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USER DOCUMENT FOR COMPUTER PROGRAMS FOR RING-STIFFENED SHELLS OF REVOLUTION

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16. Abstract

This report presents a user manual and related program documentation for six compatible computer programs for structural analysis of axisymmetric shell structures. The theory and method upon which these programs are based are presented in a separate companion report. The programs are designated simply as the SRA programs. They apply to a common structural model but analyze different modes of structural response. They may be classified according to their function into three groups, designated here as the 100, 200, and 300-series. In particular, they are

SRA 100 - Linear static response under asymmetric loads
SRA 101 - Buckling of linear states under asymmetric loads
SRA 200 - Nonlinear static response under axisymmetric loads
SRA 201 - Buckling of nonlinear states under axisymmetric loads
SRA 202 - Imperfection sensitivity of buckling modes under axisymmetric loads
SRA 300 - Vibrations about nonlinear states under axisymmetric loads

These programs treat branched shells of revolution with an arbitrary arrangement of a large number of open branches but with at most one closed branch.

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USER DOCUMENT FOR COMPUTER PROGRAMS

FOR RING-STIFFENED SHELLS OF REVOLUTION

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SUMMARY

This report presents user manuals and related program documentation for six compatible computer programs for structural analysis of axisymmetric shell structures. The theory and method upon which these programs are based are presented in a separate companion report. The programs are designated simply as the SRA programs. They apply to a common structural model but analyze different modes of structural response. They may be classified according to their function into three groups, designated here as the 100, 200, and 300-series. In particular, they are

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These programs treat branched shells of revolution with an arbitrary arrangement of a large number of open branches but with at most one closed branch. Current dimensioning allows for seven branch points, each of which may have as many as five branches emanating from it. Branches which close at the axis of revolution, i.e. dome closures, are not considered to be closed branches. A maximum of 23 dome closures or other shell edges is allowed. At each meridional station the shell wall may consist of as many as five orthotropic layers, in each of which elastic properties may vary only in the meridional direction. At each material point the shell is assumed to possess orthotropic principal axes in meridional and circumferential directions. All geometric and mechanical properties of the structure are assumed to be axisymmetric, but may have arbitrary meridional variation. A continuous reference surface, arbitrarily located within or near the shell wall is treated. The shell may be stiffened by:

(1) up to 34 discrete isotropic rings

(2) stringers, whose stiffness is circumferentially distributed, and
(3) an elastic foundation attached to the shell wall.

The effects of thermal loads and live pressure fields are included.

The programs have been written in CDC FORTRAN 2.0 language to run on CDC 6000 series computers under the SCOPE 3.0 operating system. Two of the programs, SRA 101 and SRA 202, utilize the OVERLAY capability of the SCOPE 3.0 loader. Approximate core field length (octal) requirements are given in the table below.

Program	Load	Execute
SRA 100	75 000	75 000
SRA 101	113 000	103 000
SRA 200	67 000	67 000
SRA 201	101 000	101 000
SRA 202	75 000	62 000
SRA 300	101 000	101 000

INTRODUCTION

There are at least four major commonly available systems of computer programs for the analysis of shells of revolution (ref. 1). In addition to the SRA programs presented here, these include two finite-difference programs - BOSOR (developed by Bushnell at Lockheed) and SALORS (developed at the NASA Langley Research Center) - and Kalnins' programs (developed for the Air Force Flight Dynamics Laboratory). As are Kalnins' programs, the SRA programs are based on the technique of forward integration; however, the present system employs the Zarghamee method, which for open branch problems reduces the number of complementary solutions required by a factor of 2 (ref. 2). All of these systems treat the standard problems of stress, buckling, and vibrations under axisymmetric loading. The main features of the SRA system which have not been generally available in the other systems are:

(1) buckling analysis under general asymmetric loads
(2) imperfection sensitivity analysis
(3) branched shell capability (fig. 1)

The main body of this report consists of user manuals for each of the six SRA programs. The basic program SRA 100, giving the linear static response to asymmetric loads, is described first and in complete detail. Only those operational aspects of the remaining programs which change from that given for SRA 100 are presented. Additional program information, consisting of overall logical flow charts, subroutine descriptions, definition of major FORTRAN variables, and description of nonstandard files, is presented in Appendix A.

The assistance of Raphael T. Haftka, who organized and did most of the programming for SRA 101, is gratefully acknowledged.

SYMBOLS

A	ring or stringer cross-sectional area
a	ring centroidal radius
b	second postbuckling coefficient
E	ring or stringer elastic modulus
E_1, E_2, E_{12}	orthotropic elastic moduli
e_x, e_y	axial and radial eccentricities of ring centroid relative to corresponding point of subdivision on shell reference surface
e_1, e_2	shell linearized strains
F_x, F_y, F_ϕ	externally applied ring forces
F_1, F_2, F_3, F_4	equivalent shell forces
FD_1, FD_{30}	equivalent dome forces (first and third component of {L} for n = 0)
FD_{31}, FD_4	equivalent dome forces (third and fourth component of {L} for n = 1)
FL_1, FL_2, FL_3, FL_4	components of {L}
G	ring or stringer shear modulus
h	wall layer half-thickness
I	stringer section moment of inertia about circumferential centroidal axis
I_x, I_y, I_{xy}	ring section moments of inertia about centroidal axes

J	torsion constant of ring or stringer section
K	structural stiffness
K^*	initial postbuckling stiffness
k_1, k_2, k_3	foundation moduli
L_1, L_2	surface moments
M_1, M_2	meridional and circumferential stress couples
M_y	ring out-of-plane bending moment
N	number of stringers; also convergence index
N_x, N_y, N_ϕ	externally applied ring moments
n	circumferential harmonic number
P, Q, S	effective shell forces per unit circumferential length in axial, radial, and circumferential directions, respectively
R_2	circumferential radius of curvature
r	small circle radius
s, ϕ, z	meridional, circumferential, and normal coordinates of shell reference surface
$\bar{s}$	meridional eccentricity of ring centroid from corresponding subdivision point
T_1, T_2, T_{12}	shell stress resultants
T_ϕ	ring hoop force
u, v, w	meridional, circumferential, and normal shell displacements
u_x, u_y, u_ϕ	ring displacements
w_x, w_y	ring rotations
X_1, X_2, X_3	surface loads
X_{3_x}, X_{3_y}	axial and radial derivatives of the unit load pressure field ($\partial X_3/\partial x$ and $\partial X_3/\partial y$)

x, y	axial and radial coordinates, respectively
$\bar{z}$	ring or stringer normal centroidal eccentricity from shell inner surface
$\hat{z}$	normal distance of reference surface from shell inner surface
α, β	first and second imperfection functionals
$\Delta\theta_1, \Delta\theta_2$	differences through wall layer of orthotropic free thermal strain amplitudes
$\varepsilon_1, \varepsilon_2$	shell stretching strains
ε_ϕ	ring hoop strain
θ_1, θ_2	orthotropic wall layer mean free thermal strain amplitudes
θ_r	ring free thermal strain
θ_{st}	stringer free thermal strain amplitude
κ	scaling factor for axisymmetric bending prebuckling component (SRA 101)
κ_1, κ_2	shell bending strains
κ_y	ring out-of-plane bending strain
λ	load factor
λ_0	load factor for nonlinear prebuckling state
λ_1	eigenvalue obtained by SRA 101; also critical load estimate ($\lambda_0 + \mu_s + \mu_1$) obtained by SRA 201
λ_c	critical load
λ_s	eigenvalue shift for SRA 101; also buckling load of imperfect structure
μ_1	eigenvalue obtained by SRA 201 or SRA 300
μ_2	eigenvalue which controls convergence to μ_1 by SRA 201 or SRA 300

$\mu^{(k)}$	sequence of eigenvalue estimates obtained by SRA 201 or SRA 300
μ_s	eigenvalue shift for SRA 201 or SRA 300
ν_1, ν_2	Poisson contraction ratios with meridional or circumferential stress acting, respectively
ξ, η, v	shell displacements in axial, radial, and circumferential directions, respectively
$\bar{\xi}$	root-mean-square angular imperfection amplitude
ρ	ring mass density
ρ_i	mass densities of wall layers (subscript indicates layer number, $1 \leq i \leq 5$)
$\sigma_s, \sigma_\phi, \sigma_{s\phi}$	shell in-surface stresses
$\sigma_{sz}, \sigma_{\phi z}$	shell transverse shear stresses
σ_{st}	stringer centroidal stress
χ, ψ, θ	shell rotations about circumferential, meridional, and normal directions, respectively
ω	vibration frequency

Matrices:

[B],[D]	4x4 boundary condition matrices
{c},{d}	4x1 matrices of superposition constants
{G},{J}	4x1 submatrices of particular solution vector $\begin{Bmatrix} G \\ J \end{Bmatrix}$
{L}	4x1 boundary force matrix
[p],[$\hat{p}$],{q}	matrices relating {c} and {d} of last subinterval on a closed branch to that of the first subinterval; [p] and [$\hat{p}$] are 4x4 matrices, and {q} is a 4x1 matrix
[U],[W]	4x4 submatrices of complementary solution vectors $\begin{bmatrix} U \\ W \end{bmatrix}$
[V],[Z]	4x4 submatrices of additional complementary solution vectors $\begin{bmatrix} V \\ Z \end{bmatrix}$, used only on a closed branch

$\{y\}$	4x1 shell force matrix $\{P,Q,S,M_1\}$
$\{z\}$	4x1 shell displacement matrix $\{\xi,\eta,v,\chi\}$

Generalized field variables:

ε	strain
σ	stress

Subscripts:

0	prebuckling state variable (at the load level λ_0, unless otherwise specified)
1,2,3	meridional, circumferential, and normal components, respectively (same as s,ϕ,z)
$_0(\ )$	variable of the axisymmetric component of second-order postbuckling state
$_1(\ )$	buckling mode variable
$_2(\ )$	variable of the nonsymmetric component of second-order postbuckling state

Superscripts:

$(\ )'$	$\partial(\ )/\partial s$
$(\ )^{\cdot}$	$\partial(\ )/\partial\phi$
$(\ )^{(k)}$	$\partial^k(\ )/\partial\lambda^k$

Matrix superscripts:

T	transpose

Generalized field variable subscripts:

0	prebuckling state variable (evaluated at λ_0 if not otherwise indicated)
1	buckling mode variable
2	second-order postbuckling state variable

Generalized field variable superscripts:

( )* evaluated at the critical load λ_c

SRA 100

SRA 100 computes the linear stress and displacement response under asymmetric loads. Mechanical loads and free thermal strains (thermal loads) are assumed to have harmonic circumferential variation so that only their amplitudes are input. This is sufficient to treat general asymmetric loads, which may be written as a Fourier series in the circumferential coordinate. Each of the two components (symmetric and antisymmetric) of load harmonics of any order* are treated individually by SRA 100. Since the circumferential variation of the response is also harmonic, only the amplitudes of the response variables are output.

Input Data

The input data consists essentially of: (1) a case title card and a case option card, (2) input tables giving basic structural data as a fuction of meridional distance, (3) discrete ring data, and (4) general boundary condition matrices. Each of these types of input are described further below.

Case title and option cards.- The first card of each case is a title card, on which any short description of the problems may be punched in standard alphanumeric symbols in the first 72 columns. The second card of each case is a case option card (fig. 2). The purpose of this card is to convey to the computer program the following information:

(1) if shell contains a closed branch,
(2) which tables of data are to be input for the present case, and which, in a sequence of problems, are to be taken from the preceding case,
(3) if all boundary data is to be taken from preceding case
(4) harmonic number
(5) the existence of rigid body degrees of freedom,
(6) surface on which the externally applied tangential surface loads act,

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*Current format of the case option card limits symmetric components to harmonics $n < 999$, and antisymmetric components to harmonics $n < 99$.

B

(7) relative error tolerance for forward integration routine,
(8) if punched card output is desired, and
(9) whether or not to abort run if programmed subinterval length criterion is exceeded.

The format for the case option card is as follows:

Column 4	blank:	open branched shell
	1 :	closed branched shell
Column 6	blank:	geometry (table 1) taken from preceding case
	1 :	new geometry to be input
Column 8	blank:	wall properties (table 2) taken from preceding case
	1 :	new wall properties to be input
Column 10	blank:	foundation moduli (table 3) taken from preceding case
	1 :	new foundation moduli to be input
Column 12	blank:	stringer properties (table 4) taken from preceding case
	1 :	new stringer properties to be input
Column 14	blank:	mass densities (table 5) taken from preceding case
	1 :	new mass densities to be input
Column 16	blank:	mechanical loads (table 6) taken from preceding case
	1 :	new mechanical loads to be input
Column 18	blank:	thermal loads (table 7) taken from preceding case
	1 :	new thermal loads to be input
Column 20	blank:	all boundary data taken from preceding case (col. 5 of table 1 does not apply)
	1 :	col. 5 of table 1 controls input or generation of boundary conditions
	2 :	same as 1, except that only load vectors change from previous case
Columns 21-23	harmonic number, right adjusted integer	

Column 30	This column and table 5 are used only when $n = 0$ or 1.	
	blank:	no rigid body degrees of freedom
	1 :	translational rigid body degree of freedom exists (axial translation for $n = 0$, and lateral translation for $n = 1$)
	2 :	rotational rigid body degree of freedom exists (rolling rotation for $n = 0$, and pitching rotation for $n = 1$)
	3 :	translational and rotational rigid body degrees of freedom exist
Column 34	blank:	tangential surface loads X_1 and X_2 (table 6) act at reference surface
	1 :	X_1 and X_2 act at outer surface*
Columns 48-59	relative error tolerance (E12.4) for variable step Runge-Kutta forward integration subroutine	
Column 73	blank:	no effect
	1 :	prebuckling data ($T_\phi, T_1, T_2, T_{12}, X_3$) put on punch file
Column 74	blank:	no effect
	1 :	stresses (σ_s, σ_ϕ, $\sigma_{s\phi}$) put on punch file
Column 78	blank:	abort run if subinterval length criterion is exceeded
	1 :	print diagnostic but continue execution if subinterval length criterion is exceeded

Columns 6 through 20: If one (or more) of the tables 3 through 7 does not apply in a particular case, the indicator 1 is used for that table and no data for that table is included in the corresponding case data deck. Data for that table will then automatically be set to zero. Tables 1 and 2 are always input for a single case or for the first case of a sequence of problems. A 2 in column 20 indicates that although the boundary loads may change from the preceding case, the attached structure (e.g., a ring) is unchanged. It is thus analogous to blanks in columns 6, 8, 10, and 12, which indicate that the other components of the structure are unchanged. If the total structure and the harmonic number are unchanged from the preceding case, i.e., only the loading changed, the program will use the complementary solutions from the preceding case, thereby reducing execution time. A means for taking individual boundary conditions from the previous case is provided by column 5 of the geometry table cards (see p. 19).

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*The shell outer surface is defined as the shell face at which the positive z-direction points out of the shell wall (see discussion of geometry, page 12).

Columns 21-23: Each harmonic loading and response contains a symmetric and antisymmetric component with respect to a reference axial plane, say $\phi = 0$. Here, a response (or loading) is defined as being "symmetric" or "antisymmetric" according to whether the associated normal deflection (or pressure) is an even or odd function of ϕ (table I).* Usually the loading and response are assumed to be symmetric with respect to the reference plane $\phi = 0$. However, if the harmonic number is input as a negative integer, instead of a positive one, the load components will be taken to be antisymmetric, and consequently the antisymmetric response will be output. For the case $n = 0$, the symmetric (bending) and antisymmetric (torsion) components are uncoupled and are obtained simultaneously.

Columns 48-59: A relative error tolerance of 0.01 is usually adequate (and in some cases 0.1 is adequate), although if columns 48-59 are left blank, the value 0.001 will be used. It is, of course, wasteful to use an error tolerance smaller than necessary since computer execution time will be increased with no important gain in accuracy.

Input tables.- Seven different tables may be input. These tables are listed below with the input parameters in parenthesis. Each of these variables is input in E12.4 format (fig. 3). Each card of each of these tables prescribes data at one point of the shell meridian.

TABLE	
1	Geometry (s, r, r', r/R_2, $\hat{z}$)
2	Wall Properties (E_1, E_2, E_{12}, ν_1, h)
3	Foundation Moduli (k_1, k_2, k_3)
4	Stringer Properties (E, NEA, NEI, NGJ, $\bar{z}$)
5	Mass Densities (ρ_1, ρ_2, ρ_3, ρ_4, ρ_5)
6	Mechanical Loads (X_1, X_2, X_3)
7	Thermal Loads (θ_1, θ_2, $\Delta\theta_1$, $\Delta\theta_2$, θ_{st})

Tables 1 and 2 are required (i.e., input or taken from the preceding case) for each problem. Table 5 is required for structures having rigid body degrees of freedom. Tables 3, 4, 6, and 7 are input only if applicable.

Immediately following the input tables, which are discussed more below, there should be a card with a 9 punched in column 1 but otherwise blank. This "nine" card separates the input tables from the boundary

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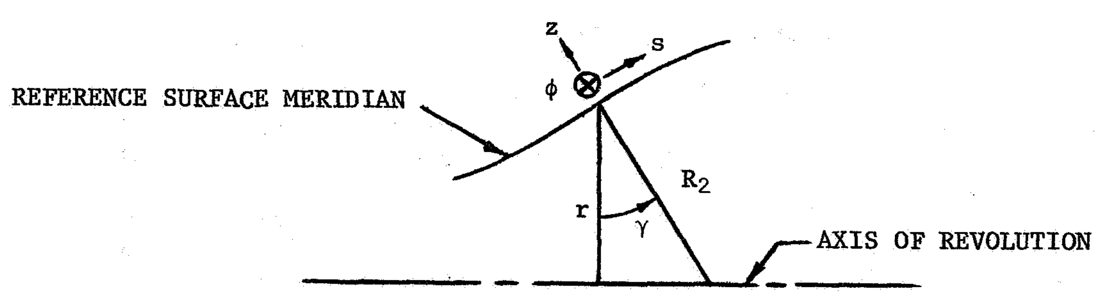
*This symmetry with respect to an axial plane (i.e., one containing the axis of revolution) should not be confused with symmetry with respect to the axis of revolution itself, or with respect to a plane normal to the axis.

data, which immediately follow the "nine" card. It is required for each case even though in a sequence of cases there may be no tables or boundary data input.

Geometry: In order to describe the shell geometry, a continuous reference surface is used. Ordinarily, the reference surface is taken as the shell wall middle surface. However, in some cases this may be inconvenient or impossible. For example, if the shell wall has a thickness discontinuity, the middle surface may not be continuous. In general, the reference surface may be any convenient surface within or near the physical shell wall (fig. 1, also see further discussion below).

In order to define the geometry of the reference surface, a coordinate system must be established. A right-handed (s, ϕ, z) coordinate system is used, where s measures meridional arc distance from an arbitrary reference point (e.g., a shell edge), ϕ measures circumferential angle from an arbitrary reference meridian, and z measures normal distance from the reference surface. The sense of coordinate directions is immaterial as long as they form a right-handed triad. In the following discussion the shell inner surface will mean the shell surface where the positive z-direction points into the interior of the shell wall.

Each card of this table gives the values of s (columns 13-24), r (columns 25-36), r' (columns 37-48), r/R_2 (columns 49-60), and $\hat{z}$ (columns 61-72) at one point of the reference surface meridian. As shown in the diagram, r is the (minimum) distance to the axis of revolution, and R_2 is numerically equal to the distance along a surface normal measured to the axis of revolution; furthermore, $r' = \sin \gamma$ and $r/R_2 = \cos \gamma$. By convention, r is always positive, but R_2 is positive only if the positive z-direction points away from the axis of revolution. In addition, $\hat{z}$ is the



normal distance of the reference surface measure from the shell inner surface. It is positive if the reference surface is displaced from the shell wall inner surface in the positive z-direction. If, for example, columns 61-72 of table 1 are left blank, the inner surface will be used as the reference surface. For axisymmetric loading of cylinders and cones it can be shown that changing the postion of the reference surface by a uniform amount without changing its other geometrical data will have no effect on the numerical values of stress and rotation. The displacements of, and the bending moment about, the reference surface change however, and it is necessary to account for this when setting up boundary conditions. For more general shells, harmonic loading, or nonuniform reference surface translation, changing the reference surface will produce small changes of the order $\Delta\hat{z}/R$ in the solution, where $\Delta\hat{z}$ is the reference surface shift and R is a radius of curvature. As long as $\Delta\hat{z}$ is of the order of the shell thickness or less, this change in the solution is like the error in thin shell theory itself, and therefore insignificant. The essential point to remember in setting up the reference surface is that it should be a continuous surface within or near the shell wall.

Two consecutive cards in table 1 with the same value of s define a point of subdivision of the shell meridian. The first card prescribes data immediately before the subdivision point and the second card prescribes data immediately after the subdivision point. Thirty-two such points are allowed. A subdivision point is required at the location of:

(1) a branch point,
(2) an interior ring or other elastic attachment,
(3) a circumferential line load,
(4) a meridional discontinuity in input data (e.g., the juncture of a cone and a cylinder or a change in the number of wall layers), and
(5) a fictitious boundary inserted to limit subinterval length.

Fictitious boundaries should be inserted according to the rule-of-thumb

$$\Delta\ell < 3(\bar{r}\bar{t})^{1/2}$$

where $\Delta\ell$ is the axial subinterval length, and $\bar{r}$ and $\bar{t}$ are average values of the radius and thickness over the subinterval considered.* This requirement is necessary to control numerical round-off error. If a subinterval is too long, the problem will be aborted (if col. 78 of the case option card is blank) and an appropriate diagnostic printed.

In addition to the basic geometrical data, supplemental data is input on the geometry cards in columns 1, 3, 5, 6, and 10-12. Columns 1 and 10-12 have a similar function for each of the tables. Column 1 is

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*It is often easier to use the alternate criterion $\Delta s < 3(\bar{R}_2\bar{t})^{1/2}$. For orthotropic layered shells these criteria may be applied with t replaced by $(12D_s/C_\phi)^{1/2}$, where D_s is the meridional bending stiffness and C_ϕ is the hoop stretching stiffness.

is used primarily for table identification. The first card of each table should have the table number in column 1. Thus, the first card of the geometry table should have a 1 in column 1. Each card of table 1 (and of the other tables) must have an entry number ($\leq$100) right adjusted in columns 10-12. The entry number starts at 1 at the initial shell boundary and increases by whole number amounts on each succeeding card. If for two consecutive cards of table 1, the entry number increases by more than unity, s, r, r', r/R_2, and $\hat{z}$ are automatically generated for the intervening entry numbers by linear interpolation with respect to the entry number. This process of interpolation may be suppressed by repeating the table number in column 1 on the second card, thus allowing isolated entries to be made on succeeding problems. The entry number also serves to relate data between different tables to the same meridional point.

Each subinterval should have at least one interior point, i.e., the entry numbers of the initial and final point of each subinterval should differ by at least 2. Also, interior points within each subinterval should have equal s-spacing, although the spacing may be different for different subintervals. Note that in table 1 only interior points of each subinterval can be interpolated points, since a point of subdivision is defined by inputting two cards for it. The actual number of cards input for table 1 is therefore determined by the number of subdivision points and the degree of variation of the functions r, r', r/R_2 and $\hat{z}$ in each subinterval. For example, for a cone only two geometry cards are required if no points of subdivision are necessary. However, in order to describe the response funtions (and possibly input functions of other tables) accurately, many more than two points are required. This is easily accomplished by using an appropriate entry number for the second card.

Columns 3 and 5 of the geometry cards pertain to boundary conditions and are discussed under that heading. Column 6 is used only for branched shells, which are discussed below.

In setting up the geometry table for branched shells, it is usually convenient to think of a main branch or trunk of the shell meridian. This is defined as a continuous line consisting of segments of the shell reference meridian containing both the initial point (entry number 1) and the terminal point (having the maximum entry number). In the case of a shell with no closed branch, the trunk will begin at some arbitrary shell edge and terminate at some other arbitrary edge. However, if the meridian contains a closed branch (i.e., a loop), it is necessary that the trunk consist solely of the loop. In this case, the trunk will begin at some arbitrary non-branching point on the loop, and will terminate at the same point.

It is necessary that each branch point be a point of subdivision. Only one branch can exit a branch point, i.e., have increasing s-values and entry numbers away from the branch point. All other branches intersecting at a branch point (of which there can be at most four) must enter the branch point, i.e., on these branches s-values and entry numbers should increase towards the branch point. In setting up the shell meridian, when a branch point is encountered, it is necessary to describe all branches entering the branch point before continuing with the branch exiting the branch point. Thus, if an entry represents the final point of a subinterval terminating at a branch point and there remain undescribed as yet more branches entering the branch point, the next entry will be an edge of one of these branches. These two cards should have consecutive entry numbers and the same value of s, just as an ordinary point of subdivision, even though they represent different points on the meridian. On the other hand, if an entry represents the final point of a subinterval terminating at a branch point, and all other branches entering the branch point have been described, the next entry is the initial point of the branch exiting the branch point. Again, these two cards should have consecutive entry numbers and the same values of s and r, as, in fact, in this case an ordinary point of subdivision is being described. In either case, if an entry represents the final point of a subinterval terminating at a branch point, it is necessary to punch in column 6 of that card the corresponding branch point number (≤ 7), which should be preassigned by the user in any convenient way.

Wall properties: This table is composed of separate subtables, one for each layer. Each card corresponds to one value of s for one layer and gives the value of

E_1	(columns 13-24)	meridional modulus of elasticity
E_2	(columns 25-36)	circumferential modulus of elasticity
E_{12}	(columns 37-48)	shear modulus
ν_1	(columns 49-60)	Poisson's contraction ratio with meridional stress acting
h	(columns 61-72)	layer half-thickness

In addition to the table number 2 in column 1 for the very first card of the wall layer tables, the first card of each subtable should have the layer number in column 7. If the layer number is inadvertently omitted from the first layer subtable input for tables 2 and 7, the default layer number 1 will be used. However, additional layer subtables must have a layer number. Wall layers are numbered in the direction of increasing z starting with unity for the layer at the shell inner surface. It should be noted that the layer numbering is done locally, so that a given continuous physical layer may have a different layer number at different locations on the meridian. However, since the number of layers can only change at a subinterval boundary, layer numbering is unique in each subinterval.

In the case of layer subtables of table 2, and also tables 3 - 7, if for two consecutive cards the entry number increases by more than unity, data for the intervening entry numbers are automatically generated by linear interpolation with respect to the s-values corresponding to the intervening entry numbers. For this purpose, it is necessary that table 1, which contains the s-values, be input first. As with table 1, the interpolation may be suppressed by repeating on the second card the table number in column 1 or, in the case of tables 2 and 7, the wall layer number in column 7. This would be done, for example, at the first entry of the second portion of a disjointed layer. Note that in contrast to table 1, data cards for tables 2 - 7 corresponding to interior points of subdivision may not be necessary.

Foundation moduli: It is assumed that an elastic foundation produces force components per unit area on the shell in s, ϕ, and z directions which are proportional and opposite to the local displacement components in s, ϕ, and z directions, respectively. The constants of proportionality (foundation moduli) for s, ϕ, and z directions, denoted by k_1 (columns 13-24), k_2 (columns 25-36), and k_3 (columns 37-48), respectively, are input on one card for each value of s. The tangential forces associated with k_1 and k_2 also produce small surface moments by virtue of the assumption that they act at the shell inner surface.

Stringer properties: Stringers are treated by circumferentially "smearing-out" their stiffness. In so doing, it is assumed that at each meridional station the stringers are equally spaced around the shell circumference. For this approximation to be accurate it is necessary to have several (more than 2) stringers for each circumferential wave of the response. Each card of this table contains the following stringer section properties at one point of the shell meridion:

E	(columns 13-24)	elastic modulus
NEA	(columns 25-36)	total extensional stiffness of all stringers
NEI	(columns 37-48)	total normal bending stiffness of all stringers (I taken about circumferential centroidal axis)
NGJ	(columns 49-60)	total torsional stiffness of all stringers
$\bar{z}$	(columns 61-72)	normal eccentricity of the stringer centroid measured from the shell inner surface, positive in the direction of the positive z-axis.

Mass densities: Although SRA 100 is essentially a shell statics program, the quasi-static problem of a shell structure accelerating in a rigid body mode can be treated automatically.* This is accomplished by specifying the type of rigid body freedom in column 30 of the case option card and inputting mass densities for the shell and rings. The program will then automatically generate the distributed inertial forces which equilibrate the applied loads. The static response of the resulting self-equilibrating system of forces is then obtained. Even though the structure lacks in this case rigid body constraint, it is still necessary to specify artifically the missing constraint (see page 23).

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*Note that rigid body degrees of freedom exist only for n = 0 or 1.

This will not affect the solution, however, since the resulting reaction will be essentially zero.

Each card of this table represents the shell wall layer mass densities (ρ_i, $i \leq 5$) in the order of increasing layer number i for a point of the shell meridian (fig. 2).

The mass of stringers can be accounted for by the use of a fictitious layer with zero stiffness but with the same mass (generally, a different mass density) and a half-thickness equal to the centroidal eccentricity of the stringer cross section relative to the nearest shell face. The mass density of rings are input with other ring data (see p. 21).

Mechanical loads: Harmonic amplitudes X_1, X_2, X_3 of applied surface force components per unit area in s, ϕ, and z-directions, respectively, are input in table 6. The corresponding symmetric force components are $X_1 \cos n\phi$, $X_2 \sin n\phi$, and $X_3 \cos n\phi$, whereas the corresponding antisymmetric force components are $X_1 \sin n\phi$, $X_2 \cos n\phi$, and $X_3 \sin n\phi$. The tangential components X_1 and X_2 may be specified to act either at the shell reference surface or the shell outer surface by use of column 34 of the case option card. When applied at the shell outer surface, the small moments they produce about the reference surface are automatically accounted for.

Mechanical loads acting on rings and other line loads are input with other boundary data (see p. 21).

Thermal loads (free thermal strains): For each layer, the averages θ_1, θ_2 and differences $\Delta\theta_1$, $\Delta\theta_2$ of free thermal strain harmonic amplitudes in s, ϕ-directions, respectively, are required. Thus, if the superscript (+) means evaluated at the layer face with positive z-direction pointing out of that layer and the superscript (-) means evaluated at the layer face with positive z-direction pointing into that layer, then

$$\theta_1 = (\theta_s^+ + \theta_s^-)/2 \quad , \quad \Delta\theta_1 = \theta_s^+ - \theta_s^-$$

$$\theta_2 = (\theta_\phi^+ + \theta_\phi^-)/2 \quad , \quad \Delta\theta_2 = \theta_\phi^+ - \theta_\phi^-$$

The free thermal strains θ_s and θ_ϕ are defined as $\int_{t_o}^{t} \alpha_s dt$ and $\int_{t_o}^{t} \alpha_\phi dt$ respectively, where t is the local temperature, t_o a reference temperature, and α_s and α_ϕ the thermal coefficients of expansion in s and ϕ directions.

θ_1, θ_2, $\Delta\theta_1$, and $\Delta\theta_2$ are input for each layer just as the wall layer properties of table 2, and the use of column 7 of the input cards for this table is the same as for table 2.

Also input along with the first layer free thermal strains is the harmonic amplitude θ_{st} of the stringers. The stringer free thermal strain is assumed to be uniform over a cross section of each stringer but may vary from stringer to stringer. The equivalent circumferential distribution for the discrete stringers can then be formed by assuming that the value of the free thermal strain for each stringer applies over the circumferential arc centered at the stringer and extending on either side to the midpoint of the interval formed by that stringer and the adjacent stringer. Thus, each card corresponding to wall layer 1 contains the following data for a point of the shell meridian: θ_1 (columns 13-24), θ_2 (columns 25-36), $\Delta\theta_1$ (columns 37-48), $\Delta\theta_2$ (columns 49-60), and θ_{st} (columns 61-72). The remaining layers are treated the same way except that columns 61-72 are left blank.

All symmetrical free thermal strain components vary circumferentially as cos $n\phi$, whereas antisymmetrical components vary as sin $n\phi$. Free thermal strain amplitudes of rings are input along with other ring data (see p. 21).

Boundary conditions.- The boundaries of the shell are defined as all shell edges plus all interior subdivision points. For the purpose of discussion, the closure point of a closed branch although not specified in the same manner as other interior boundaries is classified here as an interior boundary. As discussed previously, the boundaries other than the initial and final entry are specified in the geometry table by repeating the same value of s on two consecutive cards. A set of boundary conditions must be determined for each boundary. In general, each set of boundary conditions is expressed by four equations relating four basic force variables to four corresponding displacement variables. In matrix notation, these four equations may be written as $[B]\Delta\{y\} + [D]\{z\} = \{L\}$, where $\{y\}$ is the column force vector (P, Q, S, M_1), and $\{z\}$ is the column displacement vector (ξ, η, v, χ). At an interior boundary, $\Delta\{y\}$ represents the change in $\{y\}$ across the boundary,* i.e., $\Delta\{y\}$ is the value of $\{y\}$ on the exiting branch minus the sum of the values of $\{y\}$ on all entering branches. At all edges other than a terminal edge (i.e., the final entry), $\Delta\{y\}$ denotes simply $\{y\}$, whereas at a terminal edge $\Delta\{y\}$ denotes $-\{y\}$. Four types of boundaries are treated, and for three of these (force-free, rings, and dome closures), the 4x4 matrices [B] and [D], and the vector {L} are automatically generated by the program. The fourth type of boundary is a more general type, for which the [B], [D], and {L} matrices themselves may be input.

For the purpose of defining the sign convention of the above forces and displacements, it is convenient to define positive axial (x) and radial (y) directions as follows (see diagram).

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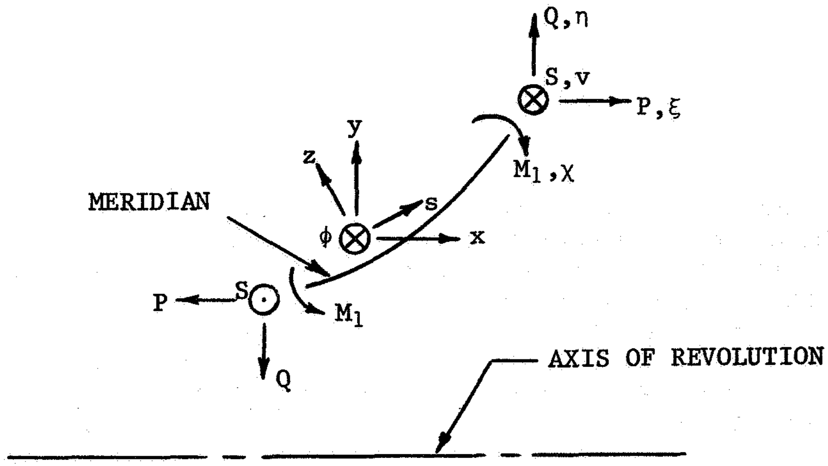
*The continuity of the displacement vector {z} at an interior boundary is automatically enforced by the program.



The positive x-direction is acute to the positive (negative) s-direction if the positive z-direction points away from (towards) the axis of revolution. The positive y-direction always points radially away from the axis of revolution. Then, ξ, η, v are positive if in the positive x, y, ϕ directions; and χ is positive if its vector points in the positive ϕ-direction. The forces P, Q, S and moment M_1 acting on a normal section with outward normal pointing in the positive s-direction have the same positive directions as the corresponding displacements.

The boundary type is specified by an indicator in column 5 of the geometry table cards. This column applies only at the initial entry of each subinterval and the final point of the meridian. Thus, for example, the boundary type of a branch point is specified in column 5 of the first entry of the subinterval exiting the branch point, and the boundary type of the edge of a branch entering a branch point is specified in column 5 of the first entry of the first subinterval of the branch. In the case of a closed loop, the boundary type of the closure point (corresponding to the first and last point of the meridian) is specified in column 5 of the final entry card of the geometry table. In this case, column 5 of the first entry, although read, is not used. The code for column 5 is given below.

Column 5 (table 1)	Type of boundary	Input data required
blank	force-free ($\Delta\{y\} = 0$)	none
1	ring	ring data
2	prescribed [B], [D], and {L}	[B], [D], {L}
3	boundary data taken from previous case	none
4	dome closure	none

Although the column 5 indicator is input on cards of table 1, it should be thought of as a separate table within the computer. In a sequence of cases, in order to change the type of a boundary, it is necessary to re-input the complete geometry card corresponding to that boundary, repeating all the geometrical data. As an example, if three cases of three different loadings of the same ring-stiffened structure are to be run in succession, it would be desirable not to have to re-input the ring data for the second and third cases. This can be accomplished simply by leaving column 20 of the case option card blank. But if, instead, the properties of one (or more) ring varies from case to case, a 1 would be required in column 20. The data for the unchanged rings still does not have to be re-input if for the second case the geometry cards corresponding to those ring boundaries are re-input, each with a 3 in column 5.* Each of these cards should also have a 1 in column 1 to suppress interpolation at the intervening entries (which would cause erroneous geometrical data to be generated). For succeeding cases after the second, it is not necessary to input a 3 in column 5 for unchanged rings and hence for these cases no geometry cards should be input. In general, the code 3 in column 5 should only be used if the previous case contains a 1 or 2 in column 5 for the corresponding boundary.

If the shell has a dome closure, the geometrical data is input only up to an artificial edge of small radius. A 4 is then inserted in column 5 of the geometry table card corresponding to this boundary. This causes boundary conditions to be generated which represent the effect of the small deleted cap. Since these boundary conditions are correct only to first-order in the radius of the artificial edge, it is necessary that this edge be suitably small. It is found that good accuracy is obtained if at this edge $r/R_2 \leq 0.05$. For a plate, this conditon may be replaced by $r/r_0 \leq 0.05$, where r_0 is the outer radius of the plate. It should be noted that the edge radius r cannot be decreased arbitrarily since execution time increases without bound as $r \to 0$.

For SRA 100 the only use of column 3 of the geometry table pertains to shell structures which have a plane (normal to the axis of revolution) of symmetry about which the loading is also symmetrical or antisymmetrical.

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*Since in this case the geometrical data is not being changed, column 6 of the case option card should be left blank. A 3 in column 5 simply changes the sign of corresponding value in the stored column 5 table, and the so-formed negative value causes the boundary data to be taken from the previous case.

In this context, a symmetrical loading is one for which X_2, X_3, and the free thermal strains are even functions of s and X_1 is an odd function of s when s is measured from the plane of symmetry. The reverse is true for an antisymmetrical loading. In either case it is only necessary to model one half of the shell, thereby reducing the computer execution time and allowing more computer storage for the remaining half.* Note that the plane of symmetry can correspond to one or more shell edges. If, in addition, a ring (of symmetrical cross section) is attached at the plane of symmetry, the problem can be run simply by inputting the actual ring data (see below) and inserting an 8 in column 3 (along with the required 1 in column 5) for the corresponding card of the geometry table in the case of symmetrical loading, or a 9 in column 3 in the case of antisymmetrical loading. For the purposes of satisfying certain boundary condition restrictions in the cases n = 0 or 1 (see p. 23), it should be noted that kinematic constraints are imposed at a symmetry edge, viz. $\xi = \chi = 0$ in the case of a symmetrical loading, and $\eta = v = 0$ in the case of an antisymmetrical loading.

Immediately following the input tables there should be a card with a 9 punched in column 1. Boundary data for boundary types 1 and 2 follows this card. This consists of ring data and [B], [D], {L} cards, which are input for each boundary in the order in which the boundary type is specified in column 5 of the geometry table. Note that if it is necessary to input boundary data for a branch point, this data will be read after the boundary data for boundaries on all branches entering the branch point.

Ring data: Ring reactions are assumed to enter the shell at the corresponding point of subdivision. For each ring, the ring data is input on three cards in the format 6E12.4 (fig. 4). The first card consists of the following section properties: EA, EI_x, EI_y, EI_{xy}, GJ, $\bar{z}$. The second card contains the harmonic amplitudes of the mechanical line forces F_x, F_y, F_ϕ, and moments N_x, N_y, N_ϕ, all per unit length, applied at the ring centroid. The third card contains the meridional ring eccentricity $\bar{s}$, the ring mass density ρ, elastic modulus E, and the harmonic amplitude of the ring free thermal strain θ_r. Here E and G are normal and shear elastic moduli of the ring (assumed homogeneous and isotropic), A is the ring cross-sectional area, I_x, I_y, and I_{xy} are the moments and product of inertia about the axial and radial centroidal axes (see p. 19), J is the torsion constant, and $\bar{s}$ and $\bar{z}$ are the coordinates of the ring centroid with respect to local s, z axes with origin at the intersection of a normal shell element through the point of subdivision and the shell inner surface (see diagram).

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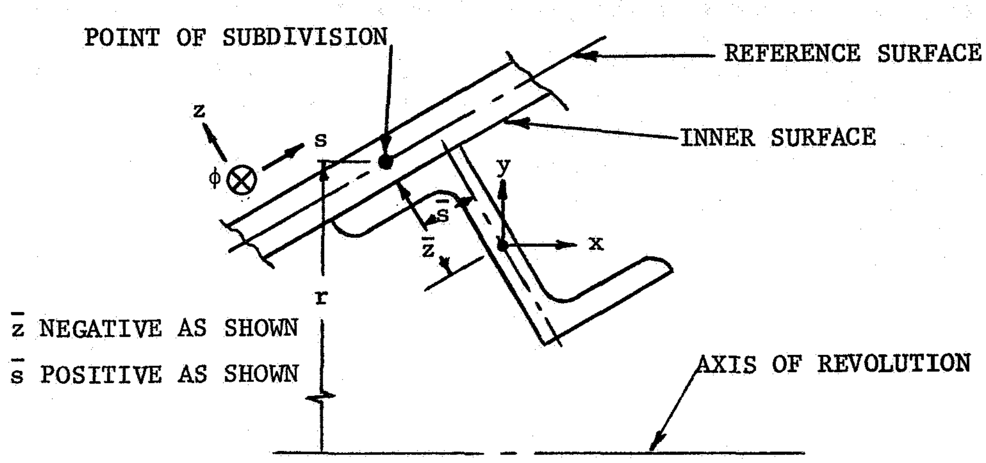
*If the purpose of the run is to prepare prebuckling data for SRA 101, then the full shell should be modeled in the case of antysimmetrical loading. In this case, the buckling mode is neither symmetrical nor antisymmetrical.



The properties ρ and E are required only for the internal generation of inertial loads in the case of an accelerating structure (i.e., when column 30 of the case option card is not blank). The free thermal strain θ_r is assumed to be uniform over each cross section of the ring. The circumferential variation of the symmetrical (antisymmerrical) ring load components is cos nφ (sin nφ) for F_x, F_y, N_ϕ, θ_r and sin nφ (cos nφ) for F_ϕ, N_x, N_y.

Prescribed [B], [D], and {L} matrices: If it is desired to input the boundary condition [B]Δ{y} + [D]{z} = {L}, corresponding to a 2 in column 5 of the appropriate geometry card, this can be accomplished by inputting the [B], [D], and {L} matrices. For example, a clamped edge corresponds to [B] = [0], [D] = [I], and {L} = {0}. Each set of this type of boundary data consists of eight cards, each of the first four cards giving the elements of the corresponding row of the [B] matrix in the format 4E12.4, and each of the second four cards giving the elements of the corresponding rows of the [D] matrix and {L} vector in the format 5E12.4 (fig. 5).

Boundary data restrictions: Although there are no restrictions on the number of boundaries with kinematic (i.e., displacement) constraint on open branches, on a closed loop at most one boundary with kinematic constraint can be treated. Furthermore, if kinematic constraint does exist at some point on a closed loop, it is necessary that this point be chosen as the closure point.

For the special cases of zero'th (n = 0) and first (n = 1) harmonics certain force boundary conditions are physically incompatible. For n = 0, $2\pi r \Delta P$ and $2\pi r^2 \Delta S$ represent resultant axial force and moment, respectively, externally applied at a shell cross section. Hence ΔP or ΔS cannot be specified at all boundaries since given ΔP or ΔS at all boundaries but one,overall axial force and moment equilibrium of the shell determines the corresponding values at the remaining boundary. In addition, the effect of arbitrary rigid body axial displacement and rotation should be eliminated by specifying ξ and v each at some boundary.* In general, ΔP or ΔS is left unspecified at the boundary where ξ or v, respectively, is specified.

For n = 1, $-\pi r(\Delta Q - \Delta S)$ and $-\pi r(r\Delta P + \Delta M_1)$ represent resultant transverse force and moment, respectively, externally applied at a shell cross section. Hence $\Delta Q - \Delta S$ cannot be specified at all boundaries since these values are related by resultant transverse force equilibrium. Furthermore, if $\Delta Q - \Delta S$ is specified at all boundaries but one, then $r\Delta P + \Delta M_1$ may at most be specified at all boundaries but one, since resultant transverse force and moment equilibrium would then determine $\Delta Q - \Delta S$ and $r\Delta P + \Delta M_1$ at the remaining boundary (or boundaries). On the other hand, $r\Delta P + \Delta M_1$ may be specified at all boundaries, but then $\Delta Q - \Delta S$ may at most be specified at all boundaries but two. In addition, the effect of arbitrary rigid body transverse displacement and rotation should be eliminated by specifying either: (1) η or v and ξ or χ each at some boundary or (2) η or v at two boundaries.* In general, $\Delta Q - \Delta S$ is left unspecified at the boundary (or boundaries) where η or v is specified, and $r\Delta P + \Delta M_1$ is left unspecified at the boundary where ξ or χ is specified.

As noted previously, even in the case of a shell with rigid body freedom, it is still necessary that rigid body constraints be provided. These will not affect the solution, however, since the corresponding resultant force (and/or moment) will turn out to be essentially zero. Also, it should be noted that symmetry conditions generated internally when only half of a symmetrical structure is modeled provide partial rigid body constraint depending on whether the loading is symmetrical or antisymmetrical (see p. 21). This is the only case in SRA 100 of internally generated boundary conditions providing rigid body constraints.

Input Deck Set-Up

As a convenience to the user, four types of input sheets are supplied (figs. 2-5), which may be used as an aid in setting up the input deck. These sheets are essentially self-explanatory and represent a condensation

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*As noted above, boundaries on closed branches other than the closure point, are excluded from this use. It has been observed for n = 0 that specification of the rigid body constraint $\xi = 0$ at the closure point of a loop results in an undetermined rigid body displacement superimposed on the axial displacement field ξ. It may be noted that for n = 1 specifying the combinations $\eta + v$ or $\xi - r\chi$ does not provide any constraint against rigid body motions since they are unaffected by rigid body motion.

of the preceding discussion.

It often happens that the solution of a problem requires several cases to be run on SRA 100. Parametric studies, for example, may require many cases which, in general, reflect modifications in shell geometry. Even a single geometry problem, however, may require several harmonics, or several cases reflecting an envelope of applied loading and/or boundary conditions.

Whenever possible, multiple cases should be stacked for a single pass solution, rather than run individually. Not only is turn-around time shortened, but actual execution time is lessened as well. In particular, execution time is greatly reduced when the stacked cases reflect different loadings with the same harmonic number applied to the same shell geometry.

For each case of a stack, a minimum of three cards is always required. These three cards are (1) a title card, (2) a case option card, and (3) a "nine" card. The title card of the next case need only follow the last card of the previous case. The program handles each case in turn until an end-of-file card is reached.

Case option card.- For the first case of a stack, columns 6, 8,...18 must each contain a 1. For the cases which follow, the 1 is omitted from those columns corresponding to tables which are unchanged from the previous case. In other words, a 1 is inserted in a column only when the corresponding table of the previous case is to be modified for the present case. For a sequence of closed branch cases, it is necessary that the case option card of each case contain a 1 in column 4.

For the first case of a stack, column 20 must also contain a 1. For the cases which follow, the 1 is omitted from this column only when all of the boundary data is unchanged from the previous case. Leaving column 20 blank is equivalent to re-inputting the geometry table cards corresponding to all ring and prescribed boundaries with a 3 in column 5. If in a succeeding case, it is necessary to change only boundary loads (i.e., ring forces or {L}-vectors at prescribed boundaries), then a 2 should be punched in column 20.

Changing table data.- In a sequence of problems it is possible to use part of a table from the previous case. This is accomplished by first entering a 1 in the corresponding column of the case option card, and then inputting only those cards with the new data for that table. The first card of the revised table requires the appropriate integer in column 1 to specify the particular table geing changed.

The following rules must be observed if either table 1 or table 2 is partially input:

(1) If table 1 is partially input, it is necessary to re-input the

the geometrical data cards for the final point of subintervals terminating at branch points and the final point of the meridian.

(2) If table 2 is partially input, it is necessary to re-input the layer properties for the wall layer with maximum layer number ($\geq$2) for the initial point of each subinterval. This is not necessary if the shell wall consists of a single layer.

A table not input is taken from the preceding case if the corresponding column on the case decision card is left blank, or is interpreted as not applying (i.e., all zeros) if 1 is entered in that column. Even when no table data is input, a "nine" card is required.

Because boundary codes (col. 5) are input via table 1, it is often required to suppress interpolation of geometry data when running a stack of cases. This requirement can best be illustrated by an example. Consider a shell, which for the initial case, contains several force-free interior boundaries. Suppose now for a second case, the effect of two interior rings is sought at two of the previous force-free boundaries. Two revised table 1 cards are required to change the stored column 5 table. (The geometry data are merely duplicated from before.) If interpolation is not suppressed, the intervening geometry between the ring boundaries will be erroneously generated. Hence a means must be available to suppress interpolation. This is effected by inserting a 1 in column 1 of the second of two cards defining a span over which linear interpolation is to be suppressed. The geometry of that span will then be as defined by the previous case. In this case column 6 of the case option card should be left blank, since the geometry table itself is not being changed.

One other circumstance may occur which requires suppression of the automatic interpolation process. As mentioned above, when table 1 or 2 is partially modified, it may be necessary to re-input several duplicate isolated data cards for these tables. Suppose, for example, that the modified portion of the shell geometry is separated from the terminal shell point by previously defined geometry. Unless a 1 is inserted in column 1 of the re-input card for this point, erroneous interpolation of the intervening geometry will occur.

Boundary conditions.- As pointed out earlier, column 5 of table 1 is stored in the computer as a separate table relating boundary codes with boundary numbers. Therefore, if a particular boundary card is omitted in the present case, the code for the previous case controls.

Final check list.- It is suggested that the following items be checked before submitting the job.

(1) Title card must be included for every case.

(2) Case option card:

Column 4 must contain a 1 if shell contains a closed branch.
Columns 6, 8,...20 must contain 1 for first case.
Columns 21-23 define the harmonic.
Column 30 not left blank when density data is input.

(3) First card of each table must have table number inserted in column 1.

(4) Check column 5 of table 1 at each boundary.

(5) Check column 6 of table 1 at each branch point.

(6) Tables 2 and 7 require a layer number in column 7 for the first card of each layer.

(7) Every card of table data must have an entry number in columns 10 through 12.

(8) Note that h of table 2 is the layer half-thickness. Tables 1 and 2 must always be input for first case.

(9) Check ring cards...must be three per ring; one set for each 1 in column 5 of table 1.

(10) Check [B], [D], and {L} boundary cards...must be eight per boundary; one set for each 2 in column 5 of table 1.

(11) Check order of ring and [B], [D], {L} cards to agree with order of boundary specification in geometry table cards.

(12) If n = 0 or 1, [B], [D], {L} matrices must be input in order to provide necessary rigid body constraint.*

(13) The final data deck should be in the order shown in the diagram below.

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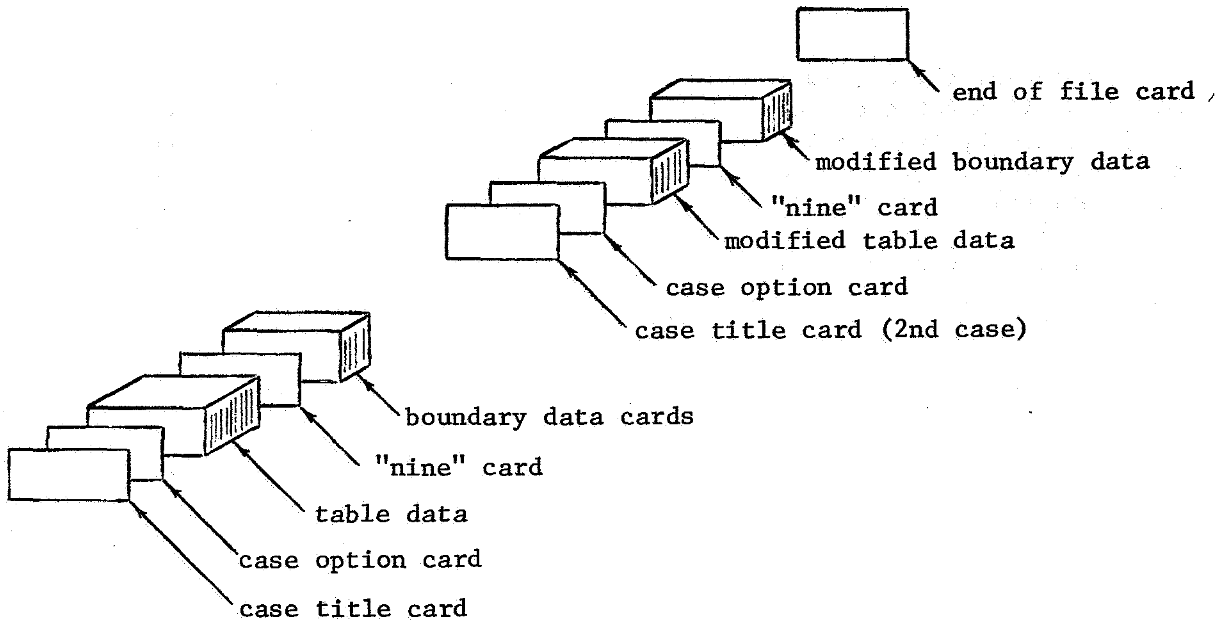
*This is not necessary for n = 1 in the case of two symmetry rings with antisymmetrical loading, since the symmetry conditions would automatically provide complete rigid body constraint (see pages 21 and 23).



Output Data

Printed output.- The output data of the program consists of a print-out of the input data and computed results. Since the print-out of the input data is self-explanatory, a discussion of it is unnecessary.

When mass density data is input and column 30 of the case option card appropriately marked (n = 0 or 1 only), the following dynamic properties of the structure are printed immediately after the input boundary data:

n = 0, column 30 = 1: total mass and axial acceleration

n = 0, column 30 = 2: rolling mass moment of inertia and angular acceleration

n = 0, column 30 = 3: total mass and axial acceleration, rolling mass moment of inertia and angular acceleration

n = 1, column 30 = 1: total mass and lateral acceleration

n = 1, column 30 = 2: pitching mass moment of inertia and angular acceleration

n = 1, column 30 = 3: total mass and lateral acceleration, pitching mass moment of inertia and angular acceleration, and center of mass location relative to the initial entry station.

Following these results (or the boundary data if this option is not employed) is a table of harmonic amplitudes of the four basic shell forces P, Q, S, and M_1 and displacements ξ, η, v, and χ as functions of meridional distance (i.e., for each value of s corresponding to integral values of the entry number). For symmetric response, P, Q, M_1, ξ, η, and χ vary circumferentially as cos $n\phi$ and S and v vary as sin $n\phi$, whereas for antisymmetric response the reverse is true.

Following this table is a table of the harmonic amplitudes of normal deflection w, primary shell stresses σ_s, σ_ϕ, $\sigma_{s\phi}$, transverse shear stresses $\sigma_{s\phi}$, σ_{sz}, and stringer centroidal stress σ_{st} as functions of meridional distance. In this table x represents the normal distance through the shell wall measured from the shell inner surface. Since the normal deflection is essentially constant through the wall thickness, it is printed only once for each value of s. The primary shell stresses, which vary linearly through the thickness of each wall layer, are printed at the outer face of each layer for each value of s. The transverse shear stresses, which vary parabolically through the thickness of each wall layer, are printed at the middle surface of each layer, at each layer interface*, and at the inner and outer wall faces for each value of s. For symmetric response w, σ_s, σ_ϕ, σ_{sz}, σ_{st} vary circumferentially as cos $n\phi$ and $\sigma_{s\phi}$ and $\sigma_{\phi z}$ vary as sin $n\phi$, whereas for antisymmetric response the reverse is true.

Optional output.- The program will punch (i.e., write on file PUNCH) two types of response data depending on columns 73 and 74 of the case option card. If column 73 contains a 1, a (component of the) prebuckling data deck required by SRA 101 is created. This deck consists of four groups of cards in the order given below:

(1) ring stress resultant cards: [no. of rings/6] cards punched.† Each card, except possibly the last card, contains six consecutive ring boundary numbers and the corresponding hoop force amplitudes T_ϕ in the format 6(I2,1PE11.4). The rings are ordered in the direction of increasing entry number.§

(2) shell normal stress resultant cards: [max. entry no./3] cards punched. Each card, except possibly for the last card, contains three consecutive entry numbers and the corresponding pairs (T_1,T_2) of amplitudes in the format 3(I2,1P2E11.4),

(3) shell shear stress resultant cards: [max. entry no./6] cards punched. Each card, except possibly the last card, contains six amplitudes T_{12} at six consecutive entry points in the format 1P6E12.4, and

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*Note that these stresses are continuous at layer interfaces.

†Here and in the following, [x] denotes the smallest integer ≥ x.

§Note that a ring at a branch point is associated with the initial entry of the exiting branch.

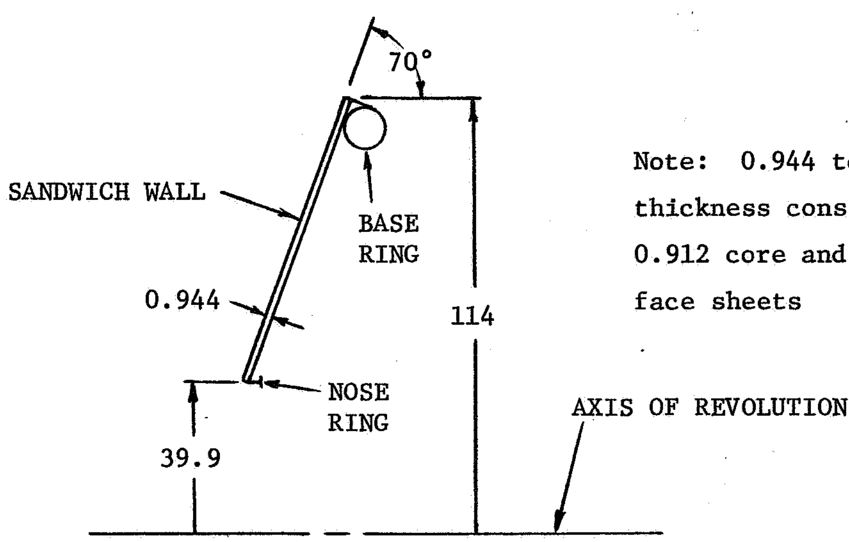
(4) normal pressure cards: This group of cards is in the same format as type 3 above with T_{12} replaced by the normal pressure amplitude X_3.

If column 74 contains a 1, the primary shell stress amplitudes σ_s, σ_ϕ, and $\sigma_{s\phi}$ will be punched. These values are given at each face of each shell wall layer for each entry point. Each card contains the layer number, a layer face indicator (1 for the inner face or 3 for the outer face), the value of s, the normal distance of the layer face from the inner wall surface, and σ_s, σ_ϕ, and $\sigma_{s\phi}$, in that order in the format 2I2, 8X, 1P5E12.4. For each entry number the cards are punched in the same order as the layer faces are encountered in traversing the wall thickness from the inner surface to the outer surface.

If both column 73 and 74 of the case option card contain a 1, the cards of the two punched decks will be intermixed with one another. They can be separated by sorting on column 80, which is blank for the pre-buckling data cards but contains a 1 for the stress cards.

Sample Problem

In order to illustrate the application of SRA 100 to a practical problem, listings of the input deck and output data are presented in Appendix B (p. 134) for symmetric n = 0 and n = 1 load components run consecutively of the 140 sandwich cone of reference 3 (see diagram). Each row of the input deck listing is the image of a punched card, ten columns of which correspond to one inch on the listing. In order to clarify the input deck, explanatory comment cards, each separated from the actual data by a blank card on each side of it, have been inserted at the beginning of each group of cards.



Note: 0.944 total wall thickness consists of 0.912 core and 0.016 face sheets

Only two geometry table cards (for the initial and final edges) are in principle required to describe the conical geometry. However, several interior boundaries have been inserted to limit subinterval length. Sufficiently many intervening points to describe adequately the variable pressure field and the calculated response are prescribed by the use of nonconsecutive entry numbers on successive cards representing the initial and final points of each subinterval. For this purpose, it should be noted that linear interpolation is used for basic shell data (tables 2-7), whereas quadratic interpolation of response data is used when required by a subsequent program (e.g., SRA 101).

Since the shell has rigid body freedom, it is necessary to provide artificial rigid body constraints ($\xi = v = 0$), which is done at the second boundary. Corresponding to this, column 30 of the case option card contains a 1, which causes the proper shell and ring inertial loads to be calculated.* These loads self-equilibrate the applied shell and ring loads, thereby producing negligible rigid body constraint reactions.

In order to generate a punch file of prebuckling data required by SRA 101, column 73 of the case option cards contains a 1.

The input tables for the second case corresponding to $n = 1$ consist primarily of new normal pressure data, i.e., a new mechanical loads table. Also a single geometry card was input to change the code 2 in column 5 at the second boundary to a 3, signifying that the corresponding boundary data will remain unchanged from the preceding case and will not be input. Since the ring loads at the first boundary for $n = 1$ are different from those for $n = 0$, it is necessary to input new ring cards for this boundary even though the remaining ring data is unchanged. Consequently, the column 5 code 1 is not changed at this boundary. Since the column 5 code 1 was left unchanged at the final boundary, it was necessary to re-input the ring data for this boundary. Since this ring data did not change, one could have alternately changed this column 5 code to 3 by re-inputting the final geometry card, and omitting these ring data cards from the deck.

In the output data listing for each case, all data preceding the mass and translational acceleration values represents input data. The remaining data represents calculated results, viz. a table of shell force and displacement amplitudes, and a table of normal displacement and shell stress amplitudes, as described in the preceding section. This job (both cases) took 25 seconds of Central Processor time (starting from a relocatable binary form of SRA 100) on the CDC 6400 computer.

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*Although (rolling) rotational freedom is also possible in the $n = 0$ response, only translational freedom need be indicated in column 30 since the rolling acceleration is zero by virtue of the absence of torsional loads.

SRA 101

SRA 101 is used to determine the buckling mode of linear asymmetric prebuckling states. It is dimensioned to treat a maximum of seven prebuckling harmonics and twenty-five buckling harmonics, the harmonic numbers of which need not be consecutive. The prebuckling state (i.e. the loading) need not have an axial plane of symmetry, and the prebuckling harmonics may contain symmetric and/or antisymmetric components. In the case of symmetric loading, the decoupled symmetric and antisymmetric buckling modes are computed simultaneously. The component prebuckling states may be computed by SRA 100 and form part of the data deck for SRA 101. Both dead and live pressure fields are treated in the buckling analysis.

SRA 101 is essentially an eigenvalue program, solving by iteration for the numerically minimum eigenvalue, corresponding to the smallest buckling load factor applied to the (unit) load distribution used in obtaining the prebuckling state. In order to avoid an unwanted negative eigenvalue, corresponding to buckling under the reversed loading, the program allows the input of an eigenvalue shift of the axisymmetric torsionless (i.e., bending) component of the prebuckling state. Further aspects of eigenvalue shifting are discussed below.

Input Data

The SRA 101 input deck is normally constructed from the SRA 100 input deck and the unit load prebuckling data deck created by SRA 100 when column 73 of the case option card of the SRA 100 data deck contains a 1.* The following steps should be taken to construct the SRA 101 data deck:

(1) Insert the prebuckling data deck followed by a card with the characters STOP in columns 1-4, after the boundary data cards. (This is in contrast to SRA 201, for which the prebuckling data deck is inserted between the "nine" card and the boundary data.) These inserted cards thus form the tail end of the input data, and are followed either by a second case or an end-of-file card. Further description of the prebuckling data deck is given below.

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*Of course, for idealized problems such as the use of membrane prebuckling states when only the zero and first prebuckling harmonics are present, the prebuckling data deck may be prepared manually.

(2) Since tables 5, 6, and 7 are not used by SRA 101, they may be removed from the deck. However, this step is optional, and if these tables are not removed, they will be ignored by the program.

(3) Modify the case option card and insert several new cards giving

   (a) shell output points for prebuckling and buckling mode data,
   (b) ring output points for prebuckling data,
   (c) initial and maximum iteration numbers,
   (d) prebuckling harmonic numbers, and
   (e) buckling harmonic numbers.

(4) Remove any artificial rigid body constraints which may have been imposed in the SRA 100 run. Generally, this is done by blanking column 5 of the appropriate card in table 1 and removing the corresponding set of eight boundary data cards from the deck. If the zeroth or first harmonics are included in the buckling mode, they may require special treatment with respect to rigid body constraints (see p. 37).

(5) For a structure with a plane of symmetry normal to the axis of revolution and symmetrical loading, both symmetric and antisymmetric buckling modes exist. For an efficient solution, only one half of such a structure should have been modeled in setting up the SRA 100 run, with symmetry conditions imposed at the artificial edge(s). If an antisymmetric mode is desired, it is necessary to: (a) change the 8 to a 9 in column 3 of the geometry table card at a symmetrical ring boundary, and/or (b) change prescribed boundary conditions at a symmetry edge from $\xi = \Delta Q = \Delta S = \chi = 0$ to $\Delta P = \eta = v = \Delta M_1 = 0$.

Case option card.- This card is similar to the case option card for SRA 100 and is required for each case (fig. 6). Columns 4, 6, 8, 10, and 12 have the same meaning as for SRA 100 except for one minor change. A -1 in columns 5 and 6 may be used in place of a 1 in column 6 in order that the converged buckling mode data be properly arranged on files TAPE8 and TAPE11 for use as the initial approximation in a succeeding case. This arrangement will occur automatically (i.e., without the minus sign in column 5) if the case terminates at the maximum iteration number without satisfying the convergence index. The -1 in columns 5-6 should be used, for example, if one expects to ascertain the effect of more (or less) buckling harmonics or study a similar shell in a succeeding case or later run. In order to have this data available in a later run, it is necessary, of course, to retain TAPE8 and TAPE11 as permanent files.

Column 16 now contains the indicator for the prebuckling state data. Column 20 has the same meaning as for SRA 100, except that here a 2 does not apply since boundary load vectors are not input.

Columns 21-22 contain an indicator specifying the symmetry (or lack of same) about an axial plane of the prebuckling state. As an example, if the prebuckling state contained both axisymmetric bending and axisymmetric torsion, columns 21-22 would be left blank (cf. definition of symmetric and antisymmetric response, p. 11).

If the user recognizes that equal and opposite eigenvalues are present, column 26 should be set to 1. The most common ways for equal and opposite eigenvalues to occur are:

(1) there is only one prebuckling harmonic and it is nonaxisymmetric,

(2) all nonaxisymmetric prebuckling harmonics are odd and the axisymmetric prebuckling harmonic, if present, represents pure torsion, or

(3) the prebuckling state other than the axisymmetric bending component is described by (1) or (2) and one is searching for a critical state with a given amount of axisymmetric bending [i.e., with a nonzero eigenvalue shift (columns 36-47) but a zero scaling factor for axisymmetric bending (columns 60-71)].

If column 26 is mistakenly left blank, and one of these three conditions is satisfied, the program will recognize the error and correct it. However, if equal and opposite eigenvalues occur for some other reason and column 26 is left blank, the program will not converge.

Column 28 contains an indicator to be set to 1 if the prebuckling state has an axisymmetric component consisting of pure torsion. It is used by the program only if column 26 is left blank to determine if equal and opposite eigenvalues in fact exist.

Column 32 gives the approximate number of significant digits desired in the eigenvalue. In the case of a symmetric prebuckling state, two eigenvalue sequences, one for symmetric buckling and one for antisymmetric buckling, are computed simultaneously. In this case, convergence is assumed if the numerically smaller of the two eigenvalue estimates satisfies the convergence test. If column 32 is left blank, four significant digits will be assumed.

Column 34 contains an indicator for a live pressure field. Only a uniform live pressure field is treated precisely, since the effect of pressure gradients associated with the pressure field are not included in this program.

Columns 36-47 contain an eigenvalue shift λ_s for the axisymmetric torsionless prebuckling component. This shift may be necessary to avoid an unwanted negative eigenvalue, corresponding to buckling under the reversed load. It is used in conjunction with a scaling factor κ (input in columns (60-71) for this prebuckling component. To explain the usage of λ_s and κ let A denote the axisymmetric torsionless component of the unit load prebuckling state and B denote the remaining components of the unit load prebuckling state. If λ_1 denotes the eigenvalue obtained by SRA 101, then the corresponding critical state has the components $(\lambda_s + \kappa\lambda_1)$A and λ_1B. Geometrically, SRA 101 searches for the critical point on a straight line in the A, B plane which intercepts the A-axis (abscissa) at λ_s and has the slope $1/\kappa$ (fig. 7). In general, the critical point obtained will be the one closest to the A-axis. Leaving columns 36-47 blank will automatically make $\kappa = 1$ as well as $\lambda_s = 0$, whereas leaving columns 60-71 blank when inputting a nonzero λ_s will cause a critical state to be found with a given fixed amount of axisymmetric bending.

Columns 59-71 are used for inputting the value of κ discussed above.

Column 76 may be used when some complementary solutions saved on a permanent file from either file TAPE2 or TAPE12 of a previous run apply to the current case. Normally in a sequence of cases run consecutively, to minimize execution time, the program computes only those complementary solutions which cannot be taken from the preceding case. For the first case of a run, the complementary solutions are placed on file TAPE2. In a succeeding case of the same run, the complementary solutions will be placed on the same file as for the last preceding case if all complementary solutions taken from that case correspond to harmonics which have the same position in the list of harmonics (ordered according to magnitude) for both cases. Otherwise, a new complementary solution file is constructed. If this file for the last preceding case was TAPE2, then it will be TAPE12 for the current case, or vice versa. Column 76 allows the same advantage to be taken of precalculated complementary solutions for two cases of two different runs as for two consecutive cases of the same run. For example, one may want to repeat a run with more buckling harmonics considered. In that case, the complementary solution file of the previous case should be attached to file TAPE2 and purged so that write access to this file is made available. In addition, a 1 should be placed in column 76 and an extra card of buckling wave numbers of the previous case should be inserted in the data deck to follow the buckling wave numbers card of the current case (see p. 36).

Column 78 performs the same function as for SRA 100, viz. to override the abort command if the subinterval length criterion is exceeded. It, however, is used for SRA 101 in an additional way, somewhat analogous to the use of column 76. Normally, in a sequence of cases run consecutively, if the geometry is unchanged from the first case, columns 5-6 will be left blank for each succeeding case, whereas it will contain -1 for the first case. In that event, even though a new complementary solution file may have to be constructed for each case, the initial approximation will be taken from the last buckling mode estimate of the last preceding case. In general, this will reduce the number of iterations for convergence from that required if the program generated initial approximation is used. Column 78 allows in the same way the buckling mode data saved as permanent files from files TAPE8 and TAPE11 of a previous run to be used as the initial approximation for the current case. To do so, the permanent files representing TAPE8 and TAPE11 from the previous run should be reattached to files TAPE8 and TAPE11 and purged so that write access to these files is made available. Then a 3 in column 78 will cause the initial approximation for each harmonic to be the last buckling mode estimate of the corresponding harmonic of the previous case, according to their position in a list of harmonics ordered by magnitude. Thus, for example, the initial estimate for the third harmonic will be the third harmonic component of the buckling mode estimate of the previous case, regardless of wave number. If the current case contains more harmonics than the pervious case from which TAPE8 and TAPE11 were saved, the initial approximation for the excess harmonics will be the buckling mode estimate for the last harmonic of the previous case.

Because of the capability afforded by columns 76 and 78, most of the advantages of running cases consecutively in the same run do not exist for SRA 101. One would do so only if forced to by an unduly large turnaround time on his computer system.

Additional cards following the case option card.- Four (five if column 76 of the case option card contains a 1) additional (groups of) cards are required between the case option card and the input tables. Each of these cards has the format 14I5. They prescribe the following data.

(1) The shell output points for both the unit load prebuckling data and buckling mode estimates: On this card(s) the first field gives the number of output points and succeeding fields specify the entry numbers of the output points in increasing order. If the first field is left blank, all entry points will be output points by default.

(2) The rings for which the unit load prebuckling hoop forces are to be output: On this card(s) the first field gives the number of rings for output and the succeeding fields specify the corresponding ring numbers in the order in which they are encountered when the shell meridian is traversed in the order of increasing entry number.* If the first field is left blank, the prebuckling hoop forces will be output for all rings.

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*Rings at branch points are associated with the initial entry of the exiting branch.

(3) The initial and maximum iteration numbers: Only the first two fields of this card are used, the first for the initial iteration number and the second for the maximum allowable iteration number. The run will terminate after the maximum number of iterations if convergence has not already been obtained prior to that point. The initial iteration number should be specified as 1 if a new complementary solution file is to be constructed or a new program generation initial approximation* is to be used. In particular, note that this is the case if column 76 of the case option card contains a 1 and/or column 78 of that card contains a 3.

If both the complementary solution file and the initial approximation are to be taken from that saved from a previous run, then the initial iteration number should be specified as 2 or greater. In this case its actual value is immaterial, the difference of the maximum and initial iteration numbers determining the allowable number of iterations. Also, it is of course necessary to attach the appropriate permanent files to TAPE2, TAPE8, and TAPE11, but write access is required for only TAPE8 and TAPE11. The most common use of this capability is simply the continuation in the current run of a nonconverged iteration process of a previous run.

If the previous run has converged to a critical state through use of a nonzero eigenvalue shift λ_s, it can also be continued in the current run to search for a new critical state with a new value of κ. In order that the complementary solutions are unchanged, however, it is necessary that λ_s be unchanged. Geometrically, we are searching for the critical state on a new line in the A,B plane with the same A-intercept but with a new slope. (cf. discussion of eigenvalue shifting, p. 34).

(4) Prebuckling wave numbers: The first field of this card contains the number (≤ 7) of prebuckling harmonics considered. The succeeding fields give the wave numbers of these harmonics in the order of increasing magnitude.

(5) Buckling wave numbers: The first field of this card(s) contains the number (≤ 25) of buckling harmonics considered. The succeeding fields give the wave numbers of these harmonics in the order of increasing magnitude.

(6) Buckling wave numbers of a previous case: This card is optional and it should be included in the deck only if column 76 of the case option card contains a 1. It is described by paragraph (5) above.

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*If the program generated initial approximation is used, the first true mathematical iteration is labeled as the "second" iteration, i.e., the number of iterations allowed is really one less than the maximum iteration number.

Prebuckling data.- For SRA 101, the unit load prebuckling data deck follows the boundary data cards. The prebuckling data deck consists of subdecks for each component (symmetric or antisymmetric) of each harmonic of the prebuckling state. These subdecks are arranged in the order of increasing wave number. In the case of loading with no axial plane of symmetry, the antisymmetric component subdeck for each harmonic should follow the corresponding symmetric component subdeck. They will automatically be in the proper order if the corresponding prebuckling cases are set up as a sequence of consecutive cases in this order for a single run of SRA 100.

In the special case of n = 0, the symmetric (bending) component and the antisymmetric (torsion) component of the prebuckling state may be obtained simultaneously by SRA 100 (see table I). This occurs if nonzero symmetric loads (e.g., X_3) and nonzero antisymmetric loads (e.g., X_2) are included in the same n = 0 data deck for a single case. In this event only one subdeck (see below) will be produced by SRA 100 for both the symmetric and antisymmetric n = 0 states. Before inputting to SRA 101, this subdeck must be separated into two separate subdecks (as for any other harmonic). This is accomplished by replacing the T_{12} cards (described as type 3 on page 28) by an equivalent number of blank cards to form the symmetric component subdeck, and replacing the T_ϕ, (T_1,T_2) and X_3 cards (described as types 1,2, and 4 on pages 28-29) by equivalent numbers of blank cards to form the antisymmetric component subdeck. This manipulation of the n = 0 prebuckling data deck can be avoided by running on SRA 100 the symmetric and antisymmetric component for this harmonic as two separate cases, as is done for higher harmonics. This is done simply by replacing nonzero antisymmetric loads by zero for the symmetric component case, and replacing nonzero symmetric loads by zero for the antisymmetric component case. The penalty for so doing is that since two cases are being run in place of one, the SRA 100 execution time is increased.

The subdeck for each component state (fig. 8) has been described as the prebuckling data deck created by SRA 100 (p. 28). It is sufficient to note here that: (a) the entry numbers on the ring and normal shell stress resultant cards are ignored by SRA 101, and (b) although the normal pressure cards are used only for live pressure loading (column 34 of the case option card set to 1), they must be included in each prebuckling subdeck in all cases.

Rigid body constraints if buckling harmonics include n = 0 or 1.- If the buckling wave numbers considered include 0 or 1, it is necessary that rigid body constraints be provided for these harmonics, if the existing kinematic constraints do not already imply these constraints (see discussion of rigid body constraints in SRA 100 manual, p. 23). This cannot be done by means of input [B] and [D] matrices since this would produce erroneous boundary conditions for higher harmonics. Instead, column 3 of geometry table cards can be used for this purpose. A 4 in column 3 at an entry corresponding to a force-free boundary will automatically provide translational rigid body constraint. A 6 in column 3 at an entry corresponding to a ring boundary will automatically provide both translational and rotational rigid body constraint. Furthermore, a 4 or 5 in column 3 at a ring boundary will provide the constraint $\xi = 0$ or $v = 0$, respectively, for $n = 0$ and $n = 1$. This is summaried in the table below.

Column 3	Column 5	Rigid body constraint
4	blank	translational
4	1	$\xi = 0$
5	1	$v = 0$
6	1	translational and rotational

It may be noted that specification of artificial rigid body translational constraint for a shell which has none, has no effect on the buckling mode obtained. This follows from the fact that no reaction forces are associated with this constraint. The same is not true for rotational constraint. Consequently, the imposition of artificial rotational rigid body constraint may have some small effect on the buckling mode insofar as the torsional axisymmetric or the first harmonic are important components in the buckling mode. Since this is rarely, if ever, the case for rotationally free shells, one may assume that the specification of artificial rotational rigid body constraint has negligible effect on the buckling mode obtained.*

Output Data

The output data of the program consists of a print-out of the input data and computed results. This print-out is essentially self-explanatory; however, a few clarifying remarks are given below.

For each specified shell and ring output point, prebuckling and buckling data for each harmonic is printed on consecutive lines in the order of increasing wave number. The printed results consist of the sequence of computed buckling mode and eigenvalue estimates. Only the shell displacements ξ,η,v, and χ of each mode estimate are shown. The letter C or S which appears in the heading for each of these variables (and also the prebuckling variables T_1, T_2, T_{12}, X_3, and T_ϕ) refers to cosine or sine amplitudes, respectively. Note that the symmetric components of the buckling mode are cosine amplitudes for ξ,η, and χ and sine amplitudes for v. The reverse is true for the antisymmetric components. If the prebuckling is symmetric, these represent two independent buckling modes computed simultaneously. Otherwise, they are coupled components of a single buckling mode. The absolute magnitude of the values shown is meaningless since the buckling mode is determined only to within an arbitrary multiplicative factor. Corresponding to the two buckling modes for symmetric prebuckling, two eigenvalue estimates LAMDA A and LAMDA S,

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*For some unknown reason, an eigenvalue shift does not eliminate the need for artificial rotational rigid body constraint, as it does for SRA 201.

standing for antisymmetric and symmetric buckling respectively, are printed. The value labeled RE printed alongside the eigenvalue estimate is the relative defference between the last two successive estimates. The iteration sequence is terminated if either: (1) RE of the numerically smaller eigenvalue estimate becomes less than 10^{-N} where N is the convergence index, or (2) the maximum iteration number is reached.

It may be emphasized here that if a nonzero eigenvalue shift λ_s is used, a converged value of LAMDA, say λ_1, corresponds to a critical state with the components $(\lambda_s + \lambda_1\kappa)A$ and $\lambda_1 B$, where A represents the unit load axisymmetric torsionless prebuckling component, B represents the remaining components of the unit load prebuckling state, and κ is the input scaling factor for A. Thus a single point of an interaction curve in the A,B plane has been found.

Sample Problem

In order to illustrate the application of SRA 101 to a practical problem, listings of the input deck and output data are presented in Appendix B (p. 168) for buckling of the 140° sandwich cone of reference 3. The prebuckling state consists of symmetric n = 0 and n = 1 components, the calculation of which has been used as the illustrative problem for SRA 100 (see p. 29). Preliminary runs of SRA 201 using only the axisymmetric part of the prebuckling data indicated critical load factors of 5.22 for n = 6 and -2.77 for n = 2. These suggest that under the combined loading a negative eigenvalue exists (corresponding to buckling under the reversed loading) which is smaller in absolute value than the smallest positive eigenvalue. In order to avoid this negative eigenvalue, it is necessary to employ the eigenvalue shift capability of SRA 101. However, unless one happens to choose the proper combination of λ_s and κ, the critical state obtained by SRA 101 will not have the desired ratio of n = 0 to n = 1 components. As discussed previously, if A represents the unit load n = 0 component and (in this example) B represents the unit load n = 1 component, and λ_1 represents the eigenvalue obtained by SRA 101, then the critical state found will contain $(\lambda_s + \kappa\lambda_1)A$ and $\lambda_1 B$. Only if $\lambda_s + \kappa\lambda_1 = \lambda_1$ will the buckling mode for the loading of interest be obtained. It is therefore clear that when using an eigenvalue shift, several SRA 101 runs have to be made in order to "zero in" on the proper value of κ for and given value of λ_s. In so doing, use can be made of the fact that for a given λ_s, as κ decreases, $\lambda_s + \kappa\lambda_1$ decreases whereas λ_1 increases. This follows from the known fact that the interaction curve in the first quadrant of the A,B plane has a negative slope (fig. 7). If an estimate of λ_1 is available, in this case something less than 5.22, say 5.0, one chooses λ_s to be greater than one-half of this value to avoid the negative eigenvalue, but also less than this value to avoid slow convergence associated with approximately equal and opposite eigenvalues. For the illustrated run λ_s was chosen to be 3.75. Then is estimated from the desired relation $\lambda_s + \kappa\lambda_1 = \lambda_1$, i.e. $\kappa = 1 - \lambda_s/\lambda_1 = 0.25$. In the illustrated run $\kappa = 0.2534$.

The input data deck is formed from the deck used for SRA 100. First, the data cards for harmonics after the first one (in this example, the cards for the n = 1 harmonic) are discarded. Second, the case option card is modified (see fig. 6) and five additional data cards are inserted as shown in the listing (p. 168). Only four shell output points are specified on the first additional card, as this will give sufficient information for the specified nine buckling harmonics to ascertain the degree of mode convergence obtained. The second additional card is a blank card, meaning that prebuckling ring hoop forces are to be output for all rings. On the third additional card, the number of iterations is limited to six, since by saving files TAPE2, TAPE8, and TAPE11 as permanent files, the iteration process can be continued in a subsequent run. On the fourth and fifth additional cards are given the number of prebuckling and buckling harmonics, respectively, and the corresponding wave numbers. Third, the 2 is removed from column 5 of the geometry table card at the second boundary, and the eight rigid body constraint [B], [D], {L} cards are removed. However, since n = 1 is included as a buckling mode harmonic, it is necessary to specify rigid body constraints for this harmonic. This is done by means of a 6 in column 3 of the geometry table card corresponding to the first ring boundary.* Fourth, the mass density and mechanical loads tables have been removed from the deck, although this step is optional. Fifth, the SRA 100 generated prebuckling data deck for the harmonic n = 0 followed by that for the harmonic n = 1 is inserted after the boundary data cards. Finally, the "STOP" card is inserted after the prebuckling data cards to complete the deck.

In the output data listing, all data preceding the heading BUCKLING MODE ESTIMATE represents input data. Note that only the first entry of the wall properties table is printed. This occurs for tables 2, 3, and 4 for SRA 101 when the data for all of these tables is constant over the shell meridian. The first buckling mode estimate shown are the crude program generated quadratic distributions for v and χ. Uncoupled anti-symmetric (LAMDA A) and symmetric (LAMDA S) buckling modes sequences are calculated and shown simultaneously. Although neither one of them has achieved the specified degree of convergence, the run terminates after six iterations as specified. It may be continued in a subsequent run by re-attaching files TAPE2, TAPE8, and TAPE11, saved as permanent files from this run, (with write access to TAPE8 and TAPE11) and changing the initial iteration number in the data deck to 2. This job took 148 seconds of Central Processor time (starting from a relocatable binary form SRA 101) on the CDC 6400 computer.

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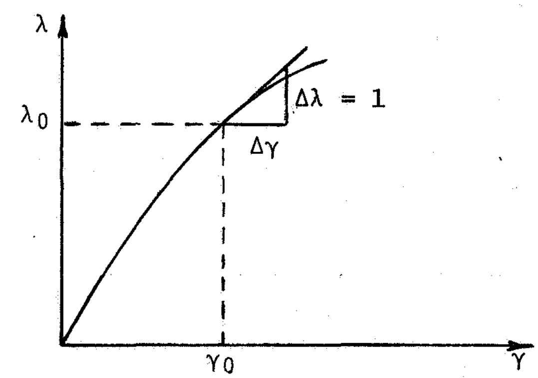
*The first ring was favored over the second ring for this purpose since in the physical problem considered, there is a heavy payload mass attached to it which in effect acts as a rigid body constraint.

SRA 200

SRA 200 computes the nonlinear large deflection (or linear) stress and displacement response to axisymmetric torsionless loads. Mechanical and/or thermal loads are treated, as in SRA 100. In contrast to SRA 100, SRA 200 treats both live and dead pressure loading. The nonlinear response is computed by an iterative process based on Newton's method.

In SRA 200 the load level is controlled by an input load factor λ_0 which multiplies a unit load system. The unit load system is defined by tables 6 and 7, the mechanical and thermal loads included in the ring data, and the {L} vector in the prescribed boundary condition matrices. In SRA 100, this data represents the total loading; in SRA 200 it represents only the unit loading of a proportional load system. The nature of the program can best be described by a plot of load factor λ and any response variable γ as shown in the diagram below.



In this sketch, γ_0 represents the nonlinear response state which is determined for the load level λ_0. The linear perturbation state $\Delta\gamma$ is the incremental response due to a unit incremental load $\Delta\lambda$ at the load level λ_0. The program computes both the γ_0 and $\Delta\gamma$ states. When λ_0 is set equal to zero (and the loading is dead), the linear perturbation state is precisely the SRA 100 solution. In addition, for pure mechanical loading the program computes and prints out the generalized structural stiffness K_0 and its derivative $K_0^{(1)} = (dK/d\lambda)_0$ at the specified level λ_0. Here, K is simply the slope $d\lambda/d\gamma$ where γ now represents the special deflection which has the property that the area under the λ-γ curve equals the work of the external loads (or equivalently the strain energy stored).

It may be noted that as the load λ_0 approaches a limit load λ_c, for which $d\lambda/d\gamma = 0$, the rate of convergence of Newton's method decreases, and when $\lambda = \lambda_c$ the method diverges. An extrapolation for the limit load may be obtained from the results of SRA 200 through use of the approximate formula

$$\lambda_c \simeq \lambda_0 - K_0/2K_0^{(1)}$$

for which the error diminishes as λ_0 approaches λ_c.

Input Data

The input data is practically identical to that for axisymmetric torsionless loading in SRA 100, with the following exceptions: (1) the case option card is modified, (2) if available, an initial approximation state is input, (3) the use of column 3 of table 1 is slightly different.

It should be noted that input data which is not required in the axisymmetric bending solution, viz. E_{12}, k_2, NGJ, X_2, EI_x, EI_{xy}, GJ, F_ϕ, N_x, and N_y, is ignored by the program. The format of the cards which normally give this data is, however, unchanged so that these cards can be used interchangeably with the other programs.

Corresponding to the reduced order of the equations for axisymmetric bending, boundary conditions for SRA 200 are specified in terms of the reduced force vector $\{y\} = \{P, Q, M_1\}$ and the reduced displacement vector $\{z\} = \{\xi, \eta, \chi\}$. Thus, in reality, input [B] and [D] matrices are only 3x3 matrices and {L} is a 3x1 matrix. In order that the eight cards giving prescribed [B], [D], and {L} matrices for the other programs may be used without modification, the third and seventh card as well as columns 25-36 of the remaining cards are ignored by SRA 200. Note that columns 25-36 give for the other programs the coefficients of ΔS and v in the boundary equations. In order that the desired interchangeability of prescribed [B], [D], {L} cards (for the case n = 0) be effected, the relationship between ΔS and v should be set up for the other programs as the third boundary equation.*

Case option card.- This card differs from the case option card of SRA 100 only as follows (fig. 9):

(1) a 2 is not used in column 20 since new complementary solutions are always required for each Newton iteration.

(2) No harmonic number is input, i.e., columns 21-23 are left blank.

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*Note that the only rigid body constraint required for SRA 200 is $\xi = 0$.

(3) Column 28 is used to indicate the initial approximation to be used in the Newton iteration for the nonlinear solution.

(4) Since only axisymmetric torsionless response is treated, rotational rigid body modes are excluded. Thus column 30 should be blank or contain a 1.

(5) A convergence index N for the Newton iteration is input in column 32. The relative difference between the rotation field χ for the converged iteration step and the preceding one will be uniformly less than 10^{-N}, i.e., they will agree essentially to N significant digits. If this column is left blank, N is automatically taken to be 4.

(6) The extra option of a live pressure field is included in the indicator specified in column 34. In contrast to SRA 201, SRA 202, and SRA 300 the effect of pressure gradients associated with the pressure field have not been included in this program.

(7) The load factor λ_0 at which the nonlinear state is computed is input in columns 36-47. If left blank, only the linear solution will be calculated. In this case, column 28 should contain a 2.

(8) Column 76 is used as a flag to create the additional prebuckling data deck (see p. 46). This data is used only by the postbuckling program SRA 202.

Initial approximation state.- If column 28 of the case option card contains a 1, a group of cards representing an initial state for the Newton iteration is input between the "nine" card (which terminates the table data) and the boundary data. This set of cards is merely the standard prebuckling data deck obtained from a previous SRA 200 run (see p. 45).

If SRA 200 has been run at one load level, and the response is desired at a neighboring load level, then the prebuckling state data from the first load level should be used to obtain the initial approximation for the second load level. Thus, in a sequence of problems, in which only the load level changes, for each case after the first, column 28 of the case option card should be left blank, as should also columns 6, 8,...,20.

In general, when no initial approximation state is available, a 2 is punched in column 28 of the case option card. In this case, the first iteration will be simply the solution of the linearized equations.

Use of column 3 of table 1.- In SRA 200, this column has two purposes: (1) to specify a symmetrical ring at a plane of symmetry when analyzing only one-half of a symmetrical structure, and (2) to specify real axial translational fixity at a ring.

Symmetrical ring at a plane of symmetry: In the case of linearized shell equations antisymmetrical loading about a symmetry plane leads to antisymmetrical response. In this case, a 9 is punched in column 3 of table 1 at the symmetry edge in the data deck for SRA 100 (see p. 21). In the nonlinear case, however, the response to an antisymmetric loading contains both antisymmetric and symmetric components. Therefore, in this case, the complete shell, instead of the half shell, must be modeled, and, consequently, the indicator 9 in column 3 of table 1 is not used for SRA 200 unless $\lambda_0 = 0$. The use of an 8 in column 3 of table 1 to specify symmetrical response is the same as for SRA 100.

Axial fixity at a ring: If real axial fixity ($\xi = 0$) exists at a ring, this may be specified simply by putting a 1 in column 3 of the corresponding geometry table card. This option should not be used to specify artificial rigid body constraint in the case of a free structure, since the ring inertial loads would then be improperly treated.

Output Data

Printed output.- The output data format is essentially the same as that for SRA 100 with the following exceptions:

(1) Input data not required in the axisymmetric bending solution is not output.

(2) For nonuniform live pressure fields, the axial and radial pressure derivatives X_{3x} and X_{3y} are required by SRA 201, SRA 202, and SRA 300. For these programs they are input in E12.4 format in columns 49-60 and 61-72, respectively, of table 6 cards. Although their effect is neglected by SRA 200, X_{3x} and X_{3y} are included in its output of the mechanical loads table.

(3) A sequence of maximum relative differences in the calculated meridional rotation fields of the last two iterations is printed.

(4) Tables of shell forces (P, Q, M_1), displacements (ξ, η, χ) and normal displacement (w), stresses (σ_s, σ_ϕ, σ_{sz}, σ_{st}) are printed for both the nonlinear state, γ_0, and the linear perturbation state $\Delta\gamma$.

(5) In the nonlinear state force-displacement table, both the meridional rotation χ of the final iteration and the meridional rotation χ_1 of the previous iteration are printed, since the convergence test is made on these values.

(6) The column labeled χ_1 in the corresponding linear perturbation state table should be ignored. (It contains simply the χ-values of the nonlinear state).

(7) If thermal loads are not input or column 76 of the case option card contains a 1, then the prebuckling stiffness K_0 and its derivative $(dK/d\lambda)_0$ at the input load level λ_0 are printed. These are printed after the stress table for the linear perturbation state and complete the printed output.

Optional output.- As for SRA 100, SRA 200 creates optional output files of prebuckling data and stresses, depending on columns 73, 74, and 76 of the case option card. The primary shell stresses σ_s and σ_ϕ are written on the PUNCH file in the same format as for SRA 100 (p. 29). However, for the sake of convenience, the prebuckling data, which here consists of a standard part required by SRA 201 and SRA 202 and an additional part which is optional input for SRA 202 only, is written on logical unit 7. This file may then be manipulated as file TAPE7 by user control cards.

Standard prebuckling data: Normally, when $\lambda_0 \neq 0$, this data consists of two basic parts: (1) nonlinear state data at the load level λ_0, followed by (2) linear perturbation state data at λ_0. The nonlinear state data consists of four groups of cards in the order given below:

(1) a single card containing the load level λ_0 and a live load indicator (given in column 34 of the case option card) in the format 1PE12.4, I2,

(2) ring stress resultant cards: [no. of rings/6] cards written. Each card, except possibly the last, contains six consecutive ring boundary numbers and the corresponding hoop forces T_ϕ in the format 6 (I2, 1PE11.4). The rings are ordered in the direction of increasing entry number.

(3) shell stress resultant cards: [max. entry no./3] cards written. Each card, except possibly the last, contain three consecutive entry numbers and the corresponding pairs of stress resultants (T_1, T_2) in the format 3 (I2, 1P2E11.4).

(4) meridional rotation cards: [max. entry no./6] cards written. Each card, except possibly the last, contains six values of χ at six consecutive entry points in the format 1P6E12.4.

The linear perturbation state data is represented by cards of types (2), (3), and (4) above in the same order and format but with the state variables at λ_0 being replaced by their derivatives with respect to λ at λ_0. If $\lambda_0 = 0$, only the linear perturbation state cards are produced.

Additional prebuckling data: Normally, when $\lambda_0 \neq 0$, this data, which follows the standard prebuckling data, is composed of four parts, all of whose variables are evaluated at λ_0, in the order given: (1) nonlinear and perturbation out-of-plane ring bending moments (M_y, $\partial M_y/\partial\lambda$), (2) nonlinear and perturbation shell bending moments (M_1, $\partial M_1/\partial\lambda$, M_2, $\partial M_2/\partial\lambda$), (3) the second-order perturbation state ($\partial^2 T_\phi/\partial\lambda^2$, $\partial^2 T_1/\partial\lambda^2$, $\partial^2 T_2/\partial\lambda^2$, $\partial^2\chi/\partial\lambda^2$), and (4) the prebuckling stiffness and its derivative (K, $\partial K/\partial\lambda$). The number and format of these cards are summarized below.

(1) Ring bending moments: [no. of rings/4] cards written. Each card, except possibly the last card, contains 4 pairs (M_y,$\partial M_y/\partial\lambda$) of ring moments for four consecutive rings in the format 1P8E10.3.

(2) Shell bending moments: [max. entry no./2] cards written. Each card, except possibly the last card, contains 2 quadruples (M_I,$\partial M_1/\partial\lambda$,$M_2$, $\partial M_2/\partial\lambda$) of shell bending moments at two consecutive entry points in the format 1P8E10.3.

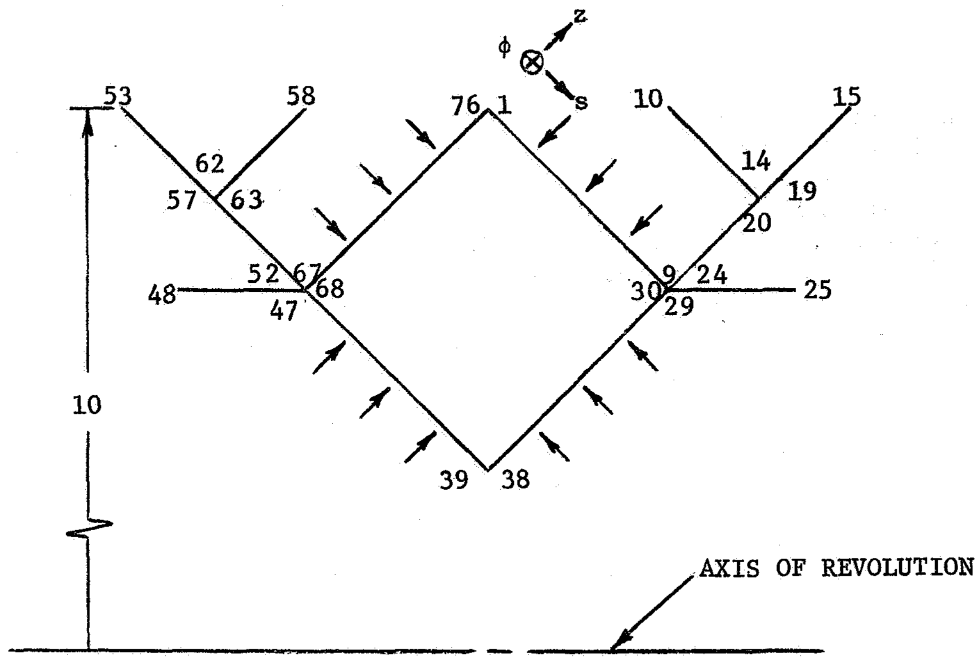
(3) Second-order perturbation state: This set of cards is completely analogous to the linear perturbation state deck discussed above with second derivatives with respect to λ replacing the corresponding first derivatives.

(4) Structural stiffness card: This is a single card with K and $\partial K/\partial\lambda$ in the format 1P2E12.4.

If $\lambda_0 = 0$, the second order perturbation state is null and is omitted from this output.

Sample Problem

In order to illustrate the shell branching capability of the SRA programs, a structure was contrived for use as a sample problem for SRA 200 (and the remaining programs). This shell consists of a closed branch with open branches off of it, set up so that the structure has a plane of symmetry normal to the axis of revolution. A diagram of its meridian with corresponding entry numbers is shown below.



All six edges are assumed to be force-free. Interior boundaries at entries 30 and 68 have identical attached rings, whereas all others are force-free. The loading consists of uniform dead external pressure on the closed branch.

In actual practice, only one-half of this structure, from entry 1 to 38, would be modeled with symmetry conditions ($\xi = \chi = \Delta Q = 0$)* specified at the artificial edges at entries 1 and 38. The complete shell is modeled here for illustrative purposes only, and was chosen so that solution of the half-shell would provide an absolute check of the results.

Input and output data listings for this structure are shown in Appendix B (p. 180). Note the 1 in column 4 of the case option card signifying a closed branched shell. A nonlinear load level of unity (i.e., a pressure load of 100 psi, assuming pound-inch units, as given by table 6) was arbitrarily chosen (col. 38). The 1 in column 73 will cause the standard prebuckling data to be written on file TAPE7. In order to use this data in a buckling run, it is necessary to either copy this file to PUNCH or save it as a permanent file.

The linear segments of the meridian between boundaries required by branch points and discontinuities in slope were chosen short enough so that no additional boundaries are required. Note that column 6 of geometry cards at the final entries of subintervals terminating at branch points contain the corresponding branch point numbers. Branch point numbers have

*These conditions may be input directly as prescribed [B], [D], and {L} matrices or indirectly through use of a symmetrical null ring (i.e., with zero stiffness, eccentricity relative to the reference surface, and load).

been assigned (at the user's option) in the order they are first encountered when the meridian is traversed in the direction of increasing entry number.

Although this structure has rigid body freedom, it is obvious that the applied loading is self-equilibrating. Therefore, it is unnecessary to specify rigid body freedom in column 30 of the case option card. However, it is still necessary to provide artificial rigid body constraint ($\xi = 0$), which is done at the final boundary, i.e., the closure point. Note that the third and seventh cards of this boundary data, which specify $v = 0$, are ignored by SRA 200.

In the output data listing, all data preceding the statement ITER = 2 represents input data. In this and the next row ITER is the Newton iteration number, and MAX. REL. ERR. is the maximum relative difference in the last two calculated meridional rotation fields. Thus, this solution converged to the required four digits (specified by default, column 32 of the case option card) in three iterations. Following are tables of shell forces and displacements, and shell normal displacement and stresses for both nonlinear and linear perturbation states, as described previously. Note that for both the nonlinear and linear states, the elastic part of the axial displacement field (the difference of ξ at two different points) has been masked by the superposition of a relatively large rigid body displacement. As noted in the footnote on page 23, this occurs when the rigid body constraint is specified at the closure point of a closed branch. There is no loss of numerical significance in the remaining part of the solution. Also, the appearance of this undesirable rigid body displacement can be suppressed by specifying the rigid body constraint on an open branch. The structural stiffness K_0 and its derivative $K_0^{(1)}$ are the final printed output. It may be noted that K_0 and $K_0^{(1)}$ do not have unique values for the nonlinear equilibrium state obtained. Their scale depends on the choice of the unit load system. For example, if a unit pressure field of 1 psi were used with a load factor of 100 to obtain the same equilibrium state, K_0 would be larger by a factor of 100^2 and $K_0^{(1)}$ would be larger by a factor of 100. In general, if the unit load system is changed by a factor C, then for a given nonlinear state K_0 changes by the factor $1/C^2$ and $K_0^{(1)}$ by the factor 1/C. This job took 10 seconds of Central Processor time (starting from a relocatable binary form of SRA 200) on the CDC 6600 computer.

SRA 201

This program is used to determine asymmetric (harmonic) buckling modes of axisymmetric torsionless prebuckling states. The prebuckling states may be computed by SRA 200 and saved as a permanent file. This data file is denoted as the standard prebuckling data in the SRA 200 user's manual. It is inserted in the SRA 200 data deck, which then, with some minor modifications, becomes the data deck for SRA 201.

Geometrically speaking, the method used consists of seeking bifurcation of fictitious equilibrium states on the tangent to the nonlinear load-deformation curve at a load level λ_0 (used in the prebuckling SRA 200 run). A sequence of eigenvalue estimates $\mu_{(k)}$ is obtained by a Stodola-type iteration whose limiting value μ_1 (plus the eigenvalue shift, μ_s, if used) represents the difference between the critical load estimate λ_1 and λ_0. If this difference is not too large, so that the linearization of the prebuckling response between λ_0 and λ_1 is a good approximation, then λ_1 will be a good approximation to the desired critical load. To test this assumption, in general one has to recompute the prebuckling state, using SRA 200, at a new value of λ_0 closer to λ_1, and then compute a new value of λ_1. If the change in λ_1 is insignificant, λ_1 is accepted as the true critical load for buckling in the harmonic considered.

For a given λ_0, SRA 201 may be run with a sequence of cases in search of the harmonic which yields the minimum eigenvalue, each case corresponding to buckling in a different harmonic. The values of λ_1 obtained are estimates of critical values of the load factor λ in the vicinity of the value λ_0.

For each harmonic, as many as four modes may be requested. The eigenvalues, $\mu_s + \mu_1$, obtained by the program will be the ones nearest to the input eigenvalue shifts, μ_s, which may be input separately for each of eigenvalues requested. In general, the eigenvalues, μ_1, will be the smallest eigenvalues in absolute magnitude for the specified harmonic, obtained in the order of increasing magnitude. More than one eigenvalue may be required, for example, if the smallest one is opposite in sign to that being sought. Further aspects of eigenvalue shifting are discussed below.

Input Data

The SRA 201 input deck is normally constructed from the SRA 200 input deck and the standard prebuckling data deck created by SRA 200 when column 73 of the case option card of the SRA 200 data deck contains a 1.* The following steps should be taken in constructing the SRA 201 data deck:

(1) Insert the standard prebuckling data deck (fig.10) as a unit between the "nine" card (following the input tables) and boundary data cards.

(2) Since tables 5 and 7 are not used by SRA 201, they may be removed from the SRA 200 deck. However, this step is optional, and if present, these tables will be ignored by the program.

(3) In the case of a nonuniform live pressure field, table 6 should contain the pressure derivatives X_{3_x} and X_{3_y} in E12.4 format in columns 49-60 and 61-72, respectively. In order to avoid overlooking this step, it is suggested that this data be included in table 6 cards at the time of original preparation.

(4) Modify the case option card (see below).

(5) Remove any artificial rigid body constraint which may have been imposed in the SRA 200 run. Generally, this is done by blanking column 5 of the appropriate card in table 1 and removing the corresponding set of eight boundary data cards from the deck. The cases of n = 0 or 1 require special consideration with respect to rigid body constraints and they are discussed further below.

(6) For a structure with a plane of symmetry normal to the axis of revolution, both symmetric and antisymmetric buckling modes exist. For an efficient solution, only one-half of such a structure should have been modeled in setting up the SRA 200 run, with symmetry conditions imposed at the artificial edge(s). If an antisymmetric mode is desired, it is necessary to: (a) change the 8 in column 3 of the geometry table card at a symmetrical ring boundary to a 9, and/or (b) change prescribed boundary conditions at a symmetry edge from $\xi = \Delta Q = \chi = 0$ to $\Delta P = \eta = v = \Delta M_1 = 0$.

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*For idealized problems using a membrane prebuckling state, it may be convenient to construct the standard prebuckling data deck by hand.

E

Case option card.- This is similar to the case option card for SRA 200 and is required for each case (fig.11). Columns which have different meanings from those of SRA 200 are discussed below.

Column 16 contains the indicator for the unit load pressure field table, i.e., table 6 from the SRA 200 run with the pressure derivatives X_{3x} and X_{3y} included in columns 49-60 and 61-72, respectively. SRA 201 uses the pressure gradient only in the case of a nonuniform live pressure field, and uses the pressure X_3 only in the case of a live pressure field or surface loading applied off of the reference surface. If neither of these cases is being considered (as determined by column 34 of the SRA 200 case option card), removal or retention of table 6 in the SRA 201 data deck is optional. Also, in this case the value of column 16 will not affect the run.

Columns 17-18 contain the indicator for the prebuckling state data. If these columns contain -1, SRA 201 will expect only the linear perturbation state part of the standard prebuckling data deck, i.e., the deck produced by SRA 200 when the nonlinear load level λ_0 is input as zero. In this case, the nonlinear prebuckling state will be set to zero, and dead loading applied at the reference surface will be assumed. Thus, this option is for studying buckling of linear states calculated by SRA 200 when columns 34 through 47 of its case option card are left blank.

Columns 21-23 contain the harmonic number (i.e., circumferential wave number) of the buckling mode to be obtained.

Column 26 contains the number of modes (≤ 4) to be obtained. If more than one mode is specified, an extra card should be inserted in the deck immediately following the case option card, giving the eigenvalue shifts for the modes after the first. The format of this card is 3(E12.4) so that the eigenvalue shift for the second mode is punched in columns 1-12, for the third mode in columns 13-24, and for the fourth mode in columns 25-36. If the shift for a higher mode in input as zero (i.e., the corresponding columns left blank), the shift left over from the previous mode will be used.

In the case of axisymmetric buckling ($n = 0$), the bending and torsional modes are uncoupled. Which of these modes is desired is specified in column 28.

Column 30 is similar to column 30 of the case option card of SRA 100. It applies only in the cases $n = 0$ or 1, and then only if the eigenvalue shift and the nonlinear load factor λ_0 are zero (see p. 53).

Column 32 gives the number of significant digits desired in the eigenvalue μ_1. Thus, if the critical load is λ_1, the eigenvalue shift is μ_s, and the nonlinear load level is λ_0, then column 32 specifies the number of significant digits in the difference $\mu_1 = \lambda_1 - (\lambda_0 + \mu_s)$, to which the computed sequence of eigenvalue estimates converges. If column 32 is left blank, four significant digits will be assumed.

Columns 36-47 contain the input eigenvalue shift for the first mode to be obtained. A shift may be input when one has some prior knowledge of the result to avoid a negative eigenvalue (since convergence is always to the eigenvalue closest to the shifted origin) or to speed up convergence (since the rate of convergence depends on the ratio of the two closest eigenvalues measured from the shifted origin). If a value greater than 10^{38} is used in columns 36-47, the eigenvalue shift left over from the previous case will be used. In a sequence of cases, this value may be unknown at the time of input since the program may make automatic shifts in order to speed up convergence.

Column 73 is used for punching the buckling mode data for the imperfection sensitivity program SRA 202.

Column 74 is used to punch the modal displacements u, v, and w.

As mentioned previously, the program has the capability during the calculation to make an automatic eigenvalue shift. This will occur if: (1) the convergence rate is too slow, (2) $\mu_2 + \mu_s$ (μ_2 being the eigenvalue which is controlling the rate of convergence to μ_1) has the same sign as $\mu_1 + \mu_s$ but is smaller in absolute value, or (3) if $\mu_2 + \mu_s$ has the opposite sign as $\mu_1 + \mu_s$ but has the same sign as μ_s. In the first case, a shift is made to the vicinity of $\mu_1 + \mu_s$, whereas in the last two cases a shift is made to the vicinity of $\mu_2 + \mu_s$. Automatic eigenvalue shifting may be suppressed by inserting a 1 in column 75.

In a sequence of cases in which the shell geometry is unchanged, the initial approximation in the iteration for the first mode of each case after the first will be taken as the last mode converged to in the preceding case if column 77 is left blank. If a 1 is inserted in column 77, this is suppressed and the same crude approximation (quadratic variation of v and χ) as used for the first case is used. In the cases n = 0 or 1 when column 30 is not blank, the rigid body modes are computed directly, and the initial approximation for first elastic mode is never taken from the preceding case.

A common use of SRA 201 is to compute the buckling modes for several different harmonic numbers of a given structure and prebuckling state in a single pass through the computer. This is accomplished by stacking several cases in sequence. For each case after the first, only three data cards are required. These are the title card, case option card, and the "nine" card to signify that no more input tables are to be read.

<u>Buckling in the harmonics $n = 0$ and 1</u>.- If the structure possesses rigid body degrees of freedom, it may be necessary, in the cases $n = 0$ and 1, for the user to specify artificial rigid body constraints, as well as observe other special rules. In the case of static prebuckling analysis by SRA 100 or SRA 200, shells with rigid body degrees of freedom are treated by the use of artificial rigid body constraints and the internal generation of equilibrating inertial forces. For the buckling (and vibrations) program, the situation is analogous to the prebuckling programs only if the eigenvalue shift μ_s and the nonlinear load level λ_0 are both zero.* The precise treatment of rigid body degrees of freedom depends on whether or not the following loading condition is satisfied:

(A) The shell is loaded by a live nonuniform pressure field λX_3 such that:

(a) if $n = 0$, $r'X_{3x}$ is not identically zero, or

(b) if $n = 1$, $(r/R_2)X_{3y}$ is not identically zero.

Condition (A) satisfied: If condition (A) is satisfied and either λ_0 or μ_s is nonzero, then the harmonics $n = 0$ and 1 are treated no differently than other harmonics, i.e., artificial rigid body constraints and column 30 of the case option card are not used.

On the other hand, if both $\lambda_0 = \mu_s = 0$, sufficient artificial rigid body constraint(s) must be specified to eliminate the rigid body freedom and the appropriate value placed in column 30 of the case option card. These artificial displacement conditions should be prescribed at a force-free boundary† instead of specifying that the external force or moment resultant is zero (see p. 23). For example, the boundary conditions $\xi = \Delta Q = v = \Delta M_1 = 0$ would provide both translational and rotational

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*Mathematically, nonzero λ_0 or μ_s eliminates rigid body degrees of freedom for SRA 201 much as an elastic foundation would for SRA 100.

†As discusses previously, boundaries on a closed branch other than the closure point, are excluded from this use (see p. 22).

constraints at a force-free boundary for both n = 0 and n = 1. The resultant force and moment reactions which are left unspecified will turn out to be negligibly small.

In order that the program recognize artificial rigid body constraints, which must be removed if an automatic eigenvalue shift is made during execution, it is necessary to specify in column 3 of the corresponding card in the geometry table the type of artificial constraint prescribed. Also, only certain rows of the [D] matrix should be used for these constraints. In the special case of n = 1 buckling of a shell with only rotational rigid body freedom, in order that the proper rigid body mode be computed, it is also necessary to observe a similar rule for the real translational constraint. These rules are summarized in the table below.

	Constraint	Col. 3	Applicable Rows of [D] n = 0	Applicable Rows of [D] n = 1
Real	translational	1	any	2nd
Artificial	translational	4	1st	2nd
Artificial	rotational	5	3rd	4th
Artificial	both	6	1st & 3rd	2nd & 4th

Note that the 1 is used in column 3 only if the constraint eliminates only one degree of rigid body freedom and the reaction is a pure force resultant, in which case the constraint equation involves only η and/or v, or a mixed resultant, in which case the constraint equation involves ξ and/or χ as well as η and/or v.

Condition (A) unsatisfied: If condition (A) is unsatisfied and either λ_0 or μ_s is nonzero (probably the most common case), artificial rotational body constraint and column 30 of the case option card are not used. However, translational rigid body constraint, whether actual or artificial, must be provided at some boundary. Translational rigid body constraint in this case has no effect on the solution as no reaction will be produced by it.

If both $\lambda_0 = \mu_s = 0$, a translational rigid body mode (i.e., a 1 or 3 in column 30 of the case option card) should not be specified even if the physical structure has translational rigid body freedom. In all other respects this case should be treated the same as when condition (A) is satisfied.

Output Data

Printed output.- The output data of the program consists of a print-out of the input data and computed results. Since the print-out of the input data is self-explanatory, a discussion of it is unnecessary.

For each elastic mode obtained the following results are output in the order listed:

(1) the convergent sequence of eigenvalue estimates, $\mu_{(k)}$, obtained in the iteration process, including eigenvalue shifts at the point they were made (the first one, which precedes the μ-sequence, being the input value and the remaining ones being automatic shifts),

(2) the next to last and the last estimates of normalized force {y}and displacement {z} modal amplitudes as functions of s (corresponding to the last two eigenvalue estimates),

(3) the corresponding critical load λ_1, and

(4) a table of meridional (u), circumferential (v), and normal (w) modal displacement as functions of s.

Numerical convergence is obtained when the relative difference between two successive estimates is less than 10^{-N}, where N is the convergence index specified in column 32 of the case option card. It is noted that not only is the μ-sequence convergent but also the ratios of successive differences of this sequence form a sequence which is convergent to the square of the ratio of the next larger eigenvalue μ_2(for the same value of n) to the one being sought. This fact allows, in many cases, a hand calculation of a rough estimate of $|\mu_2|$ from the calculation of μ_1.* This secondary convergence is used to correct the last eigenvalue estimate obtained by the amount $-\Delta/(\rho - 1)$ to give μ_1 before computing $\lambda_1 = \lambda_0 + \mu_s + \mu_1$, where Δ is the difference between the last two estimates and ρ is the last ratio of successive differences.

The harmonic amplitudes of normalized modal forces P, Q, S, M_1 and displacements ξ, η , v, χ are printed out at each discrete input or interpolated value of s. The next to last as well as the last (best) estimate of the eigenmode is printed so that the degree to which the mode has converged may be checked. In general, the mode will have converged uniformly to roughly half as many significant digits as the eigenvalue.

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*In general, for SRA 201, the μ-sequence does not reveal the sign of μ_2. If the initial equilibrium state is stable with respect to buckling in the harmonic considered and $\mu_s = 0$, then it can be shown that for large k, $|\mu_{(k)}| > |\mu_{(k+1)}|$.

The buckling mode is normalized so that the maximum value of its normal displacement w is unity. The table of u, v, w displacement amplitudes is derived from the last eigenmode table simply from the relations, $u = (r/R_2)\xi + r'\eta$, $v = v$, and $w = -r'\xi + (r/R_2)\eta$.

Rigid body modes, if specified in column 30 of the case option card, are considered to be the lowest modes of the structure since their critical load is zero. Thus, for example, if for n = 1 a 3 is used in column 30 and three modes are specified in column 26 of the case option card, only one elastic mode will be computed along with two rigid body modes. The printed output for rigid body modes is simply the modal displacement amplitudes $\{z\}$ at each discrete value of s (the corresponding force amplitudes $\{y\}$ are identically zero), followed by a statement that the corresponding critical load is zero.

Optional output.- The program will punch two types of buckling mode data depending on columns 73 and 74 of the case option card. If column 73 contains a 1, the buckling mode data deck required by SRA 202 is created. The first card of this deck gives the following three quantities:

(1) the harmonic number n of the buckling mode in the first six columns in the format I6,

(2) an indicator, applying only in the (unusual) case n = 0, in column 12; if 1, indicating a bending buckling mode; if 2, indicating a torsional buckling mode,

(3) the difference between the bifurcation load level and the nonlinear prebuckling state load level, $\lambda_1 - \lambda_0$, in columns 13-24 in the format 1PE12.4.

The remaining cards of this deck give the values of the fundamental variables P, Q, S, M_1, ξ, η, v, χ of the buckling mode at each entry point. The number of these cards equals the maximum entry number, and each card gives all eight values for each point in the format 1P8E10.3.

In column 74 contains a 1, a punched deck is produced which is a replica of the u, v, w printed output table. Each card contains the entry number, s, u, v, and w in that order in the format I5, 1PE13.4, 3E18.4. If both columns 73 and 74 contain 1, then this data deck will be punched first.

Sample Problem

The illustrative problem for SRA 201 is a n = 2 buckling analysis of the branched shell described as the illustrative problem for SRA 200. Thus the standard prebuckling data deck obtained in that run is part of the input deck for this case.

Input and output data listings for this problem are shown in Appendix B (p. 204). The input data deck is formed from the deck used for SRA 200. First, the case option card is modified in accordance with figure 11. Because of proximity of the eigenvalues corresponding to antisymmetric ($\lambda_1 = 49.9$) and symmetric ($\lambda_2 = 54.2$) modes, the deck was set up with an eigenvalue shifts which greatly speeds up convergence. This value, 48.8, is shown in columns 38-41 of the case option card. In actual practice, when analyzing a shell with a plane of symmetry, only one-half of the structure would be modeled, thereby automatically decoupling antisymmetric and symmetric modes. The 1 is placed in column 73 of the case option card in order to punch the buckling data deck required by SRA 202. Second, the artificial rigid body constraint is removed by blanking column 5 of the final card of the geometry table and removing the corresponding eight cards from the boundary data. Finally, the standard prebuckling data deck from the SRA 200 run is inserted as a unit between the "9" card and the boundary data cards.

In the output data listing, all data preceding the statement NORMALIZED DETERMINANT OF TERMINAL POINT MATRIX = 1.4838E-06 represents input data. This diagnostic is printed when this normalized determinant (i.e., the determinant divided by the product of its diagonal elements) is less than 10^{-5}. The terminal point matrix becomes singular as μ_s approaches $\lambda_1 - \lambda_0$. This is in accordance with the fact that if the eigenvalue μ_1 is zero, then the system of buckling equations itself (which the terminal point matrix represents) is singular. In the problem shown, $\mu_s = 48.8$ and $\lambda_1 - \lambda_0 = 48.9$. Since a loss of significance occurs if this determinant is too small, one cannot set the eigenvalue shift μ_s as close as one pleases to the difference $\lambda_1 - \lambda_0$. As shown in the listing, the solution converged to the required four digits (specified by default in column 32 of the case option card) in three iterations. Following are the last two buckling mode estimates, the critical load, and the displacement amplitudes of the final mode estimate in shell coordinates, as described previously. This job took 18 seconds of Central Processor time (starting from a relocatable binary form of SRA 201) on the CDC 6600 computer.

SRA 202

This program is used to determine the initial postbuckling behavior and imperfection sensitivity of unique harmonic bifurcation buckling modes of axisymmetric torsionless prebuckling states. The buckling mode data may be computed and punched on cards by SRA 201. This data deck is inserted into the SRA 201 data deck, which then, with some minor modifications, becomes the data deck for SRA 202.

The program is based on Koiter's first-order imperfection theory, which predicts the buckling load knockdown λ_s/λ_c due to a small imperfection in terms of the second postbuckling coefficient b and an imperfection functional α. This relationship is shown in figure 12, which is reproduced from reference 4. Figure 12 also includes the effect of a second imperfection functional β, although as noted in reference 4, the inclusion of β as calculated by SRA 202 is not a complete second approximation. Essentially, SRA 202 solves the differential equations for the second-order contribution to the buckled state, which consists of an axisymmetric component and a harmonic component with twice the number of circumferential waves as the buckling mode. From this it computes the value of b, a negative value of which indicates an imperfection-sensitive structure, to which figure 12 applies. The imperfection analysis is based on a mean square angular imperfection measure ξ^2, which includes imperfections of both shell and rings. Values of α are computed by SRA 202 for both the imperfection shape which produces the greatest reduction in buckling load (i.e., maximum value of α) and the imperfection shape proportional to the buckling mode displacements. As an option, the values of β and the initial postbuckling stiffness K* also are computed by the program. Using the calculated values of b, α, and β, one may estimate from figure 12 the effect of small imperfections on the buckling load.

Input Data

The SRA 202 input deck is normally constructed from the SRA 201 input deck and the buckling mode data produced by it when column 73 of the case option card of the SRA 201 data deck contains a 1. The following steps should be taken in constructing the SRA 202 data deck:

(1) If K* and β are not to be computed, the case option card from the SRA 201 run will serve, without modification, as the case option card for SRA 202 (fig. 13), since the unnecessary data on it will simply be ignored. On the other hand, if K* and β are to be computed, a 1 should be punched in column 76 of the case option card. In this case, the additional prebuckling data deck (fig. 14), created by SRA 200 when its case option card contains a 1 in column 76, should be inserted to follow

immediately after the standard prebuckling data deck.*

(2) Insert the buckling mode data deck (fig. 15) between the prebuckling data deck and the boundary data cards.

(3) It may be necessary to specify n = 0 artificial rigid body constraint. Column 3 of geometry table cards is used for this purpose. This use of column 3 depends on the following two conditions:

(A) The shell loading includes live normal pressure with $r'X_{3x}$ not identically zero. This is the same as condition (A) defined in the SRA 201 manual for the case n = 0.

(B) The quantity $(r')^2T_1 + T_2 - (r^2/R_2)\lambda_c X_3$ is identically zero. For dead loading the last term of the above expression is omitted. Here T_1 and T_2 are prebuckling stress resultants at the ctitical load λ_c. Note that in many cases neither condition is satisfied [condition (B), e.g., is satisfied for a membrane prebuckling state of a cylinder with live normal pressure loading].

The rules concerning this use of column 3 are the following:

(i) If condition (A) <u>is not</u> satisfied, then axial rigid body constraint is required at some boundary.† This may already be supplied by the real constraint $\xi = 0$, if it exists. However, if not¶ (e.g., all boundaries may be ring, dome, or force-free boundaries), then for some boundary free of axial force the corresponding geometry card should contain a 4 in column 3. Furthermore, it is essential that at that boundary the <u>first</u> boundary condition (corresponding to the first row of [B] and [D]) should be $\Delta P = 0$, as is the case for an internally generated force-free boundary. Note that a force-free boundary can always

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In addition to being necessary for the calculation of K and β, the additional prebuckling data also serves to correct the linear prebuckling perturbation state at λ_0 to the bifurcation load λ_c, thereby improving the evaluation of b and α.

†As noted previously, kinematic constraints cannot be specified at boundaries on a closed branch with the exception of the closure point (i.e., the final entry).

¶Except for a symmetrical ring boundary (an 8 or 9 in column 3), none of the internally generated boundary conditions supply rigid body constraint. For SRA 202, the rigid body constraint provided by a symmetrical ring boundary is always $\xi = 0$, since the second-order component to the buckled state is symmetric even if the buckling mode is antisymmetric (see p. 21).

be made available for this purpose by inserting it as a fictitious boundary when setting up the original deck for the SRA 200 run.

(ii) If condition (B) is satisfied in the first subinterval, then rotational rigid body constraint is required at some boundary. This may already be supplied by the real constraint v = 0 if it exists. However, if not, for some boundary free of circumferential force the corresponding geometry card should contain a 5 in column 3. Furthermore, it is essential that at that boundary the third boundary condition (corresponding to the third row of [B] and [D] should be $\Delta S = 0$, as is the case for an internally generated force-free boundary.

If both artificial translational and rotational constraint are required, column 3 of the geometry card for a force-free boundary should contain a 6.

A common use of SRA 202 is to examine the imperfection sensitivity of several buckling modes in one pass through the computer. This is accomplished by stacking several cases in sequence. For each case of a stack, a mimimum of three cards in addition to the buckling mode data deck is required. These are the title card, the case option card, and the "nine" card signifying that no more input tables are to be read.

In order to illustrate the deck set-up, let us assume that three buckling modes have been obtained using the same prebuckling data,† and that we wish to evaluate them in one computer run. Figure 16 shows the deck set-up for this type of problem. The set-up shown assumes that column 76 of the case option card contains a 1, since the additional prebuckling data deck is present. The case option card of the first case should have a 1 in each of columns 6, 8, 10, 12, 16, 18, and 20. The case option card for the second and third cases should be left blank in columns 6, 8, 10, 12, 16, 17-18, and 20, as the corresponding data will automatically be taken from the previous case. However, in order that K* and β be computed, column 76 of each of these cards should contain a 1. Also, if the shell meridian contains a closed branch, column 4 of each case option card should contain a 1.

If, on the other hand, the buckling modes are based on different prebuckling decks, the case option card should contain a 1 in column 18 (assuming $\lambda_0 \neq 0$) and the corresponding prebuckling decks should be input immediately after the "nine" card for each case.

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†Since the prebuckling data consists of a nonlinear state and a linear perturbation about it, it is not necessary that a buckling load coincide with load level of the nonlinear state.

Output Data

The output data of the program consists of a print-out of the input data and computed results. Since the print-out of the input data is self-explanatory, a discussion of it here is unnecessary.

The first computed result, printed immediately after the input boundary data, is the value of the buckling mode inner product. If the additional prebuckling data is input, this value is corrected for the difference $\lambda_c - \lambda_0$, and the corrected value is printed next.

The next data printed are the computed values of the first and second imperfection parameters α and β for both the imperfection shape producing the maximum value of α and a buckling mode imperfection shape.* These are used along with the value of the postbuckling coefficient b (if negative), to compute the buckling load knockdown (see fig. 12). In order to show the effect of the terms in the β-formula which depend quadratically on prebuckling rotations, for each imperfection shape the value of β neglecting these terms is also given. These values are printed on the same line and to the right of the correct β-values. In the case of the buckling mode imperfection, the factor relating the root-mean-square angular amplitude (in radians) to the normal displacement amplitude is also printed.

This data is followed by tables of the axisymmetric and unsymmetric components of the second-order postbuckling state. These components are presented in terms of the harmonic amplitudes of the basic force and displacement variables of the {y} and {z} vectors as functions of meridional distance. For the user's convenience, immediately following these tables the displacement components referred to meridional, circumferential, and normal directions are tabulated as a function of meridional distance.

After the data for the unsymmetric component of the second-order postbuckling state, the associated value of the second postbuckling coefficient b is printed. Finally, if column 76 of the case option card contains a 1, the values of the prebuckling and postbuckling stiffness at the bifurcation load are printed.

Sample Problem

The illustrative problem for SRA 202 is an anlysis of the imperfection sensitivity of the n = 2 buckling mode obtained in the sample problem for SRA 201. Thus the buckling mode data deck obtained in that run is part of the input data deck for this case.

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*As noted previously, the computation and printing of β is optional depending on column 76 of the case option card.

Input and output data listings for this problem are shown in Appendix B (p. 223). The input data deck is formed in two simple steps from the deck used for SRA 201. First, the buckling mode data deck is inserted between the prebuckling data deck and the boundary data cards. Second, since neither condition (A) nor (B) is satisfied (dead loading has been assumed), and the structure has no real rigid body constraint, it is necessary to punch a 4 in column 3 of a geometry table card at a force-free boundary. This is done at the final entry, corresponding to the closure point of the closed branch. Since K* and β are not being computed, it is unnecessary to change the case option card and there is no additional prebuckling data deck.

In the output data listing, all data preceding the inner product value represents input data. Note that for the imperfection shape proportional to the buckling mode displacements, the factor relating its maximum normal deflection to its root-mean-square angular deflection is printed. Thus, in this example, if inches have been used as the unit of length, $\bar{\xi} = 0.001$ rad corresponds to a maximum normal deflection of 0.0019 in.

After the print-out of the axisymmetric component of the buckled state, there is the diagnostic print-out "NORMALIZED DETERMINANT OF TERMINAL POINT MATRIX = 5.2192E-08." This small determinant was encountered in computing the unsymmetric (n = 4) component and indicates that the corresponding system of equations is almost singular, in consequence of the proximity of the lowest critical load for n = 4 (48.6) to that for n = 2 (49.9). In spite of this, the results obtained are valid, as may be verified by treating the half-shell using symmetry conditions at the artificial edges. (As noted on pages 47 and 57, in actual practice, only the half-shell would be modeled.) For the half-shell, the system of equations for the n = 4 component is well-conditioned, since the n = 4 critical load of 48.6 corresponds to an antisymmetric mode, which is suppressed by the symmetry edge conditions.* The symmetric n = 4 buckling mode has a critical load of 138.8, which by virture of its remoteness from the n = 2 value of 49.9, causes no trouble. This job took 19 seconds of Central Processor time (starting from a relocatable binary form of SRA 202) on the CDC 6600 computer.

Since the value of b (printed after the unsymmetric second-order component) is negative, the buckling mode is imperfection-sensitive. The reduction in critical load due to small imperfections may therefore be estimated from figure 12 using the computed values of b and α. For this first approximation, β should be taken as zero.

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*As already noted, for structures which have a plane of symmetry about which the loading is also symmetric, the second-order buckling state is symmetric for either symmetric or antisymmetric buckling modes.

SRA 300

This program is used to determine the asymmetric (harmonic) free vibration modes about nonlinear axisymmetric torsionless equilibrium states. The initial equilibrium state may be computed by SRA 200 and saved as a permanent file. This data file is denoted as the standard prebuckling data in the discussion of SRA 200 (p. 45). It is inserted into the SRA 200 data deck, which the, with some minor modifications, becomes the data deck for SRA 300. The load level λ_0 used in creating the prebuckling data is the load level of the prestress about which the structure vibrates.

SRA 300 is an eigenvalue program and as such is analogous to the buckling program SRA 201. In this analogy, the structural mass data replaces the linear perturbation prebuckling state data, which, although included in the standard prebuckling data deck, is not used by SRA 300. As for SRA 201, the effect of changes in magnitude and direction of live pressure loads are included.

For each harmonic, in principal, any number of modes may be requested. There is, however, a practical limit to the number of modes attainable, usually of the order of 10, and this is discussed further below. In general, the vibration modes will be obtained in the order of increasing magnitude of the corresponding eigenvalues (square frequencies) starting with the smallest. Both mode orthogonalization and automatic eigenvalue shifting are used in obtaining higher modes.

Input Data

The input deck for SRA 300, if run with prestress, is normally constructed from the SRA 200 input deck and the standard prebuckling data deck created by SRA 200 when column 73 of the case option card of the SRA 200 data deck contains a 1. If vibrations about the unstressed state are desired, the prebuckling data deck is omitted and the case option card changed accordingly. In this case, of course, it is not necessary to run SRA 200 first. The following steps should be taken in constructing the SRA 300 data deck:

(1) Insert the standard prebuckling data deck (fig. 10) as a unit between the "nine" card (following the input tables) and boundary data cards.

(2) Since table 7 is not used by SRA 300, it may be removed from the SRA 200 deck. However, this step is optional, and if present, this table will be ignored by the program.

(3) If mass densities are not included in the SRA 200 data deck, then a table 5 of mass densities (see SRA 100 user's manual for format) should be inserted. Also, the mass density ρ and elastic modulus E of each ring must be input in columns 13-25 and 26-38 respectively, on the third data card for each ring (fig. 4).

(4) In the case of a nonuniform live pressure field, table 6 should contain the pressure derivatives X_{3x} and X_{3y} in E12.4 format in columns 49-60 and 61-72, respectively. In order to avoid overlooking this step, it is suggested that this data be included in table 6 cards at the time of original preparation.

(5) Modify the case option card (see below).

(6) Remove any artificial rigid body constraint which may have been imposed in the SRA 200 run. Generally, this is done by blanking column 5 of the appropriate card in table 1 and removing the corresponding set of eight boundary cards from the deck. The cases of n = 0 or 1 may require special consideration with respect to rigid body constraints and are discussed further below.

(7) For a structure with a plane of symmetry normal to the axis of revolution, both symmetric and antisymmetric vibration modes exist. For an efficient solution, only one-half of such a structure should have been modeled in setting up the SRA 200 run, with symmetry conditions imposed at the artificial edge(s). If an antisymmetric mode is desired, it is necessary to: (a) change the 8 in column 3 of the geometry table card at a symmetrical ring boundary to a 9, and/or (b) change prescribed boundary conditions at a symmetry edge from $\xi = \Delta Q = \chi = 0$ to $\Delta P = \eta = v = \Delta M_1 = 0$.

Except for step 3, these are the same steps taken to construct the SRA 201 data deck from the SRA 200 deck.

<u>Case option card</u>.- This is similar to the case option card for SRA 201 and is required for each case (fig. 17). Differences in this card for SRA 300 relative to that for SRA 201 are noted below.

Column 14 now contains the indicator for the mass densities table (as it does for SRA 200).

Column 18 contains the indicator for the initial state data. When set equal to 2, no initial state data is input, and vibration modes about the natural unloaded state will be calculated.

F

Columns 25-26 contain the number of modes (≤99) desired. In contrast to SRA 201, for SRA 300 an extra card of eigenvalue shifts is not input when more than one mode is specified.

Column 30 is used to specify rigid body modes. As for SRA 201, it is not used with a nonzero eigenvalue shift. However, under certain conditions (see below), it may be used to specify a translational rigid body mode with a nonzero value of λ_0.

Columns 36-47 contain the input eigenvalue shift. In contrast to SRA 201, this is the only shift input, applying to higher modes as well as the first until an automatic shift is made. Note that for SRA 300 the eigenvalue represents the square of the frequency.

As previously mentioned, both eigenmode orthogonalization and automatic eigenvalue shifting are used to obtain higher modes (as specified in columns 25-26). The first six or fewer modes are obtained by storing all the preceding modes and orthogonalizing with respect to them after each step of a Stodola-type iteration. For modes higher than the sixth, orthogonalization is performed only with respect to the last five modes obtained (ones previous to these are not retained); however, prior to the iteration for these modes an eigenvalue shift is made either to: (1) an estimate of the next eigenvalue to be computed, or (2) the last eigenvalue obtained. The first shift will be made if column 76 is left blank, whereas the second shift will be made if a 1 is inserted in column 76. It may be noted that although the first shift is the most desirable from the point of execution time and accuracy of the mode to be obtained, the estimate used is not always reliable, so that the second shift is a safer approach. It should also be noted that eigenvalue shifts change the shell characteristic length, which determines how long a subinterval can be without suffering a serious degradation of numerical significance. For any particular choice of shell segmentation, this fact will limit the number of higher modes obtainable, the shorter the shell segments, the more modes can be obtained.

A common use of SRA 300 is to compute the vibration modes for several different harmonic numbers of a given structure with a given prestress in a single pass through the computer. This is accomplished by stacking several cases in sequence. For each case after the first, only three data cards are required. These are the title card, case option card, and the "nine" card to signify that no more input tables are to be read.

Vibrations in the harmonics $n = 0$ and 1.- Before discussing special aspects of $n = 0$ and 1, some general remarks concerning boundary conditions may be helpful.

In general, for $n \geq 2$, the boundary conditions are treated automatically for each of the four types (force-free, ring, prescribed matrices, and dome closure) of boundaries used in the SRA 200 run when the rules for setting up the deck given earlier are followed. Nonhomogeneous load vectors {L} input at prescribed boundaries with [B] and [D] matrices are simply ignored by SRA 300 in accordance with the fact that the eigenvalue problem is homogeneous. Usually at these prescribed boundaries, the perturbation force reactions $\Delta\{y\}$ are workless, although conservative reactions associated with the idealized case of a massless elastic attachment are allowed. Workless reactions occur when there are three mutually perpendicular directions for which either the corresponding force or displacement component is zero, and either the meridional bending moment ΔM_1 or rotation χ is zero. The simplest examples of workless reactions occur when the three directions are axial, radial, and circumferential; however, workless reactions using meridional, normal, and circumferential directions are common.

Rigid mass attachment: In some cases, the effect of an axisymmetric rigid mass attachment on the vibrations is important. Since a rigid mass cannot deform in the harmonics $n \geq 2$, for these harmonics it produces the effect of a clamped boundary and decouples the parts of the structure which are not connected except at the rigid mass boundary. On the other hand, since the harmonics n = 0 and 1 include rigid body motions, it is important in these cases to be able to model a rigid mass. The ring logic can be used for this purpose by the artifice of inputting very large values for certain ring rigidities. For n = 0, EA and EI_y should be given very large values, say 10^{38}, whereas for n = 1, the combinations $EI_y + GJ$ and $EAa^2 + EI_x$ should be given very large values. Such a ring simulates a rigid mass with the following dynamic properties:

$$M = 2\pi a\rho A$$

$$I_0 = 2\pi a\rho(a^2A + I_x)$$

$$I_1 = Ma^2/2 + \pi a\rho(I_x + 2I_y)$$

where M is mass, I_0 is the mass moment of inertia about the axis of revolution, I_1 is the mass moment of inertia about a lateral axis through the mass center, and a is the radius of the ring centroidal axis. Note that the center of mass of the simulated rigid mass lies in the plane of the ring centroidal axis, which, along with the radius a, is determined by the input normal and meridional eccentricities $\bar{z}$ and $\bar{s}$. Also, when simulating a rigid mass the ring cross-sectional inertias I_x and I_y need not be positive as long as the rigidity conditions are satisfied and the dynamic properties are correct.

Rigid body degrees of freedom: If the structure possesses rigid body degrees of freedom, it may be necessary, in the cases n = 0 and 1, for the user to specify artificial rigid body constraints, as well as observe other special rules. These rules have been discussed in the SRA 201 manual (p. 53). As presented there, they depended on whether or not the loading condition (A) is satisfied and whether or not the nonlinear state load level λ_0 and the eigenvalue shift are zero. For SRA 300, the situation is similar to that for SRA 201, the main difference being that nonzero μ_s may have a different effect than nonzero λ_0. Specifically for SRA 300, if $\mu_s \neq 0$ then the harmonics n = 0 and 1 are treated no differently than other harmonics, regardless of condition (A). Thus, in this case artificial rigid body constraints and column 30 of the case option card are not used. Only is $\mu_s = 0$, must condition (A) and λ_0 be considered.* The pertinent rules for $\mu_s = 0$ are summarized in the table below.

λ_0	Condition (A)	Rigid body constraint required	Col. 30
= 0	not considered	trans. and rot.	nonzero
≠ 0	satisfied	none	blank
≠ 0	unsatisfied	translational	blank or 1

The only difference here with the corresponding rules for SRA 201 concerns the case of unsatisfied condition (A). For this case, a translational rigid body mode is never indicated in column 30 for SRA 201. For SRA 300 real translational freedom must be indicated in column 30.

Output Data

Printed output.- The output data of the program consists of a print-out of the input data and computed results. Since the print-out of the input data is self-explanatory, a discussion of it is unnecessary. The remaining printed output is analogous to that of the buckling program SRA 201 and is briefly described below.

*Since a small eigenvalue shift can always be used, one can always avoid special treatment of n = 0 and 1. However, when the unstressed initial state is used and rigid body degrees of freedom exist, too small an eigenvalue shift may result in convergence to an uninteresting rigid body mode.

For each elastic buckling mode obtained, the program prints first the sequence of eigenvalue estimates $\mu_{(k)}$ obtained in the iteration process.* The eigenvalue shifts used are shown at the point they were made, the first one which precedes the μ-sequence being the value input and the remaining ones interspersed in the μ-sequence being automatic shifts. Numerical convergence (at which point the calculation procedure for the mode in question is complete) is obtained when the relative difference between two successive estimates is less than 10^{-N}, where N is the convergence index specified in column 32 of the case option card.

Following the converged μ-sequence are two tables of the harmonic amplitudes of the shell modal forces P, Q, S, M_1 and displacements ξ,η,v,χ as functions of the meridional distance s. These tables are the eigenmode estimates after the last two iterations, the second table being the last (best) estimate. In general, the eigenmode will not have converged to as many significant digits as the eigenvalue. The vibration mode is normalized so that its inner product with itself (i.e., the work of its associated inertial forces acting through its own displacements) is unity.

Following the second eigenmode table is the corresponding natural frequency (in radians per unit of time). This value is the square root of the sum of the converged (corrected) value of the μ-sequence plus the last eigenvalue shift, i.e., $\omega = (\mu_1 + \mu_s)^{1/2}$. After the frequency, is printed a table of harmonic amplitudes of modal displacements (u, v, w) in meridional, circumferential, and normal shell coordinates.

Optional output.- If column 74 of the case option card contains a 1, a punched deck is produced which is a replica of the u, v, w printed output table. Each card contains the entry number, s, u, v, and w in that order in the format I5, 1PE13.4, 3E18.4.

Sample Problem

The illustrative problem for SRA 300 is a calculation of the fundamental n = 2 vibration mode about the nonlinear equilibrium state computed in the SRA 200 sample problem. Thus, the standard prebuckling data deck obtained in that run is part of the input deck for this case.

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*If the initial equilibrium state is stable with respect to buckling in the harmonic considered (i.e., $\lambda_0 < \lambda_c$) and no eigenvalue shift is used, then the sequence of eigenvalue estimates is theoretically monotonically decreasing. With a nonzero eigenvalue shift the sign of the next larger eigenvalue μ_2 will be the same as the sign of successive differences $\mu_{(k)}-\mu_{(k+1)}$ for sufficiently large k. Since the ratio of successive differences converges to $(\mu_2/\mu_1)^2$, in many cases μ_2 can be estimated from the sequence for μ_1.

Input and output data listings for this problem are shown in Appendix B (p. 248). Except for the requirement of adding a mass density table to the data deck and some differences in the case option card, the input deck is identical to that used for the SRA 201 sample problem. The common steps in forming this deck from the SRA 200 data deck are: (1) the removal of the aritifcial rigid body constraint at the final entry, and (2) the insertion of the standard prebuckling data deck from the SRA 200 run between the "9" card and the boundary data cards.

Because of the proximity of the frequencies corresponding to symmetric (ω_1 = 132.1) and antisymmetric (ω_2 = 175.6) modes, it is advisable to use an eigenvalue shift to speed up the convergence to the lowest mode. The shift $\omega^2 = 1.7x10^4$ is used and is shown in columns 43-47 of the case option card. In actual practice, only one-half of the symmetric structure would be modeled, thereby decoupling the antisymmetric and symmetric modes.

In the output data listing computed results follow the printing of the eigenvalue shift. As shown, the solution converged to the required four significant digits (specified by default in column 32 of the case option card) in three iterations. Following are the last two normalized vibration mode estimates, the frequency, and the displacement amplitudes of the final mode estimate in shell coordinates, as described previously. This job took 9 seconds of Central Processor time (starting from a relocatable binary form of SRA 300) on the CDC 6600 computer.

APPENDIX A

ADDITIONAL PROGRAM DOCUMENTATION

This appendix consists of program details necessary to modify the programs but unnecessary for their use. It is organized into six main sections, one for each program. Each of these sections contains: (1) a description of external files used, (2) an overall logical flow chart, (3) brief descriptions of contractor-supplied subprograms peculiar to each program, and (4) a glossary of major FORTRAN variables peculiar to each program. This is followed by two additional sections giving brief descriptions of contractor-supplied subprograms and a glossary of major FORTRAN variables common to at least two of the programs.

SRA 100

External files.- SRA 100 uses three external files: TAPE2, TAPE3, and PUNCH. TAPE2 and TAPE3 are the standard input and output files, respectively. At the user's option, prebuckling state data required for SRA 101, and shell primary stress amplitudes ($\sigma_s,\sigma_\phi,\sigma_{s\phi}$) may be written onto PUNCH.

Overall logical flow of SRA 100.- Essential features of the overall flow of SRA 100 are listed below.

SRA100 (MAIN PROGRAM)

Call INPUT

INPUT

Read and write case title card. If end-of-file, stop
Read case option card: LOOP, NSG, NWP, NFM, NST, NMD, NML, NTL, NIC,
NASE, NDER, SFL, RTABL, ISS1, ISS2, ISS6
FN = |NASE|
Read basic input tables
    Geometry: NOUT2, NOUT1, NOUT3, TS, TR, TRP, TRR2, TXB
    Wall properties: TE1, TE2, TE12, TNU1, TH
    Foundation moduli: TK1, TK2, TK3
    Stringer properties: TEST, TEAST, TEIST, TGJST, TZBST
    Mass densities: TRHOM
    Mechanical loads: TX1, TX2, TX3
    Thermal loads: TTH1, TTH2, TDTH1, TDTH2, TTHST
Call SETUP to construct geometric parameters: NDIS, TDIS, JENT, IBR, NBR,
IEND, KEND

Write input tables

If NASE < 0, change sign of TX2(I) for antisymmetric response option

If NIC = 0, make NOUT1-table negative at all boundaries except dome closures (to indicate boundary data comes from previous case)

Call BC to read or generate boundary matrices BBP, BD, and SL for each boundary

If present case has rigid body degrees of freedom (NDER $\neq$ 0 and FN $\leq$ 1.), call RBMODE to calculate rigid body acceleration and correct ring and dome boundary conditions for inertial loads.

If complementary solutions of previous case apply, set KASE = 2; otherwise KASE = 3

Calculate initial scale factors required for START

Return

SRA100

If KASE = 3, calculate and store the complementary and particular solutions. Otherwise, calculate and store only the particular solution (in which case complementary solutions from previous case will be used)

Combine complementary and particular solutions to obtain static response vectors Y, Z

If NASE < 0, change sign of FN, TX2, and 3rd (shear) components of Y and Z for antisymmetric response option.

Write Y and Z for each entry point

If ISS1 $\neq$ 0, compute and punch hoop forces for each ring

Set up DO-Loop over entry points for calculation of the stress resultants and stresses

1. Compute partially inverted shell wall rigidities, and mass and thermal moments through shell wall
2. Correct surface loads by the inertial loads of rigid body acceleration
3. Correct surface loads by elastic foundation loads
4. Calculate stretching and bending strains and stress resultants and couples
5. If ISS1 $\neq$ 0, punch normal shell stress resultants
6. Calculate from differential equations the force and displacement derivatives, and from these the derivatives of the stretching and bending strains
7. Calculate the stress (SIGST) at the stringer centroid
8. Set up DO-loop over shell wall layers
    a. Calculate from the stress-strain relation the primary shell stresses (SIG1, SIG2, SIG12) at wall layer faces
    b. Calculate, by integration through the shell thickness of the appropriate three-dimensional equilibrium equations, the transverse shear stresses (SIG13, SIG23) at wall layer interfaces and midpoints
    c. Write normal deflection and stresses

d. If ISS2 ≠ 0, punch primary shell stresses at wall layer faces
e. End of DO-loop over wall layers

9. End of DO-loop over entry points

If ISS1 ≠ 0, punch shear stress resultant and normal pressure at entry points

Call INPUT for next case

Subprogram descriptions for SRA 100.- SRA 100 consists of twenty contractor-supplied subprograms (fig. 18). Those subprograms which have features special to SRA 100 are described below. For descriptions of the remaining subprograms of SRA 100, which are also used by other programs, see page 121.

SRA100

This is the main subprogram of SRA 100. Its essential functions are to set up the integration of the differential equations, combine the complementary and particular solutions for the force {y} and displacement {z} responses, and calculate from them the stresses and stress resultants. It is described in more detail in the overall logical flow chart of this program.

INPUT

This subprogram (and its subroutines) reads and writes all of the input data, and prepares the boundary conditions. It is described in more detail in the overall flow of this program.

PROD1(Z,Z1)

This function, which is called by RBMODE, calculates two shell functionals: (1) the shell contribution to the inner (scalar) product of two rigid body modes Z and Z1 (when MFLAG = 0), and (2) the work of the external surface loads with a rigid body mode Z1 (when MFLAG = 1).

The parameter MFLAG, set in RBMODE, determines which use of PROD1 is meant. In the second use, the first formal parameter Z in the calling sequence is ignored by PROD1 and the surface loads are obtained from blank COMMON. The integration over the shell meridian is performed by Simpson's rule. The ring contribution (PROD2) to each functional is calculated in RBMODE and added to PROD1. An approximate contribution to each functional over the small deleted cap at dome closure boundaries is included in PROD1.

RBMODE

If the structure has rigid body degrees of freedom, INPUT call RBMODE to: (1) calculate the rigid body acceleration, (2) calculate the pertinent rigid body dynamical properties of the structure, and (3) correct the ring and dome loads for the effect of inertial loads. The displacement field of the rigid body acceleration is stored in the array ZM1, which is used by DER to calculate the inertial surface forces and moments.

The calculation of the rigid body dynamics is based on the fact that the inner product of two displacements fields is proportional to the work of the inertial loads of one field acting through the displacements of the other. If one of the fields is a unit rigid body translation (or rotation), the inner product gives essentially the force (or moment) resultant of the inertial loads of the other. Since the inertial loads of a unit rigid body translational acceleration have a resultant force equal in magnitude to the total structural mass M, the inner product of the unit translation with itself gives M (within a factor of π for $n = 1$ or 2π for $n = 0$). Similarly, the inertial loads of a unit rigid body rotational acceleration have a resultant moment equal in magnitude to the total mass moment of inertia I about the axis of rotation, and so the inner product of a unit rotation with itself gives I. Noting that the resultant inertial force M of a unit rigid body translation acts through the center of mass, it follows that the inner product of the unit lateral translation with a unit lateral rotation gives the first mass moment about the axis of rotation, which divided by the mass gives the location of the center of mass.

On the other hand, if the inertial loads of one argument of the inner product are replaced by the external loads, and the other argument is a unit rigid body translation (or rotation), then one obtains the resultant force (or moment) of the external loads. The corresponding acceleration magnitude is simply the resultant force (or moment) divided by the mass (or mass moment of inertia).

Major FORTRAN variables of SRA 100.- Major variables which have special meaning for SRA 100 are defined below. For SRA 100 variables which are common to other programs, see page 126.

Variable	Definition	Subprogram where generated
ISS1	flag to punch prebuckling data for SRA 101	INPUT
NML	flag for mechanical loads table	INPUT
NTL	flag for thermal loads table	INPUT
TX2(100)	circumferential surface load (X_2)	INPUT
T12(100)	shear stress resultant (T_{12})	SRA100
ZM1(4,100)	displacement mode (ξ,η,v,χ) of rigid body acceleration	RBMODE

External files.- SRA 101 uses twelve external files, nine of which are nonstandard files. In order to understand their structure, the following discussion is presented before describing their usage.

The force and displacement variables used in the program are expanded into Fourier series having both cosine and sine components at each meridional point. This means that if LSTAB entry points and N2 harmonics are used, the size of a displacement or force vector is 2 x N2 x LSTAB.

Because of limitations on core storage it is impossible to have all the force and displacement vectors that are needed for all the calculations simultaneously in core. Consequently, most of these vectors are stored on external files and transferred into core when they are needed in the calculation process.

The files which are available to the program are assumed to be of the sequential type (no random access). This means that if the data that is to be transferred from a file to core for one calculation is scattered in different places on the file then the program has to transfer into core not only the relevant data but also everything that happens to be located in between. From the standpoint of efficiency, it is, therefore, important to store data on the files in the same arrangement as it is needed for the calculations. If some variables are needed in different groupings for different calculations it may be more efficient to store them more than once on different files in different orderings.

For the calculations done by this program there are two basic orderings of the data. In the integration of the differential equations each harmonic is integrated separately, so the program uses and produces all the relevant forces and displacements for one harmonic at a time. In the calculation of equivalent forces and the scalar product the program calculates the product of one displacement vector by one force vector at a time. Only two variables have to be in core simultaneously, but all the harmonics of these two variables are needed.

The above two requirements result in two modes of storage for almost all variables. In the first mode the variables are stored in "block" form. Each variable is stored by itself: all the cosine amplitudes for the first entry point followed by all the cosines for the second entry point and so on until the last entry point. Following all the cosine amplitudes come all the sine amplitudes in the same order. For a variable V stored in a block form, V(JCI) is the location of the Jth cosine component at the Ith entry point and V(JSI) is the corresponding sine component; JCI and JSI are given by

JCI = (I - 1)*N2 + J

JSI = JCI + N2 * LSTAB

The second storage mode, the "harmonic" form, is used when a group of variables, e.g., XI, ETA, V, are needed, one harmonic at a time. In this form, the cosine amplitudes of one harmonic for all entry points are stored for XI (the first variable) followed by the sine amplitudes of XI, the cosine amplitudes of ETA (the second variable) and so on until the sine amplitudes of V (the final variable). This group is then followed by a similar group for the next harmonic. Thus, if all N2 harmonics of a group of K variables are stored in an array B, then B(IJLC) is the address of the Jth cosine component at the Ith entry point of the Lth variable and B(IJLS) is the address of the corresponding sine, where

IJLC = 2 * (J-1) * K * LSTAB + 2 * (L-1) * LSTAB + 1

IJLS = IJLC + LSTAB

The usage of external files is given by the following table.

Logical unit no.	Usage	Variables	Storage mode	Subprogram where created
1	prebuckling data	$T_1, T_2, T_{12}, X_3, T_\phi$	block	MAIN6
ICOMP	boundary condition and complementary solution matrices	[B],[D],[U],[W], [V],[Z]	harmonic	MAIN1
3	response variables	$\chi, e_1 + e_2$ or θ, ψ	harmonic block	MAIN1 CALCUL
M4	equivalent forces (shell, rings, and domes)	F_1, F_2, F_4, F_3 FL_1, FL_2, FL_3 $FD_1, FD_{30}, FD_{31}, FD_4$	block block --	EQIFOR EQIFOR EQIFOR
5	standard input file			
6	standard output file			
7	standard overlay file			
8	psuedo forces or equivalent forces	$X_1, X_2, -L_2, L_1$ or F_1, F_2, F_4	block harmonic	FORCES MAIN3
9	response variables	ξ, η, v or ξ, η, v	harmonic block	MAIN1 MAIN4

Logical unit no.	Usage	Variables	Storage mode	Subprogram where created
10	basic structural data, axisymmetric bending prebuckling components, harmonic interaction data	COMMON/TAB/	--	INPUT
		T_1, T_2, X_3, T_ϕ	--	PREB
		COMMON/M/	--	MAIN6
11	response variables or equivalent forces	χ, $e_1 + e_2$	block	MAIN4
		u_x, u_y, u_ϕ	block	CALCUL
		$FD_1, FD_{30}, FD_{31}, FD_4$	--	MAIN3
		F_3, FL_1, FL_2, FL_3	harmonic	MAIN3
ISCR	scratch file			

The nominal values for ICOMP, M4, and ISCR are 2, 4, and 12. However, as explained on page 34, for a case (other than the first) in a one-pass sequence of cases it is possible for ICOMP to be 12, in which event ISCR is 2. For a case of equal and opposite eigenvalues, M4 alternates on successive iterations between the values 4 and ISCR, since in this case it is necessary to compute the scalar product of the displacements of each iteration by the forces of the iteration before the last. In all other cases M4 equals 4.

The prebuckling data on file 1, the response variables on files 3, 9, and 11, and the forces (except dome forces) on files M4, 8, and 11 are "packed" data. That is, blank words for problems which do not require the maximum allowable dimensions are not transferred from core to external file. In some cases a variable does not have two components for each Fourier harmonic. This is the case for the prebuckling data on file 1 if the loading has an axial plane of symmetry. It is also true for the matrices on file 2, since this data calculated for the symmetric response components is also used for the antisymmetric components. Some of the variables shown are not stored for all problems: (1) [V], [Z] are stored on file 2 only for closed branch problems, (2) ring forces FL_1, FL_2, FL_3 and dome forces FD_1, FD_{30}, FD_{31}, FD_4 are stored on files M4 and 11 only if at least one ring or one dome exists, and (3) the axisymmetric bending prebuckling components are stored on file 10 only if a nonzero eigenvalue shift is used.

Overall logical flow of SRA 101.- This program consists of a main overlay and seven primary overlays (fig. 19). The overall flow of the main overlay is listed below with brief descriptions of the function of each primary overlay when called. Following this are more detailed flow charts of each primary overlay.

MAIN

1. Initialize the complementary solution file ICOMP to unit 2, the scratch file ISCR to unit 12. Initialize NSG to -10 (indication of a first case)
2. Call OVERLAY 7 (INPUT)

   OVERLAY 7

   Read and write input data
   Set up control parameters and tables (geometry, wall properties, etc.)
   Transfer structural data to file 10

3. Call OVERLAY 6

   OVERLAY 6

   If new prebuckling data is needed, read and write it and transfer it to file 1
   If GUESS (eigenvalue shift) is nonzero, transfer axisymmetric torsionless prebuckling state data to file 10
   Calculate harmonic interaction data for Fourier products and transfer this data to file 10

4. Initialize eigenvalue estimates to 1. Initialize the equivalent forces file M4 to unit 4
5. Set up iteration DO-loop with index (IT) running from ITO to ITF
   a. Call OVERLAY 1

      OVERLAY 1

      If IT is 1, calculate complementary solutions and boundary conditions, and generate an initial guess for displacements. If IT is not 1, calculate a new approximation to the buckling mode based on the forces from the previous iteration
      The quantities ξ, η, v are written out on file 9 and χ, $e_1 + e_2$ on file 3 for each harmonic

   b. Call OVERLAY 4

OVERLAY 4

Rearrange ξ, η, v, χ, $e_1 + e_2$ into block form and calculate from them the shell rotations θ, ψ and ring displacements u_x, u_y, u_ϕ

Write ξ, η, v on file 9, χ, $e_1 + e_2$, u_x, u_y, u_ϕ on file 11, and θ, ψ on file 3, all in block form

c. If this is not the first iteration (or the first or second in case of equal and opposite eigenvalues), call OVERLAY 2. Otherwise, go to step e

OVERLAY 2

Calculate the scalar product for the numerator of the Rayleigh quotient

d. Set the numerator of the Rayleigh quotient equal to the scalar product

e. Call OVERLAY 5

OVERLAY 5

Calculate the equivalent shell, ring and dome forces based on the displacements calculated at step a. Write these forces in block form on file M4

f. If this is not the first iteration (or the first or second in case of equal and opposite eigenvalues), call OVERLAY 2. Otherwise, go to step h

OVERLAY 2

Calculate the scalar product for the denominator of the Rayleigh quotient

g. Calculate the Rayleigh quotient (eigenvalue estimate) and its relative difference with that from the previous iteration. Print the Rayleigh quotient, relative difference, and iteration number. If this is not the first calculation of the Rayleigh quotient and if the relative difference is within the required

G

accuracy,* go to step 7. Otherwise call OVERLAY 3

OVERLAY 3

Rearrange the shell and ring forces from block form into harmonic form, putting F_1, F_2, F_4 on file 8 and F_3, FL_1, FL_2, FL_3 on file 11

h. In the case of equal and opposite eigenvalues, change the equivalent force file M4. If M4 is 4, change it to ISCR and vice versa
i. End of iteration DO-loop

6. Go to step 2
7. If NSGS < 0, a second run follows which will use the forces from this run as an initial guess, so call OVERLAY 3 to rearrange the forces into harmonic form
8. Go to step 2

Logical flow of OVERLAY 1:

1. Read structural data from file 10
2. Calculate scale factors required by subroutine START
3. If GUESS ≠ 0, read axisymmetric bending prebuckling data from file 10
4. If IT is greater than one, go to step 10
5. If ISS6 = 2, go to step 8
6. Set up DO-loop to create file ICOMP containing complementary solutions and boundary conditions for each harmonic, index N running from 1 to N2. If IKASE = 0, the same file as was used in the previous case (or file 2 in a first case) will be used. This happens when all the complementary solutions to be used from the previous case are properly positioned on the file (the complementary solutions must be arranged in order of increasing wave number). If IKASE = 1, the scratch file (ISCR, initially 12) will be used for ICOMP and ICOMP of the previous case will be made the scratch file
   a. If KASE(N) = 0, go to step c
   b. If KASE(N) = I, the complementary solutions and boundary conditions are read from place I on the old complementary solution file. Go to step e

---

*In the case of a symmetric prebuckling state, for which both symmetric and antisymmetric buckling modes are computed simultaneously, it is only necessary that the numerically smaller of the two eigenvalue sequences has converged within the required accuracy.

c. Call BC1 to calculate boundary condition matrices [B] and [D] for N-th wave number
d. Calculate complementary solutions for the N-th wave number
e. Write boundary condition matrices and complementary solutions on new complementary solution file, unless they are already there
f. End of DO-loop

7. If mode shapes from previous case (files 8 and 11) are to be used as the initial approximation, i.e., NSG = 0 and NSGS < 0 or ISS6 = 3, go to step 10
8. Call INSHPE to calculate initial approximation for buckling mode shape
9. Return
10. Set up DO-loop over buckling wave numbers with index N going from 1 to N2
    a. For the N-th harmonic, read boundary condition and complementary solution matrices from file ICOMP and shell, ring and dome forces from files 11 and 8*
    b. Set IND = 0 to signal calculation of approximation to symmetric part of buckling mode
    c. Call PLCFOR to place symmetric or antisymmetric (for IND = 0 or 1, respectively) part of the shell, ring and dome forces in TF1, TF2, TF3, TF4, and SL
    d. Calculate particular solution using forces of step c
    e. Combine particular and complementary solutions
    f. Call PLCDIS to calculate $e_1 + e_2$ and place symmetric or antisymmetric part of ξ, η, v, χ, $e_1 + e_2$ in proper place in TDISP
    g. If IND = 0, set IND = 1 and go to step c to calculate approximation to antisymmetric part of buckling mode
    h. Write ξ, η, v on file 9 and χ, $e_1 + e_2$ on file 3 for the N-th harmonic
    i. End of DO-loop
11. Return

Logical flow of OVERLAY 2:

Call PROD1
Return

---

*These forces are not read in for the first iteration when NSG = 0 and N > N2S, because in this case the forces from the previous case are used for an initial approximation and these are available only for N $\leq$ N2S. The initial forces for N > N2S will simply be those left over from the N2S-th harmonic.

Logical flow of OVERLAY 3:

Read F_1 from file M4 in block form and spread it into harmonic form. Gaps are left for F_2 and F_4

Read F_2 from file M4 in block form and spread it into harmonic form. For each harmonic F_2 follows F_1

Repeat step 2 for F_4

Read F_3 in block form from file M4

Write F_1, F_2, F_4 for each harmonic onto file 8

If NRING > 0, read three blocks of ring forces FL_1, FL_2, FL_3

Spread F_3 into harmonic form

If NRING > 0, spread FL1, FL2, FL3 into harmonic form

If ND > 0, read dome forces from file M4 and write them onto file 11

Write F_3, FL_1, FL_2, FL_3 for each harmonic onto file 11

Return

Logical flow of OVERLAY 4:

Read ξ, η, v in harmonic form for all harmonics from file 9

Block ξ and write it on file 9

Block η and write it on file 9

Block v and write it on file 9

Read χ, and (if LTYPE = 1) $e_1 + e_2$ in harmonic form for all harmonics from file 3

Block χ and write it on file 11

If LTYPE = 1, block $e_1 + e_2$ and write it on file 11

Call subroutine CALCUL to calculate θ, ψ and the ring displacements u_x, u_y, u_ϕ

Return

Logical flow of OVERLAY 5:

Read mode interaction data from file 10

Read prebuckling data from file 1

Call FORCES to calculate shell pseudoforces

Call EQIFOR to calculate shell, ring, and dome equivalent pseudoforces

Return

Logical flow of OVERLAY 6:

In NPS = 0, write that the prebuckling stresses are taken from the previous case and return

Call subroutine PREB to read and block the prebuckling state data

Write the prebuckling state data on file 1

Print the prebuckling state data at selected output points

Call subroutine MODINT to set up the harmonic interaction data for Fourier products

Write the harmonic interaction data (COMMON/M/) on file 10

Return

Logical flow of OVERLAY 7:

If NSG ≠ -10, read structural data from file 10
Read and write case title card
Stop if first four characters on case title card are STOP
Read and write case option card: LOOP, NSG, NWP, NFM, NST, NPS, NIC, LSYMM, NS, NT, SIGDIG, LTYPE, GUESS, RTABL, SKAP, ISS4, ISS6
Read shell and ring output points and initial and final iteration numbers
Check if shell data, GUESS, and prebuckling state data (if GUESS ≠ 0) are unchanged from previous case; if so, set NW = 0; otherwise, NW = 1
Read prebuckling wave numbers NWAVE1(I), I = 1,N1. If NSG = 0, save N2 of previous case as N2S. If NW = 0, save NWAVE2(I) of previous case as NWS(I)
Read buckling wave numbers NWAVE2(I), I = 1, N2
If ISS4 ≠ 0, read buckling wave numbers NWS(I), I = 1, N2S of previous case
Call KASG for calculation of IKASE and KASE
Write prebuckling and buckling wave numbers
If NWAVE2(I) includes: n = 0, set ND = 1; n = 1, set ND = 2; n = 0 and 1, set ND = 3
If NS was input as 0, set NS = 1 through function NSYMM if this case is recognized as one of equal and opposite eigenvalues
Read basic input tables:
- Geometry: NOUT2, NOUT1, NOUT3, TS, TR, TRP, TRR2, TXB
- Wall properties: TE1, TE2, TE12, TNU1, TH
- Foundation moduli: TK1, TK2, TK3
- Stringer properties: TEAST, TEIST, TGJST, TZBST

Call SETUP to calculate NDIS, TDIS, JENT, IBR, NBR, IEND, KEND
Write input tables
If NIC ≠ 0, call BC to read and write boundary data
If no domes exist, set ND = 0
Write basic structural data on file 10
Call ADDRES to set up equivalent addresses and vector lengths for operations with displacement and force vectors
Call CONST to set up ICONST and ISUB, indicating whether the calculation can be reduced because of constant wall properties
Return

Subprogram descriptions for SRA 101.- SRA 101 consists of 49 contractor-supplied subprograms (fig. 19). Those subprograms which have features special to SRA 101 are described below. For descriptions of the remaining subprograms of SRA 101, which are also used by other programs, see page 121.

MAIN OVERLAY

This overlay always resides in core and consists of the main program and three contractor-supplied subroutines, NTRAN, OUTP, and TYMCHK, used by several primary overlays.

MAIN

This program sets up and controls the Stodola-type iteration process for the buckling mode. It calls, as needed, each of the seven primary overlays.

NTRAN (NU, IND, LN, A, L)

This subroutine serves for reading from (if IND = 2) or writing on (IND = 1) file NU a vector of length LN starting at address A. The subroutine uses BUFFER IN and BUFFER OUT reading and writing, respectively. The formal parameter L is not used in the CDC version.

OUTP (B, LSTAB, N2, L, KK, KN)

This subroutine is used for printing out at specified output points displacement and force vectors which are in core in block form. L is the number of half blocks starting at address B. Each block has N2 harmonics and LSTAB meridional points.* KK(K), K = 1, KN are the indices of the specified output points.

TYMCHK (L, TITLE, T, NU)

This subroutine checks whether unit NU has completed reading or writing. If the unit is still busy TYMCHK calls the system routine RECALL which releases the central processor for a few seconds and then checks again. TYMCHK uses IF UNIT to check whether NU is free, and in case of an error exit it prints out TITLE which is the name of the program that called TYMCHK. The parameters L and T are not used in the CDC version.

PRIMARY OVERLAY 1

This overlay consists of the main subprogram MAIN1 and fifteen contractor-supplied subroutines (fig. 19). Its essential function is to perform the integration of the differential equations for each iteration.

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*N2 and LSTAB do not have to be the number of buckling harmonics and number of meridional shell points, respectively. They are just the two numbers which define the block size and structure. For blocks of ring forces, for example, LSTAB is replaced by NRING.

MAIN1

This subprogram implements the integration of the differential equations. In the first pass through MAIN1 it sets up file ICOMP for the boundary condition matrices [B] and [D] and complementary solutions for each buckling harmonic. These do not vary from iteration to iteration. In each succeeding pass through MAIN1, one for each iteration, it combines the complementary and particular solutions for each harmonic and stores the resulting solution on files 9 and 3.

BC1(FN, A, NDIS, BBP, BD)

This subroutine generates the boundary condition matrices [B] and [D] which are dependent on the wave number FN, viz. for ring and dome boundaries.

INSHPE (NOUT1, TS, B)

This subroutine generates an initial guess for the buckling mode amplitudes ξ, η, v, χ, and in case of a live pressure loading (i.e., LTYPE = 1) $e_1 + e_2$. For each buckling harmonic ξ, η, and $e_1 + e_2$ are set to zero, and v and χ are set to have parabolic variation. The v and χ distributions for different buckling mode wave numbers NWAVE2(I) are proportional but have a relative magnitude which varies as 0.9^I. The initial guess is read out in harmonic form, ξ, η, v on file 9, and χ, $e_1 + e_2$ on file 3.

INTRPL (TF1, TF2, TF3, TF4)

This subroutine interpolates for the variables needed by DER for the derivative calculation. If the distance between S and the next TS-value is smaller than 0.001*DS, no interpolation is done. The interpolation is linear for all variables except the forces TF1, TF2, TF3, TF4 for which it is quadratic.

PLCDIS (IND, Y, Z, FN, TXI, TETA, TV, TCHI, TE1E2)

This subroutine calculates the dilatation $e_1 + e_2$ and then places it, the displacements ξ, η, v and the rotation χ at the corresponding vectors TE1E2, TXI, TETA, TV, TCHI. These vectors contain both the cosine and the sine components of the variables. In the symmetric case (IND = 0), PLCDIS transfers the cosine components of ξ, η, χ, $e_1 + e_2$ and the sine component of v. In the antisymmetric case (IND = 1), PLCDIS transfers the sine components of ξ, η, χ, $e_1 + e_2$ and reverses the sign of the cosine components of v before transferring it.

PLCFOR (IND, JENT, NOUT1, NN, TSA, NOUT2)

For each harmonic the symmetric and antisymmetric components of the shell, ring and dome forces are read by MAIN1 into core from files 8 and 11, the shell and ring forces into the array TF and the dome forces into DOMFOR. Subroutine PLCFOR picks either the symmetric or antisymmetric components of these forces. (IND = 0 indicates symmetric forces; IND = 1, antisymmetric.) The forces are scaled up by the eigenvalue estimate of the previous iteration and then placed into the arrays TF1, TF2, TF3, TF4 (shell forces) and SL (ring and dome forces).

In the antisymmetric case, the sign of the F_3 components of the shell forces and the FL_3 components of the ring forces are reversed. The corresponding sign changes in the dome forces are made when they are generated in FORD.

Note that the shell and ring forces are packed in the array TF in the following order: F_1, F_2, F_4, F_3, FL_1, FL_2, FL_3.

PRIMARY OVERLAY 2

This overlay consists of the main subprogram MAIN2 and five contractor-supplied subroutines (fig. 19). Its purpose is to calculate the scalar product of the forces of file M4 with the block displacements of files 9 and 11.

MAIN2

This subprogram calls PROD1 and provides through the calling sequences storage locations for the block forces and displacements.

PROD1 (PRODS, PRODA, TF1, TF2, TF3, TF4, TXI, TETA, TV, E1E2, TCHI, TFL1, TFL2, TFL3, UX, UY, UPHI)

This subroutine calculates the symmetric and antisymmetric components of the scalar product given the force and displacement vectors according to the following formula

$$(1/2\pi)\int_0^{2\pi}\left\{\int_s (F_1\xi + F_2\eta + F_3 v + F_4\chi) r\,ds + \sum_{\text{rings}} (FL_1 u_x + FL_2 u_y + FL_3 u_\phi)\right\} d\phi$$

Because of the ϕ-integration, only the zeroth harmonic of the integrand contributes to the integral. This zeroth harmonic is calculated by the subroutine ZERO which is called twice for each term in the integrand - once for the symmetric component and once for the antisymmetric one.

If the prebuckling is symmetric (LSYMM = 1) so that the symmetric and antisymmetric modes are uncoupled, two scalar products PRODS and PRODA are calculated. However, in the general case (LSYMM $\neq$ 1), the symmetric and antisymmetric components are added together to form the scalar product PRODS.

PRODOM (FINT, NDIS, JENT, NOUT1, TR)

This function calculates a correction to an integral over a shell meridion with dome closures. In treating such a shell, for each dome closure an artificial edge is created in the model by deleting a small polar cap. PRODOM gives, to first order in the edge radius, the integral over all deleted caps of the integrand FINT.

SUM (A, N)

This function performs the summation $\text{SUM} = \sum_{I=1}^{N} A(I)$ and is used to obtain the ring contribution to the scalar product.

SYMP (FINT, TS, NDIS, JENT)

This function integrates an integrand FINT over an interval with the independent variable TS. Both are given as vectors with same number of entries. FINT is assumed to be continuous except at subinterval boundary points TS(I) where the boundary indices I are given by JENT(J), J = 1, NDIS. Between two boundary points there has to be at least one interior point and the values of TS must be equally spaced. Integration proceeds by Simpson's rule in each subinterval. If the number of interior points in the subinterval is even, the trapezoidal rule is used for the last TS-increment in the subinterval.

ZERO (X, Y, Z, IZ, N2, LSTAB, IA, NWAVE2)

This subroutine calculates the zeroth harmonic of a product of two sets of Fourier sine or cosine series. Both sets consist of LSTAB series and each series of both sets included N2 harmonics NWAVE2(I), I = 1, N2. The first set is stored in X(J,I), I = 1, LSTAB, J = 1, N2, and the second set in Y(J,I). Zero assumes that X and Y are stored densely [i.e., they are dimensioned (N2,LSTAB)], and calculates equivalent addresses instead of using double indices.

The product is stored in the vector Z(I), I = 1, LSTAB according to IA. If IA = 0, Z is equal to the product; if IA = 1, the product is added to Z. The parameter IZ determines whether X and Y are cosine or sine series. IZ = 1 corresponds to cosine series and IZ = 2 to sine series.

PRIMARY OVERLAY 3

This overlay consists of the main subprogram MAIN3 and one contractor-supplied subroutine, (fig. 19). Its only purpose to rearrange the equivalent forces from block to harmonic storage. It is called before integration of the differential equations, which is performed one harmonic at a time.

MAIN3

This subprogram reads from file M4 the block forces, rearranges them through subroutine SPREAD, and writes them in harmonic form onto external files 8 and 11.

SPREAD (A, B, LS, N2, IGAP, LN)

This subroutine is the reverse of subroutine of BLOCK, transferring one variable from block storage to harmonic storage. For the definition of the formal parameters, see the description of subroutine BLOCK. A working space of 20,000 words is provided in MAIN3, the first 5,000 for a block variable, the last 15,000 for 3 variables in harmonic form.

PRIMARY OVERLAY 4

This overlay consists of the main subprogram MAIN4 and two contractor-supplied subroutines (fig. 19). Its purpose is to rearrange to block form the harmonic displacements obtained from the integration of the differential equations. These displacements are then used with the prebuckling stress resultants by OVERLAY 5 to calculate the equivalent forces.

MAIN4

This subprogram reads from files 9 and 3 the harmonic displacements, rearranges them through subroutine BLOCK, and writes them in block form onto files 9 and 11.

BLOCK (A, B, LS, N2, IGAP, LN)

This subroutine transfers one variable from harmonic to block storage. B is the address of the first element of that variable in harmonic storage. A working space of 20,000 words is provided in MAIN4, the first 15,000 for 3 variables in harmonic form and the last 5,000 for one of these variables in block form. The definition of the formal parameters is given below.

A = storage for block type variable
B = storage for harmonic variable. It is assumed that the variable which is transferred is the first in a sequence of variables
LS = number of meridional points
N2 = number of harmonics
IGAP = length of one harmonic sequence; if there are L variables then IGAP = 2 * L * LS
LN = N2 * LS

<u>CALCUL</u> (TXI, TETA, TV, TCHI, TPSI, TTHET, UX, UY, UPHI)

This subroutine calculates and stores on external files several subsidiary block displacements, viz. the ring displacements u_x, u_y, and u_ϕ, and the shell rotations ψ and θ. In MAIN4 the calling sequence for CALCUL is

CALL CALCUL(A, A(I1),A(I2),A(I3),A(I3),A(I1),A(I2),A(IR21),A(I3))

This means that η and θ share the same space in core, v shares space with u_x and u_y, and χ, ψ and u_ϕ share the same space. As χ is left over in core from MAIN4, CALCUL reads ξ and η from file 9 and calculates u_x and u_y according to the formulae

$$u_x = \xi + e_y\chi$$

$$u_y = \eta - e_x\chi$$

which are then written on file 11. Next v is read from file 9 and the values of the amplitudes of the shell displacements ξ, η, v and rotation χ for the current iteration are printed at the specified output points. Then ξ and η are differentiated to form $\xi^\bullet$ and $\eta^\bullet$, and u_ϕ is calculated from the formula

$$u_\phi = [a\ v - (e_x\xi^\bullet + e_y\eta^\bullet)]/r$$

and written on file 11. With $\xi^\bullet$, $\eta^\bullet$ and v in core, θ and ψ are calculated according to

$$\theta = (r'/r)(v - \eta^\bullet) - \xi^\bullet/R_2$$

$$\psi = (v - \eta^\bullet)/R_2 + (r'/r)\xi^\bullet$$

and written on file 3.

PRIMARY OVERLAY 5

This overlay consists of the main subprogram MAIN5 and six contractor-supplied subroutines (fig. 19). Its purpose is to generate the pseudoforces required for the equivalent statics problem of each iteration.

The calculation of the pseudoforces involves taking the product of prebuckling stress resultants vectors by buckling displacements vectors. The main problem here is to execute these calculations in a limited core storage. It is assumed that there is only space in core for at most two buckling displacement vectors (with 100 meridional points and 25 harmonics this corresponds to 10,000 words). To accomplish the calculations under this restriction, use is made of external files and the variables are equivalenced through the calling sequences. For convenience, the calculation is broken into two subroutines. Subroutine FORCES calculates the shell pseudoforces X_1, X_2, X_3, L_1, L_2. Subroutine EQIFOR calculates from these forces the equivalent shell forces F_1, F_2, F_3, F_4. It also calculates the ring forces FL_1, FL_2, FL_3, and dome forces FD_1, FD_{30}, FD_{31}, FD_4.

MAIN5

This subprogram reads the harmonic interaction data from file 10 and the prebuckling data from file 1 and calls FORCES and then EQIFOR. Through the calling sequences to these subroutines it provides storage for block variables used by them. This storage, B(17476), in MAIN5 is divided up into two main parts.

In the call to FORCES, the first part is reserved for two variables, each of the length of one buckling shell block (LN2). The second part, starting at B(J0), is reserved for the five prebuckling variables of file 1 - T_1, T_2, T_{12}, X_3, and T_ϕ - plus the derived variable $T_1 + T_2$. Each of these variables except T_ϕ has the length of one prebuckling block (LN1), whereas T_ϕ has the length of one prebuckling ring block (LNR1). The total length of B, 17476, is based on a maximum of 7 prebuckling and 25 buckling harmonics, as well as the maximum of 100 meridional points and 34 rings. The calculation of the shell pseudoforces consists of taking many products which are of the type of a prebuckling state variable by a buckling response variable. Because of the desire to minimize the field length used, each buckling response variable is brought into core only at the time it is to be used. This is brought into either the first or second half of the first part of B, the remaining half then being used for the product series to be calculated.

In the call to EQIFOR, the first part of B is also used by six variables, each of the length of one buckling ring block (LNR2). In order that the prebuckling ring stress resultant, which is the fifth variable on file 1, remain in core for the subsequent calculation of the ring forces, it is necessary that J0 be determined as the maximum of I2 (i.e., 2 * LN2 + 1) and 6 * LNR2 - 4 * LN1 + 1.

EQIFOR (TF1, TF2, TF3, TF4, TX1, TX2, TL1, TL2, TX3, TMP, UX, UY, UPHI, WX, WY, TPHIO, TFL1, TFL2, TFL3)

This subroutine calculates the equivalent shell, ring, and dome forces and writes them on file M4. The nineteen arguments of EQIFOR share the same storage in MAIN5 in accordance with the calling sequence in MAIN5.

The calculation of the equivalent shell forces is based on the formulae

$$F_1 = -(r/R_2)X_1 + r'(X_3 - \dot{L}_1/r)$$

$$F_2 = -r'X_1 - (r/R_2)(X_3 - \dot{L}_1/r)$$

$$F_3 = -X_2 + L_1/R_2$$

$$F_4 = -L_2$$

The equivalent ring forces are calculated from

$$FL_1 = (T_{\phi_0} w_y)^{\bullet}$$

$$FL_2 = -(T_{\phi_0} w_x)^{\bullet}$$

$$FL_3 = -T_{\phi_0} w_x$$

$$FL_4 = 0$$

where T_{ϕ_0} are linear ($\lambda = 1$) prebuckling ring hoop forces, and the ring rotations w_x and w_y are calculated from the ring displacements by

$$w_x = (\dot{u}_y - u_\phi)/a$$

$$w_y = -\dot{u}_x/a$$

Subroutine FORD is called by EQIFOR to calculate the dome forces FD_1, FD_{30}, FD_{31}, and FD_4.

These forces are written on file M4 in the order F_1, F_2, F_4, F_3, FL_1, FL_2, FL_3, FD_1, FD_{30}, FD_{31}, FD_4.

FORCES (TX1, TX2, TL1, TL2, TTHET, TCHI, TPSI, TPR, TT1O, TT2O, TT12O, TX3O, T1P2, E1E2, TX3)

This subroutine calculates the pseudoloads acting on the shell surface for the equivalent statics problem of each iteration. The fifteen arguments of FORCES share the same storage in MAIN5 in accordance with the calling sequence in MAIN5.

The calculation is done according to the following formulae

$$X_1 = -[(T1_0 + T2_0)\theta]^{\bullet}/r + X3_0\chi$$

$$X_2 = -r'[(T1_0 + T2_0)\theta]/r + X3_0\psi$$

$$X_3 = X3_0(e_1 + e_2)$$

$$L_1 = T2_0\psi + T12_0\chi$$

$$L_2 = -(T1_0\chi + T12_0\psi)$$

where $T1_0$ and $T2_0$ are linear ($\lambda = 1$) prebuckling stress resultants, and the terms in $X3_0$ apply only for a live pressure field $\lambda X3_0$. Upon exit from FORCES, X_1, X_2, $-L_2$, L_1 are stored in that order on file 8, and the location TX3 contains $X_3 - L_1^{\bullet}/r$ for future use by EQIFOR.

FORD (IND, SHLFOR, DOMFOR, NDIS, JENT, NOUT1, LN, NDOME, TR, KASE, N2)

This subroutine calculates the dome forces applying at the artificial edge of the model near the pole. These are computed from the pseudoforces at the edge according to the following formulae:

For n = 0

$$FD_1 = FL_1 = \pm \frac{r}{2} F_1$$

$$FD_{30} = FL_3 = \pm \frac{r}{3} F_3$$

$$FL_2 = FL_4 = 0$$

For n = 1

$$FL_1 = FL_2 = 0$$

$$FD_{31} = FL_3 = \frac{r}{2} (\pm X_2 - X_1)$$

$$FD_4 = FL_4 = -\frac{r}{2} (L_1 \pm L_2)$$

For the terms with ambiguous signs, the upper signs apply at all poles other than one at the terminal point of the shell meridian, and the lower signs apply at a terminal point dome. For $n \geq 2$ all dome forces are zero.

Subroutine FORD is called six times by subroutine EQIFOR, each time calculating a part of the dome forces.

FPROD (X, IX, Y, IY, Z IA, LSTAB, N1, N2)

This subroutine, which is called by SYMPRO, calculates the product of two sets of FOURIER sine or cosine series. Both sets consist of LSTAB series; the first set has the harmonics NWAVE1(I) , I = 1,N1, the second set the harmonics NWAVE2(I) , I = 1, N2. The first set is stored in X(J,I), I = 1, LSTAB , J = 1,N1. The second set is stored in Y(J,I), I = 1,LSTAB , J = 1,N2. Only the harmonics belonging to NWAVE2 are retained in the product which is stored in Z(J,I), I = 1,LSTAB , J = 1,N2. FPROD assumes that X,Y,Z are densely stored [i.e., they are dimensioned (N1,LSTAB) and (N2,LSTAB), respectively], and calculates equivalent addresses instead of using double indices. IX,IY determine whether X,Y are sine or cosine series. IX,IY = 1 denote a cosine series for X,Y respectively. IX,IY = -1 denote a sine series.

IA determines how the product is stored in Z:

If IA = 0	Z is equal to the product
If IA = -1	Z is equal to (-1) times the product
If IA = 1	The product is added to Z
If IA = -2	The product is subtracted from Z

KAPPA (A, B, M)

This subroutine is called by FORCES and EQIFOR to scale the unit load axisymmetric torsionless components of the prebuckling stress resultants T_1(TT10), T_2(TT20), T_ϕ(TPHI0) and, for live pressure, normal pressure X_3 (TX30) by the input factor κ (SKAP). This scaling is performed only in conjunction with an input nonzero eigenvalue shift. The variables to be scaled on a given call to KAPPA, A and possibly B, are assumed to be stored in block form. If M = 1, both shell stress resultants A = TT10 and B = TT20 are scaled. If M = 2, only A = TX30 is scaled. If M = 3, only the ring stress resultant A = TPHI0 is scaled.

SYMPRO (A, NA, B, C, IA)

This subroutine, which is called by FORCES and EQIFOR, supervises the calculation of the product C of a prebuckling variable A by a buckling variable B. While the buckling variable consists of both cosine and sine components, the prebuckling variable may consist of only cosines, only sines or both. This is determined by the symmetry (or lack of same) of the external loads and the type of variable being treated. The symmetry of the load system is indicated by the variable LSYMM, which is transmitted to SYMPRO through blank COMMON.

LSYMM = 1	indicates symmetric (about an axial plane) load system
LSYMM = -1	indicates antisymmetric load system
LSYMM = 0	indicates a general load system

A prebuckling variable may be composed of cosines for the case of symmetric loading and of sines for the case of antisymmetric loading or vice versa. In the first case it is referred to as a "normal" type and in the second case as a "shear" type variable. NA indicates the type of prebuckling variable being treated.

NA = 1	indicates normal type (T_{1_0}, T_{2_0}, T_{ϕ_0}, X_{3_0})
NA = -1	indicates shear type (T_{12_0})

The argument IA indicates whether the product is of shell variables or ring variables and whether the product should replace C or be added to C.

IA = 0	denotes that C is made equal to the product of A and B
IA = 1	denotes that the product is added to C
IA = -1	denotes that C is made equal to the negative of the product
IA = -2	denotes that the product is subtracted from C
IA < 0	applies only to ring variables
IA ≥ 0	applies only to shell variables

PRIMARY OVERLAY 6

This overlay consists of the main subprogram MAIN6 and two contractor-supplied subroutines (fig. 19). Its purposes are to create the prebuckling data file 1 and also to generate the harmonic interaction data needed for Fourier multiplication.

MAIN6

This subprogram writes the prebuckling data, read and blocked by subroutine PREB, on file 1, and writes the harmonic interaction data, generated by subroutine MODINT, on file 10.

MODINT (N1, N2, NWAVE1, NWAVE2)

A repetitive step performed by the program is the calculation by FPROD of the product of two incomplete Fourier series. Although many different series are multiplied by FPROD, the harmonic numbers included in each factor and product series remain the same (viz. the prebuckling and buckling harmonic numbers). Therefore, it is efficient to precalculate and store, once and for all, the combinations of harmonic numbers of the multiplier and multiplicand series which contribute to each harmonic of the product series.

To be specific, let us denote an incomplete Fourier series by the notation

$$[a, N_w] \equiv \sum_{n \epsilon N_w} (a_n \cos n\phi + \hat{a}_n \sin n\phi)$$

where N_w is a set of non-negative integers arranged in the order of increasing magnitude. When two such series $[a, N_{w1}]$ and $[b, N_{w2}]$ are multiplied, the product may be reduced to a series of the same type $[c, N_{w3}]$ by the use of the formulae

$$\cos n\phi \cos m\phi = (1/2)[\cos(m - n)\phi + \cos(m + n)\phi]$$

$$\cos n\phi \sin m\phi = (1/2)[\sin(m - n)\phi + \sin(m + n)\phi]$$

$$\sin n\phi \sin m\phi = (1/2)[\cos(m - n)\phi - \cos(m + n)\phi]$$

As may be seen from these formulae, the only contribution to a coefficient c_p (or $\hat{c}_p$) of the product series comes from terms of the type $a_m b_n$ and $\hat{a}_m \hat{b}_n$ (or $\hat{a}_m b_n$ and $a_m \hat{b}_n$) where*

	$m + n = p$	(m,n is denoted as a P-combination)
	$m - n = p$	(m,n is denoted as an M1-combination)
or	$n - m = p$	(m,n is denoted as an M2 combination, $m \neq n$)

When many products of the type $[c, N_{w3}] = [a, N_{w1}][b, N_{w2}]$ are calculated for different series $[a, N_{w1}]$ and $[b, N_{w2}]$ with the same N_{w1} and N_{w2}, it is efficient to precalculate and store the P, M1, and M2-combinations of the elements of N_{w3}. This is done by subroutine MODINT. It is assumed that the only elements in N_{w3} that are of interest are those that appear also in N_{w2}. The information generated by MODINT is utilized by the subroutine FPROD for the actual multiplication.

Subroutine FPROD computes products of the type [X,NWAVE1][Y,NWAVE2] with two different ordered sets of non-negative integers NWAVE1(I), I = 1,N1 and NWAVE2(I), I = 1,N2. As indicated, the harmonics of interest in the product are assumed to be those belonging to NWAVE2. The P, M1, and M2-combinations† for the harmonics of a product series are

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*In this context, m is always a harmonic of the first (a) series, and n is a harmonic of the second (b) series.

†Henceforth, the term "combination" will not denote a pair of harmonic numbers NWAVE1(I), NWAVE2(J), but instead the corresponding pair of indices I, J.

stored compactly as a vector MATCOM(1500). Additional information is needed to tell the location in MATCOM of a particular combination. This information is given by the vectors NPLUS, NMIN1, NMIN2, and NCNTP, defined as follows:

NPLUS(I)	is the number of P-combinations for the I-th harmonic of NWAVE2
NMIN1(I)	is the number of M1-combinations for the I-th harmonic
NMIN2(I)	is the number of M2-combinations for the I-th harmonic
NCNTP(I)	is the address in MATCOM of the first P-combination of the I-th harmonic

The combinations are stored in MATCOM starting with the P, M1 and M2-combinations (in this order) of the first harmonic of NWAVE2 and ending with the M2-combinations of the N2-th harmonic. A pair (J,K) is stored with J first such that J corresponds to NWAVE1(J) and K to NWAVE2(K).

Subroutine MODINT generates the vector MATCOM and the associated vectors NPLUS, NMIN1, NMIN2, and NCNTP. This information is passed back to MAIN6 through COMMON/M/. The search for combinations is in two steps. First, the sums NWAVE2(I) + NWAVE1(J), I = 1,N2, J = 1,N1 are checked for equality to NWAVE2(K), K = 1,N2. If equality holds, then (J,I) is a P-combination for K and (J,K) is an M2-combination for I. Next, the sums NWAVE2(I) + NWAVE2(J), I = 1,N2, J = 1,N2 are checked for equality to NWAVE1(K), K = 1,N1. If equality holds for some K then (K,I) is an M1-combination for J and (K,J) is an M1-combination for I. The search has to be done twice. The first time (NPASS = 1 in the subroutine) to find the number of combinations NPLUS(I), NMIN1(I), NMIN2(I) and to construct NCNTP(I); the second time (NPASS = 2) to use this information to put the combinations in their proper places in MATCOM.

<u>PREB</u> (TT10, TT20, TT120, TX30, TPHI0, N)

This subroutine reads the prebuckling stresses T_ϕ, T_1, T_2, T_{12}, X_3 for N consecutive harmonics. This data is rearranged into block form as it is read in so that when reading is complete it is ready to be transferred to file 1.

Three cases are considered depending on the symmetry of the prebuckling state:

(1) if LSYMM = 1, the prebuckling state is symmetric and PREB reads in the cosine components of T_ϕ, T_1, T_2, X_3 and the sine components of T_{12};

(2) if LSYMM = -1, the prebuckling state is antisymmetric and PREB reads the cosine components of T_{12} and the sine components of T_{ϕ}, T_1, T_2, and X_3;

(3) if LSYMM = 0, the prebuckling state has no symmetry, and for each harmonic PREB reads first the symmetric components as in case 1 and then the antisymmetric components as in case 2.

Note that in accordance with the rules of block storage, when each variable contains both cosine and sine components (LSYMM = 0), the cosine components precede the sine components in core. This is true even in the case of T_{12}, for which the sine components are read in first.

In the case of a nonzero eigenvalue shift, PREB also transfers the axisymmetric torsionless prebuckling components of T_1, T_2, X_3, and T_{ϕ} onto file 10, thus forming a second record on this file after the basic structural data.

PRIMARY OVERLAY 7

This overlay consists of the main subprogram INPUT and seven contractor-supplied subroutines (fig. 19). Its essential functions are to input and write out the basic structural data, and to generate from it subsidiary data required by other overlays.

INPUT

This subprogram (with its subroutine BC) reads all input data except the prebuckling state data, writes the first record (structural data) on file 10, and generates, with the aid of its subroutines, auxiliary data for use in other overlays.

ADDRES

This subroutine calculates most of the blank common parameters and in particular those that are used to control operations with packed vectors such as read's, write's and rearranging operations.

CONST (NDIS, JENT)

This subroutine generates control parameters to eliminate redundant calculations of shell wall rigidities at each Runge-Kutta point for shells with constant wall properties. The parameters ICONST and ISUB(I) are set according to the following rules. If all shell wall properties (i.e., the reference surface location $\hat{z}$, and tables 2, 3, and 4) are constant over the whole shell, ICONST is set to unity; otherwise, it is set to zero. If the shell wall properties are constant in the I'th subinterval, ISUB(I) is set to unity; otherwise, it is set to zero.

ICHECK(I)

This function is called by CONST and returns the value ICHECK(I) = 1 if all shell wall properties (i.e., the reference surface location $\hat{z}$, and tables 2, 3, and 4) are unchanged from station I to I + 1; otherwise, the value ICHECK(I) = 0 is returned.

KASG (NWS, N2S, NWAVE2, IKASE, KASE, NW, N2)

This subroutine generates the vector KASE(I), which controls the use of complementary solutions and boundary conditions* from the previous case. If KASE(I) = 0, the complementary solutions and boundary conditions for the I-th harmonic have to be calculated. If KASE(I) = J, J ≠ 0, the I-th harmonic of the current case is the J-th harmonic of the previous case and the corresponding complementary solutions and boundary conditions may be taken from file ICOMP. Additionally, KASG decides whether there is need to change the complementary solution-boundary condition file from 2 to 12 or vice versa. This is done through the parameter IKASE. If for any harmonic the complementary solutions and boundary conditions are taken from the previous case and if that harmonic is not in the same place in the new sequence of harmonics as it is in the old sequence, then there is a need to switch files and IKASE = 1. Otherwise, the same file may be used for the new complementary solutions and boundary conditions, and IKASE = 0. A necessary and sufficient condition for IKASE = 0 is that KASE(I) = I or KASE(I) = 0 for every I in the range [1, N2].

The decision whether any complementary solutions and boundary conditions may be used from the previous case is based on the structural data and eigenvalue shift. This decision is made in program INPUT and transmitted to KASG through the parameter NW. If NW = 1, the differential operator in the current case is different from that of the previous case and no complementary solutions or boundary conditions may be used from the previous case. Accordingly, IKASE = 0 and KASE(I) = 0 for all I.

If NW = 0, the input data permits the use of complementary solutions and boundary conditions from the previous case. KASG then searches the harmonics of the previous case - NWS(I), I = 1,N2S - to find whether any of them are equal to any of the harmonics of the current case - NWAVE2(I), I = 1,N2. If for some I and J, NWAVE2(I) = NWS(J), then KASE(I) = J. If the I-th harmonic in the current case is absent from the previous case, then KASE(I) = 0.

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*In this context, boundary conditions refer to their homogeneous part only, viz. the matrices [B] and [D].

NSYMM (N1, NWAVE1, NT)

This function checks the three conditions given on page 33, any one of which indicates the existence of equal and opposite eigenvalues. If any one of these conditions is satisfied, NSYMM = 1; otherwise, NSYMM = 0.

Major FORTRAN variables of SRA 101.- Major variables which have special meaning for SRA 101 are defined below.* For SRA 101 variables which are common to other programs, see page 126.

Variable	Definition	Subprogram where generated
ANTINT(100)	antisymmetric part of shell contribution to scalar product integrand	PROD1
ANTRNG(34)	antisymmetric part of ring contribution to scalar product integrand	PROD1
BDS(544)	BD(4,4,34)	BC
BS(544)	BBP(4,4,34)	BC
DENOMA	denominator of Raleigh quotient for antisymmetric buckling mode	MAIN
DENOMS	denominator of Raleigh quotient for (symmetric) buckling mode	MAIN
DF1(23)	FL_1 for dome boundaries for n = 0	PLCFOR
DF30(23)	FL_3 for dome boundaries for n = 0	PLCFOR
DF31(46)	FL_3 for dome boundaries for n = 1	PLCFOR
DF4(46)	FL_4 for dome boundaries for n = 1	PLCFOR
DIFA	relative difference between two successive eigenvalue estimates for antisymmetric buckling mode	MAIN
DIFS	relative difference between two successive eigenvalue estimates for (symmetric) buckling mode	MAIN
DOMFOR(138)	an array containing DF1, DF30, DF31, DF4	EQIFOR
FD1(23)	same as DF1	EQIFOR
FD30(23)	same as DF30	EQIFOR
FD31(46)	same as DF31	EQIFOR
FD4(46)	same as DF4	EQIFOR
FLAASS	eigenvalue estimate two iterations ago for antisymmetric buckling mode	MAIN
FLAMA	current eigenvalue estimate for antisymmetric buckling mode	MAIN
FLAMAS	previous eigenvalue estimate for antisymmetric buckling mode	MAIN

*If instead of the dimension, the letter I appears in parentheses after the variable name, the variable is a dummy variable of a subroutine using space provided by the calling program.

Variable	Definition	Subprogram where generated
FLAMS	current eigenvalue estimate for (symmetric) buckling mode	MAIN
FLAMSS	previous eigenvalue estimate for (symmetric) buckling mode	MAIN
FLASSS	eigenvalue estimate two iterations ago for (symmetric) buckling mode	MAIN
FNUMA	numerator of Raleigh quotient for antisymmetric buckling mode	MAIN
FNUMS	numerator of Raleigh quotient for (symmetric) buckling mode	MAIN
GUESS	eigenvalue shift for axisymmetric torsionless prebuckling component	INPUT
ICOMP	complementary solution file number	MAIN, MAIN1
ICONST	if 1, XB and data of tables 2, 3, and 4 are constant over whole shell	CONST
IGAPM	2*LSTAB + 6*NRING	ADDRES
IGAP2	2*LSTAB*(1 + LTYPE)	ADDRES
IGAP3	6*LSTAB	ADDRES
IKASE	if nonzero, the scratch file (2 or 12) of the previous case will be used as the complementary solution file	KASG
IND	if 0, indicates integration for symmetric components; if 1, indicates integration for antisymmetric components	MAIN1
IR1	LNR2 + 1	ADDRES
IR2	IR1 + LNR2	ADDRES
IR21	I2 + LNR2	ADDRES
IR3	IR2 + LNR2	ADDRES
IR31	I3 + LNR2	ADDRES
IR4	IR3 + LNR2	ADDRES
IR5	IR4 + LNR2	ADDRES
ISCR	scratch file number	MAIN, MAIN1
ISFLAG	if ISFLAG = 1, do not compute wall properties in DER and INTRPL	MAIN, DER, CNT
ISS4	if nonzero, use some complementary solutions from file TAPE2(saved from file 2 or 12 of a previous run) to construct new complementary solution file	INPUT
ISS6	if nonzero, override abort if subinterval length criterion is exceeded; if 2, compute new initial approximation (ITO = 1), but complementary solutions are to be taken from file 2 of 12 (saved from a previous run); if 3, new complementary solution file is to be constructed (ITO = 1), but initial approximation is to be taken from files 8 and 11 (saved from a previous case)	INPUT

Variable	Definition	Subprogram where generated
ISUB(33)	if ISUB(I) = 1, all wall properties are constant over subinterval I	CONST
IT	iteration number	MAIN
ITF	maximum iteration number	INPUT
ITO	initial iteration number	INPUT
I1	LN2 + 1	ADDRES
I2	I1 + LN2	ADDRES
I3	I2 + LN2	ADDRES
JR1	I1 + LNR2	ADDRES
JR2	JR1 + LNR2	ADDRES
J0	maximum of I2 and 6*LNR2 - 4*LN1 + 1	ADDRES
J1	J0 + LN1	ADDRES
J2	J1 + LN1	ADDRES
J3	J2 + LN1	ADDRES
J4	J3 + LN1	ADDRES
J5	J4 + LNR1	ADDRES
KAS	parameter to indicate (to CNT and INTRPL) whether integration is for complementary (KAS = 3)or particular solution (KAS = 2) (denoted as KASE in CNT and INTRPL)	MAIN1
KASE(25)	a vector indicating the availability and position of complementary solutions from previous case. If KASE(I) = 0, the complementary solutions for the Ith harmonic must be computed. Otherwise, KASE(I) gives their position on the complementary solution file from the previous case	KASG
KK(100)	entry numbers for output data	INPUT
KN	number of output points	INPUT
KR(34)	ring numbers for output of prebuckling ring hoop forces	INPUT
K2	max(139, I1 + LNR23)	ADDRES
LN	LSTAB*N2	ADDRES
LNR	LNR23 + LN2	ADDRES
LNR1	length of one prebuckling ring block, (N1 + N1E)*NRING	ADDRES
LNR2	length of one buckling ring block, 2*NRING*N2	ADDRES
LNR22	2*LNR2	ADDRES
LNR23	3*LNR2	ADDRES
LN1	length of one prebuckling shell block, (N1 + N1E)*LSTAB	ADDRES
LN12	2*LN1	ADDRES

Variable	Definition	Subprogram where generated
LN2	length of one buckling shell block, 2*LN	ADDRES
LN2P	LN2*(1 + LTYPE)	ADDRES
LSN1	LSTAB*N1E + 1	ADDRES
LSN2	LSTAB*N2 + 1	ADDRES
LSYMM	flag for symmetry of prebuckling data: = 0, general prebuckling; -1, antisymmetric prebuckling; 1, symmetric prebuckling	INPUT
LS2	2*LSTAB	ADDRES
LS21	2*LSTAB + 1	ADDRES
LS4	4*LSTAB	ADDRES
LS41	4*LSTAB + 1	ADDRES
LS6	6*LSTAB	ADDRES
LS61	6*LSTAB + 1	ADDRES
LS81	8*LSTAB + 1	ADDRES
LTAPE1	length of file 1, 4*LN1 + LNR1	MAIN6
MATCOM(1500)	a vector containing harmonic interaction data	MODINT
M4	equivalent force file number	MAIN
NCNTP(25)	location of P-combinations in MATCOM	MODINT
ND	a flag controlling dome forces: if domes exist and buckling wave numbers include 0 but not 1, ND = 1; 1 but not 0, ND = 2; both 0 and 1, ND = 3. If no domes exist or all buckling waves numbers ≥ 2, ND = 0	INPUT
NDOME	number of domes	BC
NMF	equal to NFM	MAIN1
NMIN1	number of M1-combinations	MODINT
NMIN2	number of M2-combinations	MODINT
NN	wave number	MAIN1
NPLUS(25)	number of P-combinations	MODINT
NPS	flag for prebuckling state table	INPUT
NR	number of rings for prebuckling ring hoop force output	INPUT
NRING	number of rings	BC
NRNG2	2*NRING	ADDRES
NRN1	NRING*N1E + 1	ADDRES
NRN2	NRING*N2 + 1	ADDRES
NS	if equal and opposite eigenvalues, NS = 1; otherwise NS = 0	INPUT, NSYMM
NSGS	NSG from the last case for which NSG ≠ 0	INPUT
NT	if the axisymmetric prebuckling harmonic exists and represents pure torsion, NT should be input as 1	INPUT

Variable	Definition	Subprogram where generated
NW	if zero, some complementary solutions of previous case may be used	INPUT
NWAVE1(25)	wave numbers in prebuckling state	INPUT
NWAVE2(25)	wave numbers in buckling mode	INPUT
NWS(25)	wave numbers in buckling mode of previous case	INPUT
N1	number of prebuckling harmonics	INPUT
N1E	equal to N1 if LSYMM = 0; otherwise, N1E = 0	ADDRES
N2	number of harmonics in buckling mode	INPUT
N2R	N2*NRING	ADDRES
N2S	N2 of previous case	INPUT
PRA	antisymmetric part of scalar product	PROD1
SKAP	scaling factor for axisymmetric torsionless prebuckling component, κ	INPUT
SYMINT(100)	symmetric part of shell contribution to scalar product integrand	PROD1
SYMRNG(34)	symmetric part of ring contribution to scalar product integrand	PROD1
TCHI(I)	χ	PLCDIS
TDISP(1000)	a buffer space for displacements	MAIN1
TETA(I)	η	PLCDIS
TE1E2(I)	$e_1 + e_2$	PLCDIS
TF(1020)	a buffer space for forces	MAIN1
TFL1(I)	FL_1	EQIFOR
TFL2(I)	FL_2	EQIFOR
TFL3(I)	FL_3	EQIFOR
TF1(I)	F_1	EQIFOR
TF2(I)	F_2	EQIFOR
TF3(I)	F_3	EQIFOR
TF4(I)	F_4	EQIFOR
TL1(I)	L_1	FORCES
TL2(I)	$-L_2$	FORCES
TPHIO(I)	T_ϕ	PREB
TPSI(I)	ψ	CALCUL
TTHET(I)	θ	CALCUL
TT10(I)	T_1	PREB
TT120(I)	T_{12}	PREB
TT20(I)	T_2	PREB
TV(I)	v	PLCDIS
TXI(I)	ξ	PLCDIS
TX1(I)	X_1	FORCES
TX2(I)	X_2	FORCES
TX3(I)	X_3	FORCES

Variable	Definition	Subprogram where generated
TX30(I)	X_{3_0}	PREB
T1P2(I)	$T_1 + T_2$	FORCES
WX(I)	w_x	EQIFOR
WY(I)	w_y	EQIFOR
UX(I)	u_x	CALCUL
UY(I)	u_y	CALCUL
UPHI(I)	u_ϕ	CALCUL

SRA 200

External files.- SRA 200 uses four external files: TAPE2, TAPE3, TAPE7, and PUNCH. TAPE2 and TAPE3 are the standard input and output files, respectively. At the user's option, prebuckling state data required for SRA 201 and SRA 202 may be written onto TAPE7, and shell primary stresses (σ_s, σ_ϕ) may be written onto PUNCH.

Overall logical flow of SRA 200.- Essential features of the overall flow of SRA 200 are listed below.

SRA200 (MAIN PROGRAM)

Call INPUT

INPUT

1. Read and write case title card. If end-of-file, stop
2. Read case option card: LOOP, NSG, NWP, NFM, NST, NMD, NML, NTL, NIC, NIS, NDER, SIGDIG, LTYPE, FLAM, RTABL, ISS1, ISS2, ISS4, ISS6
3. If ISS1 ≠ 0 and FLAM ≠ 0., write on logical unit 7, the nonlinear load card (the first card of the standard prebuckling data deck)
4. If FLAM = 0., set FLAM = 1. and to signal this, set LIN = 1
5. Read basic input tables
   Geometry: NOUT2, NOUT1. NOUT3, TS, TR, TRP, TRR2, TXB
   Wall properties: TE1, TE2, TNU1, TH
   Foundation moduli: TK1, TK3
   Stringer properties: TEST, TEAST, TEIST, TZBST
   Mass densities: TRHOM
   Mechanical loads: TX1, TX3
   Thermal loads: TTH1, TTH2, TDTH1. TDTH2, TTHST
6. Call SETUP to construct geometric parameters: NDIS, TDIS, JENT, IBR, NBR, IEND, KEND

7. Write input tables
8. Multiply mechanical and thermal loads by load factor (FLAM)
9. If NIS = 2, go to step 13
10. If NIS = 1, read standard prebuckling data (at load DLAM), to obtain nonlinear quantities at DLAM (TT1N, TCHIN) and derivatives at DLAM (TT1M1, TCHIM1)
11. Form initial approximation for T_1 and χ at load FLAM by linear extrapolation from DLAM to FLAM
12. Go to step 14
13. Set initial approximation state to zero
14. If NIC = 0, make NOUT1-table negative at all boundaries except dome closures (to indicate boundary data comes from previous case)
15. Call BC to read or generate boundary condition matrices BBP, BD, and SL for each boundary
16. If present case has a rigid body degree of freedom (NDER = 1), call RBMODE to calculate rigid body acceleration and correct ring and dome boundary conditions for inertial loads
17. Set KASE = 3 for calculation of new complementary solutions
18. If LIN ≠ 0, reset FLAM = 0.
19. Calculate initial scale factors required for START
20. Return

SRA200

1. Set NLFLAG = 0 to indicate beginning of solution for nonlinear state at load level FLAM. If FLAM = 0., set NLFLAG = 1 to indicate beginning of solution for linear perturbation state
2. Set up iteration loop for nonlinear state
3. If KASE = 3, calculate and store complementary and particular solutions. Otherwise, calculate and store only the particular solution (in this case we are calculating a linear solution for which the complementary solutions from the last iteration for the nonlinear solution will be used)
4. Combine complementary and particular solutions to obtain new estimate for nonlinear state (NLFLAG = 0) or a linearized state (NLFLAG ≠ 0)
5. If NLFLAG = 1 (indicating first linear perturbation state is being calculated), go to step 8. If NLFLAG = -1 (indicating second linear perturbation state is being calculated), go to step 9
6. Compute and write (with the iteration number) the maximum relative change (R) in the meridional rotation field for the last two successive estimates of the nonlinear state
7. If $R > 10^{-(SIGDIG)}$, i.e., uniform convergence to SIGDIG significant digits has not been achieved, store the new estimate for the meridional stress resultant and rotation in TT1M1 and TCHIM1, and go to step 3
8. Write forces (Y) and displacements (Z) of the last computed state along with meridional rotation (TCHIM1) of previous state

9. Compute and store for each ring the hoop force and out-of-plane bending moment for the nonlinear (TTPHIN, TMYN) or first linear (TTPHIL, TMYL) states, or the hoop stretching strain (TEPSL) and out-of-plane bending strain (TCAPL) for the second linear state
10. If ISS1 $\neq$ 0, write on logical unit 7 the ring hoop forces for the nonlinear or the first linear states, or (if additionally ISS4 $\neq$ 0) the second linear state
11. Set up DO-loop over entry points for calculation of stress resultants, strains, and stresses
    A. Compute partially inverted shell wall rigidities, mass and thermal moments through shell wall
    B. Compute the stretching and bending strains and stress resultants and couples
    C. If NLFLAG = -1, go to step E
    D. Compute effective surface loads for calculation of force and displacement derivatives from differential equations
    E. If NLFLAG = -1 and ISS4 = 0, go to step L
    F. If ISS1 $\neq$ 0, write normal shell stress resultants on logical unit 7
    G. If NLFLAG = -1, go to step L
    H. Calculate from differential equations the force and displacement derivatives, and from these the derivatives of the stretching bending strains
    I. Calculate the stress (SIGST) at stringer centroid
    J. Set up DO-loop over shell wall layers
        i. Calculate from the stress-strain relation the primary shell stresses (SIG1 and SIG2) at wall layer faces
        ii. Calculate, by integration of the appropriate three-dimensional equilibrium equation through the shell wall thickness, the transverse shear stress SIG13 at wall layer interfaces and midpoints
        iii. Write normal deflections and stresses
        iv. If ISS2 $\neq$ 0, punch primary shell stress at wall layer faces
        v. End of DO-loop over wall layers
    K. If NLFLAG = 0, normalize thermal and mechanical loads and (if NDER $\neq$ 0) acceleration to unit load level
    L. End of DO-loop over entry points
12. If NLFLAG = 0, normalize boundary loads to unit load level
13. If NLFLAG = -1 and ISS4 = 0, go to step 23
14. If ISS1 $\neq$ 0, write the meridional rotation field on logical unit 7
15. If NLFLAG = 0, set NLFLAG = 1, KASE = 2, and go to step 3
16. If NLFLAG = -1, go to step 23
17. If ISS1*ISS4 $\neq$ 0, write on logical unit 7 the nonlinear and linear ring out-of-plane bending moments and shell normal stress couples (additional prebuckling data)
18. If ISS4 = 0 and NTL = 2, call INPUT for next case
19. Call STREN to compute the stiffness functional $\sigma_0^{(1)} \cdot \varepsilon_0^{(1)}$ (SELL)

B

20. If FLAM = 0., calculate the (linear) stiffness at zero load, set its rate of change with load factor to zero, and go to step 25
21. Call STREN to compute the stiffness functional $\sigma_0 \cdot \varepsilon_0^{(1)}$ (SENL)
22. Set NLFLAG = -1, correct dome boundary loads for second linear state (if live pressure loading), and go to step 3
23. Call STREN to compute the stiffness functional $\sigma_0 \cdot \varepsilon_0^{(2)}$ (SENL2)
24. Calculate the stiffness and its rate of change with load factor
25. Write the stiffness and its rate of change with load factor
26. If ISS1*ISS4 $\neq$ 0, write on logical unit 7 the stiffness and its rate of change with load factor
27. Call INPUT for next case

Subprogram descriptions for SRA 200.- SRA 200 consists of 20 contractor-supplied subprograms (fig. 20). Those subprograms which have features special to SRA 200 are described below. For descriptions of the remaining subprograms of SRA 200, which are also used by other programs, see page 121.

SRA200

This is the main subprogram of the nonlinear response program SRA 200. Its essential functions are to set up and control the Newton iteration process for the nonlinear state, the integration for the first and second linear perturbation states, and the calculation of the stresses, displacements, stress resultants and couples, and structural stiffness. It is described in more detail in the overall logical flow chart of this program.

INPUT

This subprogram (and its subroutines) reads and writes all of the input data, sets up the initial approximation for the Newton iteration, and prepares the boundary conditions. It is described in more detail in the overall flow chart of this program.

PROD1 (Z, Z1) and RBMODE

PROD1 and RBMODE are essentially the same as the corresponding routines of SRA 100. In this case, they are simplified by the fact that the only rigid body mode of interest is a translational displacement along the axis of revolution.

STREN (TT1, TT2, TM1, TM2, TTPHI, TMY, ANS)

This subroutine is called by SRA200 and calculates the three functionals $\sigma_0 \cdot \varepsilon_0^{(1)}$, $\sigma_0 \cdot \varepsilon_0^{(2)}$, and $\sigma_0^{(1)} \cdot \varepsilon_0^{(1)}$ required in the calculation of the structural stiffness and its derivative, given by

$$K_0 = \lambda_0 / \sigma_0 \cdot \varepsilon_0^{(1)}$$

$$K_0^{(1)} = K_0\{1 - K_0[\sigma_0 \cdot \varepsilon_0^{(2)} + \sigma_0^{(1)} \cdot \varepsilon_0^{(1)}]\}/\lambda$$

Each of these functionals may be written in the form

$$2\pi\int(T_1\varepsilon_1 + T_2\varepsilon_2 + M_1\kappa_1 + M_2\kappa_2)rds + 2\pi \sum (T_\phi\varepsilon_\phi + M_y\kappa_y)a$$

where the integral is over the shell meridian and the summation over all rings. The stress resultants and couples correspond to either the nonlinear state σ_0 or its derivative state $\sigma_0^{(1)}$, and these variables are passed through the calling sequence. The stretching and bending strains correspond to either the first derivative state $\varepsilon_0^{(1)}$ or the second derivative state $\varepsilon_0^{(2)}$, and these variables are passed through blank COMMON. The integration is performed by means of Simpson's rule. The result of the calculation is passed back to SRA200 as the last argument in the calling sequence.

Major FORTRAN variables of SRA 200.- Major variables which have special meaning for SRA 200 are defined below. For SRA 200 variables which are common to other programs, see page 126.

Variable	Definition	Subprogram where generated
ISS1	flag to write on logical unit 7 standard prebuckling data for SRA 201	INPUT
ISS4	flag to write on logical unit 7 additional prebuckling data for SRA 202	INPUT
LIN	flag to indicate calculation of linear solution only (LIN $\neq$ 0)	INPUT
NLFLAG	flag to indicate state being computed: = 0, nonlinear state; = +1, first linear state; = -1, second linear state	SRA200
NML	flag for mechanical loads table	INPUT
NTL	flag for thermal loads table	INPUT
NIS	flag for initial approximation to nonlinear state	INPUT
REL	convergence tolerance for meridional rotation field, $10^{-(SIGDIG)}$	INPUT
TCAPL(100)	${\kappa_y}_0^{(2)}$	SRA200
TEPSL(100)	${\varepsilon_\phi}_0^{(2)}$	SRA200
TCAP1L(100)	${\kappa_1}_0^{(1)}$ or ${\kappa_1}_0^{(2)}$	SRA200
TCAP2L(100)	${\kappa_2}_0^{(1)}$ or ${\kappa_2}_0^{(2)}$	SRA200
TCHIM1(100)	rotation field (χ) of previous iteration	SRA200, INPUT

Variable	Definition	Subprogram where generated
TDIL(100)	linearized dilitation field $(e_1 + e_2)$ of previous iteration	SRA200, INPUT
TEPS1L(100)	${\varepsilon_1}_0^{(1)}$ or ${\varepsilon_1}_0^{(2)}$	SRA200
TEPS2L(100)	${\varepsilon_2}_0^{(1)}$ or ${\varepsilon_2}_0^{(2)}$	SRA200
TMYL(34)	${M_y}_0^{(1)}$	SRA200
TM1L(100)	${M_1}_0^{(1)}$	SRA200
TM2L(100)	${M_2}_0^{(1)}$	SRA200
TTPHIL(34)	${T_\phi}_0^{(1)}$	SRA200
TT1M1(100)	meridional stress resultant (T_1) of previous iteration	SRA200, INPUT
TT2L(100)	${T_2}_0^{(1)}$	SRA200
ZM1(1,100)	displacement mode (ξ = constant) of rigid body acceleration	RBMODE

SRA 201

External files.- SRA 201 uses three external files: TAPE2, TAPE3, and PUNCH. TAPE2 and TAPE3 are the standard input and output files, respectively. At the user's option, the buckling mode data required for SRA 202 may be written onto PUNCH.

Overall logical flow of SRA 201.- Essential features of the overall flow of SRA 201 are listed below.

SRA201 (MAIN PROGRAM)

Call INPUT

INPUT

Read and write case title card. If end-of-file, stop
Read case option card: LOOP, NSG, NWP, NFM, NST, NPG, NML, NIC, NASE, MAXMOD, NTL, NDER, SIGDIG, GUESS, RTABL, ISS1, ISS2, ISS3, ISS5, ISS6

If MAXMOD > 1, read card of eigenvalue shifts for higher modes
Read basic input tables
    Geometry: NOUT2, NOUT1, NOUT3, TS, TR, TRP, TRR2, TXB
    Wall properties: TE1, TE2, TE12, TNU1, TH
    Foundation moduli: TK1, TK2, TK3
    Stringer properties: TEAST, TEIST, TGJST, TZBST
    Pressure field: TX30, TX3X, TX3Y
Call SETUP to construct geometric parameters: NDIS, TDIS, JENT, IBR, NBR, IEND, KEND
Read standard prebuckling data (if NML $\neq$ 0) consisting of the variables
    FLAM, LTYPE
    TTPHIN, TT1N, TT2N, TCHIN
    TTPHIO, TTIO, TT20, TCHIO
Write input tables
Set KASE = 2 if complementary solutions of previous case apply, otherwise KASE = 3
If NIC = 0, make NOUT1-table negative at all boundaries except dome closures (to indicate boundary data comes from previous case)
Call BC to read or generate boundary matrices BBP and BD for each boundary
Calculate scale factors required for START
Return

SRA201

Compute and store partially inverted shell wall rigidities at output points for future use by PROD1
If shell has rigid body freedom (FN $\leq$ 1. and NDER input nonzero) compute, store and write the appropriate rigid body modes. Increase MINMOD from 1 by the number of rigid body modes stored
If KASE = 3, calculate and store the complementary solutions
Set up DO-loop for buckling modes, with index (MODE) running from MINMOD to MAXMOD
1. Generate (quadratic) initial guess for buckling mode displacements
2. If MODE -1 > 0, orthogonalize current mode estimate with respect to previous stored modes
3. Write eigenvalue shift and set up iteration loop for buckling mode
4. Calculate, from current mode estimate, boundary matrices SL for dome and ring boundaries
5. Compute particular solution for new buckling mode estimate
6. Superimpose particular and complementary solutions to obtain new buckling mode estimate (Y,Z)
7. If MODE -1 > 0, orthogonalize new buckling mode estimate with respect to previous stored modes
8. Calculate the Rayleigh quotient, which is the new eigenvalue estimate (OMEGA1)
9. Write iteration number and eigenvalue estimate

10. Test for convergence of successive eigenvalue estimates to SIGDIG significant digits. If converged, go to step 19
11. Test for convergence of sequence of ratios of successive differences of eigenvalue estimates to one significant digit. If not converged, go to step 16
12. Estimate the number of iterations required to achieve eigenvalue convergence. If seven or less, go to step 16
13. Make an eigenvalue shift to an estimate of desired eigenvalue
14. If necessary, remove artificial rigid body constraints
15. Correct BD matrices at ring and dome boundaries
16. Normalize and store buckling mode estimate in YM1, ZM1 arrays
17. If an eigenvalue shift has been made (GUESS ≠ GUESSS), compute and store new complementary solutions, and go to step 3
18. Go to step 4
19. If a higher mode remains to be calculated, store new mode in YMODE, ZMODE for future use in orthogonalization process
20. Improve eigenvalue estimate by using ratio of successive differences of eigenvalue sequence
21. Normalize and write last two buckling modes and eigenvalue
22. If a higher mode remains to be calculated with a new eigenvalue shift (FLAG = 2.), perform steps 14, 15, and compute and store new complementary solutions
23. End of MODE DO-loop

Call INPUT for next case

Subprogram descriptions for SRA 201.- SRA 201 consists of 20 contractor-supplied subprograms (fig. 21). Those subprograms which have features special to SRA 201 are described below. For descriptions of the remaining subprograms of SRA 201, see page 121.

SRA201

This is the main subprogram of SRA 201. Its essential function is to set up and control the iteration process for each buckling mode requested. It is described in more detail in the overall logical flow of this program.

INPUT

This subprogram (and its subroutines) reads and writes all of the input data, and prepares the homogeneous parts of the boundary conditions. It is described in more detail in the overall logical flow of this program.

PROD1(Z,Z1)

This function calculates the shell contribution to the inner product of two modal fields (Y,Z) and (Y1, Z1). The integration over the shell meridian is performed by Simpson's rule. The displacements Z, Z1 are passed through the calling sequence, whereas the forces Y, Y1 are available through blank COMMON. The ring contribution (PROD2) to the inner product is calculated in SRA201 and is always added to PROD1 to obtain the full inner product before it is used. An approximate contribution over the small deleted cap at dome closure boundaries is included in PROD1.

Major FORTRAN variables of SRA 201.- Major variables which have special meaning for SRA 201 are defined below. For SRA 201 variables which are common to other programs, see page 126.

Variable	Definition	Subprogram where generated
GLAM	FLAM + GUESS	INPUT
GUESS	eigenvalue shift	INPUT, SRA201
ISS1	flag to punch buckling mode data for SRA 202	INPUT
ITER	iteration number	SRA201
NML	flag for prebuckling data deck	INPUT
NTL	flag indicating torsional (n = 0) mode	SRA201
TCHI2(100)	rotation field (χ) of the buckling mode estimate two iterations ago	SRA201
TGUESS(4)	eigenvalue shifts for higher buckling modes	INPUT

SRA 202

External files.- SRA 202 uses three external files: TAPE1, TAPE5, and TAPE6. TAPE5 and TAPE6 are the standard input and output files, respectively. TAPE1 is used to store the data contained in COMMON/OV1/, which is not used by primary overlay 2.

Overall logical flow of SRA 202.- This program consists of a main overlay and two primary overlays (fig. 22). Essential features of its overall flow are listed below.

MAIN

Read and write case title card
IDONE = 0
ITER = 0
Call OVERLAY 1

OVERLAY 1

Read case option card: LOOP, NSG, NWP, NFM, NST, NPG, NML, NIC, RTABL,
ISS4, ISSW6

Set FN = 0.

Read basic input tables

Geometry: NOUT2, NOUT1, NOUT3, TS, TR, TRP, TRR2, TXB

Wall properties: TE1, TE2, TE12, TNU1, TH

Foundation moduli: TK1, TK2, TK3

Stringer properties: TEAST, TEIST, TGJST, TZBST

Pressure field: TX30, TX3X, TX3Y

Call SETUP to construct geometric parameters: NDIS, TDIS, JENT, IBR,
NBR, IEND, KEND

Read standard prebuckling data (if NML $\neq$ 0), consisting of the variables

FLAM, LTYPE

TTPHIN, TT1N, TT2N, TCHIN

TTPHIO, TT1O, TT2O, TCHIO

Read additional prebuckling data (if NML and ISS4 $\neq$ 0), consisting of the variables

TMYN, TMYO

TM1N, TM1O, TM2N, TM2O

TPHI1, TT11, TT21, TCHI1

STIFN, STIFO

Write input tables

Read first buckling mode data card containing

FNC, NTLC, GUESS

Write harmonic number (FNC) and critical load (FLAM + GUESS)

Read and write buckling mode data consisting of components of Y and Z

Compute buckling mode shell stress resultants: TT1C, TT2C, TT12C

Compute buckling mode rotations: TCHIC, TPSIC, TTHETC

Compute buckling mode normal strains: TEPS1C, TEPS2C, TCAP1C, TCAP2C

Compute prebuckling shell stress resultants and rotations at buckling load:
TT1NO, TT2NO, TCHINO

If NIC = 0, make NOUT1-table negative at all boundaries except dome closures (to indicate boundary data comes from previous case)

Call BC to read or generate boundary matrices BBP, BD, and SL for each boundary and calculate buckling mode ring hoop force and rotations (TPHIC, TWXC, TWYC)

Compute prebuckling stiffness (STIFNO) at buckling load (if ISS4 $\neq$ 0)

Compute and write inner product (PRODC)

Correct and write corrected inner product (if ISS4 $\neq$ 0)

Compute and write α(AMAX) for imperfection shape giving the maximum value of α

Compute and write β(BMAX) for imperfection shape giving the maximum value of α (if ISS4 $\neq$ 0)

Compute and write α(AMODE) and ratio (FI1) of maximum normal amplitude to angular amplitude for buckling mode imperfection

Compute and write β(BMODE) for buckling mode imperfection (if ISS4 $\neq$ 0)
Compute stiffness functional $\sigma_1 \cdot \varepsilon_1$ (S1E1)
Buffer out labeled common (TAPE1)
If FNC = 0., compute and write 1st postbuckling coefficient (SA) and postbuckling stiffness (STIF) (if ISS4 $\neq$ 0); set IDONE = 1 and return to MAIN for next case
Set up artificial rigid body constraint(s), if necessary, for boundary value problem for axisymmetric component of second-order postbuckling state
Return

MAIN

Check to make sure all buffered data is out of core
Call OVERLAY 2

OVERLAY 2

Compute complementary solutions for axisymmetric component of second-order state
Compute particular solution
Combine complementary and particular solutions to form axisymmetric solution (Y,Z)
Return

MAIN

Call OVERLAY 1

OVERLAY 1

Buffer in labeled common
Write axisymmetric solution
Check to make sure all buffered data is in core
Compute associated shell stress resultants: TT1SO, TT2SO
Compute associated shell rotations: TCHISO
Compute associated shell strains: EPS1SO, EPS2SO, CAP1SO, CAP2SO
Compute associated ring stress resultants: TPHISO
Compute associated ring strains: TEPSSO
If ISS4 $\neq$ 0, compute $\sigma_0{*} \cdot \varepsilon_2$ (SOE2)
Set FN = 2.*FNC
Save NOUT1-table
Make NOUT1 negative at all boundaries except dome closures
Call BC to recompute BBP, BD, SL matrices for ring (NOUT1 = -1) and dome boundaries (NOUT1 = 4)
Restore NOUT1-table for next case
Buffer out labeled common
Eliminate artificial rigid body constraint(s) if necessary
Return

MAIN

Check to make sure all buffered data is out of core
Call OVERLAY 2

OVERLAY 2

Compute complementary solutions for nonsymmetric component of second-order state
Compute particular solution for nonsymmetric component
Combine complementary and particular solutions to form nonsymmetric solution (Y,Z)
Return

MAIN

Call OVERLAY 1

OVERLAY 1

Buffer in labeled common
Write nonsymmetric solution
Check to make sure all buffered data is in core
Compute associated shell stress resultants: TT1SN, TT2SN, TT12S
Compute associated shell rotations: TCHISN, TPSIS, TTHETS
Compute associated ring stress resultants: TPHISN
Compute associated ring rotations: TWXS, TWYS
Compute and write 2nd postbuckling coefficient (SB)
IDONE = 1
If ISS4 $\neq$ 0, compute postbuckling stiffness (STIF) and write STIFNO and STIF
Return to MAIN for next case

Subprogram descriptions for SRA 202.- SRA 202 consists of 20 contractor-supplied subprograms (fig. 22). Those subprograms which have features special to SRA 202 are described below. For descriptions of the remaining subprograms of SRA 202, see page 121.

MAIN

This program always resides in core and calls the two primary overlays. It reads and prints the title card and terminates the job when completed.

PRIMARY OVERLAY 1

This overlay consists of the main subprogram INPUT and five contractor-supplied subroutines (fig. 22). This overlay essentially performs all functions other than the actual solution of the differential equations for the second-order postbuckling state.

INPUT

This subprogram reads, writes, and processes all of the input data. It prepares the boundary conditions for the axisymmetric and nonsymmetric problems and processes their solutions. It writes all output results.

INT1

This subroutine computes by quadrature nine different functionals required in the evaluation of a, b, α, β, and K*. Integrations over the shell meridian are performed by Simpson's rule. The functional to be computed is determined by the value of the parameter INTGRD, which is transmitted to INT1 through blank COMMON. The functionals which are calculated are given in a table on page 93 of reference 4. In reference to that table, it is noted that since the program was originally developed, it has been discovered that $\sigma_0{*}\cdot\varepsilon_1 \equiv 0$, so that the calculation of this functional (for INTGRD = 3) is superfluous.

I1I2

This subroutine is similar to INT1 except that it computes two functionals simultaneously each time it is entered. As with INT1, the parameter INTGRD determines the functionals to be computed. The table on page 94 of reference 4 gives the functionals calculated and the corresponding values of INTGRD.

PRIMARY OVERLAY 2

This overlay consists of the main subprogram SRA202 and twelve contractor-supplied subroutines (fig. 22). Its only function is to compute the axisymmetric and nonsymmetric components of the second-order postbuckling state for processing by PRIMARY OVERLAY 1. It accomplishes this task by solution of the linear boundary-value problem for each of these components.

SRA202

This subprogram sets up the initial conditions for the forward integration to obtain complementary and particular solutions of the differential equations for the axisymmetric problem (in the first pass through OVERLAY 2) and the nonsymmetric problem (in the second pass through OVERLAY 2). It also combines the complementary and particular solutions to form the solution for each of these problems.

Major FORTRAN variables of SRA 202.- Major variables which have special meaning for SRA 202 are defined below. For SRA 202 variables which are common to other programs, see page 126.

Variable	Definition	Subprogram where generated
AMAX	maximum value of α	INPUT
AMODE	α for buckling mode imperfection	INPUT
BMAX	β for imperfection giving maximum value of α	INPUT
BMODE	β for buckling mode imperfection	INPUT
CAP1S0(100)	${}_{0}\kappa_{1}$	INPUT
CAP2S0(100)	${}_{0}\kappa_{2}$	INPUT
EPS1S0(100)	${}_{0}\varepsilon_{1}$	INPUT
EPS2S0(100)	${}_{0}\varepsilon_{2}$	INPUT
FI1, FI2	functional values computed by I1I2	I1I2
FN	harmonic number (n) of second-order postbuckling component being calculated	INPUT
FNC	n_c	INPUT
GLAM	λ_c	INPUT
GUESS	$\lambda_c - \lambda_0$	INPUT
IDONE	flag to indicate when solution is complete	MAIN, INPUT
INTGRD	flag to determine function of I1I2 and INT1	INPUT
IOP	logical output unit number	MAIN
IP	logical input unit number	MAIN
ISS4	flag to indicate if additional prebuckling deck is present (for β and K* calculations)	INPUT
ITER	flag to indicate which pass is being made through OVERLAY 1	MAIN, SRA202
NML	flag for prebuckling data deck	INPUT
NTLC	flag for axisymmetric torsional buckling mode	INPUT
PRODC	inner product of buckling mode	INPUT
SA	first postbuckling coefficient, a	INPUT
SB	b	INPUT
STIF	K*	INPUT
STIFN	K_0	INPUT
STIFN0	prebuckling stiffness K at bifurcation load λ_c	INPUT

Variable	Definition	Subprogram where generated
STIFO	$K_0^{(1)}$	INPUT
SUM1	functional value computed by INT1	INT1
SOE2	$\sigma_0^{*} \cdot \varepsilon_2$	INPUT
S1E1	$\sigma_1 \cdot \varepsilon_1$	INPUT
TCAP1C(100)	${}_1\kappa_1$	INPUT
TCAP2C(100)	${}_1\kappa_2$	INPUT
TCHIC(100)	${}_1\chi$	INPUT
TCHINO(100)	χ_0	INPUT
TCHISN(100)	${}_2\chi$	INPUT
TCHISO(100)	${}_0\chi$	INPUT
TCHI1(100)	$\chi_0^{(2)}$	INPUT
TC1(100)	C_1	INPUT
TEPSSO(34)	${}_0\varepsilon_\phi$	INPUT
TEPS1C(100)	${}_1\varepsilon_1$	INPUT
TEPS2C(100)	${}_1\varepsilon_2$	INPUT
TG(100)	shell wall shear stiffness	INPUT
TMY0(34)	$M_{y_0}^{(1)}$	INPUT
TM10(100)	$M_{1_0}^{(1)}$	INPUT
TM20(100)	$M_{2_0}^{(1)}$	INPUT
TPHIC(34)	${}_1T_\phi$	INPUT
TPHISN(34)	${}_2T_\phi$	INPUT
TPHISO(34)	${}_0T_\phi$	INPUT
TPHI1(34)	$T_{\phi_0}^{(2)}$	INPUT
TPSIC(100)	${}_1\psi$	INPUT
TPSIS(100)	${}_2\psi$	INPUT
TTHETC(100)	${}_1\theta$	INPUT
TTHETS(100)	${}_2\theta$	INPUT
TT1C(100)	${}_1T_1$	INPUT
TT1NO(100)	T_{1_0} at $\lambda = \lambda_c$	INPUT
TT1SN(100)	${}_2T_1$	INPUT
TT1SO(100)	${}_0T_1$	INPUT

Variable	Definition	Subprogram where generated
TT11(100)	${T_{1_0}}^{(2)}$	INPUT
TT12C(100)	${}_1T_{12}$	INPUT
TT12S(100)	${}_2T_{12}$	INPUT
TT2C(100)	${}_1T_2$	INPUT
TT2NO(100)	T_{2_0} at $\lambda = \lambda_c$	INPUT
TT2SN(100)	${}_2T_2$	INPUT
TT2SO(100)	${}_0T_2$	INPUT
TT21(100)	${T_{2_0}}^{(2)}$	INPUT
TWXC(34)	${}_1w_x$	INPUT
TWXS(34)	${}_2w_x$	INPUT
TWYC(34)	${}_1w_y$	INPUT
TWYS(34)	${}_2w_y$	INPUT
Z(4,100)	solutions for {z}; also used to store ${}_1\xi$, ${}_1\eta$, ${}_1v$, ${}_1\chi$	INPUT

SRA 300

External files.- SRA 300 uses three external files: TAPE2, TAPE3, and PUNCH. TAPE2 and TAPE3 are the standard input and output files, respectively. At the user's option, the vibration mode displacements referred to shell coordinates may be written onto PUNCH.

Overall logical flow of SRA 300.- Essential features of the overall flow of SRA 300 are listed below.

SRA300 (MAIN PROGRAM)

Call INPUT

INPUT

Read and write case title card. If end-of-file, stop
Read case option card: LOOP, NSG, NWP, NFM, NST, NML, NPG, NPS, NIC, NASE, MAXMOD, NTL, NDER, SIGDIG, GUESS, RTABL, ISS2, ISS3, ISS4, ISS5, ISS6

Read basic input tables
    Geometry: NOUT2, NOUT1, NOUT3, TS, TR, TRP, TRR2, TXB
    Wall properties: TE1, TE2, TE12, TNU1, TH
    Foundation moduli: TK1, TK2, TK3
    Stringer properties: TEAST, TEIST, TGJST, TZBST
    Mass densities: TRHOM
    Pressure field: TX30, TX3X, TX3Y
Call SETUP to construct geometric parameters: NDIS, TDIS, JENT, IBR
    NBR, IEND, KEND
If NPS = 1, read standard prebuckling state data to obtain the initial
    equilibrium state variables (If NPS = 2, set initial equilibrium
    state to zero):
    FLAM, LTYPE
    TTPHIN, TT1N, TT2N, TCHIN
Write input tables
Set KASE = 2 if complementary solutions of previous case apply, otherwise
    set KASE = 3
Calculate and store mass moments (TEM, TEMB, TEMBB) through shell wall
    at output points for future use by PROD1
If NIC = 0, make NOUT1-table negative at all boundaries except dome
    closures (to indicate boundary data comes from previous case)
Call BC to read or generate boundary matrices BBP and BD for each
    boundary
Calculate scale factors required for START
Return

SRA300

If shell has rigid body freedom (FN $\leq$ 1. and NDER input nonzero)
    compute, store, and write the appropriate rigid body modes. Increase
    MINMOD from 1 by the number of rigid body modes stored
If KASE = 3, calculate and store the complementary solutions
Set up DO-loop for vibration modes, with index (MODE) running from
    MINMOD to MAXMOD
    1. Generate initial guess for vibration mode displacements
    2. If MODE -1 > 0, orthogonalize current mode estimate with respect
       to previous stored modes
    3. Write eigenvalue shift and set up iteration loop for vibration
       mode
    4. Calculate, from current mode estimate, boundary matrices SL for
       dome and ring boundaries
    5. Compute particular solution for new vibration mode estimate
    6. Superimpose particular and complementary solutions for new
       vibration mode estimate (Y,Z)
    7. If MODE -1 > 0, orthogonalize new vibration mode estimate with
       respect to previous stored modes
    8. Calculate the Rayleigh quotient, which is the new eigenvalue
       estimate (OMEGA1)

C

9. Write iteration number and eigenvalue estimate
10. Test for convergence of successive eigenvalue estimates to SIGDIG significant digits. If converged, to to step 19
11. Test for convergence of the sequence of ratios of successive differences of eigenvalue estimates to one significant digit. If not converged, to to step 16
12. Estimate the number of iterations required to achieve eigenvalue convergence. If five or less, go to step 16
13. Make an eigenvalue shift to an estimate of desired eigenvalue
14. If necessary, remove artificial rigid body constraints
15. Correct BD matrices at ring and dome boundaries
16. Normalize and store vibration mode estimate in YM1, ZM1 arrays
17. If an eigenvalue shift has been made (GUESS $\neq$ GUESSS), compute and store new complementary solutions, and go to step 3
18. Go to step 4
19. Normalize new vibration mode
20. If no higher modes remain to be calculated, go to step 23
21. If five or more lower modes have already been stored, only the most recent four modes are retained, and FLAG is set to 2. to indicate more modes are to be obtained with a new eigenvalue shift
22. Store the new mode in YMODE, ZMODE for future use in orthogonalization process
23. Improve eigenvalue estimate by using the ratio of successive differences of eigenvalue sequence
24. Write last two normalized vibration mode estimates and frequency (square root of eigenvalue)
25. If a higher mode remains to be calculated with a new eigenvalue shift (FLAG = 2.), perform steps 14 and 15 and compute and store new complementary solutions
26. End of MODE DO-loop

Call INPUT for next case

Subprogram descriptions for SRA 300.- SRA 300 consists of 20 contractor-supplied subprograms. Figure 21 for SRA 201 applies to SRA 300 as well if the main subprogram shown, SRA201, is replaced by subprogram SRA300. Also, the subprogram descriptions for SRA 201, given on page 110, apply as well to SRA 300 if the name SRA201 is replaced there by SRA300. Also, since the inner product for vibrations does not depend on the modal forces Y, references to Y and Y1 in the description of PROD1 should be ignored. For descriptions of the remaining subprograms of SRA 300, see page 121.

Major FORTRAN variables of SRA 300.- Major variables which have special meaning for SRA 300 are defined below. For SRA 300 variables which are common to ther programs, see page 126.

Variable	Definition	Subprogram where generated
GUESS	eigenvalue shift	INPUT, SRA300
ISS4	flag to determine eigenvalue shift used in calculation of vibration modes higher than the sixth	INPUT
ITER	iteration number	SRA300
NML	flag for mass density tables	INPUT
NPS	flag for initial equilibrium state data	INPUT

Subprogram Descriptions Applicable to Several Programs

BC

This subroutine is called by INPUT to read and write the input boundary data. In addition, for all programs other than SRA 101, it generates the homogeneous boundary condition matrices [B] and [D] for ring and (through use of DOME) for dome boundaries. For SRA 100, SRA 200, and SRA 202, BC also generates the boundary load matrix {L}.

CNT

This subroutine is called by RKS3 at the end of each Runge-Kutta integration step. Upon each entry to CNT during the integration for complementary solutions,* it performs the following functions:

1. checks the growth of χ to determine if the subinterval is too long,
2. forces the integration to land on the specified entry points, and stores the values of the complementary solutions at these points in the arrays PRU and PRW. Additional complementary solutions calculated on a closed branch are stored in the arrays PRV and PRZ,
3. restarts the integration at each point of subdivision with initial conditions which it calculates through use of subroutine START,
4. accumulates $[\hat{p}]$ on a closed branch, and
5. terminates the integration process at the final point of the shell meridian.

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*Programs SRA 100 and SRA 200 compute complementary solutions (if necessary) simultaneously with the particular solution. Programs SRA 101, SRA 201, SRA 202, and SRA 300 always compute complementary and particular solutions separately.

Functions (3) and (5) above are also performed upon each entry to CNT during integration for particular solutions. Also, during particular solution integration, CNT performs the following additional functions:

1. forces the integration to land on the specified entry points, and stores the values of the particular solution in the arrays PRG and PRJ,
2. accumulates [p] and {q} on a closed branch, and
3. calculates the superposition constants {c} for each subinterval and stores them in the CV array. It also calculates additional superposition constants {d} required on a closed branch and stores them in the DV array.

DER

Upon each call from RKS3, this subroutine computes the derivatives $f_i(s,y_i)$ for RKS3 using the values of s and y_i provided by RKS3. This subprogram is entered eight times for each full integration step. In SRA 101, DER call INTRPL for the interpolation of all variables, including the equivalent forces F_1, F_2, F_3, F_4. In other programs interpolation is accomplished for each variable through use of the SLOPE routines. In SRA 201, interpolated values of the prebuckling stress resultants and buckling rotations are obtained and the equivalent forces then calculated from them.

DOME(II,I,BBP,BD,SN,FN)

This subroutine calculates the boundary condition matrices [B] and [D] at an edge of small radius, to simulate the effect of a dome closure. Upon the call to DOME, I is the entry number and II the boundary number of the edge being treated. Also, SN = -1 if the edge is the terminal point; otherwise SN = +1. In all programs other than SRA 101, the variables BBP, BD, SN, and FN are passed through common blocks instead of the calling sequence.

DOME is also used simply to calculate the shell wall stiffnesses. In this case, the call to DOME is made with II = 0, and the wall stiffnesses (excluding stringer effects) are stored in TTAB1(I), TTAB2(I), and TTAB3(I). The following table gives the meaning of these arrays.

I	TTAB1(I)	TTAB2(I)	TTAB3(I)
1	$C_1^{(0)}$	$C_1^{(1)}$	$C_1^{(2)}$
2	$C_2^{(0)}$	$C_2^{(1)}$	$C_2^{(2)}$
3	$C_{12}^{(0)}$	$C_{12}^{(1)}$	$C_{12}^{(2)}$
4	$G^{(0)}$	$G^{(1)}$	$G^{(2)}$

In this table the wall stiffnesses are defined as follows:

$$C_m^{(n)} = \int [E_m/(1 - \nu_1\nu_2)] z^n dz$$

$$C_{12}^{(n)} = \int \nu_1 E_2/(1 - \nu_1\nu_2) z^n dz$$

$$G^{(n)} = \int E_{12} z^n dz$$

where the integrals are through the shell wall thickness, z is the normal distance from the reference surface, and m = 1 or 2, n = 0, 1, or 2.

MADD(A,B,R,N,M)

This subroutine forms the sum R = A + B, where A, B, and R are N×M matrices.

MCPY(A,R,N,M)

This subroutine forms the matrix R = A, where A and R are N×M matrices.

MINV(A,N,D,L,M)

This is a general purpose subroutine which calculates the inverse of an N×N matrix A by the standard Gauss-Jordan method. The parameters L and M are two work regions of length N provided to MINV by the calling program. Upon return to the calling program, A is replaced by its inverse and D contains the normalized determinant of A, i.e., its determinant divided by the product of its diagonal elements. As in all of the matrix arithmetic subroutines, MINV treats all matrices as one-dimensional arrays.

MPRD(A,B,R,N,M,L)

This subroutine forms the product R = AB, where A is an N×M matrix, B is a M×L matrix, and R is the resultant N×L matrix.

MSUB(A,B,R,N,M)

This subroutine forms the difference R = A - B, where A, B, and R are N×M matrices.

RBROT(TS,TR,TRR2,LSTAB,NOUT3,IBR,NBR,IEND,KENT,Z)

This subroutine calculates the displacement amplitudes of a unit rigid body rotation about a transverse axis which: (1) lies in the small circle plane of the initial entry point, (2) is normal to the axial plane $\phi = 0$, and (3) intersects the axis of revolution. These first harmonic displacements are stored in the Z-array.

RKS3(DER,CNT,Y1,DY1,ATABL,RTABL,WORK,S,DS,NEQ,IFVD,IBKP,NTRY,IERR)

This is a general purpose subroutine which integrates a system of first-order ordinary differential equations of the form $dy_i/ds = f_i(s,y_i)$ by the fourth-order Runge-Kutta method. Each integration step is actually performed in two half-steps, each using conventional Runge-Kutta, to obtain midpoint values of the derivatives f_i. These are used along with the derivatives at the initial and end points to form a Simpson's rule evaluation for the full step. The magnitude of the difference between the Runge-Kutta integration over the two half-steps and the Simpson's rule integration over the full step is taken as an indication of the truncation error and is used as a basis for modification of the step size. Automatic step modification is contolled by values of the absolute (ATABL) and relative (RTABL) error tolerances provided to the routine. Since RKS3 has no COMMON block, all communication with it is through its calling sequence. The values IFVD = 0 and IBKP = 1 are used to indicate integration in a variable step size mode. The parameter IERR is set to zero on a normal return from RKS3.

SETUP(TS,LSTAB,LTAB,NOUT3,NDIS,TDIS,JENT,IBR,NBR,IEND,KEND)

This subroutine is called once per case by INPUT in order to construct the geometrical parameters NDIS, TDIS(34), JENT(34), IBR(7), NBR(7,4), IEND, and KEND.

SLOPE(X,LSTAB1)

This subroutine performs linear interpolation with respect to s on the one-dimensional arrays X representing input tables.

SLOPE1(X,LSTAB1,K)

This subroutine performs linear interpolation with respect to s on the two-dimensional arrays X representing input wall properties and thermal loads. K ($1 \leq K \leq 5$) gives the number of the appropriate wall layer.

SLOPE2(X,LSTAB1,K,NTERP)

This subroutine performs quadratic interpolation with respect to s on the two-dimensional arrays X representing force and displacement vectors. K ($1 \leq K \leq 4$) indicates the component of the 4-component vectors to be interpolated.

SLOPE3(X,LSTAB1,NTERP)

This subroutine performs quadratic interpolation with respect to s on the one-dimensional arrays X representing the stress resultants and rotations.

START(B,D,FL,Y1,NJE,KASE,SC1,SC2,LOOP,M)

This subroutine calculates the initial conditions for the integration of the complementary and particular solutions over each subinterval. It is entered once from CNT at the end of the integration of each subinterval other than the last subinterval. For open branch shells, it is also entered once before starting the integration in order to obtain the initial conditions for the first subinterval.*

The initial conditions are placed in the dependent variable array Y1 according to the partitioning

$$Y1 = \left[\begin{array}{c|c|c} G & U & V \\ \hline J & W & Z \end{array}\right]$$

where the column of {G} and {J} is the particular solution vector, the columns of [U] and [W] are the four basic complementary solution vectors, and the columns of [V] and [Z] are the four additional complementary solutions vectors required on closed branches.

START employs the supplemental initial conditions

[W] = [I]

{J} = {0}

for force-free boundaries (NJE = 0), ring boundaries without kinematic constraint (|NJE| = 1), and all boundaries on closed branches (LOOP = 1). For these boundaries the matrix [B] is nonsingular. For all other types of boundaries on open branches these conditions are replaced by the more general supplemental initial conditions, which do not require the inversion of [B],

±[U] + [S][W] = [I]

±{G} + [S]{J} = {0}

Here [S] is a diagonal scaling matrix for which the first three diagonal elements are each $(SC1)^{-1} = C_1^{(0)}/t$ and the fourth element is $(SC2)^{-1} = C_1^{(2)}/t$, where t is an effective thickness given by

$$t = [12C_1^{(2)}/C_2^{(0)}]^{1/2}$$

and $C_1^{(0)}$, $C_2^{(0)}$, and $C_1^{(2)}$ are respectively the meridional and circumferential shell wall stretching stiffnesses and the meridional bending

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*For closed branch shells, the initial conditions for the first subinterval are always [U] = [Z] = [I], [V] = [W] = [0], and {G} = {J} = {0}.

stiffness. The purpose of [S] is to provide dimensional homogeneity of the supplemental conditions. In regards to the ambiguous signs in these conditions, the plus sign leads to the use of $[BS - D]^{-1}$, whereas the minus sign leads to $[BS + D]^{-1}$. Therefore, the plus sign is used if the normalized determinant (i.e., the determinant of a matrix divided by the product of its diagonal elements) of [BS - D] is greater than 10^{-2}. Otherwise, the plus (or minus) sign is used if the normalized determinant of [BS + D] is less (or greater) than that of [BS - D].

On a closed branch when calculating the initial conditions for the additional set of complementary solutions (M = 5), the supplemental initial conditions

$$[Z] = [I]$$

are always used.

Major FORTRAN Variables Common To Several Programs*

Variable	Definition	Subprogram where generated
A(4,4)	ring eccentricity matrix, [e]	BC, BC1
ATABL	absolute error tolerance for variable step Runge-Kutta integration	INPUT, MAIN1
B(4,4)	[B] matrix for a ring, $[B]^{-1} = [e]^T/r$	BC, BC1
BBP(4,4,34)	stored [B] matrices	BC, BC1
BD(4,4,34)	stored [D] matrices	BC, BC1
C(4,4)	ring stiffness matrix, [k]	BC, BC1
CARD1(5)	input table data on next to last card read	INPUT
CARD2(5)	input table data on last card read	INPUT
COMENT(5)	interpolated table data	INPUT
CV(4,33)	superposition constants for four basic complementary solutions, {c}	CNT
D(4,4)	[D] matrix for a ring, [D] = - [k][e]	BC, BC1
DELTA1	current difference of successive eigenvalue estimates	SRA201, SRA300
DELTA2	previous difference of successive eigenvalue estimates	SRA201, SRA300
DS	size for next Runge-Kutta step	CNT, calling program for RKS3

*In some cases, the dimensions of these variables are different in different programs. For these variables, only the maximum dimensions are shown.

Variable	Definition	Subprogram where generated
DSS	size of previous Runge-Kutta step	CNT
DV(4,33)	superposition constants for additional four complementary solutions required on a closed branch, {d}	CNT
DY1(8,9)	current derivative values for complementary and/or particular solutions	DER
E1(5),E12(5),E2(5)	local values of elastic moduli E_1, E_{12}, E_2 for each layer	DER, INTRPL
EST	improved eigenvalue estimate	SRA201, SRA300
FL(4)	nonhomogeneous boundary condition vector, {L}	SRA201, SRA300, BC, RBMODE
FLAG	flag indicating if we are in automatic eigenvalue shift logic simply to improve converged estimate (FLAG = 1.), or if higher modes are required with new eigenvalue shift (FLAG = 2.)	SRA201, SRA300
FLAM	load factor for nonlinear prebuckling state, λ_0	INPUT
FN	harmonic number, n	INPUT, MAIN1
FN2	n^2	INPUT
FNU1(5)	current values of Poisson's ratio ν_1 for each layer	DER, INTRPL
GUESSS	previous value of GUESS after automatic eigenvalue shift or value of GUESS from previous case	SRA201, SRA300, INPUT
IBR(7)	number of branches emanating from each branch point	SETUP
IBR1(7)	current number of converging branches already integrated to each branch point	CNT
IDERF	number of solution vectors being integrated	calling program for RKS3
IEND(21)	ordered list of edge entry numbers excluding entries 1 and LSTAB	SETUP
ISS2	if nonzero, punch modal data or shell stresses	INPUT
ISS3	if nonzero, suppress automatic eigenvalue shifting	INPUT

Variable	Definition	Subprogram where generated
ISS5	if nonzero, suppress use of mode shape from previous case as initial approximation	INPUT
ISS6, ISSW6	if nonzero, override abort if a subinterval exceeds length criteria	INPUT
ITERM	Maximum number of iterations allowed	SRA201, SRA300
JENT(34)	table of boundary point entry numbers	SETUP
KASE	parameter to indicate whether integration is for complementary (KASE = 3) or particular (KASE = 2) solutions	calling program for RKS3, INPUT
KEND	number of edges excluding entries 1 and LSTAB	SETUP
KMAT,KVEC,LMAT, LVEC,NMAT,NVEC	equivalent addresses used for two and three-dimensional arrays	CNT
KSMAX	number of entry points (same as LSTAB)	INPUT
LCOMP	flag to indicate use of computed {L} vector for rings	SRA201, SRA300, RBMODE
LOOP	indicator for closed branch: = 0, open branch shell; = 1, current branch being treated is closed; ≥ 2, closed branch shell, current branch being treated is open; = 3, {c} to be computed is for subinterval on open branch terminating at a closed branch	INPUT, CNT
LPROD	flag to indicate return point from PROD2 calculation, and also (for SRA 201) force arguments in PROD1	RBMODE, SRA201, SRA300
LSTAB	number of entry points	INPUT
LSTAB1	entry number of first point with s-value greater than current value of s (during integration)	CNT, calling program for RKS3
LTAB(100)	number of wall layers at each entry point	INPUT
LTYPE	flag to indicate live loading (LTYPE = 1)	INPUT
MAXMOD	number of eigenmodes desired	INPUT
MFLAG	flag to indicate resultant force calculation in PROD1	RBMODE
MINMOD	order of first eigenmode to be computed by iteration (= 1, if no rigid body modes specified)	SRA201, SRA300

Variable	Definition	Subprogram where generated
MM1	MODE - 1	SRA201, SRA300
MODE	order of mode being calculated	SRA201, SRA300
NASE	harmonic number, n	INPUT
NBR(7,4)	table of branch point entry numbers (of branches entering each branch point)	SETUP
NDER	flag to indicate rigid body degrees of freedom	INPUT
NDIS	number of boundaries	SETUP
NDIS1	subinterval in which current s-value resides (during integration)	CNT
NEQ	number of equations currently being integrated	CNT, calling program for RKS3
NFM	flag for foundation moduli table	INPUT
NIC	flag for boundary conditions	INPUT
NMD	flag for mass density table	INPUT
NOUT1(100)	table to indicate type of boundary	INPUT
NOUT2(100)	table to indicate need for rigid body constraint; also indicates a symmetrical ring boundary	INPUT
NOUT3(100)	table of branch point numbers	INPUT
NPG	flag for pressure field table	INPUT
NSG	flag for geometry table	INPUT
NST	flag for stringer properties table	INPUT
NTERP	parameter used in quadratic interpolation. NTERP = 0 or 1 indicates LSTAB1 - 1 or LSTAB - 2, respectively, is the entry number of the first of three output points to be used in the interpolation	DER
NTRY	parameter to control termination, restart, or continuation of Runge-Kutta integration	CNT, calling program for RKS3
NWP	flag for wall properties table	INPUT
OMEGA1	new eigenvalue estimate	SRA201, SRA300
OMEGA2	previous eigenvalue estimate	SRA201, SRA300
P(4,4)	$[p]$	CNT
PP(4,4)	$[\hat{p}]$	CNT
PRG(4,100)	particular solution force vectors, $\{G\}$	CNT
PRJ(4,100)	particular solution displacement vectors, $\{J\}$	CNT
PROD2	ring contribution to inner product	SRA201, SRA300, RBMODE

Variable	Definition	Subprogram where generated
PRS(100)	table of stored s-values [same as TS(100)]	INPUT
PRU(4,4,100)	four basic complementary solution force vectors, [U]	CNT
PRV(4,4,100)	additional complementary solution force vectors required on a closed branch, [V]	CNT
PRW(4,4,100)	four basic complementary solution displacement vectors, [W]	CNT
PRZ(4,4,100)	additional complementary solution displacement vectors, [Z]	CNT
Q(4)	{q}	CNT
RAT	ratio for interpolation	DER
RHO1	new value of DELTA2/DELTA1	SRA201, SRA300
RHO2	previous value of DELTA2/DELTA1	SRA201, SRA300
RTABL	relative error tolerance for variable step Runge-Kutta integration	INPUT
S	current value of s	CNT, RKS3, calling program for RKS3
SC1, SC2	scale factors required by START	CNT, INPUT, calling program for RKS3
SH(5)	local values of half-thickness h for each layer	DER, INTRPL
SFL	flag to indicate surface of application of dead surface loads	INPUT
SIGDIG	number of significant digits required in iteration programs, N; also set to 10^{-N} in SRA 101	INPUT
SL(4,34)	stored {L} matrices	BC, SRA200, SRA201, SRA300, PLCFOR
SN	sign for dome boundary conditions	BC, BC1
TAR(34)	ring section areas, A	BC
TCHIN(100)	χ_0	INPUT
TCHIO(100)	$\chi_0(1)$	INPUT
TDIS(34)	table of boundary point s-values	SETUP
TDTH1(100,5)	$\Delta\theta_1$	INPUT
TDTH2(100,5)	$\Delta\theta_2$	INPUT
TEA(34)	ring stretching stiffnesses, EA	BC

Variable	Definition	Subprogram where generated
TEAST(100)	total stringer stretching stiffness, NEA	INPUT
TECCX(34)	ring axial eccentricities, e_x	BC
TECCY(34)	ring radial eccentricities, e_y	BC
TEIST(100)	total stringer bending stiffness, NEI	INPUT
TEIX(34)	ring in-plane bending stiffnesses, EI_x	BC
TEIXY(34)	ring coupling bending stiffness, EI_{xy}	BC
TEIY(34)	ring out-of-plane bending stiffnesses, EI_y	BC
TEM(100)	mass density per unit of surface area	INPUT, RBMODE
TEMB(100)	first mass moment per unit of surface area	INPUT, RBMODE
TEMBB(100)	second mass moment per unit of surface area	INPUT, RBMODE
TEST(100)	stringer elastic modulus	INPUT
TE1(100,5)	E_1	INPUT
TE2(100,5)	E_2	INPUT
TE12(100,5)	E_{12}	INPUT
TGJST(100)	total stringer torsional stiffness, NGJ	INPUT
TGJT(34)	ring torsional stiffnesses, GJ	INPUT
TH(100,5)	shell wall layer half-thicknesses, h	INPUT
TIX(34)	ring section in-plane moments of inertia, I_x	BC
TIXY(34)	ring section products of inertia, I_{xy}	BC
TIY(34)	ring section out-of-plane moments of inertia, I_y	BC
TK1(100)	k_1	INPUT
TK2(100)	k_2	INPUT
TK3(100)	k_3	INPUT
TLAMIJ(100),I,J = 1,4	partially inverted shell wall normal rigidities (including stringers)	INPUT, SRA201
TMUIJ(100),I,J = 1,2	partially inverted shell wall shear rigidities (including stringers)	INPUT, SRA201
TMYN(34)	M_{y_0}	SRA200, INPUT
TM1N(100)	M_{1_0}	SRA200, INPUT
TM2N(100)	M_{2_0}	SRA200, INPUT
TNU1(100,5)	shell wall orthotropic Poisson's rations, ν_1	INPUT
TOMEGA(4)	stored eigenvalues for lower modes	SRA201
TR(100)	small circle radius, r	INPUT

Variable	Definition	Subprogram where generated
TRHOM(100,5)	shell wall layer mass densities, ρ_i	INPUT
TRHOR(34)	ring mass densities	INPUT
TRP(100)	dr/ds	INPUT
TRR2(100)	r/R_2	INPUT
TS(100)	table of s-values	INPUT
TSA(34)	ring radii, a	BC
TSBAR(34)	ring meridional eccentricities, $\bar{s}$	BC
TTAB1(4), TTAB2(4) TTAB3(4), TTAB4(4)	used to compute shell wall stiffnesses (see description of DOME)	DOME, DER
TTHST(100)	stringer free thermal strains	INPUT
TTHR(34)	ring free thermal strains	BC
TTH1(100,5)	θ_1	INPUT
TTH2(100,5)	θ_2	INPUT
TTPHIN(34)	T_{ϕ_0}	INPUT
TTPHIO(34)	$T_{\phi_0}^{(1)}$	INPUT
TT1N(100)	T_{1_0}	INPUT
TT1O(100)	$T_{1_0}^{(1)}$	INPUT
TT2N(100)	T_{2_0}	INPUT
TT2O(100)	$T_{2_0}^{(1)}$	INPUT
TXB(100)	table of reference surface locations relative to shell inner surface	INPUT
TX1(100)	X_1	INPUT
TX3(100)	X_3	INPUT
TX3X(100)	axial component of pressure gradient, $\partial X_3/\partial x$	INPUT
TX3Y(100)	radial component of pressure gradient, $\partial X_3/\partial y$	INPUT
TX30(100)	unit load pressure field, X_3	INPUT
TZBAR(34)	ring normal eccentricities, $\bar{z}$	BC
TZBST(100)	stringer normal eccentricity, $\bar{z}$	INPUT
WORK(486)	working storage used by Runge-Kutta integration subroutine	RKS3
Y(4,100)	solution for force vector, {y}	calling program for RKS3
YK(4,100)	storage area for {y} used in inner product	SRA201
YMODE(4,100,3)	storage area for {y} modes when higher modes are to be calculated	SRA201
YM1(4,100)	storage area for {y} estimate of previous iteration	SRA201, SRA300

Variable	Definition	Subprogram where generated
Y1(8,9)	current values for complementary and/or particular solutions	RKS3, calling program for RKS3
Z(4,100)	solution for displacement vector, {z}	calling program for RKS3
ZK(4,100)	storage area for {z} used in inner product	SRA201, SRA300
ZMODE(4,100,5)	storage area for {z} modes when higher modes are to be calculated	SRA201, SRA300
ZM1(4,100)	storage area for {z} estimate of previous iteration	SRA201, SRA300
ZZ(4,100)	dummy argument for Z in PROD2 calculation	SRA201, SRA300
ZZ1(4,100)	dummy argument for Z1 in PROD2 calculation	SRA201, SRA300

APPENDIX B

INPUT AND OUTPUT DATA LISTINGS

SRA 100 INPUT DATA LISTING

```
140 DEGREE SANDWICH CONE
     1 1 1 1 1 1 1 1  0        1                              1.-2

C          GEOMETRY TABLE FOLLOWS

1   1        1  42.036       39.9          .93969        .34202        .472
             5  45.6         43.249        .93969        .34202        .472
    2        6  45.6         43.249        .93969        .34202        .472
            18  68.4         64.674        .93969        .34202        .472
            19  68.4         64.674        .93969        .34202        .472
            31  91.2         86.099        .93969        .34202        .472
            32  91.2         86.099        .93969        .34202        .472
            44 114.         107.524        .93969        .34202        .472
            45 114.         107.524        .93969        .34202        .472
    1       51 120.892      114.           .93969        .34202        .472

C          WALL PROPERTIES TABLE FOLLOWS

2     1      1       9.35+6        9.35+6        3.54+6   .32          .008
            51       9.35+6        9.35+6        3.54+6   .32          .008
      2      1                                                         .456
            51                                                         .456
      3      1       9.35+6        9.35+6        3.54+6   .32          .008
            51       9.35+6        9.35+6        3.54+6   .32          .008

C          MASS DENSITY TABLE FOLLOWS

5            1.1032        .004521      .2712
            51.1032        .004521      .2712

C          MECHANICAL LOADS TABLE FOLLOWS

6            1                         -.91738
             5                         -.91371
             9                         -.90820
            12                         -.90452
            15                         -.89839
            18                         -.89226
            22                         -.88368
            25                         -.87510
            28                         -.86530
            31                         -.85426
```

```
        35                          -.83956
        38                          -.81872
        41                          -.79298
        44                          -.74764
        48                          -.67150
        51                          -.52800

      BOUNDARY DATA FOLLOWS

     6.75+6      1.29+6      7.71+6      -3.6+5      6.83+3 -.444
 8.675
            24.81           9.35+6
1.
            1.
                       0.
                                  1.
1.
            0.
                       1.
                                  0.
    1.102+7     1.275+8     1.275+8                  9.65+7 -4.8295
0.
            .1312           9.35+6

      SECOND CASE FOLLOWS

40 DEGREE SANDWICH CONE
   0 0 0 0 0 1 0 1  1       3                        1.-2
  3      6 45.6        43.249      .93969      .34202      .472

      MECHANICAL LOADS TABLE FOLLOWS

         1                          -.06875
         5                          -.06997
         9                          -.07181
        12                          -.07304
        15                          -.07427
        18                          -.07550
        22                          -.07673
        25                          -.07796
        28                          -.07796
        31                          -.07920
        35                          -.07920
        38                          -.07799
        41                          -.07678
        44                          -.07068
        48                          -.04350
        51                          -.0
```

```
C         BOUNDARY DATA FOLLOWS
      6.75+6        1.29+6        7.71+6        -3.6+5        6.83+3 -.444
 .805          -.446                        -17.65
               24.81                9.35+6
     1.102+7       1.275+8       1.275+8                      9.65+7 -4.8295
 0.
               .1312                9.35+6
          END OF FILE CARD
```

SRA 100 OUTPUT DATA LISTING

140 DEGREE SANDWICH CONE

N = -0   REL ERR CNTRL = 1.000E-2

THIS STRUCTURE HAS RIGID BODY TRANSLATIONAL FREEDOM.

TABLE 1 (SURFACE GEOMETRY)

ENTRY	S	R	R PRIME	R/R2	ZBAR
1	4.2036E+01	3.9900E+01	9.3969E-01	3.4202E-01	4.7200E-01
2	4.2927E+01	4.0737E+01	9.3969E-01	3.4202E-01	4.7200E-01
3	4.3818E+01	4.1574E+01	9.3969E-01	3.4202E-01	4.7200E-01
4	4.4709E+01	4.2412E+01	9.3969E-01	3.4202E-01	4.7200E-01
5	4.5600E+01	4.3249E+01	9.3969E-01	3.4202E-01	4.7200E-01
6	4.5600E+01	4.3249E+01	9.3969E-01	3.4202E-01	4.7200E-01
7	4.7500E+01	4.5034E+01	9.3969E-01	3.4202E-01	4.7200E-01
8	4.9400E+01	4.6820E+01	9.3969E-01	3.4202E-01	4.7200E-01
9	5.1300E+01	4.8605E+01	9.3969E-01	3.4202E-01	4.7200E-01
10	5.3200E+01	5.0391E+01	9.3969E-01	3.4202E-01	4.7200E-01
11	5.5100E+01	5.2176E+01	9.3969E-01	3.4202E-01	4.7200E-01
12	5.7000E+01	5.3961E+01	9.3969E-01	3.4202E-01	4.7200E-01
13	5.8900E+01	5.5747E+01	9.3969E-01	3.4202E-01	4.7200E-01
14	6.0800E+01	5.7532E+01	9.3969E-01	3.4202E-01	4.7200E-01
15	6.2700E+01	5.9318E+01	9.3969E-01	3.4202E-01	4.7200E-01
16	6.4600E+01	6.1103E+01	9.3969E-01	3.4202E-01	4.7200E-01
17	6.6500E+01	6.2889E+01	9.3969E-01	3.4202E-01	4.7200E-01
18	6.8400E+01	6.4674E+01	9.3969E-01	3.4202E-01	4.7200E-01
19	6.8400E+01	6.4674E+01	9.3969E-01	3.4202E-01	4.7200E-01
20	7.0300E+01	6.6459E+01	9.3969E-01	3.4202E-01	4.7200E-01
21	7.2200E+01	6.8245E+01	9.3969E-01	3.4202E-01	4.7200E-01
22	7.4100E+01	7.0030E+01	9.3969E-01	3.4202E-01	4.7200E-01
23	7.6000E+01	7.1816E+01	9.3969E-01	3.4202E-01	4.7200E-01
24	7.7900E+01	7.3601E+01	9.3969E-01	3.4202E-01	4.7200E-01
25	7.9800E+01	7.5386E+01	9.3969E-01	3.4202E-01	4.7200E-01
26	8.1700E+01	7.7172E+01	9.3969E-01	3.4202E-01	4.7200E-01
27	8.3600E+01	7.8957E+01	9.3969E-01	3.4202E-01	4.7200E-01
28	8.5500E+01	8.0743E+01	9.3969E-01	3.4202E-01	4.7200E-01
29	8.7400E+01	8.2528E+01	9.3969E-01	3.4202E-01	4.7200E-01
30	8.9300E+01	8.4314E+01	9.3969E-01	3.4202E-01	4.7200E-01
31	9.1200E+01	8.6099E+01	9.3969E-01	3.4202E-01	4.7200E-01
32	9.1200E+01	8.6099E+01	9.3969E-01	3.4202E-01	4.7200E-01
33	9.3100E+01	8.7884E+01	9.3969E-01	3.4202E-01	4.7200E-01
22	7.4100E+01	7.0030E+01	9.3969E-01	3.4202E-01	4.7200E-01
23	7.6000E+01	7.1816E+01	9.3969E-01	3.4202E-01	4.7200E-01
24	7.7900E+01	7.3601E+01	9.3969E-01	3.4202E-01	4.7200E-01
25	7.9800E+01	7.5386E+01	9.3969E-01	3.4202E-01	4.7200E-01
26	8.1700E+01	7.7172E+01	9.3969E-01	3.4202E-01	4.7200E-01
27	8.3600E+01	7.8957E+01	9.3969E-01	3.4202E-01	4.7200E-01
28	8.5500E+01	8.0743E+01	9.3969E-01	3.4202E-01	4.7200E-01
29	8.7400E+01	8.2528E+01	9.3969E-01	3.4202E-01	4.7200E-01
30	8.9300E+01	8.4314E+01	9.3969E-01	3.4202E-01	4.7200E-01
31	9.1200E+01	8.6099E+01	9.3969E-01	3.4202E-01	4.7200E-01
32	9.1200E+01	8.6099E+01	9.3969E-01	3.4202E-01	4.7200E-01
33	9.3100E+01	8.7884E+01	9.3969E-01	3.4202E-01	4.7200E-01
34	9.5000E+01	8.9670E+01	9.3969E-01	3.4202E-01	4.7200E-01
35	9.6900E+01	9.1455E+01	9.3969E-01	3.4202E-01	4.7200E-01
36	9.8800E+01	9.3241E+01	9.3969E-01	3.4202E-01	4.7200E-01
37	1.0070E+02	9.5026E+01	9.3969E-01	3.4202E-01	4.7200E-01
38	1.0260E+02	9.6811E+01	9.3969E-01	3.4202E-01	4.7200E-01
39	1.0450E+02	9.8597E+01	9.3969E-01	3.4202E-01	4.7200E-01
40	1.0640E+02	1.0038E+02	9.3969E-01	3.4202E-01	4.7200E-01
41	1.0830E+02	1.0217E+02	9.3969E-01	3.4202E-01	4.7200E-01
42	1.1020E+02	1.0395E+02	9.3969E-01	3.4202E-01	4.7200E-01
43	1.1210E+02	1.0574E+02	9.3969E-01	3.4202E-01	4.7200E-01
44	1.1400E+02	1.0752E+02	9.3969E-01	3.4202E-01	4.7200E-01
45	1.1400E+02	1.0752E+02	9.3969E-01	3.4202E-01	4.7200E-01
46	1.1515E+02	1.0860E+02	9.3969E-01	3.4202E-01	4.7200E-01
47	1.1630E+02	1.0968E+02	9.3969E-01	3.4202E-01	4.7200E-01
48	1.1745E+02	1.1076E+02	9.3969E-01	3.4202E-01	4.7200E-01
49	1.1859E+02	1.1184E+02	9.3969E-01	3.4202E-01	4.7200E-01

TABLE 2 (WALL PROPERTIES)

ENTRY	S	E1	E2	E12	NU1	H
1	4.2036E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		-0.	-0.	-0.	-0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
2	4.2927E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
3	4.3818E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
4	4.4709E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
5	4.5600E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
6	4.5600E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
7	4.7500E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
8	4.9400E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
9	5.1300E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
10	5.3200E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
11	5.5100E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
12	5.7000E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
13	5.8900E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
14	6.0800E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
15	6.2700E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
16	6.4600E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
17	6.6500E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
18	6.8400E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
19	6.8400E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
20	7.0300E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03

		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
21	7.2200E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
22	7.4100E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
23	7.6000E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
24	7.7900E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
25	7.9800E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
26	8.1700E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
27	8.3600E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
28	8.5500E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
29	8.7400E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
30	8.9300E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
31	9.1200E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
32	9.1200E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
33	9.3100E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
34	9.5000E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
35	9.6900E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
36	9.8800E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
37	1.0070E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
38	1.0260E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
39	1.0450E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
40	1.0640E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03

41	1.0830E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
42	1.1020E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
43	1.1210E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
44	1.1400E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
45	1.1400E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
46	1.1515E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
47	1.1630E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
48	1.1745E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
49	1.1859E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
50	1.1974E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		0.	0.	0.	0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
51	1.2089E+02	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		-0.	-0.	-0.	-0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03

TABLE 3 (FOUNDATION MODULI) ALL ZEROES

TABLE 4 (STRINGER PROPERTIES) ALL ZEROES

TABLE 5 (MASS DENSITY)

ENTRY	S	LAYER 1	LAYER 2	LAYER 3	LAYER 4	LAYER 5
1	4.2036E+01	1.0320E-01	4.5210E-03	2.7120E-01	-0.	-0.
2	4.2927E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
3	4.3818E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
4	4.4709E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
5	4.5600E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
6	4.5600E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
7	4.7500E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
8	4.9400E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
9	5.1300E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
10	5.3200E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
11	5.5100E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
12	5.7000E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
13	5.8900E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
14	6.0800E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
15	6.2700E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
16	6.4600E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
17	6.6500E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
18	6.8400E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
19	6.8400E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
20	7.0300E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
21	7.2200E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
22	7.4100E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
23	7.6000E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
24	7.7900E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
25	7.9800E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
26	8.1700E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
27	8.3600E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
28	8.5500E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
29	8.7400E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
30	8.9300E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
31	9.1200E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
32	9.1200E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
33	9.3100E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
34	9.5000E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
35	9.6900E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
36	9.8800E+01	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
37	1.0070E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
38	1.0260E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
39	1.0450E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
40	1.0640E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
41	1.0830E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
42	1.1020E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
43	1.1210E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
44	1.1400E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
45	1.1400E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
46	1.1515E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
47	1.1630E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
48	1.1745E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
49	1.1859E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
50	1.1974E+02	1.0320E-01	4.5210E-03	2.7120E-01	0.	0.
51	1.2089E+02	1.0320E-01	4.5210E-03	2.7120E-01	-0.	-0.

TABLE 6 (MECHANICAL LOADS)

ENTRY	S	X1	X2	X3
1	4.2036E+01	-0.	-0.	-9.1738E-01
2	4.2927E+01	0.	0.	-9.1646E-01
3	4.3818E+01	0.	0.	-9.1554E-01
4	4.4709E+01	0.	0.	-9.1463E-01
5	4.5600E+01	-0.	-0.	-9.1371E-01
6	4.5600E+01	0.	0.	-9.1371E-01
7	4.7500E+01	0.	0.	-9.1187E-01
8	4.9400E+01	0.	0.	-9.1004E-01
9	5.1300E+01	-0.	-0.	-9.0820E-01
10	5.3200E+01	0.	0.	-9.0697E-01
11	5.5100E+01	0.	0.	-9.0575E-01
12	5.7000E+01	-0.	-0.	-9.0452E-01
13	5.8900E+01	0.	0.	-9.0248E-01
14	6.0800E+01	0.	0.	-9.0043E-01
15	6.2700E+01	-0.	-0.	-8.9839E-01
16	6.4600E+01	0.	0.	-8.9635E-01
17	6.6500E+01	0.	0.	-8.9430E-01
18	6.8400E+01	-0.	-0.	-8.9226E-01
19	6.8400E+01	0.	0.	-8.9226E-01
20	7.0300E+01	0.	0.	-8.8940E-01
21	7.2200E+01	0.	0.	-8.8654E-01
22	7.4100E+01	-0.	-0.	-8.8368E-01
23	7.6000E+01	0.	0.	-8.8082E-01
24	7.7900E+01	0.	0.	-8.7796E-01
25	7.9800E+01	-0.	-0.	-8.7510E-01
26	8.1700E+01	0.	0.	-8.7183E-01
27	8.3600E+01	0.	0.	-8.6857E-01
28	8.5500E+01	-0.	-0.	-8.6530E-01
29	8.7400E+01	0.	0.	-8.6162E-01
30	8.9300E+01	0.	0.	-8.5794E-01
31	9.1200E+01	-0.	-0.	-8.5426E-01
32	9.1200E+01	0.	0.	-8.5426E-01
33	9.3100E+01	0.	0.	-8.4936E-01
34	9.5000E+01	0.	0.	-8.4446E-01
35	9.6900E+01	-0.	-0.	-8.3956E-01
36	9.8800E+01	0.	0.	-8.3261E-01
37	1.0070E+02	0.	0.	-8.2567E-01
38	1.0260E+02	-0.	-0.	-8.1872E-01
39	1.0450E+02	0.	0.	-8.1014E-01
40	1.0640E+02	0.	0.	-8.0156E-01
41	1.0830E+02	-0.	-0.	-7.9298E-01
42	1.1020E+02	0.	0.	-7.7787E-01
43	1.1210E+02	0.	0.	-7.6275E-01
44	1.1400E+02	-0.	-0.	-7.4764E-01
45	1.1400E+02	0.	0.	-7.4764E-01
46	1.1515E+02	0.	0.	-7.2226E-01
47	1.1630E+02	0.	0.	-6.9688E-01
48	1.1745E+02	-0.	-0.	-6.7150E-01
49	1.1859E+02	0.	0.	-6.2367E-01
50	1.1974E+02	0.	0.	-5.7583E-01
51	1.2089E+02	-0.	-0.	-5.2800E-01

TABLE 7 (THERMAL LOADS) ALL ZEROES

```
BOUNDARY NUMBER  1          S =  4.2036E+01

RING DATA
EA =  6.7500E+06      EI SUB X =  1.2900E+06      EI SUB Y =  7.7100E+06      EI SUB XY = -3.6000E+05
GJ SUB T =  6.8300E+03      ZBAR = -4.4400E-01      SBAR = -0.              F SUB X =  1.8675E+01
F SUB Y = -0.               F SUB PHI = -0.              N SUB X = -0.              N SUB Y = -0.
N SUB PHI = -0.               THETA = -0.              RHO =  2.4810E+01      E =  9.3500E+06

BOUNDARY NUMBER  2          S =  4.5600E+01

                  B MATRIX                                         D MATRIX                  L VECTOR

-0.         -0.          -0.         -0.          1.0000E+00 -0.          -0.         -0.          -0.
-0.          1.0000E+00 -0.          -0.         -0.          -0.          -0.         -0.          -0.
-0.         -0.          -0.         -0.         -0.          -0.          1.0000E+00 -0.          -0.
-0.         -0.          -0.          1.0000E+00 -0.          -0.          -0.         -0.          -0.

BOUNDARY NUMBER  3          S =  6.8400E+01

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  4          S =  9.1200E+01

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  5          S =  1.1400E+02

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  6          S =  1.2089E+02

RING DATA
EA =  1.1020E+07      EI SUB X =  1.2750E+08      EI SUB Y =  1.2750E+08      EI SUB XY = -0.
GJ SUB T =  9.6500E+07      ZBAR = -4.8295E+00      SBAR = -0.              F SUB X = -0.
F SUB Y = -0.               F SUB PHI = -0.              N SUB X = -0.              N SUB Y = -0.
N SUB PHI = -0.               THETA = -0.              RHO =  1.3120E-01      E =  9.3500E+06


MASS =  4.9496E+03      TRANSLATIONAL ACCELERATION =  6.9481E+00
```

ENTRY	S	P	Q	CAP S	M1	XT	ETA	V	CHT
1	4.2036E+01	1.0494E+02	2.0203E+02	0.	-4.0878E+01	-1.0717E-01	7.6528E-02	0.	3.3986E-02
2	4.2927E+01	1.0209E+02	2.1136E+02	0.	-6.2708E+01	-7.9027E-02	6.6400E-02	0.	3.3114E-02
3	4.3818E+01	9.9333E+01	2.1858E+02	0.	-7.9496E+01	-5.1677E-02	5.6665E-02	0.	3.2015E-02
4	4.4709E+01	9.6676E+01	2.2395E+02	0.	-9.2001E+01	-2.5294E-02	4.7373E-02	0.	3.0746E-02
5	4.5600E+01	9.4108E+01	2.2769E+02	0.	-1.0089E+02	-1.7764E-15	3.8560E-02	0.	2.9357E-02
6	4.5600E+01	9.4092E+01	2.2769E+02	0.	-1.0089E+02	0.	3.8560E-02	0.	2.9357E-02
7	4.7500E+01	8.8895E+01	2.3112E+02	0.	-1.1033E+02	4.9945E-02	2.1443E-02	0.	2.6176E-02
8	4.9400E+01	8.4041E+01	2.2976E+02	0.	-1.1050E+02	9.4194E-02	6.6369E-03	0.	2.2932E-02
9	5.1300E+01	7.9492E+01	2.2498E+02	0.	-1.0476E+02	1.3280E-01	-5.9490E-03	0.	1.9816E-02
10	5.3200E+01	7.5214E+01	2.1783E+02	0.	-9.5569E+01	1.6608E-01	-1.6491E-02	0.	1.6947E-02
11	5.5100E+01	7.1181E+01	2.0913E+02	0.	-8.4644E+01	1.9453E-01	-2.5211E-02	0.	1.4385E-02
12	5.7000E+01	6.7368E+01	1.9949E+02	0.	-7.3171E+01	2.1870E-01	-3.2350E-02	0.	1.2154E-02
13	5.8900E+01	6.3755E+01	1.8934E+02	0.	-6.1939E+01	2.3919E-01	-3.8145E-02	0.	1.0250E-02
14	6.0800E+01	6.0323E+01	1.7902E+02	0.	-5.1449E+01	2.5655E-01	-4.2822E-02	0.	8.6560E-03
15	6.2700E+01	5.7057E+01	1.6875E+02	0.	-4.1994E+01	2.7131E-01	-4.6586E-02	0.	7.3436E-03
16	6.4600E+01	5.3943E+01	1.5867E+02	0.	-3.3724E+01	2.8394E-01	-4.9617E-02	0.	6.2796E-03
17	6.6500E+01	5.0967E+01	1.4889E+02	0.	-2.6685E+01	2.9485E-01	-5.2072E-02	0.	5.4289E-03
18	6.8400E+01	4.8119E+01	1.3946E+02	0.	-2.0859E+01	3.0439E-01	-5.4081E-02	0.	4.7567E-03
19	6.8400E+01	4.8119E+01	1.3946E+02	0.	-2.0859E+01	3.0439E-01	-5.4081E-02	0.	4.7567E-03
20	7.0300E+01	4.5389E+01	1.3043E+02	0.	-1.6185E+01	3.1284E-01	-5.5751E-02	0.	4.2298E-03
21	7.2200E+01	4.2769E+01	1.2179E+02	0.	-1.2581E+01	3.2045E-01	-5.7165E-02	0.	3.8172E-03
22	7.4100E+01	4.0250E+01	1.1355E+02	0.	-9.9476E+00	3.2738E-01	-5.8390E-02	0.	3.4909E-03
23	7.6000E+01	3.7826E+01	1.0570E+02	0.	-8.1831E+00	3.3377E-01	-5.9472E-02	0.	3.2257E-03
24	7.7900E+01	3.5489E+01	9.8225E+01	0.	-7.1832E+00	3.3970E-01	-6.0442E-02	0.	2.9994E-03
25	7.9800E+01	3.3234E+01	9.1110E+01	0.	-6.8459E+00	3.4524E-01	-6.1317E-02	0.	2.7929E-03
26	8.1700E+01	3.1056E+01	8.4338E+01	0.	-7.0725E+00	3.5039E-01	-6.2104E-02	0.	2.5896E-03
27	8.3600E+01	2.8949E+01	7.7895E+01	0.	-7.7687E+00	3.5516E-01	-6.2798E-02	0.	2.3759E-03
28	8.5500E+01	2.6910E+01	7.1767E+01	0.	-8.8439E+00	3.5952E-01	-6.3387E-02	0.	2.1406E-03
29	8.7400E+01	2.4935E+01	6.5942E+01	0.	-1.0210E+01	3.6341E-01	-6.3855E-02	0.	1.8749E-03
30	8.9300E+01	2.3021E+01	6.0410E+01	0.	-1.1781E+01	3.6679E-01	-6.4177E-02	0.	1.5723E-03
31	9.1200E+01	2.1163E+01	5.5165E+01	0.	-1.3472E+01	3.6957E-01	-6.4327E-02	0.	1.2289E-03
32	9.1200E+01	2.1163E+01	5.5165E+01	0.	-1.3472E+01	3.6957E-01	-6.4327E-02	0.	1.2289E-03
33	9.3100E+01	1.9360E+01	5.0199E+01	0.	-1.5198E+01	3.7169E-01	-6.4278E-02	0.	8.4253E-04
34	9.5000E+01	1.7609E+01	4.5510E+01	0.	-1.6876E+01	3.7307E-01	-6.4001E-02	0.	4.1373E-04
35	9.6900E+01	1.5909E+01	4.1096E+01	0.	-1.8421E+01	3.7363E-01	-6.3468E-02	0.	-5.5013E-05
36	9.8800E+01	1.4258E+01	3.6954E+01	0.	-1.9746E+01	3.7331E-01	-6.2656E-02	0.	-5.5889E-04
37	1.0070E+02	1.2656E+01	3.3085E+01	0.	-2.0765E+01	3.7205E-01	-6.1544E-02	0.	-1.0909E-03
38	1.0260E+02	1.1101E+01	2.9489E+01	0.	-2.1393E+01	3.6981E-01	-6.0115E-02	0.	-1.6417E-03
39	1.0450E+02	9.5910E+00	2.6164E+01	0.	-2.1538E+01	3.6657E-01	-5.8361E-02	0.	-2.1999E-03
40	1.0640E+02	8.1268E+00	2.3112E+01	0.	-2.1113E+01	3.6232E-01	-5.6282E-02	0.	-2.7516E-03
41	1.0830E+02	6.7062E+00	2.0330E+01	0.	-2.0027E+01	3.5709E-01	-5.3887E-02	0.	-3.2807E-03
42	1.1020E+02	5.3331E+00	1.7814E+01	0.	-1.8191E+01	3.5093E-01	-5.1195E-02	0.	-3.7687E-03
43	1.1210E+02	4.0118E+00	1.5558E+01	0.	-1.5534E+01	3.4394E-01	-4.8240E-02	0.	-4.1953E-03
44	1.1400E+02	2.7405E+00	1.3556E+01	0.	-1.1987E+01	3.3625E-01	-4.5068E-02	0.	-4.5382E-03
45	1.1400E+02	2.7405E+00	1.3556E+01	0.	-1.1987E+01	3.3625E-01	-4.5068E-02	0.	-4.5382E-03
46	1.1515E+02	2.0042E+00	1.2462E+01	0.	-9.3859E+00	3.3133E-01	-4.3070E-02	0.	-4.6949E-03
47	1.1630E+02	1.3027E+00	1.1449E+01	0.	-6.4426E+00	3.2626E-01	-4.1031E-02	0.	-4.8069E-03
48	1.1745E+02	6.3543E-01	1.0514E+01	0.	-3.1643E+00	3.2109E-01	-3.8968E-02	0.	-4.8691E-03
49	1.1859E+02	1.4047E-02	9.6496E+00	0.	4.3588E-01	3.1588E-01	-3.6903E-02	0.	-4.8762E-03
50	1.1974E+02	-5.4999E-01	8.8481E+00	0.	4.3247E+00	3.1069E-01	-3.4858E-02	0.	-4.8235E-03
51	1.2089E+02	-1.0573E+00	8.1053E+00	0.	8.4636E+00	3.0559E-01	-3.2856E-02	0.	-4.7070E-03

ENTRY	S	W	X	SIG S	SIG PHI	SIG S PHI	SIG SZ	SIG PHI Z	SIG STR
1	4.2036E+01	1.2688E-01	0.	9.8544E+03	1.7554E+04	0.	0.	0.	
			8.0000E-03				-1.6041E+01	0.	
			1.6000E-02	9.7595E+03	1.7644E+04	0.	-3.1807E+01	0.	
			1.6000E-02	0.	0.	-0.			
			4.7200E-01				-3.1802E+01	0.	
			9.2800E-01	0.	0.	-0.	-3.1798E+01	0.	
			9.2800E-01	4.3488E+03	2.2737E+04	0.			
			9.3600E-01				-1.6036E+01	0.	
			9.4400E-01	4.2539E+03	2.2827E+04	0.	1.2073E-07	0.	
2	4.2927E+01	9.6970E-02	0.	1.1593E+04	1.5579E+04	0.	0.	0.	
			8.0000E-03				-1.2849E+01	0.	
			1.6000E-02	1.1448E+04	1.5647E+04	0.	-2.5479E+01	0.	
			1.6000E-02	0.	0.	0.			
			4.7200E-01				-2.5474E+01	0.	
			9.2800E-01	0.	0.	0.	-2.5469E+01	0.	
			9.2800E-01	3.1475E+03	1.9504E+04	0.			
			9.3600E-01				-1.2844E+01	0.	
			9.4400E-01	3.0019E+03	1.9572E+04	0.	1.2073E-07	0.	
3	4.3818E+01	6.7941E-02	0.	1.2926E+04	1.3687E+04	0.	0.	0.	
			8.0000E-03				-1.0100E+01	0.	
			1.6000E-02	1.2742E+04	1.3736E+04	0.	-2.0028E+01	0.	
			1.6000E-02	0.	0.	0.			
			4.7200E-01				-2.0023E+01	0.	
			9.2800E-01	0.	0.	0.	-2.0018E+01	0.	
			9.2800E-01	2.2193E+03	1.6539E+04	0.			
			9.3600E-01				-1.0095E+01	0.	
			9.4400E-01	2.0347E+03	1.6588E+04	0.	1.2073E-07	0.	
4	4.4709E+01	3.9971E-02	0.	1.3912E+04	1.1889E+04	0.	0.	0.	
			8.0000E-03				-7.7455E+00	0.	
			1.6000E-02	1.3698E+04	1.1923E+04	0.	-1.5359E+01	0.	
			1.6000E-02	0.	0.	0.			
			4.7200E-01				-1.5354E+01	0.	
			9.2800E-01	0.	0.	0.	-1.5349E+01	0.	
			9.2800E-01	1.5209E+03	1.3835E+04	0.			
			9.3600E-01				-7.7406E+00	0.	
			9.4400E-01	1.3073E+03	1.3868E+04	0.	1.2073E-07	0.	
5	4.5600E+01	1.3188E-02	0.	1.4603E+04	1.0194E+04	0.	0.	0.	
			8.0000E-03				-5.7403E+00	0.	
			1.6000E-02	1.4369E+04	1.0215E+04	0.	-1.1383E+01	0.	
			1.6000E-02	0.	0.	0.			
			4.7200E-01				-1.1378E+01	0.	
			9.2800E-01	0.	0.	0.	-1.1373E+01	0.	
			9.2800E-01	1.0149E+03	1.1381E+04	0.			
			9.3600E-01				-5.7354E+00	0.	
			9.4400E-01	7.8064E+02	1.1401E+04	0.	1.2073E-07	0.	
6	4.5600E+01	1.3188E-02	0.	1.4603E+04	1.0194E+04	0.	0.	0.	
			8.0000E-03				-5.7320E+00	0.	
			1.6000E-02	1.4369E+04	1.0215E+04	0.	-1.1366E+01	0.	
			1.6000E-02	0.	0.	0.			
			4.7200E-01				-1.1361E+01	0.	
			9.2800E-01	0.	0.	0.	-1.1356E+01	0.	
			9.2800E-01	1.0147E+03	1.1380E+04	0.			
			9.3600E-01				-5.7271E+00	0.	

			9.4400E-01	7.8047E+02	1.1401E+04	0.	1.2073E-07	0.
7	4.7500E+01	-3.9599E-02	0.	1.5295E+04	6.9360E+03	0.	0.	0.
			8.0000E-03				-2.4400E+00	0.
			1.6000E-02	1.5039E+04	6.9358E+03	0.	-4.8383E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-4.8334E+00	0.
			9.2800E-01	0.	0.	0.	-4.8285E+00	0.
			9.2800E-01	4.3511E+02	6.9200E+03	0.		
			9.3600E-01				-2.4351E+00	0.
			9.4400E-01	1.7890E+02	6.9198E+03	0.	1.2073E-07	0.
8	4.9400E+01	-8.6243E-02	0.	1.5215E+04	4.1629E+03	0.	0.	0.
			8.0000E-03				-2.1368E-01	0.
			1.6000E-02	1.4958E+04	4.1497E+03	0.	-4.2378E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-4.1888E-01	0.
			9.2800E-01	0.	0.	0.	-4.1398E-01	0.
			9.2800E-01	3.3256E+02	3.3941E+03	0.		
			9.3600E-01				-2.0878E-01	0.
			9.4400E-01	7.5976E+01	3.3809E+03	0.	1.2073E-07	0.
9	5.1300E+01	-1.2682E-01	0.	1.4633E+04	1.8473E+03	0.	0.	0.
			8.0000E-03				1.2200E+00	0.
			1.6000E-02	1.4389E+04	1.8268E+03	0.	2.4192E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.4241E+00	0.
			9.2800E-01	0.	0.	0.	2.4290E+00	0.
			9.2800E-01	5.2298E+02	6.5640E+02	0.		
			9.3600E-01				1.2249E+00	0.
			9.4400E-01	2.7971E+02	6.3587E+02	0.	1.2073E-07	0.
10	5.3200E+01	-1.6170E-01	0.	1.3747E+04	-5.5478E+01	0.	0.	0.
			8.0000E-03				2.0755E+00	0.
			1.6000E-02	1.3525E+04	-7.9216E+01	0.	4.1155E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.1204E+00	0.
			9.2800E-01	0.	0.	0.	4.1253E+00	0.
			9.2800E-01	8.7568E+02	-1.4322E+03	0.		
			9.3600E-01				2.0804E+00	0.
			9.4400E-01	6.5375E+02	-1.4560E+03	0.	1.2073E-07	0.
11	5.5100E+01	-1.9142E-01	0.	1.2700E+04	-1.5971E+03	0.	0.	0.
			8.0000E-03				2.5180E+00	0.
			1.6000E-02	1.2504E+04	-1.6213E+03	0.	4.9930E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.9979E+00	0.
			9.2800E-01	0.	0.	0.	5.0028E+00	0.
			9.2800E-01	1.3001E+03	-2.9972E+03	0.		
			9.3600E-01				2.5229E+00	0.
			9.4400E-01	1.1036E+03	-3.0214E+03	0.	1.2073E-07	0.
12	5.7000E+01	-2.1658E-01	0.	1.1590E+04	-2.8304E+03	0.	0.	0.
			8.0000E-03				2.6727E+00	0.
			1.6000E-02	1.1421E+04	-2.8531E+03	0.	5.2996E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				5.3045E+00	0.
			9.2800E-01	0.	0.	0.	5.3094E+00	0.
			9.2800E-01	1.7355E+03	-4.1476E+03	0.		
			9.3600E-01				2.6776E+00	0.
			9.4400E-01	1.5656E+03	-4.1703E+03	0.	1.2073E-07	0.

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13	5.8900E+01	-2.3781E-01	0.	1.0485E+04	-3.8052E+03	0.	0.	0.
			8.0000E-03				2.6327E+00	0.
			1.6000E-02	1.0341E+04	-3.8254E+03	0.	5.2203E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				5.2252E+00	0.
			9.2800E-01	0.	0.	0.	5.2301E+00	0.
			9.2800E-01	2.1423E+03	-4.9756E+03	0.		
			9.3600E-01				2.6376E+00	0.
			9.4400E-01	1.9985E+03	-4.9957E+03	0.	1.2073E-07	0.
14	6.0800E+01	-2.5572E-01	0.	9.4262E+03	-4.5669E+03	0.	0.	0.
			8.0000E-03				2.4666E+00	0.
			1.6000E-02	9.3067E+03	-4.5840E+03	0.	4.8910E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.8959E+00	0.
			9.2800E-01	0.	0.	0.	4.9008E+00	0.
			9.2800E-01	2.4968E+03	-5.5576E+03	0.		
			9.3600E-01				2.4715E+00	0.
			9.4400E-01	2.3774E+03	-5.5746E+03	0.	1.2073E-07	0.
15	6.2700E+01	-2.7088E-01	0.	8.4419E+03	-5.1551E+03	0.	0.	0.
			8.0000E-03				2.2245E+00	0.
			1.6000E-02	8.3444E+03	-5.1689E+03	0.	4.4109E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.4158E+00	0.
			9.2800E-01	0.	0.	0.	4.4207E+00	0.
			9.2800E-01	2.7859E+03	-5.9556E+03	0.		
			9.3600E-01				2.2294E+00	0.
			9.4400E-01	2.6884E+03	-5.9694E+03	0.	1.2073E-07	0.
16	6.4600E+01	-2.8379E-01	0.	7.5461E+03	-5.6039E+03	0.	0.	0.
			8.0000E-03				1.9420E+00	0.
			1.6000E-02	7.4678E+03	-5.6145E+03	0.	3.8507E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				3.8555E+00	0.
			9.2800E-01	0.	0.	0.	3.8604E+00	0.
			9.2800E-01	3.0040E+03	-6.2194E+03	0.		
			9.3600E-01				1.9469E+00	0.
			9.4400E-01	2.9257E+03	-6.2300E+03	0.	1.2073E-07	0.
17	6.6500E+01	-2.9488E-01	0.	6.7449E+03	-5.9415E+03	0.	0.	0.
			8.0000E-03				1.6437E+00	0.
			1.6000E-02	6.6829E+03	-5.9492E+03	0.	3.2593E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				3.2642E+00	0.
			9.2800E-01	0.	0.	0.	3.2691E+00	0.
			9.2800E-01	3.1509E+03	-6.3877E+03	0.		
			9.3600E-01				1.6486E+00	0.
			9.4400E-01	3.0889E+03	-6.3954E+03	0.	1.2073E-07	0.
18	6.8400E+01	-3.0453E-01	0.	6.0386E+03	-6.1912E+03	0.	0.	0.
			8.0000E-03				1.3466E+00	0.
			1.6000E-02	5.9902E+03	-6.1964E+03	0.	2.6701E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.6750E+00	0.
			9.2800E-01	0.	0.	0.	2.6799E+00	0.
			9.2800E-01	3.2293E+03	-6.4905E+03	0.		
			9.3600E-01				1.3515E+00	0.
			9.4400E-01	3.1808E+03	-6.4957E+03	0.	1.2073E-07	0.
19	6.8400E+01	-3.0453E-01	0.	6.0386E+03	-6.1912E+03	0.	0.	0.
			8.0000E-03				1.3466E+00	0.

			1.6000E-02	5.9902E+03	-6.1964E+03	0.	2.6701E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.6750E+00	0.
			9.2800E-01	0.	0.	0.	2.6799E+00	0.
			9.2800E-01	3.2293E+03	-6.4905E+03	0.		
			9.3600E-01				1.3515E+00	0.
			9.4400E-01	3.1808E+03	-6.4957E+03	0.	1.2073E-07	0.
20	7.0300E+01	-3.1304E-01	0.	5.4239E+03	-6.3717E+03	0.	0.	0.
			8.0000E-03				1.0611E+00	0.
			1.6000E-02	5.3863E+03	-6.3748E+03	0.	2.1040E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.1089E+00	0.
			9.2800E-01	0.	0.	0.	2.1138E+00	0.
			9.2800E-01	3.2440E+03	-6.5503E+03	0.		
			9.3600E-01				1.0660E+00	0.
			9.4400E-01	3.2064E+03	-6.5534E+03	0.	1.2073E-07	0.
21	7.2200E+01	-3.2067E-01	0.	4.8953E+03	-6.4975E+03	0.	0.	0.
			8.0000E-03				7.9376E-01	0.
			1.6000E-02	4.8661E+03	-6.4990E+03	0.	1.5739E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				1.5788E+00	0.
			9.2800E-01	0.	0.	0.	1.5837E+00	0.
			9.2800E-01	3.2009E+03	-6.5837E+03	0.		
			9.3600E-01				7.9866E-01	0.
			9.4400E-01	3.1717E+03	-6.5851E+03	0.	1.2073E-07	0.
22	7.4100E+01	-3.2760E-01	0.	4.4461E+03	-6.5799E+03	0.	0.	0.
			8.0000E-03				5.4850E-01	0.
			1.6000E-02	4.4230E+03	-6.5803E+03	0.	1.0876E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				1.0925E+00	0.
			9.2800E-01	0.	0.	0.	1.0974E+00	0.
			9.2800E-01	3.1063E+03	-6.6022E+03	0.		
			9.3600E-01				5.5340E-01	0.
			9.4400E-01	3.0832E+03	-6.6026E+03	0.	1.2073E-07	0.
23	7.6000E+01	-3.3398E-01	0.	4.0688E+03	-6.6272E+03	0.	0.	0.
			8.0000E-03				3.2742E-01	0.
			1.6000E-02	4.0498E+03	-6.6270E+03	0.	6.4916E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				6.5406E-01	0.
			9.2800E-01	0.	0.	0.	6.5896E-01	0.
			9.2800E-01	2.9666E+03	-6.6137E+03	0.		
			9.3600E-01				3.3231E-01	0.
			9.4400E-01	2.9476E+03	-6.6134E+03	0.	1.2073E-07	0.
24	7.7900E+01	-3.3989E-01	0.	3.7558E+03	-6.6454E+03	0.	0.	0.
			8.0000E-03				1.3136E-01	0.
			1.6000E-02	3.7391E+03	-6.6451E+03	0.	2.6040E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.6530E-01	0.
			9.2800E-01	0.	0.	0.	2.7019E-01	0.
			9.2800E-01	2.7883E+03	-6.6228E+03	0.		
			9.3600E-01				1.3625E-01	0.
			9.4400E-01	2.7716E+03	-6.6224E+03	0.	1.2073E-07	0.
25	7.9800E+01	-3.4539E-01	0.	3.4996E+03	-6.6387E+03	0.	0.	0.
			8.0000E-03				-3.9533E-02	0.
			1.6000E-02	3.4837E+03	-6.6386E+03	0.	-7.8460E-02	0.
			1.6000E-02	0.	0.	0.		

			4.7200E-01				-7.3560E-02	0.
			9.2800E-01	0.	0.	0.	-6.8661E-02	0.
			9.2800E-01	2.5776E+03	-6.6317E+03	0.		
			9.3600E-01				-3.4634E-02	0.
			9.4400E-01	2.5617E+03	-6.6316E+03	0.	1.2073E-07	0.
26	8.1700E+01	-3.5050E-01	0.	3.2930E+03	-6.6097E+03	0.	0.	0.
			8.0000E-03				-1.8567E-01	0.
			1.6000E-02	3.2766E+03	-6.6103E+03	0.	-3.6823E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-3.6333E-01	0.
			9.2800E-01	0.	0.	0.	-3.5843E-01	0.
			9.2800E-01	2.3405E+03	-6.6410E+03	0.		
			9.3600E-01				-1.8077E-01	0.
			9.4400E-01	2.3241E+03	-6.6415E+03	0.	1.2073E-07	0.
27	8.3600E+01	-3.5522E-01	0.	3.1290E+03	-6.5599E+03	0.	0.	0.
			8.0000E-03				-3.0755E-01	0.
			1.6000E-02	3.1110E+03	-6.5614E+03	0.	-6.0991E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-6.0501E-01	0.
			9.2800E-01	0.	0.	0.	-6.0011E-01	0.
			9.2800E-01	2.0827E+03	-6.6494E+03	0.		
			9.3600E-01				-3.0265E-01	0.
			9.4400E-01	2.0646E+03	-6.6509E+03	0.	1.2073E-07	0.
28	8.5500E+01	-3.5952E-01	0.	3.0009E+03	-6.4899E+03	0.	0.	0.
			8.0000E-03				-4.0540E-01	0.
			1.6000E-02	2.9804E+03	-6.4927E+03	0.	-8.0395E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-7.9905E-01	0.
			9.2800E-01	0.	0.	0.	-7.9415E-01	0.
			9.2800E-01	1.8098E+03	-6.6549E+03	0.		
			9.3600E-01				-4.0050E-01	0.
			9.4400E-01	1.7893E+03	-6.6577E+03	0.	1.2073E-07	0.
29	8.7400E+01	-3.6334E-01	0.	2.9023E+03	-6.3999E+03	0.	0.	0.
			8.0000E-03				-4.7951E-01	0.
			1.6000E-02	2.8786E+03	-6.4043E+03	0.	-9.5088E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-9.4599E-01	0.
			9.2800E-01	0.	0.	0.	-9.4109E-01	0.
			9.2800E-01	1.5272E+03	-6.6547E+03	0.		
			9.3600E-01				-4.7461E-01	0.
			9.4400E-01	1.5035E+03	-6.6591E+03	0.	1.2073E-07	0.
30	8.9300E+01	-3.6662E-01	0.	2.8270E+03	-6.2896E+03	0.	0.	0.
			8.0000E-03				-5.2989E-01	0.
			1.6000E-02	2.7997E+03	-6.2957E+03	0.	-1.0508E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-1.0459E+00	0.
			9.2800E-01	0.	0.	0.	-1.0410E+00	0.
			9.2800E-01	1.2404E+03	-6.6453E+03	0.		
			9.3600E-01				-5.2499E-01	0.
			9.4400E-01	1.2130E+03	-6.6514E+03	0.	1.2073E-07	0.
31	9.1200E+01	-3.6929E-01	0.	2.7690E+03	-6.1588E+03	0.	0.	0.
			8.0000E-03				-5.5615E-01	0.
			1.6000E-02	2.7377E+03	-6.1668E+03	0.	-1.1029E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-1.0980E+00	0.
			9.2800E-01	0.	0.	0.	-1.0931E+00	0.

			9.2800E-01	9.5455E+02	-6.6230E+03	0.		
			9.3600E-01				-5.5125E-01	0.
			9.4400E-01	9.2326E+02	-6.6310E+03	0.	1.2073E-07	0.
32	9.1200E+01	-3.6929E-01	0.	2.7690E+03	-6.1588E+03	0.	0.	0.
			8.0000E-03				-5.5615E-01	0.
			1.6000E-02	2.7377E+03	-6.1669E+03	0.	-1.1029E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-1.0980E+00	0.
			9.2800E-01	0.	0.	0.	-1.0931E+00	0.
			9.2800E-01	9.5455E+02	-6.6230E+03	0.		
			9.3600E-01				-5.5125E-01	0.
			9.4400E-01	9.2326E+02	-6.6310E+03	0.	1.2073E-07	0.
33	9.3100E+01	-3.7126E-01	0.	2.7221E+03	-6.0072E+03	0.	0.	0.
			8.0000E-03				-5.5825E-01	0.
			1.6000E-02	2.6868E+03	-6.0171E+03	0.	-1.1070E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-1.1021E+00	0.
			9.2800E-01	0.	0.	0.	-1.0972E+00	0.
			9.2800E-01	6.7522E+02	-6.5840E+03	0.		
			9.3600E-01				-5.5335E-01	0.
			9.4400E-01	6.3993E+02	-6.5940E+03	0.	1.2073E-07	0.
34	9.5000E+01	-3.7246E-01	0.	2.6807E+03	-5.8347E+03	0.	0.	0.
			8.0000E-03				-5.3595E-01	0.
			1.6000E-02	2.6415E+03	-5.8466E+03	0.	-1.0628E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-1.0579E+00	0.
			9.2800E-01	0.	0.	0.	-1.0530E+00	0.
			9.2800E-01	4.0777E+02	-6.5245E+03	0.		
			9.3600E-01				-5.3105E-01	0.
			9.4400E-01	3.6858E+02	-6.5364E+03	0.	1.2073E-07	0.
35	9.6900E+01	-3.7281E-01	0.	2.6387E+03	-5.6419E+03	0.	0.	0.
			8.0000E-03				-4.8822E-01	0.
			1.6000E-02	2.5959E+03	-5.6556E+03	0.	-9.6816E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-9.6326E-01	0.
			9.2800E-01	0.	0.	0.	-9.5836E-01	0.
			9.2800E-01	1.5773E+02	-6.4407E+03	0.		
			9.3600E-01				-4.8332E-01	0.
			9.4400E-01	1.1495E+02	-6.4545E+03	0.	1.2073E-07	0.
36	9.8800E+01	-3.7223E-01	0.	2.5902E+03	-5.4293E+03	0.	0.	0.
			8.0000E-03				-4.1496E-01	0.
			1.6000E-02	2.5444E+03	-5.4449E+03	0.	-8.2289E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-8.1799E-01	0.
			9.2800E-01	0.	0.	0.	-8.1310E-01	0.
			9.2800E-01	-6.9215E+01	-6.3292E+03	0.		
			9.3600E-01				-4.1006E-01	0.
			9.4400E-01	-1.1507E+02	-6.3448E+03	0.	1.2073E-07	0.
37	1.0070E+02	-3.7067E-01	0.	2.5293E+03	-5.1986E+03	0.	0.	0.
			8.0000E-03				-3.1601E-01	0.
			1.6000E-02	2.4811E+03	-5.2156E+03	0.	-6.2668E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-6.2178E-01	0.
			9.2800E-01	0.	0.	0.	-6.1688E-01	0.
			9.2800E-01	-2.6745E+02	-6.1871E+03	0.		
			9.3600E-01				-3.1111E-01	0.

			9.4400E-01	-3.1567E+02	-6.2042E+03	0.	1.2073E-07	0.
38	1.0260E+02	-3.6807E-01	0.	2.4501E+03	-4.9515E+03	0.	0.	0.
			8.0000E-03				-1.9015E-01	0.
			1.6000E-02	2.4004E+03	-4.9698E+03	0.	-3.7712E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-3.7223E-01	0.
			9.2800E-01	0.	0.	0.	-3.6733E-01	0.
			9.2800E-01	-4.3123E+02	-6.0118E+03	0.		
			9.3600E-01				-1.8525E-01	0.
			9.4400E-01	-4.8090E+02	-6.0301E+03	0.	1.2073E-07	0.
39	1.0450E+02	-3.6442E-01	0.	2.3463E+03	-4.6911E+03	0.	0.	0.
			8.0000E-03				-3.7127E-02	0.
			1.6000E-02	2.2963E+03	-4.7102E+03	0.	-7.3689E-02	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-6.8789E-02	0.
			9.2800E-01	0.	0.	0.	-6.3890E-02	0.
			9.2800E-01	-5.5461E+02	-5.8013E+03	0.		
			9.3600E-01				-3.2228E-02	0.
			9.4400E-01	-6.0462E+02	-5.8205E+03	0.	1.2073E-07	0.
40	1.0640E+02	-3.5972E-01	0.	2.2119E+03	-4.4209E+03	0.	0.	0.
			8.0000E-03				1.4320E-01	0.
			1.6000E-02	2.1628E+03	-4.4404E+03	0.	2.8389E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.8879E-01	0.
			9.2800E-01	0.	0.	0.	2.9369E-01	0.
			9.2800E-01	-6.3174E+02	-5.5543E+03	0.		
			9.3600E-01				1.4810E-01	0.
			9.4400E-01	-6.8077E+02	-5.5739E+03	0.	1.2073E-07	0.
41	1.0830E+02	-3.5398E-01	0.	2.0406E+03	-4.1454E+03	0.	0.	0.
			8.0000E-03				3.5159E-01	0.
			1.6000E-02	1.9941E+03	-4.1648E+03	0.	6.9709E-01	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				7.0199E-01	0.
			9.2800E-01	0.	0.	0.	7.0689E-01	0.
			9.2800E-01	-6.5672E+02	-5.2703E+03	0.		
			9.3600E-01				3.5649E-01	0.
			9.4400E-01	-7.0322E+02	-5.2897E+03	0.	1.2073E-07	0.
42	1.1020E+02	-3.4728E-01	0.	1.8263E+03	-3.8700E+03	0.	0.	0.
			8.0000E-03				5.8510E-01	0.
			1.6000E-02	1.7840E+03	-3.8886E+03	0.	1.1601E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				1.1650E+00	0.
			9.2800E-01	0.	0.	0.	1.1699E+00	0.
			9.2800E-01	-6.2380E+02	-4.9496E+03	0.		
			9.3600E-01				5.9000E-01	0.
			9.4400E-01	-6.6605E+02	-4.9682E+03	0.	1.2073E-07	0.
43	1.1210E+02	-3.3970E-01	0.	1.5639E+03	-3.6007E+03	0.	0.	0.
			8.0000E-03				8.4052E-01	0.
			1.6000E-02	1.5278E+03	-3.6178E+03	0.	1.6666E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				1.6715E+00	0.
			9.2800E-01	0.	0.	0.	1.6764E+00	0.
			9.2800E-01	-5.2832E+02	-4.5937E+03	0.		
			9.3600E-01				8.4542E-01	0.
			9.4400E-01	-5.6439E+02	-4.6108E+03	0.	1.2073E-07	0.

44	1.1400E+02	-3.3139E-01	0.	1.2485E+03	-3.3444E+03	0.	0.	0.
			8.0000E-03				1.1176E+00	0.
			1.6000E-02	1.2207E+03	-3.3593E+03	0.	2.2160E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.2209E+00	0.
			9.2800E-01	0.	0.	0.	2.2258E+00	0.
			9.2800E-01	-3.6594E+02	-4.2052E+03	0.		
			9.3600E-01				1.1225E+00	0.
			9.4400E-01	-3.9377E+02	-4.2200E+03	0.	1.2073E-07	0.
45	1.1400E+02	-3.3139E-01	0.	1.2485E+03	-3.3444E+03	0.	0.	0.
			8.0000E-03				1.1176E+00	0.
			1.6000E-02	1.2207E+03	-3.3593E+03	0.	2.2160E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.2209E+00	0.
			9.2800E-01	0.	0.	0.	2.2258E+00	0.
			9.2800E-01	-3.6594E+02	-4.2052E+03	0.		
			9.3600E-01				1.1225E+00	0.
			9.4400E-01	-3.9377E+02	-4.2200E+03	0.	1.2073E-07	0.
46	1.1515E+02	-3.2608E-01	0.	1.0303E+03	-3.1990E+03	0.	0.	0.
			8.0000E-03				1.2902E+00	0.
			1.6000E-02	1.0085E+03	-3.2121E+03	0.	2.5583E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.5631E+00	0.
			9.2800E-01	0.	0.	0.	2.5680E+00	0.
			9.2800E-01	-2.3381E+02	-3.9560E+03	0.		
			9.3600E-01				1.2951E+00	0.
			9.4400E-01	-2.5560E+02	-3.9691E+03	0.	1.2073E-07	0.
47	1.1630E+02	-3.2062E-01	0.	7.9146E+02	-3.0627E+03	0.	0.	0.
			8.0000E-03				1.4601E+00	0.
			1.6000E-02	7.7649E+02	-3.0736E+03	0.	2.8952E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.9001E+00	0.
			9.2800E-01	0.	0.	0.	2.9050E+00	0.
			9.2800E-01	-7.6260E+01	-3.6977E+03	0.		
			9.3600E-01				1.4650E+00	0.
			9.4400E-01	-9.1221E+01	-3.7086E+03	0.	1.2073E-07	0.
48	1.1745E+02	-3.1506E-01	0.	5.3230E+02	-2.9369E+03	0.	0.	0.
			8.0000E-03				1.6271E+00	0.
			1.6000E-02	5.2495E+02	-2.9454E+03	0.	3.2263E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				3.2312E+00	0.
			9.2800E-01	0.	0.	0.	3.2361E+00	0.
			9.2800E-01	1.0611E+02	-3.4317E+03	0.		
			9.3600E-01				1.6320E+00	0.
			9.4400E-01	9.8767E+01	-3.4402E+03	0.	1.2073E-07	0.
49	1.1859E+02	-3.0945E-01	0.	2.5365E+02	-2.8232E+03	0.	0.	0.
			8.0000E-03				1.7837E+00	0.
			1.6000E-02	2.5467E+02	-2.8290E+03	0.	3.5369E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				3.5418E+00	0.
			9.2800E-01	0.	0.	0.	3.5467E+00	0.
			9.2800E-01	3.1236E+02	-3.1599E+03	0.		
			9.3600E-01				1.7886E+00	0.
			9.4400E-01	3.1337E+02	-3.1657E+03	0.	1.2073E-07	0.
50	1.1974E+02	-3.0388E-01	0.	-4.2311E+01	-2.7227E+03	0.	0.	0.
			8.0000E-03				1.9228E+00	0.

			1.6000E-02	-3.2268E+01	-2.7255E+03	0.	3.8126E+00	0.
			1.6000E-02	0.	0.	0.		
			4.7200E-01				3.8175E+00	0.
			9.2800E-01	0.	0.	0.	3.8224E+00	0.
			9.2800E-01	5.4016E+02	-2.8846E+03	0.		
			9.3600E-01				1.9277E+00	0.
			9.4400E-01	5.5021E+02	-2.8874E+03	0.	1.2073E-07	0.
51	1.2089E+02	-2.9840E-01	0.	-3.5307E+02	-2.6365E+03	0.	0.	0.
			8.0000E-03				2.0439E+00	0.
			1.6000E-02	-3.3342E+02	-2.6360E+03	0.	4.0526E+00	0.
			1.6000E-02	0.	0.	-0.		
			4.7200E-01				4.0575E+00	0.
			9.2800E-01	0.	0.	-0.	4.0624E+00	0.
			9.2800E-01	7.8684E+02	-2.6084E+03	0.		
			9.3600E-01				2.0487E+00	0.
			9.4400E-01	8.0650E+02	-2.6079E+03	0.	1.2073E-07	0.

```
140 DEGREE SANDWICH CONE

    SYMMETRICAL LOADING AND RESPONSE ABOUT AN AXIAL PLANE
N =  1       REL ERR CNTRL =  1.000E-02
THIS STRUCTURE HAS RIGID BODY TRANSLATIONAL AND ROTATIONAL FREEDOM.


THIS CASE USES TABLE 1 (SURFACE GEOMETRY) FROM PREVIOUS CASE


THIS CASE USES TABLE 2 (WALL PROPERTIES) FROM PREVIOUS CASE


THIS CASE USES TABLE 3 (FOUNDATION MODULI) FROM PREVIOUS CASE


THIS CASE USES TABLE 4 (STRINGER PROPERTIES) FROM PREVIOUS CASE


THIS CASE USES TABLE 5 (MASS DENSITY) FROM PREVIOUS CASE
```

TABLE 6 (MECHANICAL LOADS)

ENTRY	S	X1	X2	X3
1	4.2036E+01	-0.	-0.	-6.8750E-02
2	4.2927E+01	0.	0.	-6.9055E-02
3	4.3818E+01	0.	0.	-6.9360E-02
4	4.4709E+01	0.	0.	-6.9665E-02
5	4.5600E+01	-0.	-0.	-6.9970E-02
6	4.5600E+01	0.	0.	-6.9970E-02
7	4.7500E+01	0.	0.	-7.0583E-02
8	4.9400E+01	0.	0.	-7.1197E-02
9	5.1300E+01	-0.	-0.	-7.1810E-02
10	5.3200E+01	0.	0.	-7.2220E-02
11	5.5100E+01	0.	0.	-7.2630E-02
12	5.7000E+01	-0.	-0.	-7.3040E-02
13	5.8900E+01	0.	0.	-7.3450E-02
14	6.0800E+01	0.	0.	-7.3860E-02
15	6.2700E+01	-0.	-0.	-7.4270E-02
16	6.4600E+01	0.	0.	-7.4680E-02
17	6.6500E+01	0.	0.	-7.5090E-02
18	6.8400E+01	-0.	-0.	-7.5500E-02
19	6.8400E+01	0.	0.	-7.5500E-02
20	7.0300E+01	0.	0.	-7.5910E-02
21	7.2200E+01	0.	0.	-7.6320E-02
22	7.4100E+01	-0.	-0.	-7.6730E-02
23	7.6000E+01	0.	0.	-7.7140E-02
24	7.7900E+01	0.	0.	-7.7550E-02
25	7.9800E+01	-0.	-0.	-7.7960E-02
26	8.1700E+01	0.	0.	-7.7960E-02
27	8.3600E+01	0.	0.	-7.7960E-02
28	8.5500E+01	-0.	-0.	-7.7960E-02
29	8.7400E+01	0.	0.	-7.8373E-02
30	8.9300E+01	0.	0.	-7.8787E-02
31	9.1200E+01	-0.	-0.	-7.9200E-02
32	9.1200E+01	0.	0.	-7.9200E-02
33	9.3100E+01	0.	0.	-7.9200E-02
34	9.5000E+01	0.	0.	-7.9200E-02
35	9.6900E+01	-0.	-0.	-7.9200E-02
36	9.8800E+01	0.	0.	-7.8797E-02
37	1.0070E+02	0.	0.	-7.8393E-02
38	1.0260E+02	-0.	-0.	-7.7990E-02
39	1.0450E+02	0.	0.	-7.7587E-02
40	1.0640E+02	0.	0.	-7.7183E-02
41	1.0830E+02	-0.	-0.	-7.6780E-02
42	1.1020E+02	0.	0.	-7.4747E-02
43	1.1210E+02	0.	0.	-7.2713E-02
44	1.1400E+02	-0.	-0.	-7.0680E-02
45	1.1400E+02	0.	0.	-7.0680E-02
46	1.1515E+02	0.	0.	-6.1620E-02
47	1.1630E+02	0.	0.	-5.2560E-02
48	1.1745E+02	-0.	-0.	-4.3500E-02
49	1.1859E+02	0.	0.	-2.9000E-02
50	1.1974E+02	0.	0.	-1.4500E-02
51	1.2089E+02	-0.	-0.	-0.

THIS CASE USES TABLE 7 (THERMAL LOADS) FROM PREVIOUS CASE

```
BOUNDARY NUMBER  1            S =  4.2036E+01

RING DATA
EA =  6.7500E+06       EI SUB X =  1.2900E+06       EI SUB Y =  7.7100E+06       EI SUB XY = -3.6000E+05
GJ SUB T =  6.8300E+03       ZBAR = -4.4400E-01       SBAR = -0.              F SUB X =  8.0500E-01
F SUB Y = -4.4600E-01       F SUB PHI = -0.              N SUB X = -1.7650E+01       N SUB Y = -0.
N SUB PHI = -0.               THETA = -0.              RHO =  2.4810E+01       E =  9.3500E+06

BOUNDARY NUMBER  2            S =  4.5600E+01

R. D. AND L VECTOR TAKEN FROM PREVIOUS CASE

BOUNDARY NUMBER  3            S =  6.8400E+01

R = I. D = 0. L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  4            S =  9.1200E+01

R = I. D = 0. L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  5            S =  1.1400E+02

R = I. D = 0. L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  6            S =  1.2089E+02

RING DATA
EA =  1.1020E+07       EI SUB X =  1.2750E+08       EI SUB Y =  1.2750E+08       EI SUB XY = -0.
GJ SUB T =  9.6500E+07       ZBAR = -4.8295E+00       SBAR = -0.              F SUB X = -0.
F SUB Y = -0.               F SUB PHI = -0.              N SUB X = -0.              N SUB Y = -0.
N SUB PHI = -0.               THETA = -0.              RHO =  1.3120E-01       E =  9.3500E+06


MASS =  4.9496E+03      TRANSLATIONAL ACCELERATION = -1.0537E-01


AXIAL DISTANCE OF CENTER OF MASS FROM INITIAL EDGE IS  2.6885E+00


MASS MOMENT OF INERTIA =  5.7851E+06      ROTATIONAL ACCELERATION =  1.9678E-02
```

ENTRY	S	P	Q	CAP S	MI	XT	ETA	V	CHI
1	4.2036E+01	1.2985E+01	2.2900E+01	2.4924E+01	8.9265E-01	-1.4774E-02	1.1231E-02	-1.2408E-03	4.5386E-03
2	4.2927E+01	1.2469E+01	2.3649E+01	2.5611E+01	-2.2440E+00	-1.0988E-02	9.8561E-03	-9.4225E-04	4.4969E-03
3	4.3818E+01	1.1969E+01	2.4163E+01	2.6067E+01	-4.7547E+00	-7.2474E-03	8.5087E-03	-6.3495E-04	4.4212E-03
4	4.4709E+01	1.1487E+01	2.4475E+01	2.6321E+01	-6.7295E+00	-3.5784E-03	7.1965E-03	-3.2041E-04	4.3209E-03
5	4.5600E+01	1.1022E+01	2.4610E+01	2.6400E+01	-8.2475E+00	0.	5.9253E-03	2.7756E-17	4.2002E-03
6	4.5600E+01	1.1012E+01	2.4610E+01	2.6399E+01	-8.2475E+00	0.	5.9253E-03	0.	4.2002E-03
7	4.7500E+01	1.0079E+01	2.4421E+01	2.6097E+01	-1.0250E+01	7.2664E-03	3.3694E-03	6.9751E-04	3.9002E-03
8	4.9400E+01	9.2229E+00	2.3746E+01	2.5317E+01	-1.1031E+01	1.3975E-02	1.0395E-03	1.4069E-03	3.5723E-03
9	5.1300E+01	8.4399E+00	2.2744E+01	2.4216E+01	-1.0998E+01	2.0098E-02	-1.0620E-03	2.1209E-03	3.2424E-03
10	5.3200E+01	7.7252E+00	2.1536E+01	2.2914E+01	-1.0450E+01	2.5648E-02	-2.9447E-03	2.8342E-03	2.9275E-03
11	5.5100E+01	7.0736E+00	2.0212E+01	2.1501E+01	-9.6000E+00	3.0656E-02	-4.6257E-03	3.5432E-03	2.6369E-03
12	5.7000E+01	6.4796E+00	1.8836E+01	2.0041E+01	-8.6015E+00	3.5173E-02	-6.1259E-03	4.2452E-03	2.3756E-03
13	5.8900E+01	5.9375E+00	1.7455E+01	1.8581E+01	-7.5586E+00	3.9250E-02	-7.4674E-03	4.9384E-03	2.1454E-03
14	6.0900E+01	5.4423E+00	1.6102E+01	1.7152E+01	-6.5412E+00	4.2942E-02	-8.6720E-03	5.6218E-03	1.9457E-03
15	6.2700E+01	4.9892E+00	1.4797E+01	1.5775E+01	-5.5937E+00	4.6303E-02	-9.7602E-03	6.2948E-03	1.7748E-03
16	6.4600E+01	4.5737E+00	1.3554E+01	1.4463E+01	-4.7422E+00	4.9380E-02	-1.0751E-02	6.9571E-03	1.6299E-03
17	6.6500E+01	4.1920E+00	1.2380E+01	1.3223E+01	-3.9998E+00	5.2218E-02	-1.1659E-02	7.6089E-03	1.5077E-03
18	6.8400E+01	3.8404E+00	1.1278E+01	1.2058E+01	-3.3707E+00	5.4853E-02	-1.2501E-02	8.2501E-03	1.4051E-03
19	6.8400E+01	3.8404E+00	1.1278E+01	1.2058E+01	-3.3707E+00	5.4853E-02	-1.2501E-02	8.2501E-03	1.4051E-03
20	7.0300E+01	3.5157E+00	1.0249E+01	1.0969E+01	-2.8528E+00	5.7319E-02	-1.3286E-02	8.8812E-03	1.3188E-03
21	7.2200E+01	3.2152E+00	9.2906E+00	9.9523E+00	-2.4402E+00	5.9640E-02	-1.4026E-02	9.5025E-03	1.2456E-03
22	7.4100E+01	2.9362E+00	8.4011E+00	9.0066E+00	-2.1244E+00	6.1839E-02	-1.4726E-02	1.0114E-02	1.1828E-03
23	7.6000E+01	2.6766E+00	7.5765E+00	8.1280E+00	-1.8953E+00	6.3930E-02	-1.5394E-02	1.0717E-02	1.1278E-03
24	7.7900E+01	2.4344E+00	6.8135E+00	7.3128E+00	-1.7419E+00	6.5928E-02	-1.6033E-02	1.1312E-02	1.0784E-03
25	7.9800E+01	2.2077E+00	6.1081E+00	6.5570E+00	-1.6530E+00	6.7838E-02	-1.6646E-02	1.1898E-02	1.0325E-03
26	8.1700E+01	1.9955E+00	5.4568E+00	5.8570E+00	-1.6173E+00	6.9667E-02	-1.7234E-02	1.2477E-02	9.8872E-04
27	8.3600E+01	1.7965E+00	4.8559E+00	5.2093E+00	-1.6245E+00	7.1417E-02	-1.7798E-02	1.3048E-02	9.4559E-04
28	8.5500E+01	1.6097E+00	4.3026E+00	4.6108E+00	-1.6646E+00	7.3089E-02	-1.8338E-02	1.3612E-02	9.0214E-04
29	8.7400E+01	1.4334E+00	3.7940E+00	4.0586E+00	-1.7274E+00	7.4680E-02	-1.8854E-02	1.4170E-02	8.5760E-04
30	8.9300E+01	1.2664E+00	3.3280E+00	3.5502E+00	-1.8017E+00	7.6190E-02	-1.9344E-02	1.4722E-02	8.1151E-04
31	9.1200E+01	1.1076E+00	2.9022E+00	3.0833E+00	-1.8760E+00	7.7614E-02	-1.9808E-02	1.5268E-02	7.6372E-04
32	9.1200E+01	1.1076E+00	2.9022E+00	3.0833E+00	-1.8760E+00	7.7614E-02	-1.9808E-02	1.5268E-02	7.6372E-04
33	9.3100E+01	9.5674E-01	2.5148E+00	2.6559E+00	-1.9391E+00	7.8950E-02	-2.0243E-02	1.5809E-02	7.1437E-04
34	9.5000E+01	8.1335E-01	2.1638E+00	2.2664E+00	-1.9807E+00	8.0196E-02	-2.0649E-02	1.6344E-02	6.6387E-04
35	9.6900E+01	6.7678E-01	1.8477E+00	1.9131E+00	-1.9907E+00	8.1349E-02	-2.1026E-02	1.6876E-02	6.1293E-04
36	9.8800E+01	5.4676E-01	1.5650E+00	1.5945E+00	-1.9588E+00	8.2411E-02	-2.1373E-02	1.7403E-02	5.6250E-04
37	1.0070E+02	4.2308E-01	1.3143E+00	1.3094E+00	-1.8761E+00	8.3383E-02	-2.1691E-02	1.7926E-02	5.1379E-04
38	1.0260E+02	3.0522E-01	1.0943E+00	1.0563E+00	-1.7334E+00	8.4269E-02	-2.1981E-02	1.8446E-02	4.6824E-04
39	1.0450E+02	1.9271E-01	9.0355E-01	8.3381E-01	-1.5218E+00	8.5078E-02	-2.2247E-02	1.8962E-02	4.2752E-04
40	1.0640E+02	8.5092E-02	7.4070E-01	6.4054E-01	-1.2323E+00	8.5818E-02	-2.2491E-02	1.9476E-02	3.9353E-04
41	1.0830E+02	-1.8012E-02	6.0421E-01	4.7486E-01	-8.5634E-01	8.6503E-02	-2.2718E-02	1.9988E-02	3.6839E-04
42	1.1020E+02	-1.1552E-01	4.9183E-01	3.3504E-01	-3.8665E-01	8.7153E-02	-2.2935E-02	2.0497E-02	3.5445E-04
43	1.1210E+02	-2.0634E-01	4.0112E-01	2.1911E-01	1.7959E-01	8.7789E-02	-2.3150E-02	2.1005E-02	3.5416E-04
44	1.1400E+02	-2.9080E-01	3.2993E-01	1.2487E-01	8.4361E-01	8.8437E-02	-2.3372E-02	2.1511E-02	3.7002E-04
45	1.1400E+02	-2.9080E-01	3.2993E-01	1.2487E-01	8.4361E-01	8.8437E-02	-2.3372E-02	2.1511E-02	3.7002E-04
46	1.1515E+02	-3.3470E-01	2.9382E-01	7.7391E-02	1.2909E+00	8.8848E-02	-2.3515E-02	2.1817E-02	3.8849E-04
47	1.1630E+02	-3.6807E-01	2.6032E-01	3.6336E-02	1.7638E+00	8.9282E-02	-2.3667E-02	2.2122E-02	4.1424E-04
48	1.1745E+02	-3.9106E-01	2.2884E-01	1.0723E-03	2.2519E+00	8.9749E-02	-2.3831E-02	2.2427E-02	4.4757E-04
49	1.1859E+02	-4.0087E-01	1.9768E-01	-2.9077E-02	2.7435E+00	9.0255E-02	-2.4010E-02	2.2731E-02	4.8863E-04
50	1.1974E+02	-3.9471E-01	1.6510E-01	-5.4923E-02	3.2223E+00	9.0809E-02	-2.4208E-02	2.3035E-02	5.3731E-04
51	1.2089E+02	-3.7277E-01	1.3042E-01	-7.6908E-02	3.6708E+00	9.1420E-02	-2.4426E-02	2.3340E-02	5.9326E-04

ENTRY	S	W	X	SIG S	SIG PHI	SIG S PHI	SIG SZ	SIG PHI Z	SIG STR
1	4.2036E+01	1.7724E-02	0.	7.5009E+02	2.0613E+03	1.1868E+03	0.	0.	
			8.0000E-03				-2.2941E+00	-8.7185E-02	
			1.6000E-02	7.5216E+02	2.0796E+03	1.1731E+03	-4.5489E+00	-1.7288E-01	
			1.6000E-02	0.	0.	0.			
			4.7200E-01				-4.5485E+00	-1.7274E-01	
			9.2800E-01	0.	0.	0.	-4.5481E+00	-1.7262E-01	
			9.2800E-01	8.7031E+02	3.1215E+03	3.9095E+02			
			9.3600E-01				-2.2937E+00	-8.6356E-02	
			9.4400E-01	8.7239E+02	3.1398E+03	3.7723E+02	-9.7061E-05	1.4061E-03	
2	4.2927E+01	1.3696E-02	0.	9.8144E+02	1.8666E+03	1.1879E+03	0.	0.	
			8.0000E-03				-1.8970E+00	-3.9926E-02	
			1.6000E-02	9.7623E+02	1.8817E+03	1.1749E+03	-3.7616E+00	-7.9161E-02	
			1.6000E-02	0.	0.	0.			
			4.7200E-01				-3.7612E+00	-7.9014E-02	
			9.2800E-01	0.	0.	0.	-3.7607E+00	-7.8884E-02	
			9.2800E-01	6.7920E+02	2.7399E+03	4.3170E+02			
			9.3600E-01				-1.8966E+00	-3.8612E-02	
			9.4400E-01	6.7399E+02	2.7549E+03	4.1866E+02	-9.7082E-05	2.3502E-03	
3	4.3818E+01	9.7205E-03	0.	1.1632E+03	1.6777E+03	1.1804E+03	0.	0.	
			8.0000E-03				-1.5520E+00	-2.5233E-03	
			1.6000E-02	1.1522E+03	1.6899E+03	1.1681E+03	-3.0774E+00	-4.9927E-03	
			1.6000E-02	0.	0.	0.			
			4.7200E-01				-3.0770E+00	-4.8331E-03	
			9.2800E-01	0.	0.	0.	-3.0766E+00	-4.6909E-03	
			9.2800E-01	5.2282E+02	2.3877E+03	4.6653E+02			
			9.3600E-01				-1.5516E+00	-8.6919E-04	
			9.4400E-01	5.1178E+02	2.3999E+03	4.5423E+02	-9.7073E-05	3.0063E-03	
4	4.4709E+01	5.8240E-03	0.	1.3025E+03	1.4962E+03	1.1658E+03	0.	0.	
			8.0000E-03				-1.2535E+00	2.6649E-02	
			1.6000E-02	1.2868E+03	1.5060E+03	1.1543E+03	-2.4855E+00	5.2855E-02	
			1.6000E-02	0.	0.	0.			
			4.7200E-01				-2.4851E+00	5.3027E-02	
			9.2800E-01	0.	0.	0.	-2.4846E+00	5.3181E-02	
			9.2800E-01	3.9611E+02	2.0644E+03	4.9576E+02			
			9.3600E-01				-1.2531E+00	2.8531E-02	
			9.4400E-01	3.8048E+02	2.0742E+03	4.8420E+02	-9.7041E-05	3.4370E-03	
5	4.5600E+01	2.0266E-03	0.	1.4055E+03	1.3232E+03	1.1457E+03	0.	0.	
			8.0000E-03				-9.9634E-01	4.8979E-02	
			1.6000E-02	1.3863E+03	1.3309E+03	1.1349E+03	-1.9757E+00	9.7134E-02	
			1.6000E-02	0.	0.	0.			
			4.7200E-01				-1.9752E+00	9.7318E-02	
			9.2800E-01	0.	0.	0.	-1.9748E+00	9.7485E-02	
			9.2800E-01	2.9464E+02	1.7690E+03	5.1973E+02			
			9.3600E-01				-9.9596E-01	5.1001E-02	
			9.4400E-01	2.7549E+02	1.7767E+03	5.0893E+02	-9.6990E-05	3.6926E-03	
6	4.5600E+01	2.0266E-03	0.	1.4054E+03	1.3232E+03	1.1456E+03	0.	0.	
			8.0000E-03				-9.9120E-01	4.8979E-02	
			1.6000E-02	1.3862E+03	1.3309E+03	1.1348E+03	-1.9655E+00	9.7134E-02	
			1.6000E-02	0.	0.	0.			
			4.7200E-01				-1.9650E+00	9.7318E-02	
			9.2800E-01	0.	0.	0.	-1.9646E+00	9.7485E-02	
			9.2800E-01	2.9453E+02	1.7690E+03	5.1968E+02			
			9.3600E-01				-9.9081E-01	5.1001E-02	

			9.4400E-01	2.7538E+02	1.7766E+03	5.0889E+02	-9.6990E-05	3.6926E-03
7	4.7500E+01	-5.6758E-03	0.	1.5270E+03	9.8570E+02	1.0890E+03	0.	0.
			8.0000E-03				-5.6035E-01	7.8740E-02
			1.6000E-02	1.5032E+03	9.8986E+02	1.0798E+03	-1.1111E+00	1.5615E-01
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-1.1107E+00	1.5636E-01
			9.2800E-01	0.	0.	0.	-1.1103E+00	1.5655E-01
			9.2800E-01	1.4647E+02	1.2268E+03	5.5505E+02		
			9.3600E-01				-5.5997E-01	8.0854E-02
			9.4400E-01	1.2267E+02	1.2309E+03	5.4585E+02	-9.6835E-05	3.8246E-03
8	4.9400E+01	-1.2777E-02	0.	1.5516E+03	6.9338E+02	1.0209E+03	0.	0.
			8.0000E-03				-2.5773E-01	9.1517E-02
			1.6000E-02	1.5260E+03	6.9507E+02	1.0131E+03	-5.1106E-01	1.8148E-01
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-5.1064E-01	1.8172E-01
			9.2800E-01	0.	0.	0.	-5.1020E-01	1.8194E-01
			9.2800E-01	6.5818E+01	7.9138E+02	5.7221E+02		
			9.3600E-01				-2.5735E-01	9.3555E-02
			9.4400E-01	4.0201E+01	7.9306E+02	5.6448E+02	-9.6640E-05	3.6189E-03
9	5.1300E+01	-1.9250E-02	0.	1.5115E+03	4.4533E+02	9.4744E+02	0.	0.
			8.0000E-03				-5.1810E-02	9.3563E-02
			1.6000E-02	1.4860E+03	4.4537E+02	9.4102E+02	-1.0274E-01	1.8554E-01
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-1.0232E-01	1.8580E-01
			9.2800E-01	0.	0.	0.	-1.0187E-01	1.8605E-01
			9.2800E-01	3.0214E+01	4.4722E+02	5.7492E+02		
			9.3600E-01				-5.1425E-02	9.5442E-02
			9.4400E-01	4.6737E+00	4.4725E+02	5.6849E+02	-9.6426E-05	3.2493E-03
10	5.3200E+01	-2.5108E-02	0.	1.4308E+03	2.3840E+02	8.7283E+02	0.	0.
			8.0000E-03				8.2181E-02	8.9176E-02
			1.6000E-02	1.4066E+03	2.3738E+02	8.6755E+02	1.6295E-01	1.7684E-01
			1.6000E-02	0.	0.	0.		
			4.7200E-01				1.6337E-01	1.7713E-01
			9.2800E-01	0.	0.	0.	1.6382E-01	1.7740E-01
			9.2800E-01	2.3417E+01	1.7924E+02	5.6652E+02		
			9.3600E-01				8.2565E-02	9.0867E-02
			9.4400E-01	-8.4899E-01	1.7822E+02	5.6124E+02	-9.6208E-05	2.8196E-03
11	5.5100E+01	-3.0390E-02	0.	1.3268E+03	6.8295E+01	7.9976E+02	0.	0.
			8.0000E-03				1.6348E-01	8.1269E-02
			1.6000E-02	1.3045E+03	6.6662E+01	7.9545E+02	3.2415E-01	1.6115E-01
			1.6000E-02	0.	0.	0.		
			4.7200E-01				3.2458E-01	1.6147E-01
			9.2800E-01	0.	0.	0.	3.2502E-01	1.6177E-01
			9.2800E-01	3.3779E+01	-2.6395E+01	5.4989E+02		
			9.3600E-01				1.6386E-01	8.2771E-02
			9.4400E-01	1.1486E+01	-2.8028E+01	5.4558E+02	-9.5994E-05	2.3892E-03
12	5.7000E+01	-3.5147E-02	0.	1.2116E+03	-6.9673E+01	7.2989E+02	0.	0.
			8.0000E-03				2.0693E-01	7.1767E-02
			1.6000E-02	1.1916E+03	-7.1607E+01	7.2640E+02	4.1031E-01	1.4231E-01
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.1073E-01	1.4265E-01
			9.2800E-01	0.	0.	0.	4.1117E-01	1.4298E-01
			9.2800E-01	5.3111E+01	-1.8185E+02	5.2738E+02		
			9.3600E-01				2.0731E-01	7.3096E-02
			9.4400E-01	3.3137E+01	-1.8378E+02	5.2389E+02	-9.5789E-05	1.9901E-03

13	5.8900E+01	-3.9437E-02	0.	1.0938E+03	-1.8015E+02	6.6416E+02	0.	0.
			8.0000E-03				2.2379E-01	6.1906E-02
			1.6000E-02	1.0763E+03	-1.8217E+02	6.6135E+02	4.4374E-01	1.2276E-01
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.4416E-01	1.2313E-01
			9.2800E-01	0.	0.	0.	4.4461E-01	1.2348E-01
			9.2800E-01	7.5792E+01	-2.9753E+02	5.0091E+02		
			9.3600E-01				2.2417E-01	6.3085E-02
			9.4400E-01	5.8240E+01	-2.9955E+02	4.9809E+02	-9.5598E-05	1.6371E-03
14	6.0800E+01	-4.3318E-02	0.	9.7909E+02	-2.6747E+02	6.0302E+02	0.	0.
			8.0000E-03				2.2250E-01	5.2447E-02
			1.6000E-02	9.6390E+02	-2.6944E+02	6.0076E+02	4.4119E-01	1.0400E-01
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.4162E-01	1.0439E-01
			9.2800E-01	0.	0.	0.	4.4206E-01	1.0477E-01
			9.2800E-01	9.8089E+01	-3.8215E+02	4.7198E+02		
			9.3600E-01				2.2289E-01	5.3502E-02
			9.4400E-01	8.2899E+01	-3.8413E+02	4.6972E+02	-9.5421E-05	1.3351E-03
15	6.2700E+01	-4.6849E-02	0.	8.7103E+02	-3.3553E+02	5.4659E+02	0.	0.
			8.0000E-03				2.0932E-01	4.3825E-02
			1.6000E-02	8.5804E+02	-3.3738E+02	5.4478E+02	4.1506E-01	8.6900E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.1548E-01	8.7321E-02
			9.2800E-01	0.	0.	0.	4.1592E-01	8.7725E-02
			9.2800E-01	1.1764E+02	-4.4288E+02	4.4174E+02		
			9.3600E-01				2.0971E-01	4.4779E-02
			9.4400E-01	1.0465E+02	-4.4473E+02	4.3993E+02	-9.5259E-05	1.0831E-03
16	6.4600E+01	-5.0079E-02	0.	7.7175E+02	-3.8774E+02	4.9475E+02	0.	0.
			8.0000E-03				1.8882E-01	3.6256E-02
			1.6000E-02	7.6074E+02	-3.8942E+02	4.9330E+02	3.7440E-01	7.1890E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				3.7483E-01	7.2338E-02
			9.2800E-01	0.	0.	0.	3.7527E-01	7.2769E-02
			9.2800E-01	1.3305E+02	-4.8550E+02	4.1109E+02		
			9.3600E-01				1.8920E-01	3.7134E-02
			9.4400E-01	1.2203E+02	-4.8718E+02	4.0965E+02	-9.5113E-05	8.7709E-04
17	6.6500E+01	-5.3056E-02	0.	6.8234E+02	-4.2699E+02	4.4727E+02	0.	0.
			8.0000E-03				1.6429E-01	2.9817E-02
			1.6000E-02	6.7305E+02	-4.2850E+02	4.4612E+02	3.2577E-01	5.9120E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				3.2619E-01	5.9594E-02
			9.2800E-01	0.	0.	0.	3.2664E-01	6.0051E-02
			9.2800E-01	1.4362E+02	-5.1460E+02	3.8068E+02		
			9.3600E-01				1.6468E-01	3.0638E-02
			9.4400E-01	1.3433E+02	-5.1611E+02	3.7953E+02	-9.4980E-05	7.1179E-04
18	6.8400E+01	-5.5821E-02	0.	6.0313E+02	-4.5569E+02	4.0385E+02	0.	0.
			8.0000E-03				1.3808E-01	2.4492E-02
			1.6000E-02	5.9530E+02	-4.5704E+02	4.0294E+02	2.7380E-01	4.8561E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.7422E-01	4.9062E-02
			9.2800E-01	0.	0.	0.	2.7467E-01	4.9545E-02
			9.2800E-01	1.4915E+02	-5.3377E+02	3.5097E+02		
			9.3600E-01				1.3847E-01	2.5275E-02
			9.4400E-01	1.4132E+02	-5.3512E+02	3.5006E+02	-9.4860E-05	5.8139E-04
19	6.8400E+01	-5.5821E-02	0.	6.0313E+02	-4.5569E+02	4.0385E+02	0.	0.
			8.0000E-03				1.3808E-01	2.4492E-02

			1.6000E-02	5.9530E+02	-4.5704E+02	4.0294E+02	2.7380E-01	4.8561E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.7422E-01	4.9062E-02
			9.2800E-01	0.	0.	0.	2.7467E-01	4.9545E-02
			9.2800E-01	1.4915E+02	-5.3377E+02	3.5097E+02		
			9.3600E-01				1.3847E-01	2.5275E-02
			9.4400E-01	1.4132E+02	-5.3512E+02	3.5006E+02	-9.4860E-05	5.8139E-04
20	7.0300E+01	-5.8406E-02	0.	5.3396E+02	-4.7584E+02	3.6415E+02	0.	0.
			8.0000E-03				1.1183E-01	2.0213E-02
			1.6000E-02	5.2734E+02	-4.7705E+02	3.6343E+02	2.2174E-01	4.0076E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.2216E-01	4.0603E-02
			9.2800E-01	0.	0.	0.	2.2260E-01	4.1112E-02
			9.2800E-01	1.4973E+02	-5.4578E+02	3.2231E+02		
			9.3600E-01				1.1221E-01	2.0972E-02
			9.4400E-01	1.4310E+02	-5.4698E+02	3.2159E+02	-9.4753E-05	4.8032E-04
21	7.2200E+01	-6.0840E-02	0.	4.7435E+02	-4.8904E+02	3.2782E+02	0.	0.
			8.0000E-03				8.6644E-02	1.6881E-02
			1.6000E-02	4.6869E+02	-4.9013E+02	3.2725E+02	1.7180E-01	3.3468E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				1.7222E-01	3.4022E-02
			9.2800E-01	0.	0.	0.	1.7267E-01	3.4558E-02
			9.2800E-01	1.4569E+02	-5.5268E+02	2.9492E+02		
			9.3600E-01				8.7030E-02	1.7628E-02
			9.4400E-01	1.4002E+02	-5.5378E+02	2.9436E+02	-9.4656E-05	4.0342E-04
22	7.4100E+01	-6.3146E-02	0.	4.2361E+02	-4.9654E+02	2.9452E+02	0.	0.
			8.0000E-03				6.3281E-02	1.4382E-02
			1.6000E-02	4.1868E+02	-4.9756E+02	2.9408E+02	1.2547E-01	2.8513E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				1.2590E-01	2.9092E-02
			9.2800E-01	0.	0.	0.	1.2634E-01	2.9655E-02
			9.2800E-01	1.3749E+02	-5.5598E+02	2.6895E+02		
			9.3600E-01				6.3667E-02	1.5127E-02
			9.4400E-01	1.3255E+02	-5.5701E+02	2.6851E+02	-9.4570E-05	3.4611E-04
23	7.6000E+01	-6.5340E-02	0.	3.8093E+02	-4.9934E+02	2.6396E+02	0.	0.
			8.0000E-03				4.2228E-02	1.2598E-02
			1.6000E-02	3.7653E+02	-5.0033E+02	2.6362E+02	8.3727E-02	2.4975E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				8.4151E-02	2.5581E-02
			9.2800E-01	0.	0.	0.	8.4593E-02	2.6169E-02
			9.2800E-01	1.2566E+02	-5.5673E+02	2.4446E+02		
			9.3600E-01				4.2613E-02	1.3348E-02
			9.4400E-01	1.2126E+02	-5.5772E+02	2.4413E+02	-9.4492E-05	3.0445E-04
24	7.7900E+01	-6.7435E-02	0.	3.4543E+02	-4.9819E+02	2.3584E+02	0.	0.
			8.0000E-03				2.3796E-02	1.1412E-02
			1.6000E-02	3.4138E+02	-4.9918E+02	2.3560E+02	4.7179E-02	2.2622E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.7602E-02	2.3255E-02
			9.2800E-01	0.	0.	0.	4.8045E-02	2.3870E-02
			9.2800E-01	1.1082E+02	-5.5562E+02	2.2151E+02		
			9.3600E-01				2.4182E-02	1.2174E-02
			9.4400E-01	1.0677E+02	-5.5661E+02	2.2126E+02	-9.4423E-05	2.7502E-04
25	7.9800E+01	-6.9440E-02	0.	3.1620E+02	-4.9368E+02	2.0993E+02	0.	0.
			8.0000E-03				8.1808E-03	1.0713E-02
			1.6000E-02	3.1236E+02	-4.9471E+02	2.0976E+02	1.6215E-02	2.1234E-02
			1.6000E-02	0.	0.	0.		

			4.7200F-01				1.6639F-02	2.1893F-02
			9.2800F-01	0.	0.	0.	1.7081E-02	2.2534F-02
			9.2800F-01	9.3567E+01	-5.5305E+02	2.0009E+02		
			9.3600F-01				8.5664E-03	1.1490F-02
			9.4400F-01	8.9728F+01	-5.5408E+02	1.9992F+02	-9.4360E-05	2.5497E-04
26	8.1700F+01	-7.1360F-02	0.	2.9236E+02	-4.8623F+02	1.8600E+02	0.	0.
			8.0000F-03				-4.7061E-03	1.0395F-02
			1.6000F-02	2.8860E+02	-4.8731E+02	1.8590E+02	-9.3384E-03	2.0605E-02
			1.6000F-02	0.	0.	0.		
			4.7200F-01				-8.9148E-03	2.1290F-02
			9.2800F-01	0.	0.	0.	-8.4728E-03	2.1958E-02
			9.2800F-01	7.4535E+01	-5.4922E+02	1.8019F+02		
			9.3600F-01				-4.3205E-03	1.1193F-02
			9.4400F-01	7.0780E+01	-5.5031E+02	1.8009E+02	-9.4305E-05	2.4192F-04
27	8.3600E+01	-7.3198E-02	0.	2.7308E+02	-4.7613E+02	1.6387E+02	0.	0.
			8.0000F-03				-1.4989F-02	1.0371E-02
			1.6000F-02	2.6931E+02	-4.7730E+02	1.6383E+02	-2.9728E-02	2.0557E-02
			1.6000F-02	0.	0.	0.		
			4.7200F-01				-2.9305E-02	2.1268F-02
			9.2800F-01	0.	0.	0.	-2.8863E-02	2.1962F-02
			9.2800E-01	5.4288E+01	-5.4416E+02	1.6176E+02		
			9.3600E-01				-1.4603E-02	1.1191F-02
			9.4400F-01	5.0516E+01	-5.4534E+02	1.6172F+02	-9.4255E-05	2.3398E-04
28	8.5500E+01	-7.4953F-02	0.	2.5758E+02	-4.6361E+02	1.4338E+02	0.	0.
			8.0000E-03				-2.2601F-02	1.0558E-02
			1.6000E-02	2.5372E+02	-4.6489E+02	1.4341E+02	-4.4822E-02	2.0927E-02
			1.6000F-02	0.	0.	0.		
			4.7200E-01				-4.4398F-02	2.1665E-02
			9.2800F-01	0.	0.	0.	-4.3956E-02	2.2386F-02
			9.2800F-01	3.3385E+01	-5.3781E+02	1.4476E+02		
			9.3600F-01				-2.2215F-02	1.1403F-02
			9.4400E-01	2.9520E+01	-5.3909E+02	1.4479F+02	-9.4210E-05	2.2956E-04
29	8.7400F+01	-7.6625F-02	0.	2.4507F+02	-4.4884F+02	1.2441E+02	0.	0.
			8.0000F-03				-2.7272E-02	1.0879F-02
			1.6000E-02	2.4106E+02	-4.5024E+02	1.2449E+02	-5.4083E-02	2.1563F-02
			1.6000F-02	0.	0.	0.		
			4.7200E-01				-5.3660E-02	2.2327F-02
			9.2800F-01	0.	0.	0.	-5.3218F-02	2.3074E-02
			9.2800F-01	1.2410E+01	-5.3000E+02	1.2915E+02		
			9.3600F-01				-2.6886F-02	1.1748F-02
			9.4400E-01	8.3989E+00	-5.3140E+02	1.2923E+02	-9.4171E-05	2.2736E-04
30	8.9300E+01	-7.8211E-02	0.	2.3468E+02	-4.3199E+02	1.0685F+02	0.	0.
			8.0000F-03				-2.8737E-02	1.1254F-02
			1.6000F-02	2.3050E+02	-4.3352E+02	1.0699E+02	-5.6989E-02	2.2307E-02
			1.6000F-02	0.	0.	0.		
			4.7200F-01				-5.6566E-02	2.3097F-02
			9.2800F-01	0.	0.	0.	-5.6123E-02	2.3870F-02
			9.2800E-01	-7.9773F+00	-5.2048E+02	1.1487E+02		
			9.3600F-01				-2.8351E-02	1.2150F-02
			9.4400F-01	-1.2161E+01	-5.2201E+02	1.1500E+02	-9.4135E-05	2.2616E-04
31	9.1200E+01	-7.9708E-02	0.	2.2558E+02	-4.1324E+02	9.0625E+01	0.	0.
			8.0000F-03				-2.6943E-02	1.1610E-02
			1.6000F-02	2.2122E+02	-4.1490E+02	9.0819E+01	-5.3432F-02	2.3011E-02
			1.6000F-02	0.	0.	0.		
			4.7200F-01				-5.3009E-02	2.3828F-02
			9.2800F-01	0.	0.	0.	-5.2567E-02	2.4627E-02

			9.2800E-01	-2.7094E+01	-5.0896E+02	1.0185E+02		
			9.3600E-01				-2.6558E-02	1.2531E-02
			9.4400E-01	-3.1450E+01	-5.1061E+02	1.0204E+02	-9.4103E-05	2.2497E-04
32	9.1200E+01	-7.9708E-02	0.	2.2558E+02	-4.1324E+02	9.0625E+01	0.	0.
			8.0000E-03				-2.6943E-02	1.1610E-02
			1.6000E-02	2.2122E+02	-4.1490E+02	9.0819E+01	-5.3432E-02	2.3011E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-5.3009E-02	2.3828E-02
			9.2800E-01	0.	0.	0.	-5.2567E-02	2.4627E-02
			9.2800E-01	-2.7094E+01	-5.0896E+02	1.0185E+02		
			9.3600E-01				-2.6558E-02	1.2531E-02
			9.4400E-01	-3.1450E+01	-5.1061E+02	1.0204E+02	-9.4103E-05	2.2497E-04
33	9.3100E+01	-8.1112E-02	0.	2.1691E+02	-3.9280E+02	7.5672E+01	0.	0.
			8.0000E-03				-2.2044E-02	1.1876E-02
			1.6000E-02	2.1241E+02	-3.9456E+02	7.5920E+01	-4.3718E-02	2.3539E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-4.3295E-02	2.4382E-02
			9.2800E-01	0.	0.	0.	-4.2852E-02	2.5208E-02
			9.2800E-01	-4.4261E+01	-4.9514E+02	9.0025E+01		
			9.3600E-01				-2.1658E-02	1.2823E-02
			9.4400E-01	-4.8764E+01	-4.9691E+02	9.0273E+01	-9.4075E-05	2.2295E-04
34	9.5000E+01	-8.2421E-02	0.	2.0792E+02	-3.7086E+02	6.1951E+01	0.	0.
			8.0000E-03				-1.4186E-02	1.1996E-02
			1.6000E-02	2.0332E+02	-3.7272E+02	6.2250E+01	-2.8136E-02	2.3776E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-2.7712E-02	2.4646E-02
			9.2800E-01	0.	0.	0.	-2.7270E-02	2.5498E-02
			9.2800E-01	-5.8855E+01	-4.7878E+02	7.9339E+01		
			9.3600E-01				-1.3800E-02	1.2967E-02
			9.4400E-01	-6.3454E+01	-4.8064E+02	7.9638E+01	-9.4050E-05	2.1948E-04
35	9.6900E+01	-8.3634E-02	0.	1.9786E+02	-3.4770E+02	4.9432E+01	0.	0.
			8.0000E-03				-3.3029E-03	1.1915E-02
			1.6000E-02	1.9324E+02	-3.4963E+02	4.9782E+01	-6.5561E-03	2.3615E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				-6.1325E-03	2.4511E-02
			9.2800E-01	0.	0.	0.	-5.6904E-03	2.5390E-02
			9.2800E-01	-7.0252E+01	-4.5963E+02	6.9716E+01		
			9.3600E-01				-2.9173E-03	1.2910E-02
			9.4400E-01	-7.4875E+01	-4.6155E+02	7.0065E+01	-9.4029E-05	2.1404E-04
36	9.8800E+01	-8.4751E-02	0.	1.8599E+02	-3.2363E+02	3.8101E+01	0.	0.
			8.0000E-03				1.0455E-02	1.1584E-02
			1.6000E-02	1.8144E+02	-3.2559E+02	3.8497E+01	2.0725E-02	2.2959E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.1148E-02	2.3881E-02
			9.2800E-01	0.	0.	0.	2.1590E-02	2.4786E-02
			9.2800E-01	-7.7837E+01	-4.3751E+02	6.1084E+01		
			9.3600E-01				1.0841E-02	1.2601E-02
			9.4400E-01	-8.2386E+01	-4.3948E+02	6.1480E+01	-9.4009E-05	2.0623E-04
37	1.0070E+02	-8.5773E-02	0.	1.7164E+02	-2.9903E+02	2.7948E+01	0.	0.
			8.0000E-03				2.6929E-02	1.0962E-02
			1.6000E-02	1.6728E+02	-3.0098E+02	2.8386E+01	5.3390E-02	2.1724E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				5.3814E-02	2.2673E-02
			9.2800E-01	0.	0.	0.	5.4256E-02	2.3605E-02
			9.2800E-01	-8.1045E+01	-4.1233E+02	5.3366E+01		
			9.3600E-01				2.7314E-02	1.2000E-02

			9.4400E-01	-8.5401E+01	-4.1428E+02	5.3805E+01	-9.3993E-05	1.9576E-04
38	1.0260E+02	-8.6705E-02	0.	1.5414E+02	-2.7435E+02	1.8970E+01	0.	0.
			8.0000E-03				4.6145E-02	1.0011E-02
			1.6000E-02	1.5012E+02	-2.7624E+02	1.9444E+01	9.1494E-02	1.9838E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				9.1918E-02	2.0813E-02
			9.2800E-01	0.	0.	0.	9.2360E-02	2.1771E-02
			9.2800E-01	-7.9323E+01	-3.8405E+02	4.6483E+01		
			9.3600E-01				4.6530E-02	1.1069E-02
			9.4400E-01	-8.3348E+01	-3.8594E+02	4.6957E+01	-9.3978E-05	1.8241E-04
39	1.0450E+02	-8.7555E-02	0.	1.3284E+02	-2.5012E+02	1.1169E+01	0.	0.
			8.0000E-03				6.8102E-02	8.6960E-03
			1.6000E-02	1.2931E+02	-2.5189E+02	1.1672E+01	1.3503E-01	1.7230E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				1.3546E-01	1.8232E-02
			9.2800E-01	0.	0.	0.	1.3590E-01	1.9216E-02
			9.2800E-01	-7.2120E+01	-3.5272E+02	4.0348E+01		
			9.3600E-01				6.8487E-02	9.7719E-03
			9.4400E-01	-7.5654E+01	-3.5449E+02	4.0851E+01	-9.3966E-05	1.6600E-04
40	1.0640E+02	-8.8334E-02	0.	1.0708E+02	-2.2699E+02	4.5450E+00	0.	0.
			8.0000E-03				9.2761E-02	6.9846E-03
			1.6000E-02	1.0422E+02	-2.2856E+02	5.0679E+00	1.8393E-01	1.3836E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				1.8435E-01	1.4864E-02
			9.2800E-01	0.	0.	0.	1.8480E-01	1.5874E-02
			9.2800E-01	-5.8895E+01	-3.1846E+02	3.4870E+01		
			9.3600E-01				9.3147E-02	8.0771E-03
			9.4400E-01	-6.1756E+01	-3.2004E+02	3.5393E+01	-9.3956E-05	1.4642E-04
41	1.0830E+02	-8.9056E-02	0.	7.6213E+01	-2.0566E+02	-8.9927E-01	0.	0.
			8.0000E-03				1.2004E-01	4.8480E-03
			1.6000E-02	7.4224E+01	-2.0696E+02	-3.6738E-01	2.3802E-01	9.5989E-03
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.3845E-01	1.0653E-02
			9.2800E-01	0.	0.	0.	2.3889E-01	1.1690E-02
			9.2800E-01	-3.9124E+01	-2.8151E+02	2.9950E+01		
			9.3600E-01				1.2043E-01	5.9554E-03
			9.4400E-01	-4.1112E+01	-2.8282E+02	3.0482E+01	-9.3947E-05	1.2356E-04
42	1.1020E+02	-8.9741E-02	0.	3.9695E+01	-1.8693E+02	-5.1660E+00	0.	0.
			8.0000E-03				1.4897E-01	2.2663E-03
			1.6000E-02	3.8797E+01	-1.8788E+02	-4.6376E+00	2.9539E-01	4.4792E-03
			1.6000E-02	0.	0.	0.		
			4.7200E-01				2.9581E-01	5.5598E-03
			9.2800E-01	0.	0.	0.	2.9626E-01	6.6230E-03
			9.2800E-01	-1.2381E+01	-2.4222E+02	2.5484E+01		
			9.3600E-01				1.4936E-01	3.3870E-03
			9.4400E-01	-1.3279E+01	-2.4317E+02	2.6013E+01	-9.3940E-05	9.7452E-05
43	1.1210E+02	-9.0412E-02	0.	-2.7292E+00	-1.7160E+02	-8.2639E+00	0.	0.
			8.0000E-03				1.7855E-01	-7.5623E-04
			1.6000E-02	-2.3122E+00	-1.7211E+02	-7.7532E+00	3.5403E-01	-1.5146E-03
			1.6000E-02	0.	0.	0.		
			4.7200E-01				3.5446E-01	-4.0766E-04
			9.2800E-01	0.	0.	0.	3.5490E-01	6.8195E-04
			9.2800E-01	2.1459E+01	-2.0114E+02	2.1359E+01		
			9.3600E-01				1.7893E-01	3.7633E-04
			9.4400E-01	2.1376E+01	-2.0165E+02	2.1870E+01	-9.3934E-05	6.8336E-05

44	1.1400E+02	-9.1097E-02	0.	-5.1210E+01	-1.6054E+02	-1.0212E+01	0.	0.
			8.0000E-03				2.0854E-01	-4.2071E-03
			1.6000E-02	-4.9251E+01	-1.6051E+02	-9.7352E+00	4.1350E-01	-8.3579E-03
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.1392E-01	-7.2245E-03
			9.2800E-01	0.	0.	0.	4.1437E-01	-6.1086E-03
			9.2800E-01	6.2412E+01	-1.5897E+02	1.7458E+01		
			9.3600E-01				2.0892E-01	-3.0641E-03
			9.4400E-01	6.4371E+01	-1.5894E+02	1.7935E+01	-9.3929E-05	3.6518E-05
45	1.1400E+02	-9.1097E-02	0.	-5.1210E+01	-1.6054E+02	-1.0212E+01	0.	0.
			8.0000E-03				2.0854E-01	-4.2071E-03
			1.6000E-02	-4.9251E+01	-1.6051E+02	-9.7352E+00	4.1350E-01	-8.3579E-03
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.1392E-01	-7.2245E-03
			9.2800E-01	0.	0.	0.	4.1437E-01	-6.1086E-03
			9.2800E-01	6.2412E+01	-1.5897E+02	1.7458E+01		
			9.3600E-01				2.0892E-01	-3.0641E-03
			9.4400E-01	6.4371E+01	-1.5894E+02	1.7935E+01	-9.3929E-05	3.6518E-05
46	1.1515E+02	-9.1532E-02	0.	-8.3384E+01	-1.5626E+02	-1.0846E+01	0.	0.
			8.0000E-03				2.2431E-01	-6.4859E-03
			1.6000E-02	-8.0386E+01	-1.5587E+02	-1.0397E+01	4.4478E-01	-1.2877E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.4520E-01	-1.1728E-02
			9.2800E-01	0.	0.	0.	4.4565E-01	-1.0596E-02
			9.2800E-01	9.0488E+01	-1.3330E+02	1.5158E+01		
			9.3600E-01				2.2470E-01	-5.3371E-03
			9.4400E-01	9.3485E+01	-1.3291E+02	1.5607E+01	-9.3927E-05	1.6187E-05
47	1.1630E+02	-9.1992E-02	0.	-1.1712E+02	-1.5387E+02	-1.1082E+01	0.	0.
			8.0000E-03				2.3521E-01	-8.8603E-03
			1.6000E-02	-1.1302E+02	-1.5307E+02	-1.0669E+01	4.6640E-01	-1.7585E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.6682E-01	-1.6420E-02
			9.2800E-01	0.	0.	0.	4.6726E-01	-1.5272E-02
			9.2800E-01	1.2044E+02	-1.0795E+02	1.2871E+01		
			9.3600E-01				2.3560E-01	-7.7059E-03
			9.4400E-01	1.2454E+02	-1.0715E+02	1.3284E+01	-9.3925E-05	-4.4595E-06
48	1.1745E+02	-9.2487E-02	0.	-1.5172E+02	-1.5333E+02	-1.0941E+01	0.	0.
			8.0000E-03				2.4120E-01	-1.1277E-02
			1.6000E-02	-1.4649E+02	-1.5213E+02	-1.0570E+01	4.7827E-01	-2.2377E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.7869E-01	-2.1196E-02
			9.2800E-01	0.	0.	0.	4.7913E-01	-2.0032E-02
			9.2800E-01	1.5157E+02	-8.3321E+01	1.0575E+01		
			9.3600E-01				2.4158E-01	-1.0116E-02
			9.4400E-01	1.5680E+02	-8.2114E+01	1.0946E+01	-9.3924E-05	-2.4907E-05
49	1.1859E+02	-9.3024E-02	0.	-1.8642E+02	-1.5462E+02	-1.0445E+01	0.	0.
			8.0000E-03				2.4052E-01	-1.3677E-02
			1.6000E-02	-1.8005E+02	-1.5298E+02	-1.0123E+01	4.7693E-01	-2.7137E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.7735E-01	-2.5940E-02
			9.2800E-01	0.	0.	0.	4.7779E-01	-2.4760E-02
			9.2800E-01	1.8309E+02	-5.9888E+01	8.2523E+00		
			9.3600E-01				2.4091E-01	-1.2511E-02
			9.4400E-01	1.8946E+02	-5.8255E+01	8.5747E+00	-9.3922E-05	-4.4624E-05
50	1.1974E+02	-9.3612E-02	0.	-2.2011E+02	-1.5755E+02	-9.6281E+00	0.	0.
			8.0000E-03				2.3145E-01	-1.5982E-02

			1.6000E-02	-2.1263E+02	-1.5549F+02	-9.3605E+00	4.5893E-01	-3.1708E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.5935E-01	-3.0495E-02
			9.2800E-01	0.	0.	0.	4.5979E-01	-2.9300E-02
			9.2800E-01	2.1389E+02	-3.8211E+01	5.8904E+00		
			9.3600E-01				2.3183E-01	-1.4809E-02
			9.4400E-01	2.2137E+02	-3.6153E+01	6.1580E+00	-9.3921E-05	-6.2909E-05
51	1.2089F+02	-9.4261E-02	0.	-2.5162E+02	-1.6191E+02	-8.5303E+00	0.	0.
			8.0000E-03				2.1392E-01	-1.8110E-02
			1.6000E-02	-2.4309E+02	-1.5944E+02	-8.3231E+00	4.2419E-01	-3.5928E-02
			1.6000E-02	0.	0.	0.		
			4.7200E-01				4.2461E-01	-3.4699E-02
			9.2800E-01	0.	0.	0.	4.2505E-01	-3.3488E-02
			9.2800E-01	2.4279E+02	-1.8870E+01	3.4829E+00		
			9.3600E-01				2.1431E-01	-1.6929E-02
			9.4400E-01	2.5131E+02	-1.6404E+01	3.6901E+00	-9.3920E-05	-7.9064E-05

SRA 101 INPUT DATA LISTING

```
140 DEGREE SANDWICH CONE
   -1 1 1 1   1   1 1        3     3.75                 1.-2  .2534
    4    1   17   34   51
    0
    1    6
    2    0    1
    9    1    2    3    4    5    6    7    8    9

C        GEOMETRY TABLE FOLLOWS

1 6 1       1  42.036      39.9         .93969       .34202       .472
            5  45.6        43.249       .93969       .34202       .472
            6  45.6        43.249       .93969       .34202       .472
           18  68.4        64.674       .93969       .34202       .472
           19  68.4        64.674       .93969       .34202       .472
           31  91.2        86.099       .93969       .34202       .472
           32  91.2        86.099       .93969       .34202       .472
           44 114.        107.524       .93969       .34202       .472
           45 114.        107.524       .93969       .34202       .472
    1      51 120.892     114.          .93969       .34202       .472

C        WALL PROPERTIES TABLE FOLLOWS

2     1     1       9.35+6      9.35+6      3.54+6  .32          .008
           51       9.35+6      9.35+6      3.54+6  .32          .008
      2     1                                                    .456
           51                                                    .456
      3     1       9.35+6      9.35+6      3.54+6  .32          .008
           51       9.35+6      9.35+6      3.54+6  .32          .008

9

C        BOUNDARY DATA FOLLOWS

      6.75+6      1.29+6      7.71+6      -3.6+5      6.83+3 -.444
 18.675
            24.81             9.35+6
     1.102+7     1.275+8     1.275+8                  9.65+7 -4.8295
 0.
            .1312             9.35+6

C        N = 0 PREBUCKLING DATA FOLLOWS

 1 8.0608E+03 6-9.2401E+02
 1 2.2573E+02 6.4610E+02 2 2.3352E+02 5.6241E+02 3 2.3937E+02 4.8440E
 4 2.4351E+02 4.1213E+02 5 2.4614E+02 3.4552E+02 6 2.4614E+02 3.4552E
 7 2.4759E+02 2.2169E+02 8 2.4465E+02 1.2070E+02 9 2.3860E+02 3.9731E
10 2.3042E+02-2.4183E+0111 2.2086E+02-7.3896E+0112 2.1050E+02-1.1201E
13 1.9973E+02-1.4082E+0214 1.8886E+02-1.6226E+0215 1.7808E+02-1.7799E
```

```
1.6755E+02-1.8934E+0217 1.5734E+02-1.9739E+0218 1.4751E+02-2.0299E+02
1.4751E+02-2.0299E+0220 1.3809E+02-2.0680E+0221 1.2907E+02-2.0932E+02
1.2047E+02-2.1092E+0223 1.1226E+02-2.1185E+0224 1.0444E+02-2.1229E+02
9.6981E+01-2.1233E+0226 8.9873E+01-2.1202E+0227 8.3099E+01-2.1137E+02
7.6643E+01-2.1036E+0229 7.0494E+01-2.0894E+0230 6.4641E+01-2.0706E+02
5.9076E+01-2.0464E+0232 5.9076E+01-2.0464E+0233 5.3793E+01-2.0162E+02
4.8788E+01-1.9794E+0235 4.4059E+01-1.9354E+0236 3.9602E+01-1.8839E+02
3.5419E+01-1.8244E+0238 3.1507E+01-1.7571E+0239 2.7867E+01-1.6818E+02
2.4498E+01-1.5992E+0241 2.1397E+01-1.5096E+0242 1.8564E+01-1.4141E+02
1.5992E+01-1.3138E+0244 1.3676E+01-1.2103E+0245 1.3676E+01-1.2103E+02
1.2396E+01-1.1469E+0247 1.1204E+01-1.0834E+0248 1.0097E+01-1.0203E+02
9.0724E+00-9.5822E+0150 8.1263E+00-8.9761E+0151 7.2549E+00-8.3910E+01
.           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.
.1738E-01  -9.1646E-01 -9.1554E-01 -9.1463E-01 -9.1371E-01 -9.1371E-01
.1187E-01  -9.1004E-01 -9.0820E-01 -9.0697E-01 -9.0575E-01 -9.0452E-01
.0248E-01  -9.0043E-01 -8.9839E-01 -8.9635E-01 -8.9430E-01 -8.9226E-01
.9226E-01  -8.8940E-01 -8.8654E-01 -8.8368E-01 -8.8082E-01 -8.7796E-01
.7510E-01  -8.7183E-01 -8.6857E-01 -8.6530E-01 -8.6162E-01 -8.5794E-01
.5426E-01  -8.5426E-01 -8.4936E-01 -8.4446E-01 -8.3956E-01 -8.3261E-01
.2567E-01  -8.1872E-01 -8.1014E-01 -8.0156E-01 -7.9298E-01 -7.7787E-01
.6275E-01  -7.4764E-01 -7.4764E-01 -7.2226E-01 -6.9688E-01 -6.7150E-01
.2367E-01  -5.7583E-01 -5.2800E-01

      N = 1 PREBUCKLING DATA FOLLOWS

9.6960E+02 6-2.8669E+00
2.5960E+01 8.3218E+01 2 2.6487E+01 7.3945E+01 3 2.6800E+01 6.5241E+01
2.6927E+01 5.7125E+01 5 2.6895E+01 4.9598E+01 6 2.6892E+01 4.9597E+01
2.6395E+01 3.5466E+01 8 2.5468E+01 2.3783E+01 9 2.4259E+01 1.4281E+01
2.2880E+01 6.6659E+0011 2.1412E+01 6.4427E-0112 1.9916E+01-4.0553E+00
1.8433E+01-7.6752E+0014 1.6992E+01-1.0426E+0115 1.5611E+01-1.2484E+01
1.4301E+01-1.3999E+0117 1.3067E+01-1.5089E+0118 1.1911E+01-1.5853E+01
1.1911E+01-1.5853E+0120 1.0833E+01-1.6365E+0121 9.8300E+00-1.6685E+01
8.8986E+00-1.6857E+0123 8.0351E+00-1.6913E+0124 7.2352E+00-1.6877E+01
6.4948E+00-1.6764E+0126 5.8102E+00-1.6585E+0127 5.1775E+00-1.6343E+01
4.5936E+00-1.6043E+0129 4.0555E+00-1.5684E+0130 3.5604E+00-1.5264E+01
3.1060E+00-1.4782E+0132 3.1060E+00-1.4782E+0133 2.6903E+00-1.4235E+01
2.3115E+00-1.3624E+0135 1.9677E+00-1.2948E+0136 1.6577E+00-1.2210E+01
1.3798E+00-1.1413E+0138 1.1327E+00-1.0565E+0139 9.1496E-01-9.6737E+00
7.2513E-01-8.7524E+0041 5.6161E-01-7.8156E+0042 4.2265E-01-6.8816E+00
3.0636E-01-5.9721E+0044 2.1057E-01-5.1116E+0045 2.1057E-01-5.1116E+00
1.6162E-01-4.6267E+0047 1.1873E-01-4.1763E+0048 8.1291E-02-3.7672E+00
4.8654E-02-3.4060E+0050 2.0144E-02-3.0992E+0051-4.9398E-03-2.8530E+00
```

```
  2.5025E+01  2.5706E+01  2.6154E+01  2.6401E+01  2.6474E+01  2.6472
  2.6158E+01  2.5366E+01  2.4255E+01  2.2945E+01  2.1525E+01  2.0060
  1.8596E+01  1.7164E+01  1.5784E+01  1.4470E+01  1.3229E+01  1.2063
  1.2063E+01  1.0972E+01  9.9548E+00  9.0085E+00  8.1294E+00  7.3137
  6.5576E+00  5.8573E+00  5.2094E+00  4.6107E+00  4.0583E+00  3.5497
  3.0826E+00  3.0826E+00  2.6551E+00  2.2654E+00  1.9120E+00  1.5933
  1.3080E+00  1.0548E+00  8.3231E-01  6.3900E-01  4.7333E-01  3.3354
  2.1769E-01  1.2357E-01  1.2357E-01  7.6175E-02  3.5227E-02  8.5751
 -2.9926E-02 -5.5521E-02 -7.7443E-02
 -6.8750E-02 -6.9055E-02 -6.9360E-02 -6.9665E-02 -6.9970E-02 -6.9970
 -7.0583E-02 -7.1197E-02 -7.1810E-02 -7.2220E-02 -7.2630E-02 -7.3040
 -7.3450E-02 -7.3860E-02 -7.4270E-02 -7.4680E-02 -7.5090E-02 -7.5500
 -7.5500E-02 -7.5910E-02 -7.6320E-02 -7.6730E-02 -7.7140E-02 -7.7550
 -7.7960E-02 -7.7960E-02 -7.7960E-02 -7.7960E-02 -7.8373E-02 -7.8787
 -7.9200E-02 -7.9200E-02 -7.9200E-02 -7.9200E-02 -7.9200E-02 -7.8797
 -7.8393E-02 -7.7990E-02 -7.7587E-02 -7.7183E-02 -7.6780E-02 -7.4747
 -7.2713E-02 -7.0680E-02 -7.0680E-02 -6.1620E-02 -5.2560E-02 -4.3500
 -2.9000E-02 -1.4500E-02 -0.
STOP
        END OF FILE CARD
```

SRA 101 OUTPUT DATA LISTING

```
140 DEGREE SANDWICH CONE

LOOP=-0   NSC=-1   LAP= 1   NEM= 1   NST= 1   NPS= 1   NIC= 1   LSYMM= 1   NS=-0   NT=-0
SIGDIG= 2.0   LTYPE=-0   GUESS=  3.7500E+00   REL ERR CNTRL = 1.000E-02   SKAP=  2.5340E-01   ISS1=-0   ISS2=-0   ISS6=-0
N1= 2   0   1
N2= 9   1   2   3   4   5   6   7   8   9
```

TABLE 1 (SURFACE GEOMETRY)

ENTRY	S	T	R PRIME	R/R2	ZBAR
1	4.2036E+01	3.9995E+01	9.3969E-01	3.4202E-01	4.7200E-01
2	4.2927E+01	4.0737E+01	9.3969E-01	3.4202E-01	4.7200E-01
3	4.3818E+01	4.1574E+01	9.3969E-01	3.4202E-01	4.7200E-01
4	4.4700E+01	4.2412E+01	9.3969E-01	3.4202E-01	4.7200E-01
5	4.5600E+01	4.3249E+01	9.3969E-01	3.4202E-01	4.7200E-01
6	4.5600E+01	4.3249E+01	9.3969E-01	3.4202E-01	4.7200E-01
7	4.7500E+01	4.5034E+01	9.3969E-01	3.4202E-01	4.7200E-01
8	4.9400E+01	4.6820E+01	9.3969E-01	3.4202E-01	4.7200E-01
9	5.1300E+01	[illegible]	9.3969E-01	3.4202E-01	4.7200E-01
10	5.3200E+01	5.0351E+01	9.3969E-01	3.4202E-01	4.7200E-01
11	5.5100E+01	5.2176E+01	9.3969E-01	3.4202E-01	4.7200E-01
12	5.7000E+01	5.3961E+01	9.3969E-01	3.4202E-01	4.7200E-01
13	5.8900E+01	5.5747E+01	9.3969E-01	3.4202E-01	4.7200E-01
14	6.0800E+01	5.7532E+01	9.3969E-01	3.4202E-01	4.7200E-01
15	6.2700E+01	5.9318E+01	9.3969E-01	3.4202E-01	4.7200E-01
16	6.4600E+01	6.1103E+01	9.3969E-01	3.4202E-01	4.7200E-01
17	6.6500E+01	6.2889E+01	9.3969E-01	3.4202E-01	4.7200E-01
18	6.8400E+01	6.4674E+01	9.3969E-01	3.4202E-01	4.7200E-01
19	6.8400E+01	6.4674E+01	9.3969E-01	3.4202E-01	4.7200E-01
20	7.0300E+01	6.6459E+01	9.3969E-01	3.4202E-01	4.7200E-01
21	7.2200E+01	6.8245E+01	9.3969E-01	3.4202E-01	4.7200E-01
22	7.4100E+01	7.0030E+01	9.3969E-01	3.4202E-01	4.7200E-01
23	7.6000E+01	7.1816E+01	9.3969E-01	3.4202E-01	4.7200E-01
24	7.7900E+01	7.3601E+01	9.3969E-01	3.4202E-01	4.7200E-01
25	7.9800E+01	7.5386E+01	9.3969E-01	3.4202E-01	4.7200E-01
26	8.1700E+01	7.7172E+01	9.3969E-01	3.4202E-01	4.7200E-01
27	8.3600E+01	7.8957E+01	9.3969E-01	3.4202E-01	4.7200E-01
28	8.5500E+01	8.0743E+01	9.3969E-01	3.4202E-01	4.7200E-01
29	8.7400E+01	8.2529E+01	9.3969E-01	3.4202E-01	4.7200E-01
30	8.9300E+01	8.4314E+01	9.3969E-01	3.4202E-01	4.7200E-01
31	9.1200E+01	8.6099E+01	9.3969E-01	3.4202E-01	4.7200E-01
32	9.1200E+01	8.6099E+01	9.3969E-01	3.4202E-01	4.7200E-01
33	9.3100E+01	8.7884E+01	9.3969E-01	3.4202E-01	4.7200E-01
34	9.5000E+01	8.9670E+01	9.3969E-01	3.4202E-01	4.7200E-01
35	9.6900E+01	9.1455E+01	9.3969E-01	3.4202E-01	4.7200E-01
36	9.8800E+01	9.3241E+01	9.3969E-01	3.4202E-01	4.7200E-01
37	1.0070E+02	9.5026E+01	9.3969E-01	3.4202E-01	4.7200E-01
38	1.0260E+02	9.6811E+01	9.3969E-01	3.4202E-01	4.7200E-01
39	1.0450E+02	9.8597E+01	9.3969E-01	3.4202E-01	4.7200E-01
40	1.0640E+02	1.0038E+02	9.3969E-01	3.4202E-01	4.7200E-01
41	1.0830E+02	1.0217E+02	9.3969E-01	3.4202E-01	4.7200E-01
42	1.1020E+02	1.0395E+02	9.3969E-01	3.4202E-01	4.7200E-01
43	1.1210E+02	1.0574E+02	9.3969E-01	3.4202E-01	4.7200E-01
44	1.1400E+02	1.0752E+02	9.3969E-01	3.4202E-01	4.7200E-01
45	1.1400E+02	1.0752E+02	9.3969E-01	3.4202E-01	4.7200E-01
46	1.1515E+02	1.0866E+02	9.3969E-01	3.4202E-01	4.7200E-01
47	1.1630E+02	1.0964E+02	9.3969E-01	3.4202E-01	4.7200E-01
48	1.1745E+02	1.1079E+02	9.3969E-01	3.4202E-01	4.7200E-01
49	1.1859E+02	1.1194E+02	9.3969E-01	3.4202E-01	4.7200E-01
50	1.1974E+02	1.1292E+02	9.3969E-01	3.4202E-01	4.7200E-01
51	1.2089E+02	1.1407E+02	9.3969E-01	3.4202E-01	4.7200E-01

TABLE 2 (WALL PROPERTIES)

ENTRY	S	E1	E2	E12	NU1	H
1	4.2036E+01	9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03
		-0.	-0.	-0.	-0.	4.5600E-01
		9.3500E+06	9.3500E+06	3.5400E+06	3.2000E-01	8.0000E-03

TABLE 3 (FOUNDATION MODULI) ALL ZEROES

TABLE 4 (STRINGER PROPERTIES) ALL ZEROES

```
BOUNDARY NUMBER  1          S=  4.2036E+01
RING DATA
EA=  6.7500E+06     EIX =  1.2900E+06     EIY =  7.7100E+06     EIXY = -3.6000E+05     GJ =  6.8300E+03
ZBAR = -4.4400E-01     SBAR = -0.

BOUNDARY NUMBER  2          S=  4.5600E+01
R = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  3          S=  6.8400E+01
R = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  4          S=  9.1200E+01
R = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  5          S=  1.1400E+02
R = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  6          S=  1.2089E+02
RING DATA
EA=  1.1020E+07     EIX =  1.2750E+08     EIY =  1.2750E+08     EIXY = -0.     GJ =  9.6500E+07
ZBAR = -4.8295E+00     SBAR = -0.
```

PREBUCKLING DATA

	T10C	T20C	T120S	X30C
1	2.257E+02	6.461E+02	0.	-9.174E-01
1	2.596E+01	8.322E+01	2.502E+01	-6.875E-02
17	1.573E+02	-1.974E+02	0.	-8.943E-01
17	1.307E+01	-1.509E+01	1.323E+01	-7.509E-02
34	4.879E+01	-1.979E+02	0.	-8.445E-01
34	2.311E+00	-1.362E+01	2.265E+00	-7.920E-02
51	7.255E+00	-8.391E+01	0.	-5.280E-01
51	-4.940E-03	-2.853E+00	-7.744E-02	-0.

	TPHIOC
1	8.061E+03
1	9.696E+02
2	-9.240E+02
2	-2.867E+00

BUCKLING MODE ESTIMATES

	XIC	XIS	ETAC	ETAS	VC	VS	CHIC	CHIS
1	0.	0.	0.	0.	1.088E-02	1.088E-02	1.088E-02	1.088E-02
1	0.	0.	0.	0.	9.793E-03	9.793E-03	9.793E-03	9.793E-03
1	0.	0.	0.	0.	8.814E-03	8.814E-03	8.814E-03	8.814E-03
1	0.	0.	0.	0.	7.933E-03	7.933E-03	7.933E-03	7.933E-03
1	0.	0.	0.	0.	7.139E-03	7.139E-03	7.139E-03	7.139E-03
1	0.	0.	0.	0.	6.425E-03	6.425E-03	6.425E-03	6.425E-03
1	0.	0.	0.	0.	5.783E-03	5.783E-03	5.783E-03	5.783E-03
1	0.	0.	0.	0.	5.205E-03	5.205E-03	5.205E-03	5.205E-03
1	0.	0.	0.	0.	4.684E-03	4.684E-03	4.684E-03	4.684E-03
17	0.	0.	0.	0.	2.723E-02	2.723E-02	2.723E-02	2.723E-02
17	0.	0.	0.	0.	2.451E-02	2.451E-02	2.451E-02	2.451E-02
17	0.	0.	0.	0.	2.206E-02	2.206E-02	2.206E-02	2.206E-02
17	0.	0.	0.	0.	1.985E-02	1.985E-02	1.985E-02	1.985E-02
17	0.	0.	0.	0.	1.787E-02	1.787E-02	1.787E-02	1.787E-02
17	0.	0.	0.	0.	1.608E-02	1.608E-02	1.608E-02	1.608E-02
17	0.	0.	0.	0.	1.447E-02	1.447E-02	1.447E-02	1.447E-02
17	0.	0.	0.	0.	1.303E-02	1.303E-02	1.303E-02	1.303E-02
17	0.	0.	0.	0.	1.172E-02	1.172E-02	1.172E-02	1.172E-02
34	0.	0.	0.	0.	5.558E-02	5.558E-02	5.558E-02	5.558E-02
34	0.	0.	0.	0.	5.002E-02	5.002E-02	5.002E-02	5.002E-02
34	0.	0.	0.	0.	4.502E-02	4.502E-02	4.502E-02	4.502E-02
34	0.	0.	0.	0.	4.052E-02	4.052E-02	4.052E-02	4.052E-02
34	0.	0.	0.	0.	3.646E-02	3.646E-02	3.646E-02	3.646E-02
34	0.	0.	0.	0.	3.282E-02	3.282E-02	3.282E-02	3.282E-02
34	0.	0.	0.	0.	2.954E-02	2.954E-02	2.954E-02	2.954E-02
34	0.	0.	0.	0.	2.658E-02	2.658E-02	2.658E-02	2.658E-02
34	0.	0.	0.	0.	2.392E-02	2.392E-02	2.392E-02	2.392E-02
51	0.	0.	0.	0.	9.000E-02	9.000E-02	9.000E-02	9.000E-02
51	0.	0.	0.	0.	8.100E-02	8.100E-02	8.100E-02	8.100E-02
51	0.	0.	0.	0.	7.290E-02	7.290E-02	7.290E-02	7.290E-02
51	0.	0.	0.	0.	6.561E-02	6.561E-02	6.561E-02	6.561E-02

G

51	0.	0.	0.	0.	5.905E-02	5.905E-02	5.905E-02	5.905E-02
51	0.	0.	0.	0.	5.314E-02	5.314E-02	5.314E-02	5.314E-02
51	0.	0.	0.	0.	4.783E-02	4.783E-02	4.783E-02	4.783E-02
51	0.	0.	0.	0.	4.305E-02	4.305E-02	4.305E-02	4.305E-02
51	0.	0.	0.	0.	3.874E-02	3.874E-02	3.874E-02	3.874E-02

	XIC	XIS	ETAC	ETAS	VC	VS	CHIC	CHIS
1	0.	0.	-2.742E-03	-2.714E-03	-0.	0.	-1.123E-03	-1.113E-03
1	-6.459E-03	-6.022E-03	-1.896E-03	-1.989E-03	-7.852E-04	7.285E-04	-1.009E-03	-9.693E-04
1	2.598E-03	2.636E-03	-1.179E-03	-1.175E-03	-3.118E-04	3.044E-04	1.851E-04	1.984E-04
1	1.020E-03	1.069E-03	-4.042E-04	-4.052E-04	-5.491E-05	5.170E-05	1.353E-04	1.570E-04
1	3.875E-04	4.274E-04	-1.567E-04	-1.502E-04	-2.034E-06	2.769E-06	5.961E-05	8.227E-05
1	1.917E-04	2.049E-04	-7.138E-05	-6.047E-05	7.382E-06	-5.498E-06	4.003E-05	5.076E-05
1	1.116E-04	1.134E-04	-3.097E-05	-2.093E-05	8.746E-06	-7.423E-06	3.379E-05	3.581E-05
1	6.633E-05	6.490E-05	-1.023E-05	-2.150E-06	7.740E-06	-6.991E-06	2.423E-05	2.285E-05
1	5.203E-05	5.062E-05	-1.316E-06	4.124E-06	6.780E-06	-6.430E-06	3.169E-05	2.980E-05
17	-1.844E-02	-1.826E-02	3.574E-03	3.538E-03	3.575E-03	-3.601E-03	-6.401E-04	-6.344E-04
17	-3.451E-02	-3.322E-02	8.347E-03	7.937E-03	4.008E-03	-4.203E-03	-1.361E-03	-1.327E-03
17	1.244E-03	1.653E-03	-6.431E-04	-7.967E-04	-1.836E-04	1.342E-04	-2.188E-04	-2.057E-04
17	2.411E-04	9.158E-04	-1.084E-04	-3.586E-04	-5.444E-05	-9.742E-06	-1.560E-04	-1.333E-04
17	-1.051E-03	-2.447E-04	3.742E-04	7.954E-05	3.348E-05	-9.619E-05	-1.550E-04	-1.234E-04
17	-9.229E-04	-3.704E-04	3.248E-04	1.249E-04	2.954E-05	-6.603E-05	-1.243E-04	-9.802E-05
17	-4.147E-04	-1.209E-04	1.414E-04	3.580E-05	8.395E-06	-2.536E-05	-7.997E-05	-6.317E-05
17	-1.310E-04	2.191E-05	4.121E-05	-1.350E-05	-8.915E-07	-7.016E-06	-4.759E-05	-3.742E-05
17	5.151E-04	5.894E-04	-1.894E-04	-2.160E-04	-2.483E-05	2.132E-05	-2.196E-06	3.305E-06
34	-3.502E-02	-3.473E-02	9.171E-03	9.097E-03	7.702E-03	-7.756E-03	-5.581E-04	-5.552E-04
34	-7.127E-02	-6.918E-02	2.169E-02	2.099E-02	9.520E-03	-9.844E-03	-1.388E-03	-1.361E-03
34	-4.810E-03	-4.347E-03	1.570E-03	1.383E-03	2.414E-04	-2.932E-04	-1.402E-04	-1.491E-04
34	-3.287E-03	-2.616E-03	1.221E-03	9.483E-04	1.415E-04	-2.027E-04	-1.158E-05	-3.510E-05
34	-3.710E-03	-2.850E-03	1.412E-03	1.071E-03	1.671E-04	-2.311E-04	4.722E-05	1.628E-05
34	-3.126E-03	-2.445E-03	1.181E-03	9.152E-04	1.298E-04	-1.722E-04	4.145E-05	1.909E-05
34	-2.128E-03	-1.697E-03	7.953E-04	6.284E-04	7.892E-05	-1.021E-04	1.712E-05	4.963E-06
34	-1.374E-03	-1.108E-03	5.091E-04	4.063E-04	4.538E-05	-5.808E-05	2.033E-06	-4.154E-06
34	-1.770E-04	-2.518E-05	5.954E-05	9.409E-07	-2.299E-06	-4.247E-06	-2.546E-05	-2.818E-05
51	-4.519E-02	-4.485E-02	1.263E-02	1.253E-02	1.115E-02	-1.123E-02	-2.638E-04	-2.618E-04
51	-1.110E-01	-1.080E-01	3.597E-02	3.493E-02	1.367E-02	-1.409E-02	-1.981E-03	-1.928E-03
51	-6.330E-03	-6.062E-03	2.104E-03	1.983E-03	2.252E-04	-2.481E-04	-1.267E-04	-1.214E-04
51	-1.376E-03	-1.292E-03	5.414E-04	4.741E-04	-2.133E-05	1.344E-05	-1.801E-05	-1.754E-05
51	-4.638E-04	-4.270E-04	2.593E-04	2.078E-04	-2.383E-05	2.109E-05	2.576E-06	1.613E-06
51	-1.907E-04	-1.739E-04	1.339E-04	1.030E-04	-1.952E-05	2.007E-05	5.830E-06	4.920E-06
51	-8.804E-05	-9.006E-05	6.270E-05	4.600E-05	-1.466E-05	1.607E-05	4.925E-06	4.364E-06
51	-4.492E-05	-4.084E-05	2.713E-05	1.766E-05	-1.024E-05	1.155E-05	3.673E-06	3.336E-06
51	-2.131E-05	-1.923E-05	-2.652E-06	-7.944E-06	-5.384E-06	6.359E-06	1.815E-06	1.629E-06

LAMDA A = 2.86107E+01   RE = 2.76107E+01

LAMDA S = 2.70295E+01   RE = 2.60295E+01   IT= 2

	XIC	XIS	ETAC	ETAS	VC	VS	CHIC	CHIS
1	0.	0.	1.026E-03	1.082E-03	-0.	0.	5.453E-04	5.731E-04
1	-5.647E-02	-5.840E-02	1.960E-02	2.035E-02	1.037E-02	-9.990E-03	-3.859E-03	-3.976E-03
1	-6.482E-03	-6.687E-03	2.805E-03	2.895E-03	9.240E-04	-9.001E-04	-8.089E-04	-8.270E-04
1	-2.315E-03	-1.848E-03	7.098E-04	6.637E-04	1.283E-04	-1.459E-04	-4.793E-04	-4.141E-04
1	-1.404E-03	-1.119E-03	3.267E-04	2.755E-04	2.743E-05	-3.635E-05	-5.944E-04	-4.525E-04
1	-6.626E-04	-5.249E-04	9.362E-05	8.119E-05	-9.066E-06	1.098E-05	-3.811E-04	-2.925E-04
1	-2.119E-04	-1.713E-04	1.943E-05	1.801E-05	-8.894E-06	1.073E-05	-1.472E-04	-1.148E-04
1	-6.430E-05	-5.272E-05	6.353E-06	5.882E-06	-4.260E-06	5.013E-06	-4.957E-05	-3.848E-05
1	-8.412E-06	-4.488E-06	4.249E-06	3.889E-06	-5.813E-07	8.911E-07	-3.921E-06	5.419E-07

17	7.726E-03	9.141E-03	-1.659E-03	-1.747E-03	-1.178E-03	1.114E-03	1.237E-04	1.324E-04
17	-1.235E-01	-1.241E-01	4.258E-02	4.393E-02	2.079E-02	-2.016E-02	-2.359E-03	-2.412E-03
17	-1.424E-02	-1.437E-02	5.695E-03	5.753E-03	1.757E-03	-1.740E-03	-6.576E-05	-5.061E-05
17	-8.779E-03	-6.972E-03	3.301E-03	2.628E-03	6.482E-04	-8.139E-04	-1.618E-04	-9.985E-05
17	-1.455E-02	-1.053E-02	5.337E-03	3.865E-03	7.984E-04	-1.101E-03	-4.886E-04	-3.410E-04
17	-1.120E-02	-8.303E-03	4.066E-03	3.013E-03	5.310E-04	-7.148E-04	-4.809E-04	-3.543E-04
17	-5.025E-03	-3.775E-03	1.810E-03	1.359E-03	2.081E-04	-2.760E-04	-2.641E-04	-2.000E-04
17	-1.748E-03	-1.245E-03	6.255E-04	4.449E-04	6.028E-05	-8.409E-05	-1.093E-04	-7.942E-05
17	1.890E-04	4.153E-04	-6.870E-05	-1.501E-04	-1.682E-05	7.339E-06	5.858E-06	2.064E-05
34	9.793E-03	1.037E-02	-2.347E-03	-2.489E-03	-2.323E-03	2.196E-03	6.839E-05	7.307E-05
34	-1.763E-01	-1.812E-01	6.298E-02	6.478E-02	3.023E-02	-2.938E-02	-2.006E-03	-2.053E-03
34	-1.066E-02	-1.052E-02	4.604E-03	4.569E-03	1.377E-03	-1.380E-03	3.044E-04	3.050E-04
34	-7.352E-03	-5.589E-03	2.990E-03	2.286E-03	5.235E-04	-6.803E-04	2.753E-04	2.080E-04
34	-1.457E-02	-1.053E-02	5.730E-03	4.144E-03	7.714E-04	-1.068E-03	5.468E-04	3.899E-04
34	-1.312E-02	-9.839E-03	5.061E-03	3.795E-03	5.975E-04	-7.985E-04	4.536E-04	3.340E-04
34	-7.109E-03	-5.492E-03	2.703E-03	2.087E-03	2.840E-04	-3.688E-04	2.140E-04	1.600E-04
34	-3.111E-03	-2.363E-03	1.170E-03	8.877E-04	1.063E-04	-1.405E-04	7.523E-05	5.263E-05
34	-7.605E-05	2.999E-04	2.646E-05	-1.143E-04	-1.303E-05	-2.276E-06	-1.011E-05	-2.040E-05
51	1.193E-02	1.252E-02	-3.088E-03	-3.272E-03	-3.299E-03	3.118E-03	1.045E-04	1.102E-04
51	-2.476E-01	-2.543E-01	8.870E-02	9.116E-02	3.669E-02	-3.570E-02	-4.372E-03	-4.489E-03
51	-4.801E-03	-4.717E-03	2.557E-03	2.538E-03	5.470E-04	-5.503E-04	-8.307E-05	-8.135E-05
51	-7.351E-04	-5.928E-04	6.588E-04	5.241E-04	7.033E-05	-9.344E-05	1.350E-06	5.582E-07
51	-4.377E-04	-3.325E-04	7.260E-04	5.313E-04	4.514E-05	-6.475E-05	2.201E-05	1.577E-05
51	-2.033E-04	-1.587E-04	4.664E-04	3.510E-04	7.232E-06	-1.084E-05	2.074E-05	1.555E-05
51	-7.457E-05	-6.118E-05	1.927E-04	1.491E-04	-6.011E-06	7.213E-06	1.052E-05	8.158E-06
51	-2.570E-05	-2.084E-05	6.699E-05	5.107E-05	-5.090E-06	6.339E-06	4.271E-06	3.276E-06
51	-2.713E-06	-8.124E-07	1.854E-06	-4.624E-06	5.362E-08	7.541E-07	1.825E-07	-2.713E-07

LAMDA A = 1.23950E+01   SF =-5.66769E-01

LAMDA S = 1.17098E+01   SF =-5.66776E-01   IT= 3

	XIC	XIS	ETAC	ETAS	VC	VS	CHIC	CHIS
1	0.	0.	-6.847E-04	-7.549E-04	-0.	0.	-2.668E-04	-2.950E-04
1	-3.445E-02	-3.724E-02	7.051E-03	7.553E-03	4.618E-03	-4.294E-03	-3.459E-03	-3.756E-03
1	4.425E-04	5.520E-04	-1.837E-04	-2.291E-04	9.843E-05	-1.012E-04	-2.228E-04	-2.305E-04
1	-6.324E-04	-4.231E-04	1.422E-04	6.103E-05	6.578E-05	-9.014E-05	-3.557E-04	-2.678E-04
1	-2.277E-03	-1.703E-03	3.745E-04	2.713E-04	5.340E-05	-7.056E-05	-1.158E-03	-8.773E-04
1	-1.265E-03	-9.324E-04	8.922E-05	6.583E-05	-1.544E-05	1.981E-05	-8.248E-04	-6.441E-04
1	-3.229E-04	-2.557E-04	-5.962E-06	-5.923E-06	-1.287E-05	1.621E-05	-2.616E-04	-2.082E-04
1	-5.311E-05	-4.510E-05	-6.532E-06	-5.297E-06	-3.495E-06	4.593E-06	-5.794E-05	-4.460E-05
1	-1.622E-06	2.071E-06	-9.042E-07	-2.826E-07	2.083E-07	1.687E-07	-2.274E-06	1.811E-06
17	-5.129E-03	-5.658E-03	1.082E-03	1.194E-03	9.405E-04	-8.540E-04	-1.659E-04	-1.822E-04
17	-1.098E-01	-1.182E-01	3.397E-02	3.684E-02	1.733E-02	-1.598E-02	-3.046E-03	-3.316E-03
17	-7.571E-03	-7.910E-03	2.834E-03	2.957E-03	8.776E-04	-8.427E-04	-3.226E-04	-3.404E-04
17	-1.106E-02	-9.813E-03	4.111E-03	3.272E-03	8.046E-04	-1.012E-03	-4.078E-04	-3.360E-04
17	-3.362E-02	-2.578E-02	1.234E-02	9.442E-03	1.940E-03	-2.535E-03	-1.252E-03	-9.635E-04
17	-2.769E-02	-2.176E-02	1.005E-02	7.892E-03	1.379E-03	-1.756E-03	-1.214E-03	-9.567E-04
17	-1.062E-02	-8.512E-03	3.828E-03	3.068E-03	4.630E-04	-5.776E-04	-5.454E-04	-4.382E-04
17	-2.408E-03	-2.245E-03	1.043E-03	8.057E-04	1.064E-04	-1.378E-04	-1.702E-04	-1.311E-04
17	-1.524E-04	3.953E-05	5.810E-05	-3.203E-05	-3.739E-06	-6.787E-06	-1.016E-05	6.399E-06
34	-8.239E-03	-9.111E-03	2.126E-03	2.338E-03	1.946E-03	-1.768E-03	-7.553E-05	-8.281E-05
34	-1.798E-01	-1.955E-01	5.983E-02	6.499E-02	2.979E-02	-2.743E-02	-2.453E-03	-2.669E-03
34	-9.109E-03	-9.532E-03	3.541E-03	3.702E-03	9.843E-04	-9.419E-04	2.036E-04	2.131E-04
34	-1.138E-02	-8.921E-03	4.416E-03	3.550E-03	7.856E-04	-9.787E-04	4.173E-04	3.352E-04
34	-3.411E-02	-2.615E-02	1.340E-02	1.027E-02	1.118E-03	-2.502E-03	1.317E-03	1.009E-03
34	-3.151E-02	-2.430E-02	1.217E-02	9.574E-03	1.518E-03	-1.929E-03	1.140E-03	8.963E-04
34	-1.335E-02	-1.113E-02	5.276E-03	4.241E-03	5.826E-04	-7.250E-04	4.566E-04	3.660E-04
34	-4.352E-03	-3.368E-03	1.641E-03	1.270E-03	1.539E-04	-1.990E-04	1.282E-04	9.849E-05
34	-2.420E-04	1.409E-04	1.055E-04	-5.233E-05	-5.781E-06	-1.142E-05	6.762E-06	-4.706E-06

51	[illegible]	-1.079E-02	2.649E-03	2.915E-03	2.778E-03	-2.523E-03	-6.879E-05	-7.589E-05
51	-2.909E-01	-2.625E-01	2.870E-02	9.639E-02	3.858E-02	-3.551E-02	-4.628E-03	-5.032E-03
51	-4.434E-03	-4.646E-03	1.920E-03	2.007E-03	4.295E-04	-4.106E-04	-8.222E-05	-8.624E-05
51	-9.313E-04	-7.523E-04	8.479E-04	6.795E-04	1.148E-04	-1.431E-04	4.163E-06	3.236E-06
51	-9.068E-04	-6.961E-04	1.646E-03	1.761E-03	1.256E-04	-1.639E-04	5.249E-05	4.022E-05
51	-4.366E-04	-3.445E-04	1.109E-03	8.726E-04	2.640E-05	-3.368E-05	4.983E-05	3.922E-05
51	-1.260E-04	-1.018E-04	3.736E-04	3.003E-04	-8.707E-06	1.073E-05	2.031E-05	1.633E-05
51	-2.930E-05	-2.293E-05	9.280E-05	7.191E-05	-5.856E-06	7.488E-06	5.820E-06	4.510E-06
51	-1.522E-06	[illegible]	4.896E-06	-2.254E-06	2.568E-07	6.444E-07	3.487E-07	-1.622E-07

LAMDA A = 9.49121E+00 AF =-2.34273E-01

LAMDA S = 8.40764E+ 0 SF =-2.82092E-01 IT= 4

	XIC	XIS	ETAC	ETAS	VC	VS	CHIC	CHIS
1	0.	0.	-6.025E-05	-7.020E-05	-0.	0.	2.019E-05	2.656E-05
1	-3.474E-02	-4.274E-02	1.028E-02	1.266E-02	6.705E-03	-5.447E-03	-2.718E-03	-3.336E-03
1	-2.549E-03	-3.151E-03	1.100E-03	1.361E-03	4.881E-04	-3.975E-04	-3.902E-04	-4.769E-04
1	-1.566E-03	-1.596E-03	4.593E-04	4.500E-04	1.373E-04	-1.456E-04	-5.313E-04	-4.976E-04
1	-4.352E-03	-3.533E-03	7.181E-04	6.283E-04	1.056E-04	-1.213E-04	-1.994E-03	-1.736E-03
1	-2.272E-03	-2.014E-03	1.854E-04	1.646E-04	-3.131E-05	3.526E-05	-1.458E-03	-1.292E-03
1	-5.139E-04	-4.633E-04	1.809E-06	1.782E-06	-2.278E-05	2.526E-05	-4.091E-04	-3.678E-04
1	-7.934E-05	-6.980E-05	-4.803E-06	-3.990E-06	-5.255E-06	5.968E-06	-7.473E-05	-6.597E-05
1	-6.335E-06	-3.582E-06	-5.026E-07	-6.059E-08	-3.228E-07	5.987E-07	-6.830E-06	-3.798E-06
17	-2.798E-04	-3.136E-04	3.112E-05	3.162E-05	1.569E-04	-1.313E-04	-5.672E-05	-6.903E-05
17	-9.593E-02	-1.053E-01	2.868E-02	3.522E-02	1.669E-02	-1.359E-02	-2.018E-03	-2.473E-03
17	-8.146E-03	-9.610E-03	3.197E-03	3.855E-03	1.176E-03	-9.761E-04	-1.422E-04	-1.616E-04
17	-1.403E-02	-1.295E-02	5.231E-03	4.793E-03	1.183E-03	-1.292E-03	-4.637E-04	-4.148E-04
17	-5.667E-02	-4.927E-02	2.076E-02	1.805E-02	3.710E-03	-4.267E-03	-2.086E-03	-1.813E-03
17	-4.804E-02	-4.258E-02	1.743E-02	1.545E-02	2.700E-03	-3.046E-03	-2.097E-03	-1.855E-03
17	-1.595E-02	-1.437E-02	5.751E-03	5.182E-03	7.811E-04	-8.669E-04	-8.040E-04	-7.264E-04
17	-3.494E-03	-3.047E-03	1.251E-03	1.094E-03	1.441E-04	-1.648E-04	-1.989E-04	-1.730E-04
17	-3.392E-04	-1.499E-04	1.217E-04	5.401E-05	6.213E-06	-1.413E-05	-2.000E-05	-7.381E-06
34	-1.674E-03	-2.017E-03	5.005E-04	6.052E-04	3.820E-04	-3.181E-04	-2.713E-05	-3.306E-05
34	-1.338E-01	-1.641E-01	4.617E-02	5.666E-02	2.620E-02	-2.135E-02	-1.688E-03	-2.069E-03
34	-7.449E-03	-3.832E-03	3.078E-03	3.660E-03	1.043E-03	-8.740E-04	1.954E-04	2.339E-04
34	-1.367E-02	-1.241E-02	5.465E-03	4.965E-03	1.106E-03	-1.216E-03	5.167E-04	4.703E-04
34	-5.725E-02	-4.978E-02	2.249E-02	1.956E-02	3.652E-03	-4.201E-03	2.212E-03	1.923E-03
34	-5.445E-02	-4.828E-02	2.102E-02	1.864E-02	2.957E-03	-3.335E-03	1.975E-03	1.751E-03
34	-2.050E-02	-1.848E-02	7.810E-03	7.039E-03	9.682E-04	-1.074E-03	6.834E-04	6.158E-04
34	-5.046E-03	-4.394E-03	1.904E-03	1.658E-03	2.013E-04	-2.312E-04	1.535E-04	1.339E-04
34	-5.095E-04	-1.845E-04	1.907E-04	6.940E-05	7.602E-06	-2.077E-05	1.495E-05	6.327E-06
51	-1.884E-03	-2.266E-03	5.559E-04	6.703E-04	5.525E-04	-4.599E-04	-4.435E-06	-5.051E-06
51	-1.907E-01	-2.339E-01	6.669E-02	8.182E-02	3.282E-02	-2.675E-02	-3.379E-03	-4.144E-03
51	-3.313E-03	-3.912E-03	1.635E-03	1.943E-03	4.263E-04	-3.581E-04	-5.836E-05	-6.879E-05
51	-1.130E-03	-1.024E-03	1.057E-03	9.625E-04	1.620E-04	-1.780E-04	5.796E-06	5.320E-06
51	-1.519E-03	-1.321E-03	2.765E-03	2.404E-03	2.395E-04	-2.754E-04	8.821E-05	7.670E-05
51	-7.516E-04	-6.659E-04	1.917E-03	1.699E-03	5.195E-05	-5.862E-05	8.612E-05	7.636E-05
51	-1.834E-04	-1.655E-04	5.532E-04	4.987E-04	-1.394E-05	1.544E-05	3.002E-05	2.706E-05
51	-3.265E-05	-2.842E-05	1.075E-04	9.362E-05	-7.339E-06	8.422E-06	6.716E-06	5.848E-06
51	-2.367E-06	-7.067E-07	8.698E-06	3.138E-06	-3.427E-07	1.040E-06	6.079E-07	2.154E-07

LAMDA A = 6.91913E+00 AF =-2.41532E-01

LAMDA S = 6.10547E+00 SF =-2.73819E-01 IT= 5

	XTC	XIS	ETAC	ETAS	VC	VS	CHIC	CHIS
1	0.	0.	-1.385E-04	-1.909E-04	-0.	0.	-4.063E-05	-5.620E-05
1	-1.498E-02	-2.220E-02	4.111E-03	5.417E-03	3.141E-03	-2.298E-03	-1.420E-03	-1.945E-03
1	-4.304E-04	-6.682E-04	2.127E-04	2.208E-04	1.580E-04	-1.172E-04	-1.437E-04	-1.938E-04
1	-1.132E-03	-1.342E-03	2.171E-04	3.167E-04	1.220E-04	-1.214E-04	-4.575E-04	-4.601E-04
1	-4.247E-03	-4.717E-03	3.457E-04	8.220E-04	1.419E-04	-1.457E-04	-2.401E-03	-2.337E-03
1	-2.317E-03	-2.793E-03	2.274E-04	2.240E-04	-4.313E-05	4.360E-05	-1.811E-03	-1.789E-03
1	-5.762E-04	-5.766E-04	2.692E-06	2.560E-06	-2.817E-05	2.814E-05	-4.578E-04	-4.582E-04
1	-7.336E-05	-7.287E-05	-4.514E-06	-4.352E-06	-5.469E-06	5.556E-06	-7.006E-05	-6.909E-05
1	-5.358E-06	-4.814E-06	-4.556E-07	-4.615E-07	-4.572E-07	5.746E-07	-6.536E-06	-5.262E-06
17	-9.962E-04	-1.375E-03	2.333E-04	2.905E-04	2.607E-04	-1.893E-04	-4.574E-05	-6.284E-05
17	-4.466E-02	-4.119E-02	1.444E-02	1.977E-02	9.328E-03	-6.813E-03	-1.148E-03	-1.574E-03
17	-3.742E-03	-4.938E-03	1.445E-03	1.914E-03	5.777E-04	-4.369E-04	-1.160E-04	-1.486E-04
17	-1.325E-02	-1.339E-02	4.931E-03	4.951E-03	1.225E-03	-1.229E-03	-4.788E-04	-4.791E-04
17	-6.366E-02	-6.649E-02	2.515E-02	2.450E-02	5.037E-03	-5.170E-03	-2.539E-03	-2.475E-03
17	-5.471E-02	-5.994E-02	2.167E-02	2.142E-02	3.743E-03	-3.785E-03	-2.598E-03	-2.570E-03
17	-1.779E-02	-1.790E-02	6.410E-03	6.420E-03	9.672E-04	-9.657E-04	-8.918E-04	-8.935E-04
17	-3.238E-03	-3.178E-03	1.163E-03	1.142E-03	1.502E-04	-1.531E-04	-1.828E-04	-1.788E-04
17	-3.443E-04	-2.618E-04	1.235E-04	9.400E-05	1.089E-05	-1.434E-05	-2.069E-05	-1.504E-05
34	[illegible]	-2.695E-03	5.201E-04	7.152E-04	5.575E-04	-4.051E-04	-2.140E-05	-2.939E-05
34	-7.146E-02	-6.815E-02	2.427E-02	3.324E-02	1.531E-02	-1.118E-02	-9.411E-04	-1.289E-03
34	[illegible]	-5.275E-03	1.615E-03	2.108E-03	5.777E-04	-4.409E-04	9.667E-05	1.271E-04
34	-1.339E-02	-1.340E-02	5.331E-03	5.342E-03	1.182E-03	-1.179E-03	5.007E-04	5.020E-04
34	-6.461E-02	-6.773E-02	2.730E-02	2.661E-02	4.968E-03	-5.098E-03	2.683E-03	2.615E-03
34	-6.762E-02	-6.649E-02	2.611E-02	2.583E-02	4.097E-03	-4.142E-03	2.454E-03	2.427E-03
34	-2.260E-02	-2.273E-02	8.647E-03	8.663E-03	1.192E-03	-1.190E-03	7.598E-04	7.610E-04
34	-4.679E-03	-4.528E-03	1.747E-03	1.709E-03	2.077E-04	-2.122E-04	1.423E-04	1.395E-04
34	-5.237E-04	-3.778E-04	1.963E-04	1.417E-04	1.546E-05	-2.138E-05	1.530E-05	1.152E-05
51	-2.294E-03	-3.143E-03	6.309E-04	8.679E-04	7.985E-04	-5.802E-04	-1.346E-05	-1.856E-05
51	-1.025E-01	-1.409E-01	3.553E-02	4.866E-02	1.950E-02	-1.424E-02	-1.828E-03	-2.503E-03
51	-1.324E-03	-2.457E-03	5.631E-04	1.128E-03	2.444E-04	-1.870E-04	-3.423E-05	-4.452E-05
51	-1.109E-03	-1.111E-03	1.019E-03	1.022E-03	1.733E-04	-1.729E-04	5.461E-06	5.465E-06
51	-1.446E-03	-1.798E-03	3.354E-03	3.268E-03	3.257E-04	-3.342E-04	1.071E-04	1.043E-04
51	-9.322E-04	-6.223E-04	2.381E-03	2.355E-03	7.197E-05	-7.278E-05	1.070E-04	1.058E-04
51	-2.120E-04	-2.025E-04	6.128E-04	6.139E-04	-1.702E-05	1.697E-05	3.323E-05	3.329E-05
51	-2.477E-05	-2.487E-05	9.858E-05	9.645E-05	-7.482E-06	7.654E-06	6.153E-06	6.018E-06
51	-2.344E-06	-1.688E-06	4.955E-06	6.448E-06	-7.555E-07	1.074E-06	6.264E-07	4.489E-07

LAMDA A = 5.47263E+00   FF =-1.36579E-01

LAMDA S = 5.27321E+00   SF =-1.36214E-01   IT= 6

SRA 200 INPUT DATA LISTING

```
3ND CLOSED BRANCH TEST CASE
   1 1 1 1 1 1 1 1 1         2         1.0                 1.-2

C        GEOMETRY TABLE FOLLOWS

1           1  0.        10.        -.70711     .70711     .05
     1      9  2.         8.58578   -.70711     .70711     .05
           10  2.        10.        -.70711     .70711     .05
     2     14  3.         9.29289   -.70711     .70711     .05
           15  3.        10.        -.70711    -.70711     .05
     2     19  4.         9.29289   -.70711    -.70711     .05
           20  4.         9.29289   -.70711    -.70711     .05
     1     24  5.         8.58578   -.70711    -.70711     .05
           25  5.         8.58578   0.         -1.         .05
     1     29  6.         8.58578   0.         -1.         .05
    1      30  6.         8.58578   -.70711    -.70711     .05
           38  8.         7.17156   -.70711    -.70711     .05
           39  8.         7.17156   +.70711    -.70711     .05
     3     47 10.         8.58578   +.70711    -.70711     .05
           48 10.         8.58578   0.          1.         .05
     3     52 11.         8.58578   0.          1.         .05
           53 11.        10.          -.70711   .70711     .05
     4     57 12.         9.29289     -.70711   .70711     .05
           58 12.        10.          -.70711  -.70711     .05
     4     62 13.         9.29289     -.70711  -.70711     .05
           63 13.         9.29289     -.70711  +.70711     .05
     3     67 14.         8.58578     -.70711  +.70711     .05
    1      68 14.         8.58578     +.70711  +.70711     .05
    2      76 16.        10.          +.70711  +.70711     .05

C        WALL PROPERTIES TABLE FOLLOWS

2     1     1        1.+7        1.+7        .4+7 .25          .05
           76        1.+7        1.+7        .4+7 .25          .05

C        MECHANICAL LOADS TABLE FOLLOWS

6           1                   -100.
            9                   -100.
           10
           29
           30                   -100.
           47                   -100.
           48
           67
           68                   -100.
           76                   -100.
9
```

```
C         BOUNDARY DATA FOLLOWS
       1.2+7          1.+6           1.+6                          .675+6 .05
 0.
              .1                    1.2+7
       1.2+7          1.+6           1.+6                          .675+6 .05
 0.
              .1                    1.2+7
 0.
              1.
                         0.
                                        1.
 1.
              0.
                         1.
                                        0.

          END OF FILE CARD
```

SRA 200 OUTPUT DATA LISTING

CLOSED BRANCH TEST CASE

SURFACE LOADING, IF ANY, IS APPLIED AT SHELL REFERENCE SURFACE
AND, DURING DEFORMATION, REMAINS FIXED IN MAGNITUDE AND DIRECTION

N = 0   LAMBDA = 1.0000E+00   REL ERR CNTRL = 1.000E-02

TABLE 1 (SURFACE GEOMETRY)

ENTRY	S	R	R PRIME	R/R2	ZBAR
1	0.E+00	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
2	2.5000E-01	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
3	5.0000E-01	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
4	7.5000E-01	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
5	1.0000E+00	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
6	1.2500E+00	9.1161E+00	-7.0711E-01	7.0711E-01	5.0000E-02
7	1.5000E+00	8.9393E+00	-7.0711E-01	7.0711E-01	5.0000E-02
8	1.7500E+00	8.7626E+00	-7.0711E-01	7.0711E-01	5.0000E-02
9	2.0000E+00	8.5858E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 1, THE NEXT POINT IS A NEW EDGE					
10	2.0000E+00	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
11	2.2500E+00	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
12	2.5000E+00	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
13	2.7500E+00	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
14	3.0000E+00	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 2, THE NEXT POINT IS A NEW EDGE					
15	3.0000E+00	1.0000E+01	-7.0711E-01	-7.0711E-01	5.0000E-02
16	3.2500E+00	9.8232E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
17	3.5000E+00	9.6464E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
18	3.7500E+00	9.4697E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
19	4.0000E+00	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 2					
20	4.0000E+00	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
21	4.2500E+00	9.1161E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
22	4.5000E+00	8.9393E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
23	4.7500E+00	8.7626E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
24	5.0000E+00	8.5858E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 1, THE NEXT POINT IS A NEW EDGE					
25	5.0000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
26	5.2500E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
27	5.5000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
28	5.7500E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
29	6.0000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
********** BRANCH POINT 1					
30	6.0000E+00	8.5858E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
31	6.2500E+00	8.4090E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
32	6.5000E+00	8.2322E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
33	6.7500E+00	8.0554E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
34	7.0000E+00	7.8787E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
35	7.2500E+00	7.7019E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
36	7.5000E+00	7.5251E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
37	7.7500E+00	7.3483E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
38	8.0000E+00	7.1716E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
39	8.0000E+00	7.1716E+00	7.0711E-01	-7.0711E-01	5.0000E-02
40	8.2500E+00	7.3483E+00	7.0711E-01	-7.0711E-01	5.0000E-02
41	8.5000E+00	7.5251E+00	7.0711E-01	-7.0711E-01	5.0000E-02
42	8.7500E+00	7.7019E+00	7.0711E-01	-7.0711E-01	5.0000E-02
43	9.0000E+00	7.8787E+00	7.0711E-01	-7.0711E-01	5.0000E-02
44	9.2500E+00	8.0554E+00	7.0711E-01	-7.0711E-01	5.0000E-02
45	9.5000E+00	8.2322E+00	7.0711E-01	-7.0711E-01	5.0000E-02
46	9.7500E+00	8.4090E+00	7.0711E-01	-7.0711E-01	5.0000E-02
47	1.0000E+01	8.5858E+00	7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 3, THE NEXT POINT IS A NEW EDGE					
48	1.0000E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
49	1.0250E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
50	1.0500E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
51	1.0750E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
52	1.1000E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
********** BRANCH POINT 3, THE NEXT POINT IS A NEW EDGE					

53	1.1000E+01	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
54	1.1250E+01	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
55	1.1500E+01	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
56	1.1750E+01	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
57	1.2000E+01	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 4, THE NEXT POINT IS A NEW EDGE					
58	1.2000E+01	1.0000E+01	-7.0711E-01	-7.0711E-01	5.0000E-02
59	1.2250E+01	9.8232E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
60	1.2500E+01	9.6464E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
61	1.2750E+01	9.4697E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
62	1.3000E+01	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 4					
63	1.3000E+01	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
64	1.3250E+01	9.1161E+00	-7.0711E-01	7.0711E-01	5.0000E-02
65	1.3500E+01	8.9393E+00	-7.0711E-01	7.0711E-01	5.0000E-02
66	1.3750E+01	8.7626E+00	-7.0711E-01	7.0711E-01	5.0000E-02
67	1.4000E+01	8.5858E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 3					
68	1.4000E+01	8.5858E+00	7.0711E-01	7.0711E-01	5.0000E-02
69	1.4250E+01	8.7626E+00	7.0711E-01	7.0711E-01	5.0000E-02
70	1.4500E+01	8.9393E+00	7.0711E-01	7.0711E-01	5.0000E-02
71	1.4750E+01	9.1161E+00	7.0711E-01	7.0711E-01	5.0000E-02
72	1.5000E+01	9.2929E+00	7.0711E-01	7.0711E-01	5.0000E-02
73	1.5250E+01	9.4697E+00	7.0711E-01	7.0711E-01	5.0000E-02
74	1.5500E+01	9.6464E+00	7.0711E-01	7.0711E-01	5.0000E-02
75	1.5750E+01	9.8232E+00	7.0711E-01	7.0711E-01	5.0000E-02
76	1.6000E+01	1.0000E+01	7.0711E-01	7.0711E-01	5.0000E-02

TABLE 2 (WALL PROPERTIES)

ENTRY	S	E1	E2	NU1	H
1	0.E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
2	2.5000E-01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
3	5.0000E-01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
4	7.5000E-01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
5	1.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
6	1.2500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
7	1.5000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
8	1.7500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
9	2.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
10	2.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
11	2.2500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
12	2.5000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
13	2.7500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
14	3.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
15	3.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
16	3.2500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
17	3.5000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
18	3.7500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
19	4.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
20	4.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
21	4.2500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
22	4.5000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
23	4.7500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
24	5.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
25	5.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
26	5.2500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
27	5.5000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
28	5.7500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
29	6.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
30	6.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
31	6.2500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
32	6.5000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
33	6.7500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
34	7.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
35	7.2500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
36	7.5000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
37	7.7500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
38	8.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
39	8.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
40	8.2500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
41	8.5000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
42	8.7500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
43	9.0000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
44	9.2500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
45	9.5000E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
46	9.7500E+00	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
47	1.0000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
48	1.0000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
49	1.0250E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
50	1.0500E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
51	1.0750E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
52	1.1000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
53	1.1000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
54	1.1250E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
55	1.1500E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
56	1.1750E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
57	1.2000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
58	1.2000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
59	1.2250E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02

60	1.2500E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
61	1.2750E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
62	1.3000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
63	1.3000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
64	1.3250E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
65	1.3500E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
66	1.3750E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
67	1.4000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
68	1.4000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
69	1.4250E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
70	1.4500E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
71	1.4750E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
72	1.5000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
73	1.5250E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
74	1.5500E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
75	1.5750E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02
76	1.6000E+01	1.0000E+07	1.0000E+07	2.5000E-01	5.0000E-02

TABLE 3 (FOUNDATION MODULI) ALL ZEROES

TABLE 4 (STRINGER PROPERTIES) ALL ZEROES

TABLE 5 (MASS DENSITY) NOT APPLICABLE

TABLE 6 (MECHANICAL LOADS)

ENTRY	S	X1	X3	X3X	X3Y
1	0.E+00	-0.E+00	-1.0000E+02	-0.E+00	-0.E+00
2	2.5000E-01	0.E+00	-1.0000E+02	0.E+00	0.E+00
3	5.0000E-01	0.E+00	-1.0000E+02	0.E+00	0.E+00
4	7.5000E-01	0.E+00	-1.0000E+02	0.E+00	0.E+00
5	1.0000E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
6	1.2500E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
7	1.5000E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
8	1.7500E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
9	2.0000E+00	-0.E+00	-1.0000E+02	-0.E+00	-0.E+00
10	2.0000E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
11	2.2500E+00	0.E+00	0.E+00	0.E+00	0.E+00
12	2.5000E+00	0.E+00	0.E+00	0.E+00	0.E+00
13	2.7500E+00	0.E+00	0.E+00	0.E+00	0.E+00
14	3.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00
15	3.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00
16	3.2500E+00	0.E+00	0.E+00	0.E+00	0.E+00
17	3.5000E+00	0.E+00	0.E+00	0.E+00	0.E+00
18	3.7500E+00	0.E+00	0.E+00	0.E+00	0.E+00
19	4.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00
20	4.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00
21	4.2500E+00	0.E+00	0.E+00	0.E+00	0.E+00
22	4.5000E+00	0.E+00	0.E+00	0.E+00	0.E+00
23	4.7500E+00	0.E+00	0.E+00	0.E+00	0.E+00
24	5.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00
25	5.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00
26	5.2500E+00	0.E+00	0.E+00	0.E+00	0.E+00
27	5.5000E+00	0.E+00	0.E+00	0.E+00	0.E+00
28	5.7500E+00	0.E+00	0.E+00	0.E+00	0.E+00
29	6.0000E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
30	6.0000E+00	-0.E+00	-1.0000E+02	-0.E+00	-0.E+00
31	6.2500E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
32	6.5000E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
33	6.7500E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
34	7.0000E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
35	7.2500E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
36	7.5000E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
37	7.7500E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
38	8.0000E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
39	8.0000E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
40	8.2500E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
41	8.5000E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
42	8.7500E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
43	9.0000E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
44	9.2500E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
45	9.5000E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
46	9.7500E+00	0.E+00	-1.0000E+02	0.E+00	0.E+00
47	1.0000E+01	-0.E+00	-1.0000E+02	-0.E+00	-0.E+00
48	1.0000E+01	-0.E+00	-0.E+00	-0.E+00	-0.E+00
49	1.0250E+01	0.E+00	0.E+00	0.E+00	0.E+00
50	1.0500E+01	0.E+00	0.E+00	0.E+00	0.E+00
51	1.0750E+01	0.E+00	0.E+00	0.E+00	0.E+00
52	1.1000E+01	0.E+00	0.E+00	0.E+00	0.E+00
53	1.1000E+01	0.E+00	0.E+00	0.E+00	0.E+00
54	1.1250E+01	0.E+00	0.E+00	0.E+00	0.E+00
55	1.1500E+01	0.E+00	0.E+00	0.E+00	0.E+00
56	1.1750E+01	0.E+00	0.E+00	0.E+00	0.E+00
57	1.2000E+01	0.E+00	0.E+00	0.E+00	0.E+00
58	1.2000E+01	0.E+00	0.E+00	0.E+00	0.E+00
59	1.2250E+01	0.E+00	0.E+00	0.E+00	0.E+00

60	1.2500E+01	0.E+00	0.E+00	0.E+00	0.E+00
61	1.2750E+01	0.E+00	0.E+00	0.E+00	0.E+00
62	1.3000E+01	0.E+00	0.E+00	0.E+00	0.E+00
63	1.3000E+01	0.E+00	0.E+00	0.E+00	0.E+00
64	1.3250E+01	0.E+00	0.E+00	0.E+00	0.E+00
65	1.3500E+01	0.E+00	0.E+00	0.E+00	0.E+00
66	1.3750E+01	0.E+00	0.E+00	0.E+00	0.E+00
67	1.4000E+01	-0.E+00	-0.E+00	-0.E+00	-0.E+00
68	1.4000E+01	-0.E+00	-1.0000E+02	-0.E+00	-0.E+00
69	1.4250E+01	0.E+00	-1.0000E+02	0.E+00	0.E+00
70	1.4500E+01	0.E+00	-1.0000E+02	0.E+00	0.E+00
71	1.4750E+01	0.E+00	-1.0000E+02	0.E+00	0.E+00
72	1.5000E+01	0.E+00	-1.0000E+02	0.E+00	0.E+00
73	1.5250E+01	0.E+00	-1.0000E+02	0.E+00	0.E+00
74	1.5500E+01	0.E+00	-1.0000E+02	0.E+00	0.E+00
75	1.5750E+01	0.E+00	-1.0000E+02	0.E+00	0.E+00
76	1.6000E+01	-0.E+00	-1.0000E+02	-0.E+00	-0.E+00

TABLE 7 (THERMAL LOADS) ALL ZEROES

INITIAL APPROXIMATION SET TO ZERO

```
BOUNDARY NUMBER  1            S =  0.E+00
THIS IS THE FIRST POINT OF A CLOSED BRANCH - SEE BOUNDARY NUMBER 13 FOR BOUNDARY DATA

BOUNDARY NUMBER  2            S =  2.0000E+00

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  3            S =  3.0000E+00

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  4            S =  4.0000E+00

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  5            S =  5.0000E+00

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  6            S =  6.0000E+00
RING DATA
EA =  1.2000E+07      EI SUB Y =  1.0000E+06      ZBAR =  5.0000E-02      SBAR = -0.E+00
F SUB X = -0.E+00           F SUB Y = -0.E+00           N SUB PHI = -0.E+00           THETA = -0.E+00

BOUNDARY NUMBER  7            S =  8.0000E+00

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  8            S =  1.0000E+01

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  9            S =  1.1000E+01

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER 10            S =  1.2000E+01

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER 11            S =  1.3000E+01

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER 12            S =  1.4000E+01
RING DATA
EA =  1.2000E+07      EI SUB Y =  1.0000E+06      ZBAR =  5.0000E-02      SBAR = -0.E+00
F SUB X = -0.E+00           F SUB Y = -0.E+00           N SUB PHI = -0.E+00           THETA = -0.E+00
```


C3

```
BOUNDARY NUMBER 13          S =  1.6000E+01

             B MATRIX                                        D MATRIX                    L VECTOR
-0.E+00     -0.E+00      -0.E+00      1.0000E+00 -0.E+00      -0.E+00      -0.E+00
-0.E+00      1.0000E+00 -0.E+00      -0.E+00      -0.E+00      -0.E+00      -0.E+00
-0.E+00     -0.E+00       1.0000E+00 -0.E+00      -0.E+00      -0.E+00      -0.E+00

ITER =  2 MAX. REL. ERR. = 2.6458E-02

ITER =  3 MAX. REL. ERR. = 9.1265E-06
```

NONLINEAR STATE

ENTRY	S	P	Q	MI	XI	ETA	CHI	CHI1
1	0.E+00	-1.3453E+02	1.3296E-04	3.2645E+01	9.7054E+01	1.6141E-03	-8.2685E-08	-8.2764E-08
2	2.5000E-01	-1.1911E+02	2.0814E+01	1.2289E+01	9.7053E+01	1.0065E-03	6.1941E-03	6.1941E-03
3	5.0000E-01	-1.0345E+02	3.9450E+01	-2.1266E+00	9.7052E+01	-2.4220E-04	7.5190E-03	7.5190E-03
4	7.5000E-01	-8.7542E+01	5.4983E+01	-1.0881E+01	9.7051E+01	-1.4207E-03	5.5927E-03	5.5927E-03
5	1.0000E+00	-7.1362E+01	6.8011E+01	-1.4308E+01	9.7050E+01	-2.0921E-03	1.9468E-03	1.9468E-03
6	1.2500E+00	-5.4896E+01	8.0129E+01	-1.2578E+01	9.7050E+01	-2.0786E-03	-1.9552E-03	-1.9552E-03
7	1.5000E+00	-3.8129E+01	9.3308E+01	-5.5675E+00	9.7051E+01	-1.4579E-03	-4.6517E-03	-4.6517E-03
8	1.7500E+00	-2.1043E+01	1.0912E+02	7.1562E+00	9.7052E+01	-5.7567E-04	-4.5935E-03	-4.5935E-03
9	2.0000E+00	-3.6161E+00	1.2769E+02	2.6179E+01	9.7052E+01	-6.9148E-05	-7.3837E-05	-7.3837E-05
10	2.0000E+00	0.E+00	0.E+00	0.E+00	9.7052E+01	-2.5587E-05	-1.4386E-05	-1.4386E-05
11	2.2500E+00	0.E+00	-6.2412E-02	-5.6043E-03	9.7052E+01	-2.3127E-05	-1.4978E-05	-1.4978E-05
12	2.5000E+00	0.E+00	-1.2111E-01	-2.2087E-02	9.7052E+01	-2.0328E-05	-1.8698E-05	-1.8698E-05
13	2.7500E+00	0.E+00	-1.7375E-01	-4.8777E-02	9.7052E+01	-1.6367E-05	-2.8542E-05	-2.8542E-05
14	3.0000E+00	0.E+00	-2.1456E-01	-8.4315E-02	9.7052E+01	-9.9023E-06	-4.7251E-05	-4.7251E-05
15	3.0000E+00	0.E+00	0.E+00	0.E+00	9.7052E+01	1.5887E-05	-3.2344E-05	-3.2344E-05
16	3.2500E+00	0.E+00	3.3415E-02	-3.1915E-03	9.7052E+01	1.0203E-05	-3.2799E-05	-3.2799E-05
17	3.5000E+00	0.E+00	5.3180E-02	-1.1191E-02	9.7052E+01	4.2915E-06	-3.4889E-05	-3.4889E-05
18	3.7500E+00	0.E+00	5.6913E-02	-2.1451E-02	9.7052E+01	-2.2406E-06	-3.9631E-05	-3.9631E-05
19	4.0000E+00	0.E+00	4.0641E-02	-3.0830E-02	9.7052E+01	-9.9023E-06	-4.7251E-05	-4.7251E-05
20	4.0000E+00	0.E+00	-1.7391E-01	-1.1515E-01	9.7052E+01	-9.9023E-06	-4.7251E-05	-4.7251E-05
21	4.2500E+00	0.E+00	-2.2115E-01	-8.2255E-02	9.7052E+01	-2.0982E-05	-7.5513E-05	-7.5513E-05
22	4.5000E+00	0.E+00	-3.1211E-01	-3.6890E-02	9.7052E+01	-3.6238E-05	-9.3076E-05	-9.3076E-05
23	4.7500E+00	0.E+00	-4.6095E-01	3.0296E-02	9.7052E+01	-5.3418E-05	-9.5121E-05	-9.5121E-05
24	5.0000E+00	0.E+00	-6.7438E-01	1.3075E-01	9.7052E+01	-6.9148E-05	-7.3837E-05	-7.3837E-05
25	5.0000E+00	0.E+00	0.E+00	0.E+00	9.7052E+01	1.6789E-05	-8.6272E-05	-8.6272E-05
26	5.2500E+00	0.E+00	2.0343E-02	-4.0686E-03	9.7052E+01	-4.8110E-06	-8.6725E-05	-8.6725E-05
27	5.5000E+00	0.E+00	-3.2939E-02	-4.0389E-03	9.7052E+01	-2.6673E-05	-8.8177E-05	-8.8177E-05
28	5.7500E+00	0.E+00	-1.6081E-01	1.8623E-02	9.7052E+01	-4.8686E-05	-8.6876E-05	-8.6876E-05
29	6.0000E+00	0.E+00	-3.6153E-01	8.2466E-02	9.7052E+01	-6.9148E-05	-7.3837E-05	-7.3837E-05
30	6.0000E+00	-3.6161E+00	1.1540E+02	2.5391E+01	9.7052E+01	-6.9148E-05	-7.3837E-05	-7.3837E-05
31	6.2500E+00	1.4171E+01	9.9728E+01	7.5246E+00	9.7052E+01	4.0476E-04	4.4381E-03	4.4381E-03
32	6.5000E+00	3.2343E+01	8.6453E+01	-4.8599E+00	9.7051E+01	1.2851E-03	4.7132E-03	4.7132E-03
33	6.7500E+00	5.0925E+01	7.6120E+01	-1.2056E+01	9.7050E+01	1.9539E-03	2.2362E-03	2.2362E-03
34	7.0000E+00	6.9944E+01	6.7407E+01	-1.4292E+01	9.7050E+01	2.0483E-03	-1.5826E-03	-1.5826E-03
35	7.2500E+00	8.9430E+01	5.7777E+01	-1.1455E+01	9.7051E+01	1.4525E-03	-5.3471E-03	-5.3471E-03
36	7.5000E+00	1.0942E+02	4.4330E+01	-2.9565E+00	9.7052E+01	3.0399E-04	-7.5557E-03	-7.5557E-03
37	7.7500E+00	1.2994E+02	2.4954E+01	1.2234E+01	9.7053E+01	-9.7748E-04	-6.4659E-03	-6.4659E-03
38	8.0000E+00	1.5104E+02	-1.3084E-04	3.5312E+01	9.7054E+01	-1.6342E-03	-5.9819E-08	-6.0730E-08
39	8.0000E+00	1.5104E+02	-1.3085E-04	3.5312E+01	9.7054E+01	-1.6342E-03	-5.9817E-08	-6.0730E-08
40	8.2500E+00	1.2994E+02	-2.4954E+01	1.2234E+01	9.7055E+01	-9.7751E-04	6.4659E-03	6.4659E-03
41	8.5000E+00	1.0942E+02	-4.4330E+01	-2.9566E+00	9.7056E+01	3.0396E-04	7.5557E-03	7.5557E-03
42	8.7500E+00	8.9430E+01	-5.7777E+01	-1.1455E+01	9.7057E+01	1.4525E-03	5.3471E-03	5.3471E-03
43	9.0000E+00	6.9944E+01	-6.7407E+01	-1.4292E+01	9.7058E+01	2.0483E-03	1.5826E-03	1.5826E-03
44	9.2500E+00	5.0925E+01	-7.6121E+01	-1.2056E+01	9.7058E+01	1.9539E-03	-2.2362E-03	-2.2362E-03
45	9.5000E+00	3.2343E+01	-8.6453E+01	-4.8598E+00	9.7057E+01	1.2851E-03	-4.7132E-03	-4.7132E-03
46	9.7500E+00	1.4171E+01	-9.9729E+01	7.5248E+00	9.7056E+01	4.0477E-04	-4.4381E-03	-4.4381E-03
47	1.0000E+01	-3.6161E+00	-1.1540E+02	2.5391E+01	9.7056E+01	-6.9145E-05	7.3831E-05	7.3831E-05
48	1.0000E+01	0.E+00	0.E+00	0.E+00	9.7056E+01	1.6787E-05	8.6268E-05	8.6268E-05
49	1.0250E+01	0.E+00	2.0338E-02	4.0680E-03	9.7056E+01	-4.8118E-06	8.6721E-05	8.6721E-05
50	1.0500E+01	0.E+00	-3.2944E-02	4.0369E-03	9.7056E+01	-2.6672E-05	8.8172E-05	8.8172E-05
51	1.0750E+01	0.E+00	-1.6081E-01	-1.8626E-02	9.7056E+01	-4.8684E-05	8.6870E-05	8.6870E-05
52	1.1000E+01	0.E+00	-3.6153E-01	-8.2468E-02	9.7056E+01	-6.9145E-05	7.3831E-05	7.3831E-05
53	1.1000E+01	0.E+00	0.E+00	0.E+00	9.7056E+01	1.5886E-05	3.2343E-05	3.2343E-05
54	1.1250E+01	0.E+00	3.3913E-02	3.1914E-03	9.7056E+01	1.0202E-05	3.2798E-05	3.2798E-05
55	1.1500E+01	0.E+00	5.3176E-02	1.1191E-02	9.7056E+01	4.2910E-06	3.4888E-05	3.4888E-05
56	1.1750E+01	0.E+00	5.6909E-02	2.1449E-02	9.7056E+01	-2.2408E-06	3.9630E-05	3.9630E-05
57	1.2000E+01	0.E+00	4.0636E-02	3.0828E-02	9.7056E+01	-9.9023E-06	4.7249E-05	4.7249E-05
58	1.2000E+01	0.E+00	0.E+00	0.E+00	9.7056E+01	-2.5586E-05	1.4385E-05	1.4385E-05
59	1.2250E+01	0.E+00	-6.2410E-02	5.6042E-03	9.7056E+01	-2.3126E-05	1.4977E-05	1.4977E-05

60	1.2500E+01	0.E+00	-1.2111E-01	2.2086E-02	9.7056E+01	-2.0328E-05	1.8697E-05	1.8697E-05
61	1.2750E+01	0.E+00	-1.7374E-01	4.8776E-02	9.7056E+01	-1.6367E-05	2.8541E-05	2.8541E-05
62	1.3000E+01	0.E+00	-2.1455E-01	8.4313E-02	9.7056E+01	-9.9023E-06	4.7249E-05	4.7249E-05
63	1.3000E+01	0.E+00	-1.7391E-01	1.1514E-01	9.7056E+01	-9.9023E-06	4.7249E-05	4.7249E-05
64	1.3250E+01	0.E+00	-2.2115E-01	8.2250E-02	9.7056E+01	-2.0981E-05	7.5510E-05	7.5510E-05
65	1.3500E+01	0.E+00	-3.1210E-01	3.6886E-02	9.7056E+01	-3.6237E-05	9.3072E-05	9.3072E-05
66	1.3750E+01	0.E+00	-4.6094E-01	-3.0299E-02	9.7056E+01	-5.3416E-05	9.5115E-05	9.5115E-05
67	1.4000E+01	0.E+00	-6.7436E-01	-1.3076E-01	9.7056E+01	-6.9145E-05	7.3831E-05	7.3831E-05
68	1.4000E+01	-3.6161E+00	-1.2769E+02	2.6179E+01	9.7056E+01	-6.9145E-05	7.3831E-05	7.3831E-05
69	1.4250E+01	-2.1043E+01	-1.0912E+02	7.1562E+00	9.7056E+01	-5.7566E-04	4.5936E-03	4.5936E-03
70	1.4500E+01	-3.8129E+01	-9.3308E+01	-5.5676E+00	9.7057E+01	-1.4579E-03	4.6518E-03	4.6518E-03
71	1.4750E+01	-5.4896E+01	-8.0129E+01	-1.2578E+01	9.7058E+01	-2.0786E-03	1.9553E-03	1.9553E-03
72	1.5000E+01	-7.1362E+01	-6.8011E+01	-1.4308E+01	9.7058E+01	-2.0922E-03	-1.9467E-03	-1.9467E-03
73	1.5250E+01	-8.7542E+01	-5.4983E+01	-1.0881E+01	9.7057E+01	-1.4207E-03	-5.5926E-03	-5.5926E-03
74	1.5500E+01	-1.0345E+02	-3.9451E+01	-2.1269E+00	9.7056E+01	-2.4227E-04	-7.5191E-03	-7.5191E-03
75	1.5750E+01	-1.1911E+02	-2.0614E+01	1.2289E+01	9.7055E+01	1.0065E-03	-6.1942E-03	-6.1942E-03
76	1.6000E+01	-1.3453E+02	1.3283E-04	3.2645E+01	9.7054E+01	1.6141E-03	-8.2616E-08	-8.2716E-08

ENTRY	S	W	X	SIG S	SIG PHI	SIG SZ	SIG STR
1	0.E+00	6.8629E+01	0.E+00	-2.0538E+04	-3.5204E+03	0.E+00	
			5.0000E-02			-1.4269E+03	
			1.0000E-01	1.8636E+04	6.2730E+03	0.E+00	
2	2.5000E-01	6.8628E+01	0.E+00	-8.3628E+03	-8.4316E+02	0.E+00	
			5.0000E-02			-1.0518E+03	
			1.0000E-01	6.3839E+03	2.3976E+03	5.6843E-14	
3	5.0000E-01	6.8626E+01	0.E+00	2.6549E+02	9.0877E+01	0.E+00	
			5.0000E-02			-6.9026E+02	
			1.0000E-01	-2.2865E+03	-1.0983E+03	6.1107E-13	
4	7.5000E-01	6.8625E+01	0.E+00	5.5206E+03	8.8749E+01	0.E+00	
			5.0000E-02			-3.5380E+02	
			1.0000E-01	-7.5363E+03	-3.5931E+03	-3.6948E-13	
5	1.0000E+00	6.8624E+01	0.E+00	7.5992E+03	-2.7742E+02	0.E+00	
			5.0000E-02			-3.8420E+01	
			1.0000E-01	-9.5702E+03	-4.7179E+03	5.6843E-14	
6	1.2500E+00	6.8624E+01	0.E+00	6.5921E+03	-7.0789E+02	0.E+00	
			5.0000E-02			2.7043E+02	
			1.0000E-01	-8.5017E+03	-4.3297E+03	-5.6843E-14	
7	1.5000E+00	6.8625E+01	0.E+00	2.4111E+03	-1.2121E+03	0.E+00	
			5.0000E-02			5.9175E+02	
			1.0000E-01	-4.2699E+03	-2.5144E+03	-4.8317E-13	
8	1.7500E+00	6.8626E+01	0.E+00	-5.2141E+03	-2.1458E+03	0.E+00	
			5.0000E-02			9.4051E+02	
			1.0000E-01	3.3733E+03	3.7172E+02	-1.9540E-14	
9	2.0000E+00	6.8626E+01	0.E+00	-1.6636E+04	-4.2426E+03	0.E+00	
			5.0000E-02			1.3161E+03	
			1.0000E-01	1.4779E+04	3.6173E+03	-1.1369E-13	
10	2.0000E+00	6.8626E+01	0.E+00	-9.0350E-16	-2.6095E+01	0.E+00	
			5.0000E-02			1.3323E-15	
			1.0000E-01	9.0350E-16	-2.5078E+01	2.6645E-15	
11	2.2500E+00	6.8626E+01	0.E+00	3.8039E+00	-2.3131E+01	0.E+00	
			5.0000E-02			-6.6200E-01	
			1.0000E-01	-2.9213E+00	-2.3734E+01	1.7764E-15	
12	2.5000E+00	6.8626E+01	0.E+00	1.4108E+01	-1.8232E+01	0.E+00	
			5.0000E-02			-1.2846E+00	
			1.0000E-01	-1.2396E+01	-2.3487E+01	1.7764E-15	
13	2.7500E+00	6.8626E+01	0.E+00	3.0495E+01	-1.0725E+01	0.E+00	
			5.0000E-02			-1.8429E+00	
			1.0000E-01	-2.8038E+01	-2.3227E+01	4.4409E-15	
14	3.0000E+00	6.8626E+01	0.E+00	5.2106E+01	5.7310E-01	0.E+00	
			5.0000E-02			-2.2758E+00	
			1.0000E-01	-4.9072E+01	-2.1126E+01	-4.4409E-16	
15	3.0000E+00	6.8626E+01	0.E+00	-1.8070E-15	1.4743E+01	0.E+00	
			5.0000E-02			-1.5543E-15	
			1.0000E-01	1.8070E-15	1.7030E+01	-3.1086E-15	
16	3.2500E+00	6.8626E+01	0.E+00	1.6786E+00	9.6253E+00	0.E+00	
			5.0000E-02			-3.5441E-01	
			1.0000E-01	-2.1512E+00	1.1029E+01	3.1086E-15	
17	3.5000E+00	6.8626E+01	0.E+00	6.3388E+00	4.7547E+00	0.E+00	
			5.0000E-02			-5.6404E-01	
			1.0000E-01	-7.0909E+00	3.9548E+00	-2.2204E-16	
18	3.7500E+00	6.8626E+01	0.E+00	1.2468E+01	-7.2872E-01	0.E+00	
			5.0000E-02			-6.0364E-01	
			1.0000E-01	-1.3273E+01	-4.2046E+00	3.8858E-16	
19	4.0000E+00	6.8626E+01	0.E+00	1.8211E+01	-7.9009E+00	0.E+00	
			5.0000E-02			-4.3104E-01	
			1.0000E-01	-1.8785E+01	-1.3554E+01	4.4409E-15	
20	4.0000E+00	6.8626E+01	0.E+00	7.0317E+01	5.1258E+00	0.E+00	
			5.0000E-02			1.8446E+00	
			1.0000E-01	-6.7858E+01	-2.5823E+01	1.1102E-14	

21	4.2500E+00	6.8626E+01	0.E+00	5.0917E+01	-1.3216E+01	0.E+00
			5.0000E-02			2.3455E+00
			1.0000E-01	-4.7789E+01	-3.2035E+01	7.1054E-15
22	4.5000E+00	6.8626E+01	0.E+00	2.4341E+01	-3.8134E+01	0.E+00
			5.0000E-02			3.3101E+00
			1.0000E-01	-1.9927E+01	-4.1839E+01	1.0658E-14
23	4.7500E+00	6.8627E+01	0.E+00	-1.4918E+01	-6.8529E+01	0.E+00
			5.0000E-02			4.8887E+00
			1.0000E-01	2.1437E+01	-5.1765E+01	3.5527E-15
24	5.0000E+00	6.8627E+01	0.E+00	-7.3684E+01	-1.0200E+02	0.E+00
			5.0000E-02			7.1524E+00
			1.0000E-01	8.3221E+01	-5.6692E+01	1.0658E-14
25	5.0000E+00	-1.6789E-05	0.E+00	0.E+00	1.9554E+01	0.E+00
			5.0000E-02			0.E+00
			1.0000E-01	0.E+00	1.9554E+01	0.E+00
26	5.2500E+00	4.8110E-06	0.E+00	2.4412E+00	-4.9932E+00	0.E+00
			5.0000E-02			-3.0514E-01
			1.0000E-01	-2.4412E+00	-6.2138E+00	0.E+00
27	5.5000E+00	2.6673E-05	0.E+00	2.4233E+00	-3.0461E+01	0.E+00
			5.0000E-02			4.9408E-01
			1.0000E-01	-2.4233E+00	-3.1672E+01	0.E+00
28	5.7500E+00	4.8686E-05	0.E+00	-1.1174E+01	-5.9499E+01	0.E+00
			5.0000E-02			2.4121E+00
			1.0000E-01	1.1174E+01	-5.3912E+01	0.E+00
29	6.0000E+00	6.9148E-05	0.E+00	-4.9480E+01	-9.2908E+01	0.E+00
			5.0000E-02			5.4230E+00
			1.0000E-01	4.9480E+01	-6.8168E+01	0.E+00
30	6.0000E+00	6.8627E+01	0.E+00	-1.6025E+04	-4.0898E+03	0.E+00
			5.0000E-02			-1.2623E+03
			1.0000E-01	1.4444E+04	3.5335E+03	-5.6843E-14
31	6.2500E+00	6.8626E+01	0.E+00	-5.3202E+03	-6.6211E+02	0.E+00
			5.0000E-02			-9.1283E+02
			1.0000E-01	3.7094E+03	1.2221E+03	-1.7053E-13
32	6.5000E+00	6.8625E+01	0.E+00	2.0759E+03	2.2824E+03	0.E+00
			5.0000E-02			-5.7986E+02
			1.0000E-01	-3.7560E+03	4.1961E+02	-1.0232E-12
33	6.7500E+00	6.8624E+01	0.E+00	6.3352E+03	4.1075E+03	0.E+00
			5.0000E-02			-2.7025E+02
			1.0000E-01	-8.1319E+03	2.9445E+02	-1.1369E-12
34	7.0000E+00	6.8624E+01	0.E+00	7.6039E+03	4.4297E+03	0.E+00
			5.0000E-02			2.9215E+01
			1.0000E-01	-9.5463E+03	2.8421E+02	-6.8212E-13
35	7.2500E+00	6.8625E+01	0.E+00	5.8323E+03	3.0985E+03	0.E+00
			5.0000E-02			3.4408E+02
			1.0000E-01	-7.9141E+03	1.5284E+02	2.2737E-13
36	7.5000E+00	6.8626E+01	0.E+00	6.8676E+02	2.2067E+02	0.E+00
			5.0000E-02			7.0267E+02
			1.0000E-01	-2.8611E+03	4.3693E+01	1.1369E-12
37	7.7500E+00	6.8628E+01	0.E+00	-8.4355E+03	-3.7502E+03	0.E+00
			5.0000E-02			1.1242E+03
			1.0000E-01	6.2450E+03	5.4216E+02	8.8107E-13
38	8.0000E+00	6.8629E+01	0.E+00	-2.2255E+04	-7.8424E+03	0.E+00
			5.0000E-02			1.6020E+03
			1.0000E-01	2.0119E+04	2.7511E+03	2.2737E-13
39	8.0000E+00	-6.8627E+01	0.E+00	-2.2255E+04	-7.8424E+03	0.E+00
			5.0000E-02			-1.6020E+03
			1.0000E-01	2.0119E+04	2.7511E+03	-3.9790E-13
40	8.2500E+00	-6.8628E+01	0.E+00	-8.4355E+03	-3.7502E+03	0.E+00
			5.0000E-02			-1.1242E+03
			1.0000E-01	6.2450E+03	5.4210E+02	-1.1084E-12
41	8.5000E+00	-6.8629E+01	0.E+00	6.8684E+02	2.2065E+02	0.E+00
			5.0000E-02			-7.0266E+02
			1.0000E-01	-2.8611E+03	4.3633E+01	-1.7053E-13
42	8.7500E+00	-6.8631E+01	0.E+00	5.8323E+03	3.0985E+03	0.E+00
			5.0000E-02			-3.4407E+02
			1.0000E-01	-7.9142E+03	1.5280E+02	2.2737E-13

43	9.0000E+00	-6.8632E+01	0.E+00	7.6039E+03	4.4297E+03	0.E+00
			5.0000E-02			-2.9205E+01
			1.0000E-01	-9.5463E+03	2.8420E+02	4.5475E-13
44	9.2500E+00	-6.8632E+01	0.E+00	6.3351E+03	4.1075E+03	0.E+00
			5.0000E-02			2.7026E+02
			1.0000E-01	-8.1319E+03	2.9446E+02	9.0949E-13
45	9.5000E+00	-6.8631E+01	0.E+00	2.0758E+03	2.2824E+03	0.E+00
			5.0000E-02			5.7987E+02
			1.0000E-01	-3.7559E+03	4.1964E+02	7.9581E-13
46	9.7500E+00	-6.8630E+01	0.E+00	-5.3203E+03	-6.6212E+02	0.E+00
			5.0000E-02			9.1284E+02
			1.0000E-01	3.7095E+03	1.2221E+03	-1.7053E-13
47	1.0000E+01	-6.8629E+01	0.E+00	-1.6025E+04	-4.0898E+03	0.E+00
			5.0000E-02			1.2623E+03
			1.0000E-01	1.4444E+04	3.5335E+03	-3.1264E-13
48	1.0000E+01	1.6787E-05	0.E+00	0.E+00	1.9552E+01	0.E+00
			5.0000E-02			0.E+00
			1.0000E-01	0.E+00	1.9552E+01	0.E+00
49	1.0250E+01	-4.8118E-06	0.E+00	-2.4408E+00	-6.2146E+00	0.E+00
			5.0000E-02			3.0507E-01
			1.0000E-01	2.4408E+00	-4.9942E+00	0.E+00
50	1.0500E+01	-2.6672E-05	0.E+00	-2.4221E+00	-3.1671E+01	0.E+00
			5.0000E-02			-4.9416E-01
			1.0000E-01	2.4221E+00	-3.0460E+01	0.E+00
51	1.0750E+01	-4.8684E-05	0.E+00	1.1175E+01	-5.3910E+01	0.E+00
			5.0000E-02			-2.4122E+00
			1.0000E-01	-1.1175E+01	-5.9497E+01	0.E+00
52	1.1000E+01	-6.9145E-05	0.E+00	4.9481E+01	-6.8164E+01	0.E+00
			5.0000E-02			-5.4229E+00
			1.0000E-01	-4.9481E+01	-9.2905E+01	0.E+00
53	1.1000E+01	6.8629E+01	0.E+00	1.8070E-15	1.7029E+01	0.E+00
			5.0000E-02			-2.4425E-15
			1.0000E-01	-1.8070E-15	1.4742E+01	-4.8850E-15
54	1.1250E+01	6.8629E+01	0.E+00	-2.1511E+00	1.1028E+01	0.E+00
			5.0000E-02			3.5439E-01
			1.0000E-01	1.6785E+00	9.6246E+00	-4.4409E-16
55	1.1500E+01	6.8629E+01	0.E+00	-7.0905E+00	3.9543E+00	0.E+00
			5.0000E-02			5.6400E-01
			1.0000E-01	6.3384E+00	4.7541E+00	4.4409E-16
56	1.1750E+01	6.8629E+01	0.E+00	-1.3272E+01	-4.2047E+00	0.E+00
			5.0000E-02			6.0359E-01
			1.0000E-01	1.2467E+01	-7.2917E-01	2.8311E-15
57	1.2000E+01	6.8629E+01	0.E+00	-1.8784E+01	-1.3554E+01	0.E+00
			5.0000E-02			4.3099E-01
			1.0000E-01	1.8209E+01	-7.9011E+00	1.2879E-14
58	1.2000E+01	6.8629E+01	0.E+00	9.0350E-16	-2.5077E+01	0.E+00
			5.0000E-02			1.3323E-15
			1.0000E-01	-9.0350E-16	-2.6094E+01	1.7764E-15
59	1.2250E+01	6.8629E+01	0.E+00	-2.9212E+00	-2.3733E+01	0.E+00
			5.0000E-02			6.6197E-01
			1.0000E-01	3.8038E+00	-2.3130E+01	3.5527E-15
60	1.2500E+01	6.8629E+01	0.E+00	-1.2395E+01	-2.3486E+01	0.E+00
			5.0000E-02			1.2846E+00
			1.0000E-01	1.4108E+01	-1.8231E+01	2.6645E-15
61	1.2750E+01	6.8629E+01	0.E+00	-2.8037E+01	-2.3227E+01	0.E+00
			5.0000E-02			1.8429E+00
			1.0000E-01	3.0494E+01	-1.0725E+01	3.5527E-15
62	1.3000E+01	6.8629E+01	0.E+00	-4.9071E+01	-2.1126E+01	0.E+00
			5.0000E-02			2.2758E+00
			1.0000E-01	5.2105E+01	5.7282E-01	3.1086E-15
63	1.3000E+01	6.8629E+01	0.E+00	-6.7855E+01	-2.5822E+01	0.E+00
			5.0000E-02			-1.8446E+00
			1.0000E-01	7.0314E+01	5.1251E+00	1.1102E-14
64	1.3250E+01	6.8629E+01	0.E+00	-4.7786E+01	-3.2034E+01	0.E+00
			5.0000E-02			-2.3455E+00
			1.0000E-01	5.0914E+01	-1.3216E+01	0.E+00

65	1.3500E+01	6.8629E+01	0.E+00	-1.9924E+01	-4.1837E+01	0.E+00
			5.0000E-02			-3.3101E+00
			1.0000E-01	2.4338E+01	-3.8133E+01	3.5527E-15
66	1.3750E+01	6.8629E+01	0.E+00	2.1439E+01	-5.1762E+01	0.E+00
			5.0000E-02			-4.8886E+00
			1.0000E-01	-1.4920E+01	-6.8527E+01	1.4211E-14
67	1.4000E+01	6.8629E+01	0.E+00	8.3222E+01	-5.6689E+01	0.E+00
			5.0000E-02			-7.1522E+00
			1.0000E-01	-7.3685E+01	-1.0200E+02	1.7764E-14
68	1.4000E+01	-6.8629E+01	0.E+00	-1.6636E+04	-4.2426E+03	0.E+00
			5.0000E-02			-1.3161E+03
			1.0000E-01	1.4779E+04	3.6173E+03	-3.4106E-13
69	1.4250E+01	-6.8630E+01	0.E+00	-5.2141E+03	-2.1458E+03	0.E+00
			5.0000E-02			-9.4051E+02
			1.0000E-01	3.3734E+03	3.7173E+02	1.4033E-13
70	1.4500E+01	-6.8631E+01	0.E+00	2.4111E+03	-1.2121E+03	0.E+00
			5.0000E-02			-5.9175E+02
			1.0000E-01	-4.2700E+03	-2.5144E+03	5.4001E-13
71	1.4750E+01	-6.8632E+01	0.E+00	6.5922E+03	-7.0792E+02	0.E+00
			5.0000E-02			-2.7043E+02
			1.0000E-01	-8.5018E+03	-4.3297E+03	-5.1159E-13
72	1.5000E+01	-6.8632E+01	0.E+00	7.5993E+03	-2.7746E+02	0.E+00
			5.0000E-02			3.8418E+01
			1.0000E-01	-9.5703E+03	-4.7180E+03	-2.8422E-13
73	1.5250E+01	-6.8631E+01	0.E+00	5.5208E+03	8.8708E+01	0.E+00
			5.0000E-02			3.5379E+02
			1.0000E-01	-7.5364E+03	-3.5932E+03	-5.4001E-13
74	1.5500E+01	-6.8629E+01	0.E+00	2.6566E+02	9.0856E+01	0.E+00
			5.0000E-02			6.9026E+02
			1.0000E-01	-2.2866E+03	-1.0984E+03	-1.3216E-12
75	1.5750E+01	-6.8628E+01	0.E+00	-8.3626E+03	-8.4315E+02	0.E+00
			5.0000E-02			1.0518E+03
			1.0000E-01	6.3838E+03	2.3976E+03	-4.5475E-13
76	1.6000E+01	-6.8627E+01	0.E+00	-2.0538E+04	-3.5204E+03	0.E+00
			5.0000E-02			1.4269E+03
			1.0000E-01	1.8636E+04	6.2730E+03	2.2737E-13

LINEAR PERTURBATION STATE

ENTRY	S	P	W	MI	XI	ETA	CHI	CHI1
1	0.E+00	-1.3451E+02	-6.7532E-04	3.2916E+01	-5.6491E+00	1.6440E-03	5.8423E-08	-8.2685E-08
2	2.5000E-01	-1.1909E+02	2.0885E+01	1.2487E+01	-5.6497E+00	1.0314E-03	6.2636E-03	6.1941E-03
3	5.0000E-01	-1.0343E+02	3.9575E+01	-2.0888E+00	-5.6510E+00	-2.2843E-04	7.6228E-03	7.5190E-03
4	7.5000E-01	-8.7521E+01	5.5129E+01	-1.0989E+01	-5.6523E+00	-1.4207E-03	5.6857E-03	5.5927E-03
5	1.0000E+00	-7.1340E+01	6.8141E+01	-1.4487E+01	-5.6530E+00	-2.1037E-03	1.9976E-03	1.9468E-03
6	1.2500E+00	-5.4874E+01	8.0218E+01	-1.2736E+01	-5.6530E+00	-2.0946E-03	-1.9539E-03	-1.9552E-03
7	1.5000E+00	-3.8107E+01	9.3354E+01	-5.6291E+00	-5.6524E+00	-1.4698E-03	-4.6827E-03	-4.6517E-03
8	1.7500E+00	-2.1019E+01	1.0914E+02	7.2190E+00	-5.6515E+00	-5.7944E-04	-4.6245E-03	-4.5935E-03
9	2.0000E+00	-3.5925E+00	1.2771E+02	2.6314E+01	-5.6510E+00	-6.8994E-05	-7.4725E-05	-7.3837E-05
10	2.0000E+00	0.E+00	0.E+00	0.E+00	-5.6511E+00	-2.5417E-05	-1.4448E-05	-1.4386E-05
11	2.2500E+00	0.E+00	-6.1962E-02	-5.5653E-03	-5.6511E+00	-2.2945E-05	-1.5037E-05	-1.4978E-05
12	2.5000E+00	0.E+00	-1.2016E-01	-2.1924E-02	-5.6511E+00	-2.0137E-05	-1.8731E-05	-1.8698E-05
13	2.7500E+00	0.E+00	-1.7225E-01	-4.8395E-02	-5.6511E+00	-1.6175E-05	-2.8500E-05	-2.8542E-05
14	3.0000E+00	0.E+00	-2.1251E-01	-8.3614E-02	-5.6511E+00	-9.7284E-06	-4.7058E-05	-4.7251E-05
15	3.0000E+00	0.E+00	0.E+00	0.E+00	-5.6511E+00	1.5887E-05	-3.2092E-05	-3.2344E-05
16	3.2500E+00	0.E+00	3.3474E-02	-3.1947E-03	-5.6511E+00	1.0248E-05	-3.2546E-05	-3.2799E-05
17	3.5000E+00	0.E+00	5.3421E-02	-1.1219E-02	-5.6511E+00	4.3820E-06	-3.4639E-05	-3.4889E-05
18	3.7500E+00	0.E+00	5.7468E-02	-2.1546E-02	-5.6511E+00	-2.1061E-06	-3.9396E-05	-3.9631E-05
19	4.0000E+00	0.E+00	4.1647E-02	-3.1063E-02	-5.6511E+00	-9.7284E-06	-4.7058E-05	-4.7251E-05
20	4.0000E+00	0.E+00	-1.7086E-01	-1.1468E-01	-5.6511E+00	-9.7284E-06	-4.7058E-05	-4.7251E-05
21	4.2500E+00	0.E+00	-2.1747E-01	-8.2378E-02	-5.6511E+00	-2.0765E-05	-7.5268E-05	-7.5513E-05
22	4.5000E+00	0.E+00	-3.0765E-01	-3.7741E-02	-5.6511E+00	-3.5985E-05	-9.2964E-05	-9.3076E-05
23	4.7500E+00	0.E+00	-4.5560E-01	2.8552E-02	-5.6511E+00	-5.3170E-05	-9.5369E-05	-9.5121E-05
24	5.0000E+00	0.E+00	-6.6824E-01	1.2795E-01	-5.6510E+00	-6.8994E-05	-7.4725E-05	-7.3837E-05
25	5.0000E+00	0.E+00	0.E+00	0.E+00	-5.6510E+00	1.7148E-05	-8.6247E-05	-8.6272E-05
26	5.2500E+00	0.E+00	2.1570E-02	-4.2216E-03	-5.6510E+00	-4.4468E-06	-8.6715E-05	-8.6725E-05
27	5.5000E+00	0.E+00	-3.0481E-02	-4.6529E-03	-5.6510E+00	-2.6316E-05	-8.8268E-05	-8.8177E-05
28	5.7500E+00	0.E+00	-1.5721E-01	1.7248E-02	-5.6510E+00	-4.8381E-05	-8.7239E-05	-8.6876E-05
29	6.0000E+00	0.E+00	-3.5712E-01	8.0079E-02	-5.6510E+00	-6.8994E-05	-7.4725E-05	-7.3837E-05
30	6.0000E+00	-3.5925E+00	1.1545E+02	2.5508E+01	-5.6510E+00	-6.8994E-05	-7.4725E-05	-7.3837E-05
31	6.2500E+00	1.4196E+01	9.9786E+01	7.5871E+00	-5.6515E+00	4.0816E-04	4.4647E-03	4.4381E-03
32	6.5000E+00	3.2368E+01	8.6538E+01	-4.9055E+00	-5.6523E+00	1.2960E-03	4.7427E-03	4.7132E-03
33	6.7500E+00	5.0950E+01	7.6259E+01	-1.2197E+01	-5.6530E+00	1.9694E-03	2.2386E-03	2.2362E-03
34	7.0000E+00	6.9969E+01	6.7605E+01	-1.4469E+01	-5.6530E+00	2.0605E-03	-1.6270E-03	-1.5826E-03
35	7.2500E+00	8.9456E+01	5.8009E+01	-1.1577E+01	-5.6523E+00	1.4540E-03	-5.4363E-03	-5.3471E-03
36	7.5000E+00	1.0944E+02	4.4542E+01	-2.9341E+00	-5.6511E+00	2.9175E-04	-7.6613E-03	-7.5557E-03
37	7.7500E+00	1.2997E+02	2.5086E+01	1.2437E+01	-5.6498E+00	-1.0015E-03	-6.5402E-03	-6.4659E-03
38	8.0000E+00	1.5107E+02	1.8518E-03	3.5613E+01	-5.6491E+00	-1.6638E-03	-5.5918E-08	-5.9819E-08
39	8.0000E+00	1.5107E+02	1.8518E-03	3.5613E+01	-5.6491E+00	-1.6638E-03	-5.5915E-08	-5.9817E-08
40	8.2500E+00	1.2997E+02	-2.5082E+01	1.2436E+01	-5.6484E+00	-1.0015E-03	6.5401E-03	6.4659E-03
41	8.5000E+00	1.0944E+02	-4.4539E+01	-2.9344E+00	-5.6470E+00	2.9175E-04	7.6611E-03	7.5557E-03
42	8.7500E+00	8.9456E+01	-5.8008E+01	-1.1577E+01	-5.6458E+00	1.4540E-03	5.4361E-03	5.3471E-03
43	9.0000E+00	6.9969E+01	-6.7602E+01	-1.4468E+01	-5.6451E+00	2.0605E-03	1.6269E-03	1.5826E-03
44	9.2500E+00	5.0950E+01	-7.6256E+01	-1.2197E+01	-5.6452E+00	1.9694E-03	-2.2386E-03	-2.2362E-03
45	9.5000E+00	3.2368E+01	-8.6535E+01	-4.9052E+00	-5.6458E+00	1.2960E-03	-4.7427E-03	-4.7132E-03
46	9.7500E+00	1.4196E+01	-9.9783E+01	7.5874E+00	-5.6466E+00	4.0813E-04	-4.4647E-03	-4.4381E-03
47	1.0000E+01	-3.5925E+00	-1.1545E+02	2.5508E+01	-5.6471E+00	-6.9025E-05	7.4750E-05	7.3831E-05
48	1.0000E+01	0.E+00	0.E+00	0.E+00	-5.6471E+00	1.7152E-05	8.6285E-05	8.6268E-05
49	1.0250E+01	0.E+00	2.1570E-02	4.2223E-03	-5.6471E+00	-4.4514E-06	8.6752E-05	8.6721E-05
50	1.0500E+01	0.E+00	-3.0513E-02	4.6503E-03	-5.6471E+00	-2.6330E-05	8.8305E-05	8.8172E-05
51	1.0750E+01	0.E+00	-1.5731E-01	-1.7266E-02	-5.6471E+00	-4.8404E-05	8.7274E-05	8.6870E-05
52	1.1000E+01	0.E+00	-3.5730E-01	-8.0131E-02	-5.6471E+00	-6.9025E-05	7.4750E-05	7.3831E-05
53	1.1000E+01	0.E+00	0.E+00	0.E+00	-5.6470E+00	1.5894E-05	3.2108E-05	3.2343E-05
54	1.1250E+01	0.E+00	3.3488E-02	3.1960E-03	-5.6470E+00	1.0252E-05	3.2561E-05	3.2798E-05
55	1.1500E+01	0.E+00	5.3442E-02	1.1223E-02	-5.6470E+00	4.3831E-06	3.4655E-05	3.4888E-05
56	1.1750E+01	0.E+00	5.7489E-02	2.1555E-02	-5.6470E+00	-2.1080E-06	3.9414E-05	3.9630E-05
57	1.2000E+01	0.E+00	4.1657E-02	3.1075E-02	-5.6470E+00	-9.7339E-06	4.7080E-05	4.7249E-05
58	1.2000E+01	0.E+00	0.E+00	0.E+00	-5.6470E+00	-2.5429E-05	1.4453E-05	1.4385E-05
59	1.2250E+01	0.E+00	-6.1992E-02	5.5680E-03	-5.6470E+00	-2.2957E-05	1.5043E-05	1.4977E-05

60	1.2500E+01	0.E+00	-1.2022E-01	2.1934E-02	-5.6470E+00	-2.0147E-05	1.8738E-05	1.8697E-05
61	1.2750E+01	0.E+00	-1.7234E-01	4.6419E-02	-5.6470E+00	-1.6183E-05	2.8513E-05	2.8541E-05
62	1.3000E+01	0.E+00	-2.1262E-01	8.3655E-02	-5.6470E+00	-9.7339E-06	4.7080E-05	4.7249E-05
63	1.3000E+01	0.E+00	-1.7096E-01	1.1473E-01	-5.6470E+00	-9.7339E-06	4.7080E-05	4.7249E-05
64	1.3250E+01	0.E+00	-2.1760E-01	8.2412E-02	-5.6470E+00	-2.0776E-05	7.5302E-05	7.5510E-05
65	1.3500E+01	0.E+00	-3.0781E-01	3.7750E-02	-5.6471E+00	-3.6002E-05	9.3005E-05	9.3072E-05
66	1.3750E+01	0.E+00	-4.5583E-01	-2.8578E-02	-5.6471E+00	-5.3195E-05	9.5408E-05	9.5115E-05
67	1.4000E+01	0.E+00	-6.6857E-01	-1.2802E-01	-5.6471E+00	-6.9025E-05	7.4750E-05	7.3831E-05
68	1.4000E+01	-3.5925E+00	-1.2771E+02	2.6314E+01	-5.6471E+00	-6.9025E-05	7.4750E-05	7.3831E-05
69	1.4250E+01	-2.1019E+01	-1.0914E+02	7.2184E+00	-5.6466E+00	-5.7947E-04	4.6245E-03	4.5936E-03
70	1.4500E+01	-3.8107E+01	-9.3356E+01	-5.6294E+00	-5.6458E+00	-1.4698E-03	4.6826E-03	4.6518E-03
71	1.4750E+01	-5.4874E+01	-8.0220E+01	-1.2736E+01	-5.6451E+00	-2.0945E-03	1.9538E-03	1.9553E-03
72	1.5000E+01	-7.1340E+01	-6.8143E+01	-1.4487E+01	-5.6452E+00	-2.1036E-03	-1.9977E-03	-1.9467E-03
73	1.5250E+01	-8.7521E+01	-5.5131E+01	-1.0989E+01	-5.6459E+00	-1.4206E-03	-5.6858E-03	-5.5926E-03
74	1.5500E+01	-1.0343E+02	-3.9577E+01	-2.0884E+00	-5.6471E+00	-2.2842E-04	-7.6228E-03	-7.5191E-03
75	1.5750E+01	-1.1909E+02	-2.0887E+01	1.2487E+01	-5.6484E+00	1.0314E-03	-6.2636E-03	-6.1942E-03
76	1.6000E+01	-1.3451E+02	-6.7508E-04	3.2916E+01	-5.6491E+00	1.6440E-03	5.8495E-08	-8.2616E-08

ENTRY	S	W	X	SIG S	SIG PHI	SIG SZ	SIG STR
1	0.E+00	-3.9934E+00	0.E+00	-2.0700E+04	-3.5311E+03	0.E+00	
			5.0000E-02			-1.4267E+03	
			1.0000E-01	1.8798E+04	6.3436E+03	-1.1369E-13	
2	2.5000E-01	-3.9943E+00	0.E+00	-8.4818E+03	-8.4502E+02	0.E+00	
			5.0000E-02			-1.0601E+03	
			1.0000E-01	6.5022E+03	2.4501E+03	2.8422E-13	
3	5.0000E-01	-3.9961E+00	0.E+00	2.4203E+02	1.0309E+02	0.E+00	
			5.0000E-02			-7.0028E+02	
			1.0000E-01	-2.2645E+03	-1.0823E+03	1.6342E-12	
4	7.5000E-01	-3.9978E+00	0.E+00	5.5847E+03	1.0824E+02	0.E+00	
			5.0000E-02			-3.6063E+02	
			1.0000E-01	-7.6021E+03	-3.6130E+03	5.9686E-13	
5	1.0000E+00	-3.9988E+00	0.E+00	7.7060E+03	-2.6123E+02	0.E+00	
			5.0000E-02			-3.9762E+01	
			1.0000E-01	-9.6786E+03	-4.7594E+03	2.2737E-13	
6	1.2500E+00	-3.9988E+00	0.E+00	6.6864E+03	-7.0187E+02	0.E+00	
			5.0000E-02			2.7441E+02	
			1.0000E-01	-8.5969E+03	-4.3711E+03	4.5475E-13	
7	1.5000E+00	-3.9979E+00	0.E+00	2.4479E+03	-1.2174E+03	0.E+00	
			5.0000E-02			5.9900E+02	
			1.0000E-01	-4.3070E+03	-2.5358E+03	2.2737E-13	
8	1.7500E+00	-3.9967E+00	0.E+00	-5.2517E+03	-2.1608E+03	0.E+00	
			5.0000E-02			9.4736E+02	
			1.0000E-01	3.4110E+03	3.7808E+02	-2.6912E-13	
9	2.0000E+00	-3.9960E+00	0.E+00	-1.6717E+04	-4.2626E+03	0.E+00	
			5.0000E-02			1.3167E+03	
			1.0000E-01	1.4860E+04	3.6377E+03	1.1369E-13	
10	2.0000E+00	-3.9960E+00	0.E+00	-9.0350E-16	-2.5928E+01	0.E+00	
			5.0000E-02			8.8818E-16	
			1.0000E-01	9.0350E-16	-2.4906E+01	8.8818E-16	
11	2.2500E+00	-3.9960E+00	0.E+00	3.7773E+00	-2.2955E+01	0.E+00	
			5.0000E-02			-6.5723E-01	
			1.0000E-01	-2.9010E+00	-2.3542E+01	1.7764E-15	
12	2.5000E+00	-3.9960E+00	0.E+00	1.4004E+01	-1.8061E+01	0.E+00	
			5.0000E-02			-1.2746E+00	
			1.0000E-01	-1.2304E+01	-2.3265E+01	1.7764E-15	
13	2.7500E+00	-3.9960E+00	0.E+00	3.0255E+01	-1.0581E+01	0.E+00	
			5.0000E-02			-1.8271E+00	
			1.0000E-01	-2.7819E+01	-2.2971E+01	7.1054E-15	
14	3.0000E+00	-3.9960E+00	0.E+00	5.1671E+01	6.5864E-01	0.E+00	
			5.0000E-02			-2.2542E+00	
			1.0000E-01	-4.8665E+01	-2.0845E+01	-8.8818E-16	
15	3.0000E+00	-3.9960E+00	0.E+00	-1.8070E-15	1.4753E+01	0.E+00	
			5.0000E-02			-2.2204E-16	
			1.0000E-01	1.8070E-15	1.7022E+01	-4.4409E-16	
16	3.2500E+00	-3.9960E+00	0.E+00	1.6801E+00	9.6811E+00	0.E+00	
			5.0000E-02			-3.5502E-01	
			1.0000E-01	-2.1535E+00	1.1065E+01	0.E+00	
17	3.5000E+00	-3.9960E+00	0.E+00	6.3536E+00	4.8614E+00	0.E+00	
			5.0000E-02			-5.6657E-01	
			1.0000E-01	-7.1090E+00	4.0349E+00	3.9968E-15	
18	3.7500E+00	-3.9960E+00	0.E+00	1.2521E+01	-5.6451E-01	0.E+00	
			5.0000E-02			-6.0950E-01	
			1.0000E-01	-1.3334E+01	-4.0867E+00	7.7716E-16	
19	4.0000E+00	-3.9959E+00	0.E+00	1.8344E+01	-7.6732E+00	0.E+00	
			5.0000E-02			-4.4169E-01	
			1.0000E-01	-1.8933E+01	-1.3411E+01	1.3767E-14	
20	4.0000E+00	-3.9959E+00	0.E+00	7.0014E+01	5.2445E+00	0.E+00	
			5.0000E-02			1.8121E+00	
			1.0000E-01	-6.7598E+01	-2.5578E+01	-8.8818E-16	

21	4.2500E+00	-3.9959E+00	0.E+00	5.0965E+01	-1.2957E+01	0.E+00
			5.0000E-02			2.3063E+00
			1.0000E-01	-4.7889E+01	-3.1832E+01	3.5527E-15
22	4.5000E+00	-3.9959E+00	0.E+00	2.4820E+01	-3.7726E+01	0.E+00
			5.0000E-02			3.2625E+00
			1.0000E-01	-2.0469E+01	-4.1695E+01	7.1054E-15
23	4.7500E+00	-3.9959E+00	0.E+00	-1.3910E+01	-6.8004E+01	0.E+00
			5.0000E-02			4.8314E+00
			1.0000E-01	2.0353E+01	-5.1742E+01	7.1054E-15
24	5.0000E+00	-3.9959E+00	0.E+00	-7.2043E+01	-1.0145E+02	0.E+00
			5.0000E-02			7.0867E+00
			1.0000E-01	8.1494E+01	-5.6908E+01	1.0658E-14
25	5.0000E+00	-1.7148E-05	0.E+00	0.E+00	1.9972E+01	0.E+00
			5.0000E-02			0.E+00
			1.0000E-01	0.E+00	1.9972E+01	0.E+00
26	5.2500E+00	4.4468E-06	0.E+00	2.5330E+00	-4.5460E+00	0.E+00
			5.0000E-02			-3.2355E-01
			1.0000E-01	-2.5330E+00	-5.8125E+00	0.E+00
27	5.5000E+00	2.6316E-05	0.E+00	2.7918E+00	-2.9953E+01	0.E+00
			5.0000E-02			4.5722E-01
			1.0000E-01	-2.7918E+00	-3.1348E+01	0.E+00
28	5.7500E+00	4.8381E-05	0.E+00	-1.0349E+01	-5.8938E+01	0.E+00
			5.0000E-02			2.3582E+00
			1.0000E-01	1.0349E+01	-5.3763E+01	0.E+00
29	6.0000E+00	6.8994E-05	0.E+00	-4.8047E+01	-9.2370E+01	0.E+00
			5.0000E-02			5.3568E+00
			1.0000E-01	4.8047E+01	-6.8347E+01	0.E+00
30	6.0000E+00	-3.9959E+00	0.E+00	-1.6096E+04	-4.1074E+03	0.E+00
			5.0000E-02			-1.2625E+03
			1.0000E-01	1.4514E+04	3.5512E+03	-2.5580E-13
31	6.2500E+00	-3.9965E+00	0.E+00	-5.3582E+03	-6.6645E+02	0.E+00
			5.0000E-02			-9.1859E+02
			1.0000E-01	3.7463E+03	1.2342E+03	1.1369E-13
32	6.5000E+00	-3.9977E+00	0.E+00	2.1025E+03	2.3037E+03	0.E+00
			5.0000E-02			-5.8648E+02
			1.0000E-01	-3.7841E+03	4.2464E+02	-1.5916E-12
33	6.7500E+00	-3.9987E+00	0.E+00	6.4187E+03	4.1477E+03	0.E+00
			5.0000E-02			-2.7448E+02
			1.0000E-01	-8.2177E+03	2.9213E+02	-1.1369E-12
34	7.0000E+00	-3.9987E+00	0.E+00	7.7084E+03	4.4693E+03	0.E+00
			5.0000E-02			2.9753E+01
			1.0000E-01	-9.6540E+03	2.7473E+02	-3.4106E-13
35	7.2500E+00	-3.9978E+00	0.E+00	5.9037E+03	3.1142E+03	0.E+00
			5.0000E-02			3.5040E+02
			1.0000E-01	-7.9892E+03	1.4010E+02	-5.6843E-13
36	7.5000E+00	-3.9962E+00	0.E+00	6.7159E+02	1.9565E+02	0.E+00
			5.0000E-02			7.1321E+02
			1.0000E-01	-2.8493E+03	3.5337E+01	4.5475E-13
37	7.7500E+00	-3.9943E+00	0.E+00	-8.5584E+03	-3.8172E+03	0.E+00
			5.0000E-02			1.1338E+03
			1.0000E-01	6.3656E+03	5.4319E+02	-8.5265E-14
38	8.0000E+00	-3.9933E+00	0.E+00	-2.2436E+04	-7.9290E+03	0.E+00
			5.0000E-02			1.6023E+03
			1.0000E-01	2.0300E+04	2.7550E+03	7.9581E-13
39	8.0000E+00	3.9957E+00	0.E+00	-2.2436E+04	-7.9290E+03	0.E+00
			5.0000E-02			-1.6023E+03
			1.0000E-01	2.0300E+04	2.7550E+03	-7.3896E-13
40	8.2500E+00	3.9947E+00	0.E+00	-8.5579E+03	-3.8171E+03	0.E+00
			5.0000E-02			-1.1338E+03
			1.0000E-01	6.3652E+03	5.4303E+02	-1.1653E-12
41	8.5000E+00	3.9929E+00	0.E+00	6.7180E+02	1.9570E+02	0.E+00
			5.0000E-02			-7.1324E+02
			1.0000E-01	-2.8494E+03	3.5281E+01	1.1369E-13
42	8.7500E+00	3.9912E+00	0.E+00	5.9037E+03	3.1142E+03	0.E+00
			5.0000E-02			-3.5043E+02
			1.0000E-01	-7.9891E+03	1.4012E+02	2.2737E-13

43	9.0000E+00	3.9903E+00	0.E+00	7.7083E+03	4.4693E+03	0.E+00
			5.0000E-02			-2.9785E+01
			1.0000E-01	-9.6539E+03	2.7479E+02	1.1369E-13
44	9.2500E+00	3.9904E+00	0.E+00	6.4185E+03	4.1477E+03	0.E+00
			5.0000E-02			2.7445E+02
			1.0000E-01	-8.2175E+03	2.9219E+02	5.6843E-13
45	9.5000E+00	3.9913E+00	0.E+00	2.1023E+03	2.3036E+03	0.E+00
			5.0000E-02			5.8645E+02
			1.0000E-01	-3.7839E+03	4.2468E+02	1.7053E-12
46	9.7500E+00	3.9925E+00	0.E+00	-5.3584E+03	-6.6654E+02	0.E+00
			5.0000E-02			9.1856E+02
			1.0000E-01	3.7465E+03	1.2343E+03	-1.7053E-13
47	1.0000E+01	3.9932E+00	0.E+00	-1.6096E+04	-4.1074E+03	0.E+00
			5.0000E-02			1.2625E+03
			1.0000E-01	1.4514E+04	3.5511E+03	4.2633E-13
48	1.0000E+01	1.7152E-05	0.E+00	0.E+00	1.9978E+01	0.E+00
			5.0000E-02			0.E+00
			1.0000E-01	0.E+00	1.9978E+01	0.E+00
49	1.0250E+01	-4.4514E-06	0.E+00	-2.5334E+00	-5.8180E+00	0.E+00
			5.0000E-02			3.2355E-01
			1.0000E-01	2.5334E+00	-4.5513E+00	0.E+00
50	1.0500E+01	-2.6330E-05	0.E+00	-2.7902E+00	-3.1364E+01	0.E+00
			5.0000E-02			-4.5769E-01
			1.0000E-01	2.7902E+00	-2.9969E+01	0.E+00
51	1.0750E+01	-4.8404E-05	0.E+00	1.0360E+01	-5.3788E+01	0.E+00
			5.0000E-02			-2.3596E+00
			1.0000E-01	-1.0360E+01	-5.8967E+01	0.E+00
52	1.1000E+01	-6.9025E-05	0.E+00	4.8079E+01	-6.8374E+01	0.E+00
			5.0000E-02			-5.3596E+00
			1.0000E-01	-4.8079E+01	-9.2414E+01	0.E+00
53	1.1000E+01	-3.9930E+00	0.E+00	1.8070E-15	1.7029E+01	0.E+00
			5.0000E-02			-6.6613E-16
			1.0000E-01	-1.8070E-15	1.4759E+01	-1.7764E-15
54	1.1250E+01	-3.9931E+00	0.E+00	-2.1544E+00	1.1070E+01	0.E+00
			5.0000E-02			3.5517E-01
			1.0000E-01	1.6808E+00	9.6848E+00	1.3323E-15
55	1.1500E+01	-3.9931E+00	0.E+00	-7.1120E+00	4.0360E+00	0.E+00
			5.0000E-02			5.6680E-01
			1.0000E-01	6.3562E+00	4.8627E+00	1.5543E-15
56	1.1750E+01	-3.9931E+00	0.E+00	-1.3339E+01	-4.0894E+00	0.E+00
			5.0000E-02			6.0971E-01
			1.0000E-01	1.2526E+01	-5.6601E-01	8.3267E-16
57	1.2000E+01	-3.9931E+00	0.E+00	-1.8939E+01	-1.3418E+01	0.E+00
			5.0000E-02			4.4180E-01
			1.0000E-01	1.8350E+01	-7.6782E+00	9.3259E-15
58	1.2000E+01	-3.9930E+00	0.E+00	9.0350E-16	-2.4918E+01	0.E+00
			5.0000E-02			8.8818E-16
			1.0000E-01	-9.0350E-16	-2.5940E+01	8.8818E-16
59	1.2250E+01	-3.9931E+00	0.E+00	-2.9024E+00	-2.3554E+01	0.E+00
			5.0000E-02			6.5755E-01
			1.0000E-01	3.7791E+00	-2.2966E+01	3.5527E-15
60	1.2500E+01	-3.9931E+00	0.E+00	-1.2310E+01	-2.3277E+01	0.E+00
			5.0000E-02			1.2752E+00
			1.0000E-01	1.4011E+01	-1.8070E+01	3.5527E-15
61	1.2750E+01	-3.9931E+00	0.E+00	-2.7833E+01	-2.2983E+01	0.E+00
			5.0000E-02			1.8280E+00
			1.0000E-01	3.0270E+01	-1.0587E+01	3.5527E-15
62	1.3000E+01	-3.9931E+00	0.E+00	-4.8689E+01	-2.0856E+01	0.E+00
			5.0000E-02			2.2554E+00
			1.0000E-01	5.1696E+01	6.5827E-01	-5.3291E-15
63	1.3000E+01	-3.9931E+00	0.E+00	-6.7629E+01	-2.5591E+01	0.E+00
			5.0000E-02			-1.8131E+00
			1.0000E-01	7.0047E+01	5.2459E+00	4.4409E-15
64	1.3250E+01	-3.9931E+00	0.E+00	-4.7909E+01	-3.1847E+01	0.E+00
			5.0000E-02			-2.3076E+00
			1.0000E-01	5.0986E+01	-1.2964E+01	-1.7764E-15

65	1.3500E+01	-3.9931E+00	0.E+00	-2.0474E+01	-4.1714E+01	0.E+00
			5.0000E-02			-3.2642E+00
			1.0000E-01	2.4827E+01	-3.7745E+01	8.8818E-15
66	1.3750E+01	-3.9931E+00	0.E+00	2.0370E+01	-5.1765E+01	0.E+00
			5.0000E-02			-4.8339E+00
			1.0000E-01	-1.3923E+01	-6.8037E+01	1.7764E-14
67	1.4000E+01	-3.9932E+00	0.E+00	8.1542E+01	-5.6931E+01	0.E+00
			5.0000E-02			-7.0902E+00
			1.0000E-01	-7.2087E+01	-1.0149E+02	2.8422E-14
68	1.4000E+01	3.9931E+00	0.E+00	-1.6717E+04	-4.2626E+03	0.E+00
			5.0000E-02			-1.3167E+03
			1.0000E-01	1.4860E+04	3.6376E+03	-1.7053E-13
69	1.4250E+01	3.9924E+00	0.E+00	-5.2514E+03	-2.1607E+03	0.E+00
			5.0000E-02			-9.4739E+02
			1.0000E-01	3.4107E+03	3.7796E+02	-4.7962E-14
70	1.4500E+01	3.9911E+00	0.E+00	2.4481E+03	-1.2174E+03	0.E+00
			5.0000E-02			-5.9903E+02
			1.0000E-01	-4.3072E+03	-2.5358E+03	5.6843E-13
71	1.4750E+01	3.9903E+00	0.E+00	6.6864E+03	-7.0180E+02	0.E+00
			5.0000E-02			-2.7444E+02
			1.0000E-01	-8.5969E+03	-4.3711E+03	-1.7053E-13
72	1.5000E+01	3.9903E+00	0.E+00	7.7059E+03	-2.6119E+02	0.E+00
			5.0000E-02			3.9737E+01
			1.0000E-01	-9.6785E+03	-4.7593E+03	-4.5475E-13
73	1.5250E+01	3.9912E+00	0.E+00	5.5844E+03	1.0820E+02	0.E+00
			5.0000E-02			3.6060E+02
			1.0000E-01	-7.6018E+03	-3.6129E+03	-5.6843E-13
74	1.5500E+01	3.9930E+00	0.E+00	2.4183E+02	1.0305E+02	0.E+00
			5.0000E-02			7.0025E+02
			1.0000E-01	-2.2643E+03	-1.0823E+03	-6.6791E-13
75	1.5750E+01	3.9948E+00	0.E+00	-8.4818E+03	-8.4503E+02	0.E+00
			5.0000E-02			1.0601E+03
			1.0000E-01	6.5022E+03	2.4501E+03	-2.2737E-13
76	1.6000E+01	3.9957E+00	0.E+00	-2.0700E+04	-3.5311E+03	0.E+00
			5.0000E-02			1.4267E+03
			1.0000E-01	1.8798E+04	6.3436E+03	4.5475E-13

STRUCTURAL STIFFNESS = 9.91079E-03

RATE OF CHANGE OF STRUCTURAL STIFFNESS WITH LOAD FACTOR (LAMBDA) = -2.84097E-04

SRA 201 INPUT DATA LISTING

```
3ND CLOSED BRANCH TEST CASE
   1 1 1 1 1 1 1 1 1  2  1             48.8                 1.-2

C          GEOMETRY TABLE FOLLOWS

1          1 0.          10.          -.70711     .70711     .05
      1    9 2.           8.58578     -.70711     .70711     .05
          10 2.          10.          -.70711     .70711     .05
      2   14 3.           9.29289     -.70711     .70711     .05
          15 3.          10.          -.70711    -.70711     .05
      2   19 4.           9.29289     -.70711    -.70711     .05
          20 4.           9.29289     -.70711    -.70711     .05
      1   24 5.           8.58578     -.70711    -.70711     .05
          25 5.           8.58578     0.         -1.         .05
      1   29 6.           8.58578     0.         -1.         .05
     1    30 6.           8.58578     -.70711    -.70711     .05
          38 8.           7.17156     -.70711    -.70711     .05
          39 8.           7.17156     +.70711    -.70711     .05
      3   47 10.          8.58578     +.70711    -.70711     .05
          48 10.          8.58578     0.          1.         .05
      3   52 11.          8.58578     0.          1.         .05
          53 11.         10.            -.70711   .70711     .05
      4   57 12.          9.29289       -.70711   .70711     .05
          58 12.         10.            -.70711  -.70711     .05
      4   62 13.          9.29289       -.70711  -.70711     .05
          63 13.          9.29289       -.70711  +.70711     .05
      3   67 14.          8.58578       -.70711  +.70711     .05
     1    68 14.          8.58578       +.70711  +.70711     .05
          76 16.         10.            +.70711  +.70711     .05

C          WALL PROPERTIES TABLE FOLLOWS

2.     1   1          1.+7        1.+7          .4+7 .25        .05
          76          1.+7        1.+7          .4+7 .25        .05

C          MECHANICAL LOADS TABLE FOLLOWS

5          1                                -100.
           9                                -100.
          10
          29
          30                                -100.
          47                                -100.
          48
          67
          68                                -100.
          76                                -100.
9
```

STANDARD PREBUCKLING DATA FOLLOWS

```
.0000E+00-0
-9.6646E+0112-9.6641E+01
-9.5125E+01 1.3763E+02 2-9.8942E+01 7.7724E+01 3-1.0105E+02-5.0370E+01
-1.0078E+02-1.7522E+02 5-9.8552E+01-2.4977E+02 6-9.5477E+01-2.5188E+02
-9.2941E+01-1.8632E+02 8-9.2036E+01-8.8705E+01 9-9.2850E+01-3.1266E+01
 0.E+00     -2.5587E+0011 4.4132E-02-2.3433E+0012 8.5640E-02-2.0859E+00
 1.2286E-01-1.6976E+0014 1.5171E-01-1.0277E+0015 0.E+00      1.5887E+00
-2.3628E-02 1.0327E+0017-3.7604E-02 4.3547E-0118-4.0244E-02-2.4666E-01
-2.8737E-02-1.0728E+0020 1.2298E-01-1.0348E+0021 1.5638E-01-2.2625E+00
 2.2070E-01-3.9986E+0023 3.2594E-01-6.0147E+0024 4.7686E-01-7.9346E+00
 0.E+00      1.9554E+0026 0.E+00     -5.6035E-0127 0.E+00     -3.1066E+00
 0.E+00     -5.6706E+0029 0.E+00     -8.0538E+0030-7.9044E+01-2.7815E+01
-8.0539E+01 2.7999E+0132-8.4002E+01 1.3510E+0233-8.9835E+01 2.2010E+02
-9.7122E+01 2.3570E+0235-1.0409E+02 1.6257E+0236-1.0871E+02 1.3218E+01
-1.0953E+02-1.6040E+0238-1.0680E+02-2.5457E+0239-1.0680E+02-2.5457E+02
-1.0953E+02-1.6041E+0241-1.0872E+02 1.3214E+0142-1.0409E+02 1.6257E+02
-9.7122E+01 2.3570E+0244-8.9836E+01 2.2010E+0245-8.4002E+01 1.3510E+02
-8.0540E+01 2.8001E+0147-7.9045E+01-2.7815E+0148 0.E+00      1.9552E+00
 0.E+00     -5.6044E-0150 0.E+00     -3.1066E+0051 0.E+00     -5.6704E+00
 0.E+00     -8.0535E+0053 0.E+00      1.5886E+0054-2.3626E-02 1.0326E+00
-3.7601E-02 4.3542E-0156-4.0241E-02-2.4669E-0157-2.8734E-02-1.0728E+00
 0.E+00     -2.5586E+0059 4.4131E-02-2.3432E+0060 8.5638E-02-2.0859E+00
 1.2285E-01-1.6976E+0062 1.5171E-01-1.0277E+0063 1.2298E-01-1.0348E+00
 1.5638E-01-2.2625E+0065 2.2069E-01-3.9985E+0066 3.2594E-01-6.0144E+00
 4.7685E-01-7.9342E+0068-9.2850E+01-3.1266E+0169-9.2036E+01-8.8705E+01
-9.2941E+01-1.8632E+0271-9.5477E+01-2.5188E+0272-9.8552E+01-2.4977E+02
-1.0078E+02-1.7523E+0274-1.0105E+02-5.0377E+0175-9.8942E+01 7.7721E+01
-9.5125E+01 1.3763E+02
.2685E-08   6.1941E-03   7.5190E-03   5.5927E-03   1.9468E-03  -1.9552E-03
.6517E-03  -4.5935E-03  -7.3837E-05  -1.4386E-05  -1.4978E-05  -1.8698E-05
.8542E-05  -4.7251E-05  -3.2344E-05  -3.2799E-05  -3.4889E-05  -3.9631E-05
.7251E-05  -4.7251E-05  -7.5513E-05  -9.3076E-05  -9.5121E-05  -7.3837E-05
.6272E-05  -8.6725E-05  -8.8177E-05  -8.6876E-05  -7.3837E-05  -7.3837E-05
.4381E-03   4.7132E-03   2.2362E-03  -1.5826E-03  -5.3471E-03  -7.5557E-03
.4659E-03  -5.9819E-08  -5.9817E-08   6.4659E-03   7.5557E-03   5.3471E-03
.5826E-03  -2.2362E-03  -4.7132E-03  -4.4381E-03   7.3831E-05   8.6268E-05
.6721E-05   8.8172E-05   8.6870E-05   7.3831E-05   3.2343E-05   3.2798E-05
.4888E-05   3.9630E-05   4.7249E-05   1.4385E-05   1.4977E-05   1.8697E-05
.8541E-05   4.7249E-05   4.7249E-05   7.5510E-05   9.3072E-05   9.5115E-05
.3831E-05   7.3831E-05   4.5936E-03   4.6518E-03   1.9553E-03  -1.9467E-03
.5926E-03  -7.5191E-03  -6.1942E-03  -8.2616E-08
-9.6430E+0112-9.6473E+01
-9.5110E+01 1.4062E+02 2-9.8978E+01 8.0253E+01 3-1.0112E+02-4.8961E+01
-1.0087E+02-1.7524E+02 5-9.8628E+01-2.5103E+02 6-9.5525E+01-2.5365E+02
-9.2957E+01-1.8766E+02 8-9.2035E+01-8.9136E+01 9-9.2846E+01-3.1247E+01
 0.E+00     -2.5417E+0011 4.3814E-02-2.3249E+0012 8.4968E-02-2.0663E+00
 1.2180E-01-1.6776E+0014 1.5027E-01-1.0093E+0015 0.E+00      1.5887E+00
-2.3670E-02 1.0373E+0017-3.7774E-02 4.4481E-0118-4.0636E-02-2.3256E-01
-2.9449E-02-1.0542E+0020 1.2082E-01-1.0167E+0021 1.5378E-01-2.2394E+00
 2.1754E-01-3.9711E+0023 3.2216E-01-5.9873E+0024 4.7252E-01-7.9177E+00
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25 0.E+00     1.9972E+0026 0.E+00     -5.1792E-0127 0.E+00     -3.0651E
28 0.E+00    -5.6351E+0029 0.E+00     -8.0358E+0030-7.9098E+01-2.7810E
31-8.0598E+01 2.8389E+0132-8.4079E+01 1.3641E+0233-8.9951E+01 2.2199E
34-9.7280E+01 2.3720E+0235-1.0427E+02 1.6272E+0236-1.0888E+02 1.1549E
37-1.0964E+02-1.6370E+0238-1.0682E+02-2.5870E+0239-1.0682E+02-2.5870E
40-1.0964E+02-1.6370E+0241-1.0888E+02 1.1549E+0142-1.0427E+02 1.6272E
43-9.7278E+01 2.3721E+0244-8.9949E+01 2.2200E+0245-8.4077E+01 1.3641E
46-8.0595E+01 2.8386E+0147-7.9096E+01-2.7814E+0148 0.E+00      1.9978E
49 0.E+00    -5.1847E-0150 0.E+00     -3.0667E+0051 0.E+00     -5.6377E
52 0.E+00    -8.0394E+0053 0.E+00      1.5894E+0054-2.3679E-02 1.0377E
55-3.7789E-02 4.4493E-0156-4.0651E-02-2.3277E-0157-2.9456E-02-1.0548E
58 0.E+00    -2.5429E+0059 4.3835E-02-2.3260E+0060 8.5009E-02-2.0673E
61 1.2186E-01-1.6785E+0062 1.5034E-01-1.0099E+0063 1.2089E-01-1,0172E
64 1.5386E-01-2.2405E+0065 2.1766E-01-3.9730E+0066 3.2232E-01-5.9901E
67 4.7275E-01-7.9212E+0068-9.2848E+01-3.1251E+0169-9.2037E+01-8.9139E
70-9.2959E+01-1.8766E+0271-9.5527E+01-2.5364E+0272-9.8630E+01-2.5102E
73-1.0087E+02-1.7524E+0274-1.0112E+02-4.8960E+0175-9.8979E+01 8.0255E
76-9.5111E+01 1.4062E+02
  5.8423E-08  6.2636E-03  7.6228E-03  5.6857E-03  1.9976E-03 -1.9539E
 -4.6827E-03 -4.6245E-03 -7.4725E-05 -1.4448E-05 -1.5037E-05 -1.8731E
 -2.8500E-05 -4.7058E-05 -3.2092E-05 -3.2546E-05 -3.4639E-05 -3.9396E
 -4.7058E-05 -4.7058E-05 -7.5268E-05 -9.2964E-05 -9.5369E-05 -7.4725E
 -8.6247E-05 -8.6715E-05 -8.8268E-05 -8.7239E-05 -7.4725E-05 -7.4725E
  4.4647E-03  4.7427E-03  2.2386E-03 -1.6270E-03 -5.4363E-03 -7.6613E
 -6.5402E-03 -5.5918E-08 -5.5915E-08  6.5401E-03  7.6611E-03  5.4361E
  1.6269E-03 -2.2386E-03 -4.7427E-03 -4.4647E-03  7.4750E-05  8.6285E
  8.6752E-05  8.8305E-05  8.7274E-05  7.4750E-05  3.2108E-05  3.2561E
  3.4655E-05  3.9414E-05  4.7080E-05  1.4453E-05  1.5043E-05  1.8738E
  2.8513E-05  4.7080E-05  4.7080E-05  7.5302E-05  9.3005E-05  9.5408E
  7.4750E-05  7.4750E-05  4.6245E-03  4.6826E-03  1.9538E-03 -1.9977E
 -5.6858E-03 -7.6228E-03 -6.2636E-03  5.8495E-08

C         BOUNDARY DATA FOLLOWS

         1.2+7          1.+6           1.+6                           .675+6 .05
 0.
               .1                     1.2+7
         1.2+7          1.+6           1.+6                           .675+6 .05
 0.
               .1                     1.2+7
          END OF FILE CARD
```

SRA 201 OUTPUT DATA LISTING

CLOSED BRANCH TEST CASE

N = 2 HIGHEST MODE = 1 REL ERR CNTRL = 1.000E-02

SURFACE LOADING, IF ANY, IS APPLIED AT SHELL REFERENCE SURFACE
AND, DURING BUCKLING, REMAINS FIXED IN MAGNITUDE AND DIRECTION

TABLE 1 (SURFACE GEOMETRY)

ENTRY	S	R	R PRIME	R/R2	ZBAR
1	0.E+00	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
2	2.5000E-01	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
3	5.0000E-01	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
4	7.5000E-01	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
5	1.0000E+00	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
6	1.2500E+00	9.1161E+00	-7.0711E-01	7.0711E-01	5.0000E-02
7	1.5000E+00	8.9393E+00	-7.0711E-01	7.0711E-01	5.0000E-02
8	1.7500E+00	8.7626E+00	-7.0711E-01	7.0711E-01	5.0000E-02
9	2.0000E+00	8.5858E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 1, THE NEXT POINT IS A NEW EDGE					
10	2.0000E+00	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
11	2.2500E+00	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
12	2.5000E+00	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
13	2.7500E+00	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
14	3.0000E+00	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 2, THE NEXT POINT IS A NEW EDGE					
15	3.0000E+00	1.0000E+01	-7.0711E-01	-7.0711E-01	5.0000E-02
16	3.2500E+00	9.8232E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
17	3.5000E+00	9.6464E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
18	3.7500E+00	9.4697E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
19	4.0000E+00	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 2					
20	4.0000E+00	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
21	4.2500E+00	9.1161E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
22	4.5000E+00	8.9393E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
23	4.7500E+00	8.7626E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
24	5.0000E+00	8.5858E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 1, THE NEXT POINT IS A NEW EDGE					
25	5.0000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
26	5.2500E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
27	5.5000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
28	5.7500E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
29	6.0000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
********** BRANCH POINT 1					
30	6.0000E+00	8.5858E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
31	6.2500E+00	8.4090E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
32	6.5000E+00	8.2322E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
33	6.7500E+00	8.0554E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
34	7.0000E+00	7.8787E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
35	7.2500E+00	7.7019E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
36	7.5000E+00	7.5251E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
37	7.7500E+00	7.3483E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
38	8.0000E+00	7.1716E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
39	8.0000E+00	7.1716E+00	7.0711E-01	-7.0711E-01	5.0000E-02
40	8.2500E+00	7.3483E+00	7.0711E-01	-7.0711E-01	5.0000E-02
41	8.5000E+00	7.5251E+00	7.0711E-01	-7.0711E-01	5.0000E-02
42	8.7500E+00	7.7019E+00	7.0711E-01	-7.0711E-01	5.0000E-02
43	9.0000E+00	7.8787E+00	7.0711E-01	-7.0711E-01	5.0000E-02
44	9.2500E+00	8.0554E+00	7.0711E-01	-7.0711E-01	5.0000E-02
45	9.5000E+00	8.2322E+00	7.0711E-01	-7.0711E-01	5.0000E-02
46	9.7500E+00	8.4090E+00	7.0711E-01	-7.0711E-01	5.0000E-02
47	1.0000E+01	8.5858E+00	7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 3, THE NEXT POINT IS A NEW EDGE					
48	1.0000E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
49	1.0250E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
50	1.0500E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
51	1.0750E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
52	1.1000E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
********** BRANCH POINT 3, THE NEXT POINT IS A NEW EDGE					

53	1.1000E+01	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
54	1.1250E+01	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
55	1.1500E+01	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
56	1.1750E+01	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
57	1.2000E+01	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 4, THE NEXT POINT IS A NEW EDGE					
58	1.2000E+01	1.0000E+01	-7.0711E-01	-7.0711E-01	5.0000E-02
59	1.2250E+01	9.8232E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
60	1.2500E+01	9.6464E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
61	1.2750E+01	9.4697E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
62	1.3000E+01	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 4					
63	1.3000E+01	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
64	1.3250E+01	9.1161E+00	-7.0711E-01	7.0711E-01	5.0000E-02
65	1.3500E+01	8.9393E+00	-7.0711E-01	7.0711E-01	5.0000E-02
66	1.3750E+01	8.7626E+00	-7.0711E-01	7.0711E-01	5.0000E-02
67	1.4000E+01	8.5858E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 3					
68	1.4000E+01	8.5858E+00	7.0711E-01	7.0711E-01	5.0000E-02
69	1.4250E+01	8.7626E+00	7.0711E-01	7.0711E-01	5.0000E-02
70	1.4500E+01	8.9393E+00	7.0711E-01	7.0711E-01	5.0000E-02
71	1.4750E+01	9.1161E+00	7.0711E-01	7.0711E-01	5.0000E-02
72	1.5000E+01	9.2929E+00	7.0711E-01	7.0711E-01	5.0000E-02
73	1.5250E+01	9.4697E+00	7.0711E-01	7.0711E-01	5.0000E-02
74	1.5500E+01	9.6464E+00	7.0711E-01	7.0711E-01	5.0000E-02
75	1.5750E+01	9.8232E+00	7.0711E-01	7.0711E-01	5.0000E-02
76	1.6000E+01	1.0000E+01	7.0711E-01	7.0711E-01	5.0000E-02

TABLE 2 (WALL PROPERTIES)

ENTRY	S	E1	E2	E12	NU1	H
1	0.E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
2	2.5000E-01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
3	5.0000E-01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
4	7.5000E-01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
5	1.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
6	1.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
7	1.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
8	1.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
9	2.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
10	2.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
11	2.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
12	2.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
13	2.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
14	3.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
15	3.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
16	3.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
17	3.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
18	3.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
19	4.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
20	4.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
21	4.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
22	4.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
23	4.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
24	5.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
25	5.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
26	5.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
27	5.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
28	5.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
29	6.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
30	6.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
31	6.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
32	6.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
33	6.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
34	7.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
35	7.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
36	7.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
37	7.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
38	8.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
39	8.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
40	8.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
41	8.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
42	8.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
43	9.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
44	9.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
45	9.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
46	9.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
47	1.0000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
48	1.0000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
49	1.0250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
50	1.0500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
51	1.0750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
52	1.1000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
53	1.1000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
54	1.1250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
55	1.1500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
56	1.1750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
57	1.2000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
58	1.2000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
59	1.2250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02

60	1.2500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
61	1.2750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
62	1.3000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
63	1.3000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
64	1.3250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
65	1.3500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
66	1.3750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
67	1.4000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
68	1.4000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
69	1.4250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
70	1.4500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
71	1.4750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
72	1.5000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
73	1.5250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
74	1.5500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
75	1.5750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
76	1.6000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02

TABLE 3 (FOUNDATION MODULI) ALL ZEROES

TABLE 4 (STRINGER PROPERTIES) ALL ZEROES

TABLE 6 (UNIT LOAD PRESSURE FIELD) WAS READ AND IGNORED

INITIAL NONLINEAR STATE SHELL DATA. LAMBDA = 1.0000E+00

ENTRY	S	T1N	T2N	CHIN
1	0.E+00	-9.5125E+01	1.3763E+02	-8.2685E-08
2	2.5000E-01	-9.8942E+01	7.7724E+01	6.1941E-03
3	5.0000E-01	-1.0105E+02	-5.0370E+01	7.5190E-03
4	7.5000E-01	-1.0078E+02	-1.7522E+02	5.5927E-03
5	1.0000E+00	-9.8552E+01	-2.4977E+02	1.9468E-03
6	1.2500E+00	-9.5477E+01	-2.5188E+02	-1.9552E-03
7	1.5000E+00	-9.2941E+01	-1.8632E+02	-4.6517E-03
8	1.7500E+00	-9.2036E+01	-8.8705E+01	-4.5935E-03
9	2.0000E+00	-9.2850E+01	-3.1266E+01	-7.3837E-05
10	2.0000E+00	0.E+00	-2.5587E+00	-1.4386E-05
11	2.2500E+00	4.4132E-02	-2.3433E+00	-1.4978E-05
12	2.5000E+00	8.5640E-02	-2.0859E+00	-1.8698E-05
13	2.7500E+00	1.2286E-01	-1.6976E+00	-2.8542E-05
14	3.0000E+00	1.5171E-01	-1.0277E+00	-4.7251E-05
15	3.0000E+00	0.E+00	1.5887E+00	-3.2344E-05
16	3.2500E+00	-2.3628E-02	1.0327E+00	-3.2799E-05
17	3.5000E+00	-3.7604E-02	4.3547E-01	-3.4889E-05
18	3.7500E+00	-4.0244E-02	-2.4666E-01	-3.9631E-05
19	4.0000E+00	-2.8737E-02	-1.0728E+00	-4.7251E-05
20	4.0000E+00	1.2298E-01	-1.0348E+00	-4.7251E-05
21	4.2500E+00	1.5638E-01	-2.2625E+00	-7.5513E-05
22	4.5000E+00	2.2070E-01	-3.9986E+00	-9.3076E-05
23	4.7500E+00	3.2594E-01	-6.0147E+00	-9.5121E-05
24	5.0000E+00	4.7686E-01	-7.9346E+00	-7.3837E-05
25	5.0000E+00	0.E+00	1.9554E+00	-8.6272E-05
26	5.2500E+00	0.E+00	-5.6035E-01	-8.6725E-05
27	5.5000E+00	0.E+00	-3.1066E+00	-8.8177E-05
28	5.7500E+00	0.E+00	-5.6706E+00	-8.6876E-05
29	6.0000E+00	0.E+00	-8.0538E+00	-7.3837E-05
30	6.0000E+00	-7.9044E+01	-2.7815E+01	-7.3837E-05
31	6.2500E+00	-8.0539E+01	2.7999E+01	4.4381E-03
32	6.5000E+00	-8.4002E+01	1.3510E+02	4.7132E-03
33	6.7500E+00	-8.9835E+01	2.2010E+02	2.2362E-03
34	7.0000E+00	-9.7122E+01	2.3570E+02	-1.5826E-03
35	7.2500E+00	-1.0409E+02	1.6257E+02	-5.3471E-03
36	7.5000E+00	-1.0871E+02	1.3218E+01	-7.5557E-03
37	7.7500E+00	-1.0953E+02	-1.6040E+02	-6.4659E-03
38	8.0000E+00	-1.0680E+02	-2.5457E+02	-5.9819E-08
39	8.0000E+00	-1.0680E+02	-2.5457E+02	-5.9817E-08
40	8.2500E+00	-1.0953E+02	-1.6041E+02	6.4659E-03
41	8.5000E+00	-1.0872E+02	1.3214E+01	7.5557E-03
42	8.7500E+00	-1.0409E+02	1.6257E+02	5.3471E-03
43	9.0000E+00	-9.7122E+01	2.3570E+02	1.5826E-03
44	9.2500E+00	-8.9836E+01	2.2010E+02	-2.2362E-03
45	9.5000E+00	-8.4002E+01	1.3510E+02	-4.7132E-03
46	9.7500E+00	-8.0540E+01	2.8001E+01	-4.4381E-03
47	1.0000E+01	-7.9045E+01	-2.7815E+01	7.3831E-05
48	1.0000E+01	0.E+00	1.9552E+00	8.6268E-05
49	1.0250E+01	0.E+00	-5.6044E-01	8.6721E-05
50	1.0500E+01	0.E+00	-3.1066E+00	8.8172E-05
51	1.0750E+01	0.E+00	-5.6704E+00	8.6870E-05
52	1.1000E+01	0.E+00	-8.0535E+00	7.3831E-05
53	1.1000E+01	0.E+00	1.5886E+00	3.2343E-05
54	1.1250E+01	-2.3626E-02	1.0326E+00	3.2798E-05
55	1.1500E+01	-3.7601E-02	4.3542E-01	3.4888E-05
56	1.1750E+01	-4.0241E-02	-2.4669E-01	3.9630E-05
57	1.2000E+01	-2.8734E-02	-1.0728E+00	4.7249E-05
58	1.2000E+01	0.E+00	-2.5586E+00	1.4385E-05
59	1.2250E+01	4.4131E-02	-2.3432E+00	1.4977E-05

60	1.2500E+01	8.5638E-02	-2.0859E+00	1.8697E-05
61	1.2750E+01	1.2285E-01	-1.6976E+00	2.8541E-05
62	1.3000E+01	1.5171E-01	-1.0277E+00	4.7249E-05
63	1.3000E+01	1.2298E-01	-1.0348E+00	4.7249E-05
64	1.3250E+01	1.5638E-01	-2.2625E+00	7.5510E-05
65	1.3500E+01	2.2069E-01	-3.9985E+00	9.3072E-05
66	1.3750E+01	3.2594E-01	-6.0144E+00	9.5115E-05
67	1.4000E+01	4.7685E-01	-7.9342E+00	7.3831E-05
68	1.4000E+01	-9.2850E+01	-3.1266E+01	7.3831E-05
69	1.4250E+01	-9.2036E+01	-8.8705E+01	4.5936E-03
70	1.4500E+01	-9.2941E+01	-1.8632E+02	4.6518E-03
71	1.4750E+01	-9.5477E+01	-2.5188E+02	1.9553E-03
72	1.5000E+01	-9.8552E+01	-2.4977E+02	-1.9467E-03
73	1.5250E+01	-1.0078E+02	-1.7523E+02	-5.5926E-03
74	1.5500E+01	-1.0105E+02	-5.0377E+01	-7.5191E-03
75	1.5750E+01	-9.8942E+01	7.7721E+01	-6.1942E-03
76	1.6000E+01	-9.5125E+01	1.3763E+02	-8.2616E-08

INITIAL PERTURBATION STATE SHELL DATA

ENTRY	S	T10	T20	CHI0
1	0.E+00	-9.5110E+01	1.4062E+02	5.8423E-08
2	2.5000E-01	-9.8978E+01	8.0253E+01	6.2636E-03
3	5.0000E-01	-1.0112E+02	-4.8961E+01	7.6228E-03
4	7.5000E-01	-1.0087E+02	-1.7524E+02	5.6857E-03
5	1.0000E+00	-9.8628E+01	-2.5103E+02	1.9976E-03
6	1.2500E+00	-9.5525E+01	-2.5365E+02	-1.9539E-03
7	1.5000E+00	-9.2957E+01	-1.8766E+02	-4.6827E-03
8	1.7500E+00	-9.2035E+01	-8.9136E+01	-4.6245E-03
9	2.0000E+00	-9.2846E+01	-3.1247E+01	-7.4725E-05
10	2.0000E+00	0.E+00	-2.5417E+00	-1.4448E-05
11	2.2500E+00	4.3814E-02	-2.3249E+00	-1.5037E-05
12	2.5000E+00	8.4968E-02	-2.0663E+00	-1.8731E-05
13	2.7500E+00	1.2180E-01	-1.6776E+00	-2.8500E-05
14	3.0000E+00	1.5027E-01	-1.0093E+00	-4.7058E-05
15	3.0000E+00	0.E+00	1.5887E+00	-3.2092E-05
16	3.2500E+00	-2.3670E-02	1.0373E+00	-3.2546E-05
17	3.5000E+00	-3.7774E-02	4.4481E-01	-3.4639E-05
18	3.7500E+00	-4.0636E-02	-2.3256E-01	-3.9396E-05
19	4.0000E+00	-2.9449E-02	-1.0542E+00	-4.7058E-05
20	4.0000E+00	1.2082E-01	-1.0167E+00	-4.7058E-05
21	4.2500E+00	1.5378E-01	-2.2394E+00	-7.5268E-05
22	4.5000E+00	2.1754E-01	-3.9711E+00	-9.2964E-05
23	4.7500E+00	3.2216E-01	-5.9873E+00	-9.5369E-05
24	5.0000E+00	4.7252E-01	-7.9177E+00	-7.4725E-05
25	5.0000E+00	0.E+00	1.9972E+00	-8.6247E-05
26	5.2500E+00	0.E+00	-5.1792E-01	-8.6715E-05
27	5.5000E+00	0.E+00	-3.0651E+00	-8.8268E-05
28	5.7500E+00	0.E+00	-5.6351E+00	-8.7239E-05
29	6.0000E+00	0.E+00	-8.0358E+00	-7.4725E-05
30	6.0000E+00	-7.9098E+01	-2.7810E+01	-7.4725E-05
31	6.2500E+00	-8.0598E+01	2.8389E+01	4.4647E-03
32	6.5000E+00	-8.4079E+01	1.3641E+02	4.7427E-03
33	6.7500E+00	-8.9951E+01	2.2199E+02	2.2386E-03
34	7.0000E+00	-9.7280E+01	2.3720E+02	-1.6270E-03
35	7.2500E+00	-1.0427E+02	1.6272E+02	-5.4363E-03
36	7.5000E+00	-1.0888E+02	1.1549E+01	-7.6613E-03
37	7.7500E+00	-1.0964E+02	-1.6370E+02	-6.5402E-03
38	8.0000E+00	-1.0682E+02	-2.5870E+02	-5.5918E-08
39	8.0000E+00	-1.0682E+02	-2.5870E+02	-5.5915E-08
40	8.2500E+00	-1.0964E+02	-1.6370E+02	6.5401E-03
41	8.5000E+00	-1.0888E+02	1.1549E+01	7.6611E-03
42	8.7500E+00	-1.0427E+02	1.6272E+02	5.4361E-03
43	9.0000E+00	-9.7278E+01	2.3721E+02	1.6269E-03
44	9.2500E+00	-8.9949E+01	2.2200E+02	-2.2386E-03
45	9.5000E+00	-8.4077E+01	1.3641E+02	-4.7427E-03
46	9.7500E+00	-8.0595E+01	2.8386E+01	-4.4647E-03
47	1.0000E+01	-7.9096E+01	-2.7814E+01	7.4750E-05
48	1.0000E+01	0.E+00	1.9978E+00	8.6285E-05
49	1.0250E+01	0.E+00	-5.1847E-01	8.6752E-05
50	1.0500E+01	0.E+00	-3.0667E+00	8.8305E-05
51	1.0750E+01	0.E+00	-5.6377E+00	8.7274E-05
52	1.1000E+01	0.E+00	-8.0394E+00	7.4750E-05
53	1.1000E+01	0.E+00	1.5894E+00	3.2108E-05
54	1.1250E+01	-2.3679E-02	1.0377E+00	3.2561E-05
55	1.1500E+01	-3.7789E-02	4.4493E-01	3.4655E-05
56	1.1750E+01	-4.0651E-02	-2.3277E-01	3.9414E-05
57	1.2000E+01	-2.9456E-02	-1.0548E+00	4.7080E-05
58	1.2000E+01	0.E+00	-2.5429E+00	1.4453E-05
59	1.2250E+01	4.3835E-02	-2.3260E+00	1.5043E-05

60	1.2500E+01	8.5009E-02	-2.0673E+00	1.8738E-05
61	1.2750E+01	1.2186E-01	-1.6785E+00	2.8513E-05
62	1.3000E+01	1.5034E-01	-1.0099E+00	4.7080E-05
63	1.3000E+01	1.2089E-01	-1.0172E+00	4.7080E-05
64	1.3250E+01	1.5386E-01	-2.2405E+00	7.5302E-05
65	1.3500E+01	2.1766E-01	-3.9730E+00	9.3005E-05
66	1.3750E+01	3.2232E-01	-5.9901E+00	9.5408E-05
67	1.4000E+01	4.7275E-01	-7.9212E+00	7.4750E-05
68	1.4000E+01	-9.2848E+01	-3.1251E+01	7.4750E-05
69	1.4250E+01	-9.2037E+01	-8.9139E+01	4.6245E-03
70	1.4500E+01	-9.2959E+01	-1.8766E+02	4.6826E-03
71	1.4750E+01	-9.5527E+01	-2.5364E+02	1.9538E-03
72	1.5000E+01	-9.8630E+01	-2.5102E+02	-1.9977E-03
73	1.5250E+01	-1.0087E+02	-1.7524E+02	-5.6858E-03
74	1.5500E+01	-1.0112E+02	-4.8960E+01	-7.6228E-03
75	1.5750E+01	-9.8979E+01	8.0255E+01	-6.2636E-03
76	1.6000E+01	-9.5111E+01	1.4062E+02	5.8495E-08

```
BOUNDARY NUMBER  1           S =  0.E+00
THIS IS THE FIRST POINT OF A CLOSED BRANCH - SEE BOUNDARY NUMBER 13 FOR BOUNDARY DATA

BOUNDARY NUMBER  2           S =  2.0000E+00
B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  3           S =  3.0000E+00
B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  4           S =  4.0000E+00
B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  5           S =  5.0000E+00
B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  6           S =  6.0000E+00
RING DATA
EA =  1.2000E+07      EI SUB X =  1.0000E+06      EI SUB Y =  1.0000E+06      EI SUB XY = -0.E+00
GJ SUB T =  6.7500E+05    ZBAR =  5.0000E-02      SBAR = -0.E+00      TPHIN = -9.6646E+01      TPHI0 = -9.6430E+01

BOUNDARY NUMBER  7           S =  8.0000E+00
B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  8           S =  1.0000E+01
B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  9           S =  1.1000E+01
B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER 10           S =  1.2000E+01
B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER 11           S =  1.3000E+01
B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER 12           S =  1.4000E+01
RING DATA
```

```
EA =  1.2000E+07       EI SUB X =  1.0000E+06       EI SUB Y =  1.0000E+06       EI SUB XY = -0.E+00
GJ SUB T =  6.7500E+05     ZBAR =  5.0000E-02      SBAR = -0.E+00          TPHIN = -9.6641E+01     TPHIO = -9.6473E+01

BOUNDARY NUMBER 13          S =  1.6000E+01

B = 1, D = 0, L VECTOR = 0  (FORCE-FREE)

EIGENVALUE SHIFT =  4.880000000E+01

NORMALIZED DETERMINANT OF TERMINAL POINT MATRIX =  1.4838E-06

ITER =  1 MU =  1.026552214E-01

NORMALIZED DETERMINANT OF TERMINAL POINT MATRIX =  1.4838E-06

ITER =  2 MU =  9.778482444E-02

NORMALIZED DETERMINANT OF TERMINAL POINT MATRIX =  1.4838E-06

ITER =  3 MU =  9.777627322E-02
```

ENTRY	S	P	Q	CAP S	M1	XI	ETA	V	CHI
1	0.E+00	1.4911E+00	9.5353E+03	2.5820E+03	-3.0556E+00	6.6130E-01	5.5343E-04	-4.7785E-04	2.5692E+00
2	2.5000E-01	-6.1710E+01	9.3143E+03	1.6963E+03	-1.6352E+03	1.4118E-01	-3.6441E-01	2.1788E-02	2.3605E+00
3	5.0000E-01	-9.4061E+01	8.3469E+03	-5.9818E+02	-3.2247E+03	-3.5270E-01	-5.9715E-01	4.3039E-02	1.6744E+00
4	7.5000E-01	-2.0631E+01	6.8261E+03	-3.8581E+03	-3.8779E+03	-6.3254E-01	-7.3447E-01	6.1203E-02	6.5388E-01
5	1.0000E+00	2.3001E+02	4.9710E+03	-7.6400E+03	-3.2321E+03	-6.5982E-01	-7.5172E-01	6.9972E-02	-3.7224E-01
6	1.2500E+00	6.9250E+02	3.1182E+03	-1.1285E+04	-1.5790E+03	-5.2579E-01	-6.1774E-01	6.6507E-02	-1.0664E+00
7	1.5000E+00	1.3621E+03	1.6537E+03	-1.4037E+04	4.2671E+02	-3.4985E-01	-3.7062E-01	5.3758E-02	-1.2326E+00
8	1.7500E+00	2.1705E+03	7.6894E+02	-1.5513E+04	2.1720E+03	-2.0421E-01	-1.3183E-01	3.7543E-02	-8.5980E-01
9	2.0000E+00	2.9739E+03	2.1347E+02	-1.6137E+04	3.2718E+03	-1.3093E-01	-3.0031E-02	2.1950E-02	-7.8297E-02
10	2.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-2.1993E-01	-3.7527E-02	2.3853E-02	-7.0512E-02
11	2.2500E+00	-5.7597E-01	2.5416E+01	4.9459E+01	1.5744E+00	-2.0753E-01	-2.5023E-02	1.6989E-02	-7.0284E-02
12	2.5000E+00	-2.9558E+00	5.0551E+01	9.5673E+01	7.3445E+00	-1.9525E-01	-1.2632E-02	1.0151E-02	-6.9043E-02
13	2.7500E+00	-7.0984E+00	7.4613E+01	1.3712E+02	1.6978E+01	-1.8335E-01	-6.3323E-04	3.3337E-03	-6.5649E-02
14	3.0000E+00	-1.2876E+01	9.5508E+01	1.6981E+02	2.9946E+01	-1.7233E-01	1.0499E-02	-3.4694E-03	-5.9067E-02
15	3.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-2.1503E-01	5.3056E-02	-2.8284E-02	-6.0942E-02
16	3.2500E+00	-3.7371E-01	-7.0950E+00	-1.3843E+01	1.5929E-01	-2.0427E-01	4.2302E-02	-2.2076E-02	-6.0779E-02
17	3.5000E+00	-1.0520E+00	-1.0465E+01	-1.9654E+01	1.1468E+00	-1.9354E-01	3.1594E-02	-1.5873E-02	-6.0459E-02
18	3.7500E+00	-1.7265E+00	-9.2708E+00	-1.6209E+01	2.2068E+00	-1.8288E-01	2.0977E-02	-9.6726E-03	-5.9855E-02
19	4.0000E+00	-2.0155E+00	-2.3719E+00	-1.7998E+00	2.4590E+00	-1.7233E-01	1.0499E-02	-3.4694E-03	-5.9067E-02
20	4.0000E+00	-1.4891E+01	9.3136E+01	1.6801E+02	3.2405E+01	-1.7233E-01	1.0499E-02	-3.4694E-03	-5.9067E-02
21	4.2500E+00	-7.8151E+00	1.1626E+02	2.0324E+02	1.1748E+01	-1.6247E-01	7.7024E-04	2.8456E-03	-5.2693E-02
22	4.5000E+00	1.4403E+00	1.5257E+02	2.6155E+02	-1.2962E+01	-1.5317E-01	-8.3443E-03	9.1755E-03	-5.2657E-02
23	4.7500E+00	1.4050E+01	2.0444E+02	3.4596E+02	-4.4077E+01	-1.4318E-01	-1.8086E-02	1.5538E-02	-6.0459E-02
24	5.0000E+00	3.1207E+01	2.6987E+02	4.5060E+02	-8.3973E+01	-1.3093E-01	-3.0031E-02	2.1950E-02	-7.8297E-02
25	5.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-1.3155E-01	2.6054E-02	-9.0255E-03	-4.9068E-02
26	5.2500E+00	1.7877E+00	3.2361E+01	6.4672E+01	-4.4400E+00	-1.3143E-01	1.3766E-02	-1.3523E-03	-4.9444E-02
27	5.5000E+00	8.1639E+00	7.4800E+01	1.4946E+02	-1.8268E+01	-1.3128E-01	1.1223E-03	6.3621E-03	-5.2358E-02
28	5.7500E+00	2.0204E+01	1.2498E+02	2.4959E+02	-4.3845E+01	-1.3111E-01	-1.2872E-02	1.4128E-02	-6.0797E-02
29	6.0000E+00	3.8459E+01	1.7591E+02	3.5095E+02	-8.2489E+01	-1.3093E-01	-3.0031E-02	2.1950E-02	-7.8297E-02
30	6.0000E+00	3.4560E+03	2.6659E+03	-1.0846E+04	5.6141E+02	-1.3093E-01	-3.0031E-02	2.1950E-02	-7.8297E-02
31	6.2500E+00	3.0103E+03	2.5342E+03	-1.1254E+04	5.3297E+02	-1.3026E-01	-2.7881E-02	2.1823E-02	8.5334E-02
32	6.5000E+00	2.4619E+03	2.3066E+03	-1.1510E+04	2.2605E+02	-1.4929E-01	5.5232E-03	2.2092E-02	1.9682E-01
33	6.7500E+00	1.8986E+03	2.2064E+03	-1.1460E+04	-1.5412E+02	-1.7895E-01	5.0655E-02	2.1860E-02	2.0843E-01
34	7.0000E+00	1.3906E+03	2.1985E+03	-1.1115E+04	-4.6747E+02	-2.0739E-01	8.2845E-02	2.0056E-02	1.1969E-01
35	7.2500E+00	9.7845E+02	2.1866E+03	-1.0647E+04	-6.0639E+02	-2.1533E-01	9.1004E-02	1.5954E-02	-3.5294E-02
36	7.5000E+00	6.6314E+02	2.0688E+03	-1.0273E+04	-5.1891E+02	-1.8593E-01	7.8359E-02	9.9762E-03	-1.9860E-01
37	7.7500E+00	3.8603E+02	1.7931E+03	-1.0163E+04	-2.6311E+02	-1.2183E-01	5.0107E-02	3.7494E-03	-3.1182E-01
38	8.0000E+00	4.2428E+00	1.3699E+03	-1.0445E+04	-1.5633E-01	-5.1103E-02	1.9069E-03	-1.0843E-03	-3.4864E-01
39	8.0000E+00	4.2428E+00	1.3699E+03	-1.0445E+04	-1.5633E-01	-5.1103E-02	1.9069E-03	-1.0843E-03	-3.4864E-01
40	8.2500E+00	-3.7767E+02	1.7907E+03	-1.0167E+04	2.6139E+02	-1.2186E-01	-4.6306E-02	-5.7582E-03	-3.1210E-01
41	8.5000E+00	-6.5579E+02	2.0652E+03	-1.0278E+04	5.1600E+02	-1.8602E-01	-7.4694E-02	-1.1792E-02	-1.9955E-01
42	8.7500E+00	-9.7103E+02	2.1842E+03	-1.0651E+04	6.0422E+02	-2.1575E-01	-8.7493E-02	-1.7601E-02	-3.6972E-02
43	9.0000E+00	-1.3837E+03	2.1973E+03	-1.1117E+04	4.6625E+02	-2.0821E-01	-7.9607E-02	-2.1531E-02	1.1753E-01
44	9.2500E+00	-1.8923E+03	2.2063E+03	-1.1459E+04	1.5424E+02	-1.8019E-01	-4.7810E-02	-2.3179E-02	2.0613E-01
45	9.5000E+00	-2.4555E+03	2.3072E+03	-1.1508E+04	-2.2410E+02	-1.5081E-01	-3.1637E-03	-2.3272E-02	1.9483E-01
46	9.7500E+00	-3.0041E+03	2.5345E+03	-1.1253E+04	-5.3031E+02	-1.3200E-01	2.9871E-02	-2.2863E-02	8.4022E-02
47	1.0000E+01	-3.4498E+03	2.8657E+03	-1.0845E+04	-5.5880E+02	-1.3281E-01	3.1832E-02	-2.2854E-02	-7.8842E-02
48	1.0000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-1.3344E-01	-2.4984E-02	8.5574E-03	-4.9859E-02
49	1.0250E+01	1.7629E+00	-3.1944E+01	-6.3840E+01	-4.3967E+00	-1.3331E-01	-1.2499E-02	7.7463E-04	-5.0234E-02
50	1.0500E+01	8.0738E+00	-7.4041E+01	-1.4794E+02	-1.8086E+01	-1.3317E-01	3.4014E-04	-7.0488E-03	-5.3122E-02
51	1.0750E+01	2.0018E+01	-1.2398E+02	-2.4756E+02	-4.3450E+01	-1.3299E-01	1.4517E-02	-1.4923E-02	-6.1485E-02
52	1.1000E+01	3.8158E+01	-1.7482E+02	-3.4877E+02	-8.1835E+01	-1.3281E-01	3.1832E-02	-2.2854E-02	-7.8842E-02
53	1.1000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-2.1891E-01	-5.3249E-02	2.8417E-02	-6.2471E-02
54	1.1250E+01	-3.8169E-01	7.2950E+00	1.4233E+01	1.6042E-01	-2.0787E-01	-4.2224E-02	2.2076E-02	-6.2308E-02
55	1.1500E+01	-1.0821E+00	1.0907E+01	2.0494E+01	1.1849E+00	-1.9687E-01	-3.1247E-02	1.5742E-02	-6.1985E-02
56	1.1750E+01	-1.7978E+00	1.0000E+01	1.7561E+01	2.3232E+00	-1.8594E-01	-2.0361E-02	9.4095E-03	-6.1362E-02
57	1.2000E+01	-2.1444E+00	3.4324E+00	3.7183E+00	2.7003E+00	-1.7513E-01	-9.6202E-03	3.0750E-03	-6.0527E-02
58	1.2000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-2.2358E-01	3.9248E-02	-2.4578E-02	-7.1623E-02
59	1.2250E+01	-5.4647E-01	-2.4738E+01	-4.8137E+01	1.5063E+00	-2.1099E-01	2.6549E-02	-1.7632E-02	-7.1398E-02
60	1.2500E+01	-2.8495E+00	-4.9200E+01	-9.3112E+01	7.0948E+00	-1.9850E-01	1.3959E-02	-1.0712E-02	-7.0196E-02
61	1.2750E+01	-6.8692E+00	-7.2619E+01	-1.3345E+02	1.6442E+01	-1.8640E-01	1.7499E-03	-3.8117E-03	-6.6907E-02

62	1.3000E+01	-1.2482E+01	-9.2964E+01	-1.6528E+02	2.9031E+01	-1.7513E-01	-9.6202E-03	3.0750E-03	-6.0527E-02
63	1.3000E+01	-1.4627E+01	-8.9531E+01	-1.6157E+02	3.1732E+01	-1.7513E-01	-9.6202E-03	3.0750E-03	-6.0527E-02
64	1.3250E+01	-7.8050E+00	-1.1205E+02	-1.9600E+02	1.1758E+01	-1.6501E-01	3.7771E-04	-3.3680E-03	-5.4251E-02
65	1.3500E+01	1.1562E+00	-1.4765E+02	-2.5338E+02	-1.2194E+01	-1.5543E-01	9.7615E-03	-9.8256E-03	-5.4112E-02
66	1.3750E+01	1.3424E+01	-1.9875E+02	-3.3679E+02	-4.2463E+01	-1.4521E-01	1.9735E-02	-1.6315E-02	-6.1585E-02
67	1.4000E+01	3.0193E+01	-2.6353E+02	-4.4076E+02	-8.1425E+01	-1.3281E-01	3.1832E-02	-2.2854E-02	-7.8842E-02
68	1.4000E+01	-2.9691E+03	2.2323E+02	-1.6125E+04	-3.2735E+03	-1.3281E-01	3.1832E-02	-2.2854E-02	-7.8842E-02
69	1.4250E+01	-2.1663E+03	7.7832E+02	-1.5501E+04	-2.1716E+03	-2.0618E-01	1.3376E-01	-3.8479E-02	-8.6053E-01
70	1.4500E+01	-1.3578E+03	1.6624E+03	-1.4025E+04	-4.2433E+02	-3.5161E-01	3.7296E-01	-5.4762E-02	-1.2329E+00
71	1.4750E+01	-6.8900E+02	3.1273E+03	-1.1272E+04	1.5826E+03	-5.2779E-01	6.1982E-01	-6.7493E-02	-1.0659E+00
72	1.5000E+01	-2.2656E+02	4.9791E+03	-7.6266E+03	3.2356E+03	-6.6154E-01	7.5370E-01	-7.0996E-02	-3.7068E-01
73	1.5250E+01	2.4148E+01	6.8324E+03	-3.8468E+03	3.8800E+03	-6.3385E-01	7.3616E-01	-6.2254E-02	6.5623E-01
74	1.5500E+01	9.7385E+01	8.3511E+03	-5.9023E+02	3.2233E+03	-3.5342E-01	5.9856E-01	-4.4059E-02	1.6768E+00
75	1.5750E+01	6.4812E+01	9.3164E+03	1.7003E+03	1.6306E+03	1.4099E-01	3.6562E-01	-2.2771E-02	2.3620E+00
76	1.6000E+01	1.4911E+00	9.5353E+03	2.5820E+03	-3.0556E+00	6.6130E-01	5.5343E-04	-4.7785E-04	2.5692E+00

ENTRY	S	P	W	CAP S	M1	XI	ETA	V	CHI
1	0.E+00	7.9122E-01	9.5346E+03	2.5847E+03	-9.1821E-01	6.6105E-01	3.2441E-04	-1.9212E-04	2.5692E+00
2	2.5000E-01	-6.2532E+01	9.3146E+03	1.7007E+03	-1.6336E+03	1.4087E-01	-3.6467E-01	2.2073E-02	2.3610E+00
3	5.0000E-01	-9.5021E+01	8.3482E+03	-5.9205E+02	-3.2242E+03	-3.5318E-01	-5.9749E-01	4.3327E-02	1.6752E+00
4	7.5000E-01	-2.1685E+01	6.8283E+03	-3.8506E+03	-3.8785E+03	-6.3324E-01	-7.3490E-01	6.1494E-02	6.5472E-01
5	1.0000E+00	2.2883E+02	4.9739E+03	-7.6316E+03	-3.2336E+03	-6.6067E-01	-7.5225E-01	7.0261E-02	-3.7171E-01
6	1.2500E+00	6.9113E+02	3.1215E+03	-1.1277E+04	-1.5806E+03	-5.2670E-01	-6.1833E-01	6.6783E-02	-1.0663E+00
7	1.5000E+00	1.3605E+03	1.6572E+03	-1.4029E+04	4.2580E+02	-3.5074E-01	-3.7118E-01	5.4012E-02	-1.2329E+00
8	1.7500E+00	2.1684E+03	7.7262E+02	-1.5505E+04	2.1721E+03	-2.0506E-01	-1.3231E-01	3.7769E-02	-8.6019E-01
9	2.0000E+00	2.9715E+03	2.1744E+02	-1.6128E+04	3.2728E+03	-1.3173E-01	-3.0445E-02	2.2155E-02	-7.8521E-02
10	2.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-2.2139E-01	-3.7951E-02	2.4041E-02	-7.0965E-02
11	2.2500E+00	-5.6938E-01	2.5293E+01	4.9218E+01	1.5600E+00	-2.0891E-01	-2.5367E-02	1.7138E-02	-7.0737E-02
12	2.5000E+00	-2.9335E+00	5.0288E+01	9.5174E+01	7.2935E+00	-1.9654E-01	-1.2895E-02	1.0259E-02	-6.9505E-02
13	2.7500E+00	-7.0502E+00	7.4198E+01	1.3635E+02	1.6867E+01	-1.8457E-01	-8.1368E-04	3.4019E-03	-6.6132E-02
14	3.0000E+00	-1.2791E+01	9.4936E+01	1.6878E+02	2.9750E+01	-1.7346E-01	1.0407E-02	-3.4417E-03	-5.9593E-02
15	3.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-2.1654E-01	5.3347E-02	-2.8439E-02	-6.1488E-02
16	3.2500E+00	-3.7610E-01	-7.1484E+00	-1.3947E+01	1.5835E-01	-2.0568E-01	4.2496E-02	-2.2184E-02	-6.1324E-02
17	3.5000E+00	-1.0608E+00	-1.0593E+01	-1.9898E+01	1.1553E+00	-1.9485E-01	3.1692E-02	-1.5936E-02	-6.1004E-02
18	3.7500E+00	-1.7491E+00	-9.4968E+00	-1.6630E+01	2.2381E+00	-1.8410E-01	2.0980E-02	-9.6903E-03	-6.0394E-02
19	4.0000E+00	-2.0552E+00	-2.7209E+00	-2.4365E+00	2.5302E+00	-1.7346E-01	1.0407E-02	-3.4417E-03	-5.9593E-02
20	4.0000E+00	-1.4846E+01	9.2215E+01	1.6635E+02	3.2280E+01	-1.7346E-01	1.0407E-02	-3.4417E-03	-5.9593E-02
21	4.2500E+00	-7.6373E+00	1.1514E+02	2.0128E+02	1.1796E+01	-1.6350E-01	5.8387E-04	2.9177E-03	-5.3230E-02
22	4.5000E+00	1.3373E+00	1.5121E+02	2.5925E+02	-1.2713E+01	-1.5411E-01	-8.6228E-03	9.2920E-03	-5.3154E-02
23	4.7500E+00	1.3850E+01	2.0283E+02	3.4331E+02	-4.3596E+01	-1.4403E-01	-1.8444E-02	1.5699E-02	-6.0855E-02
24	5.0000E+00	3.0895E+01	2.6804E+02	4.4769E+02	-8.3228E+01	-1.3173E-01	-3.0445E-02	2.2155E-02	-7.8521E-02
25	5.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-1.3236E-01	2.5955E-02	-9.0064E-03	-4.9414E-02
26	5.2500E+00	1.7763E+00	3.2169E+01	6.4287E+01	-4.4200E+00	-1.3223E-01	1.3581E-02	-1.2865E-03	-4.9789E-02
27	5.5000E+00	8.1217E+00	7.4439E+01	1.4874E+02	-1.8182E+01	-1.3209E-01	8.5234E-04	6.4743E-03	-5.2690E-02
28	5.7500E+00	2.0115E+01	1.2449E+02	2.4861E+02	-4.3656E+01	-1.3191E-01	-1.3220E-02	1.4286E-02	-6.1091E-02
29	6.0000E+00	3.8312E+01	1.7535E+02	3.4983E+02	-8.2169E+01	-1.3173E-01	-3.0445E-02	2.2155E-02	-7.8521E-02
30	6.0000E+00	3.4530E+03	2.8658E+03	-1.0843E+04	5.6066E+02	-1.3173E-01	-3.0445E-02	2.2155E-02	-7.8521E-02
31	6.2500E+00	3.0074E+03	2.5343E+03	-1.1251E+04	5.3213E+02	-1.3102E-01	-2.8364E-02	2.2078E-02	8.4877E-02
32	6.5000E+00	2.4591E+03	2.3069E+03	-1.1506E+04	2.2542E+02	-1.4997E-01	4.9111E-03	2.2400E-02	1.9615E-01
33	6.7500E+00	1.8958E+03	2.2067E+03	-1.1457E+04	-1.5434E+02	-1.7953E-01	4.9885E-02	2.2222E-02	2.0763E-01
34	7.0000E+00	1.3876E+03	2.1986E+03	-1.1112E+04	-4.6718E+02	-2.0782E-01	8.1929E-02	2.0471E-02	1.1890E-01
35	7.2500E+00	9.7569E+02	2.1864E+03	-1.0645E+04	-6.0566E+02	-2.1561E-01	8.9982E-02	1.6425E-02	-3.5946E-02
36	7.5000E+00	6.6040E+02	2.0685E+03	-1.0271E+04	-5.1800E+02	-1.8608E-01	7.7277E-02	1.0505E-02	-1.9901E-01
37	7.7500E+00	3.8332E+02	1.7932E+03	-1.0161E+04	-2.6238E+02	-1.2191E-01	4.8997E-02	4.3374E-03	-3.1201E-01
38	8.0000E+00	1.6465E+00	1.3709E+03	-1.0442E+04	1.2897E-01	-5.1154E-02	7.8358E-04	-4.4486E-04	-3.4868E-01
39	8.0000E+00	1.6465E+00	1.3709E+03	-1.0442E+04	1.2897E-01	-5.1154E-02	7.8358E-04	-4.4486E-04	-3.4868E-01
40	8.2500E+00	-3.8009E+02	1.7922E+03	-1.0162E+04	2.6202E+02	-1.2191E-01	-4.7428E-02	-5.1619E-03	-3.1202E-01
41	8.5000E+00	-6.5807E+02	2.0667E+03	-1.0274E+04	5.1679E+02	-1.8603E-01	-7.5795E-02	-1.1248E-02	-1.9926E-01
42	8.7500E+00	-9.7319E+02	2.1851E+03	-1.0647E+04	6.0487E+02	-2.1565E-01	-8.8548E-02	-1.7108E-02	-3.6475E-02
43	9.0000E+00	-1.3857E+03	2.1976E+03	-1.1113E+04	4.6650E+02	-2.0800E-01	-8.0579E-02	-2.1083E-02	1.1816E-01
44	9.2500E+00	-1.8941E+03	2.2061E+03	-1.1457E+04	1.5405E+02	-1.7987E-01	-4.8667E-02	-2.2772E-02	2.0675E-01
45	9.5000E+00	-2.4571E+03	2.3068E+03	-1.1506E+04	-2.2462E+02	-1.5041E-01	-3.8984E-03	-2.2904E-02	1.9535E-01
46	9.7500E+00	-3.0055E+03	2.5341E+03	-1.1251E+04	-5.3099E+02	-1.3155E-01	2.9232E-02	-2.2532E-02	8.4363E-02
47	1.0000E+01	-3.4511E+03	2.8654E+03	-1.0843E+04	-5.5942E+02	-1.3231E-01	3.1243E-02	-2.2560E-02	-7.8690E-02
48	1.0000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-1.3294E-01	-2.5375E-02	8.7364E-03	-4.9647E-02
49	1.0250E+01	1.7690E+00	-3.2048E+01	-6.4046E+01	-4.4071E+00	-1.3282E-01	-1.2943E-02	9.8251E-04	-5.0022E-02
50	1.0500E+01	8.0961E+00	-7.4230E+01	-1.4832E+02	-1.8131E+01	-1.3267E-01	-1.5604E-04	-6.8122E-03	-5.2916E-02
51	1.0750E+01	2.0064E+01	-1.2423E+02	-2.4809E+02	-4.3548E+01	-1.3250E-01	1.3971E-02	-1.4658E-02	-6.1297E-02
52	1.1000E+01	3.8234E+01	-1.7510E+02	-3.4933E+02	-8.1999E+01	-1.3231E-01	3.1243E-02	-2.2560E-02	-7.8690E-02
53	1.1000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-2.1783E-01	-5.3258E-02	2.8411E-02	-6.2031E-02
54	1.1250E+01	-3.7938E-01	7.2349E+00	1.4116E+01	1.5996E-01	-2.0688E-01	-4.2312E-02	2.2108E-02	-6.1867E-02
55	1.1500E+01	-1.0733E+00	1.0776E+01	2.0245E+01	1.1734E+00	-1.9595E-01	-3.1412E-02	1.5812E-02	-6.1545E-02
56	1.1750E+01	-1.7774E+00	9.7862E+00	1.7165E+01	2.2885E+00	-1.8510E-01	-2.0604E-02	9.5180E-03	-6.0928E-02
57	1.2000E+01	-2.1066E+00	3.1243E+00	3.1618E+00	2.6292E+00	-1.7437E-01	-9.9382E-03	3.2216E-03	-6.0106E-02
58	1.2000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-2.2258E-01	3.8697E-02	-2.4349E-02	-7.1320E-02
59	1.2250E+01	-5.5622E-01	-2.4973E+01	-4.8593E+01	1.5292E+00	-2.1004E-01	2.6051E-02	-1.7424E-02	-7.1094E-02
60	1.2500E+01	-2.8852E+00	-4.9661E+01	-9.3987E+01	7.1793E+00	-1.9761E-01	1.3515E-02	-1.0524E-02	-6.9879E-02
61	1.2750E+01	-6.9462E+00	-7.3293E+01	-1.3469E+02	1.6623E+01	-1.8556E-01	1.3642E-03	-3.6443E-03	-6.6554E-02

62	1.3000E+01	-1.2614E+01	-9.3810E+01	-1.6679E+02	2.9338E+01	-1.7437E-01	-9.9382E-03	3.2216E-03	-6.0106E-02
63	1.3000E+01	-1.4721E+01	-9.0686E+01	-1.6363E+02	3.1967E+01	-1.7437E-01	-9.9382E-03	3.2216E-03	-6.0106E-02
64	1.3250E+01	-7.8181E+00	-1.1339E+02	-1.9829E+02	1.1774E+01	-1.6432E-01	-1.8884E-05	-3.1844E-03	-5.3793E-02
65	1.3500E+01	1.2360E+00	-1.4920E+02	-2.5595E+02	-1.2419E+01	-1.5483E-01	9.2855E-03	-9.6051E-03	-5.3682E-02
66	1.3750E+01	1.3611E+01	-2.0054E+02	-3.3967E+02	-4.2957E+01	-1.4467E-01	1.9190E-02	-1.6058E-02	-6.1254E-02
67	1.4000E+01	3.0503E+01	-2.6553E+02	-4.4386E+02	-8.2215E+01	-1.3231E-01	3.1243E-02	-2.2560E-02	-7.8690E-02
68	1.4000E+01	-2.9701E+03	2.1930E+02	-1.6127E+04	-3.2727E+03	-1.3231E-01	3.1243E-02	-2.2560E-02	-7.8690E-02
69	1.4250E+01	-2.1672E+03	7.7449E+02	-1.5504E+04	-2.1717E+03	-2.0565E-01	1.3312E-01	-3.8179E-02	-8.6026E-01
70	1.4500E+01	-1.3586E+03	1.6586E+03	-1.4027E+04	-4.2539E+02	-3.5105E-01	3.7228E-01	-5.4450E-02	-1.2328E+00
71	1.4750E+01	-6.8979E+02	3.1236E+03	-1.1274E+04	1.5810E+03	-5.2724E-01	6.1915E-01	-6.7173E-02	-1.0662E+00
72	1.5000E+01	-2.2732E+02	4.9756E+03	-7.6292E+03	3.2342E+03	-6.6108E-01	7.5312E-01	-7.0676E-02	-3.7140E-01
73	1.5250E+01	2.3434E+01	6.8295E+03	-3.8485E+03	3.8795E+03	-6.3359E-01	7.3570E-01	-6.1941E-02	6.5524E-01
74	1.5500E+01	9.6715E+01	8.3489E+03	-5.9070E+02	3.2241E+03	-3.5340E-01	5.9821E-01	-4.3755E-02	1.6759E+00
75	1.5750E+01	6.4162E+01	9.3149E+03	1.7014E+03	1.6323E+03	1.4082E-01	3.6535E-01	-2.2476E-02	2.3615E+00
76	1.6000E+01	7.9122E-01	9.5346E+03	2.5847E+03	-9.1820E-01	6.6105E-01	3.2441E-04	-1.9212E-04	2.5692E+00

LAMBDA 1 = 4.989777626E+01

ENTRY	S	U	V	W
1	0.E+00	4.6721E-01	-1.9212E-04	4.6767E-01
2	2.5000E-01	3.5747E-01	2.2073E-02	-1.5825E-01
3	5.0000E-01	1.7275E-01	4.3327E-02	-6.7223E-01
4	7.5000E-01	7.1890E-02	6.1494E-02	-9.6742E-01
5	1.0000E+00	6.4756E-02	7.0261E-02	-9.9909E-01
6	1.2500E+00	6.4793E-02	6.6783E-02	-8.0966E-01
7	1.5000E+00	1.4451E-02	5.4012E-02	-5.1048E-01
8	1.7500E+00	-5.1441E-02	3.7769E-02	-2.3855E-01
9	2.0000E+00	-7.1618E-02	2.2155E-02	-1.1467E-01
10	2.0000E+00	-1.2971E-01	2.4041E-02	-1.8338E-01
11	2.2500E+00	-1.2979E-01	1.7138E-02	-1.6566E-01
12	2.5000E+00	-1.2986E-01	1.0259E-02	-1.4810E-01
13	2.7500E+00	-1.2993E-01	3.4019E-03	-1.3109E-01
14	3.0000E+00	-1.3001E-01	-3.4417E-03	-1.1529E-01
15	3.0000E+00	1.1540E-01	-2.8439E-02	-1.9084E-01
16	3.2500E+00	1.1539E-01	-2.2184E-02	-1.7549E-01
17	3.5000E+00	1.1537E-01	-1.5936E-02	-1.6019E-01
18	3.7500E+00	1.1534E-01	-9.6903E-03	-1.4501E-01
19	4.0000E+00	1.1529E-01	-3.4417E-03	-1.3001E-01
20	4.0000E+00	1.1529E-01	-3.4417E-03	-1.3001E-01
21	4.2500E+00	1.1520E-01	2.9177E-03	-1.1603E-01
22	4.5000E+00	1.1507E-01	9.2920E-03	-1.0287E-01
23	4.7500E+00	1.1489E-01	1.5699E-02	-8.8805E-02
24	5.0000E+00	1.1467E-01	2.2155E-02	-7.1618E-02
25	5.0000E+00	1.3236E-01	-9.0064E-03	-2.5955E-02
26	5.2500E+00	1.3223E-01	-1.2865E-03	-1.3581E-02
27	5.5000E+00	1.3209E-01	6.4743E-03	-8.5234E-04
28	5.7500E+00	1.3191E-01	1.4286E-02	1.3220E-02
29	6.0000E+00	1.3173E-01	2.2155E-02	3.0445E-02
30	6.0000E+00	1.1467E-01	2.2155E-02	-7.1618E-02
31	6.2500E+00	1.1270E-01	2.2078E-02	-7.2586E-02
32	6.5000E+00	1.0257E-01	2.2400E-02	-1.0952E-01
33	6.7500E+00	9.1672E-02	2.2222E-02	-1.6222E-01
34	7.0000E+00	6.9021E-02	2.0471E-02	-2.0489E-01
35	7.2500E+00	8.8835E-02	1.6425E-02	-2.1609E-01
36	7.5000E+00	7.6935E-02	1.0505E-02	-1.8622E-01
37	7.7500E+00	5.1557E-02	4.3374E-03	-1.2085E-01
38	8.0000E+00	3.5617E-02	-4.4486E-04	-3.6725E-02
39	8.0000E+00	3.6725E-02	-4.4486E-04	3.5617E-02
40	8.2500E+00	5.2665E-02	-5.1619E-03	1.1974E-01

41	8.5000E+00	7.7946E-02	-1.1248E-02	1.8514E-01
42	8.7500E+00	8.9878E-02	-1.7108E-02	2.1510E-01
43	9.0000E+00	9.0104E-02	-2.1083E-02	2.0406E-01
44	9.2500E+00	9.2773E-02	-2.2772E-02	1.6160E-01
45	9.5000E+00	1.0360E-01	-2.2904E-02	1.0911E-01
46	9.7500E+00	1.1369E-01	-2.2532E-02	7.2347E-02
47	1.0000E+01	1.1565E-01	-2.2560E-02	7.1466E-02
48	1.0000E+01	-1.3294E-01	8.7364E-03	-2.5375E-02
49	1.0250E+01	-1.3282E-01	9.8251E-04	-1.2943E-02
50	1.0500E+01	-1.3267E-01	-6.8122E-03	-1.5604E-04
51	1.0750E+01	-1.3250E-01	-1.4658E-02	1.3971E-02
52	1.1000E+01	-1.3231E-01	-2.2560E-02	3.1243E-02
53	1.1000E+01	-1.1637E-01	2.8411E-02	-1.9169E-01
54	1.1250E+01	-1.1637E-01	2.2108E-02	-1.7620E-01
55	1.1500E+01	-1.1635E-01	1.5812E-02	-1.6077E-01
56	1.1750E+01	-1.1632E-01	9.5180E-03	-1.4546E-01
57	1.2000E+01	-1.1627E-01	3.2216E-03	-1.3033E-01
58	1.2000E+01	1.3003E-01	-2.4349E-02	-1.8475E-01
59	1.2250E+01	1.3010E-01	-1.7424E-02	-1.6694E-01
60	1.2500E+01	1.3017E-01	-1.0524E-02	-1.4929E-01
61	1.2750E+01	1.3025E-01	-3.6443E-03	-1.3218E-01
62	1.3000E+01	1.3033E-01	3.2216E-03	-1.1627E-01
63	1.3000E+01	-1.1627E-01	3.2216E-03	-1.3033E-01
64	1.3250E+01	-1.1618E-01	-3.1844E-03	-1.1621E-01
65	1.3500E+01	-1.1605E-01	-9.6051E-03	-1.0291E-01
66	1.3750E+01	-1.1587E-01	-1.6058E-02	-8.8726E-02
67	1.4000E+01	-1.1565E-01	-2.2560E-02	-7.1466E-02
68	1.4000E+01	-7.1466E-02	-2.2560E-02	1.1565E-01
69	1.4250E+01	-5.1290E-02	-3.8179E-02	2.3955E-01
70	1.4500E+01	1.5006E-02	-5.4450E-02	5.1147E-01
71	1.4750E+01	6.4992E-02	-6.7173E-02	8.1063E-01
72	1.5000E+01	6.5081E-02	-7.0676E-02	1.0000E+00
73	1.5250E+01	7.2203E-02	-6.1941E-02	9.6824E-01
74	1.5500E+01	1.7311E-01	-4.3755E-02	6.7289E-01
75	1.5750E+01	3.5792E-01	-2.2476E-02	1.5877E-01
76	1.6000E+01	4.6767E-01	-1.9212E-04	-4.6721E-01

SRA 202 INPUT DATA LISTING

```
3ND CLOSED BRANCH TEST CASE
  1 1 1 1 1 1 1 1 1  2  1          48.8            1.-2            1

C       GEOMETRY TABLE FOLLOWS

1          1 0.         10.        -.70711     .70711     .05
     1     9 2.          8.58578   -.70711     .70711     .05
          10 2.         10.        -.70711     .70711     .05
     2    14 3.          9.29289   -.70711     .70711     .05
          15 3.         10.        -.70711    -.70711     .05
     2    19 4.          9.29289   -.70711    -.70711     .05
          20 4.          9.29289   -.70711    -.70711     .05
     1    24 5.          8.58578   -.70711    -.70711     .05
          25 5.          8.58578   0.         -1.         .05
     1    29 6.          8.58578   0.         -1.         .05
    1     30 6.          8.58578   -.70711    -.70711     .05
          38 8.          7.17156   -.70711    -.70711     .05
          39 8.          7.17156   +.70711    -.70711     .05
     3    47 10.         8.58578   +.70711    -.70711     .05
          48 10.         8.58578   0.          1.         .05
     3    52 11.         8.58578   0.          1.         .05
          53 11.        10.          -.70711   .70711     .05
     4    57 12.         9.29289     -.70711   .70711     .05
          58 12.        10.          -.70711  -.70711     .05
     4    62 13.         9.29289     -.70711  -.70711     .05
          63 13.         9.29289     -.70711  +.70711     .05
     3    67 14.         8.58578     -.70711  +.70711     .05
    1     68 14.         8.58578     +.70711  +.70711     .05
  4       76 16.        10.          +.70711  +.70711     .05

C       WALL PROPERTIES TABLE FOLLOWS

2     1    1        1.+7        1.+7        .4+7 .25      .05
          76        1.+7        1.+7        .4+7 .25      .05
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C        MECHANICAL LOADS TABLE FOLLOWS

6          1                                 -100.
           9                                 -100.
          10
          29
          30                                 -100.
          47                                 -100.
          48
          67
          68                                 -100.
          76                                 -100.
9

C        STANDARD PREBUCKLING DATA FOLLOWS

  1.0000E+00-0
 6-9.6646E+0112-9.6641E+01
 1-9.5125E+01 1.3763E+02 2-9.8942E+01 7.7724E+01 3-1.0105E+02-5.0370E+01
 4-1.0078E+02-1.7522E+02 5-9.8552E+01-2.4977E+02 6-9.5477E+01-2.5188E+02
 7-9.2941E+01-1.8632E+02 8-9.2036E+01-8.8705E+01 9-9.2850E+01-3.1266E+01
10 0.E+00    -2.5587E+0011 4.4132E-02-2.3433E+0012 8.5640E-02-2.0859E+00
13 1.2286E-01-1.6976E+0014 1.5171E-01-1.0277E+0015 0.E+00     1.5887E+00
16-2.3628E-02 1.0327E+0017-3.7604E-02 4.3547E-0118-4.0244E-02-2.4666E-01
19-2.8737E-02-1.0728E+0020 1.2298E-01-1.0348E+0021 1.5638E-01-2.2625E+00
22 2.2070E-01-3.9986E+0023 3.2594E-01-6.0147E+0024 4.7686E-01-7.9346E+00
25 0.E+00     1.9554E+0026 0.E+00    -5.6035E-0127 0.E+00    -3.1066E+00
28 0.E+00    -5.6706E+0029 0.E+00    -8.0538E+0030-7.9044E+01-2.7815E+01
31-8.0539E+01 2.7999E+0132-8.4002E+01 1.3510E+0233-8.9835E+01 2.2010E+02
34-9.7122E+01 2.3570E+0235-1.0409E+02 1.6257E+0236-1.0871E+02 1.3218E+01
37-1.0953E+02-1.6040E+0238-1.0680E+02-2.5457E+0239-1.0680E+02-2.5457E+02
40-1.0953E+02-1.6041E+0241-1.0872E+02 1.3214E+0142-1.0409E+02 1.6257E+02
43-9.7122E+01 2.3570E+0244-8.9836E+01 2.2010E+0245-8.4002E+01 1.3510E+02
46-8.0540E+01 2.8001E+0147-7.9045E+01-2.7815E+0148 0.E+00     1.9552E+00
49 0.E+00    -5.6044E-0150 0.E+00    -3.1066E+0051 0.E+00    -5.6704E+00
52 0.E+00    -8.0535E+0053 0.E+00     1.5886E+0054-2.3626E-02 1.0326E+00
55-3.7601E-02 4.3542E-0156-4.0241E-02-2.4669E-0157-2.8734E-02-1.0728E+00
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58 0.E+00    -2.5586E+0059 4.4131E-02-2.3432E+0060 8.5638E-02-2.0859E+00
61 1.2285E-01-1.6976E+0062 1.5171E-01-1.0277E+0063 1.2298E-01-1.0348E+00
64 1.5638E-01-2.2625E+0065 2.2069E-01-3.9985E+0066 3.2594E-01-6.0144E+00
67 4.7685E-01-7.9342E+0068-9.2850E+01-3.1266E+0169-9.2036E+01-8.8705E+01
70-9.2941E+01-1.8632E+0271-9.5477E+01-2.5188E+0272-9.8552E+01-2.4977E+02
73-1.0078E+02-1.7523E+0274-1.0105E+02-5.0377E+0175-9.8942E+01 7.7721E+01
76-9.5125E+01 1.3763E+02
 -8.2685E-08  6.1941E-03  7.5190E-03  5.5927E-03  1.9468E-03 -1.9552E-03
 -4.6517E-03 -4.5935E-03 -7.3837E-05 -1.4386E-05 -1.4978E-05 -1.8698E-05
 -2.8542E-05 -4.7251E-05 -3.2344E-05 -3.2799E-05 -3.4889E-05 -3.9631E-05
 -4.7251E-05 -4.7251E-05 -7.5513E-05 -9.3076E-05 -9.5121E-05 -7.3837E-05
 -8.6272E-05 -8.6725E-05 -8.8177E-05 -8.6876E-05 -7.3837E-05 -7.3837E-05
  4.4381E-03  4.7132E-03  2.2362E-03 -1.5826E-03 -5.3471E-03 -7.5557E-03
 -6.4659E-03 -5.9819E-08 -5.9817E-08  6.4659E-03  7.5557E-03  5.3471E-03
  1.5826E-03 -2.2362E-03 -4.7132E-03 -4.4381E-03  7.3831E-05  8.6268E-05
  8.6721E-05  8.8172E-05  8.6870E-05  7.3831E-05  3.2343E-05  3.2798E-05
  3.4888E-05  3.9630E-05  4.7249E-05  1.4385E-05  1.4977E-05  1.8697E-05
  2.8541E-05  4.7249E-05  4.7249E-05  7.5510E-05  9.3072E-05  9.5115E-05
  7.3831E-05  7.3831E-05  4.5936E-03  4.6518E-03  1.9553E-03 -1.9467E-03
 -5.5926E-03 -7.5191E-03 -6.1942E-03 -8.2616E-08
 6-9.6430E+0112-9.6473E+01
 1-9.5110E+01 1.4062E+02 2-9.8978E+01 8.0253E+01 3-1.0112E+02-4.8961E+01
 4-1.0087E+02-1.7524E+02 5-9.8628E+01-2.5103E+02 6-9.5525E+01-2.5365E+02
 7-9.2957E+01-1.8766E+02 8-9.2035E+01-8.9136E+01 9-9.2846E+01-3.1247E+01
10 0.E+00    -2.5417E+0011 4.3814E-02-2.3249E+0012 8.4968E-02-2.0663E+00
13 1.2180E-01-1.6776E+0014 1.5027E-01-1.0093E+0015 0.E+00     1.5887E+00
16-2.3670E-02 1.0373E+0017-3.7774E-02 4.4481E-0118-4.0636E-02-2.3256E-01
19-2.9449E-02-1.0542E+0020 1.2082E-01-1.0167E+0021 1.5378E-01-2.2394E+00
22 2.1754E-01-3.9711E+0023 3.2216E-01-5.9873E+0024 4.7252E-01-7.9177E+00
25 0.E+00     1.9972E+0026 0.E+00    -5.1792E-0127 0.E+00    -3.0651E+00
28 0.E+00    -5.6351E+0029 0.E+00    -8.0358E+0030-7.9098E+01-2.7810E+01
31-8.0598E+01 2.8389E+0132-8.4079E+01 1.3641E+0233-8.9951E+01 2.2199E+02
34-9.7280E+01 2.3720E+0235-1.0427E+02 1.6272E+0236-1.0888E+02 1.1549E+01
37-1.0964E+02-1.6370E+0238-1.0682E+02-2.5870E+0239-1.0682E+02-2.5870E+02
40-1.0964E+02-1.6370E+0241-1.0888E+02 1.1549E+0142-1.0427E+02 1.6272E+02
43-9.7278E+01 2.3721E+0244-8.9949E+01 2.2200E+0245-8.4077E+01 1.3641E+02
46-8.0595E+01 2.8386E+0147-7.9096E+01-2.7814E+0148 0.E+00     1.9978E+00
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49 0.E+00    -5.1847E-0150 0.E+00    -3.0667E+0051 0.E+00    -5.6377E+00
52 0.E+00    -8.0394E+0053 0.E+00     1.5894E+0054-2.3679E-02 1.0377E+00
55-3.7789E-02 4.4493E-0156-4.0651E-02-2.3277E-0157-2.9456E-02-1.0548E+00
58 0.E+00    -2.5429E+0059 4.3835E-02-2.3260E+0060 8.5009E-02-2.0673E+00
61 1.2186E-01-1.6785E+0062 1.5034E-01-1.0099E+0063 1.2089E-01-1.0172E+00
64 1.5386E-01-2.2405E+0065 2.1766E-01-3.9730E+0066 3.2232E-01-5.9901E+00
67 4.7275E-01-7.9212E+0068-9.2848E+01-3.1251E+0169-9.2037E+01-8.9139E+01
70-9.2959E+01-1.8766E+0271-9.5527E+01-2.5364E+0272-9.8630E+01-2.5102E+02
73-1.0087E+02-1.7524E+0274-1.0112E+02-4.8960E+0175-9.8979E+01 8.0255E+01
76-9.5111E+01 1.4062E+02
  5.8423E-08  6.2636E-03  7.6228E-03  5.6857E-03  1.9976E-03 -1.9539E-03
 -4.6827E-03 -4.6245E-03 -7.4725E-05 -1.4448E-05 -1.5037E-05 -1.8731E-05
 -2.8500E-05 -4.7058E-05 -3.2092E-05 -3.2546E-05 -3.4639E-05 -3.9396E-05
 -4.7058E-05 -4.7058E-05 -7.5268E-05 -9.2964E-05 -9.5369E-05 -7.4725E-05
 -8.6247E-05 -8.6715E-05 -8.8268E-05 -8.7239E-05 -7.4725E-05 -7.4725E-05
  4.4647E-03  4.7427E-03  2.2386E-03 -1.6270E-03 -5.4363E-03 -7.6613E-03
 -6.5402E-03 -5.5918E-08 -5.5915E-08  6.5401E-03  7.6611E-03  5.4361E-03
  1.6269E-03 -2.2386E-03 -4.7427E-03 -4.4647E-03  7.4750E-05  8.6285E-05
  8.6752E-05  8.8305E-05  8.7274E-05  7.4750E-05  3.2108E-05  3.2561E-05
  3.4655E-05  3.9414E-05  4.7080E-05  1.4453E-05  1.5043E-05  1.8738E-05
  2.8513E-05  4.7080E-05  4.7080E-05  7.5302E-05  9.3005E-05  9.5408E-05
  7.4750E-05  7.4750E-05  4.6245E-03  4.6826E-03  1.9538E-03 -1.9977E-03
 -5.6858E-03 -7.6228E-03 -6.2636E-03  5.8495E-08

C        BUCKLING MODE DATA FOLLOWS

    2     1  4.8898E+01  9.8107E+03
 7.912E-01 9.535E+03 2.585E+03-9.182E-01 6.611E-01 3.244E-04-1.921E-04 2.569E+00
-6.253E+01 9.315E+03 1.701E+03-1.634E+03 1.409E-01-3.647E-01 2.207E-02 2.361E+00
-9.502E+01 8.348E+03-5.920E+02-3.224E+03-3.532E-01-5.975E-01 4.333E-02 1.675E+00
-2.168E+01 6.828E+03-3.851E+03-3.879E+03-6.332E-01-7.349E-01 6.149E-02 6.547E-01
 2.288E+02 4.974E+03-7.632E+03-3.234E+03-6.607E-01-7.522E-01 7.026E-02-3.717E-01
 6.911E+02 3.122E+03-1.128E+04-1.581E+03-5.267E-01-6.183E-01 6.678E-02-1.066E+00
 1.360E+03 1.657E+03-1.403E+04 4.258E+02-3.507E-01-3.712E-01 5.401E-02-1.233E+00
 2.168E+03 7.726E+02-1.550E+04 2.172E+03-2.051E-01-1.323E-01 3.777E-02-8.602E-01
 2.971E+03 2.174E+02-1.613E+04 3.273E+03-1.317E-01-3.045E-02 2.215E-02-7.852E-02
 0.E+00    0.E+00    0.E+00    0.E+00   -2.214E-01-3.795E-02 2.404E-02-7.096E-02
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-5.694E-01	2.529E+01	4.922E+01	1.560E+00	-2.089E-01	-2.537E-02	1.714E-02	-7.074E-02
-2.934E+00	5.029E+01	9.517E+01	7.293E+00	-1.965E-01	-1.290E-02	1.026E-02	-6.950E-02
-7.050E+00	7.420E+01	1.364E+02	1.687E+01	-1.846E-01	-8.137E-04	3.402E-03	-6.613E-02
-1.279E+01	9.494E+01	1.688E+02	2.975E+01	-1.735E-01	1.041E-02	-3.442E-03	-5.959E-02
0.E+00	0.E+00	0.E+00	0.E+00	-2.165E-01	5.335E-02	-2.844E-02	-6.149E-02
-3.761E-01	-7.148E+00	-1.395E+01	1.584E-01	-2.057E-01	4.250E-02	-2.218E-02	-6.132E-02
-1.061E+00	-1.059E+01	-1.990E+01	1.155E+00	-1.949E-01	3.169E-02	-1.594E-02	-6.100E-02
-1.749E+00	-9.497E+00	-1.663E+01	2.238E+00	-1.841E-01	2.098E-02	-9.690E-03	-6.039E-02
-2.055E+00	-2.721E+00	-2.436E+00	2.530E+00	-1.735E-01	1.041E-02	-3.442E-03	-5.959E-02
-1.485E+01	9.222E+01	1.663E+02	3.228E+01	-1.735E-01	1.041E-02	-3.442E-03	-5.959E-02
-7.837E+00	1.151E+02	2.013E+02	1.180E+01	-1.635E-01	5.839E-04	2.918E-03	-5.323E-02
1.337E+00	1.512E+02	2.593E+02	-1.271E+01	-1.541E-01	-8.623E-03	9.292E-03	-5.315E-02
1.385E+01	2.028E+02	3.433E+02	-4.360E+01	-1.440E-01	-1.844E-02	1.570E-02	-6.085E-02
3.089E+01	2.680E+02	4.477E+02	-8.323E+01	-1.317E-01	-3.045E-02	2.215E-02	-7.852E-02
0.E+00	0.E+00	0.E+00	0.E+00	-1.324E-01	2.596E-02	-9.006E-03	-4.941E-02
1.776E+00	3.217E+01	6.429E+01	-4.420E+00	-1.322E-01	1.358E-02	-1.286E-03	-4.979E-02
8.122E+00	7.444E+01	1.487E+02	-1.818E+01	-1.321E-01	8.523E-04	6.474E-03	-5.269E-02
2.012E+01	1.245E+02	2.486E+02	-4.366E+01	-1.319E-01	-1.322E-02	1.429E-02	-6.109E-02
3.831E+01	1.754E+02	3.498E+02	-8.217E+01	-1.317E-01	-3.045E-02	2.215E-02	-7.852E-02
3.453E+03	2.866E+03	-1.084E+04	5.607E+02	-1.317E-01	-3.045E-02	2.215E-02	-7.852E-02
3.007E+03	2.534E+03	-1.125E+04	5.321E+02	-1.310E-01	-2.836E-02	2.208E-02	8.488E-02
2.459E+03	2.307E+03	-1.151E+04	2.254E+02	-1.500E-01	4.911E-03	2.240E-02	1.961E-01
1.896E+03	2.207E+03	-1.146E+04	-1.543E+02	-1.795E-01	4.988E-02	2.222E-02	2.076E-01
1.388E+03	2.199E+03	-1.111E+04	-4.672E+02	-2.078E-01	8.193E-02	2.047E-02	1.189E-01
9.757E+02	2.186E+03	-1.064E+04	-6.057E+02	-2.156E-01	8.998E-02	1.642E-02	-3.595E-02
6.604E+02	2.069E+03	-1.027E+04	-5.180E+02	-1.861E-01	7.728E-02	1.051E-02	-1.990E-01
3.833E+02	1.793E+03	-1.016E+04	-2.624E+02	-1.219E-01	4.900E-02	4.337E-03	-3.120E-01
1.646E+00	1.371E+03	-1.044E+04	1.290E-01	-5.115E-02	7.836E-04	-4.449E-04	-3.487E-01
1.646E+00	1.371E+03	-1.044E+04	1.290E-01	-5.115E-02	7.836E-04	-4.449E-04	-3.487E-01
-3.801E+02	1.792E+03	-1.016E+04	2.620E+02	-1.219E-01	-4.743E-02	-5.162E-03	-3.120E-01
-6.581E+02	2.067E+03	-1.027E+04	5.168E+02	-1.860E-01	-7.579E-02	-1.125E-02	-1.993E-01
-9.732E+02	2.185E+03	-1.065E+04	6.049E+02	-2.157E-01	-8.855E-02	-1.711E-02	-3.647E-02
-1.386E+03	2.198E+03	-1.111E+04	4.665E+02	-2.080E-01	-8.058E-02	-2.108E-02	1.182E-01
-1.894E+03	2.206E+03	-1.146E+04	1.541E+02	-1.799E-01	-4.867E-02	-2.277E-02	2.067E-01
-2.457E+03	2.307E+03	-1.151E+04	-2.246E+02	-1.504E-01	-3.898E-03	-2.290E-02	1.953E-01
-3.006E+03	2.534E+03	-1.125E+04	-5.310E+02	-1.315E-01	2.923E-02	-2.253E-02	8.436E-02
-3.451E+03	2.865E+03	-1.084E+04	-5.594E+02	-1.323E-01	3.124E-02	-2.256E-02	-7.869E-02

```
 0.E+00     0.E+00     0.E+00     0.E+00    -1.329E-01-2.538E-02 8.736E-03-4.965E-02
 1.769E+00-3.205E+01-6.405E+01-4.407E+00-1.328E-01-1.294E-02 9.825E-04-5.002E-02
 8.096E+00-7.423E+01-1.483E+02-1.813E+01-1.327E-01-1.560F-04-6.812E-03-5.292E-02
 2.006E+01-1.242E+02-2.481E+02-4.355E+01-1.325E-01 1.397E-02-1.466E-02-6.130E-02
 3.823E+01-1.751E+02-3.493E+02-8.200E+01-1.323E-01 3.124E-02-2.256E-02-7.869E-02
 0.E+00     0.E+00     0.E+00     0.E+00    -2.178E-01-5.326E-02 2.841E-02-6.203E-02
-3.794E-01 7.235E+00 1.412E+01 1.600E-01-2.069E-01-4.231E-02 2.211E-02-6.187E-02
-1.073E+00 1.078E+01 2.024E+01 1.173E+00-1.960E-01-3.141E-02 1.581E-02-6.155E-02
-1.777E+00 9.786E+00 1.716E+01 2.288E+00-1.851E-01-2.060E-02 9.518E-03-6.093E-02
-2.107E+00 3.124E+00 3.162E+00 2.629E+00-1.744E-01-9.938E-03 3.222E-03-6.011E-02
 0.E+00     0.E+00     0.E+00     0.E+00    -2.226E-01 3.870E-02-2.435E-02-7.132E-02
-5.562E-01-2.497E+01-4.859E+01 1.529E+00-2.100E-01 2.605E-02-1.742E-02-7.109E-02
-2.885E+00-4.966E+01-9.399E+01 7.179E+00-1.976E-01 1.352E-02-1.052E-02-6.988E-02
-6.946E+00-7.329E+01-1.347E+02 1.662E+01-1.856E-01 1.364E-03-3.644E-03-6.655E-02
-1.261E+01-9.381E+01-1.668E+02 2.934E+01-1.744E-01-9.938E-03 3.222E-03-6.011E-02
-1.472E+01-9.069E+01-1.636E+02 3.197E+01-1.744E-01-9.938E-03 3.222E-03-6.011E-02
-7.818E+00-1.134E+02-1.983E+02 1.177E+01-1.643E-01-1.888E-05-3.184E-03-5.379E-02
 1.236E+00-1.492E+02-2.559E+02-1.242E+01-1.548E-01 9.285E-03-9.605E-03-5.368E-02
 1.361E+01-2.005E+02-3.397E+02-4.296E+01-1.447E-01 1.919E-02-1.606E-02-6.125E-02
 3.050E+01-2.655E+02-4.439E+02-8.222E+01-1.323E-01 3.124E-02-2.256E-02-7.869E-02
-2.970E+03 2.193E+02-1.613E+04-3.273E+03-1.323E-01 3.124E-02-2.256E-02-7.869E-02
-2.167E+03 7.745E+02-1.550E+04-2.172E+03-2.057E-01 1.331E-01-3.818E-02-8.603E-01
-1.359E+03 1.659E+03-1.403E+04-4.254E+02-3.511E-01 3.723E-01-5.445E-02-1.233E+00
-6.898E+02 3.124E+03-1.127E+04 1.581E+03-5.272E-01 6.192E-01-6.717E-02-1.066E+00
-2.273E+02 4.976E+03-7.629E+03 3.234E+03-6.611E-01 7.531E-01-7.068E-02-3.714E-01
 2.343E+01 6.829E+03-3.849E+03 3.879E+03-6.336E-01 7.357E-01-6.194E-02 6.552E-01
 9.672E+01 8.349E+03-5.907E+02 3.224E+03-3.534E-01 5.982E-01-4.375E-02 1.676E+00
 6.416E+01 9.315E+03 1.701E+03 1.632E+03 1.408E-01 3.654E-01-2.248E-02 2.361E+00
 7.912E-01 9.535E+03 2.585E+03-9.182E-01 6.611E-01 3.244E-04-1.921E-04 2.569E+00

C         BOUNDARY DATA FOLLOWS

        1.2+7        1.+6        1.+6                        .675+6 .05
 0.
                .1                  1.2+7
        1.2+7        1.+6        1.+6                        .675+6 .05
 0.
                .1                  1.2+7
          END OF FILE CARD
```

SRA 202 OUTPUT DATA LISTING

CLOSED BRANCH TEST CASE

REL ERR CNTRL = 1.000E-02

SURFACE LOADING, IF ANY, IS APPLIED AT SHELL REFERENCE SURFACE
AND, DURING BUCKLING, REMAINS FIXED IN MAGNITUDE AND DIRECTION

TABLE 1 (SURFACE GEOMETRY)

ENTRY	S	R	R PRIME	R/R2	ZBAR
1	0.E+00	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
2	2.5000E-01	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
3	5.0000E-01	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
4	7.5000E-01	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
5	1.0000E+00	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
6	1.2500E+00	9.1161E+00	-7.0711E-01	7.0711E-01	5.0000E-02
7	1.5000E+00	8.9393E+00	-7.0711E-01	7.0711E-01	5.0000E-02
8	1.7500E+00	8.7626E+00	-7.0711E-01	7.0711E-01	5.0000E-02
9	2.0000E+00	8.5858E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 1. THE NEXT POINT IS A NEW EDGE					
10	2.0000E+00	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
11	2.2500E+00	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
12	2.5000E+00	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
13	2.7500E+00	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
14	3.0000E+00	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 2. THE NEXT POINT IS A NEW EDGE					
15	3.0000E+00	1.0000E+01	-7.0711E-01	-7.0711E-01	5.0000E-02
16	3.2500E+00	9.8232E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
17	3.5000E+00	9.6464E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
18	3.7500E+00	9.4697E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
19	4.0000E+00	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 2					
20	4.0000E+00	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
21	4.2500E+00	9.1161E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
22	4.5000E+00	8.9393E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
23	4.7500E+00	8.7626E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
24	5.0000E+00	8.5858E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 1. THE NEXT POINT IS A NEW EDGE					
25	5.0000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
26	5.2500E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
27	5.5000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
28	5.7500E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
29	6.0000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
********** BRANCH POINT 1					
30	6.0000E+00	8.5858E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
31	6.2500E+00	8.4090E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
32	6.5000E+00	8.2322E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
33	6.7500E+00	8.0554E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
34	7.0000E+00	7.8787E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
35	7.2500E+00	7.7019E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
36	7.5000E+00	7.5251E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
37	7.7500E+00	7.3483E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
38	8.0000E+00	7.1716E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
39	8.0000E+00	7.1716E+00	7.0711E-01	-7.0711E-01	5.0000E-02
40	8.2500E+00	7.3483E+00	7.0711E-01	-7.0711E-01	5.0000E-02
41	8.5000E+00	7.5251E+00	7.0711E-01	-7.0711E-01	5.0000E-02
42	8.7500E+00	7.7019E+00	7.0711E-01	-7.0711E-01	5.0000E-02
43	9.0000E+00	7.8787E+00	7.0711E-01	-7.0711E-01	5.0000E-02
44	9.2500E+00	8.0554E+00	7.0711E-01	-7.0711E-01	5.0000E-02
45	9.5000E+00	8.2322E+00	7.0711E-01	-7.0711E-01	5.0000E-02
46	9.7500E+00	8.4090E+00	7.0711E-01	-7.0711E-01	5.0000E-02
47	1.0000E+01	8.5858E+00	7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 3. THE NEXT POINT IS A NEW EDGE					
48	1.0000E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
49	1.0250E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
50	1.0500E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
51	1.0750E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
52	1.1000E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02

********** BRANCH POINT 3. THE NEXT POINT IS A NEW EDGE

53	1.1000E+01	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
54	1.1250E+01	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
55	1.1500E+01	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
56	1.1750E+01	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
57	1.2000E+01	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 4, THE NEXT POINT IS A NEW EDGE					
58	1.2000E+01	1.0000E+01	-7.0711E-01	-7.0711E-01	5.0000E-02
59	1.2250E+01	9.8232E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
60	1.2500E+01	9.6464E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
61	1.2750E+01	9.4697E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
62	1.3000E+01	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 4					
63	1.3000E+01	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
64	1.3250E+01	9.1161E+00	-7.0711E-01	7.0711E-01	5.0000E-02
65	1.3500E+01	8.9393E+00	-7.0711E-01	7.0711E-01	5.0000E-02
66	1.3750E+01	8.7626E+00	-7.0711E-01	7.0711E-01	5.0000E-02
67	1.4000E+01	8.5858E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 3					
68	1.4000E+01	8.5858E+00	7.0711E-01	7.0711E-01	5.0000E-02
69	1.4250E+01	8.7626E+00	7.0711E-01	7.0711E-01	5.0000E-02
70	1.4500E+01	8.9393E+00	7.0711E-01	7.0711E-01	5.0000E-02
71	1.4750E+01	9.1161E+00	7.0711E-01	7.0711E-01	5.0000E-02
72	1.5000E+01	9.2929E+00	7.0711E-01	7.0711E-01	5.0000E-02
73	1.5250E+01	9.4697E+00	7.0711E-01	7.0711E-01	5.0000E-02
74	1.5500E+01	9.6464E+00	7.0711E-01	7.0711E-01	5.0000E-02
75	1.5750E+01	9.8232E+00	7.0711E-01	7.0711E-01	5.0000E-02
76	1.6000E+01	1.0000E+01	7.0711E-01	7.0711E-01	5.0000E-02

TABLE 2 (WALL PROPERTIES)

ENTRY	S	E1	E2	E12	NU1	H
1	0.E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
2	2.5000E-01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
3	5.0000E-01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
4	7.5000E-01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
5	1.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
6	1.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
7	1.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
8	1.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
9	2.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
10	2.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
11	2.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
12	2.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
13	2.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
14	3.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
15	3.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
16	3.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
17	3.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
18	3.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
19	4.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
20	4.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
21	4.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
22	4.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
23	4.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
24	5.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
25	5.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
26	5.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
27	5.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
28	5.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
29	6.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
30	6.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
31	6.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
32	6.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
33	6.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
34	7.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
35	7.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
36	7.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
37	7.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
38	8.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
39	8.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
40	8.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
41	8.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
42	8.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
43	9.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
44	9.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
45	9.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
46	9.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
47	1.0000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
48	1.0000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
49	1.0250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
50	1.0500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
51	1.0750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
52	1.1000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
53	1.1000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
54	1.1250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
55	1.1500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
56	1.1750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
57	1.2000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
58	1.2000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
59	1.2250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02

60	1.2500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
61	1.2750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
62	1.3000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
63	1.3000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
64	1.3250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
65	1.3500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
66	1.3750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
67	1.4000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
68	1.4000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
69	1.4250E+01	1.0000E+07	1.3000E+07	4.0000E+06	2.5000E-01	5.0000E-02
70	1.4500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
71	1.4750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
72	1.5000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
73	1.5250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
74	1.5500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
75	1.5750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
76	1.6000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02

TABLE 3 (FOUNDATION MODULI) ALL ZEROES

TABLE 4 (STRINGER PROPERTIES) ALL ZEROES

TABLE 6 (UNIT LOAD PRESSURE FIELD) WAS READ AND IGNORED

INITIAL NONLINEAR STATIC SHELL DATA. LAMBDA = 1.0000E+00

ENTRY	S	T10	T20	CHI0
1	0.E+00	-9.5125E+01	1.3703E+02	-8.2685E-08
2	2.5000E-01	-9.8942E+01	7.7724E+01	6.1941E-03
3	5.0000E-01	-1.0105E+02	-5.0370E+01	7.5190E-03
4	7.5000E-01	-1.0078E+02	-1.7522E+02	5.5927E-03
5	1.0000E+00	-9.8552E+01	-2.4977E+02	1.9468E-03
6	1.2500E+00	-9.5477E+01	-2.5108E+02	-1.9552E-03
7	1.5000E+00	-9.2941E+01	-1.8632E+02	-4.6517E-03
8	1.7500E+00	-9.2036E+01	-8.8705E+01	-4.5935E-03
9	2.0000E+00	-9.2850E+01	-3.1266E+01	-7.3837E-05
10	2.0000E+00	0.E+00	-2.5587E+00	-1.4386E-05
11	2.2500E+00	4.4132E-02	-2.3433E+00	-1.4978E-05
12	2.5000E+00	8.5640E-02	-2.0859E+00	-1.8698E-05
13	2.7500E+00	1.2286E-01	-1.6976E+00	-2.8542E-05
14	3.0000E+00	1.5171E-01	-1.0277E+00	-4.7251E-05
15	3.0000E+00	0.E+00	1.5887E+00	-3.2344E-05
16	3.2500E+00	-2.3628E-02	1.0327E+00	-3.2799E-05
17	3.5000E+00	-3.7604E-02	4.3547E-01	-3.4889E-05
18	3.7500E+00	-4.0244E-02	-2.4666E-01	-3.9631E-05
19	4.0000E+00	-2.8737E-02	-1.0728E+00	-4.7251E-05
20	4.0000E+00	1.2298E-01	-1.0348E+00	-4.7251E-05
21	4.2500E+00	1.5638E-01	-2.2625E+00	-7.5513E-05
22	4.5000E+00	2.2070E-01	-3.9986E+00	-9.3076E-05
23	4.7500E+00	3.2594E-01	-6.0147E+00	-9.5121E-05
24	5.0000E+00	4.7686E-01	-7.9346E+00	-7.3837E-05
25	5.0000E+00	0.E+00	1.9554E+00	-8.6272E-05
26	5.2500E+00	0.F+00	-5.6035E-01	-8.6725E-05
27	5.5000E+00	0.E+00	-3.1066E+00	-8.8177E-05
28	5.7500E+00	0.E+00	-5.6706E+00	-8.6876E-05
29	6.0000E+00	0.E+00	-8.0538E+00	-7.3837E-05
30	6.0000E+00	-7.9044E+01	-2.7815E+01	-7.3837E-05
31	6.2500E+00	-8.0539E+01	2.7999E+01	4.4381E-03
32	6.5000E+00	-8.4002E+01	1.3510E+02	4.7132E-03
33	6.7500E+00	-8.9835E+01	2.2010E+02	2.2362E-03
34	7.0000E+00	-9.7122E+01	2.3570E+02	-1.5826E-03
35	7.2500E+00	-1.0409E+02	1.6257E+02	-5.3471E-03
36	7.5000E+00	-1.0871E+02	1.3218E+01	-7.5557E-03
37	7.7500E+00	-1.0953E+02	-1.6040E+02	-6.4659E-03
38	8.0000E+00	-1.0680E+02	-2.5457E+02	-5.9819E-08
39	8.0000E+00	-1.0680E+02	-2.5457E+02	-5.9817E-08
40	8.2500E+00	-1.0953E+02	-1.6041E+02	6.4659E-03
41	8.5000E+00	-1.0872E+02	1.3214E+01	7.5557E-03
42	8.7500E+00	-1.0409E+02	1.6257E+02	5.3471E-03
43	9.0000E+00	-9.7122E+01	2.3570E+02	1.5826E-03
44	9.2500E+00	-8.9836E+01	2.2010E+02	-2.2362E-03
45	9.5000E+00	-8.4002E+01	1.3510E+02	-4.7132E-03
46	9.7500E+00	-8.0540E+01	2.8001E+01	-4.4381E-03
47	1.0000E+01	-7.9045E+01	-2.7815E+01	7.3831E-05
48	1.0000E+01	0.E+00	1.9552E+00	8.6268E-05
49	1.0250E+01	0.E+00	-5.6044E-01	8.6721E-05
50	1.0500E+01	0.F+00	-3.1066E+00	8.8172E-05
51	1.0750E+01	0.E+00	-5.6704E+00	8.6870E-05
52	1.1000E+01	0.E+00	-8.0535E+00	7.3831E-05
53	1.1000E+01	0.E+00	1.5886E+00	3.2343E-05
54	1.1250E+01	-2.3626E-02	1.0326E+00	3.2798E-05
55	1.1500E+01	-3.7601E-02	4.3542E-01	3.4888E-05
56	1.1750E+01	-4.0241E-02	-2.4669E-01	3.9630E-05
57	1.2000E+01	-2.8734E-02	-1.0728E+00	4.7249E-05

58	1.2000E+01	0.E+00	-2.5566E+00	1.4385E-05
59	1.2250E+01	4.4131E-02	-2.3432E+00	1.4977E-05
60	1.2500E+01	8.5638E-02	-2.0859E+00	1.8697E-05
61	1.2750E+01	1.2285E-01	-1.6976E+00	2.8541E-05
62	1.3000E+01	1.5171E-01	-1.0277E+00	4.7249E-05
63	1.3000E+01	1.2298E-01	-1.0348E+00	4.7249E-05
64	1.3250E+01	1.5638E-01	-2.2625E+00	7.5510E-05
65	1.3500E+01	2.2069E-01	-3.9985E+00	9.3072E-05
66	1.3750E+01	3.2594E-01	-6.0144E+00	9.5115E-05
67	1.4000E+01	4.7685E-01	-7.9342E+00	7.3831E-05
68	1.4000E+01	-9.2850E+01	-3.1206E+01	7.3831E-05
69	1.4250E+01	-9.2036E+01	-8.8705E+01	4.5936E-03
70	1.4500E+01	-9.2941E+01	-1.8632E+02	4.6518E-03
71	1.4750E+01	-9.5477E+01	-2.5188E+02	1.9553E-03
72	1.5000E+01	-9.8552E+01	-2.4977E+02	-1.9467E-03
73	1.5250E+01	-1.0076E+02	-1.7523E+02	-5.5926E-03
74	1.5500E+01	-1.0105E+02	-5.0377E+01	-7.5191E-03
75	1.5750E+01	-9.8942E+01	7.7721E+01	-6.1942E-03
76	1.6000E+01	-9.5125E+01	1.3763E+02	-8.2616E-08

INITIAL PERTURBATION STATE SHELL DATA

ENTRY	S	T11	T21	CHI1
1	0.E+00	-9.5110E+01	1.4002E+02	5.8423E-08
2	2.5000E-01	-9.8978E+01	8.0253E+01	6.2636E-03
3	5.0000E-01	-1.0112E+02	-4.8961E+01	7.6228E-03
4	7.5000E-01	-1.0087E+02	-1.7524E+02	5.6857E-03
5	1.0000E+00	-9.8628E+01	-2.5103E+02	1.9976E-03
6	1.2500E+00	-9.5525E+01	-2.5365E+02	-1.9539E-03
7	1.5000E+00	-9.2957E+01	-1.8766E+02	-4.6827E-03
8	1.7500E+00	-9.2035E+01	-8.9136E+01	-4.6245E-03
9	2.0000E+00	-9.2846E+01	-3.1247E+01	-7.4725E-05
10	2.0000E+00	0.E+00	-2.5417E+00	-1.4448E-05
11	2.2500E+00	4.3814E-02	-2.3249E+00	-1.5037E-05
12	2.5000E+00	8.4968E-02	-2.0663E+00	-1.8731E-05
13	2.7500E+00	1.2180E-01	-1.6776E+00	-2.8500E-05
14	3.0000E+00	1.5027E-01	-1.0093E+00	-4.7058E-05
15	3.0000E+00	0.E+00	1.5887E+00	-3.2092E-05
16	3.2500E+00	-2.3670E-02	1.0373E+00	-3.2546E-05
17	3.5000E+00	-3.7774E-02	4.4481E-01	-3.4639E-05
18	3.7500E+00	-4.0636E-02	-2.3256E-01	-3.9396E-05
19	4.0000E+00	-2.9449E-02	-1.0542E+00	-4.7058E-05
20	4.0000E+00	1.2082E-01	-1.0167E+00	-4.7058E-05
21	4.2500E+00	1.5376E-01	-2.2394E+00	-7.5268E-05
22	4.5000E+00	2.1754E-01	-3.9711E+00	-9.2964E-05
23	4.7500E+00	3.2216E-01	-5.9873E+00	-9.5369E-05
24	5.0000E+00	4.7252E-01	-7.9177E+00	-7.4725E-05
25	5.0000E+00	0.E+00	1.9972E+00	-8.6247E-05
26	5.2500E+00	0.E+00	-5.1792E-01	-8.6715E-05
27	5.5000E+00	0.E+00	-3.0651E+00	-8.8268E-05
28	5.7500E+00	0.E+00	-5.6351E+00	-8.7239E-05
29	6.0000E+00	0.E+00	-8.0358E+00	-7.4725E-05
30	6.0000E+00	-7.9098E+01	-2.7810E+01	-7.4725E-05
31	6.2500E+00	-8.0598E+01	2.8389E+01	4.4647E-03
32	6.5000E+00	-8.4079E+01	1.3641E+02	4.7427E-03
33	6.7500E+00	-8.9951E+01	2.2199E+02	2.2386E-03
34	7.0000E+00	-9.7280E+01	2.3720E+02	-1.6270E-03
35	7.2500E+00	-1.0427E+02	1.6272E+02	-5.4363E-03
36	7.5000E+00	-1.0888E+02	1.1549E+01	-7.6613E-03
37	7.7500E+00	-1.0964E+02	-1.6370E+02	-6.5402E-03
38	8.0000E+00	-1.0682E+02	-2.5870E+02	-5.5918E-08
39	8.0000E+00	-1.0682E+02	-2.5870E+02	-5.5915E-08
40	8.2500E+00	-1.0964E+02	-1.6370E+02	6.5401E-03
41	8.5000E+00	-1.0888E+02	1.1549E+01	7.6611E-03
42	8.7500E+00	-1.0427E+02	1.6272E+02	5.4361E-03
43	9.0000E+00	-9.7278E+01	2.3721E+02	1.6269E-03
44	9.2500E+00	-8.9949E+01	2.2200E+02	-2.2386E-03
45	9.5000E+00	-8.4077E+01	1.3641E+02	-4.7427E-03
46	9.7500E+00	-8.0595E+01	2.8386E+01	-4.4647E-03
47	1.0000E+01	-7.9096E+01	-2.7814E+01	7.4750E-05
48	1.0000E+01	0.E+00	1.9978E+00	8.6285E-05
49	1.0250E+01	0.E+00	-5.1847E-01	8.6752E-05
50	1.0500E+01	0.E+00	-3.0667E+00	8.8305E-05
51	1.0750E+01	0.E+00	-5.6377E+00	8.7274E-05
52	1.1000E+01	0.E+00	-8.0394E+00	7.4750E-05
53	1.1000E+01	0.E+00	1.5894E+00	3.2108E-05
54	1.1250E+01	-2.3679E-02	1.0377E+00	3.2561E-05
55	1.1500E+01	-3.7789E-02	4.4493E-01	3.4655E-05
56	1.1750E+01	-4.0651E-02	-2.3277E-01	3.9414E-05
57	1.2000E+01	-2.9456E-02	-1.0548E+00	4.7080E-05

58	1.2000E+01	0.E+00	-2.5429E+00	1.4453E-05
59	1.2250E+01	4.3835E-02	-2.3260E+00	1.5043E-05
60	1.2500E+01	8.5009E-02	-2.0673E+00	1.8738E-05
61	1.2750E+01	1.2186E-01	-1.6785E+00	2.8513E-05
62	1.3000E+01	1.5034E-01	-1.0099E+00	4.7080E-05
63	1.3000E+01	1.2089E-01	-1.0172E+00	4.7080E-05
64	1.3250E+01	1.5386E-01	-2.2405E+00	7.5302E-05
65	1.3500E+01	2.1766E-01	-3.9730E+00	9.3005E-05
66	1.3750E+01	3.2232E-01	-5.9901E+00	9.5408E-05
67	1.4000E+01	4.7275E-01	-7.9212E+00	7.4750E-05
68	1.4000E+01	-9.2848E+01	-3.1251E+01	7.4750E-05
69	1.4250E+01	-9.2037E+01	-8.9139E+01	4.6245E-03
70	1.4500E+01	-9.2959E+01	-1.8766E+02	4.6826E-03
71	1.4750E+01	-9.5527E+01	-2.5364E+02	1.9538E-03
72	1.5000E+01	-9.8630E+01	-2.5102E+02	-1.9977E-03
73	1.5250E+01	-1.0087E+02	-1.7524E+02	-5.6858E-03
74	1.5500E+01	-1.0112E+02	-4.8960E+01	-7.6228E-03
75	1.5750E+01	-9.8979E+01	8.0255E+01	-6.2636E-03
76	1.6000E+01	-9.5111E+01	1.4062E+02	5.8495E-08

BUCKLING MODE

CRITICAL HARMONIC = 2
CRITICAL LOAD = 4.990E+01

ENTRY	S	P	W	CAP S	M 1	XI	ETA	V	CHI
1	0.E+00	7.912E-01	9.535E+03	2.585E+03	-9.182E-01	6.611E-01	3.244E-04	-1.921E-04	2.569E+00
2	2.5000E-01	-6.253E+01	9.315E+03	1.701E+03	-1.634E+03	1.409E-01	-3.647E-01	2.207E-02	2.361E+00
3	5.0000E-01	-9.502E+01	8.348E+03	-5.920E+02	-3.224E+03	-3.532E-01	-5.975E-01	4.333E-02	1.675E+00
4	7.5000E-01	-2.168E+01	6.828E+03	-3.851E+03	-3.879E+03	-6.332E-01	-7.349E-01	6.149E-02	6.547E-01
5	1.0000E+00	2.288E+02	4.974E+03	-7.632E+03	-3.234E+03	-6.607E-01	-7.522E-01	7.026E-02	-3.717E-01
6	1.2500E+00	6.911E+02	3.122E+03	-1.128E+04	-1.581E+03	-5.267E-01	-6.183E-01	6.678E-02	-1.066E+00
7	1.5000E+00	1.360E+03	1.657E+03	-1.403E+04	4.258E+02	-3.507E-01	-3.712E-01	5.401E-02	-1.233E+00
8	1.7500E+00	2.168E+03	7.726E+02	-1.550E+04	2.172E+03	-2.051E-01	-1.323E-01	3.777E-02	-8.602E-01
9	2.0000E+00	2.971E+03	2.174E+02	-1.613E+04	3.273E+03	[illegible]	[illegible]	[illegible]	-7.852E-02
10	2.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-2.214E-01	-3.795E-02	2.404E-02	-7.096E-02
11	2.2500E+00	-5.694E-01	2.529E+01	4.922E+01	1.560E+00	-2.089E-01	-2.537E-02	1.714E-02	-7.074E-02
12	2.5000E+00	-2.934E+00	5.029E+01	9.517E+01	7.293E+00	-1.965E-01	-1.290E-02	1.026E-02	-6.950E-02
13	2.7500E+00	-7.050E+00	7.420E+01	1.364E+02	1.687E+01	-1.846E-01	-8.137E-04	3.402E-03	-6.613E-02
14	3.0000E+00	-1.279E+01	9.494E+01	1.688E+02	2.975E+01	-1.735E-01	1.041E-02	-3.442E-03	-5.959E-02
15	3.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-2.165E-01	5.335E-02	-2.844E-02	-6.149E-02
16	3.2500E+00	-3.761E-01	-7.148E+00	-1.395E+01	1.584E-01	-2.057E-01	4.250E-02	-2.218E-02	-6.132E-02
17	3.5000E+00	-1.051E+00	-1.059E+01	-1.990E+01	1.155E+00	-1.949E-01	3.169E-02	-1.594E-02	-6.100E-02
18	3.7500E+00	-1.749E+00	-9.497E+00	-1.663E+01	2.238E+00	-1.841E-01	2.098E-02	-9.690E-03	-6.039E-02
19	4.0000E+00	-2.055E+00	-2.721E+00	-2.436E+00	2.530E+00	-1.735E-01	1.041E-02	-3.442E-03	-5.959E-02
20	4.0000E+00	-1.485E+01	9.222E+01	1.663E+02	3.228E+01	-1.735E-01	1.041E-02	-3.442E-03	-5.959E-02
21	4.2500E+00	-7.837E+00	1.151E+02	2.013E+02	1.180E+01	-1.635E-01	5.839E-04	2.918E-03	-5.323E-02
22	4.5000E+00	1.337E+00	1.512E+02	2.593E+02	-1.271E+01	-1.541E-01	-8.623E-03	9.292E-03	-5.315E-02
23	4.7500E+00	1.385E+01	2.028E+02	3.433E+02	-4.360E+01	-1.440E-01	-1.844E-02	1.570E-02	-6.085E-02
24	5.0000E+00	3.089E+01	2.680E+02	4.477E+02	-8.323E+01	-1.317E-01	-3.045E-02	2.215E-02	-7.852E-02
25	5.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-1.324E-01	2.596E-02	-9.006E-03	-4.941E-02
26	5.2500E+00	1.776E+00	3.217E+01	6.429E+01	-4.420E+00	-1.322E-01	1.358E-02	-1.286E-03	-4.979E-02
27	5.5000E+00	8.122E+00	7.444E+01	1.487E+02	-1.818E+01	-1.321E-01	8.523E-04	6.474E-03	-5.269E-02
28	5.7500E+00	2.012E+01	1.245E+02	2.486E+02	-4.366E+01	-1.319E-01	-1.322E-02	1.429E-02	-6.109E-02
29	6.0000E+00	3.831E+01	1.754E+02	3.498E+02	-8.217E+01	-1.317E-01	-3.045E-02	2.215E-02	-7.852E-02
30	6.0000E+00	3.453E+03	2.866E+03	-1.084E+04	5.607E+02	-1.317E-01	-3.045E-02	2.215E-02	-7.852E-02
31	6.2500E+00	3.007E+03	2.534E+03	-1.125E+04	5.321E+02	-1.310E-01	-2.836E-02	2.208E-02	8.488E-02
32	6.5000E+00	2.459E+03	2.307E+03	-1.151E+04	2.254E+02	-1.500E-01	4.911E-03	2.240E-02	1.961E-01
33	6.7500E+00	1.896E+03	2.207E+03	-1.146E+04	-1.543E+02	-1.795E-01	4.988E-02	2.222E-02	2.076E-01
34	7.0000E+00	1.388E+03	2.199E+03	-1.111E+04	-4.672E+02	-2.078E-01	8.193E-02	2.047E-02	1.189E-01
35	7.2500E+00	9.757E+02	2.186E+03	-1.064E+04	-6.057E+02	-2.156E-01	8.998E-02	1.642E-02	-3.595E-02
36	7.5000E+00	6.604E+02	2.069E+03	-1.027E+04	-5.180E+02	-1.861E-01	7.728E-02	1.051E-02	-1.990E-01
37	7.7500E+00	3.833E+02	1.793E+03	-1.016E+04	-2.624E+02	-1.219E-01	4.900E-02	4.337E-03	-3.120E-01
38	8.0000E+00	1.646E+00	1.371E+03	-1.044E+04	1.290E-01	-5.115E-02	7.836E-04	-4.449E-04	-3.487E-01
39	8.0000E+00	1.646E+00	1.371E+03	-1.044E+04	1.290E-01	-5.115E-02	7.836E-04	-4.449E-04	-3.487E-01
40	8.2500E+00	-3.801E+02	1.792E+03	-1.016E+04	2.620E+02	-1.219E-01	-4.743E-02	-5.162E-03	-3.120E-01
41	8.5000E+00	-6.581E+02	2.067E+03	-1.027E+04	5.168E+02	-1.860E-01	-7.579E-02	-1.125E-02	-1.993E-01
42	8.7500E+00	-9.732E+02	2.185E+03	-1.065E+04	6.049E+02	-2.157E-01	-8.855E-02	-1.711E-02	-3.647E-02
43	9.0000E+00	-1.386E+03	2.198E+03	-1.111E+04	4.665E+02	-2.080E-01	-8.058E-02	-2.108E-02	1.182E-01
44	9.2500E+00	-1.894E+03	2.206E+03	-1.146E+04	1.541E+02	-1.799E-01	-4.867E-02	-2.277E-02	2.067E-01
45	9.5000E+00	-2.457E+03	2.307E+03	-1.151E+04	-2.246E+02	-1.504E-01	-3.898E-03	-2.290E-02	1.953E-01
46	9.7500E+00	-3.006E+03	2.534E+03	-1.125E+04	-5.310E+02	-1.315E-01	2.923E-02	-2.253E-02	8.436E-02
47	1.0000E+01	-3.451E+03	2.865E+03	-1.084E+04	-5.594E+02	[illegible]	3.124E-02	-2.256E-02	-7.869E-02
48	1.0000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-1.329E-01	-2.538E-02	8.736E-03	-4.965E-02
49	1.0250E+01	1.769E+00	-3.205E+01	-6.405E+01	-4.407E+00	-1.328E-01	-1.294E-02	9.825E-04	-5.002E-02
50	1.0500E+01	8.096E+00	-7.423E+01	-1.483E+02	-1.813E+01	-1.327E-01	-1.560E-04	-6.812E-03	-5.292E-02
51	1.0750E+01	2.006E+01	-1.242E+02	-2.481E+02	-4.355E+01	-1.325E-01	1.397E-02	-1.466E-02	-6.130E-02
52	1.1000E+01	3.823E+01	-1.751E+02	-3.493E+02	-8.200E+01	-1.323E-01	3.124E-02	-2.256E-02	-7.869E-02
53	1.1000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-2.178E-01	-5.326E-02	2.841E-02	-6.203E-02
54	1.1250E+01	-3.794E-01	7.235E+00	1.412E+01	1.600E-01	-2.069E-01	-4.231E-02	2.211E-02	-6.187E-02
55	1.1500E+01	-1.073E+00	1.078E+01	2.024E+01	1.173E+00	-1.960E-01	-3.141E-02	1.581E-02	-6.155E-02
56	1.1750E+01	-1.777E+00	9.786E+00	1.716E+01	2.288E+00	-1.851E-01	-2.060E-02	9.518E-03	-6.093E-02

57	1.2000E+01	-2.167E+00	3.124E+00	3.162E+00	2.629E+00	-1.744E-01	-9.938E-03	3.222E-03	-6.011E-02
58	1.2000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-2.226E-01	3.870E-02	-2.435E-02	-7.132E-02
59	1.2250E+01	-5.562E-01	-2.497E+01	-4.859E+01	1.529E+00	-2.100E-01	2.605E-02	-1.742E-02	-7.109E-02
60	1.2500E+01	-2.885E+00	-4.966E+01	-9.399E+01	7.179E+00	-1.976E-01	1.352E-02	-1.052E-02	-6.988E-02
61	1.2750E+01	-6.946E+00	-7.329E+01	-1.347E+02	1.662E+01	-1.856E-01	1.364E-03	-3.644E-03	-6.655E-02
62	1.3000E+01	-1.261E+01	-9.381E+01	-1.668E+02	2.934E+01	-1.744E-01	-9.938E-03	3.222E-03	-6.011E-02
63	1.3000E+01	-1.472E+01	-9.069E+01	-1.636E+02	3.197E+01	-1.744E-01	-9.938E-03	3.222E-03	-6.011E-02
64	1.3250E+01	-7.816E+00	-1.134E+02	-1.983E+02	1.177E+01	-1.643E-01	-1.888E-05	-3.184E-03	-5.379E-02
65	1.3500E+01	1.236E+00	-1.492E+02	-2.559E+02	-1.242E+01	-1.548E-01	9.285E-03	-9.605E-03	-5.368E-02
66	1.3750E+01	1.361E+01	-2.005E+02	-3.397E+02	-4.296E+01	-1.447E-01	1.919E-02	-1.606E-02	-6.125E-02
67	1.4000E+01	3.050E+01	-2.655E+02	-4.439E+02	-8.222E+01	-1.323E-01	3.124E-02	-2.256E-02	-7.869E-02
68	[illegible]	-2.970E+03	2.193E+02	-1.613E+04	-3.273E+03	-1.323E-01	3.124E-02	-2.256E-02	-7.869E-02
69	1.4250E+01	-2.167E+03	7.745E+02	-1.550E+04	-2.172E+03	-2.057E-01	1.331E-01	-3.818E-02	-8.603E-01
70	1.4500E+01	-1.359E+03	1.659E+03	-1.403E+04	-4.254E+02	-3.511E-01	3.723E-01	-5.445E-02	-1.233E+00
71	1.4750E+01	-6.898E+02	3.124E+03	-1.127E+04	1.581E+03	-5.272E-01	6.192E-01	-6.717E-02	-1.066E+00
72	1.5000E+01	-2.273E+02	4.976E+03	-7.629E+03	3.234E+03	-6.611E-01	7.531E-01	-7.068E-02	-3.714E-01
73	1.5250E+01	2.343E+01	6.829E+03	-3.849E+03	3.879E+03	-6.336E-01	7.357E-01	-6.194E-02	6.552E-01
74	1.5500E+01	9.672E+01	8.349E+03	-5.907E+02	3.224E+03	-3.534E-01	5.982E-01	-4.375E-02	1.676E+00
75	1.5750E+01	6.416E+01	9.315E+03	1.701E+03	1.632E+03	1.408E-01	3.654E-01	-2.248E-02	2.361E+00
76	1.6000E+01	7.912E-01	9.535E+03	2.585E+03	-9.182E-01	6.611E-01	3.244E-04	-1.921E-04	2.569E+00

```
BOUNDARY NUMBER  1            S =  0.E+00

THIS IS THE FIRST POINT OF A CLOSED BRANCH - SEE BOUNDARY NUMBER 13 FOR BOUNDARY DATA

BOUNDARY NUMBER  2            S =  2.0000E+00

B = I, D = 0, L VECTOR = 0   (FORCE-FREE)

BOUNDARY NUMBER  3            S =  3.0000E+00

B = I, D = 0, L VECTOR = 0   (FORCE-FREE)

BOUNDARY NUMBER  4            S =  4.0000E+00

B = I, D = 0, L VECTOR = 0   (FORCE-FREE)

BOUNDARY NUMBER  5            S =  5.0000E+00

B = I, D = 0, L VECTOR = 0   (FORCE-FREE)

BOUNDARY NUMBER  6            S =  6.0000E+00

RING DATA
EA =  1.2000E+07     EIX =  1.0000E+06     EIY =  1.0000E+06     EIXY = -0.E+00     GJ =  6.7500E+05     ZBAR =  5.0000E-02

SBAR = -0.E+00        TPHI0 = -9.6646E+01     TPHI1 = -9.6430E+01

BOUNDARY NUMBER  7            S =  8.0000E+00

B = I, D = 0, L VECTOR = 0   (FORCE-FREE)

BOUNDARY NUMBER  8            S =  1.0000E+01

B = I, D = 0, L VECTOR = 0   (FORCE-FREE)

BOUNDARY NUMBER  9            S =  1.1000E+01

B = I, D = 0, L VECTOR = 0   (FORCE-FREE)

BOUNDARY NUMBER 10            S =  1.2000E+01

B = I, D = 0, L VECTOR = 0   (FORCE-FREE)

BOUNDARY NUMBER 11            S =  1.3000E+01

B = I, D = 0, L VECTOR = 0   (FORCE-FREE)

BOUNDARY NUMBER 12            S =  1.4000E+01
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```
RING DATA
EA =  1.2000E+07      EIX =  1.0000E+06      EIY =  1.0000E+06      EIXY = -0.E+00          GJ =  6.7500E+05     ZBAR =  5.0000E-02

SBAR = -0.E+00        TPHI0 = -9.6641E+01    TPHI1 = -9.6473E+01

BOUNDARY NUMBER 13          S =  1.6000E+01

B = I, D = 0, L VECTOR = 0   (FORCE-FREE)


INNER PRODUCT =  9.811E+03

MAX ALPHA =  1.836E+00

FOR BUCKLING MODE IMPERFECTION, ALPHA =  1.697E+00
                                MAX NORMAL IMPERFECTION =  1.911E+00 TIMES RMS VALUE OF ANGULAR IMPERFECTION
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AXISYMMETRIC COMPONENT OF SECOND-ORDER CONTRIBUTION TO BUCKLED STATE

ENTRY	S	F	Q	CAP S	M1	XI	ETA	V	CHI
1	0.E+00	2.5421E+03	-1.5508E+01	0.E+00	5.2796E+03	1.1287E+01	-3.0835E-02	0.E+00	-4.2218E-03
2	2.5000E-01	2.5879E+03	2.5882E+02	0.E+00	2.9951E+03	1.0869E+01	1.5862E-01	0.E+00	1.1893E+00
3	5.0000E-01	2.6353E+03	8.3434E+02	0.E+00	2.1516E+02	1.0323E+01	1.8152E-01	0.E+00	1.6430E+00
4	7.5000E-01	2.6845E+03	1.4241E+03	0.E+00	-1.7809E+03	9.8832E+00	6.6488E-02	0.E+00	1.3992E+00
5	1.0000E+00	2.7355E+03	1.7159E+03	0.E+00	-2.3279E+03	9.6418E+00	-8.4042E-02	0.E+00	7.9202E-01
6	1.2500E+00	2.7886E+03	1.6455E+03	0.E+00	-1.7041E+03	9.5276E+00	-1.4149E-01	0.E+00	2.0830E-01
7	1.5000E+00	2.8437E+03	1.4599E+03	0.E+00	-6.4787E+02	9.4618E+00	-8.1723E-02	0.E+00	-1.2441E-01
8	1.7500E+00	2.9011E+03	1.4341E+03	0.E+00	3.3176E+02	9.4309E+00	8.4570E-03	0.E+00	-1.6549E-01
9	2.0000E+00	2.9608E+03	1.5839E+03	0.E+00	1.1674E+03	9.4288E+00	3.8474E-02	0.E+00	4.7248E-02
10	2.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	9.4738E+00	1.0462E-02	0.E+00	8.5766E-03
11	2.2500E+00	0.E+00	3.7343E+01	0.E+00	3.3545E+00	9.4719E+00	9.2504E-03	0.E+00	8.9319E-03
12	2.5000E+00	0.E+00	7.1873E+01	0.E+00	1.3161E+01	9.4698E+00	7.8312E-03	0.E+00	1.1152E-02
13	2.7500E+00	0.E+00	1.0223E+02	0.E+00	2.8962E+01	9.4671E+00	5.7035E-03	0.E+00	1.7006E-02
14	3.0000E+00	0.E+00	1.2502E+02	0.E+00	[illegible]	9.4630E+00	[illegible]	0.E+00	[illegible]
15	3.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	9.4777E+00	-1.4024E-02	0.E+00	1.9273E-02
16	3.2500E+00	0.E+00	-1.9502E+01	0.E+00	1.8622E+00	9.4744E+00	-1.0447E-02	0.E+00	1.9539E-02
17	3.5000E+00	0.E+00	-3.1473E+01	0.E+00	6.5662E+00	9.4710E+00	-6.7402E-03	0.E+00	2.0764E-02
18	3.7500E+00	0.E+00	-3.4510E+01	0.E+00	1.2687E+01	9.4673E+00	-2.6729E-03	0.E+00	2.3559E-02
19	4.0000E+00	0.E+00	-2.6256E+01	0.E+00	1.8465E+01	9.4630E+00	2.0561E-03	0.E+00	[illegible]
20	4.0000E+00	0.E+00	9.8704E+01	0.E+00	6.8347E+01	9.4630E+00	2.0561E-03	0.E+00	[illegible]
21	4.2500E+00	0.E+00	1.2479E+02	0.E+00	4.9748E+01	9.4566E+00	8.7893E-03	0.E+00	4.4988E-02
22	4.5000E+00	0.E+00	1.7624E+02	0.E+00	2.4319E+01	9.4478E+00	1.8016E-02	0.E+00	5.5870E-02
23	4.7500E+00	0.E+00	2.6176E+02	0.E+00	-1.3237E+01	9.4379E+00	2.8515E-02	0.E+00	5.8074E-02
24	5.0000E+00	0.E+00	3.8593E+02	0.E+00	[illegible]	9.4288E+00	[illegible]	0.E+00	4.7248E-02
25	5.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	9.4275E+00	-1.3368E-02	0.E+00	5.1190E-02
26	5.2500E+00	0.E+00	-1.6589E+01	0.E+00	2.9652E+00	9.4276E+00	-5.4891E-04	0.E+00	5.1510E-02
27	5.5000E+00	0.E+00	1.0469E+01	0.E+00	4.6525E+00	9.4278E+00	1.2472E-02	0.E+00	5.2738E-02
28	5.7500E+00	0.E+00	8.2143E+01	0.E+00	-5.8816E+00	9.4282E+00	2.5748E-02	0.E+00	5.2982E-02
29	6.0000E+00	0.E+00	1.9837E+02	0.E+00	[illegible]	[illegible]	[illegible]	0.E+00	[illegible]
30	6.0000E+00	2.9608E+03	8.7672E+03	0.E+00	1.6993E+03	[illegible]	3.8474E-02	0.E+00	[illegible]
31	6.2500E+00	3.0231E+03	9.0958E+03	0.E+00	1.9463E+02	9.3965E+00	8.6613E-02	0.E+00	3.3663E-01
32	6.5000E+00	3.0880E+03	9.6787E+03	0.E+00	-1.7792E+03	9.3632E+00	1.4963E-01	0.E+00	1.1470E-01
33	6.7500E+00	3.1558E+03	1.0374E+04	0.E+00	-3.2580E+03	9.4003E+00	1.1016E-01	0.E+00	-6.1797E-01
34	7.0000E+00	3.2266E+03	1.0652E+04	0.E+00	-3.3565E+03	9.5980E+00	-8.2311E-02	0.E+00	-1.5952E+00
35	7.2500E+00	3.3006E+03	9.9161E+03	0.E+00	-1.6279E+03	1.0021E+01	-3.7117E-01	0.E+00	-2.3499E+00
36	7.5000E+00	3.3782E+03	7.8398E+03	0.E+00	1.4681E+03	1.0600E+01	-6.5870E-01	0.E+00	-2.4059E+00
37	7.7500E+00	3.4594E+03	4.4043E+03	0.E+00	4.6118E+03	1.1090E+01	-8.9398E-01	0.E+00	-1.5447E+00
38	8.0000E+00	3.5447E+03	-1.4132E+02	0.E+00	6.3198E+03	1.1265E+01	-1.0017E+00	0.E+00	3.0508E-02
39	8.0000E+00	3.5447E+03	-1.4132E+02	0.E+00	6.3198E+03	1.1265E+01	-1.0017E+00	0.E+00	3.0508E-02
40	8.2500E+00	3.4594E+03	-4.6629E+03	0.E+00	4.5744E+03	1.1452E+01	-8.8585E-01	0.E+00	1.6004E+00
41	8.5000E+00	3.3782E+03	-8.0645E+03	0.E+00	1.4258E+03	1.1962E+01	-6.5362E-01	0.E+00	2.4500E+00
42	8.7500E+00	3.3006E+03	-1.0108E+04	0.E+00	-1.6962E+03	1.2551E+01	-3.6265E-01	0.E+00	2.3777E+00
43	9.0000E+00	3.2266E+03	-1.0800E+04	0.E+00	-3.4175E+03	1.2977E+01	-7.0929E-02	0.E+00	1.6042E+00
44	9.2500E+00	3.1558E+03	-1.0478E+04	0.E+00	-3.3010E+03	1.3177E+01	1.1951E-01	0.E+00	6.1203E-01
45	9.5000E+00	3.0880E+03	-9.7502E+03	0.E+00	-1.7893E+03	1.3213E+01	1.5654E-01	0.E+00	-1.2800E-01
46	9.7500E+00	3.0231E+03	-9.1512E+03	0.E+00	2.1893E+02	1.3180E+01	8.8205E-02	0.E+00	-3.4749E-01
47	1.0000E+01	2.9608E+03	-8.8192E+03	0.E+00	1.7400E+03	[illegible]	3.8731E-02	0.E+00	[illegible]
48	1.0000E+01	0.E+00	0.E+00	0.E+00	0.E+00	1.3148E+01	-1.3864E-02	0.E+00	-5.1705E-02
49	1.0250E+01	0.E+00	-1.7999E+01	0.E+00	-3.1513E+00	1.3148E+01	-9.1460E-04	0.E+00	-5.2043E-02
50	1.0500E+01	0.E+00	8.1168E+00	0.E+00	-5.3208E+00	1.3148E+01	1.2251E-02	0.E+00	-5.3386E-02
51	1.0750E+01	0.E+00	7.9411E+01	0.E+00	4.5609E+00	1.3148E+01	2.5719E-02	0.E+00	-5.3907E-02
52	1.1000E+01	0.E+00	1.9606E+02	0.E+00	3.7701E+01	1.3147E+01	3.8731E-02	0.E+00	-4.8639E-02
53	1.1000E+01	0.E+00	0.E+00	0.E+00	0.E+00	1.3098E+01	-1.4177E-02	0.E+00	-1.9220E-02
54	1.1250E+01	0.E+00	-1.9768E+01	0.E+00	-1.8851E+00	1.3101E+01	-1.0607E-02	0.E+00	-1.9489E-02
55	1.1500E+01	0.E+00	-3.2050E+01	0.E+00	-6.6636E+00	1.3105E+01	-6.9046E-03	0.E+00	-2.0729E-02
56	1.1750E+01	0.E+00	-3.5437E+01	0.E+00	-1.2919E+01	1.3108E+01	-2.8374E-03	0.E+00	-2.3569E-02
57	1.2000E+01	0.E+00	-2.7553E+01	0.E+00	-1.8897E+01	1.3113E+01	1.9031E-03	0.E+00	-2.8195E-02
58	1.2000E+01	0.E+00	0.E+00	0.E+00	0.E+00	1.3102E+01	1.0400E-02	0.E+00	-8.7276E-03

59	1.2250E+01	0.E+00	3.7287E+01	0.E+00	-3.3511E+00	1.3104E+01	9.1643E-03	0.E+00	-9.0833E-03
60	1.2500E+01	0.E+00	7.1681E+01	0.E+00	-1.3136E+01	1.3106E+01	7.7206E-03	0.E+00	-1.1301E-02
61	1.2750E+01	0.E+00	1.0181E+02	0.E+00	-2.8884E+01	1.3108E+01	5.5697E-03	0.E+00	-1.7142E-02
62	1.3000E+01	0.E+00	1.2429E+02	0.E+00	-4.9703E+01	1.3113E+01	1.9031E-03	0.E+00	-2.8195E-02
63	1.3000E+01	0.E+00	9.6736E+01	0.E+00	-6.8600E+01	1.3113E+01	1.9031E-03	0.E+00	-2.8195E-02
64	1.3250E+01	0.E+00	1.2241E+02	0.E+00	-5.0402E+01	1.3119E+01	8.6661E-03	0.E+00	-4.5217E-02
65	1.3500E+01	0.E+00	1.7361E+02	0.E+00	-2.5437E+01	1.3128E+01	1.7955E-02	0.E+00	-5.6348E-02
66	1.3750E+01	0.E+00	2.5914E+02	0.E+00	1.1624E+01	1.3138E+01	2.8573E-02	0.E+00	-5.8939E-02
67	1.4000E+01	0.E+00	3.8386E+02	0.E+00	6.7293E+01	1.3147E+01	3.8731E-02	0.E+00	-4.8639E-02
68	1.4000E+01	2.9608E+03	-1.5949E+03	0.E+00	1.1852E+03	1.3147E+01	3.8731E-02	0.E+00	-4.8639E-02
69	1.4250E+01	2.9011E+03	-1.4441E+03	0.E+00	3.4557E+02	1.3145E+01	8.4889E-03	0.E+00	1.6868E-01
70	1.4500E+01	2.8437E+03	-1.4702E+03	0.E+00	-6.4589E+02	1.3116E+01	-8.1897E-02	0.E+00	1.2984E-01
71	1.4750E+01	2.7886E+03	-1.6575E+03	0.E+00	-1.7105E+03	1.3051E+01	-1.4278E-01	0.E+00	-2.0354E-01
72	1.5000E+01	2.7355E+03	-1.7322E+03	0.E+00	-2.3398E+03	1.2937E+01	-8.6111E-02	0.E+00	-7.8988E-01
73	1.5250E+01	2.6845E+03	-1.4456E+03	0.E+00	-1.7953E+03	1.2696E+01	6.4361E-02	0.E+00	-1.4009E+00
74	1.5500E+01	2.6353E+03	-8.6063E+02	0.E+00	2.0359E+02	1.2255E+01	1.7969E-01	0.E+00	-1.6483E+00
75	1.5750E+01	2.5879E+03	-2.8864E+02	0.E+00	2.9895E+03	1.1707E+01	1.5742E-01	0.E+00	-1.1970E+00
76	1.6000E+01	2.5421E+03	-1.5508E+01	0.E+00	5.2796E+03	1.1287E+01	-3.0835E-02	0.E+00	-4.2218E-03

ENTRY	S	U	V	W
1	0.E+00	8.0032E+00	0.E+00	7.9596E+00
2	2.5000E-01	7.5737E+00	0.E+00	7.7980E+00
3	5.0000E-01	7.1709E+00	0.E+00	7.4276E+00
4	7.5000E-01	6.9415E+00	0.E+00	7.0355E+00
5	1.0000E+00	6.8773E+00	0.E+00	6.7584E+00
6	1.2500E+00	6.8371E+00	0.E+00	6.6370E+00
7	1.5000E+00	6.7483E+00	0.E+00	6.6327E+00
8	1.7500E+00	6.6627E+00	0.E+00	6.6747E+00
9	2.0000E+00	6.6400E+00	0.E+00	6.6944E+00
10	2.0000E+00	6.6916E+00	0.E+00	6.7064E+00
11	2.2500E+00	6.6911E+00	0.E+00	6.7042E+00
12	2.5000E+00	6.6907E+00	0.E+00	6.7018E+00
13	2.7500E+00	6.6903E+00	0.E+00	6.6983E+00
14	3.0000E+00	6.6899E+00	0.E+00	6.6928E+00
15	3.0000E+00	-6.6919E+00	0.E+00	6.7117E+00
16	3.2500E+00	-6.6921E+00	0.E+00	6.7068E+00
17	3.5000E+00	-6.6923E+00	0.E+00	6.7018E+00
18	3.7500E+00	-6.6926E+00	0.E+00	6.6963E+00
19	4.0000E+00	-6.6928E+00	0.E+00	6.6899E+00
20	4.0000E+00	-6.6928E+00	0.E+00	6.6899E+00
21	4.2500E+00	-6.6931E+00	0.E+00	6.6807E+00
22	4.5000E+00	-6.6934E+00	0.E+00	6.6679E+00
23	4.7500E+00	-6.6938E+00	0.E+00	6.6535E+00
24	5.0000E+00	-6.6944E+00	0.E+00	6.6400E+00
25	5.0000E+00	-9.4275E+00	0.E+00	1.3368E-02
26	5.2500E+00	-9.4276E+00	0.E+00	5.4891E-04
27	5.5000E+00	-9.4278E+00	0.E+00	-1.2472E-02
28	5.7500E+00	-9.4282E+00	0.E+00	-2.5748E-02
29	6.0000E+00	-9.4288E+00	0.E+00	-3.8474E-02
30	6.0000E+00	-6.6944E+00	0.E+00	6.6400E+00
31	6.2500E+00	-6.7056E+00	0.E+00	6.5831E+00
32	6.5000E+00	-6.7266E+00	0.E+00	6.5150E+00
33	6.7500E+00	-6.7249E+00	0.E+00	6.5691E+00
34	7.0000E+00	-6.7286E+00	0.E+00	6.8450E+00
35	7.2500E+00	-6.8233E+00	0.E+00	7.3483E+00
36	7.5000E+00	-7.0294E+00	0.E+00	7.9610E+00
37	7.7500E+00	-7.2097E+00	0.E+00	8.4740E+00
38	8.0000E+00	-7.2573E+00	0.E+00	8.6739E+00
39	8.0000E+00	-8.6739E+00	0.E+00	-7.2573E+00
40	8.2500E+00	-8.7243E+00	0.E+00	-7.4715E+00
41	8.5000E+00	-8.9207E+00	0.E+00	-7.9964E+00

42	8.7500E+00	-9.1311E+00	0.E+00	-8.6182E+00
43	9.0000E+00	-9.2263E+00	0.E+00	-9.1260E+00
44	9.2500E+00	-9.2332E+00	0.E+00	-9.4022E+00
45	9.5000E+00	-9.2323E+00	0.E+00	-9.4537E+00
46	9.7500E+00	-9.2576E+00	0.E+00	-9.3824E+00
47	1.0000E+01	-9.2691E+00	0.E+00	-9.3239E+00
48	1.0000E+01	1.3148E+01	0.E+00	-1.3864E-02
49	1.0250E+01	1.3148E+01	0.E+00	-9.1460E-04
50	1.0500E+01	1.3148E+01	0.E+00	1.2251E-02
51	1.0750E+01	1.3148E+01	0.E+00	2.5719E-02
52	1.1000E+01	1.3147E+01	0.E+00	3.8731E-02
53	1.1000E+01	9.2717E+00	0.E+00	9.2516E+00
54	1.1250E+01	9.2714E+00	0.E+00	9.2564E+00
55	1.1500E+01	9.2712E+00	0.E+00	9.2614E+00
56	1.1750E+01	9.2710E+00	0.E+00	9.2669E+00
57	1.2000E+01	9.2707E+00	0.E+00	9.2734E+00
58	1.2000E+01	-9.2717E+00	0.E+00	9.2570E+00
59	1.2250E+01	-9.2722E+00	0.E+00	9.2592E+00
60	1.2500E+01	-9.2726E+00	0.E+00	9.2617E+00
61	1.2750E+01	-9.2730E+00	0.E+00	9.2651E+00
62	1.3000E+01	-9.2734E+00	0.E+00	9.2707E+00
63	1.3000E+01	9.2707E+00	0.E+00	9.2734E+00
64	1.3250E+01	9.2704E+00	0.E+00	9.2827E+00
65	1.3500E+01	9.2701E+00	0.E+00	9.2955E+00
66	1.3750E+01	9.2697E+00	0.E+00	9.3101E+00
67	1.4000E+01	9.2691E+00	0.E+00	9.3239E+00
68	1.4000E+01	9.3239E+00	0.E+00	-9.2691E+00
69	1.4250E+01	9.3011E+00	0.E+00	-9.2891E+00
70	1.4500E+01	9.2164E+00	0.E+00	-9.3322E+00
71	1.4750E+01	9.1273E+00	0.E+00	-9.3292E+00
72	1.5000E+01	9.0870E+00	0.E+00	-9.2087E+00
73	1.5250E+01	9.0227E+00	0.E+00	-8.9317E+00
74	1.5500E+01	8.7929E+00	0.E+00	-8.5388E+00
75	1.5750E+01	8.3893E+00	0.E+00	-8.1667E+00
76	1.6000E+01	7.9596E+00	0.E+00	-8.0032E+00

NORMALIZED DETERMINANT OF TERMINAL POINT MATRIX = 5.2192E-08

E

NONE

AXISYMMETRIC COMPONENT OF SECOND-ORDER CONTRIBUTION TO BUCKLED STATE

ENTRY	S	P	G	CAP S	M1	XI	ETA	V	CHI
1	0.E+00	2.4662E+03	-6.8688E+01	4.2109E+01	2.5245E+03	-4.7145E-03	-1.0746E+00	-6.2012E-03	-2.4746E-02
2	2.5000E-01	2.8071E+03	-2.6192E+03	-9.0589E+03	5.0043E+02	-3.3045E-01	-8.3538E-01	5.0992E-02	4.1883E-01
3	5.0000E-01	3.4965E+03	-4.6967E+03	-1.4086E+04	-1.2729E+03	-6.1239E-01	-6.9563E-01	1.1577E-01	3.0190E-01
4	7.5000E-01	4.7514E+03	-6.2481E+03	-1.6324E+04	-1.9349E+03	-6.9630E-01	-6.4076E-01	1.6060E-01	-1.6907E-01
5	1.0000E+00	6.5921E+03	-7.1631E+03	-1.7160E+04	-1.4568E+03	-6.1074E-01	-5.7595E-01	1.6497E-01	-6.5917E-01
6	1.2500E+00	9.2267E+03	-7.5132E+03	-1.7131E+04	-4.4906E+02	-4.9228E-01	-4.0582E-01	1.2965E-01	-9.2627E-01
7	1.5000E+00	1.2085E+04	-7.4307E+03	-1.6132E+04	5.0466E+02	-4.1612E-01	-1.4919E-01	7.2852E-02	-9.1202E-01
8	1.7500E+00	1.4796E+04	-7.2883E+03	-1.4421E+04	1.3684E+03	-3.6054E-01	7.8451E-02	1.4056E-02	-6.5027E-01
9	2.0000E+00	1.6857E+04	-7.7287E+03	-1.3273E+04	2.6315E+03	-3.1128E-01	1.7320E-01	-3.7945E-02	-1.0547E-01
10	2.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-6.3652E-01	-6.0151E-02	8.2272E-02	-4.5181E-01
11	2.2500E+00	-8.4319E+01	6.4956E+02	2.2786E+03	3.2355E+01	-5.5820E-01	2.0710E-02	4.0375E-02	-4.4727E-01
12	2.5000E+00	-3.1090E+02	1.2436E+03	3.7981E+03	1.4794E+02	-4.8189E-01	9.9015E-02	-4.8428E-04	-4.2208E-01
13	2.7500E+00	-6.2714E+02	1.7059E+03	4.4474E+03	3.1298E+02	-4.1302E-01	1.6929E-01	-4.0789E-02	-3.5737E-01
14	3.0000E+00	-9.6435E+02	1.9160E+03	4.0009E+03	4.8804E+02	-3.5944E-01	2.2351E-01	-8.1100E-02	-2.4424E-01
15	3.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-5.7344E-01	4.3929E-01	-1.2268E-01	-3.2561E-01
16	3.2500E+00	-2.3566E+01	-1.7912E+02	-6.4425E+02	-2.5632E-01	-5.1635E-01	3.8208E-01	-1.1158E-01	-3.2105E-01
17	3.5000E+00	-1.0086E+02	-4.5504E+02	-1.4685E+03	3.0206E+01	-4.6034E-01	3.2577E-01	-1.0088E-01	-3.1302E-01
18	3.7500E+00	-2.4895E+02	-6.4933E+02	-2.4430E+03	1.0031E+02	-4.0689E-01	2.7177E-01	-9.0691E-02	-2.9164E-01
19	4.0000E+00	-4.8704E+02	-1.3805E+03	-3.7169E+03	2.2029E+02	-3.5944E-01	2.2351E-01	-8.1100E-02	-2.4424E-01
20	4.0000E+00	-1.4514E+03	5.3551E+02	2.8397E+02	7.0833E+02	-3.5944E-01	2.2351E-01	-8.1100E-02	-2.4424E-01
21	4.2500E+00	-1.4989E+03	2.3463E+02	-8.5703E+02	3.8142E+02	-3.3178E-01	1.9504E-01	-6.9676E-02	-8.8486E-02
22	4.5000E+00	-1.6326E+03	-7.6436E+01	-1.7376E+03	9.6073E+01	-3.2393E-01	1.8642E-01	-5.8838E-02	-1.7969E-02
23	4.7500E+00	-1.8277E+03	-3.3169E+02	-2.1828E+03	-1.6976E+02	-3.2157E-01	1.8354E-01	-4.8358E-02	-2.4093E-02
24	5.0000E+00	-2.0492E+03	-4.9022E+02	-2.1605E+03	-4.4279E+02	-3.1128E-01	1.7320E-01	-3.7945E-02	-1.0547E-01
25	5.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	-3.0984E-01	5.1557E-01	-1.7337E-01	-4.2715E-01
26	5.2500E+00	-1.3204E+02	-5.4550E+02	-2.1997E+03	4.2403E+01	-3.1048E-01	4.0962E-01	-1.3818E-01	-4.1864E-01
27	5.5000E+00	-4.9148E+02	-9.7809E+02	-3.9264E+03	2.0825E+02	-3.1094E-01	3.0865E-01	-1.0410E-01	-3.8153E-01
28	5.7500E+00	-1.0199E+03	-1.2757E+03	-5.0921E+03	4.7047E+02	-3.1124E-01	2.2385E-01	-7.0822E-02	-2.8470E-01
29	6.0000E+00	-1.0371E+03	-1.3617E+03	-5.3920E+03	7.9234E+02	-3.1128E-01	1.7320E-01	-3.7945E-02	-1.0547E-01
30	6.0000E+00	2.5402E+03	1.0922E+03	-6.3399E+03	-7.2179E+02	-3.1128E-01	1.7320E-01	-3.7945E-02	-1.0547E-01
31	6.2500E+00	2.0093E+03	7.5684E+02	-6.2705E+03	-4.0324E+02	-2.8201E-01	1.3557E-01	-2.4786E-02	-2.5832E-01
32	6.5000E+00	1.2779E+03	6.2574E+02	-5.9623E+03	-1.4572E+02	-2.4029E-01	7.0887E-02	-6.9169E-03	-3.3235E-01
33	6.7500E+00	4.9204E+02	5.2183E+02	-5.5922E+03	6.6993E+01	-1.8832E-01	1.9954E-03	9.8803E-03	-3.4175E-01
34	7.0000E+00	-1.9994E+02	3.0305E+02	-5.2545E+03	2.3390E+02	-1.2988E-01	-5.4058E-02	2.3980E-02	-2.9846E-01
35	7.2500E+00	-6.8002E+02	-5.2328E+01	-4.8346E+03	3.2681E+02	-7.3631E-02	-8.9951E-02	3.6056E-02	-2.1874E-01
36	7.5000E+00	-9.5124E+02	-3.9395E+02	-4.0192E+03	3.2013E+02	-2.9859E-02	-1.0716E-01	4.7366E-02	-1.2690E-01
37	7.7500E+00	-1.0498E+03	-4.5320E+02	-2.4414E+03	2.3417E+02	-4.7903E-03	-1.1243E-01	5.8014E-02	-4.9011E-02
38	8.0000E+00	-9.8918E+02	-5.9732E+00	1.4076E+02	1.1003E+02	5.8104E-03	-1.0972E-01	6.7447E-02	-1.3032E-03
39	8.0000E+00	-9.8918E+02	-5.9732E+00	1.4076E+02	1.1003E+02	5.8104E-03	-1.0972E-01	6.7447E-02	-1.3032E-03
40	8.2500E+00	-1.0399E+03	4.0593E+02	2.6731E+03	2.3933E+02	1.5921E-02	-1.1276E-01	5.7206E-02	4.7283E-02
41	8.5000E+00	-9.3472E+02	3.1061E+02	4.1684E+03	3.2275E+02	4.0007E-02	-1.0682E-01	4.6308E-02	1.2653E-01
42	8.7500E+00	-6.5506E+02	-4.2597E+01	4.9402E+03	3.2225E+02	8.1587E-02	-8.7482E-02	3.5338E-02	2.1813E-01
43	9.0000E+00	-1.5118E+02	-3.9491E+02	5.3670E+03	2.2673E+02	1.3579E-01	-4.9960E-02	2.3473E-02	2.9629E-01
44	9.2500E+00	5.5938E+02	-6.0687E+02	5.7331E+03	6.2914E+01	1.9296E-01	6.3542E-03	9.3970E-03	3.3810E-01
45	9.5000E+00	1.3650E+03	-7.0777E+02	6.1233E+03	-1.4640E+02	2.4416E-01	7.4631E-02	-7.5250E-03	3.2812E-01
46	9.7500E+00	2.1113E+03	-8.4522E+02	6.4346E+03	-3.9199E+02	2.8523E-01	1.3877E-01	-2.5441E-02	2.5574E-01
47	1.0000E+01	2.6548E+03	-1.1902E+03	6.4993E+03	-7.0859E+02	3.1440E-01	1.7622E-01	-3.8582E-02	1.0664E-01
48	1.0000E+01	0.E+00	0.E+00	0.E+00	0.E+00	3.1295E-01	5.2190E-01	-1.7538E-01	4.3128E-01
49	1.0250E+01	1.3326E+02	-5.5058E+02	-2.2202E+03	-4.2793E+01	3.1360E-01	4.1493E-01	-1.3983E-01	4.2267E-01
50	1.0500E+01	4.9599E+02	-9.8698E+02	-3.9620E+03	-2.1015E+02	3.1406E-01	3.1299E-01	-1.0541E-01	3.8520E-01
51	1.0750E+01	1.0291E+03	-1.2869E+03	-5.1367E+03	-4.7470E+02	3.1436E-01	2.2738E-01	-7.1794E-02	2.8748E-01
52	1.1000E+01	1.0515E+03	-1.3729E+03	-5.4364E+03	-7.9929E+02	3.1440E-01	1.7622E-01	-3.8582E-02	1.0664E-01
53	1.1000E+01	0.E+00	0.E+00	0.E+00	0.E+00	5.7640E-01	4.4214E-01	-1.2348E-01	3.2661E-01
54	1.1250E+01	2.3734E+01	-1.8043E+02	-6.4898E+02	1.8970E-01	5.1914E-01	3.8476E-01	-1.1236E-01	3.2201E-01
55	1.1500E+01	1.0160E+02	-4.5841E+02	-1.4794E+03	-3.0573E+01	4.6297E-01	3.2828E-01	-1.0166E-01	3.1389E-01
56	1.1750E+01	2.5078E+02	-8.5565E+02	-2.5115E+03	-1.0129E+02	4.0937E-01	2.7415E-01	-9.1453E-02	2.9230E-01
57	1.2000E+01	4.9064E+02	-1.3907E+03	-3.7445E+03	-2.2225E+02	3.6185E-01	2.2580E-01	-8.1856E-02	2.4446E-01
58	1.2000E+01	0.E+00	0.E+00	0.E+00	0.E+00	6.4037E-01	-5.9376E-02	8.2798E-02	4.5456E-01

59	1.2250E+01	3.5205E+01	6.5663E+02	2.3034E+03	-3.2800E+01	5.6158E-01	2.1983E-02	4.0568E-02	4.4998E-01
60	1.2500E+01	3.1427E+02	1.2575E+03	3.8407E+03	-1.4977E+02	4.8482E-01	1.0076E-01	-6.1344E-04	4.2449E-01
61	1.2750E+01	6.3411E+02	1.7257E+03	4.4996E+03	-3.1683E+02	4.1559E-01	1.7140E-01	-4.1232E-02	3.5899E-01
62	1.3000E+01	9.7541E+02	1.9394E+03	4.0520E+03	-4.9419E+02	3.6185E-01	2.2580E-01	-8.1856E-02	2.4446E-01
63	1.3000E+01	1.4660E+03	5.4862E+02	3.0747E+02	-7.1644E+02	3.6185E-01	2.2580E-01	-8.1856E-02	2.4446E-01
64	1.3250E+01	1.5123E+03	2.4753E+02	-8.4055E+02	-3.8491E+02	3.3431E-01	1.9746E-01	-7.0400E-02	8.7040E-02
65	1.3500E+01	1.6451E+03	-6.3070E+01	-1.7242E+03	-9.5127E+01	3.2678E-01	1.8915E-01	-5.9534E-02	1.6115E-02
66	1.3750E+01	1.8394E+03	-3.1651E+02	-2.1673E+03	1.7526E+02	3.2469E-01	1.8655E-01	-4.9027E-02	2.3079E-02
67	1.4000E+01	2.0596E+03	-4.7186E+02	-2.1389E+03	4.5330E+02	3.1440E-01	1.7622E-01	-3.8582E-02	1.0664E-01
68	1.4000E+01	1.7098E+04	7.6406E+03	1.3731E+04	2.7024E+03	3.1440E-01	1.7622E-01	-3.8582E-02	1.0664E-01
69	1.4250E+01	1.4990E+04	7.3719E+03	1.4886E+04	1.4141E+03	3.6513E-01	7.9417E-02	1.4229E-02	6.6794E-01
70	1.4500E+01	1.2225E+04	7.4878E+03	1.6598E+04	5.1892E+02	4.2401E-01	-1.5296E-01	7.3757E-02	9.3827E-01
71	1.4750E+01	9.3194E+03	7.5372E+03	1.7563E+04	-4.7640E+02	5.0400E-01	-4.1508E-01	1.3099E-01	9.5078E-01
72	1.5000E+01	6.7464E+03	7.1676E+03	1.7519E+04	-1.5218E+03	6.2555E-01	-5.8879E-01	1.6654E-01	6.7050E-01
73	1.5250E+01	4.7776E+03	6.1928E+03	1.6594E+04	-2.0139E+03	7.1104E-01	-6.5414E-01	1.6223E-01	1.5975E-01
74	1.5500E+01	3.5092E+03	4.6058E+03	1.4273E+04	-1.3401E+03	6.2222E-01	-7.0684E-01	1.1703E-01	-3.3215E-01
75	1.5750E+01	2.8127E+03	2.4951E+03	9.1761E+03	4.6442E+02	3.3096E-01	-8.4239E-01	5.1569E-02	-4.6358E-01
76	1.6000E+01	2.4682E+03	-6.6688E+01	4.2109E+01	2.5245E+03	-4.7145E-03	-1.0746E+00	-6.2012E-03	-2.4746E-02

ENTRY	S	U	V	W
1	0.E+00	7.5650E-01	-6.2012E-03	-7.6316E-01
2	2.5000E-01	3.5704E-01	5.0992E-02	-8.2436E-01
3	5.0000E-01	5.8859E-02	1.1577E-01	-9.2492E-01
4	7.5000E-01	-3.9274E-02	1.6060E-01	-9.4545E-01
5	1.0000E+00	-2.4597E-02	1.6497E-01	-8.3912E-01
6	1.2500E+00	-6.1141E-02	1.2965E-01	-6.3505E-01
7	1.5000E+00	-1.8875E-01	7.2852E-02	-3.9974E-01
8	1.7500E+00	-3.1041E-01	1.4056E-02	-1.9947E-01
9	2.0000E+00	-3.4258E-01	-3.7945E-02	-9.7636E-02
10	2.0000E+00	-4.0756E-01	8.2272E-02	-4.9262E-01
11	2.2500E+00	-4.0935E-01	4.0375E-02	-3.8006E-01
12	2.5000E+00	-4.1076E-01	-4.8428E-04	-2.7073E-01
13	2.7500E+00	-4.1176E-01	-4.0789E-02	-1.7235E-01
14	3.0000E+00	-4.1221E-01	-8.1100E-02	-9.6118E-02
15	3.0000E+00	9.4861E-02	-1.2268E-01	-7.1611E-01
16	3.2500E+00	9.4944E-02	-1.1158E-01	-6.3529E-01
17	3.5000E+00	9.5160E-02	-1.0088E-01	-5.5587E-01
18	3.7500E+00	9.5541E-02	-9.0691E-02	-4.7989E-01
19	4.0000E+00	9.6118E-02	-8.1100E-02	-4.1221E-01
20	4.0000E+00	9.6118E-02	-8.1100E-02	-4.1221E-01
21	4.2500E+00	9.6684E-02	-6.9676E-02	-3.7252E-01
22	4.5000E+00	9.7232E-02	-5.8838E-02	-3.6088E-01
23	4.7500E+00	9.7600E-02	-4.8358E-02	-3.5717E-01
24	5.0000E+00	9.7636E-02	-3.7945E-02	-3.4258E-01
25	5.0000E+00	3.0984E-01	-1.7337E-01	-5.1557E-01
26	5.2500E+00	3.1046E-01	-1.3818E-01	-4.0962E-01
27	5.5000E+00	3.1094E-01	-1.0410E-01	-3.0865E-01
28	5.7500E+00	3.1124E-01	-7.0822E-02	-2.2385E-01
29	6.0000E+00	3.1128E-01	-3.7945E-02	-1.7320E-01
30	6.0000E+00	9.7636E-02	-3.7945E-02	-3.4258E-01
31	6.2500E+00	1.0355E-01	-2.4786E-02	-2.9528E-01
32	6.5000E+00	1.1979E-01	-6.9169E-03	-2.2004E-01
33	6.7500E+00	1.3175E-01	9.8803E-03	-1.3457E-01
34	7.0000E+00	1.3006E-01	2.3980E-02	-5.3612E-02
35	7.2500E+00	1.1567E-01	3.6056E-02	1.1540E-02
36	7.5000E+00	9.6888E-02	4.7366E-02	5.4661E-02
37	7.7500E+00	8.2890E-02	5.8014E-02	7.6115E-02
38	8.0000E+00	7.3474E-02	6.7447E-02	8.1691E-02
39	8.0000E+00	-8.1691E-02	6.7447E-02	7.3474E-02
40	8.2500E+00	-9.0995E-02	5.7206E-02	6.8479E-02
41	8.5000E+00	-1.0382E-01	4.6308E-02	4.7244E-02

42	8.7500E+00	-1.1955E-01	3.5338E-02	4.1682E-03
43	9.0000E+00	-1.3134E-01	2.3473E-02	-6.0690E-02
44	9.2500E+00	-1.3195E-01	9.3970E-03	-1.4094E-01
45	9.5000E+00	-1.1988E-01	-7.5250E-03	-2.2542E-01
46	9.7500E+00	-1.0356E-01	-2.5441E-02	-2.9981E-01
47	1.0000E+01	-9.7712E-02	-3.8582E-02	-3.4692E-01
48	1.0000E+01	3.1295E-01	-1.7538E-01	5.2190E-01
49	1.0250E+01	3.1360E-01	-1.3983E-01	4.1493E-01
50	1.0500E+01	3.1406E-01	-1.0541E-01	3.1299E-01
51	1.0750E+01	3.1436E-01	-7.1794E-02	2.2738E-01
52	1.1000E+01	3.1440E-01	-3.8582E-02	1.7622E-01
53	1.1000E+01	9.4939E-02	-1.2348E-01	7.2022E-01
54	1.1250E+01	9.5020E-02	-1.1236E-01	6.3916E-01
55	1.1500E+01	9.5237E-02	-1.0166E-01	5.5950E-01
56	1.1750E+01	9.5619E-02	-9.1453E-02	4.8333E-01
57	1.2000E+01	9.6199E-02	-8.1856E-02	4.1553E-01
58	1.2000E+01	-4.1082E-01	8.2798E-02	4.9480E-01
59	1.2250E+01	-4.1264E-01	4.0568E-02	3.8155E-01
60	1.2500E+01	-4.1407E-01	-6.1344E-04	2.7157E-01
61	1.2750E+01	-4.1507E-01	-4.1232E-02	1.7267E-01
62	1.3000E+01	-4.1553E-01	-8.1856E-02	9.6199E-02
63	1.3000E+01	9.6199E-02	-8.1856E-02	4.1553E-01
64	1.3250E+01	9.6767E-02	-7.0400E-02	3.7602E-01
65	1.3500E+01	9.7316E-02	-5.9534E-02	3.6482E-01
66	1.3750E+01	9.7682E-02	-4.9027E-02	3.6150E-01
67	1.4000E+01	9.7712E-02	-3.8582E-02	3.4692E-01
68	1.4000E+01	3.4692E-01	-3.8582E-02	-9.7712E-02
69	1.4250E+01	3.1434E-01	1.4229E-02	-2.0203E-01
70	1.4500E+01	1.9166E-01	7.3757E-02	-4.0798E-01
71	1.4750E+01	6.2880E-02	1.3099E-01	-6.4989E-01
72	1.5000E+01	2.5995E-02	1.6654E-01	-8.5868E-01
73	1.5250E+01	4.0234E-02	1.6223E-01	-9.6534E-01
74	1.5500E+01	-5.9834E-02	1.1703E-01	-9.3980E-01
75	1.5750E+01	-3.6164E-01	5.1569E-02	-8.2969E-01
76	1.6000E+01	-7.6316E-01	-6.2012E-03	-7.5650E-01

UNSYMMETRICAL BUCKLING MODE WITH 2 CIRCUMFERENTIAL WAVES, B = -4.9668E-01

SRA 300 INPUT DATA LISTING

```
3ND CLOSED BRANCH TEST CASE
   1 1 1 1 1 1 1 1 1  2  1                    1.7+4        1.-2

C         GEOMETRY TABLE FOLLOWS

1          1 0.        10.        -.70711    .70711     .05
     1     9 2.         8.58578   -.70711    .70711     .05
          10 2.        10.        -.70711    .70711     .05
     2    14 3.         9.29289   -.70711    .70711     .05
          15 3.        10.        -.70711   -.70711     .05
     2    19 4.         9.29289   -.70711   -.70711     .05
          20 4.         9.29289   -.70711   -.70711     .05
     1    24 5.         8.58578   -.70711   -.70711     .05
          25 5.         8.58578   0.        -1.         .05
     1    29 6.         8.58578   0.        -1.         .05
    1     30 6.         8.58578   -.70711   -.70711     .05
          38 8.         7.17156   -.70711   -.70711     .05
          39 8.         7.17156   +.70711   -.70711     .05
     3    47 10.        8.58578   +.70711   -.70711     .05
          48 10.        8.58578   0.         1.         .05
     3    52 11.        8.58578   0.         1.         .05
          53 11.       10.          -.70711  .70711     .05
     4    57 12.        9.29289     -.70711  .70711     .05
          58 12.       10.          -.70711 -.70711     .05
     4    62 13.        9.29289     -.70711 -.70711     .05
          63 13.        9.29289     -.70711 +.70711     .05
     3    67 14.        8.58578     -.70711 +.70711     .05
    1     68 14.        8.58578     +.70711 +.70711     .05
          76 16.       10.          +.70711 +.70711     .05

C         WALL PROPERTIES TABLE FOLLOWS

2     1    1        1.+7        1.+7        .4+7 .25        .05
          76        1.+7        1.+7        .4+7 .25        .05

C         MASS DENSITY TABLE FOLLOWS

5          1 .1
          76 .1

C         MECHANICAL LOADS TABLE FOLLOWS

6          1                          -100.
           9                          -100.
          10
          29
          30                          -100.
          47                          -100.
```

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48
67
68                              -100.
76                              -100.

STANDARD PREBUCKLING DATA FOLLOWS

0000E+00-0
.6646E+0112-9.6641E+01
.5125E+01 1.3763E+02 2-9.8942E+01 7.7724E+01 3-1.0105E+02-5.0370E+01
.0078E+02-1.7522E+02 5-9.8552E+01-2.4977E+02 6-9.5477E+01-2.5188E+02
.2941E+01-1.8632E+02 8-9.2036E+01-8.8705E+01 9-9.2850E+01-3.1266E+01
.E+00     -2.5587E+0011 4.4132E-02-2.3433E+0012 8.5640E-02-2.0859E+00
.2286E-01-1.6976E+0014 1.5171E-01-1.0277E+0015 0.E+00      1.5887E+00
.3628E-02 1.0327E+0017-3.7604E-02 4.3547E-0118-4.0244E-02-2.4666E-01
.8737E-02-1.0728E+0020 1.2298E-01-1.0348E+0021 1.5638E-01-2.2625E+00
.2070E-01-3.9986E+0023 3.2594E-01-6.0147E+0024 4.7686E-01-7.9346E+00
.E+00      1.9554E+0026 0.E+00     -5.6035E-0127 0.E+00     -3.1066E+00
.E+00     -5.6706E+0029 0.E+00     -8.0538E+0030-7.9044E+01-2.7815E+01
.0539E+01 2.7999E+0132-8.4002E+01 1.3510E+0233-8.9835E+01 2.2010E+02
.7122E+01 2.3570E+0235-1.0409E+02 1.6257E+0236-1.0871E+02 1.3218E+01
.0953E+02-1.6040E+0238-1.0680E+02-2.5457E+0239-1.0680E+02-2.5457E+02
.0953E+02-1.6041E+0241-1.0872E+02 1.3214E+0142-1.0409E+02 1.6257E+02
.7122E+01 2.3570E+0244-8.9836E+01 2.2010E+0245-8.4002E+01 1.3510E+02
.0540E+01 2.8001E+0147-7.9045E+01-2.7815E+0148 0.E+00      1.9552E+00
.E+00     -5.6044E-0150 0.E+00     -3.1066E+0051 0.E+00     -5.6704E+00
.E+00     -8.0535E+0053 0.E+00      1.5886E+0054-2.3626E-02 1.0326E+00
.7601E-02 4.3542E-0156-4.0241E-02-2.4669E-0157-2.8734E-02-1.0728E+00
.E+00     -2.5586E+0059 4.4131E-02-2.3432E+0060 8.5638E-02-2.0859E+00
.2285E-01-1.6976E+0062 1.5171E-01-1.0277E+0063 1.2298E-01-1.0348E+00
.5638E-01-2.2625E+0065 2.2069E-01-3.9985E+0066 3.2594E-01-6.0144E+00
.7685E-01-7.9342E+0068-9.2850E+01-3.1266E+0169-9.2036E+01-8.8705E+01
.2941E+01-1.8632E+0271-9.5477E+01-2.5188E+0272-9.8552E+01-2.4977E+02
.0078E+02-1.7523E+0274-1.0105E+02-5.0377E+0175-9.8942E+01 7.7721E+01
.5125E+01 1.3763E+02
2685E-08  6.1941E-03  7.5190E-03  5.5927E-03  1.9468E-03 -1.9552E-03
6517E-03 -4.5935E-03 -7.3837E-05 -1.4386E-05 -1.4978E-05 -1.8698E-05
8542E-05 -4.7251E-05 -3.2344E-05 -3.2799E-05 -3.4889E-05 -3.9631E-05
7251E-05 -4.7251E-05 -7.5513E-05 -9.3076E-05 -9.5121E-05 -7.3837E-05
6272E-05 -8.6725E-05 -8.8177E-05 -8.6876E-05 -7.3837E-05 -7.3837E-05
4381E-03  4.7132E-03  2.2362E-03 -1.5826E-03 -5.3471E-03 -7.5557E-03
4659E-03 -5.9819E-08 -5.9817E-08  6.4659E-03  7.5557E-03  5.3471E-03
5826E-03 -2.2362E-03 -4.7132E-03 -4.4381E-03  7.3831E-05  8.6268E-05
6721E-05  8.8172E-05  8.6870E-05  7.3831E-05  3.2343E-05  3.2798E-05
4888E-05  3.9630E-05  4.7249E-05  1.4385E-05  1.4977E-05  1.8697E-05
8541E-05  4.7249E-05  4.7249E-05  7.5510E-05  9.3072E-05  9.5115E-05
3831E-05  7.3831E-05  4.5936E-03  4.6518E-03  1.9553E-03 -1.9467E-03
5926E-03 -7.5191E-03 -6.1942E-03 -8.2616E-08
.6430E+0112-9.6473E+01
.5110E+01 1.4062E+02 2-9.8978E+01 8.0253E+01 3-1.0112E+02-4.8961E+01
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 4-1.0087E+02-1.7524E+02 5-9.8628E+01-2.5103E+02 6-9.5525E+01-2.5365E
 7-9.2957E+01-1.8766E+02 8-9.2035E+01-8.9136E+01 9-9.2846E+01-3.1247E
10 0.E+00     -2.5417E+0011 4.3814E-02-2.3249E+0012 8.4968E-02-2.0663E
13 1.2180E-01-1.6776E+0014 1.5027E-01-1.0093E+0015 0.E+00      1.5887E
16-2.3670E-02 1.0373E+0017-3.7774E-02 4.4481E-0118-4.0636E-02-2.3256E
19-2.9449E-02-1.0542E+0020 1.2082E-01-1.0167E+0021 1.5378E-01-2.2394E
22 2.1754E-01-3.9711E+0023 3.2216E-01-5.9873E+0024 4.7252E-01-7.9177E
25 0.E+00      1.9972E+0026 0.E+00     -5.1792E-0127 0.E+00     -3.0651E
28 0.E+00     -5.6351E+0029 0.E+00     -8.0358E+0030-7.9098E+01-2.7810E
31-8.0598E+01 2.8389E+0132-8.4079E+01 1.3641E+0233-8.9951E+01 2.2199E
34-9.7280E+01 2.3720E+0235-1.0427E+02 1.6272E+0236-1.0888E+02 1.1549E
37-1.0964E+02-1.6370E+0238-1.0682E+02-2.5870E+0239-1.0682E+02-2.5870E
40-1.0964E+02-1.6370E+0241-1.0888E+02 1.1549E+0142-1.0427E+02 1.6272E
43-9.7278E+01 2.3721E+0244-8.9949E+01 2.2200E+0245-8.4077E+01 1.3641E
46-8.0595E+01 2.8386E+0147-7.9096E+01-2.7814E+0148 0.E+00      1.9978E
49 0.E+00     -5.1847E-0150 0.E+00     -3.0667E+0051 0.E+00     -5.6377E
52 0.E+00     -8.0394E+0053 0.E+00      1.5894E+0054-2.3679E-02 1.0377E
55-3.7789E-02 4.4493E-0156-4.0651E-02-2.3277E-0157-2.9456E-02-1.0548E
58 0.E+00     -2.5429E+0059 4.3835E-02-2.3260E+0060 8.5009E-02-2.0673E
61 1.2186E-01-1.6785E+0062 1.5034E-01-1.0099E+0063 1.2089E-01-1.0172E
64 1.5386E-01-2.2405E+0065 2.1766E-01-3.9730E+0066 3.2232E-01-5.9901E
67 4.7275E-01-7.9212E+0068-9.2848E+01-3.1251E+0169-9.2037E+01-8.9139E
70-9.2959E+01-1.8766E+0271-9.5527E+01-2.5364E+0272-9.8630E+01-2.5102E
73-1.0087E+02-1.7524E+0274-1.0112E+02-4.8960E+0175-9.8979E+01 8.0255E
76-9.5111E+01 1.4062E+02
  5.8423E-08  6.2636E-03  7.6228E-03  5.6857E-03  1.9976E-03 -1.9539E
 -4.6827E-03 -4.6245E-03 -7.4725E-05 -1.4448E-05 -1.5037E-05 -1.8731E
 -2.8500E-05 -4.7058E-05 -3.2092E-05 -3.2546E-05 -3.4639E-05 -3.9396E
 -4.7058E-05 -4.7058E-05 -7.5268E-05 -9.2964E-05 -9.5369E-05 -7.4725E
 -8.6247E-05 -8.6715E-05 -8.8268E-05 -8.7239E-05 -7.4725E-05 -7.4725E
  4.4647E-03  4.7427E-03  2.2386E-03 -1.6270E-03 -5.4363E-03 -7.6613E
 -6.5402E-03 -5.5918E-08 -5.5915E-08  6.5401E-03  7.6611E-03  5.4361E
  1.6269E-03 -2.2386E-03 -4.7427E-03 -4.4647E-03  7.4750E-05  8.6285E
  8.6752E-05  8.8305E-05  8.7274E-05  7.4750E-05  3.2108E-05  3.2561E
  3.4655E-05  3.9414E-05  4.7080E-05  1.4453E-05  1.5043E-05  1.8738E
  2.8513E-05  4.7080E-05  4.7080E-05  7.5302E-05  9.3005E-05  9.5408E
  7.4750E-05  7.4750E-05  4.6245E-03  4.6826E-03  1.9538E-03 -1.9977E
 -5.6858E-03 -7.6228E-03 -6.2636E-03  5.8495E-08

C          BOUNDARY DATA FOLLOWS

        1.2+7          1.+6          1.+6                       .675+6 .05
 0.
           .1                      1.2+7
        1.2+7          1.+6          1.+6                       .675+6 .05
 0.
           .1                      1.2+7
          END OF FILE CARD
```

SRA 300 OUTPUT DATA LISTING

CLOSED BRANCH TEST CASE

N = 2 HIGHEST MODE = 1 REL ERR CNTRL = 1.000E-02

SURFACE LOADING, IF ANY, IS APPLIED AT SHELL REFERENCE SURFACE
AND DURING VIBRATION, REMAINS FIXED IN MAGNITUDE AND DIRECTION

TABLE 1 (SURFACE GEOMETRY)

ENTRY	S	R	R PRIME	R/R2	ZBAR
1	0.E+00	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
2	2.5000E-01	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
3	5.0000E-01	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
4	7.5000E-01	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
5	1.0000E+00	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
6	1.2500E+00	9.1161E+00	-7.0711E-01	7.0711E-01	5.0000E-02
7	1.5000E+00	8.9393E+00	-7.0711E-01	7.0711E-01	5.0000E-02
8	1.7500E+00	8.7626E+00	-7.0711E-01	7.0711E-01	5.0000E-02
9	2.0000E+00	8.5858E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 1, THE NEXT POINT IS A NEW EDGE					
10	2.0000E+00	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
11	2.2500E+00	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
12	2.5000E+00	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
13	2.7500E+00	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
14	3.0000E+00	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 2, THE NEXT POINT IS A NEW EDGE					
15	3.0000E+00	1.0000E+01	-7.0711E-01	-7.0711E-01	5.0000E-02
16	3.2500E+00	9.8232E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
17	3.5000E+00	9.6464E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
18	3.7500E+00	9.4697E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
19	4.0000E+00	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 2					
20	4.0000E+00	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
21	4.2500E+00	9.1161E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
22	4.5000E+00	8.9393E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
23	4.7500E+00	8.7626E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
24	5.0000E+00	8.5858E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 1, THE NEXT POINT IS A NEW EDGE					
25	5.0000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
26	5.2500E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
27	5.5000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
28	5.7500E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
29	6.0000E+00	8.5858E+00	0.E+00	-1.0000E+00	5.0000E-02
********** BRANCH POINT 1					
30	6.0000E+00	8.5858E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
31	6.2500E+00	8.4090E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
32	6.5000E+00	8.2322E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
33	6.7500E+00	8.0554E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
34	7.0000E+00	7.8787E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
35	7.2500E+00	7.7019E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
36	7.5000E+00	7.5251E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
37	7.7500E+00	7.3483E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
38	8.0000E+00	7.1716E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
39	8.0000E+00	7.1716E+00	7.0711E-01	-7.0711E-01	5.0000E-02
40	8.2500E+00	7.3483E+00	7.0711E-01	-7.0711E-01	5.0000E-02
41	8.5000E+00	7.5251E+00	7.0711E-01	-7.0711E-01	5.0000E-02
42	8.7500E+00	7.7019E+00	7.0711E-01	-7.0711E-01	5.0000E-02
43	9.0000E+00	7.8787E+00	7.0711E-01	-7.0711E-01	5.0000E-02
44	9.2500E+00	8.0554E+00	7.0711E-01	-7.0711E-01	5.0000E-02
45	9.5000E+00	8.2322E+00	7.0711E-01	-7.0711E-01	5.0000E-02
46	9.7500E+00	8.4090E+00	7.0711E-01	-7.0711E-01	5.0000E-02
47	1.0000E+01	8.5858E+00	7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 3, THE NEXT POINT IS A NEW EDGE					
48	1.0000E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
49	1.0250E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
50	1.0500E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
51	1.0750E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
52	1.1000E+01	8.5858E+00	0.E+00	1.0000E+00	5.0000E-02
********** BRANCH POINT 3, THE NEXT POINT IS A NEW EDGE					

53	1.1000E+01	1.0000E+01	-7.0711E-01	7.0711E-01	5.0000E-02
54	1.1250E+01	9.8232E+00	-7.0711E-01	7.0711E-01	5.0000E-02
55	1.1500E+01	9.6464E+00	-7.0711E-01	7.0711E-01	5.0000E-02
56	1.1750E+01	9.4697E+00	-7.0711E-01	7.0711E-01	5.0000E-02
57	1.2000E+01	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 4, THE NEXT POINT IS A NEW EDGE					
58	1.2000E+01	1.0000E+01	-7.0711E-01	-7.0711E-01	5.0000E-02
59	1.2250E+01	9.8232E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
60	1.2500E+01	9.6464E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
61	1.2750E+01	9.4697E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
62	1.3000E+01	9.2929E+00	-7.0711E-01	-7.0711E-01	5.0000E-02
********** BRANCH POINT 4					
63	1.3000E+01	9.2929E+00	-7.0711E-01	7.0711E-01	5.0000E-02
64	1.3250E+01	9.1161E+00	-7.0711E-01	7.0711E-01	5.0000E-02
65	1.3500E+01	8.9393E+00	-7.0711E-01	7.0711E-01	5.0000E-02
66	1.3750E+01	8.7626E+00	-7.0711E-01	7.0711E-01	5.0000E-02
67	1.4000E+01	8.5858E+00	-7.0711E-01	7.0711E-01	5.0000E-02
********** BRANCH POINT 3					
68	1.4000E+01	8.5858E+00	7.0711E-01	7.0711E-01	5.0000E-02
69	1.4250E+01	8.7626E+00	7.0711E-01	7.0711E-01	5.0000E-02
70	1.4500E+01	8.9393E+00	7.0711E-01	7.0711E-01	5.0000E-02
71	1.4750E+01	9.1161E+00	7.0711E-01	7.0711E-01	5.0000E-02
72	1.5000E+01	9.2929E+00	7.0711E-01	7.0711E-01	5.0000E-02
73	1.5250E+01	9.4697E+00	7.0711E-01	7.0711E-01	5.0000E-02
74	1.5500E+01	9.6464E+00	7.0711E-01	7.0711E-01	5.0000E-02
75	1.5750E+01	9.8232E+00	7.0711E-01	7.0711E-01	5.0000E-02
76	1.6000E+01	1.0000E+01	7.0711E-01	7.0711E-01	5.0000E-02

TABLE 2 (WALL PROPERTIES)

ENTRY	S	E1	E2	E12	NU1	H
1	0.E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
2	2.5000E-01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
3	5.0000E-01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
4	7.5000E-01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
5	1.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
6	1.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
7	1.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
8	1.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
9	2.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
10	2.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
11	2.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
12	2.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
13	2.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
14	3.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
15	3.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
16	3.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
17	3.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
18	3.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
19	4.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
20	4.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
21	4.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
22	4.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
23	4.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
24	5.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
25	5.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
26	5.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
27	5.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
28	5.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
29	6.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
30	6.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
31	6.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
32	6.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
33	6.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
34	7.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
35	7.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
36	7.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
37	7.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
38	8.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
39	8.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
40	8.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
41	8.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
42	8.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
43	9.0000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
44	9.2500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
45	9.5000E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
46	9.7500E+00	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
47	1.0000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
48	1.0000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
49	1.0250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
50	1.0500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
51	1.0750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
52	1.1000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
53	1.1000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
54	1.1250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
55	1.1500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
56	1.1750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
57	1.2000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
58	1.2000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
59	1.2250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02

60	1.2500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
61	1.2750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
62	1.3000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
63	1.3000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
64	1.3250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
65	1.3500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
66	1.3750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
67	1.4000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
68	1.4000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
69	1.4250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
70	1.4500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
71	1.4750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
72	1.5000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
73	1.5250E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
74	1.5500E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
75	1.5750E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02
76	1.6000E+01	1.0000E+07	1.0000E+07	4.0000E+06	2.5000E-01	5.0000E-02

TABLE 3 (FOUNDATION MODULI) ALL ZEROES

TABLE 4 (STRINGER PROPERTIES) ALL ZEROES

TABLE 5 (MASS DENSITY)

ENTRY	S	LAYER 1	LAYER 2	LAYER 3	LAYER 4	LAYER 5
1	0.E+00	1.0000E-01	-0.E+00	-0.E+00	-0.E+00	-0.E+00
2	2.5000E-01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
3	5.0000E-01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
4	7.5000E-01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
5	1.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
6	1.2500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
7	1.5000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
8	1.7500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
9	2.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
10	2.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
11	2.2500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
12	2.5000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
13	2.7500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
14	3.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
15	3.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
16	3.2500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
17	3.5000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
18	3.7500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
19	4.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
20	4.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
21	4.2500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
22	4.5000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
23	4.7500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
24	5.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
25	5.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
26	5.2500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
27	5.5000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
28	5.7500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
29	6.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
30	6.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
31	6.2500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
32	6.5000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
33	6.7500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
34	7.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
35	7.2500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
36	7.5000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
37	7.7500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
38	8.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
39	8.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
40	8.2500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
41	8.5000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
42	8.7500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
43	9.0000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
44	9.2500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
45	9.5000E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
46	9.7500E+00	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
47	1.0000E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
48	1.0000E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
49	1.0250E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
50	1.0500E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
51	1.0750E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
52	1.1000E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
53	1.1000E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
54	1.1250E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
55	1.1500E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
56	1.1750E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
57	1.2000E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
58	1.2000E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
59	1.2250E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00

60	1.2500E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
61	1.2750E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
62	1.3000E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
63	1.3000E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
64	1.3250E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
65	1.3500E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
66	1.3750E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
67	1.4000E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
68	1.4000E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
69	1.4250E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
70	1.4500E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
71	1.4750E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
72	1.5000E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
73	1.5250E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
74	1.5500E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
75	1.5750E+01	1.0000E-01	0.E+00	0.E+00	0.E+00	0.E+00
76	1.6000E+01	1.0000E-01	-0.E+00	-0.E+00	-0.E+00	-0.E+00

TABLE 5 (UNIT LOAD PRESSURE FIELD) WAS READ AND IGNORED

INITIAL NONLINEAR STATE SHELL DATA, LAMBDA = 1.0000E+00

ENTRY	S	T1N	T2N	CHIN
1	0.E+00	-9.5125E+01	1.3763E+02	-8.2685E-08
2	2.5000E-01	-9.8942E+01	7.7724E+01	6.1941E-03
3	5.0000E-01	-1.0105E+02	-5.0370E+01	7.5190E-03
4	7.5000E-01	-1.0078E+02	-1.7522E+02	5.5927E-03
5	1.0000E+00	-9.8552E+01	-2.4977E+02	1.9468E-03
6	1.2500E+00	-9.5477E+01	-2.5188E+02	-1.9552E-03
7	1.5000E+00	-9.2941E+01	-1.8632E+02	-4.6517E-03
8	1.7500E+00	-9.2036E+01	-8.8705E+01	-4.5935E-03
9	2.0000E+00	-9.2850E+01	-3.1266E+01	-7.3837E-05
10	2.0000E+00	0.E+00	-2.5587E+00	-1.4386E-05
11	2.2500E+00	4.4132E-02	-2.3433E+00	-1.4978E-05
12	2.5000E+00	8.5640E-02	-2.0859E+00	-1.8698E-05
13	2.7500E+00	1.2286E-01	-1.6976E+00	-2.8542E-05
14	3.0000E+00	1.5171E-01	-1.0277E+00	-4.7251E-05
15	3.0000E+00	0.E+00	1.5887E+00	-3.2344E-05
16	3.2500E+00	-2.3628E-02	1.0327E+00	-3.2799E-05
17	3.5000E+00	-3.7604E-02	4.3547E-01	-3.4889E-05
18	3.7500E+00	-4.0244E-02	-2.4666E-01	-3.9631E-05
19	4.0000E+00	-2.8737E-02	-1.0728E+00	-4.7251E-05
20	4.0000E+00	1.2298E-01	-1.0348E+00	-4.7251E-05
21	4.2500E+00	1.5638E-01	-2.2625E+00	-7.5513E-05
22	4.5000E+00	2.2070E-01	-3.9986E+00	-9.3076E-05
23	4.7500E+00	3.2594E-01	-6.0147E+00	-9.5121E-05
24	5.0000E+00	4.7686E-01	-7.9346E+00	-7.3837E-05
25	5.0000E+00	0.E+00	1.9554E+00	-8.6272E-05
26	5.2500E+00	0.E+00	-5.6035E-01	-8.6725E-05
27	5.5000E+00	0.E+00	-3.1066E+00	-8.8177E-05
28	5.7500E+00	0.E+00	-5.6706E+00	-8.6876E-05
29	6.0000E+00	0.E+00	-8.0538E+00	-7.3837E-05
30	6.0000E+00	-7.9044E+01	-2.7815E+01	-7.3837E-05
31	6.2500E+00	-8.0539E+01	2.7999E+01	4.4381E-03
32	6.5000E+00	-8.4002E+01	1.3510E+02	4.7132E-03
33	6.7500E+00	-8.9835E+01	2.2010E+02	2.2362E-03
34	7.0000E+00	-9.7122E+01	2.3570E+02	-1.5826E-03
35	7.2500E+00	-1.0409E+02	1.6257E+02	-5.3471E-03
36	7.5000E+00	-1.0871E+02	1.3218E+01	-7.5557E-03
37	7.7500E+00	-1.0953E+02	-1.6040E+02	-6.4659E-03
38	8.0000E+00	-1.0680E+02	-2.5457E+02	-5.9819E-08
39	8.0000E+00	-1.0680E+02	-2.5457E+02	-5.9817E-08
40	8.2500E+00	-1.0953E+02	-1.6041E+02	6.4659E-03
41	8.5000E+00	-1.0872E+02	1.3214E+01	7.5557E-03
42	8.7500E+00	-1.0409E+02	1.6257E+02	5.3471E-03
43	9.0000E+00	-9.7122E+01	2.3570E+02	1.5826E-03
44	9.2500E+00	-8.9836E+01	2.2010E+02	-2.2362E-03
45	9.5000E+00	-8.4002E+01	1.3510E+02	-4.7132E-03
46	9.7500E+00	-8.0540E+01	2.8001E+01	-4.4381E-03
47	1.0000E+01	-7.9045E+01	-2.7815E+01	7.3831E-05
48	1.0000E+01	0.E+00	1.9552E+00	8.6268E-05
49	1.0250E+01	0.E+00	-5.6044E-01	8.6721E-05
50	1.0500E+01	0.E+00	-3.1066E+00	8.8172E-05
51	1.0750E+01	0.E+00	-5.6704E+00	8.6870E-05
52	1.1000E+01	0.E+00	-8.0535E+00	7.3831E-05
53	1.1000E+01	0.E+00	1.5886E+00	3.2343E-05
54	1.1250E+01	-2.3626E-02	1.0326E+00	3.2798E-05
55	1.1500E+01	-3.7601E-02	4.3542E-01	3.4888E-05
56	1.1750E+01	-4.0241E-02	-2.4669E-01	3.9630E-05
57	1.2000E+01	-2.8734E-02	-1.0728E+00	4.7249E-05
58	1.2000E+01	0.E+00	-2.5586E+00	1.4385E-05
59	1.2250E+01	4.4131E-02	-2.3432E+00	1.4977E-05

60	1.2500E+01	8.5638E-02	-2.0859E+00	1.8697E-05
61	1.2750E+01	1.2285E-01	-1.6976E+00	2.8541E-05
62	1.3000E+01	1.5171E-01	-1.0277E+00	4.7249E-05
63	1.3000E+01	1.2298E-01	-1.0348E+00	4.7249E-05
64	1.3250E+01	1.5638E-01	-2.2625E+00	7.5510E-05
65	1.3500E+01	2.2069E-01	-3.9985E+00	9.3072E-05
66	1.3750E+01	3.2594E-01	-6.0144E+00	9.5115E-05
67	1.4000E+01	4.7685E-01	-7.9342E+00	7.3831E-05
68	1.4000E+01	-9.2850E+01	-3.1266E+01	7.3831E-05
69	1.4250E+01	-9.2036E+01	-8.8705E+01	4.5936E-03
70	1.4500E+01	-9.2941E+01	-1.8632E+02	4.6518E-03
71	1.4750E+01	-9.5477E+01	-2.5188E+02	1.9553E-03
72	1.5000E+01	-9.8552E+01	-2.4977E+02	-1.9467E-03
73	1.5250E+01	-1.0078E+02	-1.7523E+02	-5.5926E-03
74	1.5500E+01	-1.0105E+02	-5.0377E+01	-7.5191E-03
75	1.5750E+01	-9.8942E+01	7.7721E+01	-6.1942E-03
76	1.6000E+01	-9.5125E+01	1.3763E+02	-8.2616E-08

```
BOUNDARY NUMBER  1          S =  0.E+00

THIS IS THE FIRST POINT OF A CLOSED BRANCH - SEE BOUNDARY NUMBER 13 FOR BOUNDARY DATA

BOUNDARY NUMBER  2          S =  2.0000E+00

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  3          S =  3.0000E+00

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  4          S =  4.0000E+00

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  5          S =  5.0000E+00

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  6          S =  6.0000E+00

RING DATA
EA =  1.2000E+07     EIX =  1.0000E+06     EIY =  1.0000E+06     EIXY = -0.E+00          GJ =  6.7500E+05     ZBAR =  5.0000E-02
SBAR = -0.E+00       RHO =  1.0000E-01     E =  1.2000E+07       TPHIO = -9.6646E+01

BOUNDARY NUMBER  7          S =  8.0000E+00

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  8          S =  1.0000E+01

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER  9          S =  1.1000E+01

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER 10          S =  1.2000E+01

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER 11          S =  1.3000E+01

B = I, D = 0, L VECTOR = 0  (FORCE-FREE)

BOUNDARY NUMBER 12          S =  1.4000E+01

RING DATA
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EA = 1.2000E+07       EIX = 1.0000E+06      EIY = 1.0000E+06      EIXY = -0.E+00          GJ = 6.7500E+05     ZBAR = 5.0000E-02
SBAR = -0.E+00        RHO = 1.0000E-01      E = 1.2000E+07        TPHIO = -9.6641E+01

BOUNDARY NUMBER 13          S = 1.6000E+01

B = I. D = 0, L VECTOR = 0  (FORCE-FREE)

EIGENVALUE SHIFT = 1.700000000E+04

ITER =  1 OMEGA SQUARED =  4.061847500E+02

ITER =  2 OMEGA SQUARED =  4.570114250E+02

ITER =  3 OMEGA SQUARED =  4.570060924E+02
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ENTRY	S	P	W	CAP S	M1	XI	ETA	V	CHI
1	0.E+00	5.2671E+02	3.6045E-02	-7.4934E+00	-3.1308E+02	4.1873E-04	3.4855E-01	-1.7383E-01	1.0708E-04
2	2.5000E-01	5.3624E+02	-2.9137E+01	-2.6201E+01	-2.2423E+02	7.6193E-03	3.5550E-01	-1.8311E-01	-7.6081E-02
3	5.0000E-01	5.4724E+02	-7.6379E+01	-7.6483E+01	-1.3855E+02	2.6264E-02	3.7364E-01	-1.9243E-01	-1.2799E-01
4	7.5000E-01	5.5959E+02	-1.1909E+02	-1.1152E+02	-5.7622E+01	5.2053E-02	3.9885E-01	-2.0177E-01	-1.5678E-01
5	1.0000E+00	5.7186E+02	-1.4086E+02	-9.9670E+01	2.0346E+01	8.0874E-02	4.2729E-01	-2.1107E-01	-1.6351E-01
6	1.2500E+00	5.8184E+02	-1.3300E+02	-2.6781E+01	9.9327E+01	1.0880E-01	4.5515E-01	-2.2027E-01	-1.4841E-01
7	1.5000E+00	5.8727E+02	-9.7149E+01	9.9706E+01	1.8400E+02	1.3195E-01	4.7846E-01	-2.2935E-01	-1.1043E-01
8	1.7500E+00	5.8672E+02	-4.9373E+01	2.4408E+02	2.7762E+02	1.4619E-01	4.9288E-01	-2.3832E-01	-4.7288E-02
9	2.0000E+00	5.8100E+02	-2.6083E+01	3.3294E+02	3.7906E+02	1.4696E-01	4.9361E-01	-2.4726E-01	4.3695E-02
10	2.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	4.0926E-01	4.5333E-01	-1.7532E-01	1.3313E-01
11	2.2500E+00	-2.6547E+01	2.2722E+02	4.8745E+02	1.9454E+01	3.8528E-01	4.3020E-01	-1.7363E-01	1.3426E-01
12	2.5000E+00	-6.9185E+01	4.3114E+02	9.0157E+02	7.1632E+01	3.6038E-01	4.0605E-01	-1.7170E-01	1.4570E-01
13	2.7500E+00	-1.2570E+02	6.0090E+02	1.2235E+03	1.4960E+02	3.3198E-01	3.7827E-01	-1.6958E-01	1.7577E-01
14	3.0000E+00	-1.9250E+02	7.1377E+02	1.4123E+03	2.4411E+02	2.9625E-01	3.4296E-01	-1.6732E-01	2.3064E-01
15	3.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	4.6410E-01	1.7480E-01	-8.3070E-02	2.3854E-01
16	3.2500E+00	-1.8973E+01	1.4593E+01	4.9138E+01	-2.3905E-01	4.2191E-01	2.1707E-01	-1.0418E-01	2.3918E-01
17	3.5000E+00	-3.4575E+01	3.0664E+01	1.0337E+02	-6.0929E+00	3.7965E-01	2.5940E-01	-1.2526E-01	2.3909E-01
18	3.7500E+00	-4.6493E+01	4.8651E+01	1.6319E+02	-1.7333E+01	3.3759E-01	3.0154E-01	-1.4631E-01	2.3674E-01
19	4.0000E+00	-5.4425E+01	6.7892E+01	2.2685E+02	-3.3698E+01	2.9625E-01	3.4296E-01	-1.6732E-01	2.3064E-01
20	4.0000E+00	-2.4692E+02	7.8166E+02	1.6392E+03	2.1042E+02	2.9625E-01	3.4296E-01	-1.6732E-01	2.3064E-01
21	4.2500E+00	-1.9819E+02	8.7366E+02	1.7659E+03	3.0534E+01	2.5173E-01	3.8771E-01	-1.8741E-01	2.6596E-01
22	4.5000E+00	-1.3984E+02	9.9312E+02	1.9400E+03	-1.6070E+02	2.0555E-01	4.3422E-01	-2.0744E-01	2.4944E-01
23	4.7500E+00	-6.9571E+01	1.1354E+03	2.1484E+03	-3.6753E+02	1.6721E-01	4.7298E-01	-2.2739E-01	1.7701E-01
24	5.0000E+00	1.2812E+01	1.2602E+03	2.3087E+03	-5.9045E+02	1.4696E-01	4.9361E-01	-2.4726E-01	4.3695E-02
25	5.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	1.4673E-01	4.4238E-01	-2.1344E-01	5.2679E-02
26	5.2500E+00	-3.4044E+00	2.6781E+01	1.0191E+02	-2.9709E+00	1.4683E-01	4.5568E-01	-2.2196E-01	5.3571E-02
27	5.5000E+00	-1.5926E+00	4.0711E+01	1.7963E+02	-1.1014E+01	1.4690E-01	4.6903E-01	-2.3042E-01	5.2871E-02
28	5.7500E+00	4.0284E+00	4.1414E+01	2.3239E+02	-2.0949E+01	1.4694E-01	4.8190E-01	-2.3885E-01	4.8597E-02
29	6.0000E+00	1.1884E+01	2.6328E+01	2.5497E+02	-2.9247E+01	1.4696E-01	4.9361E-01	-2.4726E-01	4.3695E-02
30	6.0000E+00	3.8991E+02	1.3355E+03	3.5743E+03	3.8411E+02	1.4696E-01	4.9361E-01	-2.4726E-01	4.3695E-02
31	6.2500E+00	5.4431E+02	1.4363E+03	3.6245E+03	2.2429E+02	1.3113E-01	5.0983E-01	-2.6630E-01	1.3016E-01
32	6.5000E+00	7.0577E+02	1.4821E+03	3.5599E+03	7.6732E+01	1.0390E-01	5.3751E-01	-2.8538E-01	1.7357E-01
33	6.7500E+00	8.7067E+02	1.4923E+03	3.4240E+03	-4.8537E+01	7.2430E-02	5.6935E-01	-3.0460E-01	1.7874E-01
34	7.0000E+00	1.0358E+03	1.4621E+03	3.2125E+03	-1.4359E+02	4.2778E-02	5.9910E-01	-3.2403E-01	1.5288E-01
35	7.2500E+00	1.1966E+03	1.3617E+03	2.8729E+03	-1.9837E+02	1.9597E-02	6.2208E-01	-3.4374E-01	1.0564E-01
36	7.5000E+00	1.3446E+03	1.1361E+03	2.3092E+03	-1.9689E+02	5.5727E-03	6.3562E-01	-3.6382E-01	5.0283E-02
37	7.7500E+00	1.4656E+03	7.1006E+02	1.3941E+03	-1.1410E+02	5.3734E-04	6.3983E-01	-3.8437E-01	5.8589E-03
38	8.0000E+00	1.5372E+03	8.4785E-02	-4.6340E+00	8.6040E+01	1.4195E-04	6.3884E-01	-4.0553E-01	1.2196E-04
39	8.0000E+00	1.5372E+03	8.4784E-02	-4.6340E+00	8.6040E+01	1.4195E-04	6.3884E-01	-4.0553E-01	1.2196E-04
40	8.2500E+00	1.4652E+03	-7.0945E+02	-1.4029E+03	-1.1413E+02	-2.1033E-04	6.3987E-01	-3.8439E-01	-5.6190E-03
41	8.5000E+00	1.3438E+03	-1.1351E+03	-2.3175E+03	-1.9693E+02	-5.2036E-03	6.3570E-01	-3.6386E-01	-5.0053E-02
42	8.7500E+00	1.1953E+03	-1.3603E+03	-2.8808E+03	-1.9842E+02	-1.9188E-02	6.2220E-01	-3.4380E-01	-1.0542E-01
43	9.0000E+00	1.0342E+03	-1.4604E+03	-3.2200E+03	-1.4365E+02	-4.2332E-02	5.9926E-01	-3.2411E-01	-1.5268E-01
44	9.2500E+00	8.6873E+02	-1.4902E+03	-3.4312E+03	-4.8608E+01	-7.1949E-02	5.6954E-01	-3.0470E-01	-1.7856E-01
45	9.5000E+00	7.0354E+02	-1.4799E+03	-3.5667E+03	7.6663E+01	-1.0339E-01	5.3773E-01	-2.8550E-01	-1.7341E-01
46	9.7500E+00	5.4179E+02	-1.4340E+03	-3.6312E+03	2.2424E+02	-1.3059E-01	5.1008E-01	-2.6644E-01	-1.3001E-01
47	1.0000E+01	3.8713E+02	-1.3331E+03	-3.5809E+03	3.8410E+02	-1.4639E-01	4.9389E-01	-2.4742E-01	-4.3559E-02
48	1.0000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-1.4617E-01	4.4291E-01	-2.1373E-01	-5.2386E-02
49	1.0250E+01	3.3698E+00	2.6573E+01	1.0159E+02	2.9493E+00	-1.4627E-01	4.5614E-01	-2.2221E-01	-5.3281E-02
50	1.0500E+01	1.5434E+00	4.0275E+01	1.7895E+02	1.0916E+01	-1.4634E-01	4.6942E-01	-2.3065E-01	-5.2597E-02
51	1.0750E+01	-4.0699E+00	4.0744E+01	2.3131E+02	2.0716E+01	-1.4638E-01	4.8222E-01	-2.3904E-01	-4.8369E-02
52	1.1000E+01	-1.1895E+01	2.5456E+01	2.5356E+02	2.8822E+01	-1.4639E-01	4.9389E-01	-2.4742E-01	-4.3559E-02
53	1.1000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-4.6319E-01	1.7547E-01	-8.3356E-02	-2.3825E-01
54	1.1250E+01	1.8891E+01	1.4749E+01	4.9568E+01	2.4865E-01	-4.2101E-01	2.1768E-01	-1.0445E-01	-2.3889E-01
55	1.1500E+01	3.4399E+01	3.0951E+01	1.0415E+02	6.1223E+00	-3.7880E-01	2.5996E-01	-1.2551E-01	-2.3880E-01
56	1.1750E+01	4.6214E+01	4.9031E+01	1.6421E+02	1.7385E+01	-3.3679E-01	3.0205E-01	-1.4655E-01	-2.3643E-01
57	1.2000E+01	5.4039E+01	6.8317E+01	2.2801E+02	3.3768E+01	-2.9551E-01	3.4341E-01	-1.6754E-01	-2.3031E-01
58	1.2000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-4.0825E-01	4.5350E-01	-1.7538E-01	-1.3272E-01
59	1.2250E+01	2.6471E+01	2.2733E+02	4.8770E+02	-1.9466E+01	-3.8434E-01	4.3045E-01	-1.7374E-01	-1.3386E-01
60	1.2500E+01	6.9048E+01	4.3134E+02	9.0205E+02	-7.1688E+01	-3.5951E-01	4.0637E-01	-1.7189E-01	-1.4530E-01
61	1.2750E+01	1.2551E+02	6.0117E+02	1.2242E+03	-1.4972E+02	-3.3119E-01	3.7866E-01	-1.6976E-01	-1.7539E-01

62	1.3000E+01	1.9227E+02	7.1407E+02	1.4131E+03	-2.4432E+02	-2.9551E-01	3.4341E-01	-1.6754E-01	-2.3031E-01
63	1.3000E+01	2.4031E+02	7.8239E+02	1.6411E+03	-2.1055E+02	-2.9551E-01	3.4341E-01	-1.6754E-01	-2.3031E-01
64	1.3250E+01	1.9743E+02	8.7440E+02	1.7678E+03	-3.0662E+01	-2.5105E-01	3.8810E-01	-1.8762E-01	-2.6567E-01
65	1.3500E+01	1.3894E+02	9.9383E+02	1.9418E+03	1.6056E+02	-2.0492E-01	4.3457E-01	-2.0763E-01	-2.4919E-01
66	1.3750E+01	5.8533E+01	1.1360E+03	2.1500E+03	3.6734E+02	-1.6661E-01	4.7329E-01	-2.2757E-01	-1.7680E-01
67	1.4000E+01	-1.3973E+01	1.2608E+03	2.3101E+03	5.9016E+02	-1.4639E-01	4.9389E-01	-2.4742E-01	-4.3559E-02
68	1.4000E+01	5.7581E+02	2.1141E+01	-3.5223E+02	3.7912E+02	-1.4639E-01	4.9389E-01	-2.4742E-01	-4.3559E-02
69	1.4250E+01	5.9237E+02	4.5112E+01	-2.6292E+02	2.7770E+02	-1.4561E-01	4.9313E-01	-2.3846E-01	4.7444E-02
70	1.4500E+01	5.4370E+02	9.3562E+01	-1.1803E+02	1.8407E+02	-1.3133E-01	4.7868E-01	-2.2947E-01	1.1060E-01
71	1.4750E+01	5.7399E+02	1.3008E+02	9.0123E+00	9.9379E+01	-1.0816E-01	4.5534E-01	-2.2037E-01	1.4861E-01
72	1.5000E+01	5.5967E+02	1.3859E+02	8.2470E+01	2.0376E+01	-8.0188E-02	4.2744E-01	-2.1115E-01	1.6372E-01
73	1.5250E+01	5.5802E+02	1.1745E+02	9.4887E+01	-5.7611E+01	-5.1330E-02	3.9896E-01	-2.0183E-01	1.5699E-01
74	1.5500E+01	5.4624E+02	7.5339E+01	6.0415E+01	-1.3855E+02	-2.5503E-02	3.7371E-01	-1.9247E-01	1.2821E-01
75	1.5750E+01	5.3570E+02	2.8668E+01	1.0680E+01	-2.2423E+02	-6.8198E-03	3.5554E-01	-1.8313E-01	7.6296E-02
76	1.6000E+01	5.2571E+02	3.6628E-02	-7.4927E+00	-3.1308E+02	4.1869E-04	3.4855E-01	-1.7383E-01	1.0700E-04

ENTRY	S	P	Q	CAP S	M1	XI	ETA	V	CHI
1	0.E+00	5.2662E+02	8.0716E-03	-1.2806E-01	-3.1305E+02	1.3952E-06	3.4856E-01	-1.7383E-01	1.0593E-07
2	2.5000E-01	5.3591E+02	-2.8872E+01	-1.8515E+01	-2.2421E+02	7.2202E-03	3.5553E-01	-1.8312E-01	-7.6182E-02
3	5.0000E-01	5.4665E+02	-7.5809E+01	-6.8476E+01	-1.3854E+02	2.5882E-02	3.7368E-01	-1.9245E-01	-1.2809E-01
4	7.5000E-01	5.5871E+02	-1.1820E+02	-1.0319E+02	-5.7616E+01	5.1688E-02	3.9891E-01	-2.0180E-01	-1.5687E-01
5	1.0000E+00	5.7067E+02	-1.3964E+02	-9.1036E+01	2.0355E+01	8.0525E-02	4.2737E-01	-2.1111E-01	-1.6360E-01
6	1.2500E+00	5.8032E+02	-1.3145E+02	-1.7846E+01	9.9343E+01	1.0847E-01	4.5525E-01	-2.2032E-01	-1.4850E-01
7	1.5000E+00	5.8539E+02	-9.5258E+01	1.0893E+02	1.8402E+02	1.3163E-01	4.7858E-01	-2.2941E-01	-1.1051E-01
8	1.7500E+00	5.8445E+02	-4.7136E+01	2.5357E+02	2.7764E+02	1.4589E-01	4.9301E-01	-2.3839E-01	-4.7365E-02
9	2.0000E+00	5.7830E+02	-2.3501E+01	3.4265E+02	3.7908E+02	1.4666E-01	4.9375E-01	-2.4734E-01	4.3625E-02
10	2.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	4.0874E-01	4.5342E-01	-1.7535E-01	1.3291E-01
11	2.2500E+00	-2.6507E+01	2.2728E+02	4.8757E+02	1.9460E+01	3.8479E-01	4.3033E-01	-1.7369E-01	1.3405E-01
12	2.5000E+00	-6.9113E+01	4.3124E+02	9.0182E+02	7.1661E+01	3.5993E-01	4.0621E-01	-1.7178E-01	1.4549E-01
13	2.7500E+00	-1.2560E+02	6.0104E+02	1.2239E+03	1.4966E+02	3.3157E-01	3.7847E-01	-1.6967E-01	1.7557E-01
14	3.0000E+00	-1.9238E+02	7.1392E+02	1.4127E+03	2.4422E+02	2.9587E-01	3.4319E-01	-1.6743E-01	2.3047E-01
15	3.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	4.6360E-01	1.7515E-01	-8.3217E-02	2.3839E-01
16	3.2500E+00	-1.8929E+01	1.4675E+01	4.9364E+01	-2.4407E-01	4.2144E-01	2.1738E-01	-1.0432E-01	2.3903E-01
17	3.5000E+00	-3.4481E+01	3.0816E+01	1.0378E+02	-6.1083E+00	3.7921E-01	2.5969E-01	-1.2539E-01	2.3894E-01
18	3.7500E+00	-4.6344E+01	4.8853E+01	1.6373E+02	-1.7360E+01	3.3718E-01	3.0180E-01	-1.4643E-01	2.3658E-01
19	4.0000E+00	-5.4218E+01	6.8120E+01	2.2746E+02	-3.3735E+01	2.9587E-01	3.4319E-01	-1.6743E-01	2.3047E-01
20	4.0000E+00	-2.4659E+02	7.8204E+02	1.6402E+03	2.1049E+02	2.9587E-01	3.4319E-01	-1.6743E-01	2.3047E-01
21	4.2500E+00	-1.9778E+02	8.7405E+02	1.7669E+03	3.0600E+01	2.5138E-01	3.8791E-01	-1.8752E-01	2.6581E-01
22	4.5000E+00	-1.3936E+02	9.9350E+02	1.9409E+03	-1.6063E+02	2.0522E-01	4.3440E-01	-2.0754E-01	2.4931E-01
23	4.7500E+00	-6.9017E+01	1.1357E+03	2.1492E+03	-3.6743E+02	1.6690E-01	4.7314E-01	-2.2748E-01	1.7690E-01
24	5.0000E+00	1.3436E+01	1.2605E+03	2.3094E+03	-5.9030E+02	1.4666E-01	4.9375E-01	-2.4734E-01	4.3625E-02
25	5.0000E+00	0.E+00	0.E+00	0.E+00	0.E+00	1.4644E-01	4.4265E-01	-2.1359E-01	5.2527E-02
26	5.2500E+00	-3.3845E+00	2.6673E+01	1.0175E+02	-2.9597E+00	1.4654E-01	4.5592E-01	-2.2209E-01	5.3421E-02
27	5.5000E+00	-1.5631E+00	4.0486E+01	1.7928E+02	-1.0963E+01	1.4661E-01	4.6923E-01	-2.3054E-01	5.2730E-02
28	5.7500E+00	4.0562E+00	4.1069E+01	2.3184E+02	-2.0828E+01	1.4665E-01	4.8206E-01	-2.3895E-01	4.9479E-02
29	6.0000E+00	1.1898E+01	2.5879E+01	2.5425E+02	-2.9027E+01	1.4666E-01	4.9375E-01	-2.4734E-01	4.3625E-02
30	6.0000E+00	3.8857E+02	1.3344E+03	3.5777E+03	3.8410E+02	1.4666E-01	4.9375E-01	-2.4734E-01	4.3625E-02
31	6.2500E+00	5.4310E+02	1.4352E+03	3.6279E+03	2.2426E+02	1.3085E-01	5.0995E-01	-2.6637E-01	1.3008E-01
32	6.5000E+00	7.0472E+02	1.4811E+03	3.5634E+03	7.6692E+01	1.0364E-01	5.3762E-01	-2.8544E-01	1.7349E-01
33	6.7500E+00	8.6977E+02	1.4913E+03	3.4276E+03	-4.8577E+01	7.2180E-02	5.6944E-01	-3.0465E-01	1.7865E-01
34	7.0000E+00	1.0351E+03	1.4613E+03	3.2163E+03	-1.4362E+02	4.2547E-02	5.9918E-01	-3.2407E-01	1.5277E-01
35	7.2500E+00	1.1960E+03	1.3611E+03	2.8769E+03	-1.9839E+02	1.9385E-02	6.2214E-01	-3.4377E-01	1.0552E-01
36	7.5000E+00	1.3443E+03	1.1357E+03	2.3133E+03	-1.9690E+02	5.3814E-03	6.3565E-01	-3.6384E-01	5.0162E-02
37	7.7500E+00	1.4655E+03	7.0980E+02	1.3984E+03	-1.1410E+02	3.6774E-04	6.3984E-01	-3.8438E-01	5.7365E-03
38	8.0000E+00	1.5373E+03	2.3924E-02	-8.8287E-02	8.6066E+01	-6.2284E-06	6.3883E-01	-4.0553E-01	3.4368E-06
39	8.0000E+00	1.5373E+03	2.3923E-02	-8.8288E-02	8.6066E+01	-6.2284E-06	6.3883E-01	-4.0553E-01	3.4367E-06
40	8.2500E+00	1.4655E+03	-7.0975E+02	-1.3986E+03	-1.1411E+02	-3.7888E-04	6.3984E-01	-3.8438E-01	-5.7303E-03
41	8.5000E+00	1.3443E+03	-1.1356E+03	-2.3135E+03	-1.9690E+02	-5.3913E-03	6.3566E-01	-3.6384E-01	-5.0157E-02
42	8.7500E+00	1.1960E+03	-1.3610E+03	-2.8770E+03	-1.9840E+02	-1.9393E-02	6.2214E-01	-3.4377E-01	-1.0552E-01
43	9.0000E+00	1.0351E+03	-1.4612E+03	-3.2164E+03	-1.4362E+02	-4.2554E-02	5.9918E-01	-3.2407E-01	-1.5277E-01
44	9.2500E+00	8.6972E+02	-1.4912E+03	-3.4277E+03	-4.8579E+01	-7.2186E-02	5.6944E-01	-3.0465E-01	-1.7864E-01
45	9.5000E+00	7.0467E+02	-1.4810E+03	-3.5634E+03	7.6690E+01	-1.0364E-01	5.3762E-01	-2.8544E-01	-1.7349E-01
46	9.7500E+00	5.4305E+02	-1.4351E+03	-3.6280E+03	2.2426E+02	-1.3085E-01	5.0995E-01	-2.6637E-01	-1.3008E-01
47	1.0000E+01	3.8851E+02	-1.3343E+03	-3.5778E+03	3.8410E+02	-1.4667E-01	4.9375E-01	-2.4734E-01	-4.3625E-02
48	1.0000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-1.4644E-01	4.4265E-01	-2.1359E-01	-5.2528E-02
49	1.0250E+01	3.3840E+00	2.6674E+01	1.0175E+02	2.9598E+00	-1.4654E-01	4.5592E-01	-2.2209E-01	-5.3422E-02
50	1.0500E+01	1.5619E+00	4.0486E+01	1.7928E+02	1.0963E+01	-1.4661E-01	4.6923E-01	-2.3054E-01	-5.2730E-02
51	1.0750E+01	-4.0579E+00	4.1067E+01	2.3184E+02	2.0828E+01	-1.4665E-01	4.8206E-01	-2.3895E-01	-4.9480E-02
52	1.1000E+01	-1.1900E+01	2.5875E+01	2.5425E+02	2.9026E+01	-1.4667E-01	4.9375E-01	-2.4734E-01	-4.3625E-02
53	1.1000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-4.6361E-01	1.7515E-01	-8.3217E-02	-2.3839E-01
54	1.1250E+01	1.8928E+01	1.4678E+01	4.9370E+01	2.4417E-01	-4.2145E-01	2.1738E-01	-1.0432E-01	-2.3903E-01
55	1.1500E+01	3.4479E+01	3.0820E+01	1.0379E+02	6.1087E+00	-3.7921E-01	2.5969E-01	-1.2539E-01	-2.3894E-01
56	1.1750E+01	4.6341E+01	4.8860E+01	1.6374E+02	1.7361E+01	-3.3718E-01	3.0180E-01	-1.4643E-01	-2.3658E-01
57	1.2000E+01	5.4213E+01	6.8127E+01	2.2748E+02	3.3736E+01	-2.9587E-01	3.4319E-01	-1.6744E-01	-2.3047E-01
58	1.2000E+01	0.E+00	0.E+00	0.E+00	0.E+00	-4.0874E-01	4.5342E-01	-1.7535E-01	-1.3292E-01
59	1.2250E+01	2.6506E+01	2.2727E+02	4.8757E+02	-1.9460E+01	-3.8480E-01	4.3033E-01	-1.7369E-01	-1.3405E-01
60	1.2500E+01	6.9111E+01	4.3124E+02	9.0182E+02	-7.1661E+01	-3.5993E-01	4.0622E-01	-1.7178E-01	-1.4549E-01
61	1.2750E+01	1.2560E+02	6.0104E+02	1.2239E+03	-1.4966E+02	-3.3157E-01	3.7847E-01	-1.6967E-01	-1.7557E-01

62	1.3000E+01	1.9237E+02	7.1392E+02	1.4127E+03	-2.4422E+02	-2.9587E-01	3.4319E-01	-1.6744E-01	-2.3047E-01
63	1.3000E+01	2.4659E+02	7.8205E+02	1.6402E+03	-2.1049E+02	-2.9587E-01	3.4319E-01	-1.6744E-01	-2.3047E-01
64	1.3250E+01	1.9777E+02	8.7409E+02	1.7669E+03	-3.0600E+01	-2.5138E-01	3.8791E-01	-1.8752E-01	-2.6581E-01
65	1.3500E+01	1.3935E+02	9.9350E+02	1.9409E+03	1.6063E+02	-2.0523E-01	4.3440E-01	-2.0754E-01	-2.4931E-01
66	1.3750E+01	5.9004E+01	1.1357E+03	2.1493E+03	3.6743E+02	-1.6690E-01	4.7314E-01	-2.2748E-01	-1.7690E-01
67	1.4000E+01	-1.3451E+01	1.2605E+03	2.3094E+03	5.9029E+02	-1.4667E-01	4.9375E-01	-2.4734E-01	-4.3625E-02
68	1.4000E+01	3.7821E+02	2.3431E+01	-3.4299E+02	3.7908E+02	-1.4667E-01	4.9375E-01	-2.4734E-01	-4.3625E-02
69	1.4250E+01	5.8436E+02	4.7076E+01	-2.5391E+02	2.7765E+02	-1.4589E-01	4.9301E-01	-2.3839E-01	4.7366E-02
70	1.4500E+01	5.8532E+02	9.5201E+01	-1.0926E+02	1.8403E+02	-1.3164E-01	4.7858E-01	-2.2941E-01	1.1051E-01
71	1.4750E+01	5.8027E+02	1.3140E+02	1.7522E+01	9.9345E+01	-1.0847E-01	4.5525E-01	-2.2032E-01	1.4850E-01
72	1.5000E+01	5.7063E+02	1.3961E+02	9.0726E+01	2.0353E+01	-8.0525E-02	4.2737E-01	-2.1111E-01	1.6361E-01
73	1.5250E+01	5.5868E+02	1.1818E+02	1.0290E+02	-5.7621E+01	-5.1687E-02	3.9892E-01	-2.0180E-01	1.5688E-01
74	1.5500E+01	5.4663E+02	7.5805E+01	6.8200E+01	-1.3855E+02	-2.5880E-02	3.7368E-01	-1.9245E-01	1.2809E-01
75	1.5750E+01	5.3590E+02	2.8879E+01	1.8250E+01	-2.2422E+02	-7.2175E-03	3.5553E-01	-1.8312E-01	7.6183E-02
76	1.6000E+01	5.2562E+02	8.4579E-03	-1.2771E-01	-3.1305E+02	1.3754E-06	3.4856E-01	-1.7383E-01	7.7518E-08

OMEGA 1 = 1.3212496039E+02

ENTRY	S	U	V	W
1	0.E+00	-2.4647E-01	-1.7383E-01	2.4647E-01
2	2.5000E-01	-2.4630E-01	-1.8312E-01	2.5651E-01
3	5.0000E-01	-2.4593E-01	-1.9245E-01	2.8254E-01
4	7.5000E-01	-2.4553E-01	-2.0180E-01	3.1863E-01
5	1.0000E+00	-2.4526E-01	-2.1111E-01	3.5914E-01
6	1.2500E+00	-2.4521E-01	-2.2032E-01	3.9861E-01
7	1.5000E+00	-2.4533E-01	-2.2941E-01	4.3148E-01
8	1.7500E+00	-2.4545E-01	-2.3839E-01	4.5177E-01
9	2.0000E+00	-2.4543E-01	-2.4734E-01	4.5284E-01
10	2.0000E+00	-3.1593E-02	-1.7535E-01	6.0964E-01
11	2.2500E+00	-3.2198E-02	-1.7369E-01	5.7638E-01
12	2.5000E+00	-3.2728E-02	-1.7178E-01	5.4175E-01
13	2.7500E+00	-3.3165E-02	-1.6967E-01	5.0208E-01
14	3.0000E+00	-3.3462E-02	-1.6743E-01	4.5188E-01
15	3.0000E+00	-4.5166E-01	-8.3217E-02	2.0397E-01
16	3.2500E+00	-4.5172E-01	-1.0432E-01	1.4429E-01
17	3.5000E+00	-4.5177E-01	-1.2539E-01	8.4516E-02
18	3.7500E+00	-4.5183E-01	-1.4643E-01	2.5013E-02
19	4.0000E+00	-4.5188E-01	-1.6743E-01	-3.3462E-02
20	4.0000E+00	-4.5188E-01	-1.6743E-01	-3.3462E-02
21	4.2500E+00	-4.5205E-01	-1.8752E-01	-9.6544E-02
22	4.5000E+00	-4.5228E-01	-2.0754E-01	-1.6205E-01
23	4.7500E+00	-4.5258E-01	-2.2748E-01	-2.1654E-01
24	5.0000E+00	-4.5284E-01	-2.4734E-01	-2.4543E-01
25	5.0000E+00	-1.4644E-01	-2.1359E-01	-4.4265E-01
26	5.2500E+00	-1.4654E-01	-2.2209E-01	-4.5592E-01
27	5.5000E+00	-1.4661E-01	-2.3054E-01	-4.6923E-01
28	5.7500E+00	-1.4665E-01	-2.3895E-01	-4.8206E-01
29	6.0000E+00	-1.4666E-01	-2.4734E-01	-4.9375E-01
30	6.0000E+00	-4.5284E-01	-2.4734E-01	-2.4543E-01
31	6.2500E+00	-4.5312E-01	-2.6637E-01	-2.6807E-01
32	6.5000E+00	-4.5344E-01	-2.8544E-01	-3.0687E-01
33	6.7500E+00	-4.5370E-01	-3.0465E-01	-3.5162E-01
34	7.0000E+00	-4.5377E-01	-3.2407E-01	-3.9360E-01
35	7.2500E+00	-4.5363E-01	-3.4377E-01	-4.2621E-01
36	7.5000E+00	-4.5328E-01	-3.6384E-01	-4.4567E-01
37	7.7500E+00	-4.5270E-01	-3.8438E-01	-4.5218E-01
38	8.0000E+00	-4.5172E-01	-4.0553E-01	-4.5173E-01
39	8.0000E+00	4.5173E-01	-4.0553E-01	-4.5172E-01
40	8.2500E+00	4.5271E-01	-3.8438E-01	-4.5217E-01

41	8.5000E+00	4.5329E-01	-3.6384E-01	-4.4567E-01
42	8.7500E+00	4.5364E-01	-3.4377E-01	-4.2621E-01
43	9.0000E+00	4.5378E-01	-3.2407E-01	-3.9360E-01
44	9.2500E+00	4.5370E-01	-3.0465E-01	-3.5162E-01
45	9.5000E+00	4.5344E-01	-2.8544E-01	-3.0687E-01
46	9.7500E+00	4.5312E-01	-2.6637E-01	-2.6807E-01
47	1.0000E+01	4.5285E-01	-2.4734E-01	-2.4543E-01
48	1.0000E+01	-1.4644E-01	-2.1359E-01	4.4265E-01
49	1.0250E+01	-1.4654E-01	-2.2209E-01	4.5592E-01
50	1.0500E+01	-1.4661E-01	-2.3054E-01	4.6923E-01
51	1.0750E+01	-1.4665E-01	-2.3895E-01	4.8206E-01
52	1.1000E+01	-1.4667E-01	-2.4734E-01	4.9375E-01
53	1.1000E+01	-4.5167E-01	-8.3217E-02	-2.0397E-01
54	1.1250E+01	-4.5172E-01	-1.0432E-01	-1.4430E-01
55	1.1500E+01	-4.5177E-01	-1.2539E-01	-8.4519E-02
56	1.1750E+01	-4.5183E-01	-1.4643E-01	-2.5015E-02
57	1.2000E+01	-4.5189E-01	-1.6744E-01	3.3460E-02
58	1.2000E+01	-3.1590E-02	-1.7535E-01	-6.0964E-01
59	1.2250E+01	-3.2196E-02	-1.7369E-01	-5.7639E-01
60	1.2500E+01	-3.2726E-02	-1.7178E-01	-5.4175E-01
61	1.2750E+01	-3.3163E-02	-1.6967E-01	-5.0208E-01
62	1.3000E+01	-3.3460E-02	-1.6744E-01	-4.5189E-01
63	1.3000E+01	-4.5189E-01	-1.6744E-01	3.3460E-02
64	1.3250E+01	-4.5205E-01	-1.8752E-01	9.6542E-02
65	1.3500E+01	-4.5229E-01	-2.0754E-01	1.6205E-01
66	1.3750E+01	-4.5258E-01	-2.2748E-01	2.1654E-01
67	1.4000E+01	-4.5285E-01	-2.4734E-01	2.4543E-01
68	1.4000E+01	2.4543E-01	-2.4734E-01	4.5285E-01
69	1.4250E+01	2.4545E-01	-2.3839E-01	4.5178E-01
70	1.4500E+01	2.4533E-01	-2.2941E-01	4.3149E-01
71	1.4750E+01	2.4521E-01	-2.2032E-01	3.9861E-01
72	1.5000E+01	2.4526E-01	-2.1111E-01	3.5914E-01
73	1.5250E+01	2.4553E-01	-2.0180E-01	3.1863E-01
74	1.5500E+01	2.4593E-01	-1.9245E-01	2.8253E-01
75	1.5750E+01	2.4630E-01	-1.8312E-01	2.5650E-01
76	1.6000E+01	2.4647E-01	-1.7383E-01	2.4647E-01

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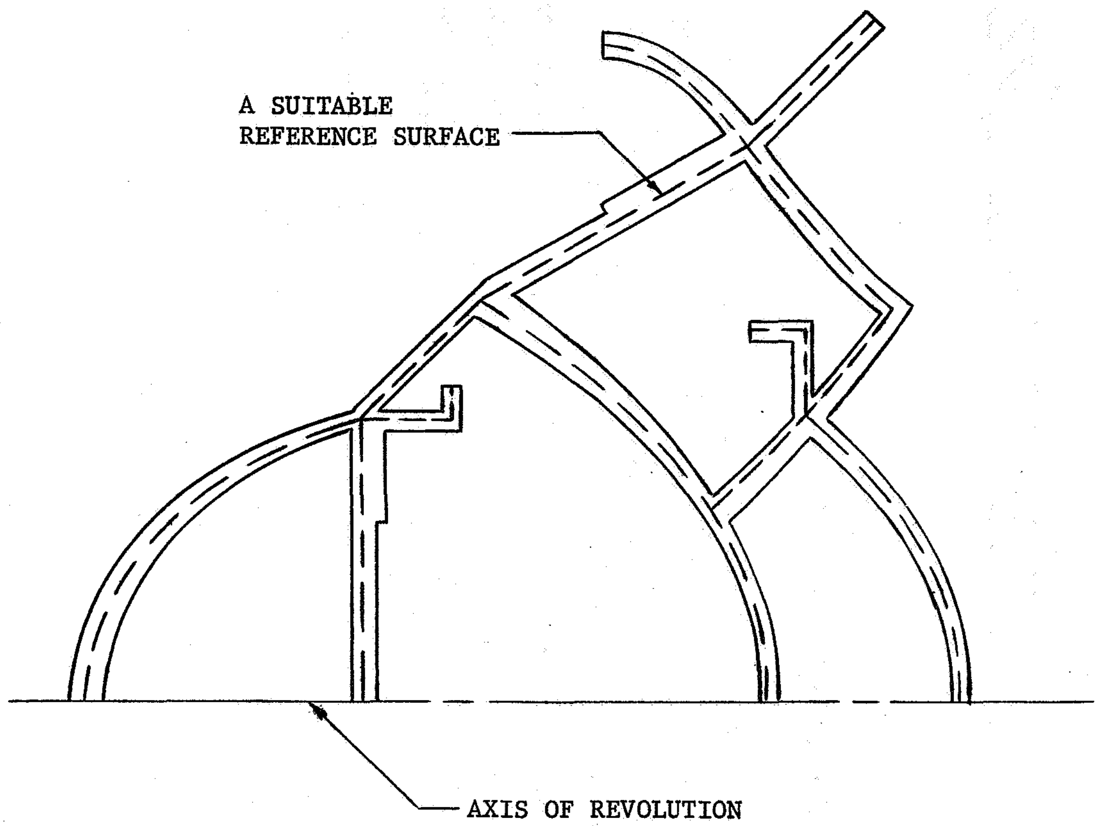
TABLE I

CIRCUMFERENTIAL VARIATION OF HARMONIC VARIABLES

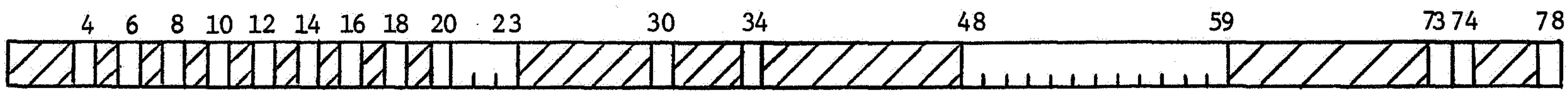
	Symmetric		Antisymmetric	
	cos $n\phi$	sin $n\phi$	cos $n\phi$	sin $n\phi$
Load (Input) Variables	F_x, F_y	F_ϕ	F_ϕ	F_x, F_y
	L_2	L_1	L_1	L_2
	N_ϕ	N_x, N_y	N_x, N_y	N_ϕ
	X_1, X_3	X_2	X_2	X_1, X_3
	$\Delta\theta_1, \Delta\theta_2$			$\Delta\theta_1, \Delta\theta_2$
	θ_1, θ_2			θ_1, θ_2
	θ_r, θ_{st}			θ_r, θ_{st}
Response (Output) Variables	M_1, M_2			M_1, M_2
	M_y			M_y
	P, Q	S	S	P, Q
	T_1, T_2	T_{12}	T_{12}	T_1, T_2
	T_ϕ			T_ϕ
	u, w	v	v	u, w
	u_x, u_y	u_ϕ	u_ϕ	u_x, u_y
		w_x, w_y	w_x, w_y	
	$\varepsilon_1, \varepsilon_2$			$\varepsilon_1, \varepsilon_2$
	ε_ϕ			ε_ϕ
	κ_1, κ_2			κ_1, κ_2
	κ_y			κ_y
	ξ, η	v	v	ξ, η
	σ_s, σ_ϕ	$\sigma_{s\phi}$	$\sigma_{s\phi}$	σ_s, σ_ϕ
	σ_{sz}	$\sigma_{\phi z}$	$\sigma_{\phi z}$	σ_{sz}
	σ_{st}			σ_{st}
	χ	ψ, θ	ψ, θ	χ



NOTE: The reference surface may be chosen as any convenient continuous surface within or near the shell wall.

FIGURE 1. HYPOTHETICAL BRANCHED SHELL PROFILE
(WITH FIVE BRANCH POINTS AND ONE CLOSED BRANCH)

SRA 100: LINEAR STATIC RESPONSE UNDER ASYMMETRIC LOADS



COLUMN

4 = BLANK, NO CLOSED BRANCH; = 1, CLOSED BRANCH CASE

6 = BLANK, USE GEOMETRY FROM PREVIOUS CASE; = 1, INPUT NEW GEOMETRY

8 = BLANK, USE WALL PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW WALL PROPERTIES

10 = BLANK, USE FOUNDATION MODULI FROM PREVIOUS CASE; = 1, INPUT NEW FOUNDATION MODULI

12 = BLANK, USE STRINGER PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW STRINGER PROPERTIES

14 = BLANK, USE MASS DENSITIES FROM PREVIOUS CASE; = 1, INPUT NEW MASS DENSITIES

16 = BLANK, USE MECHANICAL LOADS FROM PREVIOUS CASE; = 1, INPUT NEW MECHANICAL LOADS

18 = BLANK, USE THERMAL LOADS FROM PREVIOUS CASE; = 1, INPUT NEW THERMAL LOADS

20 = BLANK, USE ALL BOUNDARY DATA FROM PREVIOUS CASE; = 1, INPUT BOUNDARY DATA ACCORDING TO COLUMN 5 OF TABLE 1; = 2, INPUT BOUNDARY DATA ACCORDING TO COLUMN 5 OF TABLE 1 (ONLY LOAD VECTORS CHANGE FROM PREVIOUS CASE)

21-23 = HARMONIC NUMBER - n (NEGATIVE VALUE INDICATES ANTISYMMETRIC LOADING ABOUT AXIAL PLANE $\phi = 0$, RIGHT ADJUSTED)

30 = BLANK, NO RIGID BODY MODES; = 1, TRANS. RIGID BODY MODE; = 2, ROT. RIGID BODY MODE; = 3, TRANS. AND ROT. RIGID BODY MODES (APPLIES ONLY IF n = 0,1)

34 = BLANK, X_1, X_2 ACT AT REFERENCE SURFACE; = 1, X_1, X_2 ACT AT OUTER SURFACE

48-59 = RELATIVE ERROR TOLERANCE (E12.4), DEFAULT = 10^{-3}

73 = 1, PUNCH PREBUCKLING DATA (T_ϕ, T_1, T_2, T_{12}, X_3)

74 = 1, PUNCH STRESSES (σ_s, σ_ϕ, $\sigma_{s\phi}$)

78 = BLANK, ABORT RUN IF SUBINTERVAL LENGTH CRITERION EXCEEDED;
= 1, PRINT DIAGNOSTIC BUT CONTINUE EXECUTION IF SUBINTERVAL LENGTH CRITERION EXCEEDED

FIGURE 2. CASE OPTION CARD FOR SRA 100

COLUMN 1 = 1-7, TABLE NO., INDICATES FIRST ENTRY OF TABLE
= 9, INDICATES END OF TABLES (ALWAYS REQUIRED FOR EACH CASE)

COLUMN 3 = 8, SYMMETRICAL RESPONSE ABOUT RING; 9, ANTISYMMETRICAL RESPONSE ABOUT RING (TABLE 1, APPLIES ONLY AT EDGE RING BOUNDARIES)

COLUMN 5 = BLANK, FORCE-FREE BOUNDARY; = 1, INPUT RING DATA; = 2, INPUT [B], [D] AND {L} MATRICES; = 3, BOUNDARY DATA FROM PREVIOUS CASE, (TABLE 1, APPLIES ONLY AT 1ST ENTRY OF EACH SUBINTERVAL AND TERMINAL POINT OF MERIDIAN);
= 4, DOME CLOSURE (TABLE 1, APPLIES ONLY AT EDGES)

COLUMN 6 = BRANCH POINT NO. ($\leq$7) (TABLE 1, APPLIES ONLY AT LAST ENTRY OF A SUBINTERVAL)

COLUMN 7 = WALL LAYER NO. ($\leq$5), INDICATES FIRST ENTRY OF NEW LAYER OR NEW PORTION OF A DISJOINTED LAYER (TABLES 2,7)

COLUMNS 10-12 = TABLE ENTRY NO. ($\leq$100) (MUST BE RIGHT ADJUSTED)

1 - GEOMETRY
2 - WALL PROP.
3 - FOUND. MOD.
4 - STRINGER PROP.
5 - MASS DENSITIES
6 - MECH. LOADS
7 - THERMAL LOADS

NOTE: ALL NUMBERS IN COLUMNS 13-72 HAVE FORMAT E12.4

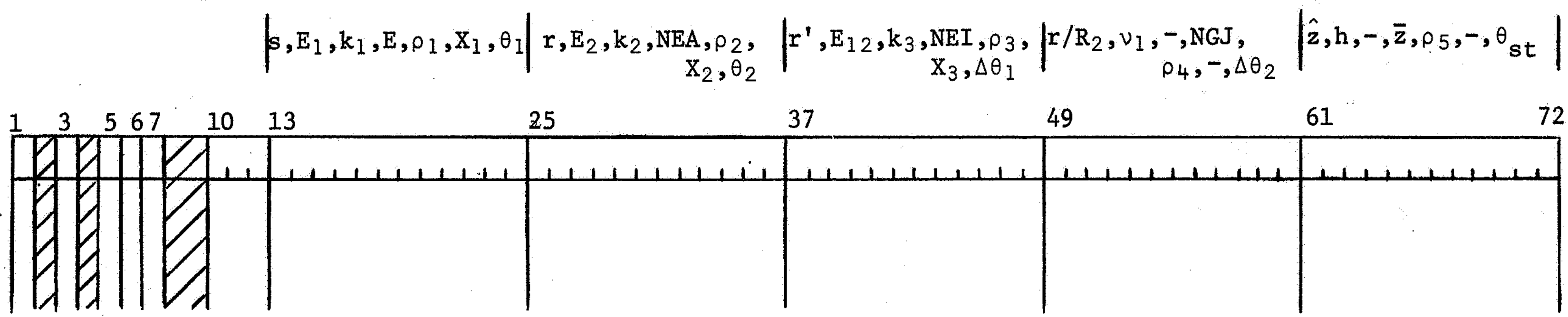


FIGURE 3. INPUT TABLES

(TO BE USED ONLY IF RING DATA ARE TO BE INPUT, REFER TO FIG. 3, COL. 5)

NOTE: ALL NUMBERS IN COLS. 1-72 HAVE FORMAT E12.4

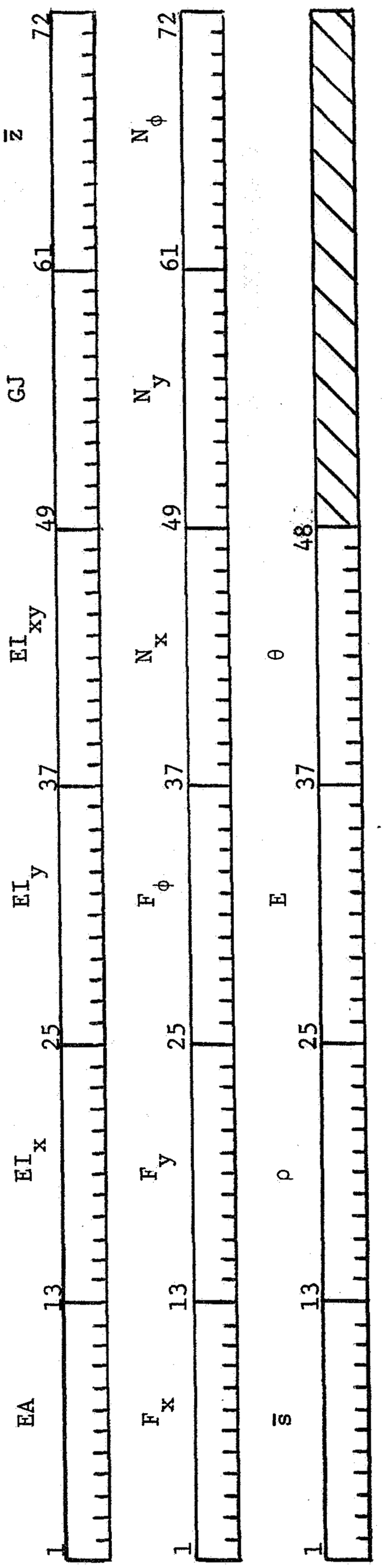
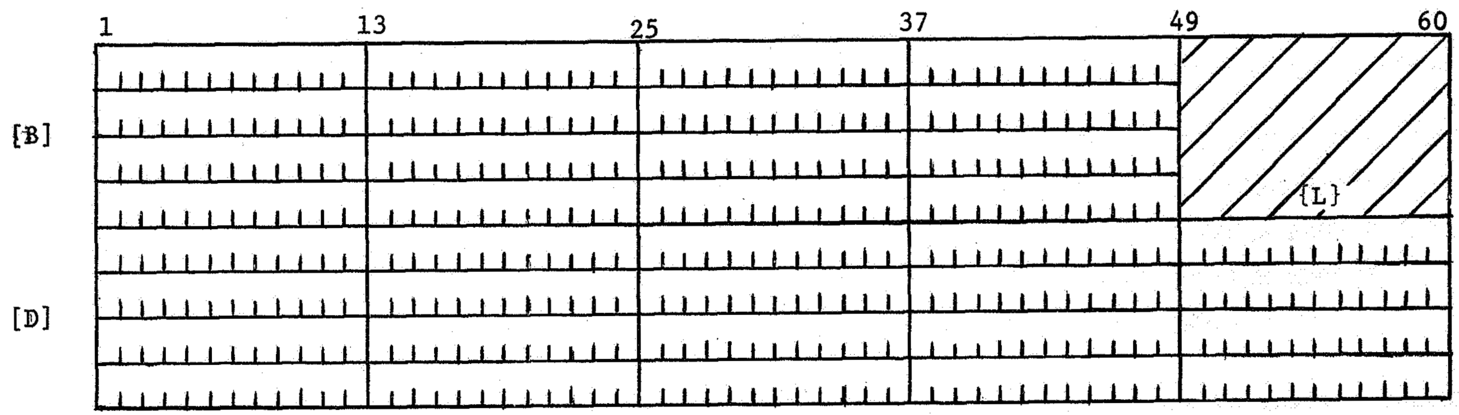


FIGURE 4. RING DATA

(TO BE USED ONLY IF [B], [D] AND {L} ARE TO BE INPUT, REFER TO FIG. 3, COL. 5)

NOTE: ALL NUMBERS IN COLS. 1-60 HAVE FORMAT E12.4

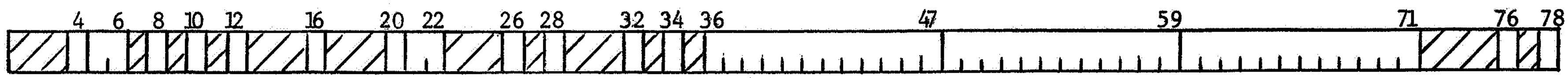


[B], [D], and {L} define boundary conditions of the form (cf. p. 18)

$$[B] \begin{Bmatrix} \Delta P \\ \Delta Q \\ \Delta S \\ \Delta M_1 \end{Bmatrix} + [D] \begin{Bmatrix} \xi \\ \eta \\ v \\ \chi \end{Bmatrix} = \{L\}$$

FIGURE 5. PRESCRIBED [B], [D], AND {L} MATRICES

SRA 101: BUCKLING OF LINEAR STATES UNDER ASYMMETRIC LOADS



COLUMN 4 = BLANK, NO CLOSED BRANCH; = 1, CLOSED BRANCH CASE

COLUMNS 5-6 = BLANK, USE GEOMETRY FROM PREVIOUS CASE; = 1 (RIGHT ADJUSTED), INPUT NEW GEOMETRY; = -1, INPUT NEW GEOMETRY (SAVE CONVERGED BUCKLING MODE DATA ON FILES 8 AND 11 FOR USE AS INITIAL APPROXIMATION FOR A SUCCEEDING CASE)

COLUMN 8 = BLANK, USE WALL PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW WALL PROPERTIES

COLUMN 10 = BLANK, USE FOUNDATION MODULI FROM PREVIOUS CASE; = 1, INPUT NEW FOUNDATION MODULI

COLUMN 12 = BLANK, USE STRINGER PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW STRINGER PROPERTIES

COLUMN 16 = BLANK, USE PREBUCKLING STATE FROM PREVIOUS CASE; = 1, INPUT NEW PREBUCKLING STATE

COLUMN 20 = BLANK, USE ALL BOUNDARY DATA FROM PREVIOUS CASE; INPUT NEW BOUNDARY DATA ACCORDING TO COLUMN 5 OF TABLE 1

COLUMNS 21-22 = BLANK, PREBUCKLING STATE CONTAINS BOTH SYMMETRIC & ANTISYMMETRIC COMPONENTS; = 1 (RIGHT ADJUSTED), SYMMETRIC PREBUCKLING; = -1, ANTISYMMETRIC PREBUCKLING

COLUMN 26 = 1, EQUAL & OPPOSITE EIGENVALUES EXIST

COLUMN 28 = 1, AXISYMMETRIC PREBUCKLING COMPONENT EXISTS AND REPRESENTS PURE TORSION

COLUMN 32 = CONVERGENCE INDEX (NUMBER OF CONVERGED DIGITS OF EIGENVALUE), DEFAULT = 4

COLUMN 34 = BLANK, EXTERNAL SURFACE LOADS ARE DEAD; = 1, LIVE NORMAL PRESSURE FIELD

COLUMNS 36-47 = EIGENVALUE SHIFT FOR AXISYMMETRIC TORSIONLESS PREBUCKLING COMPONENT (E12.4)

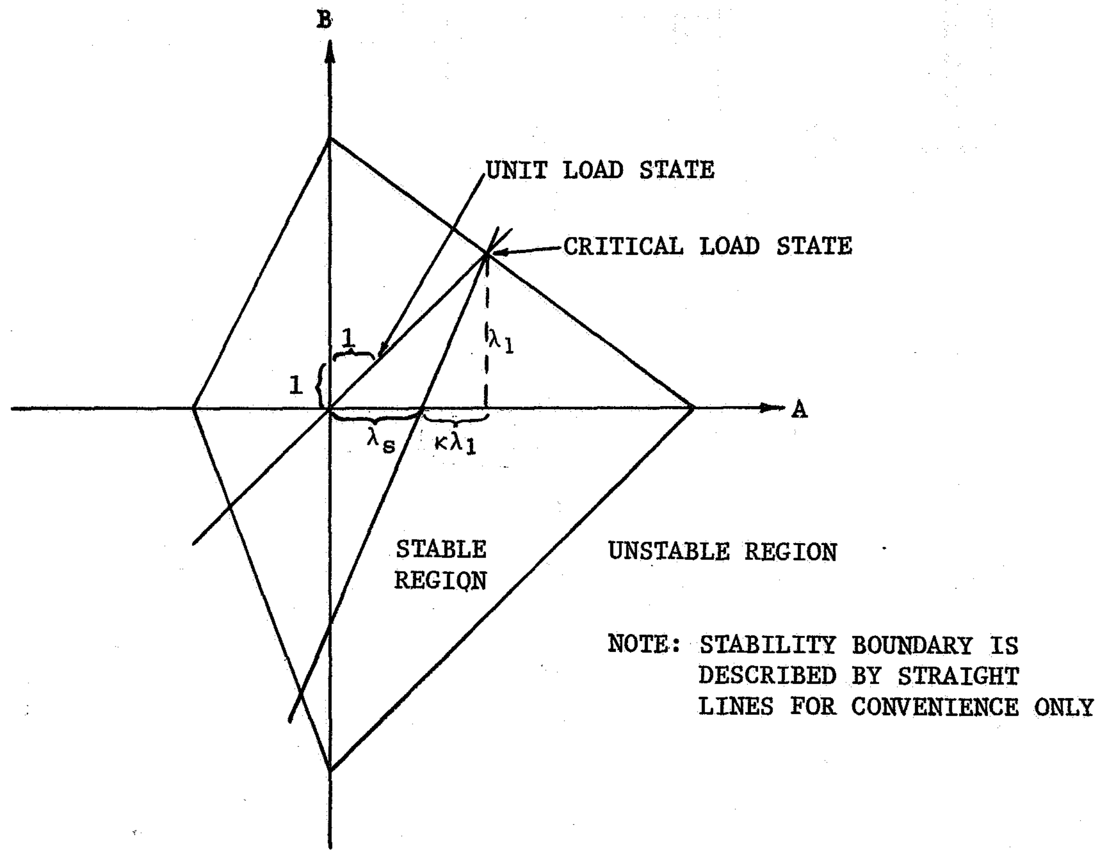
COLUMNS 48-59 = RELATIVE ERROR TOLERANCE (E12.4), DEFAULT = 10^{-3}

COLUMNS 60-71 = SCALING FACTOR FOR AXISYMMETRIC TORSIONLESS PREBUCKLING COMPONENT (E12.4)

COLUMN 76 = 1, CONSTRUCT NEW COMPLEMENTARY SOLUTION FILE USING SOME COMPLEMENTARY SOLUTIONS SAVED FROM A PREVIOUS RUN AND ATTACHED TO FILE TAPE2 (REQUIRES AN EXTRA CARD OF BUCKLING WAVE NUMBERS OF PREVIOUS RUN)

COLUMN 78 = BLANK, ABORT RUN IF SUBINTERVAL LENGTH CRITERION EXCEEDED; ≠ 0, PRINT DIAGNOSTIC BUT CONTINUE EXECUTION IF SUBINTERVAL LENGTH CRITERION IS EXCEEDED; = 3, CONSTRUCT NEW COMPLEMENTARY SOLUTION FILE BUT TAKE INITIAL APPROXIMATION FROM FILES TAPE8 AND TAPE11 (SAVED FROM A PREVIOUS RUN)

FIGURE 6. CASE OPTION CARD FOR SRA 101



THE A-AXIS IS A LINE OF SYMMETRY IF

1) B CONSISTS OF ONLY ONE HARMONIC, OR

2) ALL NONAXISYMMETRIC HARMONICS OF B ARE ODD $[f(\phi\pm\pi) = -f(\phi)]$

FIGURE 7. BUCKLING LOAD INTERACTION PLANE

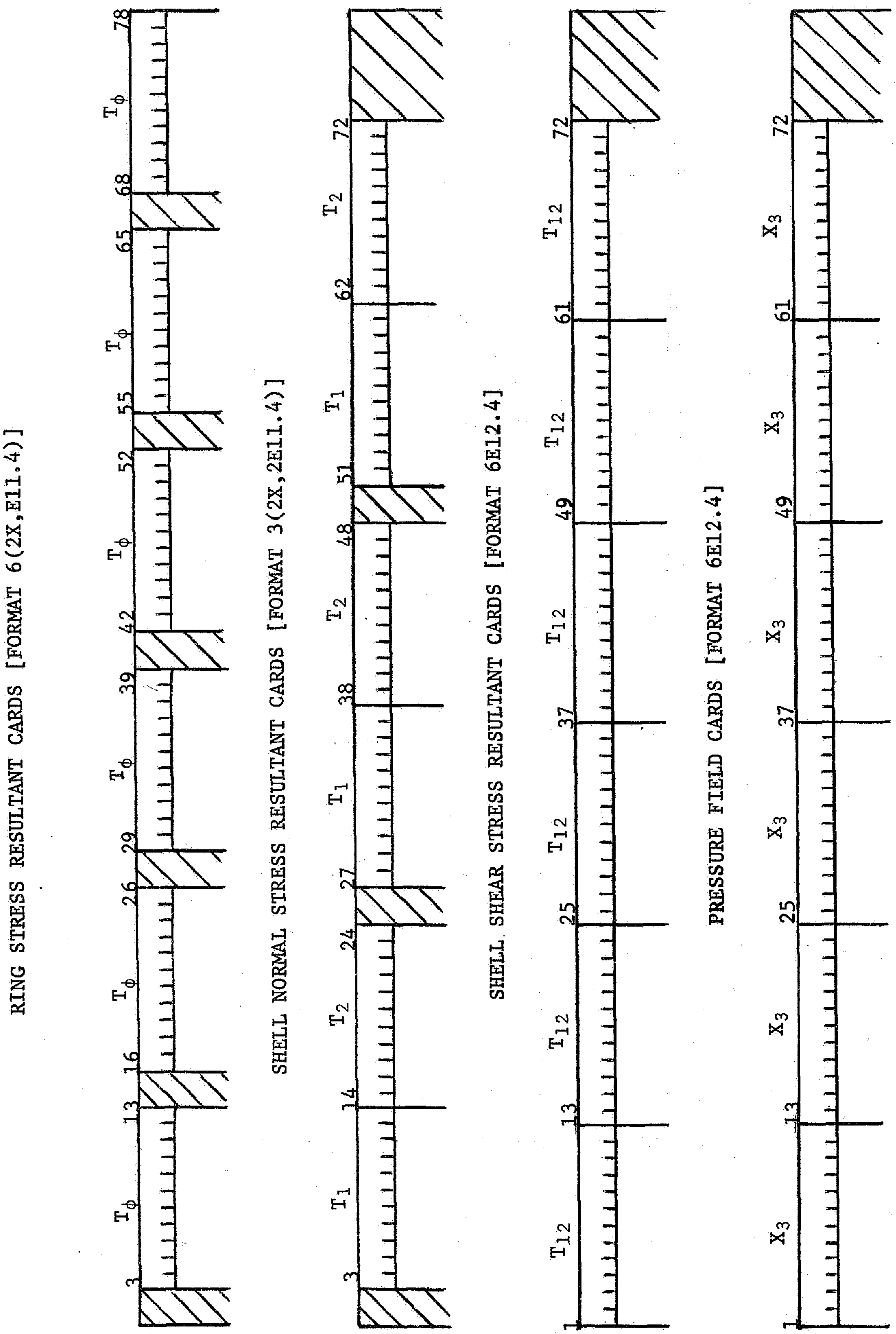
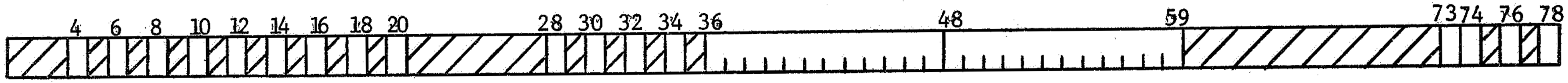


FIGURE 8. PREBUCKLING DATA (REQUIRED FOR EACH PREBUCKLING COMPONENT)

SRA 200: NONLINEAR STATIC RESPONSE UNDER AXISYMMETRIC LOADS



COLUMN

4 = BLANK, NO CLOSED BRANCH; = 1, CLOSED BRANCH CASE

6 = BLANK, USE GEOMETRY FROM PREVIOUS CASE; = 1, INPUT NEW GEOMETRY

8 = BLANK, USE WALL PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW WALL PROPERTIES

10 = BLANK, USE FOUNDATION MODULI FROM PREVIOUS CASE; = 1, INPUT NEW FOUNDATION MODULI

12 = BLANK, USE STRINGER PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW STRINGER PROPERTIES

14 = BLANK, USE MASS DENSITIES FROM PREVIOUS CASE; = 1, INPUT NEW MASS DENSITIES

16 = BLANK, USE MECHANICAL LOADS FROM PREVIOUS CASE; = 1, INPUT NEW MECHANICAL LOADS

18 = BLANK, USE THERMAL LOADS FROM PREVIOUS CASE; = 1, INPUT NEW THERMAL LOADS

20 = BLANK, USE ALL BOUNDARY DATA FROM PREVIOUS CASE; = 1, INPUT BOUNDARY DATA ACCORDING TO COLUMN 5 OF TABLE 1

28 = BLANK, USE INITIAL APPROXIMATION STATE FROM PREVIOUS CASE; = 1, INPUT INITIAL APPROXIMATION STATE; = 2, NULL INITIAL APPROXIMATION STATE

30 = BLANK, NO RIGID BODY MODES; = 1, TRANSLATIONAL RIGID BODY MODE

32 = CONVERGENCE INDEX (NUMBER OF SIGNIFICANT DIGITS UNIFORMLY CONVERGED ON FOR ROTATIONS, χ), DEFAULT = 4

34 = BLANK, EXTERNAL SURFACE LOADS ARE DEAD AND ACT AT THE REFERENCE SURFACE; = 1, EXTERNAL SURFACE LOADS ARE LIVE (NORMAL PRESSURE FIELD); = 2, EXTERNAL SURFACE LOADS ARE DEAD AND ACT AT THE OUTER SURFACE

36-47 = LOAD FACTOR, λ_0 (E12.4); IF BLANK (AND COL. 28 = 2) LINEAR SOLUTION CALCULATED

48-59 = RELATIVE ERROR TOLERANCE (E12.4), DEFAULT = 10^{-3}

73 = 1, WRITE STANDARD PREBUCKLING DATA ON LOGICAL UNIT NO. 7

74 = 1, PUNCH STRESSES

76 = 1 WRITE ADDITIONAL PREBUCKLING DATA ON LOGICAL UNIT NO. 7

78 = BLANK, ABORT RUN IF SUBINTERVAL LENGTH CRITERION EXCEEDED; = 1, PRINT DIAGNOSTIC BUT CONTINUE EXECUTION IF SUBINTERVAL LENGTH CRITERION EXCEEDED

FIGURE 9. CASE OPTION CARD FOR SRA 200

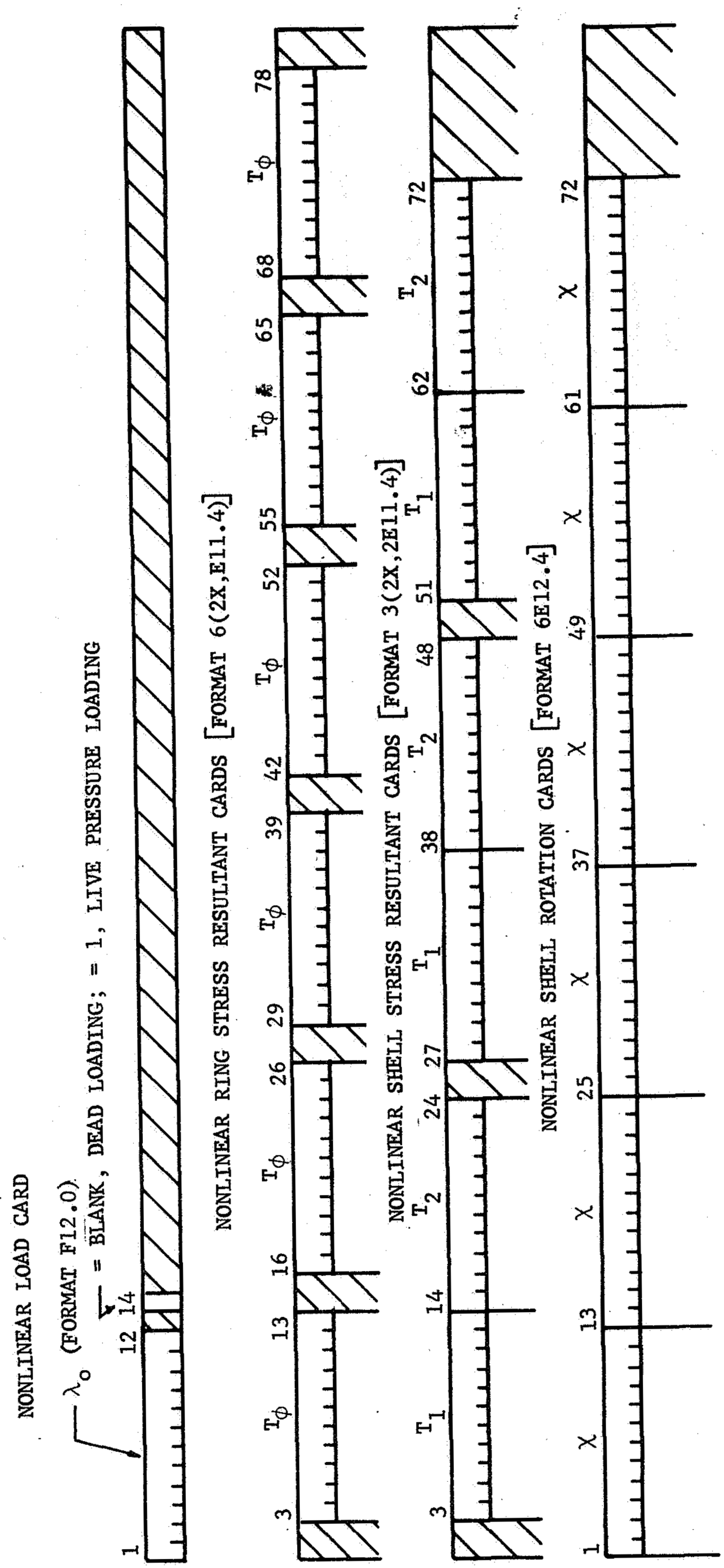


FIGURE 10. STANDARD PREBUCKLING DATA
(This data is normally generated by SRA 200)

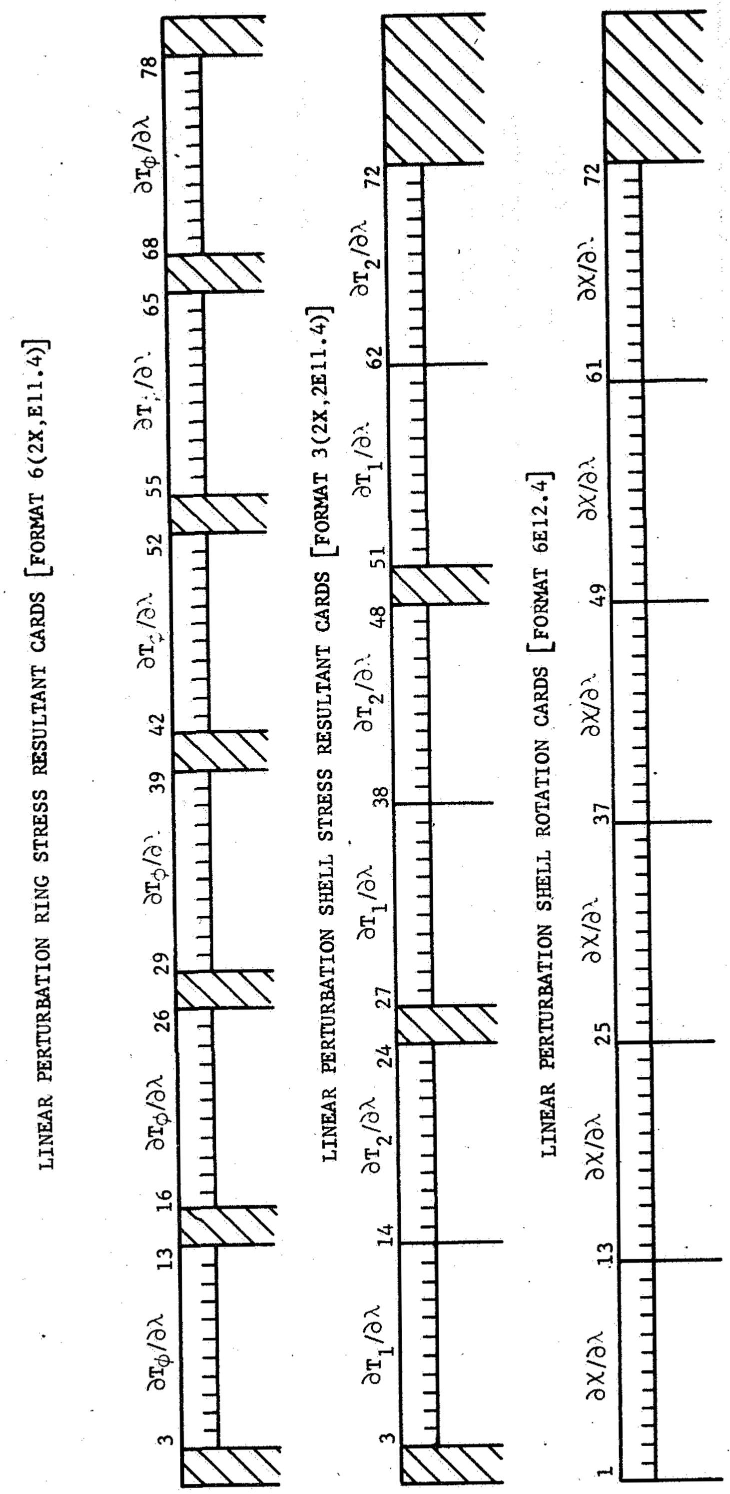
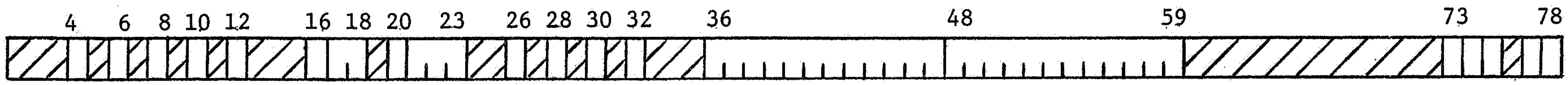


FIGURE 10. - Concluded

SRA 201: BUCKLING OF NONLINEAR STATES UNDER AXISYMMETRIC LOADS



COLUMN

4 = BLANK, NO CLOSED BRANCH; = 1, CLOSED BRANCH CASE

6 = BLANK, USE GEOMETRY FROM PREVIOUS CASE; = 1, INPUT NEW GEOMETRY

8 = BLANK, USE WALL PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW WALL PROPERTIES

10 = BLANK, USE FOUNDATION MODULI FROM PREVIOUS CASE; = 1, INPUT NEW FOUNDATION MODULI

12 = BLANK, USE STRINGER PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW STRINGER PROPERTIES

16 = BLANK, USE PRESSURE FIELD FROM PREVIOUS CASE; = 1, INPUT NEW PRESSURE FIELD

17-18 = BLANK, USE PREBUCKLING DATA FROM PREVIOUS CASE; = 1 (RIGHT ADJUSTED), INPUT NEW PREBUCKLING DATA; = -1, INPUT LINEAR PREBUCKLING DATA ONLY

20 = BLANK, USE ALL BOUNDARY DATA FROM PREVIOUS CASE; = 1, INPUT BOUNDARY DATA ACCORDING TO COLUMN 5 OF TABLE 1

21-23 = HARMONIC NUMBER - n (RIGHT ADJUSTED)

26 = NUMBER OF MODES DESIRED, $\leq$ 4 (EXTRA CARD OF EIGENVALUE SHIFTS REQUIRED WHEN MORE THAN ONE)

28 = BLANK, BENDING MODES; = 1, TORSION MODES (APPLIES ONLY IF n = 0)

30 = BLANK, NO RIGID BODY MODES; = 1, TRNASLATIONAL RIGID BODY MODE; = 2, ROTATIONAL RIGID BODY MODE; = 3, TRANS. AND ROTATIONAL RIGID BODY MODE (APPLIES ONLY IF n = 0 or 1 AND $\lambda_0 = \mu_s = 0$)

32 = CONVERGENCE INDEX (NUMBER OF CONVERGED DIGITS OF EIGENVALUE), DEFAULT = 4

36-47 = EIGENVALUE SHIFT FOR FIRST MODE, μ_s (E12.4)

48-59 = RELATIVE ERROR TOLERANCE (E12.4), DEFAULT = 10^{-3}

73 = 1, PUNCH BUCKLING MODE DATA

74 = 1, PUNCH u, v, w MODAL DISPLACEMENTS

75 = 1, SUPPRESS AUTOMATIC EIGENVALUE SHIFTING

77 = 1, SUPPRESS USE OF MODE SHAPE FROM PREVIOUS CASE AS INITIAL APPROXIMATION

FIGURE 11. CASE OPTION CARD FOR SRA 201

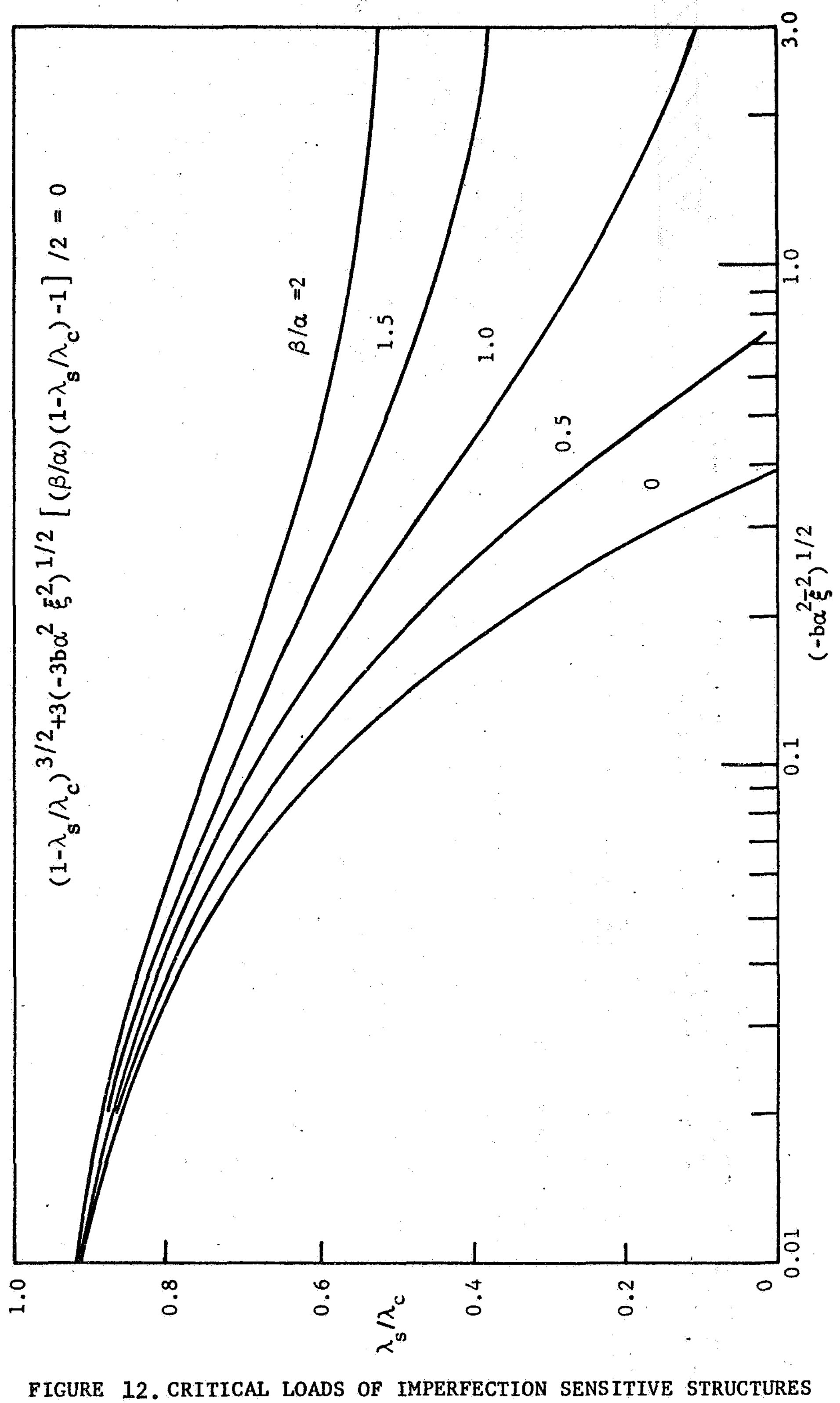
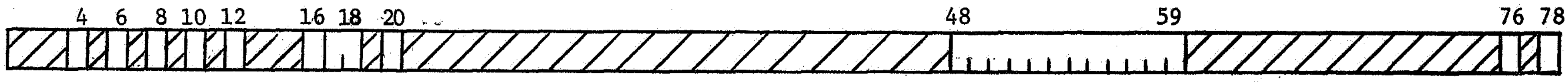


FIGURE 12. CRITICAL LOADS OF IMPERFECTION SENSITIVE STRUCTURES

SRA 202: IMPERFECTION SENSITIVITY OF BUCKLING MODES UNDER AXISYMMETRIC LOADS



COLUMN

4 = BLANK, NO CLOSED BRANCH; = 1, CLOSED BRANCH CASE

6 = BLANK, USE GEOMETRY FROM PREVIOUS CASE; = 1, INPUT NEW GEOMETRY

8 = BLANK, USE WALL PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW WALL PROPERTIES

10 = BLANK, USE FOUNDATION MODULI FROM PREVIOUS CASE; = 1, INPUT NEW FOUNDATION MODULI

12 = BLANK, USE STRINGER PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW STRINGER PROPERTIES

16 = BLANK, USE PRESSURE FIELD FROM PREVIOUS CASE; = 1, INPUT NEW PRESSURE FIELD

17-18 = BLANK, USE PREBUCKLING DATA FROM PREVIOUS CASE; = 1 (RIGHT ADJUSTED), INPUT NEW PREBUCKLING DATA; = -1, INPUT LINEAR PREBUCKLING DATA ONLY

20 = BLANK, USE ALL BOUNDARY DATA FROM PREVIOUS CASE; = 1, INPUT BOUNDARY DATA ACCORDING TO COLUMN 5 OF TABLE 1

48-59 = RELATIVE ERROR TOLERANCE (E12.4), DEFAULT = 10^{-3}

76 = BLANK, K* AND β NOT COMPUTED (STANDARD PREBUCKLING DECK INPUT IF COLUMN 18 $\neq$ 0); = 1, K* AND β COMPUTED (REQUIRES ENLARGED PREBUCKLING DECK INPUT IF COLUMN 18 $\neq$ 0)

78 = BLANK, ABORT RUN IF SUBINTERVAL LENGTH CRITERION EXCEEDED; = 1, PRINT DIAGNOSTIC BUT CONTINUE EXECUTION IF SUBINTERVAL LENGTH CRITERION EXCEEDED

FIGURE 13. CASE OPTION CARD FOR SRA 202

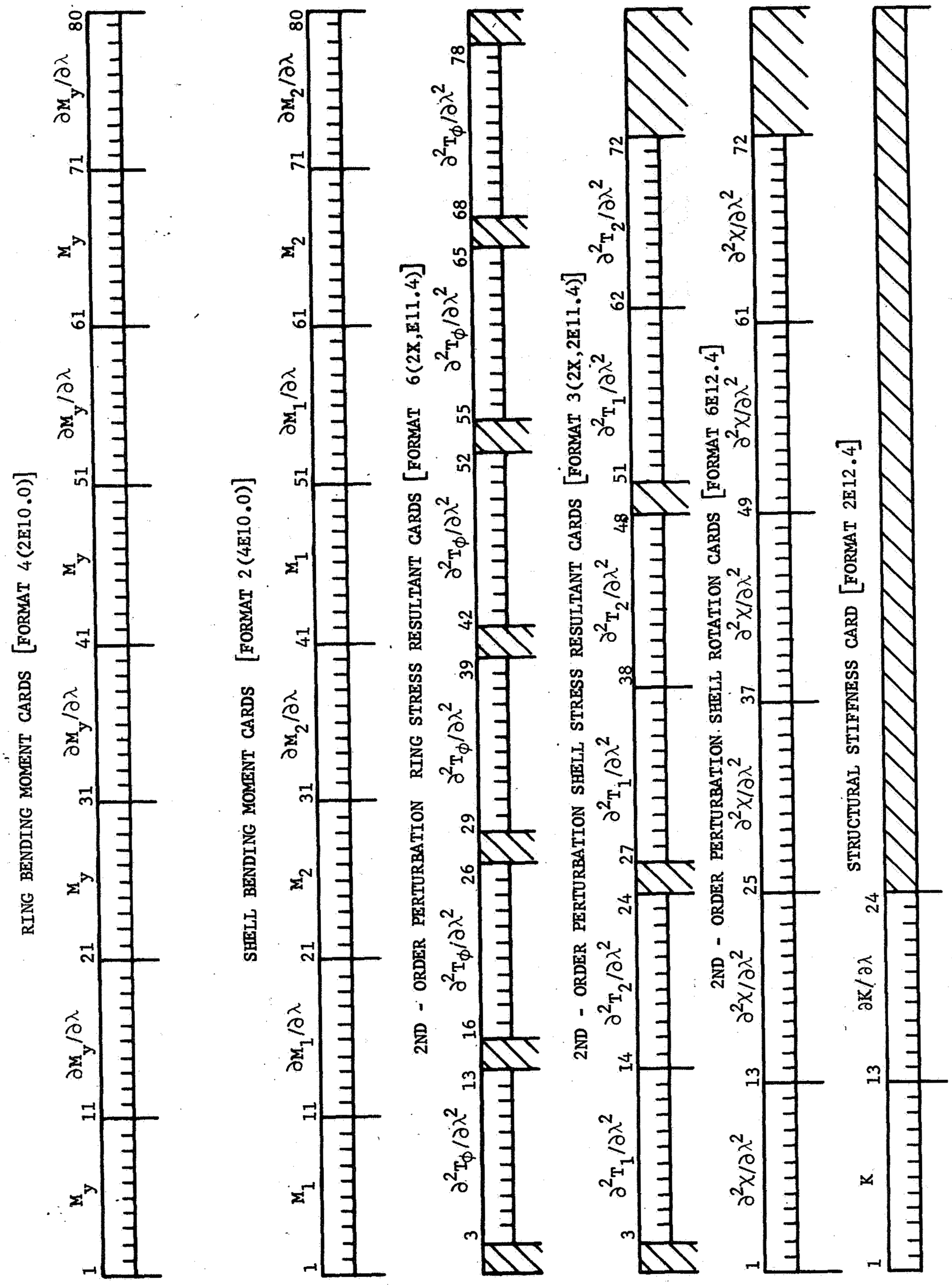


FIGURE 14. ADDITIONAL PREBUCKLING DATA
(This data is normally generated by SRA 200)

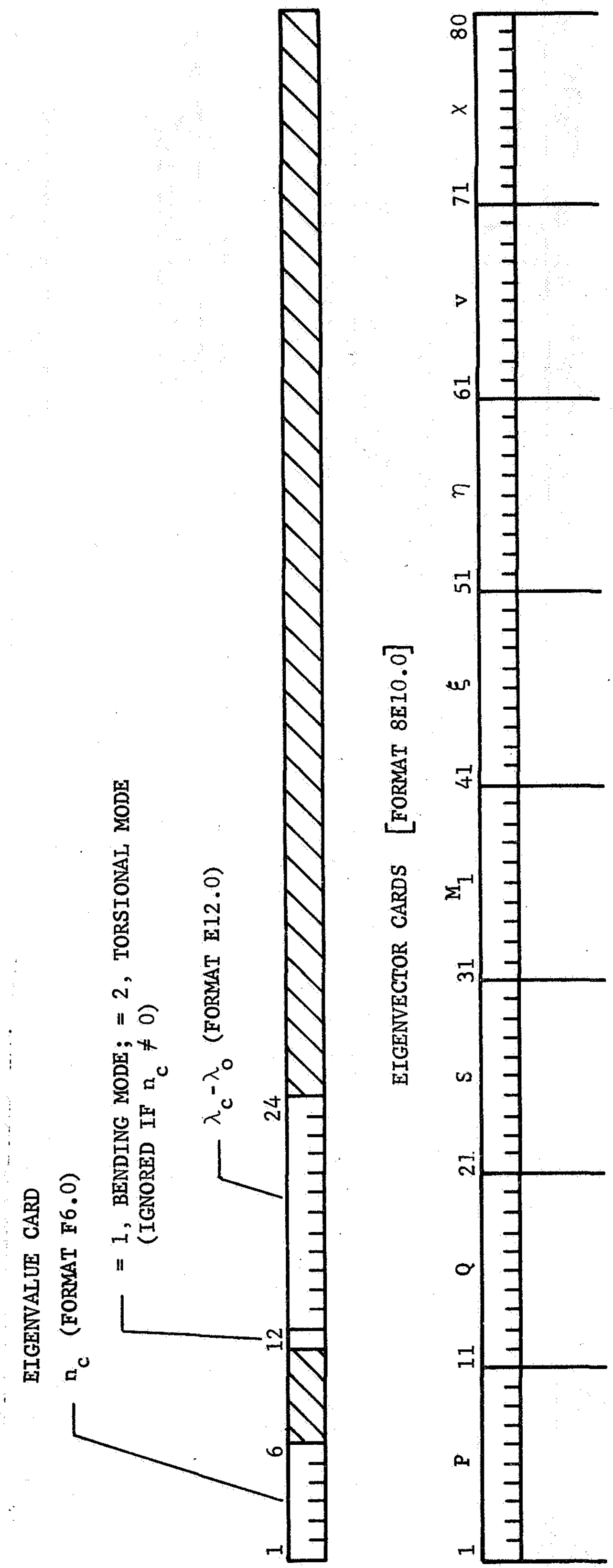


FIGURE 15. BUCKLING MODE DATA
(This data is normally generated by SRA 201)

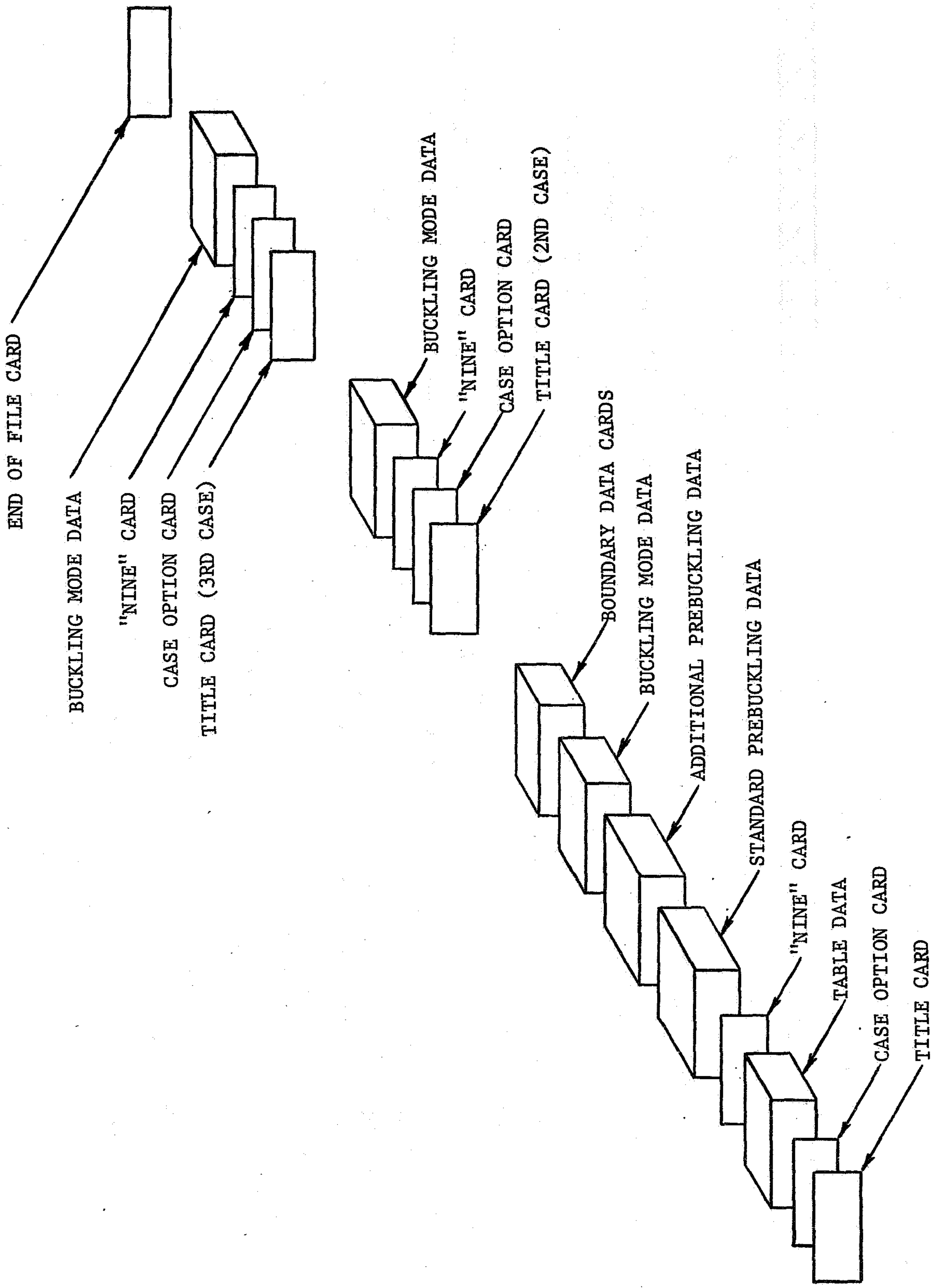
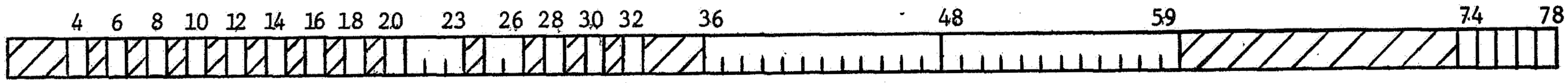


FIGURE 16. SRA 202 DECK SET-UP FOR EVALUATION OF THREE BUCKLING MODES BASED ON SAME PREBUCKLING STATE

SRA 300: VIBRATIONS ABOUT NONLINEAR STATES UNDER AXISYMMETRIC PRELOADS



COLUMN

4 = BLANK, NO CLOSED BRANCH; = 1, CLOSED BRANCH CASE

6 = BLANK, USE GEOMETRY FROM PREVIOUS CASE; = 1, INPUT NEW GEOMETRY

8 = BLANK, USE WALL PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW WALL PROPERTIES

10 = BLANK, USE FOUNDATION MODULI FROM PREVIOUS CASE; = 1, INPUT NEW FOUNDATION MODULI

12 = BLANK, USE STRINGER PROPERTIES FROM PREVIOUS CASE; = 1, INPUT NEW STRINGER PROPERTIES

14 = BLANK, USE MASS DENSITIES FROM PREVIOUS CASE; = 1, INPUT NEW MASS DENSITIES

16 = BLANK, USE PRESSURE FIELD FROM PREVIOUS CASE; = 1, INPUT NEW PRESSURE FIELD

18 = BLANK, USE INITIAL STATE FROM PREVIOUS CASE; = 1, INPUT NEW INITIAL STATE; = 2, NULL INITIAL STATE

20 = BLANK, USE ALL BOUNDARY DATA FROM PREVIOUS CASE; = 1, INPUT BOUNDARY DATA ACCORDING TO COLUMN 5 OF TABLE 1

21-23 = HARMONIC NUMBER - n (MUST BE RIGHT ADJUSTED)

25-26 = NUMBER OF MODES DESIRED (MUST BE RIGHT ADJUSTED)

28 = BLANK, BENDING MODES; = 1, TORSION MODES (APPLIES ONLY IF n = 0)

30 = BLANK, NO RIGID BODY MODES; = 1, TRANSLATIONAL RIGID BODY MODE; = 2, ROTATIONAL RIGID BODY MODE; = 3, TRANS. AND ROTATIONAL RIGID BODY MODE (APPLIES ONLY IF n = 0 OR 1 AND μ_s = 0)

32 = CONVERGENCE INDEX (NUMBER OF CONVERGED DIGITS OF EIGENVALUE), DEFAULT = 4

36-47 = EIGENVALUE SHIFT, μ_s (E12.4)

48-59 = RELATIVE ERROR TOLERANCE (E12.4), DEFAULT = 10^{-3}

74 = 1, PUNCH u, v, w MODAL DISPLACEMENTS

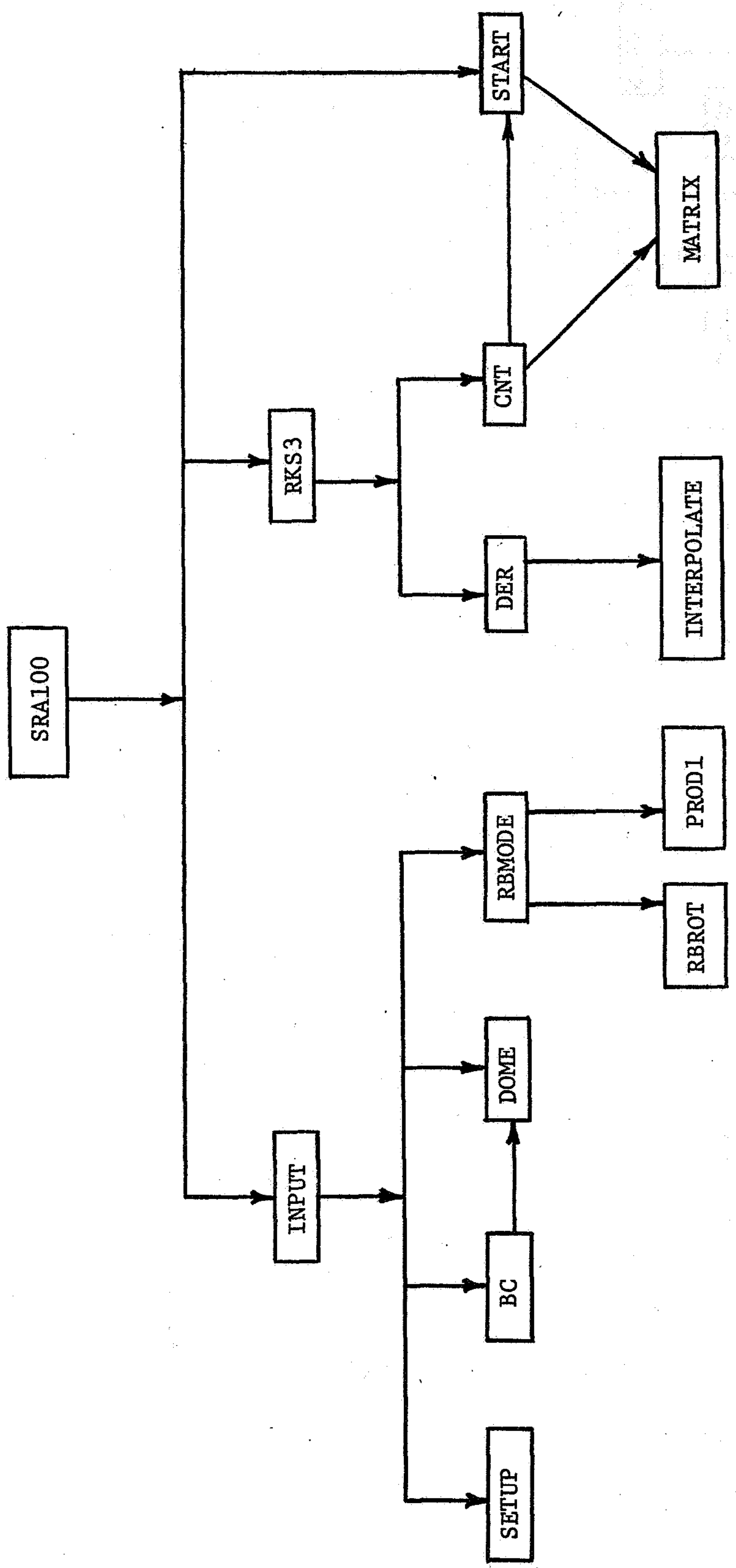
75 = 1, SUPPRESS AUTOMATIC EIGENVALUE SHIFTING

76 = BLANK, SHIFT TO ESTIMATE OF NEXT HIGHER EIGENVALUE BEFORE ITERATION FOR 7TH OR HIGHER MODES; = 1, SHIFT TO LAST EIGENVALUE OBTAINED BEFORE ITERATION FOR 7TH OR HIGHER MODES

77 = 1, SUPPRESS USE OF MODE SHAPE FROM PREVIOUS CASE AS INITIAL APPROXIMATION

FIGURE 17. CASE OPTION CARD FOR SRA 300

4 of 4



Note: MATRIX consists of the subroutines MINV, MPRD, MADD, MSUB, MCPY

INTERPOLATE consists of the subroutines SLOPE, SLOPE1, SLOPE2

FIGURE 18. HIERARCHY OF SUBPROGRAMS OF SRA 100

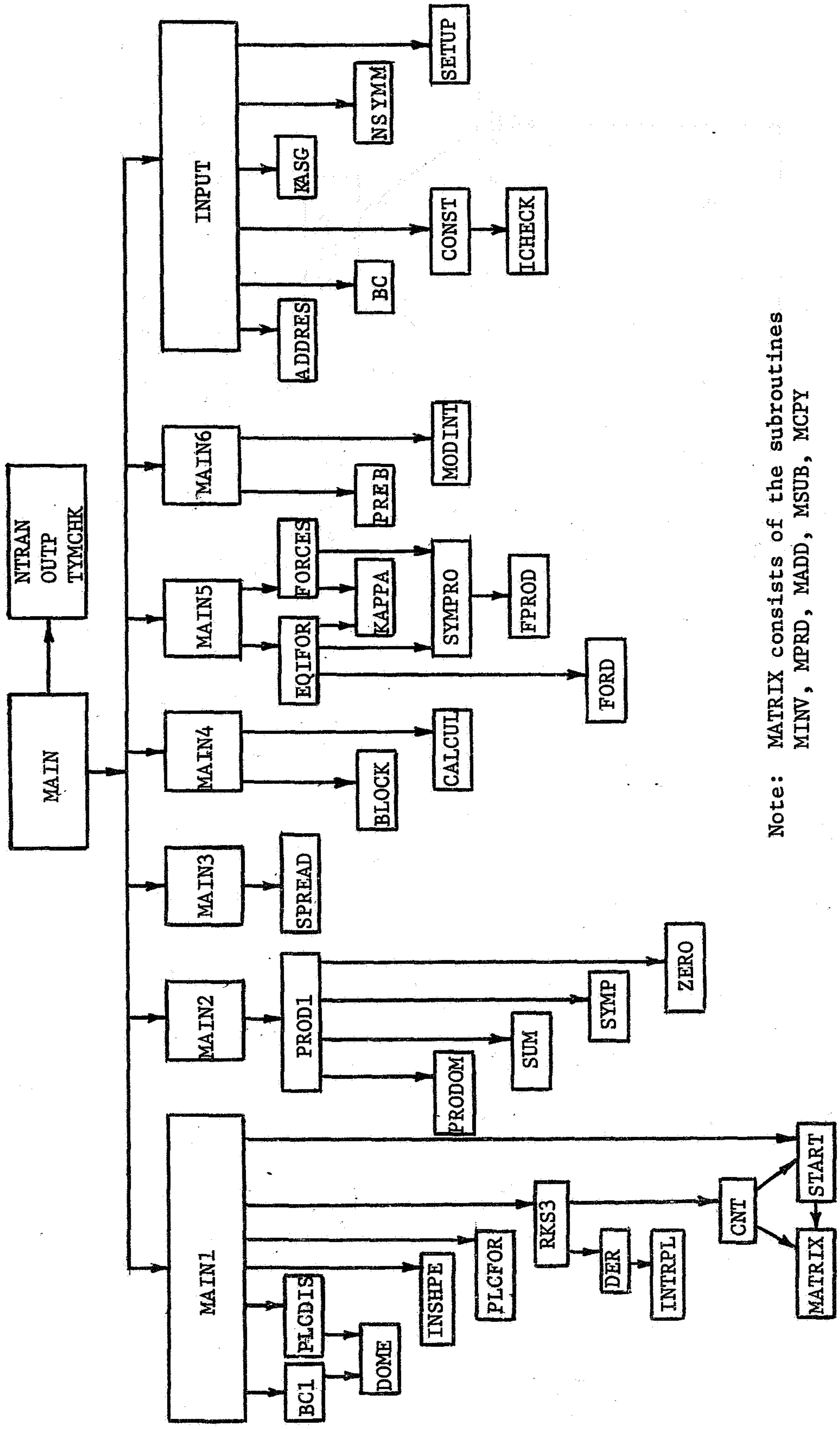
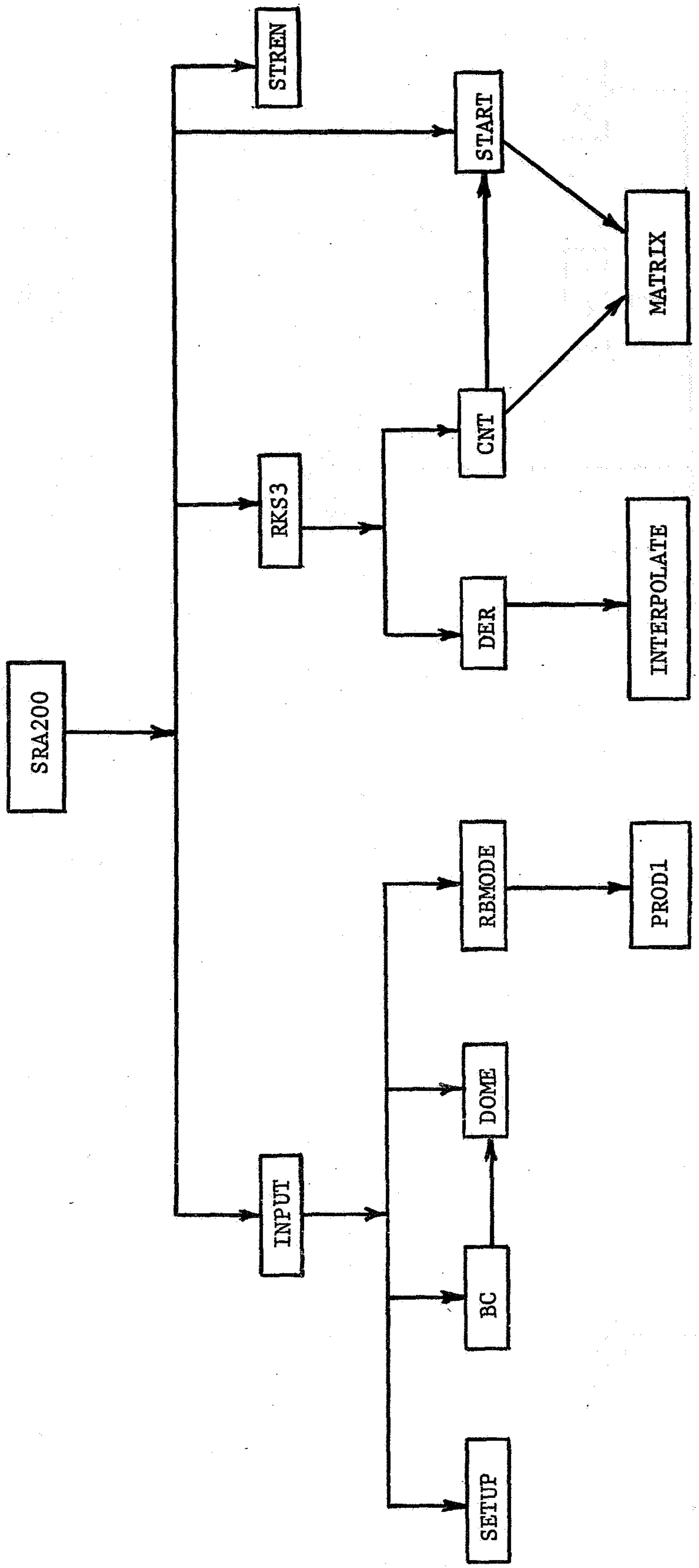


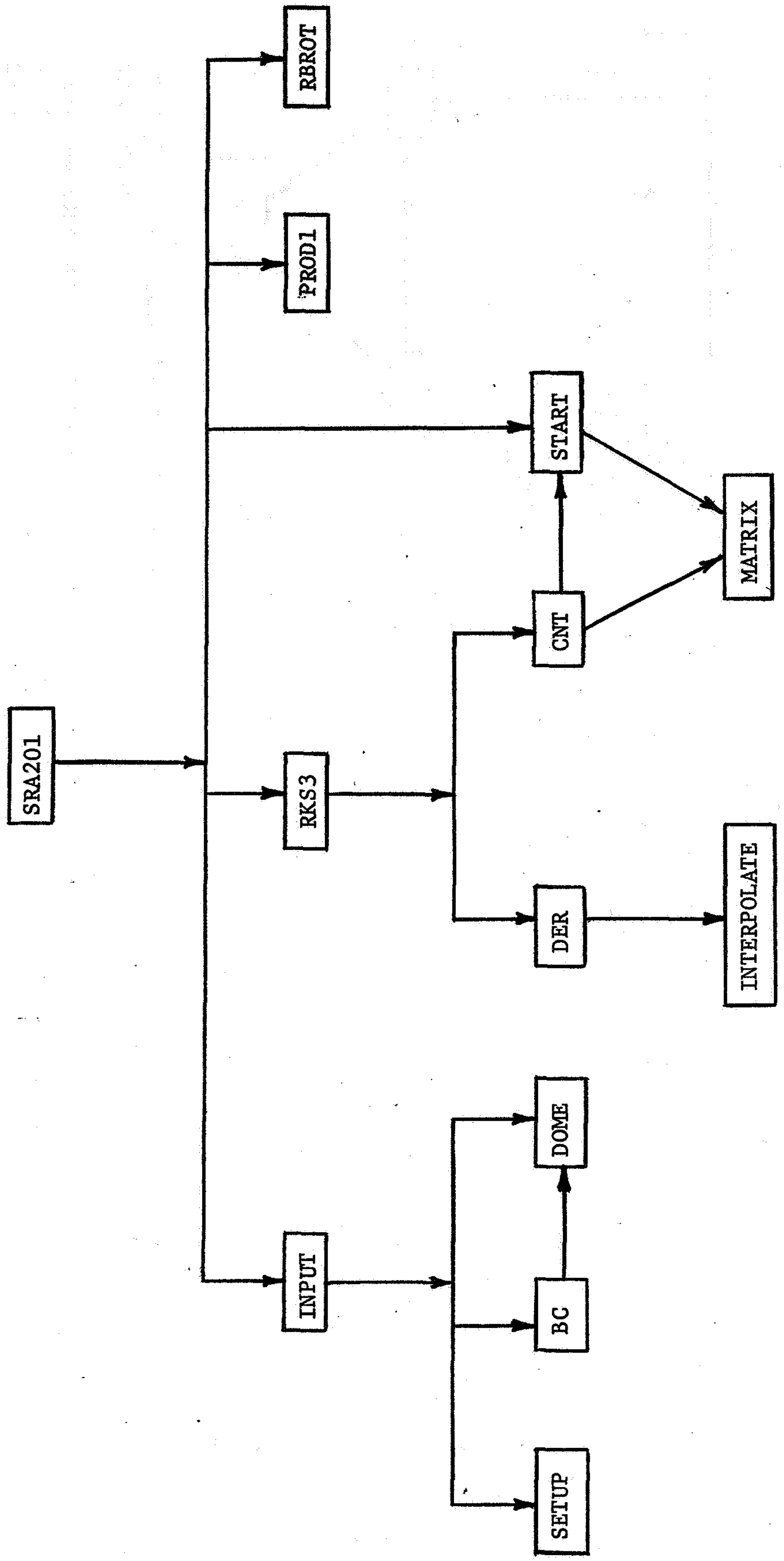
FIGURE 19. HIERARCHY OF SUBPROGRAMS OF SRA 101



Note: MATRIX consists of the subroutines MINV, MPRD, MADD, MSUB, MCPY

INTERPOLATE consists of the subroutines SLOPE, SLOPE1, SLOPE3

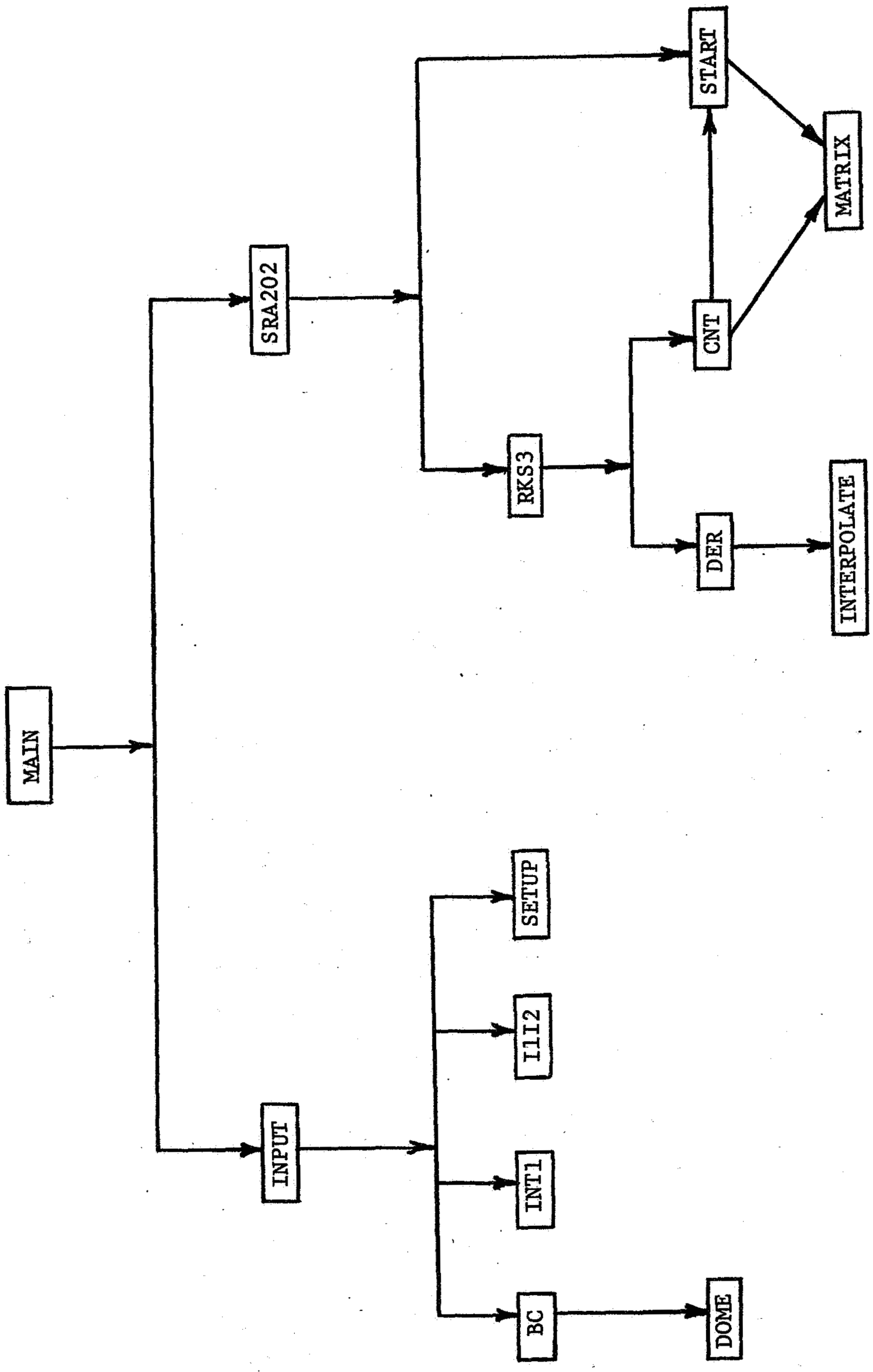
FIGURE 20. HIERARCHY OF SUBPROGRAMS OF SRA 200



Note: MATRIX consists of the subroutines MINV, MPRD, MADD,
MSUB, MCPY

INTERPOLATE consists of the subroutines SLOPE, SLOPE1
SLOPE2, SLOPE3

FIGURE 21. HIERARCHY OF SUBPROGRAMS OF SRA 201



Note: MATRIX consists of the subroutines MINV, MPRD, MADD, MSUB, MCPY

INTERPOLATE consists of the subroutines SLOPE, SLOPE1, SLOPE3

FIGURE 22. HIERARCHY OF SUBPROGRAMS OF SRA 202

"The aeronautical and space activities of the United States shall be conducted so as to contribute . . . to the expansion of human knowledge of phenomena in the atmosphere and space. The Administration shall provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."

—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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