

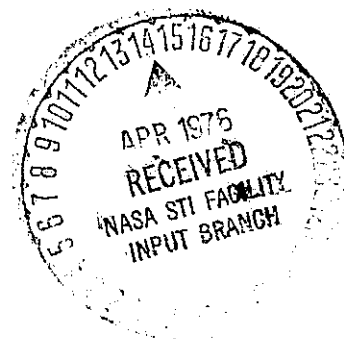
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MODAL ANALYSIS AND DYNAMIC STRESSES FOR ACOUSTICALLY EXCITED SHUTTLE INSULATION TILES

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FOREWORD

The work reported herein was performed by the Grumman Aerospace Corporation under the NASA/Langley Master Agreement and Contract No. NAS 1-10635 for the Development and Implementation of Space Shuttle Structural Dynamics Modeling Technology. The Work Statement of Task Order No. 17-Modification No. 2, "Development of an Analytical Program to Analyze Reusable Surface Insulation for Shuttle," authorized and specified the items to be performed in this study. This report covers Items F through H of the subject Task Order, for which the period of performance was 12 months starting in September 1974. Items A through E were reported upon in NASA CR-132553, September 1974.

The overall supervision of programs under the Master Agreement is provided by Mr. E. F. Baird, Master Agreement Program Manager. The Task Order No. 17 Project Manager was Dr. I. U. Ojalvo.

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ABSTRACT

This report describes improvements and extensions to the RESIST computer program, developed previously, for determining the normalized modal stress response of Shuttle insulation tiles. The new version of RESIST can accommodate primary structure panels with closed-cell stringers, in addition to the previously developed capability for treating open-cell stringers. In addition, the present version of RESIST numerically solves vibration problems several times faster than its predecessor.

A new digital computer program, titled ARREST (Acoustic Response of Reusable Shuttle Tiles) is also described. Starting with modal information contained on output tapes from RESIST computer runs, ARREST determines RMS stresses, deflections and accelerations of Shuttle panels with reusable surface insulation tiles. Both programs are applicable to stringer stiffened structural panels with or without reusable surface insulation tiles.

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Section 1
INTRODUCTION

This report describes extensions to vibration and stress analysis work performed on the Space Shuttle thermal protection system (Reference 1). These extensions are concerned with improving the structural idealization and computational efficiency of the modal response program, and developing an associated acoustic response analysis capability.

In the initial work, an efficient iterative procedure for the vibration and modal stress analysis of Reusable Surface Insulation (RSI) of multi-tiled Space Shuttle panels was presented. The method, which is quite general, is rapidly convergent and highly useful for this application. A user-oriented computer program based upon this procedure and titled RESIST (REusable Surface Insulation Stresses) was prepared for the analysis of soft-bonded Shuttle insulation tiles attached to stringer-stiffened panels. RESIST, which uses finite element methods, obtains three-dimensional tile stresses in the soft isolator and RSI materials. In addition, the program can treat non-uniform temperature-dependent material properties in the tiles. Two-dimensional stresses are obtained in the tile coating and the stringer-stiffened primary structure plate. A special feature of the program is that all the usual detailed finite element grid data is generated internally from a minimum of input data. The program can accommodate tile idealizations with up to 850 nodes (2550 degrees-of-freedom) per tile and primary structure idealization with 3000 nodes. The vibration capability of this program was made feasible through development of a new rapid eigenvalue program named ALARM (Automatic Large Reduction of Matrices to tridiagonal form) which can handle primary structure idealizations with up to 15,000 degrees-of-freedom.

Because of the complex nature of the finite element idealizations and the large size of the associated matrices, computer running time was an important factor associated with operation of the RESIST program. Therefore, attention was given in the present study to identifying time-consuming computational areas and developing improved programming and numerical algorithms for certain portions of RESIST. These improvements, which are discussed in Section 2.1,

resulted in efficiencies which have yielded computer cost-savings of over 75% for realistic tile problems.

Another basic improvement in the original version of RESIST was the development of an improved stiffened panel idealization. The version of RESIST described in Reference 1 could only accommodate compact, widely-spaced stringers, or open-section stringers attached along a single rivet (or weld) line. The present work, as described in Section 2.2, extends the RESIST modeling capability to the treatment of orthotropic plate idealizations, or closed-cell stringers attached to flat panels along double rivet lines. Thus, RESIST has been modified to treat configurations which are more representative of actual Shuttle structure.

The vibration analysis of RSI tiled panels by the RESIST program yields normalized deflections and tile stresses for each mode considered. For dynamic analyses, the results for each natural frequency may be multiplied by suitable modal participation factors and the results superimposed to yield useful engineering results. A computer program for obtaining the acoustic response of (spatially) uniformly loaded panels has been developed. The new program titled ARREST (Acoustic Response of REusable Shuttle Tiles) is described in Section 3.

Typical results for the combined usage of ARREST and the new version of RESIST are presented in Section 4. Preliminary results reveal that the RSI normal thickness stresses, near the isolator bond line, may be critical for portions of the orbiter which are subject to high acoustic launch loads. Users manuals for these programs are presented in Appendices A and B. Reference 2 is the Programmer's Manual for RESIST. Appendix C contains a programmer's manual for the newly developed ARREST program. The RESIST and ARREST computer programs have been developed on digital magnetic tape for both the CDC 6600- and the IBM 370-series machines.

Section 2
IMPROVEMENTS TO THE RESIST PROGRAM

A number of changes to the RESIST (REusable Surface Insulation STresses) program (References 1 and 2) have been made to improve its usefulness. The nature of these program changes have been to extend its applicability, reduce the program storage requirements, speed up the machine running time, and to provide additional information which is required for subsequent dynamic analyses (described in Section 3).

2.1 COMPUTATIONAL EFFICIENCIES

The reduced program storage requirements and the development of streamlined numerical algorithms have improved the program efficiency significantly. This is highlighted by a reduction in machine running time of a large sample problem, presented in Reference 1, from 68 to 16 CPU minutes on the IBM 370/168 computer. These program improvements will now be detailed.

2.1.1 Modification of The Large Eigenvalue Routine (ALARM)

The ALARM (Reference 1) routine computes the initial mode shapes and frequencies of the tiled plate. A modification to ALARM was effected to speed up this time consuming portion of the RESIST computer program. In the original version of ALARM, the number of eigenvalue reduction vectors (Reference 3) generated, $\{V_j\}$, $j = 1, 2, \dots, m$, was approximately twice the number of desired modes $\{\phi^{(i)}\}$, $i = 1, 2, \dots, q$. Since the generation of each V_j represents one of the most computationally costly portions of the ALARM algorithm, the subroutine logic was changed to initially compute only approximately 50% more reduction vectors than desired eigenvectors ($m \approx 3/2 q$). The first q eigenvalues associated with the m reduction vectors are now computed along with their associated Newman-Pipano error bounds. Should any of the error bounds in frequency squared be greater than 2%*, an additional vector is computed and the first q eigenvalues and error bounds, using $m + 1$ reduction vectors this time, are checked again. This process is repeated, adding one new vector each step

*An error bound in frequency-squared of 2% corresponds to one of approximately 1% on frequency.

of the way, until the first q desired eigenvalues are accurate to within 2%. It has been found that this procedure is extremely efficient. Repeated solution of the reduced m x m eigenvalue problem, and error bound determination, requires a minute portion of the entire computation time, as long as 5 or more modes are required and the size of the original eigenvalue problem is large (i.e., of the order of 500 or more).

2.1.2 Nonpositive Definite Solution Algorithm

The efficient solution routine (PODSYM), used to solve the tile and primary structure banded large matrix equations, required that the symmetric coefficient matrices be positive definite. Since this condition could not be guaranteed a priori, Eqs. (6) and (11) of Reference 1 were converted to the equivalent positive definite forms of Eqs. (9) and (12), respectively. This conversion required excessive storage requirements and resulted in rather high computer usage costs. Therefore, PODSYM was modified to accommodate nonpositive definite equation systems through decomposition of the symmetric coefficient matrix [A] into the form

$$[A] = [\bar{L}] [\bar{D}_s] [\bar{L}]^T$$

where $[\bar{L}]$ is a lower triangular matrix with elements \bar{l}_{ij} , and $[\bar{D}_s]$ is a diagonal matrix with plus or minus ones, d_p , on the diagonal. The original algorithm is similar to the one outlined below except that the computation and inclusion of d_p , which is always plus one if [A] is positive definite, is not necessary. The elements of $[\bar{L}]$ are given by

$$\bar{l}_{ii} = \left[(a_{ii} - \sum_{p=1}^{i-1} d_p \bar{l}_{ip}^2) / d_i \right]^{1/2}$$

$$\bar{l}_{ij} = a_{ij} - \sum_{p=1}^{j-1} d_p \bar{l}_{ip} \bar{l}_{jp}$$

where $d_i = \text{sign} (a_{ii} - \sum_{p=1}^{i-1} d_p \bar{x}_{ip}^2)$

and a_{ij} are the elements of $[A]$.

The solution of

$$[A] \{x\} = \{b\}$$

for $\{x\}$ (given $\{b\}$) then follows from the forward solution of

$$[\bar{L}] \{y\} = \{b\}$$

for $\{y\}$, and the backward solution of $\{x\}$ from

$$[\bar{L}]^T \{x\} = [\bar{D}] \{y\} .$$

2.1.3 Iterative Procedure for Changing Matrix Equations

The iterative solution of Eqs. (6) and (11) of Reference 1, both of which are of the form

$$[Z_i] \{\delta_{i+1}\} = \{p(\delta_i)\} \quad (1)$$

where

$$[Z_i] = [K] - \omega_i^2 [M]$$

required the repetitive decomposition of $[Z_i]$ into $[\bar{L}_i] [\bar{D}_i] [\bar{L}_i]^T$, since the frequency, ω_i , upon which $[Z_i]$ depends, changed from one iteration to the next. However, since ω_i may be a slowly changing value, an option, which is based upon an approximation, and which does not require the resplitting of $[Z_i]$, was introduced into RESIST. This approximation is based upon the following development.

Let

$$\omega_i^2 = \omega_o^2 + \Delta\omega_i^2$$

$$\{\delta_{i+1}^{(j+1)}\} = \{\delta_{i+1}^{(j)}\} + \{\Delta\delta_{i+1}^{(j)}\}$$

and substitute into Eq. (1) to obtain

$$[Z_o] \{\delta_{i+1}^{(j+1)}\} \approx \{p(\delta_i)\} + \Delta\omega_i^2 [M] \{\delta_{i+1}^{(j)}\} \quad (2)$$

where the higher order terms $\Delta\omega_i^2 [M] \{\Delta\delta_{i+1}^{(j)}\}$ have been dropped from the right-hand side of Eq. (2). Starting with $\delta_{i+1}^{(o)} = \delta_i$, Eq. (2) is solved in an iterative manner (this is an "inner" (j) iteration) until $\{\delta_{i+1}^{(j+1)}\}$ converges. Thus,

$[Z_o]$ is only decomposed once, regardless of the number of "outer" (i) iterations.

2.2 PROGRAM EXTENSIONS

The extended applicability associated with the new version of RESIST involves improvement of the idealization for the stiffened-plate primary structure. The new plate idealizations permit the use of either orthotropic plate properties or a more detailed stringer model. The new finite element capability for the strain isolator includes the option for material orthotropy, which is required for the current baseline TPS isolator.

2.2.1 Orthotropic Strain Isolator

RESIST has been modified to permit an orthotropic material isolator between the RSI and primary structure. This latter modification was necessary because of the current baseline usage of Nomex felt (which has different properties in the transverse and planar directions) as the isolator material. The finite element modeling of the isolator layer is still based upon the three-dimensional orthotropic hexahedron element described in Reference 1.

2.2.2 Stiffened Plate Idealization

The stiffened-plate primary structure finite-element idealization, employed in the original version of RESIST, consisted of offset beam elements attached to flat plate elements (Figure 2-1). While it is felt that this idealization is adequate for compact widely-spaced long stringers, it is inappropriate for a "typical" Shuttle panel, such as that shown in Figure 2-2. To extend the capability of RESIST for application to such structural configurations, two new idealization options have been developed and incorporated into this program.

The first development consists of a new stringer idealization to permit a more accurate modeling for closed-section stringers attached along a double line of rivets (or welds). The new stringer model consists of a pair of plate elements, which form a "V" (Figure 2-3), below which an offset beam element is rigidly attached. The rationale used in selecting the "V" shape was that it permitted the modeling of a shear-flow path to resist local plate twisting (the previous offset beam idealization could not furnish this type of twisting restraint) while only adding a single row of element-nodes per stiffener.

The offset beam element placed below the "V" is used to compensate for the fact that the original stringer possesses more cross sectional beam properties than can be accommodated by the "V" elements alone. Thus, when an actual closed stringer to be idealized has a shape that is different from the one used in the finite element model, the program assigns properties to the offset beam below the "V" such that its section properties compensate for any mismatches. A count of the actual number of stringer section properties yields six geometric values (A , I_y , I_x , J_x , β , and e) in addition to the spacing variables P , a and b (Figure 2-2), whereas the new idealization permits seven independent properties in addition to P , a and b . The additional variable permitted by the present finite element idealization, \bar{t} , may thus be used to help improve correlation with test data.

The second structural idealization option incorporated within RESIST permits the combination of stringer properties into the flat plate elements. This is affected in a uniformly distributed manner through specification of

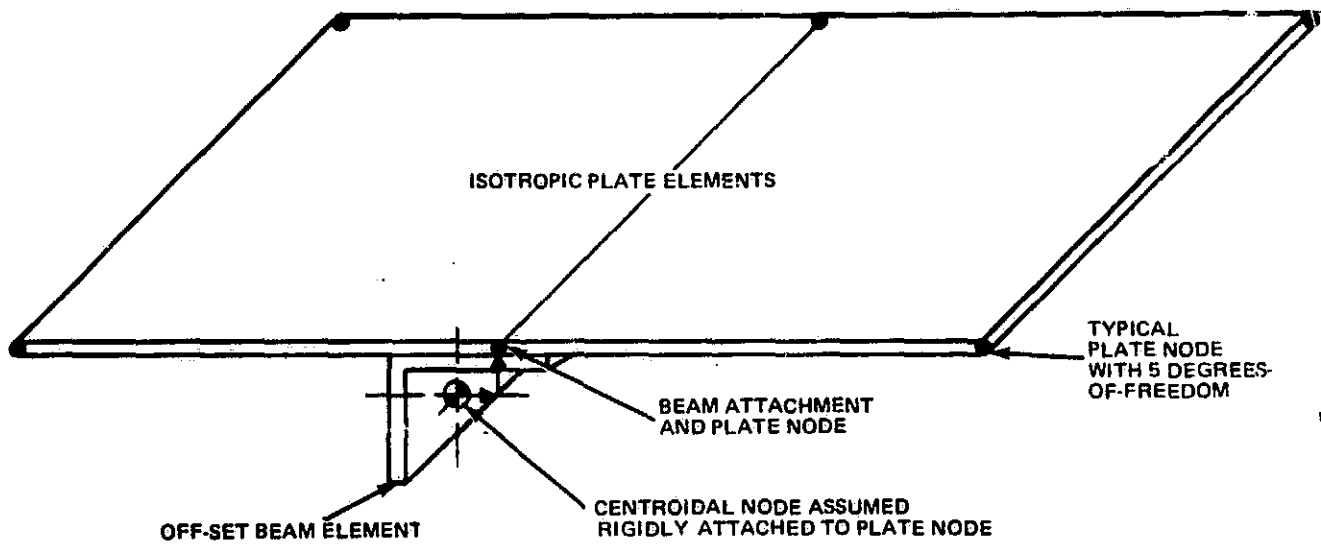


Figure 2-1 Stiffened-Plate Finite Element Idealization Employed in Original Version of RESIST Program

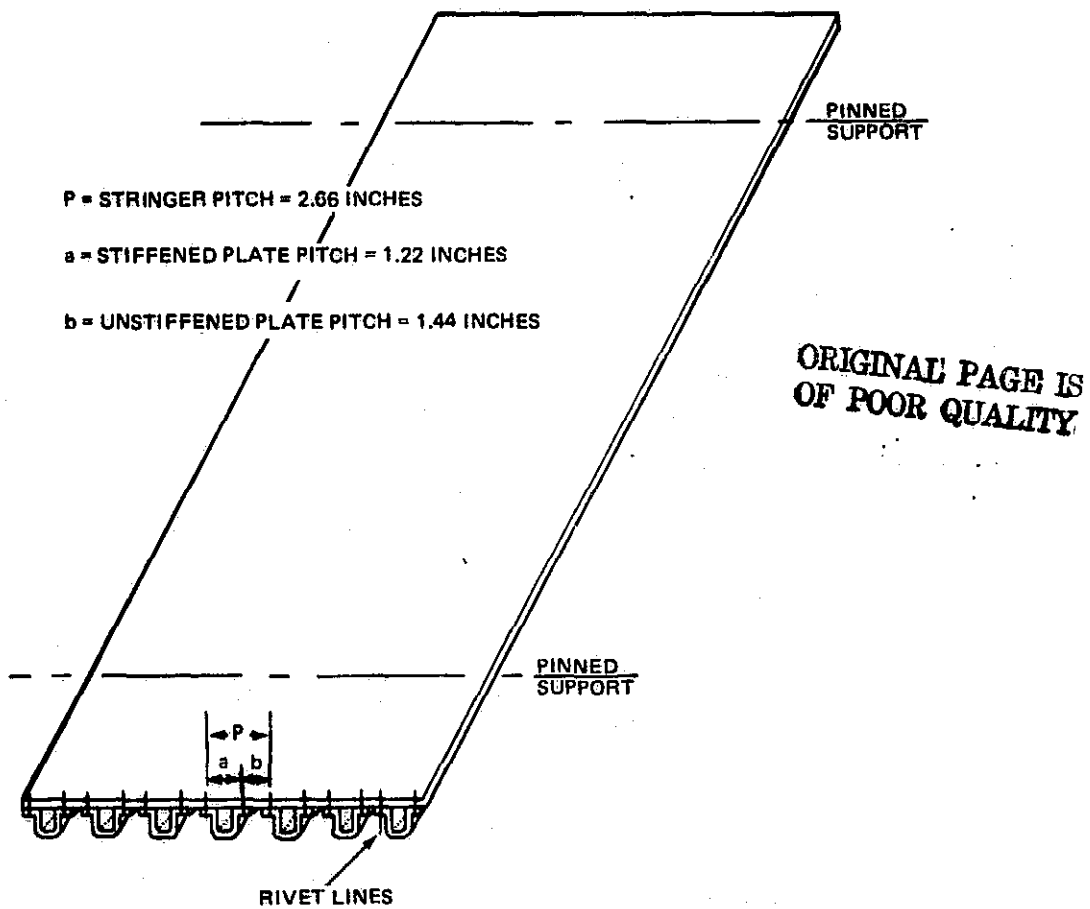


Figure 2-2 Typical Shuttle Panel

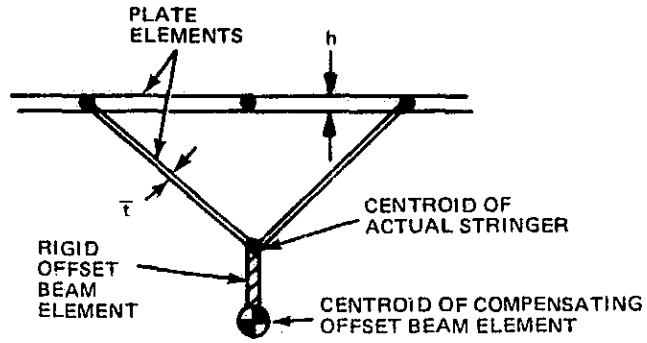
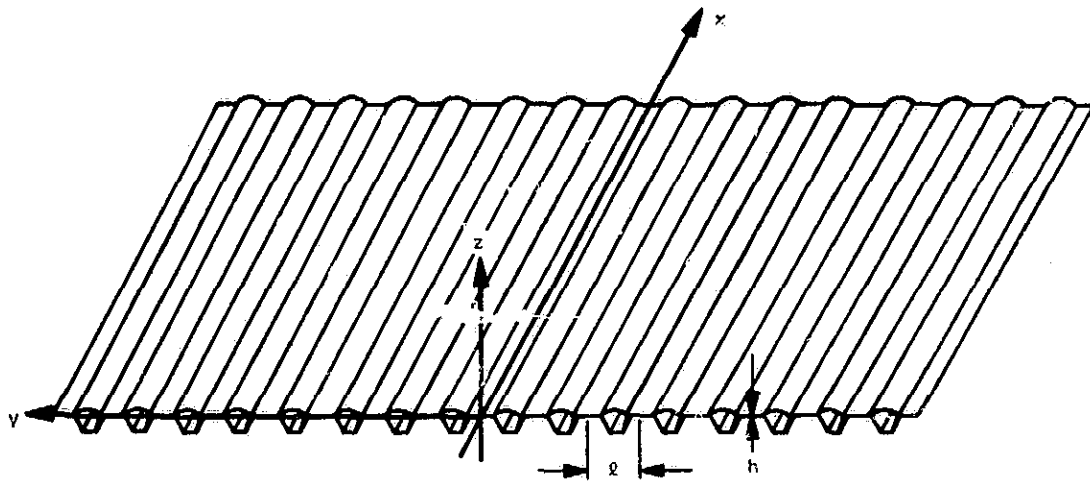


Figure 2-3 Idealization of New Stringer in RESIST Program



$$\frac{\bar{E}I}{l} \frac{\partial^4 w}{\partial x^4} + \frac{(GJ)}{l} + D_y(1-\nu) \frac{\partial^4 w}{\partial x^2 \partial y^2} + D_y \frac{\partial^4 w}{\partial y^4} = q$$

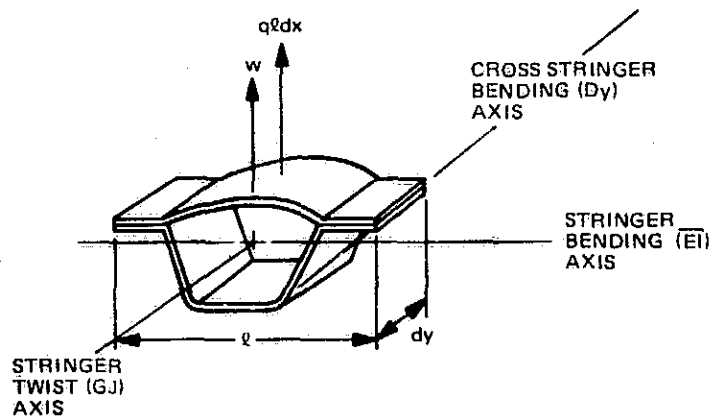


Figure 2-4 Fung's Corrugated Plate Theory (Reference 2)

appropriate orthotropic plate properties. Additional plate input required to describe the orthotropy includes the elastic constants A_{11} , A_{12} , A_{22} and A_{33} where

$$\begin{Bmatrix} \sigma_x \\ \sigma_y \\ \tau_{xy} \end{Bmatrix} = \begin{bmatrix} A_{11} & A_{12} & 0 \\ A_{21} & A_{22} & 0 \\ 0 & 0 & A_{33} \end{bmatrix} \begin{Bmatrix} \epsilon_x \\ \epsilon_y \\ \gamma_{xy} \end{Bmatrix}$$

The general form of the above stress-strain law allows the use of various orthotropic plate theories depending upon the particular specification of the A_{ij} . The equivalent values of these elastic constants which were suggested by Timoshenko (Reference 5) and Fung (see Figure 2-4 and Reference 6) are compared with their isotropic counterparts in Table 2-1. The form of the governing orthotropic plate equations for these four theories is presented in Table 2-2.

2.2.3 Additional Modal Information

The new version of RESIST has been extended to output necessary input information for the ARREST program described in Section 3. The new version of RESIST computes the modal area terms required for Eqs. (13) and (14) of Section 3:

$$\left(\sum_j A_{z_j} \bar{\phi}_{T, z_j}^{(i)} \right)^2$$

(note that this term is 0 for an antisymmetric mode), as well as the modal mass, M_i . This latter quantity is computed in discrete parts consisting of the primary structure modal mass for the i^{th} mode, $M_{PS}^{(i)}$, and the r^{th} tile's modal mass, $M_{Tr}^{(i)}$, where

$$M_{PS}^{(i)} = [\phi_{PS}^{(i)}] [M_{PS}] \{ \phi_{PS}^{(i)} \}$$

$$M_{Tr}^{(i)} = [\phi_{Tr}^{(i)}] [M_{Tr}] \{ \phi_{Tr}^{(i)} \}$$

Table 2-1
Comparison of Orthotropic Plate Variables

ISOTROPIC PLATE	TIMOSHENKO (REF. 5)	FUNG (REF. 6) (see Figure 2-4)	RESIST PROGRAM
$E/(1 - \nu^2)$	E'_x	$\frac{12 \bar{E}I}{lh^3}$	A_{11}
$\gamma E/(1 - \nu^2)$	E''	$\frac{6(1 - \nu)D_y}{h^3}$	$A_{12} = A_{21}$
$E/(1 - \nu^2)$	E'_y	$12D_y/h^3$	A_{22}
$G = \frac{E}{2(1 + \nu)}$	G	GJ/lh^3	A_{33}

Table 2-2
Comparison of Orthotropic Plate Equations

Isotropic Plate Equation	$D \frac{\partial^4 w}{\partial y^4} + 2 \left(\nu D + 2 \frac{Gh^3}{12} \right) \frac{\partial^4 w}{\partial x^2 \partial y^2} + D \frac{\partial^4 w}{\partial x^4} = q$ <p>Note: $G = \frac{E}{2(1 + \nu)}$, $D = \frac{Eh^3}{12(1 - \nu^2)}$. Therefore, $\nu D + 2 \frac{Gh^3}{12} = D$</p>
Timoshenko Plate Equation (Ref. 5)	$D_x \frac{\partial^4 w}{\partial x^4} + 2 (D_1 + 2 D_{xy}) \frac{\partial^4 w}{\partial x^2 \partial y^2} + D_y \frac{\partial^4 w}{\partial y^4} = q$ <p>where $D_x = \frac{E_x h^3}{12(1 - \nu^2)}$, $D_y = \frac{E_y h^3}{12(1 - \nu^2)}$, $D_{xy} = \frac{Gh^3}{12}$, $D_1 = \frac{\nu E_y h^3}{12(1 - \nu^2)}$</p> $\nu = \sqrt{\nu_x \nu_y}, \quad E = \frac{\nu_x E_y + \nu_y E_x}{2\nu}$
Fung Plate Equation (Ref. 6) (See Fig. 2-4)	$\frac{EI}{l} \frac{\partial^4 w}{\partial x^4} + (D_y (1 - \nu) + \frac{GJ}{l}) \frac{\partial^4 w}{\partial x^2 \partial y^2} + D_y \frac{\partial^4 w}{\partial y^4} = q$
RESIST Program	$\frac{h^3}{12} \left[A_{11} \frac{\partial^4 w}{\partial x^4} + 2 (A_{12} + 2A_{33}) \frac{\partial^4 w}{\partial x^2 \partial y^2} + A_{22} \frac{\partial^4 w}{\partial y^4} \right] = q$

The tile modal mass for all tiles vibrating in the i^{th} mode is given by

$$\bar{M}_T^{(i)} = \sum_r M_{Tr}^{(i)}$$

These quantities are related to M_i through the relationship

$$M_i = M_{PS}^{(i)} + \bar{M}_T^{(i)}$$

RESIST has also been modified to compute normalized modal stringer stresses along with the RSI and plate stresses. This data is output on magnetic tape, together with modal deflection data required for the acoustic response program.

Section 3

SHUTTLE TILE RESPONSE TO RANDOM PRESSURE FLUCTUATIONS

A computer program for calculation of the response of shuttle panels with surface insulation subjected to uniform, spatially-correlated acoustic excitation has been developed. This program, titled ARREST (Acoustic Response of Reusable Shuttle Tiles) was designed to interface with RESIST. For a dynamics problem, the output of RESIST (which consists of modal frequencies and normalized stresses of stiffened panels with RSI tiles) serves as the input to ARREST. The output of ARREST is approximate in that the analysis is based upon a number of simplifying assumptions. As will be seen, these assumptions are the usual ones associated with the use of finite element analyses, modal methods, and a simplified characterization of the acoustic forcing function. Perhaps the most limiting approximation included within ARREST is that the normal pressure field is uniformly correlated over the entire structural panel. This is a conservative assumption that is justifiable for excitation where the pressure field correlation-length is of the order of the panel size. When the excitation is caused by jet noise, such as during Shuttle liftoff, the correlation length is of the order of the engine diameter (Reference 7). The theory upon which ARREST is based is summarized below.

3.1 MODAL DYNAMICS OF RSI TILES AND PRIMARY STRUCTURE

The finite element equations governing the dynamic response of RSI tiled panels are of the general form

$$\begin{bmatrix} M_{PS} & 0 \\ 0 & \bar{M}_T \end{bmatrix} \begin{Bmatrix} \ddot{\delta}_{PS} \\ \ddot{\delta}_T \end{Bmatrix} + \begin{bmatrix} C_{PS} & 0 \\ 0 & \bar{C}_T \end{bmatrix} \begin{Bmatrix} \dot{\delta}_{PS} \\ \dot{\delta}_T \end{Bmatrix} + \begin{bmatrix} K_{PS} & 0 \\ 0 & \bar{K}_T \end{bmatrix} \begin{Bmatrix} \delta_{PS} \\ \delta_T \end{Bmatrix} = \begin{Bmatrix} P_{PS} \\ \bar{P}_T \end{Bmatrix} \quad (1)$$

where $\{\delta\}$ are the nodal degrees-of-freedom; $[M]$, $[C]$ and $[K]$ are the mass, damping and stiffness matrices, respectively; and $\{P\}$ is the dynamic loading vector. The subscripts "PS" and "T" denote the primary structure and tile components, respectively. The significance of the bar over the tile quantities is that they refer to the accumulation of all tiles rather than a single tile.

It should be noted that the primary structure and tile matrices have been cast in uncoupled form. The reason for this is that the iterative solution procedure employed to obtain the matrices and modal vectors of the coupled system was to treat each component separately. Their initial coupling is obtained within the fact that the tile/primary structure interface degrees-of-freedom, a subset of $\{\delta_{PS}\}$ and $\{\bar{\delta}_T\}$, are kinematically dependent, as are the vectors $\{P_{PS}\}$ and $\{\bar{P}_T\}$, which contain their mutual reactions. Therefore, elements of $\{P_{PS}\}$ which correspond to $\{\bar{P}_T\}$ have, by Newton's Third Law, the same magnitudes but opposite signs.

The classical modal approximation is now made:

$$\begin{Bmatrix} \delta_{PS} \\ \bar{\delta}_T \end{Bmatrix} \approx \begin{bmatrix} \phi_{PS} \\ \bar{\phi}_T \end{bmatrix} \{q\} \quad (2)$$

where the number of orthogonal modes, $\begin{Bmatrix} \phi_{PS}^{(i)} \\ \bar{\phi}_T^{(i)} \end{Bmatrix}$, and generalized coordinates

q_i , are less than the number of nodal degrees-of-freedom. The modal vectors satisfy the matrix equations

$$[M_{PS}] \{\phi_{PS}^{(i)}\} - \omega_i^2 [K_{PS}] \{\phi_{PS}^{(i)}\} = \begin{Bmatrix} 0 \\ \bar{P}_j \end{Bmatrix} \quad (3)$$

$$[\bar{M}_T] \{\bar{\phi}_T^{(i)}\} - \omega_i^2 [\bar{K}_T] \{\bar{\phi}_T^{(i)}\} = \begin{Bmatrix} -P_j \\ 0 \end{Bmatrix} \quad (4)$$

where $\{P_j\}$ are the tile boundary interface loads acting upon the primary structure and $\{-P_j\}$ are their reactions, which act upon the corresponding tile nodes. Thus, the degree-of-freedom magnitudes at these common nodes will be identical in the vector components $\{\phi_{PS}^{(i)}\}$ and $\{\bar{\phi}_T^{(i)}\}$.

The modal normalization condition selected is

$$[\phi_{PS}^{(i)}] \{\phi_{PS}^{(i)}\} = 1 \quad (5)$$

and the orthogonality of the modes yields

$$[\phi_{PS}^{(i)} \ ; \ \bar{\phi}_T^{(i)}] \begin{bmatrix} M_{PS} & 0 \\ 0 & \bar{M}_T \end{bmatrix} \begin{Bmatrix} \phi_{PS}^{(j)} \\ \bar{\phi}_T^{(j)} \end{Bmatrix} = M_i \delta_{ij}$$

$$\text{where } M_i = [\phi_{PS}^{(i)}] [M_{PS}] \{\phi_{PS}^{(i)}\} + [\bar{\phi}_T^{(i)}] [\bar{M}_T] \{\bar{\phi}_T^{(i)}\} \quad (6)$$

is the modal mass and δ_{ij} is the Kronecker delta with properties

$$\delta_{ij} \begin{cases} = 1 & \text{for } i = j \\ = 0 & \text{for } i \neq j \end{cases}$$

Substitution of Eq. (2) into Eq. (1), premultiplication by

$[\phi_{PS}^{(i)} \ ; \ \bar{\phi}_T^{(i)}]$ and application of Eqs. (3), (4) and (6) yields the scalar equations

$$M_i (\ddot{q}_i + 2 \zeta_i \omega_i \dot{q}_i + \omega_i^2 q_i) = Q_i \quad (7)$$

where the generalized forces, Q_i , are given by

$$Q_i = [\phi_{PS}^{(i)}] \{P_{PS}\} + [\bar{\phi}_T^{(i)}] \{\bar{P}_T\} \quad (8)$$

The unknown damping matrix is assumed to yield uncoupled modal damping ratios, ζ_i (for which values are either assumed or are measured in test), where

$$2 \zeta_i M_i \omega_i \delta_{ij} = [\phi_{ps}^{(i)}] [C_{ps}] \{\phi_{ps}^{(j)}\} + [\bar{\phi}_T^{(i)}] [\bar{C}_T] \{\bar{\phi}^{(j)}\} \quad (9)$$

and use has been made of the relationship

$$M_i \omega_i^2 = [\phi_{ps}^{(i)}] [K_{ps}] \{\phi_{ps}^{(i)}\} + [\bar{\phi}_T^{(i)}] [\bar{K}_T] \{\bar{\phi}_T^{(i)}\} \quad (10)$$

3.2 ACOUSTIC RESPONSE TO UNIFORMLY CORRELATED PRESSURES

If the forcing function is a stationary, random, acoustic pressure and the system damping is very small, the mean square response, $(\bar{\delta}_m)^2$, in the m^{th} degree-of-freedom, δ_m , may be approximated as (References 7, 8)

$$\bar{\delta}_m^2 \approx \frac{\pi}{4} \sum_i \frac{(\delta_m^{(i)})^2}{M_i^2 \omega_i^3 \zeta_i} S_{ii} \quad (11)$$

S_{ii} is related to the pressure power spectral density, $[S_p(\omega_i)]$ through the relationship

$$S_{ii} = [A \bar{\phi}_T^{(i)}] [S_p(\omega_i)] [A \bar{\phi}_T^{(i)}] \quad (12)$$

where $[S_p(\omega_i)]$ (measured in $\text{psi}^2/\text{radian}$) may vary spatially over the structure,

and $[A \bar{\phi}_T^{(i)}]$ are the modal degrees-of-freedom multiplied by suitable terms which account for the local normal surface area over which the pressure excitation acts.

If the pressure distribution is assumed to be "uniformly correlated" (i.e., the time averaged mean square random pressure does not vary spatially over the structure) then $[S_p(\omega_i)]$ is a matrix with equal elements $S(\omega_i)$ and Eq. (12) simplifies to

$$S_{ii} = S(\omega_i) \left(\sum_j A_{z_j} \bar{\phi}_{T,z_j}^{(i)} \right)^2 \quad (13)$$

where $\bar{\phi}_{T,z_j}^{(i)}$ are the tile degrees-of-freedom, in the i^{th} mode, which are normal to the pressure loading and A_{z_j} are the corresponding areas over which the pressure loading acts.

A similar approximation for the stress component of a given tile at the j^{th} node, under uniformly correlated random pressure loading, yields

$$\bar{\sigma}_j^2 \approx \frac{\pi}{4} \sum_i \frac{\sigma_j^{(i)^2}}{M_i^2 \omega_i^3 \zeta_i} S(\omega_i) \left(\sum_j A_{z_j} \bar{\phi}_{T,z_j}^{(i)} \right)^2 \quad (14)$$

for the mean square tile stress. It should be noted that the coefficient for Eqs. (11) and (14) changes from $\pi/4$ to $1/8$ if S is given in psi^2/Hz , i.e.,

$$\frac{\pi}{4} S(\omega_i) = \frac{1}{8} S(f_i)$$

where f_i is the i^{th} modal natural frequency in Hz.

Section 4

NUMERICAL RESULTS

Finite element results were obtained for an 18x54-inch stringer-stiffened panel, with and without RSI tiles. Three different structural models were employed to idealize the panel without tiles. Based on modal results from RESIST, the most appropriate of these was then used to model the panel with tiles. Modal and acoustic response results were then obtained for an assumed loading spectrum associated with an aft section of the Shuttle orbiter fuselage at launch.

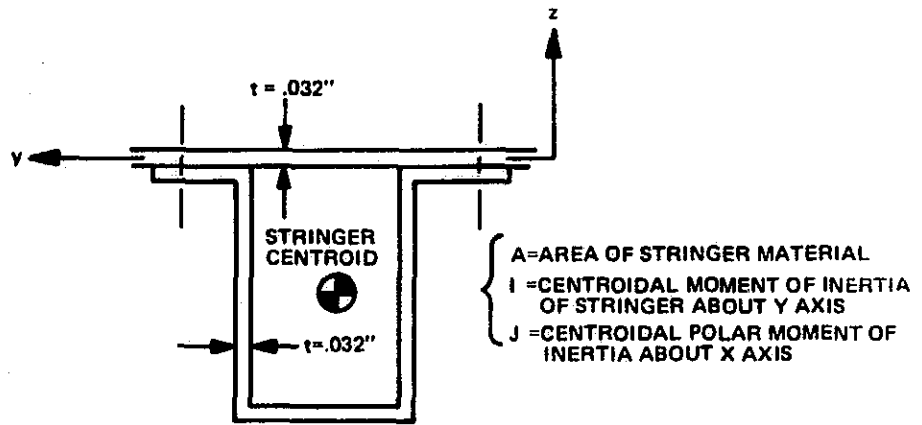
4.1 UNTILED PANELS

The three stiffened-panel options included in the new version of RESIST (Section 2.2.2) were used to analyze the Shuttle test panel of Figure 2-2. A comparison of the detailed stringer idealizations, with the actual cross section, is shown in Figure 4-1.

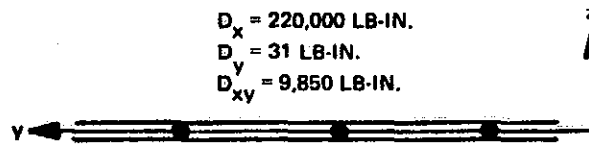
Partial frequency and mode shape results for the three models are presented in Table 4-1 and Figures 4-2 and 4-3. These results indicate that the structural stringer model selected is not critical for the "beam" type modes ($m=0$), but that the cross-stringer modes ($m \geq 1$) are sensitive to the stringer idealization, with the orthotropic (Figure 4-1b) and closed-cell stringer (Figure 4-1d) options agreeing more closely with one another, than the single attachment line stringers (Figure 4-1c). This is not surprising as the $m > 0$ modes require the transmission of torsional load through differential shear, which the singly-attached stringer cannot model properly, whereas the $m=0$ modes primarily involve stringer bending effects.

4.2 TILED PANEL RESULTS

The RSI-tiled panel of Figure 4-4 was analyzed by the RESIST program using the stringer idealization of Figure 4-1d. There are 18 6x6-inch tiles between supports, each of which is 2.6 inches thick. There is a 0.01-inch thick coating over the top of each tile and the isolator thickness is 0.16 inch. Nine-inch extensions, over opposite edges of the supports, were assumed to act as rigid bodies with rotatory inertia properties comparable to the interior

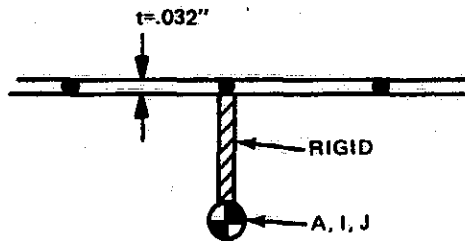


a. ACTUAL PANEL STRINGER TO BE MODELED

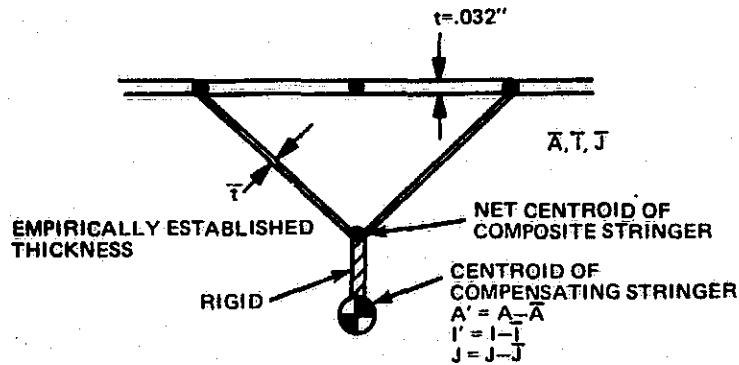


b. ORTHOTROPIC PLATE OPTION

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c. SINGLY ATTACHED STRINGER IDEALIZATION



d. DOUBLY ATTACHED STRINGER IDEALIZATION

Figure 4-1 Panel Stringer Idealizations Used for the Shuttle Panel (Fig. 2-2) with the RESIST Program

Table 4-1 Natural Frequencies (Hz) for the Shuttle Panel (Figure 2-2) Computed by RESIST for Three Different Stringer Options

m*	n**	Stringer Attached to Plate Along Single Rivet Line	Closed-Cell Stringers Attached Along Double Rivet Lines $\bar{\epsilon} = .008$ in.	Orthotropic Plate Option D_x = 220,000 lb-in. D_y = 31 lb-in. D_{xy} = 9850 lb-in.
0	1	106	110	107
1	1	108	133	134
2	1	126	174	184
0	2	286	285	271

*m = number of nodes in cross-stringer direction

**n = number of 1/2 sine waves between spanwise supports

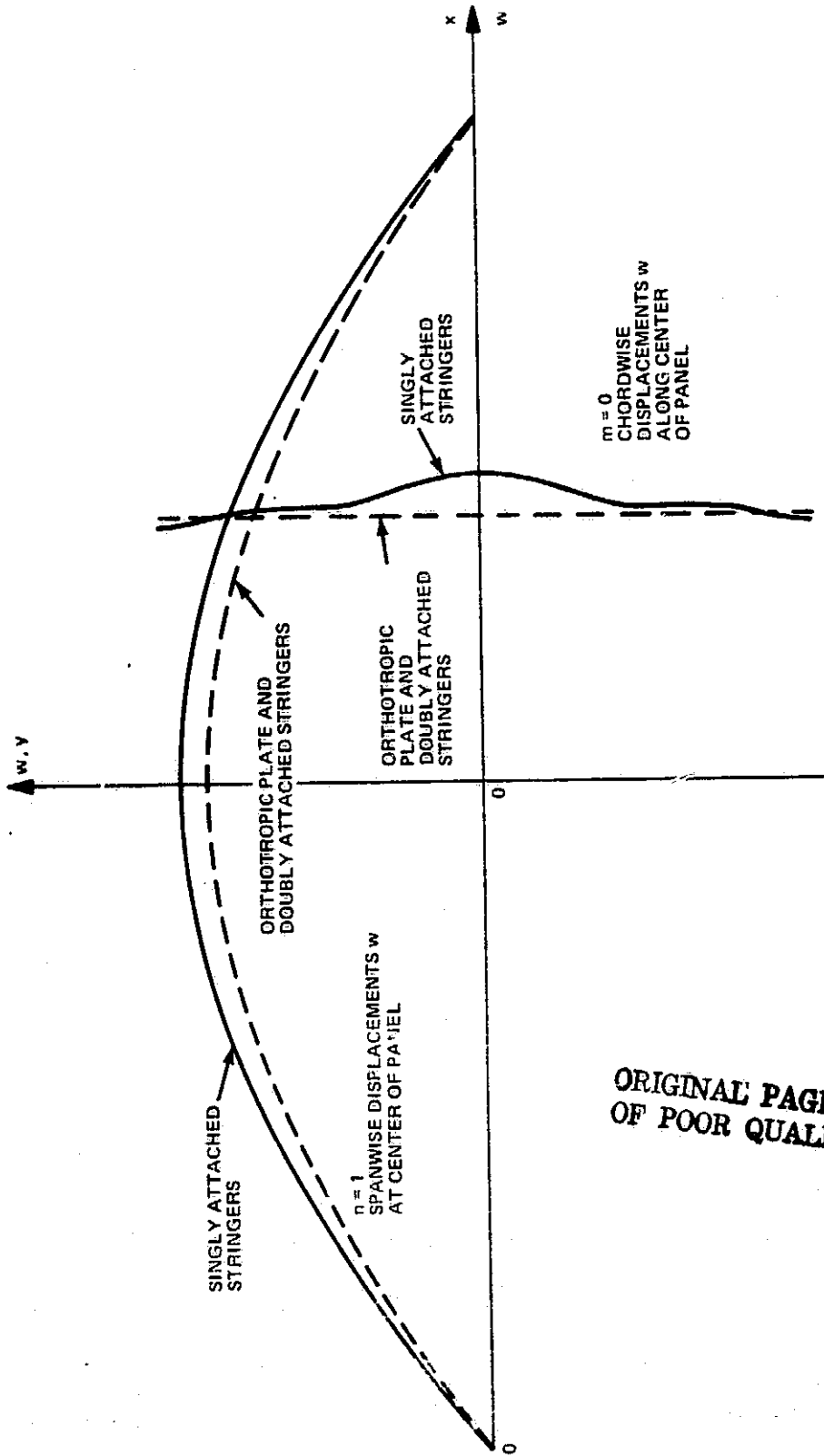


Figure 4-2 Computed Fundamental "Beam" Modes for Shuttle Panel by Three Different Resist Stringer Idealization Options

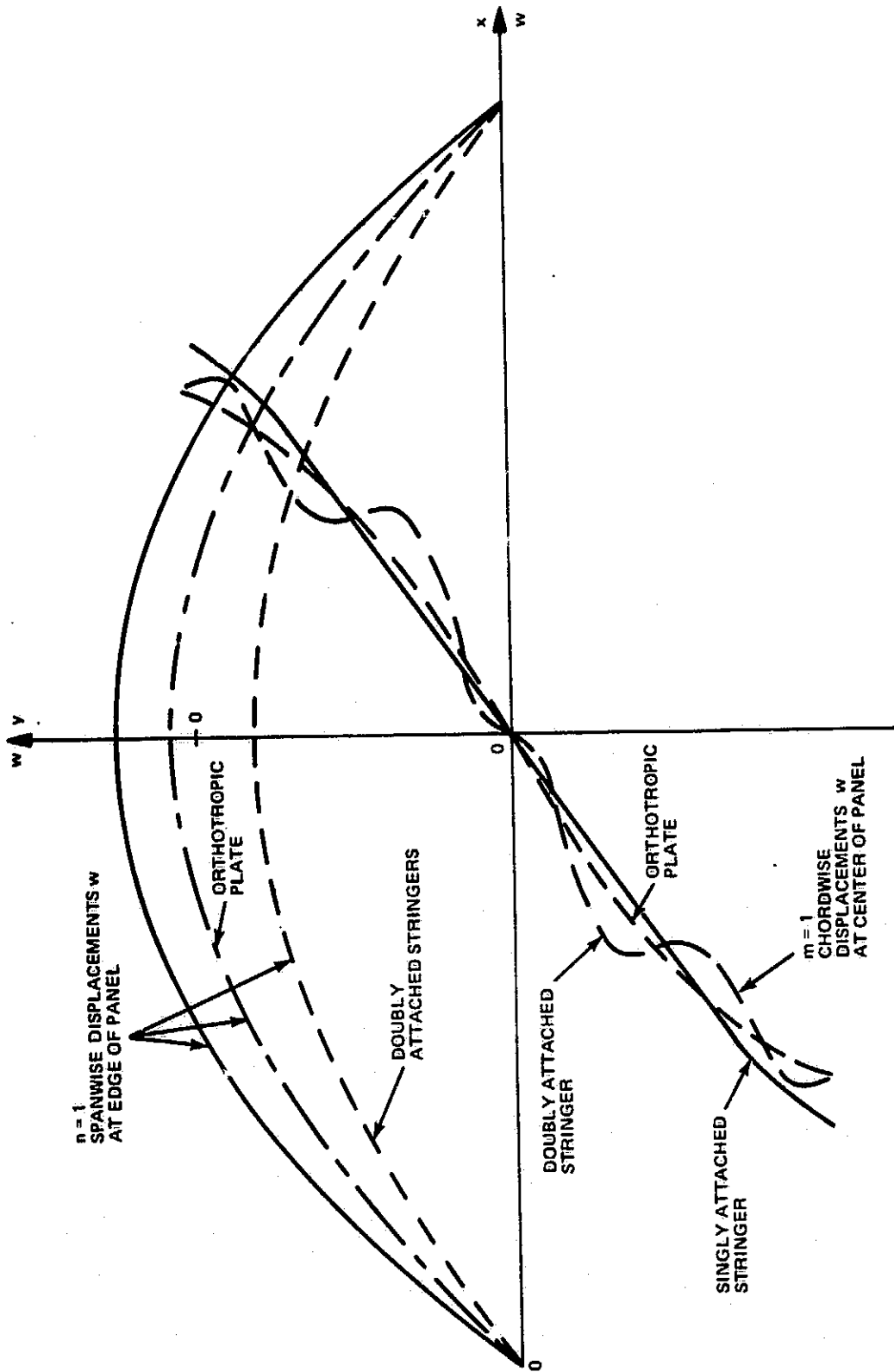


Figure 4-3 Computed First Chordwise Mode for Shuttle Panel by Three Different Stringer Idealization Options

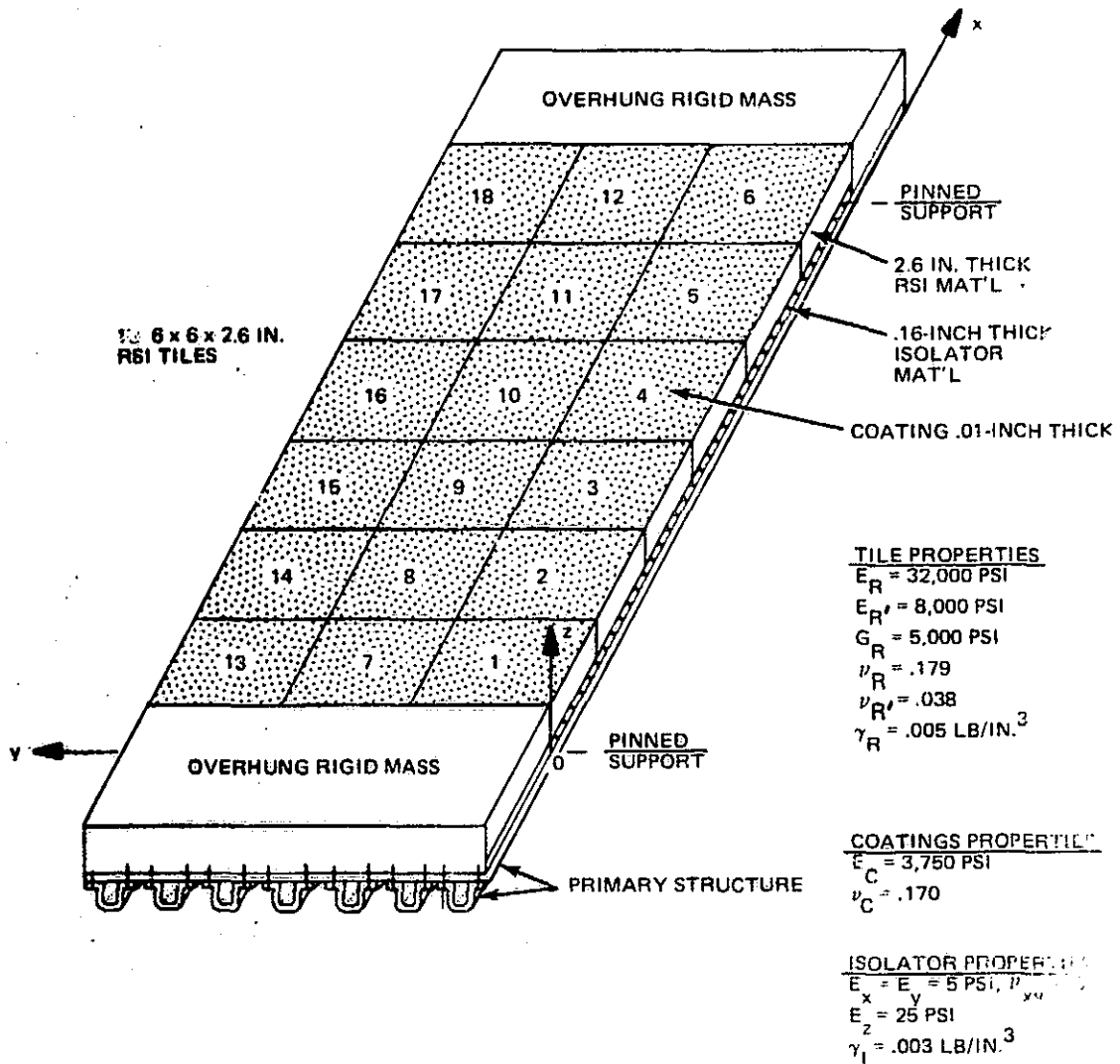


Figure 4-4 Idealized Shuttle Panel (36 x 18 Inches) with 18 RSI Tiles

(36-inch) section of tiled panel. The finite element idealization of a typical tile is shown in Figure 4-5. The resulting natural frequencies and modal data are given in Table 4-2.

The random sound pressure level curve used to simulate the panel's excitation (Figure 4-6) is thought to be representative of a structural region on the Shuttle orbiter base at liftoff. Detailed results are given for 3% modal damping. However, some results for 1% of critical damping are also presented in Table 4-3 because of the critical nature of the Shuttle TPS and the uncertainty associated with the damping parameter.

Since the ARREST program assumes uniform spatially-correlated random pressure, and the structure contains two planes of symmetry, only certain modes will contribute to the acoustic response. The contributing modes correspond to those for which the number of spanwise half-waves (n) is odd, and the number of chordwise-nodes (m) is either 0 or even. This effect is reflected by the modal terms $\left(\sum_j A_{z_j} \cdot \phi_{z_j}^{(1)} \right)^2$ of Table 4-2 (see Eq. (11) and (14) of Section 3). As may be seen, this term decays rapidly beyond the fundamental, even for the symmetric modes. Thus, for most practical purposes, only the first couple of modes need be considered.

Normal-to-the-plate RMS acceleration and stress levels for this excitation are presented in Figures 4-7 and 4-8. As determined by an automatic search procedure of the results, which is incorporated within ARREST, the σ_{zz} tile stresses are highest. In addition, the lowest RSI Material allowables are also lowest for these stress components. Hence, only the σ_{zz} stresses are plotted in Figures 4-9 through 4-13. Smooth curves are not used for the tile RMS stress-plots as the plan-form idealization is composed of a finite element grid that is comparatively coarse (4x5), but adequate, for the present purposes. The RSI stresses are plotted for $Z = .485$ in. since these are the specific points within the highest stressed elements for which the stress components were actually calculated. As shown in Table 4-3, the peak stress levels become critical for a scatter-factor* of 3. This is especially true when the modal damping decreases to 1%.

*A scatter factor of 3, applied to the RMS value, simply means that the probability that a given stress component will be below this value at any instant is approximately 99.5%.

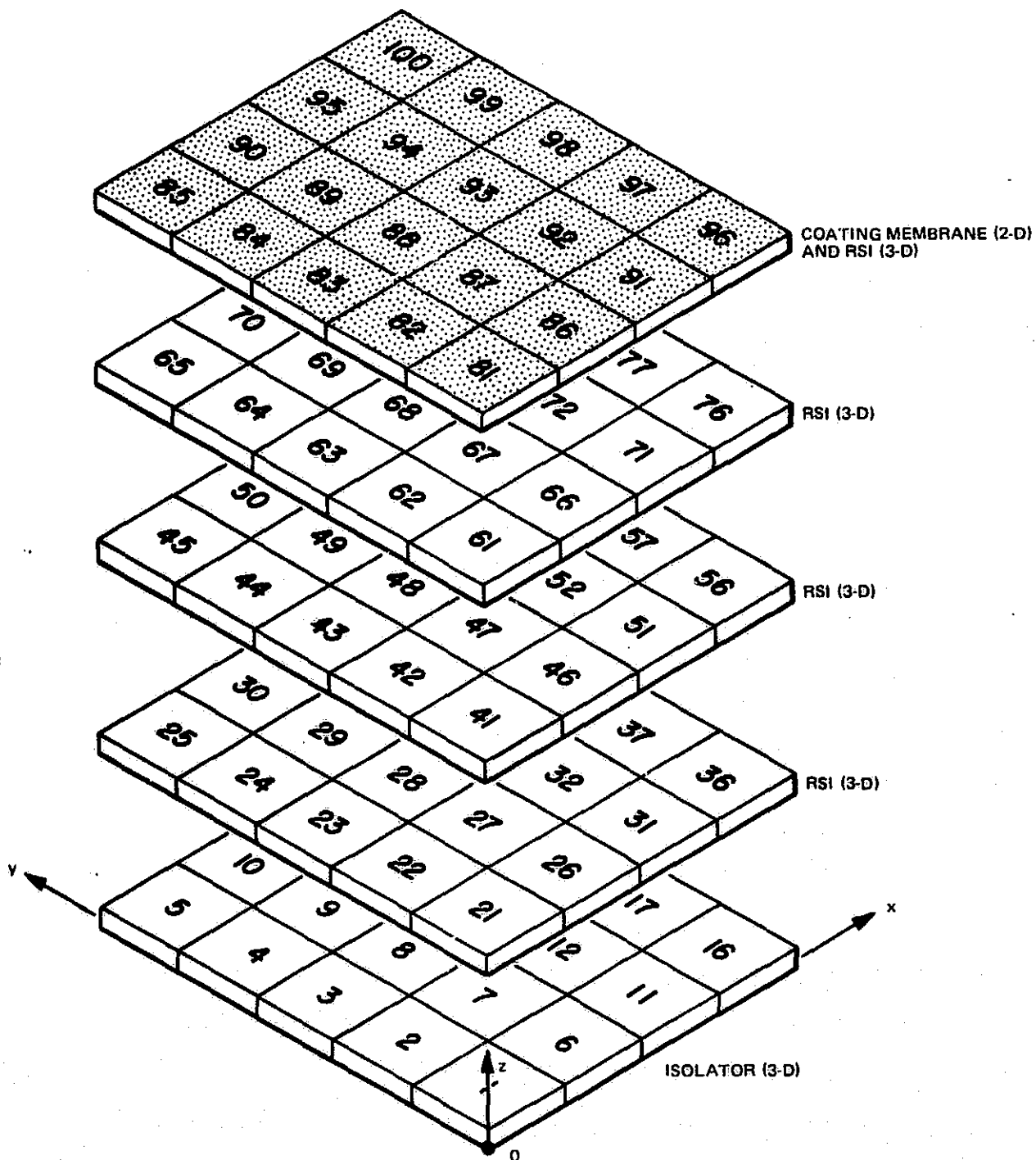


Figure 4-5 Finite Element Idealization of Typical RSI Tiles

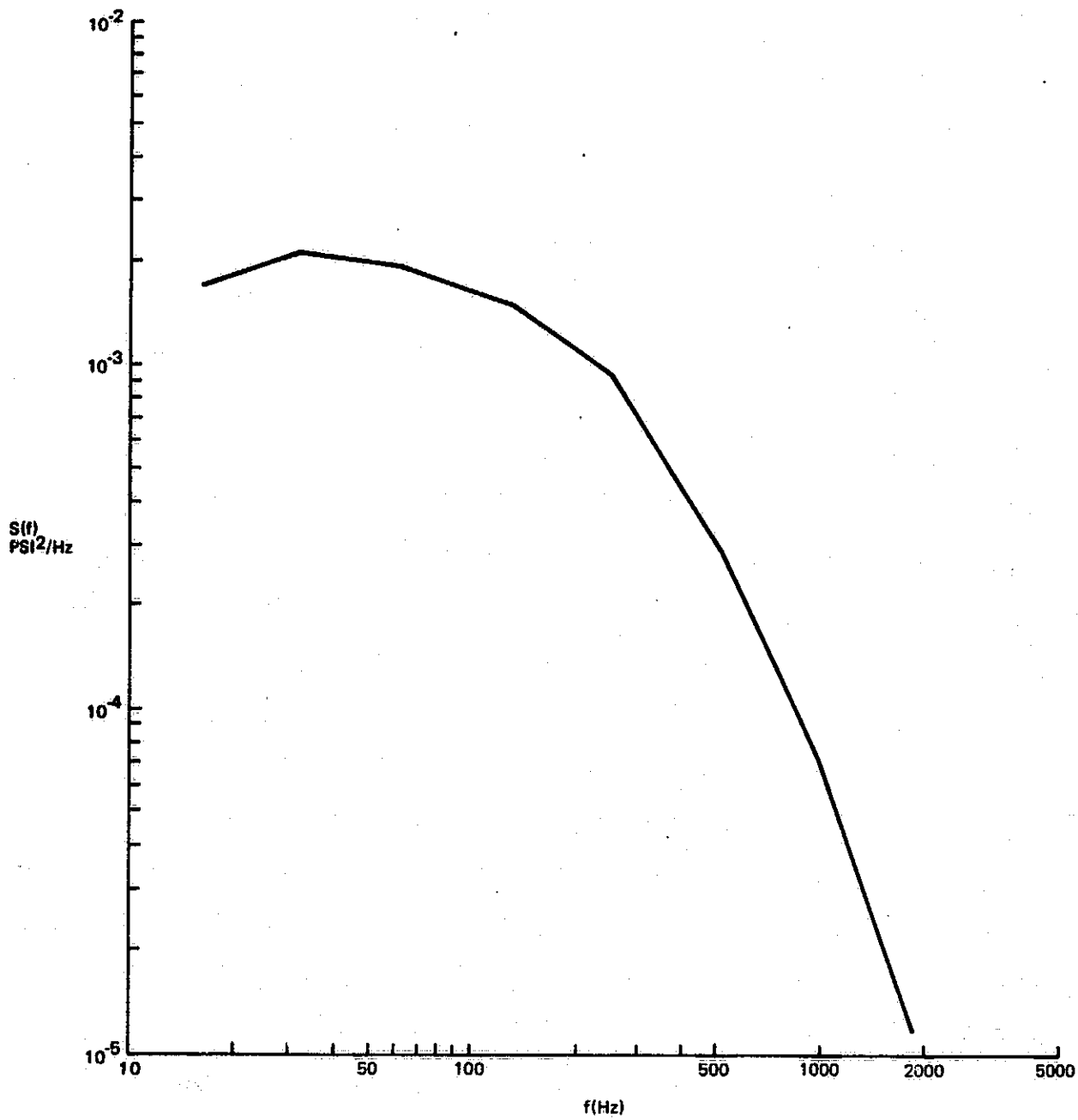


Figure 4-6 Assumed Sound Pressure Level Near Base of Orbiter at Shuttle Liftoff

Table 4-2
Computed Modal Data for the Shuttle Panel
with 2.6-Inch RSI Tiles (Figure 4-4)

Mode Number <i>i</i>	MODE <i>m*</i>	SHAPE <i>n**</i>	Frequency Hz	$(\sum_j A_{z_j} \phi_{Tz_j})^2$ (Reference Eqs. 13 and 14, Section 3)	Sound Pressure Level $S(f_i)$ (psi ² /Hz)
1	0	1	72	627.5	1.8×10^{-3}
2	1	1	81	0	—
3	2	1	92	1.186	1.68×10^{-3}
4	3	1	102	0	—

**m* = number of nodes in cross-stringer direction
***n* = number of ½ waves between spanwise supports

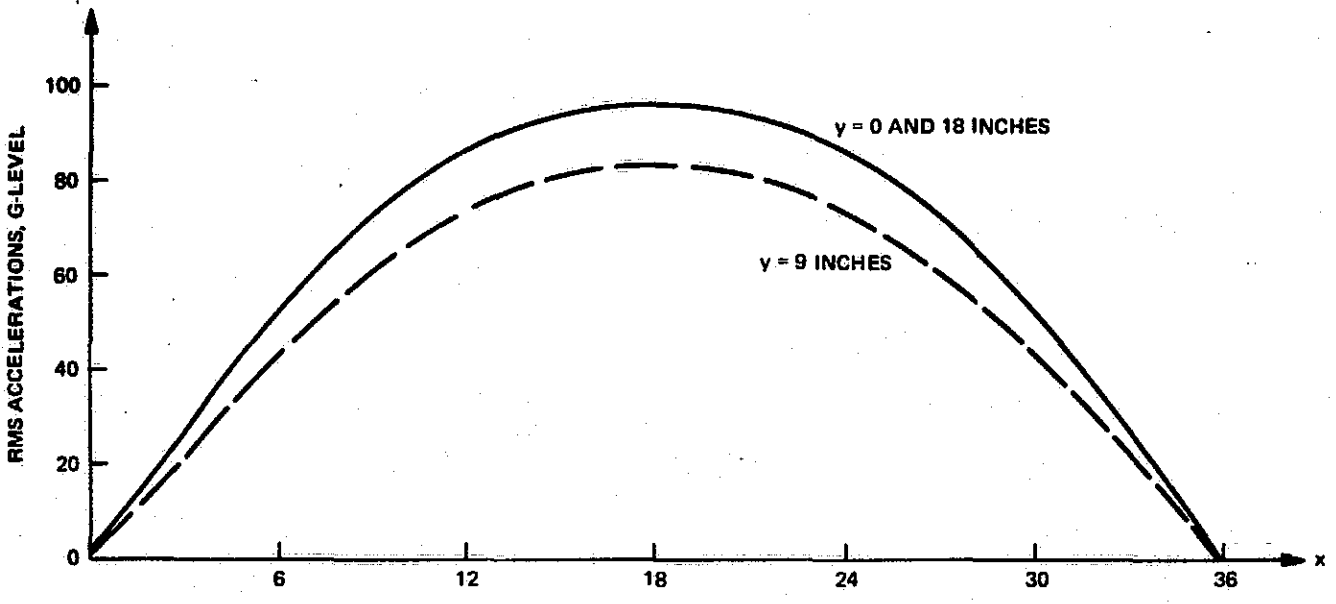
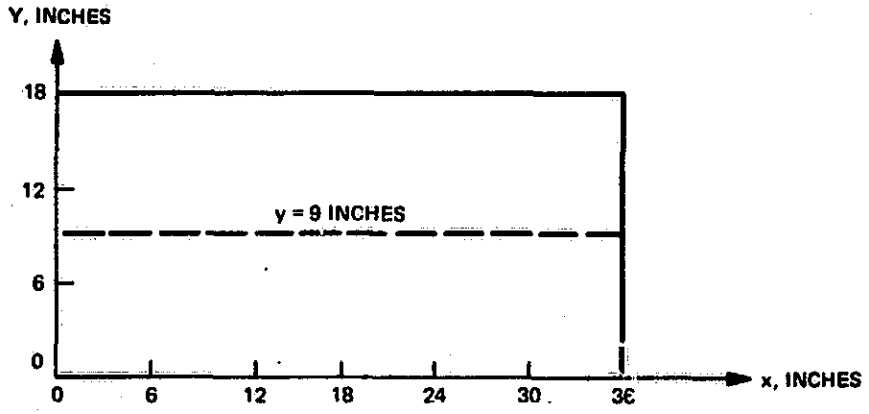


Figure 4-7 Acoustic Response of RSI-Tiled Panel, RMS Accelerations Normal to Plate

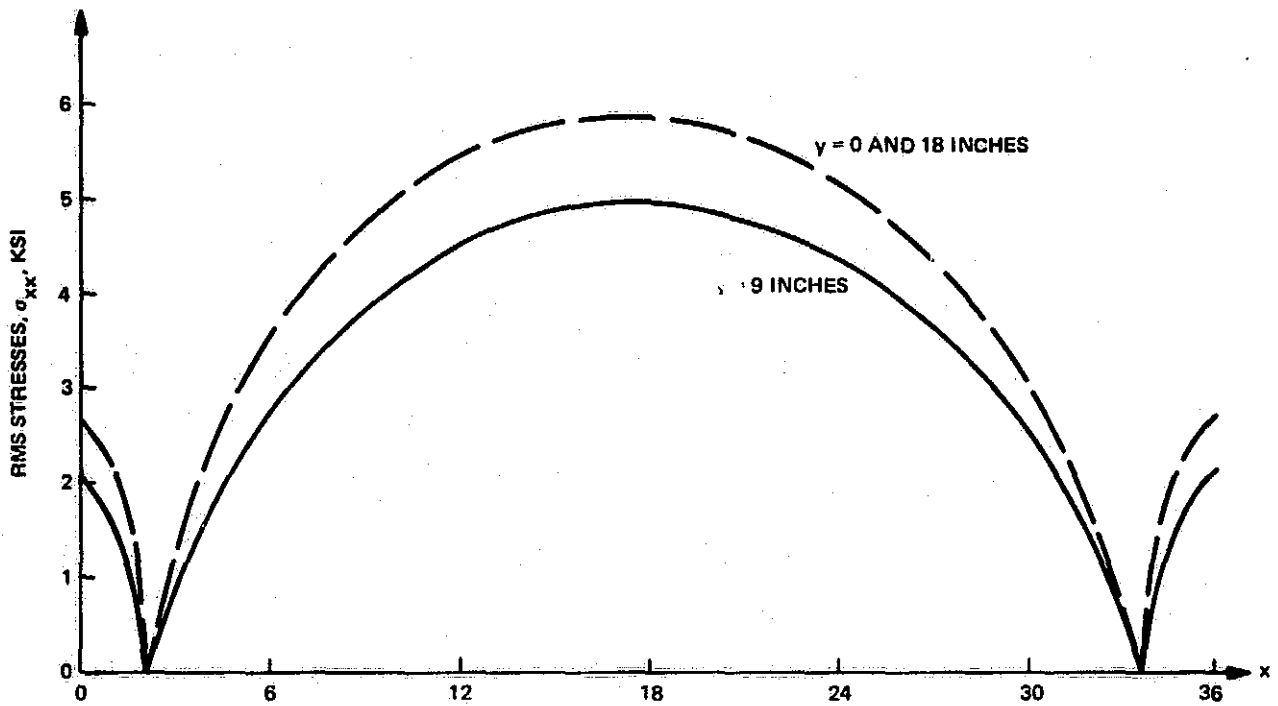
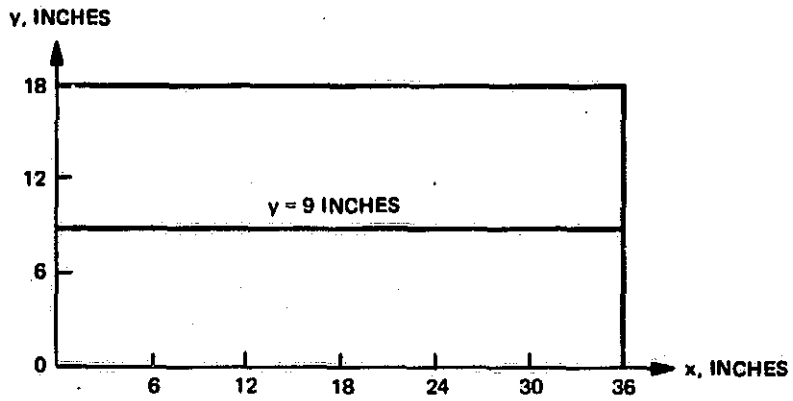


Figure 4-8 Acoustic Response of Tiled Shuttle Panel, Plate Stresses (σ_{xx}) at the Plate-Isolator Interface

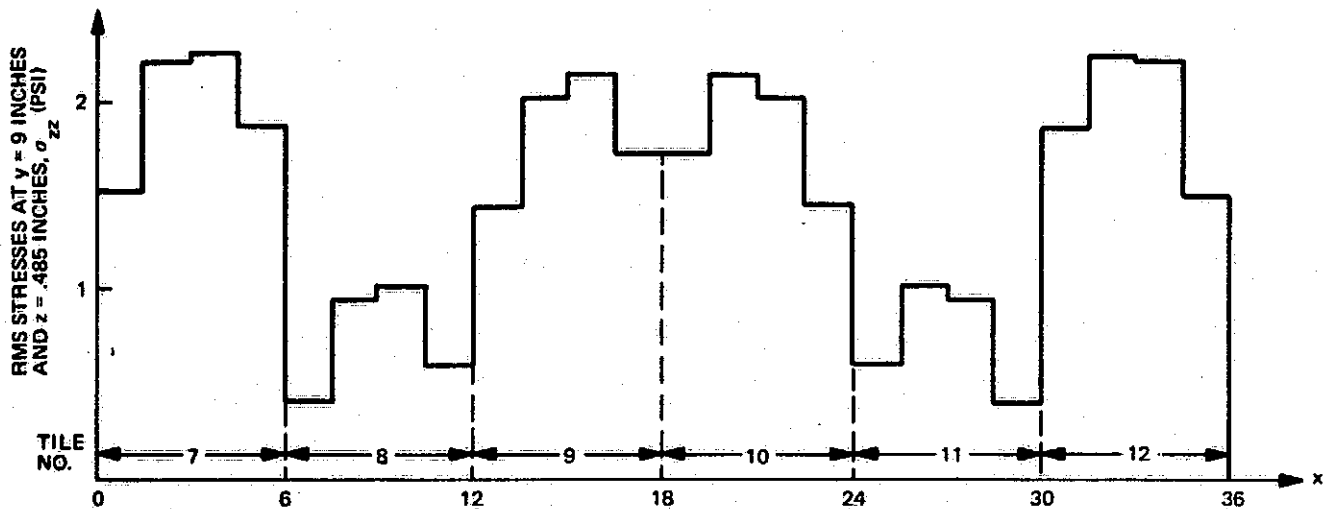
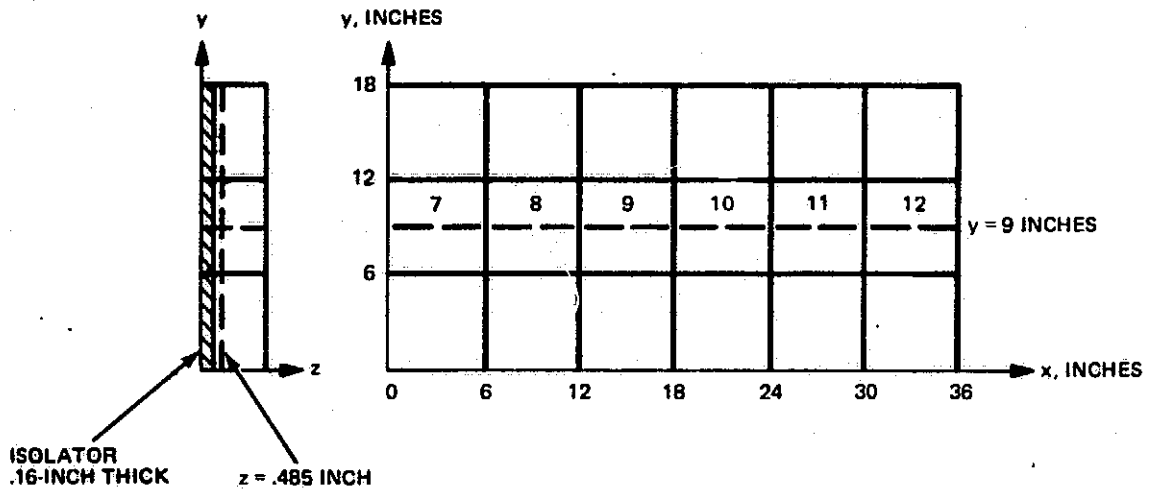


Figure 4-9 Critical Acoustic Stresses Along Center Tiles (7-12), 3% Modal Damping

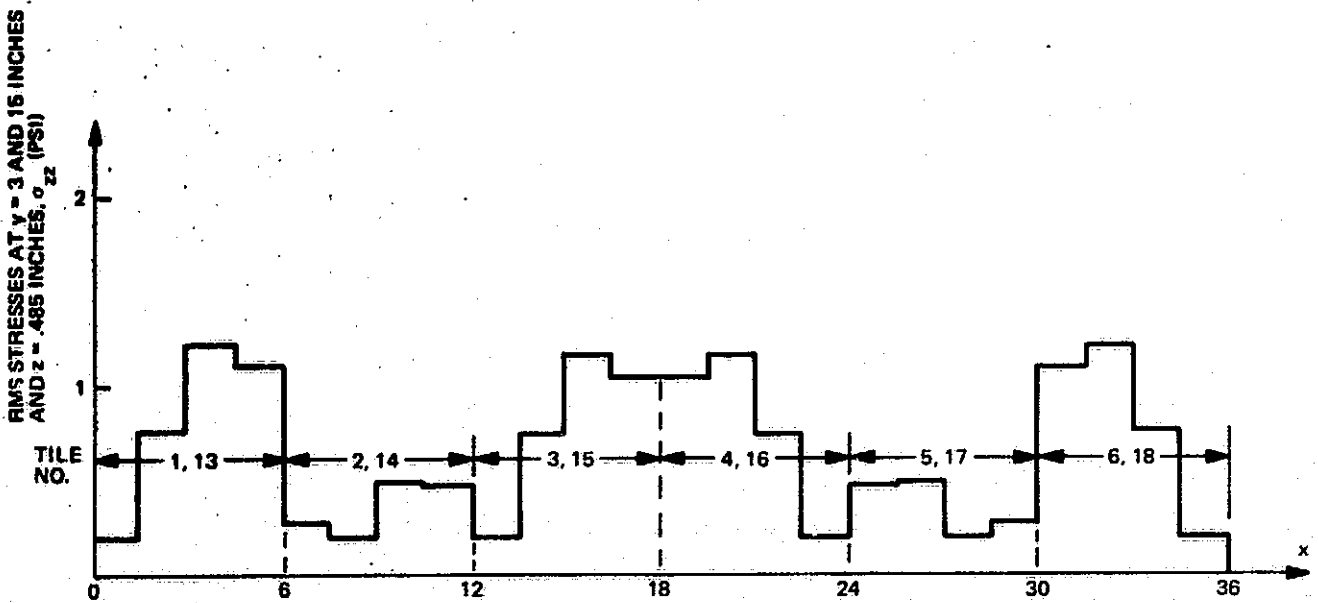
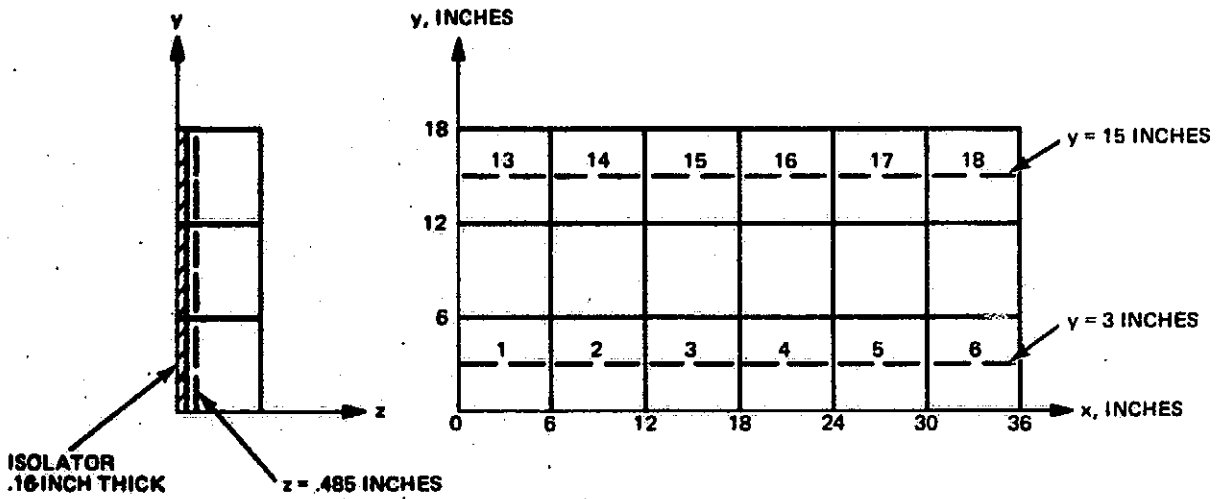


Figure 4-10 Critical Acoustic Stresses Along Outer Tiles, 3% Modal Damping

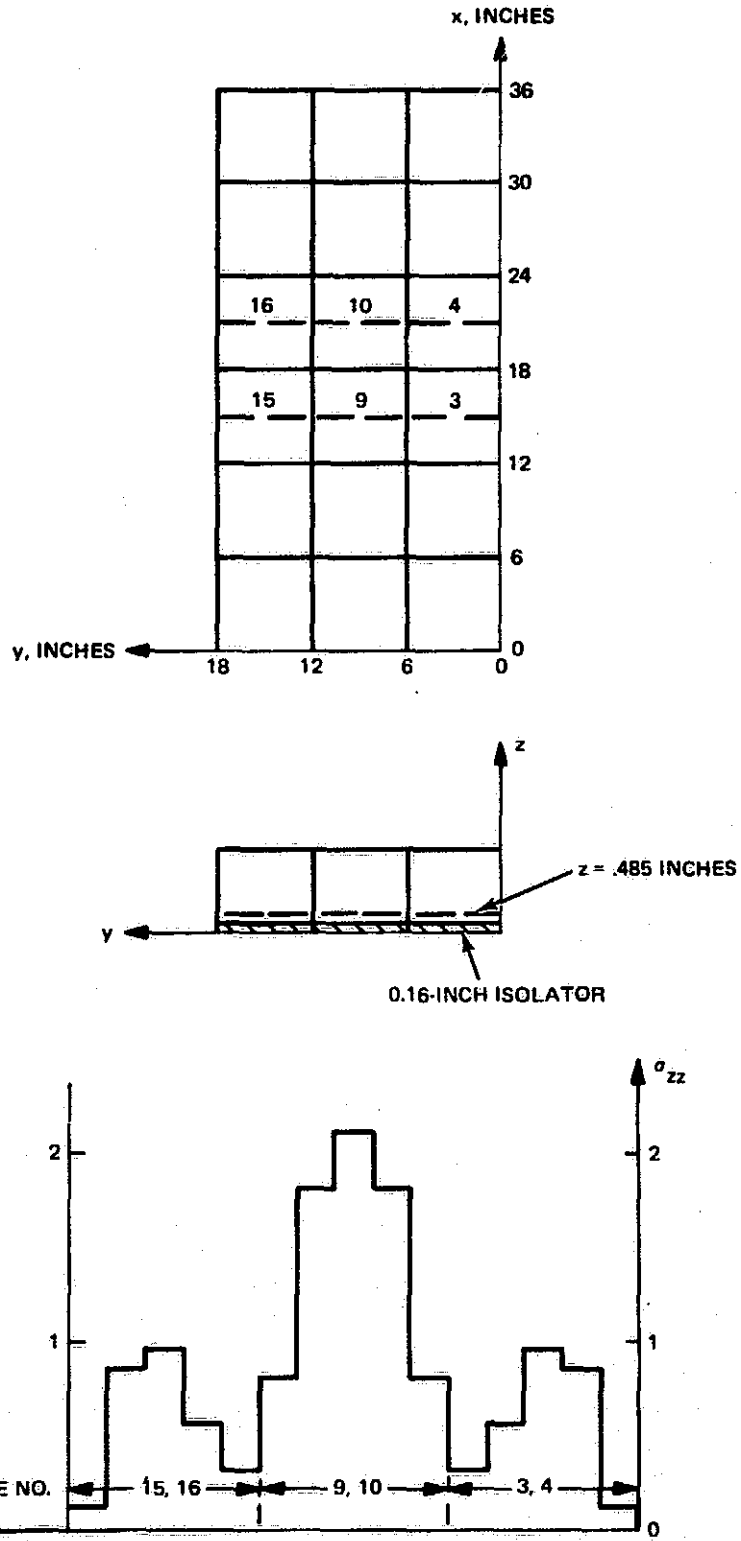


Figure 4-11 Critical Acoustic Stresses Across Center Tiles, 3% Modal Damping

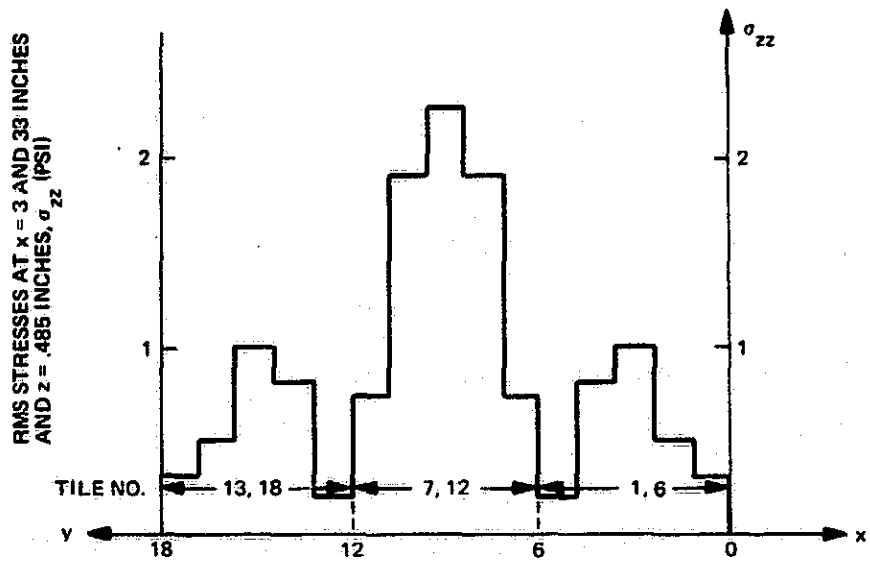
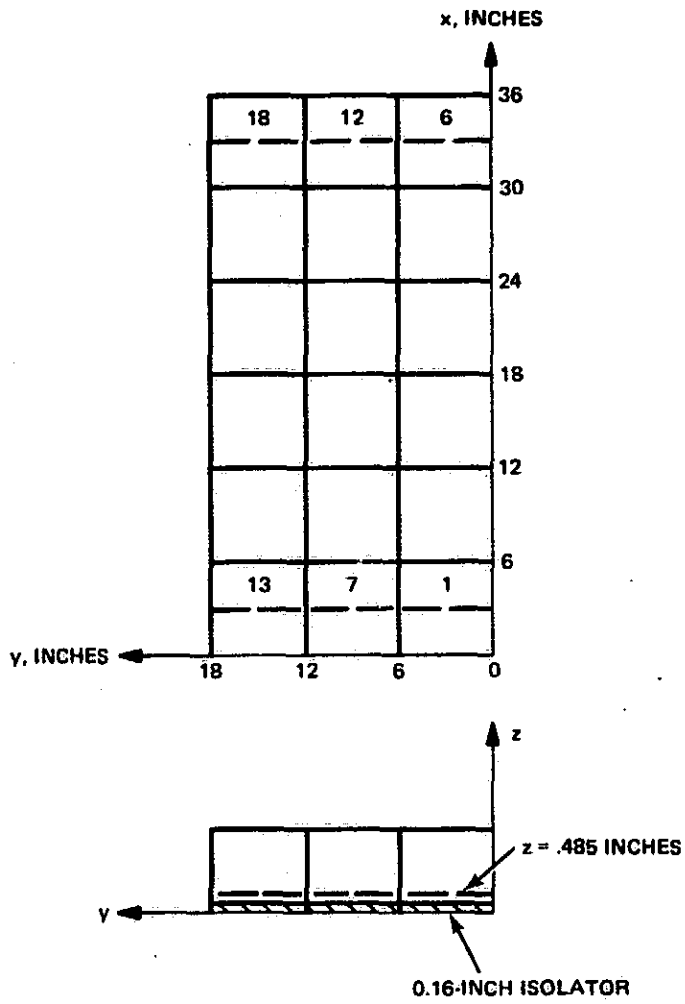


Figure 4-12 Critical Acoustic Stresses Across Tiles Near Supported-Edge of Panel

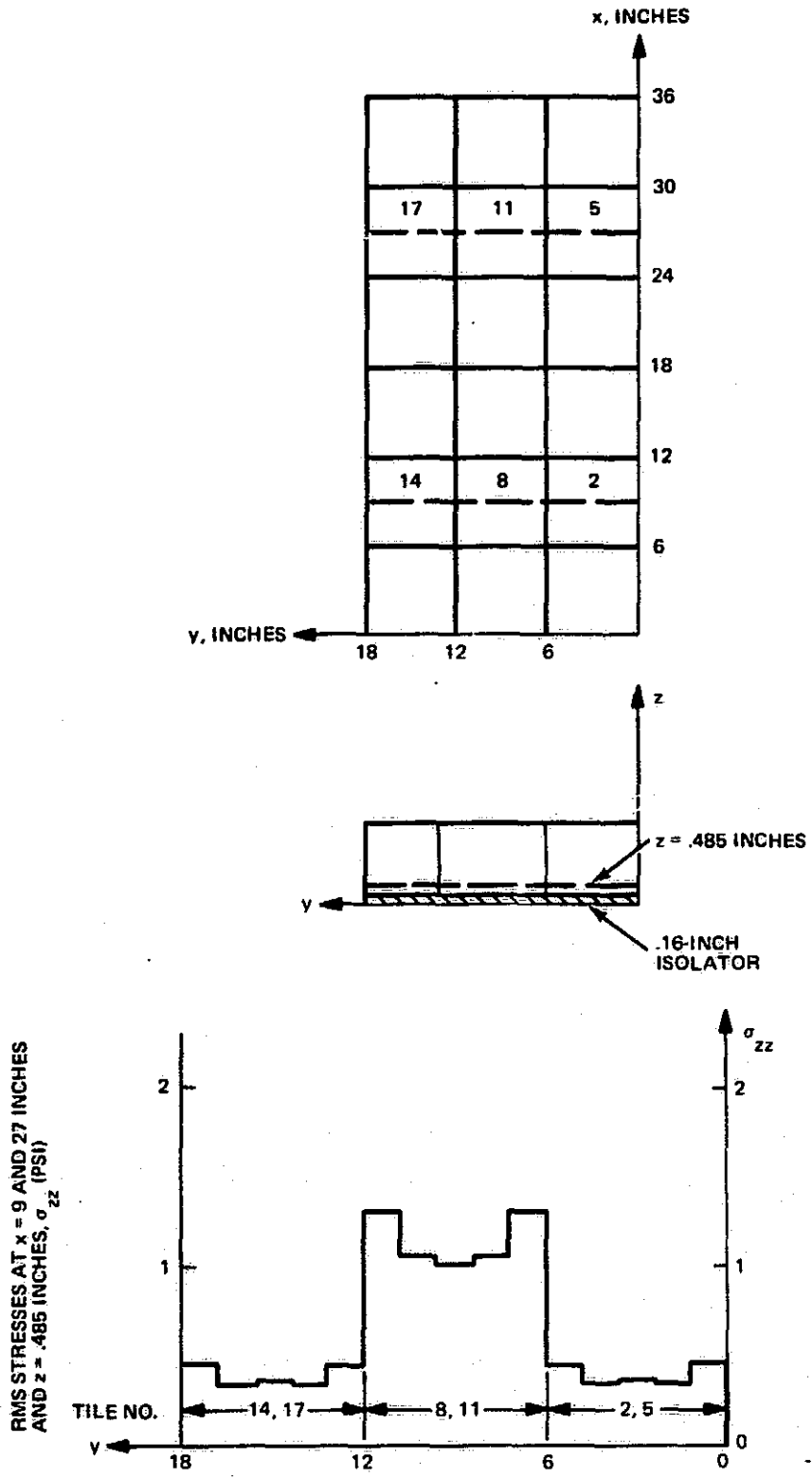


Figure 4-13 Acoustic Stresses Across Internal Tiles, 3% Modal Damping

**Table 4-3
Critical Tile Stresses for Acoustic Launch Loads**

Tile No. (See Figure 4-2)	Finite Element No. (See Figure 4-5)	σ_{zz} (psi)*			
		3% Modal Damping		1% Modal Damping	
		RMS	$3\sigma^{**}$	RMS	$3\sigma^{**}$
7	33	2.317	6.951	4.013	12.039
7	28	2.203	6.609	3.816	11.448
9	33	2.150	6.450	3.724	11.181
9	28	2.094	6.282	3.627	10.880

*The allowable σ_{zz} for the RSI at room temperature is approximately 8 psi
**The 3σ values correspond to a scatter factor of 3 (i.e., approximately 99.5% probability that the instantaneous stresses will be below this number)

Section 5

CONCLUSIONS AND RECOMMENDATIONS

A user-oriented program, RESIST, has been developed to compute the static, thermal, and normalized-modal stresses of arbitrarily heated RSI tiles affixed to typical Shuttle structural panels. The current phase of this effort reports upon improvements to the modal portion of RESIST and the development of a new program, ARREST. ARREST, which computes the response of the tiles and panels to uniformly-correlated random acoustic pressures, was designed to efficiently interface with the RESIST program.

The present version of the RESIST program has been streamlined and runs about four times as fast as its predecessor. In addition, it has been extended to accommodate orthotropic plates or isotropic plates with uniformly spaced, arbitrarily shaped stringers which are either singly or doubly attached to the plate. It is believed that the orthotropic and doubly attached stringer options better represent the stringer twist-stiffening, which is required to accurately predict the plate cross-stringer modes ($m > 0$).

Results from the ARREST computer program for a simulated Shuttle launch environment indicate potentially critical normal thickness stresses in the RSI. The other RSI stress components are generally lower and possess strength allowables which are 3 or 4 times as high as well.

Section 6
NOMENCLATURE

$[A]$	Symmetric matrix
$[C]$	Damping matrix
$[D]$	Diagonal matrix with plus or minus ones on diagonal
$[K]$	Stiffness matrix
$[\bar{L}]$	Lower triangular matrix
$[M]$	Mass matrix
$[S_p]$	Pressure power spectral density matrix
$[Z_i]$	Impedance matrix associated with ω_i
$[\phi]$	Modal matrix
$\{b\}$	Right hand side of matrix equation $[A] \{x\} = \{b\}$
$\{P\}$	Forcing function vector
$\{q\}$	Generalized modal response vector
$\{V_j\}$	j^{th} eigenvalue reduction vector
$\{x\}$	Solution vector of equation $[A] \{x\} = \{b\}$
$\{y\}$	Forward solution of matrix equation $[\bar{L}] \{y\} = \{b\}$
$\{\delta_i\}$	Nodal displacements associated with i^{th} iteration
$\{\phi^{(i)}\}$	i^{th} modal vector
A	Stringer cross-sectional area
A_{ij}	Orthotropic plate stiffness properties
A_{z_j}	Area normal to z direction at j^{th} node
D	Plate bending stiffness
E	Plate modulus of elasticity

E'_x, E'_y, E''	Elastic constants associated with orthotropic plate theory (see Table 2-1)
G	Plate shear modulus
$I_{y'}, I_{z'}$	Stringer moment of inertia about local principal axes
$J_{x'}$	Stringer polar moment of inertia about principal axis
M_i	Modal mass for i^{th} mode
$M_{PS}^{(i)}$	Primary structure portion of i^{th} modal mass
Q_i	Generalized modal force
$S(\omega_i)$	Acoustic sound pressure level at i^{th} frequency
a, b, P	Stringer spacing parameters (see Figure 2-2)
a_{ij}	Element of [A] matrix
d_p	Plus or minus one
e	Stringer eccentricity
f	Frequency in Hz
h	Plate thickness
m	Number of reduction vectors
q	Number of modal vectors
\bar{t}	Thickness parameter associated with stringer idealization (see Figure 2-3)
w	Normal plate displacement
x, y, z	Cartesian plate axes
x', y', z'	Stringer principal axes
β	Angle between stringer principal axes and plate global axes
δ_{ij}	Kronecker delta
$\epsilon_x, \epsilon_y, \gamma_{xy}$	Plate membrane strains
ζ_i	Critical damping ratio associated with i^{th} mode

$\sigma_x, \sigma_y, \zeta_{xy}$ Plate stress components
 σ_{zz} RSI direct stress component in thickness direction
 $\bar{\phi}^{(i)}$ Normal (z) deflection of j^{th} tile node associated with i^{th}
 T, z_j mode shape
 ω_i Natural frequency of i^{th} mode in radians per second
 l Stringer pitch parameter (see Figure 2-4)
 \bar{L}_{ij} Element of $[\bar{L}]$ matrix

Section 7
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7. Dowell, E. H. and Vaicaitis, R., "A Primer for Structural Response to Random Pressure Fluctuations," Princeton U. AMS Report No. 1220, April 1975.
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APPENDIX A
USER'S MANUAL FOR
RE*S*I*ST
(STATIC AND DYNAMIC REUSABLE SURFACE INSULATION STRESS PROGRAM)

AUGUST 1975 VERSION

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A. INTRODUCTION

This Appendix describes the use of a finite element based structural computer program for determining the static response and natural vibrations of TPS protected shuttle panels. The program is titled "RESIST" for static and dynamic REusable Surface Insulation Stresses. The logic flow for RESIST is presented in Figure A-1.

The basis for the method is that the TPS is nonstructural but its stress levels, which are critical, must be computed. Thus, it becomes possible to neglect the stiffness of the TPS initially, but not its mass in the vibration, to determine approximate primary structure deflections.

An iterative procedure is then performed where, for each step, the primary structure deflections are imposed individually upon each tile at the tile/primary-structure interface, and the tile deflections and interface boundary loads are obtained. For the vibration option, the frequency is updated by computing a Rayleigh quotient, using the latest non-rigid tile displacements in addition to the corresponding primary structure displacements. The individual tile boundary loads obtained are then assembled and their reactions are applied to the primary structure. New primary-structure deflections are obtained and compared to the previous set. This process is repeated until convergence is obtained.

B. PROGRAM LIMITATIONS

The usual assumptions for programs based upon the linear elastic finite element method are applicable to RESIST. However, to facilitate the preparation of program input, a number of simplifications regarding the configuration and loadings have been made. Thus, the generation of a voluminous quantity of finite element input data has been greatly reduced by inclusion of a series of data preprocessing subroutines within RESIST. The restrictions upon which these subroutines are based follows:

1. Boundary conditions and edge loadings are assumed uniform along the four rectangular plate edges defined by $x = 0$, L_x and $y = 0$, L_y .
2. The primary structure plate temperature and properties are all uniform.

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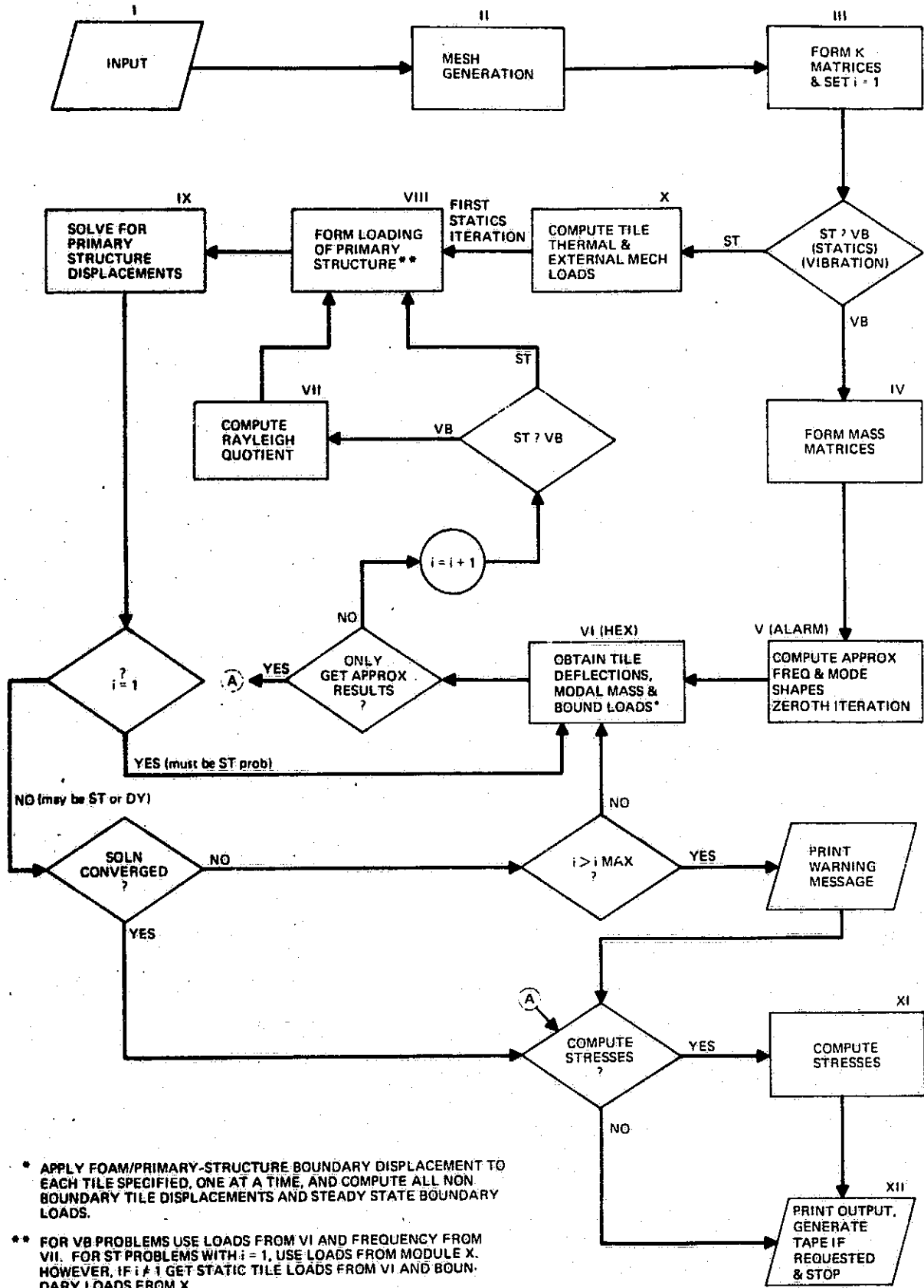


Figure A-1 Flow Chart for RSI Stress Analysis Program "RESIST"

3. The stringers are equally spaced with temperatures and properties which are all uniform.
4. All tiles are geometrically identical as are their temperature distributions and uniform pressure loadings.
5. The boundary conditions must be selected such that the primary structure is statically stable.

The remaining limitations are primarily concerned with the program's capacity and should be adhered to by the user. These limitations are as follows:

6. Maximum number of nodes in a tile = 850.
7. Maximum number of finite elements running in any one direction in a tile = 20.
8. Maximum number of nodes in primary structure = 3000.
9. Maximum number of primary structure nodes along x or y direction = 1,000.
10. Maximum number of degrees of freedom in primary structure = 15,000.
11. Maximum number of natural mode shapes = 50.
12. Maximum number of stringers = 15.

A violation of restrictions 6-12, inclusive, will cause the program to stop and an appropriate warning message to appear.

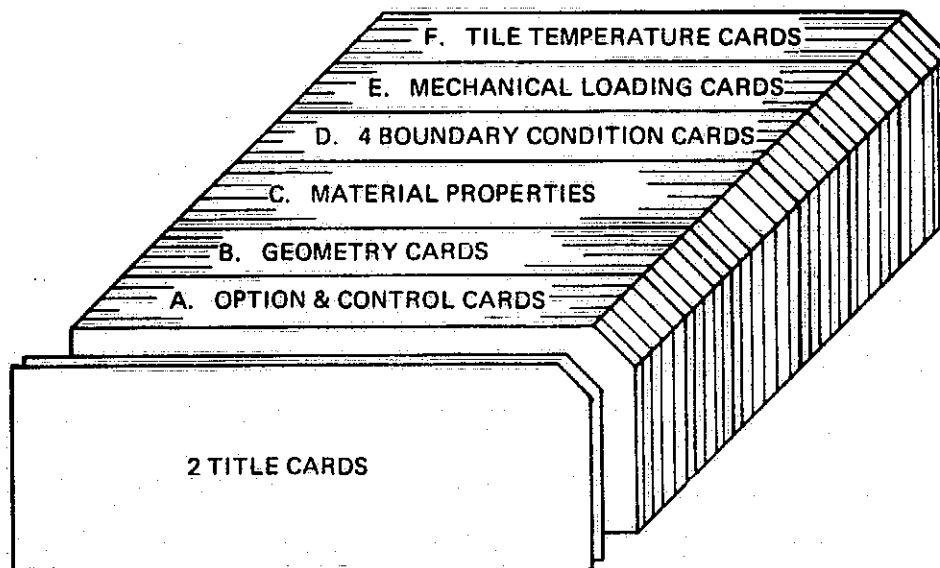
To insure symmetry of solutions for panels which are symmetric with regard to stringer locations about $y = L_y/2$, care should be taken with the input data to see that the plate nodes associated with the stringers are symmetric about $y = L_y/2$.

C. INPUT INSTRUCTIONS

A description of the card input for the IBM 370 and CDC 6600 versions of this program is presented in this section.

In addition to the first two input cards which contain literal data, such as special program title and date, in columns 1 through 80, inclusive; there are six groups of input cards containing the following information:

- Group A - Instructions regarding the type of problem being performed, number of iterations desired, and type of output information.
- Group B - Details of the geometric configuration and finite element mesh of the primary structure and tiles. (Card B.4 is omitted if there are no tiles)
- Group C - Defines the primary structure and RSI temperature dependent material properties. If there is no TPS, cards C.3 through C.11 are omitted.
- Group D - Specifies the primary structure boundary conditions
- Group E - Describes the mechanical loading upon the primary structure as well as its temperature. These cards are omitted when the vibration option is used
- Group F - Defines the RSI temperature distribution. These cards are omitted if there is no TPS.



A. PROGRAM OPTIONS AND CONTROL -- Sheet 1 of 4

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
A.1	1-5	I5	-	-	1 in col. 5 denotes that a statics problem is being treated. Skip cols. 6-25 in such cases
	6-10	I5	N_D	-	2 in col. 5 denotes that a natural vibration problem is being treated. Number of desired mode shapes (50 is the maximum permitted). * Omit for statics option.
	16-20	I5	\bar{s}	-	Number of reorthogonalizations for eigenvalue algorithm. A min of 2 and a max. of 5 is suggested with 3 as an adequate compromise for most problems. The run should be repeated with greater values for \bar{s} or N_D if the frequency error bound of a desired mode is greater than 1%. Omit for statics option.
	21-25	I5	-	-	Vibration mode number for which modal stresses are desired. ** Omit for statics option.
	26-30	I5	i_{max}	-	Maximum number of iterations
	31-40	E10.0	ϵ	{ in. -1 or rad. }	Convergence parameter. Maximum primary structure deflection or rotation difference between iterations divided by magnitude of largest element.
	46-50	I5	-	-	0 in col. 50 indicates that <u>primary structure stresses</u> and strains are not required.
					1 in col. 50 indicates that only <u>midplate strains</u> and stresses of primary structure are required.
					2 in col. 50 indicates that only <u>top</u> of plate strains and stresses of primary structure are required.
					3 in col. 50 indicates that only <u>bottom</u> of plate strains and stresses of primary structure are required.
					4 in col. 50 indicates that only <u>mid and top</u> of plate strains and stresses of primary structure are required.
					5 in col. 50 indicates that only <u>mid and bottom</u> of plate strains and stresses of primary structure are required.
					6 in col. 50 indicates that only <u>top and bottom</u> of plate strains and stresses of primary structure are required.
					7 in col. 50 indicates that <u>top, bottom, and mid</u> plate strains and stresses of primary structure are required.
					Overhung rotatory mass inertia associated with each stringer. Used if plate overhang $x = 0$ and $x = L$ boundaries.
	51-60	E10.0	-	lb-in- ² sec	

*If a restart run for a different mode number (i) is contemplated, a tape should be mounted as unit 2 to preserve the mode shapes generated with the present tape.
 **If an ARREST run is to be made using information for this mode, provision should be made on control cards to mount tapes as units numbered 1 and 21 for storage and future usage.

A. PROGRAM OPTIONS AND CONTROL - Sheet 2 of 4

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
A.1 (Cont'd.)	61-65	I5	-	-	0 in Col. 65 indicates either no stringers on the plate or that the orthotropic option is being used. 1 in Col. 65 indicates that stringers are attached to plate along only a single rivet or weld line, or have an open cross section. 2 in Col. 65 indicates that stringers have a closed cross section and are attached at double rivet or weld lines. 0 in Col. 70 indicates that orthotropic plate properties are used. 1 in Col. 70 indicates that isotropic plate properties are used.
	66-70	I5	-	-	
	71-75	I5	-	-	0 or a 1 in Col. 75 indicates that $K - \omega^2 M$ is decomposed for each primary structure and tile iteration frequency (ω). A 2 in Col. 75 indicates that an iteration procedure which avoids resplitting of $K - \omega^2 M$ is used. This procedure should always be used for statics problems. In addition this approach is generally faster for a vibration problem, but may not always converge.

A. PROGRAM OPTIONS AND CONTROL - Sheet 3 of 4

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
A.2	1-5	I5	-	-	0 in col. 5 indicates that tile stresses are not required. 1 in col. 5 indicates that tile stresses are to be computed after each iteration is performed. 2 in col. 5 indicates that tile stresses are to be computed only after last iteration is performed or only after convergence is obtained.
	6-10	I5	-	-	0 in col. 10 if primary structure stresses and strains were not requested in column 50 of Card A.1. 1 in col. 10 indicates that primary structure stresses and strains are required after each iteration. 2 in col. 10 indicates that primary structure stresses and strains are required only after last iteration or, only after convergence.
	11-15	I5	-	-	0 in col. 15 indicates no tiles on the primary structure. Skip card A.4* 1 in col. 15 indicates that there are tiles on the primary structure.
	16-20	I5	-	-	1 in col. 20 indicates tile node map printout desired. 0 = no node map printout.
	21-25	I5	-	-	1 in col. 25 indicates tile element map printout desired. 0 = no element map printout.
	26-30	I5	-	-	1 in col. 30 indicates tile nodal coordinate, temp. and nodes per element printout. 0 in col. 30 indicates suppression of this printout.
	31-35	I5	-	-	1 in col. 35 indicates printout of element stiffness matrices. 0 = no element stiffness matrices.
	36-40	I5	-	-	1 in col. 40 indicates printout of assembled stiffness matrices and ALARM reorthog. info. C in col. 40 indicates suppression of this printout.
	41-45	I5	-	-	1 in col. 45 indicates printout of unit no., file no., and matrix storage info. for program debugging. 0 in col. 45 indicates suppression of this printout.

* If there are no tiles then \bar{n}_x and \bar{n}_y , together with n_{B2} and n_{D2} , are still required since they determine the primary structure finite element grid. In analyzing panels without tiles, leave out cards B.4, C.3 through C.10 and all "P" cards.

A. PROGRAM OPTIONS AND CONTROL - Sheet 4 of 4

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
A.3	1-5	I5	IRES	-	1 in Col. 5 if this is a vibration restart run which makes use of primary structure mode shape generated in a previous run.* 0 in Col. 5 if this is not a restart run or if this is a statics problem. 1 in Col. 10 saves a tape which contains a modal solution to be used in ARREST.
	6-10	I5	-	-	0 in Col. 10 does not save such a tape or if this is a statics problem. Input frequency if IRES = 1 in Col. 5. Leave blank if IRES = 0.
A.4	1-4, 5-8, 9-12, etc.	I4 I4 I4	- - -	- - -	This card is used to indicate which tile stress states are desired. User may specifically request up to 20 tile stress states (see Figure A-3 for tile numbering scheme). A zero in Col. 4 indicates that stress states for all tiles are desired.

*Be sure to indicate, on appropriate job control cards, that this run makes use of an existing tape, mounted as unit 2, which contains the requested mode shape. Provision must also be made on these control cards to have a ring inserted on this tape since it must be written upon in subsequent RESIST calculations.

B. GEOMETRIC CONFIGURATION^m - Sheet 1 of 2 (See Figure A-2)

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
B.1	1-10	E10.0	L_x	in.	Panel dimension
	11-20	E10.0	L_y	in.	Panel dimension
	21-30	E10.0	t_p	in.	Panel thickness
	41-50	E10.0	\bar{t}	in.	Stringer effective wall thickness if attached along two plate rivet rows.
	51-60	E10.0	y_2	in.	Distance from $y = 0$ edge for second attachment row of first stringer.
	61-70	E10.0	z'	in.	Distance below middle surface of plate at which stringer stress (σ_x) will be computed.

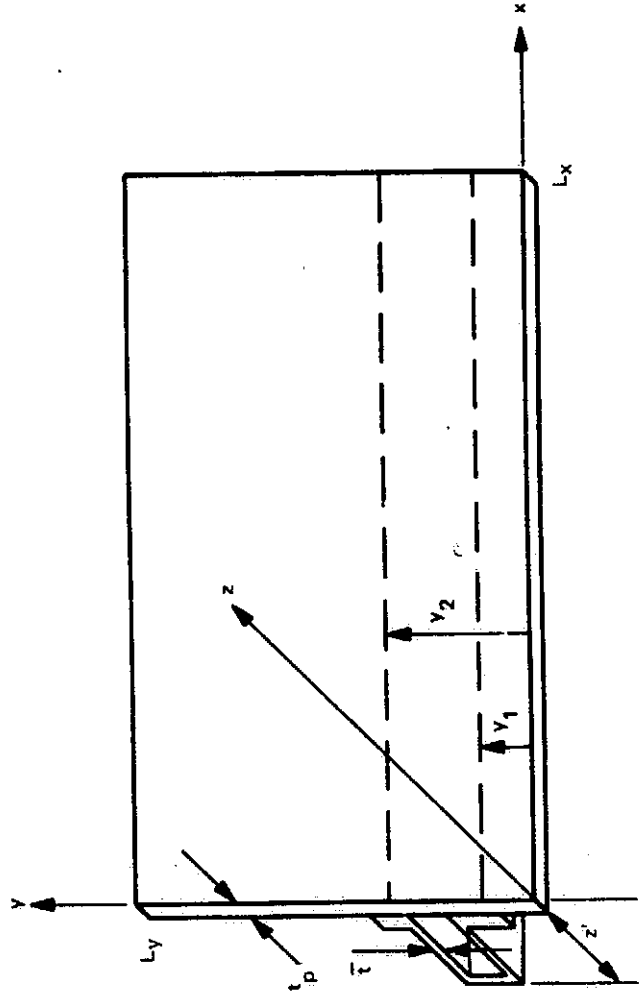


Fig. A-2 Doubly-Connected Stringer Idealization - Global Coordinates

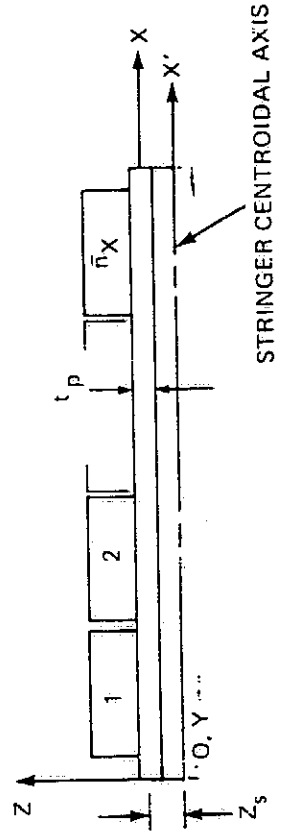
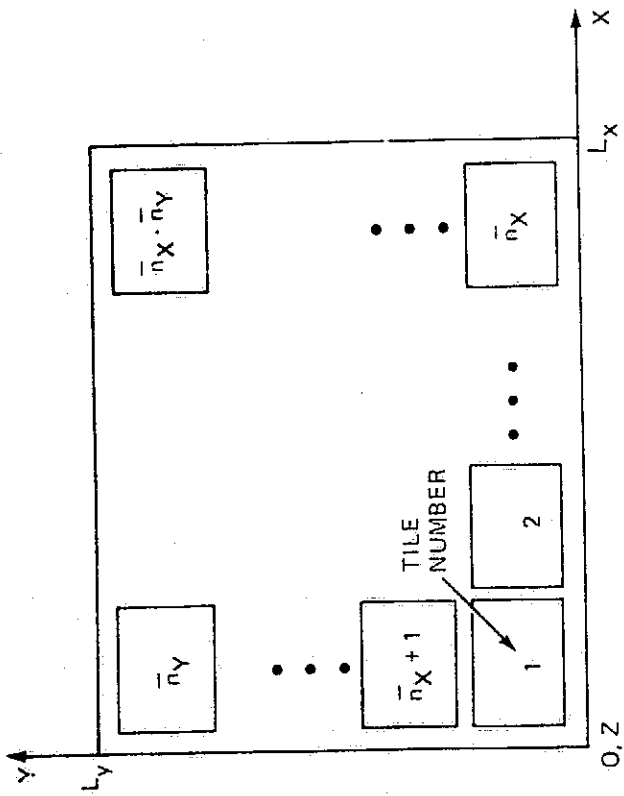
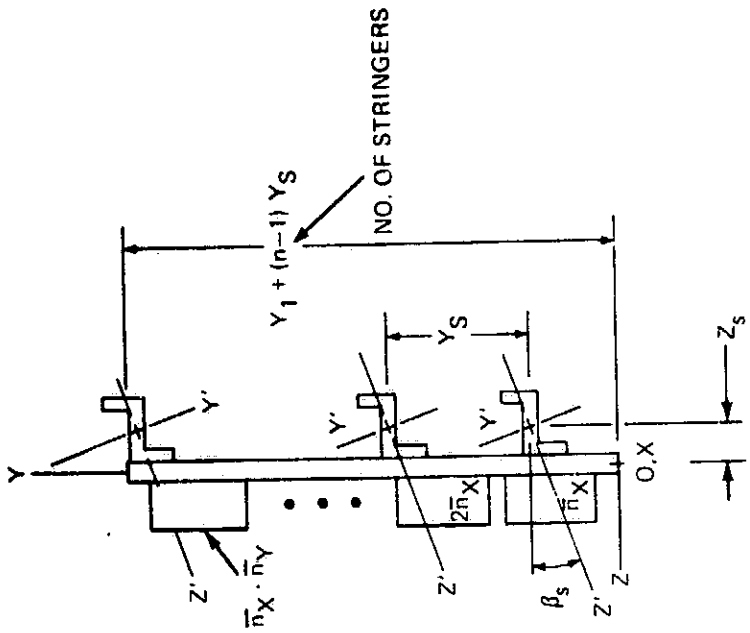

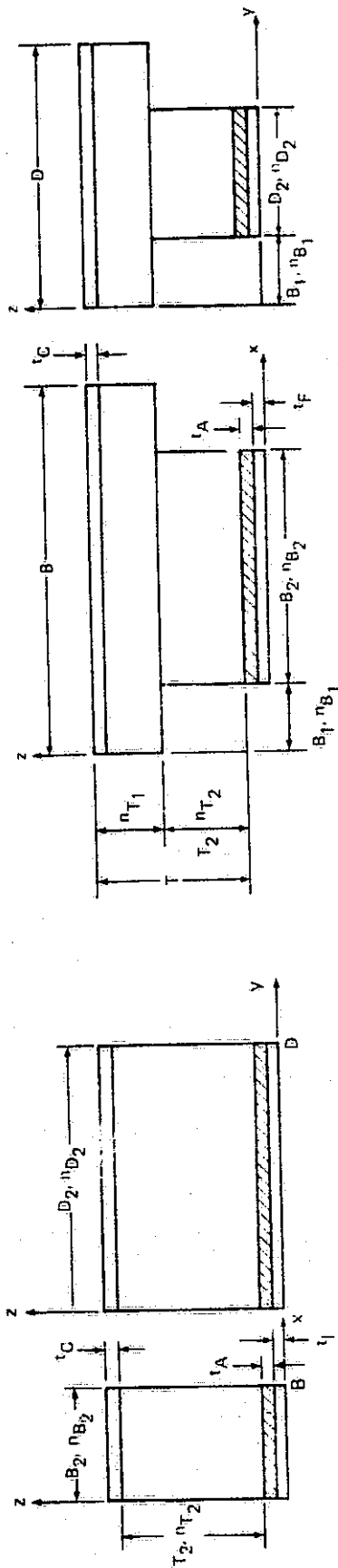


Figure A-3 TPS Configuration on Stiffened Primary Structure - Global Coordinates

B. GEOMETRIC CONFIGURATION - Sheet 2 of 2 (See Figure A-3)

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
B.2	1-10 11-20 21-30 31-40 41-50 51-60 61-70 71-80	8E10.0 	Y_1 Z_s Y_s A_s I_y' I_z' J_x' β_s	in. in. in. in. ² in. ⁴ in. ⁴ in. ⁴ Degrees	Position of first stringer attachment row. If there are no stringers, set $Y_1 > L_y$ and skip to the next card. Distance of stringer centroid below plate middle surface. Discrete stiffener spacing Stringer cross sectional area Stiffener principal mom. of inertia about y' axis Stiffener principal mom. of inertia about z' axis Stiffener twisting stiffness geometric parameter Angle between z and z' axis measured positive clockwise along x.
B.3	1-10 11-20	I10 I10	\bar{n}_x \bar{n}_y	- -	Integer number of tiles between $x = 0$ and L_x^* Integer number of tiles between $y = 0$ and L_y^*

*If there are no tiles then n_x and n_y , together with n_{B2} and n_{D2} , are still required since they determine the primary structure element grid. In analyzing panels without tiles, leave out cards B.4, C.3 through C.10 and all "F" cards.



A. BRICK TILE

B. UNDERCUT TILE

NOTE: SUBSCRIPTED SYMBOLS BEGINNING WITH "n" ARE THE NUMBER OF ELEMENTS WHICH SUBDIVIDE THE INDICATED SPAN. THE OTHER SYMBOLS ARE DIMENSIONS.

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Figure A-4 RSI Tile Parameters - Local Coordinates

B. GEOMETRIC CONFIGURATION - Sheet 2 of 2 (See Figure A-4)

CARD (S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
B.4	1-10	6E10.0 →	T	in.	Undercut RSI tile thickness. Leave blank if tile is brick shaped or if there are no tiles.
	11-20		B_1	in.	Tile undercut dimension. Leave blank if tile is brick shaped.
	21-30		T_2	in.	Tile undercut dimension or height of brick shaped tile.
	31-40		t_A	in.	Strain arrester plate (SAP) thickness. May replace with layer of isolator, RSI or bond material if no SAP.
	41-50		t_I	in.	Strain isolator thickness (SIP)
	51-60		t_c	in.	Coating thickness. Leave blank if no tile coating.
B.5	1-5	I5 →	n_{B1}	-	Number of elements along B_1 . Leave blank if tile is brick shaped or if there are no tiles.
	6-10		n_{B2}	-	Number of elements along B_2 .
	11-15		n_{D2}	-	Number of elements along D_2 .
	16-20		n_{T1}	-	Number of elements along $T-T_2$. Leave blank if tile is brick shaped.
	21-25		n_{T2}	-	Number of elements along T_2 . Leave blank if no tiles.

$$\begin{pmatrix} \epsilon_x \\ \epsilon_y \\ \epsilon_z \\ \gamma_{xy} \\ \gamma_{yz} \\ \gamma_{zx} \end{pmatrix} = \begin{bmatrix} \frac{1}{E_x} & -\frac{\nu_{xy}}{E_y} & -\frac{\nu_{xz}}{E_z} & 0 & 0 & 0 \\ -\frac{\nu_{yx}}{E_x} & \frac{1}{E_y} & -\frac{\nu_{yz}}{E_z} & 0 & 0 & 0 \\ -\frac{\nu_{zx}}{E_x} & -\frac{\nu_{zy}}{E_y} & \frac{1}{E_z} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{G_{xy}} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{1}{G_{yz}} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{1}{G_{zx}} \end{bmatrix} \begin{pmatrix} \sigma_x \\ \sigma_y \\ \sigma_z \\ \sigma_{xy} \\ \sigma_{yz} \\ \sigma_{zx} \end{pmatrix}$$

NOTE: This matrix is symmetric; thus, the program insures that

$$\begin{aligned}
 \frac{\nu_{xy}}{E_y} &= \frac{\nu_{yx}}{E_x} & \frac{\nu_{xz}}{E_z} &= \frac{\nu_{zx}}{E_x} & \frac{\nu_{yz}}{E_z} &= \frac{\nu_{zy}}{E_y}
 \end{aligned}$$

Figure A-5 Orthotropic Stress-Strain Law for 3-Dimensional Elements

C. MATERIAL PROPERTIES - Sheet 1 of 3 (See Figure A-5)

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
C.1	1-10	8E10.0	E_p	psi	Isotropic plate modulus of elasticity
	11-20		ν_p	-	Poisson's ratio for plate
	21-30		γ_p	lb/in. ³	Weight density for plate
	31-40		α_p	0_F^{-1}	Coefficient of thermal expansion for plate
	41-50		A_{11}	psi	Orthotropic plate constants associated with stress-strain law: $\begin{Bmatrix} \sigma_x \\ \sigma_y \\ \tau_{xy} \end{Bmatrix} = \begin{bmatrix} A_{11} & A_{12} & 0 \\ A_{21} & A_{22} & 0 \\ 0 & 0 & A_{33} \end{bmatrix} \begin{Bmatrix} \epsilon_x \\ \epsilon_y \\ \gamma_{xy} \end{Bmatrix}$
	51-60		A_{22}	psi	
	61-70		A_{33}	psi	
	71-80		$A_{12}=A_{21}$	psi	
					Comparable symbols used in Reference 5 are: $A_{11} = E'_x$ $A_{12} = E'_y$ $A_{22} = E'_y$ $A_{33} = G$
C.2	1-10	4E10.0	E_s	psi	Stringer modulus of elasticity (enter zero if no stringers)
	11-20		ν_s	-	Poisson's ratio for stringer
	21-30		γ_s	lb/in. ³	Weight density for stringer
	31-40		α_s	0_F^{-1}	Coefficient of thermal expansion for stringer

C. MATERIAL PROPERTIES - Sheet 2 of 3 (See Figure A-5)

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
C.3	1-10	6E10.0 ↓	E_x	psi	Arrestor x direction orthotropic stiffness
	11-20		E_y	psi	Arrestor y direction orthotropic stiffness
	21-30		E_z	psi	Arrestor z direction orthotropic stiffness
	31-40		ν_{xy}	-	See Figure A.5
	41-50		ν_{yz}	-	See Figure A.5
	51-60		ν_{zx}	-	See Figure A.5
C.4	1-10	7E10.0 ↓	G_{xy}	psi	See Figure A.5
	11-20		G_{yz}	psi	See Figure A.5
	21-30		G_{zx}	psi	See Figure A.5
	31-40		γ_A	lb/in. ³	Weight density for arrestor
	41-50		α_{AX}	\circ_F^{-1}	X coefficient of thermal expansion for arrestor
	51-60		α_{AY}	\circ_F^{-1}	Y coefficient of thermal expansion for arrestor
	61-70		α_{AZ}	\circ_F^{-1}	Z coefficient of thermal expansion for arrestor

C. MATERIAL PROPERTIES - Sheet 3 of 3 (See Figure A-5)

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
C.5	1-10	E10.0	E_{Ix}	psi	Isolator x direction orthotropic stiffness
	11-20	E10.0	E_{Iy}	psi	Isolator y direction orthotropic stiffness
	21-30	E10.0	E_{Iz}	psi	Isolator z direction orthotropic stiffness
	31-40	E10.0	ν_{xy}	-	See Figure A.5
	41-50	E10.0	ν_{yz}	-	See Figure A.5
	51-60	E10.0	ν_{zx}	-	See Figure A.5
C.6	1-10	E10.0	G_{xy}	psi	See Figure A.5
	11-20	E10.0	G_{yz}	psi	See Figure A.5
	21-30	E10.0	G_{zx}	psi	See Figure A.5
	31-40	E10.0	γ_I	lb/in. ³	Weight density for isolator
	41-50	E10.0	α_I	$^{\circ}F^{-1}$	Coefficient of thermal expansion for isolator
	C.7	1-10	E10.0	γ_R	lb/in. ³
11-20		E10.0	α_y/α_x	-	RSI coefficient of thermal expansion in y direction ($^{\circ}F^{-1}$) divided by coefficient of thermal expansion in x direction (α_x).
21-30		E10.0	α_z/α_x	-	RSI coefficient of thermal expansion ratio in z vs. x direction.

C. TEMPERATURE DEPENDENT MATERIAL PROPERTIES (Sheet 1 of 2)

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
C.8.1	1-5	I5	-	-	Number of entry sets in the following table of E_R vs. temperature ($^{\circ}F$).
C.9.1	1-10	E10.0	T_1	$^{\circ}F$	Temperature (absolute, not relative) corresponding to following value of E_R
	11-20	E10.0	$E_R(T_1)$	psi	Value of E_R (RSI modulus - refer to equations below*) associated with previous temperature.
	31-30	E10.0	T_2	$^{\circ}F$	Repeat above set of data as often as necessary, 4 sets to a card.
	etc.	etc.	etc.	etc.	Program uses closest 3 data pts. for 2nd order Langrangian interpolation of properties if element temperature is within data specified temperature range and at least 3 data-points are input. Program uses closest data-point properties for element temperature outside range. Uniform property value is used for any given property if only one value of that property is specified. Thus, program requires a minimum of 1 or 3 value(s) per property for proper execution.

*For RSI (refer to Figure B-4)

$$E_x = E_y = E_R$$

$$E_z = E'_R$$

$$v_{xy} = v_{yx} = v_R$$

$$v_{zx} = v_{zy} = \frac{E_R}{E'_R} v_R$$

$$G_{xy} = G_{yx} = \frac{E_R}{2(1 + \nu_R)}$$

$$G_{yz} = G_{zy} = G_{xz} = G_{zx} = G'_R$$

$$\nu_{xz} = \nu_{yz} = \nu'_R$$

C. TEMPERATURE DEPENDENT MATERIAL PROPERTIES - Sheet 2 of 2

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
C.8.2 & C.9.2	-	E10.0	E'_R	psi	Repeat above two card sets for E'_R **
C.8.3 & C.9.3 through C.9.6 & C.9.6	-	E10.0	-	-	Repeat above card sets for remaining RSI properties in following order: $G'_R, \nu'_R, \nu'_R,$ and α'_x where α'_x = RSI coefficient of thermal expansion in x direction.
C.10.1 & C.11.1 through C.10.3 & C.11.3	-	E10.0	-	-	Repeat above card sets for coating properties in following order: Leave this card blank if there is no coating. E_c, ν_c, α_c

D. BOUNDARY CONDITIONS - Sheet 1 of 4 (See Figure A-6)

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
D.1, D.2, D.3, D.4	1	A1	-	-	A denotes the $x=0$ edge of the plate (CARD D.1)
These are four similar boundary condition cards	2	A1	-	-	B denotes the $x=L_x$ edge of the plate (CARD D.2) C denotes the $y=0$ edge of the plate (CARD D.3) D denotes the $y=L_y$ edge of the plate (CARD D.4) O indicates that the plate edge is <u>free</u> to deflect and rotate <u>out</u> of the $z=0$ plane (FREE) 1 indicates that the plate edge is <u>not free</u> to deflect or rotate <u>out</u> of the $z=0$ plane (CLAMPED) 2 indicates that the plate edge is <u>not free</u> to deflect but is <u>free to rotate</u> out of the $z=0$ plane (PINNED) 3 indicates that the plate edge is <u>flexibly held</u> with regard to <u>out</u> of plane motion
	3-11	E9.0	$K_{\psi\psi}$	lb/in. ²	Out-of-plane force per unit edge-length caused by out-of-plane unit deflection
	12-20	→	$K_{\psi\theta}$ or $K_{\theta\psi}$	lb/in.	Out-of-plane force per unit edge-length caused by out-of-plane unit rotation or Out-of-plane moment per unit edge-length caused by out-of-plane unit deflection
	21-29	→	$K_{\theta\theta}$	lb	Out-of-plane moment per unit edge-length caused by out-of-plane unit rotation

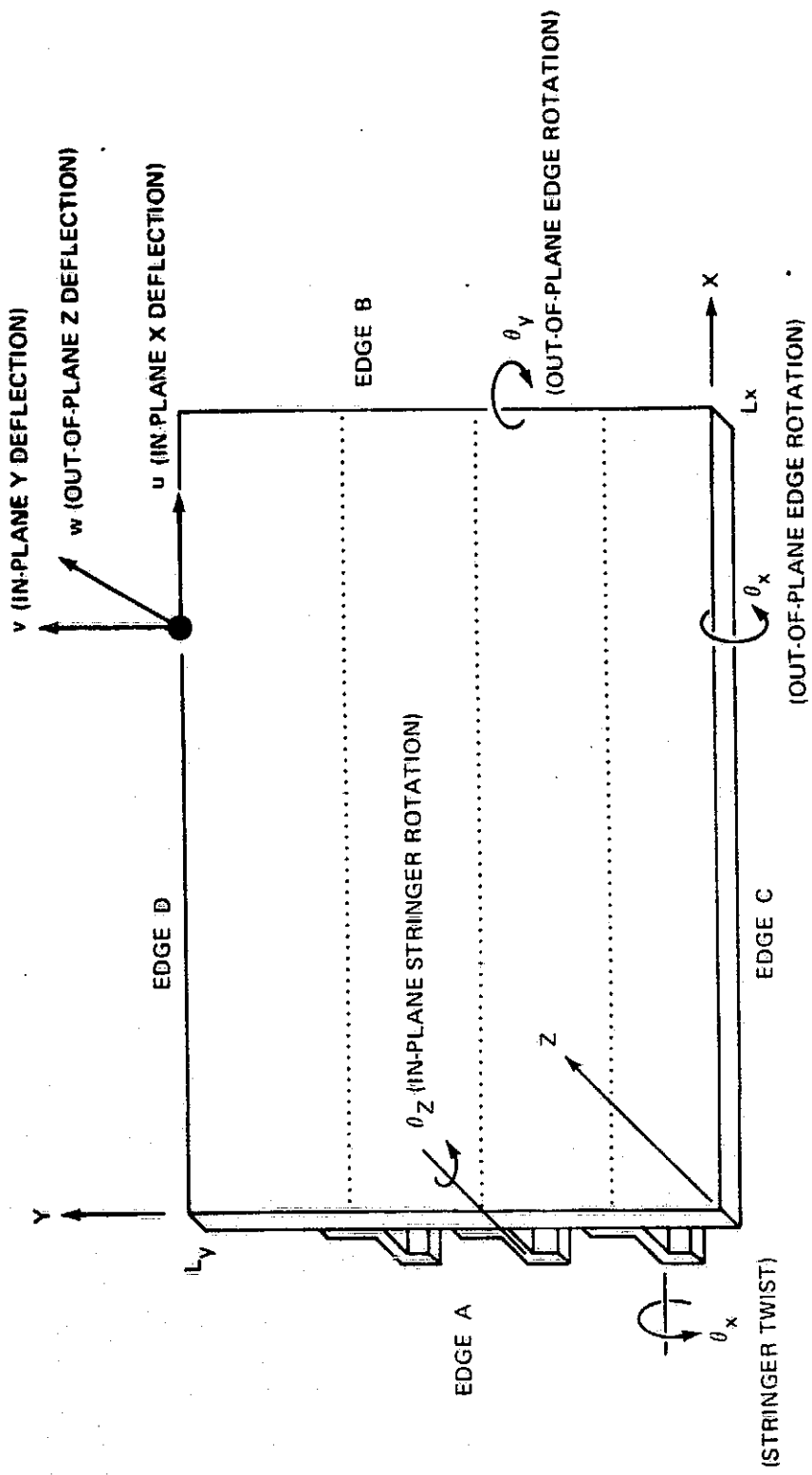


Figure A-6 Primary Structure Boundary Condition Notation - Global Coordinates

D. BOUNDARY CONDITIONS -- Sheet 2 of 4 (See Figure A-6)

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
D.1-D-4, (continued)	31	A1	-	-	0 denotes edge is <u>not held</u> from <u>in-plane</u> deflections 1 denotes edge is <u>held</u> from <u>in-plane</u> deflections 2 denotes edge is not held for y deflection, but is held for x deflection (PARTIALLY HELD) 4 denotes edge is not held for x deflection, but is held for y deflection (PARTIALLY HELD) 3 denotes edge is <u>flexibly held</u> for <u>in-plane</u> deflections
	32-40	E9.0	K_{uu}	lb/in. ²	NOTE: For non-vibratory heated or cooled primary structure problems, refer to special instructions on bottom of page A-23/24. In-plane x force per unit length on an edge caused by in-plane x direction unit deflection
	41-49		K_{uv} or K_{vu}	lb/in. ²	In-plane x force per unit length on an edge caused by in-plane y direction unit deflection or In-plane y force per unit length on an edge caused by in-plane x direction unit deflection
	50-58		K_{vv}	lb/in. ²	In-plane y force per unit length on an edge caused by in-plane y direction unit deflection

D. BOUNDARY CONDITIONS - Sheet 3 of 4 (See Figure A-6)

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
Add'l info. for cards D1 and D2 only.	60	A1		-	<p>0 denotes stringer edge not held for in-plane rotation (θ_z)</p> <p>1 denotes stringer edge held for in-plane rotation ($\theta_z = 0$)</p> <p>3 denotes stringer edge flexibly held for in-plane rotation</p> <p>Note A_z is not a primary structure degree of freedom unless a stringer element is also present at a particular plate node</p>
	61-69	E9.0	$K_{s\theta_z}$	in.-lb	In-plane stringer edge moment produced by unit rotation A_z
	71	A1	-	-	0 denotes stringer edge free to twist (θ_x)
					1 denotes stringer edge not free to twist ($\theta_x = 0$)
					3 denotes stringer edge flexibly held against twist
	72-80	E9.0	$K_{s\theta_x}$	in.-lb	Twist moment on end of stringer for a unit twist-rotation

Special Instructions for running a thermal stress problem, when the primary structure is at a uniform temperature other than the reference temperature, are required to permit free in-plane thermal straining; e.g.:

1. Permit the $x=0$ boundary to move freely or be elastically held in-plane
2. Permit the $x=L_x$ boundary to move freely in the y direction but not the x direction if free, or be elastically held if also elastically held along $x=0$.
3. Permit the $y=0$ boundary to move freely or be elastically held in-plane.
4. Permit the $y=L_y$ boundary to move freely in the x direction but not the y direction if free, or be elastically held if also elastically held along $y=0$.

D. BOUNDARY CONDITIONS - Sheet 4 of 4 (See Figure A-6)

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
D.5*	1	A1	-	-	A denotes boundary condition for closed section stringer on x = 0 edge.
	5	I4	-	-	0 in Col. 5 indicates that the closed section stringer is not held against stretching at the x = 0 edge
	10	I5	-	-	1 in Col. 5 indicates it is held in stretching.
	15	I5	-	-	0 in Col. 10 indicates that the closed-section stringer is not held against twisting at the x = 0 edge.
	26	A1	-	-	1 in Col. 10 indicates it is held against twisting.
	30	I4	-	-	0 in Col. 15 indicates that the closed-section stringer is not held against out-of-plane bending at the x = 0 edge.
	35	I5	-	-	1 in Col. 15 indicates it is held against out-of-phase bending.
	40	I5	-	-	B denotes boundary condition for closed-section stringer on x = L _x edge
					Same as for Col. 5 on x = L _x edge
					Same as for Col. 10 on x = L _x edge
					Same as for Col. 15 on x = L _x edge

*This card is required only if the stringer sections are closed and are attached at multiple plate rivet lines.

E. PRIMARY STRUCTURE LOADING (See Figure A-7)

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
E.1	1-10	8E10.0	N_x	lb/in.	Uniform, direct cover-plate running load in x direction on x = 0 edge (see Figure 7)
	11-20		N_y	lb/in.	Uniform, direct cover-plate running load in y direction on y = 0 edge (see Figure 7)
	21-30		N_{xy}	lb/in.	Uniform, shearing cover-plate running load on x = 0 edge (see Figure 7)
	31-40		N_{yx}	lb/in.	Uniform, shearing cover-plate running load on y = 0 edge (see Figure 7)
	41-50		P_z	psi	Uniform external normal pressure acting upon tiles
	51-60		T	lb	Tension force acting upon centroid of each stiffener at x = 0
	61-70		M	in.-lb	Out-of-plane bending moment acting upon each stiffener
	71-80		V	lb	Shear load acting upon each stiffener
					Note, boundary conditions for B and D edges should be selected carefully to produce desired effect, e.g. to produce a uniform primary structure tension in the x direction, $\sigma_x = \bar{\sigma}$ and $\sigma_y = 0$: set $N_x = t_p \bar{\sigma}$, $T = A_s \bar{\sigma}$, and P_z , M and V all equal to zero; then hold plate edge B from in plane x, but not y, motion and also hold the stringers at edge B; next, make edges C and D free for x motion, and only hold one of these edges against y motion.
E.2	1-10	E10.0	ΔT	F°	Temperature difference of plate from T_{Ref} .
	11-20	E10.0	ΔT_s	F°	Temperature difference of stringers from T_{Ref} .

Note: Leave out cards E.1 and E.2 if vibration option is used

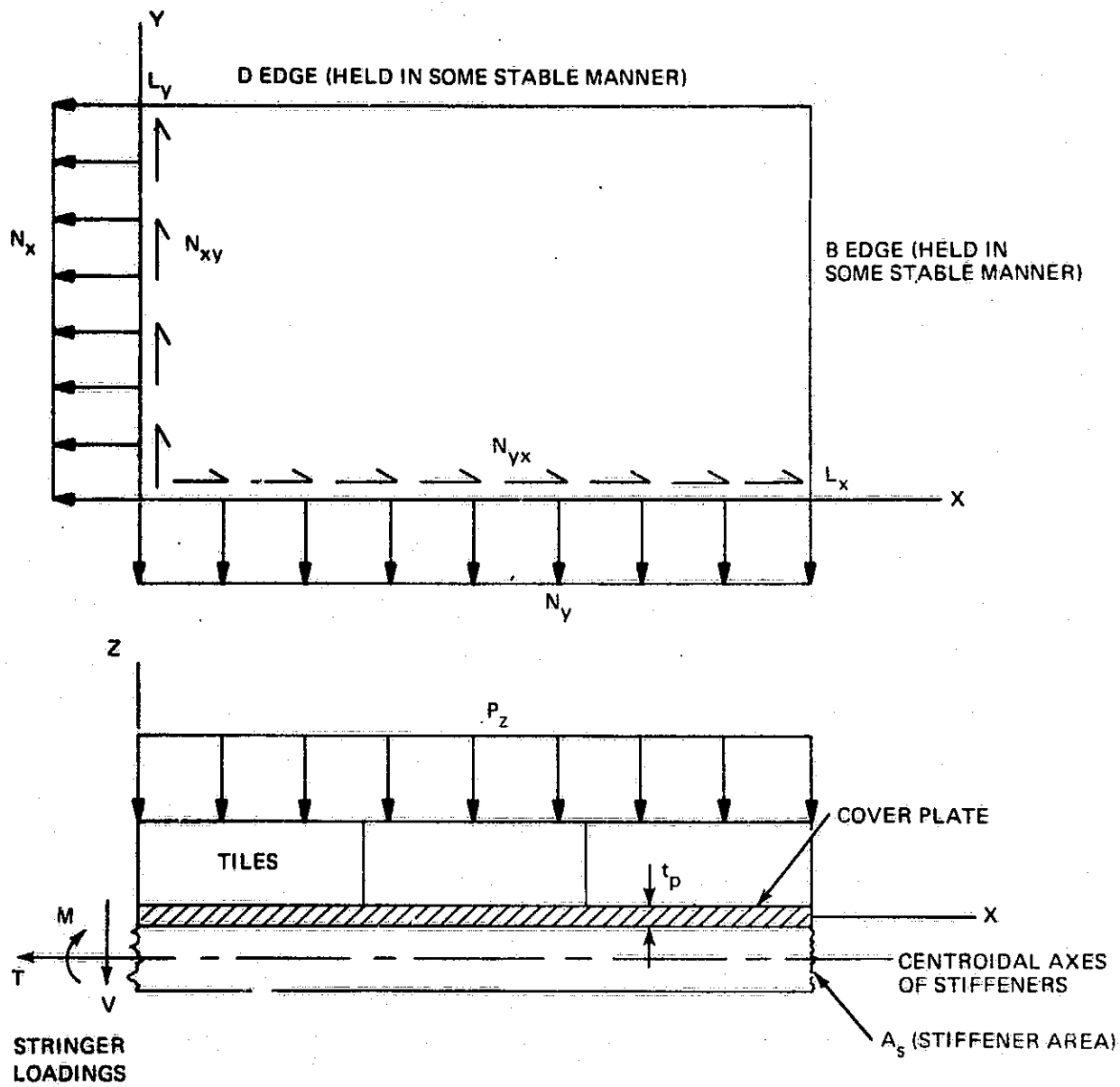


Figure A-7 Possible Static Mechanical Loadings Upon Panel - Global Coordinates

F. TILE TEMPERATURE DISTRIBUTIONS - Sheet 1 of 2

Each tile is assumed to have the same temperature distribution. There are 3 temperature distribution options, each of which is considered separately below. Tile temperature differences, rather than absolute tile temperatures, are required for each of these options (since thermal strains depend upon temperature differences). However, since temperature-dependent material property data are presented in terms of absolute temperature scales, a reference temperature (which is also input) is added to the differences to obtain absolute temperatures for internally computing material properties. Omit all F cards if there are no tiles.

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
F.1	5	I1	-	-	0 in col.5 of this card indicates no thermal static loading effects will be considered. But material properties used in forming the TPS stiffness properties will be based upon the specified temperature distribution. 1 in col. 5 indicates that thermal static loading will be considered in the analysis. In such cases, refer to bottom of following page for special instructions regarding boundary condition cards (D.1 through D.4).
	10	I1	-	-	1 in col. 10 indicates that each tile is at the same uniform temperature. 2 in Col. 10 indicates that each tile temperature distribution is governed by Lagrangian interpolation formulas. 3 in Col. 10 indicates that each tile temperature distribution is input by consecutive finite element node-temperature differences from the reference temperature.
	11-20	E10.0	T _{Ref}	°F	Panel reference temperature (added to temp. differences when obtaining mat'l. properties)

F. TIE TEMPERATURE DISTRIBUTIONS - Sheet 2 of 2

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
UNIFORM TEMPERATURE OPTION (1)					
F.2	1-10	E10-1	ΔT_u	F°	Uniform temperature difference from T_{Ref}
or LAGRANGIAN INTERPOLATION TEMPERATURE OPTION (2)					
F.2.1	1-5	2I5	-	-	Number of x coordinates through which temperature differences will be interpolated.
	6-10		+	-	Order of Lagrangian interpolation polynomial in x direction. Must be at least 1 less than number of coords given in col. 5.
F.3.1	1-10	E10.0	x_i	in.	The local x coordinates used in the x direction temperature difference interpolation. Eight to a card until all are accounted for.
F.2.2-3.2					Repeat card types F.2.1 and F.3.1 for the y coordinates
F.2.3-3.3					Repeat card types F.2.1 and F.3.1 for the z coordinates
F.4	1-10 11-20 . . . 71-80	E10.0	ΔT_R	F°	Successive interpolation point temperature, maximum of eight to a card. Start with the first x, y, z point and index on x. Next, step up y coordinate and index on x once again. Continue until all y coordinates have been stepped up in this way. Repeat the above procedure for each value of z: e.g., the temperature input order would be $T_1 = T(x_1, y_1, z_1), T_2 = T(x_2, y_1, z_1), \dots, T_n = T(x_n, y_1, z_1),$ $T_{n+1} = T(x_1, y_2, z_1), \dots, T_{n+m} = T(x_n, y_m, z_1)$ $T_{n+m+1} = T(x_1, y_1, z_2), \dots, T_{n+m+l} = T(x_n, y_m, z_l)$ Eight to a card until all data are accounted for.
or ELEMENT NODE TEMPERATURE OPTION (3)					
F.2	11-10 11-20 etc	E10.0	ΔT_R	F°	Temperature differences above reference temperatures, node by node, in consecutive order. Seven temperature differences to a card until all nodes are accounted for. Cols. 71-80 of each card are reserved for user's card identification.

D. DESCRIPTION OF OUTPUT

Output from a typical run of the RSIST computer program is explained below in outline form. References in parentheses refer to pages in this Appendix.

1. Program title and date indicating latest update of program version which was run.

INPUT INFORMATION

2. Listing of input cards, the first two of which are the title assigned to any given run by the user.
3. User selected input options are listed (pp. A-5 - A-8).
4. Plate, stringer and tile geometry and specification of finite element grids for primary structure and tiles (pp. A-9 - A-11).
5. Plate, stringer, strain isolator and arrestor material properties (pp. A-14 - A-17). Note, if there is no strain arrestor, RSI or isolator material properties may be used for the arrestor. If this is done, the thickness dimension of the usual isolator or RSI should be appropriately reduced to compensate for this addition.
6. Temperature-dependent RSI material property data used for generating curves used internally by program to compute RSI average finite element properties (pp. A-18 - A-19).
7. Plate and stringer boundary conditions (pp. A-20 - A-25).
8. Applied primary structure static mechanical and thermal loading if not a vibration problem (A-26 - A-27).
9. RSI temperature distribution input data. Used for property data (item 6 above) and thermal loading if a statics problem (pp. A-28 - A-29).

OUTPUT INFORMATION

10. Map showing typical tiles three dimensional finite element ordering, by layers. Top, or first layer also corresponds to two-dimensional tile coating elements as well.

11. Map showing ordering of a typical tiles finite element nodes by layers.
12. Position and temperatures for a typical tile in a local coordinate system (reference Figure A-4, A and B).
13. Global geometry of primary structure nodes and plate nodal degree-of-freedom numbering. D_x , D_y and D_z refer to nodal deflections, and R_x and R_y are the nodal rotations. Nodes with no degrees-of-freedom are used to define the stringer centroids for singly-attached stringers only.
- 14.a. Statics Option: Primary structure nodal deflections by iteration number. Nodes with the same x coordinate are grouped together. These groups are separated with dashed lines.
- 14.b. Vibration Option: Mode numbers, approximate frequencies and corresponding modal error bound (which should be less than 2% to be a reliable approximate mode). This is followed by the primary structure mode shapes with a similar nodal deflection format as for the Statics Option.
15. If requested by the user, the computed convergence parameter is printed out along with the input quantity it was tested against. This is done for each iteration after the first for the Static Option. The primary structure degree-of-freedom with the largest change from the previous iteration is also identified.
16. Tile nodal displacements by tile and iteration number. For a vibration option, this calculation and the subsequent ones are performed only for the user-specified vibration mode.
17. Modal mass associated with each tile for given mode is printed out as DEN.
18. Three dimensional tile stresses and strains for the bottom two layers of elements by element number. These quantities are computed at each element's 8 Gauss integration points. Gauss point stresses are believed to be more accurate than nodal values and provide more detail than simply the element's average stresses.

19. Three dimensional element average stresses and strains (by tile and iteration number).
20. Two-dimensional element average coating stresses. Coating element numbers correspond to three dimensional element numbering directly below them.
- 21.a. Statics Option: Repeat of items 16-19 for each tile. Repeat of item 14.a and 15 for each iteration.
- 21.b. Vibrations Option: Computation of Rayleigh Quotient (OMEGA SQUARED) if all tiles have been treated. Repeat of items 16-19 for each iteration. Repeat of items 14.b, 15 and Rayleigh Quotient until convergence or last iteration is performed.
22. Plate element stresses and strains for mid and/or top and/or bottom surfaces. This computation is done after each iteration if requested by the user. Otherwise, it is computed only after convergence or the last iteration is performed.
23. Vibrations Option: Stringer strains and stresses if requested in input, the quantity $\left(\sum_j A_{z_j} \bar{\phi}_{T,zj}\right)^2$ (printed out as SUM (AREA * DZ)** 2=), and the primary structure modal mass (printed out as P.S. M =).

E. SAMPLE PROBLEMS

Output for a sample statics and vibrations problem, are presented in the remaining pages of this Appendix. Only portions of the output are shown. However, the pages presented are representative of the types of information, and their respective formats, which the RESIST Program can deliver.

U P T I D U M S

STATICS PROBLEM

MAXIMUM NO. ITERATIONS # 3

CONVERGENCE PARAMETER # 5.0000E-02

PRIMARY STRUCTURE PLATE STRESSES PRESENTED AFTER EACH ITERATION AT PLATE MID, TOP AND BOTTOM SURFACES

TILES ON PRIMARY STRUCTURE

TILE STRESSES PRESENTED AFTER EACH ITERATION

TILE NODE MAP REQUIRED

TILE ELEMENT MAP REQUIRED

TILE NODE COORDINATES REQUIRED

DO NOT PRINT ELEMENT STIFFNESS MATRICES

DO NOT PRINT ASSEMBLED STIFFNESS MATRICES

PRINT FILE DEBUGGING INFORMATION

COMPUTE STRESSES FOR ALL TILES

ORIGINAL PAGE IS
OF POOR QUALITY

PLATE
 STRINGENS
 LX # 6.0000E 00 LY # 1.0000E 00 TP # 5.0000E -01
 Y1 # 2.0000E 00 Z5 # 0.0 Y5 # 0.0 AS # 0.0
 Y2 # 0.0 IZ # 0.0 JX # 0.0 DETA S # 0.0

TILES
 NXB # 1 NTR # 1
 T # 0.0 B1 # 0.0 Tz # 2.0000E 00
 TA # 5.0000E -01 TI # 3.0000E -01 TC # 0.0
 NBI # 0 NBZ # 0 NDZ # 1
 NTI # 0 NTR # 4

PLATE
 STRINGENS
 EP # 1.0000E 07 ES # 0.0
 EX # 6.0000E 04
 NU XY # 5.0000E -01
 GXY # 2.0000E 04
 GAMMA A # 0.0
 ALPHA X # 0.0

ISOLATOR
 EX # 9.0000E 01
 NU XY # 4.0000E -01
 GXY # 3.0000E 01
 GAMMA I # 0.0
 GAMMA H # 0.0

M A T E R I A L P R O P E R T I E S

 NU P # 3.0000E -01 GAMMA P # 1.0000E -01 ALPHA P # 0.0
 NU S # 0.0 GAMMA S # 0.0 ALPHA S # 0.0
 IY # 6.0000E 04 IZ # 6.0000E 03
 NU YZ # 1.0000E -02 NU ZX # 1.0000E -01
 GYZ # 3.0000E 04 GZX # 3.0000E 04
 ALPHA Y # 0.0 ALPHA Z # 0.0
 IY # 9.0000E 01 IZ # 9.0000E 01
 NU YZ # 4.0000E -01 NU ZX # 4.0000E -01
 GYZ # 3.0000E 01 GZX # 3.0000E 01
 ALPHA I # 0.0 ALPHA J # 0.0
 ALPHA NY / ALPHA NX # 0.0 ALPHA NZ / ALPHA NX # 0.0

TEMPERATURE DEPENDENT MATERIAL PROPERTIES

	TEMPERATURE	PROPERTY	TEMPERATURE	PROPERTY	TEMPERATURE	PROPERTY
1 ER	ALL	0.000E 04				
1 ERB	ALL	0.000E 03				
1 GRB	ALL	3.200E 04				
1 NUR	ALL	5.000E-01				
1 NURB	ALL	1.000E-02				
1 ALPHA R	ALL	0.0				
1 FC	ALL	0.0				
1 NUC	ALL	0.0				
1 ALPHA C	ALL	0.0				

FROM PUTLAB, 170 UNIT # 10, FILE # 1, ROWS # 14, COLUMN: # 5

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BOUNDARY CONDITIONS

EDGE	PLATE OUT OF PLANE	PLATE IN PLANE	STRINGLMS
A	PINNED	U HLD, V FREE	FREE FREE
B	PINNED	FREE	FREE FREE
C	FREE	V HLD, U FREE	
D	FREE	FREE	

FROM PUTLAB, NAME # BND COND, I/U UNIT # 1, FILE # 1, ROWS # 14, COLUMNS # 11
 FROM PUTLAB, NAME # MEMBERS, I/U UNIT # 17, FILE # 1, ROWS # 0, COLUMNS # 100
 FROM PUTLAB, NAME # LOADS, I/U UNIT # 3, FILE # 1, ROWS # 17, COLUMNS # 1

STATIC LOADING

NX # 0.0 NY # 0.0 NXY # 0.0 NYX # 0.0
 PZ # 1.00001 01 T # 0.0 M # 0.0 V # 0.0

DEL TEMP P # 0.0 DEL TEMP S # 0.0
 FROM PUTLAB, NAME # LOADS, I/U UNIT # 4, FILE # 1, ROWS # 14, COLUMNS # 0

RESI TEMPERATURES

NO STATIC THERMAL LOADING

UNIFORM TEMPERATURE (PRTION

1 REFERENCE # 7.00000E 01

DEL T U # 1 - 1 REF # 0.00

FROM PUBLAB:
NAME # JCGGNY01. I/O UNIT # 7. FILE # 1. ROWS # 40. COLUMNS # 81

N U D E M A P
S U R F A C E 1

146 88 90 92 94 96 98
145 87 89 91 93 95 97

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N O D E M A P

S U R F A C E 2

72	74	76	78	80	82	84
71	73	75	77	79	81	83

NUDE	PRIMARY GLOBAL X	STRUCTURE Y	AND Z	DEG	MIN	SEC	U	V	W	X	Y	Z
1	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0
2	0.0	1.000000E 00	0.0	0	3	0	0	0	1	2	0	0
3	1.000000E 00	0.0	0.0	0	0	0	0	0	4	5	0	0
4	1.000000E 00	1.000000E 00	0.0	10	13	12	7	15	17	14	0	0
5	2.000000E 00	0.0	0.0	15	0	16	17	22	22	18	0	0
6	2.000000E 00	1.000000E 00	0.0	15	20	21	25	26	31	27	0	0
7	3.000000E 00	0.0	0.0	24	0	30	30	31	31	32	0	0
8	3.000000E 00	1.000000E 00	0.0	26	29	30	34	35	40	36	0	0
9	4.000000E 00	0.0	0.0	53	0	39	39	40	44	41	0	0
10	4.000000E 00	1.000000E 00	0.0	57	34	43	43	44	49	45	0	0
11	5.000000E 00	0.0	0.0	42	0	47	47	48	52	50	0	0
12	5.000000E 00	1.000000E 00	0.0	42	47	48	48	49	52	53	0	0
13	6.000000E 00	0.0	0.0	51	0	0	0	0	56	57	0	0
14	6.000000E 00	1.000000E 00	0.0	54	55	0	0	0	0	0	0	0

FROM SAMAIN. AFTER PROCES - CALCULATE D.U.E.F. AND ASSIGN M.C.
 ***** ELAPSED TIME IS ***** MINUTES. 7.17 SECONDS *****
 ***** INCREMENTAL TIME IS ***** MINUTES. 0.12 SECONDS *****

FROM GETDIM. NAME # MEMBERS. 1/0 UNIT # 17. FILE # 1. ROWS # 6. COLUMNS # 100

FROM PUTLAB. NAME # EL STIFF. 1/0 UNIT # 9. FILE # 1. ROWS # 12. COLUMNS # 24

PRIMARY STRUCTURE DEFLECTIONS FOR ITERATION NUB - 1

NODE	UX	UY	DZ	HX	KY	KZ
1				-2.571537E-05	6.399191E-04	
2		0.0		2.571835E-05	6.399254E-04	
3	0.0		-8.00852E-04	3.503201E-05	7.205624E-04	
4	0.0		-9.008595E-04	-3.504021E-05	7.205880E-04	
5	0.0		-1.336696E-03	5.501719E-05	4.043205E-04	
6	0.0		-1.336696E-03	-5.501702E-05	4.043205E-04	
7	0.0		-1.559635E-03	6.503916E-05	4.055849E-04	
8	0.0		-1.559635E-03	-6.503917E-05	4.055849E-04	
9	0.0		-1.386892E-03	5.501700E-05	-4.043160E-04	
10	0.0		-1.386892E-03	-5.501716E-05	-4.043160E-04	
11	0.0		-8.009030E-04	3.503455E-05	-7.205908E-04	
12	0.0		-9.009091E-04	-3.504053E-05	-7.205945E-04	
13	0.0			-2.571737E-05	6.399326E-04	
14	0.0			2.571995E-05	6.399361E-04	

FROM SHEAR: AFTER MSOUT
 ***** ELAPSED TIME IS ***** 0 MINUTES, 9.40 SECONDS *****
 ***** INCREMENTAL TIME IS ***** 0.13 SECONDS *****

FROM GETDIM: 1/0 UNIT # 1, FILE # 1, ROWS # 14, COLUMNS # 11
 FROM GETDIM: 1/0 UNIT # 10, FILE # 2, ROWS # 57, COLUMNS # 1
 FROM GETDIM: 1/0 UNIT # 9, FILE # 1, ROWS # 14, COLUMNS # 0
 FROM PUTLAB: 1/0 UNIT # 3, FILE # 1, ROWS # 57, COLUMNS # 1
 FROM PUTLAB: 1/0 UNIT # 19, FILE # 1, ROWS # 92, COLUMNS # 1

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PRIMARY STRUCTURE NUSS ASSOCIATED WITH TILE NO. 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14
		FROM PUTLAB.				1/U UNIT # 9.	FILE # 1.	ROWS # 1.	COLUMNS # 1.				
		NAME #	LOADS										
		FROM GETDIM.				1/U UNIT # 11.	FILE # 1.	ROWS # 252.	COLUMNS # 42.				
		NAME #	NAME #										
		FROM GETDIM.				1/U UNIT # 19.	FILE # 1.	ROWS # 42.	COLUMNS # 1.				
		NAME #	LOADS										
		FROM PUTLAB.				1/U UNIT # 17.	FILE # 1.	ROWS # 252.	COLUMNS # 1.				
		NAME #	GO OA										
		FROM GETDIM.				1/U UNIT # 13.	FILE # 1.	ROWS # 252.	COLUMNS # 1.				
		NAME #	NAME #										
		FROM GETDIM.				1/U UNIT # 17.	FILE # 1.	ROWS # 252.	COLUMNS # 1.				
		NAME #	GO OA										
		FROM PUTLAB.				1/U UNIT # 14.	FILE # 1.	ROWS # 252.	COLUMNS # 1.				
		NAME #	NAME #										
		FROM GETDIM.				1/U UNIT # 18.	FILE # 1.	ROWS # 252.	COLUMNS # 252.				
		NAME #	NAME #										
		FROM PUTLAB.				1/U UNIT # 20.	FILE # 3.	ROWS # 252.	COLUMNS # 252.				
		NAME #	NAME #										
		FROM PUTLAB.				1/U UNIT # 19.	FILE # 1.	ROWS # 252.	COLUMNS # 252.				
		NAME #	NAME #										
		FROM PUDSYN.											
		NAME #	AFTER OFACT										
			ELAPSED TIME IS			1	MINUTES.	10.30	SECONDS	****			
			INCREMENTAL TIME IS			0	MINUTES.	1.90	SECONDS	****			
		FROM GETDIM.				1/U UNIT # 20.	FILE # 3.	ROWS # 252.	COLUMNS # 252.				
		NAME #	NAME #										
		FROM PUTLAB.				1/U UNIT # 1.	FILE # 1.	ROWS # 252.	COLUMNS # 252.				
		NAME #	NAME #										

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PRIMMRY STRUCTURE DEFLECTIONS FOR ITERATION NO. 2

NODE	DA	UY	DZ	RX	RY	RZ
1						
2		5.103224E-08		-2.376204E-08	7.512970E-04	
3	9.891772E-08		-7.206451E-04	3.386522E-05	6.405059E-04	
4	1.102952E-07		-7.206502E-04	-3.387271E-05	6.405097E-04	
5	2.095247E-07		-8.233010E-03	5.152416E-05	3.587529E-04	
6	2.175903E-07		-1.233010E-03	-5.153510E-05	3.587534E-04	
7	3.283773E-07		3.416336E-03	5.496373E-05	4.555410E-09	
8	3.284314E-07		-1.416336E-03	-5.497384E-05	4.287930E-09	
9	4.472565E-07		-1.233010E-03	5.152391E-05	-3.587492E-04	
10	4.393011E-07		-1.233024E-03	-5.153648E-05	-3.587492E-04	
11	5.592888E-07		-7.206560E-04	3.386816E-05	-6.405131E-04	
12	5.456802E-07		-7.206594E-04	-3.387344E-05	-6.405157E-04	
13	6.644791E-07			-2.376334E-08	-7.513096E-04	
14	6.490859E-07			2.376204E-08	-7.513121E-04	

PRIMARY STRUCTURE DEFLECTIONS FOR ITERATION NO. 3

NODE	UX	UY	UZ	RX	RY	RZ
1						
2				-2.39828E-06	7.61480E-04	
3	9.557641E-08	0.67693E-08		2.596601E-06	7.614903E-04	
4	1.056899E-07		-7.305669E-04	3.41495E-05	0.497325E-04	
5	2.018373E-07	0.494701E-08	-7.305711E-04	-3.415927E-05	0.497325E-04	
6	2.089645E-07		-1.250757E-03	5.229021E-05	3.604484E-04	
7	3.156060E-07	4.191601E-08	-1.250757E-03	-5.230139E-05	3.604487E-04	
8	3.156542E-07	3.446535E-08	-1.437097E-03	5.079414E-05	4.6064160E-04	
9	4.293984E-07		-1.437103E-03	-5.0795261E-05	4.6064507E-04	
10	4.223697E-07	4.172461E-08	-2.250761E-03	3.228892E-05	-3.604483E-04	
11	5.369311E-07		-2.250761E-03	-3.230239E-05	-3.604483E-04	
12	5.246264E-07	6.354719E-08	-7.305784E-04	3.415275E-05	0.497402E-04	
13	6.381047E-07		-7.305824E-04	-3.415921E-05	0.497430E-04	
14	6.243649E-07	4.180095E-08		-2.398456E-06	-7.615001E-04	
				2.398731E-06	-7.615027E-04	

FROM REMAIN: AFTER M'SOUT
 ***** ELAPSED TIME IS *****
 ***** INCREMENTAL TIME IS *****

FROM GETDIM: 1/0 UNIT # 10, FILE # 2, ROWS # 57, COLUMNS # 1
 NAME # DEFLECT, 1/0 UNIT # 10, FILE # 1, ROWS # 57, COLUMNS # 1

MAXIMUM DEFLECTION # -2.43710E-03 FOR DIM# 30

MAXIMUM DEFLECTION DIFFERENCE # 2.07594E-05 FOR DIM# 30

MAXIMUM CONVERGENCE PARAMETER # 1.04450E-02

SOLUTION HAS CONVERGED

FROM GETDIM: 1/0 UNIT # 1, FILE # 1, ROWS # 14, COLUMNS # 11
 NAME # BND COND.
 FROM GETDIM: 1/0 UNIT # 10, FILE # 2, ROWS # 57, COLUMNS # 1
 NAME # DEFLECT
 FROM GETDIM: 1/0 UNIT # 4, FILE # 1, ROWS # 14, COLUMNS # 6
 NAME # LOADS

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TPS DISPLACEMENTS FOR FILE NO. 1 AND ITERATION NO. 3

NODE	X COMPONENT	Y COMPONENT	Z COMPONENT
1	1.4037165E-04	5.9952233E-07	0.0
2	1.4037258E-04	-5.1097339E-07	0.0
3	1.40257870E-04	-8.5374486E-06	-7.3056694E-04
4	1.40253963E-04	8.6047585E-06	-1.207514E-03
5	9.1323891E-05	-1.3072553E-05	-1.2507574E-03
6	9.1330832E-05	1.3117266E-05	-1.4370974E-03
7	3.1677200E-07	-1.4485362E-05	-1.4371041E-03
8	3.1675600E-07	1.4522618E-05	-1.2507614E-03
9	-9.0691436E-05	-1.3072229E-05	-1.2507679E-03
10	-9.0691436E-05	1.3117327E-05	-7.3056787E-04
11	-1.0184981E-04	-3.5361671E-06	0.0
12	-1.0173691E-04	3.5361671E-06	0.0
13	-1.0173691E-04	9.19961394E-07	-9.4766752E-04
14	-1.0173691E-04	-9.19961394E-07	-9.4762165E-04
15	-2.44671151E-04	-2.4677043E-05	-1.4202336E-03
16	-2.44671151E-04	2.4652872E-05	-1.4201760E-03
17	-2.44671151E-04	1.1729229E-05	-1.7951399E-03
18	-2.44671151E-04	-1.1729229E-05	-1.7950851E-03
19	-1.3814602E-04	-2.0504580E-06	-1.9353998E-03
20	-1.3814602E-04	2.0504580E-06	-1.9353414E-03
21	3.7595543E-07	8.9219182E-06	-1.4201917E-03
22	3.7595543E-07	-8.9219182E-06	-1.4201917E-03
23	1.3889305E-04	-2.44671151E-04	-1.7950917E-03
24	1.3889305E-04	2.44671151E-04	-1.4201917E-03
25	2.44671151E-04	-1.3889305E-04	-1.4201917E-03
26	2.44671151E-04	1.3889305E-04	-9.4769949E-04
27	2.44671151E-04	8.9219182E-06	-9.4763676E-04
28	2.44671151E-04	-8.9219182E-06	-2.0491474E-03
29	1.0217422E-04	-8.1469989E-06	-2.3132695E-03
30	1.0217422E-04	8.1469989E-06	-2.3132695E-03
31	7.6192548E-05	-4.1409221E-06	-2.5260609E-03
32	7.6192548E-05	4.1409221E-06	-2.5260609E-03
33	-9.0805200E-05	-9.0951846E-07	-2.5265981E-03
34	-9.0805200E-05	9.0951846E-07	-2.5265981E-03
35	3.7973558E-07	3.60281794E-06	-2.6097754E-03
36	3.7973558E-07	-3.60281794E-06	-2.6097754E-03
37	4.1563384E-05	-9.3679759E-07	-2.5259992E-03
38	4.1563384E-05	9.3679759E-07	-2.5259992E-03
39	4.1563384E-05	-9.3679759E-07	-2.3133061E-03
40	4.1563384E-05	9.3679759E-07	-2.3133061E-03
41	7.6487952E-05	-4.5048528E-06	-2.0492096E-03
42	7.6487952E-05	4.5048528E-06	-2.0492096E-03
43	1.0296553E-04	-9.9712922E-06	-3.0715843E-03
44	1.0296553E-04	9.9712922E-06	-3.0715843E-03
45	-1.0541414E-05	-1.0371151E-05	-3.1626382E-03
46	-1.0541414E-05	1.0371151E-05	-3.1625665E-03
47	9.5457654E-07	-1.0541414E-05	-3.2865147E-03
48	9.5457654E-07	1.0541414E-05	-3.2864225E-03
49	3.8502206E-07	-8.0859121E-05	-3.3276265E-03
50	3.8502206E-07	8.0859121E-05	-3.3275315E-03

STRESSES FOR ISOLATOR AND ARRESTER FOR FILE NO. 1 AND ITERATION NO. 3

X	LOCAL COORDINATES			Z	ELEMENT NUMBER	AX	AY	ZZ	STRESSES			ZX
	X	Y	Z						XY	YZ	XY	
1	7.8868E-01	7.8868E-01	7.8868E-01	7.8868E-01	1	-1.0912E 01	-1.0913E 01	-1.1364E 01	-1.1364E 01	1.3100E-03	1.3100E-03	-1.4141E-01
2	7.8868E-01	7.8868E-01	7.8868E-01	7.8868E-01	2	-1.0913E 01	-1.0913E 01	-1.1364E 01	-1.1364E 01	1.3100E-03	1.3100E-03	-1.4141E-01
3	2.1132E-01	7.8868E-01	7.8868E-01	7.8868E-01	3	-1.3104E 01	-1.3104E 01	-1.3684E 01	-1.3684E 01	3.4308E-03	3.4308E-03	-1.5655E-01
4	2.1132E-01	2.1132E-01	7.8868E-01	7.8868E-01	4	-1.3104E 01	-1.3104E 01	-1.3684E 01	-1.3684E 01	3.4308E-03	3.4308E-03	-1.5655E-01
5	7.8868E-01	7.8868E-01	2.1132E-01	7.8868E-01	5	-1.1002E 01	-1.1002E 01	-1.1452E 01	-1.1452E 01	1.3090E-03	1.3090E-03	-1.4591E-01
6	7.8868E-01	2.1132E-01	2.1132E-01	7.8868E-01	6	-1.1002E 01	-1.1002E 01	-1.1452E 01	-1.1452E 01	1.3090E-03	1.3090E-03	-1.4591E-01
7	2.1132E-01	2.1132E-01	2.1132E-01	2.1132E-01	7	-1.3215E 01	-1.3214E 01	-1.3754E 01	-1.3754E 01	3.4308E-03	3.4308E-03	-1.6104E-01
8	2.1132E-01	2.1132E-01	2.1132E-01	2.1132E-01	8	-1.3215E 01	-1.3214E 01	-1.3754E 01	-1.3754E 01	3.4308E-03	3.4308E-03	-1.6104E-01
1	1.7887E 00	7.8868E-01	7.8868E-01	7.8868E-01	1	-5.4071E 00	-5.4104E 00	-5.7581E 00	-5.7581E 00	-1.4815E-04	-1.4815E-04	-9.4224E-02
2	1.7887E 00	2.1132E-01	7.8868E-01	7.8868E-01	2	-5.4071E 00	-5.4104E 00	-5.7581E 00	-5.7581E 00	-1.4815E-04	-1.4815E-04	-9.4224E-02
3	1.2113E 00	7.8868E-01	7.8868E-01	7.8868E-01	3	-9.6305E 00	-9.6337E 00	-1.0032E 01	-1.0032E 01	1.4815E-04	1.4815E-04	-1.2149E-01
4	1.2113E 00	2.1132E-01	7.8868E-01	7.8868E-01	4	-9.6305E 00	-9.6337E 00	-1.0032E 01	-1.0032E 01	1.4815E-04	1.4815E-04	-1.2149E-01
5	1.7887E 00	7.8868E-01	2.1132E-01	7.8868E-01	5	-8.5362E 00	-8.5329E 00	-8.8814E 00	-8.8814E 00	1.4815E-04	1.4815E-04	-9.4224E-02
6	1.7887E 00	2.1132E-01	2.1132E-01	7.8868E-01	6	-8.5362E 00	-8.5329E 00	-8.8814E 00	-8.8814E 00	1.4815E-04	1.4815E-04	-9.4224E-02
7	1.2113E 00	7.8868E-01	2.1132E-01	7.8868E-01	7	-9.7789E 00	-9.7756E 00	-1.0174E 01	-1.0174E 01	1.4815E-04	1.4815E-04	-1.2149E-01
8	1.2113E 00	2.1132E-01	2.1132E-01	7.8868E-01	8	-9.7789E 00	-9.7756E 00	-1.0174E 01	-1.0174E 01	1.4815E-04	1.4815E-04	-1.2149E-01
1	2.7887E 00	7.8868E-01	7.8868E-01	7.8868E-01	1	-7.3938E 00	-7.3938E 00	-7.7003E 00	-7.7003E 00	8.3556E-05	8.3556E-05	-1.5158E-02
2	2.7887E 00	2.1132E-01	7.8868E-01	7.8868E-01	2	-7.3938E 00	-7.3938E 00	-7.7003E 00	-7.7003E 00	8.3556E-05	8.3556E-05	-1.5158E-02
3	2.2113E 00	7.8868E-01	7.8868E-01	7.8868E-01	3	-7.7734E 00	-7.7790E 00	-8.1025E 00	-8.1025E 00	2.4979E-03	2.4979E-03	-5.9174E-02
4	2.2113E 00	2.1132E-01	7.8868E-01	7.8868E-01	4	-7.7734E 00	-7.7790E 00	-8.1025E 00	-8.1025E 00	2.4979E-03	2.4979E-03	-5.9174E-02
5	2.7887E 00	7.8868E-01	2.1132E-01	7.8868E-01	5	-7.5548E 00	-7.5509E 00	-7.8595E 00	-7.8595E 00	4.3638E-06	4.3638E-06	-1.5954E-02
6	2.7887E 00	2.1132E-01	2.1132E-01	7.8868E-01	6	-7.5548E 00	-7.5509E 00	-7.8595E 00	-7.8595E 00	4.3638E-06	4.3638E-06	-1.5954E-02
7	2.2113E 00	7.8868E-01	2.1132E-01	7.8868E-01	7	-7.9480E 00	-7.9442E 00	-8.2689E 00	-8.2689E 00	4.3638E-06	4.3638E-06	-1.5954E-02
8	2.2113E 00	2.1132E-01	2.1132E-01	7.8868E-01	8	-7.9480E 00	-7.9442E 00	-8.2689E 00	-8.2689E 00	4.3638E-06	4.3638E-06	-1.5954E-02
1	3.7887E 00	7.8868E-01	7.8868E-01	7.8868E-01	1	-7.7734E 00	-7.7790E 00	-8.1025E 00	-8.1025E 00	8.3556E-05	8.3556E-05	-1.5158E-02
2	3.7887E 00	2.1132E-01	7.8868E-01	7.8868E-01	2	-7.7734E 00	-7.7790E 00	-8.1025E 00	-8.1025E 00	8.3556E-05	8.3556E-05	-1.5158E-02
3	3.2113E 00	7.8868E-01	7.8868E-01	7.8868E-01	3	-7.3938E 00	-7.3938E 00	-7.7003E 00	-7.7003E 00	8.3556E-05	8.3556E-05	-1.5158E-02
4	3.2113E 00	2.1132E-01	7.8868E-01	7.8868E-01	4	-7.3938E 00	-7.3938E 00	-7.7003E 00	-7.7003E 00	8.3556E-05	8.3556E-05	-1.5158E-02
5	3.7887E 00	7.8868E-01	2.1132E-01	7.8868E-01	5	-7.9480E 00	-7.9442E 00	-8.2689E 00	-8.2689E 00	4.3638E-06	4.3638E-06	-1.5954E-02
6	3.7887E 00	2.1132E-01	2.1132E-01	7.8868E-01	6	-7.9480E 00	-7.9442E 00	-8.2689E 00	-8.2689E 00	4.3638E-06	4.3638E-06	-1.5954E-02
7	3.2113E 00	7.8868E-01	2.1132E-01	7.8868E-01	7	-7.5548E 00	-7.5509E 00	-7.8595E 00	-7.8595E 00	4.3638E-06	4.3638E-06	-1.5954E-02
8	3.2113E 00	2.1132E-01	2.1132E-01	7.8868E-01	8	-7.5548E 00	-7.5509E 00	-7.8595E 00	-7.8595E 00	4.3638E-06	4.3638E-06	-1.5954E-02
1	4.7887E 00	7.8868E-01	7.8868E-01	7.8868E-01	1	-9.6305E 00	-9.6337E 00	-1.0032E 01	-1.0032E 01	1.4815E-04	1.4815E-04	-1.2149E-01
2	4.7887E 00	2.1132E-01	7.8868E-01	7.8868E-01	2	-9.6305E 00	-9.6337E 00	-1.0032E 01	-1.0032E 01	1.4815E-04	1.4815E-04	-1.2149E-01
3	4.2113E 00	7.8868E-01	7.8868E-01	7.8868E-01	3	-8.0706E 00	-8.0706E 00	-8.3758E 00	-8.3758E 00	1.4815E-04	1.4815E-04	-9.4224E-02
4	4.2113E 00	2.1132E-01	7.8868E-01	7.8868E-01	4	-8.0706E 00	-8.0706E 00	-8.3758E 00	-8.3758E 00	1.4815E-04	1.4815E-04	-9.4224E-02
5	4.7887E 00	7.8868E-01	2.1132E-01	7.8868E-01	5	-9.4764E 00	-9.4715E 00	-9.8174E 00	-9.8174E 00	1.4815E-04	1.4815E-04	-1.2149E-01
6	4.7887E 00	2.1132E-01	2.1132E-01	7.8868E-01	6	-9.4764E 00	-9.4715E 00	-9.8174E 00	-9.8174E 00	1.4815E-04	1.4815E-04	-1.2149E-01
7	4.2113E 00	7.8868E-01	2.1132E-01	7.8868E-01	7	-8.5362E 00	-8.5329E 00	-8.8814E 00	-8.8814E 00	1.4815E-04	1.4815E-04	-9.4224E-02
8	4.2113E 00	2.1132E-01	2.1132E-01	7.8868E-01	8	-8.5362E 00	-8.5329E 00	-8.8814E 00	-8.8814E 00	1.4815E-04	1.4815E-04	-9.4224E-02

STRESSES AND DIRECT STRAINS FOR FILE NO. 1 AND ITERATION NO. 3

REP	TEMP	LOCAL COORDINATES	Z	XX	YY	ZZ	XX	YY	ZZ	STRESSES	XY	YZ	ZX
1	0	0.50	0.05	1.557E-05	1.174E-05	6.180E-03	-1.208E 01	-1.208E 01	-1.255E 01	0.0606E-04	-0.232E-05	-1.512E-01	-1.512E-01
2	0	0.50	0.05	1.268E-05	7.542E-05	9.213E-03	2.088E 01	2.088E 01	4.462E 00	4.170E-04	-4.389E-05	-1.081E-01	-1.081E-01
3	0	1.50	0.05	2.375E-05	7.952E-05	5.213E-03	6.688E 00	6.688E 00	7.983E 00	0.022E-04	-4.530E-05	-3.457E-02	-3.457E-02
4	0	3.50	0.05	2.375E-05	7.952E-05	5.213E-03	2.668E 00	2.668E 00	7.983E 00	0.014E-04	-5.741E-05	-3.961E-02	-3.961E-02
5	0	5.50	0.05	1.266E-05	7.174E-05	4.187E-03	2.088E 00	2.088E 00	9.464E 00	9.240E-04	7.064E-05	1.008E-01	1.008E-01
6	0	7.50	0.05	1.557E-05	7.174E-05	4.187E-03	1.208E 01	1.208E 01	1.255E 01	0.014E-04	8.509E-05	1.008E-01	1.008E-01
7	0	9.50	0.05	4.248E-05	7.348E-05	1.495E-03	1.208E 00	1.208E 00	1.255E 01	3.403E-05	7.960E-05	-1.527E-01	-1.527E-01
8	0	1.50	0.35	8.596E-05	7.324E-06	1.624E-03	3.591E 00	3.591E 00	9.694E 00	1.122E-05	4.470E-05	1.409E 00	1.409E 00
9	0	3.50	0.35	8.596E-05	7.324E-06	1.624E-03	5.210E 00	5.210E 00	8.367E 00	2.579E-05	4.470E-05	1.409E 00	1.409E 00
10	0	5.50	0.35	8.596E-05	7.324E-06	1.624E-03	3.590E 00	3.590E 00	9.694E 00	5.566E-05	3.725E-05	4.409E 00	4.409E 00
11	0	7.50	0.35	4.248E-05	7.324E-06	1.624E-03	1.208E 00	1.208E 00	1.255E 01	9.177E-05	1.416E-04	1.409E 00	1.409E 00
12	0	9.50	0.35	4.248E-05	7.324E-06	1.624E-03	1.625E-02	1.625E-02	1.135E 01	6.476E-05	2.590E-05	1.409E 00	1.409E 00
13	0	1.50	0.65	2.070E-05	1.160E-05	1.692E-03	1.727E-01	1.727E-01	9.779E 00	1.222E-05	5.960E-05	6.620E-01	6.620E-01
14	0	3.50	0.65	2.070E-05	1.160E-05	1.692E-03	1.587E-01	1.587E-01	4.870E 00	1.222E-05	5.960E-05	6.620E-01	6.620E-01
15	0	5.50	0.65	2.070E-05	1.160E-05	1.692E-03	1.587E-01	1.587E-01	4.870E 00	3.231E-05	1.490E-05	0.801E-01	0.801E-01
16	0	7.50	0.65	2.070E-05	1.160E-05	1.692E-03	1.720E-01	1.720E-01	9.779E 00	1.222E-05	1.490E-05	0.801E-01	0.801E-01
17	0	9.50	0.65	2.070E-05	1.160E-05	1.692E-03	1.449E-02	1.449E-02	1.135E 01	1.222E-05	1.490E-05	0.801E-01	0.801E-01
18	0	1.50	0.95	1.310E-05	1.625E-05	1.768E-03	2.472E-01	2.472E-01	1.074E 01	1.136E-05	2.235E-05	1.222E-01	1.222E-01
19	0	3.50	0.95	1.310E-05	1.625E-05	1.768E-03	1.426E 00	1.426E 00	9.894E 00	1.136E-05	2.235E-05	1.222E-01	1.222E-01
20	0	5.50	0.95	1.310E-05	1.625E-05	1.768E-03	1.426E 00	1.426E 00	9.894E 00	1.136E-05	2.235E-05	1.222E-01	1.222E-01
21	0	7.50	0.95	1.310E-05	1.625E-05	1.768E-03	2.472E-01	2.472E-01	1.074E 01	4.368E-07	5.960E-05	6.620E-01	6.620E-01
22	0	9.50	0.95	1.310E-05	1.625E-05	1.768E-03	1.426E 00	1.426E 00	9.894E 00	4.368E-07	5.960E-05	6.620E-01	6.620E-01
23	0	1.50	1.25	1.068E-05	2.106E-05	1.713E-03	3.430E-01	3.430E-01	1.024E 01	2.485E-05	1.192E-04	7.450E-01	7.450E-01
24	0	3.50	1.25	1.068E-05	2.106E-05	1.713E-03	1.179E 00	1.179E 00	9.751E 00	2.485E-05	1.192E-04	7.450E-01	7.450E-01
25	0	5.50	1.25	1.068E-05	2.106E-05	1.713E-03	1.179E 00	1.179E 00	9.751E 00	2.485E-05	1.192E-04	7.450E-01	7.450E-01
26	0	7.50	1.25	1.068E-05	2.106E-05	1.713E-03	3.430E-01	3.430E-01	1.024E 01	2.485E-05	1.192E-04	7.450E-01	7.450E-01
27	0	9.50	1.25	1.068E-05	2.106E-05	1.713E-03	1.179E 00	1.179E 00	9.751E 00	2.485E-05	1.192E-04	7.450E-01	7.450E-01
28	0	1.50	1.55	2.706E-05	2.577E-05	1.660E-03	4.048E-02	4.048E-02	1.069E 01	1.171E-05	7.451E-05	1.222E-01	1.222E-01
29	0	3.50	1.55	2.706E-05	2.577E-05	1.660E-03	4.048E-02	4.048E-02	1.069E 01	1.171E-05	7.451E-05	1.222E-01	1.222E-01
30	0	5.50	1.55	2.706E-05	2.577E-05	1.660E-03	4.048E-02	4.048E-02	1.069E 01	1.171E-05	7.451E-05	1.222E-01	1.222E-01
31	0	7.50	1.55	2.706E-05	2.577E-05	1.660E-03	4.048E-02	4.048E-02	1.069E 01	1.171E-05	7.451E-05	1.222E-01	1.222E-01
32	0	9.50	1.55	2.706E-05	2.577E-05	1.660E-03	4.048E-02	4.048E-02	1.069E 01	1.171E-05	7.451E-05	1.222E-01	1.222E-01
33	0	1.50	1.85	2.841E-05	2.626E-05	1.664E-03	3.210E-01	3.210E-01	1.069E 01	2.049E-05	1.222E-01	1.222E-01	1.222E-01
34	0	3.50	1.85	2.841E-05	2.626E-05	1.664E-03	1.176E 00	1.176E 00	9.949E 00	2.049E-05	1.222E-01	1.222E-01	1.222E-01
35	0	5.50	1.85	2.841E-05	2.626E-05	1.664E-03	1.176E 00	1.176E 00	9.949E 00	2.049E-05	1.222E-01	1.222E-01	1.222E-01
36	0	7.50	1.85	2.841E-05	2.626E-05	1.664E-03	3.211E-01	3.211E-01	1.069E 01	2.049E-05	1.222E-01	1.222E-01	1.222E-01

FROM GETTAB
NAME # LOADS * 1/0 UNIT # 9. FILE # 1. ROWS # 1. COLUMNS # 1
FROM GETTAB
NAME # NAME * 1/0 UNIT # 10. FILE # 2. ROWS # 42. COLUMNS # 1
FROM GETTAB
NAME # DEFLECT * 1/0 UNIT # 10. FILE # 2. ROWS # 57. COLUMNS # 1
FROM PUTTAB
NAME # DEFLECT * 1/0 UNIT # 10. FILE # 1. ROWS # 57. COLUMNS # 1
FROM SMAIN. AFTER LOCDEF
***** ELAPSED TIME IS ***** 0 MINUTES. 2.422 SECONDS *****
***** INCREMENTAL TIME IS ***** 0.0 MINUTES. 1.027 SECONDS *****

TOP-PIN PLATE MEMBER STRAINS AND STRESSES FOR ITERATION NO. 3

MEMBER	X	COORDINATES	Y	U	V	W	STRAINS	EPS X	EPS Y	EPS XY	SIG X	SIG Y	SIG XY
1	5.0000E-01	5.0000E-01	5.0000E-01	-2.07638E-05	0.01588E-06	-2.07638E-05	0.01588E-06	-2.07638E-05	0.01588E-06	-2.07638E-05	-2.7949E 02	-3.6671E 00	-3.0405E-02
2	1.5000E 00	5.0000E-01	5.0000E-01	-7.01207E-05	2.1007E-07	-7.01207E-05	2.1007E-07	-7.01207E-05	2.1007E-07	-7.01207E-05	-7.01207E 02	3.0405E 00	-6.0510E-03
3	2.5000E 00	5.0000E-01	5.0000E-01	-9.01011E-05	2.07599E-05	-9.01011E-05	2.07599E-05	-9.01011E-05	2.07599E-05	-9.01011E-05	-9.01011E 02	3.0244E 00	-9.02034E-04
4	3.5000E 00	5.0000E-01	5.0000E-01	-9.01012E-05	2.07599E-05	-9.01012E-05	2.07599E-05	-9.01012E-05	2.07599E-05	-9.01012E-05	-9.01012E 02	3.0244E 00	1.4362E-03
5	4.5000E 00	5.0000E-01	5.0000E-01	-7.01210E-05	2.1007E-07	-7.01210E-05	2.1007E-07	-7.01210E-05	2.1007E-07	-7.01210E-05	-7.01210E 02	3.0405E 00	5.01624E-04
6	5.5000E 00	5.0000E-01	5.0000E-01	-2.07640E-05	1.0170E-06	-2.07640E-05	1.0170E-06	-2.07640E-05	1.0170E-06	-2.07640E-05	-2.07640E 02	-3.6797E 00	-3.0051E-03

FROM GETDIM. I/O UNIT # 1. FILE # 1. ROWS # 14. COLUMNS # 11

FROM GETDIM. I/O UNIT # 10. FILE # 2. ROWS # 57. COLUMNS # 1

ORIGINAL PAGE IS
OF POOR QUALITY

BOTTOM-POINT PLATE MEMBER STRAINS AND STRESSES FOR ITERATION NO. 3

MEMBER	X	COORDINATE	Y	EPS X	STRAINS EPS Y	EPS XY	SIG X	STRESSES SIG Y	SIG XY
1	5.0000E-01	5.0000E-01	5.0000E-01	4.0059E-05	-7.0082E-06	-4.0040E-09	2.6620E 02	6.0037E 00	-3.0170E-02
2	1.5000E 00	5.0000E-01	5.0000E-01	7.0141E-05	-2.0179E-06	-1.0721E-09	7.0137E 02	-1.0755E 00	-1.02301E-02
3	2.5000E 00	5.0000E-01	5.0000E-01	9.0124E-05	-2.0179E-06	-9.0035E-12	9.01161E 02	-1.0685E 00	-5.04310E-05
4	3.5000E 00	5.0000E-01	5.0000E-01	9.0124E-05	-2.0179E-06	-5.0151E-11	9.01161E 02	-1.0605E 00	-9.02180E-04
5	4.5000E 00	5.0000E-01	5.0000E-01	7.0142E-05	-2.0179E-06	-1.0009E-09	7.01375E 02	-1.0670E 00	9.06675E-03
6	5.5000E 00	5.0000E-01	5.0000E-01	4.0059E-05	-7.0082E-06	-1.0319E-09	2.6622E 02	6.0048E 00	9.07111E-03

FROM MAIN, AFTER MAIN - STACK STIFFNESS SOLV FOR DEFLECT.
 ***** ELAPSED TIME IS 0.000000 *****
 ***** INCREMENTAL TIME IS 0.00 *****

FROM MAIN, AFTER MAIN - STRENGTH ANALYSIS
 ***** ELAPSED TIME IS 0.000000 *****
 ***** INCREMENTAL TIME IS 0.00 *****

C. 2

OPTIMUMS

MODE NO. = 1

NO. REORTHOGONALIZATIONS = 1

NO. DESIRED MODES = 3

FREE VIBRATION MODES

CONVERGENCE PARAMETER = 5.0000E-02

MAXIMUM NO. ITERATIONS = 2

3.0000E-01

OVERHUNG ROTATORY MASS INERTIA ASSOCIATED WITH EACH STRINGER =

PRIMARY STRUCTURE PLATE STRESSES PRESENTED AFTER EACH ITERATION AT PLATE MID, TOP AND BOTTOM SURFACES

STRINGER STRESSES PRESENTED AFTER EACH ITERATION

TILES ON PRIMARY STRUCTURE

TILE STRESSES PRESENTED AFTER EACH ITERATION

TILE NODE MAP REQUIRED

TILE ELEMENT MAP REQUIRED

TILE NODE COORDINATES REQUIRED

DO NOT PRINT ELEMENT STIFFNESS MATRICES

DO NOT PRINT ASSEMBLED STIFFNESS MATRICES

PRINT FILE DEBUGGING INFORMATION

-COMPUTE STRESSES FOR ALL TILES

GEOMETRY

PLATE
 LX = 1.0000E 01
 LY = 1.0000E 01
 TP = 2.5000E-01
 AS = 1.0000E-01
 STRINGERS
 Y1 = 1.0000E-01
 ZS = 5.0000E-01
 YS = 4.0000E 00
 YV = 2.0000E-02
 IZ = 2.0000E-02
 JX = 5.0000E-03
 Y2 = 1.8000E 00
 TBAR = 1.0000E-02
 TILES
 NXB = 2
 MYR = 1
 T = 0.0
 B1 = 0.0
 TA = 1.0000E 00
 T1 = 1.0000E-01
 T2 = 2.0000E 00
 T3 = 1.0000E-02
 NB1 = 0
 NB2 = 1
 NT1 = 0
 NT2 = 1
 ND2 = 9
 BRICK
 EP = 1.0000E 07
 ES = 1.0000E 07
 EX = 6.0000E 04
 NU XY = 5.0000E-01
 GXY = 2.0000E 04
 GAMMA A = 5.0000E-03
 ALPHA X = 0.0
 EY = 9.0000E 01
 NU XY = 4.9000E-01
 GXY = 3.0201E 01
 GAMMA I = 3.5000E-02
 GAMMA R = 5.0000E-03
 ALPHA RY / ALPHA RX = 0.0
 ALPHA P = 0.0
 ALPHA S = 0.0
 EZ = 6.0000E 03
 NU ZX = 1.0000E-02
 GZX = 3.2000E 04
 ALPHA Z = 0.0
 EZ = 9.0000E 01
 NU ZX = 4.9000E-01
 GZX = 3.0201E 01
 ALPHA RZ / ALPHA RX = 0.0

MATERIAL PROPERTIES

PLATE
 EP = 1.0000E 07
 ES = 1.0000E 07
 EX = 6.0000E 04
 NU XY = 5.0000E-01
 GXY = 2.0000E 04
 GAMMA A = 5.0000E-03
 ALPHA X = 0.0
 EY = 9.0000E 01
 NU XY = 4.9000E-01
 GXY = 3.0201E 01
 GAMMA I = 3.5000E-02
 GAMMA R = 5.0000E-03
 ALPHA RY / ALPHA RX = 0.0
 STRINGERS
 EP = 1.0000E 07
 ES = 1.0000E 07
 EX = 6.0000E 04
 NU XY = 5.0000E-01
 GXY = 2.0000E 04
 GAMMA A = 5.0000E-03
 ALPHA X = 0.0
 EY = 9.0000E 01
 NU XY = 4.9000E-01
 GXY = 3.0201E 01
 GAMMA I = 3.5000E-02
 GAMMA R = 5.0000E-03
 ALPHA RY / ALPHA RX = 0.0
 ARRESTOR
 OR RSI
 ISOLATOR
 RSI

TEMPERATURE DEPENDENT MATERIAL PROPERTIES

	TEMPERATURE	PROPERTY	TEMPERATURE	PROPERTY	TEMPERATURE	PROPERTY	TEMPERATURE	PROPERTY
1	ER	ALL	6.000E 04					
1	ER*	ALL	6.000E 03					
1	GR*	ALL	3.200E 04					
1	NU R	ALL	5.000E-01					
1	NU R*	ALL	1.000E-02					
1	ALPHA R	ALL	0.0					
1	EC	ALL	1.200E 07					
1	NU C	ALL	2.500E-01					
1	ALPHA C	ALL	0.0					

FROM OUTLAB.
 NAME = GEOMETRY, I/O UNIT = 10, FILE = 1, ROWS = 51, COLUMNS = 5

BOUNDARY CONDITIONS

EDGE	PLATE OUT OF PLANE	PLATE IN PLANE	STRINGERS
A	PINNED	FREE	FREE
B	PINNED	U HELD, V FREE	FREE
C	FREE	FREE	FREE
D	FREE	V HELD, U FREE	FREE

FROM PUTLAB.
 NAME = BND COND. 1/0 UNIT = 1. FILE = 1. ROWS = 51. COLUMNS = 11

FROM PUTLAB.
 NAME = MEMBERS. 1/0 UNIT = 17. FILE = 1. ROWS = 36. COLUMNS = 100

FROM PUTLAB.
 NAME = LOADS. 1/0 UNIT = 3. FILE = 1. ROWS = 162. COLUMNS = 1

FROM PUTLAB.
 NAME = LOADS. 1/0 UNIT = 4. FILE = 1. ROWS = 39. COLUMNS = 6

FROM PUTLAB.
 NAME = LOADS. 1/0 UNIT = 1. FILE = 2. ROWS = 3. COLUMNS = 1000

ORIGINAL PAGE IS
 OF POOR QUALITY

R S I T E M P E R A T U R E S

NO STATIC THERMAL LOADING

UNIFORM TEMPERATURE OPTION

T REFERENCE = 0.0

DEL T U = T - T REF = 0.0

FROM PUTLAB. I/O UNIT = 7. FILE = 1. ROWS = 27. COLUMNS = 81
NAME = JEGENV06.

N O D E M A P

SURFACE 1

70	80
69	79
68	78
67	77
66	76
65	75
64	74
63	73
62	72
61	71

ORIGINAL PAGE IS
OF POOR QUALITY

N O D E M A P
S U R F A C E 4

10	20
9	19
8	18
7	17
6	16
5	15
4	14
3	13
2	12
1	11

TEMPERATURE

LOCAL TILE COORDINATES

MODE

MODE	X	Y	Z	TEMPERATURE
1	0.0	0.0	0.0	0.0
2	0.0	1.1111E 00	0.0	0.0
3	0.0	2.2222E 00	0.0	0.0
4	0.0	3.3333E 00	0.0	0.0
5	0.0	4.4444E 00	0.0	0.0
6	0.0	5.5555E 00	0.0	0.0
7	0.0	6.6666E 00	0.0	0.0
8	0.0	7.7777E 00	0.0	0.0
9	0.0	8.8888E 00	0.0	0.0
10	0.0	1.0000E 01	0.0	0.0
11	5.0000E 00	0.0	0.0	0.0
12	5.0000E 00	1.1111E 00	0.0	0.0
13	5.0000E 00	2.2222E 00	0.0	0.0
14	5.0000E 00	3.3333E 00	0.0	0.0
15	5.0000E 00	4.4444E 00	0.0	0.0
16	5.0000E 00	5.5555E 00	0.0	0.0
17	5.0000E 00	6.6666E 00	0.0	0.0
18	5.0000E 00	7.7777E 00	0.0	0.0
19	5.0000E 00	8.8888E 00	0.0	0.0
20	5.0000E 00	1.0000E 01	0.0	0.0
21	0.0	0.0	1.0000E-01	0.0
22	0.0	1.1111E 00	1.0000E-01	0.0
23	0.0	2.2222E 00	1.0000E-01	0.0
24	0.0	3.3333E 00	1.0000E-01	0.0
25	0.0	4.4444E 00	1.0000E-01	0.0
26	0.0	5.5555E 00	1.0000E-01	0.0
27	0.0	6.6666E 00	1.0000E-01	0.0
28	0.0	7.7777E 00	1.0000E-01	0.0
29	0.0	8.8888E 00	1.0000E-01	0.0
30	0.0	1.0000E 01	1.0000E-01	0.0
31	5.0000E 00	0.0	1.0000E-01	0.0
32	5.0000E 00	1.1111E 00	1.0000E-01	0.0
33	5.0000E 00	2.2222E 00	1.0000E-01	0.0
34	5.0000E 00	3.3333E 00	1.0000E-01	0.0
35	5.0000E 00	4.4444E 00	1.0000E-01	0.0
36	5.0000E 00	5.5555E 00	1.0000E-01	0.0
37	5.0000E 00	6.6666E 00	1.0000E-01	0.0
38	5.0000E 00	7.7777E 00	1.0000E-01	0.0
39	5.0000E 00	8.8888E 00	1.0000E-01	0.0
40	5.0000E 00	1.0000E 01	1.0000E-01	0.0
41	0.0	0.0	1.1000E 00	0.0
42	0.0	1.1111E 00	1.1000E 00	0.0
43	0.0	2.2222E 00	1.1000E 00	0.0
44	0.0	3.3333E 00	1.1000E 00	0.0
45	0.0	4.4444E 00	1.1000E 00	0.0
46	0.0	5.5555E 00	1.1000E 00	0.0
47	0.0	6.6666E 00	1.1000E 00	0.0
48	0.0	7.7777E 00	1.1000E 00	0.0
49	0.0	8.8888E 00	1.1000E 00	0.0
50	0.0	1.0000E 01	1.1000E 00	0.0

ORIGINAL PAGE IS
OF POOR QUALITY

PRIMARY STRUCTURE

GLOBAL GEOMETRY

DEGREES OF FREEDOM

NODE	DX	DY	DZ	RX	RY	RZ
1	1	2	0	3	4	0
2	10	11	0	12	13	0
3	14	15	0	16	17	0
4	18	19	0	20	21	0
5	22	23	0	24	25	0
6	26	27	0	28	29	0
7	30	31	0	32	33	0
8	34	35	0	36	37	0
9	38	39	0	40	41	0
10	42	43	0	44	45	0
11	46	47	0	48	49	0
12	50	51	0	52	53	0
13	54	55	0	56	57	0
14	58	59	0	60	61	0
15	62	63	0	64	65	0
16	66	67	0	68	69	0
17	70	71	0	72	73	0
18	74	75	0	76	77	0
19	78	79	0	80	81	0
20	82	83	0	84	85	0
21	86	87	0	88	89	0
22	90	91	0	92	93	0
23	94	95	0	96	97	0
24	98	99	0	100	101	0
25	102	103	0	104	105	0
26	106	107	0	108	109	0
27	110	111	0	112	113	0
28	114	115	0	116	117	0
29	118	119	0	120	121	0
30	122	123	0	124	125	0
31	126	127	0	128	129	0
32	130	131	0	132	133	0
33	134	135	0	136	137	0
34	138	139	0	140	141	0
35	142	143	0	144	145	0
36	146	147	0	148	149	0
37	150	151	0	152	153	0
38	154	155	0	156	157	0
39	158	159	0	160	161	0
40	162	163	0	164	165	0
41	166	167	0	168	169	0
42	170	171	0	172	173	0
43	174	175	0	176	177	0
44	178	179	0	180	181	0
45	182	183	0	184	185	0
46	186	187	0	188	189	0
47	190	191	0	192	193	0
48	194	195	0	196	197	0
49	198	199	0	200	201	0
50	202	203	0	204	205	0
51	206	207	0	208	209	0

FROM GETDIM.
 NAME = 14. FILE = 1. ROWS = 162. COLUMNS = 1
 FROM GETDIM.
 NAME = VT 1.0 UNIT = 2. FILE = 7. ROWS = 1. COLUMNS = 162
 FROM GETDIM.
 NAME = VT 1.0 UNIT = 2. FILE = 7. ROWS = 1. COLUMNS = 162
 FROM GETDIM.
 NAME = VT 1.0 UNIT = 2. FILE = 1. ROWS = 1. COLUMNS = 162
 FROM GETDIM.
 NAME = VT 1.0 UNIT = 2. FILE = 2. ROWS = 1. COLUMNS = 162
 FROM GETDIM.
 NAME = VT 1.0 UNIT = 2. FILE = 3. ROWS = 1. COLUMNS = 162
 FROM GETDIM.
 NAME = VT 1.0 UNIT = 2. FILE = 4. ROWS = 1. COLUMNS = 162
 FROM GETDIM.
 NAME = VT 1.0 UNIT = 2. FILE = 5. ROWS = 1. COLUMNS = 162
 FROM GETDIM.
 NAME = VT 1.0 UNIT = 2. FILE = 6. ROWS = 1. COLUMNS = 162
 FROM GETDIM.
 NAME = VT 1.0 UNIT = 2. FILE = 7. ROWS = 1. COLUMNS = 162
 FROM PUTLAB.
 NAME = 9. FILE = 2. ROWS = 3. COLUMNS = 8

MODE NUMBER	FREQ. (RAD / SEC)	FREQUENCY (HERTZ)	FREQ. SORD. (PERCENT)
1	4.709976E 02	7.450158E 01	3.589739E-04
2	5.008137E 02	7.970697E 01	2.090346E-03
3	5.809937E 02	9.246800E 01	4.275488E-02
4	6.504786E 02	1.035262E 02	7.602181E-01
5	6.551184E 02	1.042653E 02	2.213668E-01

FROM PUTLAB.
 NAME = 14. FILE = 1. ROWS = 3. COLUMNS = 7
 FROM GETDIM.
 NAME = VT 1.0 UNIT = 14. FILE = 1. ROWS = 3. COLUMNS = 7
 FROM GETDIM.
 NAME = GT 1.0 UNIT = 12. FILE = 1. ROWS = 7. COLUMNS = 162
 FROM PUTLAB.
 NAME = GO 0A C. 1.0 UNIT = 11. FILE = 1. ROWS = 3. COLUMNS = 162
 FROM GETDIM.
 NAME = GO 0A C. 1.0 UNIT = 11. FILE = 1. ROWS = 3. COLUMNS = 162

PRIMARY STRUCTURE MODE SHAPE 1 ITERATION NO. 0

NODE	DX	DY	DZ	RX	RY	RZ
1	4.919000E-03	-1.678681E-03	-2.680329E-01	-2.942944E-04	7.682043E-03	-
2	4.084107E-03	-1.411957E-03	-2.495006E-01	3.290614E-04	7.425910E-02	-
3	4.074112E-03	-1.144710E-03	-2.387212E-01	2.394555E-04	7.221657E-02	-
4	3.745260E-03	-9.481291E-04	-2.57519E-01	1.063764E-04	7.108957E-02	-
5	4.106555E-03	-8.362408E-04	-2.285586E-01	8.907168E-05	7.044405E-02	-
6	4.086575E-03	-6.735038E-04	-2.285184E-01	-8.304053E-05	7.043169E-02	-
7	3.702899E-03	-5.37932E-04	-2.316149E-01	-1.953284E-04	7.105978E-02	-
8	3.95493E-03	-4.12716E-04	-2.384981E-01	-2.363409E-04	7.217294E-02	-
9	3.875989E-03	-1.966608E-04	-2.493345E-01	-2.940050E-04	7.420178E-02	-
10	4.563630E-03	-	-2.677398E-01	-	7.675540E-02	-
11	2.097168E-03	-8.901584E-04	-2.680329E-01	2.344633E-02	-3.134768E-08	-
12	2.131586E-03	-8.291784E-04	-2.495006E-01	1.402737E-02	-1.744086E-08	-
13	2.041864E-03	-7.071237E-04	-2.387212E-01	8.703039E-03	5.209143E-08	-
14	2.031667E-03	-6.627597E-04	-2.57519E-01	5.108858E-03	1.575964E-07	-
15	1.960457E-03	-6.208771E-04	-2.285586E-01	1.541893E-03	1.842143E-07	-
16	1.945788E-03	-4.772986E-04	-2.285184E-01	-1.453199E-03	1.524410E-07	-
17	1.826003E-03	-3.251850E-04	-2.316149E-01	-5.004666E-03	9.771708E-08	-
18	1.959547E-03	-3.251850E-04	-2.384981E-01	-8.637246E-03	1.210317E-07	-
19	2.005836E-03	-1.698416E-04	-2.493345E-01	-1.394677E-02	8.570913E-08	-
20	1.926900E-03	-1.053311E-04	-2.677398E-01	-2.341651E-02	4.749148E-08	-
21	-	-1.19252E-03	-	-2.939166E-04	-7.682115E-02	-
22	-	-9.815630E-04	-	3.291129E-04	-7.425970E-02	-
23	-	-7.683657E-04	-	2.395659E-04	-7.221717E-02	-
24	-	-6.721639E-04	-	1.064152E-04	-7.109010E-02	-
25	-	-5.628871E-04	-	8.922491E-05	-7.04441E-02	-
26	-	-4.461078E-04	-	-8.316951E-05	-7.043225E-02	-
27	-	-4.064254E-04	-	-1.048868E-04	-7.106000E-02	-
28	-	-3.310554E-04	-	-2.362609E-04	-7.217282E-02	-
29	-	-1.549540E-04	-	2.941429E-04	-7.420152E-02	-
30	-	-	-	-	-7.675517E-02	-
31	-	-	-	-	-	-
32	-3.482082E-03	-8.99037E-04	1.75957E-02	2.289671E-02	1.324103E-01	-
33	-9.391796E-03	-7.365609E-04	3.793820E-03	6.920351E-05	1.126416E-01	-
34	-3.630102E-03	-6.871806E-04	1.737801E-02	-2.091876E-02	1.321325E-01	-
35	2.142476E-03	5.162228E-03	-2.696783E-01	-7.941522E-03	-7.358296E-07	-
36	1.988815E-03	5.415280E-04	-2.315412E-01	4.402724E-06	-1.806144E-06	-
37	2.021304E-03	-6.195616E-03	-2.692632E-01	7.128641E-03	-2.998483E-06	-
38	7.812794E-03	-4.809673E-04	1.747533E-02	2.083176E-02	-1.323642E-01	-
39	1.361105E-02	-5.309936E-04	3.766571E-03	1.038217E-06	-1.126223E-01	-
40	7.719863E-03	-6.472273E-04	1.732934E-02	-2.111608E-02	-1.320969E-01	-

ORIGINAL PAGE IS
OF POOR QUALITY

PRIMARY STRUCTURE MIDF. SHAPE 2 ITERATION NO. 0

NODE	DX	DY	DZ	RX	RY	RZ
1	-6.849359E-03	2.190239E-03		2.617500E-03	-7.034682E-02	
2	-3.123762E-03	1.676513E-03		-2.747379E-03	-5.914012E-02	
3	-2.340957E-03	1.121387E-03		-3.563060E-03	-4.378933E-02	
4	-1.167115E-03	9.893046E-04		-3.560045E-03	-2.755198E-02	
5	2.878833E-04	7.504032E-04		-4.871336E-03	9.572677E-03	
6	7.095281E-04	5.275749E-04		-6.873313E-03	9.855520E-03	
7	1.487008E-03	3.142832E-04		-3.564462E-03	2.783487E-02	
8	2.448856E-03	-2.489719E-05		-3.564462E-03	4.407348E-02	
9	2.468306E-03	2.637331E-05		-2.743658E-03	5.942281E-02	
10	4.037179E-03			2.823395E-02	7.063395E-02	
11	-1.710632E-03	-5.561649E-04	3.482147E-01	-8.466661E-02	3.857933E-07	
12	-1.428446E-03	-6.90750E-04	2.706286E-01	-7.299274E-02	6.701354E-07	
13	-9.322513E-04	-3.600168E-04	1.983790E-01	-7.625324E-02	1.348645E-06	
14	-4.660434E-04	-1.585163E-04	1.191365E-01	-8.246887E-02	1.973407E-06	
15	3.577724E-05	1.085944E-04	3.641567E-02	-8.041823E-02	2.362180E-06	
16	4.817040E-04	-5.182569E-05	-3.943433E-02	-6.037889E-02	2.122481E-06	
17	9.171893E-04	1.424729E-05	-1.200892E-01	-8.239686E-02	1.918270E-06	
18	1.238738E-03	2.243614E-04	-1.992781E-01	-7.623649E-02	1.698577E-06	
19	1.506382E-03	5.325566E-05	-2.715546E-01	-7.305592E-02	1.469363E-06	
20	1.461302E-03		-3.492326E-01	-8.478177E-02	1.219348E-06	
21	-1.105369E-03	-1.105369E-03		2.819831E-03	7.034189E-02	
22	-1.497205E-03	-1.497205E-03		-2.746097E-03	5.913816E-02	
23	-1.905987E-03	-1.905987E-03		-3.364791E-03	4.378918E-02	
24	-1.829202E-03	-1.829202E-03		-3.560601E-03	2.755109E-02	
25	-1.786382E-03	-1.786382E-03		-4.870985E-03	9.572532E-03	
26	-1.648711E-03	-1.648711E-03		-4.875410E-03	-9.856660E-03	
27	-1.420960E-03	-1.420960E-03		-3.564668E-03	-2.783646E-02	
28	-1.236074E-03	-1.236074E-03		-3.365011E-03	-4.407473E-02	
29	-5.923453E-04	-5.923453E-04		-2.823716E-03	-5.942385E-02	
30					-7.063478E-02	
31	4.182588E-03	-9.196824E-04	-4.253948E-02	-1.182591E-01	-1.777000E-01	
32	1.992079E-04	-2.785766E-03	-1.037227E-04	-4.23771E-02	2.069016E-04	
33	-4.257739E-03	-2.504498E-03	4.131025E-02	-1.103268E-01	1.774374E-01	
34	-1.516406E-03	-3.153683E-02	3.145481E-01	3.740518E-02	7.183908E-06	
35	2.091186E-04	-3.177073E-02	-5.012995E-04	-3.270023E-02	-6.138333E-07	
36	1.550204E-03	-3.116889E-02	-3.151742E-01	3.558556E-02	-7.593579E-05	
37	-7.338256E-03	-4.00994E-03	-4.233499E-02	-1.029906E-01	1.775679E-01	
38	1.500498E-04	-5.00990E-03	4.602838E-05	-4.149028E-02	-3.117353E-04	
39	7.395574E-03	-3.111151E-03	4.290842E-02	-1.073307E-01	-1.781082E-01	

ORIGINAL PAGE IS
OF POOR QUALITY

PRIMARY STRUCTURE MODE SHAPE 3 ITERATION NO. 0

NODE	DX	DY	DZ	RX	RY	RZ
1	1.440772E-03	-1.119106E-03		-4.570793E-03	5.573226E-03	
2	1.624142E-04	-4.370969E-04		2.624766E-03	-1.100598E-02	
3	-5.472475E-04	2.891463E-04		1.690917E-03	-3.225750E-02	
4	-1.165792E-03	1.625708E-04		-1.468539E-03	-4.883947E-02	
5	-2.147410E-03	1.447766E-04		-1.348339E-03	-5.723066E-02	
6	-2.194189E-03	-6.905717E-04		1.341424E-03	-5.721913E-02	
7	-1.314473E-03	-7.647618E-04		1.446157E-03	-4.881894E-02	
8	-9.433046E-04	-1.002437E-03		-1.670264E-03	-3.214024E-02	
9	-3.857373E-04	-4.469284E-04		-2.654737E-03	-1.042544E-02	
10	4.624191E-04			4.554048E-03	5.832419E-03	
11	-3.371746E-05	9.339531E-04	-1.726429E-01	1.321144E-01	1.567243E-05	
12	-1.11062E-04	3.12314E-04	-4.48293E-02	1.252103E-01	2.567162E-05	
13	-3.403467E-04	-2.92592E-04	6.14073E-01	1.305479E-01	4.465578E-05	
14	-5.688309E-04	-1.051877E-04	2.110773E-01	1.194575E-01	6.390520E-05	
15	-6.459360E-04	-1.051877E-04	3.025250E-01	5.086674E-02	7.540513E-05	
16	-6.751809E-04	6.938358E-04	3.025250E-01	-5.194684E-02	6.996800E-05	
17	-6.643559E-04	7.467316E-04	2.107910E-01	-1.196698E-01	6.996800E-05	
18	-5.255986E-04	9.813425E-04	8.096701E-02	-1.312417E-01	5.758189E-05	
19	-4.110897E-04	4.211799E-04	-4.562734E-02	-1.255683E-01	5.143791E-05	
20	-4.555786E-04		-1.739107E-01	-1.326334E-01	4.390840E-05	
21		2.561873E-04		-4.496794E-03	-5.699601E-03	
22		8.055761E-04		2.647607E-02	1.093957E-02	
23		1.382763E-03		1.648316E-03	3.221468E-02	
24		1.058621E-03		-1.483899E-03	4.884711E-02	
25		8.149024E-04		-1.333982E-03	5.720918E-02	
26		-2.403597E-04		1.281461E-03	5.717062E-02	
27		-5.068167E-04		1.492866E-03	4.875606E-02	
28		-8.832654E-04		-1.691775E-03	3.208101E-02	
29		-4.004922E-04		-2.644882E-03	1.076647E-02	
30				4.564971E-03	-5.889494E-03	
31		3.031941E-04				
32		1.437840E-02	6.217049E-02	1.891831E-01	1.112527E-01	
33		-1.087855E-04	-3.312555E-05	7.198621E-05	-2.592007E-01	
34		-2.687154E-05	6.217049E-02	-1.841928E-01	1.114822E-01	
35		-8.243183E-04	6.217049E-02			
36		-3.239524E-04	6.217049E-02			
37		-2.398443E-04	-1.078506E-01	-6.197943E-02	-2.552111E-05	
38		-1.622823E-02	3.30413E-01	-8.017979E-05	1.048351E-05	
39		-4.348725E-04	-1.005351E-01	5.973361E-02	-2.520144E-05	
			6.211504E-02	1.831902E-01	-1.110014E-01	
			-3.340165E-02	-1.009931E-04	2.582830E-01	
			6.200704E-02	-1.844091E-01	-1.113570E-01	

FROM SGMJIN, AFTER ALANM
 ***** ELAPSED TIME IS ***** 0 MINUTES, 22.80 SECONDS *****
 ***** INCREMENTAL TIME IS ***** 0 MINUTES, 11.23 SECONDS *****

FROM GETDIM,
 NAME = EL MASS, I/O UNIT = 8, FILE = 1, ROWS = 66, COLUMNS = 24
 FROM PUTLAB.

TPS DISPLACEMENTS FOR TILE NO. 1 AND ITERATION NO. 1

NODE	X COMPONENT (U)	Y COMPONENT (V)	Z COMPONENT (W)
1	1.4521554E-02	-1.6418539E-03	0.0
2	1.3366494E-02	-1.4530898E-03	0.0
3	1.3101183E-02	-1.1746674E-03	0.0
4	1.2651455E-02	-1.0014221E-03	0.0
5	1.2912061E-02	-8.4737455E-04	0.0
6	1.2890559E-02	-6.6312123E-04	0.0
7	1.2585368E-02	-5.2477000E-04	0.0
8	1.2976561E-02	-3.8372888E-04	0.0
9	1.3151206E-02	-1.5605979E-04	0.0
10	1.4158055E-02	-3.6756629E-05	-2.6803291E-01
11	2.0971824E-03	-3.9209463E-03	-2.6940064E-01
12	2.1315834E-03	-2.6824099E-03	-2.372119E-01
13	2.041898E-03	-1.9856035E-03	-2.317519E-01
14	2.0316944E-03	-1.4013601E-03	-2.285584E-01
15	1.9604799E-03	-8.1361365E-04	-2.5951843E-01
16	1.9458069E-03	-3.0102325E-04	-2.5741489E-01
17	1.9856184E-03	9.091391E-04	-2.3194989E-01
18	1.9695678E-03	1.6442654E-03	-2.4933445E-01
19	2.0054665E-03	2.9276635E-03	-2.677977E-01
20	1.9258959E-03	1.0689202E-03	-1.0676635E-03
21	1.7894724E-02	1.0109272E-03	-1.1568845E-04
22	1.8852181E-02	7.2293172E-04	4.8008092E-04
23	1.8799594E-02	2.2083168E-04	8.5003818E-04
24	1.8227474E-02	-1.2266904E-04	1.0329369E-03
25	1.8197367E-02	-1.160920E-03	1.0372908E-03
26	1.490297E-02	-1.7609710E-03	8.6393929E-04
27	1.4796095E-02	-2.2557629E-03	5.0398335E-04
28	1.3741647E-02	-4.7174969E-03	-9.1166741E-05
29	1.3506987E-02	2.3567357E-03	-1.0212384E-03
30	1.3631355E-02	3.567357E-03	-2.5761354E-01
31	1.4170822E-02	2.5656536E-03	-2.4827802E-01
32	1.5245069E-02	1.2458430E-03	-2.4012083E-01
33	1.6090564E-02	3.6121419E-05	-2.3470795E-01
34	1.6526927E-02	-1.1945327E-03	-2.3207068E-01
35	1.6497360E-02	-1.1945327E-03	-2.3203206E-01
36	1.5995744E-02	-2.4030586E-03	-2.3459196E-01
37	1.5083637E-02	-3.5241782E-03	-2.3993725E-01
38	1.3936576E-02	-4.5141764E-03	-2.4804688E-01
39	1.3517052E-02	-5.8703721E-03	-2.5734198E-01
40	6.343376E-02	6.972788E-05	-1.1213662E-03
41	6.3240051E-02	4.8966380E-05	-7.9698457E-06
42	6.3074350E-02	-2.737016E-04	1.9070492E-03
43	6.3002586E-02	-4.9270166E-05	1.9070492E-03
44	6.2956691E-02	-5.9890025E-04	2.3576319E-03
45	6.2920034E-02	-9.611232E-04	2.3691989E-03
46	6.2897281E-02	-1.2871982E-03	1.9422688E-03
47	6.2888884E-02	-1.5137123E-03	1.1389153E-03
48	6.2976360E-02	-1.6150840E-03	7.9161438E-05
49	6.3080967E-02	-1.6390858E-03	-1.0066775E-03
50			

TPS DISPLACEMENTS FOR TILE NO. 1 AND ITERATION NO. 1

NODE	X COMPONENT(U)	Y COMPONENT(V)	Z COMPONENT(W)
51	6.3418805E-02	-5.5278535E-04	-2.4607307E-01
52	6.3360274E-02	-9.1702491E-04	-2.43657160E-01
53	6.3405454E-02	-1.0075432E-03	-2.4102080E-01
54	6.3535988E-02	-8.7207289E-04	-2.3875445E-01
55	6.3417170E-02	-6.9233368E-04	-2.3748064E-01
56	6.3580455E-02	-5.1712237E-04	-2.3667114E-01
57	6.3525422E-02	-3.3564599E-04	-2.408722E-01
58	6.3517965E-02	-1.3520277E-04	-2.4389177E-01
59	6.3074000E-02	-2.8533781E-04	-2.458794E-01
60	1.6025274E-01	-1.553037E-03	-4.5048096E-01
61	1.6031274E-01	-1.512223E-03	-3.9623864E-01
62	1.6034195E-01	-1.4149157E-03	-1.202391E-03
63	1.6034795E-01	-1.210917E-03	1.6549871E-03
64	1.6032624E-01	-9.579658E-04	2.2182009E-03
65	1.6028547E-01	-6.7173958E-04	2.2341242E-03
66	1.602285E-01	-4.1003120E-04	1.9027090E-03
67	1.6015825E-01	-2.161447E-04	1.2862468E-03
68	1.6002622E-01	-1.1389455E-04	5.1291427E-04
69	1.5988767E-01	-6.4504032E-05	-2.9121570E-04
70	1.6017270E-01	-1.6224693E-03	-2.4158254E-01
71	1.6019386E-01	-1.7311429E-03	-2.4158908E-01
72	1.6013730E-01	-1.5516283E-03	-2.4157712E-01
73	1.6005665E-01	-1.2582142E-03	-2.4125991E-01
74	1.5998858E-01	-8.5866917E-04	-2.4117053E-01
75	1.5994775E-01	-4.1663507E-04	-2.4115913E-01
76	1.5993410E-01	-1.6824677E-05	-2.412542E-01
77	1.5993327E-01	2.7706284E-04	-2.4125971E-01
78	1.5990889E-01	4.5702001E-04	-2.4123794E-01
79	1.5980804E-01	5.4797600E-04	-2.4119043E-01
80			

FROM GETDIM. I/O UNIT = 13. FILE = 1. ROWS = 240. COLUMNS = 240
 NAME = C-MATRIX.

NUM = 1.04529D 01

FROM GETDIM.
 NAME = MASS MAT.

I/O UNIT = 20. FILE = 2. ROWS = 1. COLUMNS = 240

DEN = 9.01206D-05

FROM PUTLAB.
 NAME = TILE DEF.

I/O UNIT = 21. FILE = 1. ROWS = 1. COLUMNS = 240

FROM GETDIM.
 NAME = J666NY06.

I/O UNIT = 7. FILE = 1. ROWS = 27. COLUMNS = 81

STRESSES FOR ISULATOR AND ARRESTOR FOR TILE NO. 1 AND ITERATION NO. 1

LOCAL COORDINATES		Z		STRESSES		XY		YZ		ZX	
X	Y	X	Y	XX	YY	ZZ	XY	YZ	ZX	XY	YZ
1	3.9434E 00	8.7631E-01	7.8867E-02	3.5308E 01	3.5301E 01	3.6684E 01	1.9191E-02	1.9755E 00	1.3492E 00	1.9191E-02	1.9755E 00
2	3.9434E 00	2.3481E-01	7.8867E-02	9.4781E 01	9.4781E 01	9.4781E 01	2.1999E-02	2.3421E 00	1.1950E 00	2.1999E-02	2.3421E 00
3	1.0566E 00	8.7631E-01	7.8867E-02	5.4133E 00	5.4133E 00	5.4133E 00	1.0462E-02	1.1005E 00	0.7807E-01	1.0462E-02	1.1005E 00
4	1.0566E 00	2.3481E-01	7.8867E-02	1.5405E 01	1.5405E 01	1.5405E 01	1.6109E 00	1.2302E 00	0.0807E-01	1.6109E 00	1.2302E 00
5	3.9434E 00	8.7631E-01	2.1132E-02	3.4862E 01	3.4862E 01	3.4862E 01	-5.5921E-03	2.0850E 00	1.1628E 00	-5.5921E-03	2.0850E 00
6	3.9434E 00	2.3481E-01	2.1132E-02	9.4255E 01	9.4255E 01	9.4255E 01	-7.5189E-03	2.4515E 00	1.1628E 00	-7.5189E-03	2.4515E 00
7	1.0566E 00	8.7631E-01	2.1132E-02	4.0040E 01	4.0040E 01	4.0040E 01	-2.3523E-02	1.1189E 00	0.6407E-01	-2.3523E-02	1.1189E 00
8	1.0566E 00	2.3481E-01	2.1132E-02	1.3832E 01	1.3832E 01	1.3832E 01	-2.3523E-02	1.2486E 00	-9.4072E-01	-2.3523E-02	1.2486E 00
1	3.9434E 00	1.9874E 00	7.8867E-02	9.8098E 00	9.8098E 00	-1.0135E 01	2.7483E-02	1.4400E 00	1.7066E 00	2.7483E-02	1.4400E 00
2	3.9434E 00	1.3459E 00	7.8867E-02	7.3790E 00	7.3790E 00	7.3790E 00	2.9109E-02	1.6930E 00	1.4833E 00	2.9109E-02	1.6930E 00
3	1.0566E 00	1.9874E 00	7.8867E-02	6.1899E-01	6.1899E-01	6.1899E-01	2.0846E-02	8.4118E-01	3.2919E-01	2.0846E-02	8.4118E-01
4	1.0566E 00	1.3459E 00	7.8867E-02	1.4446E 01	1.4446E 01	1.4446E 01	-2.2473E-02	9.8121E-01	5.1719E-01	-2.2473E-02	9.8121E-01
5	3.9434E 00	1.9874E 00	2.1132E-02	-1.0771E 01	-1.0771E 01	-1.0771E 01	8.6361E-04	1.4718E 00	1.4833E 00	8.6361E-04	1.4718E 00
6	3.9434E 00	1.3459E 00	2.1132E-02	6.9538E 01	6.9538E 01	6.9538E 01	-2.3087E-04	1.7247E 00	1.4833E 00	-2.3087E-04	1.7247E 00
7	1.0566E 00	1.9874E 00	2.1132E-02	8.4000E-01	8.4000E-01	8.4000E-01	-2.9321E-03	8.4284E-01	3.2508E-01	-2.9321E-03	8.4284E-01
8	1.0566E 00	1.3459E 00	2.1132E-02	1.7836E-02	1.7836E-02	1.7836E-02	-3.5647E-03	9.8286E-01	-5.2050E-01	-3.5647E-03	9.8286E-01
1	3.9434E 00	3.0985E 00	7.8867E-02	-2.9620E 01	-2.9620E 01	-2.9620E 01	2.0566E-02	9.2819E-01	2.0186E 00	2.0566E-02	9.2819E-01
2	3.9434E 00	2.4570E 00	7.8867E-02	1.9856E 01	1.9856E 01	1.9856E 01	2.0196E-02	1.1874E 00	1.8492E 00	2.0196E-02	1.1874E 00
3	1.0566E 00	3.0985E 00	7.8867E-02	-2.5205E-01	-2.5205E-01	-2.5205E-01	1.4051E-02	5.5629E-01	-2.4497E-02	1.4051E-02	5.5629E-01
4	1.0566E 00	2.4570E 00	7.8867E-02	8.642E-03	8.642E-03	8.642E-03	-1.5447E-02	7.1195E-01	1.9697E-01	-1.5447E-02	7.1195E-01
5	3.9434E 00	3.0985E 00	2.1132E-02	3.0542E 01	3.0542E 01	3.0542E 01	1.3071E-03	9.4622E-01	2.0304E 00	1.3071E-03	9.4622E-01
6	3.9434E 00	2.4570E 00	2.1132E-02	2.0800E 01	2.0800E 01	2.0800E 01	-6.3195E-04	1.2055E 00	1.8572E 00	-6.3195E-04	1.2055E 00
7	1.0566E 00	3.0985E 00	2.1132E-02	5.0985E 00	5.0985E 00	5.0985E 00	-5.4176E 00	5.5687E-01	-1.2644E-02	-5.4176E 00	5.5687E-01
8	1.0566E 00	2.4570E 00	2.1132E-02	-1.4093E 00	-1.4093E 00	-1.4093E 00	-6.1630E-03	7.1254E-01	-1.8899E-01	-6.1630E-03	7.1254E-01
1	3.9434E 00	4.2046E 00	7.8867E-02	3.7915E 01	3.7915E 01	3.7915E 01	1.1134E-02	3.9100E-01	2.1872E 00	1.1134E-02	3.9100E-01
2	3.9434E 00	3.5681E 00	7.8867E-02	3.4517E 01	3.4517E 01	3.4517E 01	2.5852E-02	6.6720E-01	2.1091E 00	2.5852E-02	6.6720E-01
3	1.0566E 00	4.2046E 00	7.8867E-02	-3.979E-01	-3.979E-01	-3.979E-01	9.6507E-02	2.3860E-01	7.0689E-02	9.6507E-02	2.3860E-01
4	1.0566E 00	3.5681E 00	7.8867E-02	3.979E-01	3.979E-01	3.979E-01	-4.424E-01	4.1463E-01	-2.0277E-02	-4.424E-01	4.1463E-01
5	3.9434E 00	4.2046E 00	2.1132E-02	3.5002E 01	3.5002E 01	3.5002E 01	2.7059E-02	3.9727E-01	4.2025E 00	2.7059E-02	3.9727E-01
6	3.9434E 00	3.5681E 00	2.1132E-02	3.2002E 01	3.2002E 01	3.2002E 01	-1.9289E-03	6.7356E-01	2.1230E 00	-1.9289E-03	6.7356E-01
7	1.0566E 00	4.2046E 00	2.1132E-02	-1.5294E 00	-1.5294E 00	-1.5294E 00	6.12203E-03	2.3838E-01	8.6194E-02	6.12203E-03	2.3838E-01
8	1.0566E 00	3.5681E 00	2.1132E-02	-1.7795E 00	-1.7795E 00	-1.7795E 00	-5.3433E-03	4.1421E-01	6.1095E-02	-5.3433E-03	4.1421E-01
1	3.9434E 00	5.3207E 00	7.8867E-02	3.9209E 01	3.9209E 01	3.9209E 01	-2.1803E-04	-1.4222E-01	2.2123E 00	-2.1803E-04	-1.4222E-01
2	3.9434E 00	4.6792E 00	7.8867E-02	3.9237E 01	3.9237E 01	3.9237E 01	1.0181E-03	1.3088E-01	2.2148E 00	1.0181E-03	1.3088E-01
3	1.0566E 00	5.3207E 00	7.8867E-02	-6.8939E-02	-6.8939E-02	-6.8939E-02	-3.0321E-03	9.7237E-02	7.6930E-02	-3.0321E-03	9.7237E-02
4	1.0566E 00	4.6792E 00	7.8867E-02	9.1543E-02	9.1543E-02	9.1543E-02	5.6866E-04	8.6019E-02	7.6930E-02	5.6866E-04	8.6019E-02
5	3.9434E 00	5.3207E 00	2.1132E-02	4.0076E 01	4.0076E 01	4.0076E 01	9.3395E-04	-1.4221E-01	2.2281E 00	9.3395E-04	-1.4221E-01
6	3.9434E 00	4.6792E 00	2.1132E-02	4.0180E 01	4.0180E 01	4.0180E 01	-4.1924E 01	1.3088E-01	2.2281E 00	-4.1924E 01	1.3088E-01
7	1.0566E 00	5.3207E 00	2.1132E-02	-1.4525E 00	-1.4525E 00	-1.4525E 00	1.5793E-04	9.2775E-02	9.2775E-02	1.5793E-04	9.2775E-02
8	1.0566E 00	4.6792E 00	2.1132E-02	-1.4528E 00	-1.4528E 00	-1.4528E 00	-1.5076E 00	8.7972E-02	9.4685E-02	-1.5076E 00	8.7972E-02

ORIGINAL PAGE IS OF POOR QUALITY

STRESSES FOR ISOLATOR AND ARRESTOR FOR TILE NO. 1 AND ITERATION NO. 1

X	LOCAL COORDINATES			Z	ELEMENT NUMBER	XX	YY	ZZ	STRESSES			ZX
	X	Y	Z						XY	YZ	ZX	
1	3.9434E 00	6.4318E 00	7.8867E -02	6	3.94701E 01	-3.6017E 01	-1.1566E-02	-6.7965E-01	2.0980E 00			
2	3.9434E 00	5.7903E 00	7.8867E -02	7	3.7989E 01	-3.9441E 01	-1.0353E-02	-4.0255E-01	3.1809E 00			
3	1.0566E 00	6.4318E 00	7.8867E -02	8	3.2219E 01	-1.0145E 01	-1.0145E-01	4.2157E-01	3.8615E-02			
4	1.0566E 00	5.7903E 00	7.8867E -02	9	3.6625E 02	-8.9317E-03	-5.2830E-04	-2.4739E-01	6.1119E 00			
5	3.9434E 00	6.4318E 00	2.1132E -02	3	3.5541E 01	-3.5021E 01	-5.6813E 01	-6.8572E-01	2.1963E 00			
6	3.9434E 00	5.7903E 00	2.1132E -02	4	3.8901E 01	-1.3732E 01	-1.3732E-03	-8.0862E-01	5.2740E-02			
7	1.0566E 00	6.4318E 00	2.1132E -02	5	3.5407E 01	-4.1507E 01	-4.1507E-03	-2.2120E-01	8.1544E-02			
8	1.0566E 00	5.7903E 00	2.1132E -02	6	1.3824E 00	-1.3393E 00	-1.3393E-03	-2.4702E-01				
1	3.9434E 00	7.5430E 00	7.8867E -02	2	2.0214E 01	-2.0944E 01	-2.1202E-02	-1.2036E 00	1.8305E 00			
2	3.9434E 00	6.9015E 00	7.8867E -02	3	2.9857E 01	-3.0983E 01	-1.9851E-01	-9.4195E-01	2.0041E 00			
3	1.0566E 00	7.5430E 00	7.8867E -02	4	1.2517E 01	-2.0076E 01	-1.4719E-02	-7.1405E-01	2.0961E-01			
4	1.0566E 00	6.9015E 00	7.8867E -02	5	1.5603E 01	-9.474E-02	-1.3419E-02	-5.6152E-01	-3.5039E-02			
5	3.9434E 00	7.5430E 00	2.1132E -02	7	3.125E 01	-2.1789E 01	8.3156E-04	-1.2215E 00	1.8385E 00			
6	3.9434E 00	6.9015E 00	2.1132E -02	8	5.0657E 01	-3.1831E 01	-5.7133E-04	-9.5980E-01	2.0160E 00			
7	1.0566E 00	7.5430E 00	2.1132E -02	9	1.737E 00	-1.1254E 00	7.3531E-03	-7.1469E-01	-2.0144E-01			
8	1.0566E 00	6.9015E 00	2.1132E -02	8	1.5560E 00	-1.4200E 00	6.5210E-03	-5.6216E-01	-2.3043E-02			
1	3.9434E 00	8.6541E 00	7.8867E -02	7	7.0715E 00	7.4447E 00	-2.8406E-02	-1.7152E 00	1.4617E 00			
2	3.9434E 00	8.0126E 00	7.8867E -02	8	1.0176E 01	-1.0510E 01	-2.6860E-02	-1.4589E 00	1.6851E 00			
3	1.0566E 00	8.6541E 00	7.8867E -02	9	1.2124E 01	-1.8384E 01	-2.1920E-02	-9.7544E-01	-5.2905E-01			
4	1.0566E 00	8.0126E 00	7.8867E -02	6	7.504E 01	8.8873E 01	-2.0374E-02	-8.4043E-01	-3.4199E-01			
5	3.9434E 00	8.6541E 00	2.1132E -02	6	6.2659E 00	6.6229E 00	1.3363E-03	-1.7470E 00	1.4594E 00			
6	3.9434E 00	8.0126E 00	2.1132E -02	7	1.1368E 01	-1.1368E 01	4.3665E-04	-1.4907E 00	1.6895E 00			
7	1.0566E 00	8.6541E 00	2.1132E -02	8	1.6088E 01	-1.8265E 01	4.5491E-03	-9.7724E-01	-5.3139E-01			
8	1.0566E 00	8.0126E 00	2.1132E -02	9	5.8092E 01	4.8270E 01	5.6696E-03	-8.4223E-01	-3.3765E-01			
1	3.9434E 00	9.7652E 00	7.8867E -02	9	9.6655E 01	9.8621E 01	-2.1361E-02	-2.3700E 00	1.1661E 00			
2	3.9434E 00	9.1237E 00	7.8867E -02	3	5.5053E 01	3.6582E 01	-1.8670E-02	-2.0003E 00	1.3226E 00			
3	1.0566E 00	9.7652E 00	7.8867E -02	4	1.5856E 01	-1.6556E 01	-1.6267E-02	-1.2131E 00	-2.0743E-01			
4	1.0566E 00	9.1237E 00	7.8867E -02	5	5.8327E 00	6.1198E 00	-1.6266E-02	-1.6903E 00	-8.8054E-01			
5	3.9434E 00	9.7652E 00	2.1132E -02	9	9.318E 01	9.8217E 01	9.2698E-03	-2.4797E 00	1.3337E 00			
6	3.9434E 00	9.1237E 00	2.1132E -02	3	3.8646E 01	3.8624E 01	7.0403E-03	-2.1099E 00	1.3304E 00			
7	1.0566E 00	9.7652E 00	2.1132E -02	4	1.8387E 01	-1.8387E 01	1.5066E 01	-1.2317E 00	-2.3384E-01			
8	1.0566E 00	9.1237E 00	2.1132E -02	10	4.4329E 00	4.6979E 00	2.4012E-02	-1.1089E 00	-6.9274E-01			
1	3.9434E 00	8.7631E-01	8.8867E-01	5	7.2975E 00	2.9560E 01	-1.0425E-01	-2.5326E 01	8.9576E 00			
2	3.9434E 00	8.1237E-01	8.8867E-01	6	3.5437E 01	5.1213E 01	-1.1570E 00	-3.7995E 01	8.7200E 00			
3	1.0566E 00	8.7631E-01	8.8867E-01	7	1.3579E 00	8.1846E 00	-2.0743E 00	-6.7408E 00	9.5294E 00			
4	1.0566E 00	8.1237E-01	8.8867E-01	8	3.6219E 00	1.3938E 01	-8.1305E-01	-1.1117E 01	6.4278E 00			
5	3.9434E 00	8.7631E-01	3.1132E-01	1	3.0728E 01	2.5738E 01	1.3673E 01	6.5031E 01	-1.3206E 01			
6	3.9434E 00	8.1237E-01	3.1132E-01	2	3.3596E 00	4.7313E 01	1.6213E 01	5.0366E 01	-2.8580E 01			
7	1.0566E 00	8.7631E-01	3.1132E-01	3	1.0069E 01	7.0364E 00	1.0205E 01	1.5508E 01	-2.8834E 01			
8	1.0566E 00	8.1237E-01	3.1132E-01	4	4.6762E 00	1.2211E 01	1.2745E 01	1.1072E 01	-3.0872E 01			

STRESSES FOR ISULATOR AND ARRESTOR FOR TILE NO. 1 AND ITERATION NO. 1

LOCAL COORDINATES		STRESSES									
X	Y	Z	XX	YY	ZZ	XY	YZ	ZX			
ELEMENT NUMBER											
1	3.9434E 00	7.5430E 00	8.867E-01	-1.9478E 01	-8.6534E 00	-2.4934E 00	1.2281E 01	-5.6237E 00	16	-4.3269E 00	-1.9478E 01
2	3.9434E 00	6.9015E 00	8.867E-01	-3.0901E 01	-1.8024E 01	-2.8592E 00	-7.1637E 00	-9.6453E 00	17	5.7361E 00	6.4876E 00
3	1.0566E 00	7.5430E 00	8.867E-01	-1.4653E 01	-5.059E-02	5.8228E-02	4.5659E 00	-1.7108E 00	18	1.8035E 01	3.5369E 01
4	1.0566E 00	6.9015E 00	8.867E-01	-1.4699E 01	-1.1638E 00	-3.0759E 01	-2.7291E 00	-3.3620E-01	19	4.7033E-01	-3.8061E 00
5	3.9434E 00	7.5430E 00	3.1132E-01	-5.7936E 01	1.5358E 01	-1.4659E 01	-4.6693E 01	3.0231E 00	20	9.1533E-01	-6.5954E 00
6	3.9434E 00	6.9015E 00	3.1132E-01	-7.8726E 01	-2.2827E 01	-1.5911E 01	-4.6693E 01	6.4021E 00	21	-1.1110E 01	-2.8984E 01
7	1.0566E 00	7.5430E 00	3.1132E-01	-3.5742E 01	-2.1789E 00	-1.1068E 01	-6.1653E 01	9.4021E 00	22	-1.8518E 01	-4.9433E 01
8	1.0566E 00	6.9015E 00	3.1132E-01	-3.5465E 01	-3.2280E 00	-1.0123E 01	-9.5900E 00	1.0357E 01	23	-6.4638E 00	-1.9494E 01
ELEMENT NUMBER											
1	3.9434E 00	8.6541E 00	8.867E-01	6.4876E 00	1.7034E 01	-2.4168E 01	1.6693E 01	6.1140E 00	24	1.8035E 01	3.5369E 01
2	3.9434E 00	8.0126E 00	8.867E-01	-1.4821E 01	2.0235E 01	-2.1041E 00	2.7474E 00	-1.3412E 00	25	5.0459E 00	7.1921E 00
3	1.0566E 00	8.6541E 00	8.867E-01	-3.8061E 00	5.1537E 00	3.8768E-01	5.3718E 00	8.5818E 00	26	3.8227E 00	7.6917E 00
4	1.0566E 00	8.0126E 00	8.867E-01	-6.5954E 00	2.1419E 00	7.0036E-01	-9.3627E-01	4.1066E 00	27	1.9688E 00	1.4582E 00
5	3.9434E 00	8.6541E 00	3.1132E-01	-2.8984E 01	1.3470E 01	-1.9696E 01	-5.3854E 01	-5.4556E 00	28	-2.2444E 00	-3.4127E 00
6	3.9434E 00	8.0126E 00	3.1132E-01	-4.9433E 01	-3.2749E 00	-1.8432E 01	-6.7782E 01	-1.5414E-01	29	1.3846E 01	-3.0817E 01
7	1.0566E 00	8.6541E 00	3.1132E-01	-1.9494E 01	3.5780E 00	-1.5219E 01	-7.7484E 00	-2.9872E 00	30	-3.2146E 00	-4.6588E 00
8	1.0566E 00	8.0126E 00	3.1132E-01	-2.1423E 01	6.5376E-01	-1.3955E 01	-1.4056E 01	5.2885E 00	31	-4.4732E 00	-2.1423E 01
ELEMENT NUMBER											
1	3.9434E 00	9.7652E 00	8.867E-01	3.5369E 01	5.1064E 01	-1.1150E 01	3.9953E 01	8.5914E 00	32	1.8035E 01	3.5369E 01
2	3.9434E 00	9.1237E 00	8.867E-01	7.1921E 00	2.9382E 01	1.2879E-01	2.5301E 01	8.7727E 00	33	5.0459E 00	7.1921E 00
3	1.0566E 00	9.7652E 00	8.867E-01	7.6917E 00	1.3702E 00	8.5905E-01	1.1320E 01	6.3162E 00	34	3.8227E 00	7.6917E 00
4	1.0566E 00	9.1237E 00	8.867E-01	1.4582E 00	8.3955E 00	2.1027E 00	6.8228E 00	9.1759E 00	35	1.9688E 00	1.4582E 00
5	3.9434E 00	9.7652E 00	3.1132E-01	-3.4127E 00	4.7165E 01	-1.6092E 01	-5.0524E 01	-2.8303E 01	36	-2.2444E 00	-3.4127E 00
6	3.9434E 00	9.1237E 00	3.1132E-01	-3.0817E 01	2.5562E 01	-1.3578E 01	-6.5187E 01	-1.2998E 01	37	1.3846E 01	-3.0817E 01
7	1.0566E 00	9.7652E 00	3.1132E-01	-4.6588E 00	1.2460E 01	-1.2617E 01	-1.1150E 01	-3.0588E 01	38	-3.2146E 00	-4.6588E 00
8	1.0566E 00	9.1237E 00	3.1132E-01	-1.0120E 01	7.2321E 00	-1.0103E 01	-1.5647E 01	-1.2595E 01	39	-4.4732E 00	-2.1423E 01

FROM GETDIM, NAME = JGGENT06, I/O UNIT = 7, FILE = 1, ROWS = 27, COLUMNS = 81

FROM GETDIM, NAME = GONO006.a, I/O UNIT = 20, FILE = 1, ROWS = 27, COLUMNS = 1

FROM PUTLAB, NAME = Y STRESS, I/O UNIT = 21, FILE = 2, ROWS = 27, COLUMNS = 6

STRESSES AND DIRECT STRAINS FOR TILE NO. 1 AND ITERATION NO. 1

MEM TEMP	LOCAL COORDINATES	* XX	STRAINS	YY	ZZ	* XX	XX	YY	YY	ZZ	STRESSES	XY	YZ	ZX
1	2.50	0.05	-1.183E-03	1.843E-06	2.640E-02	3.724E-01	3.724E-01	3.732E-01	3.891E-01	3.891E-01	8.367E-04	1.694E-00	2.298E-01	
2	2.50	0.05	-1.071E-03	-6.821E-06	7.179E-02	-6.880E-01	-6.880E-01	-6.274E-01	-5.800E-01	-5.800E-01	1.831E-02	1.247E-00	5.868E-01	
3	2.50	0.05	-9.953E-04	-1.945E-04	-7.565E-03	-1.302E-01	-1.302E-01	-1.297E-01	-1.341E-01	-1.341E-01	7.789E-03	8.506E-01	9.166E-01	
4	2.50	0.05	-9.590E-04	-2.496E-04	-1.146E-02	-1.681E-01	-1.681E-01	-1.877E-01	-1.544E-01	-1.544E-01	7.517E-03	4.204E-01	1.111E-00	
5	2.50	0.05	-9.648E-04	-2.755E-04	-1.239E-02	-2.023E-01	-2.023E-01	-2.019E-01	-2.092E-01	-2.092E-01	5.079E-03	5.150E-03	1.154E-00	
6	2.50	0.05	-9.578E-04	-2.516E-04	-1.147E-02	-1.883E-01	-1.883E-01	-1.878E-01	-1.946E-01	-1.946E-01	6.497E-03	4.392E-01	1.103E-00	
7	2.50	0.05	-9.919E-04	-1.971E-04	-7.622E-03	-1.310E-01	-1.310E-01	-1.305E-01	-1.350E-01	-1.350E-01	6.817E-03	8.599E-01	9.025E-01	
8	2.50	0.05	-1.164E-03	-7.199E-05	6.781E-04	-7.421E-01	-7.421E-01	-6.822E-01	-6.391E-01	-6.391E-01	1.054E-02	1.700E-00	5.695E-01	
9	2.50	0.05	-1.174E-03	-4.533E-06	2.646E-02	3.735E-01	3.735E-01	3.470E-01	3.931E-01	3.931E-01	6.375E-00	1.732E-00	2.140E-01	
10	2.50	0.60	6.635E-05	-4.059E-04	4.050E-03	4.570E-00	4.570E-00	4.470E-00	4.894E-00	4.894E-00	8.995E-00	1.955E-01	1.755E-00	
11	2.50	0.60	1.412E-04	-3.301E-04	1.103E-04	-1.074E-01	-1.074E-01	-1.720E-01	-8.560E-01	-8.560E-01	7.147E-00	1.955E-00	2.692E-00	
12	2.50	0.60	1.792E-04	-4.492E-04	-8.227E-04	-1.423E-01	-1.423E-01	-4.966E-01	-1.559E-01	-1.559E-01	3.968E-01	4.857E-00	3.456E-00	
13	2.50	0.60	1.960E-04	-4.755E-04	-2.043E-03	-1.535E-01	-1.535E-01	-5.387E-01	-1.566E-01	-1.566E-01	1.181E-01	5.126E-03	3.639E-00	
14	2.50	0.60	1.792E-04	-4.492E-04	-8.227E-04	-1.423E-01	-1.423E-01	-4.966E-01	-1.559E-01	-1.559E-01	3.968E-01	4.857E-00	3.456E-00	
15	2.50	0.60	1.322E-04	-3.854E-04	8.290E-04	-1.076E-01	-1.076E-01	-3.721E-01	-8.706E-00	-8.706E-00	-6.946E-00	-9.539E-00	2.450E-00	
16	2.50	0.60	6.065E-05	-7.306E-04	8.100E-03	-4.582E-00	-4.582E-00	-3.726E-01	4.870E-00	4.870E-00	-6.946E-00	-9.539E-00	2.450E-00	
17	2.50	0.60	5.495E-06	-4.706E-04	4.056E-03	7.357E-01	7.357E-01	3.760E-00	5.084E-00	5.084E-00	-2.997E-00	-1.337E-00	-6.452E-00	
18	2.50	0.60	-4.735E-06	-5.980E-05	1.096E-03	-1.566E-00	-1.566E-00	-3.760E-00	1.566E-00	1.566E-00	-2.997E-00	-1.337E-00	-6.452E-00	
19	2.50	2.10	6.393E-06	2.096E-05	3.076E-04	1.728E-00	1.728E-00	2.511E-00	1.859E-00	1.859E-00	-1.819E-00	1.800E-01	1.884E-00	
20	2.50	2.10	1.859E-05	9.967E-05	-3.518E-04	4.678E-00	4.678E-00	7.520E-00	-4.584E-00	-4.584E-00	-8.614E-01	8.400E-00	3.162E-00	
21	2.50	2.10	3.228E-05	1.161E-04	-9.021E-04	5.986E-00	5.986E-00	9.494E-00	-5.584E-00	-5.584E-00	7.238E-03	1.252E-02	3.605E-00	
22	2.50	2.10	2.841E-05	1.217E-04	-9.577E-04	6.335E-00	6.335E-00	9.913E-00	-4.684E-00	-4.684E-00	8.745E-01	8.442E-00	3.176E-00	
23	2.50	2.10	2.840E-05	1.164E-04	-8.032E-04	5.993E-00	5.993E-00	9.511E-00	-4.597E-00	-4.597E-00	1.632E-00	1.461E-01	1.889E-00	
24	2.50	2.10	1.859E-05	9.016E-05	-3.532E-04	4.694E-00	4.694E-00	7.557E-00	-1.597E-00	-1.597E-00	2.952E-00	1.570E-01	1.889E-00	
25	2.50	2.10	6.396E-06	2.134E-05	3.069E-04	1.742E-00	1.742E-00	2.340E-00	1.582E-00	1.582E-00	2.952E-00	1.570E-01	1.889E-00	
26	2.50	2.10	-4.731E-06	-5.959E-05	1.007E-03	-1.564E-00	-1.564E-00	-3.759E-00	5.988E-00	5.988E-00	2.851E-00	-1.033E-01	-4.106E-00	

FROM GETDIM, NAME = JUCENY06, I/O UNIT = 7, FILE = 1, ROWS = 27, COLUMNS = 81

ORIGINAL PAGE IS OF POOR QUALITY

STRESSES AND TOTAL STRAINS FOR COATING FOR TILE NO. 1 AND ITERATION NO. 1

MEM	TEMP	LOCAL COORDINATES	z	xx	yy	xy	xx	yy	xy	xx	yy	xy
19	0.	2.50	0.5b	3.10	-1.485E-05	5.406E-05	-1.249E-05	-9.108E 01	6.284E 02	-9.982E 01		
20	0.	2.50	1.67	3.10	-1.238E-05	2.299E-04	-4.750E-05	-9.151E 00	1.521E 03	-3.872E 02		
21	0.	2.50	2.74	3.10	-1.928E-05	2.194E-04	-5.265E-05	7.175E 01	2.551E 03	-4.232E 02		
22	0.	2.50	3.89	3.10	-2.757E-05	2.877E-04	-3.285E-05	1.816E 02	3.870E 03	-2.628E 01		
23	0.	2.50	5.00	3.10	-2.757E-05	2.877E-04	-3.285E-05	1.816E 02	3.870E 03	-2.628E 01		
24	0.	2.50	6.11	3.10	-2.757E-05	2.877E-04	-3.285E-05	1.816E 02	3.870E 03	-2.628E 01		
25	0.	2.50	7.22	3.10	-2.757E-05	2.877E-04	-3.285E-05	1.816E 02	3.870E 03	-2.628E 02		
26	0.	2.50	8.33	3.10	-2.757E-05	2.877E-04	-3.285E-05	1.816E 02	3.870E 03	-2.628E 02		
27	0.	2.50	9.44	3.10	-1.990E-05	5.418E-05	1.171E-05	-8.137E 01	6.295E 02	9.568E 01		

FROM GETDIM, NAME = LOADS, 1/0 UNIT = 9, FILE = 2, ROWS = 1, COLUMNS = 1

FROM GETDIM, NAME = NAMEA, 1/0 UNIT = 14, FILE = 2, ROWS = 60, COLUMNS = 1

FROM PUTLAB, NAME = NAMEA, 1/0 UNIT = 14, FILE = 1, ROWS = 60, COLUMNS = 1

PRIMARY STRUCTURE DEFLECTIONS FOR ITERATION NO. 1

NODE	DX	DY	DZ	RX	RY	RZ
1	4.604365E-03	-1.674674E-03		5.973264E-05	7.386667E-02	
2	4.086073E-03	-1.398843E-03		2.006021E-04	7.305036E-02	
3	4.082311E-03	-1.133196E-03		1.707556E-04	7.287503E-02	
4	3.818149E-03	-9.093746E-04		4.060654E-05	7.321954E-02	
5	4.226379E-03	-8.176223E-04		5.731522E-05	7.346296E-02	
6	4.210100E-03	-6.545833E-04		-5.299675E-05	7.340410E-02	
7	3.760333E-03	-5.215430E-04		-4.459879E-05	7.322794E-02	
8	3.979199E-03	-3.951103E-04		-1.721341E-04	7.285196E-02	
9	3.884014E-03	-1.897045E-04		-5.699808E-05	7.307297E-02	
10	4.445316E-03				7.389611E-02	
11	2.079282E-03	-9.284776E-04	-2.448226E-01	9.487666E-03	4.795204E-08	
12	2.123745E-03	-8.883520E-04	-2.398865E-01	8.877322E-04	-2.491536E-08	
13	2.049722E-03	-8.640229E-04	-2.419297E-01	-3.537915E-03	-5.626872E-08	
14	2.055865E-03	-7.441358E-04	-2.457325E-01	-3.718347E-03	-6.521071E-08	
15	1.990440E-03	-6.080248E-04	-2.487135E-01	-1.707430E-03	-9.121601E-08	
16	1.977348E-03	-4.085631E-04	-2.487319E-01	1.677107E-03	-1.075873E-07	
17	2.014890E-03	-3.187272E-04	-2.457681E-01	3.706621E-03	-1.374130E-07	
18	1.978049E-03	-1.710572E-04	-2.419814E-01	3.507455E-03	-1.601567E-07	
19	2.013590E-03	-1.016970E-04	-2.399851E-01	-8.456632E-04	-2.198697E-07	
20	1.938463E-03		-2.449861E-01	-9.557497E-03	-2.224025E-07	
21		-1.299982E-03		5.951744E-05	-7.386780E-02	
22		-1.071978E-03		2.005496E-04	-7.305157E-02	
23		-8.499143E-04		1.707435E-04	-7.283626E-02	
24		-7.319441E-04		4.073138E-05	-7.322067E-02	
25		-6.254234E-04		5.737276E-05	-7.346392E-02	
26		-5.106605E-04		-5.711164E-05	-7.346493E-02	
27		-4.173571E-04		-4.476549E-05	-7.322878E-02	
28		-3.275711E-04		-1.721034E-04	-7.285279E-02	
29		-1.549412E-04		-1.998862E-04	-7.327374E-02	
30				-5.690729E-05	-7.389671E-02	
31		-1.332033E-03	1.731810E-02	3.473107E-03	1.278385E-01	
32		-7.282774E-04	4.199851E-03	3.132628E-05	1.228974E-01	
33		-2.359805E-04	1.713035E-02	-1.707532E-03	1.277174E-01	
34	2.128990E-03	-2.972099E-04	-2.594957E-01	-1.792656E-03	-1.069129E-06	
35	2.031946E-03	-5.542266E-04	-2.520680E-01	-2.515131E-05	-4.011691E-06	
36	2.020854E-03	-7.358810E-04	-2.594339E-01	8.569399E-04	-2.160103E-06	
37	7.544737E-03	-1.014136E-03	1.725082E-02	1.903430E-03	-1.2778018E-01	
38	1.452222E-02	-5.634816E-04	4.186004E-03	-2.068962E-05	-1.228825E-01	
39	7.468767E-03	-2.014904E-04	1.708957E-02	-1.872152E-03	-1.276930E-01	

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MID-POINT PLATE MEMBER STRAINS AND STRESSES FOR ITERATION NO. 1

MEMBER	X	COORDINATES	Y	EPS X	STRAINS	EPS Y	EPS XY	SIG X	STRESSES	SIG Y	SIG XY
1	2.5000E 00	5.5556E -01	-4.6374E -04	1.4216E -04	-1.0003E -04	-4.6274E 03	3.3363E 01	-7.1446E 02	3.3363E 01	-7.1446E 02	
2	2.5000E 00	1.6667E 00	-3.9449E -04	1.3051E -04	3.2734E -05	-3.9449E 03	1.2336E 02	2.3382E 02	1.2336E 02	2.3382E 02	
3	2.5000E 00	2.7778E 00	-3.7949E -04	1.2761E -04	-3.2524E -05	-3.7949E 03	1.5139E 02	-6.3710E 02	1.5139E 02	-6.3710E 02	
4	2.5000E 00	3.8889E 00	-3.9982E -04	1.2954E -04	9.8672E -05	-3.9982E 03	2.0271E 02	7.0023E 01	2.0271E 02	7.0023E 01	
5	2.5000E 00	5.0000E 00	-4.4887E -04	1.3613E -04	1.3122E -05	-4.4887E 03	2.4537E 02	9.4987E 01	2.4537E 02	9.4987E 01	
6	2.5000E 00	6.1111E 00	-3.9842E -04	1.2729E -04	-7.1929E -05	-3.9842E 03	3.1176E 02	-6.1309E 02	3.1176E 02	-6.1309E 02	
7	2.5000E 00	7.2222E 00	-3.7546E -04	1.2335E -04	6.0892E -05	-3.7546E 03	3.4490E 02	4.3207E 01	3.4490E 02	4.3207E 01	
8	2.5000E 00	8.3333E 00	-3.6335E -04	1.2364E -04	-6.3598E -06	-3.6335E 03	3.4490E 02	-4.3207E 01	3.4490E 02	-4.3207E 01	
9	2.5000E 00	9.4444E 00	-4.3451E -04	1.3113E -04	1.2456E -04	-4.3451E 03	6.5688E 00	8.8969E 02	6.5688E 00	8.8969E 02	
10	7.5000E 00	5.5556E -01	-4.2030E -04	1.2066E -04	-1.7752E -05	-4.2030E 03	-5.9696E 01	-1.2680E 02	-5.9696E 01	-1.2680E 02	
11	7.5000E 00	1.6667E 00	-4.1735E -04	1.1088E -04	-2.5131E -05	-4.1735E 03	-1.5744E 02	1.7951E 02	-1.5744E 02	1.7951E 02	
12	7.5000E 00	2.7778E 00	-4.1056E -04	1.0704E -04	2.6972E -06	-4.1056E 03	-1.7727E 02	1.9266E 01	-1.7727E 02	1.9266E 01	
13	7.5000E 00	3.8889E 00	-4.0463E -04	1.0918E -04	-1.4981E -05	-4.0463E 03	-1.5414E 02	-1.0701E 02	-1.5414E 02	-1.0701E 02	
14	7.5000E 00	5.0000E 00	-3.9678E -04	1.1440E -04	5.9202E -06	-3.9678E 03	-3.0881E 01	1.2287E 01	-3.0881E 01	1.2287E 01	
15	7.5000E 00	6.1111E 00	-3.9522E -04	1.0941E -04	-1.4106E -06	-3.9522E 03	-1.378E 02	-1.0076E 01	-1.378E 02	-1.0076E 01	
16	7.5000E 00	7.2222E 00	-3.9909E -04	1.0677E -04	2.1506E -05	-3.9909E 03	-1.4240E 02	1.5361E 02	-1.4240E 02	1.5361E 02	
17	7.5000E 00	8.3333E 00	-3.9896E -04	1.0898E -04	-2.0505E -05	-3.9896E 03	-1.1767E 02	-1.4647E 01	-1.1767E 02	-1.4647E 01	
18	7.5000E 00	9.4444E 00	-3.9620E -04	1.1549E -04	-1.9506E -05	-3.9620E 03	-3.3783E 01	1.3976E 02	-3.3783E 01	1.3976E 02	

FROM GETDIM, NAME = BND COND, I/O UNIT = 1, FILE = 1, ROWS = 51, COLUMNS = 12

FROM GETDIM, NAME = XTN, I/O UNIT = 10, FILE = 2, ROWS = 162, COLUMNS = 1

TUP-POINT PLATE MEMBER STRAINS AND STRESSES FOR ITERATION NO. 1

MEMBER	X	COORDINATES	Y	EPS X	EPS Y	EPS XY	SIG X	SIG Y	SIG XY
1	2.5000E 00	5.5556E 01	9.2361E-04	-2.3002E-03	9.2361E-04	-1.8588E-04	-2.3221E 04	-7.3027E 02	-1.3256E 03
2	2.5000E 00	1.6667E 00	3.7551E-04	-2.3181E-03	3.7551E-04	4.6186E-05	-2.3136E 04	-3.1858E 03	3.2990E 02
3	2.5000E 00	2.7778E 00	1.5131E-04	-2.2952E-03	1.5131E-04	2.4153E-05	-2.3754E 04	-5.6748E 03	1.7252E 02
4	2.5000E 00	3.8889E 00	5.862E-05	-2.2534E-03	1.4024E-04	1.4024E-04	-2.4491E 04	-7.1926E 03	1.0017E 03
5	2.5000E 00	5.0000E 00	-4.7823E-05	-2.2855E-03	-4.7823E-05	1.3595E-05	-2.5251E 04	-8.0534E 03	9.5679E 01
6	2.5000E 00	6.1111E 00	1.2438E-04	-2.3211E-03	1.2438E-04	-1.1288E-04	-2.4487E 04	-7.2218E 03	9.0832E 02
7	2.5000E 00	7.2222E 00	1.4173E-04	-2.2015E-03	1.4173E-04	3.4741E-06	-2.3725E 04	-5.7001E 03	2.4815E 01
8	2.5000E 00	8.3333E 00	3.7006E-04	-2.2074E-03	3.7006E-04	-1.9107E-05	-2.3037E 04	-3.2106E 03	1.2648E 02
9	2.5000E 00	9.4444E 00	6.1314E-04	-2.2716E-03	6.1314E-04	2.1112E-04	-2.2992E 04	-7.5112E 02	1.5086E 03
10	7.5000E 00	5.5556E 01	9.0219E-04	-2.2568E-03	9.0219E-04	6.7796E-05	-2.2815E 04	-9.2353E 02	4.8426E 02
11	7.5000E 00	1.6667E 00	3.5587E-04	-2.2409E-03	3.5587E-04	-3.8587E-05	-2.3445E 04	-3.4771E 03	2.7562E 02
12	7.5000E 00	2.7778E 00	1.2450E-04	-2.2363E-03	1.2450E-04	5.4789E-05	-2.4164E 04	-6.0042E 03	3.9135E 02
13	7.5000E 00	3.8889E 00	-4.8661E-06	-2.2342E-03	-4.8661E-06	-5.6348E-05	-2.4611E 04	-7.4321E 03	4.0246E 02
14	7.5000E 00	5.0000E 00	-6.9533E-05	-2.2334E-03	-6.9533E-05	6.1413E-06	-2.4772E 04	-8.1270E 03	4.3866E 01
15	7.5000E 00	6.1111E 00	5.4453E-06	-2.2329E-03	5.4453E-06	4.2335E-06	-2.4555E 04	-7.4210E 03	3.0246E 02
16	7.5000E 00	7.2222E 00	1.2514E-04	-2.2251E-03	1.2514E-04	3.5510E-05	-2.4039E 04	-5.9604E 03	2.5364E 02
17	7.5000E 00	8.3333E 00	3.5541E-04	-2.2230E-03	3.5541E-04	1.0695E-05	-2.3257E 04	-3.4231E 03	7.6390E 01
18	7.5000E 00	9.4444E 00	5.9748E-04	-2.2323E-03	5.9748E-04	-1.0613E-04	-2.3256E 04	-7.9356E 02	7.5805E 01

FROM GETDIM. I/O UNIT = 1, FILE = 1, ROWS = 51, COLUMNS = 11
 NAME = BND COND.
 FROM GETDIM. I/O UNIT = 10, FILE = 2, ROWS = 162, COLUMNS = 1
 NAME = XTN

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HOTTUM-POINT PLATE MEMBER STRAINS AND STRESSES FOR ITERATION NO. 1

MEMBER	X	COORDINATE Y	EPS X	STRAINS EPS Y	EPS XY	SIG X	STRESSES SIG Y	SIG XY
1	2.5000E 00	5.5555E -01	1.3727E -03	-3.3929E -04	-1.4471E -05	1.3964E 04	7.9700E 02	-1.0336E 02
2	2.5000E 00	1.4444E 00	1.4291E -03	-1.1648E -04	-1.9242E -05	1.5327E 04	3.4532E 02	1.3773E 02
3	2.5000E 00	2.7777E 00	1.4462E -03	-1.1020E -04	-9.0820E -05	1.6256E 04	5.4780E 02	-6.4872E 02
4	2.5000E 00	4.1111E 00	1.4337E -03	-2.4359E -04	5.7504E -05	1.6556E 04	7.4033E 02	4.1074E 02
5	2.5000E 00	5.4444E 00	1.3897E -03	3.2004E -04	1.2949E -05	1.6327E 04	8.9988E 02	9.2494E 01
6	2.5000E 00	6.7777E 00	1.2355E -03	2.4215E -04	-3.1103E -05	1.6570E 04	7.3925E 02	-8.2166E 02
7	2.5000E 00	8.1111E 00	1.4502E -03	-1.0976E -04	1.1175E -04	1.6284E 04	5.9355E 02	8.3932E 02
8	2.5000E 00	9.4444E 00	1.4402E -03	-1.2374E -04	6.3875E -05	1.6247E 04	3.4004E 02	4.5925E 01
9	2.5000E 00	1.4444E 00	1.4026E -03	-3.6087E -04	3.7992E -05	1.4257E 04	7.0825E 02	2.7137E 02
10	7.5000E 00	5.5555E -01	1.4162E -03	-3.6078E -04	-1.0320E -04	1.4373E 04	7.0414E 02	-7.3757E 02
11	7.5000E 00	1.4444E 00	1.4062E -03	-1.5812E -04	-1.1637E -05	1.5011E 04	3.1622E 02	-6.3337E 01
12	7.5000E 00	2.7777E 00	1.4182E -03	6.9273E -05	2.4183E -05	1.5844E 04	5.6497E 02	4.2998E 02
13	7.5000E 00	4.1111E 00	1.4289E -03	2.2352E -04	2.4380E -05	1.6305E 04	7.1438E 02	1.6647E 02
14	7.5000E 00	5.4444E 00	1.4398E -03	2.9853E -04	5.9915E -06	1.6805E 04	9.0262E 02	-8.0709E 01
15	7.5000E 00	6.7777E 00	1.4344E -03	2.2427E -04	-3.9511E -06	1.6502E 04	7.1934E 02	-9.8224E 02
16	7.5000E 00	8.1111E 00	1.4269E -03	6.8600E -05	-7.8522E -06	1.6972E 04	5.6676E 02	-5.6087E 02
17	7.5000E 00	9.4444E 00	1.4251E -03	-1.3744E -04	1.4796E -05	1.5202E 04	7.0379E 02	-1.0565E 02
18	7.5000E 00	1.4444E 00	1.4419E -03	-3.6651E -04	6.8995E -05	1.4637E 04	7.2599E 02	4.7853E 02

FROM GETDIM, NAME = BND CUND, 1/D UNIT = 1, FILE = 1, ROWS = 51, COLUMNS = 11

FROM GETDIM, NAME = XTN, 1/D UNIT = 10, FILE = 2, ROWS = 162, COLUMNS = 1

STRINGER STRAINS AND STRESSES FOR ITERATION NO. 1

MEMBER	STRINGER NO.	X-COORDINATE	EPS X	SIG X
1	1	2.5000E 00	2.81455E-02	2.8845E 05
2	2	2.5000E 00	2.8939E-02	2.8939E 05
3	3	2.5000E 00	2.8498E-02	2.8898E 05
4	1	7.5000E 00	2.8928E-02	2.8928E 05
5	2	7.5000E 00	2.8498E-02	2.8989E 05
6	3	7.5000E 00	2.8958E-02	2.8958E 05

FROM GETDIM. NAME = BND COND. 1/0 UNIT = 1. FILE = 1. ROWS = 51. COLUMNS = 11
 FROM GETDIM. NAME = XTN. 1/0 UNIT = 10. FILE = 2. ROWS = 162. COLUMNS = 1
 FROM GETDIM. NAME = LOADS. 1/0 UNIT = 4. FILE = 1. ROWS = 39. COLUMNS = 6
 FROM PUTLAB. NAME = LOADS. 1/0 UNIT = 3. FILE = 1. ROWS = 162. COLUMNS = 1
 FROM PUTLAB. NAME = LOADS. 1/0 UNIT = 14. FILE = 1. ROWS = 60. COLUMNS = 1

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STRINGER STRAINS AND STRESSES FOR ITERATION NO. 1

MEMBER	STRINGER NO.	X-COORDINATE	EPS X	SIG X
1	1	2.5000E 00	2.8865E-02	2.8865E 05
2	2	2.5000E 00	2.8939E-02	2.8939E 05
3	3	2.5000E 00	2.8998E-02	2.8998E 05
4	1	7.5000E 00	2.8928E-02	2.8928E 05
5	2	7.5000E 00	2.8999E-02	2.8999E 05
6	3	7.5000E 00	2.8958E-02	2.8958E 05

FROM GETDIM.
 NAME = BND CONU. I/O UNIT = 1. FILE = 1. ROWS = 51. COLUMNS = 11

FROM GETDIM.
 NAME = XTN I/O UNIT = 10. FILE = 2. ROWS = 162. COLUMNS = 1

FROM GETDIM.
 NAME = LOADS I/O UNIT = 4. FILE = 1. ROWS = 39. COLUMNS = 6

FROM PUTLAB.
 NAME = LOADS I/O UNIT = 3. FILE = 1. ROWS = 162. COLUMNS = 1

FROM PUTLAB.
 NAME = LOADS I/O UNIT = 14. FILE = 1. ROWS = 60. COLUMNS = 1

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STRINGER STRAINS AND STRESSES FOR ITERATION NO. 2

MEMBER STRINGER NO. X-COORDINATE EPS X SIG X

FROM PUTLAK,
NAME = ST STRES. I/O UNIT = 21. FILE = 8. ROWS = 0. COLUMNS = 2
1 1 2.5000E 00 2.9123E-02 2.9123E 05
2 2 2.5000E 00 2.7446E-02 2.7446E 05
3 3 2.5000E 00 2.9119E-02 2.9119E 05
4 1 7.5000E 00 2.9197E-02 2.9197E 05
5 2 7.5000E 00 2.7482E-02 2.7482E 05
6 3 7.5000E 00 2.9193E-02 2.9193E 05

FROM GETDIM,
NAME = BND GUND. I/O UNIT = 1. FILE = 1. ROWS = 51. COLUMNS = 11
FROM GETDIM,
NAME = XTN. I/O UNIT = 10. FILE = 2. ROWS = 162. COLUMNS = 1
FROM GETDIM,
NAME = LOADS. I/O UNIT = 1. FILE = 2. ROWS = 3. COLUMNS = 1000

(SUM(AREA*DZ))**2 = 1.44247E 02

FROM GETDIM,
NAME = XTN. I/O UNIT = 10. FILE = 2. ROWS = 162. COLUMNS = 1
FROM GETDIM,
NAME = EL MASS. I/O UNIT = 8. FILE = 1. ROWS = 162. COLUMNS = 1

P.S. M = 2.91120-02

FROM SAMAIN, AFTER SHMAIN - STACK STIFFNESS, SOLVE FOR UEFL.C.F. *****
***** ELAPSED TIME IS 0.000000 0 MINUTES, 50.75 SECONDS *****
***** INCREMENTAL TIME IS 0.000000 0 MINUTES, 1.07 SECONDS *****
FROM MAIN, AFTER SAMAIN - STRENGTH ANALYSIS *****
***** ELAPSED TIME IS 0.000000 0 MINUTES, 50.75 SECONDS *****
***** INCREMENTAL TIME IS 0.000000 0 MINUTES, 0.0 SECONDS *****

APPENDIX B

USER'S MANUAL FOR

A**R**E**S**T

(Acoustic Response of REusable Shuttle Tiles)

This Appendix describes the input and output of the structural acoustic response program ARREST. It is designed for operation with the RESIST computer program discussed in Appendix A. The program computes the RMS stresses and deflections of stiffened rectangular panels, with or without RSI shuttle tiles, subject to uniform correlated (spatially) random acoustic pressures. When there are TPS tiles, the RSI tile stresses and deflections are also computed. The computation procedure is based upon linear modal methods and assumes well-separated lightly damped modes.

The program card input effort is small compared with that for the RESIST program, as most of the input is on tapes generated by the RESIST program. Each time information for ARREST is generated by RESIST, it is contained on tape as units 1 and 21. Unit 21 contains modal data and unit 1 contains structural idealization data. Since the idealization data is the same for each mode, only one unit 1 need be input in ARREST. This tape should be mounted as unit 9 for an ARREST run. The tapes containing modal data should be mounted, in succession, as units 1, 2, 3, 4, 7 and 8. A minimum of one tape with one mode and a maximum of 6 modes may be used in a given ARREST run. If information for more than one mode is being combined on unit 1, then unit 1 must be mounted with a ring and the added modes are assigned unit numbers 2, 3, etc.

INPUT DATA FOR ARREST - Sheet 1 of 4

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
1 and 2	1-80	20A4	-	-	These are title cards which are used to identify the problem being run.
3	1-5	I5	N	-	The total number of modes superposed to obtain acoustic response results (not to be confused with the mode-numbers, which identify the individual modes).
	6-10	I5	LIMDP	-	The number of peak RMS primary structure accelerations which are identified. Used to help locate critical primary structure regions.
	11-15	I5	LIMSP	-	The number of peak RMS primary structure stresses to be identified in output.
	16-20	I5	LIMDT	-	The number of peak RMS tile deflections identified in output.
	21-25	I5	LIMST	-	The number of peak RMS tile stresses identified in output.
	26-30	I5	NTIL	-	The number of tiles for which modal information is stored on the magnetic input tapes generated by the previously run RESIST program.

INPUT DATA FOR ARREST - Sheet 2 of 4

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
3 (cont)	31-35	I5	NSTR	-	<p>The stringer type associated with the idealization: 0 denotes either no stringers, orthotropic plate, or isotropic plate with singly attached stringers 2 denotes doubly attached stringers</p>
	36-40	I5	KSTR	-	<p>Defines whether or not stringer stress information is contained on input modal tapes: 0 denotes no stringer stress data on input tapes 1 denotes that there is stringer stress data on input tapes</p>
	41-45	I5	IRMS	-	<p>Defines whether this run contains new modes or uses the same modes used in a previous run: 0 denotes that new mode tapes are used 1 denotes that a rerun using an existing single tape with all necessary modal data is being used</p>

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
3 (cont)	46-50	I5	IMRES	-	Number of combined modes already on input tape if this is a restart run. Leave blank if not a restart run.
	51-55	I5	NAMLST	-	Debug printout clue: 0 denotes print debug information 1 denotes do not print debug information
4	1-10	I10	i	-	Mode number
Input as many cards of this type as there are modes in the acoustic response calculations.	11-20	E10.0	$\left(\sum_j^A \bar{\psi}_{T,z_j} \right)^2$		See Section 3 of report for definition of this quantity. It is printed output from a RESIST* run for the i th mode.
	21-30	E10.0	S(ω_i)	psi ² /Hz	Power spectral density at natural frequency of i th mode.

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*Denoted as (SUM (AREA*DZ))**2 on RESIST run output. This quantity is printed out at the end of the RESIST runs.

INPUT DATA FOR ARREST - Sheet 4 of 4

CARD(S)	COL(S)	FORMAT	SYMBOLS	UNITS	DESCRIPTION
4 (cont)	31-40	E10.0	M_i	lb-sec ² -in.	Modal mass of i^{th} mode. Obtained from printed output from RESIST run for i^{th} mode. Composed of modal mass for each tile** plus modal mass of primary structure***
	41-50	E10.0	ω_i	rad/sec	Natural frequency of present mode
	51-60	E10.0	ζ_i	$\frac{\text{lb-sec}}{\text{in.}}$	Damping ratio associated with i^{th} mode

See pages C-15 through C-36 for typical output from the ARREST program.

B-5

**Denoted as DEN on RESIST run output. This quantity is printed out after each tile displacement.

***Denoted as P.S.M on RESIST run output. This quantity is printed out at the end of the RESIST runs.

APPENDIX C

PROGRAMMERS MANUAL FOR

A*R*RE*S*T

(Acoustic Response of REusable Shuttle Tiles)

C.1 INTRODUCTION

This Appendix contains the overall flow chart of the program, data set allocation and subprogram calling sequence, along with a brief description of the individual subprograms and typical subprogram output for the ARREST program described in Section 4. Two versions of the program exist, one of which is written completely in FORTRAN. This version is compatible with both the IBM 370/168 and CDC 6600 machines. A more efficient second version, which runs only on the IBM computer, exists. This version contains an assembly language subroutine called DINIT with entry points: DREAD, DWRITE, DFIND, and DCLOSE.

C.2 FLOW CHART

The overall logic for the ARREST computer program is displayed in Figure C-1. The main modules of this program combine all the modal data (Module 1) contained on RESIST output tapes onto a single tape and compute the RMS deflections and stresses (Module 2). The remainder of the logic is concerned with locating the peak tile and primary structure responses for rapid identification.

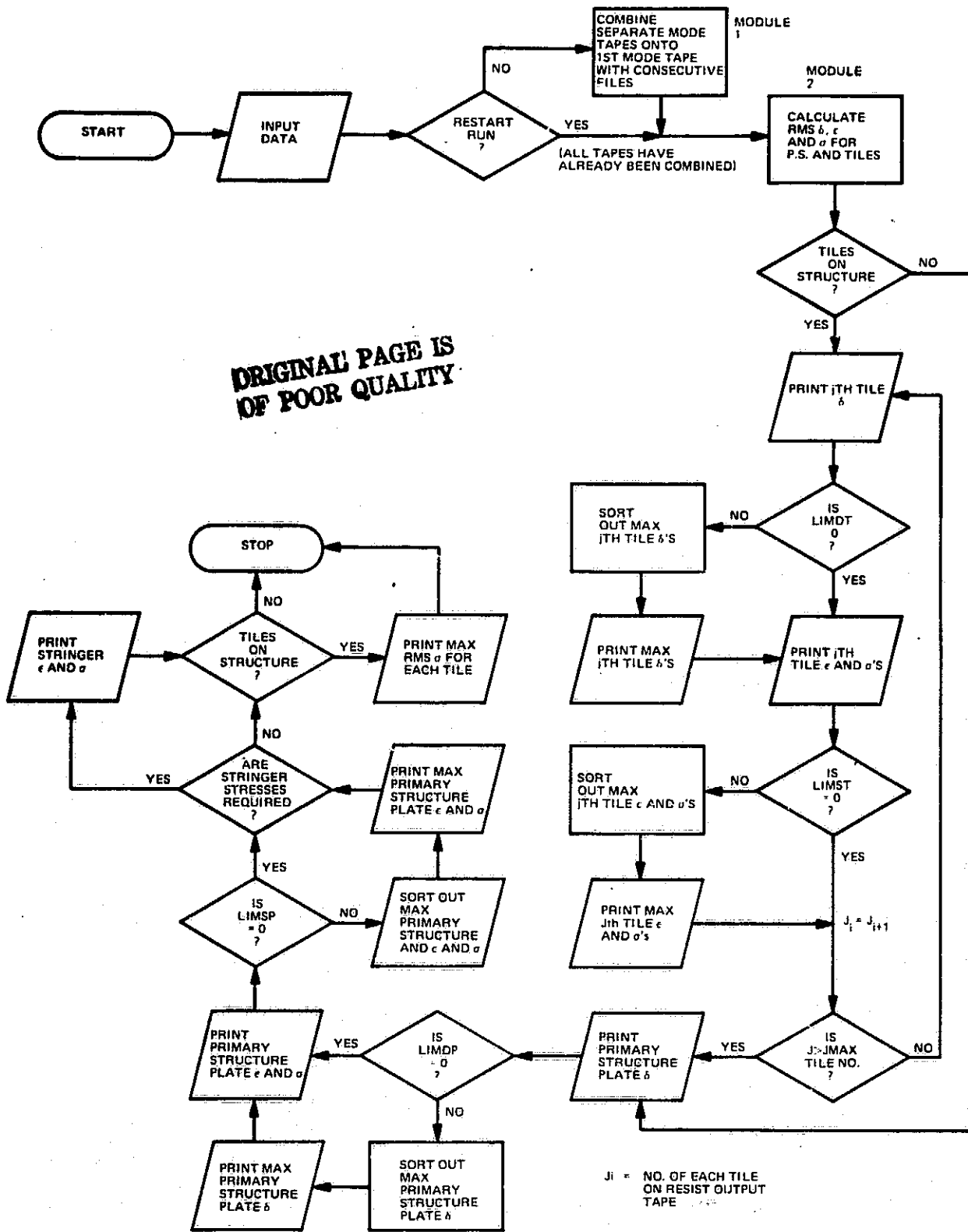


Figure C-1 Arrest Program

C.3 DATA SET ALLOCATIONS

The following chart identifies the unit and file number assignments for each data set. Symbols used in the chart are:

- δ Deflections
- ϵ Strains
- σ Stresses

DATA SET ALLOCATIONS

UNIT NO.	UNIT NAME	FILE 1	FILE 2	FILE 3	FILE N (N_{max})
1	MAT1	δ , ϵ and σ 's for a particular mode saved from RESIST run	Copy of MAT(1)*		Copy of MAT(N-1)*
2	MAT(1)	δ , ϵ and σ 's for another mode*			
3	MAT(2)	δ , ϵ and σ 's for another mode*			
4	MAT(3)	δ , ϵ and σ 's for another mode*			
6	ITAPEW	Output to printer			
7	MAT(4)	δ , ϵ and σ 's for another mode*			
8	MAT(5)	δ , ϵ and σ 's for another mode*			
9	NTAPBC	Primary structure boundary conditions (No. Nodes x 11)	External tile numbers	Geometry	
10	ITAPER	1) Input data set in card image format (20A4) 2) RMS δ , ϵ and σ 's			

*If it exists

C.4 SUBPROGRAM CALLING SEQUENCE AND COMMON BLOCKS UTILIZED

The following table lists the subprograms that are called by each parent routine. The common blocks used in each routine are also tabularized. The subprograms listed under the "Calls" heading appear in the order in which they are called. The order of the subprograms listed in the "Subroutine" column corresponds to the order in which they appear in the FORTRAN listing. An alphabetical index which cross-references this order-of-appearance number is provided in Section C.5

<u>NO.</u>	<u>SUBROUTINE</u>	<u>CALLED FROM</u>	<u>CALLS</u>	<u>COMMON</u>
1	MAIN	-	IODATA GETDIM GETROW DCLOSE COMPAK RMS SIGDEF TSTMAX	CTAPES DIMEN FILE PROPER
2	IODATA	MAIN	BIGBRD LBD	CTAPES FILE PROPER
3	COMPAK	MAIN	GETDIM PUTLAB GETROW PUTROW DCLOSE	CTAPES FILE
4	RMS	MAIN	GETDIM GETROW DCLOSE PUTLAB PUTROW SQRT	FILE PROPER
5	SIGDEF	MAIN	GETDIM GETROW DCLOSE DPRIME SORT DPMAX DTILE DTMAX STILE STMAX	CTAPES DIMEN FILE PROPER

<u>NO.</u>	<u>SUBROUTINE</u>	<u>CALLED FROM</u>	<u>CALLS</u>	<u>COMMON</u>
5 (cont)			SPRIME SPMAX STRNGR	
6	DFILE	SIGDEF	-	CTAPES
7	DTMAX	SIGDEF	-	CTAPES
8	STILE	SIGDEF	-	CTAPES
9	STMAX	SIGDEF	-	CTAPES
10	DPRIME	SIGDEF	GETDIM GETROW DCLOSE	CTAPES DIMEN FILE
11	DPMAX	SIGDEF	GETDIM GETROW DCLOSE	CTAPES DIMEN FILE
12	SPRIME	SIGDEF	GETDIM GETROW DCLOSE	CTAPES FILE DIMEN
13	SPMAX	SIGDEF	-	CTAPES DIMEN
14	STRNGR	SIGDEF		FILE DIMEN CTAPES
15	SORT	SIGDEF	-	DIMEN
16	TSTMAX	MAIN	-	CTAPES DIMEN FILE
17	BIGBRD	IODATA	-	CTAPES
18	LDB	IODATA	EOFOI PLB	-
19	PLB	LDB	-	-
20	EOFOI	LDB	-	-

NO.	SUBROUTINE	CALLED FROM	CALLS	COMMON
21	PUTLAB	COMPAK RMS	DFIND DWRITE	CTAPES FILE PUTGET
22	PUTROW	COMPAK RMS	DWRITE PACK UNPACK DCLOSE	-
23	GETDIM	MAIN COMPAK RMS SIGDEF DPRIME DPMAX SPRIME	DFIND DREAD	CTAPES FILE PUTGET
24	GETROW	MAIN COMPAK RMS SIGDEF DPRIME DPMAX SPRIME	DREAD UNPACK PACK	-
25	DWRITE	PUTLAB PUTROW	PUT	-
26	PUT	DWRITE	-	-
27	DREAD	GETDIM GETROW	GET	-
28	GET	DREAD	-	-
29	DFIND	PUTLAB GETDIM	-	-
30	DCLOSE	MAIN	-	-

<u>NO.</u>	<u>SUBROUTINE</u>	<u>CALLED FROM</u>	<u>CALLS</u>	<u>COMMON</u>
30 (cont)		COMPAK		
		RMS		
		SIGDEF		
		DPRIME		
		DPMAX		
		SPRIME		
31	PACK	PUTROW	-	-
		GETROW		
32	UNPACK	PUTROW	-	-
		GETROW		

C.5 BRIEF DESCRIPTION OF SUBROUTINES

An alphabetical and numerical index, cross-referencing the 32 subroutines contained in ARREST, appears in Figure C-2. A brief description of each subroutine is also presented in the order in which it appears in the FORTRAN program.

SUBROUTINE	ORDER	SUBROUTINE	ORDER	SUBROUTINE	ORDER
ALPHABETICAL LISTING OF SUBROUTINES					
BIGBRD	17	COMPAK	3	DCLOSE	30
DFIND	29	DPMAX	11	DPRIME	10
DREAD	27	DTILE	6	DTMAX	7
DWRITE	25	EOF01	20	GET	28
GETDIM	23	GETROW	24	IODATA	2
LDB	18	MAIN	1	PACK	31
PLB	19	PUT	26	PUTLAB	21
PUTROW	22	RMS	4	SIGDEF	5
SORT	15	SPMAX	13	SPRIME	12
STILE	8	STMAX	9	STRNGR	14
TSTMAX	16	UNPACK	32		
NUMERICAL INDEX					
MAIN	1	IODATA	2	COMPAK	3
RMS	4	SIGDEF	5	DTILE	6
DTMAX	7	STILE	8	STMAX	9
DPRIME	10	DPMAX	11	SPRIME	12
SPMAX	13	STRNGR	14	SORT	15
TSTMAX	16	BIGBRD	17	LDB	18
PLB	19	EOF01	20	PUTLAB	21
PUTROW	22	GETDIM	23	GETROW	24
DWRITE	25	PUT	26	DREAD	27
GET	28	DFIND	29	DCLOSE	30
PACK	31	UNPACK	32		

Figure C-2 Subroutine Cross-Reference

DESCRIPTION OF SUBROUTINES

- 1 MAIN - Initializes input/output unit numbers and calls all input and data processing routines.
- 2 IODATA - Reads all data from input stream and prints user options.
- 3 COMPAK - Incorporates modal data from all tapes onto the tape for the first mode in a non-restart job.
- 4 RMS - Generates all RMS deflections, strains and stresses and stores them for future printout.
- 5 SIGDEF - Supervisor that calls routines for printout of RMS results.
- 6 DTILE - Prints RMS TPS displacements for tile.
- 7 DTMAX - Prints maximum RMS TPS displacements for tile.
- 8 STILE - Prints RMS stresses for tile.
- 9 STMAX - Prints maximum RMS stresses for tile.
- 10 DPRIME - Prints primary structure RMS deflections.
- 11 DPMAX - Prints maximum primary structure RMS deflections.
- 12 SPRIME - Prints mid-point plate member RMS strains and stresses.
- 13 SPMAX - Prints maximum mid-point plate member RMS strains and stresses.
- 14 STRNGR - Prints stringer strains and stresses.
- 15 SORT - Sorts set of RMS results into decreasing order.
- 16 TSTMAX - Prints maximum RMS stress for each tile.
- 17 BIGPRD - Prints ARREST title sheet before program output.
- 18 LDB - Reads and lists data from input stream and generates data file for user's program.
- 19 PLB - Starts a new page and/or skips a number of lines.
- 20 EOFOT - Checks for an end of file on input data set unit, sets end of file control word option to its proper value and reads a two card problem title.

- 21 PUTLAB - Puts label on data set containing matrix dimensions and prints out label information, if requested.
- 22 PUTROW - Writes row of matrix on data set in format designated by packing factor.
- 23 GETDIM - Gets label of matrix from data set and prints out label information, if requested.
- 24 GETROW - Reads row of matrix from data set in format designated by packing factor.
- 25 DWRITE - Converts number of bytes in array into words by dividing by four.
- 26 PUT - Writes singly-dimensioned array onto data set.
- 27 DREAD - Converts number of bytes in array into words by dividing by four.
- 28 GET - Reads singly-dimensioned array from data set.
- 29 DFIND - Rewinds data set to appropriate file.
- 30 DCLOSE - Rewinds data set.
- 31 PACK - Packs rows of matrix so they may be written on a data set in an efficient manner. This is done by representing strings of zeros by a single fixed point negative integer where the value of the integer represents the number of zeroes in the string. Non-zero numbers are preceded by a fixed point number indicating the number of non-zero numbers that follow.
- 32 UNPACK - Unpacks rows of matrices that have been packed by subroutine PACK.

C.6 TYPICAL SUBPROGRAM OUTPUT

The following listings display subprogram output with all the debugging clues turned on. The name of the particular subprogram which generated each set of output is printed in bold type on the rotated right hand side of each photographed computer page.

IODATA

ARREST TEST PROBLEM - CLOSED STRINGERS WITH TILES
 APRIL 20, 1975

OPT I O N S

INPUT MODAL DATA IS STORED ON 2 TAPE(S)

NUMBER OF PEAK RMS ITEMS IDENTIFIED IN EACH CATEGORY

- 30 PRIMARY STRUCTURE ACCELERATIONS
- 20 PRIMARY STRUCTURE STRESSES
- 20 TILE DEFLECTIONS PER TILE
- 15 TILE STRESSES PER TILE

INPUT MODE	INTEGRATED PRESSURE SPECTRAL DENSITY FUNCTION ($\text{PSI}^2/\text{HZ}) * (\text{AREA}^2) * \text{Z}$)	MODAL MASS (IN-LB-SEC ²)	MODAL FREQUENCY (RAD/SEC)	DAMPING RATIO
1	2.59592F-01	2.62866E-02	4.71887E 02	5.00000E-02
1	2.59592F-01	2.62866E-02	4.71887E 02	5.00000E-02

COMPAK

FROM GETDIM,
NAME = TILF DEF, I/O UNIT = 2, FILE = 1, ROWS = 1, COLUMNS = 240

FROM PUTLAB,
NAME = TILF DEF, I/O UNIT = 1, FILE = 9, ROWS = 1, COLUMNS = 240

COPYING MODE 2 FILE 1 MATRIX TILF DEF 1 ROWS 240 COLUMNS

FROM GETDIM,
NAME = T STRESS, I/O UNIT = 2, FILE = 2, ROWS = 27, COLUMNS = 6

FROM PUTLAB,
NAME = T STRESS, I/O UNIT = 1, FILE = 10, ROWS = 1, COLUMNS = 162

COPYING MODE 2 FILE 2 MATRIX T STRESS 27 ROWS 6 COLUMNS

FROM GETDIM,
NAME = TILF DEF, I/O UNIT = 2, FILE = 3, ROWS = 1, COLUMNS = 240

FROM PUTLAB,
NAME = TILF DEF, I/O UNIT = 1, FILE = 11, ROWS = 1, COLUMNS = 240

COPYING MODE 2 FILE 3 MATRIX TILF DEF 1 ROWS 240 COLUMNS

FROM GETDIM,
NAME = T STRESS, I/O UNIT = 2, FILE = 4, ROWS = 27, COLUMNS = 6

FROM PUTLAB,
NAME = T STRESS, I/O UNIT = 1, FILE = 12, ROWS = 1, COLUMNS = 162

COPYING MODE 2 FILE 4 MATRIX T STRESS 27 ROWS 6 COLUMNS

FROM GETDIM,
NAME = PS DEFLS, I/O UNIT = 2, FILE = 5, ROWS = 1, COLUMNS = 162

FROM PUTLAB,
NAME = PS DEFLS, I/O UNIT = 1, FILE = 13, ROWS = 1, COLUMNS = 162

COPYING MODE 2 FILE 5 MATRIX PS DEFLS 1 ROWS 162 COLUMNS

FROM GETDIM,
NAME = PS STRES, I/O UNIT = 2, FILE = 6, ROWS = 19, COLUMNS = 6

FROM PUTLAB,
NAME = PS STRES, I/O UNIT = 1, FILE = 14, ROWS = 1, COLUMNS = 108

COPYING MODE 2 FILE 6 MATRIX PS STRES 19 ROWS 6 COLUMNS

FROM GETDIM,
NAME = PS STRES, I/O UNIT = 2, FILE = 7, ROWS = 18, COLUMNS = 6

FROM PUTLAB,
NAME = PS STRES, I/O UNIT = 1, FILE = 15, ROWS = 1, COLUMNS = 108

COPYING MODE 2 FILE 7 MATRIX PS STRES 19 ROWS 6 COLUMNS

FROM GETDIM,
NAME = T STRES, I/O UNIT = 2, FILE = 8, ROWS = 6, COLUMNS = 2

MAIN
RMS

FROM PUTLAB, I/O UNIT = 1, FILE = 16, ROWS = 1, COLUMNS = 12
 NAME = ST STRES, 2 MATRIX ST STRES, 6 ROWS, 2 COLUMNS

FROM GETDIM, I/O UNIT = 9, FILE = 2, ROWS = 3, COLUMNS = 1000
 NAME = LOADS

FROM GETDIM, I/O UNIT = 1, FILE = 1, ROWS = 1, COLUMNS = 240
 NAME = TILE DEF, I/O UNIT = 10, FILE = 1, ROWS = 1, COLUMNS = 240
 NAME = TILF DEF, I/O UNIT = 1, FILE = 9, ROWS = 1, COLUMNS = 240
 NAME = TILF DEF, I/O UNIT = 1, FILE = 2, ROWS = 27, COLUMNS = 6
 NAME = T STRESS, I/O UNIT = 10, FILE = 2, ROWS = 1, COLUMNS = 162
 NAME = T STRESS, I/O UNIT = 1, FILE = 10, ROWS = 1, COLUMNS = 162
 NAME = T STRESS, I/O UNIT = 1, FILE = 3, ROWS = 1, COLUMNS = 240
 NAME = TILF DEF, I/O UNIT = 10, FILE = 3, ROWS = 1, COLUMNS = 240
 NAME = TILF DEF, I/O UNIT = 1, FILE = 11, ROWS = 1, COLUMNS = 240
 NAME = T STRESS, I/O UNIT = 1, FILE = 4, ROWS = 27, COLUMNS = 6
 NAME = T STRESS, I/O UNIT = 10, FILE = 4, ROWS = 1, COLUMNS = 162
 NAME = T STRESS, I/O UNIT = 1, FILE = 12, ROWS = 1, COLUMNS = 162
 NAME = PS DEFLS, I/O UNIT = 1, FILE = 5, ROWS = 1, COLUMNS = 162
 NAME = PS DEFLS, I/O UNIT = 10, FILE = 5, ROWS = 1, COLUMNS = 162
 NAME = PS DEFLS, I/O UNIT = 1, FILE = 13, ROWS = 1, COLUMNS = 162
 NAME = PS STRES, I/O UNIT = 1, FILE = 5, ROWS = 18, COLUMNS = 6
 NAME = PS STRES, I/O UNIT = 10, FILE = 6, ROWS = 1, COLUMNS = 108

RMS

FROM GETDIM,
NAME = PS STRES, I/O UNIT = 1, FILE = 14, ROWS = 1, COLUMNS = 108

FROM GETDIM,
NAME = PS STRES, I/O UNIT = 1, FILE = 7, ROWS = 18, COLUMNS = 6

FROM PUTTAB,
NAME = PS STRES, I/O UNIT = 10, FILE = 7, ROWS = 1, COLUMNS = 108

FROM GETDIM,
NAME = PS STRES, I/O UNIT = 1, FILE = 15, ROWS = 1, COLUMNS = 108

FROM GETDIM,
NAME = ST STRES, I/O UNIT = 1, FILE = 8, ROWS = 4, COLUMNS = 2

FROM PUTTAB,
NAME = ST STRES, I/O UNIT = 10, FILE = 8, ROWS = 1, COLUMNS = 12

FROM GETDIM,
NAME = ST STRES, I/O UNIT = 1, FILE = 16, ROWS = 1, COLUMNS = 12

FROM GETDIM,
NAME = TILF DEF, I/O UNIT = 10, FILE = 1, ROWS = 1, COLUMNS = 240

FROM GETDIM,
NAME = J86GNVQC, I/O UNIT = 9, FILE = 3, ROWS = 1, COLUMNS = 108

FROM GETDIM,
NAME = TILF DEF, I/O UNIT = 10, FILE = 1, ROWS = 1, COLUMNS = 240

SIGDEF

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DTILE

RMS TPS DISPLACEMENTS FOR TILE NO. 1 (IN.)

NODE	X COMPONENT (U)	Y COMPONENT (V)	Z COMPONENT (W)
1	5.9237558E-05	7.0984488E-06	0.00
2	5.5564858E-05	6.0089887E-06	0.00
3	5.5646370E-05	4.8720333E-06	0.00
4	5.4734468E-05	4.1120729E-06	0.00
5	5.6585573E-05	3.4805089E-06	0.00
6	5.6517471E-05	2.7322048E-06	0.00
7	5.4520249E-05	1.7773340E-06	0.00
8	5.4220365E-05	1.5764927E-06	0.00
9	5.4766308E-05	6.9512882E-07	0.00
10	5.7743974E-05	3.0065699E-08	0.00
11	5.7743974E-05	3.9222887E-08	0.00
12	5.9619871E-05	4.1642643E-08	1.0122944E-03
13	5.6492738E-05	1.7789811E-08	1.0209167E-03
14	5.6784905E-05	1.1787943E-08	1.0369641E-03
15	5.7023900E-05	1.6651720E-08	1.0495435E-03
16	5.3123764E-05	2.8613752E-08	1.0496213E-03
17	5.1232440E-05	3.3001852E-08	1.0371145E-03
18	5.3528249E-05	2.5713764E-08	1.0211349E-03
19	5.4798342E-05	1.6921622E-08	1.0127111E-03
20	5.1798342E-05	5.0414983E-08	1.0335146E-03
21	5.4820430E-05	2.8710723E-08	2.2923767E-06
22	5.4820430E-05	4.1190573E-08	2.1742568E-06
23	5.4450956E-05	4.1190573E-08	1.8137451E-06
24	5.3938727E-05	3.9588949E-08	1.3138715E-06
25	5.3520589E-05	3.3864648E-08	9.2732779E-07
26	5.3384708E-05	2.6814741E-08	1.2952493E-06
27	5.3274777E-05	2.1138349E-08	1.2952493E-06
28	5.3771033E-05	1.8739574E-08	1.8087303E-06
29	5.3677359E-05	1.9531135E-08	1.8087303E-06
30	5.3679799E-05	2.2253389E-08	2.1320693E-06
31	5.4476306E-05	5.0234848E-08	1.91519E-06
32	5.4756183E-05	3.0043970E-08	1.0230064E-03
33	5.6074467E-05	5.3772328E-08	1.036570E-03
34	5.2663363E-05	5.0469914E-08	1.0267857E-03
35	5.1514077E-05	3.5066914E-08	1.0437486E-03
36	5.1379515E-05	1.4247480E-08	1.0437486E-03
37	5.2260719E-05	1.1391808E-07	1.0363928E-03
38	5.3405931E-05	4.3762361E-07	1.0270244E-03
39	5.3810716E-05	5.5398008E-08	1.0239222E-03
40	5.32666443E-05	5.3035812E-08	1.0239222E-03
41	2.7135178E-04	3.6026377E-06	4.9079980E-06
42	2.7135178E-04	3.5380020E-06	4.1563953E-06
43	2.7133830E-04	3.5380020E-06	2.4708534E-06
44	2.7117017E-04	3.1528850E-06	3.2709358E-06
45	2.7117017E-04	2.9040702E-06	1.9745268E-06
46	2.7094988E-04	2.6825785E-06	2.4117258E-06
47	2.7069543E-04	2.4951005E-06	3.1682666E-06
48	2.7046329E-04	2.4021847E-06	4.0045152E-06
49	2.7010205E-04	2.4211622E-06	4.7000840E-06

RMS TPS DISPLACEMENTS FOR TILE NO. 1 (IN.)

NODE	X COMPONENT (U)	Y COMPONENT (V)	Z COMPONENT (W)
51	3.710840E-04	4.664094E-06	1.032607E-03
52	2.710285E-04	2.741038E-06	1.032607E-03
53	2.707039E-04	2.710395E-06	1.032607E-03
54	2.706032E-04	2.703712E-06	1.032607E-03
55	2.704744E-04	2.626152E-06	1.032607E-03
56	2.703208E-04	2.451884E-06	1.032607E-03
57	2.701859E-04	2.120495E-06	1.032607E-03
58	2.701107E-04	1.822232E-07	1.032607E-03
59	2.699840E-04	2.264463E-06	1.032607E-03
60	2.698402E-04	2.279354E-06	1.032607E-03
61	2.696819E-04	2.372115E-06	1.032607E-03
62	2.695093E-04	2.558936E-06	1.032607E-03
63	2.693242E-04	2.816212E-06	1.032607E-03
64	2.691280E-04	3.099325E-06	1.032607E-03
65	2.689248E-04	3.356739E-06	1.032607E-03
66	2.687157E-04	3.543816E-06	1.032607E-03
67	2.685025E-04	3.636799E-06	1.032607E-03
68	2.682858E-04	3.652272E-06	1.032607E-03
69	2.680662E-04	3.623964E-06	1.032607E-03
70	2.678437E-04	3.526486E-06	1.032607E-03
71	2.676180E-04	3.353495E-06	1.032607E-03
72	2.673893E-04	3.060623E-06	1.032607E-03
73	2.671577E-04	2.698661E-06	1.032607E-03
74	2.669232E-04	2.274812E-06	1.032607E-03
75	2.666867E-04	1.824994E-06	1.032607E-03
76	2.664482E-04	1.340487E-06	1.032607E-03
77	2.662077E-04	8.851311E-07	1.032607E-03
78	2.659652E-04	4.669326E-06	1.032607E-03
79	2.657217E-04	2.282381E-06	1.032607E-03
80	2.654772E-04	1.032607E-03	1.032607E-03

ORIGINAL PAGE IS
OF POOR QUALITY

MAXIMUM RMS TPS DISPLACEMENTS FOR TILE NO. 1 (IN.)

DTMAX

NODE	X COMPONENT(U)	Y COMPONENT(V)	Z COMPONENT(W)
14	1.0369641E-03		
15	1.0495438E-03		
16	1.0496213E-03		
17	1.0371149E-03		
34	1.0362570E-03		
35	1.0437467E-03		
36	1.0437466E-03		
37	1.0363988E-03		
54	1.0367774E-03		
55	1.0384026E-03		
56	1.0366949E-03		
57	1.0367541E-03		
72	1.0375948E-03		
73	1.0370614E-03		
74	1.0365502E-03		
75	1.0365846E-03		
76	1.0371646E-03		
77	1.0378218E-03		
78	1.0369609E-03		
79			

FROM GETDIM, I/O UNIT = 10, FILE = 2, ROWS = 1, COLUMNS = 162

SIGDEF

STILE

RMS STRESSES FOR TILE NO. 1 (PSI)

MEM	TEMP	LOCAL COORDINATES	XX	YY	ZZ	XY	YZ	ZX
		X Y Z						
1	0.	2450	0.55	2.87579E-03	2.85342E-03	2.53619E-05	7.82985E-04	3.35432E-03
2	0.	2450	1.67	5.24152E-02	5.43558E-02	4.73531E-06	2.26123E-04	3.35931E-03
3	0.	2450	2.78	1.37981E-02	1.47205E-02	1.74646E-05	6.77903E-04	3.35931E-03
4	0.	2450	3.89	2.59183E-02	4.22141E-02	5.41731E-06	5.51230E-04	3.35931E-03
5	0.	2450	5.00	4.28792E-02	2.56667E-02	1.58773E-06	2.74454E-04	3.35931E-03
6	0.	2450	6.11	2.56667E-02	1.42964E-02	1.39852E-05	5.12735E-04	3.35931E-03
7	0.	2450	7.22	1.42964E-02	5.29318E-03	7.92000E-05	6.42089E-04	3.35931E-03
8	0.	2450	8.33	5.29318E-03	2.62622E-03	2.83990E-05	1.98212E-04	3.35931E-03
9	0.	2450	9.44	9.85529E-03	1.49974E-02	2.83990E-05	8.04843E-04	3.35931E-03
10	0.	2450	1.67	1.22559E-02	1.49974E-02	2.83990E-05	2.19510E-03	3.35931E-03
11	0.	2450	2.78	1.07188E-02	2.23112E-02	7.49233E-03	2.78865E-03	3.35931E-03
12	0.	2450	3.89	4.73736E-02	1.53321E-02	6.72864E-03	3.30322E-03	3.35931E-03
13	0.	2450	5.00	6.38937E-02	2.56433E-02	9.76663E-03	3.30322E-03	3.35931E-03
14	0.	2450	6.11	1.58452E-02	1.53321E-02	6.72864E-03	3.30322E-03	3.35931E-03
15	0.	2450	7.22	9.69247E-02	2.56433E-02	9.76663E-03	3.30322E-03	3.35931E-03
16	0.	2450	8.33	1.25641E-02	1.53321E-02	6.72864E-03	3.30322E-03	3.35931E-03
17	0.	2450	9.44	4.92709E-02	2.56433E-02	9.76663E-03	3.30322E-03	3.35931E-03
18	0.	2450	0.57	1.27064E-02	2.23112E-02	7.49233E-03	2.78865E-03	3.35931E-03
19	0.	2450	1.67	9.27336E-03	4.99998E-02	5.49998E-03	2.02688E-02	3.35931E-03
20	0.	2450	2.78	1.76488E-03	1.17943E-03	7.99688E-04	1.05205E-02	3.35931E-03
21	0.	2450	3.89	6.68092E-03	1.17943E-03	7.99688E-04	1.05205E-02	3.35931E-03
22	0.	2450	5.00	1.69824E-02	2.44140E-03	2.45238E-03	1.47117E-02	3.35931E-03
23	0.	2450	6.11	1.98212E-02	4.06628E-03	3.51312E-03	3.11991E-03	3.35931E-03
24	0.	2450	7.22	1.16821E-02	2.42541E-03	2.99742E-03	1.12472E-02	3.35931E-03
25	0.	2450	8.33	6.69211E-03	1.12898E-03	2.03385E-03	1.47006E-02	3.35931E-03
26	0.	2450	9.44	1.78584E-02	4.19035E-03	6.94909E-03	1.03412E-02	3.35931E-03
27	0.	2450	5.44	9.91825E-03	5.94595E-03	7.56731E-04	4.07937E-03	3.35931E-03

STMAX

MAXIMUM RMS STRESSES FOR TILE NO. 1 (PSI)

MFM	TEMP	LOCAL COORDINATES	XX	YY	ZZ	XY	YZ	ZX
12	C.	2.50 1.67 0.05	5.27409E-02	5.24152E-02	5.43559E-02			
13	C.	2.50 5.00 0.05	4.28702E-02	4.32141E-02	4.52162E-02			
14	C.	2.50 6.11 0.05	5.29318E-02	5.25083E-02	2.75336E-02		3.30328E-02	
15	C.	2.50 2.78 0.50		4.73360E-02	5.45565E-02			
16	C.	2.50 3.89 0.50		6.35917E-02				
17	C.	2.50 6.11 0.50		4.72520E-02			3.31032E-02	
18	C.	2.50 7.22 0.50						

FROM GETDIM, DFC. I/O UNIT = 10. FILE = 3. ROWS = 1. COLUMNS = 240
 NAME = TILE

SIGDEF

DTILE

RMS TPS DISPLACEMENTS FOR TILE NO. 2 (IN.)

NOTE	X COMPONENT (U)	Y COMPONENT (V)	Z COMPONENT (W)
1	8.774359E-06	9.922688E-06	1.013126E-03
2	8.961057E-06	4.164264E-06	1.012296E-03
3	8.649573E-06	1.778881E-06	1.020916E-03
4	8.675493E-06	1.178794E-06	1.036944E-03
5	8.979937E-06	1.665173E-06	1.049533E-03
6	8.734113E-06	2.861932E-06	1.049621E-03
7	8.338640E-06	3.800182E-06	1.037148E-03
8	8.338640E-06	2.571974E-06	1.031134E-03
9	8.470701E-06	1.692363E-06	1.011271E-03
10	8.170987E-06	2.841467E-06	1.033814E-03
11	3.856425E-05	3.817170E-06	0.0
12	3.853370E-05	4.629416E-06	0.0
13	3.842014E-05	3.676610E-06	0.0
14	3.862290E-05	3.110209E-06	0.0
15	3.875121E-05	2.669462E-06	0.0
16	3.875175E-05	2.144805E-06	0.0
17	3.862718E-05	1.737618E-06	0.0
18	3.842843E-05	1.292332E-06	0.0
19	3.854544E-05	5.463975E-07	0.0
20	3.897950E-05	3.001781E-06	0.0
21	4.614930E-05	5.026197E-06	1.026258E-03
22	4.657652E-05	5.012850E-06	1.023080E-03
23	4.604815E-05	5.387420E-06	1.026778E-03
24	4.478174E-05	5.059219E-06	1.043736E-03
25	4.377555E-05	3.521184E-06	1.036372E-03
26	4.480235E-05	1.440833E-06	1.036372E-03
27	4.608475E-05	9.588438E-06	1.027001E-03
28	4.622018E-05	4.165809E-07	1.023374E-03
29	4.655213E-05	2.974559E-06	1.026760E-03
30	4.663320E-05	1.877021E-06	1.026760E-03
31	4.642082E-05	3.188350E-06	2.280377E-06
32	4.672555E-05	3.473749E-06	2.170956E-06
33	4.572555E-05	3.557026E-06	1.829757E-06
34	4.577705E-05	3.215239E-06	1.309712E-06
35	4.506915E-05	2.759134E-06	9.166421E-07
36	4.506915E-05	2.060345E-06	1.291809E-06
37	4.504895E-05	1.499015E-06	1.798804E-06
38	4.558027E-05	1.264521E-06	2.123872E-06
39	4.661921E-05	1.347816E-06	2.206713E-06
40	4.661921E-05	1.622204E-06	1.030433E-03
41	2.527272E-04	4.580792E-06	1.032440E-03
42	2.527893E-04	3.757948E-06	1.034535E-03
43	2.528110E-04	1.721232E-06	1.036736E-03
44	2.528482E-04	2.052645E-06	1.038524E-03
45	2.529473E-04	2.846052E-06	1.038524E-03
46	2.529473E-04	3.177766E-06	1.036943E-03
47	2.529473E-04	2.470943E-06	1.034724E-03
48	2.529473E-04	1.139417E-06	1.032749E-03
49	2.529473E-04	3.230613E-07	1.030791E-03
50	2.529473E-04	0.0	0.0

ORIGINAL PAGE IS
OF POOR QUALITY

DTILE

RMS TPS DISPLACEMENTS FOR TILE NO. 2 (IN.)

NODE	X COMPONENT (U)	Y COMPONENT (V)	Z COMPONENT (W)
51	2.5305243E-04	2.9086640E-06	4.8641377E-06
52	2.5271058E-04	2.9022014E-06	4.1271942E-06
53	2.5230274E-04	2.9023905E-06	3.2425116E-06
54	2.5181269E-04	2.7229145E-06	2.4256174E-06
55	2.5134422E-04	2.5027552E-06	1.9325933E-06
59	2.5155306E-04	2.2820354E-06	1.932146E-06
71	2.5147644E-04	2.0625068E-06	2.918410E-06
77	2.5127581E-04	1.8623944E-06	3.1486798E-06
59	2.5126759E-04	1.7910052E-06	4.629565E-06
60	2.5124644E-04	1.8102437E-06	1.0334568E-03
61	2.5079042E-04	1.550559E-06	1.0367145E-03
62	2.5048048E-04	1.6520489E-06	1.0373075E-03
63	2.5024358E-04	1.8605379E-06	1.0370067E-03
64	2.49910079E-04	2.0862717E-06	1.0364896E-03
65	2.49519765E-04	2.2984168E-06	1.0355224E-03
66	2.491441E-04	2.5064324E-06	1.0371031E-03
67	2.48780491E-04	2.7182214E-06	1.0374622E-03
69	2.4843109E-04	2.9437042E-06	1.0357157E-03
70	2.4809306E-04	3.1518430E-06	5.4966531E-06
71	2.4776931E-04	3.2479693E-06	4.6275600E-06
72	2.47458346E-04	3.2479693E-06	3.8426242E-06
73	2.4716009E-04	1.6559624E-06	3.3077447E-06
74	2.46875227E-04	1.7528564E-06	3.0193587E-06
75	2.46603827E-04	1.900536E-06	3.045432E-06
76	2.463480E-04	2.4816590E-06	3.286408E-06
77	2.461180E-04	2.7419319E-06	3.7090071E-06
78	2.45907180E-04	3.026816E-06	4.293819E-06
79	2.4570505E-04	3.0273984E-06	5.2522000E-06
80	2.45504409E-04	3.0381307E-06	

DTMAX

MAXIMUM RMS TPS DISPLACEMENTS FOR TILE NO. 2 (IN.)

NODE	X COMPONENT(U)	Y COMPONENT(V)	Z COMPONENT(W)
4			1.034604E-03
5			1.049535E-03
6			1.040621E-03
7			1.037114E-03
24			1.035242E-03
25			1.043736E-03
26			1.043787E-03
27			1.036377E-03
44			1.038324E-03
45			1.038363E-03
46			1.036849E-03
47			1.036714E-03
52			1.037307E-03
63			1.037006E-03
64			1.036489E-03
65			1.036522E-03
66			1.037103E-03
67			1.037462E-03
68			1.036922E-03
69			1.036922E-03

FROM GETIM. I/O UNIT = 10. FILE = 4. ROWS = 1. COLUMNS = 162

SIGDEF

STILE

RMS STRESSES FOR TILE NO. 2 (PST)

MEM	TEMP	LOCAL COORDINATES	XX	YY	ZZ	XY	YZ	ZX
1	0	0	0.05	2.9885E-03	2.97060E-03	1.02622E-05	6.5683E-04	3.3351E-03
2	0	0	0.05	2.2554E-02	1.44232E-02	5.2571E-06	7.2621E-04	3.3752E-03
3	0	0	0.05	1.3382E-02	2.7162E-02	9.5354E-06	7.4938E-04	2.1035E-03
4	0	0	0.05	4.3248E-02	4.5298E-02	6.2315E-07	5.9431E-04	2.7718E-03
5	0	0	0.05	2.5958E-02	2.7247E-02	6.2633E-06	5.2422E-04	2.7571E-03
6	0	0	0.05	1.4012E-02	1.4344E-02	1.1716E-05	6.7732E-04	2.0726E-03
7	0	0	0.05	5.2627E-02	5.4570E-02	8.5997E-06	2.5255E-04	2.3174E-03
8	0	0	0.05	2.5761E-02	2.4542E-02	1.0917E-05	2.1890E-04	2.2659E-03
9	0	0	0.60	1.2873E-02	1.4992E-02	2.2337E-02	7.1927E-03	9.2786E-03
10	0	0	0.60	1.5240E-02	2.3374E-02	6.0352E-03	3.3016E-02	6.2786E-03
11	0	0	0.60	1.0148E-02	7.5095E-02	8.7263E-03	2.0516E-02	9.5714E-03
12	0	0	0.60	4.7119E-02	1.5354E-02	6.2008E-03	2.6522E-02	2.2684E-03
13	0	0	0.60	6.3416E-02	2.5629E-02	5.4419E-05	2.6522E-02	2.6852E-04
14	0	0	0.60	4.7057E-02	1.5228E-02	6.0301E-03	2.6522E-02	5.7319E-03
15	0	0	0.60	1.5329E-02	7.5886E-02	8.5601E-03	3.3190E-03	6.2586E-03
16	0	0	0.60	1.2931E-02	2.2383E-02	6.4785E-03	7.7473E-03	5.5049E-03
17	0	0	0.60	9.8749E-03	1.4884E-02	2.1395E-03	2.1132E-02	2.7142E-03
18	0	0	2.10	1.5223E-02	1.9502E-02	7.0893E-04	1.0477E-02	2.7142E-03
19	0	0	2.10	1.7717E-02	1.1153E-02	2.7066E-04	1.4776E-02	6.5152E-04
20	0	0	2.10	1.0084E-02	2.4367E-02	2.3506E-03	1.1207E-02	9.1927E-03
21	0	0	2.10	2.1829E-02	4.0673E-02	2.5062E-03	5.9070E-03	1.4282E-03
22	0	0	2.10	1.8077E-02	2.4294E-02	2.2972E-03	1.1217E-02	1.4282E-03
23	0	0	2.10	4.1777E-02	2.4294E-02	2.2972E-03	1.1217E-02	1.4282E-03
24	0	0	2.10	1.7786E-02	4.1817E-02	2.2972E-03	1.4282E-02	2.0726E-03
25	0	0	2.10	9.6595E-03	5.9279E-02	7.0576E-04	4.0483E-03	7.1618E-03

STMAX

MAXIMUM RMS STRESSES FOR TILE NO. 2 (PSI)

MEM	TEMP	LOCAL COORDINATES			MAXIMUM RMS STRESSES (PSI)					
		X	Y	Z	XX	YY	ZZ	XY	YZ	ZX
2	0.	2.50	1.67	0.05	5.28802E-02	5.25342E-02	5.44922E-02			
3	0.	2.50	3.00	0.05	4.29692E-02	4.32948E-02	4.52908E-02			
4	0.	2.50	6.11	0.05			2.72474E-02			
5	0.	2.50	8.33	0.05	5.29513E-02	5.26278E-02	5.45707E-02			
12	0.	2.50	3.78	0.60					3.30761E-02	
13	0.	2.50	3.69	0.60						
14	0.	2.50	3.00	0.60						
15	0.	2.50	6.11	0.60						
16	0.	2.50	7.22	0.60					3.31190E-02	

SIGDEF
DPRIME

FROM GETDIM, NAME = PS DEFLS, I/O UNIT = 10, FILE = 5, ROWS = 1, COLUMNS = 162
 FROM GETDIM, NAME = BND COND, I/O UNIT = 9, FILE = 1, ROWS = 51, COLUMNS = 11

ORIGINAL PAGE IS
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PRIMARY STRUCTURE RMS ACCELERATIONS

NODE	DX(G'S)	DY(G'S)	DZ(G'S)	RX/G	RY/G
1	1.199731E-02	4.083421E-03	6.551701E-01	8.708262E-04	1.858769E-01
2	5.247237E-03	3.419011E-03	5.087717E-01	8.726218E-04	1.794451E-01
3	9.518872E-03	2.754986E-03	5.804051E-01	5.773020E-04	1.741688E-01
4	5.161912E-03	2.380018E-03	5.612003E-01	2.244266E-04	1.712080E-01
5	9.982064E-03	2.016577E-03	5.519450E-01	1.424020E-04	1.694791E-01
6	9.535733E-03	1.621441E-03	5.518240E-01	1.988166E-04	1.599443E-01
7	9.016853E-03	1.300638E-03	5.607047E-01	2.198377E-04	1.711181E-01
8	5.638924E-03	1.009471E-03	5.797406E-01	5.674113E-04	1.740365E-01
9	9.482268E-03	4.789154E-04	6.079582E-01	8.686586E-04	1.792688E-01
10	1.113973E-02	2.390543E-03	6.542651E-01	8.686586E-04	1.856741E-01
11	5.096253E-03	2.255432E-03	5.517015E-01	5.576452E-02	2.479148E-07
12	5.187147E-03	2.192051E-03	5.804051E-01	3.576406E-02	2.441565E-07
13	4.570854E-03	1.928015E-03	5.612003E-01	2.334302E-02	2.785179E-07
14	4.566131E-03	1.858130E-03	5.519450E-01	1.445306E-02	2.864523E-07
15	4.774462E-03	1.508630E-03	5.518240E-01	4.255374E-03	3.482865E-07
16	4.746537E-03	1.161337E-03	5.607047E-01	4.290067E-03	4.310352E-07
17	4.840411E-03	7.854404E-04	5.797406E-01	1.415952E-02	4.925738E-07
18	4.778249E-03	3.089208E-04	6.079582E-01	2.311392E-02	3.345991E-07
19	4.894689E-03	2.500680E-04	6.542651E-01	3.464404E-02	2.434171E-07
20	4.701886E-03	2.950237E-03	6.542651E-01	5.848653E-02	2.553824E-07
21	8.468080E-03	2.423306E-03	4.411950E-02	8.708262E-04	1.858769E-01
22	2.262286E-02	1.890348E-03	9.384893E-03	8.726218E-04	1.794451E-01
23	8.811451E-03	1.507516E-03	4.363180E-02	5.774828E-04	1.741688E-01
24	5.215697E-03	1.446924E-03	1.446924E-03	2.246683E-04	1.712099E-01
25	4.840765E-03	1.308051E-03	1.308051E-03	2.125854E-04	1.694812E-01
26	4.532560E-03	1.017056E-03	1.017056E-03	1.948191E-04	1.694458E-01
27	1.501357E-02	8.369649E-04	3.927536E-04	2.195391E-04	1.711205E-01
28	3.240195E-02	3.927536E-04	3.927536E-04	5.670322E-04	1.740381E-01
29	1.879151E-02	2.927536E-04	2.927536E-04	8.686586E-04	1.792708E-01
30				8.686586E-04	1.856759E-01
31					
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100					

FROM GF TO IM, NAME = BND COND, I/O UNIT = 9, FILE = 1, ROWS = 51, COLUMNS = 11

DPMAX

MAXIMUM PRIMARY STRUCTURE RMS ACCELERATIONS

NODE	DX(G·S)	DY(G·S)	DZ(G·S)	RX/G	RY/G
1					1.858769E-01
2					1.794451E-01
3					1.741698E-01
4					1.792688E-01
5					1.855741E-01
6	6.551701E-01				
7	6.087717E-01				
8	5.804051E-01				
9	5.512002E-01				
10	5.216450E-01				
11	4.918240E-01				
12	4.617947E-01				
13	4.315992E-01				
14	4.012451E-01				
15	3.707406E-01				
16	3.400992E-01				
17	3.093212E-01				
18	2.784062E-01				
19	2.473592E-01				
20	2.161851E-01				
21	1.848842E-01				
22	1.534598E-01				
23	1.219177E-01				
24	9.02618E-02				
25	5.91240E-02				
26	2.80000E-02				
27	0.00000E+00				
28					
29					
30					
31					1.858769E-01
32					1.794451E-01
33					1.741698E-01
34					1.792688E-01
35					1.855741E-01
36					1.794451E-01
37					1.741698E-01
38					1.792688E-01
39					1.855741E-01
40					1.794451E-01
41					1.741698E-01
42					1.792688E-01
43					1.855741E-01
44					1.794451E-01
45					1.741698E-01
46					1.792688E-01
47					1.855741E-01
48					1.794451E-01
49					1.741698E-01
50					1.792688E-01
51					1.855741E-01
52					1.794451E-01
53					1.741698E-01
54					1.792688E-01
55					1.855741E-01
56					1.794451E-01
57					1.741698E-01
58					1.792688E-01
59					1.855741E-01
60					1.794451E-01
61					1.741698E-01
62					1.792688E-01
63					1.855741E-01
64					1.794451E-01
65					1.741698E-01
66					1.792688E-01
67					1.855741E-01
68					1.794451E-01
69					1.741698E-01
70					1.792688E-01
71					1.855741E-01
72					1.794451E-01
73					1.741698E-01
74					1.792688E-01
75					1.855741E-01
76					1.794451E-01
77					1.741698E-01
78					1.792688E-01
79					1.855741E-01
80					1.794451E-01
81					1.741698E-01
82					1.792688E-01
83					1.855741E-01
84					1.794451E-01
85					1.741698E-01
86					1.792688E-01
87					1.855741E-01
88					1.794451E-01
89					1.741698E-01
90					1.792688E-01
91					1.855741E-01
92					1.794451E-01
93					1.741698E-01
94					1.792688E-01
95					1.855741E-01
96					1.794451E-01
97					1.741698E-01
98					1.792688E-01
99					1.855741E-01
100					1.794451E-01

FROM GETDIM: I/O UNIT = 10, FILE = 6, ROWS = 1, COLUMNS = 100
 NAME = PS STRES.
 FROM GETDIM: I/O UNIT = 9, FILE = 2, ROWS = 3, COLUMNS = 1000
 NAME = LOADS

SIGDEF
 SPRIME

SPRIME

TOP-POINT PLATE MEMBER RMS STRAINS AND STRESSES (PST)

MEMBER	X	COORDINATES	Y	EPS X	RMS STRAINS	EPS Y	EPS XY	SIG X	RMS STRESSES	SIG XY
1	2.5000E-00	2.5000E-00	5.5556E-01	9.9175E-06	2.6845E-06	1.9545E-06	1.9545E-06	1.0045E-02	3.2939E-00	1.3247E-01
2	2.5000E-00	2.5000E-00	1.6667E-01	9.758E-06	1.9002E-06	2.2865E-07	2.2865E-07	9.4935E-01	1.2939E-01	5.9718E-00
3	2.5000E-00	2.5000E-00	3.7778E-01	9.021E-06	1.4557E-06	7.5649E-07	7.5649E-07	9.4935E-01	1.2939E-01	5.4048E-00
4	2.5000E-00	2.5000E-00	3.8889E-01	9.021E-06	1.2379E-06	5.6735E-08	5.6735E-08	9.4155E-01	1.3008E-01	5.0525E-01
5	2.5000E-00	2.5000E-00	7.0000E-01	9.158E-06	1.5630E-06	4.8265E-08	4.8265E-08	9.5755E-01	1.3890E-01	5.4474E-01
6	2.5000E-00	2.5000E-00	9.1111E-01	9.0132E-06	1.5998E-06	4.2145E-08	4.2145E-08	9.4965E-01	1.3123E-01	5.0103E-01
7	2.5000E-00	2.5000E-00	7.2222E-01	9.0566E-06	1.4342E-06	8.5503E-07	8.5503E-07	9.4755E-01	1.4035E-01	6.1074E-00
8	2.5000E-00	2.5000E-00	8.3333E-01	9.2975E-06	1.7802E-06	9.2239E-07	9.2239E-07	9.6302E-01	1.1089E-01	4.5885E-00
9	2.5000E-00	2.5000E-00	9.4444E-01	9.8238E-06	2.6302E-06	1.9370E-06	1.9370E-06	9.9285E-01	3.4931E-01	1.3836E-01
10	7.5000E-00	7.5000E-00	5.5556E-01	9.7305E-06	2.5772E-06	1.3098E-06	1.3098E-06	9.8191E-01	3.6530E-00	9.3555E-00
11	7.5000E-00	7.5000E-00	1.6667E-01	9.4328E-06	1.7069E-06	8.0977E-07	8.0977E-07	9.8039E-01	1.2340E-01	5.7840E-00
12	7.5000E-00	7.5000E-00	2.7778E-01	9.2123E-06	1.3422E-06	5.7957E-07	5.7957E-07	9.6809E-01	1.5521E-01	4.1390E-00
13	7.5000E-00	7.5000E-00	3.8889E-01	9.0765E-06	1.4071E-06	2.4123E-07	2.4123E-07	9.5103E-01	1.4460E-01	1.7231E-00
14	7.5000E-00	7.5000E-00	5.0000E-01	9.0026E-06	1.3610E-06	7.4993E-09	7.4993E-09	9.4443E-01	1.4723E-01	5.3566E-02
15	7.5000E-00	7.5000E-00	6.1111E-01	9.0496E-06	1.4084E-06	2.6253E-07	2.6253E-07	9.4803E-01	1.4357E-01	1.6752E-00
16	7.5000E-00	7.5000E-00	7.2222E-01	9.1559E-06	1.3524E-06	6.2030E-07	6.2030E-07	9.5015E-01	1.3322E-01	4.4307E-00
17	7.5000E-00	7.5000E-00	8.3333E-01	9.3431E-06	1.7128E-06	8.8268E-07	8.8268E-07	9.7016E-01	1.1976E-01	6.3049E-00
18	7.5000E-00	7.5000E-00	9.4444E-01	9.5311E-06	2.5629E-06	1.4213E-06	1.4213E-06	9.6835E-01	3.4224E-00	1.0152E-01

SPMAX

TOP-POINT PLATE MEMBER RMS STRAINS AND STRESSES (PSI)

MEMBER	X	COORDINATES	Y	MAXIMUM	EPS X	RMS STRAINS	EPS Y	SIG X	RMS STRESSES	SIG Y
1	2.5000E 00	5.5550E -01	1.0046E 01	1.6667E 00	1.6667E 00	1.6667E 00	1.6667E 00	1.6667E 00	1.6667E 00	1.6667E 00
2	2.5000E 00	1.6667E 00	2.7778E 00	3.8889E 00	3.8889E 00	3.8889E 00	3.8889E 00	3.8889E 00	3.8889E 00	3.8889E 00
3	2.5000E 00	3.8889E 00	5.0000E 00	6.1111E 00	6.1111E 00	6.1111E 00	6.1111E 00	6.1111E 00	6.1111E 00	6.1111E 00
4	2.5000E 00	6.1111E 00	7.2222E 00	8.3333E 00	8.3333E 00	8.3333E 00	8.3333E 00	8.3333E 00	8.3333E 00	8.3333E 00
5	2.5000E 00	8.3333E 00	9.4444E 00	1.1667E 01	1.1667E 01	1.1667E 01	1.1667E 01	1.1667E 01	1.1667E 01	1.1667E 01
6	2.5000E 00	1.1667E 01	1.6667E 01	2.7778E 00	2.7778E 00	2.7778E 00	2.7778E 00	2.7778E 00	2.7778E 00	2.7778E 00
7	2.5000E 00	2.7778E 00	3.8889E 00	5.0000E 00	5.0000E 00	5.0000E 00	5.0000E 00	5.0000E 00	5.0000E 00	5.0000E 00
8	2.5000E 00	5.0000E 00	6.1111E 00	7.2222E 00	7.2222E 00	7.2222E 00	7.2222E 00	7.2222E 00	7.2222E 00	7.2222E 00
9	2.5000E 00	7.2222E 00	8.3333E 00	9.4444E 00	9.4444E 00	9.4444E 00	9.4444E 00	9.4444E 00	9.4444E 00	9.4444E 00
10	2.5000E 00	9.4444E 00	1.1667E 01	1.6667E 01	1.6667E 01	1.6667E 01	1.6667E 01	1.6667E 01	1.6667E 01	1.6667E 01
11	2.5000E 00	1.6667E 01	2.7778E 00	3.8889E 00	3.8889E 00	3.8889E 00	3.8889E 00	3.8889E 00	3.8889E 00	3.8889E 00
12	2.5000E 00	3.8889E 00	5.0000E 00	6.1111E 00	6.1111E 00	6.1111E 00	6.1111E 00	6.1111E 00	6.1111E 00	6.1111E 00
13	2.5000E 00	5.0000E 00	7.2222E 00	8.3333E 00	8.3333E 00	8.3333E 00	8.3333E 00	8.3333E 00	8.3333E 00	8.3333E 00
14	2.5000E 00	7.2222E 00	8.3333E 00	9.4444E 00	9.4444E 00	9.4444E 00	9.4444E 00	9.4444E 00	9.4444E 00	9.4444E 00
15	2.5000E 00	8.3333E 00	9.4444E 00	1.1667E 01	1.1667E 01	1.1667E 01	1.1667E 01	1.1667E 01	1.1667E 01	1.1667E 01
16	2.5000E 00	9.4444E 00	1.1667E 01	1.6667E 01	1.6667E 01	1.6667E 01	1.6667E 01	1.6667E 01	1.6667E 01	1.6667E 01

FROM GETDIM, NAME = EPS STRES, I/O UNIT = 10, FILE = 7, ROWS = 1, COLUMNS = 108

SIGDEF

SPRIME

BOTTOM-POINT PLATE MEMBER RMS STRAINS AND STRESSES (PSI)

MEMBER	X	COORDINATES	Y	EPS X	RMS STRAINS	EPS XY	SIG X	RMS STRESSES	SIG XY
				EPS X	EMS Y	EPS XY	SIG X	SIG Y	SIG XY
1	2.500E	00	5.555E-01	5.900E-06	1.4359E-06	8.203E-07	6.010E	3.673E	5.650E
2	2.500E	00	1.666E-01	5.900E-06	1.4359E-06	8.203E-07	6.010E	3.673E	5.650E
3	2.500E	00	3.333E-01	5.900E-06	1.4359E-06	8.203E-07	6.010E	3.673E	5.650E
4	2.500E	00	5.000E-01	5.900E-06	1.4359E-06	8.203E-07	6.010E	3.673E	5.650E
5	2.500E	00	6.667E-01	5.900E-06	1.4359E-06	8.203E-07	6.010E	3.673E	5.650E
6	2.500E	00	8.333E-01	5.900E-06	1.4359E-06	8.203E-07	6.010E	3.673E	5.650E
7	2.500E	00	1.000E-00	5.900E-06	1.4359E-06	8.203E-07	6.010E	3.673E	5.650E
8	2.500E	00	1.667E-00	5.900E-06	1.4359E-06	8.203E-07	6.010E	3.673E	5.650E
9	2.500E	00	3.333E-00	5.900E-06	1.4359E-06	8.203E-07	6.010E	3.673E	5.650E
10	7.500E	00	5.555E-01	6.137E-06	1.5432E-06	1.365E-06	6.238E	3.282E	9.750E
11	7.500E	00	1.666E-01	6.137E-06	1.5432E-06	1.365E-06	6.238E	3.282E	9.750E
12	7.500E	00	3.333E-01	6.137E-06	1.5432E-06	1.365E-06	6.238E	3.282E	9.750E
13	7.500E	00	5.000E-01	6.137E-06	1.5432E-06	1.365E-06	6.238E	3.282E	9.750E
14	7.500E	00	6.667E-01	6.137E-06	1.5432E-06	1.365E-06	6.238E	3.282E	9.750E
15	7.500E	00	8.333E-01	6.137E-06	1.5432E-06	1.365E-06	6.238E	3.282E	9.750E
16	7.500E	00	1.000E-00	6.137E-06	1.5432E-06	1.365E-06	6.238E	3.282E	9.750E
17	7.500E	00	1.667E-00	6.137E-06	1.5432E-06	1.365E-06	6.238E	3.282E	9.750E
18	7.500E	00	3.333E-00	6.137E-06	1.5432E-06	1.365E-06	6.238E	3.282E	9.750E

SPMAX

MAXIMUM BOTTOM-POINT PLATE MEMBER RMS STRAINS AND STRESSES (PSI)

MEMBER	X	COORDINATES	Y	FPS X	RMS STRAINS	EPS Y	FPS XY	SIG X	RMS STRESSES	SIG Y	SIG XY
1	2.5000E 00	5.5556E-01	00					6.0108E 01			
2	2.5000E 00	1.6667E 00	00					6.3559E 01	1.5524E 01		
3	2.5000E 00	2.7778E 00	00					6.3559E 01	1.4800E 01		
4	2.5000E 00	3.8889E 00	00					6.1683E 01	1.4729E 01		
5	2.5000E 00	5.0000E 00	00					6.1732E 01	1.4350E 01		
6	2.5000E 00	6.1111E 00	00					6.3744E 01	1.5327E 01		
7	2.5000E 00	7.2222E 00	00					6.3865E 01			
8	2.5000E 00	8.3333E 00	00					6.1103E 01			
9	2.5000E 00	9.4444E 00	00					6.2361E 01			
10	7.5000E 00	1.6667E-01	00					6.2362E 01	1.3946E 01		
11	7.5000E 00	2.7778E 00	00					6.1691E 01			
12	7.5000E 00	3.8889E 00	00					6.0932E 01			
13	7.5000E 00	5.0000E 00	00					6.1173E 01			
14	7.5000E 00	6.1111E 00	00					6.1163E 01			
15	7.5000E 00	7.2222E 00	00					6.2366E 01	1.4040E 01		
16	7.5000E 00	8.3333E 00	00					6.3174E 01			
17	7.5000E 00	9.4444E 00	00					6.3549E 01			

FROM G-TD1M.
 NAME = ST STRES. I/D UNIT = 10. FILE = 8. ROWS = 1. COLUMNS = 12

SIGDEF

ORIGINAL PAGE IS
 OF POOR QUALITY

STRINGR

MEMBER	STRINGER NO.	STRINGER STPAINS AND STRESSES	X-COORDINATE	EPS X	SIG X
1	1		2.5000E 00	1.2280E-04	1.2280E 03
2	2		2.5000E 00	1.1582E-04	1.1582E 03
3	3		2.5000E 00	1.2288E-04	1.2288E 03
4	1		7.5000E 00	1.2321E-04	1.2321E 03
5	2		7.5000E 00	1.1597E-04	1.1597E 03
6	3		7.5000E 00	1.2319E-04	1.2319E 03

TSTMAX

MAXIMUM RMS STRESS FOR EACH TILE

TILE	MEMBER	STRESS COMPONENT	RMS STRESS
1	14	YY	6.35917E-02
2	14	YY	6.34168E-02

ORIGINAL PAGE IS
OF POOR QUALITY