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Analysis and Design of Ring Type Space Trusses

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ABSTRACT

Analysis and Design of Ring Type Space Trusses

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To provide long spans for commercial, industrial or institutional buildings the ring truss structural system has been introduced. The ring truss is a versatile structural system allowing for many different geometric configurations. In order to analyze the ring truss a structural analysis program has been developed which calculates all the member forces, and joint displacements. The RINGTRUSS program requires less than one percent the amount of input data than that required by general purpose structural analysis programs.

An investigation of the effects that the various geometric parameters have on the economy of the ring truss was performed. The geometric parameters which change the span of the truss, such as the vertical angles ALPHAT and ALPHAC or the number of rings, have a pronounced effect on

the economy of the truss; whereas those parameters which do not affect the span of the truss, such as the number of perimeter columns, have very little effect.

A ring truss was designed as a roof of 122 m span and compared to an existing radial roof truss used in the Northlands Coliseum in Edmonton Alberta. The ring truss required 41.5 percent less material than the radial truss. The ring truss is easy and fast to erect, and this further enhances the economy of the system.

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As well I would like to thank Dr. T. Stathopoulos for his general guidance and interest in my study.

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NOTATION

E	The modulus of elasticity of the material used for the structural members
LU	Logical unit
$\{Q\}$	Vector of nodal loads
$\{Q_b\}$ $\{Q_i\}$	Nodal load subvectors corresponding to the boundary and interior nodes respectively
$\{Q^r_{ob}\}$ $\{(Q_{oi}-Q_i)^r\}$	Statically condensed load subvectors
$\{D\}$	Displacement vector
$\{D_b\}$ $\{D_i\}$	Displacement subvectors corresponding to the boundary and interior nodes respectively
$[S]$	Structure stiffness matrix
$[S_{bb}]$ $[S_{ib}]$ $[S_{bi}]$ $[S_{ii}]$	Stiffness submatrices corresponding to the boundary and interior nodes respectively
$[S^r_{bb}]$ $[S^r_{ib}]$ $[S^r_{ii}]$	Statically condensed stiffness submatrices which correspond to $[S_{bb}]$ $[S_{ib}]$ and $[S_{ii}]$
$\vec{\Delta}$	Vector of member end displacements
δ_k	Axial deformation of member k
F_k	Force in member k
SMC	Specific material consumption
L_s	Live load due to snow
RHS	Round hollow structural section
NRINGS	The number of rings in the ring truss
NCOL	Number of perimeter columns supporting the ring truss

CHAPTER 1

DESCRIPTION OF THE RING TRUSS

1.1 INTRODUCTION

There is a growing need for large span roof structures. These large spans are desirable for industrial, commercial and institutional buildings, where having large spans of floor space unencumbered by columns is either desirable or necessary. With the trend towards enclosing sports facilities the need for efficient large span structures has increased. The large spans are required because the playing field as well as the spectator's view must not be impeded by vertical support structures.

The spans required for commercial, industrial, or institutional buildings are generally less than two-hundred feet, although in some special cases the span could be greater. For sports facilities the spans tend to be much greater. For example, Montreal's Olympic Stadium, which is elliptical in plan, has a clear span of approximately 750 feet along its major axis and 650 feet along its minor axis. The clear span of the Edmonton Coliseum in Edmonton, which is circular in plan, is four-hundred feet.

Conceivably the clear spans required for large capacity stadiums could exceed one-thousand feet.

There are many different types of large span structural systems, which have been developed in the past. The Houston Astrodome, which was built in the mid-sixties, uses a lamella type of roof structure. Other structural systems range from space trusses to air supported membranes. Air supported membrane roofs have been used for several sports facilities across North America. Air supported membrane roofs have been built at the University of Syracuse in Syracuse, New York; at Dalhousie University in Halifax, Nova Scotia; and more recently for B.C. Place in Vancouver, British Columbia to name only a few. The Olympic Stadium in Montreal Quebec is an exotic structure consisting of independent cantilevered frames arranged to enclose an elliptic area, and was to be built with a retractable membrane to cover the central roof opening. It is an example of a very unique method to enclose a space. Shell type structures can also be used to provide large span roofs. In Calgary the Olympic Coliseum was built of post tensioned concrete in the form of a hyperbolic paraboloid. This saddle shape attainable with the post tensioned concrete was a deciding factor in the choice of this structural system. In addition to the above rather exotic structural systems there are the more traditional space trusses.

There are different types of space trusses which could be used to provide long spans. Orthogonal grid space trusses have been used for industrial, commercial, and institutional buildings. Radial type trusses have been used for the Edmonton Coliseum. A new type of space structure is the ring type truss. The ring truss has not yet been built, but was introduced by Z. A. Zielinski and was considered as an alternative for the Calgary Olympic Coliseum.

1.2 GEOMETRY OF THE RING TYPE SPACE TRUSS

The ring type space truss is made up of four types of members: rings; diagonals; stiffeners; and in-plane bracing members. The truss is supported around its perimeter by columns or walls.

The rings are formed by placing concentric polygons one inside the other, see Fig. 1.2.1. Adjacent rings alternate between the upper and lower surfaces of the truss, see Fig. 1.2.2. Adjacent rings are interconnected by diagonals as shown in Figs. 1.2.2 and 1.2.3, and stiffeners, see Figs. 1.2.2 and 1.2.4. Two in-plane bracing trusses are formed with bracing members, one in the upper plane and one in the lower plane of the roof, as shown in Figs. 1.2.5 and 1.2.6. The ring type space truss can be

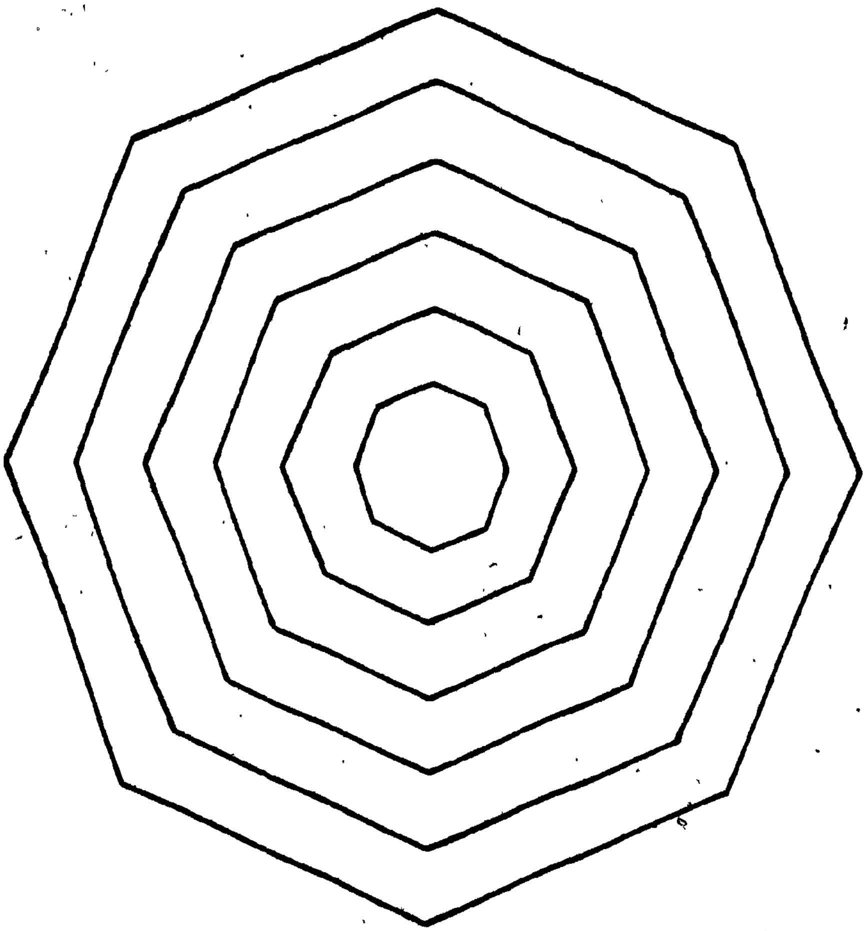


FIGURE 1.2.1 PLAN VIEW OF A RING TYPE SPACE TRUSS.
THE TRUSS HAS SIX EQUALLY SPACED
REGULAR OCTOGONAL RINGS.
NOTE THAT ONLY THE RINGS ARE SHOWN.

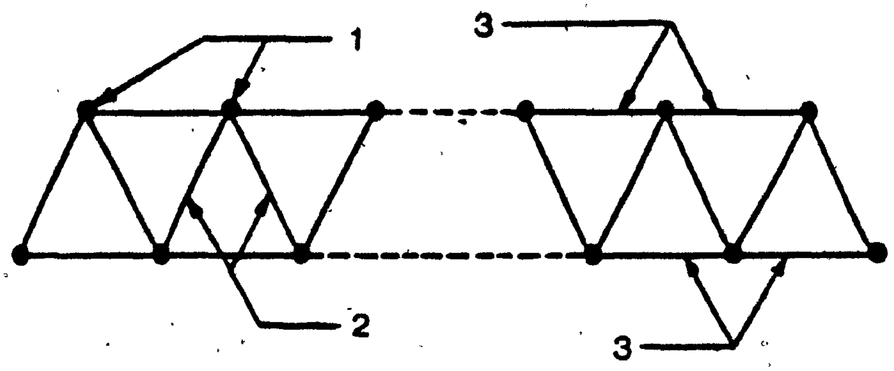


FIGURE 1.2.2 SECTION THROUGH A TYPICAL RING TRUSS. THE TRUSS HAS SIX EQUALLY SPACED RINGS.
1- RINGS
2- DIAGONALS
3- STIFFENERS

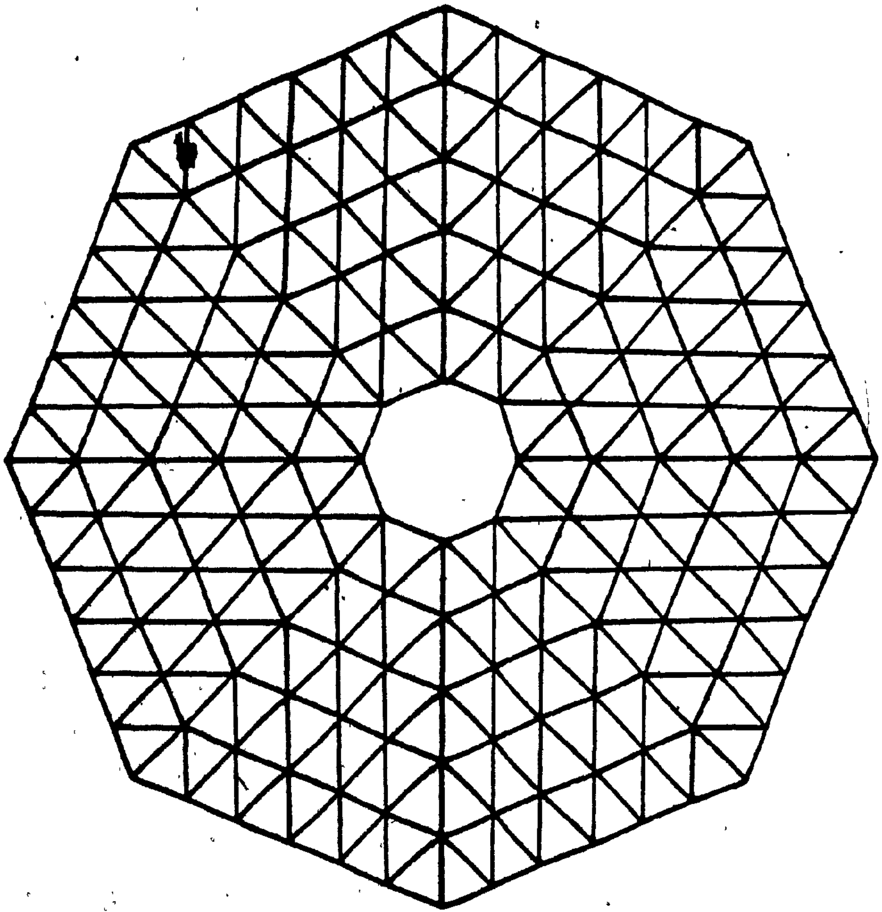


FIGURE 1.2.3 PLAN VIEW OF A RING TRUSS, THAT HAS SIX EQUALLY SPACED REGULAR OCTOGONAL RINGS. THE DIAGONALS AS WELL AS THE RINGS ARE SHOWN.

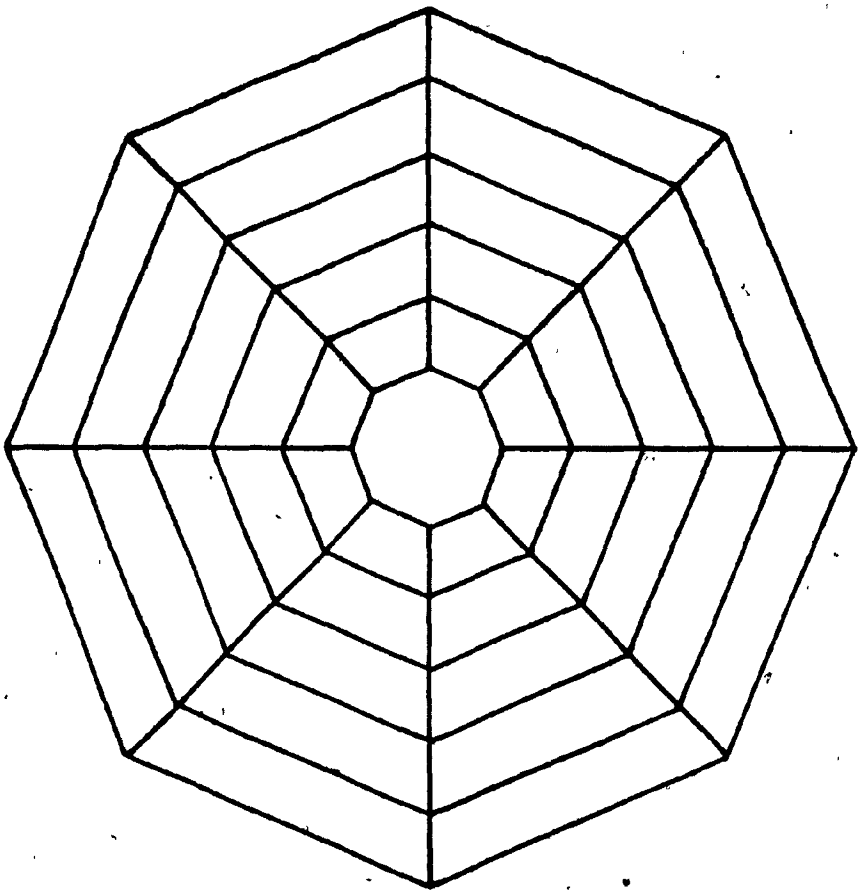


FIGURE 1.2.4 PLAN VIEW OF A TYPICAL RING TRUSS, THAT HAS SIX EQUALLY SPACED REGULAR OCTOGONAL RINGS. THE STIFFENERS ARE SHOWN IN ADDITION TO THE RINGS.

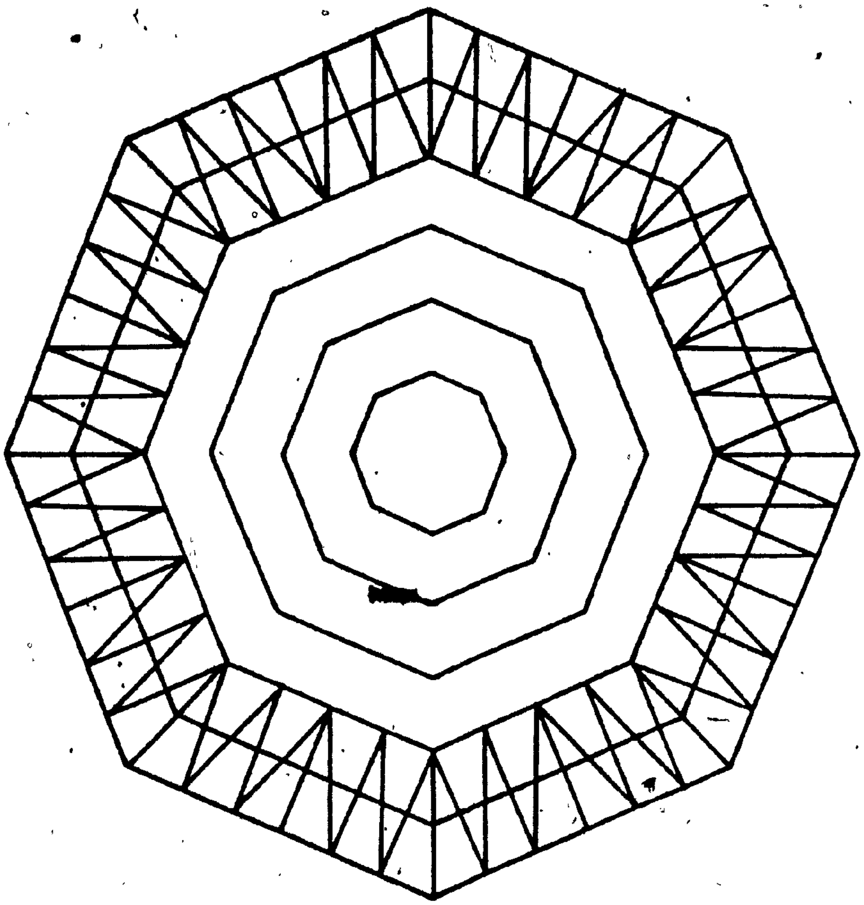


FIGURE 1.2.5 PLAN VIEW OF A TYPICAL RING TRUSS. THE TRUSS HAS SIX EQUALLY SPACED REGULAR OCTOGONAL RINGS. THE OUTERMOST PERIMETER BRACING TRUSS IS SHOWN AS WELL AS THE RINGS.

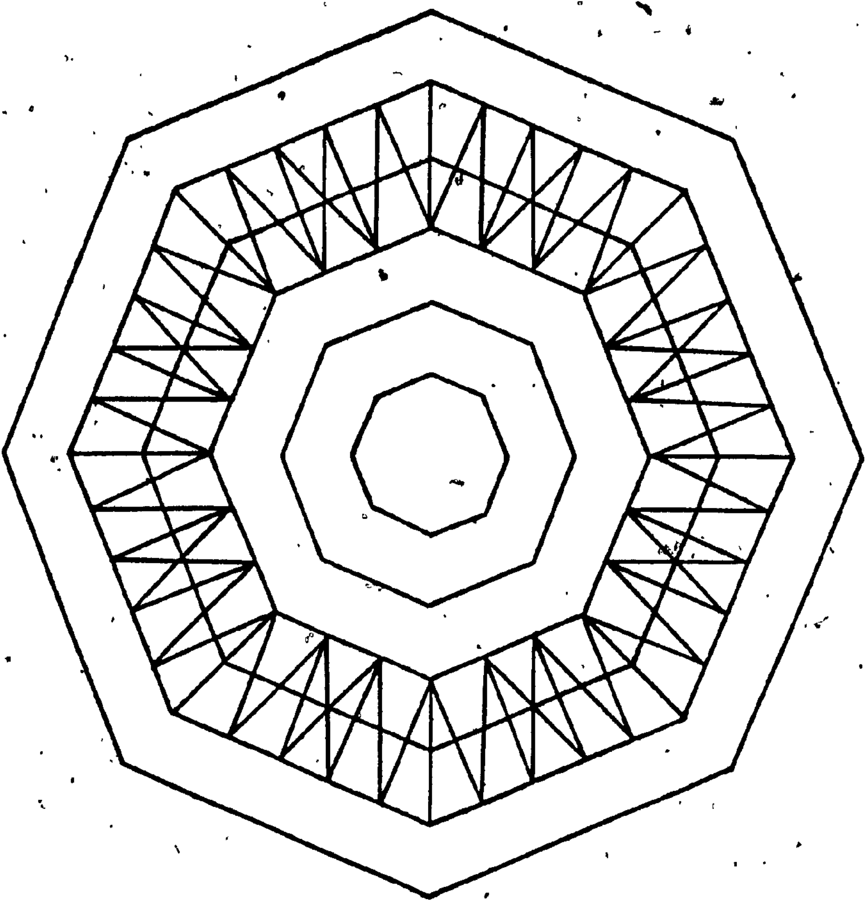


FIGURE 1.2.6 PLAN VIEW OF AN OCTOGONAL RING TRUSS, WITH SIX EQUALLY SPACED RINGS. THE INNERMOST PERIMETER BRACING TRUSS IS SHOWN IN ADDITION TO THE RINGS.

used to enclose spaces with plans of any convex polygonal shape. Thus, as shown in Fig. 1.2.7, the plan can be a square, or a rectangle as in Fig. 1.2.8. The area can be any regular n-gon, in Fig. 1.2.9 a regular dodecagon is shown, taken to an extreme the regular n-gon becomes a circle. In Fig. 1.2.10 an elongated dodecagon is shown, taken to an extreme an elongated n-gon becomes an ellipse. The number of sides of the polygon is dictated by the shape of the space to be enclosed, which in turn is dictated by the function of the space. In many cases the area to be enclosed would have one or two axes of symmetry.

The profile of the ring type space truss is also variable. Two profile curves are required to define any given profile for any section of the truss. One function describes the upper surface and the other function describes the lower surface of the truss. The two profile curves need not be from the same family of functions. If the profile curves are members of the same family of functions then the depth of the truss is constant, as shown in Figs. 1.2.2, 1.2.11, and 1.2.12. But if the profile curves are from different families of functions then the depth of the truss will vary, as shown in Figs. 1.2.13, and 1.2.14. Also, the profile can be piece-wise continuous, that is, the function used to describe either surface can be made up of several piece-wise continuous functions.

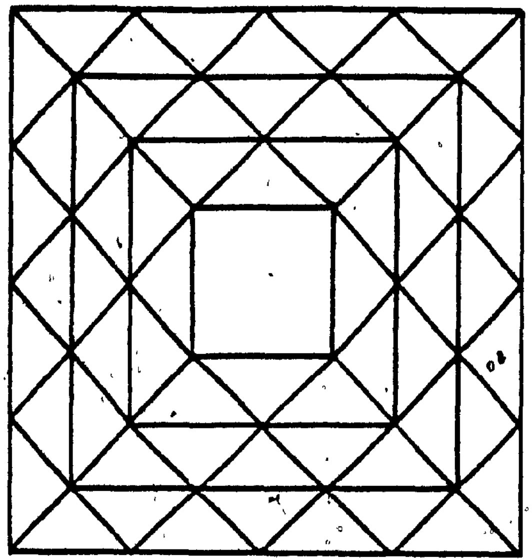


FIGURE 1.2.7 PLAN VIEW OF A RING TRUSS. THE TRUSS HAS FOUR EQUALLY SPACED SQUARE RINGS. NOTE THAT THE BRACING TRUSSES ARE NOT SHOWN.

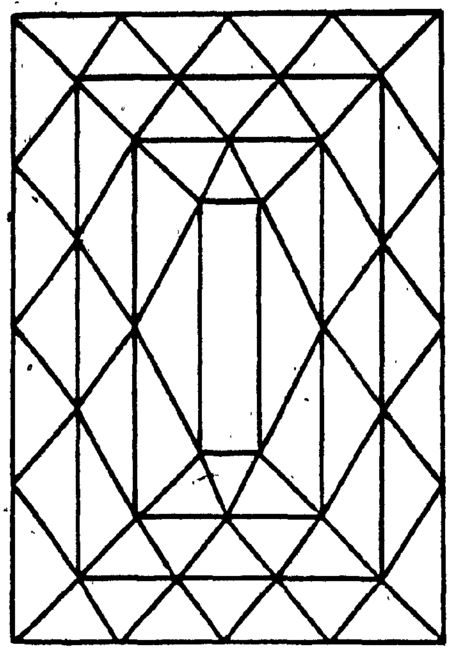


FIGURE 1.2.8 PLAN VIEW OF A RECTANGULAR RING TRUSS. THE TRUSS HAS FOUR EQUALLY SPACED RINGS. THE BRACING TRUSSES HAVE BEEN OMITTED.

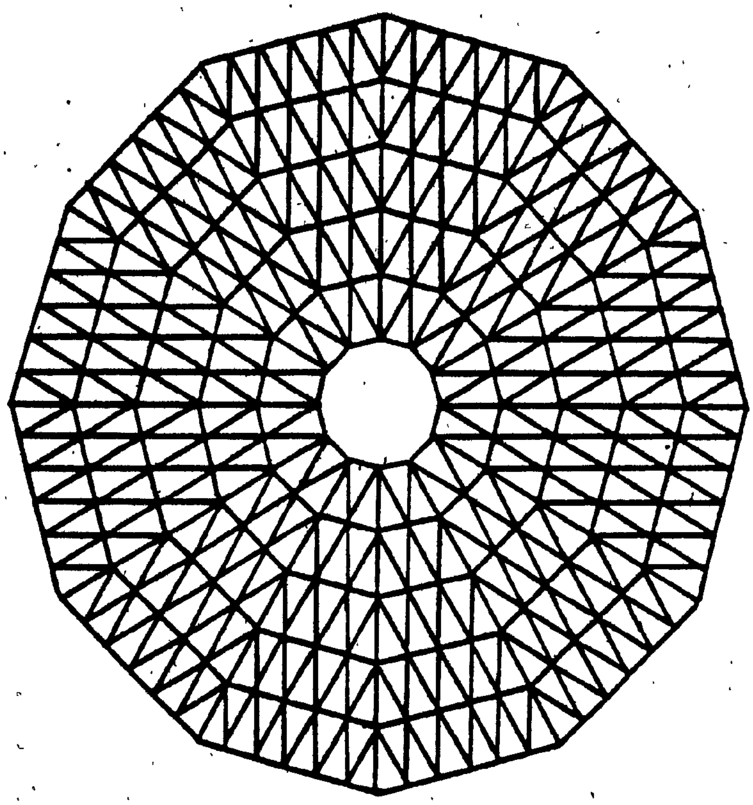


FIGURE 1.2.9 PLAN VIEW OF A REGULAR DODECAGONAL RING TRUSS WITH SIX EQUALLY SPACED RINGS. THE BRACING TRUSSES HAVE NOT BEEN SHOWN.

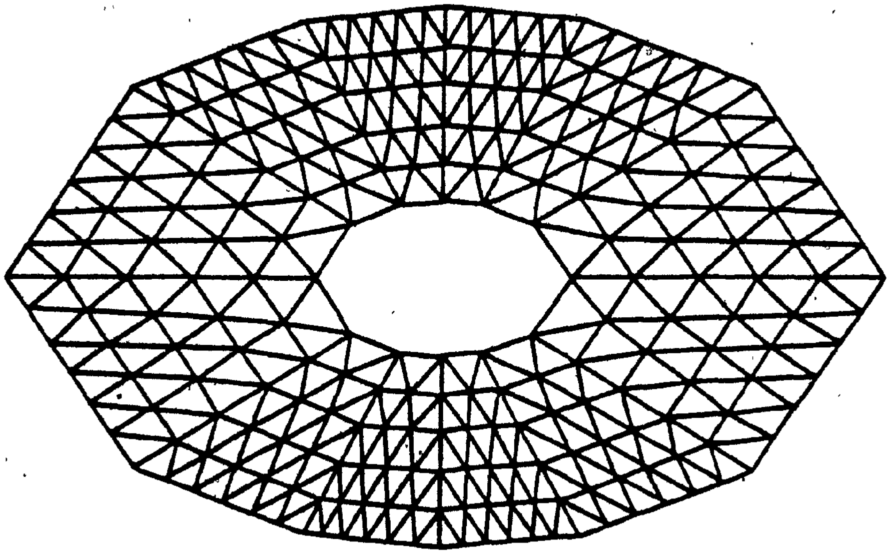


FIGURE 1.2.10 PLAN VIEW OF AN ELONGATED DODECAGONAL RING TRUSS WITH SIX EQUALLY SPACED RINGS. THE BRACING TRUSSES HAVE BEEN OMITTED.

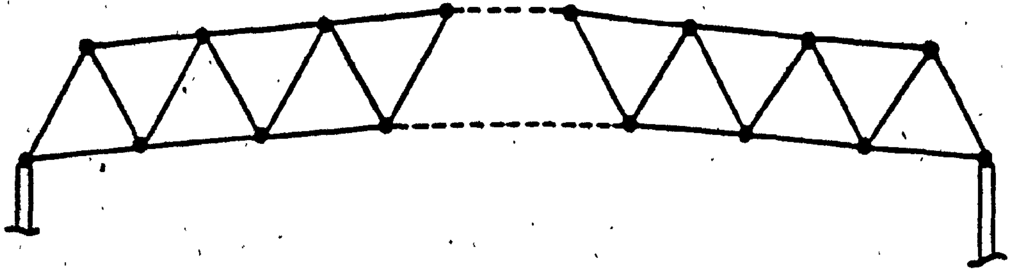


FIGURE 1.2.11 PROFILE OF A RING TRUSS WITH EIGHT EQUALLY SPACED RINGS. THE TRUSS IS SUPPORTED AT ITS LOWER SURFACE, AND SLOPES UPWARDS FROM THE COLUMNS TO THE CENTER. THE DEPTH OF THE TRUSS IS CONSTANT.

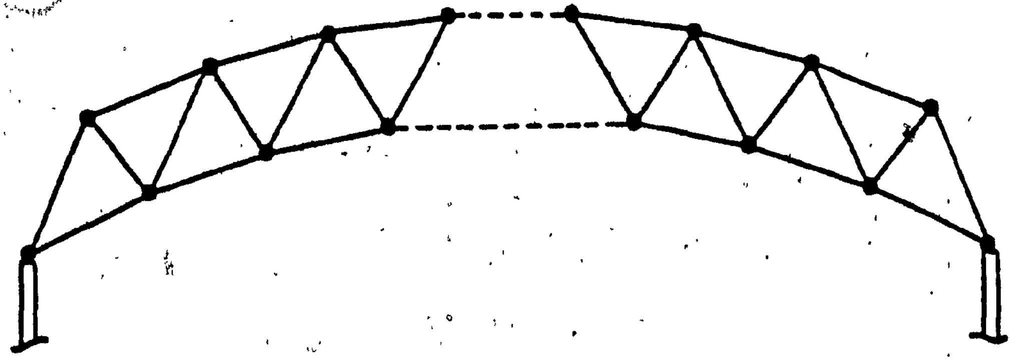


FIGURE 1.2.12 THE RING TRUSS PROFILE ARCHES UPWARDS FROM THE COLUMNS. THE TRUSS IS SUPPORTED AT ITS LOWER SURFACE AND HAS A CONSTANT DEPTH.

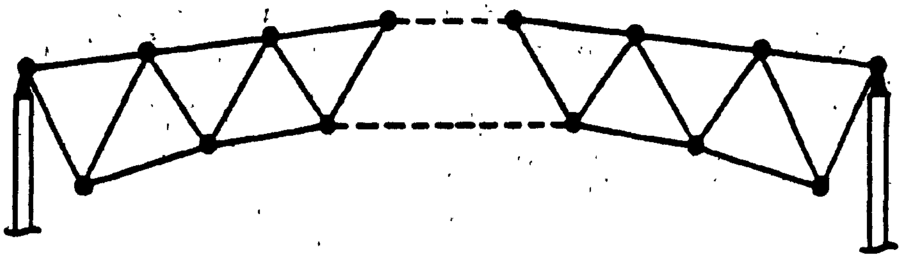


FIGURE 1.2.13 THE RING TRUSS PROFILE RISES ABOVE THE COLUMN HEIGHT. THE TRUSS IS SUPPORTED AT ITS UPPER SURFACE, AND HAS VARYING DEPTH.

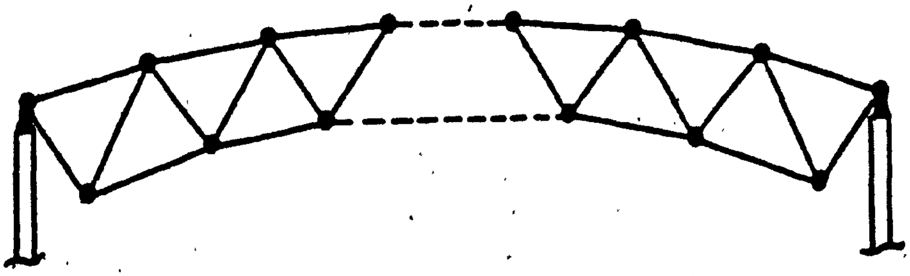


FIGURE 1.2.14 PROFILE OF A RING TRUSS WHICH IS SUPPORTED AT ITS UPPER SURFACE. THE TRUSS HAS VARYING DEPTH AND RISES ABOVE THE COLUMN HEIGHT.

The profile of the truss is dictated by the type of space being enclosed. For example the truss profile could rise above the column height, see Figs. 1.2.11 to 1.2.14. This would be useful when the truss is used as the roof structure of sports facilities which require a lot of height above the playing field, such as football or baseball fields. The truss profile could also drop below the column height as in Figs. 1.2.15 and 1.2.16. This would be appropriate when the truss is used as the roof of a sports facility that requires a lot of room for the spectators, but does not require great height above the playing surface, for example a hockey rink. The truss profile could also be a horizontal straight line as in Figs. 1.2.2 and 1.2.17. This configuration could be used when the truss is used as the floor of a large institutional, commercial or industrial building, or as the roof of a building which requires a more or less constant roof height.

In most cases the profile functions would be monotonic, although it is not required that the functions be monotonic. In all the above examples the profile functions were monotonic. Non-monotonic functions would most likely find their only applications where the designer would want to achieve a particular visual effect with the truss profile.

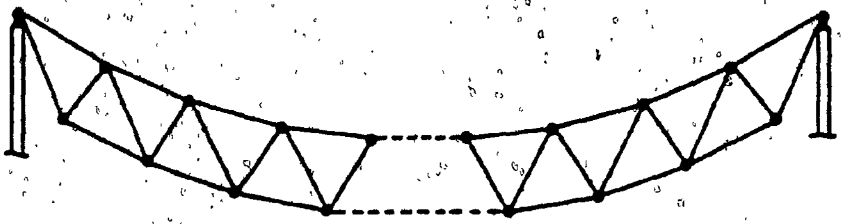


FIGURE 1.2.15 THE RING TRUSS SAGS BELOW THE COLUMN HEIGHT. THE TRUSS IS SUPPORTED AT ITS UPPER SURFACE AND HAS CONSTANT DEPTH.

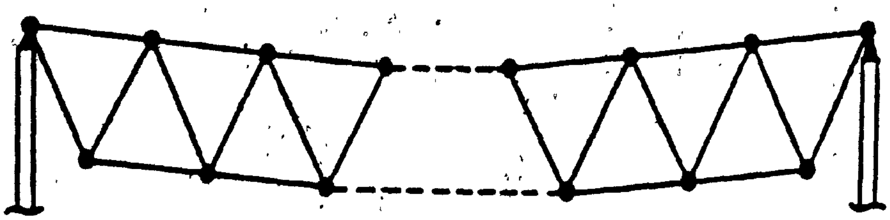


FIGURE 1.2.16 THE RING TRUSS PROFILE DROPS BELOW THE COLUMN HEIGHT. THE TRUSS HAS CONSTANT DEPTH AND IS SUPPORTED AT ITS UPPER SURFACE.

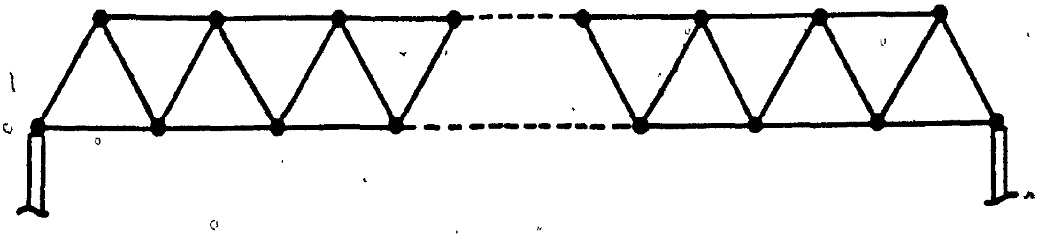


FIGURE 1.2.17 THE RING TRUSS IS SUPPORTED AT ITS LOWER SURFACE, THE TRUSS HAS CONSTANT DEPTH AND IS FLAT.

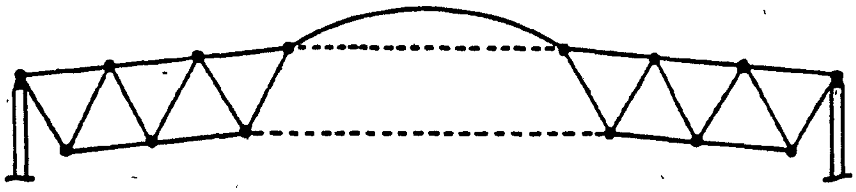


FIGURE 1.2.18 THE RING TRUSS SHOWN SUPPORTS A SPHERICAL DOME OVER ITS CENTRAL PORTION.

The truss profile need not be the same along every column line. If different profiles are used along the various column lines the surfaces of the truss could be doubly curved depending on the choice of the profile curves. But in the vast majority of cases the truss profile would be the same along every column line and so the surfaces of the truss would be surfaces of revolution. The surface of revolution being generated by rotating the profile curve about the vertical axis through the center of the truss. The surfaces of the truss structure are piece-wise smooth, that is, the surfaces are approximated by plane areas.

The ring-type truss need not be closed in the center. That is, the roof or floor supported by the truss could have a large hole in its center. This hole could allow for the passage of elevator shafts, ventilation ducts, or other services, through the truss vertically. Or in the case of a roof the center could be left open or covered by a different type of structure, such as a flat plate or a dome, see Fig. 1.2.18.

1.3 DESCRIPTION OF THE STRUCTURAL SYSTEM

The ring type space truss is supported by either columns or walls around its perimeter. If columns are used as vertical supports then a column is placed at each vertex of the perimeter polygon. The columns all support the truss vertically, and in addition some or all of the columns supply lateral restraint, as shown in Fig. 1.3.1. At least two columns must supply lateral restraint for external equilibrium to be satisfied. The truss can be supported at its upper surface, as in Figs. 1.2.13 to 1.2.16, or at its lower surface, as in Figs. 1.2.2, 1.2.11, 1.2.12, and 1.2.17.

A simplified description of how the structure behaves is that under uniform vertical loading the rings of the truss are subjected to uniform pressure. This pressure gives rise to purely compression forces in the upper rings and tension forces in the lower rings, see Fig. 1.3.2. When the structure is subjected to non-uniform loads the radial stiffening trusses resist the moments due to antisymmetric loading. According to this force distribution scheme the forces in the rings decrease parabolically from a maximum at the perimeter to a minimum at the center. The forces in the diagonals decrease linearly from a maximum at the perimeter to a minimum at the center.

The ring type truss is formed by joining modules together. This is made possible because the truss can be divided into many repetitive elements. The use of repetitive elements saves on fabrication costs and erection

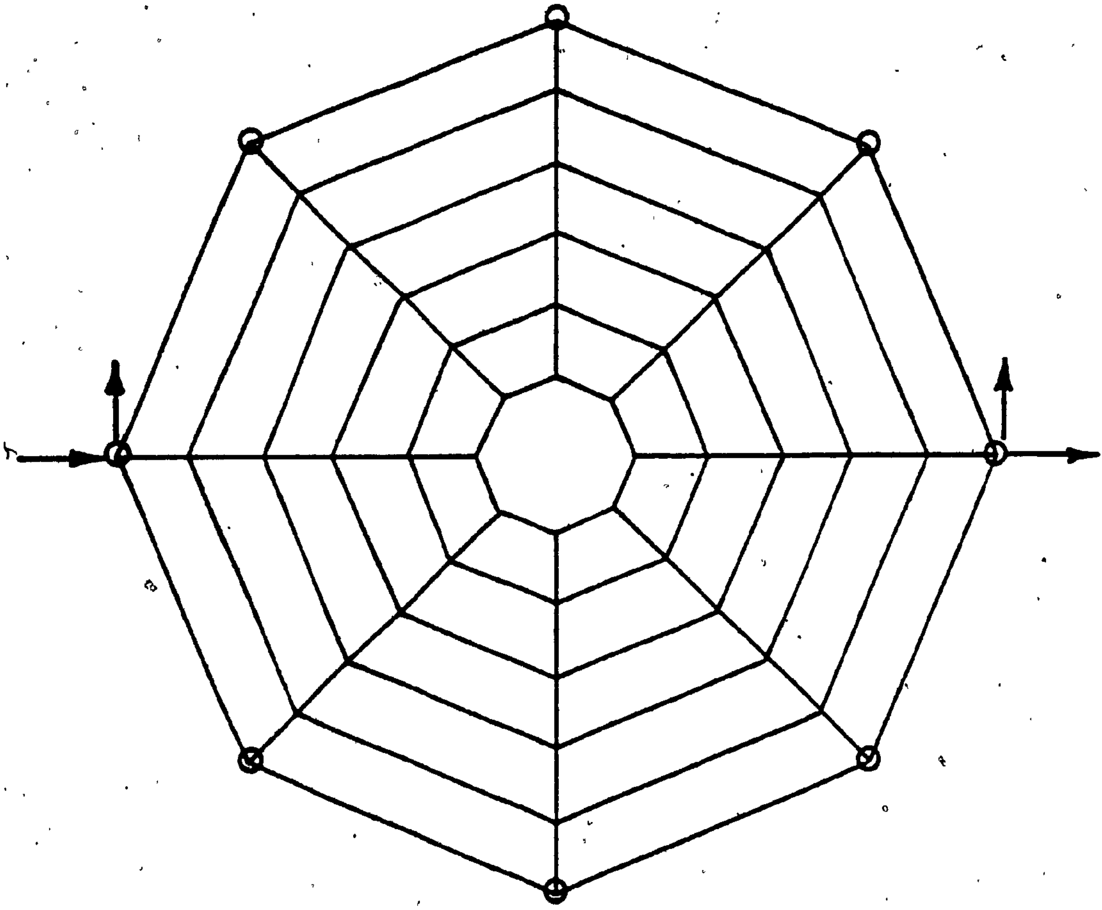


FIGURE 1.3.1 THE REACTIONS FOR A TYPICAL RING TRUSS ARE SHOWN.
○ - VERTICAL REACTION ONLY.
→ - LATERAL REACTIONS

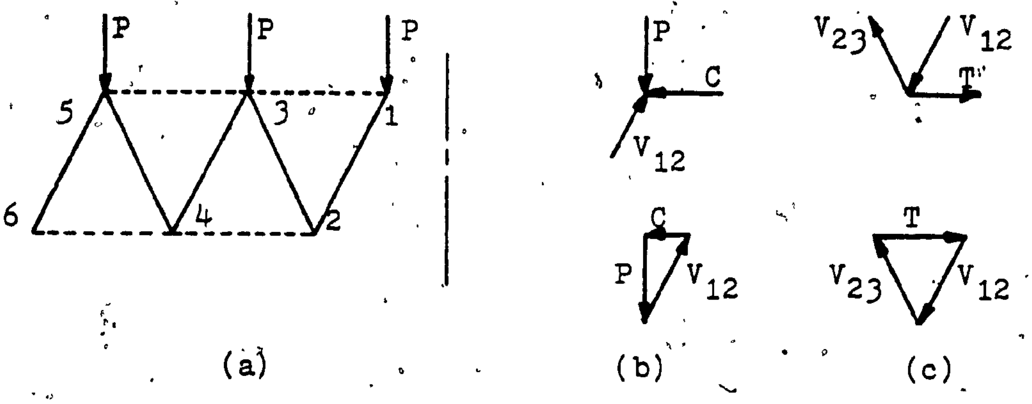


FIGURE 1.3.2 (a) A SECTION THROUGH A TYPICAL RING TRUSS SHOWING A SIMPLIFIED VIEW OF HOW THE FORCES ARE DISTRIBUTED WHEN THE TRUSS IS SUBJECTED TO UNIFORM DOWNWARD LOADING.

(b) AT NODE 1 THE LOAD P IS SPLIT INTO A COMPRESSIVE RING FORCE, C, AND A SHEAR FORCE V_{12} CARRIED BY THE DIAGONALS BETWEEN RINGS 1 AND 2.

(c) THE SHEAR V_{12} IS SPLIT INTO A TENSILE RING FORCE, T, AND A SHEAR FORCE V_{23} CARRIED BY THE DIAGONALS BETWEEN RINGS 2 AND 3.

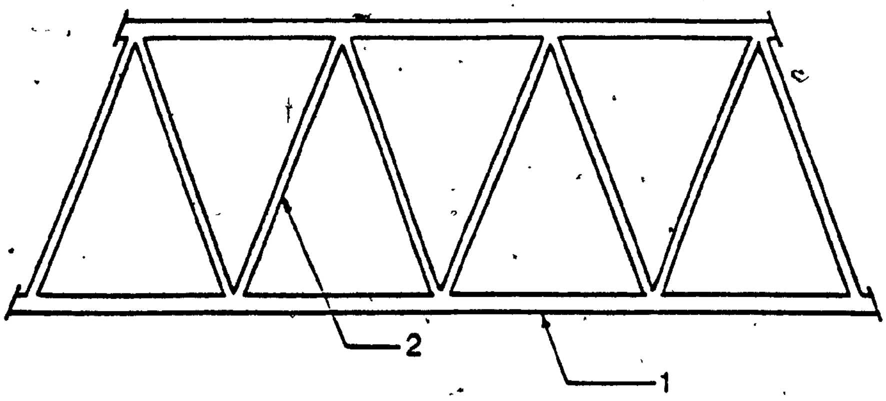


FIGURE 1.3.3 A TYPICAL RING TRUSS MODULE.
1- CHORD.
2- DIAGONAL.

costs. The modules used are plane trusses, see Fig. 1.3.3. The chords of the truss modules combine to form the rings of the space truss, and the diagonals of the modules combine to form the diagonals of the space truss. Each ring of the truss is formed with the chords of the modules from adjacent bands, see Figs. 1.3.4. and 1.3.5. Therefore all the rings, except the perimeter and innermost rings, consist of two chords from modules in adjacent bands. The i-th band is bounded by the i-th and (i+1)-th rings and includes the diagonals between the two rings. The chords can be juxtaposed either vertically or horizontally. If the chords are stacked vertically then some interference between the different members of the adjacent modules will exist when the modules are placed at certain angles, in Fig. 1.3.6 the modules are placed as steeply as they can be if interference between members is to be avoided. If the chords are placed side by side horizontally then there will not be any interference between adjacent modules, see Fig. 1.3.7, no matter how steeply the modules are placed. To ensure that the double chord rings will behave as single members the chords must be interconnected at all the nodal points, as shown in Fig. 1.3.8. The modules which are adjacent to each other in the same band are connected to each other at their ends to achieve continuity of each ring, as shown in Fig. 1.3.5.

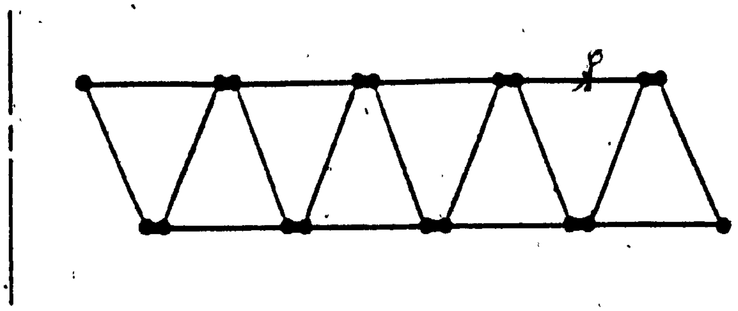


FIGURE 1.3.4 SECTION THROUGH A RING TRUSS. NOTE THAT EACH RING, EXCEPT THE PERIMETER AND INNERMOST RINGS, IS AN ASSEMBLY OF TWO CHORDS, ONE FROM EACH MODULE IN THE BANDS ADJACENT TO THE RINGS.

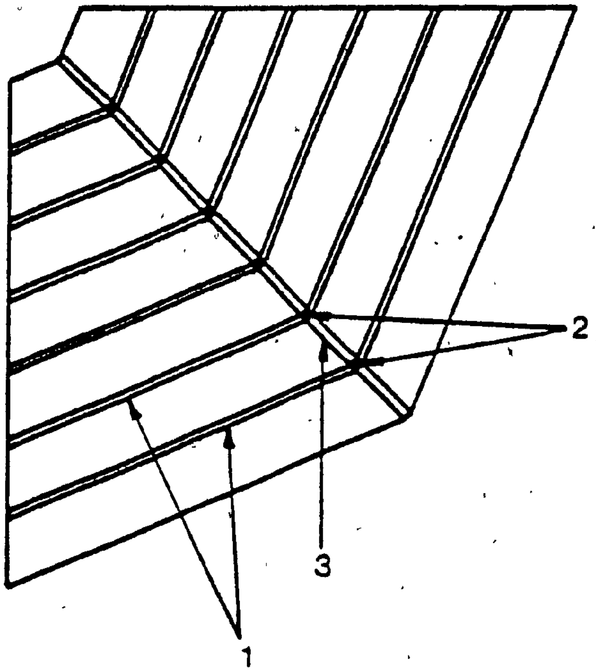


FIGURE 1.3.5 PARTIAL PLAN VIEW OF A TYPICAL RING TRUSS.
1- DOUBLE CHORD RINGS.
2- CONNECTIONS BETWEEN MODULES IN ADJACENT SECTORS TO FORM CONTINUOUS RINGS.
3- DOUBLE STIFFENING TRUSS.

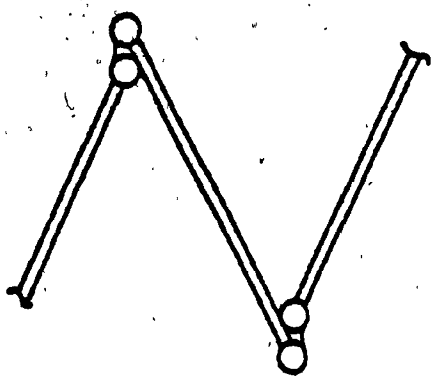


FIGURE 1.3.6 THE MODULES ARE STACKED VERTICALLY. THE MODULES CANNOT BE PLACED MORE STEEPLY IF INTERFERENCE BETWEEN THE CHORDS AND THE DIAGONALS IS TO BE AVOIDED.

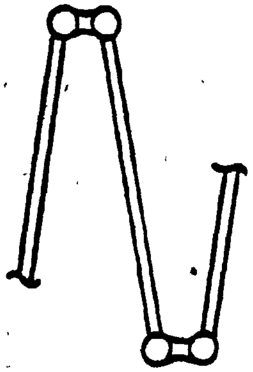


FIGURE 1.3.7 THE MODULES ARE PLACED SIDE BY SIDE. NOTE THAT THE MODULES CAN BE PLACED AS STEEPLY AS DESIRED WITH NO INTERFERENCE BETWEEN MEMBERS.

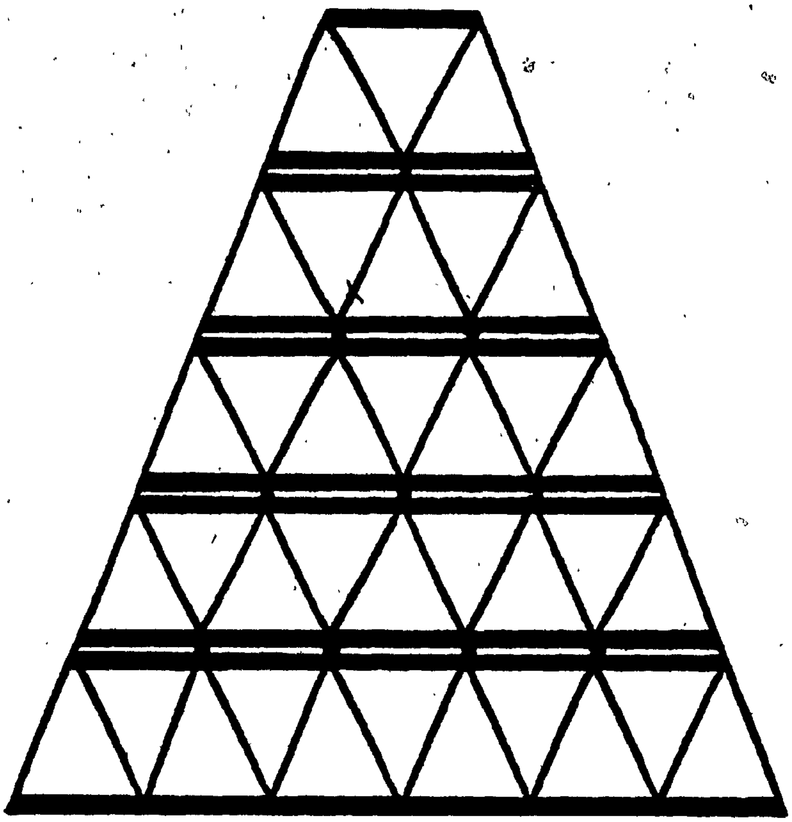


FIGURE 1.3.8 PLAN VIEW OF A SINGLE SECTOR OF A TYPICAL RING TRUSS. NOTE THE CONNECTIONS AT ALL THE NODAL POINTS BETWEEN MODULES IN ADJACENT BANDS.

Radial stiffening trusses are formed along each column line. These stiffening trusses are formed by joining the rings that are adjacent to one another in the upper surface to each other with struts at each end of the module, as shown in Figs. 1.3.4 and 1.3.5. The same is done with the lower surface rings. The struts form the chords of the stiffening trusses; while the diagonals of the stiffening trusses are formed by the end diagonals of each module. The stiffening trusses are actually double trusses, that is, one stiffening truss is placed on either side of the column line as shown in Fig. 1.3.5.

Two bracing trusses are formed around the perimeter of the ring type space truss. One of the bracing trusses is in the upper plane of the roof, and the second bracing truss is in the lower plane of the roof. One bracing truss is formed between the n-th and (n-2)-th rings, as shown in Fig. 1.2.5, if the space truss is supported at its lower surface then this bracing truss is in the lower plane; if the space truss is supported at its upper surface then this bracing truss is in the upper plane. The other bracing truss is between the (n-1)-th and (n-3)-th rings, as shown in Fig. 1.2.6, if the space truss is supported at its lower surface then this bracing truss is in the upper plane; if the space truss is supported at its upper plane then this bracing truss is in the lower plane. The chords of the bracing trusses are formed by the outermost rings in the surface being considered. The diagonals of the bracing trusses are formed with struts. As shown in Fig. 1.2.6, one of the bracing trusses has crossing diagonals in its central panel to make it symmetrical.

1.4 ERECTION PROCEDURE

The erection procedure begins at the perimeter and proceeds inwards to the center of the truss. Modules are installed in a manner that each band is completed before a subsequent band is started, in Fig. 1.4.1 the i-th band is being erected, the (i+1)-th and (i+2)-th bands have already been completed. The modules are designed so that they can be assembled to form the truss structure with minimal use of erection supports. The first modules are installed to form the perimeter band, that is, the n-th and (n-1)-th rings, as shown in Fig. 1.4.2. As each module is installed it is connected to the adjacent modules. While erecting the perimeter band temporary supports are required. Once the perimeter band is complete, the subsequent modules are used to form the next band, that is, the (n-1)-th and (n-2)-th rings. As shown in Fig. 1.4.3 the module being installed is placed so that temporary erection connections can be made, the module is then swung into position. Two stiffeners are

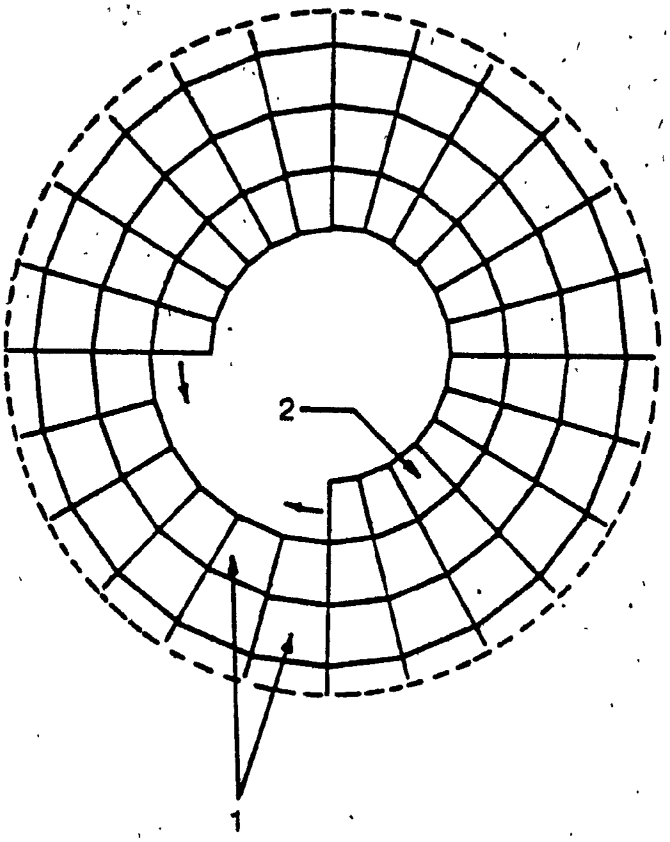


FIGURE 1.4.1 THE PROGRESS OF MODULE INSTALLATION IS SHOWN BY THE ARROWS.
1- PREVIOUSLY ERECTED BANDS.
2- BAND CURRENTLY BEING INSTALLED.

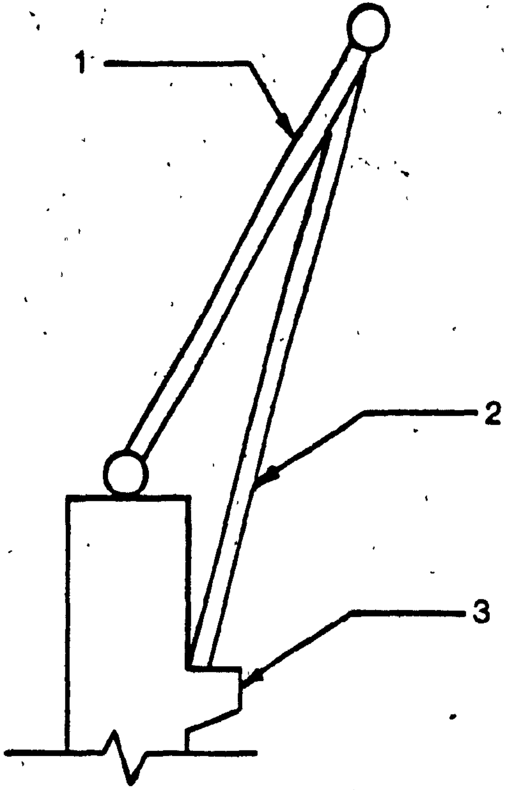


FIGURE 1.4.2 A MODULE FROM THE PERIMETER BAND IS BEING INSTALLED.

1- MODULE BEING INSTALLED.
2- TEMPORARY ERECTION SUPPORT.
3- COLUMN AND BRACKET.

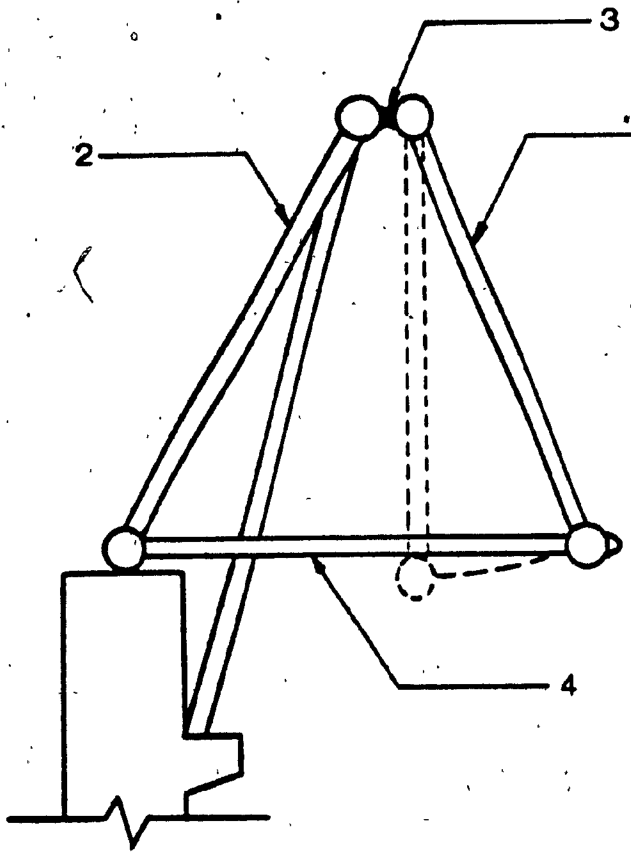


FIGURE 1.4.3 A MODULE FROM THE SECOND BAND IS BEING INSTALLED. THE DOTTED LINE IMAGE SHOWS THE MODULE'S INITIAL POSITION BEFORE BEING SWUNG INTO ITS FINAL POSITION.

1- MODULE BEING INSTALLED.
2- PERIMETER BAND.
3- TEMPORARY ERECTION CONNECTION.
4- STIFFENER.

then installed to keep the module in position, as shown in Fig. 1.4.4, and the permanent connections made. When the second band has been completed one of the bracing trusses is installed. The erection sequence is repeated for subsequent bands; that is, one by one the modules are placed so that the temporary erection connections can be made, swung into position, the stiffehers installed, and the permanent connections made. When the third band has been completed the other bracing truss is installed. After the completion of the first three bands, and the bracing trusses, the resulting structure is entirely rigid, and the temporary supports can be removed. Once five bands have been completed installation of the purlins, or floor beams, and deck can begin. This saves on construction time since the structure need not be complete before the deck can begin to be installed.

1.5 MODULE DESCRIPTION

The modules are all simple plane trusses. Plane truss modules are used to make the modules rigid, making it easier for the modules to be manipulated. All the components of the ring truss can be made of either structural steel or aluminium. The shop connections are welded, and the field connections are bolted. There are

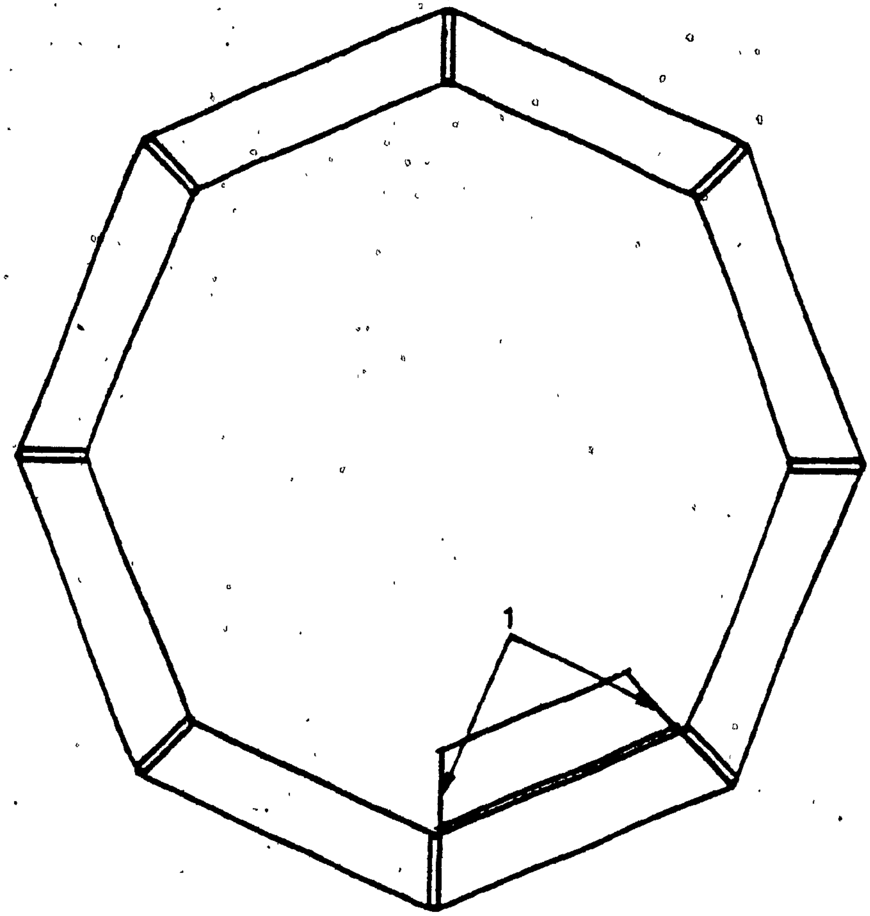


FIGURE 1.4.4 THE FIRST MODULE IN THE SECOND BAND IS HELD IN PLACE BY STIFFENERS AT EACH OF ITS ENDS. 1- STIFFENERS.

special features to distinguish the modules from ordinary trusses. The special features are simply means to connect the modules together, and also to connect the bracing and stiffening truss members to the modules. As shown in Figs. 1.5.1 and 1.5.2, there are end plates on the ends of each chord of the module, these end plates are for connecting the ends of the chords of the modules in the same band together to form the rings. There are also connection plates on the chords of the modules at all the panel points, see Figs. 1.5.1, 1.5.3, and 1.5.4, to interconnect the chords. The connections at the panel points are necessary so that the forces which are not parallel to the longitudinal axes of the chords get transferred from the modules in one band to the modules in the next band without causing any bending of the chords. The interconnection of the double chords at all the panel points also limits the unbraced length of the chords to the distance between panel points. There must also be connection points for the members from the bracing and stiffening trusses, see Figs. 1.5.5 and 1.5.6. There are also provisions made so that temporary erection connections can be made when the modules are being installed, see Figs. 1.5.7 and 1.5.8, this eliminates the need for temporary supports to hold the module being installed up. The temporary connections must allow for rotation about an

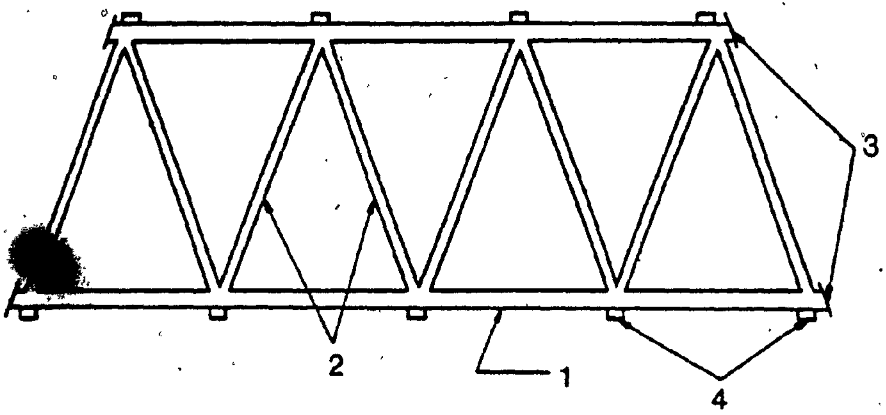


FIGURE 1.5.1 TYPICAL RING TRUSS MODULE.
1- CHORD.
2- DIAGONAL.
3- END PLATES.
4- CONNECTION PLATES.

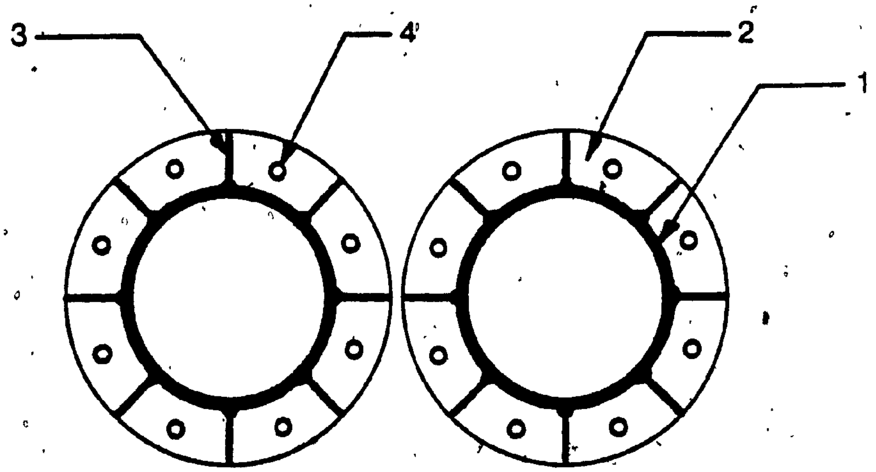


FIGURE 1.5.2 DETAIL OF END PLATE CONNECTION. BOTH CHORDS WHICH MAKE UP THE RING ARE SHOWN.
1- CHORD.
2- CONNECTION PLATE.
3- STIFFENING PLATES.
4- BOLT HOLES.

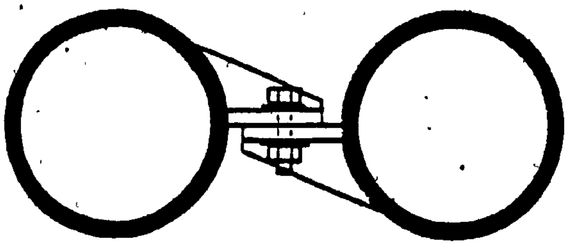


FIGURE 1.5.3 SECTION OF THE CONNECTION PLATE USED TO INTERCONNECT CHORDS OF MODULES IN ADJACENT BANDS AT ALL THE NODAL POINTS.

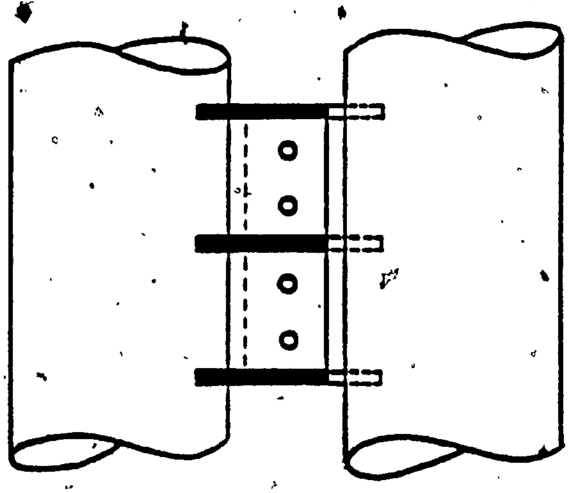


FIGURE 1.5.4 TOP VIEW OF THE CONNECTION PLATE USED TO INTERCONNECT CHORDS OF MODULES IN ADJACENT BANDS.

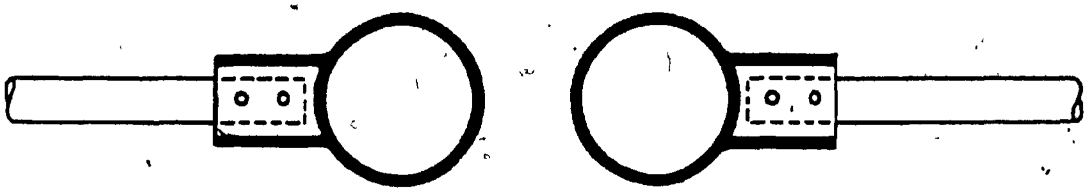


FIGURE 1.5.5 SECTION OF A TYPICAL CONNECTION BETWEEN A STIFFENER OR BRACING TRUSS MEMBER AND A RING MEMBER.

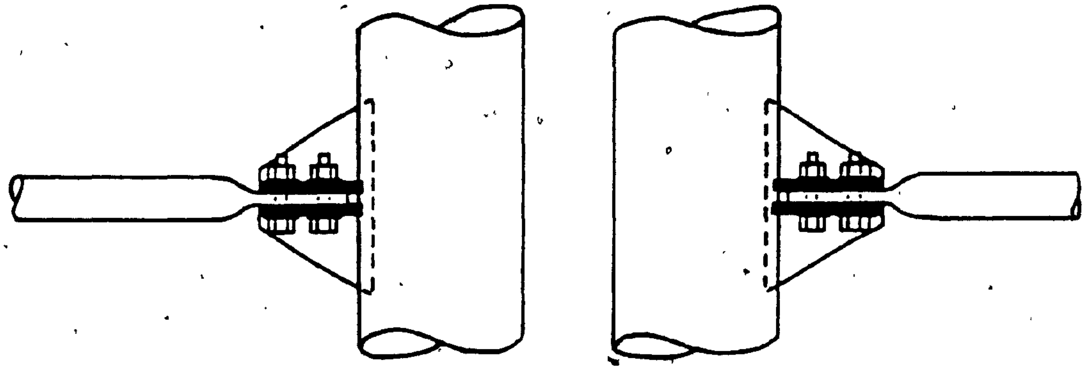


FIGURE 1.5.6 TOP VIEW OF A TYPICAL CONNECTION BETWEEN A STIFFENER OR BRACING TRUSS MEMBER AND A RING MEMBER.

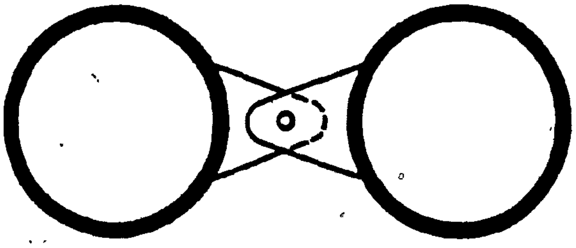


FIGURE 1.5.7 SECTION OF A TEMPORARY ERECTION CONNECTION.

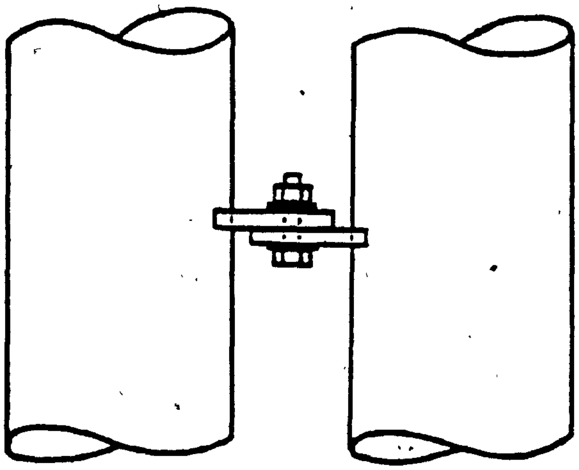


FIGURE 1.5.8 TOP VIEW OF A TEMPORARY ERECTION CONNECTION.

axis parallel to the longitudinal axis of the chord of the module being installed, this is to allow the module to be swung into position as shown in Fig. 1.4.3.

The number of panels in each module depends on which band the module is to be placed. The number of panel points is given by the following equation:

$$P_{ij} = i + P_{1j} - 1 \qquad 1.5.1$$

where, P_{ij} : The number of panels in a module located in the i-th band and the j-th sector of the truss

i : The number of the band in which the module is located

P_{1j} : The number of panels for modules in the first band and j-th sector of the truss

It is clear that the further from the center of the truss the module is to be installed, the more panels the module will have. The choice of the number of panels for modules in the first band, P_{1j} , depends on how far the first band is from the center of the truss. Usually P_{1j} will be taken as two when the first band is close to the center of the truss; but P_{1j} can be greater than two if the unbraced length of the chords is too great. For the truss shown in Fig. 1.2.8 on page 12, the number of panels in the first band could be increased for the side sectors, that is, the long sides of the rectangle. This would decrease the unbraced lengths of the ring members in the side sectors.

Circular tubes are used for all the members of the ring truss. Circular tubes are used because the moment of inertia of a circle is independent of which diametric axis is chosen. This means that the critical length for elastic buckling due to compression is the same about any diametric axis. Since the members are connected in such a way that the unbraced length is independent of the axis chosen, the section which has the required characteristics is a circle.

Rigid plane truss modules are used because they are easier to handle than space truss modules. In Fig. 1.5.9 it can be seen that plane truss modules can be closely packed. Whereas in Fig. 1.5.10 a space truss module is shown, the equivalent of two plane truss modules are placed in slightly less space than the seven modules shown in Fig. 1.5.9. It is clear that plane truss modules can be more efficiently stored than the space truss modules. Since the modules would most likely be moved to the site by truck the length of the components that can be moved is limited by the length of trucks. The depth of the module is limited by the width of the roads, or the clear height above the truck on the roads used for transport.

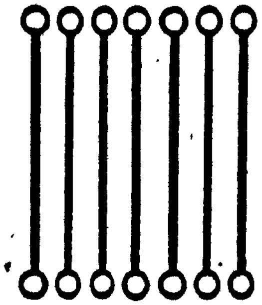


FIGURE 1.5.9 PLANE TRUSS MODULES STORED IN A COMPACT SPACE.

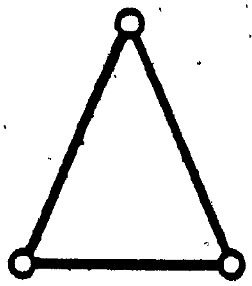


FIGURE 1.5.10 SPACE REQUIRED TO STORE A SPACE TRUSS MODULE

The problem of transportation would not be important for relatively short span structures since the modules used would not exceed the transportation limits. But for very long span structures, such as sports facilities, the problem of limited module dimensions could become important. The problem of exceeding the maximum transportation length can be solved with ease. The modules could be fabricated in several pieces, which do not exceed the maximum transportation length, as shown in Fig. 1.5.11. The pieces could then be spliced together on site to form the module, before the module is lifted into place, see Fig. 1.5.12. A detailed view of a splice connection is shown in Fig. 1.5.13. Note that to accomodate the splice, the diagonals adjacent to the splice must be moved apart. The diagonals' new lines of action no longer meet on the longitudinal axis of the chord, that is, the joint is eccentric. The eccentricity is not extremely great, since the diagonals' lines of action meet just outside the chord's section. The problem of exceeding the transportation limit for the depth is not so easily solved. But since large modules would only occur on fairly large projects it might be more economical to set up a temporary fabrication plant on the site. This would circumvent the problem of transporting large modules over public thoroughfares to the site.

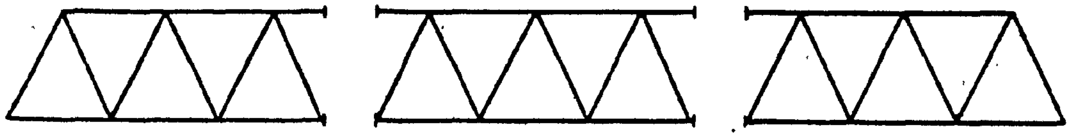


FIGURE 1.5.11 TO MAKE IT EASIER TO TRANSPORT A VERY LONG RING TRUSS MODULE IT IS FABRICATED IN THREE PIECES AND SPLICED ON SITE.

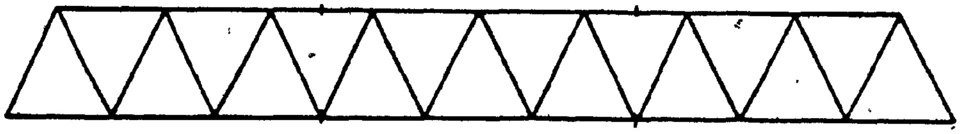


FIGURE 1.5.12 A VERY LONG RING TRUSS MODULE IS ASSEMBLED.

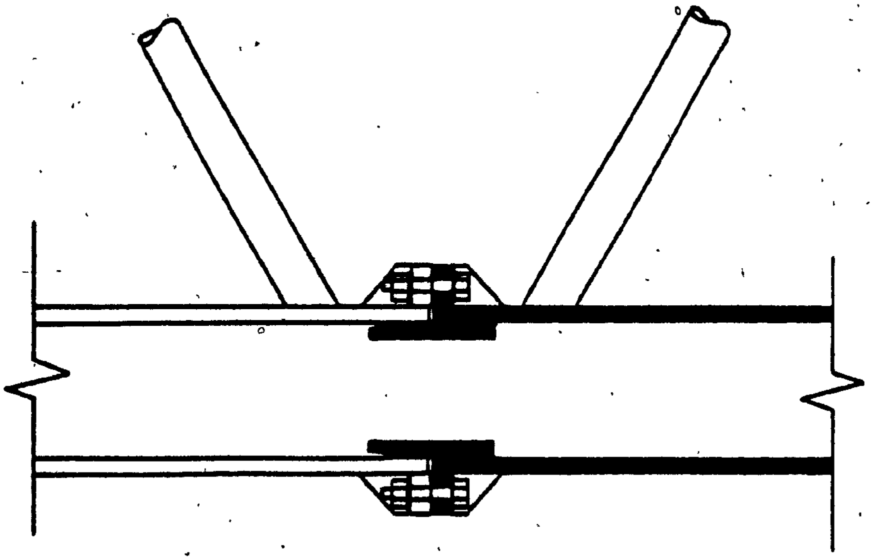


FIGURE 1.5.13 DETAIL OF A SPLICE CONNECTION.

CHAPTER 2

ANALYSIS OF THE RING TRUSS

2.1 STRUCTURAL ANALYSIS METHOD

The ring truss structural system is very versatile. A wide variety of configurations can be made to satisfy many different structural and architectural requirements. In this project the number of variables that are allowed to vary are considerably reduced. Only trusses that have regular polygonal plans, and an even number of sides are considered. The truss must have a flat profile. These restrictions on the geometry of the truss considerably reduce the number of configurations which can be formed, but they are necessary due to time constraints.

To analyze a structure such as the ring truss a computer program must be used. This can easily be seen since the number of members in the truss can easily exceed one-thousand, even for small trusses. The degree of indeterminacy for a ring truss is high. The external indeterminacy depends on the support conditions, varying between (NCOL-2) when the truss is laterally supported at only two columns, and (3*NCOL-6) when the truss is laterally supported at every column. The degree of internal indeterminacy of a ring truss with NRINGS rings, and NCOL columns, is given by:

NCOL*(3*NRINGS - 13) 2.1.1

Clearly it is not practical to analyze a ring truss by any means other than a computer program. To analyze the ring truss a computer program was developed which is based on the linear elastic displacement method of structural analysis.

There are many structural analysis programs available which can analyze space trusses. But the problem with the use of a general purpose computer program is that the user must enter an enormous amount of data. The coordinates of all the nodal points, the area of each member, member connectivity data, the degree of freedom (DOF) numbers for each node, the support conditions, and the loading at each node must all be entered. To get around this problem a program was written which requires only a small amount of data.

The computer program developed to analyze ring truss structures requires only a small fraction of the input required by general purpose structural analysis programs. Since only a small amount of input data is required the time required to run the program is considerably reduced, and the probability of making errors in the input data is cut drastically. Errors in a program's input data cause several problems. The most obvious problem is that when the errors are detected by analysis of the output data, the program must be run again with the corrected data. If several errors were made the first time, then they may not have all been detected after the first run of the program. Thus several runs of the program may be required before all the errors are detected. The repeated running of the computer program because of errors in the input data is very inefficient use of computer time. To detect errors in the input data, unless the errors are extremely blatant, could require a great deal of analysis of the output data. What would be even worse is if errors in the input data go undetected, and the structure being analyzed is designed for the wrong member forces. If the opportunities for making errors in the input data could be reduced, the productivity and reliability of the computer program would be greatly enhanced.

2.2 GENERAL DESCRIPTION OF THE COMPUTER PROGRAM

The ring truss program was developed at Concordia University using the Center for Building Studies' Perkin

Elmer 3220. The program was written using FORTRAN 77. The program is interactive. The user is prompted to enter all the data that the program needs to execute. The ring truss program is based on the displacement method of structural analysis. The user is asked to enter the general structure data, this includes the number of rings in the structure, NRINGS; the number of columns in the structure, NCOL; the modulus of elasticity, E; the depth of the truss, DEPTH; the distance from the center to the perimeter of the truss, RIN; the vertical angle between the horizontal plane and the line joining a lower surface ring and the following upper surface ring, ALPHAT; and the vertical angle between a horizontal plane and the line which joins an upper surface ring and the subsequent lower surface ring, ALPHAC, see Fig. 2.2.1. The program then calculates the coordinates of each nodal point in the structure. The user is then asked to enter all the member area data. The program subsequently generates the member area vector, and the member connectivity matrix. The user is then asked whether each support supplies lateral restraint, and the user either answers with yes or no for each column. The program then generates the substructure and structure DOF numbering. The user is then asked to enter the load data. The program calculates the substructure load vectors. Then, for each substructure, the program generates the

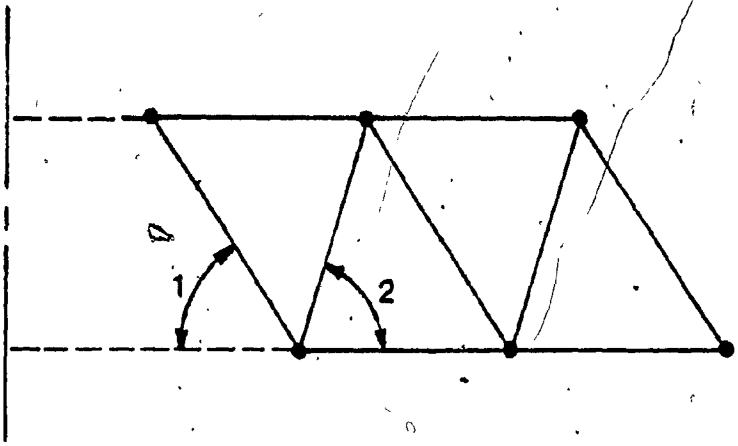


FIGURE 2.2.1 VERTICAL SECTION THROUGH THE RING TRUSS.
1- ANGLE ALPHAC.
2- ANGLE ALPHAT.

substructure stiffness matrix, statically condenses the substructure stiffness matrix along with the corresponding substructure load vector, and then assembles the reduced substructure stiffness matrix and load vector into the structure stiffness matrix and structure load vector. The program solves for the structure displacements, solves for the substructure displacements for each substructure, and finally for all the member forces. The user is then given the option to analyze the same structure for a different loading condition. If the user opts for this, then he need only input the new load data, the program will use the same structure data as the structure just analyzed. The user is also given the option, once he has finished analyzing a particular structure for different loading conditions, to analyze another structure without having to leave the program. The program flowchart is shown in Fig. 2.2.2. A complete program listing is included in Appendix A.

Although the ring,truss program is interactive, it can be used in BATCH mode. To run the program in BATCH mode the input data required to run the program is all placed on a data file. BATCH mode is useful when a particular structure will be analyzed several times, and only a few parameters will be varied at a time. The use of BATCH mode is also useful when the user wishes to run the program without being present. Sample input data is included in

FIGURE 2.2.2 FLOW CHART FOR THE RING TRUSS PROGRAM

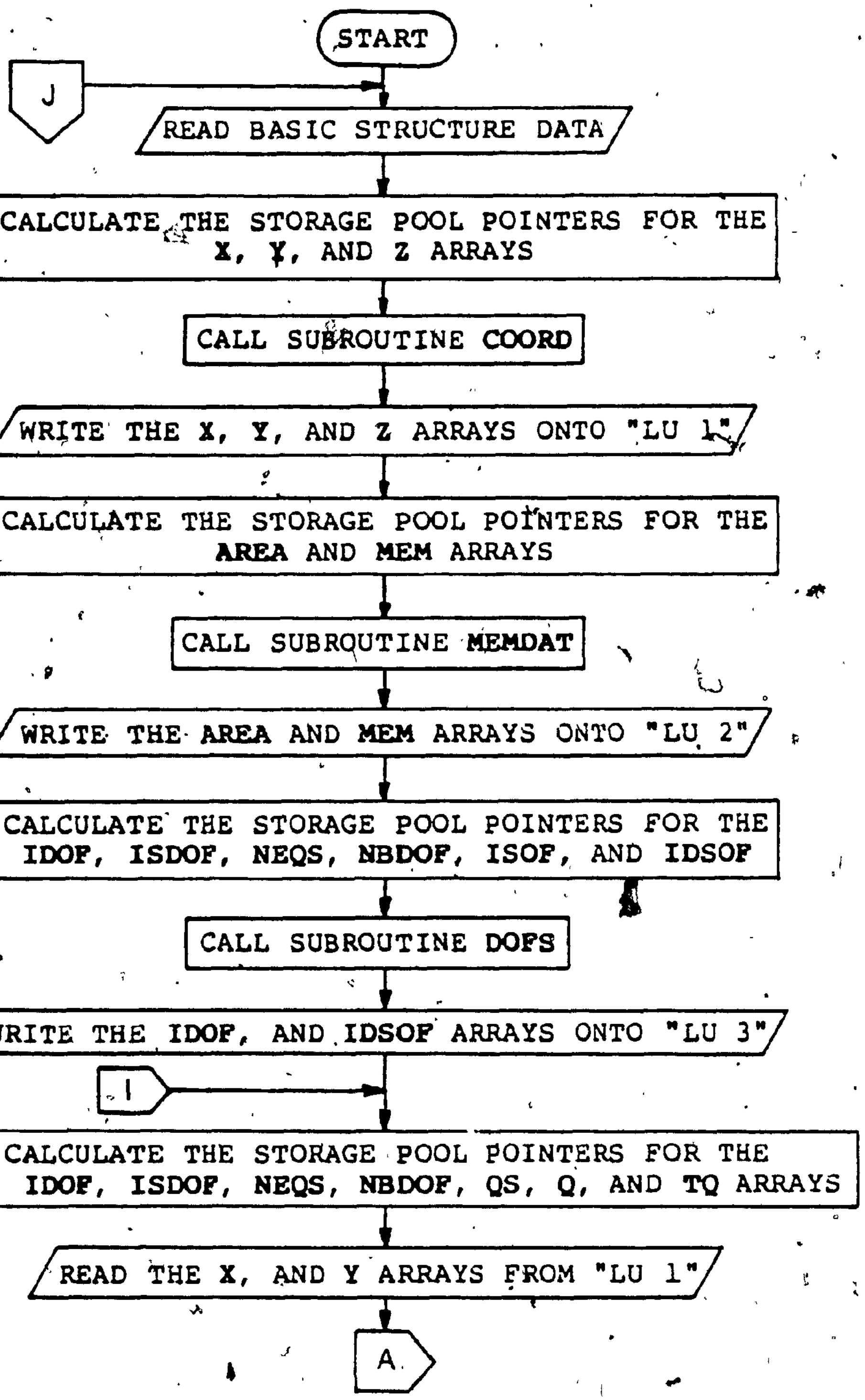


FIGURE 2.2.2 (cont.) FLOW CHART FOR THE RING TRUSS PROGRAM

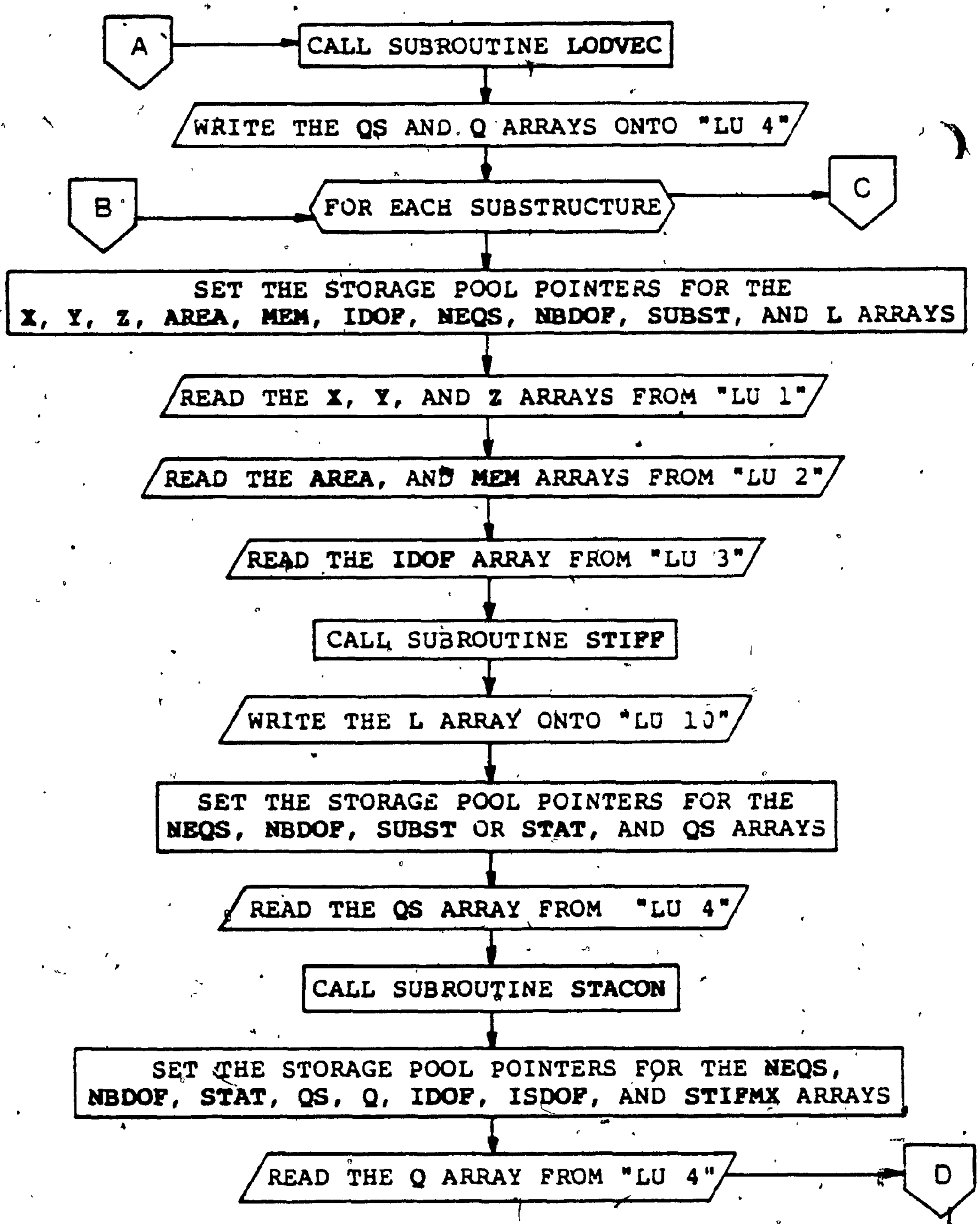


FIGURE 2.2.2 (cont.) FLOW CHART FOR THE RING TRUSS PROGRAM

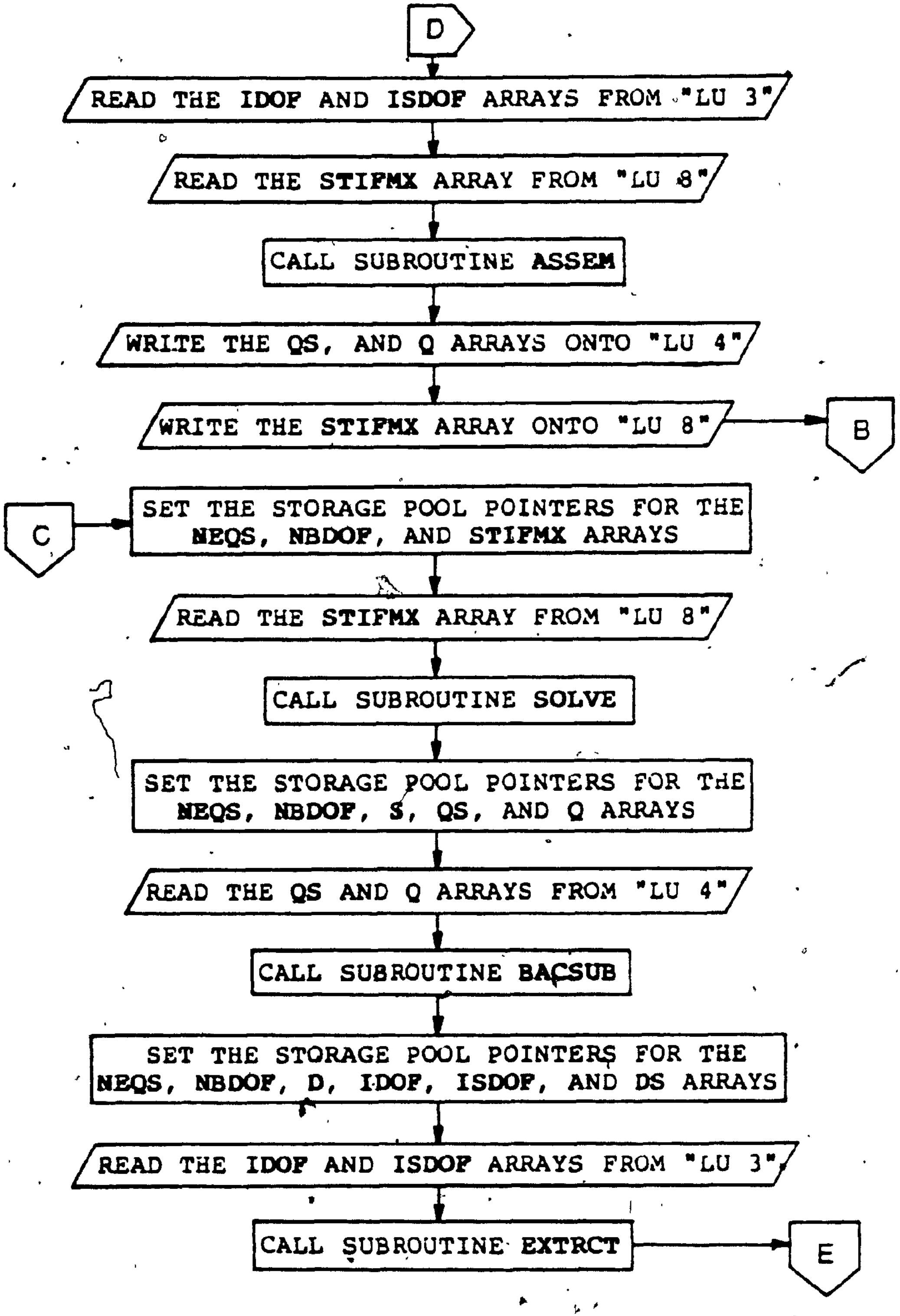


FIGURE 2.2.2 (cont.) FLOW CHART FOR THE RING TRUSS PROGRAM

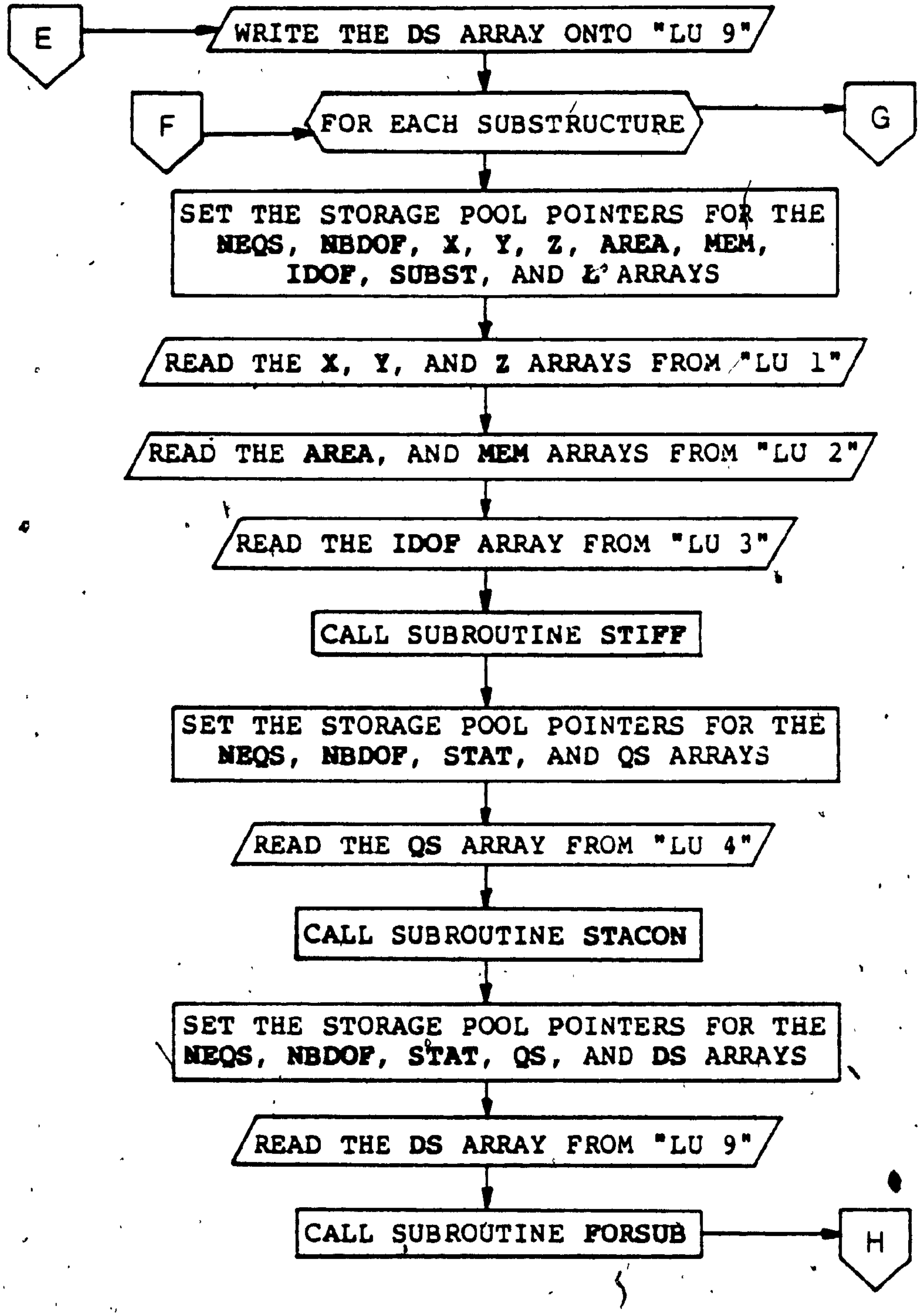
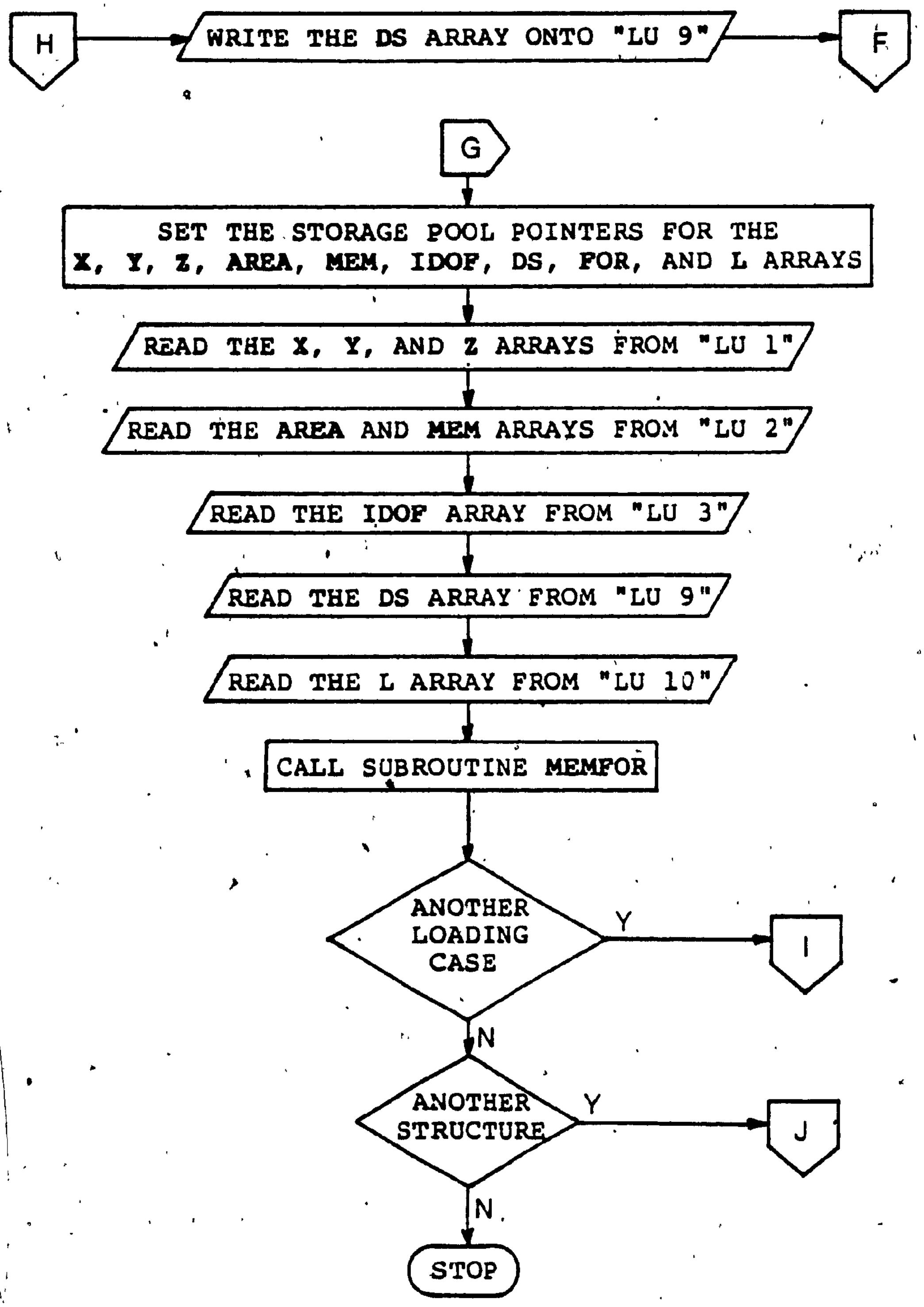


FIGURE 2.2.2 (cont.) FLOW CHART FOR THE RING TRUSS PROGRAM



Appendix B.

The output data from the ring truss program can be quite voluminous, even for small structures. The program output all goes through Logical Unit 7. Logical Unit 7 can be assigned to a printer, or to a data file. Writing the output data onto a data file is useful when the output data will be analyzed by another program. Even if the ouput data is written onto a data file, when a hard copy is required the data file can be printed. The output data from the program consists of the basic structure data; the member area array; the member end node array; the substructure DOF arrays for each substructure; the structure DOFS; the load data; the material consumption data; the structure displacements; the substructure displacements; the member forces; the x, y, and z components of the member forces; and the area of the truss. Sample output data is included in Appendix B.

All the data arrays used by the subroutines are stored in two large storage pools in the main program. Two storage pools are required because some of the arrays are real arrays, whereas some are integer arrays. The integer arrays are stored in the integer storage pool, IA; and the real arrays are stored in the real storage pool, A. The two pools are actually stored in the same location in the memory by EQUIVALENCE-ing the two storage pools. This saves on the storage space required by the program. The use of storage pools is desirable because the arrays which are used by the different subroutines vary from one subroutine to another. Instead of reserving a fixed amount of memory space for each of the arrays used throughout the program, one large space is reserved for storage of all the arrays used by the program. The same space is used to store both the real and integer arrays because the amount of storage required for all the integer arrays, and for all the real arrays varies from subroutine to subroutine. For example, in one subroutine one-thousand words of space may be required to store the integer arrays and one-thousand words may be required to store the real arrays; but in another subroutine no integer arrays are used and fifteen-hundred words of space are required for the real arrays. If one storage pool is used to store both the real and the integer arrays, then two-thousand words of space are required. But if two separate pools are used to store the integer and real arrays, 2500 words of memory would be required [1].

The main program is used to control the different subprograms. Before a particular subprogram is run the storage pool pointers for the arrays required are calculated. The data the arrays should contain is placed in the storage pool.

The program uses two other memory saving techniques.

Firstly, the subroutines are overlayed on top of each other, that is, only the subroutines that are needed at any one time to run the part of the program currently being executed are in the core at any one time. Also, to reduce the size of the storage pool needed only those arrays needed to execute the part of the program being executed are kept in the storage pool. The arrays which are not required to run the subroutine currently being executed are stored in disk files. As the arrays are needed they are read into the storage pool.

2.3 STRUCTURE GEOMETRY ALGORITHMS

The program automatically numbers the nodes of the ring truss. Since the program uses substructure technique to analyze the truss, the structure must be divided into several substructures. The program automatically divides the structure into NCOL substructures, such that each sector of the truss is a substructure, see Fig. 2.3.1. The boundaries of each substructure are the radial edges of each sector, as shown in Fig. 2.3.1. The node numbers are the same for every substructure.

For convenience in analysis of the truss as a whole, the boundary nodes of each substructure are numbered first, then the interior nodes are numbered. The number of the

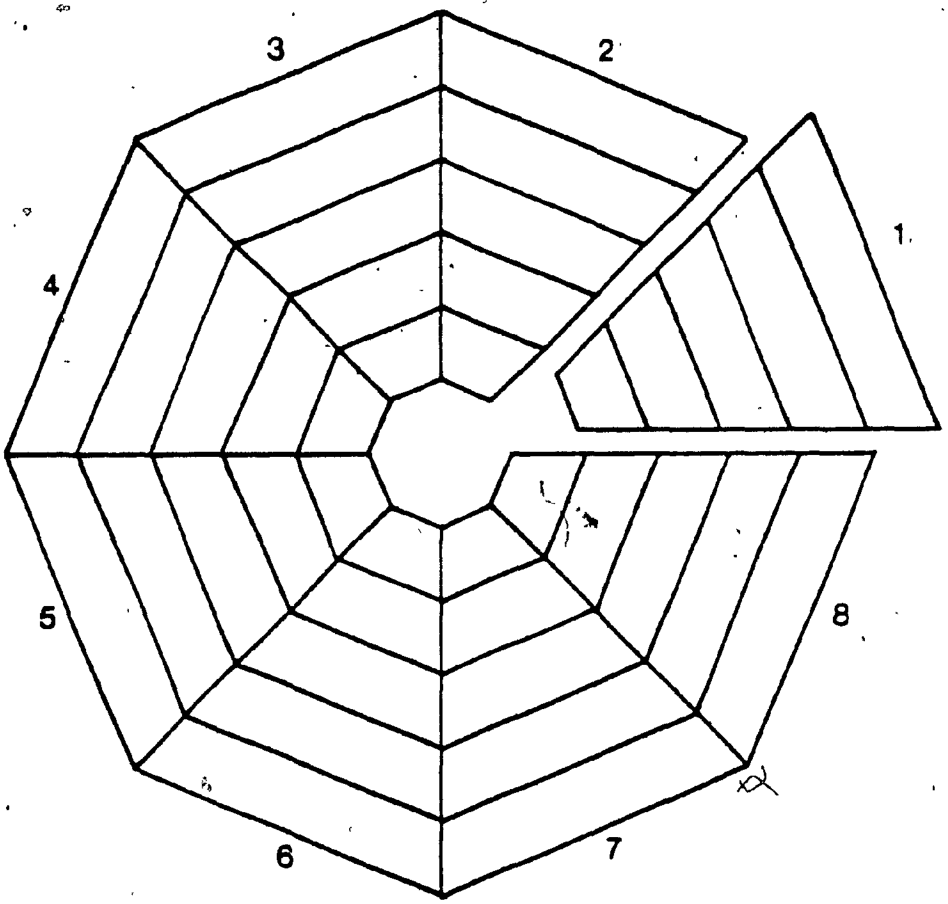


FIGURE 2.3.1 SUBSTRUCTURE DIVISION FOR A TYPICAL RING TRUSS, SUBSTRUCTURE 1 IS SEPERATED FROM THE REST OF THE STRUCTURE TO SHOW THE SUBSTRUCTURE BOUNDARIES.

first node in the J-th ring, that is the first boundary node, can be calculated using the following equation:

$$N = 2*J - 1 \tag{2.3.1}$$

The number of the last node in the J-th ring, that is, the second boundary node, can be calculated using the following equation:

$$N = 2*J \tag{2.3.2}$$

The number of the I-th interior node in the the J-th ring is calculated with the following equation:

$$N = 2*NRINGS + J*(J-1)/2 - (J-1) + I \tag{2.3.3}$$

This version of the program assumes that there are no interior nodes in the first ring. Therefore the first interior node is in the second ring. There are (J-1) interior nodes in the J-th ring, in each substructure. The node numbering for a typical ring truss is shown in Fig. 2.3.2. The number of nodes, NUMNOD, in a ring truss per substructure can be calculated using equation 2.3.4.

$$NUMNOD = 2*NRINGS + NRINGS*(NRINGS-1)/2 \tag{2.3.4}$$

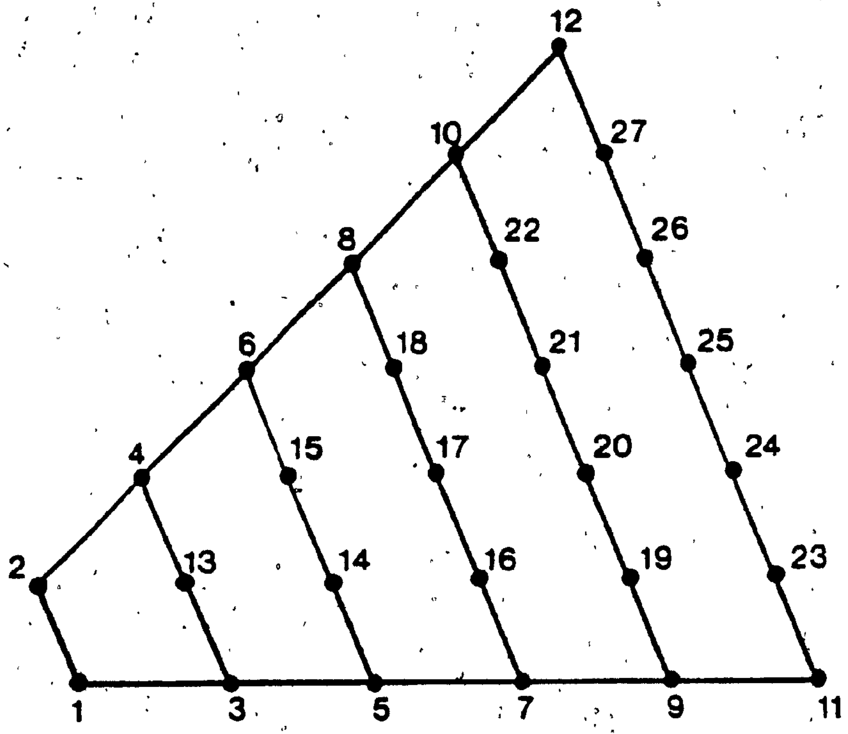


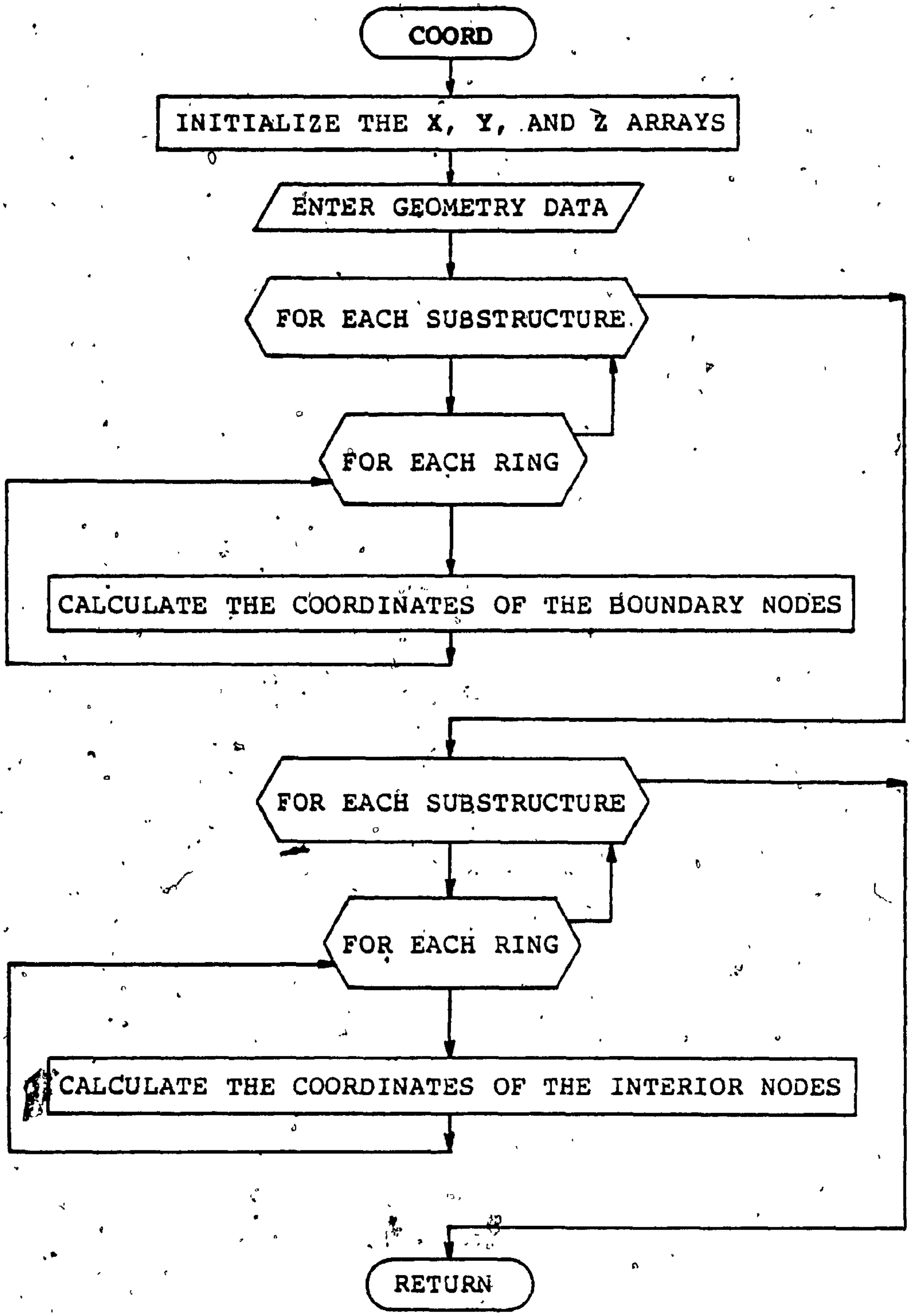
FIGURE 2.3.2 NODE NUMBERING FOR A TYPICAL RING TRUSS.

Even for a small truss with only eight rings the number of nodes per substructure is 44. If there are ten substructures, this makes a total of 440 nodes for the entire structure.

In the ring truss program the coordinates of all the nodal points are calculated in the COORD subroutine. A flowchart for the COORD subroutine is shown in Fig. 2.3.3. The x, y, and z coordinates of all the points in the structure are stored in the X, Y and Z arrays respectively. The first subscript of the coordinate arrays is the substructure number, and the second subscript is the number of the node within the substructure.

The x, y, z coordinates of any ring truss which can be analyzed by the present version of the program can be calculated using only six numbers. The six numbers are NRINGS, NCOL, DEPTH, RIN, ALPHAT, and ALPHAC. To determine the coordinates of all the nodal points the following algorithm is used. Firstly the coordinates of the end points of the truss rings are calculated for each substructure; that is, the coordinates of all the boundary nodes are calculated. To calculate the coordinates of the boundary nodes it is convenient to first calculate their polar coordinates, and then to convert to rectangular coordinates. The radial distance from the center of the truss to the boundary nodes in the i-th ring can be

FIGURE 2.3.3 — FLOW CHART FOR THE COORD SUBROUTINE



calculated using the following equations, which are based on the geometry shown in Figs. 2.3.4 to 2.3.6:

$$R_i = RIN \qquad i=1 \qquad 2.3.5$$

$$R_i = R_{i-1} + DEPTH*COT(ALPHAT) \qquad i>1 \text{ and odd} \qquad 2.3.6$$

$$R_i = R_{i-1} + DEPTH*COT(ALPHAC) \qquad i>1 \text{ and even} \qquad 2.3.7$$

The angles THETA1 and THETA2, are repectively, the angle between the positive x-axis and the line on which the odd numbered boundary nodes lie, and the angle between the positive x-axis and the line on which the even numbered boundary nodes lie, see Fig. 2.3.4. The x and y coordinates of the boundary nodes can then be calculated using the polar to rectangular coordinate transformation. For the odd numbered boundary node on the i-th ring the following equations are used:

$$X = R_i *COS(THETA1) \qquad 2.3.8$$

$$Y = R_i *SIN(THETA1) \qquad 2.3.9$$

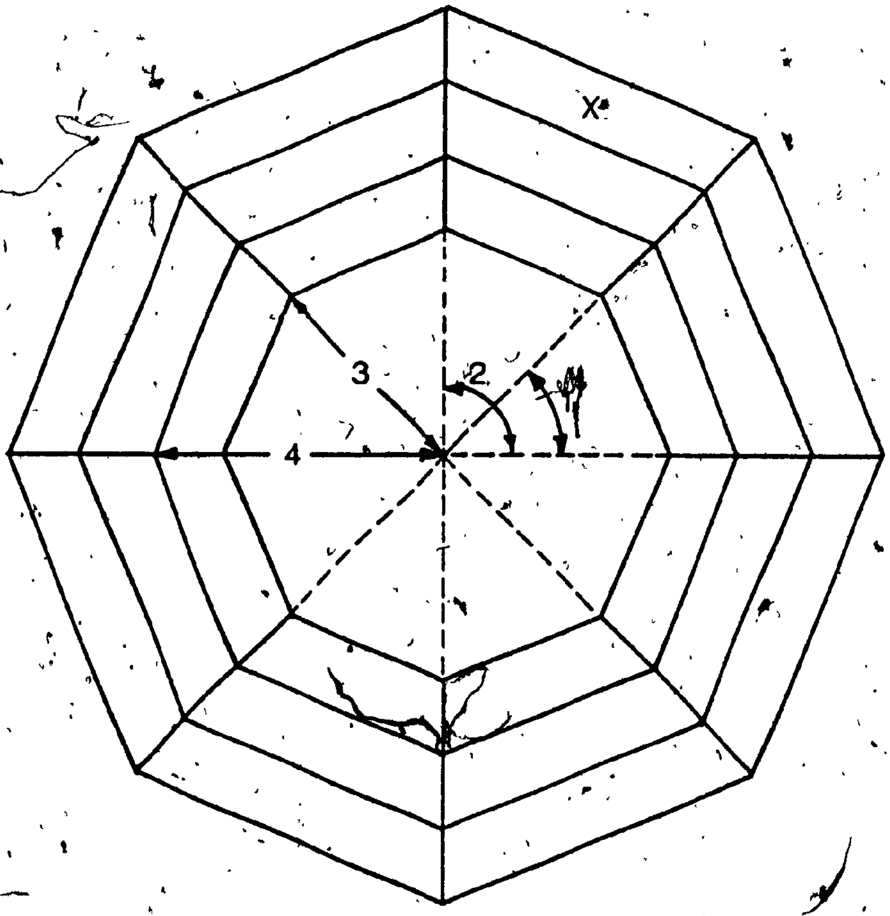


FIGURE 2.3.4 GEOMETRY FOR THE CALCULATION OF THE X AND Y COORDINATES FOR THE BOUNDARY NODES IN THE SUBSTRUCTURE MARKED WITH AN X.
1- ANGLE THETA1.
2- ANGLE THETA2.
3- RIN.
4- RADIUS OF THE SECOND RING.

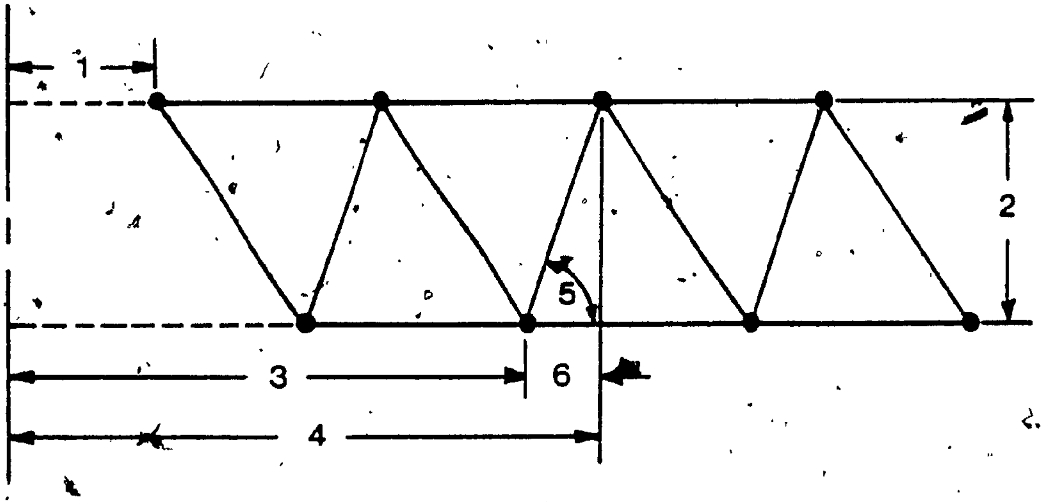


FIGURE 2.3.5 GEOMETRY FOR THE CALCULATION OF THE RADIUS OF AN ODD NUMBERED RING.
1- RIN.
2- DEPTH.
3- R_{i-1}.
4- R_i.
5- ANGLE ALPHAT.
6- DEPTH*COT(ALPHAT).

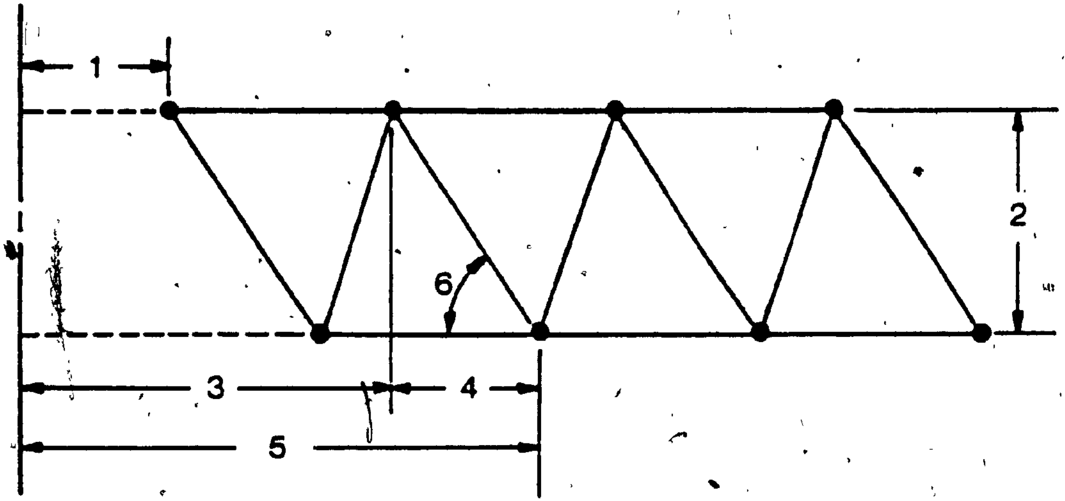


FIGURE 2.3.6 GEOMETRY FOR THE CALCULATION OF THE RADIUS OF AN EVEN NUMBERED RING.

1- RIN.
2- DEPTH.
3- R_{i-1}.
4- DEPTH*COT(ALPHAC).
5- R_i.
6- ANGLE ALPHAC.

For the even numbered boundary node on the i-th ring the following equations are used:

$$X = R_i \ \text{*COS(THETA2)} \tag{2.3.10}$$

$$Y = R_i \ \text{*SIN(THETA2)} \tag{2.3.11}$$

The value of the z-coordinate of the boundary node depends on whether or not the ring, on which the node lies, is located in the upper or lower surface of the truss. For odd numbered rings, which are located in the upper surface of the truss, the z-coordinates of all the nodes are equal to the depth of the truss, DEPTH. For all the nodal points in even numbered rings, which are located in the lower surface of the truss, the z-coordinates are equal to zero.

After the coordinates of all the boundary nodes have been calculated, the coordinates of the interior nodes are generated. The coordinates of the interior nodes are calculated by proportions. The number of interior nodes in the J-th ring is known to be (J-1), therefore, the number of line segments between the nodal points can be found to be J. The coordinates of the i-th interior node in the J-th ring can be calculated with the following equations:

$$X = X_{2J} + ((X_{2J} - X_{2J-1})*(J-i))/J \qquad 2.3.12$$

$$Y = Y_{2J-1} + ((Y_{2J} - Y_{2J-1})*i)/J \qquad 2.3.13$$

$$Z = Z_{2J-1} \qquad 2.3.14$$

The z-coordinates of the interior nodes in any ring are equal to the z-coordinates of the boundary nodes in that ring, since the rings are always horizontal in this version of the program.

An eight ring truss with ten substructures has 440 nodal points, and each nodal point requires three numbers to fully describe its position in space. For even this small structure 1320 numbers would need to be entered for a conventional structural analysis program. With the ring truss program only six numbers need be entered.

The **MEMDAT** subroutine generates the member area array, AREA, and the member end node array, MEM. The member areas and end node numbers are the same for every substructure, therefore the AREA and MEM arrays need only be generated for one of the substructures. The only subscript for the AREA array is the number of the member. The first subscript for the MEM array is either 1 or 2; 1 refers to the number of the member's node-i, and 2 refers to the number of the member's node-j. The second subscript of the MEM array is the member number. The i-th member's area is AREA(i), the number of node-i for the i-th member is MEM(1,i) and MEM(2,i) is number of node-j. A flowchart for the **MEMDAT** subroutine is shown on Fig. 2.3.7.

Another major input component for the program is the assigning of member areas for all the members of the structure. The ring truss program assigns the same member area to every ring member in the same ring. Although the forces in the rings may vary from member to member, it would not be practical to fabricate the modules with chords that have varying areas. All the diagonals that are in the same band are assigned the same member area. The same is done for the stiffeners, that is, the two stiffeners which are located between the same pair of rings are assigned the same member area. The members which make up the upper bracing truss are all assigned the same area. The lower bracing truss members are all assigned the same area.

For the ring truss program the user is required to enter the area for each ring, which is NRINGS values. The user is also required to enter the area for the diagonals between each pair of rings, which is (NRINGS-1) values. The user must enter the area stiffeners between each pair of rings, which is another (NRINGS-2) values. In addition the user must enter the member areas for the upper and lower bracing trusses, another two values. In total the user is

FIGURE 2.3.7 FLOW CHART OF THE **MEMDAT** SUBROUTINE

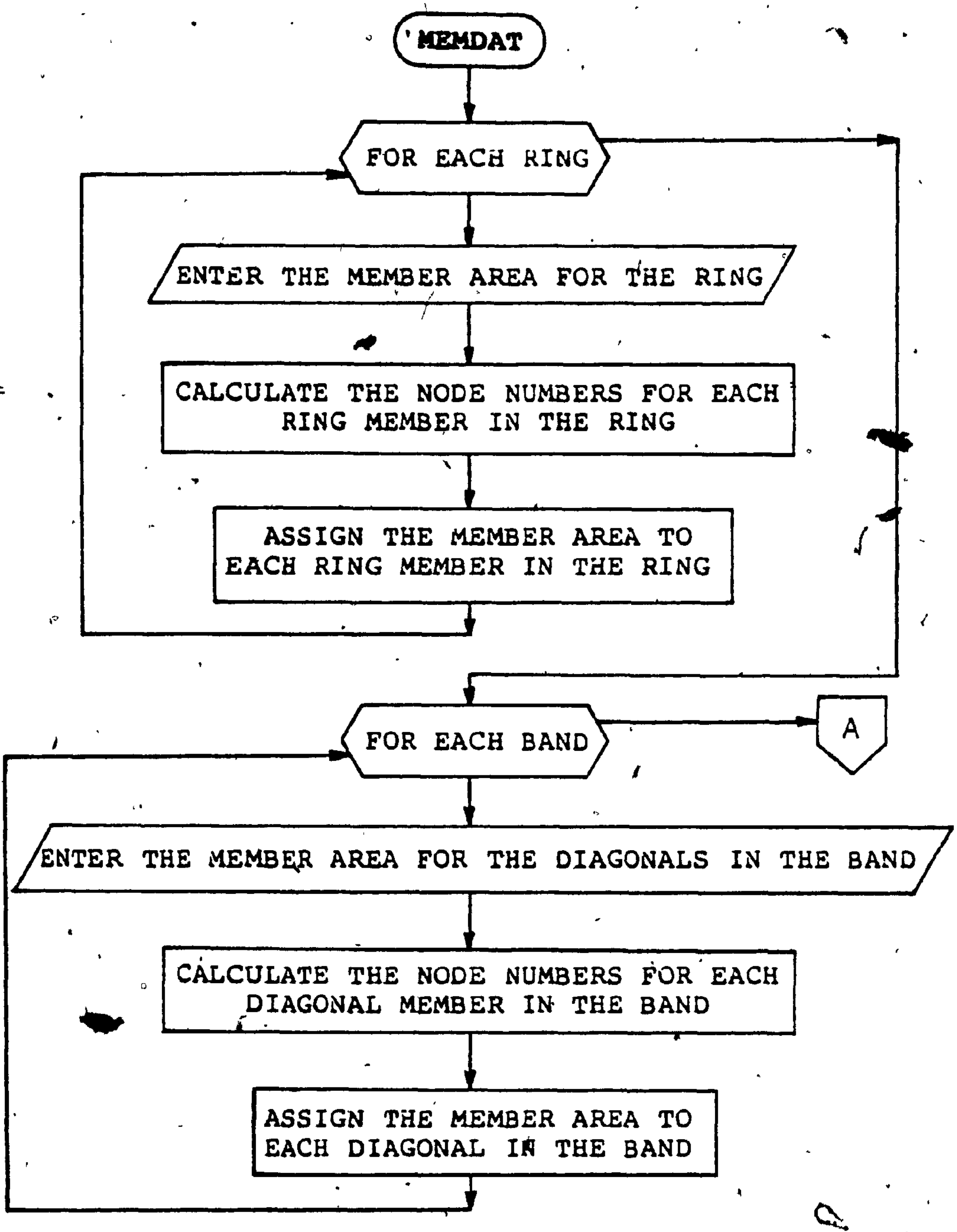


FIGURE 2.3.7 (cont.) FLOW CHART FOR THE **MEMDAT** SUBROUTINE

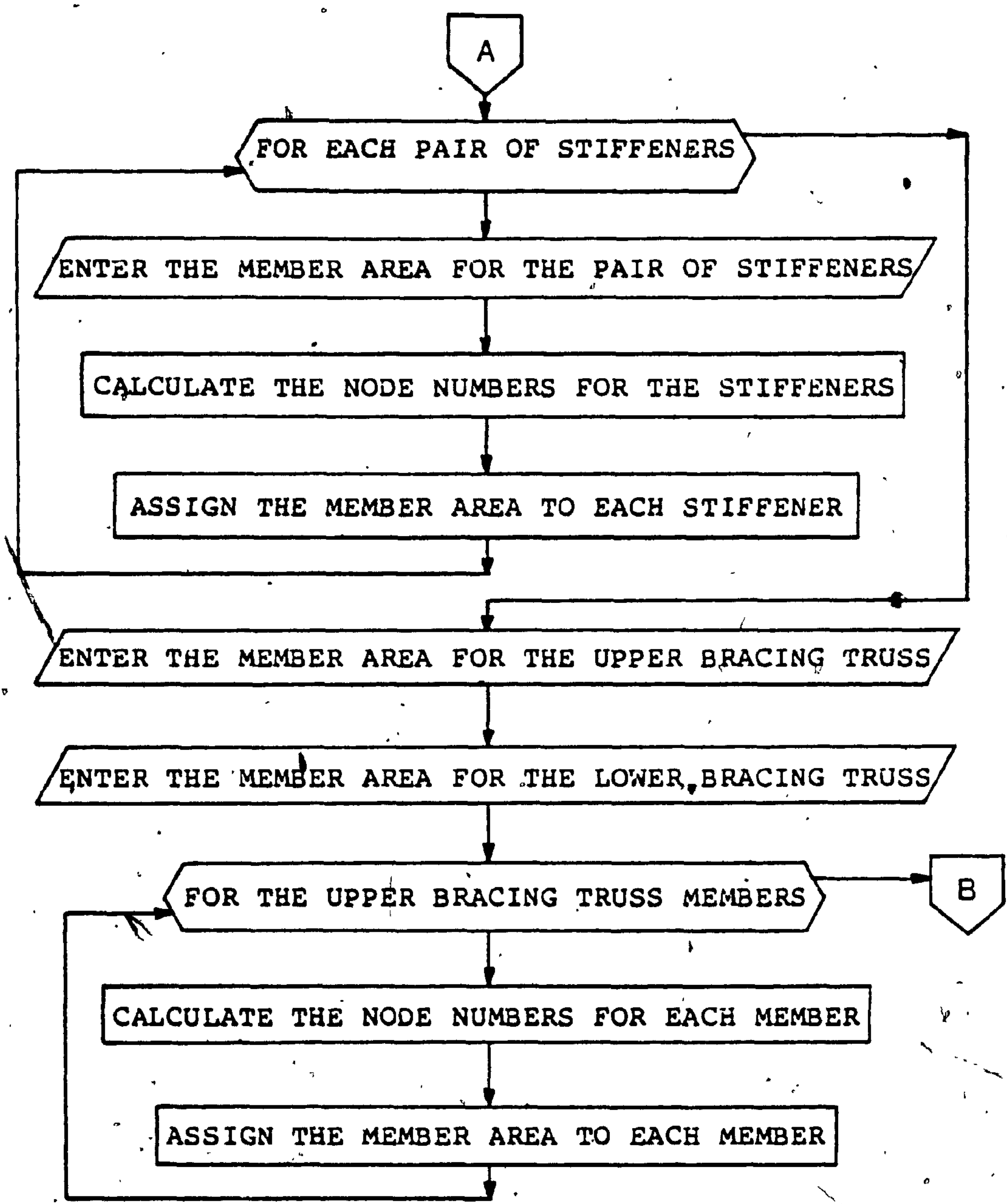
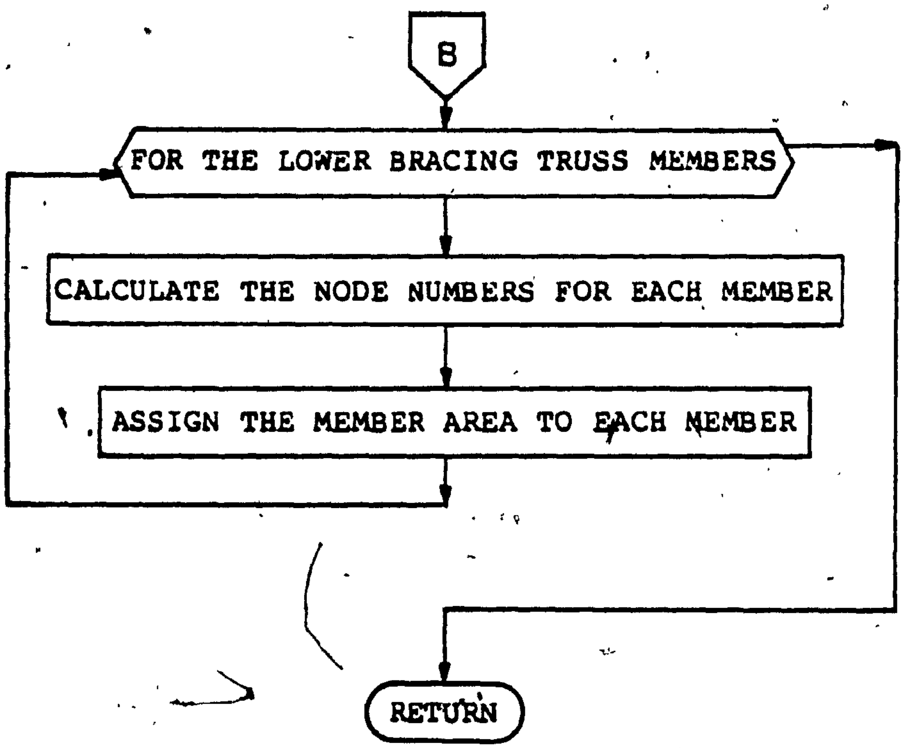


FIGURE 2.3.7 (cont.) FLOW CHART FOR THE MEMDAT SUBROUTINE



required to enter (3*NRINGS-1) values.

In a conventional program the number of values which would need to be entered for the member areas is equal to the number of members. The number of members per substructure in a ring truss is given by:

$$1.5*NRINGS^2 + 7.5*NRINGS - 13 \qquad 2.3.15$$

For a ring truss with eight rings and ten substructures there wolud be 1430 members in the entire structure, which means that 1430 values would have to be entered into a conventional program. The ring truss program requires only twenty-three values.

For the geometry of the structure to be complete the end nodes of each member must be determined. In conventional programs the two end node numbers for each member must be entered. For a truss with eight rings and ten substructures 2860 numbers would have to be entered. The ring truss program automatically assigns the correct end nodes to each member. This is possible because the geometry of the ring truss is fixed.

Since all the end nodes can be calculated using Equations 2.3.1 to 2.3.3 the members between the nodes need only be numbered in a certain sequence, and the end node numbers calculated using Equations 2.3.1 to 2.3.3. Each member can be identified by its substructure number and by its member number within that substructure. The member numbering starts at one in each substructure. Since all the substructures are identical to each other only one of the substructures is numbered, this saves on computation time, and storage space. The ring members are numbered first followed by the diagonal members, the stiffeners and finally the bracing truss members.

The ring members are numbered starting at the innermost ring and proceeding outwards. Within each ring a counter-clockwise progression is followed, see Fig. 2.3.8. The ring member numbers range between one and (NRINGS*(NRINGS+1)/2).

The diagonal members are numbered starting at the innermost band and proceeds outwards to the perimeter band. Within each band the member numbering of the diagonals proceeds in a counter-clockwise fashion, see Fig. 2.3.9. The first diagonal to be numbered in each band is the one between the two odd numbered boundary nodes. The diagonal member numbers vary between (NRINGS*(NRINGS+1)/2+1) and ($1.5*\mathrm{NRINGS}^2+1.5*\mathrm{NRINGS}-2$).

The stiffeners are numbered starting at the innermost pair of stiffeners, and proceeding outwards. First the stiffeners in the upper surface of the truss are numbered, then the stiffeners in the lower surface of the truss are

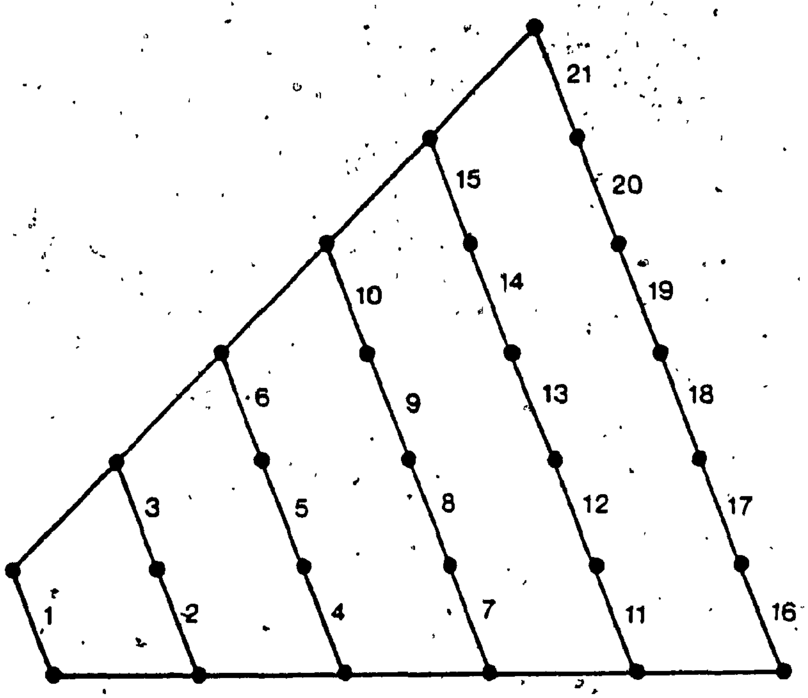


FIGURE 2.3.8 NUMBERING SCHEME FOR THE RING MEMBERS OF A TYPICAL RING TRUSS.

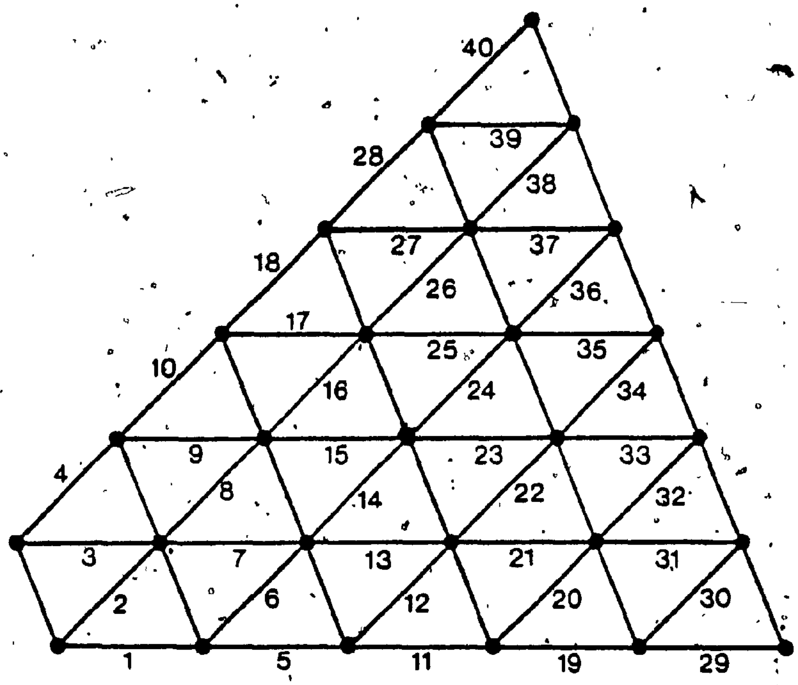


FIGURE 2.3.9 NUMBERING SEQUENCE OF THE DIAGONAL MEMBERS FOR A TYPICAL RING TRUSS.

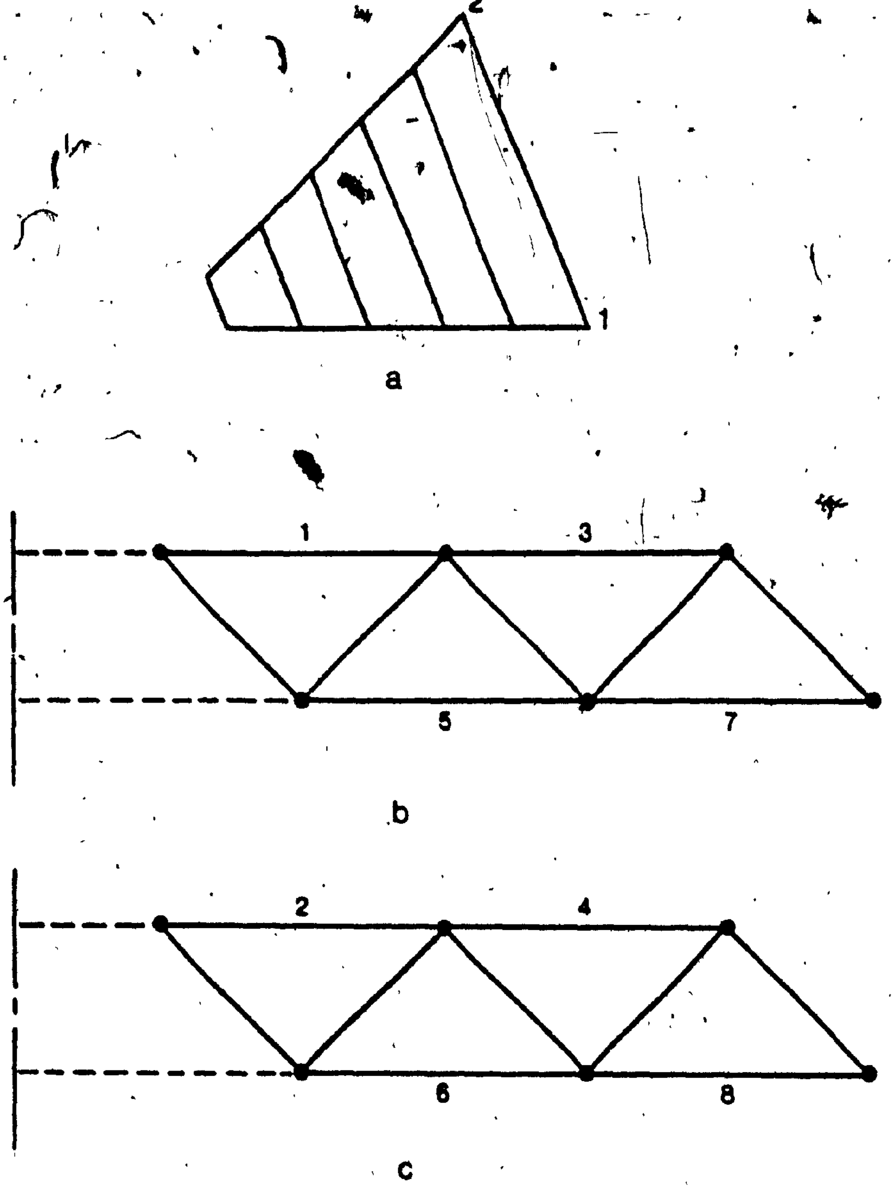


FIGURE 2.3.10 NUMBERING SEQUENCE OF THE STIFFENERS IN A TYPICAL RING TRUSS.
(a) TYPICAL SUBSTRUCTURE WITH ITS SIDE BOUNDARIES NUMBERED 1 AND 2.
(b) THE STIFFENERS ALONG EDGE 1 ARE NUMBERED ACCORDING TO THE SEQUENCE SHOWN.
(c) THE STIFFENERS ALONG EDGE 2 ARE NUMBERED ACCORDING TO THE SEQUENCE SHOWN.

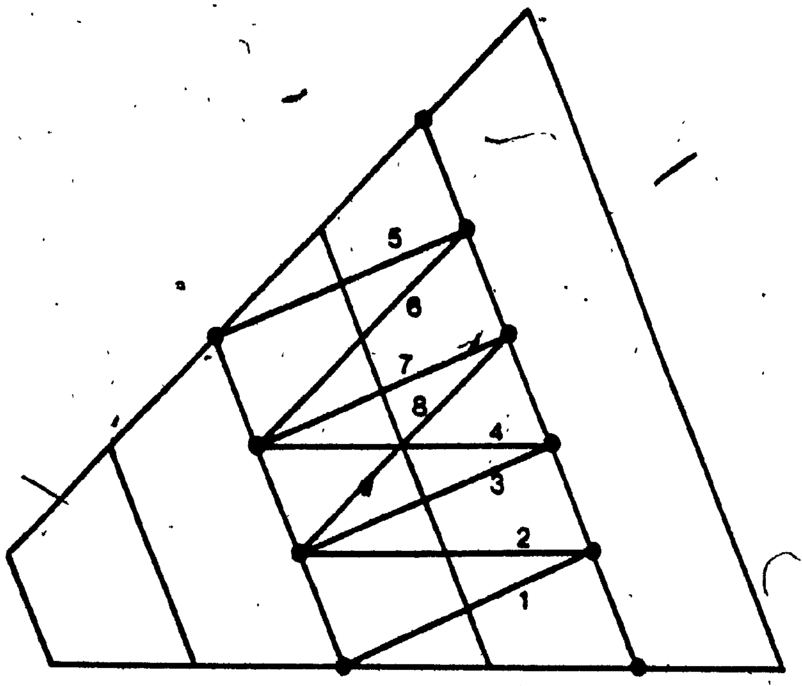


FIGURE 2.3.11 NUMBERING SEQUENCE FOR THE MEMBERS IN THE UPPER BRACING TRUSS.

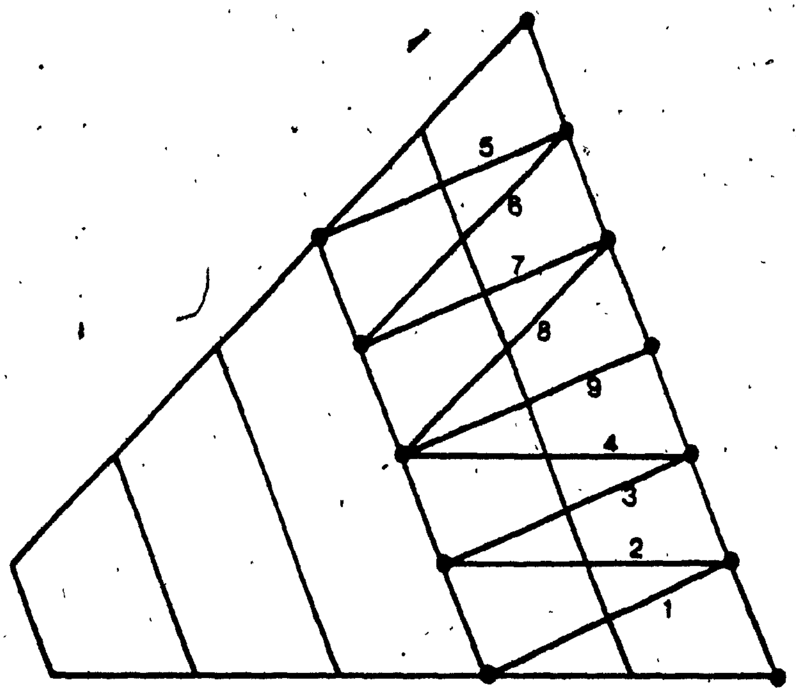


FIGURE 2.3.12 NUMBERING SEQUENCE FOR THE MEMBERS IN THE LOWER BRACING TRUSS.

numbered. For stiffeners between the same pair of rings, the stiffener between the odd numbered boundary nodes is numbered first, and the stiffener between the even numbered boundary nodes is numbered second. The stiffeners between the first and third rings are numbered first, see Fig. 2.3.10. Once all the stiffeners in the upper surface have been numbered the next pair of stiffeners to be numbered are those between the second and fourth rings. The member numbers for the stiffeners range between (1.5*NRINGS^{2}+1.5*NRINGS-1) and (1.5*NRINGS^{2}+3.5*NRINGS-6).

The next group of members to be numbered are the upper bracing truss members. The members are numbered according to the sequence shown in Fig. 2.3.11. The member numbers vary between (1.5*NRINGS^{2}+3.5*NRINGS-5) and (1.5*NRINGS^{2}+5.5*NRINGS-10). Once all the upper bracing truss members have been numbered the lower bracing truss members are numbered. The lower bracing truss members are numbered according to the sequence shown in Fig. 2.3.12. The member numbers range between (1.5*NRINGS^{2}+5.5*NRINGS-9) and (1.5*NRINGS^{2}+7.5*NRINGS-13).

Conventional programs may require the user to enter the DOF numbering, or the program may generate its own set of DOF numbers. If the program generates its own DOF numbers then it should also optimize the DOF numbering to minimize the amount of storage required to store the stiffness matrix. The optimization procedure can require a great deal of computation time. If the user enters the DOF numbers then he should make sure that the DOF numbers are optimized to save on storage space. The determination of the optimal set of DOF numbers can take a great deal of time. In addition, entering all the DOF numbers, which even for a small ring truss that has eight rings and ten substructures requires that 1320 numbers be entered for the substructure DOFS alone, and another 240 numbers for the structure DOFS, requires a lot of time.

The ring truss program generates the optimal set of DOF numbers the first time, so that there is no need to perform lengthy calculations to obtain the optimal DOF numbering scheme. This is possible because the form of the ring truss is always the same, so that once the optimal numbering scheme has been determined once it can be used for all ring trusses. At any particular node, the DOF in the x direction is numbered first, the DOF in the y direction is numbered second, and finally the DOF in the z direction is numbered.

The structure and substructure DOFS are generated by the **DOFS** subroutine. Before the DOF numbers can be generated it is necessary to determine the support conditions for the ring truss. Each column can supply either a vertical reaction only, or lateral reactions in addition to a vertical reaction. The user is simply asked, for each column, whether the column supplies lateral restraint. If the column supplies lateral restraint, then all three DOFS at that node are set to zero. If the column supplies only vertical support then the first two DOF numbers at that node are non-zero, and the third DOF number at that node is zero. The structure DOFS are generated so that the band width of the structure stiffness matrix is minimized. The structure DOFS are generated according to the scheme shown in Fig. 2.3.13, this produces the optimal set of DOF numbers. The maximum band width for the optimal numbering scheme is (9*NRINGS).

The substructure DOFS are generated according to the node numbering sequence. Since the boundary nodes were numbered first, they have the lowest DOF numbers. The interior nodes are then given DOF numbers.

The **DOFS** subroutine, as well as calculating the structure and substructure DOFS, calculates the number of structure displacements, NEQ; the number of displacements in each substructure, NEQS; and the number of boundary displacements in each substructure. The largest of the NEQS values, NEQSMX, is determined. The IDOF and ISDOF arrays, which are three-dimensional, are written onto the output file by intermediary use of the ISOF and IDSOF arrays. The ISOF and IDSOF arrays, which are two-dimensional arrays,

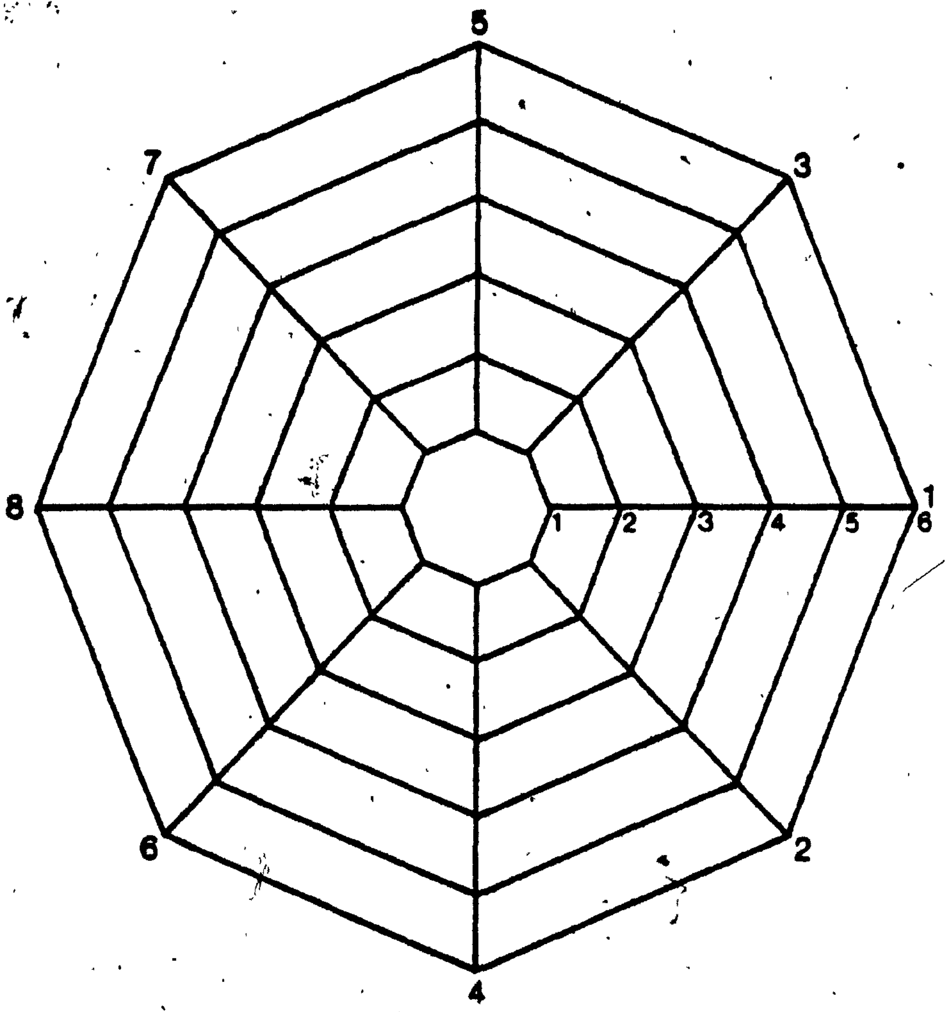


FIGURE 2.3.13 THE BOUNDARIES OF THE SUBSTRUCTURES ARE NUMBERED IN THE SEQUENCE SHOWN. ALONG EACH BOUNDARY THE PROGRESSION GOES FROM THE CENTER TO THE PERIMETER.

are necessary because the RPRINT and IPRINT subroutines are for printing two-dimensional arrays.

2.4 LOADING ALGORITHMS

The only type of loading that the ring truss can be analyzed for in the present version of the program is uniform vertical distributed loads that are applied to the upper surface of the space truss. The loads must be uniform within each substructure, but can vary from substructure to substructure. The program could analyze the truss for different types of loads, if subroutines to calculate the load vectors for the load types are added to the program. The sign convention is upward loads are positive.

The loads are considered to be applied to the joints of the truss. This is because in reality, the loads would be applied to a roof deck or floor slab. The slabs would in turn be supported by purlins or floor beams. The purlins or floor beams would be supported by the truss in such a way that only the joints of the truss would be in contact with the beams. This type of structural system was chosen to avoid bending of the truss members. The load, which is applied at each joint, is equal to the tributary area around the joint multiplied by the load intensity for that substructure.

The program calculates the load vectors using three subprograms, **LODVEC**, **LOAD**, and **XLOAD**. The **LODVEC** subroutine starts by transferring control to the **LOAD** subroutine. The **LOAD** subroutine calculates the coordinates of the vertices for the tributary area of each loaded joint.

To calculate the coordinates of the tributary area for any loaded joint the geometry shown in Fig. 2.4.1 is used. The line between two adjacent loaded nodes in the same ring is bisected. The loaded node is X and the above procedure yields points A and B, on either side of X. If the loaded node, X, is a boundary node, then, as shown in Fig. 2.4.2 point A is taken as the loaded node. Using similar tiangles, the coordinates of A', A", B', and B" are calculated. The four points A', A", B', and B" are the vertices of the trapezoidal tributary areas. The trapezoidal tributary areas for a typical ring truss are as shown in Fig. 2.4.3.

To calculate the area of a trapezoidal tributary area the **XLOAD** function is used. The **XLOAD** function simply calculates the area of a trapezoid given the coordinates of its four vertices, see Fig. 2.4.4. The area of the trapezoid is given by:

$$H*(BD + AC)/2 \qquad 2.4.1$$

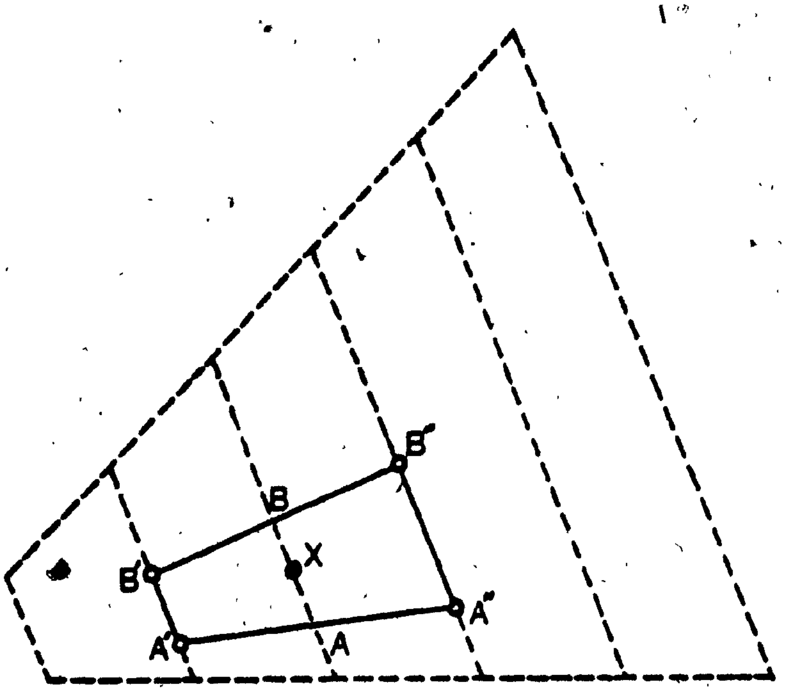


FIGURE 2.4.1 THE BOUNDARIES OF A TYPICAL TRIBUTARY AREA FOR AN INTERIOR NODE, MARKED X. POINTS A', A", B', AND B" ARE THE VERTICES OF THE AREA.

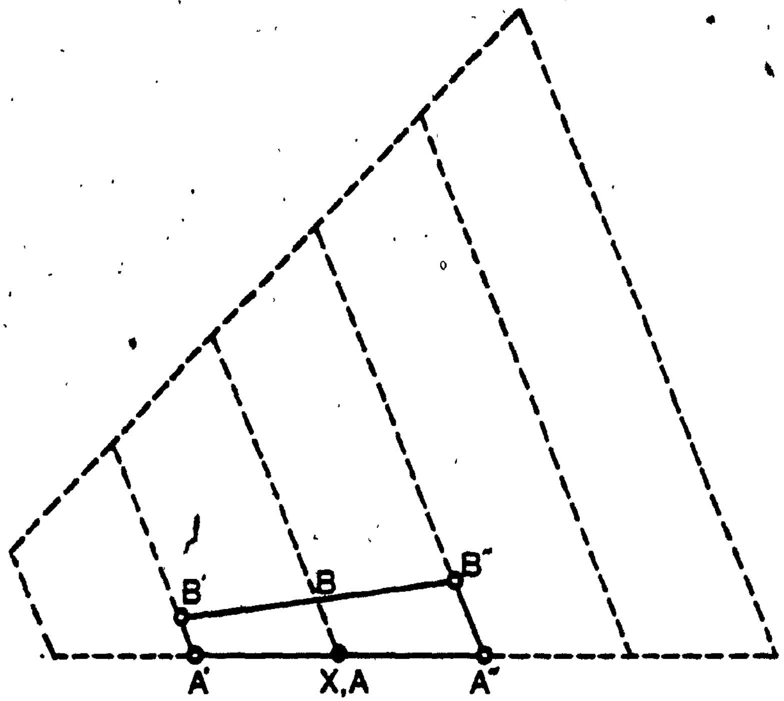


FIGURE 2.4.2 THE BOUNDARIES OF A TYPICAL TRIBUTARY AREA FOR A BOUNDARY NODE, MARKED X. POINTS A', A", B', AND B" ARE THE VERTICES OF THE AREA.

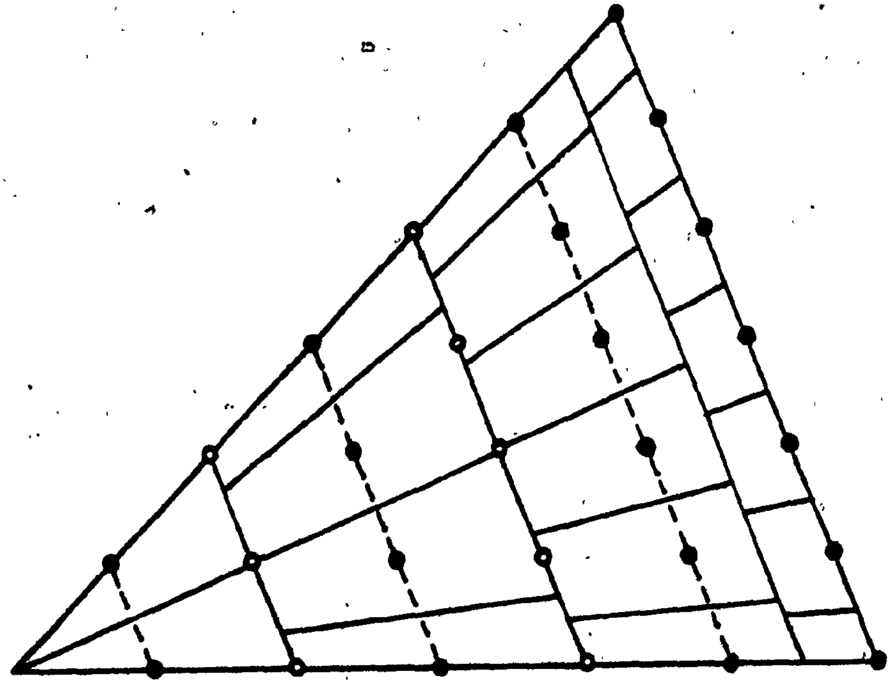


FIGURE 2.4.3 THE TRIBUTARY LOAD AREAS FOR A TYPICAL SUBSTRUCTURE ARE MARKED BY THE SOLID BLACK LINES, AND THE LOADED NODES ARE SOLID BLACK POINTS.

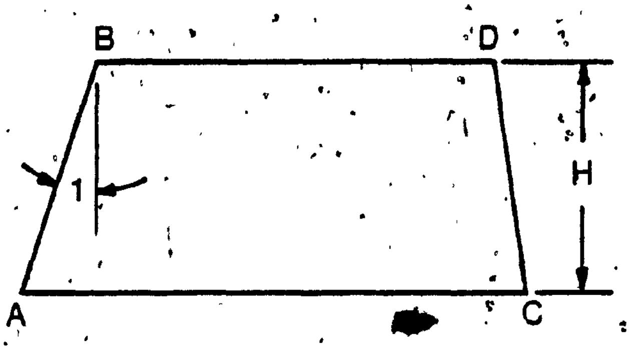


FIGURE 2.4.4 GEOMETRY OF A TRAPEZOIDAL LOAD AREA.
1- ANGLE THETA.

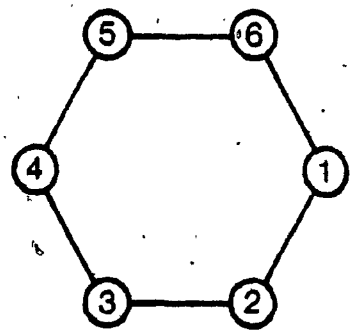


FIGURE 2.4.5 CIRCULAR ARRANGEMENT OF A LOAD CODE.

In the XLOAD function, the H is found with the following equation:

$$H = AB*SIN(THETA) \qquad 2.4.2$$

And the angle THETA is calculated using the following equation:

$$THETA = COS^{-1}\left[\frac{\overrightarrow{AB}\cdot\overrightarrow{BD}}{|AB| * |BD|}\right] \qquad 2.4.3$$

Once all the load areas have been calculated, control is transferred back to the **LODVEC** subroutine. The user is asked whether each substructure or sector is loaded or not. For those sectors that are loaded the user is asked to enter the load intensity. The substructure load vectors, QS, are then calculated for each substructure. The boundary loads for each substructure are then assembled into the structure load vector. The substructure load vectors are then modified so that there are only zeroes, for all the boundary DOFS in every substructure load vector.

Ring truss structures can be loaded in many different ways. To design a ring truss the member forces must be known for different loading conditions. The determination of all the loading cases for a truss that is only loaded with vertical distributed loads, which are uniform within each substructure, can be time consuming since many different loading conditions are possible. The problem with determining these loading conditions is identifying all the different possibilities, and making sure that the same loading condition is not repeated. The first criterion is important because the structure must be designed for the set of worst member forces. The set of worst member forces will be due to several different loading conditions. The second criterion is important because if the structure is analyzed for the same loading condition more than once valuable computer and human resources will be wasted. In order to determine all the different loading cases for a ring truss that has one or more of its substructures loaded with a uniform vertical distributed load an algorithm was developed.

The algorithm for the determination of the different loading cases is not part of the ring truss program. The algorithm simply generates a code for each loading case which is possible. To make sure the same loading code is not used more than once, an algorithm which recognizes the same pattern of numbers in different loading codes is used. If several codes are identical only one is kept as a valid loading code.

The first set of loading codes considers all the loading cases possible with any one substructure loaded. The next set of loading codes considers all the loading cases possible with any two substructures loaded. The above procedure is repeated until the set of loading codes that considers any (NCOL/2) loaded substructures is obtained. The subsequent loading codes need not be generated since they can be determined with the first (NCOL/2) sets of loading codes. The (NCOL/2+1)-th set of loading codes can be considered a negative of the (NCOL/2-1)-th set of loading codes. That is, those substructures which were loaded in the (NCOL/2-1)-th set of loading codes are not loaded in the (NCOL/2+1)-th set of loading codes. The same is true for all pairs of (NCOL/2-I)-th and (NCOL/2+I)-th sets of loading codes. Taking advantage of this symmetry saves on computation time.

The rules for generating the set of load codes for I loaded sectors are as follows. The number of digits in the load codes is I. The largest value for any digit in the load code is (NCOL-I) and the smallest value is zero. The sum of all the digits in each load code must be equal to (NCOL-I).

The rules for identifying identical load codes within the same set of load codes is as follows. For I loaded sectors the number of digits in the strings to be compared is (I-1). If any (I-1) digit string in a load code is the same as any (I-1) digit string in any other load code then the load codes being compared are identical and one is discarded. The (I-1) digit strings can be compared either backwards or forwards. The load codes can be considered to be circular, as shown in Fig. 2.4.5. So that, for example, a valid (I-1) digit string can be 4-5-6-1-2.

Once all the different load codes have been identified, they must be translated into loading conditions. This can be done using the following procedure. The first sector is always taken to be loaded. The first digit of the load code is added to the first sector and one is added, the result of this indicates which is the second loaded sector. The next digit of the load code is added to the number of the previous loaded sector and one is added, the result is the number of the next loaded sector. The procedure is repeated until the (I-1)-th digit of the load code has been used. The I-th digit of the load code is not used to calculate a loaded sector.

The load codes for an eight sector truss are shown in Table 2.4.1. The codes with an asterix (*) beside them are identical to other load codes in the same set. The loading cases which correspond to the different load codes are shown in the third column of Table 2.4.1.

The physical meaning of the load codes is that each digit of the load code represents the number of unloaded

TABLE 2.4.1 LOAD CODES FOR AN EIGHT COLUMN TRUSS

NUMBER OF LOADED SUBSTRUCTURES	LOAD CODES	LOADED SECTORS
1	7	1
2	6-0	1,8
	5-1	1,7
	4-2	1,6
	3-3	1,5
	2-4 *	
	1-5 *	
	0-6 *	
3	5-0-0	1,7,8
	4-1-0	1,6,8
	3-2-0	1,5,8
	2-3-0 *	
	1-4-0 *	
	3-1-1	1,5,7
	3-0-2 *	
	2-2-1	1,4,7
	2-1-2 *	
	2-0-3 *	
	1-3-1 *	
4	4-0-0-0	1,6,7,8
	3-1-0-0	1,5,7,8
	2-2-0-0	1,4,7,8
	1-3-0-0 *	
	3-0-1-0	1,5,6,8
	3-0-0-1 *	
	2-0-2-0	1,4,5,8
	2-0-0-2 *	
	2-1-1-0	1,4,6,8
	2-1-0-1	1,4,6,7
	2-0-1-1 *	
	1-2-1-0 *	
	1-2-0-1 *	
	1-1-1-1	1,3,5,7
5		2,3,4,5,6
		2,3,4,5,7
		2,3,4,6,7
		2,3,4,6,8
		2,3,5,6,8
6		2,3,4,5,6,7
		2,3,4,5,6,8
		2,3,4,5,7,8
		2,3,4,6,7,8
7		2,3,4,5,6,7,8
8		1,2,3,4,5,6,7,8

sectors between loaded sectors of a ring truss. The first digit of the load code is the number of unloaded sectors between the first and second loaded sectors. The second digit of the load code is the number of unloaded sectors between the second and third loaded sectors. The I-th digit of the load code is the number of unloaded sectors between the I-th and (I+1)-th loaded sectors of the ring truss. The last digit of the load code is the number of unloaded sectors between the last loaded sector and the first loaded sector.

The different loading conditions could be identified without the use of load codes. The loading conditions could be identified graphically, but since many loading conditions exist, even for relatively small ring trusses, the chances of omitting a loading case or taking the same loading case twice are not negligible.

2.5 STRUCTURE STIFFNESS AND SOLUTION ALGORITHMS

A typical space truss member has three DOFS at each of its ends, for a total of six DOFS per member, see Fig. 2.5.1. The member stiffness matrix is calculated using the following equation:

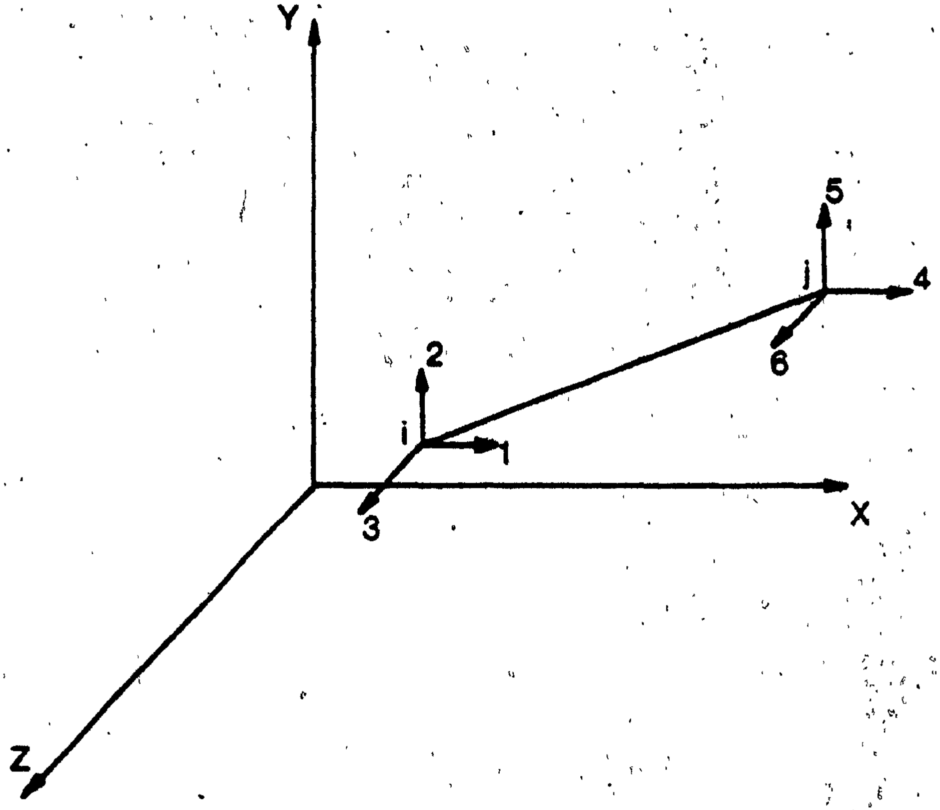


FIGURE 2.5.1 A SPACE TRUSS MEMBER IN SPACE. NOTE THE THREE DOFS PER NODE, 1-2-3 AT NODE i, AND 4-5-6 AT NODE j.

$$S_k = \left[b\right] \frac{A_k E_k}{L_k} \left[b\right]^T \qquad 2.5.1$$

where $\left[b\right]$ is:

$$\begin{bmatrix} -(X_j \ -X_i \ )/L \\ -(Y_j \ -Y_i \ )/L \\ -(Z_j \ -Z_i \ )/L \\ (X_j \ -X_i \ )/L \\ (Y_j \ -Y_i \ )/L \\ (Z_j \ -Z_i \ )/L \end{bmatrix}$$

A_k	is the member area of the k-th member.
E_k	is the Modulus of Elasticity for the k-th member.
L_k	is the length of the k-th member.
X_i , Y_i , Z_i	are the x,y,z coordinates of end i of the k-th member.
X_j , Y_j , Z_j	are the x,y,z coordinates of end j of the k-th member.

The member stiffness matrices are calculated in the ring truss program in the **MSTIFF** subroutine. In addition to generating the member stiffness matrices, the **MSTIFF** subroutine also calls the **VOLUME** subroutine, which calculates the material consumption for the truss. Each substructure stiffness matrix is formed by assembling the member stiffness matrices for all the members in the substructure. The substructure stiffness matrices are assembled in the **STIFF** subroutine.

The assembly procedure is performed by the intermediary use of a labelling vector. The labelling vector contains the six substructure DOFS which correspond to the two end nodes of the member being assembled into the substructure stiffness matrix, SUBST. The three DOFS which correspond to node-i of the member are placed in the first three positions of the labelling vector, and the three DOFS which correspond to node-j of the member are placed in the remaining three positions.

The substructure stiffness equation is:

$$\left\{\begin{array}{c} Q_b \\ \hdashline Q_i \end{array}\right\} = \left[\begin{array}{c:c} S_{bb} & S_{bi} \\ \hdashline S_{ib} & S_{ii} \end{array}\right] \left\{\begin{array}{c} D_b \\ \hdashline D_i \end{array}\right\} + \left\{\begin{array}{c} Q_{ob} \\ \hdashline Q_{oi} \end{array}\right\} \tag{2.5.2}$$

Equation 2.5.2 can be expressed in the following form:

$$\left\{\begin{array}{c} Q_b \\ \hdashline 0 \end{array}\right\} = \left[\begin{array}{c:c} S_{bb} & S_{bi} \\ \hdashline S_{ib} & S_{ii} \end{array}\right] \left\{\begin{array}{c} D_b \\ \hdashline D_i \end{array}\right\} + \left\{\begin{array}{c} Q_{ob} \\ \hdashline Q_{oi} - Q_i \end{array}\right\} \qquad 2.5.3$$

In order to obtain a set of stiffness equations that contain only boundary displacements the substructure stiffness matrices must be statically condensed. The **STACON** subroutine statically condenses a substructure stiffness matrix along with its load vector. When equation 2.5.3 is statically condensed the following matrix equation is produced:

$$\left\{\begin{array}{c} Q_b \\ \hdashline 0 \end{array}\right\} = \left[\begin{array}{c:c} S^r_{bb} & 0 \\ \hdashline S^r_{ib} & S^r_{ii} \end{array}\right] \left\{\begin{array}{c} D_b \\ \hdashline D_i \end{array}\right\} + \left\{\begin{array}{c} Q^r_{ob} \\ \hdashline (Q_{oi} - Q_i)^r \end{array}\right\} \qquad 2.5.4$$

To obtain the structure stiffness matrix the S^r_{bb} submatrices from each substructure are assembled. The structure load vector is formed by assembling the Q^r_{ob} subvectors from each substructure. The structure stiffness equation is:

$$\{Q\} = [S]\ \{D\} \qquad 2.5.5$$

The **ASSEM** subroutine performs the assembly of the structure stiffness matrix and load vector. To perform the assembly procedure two labelling vectors are used. One of the labelling vectors contains the substructure DOFS which correspond to each boundary node. The other labelling vector contains the structure DOFS which correspond to each boundary node.

Equation 2.5.5 can be solved for the structure displacements D using standard techniques to solve simultaneous linear equations. In the ring truss program Gauss Elimination is used. Since the structure stiffness matrix is symmetric and banded, only part of the matrix need be stored. The upper half-band is stored, with the diagonal elements being stored in the first column of the rectangular matrix, see Fig. 2.5.2. This storage technique saves on storage space and on computation time. A special subroutine, called SOLVE, which performs Gauss Elimination on a matrix stored in rectangular form is used. A companion subroutine, called BACSUB, performs back-substitution on a

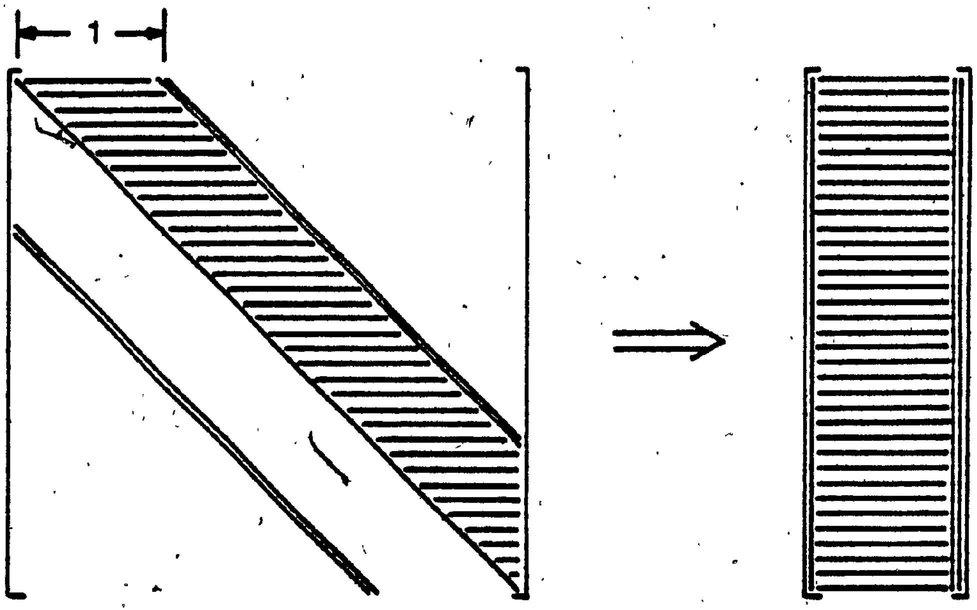


FIGURE 2.5.2 SQUARE STORAGE VERSUS RECTANGULAR STORAGE OF THE STRUCTURE STIFFNESS MATRIX.
1- MAXIMUM BAND WIDTH.

matrix which is stored in rectangular form [2,3].

Once the structure displacements have been calculated the program determines the boundary displacements in each substructure. The boundary displacements for each substructure correspond to the structure displacements at the boundary nodes of each substructure. The program merely takes the structure displacement that corresponds to a boundary node and equates the substructure displacement, that also corresponds to that node, to it. The subroutine which does this is called EXTRCT.

Once the boundary displacement vector for each substructure have been extracted from the structure displacement vector the interior displacements can be calculated. The matrix equation which must be solved is:

$$\left\{\begin{array}{c} -Q^r_{ob} \\ \hdashline (Q_i - Q_{oi})^r \end{array}\right\} = \left[\begin{array}{c:c} S^r_{ib} & S^r_{ii} \end{array}\right] \left\{\begin{array}{c} D_b \\ \hdashline D_i \end{array}\right\} \tag{2.5.6}$$

Equation 2.5.6 must be solved for each substructure. To solve for the interior displacements forward substitution can be used since S^r_{ii} is a lower diagonal matrix, that is, all the elements above the diagonal are zero. The values of D_b are substituted into Equation 2.5.6. The

FORSUB subroutine performs forward substitution. In the ring truss program the substructure stiffness matrices, as well as the statically condensed stiffness matrices, are regenerated in order to perform the forward substitution in Equation 2.5.6.

Once all the interior displacements have been calculated the member forces can be determined. The member force for any member can be calculated by multiplying the stiffness of the member by the component of the relative displacement between the two end nodes of the member which is parallel to the member's axis. The displacement vector is defined as:

$$\vec{\Delta} = \left[D_4 - D_1 \, , \, D_5 - D_2 \, , \, D_6 - D_3 \right] \qquad 2.5.7$$

The vector along the axis of the member is defined as:

$$\vec{AC} = \left[X_j - X_i \, , \, Y_j - Y_i \, , \, Z_j - Z_i \right] \qquad 2.5.8$$

The component of the displacement vector along the axis of the member can be found by using the following equation:

$$\delta = \frac{\vec{\Delta} \cdot \vec{AC}}{|AC|} = |\Delta| \cos \theta \qquad 2.5.9$$

where, θ is the angle between the displacement vector and the axis of the member.

The member force in member k is given by:

$$F_k = \frac{A_k E_k}{L_k} \delta_k \qquad 2.5.10$$

In the ring truss program the sign convention for the member forces is tension is positive.

The x, y, and z components of the member force can be calculated using the following equation:

$$F = \left[b\right] F_k \qquad 2.5.11$$

where, $\left[b\right]$ is the same as in Equation 2.5.1.

The first three elements of the member force vector are the x, y, and z components respectively at node-i of the member. The remaining three elements of the member force vector are the x, y, and z components at node-j of the member.

CHAPTER 3

VARIATION OF THE MATERIAL CONSUMPTION WITH THE VARIATION OF THE RING TRUSS GEOMETRY

3.1 OPTIMIZATION PROCEDURE

The optimal geometry for ring type space trusses must be determined so the trusses can be built for the least possible cost. The ring type truss is a new type of space truss, and therefore extensive analysis must be performed to determine the optimal geometry. The optimal geometry of the ring truss is not always the same; that is, the optimal ring truss geometry is dependent upon the shape of the space to be enclosed, the loads which the truss must support, and the support conditions of the truss.

The optimization procedure used here is very simple. The objective function is evaluated at several points. The conditions which yield the lowest objective function value are the optimal conditions. The objective function used for the optimization of the ring truss is the volume of the material required to form the truss per unit area of the truss. In order to determine the material volume, the length and required area of each member must be determined.

The lengths of the members are solely dependent on the truss geometry, whereas the member areas are dependent on the forces which the members are subjected to. To determine the member forces the RING TRUSS program described in Chapter 2 is used.

The ring trusses for which the optimal geometry is to be determined have regular polygonal plans. The independent variables upon which the ring truss geometry is dependent are the number of rings, NRINGS; the number of columns, NCOL; the ratio between the distance from the center of the truss and the first ring, RIN, and the depth of the truss, DEPTH, RIN/DEPTH; the vertical angle ALPHAT; and the vertical angle ALPHAC. In general, for a given structure, the number of columns, NCOL, is fixed since the shape of the space to be enclosed dictates the shape of the truss, and therefore the number of columns. The depth of the truss is dependent on NRINGS, ALPHAT, ALPHAC, and RIN/DEPTH for a given clear span. The span to depth ratio can be determined using the following expression:

$$2*RIN/DEPTH + NRINGS*(COT(ALPHAT)+COT(ALPHAC)) \qquad 3.1.1$$

The clear span of the truss is predetermined for any particular structure. To determine the optimal value of any one of the independent variables, the other independent variables are kept constant while only the variable being optimized for is allowed to vary.

The material consumption per unit area of the truss is used as the objective function. In order to evaluate the objective function the length and required area of each member must be determined. The area required for a member is dependent on the force which it is subjected to, and on the yield stress which the material can sustain. Since the ring truss is statically indeterminate, the member forces, are dependent on both the loads which are applied to the structure, and the stiffness of the structure. The structure stiffness is dependent on the geometry of the structure, and the member areas. This implies that to determine the member forces and areas, for a structure subjected to a set of loads, several iterations are required.

The forces are calculated for a set of member areas to obtain an initial estimate of the member forces. The member areas are then adjusted so that the area of any particular member is proportional to the force which the member was subjected to in the initial set of member forces. The next iteration uses member areas which are proportional to the set of member forces in the previous iteration. The procedure is continued until the sets of member forces obtained from two subsequent iterations are insignificantly different.

Instead of actually calculating the material consumption per unit area the Specific Material Consumption, SMC, is determined. The SMC is simply the summation of all the required member areas multiplied by the appropriate member lengths, divided by the area of the truss. The required member area for any member is the member force divided by an allowable stress. The allowable stress is taken as unity for the optimization of the ring truss geometry. The specific material consumption for the ring truss is given by:

$$SMC = \frac{1}{A} \sum_{i=1}^{n} |F_i| \, L_i \qquad 3.1.2$$

where, SMC is the specific material consumption.
F_i is the force in the i-th member.
L_i is the length of the i-th member.
A is the area enclosed by the truss.
n is the number of members in the truss.

The set of forces for which the ring truss must be designed is not only due to one loading condition, but is due to many loading conditions. The truss must be designed for the set of worst forces due to all the possible loading conditions. For the optimization of the ring truss geometry only vertical uniformly distributed loads are considered.

The procedure used to evaluate the specific material consumption for a particular truss geometry is to calculate the member forces for each loading condition. The forces for all the loading conditions are then reduced to one set of worst forces. The set of worst forces is used to calculate the specific material consumption using Equation 3.1.2.

3.2 VARIATION OF MATERIAL CONSUMPTION WITH ALPHAT AND ALPHAC

The optimal values of ALPHAT and ALPHAC were determined for ring trusses with four columns and eight rings. The columns all supplied both lateral and vertical support for all the ring trusses. The RIN to DEPTH ratio was 1:2 for all the trusses. Because the depth, the number of rings, and the RIN/DEPTH ratio were all kept constant and only the angles ALPHAT and ALPHAC were varied, the span of the ring truss changes. To compare ring trusses with different spans the specific material consumption normalized by the span of the truss are compared.

To get a rough idea of what the optimal values of ALPHAT and ALPHAC are for an eight ring truss, the angles were both varied independently between fifty-five and eighty-five degrees. The values of the specific material consumption normalized by the span tabulated in Table 3.2.1 and plotted in Fig. 3.2.1 were calculated with all the member areas equal to unity, and for only one loading case. The loading case used had all the sectors loaded with an intensity of one. The optimal values of ALPHAT and ALPHAC are 68.4° and 69.6° respectively.

A more exact estimate of the optimal values of ALPHAT and ALPHAC for an eight ring, four column truss is based on all five possible loading cases. The five possible loading cases are one sector loaded, 1; two adjacent sectors loaded, 1 and 2; two non-adjacent sectors loaded, 1 and 3; three sectors loaded, 1, 2 and 3; and four sectors loaded, 1, 2, 3 and 4. The member areas are taken so they are proportional to the forces obtained when the areas were all one. The member areas were taken as shown in Table 3.2.2. The SMC/SPAN values obtained are tabulated in Table 3.2.3 and plotted in Fig. 3.2.2. The optimal values of ALPHAT and ALPHAC are 61.7° and 76.5° respectively.

The need to determine the correct member areas before the correct member forces can be calculated is a serious drawback. The sensitivity of the specific material consumption to the distribution of the member areas was investigated for two sets of member areas for an eight

TABLE 3.2.1 SPECIFIC MATERIAL CONSUMPTION VALUES FOR VARIOUS VALUES OF ALPHAT AND ALPHAC FOR AN EIGHT RING, FOUR COLUMN RING TRUSS WITH ALL THE SECTORS LOADED WITH AN INTENSITY OF ONE.

ALPHAT	ALPHAC	SMC	SMC/SPAN
55	55	217.372	1.781
	65	169.044	1.636
	75	136.214	1.558
	80	124.068	1.549
	85	113.835	1.559
65	55	174.045	1.685
	65	132.199	1.563
	75	105.495	1.535
	80	95.8844	1.561
	85	88.8653	1.637
75	55	142.776	1.633
	65	107.114	1.558
	75	85.077	1.609
	80	77.986	1.712
	85	73.9125	1.923
80	55	130.461	1.628
	65	97.2908	1.584
	75	77.4885	1.702
	80	71.8386	1.880
	85	69.3167	2.229
85	55	119.894	1.642
	65	89.0253	1.640
	75	71.4993	1.860
	80	67.1838	2.160
	85	66.5687	2.774

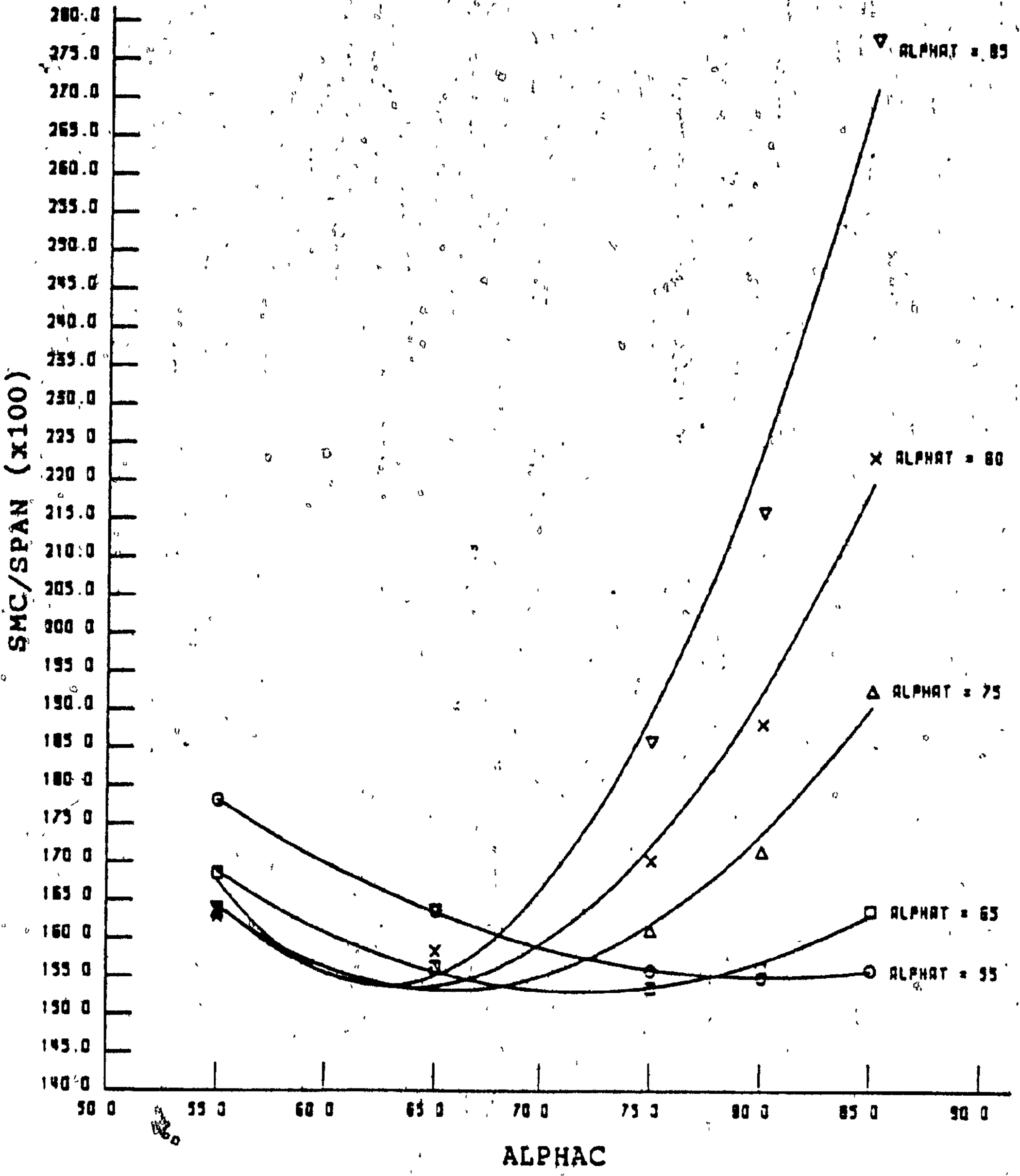


FIGURE 3.2.1 SMC/SPAN VERSUS ALPHAC FOR SEVERAL VALUES OF ALPHAT, FOR AN EIGHT RING FOUR COLUMN TRUSS, WITH ALL THE SECTORS LOADED.

TABLE 3.2.2 SET OF REFINED MEMBER AREAS

MEMBER GROUP	MEMBER AREA
RING 1	4.0
RING 2	3.5
RING 3	4.0
RING 4	2.0
RING 5	4.0
RING 6	1.5
RING 7	5.5
RING 8	3.5
DIAGONAL 1-2	8.0
DIAGONAL 2-3	10.0
DIAGONAL 3-4	13.0
DIAGONAL 4-5	10.0
DIAGONAL 5-6	11.0
DIAGONAL 6-7	16.0
DIAGONAL 7-8	15.0
STIFFENER 1-3	2.0
STIFFENER 3-5	3.0
STIFFENER 5-7	4.0
STIFFENER 2-4	2.0
STIFFENER 4-6	2.5
STIFFENER 6-8	3.5
UPPER BRACING TRUSS	2.0
LOWER BRACING TRUSS	2.0

TABLE 3.2.3 VARIATION OF SPECIFIC MATERIAL CONSUMPTION WITH ALPHAT AND ALPHAC FOR AN EIGHT RING FOUR COLUMN TRUSS TAKING INTO ACCOUNT ALL THE LOADING CASES.

ALPHAT	ALPHAC	SMC	SMC/SPAN
55	55	241.218	1.977
	65	185.652	1.797
	75	148.577	1.699
	80	134.514	1.679
	85	122.673	1.680
65	55	195.273	1.890
	65	145.839	1.724
	75	114.874	1.671
	80	103.840	1.691
	85	95.3755	1.756
75	55	163.418	1.869
	65	119.575	1.740
	75	93.2673	1.764
	80	84.8391	1.863
	85	79.3976	2.065

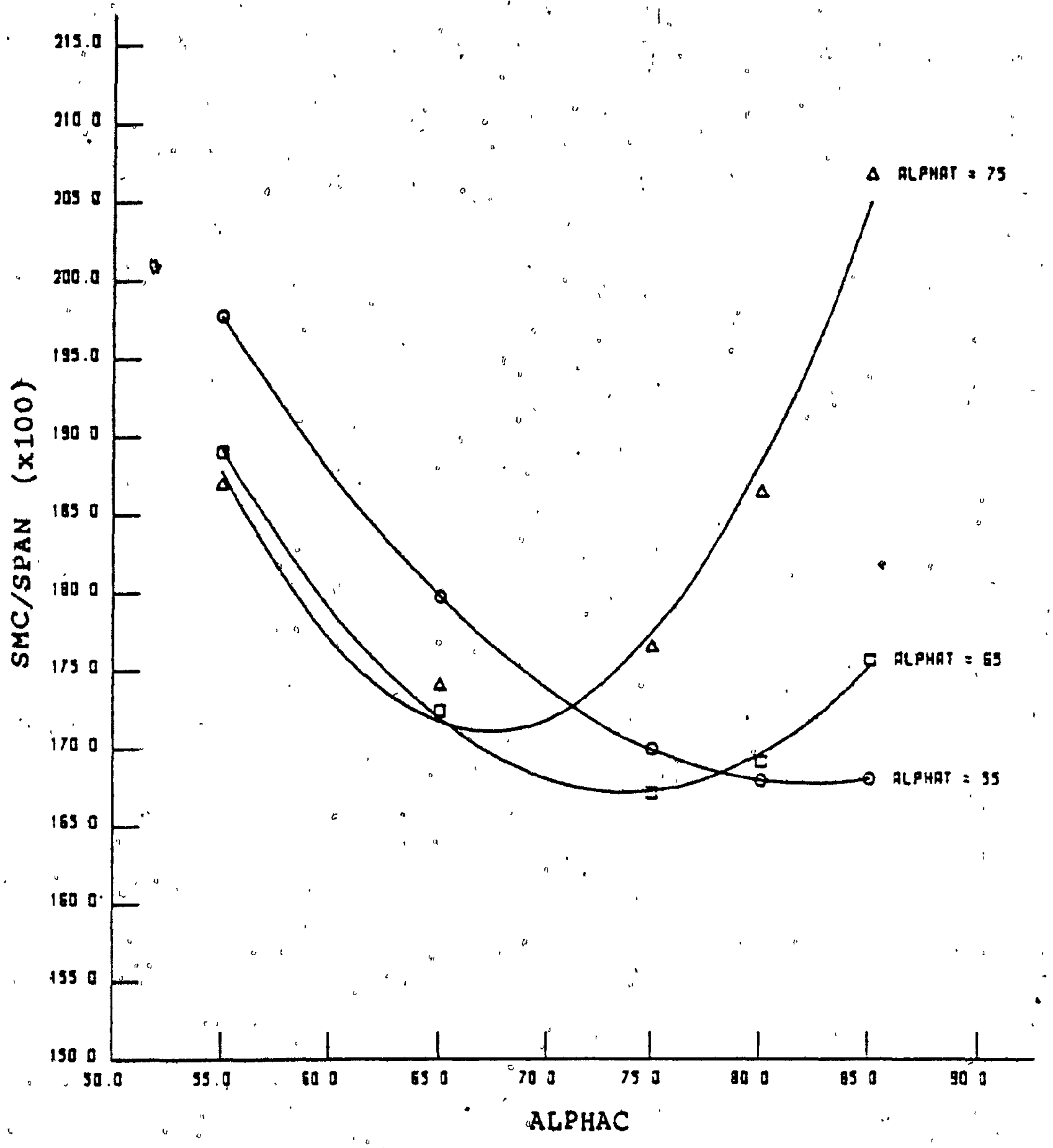


FIGURE 3.2.2 SMC/SPAN VERSUS ALPHAC FOR VARIOUS VALUES OF ALPHAT, FOR AN EIGHT RING FOUR COLUMN TRUSS, CONSIDERING ALL THE LOADING CASES.

ring, four column truss. One set of member areas had all the member areas equal to unity, and the second set of member areas are as shown in Table 3.2.2. Two sets of values of the specific material consumption were calculated, one for each set of member areas. The SMC values are based on the following four loading cases: sector 1; sectors 1 and 2; sectors 1, 2 and 3; and sectors 1, 2, 3 and 4 all loaded with an intensity of one. The specific material consumption values for both sets of member areas, as well as the difference between the two sets of SMC values, are compiled in Table 3.2.4. The average difference in SMC values is 0.36 percent. Considering the amount of computer time required to refine the choice of the member areas, and the very small effect the refinement of member areas has on the SMC, it is not practical to refine the choice of the member areas used to determine the member forces.

Once it was determined that the choice of the member areas has very little effect on the specific material comsumption the subsequent analyses were carried out with a single set of member areas. The member areas used for the rest of the analyses were all the member areas equal to unity. The specific material consumption's lack of sensitivity to the choice of member areas, justifies the simplification made for the entry of member area data in

TABLE 3.2.4 SPECIFIC MATERIAL CONSUMPTION FOR VARYING ALPHAT AND ALPHAC CONSIDERING VARYING AREAS AND FIXED AREAS

ALPHAT	ALPHAC	SMC VARYING AREAS	SMC FIXED AREAS	ABSOLUTE ERROR	PERCENT ERROR
85	85	71.6927	71.9445	0.2518	0.3506
	86	72.0169	72.2889	0.2720	0.3769
	87	72.6366	72.9706	0.3340	0.4588
86	85	71.3888	71.6180	0.2292	0.3205
	86	71.8499	72.1577	0.3078	0.4275
	87	72.7790	73.0599	0.2809	0.3852
87	85	71.1696	71.4326	0.2630	0.3689
	86	71.8674	72.1669	0.2995	0.4159
	87	73.2214	73.3322	0.1108	0.1512

the ring truss program.

To save on computation time it was decided to reduce the number of loading cases considered, if possible. For an eight ring, four column truss, instead of considering all the possible loading cases, only three loading cases were considered. The three loading cases considered were, all sectors loaded, half the truss loaded, and alternating sectors loaded. The member areas were taken as shown in Table 3.2.2. The SMC values, and the differences between the SMC values, for the two sets of loading cases are tabulated in Table 3.2.5. The average difference in SMC values for the two sets of loading cases is only 0.629 percent. The saving in computation time when three loading cases are used instead of five loading cases is forty percent. The variation of the specific material consumption with the variation of ALPHAT and ALPHAC considering only three loading cases is shown in Fig. 3.2.3. The optimal values of ALPHAT and ALPAHC are 61.9° and 76.2° respectively. The use of only three loading cases produced the same optimal values for both ALPHAT and ALPHAC.

TABLE 3.2.5 VARIATION OF SPECIFIC MATERIAL CONSUMPTION WITH VARYING ALPHAT AND ALPHAT. ERROR DUE TO ANALYSIS OF ONLY 3 LOADING CASES INSTEAD OF ALL THE LOADING CASES.

ALPHAT	ALPHAC	SMC ALL LOADING CASES	SMC THREE LOADING CASES	ABSOLUTE ERROR	PERCENT ERROR
55	55	241.218	239.528	1.690	0.701
	65	185.652	184.247	1.405	0.757
	75	148.577	147.536	1.041	0.701
	80	134.514	133.599	0.915	0.680
	85	122.673	121.908	0.765	0.628
65	55	195.273	193.843	1.430	0.732
	65	145.839	144.922	0.917	0.629
	75	114.874	114.117	0.757	0.659
	80	103.840	103.259	0.581	0.560
	85	95.3755	94.9568	0.419	0.439
75	55	163.418	162.211	1.207	0.739
	65	119.575	118.620	0.955	0.799
	75	93.2673	92.7881	0.479	0.514
	80	84.8391	84.4230	0.416	0.490
	85	79.3976	79.0708	0.327	0.412

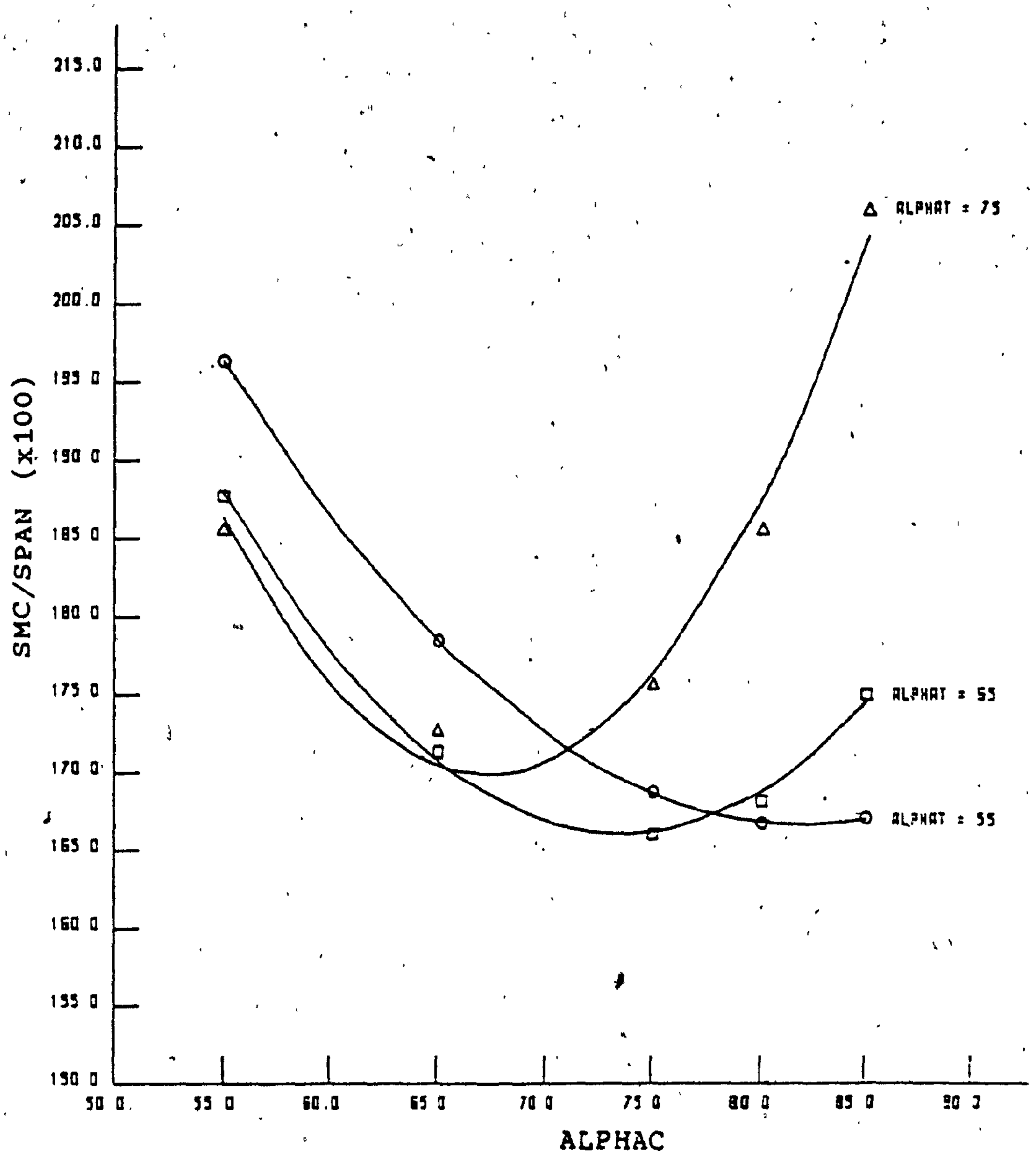


FIGURE 3.2.3 SMC/SPAN VERSUS ALPHAC FOR SEVERAL VALUES OF ALPHAT, FOR AN EIGHT RING FOUR COLUMN TRUSS, CONSIDERING THE THREE STANDARD LOAD CASES.

3.3 VARIATION OF MATERIAL CONSUMPTION WITH THE NUMBER OF PERIMETER COLUMNS

For some structures the shape of the space to be enclosed may be flexible, making it possible for the designers to choose the number of perimeter columns. In these cases the designers should choose the number of columns that will require the least amount of material to construct the truss. The effect the number of perimeter columns has on the specific material consumption was investigated. A parallel investigation was also carried out to determine the error due to using only the standard three loading cases instead of all the loading cases. Ring trusses with six rings and four, six, eight, and ten columns were analyzed. The member areas were all taken equal to one for all the trusses analyzed. The specific material consumption was calculated taking into consideration both the three standard loading cases and all the loading cases. The values of ALPHAT and ALPHAC were taken as 87° and 83° respectively, and the RIN to DEPTH ratio 1:2.

The material consumption of the ring truss rises as the number of perimeter columns is increased. The SMC values are compiled in Table 3.3.1 and shown in Fig. 3.3.1. The specific material consumption increases from 52.7985 for a four column truss, to 59.2705 for a ten column truss,

TABLE 3.3.1 EFFECT OF THE NUMBER OF COLUMNS ON THE SPECIFIC MATERIAL CONSUMPTION. ALL THE RING TRUSSES HAVE SIX RINGS. THE MEMBER AREAS ARE ALL EQUAL TO ONE. THE ERROR DUE TO CONSIDERING ONLY THE STANDARD THREE LOADING CASES IS ALSO INVESTIGATED.

NUMBER OF COLUMNS	SMC ALL LOAD CASES	SMC THREE LOAD CASES	ABSOLUTE ERROR	PERCENT ERROR
4	52.7985	52.6699	0.1286	0.244
6	54.5038	53.9649	0.5389	0.994
8	56.5854	56.2913	0.2941	0.521
10	59.2705	59.0413	0.2292	0.387

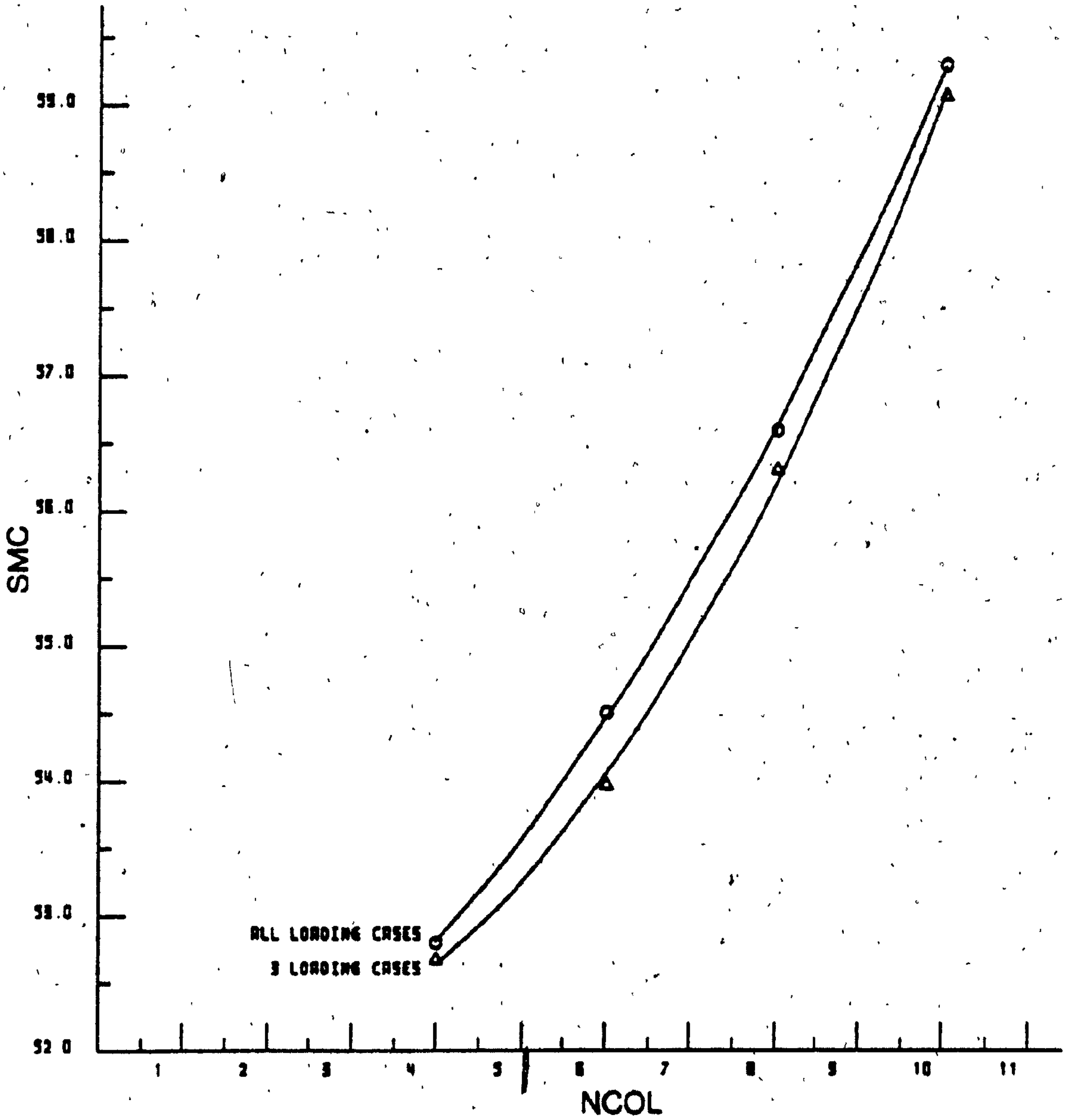


FIGURE 3.3.1 SPECIFIC MATERIAL CONSUMPTION VERSUS THE NUMBER OF COLUMNS, FOR A SIX RING TRUSS, CONSIDERING ALL THE LOADING CASES, AND THE STANDARD THREE LOADING CASES.

an increase of 11.6 percent.

The error caused by only considering the three standard loading cases as opposed to considering all the loading cases was very small. The error values are tabulated in Table 3.3.1. The average error is only 0.537 percent, and the maximum error is 0.994 percent for the six column truss. The number of possible loading cases for the four, six, eight, and ten column trusses are five, twelve, twenty-eight, and seventy-five respectively. The saving of computer time, which for a ten sided truss is 96.0 percent, is worth the slight loss in accuracy. This is especially true for trusses with many perimeter columns.

3.4 VARIATION OF MATERIAL CONSUMPTION WITH THE RIN/DEPTH RATIO

The effect of the RIN/DEPTH ratio on the material consumption was investigated. The RIN/DEPTH ratio was varied between 0.2 and 1.4 at intervals of 0.2. The analysis was performed on an eight ring, four column truss. The member areas were all taken equal to one, and the angles ALPHAT and ALPHAC were 89^o and 82^o respectively. The standard three loading cases were used to determine the specific material consumption.

The specific material consumption values are tabulated in Table 3.4.1. As shown in Fig. 3.4.1, the specific material consumption increases linearly as the RIN/DEPTH ratio is increased.

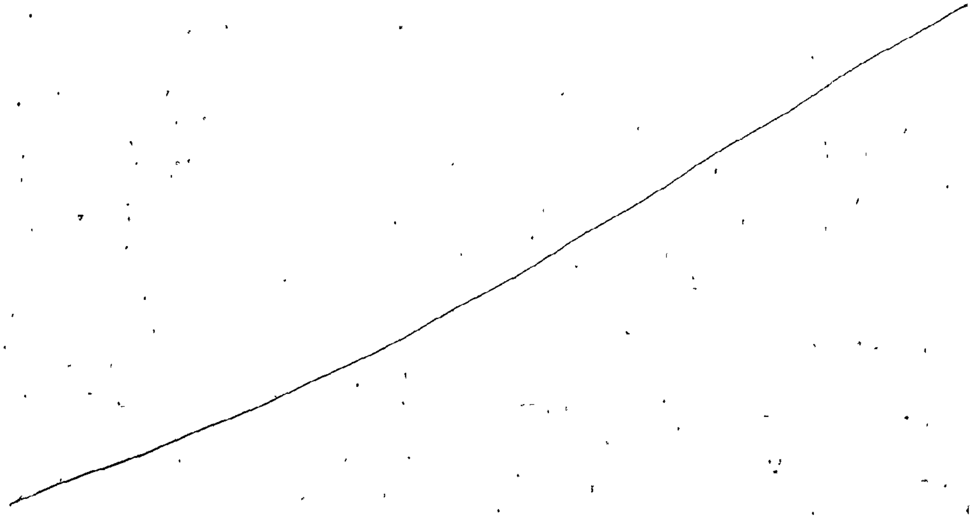
3.5 EFFECT OF THE NUMBER OF RINGS ON THE SPECIFIC MATERIAL CONSUMPTION

To determine the effect of the number of rings on the specific material consumption it was decided to analyze ring trusses with different numbers of rings. The data examined is for ring trusses that have four perimeter columns, and the number of rings varies between four and twelve. The trusses were all analyzed for the standard three loading cases. The member areas were all taken as one, except for the eight ring truss, whose member areas were as in Table 3.2.2 on page 116. The specific material consumption value was corrected for this difference by increasing its value by 0.36 percent. The optimal values of ALPHAT and ALPHAC were used for all the trusses. The specific material consumption values are tabulated in Table 3.5.1 and plotted in Fig. 3.5.1.

The specific material consumption increases linearly as the number of rings is increased. The implication is that as the span/depth ratio is increased the specific material consumption also increases; or, for a constant

TABLE 3.4.1 EFFECT OF RIN/DEPTH RATIO ON THE SPECIFIC MATERIAL CONSUMPTION FOR AN EIGHT RING, FOUR COLUMN RING TRUSS. THE STANDARD THREE LOADING CASES ARE CONSIDERED, AND ALL THE MEMBER AREAS ARE EQUAL TO ONE.

RIN/DEPTH	SMC
0.2	63.3089
0.4	68.1053
0.6	72.9669
0.8	77.9179
1.0	82.7358
1.2	87.3722
1.4	91.7633



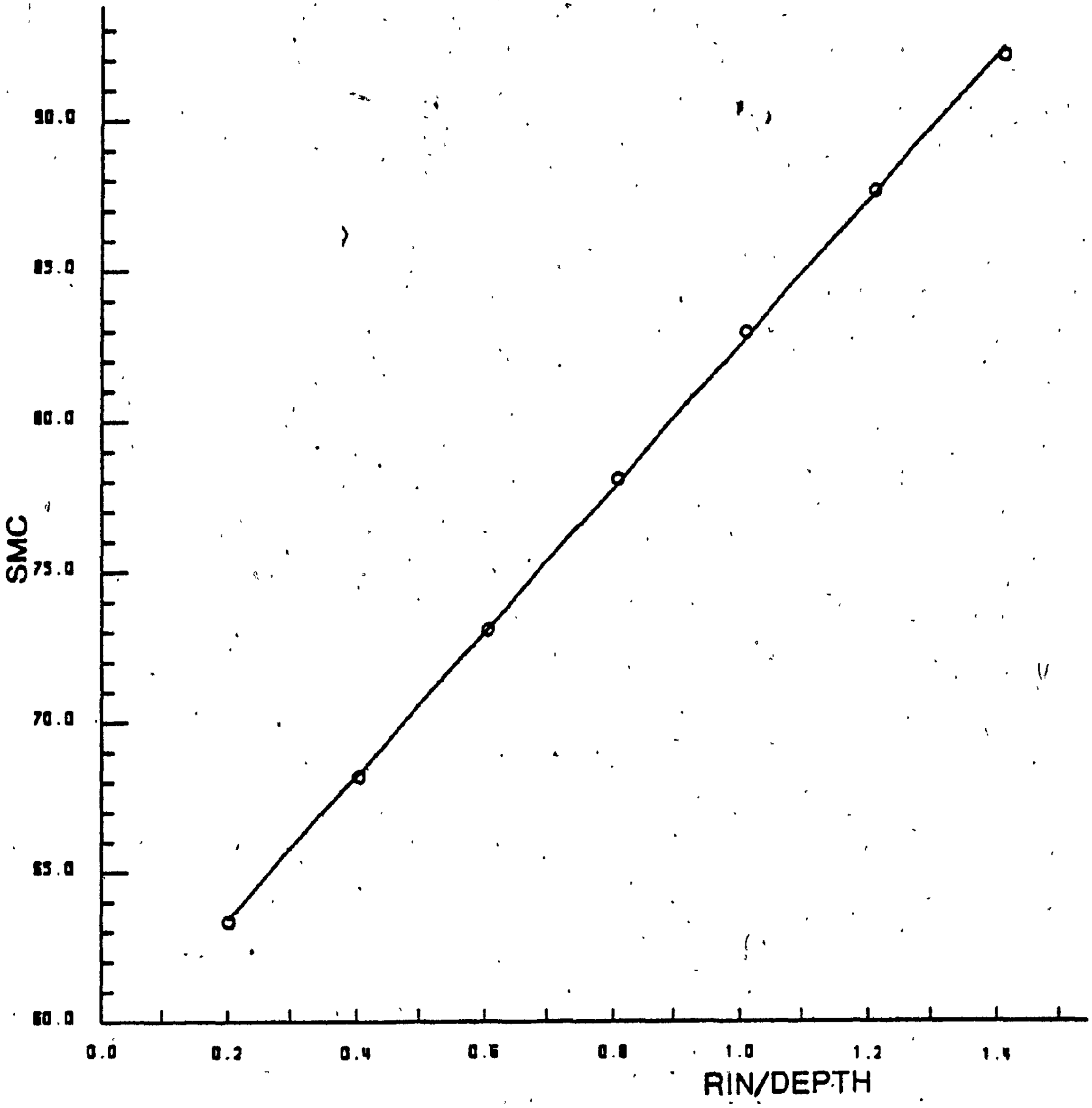


FIGURE 3.4.1 SPECIFIC MATERIAL CONSUMPTION VERSUS THE RIN DEPTH RATIO, FOR AN EIGHT RING FOUR COLUMN TRUSS, CONSIDERING THE STANDARD THREE LOAD CASES.

TABLE 3.5.1 EFFECT OF THE NUMBER OF RINGS ON THE SPECIFIC MATERIAL CONSUMPTION. THE TRUSSES ALL HAVE FOUR COLUMNS, THE MEMBER AREAS WERE ALL TAKEN AS ONE, AND THE TRUSSES WERE ANALYZED FOR THE STANDARD THREE LOADING CASES

NUMBER OF RINGS	SMC
4	32.830
6	51.226
8	69.598
10	87.412
12	105.449

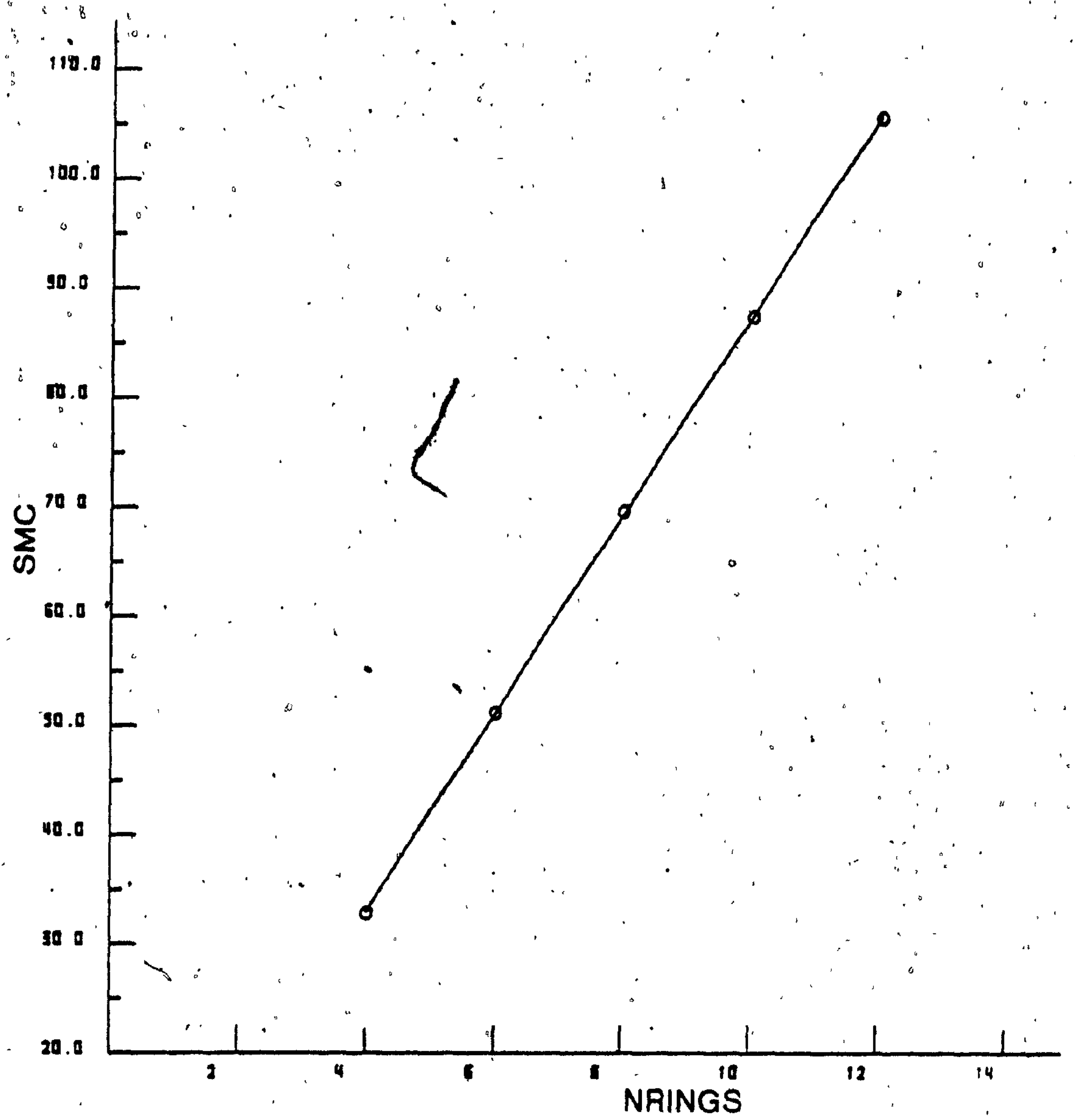


FIGURE 3.5.1 SPECIFIC MATERIAL CONSUMPTION VERSUS THE NUMBER OF RINGS, FOR A FOUR COLUMN TRUSS, CONSIDERING THE STANDARD THREE LOAD CASES.

span, the deeper the truss the lower the specific material consumption. An analogy can be drawn between the truss and a beam. The greater the span of the structure the greater the bending moment and shear which must be resisted. For a fixed depth this translates into greater forces in the truss members for greater spans. Or for a fixed span, the greater the depth of the truss, the lower the member forces in the truss need to be to resist the bending moment.

CHAPTER 4

DESIGN OF A RING TRUSS

4.1 CHOICE OF TRUSS GEOMETRY

A sample design of a ring truss was performed for comparison with other structural systems. The ring truss was designed so that it could be compared to the Edmonton Coliseum, which is a radial type truss, see Fig. 4.1.1. The Edmonton truss has a diameter of 122 m (400 ft), and a depth of 12.2 m (40 ft) [4]. The ring truss has the following characteristics: twelve rings; ten columns; ALPHAT and ALPHAC both equal to sixty-five degrees; the depth equal to 10.06 m (33.0 ft); and the RIN equal to 5.03 m (16.5 ft). The above parameters give a ring truss diameter of 122.6 m (402.3 ft). In the computer analysis the member areas were all considered to be one. The supports all supplied lateral restraint as well as vertical support. The computer listing for one of the three program runs required for the design of the ring truss is included in Appendix B.

The geometric characteristics for the ring truss were chosen in such a way that the depth of the truss would not

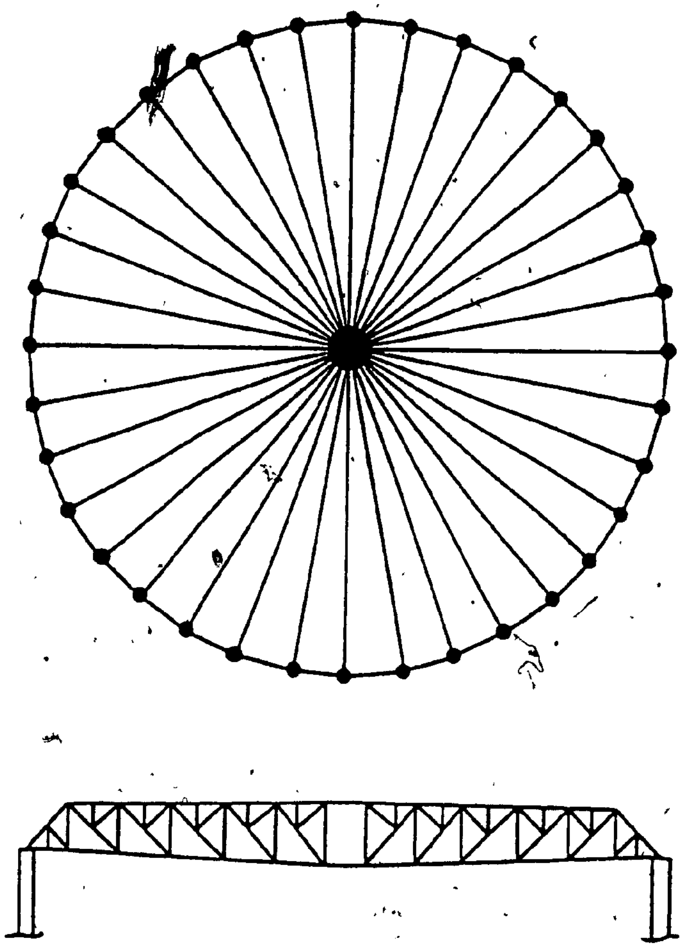


FIGURE 4.1.1 PLAN VIEW AND SECTION OF A RADIAL TYPE TRUSS.

be excessive; the depth of the ring truss is actually lower than that of the Edmonton truss. Making use of the relationships between the material consumption and the various geometric parameters, it was determined that the above values would be economical.

4.2 DESIGN LOADS

The ring truss was designed according to the loads prescribed for Edmonton, Alberta, in the National Building Code of Canada. The entire structure was designed for dead loads, snow loads, and wind loads. The dead load to be supported by the purlins is the weight of the roof deck, the insulation on the roof, and the built up roofing; the dead load was assumed to be 0.479 kPa (10.0 psf). The dead load for the design of the truss was assumed to be 1.244 kPa (26.0 psf).

The snow load is prescribed to be the greater of the following [5]:

(a) $L_S = C_S * S_O = 0.9$ kPa 4.2.1

(b) $L_S' = 1.0$ kPa

The ground snow load, S_O, for Edmonton is 1.5 kPa [6]. The value of the snow load coefficient, C_s, was taken as 0.6 because the roof was assumed not to have any obstructions which would prevent the wind from blowing the snow off the roof [7]. Therefore the snow load was taken as 1.0 kPa (20.9 psf).

A conservative estimate of the wind loads acting on the roof was made, based upon the provisions of the National Building Code of Canada. The intensity of the wind load is given by the following equation [8]:

$$p = q*C_e*C_g*C_p \qquad 4.2.2$$

The dynamic wind pressure, q, was taken as 0.51 kPa, which will probably not be exceeded more than once every one-hundred years in Edmonton [9]. The roof height was assumed to be 25 m (80 ft), this allows for 15 m (50 ft) high walls. The exposure factor, C_e, was taken as 1.2 [10]; and the gust factor, C_g, was taken to be 2.0 [11]. The pressure coefficient, C_p, was taken to be -1.0, this is the value given in the code for the roofs of large circular storage tanks [12]. The wind load thus obtained was 1.224 kPa (25.6 psf).

The factored loads were calculated using the following equation [13]:

$$\alpha_D D + \gamma\Psi[\alpha_L L + \alpha_Q Q + \alpha_T T] \qquad 4.2.3$$

where, α_D = 1.25, or for uplift 0.85
α_L = 1.5
α_Q = 1.5
α_T = 1.25
Ψ = 1.0, 0.7, or 0.6 depending on whether one, two, or three of L, Q, and T are considered simultaneously

The factored design load intensities for the purlins were as follows:

Load Case 1-

Dead Load	-0.518 kPa	(-12.5 psf)
Live Load	-1.500 kPa	(-31.35 psf)

Load Case 2-

Dead Load	-0.407 kPa	(-8.5 psf)
Live Load	1.837 kPa	(38.4 psf)

The factored design load intensities for the truss were as follows:

Load Case 1-

Dead Load -1.555 kPa (-32.5 psf)
Live Load -1.500 kPa (-31.35 psf)

Load Case 2-

Dead Load -1.057 kPa (-22.1 psf)
Live Load 1.837 kPa (38.4 psf)

The dead load was applied to the entire structure for both load cases; whereas, the live load was applied to the entire structure, half the structure, and to alternating sectors of the roof. The above combinations of dead and live loads for the above load cases yielded a total of six different loading conditions. The member forces due to the different loading conditions were calculated, and for each member the maximum positive and negative loads were determined.

4.3 RING TRUSS AND PURLIN DESIGN

The purlins were designed for a clear span of 9.381 m (30.78 ft), which is the maximum length of any purlin, except those purlins which are over the center of the truss. The purlins which are over the center of the truss have a clear span of 10.06 m (33 ft), but the tributary areas for the center purlins are much smaller than the tributary areas supported by the purlins in the rest of the roof. The maximum spacing between two purlins is conservatively assumed to be 3.0 m (9.84 ft). This spacing gives maximum loads of -6.29 kN/m (-0.431 k/ft), and 4.29 kN/m (0.294 k/ft). The purlins are assumed to be simply supported. The above loads yield a maximum positive moment of 69.2 kN-m (51.0 k-ft), and a maximum negative moment of 47.2 kN-m (34.8 k-ft). The upper flange of each purlin is laterally supported by the roof deck; therefore the unbraced length of the purlin for positive moment is zero. Although the lower flange of the purlin is not laterally supported, no instability of the lower flange is induced when the purlins are subjected to negative moment because the load is applied through the purlin's tension flange. G40.21-M 300W steel is used for the purlins. A W250x22 section is adequate to support the roof loads [14]. The section used weighs 22. kg/m, this gives a material mass of 7.33 kg/m^2 (1.50 psf).

The truss members were designed for the worst set of compression and tension forces due to the six loading conditions described in section 4.2. The set of design loads is tabulated in Table 4.3.1. The members were all

TABLE 4.3.1 DESIGN LOADS FOR ALL THE TRUSS MEMBERS

MEMBER NUMBER	FACTORED LOADS				MEMBER LENGTH	
	TENSION (kN)	COMP. (kN)	TENSION (kips)	COMP. (kips)	(m)	(ft)
1	678.27	2656.66	152.48	597.24	3.108	10.197
2	981.40	250.56	220.63	56.33	3.003	9.854
3	981.42	250.57	220.63	56.33	3.003	9.854
4	368.88	1444.86	82.93	324.82	2.969	9.739
5	371.97	1456.95	83.62	327.54	2.969	9.739
6	368.91	1444.97	82.93	324.84	2.969	9.739
7	615.32	157.10	138.33	35.32	2.951	9.682
8	638.93	163.12	143.64	36.67	2.951	9.682
9	638.98	163.13	143.65	36.67	2.951	9.682
10	615.30	157.09	138.32	35.32	2.951	9.682
11	333.60	1306.64	75.00	293.74	2.941	9.648
12	342.57	1341.80	77.01	301.65	2.941	9.648
13	345.57	1353.54	77.69	304.29	2.941	9.648
14	342.58	1341.82	77.02	301.65	2.941	9.648
15	333.61	1306.69	75.00	293.76	2.941	9.648
16	477.20	121.83	107.28	27.39	2.934	9.625
17	523.85	133.74	117.77	30.07	2.934	9.625
18	547.17	139.70	123.01	31.40	2.934	9.625
19	547.15	139.69	123.00	31.40	2.934	9.625
20	523.79	133.73	117.75	30.06	2.934	9.625
21	477.13	121.81	107.26	27.38	2.934	9.625
22	322.40	1262.78	72.48	283.88	2.929	9.608
23	337.23	1320.89	75.81	296.95	2.929	9.608
24	346.14	1355.77	77.81	304.79	2.929	9.608
25	349.13	1367.49	78.49	307.42	2.929	9.608
26	346.15	1355.82	77.82	304.80	2.929	9.608
27	337.25	1320.94	75.82	296.96	2.929	9.608
28	322.40	1262.78	72.48	283.88	2.929	9.608
29	329.02	84.00	73.97	18.88	2.925	9.596
30	396.26	101.17	89.08	22.74	2.925	9.596
31	443.55	113.24	99.71	25.46	2.925	9.596
32	469.54	119.88	105.56	26.95	2.925	9.596
33	469.61	119.89	105.57	26.95	2.925	9.596
34	443.58	113.25	99.72	25.46	2.925	9.596
35	396.33	101.19	89.10	22.75	2.925	9.596
36	328.99	83.99	73.96	18.88	2.925	9.596
37	317.67	1244.28	71.42	279.73	2.922	9.587
38	320.42	1255.05	72.03	282.15	2.922	9.587
39	334.28	1309.31	75.15	294.34	2.922	9.587
40	344.41	1348.99	77.43	303.26	2.922	9.586
41	343.94	1347.16	77.32	302.85	2.922	9.587
42	344.39	1348.92	77.42	303.25	2.922	9.587

TABLE 4.3.1 (cont.)

MEMBER NUMBER	FACTORED LOADS				MEMBER LENGTH	
	TENSION (kN)	COMP. (kN)	TENSION (kips)	COMP. (kips)	(m)	(ft)
43	334.26	1309.24	75.14	294.33	2.922	9.587
44	320.41	1254.99	72.03	282.13	2.922	9.587
45	317.66	1244.24	71.41	279.72	2.922	9.587
46	150.92	38.53	33.93	8.66	2.920	9.579
47	198.32	50.63	44.58	11.38	2.920	9.579
48	255.27	65.17	57.39	14.65	2.920	9.579
49	301.79	77.05	67.85	17.32	2.920	9.579
50	325.22	83.03	73.11	18.67	2.920	9.579
51	325.31	83.05	73.13	18.67	2.920	9.579
52	301.83	77.06	67.85	17.32	2.920	9.579
53	255.31	65.18	57.40	14.65	2.920	9.579
54	198.36	50.64	44.59	11.39	2.920	9.579
55	150.99	38.55	33.94	8.67	2.920	9.579
56	223.72	876.29	50.30	197.00	2.918	9.573
57	284.64	1114.88	63.99	250.63	2.918	9.572
58	309.27	1211.39	69.53	272.33	2.918	9.573
59	323.37	1266.59	72.70	284.74	2.918	9.573
60	330.79	1295.63	74.36	291.27	2.918	9.573
61	328.55	1286.86	73.86	289.30	2.918	9.573
62	330.83	1295.80	74.37	291.31	2.918	9.573
63	323.35	1266.53	72.69	284.73	2.918	9.573
64	309.26	1211.35	69.53	272.32	2.918	9.573
65	284.61	1114.77	63.98	250.61	2.918	9.573
66	223.75	876.37	50.30	197.02	2.918	9.573
67	98.74	293.70	22.20	66.03	2.916	9.568
68	87.60	99.02	19.69	22.26	2.916	9.567
69	75.35	57.07	16.94	12.83	2.916	9.567
70	96.01	46.87	21.58	10.54	2.916	9.568
71	101.34	34.08	22.78	7.66	2.916	9.567
72	101.97	26.03	22.92	5.85	2.916	9.567
73	101.96	26.03	22.92	5.85	2.916	9.568
74	101.31	34.08	22.77	7.66	2.916	9.567
75	95.96	46.88	21.57	10.54	2.916	9.568
76	75.30	57.07	16.93	12.83	2.916	9.567
77	87.60	99.09	19.69	22.28	2.916	9.567
78	98.74	293.75	22.20	66.04	2.916	9.568
79	64.02	89.34	14.39	20.08	11.098	36.411
80	259.49	259.51	58.34	58.34	11.112	36.457
81	259.50	259.46	58.34	58.33	11.112	36.457
82	64.02	89.34	14.39	20.08	11.098	36.411
83	131.80	72.49	29.63	16.30	11.098	36.411
84	121.05	134.21	27.21	30.17	11.107	36.442

TABLE 4.3.1 (cont.)

MEMBER NUMBER	FACTORED LOADS				MEMBER LENGTH	
	TENSION (kN)	COMP. (kN)	TENSION (kips)	COMP. (kips)	(m)	(ft)
85	109.60	109.59	24.64	24.64	11.103	36.426
86	109.62	109.59	24.64	24.64	11.103	36.426
87	121.03	134.17	27.21	30.16	11.107	36.442
88	131.80	72.49	29.63	16.30	11.098	36.411
89	55.29	188.32	12.43	42.34	11.098	36.411
90	97.78	76.50	21.98	17.20	11.105	36.434
91	76.44	97.71	17.18	21.97	11.100	36.418
92	65.08	65.03	14.63	14.62	11.103	36.426
93	65.08	65.06	14.63	14.63	11.103	36.426
94	76.40	97.83	17.18	21.99	11.100	36.418
95	97.82	76.52	21.99	17.20	11.105	36.434
96	55.29	188.32	12.43	42.34	11.098	36.411
97	269.58	68.83	60.60	15.47	11.098	36.411
98	71.04	128.01	15.97	28.78	11.104	36.429
99	83.75	59.72	18.83	13.43	11.099	36.415
100	59.68	83.74	13.42	18.82	11.102	36.425
101	48.44	48.41	10.89	10.88	11.101	36.420
102	48.43	48.41	10.89	10.88	11.101	36.420
103	59.68	83.77	13.42	18.83	11.102	36.425
104	83.74	59.69	18.82	13.42	11.099	36.415
105	71.05	128.06	15.97	28.79	11.104	36.429
106	269.58	68.83	60.60	15.47	11.098	36.411
107	102.68	402.17	23.08	90.41	11.098	36.411
108	119.36	60.50	26.83	13.60	11.103	36.426
109	60.51	119.43	13.60	26.85	11.099	36.414
110	75.20	49.21	16.91	11.06	11.102	36.423
111	49.17	75.11	11.05	16.89	11.100	36.417
112	37.94	37.90	8.53	8.52	11.101	36.420
113	37.93	37.91	8.53	8.52	11.101	36.420
114	49.24	75.16	11.07	16.90	11.100	36.417
115	75.20	49.13	16.90	11.05	11.102	36.423
116	60.51	119.44	13.60	26.85	11.099	36.414
117	119.55	60.52	26.88	13.61	11.103	36.426
118	102.68	402.17	23.08	90.41	11.098	36.411
119	534.39	136.43	120.13	30.67	11.098	36.411
120	62.34	155.47	14.02	34.95	11.102	36.424
121	111.30	51.03	25.02	11.47	11.099	36.413
122	51.07	111.44	11.48	25.05	11.101	36.422
123	67.42	39.82	15.16	8.95	11.099	36.415
124	39.86	67.37	8.96	15.15	11.101	36.420
125	28.59	28.54	6.43	6.42	11.100	36.417
126	28.58	28.54	6.43	6.42	11.100	36.417

TABLE 4.3.1 (cont.)

MEMBER NUMBER	FACTORED LOADS				MEMBER LENGTH	
	TENSION (kN)	COMP. (kN)	TENSION (kips)	COMP. (kips)	(m)	(ft)
127	39.83	67.42	8.95	15.16	11.101	36.420
128	67.45	39.77	15.16	8.94	11.099	36.415
129	51.03	111.41	11.47	25.05	11.101	36.422
130	111.51	51.04	25.07	11.47	11.099	36.413
131	62.33	155.53	14.01	34.96	11.102	36.424
132	534.38	136.43	120.13	30.67	11.098	36.411
133	181.38	710.45	40.78	159.72	11.098	36.411
134	156.40	63.44	35.16	14.26	11.101	36.422
135	63.42	156.40	14.26	35.16	11.098	36.412
136	112.34	52.17	25.26	11.73	11.101	36.421
137	52.14	112.22	11.72	25.23	11.099	36.414
138	68.26	40.92	15.34	9.20	11.100	36.419
139	40.95	68.25	9.21	15.34	11.100	36.416
140	29.70	29.66	6.68	6.67	11.100	36.417
141	29.67	29.68	6.67	6.67	11.100	36.417
142	40.89	68.37	9.19	15.37	11.099	36.416
143	68.35	40.96	15.37	9.21	11.100	36.419
144	52.13	112.34	11.72	25.26	11.099	36.414
145	112.45	52.19	25.28	11.73	11.101	36.421
146	63.45	156.41	14.26	35.16	11.098	36.412
147	156.48	63.44	35.18	14.26	11.101	36.422
148	181.38	710.46	40.78	159.72	11.098	36.411
149	712.44	181.89	160.16	40.89	11.098	36.411
150	75.90	76.09	17.06	17.11	11.101	36.421
151	129.83	39.62	29.19	8.91	11.098	36.412
152	39.63	129.85	8.91	29.19	11.101	36.420
153	96.05	29.08	21.59	6.54	11.099	36.413
154	29.11	96.09	6.54	21.60	11.100	36.418
155	59.00	19.22	13.26	4.32	11.099	36.414
156	19.21	58.96	4.32	13.25	11.100	36.417
157	7.89	7.91	1.77	1.78	11.100	36.416
158	7.91	7.92	1.78	1.78	11.100	36.416
159	19.19	58.86	4.31	13.23	11.100	36.418
160	58.89	19.22	13.24	4.32	11.099	36.415
161	29.10	96.05	6.54	21.59	11.100	36.419
162	95.95	29.05	21.57	6.53	11.099	36.414
163	39.63	129.82	8.91	29.18	11.101	36.420
164	129.82	39.59	29.18	8.90	11.098	36.412
165	75.89	76.08	17.06	17.10	11.101	36.421
166	712.43	181.89	160.16	40.89	11.098	36.411
167	199.16	780.09	44.77	175.37	11.098	36.411
168	103.88	101.73	23.35	22.87	11.101	36.420

TABLE 4.3.1 (cont.)

MEMBER NUMBER	FACTORED LOADS				MEMBER LENGTH	
	TENSION (kN)	COMP. (kN)	TENSION (kips)	COMP. (kips)	(m)	(ft)
169	70.77	277.19	15.91	62.31	11.098	36.412
170	116.43	76.59	26.18	17.22	11.100	36.419
171	73.63	156.07	16.55	35.09	11.099	36.413
172	102.10	61.92	22.95	13.92	11.100	36.418
173	64.53	115.45	14.51	25.95	11.099	36.414
174	65.03	52.45	14.62	11.79	11.100	36.417
175	53.39	70.72	12.00	15.90	11.099	36.415
176	45.50	45.42	10.23	10.21	11.099	36.416
177	45.51	45.41	10.23	10.21	11.099	36.416
178	53.40	70.73	12.00	15.90	11.099	36.415
179	65.10	52.46	14.64	11.79	11.100	36.417
180	64.53	115.51	14.51	25.97	11.099	36.414
181	102.17	61.93	22.97	13.92	11.100	36.418
182	73.61	156.13	16.55	35.10	11.099	36.413
183	116.45	76.59	26.18	17.22	11.100	36.419
184	70.77	277.18	15.91	62.31	11.098	36.412
185	103.88	101.74	23.35	22.87	11.101	36.420
186	199.16	780.09	44.77	175.37	11.098	36.411
187	921.20	235.19	207.09	52.87	11.098	36.411
188	66.18	165.70	14.88	37.25	11.100	36.419
189	433.96	110.79	97.56	24.91	11.098	36.411
190	60.08	191.96	13.51	43.15	11.100	36.418
191	183.27	46.79	41.20	10.52	11.099	36.413
192	48.98	142.93	11.01	32.13	11.100	36.418
193	114.95	39.74	25.84	8.93	11.099	36.413
194	37.12	101.63	8.35	22.85	11.100	36.417
195	61.74	27.06	13.88	6.08	11.099	36.414
196	26.11	56.06	5.87	12.60	11.100	36.416
197	12.77	12.86	2.87	2.89	11.099	36.415
198	12.77	12.85	2.87	2.89	11.099	36.415
199	26.11	56.12	5.87	12.62	11.099	36.416
200	61.77	27.06	13.89	6.08	11.099	36.414
201	37.12	101.70	8.35	22.86	11.100	36.417
202	115.00	39.75	25.85	8.94	11.099	36.413
203	48.97	143.01	11.01	32.15	11.100	36.418
204	183.26	46.79	41.20	10.52	11.098	36.412
205	60.08	192.00	13.51	43.16	11.100	36.418
206	433.99	110.80	97.56	24.91	11.098	36.412
207	66.18	165.73	14.88	37.26	11.100	36.419
208	921.20	235.19	207.09	52.87	11.098	36.411
209	402.90	1578.10	90.58	354.77	11.098	36.411
210	624.92	159.55	140.49	35.87	11.100	36.418

TABLE 4.3.1 (cont.)

MEMBER NUMBER	FACTORED LOADS				MEMBER LENGTH	
	TENSION (kN)	COMP. (kN)	TENSION (kips)	COMP. (kips)	(m)	(ft)
211	154.03	603.32	34.63	135.63	11.098	36.411
212	246.16	62.85	55.34	14.13	11.100	36.418
213	57.35	224.64	12.89	50.50	11.098	36.412
214	166.17	50.79	37.36	11.42	11.100	36.417
215	45.30	144.67	10.18	32.52	11.099	36.413
216	108.28	38.11	24.34	8.57	11.100	36.416
217	32.61	86.78	7.33	19.51	11.099	36.413
218	62.36	26.25	14.02	5.90	11.099	36.416
219	20.76	40.87	4.67	9.19	11.099	36.414
220	22.84	17.58	5.14	3.95	11.099	36.415
221	22.88	17.58	5.14	3.95	11.099	36.415
222	20.76	40.88	4.67	9.19	11.099	36.414
223	62.38	26.25	14.02	5.90	11.099	36.416
224	32.62	86.82	7.33	19.52	11.099	36.414
225	108.33	38.10	24.35	8.57	11.100	36.417
226	45.30	144.71	10.18	32.53	11.099	36.413
227	166.22	50.79	37.37	11.42	11.100	36.417
228	57.35	224.62	12.89	50.50	11.098	36.412
229	246.16	62.85	55.34	14.13	11.100	36.418
230	154.03	603.30	34.63	135.63	11.098	36.412
231	624.90	159.54	140.48	35.87	11.100	36.419
232	402.91	1578.11	90.58	354.77	11.098	36.411
233	204.53	801.13	45.98	180.10	9.380	30.776
234	204.54	801.13	45.98	180.10	9.380	30.776
235	293.01	1147.68	65.87	258.01	9.380	30.776
236	293.01	1147.68	65.87	258.01	9.380	30.776
237	331.34	1297.81	74.49	291.76	9.380	30.776
238	331.34	1297.79	74.49	291.75	9.380	30.776
239	308.19	1207.14	69.28	271.38	9.380	30.776
240	308.19	1207.14	69.28	271.38	9.380	30.776
241	146.07	572.11	32.84	128.62	9.380	30.776
242	146.07	572.13	32.84	128.62	9.380	30.775
243	303.13	119.42	68.15	26.85	9.380	30.776
244	303.13	119.42	68.15	26.85	9.380	30.776
245	407.68	218.44	91.65	49.11	9.380	30.776
246	407.68	218.44	91.65	49.11	9.380	30.776
247	287.09	267.68	64.54	60.18	9.381	30.776
248	287.10	267.68	64.54	60.18	9.380	30.776
249	204.98	493.79	46.08	111.01	9.380	30.776
250	204.97	493.78	46.08	111.01	9.381	30.776
251	316.67	1240.33	71.19	278.84	9.380	30.776
252	316.67	1240.35	71.19	278.84	9.380	30.775

TABLE 4.3.1 (cont.)

MEMBER NUMBER	FACTORED LOADS				MEMBER LENGTH	
	TENSION (kN)	COMP. (kN)	TENSION (kips)	COMP. (kips)	(m)	(ft)
253	106.62	417.61	23.97	93.88	8.921	29.269
254	164.43	41.98	36.96	9.44	9.382	30.780
255	14.26	30.27	3.21	6.80	8.922	29.270
256	18.64	19.07	4.19	4.29	9.383	30.785
257	26.33	18.48	5.92	4.15	8.922	29.270
258	17.60	30.49	3.96	6.85	9.385	30.790
259	34.26	17.54	7.70	3.94	8.922	29.270
260	17.47	29.98	3.93	6.74	9.386	30.793
261	70.70	18.05	15.89	4.06	8.921	29.269
262	16.24	63.62	3.65	14.30	9.387	30.797
263	106.63	417.65	23.97	93.89	8.921	29.269
264	164.41	41.98	36.96	9.44	9.382	30.780
265	14.26	30.26	3.21	6.80	8.921	29.269
266	18.63	19.06	4.19	4.28	9.383	30.784
267	26.31	18.48	5.91	4.15	8.921	29.269
268	17.59	30.43	3.95	6.84	9.384	30.788
269	34.23	17.54	7.70	3.94	8.921	29.269
270	17.46	29.91	3.92	6.72	9.386	30.793
271	70.68	18.05	15.89	4.06	8.921	29.269
272	16.25	63.63	3.65	14.31	9.387	30.797
273	214.48	54.76	48.22	12.31	8.921	29.269
274	59.90	234.62	13.47	52.75	9.381	30.779
275	57.18	51.22	12.85	11.52	8.921	29.270
276	50.73	64.75	11.40	14.56	9.383	30.783
277	52.75	54.68	11.86	12.29	8.922	29.270
278	53.74	53.17	12.08	11.95	9.384	30.786
279	51.45	55.82	11.57	12.55	8.921	29.269
280	52.63	51.79	11.83	11.64	9.385	30.790
281	51.11	52.62	11.49	11.83	8.921	29.270
282	51.95	51.46	11.68	11.57	9.386	30.794
283	214.50	54.76	48.22	12.31	8.921	29.270
284	59.90	234.62	13.47	52.75	9.382	30.780
285	57.18	51.23	12.85	11.52	8.921	29.270
286	50.73	64.76	11.40	14.56	9.383	30.783
287	52.75	54.64	11.86	12.28	8.921	29.269
288	53.75	53.17	12.08	11.95	9.384	30.786
289	51.45	55.76	11.57	12.53	8.921	29.270
290	52.63	51.79	11.83	11.64	9.385	30.790
291	51.12	52.55	11.49	11.81	8.921	29.269
292	51.95	51.46	11.68	11.57	9.386	30.794
293	2.21	8.65	0.50	1.95	8.922	29.270

designed according to the CAN3 S16.1-M standard. All the truss members were designed using Round Hollow Sections, abbreviated RHS, made of G40.21-M 350 W steel. Since all the connections were welded, except for the field connections, the net area for the members loaded in tension was equal to the gross member area. Although the member area was reduced by bolt holes for the stiffeners and bracing truss members, their design was governed by the compression force and their tension capacity was much greater than required.

The sections chosen for all the members are listed in Table 4.3.2 [15]. The maximum tension and compression capacities for all the members are listed in Table 4.3.3, as well as the percentage overcapacity for each member.

4.4 COMPARISON OF THE RING TRUSS WITH THE EDMONTON COLISEUM RADIAL TRUSS

The material consumption for the ring truss designed in section 4.3 was calculated. The material consumption was taken as the sum of all the member masses. The material consumption per unit area was then calculated so that it could be compared to the material consumption of the Edmonton Coliseum.

The masses for all the member groups are tabulated in

TABLE 4.3.2 SECTIONS CHOSEN IN THE TRUSS DESIGN

MEMBER GROUP	MEMBER NUMBERS	MEMBER CHOICE
RING 1	1	RHS 355.6ODx9.35
RING 2	2,3	RHS 88.9ODx6.35
RING 3	4-6	RHS 219.1ODx4.78
RING 4	7-10	RHS 88.9ODx3.81
RING 5	11-15	RHS 219.1ODx4.78
RING 6	16-21	RHS 88.9ODx3.81
RING 7	22-28	RHS 219.1ODx4.78
RING 8	29-36	RHS 73.0ODx3.81
RING 9	37-45	RHS 219.1ODx4.78
RING 10	46-55	RHS 60.3ODx3.18
RING 11	56-66	RHS 219.1ODx4.78
RING 12	67-78	RHS 114.3ODx4.78
DIAGONAL 1-2	79,82 80,81	RHS 168.3ODx4.78 RHS 219.1ODx6.35
DIAGONAL 2-3	83,85,86,88 84,87	RHS 168.3ODx4.78 RHS 219.1ODx4.78
DIAGONAL 3-4	90-95 89,96	RHS 168.3ODx4.78 RHS 219.1ODx4.78
DIAGONAL 4-5	97,99-104,106 98,105	RHS 168.3ODx4.78 RHS 219.1ODx4.78
DIAGONAL 5-6	108,110-115,117 107,118 109,116	RHS 168.3ODx4.78 RHS 273.1ODx6.35 RHS 219.1ODx4.78
DIAGONAL 6-7	121,123-128,130 119,120,122,129,131,1[illegible]2	RHS 168.3ODx4.78 RHS 219.1ODx4.78

TABLE 4.3.2 (cont.)

MEMBER GROUP	MEMBER NUMBERS	MEMBER CHOICE
DIAGONAL 7-8	134,136,138-143,145,147	RHS 168.30Dx4.78
	135,137,144,146	RHS 219.10Dx4.78
	133,148	RHS 323.90Dx6.35
DIAGONAL 8-9	150,151,153-162,164,165	RHS 168.30Dx4.78
	149,152,163,166	RHS 219.10Dx4.78
DIAGONAL 9-10	168,170,172,174-179	RHS 168.30Dx4.78
	181,183,185	RHS 168.30Dx4.78
	171,173,180,182	RHS 219.10Dx4.78
	169,184	RHS 219.10Dx6.35
	167,186	RHS 323.90Dx6.35
DIAGONAL 10-11	189,191,193-202,204,206	RHS 168.30Dx4.78
	187,188,190,192	RHS 219.10Dx4.78
	203,205,207,208	RHS 219.10Dx4.78
DIAGONAL 11-12	212,214,216-225,227,229	RHS 168.30Dx4.78
	210,213,215,226,228,231	RHS 219.10Dx4.78
	211,230	RHS 323.90Dx6.35
	209,232	RHS 406.40Dx7.95
STIFF. 1-3	233,234	RHS 323.90Dx6.35
STIFF. 3-5	235,236	RHS 355.60Dx6.35
STIFF. 5-7	237,238	RHS 355.60Dx6.35
STIFF. 7-9	239,240	RHS 355.60Dx6.35
STIFF. 9-11	241,242	RHS 273.10Dx6.35
STIFF. 2-4	243,244	RHS 168.30Dx4.78
STIFF. 4-6	245,246	RHS 219.10Dx4.78
STIFF. 6-8	247,248	RHS 219.10Dx4.78
STIFF. 8-10	249,250	RHS 219.10Dx7.95
STIFF. 10-12	251,252	RHS 355.60Dx6.35

TABLE 4.3.2 (cont.)

MEMBER GROUP	MEMBER NUMBERS	MEMBER CHOICE
UPPER BRACING TRUSS	254-262,264-272 253,263	RHS 141.30Dx4.78 RHS 219.10Dx6.35
LOWER BRACING TRUSS	273,275-283,285-293 274,284	RHS 141.30Dx4.78 RHS 219.10Dx4.78

TABLE 4.3.3 CAPACITIES OF MEMBERS CHOSEN FOR DESIGN

MEMBER GROUP	MEMBER NUMBERS	MEMBER CAPACITY		PERCENT OVERCAPACITY	
		TEN. (kN)	COMP. (kN)	TEN.	COMP.
RING 1	1	2960	2730	337	2.75
RING 2	2,3	1040	418	6.01	66.5
RING 3	4-6	2020	1758	443	20.7
RING 4	7-10	642	268	0.47	64.4
RING 5	11-15	2020	1758	484	29.9
RING 6	16-21	642	268	17.4	91.4
RING 7	22-28	2020	1758	479	28.6
RING 8	29-36	522	162	11.1	35.0
RING 9	37-45	2020	1758	487	30.3
RING 10	46-55	360	84	10.8	1.2
RING 11	56-66	2020	1758	510	35.6
RING 12	67-78	517	304	407	3.4
DIAGONAL 1-2	79,82	775	111	1110	24.7
	80,81	1340	314	417	21.2
DIAGONAL 2-3	83,85,86,88	775	111	487	0.91
	84,87	1010	241	735	78.5
DIAGONAL 3-4	90-95	775	111	691	13.3
	89,96	1010	241	1760	28.2
DIAGONAL 4-5	97,99-104,106	775	111	187	60.9
	98,105	1010	241	1320	88.3
DIAGONAL 5-6	108,110-115,117	775	111	546	48.0
	107,118	1010	241	1560	101
	109,116	1680	553	1530	37.6

TABLE 4.3.3 (cont.)

MEMBER GROUP	MEMBER NUMBERS	MEMBER CAPACITY		PERCENT OVERCAPACITY	
		TEN. (kN)	COMP. (kN)	TEN.	COMP.
DIAGONAL 6-7	121,123-128,130	775	111	598	65.7
	119,120,122,129,131,132	1010	241	89.1	55.5
DIAGONAL 7-8	134,136,138-143,145,147	775	111	592	63.2
	135,137,144,146	1010	241	1500	54.5
	133,148	1990	839	999	18.2
DIAGONAL 8-9	150,151,153-162,164,165	775	111	496	15.6
	149,152,163,166	1010	241	41.8	32.4
DIAGONAL 9-10	168,170,172,174-179	775	111	568	8.8
	181,183,185	775	111	568	8.8
	171,173,180,182	1010	241	1280	54.5
	169,184	1340	315	1790	13.7
	167,186	1990	839	900	7.6
DIAGONAL 10-11	189,191,193-202,204,206	775	111	78.6	0.0
	187,188,190,192	1010	241	9.7	2.6
	203,205,207,208	1010	241	9.7	2.6
DIAGONAL 11-12	212,214,216-225,227,229	775	111	215	29.1
	210,213,215,226,228,231	1010	241	616	7.1
	211,230	1990	839	1190	39.1
	209,232	3130	1802	677	14.2
STIFF. 1-3	233,234	1990	1040	871	29.8
STIFF. 3-5	235,236	2200	1316	651	14.6
STIFF. 5-7	237,238	2200	1316	565	1.4
STIFF. 7-9	239,240	2200	1316	614	9.0
STIFF. 9-11	241,242	1680	690	1050	20.6
STIFF. 2-4	243,244	775	149	156	24.2
STIFF. 4-6	245,246	1010	306	148	40.4
STIFF. 6-8	247,248	1010	306	252	14.2

TABLE 4.3.3 (cont.)

MEMBER GROUP	MEMBER NUMBERS	MEMBER CAPACITY		PERCENT OVERCAPACITY	
		TEN. (kN)	COMP. (kN)	TEN.	COMP.
STIFF. 8-10	249,250	1660	499	710	1.0
STIFF. 10-12	251,252	2200	1316	594	6.1
UPPER BRACING TRUSS	254-262,264-272 253,263	646 1340	88 431	294 1150	38.4 3.1
LOWER BRACING TRUSS	273,275-283,285-293 274,284	646 1010	88 306	200 1580	35.4 30.2

TABLE 4.4.1 MATERIAL MASS FOR THE TWELVE RING TEN COLUMN RING TRUSS

MEMBER GROUP	MATERIAL MASS (METRIC TONS)
RINGS	70.6
DIAGONALS	401.1
STIFFENERS	79.1
BRACING TRUSSES	65.2
TOTAL	616.0

Table 4.4.1. The material mass for the entire structure is 616.0 metric tons (677.6 tons). The material consumption per unit area is 65.37 kg/m^2 (13.36 psf). When the weight of the purlins is taken into account, the material consumption per unit area is 72.7 kg/m^2 (14.86 psf). This agrees closely with preliminary calculations by Zielinski [16,17] which yielded a material consumption figure of 77.8 kg/m^2 (15.9 psf). The material consumption for the Edmonton Coliseum is 124.2 kg/m^2 (25.39 psf). This means that the ring type truss requires 41.5 percent less material than the radial truss built in Edmonton.

From Table 4.4.1 it can clearly be seen that approximately two-thirds of the material required to build the truss is used for the diagonals. The design of the diagonals was, in every case, governed by buckling of the diagonals. The diagonals could be braced in such a way that their effective length would only be half as great. This measure would increase the compression capacity of the diagonals four-fold. This would decrease the material consumption for the ring truss still further.

The maximum vertical deflection of the ring truss designed in section 4.3 under service loads, occurs at the center and is:

Dead Load	Deflection	-0.119 m	(-0.391 ft)
	Deflection/Span	1/1029	
Live Load 1	Deflection	-0.0958 m	(-0.314 ft)
	Deflection/Span	1/1280	
Live Load 2	Deflection	0.117 m	(0.385 ft)
	Deflection/Span	1/1045	
Maximum Total	Deflection	-0.215 m	(-0.705 ft)
	Deflection/Span	1/570	

For live loads the recommended maximum vertical deflection is limited to 1/360 for roofs "supporting construction and finishes susceptible to cracking", or 1/300 for roofs "supporting construction and finishes not susceptible to cracking" [18]. The maximum deflection is well within the limits for a roof structure.

CHAPTER 5

CONCLUSION

The ring truss is a promising structural system for horizontal structures. The ring truss system is versatile, having the capacity to adapt to many different geometric constraints. Another advantage of the ring truss, over other systems, is that it can be erected without the need for falsework or heavy cranes. The ring truss only requires a bare minimum of temporary erection supports at the beginning of the erection procedure. To help speed up construction of the structure, installation of the purlins, or floor beams, and deck can begin after the first five rings have been completed.

To build a ring truss for the least possible cost, the optimal geometry should be used. The optimal geometry of any ring truss depends on the design constraints. Use should be made of the relationships, developed in Chapter 3, between the material consumption of the truss and the various geometric parameters.

Material consumption of the ring truss, when compared to the radial truss of the Edmonton Coliseum, is low. If measures are taken to brace the diagonals against buckling, the material consumption will be even lower. Taking into account the ring truss's ease and speed of erection, and low material consumption, the ring truss is a feasible system. The ring truss should be considered as an economical alternative for use in long span structures.

When comparing the variation of ring forces in a ring truss which is stiffened by radial stiffening trusses, and what is expected for a ring truss without stiffening there are dramatic differences. For a ring truss without stiffening, subjected to uniform vertical loading, the forces will vary from a maximum at the supports to a minimum at the center of the truss, and within each ring the ring force will be constant. For a stiffened ring truss, subjected to uniform as well as non-uniform vertical loading, as was analyzed throughout the research, the ring force will vary within each ring from a maximum adjacent to the stiffeners to a minimum near the middle of each module. The maximum ring forces will occur at the center of the truss and decrease to a minimum at the perimeter. The differences in the distribution of the forces between the two ring truss configurations could be expected since the non-stiffened ring truss behaves like a cantilevering structure, hence having maximum moment near the supports, whereas the stiffened ring truss behaves like a simply supported structure, with maximum moment at mid-span.

The RINGTRUSS program is a useful tool for the analysis of ring type space trusses. The main advantage of the RINGTRUSS program over general purpose structural analysis programs is the ability to use it on smaller computers. Since the RINGTRUSS program requires very little input data, the designer spends much less time preparing and checking the input data. This enhances the productivity of the program.

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APPENDIX A

RINGTRUSS Program Listing

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      PROGRAM RINGTRUS
C
C
C
C     THIS PROGRAM IS USED TO ANALYZE RING-TYPE SPACE TRUSSES
C     AS THEY ARE APPLIED TO ROOF OR FLOOR STRUCTURES. THE PROGRAM
C     IS BASED ON THE LINEAR ELASTIC DISPLACEMENT METHOD OF
C     STRUCTURAL ANALYSIS. THE LOADS THE STRUCTURE IS
C     SUBJECTED TO ARE VERTICAL UNIFORM LOADS, THAT IS, THEY
C     MUST BE UNIFORM IN EACH SECTOR OF THE STRUCTURE,
C     ALTHOUGH THEY MAY VARY FROM SECTOR TO SECTOR.
C     THE PROGRAM CAN ALSO BE USED TO ANALYZE THE STRUCTURE
C     FOR DIFFERENT TYPES OF LOADING, BUT NEW SUBROUTINES
C     TO GENERATE THE CORRESPONDING LOADING VECTORS WOULD
C     HAVE TO BE ADDED. BECAUSE OF THE NUMBER OF DEGREES
C     OF FREEDOM (DOFS) MEMORY OVERLAYS ARE NECESSARY TO RUN
C     THE PROGRAM ON MANY COMPUTERS, UNLESS THE COMPUTER
C     HAS VIRTUAL MEMORY, OR A VERY LARGE CORE MEMORY.
C     THIS VERSION OF THE PROGRAM WAS DESIGNED FOR USE ON
C     THE PERKIN-ELMER 3220 AND USES TWO TYPES OF OVERLAYING
C     TECHNIQUES. FIRSTLY THE SUBROUTINES ARE OVERLAYED
C     ON TOP OF EACH OTHER BY USING A SPECIAL LINKING
C     ROUTINE; AND SECONDLY THE "STORAGE POOL" CONTAINS
C     ONLY THE ARRAYS NECESSARY FOR EACH SUBROUTINE, THE
C     UNNEEDED ARRAYS ARE TEMPORARILY STORED IN DISK FILES.
C     THE PROGRAM IS INTERACTIVE, WHICH MEANS THE USER
C     NEED NOT REMEMBER WHAT INPUT IS REQUIRED, THE PROGRAM
C     ASKS THE USER FOR THE REQUIRED INPUT. THE PROGRAM
C     WAS ALSO DESIGNED SO THAT THE USER WOULD HAVE TO ENTER
C     A MINIMUM OF DATA, THIS SAVES TIME AND MINIMIZES
C     THE CHANCES FOR ERROR IN THE INPUT DATA.
C     EACH LOGICAL UNIT "LU" MUST BE ASSIGNED ACCORDING TO
C     THE FOLLOWING:
C        "LU 1"- IS ASSIGNED TO A DISK FILE, NAMELY "CORD.DAT"
C                THIS FILE IS USED TO STORE THE "X", "Y", AND
C                "Z" ARRAYS.
C        "LU 2"- IS ASSIGNED TO A DISK FILE, NAMELY "MEM.DAT"
C                THIS FILE IS USED TO STORE THE "AREA" AND
C                "MEM" ARRAYS.
C        "LU 3"- IS ASSIGNED TO A DISK FILE, NAMELY "DOF.DAT"
C                THIS FILE IS USED TO STORE THE "IDOF" AND
C                "ISDOF" ARRAYS.
C        "LU 4"- IS ASSIGNED TO A DISK FILE, NAMELY "LOAD.DAT"
C                THIS FILE IS USED TO STORE THE "QS" AND "Q"
C                ARRAYS.
C        "LU 5"- MUST BE ASSIGNED TO THE KEYBOARD FOR
C                INTERACTIVE OPERATION, OR TO ANOTHER
C                INPUT DEVICE IF INTERACTION IS NOT DESIRED.
C        "LU 6"- MUST BE ASSIGNED TO THE TERMINAL SCREEN
C                FOR INTERACTIVE OPERATION, OR TO ANY
C                DUMMY FILE IF INTERACTIVE OPERATION IS
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C               NOT REQUIRED.
C        "LU 7"- MUST BE ASSIGNED TO A PRINTER, SINCE
C               THIS IS THE PROGRAM'S MAJOR OUTPUT
C               DEVICE AND THERE IS A LARGE VOLUME OF
C               OUTPUT, A FILE COULD ALSO BE ASSIGNED
C               TO "LU 7", IF THE USER REQUIRES THIS
C               PROGRAM'S OUTPUT DATA AS INPUT DATA FOR
C               OTHER PROGRAMS.
C        "LU 8"- IS ASSIGNED TO A DISK FILE, NAMELY "STIFF.DAT"
C               THIS FILE IS USED TO STORE THE STRUCTURE
C               STIFFNESS MATRIX.
C        "LU 9"- IS ASSIGNED TO A DISK FILE, NAMELY "DISP.DAT"
C               THIS FILE IS USED TO STORE THE SUBSTRUCTURE
C               DISPLACEMENTS.
C        "LU 10"- IS ASSIGNED TO A DISK FILE, NAMELY "LEN.DAT"
C                THIS FILE IS USED TO STORE THE MEMBER LENGTHS.
C     THE SIGN CONVENTION USED THROUGHOUT THE PROGRAM CALCULATIONS
C     IS UP IS POSITIVE, RIGHT IS POSITIVE, AND OUT OF THE PAGE IS
C     POSITIVE.
C
C
C
      COMMON /E/ VOL(5)
      DIMENSION A(120000), IA(120000)
      EQUIVALENCE(A(1),IA(1))
      CHARACTER*1 ANS
      MAX=120000
      REWIND (1)
      REWIND (2)
      REWIND (3)
      REWIND (4)
      REWIND (8)
      REWIND (9)
      REWIND(10)
C
C
C     THE MAXIMUM SIZE OF THE TOTAL ARRAY STORAGE IS LIMITED BY
C     THE DIMENSION OF ARRAYS "A" AND "IA". IF THE ARRAY SPACE
C     IS INSUFFICIENT THE DIMENSION OF "A" AND "IA" SHOULD BE
C     INCREASED ACCORDINGLY ON LINE 75, AND THE VALUE OF "MAX"
C     SHOULD BE INCREASED ACCORDINGLY ON LINE 78.
C
C
 1860 DO 10000 I=1,MAX
         A(I)=0.0
         IA(I)=0
10000 CONTINUE
      WRITE(6,*) 'INPUT BASIC STRUCTURE DATA: NRINGS (INTEGER)'
      READ(5,*) NRINGS
      WRITE(6,*) '                                    NCOL (INTEGER)'
      READ(5,*) NCOL
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      WRITE(6,*) '                              E (REAL)'
      READ(5,*) E
C
C
C     THE NUMBER OF NODES "NUMNOD", AND THE NUMBER OF MEMBERS
C     "NUMMEM" IN EACH SUBSTRUCTURE ARE CALCULATED.
C
C
      NUMNOD=2*NRINGS+NRINGS*(NRINGS-1)/2
      NUMMEM=NRINGS*(NRINGS+1)/2+(NRINGS+2)*(NRINGS-1)+NRINGS*2-4
     $+(NRINGS-2)*2+(NRINGS-2)*2+1
      WRITE(7,106) 'BASIC STRUCTURE DATA: '
  106 FORMAT('-',//,20X,C22,///)
      WRITE(7,101) 'NUMBER OF RINGS: ',NRINGS
  101 FORMAT(' ',//,20X,C17,9X,I3)
      WRITE(7,102) 'NUMBER OF COLUMNS: ',NCOL
  102 FORMAT(' ',//,20X,C19,7X,I3)
      WRITE(7,103) 'MODULUS OF ELASTICITY: ',E
  103 FORMAT(' ',//,20X,C23,3X,F9.1)
C
C
C     THE FIRST FOUR ARRAY POINTERS ARE CALCULATED.
C     THE X-COORDINATE ARRAY "X" IS STORED IN THE "A-POOL"
C     STARTING AT N1.
C     THE Y-COORDINATE ARRAY "Y" IS STORED IN THE "A-POOL"
C     STARTING AT N2.
C     THE Z-COORDINATE ARRAY "Z" IS STORED IN THE "A-POOL"
C     STARTING AT N3.
C
C
      N1=1
      N2=N1+NUMNOD*NCOL
      IF(N2.GT.MAX) GO TO 1
      N3=N2+NUMNOD*NCOL
      IF(N3.GT.MAX) GO TO 2
      N4=N3+NUMNOD*NCOL
      IF(N4.GT.MAX) GO TO 3
C
C
C     THE COORDINATES OF ALL THE NODAL POINTS IN THE STRUCTURE
C     ARE CALCULATED IN THE "COORD" SUBROUTINE.
C
C
      CALL COORD(NCOL,NRINGS,NUMNOD,A(N1),A(N2),A(N3),
     $ALPHAC,ALPHAT,DEPTH,RIN)
C
C
C     THE "X" "Y" AND "Z" ARRAYS ARE STORED ON "LU 1"
C     WHICH IS ASSIGNED TO "CORD.DAT".
C
C
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      DO 1100 II=1,N4-1
         WRITE(1,*) A(II)
 1100 CONTINUE
C
C
C     THE FIFTH AND SIXTH POINTERS ARE CALCULATED.
C     THE MEMBER AREA ARRAY "AREA" IS STORED IN THE "A-POOL"
C     STARTING AT N4.
C     THE MEMBER END-NODE ARRAY "MEM" IS STORED IN THE "IA-POOL"
C     STARTING AT N5.
C
C
      N4=1
      N5=N4+NUMMEM
      IF(N5.GT.MAX) GO TO 4
      N6=N5+NUMMEM*2
      IF(N6.GT.MAX) GO TO 5
C
C
C     THE "MEMDAT" SUBROUTINE ASSIGNS THE APPROPRIATE MEMBER AREA
C     AND END-NODE NUMBERS TO EACH MEMBER.
C
C
      CALL MEMDAT(NRINGS,MNUM,A(N4),IA(N5))
C
C
C     THE "AREA" AND "MEM" ARRAYS ARE STORED ON "LU 2"
C     WHICH IS ASSIGNED TO "MEM.DAT".
C
C
      DO 2100 II=N4,N5-1
         WRITE(2,*) A(II)
 2100 CONTINUE
      DO 2200 II=N5,N6-1
         WRITE(2,*) IA(II)
 2200 CONTINUE
C
C
C     POINTERS SEVEN, EIGHT, NINE, TEN, ELEVEN AND TWELVE ARE
C     CALCULATED.
C     THE SUBSTRUCTURE DOF ARRAY "IDOF" IS STORED IN THE "IA-POOL"
C     STARTING AT N6.
C     THE STRUCTURE DOF ARRAY "ISDOF" IS STORED IN THE "IA-POOL"
C     STARTING AT N7.
C     THE "NEQS" ARRAY, WHICH STORES THE NUMBER OF SUBSTRUCTURE DOFS
C     IN EACH SUBSTRUCTURE IS STORED IN THE "IA-POOL"
C     STARTING AT N8.
C     THE "NBDOF" ARRAY, WHICH STORES THE NUMBER OF BOUNDARY
C     DOFS IN EACH SUBSTRUCTURE IS STORED IN THE "IA-POOL"
C     STARTING AT N9.
C     THE "ISOF" ARRAY WHICH IS A TEMPORARY ARRAY USED TO
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C     PRINT THE "IDOF" ARRAY IS STORED IN THE "IA-POOL"
C     STARTING AT N10.
C     THE "IDSOF" ARRAY WHICH IS A TEMPORARY ARRAY USED TO
C     PRINT THE "ISDOF" ARRAY IS STORED IN THE "IA-POOL"
C     STARTING AT N11.
C
C
      N6=1
      N7=N6+NCOL*3*NUMNOD
      IF(N7.GT.MAX) GO TO 6
      N8=N7+3*NCOL*NRINGS
      IF(N8.GT.MAX) GO TO 7
      N9=N8+NCOL
      IF(N9.GT.MAX) GO TO 9
      N10=N9+NCOL
      IF(N10.GT.MAX) GO TO 10
      N11=N10+3*NUMNOD
      IF(N11.GT.MAX) GO TO 8
      N12=N11+3*NRINGS
      IF(N12.GT.MAX) GO TO 8
C
C
C     THE "DOFS" SUBROUTINE CREATES THE "IDOF" AND "ISDOF"
C     ARRAYS, AS WELL AS DETERMINING THE NUMBER OF DOFS IN
C     EACH SUBSTRUCTURE "NEQS", THE NUMBER OF STRUCTURE
C     DOFS "NEQ", AND THE NUMBER OF BOUNDARY DOFS "NBDOF".
C
C
      CALL DOFS(NCOL,NRINGS,NEQ,IA(N8),IA(N6),IA(N7),IA(N9),IA(N11)
     $,IA(N10),NEQSMX)
C
C
C     THE "IDOF" AND "ISDOF" ARRAYS ARE STORED ON "LU 3"
C     WHICH IS ASSIGNED TO "DOF.DAT".
C
C
      DO 3200 II=N6,N8-1
         WRITE(3,*) IA(II)
 3200 CONTINUE
C
C
C     POINTERS ONE, TWO, SIX, SEVEN, EIGHT, NINE, TEN,
C     ELEVEN, TWELVE, AND THIRTEEN ARE SET.
C     THE "X" ARRAY IS STORED IN THE "A-POOL" STARTING AT N1.
C     THE "Y" ARRAY IS STORED IN THE "A-POOL" STARTING AT N2.
C     THE "IDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N6.
C     THE "ISDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N7.
C     THE "NEQS" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N8.
C     THE "NBDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N9.
C     THE SUBSTRUCTURE LOAD VECTOR "QS" IS STORED IN THE
C     "A-POOL" STARTING AT N10.
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C     THE STRUCTURE LOAD VECTOR "Q", IS STORED IN THE "A-POOL"
C     STARTING AT N11.
C     THE LOAD-AREA ARRAY, "TQ", IS STORED IN THE "A-POOL"
C     STARTING AT N12.
C
C
 1890 N1=1
      N2=N1+NUMNOD*NCOL
      IF(N2.GT.MAX) GO TO 1
      N6N=N2+NUMNOD*NCOL
      IF(N6N.GT.MAX) GO TO 2
      N7N=N6N+NUMNOD*NCOL*3
      IF(N7N.GT.MAX) GO TO 6
      N8N=N7N+3*NCOL*NRINGS
      IF(N8N.GT.MAX) GO TO 7
      N9N=N8N+NCOL
      IF(N9N.GT.MAX) GO TO 8
      N10N=N9N+NCOL
      IF(N10N.GT.MAX) GO TO 9
      N11N=N10N+NEQSMX*NCOL
      IF(N11N.GT.MAX) GO TO 10
      N12N=N11N+NEQ
      IF(N12N.GT.MAX) GO TO 11
      N13N=N12N+NUMNOD
      IF(N13N.GT.MAX) GO TO 12
C
C     THE "IDOF", "ISDOF", "NEQS", AND "NBDOF" ARRAYS
C     ARE MOVED TO THEIR NEW POSITIONS IN THE STORAGE POOL.
C
      DO 3100 II=1,N10N-N6N
         K=N10N-II
         J=N10-II
         IA(K)=IA(J)
 3100 CONTINUE
C
C     THE "A-POOL" IS CLEARED BEFORE THE LOAD VECTORS ARE STORED
C     IN IT.
      DO 3300 II=N10N,N13N-1
         A(II)=0.0
 3300 CONTINUE
C
C     "LU 1" IS REWOUND BEFORE THE "X" AND "Y" ARRAYS ARE READ
C     FROM IT AND STORED IN THE "A-POOL" AT THE APPROPRIATE PLACE.
C
      REWIND(1)
      DO 4100 II=N1,N6N-1
         READ(1,*) A(II)
 4100 CONTINUE
      N6=N6N
      N7=N7N
      N8=N8N
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      N9=N9N
      N10=N10N
      N11=N11N
      N12=N12N
      N13=N13N
C
C
C     THE "LODVEC" SUBROUTINE CALCULATES BOTH THE STRUCTURE
C     AND SUBSTRUCTURE LOAD VECTORS.
C
C
      CALL LODVEC(NCOL,NUMNOD,NRINGS,IA(N6),A(N1),A(N2),
     $A(N10),NEQSMX,A(N12),A(N11),IA(N9),IA(N7),NEQ)
C
C     THE "QS" AND "Q" ARRAYS ARE STORED ON "LU 4" WHICH
C     IS ASSIGNED TO "LOAD.DAT".
C
      DO 5100 II=N10,N12-1
         WRITE(4,*) A(II)
 5100 CONTINUE
C
C
C     THE MATERIAL VOLUME ARRAY "VOL" IS ZEROED BEFORE THE
C     MATERIAL VOLUME FOR THE STRUCTURE IS CALCULATED.
C
C
      DO 900 I=1,5
         VOL(I)=0.0
  900 CONTINUE
C
C     THE "DO 1111" LOOP SETS THE "STIFF.DAT" WHICH IS ASSIGNED
C     TO "LU 8" TO ZERO.
C
      DO 1111 II=1,NEQ*9*NRINGS
         X=0.0
         WRITE(8,*) X
 1111 CONTINUE
C
C
C     THE FOLLOWING LOOP CALCULATES THE SUBSTRUCTURE STIFFNESS
C     MATRIX, STATICALLY CONDENSES THE SUBSTRUCTURE STIFFNESS
C     MATRIX AND THE SUBSTRUCTURE LOAD VECTOR, AND ASSEMBLES
C     THE STRUCTURE STIFFNESS MATRIX FOR EACH SUBSTRUCTURE.
C
C
      DO 1000 I=1,NCOL
C
C
C     POINTERS ONE, TWO, THREE, FOUR, FIVE, SIX, EIGHT, NINE,
C     FOURTEEN, AND FIFTEEN ARE SET.
C     THE "X" ARRAY IS STORED IN THE "A-POOL" STARTING AT N1.
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C     THE "Y" ARRAY IS STORED IN THE "A-POOL" STARTING AT N2.
C     THE "Z" ARRAY IS STORED IN THE "A-POOL" STARTING AT N3.
C     THE "AREA" ARRAY IS STORED IN THE "A-POOL" STARTING AT N4.
C     THE "MEM" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N5.
C     THE "IDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N6.
C     THE "NEQS" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N8.
C     THE "NBDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N9.
C     THE SUBSTRUCTURE STIFFNESS MATRIX "SUBST" IS STORED IN
C     THE "A-POOL" STARTING AT N14.
C     THE MEMBER LENGTH ARRAY "L" IS STORED IN THE "A-POOL"
C     STARTING AT N15.
C
C
         N1N=1
         N2N=N1N+NUMNOD*NCOL
         IF(N2N.GT.MAX) GO TO 1
         N3N=N2N+NUMNOD*NCOL
         IF(N3N.GT.MAX) GO TO 2
         N4N=N3N+NUMNOD*NCOL
         IF(N4N.GT.MAX) GO TO 3
         N5N=N4N+NUMMEM
         IF(N5N.GT.MAX) GO TO 4
         N6N=N5N+2*NUMMEM
         IF(N6N.GT.MAX) GO TO 5
         N8N=N6N+3*NCOL*NUMNOD
         IF(N8N.GT.MAX) GO TO 6
         N9N=N8N+NCOL
         IF(N9N.GT.MAX) GO TO 8
         N14N=N9N+NCOL
         IF(N14N.GT.MAX) GO TO 9
         N15N=N14N+NEQSMX*NEQSMX
         IF(N15N.GT.MAX) GO TO 14
         N16N=N15N+NUMMEM
         IF(N16N.GT.MAX) GO TO 19
         REWIND(1)
         REWIND(2)
         REWIND (3)
C
C     THE "NEQS" AND "NBDOF" ARE MOVED TO THEIR NEW POSITIONS
C     IN THE "IA-POOL".
C
         DO 10100 II=1,N14N-N8N
            K=N14N-II
            J=N10-II
            IA(K)=IA(J)
10100    CONTINUE
C
C     THE "X" "Y" AND "Z" ARRAYS ARE READ FROM "LU 1", WHICH
C     IS ASSIGNED TO "CORD.DAT".
C
         DO 6100 II=N1N,N4N-1
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            READ(1,*) A(II)
 6100    CONTINUE
C
C     THE "AREA" ARRAY IS READ FROM "LU 2" WHICH IS
C     ASSIGNED TO "MEM.DAT".
C
         DO 7100 II=N4N,N5N-1
            READ(2,*) A(II)
 7100    CONTINUE
C
C     THE "MEM" ARRAY IS READ FROM "LU 2" WHICH IS
C     ASSIGNED TO "MEM.DAT".
C
         DO 8100 II=N5N,N6N-1
            READ(2,*) IA(II)
 8100    CONTINUE
C
C     THE "IDOF" ARRAY IS READ FROM "LU 3" WHICH IS
C     ASSIGNED TO "DOF.DAT".
C
         DO 9100 II=N6N,N8N-1
            READ(3,*) IA(II)
 9100    CONTINUE
         N1=N1N
         N2=N2N
         N3=N3N
         N4=N4N
         N5=N5N
         N6=N6N
         N8=N8N
         N9=N9N
         N14=N14N
         N15=N15N
         N16=N16N
         IIPAR=0
         NEQS=IA(N8+I-1)
         NBDOF=IA(N9+I-1)
C
C
C     SUBROUTINE "STIFF" GENERATES THE SUBSTRUCTURE STIFFNESS MATRIX.
C
C
         CALL STIFF(NUMMEM,NCOL,I,E,NEQS,NRINGS,A(N4),IA(N5),
     $   A(N1),A(N2),A(N3),IA(N6),A(N14),A(N15))
C
C     THE MEMBER LENGTH ARRAY "L" IS OUTPUT ONTO "LU 10", BUT
C     ONLY FOR THE FIRST SUBSTRUCTURE.
C
         IF(I.NE.1) GO TO 9200
         DO 9300 II=N15,N16-1
            WRITE(10,*) A(II)
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 9300   CONTINUE
C
C
C     POINTERS EIGHT, NINE, FOURTEEN, FIFTEEN, AND SIXTEEN ARE SET.
C     THE "NEQS" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N8.
C     THE "NBDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N9.
C     THE SUBSTRUCTURE STIFFNESS MATRIX "SUBST" AS WELL AS THE
C     STATICALLY CONDENSED SUBSTRUCTURE STIFFNESS MATRIX "STAT"
C     ARE STORED IN THE "A-POOL" STARTING AT N14.
C     THE SUBSTRUCTURE LOAD VECTORS "QS" AS WELL AS THE
C     STATICALLY CONDENSED SUBSTRUCTURE LOAD VECTORS ARE STORED
C     IN THE "A-POOL" STARTING AT N15.
C
C
 9200   N8N=1
        N9N=N8N+NCOL
        IF(N9N.GT.MAX) GO TO 8
        N14N=N9N+NCOL
        IF(N14N.GT.MAX) GO TO 9
        N15N=N14N+NEQSMX*NEQSMX
        IF(N15N.GT.MAX) GO TO 14
        N16N=N15N+NCOL*NEQSMX
        IF(N16N.GT.MAX) GO TO 11
C
C     THE "NEQS" AND "NBDOF" ARRAYS ARE MOVED TO THEIR
C     NEW POSITIONS IN THE "IA-POOL".
C
        DO 11100 II=1,N14N-N8N
           K=II+N8N-1
           J=II+N8-1
           IA(K)=IA(J)
11100   CONTINUE
C
C     THE "STAT" ARRAY IS MOVED TO ITS NEW POSITION IN
C     THE "A-POOL".
C
        DO 12100 II=1,N15N-N14N
           K=II+N14N-1
           J=II+N14-1
           A(K)=A(J)
12100   CONTINUE
        REWIND (4)
C
C     THE "QS" ARRAY IS READ FROM "LU 4" WHICH IS ASSIGNED TO
C     "LOAD.DAT", AND IS STORED IN THE "A-POOL".
C
        DO 13100 II=N15N,N16N-1
           READ(4,*) A(II)
13100   CONTINUE
        N8=N8N
        N9=N9N
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      N14=N14N
      N15=N15N
      N16=N16N
C
C
C     THE "STACON" SUBROUTINE STATICALLY CONDENSES THE SUBSTRUCTURE
C     STIFFNESS MATRIX AND THE SUBSTRUCTURE LOAD VECTOR.
C
C
      CALL STACON(A(N14),NBDOF,A(N15),NEQS,NCOL,I,IIPAR)
C
C
C     POINTERS SIX, SEVEN, EIGHT, NINE, TEN, ELEVEN, TWELVE,
C     FIFTEEN, AND SIXTEEN ARE SET.
C     THE "NEQS" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N8.
C     THE "NBDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N9.
C     THE "STAT" ARRAY IS STORED IN THE "A-POOL" STARTING AT N10.
C     THE "QS" ARRAY IS STORED IN THE "A-POOL" STARTING AT N11.
C     THE STRUCTURE LOAD VECTOR "Q" IS STORED IN THE "A-POOL"
C     STARTING AT N12.
C     THE "IDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N6.
C     THE "ISDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N7.
C     THE STRUCTURE STIFFNESS MATRIX "STIFMX" IS STORED IN THE
C     "A-POOL" STARTING AT N15.
C
C
      MBAND=9*NRINGS
      N8N=1
      N9N=N8N+NCOL
      IF(N9N.GT.MAX) GO TO 9
      N10N=N9N+NCOL
      IF(N10N.GT.MAX) GO TO 10
      N11N=N10N+NEQSMX*NEQSMX
      IF(N11N.GT.MAX) GO TO 15
      N12N=N11N+NEQSMX*NCOL
      IF(N12N.GT.MAX) GO TO 11
      N6N=N12N+NEQ
      IF(N6N.GT.MAX) GO TO 13
      N7N=N6N+NCOL*3*NUMNOD
      IF(N7N.GT.MAX) GO TO 6
      N15N=N7N+NCOL*3*NRINGS
      IF(N15N.GT.MAX) GO TO 7
      N16N=N15N+NEQ*MBAND
      IF(N16N.GT.MAX) GO TO 16
C
C     THE "STAT" ARRAY IS MOVED TO ITS NEW PLACE IN THE "A-POOL".
C
      DO 14100 II=1,N10N-N9N
         K=II+N10N-1
         J=II+N14-1
         A(K)=A(J)
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14100    CONTINUE
         REWIND (3)
C
C     THE "Q" ARRAY IS READ FROM "LU 4" WHICH IS ASSIGNED
C     TO "LOAD.DAT". NOTE THAT THE FILE IS NOT REWOUND
C     BEFORE READING "Q"; THIS IS BECAUSE THE "Q" ARRAY
C     IS LOCATED AFTER THE "QS" ARRAY ON THE "LOAD.DAT"
C     FILE AND "QS" WAS PREVIOUSLY READ FROM THE FILE.
C
         DO 15100 II=N12N,N6N-1
           READ(4,*) A(II)
15100    CONTINUE
C
C     THE "IDOF" AND "ISDOF" ARRAYS ARE READ FROM "LU 3"
C     WHICH IS ASSIGNED TO "DOF.DAT".
C
         DO 16100 II=N6N,N15N-1
           READ(3,*) IA(II)
16100    CONTINUE
C
C     THE "STIFMX" ARRAY IS READ FROM "LU 8" WHICH IS
C     ASSIGNED TO "STIFF.DAT"
C
         REWIND (8)
         DO 16200 II=N15N,N16N-1
           READ(8,*) A(II)
16200    CONTINUE
         N8=N8N
         N9=N9N
         N10=N10N
         N11=N11N
         N12=N12N
         N6=N6N
         N7=N7N
         N15=N15N
         N16=N16N
C
C
C     THE "ASSEM" SUBROUTINE ASSEMBLES THE STRUCTURE STIFFNESS
C     MATRIX FROM THE STATICALLY CONDENSED SUBSTRUCTURE
C     STIFFNESS MATRICES, AS WELL AS ASSEMBLING THE STRUCTURE
C     LOAD VECTOR FROM THE STATICALLY CONDENSED SUBSTRUCTURE
C     LOAD VECTORS.
C
C
         CALL ASSEM(A(N15),A(N10),A(N11),IA(N7),A(N12),IA(N6)
      $  ,NEQS,NEQ,NCOL,NRINGS,I)
C
C
         REWIND (4)
         REWIND (8)
```

```
C
C     THE "QS" AND "Q" ARRAYS ARE STORED ON "LU 4" AFTER BEING
C     MODIFIED BY THE ASSEM SUBROUTINE.
C
         DO 17100 II=N11,N6-1
            WRITE(4,*) A(II)
17100    CONTINUE
C
C     THE "STIFMX" ARRAY IS STORED ON "LU 8" WHICH IS ASSIGNED
C     TO "STIFF.DAT".
C
         DO 18100 II=N15,N16-1
            WRITE(8,*) A(II)
18100    CONTINUE
 1000 CONTINUE
      WRITE(7,201)'MATERIAL CONSUMPTION FOR RINGS:  ',VOL(1)
  201 FORMAT('1',10X,C33,14X,F10.3)
      WRITE(7,301) 'FOR DIAGONALS:  ',VOL(2)
  301 FORMAT('-',31X,C16,10X,F10.3)
      WRITE(7,401) 'FOR STIFFENERS:  ',VOL(3)
  401 FORMAT('-',31X,C17,9X,F10.3)
      WRITE(7,501) 'FOR UPPER BRACING TRUSS:  ',VOL(4)
      WRITE(7,501) 'FOR LOWER BRACING TRUSS:  ',VOL(5)
  501 FORMAT('-',31X,C26,F10.3)
C
C
C     POINTERS EIGHT, NINE, SIXTEEN, AND SEVENTEEN ARE SET.
C     THE "NEQS" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N8.
C     THE "NBDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N9.
C     THE "STIFMX" ARRAY IS STORED IN THE "A-POOL" STARTING AT N16.
C
C
      N8N=1
      N9N=N8N+NCOL
      IF(N9N.GT.MAX) GO TO 9
      N16N=N9N+NCOL
      IF(N16N.GT.MAX) GO TO 10
      N17N=N16N+NEQ*MBAND
      IF(N17N.GT.MAX) GO TO 16
      REWIND (8)
C
C     THE "STIFMX" ARRAY IS READ FROM "LU 8" WHICH IS ASSIGNED
C     TO "STIFF.DAT"
C
      DO 21100 II=N16N,N17N-1
         READ(8,*) A(II)
21100 CONTINUE
      N8=N8N
      N9=N9N
      N16=N16N
      N17=N17N
```

```
C
C
C     THE "SOLVE" SUBROUTINE PERFORMS GAUSSIAN ELIMINATION ON THE
C     STRUCTURE STIFFNESS MATRIX.
C
C
      CALL SOLVE(A(N16),NEQ,MBAND)
C
C
C     POINTER EIGHT, NINE, SIXTEEN, SEVENTEEN, TEN AND ELEVEN
C     ARE SET.
C     THE "NEQS" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N8.
C     THE "NBDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N9.
C     THE REDUCED STRUCTURE STIFFNESS MATRIX "S" IS STORED IN THE
C     "A-POOL" STARTING AT N16.
C     THE "QS" ARRAY IS STORED IN THE "A-POOL" STARTING AT N17,
C     ALTHOUGH IT IS NOT REQUIRED FOR THIS SUBROUTINE IT MUST BE
C     READ BEFORE THE "Q" ARRAY FROM "LOAD.DAT".
C     THE "Q" ARRAY IS STORED IN THE "A-POOL" STARTING AT N10.
C
C
      N8N=1
      N9N=N8N+NCOL
      IF(N9N.GT.MAX) GO TO 9
      N16N=N9N+NCOL
      IF(N16N.GT.MAX) GO TO 10
      N17N=N16N+NEQ*MBAND
      IF(N17N.GT.MAX) GO TO 16
      N10N=N17N+NEQSMX*NCOL
      IF(N10N.GT.MAX) GO TO 11
      N11N=N10N+NEQ
      IF(N11N.GT.MAX) GO TO 13
      REWIND (4)
C
C     THE "QS" AND "Q" ARRAYS ARE READ FROM "LU 4" WHICH
C     ASSIGNED TO "LOAD.DAT".
C
      DO 25100 II=N17N,N11N-1
         READ(4,*) A(II)
25100 CONTINUE
      N8=N8N
      N9=N9N
      N16=N16N
      N17=N17N
      N10=N10N
      N11=N11N
C
C
C     THE "BACSUB" SUBROUTINE DOES BACK-SUBSTITUTION ON THE
C     STRUCTURE STIFFNESS MATRIX, WHICH IS REDUCED BY "SOLVE",
C     AND THE STRUCTURE LOAD VECTOR TO OBTAIN THE GLOBAL
```

```
C     DISPLACEMENT VECTOR.
C
C
      CALL BACSUB(A(N16),A(N10),NEQ,MBAND)
C
C
C     POINTERS EIGHT, NINE, TEN, SIX, SEVEN, THIRTEEN AND
C     FOURTEEN ARE SET.
C     THE "NEQS" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N8.
C     THE "NBDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N9.
C     THE STRUCTURE DISPLACEMENT VECTOR "D" IS STORED IN THE
C     "A-POOL" STARTING AT N10.
C     THE "IDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N6.
C     THE "ISDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N7.
C     THE SUBSTRUCTURE DISPLACEMENT VECTORS "DS" ARE STORED IN THE
C     "A-POOL" STARTING AT N13.
C
C
      N8N=1
      N9N=N8N+NCOL
      IF(N9N.GT.MAX) GO TO 9
      N10N=N9N+NCOL
      IF(N10N.GT.MAX) GO TO 10
      N6N=N10N+NEQ
      IF(N6N.GT.MAX) GO TO 13
      N7N=N6N+3*NCOL*NUMNOD
      IF(N7N.GT.MAX) GO TO 6
      N13N=N7N+3*NCOL*NRINGS
      IF(N13N.GT.MAX) GO TO 7
      N14N=N13N+NCOL*NEQSMX
      IF(N14N.GT.MAX) GO TO 11
C
C     THE "D" VECTOR IS MOVED TO ITS NEW POSITION IN
C     THE "A-POOL".
C
      DO 25200 II=1,N6N-N10N
         K=II+N10N-1
         J=II+N10-1
         A(K)=A(J)
25200 CONTINUE
      REWIND (3)
C
C     THE "IDOF" AND "ISDOF" ARRAYS ARE READ FROM "LU 3" WHICH
C     IS ASSIGNED TO "DOF.DAT".
C
      DO 26100 II=N6N,N13N-1
         READ(3,*) IA(II)
26100 CONTINUE
      N8=N8N
      N9=N9N
      N10=N10N
```

```
      N6=N6N
      N7=N7N
      N13=N13N
      N14=N14N
C
C
C     THE "EXTRCT" SUBROUTINE EXTRACTS THE BOUNDARY DISPLACEMENTS
C     FOR EACH SUBSTRUCTURE FROM THE GLOBAL DISPLACEMENT VECTOR.
C
C
      CALL EXTRCT(A(N13),A(N10),IA(N7),IA(N6),NCOL,NRINGS)
C
C     THE "DS" ARRAY IS STORED ON "LU 9" WHICH IS ASSIGNED
C     TO "DISP.DAT".
C
      DO 26200 II=N13,N14-1
         WRITE(9,*) A(II)
26200 CONTINUE
C
C
C     THE FOLLOWING LOOP REGENERATES THE SUBSTRUCTURE STIFFNESS
C     MATRIX, AND CALCULATES THE STATICALLY CONDENSED STIFFNESS
C     MATRIX FOR EACH SUBSTRUCTURE. THE INTERNAL DISPLACEMENTS
C     ARE THEN CALCULATED BY FORWARD SUBSTITUTION FOR EACH
C     SUBSTRUCTURE.
C
C
      DO 5000 I=1,NCOL
C
C
C     POINTERS EIGHT, NINE, ONE, TWO, THREE, FOUR, FIVE,
C     SIX, FOURTEEN AND FIFTEEN ARE SET.
C     THE "NEQS" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N8.
C     THE "NBDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N9.
C     THE "X" ARRAY IS STORED IN THE "A-POOL" STARTING AT N1.
C     THE "Y" ARRAY IS STORED IN THE "A-POOL" STARTING AT N2.
C     THE "Z" ARRAY IS STORED IN THE "A-POOL" STARTING AT N3.
C     THE "AREA" ARRAY IS STORED IN THE "A-POOL" STARTING AT N4.
C     THE "MEM" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N5.
C     THE "IDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N6.
C     THE "SUBST" ARRAY IS STORED IN THE "A-POOL" STARTING AT N14.
C      THE "L" ARRAY IS STORED IN THE "A-POOL" STARTING AT N15.
C
C
         N8N=1
         N9N=N8N+NCOL
         IF(N9N.GT.MAX) GO TO 9
         N1N=N9N+NCOL
         IF(N1N.GT.MAX) GO TO 10
         N2N=N1N+NUMNOD*NCOL
         IF(N2N.GT.MAX) GO TO 1
```

```
      N3N=N2N+NUMNOD*NCOL
      IF(N3N.GT.MAX) GO TO 2
      N4N=N3N+NUMNOD*NCOL
      IF(N4N.GT.MAX) GO TO 3
      N5N=N4N+NUMMEM
      IF(N5N.GT.MAX) GO TO 4
      N6N=N5N+2*NUMMEM
      IF(N6N.GT.MAX) GO TO 5
      N14N=N6N+3*NCOL*NUMNOD
      IF(N14N.GT.MAX) GO TO 6
      N15N=N14N+NEQSMX*NEQSMX
      IF(N15N.GT.MAX) GO TO 14
      N16N=N15N+NUMMEM
      IF(N16N.GT.MAX) GO TO 19
      REWIND (1)
      REWIND (2)
      REWIND (3)
C
C     THE "X" "Y" AND "Z" ARRAYS ARE READ FROM "LU 1" WHICH
C     IS ASSIGNED TO "CORD.DAT"
C
      DO 27100 II=N1N,N4N-1
         READ(1,*) A(II)
27100 CONTINUE
C
C     THE "AREA" ARRAY IS READ FROM "LU 2" WHICH IS ASSIGNED
C     TO "MEM.DAT".
C
      DO 28100 II=N4N,N5N-1
         READ(2,*) A(II)
28100 CONTINUE
C
C     THE "MEM" ARRAY IS READ FROM "LU 2".
C
      DO 29100 II=N5N,N6N-1
         READ(2,*) IA(II)
29100 CONTINUE
C
C     THE "IDOF" ARRAY IS READ FROM "LU 3" WHICH IS
C     ASSIGNED TO "DOF.DAT".
C
      DO 31100 II=N6N,N14N-1
         READ(3,*) IA(II)
31100 CONTINUE
      N1=N1N
      N2=N2N
      N3=N3N
      N4=N4N
      N5=N5N
      N6=N6N
      N8=N8N
```

```
         N9=N9N
         N14=N14N
         N15=N15N
         N16=N16N
         IIPAR=1
         NEQS=IA(N8+I-1)
         NBDOF=IA(N9+I-1)
C
C
         CALL STIFR(NUMMEM,NCOL,I,E,NEQS,NRINGS,A(N4),IA(N5),
     $    A(N1),A(N2),A(N3),IA(N6),A(N14),A(N15))
C
C
C     POINTERS EIGHT, NINE, FOURTEEN AND TEN ARE SET.
C     THE "NEQS" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N8.
C     THE "NBDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N9.
C     THE "STAT" ARRAY IS STORED IN THE "A-POOL" STARTING AT N14.
C     THE "QS" ARRAY IS STORED IN THE "A-POOL" STARTING AT N10.
C
C
         N8N=1
         N9N=N8N+NCOL
         IF(N9N.GT.MAX) GO TO 9
         N14N=N9N+NCOL
         IF(N14N.GT.MAX) GO TO 10
         N10N=N14N+NEQSMX*NEQSMX
         IF(N10N.GT.MAX) GO TO 14
         N11N=N10N+NCOL*NEQSMX
         IF(N11N.GT.MAX) GO TO 11
C
C     THE "STAT" ARRAY IS MOVED TO ITS NEW POSITION IN THE
C     "A-POOL".
C
         DO 35100 II=1,N15N-N14N
            K=II+N14N-1
            J=II+N14-1
            A(K)=A(J)
35100    CONTINUE
         REWIND (4)
C
C     THE "QS" ARRAY IS READ FROM "LU 4" WHICH IS ASSIGNED
C     TO "LOAD.DAT"
C
         DO 34100 II=N10N,N11N-1
            READ(4,*) A(II)
34100    CONTINUE
         N8=N8N
         N9=N9N
         N10=N10N
         N14=N14N
         N11=N11N
```

```
        CALL STACON(A(N14),NBDOF,A(N10),NEQS,NCOL,I,IIPAR)
        N8N=1
C
C
C     POINTERS EIGHT, NINE, FOURTEEN, TEN, FIFTEEN AND SIXTEEN
C     ARE SET.
C     THE "NEQS" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N8.
C     THE "NBDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N9.
C     THE "STAT" ARRAY IS STORED IN THE "A-POOL" STARTING AT N14.
C     THE "QS" ARRAY IS STORED IN THE "A-POOL" STARTING AT N10.
C     THE "DS" ARRAY IS STORED IN THE "A-POOL" STARTING AT N15.
C
C
        N9N=N8N+NCOL
        IF(N9N.GT.MAX) GO TO 9
        N14N=N9N+NCOL
        IF(N14N.GT.MAX) GO TO 10
        N10N=N14N+NEQSMX*NEQSMX
        IF(N10N.GT.MAX) GO TO 14
        N15N=N10N+NCOL*NEQSMX
        IF(N15N.GT.MAX) GO TO 11
        N16N=N15N+NEQSMX*NCOL
        IF(N16N.GT.MAX) GO TO 17
        REWIND (9)
C
C     THE "DS" ARRAY IS READ FROM "LU 9" WHICH IS ASSIGNED
C     TO "DISP.DAT".
C
        DO 36100 II=N15N,N16N-1
           READ(9,*) A(II)
36100   CONTINUE
        N8=N8N
        N9=N9N
        N10=N10N
        N14=N14N
        N15=N15N
        N16=N16N
C
C
C     THE "FORSUB" SUBROUTINE PERFORMS FORWARD SUBSTITUTION
C     ON THE STATICALLY CONDENSED SUBSTRUCTURE STIFFNESS MATRIX AND
C     SUBSTRUCTURE LOAD VECTOR TO OBTAIN THE INTERIOR
C     DISPLACEMENTS FOR EACH SUBSTRUCTURE.
C
C
        CALL FORSUB(A(N14),A(N10),A(N15),NCOL,NBDOF,NEQS,I)
        REWIND (9)
C
C     THE "DS" ARRAY IS STORED ON "LU 9", WHICH IS ASSIGNED TO
C     "DISP.DAT", AFTER BEING MODIFIED BY "FORSUB".
C
```

```
         DO 36200 II=N15,N16-1
            WRITE(9,*) A(II)
36200    CONTINUE
 5000 CONTINUE
C
C
C     POINTERS ONE, TWO, THREE, FOUR, FIVE, SIX, FIFTEEN,
C     SIXTEEN AND SEVENTEEN ARE SET.
C     THE "X" ARRAY IS STORED IN THE "A-POOL" STARTING AT N1.
C     THE "Y" ARRAY IS STORED IN THE "A-POOL" STARTING AT N2.
C     THE "Z" ARRAY IS STORED IN THE "A-POOL" STARTING AT N3.
C     THE "AREA" ARRAY IS STORED IN THE "A-POOL" STARTING AT N4.
C     THE "MEM" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N5.
C     THE "IDOF" ARRAY IS STORED IN THE "IA-POOL" STARTING AT N6.
C     THE "DS" ARRAY IS STORED IN THE "A-POOL" STARTING AT N15.
C     THE MEMBER FORCE ARRAY "FOR" IS STORED IN THE "A-POOL"
C     STARTING AT N16.
C     THE "L" ARRAY IS STORED IN THE "A-POOL" STARTING AT N17.
C
C
      N1=1
      N2=N1+NUMNOD*NCOL
      IF(N2.GT.MAX) GO TO 1
      N3=N2+NUMNOD*NCOL
      IF(N3.GT.MAX) GO TO 2
      N4=N3+NUMNOD*NCOL
      IF(N4.GT.MAX) GO TO 3
      N5=N4+NUMMEM
      IF(N5.GT.MAX) GO TO 4
      N6=N5+2*NUMMEM
      IF(N6.GT.MAX) GO TO 5
      N15=N6+3*NCOL*NUMNOD
      IF(N15.GT.MAX) GO TO 6
      N16=N15+NEQSMX*NCOL
      IF(N16.GT.MAX) GO TO 17
      N17=N16+NCOL*NUMMEM
      IF(N17.GT.MAX) GO TO 18
      N18=N17+NUMMEM
      REWIND (1)
      REWIND (2)
      REWIND (9)
C
C     THE "A-POOL" AND "IA-POOL" ARE BOTH CLEARED.
C
      DO 39200 II=N1,N17
         A(II)=0.0
         IA(II)=0
39200 CONTINUE
C
C     THE "X" "Y" AND "Z" ARRAYS ARE READ FROM "LU 1"
C     WHICH IS ASSIGNED TO "CORD.DAT"
```

```
C
      DO 39100 II=N1,N4-1
         READ(1,*) A(II)
39100 CONTINUE
C
C     THE "AREA" ARRAY IS READ FROM "LU 2" WHICH
C     IS ASSIGNED TO "MEM.DAT".
C
      DO 40100 II=N4,N5-1
         READ(2,*) A(II)
40100 CONTINUE
C
C     THE "MEM" ARRAY IS READ FROM "LU 2".
C
      DO 41100 II=N5,N6-1
         READ(2,*) IA(II)
41100 CONTINUE
      REWIND(3)
C
C     THE "IDOF" ARRAY IS READ FROM "LU 3" WHICH IS ASSIGNED
C     TO "DOF.DAT".
C
      DO 42100 II=N6,N15-1
         READ(3,*) IA(II)
42100 CONTINUE
C
C     THE "DS" ARRAY IS READ FROM "LU 9" WHICH IS
C     ASSIGNED TO "DISP.DAT".
C
      DO 43100 II=N15,N16-1
         READ(9,*) A(II)
43100 CONTINUE
C
C     THE "L" ARRAY IS READ FROM "LU 10".
C
      REWIND (10)
      DO 44100 II=N17,N18-1
         READ(10,*) A(II)
44100 CONTINUE
C
C
C     SUBROUTINE "MEMFOR" CALCULATES THE MEMBER FORCE FOR
C     EACH MEMBER IN EACH SUBSTRUCTURE.
C
C
      CALL MEMFOR(A(N15),IA(N5),A(N4),NCOL,A(N1),A(N2),A(N3),
     $IA(N6),NUMMEM,A(N16),E,NEQSMX,ALPHAC,ALPHAT,DEPTH,RIN,
     $NRINGS,A(N17))
      REWIND(1)
      REWIND(2)
      REWIND(3)
```

```
      REWIND(4)
      REWIND(8)
      REWIND(9)
      REWIND(10)
      WRITE(6,*) 'DO YOU WISH TO ANALYZE THIS STRUCTURE'
      WRITE(6,*) 'FOR ANOTHER LOADING CASE'
      WRITE(6,*) 'IF YES ENTER Y, IF NOT ENTER N'
      READ(5,1867) ANS
      IF(ANS.EQ.'Y') GO TO 1890
      WRITE(6,*) 'DO YOU WISH TO ANALYZE ANOTHER STRUCTURE'
      WRITE(6,*) 'IF YES ENTER Y, IF NOT ENTER N'
      READ(5,1867) ANS
 1867 FORMAT(C1)
      IF(ANS.EQ.'Y') GO TO 1860
      STOP
C
C
C     THE FOLLOWING LINES CALL THE "ERROR" SUBROUTINE.
C     THE "ERROR" SUBROUTINE WARNS THE USER THAT THERE
C     IS NOT ENOUGH MEMORY IN THE STORAGE POOLS TO
C     STORE ALL THE ARRAYS REQUIRED TO EXECUTE THE PROGRAM.
C
C
    1 IPAR=1
      CALL ERROR(IPAR)
      STOP
    2 IPAR=2
      CALL ERROR(IPAR)
      STOP
    3 IPAR=3
      CALL ERROR(IPAR)
      STOP
    4 IPAR=4
      CALL ERROR(IPAR)
      STOP
    5 IPAR=5
      CALL ERROR(IPAR)
      STOP
    6 IPAR=6
      CALL ERROR(IPAR)
      STOP
    7 IPAR=7
      CALL ERROR(IPAR)
      STOP
    8 IPAR=8
      CALL ERROR(IPAR)
      STOP
    9 IPAR=9
      CALL ERROR(IPAR)
      STOP
   10 IPAR=10
```

```
      CALL ERROR(IPAR)
      STOP
   11 IPAR=11
      CALL ERROR(IPAR)
      STOP
   12 IPAR=12
      CALL ERROR(IPAR)
      STOP
   13 IPAR=13
      CALL ERROR(IPAR)
      STOP
   14 IPAR=14
      CALL ERROR(IPAR)
      STOP
   15 IPAR=15
      CALL ERROR(IPAR)
      STOP
   16 IPAR=16
      CALL ERROR(IPAR)
      STOP
   17 IPAR=1[illegible]
      CALL ERROR(IPAR)
      STOP
   18 IPAR=18
      CALL ERROR(IPAR)
      STOP
   19 IPAR=19
      CALL ERROR(IPAR)
      STOP
      END
```

```
C
C     THE "COORD" SUBROUTINE CALCULATES THE COORDINATES OF
C     ALL THE NODAL POINTS IN THE STRUCTURE. THE "X-COORD."
C     ARE STORED IN THE "X" ARRAY, SUCH THAT THE FIRST
C     INDEX INDICATES THE SUBSTRUCTURE THE POINT IS IN, AND
C     THE SECOND INDEX INDICATES WHICH NODAL POINT IS BEING
C     ACCESSED IN THE SUBSTRUCTURE. THE "Y-COORD." AND
C     "Z-COORD." ARE SIMILARLY STORED IN THE "Y" AND "Z"
C     ARRAYS RESPECTIVELY. THE USER IS PROMPTED BY THE PROGRAM
C     TO ENTER BASIC GEOMETRIC STRUCTURE DATA SUCH AS:
C     -THE ANGLE BETWEEN THE PLANE FORMED BY THE DIAGONALS
C      BETWEEN ANY TOP RING AND THE NEXT BOTTOM RING AND A
C      HORIZONTAL PLANE "ALPHAC".
C     -THE ANGLE BETWEEN THE PLANE FORMED BY THE DIAGONALS
C      BETWEEN ANY BOTTOM RING AND THE NEXT TOP RING AND A
C      HORIZONTAL PLANE "ALPHAT".
C     -THE DEPTH OF THE ROOF TRUSS "DEPTH".
C     -AND THE DISTANCE FROM THE CENTER OF THE ROOF TO
C      THE FIRST RING, MEASURED ALONG A COLUMN LINE "RIN".
C
C
C
      SUBROUTINE COORD(NCOL,NRINGS,NUM,X,Y,Z,ALPHAC,ALPHAT,DEPTH,
     $RIN)
      DIMENSION X(NCOL,1),Y(NCOL,1),Z(NCOL,1)
      DO 100 I=1,NCOL
      DO 100 J=1,NUM
         X(I,J)=0.0
         Y(I,J)=0.0
         Z(I,J)=0.0
  100 CONTINUE
C
C
C     INPUT BASIC STRUCTURE DATA
C
C
      WRITE(6,*) '                               ALPHAT (REAL)'
      READ(5,*) ALPHAT
      WRITE(6,*) '                               ALPHAC (REAL)'
      READ(5,*) ALPHAC
      WRITE(6,*) '                               DEPTH (REAL)'
      READ(5,*) DEPTH
      WRITE(6,*) '                               RIN (REAL)'
      READ(5,*) RIN
C
C
C     OUTPUT BASIC STRUCTURE DATA.
C
C
      WRITE(7,101) 'ANGLE ALPHA-T: ',ALPHAT
```

```
 101 FORMAT(' ',//,20X,C15,11X,F6.2)
     WRITE(7,101) 'ANGLE ALPHA-C: ',ALPHAC
     WRITE(7,103) 'DEPTH OF TRUSS: ',DEPTH
 103 FORMAT(' ',//,20X,C16,10X,F7.3)
     WRITE(7,104) 'INNER RADIUS: ',RIN
 104 FORMAT(' ',//,20X,C14,12X,F7.3)
C
C    CONVERT ANGLES ALPHAC AND ALPHAT FROM DEGREES TO RADIANS.
C
     ALPHAC=ALPHAC*2.0*3.141592654/360.0
     ALPHAT=ALPHAT*2.0*3.141592654/360.0
C
C
C    CALCULATE THE COORDINATES OF THE END POINTS OF THE
C    T-C SEGMENTS IN EACH SUBSTRUCTURE
C
C
     DO 1000 I=1,NCOL
        THETA1=(I-1)*2.0*3.141592654/NCOL
        THETA2=I*2.0*3.141592654/NCOL
        R=RIN
        DO 1001 J=1,NRINGS-1,2
C
C    COMPRESSION RINGS
C
           X(I,2*J-1)=R*COS(THETA1)
           Y(I,2*J-1)=R*SIN(THETA1)
           Z(I,2*J-1)=DEPTH
           X(I,2*J)=R*COS(THETA2)
           Y(I,2*J)=R*SIN(THETA2)
           Z(I,2*J)=DEPTH
C
C    TENSION RINGS
C
           JJ=J+1
           R=R+DEPTH*COS(ALPHAC)/SIN(ALPHAC)
           X(I,2*JJ-1)=R*COS(THETA1)
           Y(I,2*JJ-1)=R*SIN(THETA1)
           Z(I,2*JJ-1)=0.0
           X(I,2*JJ)=R*COS(THETA2)
           Y(I,2*JJ)=R*SIN(THETA2)
           Z(I,2*JJ)=0.0
           R=R+DEPTH*COS(ALPHAT)/SIN(ALPHAT)
1001    CONTINUE
1000 CONTINUE
C
C
C    CALCULATE THE COORDINATES OF THE INTERIOR NODES
C    FOR EACH SUBSTRUCTURE
C
C
```

```
      DO 2000 I=1,NCOL
         NUM=2*NRINGS+1
         DO 2001 J=2,NRINGS
            JJ=J-1
            DO 2002 K=1,JJ
               X(I,NUM)=X(I,2*J)+(X(I,2*J-1)
     $         -X(I,2*J))/(JJ+1)*(JJ+1-K)
               Y(I,NUM)=Y(I,2*J-1)+(Y(I,2*J)
     $         -Y(I,2*J-1))/(JJ+1)*K
               Z(I,NUM)=Z(I,2*J)
               NUM=NUM+1
2002        CONTINUE
2001     CONTINUE
2000  CONTINUE
      NUM=NUM-1
      RETURN
      END
```

```
C
C
C     THE "MEMDAT" SUBROUTINE ASSIGNS THE APPROPRIATE MEMBER
C     AREA TO EACH MEMBER. THESE MEMBER AREAS ARE STORED IN
C     THE "AREA" ARRAY. THE MEMBER AREA FOR A PARTICULAR MEMBER
C     CAN BE ACCESSED BY THE MEMBER NUMBER. THE "MEMDAT"
C     SUBROUTINE ALSO CALCULATES THE MEMBER END-NODES FOR EACH
C     MEMBER. THE END-NODE NUMBERS ARE STORED IN THE "MEM"
C     ARRAY, THE FIRST INDEX IS THE MEMBER NUMBER, AND THE
C     SECOND INDEX IS EITHER "1" FOR "NODE I" OR "2" FOR
C     "NODE J". THE USER IS PROMPTED BY THE COMPUTER TO INPUT
C     THE MEMBER AREAS FOR THE DIFFERENT TYPES OF MEMBERS.
C
C
C
      SUBROUTINE MEMDAT(NRINGS,MNUM,AREA,MEM)
      DIMENSION AREA(1), MEM(2,1)
      DIMENSION A(30)
C
C
C     SUPPLY MEMBER AREAS FOR THE RINGS
C
C
      DO 1000 I=1,NRINGS
         WRITE(6,*) 'ENTER THE MEMBER AREA FOR RING    ',I
         READ(5,*) A(I)
 1000 CONTINUE
C
C
C     DETERMINE NODE NUMBERS AND ASSIGN MEMBER AREA
C     TO EACH RING
C
C
      MNUM=1
      DO 2000 I=1,NRINGS
         IF(I.EQ.1) GO TO 2001
         GO TO 2002
 2001    MEM(1,MNUM)=2*I-1
         MEM(2,MNUM)=2*I
         AREA(MNUM)=A(I)
         MNUM=MNUM+1
         GO TO 2000
 2002    INT=2*NRINGS+I*(I-1)/2-I+2
         DO 2003 J=1,I
            IF(J.EQ.1) GO TO 2004
            IF(J.EQ.I) GO TO 2005
            GO TO 2006
 2004       AREA(MNUM)=A(I)
            MEM(1,MNUM)=2*I-1
            MEM(2,MNUM)=INT
            MNUM=MNUM+1
```

```
            GO TO 2003
 2005       AREA(MNUM)=A(I)
            MEM(1,MNUM)=INT
            MEM(2,MNUM)=2*I
            MNUM=MNUM+1
            GO TO 2003
 2006       AREA(MNUM)=A(I)
            MEM(1,MNUM)=INT
            INT=INT+1
            MEM(2,MNUM)=INT
            MNUM=MNUM+1
 2003    CONTINUE
 2000 CONTINUE
C
C
C     INPUT AREAS FOR DIAGONAL MEMBERS RING BY RING
C
C
      DO 4000 I=1,NRINGS-1
         WRITE(6,*) 'INPUT DIAGONAL MEMBER AREAS RING BY RING'
         WRITE(6,*) 'BETWEEN RINGS  ',I,'  AND  ',I+1
         READ(5,*) A(I)
 4000 CONTINUE
C
C
C     DETERMINE END NODES OF DIAGONAL MEMBERS AND
C     ASSIGN MEMBER AREAS
C
C
      DO 5000 I=1,NRINGS-1
         N1=2*I-1
         N2=2*(I+1)-1
         IF(I.EQ.1) GO TO 5001
         INT1=2*NRINGS+I*(I-1)/2-I+2
         GO TO 5002
 5001    INT1=2
 5002    INT2=2*NRINGS+I*(I+1)/2-(I+1)+2
C
C     CALCULATES FOR THE FIRST PAIR
C
         AREA(MNUM)=A(I)
         MEM(1,MNUM)=N2
         MEM(2,MNUM)=N1
         MNUM=MNUM+1
         AREA(MNUM)=A(I)
         MEM(1,MNUM)=N1
         MEM(2,MNUM)=INT2
         MNUM=MNUM+1
         N2=INT2
         IF(I.EQ.1) GO TO 5003
         N1=INT1
```

```
C
C     CALCULATES FOR THE INTERIOR PAIRS
C
         DO 5004 J=1,I-1
            AREA(MNUM)=A(I)
            MEM(1,MNUM)=N2
            MEM(2,MNUM)=N1
            N2=N2+1
            MNUM=MNUM+1
            AREA(MNUM)=A(I)
            MEM(1,MNUM)=N1
            MEM(2,MNUM)=N2
            MNUM=MNUM+1
            N1=N1+1
 5004    CONTINUE
C
C     CALCULATES FOR THE LAST PAIR
C
 5003    N1=2*I
         AREA(MNUM)=A(I)
         MEM(1,MNUM)=N2
         MEM(2,MNUM)=N1
         MNUM=MNUM+1
         N2=2*(I+1)
         AREA(MNUM)=A(I)
         MEM(1,MNUM)=N1
         MEM(2,MNUM)=N2
         MNUM=MNUM+1
 5000 CONTINUE
C
C
C     INPUT MEMBER AREAS FOR THE STIFFENERS RING BY RING
C
C
      DO 6000 I=1,NRINGS-2
         WRITE(6,*) 'INPUT MEMBER AREAS FOR STIFFENERS RING BY RING'
         WRITE(6,*) 'BETWEEN RINGS  ',I,'  AND  ',I+2
         READ(5,*) A(I)
 6000 CONTINUE
C
C
C     DETERMINE NODE NUMBERS AND ASSIGN MEMBER AREAS
C     FOR THE STIFFENERS
C
C
C     BETWEEN COMPRESSION RINGS
C
      DO 7000 I=1,NRINGS-3,2
         AREA(MNUM)=A(I)
         MEM(1,MNUM)=2*I-1
         MEM(2,MNUM)=2*(I+2)-1
```

```
         MNUM=MNUM+1
         AREA(MNUM)=A(I)
         MEM(1,MNUM)=2*I
         MEM(2,MNUM)=2*(I+2)
         MNUM=MNUM+1
 7000 CONTINUE
C
C     BETWEEN TENSION RINGS
C
      DO 8000 I=2,NRINGS-2,2
         AREA(MNUM)=A(I)
         MEM(1,MNUM)=2*I-1
         MEM(2,MNUM)=2*(I+2)-1
         MNUM=MNUM+1
         AREA(MNUM)=A(I)
         MEM(1,MNUM)=2*I
         MEM(2,MNUM)=2*(I+2)
         MNUM=MNUM+1
 8000 CONTINUE
C
C
C     INPUT MEMBER AREAS FOR IN-PLANE BRACING TRUSSES
C
C
      WRITE(6,*) 'INPUT MEMBER AREA FOR LOWER PLANE BRACING TRUSS'
      READ(5,*) A(1)
      WRITE(6,*) 'INPUT MEMBER AREA FOR UPPER PLANE BRACING TRUSS'
      READ(5,*) A(2)
C
C     DETERMINE NODE NUMBERS FOR UPPER-PLANE BRACING TRUSS
C
C     FOR FIRST PAIR OF FIRST HALF
C
      IRING1=NRINGS-3
      IRING2=NRINGS-1
      N1=2*(IRING1)-1
      N2=2*NRINGS+IRING2*(IRING2-1)/2-IRING2+2
      IF(IRING1.EQ.1) GO TO 8010
      INT1=2*NRINGS+IRING1*(IRING1-1)/2-IRING1+2
      GO TO 8020
 8010 INT1=2
 8020 AREA(MNUM)=A(1)
      MEM(1,MNUM)=N1
      MEM(2,MNUM)=N2
      MNUM=MNUM+1
      N1=INT1
      AREA(MNUM)=A(1)
      MEM(1,MNUM)=N2
      MEM(2,MNUM)=N1
      MNUM=MNUM+1
C
```

```
C     FOR THE REMAINDER OF THE FIRST HALF
C
      DO 9000 I=1,(IRING1-1)/2
         N2=N2+1
         AREA(MNUM)=A(1)
         MEM(1,MNUM)=N1
         MEM(2,MNUM)=N2
         MNUM=MNUM+1
         N1=N1+1
         AREA(MNUM)=A(1)
         MEM(1,MNUM)=N2
         MEM(2,MNUM)=N1
         MNUM=MNUM+1
 9000 CONTINUE
C
C     FOR FIRST PAIR OF SECOND HALF
C
      N1=2*IRING1
      N2=2*NRINGS+(IRING2-1)*IRING2/2
      IF(IRING1.EQ.1) GO TO 9010
      INT1=2*NRINGS+IRING1*(IRING1-1)/2
      GO TO 9020
 9010 INT1=1
 9020 AREA(MNUM)=A(1)
      MEM(1,MNUM)=N1
      MEM(2,MNUM)=N2
      MNUM=MNUM+1
      N1=INT1
      AREA(MNUM)=A(1)
      MEM(1,MNUM)=N2
      MEM(2,MNUM)=N1
      MNUM=MNUM+1
C
C     FOR REMAINDER OF SECOND HALF
C
      DO 10000 I=1,(IRING1-1)/2
         N2=N2-1
         AREA(MNUM)=A(1)
         MEM(1,MNUM)=N1
         MEM(2,MNUM)=N2
         MNUM=MNUM+1
         N1=N1-1
         AREA(MNUM)=A(1)
         MEM(1,MNUM)=N2
         MEM(2,MNUM)=N1
         MNUM=MNUM+1
10000 CONTINUE
C
C     DETERMINING NODE NUMBERS FOR THE LOWER-PLANE BRACING TRUSS
C
      IRING1=NRINGS-2
```

```
      IRING2=NRINGS
      N1=2*IRING1-1
      N2=2*NRINGS+IRING2*(IRING2-1)/2-IRING2+2
      INT1=2*NRINGS+IRING1*(IRING1-1)/2-IRING1+2
C
C     FOR THE FIRST PAIR OF THE FIRST HALF
C
      AREA(MNUM)=A(2)
      MEM(1,MNUM)=N1
      MEM(2,MNUM)=N2
      MNUM=MNUM+1
      N1=INT1
      AREA(MNUM)=A(2)
      MEM(1,MNUM)=N2
      MEM(2,MNUM)=N1
      MNUM=MNUM+1
C
C     FOR THE REMAINDER OF THE FIRST HALF
C
      DO 11000 I=1,(IRING2-2)/2-1
      N2=N2+1
      AREA(MNUM)=A(2)
      MEM(1,MNUM)=N2
      MEM(2,MNUM)=N1
         MNUM=MNUM+1
         N1=N1+1
         AREA(MNUM)=A(2)
         MEM(1,MNUM)=N2
         MEM(2,MNUM)=N1
         MNUM=MNUM+1
11000 CONTINUE
C
C     FOR THE FIRST PAIR OF THE SECOND HALF
C
      N1=2*IRING1
      N2=2*NRINGS+IRING2*(IRING2-1)/2
      INT1=2*NRINGS+IRING1*(IRING1-1)/2
      AREA(MNUM)=A(2)
      MEM(1,MNUM)=N1
      MEM(2,MNUM)=N2
      MNUM=MNUM+1
      N1=INT1
      AREA(MNUM)=A(2)
      MEM(1,MNUM)=N2
      MEM(2,MNUM)=N1
      MNUM=MNUM+1
C
C     FOR THE REMAINDER OF THE SECOND HALF
C
      DO 12000 I=1,(IRING2-2)/2-1
         N2=N2-1
```

```
         AREA(MNUM)=A(2)
         MEM(1,MNUM)=N1
         MEM(2,MNUM)=N2
         MNUM=MNUM+1
         N1=N1-1
         AREA(MNUM)=A(2)
         MEM(1,MNUM)=N2
         MEM(2,MNUM)=N1
         MNUM=MNUM+1
12000 CONTINUE
C
C     FOR THE MIDDLE MEMBER
C
      N2=N2-1
      AREA(MNUM)=A(2)
      MEM(1,MNUM)=N2
      MEM(2,MNUM)=N1
C
C
C     OUTPUT THE "AREA" AND "MEM" ARRAYS.
C
C
      WRITE(7,101)
  101 FORMAT('1')
      CALL RPRINT(AREA,MNUM,1,'MEMBER AREAS        ')
      WRITE(7,101)
      CALL IPRINT(MEM,2,MNUM,'MEMBER END NODES    ')
      RETURN
      END
```

```
C
C
C
C     THE "DOFS" SUBROUTINE DETERMINES THE DOF NUMBERING FOR
C     THE STRUCTURE AS A WHOLE, AS WELL AS THE DOF NUMBERING
C     FOR EACH SUBSTRUCTURE. THE SUBROUTINE ALSO ASKS THE
C     USER WHICH COLUMNS ARE LATERALLY SUPPORTED AS WELL AS
C     BEING VERTICALLY SUPPORTED, AND WHICH COLUMNS ARE
C     FREE TO MOVE LATERALLY. THE NUMBER OF GLOBAL DOFS
C     IS CALCULATED, AS WELL AS THE NUMBER OF DOFS AND
C     BOUNDARY DOFS IN EACH SUBSTRUCTURE. THE GLOBAL DOFS
C     ARE STORED IN THE "ISDOF" ARRAY, THE FIRST INDEX
C     INDICATES WHICH COLUMN LINE THE DOFS ARE ON; THE
C     SECOND INDEX INDICATES WHETHER THE DOF IS IN THE
C     "X" DIRECTION, "Y" DIRECTION, OR "Z" DIRECTION, INDICATED
C     BY "1" "2" OR "3" RESPECTIVELY; AND THE THIRD INDEX
C     INDICATES THE RING THE DOF IS ON. THE SUBSTRUCTURE DOFS
C     ARE STORED IN THE "IDOF" ARRAY, THE FIRST INDEX INDICATES
C     WHICH SUBSTRUCTURE THE DOF IS A PART OF; THE SECOND INDEX
C     INDICATES WHETHER THE DOF IS IN THE "X" "Y" OR "Z"
C     DIRECTION AS FOR THE "ISDOF" ARRAY; AND THE THIRD INDEX
C     INDICATES WHICH NODAL POINT THE DOF IS ATTACHED TO.
C     THE SUBROUTINE ALSO CALCULATES THE MAXIMUM NUMBER OF
C     DOFS IN ANY SUBSTRUCTURE, THIS IS LATER USED TO DETERMINE
C     THE MAXIMUM SIZE OF THE SUBSTRUCTURE STIFFNESS MATRIX AND
C     SUBSTRUCTURE LOAD VECTOR.
C
C
C
C
      SUBROUTINE DOFS(NCOL,NRINGS,NEQ,NEQS,IDOF,ISDOF,NBDOF,IDSOF,
     $ISOF,NEQSMX)
      DIMENSION IDOF(NCOL,3,1),ISDOF(NCOL,3,1),IDSOF(3,1)
      DIMENSION ISOF(3,1),IA(30),NEQS(1),NBDOF(1)
      INTEGER DOF,SUB
      CHARACTER*1 ANS
      NUMNOD=2*NRINGS+NRINGS*(NRINGS-1)/2
C
C
C     ENTER WHICH COLUMNS SUPPLY HORIZONTAL SUPPORT
C
C
      DO 101 III=1,NCOL
         DO 101 JJJ=1,3
            DO 101 KKK=1,NUMNOD
               IDOF(III,JJJ,KKK)=0
  101 CONTINUE
      DO 1000 I=1,NCOL
 1003    WRITE(6,*) 'DOES COLUMN ',I,' SUPPLY HORIZONTAL RESTRAINT ?'
         WRITE(6,*) 'IF YES ENTER Y, IF NO ENTER N OR PRESS <CR>'
         READ(5,2) ANS
```

```
    2     FORMAT(C1)
          IF(ANS.EQ.'Y') GO TO 1001
          IF(ANS.EQ.'N'.OR. ANS .EQ. ' ') GO TO 1002
          WRITE(6,*) 'ERROR IN INPUT, RE-ENTER DATA'
          GO TO 1003
 1001     IA(I)=1
          GO TO 1000
 1002     IA(I)=0
 1000 CONTINUE
C
C
C     DETERMINE OVERALL STRUCTURE DEGREES OF FREEDOM
C
C
      DOF=1
      KK=0
      DO 2000 I=1,NCOL/2
          KK=KK+1
          DO 2010 J=1,NRINGS
             IF(J.EQ.NRINGS) GO TO 2011
             ISDOF(I,1,J)=DOF
             DOF=DOF+1
             ISDOF(I,2,J)=DOF
             DOF=DOF+1
             ISDOF(I,3,J)=DOF
             DOF=DOF+1
             GO TO 2010
 2011        IF(IA(I).EQ.1) GO TO 2010
             ISDOF(I,1,J)=DOF
             DOF=DOF+1
             ISDOF(I,2,J)=DOF
             DOF=DOF+1
 2010     CONTINUE
          K=NCOL-I+1
          DO 2020 J=1,NRINGS
             IF(J.EQ.NRINGS) GO TO 2021
             ISDOF(K,1,J)=DOF
             DOF=DOF+1
             ISDOF(K,2,J)=DOF
             DOF=DOF+1
             ISDOF(K,3,J)=DOF
             DOF=DOF+1
             GO TO 2020
 2021        IF(IA(K).EQ.1) GO TO 2020
             ISDOF(K,1,J)=DOF
             DOF=DOF+1
             ISDOF(K,2,J)=DOF
             DOF=DOF+1
 2020     CONTINUE
 2000 CONTINUE
      NEQ=DOF-1
```

```
C
C
C     DETERMINE BOUNDARY DEGREES OF FREEDOM FOR EACH SUBSTRUCTURE
C
C
      DO 3000 SUB=1,NCOL
         DOF=1
         DO 3010 J=1,NRINGS*2
            IF(J.EQ.2*NRINGS) GO TO 3001
            IF(J.EQ.(2*NRINGS-1)) GO TO 3002
            IDOF(SUB,1,J)=DOF
            DOF=DOF+1
            IDOF(SUB,2,J)=DOF
            DOF=DOF+1
            IDOF(SUB,3,J)=DOF
            DOF=DOF+1
            GO TO 3010
 3001       IF(IA(I).EQ.1) GO TO 3010
            GO TO 3003
 3002       IF(IA(I+1).EQ.1) GO TO 3010
 3003       IDOF(SUB,1,J)=DOF
            DOF=DOF+1
            IDOF(SUB,2,J)=DOF
            DOF=DOF+1
 3010    CONTINUE
         NBDOF(SUB)=DOF-1
C
C
C     DETERMINE INTERIOR DEGREES OF FREEDOM FOR EACH SUBSTRUCTURE
C
C
         DO 3020 J=2*NRINGS+1,NUMNOD
            IDOF(SUB,1,J)=DOF
            DOF=DOF+1
            IDOF(SUB,2,J)=DOF
            DOF=DOF+1
            IDOF(SUB,3,J)=DOF
            DOF=DOF+1
 3020    CONTINUE
         NEQS(SUB)=DOF-1
 3000 CONTINUE
C
C
C     THE MAXIMUM NUMBER OF SUBSTRUCTURE DOFS "NEQSMX" IS
C     DETERMINED.
C
C
      NEQSMX=NEQS(1)
      DO 4000 I=2,NCOL
         IF(NEQS(I).GT.NEQSMX) GO TO 4001
         GO TO 4000
```

```
 4001    NEQSMX=NEQS(I)
 4000 CONTINUE
C
C
C     THE SUBSTRUCTURE DEGREES OF FREEDOM FOR EACH SUBSTRUCTURE ARE
C     OUTPUT.
C
C
      DO 6000 I=1,NCOL
         DO 6010 K=1,NUMNOD
            DO 6020 J=1,3
               ISOF(J,K)=IDOF(I,J,K)
 6020       CONTINUE
 6010    CONTINUE
         WRITE(7,6001) 'SUBSTRUCTURE',I
 6001    FORMAT('1',20X,A12,2X,I4)
         CALL IPRINT(ISOF,3,NUMNOD,'SUBSTRUCTURE DOFS   ')
 6000 CONTINUE
C
C
C     THE STRUCTURE DEGREES OF FREEDOM ALONG EACH COLUMN LINE
C     ARE OUTPUT.
C
C
      DO 5000 I=1,NCOL
         DO 5010 J=1,3
            DO 5020 K=1,NRINGS
               IDSOF(J,K)=ISDOF(I,J,K)
 5020       CONTINUE
 5010    CONTINUE
         WRITE(7,5001) 'STRUCTURE DOFS ON COLUMN LINE',I
 5001    FORMAT('1',10X,A29,4X,I4)
         CALL IPRINT(IDSOF,3,NRINGS,'STRUCTURE DOFS      ')
 5000 CONTINUE
      RETURN
      END
```

```
C
C
C
C     THE "STIFF" SUBROUTINE GENERATES THE SUBSTRUCTURE
C     STIFFNESS MATRIX FOR EACH SUBSTRUCTURE. THE
C     SUBSTRUCTURE STIFFNESS MATRIX IS STORED IN "SUBST".
C
C
C
C
      SUBROUTINE STIFF(MNUM,NCOL,SUB,E,NEQS,NRINGS,AREA,
     $MEM,X,Y,Z,IDOF,SUBST,L)
      DIMENSION X(NCOL,1),Y(NCOL,1),Z(NCOL,1),AREA(1),MEM(2,1)
      DIMENSION IDOF(NCOL,3,1),SUBST(NEQS,1)
      COMMON /E/ VOL(5)
      DIMENSION  SM(6,6), LA(6)
      INTEGER SUB
      REAL L(1)
C
C     CLEARS SUBSTRUCTURE STIFFNESS MATRIX
C
      DO 1000 I=1,NEQS
      DO 1000 J=1,NEQS
         SUBST(I,J)=0.0
 1000 CONTINUE
C
C
C     DETERMINES THE MEMBER STIFFNESS MATRIX
C
C
      DO 2000 I=1,MNUM
         NODEI=MEM(1,I)
         NODEJ=MEM(2,I)
         CALL MSTIFF(NODEI,NODEJ,X,Y,Z,SM,AREA,I,SUB,E,NRINGS
     $   ,NCOL,L)
C
C     DETERMINE THE LABELLING VECTOR
C
         LA(1)=IDOF(SUB,1,NODEI)
         LA(2)=IDOF(SUB,2,NODEI)
         LA(3)=IDOF(SUB,3,NODEI)
         LA(4)=IDOF(SUB,1,NODEJ)
         LA(5)=IDOF(SUB,2,NODEJ)
         LA(6)=IDOF(SUB,3,NODEJ)
C
C     ASSEMBLE SUBSTRUCTURE STIFFNESS MATRIX
C
         DO 2001 J=1,6
            DO 2001 K=1,6
               IF(LA(J).EQ.0) GO TO 2001
               IF(LA(K).EQ.0) GO TO 2001
```

```
              SUBST(LA(J),LA(K))=SUBST(LA(J),LA(K))+SM(J,K)
2001    CONTINUE
2000 CONTINUE
     RETURN
     END
```

```
C
C
C
C     THE "MSTIFF" SUBROUTINE CALCULATES THE MEMBER STIFFNESS
C     MATRIX FOR EACH MEMBER IN EACH SUBSTRUCTURE.
C
C
C
C
      SUBROUTINE MSTIFF(NODEI,NODEJ,X,Y,Z,SM,AREA,I,SUB,E,NRINGS
     $,NCOL,L)
      DIMENSION X(NCOL,1),Y(NCOL,1),Z(NCOL,1),AREA(1)
      DIMENSION SM(6,6),B(6)
      INTEGER SUB
      REAL L(1)
      XX=X(SUB,NODEJ)-X(SUB,NODEI)
      YY=Y(SUB,NODEJ)-Y(SUB,NODEI)
      ZZ=Z(SUB,NODEJ)-Z(SUB,NODEI)
      L(I)=(XX*XX+YY*YY+ZZ*ZZ)
      L(I)=SQRT(L(I))
      CALL VOLUME(L,AREA(I),I,NRINGS)
      B(1)=-XX/L(I)
      B(2)=-YY/L(I)
      B(3)=-ZZ/L(I)
      B(4)=XX/L(I)
      B(5)=YY/L(I)
      B(6)=ZZ/L(I)
      STIF=AREA(I)*E/L(I)
      SM(1,1)=B(1)*B(1)*STIF
      SM(1,2)=B(1)*B(2)*STIF
      SM(1,3)=B(1)*B(3)*STIF
      SM(1,4)=-SM(1,1)
      SM(1,5)=-SM(1,2)
      SM(1,6)=-SM(1,3)
      SM(2,1)=SM(1,2)
      SM(2,2)=B(2)*B(2)*STIF
      SM(2,3)=B(2)*B(3)*STIF
      SM(2,4)=-SM(2,1)
      SM(2,5)=-SM(2,2)
      SM(2,6)=-SM(2,3)
      SM(3,1)=SM(1,3)
      SM(3,2)=SM(2,3)
      SM(3,3)=B(3)*B(3)*STIF
      SM(3,4)=-SM(3,1)
      SM(3,5)=-SM(3,2)
      SM(3,6)=-SM(3,3)
      SM(4,1)=SM(1,4)
      SM(4,2)=SM(2,4)
      SM(4,3)=SM(3,4)
      SM(4,4)=SM(1,1)
      SM(4,5)=-SM(4,2)
```

```
SM(4,6)=-SM(4,3)
SM(5,1)=SM(1,5)
SM(5,2)=SM(2,5)
SM(5,3)=SM(3,5)
SM(5,4)=SM(4,5)
SM(5,5)=SM(2,2)
SM(5,6)=-SM(5,3)
SM(6,1)=SM(1,6)
SM(6,2)=SM(2,6)
SM(6,3)=SM(3,6)
SM(6,4)=SM(4,6)
SM(6,5)=SM(5,6)
SM(6,6)=SM(3,3)
RETURN
END
```

```
C
C
C
C     THE "VOLUME" SUBROUTINE CALCULATES THE VOLUME OF THE
C     MEMBERS FOR MATERIAL CONSUMPTION PURPOSES. THE VOLUME
C     OF THE DIFFERENT TYPES OF MEMBERS IS CALCULATED
C     SEPERATELY, NAMELY FOR:
C        -RING MEMBERS
C        -DIAGONALS
C        -STIFFENERS
C        -UPPER BRACING TRUSS
C        -LOWER BRACING TRUSS
C     THE VOLUMES ARE STORED IN THE "VOL" ARRAY, WHERE
C     THE INDEX INDICATES WHICH MEMBER TYPE IS UNDER
C     CONSIDERATION, "1" CORRESPONDS TO RING MEMBERS,
C     "2" CORRESPONDS TO DIAGONALS, "3" TO STIFFENERS,
C     "4" TO THE UPPER BRACING TRUSS, AND "5" TO THE
C     LOWER BRACING TRUSS.
C
C
C
C
      SUBROUTINE VOLUME(L,A,MEM,NRINGS)
      COMMON /E/ VOL(5)
      REAL L
      N1=NRINGS*(NRINGS+1)/2
      IF(MEM.LE.N1) GO TO 1000
      N2=N1+(NRINGS+2)*(NRINGS-1)
      IF(MEM.LE.N2) GO TO 2000
      N3=N2+NRINGS*2-4
      IF(MEM.LE.N3) GO TO 3000
      N4=N3+NRINGS*2
      IF(MEM.LE.N4) GO TO 4000
      N5=N4+(NRINGS-2)*2+1
      IF(MEM.LE.N5) GO TO 5000
      WRITE(6,*) 'ERROR'
      RETURN
C
C     FOR RING MEMBERS
C
 1000 VOL(1)=VOL(1)+L*A
      RETURN
C
C     FOR THE DIAGONAL MEMBERS
C
 2000 VOL(2)=VOL(2)+L*A
      RETURN
C
C     FOR THE STIFFENERS
C
 3000 VOL(3)=VOL(3)+L*A
```

```
      RETURN
C
C     FOR THE UPPER BRACING TRUSS
C
 4000 VOL(4)=VOL(4)+L*A
      RETURN
C
C     FOR THE LOWER BRACING TRUSS
C
 5000 VOL(5)=VOL(5)+L*A
      RETURN
      END
```

```
C
C
C
C     THE "LODVEC" SUBROUTINE CALCULATES THE SUBSTRUCTURE LOAD
C     VECTOR "QS" AS WELL AS THE BOUNDARY LOADS ACTING ON EACH
C     SUBSTRUCTURE.
C     THE USER IS ASKED WHICH SUBSTRUCTURES ARE LOADED, AND
C     WITH WHAT INTENSITY. THE LOAD IS UNIFORMLY DISTRIBUTED
C     WITHIN EACH SUBSTRUCTURE, AND IS APPLIED TO THE
C     "OUTSIDE SURFACE" OF THE ROOF TRUSS.
C     THE SIGN CONVENTION FOR THE LOADS IS POSITIVE IS AN UPWARD
C     LOAD AND NEGATIVE IS A DOWNWARD LOAD.
C
C
C
C
      SUBROUTINE LODVEC(NCOL,NUM,NRINGS,IDOF,X,Y,QS,NEQS,TQ,Q
     $,NBDOF,ISDOF,NEQ)
      CHARACTER*1 ANS
      DIMENSION X(NCOL,1),Y(NCOL,1),IDOF(NCOL,3,1),QS(NCOL,1)
      DIMENSION TQ(1),NBDOF(1),ISDOF(NCOL,3,1),Q(1)
      CALL LOAD(NRINGS,X,Y,TQ,NCOL,NUM)
      WRITE(7,102) 'STRUCTURE LOAD DATA: '
  102 FORMAT('1',///,20X,C21,///)
C
C
C     THE USER IS ASKED TO ENTER WHICH SUBSTRUCTURES ARE LOADED
C     AND WHICH ARE NOT, AND WHAT THE LOAD INTENSITY IS FOR
C     THOSE SUBSTRUCTURES THAT ARE LOADED.
C
C
      DO 2000 I=1,NCOL
 2030    WRITE(6,*) 'IS SECTOR ',I,' LOADED?'
         WRITE(6,*) 'IF YES ENTER Y OR PRESS <CR>'
         WRITE(6,*) 'IF NOT ENTER N'
         READ(5,100) ANS
  100    FORMAT(C1)
         IF(ANS.EQ.'Y'.OR.ANS.EQ.' ') GO TO 2010
         IF(ANS.EQ.'N') GO TO 2000
         WRITE(6,*) 'ERROR MADE IN INPUT DATA, REENTER DATA'
         GO TO 2030
 2010    WRITE(6,*) 'ENTER LOAD INTENSITY FOR SECTOR ',I
         READ(5,*) XLI
         WRITE(7,101) 'SECTOR ',I,' LOADED ',
     $   'WITH INTENSITY ',XLI
  101    FORMAT(' ',20X,C7,I3,C8,C15,F7.4)
C
C
C     THE LOAD VECTOR FOR EACH SUBSTRUCTURE IS CALCULATED.
C
C
```

```
         DO 2100 J=1,NUM
            IF(IDOF(I,3,J).EQ.0) GO TO 2100
            QS(I,IDOF(I,3,J))=TQ(J)*XLI
 2100    CONTINUE
 2000 CONTINUE
C
C
C     THE BOUNDARY LOADS FOR EACH SUBSTRUCTURE ARE ASSEMBLED
C     TO FORM THE OVERALL STRUCTURE LOAD VECTOR
C
C
      DO 3000 I=1,NCOL
         DO 3010 J=1,NRINGS-1
            IROW=ISDOF(I,3,J)
            Q(IROW)=Q(IROW)+QS(I,IDOF(I,3,2*J-1))
            IF(I.EQ.1) GO TO 3011
            II=I-1
            Q(IROW)=Q(IROW)+QS(II,IDOF(II,3,2*J))
            GO TO 3010
 3011       II=NCOL
            Q(IROW)=Q(IROW)+QS(II,IDOF(II,3,2*J))
 3010    CONTINUE
 3000 CONTINUE
C
C
C     THE SUBSTRUCTURE LOAD VECTORS ARE MODIFIED AFTER THE
C     BOUNDARY LOADS HAVE BEEN PLACED IN THE STRUCTURE LOAD
C     VECTOR SO THAT THE SUBSTRUCTURE BOUNDARY LOADS ARE ALL
C     SET TO ZERO.
C
C
      DO 4000 I=1,NCOL
         DO 4000 J=1,NBDOF(I)
            QS(I,J)=0.0
 4000 CONTINUE
      RETURN
      END
```

```
C
C
C
C     THE "LOAD" SUBROUTINE CALCULATES THE LOADED AREA FOR
C     EACH NODAL POINT THAT WOULD BE LOADED BY A UNIFORMLY
C     DISTRIBUTED VERTICAL LOAD WHEN APPLIED TO THE OUTSIDE
C     SURFACE OF THE ROOF STRUCTURE.
C
C
C
      SUBROUTINE LOAD(NRINGS,X,Y,TQ,NCOL,NUM)
      DIMENSION X(NCOL,1),Y(NCOL,1)
      DIMENSION XX(22),YY(22),XXM1(22),XXP1(22),YYP1(22)
      DIMENSION YYM1(22),TQ(1)
      DIMENSION A(2),B(2),C(2),D(2)
      INTEGER T
C
C     CLEARS THE TQ VECTOR
C
      DO 1000 I=1,NUM
        TQ(I)=0.0
 1000 CONTINUE
      DO 2000 I=1,NRINGS
C
C
C     CALCULATES THE END POINTS FOR EACH TRAPEZOIDAL LOAD AREA
C
C
        T=IFIX(FLOAT(I)/2.0)*2
        IF(T.EQ.I) GO TO 2001
        GO TO 2002
 2001   IF(I.NE.NRINGS) GO TO 2000
        GO TO 2003
 2002   DO 2010 J=1,I+2
          IF(J.EQ.1) GO TO 2011
          IF(J.EQ.I+2) GO TO 2011
          IF(I.EQ.1) GO TO 2016
          GO TO 2012
 2011     XX(1)=X(1,2*I-1)
          YY(1)=Y(1,2*I-1)
          XX(I+2)=X(1,2*I)
          YY(I+2)=Y(1,2*I)
          GO TO 2010
 2012     IF(J.EQ.2) GO TO 2013
          IF(J.EQ.I+1) GO TO 2014
          GO TO 2015
 2013     NODE=2*NRINGS+I*(I-1)/2-I+J
          XX(J)=(X(1,2*I-1)+X(1,NODE))/2.0
          YY(J)=(Y(1,2*I-1)+Y(1,NODE))/2.0
          GO TO 2010
 2014     NODE=2*NRINGS+I*(I-1)/2-I+J-1
```

```
         XX(J)=(X(1,2*I)+X(1,NODE))/2.0
         YY(J)=(Y(1,2*I)+Y(1,NODE))/2.0
         GO TO 2010
2015     NODE1=2*NRINGS+I*(I-1)/2-I+J-1
         NODE2=2*NRINGS+I*(I-1)/2-I+J
         XX(J)=(X(1,NODE1)+X(1,NODE2))/2.0
         YY(J)=(Y(1,NODE1)+Y(1,NODE2))/2.0
         GO TO 2010
2016     XX(2)=(XX(1)+XX(I+2))/2.0
         YY(2)=(YY(1)+YY(I+2))/2.0
2010  CONTINUE
      DO 2020 J=1,I+2
         IF(I.EQ.1) GO TO 2021
         GO TO 2022
2021     XXM1(J)=0.0
         YYM1(J)=0.0
         GO TO 2020
2022     IF(J.EQ.1) GO TO 2023
         IF(J.EQ.I+2) GO TO 2023
         GO TO 2024
2023     XXM1(1)=(X(1,2*I-1)+X(1,2*(I-2)-1))/2.0
         YYM1(1)=(Y(1,2*I-1)+Y(1,2*(I-2)-1))/2.0
         XXM1(I+2)=(X(1,2*I)+X(1,2*(I-2)))/2.0
         YYM1(I+2)=(Y(1,2*I)+Y(1,2*(I-2)))/2.0
         GO TO 2020
2024     XL=SQRT((XX(I+2)-XX(1))*(XX(I+2)-XX(1))+
     $            (YY(I+2)-YY(1))*(YY(I+2)-YY(1)))
         XLM1=SQRT((XXM1(I+2)-XXM1(1))*(XXM1(I+2)-XXM1(1))+
     $            (YYM1(I+2)-YYM1(1))*(YYM1(I+2)-YYM1(1)))
         XXM1(J)=XXM1(1)+(XX(J)-XX(1))*XLM1/XL
         YYM1(J)=YYM1(1)+(YY(J)-YY(1))*XLM1/XL
2020  CONTINUE
      IPAR=0
      DO 2030 J=1,I+2
         IF(I.EQ.NRINGS-1) GO TO 2031
         IF(J.EQ.1) GO TO 2032
         IF(J.EQ.I+2) GO TO 2032
         GO TO 2033
2032     XL=SQRT((XX(I+2)-XX(1))*(XX(I+2)-XX(1))+
     $           (YY(I+2)-YY(1))*(YY(I+2)-YY(1)))
         XXP1(1)=(X(1,2*I-1)+X(1,2*(I+2)-1))/2.0
         YYP1(1)=(Y(1,2*I-1)+Y(1,2*(I+2)-1))/2.0
         XXP1(I+2)=(X(1,2*I)+X(1,2*(I+2)))/2.0
         YYP1(I+2)=(Y(1,2*I)+Y(1,2*(I+2)))/2.0
         XLP1=SQRT((XXP1(I+2)-XXP1(1))*(XXP1(I+2)-XXP1(1))+
     $    (YYP1(I+2)-YYP1(1))*(YYP1(I+2)-YYP1(1)))
         GO TO 2030
2033     XXP1(J)=XXP1(1)+(XX(J)-XX(1))*XLP1/XL
         YYP1(J)=YYP1(1)+(YY(J)-YY(1))*XLP1/XL
         GO TO 2030
2031     IF(J.EQ.I+2) GO TO 2030
```

```
           IF(IPAR.EQ.1) GO TO 2033
           IPAR=1
           XXP1(1)=(X(1,2*I-1)+X(1,2*NRINGS-1))/2.0
           YYP1(1)=(Y(1,2*I-1)+Y(1,2*NRINGS-1))/2.0
           XXP1(I+2)=(X(1,2*I)+X(1,2*NRINGS))/2.0
           YYP1(I+2)=(Y(1,2*I)+Y(1,2*NRINGS))/2.0
           XL=SQRT((XX(I+2)-XX(1))*(XX(I+2)-XX(1))+
    $              (YY(I+2)-YY(1))*(YY(I+2)-YY(1)))
           XLP1=SQRT((XXP1(I+2)-XXP1(1))*(XXP1(I+2)-XXP1(1))+
    $                (YYP1(I+2)-YYP1(1))*(YYP1(I+2)-YYP1(1)))
           GO TO 2030
2030    CONTINUE
        GO TO 2004
2003    DO 2050 J=1,I+2
           IF(J.EQ.1) GO TO 2051
           IF(J.EQ.I+2) GO TO 2051
           GO TO 2052
2051       XX(1)=X(1,2*I-1)
           YY(1)=Y(1,2*I-1)
           XX(I+2)=X(1,2*I)
           YY(I+2)=Y(1,2*I)
           GO TO 2050
2052       IF(J.EQ.2) GO TO 2053
           IF(J.EQ.I+1) GO TO 2054
           GO TO 2055
2053       NODE=2*NRINGS+I*(I-1)/2-I+J
           XX(J)=(X(1,2*I-1)+X(1,NODE))/2.0
           YY(J)=(Y(1,2*I-1)+Y(1,NODE))/2.0
           GO TO 2050
2054       NODE=2*NRINGS+I*(I-1)/2-I+J-1
           XX(J)=(X(1,2*I)+X(1,NODE))/2.0
           YY(J)=(Y(1,2*I)+Y(1,NODE))/2.0
           GO TO 2050
2055       NODE1=2*NRINGS+I*(I-1)/2-I+J-1
           NODE2=2*NRINGS+I*(I-1)/2-I+J
           XX(J)=(X(1,NODE1)+X(1,NODE2))/2.0
           YY(J)=(Y(1,NODE1)+Y(1,NODE2))/2.0
2050    CONTINUE
        XXM1(1)=(X(1,2*(I-1)-1)+XX(1))/2.0
        YYM1(1)=(Y(1,2*(I-1)-1)+YY(1))/2.0
        XXM1(I+2)=(X(1,2*(I-1))+XX(I+2))/2.0
        YYM1(I+2)=(Y(1,2*(I-1))+YY(I+2))/2.0
        XLM1=SQRT((XXM1(I+2)-XXM1(1))*(XXM1(I+2)-XXM1(1))+
    $         (YYM1(I+2)-YYM1(1))*(YYM1(I+2)-YYM1(1)))
        XL=SQRT((XX(I+2)-XX(1))*(XX(I+2)-XX(1))+
    $         (YY(I+2)-YY(1))*(YY(I+2)-YY(1)))
        DO 2060 J=2,I+1
           XXM1(J)=XXM1(1)+(XX(J)-XX(1))*XLM1/XL
           YYM1(J)=YYM1(1)+(YY(J)-YY(1))*XLM1/XL
2060    CONTINUE
        DO 2070 J=1,I+2
```

```
          XXP1(J)=XX(J)
          YYP1(J)=YY(J)
 2070   CONTINUE
 2004   DO 2040 J=1,I+1
C
C
C       CALCULATE THE AREA OF EACH TRAPEZOIDAL LOAD AREA
C       FOR EACH NODE
C
C
          A(1)=XXM1(J)
          A(2)=YYM1(J)
          B(1)=XXP1(J)
          B(2)=YYP1(J)
          C(1)=XXM1(J+1)
          C(2)=YYM1(J+1)
          D(1)=XXP1(J+1)
          D(2)=YYP1(J+1)
          XL=XLOAD(A,B,C,D)
          IF(J.EQ.1) GO TO 2041
          IF(J.EQ.I+1) GO TO 2042
          NODE=2*NRINGS+I*(I-1)/2-I+J
          TQ(NODE)=XL
          GO TO 2040
 2041     TQ(2*I-1)=XL
          GO TO 2040
 2042     TQ(2*I)=XL
 2040   CONTINUE
 2000 CONTINUE
      RETURN
      END
```

```
C
C
C
C     THE "XLOAD" FUNCTION SIMPLY CALCULATES THE AREA OF A
C     PARALLELOGRAM. WHERE "A" "B" "C" "D" CONTAIN THE
C     COORDINATES OF THE VERTICES OF THE PARALLELOGRAM.
C
C
C
      FUNCTION XLOAD(A,B,C,D)
      DIMENSION A(2),B(2),C(2),D(2),VAB(2),VBD(2),VAC(2)
      VAB(1)=B(1)-A(1)
      VAB(2)=B(2)-A(2)
      VAC(1)=C(1)-A(1)
      VAC(2)=C(2)-A(2)
      VBD(1)=D(1)-B(1)
      VBD(2)=D(2)-B(2)
      AC=SQRT(VAC(1)*VAC(1)+VAC(2)*VAC(2))
      AB=SQRT(VAB(1)*VAB(1)+VAB(2)*VAB(2))
      BD=SQRT(VBD(1)*VBD(1)+VBD(2)*VBD(2))
      THETA=ACOS((VAB(1)*VBD(1)+VAB(2)*VBD(2))/(AB*BD))
      XLOAD=(BD+AC)/2.0*AB*SIN(THETA)
      RETURN
      END
```

```
C
C
C
C     THE "STACON" SUBROUTINE STATICALLY CONDENSES THE SUBSTRUCTURE
C     STIFFNESS MATRIX "SUBST" AND THE SUBSTRUCTURE LOAD VECTOR
C     "QS". THE REDUCED SUBSTRUCTURE STIFFNESS MATRIX IS STORED
C     IN "STAT", AND THE REDUCED LOAD VECTOR IS STORED IN "QS".
C     THE SUBSTRUCTURE LOAD VECTOR IS ONLY REDUCED WHEN "IIPAR"
C     IS NOT EQUAL TO 1.
C
C
C
C
C
      SUBROUTINE STACON(STAT,NBDOF,QS,NEQS,NCOL,SUB,IIPAR)
      INTEGER SUB
      DIMENSION STAT(NEQS,1),QS(NCOL,1)
      DO 1000 II=1,NEQS-NBDOF
         ICOL=NEQS-II+1
         DO 1100 J=1,ICOL-1
            IF(ABS(STAT(ICOL,ICOL)).LE.0.00001) GO TO 1111
            FAC=STAT(J,ICOL)/STAT(ICOL,ICOL)
            IF(IIPAR.EQ.1) GO TO 1110
            QS(SUB,J)=QS(SUB,J)-FAC*QS(SUB,ICOL)
            GO TO 1110
1111        WRITE(6,*) 'THE SUBSTRUCTURE IS UNSTABLE'
            WRITE(6,*) 'ZERO DIAGONAL ELEMENT AT ROW ',ICOL
            RETURN
1110        DO 1200 K=1,NEQS
               STAT(J,K)=STAT(J,K)-FAC*STAT(ICOL,K)
1200        CONTINUE
1100     CONTINUE
1000 CONTINUE
      RETURN
      END
```

```
C
C
C
C     THE "ASSEM" SUBROUTINE IS TO ASSEMBLE THE GLOBAL
C     STRUCTURE STIFFNESS MATRIX "STIFMX", AND LOAD VECTOR
C     "Q". THE GLOBAL STIFFNESS MATRIX ONLY STORES THE
C     UPPER HALF OF THE STIFFNESS MATRIX, AND ONLY THE
C     ELEMENTS WHICH ARE IN THE BANDWIDTH.
C
C
C
C
      SUBROUTINE ASSEM(STIFMX,STAT,QS,ISDOF,Q,IDOF,NEQS,NEQ,
     $NCOL,NRINGS,SUB)
      DIMENSION STIFMX(NEQ,1),Q(1),STAT(NEQS,1),QS(NCOL,1)
      DIMENSION ISDOF(NCOL,3,1),IDOF(NCOL,3,1)
      DIMENSION LA(600),LAS(600)
      INTEGER SUB
C
C
C     DETERMINE THE LABELLING VECTORS
C
C
      II=1
      I=SUB
      DO 2000 J=1,NRINGS
         LA(II)=ISDOF(I,1,J)
         LAS(II)=IDOF(SUB,1,2*J-1)
         II=II+1
         LA(II)=ISDOF(I,2,J)
         LAS(II)=IDOF(SUB,2,2*J-1)
         II=II+1
         LA(II)=ISDOF(I,3,J)
         LAS(II)=IDOF(SUB,3,2*J-1)
         II=II+1
         IF(I.EQ.NCOL) GO TO 2001
         K=I+1
 2002    LA(II)=ISDOF(K,1,J)
         LAS(II)=IDOF(SUB,1,2*J)
         II=II+1
         LA(II)=ISDOF(K,2,J)
         LAS(II)=IDOF(SUB,2,2*J)
         II=II+1
         LA(II)=ISDOF(K,3,J)
         LAS(II)=IDOF(SUB,3,2*J)
         II=II+1
         GO TO 2000
 2001    K=1
         GO TO 2002
 2000 CONTINUE
C
```

```
C
C     ASSEMBLE THE OVERALL STRUCTURE LOADING VECTOR
C
C
      DO 3000 J=1,II-1
         IF(LA(J).EQ.0) GO TO 3000
         IF(LAS(J).EQ.0) GO TO 3000
         Q(LA(J))=Q(LA(J))+QS(I,LAS(J))
 3000 CONTINUE
C
C
C     ASSEMBLE THE OVERALL STRUCTURE STIFFNESS MATRIX
C
C
      DO 4000 J=1,II-1
         DO 5000 K=1,II-1
            IF(LA(J).EQ.0) GO TO 5000
            IF(LA(K).EQ.0) GO TO 5000
            L=LA(K)-LA(J)+1
            IF(L.LE.0) GO TO 5000
            STIFMX(LA(J),L)=STIFMX(LA(J),L)+STAT(LAS(J),LAS(K))
 5000    CONTINUE
 4000 CONTINUE
      RETURN
      END
```

```
C
C
C
C     THE "SOLVE" SUBROUTINE PERFORMS GAUSSIAN ELIMINATION
C     ON A MATRIX WHICH IS STORED IN BAND FORM.
C
C
C
C
      SUBROUTINE SOLVE(S,NEQ,MBAND)
      DIMENSION S(NEQ,1)
      DO 790 N=1,NEQ
         DO 780 L=2,MBAND
            IF(S(N,L).EQ.0.0) GO TO 780
            I=N+L-1
            C=S(N,L)/S(N,1)
            J=0
            DO 750 K=L,MBAND
               J=J+1
               S(I,J)=S(I,J)-C*S(N,K)
750         CONTINUE
            S(N,L)=C
780      CONTINUE
790   CONTINUE
      RETURN
      END
```

```
C
C
C
C     THE "BACSUB" SUBROUTINE PERFORMS BACK-SUBSTITUTION ON
C     THE REDUCED "S" MATRIX, WHICH IS THE GLOBAL STIFFNESS
C     MATRIX, AND THE "R" VECTOR, WHICH IS THE STRUCTURE
C     LOAD VECTOR, AND PLACES THE RESULTING GLOBAL
C     DISPLACEMENT VECTOR IN "R".
C
C
C
C
      SUBROUTINE BACSUB(S,R,NEQ,MBAND)
      DIMENSION S(NEQ,1),R(1)
      DO 830 N=1,NEQ
         DO 820 L=2,MBAND
            IF(S(N,L).EQ.0.0) GO TO 820
            I=N+L-1
            R(I)=R(I)-S(N,L)*R(N)
  820    CONTINUE
         R(N)=R(N)/S(N,1)
  830 CONTINUE
      DO 860 M=2,NEQ
         N=NEQ+1-M
         DO 850 L=2,MBAND
            IF(S(N,L).EQ.0.0) GO TO 850
            K=N+L-1
            R(N)=R(N)-S(N,L)*R(K)
  850    CONTINUE
  860 CONTINUE
      WRITE(7,101)
  101 FORMAT('1')
      CALL RPRINT(R,NEQ,1,'GLOBAL DISPLACEMENTS')
      RETURN
      END
```

```
C
C
C
C     THE "RPRINT" SUBROUTINE WILL PRINT AN "M BY N" REAL
C     NUMBER MATRIX, AND PRINT THE HEADING MATRIX.. "NAME".
C     THE FORMATS ARE FOR A 132 COLUMN OUTPUT DEVICE.
C
C
C
C
      SUBROUTINE RPRINT(X,M,N,NAME)
      DIMENSION X(M,N)
      CHARACTER*20 NAME
      WRITE(7,12) 'MATRIX..',NAME
   12 FORMAT('-',20X,C8,3X,C20)
      K=N
      N1=1
   20 N2=N1+K-1
      IF((N2-N1+1).LE.6) GO TO 30
      N2=N1+5
   30 WRITE(7,22) (J,J=N1,N2)
   22 FORMAT('-',21X,I4,15X,I4,15X,I4,15X,I4,15X,I4,15X,I4)
      DO 100 I=1,M
         WRITE(7,32) I,(X(I,J),J=N1,N2)
   32    FORMAT(' ',5X,I4,6X,E14.7,5X,E14.7,5X,E14.7,5X,
     $         E14.7,5X,E14.7,5X,E14.7)
  100 CONTINUE
      K=K-6
      N1=N1+6
      IF(K.LE.0) RETURN
      GO TO 20
      END
```

```
C
C
C
C     SUBROUTINE "IPRINT" PRINTS AN "M BY N" INTEGER VALUE
C     MATRIX, AND PRINTS THE HEADING MATRIX.. "NAME".
C     THE FORMATS REQUIRE A 132 COLUMN OUTPUT DEVICE.
C
C
C
C
      SUBROUTINE IPRINT(MAT,M,N,NAME)
      DIMENSION MAT(M,N)
      CHARACTER*20 NAME
      WRITE(7,12) 'MATRIX..',NAME
   12 FORMAT('-',20X,C8,3X,C20)
      K=N
      N1=1
   20 N2=N1+K-1
      IF((N2-N1+1).LE.12) GO TO 30
      N2=N1+11
   30 WRITE(7,22) (J,J=N1,N2)
   22 FORMAT('-',10X,12(I4,6X))
      DO 100 I=1,M
         WRITE(7,32) I,(MAT(I,J),J=N1,N2)
   32    FORMAT(' ',1X,I4,3X,12(I7,3X))
  100 CONTINUE
      K=K-12
      N1=N1+12
      IF(K.LE.0) RETURN
      GO TO 20
      END
```

```
C
C
C
C     THE "FORSUB" SUBROUTINE PERFORMS FORWARD SUBSTITUTION
C     ON THE STATICALLY CONDENSED STIFFNESS MATRIX AND LOAD
C     VECTOR, USING THE BOUNDARY DISPLACEMENTS FOR THE
C     SUBSTRUCTURE TO OBTAIN THE INTERIOR DISPLACEMENTS FOR
C     THE SUBSTRUCTURE. THE SUBSTRUCTURE DISPLACEMENTS ARE
C     STORED IN THE "DS" ARRAY, THE FIRST INDEX INDICATES THE
C     SUBSTRUCTURE UNDER CONSIDERATION, AND THE SECOND
C     INDEX THE DOF THE DISPLACEMENT CORRESPONDS TO.
C
C
C
C
      SUBROUTINE FORSUB(STAT,QS,DS,NCOL,NBDOF,NEQS,SUB)
      DIMENSION STAT(NEQS,1),QS(NCOL,1),DS(NCOL,1)
      INTEGER SUB
      DO 1000 I=NBDOF+1,NEQS
         DS(SUB,I)=QS(SUB,I)
         DO 2000 J=1,I-1
            DS(SUB,I)=DS(SUB,I)-STAT(I,J)*DS(SUB,J)
2000     CONTINUE
         DS(SUB,I)=DS(SUB,I)/STAT(I,I)
1000  CONTINUE
      RETURN
      END
```

```
C
C
C
C     THE "EXTRCT" SUBROUTINE EXTRACTS THE BOUNDARY DISPLACEMENTS
C     FOR EACH SUBSTRUCTURE FROM THE VECTOR OF GLOBAL
C     DISPLACEMENTS.
C
C
C
C
      SUBROUTINE EXTRCT(DS,Q,ISDOF,IDOF,NCOL,NRINGS)
      DIMENSION DS(NCOL,1),Q(1),ISDOF(NCOL,3,1),IDOF(NCOL,3,1)
      DIMENSION LA(6),LAS(6)
      DO 1000 I=1,NCOL
         N1=I
         IF(I.EQ.NCOL) GO TO 1001
         N2=I+1
         GO TO 1002
 1001    N2=1
 1002    DO 1010 J=1,NRINGS
            LA(1)=ISDOF(N1,1,J)
            LAS(1)=IDOF(I,1,2*J-1)
            LA(2)=ISDOF(N1,2,J)
            LAS(2)=IDOF(I,2,2*J-1)
            LA(3)=ISDOF(N1,3,J)
            LAS(3)=IDOF(I,3,2*J-1)
            LA(4)=ISDOF(N2,1,J)
            LAS(4)=IDOF(I,1,2*J)
            LA(5)=ISDOF(N2,2,J)
            LAS(5)=IDOF(I,2,2*J)
            LA(6)=ISDOF(N2,3,J)
            LAS(6)=IDOF(I,3,2*J)
            DO 1020 K=1,6
               IF(LA(K).EQ.0) GO TO 1020
               IF(LAS(K).EQ.0) GO TO 1020
               DS(I,LAS(K))=Q(LA(K))
 1020       CONTINUE
 1010    CONTINUE
 1000 CONTINUE
      RETURN
      END
```

```
C
C
C
C      THE "ERROR" SUBROUTINE WARNS THE USER WHEN THERE IS
C      NOT ENOUGH STORAGE SPACE IN THE STORAGE POOLS TO
C      STORE ALL THE ARRAYS NECCESSARY TO RUN THE ENTIRE
C      PROGRAM.
C
C
C
C
       SUBROUTINE ERROR(IPAR)
       IF(IPAR.EQ.1) GO TO 1
       IF(IPAR.EQ.2) GO TO 2
       IF(IPAR.EQ.3) GO TO 3
       IF(IPAR.EQ.4) GO TO 4
       IF(IPAR.EQ.5) GO TO 5
       IF(IPAR.EQ.6) GO TO 6
       IF(IPAR.EQ.7) GO TO 7
       IF(IPAR.EQ.8) GO TO 8
       IF(IPAR.EQ.9) GO TO 9
       IF(IPAR.EQ.10) GO TO 10
       IF(IPAR.EQ.11) GO TO 11
       IF(IPAR.EQ.12) GO TO 12
       IF(IPAR.EQ.13) GO TO 13
       IF(IPAR.EQ.14) GO TO 14
       IF(IPAR.EQ.15) GO TO 15
       IF(IPAR.EQ.16) GO TO 16
       IF(IPAR.EQ.17) GO TO 17
       IF(IPAR.EQ.18) GO TO 18
       IF(IPAR.EQ.19) GO TO 19
       RETURN
     1 WRITE(6,*) 'NOT ENOUGH STORAGE FOR X-ARRAY,'
       WRITE(6,*) 'NOR FOR SUBSEQUENT ARRAYS'
       GO TO 1000
     2 WRITE(6,*) 'NOT ENOUGH STORAGE FOR Y-ARRAY,'
       WRITE(6,*) 'NOR FOR SUBSEQUENT ARRAYS'
       GO TO 1000
     3 WRITE(6,*) 'NOT ENOUGH STORAGE FOR Z-ARRAY,'
       WRITE(6,*) 'NOR FOR SUBSEQUENT ARRAYS'
       GO TO 1000
     4 WRITE(6,*) 'NOT ENOUGH STORAGE FOR AREA-ARRAY,'
       WRITE(6,*) 'NOR FOR SUBSEQUENT ARRAYS'
       GO TO 1000
     5 WRITE(6,*) 'NOT ENOUGH STORAGE FOR NODE-NUMBER-ARRAY,'
       WRITE(6,*) 'NOR FOR THE SUBSEQUENT ARRAYS'
       GO TO 1000
     6 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE SUBSTRUCTURE-'
       WRITE(6,*) 'DOF-ARRAY, NOR FOR SUBSEQUENT ARRAYS'
       GO TO 1000
     7 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE STRUCTURE-'
```

```
      WRITE(6,*) 'DOF-ARRAY, NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
    8 WRITE(6,*) 'NOT ENOUGH STORAGE FOR TEMPORARY ARRAY'
      WRITE(6,*) 'USED TO OUTPUT THE SUBSTRUCTURE DOFS'
      WRITE(6,*) 'ARRAY, NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
    9 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE ARRAY USED'
      WRITE(6,*) 'TO STORE THE NUMBER OF DOFS IN EACH'
      WRITE(6,*) 'SUBSTRUCTURE, NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
   10 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE ARRAY USED TO'
      WRITE(6,*) 'STORE THE NUMBER OF BOUNDARY DOFS FOR EACH'
      WRITE(6,*) 'SUBSTRUCTURE, NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
   11 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE SUBSTRUCTURE'
      WRITE(6,*) 'LOAD VECTORS, NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
   12 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE LOAD AREA'
      WRITE(6,*) 'ARRAY, NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
   13 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE STRUCTURE '
      WRITE(6,*) 'LOAD VECTOR, NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
   14 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE SUBSTRUCTURE'
      WRITE(6,*) 'STIFFNESS MATRIX, NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
   15 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE STATICALLY'
      WRITE(6,*) 'CONDENSED SUBSTRUCTURE STIFFNESS MATRIX, '
      WRITE(6,*) 'NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
   16 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE STRUCTURE'
      WRITE(6,*) 'STIFFNESS MATRIX, NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
   17 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE SUBSTRUCTURE'
      WRITE(6,*) 'DISPLACEMENT VECTORS, NOR FOR'
      WRITE(6,*) 'SUBSEQUENT ARRAYS'
      GO TO 1000
   18 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE MEMBER FORCE'
      WRITE(6,*) 'ARRAY, NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
   19 WRITE(6,*) 'NOT ENOUGH STORAGE FOR THE MEMBER LENGTH'
      WRITE(6,*) 'ARRAY, NOR FOR SUBSEQUENT ARRAYS'
      GO TO 1000
 1000 WRITE(6,*) 'ALLOCATE LARGER SPACE ON LINES 75 AND 78'
      WRITE(6,*) 'OF THE MAIN PROGRAM'
      RETURN
      END
```

```
C
C
C
C     THE "MEMFOR" SUBROUTINE CALCULATES THE MEMBER FORCE
C     FOR EACH MEMBER IN EACH SUBSTRUCTURE. IT ALSO
C     CALCULATES THE "X" "Y" "Z" COMPONENTS AT EACH
C     END OF EACH MEMBER, THIS IS TO FACILITATE EQUILIBRIUM
C     CHECKS.
C
C
C
C
      SUBROUTINE MEMFOR(DS,MEM,AREA,NCOL,X,Y,Z,IDOF,MNUM,
     $FOR,E,NEQSMX,ALPHAC,ALPHAT,DEPTH,RIN,NRINGS,L)
      DIMENSION DS(NCOL,1),MEM(2,1),AREA(1),X(NCOL,1)
      DIMENSION Y(NCOL,1),Z(NCOL,1),IDOF(NCOL,3,1),FOR(NCOL,1)
      DIMENSION FORCE(6),A(2),B(2),C(2)
      REAL L(1)
C
C
C     THE SUBSTRUCTURE DISPLACEMENTS ARE OUTPUT.
C
C
      WRITE(7,102)
  102 FORMAT('1')
      CALL RPRINT(DS,NCOL,NEQSMX,'SUBSTRUCTURE DISP.   ')
C
C
C     THE MEMBER FORCES ARE CALCULATED FOR EACH MEMBER IN EACH
C     SUBSTRUCTURE.
C
C
      DO 1000 I=1,MNUM
         NODEI=MEM(1,I)
         NODEJ=MEM(2,I)
         STIF=AREA(I)*E/L(I)
         DO 2000 J=1,NCOL
            IF(IDOF(J,1,NODEJ).EQ.0) GO TO 3000
            IF(IDOF(J,1,NODEI).EQ.0) GO TO 4004
            DELTAX=DS(J,IDOF(J,1,NODEJ))-DS(J,IDOF(J,1,NODEI))
 3003       IF(IDOF(J,2,NODEJ).EQ.0) GO TO 5000
            IF(IDOF(J,2,NODEI).EQ.0) GO TO 6000
            DELTAY=DS(J,IDOF(J,2,NODEJ))-DS(J,IDOF(J,2,NODEI))
 5003       IF(IDOF(J,3,NODEJ).EQ.0) GO TO 7000
            IF(IDOF(J,3,NODEI).EQ.0) GO TO 8000
            DELTAZ=DS(J,IDOF(J,3,NODEJ))-DS(J,IDOF(J,3,NODEI))
10000       DELX=X(J,NODEJ)-X(J,NODEI)
            DELY=Y(J,NODEJ)-Y(J,NODEI)
            DELZ=Z(J,NODEJ)-Z(J,NODEI)
            DELTA=(DELTAX*DELX+DELTAY*DELY+DELTAZ*DELZ)/L(I)
            GO TO 9000
```

```
3000        IF(IDOF(J,1,NODEI).EQ.0) GO TO 3001
            DELTAX=-DS(J,IDOF(J,1,NODEI))
            GO TO 3002
3001        DELTAX=0.0
3002        GO TO 3003
4004        IF(IDOF(J,1,NODEJ).EQ.0) GO TO 4001
            DELTAX=DS(J,IDOF(J,1,NODEJ))
            GO TO 4002
4001        DELTAX=0.0
4002        GO TO 3003
5000        IF(IDOF(J,2,NODEI).EQ.0) GO TO 5001
            DELTAY=-DS(J,IDOF(J,2,NODEI))
            GO TO 5002
5001        DELTAY=0.0
5002        GO TO 5003
6000        IF(IDOF(J,2,NODEJ).EQ.0) GO TO 6001
            DELTAY=DS(J,IDOF(J,2,NODEJ))
            GO TO 6002
6001        DELTAY=0.0
6002        GO TO 5003
7000        IF(IDOF(J,3,NODEI).EQ.0) GO TO 7001
            DELTAZ=-DS(J,IDOF(J,3,NODEI))
            GO TO 7002
7001        DELTAZ=0.0
7002        GO TO 10000
8000        IF(IDOF(J,3,NODEJ).EQ.0) GO TO 8001
            DELTAZ=DS(J,IDOF(J,3,NODEJ))
            GO TO 8002
8001        DELTAZ=0.0
8002        GO TO 10000
9000        FOR(J,I)=DELTA*STIF
2000     CONTINUE
1000  CONTINUE
C
C
C     THE MEMBER FORCES ARE OUTPUT.
C
C
      WRITE(7,102)
      CALL RPRINT(FOR,NCOL,MNUM,'MEMBER FORCES             ')
      ROOFA=0.0
      SPVOL=0.0
C
C
      DO 4000 I=1,NCOL
         A(1)=0.0
         A(2)=0.0
         B(1)=X(I,2*NRINGS-1)
         B(2)=Y(I,2*NRINGS-1)
         C(1)=X(I,2*NRINGS)
         C(2)=Y(I,2*NRINGS)
```

```
        ROOFA=ROOFA+AR(A,B,C)
C
C
C     THE HEADINGS FOR THE X-Y-Z COMPONENTS OF THE MEMBER FORCES
C     ARE OUTPUT.
C
C
        WRITE(7,101) 'MEMBER FORCES DECOMPOSED INTO X-Y-Z COMPONENTS'
  101   FORMAT('1',43X,C46)
        WRITE(7,103) 'FOR SUBSTRUCTURE:  ',I
  103   FORMAT(' ',53X,C19,3X,I3,///)
        WRITE(7,104) 'MEM.','X-DIR.','Y-DIR.','Z-DIR.',
     $  'X-DIR.','Y-DIR.','Z-DIR.'
  104   FORMAT(' ',20X,C4,7X,6(C6,9X))
        WRITE(7,104) 'NO. ','NODE I','NODE I','NODE I',
     $  'NODE J','NODE J','NODE J'
C
C
C     THE X-Y-Z COMPONENTS OF THE MEMBER FORCES ARE CALCULATED
C     FOR EACH MEMBER OF EACH SUBSTRUCTURE.
C
C
        DO 4010 J=1,MNUM
           NODEI=MEM(1,J)
           NODEJ=MEM(2,J)
           XLEN=SQRT((X(1,NODEJ)-X(1,NODEI))*(X(1,NODEJ)-X(1,NODEI)
     $     )+(Y(1,NODEJ)-Y(1,NODEI))*(Y(1,NODEJ)-Y(1,NODEI))+
     $     (Z(1,NODEJ)-Z(1,NODEI))*(Z(1,NODEJ)-Z(1,NODEI)))
           FORCE(1)=-FOR(I,J)*(X(I,NODEJ)-X(I,NODEI))/XLEN
           FORCE(4)=-FORCE(1)
           FORCE(2)=-FOR(I,J)*(Y(I,NODEJ)-Y(I,NODEI))/XLEN
           FORCE(5)=-FORCE(2)
           FORCE(3)=-FOR(I,J)*(Z(I,NODEJ)-Z(I,NODEI))/XLEN
           FORCE(6)=-FORCE(3)
           SPVOL=SPVOL+ABS(FOR(I,J))*L(J)
C
C     THE X-Y-Z COMPONENTS OF THE MEMBER FORCES ARE OUTPUT.
C
           WRITE(7,105) J,(FORCE(K),K=1,6)
  105      FORMAT(' ',20X,I4,5X,6(F10.2,5X))
 4010   CONTINUE
 4000 CONTINUE
      SPVOL=SPVOL/ROOFA
      WRITE(7,*) 'SPECIFIC MATERIAL CONSUMPTION :  ',SPVOL
      WRITE(7,*) 'ROOF AREA :                      ',ROOFA
      DO 11111 I=1,MNUM
        WRITE(7,*) I,L(I)
11111 CONTINUE
      RETURN
      END
```

```
C
C
C
C     THE FUNCTION "AR" CALCULATES THE AREA OF A
C     TRIANGLE GIVEN THE COORDINATES OF THE
C     THE THREE VERTICES.
C
C
C
      FUNCTION AR(A,B,C)
      DIMENSION A(2),B(2),C(2),VAB(2),VBC(2)
      VAB(1)=B(1)-A(1)
      VAB(2)=B(2)-A(2)
      VBC(1)=C(1)-B(1)
      VBC(2)=C(2)-B(2)
      AB=SQRT(VAB(1)*VAB(1)+VAB(2)*VAB(2))
      BC=SQRT(VBC(1)*VBC(1)+VBC(2)*VBC(2))
      THETA=3.1415927/2.0-ACOS((VAB(1)*VBC(1)+VAB(2)*VBC(2))
     $/(AB*BC))
      AR=0.5*AB*BC*COS(THETA)
      RETURN
      END
```

APPENDIX B

Sample Input and Output
For the RINGTRUSS Program

TYPICAL INPUT DATA FOR THE RING TRUSS PROGRAM

DATA DESCRIPTION	INPUT DATA
NUMBER OF RINGS	12
NUMBER OF COLUMNS	10
MODULUS OF ELASTICITY	1.0
ANGLE ALPHAT	65.0
ANGLE ALPHAC	65.0
TRUSS DEPTH	31.0
INNER RADIUS	15.5
AREA OF RING 1	1.0
AREA OF RING 2	1.0
AREA OF RING 3	1.0
AREA OF RING 4	1.0
AREA OF RING 5	1.0
AREA OF RING 6	1.0
AREA OF RING 7	1.0
AREA OF RING 8	1.0
AREA OF RING 9	1.0
AREA OF RING 10	1.0
AREA OF RING 11	1.0
AREA OF RING 12	1.0
AREA OF DIAGONAL 1-2	1.0
AREA OF DIAGONAL 2-3	1.0
AREA OF DIAGONAL 3-4	1.0
AREA OF DIAGONAL 4-5	1.0
AREA OF DIAGONAL 5-6	1.0
AREA OF DIAGONAL 6-7	1.0
AREA OF DIAGONAL 7-8	1.0
AREA OF DIAGONAL 8-9	1.0
AREA OF DIAGONAL 9-10	1.0
AREA OF DIAGONAL 10-11	1.0
AREA OF DIAGONAL 11-12	1.0
AREA OF STIFFENER 1-3	1.0
AREA OF STIFFENER 3-5	1.0
AREA OF STIFFENER 5-7	1.0
AREA OF STIFFENER 7-9	1.0
AREA OF STIFFENER 9-11	1.0
AREA OF STIFFENER 2-4	1.0
AREA OF STIFFENER 4-6	1.0
AREA OF STIFFENER 6-8	1.0
AREA OF STIFFENER 8-10	1.0
AREA OF STIFFENER 10-12	1.0
AREA OF UPPER BRACING TRUSS	1.0
AREA OF LOWER BRACING TRUSS	1.0
COLUMN 1 SUPPLIES HORIZONTAL RESTRAINT	Y
COLUMN 2 SUPPLIES HORIZONTAL RESTRAINT	Y
COLUMN 3 SUPPLIES HORIZONTAL RESTRAINT	Y

TYPICAL INPUT DATA FOR THE RING TRUSS PROGRAM (cont.)

DATA DESCRIPTION	INPUT DATA
COLUMN 4 SUPPLIES HORIZONTAL RESTRAINT	Y
COLUMN 5 SUPPLIES HORIZONTAL RESTRAINT	Y
COLUMN 6 SUPPLIES HORIZONTAL RESTRAINT	Y
COLUMN 7 SUPPLIES HORIZONTAL RESTRAINT	Y
COLUMN 8 SUPPLIES HORIZONTAL RESTRAINT	Y
COLUMN 9 SUPPLIES HORIZONTAL RESTRAINT	Y
COLUMN 10 SUPPLIES HORIZONTAL RESTRAINT	Y
SECTOR 1 LOADED	Y
LOAD INTENSITY	1.0
SECTOR 2 LOADED	Y
LOAD INTENSITY	1.0
SECTOR 3 LOADED	Y
LOAD INTENSITY	1.0
SECTOR 4 LOADED	Y
LOAD INTENSITY	1.0
SECTOR 5 LOADED	Y
LOAD INTENSITY	1.0
SECTOR 6 LOADED	Y
LOAD INTENSITY	1.0
SECTOR 7 LOADED	Y
LOAD INTENSITY	1.0
SECTOR 8 LOADED	Y
LOAD INTENSITY	1.0
SECTOR 9 LOADED	Y
LOAD INTENSITY	1.0
SECTOR 10 LOADED	Y
LOAD INTENSITY	1.0
ANALYZE THE SAME STRUCTURE FOR OTHER LOADS	N
ANALYZE ANOTHER STRUCTURE	N

```
BASIC STRUCTURE DATA:


NUMBER OF RINGS:          12

NUMBER OF COLUMNS:        10

MODULUS OF ELASTICITY:        1.0

ANGLE ALPHA-T:            65.00

ANGLE ALPHA-C:            65.00

DEPTH OF TRUSS:           31.000

INNER RADIUS:             15.500
```

```
          MATRIX..   MEMBER AREAS

                    1
  1        0.1000000E+01
  2        0.1000000E+01
  3        0.1000000E+01
  4        0.1000000E+01
  5        0.1000000E+01
  6        0.1000000E+01
  7        0.1000000E+01
  8        0.1000000E+01
  9        0.1000000E+01
 10        0.1000000E+01
 11        0.1000000E+01
 12        0.1000000E+01
 13        0.1000000E+01
 14        0.1000000E+01
 15        0.1000000E+01
 16        0.1000000E+01
 17        0.1000000E+01
 18        0.1000000E+01
 19        0.1000000E+01
 20        0.1000000E+01
 21        0.1000000E+01
 22        0.1000000E+01
 23        0.1000000E+01
 24        0.1000000E+01
 25        0.1000000E+01
 26        0.1000000E+01
 27        0.1000000E+01
 28        0.1000000E+01
 29        0.1000000E+01
 30        0.1000000E+01
 31        0.1000000E+01
 32        0.1000000E+01
 33        0.1000000E+01
 34        0.1000000E+01
 35        0.1000000E+01
 36        0.1000000E+01
 37        0.1000000E+01
 38        0.1000000E+01
 39        0.1000000E+01
 40        0.1000000E+01
 41        0.1000000E+01
 42        0.1000000E+01
```

```
43        0.1000000E+01
44        0.1000000E+01
45        0.1000000E+01
46        0.1000000E+01
47        0.1000000E+01
48        0.1000000E+01
49        0.1000000E+01
50        0.1000000E+01
51        0.1000000E+01
52        0.1000000E+01
53        0.1000000E+01
54        0.1000000E+01
55        0.1000000E+01
56        0.1000000E+01
57        0.1000000E+01
58        0.1000000E+01
59        0.1000000E+01
60        0.1000000E+01
61        0.1000000E+01
62        0.1000000E+01
63        0.1000000E+01
64        0.1000000E+01
65        0.1000000E+01
66        0.1000000E+01
67        0.1000000E+01
68        0.1000000E+01
69        0.1000000E+01
70        0.1000000E+01
71        0.1000000E+01
72        0.1000000E+01
73        0.1000000E+01
74        0.1000000E+01
75        0.1000000E+01
76        0.1000000E+01
77        0.1000000E+01
78        0.1000000E+01
79        0.1000000E+01
80        0.1000000E+01
81        0.1000000E+01
82        0.1000000E+01
83        0.1000000E+01
84        0.1000000E+01
85        0.1000000E+01
86        0.1000000E+01
87        0.1000000E+01
88        0.1000000E+01
89        0.1000000E+01
90        0.1000000E+01
91        0.1000000E+01
92        0.1000000E+01
93        0.1000000E+01
```

```
  94        0.1000000E+01
  95        0.1000000E+01
  96        0.1000000E+01
  97        0.1000000E+01
  98        0.1000000E+01
  99        0.1000000E+01
 100        0.1000000E+01
 101        0.1000000E+01
 102        0.1000000E+01
 103        0.1000000E+01
 104        0.1000000E+01
 105        0.1000000E+01
 106        0.1000000E+01
 107        0.1000000E+01
 108        0.1000000E+01
 109        0.1000000E+01
 110        0.1000000E+01
 111        0.1000000E+01
 112        0.1000000E+01
 113        0.1000000E+01
 114        0.1000000E+01
 115        0.1000000E+01
 116        0.1000000E+01
 117        0.1000000E+01
 118        0.1000000E+01
 119        0.1000000E+01
 120        0.1000000E+01
 121        0.1000000E+01
 122        0.1000000E+01
 123        0.1000000E+01
 124        0.1000000E+01
 125        0.1000000E+01
 126        0.1000000E+01
 127        0.1000000E+01
 128        0.1000000E+01
 129        0.1000000E+01
 130        0.1000000E+01
 131        0.1000000E+01
 132        0.1000000E+01
 133        0.1000000E+01
 134        0.1000000E+01
 135        0.1000000E+01
 136        0.1000000E+01
 137        0.1000000E+01
 138        0.1000000E+01
 139        0.1000000E+01
 140        0.1000000E+01
 141        0.1000000E+01
 142        0.1000000E+01
 143        0.1000000E+01
 144        0.1000000E+01
```

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145        0.1000000E+01
146        0.1000000E+01
147        0.1000000E+01
148        0.1000000E+01
149        0.1000000E+01
150        0.1000000E+01
151        0.1000000E+01
152        0.1000000E+01
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161        0.1000000E+01
162        0.1000000E+01
163        0.1000000E+01
164        0.1000000E+01
165        0.1000000E+01
166        0.1000000E+01
167        0.1000000E+01
168        0.1000000E+01
169        0.1000000E+01
170        0.1000000E+01
171        0.1000000E+01
172        0.1000000E+01
173        0.1000000E+01
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175        0.1000000E+01
176        0.1000000E+01
177        0.1000000E+01
178        0.1000000E+01
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180        0.1000000E+01
181        0.1000000E+01
182        0.1000000E+01
183        0.1000000E+01
184        0.1000000E+01
185        0.1000000E+01
186        0.1000000E+01
187        0.1000000E+01
188        0.1000000E+01
189        0.1000000E+01
190        0.1000000E+01
191        0.1000000E+01
192        0.1000000E+01
193        0.1000000E+01
194        0.1000000E+01
195        0.1000000E+01
```

```
196     0.1000000E+01
197     0.1000000E+01
198     0.1000000E+01
199     0.1000000E+01
200     0.1000000E+01
201     0.1000000E+01
202     0.1000000E+01
203     0.1000000E+01
204     0.1000000E+01
205     0.1000000E+01
206     0.1000000E+01
207     0.1000000E+01
208     0.1000000E+01
209     0.1000000E+01
210     0.1000000E+01
211     0.1000000E+01
212     0.1000000E+01
213     0.1000000E+01
214     0.1000000E+01
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217     0.1000000E+01
218     0.1000000E+01
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222     0.1000000E+01
223     0.1000000E+01
224     0.1000000E+01
225     0.1000000E+01
226     0.1000000E+01
227     0.1000000E+01
228     0.1000000E+01
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230     0.1000000E+01
231     0.1000000E+01
232     0.1000000E+01
233     0.1000000E+01
234     0.1000000E+01
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237     0.1000000E+01
238     0.1000000E+01
239     0.1000000E+01
240     0.1000000E+01
241     0.1000000E+01
242     0.1000000E+01
243     0.1000000E+01
244     0.1000000E+01
245     0.1000000E+01
246     0.1000000E+01
```

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247        0.1000000E+01
248        0.1000000E+01
249        0.1000000E+01
250        0.1000000E+01
251        0.1000000E+01
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257        0.1000000E+01
258        0.1000000E+01
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261        0.1000000E+01
262        0.1000000E+01
263        0.1000000E+01
264        0.1000000E+01
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267        0.1000000E+01
268        0.1000000E+01
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271        0.1000000E+01
272        0.1000000E+01
273        0.1000000E+01
274        0.1000000E+01
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276        0.1000000E+01
277        0.1000000E+01
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279        0.1000000E+01
280        0.1000000E+01
281        0.1000000E+01
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283        0.1000000E+01
284        0.1000000E+01
285        0.1000000E+01
286        0.1000000E+01
287        0.1000000E+01
288        0.1000000E+01
289        0.1000000E+01
290        0.1000000E+01
291        0.1000000E+01
292        0.1000000E+01
293        0.1000000E+01
```

```
MATRIX..   MEMBER END NODES

          1     2     3     4     5     6     7     8     9    10    11    12
    1     1     3    25     5    26    27     7    28    29    30     9    31
    2     2    25     4    26    27     6    28    29    30     8    31    32

         13    14    15    16    17    18    19    20    21    22    23    24
    1    32    33    34    11    35    36    37    38    39    13    40    41
    2    33    34    10    35    36    37    38    39    12    40    41    42

         25    26    27    28    29    30    31    32    33    34    35    36
    1    42    43    44    45    15    46    47    48    49    50    51    52
    2    43    44    45    14    46    47    48    49    50    51    52    16

         37    38    39    40    41    42    43    44    45    46    47    48
    1    17    53    54    55    56    57    58    59    60    19    61    62
    2    53    54    55    56    57    58    59    60    18    61    62    63

         49    50    51    52    53    54    55    56    57    58    59    60
    1    63    64    65    66    67    68    69    21    70    71    72    73
    2    64    65    66    67    68    69    20    70    71    72    73    74

         61    62    63    64    65    66    67    68    69    70    71    72
    1    74    75    76    77    78    79    23    80    81    82    83    84
    2    75    76    77    78    79    22    80    81    82    83    84    85

         73    74    75    76    77    78    79    80    81    82    83    84
    1    85    86    87    88    89    90     3     1    25     2     5     3
    2    86    87    88    89    90    24     1    25     2     4     3    26

         85    86    87    88    89    90    91    92    93    94    95    96
```

```
 1     26    25    27     4     7     5    28    26    29    27    30     6
 2     25    27     4     6     5    28    26    29    27    30     6     8

      97    98    99   100   101   102   103   104   105   106   107   108
 1     9     7    31    28    32    29    33    30    34     8    11     9
 2     7    31    28    32    29    33    30    34     8    10     9    35

     109   110   111   112   113   114   115   116   117   118   119   120
 1    35    31    36    32    37    33    38    34    39    10    13    11
 2    31    36    32    37    33    38    34    39    10    12    11    40

     121   122   123   124   125   126   127   128   129   130   131   132
 1    40    35    41    36    42    37    43    38    44    39    45    12
 2    35    41    36    42    37    43    38    44    39    45    12    14

     133   134   135   136   137   138   139   140   141   142   143   144
 1    15    13    46    40    47    41    48    42    49    43    50    44
 2    13    46    40    47    41    48    42    49    43    50    44    51

     145   146   147   148   149   150   151   152   153   154   155   156
 1    51    45    52    14    17    15    53    46    54    47    55    48
 2    45    52    14    16    15    53    46    54    47    55    48    56

     157   158   159   160   161   162   163   164   165   166   167   168
 1    56    49    57    50    58    51    59    52    60    16    19    17
 2    49    57    50    58    51    59    52    60    16    18    17    61

     169   170   171   172   173   174   175   176   177   178   179   180
 1    61    53    62    54    63    55    64    56    65    57    66    58
 2    53    62    54    63    55    64    56    65    57    66    58    67

     181   182   183   184   185   186   187   188   189   190   191   192
 1    67    59    68    60    69    18    21    19    70    61    71    62
 2    59    68    60    69    18    20    19    70    61    71    62    72
```

	193	194	195	196	197	198	199	200	201	202	203	204
1	72	63	73	64	74	65	75	66	76	67	77	68
2	63	73	64	74	65	75	66	76	67	77	68	78
	205	206	207	208	209	210	211	212	213	214	215	216
1	78	69	79	20	23	21	80	70	81	71	82	72
2	69	79	20	22	21	80	70	81	71	82	72	83
	217	218	219	220	221	222	223	224	225	226	227	228
1	83	73	84	74	85	75	86	76	87	77	88	78
2	73	84	74	85	75	86	76	87	77	88	78	89
	229	230	231	232	233	234	235	236	237	238	239	240
1	89	79	90	22	1	2	5	6	9	10	13	14
2	79	90	22	24	5	6	9	10	13	14	17	18
	241	242	243	244	245	246	247	248	249	250	251	252
1	17	18	3	4	7	8	11	12	15	16	19	20
2	21	22	7	8	11	12	15	16	19	20	23	24
	253	254	255	256	257	258	259	260	261	262	263	264
1	17	70	53	71	54	72	55	73	56	74	18	79
2	70	53	71	54	72	55	73	56	74	57	79	60
	265	266	267	268	269	270	271	272	273	274	275	276
1	60	78	59	77	58	76	57	75	19	80	81	81
2	78	59	77	58	76	57	75	56	80	61	61	62
	277	278	279	280	281	282	283	284	285	286	287	288
1	82	82	83	83	84	84	20	90	69	89	68	88
2	62	63	63	64	64	65	90	69	89	68	88	67
	289	290	291	292	293							
1	67	87	66	86	85							
2	87	66	86	65	65							

```
SUBSTRUCTURE     1

MATRIX..   SUBSTRUCTURE DOFS

          1         2         3         4         5         6         7         8         9        10        11        12
 1        1         4         7        10        13        16        19        22        25        28        31        34
 2        2         5         8        11        14        17        20        23        26        29        32        35
 3        3         6         9        12        15        18        21        24        27        30        33        36

         13        14        15        16        17        18        19        20        21        22        23        24
 1       37        40        43        46        49        52        55        58        61        64         0         0
 2       38        41        44        47        50        53        56        59        62        65         0         0
 3       39        42        45        48        51        54        57        60        63        66         0         0

         25        26        27        28        29        30        31        32        33        34        35        36
 1       67        70        73        76        79        82        85        88        91        94        97       100
 2       68        71        74        77        80        83        86        89        92        95        98       101
 3       69        72        75        78        81        84        87        90        93        96        99       102

         37        38        39        40        41        42        43        44        45        46        47        48
 1      103       106       109       112       115       118       121       124       127       130       133       136
 2      104       107       110       113       116       119       122       125       128       131       134       137
 3      105       108       111       114       117       120       123       126       129       132       135       138

         49        50        51        52        53        54        55        56        57        58        59        60
 1      139       142       145       148       151       154       157       160       163       166       169       172
 2      140       143       146       149       152       155       158       161       164       167       170       173
 3      141       144       147       150       153       156       159       162       165       168       171       174

         61        62        63        64        65        66        67        68        69        70        71        72
 1      175       178       181       184       187       190       193       196       199       202       205       208
 2      176       179       182       185       188       191       194       197       200       203       206       209
 3      177       180       18        186       189       192       195       198       201       204       207       210

         73        74        75        76        77        78        79        80        81        82        83        84
```

```
1    211  214  217  220  223  226  229  232  235  238  241  244
2    212  215  218  221  224  227  230  233  236  239  242  245
3    213  216  219  222  225  228  231  234  237  240  243  246

     85   86   87   88   89   90
1    247  250  253  256  259  262
2    248  251  254  257  260  263
3    249  252  255  258  261  264
```

```
          SUBSTRUCTURE      2

          MATRIX..   SUBSTRUCTURE DOFS

           1        2        3        4        5        6        7        8        9       10       11       12
   1       1        4        7       10       13       16       19       22       25       28       31       34
   2       2        5        8       11       14       17       20       23       26       29       32       35
   3       3        6        9       12       15       18       21       24       27       30       33       36

          13       14       15       16       17       18       19       20       21       22       23       24
   1      37       40       43       46       49       52       55       58       61       64        0        0
   2      38       41       44       47       50       53       56       59       62       65        0        0
   3      39       42       45       48       51       54       57       60       63       66        0        0

          25       26       27       28       29       30       31       32       33       34       35       36
   1      67       70       73       76       79       82       85       88       91       94       97      100
   2      68       71       74       77       80       83       86       89       92       95       98      101
   3      69       72       75       78       81       84       87       90       93       96       99      102

          37       38       39       40       41       42       43       44       45       46       47       48
   1     103      106      109      112      115      118      121      124      127      130      133      136
   2     104      107      110      113      116      119      122      125      128      131      134      137
   3     105      108      111      114      117      120      123      126      129      132      135      138

          49       50       51       52       53       54       55       56       57       58       59       60
   1     139      142      145      148      151      154      157      160      163      166      169      172
   2     140      143      146      149      152      155      158      161      164      167      170      173
   3     141      144      147      150      153      156      159      162      165      168      171      174

          61       62       63       64       65       66       67       68       69       70       71       72
   1     175      178      181      184      187      190      193      196      199      202      205      208
   2     176      179      182      185      188      191      194      197      200      203      206      209
   3     177      180      183      186      189      192      195      198      201      204      207      210

          73       74       75       76       77       78       79       80       81       82       83       84
```

1	211	214	217	220	223	226	229	232	235	238	241	244
2	212	215	218	221	224	227	230	233	236	239	242	245
3	213	216	219	222	225	228	231	234	237	240	243	246

	85	86	87	88	89	90
1	247	250	253	256	259	262
2	248	251	254	257	260	263
3	249	252	255	258	261	264

```
      SUBSTRUCTURE      3

      MATRIX..   SUBSTRUCTURE DOFS

            1     2     3     4     5     6     7     8     9    10    11    12
    1       1     4     7    10    13    16    19    22    25    28    31    34
    2       2     5     8    11    14    17    20    23    26    29    32    35
    3       3     6     9    12    15    18    21    24    27    30    33    36

           13    14    15    16    17    18    19    20    21    22    23    24
    1      37    40    43    46    49    52    55    58    61    64     0     0
    2      38    41    44    47    50    53    56    59    62    65     0     0
    3      39    42    45    48    51    54    57    60    63    66     0     0

           25    26    27    28    29    30    31    32    33    34    35    36
    1      67    70    73    76    79    82    85    88    91    94    97   100
    2      68    71    74    77    80    83    86    89    92    95    98   101
    3      69    72    75    78    81    84    87    90    93    96    99   102

           37    38    39    40    41    42    43    44    45    46    47    48
    1     103   106   109   112   115   118   121   124   127   130   133   136
    2     104   107   110   113   116   119   122   125   128   131   134   137
    3     105   108   111   114   117   120   123   126   129   132   135   138

           49    50    51    52    53    54    55    56    57    58    59    60
    1     139   142   145   148   151   154   157   160   163   166   169   172
    2     140   143   146   149   152   155   158   161   164   167   170   173
    3     141   144   147   150   153   156   159   162   165   168   171   174

           61    62    63    64    65    66    67    68    69    70    71    72
    1     175   178   181   184   187   190   193   196   199   202   205   208
    2     176   179   182   185   188   191   194   197   200   203   206   209
    3     177   180   183   186   189   192   195   198   201   204   207   210

           73    74    75    76    77    78    79    80    81    82    83    84
```

246

```
1    211   214   217   220   223   226   229   232   235   238   241   244
2    212   215   218   221   224   227   230   233   236   239   242   245
3    213   216   219   222   225   228   231   234   237   240   243   246

     85    86    87    88    89    90
1    247   250   253   256   259   262
2    248   251   254   257   260   263
3    249   252   255   258   261   264
```

```
SUBSTRUCTURE     4

MATRIX..   SUBSTRUCTURE DOFS

        1     2     3     4     5     6     7     8     9    10    11    12
 1      1     4     7    10    13    16    19    22    25    28    31    34
 2      2     5     8    11    14    17    20    23    26    29    32    35
 3      3     6     9    12    15    18    21    24    27    30    33    36

       13    14    15    16    17    18    19    20    21    22    23    24
 1     37    40    43    46    49    52    55    58    61    64     0     0
 2     38    41    44    47    50    53    56    59    62    65     0     0
 3     39    42    45    48    51    54    57    60    63    66     0     0

       25    26    27    28    29    30    31    32    33    34    35    36
 1     67    70    73    76    79    82    85    88    91    94    97   100
 2     68    71    74    77    80    83    86    89    92    95    98   101
 3     69    72    75    78    81    84    87    90    93    96    99   102

       37    38    39    40    41    42    43    44    45    46    47    48
 1    103   106   109   112   115   118   121   124   127   130   133   136
 2    104   107   110   113   116   119   122   125   128   131   134   137
 3    105   108   111   114   117   120   123   126   129   132   135   138

       49    50    51    52    53    54    55    56    57    58    59    60
 1    139   142   145   148   151   154   157   160   163   166   169   172
 2    140   143   146   149   152   155   158   161   164   167   170   173
 3    141   144   147   150   153   156   159   162   165   168   171   174

       61    62    63    64    65    66    67    68    69    70    71    72
 1    175   178   181   184   187   190   193   196   199   202   205   208
 2    176   179   182   185   188   191   194   197   200   203   206   209
 3    177   180   183   186   189   192   195   198   201   204   207   210

       73    74    75    76    77    78    79    80    81    82    83    84
```

1	211	214	217	220	223	226	229	232	235	218	241	244
2	212	215	218	221	224	227	230	233	236	239	242	245
3	213	216	219	222	225	228	231	234	237	240	243	246

	85	86	87	88	89	90
1	247	250	253	256	259	262
2	248	251	254	257	260	263
3	249	252	255	258	261	264

```
SUBSTRUCTURE     5

MATRIX..   SUBSTRUCTURE DOFS

        1     2     3     4     5     6     7     8     9    10    11    12
  1     1     4     7    10    13    16    19    22    25    28    31    34
  2     2     5     8    11    14    17    20    23    26    29    32    35
  3     3     6     9    12    15    18    21    24    27    30    33    36

       13    14    15    16    17    18    19    20    21    22    23    24
  1    37    40    43    46    49    52    55    58    61    64     0     0
  2    38    41    44    47    50    53    56    59    62    65     0     0
  3    39    42    45    48    51    54    57    60    63    66     0     0

       25    26    27    28    29    30    31    32    33    34    35    36
  1    67    70    73    76    79    82    85    88    91    94    97   100
  2    68    71    74    77    80    83    86    89    92    95    98   101
  3    69    72    75    78    81    84    87    90    93    96    99   102

       37    38    39    40    41    42    43    44    45    46    47    48
  1   103   106   109   112   115   118   121   124   127   130   133   136
  2   104   107   110   113   116   119   122   125   128   131   134   137
  3   105   108   111   114   117   120   123   126   129   132   135   138

       49    50    51    52    53    54    55    56    57    58    59    60
  1   139   142   145   148   151   154   157   160   163   166   169   172
  2   140   143   146   149   152   155   158   161   164   167   170   173
  3   141   144   147   150   153   156   159   162   165   168   171   174

       61    62    63    64    65    66    67    68    69    70    71    72
  1   175   178   181   184   187   190   193   196   199   202   205   208
  2   176   179   182   185   188   191   194   197   200   203   206   209
  3   177   180   183   186   189   192   195   198   201   204   207   210

       73    74    75    76    77    78    79    80    81    82    83    84
```

1	211	214	217	220	223	226	229	232	235	238	241	244
2	212	215	218	221	224	227	230	233	236	239	242	245
3	213	216	219	222	225	228	231	234	237	240	243	246

	85	86	87	88	89	90
1	247	250	253	256	259	262
2	248	251	254	257	260	263
3	249	252	255	258	261	264

```
SUBSTRUCTURE      6

MATRIX..   SUBSTRUCTURE DOFS

          1       2       3       4       5       6       7       8       9      10      11      12
 1        1       4       7      10      13      16      19      22      25      28      31      34
 2        2       5       8      11      14      17      20      23      26      29      32      35
 3        3       6       9      12      15      18      21      24      27      30      33      36

         13      14      15      16      17      18      19      20      21      22      23      24
 1       37      40      43      46      49      52      55      58      61      64       0       0
 2       38      41      44      47      50      53      56      59      62      65       0       0
 3       39      42      45      48      51      54      57      60      63      66       0       0

         25      26      27      28      29      30      31      32      33      34      35      36
 1       67      70      73      76      79      82      85      88      91      94      97     100
 2       68      71      74      77      80      83      86      89      92      95      98     101
 3       69      72      75      78      81      84      87      90      93      96      99     102

         37      38      39      40      41      42      43      44      45      46      47      48
 1      103     106     109     112     115     118     121     124     127     130     133     136
 2      104     107     110     113     116     119     122     125     128     131     134     137
 3      105     108     111     114     117     120     123     126     129     132     135     138

         49      50      51      52      53      54      55      56      57      58      59      60
 1      139     142     145     148     151     154     157     160     163     166     169     172
 2      140     143     146     149     152     155     158     161     164     167     170     173
 3      141     144     147     150     153     156     159     162     165     168     171     174

         61      62      63      64      65      66      67      68      69      70      71      72
 1      175     178     181     184     187     190     193     196     199     202     205     208
 2      176     179     182     185     188     191     194     197     200     203     206     209
 3      177     180     183     186     189     192     195     198     201     204     207     210

         73      74      75      76      77      78      79      80      81      82      83      84
```

1	211	214	217	220	223	226	229	232	235	238	241	244
2	212	215	218	221	224	227	230	233	236	239	242	245
3	213	216	219	222	225	228	231	234	237	240	243	246

	85	86	87	88	89	90
1	247	250	253	256	259	262
2	248	251	254	257	260	263
3	249	252	255	258	261	264

```
          SUBSTRUCTURE     7

          MATRIX..   SUBSTRUCTURE DOFS

            1       2       3       4       5       6       7       8       9      10      11      12
  1         1       4       7      10      13      16      19      22      25      28      31      34
  2         2       5       8      11      14      17      20      23      26      29      32      35
  3         3       6       9      12      15      18      21      24      27      30      33      36

           13      14      15      16      17      18      19      20      21      22      23      24
  1        37      40      43      46      49      52      55      58      61      64       0       0
  2        38      41      44      47      50      53      56      59      62      65       0       0
  3        39      42      45      48      51      54      57      60      63      66       0       0

           25      26      27      28      29      30      31      32      33      34      35      36
  1        67      70      73      76      79      82      85      88      91      94      97     100
  2        68      71      74      77      80      83      86      89      92      95      98     101
  3        69      72      75      78      81      84      87      90      93      96      99     102

           37      38      39      40      41      42      43      44      45      46      47      48
  1       103     106     109     112     115     118     121     124     127     130     133     136
  2       104     107     110     113     116     119     122     125     128     131     134     137
  3       105     108     111     114     117     120     123     126     129     132     135     138

           49      50      51      52      53      54      55      56      57      58      59      60
  1       139     142     145     148     151     154     157     160     163     166     169     172
  2       140     143     146     149     152     155     158     161     164     167     170     173
  3       141     144     147     150     153     156     159     162     165     168     171     174

           61      62      63      64      65      66      67      68      69      70      71      72
  1       175     178     181     184     187     190     193     196     199     202     205     208
  2       176     179     182     185     188     191     194     197     200     203     206     209
  3       177     180     183     186     189     192     195     198     201     204     207     210

           73      74      75      76      77      78      79      80      81      82      83      84
```

1	211	214	217	220	223	226	229	232	235	238	241	244
2	212	215	218	221	224	227	230	233	236	239	242	245
3	213	216	219	222	225	228	231	234	237	240	243	246

	85	86	87	88	89	90
1	247	250	253	256	259	262
2	248	251	254	257	260	263
3	249	252	255	258	261	264

```
SUBSTRUCTURE     8

MATRIX..   SUBSTRUCTURE DOFS

         1      2      3      4      5      6      7      8      9     10     11     12
 1       1      4      7     10     13     16     19     22     25     28     31     34
 2       2      5      8     11     14     17     20     23     26     29     32     35
 3       3      6      9     12     15     18     21     24     27     30     33     36

        13     14     15     16     17     18     19     20     21     22     23     24
 1      37     40     43     46     49     52     55     58     61     64      0      0
 2      38     41     44     47     50     53     56     59     62     65      0      0
 3      39     42     45     48     51     54     57     60     63     66      0      0

        25     26     27     28     29     30     31     32     33     34     35     36
 1      67     70     73     76     79     82     85     88     91     94     97    100
 2      68     71     74     77     80     83     86     89     92     95     98    101
 3      69     72     75     78     81     84     87     90     93     96     99    102

        37     38     39     40     41     42     43     44     45     46     47     48
 1     103    106    109    112    115    118    121    124    127    130    133    136
 2     104    107    110    113    116    119    122    125    128    131    134    137
 3     105    108    111    114    117    120    123    126    129    132    135    138

        49     50     51     52     53     54     55     56     57     58     59     60
 1     139    142    145    148    151    154    157    160    163    166    169    172
 2     140    143    146    149    152    155    158    161    164    167    170    173
 3     141    144    147    150    153    156    159    162    165    168    171    174

        61     62     63     64     65     66     67     68     69     70     71     72
 1     175    178    181    184    187    190    193    196    199    202    205    208
 2     176    179    182    185    188    191    194    197    200    203    206    209
 3     177    180    183    186    189    192    195    198    201    204    207    210

        73     74     75     76     77     78     79     80     81     82     83     84
```

```
1   211   214   217   220   223   226   229   232   235   238   241   244
2   212   215   218   221   224   227   230   233   236   239   242   245
3   213   216   219   222   225   228   231   234   237   240   243   246

    85    86    87    88    89    90
1   247   250   253   256   259   262
2   248   251   254   257   260   263
3   249   252   255   258   261   264
```

```
          SUBSTRUCTURE      9

          MATRIX..   SUBSTRUCTURE DOFS

          1         2         3         4         5         6         7         8         9        10        11        12
 1        1         4         7        10        13        16        19        22        25        28        31        34
 2        2         5         8        11        14        17        20        23        26        29        32        35
 3        3         6         9        12        15        18        21        24        27        30        33        36

         13        14        15        16        17        18        19        20        21        22        23        24
 1       37        40        43        46        49        52        55        58        61        64         0         0
 2       38        41        44        47        50        53        56        59        62        65         0         0
 3       39        42        45        48        51        54        57        60        63        66         0         0

         25        26        27        28        29        30        31        32        33        34        35        36
 1       67        70        73        76        79        82        85        88        91        94        97       100
 2       68        71        74        77        80        83        86        89        92        95        98       101
 3       69        72        75        78        81        84        87        90        93        96        99       102

         37        38        39        40        41        42        43        44        45        46        47        48
 1      103       106       109       112       115       118       121       124       127       130       133       136
 2      104       107       110       113       116       119       122       125       128       131       134       137
 3      105       108       111       114       117       120       123       126       129       132       135       138

         49        50        51        52        53        54        55        56        57        58        59        60
 1      139       142       145       148       151       154       157       160       163       166       169       172
 2      140       143       146       149       152       155       158       161       164       167       170       173
 3      141       144       147       150       153       156       159       162       165       168       171       174

         61        62        63        64        65        66        67        68        69        70        71        72
 1      175       178       181       184       187       190       193       196       199       202       205       208
 2      176       179       182       185       188       191       194       197       200       203       206       209
 3      177       180       183       186       189       192       195       198       201       204       207       210

         73        74        75        76        77        78        79        80        81        82        83        84
```

1	211	214	217	220	223	226	229	232	235	238	241	244
2	212	215	218	221	224	227	230	233	236	239	242	245
3	213	216	219	222	225	228	231	234	237	240	243	246

	85	86	87	88	89	90
1	247	250	253	256	259	262
2	248	251	254	257	260	263
3	249	252	255	258	261	264

```
SUBSTRUCTURE   10

MATRIX..  SUBSTRUCTURE DOFS

        1     2     3     4     5     6     7     8     9    10    11    12
  1     1     4     7    10    13    16    19    22    25    28    31    34
  2     2     5     8    11    14    17    20    23    26    29    32    35
  3     3     6     9    12    15    18    21    24    27    30    33    36

       13    14    15    16    17    18    19    20    21    22    23    24
  1    37    40    43    46    49    52    55    58    61    64     0     0
  2    38    41    44    47    50    53    56    59    62    65     0     0
  3    39    42    45    48    51    54    57    60    63    66     0     0

       25    26    27    28    29    30    31    32    33    34    35    36
  1    67    70    73    76    79    82    85    88    91    94    97   100
  2    68    71    74    77    80    83    86    89    92    95    98   101
  3    69    72    75    78    81    84    87    90    93    96    99   102

       37    38    39    40    41    42    43    44    45    46    47    48
  1   103   106   109   112   115   118   121   124   127   130   133   136
  2   104   107   110   113   116   119   122   125   128   131   134   137
  3   105   108   111   114   117   120   123   126   129   132   135   138

       49    50    51    52    53    54    55    56    57    58    59    60
  1   139   142   145   148   151   154   157   160   163   166   169   172
  2   140   143   146   149   152   155   158   161   164   167   170   173
  3   141   144   147   150   153   156   159   162   165   168   171   174

       61    62    63    64    65    66    67    68    69    70    71    72
  1   175   178   181   184   187   190   193   196   199   202   205   208
  2   176   179   182   185   188   191   194   197   200   203   206   209
  3   177   180   183   186   189   192   195   198   201   204   207   210

       73    74    75    76    77    78    79    80    81    82    83    84
```

1	211	214	217	220	223	226	229	232	235	238	241	244
2	212	215	218	221	224	227	230	233	236	239	242	245
3	213	216	219	222	225	228	231	234	237	240	243	246

	85	86	87	88	89	90
1	247	250	253	256	259	262
2	248	251	254	257	260	263
3	249	252	255	258	261	264

```
STRUCTURE DOFS ON COLUMN LINE        1

          MATRIX..   STRUCTURE DOFS

          1       2       3       4       5       6       7       8       9      10      11      12
 1        1       4       7      10      13      16      19      22      25      28      31       0
 2        2       5       8      11      14      17      20      23      26      29      32       0
 3        3       6       9      12      15      18      21      24      27      30      33       0
```

```
STRUCTURE DOFS ON COLUMN LINE        2

          MATRIX..   STRUCTURE DOFS

        1      2      3      4      5      6      7      8      9     10     11     12
  1    67     70     73     76     79     82     85     88     91     94     97      0
  2    68     71     74     77     80     83     86     89     92     95     98      0
  3    69     72     75     78     81     84     87     90     93     96     99      0
```

```
STRUCTURE DOFS ON COLUMN LINE      3

          MATRIX..   STRUCTURE DOFS

         1      2      3      4      5      6      7      8      9     10     11     12
 1     133    136    139    142    145    148    151    154    157    160    163      0
 2     134    137    140    143    146    149    152    155    158    161    164      0
 3     135    138    141    144    147    150    153    156    159    162    165      0
```

```
STRUCTURE DOFS ON COLUMN LINE        4

          MATRIX..   STRUCTURE DOFS

           1     2     3     4     5     6     7     8     9    10    11    12
   1     199   202   205   208   211   214   217   220   223   226   229     0
   2     200   203   206   209   212   215   218   221   224   227   230     0
   3     201   204   207   210   213   216   219   222   225   228   231     0
```

```
STRUCTURE DOFS ON COLUMN LINE       5


                  MATRIX..   STRUCTURE DOFS

          1      2      3      4      5      6      7      8      9     10     11     12
   1    265    268    271    274    277    280    283    286    289    292    295      0
   2    266    269    272    275    278    281    284    287    290    293    296      0
   3    267    270    273    276    279    282    285    288    291    294    297      0
```

```
STRUCTURE DOFS ON COLUMN LINE        6

            MATRIX..   STRUCTURE DOFS

          1       2       3       4       5       6       7       8       9      10      11      12
  1     298     301     304     307     310     313     316     319     322     325     328       0
  2     299     302     305     308     311     314     317     320     323     326     329       0
  3     300     303     306     309     312     315     318     321     324     327     330       0
```

```
STRUCTURE DOFS ON COLUMN LINE      7

          MATRIX..   STRUCTURE DOFS

          1       2       3       4       5       6       7       8       9      10      11      12
   1    232     235     238     241     244     247     250     253     256     259     262       0
   2    233     236     239     242     245     248     251     254     257     260     263       0
   3    234     237     240     243     246     249     252     255     258     261     264       0
```

```
 STRUCTURE DOFS ON COLUMN LINE      8

           MATRIX..   STRUCTURE DOFS

          1      2      3      4      5      6      7      8      9     10     11     12
   1    166    169    172    175    178    181    184    187    190    193    196      0
   2    167    170    173    176    179    182    185    188    191    194    197      0
   3    168    171    174    177    180    183    186    189    192    195    198      0
```

```
STRUCTURE DOFS ON COLUMN LINE       9

          MATRIX..   STRUCTURE DOFS

        1      2      3      4      5      6      7      8      9     10     11     12
 1    100    103    106    109    112    115    118    121    124    127    130      0
 2    101    104    107    110    113    116    119    122    125    128    131      0
 3    102    105    108    111    114    117    120    123    126    129    132      0
```

```
          STRUCTURE DOFS ON COLUMN LINE      10

                    MATRIX..   STRUCTURE DOFS

          1      2      3      4      5      6      7      8      9     10     11     12
  1      34     37     40     43     46     49     52     55     58     61     64      0
  2      35     38     41     44     47     50     53     56     59     62     65      0
  3      36     39     42     45     48     51     54     57     60     63     66      0
```

```
STRUCTURE LOAD DATA:


 SECTOR    1 LOADED WITH INTENSITY  1.0000
 SECTOR    2 LOADED WITH INTENSITY  1.0000
 SECTOR    3 LOADED WITH INTENSITY  1.0000
 SECTOR    4 LOADED WITH INTENSITY  1.0000
 SECTOR    5 LOADED WITH INTENSITY  1.0000
 SECTOR    6 LOADED WITH INTENSITY  1.0000
 SECTOR    7 LOADED WITH INTENSITY  1.0000
 SECTOR    8 LOADED WITH INTENSITY  1.0000
 SECTOR    9 LOADED WITH INTENSITY  1.0000
 SECTOR   10 LOADED WITH INTENSITY  1.0000
```

```
MATERIAL CONSUMPTION FOR RINGS:              7471.563

                     FOR DIAGONALS:         14750.940

                     FOR STIFFENERS:         1915.917

                     FOR UPPER BRACING TRUSS:  2299.100

                     FOR LOWER BRACING TRUSS:  1628.529
```

```
                    MATRIX..   GLOBAL DISPLACEMENTS


                              1
             1       0.1279587E+06
             2      -0.4220337E+02
             3       0.3248258E+07
             4      -0.9124031E+05
             5      -0.8364722E+02
             6       0.3140544E+07
             7       0.1999146E+06
             8      -0.1719016E+02
             9       0.2994023E+07
            10      -0.1145855E+06
            11      -0.5740511E+02
            12       0.2826165E+07
            13       0.3029886E+06
            14      -0.7205078E+01
            15       0.2599883E+07
            16      -0.1406252E+06
            17      -0.5451627E+02
            18       0.2345879E+07
            19       0.4195592E+06
            20      -0.3113036E+02
            21       0.2022036E+07
            22      -0.1484176E+06
            23      -0.3831445E+02
            24       0.1673884E+07
            25       0.5279856E+06
            26      -0.5179688E+01
            27       0.1274954E+07
            28      -0.1113945E+06
            29      -0.1367969E+02
            30       0.8853274E+06
            31       0.5793759E+06
            32       0.3101563E+01
            33       0.4552230E+06
            34       0.1035021E+06
            35      -0.7523456E+05
            36       0.3248322E+07
            37      -0.7380438E+05
            38       0.5360360E+05
            39       0.3140641E+07
            40       0.1617276E+06
            41      -0.1175179E+06
            42       0.2994164E+07
```

```
43        -0.9268913E+05
44         0.6735331E+05
45         0.2826297E+07
46         0.2451361E+06
47        -0.1781032E+06
48         0.2599991E+07
49        -0.1137577E+06
50         0.8266800E+05
51         0.2345970E+07
52         0.3394413E+06
53        -0.2466313E+06
54         0.2022105E+07
55        -0.1200712E+06
56         0.8724244E+05
57         0.1673935E+07
58         0.4271711E+06
59        -0.3103454E+06
60         0.1274982E+07
61        -0.9011600E+05
62         0.6548331E+05
63         0.8853471E+06
64         0.4687414E+06
65        -0.3405514E+06
66         0.4552076E+06
67         0.1035412E+06
68         0.7515788E+05
69         0.3248183E+07
70        -0.7377444E+05
71        -0.5375230E+05
72         0.3140467E+07
73         0.1617424E+06
74         0.1174736E+06
75         0.2993935E+07
76        -0.9267631E+05
77        -0.6744050E+05
78         0.2826061E+07
79         0.2451266E+06
80         0.1780584E+06
81         0.2599774E+07
82        -0.1137381E+06
83        -0.8274200E+05
84         0.2345775E+07
85         0.3394466E+06
86         0.2465448E+06
87         0.2021933E+07
88        -0.1200522E+06
89        -0.8729775E+05
90         0.1673783E+07
91         0.4271235E+06
92         0.3103109E+06
93         0.1274856E+07
```

```
  94        -0.9011619E+05
  95        -0.6549441E+05
  96         0.8852511E+06
  97         0.4686925E+06
  98         0.3405154E+06
  99         0.4551739E+06
 100         0.3949880E+05
 101        -0.1216611E+06
 102         0.3248261E+07
 103        -0.2817038E+05
 104         0.8683269E+05
 105         0.3140563E+07
 106         0.6173067E+05
 107        -0.1900984E+06
 108         0.2994066E+07
 109        -0.3536379E+05
 110         0.1090498E+06
 111         0.2826200E+07
 112         0.9360638E+05
 113        -0.2881359E+06
 114         0.2599876E+07
 115        -0.4341536E+05
 116         0.1338129E+06
 117         0.2345845E+07
 118         0.1296250E+06
 119        -0.3989976E+06
 120         0.2021959E+07
 121        -0.4583364E+05
 122         0.1412021E+06
 123         0.1673801E+07
 124         0.1631634E+06
 125        -0.5020927E+06
 126         0.1274860E+07
 127        -0.3440341E+05
 128         0.1059646E+06
 129         0.8852625E+06
 130         0.1790264E+06
 131        -0.5509656E+06
 132         0.4551708E+06
 133         0.3957039E+05
 134         0.1216206E+06
 135         0.3248055E+07
 136        -0.2810354E+05
 137        -0.8688694E+05
 138         0.3140323E+07
 139         0.6178891E+05
 140         0.1900523E+06
 141         0.2993824E+07
 142        -0.3534418E+05
 143        -0.1090690E+06
 144         0.2825980E+07
```

```
145        0.9364430E+05
146        0.2880805E+06
147        0.2599676E+' 7
148       -0.4339706E+05
149       -0.1338149E+06
150        0.2345701E+07
151        0.1296804E+06
152        0.3989321E+06
153        0.2021869E+07
154       -0.4582242E+05
155       -0.1412041E+06
156        0.1673744E+07
157        0.1631521E+06
158        0.5020566E+06
159        0.1274821E+07
160       -0.3441813E+05
161       -0.1059618E+06
162        0.8852374E+06
163        0.1790243E+06
164        0.5509318E+06
165        0.4551589E+06
166       -0.3956427E+05
167       -0.1216296E+06
168        0.3248105E+07
169        0.2826446E+05
170        0.8684425E+05
171        0.3140387E+07
172       -0.6180887E+05
173       -0.1900669E+06
174        0.2993843E+07
175        0.3549996E+05
176        0.1090299E+06
177        0.2825966E+07
178       -0.9363331E+05
179       -0.2881028E+06
180        0.2599629E+07
181        0.4352647E+05
182        0.1337718E+06
183        0.2345650E+07
184       -0.1296294E+06
185       -0.3989573E+06
186        0.2021822E+07
187        0.4589767E+05
188        0.1411699E+06
189        0.1673714E+07
190       -0.1631198E+06
191       -0.5020696E+06
192        0.1274799E+07
193        0.3443494E+05
194        0.1059476E+06
195        0.8852270E+06
```

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196       -0.1790060E+06
197       -0.5509393E+06
198        0.4551551E+06
199       -0.3948570E+05
200        0.1216453E+06
201        0.3247997E+07
202        0.2831277E+05
203       -0.8680144E+05
204        0.3140304E+07
205       -0.6173143E+05
206        0.1900731E+06
207        0.2993807E+07
208        0.3550486E+05
209       -0.1090008E+06
210        0.2825964E+07
211       -0.9358331E+05
212        0.2881049E+06
213        0.2599675E+07
214        0.4353713E+05
215       -0.1337563E+06
216        0.2345702E+07
217       -0.1295724E+06
218        0.3989768E+06
219        0.2021870E+07
220        0.4590788E+05
221       -0.1411658E+06
222        0.1673740E+07
223       -0.1631278E+06
224        0.5020727E+06
225        0.1274817E+07
226        0.3442464E+05
227       -0.1059509E+06
228        0.8852404E+06
229       -0.1790065E+06
230        0.5509464E+06
231        0.4551631E+06
232       -0.1035268E+06
233       -0.7516475E+05
234        0.3248047E+07
235        0.7391094E+05
236        0.5367635E+05
237        0.3140298E+07
238       -0.1617362E+06
239       -0.1174481E+06
240        0.2993742E+07
241        0.9279913E+05
242        0.6736888E+05
243        0.2825850E+07
244       -0.2450982E+06
245       -0.1780451E+06
246        0.2599521E+07
```

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247        0.1138301E+06
248        0.8266219E+05
249        0.2345546E+07
250       -0.3393686E+06
251       -0.2465528E+06
252        0.2021744E+07
253        0.1201087E+06
254        0.8723238E+05
255        0.1673642E+07
256       -0.4270623E+06
257       -0.3102879E+06
258        0.1274757E+07
259        0.9013456E+05
260        0.6547265E+05
261        0.8851883E+06
262       -0.4686387E+06
263       -0.3404779E+06
264        0.4551213E+06
265       -0.1034526E+06
266        0.7519625E+05
267        0.3247932E+07
268        0.7394106E+05
269       -0.5362473E+05
270        0.3140194E+07
271       -0.1616631E+06
272        0.1174768E+06
273        0.2993661E+07
274        0.9280131E+05
275       -0.6734106E+05
276        0.2825820E+07
277       -0.2450451E+06
278        0.1780496E+06
279        0.2599543E+07
280        0.1138433E+06
281       -0.8263056E+05
282        0.2345591E+07
283       -0.3393323E+06
284        0.2465700E+06
285        0.2021802E+07
286        0.1201241E+06
287       -0.8721131E+05
288        0.1673710E+07
289       -0.4270675E+06
290        0.3102836E+06
291        0.1274804E+07
292        0.9013481E+05
293       -0.6547426E+05
294        0.8852210E+06
295       -0.4686500E+06
296        0.3404808E+06
297        0.4551613E+06
```

```
298       -0.1279273E+06
299        0.2961470E+02
300        0.3247954E+07
301        0.9136413E+05
302        0.2595157E+02
303        0.3140179E+07
304       -0.1998678E+06
305        0.2942218E+02
306        0.2993612E+07
307        0.1146868E+06
308        0.1018132E+02
309        0.2825717E+07
310       -0.3029081E+06
311        0.9210566E+01
312        0.2599431E+07
313        0.1406918E+06
314        0.2256229E+02
315        0.2345454E+07
316       -0.4194454E+06
317        0.9044375E+01
318        0.2021659E+07
319        0.1484503E+06
320        0.1423599E+02
321        0.1673576E+07
322       -0.5278503E+06
323       -0.2396922E+01
324        0.1274716E+07
325        0.1114051E+06
326        0.2941393E+01
327        0.8851668E+06
328       -0.5792376E+06
329       -0.4729794E+01
330        0.4551384E+06
```

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          MATRIX..   SUBSTRUCTURE DISP.

                    1              2              3              4              5              6
   1      0.1279590E+06  -0.4220340E+02   0.3248260E+07   0.1035410E+06   0.7515788E+05   0.3248180E+07
   2      0.1035410E+06   0.7515788E+05   0.3248160E+07   0.3957040E+05   0.1216210E+06   0.3248060E+07
   3      0.3957040E+05   0.1216210E+06   0.3248060E+07  -0.3948570E+05   0.1216450E+06   0.3248000E+07
   4     -0.3948570E+05   0.1216450E+06   0.3248000E+07  -0.1034530E+06   0.7519625E+05   0.3247930E+07
   5     -0.1034530E+06   0.7519625E+05   0.3247930E+07  -0.1279270E+06   0.2961469E+02   0.3247950E+07
   6     -0.1279270E+06   0.2961469E+02   0.3247950E+07  -0.1035270E+06  -0.7516475E+05   0.3248050E+07
   7     -0.1035270E+06  -0.7516475E+05   0.3248050E+07  -0.3956430E+05  -0.1216300E+06   0.3248110E+07
   8     -0.3956430E+05  -0.1216300E+06   0.3248110E+07   0.3949880E+05  -0.1216610E+06   0.3248260E+07
   9      0.3949880E+05  -0.1216610E+06   0.3248260E+07   0.1035020E+06  -0.7523456E+05   0.3248320E+07
  10      0.1035020E+06  -0.7523456E+05   0.3248320E+07   0.1279590E+06  -0.4220340E+02   0.3248260E+07

                    7              8              9             10             11             12
   1     -0.9124025E+05  -0.8364719E+02   0.3140540E+07  -0.7377438E+05  -0.5375230E+05   0.3140470E+07
   2     -0.7377438E+05  -0.5375230E+05   0.3140470E+07  -0.2810350E+05  -0.8688688E+05   0.3140320E+07
   3     -0.2810350E+05  -0.8688688E+05   0.3140320E+07   0.2831260E+05  -0.8680138E+05   0.3140300E+07
   4      0.2831280E+05  -0.8680138E+05   0.3140300E+07   0.7394106E+05  -0.5362470E+05   0.3140190E+07
   5      0.7394106E+05  -0.5362470E+05   0.3140190E+07   0.9136406E+05   0.2595160E+02   0.3140180E+07
   6      0.9136406E+05   0.2595160E+02   0.3140180E+07   0.7391088E+05   0.5367640E+05   0.3140300E+07
   7      0.7391088E+05   0.5367640E+05   0.3140300E+07   0.2826450E+05   0.8684425E+05   0.3140390E+07
   8      0.2826450E+05   0.8684425E+05   0.3140390E+07  -0.2817040E+05   0.8683269E+05   0.3140560E+07
   9     -0.2817040E+05   0.8683269E+05   0.3140560E+07  -0.7380438E+05   0.5360360E+05   0.3140640E+07
  10     -0.7380438E+05   0.5360360E+05   0.3140640E+07  -0.9124025E+05  -0.8364719E+02   0.3140540E+07

                   13             14             15             16             17             18
   1      0.1999150E+06  -0.1719019E+02   0.2994020E+07   0.1617420E+06   0.1174740E+06   0.2993940E+07
   2      0.1617420E+06   0.1174740E+06   0.2993940E+07   0.6178890E+05   0.1900520E+06   0.2993820E+07
   3      0.6178890E+05   0.1900520E+06   0.2993820E+07  -0.6173140E+05   0.1900730E+06   0.2993810E+07
   4     -0.6173140E+05   0.1900730E+06   0.2993810E+07  -0.1616630E+06   0.1174770E+06   0.2993660E+07
   5     -0.1616630E+06   0.1174770E+06   0.2993660E+07  -0.1998680E+06   0.2942220E+02   0.2993610E+07
   6     -0.1998680E+06   0.2942220E+02   0.2993610E+07  -0.1617360E+06  -0.1174480E+06   0.2993740E+07
   7     -0.1617360E+06  -0.1174480E+06   0.2993740E+07  -0.6180890E+05  -0.1900670E+06   0.2993840E+07
   8     -0.6180890E+05  -0.1900670E+06   0.2993840E+07   0.6173070E+05  -0.1900980E+06   0.2994070E+07
   9      0.6173070E+05  -0.1900980E+06   0.2994070E+07   0.1617280E+06  -0.1175180E+06   0.2994160E+07
  10      0.1617280E+06  -0.1175160E+06   0.2994160E+07   0.1999150E+06  -0.1719019E+02   0.2994020E+07

                   19             20             21             22             23             24
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 1      -0.1145860E+06    -0.5740509E+02     0.2826170E+07    -0.9267625E+05    -0.6744050E+05     0.2826060E+07
 2      -0.9267625E+05    -0.6744050E+05     0.2826060E+07    -0.3534420E+05    -0.1090690E+06     0.2825980E+07
 3      -0.3534420E+05    -0.1090690E+06     0.2825980E+07     0.3550490E+05    -0.1090010E+06     0.2825960E+07
 4       0.3550490E+05    -0.1090010E+06     0.2825960E+07     0.9280125E+05    -0.6734106E+05     0.2825820E+07
 5       0.9280125E+05    -0.6734106E+05     0.2825820E+07     0.1146870E+06     0.1018130E+02     0.2825720E+07
 6       0.1146870E+06     0.1018130E+02     0.2825720E+07     0.9279906E+05     0.6736888E+05     0.2825850E+07
 7       0.9279906E+05     0.6736888E+05     0.2825850E+07     0.3550000E+05     0.1090300E+06     0.2825970E+07
 8       0.3550000E+05     0.1090300E+06     0.2825970E+07    -0.3536380E+05     0.1090500E+06     0.2826200E+07
 9      -0.3536380E+05     0.1090500E+06     0.2826200E+07    -0.9268906E+05     0.6735325E+05     0.2826300E+07
10      -0.9268906E+05     0.6735325E+05     0.2826300E+07    -0.1145860E+06    -0.5740509E+02     0.2826170E+07


              25                26                27                28                29                30
 1       0.3029890E+06    -0.7205879E+01     0.2599880E+07     0.2451270E+06     0.1780580E+06     0.2599770E+07
 2       0.2451270E+06     0.1780580E+06     0.2599770E+07     0.9364438E+05     0.2880610E+06     0.2599680E+07
 3       0.9364438E+05     0.2880810E+06     0.2599680E+07    -0.9358325E+05     0.2881050E+06     0.2599680E+07
 4      -0.9358325E+05     0.2881050E+06     0.2599680E+07    -0.2450450E+06    -0.1780500E+06     0.2599540E+07
 5      -0.2450450E+06     0.1780500E+06     0.2599540E+07    -0.3029080E+06     0.9210569E+01     0.2599430E+07
 6      -0.3029080E+06     0.9210569E+01     0.2599430E+07    -0.2450900E+06    -0.1780450E+06     0.2599520E+07
 7      -0.2450900E+06    -0.1780450E+06     0.2599520E+07    -0.9363325E+05    -0.2881030E+06     0.2599630E+07
 8      -0.9363325E+05    -0.2881030E+06     0.2599630E+07     0.9360638E+05    -0.2881360E+06     0.2599880E+07
 9       0.9360638E+05    -0.2881360E+06     0.2599880E+07     0.2451360E+06    -0.1781030E+06     0.2599990E+07
10       0.2451360E+06    -0.1781030E+06     0.2599990E+07     0.3029890E+06    -0.7205879E+01     0.2599880E+07


              31                32                33                34                35                36
 1      -0.1406250E+06    -0.5451630E+02     0.2345880E+07    -0.1137380E+06    -0.8274200E+05     0.2345780E+07
 2      -0.1137380E+06    -0.8274200E+05     0.2345780E+07    -0.4339710E+05    -0.1338150E+06     0.2345700E+07
 3      -0.4339710E+05    -0.1338150E+06     0.2345700E+07     0.4353710E+05    -0.1337560E+06     0.2345700E+07
 4       0.4353710E+05    -0.1337560E+06     0.2345700E+07     0.1138430E+06    -0.8263056E+05     0.2345590E+07
 5       0.1138430E+06    -0.8263056E+05     0.2345590E+07     0.1406920E+06     0.2256229E+02     0.2345450E+07
 6       0.1406920E+06     0.2256229E+02     0.2345450E+07     0.1138300E+06     0.8266219E+05     0.2345550E+07
 7       0.1138300E+06     0.8266219E+05     0.2345550E+07     0.4352650E+05     0.1337720E+06     0.2345650E+07
 8       0.4352650E+05     0.1337720E+06     0.2345650E+07    -0.4341540E+05     0.1338130E+06     0.2345850E+07
 9      -0.4341540E+05     0.1338130E+06     0.2345850E+07    -0.1137580E+06     0.8266800E+05     0.2345970E+07
10      -0.1137580E+06     0.8266800E+05     0.2345970E+07    -0.1406250E+06    -0.5451630E+02     0.2345880E+07


              37                38                39                40                41                42
 1       0.4195590E+06    -0.3113039E+02     0.2022040E+07     0.3394470E+06     0.2465450E+06     0.2021930E+07
 2       0.3394470E+06     0.2465450E+06     0.2021930E+07     0.1296800E+06     0.3989320E+06     0.2021870E+07
 3       0.1296800E+06     0.3989320E+06     0.2021870E+07    -0.1295720E+06     0.3989770E+06     0.2021870E+07
 4      -0.1295720E+06     0.3989770E+06     0.2021870E+07    -0.3393320E+06     0.2465700E+06     0.2021800E+07
 5      -0.3393320E+06     0.2465700E+06     0.2021800E+07    -0.4194450E+06     0.9044379E+01     0.2021660E+07
 6      -0.4194450E+06     0.9044379E+01     0.2021660E+07    -0.3393690E+06    -0.2465530E+06     0.2021740E+07
 7      -0.3393690E+06    -0.2465530E+06     0.2021740E+07    -0.1296290E+06    -0.3989570E+06     0.2021820E+07
 8      -0.1296290E+06    -0.3989570E+06     0.2021820E+07     0.1296250E+06    -0.3989980E+06     0.2021960E+07
 9       0.1296250E+06    -0.3989980E+06     0.2021960E+07     0.3394410E+06    -0.2466310E+06     0.2022110E+07
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10     0.3394410E+06    -0.2466310E+06     0.2022110E+07     0.4195590E+06    -0.3113039E+02     0.2022040E+07

            43                44                45                46                47                48
 1    -0.1484180E+06    -0.3831450E+02     0.1673880E+07    -0.1200520E+06    -0.8729775E+05     0.1673700E+07
 2    -0.1200520E+06    -0.8729775E+05     0.1673780E+07    -0.4562240E+05    -0.1412040E+06     0.1673740E+07
 3    -0.4582240E+05    -0.1412040E+06     0.1673740E+07     0.4590790E+05    -0.1411660E+06     0.1673740E+07
 4     0.4590790E+05    -0.1411660E+06     0.1673740E+07     0.1201240E+06    -0.8721125E+05     0.1673710E+07
 5     0.1201240E+06    -0.8721125E+05     0.1673710E+07     0.1484500E+06     0.1423600E+02     0.16[illegible]580E+07
 6     0.1484500E+06     0.1423600E+02     0.1673580E+07     0.1201090E+06     0.8723238E+05     0.1673540E+07
 7     0.1201090E+06     0.8723238E+05     0.1673640E+07     0.4589770E+05     0.1411700E+06     0.16[illegible]710E+07
 8     0.4589770E+05     0.1411700E+06     0.1673710E+07    -0.45833[illegible]E+05     0.1412020E+06     0.1673800E+07
 9    -0.4583360E+05     0.1412020E+06     0.1673800E+07    -0.12007[illegible]E+06     0.8724238E+05     0.1673940E+07
10    -0.1200710E+06     0.8724238E+05     0.1673940E+07    -0.1484180E+06    -0.3831450E+02     0.1673880E+07

            49                50                51                52                53                54
 1     0.5279860E+06    -0.5179689E+01     0.1274950E+07     0.4271240E+06     0.3103110E+06     0.1274860E+07
 2     0.4271240E+06     0.3103110E+06     0.1274860E+07     0.1631520E+06     0.5020570E+06     0.1274820E+07
 3     0.1631520E+06     0.5020570E+06     0.1274820E+07    -0.1631280E+06     0.5020730E+06    -0.1274820E+07
 4    -0.1631280E+06     0.5020730E+06     0.1274820E+07    -0.4270680E+06     0.3102840E+06     0.1274800E+07
 5    -0.4270680E+06     0.3102840E+06     0.1274800E+07    -0.5278500E+06    -0.2396919E+01     0.1274720E+07
 6    -0.5278500E+06    -0.2396919E+01     0.1274720E+07    -0.4270620E+06    -0.3102880E+06     0.1274760E+07
 7    -0.4270620E+06    -0.3102880E+06     0.1274760E+07    -0.1631200E+06    -0.5020700E+06     0.1274800E+0[illegible]
 8    -0.1631200E+06    -0.5020700E+06     0.1274800E+07     0.1631630E+06    -0.5020930E+06     0.1274860E+07
 9     0.1631630E+06    -0.5020930E+06     0.1274860E+07     0.4271710E+06    -0.3103450E+06     0.1274960E+07
10     0.4271710E+06    -0.3103450E+06     0.1274980E+07     0.5279860E+06    -0.5179689E+01     0.1274950E+07

            55                56                57                58                59                60
 1    -0.1113950E+06    -0.1367970E+02     0.8853270E+06    -0.9011619E+05    -0.6549440E+05     0.8852510E+06
 2    -0.9011619E+05    -0.6549440E+05     0.8852510E+06    -0.3441810E+05    -0.1059620E+06     0.8852370E+[illegible]
 3    -0.3441810E+05    -0.1059620E+06     0.8852370E+06     0.3442460E+05    -0.1059510E+06     0.8852400E+06
 4     0.3442460E+05    -0.1059510E+06     0.8852400E+06     0.9013475E+05    -0.6547430E+05     0.8852210E+06
 5     0.9013475E+05    -0.6547430E+05     0.8852210E+06     0.1114050E+06     0.2941389E+01     0.8851670E+06
 6     0.1114050E+06     0.2941389E+01     0.8851670E+06     0.9013456E+05     0.6547260E+05     0.8851880E+06
 7     0.9013496E+05     0.6547260E+05     0.8851880E+06     0.3443490E+05     0.1059480E+06     0.8852270E+06
 8     0.3443490E+05     0.1059480E+06     0.8852270E+06    -0.3440340E+05     0.1059650E+06     0.8852630E+06
 9    -0.3440340E+05     0.1059650E+06     0.8852630E+06    -0.9011600E+05     0.6548330E+05     0.8853470E+06
10    -0.9011600E+05     0.6548330E+05     0.8853470E+06    -0.1113950E+06    -0.1367970E+02     0.8853270E+06

            61                62                63                64                65                66
 1     0.5793760E+06     0.3101560E+01     0.4552230E+06     0.4686930E+06     0.3405150E+06     0.4551740E+06
 2     0.4686930E+06     0.3405150E+06     0.4551740E+06     0.1790240E+06     0.5509320E+06     0.4551590E+06
 3     0.1790240E+06     0.5509320E+06     0.4551590E+06    -0.1790070E+06     0.5509460E+06     0.4551630E+06
 4    -0.1790070E+06     0.5509460E+06     0.4551630E+06    -0.4686500E+06     0.3404610E+06     0.4551610E+06
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 5      -0.4686500E+06     0.34048[illegible]06     0.4551610E+06    -0.5792380E+06    -0.4729790E+01     0.4551380E+06
 6      -0.5792380E+06    -0.4729790E+01     0.4551300E+06    -0.4686390E+06    -0.3404780E+06     0.4551210E+06
 7      -0.4686390E+06    -0.3404780E+06     0.4551210E+06    -0.1790060E+06    -0.5509390E+06     0.4551550E+06
 8      -0.1790060E+06    -0.5509390E+06     0.4551550E+06     0.1790260E+06    -0.5509660E+06     0.4551710E+06
 9       0.1790260E+06    -0.5509660E+06     0.4551710E+06     0.4687410E+06    -0.3405510E+06     0.4552080E+06
10       0.4687410E+06    -0.3405510E+06     0.4552080E+06     0.5793760E+06     0.3101560E+01     0.4552230E+06

              67                68                69                70                71                72
 1      -0.8856606E+05    -0.2889440E+05     0.3159040E+07     0.1961350E+06     0.4193340E+05     0.3026200E+07
 2      -0.5465670E+05    -0.7549606E+05     0.3158930E+07     0.1340130E+06     0.1491680E+06     0.3026110E+07
 3       0.1049500E+03    -0.9324125E+05     0.3158840E+07     0.2073090E+05     0.1993750E+06     0.3026010E+07
 4       0.5488400E+05    -0.7538125E+05     0.3158780E+07    -0.1004410E+06     0.1734960E+06     0.3025960E+07
 5       0.8875036E+05    -0.2878100E+05     0.3158720E+07    -0.1832760E+06     0.8133175E+05     0.3025840E+07
 6       0.8873375E+05     0.2882970E+05     0.3158770E+07    -0.1961080E+06    -0.4191590E+05     0.3025850E+07
 7       0.5484580E+05     0.7543100E+05     0.3158880E+07    -0.1340230E+06    -0.1491620E+06     0.3025980E+07
 8       0.4993320E+02     0.9321788E+05     0.3159000E+07    -0.2074620E+05    -0.1994190E+06     0.3026120E+07
 9      -0.5473260E+05     0.7537425E+05     0.3159130E+07     0.1004400E+06    -0.1735020E+06     0.3026300E+07
10      -0.8859700E+05     0.2873220E+05     0.3159120E+07     0.1833170E+06    -0.8134719E+05     0.3026320E+07

              73                74                75                76                77                78
 1       0.1833380E+06     0.8131306E+05     0.3026170E+07    -0.1223450E+06    -0.2085340E+05     0.2872390E+07
 2       0.1004910E+06     0.1734680E+06     0.3026060E+07    -0.8673788E+05    -0.8683538E+05     0.2872290E+07
 3      -0.2067060E+05     0.1993930E+06     0.3026020E+07    -0.1796760E+05    -0.1228500E+06     0.2872220E+07
 4      -0.1339390E+06     0.1491670E+06     0.3025910E+07     0.5768810E+05    -0.1099680E+06     0.2872170E+07
 5      -0.1960870E+06     0.4196810E+05     0.3025830E+07     0.1112990E+06    -0.5508570E+05     0.2872030E+07
 6      -0.1833350E+06    -0.8129406E+05     0.3025900E+07     0.1224490E+06     0.2079620E+05     0.2871990E+07
 7      -0.1005390E+06    -0.1735150E+06     0.3026020E+07     0.8686838E+05     0.8876869E+05     0.2872130E+07
 8       0.2066140E+05    -0.1994340E+06     0.3026210E+07     0.1812200E+05     0.1228410E+06     0.2872270E+07
 9       0.1339680E+06    -0.1491900E+06     0.3026340E+07    -0.5754530E+05     0.1100010E+06     0.2872490E+07
10       0.1961190E+06    -0.4196420E+05     0.3026270E+07    -0.1112150E+06     0.5508960E+05     0.2872520E+07

              79                80                81                82                83                84
 1      -0.1173080E+06    -0.3819470E+05     0.2886060E+07    -0.1111850E+06    -0.5518190E+05     0.2872340E+07
 2      -0.7246775E+05    -0.9989906E+05     0.2885970E+07    -0.5751810E+05    -0.1100250E+06     0.2872240E+07
 3       0.7879259E+02    -0.1234180E+06     0.2885920E+07     0.1812610E+05    -0.1228350E+06     0.2872210E+07
 4       0.7261006E+05    -0.9980556E+05     0.2885630E+07     0.8685506E+05    -0.8871406E+05     0.2872090E+07
 5       0.1174190E+06    -0.3810670E+05     0.2885690E+07     0.1224550E+06    -0.2077670E+05     0.2871970E+07
 6       0.1174240E+06     0.3813200E+05     0.2885720E+07     0.1113110E+06     0.5511560E+05     0.2872060E+07
 7       0.7261138E+05     0.9984656E+05     0.2885840E+07     0.5767950E+05     0.1099940E+06     0.2872180E+07
 8       0.7273360E+02     0.1234370E+06     0.2886040E+07    -0.1797900E+05     0.1228760E+06     0.2872400E+07
 9      -0.7249056E+05     0.9985338E+05     0.2886220E+07    -0.8675700E+05     0.8877000E+05     0.2872540E+07
10      -0.1173230E+06     0.3809010E+05     0.2886180E+07    -0.1223360E+06     0.2073740E+05     0.2872440E+07


              85                86                87                88                89                90
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  1        0.3159000E+06        0.4286690E+05        0.2662770E+07        0.3049980E+06        0.7904556E+05        0.2689100E+07
  2        0.2303680E+06        0.2203250E+06        0.2662670E+07        0.2002800E+06        0.2431800E+06        0.2689000E+07
  3        0.5686130E+05        0.3136140E+06        0.2662590E+07        0.1908630E+05        0.3144340E+06        0.2688950E+07
  4       -0.1383500E+06        0.2871370E+06        0.2662560E+07       -0.1693840E+06        0.2655840E+06        0.2688870E+07
  5       -0.2806860E+06        0.1509550E+06        0.2662420E+07       -0.2931250E+06        0.1152810E+06        0.2688740E+07
  6       -0.3158160E+06       -0.4285590E+05        0.2662350E+07       -0.3049440E+06       -0.7903788E+05        0.2688710E+07
  7       -0.2303520E+06       -0.2203410E+06        0.2662470E+07       -0.2002710E+06       -0.2432040E+06        0.2688830E+07
  8       -0.5684980E+05       -0.3136600E+06        0.2662610E+07       -0.1907320E+05       -0.3144770E+06        0.2689010E+07
  9        0.1384010E+06       -0.2871980E+06        0.2662830E+07        0.1694630E+06       -0.2656710E+06        0.2689200E+07
 10        0.2807960E+06       -0.1510030E+06        0.2662900E+07        0.2932080E+06       -0.1153080E+06        0.2689230E+07


               91                   92                   93                   94                   95                   96
  1        0.2932140E+06        0.1152850E+06        0.2689080E+07        0.2807650E+06        0.1509600E+06        0.2662700E+07
  2        0.1694490E+06        0.2655720E+06        0.2688980E+07        0.1384130E+06        0.2871210E+06        0.2662610E+07
  3       -0.1902010E+05        0.3144360E+06        0.2688940E+07       -0.5679670E+05        0.3136210E+06        0.2662600E+07
  4       -0.2002140E+06        0.2431890E+06        0.2688650E+07       -0.2302880E+06        0.2203160E+06        0.2662470E+07
  5       -0.3048830E+06        0.7903788E+05        0.2688710E+07       -0.3157850E+06        0.4286530E+05        0.2662350E+07
  6       -0.2931670E+06       -0.1152810E+06        0.2688740E+07       -0.2807660E+06       -0.1509610E+06        0.2662420E+07
  7       -0.1694530E+06       -0.2656140E+06        0.2688850E+07       -0.1384230E+06       -0.2871700E+06        0.2662530E+07
  8        0.1903560E+05       -0.3144930E+06        0.2689060E+07        0.5681580E+05       -0.3136900E+06        0.2662760E+07
  9        0.2002980E+06       -0.2432690E+06        0.2689220E+07        0.2303860E+06       -0.2204030E+06        0.2662690E+07
 10        0.3049830E+06       -0.7906038E+05        0.2689200E+07        0.3156780E+06       -0.4287590E+05        0.2662820E+07


               97                   98                   99                  100                  101                  102
  1       -0.1702260E+06       -0.2376150E+05        0.2425650E+07       -0.1655930E+06       -0.3772320E+05        0.2464430E+07
  2       -0.1237470E+06       -0.1193090E+06        0.2425560E+07       -0.1118060E+06       -0.1278940E+06        0.2464320E+07
  3       -0.3000230E+05       -0.1692750E+06        0.2425480E+07       -0.1529590E+05       -0.1691960E+06        0.2464270E+07
  4        0.7521106E+05       -0.1545600E+06        0.2425480E+07        0.8703906E+05       -0.1450170E+06        0.2464240E+07
  5        0.1516950E+06       -0.8084706E+05        0.2425340E+07        0.1561530E+06       -0.6683556E+05        0.2464100E+07
  6        0.1702960E+06        0.2371840E+05        0.2425230E+07        0.1656750E+06        0.3767340E+05        0.2464020E+07
  7        0.1230290E+06        0.1192110E+06        0.2425350E+07        0.1118930E+06        0.1270010E+06        0.24[illegible]E+07
  8        0.3013190E+05        0.1692380E+06        0.2425470E+07        0.1542490E+05        0.1691810E+06        0.2464300E+07
  9       -0.7511419E+05        0.1546440E+06        0.2425680E+07       -0.8695225E+05        0.1459060E+06        0.2464490E+07
 10       -0.1516600E+06        0.8088788E+05        0.2425770E+07       -0.1561270E+06        0.6686638E+05        0.2464550E+07


              103                  104                  105                  106                  107                  108
  1       -0.1608110E+06       -0.5232610E+05        0.2477410E+07       -0.1560730E+06       -0.6694325E+05        0.2464400E+07
  2       -0.9935025E+05       -0.1368950E+06        0.2477300E+07       -0.8693525E+05       -0.1459340E+06        0.2464300E+07
  3        0.6675890E+02       -0.1691550E+06        0.2477260E+07        0.1543050E+05       -0.1691610E+06        0.2464280E+07
  4        0.9943825E+05       -0.1367460E+06        0.2477220E+07        0.1118790E+06       -0.1277320E+06        0.2464200E+07
  5        0.1608690E+06       -0.5221880E+05        0.2477080E+07        0.1656490E+06       -0.3762360E+05        0.2464070E+07
  6        0.1608960E+06        0.5226690E+05        0.2477030E+07        0.1561610E+06        0.6687550E+05        0.2464060E+07
  7        0.9945088E+05        0.1368090E+06        0.2477150E+07        0.8704075E+05        0.1458610E+06        0.2464170E+07
  8        0.6058809E+02        0.1691760E+06        0.2477330E+07       -0.1530450E+05        0.1692210E+06        0.2464370E+07
  9       -0.9935956E+05        0.1368360E+06        0.2477510E+07       -0.1118050E+06        0.1270160E+06        0.2464540E+07
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10    -0.1608430E+06    0.5223650E+05    0.2477530E+07   -0.1[illegible]6100E+06    0.3762410E+05    0.2464520E+07

               109              110              111              112              113              114
 1    -0.1515970E+06   -0.8095556E+05    0.2425590E+07    0.4611660E+06    0.5071600E+05    0.2120850E+07
 2    -0.7508006E+05   -0.1546360E+06    0.2425500E+07    0.3432690E+06    0.3120510E+06    0.212075[illegible]+07
 3     0.3013950E+05   -0.1692340E+06    0.2425500E+07    0.9427425E+05    0.4542020E+06    0.21206[illegible]E+07
 4     0.1230250E+06   -0.1191570E+06    0.2425400E+07   -0.1906850E+06    0.4228500E+06    0.2120690E+07
 5     0.1702720E+06   -0.2366720E+05    0.2425260E+07   -0.4027990E+06    0.2299620E+06    0.2120590E+07
 6     0.1516650E+06    0.8088025E+05    0.2425310E+07   -0.4610270E+06   -0.5072490E+05    0.2120450E+07
 7     0.7519856E+05    0.1545780E+06    0.2425410E+07   -0.3431780E+06   -0.3120330E+06    0.2120570E+07
 8    -0.3001500E+05    0.1693130E+06    0.2425620E+07   -0.9422469E+05   -0.4542330E+06    0.2120660E+07
 9    -0.1237630E+06    0.1192420E+06    0.2425770E+07    0.1907670E+06   -0.4229090E+06    0.2120840E+07
10    -0.1702280E+06    0.2365430E+05    0.2425700E+07    0.4029580E+06   -0.2300340E+06    0.2120930E+07

               115              116              117              118              119              120
 1     0.4510510E+06    0.8037625E+05    0.2171640E+07    0.4399670E+06    0.1227480E+06    0.2197230E+07
 2     0.3141200E+06    0.3349470E+06    0.2171550E+07    0.2837590E+06    0.3578390E+06    0.2197140E+07
 3     0.5723860E+05    0.4556170E+06    0.2171480E+07    0.1922500E+05    0.4563220E+06    0.2197070E+07
 4    -0.2214670E+06    0.4022000E+06    0.2171510E+07   -0.2526320E+06    0.3804110E+06    0.2197110E+07
 5    -0.4155680E+06    0.1951670E+06    0.2171370E+07   -0.4279810E+06    0.1592290E+06    0.2196950E+07
 6    -0.4509090E+06   -0.8637580E+05    0.2171260E+07   -0.4398280E+06   -0.1227430E+06    0.2196670E+07
 7    -0.3140330E+06   -0.3349320E+06    0.2171400E+07   -0.2836820E+06   -0.3578340E+06    0.2197010E+07
 8    -0.5718930E+05   -0.4556590E+06    0.2171480E+07   -0.1917590E+05   -0.4563710E+06    0.2197100E+07
 9     0.2215580E+06   -0.4022680E+06    0.2171680E+07    0.2527300E+06   -0.3804870E+06    0.2197310E+07
10     0.4157520E+06   -0.1952420E+06    0.2171730E+07    0.4281600E+06   -0.1592990E+06    0.2197320E+07

               121              122              123              124              125              126
 1     0.4281180E+06    0.1592130E+06    0.2197220E+07    0.4157200E+06    0.1951580E+06    0.2171610E+07
 2     0.2527450E+06    0.3803870E+06    0.2197130E+07    0.2215870E+06    0.4021800E+06    0.2171520E+07
 3    -0.1911480E+05    0.4563460E+06    0.2197090E+07   -0.5712910E+05    0.4556610E+06    0.2171490E+07
 4    -0.2836490E+06    0.3578640E+06    0.2197100E+07   -0.3139950E+06    0.3349510E+06    0.2171480E+07
 5    -0.4398370E+06    0.1227670E+06    0.2196930E+07   -0.4509250E+06    0.8640069E+05    0.2171300E+07
 6    -0.4279790E+06   -0.1592040E+06    0.2196890E+07   -0.4155970E+06   -0.1951510E+06    0.2171330E+07
 7    -0.2526690E+06   -0.3803810E+06    0.2197020E+07   -0.2215140E+06   -0.4021770E+06    0.2171420E+07
 8     0.1916440E+05   -0.4563760E+06    0.2197130E+07    0.5717960E+05   -0.4556930E+06    0.2171550E+07
 9     0.2837610E+06   -0.3579540E+06    0.2197340E+07    0.3141260E+06   -0.3350600E+06    0.2171750E+07
10     0.4400290E+06   -0.1226340E+06    0.2197310E+07    0.4511030E+06   -0.8645656E+05    0.2171690E+07

               127              128              129              130              131              132
 1     0.4029470E+06    0.2299500E+06    0.2120770E+07   -0.2361660E+06   -0.3823940E+05    0.1780130E+07
 2     0.1908060E+06    0.4220270E+06    0.2120700E+07   -0.1686000E+06   -0.1697870E+06    0.1780030E+07
 3    -0.9416550E+05    0.4542550E+06    0.2120690E+07   -0.3661410E+05   -0.2364400E+06    0.1779980E+07
 4    -0.3431390E+06    0.3120480E+06    0.2120650E+07    0.1093510E+06   -0.2128130E+06    0.1780000E+07
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  5    -0.4610320E+06    0.5074490E+05    0.2120470E+07    0.2135350E+06   -0.1078810E+06    0.1779930E+07
  6    -0.4028370E+06   -0.2299470E+06    0.2120530E+07    0.2361280E+06    0.3818310E+05    0.1779820E+07
  7    -0.1907410E+06   -0.4228340E+06    0.2120630E+07    0.1686330E+06    0.1696840E+06    0.1779900E+07
  8     0.9421706E+05   -0.4542980E+06    0.2120770E+07    0.3669000E+05    0.2363940E+06    0.1779950E+07
  9     0.3432720E+06   -0.3121530E+06    0.2120950E+07   -0.1092870E+06    0.2128620E+06    0.1780080E+07
 10     0.4611940E+06   -0.5078930E+05    0.2120860E+07   -0.2135320E+06    0.1079200E+06    0.1780190E+07

            133              134              135              136              137              138
  1    -0.2337710E+06   -0.4912970E+05    0.1841930E+07   -0.2283620E+06   -0.6043250E+05    0.1880380E+07
  2    -0.1602640E+06   -0.1771880E+06    0.1841830E+07   -0.1492490E+06   -0.1831550E+06    0.1880310E+07
  3    -0.2552090E+05   -0.2374940E+06    0.1841780E+07   -0.1310350E+05   -0.2358340E+06    0.1880250E+07
  4     0.1189690E+06   -0.2071750E+06    0.1841810E+07    0.1280560E+06   -0.1985490E+06    0.1880290E+07
  5     0.2179860E+06   -0.9766388E+05    0.1841710E+07    0.2202660E+06   -0.8534988E+05    0.1880180E+07
  6     0.2337310E+06    0.4906390E+05    0.1841620E+07    0.2283280E+06    0.6036040E+05    0.1880090E+07
  7     0.1602960E+06    0.1770830E+06    0.1841720E+07    0.1492810E+06    0.1830500E+06    0.1880220E+07
  8     0.2559730E+05    0.2374670E+06    0.1841760E+07    0.1318010E+05    0.2358270E+06    0.1880250E+07
  9    -0.1189120E+06    0.2072310E+06    0.1841920E+07   -0.1280050E+06    0.1986120E+06    0.1880420E+07
 10    -0.2179740E+06    0.9769325E+05    0.1841980E+07   -0.2202520E+06    0.8537188E+05    0.1880450E+07

            139              140              141              142              143              144
  1    -0.2230760E+06   -0.7254056E+05    0.1893590E+07   -0.2202600E+06   -0.8545075E+05    0.1880360E+07
  2    -0.1378470E+06   -0.1898290E+06    0.1893520E+07   -0.1279660E+06   -0.1985940E+06    0.1880290E+07
  3     0.4219539E+02   -0.2345260E+06    0.1893470E+07    0.1318800E+05   -0.2358340E+06    0.1880250E+07
  4     0.1379280E+06   -0.1897660E+06    0.1893520E+07    0.1493230E+06   -0.1830780E+06    0.1880280E+07
  5     0.2230860E+06   -0.7244600E+05    0.1893370E+07    0.2283730E+06   -0.6034510E+05    0.1880110E+07
  6     0.2230500E+06    0.7246400E+05    0.1893330E+07    0.2202450E+06    0.8537238E+05    0.1880130E+07
  7     0.1378760E+06    0.1897210E+06    0.1893450E+07    0.1280000E+06    0.1984980E+06    0.1880230E+07
  8     0.3445029E+02    0.2345400E+06    0.1893480E+07   -0.1311150E+05    0.2358600E+06    0.1880280E+07
  9    -0.1378870E+06    0.1898390E+06    0.1893670E+07   -0.1492870E+06    0.1831530E+06    0.1880450E+07
 10    -0.2230710E+06    0.7246056E+05    0.1893660E+07   -0.2283650E+06    0.6035390E+05    0.1880410E+07

            145              146              147              148              149              150
  1    -0.2179700E+06   -0.9776500E+05    0.1841850E+07   -0.2134990E+06   -0.1079770E+06    0.1780040E+07
  2    -0.1188690E+06   -0.2072000E+06    0.1841800E+07   -0.1092530E+06   -0.2128390E+06    0.1780000E+07
  3     0.2560550E+05   -0.2374820E+06    0.1841770E+07    0.3669880E+05   -0.2364120E+06    0.1779970E+07
  4     0.1603310E+06   -0.1770960E+06    0.1841790E+07    0.1686560E+06   -0.1696770E+06    0.1779970E+07
  5     0.2337680E+06   -0.4904600E+05    0.1841630E+07    0.2361530E+06   -0.3816210E+05    0.1779820E+07
  6     0.2179690E+06    0.9768638E+05    0.1841660E+07    0.2135140E+06    0.1079010E+06    0.1779870E+07
  7     0.1189150E+06    0.2071220E+06    0.1841760E+07    0.1093080E+06    0.2127750E+06    0.1779950E+07
  8    -0.2552950E+05    0.2375190E+06    0.1841810E+07   -0.3662370E+05    0.2364580E+06    0.1780030E+07
  9    -0.1602960E+06    0.1771690E+06    0.1841980E+07   -0.1686290E+06    0.1697530E+06    0.1780190E+07
 10    -0.2337710E+06    0.4905110E+05    0.1841940E+07   -0.2361650E+06    0.3816130E+05    0.1780140E+07

            151              152              153              154              155              156
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 1      0.5740070E+06     0.5155370E+05     0.1387860E+07     0.5739930E+06     0.8847150E+05     0.1454490E+07
 2      0.4340560E+06     0.3790760E+06     0.1387750E+07     0.4123540E+06     0.4089370E+06     0.1454380E+07
 3      0.1283400E+06     0.5617640E+06     0.1387730E+07     0.9322756E+05     0.5731690E+06     0.1454370E+07
 4     -0.2263970E+06     0.5299250E+06     0.1387740E+07    -0.2615030E+06     0.5185130E+06     0.1454360E+07
 5     -0.4945950E+06     0.2956250E+06     0.1387700E+07    -0.5162720E+06     0.2657510E+06     0.1454330E+07
 6     -0.5738630E+06    -0.5154970E+05     0.1387630E+07    -0.5738550E+06    -0.8846269E+05     0.1454270E+07
 7     -0.4339960E+06    -0.3790500E+06     0.1387660E+07    -0.4123010E+06    -0.4089200E+06     0.1454310E+07
 8     -0.1283090E+06    -0.5617770E+06     0.1387710E+07    -0.9319606E+05    -0.5731840E+06     0.1454350E+07
 9      0.2264370E+06    -0.5299480E+06     0.1387800E+07     0.2615490E+06    -0.5185410E+06     0.1454430E+07
10      0.4947120E+06    -0.2956840E+06     0.1387890E+07     0.5163990E+06    -0.2658070E+06     0.1454530E+07

             157               158               159               160               161               162
 1      0.5699270E+06     0.1256670E+06     0.1501680E+07     0.5653930E+06     0.1638770E+06     0.1525900E+07
 2      0.3872090E+06     0.4366410E+06     0.1501570E+07     0.3611010E+06     0.4649070E+06     0.1525820E+07
 3      0.5659700E+05     0.5807990E+06     0.1501570E+07     0.1885690E+05     0.5883200E+06     0.1525820E+07
 4     -0.2956290E+06     0.5031650E+06     0.1501570E+07    -0.3305750E+06     0.4870630E+06     0.1525810E+07
 5     -0.5348300E+06     0.2332690E+06     0.1501510E+07    -0.5536340E+06     0.1996990E+06     0.1525740E+07
 6     -0.5697790E+06    -0.1256460E+06     0.1501450E+07    -0.5652760E+06    -0.1638630E+06     0.1525700E+07
 7     -0.3871590E+06    -0.4366260E+06     0.1501520E+07    -0.3610550E+06    -0.4648990E+06     0.1525790E+07
 8     -0.5656640E+05    -0.5608150E+06     0.1501560E+07    -0.1882650E+05    -0.5083380E+06     0.1525810E+07
 9      0.2956810E+06    -0.5031970E+06     0.1501660E+07     0.3306350E+06    -0.4871000E+06     0.1525910E+07
10      0.5349640E+06    -0.2333190E+06     0.1501720E+07     0.5537730E+06    -0.1997450E+06     0.1525960E+07

             163               164               165               166               167               168
 1      0.5537430E+06     0.1997240E+06     0.1525880E+07     0.5349210E+06     0.2332940E+06     0.1501620E+07
 2      0.3306070E+06     0.4870530E+06     0.1525810E+07     0.2956590E+06     0.5031520E+06     0.1501580E+07
 3     -0.1883340E+05     0.5883190E+06     0.1525820E+07    -0.5657360E+05     0.5807990E+06     0.1501570E+07
 4     -0.3610650E+06     0.4649090E+06     0.1525820E+07    -0.3871640E+06     0.4366280E+06     0.1501570E+07
 5     -0.5652710E+06     0.1638530E+06     0.1525710E+07    -0.5697890E+06     0.1256460E+06     0.1501470E+07
 6     -0.5536340E+06    -0.1997070E+06     0.1525700E+07    -0.5348270E+06    -0.2332760E+06     0.1501460E+07
 7     -0.3305650E+06    -0.4870530E+06     0.1525790E+07    -0.2956200E+06    -0.5031560E+06     0.1501550E+07
 8      0.1886360E+05    -0.5883410E+06     0.1525820E+07     0.5660420E+05    -0.5808200E+06     0.1501580E+07
 9      0.3611330E+06    -0.4649530E+06     0.1525930E+07     0.3872460E+06    -0.4366840E+06     0.1501700E+07
10      0.5654170E+06    -0.1638950E+06     0.1525950E+07     0.5699200E+06    -0.1256730E+06     0.1501690E+07

             169               170               171               172               173               174
 1      0.5163470E+06     0.2657760E+06     0.1454410E+07     0.4946580E+06     0.2956500E+06     0.1387770E+07
 2      0.2615310E+06     0.5184980E+06     0.1454370E+07     0.2264220E+06     0.5299090E+06     0.1387750E+07
 3     -0.9320338E+05     0.5731750E+06     0.1454360E+07    -0.1283160E+06     0.5617780E+06     0.1387730E+07
 4     -0.4123060E+06     0.4089190E+06     0.1454370E+07    -0.4340040E+06     0.3790520E+06     0.1387730E+07
 5     -0.5738490E+06     0.8845469E+05     0.1454260E+07    -0.5738630E+06     0.5154490E+05     0.1387620E+07
 6     -0.5162650E+06    -0.2657570E+06     0.1454270E+07    -0.4945850E+06    -0.2956290E+06     0.1387750E+07
 7     -0.2614930E+06    -0.5185040E+06     0.1454350E+07    -0.2263840E+06    -0.5299160E+06     0.1387720E+07
 8      0.9323488E+05    -0.5731960E+06     0.1454380E+07     0.1283490E+06    -0.5617990E+06     0.1387760E+07
 9      0.4124000E+06    -0.4089830E+06     0.1454510E+07     0.4341050E+06    -0.3791180E+06     0.1387890E+07
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 10     0.5739990E+06   -0.8848375E+05    0.1454500E+07    0.5740110E+06   -0.5156550E+05    0.1307870E+07


          175              176              177              178              179              180
  1    -0.1415270E+06   -0.1424190E+05    0.1021660E+07   -0.1390090E+06   -0.1925320E+05    0.1107740E+07
  2    -0.1061260E+06   -0.9470525E+05    0.1021580E+07   -0.1011360E+06   -0.9726725E+05    0.1107640E+07
  3    -0.3620060E+05   -0.1390090E+06    0.1021570E+07   -0.2465810E+05   -0.1381520E+06    0.1107650E+07
  4     0.5725630E+05   -0.1301960E+06    0.1021580E+07    0.6123230E+05   -0.1262380E+06    0.1107660E+07
  5     0.1228760E+06   -0.7167550E+05    0.1021560E+07    0.1237780E+06   -0.6614056E+05    0.1107630E+07
  6     0.1415300E+06    0.1422650E+05    0.1021490E+07    0.1390130E+06    0.1923580E+05    0.1107570E+07
  7     0.1061430E+06    0.9468275E+05    0.1021510E+07    0.1011540E+06    0.9724588E+05    0.1107590E+07
  8     0.3021760E+05    0.1389920E+06    0.1021550E+07    0.2467530E+05    0.1381350E+06    0.1107630E+07
  9    -0.5723370E+05    0.1302090E+06    0.1021620E+07   -0.6120960E+05    0.1262510E+06    0.1107700E+07
 10    -0.1228540E+06    0.7168156E+05    0.1021700E+07   -0.1237520E+06    0.6614338E+05    0.1107780E+07


          181              182              183              184              185              186
  1    -0.1319070E+06   -0.2444810E+05    0.1165040E+07   -0.1259180E+06   -0.3137260E+05    0.1199500E+07
  2    -0.9233525E+05   -0.9729200E+05    0.1164970E+07   -0.8341738E+05   -0.9936906E+05    0.1199430E+07
  3    -0.1752380E+05   -0.1329980E+06    0.1164980E+07   -0.9087930E+04   -0.1294340E+06    0.1199440E+07
  4     0.6397390E+05   -0.1178710E+06    0.1164980E+07    0.6870450E+05   -0.1100280E+06    0.1199430E+07
  5     0.1210840E+06   -0.5776310E+05    0.1164950E+07    0.1202990E+06   -0.4863810E+05    0.1199390E+07
  6     0.1319140E+06    0.2443000E+05    0.1164890E+07    0.1259250E+06    0.3135300E+05    0.1199360E+07
  7     0.9235525E+05    0.9727325E+05    0.1164930E+07    0.8343800E+05    0.9935108E+05    0.1199400E+07
  8     0.1754120E+05    0.1329840E+06    0.1164960E+07    0.9105590E+04    0.1294240E+06    0.1199430E+07
  9    -0.6395030E+05    0.1178830E+06    0.1165030E+07   -0.6868050E+05    0.1100390E+06    0.1199500E+07
 10    -0.1210540E+06    0.5776300E+05    0.1165100E+07   -0.1202690E+06    0.4863580E+05    0.1199550E+07


          167              188              189              190              191              192
  1    -0.1223980E+06   -0.3978730E+05    0.1210740E+07   -0.1202950E+06   -0.4866220E+05    0.1199470E+07
  2    -0.7561975E+05   -0.1041030E+06    0.1210660E+07   -0.6870706E+05   -0.1100550E+06    0.1199420E+07
  3     0.3098300E+01   -0.1286780E+06    0.1210690E+07    0.9094348E+04   -0.1294260E+06    0.1199440E+07
  4     0.7561830E+05   -0.1040760E+06    0.1210680E+07    0.8341969E+05   -0.9934200E+05    0.1199460E+07
  5     0.1223920E+06   -0.3975970E+05    0.1210640E+07    0.1259070E+06   -0.3134300E+05    0.1199370E+07
  6     0.1224030E+06    0.3976600E+05    0.1210610E+07    0.1203010E+06    0.4864040E+05    0.1199350E+07
  7     0.7564175E+05    0.1040890E+06    0.1210670E+07    0.6872438E+05    0.1100370E+06    0.1199410E+07
  8     0.1498720E+02    0.1286720E+06    0.1210680E+07   -0.9075469E+04    0.1294260E+06    0.1199440E+07
  9    -0.7559400E+05    0.1040850E+06    0.1210760E+07   -0.8339438E+05    0.9934969E+05    0.1199540E+07
 10    -0.1223650E+06    0.3975630E+05    0.1210820E+07   -0.1258870E+06    0.3133930E+05    0.1199560E+07


          193              194              195              196              197              198
  1    -0.1210720E+06   -0.5778440E+05    0.1165010E+07   -0.1237620E+06   -0.6616038E+05    0.1107680E+07
  2    -0.6397770E+05   -0.1178970E+06    0.1164970E+07   -0.6123540E+05   -0.1262620E+06    0.1107660E+07
  3     0.1753050E+05   -0.1329840E+06    0.1164970E+07    0.2466480E+05   -0.1381360E+06    0.1107650E+07
  4     0.9234288E+05   -0.9726738E+05    0.1164990E+07    0.1011480E+06   -0.9724475E+05    0.1107650E+07
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  5     0.1318950E+06   -0.2441880E+05    0.1164890E+07    0.1389990E+06   -0.1922580E+05    0.1107570E+07
  6     0.1210790E+06    0.5776220E+05    0.1164900E+07    0.1237720E+06    0.6613819E+05    0.1107580E+07
  7     0.6399390E+05    0.1178800E+06    0.1164960E+07    0.6125050E+05    0.1262440E+06    0.1107640E+07
  8    -0.1751080E+05    0.1329910E+06    0.1164980E+07   -0.2464440E+05    0.1381470E+06    0.1107660E+07
  9    -0.9231738E+05    0.9727388E+05    0.1165080E+07   -0.1011260E+06    0.9725425E+05    0.1107760E+07
 10    -0.1318600E+06    0.2441420E+05    0.1165080E+07   -0.1389890E+06    0.1922050E+05    0.1107760E+07


             199              200              201              202              203              204
  1    -0.1228570E+06   -0.7169468E+05    0.1021600E+07    0.5592350E+06    0.1920100E+05    0.6439850E+06
  2    -0.5725510E+05   -0.1302140E+06    0.1021590E+07    0.4411210E+06    0.3442100E+06    0.6439220E+06
  3     0.3020740E+05   -0.1389930E+06    0.1021570E+07    0.1545460E+06    0.5377100E+06    0.6439170E+06
  4     0.1061410E+06   -0.9460256E+05    0.1021570E+07   -0.1910420E+06    0.5258670E+06    0.6439230E+06
  5     0.1415230E+06   -0.1421860E+05    0.1021490E+07   -0.4636290E+06    0.3131120E+06    0.6439190E+06
  6     0.1228710E+06    0.7167275E+05    0.1021570E+07   -0.5590950E+06   -0.1919410E+05    0.6436830E+06
  7     0.5726980E+05    0.1301970E+06    0.1021570E+07   -0.4410710E+06   -0.3441790E+06    0.6438870E+06
  8    -0.3018650E+05    0.1390070E+06    0.1021590E+07   -0.1545280E+06   -0.5377210E+06    0.6439080E+06
  9    -0.1061220E+06    0.9469525E+05    0.1021680E+07    0.1910670E+06   -0.5258940E+06    0.6439360E+06
 10    -0.1415170E+06    0.1421170E+05    0.1021670E+07    0.4637390E+06   -0.3131830E+06    0.6440030E+06


             205              206              207              208              209              210
  1     0.5743840E+06    0.5696760E+05    0.7535190E+06    0.5717060E+06    0.9158419E+05    0.8246550E+06
  2     0.4312470E+06    0.3835990E+06    0.7534680E+06    0.4086760E+06    0.4101060E+06    0.8245910E+06
  3     0.1234050E+06    0.5637720E+06    0.7534770E+06    0.8956309E+05    0.5719560E+06    0.8246180E+06
  4    -0.2315620E+06    0.5286530E+06    0.7534850E+06   -0.2637560E+06    0.5153900E+06    0.8246290E+06
  5    -0.4980240E+06    0.2915440E+06    0.7534750E+06   -0.5162470E+06    0.2618850E+06    0.8246130E+06
  6    -0.5742440E+06   -0.5685210E+05    0.7534160E+06   -0.5715660E+06   -0.9156038E+05    0.8245560E+06
  7    -0.4311980E+06   -0.3835640E+06    0.7534310E+06   -0.4086410E+06   -0.4100860E+06    0.8245790E+06
  8    -0.1233870E+06   -0.5637840E+06    0.7534640E+06   -0.8954569E+05   -0.5719700E+06    0.8246040E+06
  9     0.2315910E+06   -0.5286860E+06    0.7535070E+06    0.2637910E+06   -0.5154260E+06    0.8246590E+06
 10     0.4981410E+06   -0.2916110E+06    0.7535710E+06    0.5163730E+06   -0.2619470E+06    0.8247190E+06


             211              212              213              214              215              216
  1     0.5671230E+06    0.1273030E+06    0.8704030E+06    0.5593800E+06    0.1628460E+06    0.8929140E+06
  2     0.3039910E+06    0.4363320E+06    0.8703620E+06    0.3568390E+06    0.4605390E+06    0.8928610E+06
  3     0.5418050E+05    0.5786490E+06    0.8703760E+06    0.1798470E+05    0.5822830E+06    0.8928930E+06
  4    -0.2963110E+06    0.5000020E+06    0.8703680E+06   -0.3277310E+06    0.4816660E+06    0.8928670E+06
  5    -0.5335310E+06    0.2302980E+06    0.8703640E+06   -0.5481610E+06    0.1969970E+06    0.8928710E+06
  6    -0.5669920E+06   -0.1272740E+06    0.8703110E+06   -0.5592680E+06   -0.1628100E+06    0.8928270E+06
  7    -0.3839500E+06   -0.4362980E+06    0.8703300E+06   -0.3560090E+06   -0.4605240E+06    0.8928530E+06
  8    -0.5416230E+05   -0.5786640E+06    0.8703620E+06   -0.1796710E+05   -0.5823010E+06    0.8928790E+06
  9     0.2963510E+06   -0.5000440E+06    0.8704060E+06    0.3277780E+06   -0.4817150E+06    0.8929330E+06
 10     0.5336620E+06   -0.2303550E+06    0.8704770E+06    0.5482980E+06   -0.1970490E+06    0.8929920E+06


             217              218              219              220              221              222
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 1     0.5482670E+06    0.1970370E+06    0.8929090E+06    0.5336210E+06    0.2303370E+06    0.8703940E+06
 2     0.3277520E+06    0.4816670E+06    0.8928590E+06    0.2963300E+06    0.4999970E+06    0.8703480E+06
 3    -0.1796620E+05    0.5022830E+06    0.8928950E+06   -0.5416210E+05    0.5786470E+06    0.8703800E+06
 4    -0.3568180E+06    0.4605350E+06    0.8929000E+06   -0.3839610E+06    0.4363090E+06    0.8703890E+06
 5    -0.5592670E+06    0.1628090E+06    0.8928590E+06   -0.5669950E+06    0.1272660E+06    0.8703340E+06
 6    -0.5481630E+06   -0.1970050E+06    0.8928300E+06   -0.5335290E+06   -0.2303040E+06    0.8703220E+06
 7    -0.3277240E+06   -0.4816550E+06    0.8928550E+06   -0.2963050E+06   -0.4999900E+06    0.8703440E+06
 8     0.1798360E+05   -0.5823040E+06    0.8928840E+06    0.5417910E+05   -0.5786700E+06    0.8703710E+06
 9     0.3568700E+06   -0.4605870E+06    0.8929520E+06    0.3840220E+06   -0.4363680E+06    0.8704450E+06
10     0.5594090E+06   -0.1628540E+06    0.8929870E+06    0.5671330E+06   -0.1273010E+06    0.8704650E+06

            223              224              225              226              227              228
 1     0.5163220E+06    0.2619210E+06    0.8246350E+06    0.4980860E+06    0.2915800E+06    0.7534930E+06
 2     0.2637730E+06    0.5153790E+06    0.8246160E+06    0.2315800E+06    0.5286430E+06    0.7534780E+06
 3    -0.8954538E+05    0.5719590E+06    0.8246220E+06   -0.1233870E+06    0.5637820E+06    0.7534810E+06
 4    -0.4086420E+06    0.4100840E+06    0.8246260E+06   -0.4312070E+06    0.3835670E+06    0.7534890E+06
 5    -0.5715670E+06    0.9155106E+05    0.8245690E+06   -0.5742420E+06    0.5684240E+05    0.7534230E+06
 6    -0.5162430E+06   -0.2618680E+06    0.8245710E+06   -0.4980160E+06   -0.2915460E+06    0.7534370E+06
 7    -0.2637500E+06   -0.5153760E+06    0.8246120E+06   -0.2315570E+06   -0.5286410E+06    0.7534730E+06
 8     0.8956319E+05   -0.5719820E+06    0.8246170E+06    0.1234040E+06   -0.5638050E+06    0.7534810E+06
 9     0.4087220E+06   -0.4101610E+06    0.8247020E+06    0.4312880E+06   -0.3836420E+06    0.7535520E+06
10     0.5717080E+06   -0.9157936E+05    0.8246950E+06    0.5743900E+06   -0.5686390E+05    0.7535440E+06

            229              230              231              232              233              234
 1     0.4636840E+06    0.3131470E+06    0.6439340E+06   -0.1204560E+06   -0.3124290E+05    0.2562750E+06
 2     0.1910600E+06    0.5258540E+06    0.6439200E+06   -0.7909500E+05   -0.9607525E+05    0.2562270E+06
 3    -0.1545290E+06    0.5377240E+06    0.6439220E+06   -0.7516297E+04   -0.1242280E+06    0.2562400E+06
 4    -0.4410790E+06    0.3441750E+06    0.6439280E+06    0.6693038E+05   -0.1049060E+06    0.2562460E+06
 5    -0.5590960E+06    0.1918500E+05    0.6438880E+06    0.1158190E+06   -0.4554380E+05    0.2562340E+06
 6    -0.4636270E+06   -0.3131140E+06    0.6438880E+06    0.1204610E+06    0.3124280E+05    0.2562380E+06
 7    -0.1910390E+06   -0.5258560E+06    0.6439150E+06    0.7909538E+05    0.9607100E+05    0.2562170E+06
 8     0.1545470E+06   -0.5377460E+06    0.6439270E+06    0.7518219E+04    0.1242150E+06    0.2562360E+06
 9     0.4411680E+06   -0.3442540E+06    0.6439980E+06   -0.6692875E+05    0.1049090E+06    0.2562420E+06
10     0.5592400E+06   -0.1919620E+05    0.6439980E+06   -0.1158060E+06    0.4553920E+05    0.2562620E+06

            235              236              237              238              239              240
 1    -0.1363660E+06   -0.3539150E+05    0.3957260E+06   -0.1324890E+06   -0.3519780E+05    0.4802860E+06
 2    -0.8951028E+05   -0.1087740E+06    0.3956770E+06   -0.8649006E+05   -0.1063310E+06    0.4802560E+06
 3    -0.8486398E+04   -0.1406320E+06    0.3957020E+06   -0.7472668E+04   -0.1368770E+06    0.4802770E+06
 4     0.7578175E+05   -0.1187400E+06    0.3957000E+06    0.7439019E+05   -0.1151010E+06    0.4802820E+06
 5     0.1311260E+06   -0.5153680E+05    0.3957050E+06    0.1278730E+06   -0.4941330E+05    0.4802920E+06
 6     0.1363680E+06    0.3538640E+05    0.3956820E+06    0.1324920E+06    0.3519370E+05    0.4802460E+06
 7     0.8952075E+05    0.1087670E+06    0.3956660E+06    0.8649419E+05    0.1063250E+06    0.4802440E+06
 8     0.8490277E+04    0.1406170E+06    0.3956930E+06    0.7478148E+04    0.1368630E+06    0.4802640E+06
 9    -0.7577819E+05    0.1187430E+06    0.3957080E+06   -0.7438519E+05    0.1151040E+06    0.4802880E+06
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 10   -0.1311080E+06   0.5153110E+05   0.3957470E+06  -0.1278480E+06   0.4940630E+05   0.4803450E+06


           241              242              243              244              245              246
  1   -0.1267520E+06  -0.3547490E+05   0.5379060E+06  -0.1228740E+06  -0.3694140E+05   0.5712150E+06
  2   -0.8168325E+05  -0.1031790E+06   0.5378510E+06  -0.7768175E+05  -0.1020810E+06   0.5711760E+06
  3   -0.5436559E+04  -0.1315000E+06   0.5378930E+06  -0.2843840E+04  -0.1282570E+06   0.5712190E+06
  4    0.7287456E+05  -0.1095530E+06   0.5378980E+06   0.7306575E+05  -0.1054060E+06   0.5712240E+06
  5    0.1233880E+06  -0.4581390E+05   0.5379000E+06   0.1211050E+06  -0.4234550E+05   0.5712330E+06
  6    0.1267570E+06   0.3547040E+05   0.5378710E+06   0.1228770E+06   0.3693630E+05   0.5711800E+06
  7    0.8169056E+05   0.1031750E+06   0.5378640E+06   0.7768969E+05   0.1020780E+06   0.5711810E+06
  8    0.5443270E+04   0.1314900E+06   0.5378770E+06   0.2851400E+04   0.1282500E+06   0.5712010E+06
  9   -0.7286825E+05   0.1095550E+06   0.5379100E+06  -0.7305869E+05   0.1054080E+06   0.5712390E+06
 10   -0.1233610E+06   0.4580680E+05   0.5379600E+06  -0.1210790E+06   0.4233930E+05   0.5712980E+06


           247              248              249              250              251              252
  1   -0.1216970E+06  -0.3955280E+05   0.5817700E+06  -0.1211140E+06  -0.4235700E+05   0.5712150E+06
  2   -0.7519525E+05  -0.1035000E+06   0.5817460E+06  -0.7307788E+05  -0.1054280E+06   0.5711840E+06
  3    0.2778139E+01  -0.1279410E+06   0.5817890E+06   0.2849440E+04  -0.1282520E+06   0.5712250E+06
  4    0.7518375E+05  -0.1034800E+06   0.5817960E+06   0.7767256E+05  -0.1020630E+06   0.5712380E+06
  5    0.1216860E+06  -0.3954030E+05   0.5817820E+06   0.1228620E+06  -0.3692860E+05   0.5712160E+06
  6    0.1216970E+06   0.3954660E+05   0.5817370E+06   0.1211120E+06   0.4235000E+05   0.5711870E+06
  7    0.7520219E+05   0.1034970E+06   0.5817520E+06   0.7308119E+05   0.1054210E+06   0.5711920E+06
  8    0.5183209E+01   0.1279350E+06   0.5817700E+06  -0.2841170E+04   0.1282480E+06   0.5712060E+06
  9   -0.7517438E+05   0.1034780E+06   0.5818170E+06  -0.7766088E+05   0.1020580E+06   0.5712620E+06
 10   -0.1216610E+06   0.3953460E+05   0.5818530E+06  -0.1228390E+06   0.3692400E+05   0.5712910E+06


           253              254              255              256              257              258
  1   -0.1233880E+06  -0.4582140E+05   0.5378850E+06  -0.1278670E+06  -0.4941720E+05   0.4802800E+06
  2   -0.7288638E+05  -0.1095740E+06   0.5378690E+06  -0.7440150E+05  -0.1151220E+06   0.4802610E+06
  3    0.5441727E+04  -0.1314890E+06   0.5379070E+06   0.7476988E+04  -0.1368630E+06   0.4802850E+06
  4    0.8167688E+05  -0.1031640E+06   0.5379130E+06   0.8648688E+05  -0.1063200E+06   0.4803070E+06
  5    0.1267380E+06  -0.3546210E+05   0.5378980E+06   0.1324750E+06  -0.3518700E+05   0.4802660E+06
  6    0.1233860E+06   0.4581520E+05   0.5378590E+06   0.1278670E+06   0.4941210E+05   0.4802570E+06
  7    0.7288756E+05   0.1095650E+06   0.5378760E+06   0.7440119E+05   0.1151130E+06   0.4802670E+06
  8   -0.5433750E+04   0.1314910E+06   0.5378840E+06  -0.7469969E+04   0.1368700E+06   0.4802690E+06
  9   -0.8166556E+05   0.1031580E+06   0.5379500E+06  -0.8647619E+05   0.1063150E+06   0.4803250E+06
 10   -0.1267210E+06   0.3545890E+05   0.5379710E+06  -0.1324620E+06   0.3518460E+05   0.4803310E+06


           259              260              261              262              263              264
  1   -0.1311180E+06  -0.5153820E+05   0.3956950E+06  -0.1158110E+06  -0.4554300E+05   0.2562260E+06
  2   -0.7579025E+05  -0.1187570E+06   0.3956940E+06  -0.6693475E+05  -0.1049160E+06   0.2562380E+06
  3    0.8469477E+04  -0.1406170E+06   0.3957080E+06   0.7517879E+04  -0.1242160E+06   0.2562440E+06
  4    0.8951725E+05  -0.1087660E+06   0.3957150E+06   0.7909450E+05  -0.9607125E+05   0.2562480E+06
```

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  5     0.1363570E+06   -0.3538410E+05    0.3956960E+06    0.1204570E+06   -0.3124120E+05    0.2562430E+06
  6     0.1311210E+06    0.5153470E+05    0.3956750E+06    0.1158170E+06    0.4554230E+05    0.2562100E+06
  7     0.7578875E+05    0.1187480E+06    0.3956980E+06    0.6693300E+05    0.1049100E+06    0.2562400E+06
  8    -0.8484129E+04    0.1406270E+06    0.3956960E+06   -0.7514887E+04    0.1242270E+06    0.2562370E+06
  9    -0.8951050E+05    0.1087640E+06    0.3957340E+06   -0.7908969E+05    0.9606838E+05    0.2562660E+06
 10    -0.1363480E+06    0.3536220E+05    0.3957520E+06   -0.1204470E+06    0.3123820E+05    0.2562860E+06
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          MATRIX..   MEMBER FORCES

                  1               2               3               4               5               6
   1     0.8253566E+04  -0.3048671E+04  -0.3048409E+04   0.4488414E+04   0.4525719E+04   0.4488340E+04
   2     0.8253477E+04  -0.3048027E+04  -0.3047477E+04   0.4488086E+04   0.4525297E+04   0.4487695E+04
   3     0.8257637E+04  -0.3047332E+04  -0.3047288E+04   0.4487570E+04   0.4525133E+04   0.4487934E+04
   4     0.8252297E+04  -0.3047417E+04  -0.3047033E+04   0.4487632E+04   0.4525078E+04   0.4487383E+04
   5     0.8252055E+04  -0.3046846E+04  -0.3046948E+04   0.4487254E+04   0.4524512E+04   0.4487242E+04
   6     0.8252434E+04  -0.3047154E+04  -0.3047638E+04   0.4487191E+04   0.4524750E+04   0.4487703E+04
   7     0.8252934E+04  -0.3047591E+04  -0.3047889E+04   0.4487957E+04   0.4525383E+04   0.4488066E+04
   8     0.8253371E+04  -0.3047994E+04  -0.3048635E+04   0.4488125E+04   0.4525797E+04   0.4488675E+04
   9     0.8253965E+04  -0.3049068E+04  -0.3049215E+04   0.4489023E+04   0.4526641E+04   0.4489445E+04
  10     0.8254070E+04  -0.3049143E+04  -0.3048852E+04   0.4489090E+04   0.4526234E+04   0.4488605E+04

                  7               8               9              10              11              12
   1    -0.1910922E+04  -0.1984407E+04  -0.1984297E+04  -0.1910661E+04   0.4058898E+04   0.4168184E+04
   2    -0.1910870E+04  -0.1984249E+04  -0.1984132E+04  -0.1910555E+04   0.4058660E+04   0.4168027E+04
   3    -0.1910501E+04  -0.1984101E+04  -0.1984239E+04  -0.1910743E+04   0.4058564E+04   0.4167949E+04
   4    -0.1910656E+04  -0.1983989E+04  -0.1983850E+04  -0.1910132E+04   0.4058890E+04   0.4168000E+04
   5    -0.1909972E+04  -0.1983298E+04  -0.1983226E+04  -0.1909675E+04   0.4058520E+04   0.4167633E+04
   6    -0.1909775E+04  -0.1983413E+04  -0.1983599E+04  -0.1910212E+04   0.4058059E+04   0.4167484E+04
   7    -0.1910470E+04  -0.1984031E+04  -0.1983939E+04  -0.1910537E+04   0.4058732E+04   0.4167922E+04
   8    -0.1910644E+04  -0.1984418E+04  -0.1984726E+04  -0.1911410E+04   0.4058602E+04   0.4168148E+04
   9    -0.1911538E+04  -0.1985104E+04  -0.1985265E+04  -0.1911703E+04   0.4059433E+04   0.4168844E+04
  10    -0.1911757E+04  -0.1985053E+04  -0.1984811E+04  -0.1911119E+04   0.4059650E+04   0.4168887E+04

                 13              14              15              16              17              18
   1     0.4204672E+04   0.4168105E+04   0.4058676E+04  -0.1481979E+04  -0.1626941E+04  -0.1699456E+04
   2     0.4204395E+04   0.4167977E+04   0.4058497E+04  -0.1481598E+04  -0.1626580E+04  -0.1699087E+04
   3     0.4204598E+04   0.4168188E+04   0.4058853E+04  -0.1481463E+04  -0.1626539E+04  -0.1699085E+04
   4     0.4204500E+04   0.4167973E+04   0.4058380E+04  -0.1481655E+04  -0.1626729E+04  -0.1699115E+04
   5     0.4204188E+04   0.4167582E+04   0.4058077E+04  -0.1481270E+04  -0.1626214E+04  -0.1698635E+04
   6     0.4204176E+04   0.4167676E+04   0.4058427E+04  -0.1480706E+04  -0.1625835E+04  -0.1698365E+04
   7     0.4204371E+04   0.4167922E+04   0.4058582E+04  -0.1481310E+04  -0.1626447E+04  -0.1698860E+04
   8     0.4204867E+04   0.4168602E+04   0.4059297E+04  -0.1481440E+04  -0.1626613E+04  -0.1699268E+04
   9     0.4205371E+04   0.4168977E+04   0.4059794E+04  -0.1482120E+04  -0.1627304E+04  -0.1699790E+04
  10     0.4205266E+04   0.4168590E+04   0.4058992E+04  -0.1482625E+04  -0.1627577E+04  -0.1700011E+04

                 19              20              21              22              23              24
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  1     -0.1699458E+04  -0.1626900E+04  -0.1481808E+04   0.3922925E+04   0.4103461E+04   0.4211781E+04
  2     -0.1699002E+04  -0.1626500E+04  -0.1481379E+04   0.3923238E+04   0.4103594E+04   0.4211898E+04
  3     -0.1699223E+04  -0.1626846E+04  -0.1481745 +04   0.3922579E+04   0.4103113E+04   0.4211422E+04
  4     -0.1699141E+04  -0.1626369E+04  -0.1481366E+04   0.3922954E+04   0.4103730E+04   0.4212125E+04
  5     -0.1698583E+04  -0.1626058E+04  -0.1480880E+04   0.3922802E+04   0.4103402E+04   0.4211523E+04
  6     -0.1698434E+04  -0.1626126E+04  -0.1481199E+04   0.3922183E+04   0.4102824E+04   0.4211152E+04
  7     -0.1698886E+04  -0.1626312E+04  -0.1481344E+04   0.3922702E+04   0.4103461E+04   0.4211695E+04
  8     -0.1699370E+04  -0.1627003E+04  -0.1482072E+04   0.3922419E+04   0.4103133E+04   0.4211371E+04
  9     -0.1699951E+04  -0.1627378E+04  -0.1482401E+04   0.3923116E+04   0.4103910E+04   0.4212270E+04
 10     -0.1699952E+04  -0.1627294E+04  -0.1482093E+04   0.3923367E+04   0.4103926E+04   0.4212168E+04


              25              26              27              28              29              30
  1      0.4247852E+04   0.4211809E+04   0.4103203E+04   0.3922499E+04  -0.1021960E+04  -0.1231014E+04
  2      0.4248156E+04   0.4211809E+04   0.4103480E+04   0.3922630E+04  -0.1021586E+04  -0.1230650E+04
  3      0.4247652E+04   0.4211496E+04   0.4103238E+04   0.3922607E+04  -0.1021455E+04  -0.1230537E+04
  4      0.4248363E+04   0.4211902E+04   0.4103668E+04   0.3922668E+04  -0.1021729E+04  -0.1230759E+04
  5      0.4247828E+04   0.4211313E+04   0.4102973E+04   0.3922120E+04  -0.1021374E+04  -0.1230462E+04
  6      0.4247469E+04   0.4211434E+04   0.4103219E+04   0.3922544E+04  -0.1020963E+04  -0.1230077E+04
  7      0.4248004E+04   0.4211734E+04   0.4103375E+04   0.3922547E+04  -0.1021350E+04  -0.1230609E+04
  8      0.4247711E+04   0.4211621E+04   0.4103355E+04   0.3922727E+04  -0.1021388E+04  -0.1230485E+04
  9      0.4248707E+04   0.4212438E+04   0.4104105E+04   0.3923372E+04  -0.1021869E+04  -0.1230930E+04
 10      0.4248301E+04   0.4212008E+04   0.4103648E+04   0.3922834E+04  -0.1022240E+04  -0.1231170E+04


              31              32              33              34              35              36
  1     -0.1377886E+04  -0.1458597E+04  -0.1458558E+04  -0.1377673E+04  -0.1230637E+04  -0.1021606E+04
  2     -0.1377660E+04  -0.1458402E+04  -0.1458261E+04  -0.1377528E+04  -0.1230692E+04  -0.1021490E+04
  3     -0.1377517E+04  -0.1458217E+04  -0.1458265E+04  -0.1377492E+04  -0.1230583E+04  -0.1021564E+04
  4     -0.1377990E+04  -0.1458595E+04  -0.1458706E+04  -0.1377956E+04  -0.1230872E+04  -0.1021555E+04
  5     -0.1377349E+04  -0.1458014E+04  -0.1457892E+04  -0.1376970E+04  -0.1230035E+04  -0.1020908E+04
  6     -0.1377016E+04  -0.1457853E+04  -0.1458004E+04  -0.1377164E+04  -0.1230371E+04  -0.1021287E+04
  7     -0.1377660E+04  -0.1458463E+04  -0.1458604E+04  -0.1377635E+04  -0.1230786E+04  -0.1021625E+04
  8     -0.1377500E+04  -0.1458212E+04  -0.1458281E+04  -0.1377541E+04  -0.1230696E+04  -0.1021651E+04
  9     -0.1378083E+04  -0.1458839E+04  -0.1459039E+04  -0.1378177E+04  -0.1231394E+04  -0.1022163E+04
 10     -0.1378056E+04  -0.1458763E+04  -0.1458756E+04  -0.1377738E+04  -0.1230957E+04  -0.1021865E+04


              37              38              39              40              41              42
  1      0.3865705E+04   0.3899193E+04   0.4067548E+04   0.4190965E+04   0.4185406E+04   0.4191016E+04
  2      0.3865367E+04   0.3898547E+04   0.4066999E+04   0.4190449E+04   0.4184675E+04   0.4190129E+04
  3      0.3865504E+04   0.3898875E+04   0.4067459E+04   0.4190891E+04   0.4185164E+04   0.4190656E+04
  4      0.3865625E+04   0.3898469E+04   0.4067422E+04   0.4190410E+04   0.4185008E+04   0.4190391E+04
  5      0.3865204E+04   0.3898702E+04   0.4067021E+04   0.4190676E+04   0.4184895E+04   0.4189777E+04
  6      0.3864766E+04   0.3896511E+04   0.4066512E+04   0.4190695E+04   0.4184855E+04   0.4190355E+04
  7      0.3865077E+04   0.3898472E+04   0.4066895E+04   0.4190551E+04   0.4185035E+04   0.4190117E+04
  8      0.3865386E+04   0.3898977E+04   0.4067314E+04   0.4190879E+04   0.4185148E+04   0.4190688E+04
  9      0.3865889E+04   0.3898682E+04   0.4067738E+04   0.4190801E+04   0.4185297E+04   0.4190828E+04
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 10     0.3865076E+04   0.3899361E+04   0.4067938E+04   0.4191223E+04   0.4185559E+04   0.4190953E+04

              43              44              45              46              47              48
  1     0.4067639E+04   0.3899071E+04   0.3865635E+04  -0.4689038E+03  -0.6161108E+03  -0.7929153E+03
  2     0.4067571E+04   0.3898631E+04   0.3865697E+04  -0.4687014E+03  -0.6159641E+03  -0.7929260E+03
  3     0.4067385E+04   0.3898899E+04   0.3865487E+04  -0.4686741E+03  -0.6159224E+03  -0.7928740E+03
  4     0.4067088E+04   0.3898503E+04   0.3865173E+04  -0.4687639E+03  -0.6159766E+03  -0.7930347E+03
  5     0.4066969E+04   0.3898314E+04   0.3864733E+04  -0.4686602E+03  -0.6159570E+03  -0.7929299E+03
  6     0.4067158E+04   0.3898551E+04   0.3865030E+04  -0.4686516E+03  -0.6158645E+03  -0.7927383E+03
  7     0.4067612E+04   0.3898696E+04   0.3865562E+04  -0.4687417E+03  -0.6159480E+03  -0.7929080E+03
  8     0.4067409E+04   0.3899066E+04   0.3865702E+04  -0.4686519E+03  -0.6159001E+03  -0.7928528E+03
  9     0.4067708E+04   0.3899001E+04   0.3865778E+04  -0.4687041E+03  -0.6159675E+03  -0.7930217E+03
 10     0.4067304E+04   0.3899166E+04   0.3865708E+04  -0.4688525E+03  -0.6161567E+03  -0.7931094E+03

              49              50              51              52              53              54
  1    -0.9375117E+03  -0.1010225E+04  -0.1010240E+04  -0.9374131E+03  -0.7928555E+03  -0.6160071E+03
  2    -0.9374006E+03  -0.1010304E+04  -0.1010312E+04  -0.9373794E+03  -0.7929172E+03  -0.6159651E+03
  3    -0.9374336E+03  -0.1010265E+04  -0.1010360E+04  -0.9374639E+03  -0.7928208E+03  -0.6159268E+03
  4    -0.9375579E+03  -0.1010350E+04  -0.1010708E+04  -0.9377075E+03  -0.7931277E+03  -0.6162393E+03
  5    -0.9374229E+03  -0.1010210E+04  -0.1010333E+04  -0.9374438E+03  -0.7927310E+03  -0.6158777E+03
  6    -0.9373542E+03  -0.1010112E+04  -0.1010165E+04  -0.9373245E+03  -0.7927649E+03  -0.6158699E+03
  7    -0.9374468E+03  -0.1010329E+04  -0.1010547E+04  -0.9375442E+03  -0.7929507E+03  -0.6160662E+03
  8    -0.9374038E+03  -0.1010219E+04  -0.1010272E+04  -0.9373706E+03  -0.7927449E+03  -0.6158713E+03
  9    -0.9375874E+03  -0.1010452E+04  -0.1010704E+04  -0.9377783E+03  -0.7932366E+03  -0.6163010E+03
 10    -0.9376577E+03  -0.1010429E+04  -0.1010605E+04  -0.9377109E+03  -0.7929753E+03  -0.6161838E+03

              55              56              57              58              59              60
  1    -0.4687576E+03   0.2722401E+04   0.3463394E+04   0.3763572E+04   0.3935030E+04   0.4025069E+04
  2    -0.4688181E+03   0.2721897E+04   0.3463181E+04   0.3763083E+04   0.3934079E+04   0.4024876E+04
  3    -0.4686760E+03   0.2721965E+04   0.3463162E+04   0.3763136E+04   0.3934560E+04   0.4025080E+04
  4    -0.4688506E+03   0.2721998E+04   0.3463436E+04   0.3763158E+04   0.3934346E+04   0.4025254E+04
  5    -0.4687139E+03   0.2721960E+04   0.3463193E+04   0.3762872E+04   0.3934516E+04   0.4024632E+04
  6    -0.4686343E+03   0.2721629E+04   0.3462485E+04   0.3762686E+04   0.3934172E+04   0.4024528E+04
  7    -0.4688259E+03   0.2722267E+04   0.3462880E+04   0.3762479E+04   0.3934518E+04   0.4025431E+04
  8    -0.4686421E+03   0.2721969E+04   0.3463156E+04   0.3763143E+04   0.3934623E+04   0.4024968E+04
  9    -0.4691145E+03   0.2722080E+04   0.3463411E+04   0.3763538E+04   0.3934404E+04   0.4025426E+04
 10    -0.4689817E+03   0.2722569E+04   0.3463856E+04   0.3763710E+04   0.3935217E+04   0.4025367E+04

              61              62              63              64              65              66
  1     0.3997838E+04   0.4025071E+04   0.3934715E+04   0.3763324E+04   0.3463116E+04   0.2722250E+04
  2     0.3997725E+04   0.4025042E+04   0.3934141E+04   0.3763169E+04   0.3463040E+04   0.2722004E+04
  3     0.3997711E+04   0.4025095E+04   0.3934569E+04   0.3763171E+04   0.3463065E+04   0.2721951E+04
  4     0.3997927E+04   0.4025610E+04   0.3934147E+04   0.3763197E+04   0.3462989E+04   0.2721718E+04
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  5     0.3997273E+04   0.4024560E+04   0.3934243E+04   0.3762624E+04   0.3462316E+04   0.2721615E+04
  6     0.3997133E+04   0.4024596E+04   0.3934232E+04   0.3762903E+04   0.3462779E+04   0.2721784E+04
  7     0.3997747E+04   0.4025099E+04   0.3934215E+04   0.3763235E+04   0.3463121E+04   0.2722061E+04
  8     0.3997693E+04   0.4025001E+04   0.3934748E+04   0.3763043E+04   0.3463170E+04   0.2722062E+04
  9     0.3998180E+04   0.4025962E+04   0.3935001E+04   0.3763092E+04   0.3463499E+04   0.2722830E+04
 10     0.3998186E+04   0.4025520E+04   0.3935012E+04   0.3763585E+04   0.3463273E+04   0.2722419E+04

             67              68              69              70              71              72
  1     0.8363696E+03   0.1079525E+03  -0.1127865E+03  -0.2266006E+03  -0.2885020E+03  -0.3167991E+03
  2     0.8359937E+03   0.1077567E+03  -0.1128911E+03  -0.2265059E+03  -0.2883853E+03  -0.3166335E+03
  3     0.8362434E+03   0.1079387E+03  -0.1127928E+03  -0.2265273E+03  -0.2884790E+03  -0.3167290E+03
  4     0.8362117E+03   0.1080003E+03  -0.1127330E+03  -0.2263972E+03  -0.2884292E+03  -0.3166155E+03
  5     0.8362861E+03   0.1079499E+03  -0.1128755E+03  -0.2266242E+03  -0.2885886E+03  -0.3168252E+03
  6     0.8365530E+03   0.1081666E+03  -0.1126467E+03  -0.2264889E+03  -0.2885085E+03  -0.3167864E+03
  7     0.8363062E+03   0.1080724E+03  -0.1127539E+03  -0.2263685E+03  -0.2883809E+03  -0.3167205E+03
  8     0.8364556E+03   0.1081509E+03  -0.1126087E+03  -0.2263908E+03  -0.2883840E+03  -0.3166846E+03
  9     0.8364778E+03   0.1081747E+03  -0.1126036E+03  -0.2263425E+03  -0.2883618E+03  -0.3166689E+03
 10     0.8363674E+03   0.1080041E+03  -0.1127726E+03  -0.2265661E+03  -0.2884780E+03  -0.3168062E+03

             73              74              75              76              77              78
  1    -0.3167666E+03  -0.2884248E+03  -0.2264545E+03  -0.1126799E+03   0.1081810E+03   0.8365210E+03
  2    -0.3166687E+03  -0.2883918E+03  -0.2264442E+03  -0.1127250E+03   0.1080865E+03   0.8363794E+03
  3    -0.3167129E+03  -0.2884302E+03  -0.2264369E+03  -0.1126547E+03   0.1081047E+03   0.8364111E+03
  4    -0.3166865E+03  -0.2884421E+03  -0.2265352E+03  -0.1128357E+03   0.1079164E+03   0.8361946E+03
  5    -0.3167756E+03  -0.2884331E+03  -0.2263924E+03  -0.1125993E+03   0.1082126E+03   0.8365684E+03
  6    -0.3167507E+03  -0.2885095E+03  -0.2265011E+03  -0.1127463E+03   0.1079882E+03   0.8363005E+03
  7    -0.3167334E+03  -0.2884524E+03  -0.2265792E+03  -0.1128316E+03   0.1078683E+03   0.8361450E+03
  8    -0.3166785E+03  -0.2884629E+03  -0.2265438E+03  -0.1128406E+03   0.1078428E+03   0.8360688E+03
  9    -0.3166746E+03  -0.2885278E+03  -0.2265648E+03  -0.1129940E+03   0.1076851E+03   0.8359495E+03
 10    -0.3167278E+03  -0.2884929E+03  -0.2264454E+03  -0.1126835E+03   0.1081299E+03   0.8365356E+03

             79              80              81              82              83              84
  1     0.1458912E+03   0.8329461E+00  -0.9932261E+00   0.1453432E+03  -0.2848787E+03   0.1388741E+03
  2     0.1453432E+03   0.1247207E+01  -0.1246435E+01   0.1462236E+03  -0.2848301E+03   0.1384602E+03
  3     0.1462236E+03   0.7886131E+00  -0.5670014E+00   0.1454090E+03  -0.2842820E+03   0.1393152E+03
  4     0.1454090E+03   0.7238187E+00  -0.8559650E+00   0.1460014E+03  -0.2841914E+03   0.1385583E+03
  5     0.1460014E+03  -0.1108321E+00   0.1006014E+00   0.1460818E+03  -0.2848582E+03   0.1389501E+03
  6     0.1460818E+03  -0.9761751E+00   0.1034149E+01   0.1456808E+03  -0.2852546E+03   0.1395406E+03
  7     0.1456808E+03  -0.6743706E+00   0.3290861E+00   0.1454963E+03  -0.2850735E+03   0.1391037E+03
  8     0.1454963E+03  -0.1342773E+01   0.1583194E+01   0.1453484E+03  -0.2852344E+03   0.1396839E+03
  9     0.1453484E+03  -0.3094773E+00   0.1943824E+00   0.1451620E+03  -0.2840742E+03   0.1394910E+03
 10     0.1451620E+03   0.9190540E+00  -0.8056642E+00   0.1458912E+03  -0.2841179E+03   0.1385823E+03

             85              86              87              88              89              90
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  1    -0.1708041E-01    -0.2100890E+00     0.1389569E+03    -0.2848301E+03     0.5616245E+03    -0.1386319E+03
  2     0.5337629E+00    -0.6208728E+00     0.1394756E+03    -0.2842820E+03     0.5621921E+03    -0.1385303E+03
  3    -0.4150539E+00     0.6456395E+00     0.1387214E+03    -0.2841914E+03     0.5613811E+03    -0.1392013E+03
  4     0.1784903E+00    -0.4842295E+00     0.1394125E+03    -0.2840582E+03     0.5618357E+03    -0.1385014E+03
  5    -0.1528696E+00     0.1058986E+00     0.1388058E+03    -0.2852546E+03     0.5613794E+03    -0.1386397E+03
  6    -0.6353914E+00     0.6439316E+00     0.1380055E+03    -0.2850735E+03     0.5620176E+03    -0.1389496E+03
  7    -0.4953319E+00     0.1527237E+00     0.1387119E+03    -0.2852344E+03     0.5619844E+03    -0.1369743E+03
  8    -0.8318157E+00     0.1005182E+01     0.1383237E+03    -0.2840742E+03     0.5617957E+03    -0.1393730E+03
  9    -0.6686978E+00     0.5175364E+00     0.1385114E+03    -0.2841179E+03     0.5620144E+03    -0.1390563E+03
 10     0.6285591E+00    -0.3356300E+00     0.1395574E+03    -0.2848787E+03     0.5619741E+03    -0.1381479E+03

              91                92                93                94                95                96
  1     0.1385889E+03     0.8113194E-01    -0.3117175E+00     0.1388205E+03    -0.1389879E+03     0.5621921E+03
  2     0.1387778E+03     0.9394275E-02    -0.3561265E+00     0.1393032E+03    -0.1392219E+03     0.5613811E+03
  3     0.1388906E+03    -0.4466527E+00    -0.1366433E-01     0.1390299E+03    -0.1388471E+03     0.5618357E+03
  4     0.1383968E+03     0.2459579E+00    -0.7011508E+00     0.1392494E+03    -0.1393909E+03     0.5613794E+03
  5     0.1383386E+03     0.1349353E+00    -0.1528696E+00     0.1391460E+03    -0.1387712E+03     0.5620178E+03
  6     0.1389590E+03    -0.4765432E+00     0.1733661E+00     0.1365079E+03    -0.1383819E+03     0.5619844E+03
  7     0.1387112E+03     0.1443294E+00     0.1383513E+00     0.1388538E+03    -0.1388104E+03     0.5617957E+03
  8     0.1394117E+03    -0.7993632E+00     0.5081422E+00     0.1386453E+03    -0.1383750E+03     0.5620144E+03
  9     0.1390102E+03    -0.2527900E+00    -0.1383513E+00     0.1388435E+03    -0.1391108E+03     0.5619741E+03
 10     0.1383882E+03     0.5875659E+00    -0.6874866E+00     0.1394246E+03    -0.1392628E+03     0.5616245E+03

              97                98                99               100               101               102
  1    -0.8365508E+03     0.2748293E+03    -0.1373501E+03     0.1374196E+03     0.1161854E+00    -0.6570141E-01
  2    -0.8363833E+03     0.2751428E+03    -0.1371393E+03     0.1375811E+03    -0.5630409E-01    -0.2520198E+00
  3    -0.8360662E+03     0.2750854E+03    -0.1378750E+03     0.1377673E+03    -0.2955894E+00    -0.1836755E+00
  4    -0.8364329E+03     0.2747644E+03    -0.1370478E+03     0.1372207E+03    -0.1255828E+00    -0.1657351E+00
  5    -0.8364602E+03     0.2746721E+03    -0.1372640E+03     0.1371334E+03     0.2303510E+00    -0.4579073E+00
  6    -0.8363037E+03     0.2753645E+03    -0.1376392E+03     0.1377032E+03    -0.4374039E+00     0.3468477E+00
  7    -0.8371882E+03     0.2751487E+03    -0.1374195E+03     0.1372735E+03     0.2990066E-01     0.1486490E+00
  8    -0.8375635E+03     0.2754041E+03    -0.1376027E+03     0.1378798E+03    -0.6210796E+00     0.1819669E+00
  9    -0.8370337E+03     0.2754116E+03    -0.1376144E+03     0.1376741E+03    -0.3135298E+00    -0.1281457E+00
 10    -0.8369910E+03     0.2746038E+03    -0.1369094E+03     0.1371557E+03     0.2340795E+00    -0.4083576E+00

             103               104               105               106               107               108
  1     0.1376476E+03    -0.1376896E+03     0.2751162E+03    -0.8363833E+03     0.1249011E+04    -0.2746316E+03
  2     0.1375477E+03    -0.1375016E+03     0.2749172E+03    -0.8366662E+03     0.1248667E+04    -0.2751277E+03
  3     0.1372889E+03    -0.1370427E+03     0.2748276E+03    -0.8364329E+03     0.1248750E+04    -0.2749065E+03
  4     0.1377732E+03    -0.1376819E+03     0.2751179E+03    -0.8364602E+03     0.1248801E+04    -0.2747529E+03
  5     0.1375435E+03    -0.1374162E+03     0.2749761E+03    -0.8363037E+03     0.1248221E+04    -0.2746555E+03
  6     0.1372889E+03    -0.1368466E+03     0.2748027E+03    -0.8371882E+03     0.1248654E+04    -0.2749844E+03
  7     0.1374025E+03    -0.1371692E+03     0.2748071E+03    -0.8375635E+03     0.1248274E+04    -0.2750356E+03
  8     0.1370652E+03    -0.1370692E+03     0.2745415E+03    -0.8370337E+03     0.1248546E+04    -0.2753267E+03
  9     0.1372087E+03    -0.1374520E+03     0.2746260E+03    -0.8369910E+03     0.1249528E+04    -0.2748391E+03
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  10     0.1377567E+03   -0.1377383E+03    0.2751555E+03   -0.8365508E+03    0.1249395E+04   -0.2747717E+03


              109              110              111              112              113              114
   1     0.2748677E+03   -0.1374681E+03    0.1372435E+03   -0.1127682E+00   -0.1136225E+00    0.1375424E+03
   2     0.2747114E+03   -0.1373481E+03    0.1374665E+03    0.1290000E+00    0.2904636E-01    0.1375117E+03
   3     0.2749763E+03   -0.1377298E+03    0.1376016E+03    0.1674437E+00    0.1392516E+00    0.1372194E+03
   4     0.2744609E+03   -0.1370619E+03    0.1372759E+03    0.5382118E-01   -0.1366888E+00    0.1377099E+03
   5     0.2747214E+03   -0.1371687E+03    0.1373460E+03   -0.5638409E-01   -0.3032781E+00    0.1372075E+03
   6     0.2750410E+03   -0.1372900E+03    0.1374161E+03   -0.2075960E+00    0.2255364E+00    0.1374305E+03
   7     0.2749104E+03   -0.1372046E+03    0.1374827E+03    0.4100662E-01   -0.1127602E+00    0.1374245E+03
   8     0.2752129E+03   -0.1378756E+03    0.1376433E+03   -0.4066490E+00    0.1144768E+00    0.1370656E+03
   9     0.2747839E+03   -0.1372549E+03    0.1373153E+03   -0.1691523E+00   -0.5125828E-02    0.1372510E+03
  10     0.2746506E+03   -0.1374506E+03    0.1374289E+03    0.3195099E+00   -0.3118212E+00    0.1374715E+03


              115              116              117              118              119              120
   1    -0.1376974E+03    0.2748804E+03   -0.2749536E+03    0.1248667E+04   -0.1659396E+04    0.4104363E+03
   2    -0.1376452E+03    0.2740079E+03   -0.2749673E+03    0.1248750E+04   -0.1659519E+04    0.4103867E+03
   3    -0.1371055E+03    0.2740250E+03   -0.2749502E+03    0.1248861E+04   -0.1659323E+04    0.4106858E+03
   4    -0.1373925E+03    0.2748386E+03   -0.2751057E+03    0.1248221E+04   -0.1659399E+04    0.4104441E+03
   5    -0.1377077E+03    0.2749233E+03   -0.2752996E+03    0.1248654E+04   -0.1658722E+04    0.4105090E+03
   6    -0.1372379E+03    0.2745317E+03   -0.2747810E+03    0.1240274E+04   -0.1658652E+04    0.4103296E+03
   7    -0.1373088E+03    0.2746899E+03   -0.2747161E+03    0.1248546E+04   -0.1658866E+04    0.4105669E+03
   8    -0.1371789E+03    0.2745563E+03   -0.2745085E+03    0.1249528E+04   -0.1659234E+04    0.4110300E+03
   9    -0.1373864E+03    0.2745361E+03   -0.2746863E+03    0.1249395E+04   -0.1660300E+04    0.4108804E+03
  10    -0.1378400E+03    0.2751147E+03   -0.2752935E+03    0.1249011E+04   -0.1659583E+04    0.4104062E+03


              121              122              123              124              125              126
   1    -0.2733369E+03    0.2737610E+03   -0.1370315E+03    0.1367005E+03   -0.1025310E+00   -0.1546509E+00
   2    -0.2737891E+03    0.2733945E+03   -0.1366785E+03    0.1368132E+03   -0.1537965E-01    0.3503144E-01
   3    -0.2735796E+03    0.2739312E+03   -0.1369162E+03    0.1368525E+03   -0.2580363E+00    0.5869901E+00
   4    -0.2739463E+03    0.2737678E+03   -0.1368340E+03    0.1370676E+03    0.3503144E-01   -0.1332903E+00
   5    -0.2733054E+03    0.2736321E+03   -0.1367785E+03    0.1368610E+03   -0.6664515E-01   -0.2064797E+00
   6    -0.2736599E+03    0.2737893E+03   -0.1369777E+03    0.1370422E+03   -0.3512010E+00    0.1324359E+00
   7    -0.2739224E+03    0.2736721E+03   -0.1365845E+03    0.1370653E+03    0.7775265E-01    0.1290182E+00
   8    -0.2736062E+03    0.2739353E+03   -0.1371135E+03    0.1369200E+03   -0.1931000E+00    0.1486700E+00
   9    -0.2736455E+03    0.2739849E+03   -0.1371105E+03    0.1370482E+03   -0.2742704E+00    0.2230049E+00
  10    -0.2735754E+03    0.2736184E+03   -0.1368666E+03    0.1367209E+03    0.6151861E-01   -0.6066417E-01


              127              128              129              130              131              132
   1     0.1367953E+03   -0.1369290E+03    0.2740540E+03   -0.2739021E+03    0.4106198E+03   -0.1659509E+04
   2     0.1367722E+03   -0.1369846E+03    0.2737705E+03   -0.2736482E+03    0.4107744E+03   -0.1659313E+04
   3     0.1368141E+03   -0.1367941E+03    0.2725286E+03   -0.2736602E+03    0.4107070E+03   -0.1659388E+04
   4     0.1371789E+03   -0.1369761E+03    0.2738567E+03   -0.2738816E+03    0.4112913E+03   -0.1658711E+04
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  5      0.1370020E+03    -0.1273093E+03     0.2737773E+03    -0.2741577E+03     0.4107256E+03    -0.1658641E+04
  6      0.1363971E+03    -0.1362865E+03     0.2736047E+03    -0.2736321E+03     0.4103398E+03    -0.1658856E+04
  7      0.1370268E+03    -0.1369599E+03     0.2735220E+03    -0.2734902E+03     0.4106353E+03    -0.1659223E+04
  8      0.1368995E+03    -0.1367376E+03     0.2735962E+03    -0.2734971E+03     0.4103542E+03    -0.1660289E+04
  9      0.1367680E+03    -0.1368231E+03     0.2737935E+03    -0.2736047E+03     0.4110745E+03    -0.1659572E+04
 10      0.1371148E+03    -0.1372376E+03     0.2741079E+03    -0.2740234E+03     0.4107046E+03    -0.1659386E+04

             133              134              135              136              137              138
  1      0.2207124E+04    -0.4106013E+03     0.4106589E+03    -0.2737932E+03     0.2733652E+03    -0.1367738E+03
  2      0.2207171E+04    -0.4107336E+03     0.4107444E+03    -0.2737778E+03     0.2735771E+03    -0.1369643E+03
  3      0.2206934E+04    -0.4104417E+03     0.4104863E+03    -0.2737095E+03     0.2734192E+03    -0.1366422E+03
  4      0.2206886E+04    -0.4109387E+03     0.4106094E+03    -0.2740544E+03     0.2738813E+03    -0.1366225E+03
  5      0.2206433E+04    -0.4105576E+03     0.4106631E+03    -0.2735444E+03     0.2736370E+03    -0.1368891E+03
  6      0.2206018E+04    -0.4106892E+03     0.4104622E+03    -0.2739580E+03     0.2737695E+03    -0.1368609E+03
  7      0.2206446E+04    -0.4111121E+03     0.4108340E+03    -0.2740049E+03     0.2739377E+03    -0.1368490E+03
  8      0.2206417E+04    -0.4106277E+03     0.4108264E+03    -0.2736504E+03     0.2736626E+03    -0.1369523E+03
  9      0.2207144E+04    -0.4110308E+03     0.4111255E+03    -0.2740767E+03     0.2738523E+03    -0.1370891E+03
 10      0.2207321E+04    -0.4105337E+03     0.4104299E+03    -0.2734983E+03     0.2734900E+03    -0.1366004E+03

             139              140              141              142              143              144
  1      0.1366505E+03     0.1845558E+00     0.2905045E-01     0.1369395E+03    -0.1370770E+03     0.2742825E+03
  2      0.1367003E+03     0.3733837E+00    -0.6408191E-01     0.1370779E+03    -0.1370463E+03     0.2742441E+03
  3      0.1365952E+03     0.1033854E+00     0.1888279E+00     0.1368804E+03    -0.1370581E+03     0.2735972E+03
  4      0.1368499E+03    -0.2221505E-01    -0.1623409E+00     0.1371752E+03    -0.1369257E+03     0.2740005E+03
  5      0.1364269E+03     0.2383846E+00    -0.1854102E+00     0.1373180E+03    -0.1370240E+03     0.2738955E+03
  6      0.1369404E+03    -0.2230049E+00     0.2298402E+00     0.1364660E+03    -0.1367215E+03     0.2736799E+03
  7      0.1369310E+03     0.3058842E+00     0.1862646E+00     0.1370822E+03    -0.1370257E+03     0.2737100E+03
  8      0.1367908E+03    -0.8544251E-03     0.4255037E+00     0.1366540E+03    -0.1369796E+03     0.2734851E+03
  9      0.1369429E+03    -0.3024665E+00     0.7775265E-01     0.1370761E+03    -0.1368087E+03     0.2738389E+03
 10      0.1367319E+03     0.2853780E+00    -0.1631952E+00     0.1371821E+03    -0.1367951E+03     0.2737920E+03

             145              146              147              148              149              150
  1     -0.2740505E+03     0.4108008E+03    -0.4109685E+03     0.2207197E+04    -0.2213269E+04     0.6325866E+01
  2     -0.2737771E+03     0.4107512E+03    -0.4108643E+03     0.2206959E+04    -0.2212927E+04     0.6374559E+01
  3     -0.2738250E+03     0.4107419E+03    -0.4105251E+03     0.2206912E+04    -0.2213325E+04     0.6513805E+01
  4     -0.2740530E+03     0.4112068E+03    -0.4114358E+03     0.2206459E+04    -0.2213353E+04     0.6614609E+01
  5     -0.2741316E+03     0.4106204E+03    -0.4109165E+03     0.2206044E+04    -0.2213276E+04     0.6339534E+01
  6     -0.2740625E+03     0.4104700E+03    -0.4107507E+03     0.2206471E+04    -0.2212699E+04     0.6858076E+01
  7     -0.2738386E+03     0.4109297E+03    -0.4106226E+03     0.2206442E+04    -0.2212591E+04     0.6660739E+01
  8     -0.2737268E+03     0.4103896E+03    -0.4105457E+03     0.2207169E+04    -0.2213146E+04     0.6360037E+01
  9     -0.2736055E+03     0.4109470E+03    -0.4109812E+03     0.2207367E+04    -0.2213375E+04     0.6700036E+01
 10     -0.2740137E+03     0.4103264E+03    -0.4107405E+03     0.2207149E+04    -0.2213514E+04     0.6015766E+01

             151              152              153              154              155              156
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  1    -0.3826067E+03    0.3826912E+03   -0.2836621E+03    0.2836431E+03   -0.1698893E+03    0.1695540E+03
  2    -0.3826665E+03    0.3828757E+03   -0.2836970E+03    0.2837190E+03   -0.1701371E+03    0.1697147E+03
  3    -0.3826460E+03    0.3831235E+03   -0.2838406E+03    0.2837781E+03   -0.1698748E+03    0.1699813E+03
  4    -0.3827366E+03    0.3828074E+03   -0.2838354E+03    0.2838755E+03   -0.1699911E+03    0.1698540E+03
  5    -0.3825513E+03    0.3828953E+03   -0.2834185E+03    0.2836721E+03   -0.1696911E+03    0.1696480E+03
  6    -0.3827349E+03    0.3828518E+03   -0.2834656E+03    0.2839326E+03   -0.1698714E+03    0.1698027E+03
  7    -0.3828137E+03    0.3829304E+03   -0.2837791E+03    0.2838198E+03   -0.1700372E+03    0.1700112E+03
  8    -0.3825964E+03    0.3828406E+03   -0.2838164E+03    0.2837371E+03   -0.1698552E+03    0.1696676E+03
  9    -0.3825383E+03    0.3828894E+03   -0.2839792E+03    0.2839326E+03   -0.1698663E+03    0.1699360E+03
 10    -0.3826042E+03    0.3827834E+03   -0.2835647E+03    0.2834937E+03   -0.1695817E+03    0.1698710E+03

            157              158              159              160              161              162
  1     0.2768530E+00   -0.1281735E-01    0.1698577E+03   -0.1697741E+03    0.2837959E+03   -0.2834917E+03
  2     0.1264637E+00    0.9570289E-01    0.1695228E+03   -0.1695784E+03    0.2837488E+03   -0.2835227E+03
  3     0.4956010E-01    0.2725822E+00    0.1697313E+03   -0.1696314E+03    0.2836616E+03   -0.2836875E+03
  4    -0.3426483E+00    0.1948237E+00    0.1698663E+03   -0.1696570E+03    0.2836079E+03   -0.2838259E+03
  5     0.2674536E+00   -0.3093253E+00    0.1697287E+03   -0.1698622E+03    0.2838513E+03   -0.2836208E+03
  6     0.1008292E+00    0.9655732E-01    0.1696527E+03   -0.1697347E+03    0.2833252E+03   -0.2837739E+03
  7     0.2272929E+00    0.1529537E+00    0.1698074E+03   -0.1698792E+03    0.2835874E+03   -0.2837747E+03
  8     0.7348567E-01    0.2512200E+00    0.1696783E+03   -0.1697869E+03    0.2837241E+03   -0.2837046E+03
  9    -0.2486550E+00    0.2452385E+00    0.1697441E+03   -0.1693083E+03    0.2837224E+03   -0.2832935E+03
 10     0.9228432E-01   -0.1623530E-01    0.1699073E+03   -0.1697852E+03    0.2837207E+03   -0.2835723E+03

            163              164              165              166              167              168
  1     0.3825210E+03   -0.3825066E+03    0.6170283E+01   -0.2212901E+04    0.2423493E+04   -0.7381665E+02
  2     0.3824158E+03   -0.3826545E+03    0.6434249E+01   -0.2213300E+04    0.2423679E+04   -0.7361758E+02
  3     0.3826150E+03   -0.3823083E+03    0.5990891E+01   -0.2213327E+04    0.2423540E+04   -0.7385167E+02
  4     0.3824082E+03   -0.3825347E+03    0.6516257E+01   -0.2213250E+04    0.2423469E+04   -0.7358855E+02
  5     0.3825542E+03   -0.3826868E+03    0.6349677E+01   -0.2212673E+04    0.2423601E+04   -0.739[illegible]067E+02
  6     0.3824912E+03   -0.3824663E+03    0.6507714E+01   -0.2212565E+04    0.2423195E+04   -0.7402168E+02
  7     0.3829619E+03   -0.3827295E+03    0.6613642E+01   -0.2213121E+04    0.2423431E+04   -0.7370131E+02
  8     0.3825115E+03   -0.3824775E+03    0.6028478E+01   -0.2213349E+04    0.2423343E+04   -0.7386534E+02
  9     0.3824561E+03   -0.3823535E+03    0.5993453E+01   -0.2213488E+04    0.2423465E+04   -0.7395505E+02
 10     0.3822629E+03   -0.3825654E+03    0.6156616E+01   -0.2213243E+04    0.2423652E+04   -0.7387816E+02

            169              170              171              172              173              174
  1     0.8610591E+03   -0.2115913E+03    0.3766392E+03   -0.2023260E+03    0.2463665E+03   -0.8718102E+02
  2     0.8606812E+03   -0.2114409E+03    0.3767656E+03   -0.2022944E+03    0.2462836E+03   -0.8718443E+02
  3     0.8609956E+03   -0.2116588E+03    0.3767212E+03   -0.2024865E+03    0.2463870E+03   -0.8716393E+02
  4     0.8611274E+03   -0.2116561E+03    0.3765461E+03   -0.2025328E+03    0.2462220E+03   -0.8725279E+02
  5     0.8610820E+03   -0.2116972E+03    0.3768784E+03   -0.2024661E+03    0.2463356E+03   -0.8699046E+02
  6     0.8612119E+03   -0.2116254E+03    0.3769792E+03   -0.2026660E+03    0.2465062E+03   -0.8727159E+02
  7     0.8610256E+03   -0.2116921E+03    0.3769170E+03   -0.2025763E+03    0.2465630E+03   -0.8722374E+02
  8     0.8610964E+03   -0.2116656E+03    0.3767808E+03   -0.2025609E+03    0.2466802E+03   -0.8728441E+02
  9     0.8611675E+03   -0.2115596E+03    0.3767700E+03   -0.2025429E+03    0.2466554E+03   -0.8731432E+02
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 10     0.8610101E+03   -0.2117552E+03    0.3767700E+03   -0.2023089E+03    0.2465229E+03   -0.8694604E+02

             175              176              177              178              179              180
  1     0.1064611E+03   -0.2506261E+01   -0.3033490E+01    0.1065337E+03   -0.8724394E+02    0.2465363E+03
  2     0.1062957E+03   -0.2773721E+01   -0.3000164E+01    0.1063329E+03   -0.8715166E+02    0.2464764E+03
  3     0.1063623E+03   -0.2873698E+01   -0.2929241E+01    0.1065320E+03   -0.8713544E+02    0.2468866E+03
  4     0.1063948E+03   -0.3077925E+01   -0.2820719E+01    0.1060697E+03   -0.8734563E+02    0.2464440E+03
  5     0.1063256E+03   -0.2672890E+01   -0.3251389E+01    0.1065149E+03   -0.8744473E+02    0.2466354E+03
  6     0.1062594E+03   -0.2982220E+01   -0.3052289E+01    0.1062560E+03   -0.8723882E+02    0.2463773E+03
  7     0.1067323E+03   -0.2999310E+01   -0.2989911E+01    0.1063679E+03   -0.8736186E+02    0.2461859E+03
  8     0.1063170E+03   -0.3061688E+01   -0.2805338E+01    0.1062295E+03   -0.8707306E+02    0.2465166E+03
  9     0.1064879E+03   -0.3239426E+01   -0.2867716E+01    0.1050107E+03   -0.8698590E+02    0.2464474E+03
 10     0.1065341E+03   -0.2975384E+01   -0.3113813E+01    0.1063004E+03   -0.8733792E+02    0.2465936E+03

             181              182              183              184              185              186
  1    -0.2027175E+03    0.3767642E+03   -0.2117436E+03    0.8611296E+03   -0.7386574E+02    0.2423694E+04
  2    -0.2024303E+03    0.3765891E+03   -0.2117316E+03    0.8610220E+03   -0.7409811E+02    0.2423557E+04
  3    -0.2024739E+03    0.3766320E+03   -0.2117034E+03    0.8610955E+03   -0.7391956E+02    0.2423484E+04
  4    -0.2027030E+03    0.3766257E+03   -0.2115019E+03    0.8611714E+03   -0.7416646E+02    0.2423615E+04
  5    -0.2025568E+03    0.3769531E+03   -0.2116479E+03    0.8610415E+03   -0.7386061E+02    0.2423210E+04
  6    -0.2025559E+03    0.3767231E+03   -0.2114958E+03    0.8610027E+03   -0.7380508E+02    0.2423445E+04
  7    -0.2023971E+03    0.3768171E+03   -0.2116872E+03    0.8609639E+03   -0.7389905E+02    0.2423359E+04
  8    -0.2024911E+03    0.3764788E+03   -0.2115009E+03    0.8609021E+03   -0.7373759E+02    0.2423480E+04
  9    -0.2022355E+03    0.3764856E+03   -0.2113096E+03    0.8611604E+03   -0.7352913E+02    0.2423667E+04
 10    -0.2027457E+03    0.3765583E+03   -0.2115437E+03    0.8611440E+03   -0.7383754E+02    0.2423508E+04

             187              188              189              190              191              192
  1    -0.2861776E+04    0.4382883E+03   -0.1348028E+04    0.5609165E+03   -0.5692268E+03    0.4040003E+03
  2    -0.2861575E+04    0.4383936E+03   -0.1348129E+04    0.5609551E+03   -0.5689431E+03    0.4041870E+03
  3    -0.2861670E+04    0.4383525E+03   -0.1348189E+04    0.5610320E+03   -0.5693508E+03    0.4041077E+03
  4    -0.2861645E+04    0.4383779E+03   -0.1348036E+04    0.5612207E+03   -0.5694124E+03    0.4041248E+03
  5    -0.2861762E+04    0.4383953E+03   -0.1348111E+04    0.5611499E+03   -0.5693003E+03    0.4041409E+03
  6    -0.2861369E+04    0.4383994E+03   -0.1347918E+04    0.5610986E+03   -0.5691318E+03    0.4043008E+03
  7    -0.2861652E+04    0.4383574E+03   -0.1347920E+04    0.5610754E+03   -0.5692737E+03    0.4042581E+03
  8    -0.2861597E+04    0.4383457E+03   -0.1347974E+04    0.5611626E+03   -0.5692266E+03    0.4042324E+03
  9    -0.2861654E+04    0.4384448E+03   -0.1348276E+04    0.5611404E+03   -0.5693242E+03    0.4043630E+03
 10    -0.2862118E+04    0.4383779E+03   -0.1348154E+04    0.5611560E+03   -0.5693423E+03    0.4041836E+03

             193              194              195              196              197              198
  1    -0.3238350E+03    0.2799626E+03   -0.1556121E+03    0.1363627E+03    0.3123304E+01    0.2973763E+01
  2    -0.3238784E+03    0.2801899E+03   -0.1554172E+03    0.1365550E+03    0.3071178E+01    0.3076305E+01
  3    -0.3241375E+03    0.2800457E+03   -0.1556685E+03    0.1365747E+03    0.2927618E+01    0.2933599E+01
  4    -0.3240288E+03    0.2799978E+03   -0.1556139E+03    0.1366370E+03    0.2868655E+01    0.3125869E+01
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  5     -0.3242085E+03     0.2790730E+03    -0.1557291E+03     0.1363987E+03     0.3005380E+01     0.2845001E+01
  6     -0.3241272E+03     0.2799175E+03    -0.1558744E+03     0.1363713E+03     0.2943854E+01     0.2948126E+01
  7     -0.3240303E+03     0.2800747E+03    -0.1556796E+03     0.1367285E+03     0.2790893E+01     0.2675491E+01
  8     -0.3239810E+03     0.2802139E+03    -0.1557231E+03     0.1365627E+03     0.2965217E+01     0.3060579E+01
  9     -0.3239512E+03     0.2802361E+03    -0.1557770E+03     0.1366669E+03     0.2736203E+01     0.3103651E+01
 10     -0.3239656E+03     0.2801404E+03    -0.1555642E+03     0.1366900E+03     0.2695145E+01     0.2891727E+01


            199               200               201               202               203               204
  1      0.1365720E+03    -0.1557130E+03     0.2800388E+03    -0.3241750E+03     0.4041301E+03    -0.5692913E+03
  2      0.1366054E+03    -0.1555352E+03     0.2801201E+03    -0.3238545E+03     0.4041055E+03    -0.5693665E+03
  3      0.1365822E+03    -0.1557275E+03     0.2802756E+03    -0.3239426E+03     0.4041096E+03    -0.5693716E+03
  4      0.1363643E+03    -0.1557745E+03     0.2801423E+03    -0.3240854E+03     0.4042463E+03    -0.5693406E+03
  5      0.1366275E+03    -0.1557172E+03     0.2802260E+03    -0.3240083E+03     0.4043789E+03    -0.5691572E+03
  6      0.1364268E+03    -0.1556993E+03     0.2800227E+03    -0.3240732E+03     0.4042000E+03    -0.5691665E+03
  7      0.1364352E+03    -0.1557044E+03     0.2800122E+03    -0.3239570E+03     0.4042986E+03    -0.5692341E+03
  8      0.1365429E+03    -0.1557095E+03     0.2801294E+03    -0.3239846E+03     0.4041301E+03    -0.5692502E+03
  9      0.1364268E+03    -0.1555694E+03     0.2801096E+03    -0.3237751E+03     0.4041995E+03    -0.5693384E+03
 10      0.1365036E+03    -0.1558360E+03     0.2801028E+03    -0.3241453E+03     0.4041592E+03    -0.5692800E+03


            205               206               207               208               209               210
  1      0.5611047E+03    -0.1348002E+04     0.4384487E+03    -0.2861575E+04     0.4903063E+04    -0.1941437E+04
  2      0.5610005E+03    -0.1346240E+04     0.4384788E+03    -0.2861670E+04     0.4902449E+04    -0.1941307E+04
  3      0.5611150E+03    -0.1348103E+04     0.4384029E+03    -0.2861645E+04     0.4902680E+04    -0.1941407E+04
  4      0.5610422E+03    -0.1348377E+04     0.4385752E+03    -0.2861762E+04     0.4902676E+04    -0.1941369E+04
  5      0.5610706E+03    -0.1347844E+04     0.4384343E+03    -0.2861369E+04     0.4902613E+04    -0.1941592E+04
  6      0.5610457E+03    -0.1347932E+04     0.4383950E+03    -0.2861652E+04     0.4902512E+04    -0.1941393E+04
  7      0.5611772E+03    -0.1348049E+04     0.4384812E+03    -0.2861597E+04     0.4902223E+04    -0.1941327E+04
  8      0.5610347E+03    -0.1348091E+04     0.4384395E+03    -0.2861654E+04     0.4902563E+04    -0.1941400E+04
  9      0.5611072E+03    -0.1348072E+04     0.4383933E+03    -0.2862110E+04     0.4902594E+04    -0.1941391E+04
 10      0.5610303E+03    -0.1347994E+04     0.4384504E+03    -0.2861776E+04     0.4902980E+04    -0.1941550E+04


            211               212               213               214               215               216
  1      0.1874315E+04    -0.7646858E+03     0.6977654E+03    -0.4894858E+03     0.4226689E+03    -0.3029001E+03
  2      0.1874148E+04    -0.7645552E+03     0.6976348E+03    -0.4894414E+03     0.4225706E+03    -0.3026995E+03
  3      0.1874303E+04    -0.7646440E+03     0.6977783E+03    -0.4895405E+03     0.4227424E+03    -0.3029644E+03
  4      0.1874264E+04    -0.7645713E+03     0.6977278E+03    -0.4895002E+03     0.4226946E+03    -0.3029729E+03
  5      0.1874435E+04    -0.7647876E+03     0.6979294E+03    -0.4897175E+03     0.4228518E+03    -0.3030779E+03
  6      0.1874261E+04    -0.7647705E+03     0.6979092E+03    -0.4896431E+03     0.4227980E+03    -0.3030310E+03
  7      0.1874199E+04    -0.7646030E+03     0.6977227E+03    -0.4894507E+03     0.4226304E+03    -0.3029736E+03
  8      0.1874252E+04    -0.7646519E+03     0.6977629E+03    -0.4895654E+03     0.4227629E+03    -0.3030020E+03
  9      0.1874273E+04    -0.7646587E+03     0.6977944E+03    -0.4895737E+03     0.4227886E+03    -0.3030583E+03
 10      0.1874471E+04    -0.7648098E+03     0.6979253E+03    -0.4897131E+03     0.4228860E+03    -0.3030813E+03


            217               218               219               220               221               222
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  1     0.2361386E+03   -0.1606393E+03    0.9388731E+02   -0.3331363E+02   -0.3342491E+02    0.9385535E+02
  2     0.2359122E+03   -0.1605922E+03    0.9380101E+02   -0.3340184E+02   -0.3337364E+02    0.9379895E+02
  3     0.2361916E+03   -0.1606416E+03    0.9386510E+02   -0.3339757E+02   -0.3339415E+02    0.9386731E+02
  4     0.2361992E+03   -0.1606418E+03    0.9387193E+02   -0.3348367E+02   -0.3328819E+02    0.9369298E+02
  5     0.2362659E+03   -0.1606777E+03    0.9389159E+02   -0.3330699E+02   -0.3348987E+02    0.9395105E+02
  6     0.2361975E+03   -0.1606230E+03    0.9385912E+02   -0.3337706E+02   -0.3336168E+02    0.9384253E+02
  7     0.2361899E+03   -0.1606145E+03    0.9384715E+07   -0.3347447E+02   -0.3332408E+02    0.9379297E+02
  8     0.2362249E+03   -0.1606769E+03    0.9388040E+02   -0.3344286E+02   -0.3332323E+02    0.9384424E+02
  9     0.2362429E+03   -0.1606811E+03    0.9394115E+02   -0.3353943E+02   -0.3321642E+02    0.9369127E+02
 10     0.2362676E+03   -0.1607024E+03    0.9393260E+02   -0.3336595E+02   -0.3343431E+02    0.9388525E+02


             223              224              225              226              227              228
  1    -0.1606272E+03    0.2362150E+03   -0.3030171E+03    0.4228083E+03   -0.4896133E+03    0.6978484E+03
  2    -0.1605417E+03    0.2361321E+03   -0.3029036E+03    0.4227117E+03   -0.4894985E+03    0.6977178E+03
  3    -0.1606622E+03    0.2362560E+03   -0.3030461E+03    0.4228193E+03   -0.4896516E+03    0.6978269E+03
  4    -0.1604905E+03    0.2360184E+03   -0.3028188E+03    0.4227578E+03   -0.4895662E+03    0.6978801E+03
  5    -0.1607322E+03    0.2362705E+03   -0.3030974E+03    0.4228091E+03   -0.4896790E+03    0.6978716E+03
  6    -0.1606100E+03    0.2362423E+03   -0.3030229E+03    0.4227927E+03   -0.4896233E+03    0.6978364E+03
  7    -0.1605452E+03    0.2361141E+03   -0.3028989E+03    0.4226765E+03   -0.4894773E+03    0.6977058E+03
  8    -0.1605913E+03    0.2361628E+03   -0.3029497E+03    0.4227244E+03   -0.4895422E+03    0.6977161E+03
  9    -0.1604648E+03    0.2360908E+03   -0.3028821E+03    0.4226416E+03   -0.4894646E+03    0.6977734E+03
 10    -0.1606314E+03    0.2363115E+03   -0.3031042E+03    0.4228457E+03   -0.4896814E+03    0.6978767E+03


             229              230              231              232              233              234
  1    -0.7647048E+03    0.1874292E+04   -0.1941420E+04    0.4902480E+04    0.2488872E+04    0.2488966E+04
  2    -0.7645732E+03    0.1874310E+04   -0.1941404E+04    0.4902711E+04    0.2488950E+04    0.2488590E+04
  3    -0.7647083E+03    0.1874331E+04   -0.1941442E+04    0.4902707E+04    0.2488576E+04    0.2488785E+04
  4    -0.7647280E+03    0.1874427E+04   -0.1941508E+04    0.4902844E+04    0.2488768E+04    0.2488500E+04
  5    -0.7648083E+03    0.1874263E+04   -0.1941358E+04    0.4902543E+04    0.2488485E+04    0.2488370E+04
  6    -0.7647229E+03    0.1874257E+04   -0.1941307E+04    0.4902254E+04    0.2488353E+04    0.2488517E+04
  7    -0.7645322E+03    0.1874262E+04   -0.1941369E+04    0.4902594E+04    0.2488500E+04    0.2489070E+04
  8    -0.7645852E+03    0.1874201E+04   -0.1941349E+04    0.4902625E+04    0.2489054E+04    0.2488934E+04
  9    -0.7646357E+03    0.1874369E+04   -0.1941466E+04    0.4903008E+04    0.2488917E+04    0.2488997E+04
 10    -0.7647930E+03    0.1874384E+04   -0.1941512E+04    0.4903090E+04    0.2488980E+04    0.2488889E+04


             235              236              237              238              239              240
  1     0.3565220E+04    0.3565092E+04    0.4032045E+04    0.4031749E+04    0.3750374E+04    0.3749876E+04
  2     0.3565092E+04    0.3565265E+04    0.4031805E+04    0.4031715E+04    0.3749901E+04    0.3750196E+04
  3     0.3565265E+04    0.3565324E+04    0.4031771E+04    0.4031896E+04    0.3750219E+04    0.3750153E+04
  4     0.3565324E+04    0.3564785E+04    0.4031952E+04    0.4031488E+04    0.3750178E+04    0.3750488E+04
  5     0.3564785E+04    0.3564044E+04    0.4031541E+04    0.4030846E+04    0.3750510E+04    0.3749589E+04
  6     0.3564044E+04    0.3564500E+04    0.4030904E+04    0.4031016E+04    0.3749814E+04    0.3749695E+04
  7     0.3564500E+04    0.3565162E+04    0.4031072E+04    0.4031380E+04    0.3749717E+04    0.3750004E+04
  8     0.3565102E+04    0.3565775E+04    0.4031444E+04    0.4031896E+04    0.3750026E+04    0.3749513E+04
  9     0.3565775E+04    0.3565767E+04    0.4031952E+04    0.4032151E+04    0.3749938E+04    0.3750302E+04
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 10       0.3565767E+04    0.3565220E+04    0.4032207E+04    0.4031989E+04    0.3750327E+04    0.3750350E+04


              241              242              243              244              245              246
  1       0.1777524E+04    0.1777325E+04   -0.8075020E+03   -0.8072227E+03   -0.9006584E+03   -0.9004648E+03
  2       0.1777277E+04    0.1777489E+04   -0.8072227E+03   -0.8070942E+03   -0.9004592E+03   -0.9001179E+03
  3       0.1777440E+04    0.1777499E+04   -0.8070942E+03   -0.8071477E+03   -0.9001123E+03   -0.9001965E+03
  4       0.1777450E+04    0.1777547E+04   -0.8071477E+03   -0.8066279E+03   -0.9001909E+03   -0.8996641E+03
  5       0.1777490E+04    0.1777504E+04   -0.8066279E+03   -0.8067129E+03   -0.8996584E+03   -0.8994880E+03
  6       0.1777455E+04    0.1777315E+04   -0.8067129E+03   -0.8069265E+03   -0.8994024E+03   -0.8994363E+03
  7       0.1777266E+04    0.1777443E+04   -0.8069265E+03   -0.8071577E+03   -0.8994307E+03   -0.8997053E+03
  8       0.1777394E+04    0.1777328E+04   -0.8071577E+03   -0.8077461E+03   -0.8996995E+03   -0.9006643E+03
  9       0.1777279E+04    0.1777444E+04   -0.8077461E+03   -0.8079910E+03   -0.9006567E+03   -0.9009355E+03
 10       0.1777395E+04    0.1777573E+04   -0.8079910E+03   -0.8075020E+03   -0.9009297E+03   -0.9006641E+03


              247              248              249              250              251              252
  1      -0.2695498E+03   -0.2693064E+03    0.1280586E+04    0.1280962E+04    0.3853032E+04    0.3853320E+04
  2      -0.2693027E+03   -0.2689944E+03    0.1280988E+04    0.1281192E+04    0.3853240E+04    0.3853689E+04
  3      -0.2689907E+03   -0.2691033E+03    0.1281217E+04    0.1281147E+04    0.3853607E+04    0.3853400E+04
  4      -0.2690994E+03   -0.2688894E+03    0.1281173E+04    0.1281112E+04    0.3853320E+04    0.3853421E+04
  5      -0.2688555E+03   -0.2683420E+03    0.1281137E+04    0.1281321E+04    0.3853341E+04    0.3853460E+04
  6      -0.2683381E+03   -0.2686206E+03    0.1281347E+04    0.1281157E+04    0.3853378E+04    0.3853393E+04
  7      -0.2686169E+03   -0.2687124E+03    0.1281183E+04    0.1281159E+04    0.3853311E+04    0.3853408E+04
  8      -0.2687085E+03   -0.2689187E+03    0.1281185E+04    0.1281304E+04    0.3853326E+04    0.3853631E+04
  9      -0.2689148E+03   -0.2696572E+03    0.1281330E+04    0.1280598E+04    0.3853549E+04    0.3853088E+04
 10      -0.2696533E+03   -0.2695525E+03    0.1280624E+04    0.1280560E+04    0.3853006E+04    0.3853114E+04


              253              254              255              256              257              258
  1       0.1297393E+04   -0.5103970E+03    0.7305507E+02    0.1445758E+02   -0.4396410E+02    0.6302095E+02
  2       0.1297305E+04   -0.5100111E+03    0.7332742E+02    0.1446675E+02   -0.4406978E+02    0.6271101E+02
  3       0.1297339E+04   -0.5106267E+03    0.7332205E+02    0.1435944E+02   -0.4395447E+02    0.6295299E+02
  4       0.1297460E+04   -0.5108400E+03    0.7327991E+02    0.1446772E+02   -0.4356305E+02    0.6296165E+02
  5       0.1297047E+04   -0.5104287E+03    0.7303262E+02    0.1470520E+02   -0.4415283E+02    0.6327504E+02
  6       0.1297091E+04   -0.5102578E+03    0.7306329E+02    0.1439209E+02   -0.4420287E+02    0.6329617E+02
  7       0.1297324E+04   -0.5104292E+03    0.7329724E+02    0.1420812E+02   -0.4377484E+02    0.6305870E+02
  8       0.1297265E+04   -0.5105540E+03    0.7328560E+02    0.1440935E+02   -0.4399167E+02    0.6302208E+02
  9       0.1297477E+04   -0.5108684E+03    0.7333809E+02    0.1445106E+02   -0.4356311E+02    0.6291234E+02
 10       0.1297401E+04   -0.5103826E+03    0.7312265E+02    0.1464617E+02   -0.4411971E+02    0.6329575E+02


              259              260              261              262              263              264
  1      -0.7853645E+02    0.6197333E+02   -0.2195641E+03    0.1975739E+03    0.1297121E+04   -0.5104600E+03
  2      -0.7781422E+02    0.6170860E+02   -0.2196254E+03    0.1976006E+03    0.1297464E+04   -0.5108267E+03
  3      -0.7812631E+02    0.6156004E+02   -0.2195549E+03    0.1975695E+03    0.1297284E+04   -0.5105627E+03
  4      -0.7842233E+02    0.6155011E+02   -0.2195899E+03    0.1975444E+03    0.1297382E+04   -0.5105618E+03
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 5      -0.7825307E+02    0.6170695E+02   -0.2196659E+03    0.1976651E+03    0.1297096E+04   -0.5102363E+03
 6      -0.7803505E+02    0.6149091E+02   -0.2195487E+03    0.1974750E+03    0.1297182E+04   -0.5102585E+03
 7      -0.7818523E+02    0.6134657E+02   -0.2194896E+03    0.1976333E+03    0.1297377E+04   -0.5108096E+03
 8      -0.7816267E+02    0.6158902E+02   -0.2195551E+03    0.1975748E+03    0.1297358E+04   -0.5106909E+03
 9      -0.7838498E+02    0.6150208E+02   -0.2195149E+03    0.1974883E+03    0.1297618E+04   -0.5106335E+03
10      -0.7827837E+02    0.6170360E+02   -0.2196073E+03    0.1976134E+03    0.1297413E+04   -0.5103723E+03

              265              266              267              268              269              270
 1       0.7312682E+02    0.1456683E+02   -0.4403311E+02    0.6305716E+02   -0.7813693E+02    0.6146123E+02
 2       0.7331204E+02    0.1452685E+02   -0.4368423E+02    0.6289435E+02   -0.7842868E+02    0.6157678E+02
 3       0.7318265E+02    0.1456235E+02   -0.4406787E+02    0.6311139E+02   -0.7820541E+02    0.6158440E+02
 4       0.7335297E+02    0.1440772E+02   -0.4389229E+02    0.6283929E+02   -0.7779837E+02    0.6139886E+02
 5       0.7294507E+02    0.1452762E+02   -0.4397873E+02    0.6299280E+02   -0.7837717E+02    0.6176306E+02
 6       0.7308586E+02    0.1459380E+02   -0.4408560E+02    0.6317102E+02   -0.7823630E+02    0.6161017E+02
 7       0.7336897E+02    0.1442349E+02   -0.4362759E+02    0.6283435E+02   -0.7845262E+02    0.6152719E+02
 8       0.7325656E+02    0.1447274E+02   -0.4399498E+02    0.6304385E+02   -0.7813200E+02    0.6147005E+02
 9       0.7319247E+02    0.1426191E+02   -0.4380914E+02    0.6324080E+02   -0.7815855E+02    0.6150328E+02
10       0.7295488E+02    0.1446273E+02   -0.4429883E+02    0.6333638E+02   -0.7804147E+02    0.6149559E+02

              271              272              273              274              275              276
 1      -0.2196012E+03    0.1975419E+03   -0.6663147E+03    0.7289561E+03   -0.6041360E+02    0.9179178E+02
 2      -0.2195014E+03    0.1974874E+03   -0.6661320E+03    0.7286907E+03   -0.6017165E+02    0.9150964E+02
 3      -0.2195187E+03    0.1975934E+03   -0.6662532E+03    0.7288384E+03   -0.6026398E+02    0.9164200E+02
 4      -0.2194809E+03    0.1976267E+03   -0.6660740E+03    0.7287002E+03   -0.6017867E+02    0.9151645E+02
 5      -0.2193991E+03    0.1974370E+03   -0.6663398E+03    0.7289045E+03   -0.6026736E+02    0.9165912E+02
 6      -0.2195964E+03    0.1975376E+03   -0.6662615E+03    0.7288877E+03   -0.6051752E+02    0.9186166E+02
 7      -0.2195552E+03    0.1975460E+03   -0.6662661E+03    0.7287052E+03   -0.6030754E+02    0.9166757E+02
 8      -0.2195548E+03    0.1975517E+03   -0.6662908E+03    0.7288602E+03   -0.6033789E+02    0.9171913E+02
 9      -0.2195880E+03    0.1977067E+03   -0.6661697E+03    0.7288054E+03   -0.6029216E+02    0.9164156E+02
10      -0.2195036E+03    0.1975456E+03   -0.6663896E+03    0.7288691E+03   -0.6027431E+02    0.9160696E+02

              277              278              279              280              281              282
 1       0.4559537E+02   -0.1972923E+02    0.5403223E+02   -0.2863367E+02    0.4261401E+02   -0.1662843E+02
 2       0.4565215E+02   -0.1981084E+02    0.5414813E+02   -0.2872369E+02    0.4273062E+02   -0.1675891E+02
 3       0.4563380E+02   -0.1976936E+02    0.5413887E+02   -0.2872141E+02    0.4271690E+02   -0.1674402E+02
 4       0.4567340E+02   -0.1981270E+02    0.5412714E+02   -0.2873274E+02    0.4267055E+02   -0.1663039E+02
 5       0.4561665E+02   -0.1981210E+02    0.5425821E+02   -0.2880714E+02    0.4275302E+02   -0.1672169E+02
 6       0.4540021E+02   -0.1959041E+02    0.5394946E+02   -0.2856326E+02    0.4258931E+02   -0.1655830E+02
 7       0.4549417E+02   -0.1962582E+02    0.5399132E+02   -0.2861409E+02    0.4258347E+02   -0.1658539E+02
 8       0.4552419E+02   -0.1964136E+02    0.5399307E+02   -0.2860396E+02    0.4260779E+02   -0.1659818E+02
 9       0.4558867E+02   -0.1971339E+02    0.5405124E+02   -0.2862483E+02    0.4257300E+02   -0.1658339E+02
10       0.4569009E+02   -0.1981143E+02    0.5423286E+02   -0.2879315E+02    0.4265858E+02   -0.1669257E+02

              283              284              285              286              287              288
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  1     -0.6664387E+03     0.7289565E+03    -0.6044485E+02     0.9181160E+02     0.4545226E+02    -0.1962628E+02
  2     -0.6662444E+03     0.7288530E+03    -0.6035532E+02     0.9169052E+02     0.4558900E+02    -0.1972739E+02
  3     -0.6661838E+03     0.7287122E+03    -0.6029880E+02     0.9164926E+02     0.4556393E+02    -0.1974435E+02
  4     -0.6661631E+03     0.7286941E+03    -0.6024794E+02     0.9159792E+02     0.4564059E+02    -0.1978522E+02
  5     -0.6661401E+03     0.7287324E+03    -0.6041864E+02     0.9175943E+02     0.4554941E+02    -0.1965994E+02
  6     -0.6662400E+03     0.7287441E+03    -0.6027290E+02     0.9167526E+02     0.4560463E+02    -0.1977658E+02
  7     -0.6660813E+03     0.7286670E+03    -0.6024306E+02     0.9157176E+02     0.4565440E+02    -0.1981474E+02
  8     -0.6660735E+03     0.7286191E+03    -0.6015288E+02     0.9152063E+02     0.4570998E+02    -0.1988013E+02
  9     -0.6661145E+03     0.7286130E+03    -0.6007855E+02     0.9140314E+02     0.4582494E+02    -0.1996710E+02
 10     -0.6662263E+03     0.7288711E+03    -0.6037119E+02     0.9172490E+02     0.4562082E+02    -0.1972900E+02

             289               290               291               292               293
  1      0.5399512E+02    -0.2858011E+02     0.4244749E+02    -0.1647778E+02     0.2688164E+02
  2      0.5410033E+02    -0.2863336E+02     0.4261494E+02    -0.1658034E+02     0.2681480E+02
  3      0.5402737E+02    -0.2860896E+02     0.4260994E+02    -0.1657367E+02     0.2680255E+02
  4      0.5416133E+02    -0.2872490E+02     0.4271077E+02    -0.1672252E+02     0.2682529E+02
  5      0.5391333E+02    -0.2852866E+02     0.4246152E+02    -0.1642035E+02     0.2688490E+02
  6      0.5412735E+02    -0.2867456E+02     0.4255734E+02    -0.1657352E+02     0.2680490E+02
  7      0.5418639E+02    -0.2875790E+02     0.4259081E+02    -0.1661368E+02     0.2681395E+02
  8      0.5420955E+02    -0.2879176E+02     0.4275540E+02    -0.1674475E+02     0.2680255E+02
  9      0.5423285E+02    -0.2883476E+02     0.4279311E+02    -0.1679228E+02     0.2682962E+02
 10      0.5396790E+02    -0.2863191E+02     0.4257533E+02    -0.1655870E+02     0.2684154E+02
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                    MEMBER FORCES DECOMPOSED INTO X-Y-Z COMPONENTS
                               FOR SUBSTRUCTURE:      1

MEM.       X-DIR.        Y-DIR.        Z-DIR.        X-DIR.        Y-DIR.        Z-DIR.
NO.        NODE I        NODE I        NODE I        NODE J        NODE J        NODE J
   1      2550.46      -7849.62          0.00      -2550.46       7849.62          0.00
   2      -942.09       2899.46          0.00        942.09      -2899.46          0.00
   3      -942.01       2899.21          0.00        942.01      -2899.21          0.00
   4      1387.02      -4268.73          0.00      -1387.02       4268.73          0.00
   5      1398.54      -4304.21          0.00      -1398.54       4304.21          0.00
   6      1386.95      -4268.68          0.00      -1386.95       4268.68          0.00
   7      -590.50       1817.40          0.00        590.50      -1817.40          0.00
   8      -613.23       1887.28          0.00        613.23      -1887.28          0.00
   9      -613.18       1887.18          0.00        613.18      -1887.18          0.00
  10      -590.42       1817.15          0.00        590.42      -1817.15          0.00
  11      1254.25      -3860.25          0.00      -1254.25       3860.25          0.00
  12      1288.06      -3964.17          0.00      -1288.06       3964.17          0.00
  13      1299.29      -3998.89          0.00      -1299.29       3998.89          0.00
  14      1288.04      -3964.10          0.00      -1288.04       3964.10          0.00
  15      1254.21      -3860.03          0.00      -1254.21       3860.03          0.00
  16      -457.96       1409.45          0.00        457.96      -1409.45          0.00
  17      -502.75       1547.31          0.00        502.75      -1547.31          0.00
  18      -525.17       1616.27          0.00        525.17      -1616.27          0.00
  19      -525.16       1616.28          0.00        525.16      -1616.28          0.00
  20      -502.74       1547.27          0.00        502.74      -1547.27          0.00
  21      -457.90       1409.28          0.00        457.90      -1409.28          0.00
  22      1212.19      -3730.94          0.00      -1212.19       3730.94          0.00
  23      1268.02      -3902.63          0.00      -1268.02       3902.63          0.00
  24      1301.53      -4005.64          0.00      -1301.53       4005.64          0.00
  25      1312.64      -4039.95          0.00      -1312.64       4039.95          0.00
  26      1301.53      -4005.66          0.00      -1301.53       4005.66          0.00
  27      1267.94      -3902.38          0.00      -1267.94       3902.38          0.00
  28      1212.13      -3730.51          0.00      -1212.13       3730.51          0.00
  29      -315.83        971.93          0.00        315.83       -971.93          0.00
  30      -380.44       1170.75          0.00        380.44      -1170.75          0.00
  31      -425.69       1310.48          0.00        425.69      -1310.48          0.00
  32      -450.77       1387.19          0.00        450.77      -1387.19          0.00
  33      -450.77       1387.16          0.00        450.77      -1387.16          0.00
  34      -425.70       1310.25          0.00        425.70      -1310.25          0.00
  35      -380.28       1170.41          0.00        380.28      -1170.41          0.00
  36      -315.69        971.61          0.00        315.69       -971.61          0.00
  37      1194.60      -3676.49          0.00      -1194.60       3676.49          0.00
  38      1204.95      -3708.34          0.00      -1204.95       3708.34          0.00
  39      1256.96      -3868.46          0.00      -1256.96       3868.46          0.00
  40      1294.69      -3985.97          0.00      -1294.69       3985.97          0.00
  41      1293.40      -3980.55          0.00      -1293.40       3980.55          0.00
  42      1295.13      -3985.88          0.00      -1295.13       3985.88          0.00
  43      1257.01      -3868.54          0.00      -1257.01       3868.54          0.00
  44      1204.90      -3708.23          0.00      -1204.90       3708.23          0.00
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45     1194.57    -3676.43       0.00    -1194.57     3676.43       0.00
46     -144.91      445.95       0.00      144.91     -445.95       0.00
47     -190.41      585.95       0.00      190.41     -585.95       0.00
48     -244.97      754.13       0.00      244.97     -754.13       0.00
49     -289.73      891.62       0.00      289.73     -891.62       0.00
50     -312.21      960.77       0.00      312.21     -960.77       0.00
51     -312.11      960.82       0.00      312.11     -960.82       0.00
52     -289.70      891.53       0.00      289.70     -891.53       0.00
53     -245.03      754.04       0.00      245.03     -754.04       0.00
54     -190.37      585.85       0.00      190.37     -585.85       0.00
55     -144.82      445.83       0.00      144.82     -445.83       0.00
56      841.32    -2589.20       0.00     -841.32     2589.20       0.00
57     1069.94    -3293.98       0.00    -1069.94     3293.98       0.00
58     1163.04    -3579.36       0.00    -1163.04     3579.36       0.00
59     1216.03    -3742.42       0.00    -1216.03     3742.42       0.00
60     1243.86    -3828.05       0.00    -1243.86     3828.05       0.00
61     1235.44    -3802.16       0.00    -1235.44     3802.16       0.00
62     1243.86    -3828.05       0.00    -1243.86     3828.05       0.00
63     1215.93    -3742.12       0.00    -1215.93     3742.12       0.00
64     1162.96    -3579.12       0.00    -1162.96     3579.12       0.00
65     1070.21    -3293.60       0.00    -1070.21     3293.60       0.00
66      841.24    -2589.01       0.00     -841.24     2589.01       0.00
67      258.50     -795.42       0.00     -258.50      795.42       0.00
68       33.35     -102.67       0.00      -33.35      102.67       0.00
69      -34.85      107.27       0.00       34.85     -107.27       0.00
70      -70.04      215.51       0.00       70.04     -215.51       0.00
71      -89.14      274.39       0.00       89.14     -274.39       0.00
72      -97.88      301.30       0.00       97.88     -301.30       0.00
73      -97.91      301.26       0.00       97.91     -301.26       0.00
74      -89.12      274.31       0.00       89.12     -274.31       0.00
75      -69.99      215.37       0.00       69.99     -215.37       0.00
76      -34.82      107.17       0.00       34.82     -107.17       0.00
77       33.43     -102.89       0.00      -33.43      102.89       0.00
78      258.55     -795.56       0.00     -258.55      795.56       0.00
79       61.66        0.00    -132.22      -61.66        0.00     132.22
80       -0.28       -0.21       0.75        0.28        0.21      -0.75
81       -0.42        0.01       0.90        0.42       -0.01      -0.90
82      -49.69      -36.10     131.73       49.69       36.10    -131.73
83     -120.40        0.00    -258.19      120.40        0.00     258.19
84      -47.17      -35.30    -125.76       47.17       35.30     125.76
85       -0.01        0.00      -0.02        0.01        0.00       0.02
86        0.07        0.05       0.19       -0.07       -0.05      -0.19
87       58.95       -0.83     125.83      -58.95        0.83    -125.83
88       97.39       70.75     258.14      -97.39      -70.75    -258.14
89      237.35        0.00    -509.00     -237.35        0.00     509.00
90       47.17       35.04    -125.56      -47.17      -35.04     125.56
91       58.63       -0.21    -125.58      -58.63        0.21     125.58
92       -0.03       -0.02       0.07        0.03        0.02      -0.07
93       -0.13        0.00       0.28        0.13        0.00      -0.28
94      -47.39      -34.68     125.79       47.39       34.68    -125.79
95      -58.90        0.62     125.89       58.90       -0.62    -125.89
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96	-192.22	-139.65	509.52	192.22	139.65	-509.52
97	-353.54	0.00	-758.17	353.54	0.00	758.17
98	-93.60	-69.22	-248.96	93.60	69.22	248.96
99	-58.08	0.12	-124.47	58.08	-0.12	124.47
100	-46.85	-34.49	-124.50	46.85	34.49	124.50
101	0.05	0.00	0.11	-0.05	0.00	-0.11
102	0.02	0.02	0.06	-0.02	-0.02	-0.06
103	58.27	-0.37	124.70	-58.27	0.37	-124.70
104	47.03	34.32	124.77	-47.03	-34.32	-124.77
105	116.53	-0.99	249.22	-116.53	0.99	-249.22
106	285.96	207.77	758.02	-285.96	-207.77	-758.02
107	527.86	0.00	-1131.99	-527.86	0.00	1131.99
108	93.59	69.01	-248.80	-93.59	-69.01	248.80
109	116.21	-0.16	-249.09	-116.21	0.16	249.09
110	46.89	34.47	-124.57	-46.89	-34.47	124.57
111	58.05	-0.16	-124.36	-58.05	0.16	124.36
112	0.04	0.03	-0.10	-0.04	-0.03	0.10
113	-0.05	0.00	0.10	0.05	0.00	-0.10
114	-46.96	-34.33	124.64	46.96	34.33	-124.64
115	-58.28	0.33	124.75	58.28	-0.33	-124.75
116	-93.92	-68.44	249.11	93.92	68.44	-249.11
117	-116.42	0.82	249.09	116.42	-0.82	-249.09
118	-426.93	-310.18	1131.68	426.93	310.18	-1131.68
119	-701.28	0.00	-1503.93	701.28	0.00	1503.93
120	-139.94	-102.97	-371.85	139.94	102.97	371.85
121	-115.55	0.12	-247.71	115.55	-0.12	247.71
122	-93.38	-68.57	-248.04	93.38	68.57	248.04
123	-57.94	0.12	-124.18	57.94	-0.12	124.18
124	-46.65	-34.18	-123.86	46.65	34.18	123.86
125	-0.04	0.00	-0.09	0.04	0.00	0.09
126	0.05	0.04	0.14	-0.05	-0.04	-0.14
127	57.87	-0.23	123.95	-57.87	0.23	-123.95
128	46.77	34.13	124.09	-46.77	-34.13	-124.09
129	115.98	-0.58	248.30	-115.98	0.58	-248.30
130	93.61	68.15	248.22	-93.61	-68.15	-248.22
131	173.90	-1.05	372.20	-173.90	1.05	-372.20
132	567.40	412.24	1504.03	-567.40	-412.24	-1504.03
133	932.80	0.00	-2000.32	-932.80	0.00	2000.32
134	140.05	102.89	-372.01	-140.05	-102.89	372.01
135	173.59	-0.13	-372.17	-173.59	0.13	372.17
136	93.41	68.52	-248.08	-93.41	-68.52	248.08
137	115.57	-0.18	-247.73	-115.57	0.18	247.73
138	46.68	34.19	-123.93	-46.68	-34.19	123.93
139	57.79	-0.13	-123.84	-57.79	0.13	123.84
140	-0.06	-0.05	0.17	0.06	0.05	-0.17
141	0.01	0.00	-0.03	-0.01	0.00	0.03
142	-46.77	-34.14	124.09	46.77	34.14	-124.09
143	-57.99	0.22	124.21	57.99	-0.22	-124.21
144	-93.71	-68.30	248.56	93.71	68.30	-248.56
145	-115.96	0.53	248.31	115.96	-0.53	-248.31
146	-140.41	-102.17	372.30	140.41	102.17	-372.30

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147     -173.93      0.92     372.35     173.93     -0.92    -372.35
148     -754.65   -548.28    2000.40     754.65    548.28   -2000.40
149     -935.34      0.00   -2005.92     935.34      0.00    2005.92
150       -2.16     -1.58      -5.73       2.16      1.58       5.73
151     -161.72      0.10    -346.75     161.72     -0.10     346.75
152     -130.59    -95.71    -346.75     130.59     95.71     346.75
153     -119.92      0.14    -257.07     119.92     -0.14     257.07
154      -96.82    -70.87    -257.02      96.82     70.87     257.02
155      -71.83      0.13    -153.96      71.83     -0.13     153.96
156      -57.89    -42.32    -153.64      57.89     42.32     153.64
157        0.12      0.00       0.25      -0.12      0.00      -0.25
158        0.00      0.00       0.01       0.00      0.00      -0.01
159       71.84     -0.21     153.92     -71.84      0.21    -153.92
160       58.00     42.30     153.85     -58.00    -42.30    -153.85
161      120.05     -0.42     257.15    -120.05      0.42    -257.15
162       96.88     70.56     256.91     -96.88    -70.56    -256.91
163      161.84     -0.67     346.60    -161.84      0.67    -346.60
164      130.75     95.11     346.66    -130.75    -95.11    -346.66
165        2.61     -0.01       5.59      -2.61      0.01      -5.59
166      756.60    549.71    2005.57    -756.60   -549.71   -2005.57
167     1024.24      0.00   -2196.42   -1024.24      0.00    2196.42
168       25.19     18.46     -66.88     -25.19    -18.46      66.88
169      363.95     -0.17    -780.36    -363.95      0.17     780.36
170       72.22     52.89    -191.72     -72.22    -52.89     191.72
171      159.21     -0.15    -341.33    -159.21      0.15     341.33
172       69.08     50.53    -183.33     -69.08    -50.53     183.33
173      104.16     -0.15    -223.26    -104.16      0.15     223.26
174       29.77     21.76     -79.00     -29.77    -21.76      79.00
175       45.02     -0.08     -96.49     -45.02      0.08      96.49
176        0.86      0.62      -2.27      -0.86     -0.62       2.27
177       -1.28      0.00       2.75       1.28      0.00      -2.75
178      -36.39    -26.55      96.54      36.39     26.55     -96.54
179      -36.90      0.10      79.06      36.90     -0.10     -79.06
180      -84.24    -61.38     223.42      84.24     61.38    -223.42
181      -85.75      0.28     183.69      85.75     -0.28    -183.69
182     -128.76    -93.74     341.45     128.76     93.74    -341.45
183      -89.58      0.34     191.86      89.58     -0.34    -191.86
184     -294.35   -214.08     780.43     294.35    214.08    -780.43
185      -31.25      0.13      66.93      31.25     -0.13     -66.93
186     -828.69   -602.06    2196.61     828.69    602.06   -2196.61
187    -1209.40      0.00   -2593.67    1209.40      0.00    2593.67
188     -149.58   -109.57    -397.14     149.58    109.57     397.14
189     -569.75      0.22   -1221.71     569.75     -0.22    1221.71
190     -191.48   -140.13    -508.26     191.48    140.13     508.26
191     -240.63      0.19    -515.87     240.63     -0.19     515.87
192     -137.97   -100.89    -366.15     137.97    100.89     366.15
193     -136.90      0.16    -293.47     136.90     -0.16     293.47
194      -95.60    -69.85    -253.69      95.60     69.85     253.69
195      -65.79      0.10    -141.02      65.79     -0.10     141.02
196      -46.57    -34.00    -123.57      46.57     34.00     123.57
197        1.32      0.00       2.83      -1.32      0.00      -2.83
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198      -1.02      -0.74     -2.69      1.02      0.74      2.69
199      57.75      -0.13    123.76    -57.75      0.13   -123.76
200      53.20      38.78    141.11    -53.20    -38.78   -141.11
201     118.43      -0.32    253.76   -118.43      0.32   -253.76
202     110.78      80.68    293.78   -110.78    -80.68   -293.78
203     170.93      -0.53    366.20   -170.93      0.53   -366.20
204     194.57     141.60    515.93   -194.57   -141.60   -515.93
205     237.35      -0.82    508.43   -237.35      0.82   -508.43
206     460.81     335.07   1221.68   -460.81   -335.07  -1221.68
207     185.48      -0.72    397.28   -185.48      0.72   -397.28
208     978.33     710.85   2593.49   -978.33   -710.85  -2593.49
209    2072.18       0.00  -4443.66  -2072.18      0.00   4443.66
210     662.70     485.07  -1759.18   -662.70   -485.07   1759.18
211     792.19      -0.25  -1698.68   -792.19      0.25   1698.68
212     261.07     190.96   -692.91   -261.07   -190.96    692.91
213     294.93      -0.19   -632.37   -294.93      0.19    632.37
214     167.13     122.17   -443.55   -167.13   -122.17    443.55
215     178.67      -0.17   -383.05   -178.67      0.17    383.05
216     103.44      75.56   -274.48   -103.44    -75.56    274.48
217      99.83      -0.13   -214.00    -99.83      0.13    214.00
218      54.87      40.05   -145.57    -54.87    -40.05    145.57
219      39.70      -0.06    -85.08    -39.70      0.06     85.08
220      11.38       8.30    -30.19    -11.38     -8.30     30.19
221     -14.13       0.03     30.29     14.13     -0.03    -30.29
222     -32.07     -23.38     85.05     32.07     23.38    -85.05
223     -67.92       0.15    145.56     67.92     -0.15   -145.56
224     -80.72     -58.80    214.07     80.72     58.80   -214.07
225    -128.15       0.33    274.58    128.15     -0.33   -274.58
226    -144.49    -105.20    383.17    144.49    105.20   -383.17
227    -207.08       0.60    443.67    207.08     -0.60   -443.67
228    -238.53    -173.53    632.44    238.53    173.53   -632.44
229    -323.46       1.04    692.92    323.46     -1.04   -692.92
230    -640.77    -465.83   1698.64    640.77    465.83  -1698.64
231    -821.29       2.91   1759.14    821.29     -2.91  -1759.14
232   -1676.21   -1217.82   4443.14   1676.21   1217.82  -4443.14
233   -2488.87       0.00      0.00   2488.87      0.00      0.00
234   -2013.61   -1462.98      0.00   2013.61   1462.98      0.00
235   -3565.22       0.00      0.00   3565.22      0.00      0.00
236   -2884.22   -2095.51      0.00   2884.22   2095.51      0.00
237   -4032.04       0.00      0.00   4032.04      0.00      0.00
238   -3261.76   -2369.80      0.00   3261.76   2369.80      0.00
239   -3750.37       0.00      0.00   3750.37      0.00      0.00
240   -3033.72   -2204.12      0.00   3033.72   2204.12      0.00
241   -1777.52       0.00      0.00   1777.52      0.00      0.00
242   -1437.88   -1044.70      0.00   1437.88   1044.70      0.00
243     807.50       0.00      0.00   -807.50      0.00      0.00
244     653.06     474.47      0.00   -653.06   -474.47      0.00
245     900.66       0.00      0.00   -900.66      0.00      0.00
246     728.49     529.28      0.00   -728.49   -529.28      0.00
247     269.55       0.00      0.00   -269.55      0.00      0.00
248     217.87     158.29      0.00   -217.87   -158.29      0.00
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249	-1280.59	0.00	0.00	1280.59	0.00	0.00
250	-1036.32	-752.93	0.00	1036.32	752.93	0.00
251	-3853.03	0.00	0.00	3853.03	0.00	0.00
252	-3117.37	-2264.97	0.00	3117.37	2264.97	0.00
253	-1233.03	-403.55	0.00	1233.[illegible]3	403.55	0.00
254	-510.40	0.22	0.00	510.40	-0.22	0.00
255	-69.44	-22.69	0.00	69.44	22.69	0.00
256	14.46	-0.01	0.00	-14.46	0.01	0.00
257	41.80	13.63	0.00	-41.80	-13.63	0.00
258	63.02	-0.08	0.00	-63.02	0.08	0.00
259	74.68	24.32	0.00	-74.68	-24.32	0.00
260	61.97	-0.11	0.00	-61.97	0.11	0.00
261	208.80	67.90	0.00	-208.80	-67.90	0.00
262	197.57	-0.42	0.00	-197.57	0.42	0.00
263	-1234.49	-398.20	0.00	1234.49	398.20	0.00
264	-412.84	-300.22	0.00	412.84	300.22	0.00
265	-69.58	-22.48	0.00	69.58	22.48	0.00
266	11.78	8.57	0.00	-11.78	-8.57	0.00
267	41.89	13.56	0.00	-41.89	-13.56	0.00
268	50.97	37.13	0.00	-50.97	-37.13	0.00
269	74.33	24.09	0.00	-74.33	-24.09	0.00
270	49.66	36.21	0.00	-49.66	-36.21	0.00
271	208.87	67.81	0.00	-208.87	-67.81	0.00
272	159.56	116.46	0.00	-159.56	-116.46	0.00
273	633.30	207.15	0.00	-633.30	-207.15	0.00
274	728.96	-0.26	0.00	-728.96	0.26	0.00
275	-57.43	-18.76	0.00	57.43	18.76	0.00
276	91.79	-0.07	0.00	-91.79	0.07	0.00
277	43.35	14.14	0.00	-43.35	-14.14	0.00
278	-19.73	0.02	0.00	19.73	-0.02	0.00
279	51.37	16.74	0.00	-51.37	-16.74	0.00
280	-28.63	0.04	0.00	28.63	-0.04	0.00
281	40.52	13.18	0.00	-40.52	-13.18	0.00
282	-16.63	0.03	0.00	16.63	-0.03	0.00
283	634.22	204.70	0.00	-634.22	-204.70	0.00
284	589.59	428.67	0.00	-589.59	-428.67	0.00
285	57.52	18.59	0.00	-57.52	-18.59	0.00
286	74.24	54.02	0.00	-74.24	-54.02	0.00
287	-43.24	-13.99	0.00	43.24	13.99	0.00
288	-15.87	-11.55	0.00	15.87	11.55	0.00
289	-51.37	-16.65	0.00	51.37	16.65	0.00
290	-23.10	-16.83	0.00	23.10	16.83	0.00
291	-40.37	-13.10	0.00	40.37	13.10	0.00
292	-13.31	-9.71	0.00	13.31	9.71	0.00
293	25.57	8.31	0.00	-25.57	-8.31	0.00

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               MEMBER FORCES DECOMPOSED INTO X-Y-Z COMPONENTS
                          FOR SUBSTRUCTURE:      2

MEM.     X-DIR.      Y-DIR.      Z-DIR.      X-DIR.      Y-DIR.      Z-DIR.
NO.      NODE I      NODE I      NODE I      NODE J      NODE J      NODE J
  1     6677.25    -4851.30        0.00    -6677.25     4851.30        0.00
  2    -2465.91     1791.59        0.00     2465.91    -1791.59        0.00
  3    -2465.45     1791.27        0.00     2465.45    -1791.27        0.00
  4     3630.96    -2638.00        0.00    -3630.96     2638.00        0.00
  5     3661.01    -2659.92        0.00    -3661.01     2659.92        0.00
  6     3630.65    -2637.78        0.00    -3630.65     2637.78        0.00
  7    -1545.95     1123.20        0.00     1545.95    -1123.20        0.00
  8    -1605.27     1166.30        0.00     1605.27    -1166.30        0.00
  9    -1605.20     1166.24        0.00     1605.20    -1166.24        0.00
 10    -1545.67     1123.01        0.00     1545.67    -1123.01        0.00
 11     3283.53    -2385.60        0.00    -3283.53     2385.60        0.00
 12     3371.98    -2449.91        0.00    -3371.98     2449.91        0.00
 13     3401.44    -2471.31        0.00    -3401.44     2471.31        0.00
 14     3371.97    -2449.85        0.00    -3371.97     2449.85        0.00
 15     3283.40    -2385.52        0.00    -3283.40     2385.52        0.00
 16    -1198.64      870.86        0.00     1198.64     -870.86        0.00
 17    -1315.94      956.10        0.00     1315.94     -956.10        0.00
 18    -1374.58      998.69        0.00     1374.58     -998.69        0.00
 19    -1374.52      998.64        0.00     1374.52     -998.64        0.00
 20    -1315.88      956.04        0.00     1315.88     -956.04        0.00
 21    -1198.47      870.73        0.00     1198.47     -870.73        0.00
 22     3174.00    -2306.05        0.00    -3174.00     2306.05        0.00
 23     3319.90    -2411.99        0.00    -3319.90     2411.99        0.00
 24     3407.45    -2475.69        0.00    -3407.45     2475.69        0.00
 25     3436.86    -2497.03        0.00    -3436.86     2497.03        0.00
 26     3407.42    -2475.63        0.00    -3407.42     2475.63        0.00
 27     3319.82    -2411.99        0.00    -3319.82     2411.99        0.00
 28     3173.47    -2305.66        0.00    -3173.47     2305.66        0.00
 29     -826.48      600.47        0.00      826.48     -600.47        0.00
 30     -995.61      723.35        0.00      995.61     -723.35        0.00
 31    -1114.57      809.80        0.00     1114.57     -809.80        0.00
 32    -1179.87      857.22        0.00     1179.87     -857.22        0.00
 33    -1179.75      857.14        0.00     1179.75     -857.14        0.00
 34    -1114.44      809.66        0.00     1114.44     -809.66        0.00
 35     -995.66      723.42        0.00      995.66     -723.42        0.00
 36     -826.41      600.45        0.00      826.41     -600.45        0.00
 37     3127.19    -2271.99        0.00    -3127.19     2271.99        0.00
 38     3153.99    -2291.53        0.00    -3153.99     2291.53        0.00
 39     3290.26    -2390.50        0.00    -3290.26     2390.50        0.00
 40     3390.24    -2463.13        0.00    -3390.24     2463.13        0.00
 41     3385.65    -2459.89        0.00    -3385.65     2459.89        0.00
 42     3389.88    -2462.68        0.00    -3389.88     2462.68        0.00
 43     3290.75    -2391.12        0.00    -3290.75     2391.12        0.00
 44     3154.04    -2291.35        0.00    -3154.04     2291.35        0.00
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45     3127.40   -2272.43      0.00   -3127.40    2272.43      0.00
46     -379.18     275.50      0.00     379.18    -275.50      0.00
47     -498.32     362.05      0.00     498.32    -362.05      0.00
48     -641.53     466.07      0.00     641.53    -466.07      0.00
49     -758.36     550.96      0.00     758.36    -550.96      0.00
50     -817.35     593.93      0.00     817.35    -593.93      0.00
51     -817.38     593.84      0.00     817.38    -593.84      0.00
52     -758.34     550.95      0.00     758.34    -550.95      0.00
53     -641.48     466.04      0.00     641.48    -466.04      0.00
54     -498.32     362.03      0.00     498.32    -362.03      0.00
55     -379.29     275.61      0.00     379.29    -275.61      0.00
56     2201.98   -1599.90      0.00   -2201.98    1599.90      0.00
57     2801.77   -2035.76      0.00   -2801.77    2035.76      0.00
58     3044.27   -2211.96      0.00   -3044.27    2211.96      0.00
59     3183.69   -2312.51      0.00   -3183.69    2312.51      0.00
60     3256.01   -2365.87      0.00   -3256.01    2365.87      0.00
61     3234.17   -2349.89      0.00   -3234.17    2349.89      0.00
62     3256.37   -2365.97      0.00   -3256.37    2365.97      0.00
63     3182.75   -2312.08      0.00   -3182.75    2312.08      0.00
64     3044.46   -2212.01      0.00   -3044.46    2212.01      0.00
65     2801.65   -2035.62      0.00   -2801.65    2035.62      0.00
66     2202.15   -1600.01      0.00   -2202.15    1600.01      0.00
67      676.29    -491.38      0.00    -676.29     491.38      0.00
68       87.17     -63.34      0.00     -87.17      63.34      0.00
69      -91.34      66.36      0.00      91.34     -66.36      0.00
70     -183.23     133.13      0.00     183.23    -133.13      0.00
71     -233.30     169.48      0.00     233.30    -169.48      0.00
72     -256.17     186.12      0.00     256.17    -186.12      0.00
73     -256.19     186.13      0.00     256.19    -186.13      0.00
74     -233.32     169.52      0.00     233.32    -169.52      0.00
75     -183.19     133.10      0.00     183.19    -133.10      0.00
76      -91.20      66.26      0.00      91.20     -66.26      0.00
77       87.45     -63.53      0.00     -87.45      63.53      0.00
78      676.63    -491.60      0.00    -676.63     491.60      0.00
79       49.69      36.10   -131.73     -49.69     -36.10    131.73
80       -0.15      -0.51      1.13       0.15       0.51     -1.13
81       -0.44      -0.30      1.13       0.44       0.30     -1.13
82      -19.10     -58.77    132.52      19.10      58.77   -132.52
83      -97.39     -70.75   -258.14      97.39      70.75    258.14
84      -17.36     -56.12   -125.38       7.36      56.12    125.38
85        0.18       0.13      0.48      -0.18      -0.13     -0.48
86        0.08       0.25      0.56      -0.08      -0.25     -0.56
87       48.36      34.10    126.30     -48.36     -34.10   -126.30
88       37.13     114.26    257.65     -37.13    -114.26   -257.65
89      192.22     139.65   -509.52    -192.22    -139.65    509.52
90       17.55      56.03   -125.47     -17.55     -56.03    125.47
91       47.62      34.34   -125.75     -47.62     -34.34    125.75
92        0.00       0.00      0.01       0.00       0.00     -0.01
93       -0.12      -0.09      0.32       0.12       0.09     -0.32
94      -18.01     -56.11    126.23      18.01      56.11   -126.23
95      -48.10     -34.18    126.10      48.10      34.18   -126.10
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96	-73.32	-225.64	508.78	73.32	225.64	-508.78
97	-285.96	-207.77	-758.02	285.96	207.77	758.02
98	-35.07	-111.14	-249.24	35.07	111.14	249.24
99	-46.99	-33.99	-124.28	46.99	33.99	124.28
100	-17.65	-55.51	-124.64	17.65	55.51	124.64
101	-0.02	-0.01	-0.05	0.02	0.01	0.05
102	0.03	0.10	0.23	-0.03	-0.10	-0.23
103	47.33	33.93	124.61	-47.33	-33.93	-124.61
104	17.85	55.34	124.60	-17.85	-55.34	-124.60
105	94.79	67.65	249.04	-94.79	-67.65	-249.04
106	109.29	336.36	758.46	-109.29	-336.36	-758.46
107	426.93	310.18	-1131.68	-426.93	-310.18	1131.68
108	35.22	111.05	-249.25	-35.22	-111.05	249.25
109	94.06	68.13	-248.95	-94.06	-68.13	248.95
110	17.65	55.39	-124.44	-17.65	-55.39	124.44
111	47.13	34.04	-124.57	-47.13	-34.04	124.57
112	-0.02	-0.05	0.12	0.02	0.05	-0.12
113	0.01	0.01	-0.03	-0.01	-0.01	0.03
114	-17.82	-55.36	124.61	17.82	55.36	-124.61
115	-47.33	-33.98	124.71	47.33	33.98	-124.71
116	-35.75	-110.55	249.04	35.75	110.55	-249.04
117	-94.67	-67.77	249.10	94.67	67.77	-249.10
118	-163.08	-501.91	1131.75	163.08	501.91	-1131.75
119	-567.40	-412.24	-1504.04	567.40	412.24	1504.04
120	-52.68	-165.54	-371.80	52.68	165.54	371.80
121	-93.70	-67.94	-248.12	93.70	67.94	248.12
122	-35.20	-110.21	-247.71	35.20	110.21	247.71
123	-46.82	-33.88	-123.86	46.82	33.88	123.86
124	-17.66	-55.12	-123.97	17.66	55.12	123.97
125	-0.01	0.00	-0.01	0.01	0.00	0.01
126	0.00	-0.01	-0.03	0.00	0.01	0.03
127	46.95	33.82	123.93	-46.95	-33.82	-123.93
128	17.79	55.12	124.14	-17.79	-55.12	-124.14
129	94.07	67.63	248.05	-94.07	-67.63	-248.05
130	35.64	110.05	247.99	-35.64	-110.05	-247.99
131	141.29	101.35	372.16	-141.29	-101.35	-372.16
132	216.70	666.94	1503.85	-216.70	-666.94	-1503.85
133	754.64	548.27	-2000.37	-754.64	-548.27	2000.37
134	52.84	165.60	-372.13	-52.84	-165.60	372.13
135	140.54	101.95	-372.24	-140.54	-101.95	372.24
136	35.30	110.34	-248.06	-35.30	-110.34	248.06
137	93.68	67.84	-247.92	-93.68	-67.84	247.92
138	17.70	55.17	-124.10	-17.70	-55.17	124.10
139	46.84	33.87	-123.88	-46.84	-33.87	123.88
140	-0.05	-0.15	0.34	0.05	0.15	-0.34
141	-0.02	-0.02	0.06	0.02	0.02	-0.06
142	-17.79	-55.17	124.22	17.79	55.17	-124.22
143	-47.03	-33.90	124.18	47.03	33.90	-124.18
144	-35.66	-110.33	248.53	35.66	110.33	-248.53
145	-94.03	-67.66	248.06	94.03	67.66	-248.06
146	-53.53	-165.17	372.25	53.53	165.17	-372.25

147	-141.22	-101.46	372.25	141.22	101.46	-372.25
148	-288.22	-887.08	2000.19	288.22	887.08	-2000.19
149	-756.62	-549.72	-2005.61	756.62	549.72	2005.61
150	-0.82	-2.57	-5.78	0.82	2.57	5.78
151	-130.91	-95.00	-346.80	130.91	95.00	346.80
152	-49.42	-154.27	-346.92	49.42	154.27	346.92
153	-97.11	-70.38	-257.10	97.11	70.38	257.10
154	-36.68	-114.28	-257.08	36.68	114.28	257.08
155	-58.27	-42.18	-154.18	58.27	42.18	154.18
156	-21.98	-68.33	-153.79	21.98	68.33	153.79
157	0.04	0.03	0.11	-0.04	-0.03	-0.11
158	-0.01	-0.04	-0.09	0.01	0.04	0.09
159	58.13	41.97	153.61	-58.13	-41.97	-153.61
160	22.04	68.23	153.67	-22.04	-68.23	-153.67
161	97.35	70.21	257.11	-97.35	-70.21	-257.11
162	36.90	114.04	256.94	-36.90	-114.04	-256.94
163	131.29	94.56	346.50	-131.29	-94.56	-346.50
164	49.89	153.85	346.79	-49.89	-153.85	-346.79
165	2.21	1.59	5.83	-2.21	-1.59	-5.83
166	289.05	889.60	2005.93	-289.05	-889.60	-2005.93
167	828.68	602.06	-2196.59	-828.68	-602.06	2196.59
168	9.50	29.66	-66.70	-9.50	-29.66	66.70
169	294.42	213.69	-780.02	-294.42	-213.69	780.02
170	27.32	85.18	-191.59	-27.32	-85.18	191.59
171	128.94	93.49	-341.45	-128.94	-93.49	341.45
172	26.17	81.47	-183.30	-26.17	-81.47	183.30
173	84.32	61.08	-223.19	-84.32	-61.08	223.19
174	11.30	35.10	-79.00	-11.30	-35.10	79.00
175	36.41	26.35	-96.33	-36.41	-26.35	96.33
176	0.36	1.12	-2.51	-0.36	-1.12	2.51
177	-1.03	-0.74	2.72	1.03	0.74	-2.72
178	-13.81	-42.79	96.36	13.81	42.79	-96.36
179	-29.88	-21.58	78.97	29.88	21.58	-78.97
180	-32.06	-99.15	223.37	32.06	99.15	-223.37
181	-69.44	-50.10	183.43	69.44	50.10	-183.43
182	-49.05	-151.44	341.29	49.05	151.44	-341.29
183	-72.66	-52.38	191.85	72.66	52.38	-191.85
184	-112.30	-346.17	780.33	112.30	346.17	-780.33
185	-25.44	-18.32	67.14	25.44	18.32	-67.14
186	-316.51	-974.11	2196.48	316.51	974.11	-2196.48
187	-978.33	-710.85	-2593.48	978.33	710.85	2593.48
188	-56.62	-176.61	-397.23	56.62	176.61	397.23
189	-461.09	-334.74	-1221.80	461.09	334.74	1221.80
190	-72.54	-225.93	-508.29	72.54	225.93	508.29
191	-194.67	-141.21	-515.61	194.67	141.21	515.61
192	-52.33	-162.76	-366.25	52.33	162.76	366.25
193	-110.87	-80.36	-293.51	110.87	80.36	293.51
194	-36.31	-112.80	-253.90	36.31	112.80	253.90
195	-53.22	-38.54	-140.84	53.22	38.54	140.84
196	-17.72	-54.96	-123.74	17.72	54.96	123.74
197	1.05	0.76	2.78	-1.05	-0.76	-2.78

198	-0.40	-1.24	-2.79	0.40	1.24	2.79
199	46.81	33.85	123.79	-46.81	-33.85	-123.79
200	20.22	62.57	140.95	-20.22	-62.57	-140.95
201	96.03	69.38	253.84	-96.03	-69.38	-253.84
202	42.16	130.25	293.49	-42.16	-130.25	-293.49
203	138.59	100.04	366.18	-138.59	-100.04	-366.18
204	74.20	228.95	516.00	-74.20	-228.95	-516.00
205	192.47	138.82	508.34	-192.47	-138.82	-508.34
206	175.89	542.05	1221.90	-175.89	-542.05	-1221.90
207	150.49	108.45	397.31	-150.49	-108.45	-397.31
208	373.73	1150.21	2593.57	-373.73	-1150.21	-2593.57
209	1676.20	1217.81	-4443.10	-1676.20	-1217.81	4443.10
210	251.03	781.92	-1759.06	-251.03	-781.92	1759.06
211	641.00	465.40	-1698.52	-641.00	-465.40	1698.52
212	98.96	307.89	-692.79	-98.96	-307.89	692.79
213	238.69	173.18	-632.25	-238.69	-173.18	632.25
214	63.39	197.06	-443.51	-63.39	-197.06	443.51
215	144.61	104.86	-382.96	-144.61	-104.86	382.96
216	39.24	121.85	-274.30	-39.24	-121.85	274.30
217	80.77	50.52	-213.79	-80.77	-50.52	213.79
218	20.84	64.63	-145.53	-20.84	-64.63	145.53
219	32.12	23.26	-85.00	-32.12	-23.26	85.00
220	4.34	13.44	-30.27	-4.34	-13.44	30.27
221	-11.43	-8.27	30.24	11.43	8.27	-30.24
222	-12.19	-37.74	85.00	12.19	37.74	-85.00
223	-55.01	-39.78	145.48	55.01	39.78	-145.48
224	-30.73	-94.98	213.99	30.73	94.98	-213.99
225	-103.83	-75.03	274.48	103.83	75.03	-274.48
226	-55.05	-170.00	383.09	55.05	170.00	-383.09
227	-167.84	-121.21	443.56	167.84	121.21	-443.56
228	-90.95	-280.55	632.32	90.95	280.55	-632.32
229	-262.25	-189.25	692.81	262.25	189.25	-692.81
230	-244.55	-753.49	1698.66	244.55	753.49	-1698.66
231	-666.10	-480.36	1759.13	666.10	480.36	-1759.13
232	-640.27	-1970.56	4443.36	640.27	1970.56	-4443.36
233	-2013.60	-1462.97	0.00	2013.60	1462.97	0.00
234	-769.01	-2366.79	0.00	769.01	2366.79	0.00
235	-2884.22	-2095.51	0.00	2884.22	2095.51	0.00
236	-1101.73	-3390.78	0.00	1101.73	3390.78	0.00
237	-3261.83	-2369.85	0.00	3261.83	2369.85	0.00
238	-1245.86	-3834.39	0.00	1245.86	3834.39	0.00
239	-3033.75	-2204.14	0.00	3033.75	2204.14	0.00
240	-1158.87	-3566.69	0.00	1158.87	3566.69	0.00
241	-1437.82	-1044.66	0.00	1437.82	1044.66	0.00
242	-549.28	-1690.51	0.00	549.28	1690.51	0.00
243	653.06	474.47	0.00	-653.06	-474.47	0.00
244	249.41	767.59	0.00	-249.41	-767.59	0.00
245	728.48	529.28	0.00	-728.48	-529.28	0.00
246	278.15	856.06	0.00	-278.15	-856.06	0.00
247	217.87	158.29	0.00	-217.87	-158.29	0.00
248	83.12	255.83	0.00	-83.12	-255.83	0.00

249	-1036.35	-752.95	0.00	1036.35	752.95	0.00
250	-395.91	-1218.47	0.00	395.91	1218.47	0.00
251	-3117.27	-2264.90	0.00	3117.27	2264.90	0.00
252	-1190.87	-3665.11	0.00	1190.87	3665.11	0.00
253	-760.29	-1051.18	0.00	760.29	1051.18	0.00
254	-413.22	-299.95	0.00	413.22	299.95	0.00
255	-43.00	-59.39	0.00	43.00	59.39	0.00
256	11.71	8.49	0.00	-11.71	-8.49	0.00
257	25.86	35.68	0.00	-25.86	-35.68	0.00
258	50.78	36.80	0.00	-50.78	-36.80	0.00
259	45.69	62.98	0.00	-45.69	-62.98	0.00
260	49.98	36.19	0.00	-49.98	-36.19	0.00
261	129.05	177.71	0.00	-129.05	-177.71	0.00
262	160.11	115.80	0.00	-160.11	-115.80	0.00
263	-764.88	-1048.04	0.00	764.88	1048.04	0.00
264	-157.65	-485.90	0.00	157.65	485.90	0.00
265	-43.19	-59.24	0.00	43.19	59.24	0.00
266	4.48	13.82	0.00	-4.48	-13.82	0.00
267	25.72	35.31	0.00	-25.72	-35.31	0.00
268	19.36	59.84	0.00	-19.36	-59.84	0.00
269	46.14	63.42	0.00	-46.14	-63.42	0.00
270	18.93	58.60	0.00	-18.93	-58.60	0.00
271	129.06	177.55	0.00	-129.06	-177.55	0.00
272	60.63	187.96	0.00	-60.63	-187.96	0.00
273	390.49	539.70	0.00	-390.49	-539.70	0.00
274	589.68	428.11	0.00	-589.68	-428.11	0.00
275	-35.29	-48.74	0.00	35.29	48.74	0.00
276	74.07	53.74	0.00	-74.07	-53.74	0.00
277	26.79	36.96	0.00	-26.79	-36.96	0.00
278	-16.04	-11.63	0.00	16.04	11.63	0.00
279	31.79	43.83	0.00	-31.79	-43.83	0.00
280	-23.26	-16.85	0.00	23.26	16.85	0.00
281	25.10	34.58	0.00	-25.10	-34.58	0.00
282	-13.58	-9.83	0.00	13.58	9.83	0.00
283	392.66	538.23	0.00	-392.66	-538.23	0.00
284	224.98	693.26	0.00	-224.98	-693.26	0.00
285	35.55	48.77	0.00	-35.55	-48.77	0.00
286	28.27	87.22	0.00	-28.27	-87.22	0.00
287	-26.84	-36.85	0.00	26.84	36.85	0.00
288	-6.08	-18.77	0.00	6.08	18.77	0.00
289	-31.83	-43.74	0.00	31.83	43.74	0.00
290	-8.81	-27.24	0.00	8.81	27.24	0.00
291	-25.06	-34.47	0.00	25.06	34.47	0.00
292	-5.10	-15.78	0.00	5.10	15.78	0.00
293	15.76	21.69	0.00	-15.76	-21.69	0.00

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                MEMBER FORCES DECOMPOSED INTO X-Y-Z COMPONENTS
                          FOR SUBSTRUCTURE:        3

MEM.       X-DIR.        Y-DIR.        Z-DIR.        X-DIR.        Y-DIR.        Z-DIR.
NO.        NODE I        NODE I        NODE I        NODE J        NODE J        NODE J
  1        8252.64         0.00          0.00       -8252.64         0.00          0.00
  2       -3047.33         0.00          0.00        3047.33         0.00          0.00
  3       -3047.30         0.00          0.00        3047.30         0.00          0.00
  4        4487.54         0.00          0.00       -4487.54         0.00          0.00
  5        4525.13         0.00          0.00       -4525.13         0.00          0.00
  6        4487.94         0.00          0.00       -4487.94         0.00          0.00
  7       -1910.51         0.00          0.00        1910.51         0.00          0.00
  8       -1984.09         0.00          0.00        1984.09         0.00          0.00
  9       -1984.24        -0.02          0.00        1984.24         0.02          0.00
 10       -1910.75         0.00          0.00        1910.75         0.00          0.00
 11        4058.57         0.00          0.00       -4058.57         0.00          0.00
 12        4167.92         0.00          0.00       -4167.92         0.00          0.00
 13        4204.62         0.00          0.00       -4204.62         0.00          0.00
 14        4168.19         0.00          0.00       -4168.19         0.00          0.00
 15        4058.81         0.00          0.00       -4058.81         0.00          0.00
 16       -1481.46         0.00          0.00        1481.46         0.00          0.00
 17       -1626.54         0.00          0.00        1626.54         0.00          0.00
 18       -1699.07         0.00          0.00        1699.07         0.00          0.00
 19       -1699.22         0.00          0.00        1699.22         0.00          0.00
 20       -1626.87         0.00          0.00        1626.87         0.00          0.00
 21       -1481.72         0.00          0.00        1481.72         0.00          0.00
 22        3922.59         0.00          0.00       -3922.59         0.00          0.00
 23        4103.11         0.00          0.00       -4103.11         0.00          0.00
 24        4211.41         0.00          0.00       -4211.41         0.00          0.00
 25        4247.68         0.05          0.00       -4247.68        -0.05          0.00
 26        4211.47         0.00          0.00       -4211.47         0.00          0.00
 27        4103.25         0.00          0.00       -4103.25         0.00          0.00
 28        3922.61         0.00          0.00       -3922.61         0.00          0.00
 29       -1021.44         0.00          0.00        1021.44         0.00          0.00
 30       -1230.52         0.00          0.00        1230.52         0.00          0.00
 31       -1377.54         0.00          0.00        1377.54         0.00          0.00
 32       -1458.20         0.00          0.00        1458.20         0.00          0.00
 33       -1458.27         0.00          0.00        1458.27         0.00          0.00
 34       -1377.50         0.00          0.00        1377.50         0.00          0.00
 35       -1230.58         0.00          0.00        1230.58         0.00          0.00
 36       -1021.56         0.00          0.00        1021.56         0.00          0.00
 37        3865.48         0.00          0.00       -3865.48         0.00          0.00
 38        3898.86         0.00          0.00       -3898.86         0.00          0.00
 39        4067.47         0.00          0.00       -4067.47         0.00          0.00
 40        4190.99         0.00          0.00       -4190.99         0.00          0.00
 41        4185.18         0.00          0.00       -4185.18         0.00          0.00
 42        4190.64         0.00          0.00       -4190.64         0.00          0.00
 43        4067.38         0.00          0.00       -4067.38         0.00          0.00
 44        3898.90         0.00          0.00       -3898.90         0.00          0.00
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45     3865.45     0.00      0.00   -3865.45     0.00      0.00
46     -468.67     0.00      0.00     468.67     0.00      0.00
47     -615.92     0.00      0.00     615.92     0.00      0.00
48     -792.90     0.00      0.00     792.90     0.00      0.00
49     -937.41     0.00      0.00     937.41     0.00      0.00
50    -1010.26     0.00      0.00    1010.26     0.00      0.00
51    -1010.39     0.00      0.00    1010.39     0.00      0.00
52     -937.44     0.00      0.00     937.44     0.00      0.00
53     -792.82     0.00      0.00     792.82     0.00      0.00
54     -615.92     0.00      0.00     615.92     0.00      0.00
55     -468.69     0.00      0.00     468.69     0.00      0.00
56     2721.95     0.00      0.00   -2721.95     0.00      0.00
57     3463.29     0.00      0.00   -3463.29     0.00      0.00
58     3763.10     0.00      0.00   -3763.10     0.00      0.00
59     3934.49     0.00      0.00   -3934.49     0.00      0.00
60     4025.12     0.00      0.00   -4025.12     0.00      0.00
61     3997.67     0.00      0.00   -3997.67     0.00      0.00
62     4025.14     0.00      0.00   -4025.14     0.00      0.00
63     3934.50     0.00      0.00   -3934.50     0.00      0.00
64     3763.14     0.00      0.00   -3763.14     0.00      0.00
65     3463.08     0.00      0.00   -3463.08     0.00      0.00
66     2721.94     0.00      0.00   -2721.94     0.00      0.00
67      836.23     0.00      0.00    -836.23     0.00      0.00
68      107.94     0.00      0.00    -107.94     0.00      0.00
69     -112.79     0.00      0.00     112.79     0.00      0.00
70     -226.52     0.00      0.00     226.52     0.00      0.00
71     -280.48     0.00      0.00     288.48     0.00      0.00
72     -316.73     0.00      0.00     316.73     0.00      0.00
73     -316.71     0.00      0.00     316.71     0.00      0.00
74     -288.43     0.00      0.00     288.43     0.00      0.00
75     -226.43     0.00      0.00     226.43     0.00      0.00
76     -112.66     0.00      0.00     112.66     0.00      0.00
77      108.11     0.00      0.00    -108.11     0.00      0.00
78      836.39     0.00      0.00    -836.39     0.00      0.00
79       19.10    58.77   -132.52     -19.10   -58.77    132.52
80        0.11    -0.32      0.71      -0.11     0.32     -0.71
81       -0.08    -0.23      0.51       0.08     0.23     -0.51
82       18.99   -58.44    131.79     -18.99    58.44   -131.79
83      -37.13  -114.26   -257.65      37.13   114.26    257.65
84       19.05   -55.95   -126.16     -19.05    55.95    126.16
85       -0.06    -0.17     -0.38       0.06     0.17      0.38
86        0.09    -0.26     -0.58      -0.09     0.26      0.58
87       18.97    55.71    125.62     -18.97   -55.71   -125.62
88      -37.11   114.23    257.56      37.11  -114.23   -257.56
89       73.32   225.64   -508.78     -73.32  -225.64    508.78
90      -18.82    55.91   -126.08      18.82   -55.91    126.08
91       18.35    55.81   -125.85     -18.35   -55.81    125.85
92       -0.06     0.18     -0.40       0.06    -0.18      0.40
93        0.00    -0.01      0.01       0.00     0.01     -0.01
94       18.37   -55.87    125.98     -18.37    55.87   -125.98
95      -18.78   -55.77    125.76      18.78    55.77   -125.76
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96	73.37	-225.82	509.20	-73.37	225.82	-509.20
97	-109.29	-336.36	-758.46	109.29	336.36	758.46
98	36.95	-110.51	-249.19	-36.95	110.51	249.19
99	-18.13	-55.41	-124.94	18.13	55.41	124.94
100	18.38	-55.35	-124.81	-18.38	55.35	124.81
101	-0.04	-0.12	-0.27	0.04	0.12	0.27
102	-0.02	0.07	0.17	0.02	-0.07	-0.17
103	18.31	55.16	124.38	-18.31	-55.16	-124.38
104	-18.02	55.08	124.19	18.02	-55.08	-124.19
105	36.91	110.41	248.95	-36.91	-110.41	-248.95
106	-109.23	336.19	758.07	109.23	-336.19	-758.07
107	163.08	501.91	-1131.75	-163.08	-501.91	1131.75
108	-36.75	110.45	-249.05	36.75	-110.45	249.05
109	36.08	110.51	-249.19	-36.08	-110.51	249.19
110	-18.33	55.34	-124.78	18.33	-55.34	124.78
111	18.14	55.30	-124.69	-18.14	-55.30	124.69
112	0.02	-0.07	0.15	-0.02	0.07	-0.15
113	0.02	0.06	-0.13	-0.02	-0.06	0.13
114	18.09	-55.14	124.34	-18.09	55.14	-124.34
115	-18.24	-55.09	124.22	18.24	55.09	-124.22
116	36.06	-110.45	249.06	-36.06	110.45	-249.06
117	-36.76	-110.47	249.09	36.76	110.47	-249.09
118	163.10	-501.96	1131.85	-163.10	501.96	-1131.85
119	-216.70	-666.94	-1503.86	216.70	666.94	1503.86
120	54.72	-165.01	-372.08	-54.72	165.01	372.08
121	-35.85	-109.96	-247.93	35.85	109.96	247.93
122	36.38	-110.07	-248.19	-36.38	110.07	248.19
123	-18.00	-55.03	-124.07	18.00	55.03	124.07
124	18.11	-54.99	-124.00	-18.11	54.99	124.00
125	-0.03	-0.10	-0.23	0.03	0.10	0.23
126	0.08	-0.24	-0.53	-0.08	0.24	0.53
127	18.11	54.98	123.97	-18.11	-54.98	-123.97
128	-17.99	54.98	123.96	17.99	-54.98	-123.96
129	36.33	109.91	247.83	-36.33	-109.91	-247.83
130	-35.86	109.99	248.01	35.86	-109.99	-248.01
131	54.72	165.02	372.09	-54.72	-165.02	-372.09
132	-216.71	666.96	1503.92	216.71	-666.96	-1503.92
133	288.21	887.06	-2000.15	-288.21	-887.06	2000.15
134	-54.55	164.92	-371.87	54.55	-164.92	371.87
135	53.74	164.99	-372.01	-53.74	-164.99	372.01
136	-36.29	109.99	-248.00	36.29	-109.99	248.00
137	35.89	109.89	-247.78	-35.89	-109.89	247.78
138	-18.07	54.91	-123.81	18.07	-54.91	123.81
139	17.97	54.90	-123.78	-17.97	-54.90	123.78
140	0.01	-0.04	0.09	-0.01	0.04	-0.09
141	0.02	0.08	-0.17	-0.02	-0.08	0.17
142	18.01	-55.01	124.04	-18.01	55.01	-124.04
143	-18.13	-55.08	124.19	18.13	55.08	-124.19
144	35.91	-109.96	247.94	-35.91	109.96	-247.94
145	-36.30	-110.03	248.10	36.30	110.03	-248.10
146	53.78	-165.09	372.24	-53.78	165.09	-372.24

147	-54.56	-164.96	371.95	54.56	164.96	-371.95
148	288.21	-887.06	2000.14	-288.21	887.06	-2000.14
149	-289.05	-889.61	-2005.97	289.05	889.61	2005.97
150	0.86	-2.62	-5.90	-0.86	2.62	5.90
151	-50.07	-153.79	-346.78	50.07	153.79	346.78
152	50.72	-153.95	-347.15	-50.72	153.95	347.15
153	-37.22	-114.08	-257.23	37.22	114.08	257.23
154	37.50	-114.04	-257.14	-37.50	114.04	257.14
155	-22.32	-68.27	-153.94	22.32	68.27	153.94
156	22.42	-68.31	-154.03	-22.42	68.31	154.03
157	0.01	0.02	0.04	-0.01	-0.02	-0.04
158	0.04	-0.11	-0.25	-0.04	0.11	0.25
159	22.38	68.21	153.80	-22.38	-68.21	-153.80
160	-22.28	68.17	153.72	22.28	-68.17	-153.72
161	37.48	113.99	257.03	-37.48	-113.99	-257.03
162	-37.19	114.02	257.09	37.19	-114.02	-257.09
163	50.66	153.75	346.68	-50.66	-153.75	-346.68
164	-50.03	153.66	346.48	50.03	-153.66	-346.48
165	0.79	2.41	5.43	-0.79	-2.41	-5.43
166	-289.05	889.61	2005.95	289.05	-889.61	-2005.95
167	316.50	974.10	-2196.46	-316.50	-974.10	2196.46
168	-9.78	29.68	-66.92	9.78	-29.68	66.92
169	112.62	346.05	-780.30	-112.62	-346.05	780.30
170	-27.99	85.05	-191.79	27.99	-85.05	191.79
171	49.35	151.41	-341.41	-49.35	-151.41	341.41
172	-26.74	81.37	-183.48	26.74	-81.37	183.48
173	32.33	99.02	-223.28	-32.33	-99.02	223.28
174	-11.49	35.03	-78.98	11.49	-35.03	78.98
175	13.98	42.75	-96.39	-13.98	-42.75	96.39
176	-0.38	1.15	-2.60	0.38	-1.15	2.60
177	-0.39	-1.18	2.65	0.39	1.18	-2.65
178	14.00	-42.81	96.54	-14.00	42.81	-96.54
179	-11.49	-35.02	78.96	11.49	35.02	-78.96
180	32.39	-99.22	223.74	-32.39	99.22	-223.74
181	-26.73	-81.37	183.47	26.73	81.37	-183.47
182	49.34	-151.37	341.33	-49.34	151.37	-341.33
183	-28.00	-85.07	191.83	28.00	85.07	-191.83
184	112.63	-346.09	780.40	-112.63	346.09	-780.40
185	-9.79	-29.70	66.98	9.79	29.70	-66.98
186	316.50	-974.08	2196.42	-316.50	974.08	-2196.42
187	-373.72	-1150.21	-2593.57	373.72	1150.21	2593.57
188	57.99	-176.15	-397.20	-57.99	176.15	397.20
189	-176.29	-541.87	-1221.85	176.29	541.87	1221.85
190	74.12	-225.45	-508.36	-74.12	225.45	508.36
191	-74.55	-228.83	-515.98	74.55	228.83	515.98
192	53.32	-162.39	-366.18	-53.32	162.39	366.18
193	-42.50	-130.27	-293.75	42.50	130.27	293.75
194	36.90	-112.54	-253.77	-36.90	112.54	253.77
195	-20.43	-62.56	-141.07	20.43	62.56	141.07
196	17.97	-54.89	-123.76	-17.97	54.89	123.76
197	0.38	1.18	2.65	-0.38	-1.18	-2.65

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198      0.39     -1.18     -2.66     -0.39      1.18      2.66
199     17.98     54.89    123.77    -17.98    -54.89   -123.77
200    -20.44     62.59    141.12     20.44    -62.59   -141.12
201     36.93    112.63    253.98    -36.93   -112.63   -253.98
202    -42.47    130.19    293.57     42.47   -130.19   -293.57
203     53.32    162.40    366.18    -53.32   -162.40   -366.18
204    -74.55    228.84    516.00     74.55   -228.84   -516.00
205     74.13    225.48    508.44    -74.13   -225.48   -508.44
206   -176.28    541.83   1221.77    176.28   -541.83  -1221.77
207     58.00    176.20    397.31    -58.00   -176.20   -397.31
208   -373.72   1150.20   2593.55    373.72  -1150.20  -2593.55
209    640.27   1970.54  -4443.31   -640.27  -1970.54   4443.31
210   -256.54    780.16  -1759.15    256.54   -780.16   1759.15
211    245.04    753.33  -1698.66   -245.04   -753.33   1698.66
212   -100.93    307.28   -692.87    100.93   -307.28    692.87
213     91.32    280.45   -632.38    -91.32   -280.45    632.38
214    -64.55    196.73   -443.60     64.55   -196.73    443.60
215     55.39    169.90   -383.11    -55.39   -169.90    383.11
216    -39.91    121.75   -274.54     39.91   -121.75    274.54
217     30.98     94.93   -214.05    -30.98    -94.93    214.05
218    -21.14     64.56   -145.57     21.14    -64.56    145.57
219     12.32     37.72    -85.06    -12.32    -37.72     85.06
220     -4.39     13.42    -30.26      4.39    -13.42     30.26
221     -4.39    -13.42     30.26      4.39     13.42    -30.26
222     12.32    -37.72     85.06    -12.32     37.72    -85.06
223    -21.14    -64.57    145.59     21.14     64.57   -145.59
224     30.99    -94.95    214.10    -30.99     94.95   -214.10
225    -39.92   -121.79    274.61     39.92    121.79   -274.61
226     55.40   -169.94    383.18    -55.40    169.94   -383.18
227    -64.57   -196.77    443.70     64.57    196.77   -443.70
228     91.33   -280.47    632.42    -91.33    280.47   -632.42
229   -100.94   -307.30    692.93    100.94    307.30   -692.93
230    245.04   -753.34   1698.68   -245.04    753.34  -1698.68
231   -256.54   -780.16   1759.16    256.54    780.16  -1759.16
232    640.28  -1970.55   4443.35   -640.28   1970.55  -4443.35
233   -769.01  -2366.77      0.00    769.01   2366.77      0.00
234    769.08  -2366.97      0.00   -769.08   2366.97      0.00
235  -1101.73  -3390.78      0.00   1101.73   3390.78      0.00
236   1101.74  -3390.83      0.00  -1101.74   3390.83      0.00
237  -1245.89  -3834.47      0.00   1245.89   3834.47      0.00
238   1245.93  -3834.55      0.00  -1245.93   3834.55      0.00
239  -1158.88  -3566.72      0.00   1158.88   3566.72      0.00
240   1158.86  -3566.66      0.00  -1158.86   3566.66      0.00
241   -549.26  -1690.45      0.00    549.26   1690.45      0.00
242    549.29  -1690.52      0.00   -549.29   1690.52      0.00
243    249.41    767.59      0.00   -249.41   -767.59      0.00
244   -249.42    767.64      0.00    249.42   -767.64      0.00
245    278.15    856.05      0.00   -278.15   -856.05      0.00
246   -278.18    856.14      0.00    278.18   -856.14      0.00
247     83.12    255.83      0.00    -83.12   -255.83      0.00
248    -83.16    255.94      0.00     83.16   -255.94      0.00
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249      -395.92    -1218.51       0.00      395.92    1218.51       0.00
250       395.89    -1218.43       0.00     -395.89    1218.43       0.00
251     -1190.83    -3665.00       0.00     1190.83    3665.00       0.00
252      1190.79    -3664.84       0.00    -1190.79    3664.84       0.00
253         2.77    -1297.34       0.00       -2.77    1297.34       0.00
254      -158.00     -485.57       0.00      158.00     485.57       0.00
255         0.12      -73.32       0.00       -0.12      73.32       0.00
256         4.45       13.65       0.00       -4.45     -13.65       0.00
257        -0.05       43.95       0.00        0.05     -43.95       0.00
258        19.53       59.84       0.00      -19.53     -59.84       0.00
259        -0.06       76.12       0.00        0.06     -78.12       0.00
260        19.12       58.51       0.00      -19.12     -58.51       0.00
261        -0.05      219.56       0.00        0.05    -219.56       0.00
262        61.46      187.77       0.00      -61.46    -187.77       0.00
263        -2.77    -1297.30       0.00        2.77    1297.30       0.00
264       157.98     -485.51       0.00     -157.98     485.51       0.00
265        -0.12      -73.18       0.00        0.12      73.18       0.00
266        -4.51       13.85       0.00        4.51     -13.85       0.00
267         0.05       44.07       0.00       -0.05     -44.07       0.00
268       -19.58       60.00       0.00       19.58     -60.00       0.00
269         0.06       78.21       0.00       -0.06     -78.21       0.00
270       -19.13       58.54       0.00       19.13     -58.54       0.00
271         0.05      219.52       0.00       -0.05    -219.52       0.00
272       -61.46      187.79       0.00       61.46    -187.79       0.00
273        -1.30      666.27       0.00        1.30    -666.27       0.00
274       225.47      693.09       0.00     -225.47    -693.09       0.00
275         0.09      -60.26       0.00       -0.09      60.26       0.00
276        28.38       87.14       0.00      -28.38     -87.14       0.00
277        -0.05       45.63       0.00        0.05     -45.63       0.00
278        -6.13      -18.80       0.00        6.13      18.80       0.00
279        -0.04       54.14       0.00        0.04     -54.14       0.00
280        -8.91      -27.30       0.00        8.91      27.30       0.00
281        -0.02       42.72       0.00        0.02     -42.72       0.00
282        -5.20      -15.92       0.00        5.20      15.92       0.00
283         1.30      666.18       0.00       -1.30    -666.18       0.00
284      -225.42      692.95       0.00      225.42    -692.95       0.00
285         0.09       60.30       0.00       -0.09     -60.30       0.00
286       -28.38       87.14       0.00       28.38     -87.14       0.00
287        -0.05      -45.56       0.00        0.05      45.56       0.00
288         6.12      -18.77       0.00       -6.12      18.77       0.00
289        -0.04      -54.03       0.00        0.04      54.03       0.00
290         8.88      -27.20       0.00       -8.88      27.20       0.00
291        -0.02      -42.61       0.00        0.02      42.61       0.00
292         5.15      -15.75       0.00       -5.15      15.75       0.00
293         0.00       26.80       0.00        0.00     -26.80       0.00
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                         MEMBER FORCES DECOMPOSED INTO X-Y-Z COMPONENTS
                                   FOR SUBSTRUCTURE:      4

MEM.      X-DIR.        Y-DIR.        Z-DIR.        X-DIR.        Y-DIR.        Z-DIR.
NO.       NODE I        NODE I        NODE I        NODE J        NODE J        NODE J
   1      6676.29       4850.60          0.00      -6676.29      -4850.60          0.00
   2     -2465.42      -1791.23          0.00       2465.42       1791.23          0.00
   3     -2465.08      -1791.01          0.00       2465.08       1791.01          0.00
   4      3630.70       2637.85          0.00      -3630.70      -2637.85          0.00
   5      3660.88       2659.79          0.00      -3660.88      -2659.79          0.00
   6      3630.35       2637.59          0.00      -3630.35      -2637.59          0.00
   7     -1545.75      -1123.05          0.00       1545.75       1123.05          0.00
   8     -1605.07      -1166.14          0.00       1605.07       1166.14          0.00
   9     -1604.97      -1166.07          0.00       1604.97       1166.07          0.00
  10     -1545.33      -1122.75          0.00       1545.33       1122.75          0.00
  11      3283.71       2385.77          0.00      -3283.71      -2385.77          0.00
  12      3371.96       2449.85          0.00      -3371.96      -2449.85          0.00
  13      3401.52       2471.37          0.00      -3401.52      -2471.37          0.00
  14      3371.96       2449.85          0.00      -3371.96      -2449.85          0.00
  15      3283.26       2385.46          0.00      -3283.26      -2385.46          0.00
  16     -1198.68       -870.89          0.00       1198.68        870.89          0.00
  17     -1316.06       -956.17          0.00       1316.06        956.17          0.00
  18     -1374.60       -998.70          0.00       1374.60        998.70          0.00
  19     -1374.63       -998.72          0.00       1374.63        998.72          0.00
  20     -1315.77       -955.96          0.00       1315.77        955.96          0.00
  21     -1198.45       -870.72          0.00       1198.45        870.72          0.00
  22      3173.73       2305.83          0.00      -3173.73      -2305.83          0.00
  23      3320.01       2412.12          0.00      -3320.01      -2412.12          0.00
  24      3407.63       2475.82          0.00      -3407.63      -2475.82          0.00
  25      3437.03       2497.15          0.00      -3437.03      -2497.15          0.00
  26      3407.45       2475.65          0.00      -3407.45      -2475.65          0.00
  27      3319.97       2412.10          0.00      -3319.97      -2412.10          0.00
  28      3173.46       2305.69          0.00      -3173.46      -2305.69          0.00
  29      -826.58       -600.59          0.00        826.58        600.59          0.00
  30      -995.69       -723.45          0.00        995.69        723.45          0.00
  31     -1114.85       -809.95          0.00       1114.85        809.95          0.00
  32     -1180.01       -857.33          0.00       1180.01        857.33          0.00
  33     -1180.11       -857.41          0.00       1180.11        857.41          0.00
  34     -1114.79       -809.94          0.00       1114.79        809.94          0.00
  35      -995.81       -723.49          0.00        995.81        723.49          0.00
  36      -826.45       -600.45          0.00        826.45        600.45          0.00
  37      3127.35       2272.40          0.00      -3127.35      -2272.40          0.00
  38      3153.93       2291.27          0.00      -3153.93      -2291.27          0.00
  39      3290.56       2391.02          0.00      -3290.56      -2391.02          0.00
  40      3390.21       2462.92          0.00      -3390.21      -2462.92          0.00
  41      3385.76       2459.92          0.00      -3385.76      -2459.92          0.00
  42      3390.08       2463.07          0.00      -3390.08      -2463.07          0.00
  43      3290.31       2390.57          0.00      -3290.31      -2390.57          0.00
  44      3153.94       2291.45          0.00      -3153.94      -2291.45          0.00
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45	3127.02	2271.86	0.00	-3127.02	-2271.86	0.00
46	-379.23	-275.57	0.00	379.23	275.57	0.00
47	-498.33	-362.04	0.00	498.33	362.04	0.00
48	-641.59	-466.13	0.00	641.59	466.13	0.00
49	-758.49	-551.05	0.00	758.49	551.05	0.00
50	-817.39	-593.84	0.00	817.39	593.84	0.00
51	-817.70	-594.18	0.00	817.70	594.18	0.00
52	-758.60	-551.14	0.00	758.60	551.14	0.00
53	-641.68	-466.18	0.00	641.68	466.18	0.00
54	-498.54	-362.21	0.00	498.54	362.21	0.00
55	-379.32	-275.59	0.00	379.32	275.59	0.00
56	2202.15	1600.01	0.00	-2202.15	-1600.01	0.00
57	2802.05	2035.91	0.00	-2802.05	-2035.91	0.00
58	3044.42	2212.00	0.00	-3044.42	-2212.00	0.00
59	3182.91	2312.20	0.00	-3182.91	-2312.20	0.00
60	3256.54	2366.09	0.00	-3256.54	-2366.09	0.00
61	3234.34	2350.01	0.00	-3234.34	-2350.01	0.00
62	3257.00	2366.30	0.00	-3257.00	-2366.30	0.00
63	3182.66	2312.08	0.00	-3182.66	-2312.08	0.00
64	3044.37	2212.02	0.00	-3044.37	-2212.02	0.00
65	2801.53	2035.59	0.00	-2801.53	-2035.59	0.00
66	2201.83	1599.75	0.00	-2201.83	-1599.75	0.00
67	676.49	491.51	0.00	-676.49	-491.51	0.00
68	87.38	63.48	0.00	-87.38	-63.48	0.00
69	-91.20	-66.27	0.00	91.20	66.27	0.00
70	-183.15	-133.07	0.00	183.15	133.07	0.00
71	-233.35	-169.54	0.00	233.35	169.54	0.00
72	-256.15	-186.11	0.00	256.15	186.11	0.00
73	-256.20	-186.14	0.00	256.20	186.14	0.00
74	-233.35	-169.52	0.00	233.35	169.52	0.00
75	-183.26	-133.15	0.00	183.26	133.15	0.00
76	-91.30	-66.33	0.00	91.30	66.33	0.00
77	87.30	63.43	0.00	-87.30	-63.43	0.00
78	676.45	491.50	0.00	-676.45	-491.50	0.00
79	-18.99	58.44	-131.79	18.99	-58.44	131.79
80	0.25	-0.18	0.66	-0.25	0.18	-0.66
81	0.11	-0.35	0.77	-0.11	0.35	-0.77
82	49.92	-36.27	132.32	-49.92	36.27	-132.32
83	37.11	-114.23	-257.56	-37.11	114.23	257.56
84	48.04	-33.88	-125.47	-48.04	33.88	125.47
85	-0.02	0.07	0.16	0.02	-0.07	-0.16
86	-0.17	0.12	0.44	0.17	-0.12	-0.44
87	-17.48	56.50	126.24	17.48	-56.50	-126.24
88	-97.39	70.76	258.17	97.39	-70.76	-258.17
89	-73.37	225.82	-509.20	73.37	-225.82	509.20
90	-47.85	34.00	-125.45	47.85	-34.00	125.45
91	-17.89	55.74	-125.40	17.89	-55.74	125.40
92	0.08	-0.06	0.22	-0.08	0.06	-0.22
93	0.09	-0.28	0.64	-0.09	0.28	-0.64
94	47.78	-34.46	126.18	-47.78	34.46	-126.18
95	17.66	-56.38	126.25	-17.66	56.38	-126.25

96	191.94	-139.45	508.78	-191.94	139.45	-508.78
97	109.23	-336.19	-758.07	-109.23	336.19	758.07
98	94.73	-67.61	-248.90	-94.73	67.61	248.90
99	17.79	-55.15	-124.19	-17.79	55.15	124.19
100	47.21	-33.85	-124.32	-47.21	33.85	124.32
101	0.02	-0.05	-0.11	-0.02	0.05	0.11
102	-0.06	0.04	0.15	0.06	-0.04	-0.15
103	-17.67	55.58	124.82	17.67	-55.58	-124.82
104	-47.17	34.12	124.77	47.17	-34.12	-124.77
105	-35.07	111.13	249.22	35.07	-111.13	-249.22
106	-285.99	207.78	758.09	285.99	-207.78	-758.09
107	-163.10	501.96	-1131.85	163.10	-501.96	1131.85
108	-94.60	67.71	-248.91	94.60	-67.71	248.91
109	-35.70	110.41	-248.73	35.70	-110.41	248.73
110	-47.13	33.83	-124.18	47.13	-33.83	124.18
111	-17.79	55.27	-124.39	17.79	-55.27	124.39
112	0.02	-0.01	0.05	-0.02	0.01	-0.05
113	0.02	-0.06	0.12	-0.02	0.06	-0.12
114	47.22	-34.10	124.79	-47.22	34.10	-124.79
115	17.66	-55.41	124.48	-17.66	55.41	-124.48
116	94.10	-68.17	249.07	-94.10	68.17	-249.07
117	35.21	-111.04	249.23	-35.21	111.04	-249.23
118	426.77	-310.07	1131.27	-426.77	310.07	-1131.27
119	216.72	-666.97	-1503.93	-216.72	666.97	1503.93
120	141.18	-101.27	-371.86	-141.18	101.27	371.86
121	35.67	-110.17	-248.27	-35.67	110.17	248.27
122	94.07	-67.62	-248.04	-94.07	67.62	248.04
123	17.77	-55.06	-124.00	-17.77	55.06	124.00
124	47.05	-33.90	-124.20	-47.05	33.90	124.20
125	0.00	0.01	0.03	0.00	-0.01	-0.03
126	-0.05	0.03	0.12	0.05	-0.03	-0.12
127	-17.71	55.27	124.30	17.71	-55.27	-124.30
128	-46.93	33.95	124.13	46.93	-33.95	-124.13
129	-35.26	110.40	248.13	35.26	-110.40	-248.13
130	-93.74	67.96	248.21	93.74	-67.96	-248.21
131	-52.80	165.90	372.62	52.80	-165.90	-372.62
132	-567.12	412.04	1503.30	567.12	-412.04	-1503.30
133	-288.21	887.05	-2000.11	288.21	-887.05	2000.11
134	-141.24	101.48	-372.32	141.24	-101.48	372.32
135	-53.51	165.11	-372.12	53.51	-165.11	372.12
136	-94.12	67.73	-248.31	94.12	-67.73	248.31
137	-35.62	110.18	-248.20	35.62	-110.18	248.20
138	-46.96	33.84	-123.98	46.96	-33.84	123.98
139	-17.76	55.08	-124.01	17.76	-55.08	124.01
140	-0.01	0.01	-0.02	0.01	-0.01	0.02
141	0.02	-0.07	0.15	-0.02	0.07	-0.15
142	47.01	-33.99	124.31	-47.01	33.99	-124.31
143	17.69	-55.16	124.07	-17.69	55.16	-124.07
144	93.82	-67.95	248.31	-93.82	67.95	-248.31
145	35.33	-110.45	248.31	-35.33	110.45	-248.31
146	140.70	-102.06	372.66	-140.70	102.06	-372.66

147	52.93	-165.89	372.77	-52.93	165.89	-372.77
148	754.40	-548.11	1999.73	-754.40	546.11	-1999.73
149	289.06	-889.63	-2005.99	-289.06	889.63	2005.99
150	2.27	-1.63	-5.99	-2.27	1.63	5.99
151	49.90	-153.89	-346.87	-49.90	153.89	346.87
152	131.42	-94.66	-346.86	-131.42	94.66	346.86
153	36.95	-114.17	-257.22	-36.95	114.17	257.22
154	97.40	-70.24	-257.23	-97.40	70.24	257.23
155	22.09	-68.40	-154.05	-22.09	68.40	154.05
156	58.24	-42.06	-153.91	-58.24	42.06	153.91
157	0.04	-0.14	-0.31	-0.04	0.14	0.31
158	0.07	-0.05	-0.18	-0.07	0.05	0.18
159	-22.00	68.39	153.92	22.00	-68.39	-153.92
160	-58.11	42.06	153.74	58.11	-42.06	-153.74
161	-36.67	114.23	256.98	36.67	-114.23	-256.98
162	-97.16	70.41	257.22	97.16	-70.41	-257.22
163	-49.36	154.08	346.50	49.36	-154.08	-346.50
164	-130.87	94.96	346.68	130.87	-94.96	-346.68
165	-0.84	2.63	5.90	0.84	-2.63	-5.90
166	-756.73	549.79	2005.89	756.73	-549.79	-2005.89
167	-316.49	974.07	-2196.40	316.49	-974.07	2196.40
168	-25.27	18.19	-66.68	25.27	-18.19	66.68
169	-112.31	346.21	-780.42	112.31	-346.21	780.42
170	-72.64	52.36	-191.78	72.64	-52.36	191.78
171	-49.04	151.43	-341.25	49.04	-151.43	341.25
172	-69.47	50.12	-183.52	69.47	-50.12	183.52
173	-32.03	99.05	-223.13	32.03	-99.05	223.13
174	-29.92	21.61	-79.06	29.92	-21.61	79.06
175	-13.82	42.81	-96.42	13.82	-42.81	96.42
176	-1.05	0.76	-2.79	1.05	-0.76	2.79
177	0.37	-1.14	2.56	-0.37	1.14	-2.56
178	36.33	-26.29	96.12	-36.33	26.29	-96.12
179	11.32	-35.17	79.15	-11.32	35.17	-79.15
180	84.38	-61.12	223.34	-84.38	61.12	-223.34
181	26.23	-81.63	183.68	-26.23	81.63	-183.68
182	128.89	-93.46	341.32	-128.89	93.46	-341.32
183	27.33	-85.20	191.64	-27.33	85.20	-191.64
184	294.59	-213.81	780.47	-294.59	213.81	-780.47
185	9.57	-29.88	67.20	-9.57	29.88	-67.20
186	828.66	-602.04	2196.54	-828.66	602.04	-2196.54
187	373.72	-1150.20	-2593.55	-373.72	1150.20	2593.55
188	150.46	-108.43	-397.22	-150.46	108.43	397.22
189	175.86	-541.97	-1221.71	-175.86	541.97	1221.71
190	192.55	-138.88	-508.53	-192.55	138.88	508.53
191	74.20	-228.97	-516.03	-74.20	228.97	516.03
192	136.59	-100.04	-366.19	-138.59	100.04	366.19
193	42.18	-130.32	-293.65	-42.18	130.32	293.65
194	95.99	-69.35	-253.72	-95.99	69.35	253.72
195	20.23	-62.60	-141.02	-20.23	62.60	141.02
196	46.82	-33.85	-123.82	-46.82	33.85	123.82
197	-0.37	1.15	2.60	0.37	-1.15	-2.60

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198        1.07      -0.77      -2.83      -1.07       0.77       2.83
199      -17.69      54.89     123.57      17.69     -54.89    -123.57
200      -53.34      38.63     141.17      53.34     -38.63    -141.17
201      -36.31     112.78     253.86      36.31    -112.78    -253.86
202     -110.94      80.41     293.70     110.94     -80.41    -293.70
203      -52.33     162.78     366.31      52.33    -162.78    -366.31
204     -194.81     141.31     515.98     194.81    -141.31    -515.98
205      -72.55     225.97     508.37      72.55    -225.97    -508.37
206     -461.17     334.81    1222.02     461.17    -334.81   -1222.02
207      -56.65     176.68     397.40      56.65    -176.68    -397.40
208     -978.39     710.90    2593.66     978.39    -710.90   -2593.66
209     -640.28    1970.54   -4443.31     640.28   -1970.54    4443.31
210     -666.10     480.35   -1759.12     666.10    -480.35    1759.12
211     -244.55     753.48   -1698.63     244.55    -753.48    1698.63
212     -262.24     189.25    -692.80     262.24    -189.25     692.80
213      -90.96     280.55    -632.34      90.96    -280.55     632.34
214     -167.84     121.21    -443.56     167.84    -121.21     443.56
215      -55.05     170.00    -383.07      55.05    -170.00     383.07
216     -103.85      75.05    -274.55     103.85     -75.05     274.55
217      -30.74      95.01    -214.05      30.74     -95.01     214.05
218      -55.05      39.80    -145.57      55.05     -39.80     145.57
219      -12.20      37.77     -85.07      12.20     -37.77      85.07
220      -11.47       8.30     -30.34      11.47      -8.30      30.34
221        4.32     -13.39      30.17      -4.32      13.39     -30.17
222       32.09     -23.23      84.91     -32.09      23.23     -84.91
223       20.83     -64.59     145.43     -20.83      64.59    -145.43
224       80.79     -58.55     213.89     -80.79      58.55    -213.89
225       39.26    -121.90     274.40     -39.26     121.90    -274.40
226      144.67    -104.90     383.13    -144.67     104.90    -383.13
227       63.41    -197.11     443.62     -63.41     197.11    -443.62
228      238.77    -173.24     632.47    -238.77     173.24    -632.47
229       90.98    -307.96     692.95     -98.98     307.96    -692.95
230      641.09    -465.46    1698.76    -641.09     465.46   -1698.76
231      251.06    -781.99    1759.22    -251.06     781.99   -1759.22
232     1676.34   -1217.90    4443.48   -1676.34    1217.90   -4443.48
233      769.07   -2366.95       0.00    -769.07    2366.95       0.00
234     2013.24   -1462.71       0.00   -2013.24    1462.71       0.00
235     1101.75   -3390.84       0.00   -1101.75    3390.84       0.00
236     2883.97   -2095.33       0.00   -2883.97    2095.33       0.00
237     1245.96   -3834.63       0.00   -1245.96    3834.63       0.00
238     3261.53   -2369.64       0.00   -3261.53    2369.64       0.00
239     1158.87   -3566.70       0.00   -1158.87    3566.70       0.00
240     3034.22   -2204.49       0.00   -3034.22    2204.49       0.00
241      549.26   -1690.46       0.00    -549.26    1690.46       0.00
242     1438.05   -1049.83       0.00   -1438.05    1044.03       0.00
243     -249.42     767.64       0.00     249.42    -767.64       0.00
244     -652.57     474.13       0.00     652.57    -474.13       0.00
245     -278.17     856.13       0.00     278.17    -856.13       0.00
246     -727.85     528.81       0.00     727.85    -528.81       0.00
247      -83.16     255.93       0.00      83.16    -255.93       0.00
248     -217.54     158.05       0.00     217.54    -158.05       0.00
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249      395.90    -1218.47      0.00     -395.90     1218.47      0.00
250     1036.45     -753.01      0.00    -1036.45      753.01      0.00
251     1190.76    -3664.72      0.00    -1190.76     3664.72      0.00
252     3117.45    -2265.01      0.00    -3117.45     2265.01      0.00
253      764.89    -1048.05      0.00     -764.89     1048.05      0.00
254      157.65     -485.91      0.00     -157.65      485.91      0.00
255       43.17      -59.21      0.00      -43.17       59.21      0.00
256       -4.46       13.76      0.00        4.46      -13.76      0.00
257      -25.65       35.21      0.00       25.65      -35.21      0.00
258      -19.38       59.90      0.00       19.38      -59.90      0.00
259      -46.14       63.41      0.00       46.14      -63.41      0.00
260      -18.92       58.57      0.00       18.92      -58.57      0.00
261     -129.12      177.62      0.00      129.12     -177.62      0.00
262      -60.64      188.01      0.00       60.64     -188.01      0.00
263      760.34    -1051.24      0.00     -760.34     1051.24      0.00
264      413.18     -299.93      0.00     -413.18      299.93      0.00
265       43.02      -59.42      0.00      -43.02       59.42      0.00
266      -11.66        8.46      0.00       11.66       -8.46      0.00
267      -25.76       35.54      0.00       25.76      -35.54      0.00
268      -50.89       36.87      0.00       50.89      -36.87      0.00
269      -45.69       62.97      0.00       45.69      -62.97      0.00
270      -49.74       36.00      0.00       49.74      -36.00      0.00
271     -128.97      177.60      0.00      128.97     -177.60      0.00
272     -160.13      115.82      0.00      160.13     -115.82      0.00
273     -392.57      538.11      0.00      392.57     -538.11      0.00
274     -224.94      693.14      0.00      224.94     -693.14      0.00
275       35.45      -48.63      0.00      -35.45       48.63      0.00
276      -28.22       87.06      0.00       28.22      -87.06      0.00
277      -26.89       36.92      0.00       26.89      -36.92      0.00
278        6.10      -18.85      0.00       -6.10       18.85      0.00
279      -31.85       43.77      0.00       31.85      -43.77      0.00
280        8.84      -27.34      0.00       -8.84       27.34      0.00
281      -25.09       34.51      0.00       25.09      -34.51      0.00
282        5.11      -15.82      0.00       -5.11       15.82      0.00
283     -390.50      539.70      0.00      390.50     -539.70      0.00
284     -589.66      428.10      0.00      589.66     -428.10      0.00
285      -35.34       48.80      0.00       35.34      -48.80      0.00
286      -74.14       53.79      0.00       74.14      -53.79      0.00
287       26.78      -36.96      0.00      -26.78       36.96      0.00
288       16.02      -11.61      0.00      -16.02       11.61      0.00
289       31.80      -43.84      0.00      -31.80       43.84      0.00
290       23.26      -16.85      0.00      -23.26       16.85      0.00
291       25.09      -34.56      0.00      -25.09       34.56      0.00
292       13.55       -9.80      0.00      -13.55        9.80      0.00
293      -15.77       21.70      0.00       15.77      -21.70      0.00
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                MEMBER FORCES DECOMPOSED INTO X-Y-Z COMPONENTS
                           FOR SUBSTRUCTURE:      5

MEM.      X-DIR.      Y-DIR.      Z-DIR.      X-DIR.      Y-DIR.      Z-DIR.
NO.       NODE I      NODE I      NODE I      NODE J      NODE J      NODE J
   1     2550.00     7848.18        0.00    -2550.00    -7848.18        0.00
   2     -941.52    -2897.71        0.00      941.52     2897.71        0.00
   3     -941.56    -2897.83        0.00      941.56     2897.83        0.00
   4     1386.61     4267.63        0.00    -1386.61    -4267.63        0.00
   5     1398.17     4303.04        0.00    -1398.17    -4303.04        0.00
   6     1386.66     4267.63        0.00    -1386.66    -4267.63        0.00
   7     -590.23    -1816.51        0.00      590.23     1816.51        0.00
   8     -612.86    -1886.21        0.00      612.86     1886.21        0.00
   9     -612.87    -1886.17        0.00      612.87     1886.17        0.00
  10     -590.12    -1816.21        0.00      590.12     1816.21        0.00
  11     1254.18     3859.87        0.00    -1254.18    -3859.87        0.00
  12     1287.84     3963.67        0.00    -1287.84    -3963.67        0.00
  13     1299.19     3998.43        0.00    -1299.19    -3998.43        0.00
  14     1287.88     3963.61        0.00    -1287.88    -3963.61        0.00
  15     1253.98     3859.43        0.00    -1253.98    -3859.43        0.00
  16     -457.74    -1408.78        0.00      457.74     1408.78        0.00
  17     -502.53    -1546.64        0.00      502.53     1546.64        0.00
  18     -524.90    -1615.47        0.00      524.90     1615.47        0.00
  19     -524.89    -1615.45        0.00      524.89     1615.45        0.00
  20     -502.50    -1546.48        0.00      502.50     1546.48        0.00
  21     -457.62    -1408.40        0.00      457.62     1408.40        0.00
  22     1212.23     3730.80        0.00    -1212.23    -3730.80        0.00
  23     1268.05     3902.60        0.00    -1268.05    -3902.60        0.00
  24     1301.40     4005.35        0.00    -1301.40    -4005.35        0.00
  25     1312.68     4039.97        0.00    -1312.68    -4039.97        0.00
  26     1301.38     4005.15        0.00    -1301.38    -4005.15        0.00
  27     1267.87     3902.19        0.00    -1267.87    -3902.19        0.00
  28     1211.92     3730.14        0.00    -1211.92    -3730.14        0.00
  29     -315.62     -971.38        0.00      315.62      971.38        0.00
  30     -380.23    -1170.23        0.00      380.23     1170.23        0.00
  31     -425.61    -1309.97        0.00      425.61     1309.97        0.00
  32     -450.59    -1386.64        0.00      450.59     1386.64        0.00
  33     -450.56    -1386.52        0.00      450.56     1386.52        0.00
  34     -425.40    -1309.58        0.00      425.40     1309.58        0.00
  35     -380.15    -1169.84        0.00      380.15     1169.84        0.00
  36     -315.51     -970.94        0.00      315.51      970.94        0.00
  37     1194.44     3676.03        0.00    -1194.44    -3676.03        0.00
  38     1204.79     3707.90        0.00    -1204.79    -3707.90        0.00
  39     1256.81     3867.92        0.00    -1256.81    -3867.92        0.00
  40     1295.06     3985.70        0.00    -1295.06    -3985.70        0.00
  41     1293.24     3980.10        0.00    -1293.24    -3980.10        0.00
  42     1294.28     3984.66        0.00    -1294.28    -3984.66        0.00
  43     1256.80     3867.95        0.00    -1256.80    -3867.95        0.00
  44     1204.67     3707.49        0.00    -1204.67    -3707.49        0.00
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45     1194.30    3675.55      0.00   -1194.30   -3675.55      0.00
46     -144.79    -445.72      0.00     144.79     445.72      0.00
47     -190.36    -585.81      0.00     190.36     585.81      0.00
48     -245.06    -754.14      0.00     245.06     754.14      0.00
49     -289.70    -891.52      0.00     289.70     891.52      0.00
50     -312.09    -960.77      0.00     312.09     960.77      0.00
51     -312.25    -960.91      0.00     312.25     960.91      0.00
52     -289.71    -891.55      0.00     289.71     891.55      0.00
53     -244.90    -753.93      0.00     244.90     753.93      0.00
54     -190.33    -585.73      0.00     190.33     585.73      0.00
55     -144.86    -445.79      0.00     144.86     445.79      0.00
56      841.16    2588.74      0.00    -841.16   -2588.74      0.00
57     1070.27    3293.78      0.00   -1070.27   -3293.78      0.00
58     1162.82    3578.69      0.00   -1162.82   -3578.69      0.00
59     1215.87    3741.93      0.00   -1215.87   -3741.93      0.00
60     1243.73    3827.64      0.00   -1243.73   -3827.64      0.00
61     1235.26    3801.61      0.00   -1235.26   -3801.61      0.00
62     1243.71    3827.57      0.00   -1243.71   -3827.57      0.00
63     1215.79    3741.67      0.00   -1215.79   -3741.67      0.00
64     1162.74    3578.45      0.00   -1162.74   -3578.45      0.00
65     1069.57    3292.86      0.00   -1069.57   -3292.86      0.00
66      841.05    2588.39      0.00    -841.05   -2588.39      0.00
67      258.48     795.34      0.00    -258.48    -795.34      0.00
68       33.35     102.67      0.00     -33.35    -102.67      0.00
69      -34.88    -107.35      0.00      34.88     107.35      0.00
70      -70.04    -215.53      0.00      70.04     215.53      0.00
71      -89.15    -274.42      0.00      89.15     274.42      0.00
72      -97.93    -301.32      0.00      97.93     301.32      0.00
73      -97.87    -301.27      0.00      97.87     301.27      0.00
74      -89.12    -274.32      0.00      89.12     274.32      0.00
75      -69.97    -215.31      0.00      69.97     215.31      0.00
76      -34.79    -107.09      0.00      34.79     107.09      0.00
77       33.44     102.92      0.00     -33.44    -102.92      0.00
78      258.56     795.60      0.00    -258.56    -795.60      0.00
79      -49.92      36.27   -132.32      49.92     -36.27    132.32
80       -0.05       0.00     -0.10       0.05       0.00      0.10
81       -0.03       0.03     -0.09       0.03      -0.03      0.09
82       61.74       0.00    132.40     -61.74       0.00   -132.40
83       97.39     -70.76   -258.17     -97.39      70.76    258.17
84       58.94       0.83   -125.83     -58.94      -0.83    125.83
85        0.05      -0.04     -0.14      -0.05       0.04      0.14
86        0.04       0.00     -0.10      -0.04       0.00      0.10
87      -47.15      35.28    125.70      47.15     -35.28   -125.70
88     -120.55       0.00    258.53     120.55       0.00   -258.53
89     -191.94     139.45   -508.78     191.94    -139.45    508.78
90      -58.76      -0.62   -125.57      58.76       0.62    125.57
91      -47.22      34.56   -125.35      47.22     -34.56    125.35
92        0.06       0.00      0.12      -0.06       0.00     -0.12
93        0.05      -0.04      0.14      -0.05       0.04     -0.14
94       58.86       0.21    126.08     -58.86      -0.21   -126.08
95       47.21     -35.07    125.69     -47.21      35.07   -125.69
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96	237.52	0.00	509.36	-237.52	0.00	-509.36
97	285.99	-207.78	-758.09	-285.99	207.78	758.09
98	116.34	0.99	-248.81	-116.34	-0.99	248.81
99	46.89	-34.22	-124.39	-46.89	34.22	124.39
100	58.05	0.37	-124.24	-58.05	-0.37	124.24
101	-0.08	0.06	0.22	0.08	-0.06	-0.22
102	-0.19	0.00	0.41	0.19	0.00	-0.41
103	-46.89	34.52	124.61	46.89	-34.52	-124.61
104	-58.11	-0.12	124.53	58.11	0.12	-124.53
105	-93.65	69.26	249.09	93.65	-69.26	-249.09
106	-353.44	0.00	757.95	353.44	0.00	-757.95
107	-426.77	310.07	-1131.27	426.77	-310.07	1131.27
108	-116.29	-0.82	-248.82	116.29	0.82	248.82
109	-93.87	68.40	-248.96	93.87	-68.40	248.96
110	-58.06	-0.33	-124.28	58.06	0.33	124.28
111	-46.90	34.28	-124.46	46.90	-34.28	124.46
112	-0.02	0.00	-0.05	0.02	0.00	0.05
113	0.10	-0.08	0.27	-0.10	0.08	-0.27
114	58.03	0.16	124.33	-58.03	-0.16	-124.33
115	46.96	-34.53	124.76	-46.96	34.53	-124.76
116	116.23	0.16	249.14	-116.23	-0.16	-249.14
117	93.82	-69.18	249.40	-93.82	69.18	-249.40
118	527.71	0.00	1131.67	-527.71	0.00	-1131.67
119	567.12	-412.04	-1503.32	-567.12	412.04	1503.32
120	173.77	1.05	-371.92	-173.77	-1.05	371.92
121	93.40	-68.00	-247.68	-93.40	68.00	247.68
122	115.80	0.58	-247.92	-115.80	-0.58	247.92
123	46.72	-34.09	-123.95	-46.72	34.09	123.95
124	57.90	0.23	-124.01	-57.90	-0.23	124.01
125	0.02	-0.02	-0.06	-0.02	0.02	0.06
126	-0.09	0.00	0.19	0.09	0.00	-0.19
127	-46.75	34.26	124.14	46.75	-34.26	-124.14
128	-58.06	-0.12	124.43	58.06	0.12	-124.43
129	-93.39	68.57	248.05	93.39	-68.57	-248.05
130	-115.89	-0.12	248.46	115.89	0.12	-248.46
131	-140.04	103.04	372.11	140.04	-103.04	-372.11
132	-700.96	0.00	1503.24	700.96	0.00	-1503.24
133	-754.39	548.10	-1999.70	754.39	-548.10	1999.70
134	-173.75	-0.92	-371.98	173.75	0.92	371.98
135	-140.36	102.14	-372.17	140.36	-102.14	372.17
136	-115.75	-0.53	-247.85	115.75	0.53	247.85
137	-93.49	68.14	-247.98	93.49	-68.14	247.98
138	-57.91	-0.22	-124.04	57.91	0.22	124.04
139	-46.60	34.02	-123.63	46.60	-34.02	123.63
140	0.10	0.00	0.22	-0.10	0.00	-0.22
141	0.06	-0.05	0.17	-0.06	0.05	-0.17
142	58.07	0.13	124.44	-58.07	-0.13	-124.44
143	46.77	-34.25	124.16	-46.77	34.25	-124.16
144	115.80	0.18	248.21	-115.80	-0.18	-248.21
145	93.53	-68.61	248.38	-93.53	68.61	-248.38
146	173.57	0.13	372.13	-173.57	-0.13	-372.13

147	140.15	-102.97	372.30	-140.15	102.97	-372.30
148	932.34	0.00	1999.36	-932.34	0.00	-1999.36
149	756.74	-549.80	-2005.92	-756.74	549.80	2005.92
150	2.68	0.01	-5.74	-2.68	-0.01	5.74
151	130.76	-95.12	-346.70	-130.76	95.12	346.70
152	162.00	0.67	-346.94	-162.00	-0.67	346.94
153	96.85	-70.54	-256.85	-96.85	70.54	256.85
154	120.00	0.42	-257.04	-120.00	-0.42	257.04
155	57.97	-42.28	-153.78	-57.97	42.28	153.78
156	71.76	0.21	-153.73	-71.76	-0.21	153.73
157	-0.09	0.07	0.24	0.09	-0.07	-0.24
158	-0.13	0.00	0.28	0.13	0.00	-0.28
159	-57.95	42.37	153.80	57.95	-42.37	-153.80
160	-71.82	-0.13	153.93	71.82	0.13	-153.93
161	-96.89	70.92	257.20	96.89	-70.92	-257.20
162	-119.90	-0.14	257.03	119.90	0.14	-257.03
163	-130.54	95.67	346.63	130.54	-95.67	-346.63
164	-161.75	-0.10	346.82	161.75	0.10	-346.82
165	-2.17	1.59	5.75	2.17	-1.59	-5.75
166	-935.08	0.00	2005.36	935.08	0.00	-2005.36
167	-828.65	602.04	-2196.52	828.65	-602.04	2196.52
168	-31.28	-0.13	-67.00	31.28	0.13	67.00
169	-294.33	214.07	-780.38	294.33	-214.07	780.38
170	-89.56	-0.34	-191.82	89.56	0.34	191.82
171	-128.80	93.77	-341.55	128.80	-93.77	341.55
172	-85.64	-0.28	-183.46	85.64	0.28	183.46
173	-84.17	61.33	-223.24	84.17	-61.33	223.24
174	-36.79	-0.10	-78.83	36.79	0.10	78.83
175	-36.32	26.49	-96.35	36.32	-26.49	96.35
176	-1.13	0.00	-2.42	1.13	0.00	2.42
177	1.11	-0.81	2.95	-1.11	0.81	-2.95
178	45.04	0.08	96.52	-45.04	-0.08	-96.52
179	29.86	-21.82	79.24	-29.86	21.82	-79.24
180	104.28	0.15	223.51	-104.28	-0.15	-223.51
181	69.15	-50.59	183.54	-69.15	50.59	-183.54
182	159.35	0.15	341.62	-159.35	-0.15	-341.62
183	72.24	-52.90	191.78	-72.24	52.90	-191.78
184	363.95	0.17	780.35	-363.95	-0.17	-780.35
185	25.20	-18.48	66.92	-25.20	18.48	-66.92
186	1024.12	0.00	2196.17	-1024.12	0.00	-2196.17
187	978.39	-710.90	-2593.65	-978.39	710.90	2593.65
188	185.46	0.72	-397.23	-185.46	-0.72	397.23
189	460.85	-335.10	-1221.78	-460.85	335.10	1221.78
190	237.37	0.82	-508.47	-237.37	-0.82	508.47
191	194.57	-141.60	-515.93	-194.57	141.60	515.93
192	170.94	0.53	-366.21	-170.94	-0.53	366.21
193	110.79	-80.69	-293.81	-110.79	80.69	293.81
194	118.36	0.32	-253.61	-118.36	-0.32	253.61
195	53.20	-38.78	-141.13	-53.20	38.78	141.13
196	57.68	0.13	-123.60	-57.68	-0.13	123.60
197	-1.03	0.75	2.72	1.03	-0.75	-2.72

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198        1.20        0.00       -2.58       -1.20        0.00        2.58
199      -46.66       34.07      123.81       46.66      -34.07     -123.81
200      -65.84       -0.10      141.12       65.84        0.10     -141.12
201      -95.69       69.92      253.93       95.69      -69.92     -253.93
202     -136.97       -0.16      293.63      136.97        0.16     -293.63
203     -138.07      100.96      366.43      138.07     -100.96     -366.43
204     -240.60       -0.19      515.81      240.60        0.19     -515.81
205     -191.54      140.17      508.40      191.54     -140.17     -508.40
206     -569.67       -0.22     1221.53      569.67        0.22    -1221.53
207     -149.63      109.60      397.27      149.63     -109.60     -397.27
208    -1209.23        0.00     2593.30     1209.23        0.00    -2593.30
209    -1676.32     1217.89    -4443.43     1676.32    -1217.89     4443.43
210     -821.37       -2.91    -1759.32      821.37        2.91     1759.32
211     -640.82      465.87    -1698.78      640.82     -465.87     1698.78
212     -323.50       -1.04     -693.00      323.50        1.04      693.00
213     -238.56      173.56     -632.52      238.56     -173.56      632.52
214     -207.12       -0.60     -443.76      207.12        0.60      443.76
215     -144.52      105.22     -383.25      144.52     -105.22      383.25
216     -128.18       -0.33     -274.64      128.18        0.33      274.64
217      -80.74       58.82     -214.12       80.74      -58.82      214.12
218      -67.95       -0.15     -145.60       67.95        0.15      145.60
219      -32.08       23.39      -85.09       32.08      -23.39       85.09
220      -14.08       -0.03      -30.18       14.08        0.03       30.18
221       11.44       -8.35       30.35      -11.44        8.35      -30.35
222       39.72        0.06       85.14      -39.72       -0.06      -85.14
223       54.90      -40.08      145.65      -54.90       40.08     -145.65
224       99.88        0.13      214.12      -99.88       -0.13     -214.12
225      103.50      -75.61      274.66     -103.50       75.61     -274.66
226      178.73        0.17      383.17     -178.73       -0.17     -383.17
227      167.20     -122.22      443.73     -167.20      122.22     -443.73
228      294.97        0.19      632.46     -294.97       -0.19     -632.46
229      261.11     -190.99      693.02     -261.11      190.99     -693.02
230      792.16        0.25     1698.61     -792.16       -0.25    -1698.61
231      662.66     -485.05     1759.09     -662.66      485.05    -1759.09
232     2071.96        0.00     4443.20    -2071.96        0.00    -4443.20
233     2013.22    -1462.70        0.00    -2013.22     1462.70        0.00
234     2488.37        0.00        0.00    -2488.37        0.00        0.00
235     2883.97    -2095.33        0.00    -2883.97     2095.33        0.00
236     3564.04        0.00        0.00    -3564.04        0.00        0.00
237     3261.60    -2369.70        0.00    -3261.60     2369.70        0.00
238     4030.82        0.00        0.00    -4030.82        0.00        0.00
239     3034.25    -2204.51        0.00    -3034.25     2204.51        0.00
240     3749.57        0.00        0.00    -3749.57        0.00        0.00
241     1438.00    -1044.79        0.00    -1438.00     1044.79        0.00
242     1777.53        0.00        0.00    -1777.53        0.00        0.00
243     -652.57      474.13        0.00      652.57     -474.13        0.00
244     -806.71        0.00        0.00      806.71        0.00        0.00
245     -727.84      528.81        0.00      727.84     -528.81        0.00
246     -899.49        0.00        0.00      899.49        0.00        0.00
247     -217.53      158.05        0.00      217.53     -158.05        0.00
248     -268.34        0.00        0.00      268.34        0.00        0.00
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249	1036.48	-753.04	0.00	-1036.48	753.04	0.00
250	1281.31	0.00	0.00	-1281.31	0.00	0.00
251	3117.35	-2264.94	0.00	-3117.35	2264.94	0.00
252	3853.50	0.00	0.00	-3853.50	0.00	0.00
253	1234.41	-398.18	0.00	-1234.41	398.18	0.00
254	412.81	-300.20	0.00	-412.81	300.20	0.00
255	69.49	-22.45	0.00	-69.49	22.45	0.00
256	-11.89	8.65	0.00	11.89	-8.65	0.00
257	-42.01	13.59	0.00	42.01	-13.59	0.00
258	-51.14	37.26	0.00	51.14	-37.26	0.00
259	-74.44	24.13	0.00	74.44	-24.13	0.00
260	-49.86	36.36	0.00	49.86	-36.36	0.00
261	-208.93	67.83	0.00	208.93	-67.83	0.00
262	-159.66	116.53	0.00	159.66	-116.53	0.00
263	1232.76	-403.46	0.00	-1232.76	403.46	0.00
264	510.24	0.22	0.00	-510.24	-0.22	0.00
265	69.34	-22.66	0.00	-69.34	22.66	0.00
266	-14.53	-0.01	0.00	14.53	0.01	0.00
267	-41.81	13.64	0.00	41.81	-13.64	0.00
268	-63.00	-0.08	0.00	63.00	0.08	0.00
269	-74.53	24.27	0.00	74.53	-24.27	0.00
270	-61.76	-0.11	0.00	61.76	0.11	0.00
271	-208.64	67.85	0.00	208.64	-67.85	0.00
272	-197.44	-0.42	0.00	197.44	0.42	0.00
273	-634.15	204.68	0.00	634.15	-204.68	0.00
274	-589.57	428.65	0.00	589.57	-428.65	0.00
275	57.35	-18.53	0.00	-57.35	18.53	0.00
276	-74.12	53.93	0.00	74.12	-53.93	0.00
277	-43.40	14.05	0.00	43.40	-14.05	0.00
278	16.02	-11.66	0.00	-16.02	11.66	0.00
279	-51.62	16.73	0.00	51.62	-16.73	0.00
280	23.28	-16.97	0.00	-23.28	16.97	0.00
281	-40.66	13.20	0.00	40.66	-13.20	0.00
282	13.51	-9.85	0.00	-13.51	9.85	0.00
283	-633.11	207.09	0.00	633.11	-207.09	0.00
284	-728.71	-0.26	0.00	728.71	0.26	0.00
285	-57.43	18.76	0.00	57.43	-18.76	0.00
286	-91.76	-0.07	0.00	91.76	0.07	0.00
267	43.30	-14.13	0.00	-43.30	14.13	0.00
288	19.66	0.02	0.00	-19.66	-0.02	0.00
289	51.26	-16.70	0.00	-51.26	16.70	0.00
290	28.53	0.04	0.00	-28.53	-0.04	0.00
291	40.38	-13.14	0.00	-40.38	13.14	0.00
292	16.42	0.03	0.00	-16.42	-0.03	0.00
293	-25.57	8.31	0.00	25.57	-8.31	0.00

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                      MEMBER FORCES DECOMPOSED INTO X-Y-Z COMPONENTS
                              FOR SUBSTRUCTURE:      6

MEM.      X-DIR.       Y-DIR.       Z-DIR.       X-DIR.       Y-DIR.       Z-DIR.
NO.       NODE I       NODE I       NODE I       NODE J       NODE J       NODE J
  1     -2550.11      7848.55         0.00      2550.11     -7848.55         0.00
  2       941.62     -2898.01         0.00      -941.62      2898.01         0.00
  3       941.77     -2898.48         0.00      -941.77      2898.48         0.00
  4     -1386.64      4267.56         0.00      1386.64     -4267.56         0.00
  5     -1398.19      4303.30         0.00      1398.19     -4303.30         0.00
  6     -1386.80      4268.02         0.00      1386.80     -4268.02         0.00
  7       590.15     -1816.31         0.00      -590.15      1816.31         0.00
  8       612.92     -1886.32         0.00      -612.92      1886.32         0.00
  9       612.96     -1886.54         0.00      -612.96      1886.54         0.00
 10       590.28     -1816.72         0.00      -590.28      1816.72         0.00
 11     -1253.99      3859.45         0.00      1253.99     -3859.45         0.00
 12     -1287.84      3963.48         0.00      1287.84     -3963.48         0.00
 13     -1299.14      3998.46         0.00      1299.14     -3998.46         0.00
 14     -1287.91      3963.69         0.00      1287.91     -3963.69         0.00
 15     -1254.09      3859.75         0.00      1254.09     -3859.75         0.00
 16       457.56     -1408.24         0.00      -457.56      1408.24         0.00
 17       502.41     -1546.27         0.00      -502.41      1546.27         0.00
 18       524.84     -1615.24         0.00      -524.84      1615.24         0.00
 19       524.82     -1615.29         0.00      -524.82      1615.29         0.00
 20       502.52     -1546.55         0.00      -502.52      1546.55         0.00
 21       457.71     -1408.71         0.00      -457.71      1408.71         0.00
 22     -1211.96      3730.24         0.00      1211.96     -3730.24         0.00
 23     -1267.82      3902.05         0.00      1267.82     -3902.05         0.00
 24     -1301.33      4005.00         0.00      1301.33     -4005.00         0.00
 25     -1312.52      4039.63         0.00      1312.52     -4039.63         0.00
 26     -1301.41      4005.26         0.00      1301.41     -4005.26         0.00
 27     -1267.95      3902.44         0.00      1267.95     -3902.44         0.00
 28     -1212.15      3730.52         0.00      1212.15     -3730.52         0.00
 29       315.53      -970.98         0.00      -315.53       970.98         0.00
 30       380.15     -1169.86         0.00      -380.15      1169.8[illegible]         0.00
 31       425.43     -1309.65         0.00      -425.43      1309.65         0.00
 32       450.54     -1386.49         0.00      -450.54      1386.49         0.00
 33       450.60     -1386.64         0.00      -450.60      1386.64         0.00
 34       425.52     -1309.77         0.00      -425.52      1309.77         0.00
 35       380.21     -1170.16         0.00      -380.21      1170.16         0.00
 36       315.59      -971.30         0.00      -315.59       971.30         0.00
 37     -1194.31      3675.61         0.00      1194.31     -3675.61         0.00
 38     -1204.74      3707.72         0.00      1204.74     -3707.72         0.00
 39     -1256.20      3867.43         0.00      1256.20     -3867.43         0.00
 40     -1295.07      3985.71         0.00      1295.07     -3985.71         0.00
 41     -1293.23      3980.07         0.00      1293.23     -3980.07         0.00
 42     -1294.92      3985.21         0.00      1294.92     -3985.21         0.00
 43     -1256.86      3868.13         0.00      1256.86     -3868.13         0.00
 44     -1204.74      3707.74         0.00      1204.74     -3707.74         0.00
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45	-1194.39	3675.81	0.00	1194.39	-3675.81	0.00
46	144.84	-445.71	0.00	-144.84	445.71	0.00
47	190.33	-585.72	0.00	-190.33	585.72	0.00
48	244.91	-753.96	0.00	-244.91	753.96	0.00
49	289.68	-891.47	0.00	-289.68	891.47	0.00
50	312.17	-960.66	0.00	-312.17	960.66	0.00
51	312.09	-960.76	0.00	-312.09	960.76	0.00
52	289.67	-891.43	0.00	-289.67	891.43	0.00
53	245.00	-753.97	0.00	-245.00	753.97	0.00
54	190.33	-585.72	0.00	-190.33	585.72	0.00
55	144.78	-445.71	0.00	-144.78	445.71	0.00
56	-841.06	2588.42	0.00	841.06	-2588.42	0.00
57	-1069.66	3293.12	0.00	1069.66	-3293.12	0.00
58	-1162.76	3578.51	0.00	1162.76	-3578.51	0.00
59	-1215.77	3741.61	0.00	1215.77	-3741.61	0.00
60	-1243.70	3827.54	0.00	1243.70	-3827.54	0.00
61	-1235.22	3801.48	0.00	1235.22	-3801.48	0.00
62	-1243.72	3827.65	0.00	1243.72	-3827.65	0.00
63	-1215.78	3741.62	0.00	1215.78	-3741.62	0.00
64	-1162.83	3578.72	0.00	1162.83	-3578.72	0.00
65	-1070.10	3293.29	0.00	1070.10	-3293.29	0.00
66	-840.80	2588.56	0.00	840.80	-2588.56	0.00
67	-258.56	795.59	0.00	258.56	-795.59	0.00
68	-33.42	102.87	0.00	33.42	-102.87	0.00
69	34.81	-107.13	0.00	-34.81	107.13	0.00
70	70.00	-215.40	0.00	-70.00	215.40	0.00
71	89.14	-274.39	0.00	-89.14	274.39	0.00
72	97.88	-301.29	0.00	-97.88	301.29	0.00
73	97.90	-301.24	0.00	-97.90	301.24	0.00
74	89.14	-274.39	0.00	-89.14	274.39	0.00
75	70.01	-215.41	0.00	-70.01	215.41	0.00
76	34.84	-107.23	0.00	-34.84	107.23	0.00
77	-33.37	102.70	0.00	33.37	-102.70	0.00
78	-258.48	795.36	0.00	258.48	-795.36	0.00
79	-61.74	0.00	-132.40	61.74	0.00	132.40
80	-0.33	-0.25	-0.88	0.33	0.25	0.88
81	-0.44	0.01	-0.94	0.44	-0.01	0.94
82	49.81	36.19	132.03	-49.81	-36.19	-132.03
83	120.55	0.00	-258.53	-120.55	0.00	258.53
84	47.40	35.47	-126.36	-47.40	-35.47	126.36
85	0.27	0.00	-0.58	-0.27	0.00	0.58
86	0.22	0.16	-0.58	-0.22	-0.16	0.58
87	-58.54	0.82	124.97	58.54	-0.82	-124.97
88	-97.47	-70.81	258.36	97.47	70.81	-258.36
89	-237.52	0.00	-509.36	237.52	0.00	509.36
90	-47.28	-35.12	-125.85	47.28	35.12	125.85
91	-58.78	0.21	-125.91	58.78	-0.21	125.91
92	-0.16	-0.12	-0.43	0.16	0.12	0.43
93	-0.07	0.00	-0.16	0.07	0.00	0.16
94	47.28	34.61	125.50	-47.20	-34.61	-125.50
95	58.65	-0.62	125.34	-50.65	0.62	-125.34

96	192.15	139.60	509.33	-192.15	-139.60	-509.33
97	353.44	0.00	-757.95	-353.44	0.00	757.95
98	93.78	69.36	-249.44	-93.78	-69.36	249.44
99	58.20	-0.12	-124.73	-58.20	0.12	124.73
100	46.94	34.56	-124.75	-46.94	-34.56	124.75
101	0.19	0.00	-0.40	-0.19	0.00	0.40
102	0.12	0.09	-0.31	-0.12	-0.09	0.31
103	-58.12	0.37	124.38	58.12	-0.37	-124.38
104	-46.76	-34.12	124.06	46.76	34.12	-124.06
105	-116.40	0.99	248.93	116.40	-0.99	-248.93
106	-286.24	-207.96	758.75	286.24	207.96	-758.75
107	-527.71	0.00	-1131.66	527.71	0.00	1131.66
108	-93.71	-69.10	-249.12	93.71	69.10	249.12
109	-116.28	0.16	-249.25	116.28	-0.16	249.25
110	-46.82	-34.42	-124.39	46.82	34.42	124.39
111	-58.12	0.16	-124.52	58.12	-0.16	124.52
112	-0.07	-0.05	-0.19	0.07	0.05	0.19
113	-0.10	0.00	-0.20	0.10	0.00	0.20
114	46.93	34.30	124.53	-46.93	-34.30	-124.53
115	58.09	-0.33	124.34	-58.09	0.33	-124.34
116	93.80	68.35	248.79	-93.80	-68.35	-248.79
117	116.35	-0.82	248.93	-116.35	0.82	-248.93
118	426.79	310.08	1131.32	-426.79	-310.08	-1131.32
119	700.97	0.00	-1503.25	-700.97	0.00	1503.25
120	139.90	102.94	-371.75	-139.90	-102.94	371.75
121	115.68	-0.12	-248.01	-115.68	0.12	248.01
122	93.39	68.58	-248.06	-93.39	-68.58	248.06
123	57.92	-0.12	-124.13	-57.92	0.12	124.13
124	46.77	34.27	-124.17	-46.77	-34.27	124.17
125	0.11	0.00	-0.23	-0.11	0.00	0.23
126	0.05	0.03	-0.12	-0.05	-0.03	0.12
127	-57.71	0.23	123.59	57.71	-0.23	-123.59
128	-46.55	-33.97	123.50	46.55	33.97	-123.50
129	-115.79	0.58	247.90	115.79	-0.58	-247.90
130	-93.51	-68.09	247.98	93.51	68.09	-247.98
131	-173.70	1.05	371.76	173.70	-1.05	-371.76
132	-567.17	-412.07	1503.43	567.17	412.07	-1503.43
133	-932.33	0.00	-1999.32	932.33	0.00	1999.32
134	-140.08	-102.91	-372.09	140.08	102.91	372.09
135	-173.50	0.13	-371.99	173.50	-0.13	371.99
136	-93.47	-68.56	-248.22	93.47	68.56	248.22
137	-115.74	0.18	-248.10	115.74	-0.18	248.10
138	-46.71	-34.21	-124.01	46.71	34.21	124.01
139	-57.91	0.13	-124.09	57.91	-0.13	124.09
140	-0.08	-0.06	-0.20	0.08	0.06	0.20
141	-0.10	0.00	-0.21	0.10	0.00	0.21
142	46.61	34.03	123.66	-46.61	-34.03	-123.66
143	57.84	-0.22	123.88	-57.84	0.22	-123.88
144	93.51	68.15	248.02	-93.51	-68.15	-248.02
145	115.96	-0.53	248.32	-115.96	0.53	-248.32
146	140.29	102.09	372.00	-140.29	-102.09	-372.00

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147     173.84     -0.92     372.15    -173.84      0.92    -372.15
148     754.41    548.11    1999.74    -754.41   -548.11   -1999.74
149     935.10      0.00   -2005.40    -935.10      0.00    2005.40
150       2.34      1.72      -6.21      -2.34     -1.72       6.21
151     161.77     -0.10    -346.87    -161.77      0.10     346.87
152     130.65     95.75    -346.90    -130.65    -95.75     346.90
153     119.83     -0.14    -256.89    -119.83      0.14     256.89
154      96.93     70.94    -257.28     -96.93    -70.94     257.28
155      71.83     -0.13    -153.94     -71.83      0.13     153.94
156      57.98     42.38    -153.87     -57.98    -42.38     153.87
157      -0.04      0.00       0.09       0.04      0.00      -0.09
158       0.03      0.02      -0.09      -0.03     -0.02       0.09
159     -71.76      0.21     153.73      71.76     -0.21    -153.73
160     -57.99    -42.29     153.82      57.99     42.29    -153.82
161    -119.85      0.42     256.73     119.85     -0.42    -256.73
162     -96.97    -70.63     257.17      96.97     70.63    -257.17
163    -161.83      0.67     346.57     161.83     -0.67    -346.57
164    -130.73    -95.10     346.62     130.73     95.10    -346.62
165      -2.75      0.01       5.90       2.75     -0.01      -5.90
166    -756.49   -549.62    2005.26     756.49    549.62   -2005.26
167   -1024.11      0.00   -2196.15    1024.11      0.00    2196.15
168     -25.26    -18.52     -67.07      25.26     18.52      67.07
169    -364.01      0.17    -780.50     364.01     -0.17     780.50
170     -72.23    -52.90    -191.76      72.23     52.90     191.76
171    -159.36      0.15    -341.64     159.36     -0.15     341.64
172     -69.19    -50.62    -183.64      69.19     50.62     183.64
173    -104.25      0.15    -223.46     104.25     -0.15     223.46
174     -29.80    -21.78     -79.08      29.80     21.78      79.08
175     -44.92      0.08     -96.29      44.92     -0.08      96.29
176      -1.02     -0.74      -2.70       1.02      0.74       2.70
177       1.29      0.00       2.77      -1.29      0.00      -2.77
178      36.30     26.48      96.29     -36.30    -26.48     -96.29
179      36.90     -0.10      79.05     -36.90      0.10     -79.05
180      84.18     61.34     223.28     -84.18    -61.34    -223.28
181      85.68     -0.28     183.54     -85.68      0.28    -183.54
182     128.74     93.73     341.41    -128.74    -93.73    -341.41
183      89.47     -0.34     191.64     -89.47      0.34    -191.64
184     294.31    214.05     780.32    -294.31   -214.05    -780.32
185      31.23     -0.13      66.87     -31.23      0.13     -66.87
186     828.60    602.01    2196.38    -828.60   -602.01   -2196.38
187    1209.23      0.00   -2593.30   -1209.23      0.00    2593.30
188     149.62    109.59    -397.24    -149.62   -109.59     397.24
189     569.70     -0.22   -1221.61    -569.70      0.22    1221.61
190     191.54    140.18    -508.42    -191.54   -140.18     508.42
191     240.59     -0.19    -515.78    -240.59      0.19     515.78
192     138.04    100.94    -366.35    -138.04   -100.94     366.35
193     137.02     -0.16    -293.74    -137.02      0.16     293.74
194      95.59     69.84    -253.65     -95.59    -69.84     253.65
195      65.90     -0.10    -141.26     -65.90      0.10     141.26
196      46.58     34.00    -123.58     -46.58    -34.00     123.58
197      -1.24      0.00       2.67       1.24      0.00      -2.67
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198        1.01        0.73       -2.67       -1.01       -0.73        2.67
199      -57.69        0.13      123.63       57.69       -0.13     -123.63
200      -53.19      -38.78      141.10       53.19       38.78     -141.10
201     -118.43        0.32      253.75      118.43       -0.32     -253.75
202     -110.74      -80.66      293.69      110.74       80.66     -293.69
203     -170.97        0.53      366.27      170.97       -0.53     -366.27
204     -194.53     -141.57      515.82      194.53      141.57     -515.82
205     -237.33        0.82      508.38      237.33       -0.82     -508.38
206     -460.78     -335.05     1221.61      460.78      335.05    -1221.61
207     -185.46        0.72      397.23      185.46       -0.72     -397.23
208     -978.44     -710.86     2593.56      978.44      710.86    -2593.56
209    -2071.94        0.00    -4443.16     2071.94        0.00     4443.16
210     -662.68     -485.06    -1759.14      662.68      485.06     1759.14
211     -792.16        0.26    -1698.63      792.16       -0.26     1698.63
212     -261.10     -190.98     -692.99      261.10      190.98      692.99
213     -294.99        0.19     -632.50      294.99       -0.19      632.50
214     -167.19     -122.21     -443.69      167.19      122.21      443.69
215     -178.73        0.17     -383.16      178.73       -0.17      383.16
216     -103.48      -75.59     -274.60      103.48       75.59      274.60
217      -99.85        0.13     -214.05       99.85       -0.13      214.05
218      -54.86      -40.05     -145.56       54.86       40.05      145.56
219      -39.68        0.06      -85.06       39.68       -0.06       85.06
220      -11.40       -8.32      -30.25       11.40        8.32       30.25
221       14.11       -0.03       30.23      -14.11        0.03      -30.23
222       32.06       23.37       85.04      -32.06      -23.37      -85.04
223       67.92       -0.15      145.54      -67.92        0.15     -145.54
224       80.73       58.81      214.09      -80.73      -58.81     -214.09
225      128.15       -0.33      274.59     -128.15        0.33     -274.59
226      144.49      105.19      383.16     -144.49     -105.19     -383.16
227      207.08       -0.60      443.68     -207.08        0.60     -443.68
228      238.53      173.53      632.43     -238.53     -173.53     -632.43
229      323.47       -1.04      692.94     -323.47        1.04     -692.94
230      640.76      465.82     1698.61     -640.76     -465.82    -1698.61
231      821.19       -2.91     1759.04     -821.19        2.91    -1759.04
232     1675.99     1217.78     4442.94    -1675.99    -1217.78    -4442.94
233     2488.35        0.00        0.00    -2488.35        0.00        0.00
234     2013.25     1462.71        0.00    -2013.25    -1462.71        0.00
235     3564.04        0.00        0.00    -3564.04        0.00        0.00
236     2883.75     2095.16        0.00    -2883.75    -2095.16        0.00
237     4030.90        0.00        0.00    -4030.90        0.00        0.00
238     3261.15     2369.37        0.00    -3261.15    -2369.37        0.00
239     3749.61        0.00        0.00    -3749.61        0.00        0.00
240     3033.57     2204.01        0.00    -3033.57    -2204.01        0.00
241     1777.45        0.00        0.00    -1777.45        0.00        0.00
242     1437.93     1044.70        0.00    -1437.93    -1044.70        0.00
243     -806.71        0.00        0.00      806.71        0.00        0.00
244     -652.82     -474.30        0.00      652.82      474.30        0.00
245     -899.48        0.00        0.00      899.48        0.00        0.00
246     -727.66     -528.68        0.00      727.66      528.68        0.00
247     -268.34        0.00        0.00      268.34        0.00        0.00
248     -217.32     -157.89        0.00      217.32      157.89        0.00
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249	1281.35	0.00	0.00	-1281.35	0.00	0.00
250	1036.48	753.04	0.00	-1036.48	-753.04	0.00
251	3853.38	0.00	0.00	-3853.38	0.00	0.00
252	3117.43	2265.01	0.00	-3117.43	-2265.01	0.00
253	1232.75	403.46	0.00	-1232.75	-403.46	0.00
254	510.26	-0.22	0.00	-510.26	0.22	0.00
255	69.45	22.69	0.00	-69.45	-22.69	0.00
256	-14.39	0.01	0.00	14.39	-0.01	0.00
257	-42.02	-13.71	0.00	42.02	13.71	0.00
258	-63.29	0.08	0.00	63.29	-0.08	0.00
259	-74.20	-24.17	0.00	74.20	24.17	0.00
260	-61.49	0.11	0.00	61.49	-0.11	0.00
261	-208.79	-67.89	0.00	208.79	67.89	0.00
262	-197.47	0.42	0.00	197.47	-0.42	0.00
263	1234.54	398.22	0.00	-1234.54	-398.22	0.00
264	412.68	300.10	0.00	-412.68	-300.10	0.00
265	69.55	22.47	0.00	-69.55	-22.47	0.00
266	-11.80	-8.59	0.00	11.80	8.59	0.00
267	-41.94	-13.57	0.00	41.94	13.57	0.00
268	-51.06	-37.20	0.00	51.06	37.20	0.00
269	-74.42	-24.12	0.00	74.42	24.12	0.00
270	-49.78	-36.30	0.00	49.78	36.30	0.00
271	-208.86	-67.81	0.00	208.86	67.81	0.00
272	-159.56	-116.45	0.00	159.56	116.45	0.00
273	-633.25	-207.13	0.00	633.25	207.13	0.00
274	-728.89	0.26	0.00	728.89	-0.26	0.00
275	57.53	18.79	0.00	-57.53	-18.79	0.00
276	-91.86	0.07	0.00	91.86	-0.07	0.00
277	-43.24	-14.10	0.00	43.24	14.10	0.00
278	19.59	-0.02	0.00	-19.59	0.02	0.00
279	-51.30	-16.71	0.00	51.30	16.71	0.00
280	28.56	-0.04	0.00	-28.56	0.04	0.00
281	-40.50	-13.18	0.00	40.50	13.18	0.00
282	16.56	-0.03	0.00	-16.56	0.03	0.00
283	-634.04	-204.64	0.00	634.04	204.64	0.00
284	-589.42	-428.54	0.00	589.42	428.54	0.00
285	-57.35	-18.54	0.00	57.35	18.54	0.00
286	-74.09	-53.91	0.00	74.09	53.91	0.00
287	43.39	14.04	0.00	-43.39	-14.04	0.00
288	15.99	11.64	0.00	-15.99	-11.64	0.00
289	51.49	16.69	0.00	-51.49	-16.69	0.00
290	23.17	16.89	0.00	-23.17	-16.89	0.00
291	40.48	13.14	0.00	-40.48	-13.14	0.00
292	13.39	9.77	0.00	-13.39	-9.77	0.00
293	-25.57	-8.31	0.00	25.57	8.31	0.00

```
              MEMBER FORCES DECOMPOSED INTO X-Y-Z COMPONENTS
                      FOR SUBSTRUCTURE:        7

MEM.      X-DIR.       Y-DIR.       Z-DIR.       X-DIR.       Y-DIR.       Z-DIR.
NO.       NODE I       NODE I       NODE I       NODE J       NODE J       NODE J
   1     -6676.81      4850.98         0.00      6676.81     -4850.98         0.00
   2      2465.52     -1791.33         0.00     -2465.52      1791.33         0.00
   3      2465.82     -1791.52         0.00     -2465.82      1791.52         0.00
   4     -3630.80      2637.97         0.00      3630.80     -2637.97         0.00
   5     -3661.13      2659.97         0.00      3661.13     -2659.97         0.00
   6     -3630.90      2637.99         0.00      3630.90     -2637.99         0.00
   7      1545.60     -1122.94         0.00     -1545.60      1122.94         0.00
   8      1605.12     -1166.19         0.00     -1605.12      1166.19         0.00
   9      1605.04     -1166.13         0.00     -1605.04      1166.13         0.00
  10      1545.66     -1123.00         0.00     -1545.66      1123.00         0.00
  11     -3283.63      2385.68         0.00      3283.63     -2385.68         0.00
  12     -3371.90      2449.85         0.00      3371.90     -2449.85         0.00
  13     -3401.42      2471.24         0.00      3401.42     -2471.24         0.00
  14     -3371.92      2449.87         0.00      3371.92     -2449.87         0.00
  15     -3283.43      2305.57         0.00      3283.43     -2385.57         0.00
  16      1198.40      -870.69         0.00     -1198.40       870.69         0.00
  17      1315.83      -956.00         0.00     -1315.83       956.00         0.00
  18      1374.39      -998.55         0.00     -1374.39       998.55         0.00
  19      1374.42      -998.59         0.00     -1374.42       998.59         0.00
  20      1315.72      -955.93         0.00     -1315.72       955.93         0.00
  21      1198.43      -870.71         0.00     -1198.43       870.71         0.00
  22     -3173.52      2305.73         0.00      3173.52     -2305.73         0.00
  23     -3319.79      2411.96         0.00      3319.79     -2411.96         0.00
  24     -3407.33      2475.57         0.00      3407.33     -2475.57         0.00
  25     -3436.74      2496.94         0.00      3436.74     -2496.94         0.00
  26     -3407.36      2475.59         0.00      3407.36     -2475.59         0.00
  27     -3319.68      2411.92         0.00      3319.68     -2411.92         0.00
  28     -3173.40      2305.62         0.00      3173.40     -2305.62         0.00
  29       826.20      -600.33         0.00      -826.28       600.33         0.00
  30       995.58      -723.32         0.00      -995.58       723.32         0.00
  31      1114.59      -809.79         0.00     -1114.59       809.79         0.00
  32      1179.90      -857.25         0.00     -1179.90       857.25         0.00
  33      1180.03      -857.36         0.00     -1180.03       857.36         0.00
  34      1114.54      -809.72         0.00     -1114.54       809.72         0.00
  35       995.72      -723.48         0.00      -995.72       723.48         0.00
  36       826.52      -600.53         0.00      -826.52       600.53         0.00
  37     -3126.91      2271.86         0.00      3126.91     -2271.86         0.00
  38     -3153.93      2291.45         0.00      3153.93     -2291.45         0.00
  39     -3290.18      2390.48         0.00      3290.18     -2390.48         0.00
  40     -3390.32      2463.19         0.00      3390.32     -2463.19         0.00
  41     -3385.78      2459.98         0.00      3385.78     -2459.98         0.00
  42     -3389.86      2462.67         0.00      3389.86     -2462.67         0.00
  43     -3290.78      2391.15         0.00      3290.78     -2391.15         0.00
  44     -3154.09      2291.39         0.00      3154.09     -2291.39         0.00
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45    -3127.30    2272.35      0.00    3127.30   -2272.35      0.00
46      379.22    -275.52      0.00    -379.22     275.52      0.00
47      498.31    -362.04      0.00    -498.31     362.04      0.00
48      641.51    -466.07      0.00    -641.51     466.07      0.00
49      758.40    -550.99      0.00    -758.40     550.99      0.00
50      817.37    -593.83      0.00    -817.37     593.83      0.00
51      817.57    -594.09      0.00    -817.57     594.09      0.00
52      758.48    -551.04      0.00    -758.40     551.04      0.00
53      641.51    -466.06      0.00    -641.51     466.06      0.00
54      498.40    -362.09      0.00    -498.40     362.09      0.00
55      379.30    -275.62      0.00    -379.30     275.62      0.00
56    -2202.58    1600.11      0.00    2202.58   -1600.11      0.00
57    -2801.53    2035.63      0.00    2801.53   -2035.63      0.00
58    -3043.78    2211.19      0.00    3043.78   -2211.19      0.00
59    -3182.96    2312.73      0.00    3182.96   -2312.73      0.00
60    -3256.86    2366.20      0.00    3256.86   -2366.20      0.00
61    -3234.20    2349.90      0.00    3234.20   -2349.90      0.00
62    -3256.41    2366.00      0.00    3256.41   -2366.00      0.00
63    -3182.80    2312.12      0.00    3182.80   -2312.12      0.00
64    -3044.52    2212.05      0.00    3044.52   -2212.05      0.00
65    -2801.72    2035.66      0.00    2801.72   -2035.66      0.00
66    -2202.20    1600.04      0.00    2202.20   -1600.04      0.00
67     -676.54     491.57      0.00     676.54    -491.57      0.00
68      -87.43      63.53      0.00      87.43     -63.53      0.00
69       91.23     -66.28      0.00     -91.23      66.28      0.00
70      183.14    -133.04      0.00    -183.14     133.04      0.00
71      233.30    -169.51      0.00    -233.30     169.51      0.00
72      255.24    -186.17      0.00    -256.24     186.17      0.00
73      256.24    -186.17      0.00    -256.24     186.17      0.00
74      233.37    -169.55      0.00    -233.37     169.55      0.00
75      183.30    -133.18      0.00    -183.30     133.18      0.00
76       91.28     -66.32      0.00     -91.28      66.32      0.00
77      -87.27      63.41      0.00      87.27     -63.41      0.00
78     -676.44     491.47      0.00     676.44    -491.47      0.00
79      -49.81     -36.19   -132.03      49.81      36.19    132.03
80       -0.08      -0.27     -0.61       0.08       0.27      0.61
81       -0.11      -0.08     -0.30       0.11       0.08      0.30
82       19.00      58.48    131.86     -19.00     -58.48   -131.86
83       97.47      70.81   -258.36     -97.47     -70.81    258.36
84       17.44      56.38   -125.96     -17.44     -56.38    125.96
85        0.17       0.12     -0.45      -0.17      -0.12      0.45
86        0.02       0.06     -0.14      -0.02      -0.06      0.14
87      -48.09     -33.92    125.61      48.09      33.92   -125.61
88      -37.25    -114.65    258.51      37.25     114.65   -258.51
89     -192.15    -139.60   -509.33     192.15     139.60    509.33
90      -17.61     -56.21   -125.87      17.61      56.21    125.87
91      -47.59     -34.32   -125.69      47.59      34.32    125.69
92        0.02       0.06      0.13      -0.02      -0.06     -0.13
93       -0.05      -0.03     -0.13       0.05       0.03      0.13
94       17.95      55.93    125.82     -17.95     -55.93   -125.82
95       47.96      34.08    125.73     -47.96     -34.08   -125.73
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96	73.37	225.81	509.16	-73.37	-225.81	-509.16
97	286.24	207.96	-758.75	-286.24	-207.96	758.75
98	35.08	111.15	-249.24	-35.08	-111.15	249.24
99	47.08	34.06	-124.53	-47.08	-34.06	124.53
100	17.61	55.38	-124.37	-17.61	-55.38	124.37
101	-0.01	-0.01	0.03	0.01	0.01	-0.03
102	0.02	0.06	-0.13	-0.02	-0.06	0.13
103	-47.28	-33.89	124.48	47.28	33.89	-124.48
104	-17.81	-55.20	124.30	17.81	55.20	-124.30
105	-94.75	-67.62	248.94	94.75	67.62	-248.94
106	-109.38	-336.64	759.09	109.38	336.64	-759.09
107	-426.79	-310.08	-1131.32	426.79	310.08	1131.32
108	-35.20	-111.01	-249.16	35.20	111.01	249.16
109	-94.13	-68.18	-249.13	94.13	68.18	249.13
110	-17.63	-55.33	-124.31	17.63	55.33	124.31
111	-47.14	-34.04	-124.58	47.14	34.04	124.58
112	0.01	0.02	0.04	-0.01	-0.02	-0.04
113	0.04	0.03	0.10	-0.04	-0.03	-0.10
114	17.80	55.33	124.53	-17.80	-55.33	-124.53
115	47.21	33.89	124.40	-47.21	-33.89	-124.40
116	35.73	110.50	248.93	-35.73	-110.50	-248.93
117	94.59	67.71	248.87	-94.59	-67.71	-248.87
118	163.05	501.83	1131.57	-163.05	-501.83	-1131.57
119	567.18	412.08	-1503.45	-567.18	-412.08	1503.45
120	52.71	165.61	-371.97	-52.71	-165.61	371.97
121	93.75	67.97	-248.24	-93.75	-67.97	248.24
122	35.23	110.33	-247.96	-35.23	-110.33	247.96
123	46.79	33.85	-123.77	-46.79	-33.85	123.77
124	17.70	55.22	-124.19	-17.70	-55.22	124.19
125	-0.03	-0.02	0.07	0.03	0.02	-0.07
126	0.02	0.05	-0.12	-0.02	-0.05	0.12
127	-47.04	-33.89	124.16	47.04	33.89	-124.16
128	-17.78	-55.11	124.11	17.78	55.11	-124.11
129	-93.99	-67.56	247.82	93.99	67.56	-247.82
130	-35.62	-109.99	247.85	35.62	109.99	-247.85
131	-141.24	-101.32	372.03	141.24	101.32	-372.03
132	-216.69	-666.90	1503.77	216.69	666.90	-1503.77
133	-754.39	-548.10	-1999.71	754.39	548.10	1999.71
134	-52.89	-165.76	-372.48	52.89	165.76	372.48
135	-140.57	-101.97	-372.33	140.57	101.97	372.33
136	-35.33	-110.43	-248.27	35.33	110.43	248.27
137	-93.80	-67.93	-248.25	93.80	67.93	248.25
138	-17.68	-55.13	-124.00	17.68	55.13	124.00
139	-46.92	-33.93	-124.08	46.92	33.93	124.08
140	0.04	0.12	0.28	-0.04	-0.12	-0.28
141	-0.06	-0.05	-0.17	0.06	0.05	0.17
142	17.79	55.17	124.22	-17.79	-55.17	-124.22
143	47.03	33.90	124.16	-47.03	-33.90	-124.16
144	35.59	110.11	248.04	-35.59	-110.11	-248.04
145	94.05	67.68	248.12	-94.05	-67.68	-248.12
146	53.55	165.24	372.41	-53.55	-165.24	-372.41

147	141.13	101.40	372.03	-141.13	-101.40	-372.03
148	288.15	886.87	1999.72	-288.15	-886.87	-1999.72
149	756.50	549.63	-2005.30	-756.50	-549.63	2005.30
150	0.86	2.68	-6.04	-0.86	-2.68	6.04
151	130.96	95.03	-346.94	-130.96	-95.03	346.94
152	49.43	154.29	-346.97	-49.43	-154.29	346.97
153	97.14	70.40	-257.17	-97.14	-70.40	257.17
154	36.70	114.32	-257.18	-36.70	-114.32	257.18
155	58.24	42.16	-154.09	-58.24	-42.16	154.09
156	22.02	68.45	-154.06	-22.02	-68.45	154.06
157	-0.08	-0.06	0.21	0.08	0.06	-0.21
158	0.02	0.06	-0.14	-0.02	-0.06	0.14
159	-58.23	-42.04	153.87	58.23	42.04	-153.87
160	-22.07	-68.35	153.95	22.07	68.35	-153.95
161	-97.30	-70.17	256.96	97.30	70.17	-256.96
162	-36.94	-114.14	257.17	36.94	114.14	-257.17
163	-131.47	-94.70	347.00	131.47	94.70	-347.00
164	-49.90	-153.88	346.86	49.90	153.88	-346.86
165	-2.27	-1.63	5.99	2.27	1.63	-5.99
166	-289.02	-889.53	2005.77	289.02	889.53	-2005.77
167	-828.60	-602.00	-2196.36	828.60	602.00	2196.36
168	-9.51	-29.70	-66.78	9.51	29.70	66.78
169	-294.53	-213.77	-780.33	294.53	213.77	780.33
170	-27.35	-85.28	-191.82	27.35	85.28	191.82
171	-128.99	-93.53	-341.58	128.99	93.53	341.58
172	-26.21	-81.58	-183.56	26.21	81.58	183.56
173	-84.42	-61.15	-223.44	84.42	61.15	223.44
174	-11.30	-35.12	-79.04	11.30	35.12	79.04
175	-36.56	-26.46	-96.72	36.56	26.46	96.72
176	-0.39	-1.21	-2.72	0.39	1.21	2.72
177	1.02	0.74	2.71	-1.02	-0.74	-2.71
178	13.82	42.80	96.39	-13.82	-42.80	-96.39
179	29.95	21.63	79.16	-29.95	-21.63	-79.16
180	32.02	99.04	223.10	-32.02	-99.04	-223.10
181	69.43	50.09	183.40	-69.43	-50.09	-183.40
182	49.08	151.54	341.49	-49.08	-151.54	-341.49
183	72.65	52.36	191.81	-72.65	-52.36	-191.81
184	112.29	346.14	780.28	-112.29	-346.14	-780.28
185	25.37	18.27	66.96	-25.37	-18.27	-66.96
186	316.40	974.03	2196.30	-316.48	-974.03	-2196.30
187	978.44	710.86	-2593.56	-978.44	-710.86	2593.56
188	56.62	176.59	-397.20	-56.62	-176.59	397.20
189	461.02	334.69	-1221.61	-461.02	-334.69	1221.61
190	72.55	225.98	-508.40	-72.55	-225.98	508.40
191	194.78	141.30	-515.91	-194.78	-141.30	515.91
192	52.34	162.78	-366.31	-52.34	-162.78	366.31
193	110.92	80.39	-293.66	-110.92	-80.39	293.66
194	36.30	112.75	-253.79	-36.30	-112.75	253.79
195	53.31	38.61	-141.08	-53.31	-38.61	141.08
196	17.74	55.03	-123.90	-17.74	-55.03	123.90
197	-0.96	-0.69	2.53	0.96	0.69	-2.53

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198      0.37       1.16      -2.61      -0.37      -1.16       2.61
199    -46.76     -33.80     123.64      46.76      33.80    -123.64
200    -20.25     -62.64     141.10      20.25      62.64    -141.10
201    -95.99     -69.35     253.74      95.99      69.35    -253.74
202    -42.17    -130.30     293.59      42.17     130.30    -293.59
203   -138.66    -100.09     366.35     138.66     100.09    -366.35
204    -74.18    -228.90     515.88      74.18     228.90    -515.88
205   -192.53    -138.87     508.50     192.53     138.87    -508.50
206   -175.86    -541.97    1221.72     175.86     541.97   -1221.72
207   -150.50    -108.45     397.31     150.50     108.45    -397.31
208   -373.72   -1150.18    2593.51     373.72    1150.18   -2593.51
209  -1675.98   -1217.77   -4442.89    1675.98    1217.77    4442.89
210   -250.98    -781.93   -1759.08     250.98     701.93    1759.08
211   -641.02    -465.41   -1698.57     641.02     465.41    1698.57
212    -98.96    -307.91    -692.83      98.96     307.91     692.83
213   -238.72    -173.20    -632.33     238.72     173.20     632.33
214    -63.39    -197.07    -443.52      63.39     197.07     443.52
215   -144.63    -104.88    -383.01     144.63     104.88     383.01
216    -39.28    -121.96    -274.55      39.28     121.96     274.55
217    -80.85     -58.59    -214.05      80.85      58.59     214.05
218    -20.84     -64.64    -145.55      20.84      64.64     145.55
219    -32.14     -23.27     -85.05      32.14      23.27      85.05
220     -4.35     -13.47     -30.33       4.35      13.47      30.33
221     11.42       8.26      30.20     -11.42      -8.26     -30.20
222     12.19      37.73      85.00     -12.19     -37.73     -85.00
223     55.01      39.78     145.48     -55.01     -39.78    -145.48
224     30.72      94.97     213.98     -30.72     -94.97    -213.98
225    103.82      75.03     274.47    -103.82     -75.03    -274.47
226     55.05     169.99     383.05     -55.05    -169.99    -383.05
227    167.84     121.20     443.54    -167.84    -121.20    -443.54
228     90.95     280.54     632.31     -90.95    -280.54    -632.31
229    262.23     189.24     692.77    -262.23    -189.24    -692.77
230    244.55     753.47    1698.61    -244.55    -753.47   -1698.61
231    666.09     480.35    1759.10    -666.09    -480.35   -1759.10
232    640.26    1970.51    4443.25    -640.26   -1970.51   -4443.25
233   2013.23    1462.70       0.00   -2013.23   -1462.70       0.00
234    769.17    2367.24       0.00    -769.17   -2367.24       0.00
235   2883.75    2095.16       0.00   -2883.75   -2095.16       0.00
236   1101.69    3390.68       0.00   -1101.69   -3390.68       0.00
237   3261.22    2369.42       0.00   -3261.22   -2369.42       0.00
238   1245.76    3834.08       0.00   -1245.76   -3834.08       0.00
239   3033.60    2204.03       0.00   -3033.60   -2204.03       0.00
240   1158.81    3566.50       0.00   -1158.81   -3566.50       0.00
241   1437.87    1044.65       0.00   -1437.87   -1044.65       0.00
242    549.27    1690.47       0.00    -549.27   -1690.47       0.00
243   -652.82    -474.30       0.00     652.82     474.30       0.00
244   -249.43    -767.65       0.00     249.43     767.65       0.00
245   -727.65    -528.67       0.00     727.65     528.67       0.00
246   -278.02    -855.67       0.00     278.02     855.67       0.00
247   -217.31    -157.89       0.00     217.31     157.89       0.00
248    -83.04    -255.56       0.00      83.04     255.56       0.00
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249      1036.51     753.06      0.00    -1036.51    -753.06      0.00
250       395.90    1218.44      0.00     -395.90   -1218.44      0.00
251      3117.33    2264.94      0.00    -3117.33   -2264.94      0.00
252      1190.78    3664.85      0.00    -1190.78   -3664.85      0.00
253       760.30    1051.19      0.00     -760.30   -1051.19      0.00
254       413.07     299.85      0.00     -413.07    -299.85      0.00
255        42.98      59.37      0.00      -42.98     -59.37      0.00
256       -11.50      -8.34      0.00       11.50       8.34      0.00
257       -25.69     -35.44      0.00       25.69      35.44      0.00
258       -51.06     -37.00      0.00       51.06      37.00      0.00
259       -45.91     -63.28      0.00       45.91      63.28      0.00
260       -49.69     -35.97      0.00       49.69      35.97      0.00
261      -128.97    -177.60      0.00      128.97     177.60      0.00
262      -160.14    -115.82      0.00      160.14     115.82      0.00
263       764.83    1047.97      0.00     -764.83   -1047.97      0.00
264       157.64     485.89      0.00     -157.64    -485.89      0.00
265        43.22      59.29      0.00      -43.22     -59.29      0.00
266        -4.45     -13.72      0.00        4.45      13.72      0.00
267       -25.69     -35.26      0.00       25.69      35.26      0.00
268       -19.34     -59.78      0.00       19.34      59.78      0.00
269       -46.16     -63.44      0.00       46.16      63.44      0.00
270       -18.91     -58.55      0.00       18.91      58.55      0.00
271      -129.10    -177.60      0.00      129.10     177.60      0.00
272       -60.64    -188.01      0.00       60.64     188.01      0.00
273      -390.57    -539.80      0.00      390.57     539.80      0.00
274      -589.75    -428.17      0.00      589.75     428.17      0.00
275        35.37      48.85      0.00      -35.37     -48.85      0.00
276       -74.20     -53.83      0.00       74.20      53.83      0.00
277       -26.70     -36.84      0.00       26.70      36.84      0.00
278        15.89      11.52      0.00      -15.89     -11.52      0.00
279       -31.70     -43.70      0.00       31.70      43.70      0.00
280        23.17      16.79      0.00      -23.17     -16.79      0.00
281       -25.02     -34.46      0.00       25.02      34.46      0.00
282        13.44       9.72      0.00      -13.44      -9.72      0.00
283      -392.57    -538.10      0.00      392.57     530.10      0.00
284      -224.92    -693.08      0.00      224.92     693.08      0.00
285       -35.49     -48.68      0.00       35.49      48.68      0.00
286       -28.24     -87.11      0.00       28.24      87.11      0.00
287        26.88      36.90      0.00      -26.88     -36.90      0.00
288         6.10      18.85      0.00       -6.10     -18.85      0.00
289        31.88      43.81      0.00      -31.88     -43.81      0.00
290         8.85      27.36      0.00       -8.85     -27.36      0.00
291        25.05      34.45      0.00      -25.05     -34.45      0.00
292         5.11      15.81      0.00       -5.11     -15.81      0.00
293       -15.76     -21.69      0.00       15.76      21.69      0.00
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                     MEMBER FORCES DECOMPOSED INTO X-Y-Z COMPONENTS
                                FOR SUBSTRUCTURE:        8

MEM.      X-DIR.        Y-DIR.        Z-DIR.        X-DIR.        Y-DIR.        Z-DIR.
NO.       NODE I        NODE I        NODE I        NODE J        NODE J        NODE J
  1      -8253.38         0.00          0.00        8253.38         0.00          0.00
  2       3047.99         0.00          0.00       -3047.99         0.00          0.00
  3       3048.64         0.00          0.00       -3048.64         0.00          0.00
  4      -4488.13         0.00          0.00        4488.13         0.00          0.00
  5      -4525.79         0.00          0.00        4525.79         0.00          0.00
  6      -4488.89         0.00          0.00        4488.89         0.00          0.00
  7       1910.65         0.00          0.00       -1910.65         0.00          0.00
  8       1984.41         0.00          0.00       -1984.41         0.00          0.00
  9       1984.73         0.00          0.00       -1984.73         0.00          0.00
 10       1911.42         0.00          0.00       -1911.42         0.00          0.00
 11      -4058.60         0.00          0.00        4058.60         0.00          0.00
 12      -4168.14         0.00          0.00        4168.14         0.00          0.00
 13      -4204.89         0.00          0.00        4204.89         0.00          0.00
 14      -4168.63         0.00          0.00        4168.63         0.00          0.00
 15      -4059.25         0.00          0.00        4059.25         0.00          0.00
 16       1481.44         0.00          0.00       -1481.44         0.00          0.00
 17       1626.62         0.00          0.00       -1626.62         0.00          0.00
 18       1699.26         0.00          0.00       -1699.26         0.00          0.00
 19       1699.37         0.00          0.00       -1699.37         0.00          0.00
 20       1627.01         0.00          0.00       -1627.01         0.00          0.00
 21       1482.07         0.00          0.00       -1482.07         0.00          0.00
 22      -3922.43         0.00          0.00        3922.43         0.00          0.00
 23      -4103.18         0.00          0.00        4103.18         0.00          0.00
 24      -4211.33         0.00          0.00        4211.33         0.00          0.00
 25      -4247.74         0.00          0.00        4247.74         0.00          0.00
 26      -4211.63         0.00          0.00        4211.63         0.00          0.00
 27      -4103.37         0.00          0.00        4103.37         0.00          0.00
 28      -3922.69         0.00          0.00        3922.69         0.00          0.00
 29       1021.38         0.00          0.00       -1021.38         0.00          0.00
 30       1230.47         0.00          0.00       -1230.47         0.00          0.00
 31       1377.53         0.00          0.00       -1377.53         0.00          0.00
 32       1458.19         0.00          0.00       -1458.19         0.00          0.00
 33       14[illegible].28         0.00          0.00       -1458.28         0.00          0.00
 34       1377.54         0.00          0.00       -1377.54         0.00          0.00
 35       1230.69         0.00          0.00       -1230.69         0.00          0.00
 36       1021.65         0.00          0.00       -1021.65         0.00          0.00
 37      -3865.36         0.00          0.00        3865.36         0.00          0.00
 38      -3899.00         0.00          0.00        3899.00         0.00          0.00
 39      -4067.28         0.00          0.00        4067.28         0.00          0.00
 40      -4190.99         0.00          0.00        4190.99         0.00          0.00
 41      -4185.16         0.00          0.00        4185.16         0.00          0.00
 42      -4190.66         0.00          0.00        4190.66         0.00          0.00
 43      -4067.48         0.00          0.00        4067.48         0.00          0.00
 44      -3899.07         0.00          0.00        3899.07         0.00          0.00
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45	-3865.66	0.00	0.00	3865.66	0.00	0.00
46	468.64	0.00	0.00	-468.64	0.00	0.00
47	615.90	0.00	0.00	-615.90	0.00	0.00
48	792.88	0.00	0.00	-792.88	0.00	0.00
49	937.38	0.00	0.00	-937.38	0.00	0.00
50	1010.21	0.00	0.00	-1010.21	0.00	0.00
51	1010.30	0.00	0.00	-1010.30	0.00	0.00
52	937.35	0.00	0.00	-937.35	0.00	0.00
53	792.75	0.00	0.00	-792.75	0.00	0.00
54	615.86	0.00	0.00	-615.86	0.00	0.00
55	468.65	0.00	0.00	-468.65	0.00	0.00
56	-2721.96	0.00	0.00	2721.96	0.00	0.00
57	-3463.27	0.00	0.00	3463.27	0.00	0.00
58	-3763.11	0.00	0.00	3763.11	0.00	0.00
59	-3934.59	0.00	0.00	3934.59	0.00	0.00
60	-4024.96	0.00	0.00	4024.96	0.00	0.00
61	-3997.66	0.00	0.00	3997.66	0.00	0.00
62	-4025.00	0.00	0.00	4025.00	0.00	0.00
63	-3934.76	0.00	0.00	3934.76	0.00	0.00
64	-3762.97	0.00	0.00	3762.97	0.00	0.00
65	-3463.18	0.00	0.00	3463.18	0.00	0.00
66	-2722.05	0.00	0.00	2722.05	0.00	0.00
67	-836.44	0.00	0.00	836.44	0.00	0.00
68	-108.15	0.00	0.00	108.15	0.00	0.00
69	112.61	0.00	0.00	-112.61	0.00	0.00
70	226.38	0.00	0.00	-226.38	0.00	0.00
71	288.39	0.00	0.00	-288.39	0.00	0.00
72	316.69	0.00	0.00	-316.69	0.00	0.00
73	316.67	0.00	0.00	-316.67	0.00	0.00
74	288.47	0.00	0.00	-288.47	0.00	0.00
75	226.54	0.00	0.00	-226.54	0.00	0.00
76	112.84	0.00	0.00	-112.84	0.00	0.00
77	-107.84	0.00	0.00	107.84	0.00	0.00
78	-836.04	0.00	0.00	836.04	0.00	0.00
79	-19.00	-58.48	-131.86	19.00	58.48	131.86
80	0.19	-0.54	-1.22	-0.19	0.54	1.22
81	-0.22	-0.64	-1.43	0.22	0.64	1.43
82	-18.98	58.42	131.73	18.98	-58.42	-131.73
83	37.25	114.65	-258.51	-37.25	-114.65	258.51
84	-19.10	56.10	-126.49	19.10	-56.10	126.49
85	0.11	0.33	-0.75	-0.11	-0.33	0.75
86	-0.13	0.40	-0.91	0.13	-0.40	0.91
87	-18.92	-55.55	125.26	18.92	55.55	-125.26
88	37.10	-114.18	257.46	-37.10	114.18	-257.46
89	-73.37	-225.81	-509.16	73.37	225.81	509.16
90	18.85	-55.98	-126.24	-18.85	55.98	126.24
91	-18.42	-56.02	-126.32	18.42	56.02	126.32
92	0.11	-0.32	-0.72	-0.11	0.32	0.72
93	-0.07	-0.20	-0.46	0.07	0.20	0.46
94	-18.32	55.71	125.63	18.32	-55.71	-125.63
95	18.71	55.58	125.33	-18.71	-55.58	-125.33

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 96      -73.40      225.89      509.36       73.40     -225.89     -509.36
 97      109.38      336.64     -759.09     -109.38     -336.64      759.09
 98      -36.99      110.64     -249.48       36.99     -110.64      249.48
 99       18.11       55.33     -124.77      -18.11      -55.33      124.77
100      -18.39       55.40     -124.92       18.39      -55.40      124.92
101        0.08        0.25       -0.56       -0.08       -0.25        0.56
102       -0.02        0.07       -0.16        0.02       -0.07        0.16
103      -18.28      -55.07      124.18       18.28       55.07     -124.18
104       18.03      -55.09      124.21      -18.03       55.09     -124.21
105      -36.87     -110.29      248.69       36.87      110.29     -248.69
106      109.31     -336.43      758.61     -109.31      336.43     -756.61
107     -163.05     -501.83    -1131.57      163.05      501.83     1131.57
108       36.81     -110.62     -249.43      -36.81      110.62      249.43
109      -36.11     -110.61     -249.41       36.11      110.61      249.41
110       18.35      -55.40     -124.92      -18.35       55.40      124.92
111      -18.15      -55.31     -124.73       18.15       55.31      124.73
112        0.05       -0.16       -0.37       -0.05        0.16        0.37
113       -0.02       -0.05       -0.10        0.02        0.05        0.10
114      -18.07       55.08      124.20       18.07      -55.08     -124.20
115       18.25       55.12      124.29      -18.25      -55.12     -124.29
116      -36.03      110.34      248.81       36.03     -110.34     -248.81
117       36.70      110.29      248.69      -36.70     -110.29     -248.69
118     -163.18      502.23     1132.46      163.18     -502.23    -1132.46
119      216.69      666.91    -1503.78     -216.69     -666.91     1503.78
120      -54.77      165.15     -372.39       54.77     -165.15      372.39
121       35.85      109.97     -247.96      -35.85     -109.97      247.96
122      -36.38      110.07     -248.20       36.38     -110.07      248.20
123       18.03       55.10     -124.25      -18.03      -55.10      124.25
124      -18.12       55.02     -124.06       18.12      -55.02      124.06
125        0.03        0.08       -0.17       -0.03       -0.08        0.17
126       -0.02        0.06       -0.13        0.02       -0.06        0.13
127      -18.12      -55.01      124.04       18.12       55.01     -124.04
128       17.98      -54.95      123.91      -17.98       54.95     -123.91
129      -36.33     -109.94      247.89       36.33      109.94     -247.89
130       35.84     -109.92      247.86      -35.84      109.92     -247.86
131      -54.68     -164.80      371.77       54.68      164.88     -371.77
132      216.83     -667.33     1504.73     -216.83      667.33    -1504.73
133     -289.15     -886.85    -1999.68      288.15      886.85     1999.68
134       54.58     -165.00     -372.04      -54.58      165.00      372.04
135      -53.79     -165.12     -372.32       53.79      165.12      372.32
136       36.28     -109.96     -247.95      -36.28      109.96      247.95
137      -35.92     -109.99     -248.00       35.92      109.99      240.00
138       18.11      -55.03     -124.09      -18.11       55.03      124.09
139      -18.00      -54.97     -123.96       18.00       54.97      123.96
140        0.00        0.00        0.00        0.00        0.00        0.00
141       -0.06       -0.17       -0.39        0.06        0.17        0.39
142      -17.98       54.92      123.83       17.98      -54.92     -123.83
143       18.12       55.05      124.12      -18.12      -55.05     -124.12
144      -35.90      109.92      247.84       35.90     -109.92     -247.84
145       36.29      109.99      240.02      -36.29     -109.99     -240.02
146      -53.73      164.95      371.92       53.73     -164.95     -371.92
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147        54.57      164.97       371.96       -54.57     -164.97      -371.96
148      -288.25      807.16      2000.38       288.25     -807.16     -2000.38
149       289.03      889.54     -2005.81      -289.03     -889.54      2005.81
150        -0.84        2.56        -5.76         0.84       -2.56         5.76
151        50.06      153.77      -346.74       -50.06     -153.77       346.74
152       -50.69      153.84      -346.89        50.69     -153.84       346.89
153        37.21      114.07      -257.21       -37.21     -114.07       257.21
154       -37.49      114.02      -257.10        37.49     -114.02       257.10
155        22.31       68.26      -153.93       -22.31      -68.26       153.93
156       -22.38       68.18      -153.74        22.38      -68.18       153.74
157        -0.01       -0.03         0.07         0.01        0.03        -0.07
158        -0.03        0.10        -0.23         0.03       -0.10         0.23
159       -22.38      -68.19       153.75        22.38       68.19      -153.75
160        22.30      -68.24       153.86       -22.30       68.24      -153.86
161       -37.49     -114.01       257.09        37.49      114.01      -257.09
162        37.20     -114.02       257.11       -37.20      114.02      -257.11
163       -50.64     -153.71       346.59        50.64      153.71      -346.59
164        50.05     -153.72       346.63       -50.05      153.72      -346.63
165        -0.80       -2.42         5.46         0.60        2.42        -5.46
166       289.05     -889.62      2005.97      -289.05      889.62     -2005.97
167      -316.48     -974.02     -2196.28       316.48      974.02      2196.28
168         9.78      -29.68       -66.93        -9.78       29.68        66.93
169      -112.63     -346.09      -780.39       112.63      346.09       780.39
170        27.99      -85.06      -191.79       -27.99       85.06       191.79
171       -49.36     -151.44      -341.47        49.36      151.44       341.47
172        26.75      -81.40      -183.55       -26.75       81.40       183.55
173       -32.37      -99.14      -223.55        32.37       99.14       223.55
174        11.51      -35.08       -79.09       -11.51       35.08        79.09
175       -13.97      -42.73       -96.35        13.97       42.73        96.35
176         0.40       -1.23        -2.77        -0.40        1.23         2.77
177         0.37        1.13         2.54        -0.37       -1.13        -2.54
178       -13.96       42.69        96.27        13.96      -42.69       -96.27
179        11.48       34.99        78.90       -11.48      -34.99       -78.90
180       -32.35       99.08       223.40        32.35      -99.08      -223.40
181        26.74       81.37       183.48       -26.74      -81.37      -183.48
182       -49.32      151.31       341.19        49.32     -151.31      -341.19
183        27.97       84.99       191.64       -27.97      -84.99      -191.64
184      -112.61      346.02       780.23       112.61     -346.02      -780.23
185         9.77       29.63        66.81        -9.77      -29.63       -66.81
186      -316.50      974.07      2196.41       316.50     -974.07     -2196.41
187       373.72     1150.18     -2593.51      -373.72    -1150.18      2593.51
188       -57.99      176.15      -397.19        57.99     -176.15       397.19
189       176.27      541.78     -1221.66      -176.27     -541.78      1221.66
190       -74.14      225.50      -508.48        74.14     -225.50       508.48
191        74.53      228.78      -515.87       -74.53     -228.78       515.87
192       -53.34      162.44      -366.29        53.34     -162.44       366.29
193        42.47      130.21      -293.61       -42.47     -130.21       293.61
194       -36.93      112.61      -253.92        36.93     -112.61       253.92
195        20.44       62.58      -141.12       -20.44      -62.58       141.12
196       -17.97       54.88      -123.75        17.97      -54.88       123.75
197        -0.39       -1.19         2.69         0.39        1.19        -2.69
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198	-0.40	1.24	-2.79	0.40	-1.24	2.79
199	-17.97	-54.87	123.73	17.97	54.87	-123.73
200	20.44	-62.58	141.11	-20.44	62.58	-141.11
201	-36.91	-112.58	253.84	36.91	112.58	-253.84
202	42.48	-130.21	293.61	-42.48	130.21	-293.61
203	-53.32	-162.40	366.20	53.32	162.40	-366.20
204	74.53	-226.79	515.89	-74.53	226.79	-515.89
205	-74.12	-225.45	508.37	74.12	225.45	-508.37
206	176.28	-541.83	1221.76	-176.28	541.83	-1221.76
207	-58.00	-176.18	397.27	58.00	176.18	-397.27
208	373.72	-1150.20	2593.56	-373.72	1150.20	-2593.56
209	-640.25	-1970.49	-4443.21	640.25	1970.49	4443.21
210	256.54	-780.15	-1759.15	-256.54	780.15	1759.15
211	-245.03	-753.31	-1698.62	245.03	753.31	1698.62
212	100.93	-307.28	-692.88	-100.93	307.28	692.88
213	-91.32	-280.45	-632.37	91.32	280.45	632.37
214	64.55	-196.74	-443.62	-64.55	196.74	443.62
215	-55.39	-169.91	-383.13	55.39	169.91	383.13
216	39.91	-121.77	-274.57	-39.91	121.77	274.57
217	-30.98	-94.94	-214.08	30.98	94.94	214.08
218	21.14	-64.57	-145.60	-21.14	64.57	145.60
219	-12.33	-37.73	-85.08	12.33	37.73	85.08
220	4.40	-13.44	-30.31	-4.40	13.44	30.31
221	4.38	13.39	30.20	-4.38	-13.39	-30.20
222	-12.32	37.72	85.04	12.32	-37.72	-85.04
223	21.13	64.54	145.53	-21.13	-64.54	-145.53
224	-30.97	94.91	214.02	30.97	-94.91	-214.02
225	39.91	121.75	274.52	-39.91	-121.75	-274.52
226	-55.38	169.90	383.10	55.38	-169.90	-383.10
227	64.55	196.73	443.60	-64.55	-196.73	-443.60
228	-91.32	280.42	632.32	91.32	-280.42	-632.32
229	100.93	307.25	692.82	-100.93	-307.25	-692.82
230	-245.03	753.28	1698.56	245.03	-753.28	-1698.56
231	256.53	780.12	1759.08	-256.53	-780.12	-1759.08
232	-640.26	1970.52	4443.28	640.26	-1970.52	-4443.28
233	769.16	2367.22	0.00	-769.16	-2367.22	0.00
234	-769.13	2367.11	0.00	769.13	-2367.11	0.00
235	1101.70	3390.68	0.00	-1101.70	-3390.68	0.00
236	-1101.88	3391.26	0.00	1101.88	-3391.26	0.00
237	1245.79	3834.16	0.00	-1245.79	-3834.16	0.00
238	-1245.92	3834.56	0.00	1245.92	-3834.56	0.00
239	1158.82	3566.54	0.00	-1158.82	-3566.54	0.00
240	-1158.78	3566.42	0.00	1158.78	-3566.42	0.00
241	549.25	1690.40	0.00	-549.25	-1690.40	0.00
242	-549.23	1690.36	0.00	549.23	-1690.36	0.00
243	-249.43	-767.65	0.00	249.43	767.65	0.00
244	249.61	-768.21	0.00	-249.61	768.21	0.00
245	-278.02	-855.66	0.00	278.02	855.66	0.00
246	278.32	-856.58	0.00	-278.32	856.58	0.00
247	-83.03	-255.56	0.00	83.03	255.56	0.00
248	83.10	-255.76	0.00	-83.10	255.76	0.00

249	395.91	1218.48	0.00	-395.91	-1218.48	0.00
250	-395.94	1218.58	0.00	395.94	-1218.58	0.00
251	1190.74	3664.73	0.00	-1190.74	-3664.73	0.00
252	-1190.85	3665.06	0.00	1190.85	-3665.06	0.00
253	-2.77	1297.27	0.00	2.77	-1297.27	0.00
254	157.98	485.50	0.00	-157.98	-485.50	0.00
255	-0.12	73.28	0.00	0.12	-73.28	0.00
256	-4.46	-13.70	0.00	4.46	13.70	0.00
257	0.05	-43.99	0.00	-0.05	43.99	0.00
258	-19.55	-59.91	0.00	19.55	59.91	0.00
259	0.06	-78.16	0.00	-0.06	78.16	0.00
260	-19.13	-58.54	0.00	19.13	58.54	0.00
261	0.05	-219.56	0.00	-0.05	219.56	0.00
262	-61.46	-187.77	0.00	61.46	187.77	0.00
263	2.77	1297.37	0.00	-2.77	-1297.37	0.00
264	-158.02	485.63	0.00	158.02	-485.63	0.00
265	0.12	73.26	0.00	-0.12	-73.26	0.00
266	4.48	-13.76	0.00	-4.48	13.76	0.00
267	-0.05	-44.00	0.00	0.05	44.00	0.00
268	19.56	-59.93	0.00	-19.56	59.93	0.00
269	-0.06	-78.13	0.00	0.06	78.13	0.00
270	19.10	-58.43	0.00	-19.10	58.43	0.00
271	-0.05	-219.56	0.00	0.05	219.56	0.00
272	61.45	-187.75	0.00	-61.45	187.75	0.00
273	1.30	-666.30	0.00	-1.30	666.30	0.00
274	-225.48	-693.12	0.00	225.48	693.12	0.00
275	-0.09	60.34	0.00	0.09	-60.34	0.00
276	-28.40	-87.21	0.00	28.40	87.21	0.00
277	0.05	-45.52	0.00	-0.05	45.52	0.00
278	6.09	18.67	0.00	-6.09	-18.67	0.00
279	0.04	-53.99	0.00	-0.04	53.99	0.00
280	8.88	27.19	0.00	-8.88	-27.19	0.00
281	0.02	-42.61	0.00	-0.02	42.61	0.00
282	5.16	15.78	0.00	-5.16	-15.78	0.00
283	-1.30	-666.07	0.00	1.30	666.07	0.00
284	225.39	-692.86	0.00	-225.39	692.86	0.00
285	-0.09	-60.15	0.00	0.09	60.15	0.00
286	28.34	-87.02	0.00	-28.34	87.02	0.00
287	0.05	45.71	0.00	-0.05	-45.71	0.00
288	-6.16	18.90	0.00	6.16	-18.90	0.00
289	0.04	54.21	0.00	-0.04	-54.21	0.00
290	-8.94	27.37	0.00	8.94	-27.37	0.00
291	0.02	42.76	0.00	-0.02	-42.76	0.00
292	-5.20	15.92	0.00	5.20	-15.92	0.00
293	0.00	-26.80	0.00	0.00	26.80	0.00

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                        MEMBER FORCES DECOMPOSED INTO X-Y-Z COMPONENTS
                                FOR SUBSTRUCTURE:       9

 MEM.      X-DIR.       Y-DIR.       Z-DIR.       X-DIR.       Y-DIR.       Z-DIR.
 NO.       NODE I       NODE I       NODE I       NODE J       NODE J       NODE J
   1     -6677.63     -4851.59         0.00      6677.63      4851.59         0.00
   2      2466.76      1792.20         0.00     -2466.76     -1792.20         0.00
   3      2466.85      1792.29         0.00     -2466.85     -1792.29         0.00
   4     -3631.67     -2638.55         0.00      3631.67      2638.55         0.00
   5     -3662.15     -2660.71         0.00      3662.15      2660.71         0.00
   6     -3632.02     -2638.85         0.00      3632.02      2638.85         0.00
[illegible]  1546.46   1123.59         0.00     -1546.46     -1123.59         0.00
[illegible]  1605.97   1166.80         0.00     -1605.97     -1166.80         0.00
   9      1606.14      1166.93         0.00     -1606.14     -1166.93         0.00
  10      1546.60      1123.67         0.00     -1546.60     -1123.67         0.00
  11     -3284.15     -2386.09         0.00      3284.15      2386.09         0.00
  12     -3372.64     -2450.39         0.00      3372.64      2450.39         0.00
  13     -3402.23     -2471.83         0.00      3402.23      2471.83         0.00
  14     -3372.78     -2450.49         0.00      3372.78      2450.49         0.00
  15     -3284.46     -2386.28         0.00      3284.46      2386.28         0.00
  16      1199.06       871.17         0.00     -1199.06      -871.17         0.00
  17      1316.52       956.51         0.00     -1316.52      -956.51         0.00
  18      1375.15       999.12         0.00     -1375.15      -999.12         0.00
  19      1375.28       999.20         0.00     -1375.28      -999.20         0.00
  20      1316.59       956.55         0.00     -1316.59      -956.55         0.00
  21      1199.28       871.33         0.00     -1199.28      -871.33         0.00
  22     -3173.90     -2305.98         0.00      3173.90      2305.98         0.00
  23     -3320.10     -2412.23         0.00      3320.10      2412.23         0.00
  24     -3407.79     -2475.90         0.00      3407.79      2475.90         0.00
  25     -3437.31     -2497.35         0.00      3437.31      2497.35         0.00
  26     -3407.94     -2476.01         0.00      3407.94      2476.01         0.00
  27     -3320.32     -2412.35         0.00      3320.32      2412.35         0.00
  28     -3174.02     -2306.09         0.00      3174.02      2306.09         0.00
  29       826.72       600.68         0.00      -826.72      -600.68         0.00
  30       995.83       723.55         0.00      -995.83      -723.55         0.00
  31      1114.93       810.02         0.00     -1114.93      -810.02         0.00
  32      1180.20       857.47         0.00     -1180.20      -857.47         0.00
  33      1180.40       857.60         0.00     -1180.40      -857.60         0.00
  34      1114.97       810.08         0.00     -1114.97      -810.08         0.00
  35       996.23       723.79         0.00      -996.23      -723.79         0.00
  36       826.94       600.81         0.00      -826.94      -600.81         0.00
  37     -3127.57     -2272.55         0.00      3127.57      2272.55         0.00
  38     -3154.10     -2291.40         0.00      3154.10      2291.40         0.00
  39     -3290.86     -2391.20         0.00      3290.86      2391.20         0.00
  40     -3390.52     -2463.15         0.00      3390.52      2463.15         0.00
  41     -3385.99     -2460.14         0.00      3385.99      2460.14         0.00
  42     -3390.44     -2463.27         0.00      3390.44      2463.27         0.00
  43     -3290.86     -2390.97         0.00      3290.86      2390.97         0.00
  44     -3154.34     -2291.74         0.00      3154.34      2291.74         0.00
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357

45	-3127.47	-2272.26	0.00	3127.47	2272.26	0.00
46	379.19	275.54	0.00	-379.19	-275.54	0.00
47	498.32	362.04	0.00	-498.32	-362.04	0.00
48	641.59	466.12	0.00	-641.59	-466.12	0.00
49	758.51	551.07	0.00	-758.51	-551.07	0.00
50	817.47	593.90	0.00	-817.47	-593.90	0.00
51	817.70	594.18	0.00	-817.70	-594.18	0.00
52	758.67	551.18	0.00	-758.67	-551.18	0.00
53	641.76	466.25	0.00	-641.76	-466.25	0.00
54	498.59	362.25	0.00	-498.59	-362.25	0.00
55	379.53	275.75	0.00	-379.53	-275.75	0.00
56	-2202.22	-1600.06	0.00	2202.22	1600.06	0.00
57	-2802.04	-2035.90	0.00	2802.04	2035.90	0.00
58	-3044.76	-2212.23	0.00	3044.76	2212.23	0.00
59	-3182.95	-2312.23	0.00	3182.95	2312.23	0.00
60	-3256.68	-2366.20	0.00	3256.68	2366.20	0.00
61	-3234.55	-2350.16	0.00	3234.55	2350.16	0.00
62	-3257.29	-2366.51	0.00	3257.29	2366.51	0.00
63	-3183.35	-2313.01	0.00	3183.35	2313.01	0.00
64	-3044.28	-2211.55	0.00	3044.28	2211.55	0.00
65	-2801.94	-2035.93	0.00	2801.94	2035.93	0.00
66	-2203.03	-1600.43	0.00	2203.03	1600.43	0.00
67	-676.71	-491.67	0.00	676.71	491.67	0.00
68	-87.52	-63.59	0.00	87.52	63.59	0.00
69	91.10	66.19	0.00	-91.10	-66.19	0.00
70	183.11	133.04	0.00	-183.11	-133.04	0.00
71	233.29	169.50	0.00	-233.29	-169.50	0.00
72	256.19	186.14	0.00	-256.19	-186.14	0.00
73	256.19	186.14	0.00	-256.19	-186.14	0.00
74	233.42	169.60	0.00	-233.42	-169.60	0.00
75	183.28	133.15	0.00	-183.28	-133.15	0.00
76	91.42	66.42	0.00	-91.42	-66.42	0.00
77	-87.12	-63.30	0.00	87.12	63.30	0.00
78	-676.25	-491.35	0.00	676.25	491.35	0.00
79	18.98	-58.42	-131.73	-18.98	58.42	131.73
80	0.11	-0.08	-0.28	-0.11	0.08	0.28
81	0.02	-0.08	-0.18	-0.02	0.08	0.18
82	-49.63	36.06	131.56	49.63	-36.06	-131.56
83	-37.10	114.18	-257.46	37.10	-114.18	257.46
84	-48.36	34.11	-126.32	48.36	-34.11	126.32
85	-0.09	0.27	-0.61	0.09	-0.27	0.61
86	-0.18	0.13	-0.47	0.18	-0.13	0.47
87	17.37	-56.14	125.43	-17.37	56.14	-125.43
88	97.14	-70.58	257.50	-97.14	70.58	-257.50
89	73.40	-225.89	-509.36	-73.40	225.89	509.36
90	48.04	-34.14	-125.95	-48.04	34.14	125.95
91	17.97	-55.99	-125.96	-17.97	55.99	125.96
92	0.09	-0.06	-0.23	-0.09	0.06	0.23
93	-0.02	0.06	0.13	0.02	-0.06	-0.13
94	-47.64	34.35	125.81	47.64	-34.35	-125.81
95	-17.63	56.26	126.00	17.63	-56.26	-126.00

96	-192.14	139.60	509.32	192.14	-139.60	-509.32
97	-109.31	336.43	-758.61	109.31	-336.43	758.61
98	-94.96	67.77	-249.48	94.96	-67.77	249.48
99	-17.86	55.38	-124.71	17.86	-55.38	124.71
100	-47.37	33.96	-124.73	47.37	-33.96	124.73
101	-0.04	0.13	-0.28	0.04	-0.13	0.28
102	0.04	-0.03	0.12	-0.04	0.03	-0.12
103	17.60	-55.36	124.31	-17.60	55.36	-124.31
104	47.09	-34.06	124.56	-47.09	34.06	-124.56
105	35.01	-110.94	248.77	-35.01	110.94	-248.77
106	286.17	-207.81	758.57	-286.17	207.81	-758.57
107	163.18	-502.23	-1132.46	-163.18	502.23	1132.46
108	94.63	-67.74	-248.99	-94.63	67.74	248.99
109	35.74	-110.54	-249.02	-35.74	110.54	249.02
110	47.19	-33.88	-124.35	-47.19	33.88	124.35
111	17.79	-55.28	-124.43	-17.79	55.28	124.43
112	0.06	-0.04	-0.15	-0.06	0.04	0.15
113	0.00	0.00	0.00	0.00	0.00	0.00
114	-47.06	33.99	124.37	47.06	-33.99	-124.37
115	-17.66	55.40	124.47	17.66	-55.40	-124.47
116	-94.00	68.09	248.79	94.00	-68.09	-248.79
117	-35.16	110.87	248.85	35.16	-110.87	-248.85
118	-427.17	310.36	1132.34	427.17	-310.36	-1132.34
119	-216.83	667.34	-1504.75	216.83	-667.34	1504.75
120	-141.33	101.38	-372.25	141.33	-101.38	372.25
121	-35.64	110.05	-247.99	35.64	-110.05	247.99
122	-94.15	67.68	-248.24	94.15	-67.68	248.24
123	-17.81	55.10	-124.26	17.81	-55.10	124.26
124	-47.05	33.89	-124.18	47.05	-33.89	124.10
125	-0.04	0.11	-0.25	0.04	-0.11	0.25
126	-0.08	0.06	-0.20	0.08	-0.06	0.20
127	17.66	-55.10	123.92	-17.66	55.10	-123.92
128	46.87	-33.91	123.99	-46.87	33.91	-123.99
129	35.25	-110.38	248.07	-35.25	110.38	-248.07
130	93.64	-67.89	247.96	-93.64	67.89	-247.96
131	52.77	-165.82	372.43	-52.77	165.82	-372.43
132	567.42	-412.25	1504.08	-567.42	412.25	-1504.08
133	288.24	-887.14	-2000.34	-288.24	887.14	2000.34
134	141.27	-101.50	-372.40	-141.27	101.50	372.40
135	53.58	-165.32	-372.59	-53.58	165.32	372.59
136	94.13	-67.74	-248.33	-94.13	67.74	248.33
137	35.61	-110.17	-248.17	-35.61	110.17	248.17
138	47.05	-33.91	-124.22	-47.05	33.91	124.22
139	17.77	-55.12	-124.10	-17.77	55.12	124.10
140	0.10	-0.07	-0.27	-0.10	0.07	0.27
141	0.01	-0.03	-0.07	-0.01	0.03	0.07
142	-46.97	33.96	124.22	46.97	-33.96	-124.22
143	-17.68	55.11	123.96	17.68	-55.11	-123.96
144	-93.77	67.91	248.16	93.77	-67.91	-248.16
145	-35.27	110.27	247.91	35.27	-110.27	-247.91
146	-140.61	102.00	372.43	140.61	-102.00	-372.43

147	-52.87	165.71	372.36	52.87	-165.71	-372.36
148	-754.71	548.33	2000.54	754.71	-548.33	-2000.54
149	-289.06	889.63	-2006.01	289.06	-889.63	2006.01
150	-2.30	1.66	-6.07	2.30	-1.66	6.07
151	-49.87	153.81	-346.69	49.87	-153.81	346.69
152	-131.45	94.68	-346.93	131.45	-94.68	346.93
153	-36.96	114.22	-257.36	36.96	-114.22	257.36
154	-97.42	70.25	-257.28	97.42	-70.25	257.28
155	-22.07	68.35	-153.94	22.07	-68.35	153.94
156	-58.27	42.08	-153.99	58.27	-42.08	153.99
157	-0.03	0.10	-0.23	0.03	-0.10	0.23
158	-0.08	0.06	-0.22	0.08	-0.06	0.22
159	21.98	-68.34	153.81	-21.98	68.34	-153.81
160	57.99	-41.98	153.43	-57.99	41.98	-153.43
161	36.68	-114.28	257.09	-36.68	114.28	-257.09
162	96.97	-70.28	256.73	-96.97	70.28	-256.73
163	49.37	-154.10	346.54	-49.37	154.10	-346.54
164	130.80	-94.92	346.52	-130.80	94.92	-346.52
165	0.77	-2.42	5.43	-0.77	2.42	-5.43
166	756.80	-549.85	2006.10	-756.80	549.85	-2006.10
167	316.49	-974.06	-2196.39	-316.49	974.06	2196.39
168	25.39	-18.28	-67.01	-25.39	18.28	67.01
169	112.32	-346.22	-780.46	-112.32	346.22	780.46
170	72.60	-52.33	-191.70	-72.60	52.33	191.70
171	49.07	-151.52	-341.45	-49.07	151.52	341.45
172	69.48	-50.13	-183.53	-69.48	50.13	183.53
173	32.08	-99.22	-223.53	-32.08	99.22	223.53
174	29.94	-21.62	-79.12	-29.94	21.62	79.12
175	13.83	-42.85	-96.50	-13.83	42.85	96.50
176	1.11	-0.80	-2.94	-1.11	0.80	2.94
177	-0.37	1.15	2.60	0.37	-1.15	-2.60
178	-36.31	26.28	96.07	36.31	-26.28	-96.07
179	-11.27	35.02	78.82	11.27	-35.02	-78.82
180	-84.38	61.12	223.34	84.38	-61.12	-223.34
181	-26.17	81.44	183.25	26.17	-81.44	-183.25
182	-128.85	93.42	341.19	128.85	-93.42	-341.19
183	-27.30	85.12	191.47	27.30	-85.12	-191.47
184	-294.58	213.81	780.46	294.58	-213.81	-780.46
185	-9.49	29.63	66.62	9.49	-29.63	-66.62
186	-828.68	602.06	2196.58	828.68	-602.06	-2196.58
187	-373.72	1150.20	-2593.56	373.72	-1150.20	2593.56
188	-150.48	108.44	-397.28	150.48	-108.44	397.28
189	-175.89	542.06	-1221.93	175.89	-542.06	1221.93
190	-192.52	138.86	-508.46	192.52	-138.86	508.46
191	-74.19	228.93	-515.95	74.19	-228.93	515.95
192	-138.68	100.10	-366.41	138.68	-100.10	366.41
193	-42.17	130.29	-293.58	42.17	-130.29	293.58
194	-96.07	69.41	-253.94	96.07	-69.41	253.94
195	-20.26	62.67	-141.17	20.26	-62.67	141.17
196	-46.83	33.86	-123.85	46.83	-33.86	123.85
197	0.36	-1.10	2.40	-0.36	1.10	-2.40

198	-1.06	0.77	-2.01	1.06	-0.77	2.81
199	17.70	-54.91	123.63	-17.70	54.91	-123.63
200	53.27	-38.58	140.98	-53.27	38.58	-140.98
201	36.31	-112.76	253.83	-36.31	112.76	-253.83
202	110.83	-80.32	293.42	-110.83	80.32	-293.42
203	52.33	-162.75	366.26	-52.33	162.75	-366.26
204	194.80	-141.31	515.97	-194.80	141.31	-515.97
205	72.56	-226.00	508.43	-72.56	226.00	-508.43
206	461.07	-334.73	1221.74	-461.07	334.73	-1221.74
207	56.62	-176.61	397.23	-56.62	176.61	-397.23
208	978.60	-710.98	2593.98	-978.60	710.98	-2593.98
209	640.25	-1970.50	-4443.23	-640.25	1970.50	4443.23
210	666.11	-480.36	-1759.14	-666.11	480.36	1759.14
211	244.55	-753.48	-1698.64	-244.55	753.48	1698.64
212	262.27	-189.27	-692.88	-262.27	189.27	692.88
213	90.97	-280.58	-632.40	-90.97	280.58	632.40
214	167.87	-121.23	-443.63	-167.87	121.23	443.63
215	55.06	-170.03	-383.16	-55.06	170.03	383.16
216	103.88	-75.07	-274.62	-103.88	75.07	274.62
217	30.74	-95.02	-214.09	-30.74	95.02	214.09
218	55.06	-39.81	-145.61	-55.06	39.81	145.61
219	12.21	-37.79	-85.13	-12.21	37.79	85.13
220	11.49	-8.31	-30.39	-11.49	8.31	30.39
221	-4.31	13.37	30.10	4.31	-13.37	-30.10
222	-32.09	23.23	84.91	32.09	-23.23	-84.91
223	-20.82	64.58	145.41	20.82	-64.58	-145.41
224	-80.82	58.56	213.96	80.82	-58.56	-213.96
225	-39.27	121.92	274.46	39.27	-121.92	-274.46
226	-144.63	104.89	383.02	144.63	-104.89	-383.02
227	-63.40	197.07	443.53	63.40	-197.07	-443.53
228	-238.73	173.21	632.37	238.73	-173.21	-632.37
229	-98.97	307.92	692.86	98.97	-307.92	-692.86
230	-641.07	465.45	1698.71	641.07	-465.45	-1698.71
231	-251.00	781.98	1759.18	251.00	-781.98	-1759.18
232	-1676.25	1217.97	4443.62	1676.25	-1217.97	-4443.62
233	-769.12	2367.09	0.00	769.12	-2367.09	0.00
234	-2013.64	1462.99	0.00	2013.64	-1462.99	0.00
235	-1101.88	3391.26	0.00	1101.88	-3391.26	0.00
236	-2884.78	2095.91	0.00	2884.78	-2095.91	0.00
237	-1245.95	3834.65	0.00	1245.95	-3834.65	0.00
238	-3262.07	2370.04	0.00	3262.07	-2370.04	0.00
239	-1158.79	3566.45	0.00	1158.79	-3566.45	0.00
240	-3034.06	2204.37	0.00	3034.06	-2204.37	0.00
241	-549.21	1690.29	0.00	549.21	-1690.29	0.00
242	-1438.03	1044.77	0.00	1438.03	-1044.77	0.00
243	249.61	-768.21	0.00	-249.61	768.21	0.00
244	653.68	-474.92	0.00	-653.68	474.92	0.00
245	278.32	-856.57	0.00	-278.32	856.57	0.00
246	728.87	-529.56	0.00	-728.87	529.56	0.00
247	83.10	-255.76	0.00	-83.10	255.76	0.00
248	218.16	-158.50	0.00	-218.16	158.50	0.00

249	-395.95	1218.62	0.00	395.95	-1218.62	0.00
250	-1036.03	752.71	0.00	1036.03	-752.71	0.00
251	-1190.81	3664.94	0.00	1190.81	-3664.94	0.00
252	-3117.18	2264.83	0.00	3117.18	-2264.83	0.00
253	-764.88	1048.04	0.00	764.88	-1048.04	0.00
254	-157.66	485.94	0.00	157.66	-485.94	0.00
255	-43.20	59.26	0.00	43.20	-59.26	0.00
256	4.45	-13.75	0.00	-4.45	13.75	0.00
257	25.65	-35.21	0.00	-25.65	35.21	0.00
258	19.36	-59.86	0.00	-19.36	59.86	0.00
259	46.12	-63.38	0.00	-46.12	63.38	0.00
260	18.90	-58.53	0.00	-18.90	58.53	0.00
261	129.07	-177.56	0.00	-129.07	177.56	0.00
262	60.63	-187.96	0.00	-60.63	187.96	0.00
263	-760.48	1051.44	0.00	760.48	-1051.44	0.00
264	-413.24	299.97	0.00	413.24	-299.97	0.00
265	-42.92	59.29	0.00	42.92	-59.29	0.00
266	11.55	-8.37	0.00	-11.55	8.37	0.00
267	25.71	-35.47	0.00	-25.71	35.47	0.00
268	51.21	-37.11	0.00	-51.21	37.11	0.00
269	45.90	-63.26	0.00	-45.90	63.26	0.00
270	49.82	-36.07	0.00	-49.82	36.07	0.00
271	129.03	-177.68	0.00	-129.03	177.66	0.00
272	160.20	-115.87	0.00	-160.20	115.87	0.00
273	392.63	-538.18	0.00	-392.63	538.18	0.00
274	224.97	-693.24	0.00	-224.97	693.24	0.00
275	-35.52	48.72	0.00	35.52	-48.72	0.00
276	28.26	-87.18	0.00	-28.26	87.18	0.00
277	26.84	-36.85	0.00	-26.84	36. 5	0.00
278	-6.07	18.76	0.00	6.07	-18.76	0.00
279	31.81	-43.70	0.00	-31.81	43.70	0.00
280	-8.81	27.24	0.00	8.81	-27.24	0.00
281	25.04	-34.43	0.00	-25.04	34.43	0.00
282	-5.10	15.78	0.00	5.10	-15.78	0.00
283	390.47	-539.67	0.00	-390.47	539.67	0.00
284	589.59	-428.06	0.00	-509.59	428.06	0.00
285	35.24	-48.66	0.00	-35.24	48.66	0.00
286	73.98	-53.67	0.00	-73.98	53.67	0.00
287	-26.89	37.11	0.00	26.89	-37.11	0.00
288	-16.17	11.72	0.00	16.17	-11.72	0.00
289	-31.84	43.90	0.00	31.84	-43.90	0.00
290	-23.35	16.92	0.00	23.35	-16.92	0.00
291	-25.14	34.63	0.00	25.14	-34.63	0.00
292	-13.60	9.85	0.00	13.60	-9.85	0.00
293	15.77	-21.70	0.00	-15.77	21.70	0.00

MEMBER FORCES DECOMPOSED INTO X-Y-Z COMPONENTS
FOR SUBSTRUCTURE: 10

MEM. NO.	X-DIR. NODE I	Y-DIR. NODE I	Z-DIR. NODE I	Y-DIR. NODE J	Y-DIR. NODE J	Z-DIR. NODE J
1	-2550.62	-7850.11	0.00	2550.62	7850.11	0.00
2	942.23	2899.90	0.00	-942.23	-2899.90	-0.00
3	942.15	2899.64	0.00	-942.15	-2899.64	0.00
4	-1387.23	-4269.33	0.00	1387.23	4269.33	0.00
5	-1398.65	-4304.72	0.00	1398.65	4304.72	0.00
6	-1387.08	-4268.91	0.00	1387.08	4268.91	0.00
7	590.76	1818.18	0.00	-590.76	-1818.18	0.00
8	613.40	1887.90	0.00	-613.40	-1887.90	0.00
9	613.36	1887.67	0.00	-613.36	-1887.67	0.00
10	590.56	1817.59	0.00	-590.56	-1817.59	0.00
11	-1254.48	-3860.95	0.00	1254.48	3860.95	0.00
12	-1288.27	-3964.81	0.00	1288.27	3964.81	0.00
13	-1299.48	-3999.49	0.00	1299.48	3999.49	0.00
14	-1288.19	-3964.56	0.00	1288.19	3964.56	0.00
15	-1254.26	-3860.30	0.00	1254.26	3860.30	0.00
16	458.15	1410.07	0.00	-458.15	-1410.07	0.00
17	502.97	1547.93	0.00	-502.97	-1547.93	0.00
18	525.33	1616.78	0.00	-525.33	-1616.78	0.00
19	525.31	1616.75	0.00	-525.31	-1616.75	0.00
20	502.86	1547.66	0.00	-502.86	-1547.66	0.00
21	457.99	1409.55	0.00	-457.99	-1409.55	0.00
22	-1212.42	-3731.34	0.00	1212.42	3731.34	0.00
23	-1268.16	-3903.10	0.00	1268.16	3903.10	0.00
24	-1301.64	-4005.96	0.00	1301.64	4005.96	0.00
25	-1312.78	-4040.42	0.00	1312.78	4040.42	0.00
26	-1301.60	-4005.81	0.00	1301.60	4005.81	0.00
27	-1268.08	-3902.85	0.00	1268.08	3902.85	0.00
28	-1212.14	-3730.82	0.00	1212.14	3730.82	0.00
29	315.89	972.20	0.00	-315.89	-972.20	0.00
30	380.45	1170.90	0.00	-380.45	-1170.90	0.00
31	425.81	1310.64	0.00	-425.81	-1310.64	0.00
32	450.83	1387.35	0.00	-450.83	-1387.35	0.00
33	450.83	1387.36	0.00	-450.83	-1387.36	0.00
34	425.64	1310.31	0.00	-425.64	-1310.31	0.00
35	380.43	1170.71	0.00	-380.43	-1170.71	0.00
36	315.81	971.85	0.00	-315.81	-971.85	0.00
37	-1194.65	-3676.63	0.00	1194.65	3676.63	0.00
38	-1205.00	-3708.53	0.00	1205.00	3708.53	0.00
39	-1257.09	-3866.84	0.00	1257.09	3866.84	0.00
40	-1295.23	-3986.17	0.00	1295.23	3986.17	0.00
41	-1293.44	-3980.73	0.00	1293.44	3980.73	0.00
42	-1295.11	-3985.83	0.00	1295.11	3985.83	0.00
43	-1256.45	-3868.22	0.00	1256.45	3868.22	0.00
44	-1204.94	-3708.33	0.00	1204.94	3708.33	0.00

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45    -1194.60   -3676.49      0.00    1194.60    3676.49      0.00
46      144.84     445.90      0.00    -144.84    -445.90      0.00
47      190.42     585.99      0.00    -190.42    -585.99      0.00
48      245.12     754.32      0.00    -245.12    -754.32      0.00
49      289.78     891.75      0.00    -289.78    -891.75      0.00
50      312.16     960.98      0.00    -312.16    -960.98      0.00
51      312.33     961.16      0.00    -312.33    -961.16      0.00
52      289.79     891.81      0.00    -289.79    -891.81      0.00
53      244.98     754.16      0.00    -244.98    -754.16      0.00
54      190.43     586.02      0.00    -190.43    -586.02      0.00
55      144.94     446.04      0.00    -144.94    -446.04      0.00
56     -841.05   -2589.32      0.00     841.05    2589.32      0.00
57    -1070.47   -3294.41      0.00    1070.47    3294.41      0.00
58    -1163.08   -3579.40      0.00    1163.08    3579.48      0.00
59    -1216.09   -3742.60      0.00    1216.09    3742.60      0.00
60    -1243.95   -3828.34      0.00    1243.95    3828.34      0.00
61    -1235.55   -3802.48      0.00    1235.55    3802.48      0.00
62    -1244.00   -3828.53      0.00    1244.00    3828.53      0.00
63    -1216.02   -3742.37      0.00    1216.02    3742.37      0.00
64    -1163.04   -3579.37      0.00    1163.04    3579.37      0.00
65    -1069.87   -3293.77      0.00    1069.87    3293.77      0.00
66     -841.30   -2589.16      0.00     841.30    2589.16      0.00
67     -258.50    -795.43      0.00     258.50     795.43      0.00
68      -33.37    -102.72      0.00      33.37     102.72      0.00
69       34.84     107.25      0.00     -34.84    -107.25      0.00
70       70.03     215.47      0.00     -70.03    -215.47      0.00
71       89.13     274.36      0.00     -89.13    -274.36      0.00
72       97.92     301.30      0.00     -97.92    -301.30      0.00
73       97.86     301.22      0.00     -97.86    -301.22      0.00
74       89.14     274.38      0.00     -89.14    -274.38      0.00
75       69.99     215.36      0.00     -69.99    -215.36      0.00
76       34.82     107.17      0.00     -34.82    -107.17      0.00
77      -33.41    -102.84      0.00      33.41     102.84      0.00
78     -258.55    -795.57      0.00     258.55     795.57      0.00
79       49.63     -36.06   -131.56     -49.63      36.06    131.56
80       -0.39      -0.01      0.83       0.39       0.01     -0.83
81       -0.27       0.21      0.73       0.27      -0.21     -0.73
82      -61.66       0.00    132.22 [illegible].66       0.00   -132.22
83      -97.14      70.58   -257.50      97.14     -70.58    257.50
84      -58.79      -0.83   -125.49      58.79       0.83    125.49
85        0.21      -0.16      0.57      -0.21       0.16     -0.57
86        0.14       0.00      0.30      -0.14       0.00     -0.30
87       47.40     -35.47    126.37     -47.40      35.47   -126.37
88      120.40       0.00    258.19    -120.40       0.00   -258.19
89      192.14    -139.60   -509.32    -192.14     139.60    509.32
90       58.55       0.62   -125.13     -58.55      -0.62    125.13
91       47.24     -34.58   -125.40     -47.24      34.58    125.40
92       -0.25       0.00      0.53       0.25       0.00     -0.53
93       -0.23       0.17      0.62       0.23      -0.17     -0.62
94      -58.98      -0.21    126.34      58.98       0.21   -126.34
95      -47.38      35.20    126.14      47.38     -35.20   -126.14
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96	-237.35	0.00	509.00	237.35	0.00	-509.00
97	-286.17	207.91	-758.57	286.17	-207.91	758.57
98	-116.31	-0.99	-248.75	116.31	0.99	248.75
99	-46.76	34.13	-124.07	46.76	-34.13	124.07
100	-58.06	-0.37	-124.26	58.06	0.37	124.26
101	0.08	-0.06	0.21	-0.08	0.06	-0.21
102	0.17	0.00	0.37	-0.17	0.00	-0.37
103	46.96	-34.58	124.81	-46.96	34.58	-124.81
104	58.24	0.12	124.82	-58.24	-0.12	-124.82
105	93.71	-69.30	249.25	-93.71	69.30	-249.25
106	353.54	0.00	758.17	-353.54	0.00	-758.17
107	427.17	-310.36	-1132.34	-427.17	310.36	1132.34
108	116.34	0.82	-248.92	-116.34	-0.82	248.92
109	93.84	-68.38	-248.90	-93.84	68.38	248.90
110	58.18	0.33	-124.53	-58.18	-0.33	124.53
111	46.93	-34.30	-124.53	-46.93	34.30	124.53
112	-0.14	0.00	0.29	0.14	0.00	-0.29
113	-0.11	0.08	0.28	0.11	-0.08	-0.28
114	-58.14	-0.16	124.57	58.14	0.16	-124.57
115	-47.01	34.56	124.88	47.01	-34.56	-124.88
116	-116.31	-0.16	249.32	116.31	0.16	-249.32
117	-93.82	69.18	249.40	93.82	-69.18	-249.40
118	-527.86	0.00	1131.99	527.86	0.00	-1131.99
119	-567.42	412.25	-1504.10	567.42	-412.25	1504.10
120	-173.73	-1.05	-371.82	173.73	1.05	371.82
121	-93.49	68.07	-247.93	93.49	-68.07	247.93
122	-115.79	-0.58	-247.91	115.79	0.58	247.91
123	-46.75	34.11	-124.03	46.75	-34.11	124.03
124	-57.84	-0.23	-123.88	57.84	0.23	123.88
125	0.02	-0.02	0.06	-0.02	0.02	-0.06
126	0.03	0.00	0.05	-0.03	0.00	-0.05
127	46.79	-34.29	124.24	-46.79	34.29	-124.24
128	58.03	0.12	124.36	-58.03	-0.12	-124.36
129	93.50	-68.66	248.35	-93.50	68.66	-248.35
130	115.84	0.12	248.33	-115.84	-0.12	-248.33
131	140.03	-103.04	372.09	-140.03	103.04	-372.09
132	701.27	0.00	1503.91	-701.27	0.00	-1503.91
133	754.69	-548.32	-2000.50	-754.69	548.32	2000.50
134	173.74	0.92	-371.95	-173.74	-0.92	371.95
135	140.28	-102.08	-371.96	-140.28	102.08	371.96
136	115.73	0.53	-247.81	-115.73	-0.53	247.81
137	93.44	-68.11	-247.85	-93.44	68.11	247.85
138	57.79	0.22	-123.77	-57.79	-0.22	123.77
139	46.70	-34.09	-123.90	-46.70	34.09	123.90
140	-0.12	0.00	0.26	0.12	0.00	-0.26
141	-0.06	0.04	0.15	0.06	-0.04	-0.15
142	-58.01	-0.13	124.31	58.01	0.13	-124.31
143	-46.69	34.19	123.95	46.69	-34.19	-123.95
144	-115.75	-0.18	248.12	115.75	0.18	-248.12
145	-93.49	68.58	248.28	93.49	-68.58	-248.28
146	-173.45	-0.13	371.87	173.45	0.13	-371.87

147	-140.09	102.92	372.14	140.09	-102.92	-372.14
148	-932.81	0.00	2000.36	932.81	0.00	-2000.36
149	-756.82	549.86	-2006.14	756.82	-549.86	2006.14
150	-2.55	-0.01	-5.45	2.55	0.01	5.45
151	-130.78	95.14	-346.75	130.78	-95.14	346.75
152	-161.95	-0.67	-346.84	161.95	0.67	346.84
153	-96.90	70.58	-256.98	96.90	-70.58	256.98
154	-119.92	-0.42	-256.88	119.92	0.42	256.88
155	-57.94	42.25	-153.68	57.94	-42.25	153.68
156	-71.85	-0.21	-153.93	71.85	0.21	153.93
157	0.03	-0.02	0.08	-0.03	0.02	-0.08
158	0.01	0.00	0.01	-0.01	0.00	-0.01
159	58.01	-42.41	153.96	-58.01	42.41	-153.96
160	71.79	0.13	153.86	-71.79	-0.13	-153.86
161	96.85	-70.89	257.08	-96.85	70.89	-257.08
162	119.88	0.14	256.99	-119.88	-0.14	-256.99
163	130.44	-95.60	346.36	-130.44	95.60	-346.36
164	161.70	0.10	346.71	-161.70	-0.10	-346.71
165	2.10	-1.54	5.58	-2.10	1.54	-5.58
166	935.32	0.00	2005.88	-935.32	0.00	-2005.88
167	828.67	-602.06	-2196.56	-828.67	602.06	2196.56
168	31.26	0.13	-66.94	-31.26	-0.13	66.94
169	294.31	-214.05	-780.32	-294.31	214.05	780.32
170	89.58	0.34	-191.87	-89.58	-0.34	191.87
171	128.76	-93.74	-341.45	-128.76	93.74	341.45
172	85.57	0.28	-183.32	-85.57	-0.28	183.32
173	84.23	-61.38	-223.41	-84.23	61.38	223.41
174	36.77	0.10	-78.79	-36.77	-0.10	78.79
175	36.39	-26.55	-96.54	-36.39	26.55	96.54
176	1.26	0.00	-2.70	-1.26	0.00	2.70
177	-1.06	0.78	2.82	1.06	-0.78	-2.82
178	-44.95	-0.08	96.33	44.95	0.08	-96.33
179	-29.82	21.80	79.14	29.82	-21.80	-79.14
180	-104.25	-0.15	223.47	104.25	0.15	-223.47
181	-69.22	50.64	183.71	69.22	-50.64	-183.71
182	-159.18	-0.15	341.26	159.18	0.15	-341.26
183	-72.20	52.88	191.68	72.20	-52.88	-191.68
184	-363.99	-0.17	780.44	363.99	0.17	-780.44
185	-25.20	18.47	66.90	25.20	-18.47	-66.90
186	-1024.25	0.00	2196.44	1024.25	0.00	-2196.44
187	-978.60	710.98	-2593.98	978.60	-710.98	2593.98
188	-185.45	-0.72	-397.22	185.45	0.72	397.22
189	-460.86	335.11	-1221.82	460.86	-335.11	1221.82
190	-237.38	-0.82	-508.47	237.38	0.82	508.47
191	-194.59	141.61	-515.97	194.59	-141.61	515.97
192	-170.95	-0.53	-366.25	170.95	0.53	366.25
193	-110.70	80.63	-293.59	110.70	-80.63	293.59
194	-118.48	-0.32	-253.85	118.48	0.32	253.85
195	-53.15	38.74	-140.98	53.15	-38.74	140.98
196	-57.80	-0.13	-123.87	57.80	0.13	123.87
197	0.99	-0.72	2.62	-0.99	0.72	-2.62

198	-1.22	0.00	-2.62	1.22	0.00	2.62
199	46.62	-34.04	123.70	-46.62	34.04	-123.70
200	65.89	0.10	141.22	-65.89	-0.10	-141.22
201	95.65	-69.89	253.82	-95.65	69.89	-253.82
202	137.03	0.16	293.76	-137.03	-0.16	-293.76
203	138.00	-100.91	366.23	-138.00	100.91	-366.23
204	240.65	0.19	515.92	-240.65	-0.19	-515.92
205	191.52	-140.16	508.36	-191.52	140.16	-508.36
206	569.73	0.22	1221.67	-569.73	-0.22	-1221.67
207	149.64	-109.61	397.28	-149.64	109.61	-397.28
208	1209.40	0.00	2593.67	-1209.40	0.00	-2593.67
209	1676.23	-1217.96	-4443.58	-1676.23	1217.96	4443.58
210	821.30	2.91	-1759.28	-821.30	-2.91	1759.28
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212	323.51	1.04	-693.02	-323.51	-1.04	693.02
213	238.56	-173.55	-632.52	-238.56	173.55	632.52
214	207.12	0.60	-443.76	-207.12	-0.60	443.76
215	144.52	-105.22	-383.24	-144.52	105.22	383.24
216	128.18	0.33	-274.65	-128.18	-0.33	274.65
217	80.74	-58.82	-214.12	-80.74	58.82	214.12
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227	-167.20	122.22	443.73	167.20	-122.22	-443.73
228	-294.97	-0.19	632.47	294.97	0.19	-632.47
229	-261.11	190.98	693.00	261.11	-190.98	-693.00
230	-792.21	-0.25	1698.72	792.21	0.25	-1698.72
231	-662.72	485.09	1759.23	662.72	-485.09	-1759.23
232	-2072.20	0.00	4443.70	2072.20	0.00	-4443.70
233	-2013.62	1462.98	0.00	2013.62	-1462.98	0.00
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239	-3034.09	2204.39	0.00	3034.09	-2204.39	0.00
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