E+03   SIGRZ =  0.276277E+02   SIGXIET=  0.276277E+02   SIGTH  =  0.181280E+02   ITHETA  =  0
                                                                                  GAMA   =  0.793659E+02   IXIETA  =  0

54   IG  = 1   XG   =  0.624717E+02   SIGR  =  0.953629E-01   SIGXI  =  0.953629E-01   SIG1   =  0.510227E+02   IXI     =  0
     JG  = 1   YG   =  0.946410E+01   SIGZ  =  0.506678E+02   SIGETA =  0.506678E+02   SIG2   = -0.259450E+00   IETA    =  0
               ZETA = -0.180000E+03   SIGRZ =  0.425084E+01   SIGXIET=  0.425084E+01   SIGTH  =  0.327206E+02   ITHETA  =  0
                                                                                  GAMA   =  0.852287E+02   IXIETA  =  0
54   IG  = 2   XG   =  0.610283E+02   SIGR  = -0.259152E+01   SIGXI  = -0.259152E+01   SIG1   =  0.525253E+02   IXI     =  0
     JG  = 1   YG   =  0.946410E+01   SIGZ  =  0.504886E+02   SIGETA =  0.504886E+02   SIG2   = -0.462818E+01   IETA    =  0
               ZETA = -0.180000E+03   SIGRZ =  0.105950E+02   SIGXIET=  0.105950E+02   SIGTH  =  0.331056E+02   ITHETA  =  0
                                                                                  GAMA   =  0.791189E+02   IXIETA  =  0
54   IG  = 1   XG   =  0.624717E+02   SIGR  =  0.420140E+00   SIGXI  =  0.420140E+00   SIG1   =  0.774977E+01   IXI     =  0
     JG  = 2   YG   =  0.253590E+01   SIGZ  = -0.586020E+01   SIGETA = -0.586020E+01   SIG2   = -0.131898E+02   IETA    =  0
               ZETA =  0.180000E+03   SIGRZ =  0.998780E+01   SIGXIET=  0.998780E+01   SIGTH  =  0.344790E+01   ITHETA  =  0
                                                                                  GAMA   =  0.362734E+02   IXIETA  =  0
54   IG  = 2   XG   =  0.610283E+02   SIGR  = -0.108452E+01   SIGXI  = -0.108452E+01   SIG1   =  0.421915E+02   IXI     =  0
     JG  = 2   YG   =  0.253590E+01   SIGZ  =  0.344175E+02   SIGETA =  0.344175E+02   SIG2   = -0.885852E+01   IETA    =  0
               ZETA =  0.180000E+03   SIGRZ =  0.183420E+02   SIGXIET=  0.183420E+02   SIGTH  =  0.114203E+02   ITHETA  =  0
                                                                                  GAMA   =  0.670310E+02   IXIETA  =  0
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55   IG  = 1   XG   =   0.612217E+02   SIGR  =   0.226274E+02   SIGXI  =   0.226274E+02   SIG1  =   0.393712E+02   IXI    = 0
     JG  = 1   YG   =  -0.158494E+00   SIGZ  =   0.329445E+02   SIGETA =   0.329445E+02   SIG2  =   0.162006E+02   IETA   = 0
               ZETA =  -0.180000E+03   SIGRZ =   0.103734E+02   SIGXIET=   0.103734E+02   SIGTH =   0.109310E+02   ITHETA = 0
                                                                                          GAMA  =   0.582203E+02   IXIETA = 0

55   IG  = 2   XG   =   0.597783E+02   SIGR  =  -0.326943E+02   SIGXI  =  -0.326943E+02   SIG1  =   0.824145E+02   IXI    = 0
     JG  = 1   YG   =  -0.158494E+00   SIGZ  =   0.526981E+02   SIGETA =   0.526981E+02   SIG2  =  -0.624107E+02   IETA   = 0
               ZETA =  -0.180000E+03   SIGRZ =   0.584861E+02   SIGXIET=   0.584861E+02   SIGTH =   0.417776E+01   ITHETA = 0
                                                                                          GAMA  =   0.630651E+02   IXIETA = 0

55   IG  = 1   XG   =   0.612217E+02   SIGR  =   0.199838E+02   SIGXI  =   0.199838E+02   SIG1  =   0.429746E+02   IXI    = 0
     JG  = 2   YG   =  -0.591506E+00   SIGZ  =   0.308450E+02   SIGETA =   0.308450E+02   SIG2  =   0.785420E+01   IETA   = 0
               ZETA =   0.180000E+03   SIGRZ =  -0.166993E+02   SIGXIET=  -0.166993E+02   SIGTH =   0.100319E+02   ITHETA = 0
                                                                                          GAMA  =  -0.540073E+02   IXIETA = 0

55   IG  = 2   XG   =   0.597783E+02   SIGR  =   0.108664E+02   SIGXI  =   0.108664E+02   SIG1  =   0.686171E+02   IXI    = 0
     JG  = 2   YG   =  -0.591506E+00   SIGZ  =   0.591269E+02   SIGETA =   0.591269E+02   SIG2  =   0.137623E+01   IETA   = 0
               ZETA =   0.180000E+03   SIGRZ =  -0.234108E+02   SIGXIET=  -0.234108E+02   SIGTH =   0.137639E+02   ITHETA = 0
                                                                                          GAMA  =  -0.679335E+02   IXIETA = 0
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STRESSES AT THE GAUSS POINTS FOR LONG. REINFORCING ELEMENTS
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ME	NL	JG	XG	YG	SIGT	EPST
1	1	1	0.1321E+01	0.1493E+03	0.889292E+03	0.291933E-04
1	1	2	0.4927E+01	0.1492E+03	0.295662E+03	0.970588E-05
2	1	1	0.1291E+01	0.1466E+03	-0.154866E+04	-0.508388E-04
2	1	2	0.4816E+01	0.1466E+03	-0.202782E+04	-0.665685E-04
3	1	1	0.7565E+01	0.1491E+03	0.275412E+02	0.904110E-06
3	1	2	0.1116E+02	0.1488E+03	-0.839681E+02	-0.275647E-05
4	1	1	0.7394E+01	0.1464E+03	-0.225749E+04	-0.741079E-04
4	1	2	0.1091E+02	0.1461E+03	-0.221085E+04	-0.725768E-04
5	1	1	0.1379E+02	0.1486E+03	-0.141338E+03	-0.463979E-05
5	1	2	0.1736E+02	0.1481E+03	-0.133217E+03	-0.437319E-05
6	1	1	0.1348E+02	0.1459E+03	-0.207097E+04	-0.679849E-04
6	1	2	0.1697E+02	0.1454E+03	-0.186441E+04	-0.612042E-04
7	1	1	0.1997E+02	0.1477E+03	-0.137198E+03	-0.450387E-05
7	1	2	0.2352E+02	0.1470E+03	-0.178344E+03	-0.585461E-05
8	1	1	0.1952E+02	0.1450E+03	-0.165629E+04	-0.543720E-04
8	1	2	0.2299E+02	0.1444E+03	-0.149285E+04	-0.490065E-04
9	1	1	0.2610E+02	0.1465E+03	-0.241873E+03	-0.794009E-05
9	1	2	0.2961E+02	0.1456E+03	-0.395572E+03	-0.129857E-04
10	1	1	0.2551E+02	0.1438E+03	-0.141967E+04	-0.466044E-04
10	1	2	0.2894E+02	0.1430E+03	-0.123799E+04	-0.406403E-04
11	1	1	0.3216E+02	0.1449E+03	-0.567875E+03	-0.186420E-04
11	1	2	0.3562E+02	0.1439E+03	-0.890071E+03	-0.292189E-04
12	1	1	0.3144E+02	0.1423E+03	-0.109558E+04	-0.359652E-04
12	1	2	0.3482E+02	0.1413E+03	-0.799225E+03	-0.262366E-04
13	1	1	0.3813E+02	0.1431E+03	-0.119736E+04	-0.393066E-04
13	1	2	0.4154E+02	0.1419E+03	-0.176164E+04	-0.578304E-04
14	1	1	0.3727E+02	0.1405E+03	-0.499119E+03	-0.163849E-04
14	1	2	0.4060E+02	0.1394E+03	0.526475E+01	0.172829E-06
15	1	1	0.4400E+02	0.1409E+03	-0.226166E+04	-0.742448E-04
15	1	2	0.4733E+02	0.1396E+03	-0.311821E+04	-0.102363E-03
16	1	1	0.4301E+02	0.1384E+03	0.466168E+03	0.153032E-04
16	1	2	0.4626E+02	0.1371E+03	0.124385E+04	0.408326E-04
17	1	1	0.4949E+02	0.1387E+03	-0.330531E+04	-0.108505E-03
17	1	2	0.5208E+02	0.1377E+03	-0.315175E+04	-0.103464E-03
18	1	1	0.4830E+02	0.1361E+03	0.163496E+04	0.536719E-04
18	1	2	0.5060E+02	0.1347E+03	0.175068E+04	0.574708E-04

19	1	1	0.5397E+02	0.1370E+03	-0.288507E+04	-0.947100E-04
19	1	2	0.5655E+02	0.1359E+03	-0.278683E+04	-0.914850E-04
20	1	1	0.5226E+02	0.1337E+03	0.168462E+04	0.553021E-04
20	1	2	0.5443E+02	0.1321E+03	0.162315E+04	0.532841E-04
21	1	1	0.5813E+02	0.1354E+03	-0.231604E+04	-0.787152E-04
21	1	2	0.5987E+02	0.1350E+03	-0.137690E+04	-0.467967E-04
22	1	1	0.5577E+02	0.1310E+03	0.135879E+04	0.461811E-04
22	1	2	0.5718E+02	0.1298E+03	0.108342E+04	0.368221E-04
23	1	1	0.6219E+02	0.1352E+03	-0.326735E+03	-0.111047E-04
23	1	2	0.6219E+02	0.1316E+03	0.696916E+03	0.236860E-04
23	3	1	0.6247E+02	0.1344E+03	-0.100099E+04	-0.340206E-04
23	3	2	0.6103E+02	0.1347E+03	-0.181882E+04	-0.618160E-04
24	1	1	0.6219E+02	0.1292E+03	0.184459E+03	0.626919E-05
24	1	2	0.6219E+02	0.1262E+03	0.950094E+03	0.322908E-04
25	1	1	0.5798E+02	0.1282E+03	0.164767E+04	0.559992E-04
25	1	2	0.5866E+02	0.1253E+03	0.219244E+04	0.745144E-04
26	1	1	0.6750E+02	0.1344E+03	0.491179E+03	0.166937E-04
26	1	2	0.6751E+02	0.1288E+03	-0.376226E+04	-0.127868E-03
26	3	1	0.6695E+02	0.1335E+03	0.641739E+03	0.218107E-04
26	3	2	0.6406E+02	0.1341E+03	-0.102708E+03	-0.349072E-05
27	1	1	0.6751E+02	0.1261E+03	0.262040E+04	0.890592E-04
27	1	2	0.6750E+02	0.1241E+03	0.700922E+03	0.238222E-04
28	1	1	0.6750E+02	0.1227E+03	0.580929E+03	0.197440E-04
28	1	2	0.6750E+02	0.1207E+03	0.643266E+03	0.218626E-04
28	3	1	0.6694E+02	0.1205E+03	0.210569E+03	0.715659E-05
28	3	2	0.6406E+02	0.1206E+03	0.839822E+03	0.285430E-04
29	1	1	0.6219E+02	0.1241E+03	0.653345E+03	0.214477E-04
29	1	2	0.6219E+02	0.1211E+03	0.648779E+03	0.212978E-04
29	3	1	0.6247E+02	0.1205E+03	0.214513E+03	0.704194E-05
29	3	2	0.6103E+02	0.1205E+03	0.157025E+03	0.515476E-05
30	1	1	0.5881E+02	0.1233E+03	0.209237E+04	0.686876E-04
30	1	2	0.5881E+02	0.1209E+03	0.158939E+04	0.521758E-04
30	3	1	0.5997E+02	0.1205E+03	-0.226781E+03	-0.744467E-05
30	3	2	0.5853E+02	0.1204E+03	-0.209389E+03	-0.687374E-05
31	1	1	0.5881E+02	0.1194E+03	0.189327E+04	0.621514E-04
31	1	2	0.5881E+02	0.1176E+03	0.140566E+04	0.461444E-04
32	1	1	0.6131E+02	0.1194E+03	0.108790E+04	0.357131E-04
32	1	2	0.6131E+02	0.1176E+03	0.125543E+04	0.412126E-04
33	1	1	0.5881E+02	0.1164E+03	0.107682E+04	0.353492E-04
33	1	2	0.5881E+02	0.1146E+03	0.730795E+03	0.239903E-04
34	1	1	0.6131E+02	0.1164E+03	0.124773E+04	0.409601E-04
34	1	2	0.6131E+02	0.1146E+03	0.132696E+04	0.435610E-04
35	1	1	0.5881E+02	0.1127E+03	0.459222E+03	0.150751E-04

35	1	2	0.5881E+02	0.1093E+03	0.152692E+03	0.501250E-05
36	1	1	0.6219E+02	0.1127E+03	0.170455E+04	0.559562E-04
36	1	2	0.6219E+02	0.1093E+03	0.184524E+04	0.605747E-04
37	1	1	0.5881E+02	0.1055E+03	0.520324E+02	0.170810E-05
37	1	2	0.5881E+02	0.9854E+02	0.156881E+03	0.515003E-05
38	1	1	0.6219E+02	0.1055E+03	0.177702E+04	0.583352E-04
38	1	2	0.6219E+02	0.9854E+02	0.149850E+04	0.491921E-04
39	1	1	0.5881E+02	0.9346E+02	0.363542E+03	0.119342E-04
39	1	2	0.5881E+02	0.8654E+02	0.585077E+03	0.192067E-04
40	1	1	0.6219E+02	0.9346E+02	0.124019E+04	0.407123E-04
40	1	2	0.6219E+02	0.8654E+02	0.999867E+03	0.328232E-04
41	1	1	0.5881E+02	0.8146E+02	0.694094E+03	0.227854E-04
41	1	2	0.5881E+02	0.7454E+02	0.768419E+03	0.252253E-04
42	1	1	0.6219E+02	0.8146E+02	0.896020E+03	0.294142E-04
42	1	2	0.6219E+02	0.7454E+02	0.834062E+03	0.273802E-04
43	1	1	0.5881E+02	0.6946E+02	0.797374E+03	0.261759E-04
43	1	2	0.5881E+02	0.6254E+02	0.835640E+03	0.274321E-04
44	1	1	0.6219E+02	0.6946E+02	0.827659E+03	0.271701E-04
44	1	2	0.6219E+02	0.6254E+02	0.782255E+03	0.256795E-04
45	1	1	0.5881E+02	0.5746E+02	0.525166E+03	0.172399E-04
45	1	2	0.5881E+02	0.5054E+02	0.523145E+03	0.171736E-04
46	1	1	0.6219E+02	0.5746E+02	0.425459E+03	0.139668E-04
46	1	2	0.6219E+02	0.5054E+02	0.413507E+03	0.135744E-04
47	1	1	0.5881E+02	0.4546E+02	0.505010E+03	0.165783E-04
47	1	2	0.5881E+02	0.3854E+02	0.448980E+03	0.147389E-04
48	1	1	0.6219E+02	0.4546E+02	0.440159E+03	0.144494E-04
48	1	2	0.6219E+02	0.3854E+02	0.486592E+03	0.159736E-04
49	1	1	0.5881E+02	0.3346E+02	0.394296E+03	0.129438E-04
49	1	2	0.5881E+02	0.2654E+02	0.329760E+03	0.108252E-04
50	1	1	0.6219E+02	0.3346E+02	0.535524E+03	0.175800E-04
50	1	2	0.6219E+02	0.2654E+02	0.604455E+03	0.198428E-04
51	1	1	0.5881E+02	0.2146E+02	0.276261E+03	0.938925E-05
51	1	2	0.5881E+02	0.1454E+02	0.332317E+03	0.112944E-04
52	1	1	0.6219E+02	0.2146E+02	0.586457E+03	0.199319E-04
52	1	2	0.6219E+02	0.1454E+02	0.565634E+03	0.192242E-04
53	1	1	0.5881E+02	0.9464E+01	0.403077E+03	0.136994E-04
53	1	2	0.5881E+02	0.2536E+01	0.892954E+03	0.303488E-04
53	2	1	0.6050E+02	0.9464E+01	0.422729E+03	0.143673E-04
53	2	2	0.6050E+02	0.2536E+01	0.442953E+03	0.150546E-04
53	3	1	0.5997E+02	0.3000E+01	-0.412686E+03	-0.140259E-04
53	3	2	0.5853E+02	0.3000E+01	-0.597177E+03	-0.202962E-04
53	4	1	0.5997E+02	0.9000E+01	-0.431210E+03	-0.146555E-04

53	4	2	0.5853E+02	0.9000E+01	-0.477522E+03	-0.162295E-04
54	1	1	0.6219E+02	0.9464E+01	0.418987E+03	0.142401E-04
54	1	2	0.6219E+02	0.2536E+01	0.973860E+01	0.330985E-06
54	3	1	0.6247E+02	0.3000E+01	-0.801129E+01	-0.272279E-06
54	3	2	0.6103E+02	0.3000E+01	-0.108526E+03	-0.368848E-05
54	4	1	0.6247E+02	0.9000E+01	-0.151733E+03	-0.515692E-05
54	4	2	0.6103E+02	0.9000E+01	-0.182983E+03	-0.621902E-05
55	1	1	0.6050E+02	-0.1585E+00	0.335461E+03	0.114013E-04
55	1	2	0.6050E+02	-0.5915E+00	0.308925E+03	0.104994E-04

STRESSES AT THE GAUSS POINTS FOR HOOP REINF ELEMENTS
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ME	NL	JG	XG	YG	SIGT	EPST
1	1	1	0.1318E+01	0.1491E+03	0.942549E+03	0.309416E-04
1	1	2	0.4919E+01	0.1490E+03	0.490879E+03	0.161144E-04
2	1	1	0.1293E+01	0.1468E+03	-0.114171E+04	-0.374795E-04
2	1	2	0.4824E+01	0.1468E+03	-0.155491E+04	-0.510439E-04
3	1	1	0.7552E+01	0.1489E+03	0.189031E+03	0.620543E-05
3	1	2	0.1114E+02	0.1486E+03	-0.148123E+03	-0.486254E-05
4	1	1	0.7407E+01	0.1466E+03	-0.182878E+04	-0.600344E-04
4	1	2	0.1093E+02	0.1463E+03	-0.211941E+04	-0.695752E-04
5	1	1	0.1376E+02	0.1483E+03	-0.385192E+03	-0.126449E-04
5	1	2	0.1734E+02	0.1479E+03	-0.714401E+03	-0.234521E-04
6	1	1	0.1350E+02	0.1461E+03	-0.231054E+04	-0.758494E-04
6	1	2	0.1700E+02	0.1456E+03	-0.256375E+04	-0.841616E-04
7	1	1	0.1994E+02	0.1475E+03	-0.959492E+03	-0.314978E-04
7	1	2	0.2348E+02	0.1468E+03	-0.131897E+04	-0.432985E-04
8	1	1	0.1956E+02	0.1452E+03	-0.274825E+04	-0.902185E-04
8	1	2	0.2303E+02	0.1446E+03	-0.302041E+04	-0.991527E-04
9	1	1	0.2606E+02	0.1463E+03	-0.159828E+04	-0.524677E-04
9	1	2	0.2956E+02	0.1454E+03	-0.201011E+04	-0.659869E-04
10	1	1	0.2556E+02	0.1440E+03	-0.323803E+04	-0.106297E-03
10	1	2	0.2899E+02	0.1432E+03	-0.355880E+04	-0.116827E-03
11	1	1	0.3211E+02	0.1447E+03	-0.233021E+04	-0.764953E-04
11	1	2	0.3556E+02	0.1437E+03	-0.278639E+04	-0.914704E-04
12	1	1	0.3149E+02	0.1425E+03	-0.380525E+04	-0.124917E-03
12	1	2	0.3488E+02	0.1415E+03	-0.413824E+04	-0.135849E-03
13	1	1	0.3807E+02	0.1429E+03	-0.312896E+04	-0.102716E-03
13	1	2	0.4146E+02	0.1417E+03	-0.358348E+04	-0.117637E-03
14	1	1	0.3734E+02	0.1407E+03	-0.437336E+04	-0.143567E-03
14	1	2	0.4067E+02	0.1395E+03	-0.464228E+04	-0.152395E-03
15	1	1	0.4393E+02	0.1408E+03	-0.390082E+04	-0.128054E-03
15	1	2	0.4725E+02	0.1394E+03	-0.425851E+04	-0.139797E-03
16	1	1	0.4308E+02	0.1386E+03	-0.479790E+04	-0.157504E-03
16	1	2	0.4634E+02	0.1373E+03	-0.488242E+04	-0.160278E-03
17	1	1	0.4940E+02	0.1385E+03	-0.441462E+04	-0.144921E-03
17	1	2	0.5197E+02	0.1375E+03	-0.447411E+04	-0.146874E-03
18	1	1	0.4839E+02	0.1363E+03	-0.486917E+04	-0.159843E-03
18	1	2	0.5071E+02	0.1350E+03	-0.477734E+04	-0.156828E-03

19	1	1	0.5385E+02	0.1367E+03	-0.445955E+04	-0.146396E-03
19	1	2	0.5640E+02	0.1357E+03	-0.438930E+04	-0.144090E-03
20	1	1	0.5239E+02	0.1339E+03	-0.465689E+04	-0.152874E-03
20	1	2	0.5460E+02	0.1324E+03	-0.444168E+04	-0.145810E-03
21	1	1	0.5800E+02	0.1351E+03	-0.417046E+04	-0.141741E-03
21	1	2	0.5983E+02	0.1345E+03	-0.405347E+04	-0.137765E-03
22	1	1	0.5589E+02	0.1312E+03	-0.412576E+04	-0.140222E-03
22	1	2	0.5737E+02	0.1299E+03	-0.391802E+04	-0.133162E-03
23	1	1	0.6231E+02	0.1352E+03	-0.398505E+04	-0.135440E-03
23	1	2	0.6232E+02	0.1315E+03	-0.368813E+04	-0.125348E-03
23	3	1	0.6247E+02	0.1345E+03	-0.391349E+04	-0.133008E-03
23	3	2	0.6103E+02	0.1348E+03	-0.401562E+04	-0.136478E-03
24	1	1	0.6232E+02	0.1291E+03	-0.355175E+04	-0.120713E-03
24	1	2	0.6231E+02	0.1262E+03	-0.325641E+04	-0.110675E-03
25	1	1	0.5798E+02	0.1282E+03	-0.372103E+04	-0.126466E-03
25	1	2	0.5866E+02	0.1253E+03	-0.331643E+04	-0.112715E-03
26	2	1	0.6650E+02	0.1346E+03	-0.366362E+04	-0.124515E-03
26	2	2	0.6651E+02	0.1294E+03	-0.337506E+04	-0.114708E-03
26	3	1	0.6695E+02	0.1346E+03	-0.363266E+04	-0.123463E-03
26	3	2	0.6406E+02	0.1350E+03	-0.385808E+04	-0.131124E-03
27	2	1	0.6651E+02	0.1267E+03	-0.320595E+04	-0.108960E-03
27	2	2	0.6650E+02	0.1245E+03	-0.283381E+04	-0.963123E-04
28	2	1	0.6650E+02	0.1229E+03	-0.256098E+04	-0.870398E-04
28	2	2	0.6650E+02	0.1208E+03	-0.220656E+04	-0.749941E-04
28	3	1	0.6694E+02	0.1207E+03	-0.218117E+04	-0.741313E-04
28	3	2	0.6406E+02	0.1209E+03	-0.233945E+04	-0.795107E-04
29	1	1	0.6231E+02	0.1240E+03	-0.292475E+04	-0.994034E-04
29	1	2	0.6231E+02	0.1211E+03	-0.244654E+04	-0.831505E-04
30	1	1	0.5869E+02	0.1232E+03	-0.298472E+04	-0.101441E-03
30	1	2	0.5869E+02	0.1209E+03	-0.256007E+04	-0.870090E-04
31	1	1	0.5869E+02	0.1194E+03	-0.227109E+04	-0.771874E-04
31	1	2	0.5869E+02	0.1176E+03	-0.192896E+04	-0.655594E-04
32	1	1	0.6231E+02	0.1194E+03	-0.214353E+04	-0.728520E-04
32	1	2	0.6231E+02	0.1176E+03	-0.182586E+04	-0.620552E-04
33	1	1	0.5869E+02	0.1164E+03	-0.167933E+04	-0.570752E-04
33	1	2	0.5869E+02	0.1146E+03	-0.134917E+04	-0.458542E-04
34	1	1	0.6231E+02	0.1164E+03	-0.159202E+04	-0.541080E-04
34	1	2	0.6231E+02	0.1146E+03	-0.128466E+04	-0.436617E-04
35	1	1	0.5869E+02	0.1127E+03	-0.100691E+04	-0.342216E-04
35	1	2	0.5869E+02	0.1093E+03	-0.462350E+03	-0.157138E-04
36	1	1	0.6231E+02	0.1127E+03	-0.967293E+03	-0.328753E-04
36	1	2	0.6231E+02	0.1093E+03	-0.460622E+03	-0.156551E-04

37	1	1	0.5869E+02	0.1055E+03	0.561916E+01	0.190978E-06
37	1	2	0.5869E+02	0.9854E+02	0.551888E+03	0.187570E-04
38	1	1	0.6231E+02	0.1055E+03	-0.251923E+02	-0.856210E-06
38	1	2	0.6231E+02	0.9854E+02	0.482995E+03	0.164155E-04
39	1	1	0.5869E+02	0.9346E+02	0.728297E+03	0.247526E-04
39	1	2	0.5869E+02	0.8654E+02	0.822057E+03	0.279392E-04
40	1	1	0.6231E+02	0.9346E+02	0.646821E+03	0.219835E-04
40	1	2	0.6231E+02	0.8654E+02	0.734369E+03	0.249590E-04
41	1	1	0.5869E+02	0.8146E+02	0.814950E+03	0.276976E-04
41	1	2	0.5869E+02	0.7454E+02	0.780402E+03	0.265235E-04
42	1	1	0.6231E+02	0.8146E+02	0.726988E+03	0.247081E-04
42	1	2	0.6231E+02	0.7454E+02	0.695919E+03	0.236522E-04
43	1	1	0.5869E+02	0.6946E+02	0.742844E+03	0.252470E-04
43	1	2	0.5869E+02	0.6254E+02	0.687212E+03	0.233562E-04
44	1	1	0.6231E+02	0.6946E+02	0.659134E+03	0.224019E-04
44	1	2	0.6231E+02	0.6254E+02	0.609772E+03	0.207243E-04
45	1	1	0.5869E+02	0.5746E+02	0.644656E+03	0.219099E-04
45	1	2	0.5869E+02	0.5054E+02	0.620226E+03	0.210796E-04
46	1	1	0.6231E+02	0.5746E+02	0.580381E+03	0.197254E-04
46	1	2	0.6231E+02	0.5054E+02	0.559178E+03	0.190048E-04
47	1	1	0.5869E+02	0.4546E+02	0.622786E+03	0.211666E-04
47	1	2	0.5869E+02	0.3854E+02	0.633696E+03	0.215374E-04
48	1	1	0.6231E+02	0.4546E+02	0.560274E+03	0.190420E-04
48	1	2	0.6231E+02	0.3854E+02	0.571206E+03	0.194135E-04
49	1	1	0.5869E+02	0.3346E+02	0.642137E+03	0.218243E-04
49	1	2	0.5869E+02	0.2654E+02	0.617347E+03	0.209817E-04
50	1	1	0.6231E+02	0.3346E+02	0.578484E+03	0.196609E-04
50	1	2	0.6231E+02	0.2654E+02	0.555822E+03	0.188907E-04
51	1	1	0.5869E+02	0.2146E+02	0.562536E+03	0.191189E-04
51	1	2	0.5869E+02	0.1454E+02	0.415574E+03	0.141241E-04
52	1	1	0.6231E+02	0.2146E+02	0.504882E+03	0.171594E-04
52	1	2	0.6231E+02	0.1454E+02	0.367764E+03	0.124992E-04
53	1	1	0.5869E+02	0.9464E+01	0.248217E+03	0.843614E-05
53	1	2	0.5869E+02	0.2536E+01	0.629227E+02	0.213855E-05
54	1	1	0.6231E+02	0.9464E+01	0.215153E+03	0.731239E-05
54	1	2	0.6231E+02	0.2536E+01	0.431548E+02	0.146670E-05

STRESSES AT THE GAUSS POINTS FOR LONG. PRESTRESSING ELEMENTS

ME	NL	JG	XG	YG	SIGT	EPST
1	1	1	0.1306E+01	0.1480E+03	0.116450E+06	0.388815E-02
1	1	2	0.4871E+01	0.1479E+03	0.116274E+06	0.388227E-02
3	1	1	0.7479E+01	0.1478E+03	0.116206E+06	0.387998E-02
3	1	2	0.1103E+02	0.1475E+03	0.116079E+06	0.387575E-02
5	1	1	0.1363E+02	0.1472E+03	0.115981E+06	0.387247E-02
5	1	2	0.1717E+02	0.1467E+03	0.115837E+06	0.386767E-02
7	1	1	0.1975E+02	0.1463E+03	0.115687E+06	0.386267E-02
7	1	2	0.2325E+02	0.1457E+03	0.115563E+06	0.385853E-02
9	1	1	0.2581E+02	0.1451E+03	0.115510E+06	0.385675E-02
9	1	2	0.2928E+02	0.1443E+03	0.115394E+06	0.385287E-02
11	1	1	0.3180E+02	0.1436E+03	0.115286E+06	0.384927E-02
11	1	2	0.3522E+02	0.1426E+03	0.115134E+06	0.384419E-02
13	1	1	0.3770E+02	0.1418E+03	0.114994E+06	0.383953E-02
13	1	2	0.4107E+02	0.1406E+03	0.114783E+06	0.383247E-02
15	1	1	0.4350E+02	0.1397E+03	0.114680E+06	0.382904E-02
15	1	2	0.4680E+02	0.1383E+03	0.114263E+06	0.381513E-02
17	1	1	0.4890E+02	0.1374E+03	0.113970E+06	0.380532E-02
17	1	2	0.5136E+02	0.1362E+03	0.113531E+06	0.379066E-02
19	1	1	0.5314E+02	0.1354E+03	0.113125E+06	0.377712E-02
19	1	2	0.5554E+02	0.1341E+03	0.112788E+06	0.376587E-02
21	1	1	0.5729E+02	0.1332E+03	0.112713E+06	0.376335E-02
21	1	2	0.5965E+02	0.1318E+03	0.112540E+06	0.375760E-02
23	1	1	0.6050E+02	0.1354E+03	0.903320E+05	0.298096E-02
23	1	2	0.6050E+02	0.1324E+03	0.900426E+05	0.297141E-02
24	3	1	0.6247E+02	0.1301E+03	0.111785E+06	0.373238E-02
24	3	2	0.6103E+02	0.1310E+03	0.112078E+06	0.374215E-02
25	1	1	0.6050E+02	0.1301E+03	0.903663E+05	0.298209E-02
25	1	2	0.6050E+02	0.1269E+03	0.912525E+05	0.301133E-02
26	3	1	0.6696E+02	0.1272E+03	0.111725E+06	0.373037E-02
26	3	2	0.6407E+02	0.1291E+03	0.111938E+06	0.373747E-02
30	1	1	0.6050E+02	0.1245E+03	0.916221E+05	0.302353E-02
30	1	2	0.6050E+02	0.1212E+03	0.919578E+05	0.303461E-02
31	1	1	0.6050E+02	0.1194E+03	0.931852E+05	0.307511E-02
31	1	2	0.6050E+02	0.1176E+03	0.926024E+05	0.305588E-02
33	1	1	0.6050E+02	0.1164E+03	0.927411E+05	0.306046E-02
33	1	2	0.6050E+02	0.1146E+03	0.925448E+05	0.305398E-02

35	1	1	0.6050E+02	0.1127E+03	0.925581E+05	0.305442E-02
35	1	2	0.6050E+02	0.1093E+03	0.923210E+05	0.304659E-02
37	1	1	0.6050E+02	0.1055E+03	0.921852E+05	0.304211E-02
37	1	2	0.6050E+02	0.9854E+02	0.919824E+05	0.303542E-02
39	1	1	0.6050E+02	0.9346E+02	0.919264E+05	0.303357E-02
39	1	2	0.6050E+02	0.8654E+02	0.918719E+05	0.303177E-02
41	1	1	0.6050E+02	0.8146E+02	0.919039E+05	0.303283E-02
41	1	2	0.6050E+02	0.7454E+02	0.919204E+05	0.303337E-02
43	1	1	0.6050E+02	0.6946E+02	0.919853E+05	0.303551E-02
43	1	2	0.6050E+02	0.6254E+02	0.921021E+05	0.303937E-02
45	1	1	0.6050E+02	0.5746E+02	0.909350E+05	0.300086E-02
45	1	2	0.6050E+02	0.5054E+02	0.910425E+05	0.300440E-02
47	1	1	0.6050E+02	0.4546E+02	0.910614E+05	0.300503E-02
47	1	2	0.6050E+02	0.3854E+02	0.910733E+05	0.300542E-02
49	1	1	0.6050E+02	0.3346E+02	0.910888E+05	0.300593E-02
49	1	2	0.6050E+02	0.2654E+02	0.911439E+05	0.300775E-02
51	1	1	0.6050E+02	0.2146E+02	0.910811E+05	0.300568E-02
51	1	2	0.6050E+02	0.1454E+02	0.913364E+05	0.301410E-02
53	1	1	0.6050E+02	0.9464E+01	0.912881E+05	0.301251E-02
53	1	2	0.6050E+02	0.2536E+01	0.914566E+05	0.301807E-02
55	1	1	0.6050E+02	-0.1585E+00	0.911761E+05	0.300881E-02
55	1	2	0.6050E+02	-0.5915E+00	0.911130E+05	0.300673E-02

STRESSES AT THE GAUSS POINTS FOR HOOP PRESTRESSING ELEMENTS
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ME	NL	JG	XG	YG	SIGT	EPST
2	1	1	0.1306E+01	0.1480E+03	0.116492E+06	0.388955E-02
2	1	2	0.4871E+01	0.1479E+03	0.116359E+06	0.388509E-02
4	1	1	0.7479E+01	0.1478E+03	0.116264E+06	0.388193E-02
4	1	2	0.1103E+02	0.1475E+03	0.116099E+06	0.387641E-02
6	1	1	0.1363E+02	0.1472E+03	0.115956E+06	0.387163E-02
6	1	2	0.1717E+02	0.1467E+03	0.115703E+06	0.386321E-02
8	1	1	0.1975E+02	0.1463E+03	0.115483E+06	0.385586E-02
8	1	2	0.2325E+02	0.1457E+03	0.115121E+06	0.384376E-02
10	1	1	0.2581E+02	0.1451E+03	0.114823E+06	0.383382E-02
10	1	2	0.2928E+02	0.1443E+03	0.114360E+06	0.381836E-02
12	1	1	0.3180E+02	0.1436E+03	0.113984E+06	0.380580E-02
12	1	2	0.3522E+02	0.1426E+03	0.113428E+06	0.378723E-02
14	1	1	0.3770E+02	0.1418E+03	0.112997E+06	0.377285E-02
14	1	2	0.4107E+02	0.1406E+03	0.112417E+06	0.375348E-02
16	1	1	0.4350E+02	0.1397E+03	0.112010E+06	0.373989E-02
16	1	2	0.4680E+02	0.1383E+03	0.111558E+06	0.372481E-02
18	1	1	0.4890E+02	0.1374E+03	0.111344E+06	0.371764E-02
18	1	2	0.5136E+02	0.1362E+03	0.111197E+06	0.371274E-02
20	1	1	0.5314E+02	0.1354E+03	0.111145E+06	0.371099E-02
20	1	2	0.5554E+02	0.1341E+03	0.111133E+06	0.371062E-02
22	1	1	0.5729E+02	0.1332E+03	0.111169E+06	0.371180E-02
22	1	2	0.5965E+02	0.1318E+03	0.111259E+06	0.371481E-02
23	1	1	0.6300E+02	0.1351E+03	0.136986E+06	0.452053E-02
23	1	2	0.6300E+02	0.1312E+03	0.137182E+06	0.452700E-02
24	3	1	0.6247E+02	0.1301E+03	0.111395E+06	0.371935E-02
24	3	2	0.6103E+02	0.1310E+03	0.111327E+06	0.371708E-02
26	3	1	0.6696E+02	0.1272E+03	0.111644E+06	0.372766E-02
26	3	2	0.6407E+02	0.1291E+03	0.111478E+06	0.372212E-02
27	1	1	0.6300E+02	0.1287E+03	0.137314E+06	0.453137E-02
27	1	2	0.6300E+02	0.1259E+03	0.137542E+06	0.453889E-02
29	1	1	0.6300E+02	0.1239E+03	0.137759E+06	0.454604E-02
29	1	2	0.6300E+02	0.1210E+03	0.138110E+06	0.455762E-02
32	1	1	0.6050E+02	0.1194E+03	0.138478E+06	0.456978E-02
32	1	2	0.6050E+02	0.1176E+03	0.138904E+06	0.458383E-02
34	1	1	0.6050E+02	0.1164E+03	0.139257E+06	0.459548E-02
34	1	2	0.6050E+02	0.1146E+03	0.139744E+06	0.461156E-02

36	1	1	0.6050E+02	0.1127E+03	0.140287E+06	0.462947E-02
36	1	2	0.6050E+02	0.1093E+03	0.141207E+06	0.465982E-02
38	1	1	0.6050E+02	0.1055E+03	0.142074E+06	0.468845E-02
38	1	2	0.6050E+02	0.9854E+02	0.143172E+06	0.472468E-02
40	1	1	0.6050E+02	0.9346E+02	0.143597E+06	0.473872E-02
40	1	2	0.6050E+02	0.8654E+02	0.143835E+06	0.474656E-02
42	1	1	0.6050E+02	0.8146E+02	0.143806E+06	0.474560E-02
42	1	2	0.6050E+02	0.7454E+02	0.143589E+06	0.473844E-02
44	1	1	0.6050E+02	0.6946E+02	0.143296E+06	0.472875E-02
44	1	2	0.6050E+02	0.6254E+02	0.142778E+06	0.471168E-02
46	1	1	0.6050E+02	0.5746E+02	0.142374E+06	0.469835E-02
46	1	2	0.6050E+02	0.5054E+02	0.141989E+06	0.468565E-02
48	1	1	0.6050E+02	0.4546E+02	0.141841E+06	0.468075E-02
48	1	2	0.6050E+02	0.3854E+02	0.141721E+06	0.467678E-02
50	1	1	0.6050E+02	0.3346E+02	0.141651E+06	0.467447E-02
50	1	2	0.6050E+02	0.2654E+02	0.141361E+06	0.466492E-02
52	1	1	0.6050E+02	0.2146E+02	0.140952E+06	0.465141E-02
52	1	2	0.6050E+02	0.1454E+02	0.140010E+06	0.462034E-02
54	1	1	0.6050E+02	0.9464E+01	0.139035E+06	0.458817E-02
54	1	2	0.6050E+02	0.2536E+01	0.137971E+06	0.455303E-02

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