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BLADE LOSS TRANSIENT DYNAMICS ANALYSIS WITH FLEXIBLE BLADED DISK

FINAL REPORT

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16. Abstract

The transient dynamic response of a flexible bladed disk on a flexible rotor in a two-rotor system is formulated by modal synthesis and a Lagrangian approach. Only the nonequilibrated one-diameter flexible mode is considered for the flexible bladed-disk, while the two flexible rotors are represented by their normal modes. The flexible bladed-disk motion is modeled as a combination of two one-diameter standing waves, and is coupled inertially and gyroscopically to the flexible rotors. Application to a two-rotor model shows that a flexible bladed disk on one rotor can be driven into resonance by an unbalance in the other rotor, and at a frequency equal to the difference in the rotor speeds.

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1.0 SUMMARY

The capability of the NASA-Lewis-sponsored Blade Loss Turbine Engine Transient Response Analysis (TETRA) computer program has been enhanced in two ways. These are: (1) development of a flexible bladed-disk module, its incorporation in TETRA and its installation in the NASA-Lewis computer, and (2) preparation of a structural model of the General Electric E^3 Engine for TETRA analysis.

The flexible bladed-disk (FBD) module was developed for the nonequilibrated one-diameter bladed-disk mode. The FBD motion is considered as a sum of two standing waves constrained (but not rotating) to the rotor. The FBD is coupled inertially and gyroscopically to its rotor support and indirectly through connecting elements, to the adjacent rotor and/or other supporting structures. Incorporated in the basic TETRA, the FBD module is demonstrated with a two-rotor model where the FBD is on one rotor. Results of the program demonstrate that the FBD can be excited into resonance by an unbalance in the adjacent rotor and at a frequency equal to the differential rotor speeds.

The FBD module allows two flexible-bladed disks in only one rotor. Transient FBD stresses and deflections are calculated from the normal mode input and the dynamic FBD generalized coordinates.

The principal object of the E^3 engine structural modeling activity was to provide an engine structural model which can be used to exercise the TETRA program for engine transient response under unbalance. This investigational effort would explore the range of capabilities of the TETRA computer program as well as define its limitations. From these results, systematic criteria for the optimum modeling and analysis of turbine engine dynamics response can be established.

Hence the essential task was to provide the following items:

1. An E^3 structural schematic diagram including descriptions of interconnections, rotors, casing, and boundary conditions.

2. A breakdown of the entire engine structure into three major subsystems: high pressure rotor, low pressure rotor, and casing, including the interconnections.

3. The results of modal analysis of each of the three major components: modal frequencies, modal potential or kinetic energies, and modal displacements and slopes in vertical and horizontal planes. These range from the rigid body modes to about 20 times the low rotor maximum speed.

4. Spring and damping rates of interconnecting elements and suggested modal damping factors.

The NASA blade loss addenda are divided into two main tasks. The first is the FBD module analytical development and overall project coordination, done by V. Gallardo, Principal Investigator. The computer programming and embeddment of the FBD module in TETRA were made by G. Black, while L. Bach and J. Juenger made the demonstrator model analyses. The E^3 structural modeling was done by S. Cline and A. Storace. M.J. Stallone provided technical guidance as Technical Program Manager and J. McKenzie, the Program Manager, was responsible for NASA-GE interface communications on this project.

Finally, the assistance of the following NASA-Lewis personnel, Ming Tang and Paul Manos, were especially helpful in the installation and checkout of the FBD-TETRA computer program in the NASA CRAY computer. Encouragement of Gerald Brown, Project Manager, is appreciated, especially in discussions about possible examples of one-diameter bladed disk modes in NASA experience.

2.0 INTRODUCTION - FLEXIBLE BLADED DISK

The recently completed Turbine Engine Transient Response Analysis (TETRA) computer program, developed under Task II of the NASA Blade Loss Program (Reference 1), fills a much needed gap in the evaluation of engine structural response at high unbalance. Being a new program, the scope of its capabilities needed to be explored by applying it extensively to a complex turbine engine. It was also desirable to add a feature that allows the analysis of the transient response of a flexible bladed disk (FBD) on a rotor.

From past experience it is known that the rotor response is influenced by the elasticity of a bladed disk, and that a bladed-disk mode can be excited by difference speeds in two-rotor systems wherein one rotor is unbalanced. This is especially true for the one-diameter flexible bladed-disk mode. Stresses developed in the disk at resonance can be sufficient to result in fatigue failure.

The mechanism for excitation for a bladed disk in one rotor by an unbalance in the other rotor is not obvious because the unbalance force does not act directly on the disk. The unbalance force also acts in a radial plane, whereas the bladed-disk mode is essentially an axial motion. The physical explanation is in the induced axial motion of the disk produced by the bending slope of the rotor on which it is attached. Hence, the disk loading is both inertial and gyroscopic and greatly dependent on the flexibilities of both the rotors and their bearings. The unequal rotational speeds of the rotors result in excitation frequencies of the sum and difference of the two speeds.

The flexible bladed-disk mode normally encountered is the one-diameter variety which is a nonequilibriated mode; that is, there is a resultant unbalanced or nonequilibriated moment and transverse shear on the disk which must be supported by the rotor. Other flexible disk modes of two or more diameters are all "balanced" so that they would not be of interest here. However, they may be pertinent in rotor-bladed-disk aeromechanical-whirl problems.

To take advantage of the flexibility of the TETRA computer program, the FBD has been treated as a module that is embedded in TETRA. This approach allows just the addition of the necessary FBD inputs to the basic rotor model to be able to calculate the transient response of the FBD and the rest of the engine structure.

A Lagrangian formulation was employed to obtain the equations governing the FBD module dynamics as well as its interactions with the rotor on which the FBD is a part. The complexitites that arise from the rotation and the one-diameter mode of the FBD with its coupling with the rotor, are minimized in this approach, and renders the formulation so much more rational and straightforward.

The following sections give details of the mathematical formulation of the FBD, its application to a demonstrator model, and the embedded FBD module in the TETRA computer program. Included are the requisite FBD input/output and definitions of variables pertinent to the flexible bladed disk.

3.0 ANALYTICAL DEVELOPMENT

3.1 TECHNICAL APPROACH TO THE FLEXIBLE BLADED DISK

The flexible bladed disk (FBD) is considered as an engine subsystem or component, much like the rotor or casing. Because of the orientation of the disk, a blade disk degree-of-freedom in the axial direction is defined. In addition, the modes of the FBD are treated as constrained modes supported directly on the rotor. The FBD one-diameter modes are the classic standing wave solutions. One corresponds to a horizontal node line and the other to a vertical node line. Points on the FBD undergo these standing wave displacements at each rotation.

The mathematical model of the FBD module is determined using the modal synthesis method in conjunction with the Lagrangian or variational formulation described in Task II. Briefly, the position vector of a point on the FBD is established from geometry and kinematical considerations. The rotor bending slope as well as its translation induce axial and radial motions of the disk. No external force as such is developed; however gyroscopic and translational as well as axial accelerations are developed which produce internal or coupling forces and moments on the disk, which are of the first order. The FBD potential energy is given as the sum of its modal energies with this addition: the centrifugal stiffening is added to the modal energies as function of rotor speed (which permits consideration of the effect of rotor speed on the FBD system frequencies).

Consideration of the FBD modes as constrained modes yields coupling coefficients (between generalized coordinates) having acceleration terms. This means that unlike the current TETRA system where the global mass matrix is diagonal, the use of constrained modes results in a nondiagonal mass matrix, at least for the generalized coordinates that are coupled. This is not a difficulty since this requires only a one-time inversion of the mass matrix of the affected generalized coordinates and subsequently using it to multiply the rest of the coupling coefficient matrices once. The result is a set of equations whose form is similar to that in the current TETRA.

The solution scheme is identical to the present version. Of course, additional inputs as well as outputs are required with the FBD.

A major portion of the additional inputs are the FBD modal data. These must be provided from a source external to this contract. In the FBD module, the required modal data are entered by hand into an input file for the computer program. Additional outputs include transient FBD deflections and selected components of FBD stresses.

Because of the structural complexity of a rotor with a flexible bladed disk, the means for checking the mathematical modeling could be awesome. Rather than solely depending on the interpretation of numerical output of the transient solution, which is difficult in itself, some basis in the correctness of the formulation is established by considering reductions to degenerate cases with known solutions. This was done with the decoupled equations of the FBD and those of its center of gravity. The equations of the FBD alone (without rigid properties) as well as those of its center of gravity (rigid properties only and corresponds to the rotor) were examined and their characteristic or frequency equations solved in closed form. The earlier solutions of the cross axis coupled rotor, and the backward and forward traveling wave solutions of the FBD were obtained; from this, one can infer that the basic formulation of the FBD module is realistic and logical. In addition to this the FBD-TETRA is applied to a demonstrator model, both to demonstrate its practicality and illustrate its usage.

3.2 AN OVERVIEW OF THE FBD AND THE ENTIRE ENGINE STRUCTURE

The essential differences between the original TETRA and the present version with the FBD module as well as the way the FBD fits in the general scheme may be viewed from the complete system of equations of the entire engine structure. Using the variational or Lagrangian formulation, the complete set of equations may be written formally as:

$$M_{ij}\,\ddot{\gamma}_j = -K_{ij}\gamma_j - C_{ij}\dot{\gamma}_j + F_i \qquad (1)$$

where:

M_{ij} = Mass Matrix: Symmetric but can be full

K_{ij} = Generalized Stiffness Matrix which can contain the elastic coupling between subsystems or modes

C_{ij} = Generalized Damping or Velocity Matrix which contains damping, gyroscopic and other velocity coefficients

F_i = i^{th} Generalized External Force

= 1, 2, 3, ...N

γ_i = i^{th} Generalized Coordinate.

In the original TETRA, the mass matrix is diagonal so that each equation can be solved directly for the generalized acceleration in terms of displacements, velocities and external forces. However with the FBD constrained to a rotor, the generalized accelerations of the rotor (in two planes) and the FBD become coupled, such that the mass matrix is no longer diagonal. Fortunately, only the mass matrix of the FBD and its rotor is not diagonal, so that the affected equations of motion may be separated from those components whose mass matrix is diagonal. With this consideration, equation 4.0 may be rewritten as two sets: (1) equations with diagonal mass matrix and (2) equations of the FBD-with-the rotor. Thus:

Diagonal Mass Matrix = i = 1, 2 ...M

$$M_{ij}\ddot{\gamma}_j = -K_{ij}\gamma_j - C_{ij}\dot{\gamma}_j + F_i: \quad i,j = 1,2, \ldots N\text{-}M \qquad (2)$$

Non-Diagonal Mass Matrix: $i = M+1, M+2, \ldots N$

$$M_{ij}\ddot{Y}_j = -K_{ij}Y_j - C_{ij}\dot{Y}_j + F_i: \quad i,j = M+1, M+2, \ldots N \tag{3}$$

With this device, Equation (2) is found to be identical in form to the equations in the old TETRA. Now the Mass Matrix of Equation (3) may be inverted so that by multiplying Equation (3) with its inverse, the resulting matrix equation is also identical in form to Equation (2). Consequently, the same central difference integration routine employed in the original TETRA can be used.

From the foregoing discussion, it is seen that to obtain the governing equations of the FBD module, the FBD must be considered to undergo both the displacements due to its one-diameter degrees of freedom and the motion of its center of gravity or attachment point on the rotor. The results add two equations for the two FBD coordinates, and produce off-diagonal terms in the mass matrix and additional cross-coupling terms in the gyroscopic matrix.

3.3 KINEMATIC REPRESENTATION

In order to formulate the FBD's equations of motion with the method of Lagrange, we proceed as in Reference 1, by defining the components of the position vector of a point on the bladed disk. But first we list the following allowable displacements of a point on the FBD:

1. Y (Horizontal) and Z (Vertical) displacements and rotations of the FBD center of gravity where it is attached to the rotor. These are displacements of the rotor relative to ground (Figure 1).

2. Axial (v) and tangential (u) displacements of a point on the FBD. These are rotating with the shaft. A point on the FBD undergoes these displacements as it rotates about the rotor axis (Figure 1).

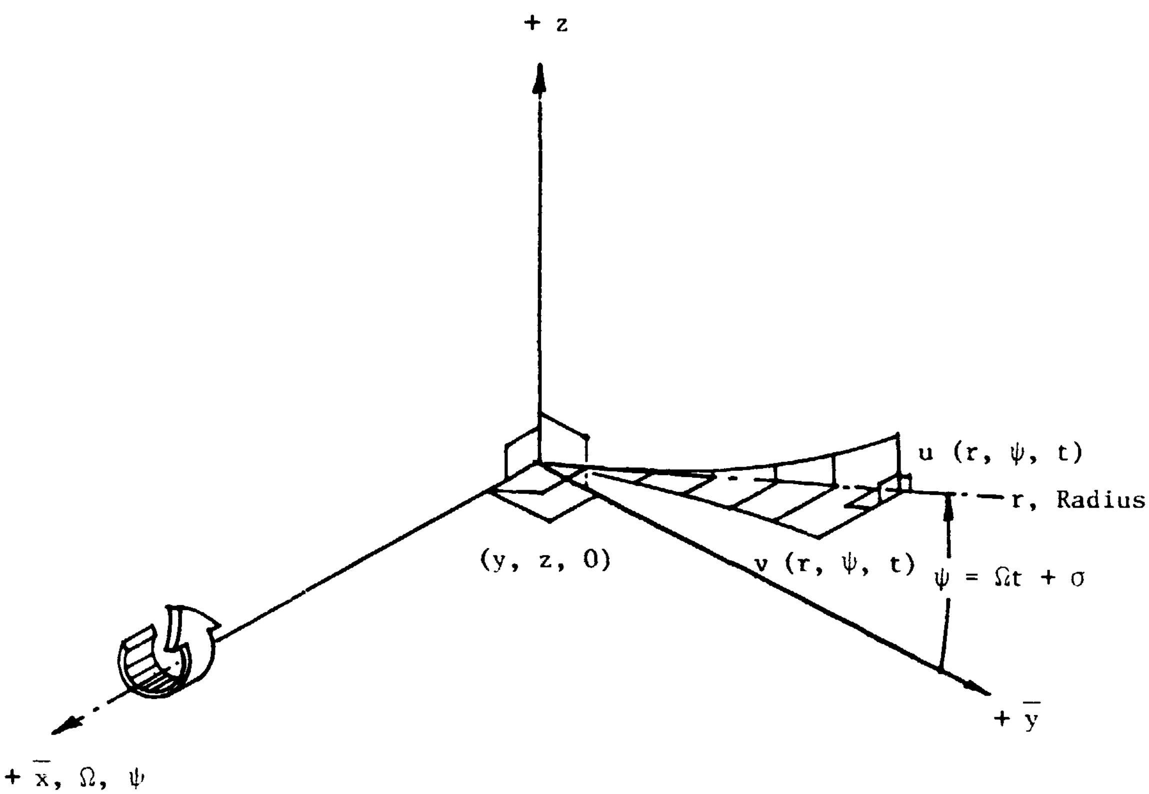
3. These two sets of FBD axial and tangential displacements are then written as the sum of two standing waves (P and q): one corresponds to a horizontal diameter node line (P); the other corresponds to a vertical diameter node line (q). Both are illustrated in Figure 3.

The FBD axial and tangential standing wave displacement sets represent motion about both the horizontal and vertical axes and therefore can reconstruct traveling wave motions in the direction of and opposite to the sense of rotor spin.

From Figures 1 to 3, the components of the total displacement vector of a point on the FBD, relative to ground can be written. These are:

Horizontal Displacement Component

$$\bar{y} = R_y \cos \alpha + R_x \sin \alpha + y \tag{4}$$

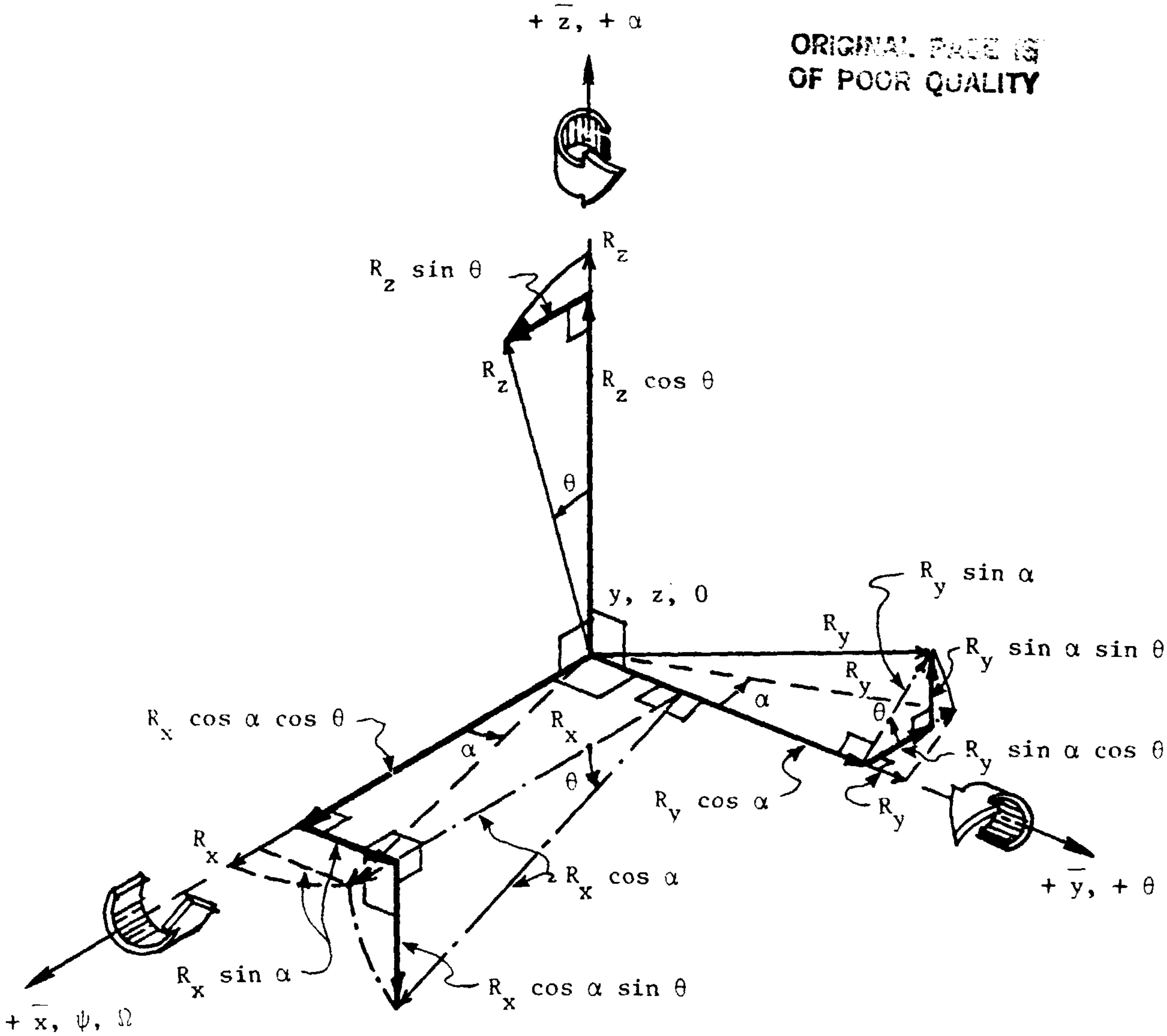


$\Delta y = -u \sin \psi$ $\qquad R_y = r \cos \psi + \Delta y$

$\Delta z = u \cos \psi$ $\qquad R_z = r \sin \psi + \Delta z$

$\Delta x = v$ $\qquad R_x = \Delta x$

Figure 1. Axial and Tangential Displacement of a Point on the FBD. (Note: $u(r, \psi, t) = 0$ on the Disk).



$$\bar{y} = R_y \cos \alpha + R_x \sin \alpha + y$$

$$\bar{z} = R_y \sin \alpha \sin \theta + R_z \cos \theta - R_x \cos \theta \sin \theta + z$$

$$\bar{x} = - R_y \sin \alpha \cos \theta + R_z \sin \theta + R_x \cos \alpha \cos \theta$$

Figure 2. Position Vector Components of the FBD from Rotor Displacements and Rotations.

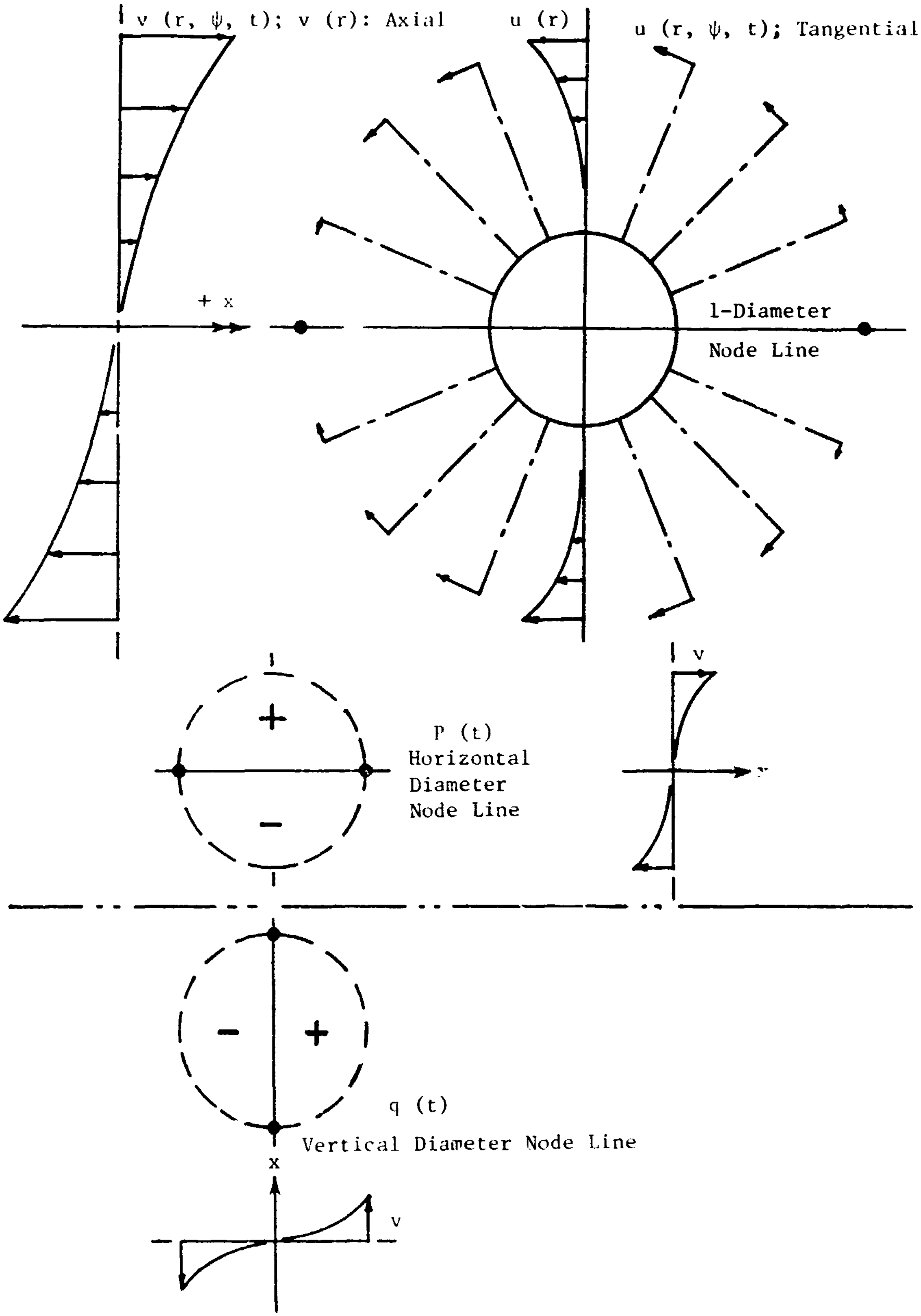


Figure 3. Standing Wave Representation of TBD 1-Diameter Mode.

Vertical Displacement Component

$$\bar{z} = R_y \sin\alpha \sin\theta + R_z \cos\theta - R_x \cos\alpha \sin\theta + z \quad (5)$$

Axial Displacement Component

$$\bar{x} = -R_y \sin\alpha \cos\theta + R_z \sin\theta + R_x \cos\alpha \cos\theta \quad (6)$$

with the following definition:

$$R_y = r\cos\psi - u\sin\psi \quad (7)$$

$$R_z = r\sin\psi + u\cos\psi \quad (8)$$

$$R_x = v \quad (9)$$

and

$$u(r,\psi,t) = \bar{u}(r)\{p(t)\sin\psi + q(t)\cos\psi\} \quad (10)$$

$$v(r,\psi,t) = \bar{v}(r)\{p(t)\sin\psi + q(t)\cos\psi\} \quad (11)$$

$$\psi = (\Omega t + \sigma) \quad (12)$$

where:

r = Radial location of a point on the FBD

ψ = Azimuth or polar angle of the point on the FBD

σ = The polar angle position of the point relative to the FBD reference diameter

Ω = Rotor-FBD spin about the rotor axis, x

$p(t)$ = Generalized coordinate of the sine or horizontal, nodal diameter mode

$q(t)$ = Generalized coordinate of the cosine or vertical nodal diameter mode

y, z = Horizontal and vertical bending displacements of the rotor at the FBD attachment point or center of gravity

α, θ = Horizontal and vertical plane(s) slopes of the rotor bending displacements at the FBD center of gravity

$\bar{v}(r)$ = FBD axial 1-D modal deflection shape

$\bar{u}(r)$ = FBD tangential 1-D modal deflection shape.

Finally, the displacement vector components can be rewritten (for brevity, the FBD $u(r,\psi,t)$ and $v(r,\psi,t)$ displacements are retained). Thus

$$\bar{y} = r \cos \alpha \cos \psi - u \cos \alpha \sin \psi + v \sin \alpha + y \quad (13)$$

$$\bar{z} = r \sin \theta \sin \alpha \cos \psi - u \sin \alpha \sin \theta \sin \psi + r \cos \theta \sin \psi + u \cos \theta \cos \psi - v \cos \alpha \sin \theta + z \quad (14)$$

$$\bar{x} = -r \sin \alpha \cos \theta \cos \psi + u \sin \alpha \cos \theta \sin \psi + r \sin \theta \sin \psi + u \sin \theta \cos \psi + v \cos \theta \cos \alpha \quad (15)$$

NOTE: The centrifugal stiffening associated with spin can be considered in the potential energy of the FBD. However, it can be treated as part of the kinetic energy by adding the radial blade foreshortening to the radius of the point on the blade. This results in replacing r in Eqs. 1 and 3 with:

$$r + \frac{1}{2}\int \left\{ \left(\frac{du}{dr}\right)^2 + \left(\frac{du}{dr}\right)^2 \right\} dr \quad (16)$$

The classic Lagrangian operator must also be replaced if we use physical displacements to account for the presence of $(du/dr)^2$ and its time derivatives in the kinetic energy expression. Note that in the end, only linear terms in the equations of motion will be retained, so that simplifications can be made. For simplicity and brevity, the centrifugal stiffening would best be considered in the poential energy.

3.4 DYNAMICAL EQUATIONS OF THE FBD MODULE

The FBD with the motion of the rotor at its attachment, is one subsystem with the rotor. This means that the equations of the FBD can be added to or overlaid on the rotor equations. Because of the FBD one-diameter mode coordinates, the FBD-rotor equations will be two more than the number of the original rotor equations. The external excitations are the same as in the original TETRA, such as unbalance in the rotor, time dependent forces and the interaction forces introduced through the rotor's connecting elements with other subsystems. Though not true "external forces" in the sense of the total engine structure, these connecting forces can be considered as external to any subsystem.

This convention is adapted in developing the FBD module's equations, and it serves to keep the FBD in the proper context of the complete structure.

The equations of the FBD contain essentially inertial forces, its stiffness or restoring forces relative to the rotor and its modal damping. These are derived by Lagrangian dynamics from the instantaneous position or displacement vector of a point on the FBD. The various rotations and displacements follow essentially Reference 1 and are shown graphically in Figures 1, 2, and 3.

The stiffness and damping forces are straightforward and the potential energy and modal dissipation function can be simply written in shorthand:

$$U = 1/2\ w^2_{(ij)}\ M_{ij}\ \gamma_i \gamma_j \qquad (17)$$

$$D = 1/2\ C_{ij}\ \dot{\gamma}_i\ \dot{\gamma}_j \qquad (18)$$

i,j: takes on indices denoting the FBD and rotor generalized coordinates.

w_{ij} = FBD one-diameter natural frequency with centrifugal stiffening; the rotor frequencies are excluded here since they are already in the original TETRA.

with: M_{ij} = FBD one-diameter modal mass (without gyroscopic effects); M_{ij} = diagonal. Rotor MASS matrix is excluded here since these are in the original TETRA.

C_{ij} = FBD modal damping, diagonal; rotor modal damping are excluded here also.

U = FBD one-diameter mode elastic energy

D = FBD one-diameter mode dissipation function

The kinetic energy is written in terms of the total velocity components relative to ground.

$$T = 1/2 \int \{\dot{\bar{x}}^2 (\gamma_i, \dot{\gamma}_i) + \dot{\bar{y}}^2 (\gamma_i, \dot{\gamma}_i) + \dot{\bar{z}}^2 (\gamma_i \dot{\gamma}_i)\}\ dm \qquad (19)$$

Since the centrifugal stiffening on the FBD one-diameter mode has been included in the potential energy, the Lagrangian operation on the kinetic energy can be simplified. In Reference 1 and 3, it is shown that when the functional is dependent only on velocities and displacements, the Lagrangian equation becomes:

$$F_i = \int \left\{ \ddot{\bar{x}} \frac{\partial \bar{x}}{\partial \gamma_i} + \ddot{\bar{y}} \frac{\partial \bar{y}}{\partial \gamma_i} + \ddot{\bar{z}} \frac{\partial \bar{z}}{\partial \gamma_i} \right\} dm + w^2_{(ij)}\ M_{ij}\ \gamma_j + C_{ij}\ \dot{\gamma}_j \qquad (20)$$

Since the FBD-rotor coupling involves only the kinetic energy, the kinetic terms are first derived and examined. Finally, these will be combined with the stiffness and damping terms.

First, the governing FBD equations will be obtained in the physical rotor coordinates and the FBD axial and tangential coordinates. This will give some physical insight on the FBD-rotor coupled system and also provide a basis with which comparisons can be made with analogous dynamic problems such as propeller whirl. Such comparison will help assure that the resulting FBD equations have a correct physical and mathematical basis.

Finally, these equations will be transformed to generalized coordinates, which become the working equations for the computer coding of the FBD and its embeddement in TETRA.

3.4.1 The Kinetic Terms of the FBD-Rotor Equations

The Lagrangian operation on the kinetic energy is evaluated here but the results are given in the context of the complete equation. Rewrite Eq. 7, as:

$$Q_{\gamma i} = \int \left\{ \ddot{\bar{x}} \frac{\partial \bar{x}}{\partial \gamma_i} + \ddot{\bar{y}} \frac{\partial \bar{y}}{\partial \gamma_i} + \ddot{\bar{z}} \frac{\partial \bar{z}}{\partial \gamma_i} \right\} dm = F_i - w^2_{(ij)} M_{ij} \gamma_j - C_{ij} \dot{\gamma}_j \quad (21)$$

Obtain the terms within the brackets, thus,

$$\frac{dQ_{\gamma i}}{\partial m} = \ddot{\bar{x}} \frac{\partial \bar{x}}{\partial \gamma_i} + \ddot{\bar{y}} \frac{\partial \bar{y}}{\partial \gamma_i} + \ddot{\bar{z}} \frac{\partial \bar{z}}{\partial \gamma_i} \quad (22)$$

Substituting the position vector components, (13), (14), and (15), into (22) and performing the indicated operations yield the generalized kinetic force in the FBD coordinates. Here instead of using the index notation, γ_i is replaced with: y, z, θ, α, u and v. The results are given below.

Horizontal Translation - Rotor Bending

$$\frac{dQy}{dm} = \ddot{y} - \ddot{u} \sin \psi - 2\dot{u}\, \Omega \cos \psi + u\Omega^2 \sin \psi - \Omega^2 r \cos \psi \quad (23)$$

Vertical Translation - Rotor Bending

$$\frac{dQz}{dm} = \ddot{z} + \ddot{u} \cos \psi - 2\, \dot{u}\, \Omega \sin \psi - u\, \Omega^2 \cos \psi - \Omega^2 r \sin \psi \quad (24)$$

Horizontal Rotation - Rotor Bending

$$\frac{dQ\alpha}{dm} = \ddot{\alpha}\, r^2 \cos^2 \psi - 2\dot{\alpha}\, \Omega\, r^2 \sin \psi \cos \psi \quad (25)$$
$$- \ddot{\theta}\, r^2 \sin \psi \cos \psi - 2\dot{\theta}\, \Omega\, r^2 \cos^2 \psi$$
$$- \ddot{v}\, r \cos \psi - v\, \Omega^2\, r \cos \psi$$

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Vertical Rotation - Rotor Bending

$$\frac{dQ_\theta}{dm} = -\ddot{\alpha}\, r^2 \sin\psi \cos\psi + 2\dot{\alpha}\,\Omega\, r^2 \sin^2\psi + \ddot{\theta}\, r^2 \sin^2\psi + 2\dot{\theta}\,\Omega\, r^2 \sin\psi \cos\psi + \ddot{v}\, r \sin\psi + v\,\Omega^2\, r \sin\psi \tag{26}$$

FBD Tangential Blade Bending

$$\frac{dQ_u}{dm} = -\ddot{y} \sin\psi + \ddot{z} \cos\psi + \ddot{u} \tag{27}$$

FBD Axial Blade and Disk Bending

$$\frac{dQ_V}{dm} = -\ddot{\alpha}\, r \cos\psi + 2\,\dot{\alpha}\, r\,\Omega \sin\psi + \ddot{\theta}\, r \sin\psi + 2\,\dot{\theta}\,\Omega\, r \cos\psi + \ddot{v} \tag{28}$$

Examining these equations, one can conclude that the rotor coordinates' equations are the same as those in Reference 1 (there is a minor change in notation) except for the addition of the FBD's degrees of freedom of tangential and axial displacement. It can be observed that the mass matrix or acceleration coefficient matrix is no longer diagonal; this shows the inertial coupling between the FBD and the rotor.

When obtaining the complete equations, it should be noted that integration of the rotor coordinates equations, [(23) through (26)], must be made over the entire rotor including the FBD; whereas integration over the FBD coordinates' equations, (27) and (28), is made over the FBD mass, with the rotor displacements, velocities and acceleration taking values only at the attachment to the FBD center of gravity.

It is interesting to compare these equations with those for nacelle-propeller whirl flutter with rigid flapping blades, (Reference 3). The inertial and gyroscopic terms are identical when the tangential degree of freedom of the FBD is ignored.

3.4.2 Complete FBD Module Equations in Generalized Coordinates

The complete equations of the FBD-rotor are obtained from (23) through (28) in view of (21) with the following modal coordinate definitions and tranformations from physical to generalized coordinates.

$$y(x,t) = y_i(t)\,\phi_{yi}(x) \equiv \sum_i y_i(t)\,\phi_{yi}(x), \text{ Horiz. Trans.} \tag{29}$$

$$z(x,t) = z_i(t)\,\phi_{zi}(x) \equiv \sum_i z_i(t)\,\phi_{zi}(x), \text{ Vert. Trans.}$$

$$\alpha(x,t) = y_i(t)\,\phi'_{yi}(x) \equiv \sum_i y_i(t)\,\phi'_{yi}(x), \text{ Horiz. Rot.}$$

$$\theta(x,t) = z_i(t)\,\phi'_{zi}(x) \equiv \Sigma\, y_i(t)\,\phi'_{yi}(x), \text{ Vert. Rot.}$$

$$u(r,\psi,t) = \bar{u}(r)\{p(t)\sin\psi + q(t)\cos\psi\}, \text{ FBD Blade Tan. Defl.}$$

$$v(r,\psi,t) = \bar{v}(r)\{p(t)\sin\psi + q(t)\cos\psi\}, \text{ FBD Axial Defl.}$$

Note that $p(t)$ and $q(t)$ are the FBD one-diameter standing wave solutions.

The transformation equations are:

$$Qyi = Qy\,\frac{dy}{dy_i} + Q\alpha\,\frac{d\alpha}{dy_i} = \phi_{y_i}\,Q_y + \phi'_{y_i}\,Q_\alpha \tag{30}$$

$$Q_{z_i} = Q_z\,\frac{dz}{d_{zi}} + Q_\alpha\,\frac{d\theta}{d_{zi}} = \phi_{zi}Q_z + \phi'_{z_i}\,Q_\theta \tag{31}$$

$$Q_p = Q_u\,\frac{du}{dp} + Q_v\,\frac{du}{dp} = \bar{u}(r)Q_u \sin\psi + \bar{v}(r)\,Q_v \cos\psi \tag{32}$$

$$Q_q = Q_u\,\frac{du}{dq} + Q_v\,\frac{dv}{dq} = \bar{u}(r)Q_u \cos\psi + \bar{v}(r)\,Q_v \sin\psi \tag{33}$$

Recalling that the potential energies and dissipation functions were given in terms of modal variables and noting the domain of integration described in the previous section, the complete FBD-rotor equations may be written with the aid of (29) through (33) and (23) through (28):

$$Q_{\gamma i} = F_i - M_{ij}w^2_{(ij)}\gamma_j - C_{ij}\dot{\gamma}_j \tag{34}$$

These are given below:

where:

$$M_{z_{ij}} = M_{y_{ij}} = \phi_{z_i}\phi_{z_j}M + \phi'_{z_i}\phi'_{z_j}I, \qquad \phi_{z_i} = \phi_{y_i} \text{ @ FBD C.G.} \tag{35}$$

M, I = Rigid mass and Diametric Moment of Inertia of FBD

I_p = Rigid polar moment of Inertia of FBD

$$S_v = \int_{FBD} \bar{v}(r)\, r \begin{Bmatrix} \cos^2\psi \\ \sin^2\psi \end{Bmatrix} dm \tag{36}$$

$$M_u = \int_{\text{All Blades}} \bar{u}(r) \begin{Bmatrix} \cos^2\psi \\ \sin^2\psi \end{Bmatrix} dm = \frac{1}{2} N_{BLD} \int_{\text{1 Blade}} \bar{u}(r) \begin{Bmatrix} \cos^2\sigma \\ \sin^2\sigma \end{Bmatrix} dm \tag{37}$$

N_{BLD} = Number of blades. N.B. Since M_u contains tangential motion, the disk contribution is zero.

$$M_{pp} = M_{qq} = M_{pq} = M_{qp} = \int_{FBD} \left[(\bar{v}^2(r) + \bar{u}^2(r)\right] \begin{Bmatrix} \cos^2\psi \\ \sin^2\psi \end{Bmatrix} dm; \text{ Modal MASS of FBD, Fixed Axes} \tag{38}$$

$K_{pp} = K_{qq} = M_{pp}\,(w_{pp}^2 + (\beta_p - 1)\Omega^2)$, FBD Modal Stiffness in the Non-rotating Axis System.

$w_{pp} = w_{ff} = w_o$, FBD Natural Frequency at Zero Speed

β_p = Speed Coefficient in the Rotating FBD Natural Frequency Equation.

$w_r = \sqrt{w_{pp}^2 + \beta_p\Omega^2}$; $\beta_p = \beta_q = \beta$

F_{Yi} = External or Connecting Forces from other Subsystems to the Rotor Containing the FBD.

w_r = FBD Rotating Natural Frequency

Vertical Plane - Rotor Bending Generalized Coordinates

$$Q_{z_i} = \underset{\sim}{M_{z_{ij}}}\ddot{z}_j + S_v \phi'_{z_i}\ddot{p} + M_u \phi_{z_i}\ddot{q} = -\Omega I_p \phi'_{y_i}\phi'_{z_j}\dot{y}_j + 2\Omega S_v \phi'_{z_i}\dot{q} \qquad (40)$$

$$-M_{z_{ij}}\omega^2_{(ij)} z_j - C_{z_{ij}}\dot{z}_j + F_{z_i}$$

Horizontal Plane - Rotor Bending Generalized Coordinates

$$Q_{y_i} = \underset{\sim}{M_{y_{ij}}}\ddot{Y}_j - M_u \phi_{y_i}\ddot{p} - S_v \phi'_{y_i}\ddot{q} = \Omega I_p \phi'_{z_i}\phi'_{y_j}\dot{z}_j + 2\Omega S_v \phi'_{y_i}\dot{p} \qquad (41)$$

$$- M_{y_{ij}}\omega^2_{(ij)} Y_j - C_{y_{ij}}\dot{Y}_j + F_{y_i}$$

FBD - Sine Component : 1-Diameter Mode Horiz. Node Line)

$$Q_p = S_v \phi'_{z_i}\ddot{Z}_i - M_u \phi_{y_i}\ddot{Y}_i + \underset{\sim}{M_{pp}}\ddot{p} = -2\Omega S_v \phi'_{y_i}\dot{Y}_i + 2\Omega M_{pq}\dot{q} \qquad (42)$$

$$- K_{pp}P - C_{pp}\dot{P} + F_p$$

FBD-Cosine Component: 1-Diameter Mode (Vertical Node Line)

$$Q_q = M_u \phi'_{z_i}\ddot{Z}_i - S_v \phi'_{y_i}\ddot{Y}_i + \underset{\sim}{M_{qq}}\ddot{q} = -2\Omega S_v \phi'_{z_i}\dot{Z}_i + 2\Omega M_{qp}\dot{p} \qquad (43)$$

$$- K_{qq}q - C_{qq}\dot{q} + F_q$$

N.B. the acceleration terms underlined with (∼∼∼) are the diagonal mass matrix elements and denote the equation's principal coordinates i, j: 1, 2, 3, 4, ... rotor generalized modal coordinate index and p, q as the FBD Standing Wave Coordinates.

3.5 TWO DEGENERATE CASES

Because of the complexity of a rotor with an FBD and the paucity of results of a transient FBD-rotor analysis, it becomes necessary to show the logic of the formulation and the resulting FBD equations have a firm theoretical basis. Therefore, two special degenerate cases have been chosen:

1. Two degrees-of-freedom (Horizontal and Vertical planes) rotor with a rigid FBD.

2. One-Diameter (Vertical and Horizontal Planes) flexible mode FBD without rotor degrees of freedom.

Rather than obtaining the transient solutions for these cases, their characteristic equations will be solved in closed form to obtain their natural frequencies. Each case is just a subsystem independent of the other. The rationale of this approach is that if the subsystem equations, which are obtained from the whole, yield the classic solutions, then there is confidence that the complete equations for the total structure are correct.

3.5.1 Two Degrees-of-Freedom Rotor with a Rigid FBD

These are obtained from (40) and (41) by ignoring the terms containing p and q and their derivatives. The resulting equations are the classic symmetric rotor equations with cross-coupled gyroscopic terms whose two frequencies correspond to an advancing and a regressive whirl mode and which diverge from a common value (at zero rotor speed) with increasing speed. A plot of these frequencies as functions of rotor speed has been published in standard works (for example - Reference 4).

3.5.2 One-Diameter Flexible Blade Disk : Cross-Axis Coupled

Similarily, ignoring the terms containing Zi and Yj and their derivatives from equations (42) and (43) yields the governing equation of a flexible bladed disk or a plate fixed at its center. These are the "standing wave" equations of the flexible blade disk. The form is similar to the degenerate rotor case in Section 3.5.1. However, the two frequencies of the FBD correspond to two traveling waves: forward (in the direction of rotation) and backward. The frequencies can be written in terms of rotor speed as:

$$w_F^2 = \sqrt{w_o^2 + \beta^2 \Omega^2} + \Omega \quad , \text{ Forward} \tag{44}$$

$$W_B = \sqrt{w_o^2 + \beta^2 \Omega^2} - \Omega \quad , \text{ Backward} \tag{45}$$

The term under the radical is the classic rotating natural frequency while the $\pm\Omega$ term denotes that the solutions correspond to waves whose propagation speed is the same speed as the rotor. These solutions are the classic standing wave (on the rotating FBD, but fixed to ground) solutions of a rotating flexible bladed disk.

3.6 THEORETICAL CONSIDERATIONS IN THE EMBEDMENT OF THE FBD MODULE IN TETRA

An overview of the FBD module and its relation to the entire engine structure was given in Section 2.2 in terms of the complete system's equations of motion. To implement this scheme in an existing computer program (namely TETRA) both the TETRA main computer code and the FBD module must be tailored to accommodate one another. That is, buffers must be coded to make the two compatible. At the same time, the basic TETRA must be able to operate as before when there is no FBD.

Because the FBD introduces a nondiagonal mass matrix of the rotor coordinate of which it is a part, global matrices for these affected coordinates must be formed, whereas there is no need for them in the original TETRA. However, by limiting these global matrices only to the FBD and its rotor, this complication is reduced. The inverse of the nondiagonal matrix is subsequently used to render the affected equilibrium equations to the same form as in the original TETRA or the rest of the unaffected subsystems (without the FBD).

In addition the rigid FBD properties can also be considered as a part of the rotor so that the rotor's nonrotating modes (or rotating modes) include the FBD's inertia. The cross-axis coupling can therefore be included in the "right side" of the equilibrium equations, as in the original TETRA. One benefit from this is the effective increase in the solution time-interval step, since the FBD rigid inertia properties would lower the rotor modal frequencies. The FBD requires inputs describing its modal characteristics, e.g., modal displacements, modal potential energy and modal stress components. These are to be provided from a source external to this project. However, some considerations must be noted here. The FBD one-diameter mode is essentially an axial deflection of the blades and disk. In other words, deflections parallel to the rotor axis or FBD axis of symmetry predominates any tangential (in the plane of the FBD) motion. This means that the "BETA" factor or speed coefficient in the FBD rotating natural frequency expression must be at least equal to (or greater than) unity.

To calculate the FBD input variables, integration is performed over the disk volume as well as over each blade. Since the blades are discrete and finite in number, the integration over the circumference is transformed to a finite sum over the number of blades. The transient solution also requires specifying a reference blade or polar angle location on the FBD as well as the relative position (with respect to the angular reference) of a blade or a point on the disk where deflections or stresses are desired, because the stresses on each blade will not necessarily be the same at the same radial location and the same time.

To calculate the transient stresses at designated points on the FBD, the appropriate one-diameter modal stress components must be input since stresses are calculated relative to the disk center of gravity. Similarly, the FBD transient deflections are calculated at designated points where the location and one-diameter modal deflections are also provided.

3.7 FBD TRANSIENT DISPLACEMENTS AND STRESSES

The FBD displacements are the sums of the rotor deflections at the FBD attachment, the contribution of rotor rotation, and the FBD one-diameter (horizontal and vertical diametral Modes) modes relative to its center of gravity.

However, the FBD deflections of interest are those which correspond to the one-diameter modes relative to the center of gravity. Recall that rotor deflections are already calculated at selected points and that the rotational displacement of a point on the FBD due to spin overwhelms all the other displacement components. The FBD one-diameter displacement relative to its center of gravity are calculated from equations (10) and (11) with the polar angle definition of (12).

The FBD stresses are calculated in a similar fashion. The modal stress components of the blades and disk must be provided at selected points. These modal stress components depend on:

Radius and

Polar Angle.

The stress components can be: (1) resultant bending; (2) radial; (3) tangential bending; (4) shear; (5) principal, or effective-stresses. These depend on what the user desires to calculate. These stress components are calculated as follows:

$$\bar{S}_{FBD}(r,\psi,t) = S_{FBD}(r,\sigma)\left[p(t)\sin\psi + q(t)\cos\psi\right] \qquad (46)$$

$\bar{S}_{FBD}$ = Transient FBD stress-output.

S_{FBD} = Modal stress component input; the same for either vertical or horizontal diameter mode

with

ψ = $\Omega t + \sigma$, Instantaneous Polar Angle Relative to Ground

σ = Polar Location of FBD Point Relative to a Reference Diameter.

Ω = Rotor Spin Speed.

4.0 APPLICATION OF FBD-TETRA TO A DEMONSTRATOR MODEL

Applications are made to demonstrate the use of the FBD module and verify its capability to calculate resonant excitation of the FBD with unbalance (or force) on an adjoining rotor.

4.1 DESCRIPTION OF THE DEMONSTRATOR MODEL'S STRUCTURE

The demonstrator model is a two subsystem structure, illustrated in Figure 4, consisting of (1) a low pressure (LP) rotor containing the FBD and (2) a high pressure (HP) rotor. This system is essentially the same as the demonstrator model in Reference 1. In this present work, however, the former casing is considered as the HP rotor with a 100 gm-in unbalance at its first spanwise location. A modification has also been made to the HP and LP stiffnesses e.g., reducing them to a tenth of their former values. The reduction in stiffness results in lower frequencies and hence larger time intervals for the numerical solution. Figure 5 shows the modeshapes of the model's two components.

The FBD properties are derived from the original (Reference 1) bladed-disk by allowing it to undergo a one-diameter axial vibration mode shape. The FBD modal properties are then calculated with the formulae developed in Section 3.4.2. The FBD stiffness is chosen arbitrarily so that its one-diameter resonance is in the range of the HP-LP differential speeds. Also, several values of the FBD stiffnesses (or natural frequencies) are considered in order to observe how its resonance speed can be raised or lowered - e.g., exhibit the classic observation of resonance frequency-excitation frequency cross-overs.

The excitation source is the unbalance in the HP rotor. The ratio of the LP to the HP rotor speeds is held a constant 2.045; however, the LP speed (and hence the HP's) is allowed to increase, from 2400 rpm, linearly with time, resulting in an FBD excitation frequency that also increases linearly with time. Figure 6 shows the prescribed time histories of the HP and LP rotor speeds.

4.2 DEMONSTRATOR SUBSYSTEMS' MODAL CHARACTERISTICS

Since the objective of the demonstrator model is simply to show how the FBD-TETRA is used and that it is feasible to excite the FBD one-diameter mode in one rotor by an unbalance in the other rotor, the number of subsystem modes is minimal. The subsystem modes are obtained from an in-house direct solution method, and its modal output is stored into a TETRA input file.

The LP rotor modes are represented by their first five modes (two rigid body and three flexural modes); while the HP is represented by four modes (two rigid modes and two flexural modes). Polar symmetry being assumed, these modes are replicated in the vertical and horizontal planes. The frequencies and sketches of the subsystems' mode shapes are summarized in Figure 5.

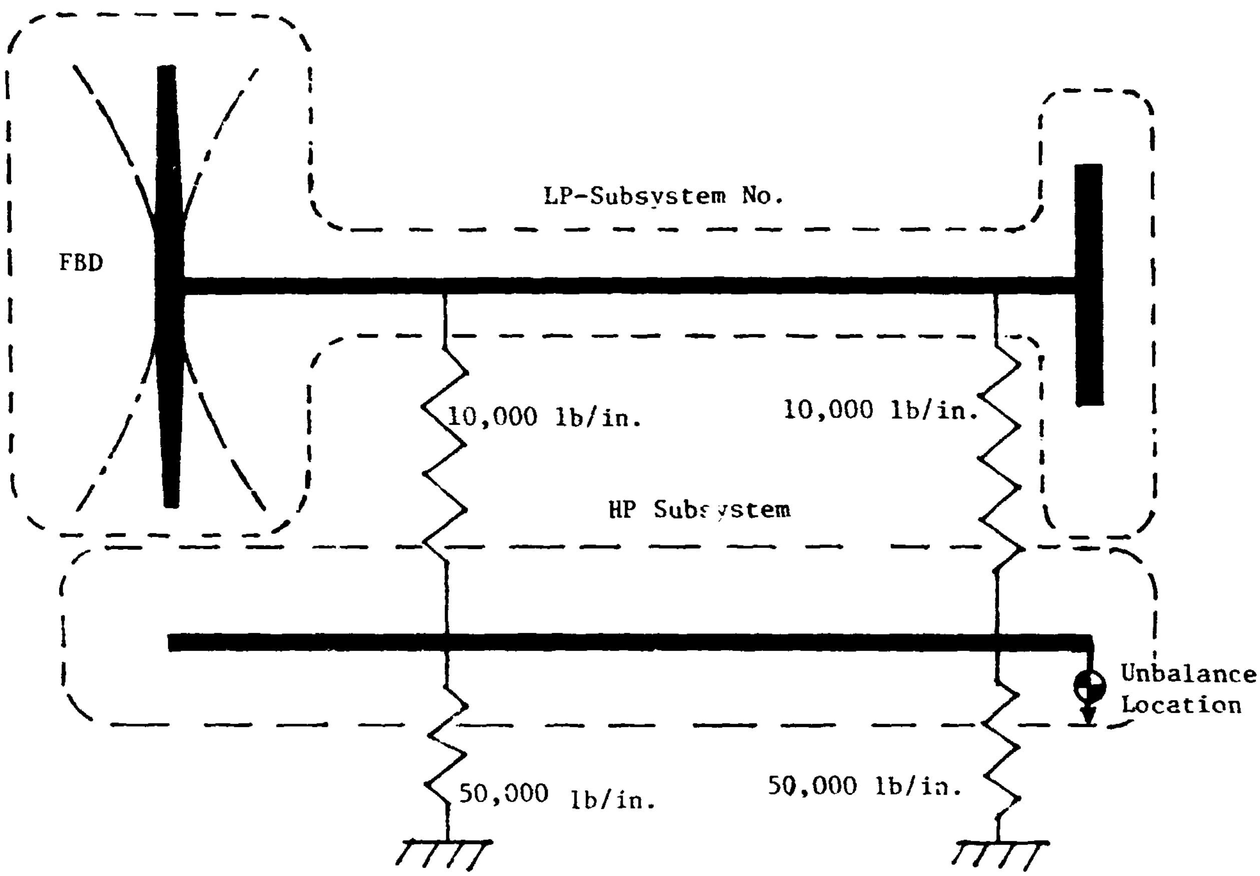
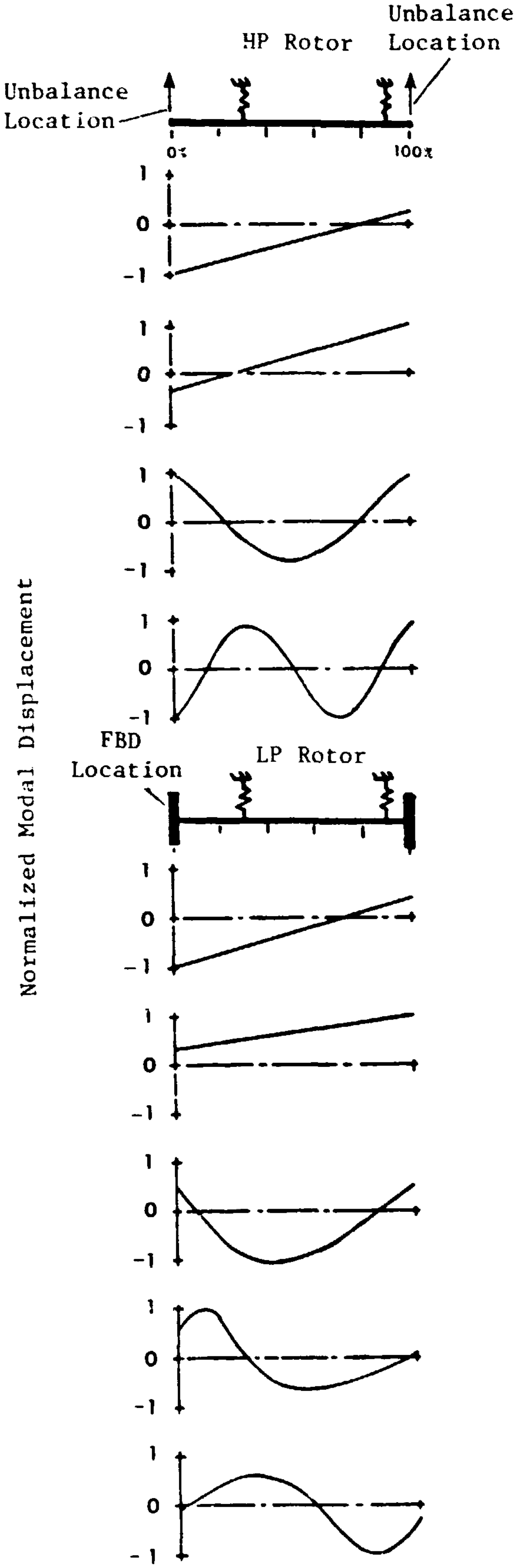


Figure 4. Schematic of Demonstrator Model.



Frequency, cpm	Modal Kinetic Energy in.-lb/in.^{2}
123.6	1.063 E2
170.4	1.911 E2
5356.0	2.358 E5
9341.0	1.022 E6
71.0	6.25 E1
106.4	1.628 E2
2289.0	1.008 E5
4314.0	9.530 E5
7810.0	1.468 E6

Figure 5. Summary of Demomstrator Subsystems' Modal Characteristics.

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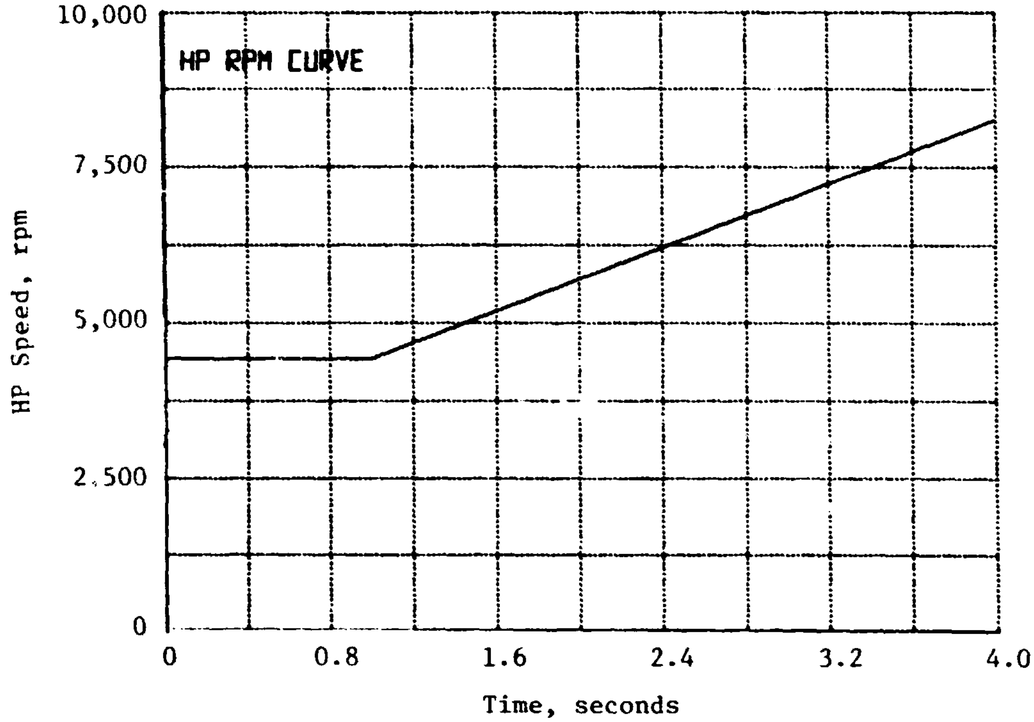

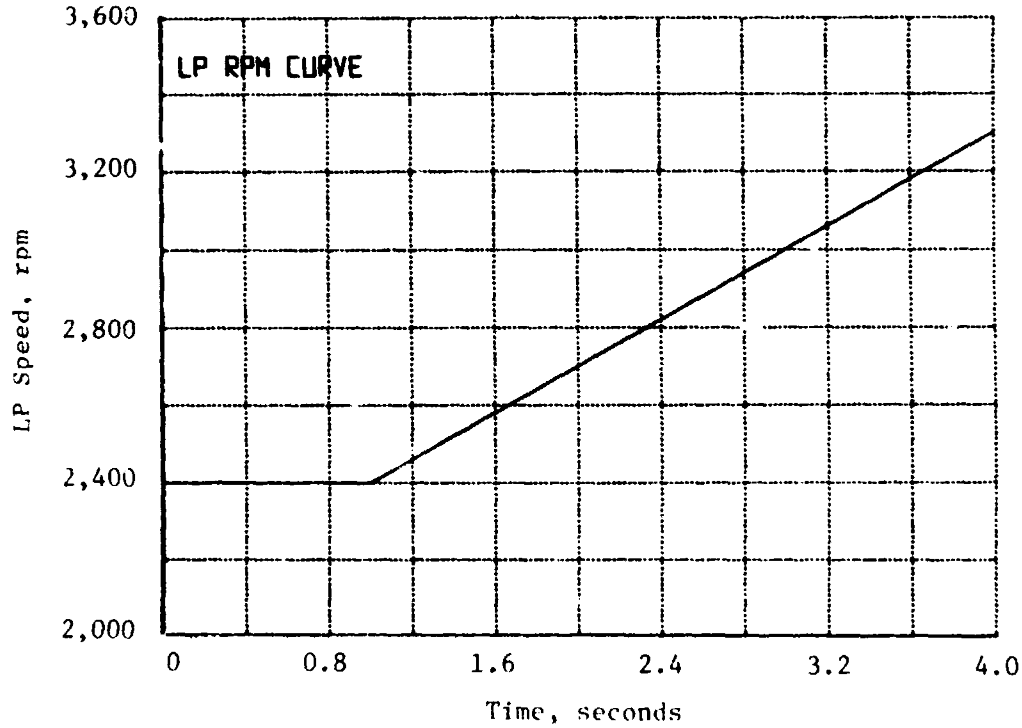

Figure 6. HP and LP Rotor Speeds Versus Time-Demonstrator Model.

It must be noted that the FBD modal characteristics are obtained in a program external to this present task. For the purpose of this demonstration, it is convenient to pick the FBD input arbitrarily; however the values that are selected are typical of FBD one-diameter modes in production turbine engines. Inputs for the demonstrator model are given in Table 1: The first part contains rotor modal/inputs as in the original TETRA; the second part shows (compare with FBD input sheets in Section 5.0) the FBD inputs and the connecting elements, and finally the third part contains the summary of the complete inputs as made by and rearranged by the program.

The FBD one-diameter mode is a standing (nonrotating) wave and is replicated as vibrations in two orthogonal diameter node lines (vertical and horizontal).

4.2.1 Natural Frequencies of the FBD

In demonstrating the resonant amplification of the FBD, it is necessary to input a one-diameter natural frequency which will lead to the desired values when the effects of rotation and gyroscopic cross-axis coupling are accounted for in the FBD-TETRA program. In addition, the system frequencies of the FBD-rotor combination are different from the initial modal inputs, since the modal synthesis by TETRA includes inter-subsystem and inter-modal couplings. As a consequence, the true combined FBD-rotor resonant frequencies are found only as a result of the analysis.

Therefore, in the FBD-TETRA calculations, it is prudent to arrive at a "good" initial value of the FBD frequency in order to minimize repeat runs to show FBD resonant response in the context of the complete structure.

To achieve this initial selection the effective resonant frequencies of the FBD when isolated from the rotor degrees-of-freedom, is calculated. The resulting FBD one-diameter mode frequencies with gyroscopic coupling are calculated from the equations of the degenerate FBD as described in Section 3.5.2. There are two frequencies since the cross-axis coupling has the effect of splitting the symmetric FBD's frequency at zero speed, into two modes corresponding to a forward and a backward wave. Thus:

$$w_{fwd} = \sqrt{w_o^2 + \beta^2\Omega^2} + \Omega$$

$$w_{bkd} = \sqrt{w_o^2 + \beta^2\Omega^2} - \Omega \qquad (47)$$

From these expressions, one can select the nonrotating frequency w_o and beta factor, β, that would result in the desired effective FBD frequencies with gyroscopic coupling. These expressions also indicate the two possible FBD resonant excitations.

In the demonstrator cases, the nonrotating one-diameter frequency and the beta factor are selected to produce effective FBD rotating frequencies close to a rotor critical speed and/or excitation frequency.

4.3 TWO-ROTOR MODEL WITH FBD: TRANSIENT RESPONSE

The two-rotor model is designed to illustrate the phenomenon of resonant response of the one-diameter FBD mode (on the LP) from an unbalance stimulus in the HP rotor. In this case, the unbalance load on the HP rotor is transmitted to the LP via the connecting springs. Due to the HP-LP differential rotational speed, the unbalance is "felt" by the LP (and consequently, the FBD) as an oscillating force in the direction of rotation of the LP, and at a frequency equal to the difference in the rotors' speeds. Because there is no direct physical link between the HP and the FBD, the FBD is excited inertially by the motion of the LP rotor.

To demonstrate the FBD resonant response, its rotating natural frequency (FBD alone) is chosen to be near the HP-LP difference speed. It must be recalled that the FBD's true resonant frequency is a result of the inertial and gyroscopic effects of the HP and LP rotors, which can be calculated only (by fast fourier transform analysis) from the fully coupled system. The FBD resonance is therefore identified as one of the modes of the fully coupled HP, LP and FBD system wherein the motion of the FBD in its one-diameter vibration is predominant.

The FBD model was also modified to study the effect of its basic nonrotating frequency, (or elasticity) on its critical speed. By lowering this frequency as well as the HP and LP speeds one would expect the FBD resonant frequency or critical speed to occur at correspondingly lower rotor speeds (this translates to earlier times in the Transient-response plots).

The calculated transient responses for the basic demonstrator model as well as the several modifications of its nonrotating natural frequency are illustrated in Figure 7(a). Each plot contains the FBD's transient axial displacement history in a rotating axis. In addition, Figure 7(b) shows the corresponding transient responses of points on the LP and the HP, for the case of the stiff FBD (42.5 Hz).

The initial peak corresponds to the HP rotor bending mode resonance. The second peak is the FBD response. When the FBD natural frequency (or stiffness) is reduced, its resonance response occurs at an earlier time which corresponds to a lower LP rotor speed and a smaller HP-LP differential speed. The FBD resonances represent approximately the crossings of the HP-LP differential speed (excitation frequency) curve with the speed versus frequency curves of the FBD for various stiffnesses. This is given in Figure 8(a) which shows the rotating frequencies of the "FBD-alone" module. Note the effect of rotor speed acceleration rate and the gyroscopic coupling between the FBD and the rest of the mode.

From Figure 7(a) and 8(a), the FBD resonant amplitude (the second or later peak) is found to be smallest for the high stiffness (42.6 Hz) case and increases as its resonant speed (lower stiffness) approaches the HP resonance (first peak). This is explained by the fact that the FBD stimulus is by an inertial interaction with the LP and HP, and that this stimulus is largest

Effect of Flexible Blade Disk 1-Diameter Stiffness on Resonance Speed for:

- $\beta = 1.0$
- Flexible Blade Disk on LP Rotor
- HP Rotor Unbalance Excitation
- LP and HP Speeds per Figure 6

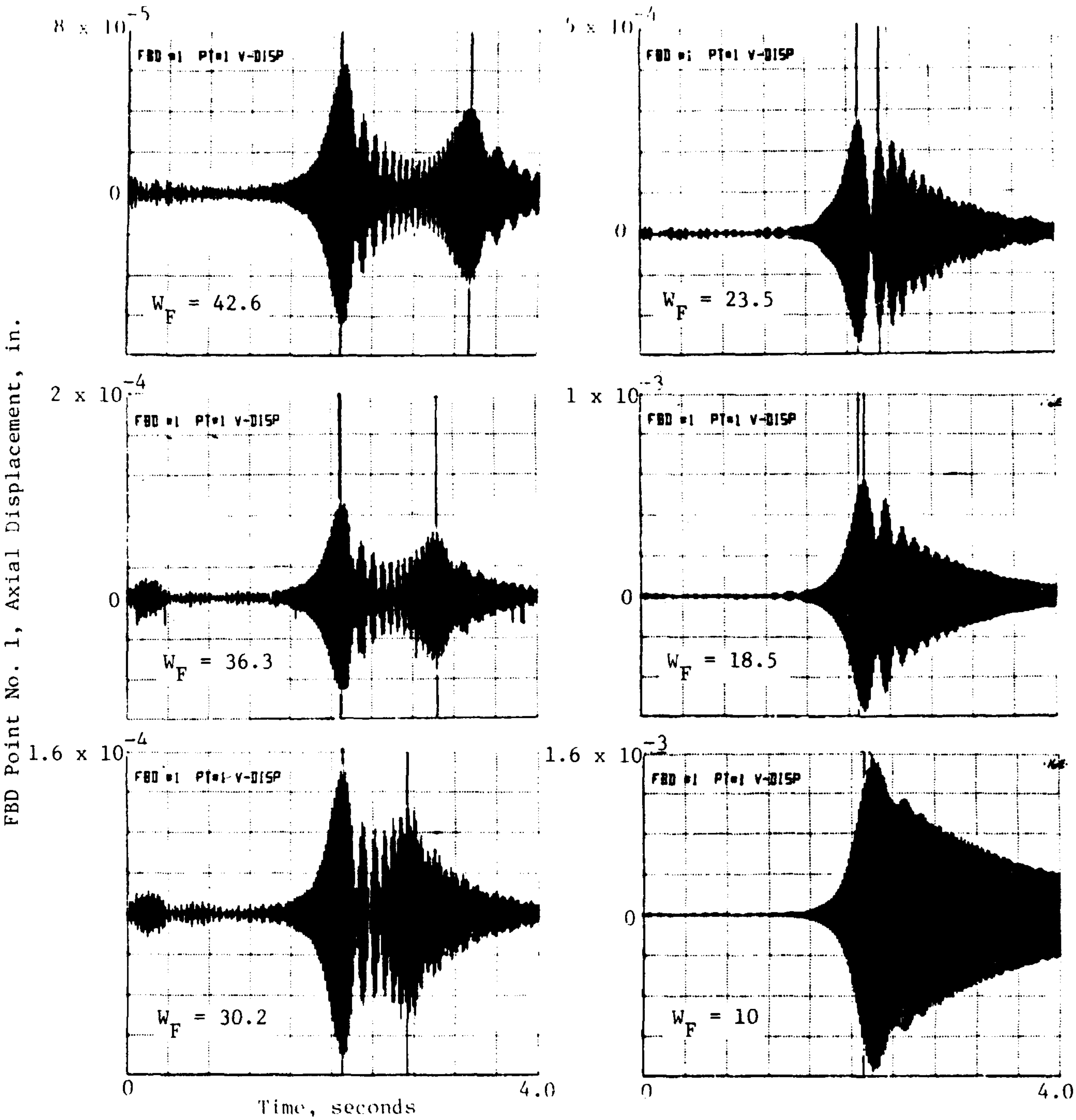

Figure 7a. Two-Rotor Demonstrator Model of FBD Point No. 1 Transient Response.

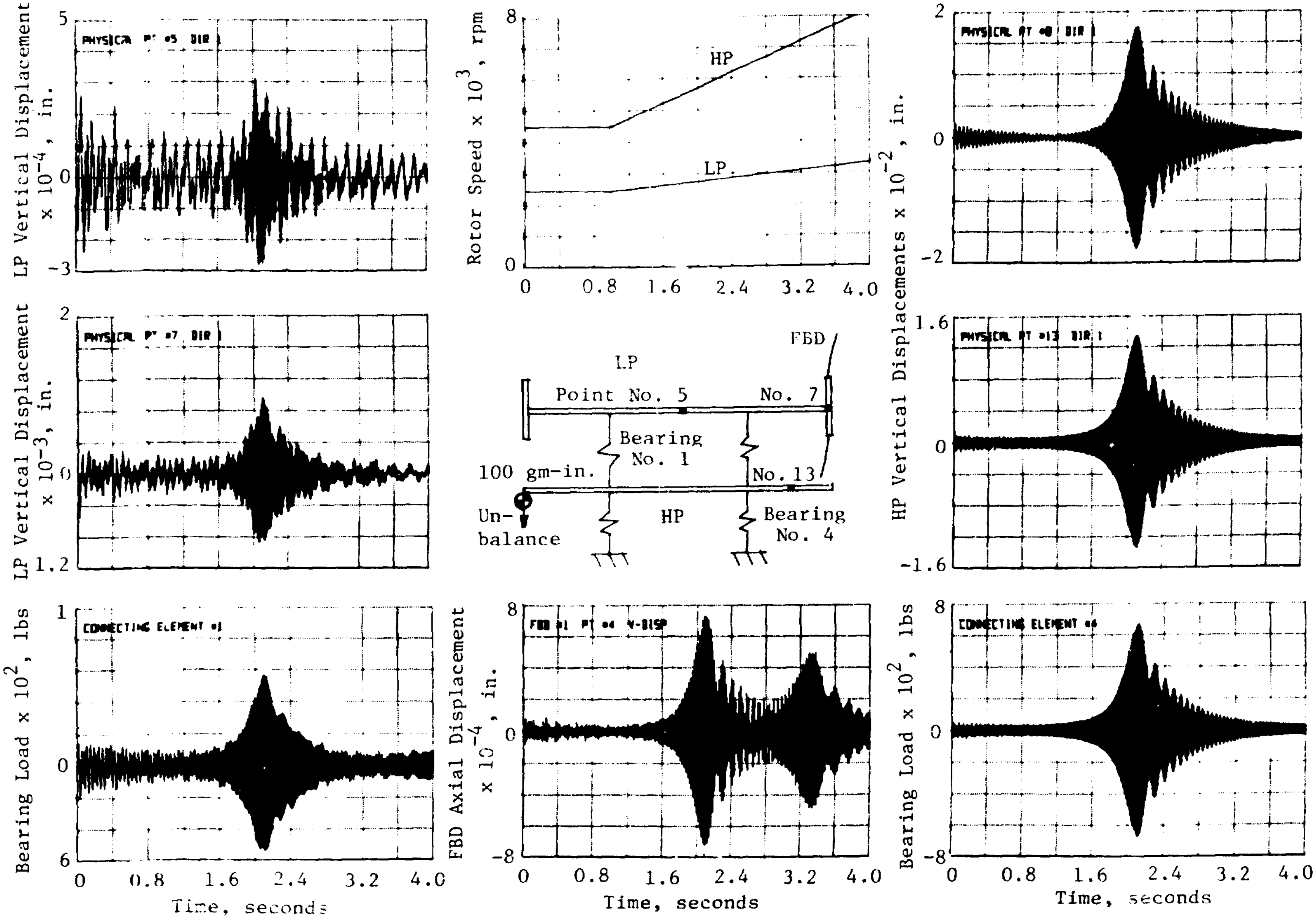

Figure 7b. Two-Rotor Demonstrator Model: HP and LP Transient Response at Selected Rotor Stations (Stiff (42.6 Hz) FBD on LP).

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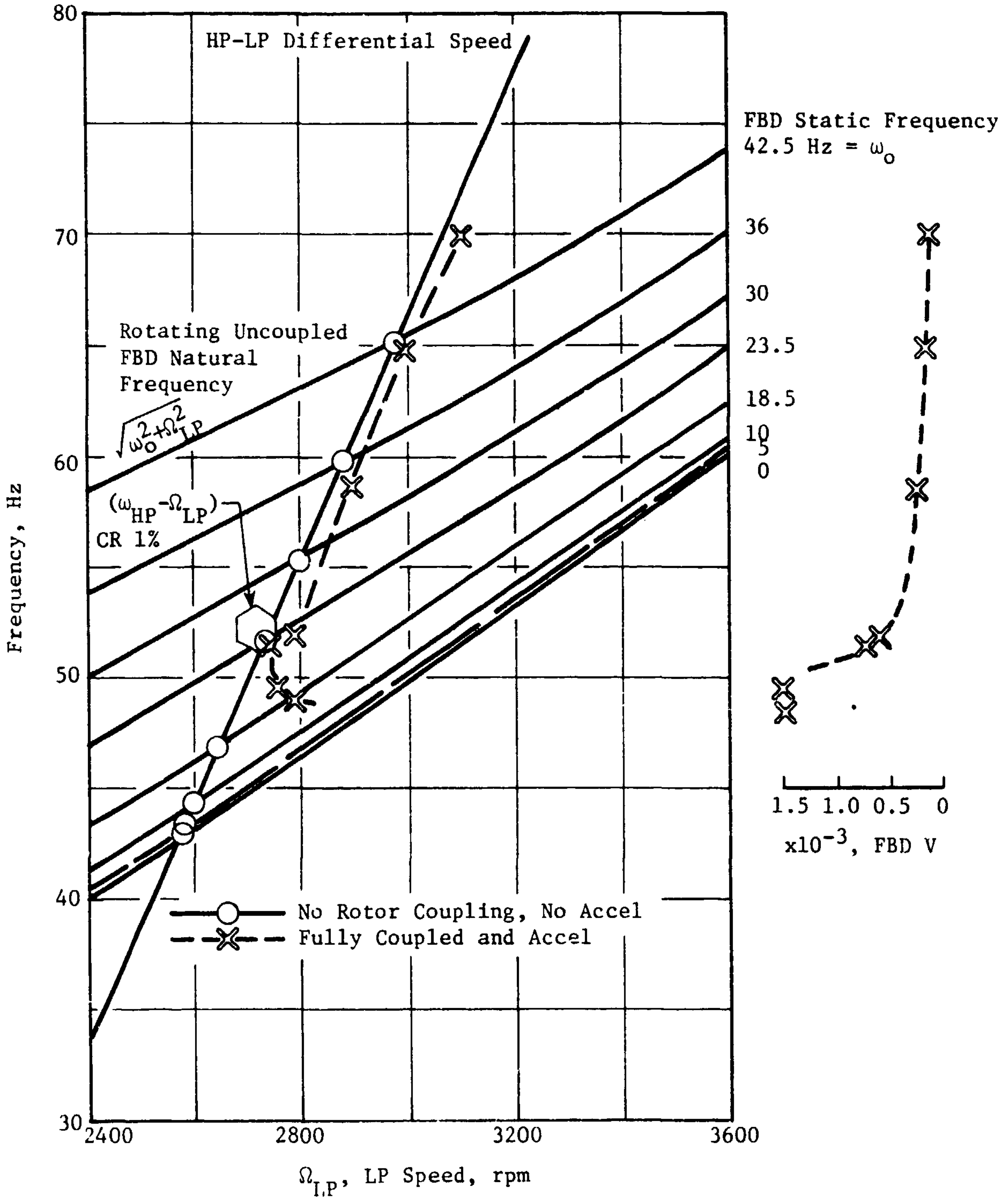


Figure 8a. Effect of FBD Static Natural Frequency (Stiffness) on its Coupled Resonance Frequency.

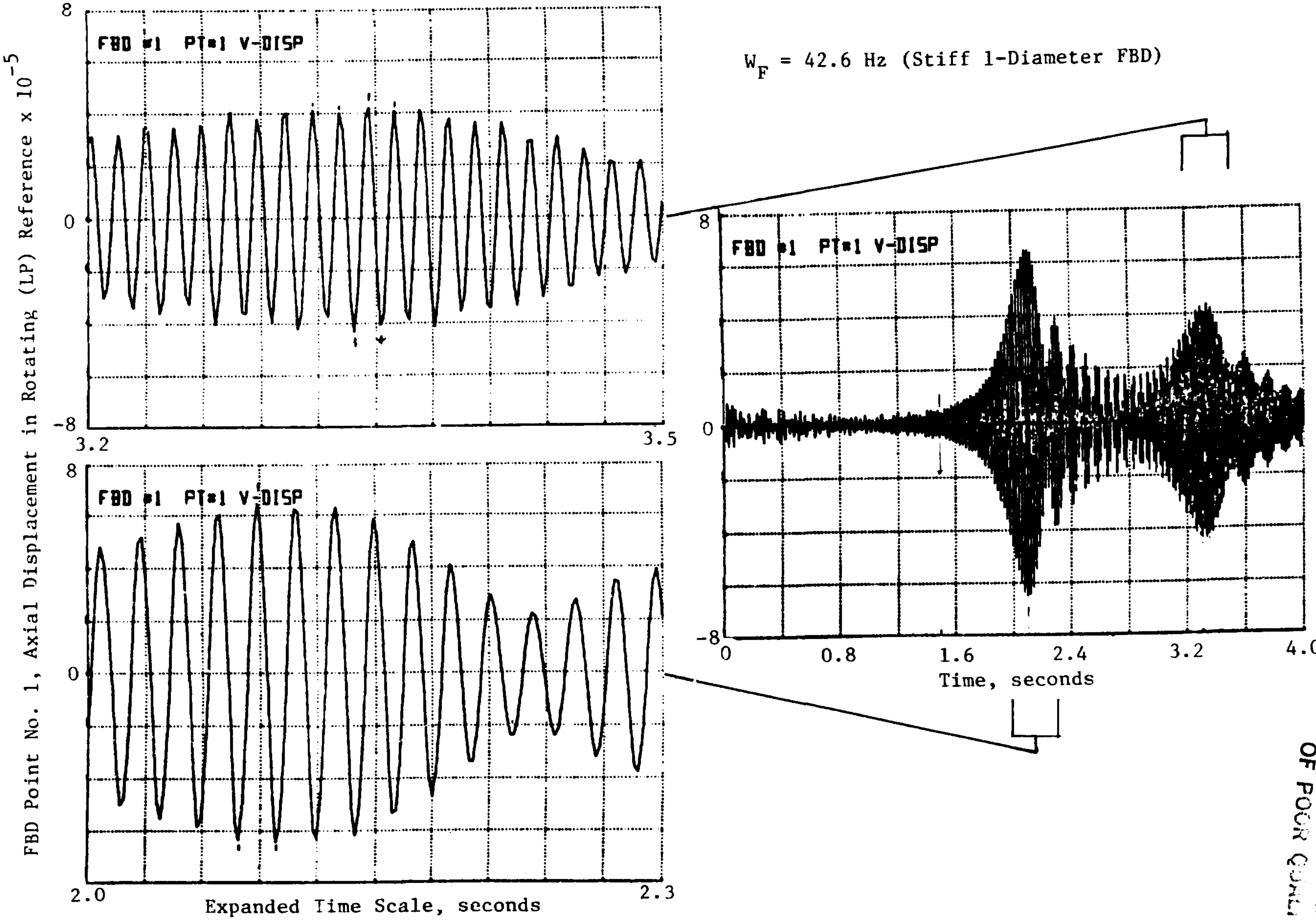


Figure 8b. Expanded Time Scale of FBD Transient Response from HP Rotor Unbalance.

at the HP resonant speed. Also, at the lower stiffness, the FBD is more flexible and hence exhibits a smaller impedance. It can also be observed that the HP resonant frequency relative to ground is higher compared to what is "seen" by the FBD (first peak). This difference is explained by the fact that the FBD response is shown relative to a rotating LP reference frame, and hence the HP vibration is seen at the difference (HP-LP) frequency.

The FBD resonant frequencies shown in Figure 8(a) by the circles, are with respect to the rotating LP. These are obtained from an expanded time-scale plot of the resonant peaks by counting the number of cycles per unit time (these can also be obtained by an FFT analysis), for example see Figure 8(b). The FBD displacements and stresses are also calculated with respect to the LP rotating reference, since these would be more meaningful for the interpretation and visualization of the FBD response.

Finally a typical FBD stress component's transient response is shown in Figure 9 for the high stiffness configuration (w_f = 42.6 Hz). The stress, being directly proportional to the displacement, has an identical time history except for the amplitude, e.g., the same frequency content. The stresses at various points in the FBD do not have the same amplitude or phase, since these stresses depend on their polar as well as radial position and on whether a point is on the disk or on the blade. Being a single mode representation, the FBD response follows exactly the relative modal stress- and displacement shapes. Also, since the FBD deflections and stresses at arbitrary locations are found subsequent to the calculation of the generalized coordinates' response, the transient FBD displacements and stresses may be calculated from input values of modal-stresses and displacement shapes at desired FBD points.

By way of illustration, a sample output of the FBD and rotor responses are given in the last part of Table 1.

4.4 CONCLUSIONS AND RECOMMENDATIONS

The flexible-bladed disk (FBD) module has been embedded in the Turbine Engine Transient Response Analysis computer program (TETRA). This version of TETRA now permits the calculation of the transient response of one or two FBD's on a rotor in a turbine engine structure.

The logic of the theoretical formulation has been checked with closed-form solutions of the degenerate cases for (1) FBD alone and (2) rotor without an FBD. Also, application of the TETRA-with-FBD to a two rotor paradigm model has demonstrated that the FBD one-diameter mode (on one rotor) can be excited into resonance by an unbalance on the other rotor. The latter phenomenon has been observed to occur in actual engine experience, and is the principal reason for developing the FBD module of the TETRA Program.

Within the assumption of a single bladed-disk mode, the FBD-TETRA also calculates dynamic stresses in the disk and/or blading (on one rotor) that result from unbalance in the other rotor. With the formulation of the rotor-FBD-structural interaction, this program can be employed to identify potential dynamical problems of blade-disk-rotor systems and also to evaluate analytically solutions to current problems.

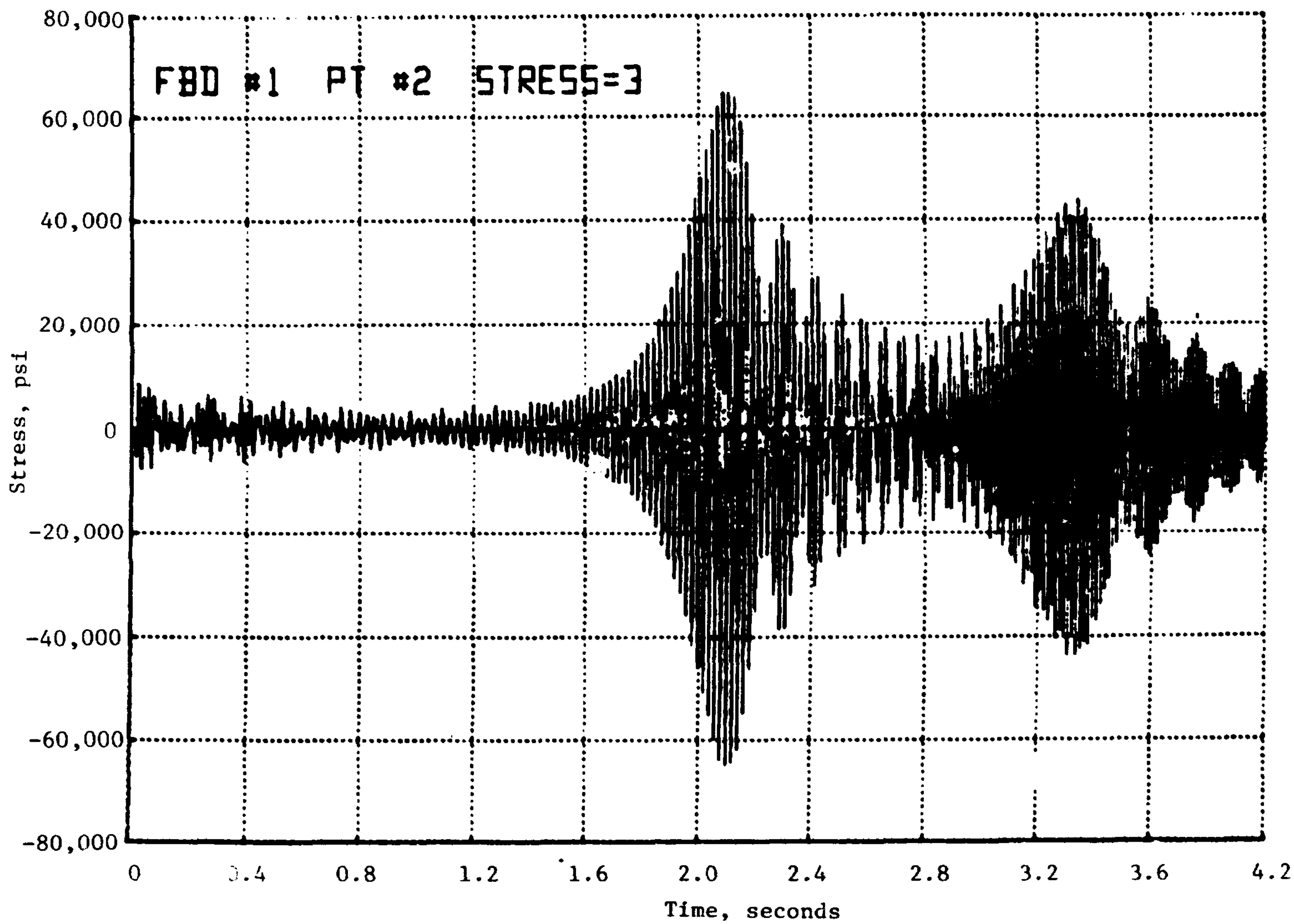


Figure 9. Two-Rotor Demonstrator Model: Transient Stress on a Typical Point on the FBD (at 10 in. Radius and 0° Azimuth).

Finally, the FBD-TETRA Program has been installed in the NASA LeRC "Cray" computer, and run successfully there.

Due to the volume of calculated data inherent in a transient analysis of engine structural systems, it is recommended that a plotting capability be added to the "Cray" version of the FBD-TETRA. Whereas this capability is incorporated in the NASA Univac version of the original TETRA, the "Cray" needs this to make the interpretation of results more rapid and meaningful. When one looks at any of the transient plots in Figures 7a, and note that each plot is made up of 5000 separate time steps and that each time step represents several pages of printout, a plotting facility becomes a necessity.

Another recommendation is for updating the NASTRAN modal input file. The original TETRA employed the subsystems' modal data calculated by NASTRAN as input to the Univac version of TETRA. Since the "Cray" uses 64 bit words rather than the Univac's 32, and due to other differences in the two computers, the NASTRAN-Interface Program (which processes NASTRAN output for TETRA-Univac input) should be updated to permit NASTRAN modal data to be input directly in the TETRA-"Cray" computer.

Beside the "Computer Systems" recommendations, the FBD-TETRA should be applied to larger engine systems. Any new program needs to be exercised thoroughly to discover all its potentials as well as expose its bugs and shortcomings. The E^3 structural model provided in Task II of the present contract is one such system.

The current interest in high speed turboprop propulsion is another area of possible application and extension of the FBD-TETRA. With the comparatively large multibladed propellers, propeller-engine-nacelle-support interaction may become an important aspect of these propulsion systems. A modification of the basic FBD-TETRA may be made to include one-diameter-mode propeller blade aerodynamic loadings which would be comprised of external forces and so called motion dependent aerodynamic loads. This would extend the capability of the computer program to analyze propeller-rotor aeromechanical problems such as forced resonant vibration of whole propulsion systems and the classic whirl flutter[3,5], which is essentially characterized as a one-diameter propeller mode.

Other possible additions to the program could also include embedding new connecting elements such as nonlinear squeeze-film bearings (Reference 6 for example) or nonlinear springs.

5.0 FLEXIBLE BLADED DISK/TETRA PROGRAM DOCUMENTATION

5.1 SUMMARY AND INTRODUCTION

The original Turbine Engine Transient Response Analysis (TETRA, Reference 1) subsystems are coupled gyroscopically and/or by connecting elements such as bearings, springs, etc. This results in equations of motion wherein the generalized or physical acceleration, hence mass, occur only once in each equation. In other words, the modal mass matrix is diagonal. This property of the equations of motion is ideally suited to a central-difference integration scheme for the transient response solution; as a matter of fact global matrix equations are not necessary.

In the present development, the flexible bladed disk (FBD) motion is considered relative to the rotor, which means that the FBD is a mode constrained to the rotor on which it is a component. In order to derive the equation of the FBD module, one must include the motion of the rotor (at its attachment to the FBD) as well as the FBD. This results in a mass or inertial coupling between the rotor and FBD - in other words, the mass matrix of the rotor and FBD equations are no longer diagonal. As noted in Section 2.0, this requires construction of a global matrix equation of the rotor and FBD, taking the inverse of the mass matrix, and multiplying the matrix equation of the rotor and FBD by the inverse. This results in the diagonalization of the acceleration coefficient matrix - identical in form to the original TETRA. Consequently, the central-difference integration scheme is employed in the solution of the combined FBD-TETRA.

The embedment of the FBD into TETRA requires the following:

1. Discretized FBD rotor equations
2. Global matrix formation, mass matrix inversion and multiplication
3. Definition of FBD coordinates and convention
4. Definition of essential FBD geometric, elastic and dynamic properties
5. Definition of rotor-FBD interface
6. Definition of input/output.

These items as well as the overview of the FBD-TETRA program structure are described below.

5.2 GENERAL SCHEME OF FBD's EMBEDMENT IN TETRA

The FBD and the rotor on which it is a part are identified and defined. This description of the FBD and its rotor allows the extraction from the engine structural subsystems, the connecting forces joining the FBD rotor to other subsystems.

The FBD-rotor coupled equations are treated in the FBD module (actually several subroutines) while the rest of the subsystems are unaffected. The FBD module performs the global matrix operations of formation, inversion, and multiplication. After the FBD rotor equations are restored to the same form as the original TETRA, the FBD rotor is returned to the overall TETRA program for transient solution. Additional output variables are calculated to provide the FBD transient displacements and stresses.

Figure 10 gives a view of the general scheme of FBD's embedment in TETRA.

Modeling the FBD rotor system must include the total engine structure as well. The FBD input are therefore additions to the original TETRA inputs.

5.3 FBD MODULE INPUT

FBD input has been accommodated by adding input sheets C-13 through C-16 to the program input. No changes were made to any of the already existing TETRA input sheets. Thus, any run made on the previous version of the program that did not include FBD capability will still run on the new version.

As noted above, FBD input is entered on Type C-13 through C-16 input sheets. Each FBD is represented by a modal subsystem, which is why the FBD input has been grouped with the other modal subsystem (Type C) input sheets. A TETRA model may include 0, 1, or 2 FBD's. If no FBD's are present, input sheets C-13 through C-16 are omitted; whereas if one FBD is present, sheets C-13 through C-16 are included once; and when two FBD's are present these input sheets are included twice. For other important information regarding the FBD input see the notes included on the Type C-13 through C-16 input sheets.

The FBD one-diameter modal data are replicated for two planes: That is, a horizontal diametric mode and a vertical diametric mode. These two modes represent two standing waves, which the FBD traverses as it spins. The FBD generalized coordinates are the participations of these two modes.

The FBD modal inputs can be divided into two groups. Group 1 input data (that include input sheets C-13 and C-14) are essential to the dynamic response of the FBD as a subsystem of the engine structure - they characterize the fundamental one-diameter modal properties of the FBD. They include the FBD center of gravity location, the FBD modal weight and modal inertial properties, Q-factor, static one-diameter modal frequency, and beta factor input. Group 2 input data (that include input sheets C-15 and C-16) have no effect on

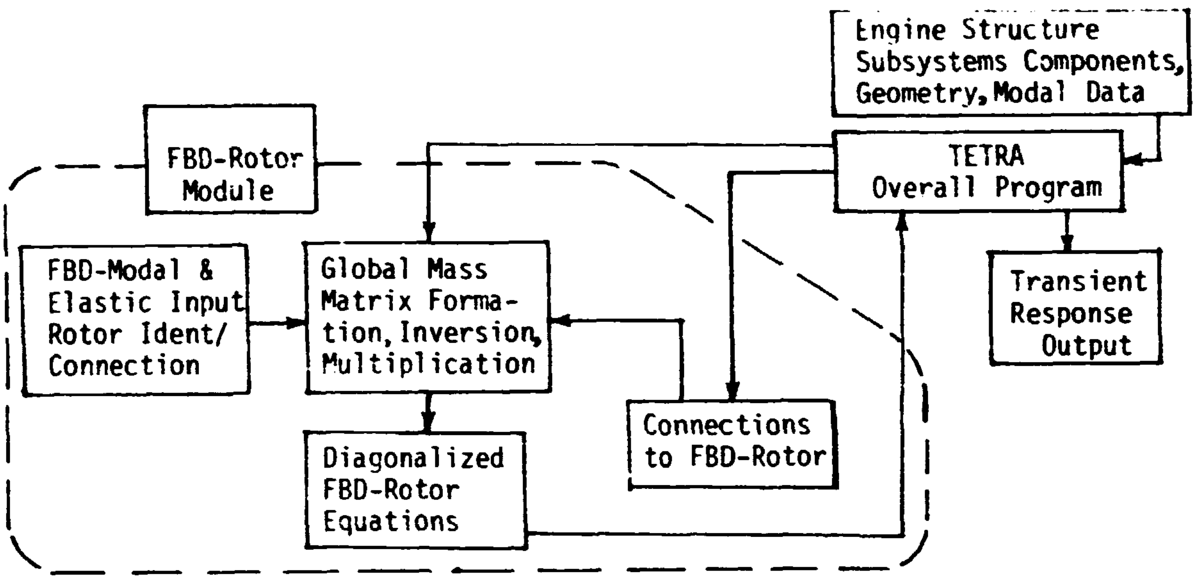


Figure 10. General Scheme of FBD's Embedment in TETRA.

MODAL SUBSYSTEM INPUT FOR FLEXIBLE BLADED DISK SUBSYSTEMS

Input sheets C-13 through C-16 apply for Subsystem 12 (Flexible Bladed Disk Number 1) and Subsystem 13 (Flexible Bladed Disk Number 2).

If both FBD Number 1 and FBD Number 2 are present, they must be located on the same rotor. If the FBD(s) are on Rotor 1, then the rigid body modes for Rotor 1 must be included in modal Subsystems 1 and 2, and modal Subsystem 3 must be omitted. If the FBD(s) are on Rotor 2, then the rigid body modes for Rotor 2 must be included in Subsystems 4 and 5, and Subsystem 6 must be omitted. Both the rotor vertical plane and horizontal plane subsystems should be included for the rotor which includes the FBD(s) to account for coupling between the generalized coordinates. The physical weight and [illegible] moment of inertia properties of the FBD(s) must be included in the applicable rotor vertical and horizontal plane subsystems. Rotor speed input (Input Sheet J) must be included for the rotor on which the FBD(s) are located.

▽2

```
$
$LIST2
TITLE=' ________________________________________________________________ ',
ISUB= ________,SUBSYSTEM NUMBER (12 or 13)
ICG= _________,TETRA Point number for the FBD center of gravity (This
               point must be included in the applicable rotor vertical
               and horizontal plane subsystem input)
```

MODAL SUBSYSTEM INPUT FOR FLEXIBLE BLADED DISK SUBSYSTEMS

2

WTF= ________, one-diameter modal weight WT_f (lb)

QFAC=________, modal Q-factor (omit or set to 0 if no damping desired)

WF= ________, static frequency w_f (hertz)

XMU= ________. modal tangential shear coefficient, M_u (lb)

SV= ________, modal moment coefficient, S_v (in-lb)

Note: To account for gyroscopic effects for the FBD, the polar moment of inertia of the FBD must be input on Sheet N at the FBD C.G. point.

Input the following table for beta factors. Include at least 2 and a maximum of 10 lines. Entries must be in order of increasing rpm.

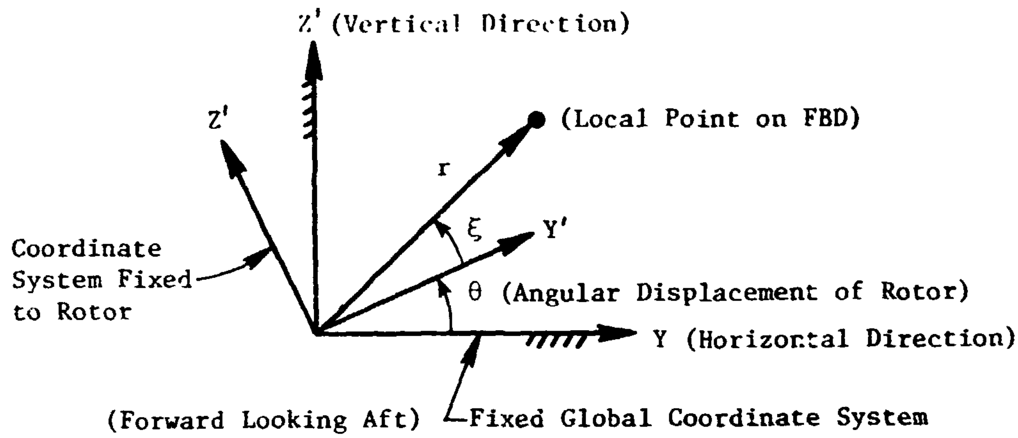
RPM	β FACTOR

2

BETA=

________,________,
________,________,
________,________,
________,________,
________,________,
________,________,
________,________,
________,________,
________,________,
________,________,

MODAL SUBSYSTEM INPUT FOR FLEXIBLE BLADED DISK SUBSYSTEMS (Continued)



Enter the r and ξ coordinates for each of the subsystem points other than the center of gravity point. Maximum of 200 points for subsystem 12 and 200 points for subsystem 13 other than the center of gravity points. n = number of subsystem points other than the center of gravity point.

Radius r inches	Polar Angle ξ degrees

$r \geq 0$

$0° \leq \xi \leq 360°$

FBDPTS=

Local Point Number	Radius	Polar Angle
1	________,	________,
2	________,	________,
3	________,	________,
.		
.		
.		
.		
.		
.		
n	________,	________,

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MODAL SUBSYSTEM INPUT FOR FLEXIBLE BLADED DISK SUBSYSTEMS (Concluded)

For each of the subsystem points other than the C.G. point enter the static (zero speed) mode shapes (assumed to be 0 if not entered):

FBD Tangential Translation, $\bar{u}$ (inches)	FBD Axial Translation, $\bar{v}$ (inches

▽2

FBDMS =

Local Point Number

1 ________, ________,
2 ________, ________,
3 ________, ________,
.
.
.
.
.
.
n ________, ________.

For each of the subsystem points other than the C.G. point enter the modal stress components (assumed to be 0 is not entered):

σ_1, psi	σ_2, psi	σ_3, psi

▽2

FBDS =

Local Point Number

1 ______, ______, ______,
2 ______, ______, ______,
3 ______, ______, ______,
.
.
.
.
.
.
n ______, ______, ______,

the FBD-engine interaction; they, however, allow the calculation of the response of any of the local points on the FBD as determined by the Group 1 inputs. The Group 2 input includes the r and ξ coordinates, the mode shapes, and the modal stress components for each of the local points on the FBD on which transient displacements and/or stresses are desired.

Input sheets C-13 through C-16 follow. See Table 1 for sample input demonstration case.

5.4 FBD MODULE OUTPUT

In addition to the original TETRA output (Reference 1), FBD output are calculated for:

1. FBD one-diameter participation factors (generalized displacement) for (a) horizontal diameter node line standing wave and (b) vertical diameter node line standing wave

2. Axial and tangential displacements relative to the rotor attachment, of any designated point(s) on the FBD (the point coordinates and mode shapes must be in Group 2 input)

3. Stress components on the FBD at designated points (location and modal stress components; that is, stress/deflection must be included in Group 2 input).

Also, the FBD rotor mass matrix and its inverse are printed out. This is intended to provide assistance in diagnostics. A sample of a typical output is given in the pages which follow.

5.5 OUTPUT PLOT FILE: FORMATS AND DEFINITIONS

Some changes to the content of the output plot file were unavoidable because of the need to add the FBD displacements, stresses, participation factors (generalized displacemments), and other FBD parameters to the output plot file. For this reason, any TETRA postprocessor program that reads this output plot file and which was written for the old version of the program without FBD capability will have to be modified slightly to work with the revised TETRA program. However, such required changes are minimal and can be accomplished quite easily.

The following is a listing of the contents of the output plot file for the revised TETRA program. This listing should be helpful to anyone modifying an existing program which reads the TETRA output plot file or to anyone writing a new program to read this plot file.

See Table 1 for sample output demonstration case.

Table 1. Two-Rotor Model with FBD, Input and Output.

Modal Subsystem Input for Rotor 1 and 2

```
$LIST2
TITLE='SUBSYSTEM 1 ----VERTICAL LF ROTOR----',
ISUB= 1,
XREF=    0.   ,
YREF=    0.   ,
ZREF=    0.   ,
PTS=
    1,     0.    ,     0.   ,     0.   ,
    2,    10.000,      0.   ,     0.   ,
    3,    30.000,      0.   ,     0.   ,
    4,    50.000,      0.   ,     0.   ,
    5,    70.000,      0.   ,     0.   ,
    6,    90.000,      0.   ,     0.   ,
    7,   100.000,      0.   ,     0.   ,
MODES=
      71.0,   6.30715E 01,   100.,  1,
     106.4,   1.00158E 02,   100.,  1,
    2289.2,   1.00840E 05,   100.,  0,
    4314.1,   9.53015E 05,   100.,  0,
    7810.2,   1.46816E 06,   100.,  0,
VH(1,1,1)=
    -1.00000E 00,    1.42427E-02,    2.80001E 01,   -1.94036E 02,
    -8.57165E-01,    1.42365E-02,    8.95002E 01,   -1.07634E 03,
    -5.71870E-01,    1.41980E-02,    9.40023E 01,   -2.90055E 03,
    -2.79762E-01,    1.46101E-02,   -5.04498E 01,   -1.39611E 03,
     1.22652E-02,    1.46057E-02,   -5.00247E 01,   -4.01251E 02,
     3.04253E-01,    1.46062E-02,   -5.11110E 01,    5.97691E 02,
     4.50370E-01,    1.46072E-02,    3.49516E-07,   -4.45314E-06,
VH(1,1,2)=
     2.08094E-01,    6.87439E-03,   -5.70241E 01,   -2.10651E 02,
     3.56557E-01,    6.07511E-03,   -5.84276E 01,    3.57097E 02,
     4.93615E-01,    6.09353E-03,   -6.56599E 01,    1.54907E 03,
     6.31727E-01,    6.89718E-03,   -4.89630E 01,   -2.93136E 01,
     7.69558E-01,    6.89947E-03,   -6.05572E 01,    9.95961E 02,
     9.07459E-01,    6.90733E-03,   -7.07304E 01,    2.26558E 03,
     1.00000E 00,    9.23097E-03,    7.73343E-08,   -1.68799E-05,
VH(1,1,3)=
     5.76601E-01,   -4.20310E-02,   -5.27821E 04,    5.95645E 05,
    -6.52400E-02,   -3.36735E-02,   -5.26633E 04,    1.12913E 06,
    -9.57160E-01,   -1.51503E-03,   -6.70040E 04,    2.16795E 06,
    -9.74762E-01,    1.11925E-02,    4.73169E 04,    3.03757E 06,
    -4.99209E-01,    2.36106E-02,    5.19371E 04,    2.04920E 06,
     1.83892E-01,    3.10172E-02,    5.22452E 04,    9.89392E 05,
     5.67681E-01,    3.27779E-02,    2.87951E-05,   -7.37155E-03,
VH(1,1,4)=
     6.29363E-01,    1.77630E-01,   -2.04600E 05,   -8.94015E 06,
     1.00000E 00,    1.00652E-01,   -2.11073E 05,   -6.95425E 06,
    -1.80939E-01,    6.30030E-03,   -2.17354E 05,   -2.70597E 06,
    -6.39536E-01,    3.64252E-03,   -3.07511E 03,    1.55516E 06,
    -4.88721E-01,    1.12304E-02,    1.00456E 04,    1.51030E 06,
    -1.61962E-01,    1.79952E-02,    1.63540E 04,    1.22032E 06,
     5.33754E-02,    2.07439E-02,   -2.14493E-04,    9.15172E-03,
VH(1,1,5)=
    -5.24565E-02,   -4.53012E-03,    5.58947E 04,    7.47287E 05,
     2.03841E-01,    1.84560E-05,    5.15753E 04,    1.00304E 05,
     5.88236E-01,   -5.30055E-03,    7.23746E 03,   -6.25459E 05,
     4.14102E-01,   -7.79119E-03,   -4.68352E 05,   -2.35870E 05,
    -7.39403E-01,    1.37421E-02,   -4.27592E 05,    8.99355E 06,
    -8.89708E-01,    7.73402E-02,   -3.66359E 05,    1.60102E 07,
    -3.26380E-01,    1.22060E-01,   -9.70400E-03,    2.50491E-01,
$END
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
$LIST2
TITLE='SUBSYSTEM 2 ----HORIZONTAL LP ROTOR----',
ISUB= 2,
XREF=    0.   ,
YREF=    0.   ,
ZREF=    0.   ,
PTS=
   1,     0.   ,     0.   ,     0.   ,
   2,    10.000,     0.   ,     0.   ,
   3,    30.000,     0.   ,     0.   ,
   4,    50.000,     0.   ,     0.   ,
   5,    70.000,     0.   ,     0.   ,
   6,    90.000,     0.   ,     0.   ,
   7,   100.000,     0.   ,     0.   ,
XMODES=
     71.0,   6.30718E 01,   100.,  1,
    106.4,   1.60158E 02,   100.,  1,  ,
   2289.2,   1.00840E 05,   100.,  0,
   4314.1,   9.53015E 05,   100.,  0,
   7810.2,   1.46816E 06,   100.,  0,
VH(1,1,1)=
   -1.00000E 00,    1.42427E-02,    8.80001E 01,   -1.94036E 02,
   -8.57165E-01,    1.42365E-02,    8.95002E 01,   -1.07634E 03,
   -5.71870E-01,    1.41980E-02,    9.40023E 01,   -2.90055E 03,
   -2.79762E-01,    1.46101E-02,   -5.04498E 01,   -1.39611E 03,
    1.22652E-02,    1.46057E-02,   -5.00247E 01,   -4.01251E 02,
    3.04253E-01,    1.46062E-02,   -5.11110E 01,    5.97691E 02,
    4.50370E-01,    1.46072E-02,    3.49516E-07,   -4.45314E-06,
VH(1,1,2)=
    2.88094E-01,    6.87439E-03,   -5.70241E 01,   -2.10651E 02,
    3.56557E-01,    6.87511E-03,   -5.84276E 01,    3.57037E 02,
    4.93615E-01,    6.89353E-03,   -6.56599E 01,    1.54907E 03,
    6.31727E-01,    6.89718E-03,   -4.89830E 01,   -2.28136E 01,
    7.69550E-01,    6.89947E-03,   -6.05572E 01,    9.95961E 02,
    9.07459E-01,    6.90733E-03,   -7.07304E 01,    2.26556E 03,
    1.00000E 00,    9.23097E-03,    7.73343E-06,   -1.69799E-05,
VH(1,1,3)=
    5.76601E-01,   -4.20310E-02,   -5.27821E 04,    5.95645E 05,
   -6.52480E-02,   -3.36735E-02,    5.26633E 04,    1.12913E 06,
    9.57160E-01,   -1.51503E-03,   -4.70048E 04,    2.16795E 06,
   -9.74762E-01,    1.11925E-02,    4.73169E 04,    3.03757E 06,
   -4.99209E-01,    2.36106E-02,    5.19371E 04,    2.04920E 06,
    1.82892E-01,    3.10172E-02,    5.22452E 04,    9.89392E 05,
    5.67601E-01,    3.27779E-02,    2.87951E-05,   -7.37155E-03,
VH(1,1,4)=
    6.29363E-01,    1.77630E-01,   -2.04600E 05,   -8.94015E 06,
    1.00000E 00,    1.00652E-31,   -2.11073E 05,   -6.95425E 06,
   -1.80939E-01,    6.38030E-03,   -2.17354E 05,   -2.70597E 06,
   -6.39536E-01,    3.64252E-03,   -3.07511E 03,    1.55516E 06,
   -4.98721E-01,    1.12384E-02,    1.98456E 04,    1.51830E 06,
   -1.61962E-01,    1.79952E-02,    1.63540E 04,    1.22832E 06,
    5.33754E-02,    2.07439E-02,   -2.14493E-04,    9.15172E-03,
VH(1,1,5)=
   -5.24565E-02,   -4.53012E-03,    5.58947E 04,    7.47287E 05,
    2.03841E-01,    1.84566E-05,    5.15753E 04,    1.88304E 05,
    5.88236E-01,   -5.38055E-03,    7.23746E 03,   -6.25459E 05,
    4.14102E-01,   -7.79119E-03,   -4.68352E 05,   -2.35678E 05,
   -7.39403E-01     1.37421E-02,   -4.27592E 05,    8.99355E 06,
   -8.89708E-01.    7.73402E-02,   -3.66359E 05,    1.68102E 07,
   -3.26380E-01,    1.22068E-01,   -9.78480E-03,    2.50491E-01,
$END
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
$LISTZ
TITLE='SUBSYSTEM 4 ---HP ROTOR VERT.---',
ISUB= 4,
XREF=    0.   ,
YREF=    0.   ,
ZREF=    0.   ,
PTS=
   8,     0.   ,      0.   ,     0.   ,
   9,    10.000,      0.   ,     0.   ,
  10,    30.000,      0.   ,     0.   ,
  11,    50.000,      0.   ,     0.   ,
  12,    70.000,      0.   ,     0.   ,
  13,    90.000,      0.   ,     0.   ,
  14,   100.000,      0.   ,     0.   ,
XMODES=
     123.6,   1.06556E 02, 10000.,  1,
     170.4,   1.90866E 02, 10000.,  1,
    5355.9,   2.35766E 05, 10000.,  0,
    9340.8,   1.02190E 06, 10000.,  0,
VH(1,1,1)=
    -1.00000E 00,    1.16527E-02,    3.90772E 01,   -1.61282E 01,
    -8.83422E-01,    1.16524E-02,    1.00449E 02,   -4.39156E 02,
    -6.50074E-01,    1.16471E-02,    1.79120E 02,   -3.02919E 03,
    -4.13985E-01,    1.10154E-02,   -5.47929E 01,   -1.07031E 03,
    -1.77020E-01,    1.10134E-02,   -2.10825E 01,   -2.45427E 02,
     5.03920E-02,    1.10132E-02,   -2.00157E 01,    1.01686E 02,
     1.76534E-01,    1.10133E-02,    2.02284E-07,   -7.57617E-07,
VH(1,1,2)=
    -3.17001E-01,    1.34201E-02,    2.35402E 01,   -3.52972E 01,
    -1.02770E-01,    1.34199E-02,    4.76687E 01,   -3.41292E 02,
     8.57410E-02,    1.34170E-02,    4.77059E 01,   -1.46459E 03,
     3.47421E-01,    1.30704E-02,    9.74697E 00,   -3.03473E 03,
     6.00670E-01,    1.30604E-02,   -1.33726E 02,   -2.73592E 03,
     8.69332E-01,    1.30564E-02,   -2.95051E 02,    8.11273E 02,
     1.00000E 00,    1.30571E-02,   -1.51115E-06,    0.           ,
VH(1,1,3)=
     1.00000E 00,   -2.84524E-02,   -7.33608E 04,    7.39295E 04,
     6.20320E-01,   -2.77179E-02,   -1.54262E 05,    9.51580E 05,
    -3.03799E-01,   -1.90265E-02,   -1.51497E 05,    4.41060E 06,
    -7.44066E-01,   -4.37467E-04,    4.93966E 04,    6.28005E 06,
    -3.16035E-01,    1.01044E-02,    1.73085E 05,    4.33128E 06,
     5.90030E-01,    2.67032E-02,    1.13170E 05,    8.41009E 05,
     9.55042E-01,    2.74062E-02,    1.59249E-04,    6.27197E-03,
VH(1,1,4)=
    -1.00000E 00,    4.32023E-02,    2.23130E 05,   -3.41441E 05,
    -2.79516E-01,    4.07739E-02,    3.34019E 05,   -3.21732E 06,
     9.62537E-01,    1.90340E-02,   -9.39703E 04,   -8.43009E 06,
    -3.75221E-02,    3.51064E-03,   -5.65035E 05,    1.11711E 05,
    -9.64346E-01,    2.00020E-02,    1.10302E 05,    8.04198E 06,
     2.56016E-01,    4.05270E-02,    2.72170E 05,    2.00915E 06,
     9.63499E-01,    4.20034E-02,   -3.67906E-04,    0.           ,
$END
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
$LIST2
TITLE='SUBSYSTEM 5  ---HP ROTOR HORIZ.',
ISUB= 5,
XREF=    0.   ,
YREF=    0.   ,
ZREF=    0.   ,
PTS=
   9,     0.   ,     0.   ,     0.   ,
   9,   10.000,     0.   ,     0.   ,
  10,   30.000,     0.   ,     0.   ,
  11,   50.000,     0.   ,     0.   ,
  12,   70.000,     0.   ,     0.   ,
  13,   90.000,     0.   ,     0.   ,
  14,  100.000,     0.   ,     0.   ,
XMODES=
    123.6,   1.06556E 02, 10000.,  1,
    170.4,   1.90866E 02, 10000.,  1,
   5355.9,   2.35766E 05, 10000.,  0,
   9340.8,   1.02190E 06, 10000.,  0,
VH(1,1,1)=
   -1.00000E 00,    1.16527E-02,    3.90772E 01,   -1.61232E 01,
   -8.93422E-01,    1.16524E-02,    1.00449E 02,   -4.39156E 02,
   -6.50074E-01,    1.16471E-02,    1.79120E 02,   -3.02919E 03,
   -4.13985E-01,    1.18154E-02,   -5.47929E 01,   -1.07031E 03,
   -1.77820E-01,    1.18134E-02,   -2.18825E 01,   -2.45427E 02,
    5.83920E-02,    1.18132E-02,   -2.00157E 01,    1.01636E 02,
    1.76534E-01,    1.18133E-02,    2.02294E-07,   -7.57617E-07,
VH(1,1,2)=
   -3.17001E-01,    1.34201E-02,    2.35402E 01,   -3.52972E 01,
   -1.92770E-01,    1.34199E-02,    4.76687E 01,   -3.41292E 02,
    8.57410E-02,    1.34170E-02,    4.77059E 01,   -1.46459E 03,
    3.47421E-01,    1.30704E-02,    9.74697E 00,   -3.03473E 03,
    6.09670E-01,    1.30604E-02,   -1.33726E 02,   -2.73592E 03,
    6.69332E-01,    1.30564E-02,   -2.95551E 02,    8.11273E 02,
    1.00000E 00,    1.30571E-02,   -1.51115E-06,    0.          ,
VH(1,1,3)=
    1.00000F 00,   -2.84524E-02,   -7.33608E 04,    7.39295E 04,
    6.20320    ,   -2.77179E-02,   -1.54262E 05,    9.51580E 05,
   -3.03799E-01,   -1.90265E-02,   -1.51497E 05,    4.41060E 06,
   -7.44866E-01,   -4.37467E-04,    4.93966E 04,    6.29805E 06,
   -3.16035E-01,    1.81044E-02,    1.73085E 05,    4.33128E 06,
    5.90830E-01,    2.67032E-02,    1.13170E 05,    8.41809E 05,
    9.55842E-01,    2.74062E-02,    1.59249E-04,    6.27197E-03,
VH(1,1,4)=
   -1.00000E 00,    4.32023E-02,    2.23138E 05,   -3.41441E 05,
   -2.79516E 01,    4.07739E-02,    3.34019E 05,   -3.21732E 06,
    9.62537E-01,    1.98340E-02,   -9.39703E 04,   -8.43809E 06,
   -3.75221E-02,    3.51864E-03,   -5.65835E 05,    1.11711E 05,
   -9.64346E-01,    2.00828E-02,    1.10302E 05,    6.04198E 06,
    2.56816E-01,    4.05270E-02,    2.72170E 05,    2.80915E 06,
    9.63499E-01,    4.28834E-02,   -3.67906E-04,    0.          ,
$END
```

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Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

FBD Inputs

```
$LIST2
TITLE=' FBD AT PT 7 OF LP ROTOR-SIMULATED TURBINE',
ISUB=12,
ICC=7,
WTF=200,
GFAC=100,
WF=42.6,
XMU=50,
SV=2000,
BETA=
0,1.0,
100000,1.0,
FBDPTS=
10,0,
20,0,
20,30,
25,30,
30,45,
20,90,
30,90,
FBDMS=
0,.05,
.1,.35,
.1,.35,
.2,.56,
.7,1.0,
.1,.4,
.7,1.0,
FBDS=
5E5,2E5,1E5,
3E5,4E5,5E4,
3E5,4E5,5E4,
2E5,1E5,1E4,
0,0,0,
3E5,4E5,5E4,
0,0,0,
$END

$LIST3
ITYPE=5,
ILEM=1,
JT=3,10,
YS=10000,
ZS=10000,
IDAMP=1,
QELEM=15,
QFREQ=93.3,
$END
$LIST3
ITYPE=5,
ILEM=2,
JT=6,13,
YS=50000,
ZS=50000,
IDAMP=1,
QELEM=15,
QFREQ=93.3,
$END
$LIST3
ITYPE=5,
ILEM=3,
JT=10,31,
YS=50000,
ZS=50000,
IDAMP=1,
QELEM=15,
QFREQ=93.3,
$END
$LIST3
ITYPE=5,
ILEM=4,
JT=13,32,
YS=50000,
ZS=50000,
IDAMP=1,
QELEM=15,
QFREQ=93.3,
$END
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
$LIST4
ISTART=0,
DELTA=.00015,
TFINAL=.45,
IPRMUL=1000,
IPLMUL=13,
IROTI=1,
BEGTIM=0,
BEGRPM=2400,
TRHIS(1,1)=
1.0,0,
4.0,300,
A=0,
B=0,
C=4.25,
D=-5775.0,
UNBAL(1,1)=
.00005,8,100,0,
GYRO(1,1)=
1,184205,
7,184205,
NPD(1,1'=
1,1;
2,1,
3,1,
4,1,
4,3,
5,1,
6,1,
7,1,
8,1,
9,1,
10,1,
11,1,
11,3,
12,1,
13,1,
14,1,
NEPD(1,1)=
1,3,1,
1,3,3,
2,6,1,
3,10,1,
3,10,3,
4,13,1,
$END
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

TETRA Processed Input from Initial and Basic Input

```
 END OF INPUT FILE
1THE CURRENT PROGRAM LIMITS FOR THE INPUT VARIABLES ARE-

 MAX. NO. OF PHYSICAL POINTS NOT LOCATED ON THE MODAL SUBSYSTEMS= 10


                       MAX. NO.
                     OF PHYSICAL      MAX. NO.
       SUBSYSTEM        POINTS        OF MODES


           1              10             15
           2              10             15
           3              10              5
           4              10             15
           5              10             15
           6              10              5
           7              20             30
           8              10             30
           9              10              5
          10              20             30
          11              10             30


 MAX. NO. OF PHYSILAL POINTS FOR SUBSYSTEM 12 OTHER THAN THE [illegible] POINT [illegible]
 MAX. NO. OF PHYSICAL POINTS FOR SUBSYSTEM 13 OTHER THAN THE [illegible] POINT [illegible]
 NUMBER OF MODES FOR SUBSYSTEM 12 = 2
 NUMBER OF MODES FOR SUBSYSTEM 13 = 2
 MAX. NO. OF TYPE 1 PHYSICAL CONNECTING ELEMENTS=  5
 MAX. NO. OF TYPE 2 PHYSICAL CONNECTING ELEMENTS= 10
 MAX. NO. OF TYPE 3 PHYSICAL CONNECTING ELEMENTS= 10
 MAX. NO. OF TYPE 4 PHYSICAL CONNECTING ELEMENTS=  4
 MAX. NO. OF TYPE 5 PHYSICAL CONNECTING ELEMENTS= 10
 MAX. NO. OF SPEED SEGMENTS= 10
 MAX. NO. OF UNBALANCE BIRTH EVENTS= 20
 MAX. NO. OF P*COS(WT) AND P*SIN(WT) LOADS= 30
 MAX. NO. OF TIME-FORCE HISTORY LOADS= 30
 MAX. NO. OF TIME-FORCE HISTORY TABLES= 10
 MAX. NO. OF (TIME-FORCE) PAIRS IN EACH HISTORY TABLE= 10
 MAX. NO. OF GYROSCOPIC LOAD LOCATIONS= 30
 MAX. NO. OF (POINT,DIRECTION) PAIRS FOR WHICH COORDINATES, DISPLACEMENTS,
       VELOCITIES, AND MODAL FORCES ARE WRITTEN TO THE PLOT FILE= 50
 MAX. NO. OF (ELEMENT,POINT,DIRECTION) TRIOS FOR WHICH CONNECTING
       ELEMENT FORCES ARE WRITTEN TO THE PLOT FILE= 50
1INPUT DATA FOR POINTS NOT LOCATED ON THE MODAL SUBSYSTEMS-



                   CODE
   POINT         (0=FREE)    COORDINATES (INCHES)-GLOBAL SYSTEM
   NUMBER        (1=FIXED)         X            Y            Z


    31               1           30.000       0.000        0.000
    32               1           90.000       0.000        0.000
0NUMBER OF PHYSICAL POINTS NOT ON MODAL SUBSYSTEMS=  2
1                    DATA FOR MODAL SUBSYSTEM  1


         SUBSYSTEM 1 ----VERTICAL LP ROTOR----


 NUMBER OF SUBSYSTEM DIRECTIONS=  2


 SUBSYSTEM DIRECTIONS-
              Z     (GLOBAL DIRECTION 1)
        THETA-Y (GLOBAL DIRECTION 2)
0COORDINATES OF REFERENCE POINT RELATIVE TO GLOBAL SYSTEM (IN.)
 X=     0.000            Y=     0.000           Z=     0.000
```

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Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
0048300
0048400                       COORDINATES OF POINTS ON SUBSYSTEM (INCHES)
0048500  POINT         LOCAL COORDINATE SYSTEM          GLOBAL COORDINATE SYSTEM
0048600  NUMBER          X           Y           Z           X           Y           Z
0048700
0048800
0048900     1          0.000       0.000       0.000       0.000       0.000       0.000
0049000     2         10.000       0.000       0.000      10.000       0.000       0.000
0049100     3         30.000       0.000       0.000      30.000       0.000       0.000
0049200     4         50.000       0.000       0.000      50.000       0.000       0.000
0049300     5         70.000       0.000       0.000      70.000       0.000       0.000
0049400     6         90.000       0.000       0.000      90.000       0.000       0.000
0049500     7        100.000       0.000       0.000     100.000       0.000       0.000
0049600 0NUMBER OF SUBSYSTEM POINTS=  7
0049700
0049800
0049900 0LOCAL    GENERALIZED                                     MODE TYPE                   GENERALIZED  [illegible]
0050000   MODE    COORDINATE    FREQUENCY  POTENTIAL      Q      0=FLEXIBLE   GENERALIZED   STIFFNESS    [illegible]
0050100  NUMBER     NUMBER         RPM       ENERGY     FACTOR  1=RIGID BODY   WEIGHT-LB      LB/IN       [illegible]
0050200
0050300
0050400    1          1              71.   6.307E+01    100.        1          8.617E+02   0.000E+00   [illegible]
0050500    2          2             106.   1.602E+02    100.        1          9.970E+02   0.000E+00   [illegible]
0050600    3          3            2209.   1.000E+05    100.        0          1.356E+03   2.017E+05   [illegible]
0050700    4          4            4314.   9.530E+05    100.        0          3.629E+03   1.90?E+06   [illegible]
0050800    5          5            7810.   1.460E+06    100.        0          1.696E+03   2.93?E+06   [illegible]
0050900 0NUMBER OF SUBSYSTEM MODES=  5
0051000 0THE MODE SHAPES FOR THIS SUBSYSTEM ARE-
0051100 0                                         MODAL DISPLACEMENTS          MODAL FORCES
0051200  LOCAL    GENERALIZED                      GLOBAL DIRECTION          GLOBAL DIRECTION
0051300  MODE     COORDINATE     POINT              1             2             1            2
0051400  NUMBER     NUMBER       NUMBER             Z          THETA-Y          Z          THETA-Y
0051500
0051600
0051700    1          1             1          +1.00000       0.01424     8.900E+01   -1.940E+02
0051800    1          1             2          -0.85716       0.01424     9.950E+01   -1.076E+02
0051900    1          1             3          -0.57187       0.01426     9.400E+01   -2.901E+02
0052000    1          1             4          -0.27976       0.01461    -5.045E+01   -1.396E+02
0052100    1          1             5           0.01227       0.01461    -5.002E-01   -4.011E+02
0052200    1          1             6           0.30425       0.01461    -5.111E+01    5.977E+02
0052300    1          1             7           0.45037       0.01461     3.495E-07   -4.453E+02
0052400
0052500    2          2             1           0.28999       0.00667    -5.702E+01   -2.107E+02
0052600    2          2             2           0.35656       0.00688    -5.943E+01    3.571E+02
0052700    2          2             3           0.49262       0.00689    -6.566E+01    1.549E-03
0052800    2          2             4           0.63173       0.00690    -4.993E-01   -2.821E+02
0052900    2          2             5           0.76956       0.00690    -6.056E+01    9.760E+02
0053000    2          2             6           0.90746       0.00691    -7.073E+01    2.266E+03
0053100    2          2             7           1.00000       0.00923     7.733E-02   -1.688E-05
0053200
0053300    3          3             1           0.57660      -0.04203    -5.278E+04    5.956E+05
0053400    3          3             2          -0.06525      -0.03367    -5.266E+04    1.129E+06
0053500    3          3             3          -0.95716      -0.00152    -4.700E+04    2.133E+06
0053600    3          3             4          -0.97476       0.01119     4.732E+04    1.032E+06
0053700    3          3             5          -0.49921       0.02361     5.194E+04    2.049E+06
0053800    3          3             6           0.18389       0.03102     5.225E+04    9.894E+05
0053900    3          3             7           0.56769       0.03278     2.860E-05   -7.372E-03
0054000
0054100    4          4             1           0.62926       0.17763    -2.046E+05   -8.940E+06
0054200    4          4             2           1.00000       0.10065    -2.111E+05   -6.954E+06
0054300    4          4             3          -0.10094       0.00638    -2.174E+05   -2.706E+06
0054400    4          4             4          -0.63954       0.00364    -3.075E+03    1 555E+06
0054500    4          4             5          -0.40872       0.01124     1.085E+04    1.518E+06
0054600    4          4             6          -0.16196       0.01800     1.635E+04    1.220E+06
0054700    4          4             7           0.05339       0.02074    -2.145E-04    9.152E-03
0054800
0054900    5          5             1          -0.05246      -0.00453     5.509E+04    7.473E+05
0055000    5          5             2           0.20384       0.00002     5.150E+04    1.893E+05
0055100    5          5             3           0.58824      -0.00538     7.237E+03   -6.255E+05
0055200    5          5             4           0.41410      -0.00779    -4.684E+05   -2.359E+05
0055300    5          5             5          -0.73940       0.01374    -4.276E+05    8.994E+06
0055400    5          5             6          -0.00971       0.07735    -3.664E+05    1.681E+07
0055500    5          5             7          -0.32658       0.12207    -9.785E-03    2.505E-01
0055600
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)


```
1                 DATA FOR MODAL SUBSYSTEM  2



         SUBSYSTEM 2 ----HORIZONTAL LP ROTOR----


 NUMBER OF SUBSYSTEM DIRECTIONS=  2


 SUBSYSTEM DIRECTIONS-
            Y      (GLOBAL DIRECTION 3)
         THETA-Z (GLOBAL DIRECTION 4)
0COORDINATES OF REFERENCE POINT RELATIVE TO GLOBAL SYSTEM (IN.)
 X=    0.000          Y=     0.000          Z=    0.000
     .

                    COORDINATES OF POINTS ON SUBSYSTEM (INCHES)
 POINT          LOCAL COORDINATE SYSTEM        GLOBAL COORDINATE SYSTEM
 NUMBER          X          Y          Z          X          Y          Z


   1           0.000      0.000      0.000      0.000      0.000      0.000
   2          10.000      0.000      0.000     10.000      0.000      0.000
   3          20.000      0.000      0.000     30.000      0.000      0.000
   4          50.000      0.000      0.000     50.000      0.000      0.000
   5          70.000      0.000      0.000     70.500      0.000      0.000
   6          90.000      0.000      0.000     90.000      0.000      0.000
   7         100.000      0.000      0.000    100.000      0.000      0.000
0NUMBER OF SUBSYSTEM POINTS=  7


0LOCAL    GENERALIZED                                      MODE TYPE                        GENERALIZED    GENERALIZED
  MODE    COORDINATE    FREQUENCY  POTENTIAL      Q      0=FLEXIBLE   GENERALIZED   STIFFNESS-     DAMPING-
 NUMBER     NUMBER         RPM       ENERGY    FACTOR  1=RIGID BODY  WEIGHT-LB       LB/IN        [illegible]


   1          6             71.   6.307E+01    100.         1         8.817E-02    [illegible]    [illegible]
   2          7            106.   1.602E+02    100.         1         9.970E-02    [illegible]    [illegible]
   3          8           2289.   1.000E+05    100.         0         1.356E-03    [illegible]    [illegible]
   4          9           4314.   9.530E+05    100.         0         3.609E+03    [illegible]    [illegible]
   5         10           7810.   1.460E+06    100.         0         1.696E-03    [illegible]    [illegible]
0NUMBER OF SUBSYSTEM MODES=  5
0THE MODE SHAPES FOR THIS SUBSYSTEM ARE-
  (SIGNS IN THETA-Z DIRECTION CHANGED TO OBTAIN RIGHT HAND COORDINATE SYSTEM)
0                                          MODAL DISPLACEMENTS            MODAL FORCES
 LOCAL     GENERALIZED                       GLOBAL DIRECTION            GLOBAL DIRECTION
 MODE      COORDINATE      POINT              3              4              3              4
 NUMBER      NUMBER        NUMBER             Y           THETA-Z           Y           THETA-Z


   1           6             1          -1.00000       -0.01424       8.800E+01     1.940E-02
   1           6             2          -0.05716       -0.01424       8.950E+01     1.076E+03
   1           6             3          -0.57107       -0.01420       9.400E+01     2.901E+03
   1           6             4          -0.27976       -0.01461      -5.045E+01     1.396E+03
   1           6             5           0.01227       -0.01461      -5.002E+01     4.013E+02
   1           6             6           0.30425       -0.01461      -5.111E+01    -5.977E+02
   1           6             7           0.45037       -0.01461       3.495E-07     4.453E-06

   2           7             1           0.28009       -0.00687      -5.702E+01     2.107E+02
   2           7             2           0.35656       -0.00688      -5.043E+01    -3.571E+02
   2           7             3           0.49362       -0.00689      -6.566E+01    -1.549E+03
   2           7             4           0.63173       -0.00690      -4.898E+01     2.881E+01
   2           7             5           0.76956       -0.00690      -6.056E+01    -9.960E+02
   2           7             6           0.90746       -0.00691      -7.073E+01    -2.266E+03
   2           7             7           1.00000       -0.00923       7.733E-08     1.680E-05

   3           8             1           0.57660        0.04203      -5.278E+04    -5.956E+05
   3           8             2          -0.06525        0.03367      -5.266E+04    -1.129E+06
   3           8             3          -0.95716        0.00152      -4.700E+04    -2.160E+06
   3           8             4          -0.97476       -0.01119       4.732E+04    -3.030E+06
   3           8             5          -0.49921       -0.02361       5.194E+04    -2.049E+06
   3           8             6           0.10309       -0.03102       5.225E+04    -9.894E+05
   3           8             7           0.56760       -0.03270       2.800E-05     7.372E-03

   4           9             1           0.62936       -0.17763      -2.046E+05     8.940E+06
   4           9             2           1.00000       -0.10065      -2.111E+05     6.954E+06
   4           9             3          -0.10094       -0.00630      -2.174E+05     2.706E+06
   4           9             4          -0.63954       -0.00364      -3.075E+03    -1.555E+06
   4           9             5          -0.40072       -0.01124       1.005E+04    -1.510E+06
   4           9             6          -0.16196       -0.01000       1.635E+04    -1.220E+06
   4           9             7           0.05338       -0.02074      -2.145E-04    -9.152E-03

   5          10             1          -0.05246        0.00453       5.509E+04    -7.473E+05
   5          10             2           0.20304       -0.00002       5.150E+04    -1.003E+05
   5          10             3           0.50024        0.00530       7.237E+03     6.255E+05
   5          10             4           0.41410        0.00779      -4.684E+05     2.359E+05
   5          10             5          -0.73940       -0.01374      -4.276E+05    -8.994E+06
   5          10             6          -0.00971       -0.07735      -3.664E+05    -1.681E+07
   5          10             7          -0.32630       -0.12207      -9.705E-03    -2.505E-01
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
 1                    DATA FOR MODAL SUBSYSTEM  4


            SUBSYSTEM 4 ---HP ROTOR VERT.---


 NUMBER OF SUBSYSTEM DIRECTIONS=  2


 SUBSYSTEM DIRECTIONS-
              Z     (GLOBAL DIRECTION 1)
          THETA-Y  (GLOBAL DIRECTION 2)
0COORDINATES OF REFERENCE POINT RELATIVE TO GLOBAL SYSTEM (IN.)
 X=     0.000            Y=     0.000            Z=     0.000


                   COORDINATES OF POINTS ON SUBSYSTEM (INCHES)
 POINT          LOCAL COORDINATE SYSTEM          GLOBAL COORDINATE SYSTEM
 NUMBER          X          Y          Z          X          Y          Z


    8          0.000      0.000      0.000      0.000      0.000      0.000
    9         10.000      0.000      0.000     10.000      0.000      0.000
   10         30.000      0.000      0.000     30.000      0.000      0.000
   11         50.000      0.000      0.000     50.000      0.000      0.000
   12         70.000      0.000      0.000     70.000      0.000      0.000
   13         90.000      0.000      0.000     90.000      0.000      0.000
   14        100.000      0.000      0.000    100.000      0.000      0.000
0NUMBER OF SUBSYSTEM POINTS=  7


0LOCAL   GENERALIZED                                     MODE TYPE                      GENERALIZED    [illegible]
  MODE   COORDINATE    FREQUENCY  POTENTIAL      Q      0=FLEXIBLE    GENERALIZED    STIFFNESS      [illegible]
 NUMBER    NUMBER         RPM       ENERGY     FACTOR  1=RIGID BODY   WEIGHT-LB        LB/IN         [illegible]


    1        11           124.   1.065E+02   10000.        1          4.915E+02     3.369E-01     [illegible]
    2        12           172.   1.909E+02   10000.        1          4.232E+02     0.000E+03     [illegible]
    3        13          5356.   2.359E+05   10000.        0          5.792E+02     4.715E-05     [illegible]
    4        14          9341.   1.022E+06   10000.        0          3.254E+02     [illegible]   [illegible]
0NUMBER OF SUBSYSTEM MODES=  4
0THE MODE SHAPES FOR THIS SUBSYSTEM ARE-
0                                            MODAL DISPLACEMENTS             MODAL FORCES
  LOCAL    GENERALIZED                         GLOBAL DIRECTION             GLOBAL DIRECTION
  MODE     COORDINATE     POINT              1              2              1              2
 NUMBER      NUMBER       NUMBER             Z           THETA-Y           Z           THETA-Y


    1          11            8         -1.00000        0.01165      3.909E+01     -1.613E+01
    1          11            9         -0.88342        0.01165      1.004E+02     -4.392E+02
    1          11           10         -0.65007        0.01165      1.791E+02     -3.029E+03
    1          11           11         -0.41399        0.01182     -5.479E+01     -1.070E+03
    1          11           12         -0.17782        0.01181     -2.166E+01     -2.454E+02
    1          11           13          0.05839        0.01181     -2.002E+01      1.017E+02
    1          11           14          0.17653        0.01181      2.023E-07     -7.576E-07

    2          12            8         -0.31700        0.01342      2.354E+01     -3.530E+01
    2          12            9         -0.18277        0.01342      4.767E+01     -3.413E+02
    2          12           10          0.08574        0.01342      4.771E+01     -1.465E+03
    2          12           11          0.34742        0.01307      9.747E+00     -3.035E+03
    2          12           12          0.60867        0.01306     -1.337E+02     -2.736E+03
    2          12           13          0.86933        0.01306     -2.959E+02      8.113E+02
    2          12           14          1.00000        0.01306     -1.511E-06      0.000E+00

    3          13            8          1.00000       -0.02845     -7.336E+04      7.393E+04
    3          13            9          0.62032       -0.02772     -1.543E+05      9.516E+05
    3          13           10         -0.30380       -0.01903     -1.515E+05      4.411E+06
    3          13           11         -0.74487       -0.00044      4.940E+04      6.280E+06
    3          13           12         -0.31603        0.01810      1.731E+05      4.331E+06
    3          13           13          0.59083        0.02670      1.132E+05      8.410E+05
    3          13           14          0.95584        0.02741      1.592E-04      6.272E-03

    4          14            8         -1.00000        0.04320      2.231E+05     -3.414E+05
    4          14            9         -0.27952        0.04077      3.340E+05     -3.217E+06
    4          14           10          0.96254        0.01983     -9.397E+04     -8.430E+06
    4          14           11         -0.03752        0.00352     -5.656E+05      1.117E+05
    4          14           12         -0.96435        0.02008      1.103E+05      8.042E+06
    4          14           13          0.25682        0.04053      2.722E+05      2.809E+06
    4          14           14          0.96350        0.04288     -3.679E-04      0.000E+00
```

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Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
1                  DATA FOR MODAL SUBSYSTEM  5


         SUBSYSTEM 5  ---HP ROTOR HORIZ.


NUMBER OF SUBSYSTEM DIRECTIONS=  2


SUBSYSTEM DIRECTIONS-
          Y     (GLOBAL DIRECTION 3)
       THETA-Z  (GLOBAL DIRECTION 4)
0COORDINATES OF REFERENCE POINT RELATIVE TO GLOBAL SYSTEM (IN.)
 X=    0.000         Y=     0.000         Z=    0.000


                     COORDINATES OF POINTS ON SUBSYSTEM (INCHES)
 POINT          LOCAL COORDINATE SYSTEM          GLOBAL COORDINATE SYSTEM
 NUMBER           X          Y          Z          X          Y          Z


    8           0.000      0.000      0.000      0.000      0.000      0.000
    9          10.000      0.000      0.000     10.000      0.000      0.000
   10          30.000      0.000      0.000     30.000      0.000      0.000
   11          50.000      0.000      0.000     50.000      0.000      0.000
   12          70.000      0.000      0.000     70.000      0.000      0.000
   13          90.000      0.000      0.000     90.000      0.000      0.000
   14         100.000      0.000      0.000    100.000      0.000      0.000
0NUMBER OF SUBSYSTEM POINTS=   7


0LOCAL   GENERALIZED                                      MODE TYPE                          GENERALIZED   [illegible]
  MODE   COORDINATE    FREQUENCY  POTENTIAL      Q        0=FLEXIBLE    GENERALIZED    STIFFNESS     [illegible]
 NUMBER    NUMBER         RPM       ENERGY     FACTOR   1=RIGID BODY    WEIGHT-LB       LB/IN         [illegible]


    1        15           124.    1.066E+02  10000.          1          4.915E+02   [illegible]   [illegible]
    2        16           170.    1.909E+02  10000.          1          4.632E+02   [illegible]   [illegible]
    3        17          5356.    2.350E+05  10000.          0          5.792E+02   4.715E+05     [illegible]
    4        18          9341.    1.022E+06  10000.          0          8.254E+02   [illegible]   [illegible]
0NUMBER OF SUBSYSTEM MODES=  4
0THE MODE SHAPES FOR THIS SUBSYSTEM ARE-
 (SIGNS IN THETA-Z DIRECTION CHANGED TO OBTAIN RIGHT HAND COORDINATE SYSTEM)
0                                            MODAL DISPLACEMENTS           MODAL FORCES
 LOCAL    GENERALIZED                          GLOBAL DIRECTION          GLOBAL DIRECTION
 MODE     COORDINATE    POINT                 3               4           3               4
 NUMBER     NUMBER      NUMBER                Y            THETA-Z        Y            THETA-Z


   1          15           8         -1.00000       -0.01165       3.908E+01      1.613E+01
   1          15           9         -0.80342       -0.01165       1.004E+02      4.392E+02
   1          15          10         -0.65007       -0.01165       1.791E+02      3.029E+03
   1          15          11         -0.41399       -0.01192      -5.479E+01      1.070E+03
   1          15          12         -0.17702       -0.01101      -2.100E+01      2.454E+02
   1          15          13          0.05039       -0.01101      -2.002E+01     -1.017E+02
   1          15          14          0.17653       -0.01101       2.023E-07      7.576E-07

   2          16           8         -0.31700       -0.01342       2.354E+01      3.530E+01
   2          16           9         -0.18277       -0.01342       4.767E+01      3.413E+02
   2          16          10          0.00574       -0.01342       4.771E+01      1.465E+03
   2          16          11          0.34742       -0.01307       9.747E+00      3.035E+03
   2          16          12          0.60367       -0.01306      -1.337E+02      2.736E+03
   2          16          13          0.86933       -0.01306      -2.959E+02     -8.113E+02
   2          16          14          1.00000       -0.01306      -1.511E-06      0.000E+00

   3          17           8          1.00000        0.02045      -7.336E+04     -7.393E+04
   3          17           9          0.62032        0.02772      -1.543E+05     -9.516E+05
   3          17          10         -0.30300        0.01903      -1.515E+05     -4.411E+06
   3          17          11         -0.74487        0.00044       4.940E+04     -6.200E+06
   3          17          12         -0.31603       -0.01810       1.731E+05     -4.331E+06
   3          17          13          0.59003       -0.02670       1.132E+05     -8.410E+05
   3          17          14          0.95504       -0.02741       1.592E-04     -6.272E-03

   4          18           8         -1.00000       -0.04320       2.231E+05      3.414E+05
   4          18           9         -0.27952       -0.04077       3.340E+05      3.217E+06
   4          18          10          0.96254       -0.01903      -9.397E+04      8.430E+06
   4          18          11         -0.03752       -0.00352      -5.650E+05     -1.117E+05
   4          18          12         -0.96435       -0.02000       1.103E+05     -8.042E+06
   4          18          13          0.25602       -0.04053       2.722E+05     -2.809E+06
   4          18          14          0.96350       -0.04280      -3.679E-04      0.000E+00
```

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Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
1                    DATA FOR MODAL SUBSYSTEM 12


          FBD AT PT 7 OF LP ROTOR-SIMULATED TURBINE


0TETRA POINT NUMBER FOR THE FBD CENTER OF GRAVITY=  7
01-DIAMETER MODAL WEIGHT WTF=     200.0 POUNDS
 MODAL Q-FACTOR=  100.
 STATIC FREQUENCY WF=      43. HERTZ
 MODAL TANGENTIAL SHEAR COEFFICIENT MU=        50.0 LB
 MODAL MOMENT COEFFICIENT SV=       2000.0 IN-LB


0      GENERALIZED                             GENERALIZED
       COORDINATE      GENERALIZED           DAMPING VALUE
         NUMBER         WEIGHT-LB             (LB-SEC)/IN


           19           2.000E+02           1.335E+00
           20           2.000E+02           1.305E+00
0NUMBER OF SUBSYSTEM MODES= 2
0               BETA
      RPM      FACTOR


        0.       1.000
   100000.       1.000
0NUMBER OF ENTRIES IN THE BETA FACTOR TABLE=  2


0THE FOLLOWING DATA IS FOR THE LOCAL POINTS ON THE FLEXIBLE BLADED DISK-

                                   TANGENTIAL      AXIAL
  LOCAL                   POLAR   TRANSLATION   TRANSLATION       MODAL STRESS COMPONENTS
  POINT   RADIUS   ANGLE     MODE SHAPE    MODE SHAPE     SIGMA1     SIGMA2     SIGMA3
  NUMBER  INCHES  DEGREES      INCHES        INCHES         PSI        PSI        PSI


      1   10.000      0.0      0.00000       0.05000    500000.    200000.    100000.
      2   20.000      0.0      0.10000       0.35000    300000.    400000.     50000.
      3   20.000     30.0      0.10000       0.35000    300000.    400000.     50000.
      4   25.000     30.0      0.20000       0.50000    200000.    100000.     10000.
      5   30.000     45.0      0.70000       1.00000         0.         0.         0.
      6   20.000     90.0      0.10000       0.40000    300000.    400000.     50000.
      7   30.000     90.0      0.70000       1.00000         0.         0.         0.
0NUMBER OF LOCAL POINTS ON THE FBD=   7
1TOTAL NUMBER OF SUBSYSTEMS=  5
0TOTAL NUMBER OF MODES OR GENERALIZED COORDINATES=  20
0SUMMARY OF THE MODES OR GENERALIZED COORDINATES-


 GENERALIZED
  COORDINATE  GENERALIZED      GENERALIZED     GENERALIZED
    NUMBER       WEIGHT         STIFFNESS     DAMPING VALUE


       1        8.817E+02       0.000E+00      0.000E+00
       2        9.970E+02       0.000E+00      0.000E+00
       3        1.356E+03       2.017E+05      8.413E+00
       4        3.609E+03       1.906E+06      4.219E+01
       5        1.696E+03       2.936E+06      3.590E+01
       6        8.817E+02       0.000E+00      0.000E+00
       7        9.970E+02       0.000E+00      0.000E+00
       8        1.356E+03       2.017E+05      8.413E+00
       9        3.609E+03       1.906E+06      4.219E+01
      10        1.696E+03       2.936E+06      3.590E+01
      11        4.915E+02       0.000E+00      0.000E+00
      12        4.632E+02       0.000E+00      0.000E+00
      13        5.792E+02       4.715E+05      8.407E-02
      14        8.254E+02       2.044E+06      2.009E-01
      15        4.915E+02       0.000E+00      0.000E+00
      16        4.632E+02       0.000E+00      0.000E+00
      17        5.792E+02       4.715E+05      8.407E-02
      18        8.254E+02       2.044E+06      2.009E-01
      19        2.000E+02           *          1.305E+00
      20        2.000E+02           *          1.305E+00
0*    THE GENERALIZED STIFFNESS FOR THE FBD MODES VARIES WITH TIME AND IS
      CALCULATED AT EACH TIME STEP.
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
0SUMMARY OF THE COORDINATES FOR THE PHYSICAL POINTS (NOT INCLUDING
 THE LOCAL POINTS ON THE FBD(S))-
0POINT                    COORDINATES (INCHES)-GLOBAL SYSTEM
 NUMBER                      X             Y             Z


    1                       0.000         0.000         0.000
    2                      10.000         0.000         0.000
    3                      30.000         0.000         0.000
    4                      50.000         0.000         0.000
    5                      70.000         0.000         0.000
    6                      90.000         0.000         0.000
    7                     100.000         0.000         0.000
    8                       0.000         0.000         0.000
    9                      10.000         0.000         0.000
   10                      30.000         0.000         0.000
   11                      50.000         0.000         0.000
   12                      70.000         0.000         0.000
   13                      90.000         0.000         0.000
   14                     100.000         0.000         0.000
   31                      30.000         0.000         0.000
   32                      90.000         0.000         0.000
1                  PHYSICAL CONNECTING ELEMENT NUMBER  1


 ELEMENT TYPE=  5


 NUMBER OF END POINTS= 2


 POINT NUMBER AT I END=  3
 POINT NUMBER AT J END= 10


 NUMBER OF DIRECTIONS FOR POINT AT I END= 5


 DIRECTIONS FOR POINT AT I END-
       X     (GLOBAL DIRECTION 5)
       Y     (GLOBAL DIRECTION 3)
       Z     (GLOBAL DIRECTION 1)
    THETA-Y  (GLOBAL DIRECTION 2)
    THETA-Z  (GLOBAL DIRECTION 4)


 NUMBER OF DIRECTIONS FOR POINT AT J END= 5


 DIRECTIONS FOR POINT AT J END-
       X     (GLOBAL DIRECTION 5)
       Y     (GLOBAL DIRECTION 3)
       Z     (GLOBAL DIRECTION 1)
    THETA-Y  (GLOBAL DIRECTION 2)
    THETA-Z  (GLOBAL DIRECTION 4)


 SPRING CONSTANT IN X DIRECTION=    0.000E+00
 SPRING CONSTANT IN Y DIRECTION=    1.000E+04
 SPRING CONSTANT IN Z DIRECTION=    1.000E+04
 SPRING CONSTANT IN THETA-Y DIRECTION=    0.000E+00
 SPRING CONSTANT IN THETA-Z DIRECTION=    0.000E+00
0Q-FACTOR=  15.0          FREQUENCY=      93.3 HERTZ


0DAMPING CONSTANTS (CALCULATED BASED ON ABOVE Q-FACTOR AND FREQUENCY)-


 DAMPING COEFFICIENT IN X DIRECTION=   0.000E+00
 DAMPING COEFFICIENT IN Y DIRECTION=   1.137E+00
 DAMPING COEFFICIENT IN Z DIRECTION=   1.137E+00
 DAMPING COEFFICIENT IN THETA-Y DIRECTION=   0.000E+00
 DAMPING COEFFICIENT IN THETA-Z DIRECTION=   0.000E+00
1                  PHYSICAL CONNECTING ELEMENT NUMBER  2
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
 ELEMENT TYPE=  5


 NUMBER OF END POINTS= 2


 POINT NUMBER AT I END=  6
 POINT NUMBER AT J END= 13


 NUMBER OF DIRECTIONS FOR POINT AT I END= 5


 DIRECTIONS FOR POINT AT I END-
       X     (GLOBAL DIRECTION 5)
       Y     (GLOBAL DIRECTION 3)
       Z     (GLOBAL DIRECTION 1)
    THETA-Y  (GLOBAL DIRECTION 2)
    THETA-Z  (GLOBAL DIRECTION 4)


 NUMBER OF DIRECTIONS FOR POINT AT J END= 5


 DIRECTIONS FOR POINT AT J END-
       X     (GLOBAL DIRECTION 5)
       Y     (GLOBAL DIRECTION 3)
       Z     (GLOBAL DIRECTION 1)
    THETA-Y  (GLOBAL DIRECTION 2)
    THETA-Z  (GLOBAL DIRECTION 4)


 SPRING CONSTANT IN X DIRECTION=   0.000E+00
 SPRING CONSTANT IN Y DIRECTION=   5.000E+04
 SPRING CONSTANT IN Z DIRECTION=   5.000E+04
 SPRING CONSTANT IN THETA-Y DIRECTION=   0.000E+00
 SPRING CONSTANT IN THETA-Z DIRECTION=   0.000E+00
0Q-FACTOR=  15.0           FREQUENCY=     93.3 HERTZ


0DAMPING CONSTANTS (CALCULATED BASED ON ABOVE Q-FACTOR AND FREQUENCY)-


 DAMPING COEFFICIENT IN X DIRECTION=   0.000E+00
 DAMPING COEFFICIENT IN Y DIRECTION=   5.686E+00
 DAMPING COEFFICIENT IN Z DIRECTION=   5.686E+00
 DAMPING COEFFICIENT IN THETA-Y DIRECTION=   0.000E+00
 DAMPING COEFFICIENT IN THETA-Z DIRECTION=   0.000E+00
1                 PHYSICAL CONNECTING ELEMENT NUMBER  3


 ELEMENT TYPE=  5


 NUMBER OF END POINTS= 2


 POINT NUMBER AT I END= 10
 POINT NUMBER AT J END= 31


 NUMBER OF DIRECTIONS FOR POINT AT I END= 5


 DIRECTIONS FOR POINT AT I END-
       X     (GLOBAL DIRECTION 5)
       Y     (GLOBAL DIRECTION 3)
       Z     (GLOBAL DIRECTION 1)
    THETA-Y  (GLOBAL DIRECTION 2)
    THETA-Z  (GLOBAL DIRECTION 4)
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
0DAMPING CONSTANTS (CALCULATED BASED ON ABOVE Q-FACTOR AND FREQUENCY)-


 DAMPING COEFFICIENT IN X DIRECTION=   0.000E+00
 DAMPING COEFFICIENT IN Y DIRECTION=   5.606E+00
 DAMPING COEFFICIENT IN Z DIRECTION=   5.606E+00
 DAMPING COEFFICIENT IN THETA-Y DIRECTION=   0.000E+00
 DAMPING COEFFICIENT IN THETA-Z DIRECTION=   0.000E+00
1                    PHYSICAL CONNECTING ELEMENT NUMBER  4


 ELEMENT TYPE=  5


 NUMBER OF END POINTS= 2


 POINT NUMBER AT I END= 13
 POINT NUMBER AT J END= 32


 NUMBER OF DIRECTIONS FOR POINT AT I END= 5


 DIRECTIONS FOR POINT AT I END-
       X     (GLOBAL DIRECTION 5)
       Y     (GLOBAL DIRECTION 3)
       Z     (GLOBAL DIRECTION 1)
    THETA-Y  (GLOBAL DIRECTION 2)
    THETA-Z  (GLOBAL DIRECTION 4)


 NUMBER OF DIRECTIONS FOR POINT AT J END= 5


 DIRECTIONS FOR POINT AT J END-
       X     (GLOBAL DIRECTION 5)
       Y     (GLOBAL DIRECTION 3)
       Z     (GLOBAL DIRECTION 1)
    THETA-Y  (GLOBAL DIRECTION 2)
    THETA-Z  (GLOBAL DIRECTION 4)


 SPRING CONSTANT IN X DIRECTION=   0.000E+00
 SPRING CONSTANT IN Y DIRECTION=   5.000E+04
 SPRING CONSTANT IN Z DIRECTION=   5.000E+04
 SPRING CONSTANT IN THETA-Y DIRECTION=   0.000E+00
 SPRING CONSTANT IN THETA-Z DIRECTION=   0.000E+00
0Q-FACTOR=  15.0          FREQUENCY=     93.3 HERTZ


 DAMPING COEFFICIENT IN Z DIRECTION=   5.606E+00
 DAMPING COEFFICIENT IN THETA-Y DIRECTION=   0.000E+00
 DAMPING COEFFICIENT IN THETA-Z DIRECTION=   0.000E+00
1NUMBER OF TYPE 1 PHYSICAL CONNECTING ELEMENTS=  0
0NUMBER OF TYPE 2 PHYSICAL CONNECTING ELEMENTS=  0
0NUMBER OF TYPE 3 PHYSICAL CONNECTING ELEMENTS=  0
0NUMBER OF TYPE 4 PHYSICAL CONNECTING ELEMENTS=  0
0NUMBER OF TYPE 5 PHYSICAL CONNECTING ELEMENTS=  4
0TOTAL NUMBER OF PHYSICAL CONNECTING ELEMENTS=  4
0THIS RUN IS NOT A RESTART RUN.
0TIME STEP=  0.000150 SECONDS
 FINAL TIME=  0.450000 SECONDS
 PRINT MULTIPLE=     1000
 PLOT MULTIPLE=       13
0INDEPENDENT ROTOR NUMBER (ONE FOR WHICH SPEED-TIME HISTORY IS INPUT)= 1


 BEGINNING TIME FOR FIRST SEGMENT=   0.00000 SECONDS
 BEGINNING SPEED FOR FIRST SEGMENT=     2400. RPM


              ENDING         ACCEL
               TIME          RATE
 SEGMENT    SECONDS          RPM/SEC


    1     1.000000            0.
    2     4.000000          300.
0TOTAL NUMBER OF SPEED SEGMENTS FOR INDEPENDENT ROTOR SPEED-TIME
 HISTORY=  2
0DEPENDENT ROTOR NUMBER= 2


 THE SPEED POLYNOMIAL COEFFICIENTS FOR THE DEPENDENT ROTOR ARE-
 A=  0.000         B=  0.000         C=    4.25        D=  -0.578E+04
0SUMMARY OF UNBALANCE LOAD INPUT-
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

One Time Output Shown at Speed Range, Mass Matrix and its Inverse

```
    BIRTH      POINT    MAGNITUDE  PHASE ANGLE
 TIME (SEC.)  NUMBER      GM-IN      DEGREES


    0.00005      8         100.          0.0
0TOTAL NUMBER OF UNBALANCE BIRTH EVENTS=  1
0TOTAL NUMBER OF P*COS(WT) AND P*SIN(WT) LOADS=  0
0TOTAL NUMBER OF TIME-FORCE HISTORY LOADS=  0
0SUMMARY OF THE GYROSCOPIC LOAD INPUT-


                  POLAR MOMENT
 POINT             OF INERTIA
 NUMBER             LB-IN**2


   1                  184205.
   7                  184205.
0TOTAL NUMBER OF GYRO LOAD LOCATIONS=  2


1THE FOLLOWING ROTOR SUBSYSTEMS INCLUDE THE POINT(S) FOR THE C.G.(S) OF THE FBD(S)-
            SUBSYSTEM 1
            SUBSYSTEM 2
0THE FBD(S) ARE LOCATED ON ROTOR 1.
0THE FOLLOWING SUBSYSTEMS ARE FOR THE FBD(S)- .
            SUBSYSTEM 12
0THE GENERALIZED COORDINATE NUMBERS FOR THE ROTOR WHICH INCLUDES THE FBD(S) AND
 FOR THE FBD(S) ARE-
        1  2  3  4  5  6  7  8  9 10 19 20
0TOTAL NUMBER OF GENERALIZED COORDINATES FOR THE ROTOR WHICH INCLUDES THE FBD(S) AND
 FOR THE FBD(S)= 12
1THE MASS MATRIX IS AS FOLLOWS-
0ROW  1-   2.28E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   3.00E-[illegible]   [illegible]
           0.00E+00   7.56E-02   5.83E-02
0ROW  2-   0.00E+00   2.58E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   [illegible]   [illegible]
           0.00E+00   4.78E-02   1.29E-01
0ROW  3-   0.00E+00   0.00E+00   3.51E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   [illegible]
           0.00E+00   1.70E-01   7.35E-02
0ROW  4-   0.00E+00   0.00E+00   0.00E+00   9.34E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   [illegible]
           0.00E+00   1.07E-01   6.91E-03
0ROW  5-   0.00E+00   0.00E+00   0.00E+00   0.00E+00   4.39E+00   0.00E+00   0.00E+00   0.00E+00   [illegible]
           0.00E+00   6.32E-01  -4.22E-02
0ROW  6-   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   2.28E+00   0.00E+00   0.00E+00   [illegible]
           0.00E+00  -5.83E-02   7.56E-02
0ROW  7-   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   2.58E+00   0.00E+00   [illegible]
           0.00E+00  -1.29E-01   4.78E-02
0ROW  8-   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   3.51E+00   [illegible]
           0.00E+00  -7.35E-02   1.70E-01
0ROW  9-   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   [illegible]
           0.00E+00  -6.91E-03   1.07E-01
0ROW 10-   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   [illegible]
           4.39E+00   4.22E-02   6.32E-01
0ROW 11-   7.56E-02   4.78E-02   1.70E-01   1.07E-01   6.32E-01  -5.83E-02  -1.29E-01  -7.35E-02   [illegible]
           4.22E-02   5.18E-01   0.00E+00
0ROW 12-   5.83E-02   1.29E-01   7.35E-02   6.91E-03  -4.22E-02   7.56E-02   4.78E-02   1.70E-01   [illegible]
           6.32E-01   0.00E+00   5.18E-01
1THE INVERSE OF THE MASS MATRIX IS AS FOLLOWS-
0ROW  1-   4.43E-01   4.69E-03   5.29E-03   9.90E-04   1.12E-02   0.00E+00  -2.94E-03   1.34E-03   [illegible]
           9.89E-03  -8.20E-02  -6.32E-02
0ROW  2-   4.69E-03   3.95E-01   4.82E-03   6.19E-04   5.40E-03   2.94E-03   0.00E+00   5.04E-03   [illegible]
           1.83E-02  -4.58E-02  -1.24E-01
0ROW  3-   5.29E-03   4.82E-03   2.92E-01   1.41E-03   1.67E-02  -1.34E-03  -5.04E-03   0.00E+00   [illegible]
           8.61E-03  -1.20E-01  -5.18E-02
0ROW  4-   9.90E-04   6.19E-04   1.41E-03   1.07E-01   4.08E-03  -6.66E-04  -1.39E-03  -5.07E-04   [illegible]
           5.37E-04  -2.85E-02  -1.83E-03
0ROW  5-   1.12E-02   5.40E-03   1.67E-02   4.08E-03   2.79E-01  -9.89E-03  -1.83E-02  -8.61E-03   [illegible]
           1.26E-17  -3.56E-01   2.38E-02
0ROW  6-   0.00E+00   2.94E-03  -1.34E-03  -6.66E-04  -9.89E-03   4.43E-01   4.69E-03   5.29E-03   [illegible]
           1.12E-02   6.32E-02  -8.20E-02
0ROW  7-  -2.94E-03   0.00E+00  -5.04E-03  -1.39E-03  -1.83E-02   4.69E-03   3.95E-01   4.82E-03   [illegible]
           5.40E-03   1.24E-01  -4.58E-02
0ROW  8-   1.34E-03   5.04E-03   0.00E+00  -5.07E-04  -8.61E-03   5.29E-03   4.82E-03   2.92E-01   [illegible]
           1.67E-02   5.18E-02  -1.20E-01
0ROW  9-   6.66E-04   1.39E-03   5.07E-04   0.00E+00  -5.37E-04   9.90E-04   6.19E-04   1.41E-03   [illegible]
           4.08E-03   1.83E-03  -2.85E-02
0ROW 10-   9.89E-03   1.83E-02   8.61E-03   5.37E-04   0.00E+00   1.12E-02   5.40E-03   1.67E-02   [illegible]
           2.79E-01  -2.38E-02  -3.56E-01
0ROW 11-  -8.20E-02  -4.58E-02  -1.20E-01  -2.85E-02  -3.56E-01   6.32E-02   1.24E-01   5.18E-02   [illegible]
          -2.38E-02   2.40E+00  -3.40E-16
0ROW 12-  -6.32E-02  -1.24E-01  -5.18E-02  -1.83E-03   2.38E-02  -8.20E-02  -4.58E-02  -1.20E-01   [illegible]
          -3.56E-01  -3.40E-16   2.40E+00
1THIS RUN PRODUCES A PLOT FILE (FILE CODE 23).
0TIMES, ROTOR SPEEDS, AND ROTOR ANGULAR DISPLACEMENTS
 (IF ANY) ARE WRITTEN ONTO THE PLOT FILE.
0DISPLACEMENTS, VELOCITIES, MODAL FORCES AND COORDINATES ARE WRITTEN
 ONTO THE PLOT FILE FOR THE FOLLOWING POINTS AND DIRECTIONS-
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
                            GLOBAL
          POINT            DIRECTION
          NUMBER            NUMBER       DIRECTION


             1                 1             Z
             2                 1             Z
             3                 1             Z
             4                 1             Z
             4                 3             Y
             5                 1             Z
             6                 1             Z
             7                 1             Z
             8                 1             Z
             9                 1             Z
            10                 1             Z
            11                 1             Z
            11                 3             Y
            12                 1             Z
            13                 1             Z
            14                 1             Z
         0TOTAL NUMBER OF POINTS AND DIRECTIONS FOR DISPLACEMENT, VELOCITY
          MODAL FORCE, AND COORDINATE PLOT FILE OUTPUT= 16
         0THE RELATIVE DISPLACEMENT MAGNITUDE, CLEARANCE, AND FORCE MAGNITUDE
          IS WRITTEN TO THE PLOT FILE FOR ALL TYPE 3 PHYSICAL CONNECTING
          ELEMENTS (RUB ELEMENTS)(IF ANY).
         0PHYSICAL CONNECTING ELEMENT FORCES ARE WRITTEN ONTO THE PLOT FILE FOR THE
          FOLLOWING PHYSICAL CONNECTING ELEMENTS, POINTS, AND DIRECTIONS-
         0ELEMENT      POINT      DIRECTION
          NUMBER       NUMBER      NUMBER       DIRECTION


             1            3           1             Z
             1            3           3             Y
             2            6           1             Z
             3           10           1             Z
             3           10           3             Y
             4           13           1             Z
         0TOTAL NUMBER OF ELEMENTS, POINTS, AND DIRECTIONS FOR ELEMENT FORCE PLOT
          FILE OUTPUT=  6
         1SUMMARY OF THE CONNECTIONS BETWEEN THE PHYSICAL CONNECTING ELEMENTS
          AND THE MODAL SUBSYSTEMS-


          ELEMENT   1 IS CONNECTED TO SUBSYSTEM  1 AT POINT  3
          ELEMENT   1 IS CONNECTED TO SUBSYSTEM  2 AT POINT  3
          ELEMENT   1 IS CONNECTED TO SUBSYSTEM  4 AT POINT 10
          ELEMENT   1 IS CONNECTED TO SUBSYSTEM  5 AT POINT 10
          ELEMENT   2 IS CONNECTED TO SUBSYSTEM  1 AT POINT  6
          ELEMENT   2 IS CONNECTED TO SUBSYSTEM  2 AT POINT  6
          ELEMENT   2 IS CONNECTED TO SUBSYSTEM  4 AT POINT 13
          ELEMENT   2 IS CONNECTED TO SUBSYSTEM  5 AT POINT 13
          ELEMENT   3 IS CONNECTED TO SUBSYSTEM  4 AT POINT 10
          ELEMENT   3 IS CONNECTED TO SUBSYSTEM  5 AT POINT 10
          ELEMENT   4 IS CONNECTED TO SUBSYSTEM  4 AT POINT 13
          ELEMENT   4 IS CONNECTED TO SUBSYSTEM  5 AT POINT 13
         0SUMMARY OF THE GYRO LOAD LOCATIONS ON THE MODAL SUBSYSTEMS-


          POINT   1 OF SUBSYSTEM   1 IS A GYRO LOAD LOCATION
          POINT   1 OF SUBSYSTEM   2 IS A GYRO LOAD LOCATION
          POINT   7 OF SUBSYSTEM   1 IS A GYRO LOAD LOCATION
          POINT   7 OF SUBSYSTEM   2 IS A GYRO LOAD LOCATION
                                    TIME=    0.0000000 SECONDS
```

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Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

Response at 0.0 Sec

```
0130200 1
0130300 0SPEED SEGMENT NUMBER=
0130400 0ROTOR PROPERTIES FOR INDEPENDENT ROTOR (ROTOR 1)-
0130500
0130600
0130700  SPEED=      2400. RPM
0130800  ACCELERATION=         0. RPM/SEC
0130900  ANGULAR DISPLACEMENT=        0.00000000 REVOLUTIONS
0131800
0131900
0132000 0                               DISPLACEMENTS IN GIVEN DIRECTION
0132100  POINT        X           Y           Z          THETA-X     THETA-Y     THETA-Z
0132200  NUMBER     INCHES      INCHES      INCHES      RADIANS     RADIANS     RADIANS
0132300
0132400
0132500    1     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0132600    2     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0132700    3     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0132800    4     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0132900    5     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0133000    6     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0133100    7     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0133200    8     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0133300    9     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0133400   10     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0133500   11     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0133600   12     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0133700   13     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0133800   14     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0133900   31     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0134000   32     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
0134100 0                                 VELOCITIES IN GIVEN DIRECTION
0134200  POINT        X           Y           Z          THETA-X     THETA-Y     THETA-Z
0134300  NUMBER     IN/SEC      IN/SEC      IN/SEC      RAD/SEC     RAD/SEC     RAD/SEC
0134400
0134500
0134600    1       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0134700    2       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0134800    3       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0134900    4       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0135000    5       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0135100    6       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0135200    7       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0135300    8       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0135400    9       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0135500   10       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0135600   11       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0135700   12       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0135800   13       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0135900   14       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0136000   31       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0136100   32       0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
```

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

FORCES CONTRIBUTED BY THE SUBSYSTEM MODE SHAPES
(POINTS ON PYLON AND POINTS NOT ON MODAL SUBSYSTEMS EXCLUDED)

POINT NUMBER	X POUNDS	Y POUNDS	Z POUNDS	THETA-X IN-LB	THETA-Y IN-LB	THETA-Z IN-LB
1	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000	0.000

0THE FOLLOWING IS FOR THE LOCAL POINTS ON FBD NUMBER 1-

LOCAL POINT NUMBER	ANGLE PSI DEGREES	TANGENTIAL DISPLACEMENT U INCHES	AXIAL DISPLACEMENT V INCHES	STRESS SIGMA1 PSI	STRESS SIGMA2 PSI	STRESS SIGMA3 PSI
1	0.0	0.00000000	0.00000000	0.	0.	0.
2	0.0	0.00000000	0.00000000	0.	0.	0.
3	30.0	0.00000000	0.00000000	0.	0.	0.
4	30.0	0.00000000	0.00000000	0.	0.	0.
5	45.0	0.00000000	0.00000000	0.	0.	0.
6	90.0	0.00000000	0.00000000	0.	0.	0.
7	90.0	0.00000000	0.00000000	0.	0.	0.

0THE FORCES THAT THE TYPE 5 PHYSICAL CONNECTING ELEMENTS (UNCOUPLED POINT
SPRING-DAMPER ELEMENTS) EXERT ON THE ENGINE COMPONENTS OR GROUND ARE-

0 FORCE IN GIVEN DIRECTION

ELEMENT NUMBER	END	POINT NUMBER	X POUNDS	Y POUNDS	Z POUNDS	THETA-Y IN-LB	THETA-Z IN-LB
1	I	3	0.000	0.000	0.000	0.000	0.000
1	J	10	0.000	0.000	0.000	0.000	0.000
2	I	6	0.000	0.000	0.000	0.000	0.000
2	J	13	0.000	0.000	0.000	0.000	0.000
3	I	10	0.000	0.000	0.000	0.000	0.000
3	J	31	0.000	0.000	0.000	0.000	0.000
4	I	13	0.000	0.000	0.000	0.000	0.000
4	J	32	0.000	0.000	0.000	0.000	0.000

0THE GYROSCOPIC FORCES ACTING ON THE ROTOR(S) ARE-

0

POINT NUMBER	ROTOR NUMBER	POLAR MOMENT OF INERTIA LB-IN**2	Y-AXIS MOMENT IN-LB	Z-AXIS MOMENT IN-LB
1	1	184205.	0.000	0.000
7	1	184205.	0.000	0.000

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Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

```
0142000 0SUMMARY OF  UNBALANCE FORCES-
0142100
0142200
0142300    BIRTH                                    PHASE
0142400     TIME     POINT   ROTOR   MAGNITUDE     ANGLE    FORCE (LB.)   FORCE (LB.)
0142500   SECONDS   NUMBER  NUMBER     GM-IN     DEGREES  Y-DIRECTION   Z-DIRECTION
0142600
0142700
0142800  0.000050      8       2        100.        0.0        0.000         0.000
0142900 0                  GENERALIZED
0143000   GENERALIZED         FORCE DUE
0143100   COORDINATE          TO APPLIED
0143200     NUMBER           FORCES ONLY
0143300
0143400
0143500        1                 0.000
0143600        2                 0.000
0143700        3                 0.000
0143800        4                 0.000
0143900        5                 0.000
0144000        6                 0.000
0144100        7                 0.000
0144200        8                 0.000
0144300        9                 0.000
0144400       10                 0.000
0144500       11                 0.000
0144600       12                 0.000
0144700       13                 0.000
0144800       14                 0.000
0144900       15                 0.000
0145000       16                 0.000
0145100       17                 0.000
0145200       18                 0.000
0145300       19                 0.000
0145400       20                 0.000
0145500 0FLEXIBLE BLADED DISK ROTOR SPEED=      2400. RPM
0145600  FLEXIBLE BLADED DISK NUMBER 1 BETA FACTOR=  1.000
0145700 0GENERALIZED                                              GENERALIZED  GENERALIZED   GENERALIZED
0145800   COORDINATE  GENERALIZED   GENERALIZED  GENERALIZED       WEIGHT      STIFFNESS   DAMPING VALUE   GENERALIZED
0145900     NUMBER    DISPLACEMENT   VELOCITY       FORCE          POUNDS        LB/IN     (LB-SEC)/IN    ACCELERATION
0146000
0146100
0146200       1        0.00000000    0.000000       0.000       8.817E+02    0.000E+00    0.000E+00          0.0000
0146300       2        0.00000000    0.000000       0.000       9.970E+02    0.000E+00    0.000E+00          0.0000
0146400       3        0.00000000    0.000000       0.000       1.356E+03    2.017E+05    6.413E+00          0.0000
0146500       4        0.00000000    0.000000       0.000       3.609E+03    1.906E+06    4.219E+01          0.0000
0146600       5        0.00000000    0.000000       0.000       1.696E+03    2.936E+06    3.590E+01          0.0000
0146700       6        0.00000000    0.000000       0.000       8.817E+02    0.000E+00    0.000E+00          0.0000
0146800       7        0.00000000    0.000000       0.000       9.970E+02    0.000E+00    0.000E+00          0.0000
0146900       8        0.00000000    0.000000       0.000       1.356E+03    2.017E+05    8.413E+00          0.0000
0147000       9        0.00000000    0.000000       0.000       3.609E+03    1.906E+06    4.219E+01          0.0000
0147100      10        0.00000000    0.000000       0.000       1.696E+03    2.936E+06    3.590E+01          0.0000
0147200      11        0.00000000    0.000000       0.000       4.915E+02    0.000E+00    0.000E+00          0.0000
0147300      12        0.00000000    0.000000       0.000       4.632E+02    0.000E+00    0.000E+00          0.0000
0147400      13        0.00000000    0.000000       0.000       5.792E+02    4.715E+05    8.407E-02          0.0000
0147500      14        0.00000000    0.000000       0.000       8.254E+02    2.044E+06    2.089E-01          0.0000
0147600      15        0.00000000    0.000000       0.000       4.915E+02    0.000E+00    0.000E+00          0.0000
0147700      16        0.00000000    0.000000       0.000       4.632E+02    0.000E+00    0.000E+00          0.0000
0147800      17        0.00000000    0.000000       0.000       5.792E+02    4.715E+05    8.407E-02          0.0000
0147900      18        0.00000000    0.000000       0.000       8.254E+02    2.044E+06    2.089E-01          0.0000
0148000      19        0.00000000    0.000000       0.000       2.000E+02    3.700E+04    1.385E+00          0.0000
0148100      20        0.00000000    0.000000       0.000       2.000E+02    3.700E+04    1.385E+00          0.0000
                               TIME=   0.15[illegible]000 SECONDS
```

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Table 1. Two-Rotor Model with FBD, Input and Output (Continued)

```
0148200 1
0148300 0SPEED SEGMENT NUMBER= 1
0148400 0ROTOR PROPERTIES FOR INDEPENDENT ROTOR (ROTOR 1)-
0148500
0148600
0148700  SPEED=      2400. RPM
0148800  ACCELERATION=          0. RPM/SEC
0148900  ANGULAR DISPLACEMENT=        6.00000000 REVOLUTIONS
0149000
0149100
0149200 0ROTOR PROPERTIES FOR DEPENDENT ROTOR (ROTOR 2)-
0149300
0149400
0149500  SPEED=      4425. RPM
0149600  ACCELERATION=          0. RPM/SEC
0149700  ANGULAR DISPLACEMENT=       11.06250000 REVOLUTIONS
0149800
0149900
0150000 0                              DISPLACEMENTS IN GIVEN DIRECTION
```

0150100	POINT	X	Y	Z	THETA-X	THETA-Y	THETA-Z
0150200	NUMBER	INCHES	INCHES	INCHES	RADIANS	RADIANS	RADIANS
0150300							
0150400							
0150500	1	0.00000000	0.00024331	-0.00024428	0.00000000	0.00000765	0.0000[illegible]
0150600	2	0.00000000	0.00022216	-0.00011448	0.00000000	0.00000651	0.0000[illegible]
0150700	3	0.00000000	0.00017644	0.00007909	0.00000000	0.00000678	0.00000214
0150800	4	0.00000000	0.00013092	0.00029564	0.00000000	-0.00000164	0.00000224
0150900	5	0.00000000	0.00000740	0.00000499	0.00000000	-0.00000389	0.0000022[illegible]
0151000	6	0.00000000	0.00004208	-0.00011770	0.00000000	-0.00000473	0.00000232
0151100	7	0.00000000	0.00002265	-0.00010447	0.00000000	-0.00000500	0.00000210
0151200	8	0.00000000	-0.00065507	0.00125119	0.00000000	-0.00001956	-0.0000058[illegible]
0151300	9	0.00000000	-0.00062586	0.00102543	0.00000000	-0.00001934	-0.00000604
0151400	10	0.00000000	-0.00057271	0.00057000	0.00000000	-0.00001696	-0.0000083[illegible]
0151500	11	0.00000000	-0.00032248	0.00032006	0.00000000	-0.00001409	-0.00001142
0151600	12	0.00000000	0.00001806	0.00015300	0.00000000	-0.00001334	-0.00001246
0151700	13	0.00000000	0.00027556	-0.00011532	0.00000000	-0.00001389	-0.00001210
0151800	14	0.00000000	0.00030813	-0.00026531	0.00000000	-0.00001399	-0.00001203
0151900	31	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
0152000	32	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000

```
0152100 0                              VELOCITIES IN GIVEN DIRECTION
```

0152200	POINT	X	Y	Z	THETA-X	THETA-Y	THETA-Z
0152300	NUMBER	IN/SEC	IN/SEC	IN/SEC	RAD/SEC	RAD/SEC	RAD/SEC
0152400							
0152500							
0152600	1	0.000000	0.000859	0.021180	0.000000	-0.000205	0.000283
0152700	2	0.000000	-0.099004	0.019610	0.000000	-0.000225	0.000384
0152800	3	0.000000	-0.042427	0.015766	0.000000	-0.000301	-0.000316
0152900	4	0.000000	-0.030352	0.009724	0.000000	-0.000346	-0.000777
0153000	5	0.000000	-0.011411	0.003483	0.000000	-0.000418	-0.001229
0153100	6	0.000000	0.022152	-0.004932	0.000000	-0.000537	-0.001417
0153200	7	0.000000	0.039005	-0.010203	0.000000	-0.000607	-0.001436
0153300	8	0.000000	0.003874	-0.259662	0.000000	0.002029	-0.001591
0153400	9	0.000000	0.030167	-0.252994	0.000000	0.002140	-0.001435
0153500	10	0.000000	0.091661	-0.242791	0.000000	0.003226	-0.000119
0153600	11	0.000000	-0.000375	-0.140344	0.000000	0.004743	0.00078[illegible]
0153700	12	0.000000	-0.070430	0.007541	0.000000	0.005271	-0.000525
0153800	13	0.000000	-0.007153	0.118753	0.000000	0.005144	-0.001988
0153900	14	0.000000	0.033965	0.166752	0.000000	0.005113	-0.002154
0154000	31	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0154100	32	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Table 1. Two-Rotor Model with FBD, Input and Output. (Continued)

FORCES CONTRIBUTED BY THE SUBSYSTEM MODE SHAPES
(POINTS ON PYLON AND POINTS NOT ON MODAL SUBSYSTEMS EXCLUDED)

POINT NUMBER	X POUNDS	Y POUNDS	Z POUNDS	THETA-X IN-LB	THETA-Y IN-LB	THETA-Z IN-LB
1	0.000	-0.433	11.828	0.000	-50.428	17.352
2	0.000	-0.440	11.003	0.000	-177.465	13.132
3	0.000	-0.403	10.352	0.000	-400.946	4.526
4	0.000	0.530	-13.209	0.000	-596.487	-1.727
5	0.000	0.510	-13.892	0.000	-323.209	9.015
6	0.000	0.445	-13.434	0.000	-47.562	10.445
7	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	-22.299	-23.127	0.000	31.439	-29.934
9	0.000	-38.241	-39.203	0.000	322.489	-309.920
10	0.000	-10.538	-9.095	0.000	1043.351	-1022.199
11	0.000	41.545	44.640	0.000	635.734	-604.030
12	0.000	11.975	10.004	0.000	-119.134	37.372
13	0.000	-4.997	-7.409	0.000	-110.540	86.457
14	0.000	0.000	0.000	0.000	0.000	0.000

THE FOLLOWING IS FOR THE LOCAL POINTS ON FBD NUMBER 1-

LOCAL POINT NUMBER	ANGLE PSI DEGREES	TANGENTIAL DISPLACEMENT U INCHES	AXIAL DISPLACEMENT V INCHES	STRESS SIGMA1 PSI	STRESS SIGMA2 PSI	STRESS SIGMA3 PSI
1	360.0	0.00000000	0.00000107	11.	4.	2.
2	360.0	0.00000214	0.00000749	6.	9.	1.
3	30.0	0.00000626	0.00002193	19.	25.	3.
4	30.0	0.00001253	0.00003508	13.	6.	1.
5	45.0	0.00005426	0.00007752	0.	0.	0.
6	90.0	0.00000882	0.00003529	26.	35.	4.
7	90.0	0.00006177	0.00008824	0.	0.	0.

THE FORCES THAT THE TYPE 5 PHYSICAL CONNECTING ELEMENTS (UNCOUPLED POINT SPRING-DAMPER ELEMENTS) EXERT ON THE ENGINE COMPONENTS OR GROUND ARE-

			FORCE IN GIVEN DIRECTION				
ELEMENT NUMBER	END	POINT NUMBER	X POUNDS	Y POUNDS	Z POUNDS	THETA-Y IN-LB	THETA-Z IN-LB
1	I	3	0.000	-7.339	4.623	0.000	0.000
1	J	19	0.000	7.339	-4.623	0.000	0.000
2	I	6	0.000	11.467	0.822	0.000	0.000
2	J	13	0.000	-11.467	-0.822	0.000	0.000
3	I	10	0.000	28.114	-27.159	0.000	0.000
3	J	31	0.000	-28.114	27.159	0.000	0.000
4	I	13	0.000	-13.737	5.091	0.000	0.000
4	J	32	0.000	13.737	-5.091	0.000	0.000

THE GYROSCOPIC FORCES ACTING ON THE ROTOR(S) ARE-

POINT NUMBER	ROTOR NUMBER	POLAR MOMENT OF INERTIA LB-IN**2	Y-AXIS MOMENT IN-LB	Z-AXIS MOMENT IN-LB
1	1	104205.	-34.464	-24.580
7	1	104205.	133.410	-73.709

Definitions

NP = Number of (global point, global direction) pairs for which data is written to the plot file

NL1 = Number of local points on flexible bladed disk Number 1 for which data is written to the plot file

NL2 = Number of local points on flexible bladed disk Number 2 for which data is written to the plot file

NRE = Number of Type 3 physical connecting elements (rub elements) for which data is written to the plot file

NEL = Number of (element number, global point number, global direction number) triads for which data is written to the plot file

NUMT = Number of time steps for which data is written to the plot file

$IPLOT_i$ = Global point number for the i-th (global point, global direction) pair for which data is written to the plot file

$IDPLOT_i$ = Global direction number for the i-th (global point, global direction pair for which data is written to the plot file

XPT_i,YPT_i,ZPT_i - x, y, and z coordinates (global system) respectively for the i-th (global point, global direction) pair for which data is written to the plot file

$LFBD1_i$ = Local point number on flexible bladed disk Number 1 for the i-th local point for which data is written to the plot file

$RFBD1_i$ = Radius r (inches) on flexible bladed disk Number 1 for the i-th local point for which data is written to the plot file

$AFBD1_i$ = Angle ξ (degrees) on flexible bladed disk Number 1 for the i-th local point for which data is written to the plot file

$LFBD2_i$ = Local point number on flexible bladed disk Number 2 for the i-th local point for which data is written to the plot file

$RFBD2_i$ = Radius r (inches) on flexible bladed disk Number 2 for the i-th local point for which data is written to the plot file

$AFBD2_i$ = Angle ξ (degrees) on flexible bladed disk Number 2 for the i-th local point for which data is written to the plot file

$ILEM3_i$ = Element number for the i-th Type 3 physical connecting element (rub element) for which data is written to the plot file

$ILEM_i$ = Element number for the i-th physical connecting element or gyro element for which data is written to the plot file

IPT_i = Global point number for the i-th physical connecting element or gyro element for which data is written to the plot file

$IDIR_i$ = Global direction number for the i-th physical connecting element or gyro element for which data is written to the plot file

TIME = Time (seconds)

SPEEDI = Independent rotor speed (rpm)

SPEEDD = Dependent rotor speed (rpm)

THETAI = Independent rotor angular displacement (revolutions)

THETAD = Dependent rotor angular displacement (revolutions)

P1 = Generalized displacement p for flexible bladed disk Number 1

Q1 = Generalized displacement q for flexible bladed disk Number1

P2 = Generalized displacement p for flexible bladed disk Number 2

Q2 = Generalized displacement q for flexible bladed disk Number 2

X_i = Displacement (inches or radians) for the i-th (global point, global direction) pair

VEL_i = Velocity (inches/second or radians/second) for the i-th (global point, global direction) pair

$FMOD_i$ = Modal force (ib or in-lb) for the i-th (global point, global direction) pair

$PSI1_i$ = Angle ψ (degrees) for the i-th local point on flexi[illegible] bladed disk Number 1

$UDISP1_i$ = Displacement u (inches) for the i-th local point on flexible bladed disk Number 1

$VDISP1_i$ = Displacement v (inches) for the i-th local point on flexible bladed disk Number 1

$S1FBD1_i$ = σ_1 stress (psi) for the i-th local point on flexible bladed disk Number 1

$S2FBD1_i$ = σ_2 stress (psi) for the i-th local point on flexible bladed disk Number 1

$S3FBD1_i$ = σ_3 stress (psi) for the i-th local point on flexible bladed disk Number 1

$PSI2_i$ = Angle ψ (degrees) for the i-th local point on flexible bladed disk Number 1

$UDISP2_i$ = Displacement u (inches) for the i-th local point on flexible bladed disk Number 2

$VDISP2_i$ = Displacement v (inches) for the i-th local point on flexible bladed disk Number 2

$S1FBD2_i$ = σ_1 stress (psi) for the i-th local point on flexible bladed disk Number 2

$S2FBD2_i$ = σ_2 stress (psi) for the i-th local point on flexible bladed disk Number 2

$S3FBD2_i$ = σ_3 stress (psi) for the i-th local point on flexible bladed disk Number 2

$DMAG_i$ = Relative displacement magnitude (inches) for the i-th Type 3 physical connecting element (rub element)

$CLEAR_i$ = Clearance (inches) for the i-th Type 3 physical connecting element (rub element)

$FMAG_i$ = Force magnitude (pounds) for the i-th Type 3 physical connecting element (rub element)

$FELEM_i$ = Force (lb or in-lb) for the i-th (element number, global point number, global direction number) triad

Mass Matrix (mm)

$$
\begin{array}{c}
\text{Vertical} \qquad\qquad\qquad\qquad \text{Horizontal} \qquad\qquad\qquad\qquad \text{FBD No. 1} \qquad\qquad \text{FBD No. 2}
\end{array}
$$

$$
\left[\begin{array}{ccccccccccccc}
\ddot{Z}_1 & \ddot{Z}_2 & \ddot{Z}_3 & & \ddot{Y}_1 & \cdots & \ddot{Y}_2 & \ddot{Y}_3 & & \ddot{P}_1 & \ddot{q}_1 & \ddot{P}_2 & \ddot{q}_2
\end{array}\right]
$$

$$
\left[\begin{array}{ccccccccccccc}
M_{v1} & 0 & 0 & \cdots & 0 & 0 & 0 & \cdots & (\phi'_{v1}S_v)_1 & (\phi_{v1}M_u)_1 & (\phi'_{v1}S_v)_2 & (\phi_{v1}M_u)_2 \\
0 & M_{v2} & 0 & \cdots & 0 & 0 & 0 & \cdots & (\phi'_{v2}S_v)_1 & (\phi_{v2}M_u)_1 & (\phi'_{v2}S_v)_2 & (\phi'_{v2}M_u)_2 \\
0 & 0 & M_{v3} & \cdots & 0 & 0 & 0 & \cdots & -(\phi_{v3}S_v)_1 & -(\phi'_{v3}M_u)_1 & -(\phi_{v3}S_v)_2 & -(\phi'_{v3}M_u)_2 \\
\vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
0 & 0 & 0 & \cdots & M_{H1} & 0 & 0 & \cdots & -(\phi_{H1}M_u)_1 & -(\phi'_{H1}S_v)_1 & -(\phi_{H1}M_u)_2 & -(\phi'_{H1}S_v)_2 \\
0 & 0 & 0 & \cdots & 0 & M_{H2} & 0 & \cdots & -(\phi_{H2}M_u)_1 & -(\phi'_{H2}S_v)_1 & -(\phi_{H2}M_u)_2 & -(\phi'_{H2}S_v)_2 \\
0 & 0 & 0 & \cdots & 0 & 0 & M_{H3} & \cdots & -(\phi_{H3}M_u)_1 & -(\phi'_{H3}S_v)_1 & -(\phi_{H3}M_u)_2 & (-\phi'_{H3}S_v)_2 \\
\vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \vdots \\
(\phi'_{v1}S_v)_1 & (\phi'_{v2}S_v)_1 & (\phi'_{v3}S_v)_1 & \cdots & -(\phi_{H1}M_u)_1 & -(\phi_{H2}M_u)_1 & -(\phi_{H3}M_u)_1 & \cdots & M_{f1} & 0 & 0 & 0 \\
(\phi_{v1}M_u)_1 & (\phi_{v2}M_u)_1 & (\phi_{v3}M_u)_1 & \cdots & -(\phi'_{H1}S_v)_1 & -(\phi'_{H2}S_v)_1 & -(\phi'_{H3}S_v)_1 & \cdots & 0 & M_{f1} & 0 & 0 \\
(\phi'_{v1}S_v)_2 & (\phi'_{v2}S_v)_2 & (\phi'_{v3}S_v)_2 & \cdots & -(\phi_{H1}M_u)_2 & -(\phi_{H2}M_u)_2 & -(\phi_{H3}M_u)_2 & \cdots & 0 & 0 & M_{f2} & 0 \\
(\phi_{v1}M_u)_2 & (\phi_{v2}M_u)_2 & (\phi_{v3}M_u)_2 & \cdots & -(\phi'_{H1}S_v)_2 & -(\phi'_{H2}S_v)_2 & -(\phi'_{H3}S_v)_2 & \cdots & 0 & 0 & 0 & M_{f2}
\end{array}\right]
\left[\begin{array}{c}
\ddot{Z}_1 \\ \ddot{Z}_2 \\ \ddot{Z}_3 \\ \vdots \\ \ddot{Y}_1 \\ \ddot{Y}_2 \\ \ddot{Y}_3 \\ \vdots \\ \ddot{P}_1 \\ \ddot{q}_1 \\ \ddot{P}_2 \\ \ddot{q}_2
\end{array}\right]
$$

Generalized Acceleration Vector	Generalized Displacement Vector	Generalized Velocity Vector	Generalized Force Matrix

$$
(ZA) = \begin{bmatrix} \ddot{Z}_1 \\ \ddot{Z}_2 \\ \ddot{Z}_3 \\ \vdots \\ \ddot{Y}_1 \\ \ddot{Y}_2 \\ \ddot{Y}_3 \\ \vdots \\ \ddot{P}_1 \\ \ddot{q}_1 \\ \ddot{P}_2 \\ \ddot{q}_2 \end{bmatrix}
\quad (Z) = \begin{bmatrix} Z_1 \\ Z_2 \\ Z_3 \\ \vdots \\ Y_1 \\ Y_2 \\ Y_3 \\ \vdots \\ P_1 \\ q_1 \\ P_2 \\ q_2 \end{bmatrix}
\quad (ZV) = \begin{bmatrix} \dot{Z}_1 \\ \dot{Z}_2 \\ \dot{Z}_3 \\ \vdots \\ \dot{Y}_1 \\ \dot{Y}_2 \\ \dot{Y}_3 \\ \vdots \\ \dot{P}_1 \\ \dot{q}_1 \\ \dot{P}_2 \\ \dot{q}_2 \end{bmatrix}
\quad (F_{Gen}) = \begin{bmatrix} F_{Z1} \\ F_{Z2} \\ F_{Z3} \\ \vdots \\ F_{Y1} \\ F_{Y2} \\ F_{Y3} \\ \vdots \\ F_{P1} \\ F_{q1} \\ F_{P2} \\ F_{q2} \end{bmatrix}
$$

Generalized Stiffness Matrix (Diagonal Elements)

$$
(ZA) = \begin{bmatrix}
K_{1_V} \\
K_{2_V} \\
K_{3_V} \\
\vdots \\
K_{1_H} \\
K_{2_H} \\
K_{3_V} \\
\vdots \\
M_{f1}\left\{W_{f1}^{2} + \Omega^{2}(\beta_{f1} - 1)\right\} \\
M_{f1}\left\{W_{f1}^{2} + \Omega^{2}(\beta_{f1} - 1)\right\} \\
M_{f2}\left\{W_{f2}^{2} + \Omega^{2}(\beta_{f2} - 1)\right\} \\
M_{f2}\left\{W_{f2}^{2} + \Omega^{2}(\beta_{f2} - 1)\right\}
\end{bmatrix}
$$

Note: $\beta_{f1} > 0$ and $\beta_{f2} > 0$

Generalized Damping Matrix (Diagonal Elements)

$$
(ZC) = \begin{bmatrix}
C_{1_V} \\
C_{1_V} \\
C_{3_V} \\
\vdots \\
C_{1_H} \\
C_{2_H} \\
C_{3_H} \\
\vdots \\
C_{p1} \\
C_{q1} \\
C_{p2} \\
C_{q2}
\end{bmatrix}
$$

FBD Center of Gravity Mode Shape Definitions

ϕ_{vi} = Vertical plane translation mode shape ith mode

ϕ'_{vi} = Vertical plane slope mode shape ith mode

ϕ_{Hi} = Horizontal plane translation mode shape ith mode

ϕ'_{Hi} = Horizontal plane slope mode shape ith mode

$(\quad)_1$ refers to FBD Number 1

$(\quad)_2$ refers to FBD Number 2

If the FBD(s) are attached to Rotor 1:

$(\phi_{vi})_1$ = S1(i, ℓ_{1v} , 1) ; $(\phi'_{vi})_1$ = S1 (i, ℓ_{1v}, 2)

$(\phi_{Hi})_1$ = S2(i, ℓ_{1n} , 1) ; $(\phi'_{Hi})_1$ = S2 (i, ℓ_{1H}, 2)

$(\phi_{vi})_2$ = S1(i, ℓ_{2v} , 1) ; $(\phi'_{vi})_2$ = S1 (i, ℓ_{2v}, 2)

$(\phi_{Hi})_2$ = S2(i, ℓ_{2H} , 1) ; $(\phi'_{Hi})_2$ = S2 (i, ℓ_{2H}, 2)

If the FBD(s) are attached to Rotor 2:

$(\phi_{vi})_1$ = S4(i, ℓ_{1v} , 1) ; $(\phi'_{vi})_1$ = S4 (i, ℓ_{1v}, 2)

$(\phi_{Hi})_1$ = S5(i, ℓ_{1H} , 1) ; $(\phi'_{Hi})_1$ = S5 (i, ℓ_{1H}, 2)

$(\phi_{vi})_2$ = S4(i, ℓ_{2v} , 1) ; $(\phi'_{vi})_2$ = S4 (i, ℓ_{1v}, 2)

$(\phi_{Hi})_2$ = S5(i, ℓ_{2H} , 1) ; $(\phi'_{Hi})_2$ = S5 (i, ℓ_{1H}, 2)

where:

S1(i,j,k) = Subsystem 1 (Rotor 1 vertical plane) mode shape for local mode i, local point j, local direction k

S2(i,j,k) = Subsystem 2 (Rotor 1 horizontal plane) mode shape for local mode i, local point j, local direction k

$S4(i,j,k)$ = Subsystem 4 (Rotor 2 vertical plane) mode shape for local mode i, local point j, local direction k

$S5(i,j,k)$ = Subsystem 5 (Rctor 2 horizontal plane) mode shape for local mode i, local point j, local direction k

ℓ_{1V} = Local point number for the center of gravity of FBD Number 1 in the rotor vertical plane subsystem which includes FBD No. 1.

ℓ_{1H} = Local point number for the center of gravity of FBD Number 1 in the rotor vertical plan subsystem which includes FBD No. 1.

ℓ_{2V} = Local point number for the center of gravity of FBD Number 2 in the rotor vertical plane subsystem which includes FBD No. 2.

ℓ_{2H} = Local point number for the center of gravity of FBD Number 2 in the rotor horizontal plane subsystem which includes FBD No. 2.

Generalized Forces Due to Gyroscopic Loading for the FBD Center of Gravity Points

The physical velocities are:

(Subroutine CURRT)

Vertical $(\dot{Z}'phys)_1 = \sum_{i=1}^{n} \dot{Z}_i(\phi'_{vi})_1$

Plane $(\dot{Z}'phys)_2 = \sum_{i=1}^{n} \dot{Z}_i(\phi'_{vi})_2$

Horizontal $(\dot{Y}'phys)_1 = \sum_{j=1}^{m} \dot{Y}_j(\phi'_{Hj})_1$

Plane $(\dot{Y}'phys)_2 = \sum_{j=1}^{m} \dot{Y}_j(\phi_{Hj})_2$

The physical moments about the Y and Z axes are:

(Subroutine FORCE)

Vertical $(M_y)_1 = -\Omega I_p(\dot{Y}'phys)_1 + 2\Omega(S_v)_1\dot{q}_1$

Plane $(M_y)_2 = -\Omega Ip(\dot{Y}'phys)_2 + 2\Omega(S_v)_2\dot{q}_2$

Horizontal $(M_z)_1 = \Omega Ip(\dot{Z}'phys)_1 + 2\Omega(S_v)_1\dot{p}_1$

Plane $(M_z)_2 = \Omega Ip(\dot{Z}'phys)_2 + 2\Omega(S_v)_2\dot{p}_2$

The genralized forces are:

(Subroutine GEN)

Vertical Plane $F_{zi} = (M_z\phi'_{vi})_1 + (M_y\phi'_{vi})_2$

Horizontal Plane $F_{yj} = (M_z\phi'_{Hj})_1 + (M_z\phi'_{Hj})_2$

FBD Number 1 $F_{p1} = -2\Omega \quad S_v\dot{Y}'phys)_1 - m_{f1}\dot{q}_1$

$F_{q1} = -2\Omega \quad S_v\dot{Z}'phys)_1 + m_{f1}\dot{p}_1$

FBD Number 2 $F_{p2} = -2\Omega \quad S_v\dot{Y}'phys)_2 - m_{f2}\dot{q}_2$

$F_{q2} = -2\Omega \quad S_v\dot{Z}'phys)_2 + m_{f2}\dot{p}_2$

5.6 EQUATIONS AND SYMBOLS USED IN TETRA

The following are the equations and a description of the symbols used in the computer coding of the FBD calculations in TETRA.

These matrix equations are developed in Section 2.0. Note that only the rotor-FBD equations are formed into matrix equations since only these contain the nondiagonal mass matrix. The subsystem connecting forces, being on the right-hand side, are treated numerically as vectors in the mass matrix inverse multiplication.

TETRA Matrix Equation

$$[ZA] = [MM]^{-1} [F_{gen} - ZK \cdot Z - ZC \cdot ZV]$$

where

$[ZA]$ = Generalized acceleration matrix

$[MM]^{-1}$ = Inverse of mass matrix

F_{gen} = Generalized force

ZK = Generalized stiffness

Z = Generalized displacement

ZC = Generalized damping

ZV = Generalized velocity

The generalized FBD module's equations are given in matrix form below. Note that the "Vertical" and "Horizontal" equilibrium equations are added to the rotor [which contains the FBD(s)] equations.

5.7 OVERALL PROGRAM STRUCTURE

The revised computer program consists of the main routine plus 36 subroutines. A brief description of each of the 36 subroutines is given in Table 2. A structure chart showing the hierarchy of the program and subroutines is given in Figure 11. Finally, a condensed flow chart of the entire program is given in Figure 12.

Table 2. TETRA Subroutines.

INIT	Initializes variables and arrays
SYBSYS	Processes data for the modal subsystems
FLEXSS	Processes data for the flexible modal subsystems
FLEX	Finds flexible subsystem mode shapes
RBODSS	Processes data for the rigid body modal subsystems
RBODY	Computes rigid body mode shapes
FBDSS	Processes data for the FBD modal subsystems
FBDL	Processes data for the local points on the FBD's
CONEL	Processes data for the physical connecting elements
ELEM1	Processes spring-damper (Type 1) physical connecting element data
ELEM2	Processes link-damper (Type 2) physical connecting element data
ELEM3	Processes rub (Type 3) physical connecting element data
ELEM4	Processes engine support-links (Type 4) physical connecting element data
ELEM5	Processes data for the uncoupled point spring-damper (Type 5) physical connecting element
STIFFE	Computes stiffness matrix for engine support element
STIFFT	Computes stiffness matrix for link elements that are to be combined with engine support element
LINV3F	Matrix inversion and determinant calculation for the engine support-links (Type 4) physical connecting element and the FBD-rotor mass matrix
MATM	Matrix multiplication for the engine support-links (Type 4) physical connecting element
UBAL	Processes unbalance load data
SINSOS	Processes Pcos wt and Psin wt load data
FORHIS	Processes force-time history load data

Table 2. TETRA Subroutines (Concluded).

GYROE	Processes gyroscopic load data
FBD	Processes data for the FBD's and the rotor to which they are attached
MASSM	Computes the mass matrix for the FBD's and the rotor to which they are attached
PLOTD	Processes data for output plot file
SCAN	Establishes element/subsystem connections
TILOOP	Time integration loop
ROPROP	Calculates rotor properties (speed, acceleration, and angular displacement)
CURRT	Computes current physical displacements, velocities, and modal forces
FBDDS	Computes displacements and stresses for the local points on the FBD's
FORCE	Computes physical connecting element and gyro element forces
APFOR	Computes applied forces
GEN	Computes generalized forces
MODES	Finds the mode shapes
GENDIS	Computes the generalized displacements
LISTPF	Prints at least a partial listing of the output plot file
BUFIO	Buffers output for the plot file

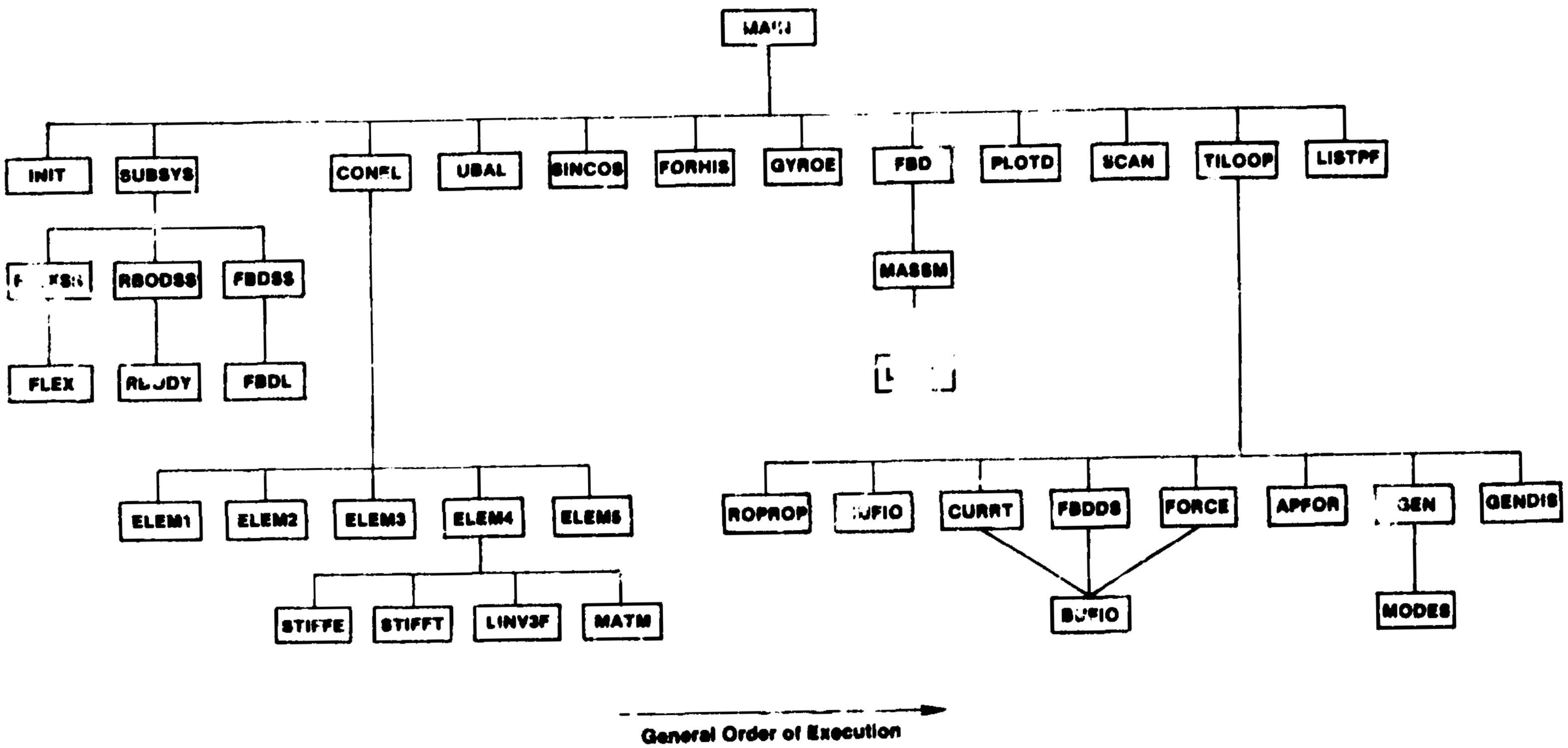


Figure 11. TETRA Structure Hierarchy.

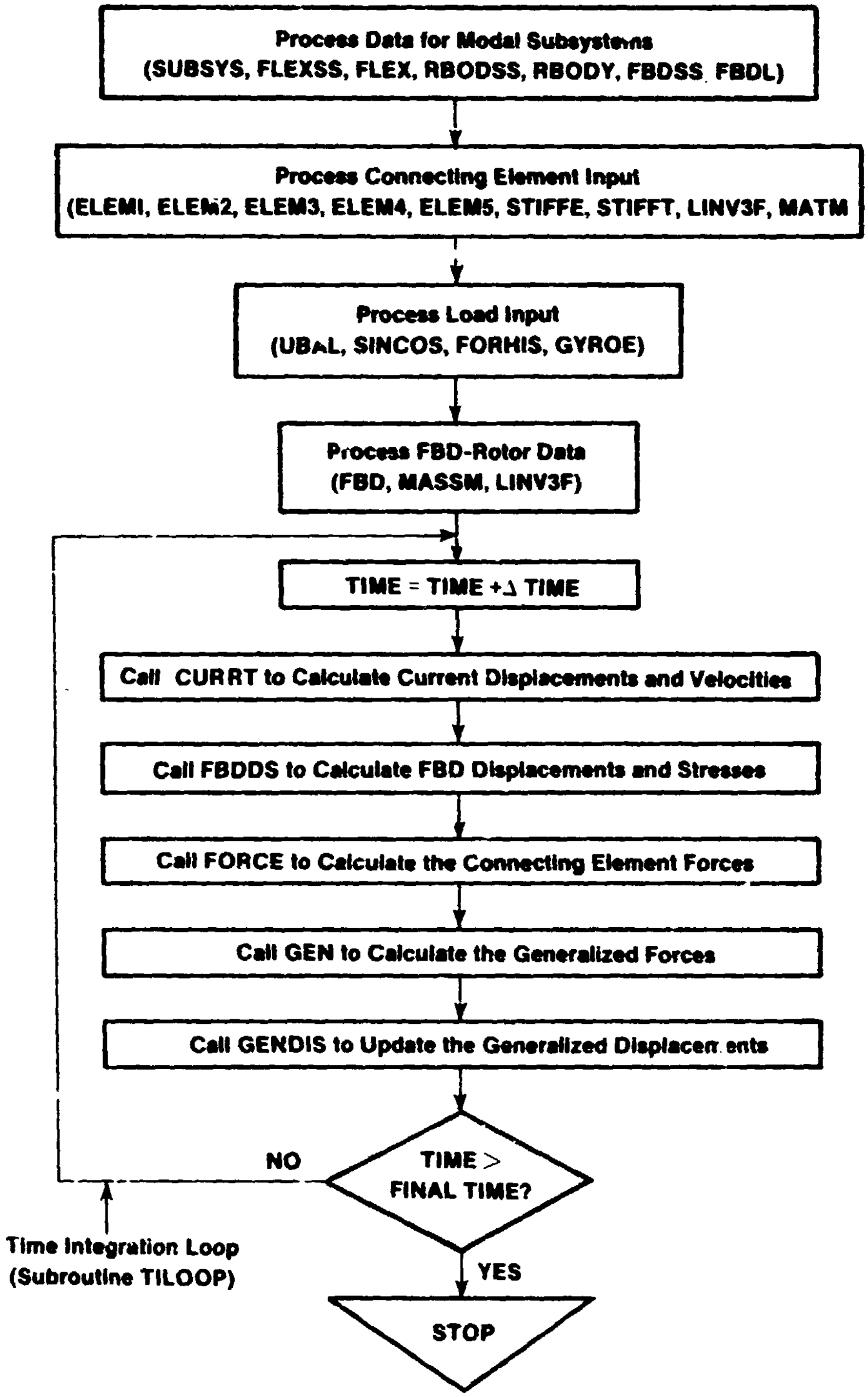


Figure 12. TETRA Flowchart.

5.8 NASTRAN/TETRA INTERFACE PROGRAM

The NASTRAN/TETRA interface computer program has also been installed on the IBM computer which front-ends the CRAY-1 Computer at NASA Lewis Research Center. This interface program generates modal subsystem input for TETRA for the flexible modal subsystems (can generate modal subsystem input for Subsystem 1, 2, 4, 5, 7, 8, or 10). The procedure used is as follows.

First, a NASTRAN run is made on the CRAY-1 computer, and the NASTRAN output file is sent back and saved on the IBM computer. The interface program must read and obtain data from the NASTRAN output file that it needs to generate the TETRA input.

A PROCDEF named RUNNT was generated to make it easier to run the interface program. (If you don't know what a PROCDEF is, see the 370 User's Guide Manual p. 102 or the Command Systems User's Guide Section 4). The user need only supply the PROCDEF name (RUNNT) followed by the NASTRAN output file name and the TETRA modal subsystem input file name as shown in Figure 13. Then, the interface program asks a series of questions at the terminal which the user must answer (see Figure 14), Both the horizontal plane and the vertical plane subsystem input can be generated in the same interface program run as was done in Figure 14 (Subsystem 7 = case vertical plane and Subsystem 8 = case horizontal plane). The resulting TETRA input file which includes the modal subsystem input for Subsystems 7 and 8 is shown in Figure 15.

The source for the NASTRAN/TETRA interface program is saved in a file named SOURCE.NASTET on the IBM system.

Procedure to Run TETRA Computer Program

The TETRA input file must consist of CRAY JCL statements, a LIST1 namelist section, one or more LIST2 namelist sections, zero or more LIST3 namelist sections, and a LIST4 namelist section in order (see Figures 16 and 17). The JCL statements that must be at the front of the input file are shown in Figure 18 along with a brief explanation for each statement.

Usually it is easiest to generate separate files for different portions of the TETRA input and then merge these files together. Often the modal subsystem (LIST2) input can be generated automatically using the NASTRAN/TETRA interface program. The NASTRAN/TETRA interface program might have to be run three times - once to generate the the modal subsystem input for the low pressure rotor system, again to generate the modal subsystem input for the high pressure rotor system, and again to get the modal subsystem input for the engine casing. The three modal subsystem files thus generated would then have to be merged with the other files that the user typed in by hand containing the CRAY JCL statements and the LIST1, LIST3, and LIST4 input. The procedure for merging the files into one input file is shown in Figure 19.

A PROCDEF named TOCRAY was generated to make it easier to submit the input file to the CRAY to run. (If you don't know what a PROCDEF is, see the 370 User's Guide Manual p. 102 or the Command Systems User's Guide Section 4). The user need only type the PROCDEF name (TOCRAY) followed by the TETRA input file name as shown in Figure 19.

1) Type in:

RUNNT file1,file2

where file1 = NASTRAN output file name

and file2 = TETRA subsystem input file name

2) Type in answers to questions from the computer

Figure 13. Procedure to Run NASTRAN/TETRA Interface Program.

RUNNT PRMCASE, F29. DATA

```
G O O D   L U C K !

INPUT SUBSYSTEM NUMBER, NUMBER OF FREQUENCIES DESIRED, AND Q-FACTOR
7,3,15

INPUT FREQUENCY NUMBERS DESIRED
2,3,4

INPUT NUMBER OF GRID POINTS YOU WISH TO ELIMINATE
7

INPUT THE GRID POINTS TO BE ELIMINATED
94,95,100,101,102,103,9999

INPUT TITLE IDENTIFICATION
CASE VERTICAL PLANE SUBSYSTEM FOR DEMONSTRATOR MODEL

THERE WERE     5 JOINTS
THERE WERE     3 EIGENVALUES
THERE WERE     3 EIGENVECTORS
WRITTEN TO THE TETRA INPUT FILE

TYPE 1 TO GENERATE ANOTHER SUBSYSTEM INPUT FILE (OTHERWISE TYPE 0)
1

INPUT SUBSYSTEM NUMBER, NUMBER OF FREQUENCIES DESIRED, AND Q-FACTOR
9,3,15

INPUT FREQUENCY NUMBERS DESIRED
2,3,4

INPUT NUMBER OF GRID POINTS YOU WISH TO ELIMINATE
7

INPUT THE GRID POINTS TO BE ELIMINATED
94,95,100,101,102,103,9999

INPUT TITLE IDENTIFICATION
CASE HORIZONTAL PLANE SUBSYSTEM FOR DEMONSTRATOR MODEL

THERE WERE     5 JOINTS
THERE WERE     3 EIGENVALUES
THERE WERE     3 EIGENVECTORS
WRITTEN TO THE TETRA INPUT FILE

TYPE 1 TO GENERATE ANOTHER SUBSYSTEM INPUT FILE (OTHERWISE TYPE 0)
0

PROGRAM TERMINATED NORMALLY.  HAVE A NICE DAY
 TERMINATED: STOP
```

Figure 14. NASTRAN/TETRA Interface Program Run.

ORIGINAL PAGE IS
OF POOR QUALITY

```
     TOP RECORD
$END
$LIST2
TITLE='CASE VERTICAL PLANE SUBSYSTEM FOR DEMONSTRATOR MODEL
ISUB= 7,
XREF=0,
YREF=0,
ZREF=0,
PTS(1,1)=
   1,      0.0000,      0.0000,      0.0000,
   2,    -10.0000,      0.0000,      0.0000,
   3,    -90.0000,      0.0000,      0.0000,
  33,   -100.0000,      0.0000,      0.0000,
  37,    -50.0000,      0.0000,      0.0000,
XMODES(1,1)=
1.250910E 02, 9.999438E 01,15, 1,
1.588929E 02, 6.399969E 01,15, 1,
3.064350E 04, 2.379933E 06,15, 0,
VH(1,1,1)=
 9.999578E-01, 6.191237E-07,-4.999695E 00,-8.828640E-04,
 9.999627E-01, 6.274564E-07, 2.999930E 01, 9.999129E 01,
 9.999622E-01,-6.391879E-07,-2.999928E 01, 9.999292E 01,
 9.999571E-01,-6.308552E-07, 4.999690E 00,     0.000000,
 1.000000E 00,-5.865729E-09, 1.907349E-06,-1.499972E 03,
VH(1,1,2)=
-9.999998E-01, 2.000014E-02, 8.067109E 00,-4.571686E 01,
-7.999963E-01, 2.000012E-02,-1.095825E 01,-2.984927E 02,
 7.999965E-01, 2.000012E-02,-1.095826E 01, 2.070592E 02,
 1.000000E 00, 2.000014E-02, 8.067116E 00,     0.000000,
 1.163417E-07, 2.000014E-02, 6.715444E-01,-4.571706E 01,
VH(1,1,3)=
 1.000000E 00,-3.121830E-02,-3.000452E 05, 2.654122E 06,
 6.116835E-01,-3.027587E-02,-9.671252E 05, 1.380302E 07,
 6.116835E-01, 3.027587E-02, 9.671252E 05, 8.655026E 06,
 1.000000E 00, 3.121830E-02, 3.000452E 05,     0.000000,
-7.185308E-01, 1.825181E-15,     0.000000, 6.802237E 07,
$END
$LIST2
TITLE='CASE HORIZONTAL PLANE SUBSYSTEM FOR DEMONSTRATOR MODEL
ISUB= 8,
XREF=0,
YREF=0,
ZREF=0,
PTS(1,1)=
   1,      0.0000,      0.0000,      0.0000,
   2,    -10.0000,      0.0000,      0.0000,
   3,    -90.0000,      0.0000,      0.0000,
  33,   -100.0000,      0.0000,      0.0000,
  37,    -50.0000,      0.0000,      0.0000,
XMODES(1,1)=
1.250910E 02, 9.999438E 01,15, 1,
1.588929E 02, 6.399969E 01,15, 1,
3.064350E 04, 2.379933E 06,15, 0,
VH(1,1,1)=
 9.999578E-01, 6.191237E-07,-4.999695E 00,-8.828640E-04,
 9.999627E-01, 6.274564E-07, 2.999930E 01, 9.999129E 01,
 9.999622E-01,-6.391879E-07,-2.999928E 01, 9.999292E 01,
 9.999571E-01,-6.308552E-07, 4.999690E 00,     0.000000,
 1.000000E 00,-5.865729E-09, 1.907349E-06,-1.499972E 03,
VH(1,1,2)=
-9.999998E-01, 2.000014E-02, 8.067108E 00,-4.571686E 01,
-7.999963E-01, 2.000012E-02,-1.095825E 01,-2.984927E 02,
 7.999965E-01, 2.000012E-02,-1.095826E 01, 2.070592E 02,
 1.000000E 00, 2.000014E-02, 8.067116E 00,     0.000000,
 1.163417E-07, 2.000014E-02, 6.715444E-01,-4.571706E 01,
VH(1,1,3)=
 1.000000E 00,-3.121830E-02,-3.000452E 05, 2.654122E 06,
 6.116835E-01,-3.027587E-02,-9.671252E 05, 1.380302E 07,
 6.116835E-01, 3.027587E-02, 9.671252E 05, 8.655026E 06,
 1.000000E 00, 3.121830E-02, 3.000452E 05,     0.000000,
-7.185308E-01, 1.825181E-15,     0.000000, 6.802237E 07,
EOF
```

Figure 15. NASTRAN Generated Modal Input File for Subsystems 7 and 8.

1. CRAY JCL Statements

2. LIST1 Namelist Section (one such section)
Type A and B input sheets

3. LIST2 Namelist Section (one for each modal
subsystem) Type C-1 through C-12
input sheets.

4. LIST3 Namelist Section (one for each physical
connecting element)
Type D-1 through H-2 input sheets.

5. LIST4 Namelist Section (one such section)
Type I through Type P-2 input sheets

Figure 16. Input Order.

```
Example:  Set up for a run with four modal subsystems
          and two physical connecting elements.

∇
CRAY JCL STATEMENTS

∇
$LIST1
  .
  .
  .
$END
$LIST2
  .
  .
  .
$END
$LIST2
  .
  .
  .
$END
$LIST2
  .
  .
  .
$END
$LIST2
  .
  .
  .
$END
$LIST3
  .
  .
  .
$END
$LIST3
  .
  .
  .
$END
$LIST4
  .
  .
  .
$END
```

Figure 17. CRAY Input Setup for Four Modal Subsystems Example.

▽1

	Notes
JOB, JN = jobname, M = 400, T = 600.	jobname=file name for printed output (returned to IBM)
ACCOUNT, AC = userid, PW = password	enter your IBM userid and password
ACCESS, DN = A, PDN = TETRA, ID = SMBLACK.	accesses TETRA program on Cray
ACCESS, DN = B, PDN = filename, ID = userid.	filename=input restart file name
ASSIGN, DN = B, A = FT22.	assigns input restart file to file code 22
ASSIGN, DN = C,A = FT23.	assigns output plot file to file code 23
ASSIGN, DN = D,A = FT24.	assigns output restart file to file code 24
LDR, DN=A.	load and run
DISPOSE, DN = C,SDN = filename.	filename=output plot file name (returned to IBM)
SAVE, DN = D, PDN=filename, ID = userid.	filename=output restart file name (saved on Cray)
ERASE, PDN = filename, ID= userid, ED= -2.	Erases all except last two editions of restart file
EXIT.	
DUMPJOB.	these cards generate dump if program aborts (EXIT., DUMPJOB., DUMP.)
DUMP.	
/EOF	

Figure 18. CRAY JCL Statements Needed for TETRA.

1) Run NASTRAN/TETRA interface program as often as necessary to obtain subsystem (LIST2) input.

2) Remaining input must be typed in and saved.

3) Merge together the files containing the TETRA input into one input file as per the following example:

REDIT JCL	JCL	file containing CRAY JCL
B		
LOA LIST1	LIST1	file containing LIST1 input
B		
LOA LIST 2A	LIST2A	file containing LIST2 (subsystem) input
B		
LOA LIST 2B	LIST2B	" " " " "
B		
LOA LIST 2C		
B	LIST2C	" " " " "
LOA LIST 34		
VSFILE FILENAM	LIST34	file containing LIST3 and LIST4 input

4) Type the following to submit the run to the CRAY computer:

TOCRAY FILNAM

Figure 19. Procedure to Prepare TETRA Input File.

6.0 E^3 STRUCTURAL MODELING

6.1 INTRODUCTION

An engine structural model representing the E^3/ICLS has been assembled that can be analyzed with the TETRA program for engine transient response. The TETRA model includes six subsystems; LP rotor vertical and horizontal, HP rotor vertical and horizontal and static structure vertical and horizontal. A total of 100 modes have been included, extending from the rigid body modes to approximately 20 times the low rotor maximum speed. These subsystems are assembled with five connecting elements that represent the five main engine bearings. One rub element is included representing an additional load path between the fan rotor and containment case that becomes active when the relative displacement exceeds a specified clearance. The model is defined so that additional rub elements can be easily added at 12 other rotor/stator locations and at one rotor/rotor location. Gyroscopic effects are included in both the LP and HP rotor subsystems. The polynomial which defines the LP rotor to HP rotor speed relationship is based on sea level static standard day cycle deck data. Steady-state test runs of the TETRA model have been made on the Honeywell computer at the General Electric Company in Evendale, Ohio. Preliminary results from these test runs in the time domain correlate well with results from the baseline dynamic analyses conducted in the frequency domain. Therefore, this TETRA model provides NASA with the capacity to explore the range of capabilities of the TETRA program as well as define its limitations.

The purpose of this report is to describe how the E^3/ICLS engine was modeled, broken down into subsystems and connecting elements and then reassembled into the TETRA model. The ICLS configuration shown in Figure 20 has been chosen for this project since it represents the engine system that will be actually tested.

6.2 ASSEMBLED PLANAR MODEL DESCRIPTION AND LP SYNCHRONOUS FREQUENCY RESPONSE CHARACTERISTICS

The General Electric Company-developed VAST computer program (Reference 1) was used to define a planar system dynamics model of the E^3/ICLS engine, and to generate the associated modal data. This program is an extension to the Prohl-Myklestad method which addresses to the branched load paths found in real engine structures and assumes the motion to be axisymmetric. The program includes bending, shear deformation, rotary inertia and gyroscopic effects. It computes and prints out the system natural frequencies, displacements, rotations, loads and moments for each normal mode, together with the potential (strain) and kinetic energy distributions in the various components. Post-processors to the VAST program are used to compute the forced steady-state combined modes frequency response for any point in the engine system model. The purpose of this section of the report is to describe how the assembled

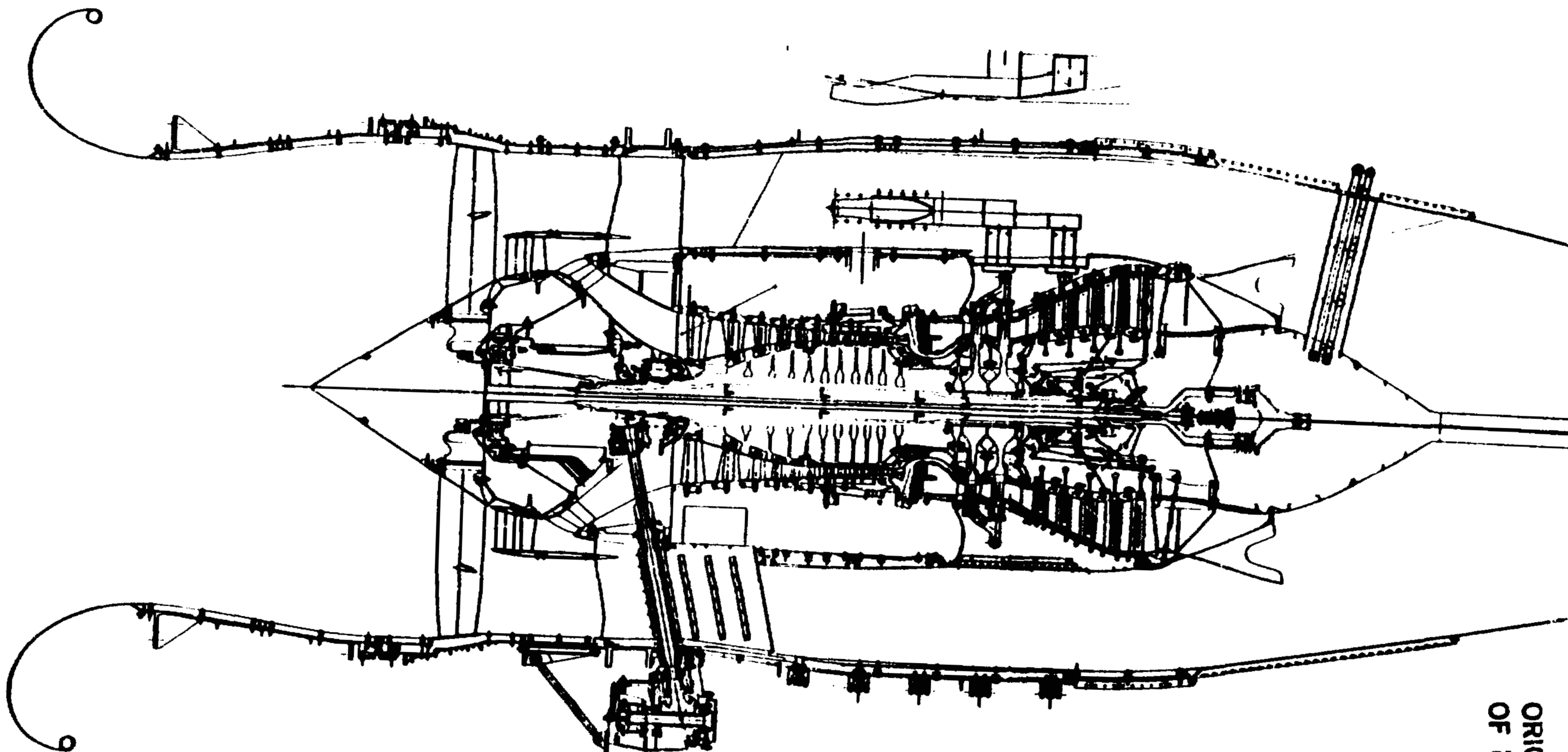


Figure 20. E^3/ICLS Engine System.

engine structure was modeled, summarize the elastic-mass data, and to define the assembled system critical speeds along with the frequency response characteristics.

Figure 21 is a drawing of the E^3/ICLS engine system modeled for this project. Figures 22 and 20 illustrate the VAST model in schematic form. The major engine components are identified in Figure 22. Figure 23 shows the VAST span, joint, and spring numbers and defines the boundary conditions at all joints. Note that the inlet bellmouth and fan exhaust nozzle shown in the engine drawing are not included in the schematics since these components are not structurally coupled to the main engine system.

The VAST model was generated with the General Electric Company-developed preprocessor VEGA. VEGA input represents the geometry, i.e. lengths, radii, thicknesses as well as the material properties, required to define VAST elastic-mass input data. VEGA and VAST input are both defined in this report to provide a comprehensive explanation of the structural element physical properties.

VEGA Listing

The VEGA listing is contained in Section 7.1. Two types of elements are used to define VEGA input, springs and spans, which are connected at joints. The schematic illustrated in Figure 23 identifies the spans, springs and joints. Spring properties are defined in the upper half of the first page of the VEGA Listing. The first column identifies the spring number. Columns 2, 3, and 4 define the first end connection of the spring. The second column identifies the joint number and the third column identifies the span number to which the first end of the spring is connected. Columns 5, 6, and 7 define the second end connection of the spring. The fifth column identifies the joint number and the sixth column identifies the span number to which the second end of the spring is connected. Columns 4 and 7 define boundary conditions at the spring connection ends. Type 1 spring boundary condition indicates that both shear and moment will be transmitted while Type 2 transmits only shear. Zeros in Columns 2 and 3 or 5 and 6 in place of joint and span numbers indicate a connection to ground. The eighth column defines the coefficient type to be used, 0 for flexibility or 1 for stiffness. Columns 9-12 define the flexibility coefficients or stiffness coefficients.

For flexibility:

PHIM = ϕ_M rad/in-lb = rotation due to unit moment
PHIV = ϕ_V rad/lb = rotation due to unit force
ETAM = η_M in/in-lb = deflection due to unit moment
ETAV = η_V in/lb = deflection due to unit force

The thirteenth column indicates the axial offset of the spring element. The VAST convention required for all spring input is defined in the following sketch.

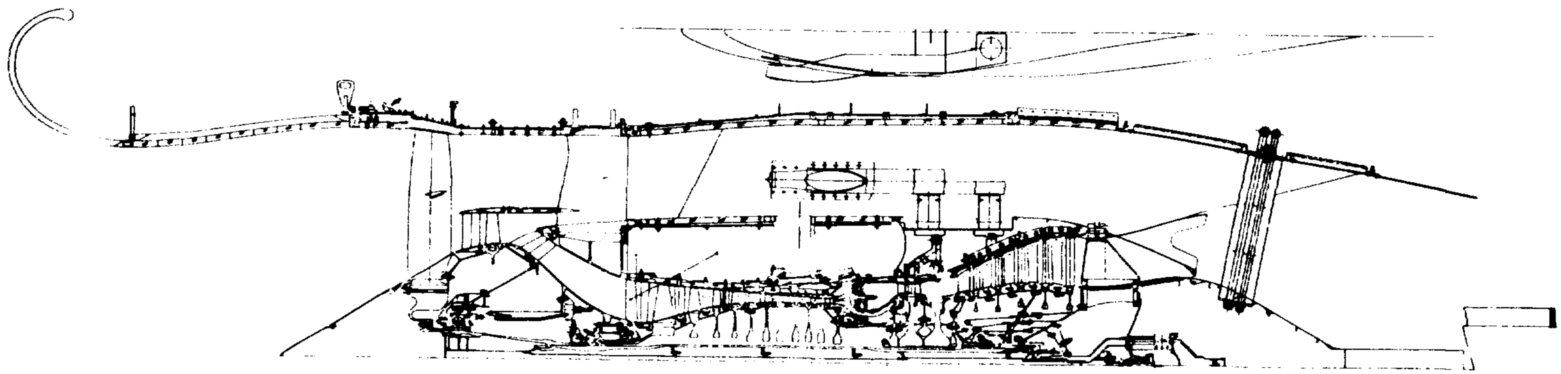


Figure 21. Cross Section of the E^3/ICLS Engine System.

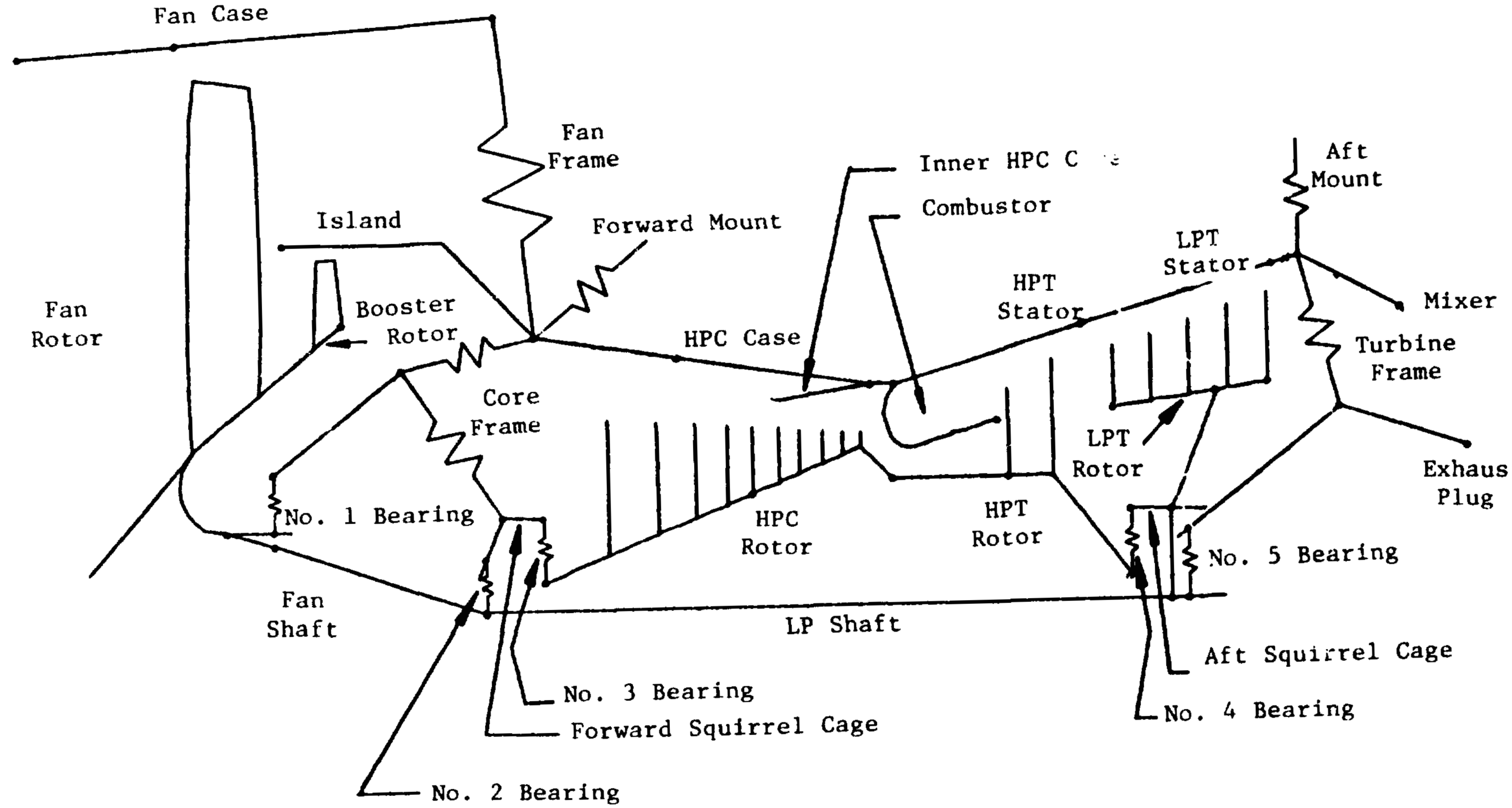


Figure 22. E^3 ICLS System Dynamics Computer Model Schematic.

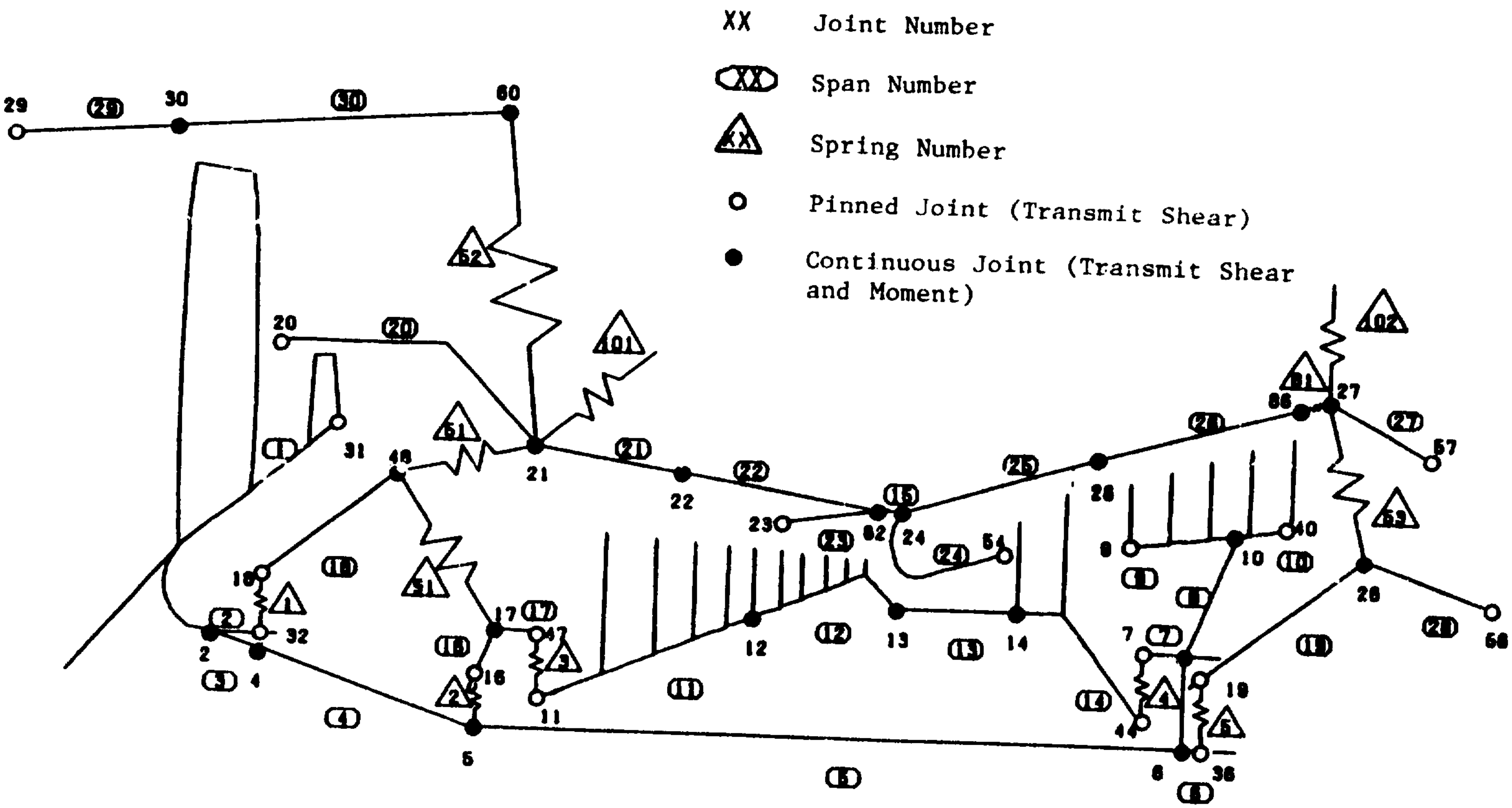
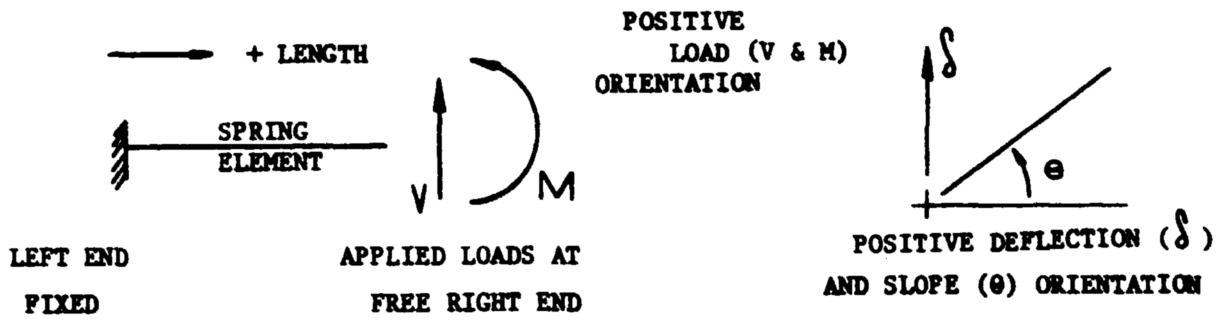


Figure 23. Assembled Vast Model Span-Spring-Joint Identification and Boundary Condition Definition.



The segmented span data for all 30 spans follows the spring input. Listed in the heading of each span sheet are the rotor speed and the ratio of rotor speed to frequency of vibration. The speeds shown are for LP synchronous vibration at FPS growth conditions. The ratio of rotor speed to frequency of vibration is used to introduce gyroscopic effects in the vibration model. This ratio is zero for all spans representing nonrotating components such as the casing and bearing supports, and is nonzero for all spans representing rotor systems. The rotor speed is not required in critical frequency calculations but is used for gyro maneuver calculations. Also listed in the heading are the span number identification, joint numbers identifying each end of the span and boundary conditions at each end of the span. Continuous boundary condition indicates that the end is fixed to another span and both shear and moment are transmitted through the joint. Pinned boundary condition indicates one of three conditions; (1) a free end, (2) pinned connection to another span transmitting only shear, or (3) connection to a spring where the spring boundary condition applies. Column 1 identifies each segment of the span with a station number. The interval length listed in the second column gives the length of each station-to-station segment in inches. Four element types (Column 3) are used to define interval properties listed in Columns 4-10;

a. Element Type 2 is a massless spring where Columns 4-7 identify either flexibility coefficients (0 in Column 8) or stiffness coefficients (1 in Column 8),

Column 4 PHI(M) = ϕ_M rad/in-lb = rotation due to unit moment

Column 5 PHI(V) = ϕ_V rad/lb = rotation due to unit force

Column 6 ETA(M) = η_M in/in-lb = deflection due to unit moment

Column 7 ETA(V) = η_V in/lb = deflection due to unit force

b. Element Type 3 is a cone used to model thin wall shell elements using a membrane analysis,

Column 4 E = elastic modulus (psi x 10^{-6})

Column 5 G = shear modulus (psi x 10^{-6})

Column 6 ρ = material weight density (lb/in^3)

Column 7 r_{i-1} = mean radius of wall at left end (inches)

Column 8 t_{i-1} = wall thickness at left end (inches)

Column 9 r_i = mean radius of wall at right end (inches)

Column 10 t_i = wall thickness at right end (inches)

c. Element Type 4 is a uniform weight cylindrical beam,

Column 4 E = elastic modulus (psi x 10^{-6})

Column 5 G = shear modulus (psi x 10^{-6})

Column 6 ρ = material weight density (lb/in^3)

Column 7 r_o = outside radius of cylindrical section (inches)

Column 8 t = wall thickness of cylindrical section (inches)

d. Element Type 5 is a uniform weight rigid cylindrical beam with input exactly the same as for Element Type 4 (except that the values for E and G are arbitrary).

The material data indicating metal temperature and material name is an option used for selecting material properties listed in Columns 4, 5 and 6. Weight properties are listed in the three columns to the extreme right; polar weight moment of inertia (lb-in^2), weight (lbs.), and transverse or rotary weight moment of inertia (lb-in^2). The polar weight moment of inertia is taken about the axis of revolution of the body while the transverse weight moment of inertia is about any axis normal to the axis of revolution normal to the plane of the station axial coordinate. Weight properties of element Types 3, 4 and 5 are computed by VEGA for the VAST input and are therefore not included in the VEGA weight property listing. The summary at the bottom of each span listing also excludes internally computed weight properties. Weight properties which are in the VEGA listing include all weights not calculated by VEGA. These include weight properties for frames, bearings, disks, blades, vanes and all nonstructural components.

VAST Listing

Mass-elastic data from the VAST listing is contained in Section 7.2. This data is for the segmented span components. Spring data and boundary conditions are described in detail within the VEGA listing. Each segment of a span is identified by a station number and includes a massless interval length for which the flexibility is defined and a point mass for which weight properties are defined. The program computes stepping or transfer matrices for each segment and performs a progressive multiplication across each span to obtain equilibrium and compatibility equations which are then combined with boundary condition equations to form dynamic equations for the complete system. A solution for the natural frequencies is obtained by calculating the determinant of the coefficients of the computed equations and the minimums are searched out to determine the natural frequencies. Once the minimums are obtained, the mode shapes are computed.

Listed in the heading of each span sheet are the rotor speed and the ratio of rotor speed to frequency of vibration. The speeds shown correspond to LP synchronous vibration at FPS growth conditions. The ratio of rotor speed to frequency of vibration is used to introduce gyroscopic effects in the vibration model. This ratio is zero for all spans representing nonrotating components such as the casing and bearing supports, and is nonzero for all spans representing rotor systems. The rotor speed is not required in critical frequency calculations but is used for gyro loading maneuver calculations. Following the station number (Column 1) is the interval length (Column 2) which gives the length of each station-to-station segment in inches. Column 7 is an indicator that indicates whether the segment flexibility is defined with beam or spring properties. If Column 7 is 1, then Columns 3-6 give the tensile modulus E lb/in^2, the bending area moment of inertia I in^4, the shear modulus G lb/in^2, and the shear area A in^2, respectively. If Column 7 is 2, then Columns 3-6 give the flexibility coefficients for the segment as follows:

PHI(M)	rad/in-lb	= rotation due to unit moment
PHI(F)	rad/lb	= rotation due to unit force
ETA(M)	in/in-lb	= deflection due to unit moment
ETA(F)	in/lb	= deflection due to unit force

If the above flexibility coefficients are entered as zero, then a rigid segment results. Columns 8, 9, and 10 give the weight polar moment of inertia (lb-in^2), the weight (lb.), and the weight transverse moment of inertia (lb-in^2) respectively, which are lumped at the indicated station. The shear-stress ratio values are used for including the effect of shear deformation and do not apply when flexibility input is used.

VAST Solution

Results from the VAST frequency domain analysis are included herein to provide background information that may help evaluate the TETRA time domain solution. LP synchronous critical frequencies with the undamped mode shapes and energy distribution characteristics are summarized in Figures 24 through 31. Modal deflections are indicated by the broken line and referenced to the undeflected solid line. Details of the energy distribution are contained in Section 7.3. Combined modes frequency response characteristics are illustrated in Figures 32 through 36 for fan and LP turbine unbalance. Damping for this forced response solution is based on Q-factors equal to 15 for all spring elements and all static structure span elements and effective Q-factors equal to -41.60 for the core rotor span elements.

$$\text{Q-factor} = Q_f = \frac{1}{2C/C_c}$$

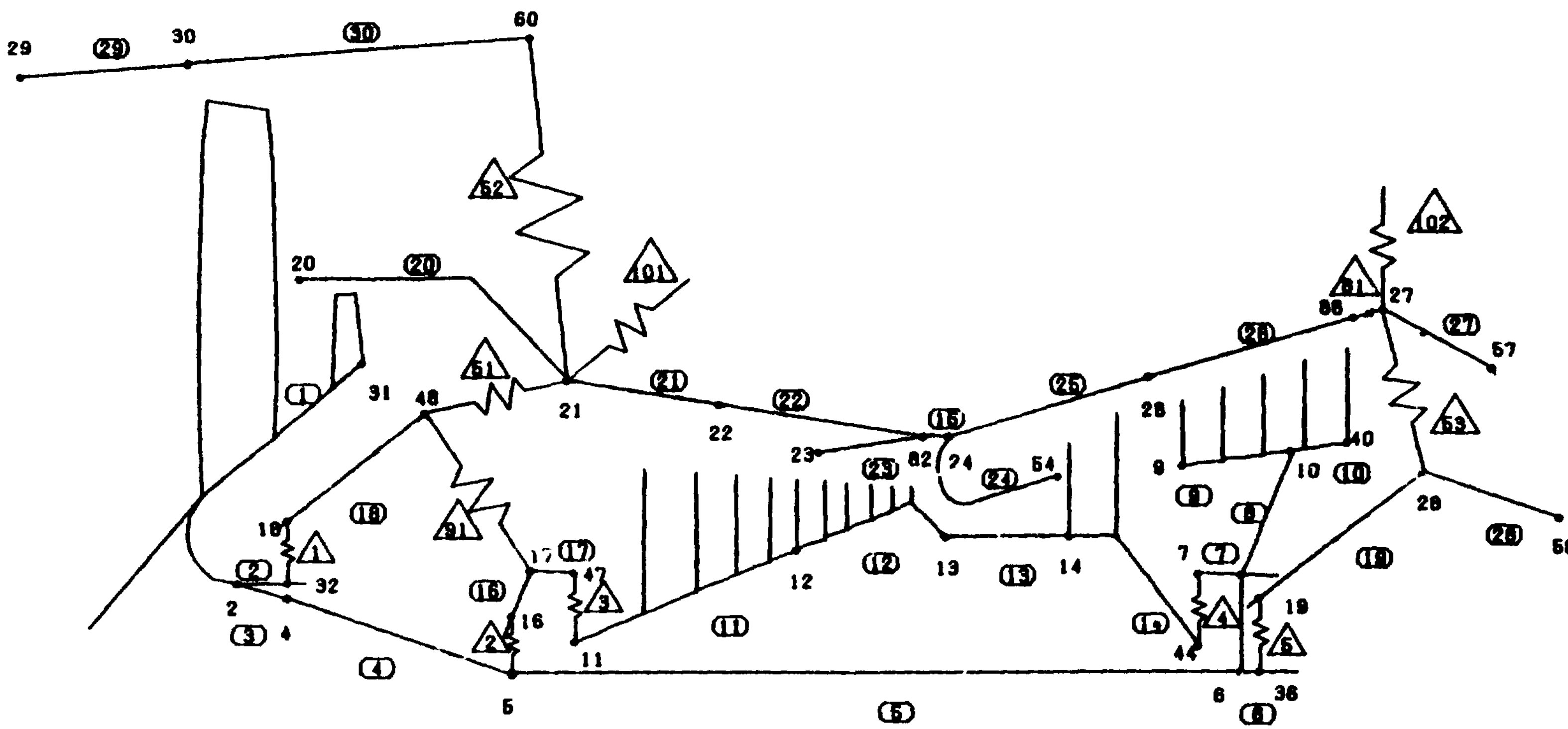


Figure 24. EEE-ICLS LP Synchronous Baseline for Complete Model.

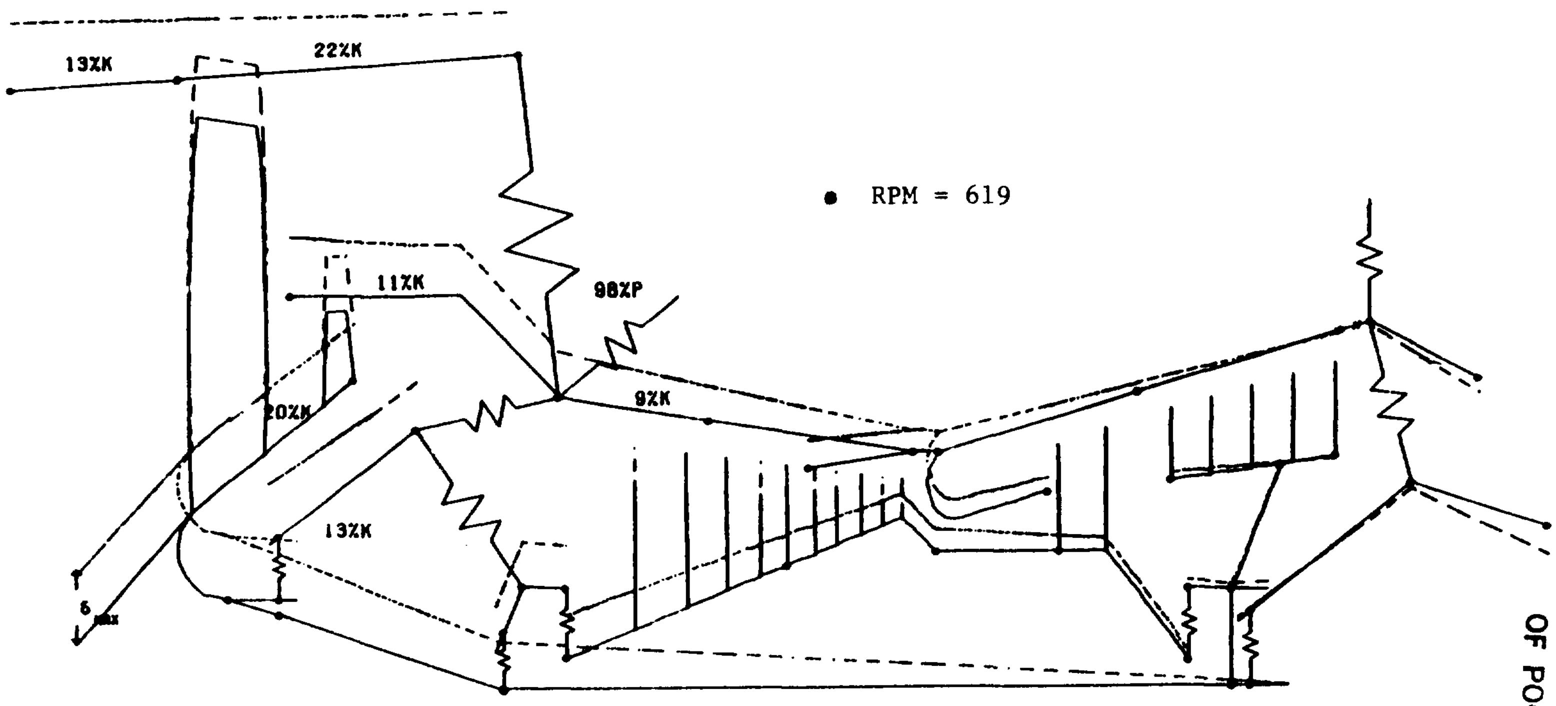


Figure 25. EEE-ICLS LP Synchronous Baseline for Complete Model.

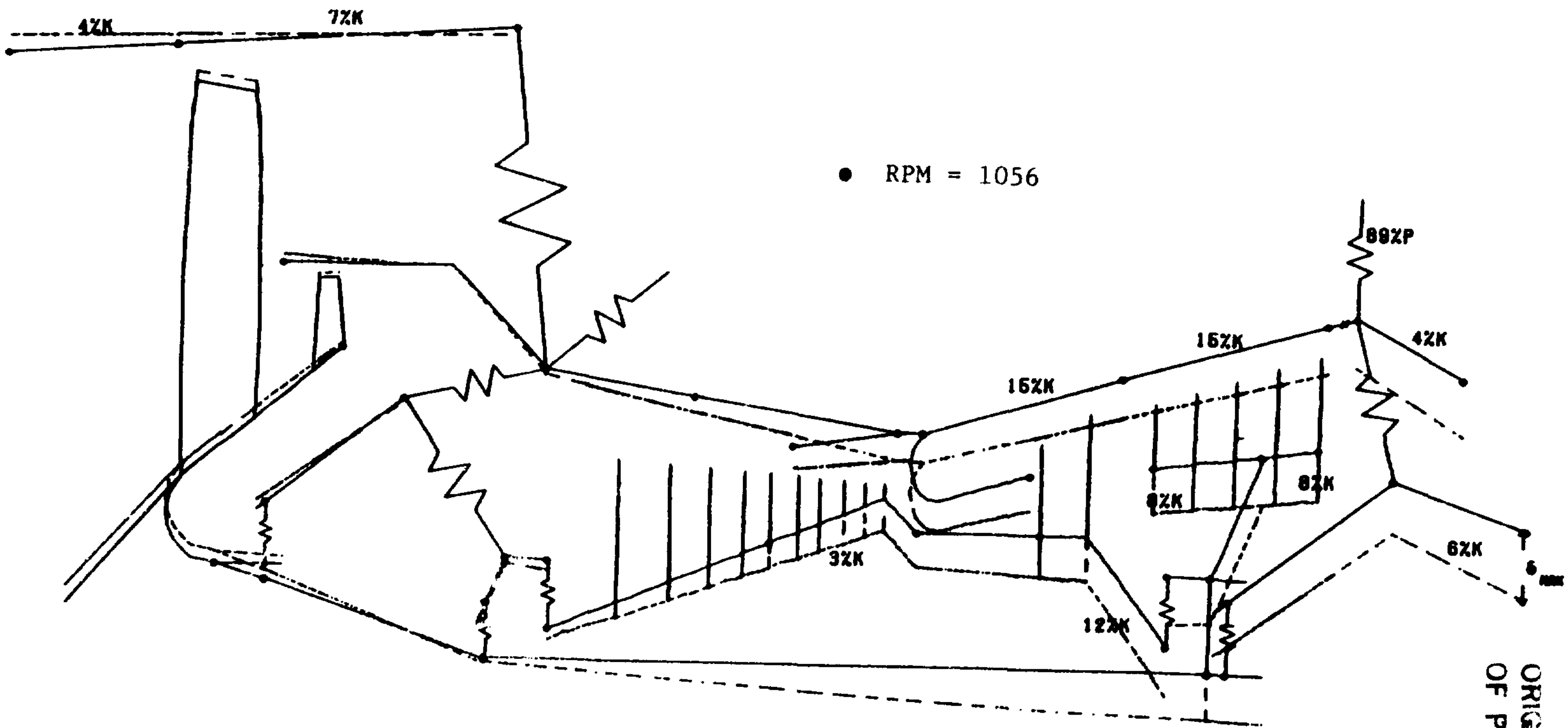


Figure 26. EEE-ICLS LP Synchronous Baseline for Complete Model.

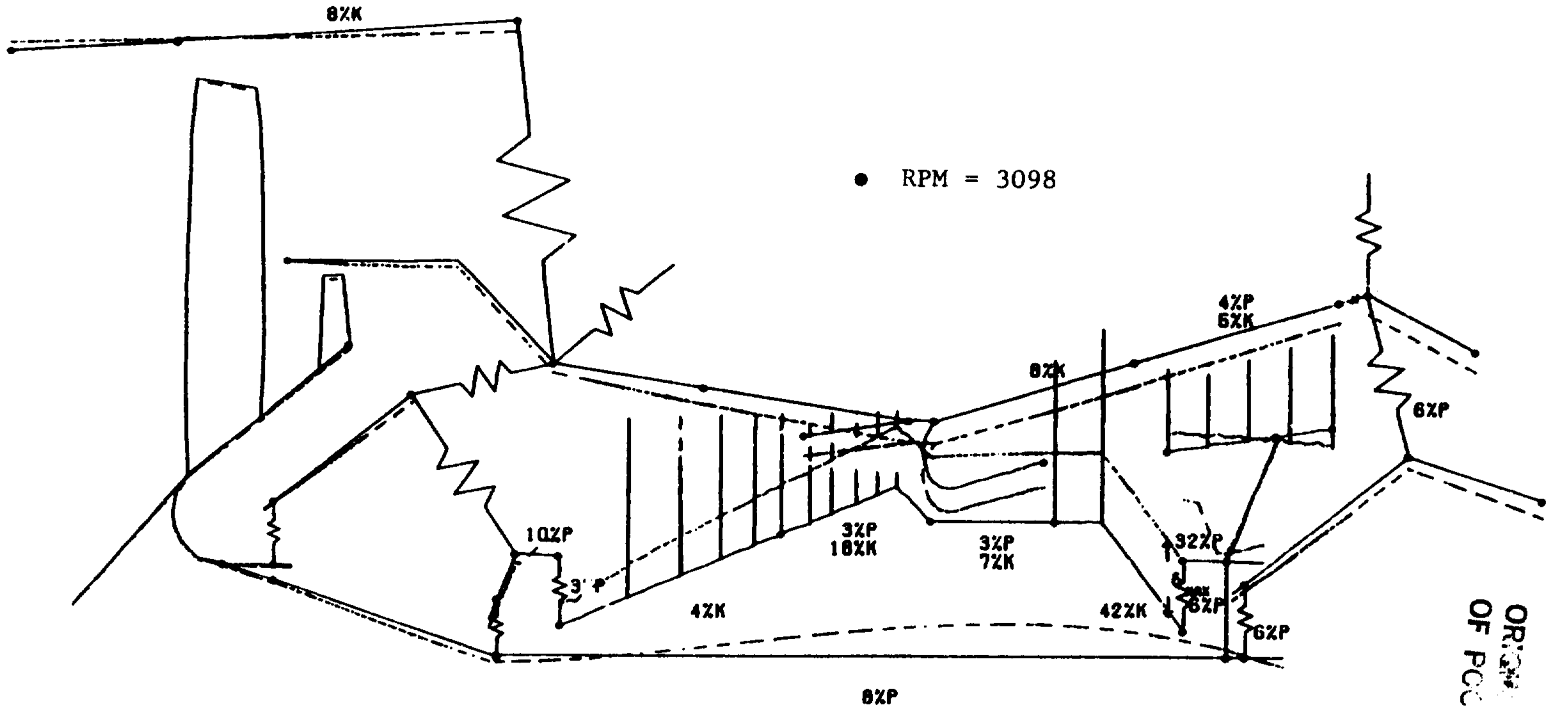


Figure 27. EEE-ICLS LP Synchronous Baseline foı Complete Model.

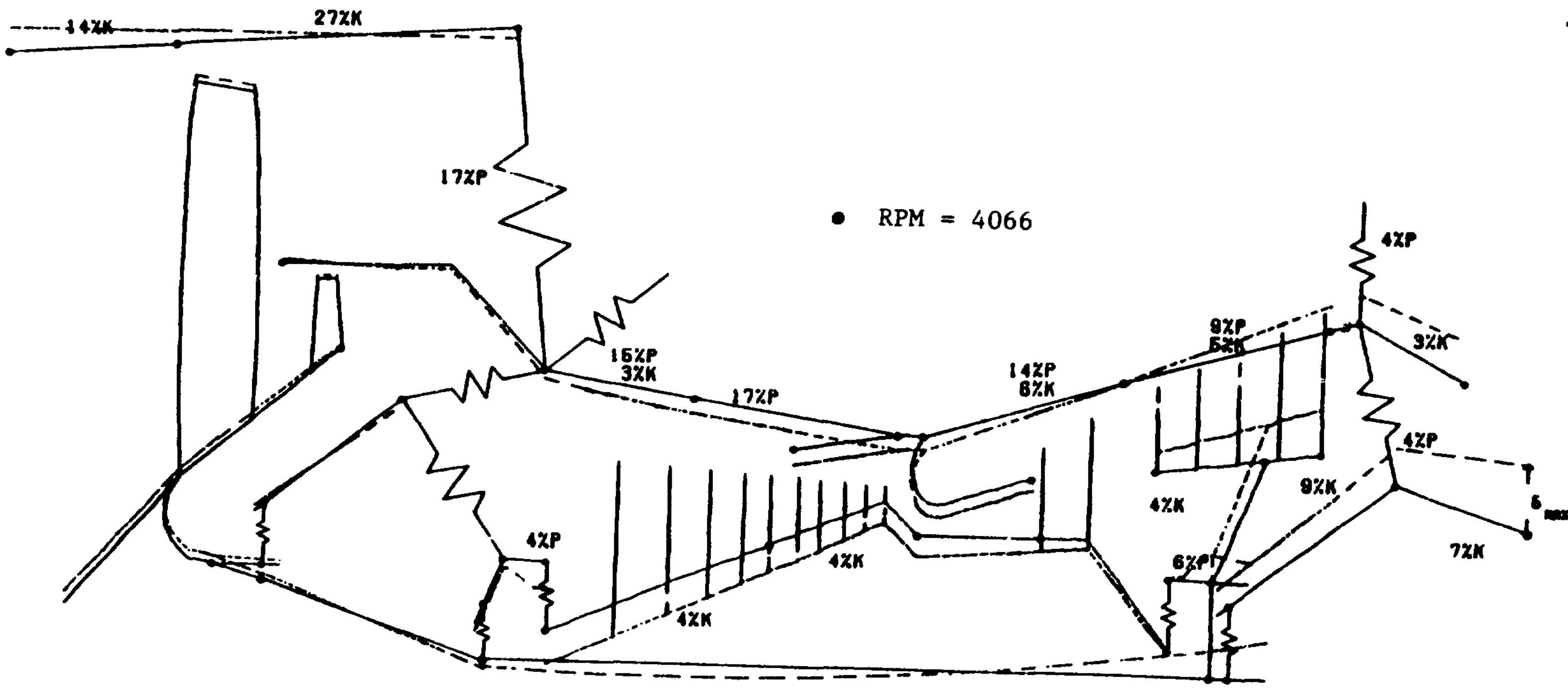


Figure 28. EEE-ICLS LP Synchronous Baseline for Complete Model.

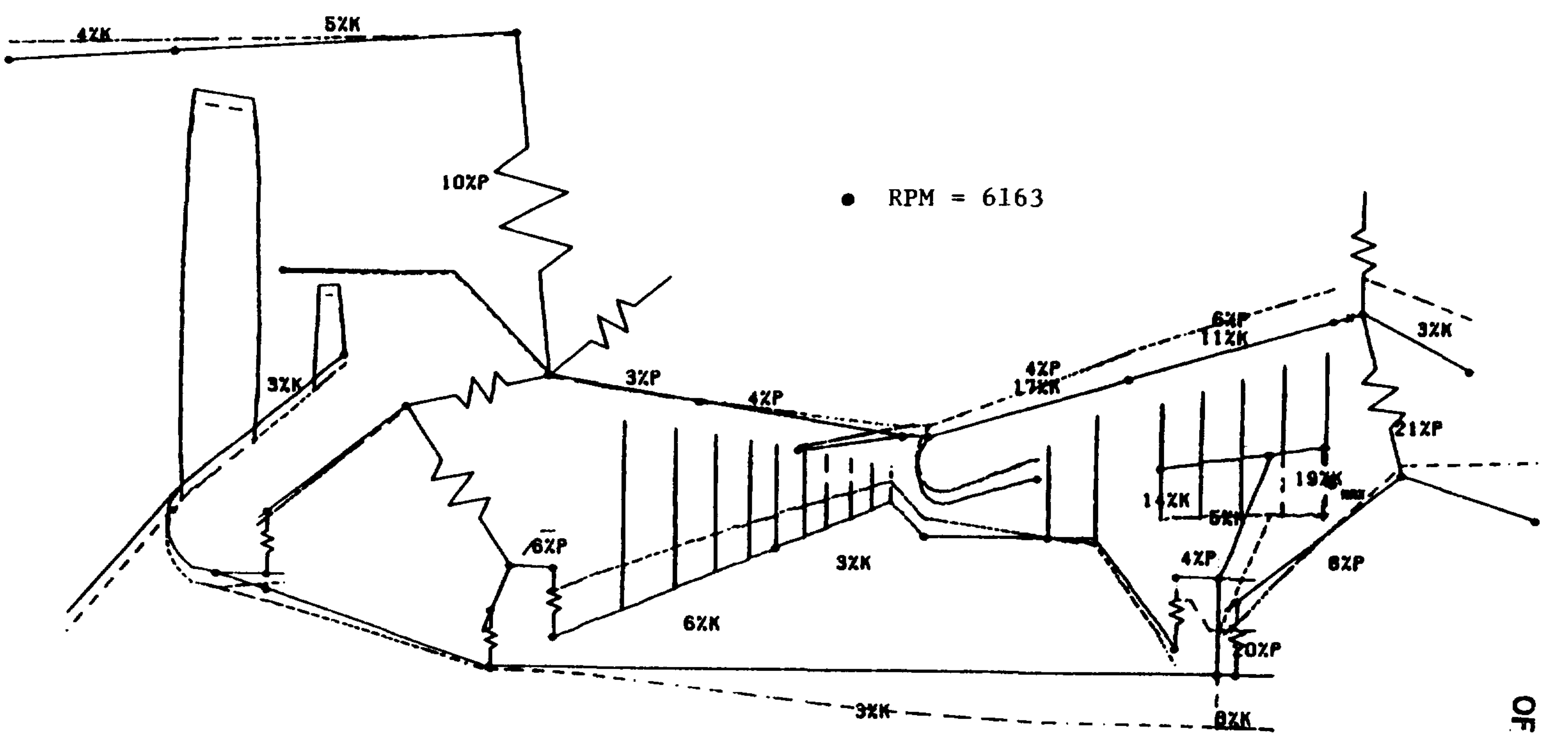


Figure 29. EEE-ICLS LP Synchronous Baseline for Complete Model.

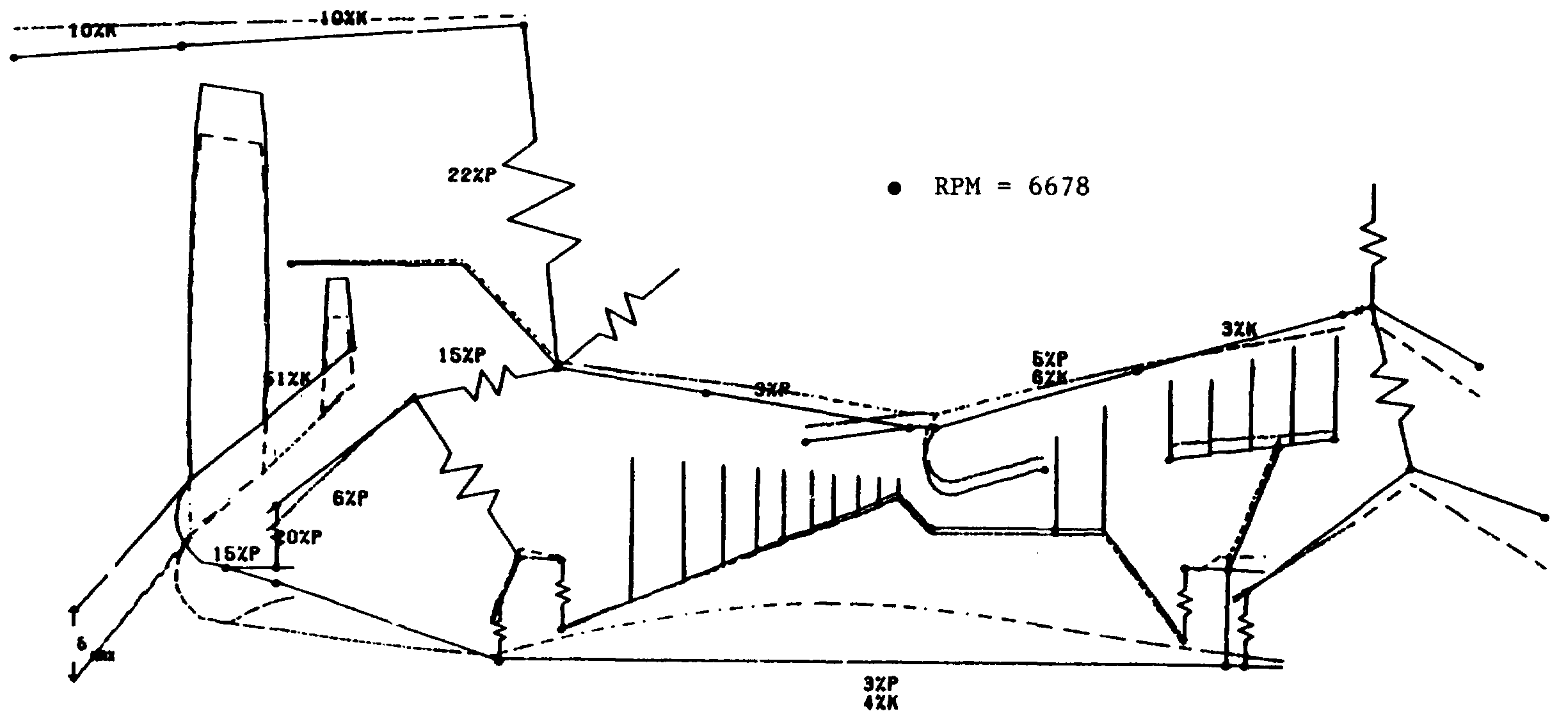


Figure 30. EEE-ICLS LP Synchronous Baseline for Complete Model.

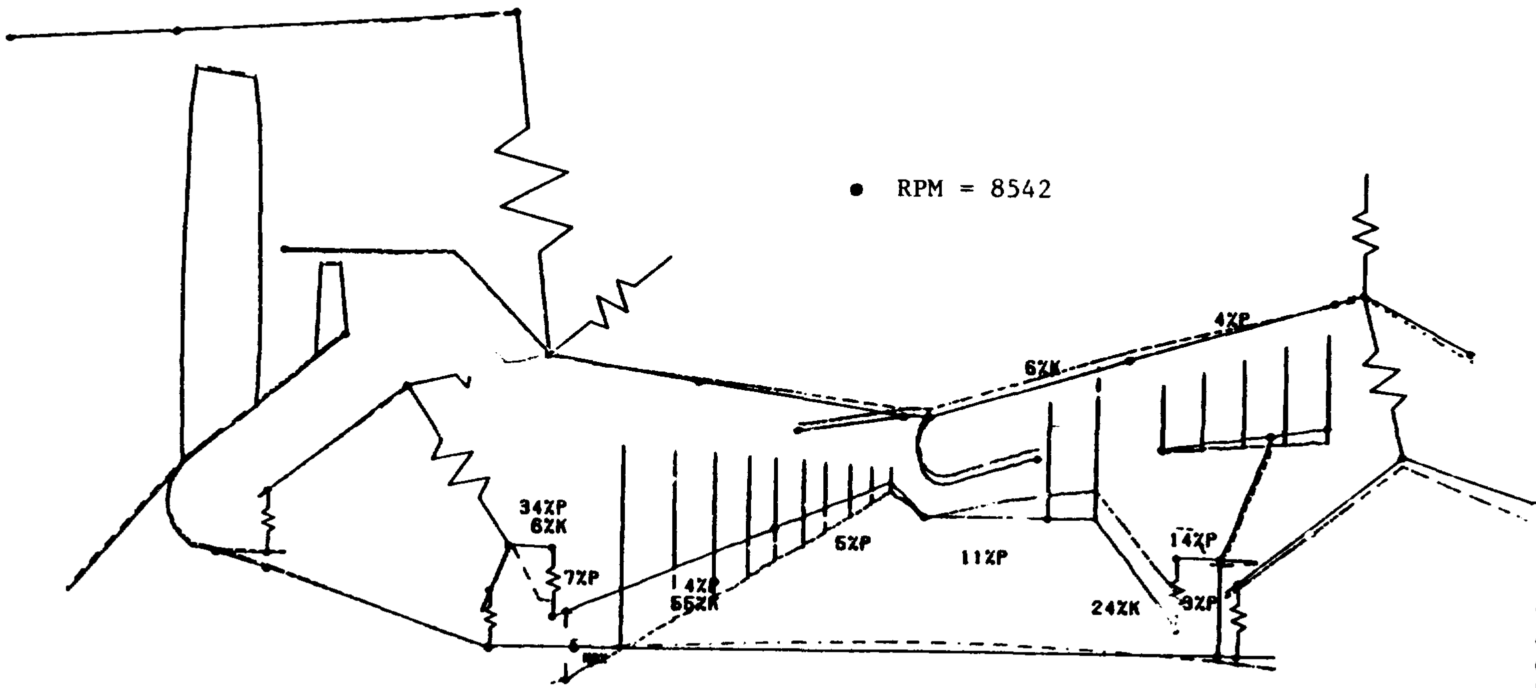


Figure 31. EEE-ICLS LP Synchronous Baseline for Complete Model.

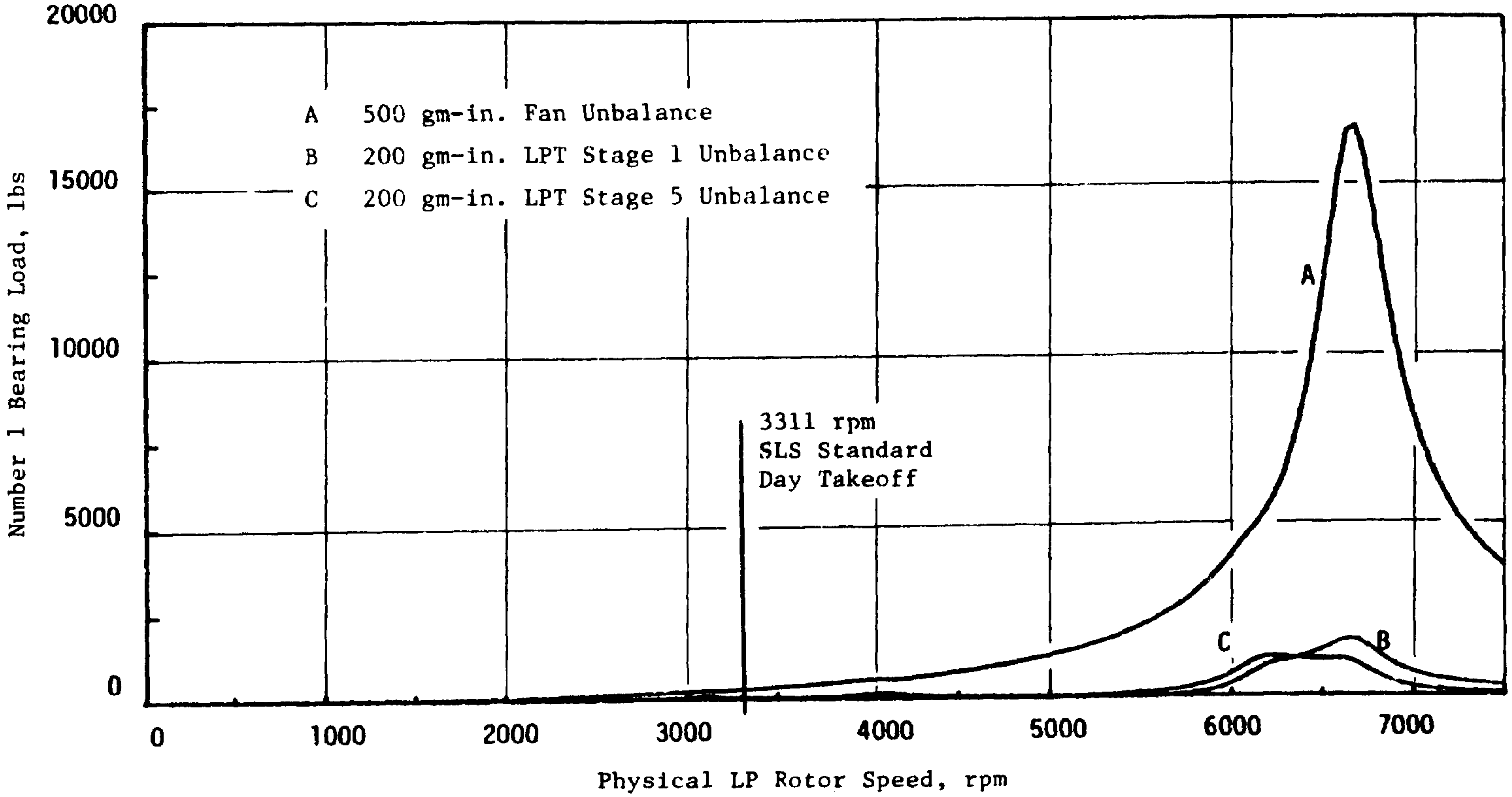


Figure 32. E^3/ICLS LP Synchronous Combined Modes Frequency Response No. 1 Bearing Load Versus LP Rotor Speed.

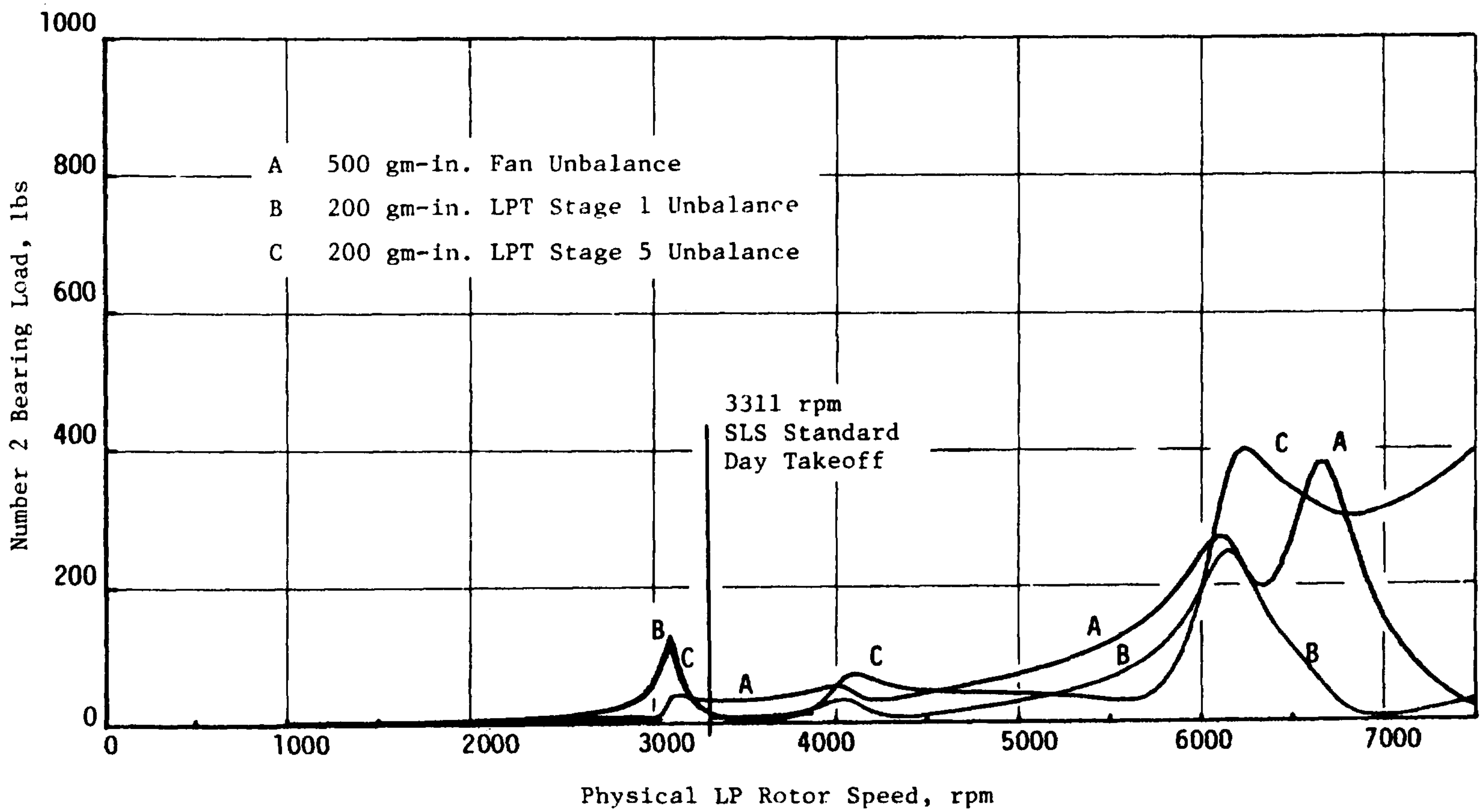


Figure 33. E^3/ICLS LP Synchronous Combined Modes Frequency Response No. 2 Bearing Load Versus LP Rotor Speed.

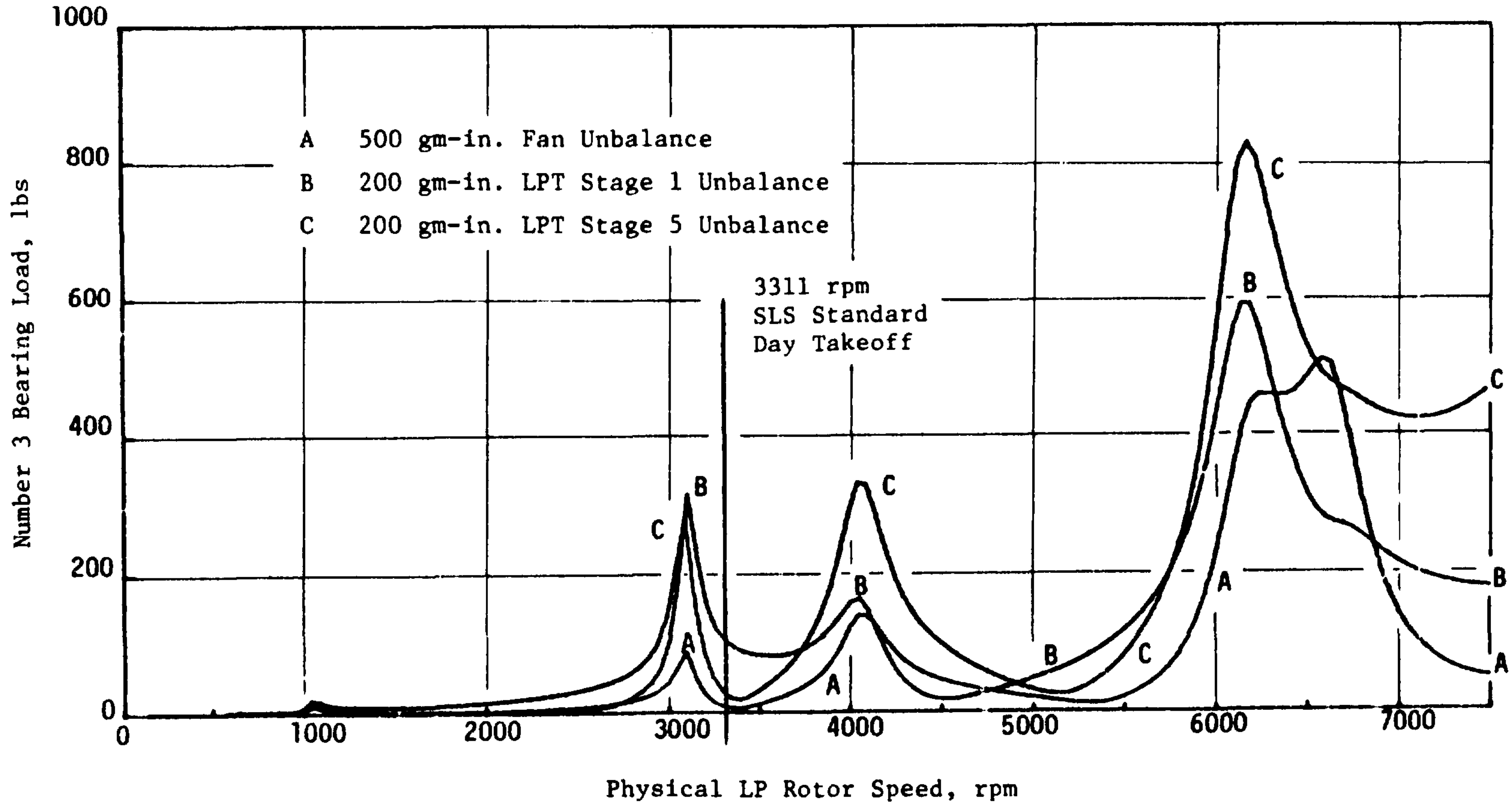


Figure 34. E^3/ICLS LP Synchronous Combined Modes Frequency Response No. 3 Bearing Load Versus LP Rotor Speed.

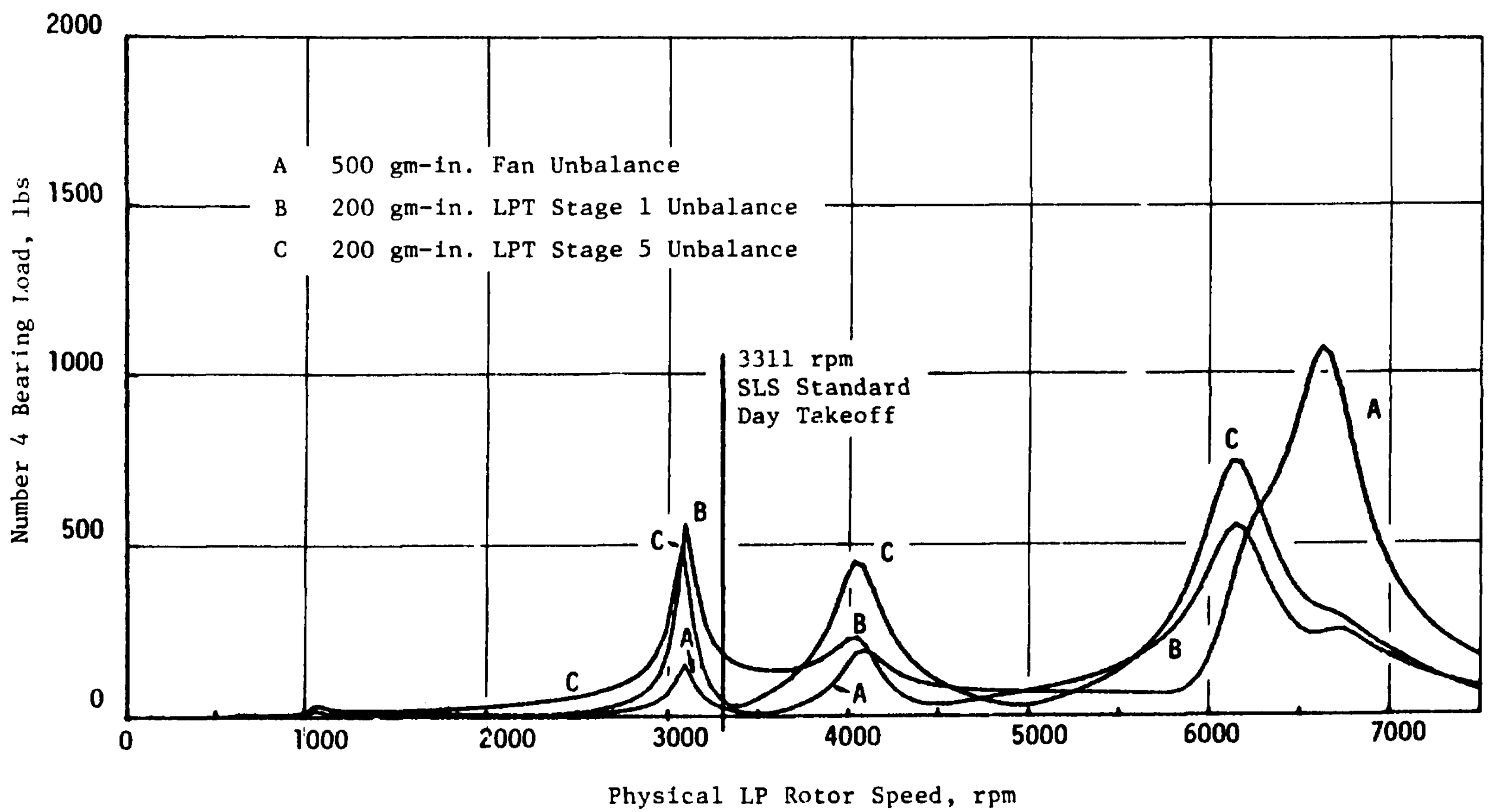


Figure 35. E^3/ICLS Synchronous Combined Modes Frequency Response No. 4 Bearing Load Versus LP Rotor Speed.

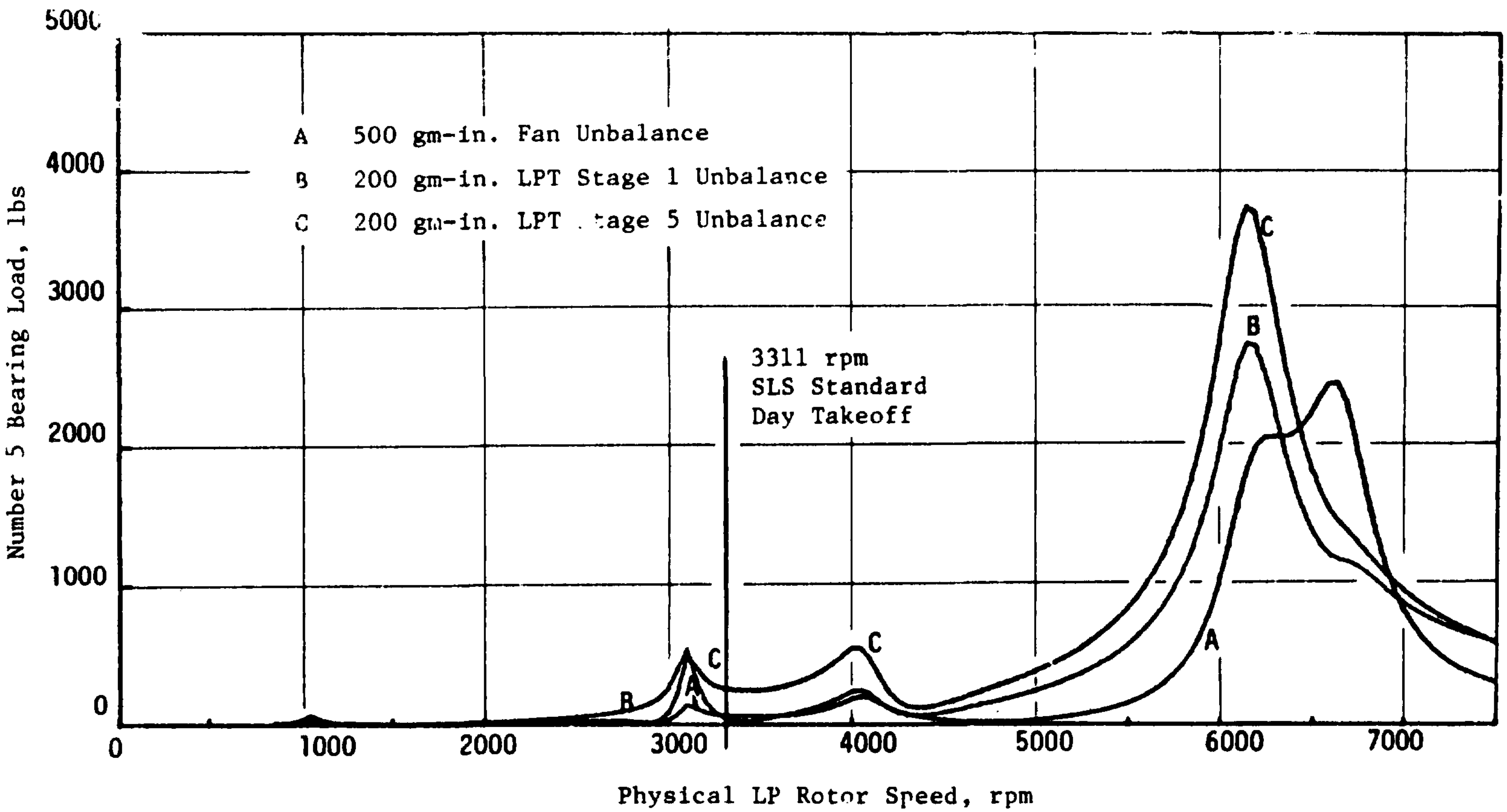


Figure 36. E^3/ICLS LP Synchronous Combined Modes Frequency Response No. 5 Bearing Load Versus LP Rotor Speed.

$$\text{Effective Q-factor} = Q_{EQ} = \frac{Q_f}{1 - \frac{\omega}{\dot{\phi}}}$$

ω = Rotational Speed $\dot{\phi}$ = Frequency of Vibration

6.3 TETRA MODEL SUBSYSTEMS AND CONNECTING ELEMENTS

The baseline VAST model was broken down into three subsystems and five connecting elements plus one rub element as shown in Figure 37. Spans 1-10 from the baseline VAST model were used to generate the LP Rotor subsystem. Figure 38 illustrates this subsystem simply supported with 100 lb/in. springs (spring numbers 1 and 5). The soft springs were used to simulate free-free end conditions. Spans 11 - 14 from the baseline VAST model were used to generate the HP Rotor subsystem. Span Numbers 11 - 14 were changed to 1-4 as required by the VAST convention. Figure 39 illustrates the HP Rotor subsystem simply supported with 100 lb/in. springs (spring Numbers 3 and 4). Spans 15-30 from the baseline VAST model were used along with external Springs 51, 52, 53, 81, 91, 101 and 102 to generate the static structure subsystem. The span numbers were changed from 15-30 to 1-16 as required for the VAST convention. Static structure subsystem supports were modeled as 100,000 lb/in. springs (spring Numbers 101 and 102) to represent the engine mount system. Figure 40 illustrates the static structure subsystem. Gyroscopic stiffening was deleted from both rotor subsystem models since the TETRA program addresses gyroscopic stiffening as discrete input.

The VAST program was used to compute critical speeds for each subsystem from the rigid body modes up to about twenty times the low rotor maximum speed. Mode shapes and energy distribution (potential and kinetic) were computed for each critical speed. The critical speeds are listed in Table 3 and the undamped mode shapes are illustrated in Figures 41 through 56. Modal deflections are indicated by the broken line and referenced to the undeflected solid line. Maximum deflection point is indicated by δ_{MAX}, and all other deflections are plotted relative to this point. However, since the span lengths are not illustrated exactly to scale, changes in slope are only accurate for individual spans but not between spans at the joints.

Characteristics of the physical connecting elements are summarized in Table 4. Uncoupled point spring-damper elements (Type 5) represent the five main engine bearings which assemble the six subsystems into the complete engine system. Radial stiffnesses listed for Bearings 1, 2 and 5 are based on analysis along with CF6 experience and testing since the ICLS bearings are similar to those used in the CF6. Radial stiffnesses for bearings 3 and 4 represent the bearings in series with centering springs which are used to isolate core rotor vibration. Squirrel cages with 300,000 lb/in radial spring rates are used at both ends of the core rotor. Squirrel cage stiffnesses were determined using a finite element analysis. The Number 3 bearing radial stiffness is 1,000,000 lb/in. and the Number 4 bearing radial stiffness is

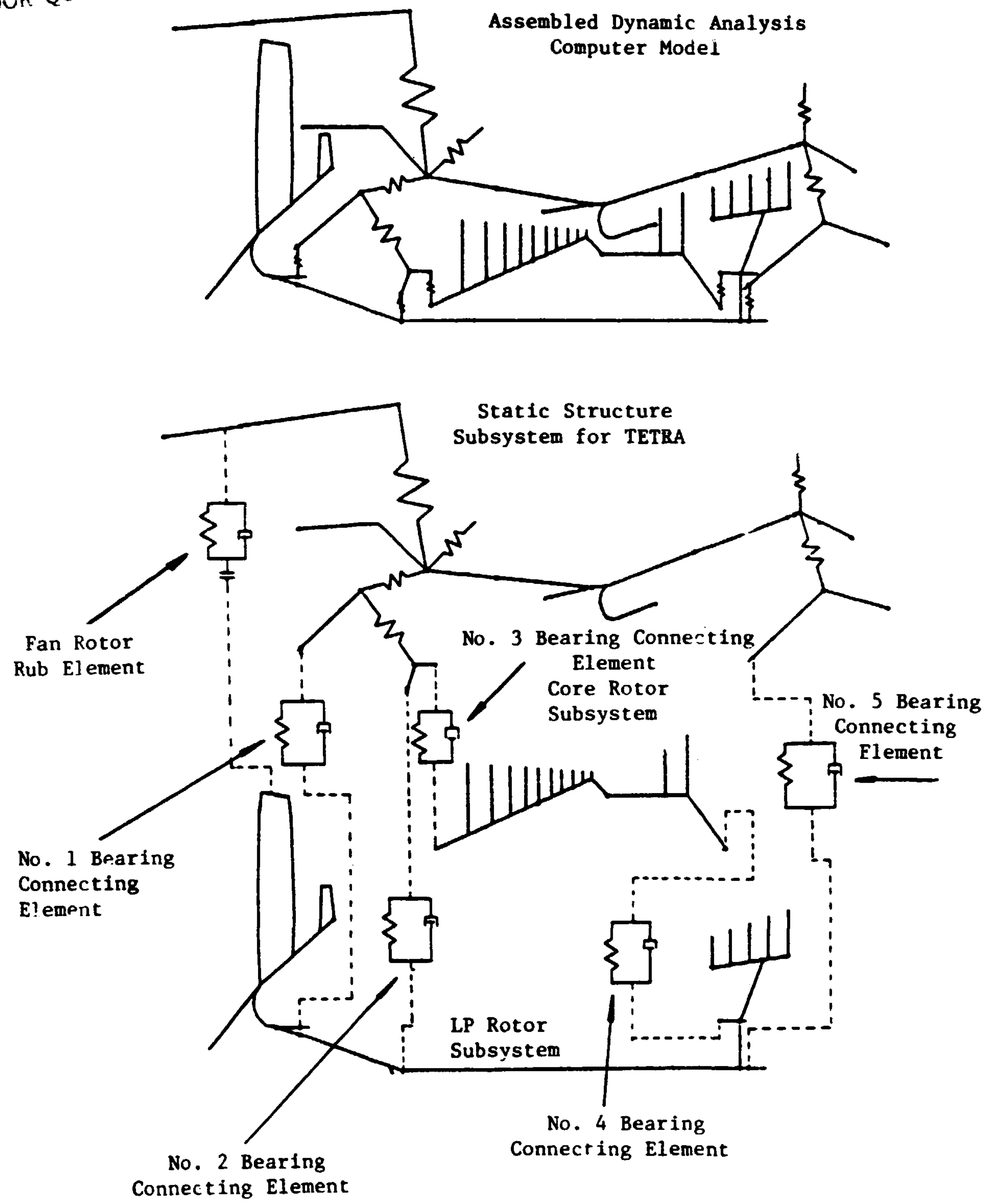


Figure 37. Subsystems and Connecting Elements.

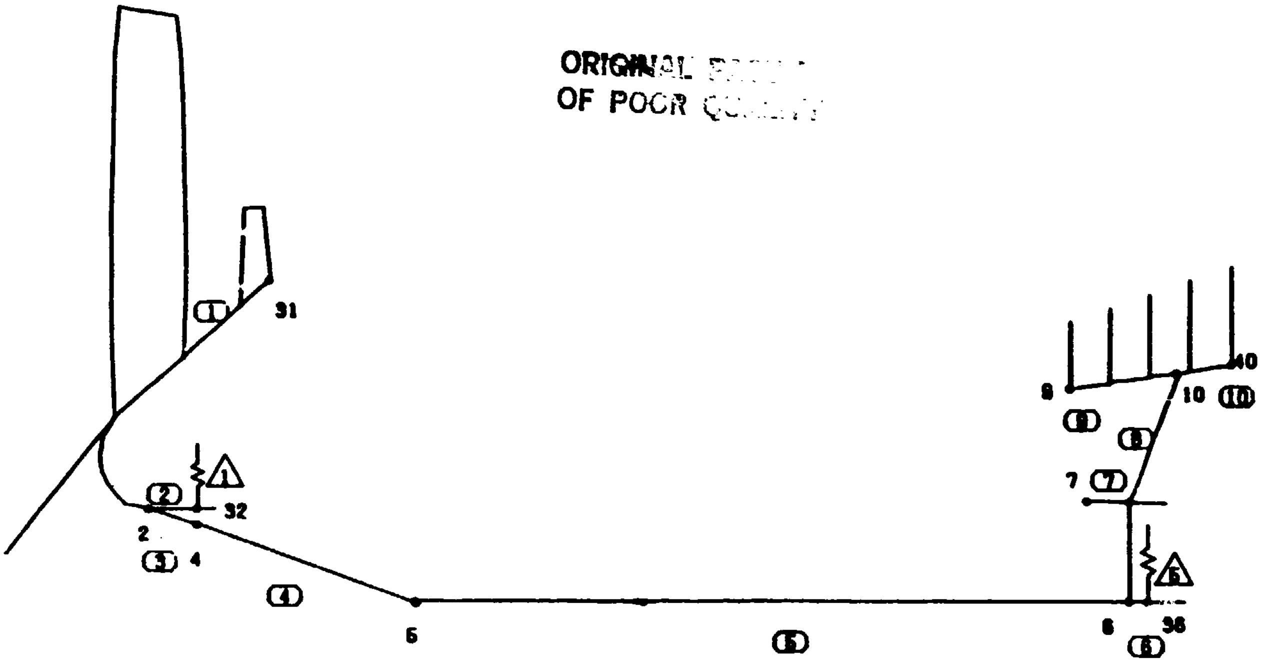


Figure 38. EEE-ICLS LP Rotor Subsystem for TETRA.

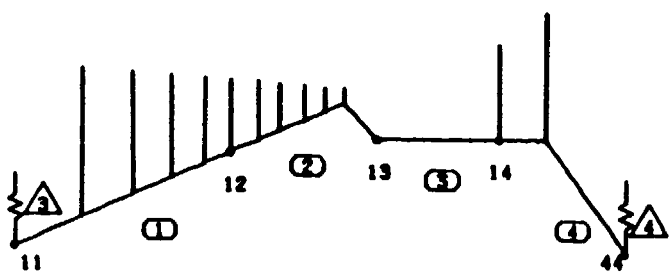


Figure 39. EEE-ICLS Core Rotor Subsystem for TETRA.

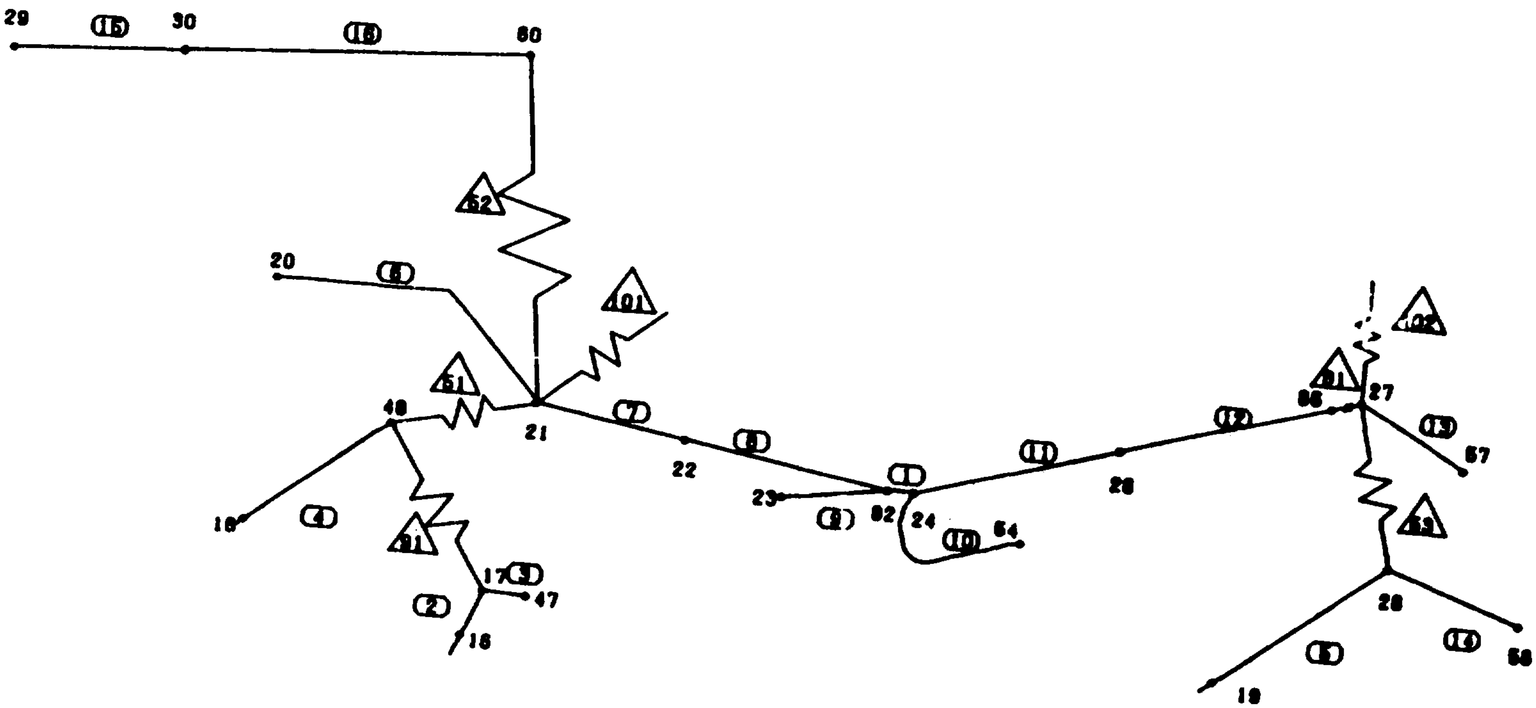


Figure 40. EEE-ICLS Static Structure Subsystem for TETRA.

Table 3. Subsystem Critical Speeds.

LP Rotor Subsystem rpm	HP Rotor Subsystem rpm	Static Structure Subsystem rpm	
53	73	718	39416
62	139	1341	43312
1273	16459	4351	46780
2847	29833	8541	50137
8121	38775	11476	53499
16218	51787	13131	54901
28098	66916	17011	59089
37651	74534	18937	65253
40193	87882	21255	71144
43146		24719	74502
50931		27768	75901
57298		28989	76634
69020		31863	78499
87068		38147	

ICLS max speed = 3311 rpm
FPS growth max speed = 4100 rpm

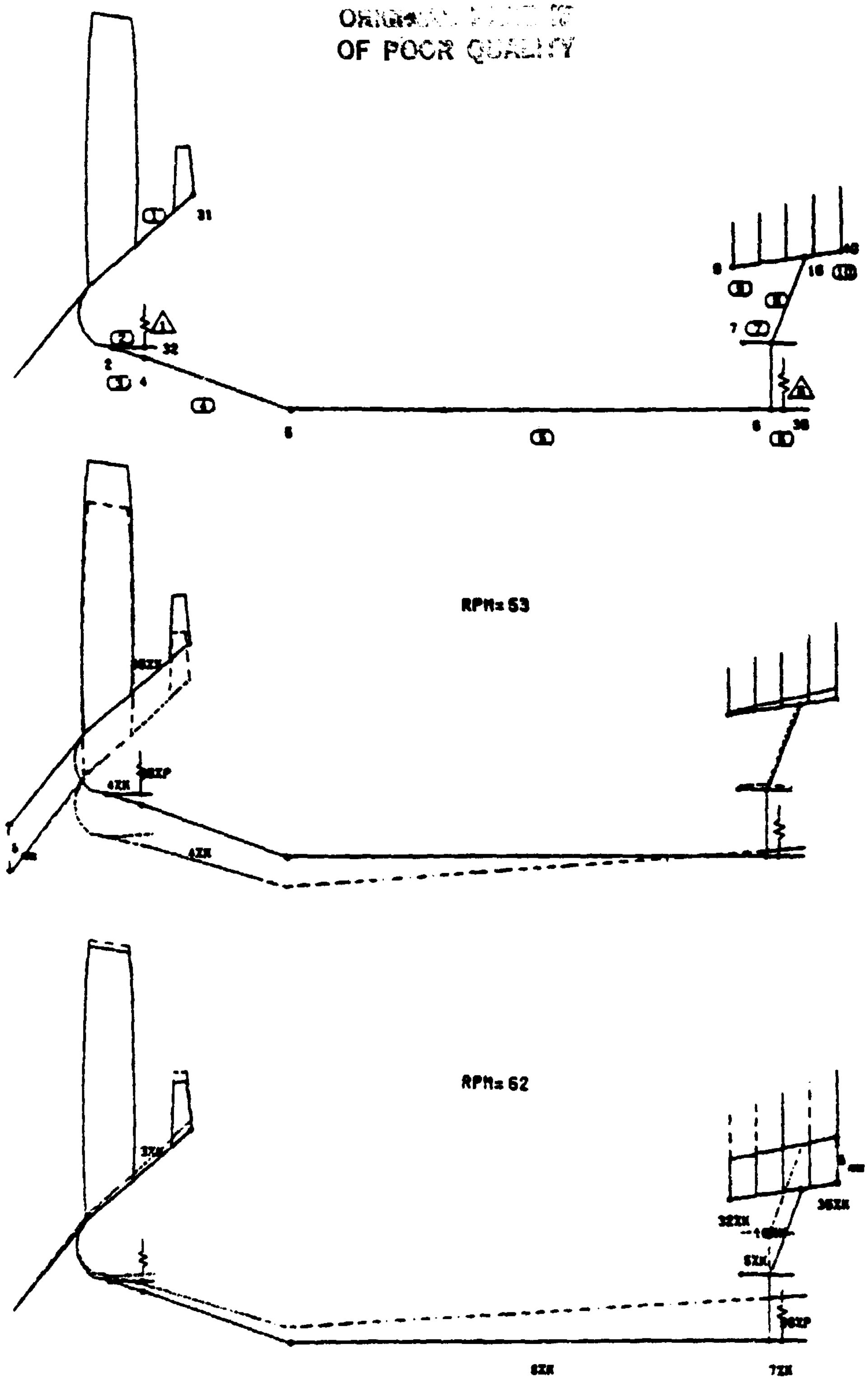


Figure 41. EEE-ICLS LP Rotor Subsystem for TETRA.

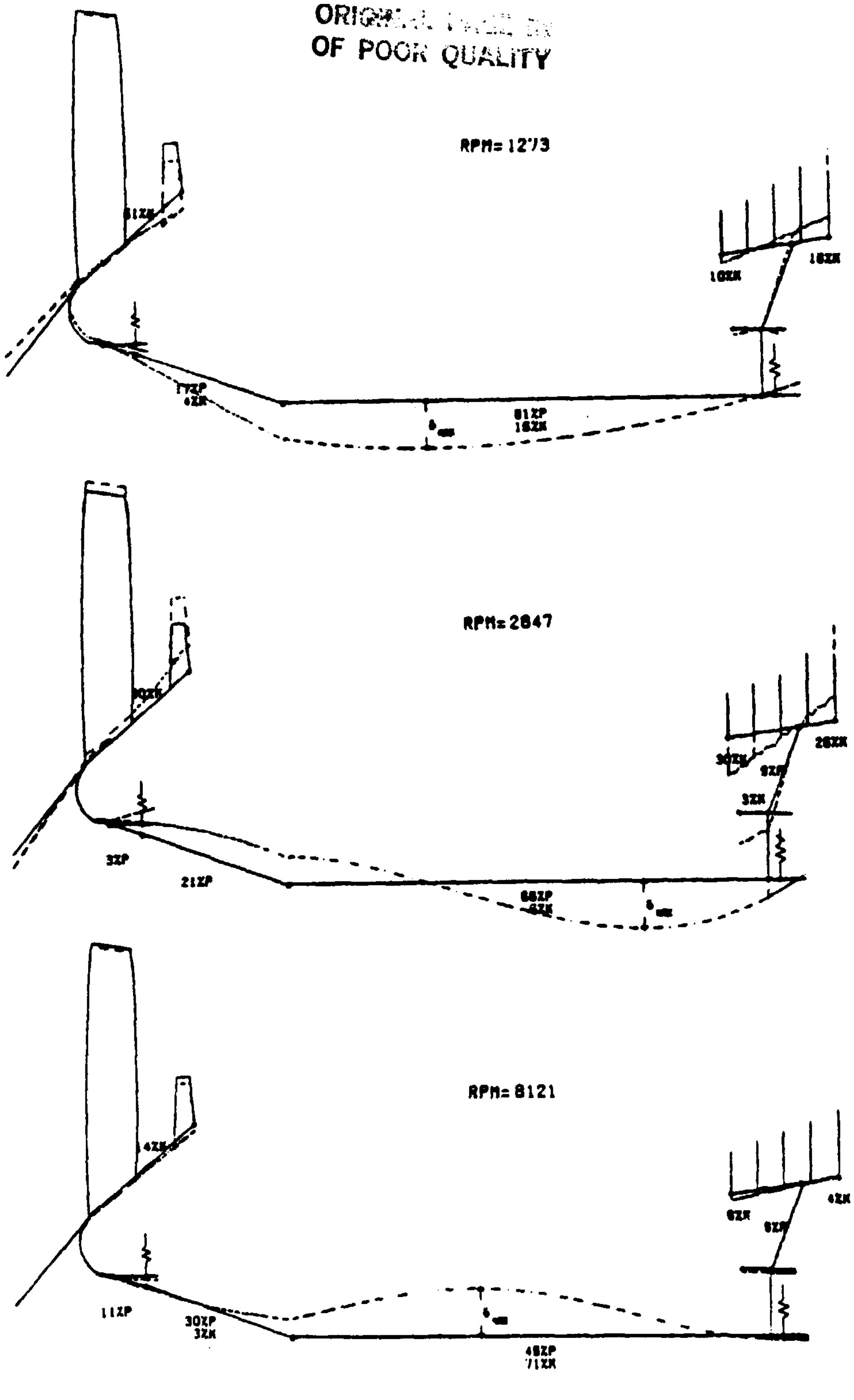


Figure 42. EEE-ICLS LP Rotor Subsystem for TETRA.

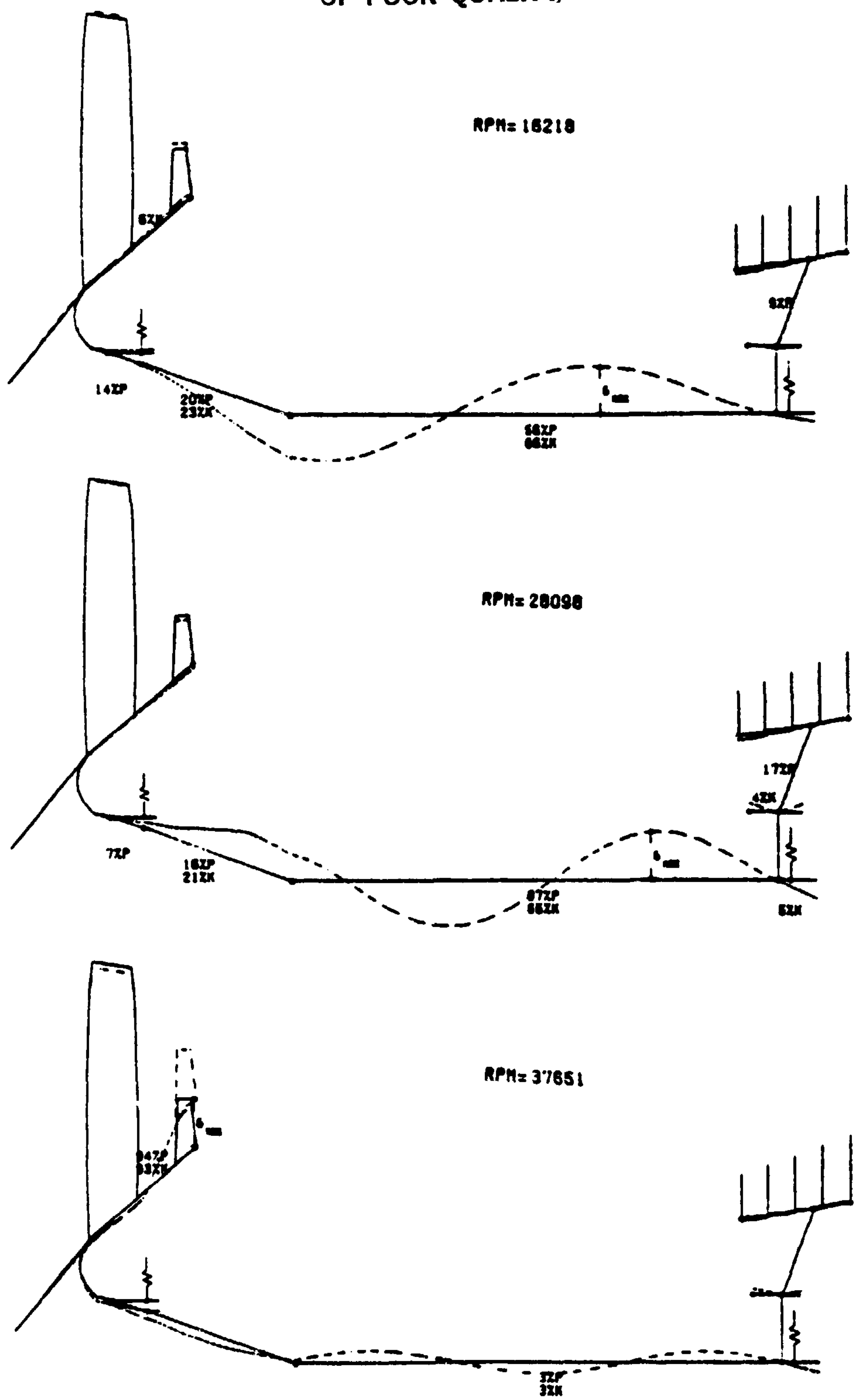


Figure 43. EEE-ICLS LP Rotor Subsystem for TETRA.

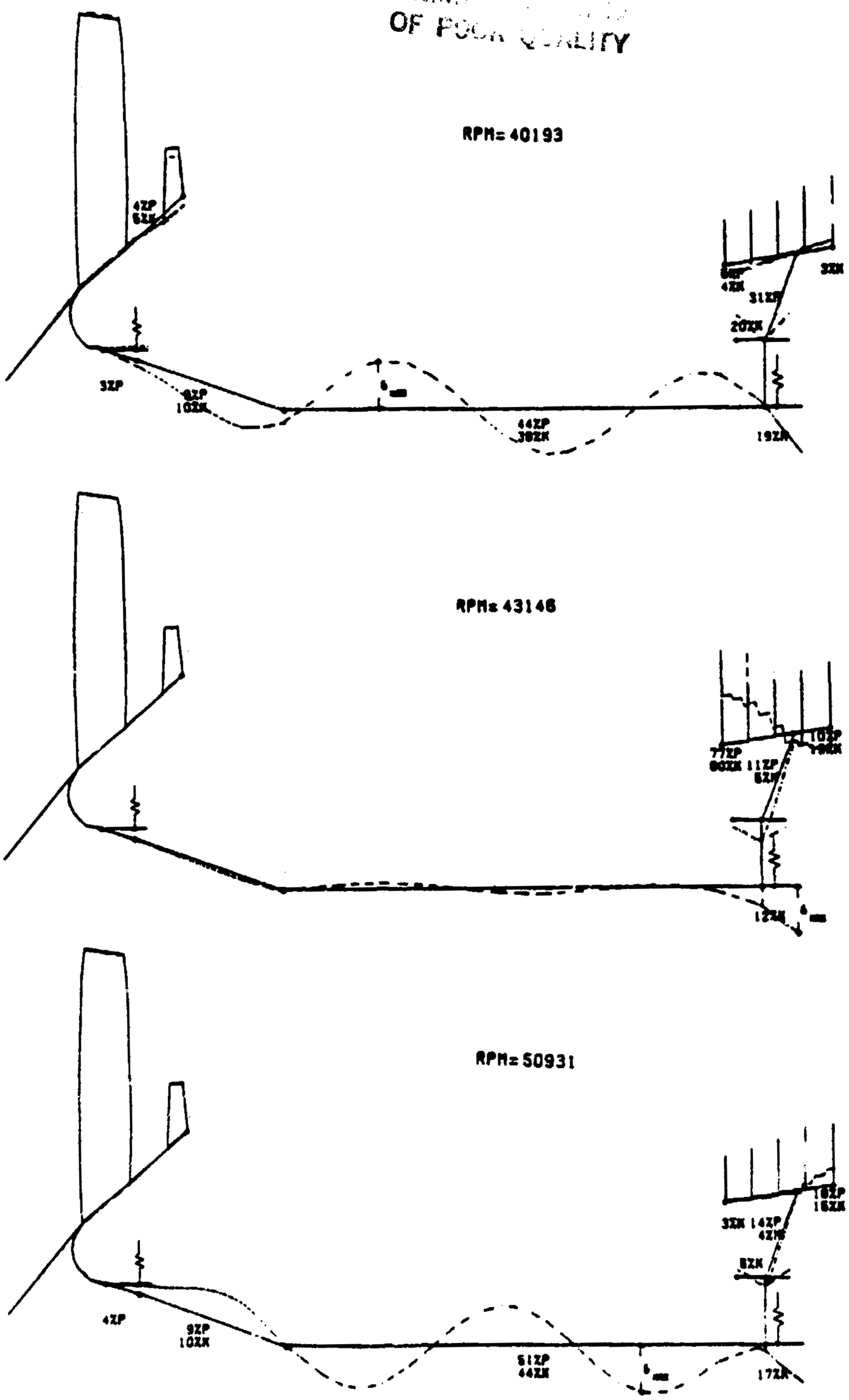


Figure 44. EEE-ICLS LP Rotor Subsystem for TETRA.

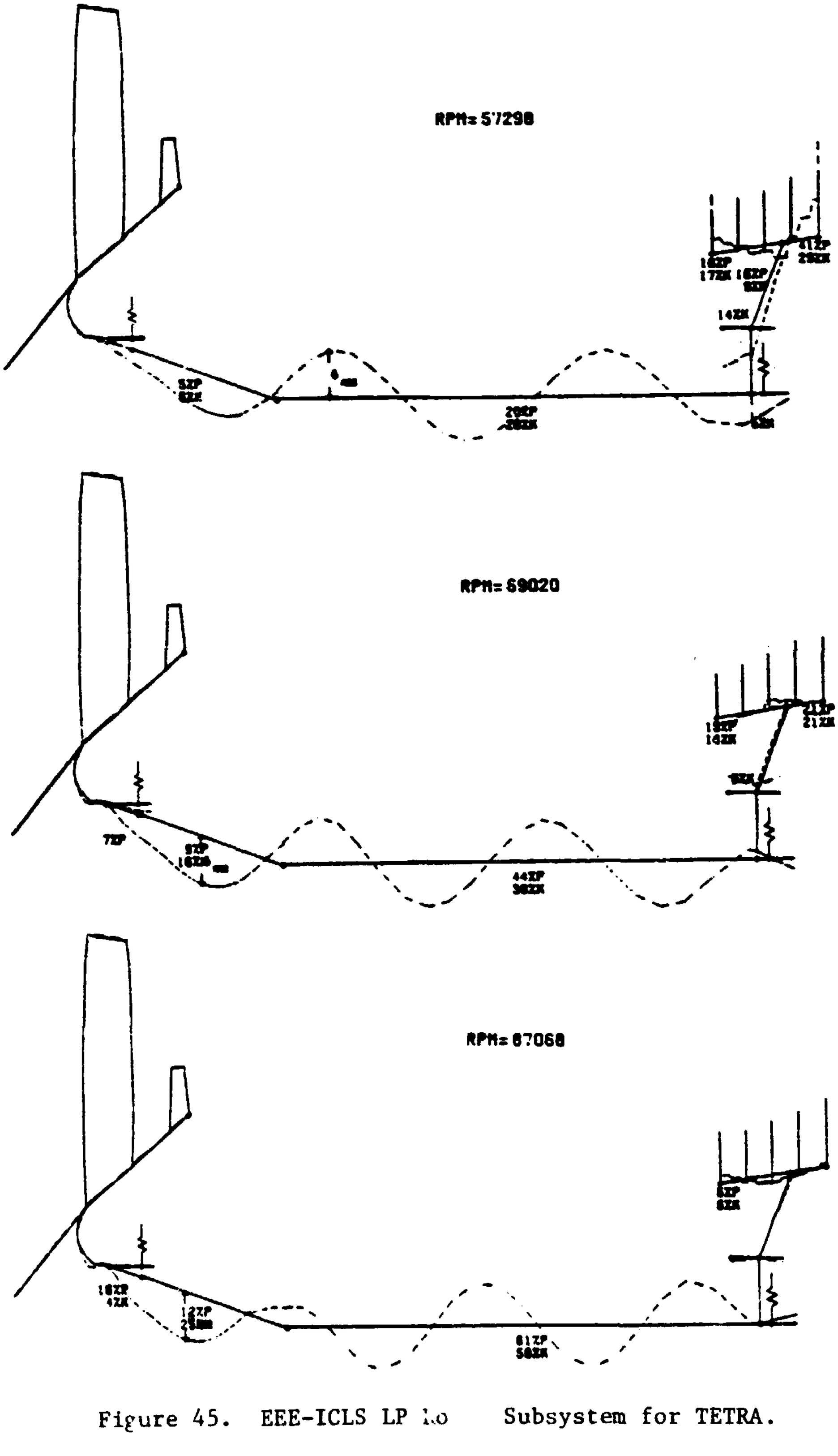


Figure 45. EEE-ICLS LP Lo Subsystem for TETRA.

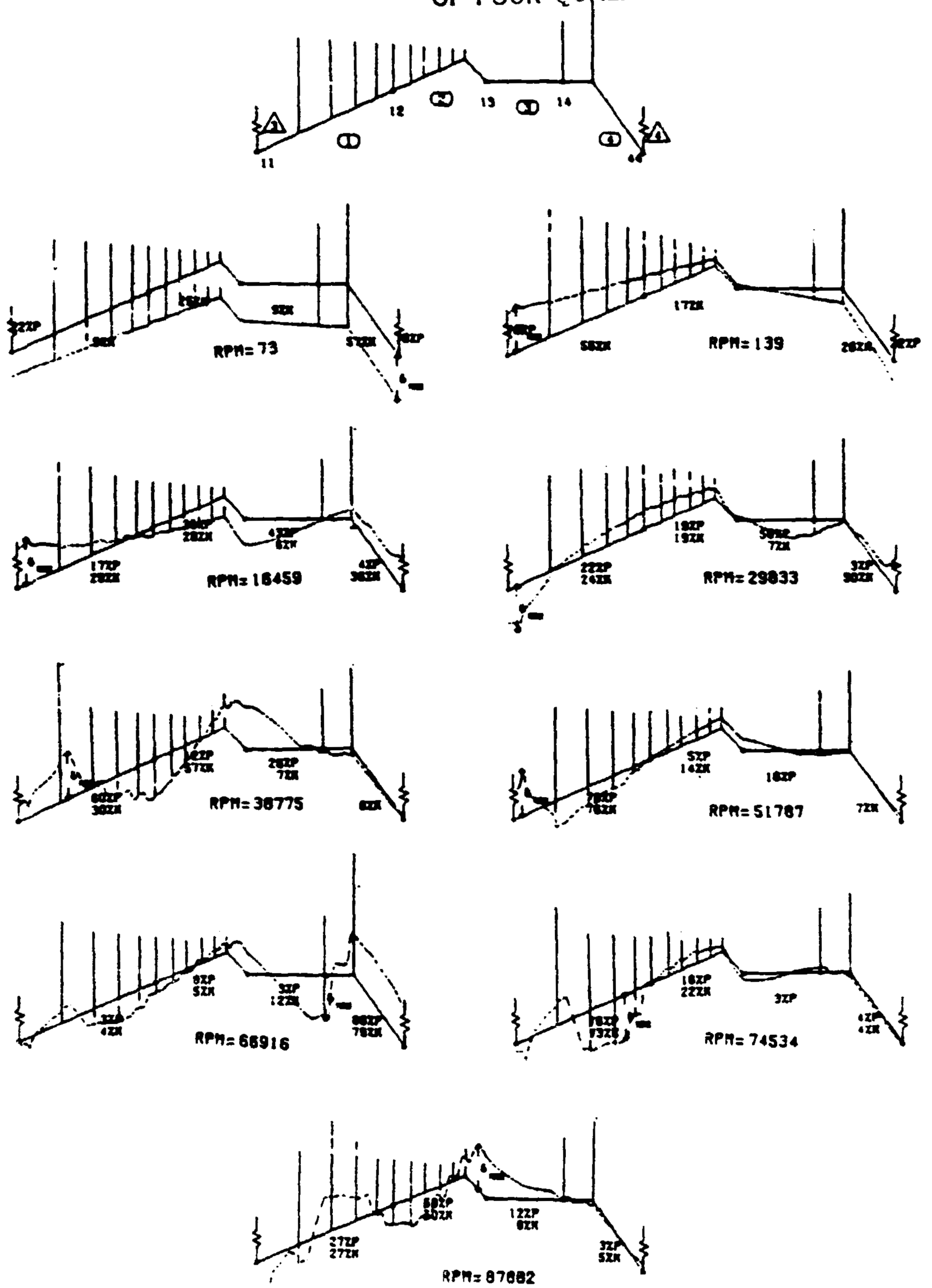


Figure 46. EEE-ICLS Core Rotor Subsystem for TETRA.

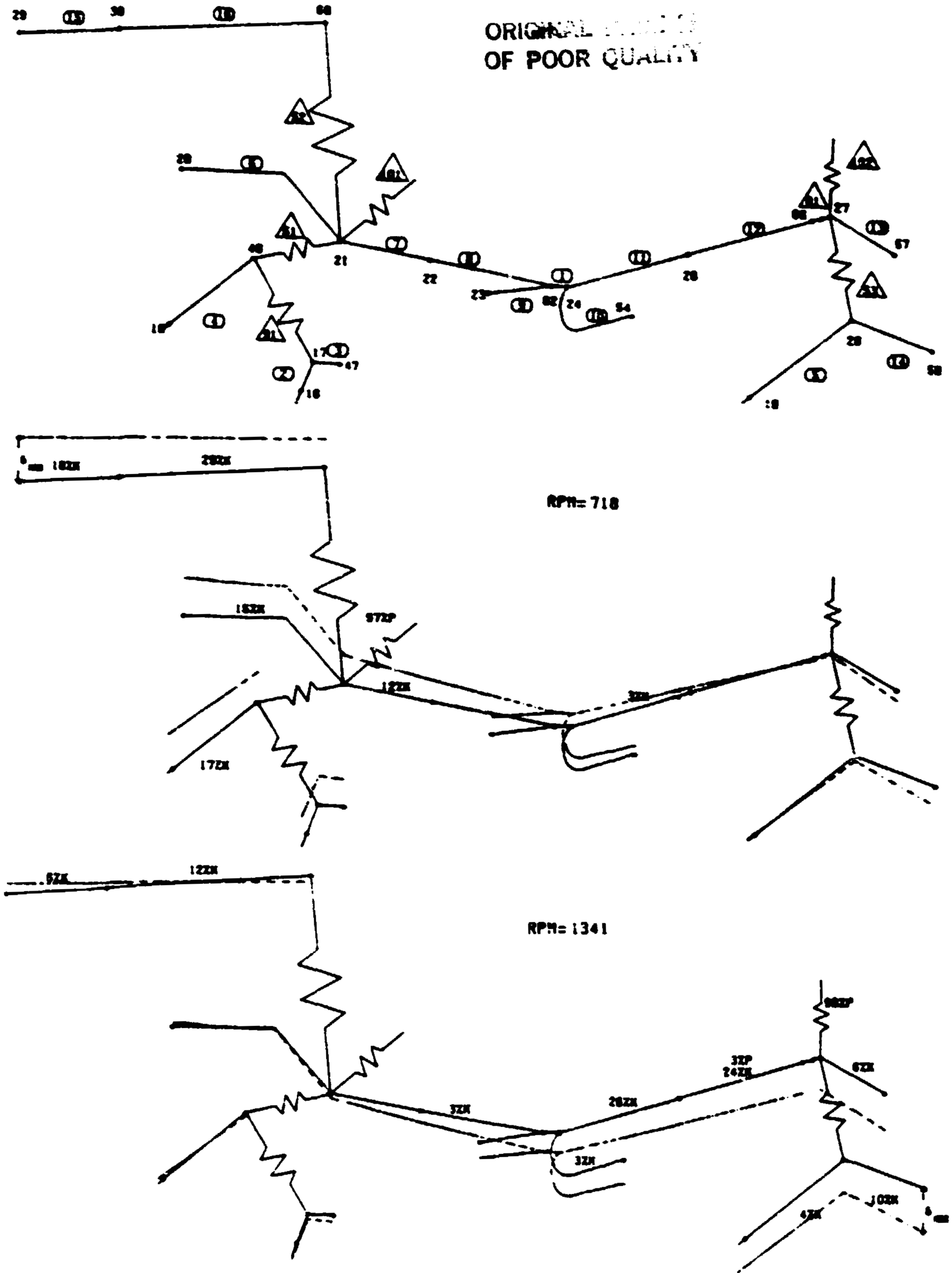


Figure 47. EEE-ICLS Static Structure Subsystem for TETRA.

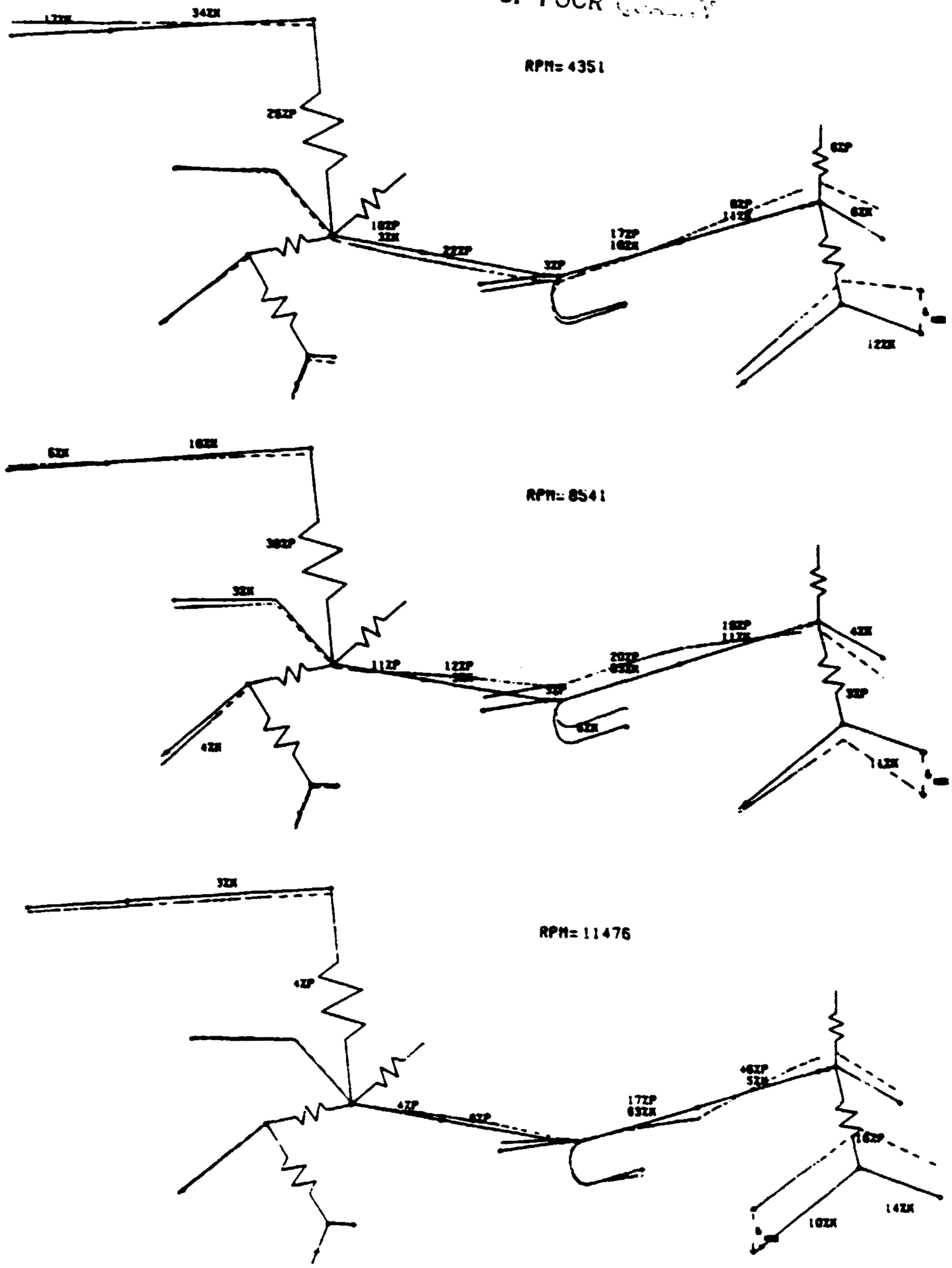


Figure 48. EEE-ICLS Static Structure Subsystem for TETRA.

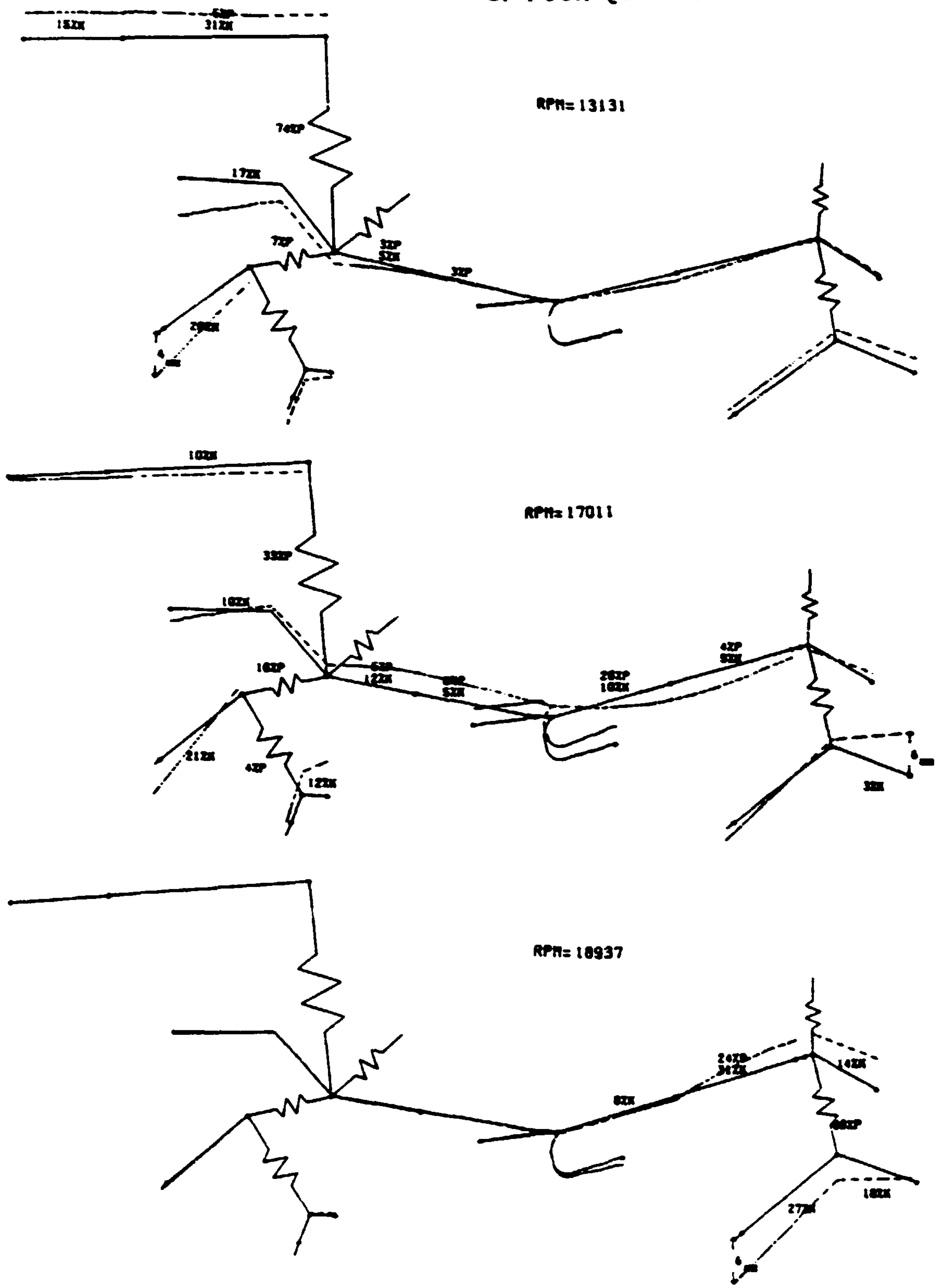


Figure 49. EEE-ICLS Static Structure Subsystem for TETRA.

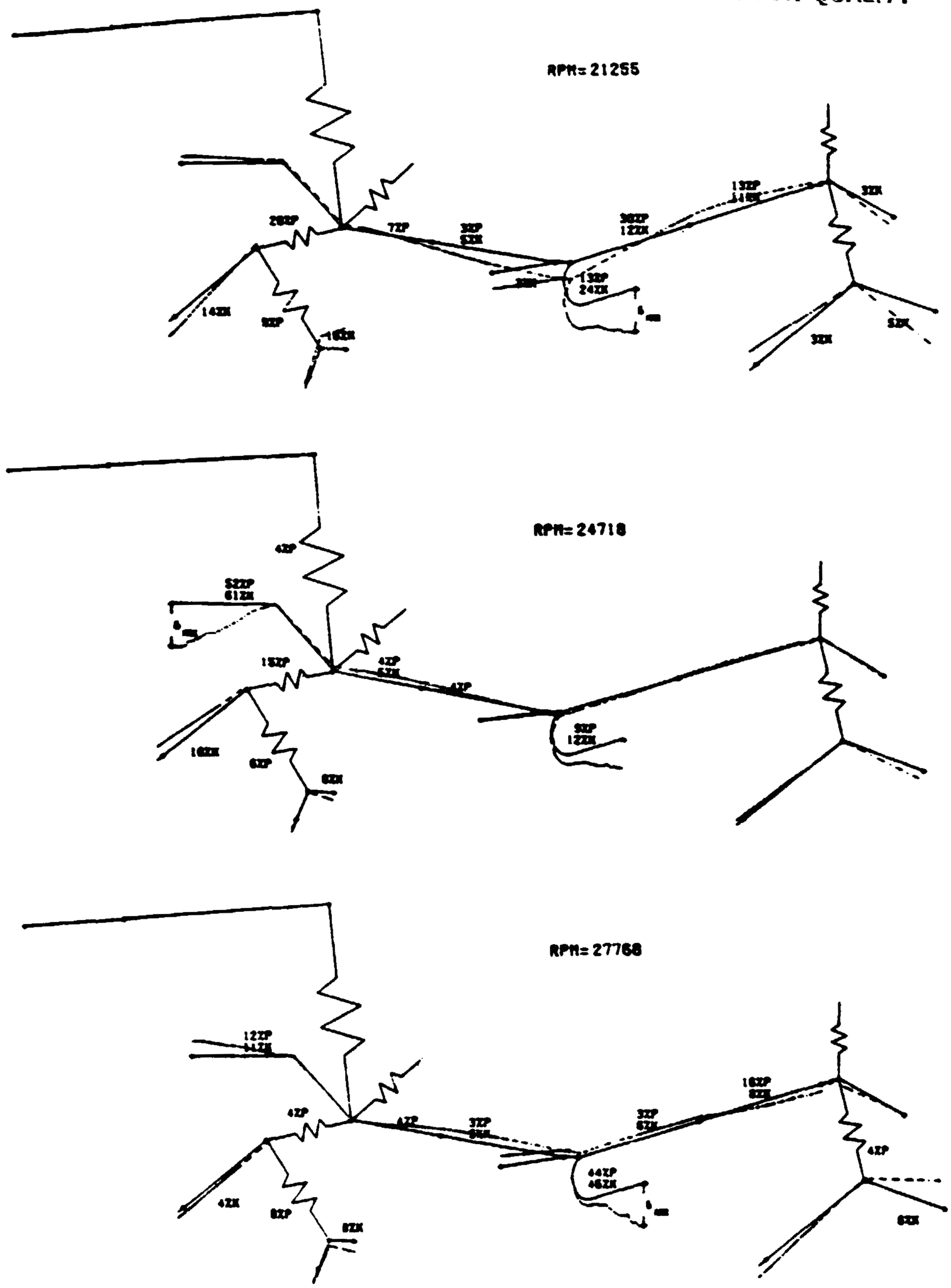


Figure 50. EEE-ICLS Static Structure Subsystem for TETRA.

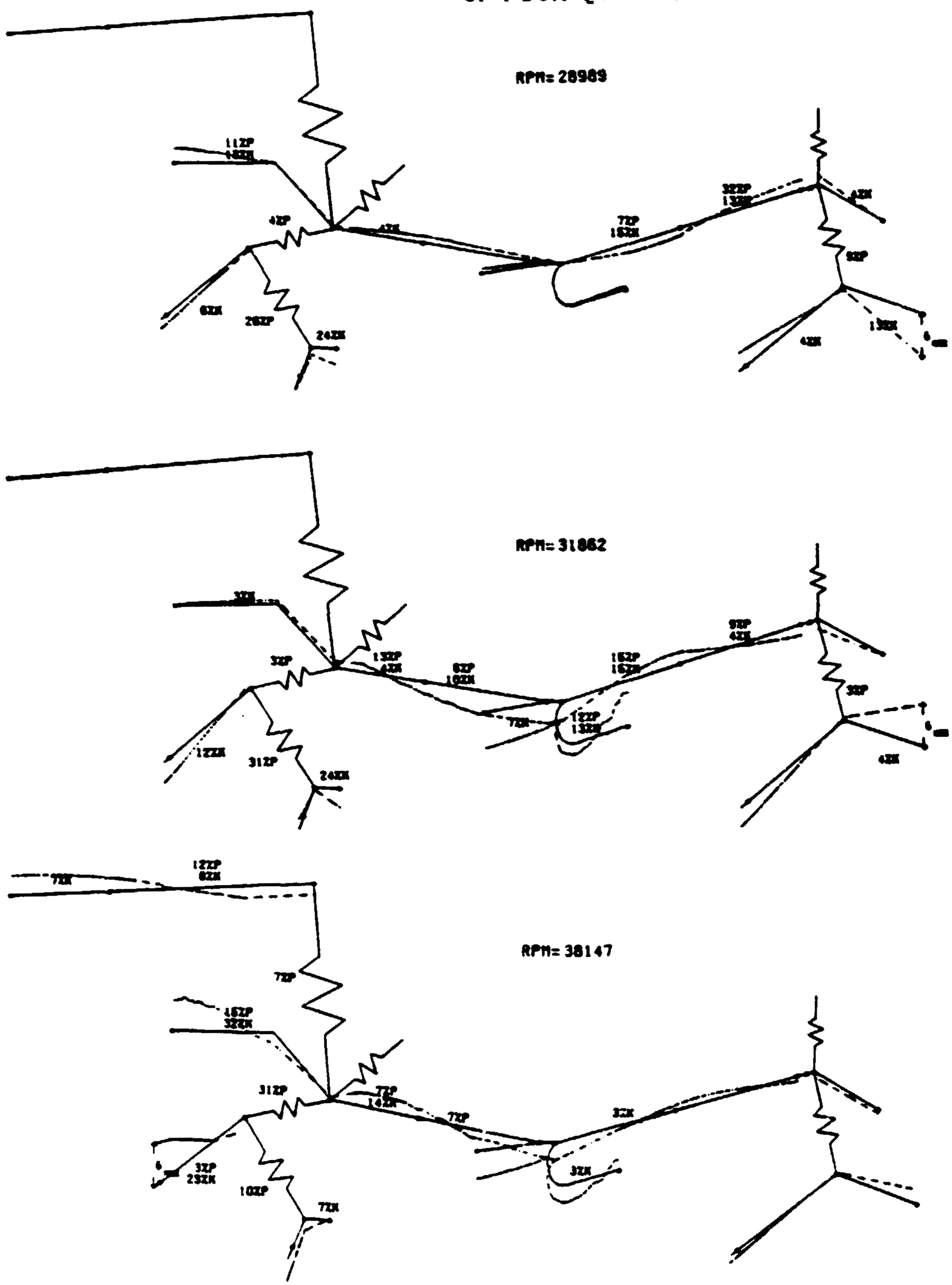


Figure 51. EEE-ICLS Static Structure Subsystem for TETRA.

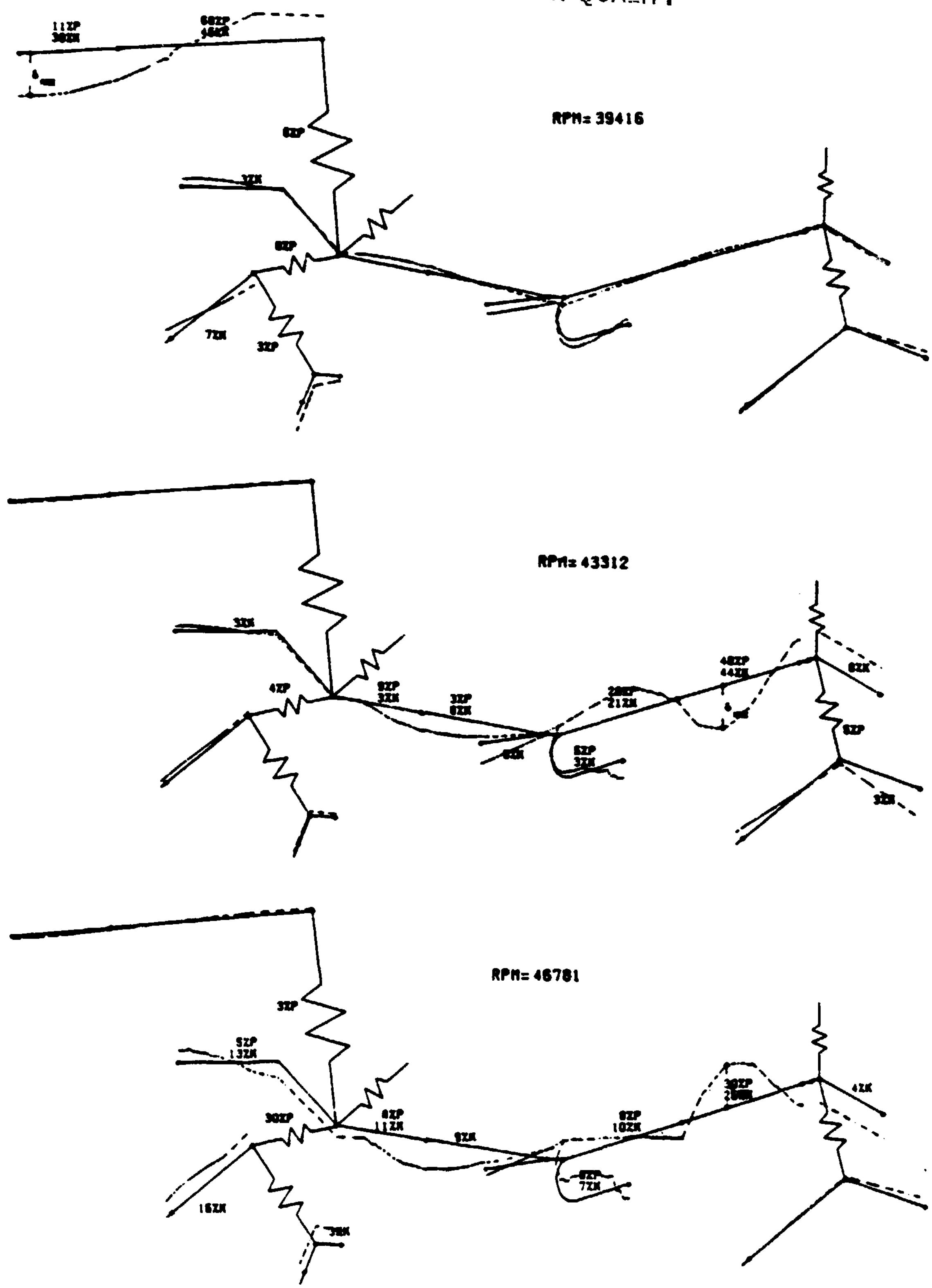


Figure 52. EEE-ICLS Static Structure Subsystem for TETRA.

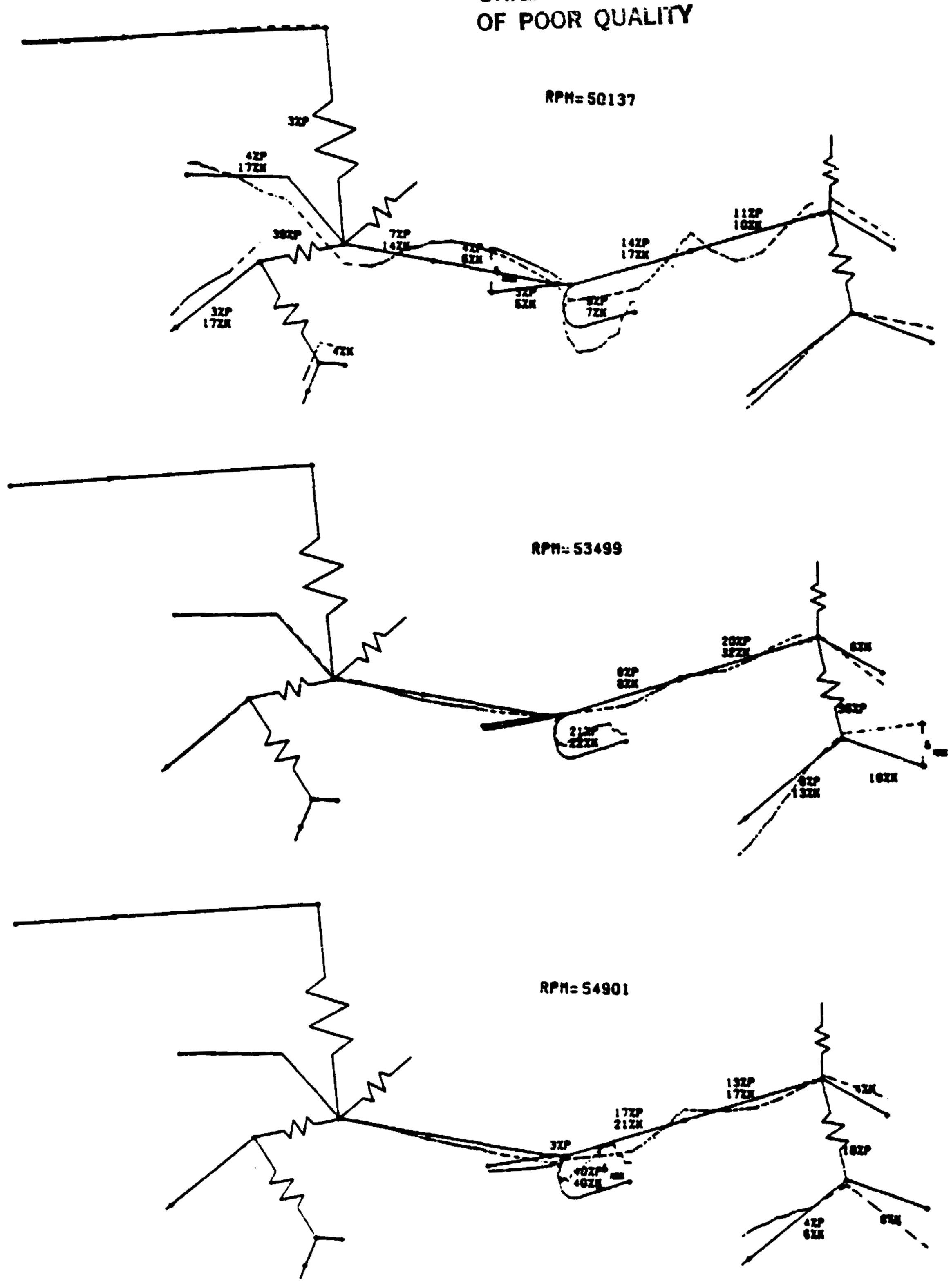


Figure 53. EEE-ICLS Static Structure Subsystem for TETRA.

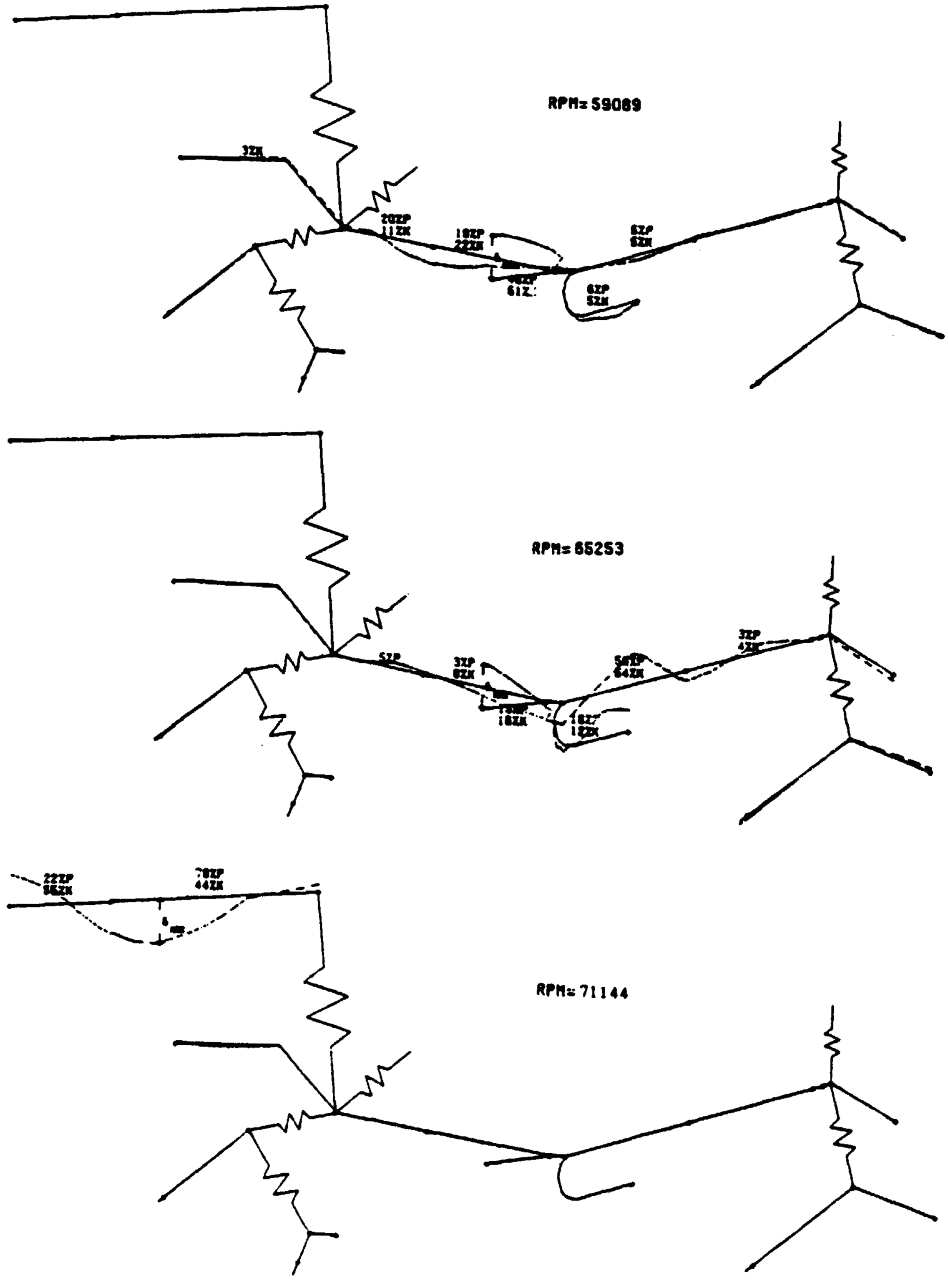


Figure 54. EEE-ICLS Static Structure Subsystem for TETRA.

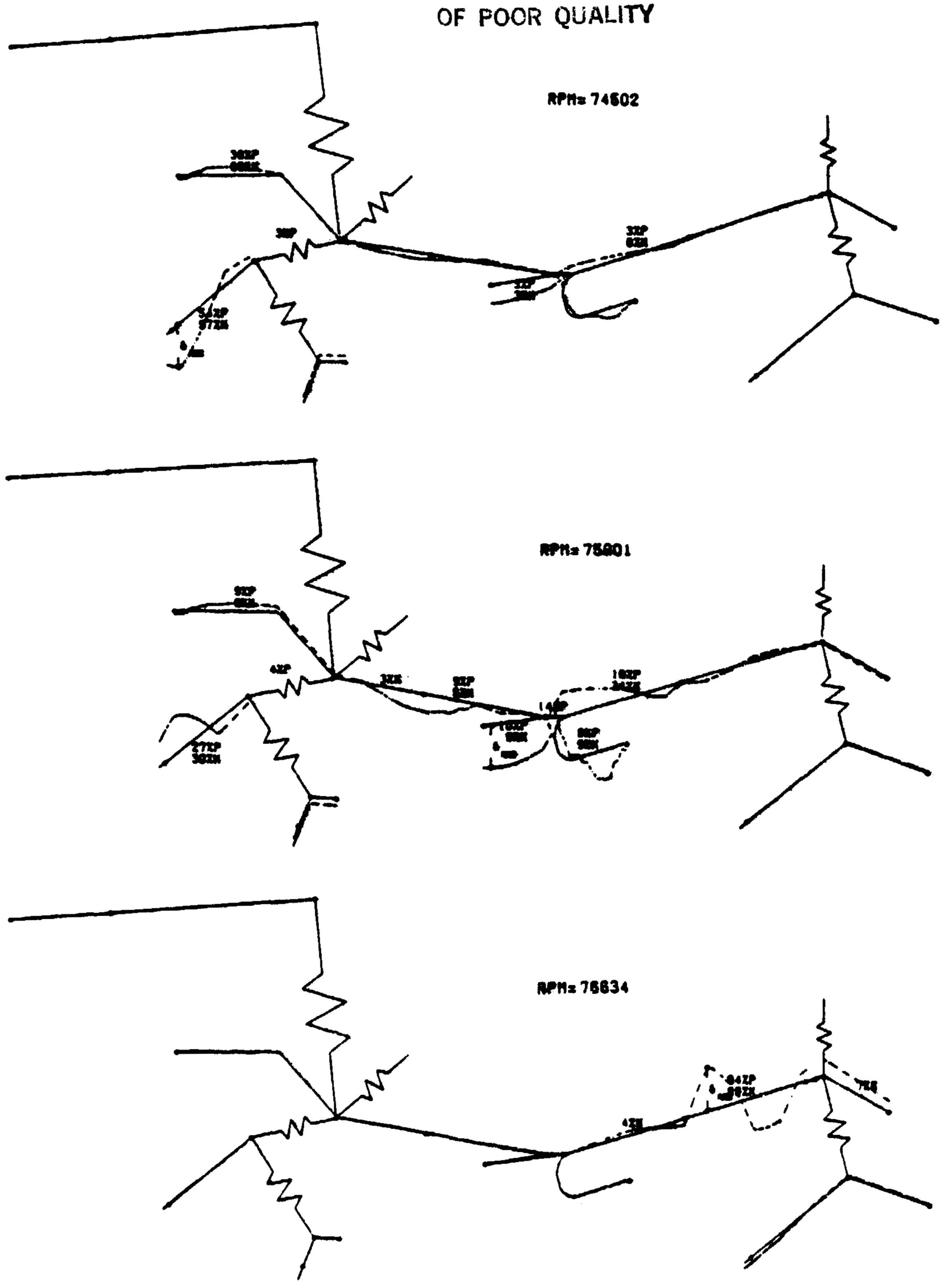


Figure 55. EŁE-ICLS Static Structure Subsystem for TETRA.

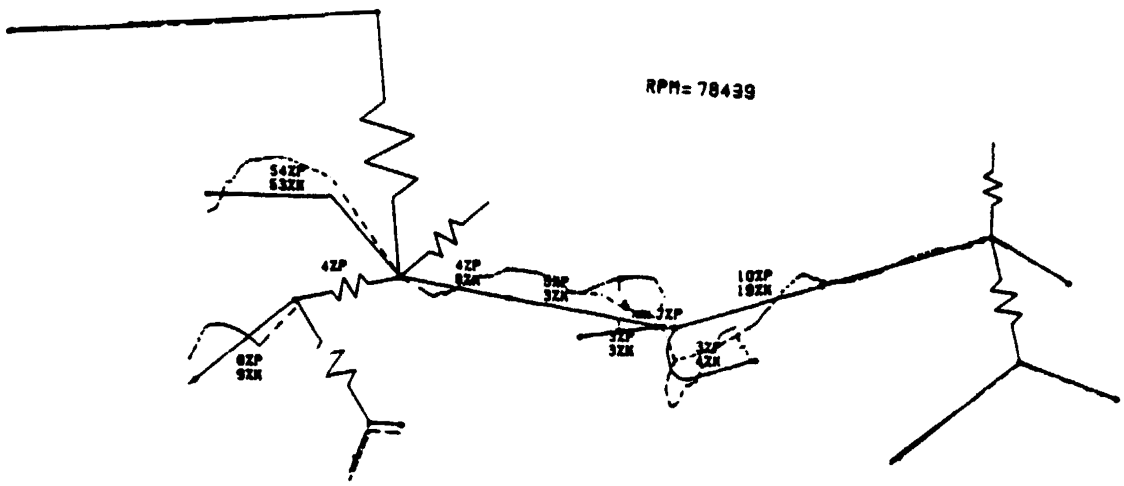


Figure 56. EEE-ICLS Static Structure Subsystem for TETRA.

Table 4. Connecting Elements.

Type 5 Physical Connecting Elements
(Uncoupled Point Spring-Damper Element)

Element Description	Element Number	Connection Points		Spring Constant, lb/in.	Q-Factor	Frequency
		I-End	J-End			
No. 1 Brg.	1	3	34	4,000,000	15	55.2
No. 2 Brg.	2	4	35	1,695,000	15	55.2
No. 3 Brg.*	3	11	36	230,769	15	55.2
No. 4 Brg.*	4	20	6	248,864	15	55.2
No. 5 Brg.	5	7	37	1,500,000	15	55.2

*Includes squirrel cage spring rate of 300,000 lb/in. series with bearing

Type 3 Physical Connecting Element
(Rub Element)

Element Description	Element Number	Connection Points,		Rub Spring Constant, lb/in.	Damping Coefficient	Dead Band, mils
		I-End	J-End			
Fan Blade Rub Path	6	1	21	1,000,000	0	250

1,460,000 lb/in. as derived through analysis and CF6 experience and testing. The bearing damping is defined via a specified Q-factor and frequency pair. TETRA uses this data to calculate the equivalent viscous damping coefficient for shear as follows:

$$c = \text{damping coefficient} = \frac{k}{2\pi fQ} \quad \frac{\text{LB-SEC}}{\text{IN.}}$$

In this expression, k is the bearing spring rate (lb/in.), and f is the frequency (CYCLES/SEC). Table 4 shows that the frequency selected is equal to 55.2 Hz which corresponds to 3311 rpm, the maximum fan speed for ICLS. It will be noted that the TETRA model has been set up to obtain a solution at a fan speed of 3311 rpm. The Q-factor for normal unbalance is equal to 15 and for bladeout conditions it is equal to 7.5. These values are consistant with large turbofan experience.

The connection points are represented by physical points on the subsystems to which the connecting elements are attached, resulting in a reassembled system. Figure 57 illustrates the reassembled system and identifies the TETRA physical point numbers. No damping is included to account for the squeeze film damper located at the Number 3 bearing since this TETRA model is set up to evaluate LP unbalance and damper-system solutions have only been obtained for core rotor unbalance.

The capability to analyze the effects of secondary load paths due to rotor-case and rotor-rotor rubs is one of the TETRA programs primary features. One rub element has been included in the TETRA model that accounts for fan blade rubs with the containment case. This rub element (TYPE 3 Physical Connecting Element) is identified as connecting element Number 6 in Table 4. Based on steady-state dynamic analyses in the frequency domain that have been performed for turbofan engines with large rotor unbalance due to fan blade loss, a casing ovalization stiffness of 1,000,000 lb/in. appears to give reasonable agreement with test data. The rub element dumping coefficient is equal to zero based on the Test Vehicle TETRA bladeout analysis and test data correlation conducted in Reference 2. Radial clearance between the blade and structural casing is represented by the dead band, which is the structural clearance over which no load is transmitted. A dead band of 250 mils is indicated in Table 4 which represents the structural clearance (not flowpath clearance between blade tip and abradable rub material) for the FPS design. The FPS clearance is referenced here since the ICLS structural clearance is between 2.05 inches at the blade leading edge and 1.70 inches at the trailing edge. This large structural clearance is the result of a slave nonflight design for the ICLS test program that utilizes a wood-lined CF6 containment case. The TETRA model has been defined to maximize the number of rub elements that can be added. Physical points exist on the case which are adjacent to every rotor physical point. Table 5 describes alternate rub elements that can be added to the TETRA model. Figure 57 illustrates the connection point orientation in the TETRA model.

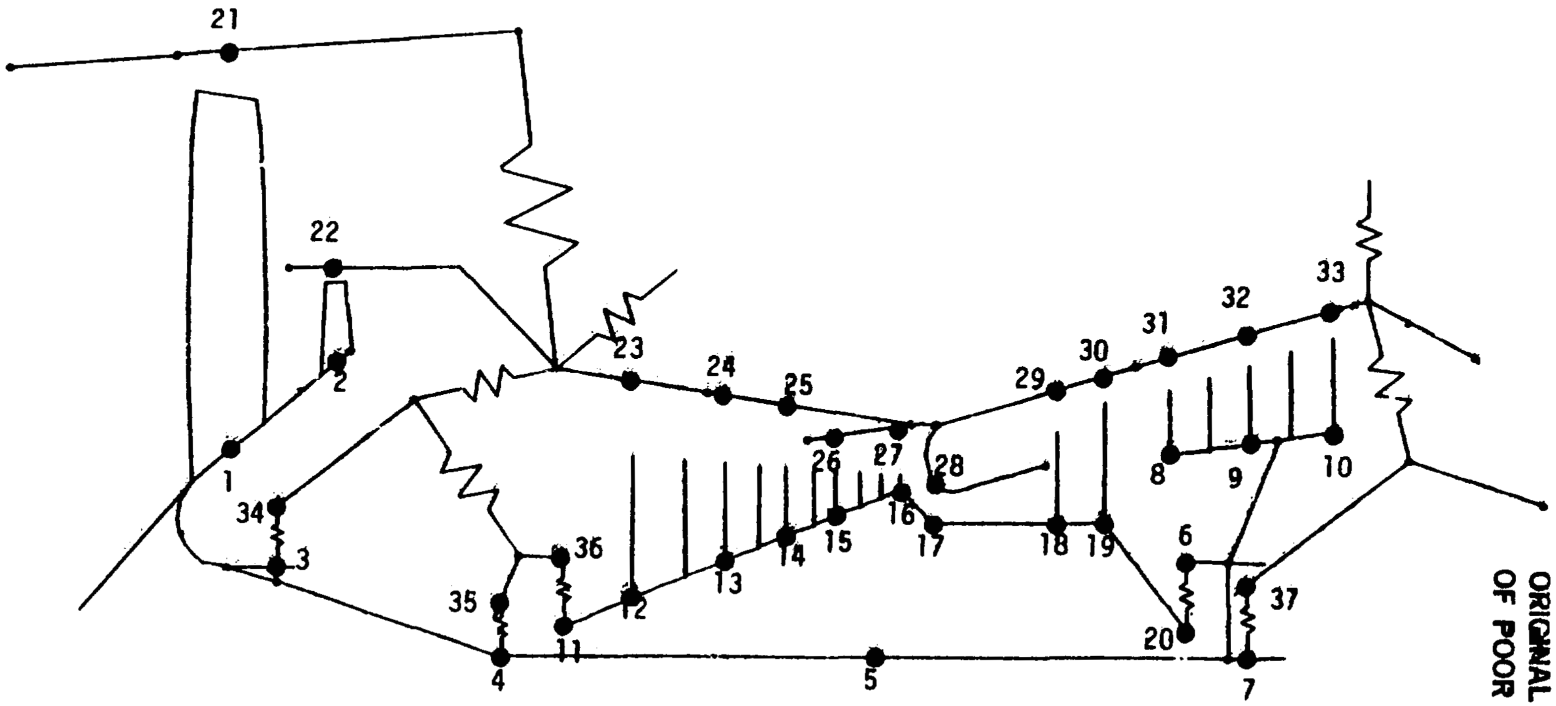


Figure 57. TETRA Model Point Identification.

Table 5. Alternate Rub Element.

(Type 3 Physical Connecting Element)

Description	Connection Points, I-End	Connection Points, J-End
Fan	1	21
Booster	2	22
HP Compressor Stage 1	12	23
HP Compressor Stage 3	13	24
HP Compressor Stage 5	14	25
HP Compressor Stage 7	15	26
HP Compressor Stage 10	16	27
CDP Seal	17	28
HP Turbine Stage 1	18	29
HP Turbine Stage 2	19	30
LP Turbine Stage 1	8	31
LP Turbine Stage 3	9	32
LP Turbine Stage 5	10	33
Mid LP Shaft w/Core Rotor	5	16*

*Connection Points 5 and 16 are axially misaligned by 4.262 inches

6.4 ASSEMBLED TETRA INPUT DESCRIPTION

The TETRA model was generated using the subsystem modal data and physical connecting elements described in Section 6.3 of this report. This section defines the assembled TETRA model input, which is listed in Section 7.4 and is also provided as punched cards.

The global coordinate system was established such that all axial coordinates match engine stations as referenced on drawings and in reports pertaining to the E^3 Program. However, since the engine stations are identified in inches forward to aft (left to right) and the TETRA global coordinate system in positive-forward (right to left) in the axial direction, the axial global coordinates include negative signs (-). All Y (horizontal) and Z (vertical) coordinates are equal to zero since the X axis goes through the engine centerline and no physical points are located off the model subsystems. Figure 58 references the engine system with the global coordinate system.

A total of 37 physical points have been identified on the modal subsystems. This includes the maximum of 10 points on each rotor subsystem, and 17 on the static structure model subsystem. Tables 6 and 7 identify the physical point locations and show the span and station numbers corresponding to the VAST subsystem models. The physical point locations are also illustrated in Figure 57. Physical points provide for assembly of the subsystems through physical connecting elements. Coordinates, displacements and velocities are computed at the physical points by the TETRA program.

The TETRA listing is standard FORTRAN namelist input with line numbers in the extreme left hand column. Identifying input is contained in Lines 90 through 140. Subsystem modal data for all 100 modes is in Lines 150 through 17200. Model subsystem Number 1 (ISUB = 1) is the LP rotor vertical plane and model subsystem Number 2 (ISUB = 2) is the LP rotor horizontal. Lines 150 through 2010 represent subsystem Number 1 and subsystem Number 2 is represented by Lines 2020 through 3880. Lines 160 and 170 identify the modal subsystem and Lines 180 through 310 establish the global coordinate system and physical points for the LP rotor subsystem. Lines 320 through 460 (XMODES =) identify the modes; frequency (rpm) is in the first column, potential energy is in the second column and the Q-factor is in the third column. The Q-factor is equal to zero (a Q-factor set to zero is a flag that sets the damping to zero) for the LP rotor modes since this model is set up for a LP synchronous run. The forth column identifies the mode type; rigid body modes = 1, and flexible modes = 0. Lines 470 through 2010 define the actual mode shapes. Each group VH(1,1,N) = of 10 lines define a local mode and each of the 10 lines within each group specify a local point number. The "VH" groups appear in the same order as the critical speed listing above in Lines 330 through 460. The 10 local points are in the same order as defined in Lines 220 through 310 (PTS =). Model data is defined in four columns. Column one is the modal translation, column two is the slope, column three is the shear force and column four is the bending moment. Modal subsystem Number 2 is defined by lines 2020 through 3880. Line 2040 sets ISUB = 2 signifying the horizontal direction LP rotor subsystem whereas line 170 sets ISUB = 1 for the

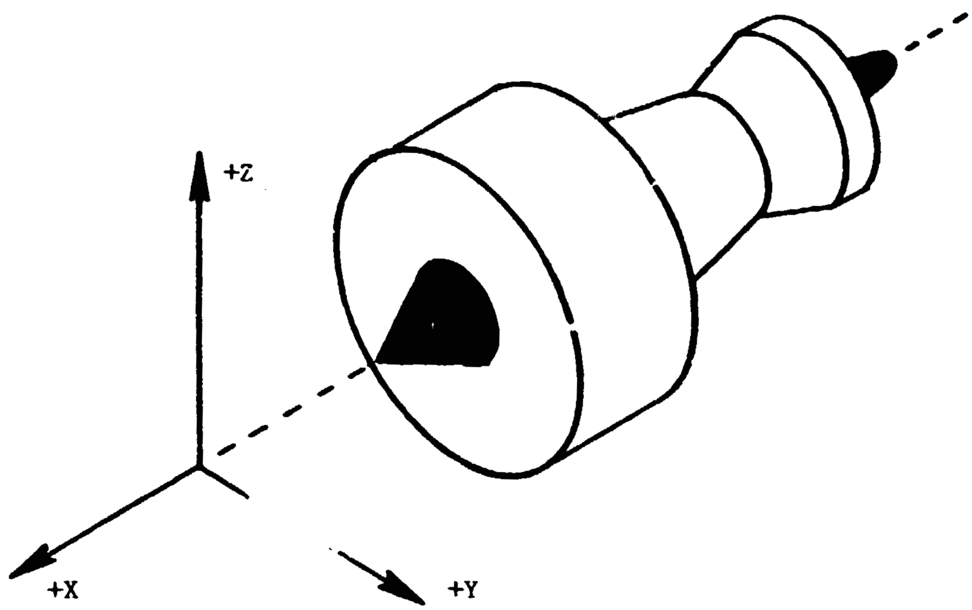


Figure 58. TETRA Global Coordinate System.

Table 6. TETRA Point Identification.

LP Rotor Subsystem Point Numbers 1-10
Core Rotor Subsystem Point Numbers 11-20
Static Structure Subsystem Point Numbers 21-37

TETRA Point Number	Description	Corresponding VAST Subsystem Span, Station Number
1	Fan Rotor	1, 12
2	Booster Rotor	1, 21
3	No. 1 Brg. Connection	2, 10
4	No. 2 Brg. Connection	5, 1
5	Mid LP Shaft	5, 13
6	No. 4 Brg. Connection	7, 1
7	No. 5 Brg. Connection	6, 10
8	LP Turbine Rotor 1	9, 1
9	LP Turbine Rotor 3	9, 14
10	LP Turbine Rotor 5	10, 11
11	No. 3 Brg. Connection	1, 1
12	HP Compressor Rotor 1	1, 11
13	HP Compressor Rotor 3	1, 18
14	HP Compressor Rotor 5	2, 1
15	HP Compressor Rotor 7	2, 9
16	HP Compressor Rotor 10	2, 18
17	CDP Seal	2, 24
18	HP Turbine Rotor 1	4, 1
19	HP Turbine Rotor 2	4, 14
20	No. 4 Brg. Connection	4, 25

Table 7. TETRA Point Identification.

LP Rotor Subsystem Point Numbers 1-10
Core Rotor Subsystem Point Numbers 11-20
Static Structure Subsystem Point Numbers 21-37

TETRA Point Number	Description	Corresponding VAST Subsystem Span, Station Number
21	Fan Case @ Fan Rotor	15, 16
22	Booster Island @ Rotor	6, 8
23	HP Comp. Case @ Rotor 1	7, 14
24	HP Comp. Case @ Rotor 3	8, 6
25	HP Comp. Case @ Rotor 5	8, 16
26	HP Comp Case @ Rotor 7	9, 7
27	HP Comp. Case @ Rotor 10	9, 21
28	CDP Seal	10, 6
29	HP Turb. Case @ Rotor 1	11, 11
30	HP Turb. Case @ Rotor 2	11, 17
31	LP Turb. Case @ Rotor 1	12, 4
32	LP Turb. Case @ Rotor 3	12, 14
33	LP Turb. Case @ Rotor 5	12, 23
34	No. 1 Brg. Connection	4, 1
35	No. 2 Brg. Connection	2, 1
36	No. 3 Brg. Connection	3, 7
37	No. 5 Brg. Connection	5, 1

All static structure TETRA points are axially aligned with corresponding rotor TETRA points.

vertical direction LP rotor subsystem. Since the LP rotor is symmetrical, the input for modal subsystem Number 2 is exactly the same as the input described for modal subsystem Number 1.

The input description continues with modal subsystem data for the core rotor. This input is in exactly the same format as previously described in the LP rotor modal subsystem discussion. Lines 3890 through 5150 list the input data for modal subsystem Number 4 (ISUB = 4), the core rotor vertical plane. Lines 3900 and 3910 identify the modal subsystem and lines 3920 through 4050 establish the global coordinate system and physical points for the core rotor subsystem. Lines 4060 through 4150 (XMODES =) identify the modes. The Q-factor is nonzero to reflect the nonsynchronous vibration induced by LP rotor unbalance. Recall, this TETRA model is set up for LP synchronous vibration.

Effective Q-factor $$Q_{EQ} = \frac{Q}{1 - \frac{1}{\dot{\phi}}}$$

where

Q = 100 Rotor Structural Damping

ω = 12875.9 rpm Rotational Speed

$\dot{\phi}$ = 3311.2 rpm Frequency of Vibration

Rotor speeds are for the SLS Standard Day takeoff condition since this is where the TETRA model is set up to start at. Therefore, Q_{EQ} = -34.6 for the core rotor modal subsystem. Lines 4160 through 5150 contain the mode shape data. Modal subsystem Number 5 (ISUB = 5), the core rotor horizontal plane, is defined by Lines 5160 through 6420. Line 5180 sets ISUB = 5 signifying the horizontal direction core rotor subsystem where as Line 3910 sets ISUB = 4 for the vertical direction core rotor subsystem. Since the core rotor is symmetrical, the input for modal subsystem Number 5 is exactly the same as the input described for modal subsystem Number 4.

Modal subsystem data for the static structure follows the core rotor modal subsystem. This input is in exactly the same format as previously described in the LP rotor and core rotor modal subsystem discussions. Lines 6430 through 11810 list the input data for modal subsystem Number 7 (ISUB = 7), the static structure vertical plane. Lines 6440 and 6450 identify the modal subsystem and lines 6460 through 6660 establish the global coordinate system and physical points for the static structure subsystem. Lines 6670 through 6940 (XMODES =) identify the modes. The structural damping input of Q = 15 is representative of the damping for normal unbalance in a large turbofan engine. For high unbalance associated with blade loss, Q = 7.5 has been shown to result in good agreement between analysis and engine test data. Note that the Q-factor used for the static structure subsystem is the same as for the connecting elements as described in Section 6.3. Lines 6950 through 11810 contain the mode shape data. Modal subsystem Number 8 (ISUB = 8), the static structure horizontal plane, is defined by Lines 11820 through 17200.

Line 11840 sets ISUB = 8 signifying the horizontal direction static structure subsystem whereas Line 6450 set ISUB = 7 for the vertical direction static structure subsystem. Since differences in the static structure between the vertical and horizontal planes are small, the input for modal subsystem Number 8 is exactly the same as the input described for modal subsystem Number 7.

Physical connecting element input is included in Lines 17210 through 17780. Characteristics of the physical connecting elements are summarized in Table 4 and described in detail in Section 6.3 of this report. This input identifies the element type, element number, physical connecting points, along with the flexibility and damping characteristics. For the rub element, the structural clearance is also identified. Alternate rub elements can be added to the input file following Line 17780.

Restart and time integration input is contained in Lines 17790 through 17840. Line 17800, ISTART = 0, signifies a new run. For a restart run, ISTART = 1 and a line must be added between Lines 17800 and 17810 to indicate the desired restart time. The added line would be, RTIME = the restart time in seconds. Line 17810, DELTA = 5E-6, indicates a time integration step size of 5 microseconds. Selection of the proper time step size is crucial for obtaining a correct solution. Effect of step size is discussed in Section 6.5 of this report. Line 17820, TFINAL = 0.200, signifies the time in seconds at which the time integration is completed. Since this is a new run (ISTART = 0), the solution encompasses 0.20 second. The result is forty thousand one (40,001) time steps using a step size of 5 microseconds. Line 17830, IPRMUL = 1500, indicates a print multiple of 1/1500, and line 17840, IPLMUL = 20, indicates a plot multiple of 1/20. For this input, 1/1500 of the time steps (26) are printed and 1/20 of the time steps (2000) are plotted.

Rotor speed and rate input is contained in Lines 17850 through 17930. The independent rotor is established as the LP rotor with Line 17850, IROTI = 1. For the core rotor to be the independent rotor, Line 17850 would have to be changed to IROTI = 2. (Q-factor damping characteristics in the LP rotor and core rotor subsystems would also need to be revised.) Line 17860, BEGTIM = 0, and Line 17870, BEGRPM = 3311.2, define the beginning time (seconds) and the beginning speed (rpm) for the first speed segment as applied to the independent rotor. Lines 17880 and 17890 (TRHIS =) define the time segment length (seconds) along with the accel or decel rate (rpm/sec). This time history is limited to 10 segments which must be entered in chronological order. The input shown on Line 17890 indicates a single segment of one second duration with no accel or decel rate. Lines 17900 through 17930 define the polynomial coefficients relating the dependent core rotor speed to the independent LP rotor speed. Figure 59 illustrates the speed relationship assumed for the analysis. An orthogonal polynomial method was used to fit the least-square polynomial to the data illustrated. The solution yielded an index of determination of 0.9745 and the standard error of estimate for the dependent rotor was 610.8 rpm. Table 8 lists the speeds used to determine the polynomial coefficients. These coefficients are valid when the LP rotor is the independent rotor.

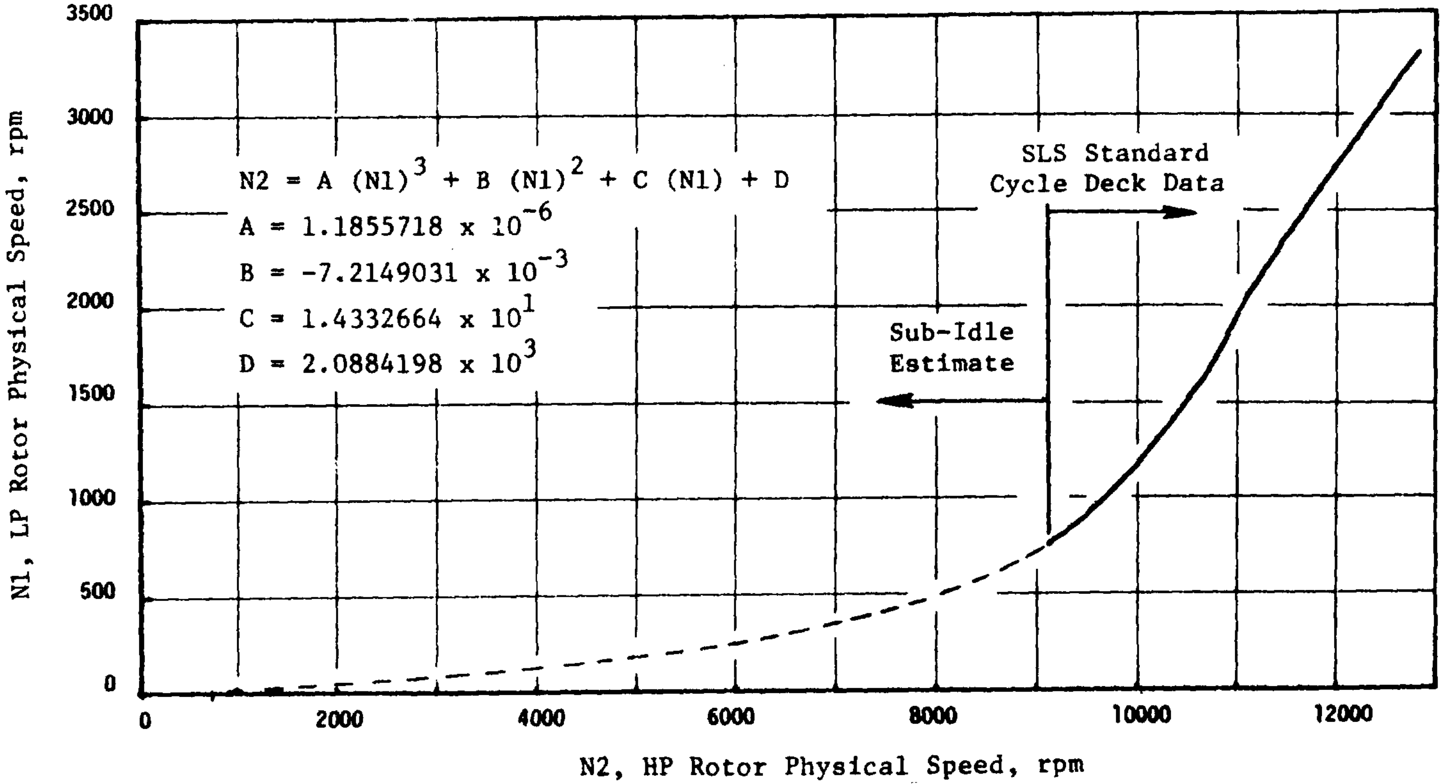


Figure 59. E^3/ICLS LP Rotor Versus HP Rotor Physical Speed Relationship.

Table 8. LP Rotor Versus HP Rotor Physical Speeds.

LP Rotor Speed N1, rpm	HP Rotor Speed N2, rpm	
0	750	
50	2000	
80	3000	
130	4000	
190	5000	
250	6000	
300	6500	
350	7000	Subidle Estimate
420	7500	
500	8000	
600	8500	
710	9000	
755.9	9127.0	
912.4	9512.5	
1167.9	10017.9	
1658.0	10754.4	
2020.9	11115.4	
2300.1	11471.4	SLS Std. Day Cycle Deck Data
2522.8	11766.9	
2701.4	12017.0	
2870.5	12256.7	
3034.9	12477.3	
3182.2	12681.8	
3311.2	12875.9	

Unbalance loads are specified in Lines 17940 and 17950. One unbalance load is specified in the input listing, Line 17950; the time of birth is 0 seconds, the unbalance point number is 1 indicating the fan rotor, the magnitude of the unbalance is 500 gm-in, and the phase angle for the birth event is 0 degrees. A maximum of 20 unbalance loads can be included.

The data needed to define the gyroscopic loads are contained in lines 17960 through 18160. This data consists of the polar moments of inertia (lb-in^2) at physical points on both rotor subsystems. Table 9 summarizes the polar moments of inertia.

The TETRA input file is completed by specifying the desired plot file. Lines 18170 through 18510 define the point numbers and global direction numbers for which the coordinates, displacements, velocities and modal forces are written onto the plot file. Lines 18520 through 18760 define the physical connecting element numbers, point numbers, and global direction numbers for which the physical connecting element forces are written onto the plot file. Line 18770, $END, completes the TETRA namelist input file.

6.5 TETRA TEST RUN RESULTS AND OBSERVATIONS

A limited number of TETRA test runs were made using the General Electric Company, Evendale, Ohio-based Honeywell computer. Results from these tests indicate that the TETRA input file has been correctly assembled. This TETRA model represents an ambitious effort as it includes; six subsystems with 100 modes, 6 connecting elements, 20 gyroscopic load inputs, and 37 physical points.

Using the proper time step size is essential for obtaining a correct solution with the central difference method that TETRA employs. In general, the time step should be equal to about 1/40 of the smallest period of oscillation for the subsystem modes. For the baseline TETRA model, the smallest period of oscillation is equal to 0.6827 milliseconds (the highest natural frequency is at 87882 rpm - core rotor modal subsystem). Therefore, using a time step of 17 microseconds would satisfy the forementioned 1/40 criterion, and result in the computation of 11765 time steps during a 0.200 second time interval. Results from the test run using a 17 microsecond time step are illustrated in Figures 60 and 61, which show Number 1 bearing loads as computed for the No. 1 physical connecting element at physical point Number 34. The wave forms look reasonable for the initial 110 milliseconds showing clean LP synchronous 1/Rev as expected for fan unbalance. Also, following the expected initial transient, the amplitude (390 lbs) stabilizes and is close in value to the VAST frequency domain solution amplitude (330 lbs). Recall that Figures 32 through 36 illustrate the frequency domain forced response characteristics. However, as shown in Figures 60 and 61 this TETRA solution begins to diverge at about 110 milliseconds and thereafter it is apparent that the predictions are not correct. It appears that numerical problems begin to occur at approximately 110 milliseconds and are probably related to truncating error associated with the large number of generalized coordinates (100 subsystem modes). Since numerical difficulties did not occur early in the solution time frame,

Table 9. Gyroscopic Load Input.

TETRA Point Number on Rotor	Polar Moment of Inertia, Ip (lb-in.2)	Rotor Component Identification
1	381881	Fan and Booster
2	42599	
3	2202	
4	620	
5	271	Shafting
6	4450	
7	512	
8	27727	
9	62440	LP Turbine
10	49497	
LP Rotor Total	572199 lb-in^2	
11	276	
12	5261	
13	4482	HP Compressor
14	5959	
15	9406	
16	6908	
17	4211	
18	20293	
19	18597	HP Turbine
20	466	
HP Rotor Total	75859 lb-in^2	

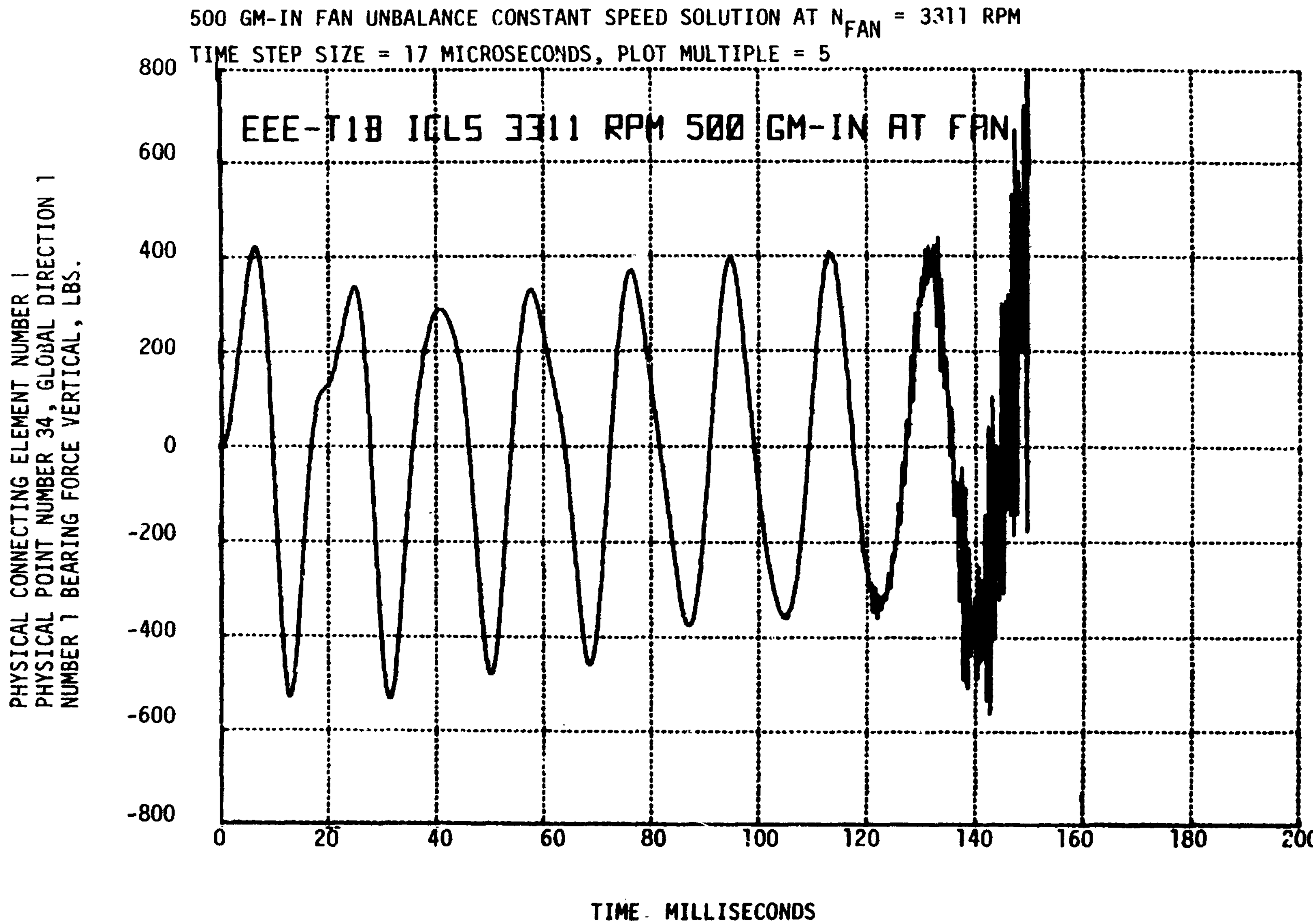


Figure 60. TETRA Test Case Solution with 100 Subsystem Modes.

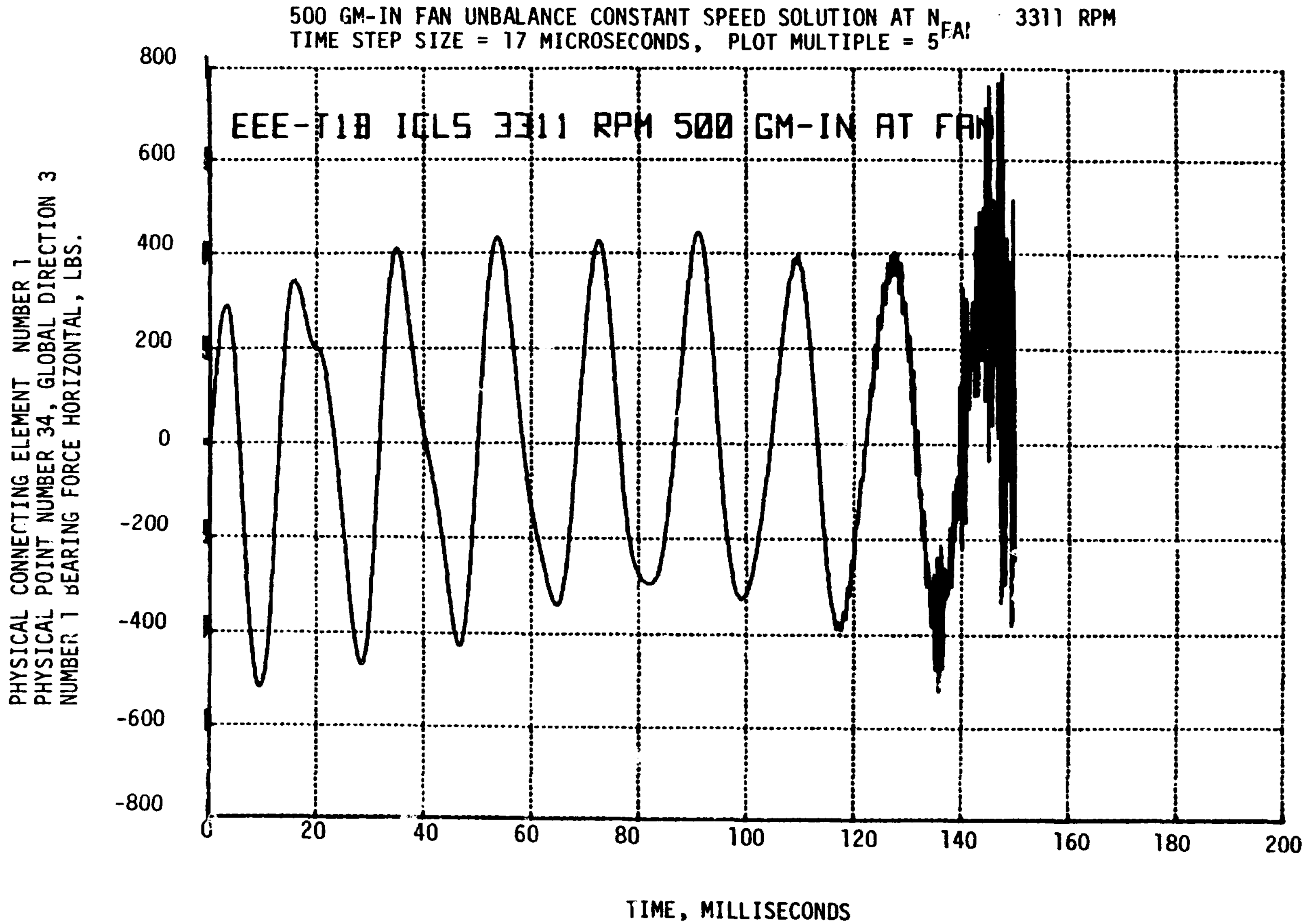


Figure 61. TETRA Test Case Solution with 100 Subsystem Modes.

it was concluded that the problem was not related to time step size. To verify this conclusion, the time step was reduced to 5 microseconds which is less than 1/125 of the smallest period of oscillation. Results from this test run, illustrated in Figures 62 and 63, show that the reduced time step had no effect on the solution which demonstrated the same divergence as obtained for the 17 microsecond time step solution (Figures 60 and 61). An example of the TETRA output for this test case (100 subsystem modes and 5 microsecond time step) is provided in Section 7.5. This output file includes the printout for the first two (2) time steps.

The number of subsystem modes was reduced to what was considered a minimum, using the first seven LP rotor subsystem modes including the rigid body modes (N_{MAX} = 28096 rpm), the first four core rotor subsystem modes including the rigid body modes (N_{MAX} = 29833 rpm) and the first six static structure subsystem modes (N_{MAX} = 13131 rpm). This reduced the total number of subsystem modes to 34 from 100. A 20 microsecond time step was chosen, which is 1/100 of the smallest period of oscillation and results in a step size to smallest period of oscillation ratio which is similar to that used for the 100 subsystem mode/5 microseconds case. Using a 0.200 second time interval resulted in 10001 solution steps with no indication of numerical difficulties. In addition, the analysis was restarted and continued for an additional 0.200 second. Results for the entire 0.400 second are shown in Figures 64 and 65.

The success of this test run with a reduced number of generalized coordinates would seem to indicate that the numerical problems encountered with the original 100 generalized coordinates were caused by truncation error.

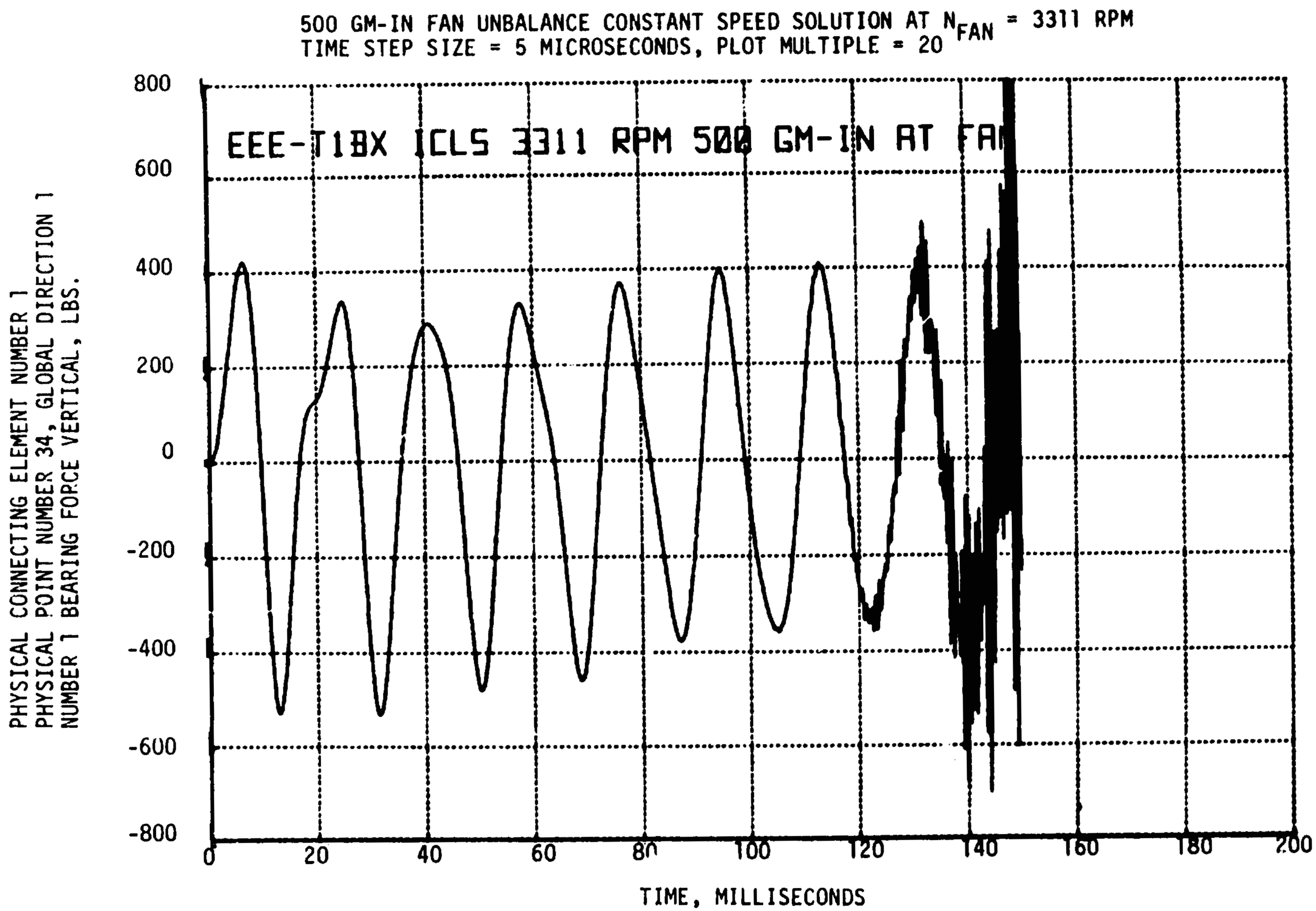


Figure 62. TETRA Test Case Solution with 100 Subsystem Modes.

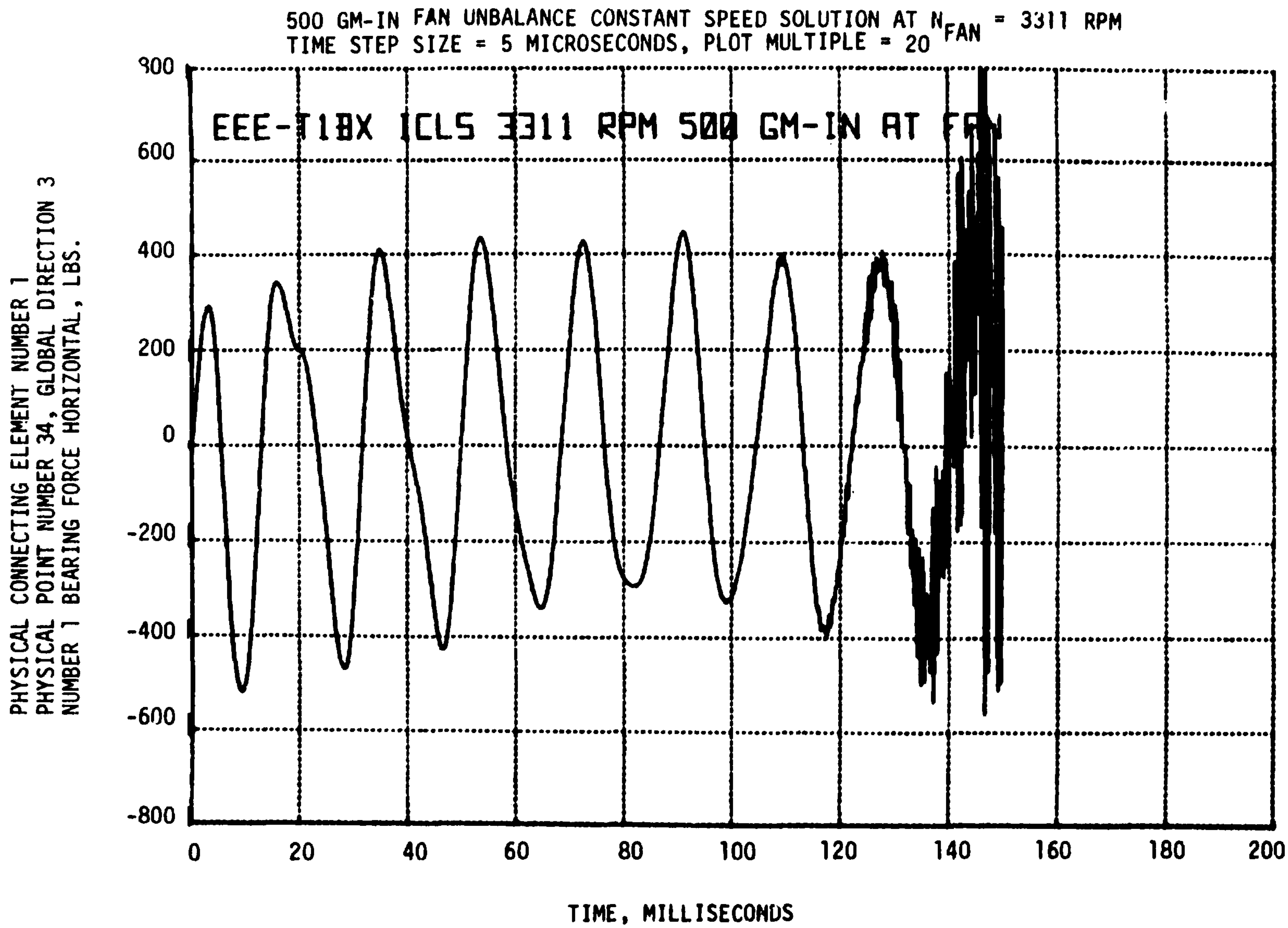


Figure 63. TETRA Test Case Solution with 100 Subsystem Modes.

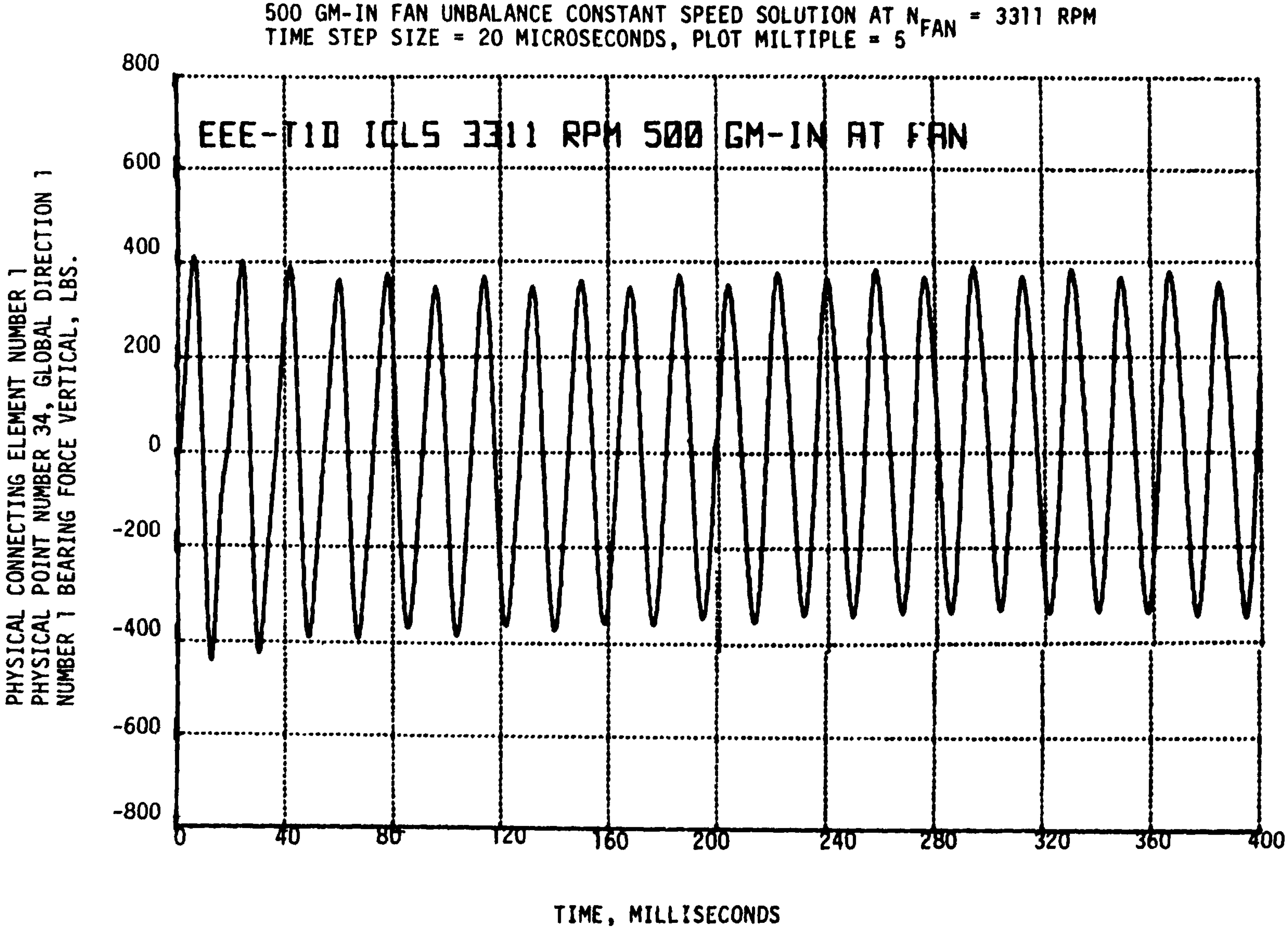


Figure 64. TETRA Test Case Solution with 34 Subsystem Modes.

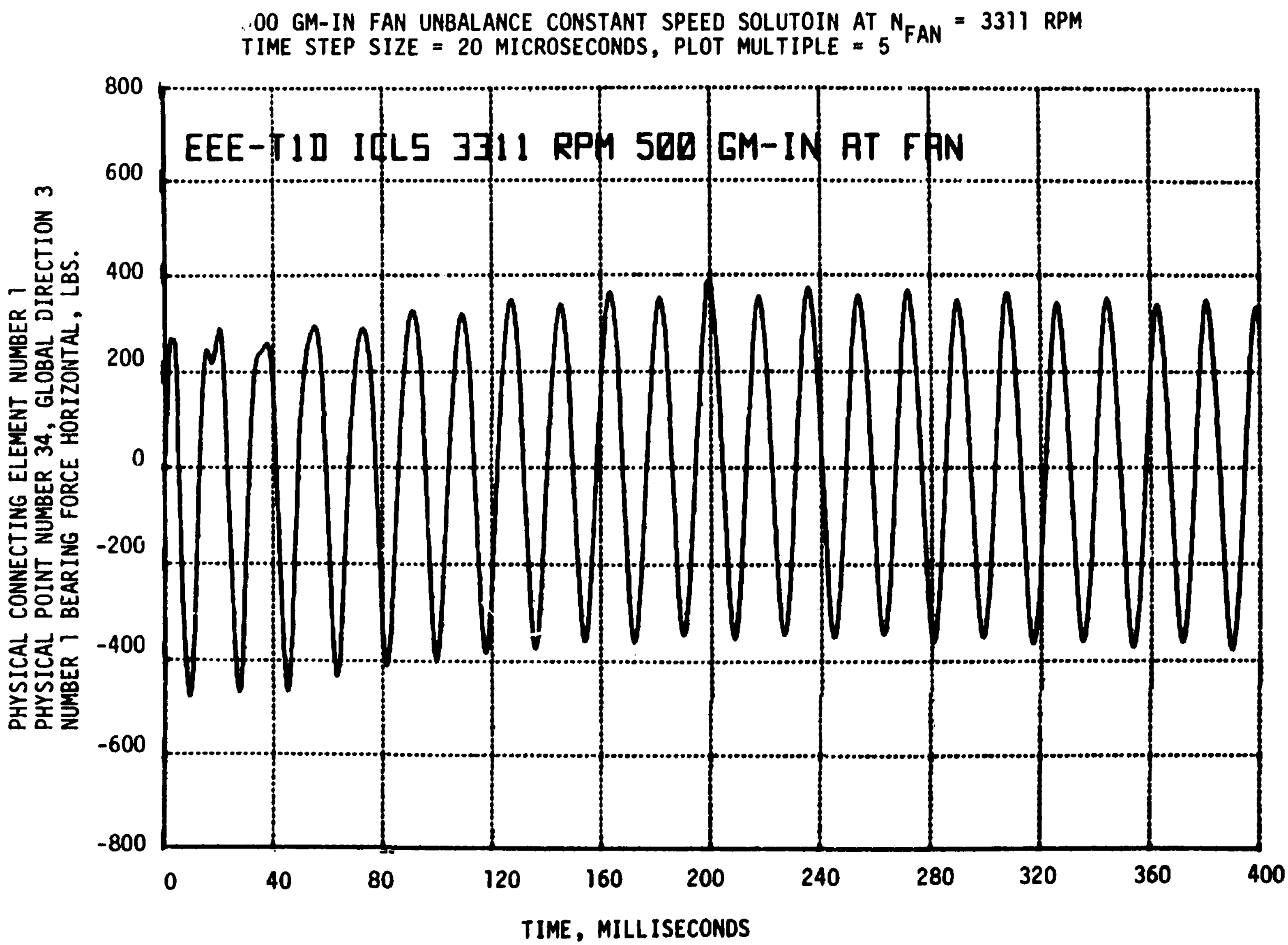


Figure 65. TETRA Test Case Solution with 34 Subsystem Modes.

7.0 SUPPLEMENTARY INFORMATION

7.1 E^3 VEGA LISTING FOR ASSEMBLED ENGINE SYSTEM

PROGRAM NO U3574A * * * * * V E G A * * * * *
EDITION 08 NOV 1979

S J CLINE EXT 2338 CHARGE 15631
SPDA BLDG 300 DATE 06-16-82
EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

TOTAL OF 30 SPANS 12 SPRINGS 5 SPRINGS ARE OFFSET

MODE SHAPE CALCULATION AT CRITICAL SPEEDS
KINETIC AND POTENTIAL ENERGY CALCULATION AT CRITICAL SPEEDS

FREQUENCY SEARCH DATA

LIMIT: 10 ITERATIONS WITH 2.00 RPM TOLERANCE ON CRITICAL SPEED CONVERGENCE

SPRING DATA INPUT

SPRING NO	FIRST END CONNECTION JOINT NO	SPAN NO	TYPE JOINT	SECOND END CONNECTION JOINT NJ	SPAN NO	TYPE JOINT	COEF	PHIM	PHIV	ETAM	ETAV	OFFSET LENGTH
1	32	2	0	18	18	1	0	0	0	0	2.500E-07	0
2	5	5	0	16	16	1	0	0	0	0	5.000E-07	0
3	11	11	0	47	17	1	0	0	0	0	1.000E-06	0
4	44	14	0	7	7	1	0	0	0	0	5.550E-07	0
5	35	5	0	19	19	1	0	0	0	0	5.557E-07	0
51	46	18	1	21	21	1	0	4.000E-10	2.230E-09	2.230E-09	4.000E-08	4.000E 00
52	21	21	1	6C	30	1	0	3.620E-10	1.610E-09	1.610E-08	1.430E-07	3.000E 00
53	27	27	1	28	28	1	0	3.000E-10	0	0	5.557E-07	3.250E 00
81	86	26	1	27	27	1	0	3.620E-11	-3.750E-10	-3.750E-10	2.120E-08	3.720E 00
91	46	18	1	17	17	1	0	2.385E-09	5.538E-09	5.538E-09	3.223E-08	4.700E 00
101	21	21	1	0	0	0	0	0	0	0	1.000E-05	0
102	27	27	1	0	0	0	0	0	0	0	1.000E-05	0

SPRING NO	SPRING DESCRIPTION	SPRING DATA SOURCE
1	NO 1 BRG - FAN THRUST - BALL	*LIKE CF6-32 7-25-78
2	NO 2 BRG -ROLLER BRG	*LIKE CF6-50 (NO 2) GM HOLLOWAY / VALUES-EA LANG 4-13-78
3	NO 3 BRG - BALL	*THRUST BEARING K=1E6 LB/IN
4	NO 4 DIFF BRG - ROLLER BRG	*LIKE CF6-32 (NO 5) GM HOLLOWAY / VALUES EA LANG 4-13-78
5	NO 5 BRG - ROLLER BRG	*LIKE CF6-32 (NO 7) GM HOLLOWAY / VALUES EA LANG 4-13-78
51	CORE FAN FRAME - SLAVE	*KUTNEY-STORACE MASS ANALYSIS 2-05-82
52	BYPASS FAN FRAME - SLAVE	*KUTNEY-STORACE MASS ANALYSIS 2-05-82
53	TURBINE FRAME-STRUTS	*OVERALL BEARING SUPT & FRAME STIFFNESS = 1E6 03-21-78
81	LPT CASE - TURBINE FRAME	*SPRING 82 FROM FPS-S35A, SJ CLINE
91	FAN FRM - 2 & 3 BRG SUPPORT	*EOSPAN CALCULATION SPAN 18 FROM EEE-S37A SJ CLINE 8-13-78
101	FRONT MOUNT	*ESTIMATED SOFT MOUNT
102	AFT MOUNT	*ESTIMATED SOFT MOUNT

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 1

FAN & BOOSTER ROTOR

ROTOR SPAN RATIO = 1.000 OMEGA = 4.08800E 03

FORE END -- JOINT 2 TYPE CONTINUOUS AFT END -- JOINT 31 TYPE PINNED

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					0.	0	0.
3	-0.400	5	1.618E 01*	6.117E 00*	1.610E-01*	7.030E 00	1.600			200	TI 6-4 F	0.	0.	0.
4	-1.080	4	1.618E 01*	6.117E 00*	1.610E-01*	6.870E 00	0.320					0.	0.	0
5	-0.500	4	1.618E 01*	6.117E 00*	1.610E-01*	5.550E 00	0.300					0.	0.	0
6	-0.590	3	1.618E 01*	6.117E 00*	1.610E-01*	5.800E 00	0.320	5.900	0.330			0.	0.	0.
7	-0.500	3	1.618E 01*	6.117E 00*	1.610E-01*	5.900E 00	0.320	7.110	0.420			0.	0.	0.
8	-0.480	5	1.618E 01*	6.117E 00*	1.610E-01*	8.280E 00	1.170					0	0.	0.
9	0.450	2	0	0.	0.	0	0					0.	0.	0.
10	1.120	3	1.618E 01*	6.117E 00*	1.610E-01*	5.200E 00	0.500	5.010	0.500	200.	TI 6-4 F	0.	0.	0.
11	-7.505	2	0.	0.	0	0	0					2.114E 03	1.920E 01	1.057E 03
12	9.810	2	0	0.	0	0.	0.					3.741E 05	6.210E 02	1.870E 05
13	3.234	2	0	0.	0	0.	0.					1.472E 03	7.000E 00	7.360E 02
14	0.250	6	1.577E 01*	5.948E 00*	1.610E-01*	1.524E 01	1.500			200.	TI 6-4 F	0	0.	0.
15	0.950	3	1.577E 01*	5.948E 00*	1.610E-01*	1.525E 01	0.250	16.480	0.200			0	0.	0.
16	0.870	3	1.577E 01*	5.948E 00*	1.610E-01-	1.648E 01	0.200	17.570	0.160			1.165E 03	3.400E 00	5.870E 02
17	1.250	3	1.577E 01*	5.948E 00*	1.610E-01*	1.770E 01	0.170	18.130	0.150			0	0	0
18	1.260	3	1.577E 01*	5.948E 00*	1.610E-01*	1.814E 01	0.150	18.540	0.150			0	0	0
19	1.150	3	1.577E 01*	5.948E 00*	1.610E-01*	1.854E 01	0.150	18.900	0.150			0.	0.	0.
20	1.000	3	1.577E 01*	5.948E 00*	1.610E-01*	1.890E 01	0.150	19.250	0.170			0	0	0
21	0.900	2	0	0	0	0.	0.					3.497E 04	5.570E 01	1.750E 04
22	1.780	2	0.	0	0.	0	0					0	0	0.

TOTAL WEIGHT 9.3530E 02 POUNDS
TOTAL LENGTH 1.2738E 01 INCHES
TOTAL POLAR MOMENT 4.1362E 05 LB.-IN**2

ORIGINAL PAGE IS
OF POOR QUALITY

PROGRAM NO U3674A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 2

OUTER FAN SHAFT

ROTOR SPAN RATIO = 1.000 OMEGA = 4.09800E 03

FORE END -- JOINT 2 TYPE CONTINUOUS AFT END -- JOINT 32 TYPE PINNED

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) / PHI(M) / E(PSI) / E(PSI)	G(PSI) / PHI(V) / G(PSI) / G(PSI)	I / ETA(M) / RHO / RHO	AREA / ETA(V) / R(I-1) / R(O)	ALPHA / TYPE COEF / T(I-1) / T	R(I) / ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0.	0	0	0					0	0	0
3	0.350	5	1.605E 01*	5.067E 00*	1.810E-01*	7.270E 00	2.100			230	TI 6-4 F	0	0.	0
4	0.850	4	1.605E 01*	5.067E 00*	1.810E-01*	5.300E 00	0.240					0.	0.	0
5	1.150	4	1.605E 01*	5.067E 00*	1.810E-01*	5.250E 00	0.180					0	0	0
6	0.500	4	1.605E 01*	5.067E 00*	1.810E-01*	5.540E 00	0.370					8.800E 01	2.700E 00	4.800E 01
7	1.500	4	1.605E 01*	5.067E 00*	1.810E-01*	5.420E 00	0.350					1.430E 02	5.800E 00	1.230E 02
8	0.780	4	1.605E 01*	5.067E 00*	1.810E-01*	5.400E 00	0.420					7.780E 02	2.060E 01	2.830E 02
9	1.750	5	1.605E 01*	5.067E 00*	1.810E-01*	5.400E 00	0.420					1.310E 02	4.500E 00	5.800E 01
10	-1.750	2	0.	0	0	0.	0					0.	0	0.

TOTAL WEIGHT 3.2200E 01 POUNDS
TOTAL LENGTH 5.1300E 00 INCHES
TOTAL POLAR MOMENT 1.2360E 03 LB.-IN**2

PROGRAM NO U3674A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 3

INNER FAN SHAFT

ROTOR SPAN RATIO = 1.000 OMEGA = 4.09800E 03

FORE END -- JOINT 2 TYPE CONTINUOUS AFT END -- JOINT 4 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) / PHI(M) / E(PSI) / E(PSI)	G(PSI) / PHI(V) / G(PSI) / G(PSI)	I / ETA(M) / RHO / RHO	AREA / ETA(V) / R(I-1) / R(O)	ALPHA / TYPE COEF / T(I-1) / T	R(I) / ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0.	2	0	0	[illegible]	0.	0					0	0.	0
3	-0.400	2	0	0	[illegible]	0.	0					0.	0.	0.
4	-0.400	2	0.	0	[illegible]	0	0.					0.	0.	0.
5	0.400	5	2.500E 01	[illegible]	2.684E-01	5.800E 00	1.800					0.	0.	0.
6	1.250	4	2.500E 01	[illegible]	2.890E-01	5.000E 00	0.250					0.	0.	0.
7	1.420	4	2.500E 01	[illegible]	2.890E-01	4.920E 00	0.180					0.	0.	0.
8	0.280	4	2.500E 01	[illegible]	2.890E-01	4.920E 00	0.240					0	0.	0.
9	0.750	4	2.500E 01	1.000E 01	2.890E-01	4.920E 00	0.800					0.	0.	0.
10	1.820	4	2.500E 01	1.000E 01	2.890E-01	4.920E 00	0.400					0.	0.	0.

TOTAL WEIGHT 0. POUNDS
TOTAL LENGTH 5.1300E 00 INCHES
TOTAL POLAR MOMENT 0 LB.-IN**2

PROGRAM NO. U3574A * * * * * V E G A * * * * *

EEE-663E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 4

FAN SPLINE STUD SHAFT

ROTOR SPAN RATIO = 1.000 OMEGA = 4.05800E 03

FORE END -- JOINT 4 TYPE CONTINUOUS AFT END -- JOINT 5 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					0	0	0
3	0.720	4	2.500E 01	1.000E 01	2.830E-01	4.920E 00	0.840					0	0	0
4	0.540	4	2.500E 01	1.000E 01	2.830E-01	4.890E 00	0.560					0	0	0
5	1.120	3	2.500E 01	1.000E 01	2.830E-01	4.600E 00	0.400	4.380	0.400			0	0	0
6	1.100	3	2.500E 01	1.000E 01	2.830E-01	4.380E 00	0.400	4.270	0.400			0	0	0
7	0.410	3	2.500E 01	1.000E 01	2.830E-01	4.270E 00	0.400	4.320	0.200			0	0	0
8	1.010	3	2.500E 01	1.000E 01	2.830E-01	4.320E 00	0.180	4.200	0.180			0	0	0
9	1.010	3	2.500E 01	1.000E 01	2.830E-01	4.200E 00	0.180	4.100	0.180			0	0	0
10	1.010	3	2.500E 01	1.000E 01	2.830E-01	4.100E 00	0.180	4.000	0.180			0	0	0
11	1.010	3	2.500E 01	1.000E 01	2.830E-01	4.000E 00	0.180	3.880	0.180			0	0	0
12	1.010	3	2.500E 01	1.000E 01	2.830E-01	3.880E 00	0.180	3.780	0.180			0	0	0
13	1.010	3	2.500E 01	1.000E 01	2.830E-01	3.780E 00	0.180	3.680	0.180			0	0	0
14	1.010	3	2.500E 01	1.000E 01	2.830E-01	3.680E 00	0.180	3.570	0.180			0	0	0
15	1.010	3	2.500E 01	1.000E 01	2.830E-01	3.570E 00	0.180	3.480	0.180			0	0	0
16	1.010	3	2.500E 01	1.000E 01	2.830E-01	3.480E 00	0.180	3.350	0.180			0	0	0
17	1.010	3	2.500E 01	1.000E 01	2.830E-01	3.350E 00	0.180	3.230	0.180			0	0	0
18	1.010	3	2.500E 01	1.000E 01	2.830E-01	3.230E 00	0.180	3.100	0.180			0	0	0
19	1.010	3	2.500E 01	1.000E 01	2.830E-01	3.100E 00	0.180	2.850	0.220			0	0	0
20	0.340	4	2.500E 01	1.000E 01	2.830E-01	3.070E 00	0.410					2.340E 01	7.800E 00	5.850E 01
21	0.510	4	2.500E 01	1.000E 01	2.830E-01	3.000E 00	1.420					0	0	0
22	1.000	4	2.500E 01	1.000E 01	2.830E-01	2.900E 00	1.320					0	0	0
23	2.220	4	2.500E 01	1.000E 01	2.830E-01	2.750E 00	1.100					0	0	0
24	2.442	4	2.500E 01	1.000E 01	2.830E-01	2.650E 00	1.250					0	0	0

TOTAL WEIGHT 7.8000E 00 POUNDS
TOTAL LENGTH 2.2622E 01 INCHES
TOTAL POLAR MOMENT 2.3400E 01 LB.-IN**2

PROGRAM NO. U3574A * * * * * V E G A * * * * *

EEE-663E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 5

LP SHAFT M250 BOTTLE

ROTOR SPAN RATIO = 1.000 OMEGA = 4.05800E 03

FORE END -- JOINT 5 TYPE CONTINUOUS AFT END -- JOINT 6 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					7.220E 01	6.760E 00	3.610E 01
3	2.320	4	2.580E 01	9.900E 00	2.890E-01	2.350E 00	0.590					0	0	0
4	3.000	4	2.580E 01	9.900E 00	2.890E-01	2.350E 00	0.650					0	0	0
5	3.000	4	2.580E 01	9.900E 00	2.890E-01	2.350E 00	0.290					0	0	0
6	3.000	4	2.580E 01	9.900E 00	2.890E-01	2.350E 00	0.290					0	0	0
7	3.080	4	2.580E 01	9.900E 00	2.890E-01	2.525E 00	0.290					0	0	0
8	4.160	4	2.580E 01	9.900E 00	2.890E-01	2.750E 00	0.340					5.800E 00	3.600E 00	5.150E 01
9	3.380	4	2.580E 01	9.900E 00	2.890E-01	2.700E 00	0.290					0	0	0
10	3.380	4	2.580E 01	9.900E 00	2.890E-01	2.700E 00	0.290					0	0	0
11	3.380	4	2.580E 01	9.900E 00	2.890E-01	2.700E 00	0.280					0	0	0
12	4.040	4	2.580E 01	9.900E 00	2.890E-01	2.750E 00	0.340					0	0	0
13	3.350	4	2.580E 01	9.900E 00	2.890E-01	2.700E 00	0.280					0	0	0
14	3.350	4	2.580E 01	9.900E 00	2.890E-01	2.700E 00	0.290					5.800E 00	3.800E 00	5.850E 01
15	3.030	4	2.580E 01	9.900E 00	2.890E-01	2.700E 00	0.280					0	0	0
16	4.150	4	2.580E 01	9.900E 00	2.890E-01	2.750E 00	0.340					0	0	0
17	3.540	4	2.580E 01	9.900E 00	2.890E-01	2.575E 00	0.350					0	0	0
18	3.555	4	2.580E 01	9.900E 00	2.890E-01	2.400E 00	0.400					0	0	0
19	3.555	4	2.580E 01	9.900E 00	2.890E-01	2.400E 00	0.400					0	0	0
20	3.555	4	2.580E 01	9.900E 00	2.890E-01	2.400E 00	0.400					4.400E 00	3.400E 00	5.250E 01
21	3.555	4	2.580E 01	9.900E 00	2.890E-01	2.400E 00	0.400					0	0	0
22	0.870	4	2.580E 01	9.900E 00	2.890E-01	2.890E 00	0.890					0	0	0
23	5.317	4	2.580E 01	9.900E 00	2.890E-01	2.400E 00	0.400					2.800E 01	3.100E 00	5.400E 01
24	0.540	4	2.580E 01	9.900E 00	2.890E-01	2.880E 00	0.810					0	0	0
25	0.840	4	2.580E 01	9.900E 00	2.890E-01	3.750E 00	1.430					0	0	0

TOTAL WEIGHT 2.0950E 01 POUNDS
TOTAL LENGTH 7.2387E 01 INCHES
TOTAL POLAR MOMENT 1.1820E 02 LB.-IN**2

PROGRAM NO. U3574A * * * * * V E G A * * * *

ORIGINAL PAGE IS OF POOR QUALITY

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 6

LPSHAFT-AFT END

ROTOR SPAN RATIO = 1.000 OMEGA = 4.05500E 03

FORE END -- JOINT 6 TYPE CONTINUOUS AFT END -- JOINT 35 TYPE PINNED

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	T ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2.	0.	0	0	0	0					0	0	0.
3	0.650	5	2.602E 01*	1.063E 01*	2.550E-01*	7.000E 00	4.700			300.	INCO 718	0	0.	0.
4	1.000	4	2.602E 01*	1.063E 01*	2.550E-01*	3.220E 00	0.550					0.	0.	0
5	0.550	4	2.602E 01*	1.063E 01*	2.550E-01*	2.970E 00	0.450					1.350E 01	2.300E 00	7.100E 00
6	0.940	2.	0	0	0	0.	0					3.410E 01	5.600E 00	1.750E 01
7	1.040	2	0.	0.	0	0.	0					3.180E 01	5.800E 00	1.640E 01
8	1.440	2	0	0	0	0.	0					1.270E 01	3.100E 00	7.200E 00
9	1.150	2	0	0	0	0	0					1.085E 02	1.270E 01	1.231E 02
10	-4.800	2.	0.	0.	0	0.	0					7.080E 01	6.030E 00	3.530E 01

TOTAL WEIGHT 3.5530E 01 POUNDS
TOTAL LENGTH 2.3100E 00 INCHES
TOTAL POLAR MOMENT 2.6380E 02 LB -IN**2

PROGRAM NO. U3574A * * * * * V E G A * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 7

NO 4 BRG SUPT. K=3E6

ROTOR SPAN RATIO = 1.000 OMEGA = 4.09800E 03

FORE END -- JOINT 7 TYPE PINNED AFT END -- JOINT 6 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	T ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0.	2	0	0	0.	0.	0					2.086E 02	1.065E 01	1.139E 02
3	1.120	2.	0	0.	0	0	0.					2.561E 01	1.234E 00	1.280E 01
4	2.520	2	0	0.	0.	3.333E-06	0.					2.561E 01	1.234E 00	1.280E 01
5	0.200	5	2.602E 01*	1.063E 01*	2.550E-01*	5.300E 00	0.500			300	INCO 718	0.	0.	0.
6	-4.140	2	0	0.	0.	0.	0.					1.284E 03	3.878E 01	7.589E 02
7	4.140	2	0.	0.	0.	0.	0.					0	0.	0

TOTAL WEIGHT 5.2838E 01 POUNDS
TOTAL LENGTH 3.8400E 00 INCHES
TOTAL POLAR MOMENT 1.5552E 03 LB -IN**2

ORIGINAL [illegible]
OF POOR QUALITY

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 8

LPT ROTOR CONE

ROTOR SPAN RATIO : 1 000 OMEGA : 4.08800E 03

FORE END -- JOINT 8 TYPE CONTINUOUS AFT END -- JOINT 10 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	[illegible] 000E-08	0.	0	0	0					0	0	0
3	0 870	2	0	0	0	0	0					0	0	0
4	0.870	4	2 757E 01*	1.045E 01*	2 980E-01*	7 440E 00	1.840			600	INCO 718	2 910E 02	8.090E 00	1 558E 02
5	0 480	3	2 757E 01*	1 045E 01*	2 980E-01*	7 400E 00	0.380	8.050	0.380			1 328E 03	2 410E 01	8 188E 02
6	0 800	4	2 757E 01*	1.045E 01*	2.980E-01*	5 180E 00	1 000					4 340E 02	6 040E 00	2.240E 02
7	0 700	3	2 757E 01*	1 045E 01*	2 980E-01*	8.330E 00	0.280	10 430	0.240			0	0	0
8	0.700	3	2 757E 01*	1.045E 01*	2.980E-01*	1.043E 01	0.240	11 460	0.200			0	0	0
9	0.510	3	2 757E 01*	1.045E 01*	2.980E-01*	1 145E 01	0.200	12.100	0 170			0	0	0
10	0 120	4	2 757E 01*	1.045E 01*	2 980E-01*	1.254E 01	0 800					0	0	0.

TOTAL WEIGHT 3 8230E 01 POUNDS
TOTAL LENGTH 4.8500E 00 INCHES
TOTAL POLAR MOMENT 2 0840E 03 LB.-IN**2

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 9

LPT ROTOR STAGES 1-3

ROTOR SPAN RATIO : 1.000 OMEGA : 4 08800E 03

FORE END -- JOINT 9 TYPE PINNED AFT END -- JOINT 10 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0.	2	0	0	0	0	0					1 028E 04	7.900E 01	7.137E 03
3	0 400	2	0.	0	0	0	0					0.	0	0
4	1.350	3	2 620E 01*	9 892E 00*	2 980E-01*	1 205E 01	0 100	12 300	0 100	700	INCO 718	0	0	0.
5	0.170	2	0	0	0	0	0					2 554E 03	1 750E 01	1 278E 03
6	0 170	2	0	0	0	0	0.					0	0	0.
7	1.300	3	2 620E 01*	9.892E 00*	2 980E-01*	1.212E 01	0.100	12 850	0.100			0	0.	0.
8	0 420	2	0	0.	0.	0	0					1.831E 04	6.300E 01	9.157E 03
9	0.420	2	0	0	0	0	0.					0.	0.	0.
10	1.420	4	2.620E 01*	9 892E 00*	2 980E-01*	1.280E 01	0.100					0	0.	0.
11	0 170	2	0.	0.	0.	0	0					3 100E 03	1.830E 01	1.561E 03
12	0.170	2	0.	0.	0.	0	0.					0.	0.	0.
13	1 400	3	2 620E 01*	9.892E 00*	2 980E-01*	1 275E 01	0 100	12.850	0.100			0	0	0
14	0 450	2	0	0	0	0	0.					2 531E 04	1.004E 02	1 288E 04
15	0.450	2	0	0	0	0	0					0	0.	0.
16	1.430	3	2 620E 01*	9.892E 00*	2 980E-01*	1 380E 01	0.100	12.200	0 100			0	0.	0
17	0.250	2	0.	0	0.	0.	0					0	0	0.

TOTAL WEIGHT 2.8860E 02 POUNDS
TOTAL LENGTH 1.0000E 01 INCHES
TOTAL POLAR MOMENT 6.3554E 04 LB.-IN**2

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-563E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 10

LPT ROTOR STAGES 4-5

ROTOR SPAN RATIO = 1.000 OMEGA = 4.08800E 03

FORE END -- JOINT 10 TYPE CONTINUOUS AFT END -- JOINT 40 TYPE PINNED

			INTERVAL PROPERTIES							MATERIAL DATA			WEIGHT PROPERTIES		
STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME		POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0.	0.	0	0	0						4.137E 03	2.600E 01	2.084E 03
3	0.250	2	0.	0.	0	0	0						0	0	[illegible]
4	1.300	3	2.620E 01*	9.882E 00*	2.880E-01*	1.327E 01	0.100	13.600	0.100	700	INCO 718		[illegible]	0	[illegible]
5	0.450	2	0.	0	0	0	0						3.088E 04	1.135E 02	1.508E 04
6	0.450	2	0	0	0	0	0						0.	0	0
7	1.510	3	2.620E 01*	9.882E 00*	2.880E-01*	1.360E 01	0.100	12.750	0.100				0	0	0.
8	0.150	2	0	0	0	0.	0						2.873E 03	1.830E 01	1.424E 03
9	0.150	2	0	0	0	0	0						0	0	0
10	1.490	3	2.620E 01*	9.882E 00*	2.880E-01*	1.280E 01	0.100	13.200	0.100				0	0	0
11	0.470	2	0	0.	0	0	0						2.898E 04	1.200E 02	1.498E 04
12	1.290	2	0	0.	0.	0	0.						0	0	0.

TOTAL WEIGHT 2.7710E 02 POUNDS
TOTAL LENGTH 7.5100E 00 INCHES
TOTAL POLAR MOMENT 6.7047E 04 LB-IN**2

PROGRAM NO. U3574A * * * * * V E G A * * * * *

EEE-563E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 11

COMPR ROTOR STG 1-4

ROTOR SPAN RATIO = 3.404 OMEGA = 1.39480E 04

FORE END -- JOINT 11 TYPE PINNED AFT END -- JOINT 12 TYPE CONTINUOUS

			INTERVAL PROPERTIES							MATERIAL DATA			WEIGHT PROPERTIES		
STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME		POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0.	0.						9.990E 01	6.740E 00	4.990E 01
3	-0.580	5.	1.598E 01*	6.033E 00*	1.810E-01*	3.200E 00	0.530			250	TI 6-4	F	0	0	0
4	-2.280	5	1.598E 01*	6.033E 00*	1.610E-01*	3.360E 00	0.600						8.892E 01	1.052E 01	6.898E 01
5	2.880	2	0	0	0.	0	0						0	0	0
6	1.540	4	1.598E 01*	6.033E 00*	1.610E-01*	3.200E 00	0.430			250.	TI 6-4	F	0.	0	0.
7	0.810	4	1.598E 01*	6.033E 00*	1.610E-01*	3.200E 00	0.450						0.	0	0.
8	0.680	4	1.598E 01*	6.033E 00*	1.610E-01*	3.370E 00	0.610						0	0	0.
9	1.170	4	1.594E 01*	6.016E 00*	1.610E-01*	3.750E 00	0.450			280	TI 6-4	F	0.	0.	0.
10	0.810	3.	1.594E 01*	6.016E 00*	1.610E-01*	3.900E 00	0.389	4.530	0.300				0	0.	0
11	1.810	2	0.	0.	0	0.	0						3.660E 03	7.621E 01	1.970E 03
12	1.990	2.	0	0	0.	0.	0						0	0	0.
13	1.420	3	1.590E 01*	5.999E 00*	1.610E-01*	5.990E 00	0.120	6.280	0.120	270	TI 6-4	F	0	0	0
14	1.420	3	1.590E 01*	5.999E 00*	1.610E-01*	6.280E 00	0.120	6.590	0.120				0	0.	0.
15	0.630	2.	0.	0.	0	0.	0						2.520E 03	3.843E 01	1.280E 03
16	0.880	2.	0.	0.	0	0	0.						0	0.	0
17	2.220	3	1.543E 01*	5.805E 00*	1.610E-01*	7.630E 00	0.130	6.210	0.130	385	TI 6-4	F	0.	0.	0
18	0.?00	2	0.	0.	0.	0.	0						1.990E 02	2.785E 01	9.840E 02
19	0.800	2	0.	0.	0	0.	0						0.	0.	0
20	1.770	2.	1.498E 01*	5.611E 00*	1.610E-01*	8.710E 00	0.120	8.280	0.120	500	TI 6-4	F	0.	0.	0
21	0.880	2.	0.	0.	0	0	0						1.767E 03	3.535E 01	8.820E 02
22	0.880	2.	0.	0	0	0.	0						0.	0.	0
23	1.840	4.	1.434E 01*	5.357E 00*	1.610E-01*	8.440E 00	0.120			850	TI 6-4	F	0	0.	0.
24	0.280	4	1.434E 01*	5.357E 00*	1.610E-01*	8.600E 00	0.280						0.	0	0.
25	0.330	2	0.	0	0	0	0						0	0.	0.

TOTAL WEIGHT 1.8813E 02 POUNDS
TOTAL LENGTH 2.1880E 01 INCHES
TOTAL POLAR MOMENT 1.0326E 04 LB-IN**2

ORIGINAL PAGE IS OF POOR QUALITY

PROGRAM NO. U3574A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 12

COMPR ROTOR STG 5-10

ROTOR SPAN RATIO = 3.404 OMEGA = 1.38480E 04

FORE END -- JOINT 12 TYPE CONTINUOUS AFT END -- JOINT 13 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	J ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME		POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0						2.717E 03	3.738E 01	1.376E 03
3	0.380	2	0	0	0	0	0						0	0	0
4	0.830	3	2.926E 01*	1.114E 01*	2.874E-01*	8.320E 00	0.200	8.880	0.140	720	RENE 95	F	0	0	0
5	0.830	3	2.914E 01*	1.109E 01*	2.874E-01*	8.620E 00	0.140	8.870	0.200	750	RENE 95	F	0	0	0
6	0.550	2	0	0	0	0	0						3.384E 03	5.388E 01	1.685E 03
7	0.725	2	0	0	0	0	0						0	0	0
8	1.040	4	2.855E 01*	1.085E 01*	2.874E-01*	9.820E 00	0.130			875	RENE 95	F	0	0	0
9	0.575	2	0	0	0	0	0						3.685E 03	5.878E 01	1.838E 03
10	0.870	2	0	0	0	0	0						0	0	0
11	1.355	4	2.805E 01*	1.064E 01*	2.874E-01*	1.001E 01	0.125			975	RENE 95	F	0	0	0
12	0.850	2	0	0	0	0	0						3.358E 03	5.377E 01	1.683E 03
13	0.830	2	0	0	0	0	0						0	0	0
14	1.050	4	2.749E 01*	1.041E 01*	2.874E-01*	1.008E 01	0.135			1080	RENE 95	F	0	0	0
15	0.550	2	0	0	0	0	0						2.941E 03	4.701E 01	1.473E 03
16	0.555	2	0	0	0	0	0						0	0	0
17	1.030	4	2.710E 01*	1.078E 01*	2.874E-01*	1.008E 01	0.130			1150	RENE 95	F	0	0	0
18	0.580	2	0	0	0	0	0						3.181E 03	5.258E 01	1.589E 03
19	0.395	2	0	0	0	0	0						0	0	0
20	0.870	3	2.655E 01*	1.004E 01*	2.874E-01*	1.000E 01	0.120	8.200	0.120	1240	RENE 95	F	0	0	0
21	0.830	3	2.655E 01*	1.004E 01*	2.874E-01*	[illegible].200E 00	0.120	8.500	0.140				0	0	0
22	0.630	3	2.658E 01*	1.004E 01*	2.874E-01*	[illegible].500E 00	0.120	7.880	0.250				0	0	0
23	0.280	5	2.655E 01*	1.004E 01*	2.874E-01*	[illegible]150E 00	0.830						0	0	0
24	0.320	2	0	0	0	0	0						1.734E 03	4.010E 01	8.890E 02
25	0.270	2	0	0	0	0	0						0	0	0

TOTAL WEIGHT 3.4346E 02 POUNDS
TOTAL LENGTH 1.5855E 01 INCHES
TOTAL POLAR MOMENT 2.0992E 04 LB -IN**2

PROGRAM NO. U3574A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 13

COMPR-HPT ROTOR SHAFT

ROTOR SPAN RATIO = 3.404 OMEGA = 1.38480E 04

FORE END -- JOINT 13 TYPE CONTINUOUS AFT END -- JOINT 14 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	J ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME		POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0						0	0	0
3	0.280	5	2.548E 01*	9.598E 00*	2.980E-01*	5.050E 00	1.250			850	INCO 718		4.580E 02	8.400E 00	3.000E 02
4	0.800	3	2.548E 01*	9.598E 00*	2.980E-01*	5.840E 00	0.210	6.570	0.180				0	0	0
5	0.750	4	2.548E 01*	9.598E 00*	2.980E-01*	5.770E 00	0.180						0	0	0
6	1.000	4	2.548E 01*	9.598E 00*	2.980E-01*	5.730E 00	0.150						0	0	0
7	1.000	4	2.548E 01*	9.598E 00*	2.980E-01*	5.730E 00	0.150						0	0	0
8	0.870	4	2.548E 01*	9.598E 00*	2.980E-01*	5.730E 00	0.150						0	0	0
9	0.450	4	2.548E 01*	9.598E 00*	2.980E-01*	5.730E 00	0.150						0	0	0
10	1.000	3	2.548E 01*	9.598E 00*	2.980E-01*	5.880E 00	0.130	6.750	0.130				0	0	0
11	1.020	3	2.548E 01*	9.598E 00*	2.980E-01*	6.740E 00	0.130	6.830	0.130				0	0	0
12	0.420	4	2.548E 01*	9.598E 00*	2.980E-01*	6.900E 00	0.140						0	0	0
13	0.850	4	2.548E 01*	9.598E 00*	2.980E-01*	5.900E 00	0.200						0	0	0
14	0.300	5	2.548E 01*	9.598E 00*	2.980E-01*	5.880E 00	1.200						0	0	0
15	0.280	2	0	0	0	0	0						2.168E 03	5.280E 01	1.168E 03
16	0.280	2	0	0	0	0	0						0	0	0
17	0.340	5	2.812E 01*	1.067E 01*	2.874E-01*	5.880E 00	1.200			950	RENE 95	F	0	0	0
18	0.700	4	2.812E 01*	1.067E 01*	2.874E-01*	5.840E 00	0.200						0	0	0
19	0.880	4	2.812E 01*	1.067E 01*	2.874E-01*	5.900E 00	0.180						0	0	0
20	0.870	2	0	0	0	0	0						0	0	0

TOTAL WEIGHT 6.1000E 01 POUNDS
TOTAL LENGTH 1.2200E 01 INCHES
TOTAL POLAR MOMENT 2.6140E 03 LB.-IN**2

PROGRAM NO U3574A . . . . . V E G A . . . .

ORIGINAL PAGE IS OF POOR QUALITY

EEE-5632 LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 14

STG 1 & 2 HPT ROTOR

ROTOR SPAN RATIO = 3.404 OMEGA = 1.38480E 04

FORE END -- JOINT 14 TYPE CONTINUOUS AFT END -- JOINT 44 TYPE PINNED

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME		POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0						1.881E 04	2.220E 02	8.008E 03
3	0.410	2	0	0	0	0	0						0	0	0
4	0.340	3	2.812E 01*	1.087E 01*	2.874E-01*	8.880E 00	0.450	7.120	0.220	880	RENE 95	F	0	0	0
5	0.870	3	2.812E 01*	1.087E 01*	2.874E-01*	7.120E 00	0.150	7.380	0.150				0	0	0
6	0.240	3	2.812E 01*	1.087E 0	2.874E-01*	7.380E 00	0.150	7.480	0.243				0	0	0
7	0.250	5	2.812E 01*	1.[illegible]	2.874E-01*	8.480E 00	1.100						0	0	0
8	0.250	2	0	0	0	0	0						3.815E 04	6.300E 01	[illegible] 817E 03
9	0.250	2	0	0	0	0	0						0	0	0
10	0.310	5	2.842E 01*	1.080E 01*	2.874E-01*	8.480E 00	1.100			800	RENE 95	F	0	0	0
11	0.270	4	2.842E 01*	1.080E 01*	2.874E-01*	7.880E 00	0.220						0	0	0
12	0.700	4	2.842E 01*	1.080E 01*	2.874E-01*	7.830E 00	0.180						0	0	0
13	0.240	4	2.842E 01*	1.080E 01*	2.874E-01*	7.870E 00	0.300						0	0	0
14	0.470	2	0	0	0	0	0						1.583E 04	2.220E 02	8.087E 03
15	0.470	2	0	0	0	0	0						0	0	0
16	0.430	4	2.842E 01*	1.080E 01*	2.874E-01*	7.550E 00	0.320			800	RENE 95	F	0	0	0
17	1.240	3	2.842E 01*	1.080E 01*	2.874E-01*	7.460E 00	0.200	8.800	0.280				0	0	0
18	0.210	3	2.842E 01*	1.010E 01*	2.874E-01*	8.800E 00	0.180	8.750	0.280				0	0	0
19	0.280	5	2.842E 01*	1.[illegible]E 01*	2.874E-01*	8.800E 00	1.020						0	0	0
20	0.180	2	0	0	0	0	0						0	0	0
21	0.120	2	0	0	0	0	0						0	0	0
22	0.320	5	2.712E 01*	1.027E 01*	2.980E-01*	5.880E 00	2.070			500	INCO 718		7.810E 01	3.850E 00	3.800E 01
23	1.600	2	5.800E-08	-8.200E-08	-8.200E-08	3.000E-08	0						8.850E 01	3.850E 00	3.800E 01
24	1.720	4	2.712E 01*	1.027E 01*	2.980E-01*	3.800E 00	0.380			500	INCO 718		0	0	0
25	1.250	6	2.712E 01*	1.027E 01*	2.980E-01*	3.430E 00	0.300						0	0	0

TOTAL WEIGHT 5.2470E 02 POUNDS
TOTAL LENGTH 1.2460E 01 INCHES
TOTAL POLAR MOMENT 3.8488E 04 LB -IN**2

PROGRAM NO U3574A . . . . . V E G A . . . .

EEE-5632 LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 16

HPC-COMBUSTOR CASE

STATOR SPAN RATIO = 0 OMEGA = 0

FORE END -- JOINT 82 TYPE CONTINUOUS AFT END -- JOINT 24 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					0	0	0
3	0.150	5	2.597E 01*	9.786E 00*	2.980E-01*	1.538E 01	1.850			750	INCO 718	0	0	0
4	0.100	4	2.597E 01*	9.786E 00*	2.980E-01*	1.475E 01	0.200					0	0	0
5	1.050	4	2.597E 01*	9.786E 00*	2.980E-01*	1.471E 01	0.150					0	0	0
6	1.050	4	2.597E 01*	9.786E 00*	2.980E-01*	1.471E 01	0.150					0	0	0
7	0.290	4	2.597E 01*	9.786E 00*	2.980E-01*	1.471E 01	0.150					0	0	0

TOTAL WEIGHT 0 POUNDS
TOTAL LENGTH 2.8400E 00 INCHES
TOTAL POLAR MOMENT 0 LB -IN**2

ORIGINAL PAGE IS
OF POOR QUALITY

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 16

NO 2 BEARING SUPPORT

STATOR SPAN RATIO : 0 OMEGA : 0

FORE END -- JOINT 16 TYPE PINNED AFT END -- JOINT 17 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					5 200E 01	4 800E 00	3 100E 01
3	-0 810	2	0	0	0	0	0					0	0	0
4	0 810	5	2 875E 01*	1 112E 01*	2 830E-01*	4 330E 00	0 700			200	17-4 PH	0	0	0
5	0 710	4	2 875E 01*	1 112E 01*	2 830E-01*	4 700E 00	1 050					0	0	0
6	0 430	4	2 875E 01*	1 112E 01*	2 830E-01*	4 670E 00	1 520					0	0	0
7	0 320	4	2 875E 01*	1 112E 01*	2 830E-01*	4 800E 00	0 720					0	0	0
8	0 562	4	2 875E 01*	1 112E 01*	2 830E-01*	5 730E 00	1 050					0	0	0

TOTAL WEIGHT 4 6000E 00 POUNDS
TOTAL LENGTH 2 0220E 00 INCHES
TOTAL POLAR MOMENT 5 2000E 01 LB -IN**2

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 17

NO 3 BRG SUPT & CNTR SPR

STATOR SPAN RATIO : 0 OMEGA : 0

FORE END -- JOINT 17 TYPE CONTINUOUS AFT END -- JOINT 47 TYPE PINNED

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					3 382E 04	1 140E 02	1 698E 04
3	0 180	5	2 875E 01*	1 112E 01*	2 830E-01*	5 740E 00	1 050			200	17-4 PH	0	0	0
4	0 200	4	2 875E 01*	1 112E 01*	2 830E-01*	4 950E 00	0 250					4 800E 01	1 700E 00	2 800E 01
5	2 620	2	0	0	0	3 333E-05	0					4 800E 01	1 700E 00	2 800E 01
6	0 280	4	2 875E 01*	1 112E 01*	2 830E-01*	5 470E 00	0 770			200	17-4 PH	0	0	0
7	0 940	4	2 875E 01*	1 112E 01*	2 830E-01*	5 170E 00	0 370					3 200E 02	1 260E 01	1 600E 02

TOTAL WEIGHT 1 3000E 02 POUNDS
TOTAL LENGTH 4 2400E 00 INCHES
TOTAL POLAR MOMENT 3 4338E 04 LB -IN**2

PROGRAM NO U3574A . . . . . V E G A . . . . .

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 18

NO 1 BEARING SUPPORT

STATOR SPAN RATIO = 0 OMEGA = 0

FORE END -- JOINT 18 TYPE PINNED AFT END -- JOINT 48 TYPE CONTINUOUS

	INTERVAL PROPERTIES									MATERIAL DATA		WEIGHT PROPERTIES		
STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	T ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					1.332E 03	2.840E 01	5.740E 02
3	-1.400	2	0	0	0	0	0					0	0	0
4	0.300	5	2.875E 01*	1.112E 01*	2.830E-01*	8.100E 00	0.880			200	17-4 PH	0	0	0
5	0.570	5	2.875E 01*	1.112E C1*	2.830E-01*	8.100E 00	0.380					0	0	0
6	0.530	5	2.875E 01*	1.112E 01*	2.830E-01*	8.870E 00	1.150					0	0	0
7	1.080	4	2.875E 01*	1.112E 01*	2.830E-01*	9.200E 00	1.380					9.880E 02	1.710E 01	5.170E 02
8	0.570	4	2.875E 01*	1.112E 01*	2.830E-01*	9.550E 00	1.800					5.120E 02	7.800E 00	2.570E 02
9	0.570	3	2.875E 01*	1.112E 01*	2.830E-01*	9.800E 00	0.520	10.000	0.520			0	0	0
10	1.000	3	2.875E 01*	1.112E 01*	2.830E-01*	1.010E 01	0.360	10.700	0.340			0	0	0
11	1.000	3	2.875E 01*	1.112E 01*	2.830E-01*	1.070E 01	0.340	11.300	0.340			0	0	0
12	1.000	3	2.875E 01*	1.112E 01*	2.830E-C1*	1.130E 01	0.320	11.880	0.300			0	0	0
13	0.580	3	2.875E 01*	1.112E 01*	2.830E-01*	1.188E 01	0.300	12.500	0.280			0	0	0
14	1.000	3	2.875E 01*	1.112E 01*	2.830E-01*	1.250E 01	0.280	13.060	0.280			0	0	0
15	1.000	3	2.875E 01*	1.112E 01*	2.830E-01*	1.308E 01	0.280	13.680	0.250			0	0	0
16	1.000	3	2.875E 01*	1.112E 01*	2.830E-01*	1.368E 01	0.250	14.260	0.230			0	0	0
17	0.580	3	2.875E 01*	1.112E 01*	2.830E-01*	1.428E 01	0.230	14.870	0.220			0	0	0
18	1.000	3	2.875E 01*	1.112E 01*	2.830E-01*	1.487E 01	0.220	15.480	0.200			0	0	0
19	1.000	3	2.875E 01*	1.112E 01*	2.830E-01*	1.548E 01	0.200	16.040	0.180			0	0	0
20	0.370	3	2.875E 01*	1.112E 01*	2.830E-01*	1.604E 01	0.180	16.320	0.270			0	0	0
21	0.270	5	2.875E 01*	1.112E 01*	2.830E-01*	1.748E 01	1.240					3.888E 04	8.000E 01	1.985E 04
22	0.500	5	2.875E 01*	1.112E 01*	2.830E-01*	1.827E 01	2.000					3.694E 04	1.140E 02	1.847E 04
23	4.444	2	0	0	0	0	0					5.723E 04	5.180E 02	2.861E 04

TOTAL WEIGHT 7.7310E 02 POUNDS
TOTAL LENGTH 1.9844E 01 INCHES
TOTAL POLAR MOMENT 1.3687E 05 LB -IN**2

PROGRAM NO U3574A . . . . . V E G A . . . . .

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 19

NO 5 BEARING SUPPORT

STATOR SPAN RATIO = 0 OMEGA = 0

FORE END -- JOINT 19 TYPE PINNED AFT END -- JOINT 28 TYPE CONTINUOUS

	INTERVAL PROPERTIES									MATERIAL DATA		WEIGHT PROPERTIES		
STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	T ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0.	2	0.	0	0	0	0					1.122E 02	7.840E 00	5.610E 01
3	-1.300	2	0	0	0	0	0					0	0	0
4	1.300	5	2.757E 01*	1.045E 01*	2.980E-01*	4.350E 00	0.220			400	INCO 718	0	0	0.
5	0.570	4	2.757E 01*	1.045E 01*	2.980E-01*	4.520E 00	0.400					0	0.	0.
6	0.220	4	2.757E 01*	1.045E 01*	2.980E-01*	4.670E 00	0.430					0	0.	0
7	0.210	3	2.757E 01*	1.045E 01*	2.980E-01*	4.590E 00	0.200	4.780	0.120			0.	0.	0
8	0.750	3	2.757E 01*	1.045E 01*	2.980E-01*	4.750E 00	0.120	5.220	0.090			0.	0.	0.
9	0.750	3	2.757E 01*	1.045E 01*	2.980E-01*	5.220E 00	0.080	5.720	0.080			0.	0	0
10	0.740	3	2.757E 01*	1.045E 01*	2.980E-01*	5.720E 00	0.080	6.200	0.100			1.314E 02	3.150E 00	6.807E 01
11	0.350	4	2.757E 01*	1.045E 01*	2.980E-01*	6.280E 00	0.370					0.	0.	0.
12	0.840	5	2.757E 01*	1.045E 01*	2.980E-01*	6.890E 00	1.220					2.733E 02	4.830E 00	1.381E 02
13	0.460	5	2.757E 01*	1.045E 01*	2.980E-01*	7.050E 00	1.780					2.005E 02	1.498E 01	1.224E 02
14	0.240	3	2.757E 01*	1.045E 01*	2.980E-01*	7.130E 00	0.140	7.300	0.080			0.	0.	0.
15	0.380	3	2.757E 01*	1.045E 01*	2.980E-01*	7.300E 00	0.080	7.550	0.100			0	0.	0
16	0.890	3	2.757E 01*	1.045E 01*	2.980E-01*	7.550E 00	0.100	8.040	0.290			0.	0.	0
17	0.610	4	2.757E 01*	1.045E 01*	2.980E-01*	8.180E 00	0.280					9.744E 02	1.264E 01	5.152E 02
18	0.520	2	3.226E-10	0	0	0.	0.					4.518E 02	8.020E 00	2.329E 02
19	0.240	4	2.757E 01*	1.045E 01*	2.980E-01*	8.250E 00	0.250					0	0	0.
20	0.740	3	2.757E 01*	1.045E 01*	2.980E-01*	8.180E 00	0.250	8.570	0.100			0.	0	0
21	0.580	3	2.757E 01*	1.045E	2.980E-01*	9.570E 00	0.100	10.210	0.080			0	0.	0
22	0.800	3	2.757E 01*	1.045E	2.980E-01*	1.021E 01	0.080	10.800	0.100			0.	0.	0.
23	0.530	3	2.757E 01*	1.045E	2.980E-01*	1.080E 01	0.100	11.080	0.350			0	0	0.
24	6.000	2	0.	0	0	0	0.					0	0	0.

TOTAL WEIGHT 4.8260E 01 POUNDS
TOTAL LENGTH 1.6810E 01 INCHES
TOTAL POLAR MOMENT 2.1435E 03 LB -IN**2

PROGRAM NO U3574A . . . . . V E G A . . . . . OF POOR QUALITY

EEE-SS3E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 20

BOOSTER CASING

STATOR SPAN RATIO = 0 OMEGA = 0

FORE END -- JOINT 20 TYPE PINNED AFT END -- JOINT 21 TYPE CONTINUOUS

INTERVAL PROPERTIES / MATERIAL DATA / WEIGHT PROPERTIES

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					3.545E 03	4.880E 00	1.512E 02
3	0.220	4	1.000E 01	3.500E 00	1.000E-01	2.654E 01	0.120					0	0	0
4	0.280	4	1.000E 01	3.500E 00	1.000E-01	2.654E 01	0.210					0	0	0
5	1.300	4	1.000E 01	3.500E 00	1.000E-01	2.652E 01	0.130					5.510E 04	1.230E 02	3.255E 04
6	1.450	4	1.000E 01	3.500E 00	1.000E-01	2.652E 01	0.130					0	0	0
7	0.100	4	1.000E 01	3.500E 00	1.000E-01	2.661E 01	0.380					0	0	0
8	0.890	4	1.000E 01	3.500E 00	1.000E-01	2.652E 01	0.140					0	0	0
9	1.010	5	1.000E 01	3.500E 00	1.000E-01	2.720E 01	0.700					1.104E 04	1.472E 01	5.225E 03
10	0.550	4	1.000E 01	3.500E 00	1.000E-01	2.673E 01	0.180					0	0	0
11	1.220	4	1.000E 01	3.500E 00	1.000E-01	2.673E 01	0.180					0	0	0
12	0.170	4	1.000E 01	3.500E 00	1.000E-01	2.673E 01	0.400					0	0	0
13	1.000	4	1.000E 01	3.500E 00	1.000E-01	2.625E 01	0.120					0	0	0
14	1.000	4	1.000E 01	3.500E 00	1.000E-01	2.618E 01	0.120					0	0	0
15	1.000	4	1.000E 01	3.500E 00	1.000E-01	2.608E 01	0.120					0	0	0
16	1.370	4	1.000E 01	3.500E 00	1.000E-01	2.608E 01	0.120					0	0	0
17	1.120	4	1.000E 01	3.500E 00	1.000E-01	2.617E 01	0.120					0	0	0
18	1.000	4	1.000E 01	3.500E 00	1.000E-01	2.630E 01	0.120					0	0	0
19	1.000	4	1.000E 01	3.500E 00	1.000E-01	2.648E 01	0.120					8.155E 03	1.089E 01	4.284E 03
20	0.830	2	0	0	0	0	0					1.469E 05	2.550E 02	7.344E 04
21	7.255	2	0	0	0	0	0					1.170E 05	4.050E 02	5.852E 04

TOTAL WEIGHT 8.1350E 02 POUNDS
TOTAL LENGTH 2.2845E 01 INCHES
TOTAL POLAR MOMENT 3.5176E 05 LB -IN**2

PROGRAM NO U3574A . . . . . V E G A . . . . .

EEE-SS3E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 21

COMPR STATOR I[illegible]-STG 1

STATOR SPAN RATIO = 0 OMEGA = 0

FORE END -- JOINT 21 TYPE CONTINUOUS AFT END -- JOINT 22 TYPE CONTINUOUS

INTERVAL PROPERTIES / MATERIAL DATA / WEIGHT PROPERTIES

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					[illegible] 05	4.450E 02	6.430E 04
3	5.075	2	0	0	0	0	0					6.52[illegible] 04	2.550E 02	3.264E 04
4	0.250	5	2.850E 01	1.100E 01	2.800E-01	1.587E 01	1.320					0	0	0
5	0.320	5	2.850E 01	1.100E 01	2.800E-01	1.561E 01	1.140					0	0	0
6	0.130	5	2.850E 01	1.100E 01	2.800E-01	1.484E 01	0.400					0	0	0
7	0.790	4	2.850E 01	1.100E 01	2.800E-01	1.457E 01	0.210					0	0	0
8	0.710	4	2.850E 01	1.100E 01	2.800E-01	1.457E 01	0.140					0	0	0
9	0.370	2	0	0	0	0	0					6.400E 03	4.543E 01	3.200E 03
10	0.370	2	0	0	0	0	0					0	0	0
11	0.710	4	2.850E 01	1.100E 01	2.800E-01	1.457E 01	0.140					0	0	0
12	0.160	5	2.850E 01	1.100E [illegible]	2.800E-01	1.457E 01	0.550					0	0	0
13	1.140	3	2.850E 01	1.100E 01	2.800E-01	1.414E 01	0.220	13.980	0.180			0	0	0
14	1.500	3	2.850E 01	1.100E 01	2.800E-01	1.398E 01	0.150	13.750	0.150			0	0	0
15	1.270	3	2.850E 01	1.100E 01	2.800E-01	1.376E 01	0.220	13.600	0.220			0	0	0
16	0.530	4	2.850E 01	1.100E 01	2.800E-01	1.371E 01	0.270					0	0	0
17	0.450	4	2.850E 01	1.100E 01	2.800E-01	1.372E 01	0.150					0	0	0
18	0.370	2	0	0	0	0	0					6.880E 03	5.072E 01	3.440E 03
19	0.370	2	0	0	0	0	0					0	0	0
20	0.470	4	2.800E 01	1.080E 01	2.800E-01	1.372E 01	0.150					0	0	0
21	0.570	5	2.800E 01	1.080E 01	2.800E-01	1.372E 01	0.436					0	0	0
22	1.370	4	2.800E 01	1.080E 01	2.800E-01	1.342E 01	0.190					0	0	0
23	1.240	4	2.800E 01	1.080E 01	2.800E-01	1.336E 01	0.180					0	0	0
24	0.230	4	2.800E 01	1.080E 01	2.800E-01	1.335E 01	0.180					0	0	0
25	0.370	2	0	0	0	0	0					0	0	0

TOTAL WEIGHT 7.8615E 02 POUNDS
TOTAL LENGTH 1.8835E 01 INCHES
TOTAL POLAR MOMENT 2.0716E 05 LB -IN**2

EEE-S63E LP REF ICLS BASE' NE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 22

COMPR STATOR STGS 2-5

STATOR SPAN RATIO = 0 OMEGA = 0

FORE END -- JOINT 22 TYPE CONTINUOUS AFT END -- JOINT 62 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0.	2	0.	0	0	0	0					5.780E 03	4.815E 01	3.400E 03
3	0.370	2	0.	0.	0	0	0					0	0	0
4	0.230	4	2.750E 01	1.080E 01	2.800E-01	1.335E 01	0.150					0	0	0
5	0.150	5	2.750E 01	1.080E 01	2.800E-01	1.335E 01	0.350					0	0.	0
6	1.220	4	2.750E 01	1.080E 01	2.800E-01	1.312E 01	0.150					0	0	0
7	0.840	4	2.750E 01	1.080E 01	2.800E-01	1.310E 01	0.200					0	0	0
8	0.230	5	2.750E 01	1.080E 01	2.800E-01	1.305E 01	0.150					0	0	0
9	0.310	2	0	0	0	0	0					5.430E 03	3.451E 01	2.710E 03
10	0.310	2	0	0	0	0	0					0	0	0
11	0.660	4	2.700E 01	1.040E 01	2.800E-01	1.320E 01	0.210					3.040E 02	1.830E 00	1.410E 02
12	0.740	4	2.700E 01	1.040E 01	2.800E-01	1.325E 01	0.180					0.	0	0
13	0.850	4	2.700E 01	1.040E 01	2.800E-01	1.318E 01	0.150					3.040E 02	1.830E 00	1.410E 02
14	0.330	2	0.	0.	0	0	0					5.380E 03	3.340E 01	2.876E 03
15	0.340	2	0.	0.	0.	0	0					4.320E 02	2.740E 00	2.040E 02
16	1.200	4	2.800E 01	1.000E 01	2.800E-01	1.381E 01	0.180					0	0	0
17	0.760	4	2.800E 01	1.000E 01	2.800E-01	1.388E 01	0.180					4.330E 02	2.740E 00	2.040E 02
18	0.330	2	0	0	0	0	0					8.260E 02	7.000E 00	6.820E 02
19	0.350	4	2.820E 01	2.870E 01	2.800E-01	1.435E 01	2.120					0	0	0
20	1.380	4	2.820E 01	2.870E 01	2.800E-01	1.413E 01	0.700					0	0	0
21	2.270	4	2.820E 01	2.870E 01	2.800E-01	1.440E 01	0.750					0	0	0
22	2.450	4	2.820E 01	2.870E 01	2.800E-01	1.385E 01	0.150					0	0	0
23	2.080	4	2.820E 01	2.870E 01	2.800E-01	1.418E 01	0.170					0	0.	0
24	1.850	4	2.820E 01	2.870E 01	2.800E-01	1.438E 01	0.180					0.	0.	0
25	1.850	4	2.820E 01	2.870E 01	2.800E-01	1.448E 01	0.180					0	0.	0

TOTAL WEIGHT 1.3261E 02 POUNDS
TOTAL LENGTH 2.1150E 01 INCHES
TOTAL POLAR MOMENT 1.5570E 04 LB.-IN**2

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 23

COMPR STATOR STGS 6-9

STATOR SPAN RATIO = 0. OMEGA = 0.

FORE END -- JOINT 23 TYPE PINNED AFT END -- JOINT 62 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0.	2	0	0	0.	0	0.					0	0.	0
3	0.240	4	2.800E 01	2.650E 01	2.800E-01	1.227E 01	0.130					0	0	0
4	0.240	4	2.800E 01	2.650E 01	2.800E-01	1.228E 01	0.210					4.410E 02	4.080E 00	2.205E 02
5	0.555	4	2.800E 01	2.650E 01	2.800E-01	1.285E 01	0.750					4.410E 02	4.580E 00	2.205E 02
6	0.250	4	2.800E 01	2.650E 01	2.800E-01	1.232E 01	0.160					0.	0.	0.
7	0.755	4	2.800E 01	2.650E 01	2.800E-01	1.230E 01	0.110					0	0	0
8	1.070	4	2.800E 01	2.650E 01	2.800E-01	1.230E 01	0.110					5.645E 02	5.560E 00	3.323E 02
9	0.440	4	2.800E 01	2.650E 01	2.800E-01	1.230E 01	0.110					0.	0.	0.
10	0.125	4	2.800E 01	2.650E 01	2.800E-01	1.324E 01	1.040					0	0	0
11	0.220	4	2.760E 01	2.620E 01	2.800E-01	1.259E 01	0.440					0	0	0.
12	0.540	4	2.760E 01	2.620E 01	2.800E-01	1.229E 01	0.100					0.	0.	0.
13	0.500	4	2.760E 01	2.620E 01	2.800E-01	1.228E 01	0.100					0.	0.	0.
14	0.125	4	2.760E 01	2.620E 01	2.800E-01	1.324E 01	1.140					0.	0.	0.
15	0.545	4	2.760E 01	2.620E 01	2.800E-01	1.230E 01	0.100					6.188E 02	8.200E 00	3.084E 02
16	0.580	4	2.760E 01	2.620E 01	2.800E-01	1.230E 01	0.100					0	0.	0.
17	0.125	4	2.760E 01	2.620E 01	2.800E-01	1.324E 01	1.080					0.	0.	0
18	0.490	4	2.760E 01	2.620E 01	2.800E-01	1.220E 01	0.100					0	0	0
19	0.850	4	2.760E 01	2.620E 01	2.800E-01	1.230E 01	0.100					5.828E 02	4.850E 00	2.913E 02
20	0.480	4	2.760E 01	2.620E 01	2.800E-01	1.230E 01	0.100					0	0.	0.
21	0.125	4	2.760E 01	2.620E 01	2.800E-01	1.324E 01	1.040					0.	0.	0.
22	1.080	4	2.760E 01	2.620E 01	2.800E-01	1.230E 01	0.100					0	0.	0.
23	0.370	4	2.694E 01*	1.018E 01*	2.980E-01*	1.320E 01	0.080			540	INCO 718	0	0.	0
24	1.050	3	2.694E 01*	1.018E 01*	2.980E-01*	1.320E 01	0.080	12.800	0.080			0.	0.	0.
25	-0.875	3	2.694E 01*	1.018E 01*	2.980E-01*	1.381E 01	0.080	14.400	0.080			0.	0	0.

TOTAL WEIGHT 2.3870E 01 POUNDS
TOTAL LENGTH 1.0200E 01 INCHES
TOTAL POLAR MOMENT 2.7478E 03 LB.-IN**2

ORIGINAL PAGE IS OF POOR QUALITY

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-5632 LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 24

COMBUSTOR CASING

STATOR SPAN RATIO : 0 OMEGA : 0

FORE END -- JOINT 24 TYPE CONTINUOUS AFT END -- JOINT 54 TYPE PINNED

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) C(PSI)	T ETA(M) RHO RHC	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					1.540E 03	5.850E 00	7.710E 02
3	-1.540	3	2.357E 01*	8.820E 00*	2.980E-01*	1.435E 01	0.120	12.750	0.120	1200	INCO 718	0	0	0
4	-0.800	5	2.357E 01*	8.820E 00*	2.980E-01*	1.285E 01	0.100					0	0	0
5	0.800	2	0	0	0	0	0					0	0	0
6	0.730	3	2.357E 01*	8.820E 00*	2.980E-01*	1.242E 01	0.090	12.000	0.080			1.554E 03	1.217E 01	7.770E 02
7	1.860	2	0	0	0	0	0					1.554E 03	1.217E 01	7.770E 02
8	1.050	3	2.357E 01*	8.820E 00*	2.980E-01*	1.014E 01	0.120	9.250	0.120			1.083E 03	1.200E 01	5.685E 02
9	0.125	5	2.357E 01*	8.820E 00*	2.980E-01*	5.250E 00	1.070					0	0	0
10	0.280	4	2.357E 01*	8.820E 00*	2.980E-01*	8.860E 00	0.150					0	0	0
11	1.010	3	2.357E 01*	8.820E 00*	2.980E-01*	8.810E 00	0.200	8.530	0.120			0	0	0
12	0.350	4	2.357E 01*	8.820E 00*	2.980E-01*	8.570E 00	0.120					0	0	0
13	1.480	4	2.357E 01*	8.820E 00*	2.980E-01*	8.530E 00	0.120					0	0	0
14	1.480	4	2.357E 01*	8.820E 00*	2.980E-01*	8.530E 00	0.120					0	0	0
15	0.820	3	2.357E 01*	8.820E 00*	2.980E-01*	8.400E 00	0.120	8.740	0.150			0	0	0
16	0.240	4	2.357E 01*	8.820E 00*	2.980E-01*	8.520E 00	0.150					0	0	0
17	0.480	5	2.357E 01*	8.820E 00*	2.980E-01*	5.040E 00	1.050					3.510E 02	2.800E 00	1.750E 02
18	1.340	3	2.357E 01*	8.820E 00*	2.980E-01*	8.840E 00	0.120	10.420	0.120			0	0	0
19	0.260	4	2.357E 01*	8.820E 00*	2.980E-01*	1.085E 01	0.320					1.007E 03	1.250E 01	6.410E 02
20	1.140	3	2.357E 01*	8.820E 00*	2.980E-71*	1.070E 01	0.120	11.830	0.120			4.755E 03	2.510E 01	2.400E 03
21	0.120	5	2.357E 01*	8.820E 00*	2.980E-01*	1.282E 01	0.850					5.520E 02	4.600E 00	3.310E *2

TOTAL WEIGHT 8.9280E 01 POUNDS
TOTAL LENGTH 1.1120E 01 INCHES
TOTAL POLAR MOMENT 1.2550E 04 LB.-IN**2

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-5632 LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 25

COMBUSTOR-HPT CASING

STATOR SPAN RATIO : 0 OMEGA : 0

FORE END -- JOINT 24 TYPE CONTINUOUS AFT END -- JOINT 25 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) C(PSI)	T ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					1.984E 04	8.300E 01	8.970E 03
3	0.110	5	2.573E 01*	9.698E 00*	2.980E-01*	1.480E 01	0.920			800	INCO 718	1.440E 04	1.000E 02	7.200E 03
4	1.850	3	2.573E 01*	9.698E 00*	2.980E-01*	1.476E 01	0.150	15.000	0.150			0	0	0
5	1.150	3	2.573E 01*	9.698E 00*	2.980E-01*	1.500E 01	0.150	15.430	0.150			0	0	0
6	3.150	4	2.573E 01*	9.698E 00*	2.980E-01*	1.555E 01	0.150					0	0	0
7	1.840	3	2.573E 01*	9.698E 00*	2.980E-01*	1.547E 01	0.150	15.710	0.150			0	0	0
8	2.080	4	2.573E 01*	9.698E 00*	2.980E-01*	1.578E 01	0.150					0	0	0
9	0.740	4	2.357E 01*	8.820E 00*	2.980E-01*	1.581E 01	0.170			1200	INCO 718	4.050E 04	1.250E 02	2.025E 04
10	0.530	5	2.357E 01*	8.820E 00*	2.980E-01*	1.885E 01	0.910					2.385E 03	1.075E 01	1.177E 03
11	0.500	3	2.357E 01*	8.820E 00*	2.980E-01*	1.582E 01	0.150	15.700	0.150			0	0	0
12	0.570	3	2.357E 01*	8.820E 00*	2.980E-01*	1.570E 01	0.150	15.780	0.150			0	0	0
13	0.400	5	2.357E 01*	8.820E 00*	2.980E-01*	1.884E 01	0.840					5.205E 03	2.540E 01	3.103E 03
14	1.150	3	2.357E 01*	8.820E 00*	2.980E-01*	1.583E 01	0.150	15.880	0.150			0	0	0
15	1.150	3	2.357E 01*	8.820E 00*	2.980E-01*	1.588E 01	0.150	16.140	0.150			0	0	0
16	0.280	5	2.357E 01*	8.820E 00*	2.980E-01*	1.886E 01	0.870					6.532E 03	2.980E 01	3.285E 03
17	1.060	3	2.357E 01*	8.820E 00*	2.980E-01*	1.618E 01	0.150	16.310	0.150			0	0	0
18	0.340	3	2.357E 01*	8.820E 00*	2.980E-01*	1.632E 01	0.150	16.360	0.150			0	0	0
19	0.300	5	2.357E 01*	8.820E 00*	2.980E-01*	1.715E 01	0.920					2.679E 03	1.150E 01	1.330E 03
20	0.200	4	2.357E 01*	8.820E 00*	2.980E-01*	1.853E 01	0.310					0	0	0
21	0.880	3	2.357E 01*	8.820E 00*	2.980E-01*	1.645E 01	0.130	16.800	0.130			0	0	0
22	0.880	3	2.357E 01*	8.820E 00*	2.980E-01*	1.880E 01	0.130	17.080	0.130			0	0	0
23	0.450	5	2.357E 01*	8.820E 00*	2.980E-01*	1.725E 01	1.270					0	0	0
24	0.720	3	2.357E 01*	8.820E 00*	2.980E-01*	1.722E 01	0.130	17.800	0.130			0	0	0
25	0.170	5	2.357E 01*	8.820E 00*	2.980E-01*	1.880E 01	1.040					1.280E 05	3.20C 02	6.400E 05

TOTAL WEIGHT 7.0848E 02 POUNDS
TOTAL LENGTH 2.0550E 01 INCHES
TOTAL POLAR MOMENT .2052E 06 LB-IN**2

ORIGINAL PAGE IS
OF POOR QUALITY

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 26

LP TURBINE CASING

STATOR SPAN RATIO = 0. OMEGA = 0

FORE END -- JOINT 26 TYPE CONTINUOUS AFT END -- JOINT 56 TYPE CONTINUOUS

			INTERVAL PROPERTIES							MATERIAL DATA		WEIGHT PROPERTIES		
STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					1.893E 04	8.300E 01	8.464E 03
3	1.550	2	1.074E-10	1.285E-08	1.285E-08	5.945E-08	0					3.656E 03	1.220E 01	1.970E 03
4	1.370	3	2.357E 01*	8.820E 00*	2.980E-01*	1.829E 01	0.080	18.810	0.080	1200	INCO 718	0	0	0
5	0.550	3	2.357E 01*	8.820E 00*	2.980E-01*	1.881E 01	0.080	19.160	0.080			0	0	0
6	0.310	4	2.357E 01*	8.820E 00*	2.980E-01*	1.930E 01	0.170					0	0	0
7	0.150	4	2.357E 01*	8.820E 00*	2.980E-01*	1.940E 01	0.400					1.838E 04	6.250E 01	9.180E 03
8	1.520	2	7.338E-11	1.042E-08	1.042E-08	4.455E-08	0					3.605E 03	9.100E 00	1.804E 03
9	1.310	3	2.357E 01*	8.820E 00*	2.980E-01*	2.010E 01	0.080	20.720	0.080			0	0	0
10	0.480	3	2.357E 01*	8.820E 00*	2.980E-01*	2.072E 01	0.080	20.880	0.080			0	0	0
11	0.380	4	2.357E 01*	8.820E 00*	2.980E-01*	2.108E 01	0.130					0.	0	0
12	0.150	4	2.357E 01*	8.820E 00*	2.980E-01*	2.120E 01	0.400					2.255E 04	5.930E 01	1.128E 04
13	1.710	2	5.015E-11	5.258E-10	5.258E-10	4.467E-08	0					7.757E 03	1.810E 01	3.878E 03
14	1.400	3	2.357E 01*	8.820E 00*	2.980E-01*	2.188E 01	0.080	22.410	0.080			0	0	0
15	0.520	3	2.357E 01*	8.820E 00*	2.980E-01*	2.241E 01	0.080	22.600	0.080			0.	0	0.
16	0.300	4	2.357E 01*	8.820E 00*	2.980E-01*	2.269E 01	0.110					0	0	0.
17	0.150	4	2.357E 01*	8.820E 00*	2.980E-01*	2.275E 01	0.400					2.955E 04	6.126E 01	1.455E 04
18	1.710	2	4.143E-11	6.347E-10	6.347E-10	4.175E-08	0					5.270E 03	8.900E 00	2.640E 03
19	1.350	3	2.357E 01*	8.820E 00*	2.980E-01*	2.330E 01	0.080	23.750	0.080			0	0	0.
20	0.500	3	2.357E 01*	8.820E 00*	2.980E-01*	2.375E 01	0.060	23.810	0.060			0	0.	0
21	0.300	4	2.357E 01*	8.820E 00*	2.984E-01*	2.388E 01	0.100					3.321E 04	5.550E 01	1.660E 04
22	1.870	2	2.645E-11	2.366E-11	2.366E-11	4.059E-08	0					1.021E 04	1.770E 01	5.107E 03
23	1.450	4	2.357E 01*	8.820E 00*	2.980E-01*	2.390E 01	0.080					0.	0	0.
24	0.830	4	2.357E 01*	8.820E 00*	2.980E-01*	2.412E 01	0.220					2.342E 03	4.100E 00	1.171E 03
25	0.210	5	2.357E 01*	8.820E 00*	2.980E-01*	2.478E 01	0.700					7.560E 04	1.200E 02	3.750E 04

TOTAL WEIGHT 6.8170E 02 POUNDS
TOTAL LENGTH 2.0310E 01 INCHES
TOTAL POLAR MOMENT 2.3081E 05 LB.-IN**2

PROGRAM NO. U3574A * * * * * V E G A * * * * *

EEE-S63E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 27

MIXER

STATOR SPAN RATIO = 0 OMEGA = 0

FORE END -- JOINT 27 TYPE PINNED AFT END -- JOINT 57 TYPE PINNED

			INTERVAL PROPERTIES							MATERIAL DATA		WEIGHT PROPERTIES		
STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0.	0.	0.	0	0					4.340E 04	7.995E 01	2.170E 04
3	1.950	2	0	0.	0	0	0.					0.	0	0
4	7.750	2	0	0.	0	0.	0					1.873E 04	4.100E 01	9.388E 03
5	7.750	2	0.	0.	0	0.	0					0.	0.	0

TOTAL WEIGHT 1.2095E 02 POUNDS
TOTAL LENGTH 1.7450E 01 INCHES
TOTAL POLAR MOMENT 6.2176E 04 LB.-IN**2

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-5632 LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 26

EXHAUST CONE

STATOR SPAN RATIO : 0 OMEGA : 0

FORE END -- JOINT 28 TYPE CONTINUOUS AFT END -- JOINT 58 TYPE PINNED

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0	0	0	0	0					1.431E 04	1.145E 02	7.153E 03
3	4.100	2	0	0	0	0	0					0	0	0
4	9.650	2	0	0	0	0	0					7.178E 03	3.510E 01	3.565E 03
5	5.550	2	0	0	c	0	0					0	0	0
6	8.250	2	0	0	0	0	[illegible]					1.108E 03	1.630E 01	5.547E 02
7	8.250	2	c	0	0	0	[illegible]					2.840E 01	4.200E 00	2.110E 01

TOTAL WEIGHT 1.7010E 02 POUNDS
TOTAL LENGTH 3.9800E 01 INCHES
TOTAL POLAR MOMENT 2.2823E 04 LB -IN**2

PROGRAM NO U3574A * * * * * V E G A * * * * *

EEE-5632 LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 28

INLET FAN CONTAINMENT

STATOR SPAN RATIO : 0. OMEGA : 0.

FORE END -- JOINT 29 TYPE PINNED AFT END -- JOINT 30 TYPE CONTINUOUS

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	G(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
2	0	2	0.	0	0.	0.	0					9.680E 04	5.000E 01	4.840E 04
3	0.300	5	2.898E 01*	1.121E 01*	2.830E-01*	4.587E 01	1.800			200	AISI 4340	0.	0	0
4	1.000	4	2.898E 01*	1.121E 01*	2.830E-01*	4.445E 01	0.400					0	0.	0.
5	0.350	5	2.898E 01*	1.121E 01*	2.830E-01*	4.555E 01	1.600					0	0	0
6	0.800	4	2.898E 01*	1.121E 01*	2.830E-01*	4.445E 01	0.400					0	0.	0.
7	0.200	4.	2.898E 01*	1.121E 01*	2.830E-01*	4.475E 01	0.700					0	0	0.
8	0.570	4.	2.898E 01*	1.121E 01*	2.830E-01*	4.445E 01	0.400					0	0.	0.
9	0.250	4	2.898E 01*	1.121E 01*	2.830E-01*	4.475E 01	0.700					0	0.	0.
10	1.800	4	2.898E 01*	1.121E 01*	2.830E-01*	4.445E 01	0.400					0.	0	0.
11	0.300	4.	2.898E 01*	1.121E 01*	2.830E-01*	4.475E 01	0.700					0	0	0.
12	1.250	3	2.898E 01*	1.121E 01*	2.830E-01*	4.380E 01	0.450	43.350	0.200			0	0.	0.
13	0.200	4	2.898E 01*	1.121E 01*	2.830E-01*	4.370E 01	0.450					0	0.	0.
14	0.700	3.	2.898E 01*	1.121E 01*	2.830E-01*	4.330E 01	0.180	43.150	0.180			c.	0.	0.
15	0.150	5	2.898E 01*	1.121E 01*	2.830E-01*	4.415E 01	1.100					0.	0	0
16	0.750	3.	2.898E 01*	1.121E 01*	2.830E-01*	4.312E 01	0.180	42.970	0.180			8.173E 04	5.200E 01	4.565E 04
17	0.250	4.	2.898E 01*	1.121E 01*	2.830E-01*	4.350E 01	0.650					0	0.	0
18	0.650	3.	2.898E 01*	1.121E 01*	2.830E-01*	4.290E 01	0.220	42.770	0.220			0.	0.	0
19	0.250	4.	2.898E 01*	1.121E 01*	2.830E-01*	4.830E 01	0.670					0.	0	0.
20	0.750	3.	2.898E 01*	1.121E 01*	2.830E-01*	4.270E 01	0.220	42.520	0.220			0.	0	0.
21	0.150	5.	2.898E 01*	1.121E 01*	2.830E-01*	4.345E 01	1.050						0.	0.
22	0.650	3.	2.898E 01*	1.121E 01*	2.830E-01*	4.250E 01	0.220	42.350	0.220			0	0.	0.
23	0.250	4	2.898E 01*	1.121E 01*	2.830E-01*	4.287E 01	0.670					0	0	0.
24	1.000	3	2.898E 01*	1.121E 01*	2.830E-01*	4.220E 01	0.220	42.150	0.350			0.	0	0.
25	0.150	5.	2.898E 01*	1.121E 01*	2.830E-01*	4.315E 01	1.400					0.	0.	0

TOTAL WEIGHT 1.0200E 02 POUNDS
TOTAL LENGTH 1.2620E 01 INCHES
TOTAL POLAR MOMENT 1.8853E 05 LB -IN**2

EEE-883E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & SF

SPAN PROPERTIES INPUT

SPAN NUMBER 30

FWD FAN EXHAUST NOZZLE

STATOR SPAN RATIO = 0 OMEGA = 0

FORE END -- JOINT 30 TYPE CONTINUOUS AFT END -- JOINT 60 TYPE PINNED

STA	INTERVAL LENGTH INCHES	TYPE ELEM	E(PSI) PHI(M) E(PSI) E(PSI)	E(PSI) PHI(V) G(PSI) G(PSI)	I ETA(M) RHO RHO	AREA ETA(V) R(I-1) R(O)	ALPHA TYPE COEF T(I-1) T	R(I) ALPHA	T(I)	TEMP (F)	MATERIAL NAME	POLAR MOMENT OF INERTIA (LB-IN**2)	WEIGHT (LB)	TRANSVERSE MOMENT OF INERTIA (LB-IN**2)
			INTERVAL	PROPERTIES						MATERIAL	DATA	WEIGHT		PROPERTIES
2	0	2	0	0	0	0	0					0.	0	0
3	0.880	4	2.898E 01*	1.121E 01*	2.830E-01*	4.186E 01	0.220			200	AISI 4340	0.	0.	0
4	0.220	4	2.898E 01*	1.121E 01*	2.830E-01*	4.205E 01	0.420					0	0.	0
5	0.570	4	2.898E 01*	1.121E 01*	2.830E-01*	4.180E 01	0.180					0	0	0.
6	0.200	4	2.898E 01*	1.121E 01*	2.830E-01*	4.205E 01	0.420					0	0	0
7	0.570	4	2.898E 01*	1.121E 01*	2.830E-01*	4.175E 01	0.180					0	0	0
8	0.220	4	2.898E 01*	1.121E 01*	2.830E-01*	4.202E 01	0.500					0.	0	0
9	0.840	4	2.898E 01*	1.121E 01*	2.830E-01*	4.170E 01	0.180					0	0	0
10	0.270	5	2.898E 01*	1.121E 01*	2.830E-01*	4.205E 01	0.550					5.547E 04	2.300E 01	2.774E 04
11	2.350	4	2.898E 01*	1.121E 01*	2.830E-01*	4.170E 01	0.200					0	0	0
12	0.500	5	2.898E 01*	1.121E 01*	2.830E-01*	4.325E 01	1.750					0.	0	0
13	0.750	4	1.600E 01	3.500E 00	5.800E-02	4.175E 01	0.200					0	0	0.
14	0.850	4	2.898E 01*	1.121E 01*	2.830E-01*	4.176E 01	0.250					0.	0	0
15	2.000	4	2.898E 01*	1.121E 01*	2.830E-01*	4.175E 01	0.250					0.	0	0.
16	0.550	4	2.898E 01*	1.121E 01*	2.830E-01*	4.187E 01	0.320					0.	0.	0.
17	1.300	4	2.898E 01*	1.121E 01*	2.830E-01*	4.175E 01	0.200					0.	0	0.
18	0.850	4	2.898E 01*	1.121E 01*	2.830E-01*	4.175E 01	0.250					0.	0	0
19	1.250	4	2.898E 01*	1.121E 01*	2.830E-01*	4.175E 01	0.200					0.	0	0.
20	0.520	4	2.898E 01*	1.121E 01*	2.830E-01*	4.187E 01	0.320					0.	0	0
21	2.050	4	2.898E 01*	1.121E 01*	2.830E-01*	4.175E 01	0.200					0	0	0
22	0.820	4	2.898E 01*	1.121E 01*	2.830E-01*	4.175E 01	0.250					0.	0	0.
23	0.800	4	2.898E 01*	1.121E 01*	2.830E-01*	4.175E 01	0.200					0.	0	0.
24	0.300	5	2.898E 01*	1.121E 01*	2.830E-01*	4.350E 01	2.000					0.	0	0.
25	5.235	3	0	0.	0.	0.	0					2.083E 06	1.191E 03	1.042E 06

TOTAL WEIGHT 1.2140E 03 POUNDS
TOTAL LENGTH 2.6055E 01 INCHES
TOTAL POLAR MOMENT 2.1388E 06 LB -IN**2

*****FOR MORE THAN 20 SPANS MAKE SURE TO USE THE 30 SPAN VERSION OF VAST OR VASTD*****

SPAN NO	STARTING COORDINATE	JOINTS FORE END	JOINTS AFT END
1	167.0280	2	31
2	167.0280	2	32
3	167.0280	2	3
4	172.1580	4	5
5	184.7780	5	6
6	267.1650	6	36
7	263.3250	7	8
8	267.1650	8	10
9	282.1150	9	10
10	273.1150	10	40
11	201.0400	11	12
12	223.0000	12	13
13	238.8550	13	14
14	250.8550	14	44
15	238.0850	62	24
16	184.7780	16	17
17	186.6000	17	47
18	172.1560	18	48
19	268.4750	19	26
20	173.2150	20	21
21	196.1000	21	22
22	218.9350	22	83
23	228.8850	23	62
24	238.7250	24	54
25	238.7250	24	28
26	259.3050	26	66
27	283.0350	27	57
28	288.2850	28	68
29	188.3810	29	30
30	171.0010	30	60

7.2 E^3 VAST LISTING FOR ASSEMBLED ENGINE SYSTEM

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

VIBRATION ANALYSIS PREPARED FOR

S J CLINE EXT 2338 CHARGE 15531

5DDA BLDG 300 DATE 08-18-82

EEE-583E LP REF ICLS BASELINE FOR TETRA FREQ SEARCH & RF

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V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * FAN & BOOSTER ROTOR * * *

SPAN NUMBER 1 STATION NUMBER AT LAST WEIGHT POIN. 22
ROTOR SPEED 4.09800E 03 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 1.00000E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	=	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0.	0	0.	0	2.	=	7.857E 01	2.0187E 00	3.8809E 01
3	-4.0000E-01	0.	0	0.	0.	2.	=	1.248E 02	3.2071E 00	5.7544E 01
4	-1.0800E 00	1.618E 07	3.1767E 02	6.117E 06	1.3892E 01	1.	=	9.342E 01	2.0169E 00	4.8872E 01
5	-8.0000E-01	1.618E 07	2.8649E 02	6.117E 06	1.2818E 01	1.	=	6.555E 01	1.4942E 00	3.4918E 01
6	-5.5000E-01	1.245E-10	3.8333E-10	3.833E-10	1.4205E-08	2.	=	6.812E 01	1.3648E 00	3.2701E 01
7	-5.0000E-01	1.390E-10	5.9467E-10	5.947E-10	1.1322E-08	2	=	1.568E 02	2.7862E 00	7.9484E 01
8	-4.5000E-01	0.	0	0.	0.	2.	=	1.220E 02	2.0492E 00	6.1088E 01
9	4.5000E-01	0.	0	0.	0.	2.	=	2.841E 02	3.7860E 00	1.4395E 02
10	1.1300E 00	1.845E-10	1.1802E-08	1.180E-08	1.3844E-08	2.	=	3.547E 02	4.7247E 00	1.7803E 02
11	-7.5050E 00	0.	0	0	0	2.	=	2.114E 03	1.8200E 01	1.0570E 0[illegible]
12	6.8100E 00	0	0	0.	0.	2	=	3.741E 05	8.2100E 02	1.8700E 05
13	3.2340E 00	0.	0	0.	0	2.	=	2.051E 03	8.7464E 00	1.0253E 03
14	2.5000E-01	0.	0	0.	0	2.	=	1.300E 03	5.5180E 00	6.5054E 02
15	5.5000E-01	2.453E-10	2.0252E-08	2.025E-08	2.5239E-08	2.	=	1.388E 03	5.1344E 00	6.944[illegible] 02
16	5.7000E-01	2.320E-10	2.0856E-08	2.086E-08	2.9597E-08	2	=	2.443E 03	7.5864E 00	1.2271E 03
17	1.2500E 00	4.222E-11	5.1243E-10	5.124E-10	2.5381E-08	2	=	1.223E 03	3.7218E 00	6.1348E 02
18	1.2500E 00	3.585E-11	4.7028E-10	4.703E-10	2.8302E-08	2.	=	1.233E 03	3.5527E 00	6.1637E 02
19	1.1800E 00	3.391E-11	4.0338E-10	4.034E-10	2.3882E-08	2.	=	1.197E 03	3.3548E 00	6.0003E 02
20	1.0000E 00	2.782E-11	3.5583E-10	3.558E-10	1.8985E-08	2.	=	6.057E 02	1.5749E 00	3.0540E 02
21	5.0000E-01	0	0	0.	0	2.	=	3.497E 04	8.5700E 01	1.7804E 04
22	1.7800E 00	0.	0	0	0	2	=	0.	0.	0.

TOTAL WEIGHT OF THIS SPAN IS 9.8977[illegible]E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 1.27280E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 4.23886E 06 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

OF POOR QUALITY

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * OUTER FAN SHAFT * * *

SPAN NUMBER 2 STATION NUMBER AT LAST WEIGHT POINT 10
ROTOR SPEED 4.09800E 03 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 1.00000E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0.	2	*	5.201E 01	2.3123E 00	4.6028E 01
3	3.5000E-01	0	0	0	0.	2.	*	1.084E 02	2.6488E 00	5.2238E 01
4	6.5000E-01	1.606E 07	1.0486E 02	6.067E 06	7.8112E 00	1.	*	2.874E 01	1.0747E 00	1.4461E 01
5	1.1500E 00	1.606E 07	7.7715E 01	6.067E 06	5.8358E 00	1	*	2.877E 01	1.0413E 00	1.4457E 01
6	5.0000E-01	1.606E 07	1.7471E 02	6.067E 06	1.2449E 01	1.	*	1.407E 02	4.5838E 00	7.1644E 01
7	1.5000E 00	1.606E 07	1.5882E 02	6.067E 06	1.1634E 01	1	*	3.048E 02	7.7527E 00	1.5408E 02
8	7.8000E-01	1.606E 07	1.8476E 02	6.067E 06	1.3886E 01	1	*	8.816E 02	2.3300E 01	4.3132E 02
9	1.7800E 00	0	0	0	0	2.	*	1.834E 02	5.4405E 00	9.2876E 01
10	-1.7800E 00	0	0	0	0	2.	*	0.	0	0

TOTAL WEIGHT OF THIS SPAN IS 4.83827E 01 POUNDS
TOTAL LENGTH OF THIS SPAN IS 5.13000E 00 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 1.73610E 03 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * INNER FAN SHAFT * * *

SPAN NUMBER 3 STATION NUMBER AT LAST WEIGHT POINT 10
ROTOR SPEED 4.09800E 03 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 1.00000E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0.	0.	0.	0.	2.	*	0.	0	0.
3	-4.0000E-01	0	0	0.	0.	2	*	0	0.	0
4	-4.0000E-01	0	0	0.	0.	2.	*	1.241E 02	3.7281E 00	5.2089E 01
5	4.0000E-01	0.	0	0.	0	2	*	1.582E 02	5.1631E 00	7.8328E 01
6	1.2500E 00	2.500E 07	3.4410E 01	1.000E 07	7.8558E 00	1	*	5.028E 01	2.5578E 00	3.0507E 01
7	1.4200E 00	2.500E 07	6.3740E 01	1.000E 07	5.4826E 00	1.	*	3.281E 01	1.4137E 00	1.6645E 01
8	2.8000E-01	2.500E 07	6.3436E 01	1.000E 07	7.2382E 00	1.	*	4.775E 01	2.2058E 00	2.3869E 01
9	7.6000E-01	2.500E 07	[illegible]	1.000E 07	1.7417E 01	1.	*	1.108E 02	5.0325E 00	5.6266E 01
10	1.8200E 00	2.500E 07	1.3238E 02	1.000E 07	1.1863E 01	1.	*	8.862E 01	3.1188E 00	3.5875E 01

TOTAL WEIGHT OF THIS SPAN IS 2.32187E 01 POUNDS
TOTAL LENGTH OF THIS SPAN IS 5.13000E 00 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 6.03441E 02 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

ORIGINAL PAGE IS OF POOR QUALITY

V A S T
VIBRATION ANALYSIS SYSTEM   U3342A-B

* * * FAN SPLINE STUB SHAFT * * *

SPAN NUMBER 4 STATION NUMBER AT LAST WEIGHT POINT 24
ROTOR SPEED 4.09800E 03 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 1.00000E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	*	5.047E 01	2.4710E 00	2.5343E 01
3	7.2000E-01	2.500E 07	2.4257E 02	1.000E 07	2.3780E 01	1	*	7.747E 01	3.7387E 00	3.8873E 01
4	5.4000E-01	2.500E 07	1.7300E 02	1.000E 07	1.8221E 01	1.	*	5.483E 01	3.1421E 00	3.3288E 01
5	1.1200E 00	4.581E-10	-5.3535E-10	-5.364E-10	1.8442E-08	2	*	7.001E 01	3.5898E 00	3.8484E 01
6	1.1000E 00	4.503E-10	-2.2584E-10	-2.258E-10	2.0008E-08	2	*	4.230E 01	2.2847E 00	2.1477E 01
7	4.1000E-01	2.415E-10	3.4495E-10	3.450E-10	1.0723E-08	2	*	2.085E 01	1.1418E 00	1.0888E 01
8	1.0100E 00	8.770E-10	-6.8136E-10	-6.814E-10	4.1371E-08	2	*	2.471E 01	1.3859E 00	1.2829E 01
9	1.0100E 00	1.038E-09	-6.1347E-10	-6.135E-10	4.2861E-08	2	*	2.288E 01	1.3501E 00	1.1805E 01
10	1.0100E 00	1.118E-09	-6.2587E-10	-6.259E-10	4.3804E-08	2	*	2.123E 01	1.3271E 00	1.1088E 01
11	1.0100E 00	1.220E-09	-6.5023E-10	-6.502E-10	4.4882E-08	2	*	1.858E 01	1.2817E 00	1.0238E 01
12	1.0100E 00	1.312E-09	-6.6148E-10	-6.615E-10	4.5873E-08	2	*	1.806E 01	1.2574E 00	9.4888E 00
13	1.0100E 00	1.437E-09	-6.8768E-10	-6.878E-10	4.7179E-08	2	*	1.657E 01	1.2220E 00	8.7013E 00
14	1.0100E 00	1.572E-09	-7.0758E-10	-7.076E-10	4.8598E-08	2	*	1.513E 01	1.1858E 00	7.9884E 00
15	1.0100E 00	1.724E-09	-7.2695E-10	-7.269E-10	5.0108E-08	2	*	1.378E 01	1.1490E 00	7.2787E 00
16	1.0100E 00	1.897E-09	-7.4565E-10	-7.456E-10	5.1710E-08	2	*	1.249E 01	1.1125E 00	6.8218E 00
17	1.0100E 00	2.122E-09	-8.2312E-10	-8.231E-10	5.3407E-08	2	*	1.121E 01	1.0730E 00	5.9894E 00
18	1.0100E 00	2.408E-09	-1.1249E-09	-1.125E-09	5.5352E-08	2	*	1.028E 01	1.0888E 00	5.4857E 00
19	1.0100E 00	2.535E-09	-1.3524E-09	-1.352E-09	5.2027E-08	2	*	8.248E 00	9.3707E-01	4.3186E 00
20	3.4000E-01	2.500E 07	3.0446E 01	1.000E 07	7.2808E 00	1.	*	3.574E 01	8.8526E 00	6.8231E 01
21	5.1000E-01	2.500E 07	5.8723E 01	1.000E 07	2.0432E 01	1	*	2.498E 01	4.4855E 00	[illegible]
22	1.0000E 00	2.500E 07	5.0555E 01	1.000E 07	1.8578E 01	1	*	3.872E 01	7.5822E 00	2.2088E 01
23	2.2200E 00	2.500E 07	2.9087E 01	1.000E 07	1.5205E 01	1	*	5.028E 01	1.0490E 01	2.8837E 01
24	2.4420E 00	2.500E 07	3.5718E 01	1.000E 07	1.5904E 01	1.	*	2.521E 01	5.6121E 00	1.5382E 01

TOTAL WEIGHT OF THIS SPAN IS 5.58408E 01 POUNDS
TOTAL LENGTH OF THIS SPAN IS 2.28220E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 5.97132E 02 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM   U3342A-B

* * * LP SHAFT M250 BOTTLE * * *

SPAN NUMBER 5 STATION NUMBER AT LAST WEIGHT POINT 25
ROTOR SPEED 4.09800E 03 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 1.00000E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	*	8.848E 01	1.0528E 01	4.4884E 01
3	2.3200E 00	2.580E 07	2.1266E 01	9.900E 06	1.1539E 01	1.	*	2.834E 01	7.4534E 00	1.9093E 01
4	3.0000E 00	2.580E 07	1.7383E 01	9.900E 06	8.2702E 00	1.	*	2.358E 01	5.3258E 00	1.5788E 01
5	3.0000E 00	2.580E 07	9.8095E 00	9.900E 06	4.0178E 00	1.	*	1.701E 01	3.4874E 00	1.1117E 01
6	3.0000E 00	2.580E 07	9.8095E 00	9.900E 06	4.0178E 00	1	*	1.848E 01	3.5718E 00	1.2571E 01
7	3.0800E 00	2.580E 07	1.2328E 01	9.900E 06	4.3367E 00	1	*	3.312E 01	5.2432E 00	2.2868E 01
8	4.1600E 00	2.580E 07	1.8423E 01	9.900E 06	5.5115E 00	1	*	4.376E 01	9.2735E 00	8.8881E 01
9	3.3600E 00	2.580E 07	1.5245E 01	9.900E 06	4.8553E 00	1.	*	2.881E 01	4.5207E 00	1.9058E 01
10	3.3600E 00	2.580E 07	1.5245E 01	9.900E 06	4.8555E 00	1	*	2.881E 01	4.5207E 00	1.9058E 01
11	3.3800E 00	2.580E 07	1.5245E 01	9.900E 06	4.8555E 00	1.	*	3.831E 01	5.4778E 00	2.4860E 01
12	4.0400E 00	2.580E 07	1.8423E 01	9.900E 06	5.5115E 00	1.	*	3.827E 01	5.4712E 00	2.4818E 01
13	3.3500E 00	2.580E 07	1.5245E 01	9.900E 06	4.8555E 00	1	*	2.852E 01	4.5072E 00	1.6874E 01
14	[illegible]	2.580E 07	1.5245E 01	9.900E 06	4.8555E 00	1	*	3.491E 01	5.1520E 00	8.7221E 01
15	3.0300E 00	2.580E 07	1.5245E 01	9.900E 06	4.5555E 00	1.	*	3.848E 01	5.3435E 00	2.4028E 01
16	4.1500E 00	2.580E 07	1.8423E 01	9.900E 06	5.5118E 00	1.	*	3.772E 01	5.0050E 00	2.8428E 01
17	3.5400E 00	2.580E 07	1.5281E 01	9.900E 06	5.2770E 00	1.	*	2.988E 01	5.8200E 00	2.1012E 01
18	3.6550E 00	2.580E 07	1.3481E 01	9.900E 06	5.5282E 00	1	*	2.850E 01	5.8405E 00	2.0753E 01
19	3.6550E 00	2.580E 07	1.3481E 01	9.900E 06	5.5282E 00	1.	*	2.850E 01	5.8405E 00	2.0753E 01
20	3.6550E 00	2.580E 07	1.3481E 01	9.900E 06	5.5282E 00	1.	*	3.294E 01	8.2405E 00	8.3253E 01
21	3.6550E 00	2.580E 07	1.3481E 01	9.900E 06	5.5282E 00	1	*	2.143E 01	4.1883E 00	1.4047E 01
22	8.7000E-01	2.580E 07	2.8558E 01	9.900E 06	1.0158E 01	1.	*	2.781E 01	5.5252E 00	2.4044E 01
23	5.3170E 00	2.580E 07	1.3481E 01	9.900E 06	5.5282E 00	1	*	5.408E 01	8.5130E 00	8.8077E 01
24	6.4000E-01	2.580E 07	3.9513E 01	9.900E 06	1.2598E 01	1	*	3.551E 01	4.4748E 00	1.9988E 01
25	6.4000E-01	2.580E 07	1.3758E 02	9.900E 06	2.7258E 01	1.	*	3.218E 01	3.3099E 00	1.8285E 01

TOTAL WEIGHT OF THIS SPAN IS 1.41782E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 7.23870E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 8.17018E 02 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * LPSHAFT-AFT END * * *

SPAN NUMBER 6 STATION NUMBER AT LAST WEIGHT POINT 10
ROTOR SPEED 4.09800E 03 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 1.00000E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 * SPRING=2 *	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0	0	0	0	2. *	3.810E 02	1.3255E 01	1.5057E 02
3	6.5000E-01	0.	0	0	0	2. *	3.743E 02	1.4815E 01	1.8773E 02
4	1.0000E 00	2.802E 07	4.4818E 01	1.083E 07	1.0177E 01	1 *	1.806E 01	2.2798E 00	9.6822E 00
5	5.8000E-01	2.802E 07	2.8437E 01	1.083E 07	7.7813E 00	1. *	1.858E 01	3.0832E 00	1.0023E 01
6	5.4000E-01	0	0	0	0	2. *	3.410E 01	5.8000E 00	1.7600E 01
7	1.0400E 00	0	0.	0.	0.	2 *	3.180E 01	5.8000E 00	1.8800E 01
8	1.4400E 00	0	0	0	0	2 *	1.270E 01	3.1000E 00	7.2000E 00
9	1.1800E 00	0	0	0.	0	2 *	1.008E 02	1.2700E 01	1.2310E 02
10	-4.8800E 00	0	0	0.	0.	2 *	7.080E 01	5.0308E 00	3.5300E 01

TOTAL WEIGHT OF THIS SPAN IS 5.56880E 01 POUNDS
TOTAL LENGTH OF THIS SPAN IS 2.31000E 00 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 1.02402E 03 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * -6.4 BRG SUPT K=3E5 * * *

SPAN NUMBER 7 STATION NUMBER AT LAST WEIGHT POINT 7
ROTOR SPEED 4.09800E 03 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 1.00000E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 * SPRING=2 *	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0.	0	0.	0	2. *	2.088E 02	1.0580E 01	1.1280E 02
3	1.1200E 00	0.	0.	0.	0	2. *	2.581E 01	1.2340E 00	1.2800E 01
4	2.5200E 00	0.	0.	0.	3.3333E-06	2. *	8.500E 01	2.0513E 00	2.2488E 01
5	2.0000E-01	0	0.	0.	0.	2. *	1.939E 01	5.1730E-01	9.5979E 00
6	-4.1400E 00	0	0	0.	0	2 *	1.284E 03	3.5780E 01	7.5890E 02
7	4.1400E 00	0.	0	0	0	2. *	0	0	0.

TOTAL WEIGHT OF THIS SPAN IS 5.44728E 01 POUNDS
TOTAL LENGTH OF THIS SPAN IS 3.84000E 00 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 1.58401E 03 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * LPT ROTOR CONE * * *

SPAN NUMBER 8 STATION NUMBER AT LAST WEIGHT POINT 10
ROTOR SPEED 4.09800E 03 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 1.00000E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	6.000E-08	0	0	0	2	*	0	0	0
3	5.7000E-01	0	0	0	0	2	*	4.237E 02	9.7713E 00	2.1244E 02
4	8.7000E-01	2.787E 07	1.6341E 03	1.045E 07	7.6378E 01	1	*	8.433E 02	2.0012E 01	4.3264E 02
5	4.8000E-01	4.207E-10	1.8157E-08	1.816E-08	8.3886E-08	2	*	2.012E 03	3.3586E 01	1.1607E 03
6	8.0000E-01	2.787E 07	2.8813E 03	1.045E 07	5.4838E 01	1	*	1.285E 03	1.8807E 01	5.5548E 02
7	7.0000E-01	6.017E-10	2.8815E-08	2.882E-08	1.7333E [illegible]	2	*	6.417E 02	5.8336E 00	3.2181E 02
8	7.0000E-01	4.338E-10	2.2441E-08	2.244E-08	1.7226E [illegible]	2	*	5.655E 02	4.4561E 00	2.8338E 02
9	5.1000E-01	2.185E-10	1.3081E-08	1.308E-08	1.2225E-06	2	*	3.335E 02	2.3440E 00	1.6888E 02
10	1.2000E-01	2.787E 07	2.8171E 03	1.045E 07	3.8810E 01	1	*	1.043E 02	5.8038E-01	5.2.68E 01

TOTAL WEIGHT OF THIS SPAN IS 5.32988E 01 POUNDS
TOTAL LENGTH OF THIS SPAN IS 4.88000E 00 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 6.21876E 03 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * LPT ROTOR STAGES 1-2 * * *

SPAN NUMBER 9 STATION NUMBER AT LAST WEIGHT POINT 17
ROTOR SPEED 4.09800E 03 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 1.00000E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	*	1.428E 04	7.8000E 01	7.1370E 03
3	4.0000E-01	0	0	0	0	2	*	2.312E 02	1.55[illegible] 00	1.1858E 02
4	1.3600E 00	1.040E-10	5.2293E-10	5.229E-10	3.7104E-08	2	*	2.328E 02	1.5703[illegible] 00	1.1734E 02
5	1.7000E-01	0	0	0	0	2	*	2.584E 03	1.7830E 01	1.2780E 03
6	1.7000E-01	0	0	0	0	2	*	2.704E 02	1.7318E 00	1.3620E 02
7	1.3000E 00	2.038E-10	1.8844E-08	1.884E-08	8.1001E-08	2	*	2.756E 02	1.7664E 00	1.3886E 02
8	4.2000E-01	0	0	0	0	2	*	1.831E 04	8.7000E 01	9.1570E 03
9	4.2000E-01	0	0	0	0	2	*	2.821E 02	1.7083E 00	1.4133E 02
10	1.4200E 00	2.870E 07	5.5560E 02	1.152E 06	8.0738E 00	1	*	2.821E 02	1.7083E 00	1.4133E 02
11	1.7000E-01	0	0	0	0	2	*	3.100E 03	1.9300E 01	1.5510E 03
12	1.7000E-01	0	0	0	0	2	*	3.401E 0[illegible]	1.9850E 00	1.7136E 02
13	1.6000E 00	1.881E-10	1.8527E-08	1.853E-08	4.2051E-08	2	*	3.471[illegible] 0	2.0032E 00	1.7483E 02
14	4.5000E-01	0	0	0	0	2	*	2.531E 04	1.0042E 02	1.2658E 04
15	4.5000E-01	0	0	0	0	2	*	3.362E 02	1.8721E 00	1.6638E 02
16	1.4300E 00	9.841E-11	-5.7663E-10	-5.766E-10	3.4872E-08	2	*	3.328E 02	1.8535E 00	1.6772E 02
17	2.8000E-01	0	0	0	0	2	*	0	0	0

TOTAL WEIGHT OF THIS SPAN IS 3.17340E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 1.00000E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 6.64847E 04 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

OF POOR QUALITY

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * LPT ROTOR STAGES 4-5 * * *

SPAN NUMBER 10 STATION NUMBER AT LAST WEIGHT POINT 12
ROTOR SPEED 4.08800E 03 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 1.00000E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	*	4.137E 03	2.5000E 01	2.0840E 03
3	2.5000E-01	0	0	0	0	2	*	3.033E 02	1.6801E 00	1.5260E 02
4	1.3000E 00	8.301E-11	8.6189E-10	6.617E-10	3.2570E-08	2	*	3.058E 02	1.8838E 00	1.5385E 02
5	4.5000E-01	0	0	0	0	2	*	3.008E 04	1.1380E 02	1.6033E 04
6	4.5000E-01	0	0	0	0	2	*	3.764E 02	2.1503E 00	1.8831E 02
7	1.5100E 00	1.889E-10	-1.6848E-09	-1.685E-09	3.8807E-08	2	*	3.874E 02	2.1143E 00	1.8533E 02
8	1.5000E-01	0	0	0	0	2	*	2.873E 03	1.8300E 01	1.4240E 03
9	1.5000E-01	0	0	0	0	2	*	3.158E 02	1.8880E 00	1.5928E 02
10	1.4800E 00	1.078E-10	8.7033E-10	8.703E-10	3.9481E-08	2	*	3.190E 02	1.8872E 00	1.6080E 02
11	4.7000E-01	0	0	0	0	2	*	2.886E 04	1.2000E 02	1.4880E 04
12	1.2800E 00	0	0	0	0	2	*	0	0	0

TOTAL WEIGHT OF THIS SPAN IS 2.88584E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 7.51000E 00 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 6.90337E 04 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * COMPR ROTOR STG 1-4 * * *

SPAN NUMBER 11 STATION NUMBER AT LAST WEIGHT POINT 25
ROTOR SPEED 1.39480E 04 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 3.40400E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0	0	0	0.	2	*	1.038E 02	7.1883E 00	5.1834E 01
3	-5.8000E-01	0.	0	0.	0	2	*	2.882E 01	3.2056E 00	1.5613E 01
4	-2.2800E 00	0.	0	0	0.	2	*	1.128E 02	1.3262E 01	8.2588E 01
5	2.8600E 00	0.	0	0	0	2	*	8.955E 00	5.8978E-01	4.5749E 00
6	1.5400E 00	1.598E 07	3.6116E 01	6.033E 06	8.0848E 00	1	*	1.203E 01	1.3451E 00	6.2183E 00
7	5.1000E-01	1.598E 07	3.7437E 01	6.033E 06	8.4116E 00	1	*	9.264E 00	9.9784E-01	4.8856E 00
8	6.8000E-01	1.598E 07	5.5726E 01	6.033E 06	1.1747E 01	1	*	1.800E 01	1.5939E 00	9.1342E 00
9	1.1700E 00	1.594E 07	6.2703E 01	6.018E 06	9.898CE 00	1	*	2.649E 01	1.7684E 00	1.3575E 01
10	5.1000E-01	2.372E-08	7.7882E-09	7.789E-09	4.7284E-08	2	*	1.416E 01	7.8852E-01	7.3037E 00
11	1.8100E 00	0.	0	0.	0.	2.	*	3.880E 03 *	7.6210E 01	1.9700E 03
12	1.8900E 00		0	0	0.	2	*	1.952E 01	5.5761E-01	1.0164E 01
13	1.4200E 00	[illegible]8E-09	1.1968E-08	1.197E-08	1.3576E-07	2	*	4.805E 01	1.2106E 00	2.4845E 01
14	1.4200E 00	[illegible]E-08	8.6805E-09	8.681E-09	1.2020E-07	2	*	2.878E 01	[illegible]5382E-01	1.4321E 01
15	6.3000E-01	0	0	0	0	2.	*	2.520E 03 *	3.8430E 01	1.2800E 03
16	8.8000E-01	0	0	0.	0.	2	*	7.348E 01	1.1842E 00	3.8731E 01
17	2.2200E 00	1.018E-08	6.0322E-09	6.032E-08	1.3738E-07	2	*	7.563E 01	1.2188E 00	3.8778E 01
18	6.0000E-01	0	0	0	0.	2	*	1.880E 03 *	2.7850E 01	9.8400E 02
19	8.0000E-01	0.	0	0	0	2.	*	8.085E 01	1.0005E 00	4.1485E 01
20	1.7700E 00	6.148E-10	3.9368E-09	3.937E-09	1.0433E-07	2.	*	8.252E 01	1.0211E 00	4.2308E 01
21	6.5000E-01	0.	0	0	0.	2.	*	1.767E 03 *	2.5280E 01	8.8200E 02
22	5.5000E-01	0	0	0	0	2	*	7.714E 01	8.7878E-01	3.8748E 01
23	1.5400E 00	1.434E 07	3.1114E 02	5.357E 06	7.0723E 00	1	*	1.042E 02	[illegible]1848E 00	6.2273E 01
24	2.5000E-01	1.434E 07	8.7208E 02	5.357E 06	1.5307E 01	1	*	2.705E 01	3.0868E-01	1.3527E 01
25	3.3000E-01	0	0	0.	0	2	*	0.	0	0

TOTAL WEIGHT OF THIS SPAN IS 2.09258E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 2.18800E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 1.13898E 04 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

ORIGINAL PAGE IS OF POOR QUALITY

V A S T
VIBRATION ANALYSIS SYSTEM — U3342A-8

*** COMPR ROTOR STG 5-10 ***

SPAN NUMBER 12 STATION NUMBER AT LAST WEIGHT POINT 25
ROTOR SPEED 1.38480E 04 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 3.40400E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	*	2.717E 03*	3.7260E 01	1.3780E 03
3	3.6000E-01	0	0	0	0	2	*	1.232E 02	1.3805E 00	6.1813E 01
4	4.3000E-01	9.215E-11	5.7501E-10	5.750E-10	1.6107E-08	2	*	2.303E 02	2.4668E 00	1.1576E 02
5	4.3000E-01	8.105E-11	5.0607E-10	5.081E-10	1.5830E-08	2	*	1.358E 02	1.4274E 00	6.8181E 01
6	5.5000E-01	0	0	0	0	2	*	3.384E 03*	5.3880E 01	1.8854E 03
7	7.2500E-01	0	0	0	0	2	*	1.208E 02	1.2448E 00	6.0688E 01
8	1.0400E 00	2.855E 07	3.9081E 02	1.085E 07	8.0487E 00	1	*	1.208E 02	1.2448E 00	6.0688E 01
9	6.7500E-01	0	0	0	0	2	*	3.668E 03*	5.6780E 01	1.8382E 03
10	6.7000E-01	0	0	0	0	2	*	1.558E 02	1.5742E 00	7.8128E 01
11	1.3550E 00	2.808E 07	3.8556E 02	1.064E 07	7.8127E 00	1	*	1.558E 02	1.5742E 00	7.8128E 01
12	6.6000E-01	0	0	0	0	2	*	3.358E 03*	5.3770E 01	1.8828E 03
13	6.3000E-01	0	0	0	0	2	*	1.321E 02	1.3234E 00	6.6185E 01
14	1.0600E 00	2.748E 07	4.2316E 02	[illegible]	4.4765E 00	1	*	1.321E 02	1.3234E 00	6.6185E 01
15	6.5000E-01	0	0	0	0	2	*	2.841E 03*	4.[illegible]010E 01	1.4738E 03
16	5.5600E-01	0	0	0	0	2	*	1.248E 02	1.[illegible]504E 00	6.2571E 01
17	1.0300E 00	2.71[illegible]E 07	[illegible].0781E 02	1.026E 07	8.1640E 00	1	*	1.248E 02	1.2504E 00	6.2571E 01
18	5.6000E-01	0	0	0	0	2	*	3.181E 03*	5.2560E 01	1.6858E 03
19	2.2500E-01	0	0	0	0	2	*	1.181E 02	1.2808E 00	5.8858E 01
20	8.7000E-01	5.466E-10	-2.8839E-08	-2.88[illegible]E-08	3.0042E-08	2	*	2.060E 02	2.4058E 00	1.0358E 02
21	8.3000E-01	5.188E-10	-2.6435E-08	-2.643E-08	2.7720E-08	2	*	1.623E 02	2.2158E 00	8.1561E 01
22	6.3000E-01	3.408E-10	-1.6481E-08	-1.648E-08	1.8618E-08	2	*	1.832E 02	3.1288E 00	9.8732E 01
23	2.6000E-01	0	0	0	0	2	*	1.068E 02	1.8464E 00	5.3288E 01
24	3.2000E-01	0	0	0	0	2	*	1.734E 03*	4.0100E 01	8.6800E 02
25	2.7000E-01	0	0	0	0	2	*	0	0	0

TOTAL WEIGHT OF THIS SPAN IS 3.70435E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 1.66850E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 2.33389E 04 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM — U3342A-8

*** COMPR-HPT ROTOR SHAFT ***

SPAN NUMBER 13 STATION NUMBER AT LAST WEIGHT POINT 20
ROTOR SPEED 1.38480E 04 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 3.40400E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	*	1.351E 02	2.4328E 00	6.7556E 01
3	2.8000E-01	0	0	0	0	2	*	6.385E 02	1.1872E 01	3.0150E 02
4	3.0000E-01	1.887E-10	-5.7308E-10	-5.731E-10	2.0178E-08	2	*	8.285E 01	1.6343E 00	4.[illegible]705E 01
5	7.8000E-01	2.849E 07	1.8859E 02	9.898E 06	7.8548E 00	1	*	7.858E 01	1.7801E 00	3.9908E 01
6	1.0000E 00	2.849E 07	1.3881E 02	9.898E 06	6.2722E 00	1	*	8.[illegible]78E 01	1.8881E 00	4.1852E 01
7	1.0000E 00	2.549E 07	1.3881E 02	9.898E 06	6.2722E 00	1	*	7.741E 01	1.7476E 00	3.8834E 01
8	8.7000E-01	2.848E 07	1.3881E 02	9.898E 06	6.[illegible]722E 00	1	*	7.120E 01	1.8074E 00	3.5700E 01
9	8.3000E-01	2.849E 07	1.3881E 02	9.898E 06	6.2722E 00	1	*	7.184E 01	1.[illegible]119E 00	3.6293E 01
10	1.0000E 00	3.255E-10	6.7860E-10	6.786E-10	3.8824E-08	2	*	7.577E 01	1.6649E 00	3.6460E 01
11	1.0200E 00	3.240E-10	6.6694E-10	6.669E-10	3.8123E-08	2	*	5.656E 01	1.2234E 00	2.8578E 01
12	4.2000E-01	2.849E 07	1.4015E 02	9.898E 06	6.0080E 00	1	*	6.768E 01	1.4682E 00	3.3[illegible]8E 01
13	8.5000E-01	2.849E 07	1.9761E 02	9.898E 06	8.5481E 00	1	*	1.343E 02	3.1888E 00	6.[illegible]225E 01
14	3.0000E-01	0	0	0	0	2	*	8.424E 01	2.1186E 00	4.7133E 01
15	2.8003E-01	0	0	0	0	2	*	2.158E 03	5.2800E 01	1.1580E 03
16	2.8300E-01	0	0	0	0	2	*	8.527E 01	2.3839E 00	4.7550E 01
17	3.8000E-01	0	0	0	0	2	*	1.371E 02	3.2886E 00	6.[illegible]821E 01
18	7.0000E-01	2.812E 07	2.0111E 02	[illegible]87E 07	8.8854E 00	1	*	8.018E 01	1.7[illegible]73E 00	4.0182E 01
19	6.8000E-01	2.812E 07	1.4843E 02	1.087E 07	6.4324E 00	1	*	7.832E 01	8.22[illegible]E-01	1.8211E 01
20	5.7000E-01	0	0	0	0	2	*	0	0	0

TOTAL WEIGHT OF THIS SPAN IS 5.52488E 01 POUNDS
TOTAL LENGTH OF THIS SPAN IS 1.22000E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 4.18680E 03 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-8

* * * SYC 1 & 2 HPT ROTOR * * *

SPAN NUMBER 14 STATION NUMBER AT LAST WEIGHT POINT 25
ROTOR SPEED 1.3448E 04 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 2.4040E 00

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	1.551E 04	2.2260E 02	8.6680E 03
3	4.1000E-01	0	0	0	0	2	6.470E 01	9.0058E-01	2.2378E 01
4	3.4000E-01	5.553E-11	2.9108E-10	2.911E-10	4.8213E-08	2	8.387E 01	1.6374E 00	4.2253E 01
5	5.7000E-01	2.383E-10	1.1323E-09	1.132E-09	2.5670E-08	2	6.673E 01	1.2624E 00	3.3604E 01
6	2.4000E-01	5.121E-11	2.1384E-10	3.?38E-10	5.5335E-08	2	1.483E 02	2.4085E 00	7.4168E 01
7	2.8000E-01	0	0	0	0	2	1.273E 02	2.0286E 00	6.3857E 01
8	2.8000E-01	0	0	0	0	2	3.615E 03	6.3000E 01	1.8170E 03
9	2.5000E-01	0	0	0	0	2	1.576E 02	2.5169E 00	7.8942E 01
10	3.1000E-01	0	0	0	0	2	1.810E 02	2.8315E 00	9.0514E 01
11	2.7000E-01	2.842E 07	2.8818E 02	1.080E 07	1.0326E 01	1	7.183E 01	1.2904E 00	3.5852E 01
12	7.0000E-01	2.842E 07	2.3292E 02	1.080E 07	8.4144E 00	1	7.598E 01	1.2756E 00	3.8028E 01
13	2.4000E-01	2.842E 07	3.8516E 02	1.080E 07	1.3988E 01	1	2.748E 01	4.8915E-01	1.3748E 01
14	4.7000E-01	0	0	0	0	2	1.582E 04	2.3280E 02	8.0870E 03
15	4.7000E-01	0	0	0	0	2	5.342E 01	9.7808E-01	2.6727E 01
16	4.3000E-01	2.842E 07	4.1776E 02	1.080E 07	1.5312E 01	1	1.459E 02	2.7862E 00	7.3857E 01
17	1.2400E 00	3.288E-10	-1.3612E-09	-1.361E-09	2.5853E-08	2	1.083E 02	2.1087E 00	5.4080E 01
18	2.1800E-01	1.180E-10	-5.2257E-10	-5.228E-10	5.0048E-08	2	8.840E 01	2.1028E 00	4.4214E 01
19	2.8000E-01	0	0	0	0	2	7.060E 01	1.7205E 00	3.5310E 01
20	1.800CE-01	0	0	0	0	2	0	0	0
21	1.2000E-01	0	0	0	0	2	1.284E 02	3.6308E 00	6.4211E 01
22	[illegible]	0	0	0	0	2	1.855E 02	7.4485E 00	1.0271E 02
23	1.8000E 00	5.600E-09	-8.2000E-09	-8.200E-09	3.0000E-08	2	8.275E 01	5.8325E 00	5.0158E 01
24	1.7200E 00	2.712E 07	4.5348E 01	1.027E 07	7.7358E 00	1	3.308E 01	3.1709E 00	1.6565E 01
25	1.2800E 00	2.712E 07	3.3327E 01	1.027E 07	5.1826E 00	1	1.281E 01	1.1884E 00	6.5706E 00

TOTAL WEIGHT OF THIS SPAN IS 5.64842E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 1.24600E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 3.72730E 04 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-8

* * * HPC-COMBUSTOR CASE * * *

SPAN NUMBER 15 STATION NUMBER AT LAST WEIGHT POINT 7
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0.

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0	0.	0	0.	2	7.885E 02	3.7578E 00	2.8475E 02
3	1.5000E-01	0	0	0	0	2	8.484E 02	4.0322E 00	4.2420E 02
4	1.0000E-01	2.597E 07	1.9757E 03	9.798E 06	1.8410E 01	1	5.211E 02	2.4322E 00	2.6074E 02
5	1.0500E 00	2.597E 07	1.4772E 03	9.798E 06	1.3793E 01	1	9.244E 02	4.3159E 00	4.6280E 02
6	1.0500E 00	2.597E 07	1.4772E 03	9.798E 06	1.3793E 01	1	5.895E 02	2.7539E 00	2.9513E 02
7	2.5000E-01	2.597E 07	1.4772E 03	9.798E 06	1.3793E 01	1	1.277E 02	5.9600E-01	6.3833E 01

TOTAL WEIGHT OF THIS SPAN IS 1.78882E 01 POUNDS
TOTAL LENGTH OF THIS SPAN IS 2.64000E 00 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 3.80090E 03 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

ORIGINAL PAGE IS OF POOR QUALITY

V A S T
VIBRATION ANALYSIS SYSTEM   U3342A-8

* * * NO 2 BEARING SUPPORT * * *

SPAN NUMBER 16   STATION NUMBER AT LAST WEIGHT POINT 8
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0.

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 * SPRING=2 *		POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	*	5.200E 01	4.8806E 00	3.1600E 01
3	-9.1000E-01	0	0	0	0	2	*	3.898E 01	2.2540E 00	1.8148E 01
4	8.1000E-01	0	0	0	0	2	*	6.488E 01	5.0212E 00	4.2761E 01
5	7.1000E-01	2.875E 07	2.4385E 02	1.112E 07	2.7544E 01	1	*	6.504E 01	5.0383E 00	4.2674E 01
6	4.2000E-01	2.875E 07	2.5523E 02	1.112E 07	3.7342E 01	1	*	5.810E 01	3.1816E 00	2.7081E 01
7	3.2000E-01	2.875E 07	1.8829E 02	1.112E 07	2.0088E 01	1	*	6.278E 01	3.6402E 00	4.6470E 01
8	5.6200E-01	2.875E 07	4.8889E 02	1.112E 07	3.4339E 01	1	*	7.473E 01	2.[illegible]08E 00	3.7439E 01

TOTAL WEIGHT OF THIS SPAN IS 2.88571E 01 POUNDS
TOTAL LENGTH OF THIS SPAN IS 2.02200E 00 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 4.88618E 02 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM   U3342A-8

* * * NO 3 BRG SUPT & CNTR SPR * * *

SPAN NUMBER 17   STATION NUMBER AT LAST WEIGHT POINT 7
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 * SPRING=2 *		POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2.	*	3.385E 04	1.1483E 02	1.6873E 04
3	1.8000E-01	0	0	0	0	2	*	3.041E 01	1.1385E 00	1.6207E 01
4	2.0000E-01	2.875E 07	6.8262E 01	1.112E 07	7.5791E 00	1.	*	5.400E 01	1.8145E 00	3.1488E 01
5	2.6200E 00	0.	0	0	3.3333E-06	2.	*	7.625E 01	2.7085E 00	4.2134E 01
6	2.5000E-01	2.875E 07	3.1889E 02	1.112E 07	2.4801E 01	1.	*	8.481E 01	2.5510E 00	3.2428E 01
7	9.4000E-01	2.875E 07	1.4419E 02	1.112E 07	1.1889E 01	1	*	3.524E 02	1.4141E 01	1.7929E 02

TOTAL WEIGHT OF THIS SPAN IS 1.37381E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 4.24000E 00 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 3.45280E 04 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM   U3342A-B

* * * NO 1 BEARING SUPPORT * * *

SPAN NUMBER 18   STATION NUMBER AT LAST WEIGHT POINT 23
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	*	1.332E 03	2.5400E 01	5.7400E 02
3	-1.4000E 00	0	0	0	0	2	*	6.163E 01	1.3478E 00	6.0823E 01
4	3.0000E-01	0	0	0	0	2	*	1.5_0E 02	2.5568E 00	7.9084E 01
5	5.7000E-01	0	0	0	0	2	*	3.985E 02	5.7578E 00	1.9940E 02
6	5.3000E-01	0	0	0	C	2	*	1.128E 03	1.5517E 01	5.5558E 02
7	1.0800E 00	2.875E 07	2.6894E 03	1.112E 07	7.3788E 01	1	*	2.574E 03	3.7871E 01	1.3231E 03
8	6.7000E-01	2.875E 07	4.2328E 03	1.112E 07	1.0236E 02	1	*	1.852E 03	2.0815E 01	8.2804E 02
9	6.7000E-01	4.024E-11	2.8092E-10	2.809E-10	4.5720E-08	2	*	7.808E 02	7.3321E 00	3.7711E 02
10	1.0000E 00	7.521E-11	5.5775E-10	5.578E-10	9.7350E-09	2	*	8.738E 02	7.5188E 00	4.3847E 02
11	1.0000E 00	5.545E-11	5.2090E-10	5.209E-10	9.4479E-09	2	*	9.712E 02	7.8138E 00	4.8814E 02
12	1.0000E 00	5.855E-11	4.8038E-10	4.809E-10	9.5978E-09	2	*	1.038E 03	7.3375E 00	5.2144E 02
13	9.8000E-01	5.958E-11	5.1722E-10	5.172E-10	9.8843E-09	2	*	1.138E 03	7.2858E 00	5.7135E 02
14	1.0000E 00	4.825E-11	4.4397E-10	4.440E-10	9.5853E-09	2	*	1.272E 03	7.4261E 00	5.3859E 02
15	1.0000E 00	4.663E-11	4.4585E-10	4.459E-10	9.8602E-09	2	*	1.327E 03	7.1018E 00	5.5598E 02
16	1.0000E 00	4.218E-11	4.3173E-10	4.317E-10	1.0300E-08	2	*	1.381E 03	6.7852E 00	6.9295E 02
17	9.8000E-01	4.355E-11	4.5291E-10	4.529E-10	1.0525E-08	2	*	1.478E 03	6.6788E 00	7.4016E 02
18	1.0000E 00	3.548E-11	4.2510E-10	4.251E-10	1.0852E-08	2	*	1.520E 03	5.3853E 00	7.6201E 02
19	1.0000E 00	3.606E-11	4.2657E-10	4.266E-10	1.1455E-08	2	*	1.120E 03	4.4378E 00	5.5127E 02
20	3.7000E-01	1.671E-11	1.7654E-10	1.765E-10	3.7708E-08	2	*	1.845E 03	6.5198E 00	9.2248E 02
21	2.7000E-01	0	0	0	0	2	*	4.571E 04	1.1037E 02	2.2854E 04
22	5.0000E-01	0	0	0	0	2	*	4.153E 04	1.2835E 02	2.0765E 04
23	6.4440E 00	0	0	0	0	2	*	5.723E 04	5.1800E 02	2.8613E 04

TOTAL WEIGHT OF THIS SPAN IS 9.50684E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 1.99440E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 1.66512E 05 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM   U3342A-B

* * * NO 5 BEARING SUPPORT * * *

SPAN NUMBER 19   STATION NUMBER AT LAST WEIGHT POINT 24
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	*	1.122E 02	7.8400E 00	5.8100E 01
3	-1.3000E 00	0	0	0	0	2	*	2.042E 01	1.1353E 00	1.0371E 01
4	1.3000E 00	0	0	0	0	2	*	3.787E 01	2.0574E 00	1.9019E 01
5	5.7000E-01	2.757E 07	1.0153E 02	1.045E 07	1.0857E 01	1	*	2.509E 01	1.3167E 00	1.2574E 01
6	2.2000E-01	2.757E 07	1.1972E 02	1.045E 07	1.2036E 01	1	*	1.217E 01	5.9330E-01	5.0514E 00
7	2.1000E-01	5.924E-10	1.6473E-09	1.647E-09	1.1337E-08	2	*	1.478E 01	5.1687E-01	7.4704E 00
8	7.5000E-01	1.917E-09	7.2232E-09	7.223E-09	5.9943E-08	2	*	2.217E 01	8.1284E-01	1.1242E 01
9	7.5000E-01	1.983E-09	7.9831E-09	7.983E-09	6.4858E-08	2	*	2.672E 01	8.1154E-01	1.3514E 01
10	7.4000E-01	1.389E-09	5.0448E-09	5.045E-09	5.5009E-08	2	*	1.759E 02	4.3670E 00	9.1888E 01
11	3.8000E-01	2.757E 07	2.7861E 02	1.045E 07	1.4402E 01	1	*	1.948E 02	5.1954E 00	9.7557E 01
12	6.4000E-01	0	0	0	0	2	*	6.228E 02	1.3819E 01	3.1305E 02
13	4.6000E-01	0	0	0	0	2	*	3.988E 02	1.9969E 01	2.2060E 02
14	2.4000E-01	2.252E-10	1.1009E-09	1.101E-09	1.1209E-08	2	*	2.755E 01	6.1153E-01	1.3753E 01
15	3.9000E-01	3.439E-10	1.7996E-09	1.800E-09	2.0744E-08	2	*	9.122E 01	1.5163E 00	4.6025E 01
16	8.9000E-01	2.972E-10	1.7496E-09	1.750E-09	2.4173E-08	2	*	1.821E 02	2.8983E 00	9.1440E 01
17	6.1000E-01	2.757E 07	4.2621E 02	1.045E 07	1.3151E 01	1	*	1.052E 03	1.6035E 01	5.5398E 02
18	5.2000E-01	3.226E-10	0	0	0	2	*	5.121E 02	6.7461E 00	2.6314E 02
19	3.4000E-01	2.757E 07	5.9868E 02	1.045E 07	1.4334E 01	1	*	1.887E 02	2.1960E 00	9.4550E 01
20	7.4000E-01	1.524E-10	1.0375E-09	1.038E-09	1.7411E-08	2	*	1.874E 02	2.1391E 00	9.9242E 01
21	9.6000E-01	3.798E-10	2.7088E-09	2.709E-09	3.9968E-08	2	*	2.068E 02	1.9863E 00	1.0398E 02
22	8.0000E-01	2.903E-10	2.1920E-09	2.192E-09	3.4903E-08	2	*	2.505E 02	2.1852E 00	1.2588E 02
23	5.3000E-01	5.616E-11	4.4168E-10	4.417E-10	6.7282E-09	2	*	1.998E 02	1.6604E 00	1.0008E 02
24	6.0000E 00	0	0	0	0	2	*	0	0	0

TOTAL WEIGHT OF THIS SPAN IS 8.41821E 01 POUNDS
TOTAL LENGTH OF THIS SPAN IS 1.88100E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 4.57067E 03 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

ORIGINAL PAGE IS
OF POOR QUALITY

V A S T
VIBRATION ANALYSIS SYSTEM   U3342A-B

* * * [illegible] CASING * * *

SPAN NUMBER 20   STATION NUMBER AT LAST WEIGHT POINT 21
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 * SPRING=2 *	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2 *	3 688E 03	5 1898E 00	1 8865E 03
3	2 2000E-01	1 000E 07	6 8884E 03	3 500E 06	1 9985E 01	1 *	4 952E 02	7 0784E-01	2 4763E 02
4	2 8000E-01	1 000E 07	1 2187E 04	3 500E 06	3 4880E 01	1 *	1 324E 03	1 8828E 00	6 8234E 02
5	1 3000E 00	1 000E 07	7 8617E 03	3 500E 06	2 1608E 01	1 *	5 718E 04	1 2587E 02	3 3590E 04
6	1 4500E 00	1 000E 07	7 8617E 03	3 500E 06	2 1608E 01	1 *	1 310E 03	1 8578E 00	5 5528E 02
7	1 0000E-01	1 000E 07	2 1359E 04	3 500E 06	6 0238E 01	1 *	9 378E 02	1 3358E 00	4 6904E 02
8	8 8000E-01	1 000E 07	8 1367E 03	3 500E 06	2 3267E 01	1 *	5 024E 03	6 8890E 00	2 6128E 03
9	1 0100E 00	0	0	0	0	2 *	1 587E 04	2 1434E 01	7 8420E 03
10	5 8000E-01	1 000E 07	8 5140E 03	3 500E 06	2 5782E 01	1 *	1 884E 03	2 [illegible] 00	6 4857E 02
11	1 2200E 00	1 000E 07	8 5140E 03	3 500E 06	2 5782E 01	1 *	1 860E 03	2 2010E 00	7 6003E 02
12	1 7000E-01	1 000E 07	2 3455E 04	3 500E 06	6 8877E 01	1 *	1 078E 03	1 6541E 00	5 3817E 02
13	1 0000E 00	1 000E 07	6 7723E 03	3 500E 06	1 8747E 01	1 *	1 348E 03	1 5713E 00	5 7382E 02
14	1 0000E 00	1 000E 07	6 7024E 03	3 500E 06	1 8575E 01	1 *	1 334E 03	1 5585E 00	5 6737E 02
15	1 0000E 00	1 000E 07	6 6413E 03	3 500E 06	1 8818E 01	1 *	1 575E 03	2 2253E 00	7 8781E 02
16	1 3700E 00	1 000E 07	6 6490E 03	3 500E 06	1 8626E 01	1 *	1 852E 03	2 4458E 00	8 3157E 02
17	1 1200E 00	1 000E 07	6 7105E 03	3 500E 06	1 8685E 01	1 *	1 432E 03	2 0817E 00	7 1854E 02
18	1 0000E 00	1 000E 07	6 6112E 03	3 500E 06	1 8784E 01	1 *	1 378E 03	1 9852E 00	6 8834E 02
19	1 0000E 00	1 000E 07	6 8823E 03	3 500E 06	1 9820E 01	1 *	6 850E 03	1 1868E 01	4 6417E 03
20	8 3000E-01	0	0	0	0	2 *	1 488E 05	2 5500E 02	7 3440E 04
21	7 2850E 00	0	0	0	0	2 *	1 170E 05	4 0500E 02	5 8621E 04

TOTAL WEIGHT OF THIS SPAN IS 8 86220E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 2 28850E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 3.81572E 05 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2 00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM   U3342A-B

* * * COMPR STATOR IGV-STG 1 * * *

SPAN NUMBER 21   STATION NUMBER AT LAST WEIGHT POINT 25
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 * SPRING=2 *	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0.	0.	0	0	2. *	1 285E 05	4 4500E 02	6 4300E 04
3	5 0750E 00	0	0.	0	0.	2 *	6 834E 04	2 5858E 02	3 3172E 04
4	2 5000E-01	0.	0.	0	0	2. *	2 188E 03	9 4181E 00	1 0788E 03
5	3 2000E-01	0.	0	0	0.	2 *	1 237E 03	5 4868E 00	8 1846E 02
6	1 3000E-01	0	0	0	0	2. *	5 853E 02	2 7808E 00	2 8274E 02
7	7 8000E-01	2 850E 07	1 8878E 03	1 100E 07	1 8085E 01	1 *	7 083E 02	3 3788E 00	3 8430E 02
8	7 1000E-01	2 850E 07	1 3408E 03	1 100E 07	1 2758E 01	1 *	2 858E 02	1 2678E 00	1 3234E 02
9	3 7000E-01	0	0	0.	0.	2. *	6 400E 03	4 5430E 01	3 2000E 03
10	3 7000E-01	0	0	0.	0	2 *	2 858E 02	1 2878E 00	1 3234E 02
11	7 1000E-01	2 850E 07	1 3408E 03	1.100E 07	1 2758E 01	1 *	4 828E 02	2 3744E 00	2 4644E 02
12	1 8000E-01	0	0.	0	0	2 *	8 185E 02	4 0998E 00	4 1050E 02
13	1 1400E 00	2 397E-11	-8 4824E-11	-8 482E-11	1 1452E-08	2 *	1 098E 03	5 6253E 00	5 5260E 02
14	1 5000E 00	4 588E-11	-1 8808E-10	-1 831E-10	2 0788E-08	2 *	1 189E 03	6 1858E 00	5 6836E 02
15	1 2700E 00	2 683E-11	-8 8410E-11	-8 841E-11	1 2178E-08	2. *	9 479E 02	5 0908E 00	4 7583E 02
16	8 3000E-01	2 850E 07	2 1221E 03	1 100E 07	2 3029E 01	1 *	4 792E 02	2 5810E 00	2 3965E 02
17	4 8000E-01	2 850E 07	1 1872E 03	1 10[illegible] 07	1 2850E 01	1. *	1 643E 02	8 8220E-01	8 2147E 01
18	3 7000E-01	0	0	0.	0	2 *	6 880E 03	5 0720E 01	3 4400E 03
19	3 7000E-01	0.	0.	0.	0	2. *	1 578E 02	8 4818E-01	7 8783E 01
20	4 7000E-01	2 800E 07	1 1872E 03	1 080E 07	1 2850E 01	1. *	6 887E 02	3 7578E 00	3 4448E 02
21	5 7000E-01	0.	0.	0	0	2 *	1 073E 03	5 9827E 00	5 3703E 02
22	1 2700E 00	2 800E 07	1 6123E 03	1 080E 07	1 5907E 01	1 *	1 033E 03	5 5448E 00	5 1751E 02
23	1 2800E 00	2 800E 07	1 3832E 03	1 080E 07	1 5838E 01	1. *	5 626E 02	3 [illegible]863E 00	2 8168E 02
24	2 3000E-01	2 800E 07	1 1024E 03	1 080E 07	1 2511E 01	1 *	7 100E 01	4 [illegible]287E-01	3 5501E 01
25	3 7000E-01	0.	0	0.	0	2. *	0	0	0

TOTAL WEIGHT OF THIS SPAN IS 8 71182E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 1 88350E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 2 22201E 05 LBS IN**2

ALL VALUES OF THE [illegible]AR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

ORIGINAL PAGE IS OF POOR QUALITY

* * * COMPR STATOR STGS 2-5 * * *

SPAN NUMBER 22 STATION NUMBER AT LAST WEIGHT POINT 25
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0	0	0	0	2.	*	5.785E 03	4.8188E 01	3.6000E 03
3	3.7000E-01	0	0	0	0.	2	*	7.100E 01	4.0287E-01	3.8801E 01
4	2.3000E-01	2.750E 07	1.1024E 03	1.080E 07	1.2511E 01	1.	*	1.853E 02	1.0627E 00	5.2851E 01
5	1.5000E-01	0	0	0	0	2	*	5.757E 02	3.3832E 00	2.8874E 02
6	1.3200E 00	2.750E 07	1.2511E 03	1.080E 07	1.4737E 01	1.	*	8.267E 02	6.8732E 00	4.1342E 02
7	8.4000E-01	2.750E 07	1.3808E 03	1.08CE 07	1.6338E 01	1	*	4.298E 02	2.8438E 00	2.1808E 02
8	2.3000E-01	0	0.	0.	0	2.	*	6.645E 01	3.8407E-01	3.3225E 01
9	2.1000E-01	0.	0	0	0	2	*	5.430E 03	3.4910E 01	2.7100E 03
10	3.1000E-01	0	0	0	0	2	*	2.738E 02	1.8858E 00	1.3888E 02
11	6.8000E-01	2.700E 07	1.4815E 03	1.040E 07	1.7278E 01	1	*	8.448E 02	4.8888E 00	4.1155E 02
12	7.4000E-01	2.700E 07	1.2888E 03	1.040E 07	1.4884E 01	1	*	5.482E 02	3.1848E 00	2.7478E 02
13	9.5000E-01	2.700E 07	1.0808E 03	1.040E 07	1.2351E 01	1	*	5.851E 02	3.4727E 00	2.8218E 02
14	3.3000E-01	0.	0	0.	0.	2	*	5.350E 03	3.3400E 01	2.8700E 03
15	3.4000E-01	0.	0	0	0.	2	*	9.281E 02	5.4508E 00	4.5189E 02
16	1.2000E 00	2.800E 07	1.4738E 03	1.000E 07	1.5134E 01	1.	*	7.381E 02	4.0418E 00	3.8841E 02
17	7.0000E-01	2.800E 07	1.2388E 03	1.000E 07	1.3582E 01	1	*	6.758E 02	4.0710E 00	3.2853E 02
18	3.3000E-01	0	0	0	0	2	*	2.471E 03	1.5881E 01	1.2357E 03
19	3.5000E-01	2.820E 07	1.5768E 04	2.670E 07	1.7718E 02	1.	*	2.788E 03	2.0475E 01	1.8852E 03
20	1.3800E 00	2.620E 07	5.7580E 03	2.870E 07	8.0508E 01	1.	*	4.375E 03	3.2788E 01	3.1988E 03
21	2.2700E 00	2.820E 07	6.8047E 03	2.870E 07	6.6091E 01	1	*	4.958E 03	2.8489E 01	2.5102E 03
22	2.4600E 00	2.820E 07	1.2588E 03	2.870E 07	1.3077E 01	1	*	1.738E 03	8.8858E 00	8.7110E 02
23	2.0800E 00	2.822E 07	1.4956E 03	2.870E 07	1.5055E 01	1	*	1.728E 03	8.5700E 00	8.8557E 02
24	1.8500E 00	2.820E 07	1.6502E 03	2.870E 07	1.6162E 01	1.	*	1.628E 03	7.8375E 00	8.1627E 02
25	1.8500E 00	2.820E 07	1.8748E 03	2.870E 07	1.8241E 01	1.	*	7.738E 02	3.7518E 00	3.8788E 02

TOTAL WEIGHT OF THIS SPAN IS 2.80487E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 2.11500E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 4.76146E 04 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * COMPR STATOR STGS 6-8 * * *

SPAN NUMBER 23 STATION NUMBER AT LAST WEIGHT POINT 25
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0	0	0	0.	2	*	4.880E 01	3.3487E-01	2.4851E 01
3	2.4000E-01	2.800E 07	7.4254E 02	2.650E 07	9.8692E 00	1	*	1.283E 02	8.7340E-01	6.4657E 01
4	2.4000E-01	2.800E 07	1.1818E 03	2.650E 07	1.5025E 01	1.	*	1.411E 03	1.0338E 01	7.0593E 02
5	5.9500E-01	2.800E 07	4.5786E 03	2.650E 07	5.8767E 01	1	*	1.407E 03	1.0300E 01	7.0384E 02
6	2.8000E-01	2.800E 07	8.2178E 02	2.650E 07	1.2308E 01	1	*	2.090E 02	1.3841E 00	1.0484E 02
7	7.8500E-01	2.800E 07	6.3449E 02	2.650E 07	8.4831E 00	1.	*	3.242E 02	2.1623E 00	1.6228E 02
8	1.0700E 00	2.800E 07	5.3449E 02	2.650E 07	8.4831E 00	1.	*	9.328E 02	7.3491E 00	4.8854E 02
9	4.4000E-01	2.800E 07	6.3449E 02	2.650E 07	8.4831E 00	1.	*	3.328E 02	2.0923E 00	1.6840E 02
10	1.3500E-01	2.800E 07	8.7358E 03	2.650E 07	8.3119E 01	1.	*	4.158E 02	2.6242E 00	2.0782E 02
11	2.2000E-01	2.760E 07	2.8173E 03	2.620E 07	3.4188E 01	1.	*	2.483E 02	1.6347E 00	1.2418E 02
12	5.4000E-01	2.760E 07	5.7810E 02	2.620E 07	7.5908E 00	1.	*	1.639E 02	1.2274E 00	8.1980E 01
13	6.0000E-01	2.760E 07	5.7610E 02	2.620E C7	7.5905E 00	1.	*	3.522E 02	2.2342E 00	1.7618E 02
14	1.2500E-01	2.760E 07	7.2980E 03	2.620E 07	8.0753E 01	1	*	3.438E 02	2.1755E 00	1.7181E 02
15	5.4500E-01	2.760E 07	5.7752E 02	2.620E 07	7.5959E 00	1.	*	8.007E 02	6.4123E 00	4.0038E 02
16	5.8000E-01	2.760E 07	5.7752E 02	2.820E C7	7.6969E 00	1.	*	3.215F 02	2.0820E 00	1.5578E 02
17	1.2500E-01	2.760E 07	6.7825E 03	2.620E 07	8.3885E 01	1.	*	3.170E 02	1.9960E 00	1.5850E 02
18	4.5300E-01	2.760E 07	5.7752E 02	2.620E 07	7.6968E 00	1	*	2.345E 02	1.5625E 00	1.1733E 02
19	8.8000E-01	2.760E 07	5.7752E 02	2.620E 07	7.6968E 00	1.	*	8.171E 02	6.5125E 00	4.0855E 02
20	4.9000E-01	2.760E 07	5.7752E 02	2.6[illegible] 07	7.6968E 00	1	*	3.150E 02	1.9826E 00	1.5750E 02
21	1.2500E-01	2.760E 07	6.7358E 03	[illegible] 07	8.3119E 01	1.	*	4.120E 02	2.6291E 00	2.0612E 02
22	1.0800E 00	2.760E 07	5.7752E 02	[illegible]	7.6968E 00	1	*	2.472E 02	1.5847E 00	1.2374E 02
23	3.7000E-01	2.594E 07	5.4388E 02	[illegible]E 07	7.4300E 00	1.	*	3.212E 02	1.7818E 00	1.6113E 02
24	1.0800E 00	1.448E-10	1.4205E-08	1.[illegible]E-08	3.2684E-08	2	*	5.217E 02	2.7371E 00	2.6181E 02
25	-8.7500E-01	1.265E-10	1.2554E-08	1.265E 0[illegible]	2.8272E-08	2	*	2.715E 02	1.3638E 00	1.3618E 02

TOTAL WEIGHT OF THIS SPAN IS 7.83852E 01 POUNDS
TOTAL LENGTH OF THIS SPAN IS 1.02000E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 1.08295E 04 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * COMBUSTOR CASING * * *

SPAN NUMBER 24 STATION NUMBER AT LAST WEIGHT POINT 21
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 * SPRING=2*		POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	*	2.175E 03	1.8397E 01	1.0812E 03
3	-1.5400E 00	5.022E-10	-3.4268E-08	-3.428E-08	4.6100E-08	2.	*	7.220E 02	4.0217E 00	3.8420E 02
4	-5.0000E-01	0	0	0	0	2	*	1.124E 02	7.0778E-01	6.8206E 01
5	6.0000E-01	0	0	0	0.	2	*	1.300E 02	8.7141E-01	6.6130E 01
6	7.3000E-01	1.535E-10	-1.2485E-08	-1.248E-08	2.5748E-08	2	*	1.882E 03	1.3031E 01	6.4138E 02
7	1.8800E 00	0	0	0	0	2.	*	1.808E 03	1.3701E 01	6.4868E 02
8	1.0600E 00	5.161E-10	-3.4148E-08	-3.415E-08	3.9383E-08	2	*	1.303E 03	1.4533E 01	6.7808E 02
9	1.2000E-01	0	0	0	0	2	*	1.068E 02	1.3732E 00	5.2878E 01
10	2.8000E-01	2.357E 07	3.3058E 02	8.820E 06	6.3738E 00	1.	*	1.432E 02	1.8842E 00	7.2047E 01
11	1.0100E 00	2.147E-10	-1.1388E-08	-1.138E-08	2.7514E-08	2.	*	1.223E 02	1.6180E 00	6.1853E 01
12	3.5000E-01	2.357E 07	2.3235E 02	8.820E 06	6.4184E 00	1	*	1.253E 02	1.7428E 00	6.2888E 01
13	1.4800E 00	2.357E 07	2.2808E 02	8.820E 06	6.3862E 00	1.	*	2.021E 02	2.6168E 00	1.0188E 02
14	1.4800E 00	2.357E 07	2.2808E 02	8.820E 06	6.3862E 00	1	*	1.758E 02	2.4251E 00	8.8451E 01
15	8.2000E-01	2.357E-10	1.4420E-08	1.442E-08	2.2108E-08	2.	*	1.042E 02	1.4042E 00	5.2387E 01
16	2.4000E-01	2.357E 07	3.1518E 02	8.820E 06	8.2420E 00	1.	*	3.210E 02	4.3862E 00	1.6061E 02
17	4.8000E-01	0	0	0.	0	2.	*	8.488E 02	9.3173E 00	4.2637E 02
18	1.3400E 00	1.373E-08	8.1088E-08	8.110E-08	7.3087E-08	2.	*	2.888E 02	3.6438E 00	1.5118E 02
19	2.8000E-01	2.357E 07	1.1607E 03	8.820E 06	2.1081E 01	1	*	1.358E 03	1.637?E 01	1.0177E 03
20	1.1400E 00	5.633E-10	3.8774E-08	3.877E-08	4.6832E-08	2.	*	5.280E 03	2.8448E 01	2.8268E 03
21	1.2000E-01	0	0	0.	0	2	*	8.354E 02	5.7648E 00	4.1770E 02

TOTAL WEIGHT OF THIS SPAN IS 1.37546E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 1.11200E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 1.77167E 04 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * COMBUSTOR-HPT CASING * * *

SPAN NUMBER 25 STATION NUMBER AT LAST WEIGHT POINT 25
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0.

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 * SPRING=2*		POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0	0	0.	0.	2.	*	2.022E 04	6.4358E 01	1.0110E 04
3	1.1000E-01	0	0	0.	0.	2.	*	1.585E 04	1.0527E 02	7.7771E 03
4	1.8500E 00	4.981E-11	2.8588E-10	2.858E-10	2.8084E-08	2	*	1.493E 03	6.6201E 00	7.6238E 02
5	1.1900E 00	4.378E-11	4.5855E-10	4.587E-10	1.8738E-08	2.	*	2.268E 03	8.5516E 00	1.1411E 03
6	3.1500E 00	2.573E 07	1.7464E 03	9.898E 06	1.4585E 01	1.	*	2.677E 03	1.[illegible]4E 01	1.3488E 03
7	1.9400E 00	4.483E-11	2.6164E-10	2.616E-10	2.7918E-08	2	*	2.174E 03	8.[illegible]9E 00	1.0842E 03
8	2.0800E 00	2.573E 07	1.8284E 03	9.898E 06	1.4802E 01	1.	*	1.589E 03	6.4393E 00	7.9848E 02
9	7.4000E-01	2.357E 07	2.0767E 03	8.820E 06	1.6787E 01	1.	*	4.284E 04	1.3412E 02	2.1421E 04
10	5.3000E-01	0	0	0.	0	2	*	4.585E 03	1.9347E 01	2.2825E 03
11	6.0000E-01	1.612E-11	8.3731E-11	8.373E-11	9.3495E-09	2.	*	6.427E 02	2.6070E 00	3.2167E 02
12	[illegible]000E-01	1.453E-11	1.2685E-11	9.269E-11	8.8704E-09	2.	*	1.778E 03	6.9339E 00	8.8958E 02
13	[illegible]000E-01	0.	0	0.	0.	2.	*	8.320E 03	3.7665E 01	4.1652E 03
14	[illegible]1600E 00	2.778E-11	1.6005E-10	1.600E-10	1.7875E-08	2	*	1.342E 03	5.2531E 00	6.7338E 02
15	1.1600E 00	2.723E-11	1.6655E-10	1.666E-10	1.7731E-08	2	*	1.712E 03	6.4138E 00	8.5728E 02
16	2.8000E-01	0	0	0.	0	2	*	8.204E 03	3.6002E 01	4.1019E 03
17	1.0800E 00	2.367E-11	1.3201E-10	1.320E-10	1.5854E-08	2	*	8.535E 02	3.2247E 00	4.2768E 02
18	3.4000E-01	7.424E-12	3.7559E-11	3.755E-11	6.0535E-09	2	*	1.412E 03	5.0844E 00	7.0607E 02
19	3.0000E-01	0.	0	0.	0.	2.	*	4.136E 03	1.6753E 01	2.0676E 03
20	2.0000E-01	2.357E 07	4.2768E 03	8.820E 06	3.1895E 01	1	*	7.879E 02	2.8787E 00	3.9446E 02
21	8.8000E-01	3.381E-11	3.9306E-10	3.931E-10	1.6318E-08	2.	*	8.657E 02	3.4380E 00	4.6357E 02
22	6.8000E-01	2.386E-11	2.7754E-10	2.775E-10	1.2128E-08	2	*	3.058E 03	1.1058E 01	1.5288E 03
23	4.5000E-01	0.	0	0	0	2	*	3.119E 03	1.1189E 01	1.5597E 03
24	7.2000E-01	2.386E-11	2.8843E-10	2.884E-10	1.2855E-08	2	*	1.472E 03	4.8292E 00	7.3644E 02
25	1.7000E-01	0.	0	0.	0	2	*	1.280E 05	3.2298E 02	6.4048E 05

TOTAL WEIGHT OF THIS SPAN IS 8.81858E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 2.05800E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 2.80188E 05 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

ORIGINAL PAGE IS OF POOR QUALITY

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-8

* * * LP TURBINE CASING * * *

SPAN NUMBER 26 STATION NUMBER AT LAST WEIGHT POINT 25
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	*	1.893E 04	5.3000E 01	8.4840E 03
3	1.5900E 00	1.074E-10	1.2850E-09	1.285E-09	5.8450E-08	2.	*	4.497E 03	1.3782E 01	2.2802E 03
4	1.3700E 00	8.221E-11	1.2478E-09	1.248E-09	5.0334E-08	2	*	7.838E 02	2.2341E 00	3.8208E 02
5	5.6000E-01	3.467E-11	4.6430E-10	4.643E-10	1.8638E-08	2	*	5.862E 02	1.6082E 00	7.9415E 02
6	3.1000E-01	2.357E 07	3.7880E 03	8.820E 06	2.0524E 01	1.	*	7.477E 02	2.0288E 00	3.7362E 02
7	1.5000E-01	2.357E 07	8.8893E 03	8.820E 06	4.8255E 01	1	*	1.877E 04	6.3678E 01	8.3888E 03
8	1.5200E 00	7.398E-11	1.0420E-09	1.042E-09	4.4580E-08	2	*	4.284E 03	1.0753E 01	2.1494E 03
9	1.3100E 00	6.898E-11	1.0372E-09	1.037E-09	4.4069E-08	2	*	8.727E 02	2.3078E 00	4.6735E 02
10	4.8000E-01	2.652E-11	3.7843E-10	3.784E-10	1.8333E-08	2.	*	6.852E 02	1.8611E 00	3.4264E 02
11	3.8000E-01	2.357E 07	3.7958E 03	8.820E 06	1.7174E 01	1	*	9.278E 02	2.1008E 00	4.6375E 02
12	1.5000E-01	2.357E 07	1.1638E 04	8.820E 06	5.2779E 01	1.	*	2.308E 04	7.0480E 01	1.1541E 04
13	1.7100E 00	6.018E-11	9.2580E-10	9.258E-10	4.4670E-08	2	*	8.658E 03	1.7828E 01	4.3297E 03
14	1.4000E 00	4.182E-11	6.0732E-10	6.073E-10	4.0718E-08	2	*	1.288E 03	2.5378E 00	6.3078E 02
15	5.2000E-01	1.828E-11	2.4450E-10	2.445E-10	1.4824E-08	2.	*	7.132E 02	1.4001E 00	3.5669E 02
16	3.0000E-01	2.357E 07	4.0078E 03	8.820E 06	1.5644E 01	1.	*	1.002E 03	1.9880E 00	5.0123E 02
17	1.5000E-01	2.357E 07	1.4411E 04	8.820E 06	5.8874E 01	1	*	3.034E 04	8.2467E 01	1.5188E 04
18	1.7100E 00	4.143E-11	6.3470E-10	6.347E-10	4.1760E-08	2.	*	6.318E 03	1.1774E 01	3.1888E 03
19	1.3500E 00	3.485E-11	5.3921E-10	5.392E-10	3.7108E-08	2	*	1.518E 03	2.7167E 00	7.5804E 02
20	6.0000E-01	1.303E-11	1.7933E-10	1.793E-10	1.5762E-08	2.	*	8.574E 02	1.5042E 00	4.2882E 02
21	3.0000E-01	2.357E 07	4.3051E 03	8.820E 06	1.5038E 01	1	*	3.358E 04	8.7172E 01	1.6788E 04
22	1.5700E 00	2.848E-11	2.3880E-11	2.388E-11	4.8880E-08	2	*	1.133E 04	1.8852E 01	5.8678E 03
23	1.4500E 00	2.357E 07	2.6828E 03	8.820E 06	8.0327E 00	1.	*	3.487E 03	6.0560E 00	1.7438E 03
24	8.3000E-01	2.357E 07	9.5866E 03	8.820E 06	3.3189E 01	1	*	6.718E 03	1.1568E 01	3.3581E 03
25	2.1000E-01	0	0	0	0.	2.	*	7.701E 04	1.2338E 02	3.8505E 04

TOTAL WEIGHT OF THIS SPAN IS 6.33612E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 2.03100E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 2.57071E 05 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-8

* * * MIXER * * *

SPAN NUMBER 27 STATION NUMBER AT LAST WEIGHT POINT 5
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0.

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 SPRING=2	*	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0	0.	0.	0.	2.	*	4.340E 04	7.5850E 01	2.1702E 04
3	1.9500E 00	0	0	0	0.	2	*	0.	0.	0.
4	7.7500E 00	0.	0.	0	0.	2	*	1.878E 04	4.1000E 01	8.3880E 03
5	7.7500E 00	0	0.	0	0.	2.	*	0.	0.	0.

TOTAL WEIGHT OF THIS SPAN IS 1.20950E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 1.74500E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 6.21760E 04 LBS IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-8

*** EXHAUST CONE ***

SPAN NUMBER 28 STATION NUMBER AT LAST WEIGHT POINT 7
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM:1 = SPRING:2 =	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0	0	0	0	2	1.431E 04	1.1480E 02	7.1530E 03
3	4.1000E 00	0	0	0	0	2	0	0	0
4	9.6500E 00	0	0	0	0	2	7.178E 03	3.6100E 01	3.6880E 03
5	9.6500E 00	0	0	0	0	2	0	0	0
6	8.2500E 00	0	0	0	0	2	1.108E 03	1.8300E 01	5.5470E 02
7	8.2500E 00	0	0	0	0	2	2.940E 01	4.2000E 00	2.1100E 01

TOTAL WEIGHT OF THIS SPAN IS 1.70100E 02 POUNDS
TOTAL LENGTH OF THIS SPAN IS 3.55000E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 2.26228E 04 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-5

*** INLET FAN CONTAINMENT ***

SPAN NUMBER 29 STATION NUMBER AT LAST WEIGHT POINT 25
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM:1 = SPRING:2 =	POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0.	0	0	0.	0.	2	1.431E 05	7.2516E 01	7.1531E 04
3	3.0000E-01	0	0	0	0	2	7.708E 04	3.8551E 01	3.8538E 04
4	1.0000E 00	2.888E 07	1.0888E 05	1.121E 07	1.1121E 02	1.	7.575E 04	3.8066E 01	3.7874E 04
5	3.5000E-01	0	0	0	0.	2.	6.958E 04	3.4919E 01	3.4792E 04
6	8.0000E-01	2.888E 07	1.0888E 05	1.121E 07	1.1121E 02	1	3.555E 04	1.8116E 01	1.7774E 04
7	2.0000E-01	2.888E 07	1.8250E 05	1.121E 07	1.8528E 02	1.	3.154E 04	1.5070E 01	1.5771E 04
8	5.7000E-01	2.898E 07	1.0888E 05	1.121E 07	1.1121E 02	1	3.426E 04	1.7492E 01	1.7133E 04
9	2.5000E-01	2.898E 07	1.8250E 05	1.121E 07	1.8528E 02	1	6.292E 04	3.2087E 01	3.1468E 04
10	1.8000E 00	2.888E 07	1.0888E 05	1.121E 07	1.1121E 02	1.	6.564E 04	3.3488E 01	3.2828E 04
11	3.0000E-01	2.888E 07	1.8250E 05	1.121E 07	1.8528E 02	1.	5.230E 04	2.7202E 01	2.6188E 04
12	1.2500E 00	8.387E-13	-2.2778E-11	-2.278E-11	2.7849E-08	2	3.427E 04	1.8044E 01	1.7144E 04
13	2.0000E-01	2.898E 07	1.1617E 05	1.121E 07	1.2292E 02	1	1.563E 04	8.4337E 00	7.8174E 03
14	7.0000E-01	6.300E-13	-1.2730E-11	-1.273E-11	2.5031E-08	2	2.141E 04	1.1346E 01	1.0706E 04
15	1.5000E-01	0	0	0	0	2	2.193E 04	1.1666E 01	1.0966E 04
16	7.5000E-01	6.692E-13	-1.2771E-11	-1.277E-11	2.7827E-08	2.	1.131E 05	6.3503E 01	5.6557E 04
17	2.5000E-01	2.888E 07	1.6436E 05	1.121E 07	1.7633E 02	1	2.182E 04	1.1794E 01	1.0913E 04
18	5.5000E-01	4.818E-13	-8.1878E-12	-8.188E-12	1.8808E-08	2.	2.465E 04	1.2396E 01	1.2325E 04
19	2.5000E-01	2.888E 07	2.0442E 05	1.121E 07	1.8350E 02	1	2.614E 04	1.3278E 01	1.3072E 04
20	7.5000E-01	6.008E-13	-1.2832E-11	-1.283E-11	2.3260E-08	2	2.274E 04	1.2434E 01	1.1371E 04
21	1.5000E-01	0.	0	0	0.	2	2.108E 04	1.1550E 01	1.0524E 04
22	5.5000E-01	5.186E-13	-1.0888E-11	-1.087E-11	2.0218E-08	2	2.142E 04	1.1667E 01	1.0710E 04
23	2.5000E-01	2.888E 07	1.8199E 05	1.121E 07	1.7808E 02	1	2.929E 04	1.5338E 01	1.4648E 04
24	1.0000E 00	5.692E-13	-8.3176E-12	-8.318E-12	2.4188E-08	2	3.502E 04	1.8558E 01	1.7516E 04
25	1.5000E-01	0.	0.	0	0.	2	1.429E 04	7.8258E 00	7.1429E 03

TOTAL WEIGHT OF THIS SPAN IS 5.56875E 02 UNDS
TOTAL LENGTH OF THIS SPAN IS 1.26200E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 1.07085E 06 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

ORIGINAL PAGE
OF POOR QUALITY

V A S T
VIBRATION ANALYSIS SYSTEM U3342A-B

* * * FWD FAN EXHAUST NOZZLE * * *

SPAN NUMBER 30 STATION NUMBER AT LAST WEIGHT POINT 25
ROTOR SPEED 0 RPM
RATIO OF ROTOR SPEED TO FREQUENCY OF VIBRATION 0

STATION	INTERVAL LENGTH INCHES	YOUNGS MODULUS PHI(M)	AREA MOMENT PHI(F)	SHEAR MODULUS ETA(M)	SHEAR AREA ETA(F)	BEAM=1 * SPRING=2*		POLAR MOMENT	WEIGHT IN POUNDS	WEIGHT MOMENT
2	0	0.	0	0	0	2.	*	5.742E 03	5.5648E 00	4.8712E 03
3	5.8000E-01	2.898E 07	5.0523E 04	1.121E 07	5.7825E 01	1.	*	1.576E 04	9.0031E 00	7.8788E 03
4	2.2000E-01	2.898E 07	5.6648E 04	1.121E 07	1.1041E 02	1	*	1.284E 04	7.2419E 00	6.3183E 03
5	5.7000E-01	2.898E 07	4.1034E 04	1.121E 07	4.7173E 01	1	*	1.209E 04	6.9294E 00	5.0468E 03
6	2.0000E-01	2.898E 07	5.6648E 04	1.121E 07	1.1041E 02	1.	*	1.207E 04	6.9249E 00	5.0328E 03
7	5.7000E-01	2.898E 07	4.0887E 04	1.121E 07	4.7118E 01	1.	*	1.372E 04	7.8852E 00	5.8818E 03
8	2.2000E-01	2.898E 07	1.1448E 05	1.121E 07	1.3122E 02	1	*	1.481E 04	8.3487E 00	7.2533E 03
9	5.6000E-01	2.898E 07	4.0740E 04	1.121E 07	4.7060E 01	1	*	1.700E 04	9.7772E 00	8.5024E 03
10	2.7000E-01	0	0	0	0	2	*	1.025E 05	5.0337E 01	5.1448E 04
11	2.9500E 00	2.898E 07	4.5234E 04	1.121E 07	5.2278E 01	1	*	8.888E 04	5.4788E 01	4.8507E 04
12	5.0000E-01	0.	0	0	0	2	*	5.286E 04	3.4808E 01	3.1278E 04
13	7.5000E-01	1.000E 07	4.5397E 04	3.800E 06	5.2339E 01	1	*	1.888E 04	9.7878E 00	8.4818E 03
14	8.5000E-01	2.898E 07	5.6644E 04	1.121E 07	6.5384E 01	1	*	4.585E 04	2.5358E 01	2.2850E 04
15	2.0000E 00	2.898E 07	5.6644E 04	1.121E 07	6.5384E 01	1	*	4.342E 04	2.5030E 01	2.1714E 04
16	5.5000E-01	2.898E 07	7.2850E 04	1.121E 07	8.3863E 01	1.	*	2.808E 04	1.6164E 01	1.4030E 04
17	1.3000E 00	2.898E 07	4.5397E 04	1.121E 07	5.2339E 01	1	*	3.033E 04	1.7492E 01	1.5168E 04
18	8.5000E-01	2.898E 07	5.6644E 04	1.121E 07	6.5384E 01	1	*	2.968E 04	1.7122E 01	1.4844E 04
19	1.2500E 00	2.898E 07	4.5397E C4	1.121E 07	5.2339E 01	1.	*	2.678E 04	1.5428E 01	1.3398E 04
20	5.2000E-01	2.898E 07	7.2850E 04	1.121E 07	8.3863E 01	1.	*	3.707E 04	2.1353E 01	1.8542E 04
21	2.0500E 00	2.898E 07	4.5397E 04	1.121E 07	5.2339E 01	1	*	3.948E 04	2.2769E 01	1.9747E 04
22	5.2000E-01	2.898E 07	5.6644E 04	1.121E 07	6.5384E 01	1.	*	2.342E 04	1.3511E 01	1.1712E 04
23	8.0000E-01	2.898E 07	4.5397E 04	1.121E 07	5.2339E 01	1	*	5.125E 04	2.8598E 01	2.5628E 04
24	3.0000E-01	0	0	0.	0	2.	*	4.087E 04	2.2871E 01	2.0487E 04
25	9.2390E 00	0	0	0.	0.	2	*	2.083E 06	1.1810E 03	1.0418E 06

TOTAL WEIGHT OF THIS SPAN IS 1.82897E 03 POUNDS
TOTAL LENGTH OF THIS SPAN IS 2.80990E 01 INCHES
TOTAL POLAR MOMENT OF THIS SPAN IS 2.88834E 06 LBS.IN**2

ALL VALUES OF THE SHEAR-STRESS RATIO (ALFA) ARE 2.00000E 00

7.3 E^3 VAST SOLUTION ENERGY SUMMARY FOR ASSEMBLED ENGINE SYSTEM

V A S T
VIBRATION ANALYSIS SYSTEM U3342A

KINETIC AND POTENTIAL ENERGY

AT CRITICAL SPEED 8.18782E 02 RPM

TOTAL KINETIC ENERGY	TOTAL PE	PE SYSTEM	PE SPRINGS
2.14838E 04	2.14888E 04	2.22495E 02	2.12631E 04

STATION	KINETIC ENERGY	PERCENT	TRANSLATION	ROTATION	SPAN	POTENTIAL ENERGY	PERCENT	FORCE	MOMENT
1	4.28228E 02	19.932	4.37977E 03	-9.75268E 01	1	5.97208E-02	0.000	-2.83535E-01	3.23258E-01
2	1.01881E 02	0.480	2.02284E 02	-3.88154E-01	2	1.11180E 01	0.052	1.00588E 01	1.05614E 00
3	1.00826E 02	0.470	1.01083E 02	-1.37181E-01	3	6.94689E-01	0.003	4.12261E-02	8.53452E-01
4	2.10476E 02	0.980	2.10801E 02	-1.28559E-01	4	4.06583E 00	0.019	1.86004E-02	4.04713E 00
5	1.29844E 02	0.603	1.29604E 02	-2.08742E-02	5	4.87285E 00	0.023	3.33940E-01	4.53891E 00
6	7.47745E-01	0.003	9.20538E-01	-1.72853E-01	6	1.19557E-01	0.001	1.17872E-01	2.01504E-03
7	2.91994E 00	0.014	3.18810E 00	-2.68181E-01	7	9.44901E 00	0.044	9.44901E 00	0.
8	1.47120E-01	0.001	1.29982E 00	-1.16270E 00	8	1.33789E-01	0.001	6.74342E-03	1.27048E-01
9	-1.69281E 00	-0.008	1.11561E 01	-1.30377E 01	9	3.65455E-03	0.000	3.35977E-03	2.94774E-04
10	-1.28217E 01	-0.060	9.18851E-01	-1.38458E 01	10	7.16781E-04	0.000	6.07688E-05	6.56023E-04
11	3.18402E 02	1.482	3.20610E 02	-1.12078E 01	11	1.01784E 00	0.005	1.66968E-01	8.50988E-01
12	2.64971E 02	1.233	2.88942E 02	-2.30715E 01	12	7.30048E-01	0.003	-5.69188E-02	7.86565E-01
13	2.91221E 01	0.136	3.33795E 01	-4.25686E 00	13	9.53142E-01	0.004	1.88138E-01	7.67006E-01
14	7.47911E 01	0.348	1.13174E 02	-3.83741E 01	14	6.69372E-01	0.003	4.61203E-01	2.08170E-01
15	9.75614E 00	0.045	9.04459E 00	7.11561E-01	15	5.20567E 00	0.024	2.27365E 00	2.93183E 00
16	6.18515E 01	0.288	6.17457E 01	1.13784E-01	16	4.40052E-03	0.000	4.28434E-03	1.16181E-04
17	3.11153E 02	1.448	3.04060E 02	7.10328E 00	17	6.28005E 00	0.029	6.27760E 00	2.25917E-03
18	2.77910E 03	12.935	2.74539E 03	3.36092E 01	18	5.30552E 00	0.025	5.67510E 00	-3.70482E-01
19	1.10218E 00	0.005	2.88890E-01	8.33074E-01	19	8.79118E-01	0.004	8.01810E-01	7.73086E-02
20	2.40813E 03	11.211	2.33130E 03	7.73323E 01	20	3.85386E-01	0.002	3.64150E-01	2.12363E-02
21	1.85316E 03	8.628	1.80858E 03	4.50570E 01	21	6.14000E 01	0.286	9.21124E 00	5.21888E 01
22	2.88316E 02	1.342	2.78187E 02	8.17560E 00	22	4.98377E 01	0.232	1.02480E 01	3.95897E 01
23	5.49141E 01	0.256	5.28648E 01	2.05005E 00	23	5.22039E-03	0.000	4.19522E-03	[illegible]
24	4.93828E 01	0.230	4.59477E 01	3.44502E 00	24	9.25613E-03	0.000	8.15544E-03	[illegible]
25	4.39276E 02	2.045	1.82762E 02	2.56514E 02	25	2.68134E 01	0.125	1.95789E 01	[illegible]
26	6.11512E 01	0.285	1.57888E 01	4.54083E 01	26	3.01043E 01	0.140	2.33912E 01	6.71318E 00
27	1.72206E 01	0.080	6.29640E 00	1.09242E 01	27	3.76216E-08	0.000	3.76216E-08	0.
28	3.07966E 01	0.143	2.66048E 01	3.99131E 00	28	-8.46281E-08	-0.000	-8.46281E-08	0.
29	2.89540E 03	13.479	2.67105E 03	2.24758E 02	29	2.35405E-01	0.001	2.11815E-01	2.37897E-02
30	4.61943E 03	21.502	4.01808E 03	6.01338E 02	30	2.05020E 00	0.010	1.81211E 00	2.38081E-01

POTENTIAL ENERGY OF SPRINGS

SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT
2	1.65841E-01	0.001	*	4	1.81908E 00	0.008	*	3	1.62817E 00	0.008
81	2.73242E-01	0.001	*	1	1.50317E 01	0.070	*	5	2.28047E 00	0.011
82	4.80476E 01	0.224	*	61	1.55713E 01	0.073	*	101	2.09891E 04	97.696
81	9.72383E-0	0.005	*	63	2.19234E 00	0.010	*	102	2.05880E 02	0.958

V A S T
VIBRATION ANALYSIS SYSTEM U3342A

KINETIC AND POTENTIAL ENERGY

AT CRITICAL SPEED 1.06550E 03 RPM

TOTAL KINETIC ENERGY	TOTAL PE	PE SYSTEM	PE SPRINGS
2.79930E 04	2.78918E 04	1.89711E 03	2.60947E 04

STATION	KINETIC ENERGY	PERCENT	TRANSLATION	ROTATION	SPAN	POTENTIAL ENERGY	PERCENT	FORCE	MOMENT
1	1.97348E 02	0.705	4.21982E 02	-2.24637E 02	1	2.63847E-01	0.001	-5.67463E-02	3.40593E-01
2	1.29018E 01	0.042	1.38212E 01	-9.18308E-01	2	2.88875E 00	0.010	2.60040E 00	2.88357E-01
3	8.82431E 00	0.031	8.84388E 00	-3.19308E-01	3	9.70169E-01	0.003	-1.78878E-03	9.71828E-01
4	4.47912E 00	0.016	4.79923E 00	-3.19808E-01	4	1.31338E 01	0.048	6.84048E-03	1.34270E 01
5	4.51236E 02	1.612	4.51349E 02	-8.48648E-02	5	1.69642E 02	0.604	-1.48890E 00	1.70508E 02
6	4.79810E 02	1.713	4.78745E 02	-1.04702E-01	6	1.48784E 01	0.053	1.48631E 01	2.13240E-01
7	3.73964E 02	1.335	3.73747E 02	-1.82848E-01	7	2.64099E 02	0.943	2.64099E 02	0
8	6.69237E 02	2.391	5.70061E 02	-8.24895E-01	8	1.16264E 01	0.041	5.36959E 00	6.18577E 00
9	2.18873E 03	7.819	2.19832E 03	-9.58522E 00	9	1.66573E 00	0.006	1.53879E 00	1.26837E-01
10	2.24078E 03	8.005	2.25078E 03	-1.00020E 01	10	8.44980E-01	0.003	8.29128E-01	1.56522E-02
11	1.63546E 02	0.584	2.06435E 02	-4.28888E 01	11	2.06832E 01	0.075	6.55481E 00	1.43086E 01
12	9.78426E 02	3.495	1.06405E 03	-8.56259E 01	12	2.48944E 01	0.089	1.28246E 00	2.36119E 01
13	4.59527E 02	1.642	4.72866E 02	-1.33381E 01	13	3.28184E 01	0.117	4.13422E-02	3.27771E 01
14	3.34901E 03	11.935	3.45510E 03	-1.16234E 02	14	1.78998E 01	0.064	1.04379E 01	7.46188E 00
15	4.82985E 01	0.173	4.65411E 01	1.75739E 00	15	3.07830E 01	0.110	2.17830E-01	3.06451E 01
16	2.47013E 00	0.009	2.18845E 00	2.82479E-01	16	3.02073E-02	0.000	2.94503E-02	7.56961E-04
17	3.92975E 01	0.140	1.83500E 01	1.99476E 01	17	8.54191E 01	0.305	8.52876E 01	3.14586E-02
18	1.40318E 02	0.501	4.69088E 01	9.34051E 01	18	1.27830E 00	0.005	1.34422E 00	-6.79189E-02
19	6.87015E 02	2.454	6.85640E 02	1.42473E 00	19	1.19788E 02	0.428	1.10897E 02	9.12028E 00
20	2.72201E 02	0.972	6.33384E 01	2.08863E 02	20	6.05838E-02	0.000	3.84792E-02	2.22044E-02
21	2.99244E 02	1.069	1.77589E 02	1.21555E 02	21	1.26327E 02	0.456	2.38094E-01	1.28061E 02
22	4.10411E 02	1.466	3.86820E 02	2.35740E 01	22	2.03168E 02	0.726	2.67540E-01	2.02872E 02
23	1.57313E 02	0.562	1.52276E 02	5.07638E 00	23	3.61669E-02	0.000	3.32408E-02	1.92603E-03
24	4.74461E 02	1.696	4.66188E 02	8.49247E 00	24	4.64424E-01	0.002	3.34808E-01	1.63616E-01
25	4.18158E 03	14.939	3.80745E 03	5.74619E 02	25	2.287[illegible]E 02	0.821	2.63500E 01	2.03396E 02
26	4.06310E 03	14.515	3.87492E 03	8.81848E 01	26	5.77633E 02	1.880	3.32877E 02	2.67765E 02
27	1.03126E 03	3.684	1.01099E 03	2.02679E 01	27	6.22364E-07	0.000	6.22364E-07	0
28	1.71304E 03	6.120	1.70599E 03	7.04580E 00	28	-9.63286E-07	-0.000	-9.63286E-07	0
29	9.96413E 02	3.560	3.73113E 02	6.23300E 02	29	1.53185E-01	0.00[illegible]	1.04025E-01	5.91702E-02
30	1.50613E 03	5.512	2.38671E 02	1.66716E 03	30	1.02728E 00	0.004	5.32928E-01	4.94338E-01

POTENTIAL ENERGY OF SPRINGS

SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT
2	1.46535E 00	0.005	*	4	5.20541E 01	0.19	*	3	2.46369E 01	0.088
81	[illegible]77184E 00	0.013	*	1	3.84343E 00	0.014	*	5	2.94446E 02	1.052
82	8.40381E 01	0.300	*	61	1.04581E 01	0.037	*	101	2.99966E 02	1.061
81	8.71263E 00	0.031	*	63	4.67929E 02	1.672	*	102	2.48463E 04	88.763

V A S T
VIBRATION ANALYSIS SYSTEM U3342A

KINETIC AND POTENTIAL ENERGY

AT CRITICAL SPEED 3.08839E 03 RPM

TOTAL KINETIC ENERGY	TOTAL PE	PE SYSTEM	PE SPRINGS
1.79711E 05	1.79711E 05	1.28749E 05	4.89622E 04

SPAN	KINETIC ENERGY	PERCENT	TRANSLATION	ROTATION	SPAN	POTENTIAL ENERGY	PERCENT	FORCE	MOMENT
1	-1.42774E 01	-0.008	1.39376E 02	-1.83653E 02	1	-3.88275E-01	-0.000	-2.67334E-01	-1.30941E-01
2	7.05842E 00	0.004	7.57432E 00	-5.18503E-01	2	1.20883E 02	0.067	1.08383E 02	1.18200E 01
3	3.79250E 00	0.002	4.01390E 00	2.61008E-01	3	1.14311E 02	0.064	5.03081E 01	6.40033E 01
4	7.84893E 01	0.042	7.57738E 01	2.74238E-01	4	9.28287E 02	0.518	2.28268E 02	6.80033E 02
5	1.83973E 03	0.812	1.83847E 03	2.45884E-01	5	1.44841E 04	8.049	-4.05123E 01	1.45048E 04
6	5.48353E 00	0.003	7.32347E 01	-6.77811E 01	6	5.84908E 02	0.325	5.74573E 02	1.03348E 01
7	1.41828E 03	0.787	1.51820E 03	-1.04838E 02	7	5.79885E 04	32.255	5.79885E 04	0.
8	-3.40777E 02	-0.196	3.18880E 01	-3.81346E 02	8	7.10617E 02	0.395	-8.15811E-01	7.11533E 02
9	-3.00608E 03	-1.672	1.17738E 03	-4.18144E 03	9	1.38008E 01	0.008	9.20540E 00	4.30406E 00
10	-3.19785E 03	-1.779	1.16081E 03	-4.34888E 03	10	8.55223E 00	0.005	4.52071E 00	4.02751E 00
11	6.41843E 03	3.572	7.55666E 03	-1.13823E 03	11	4.39763E 03	2.447	1.36444E 03	3.03320E 03
12	3.17988E 04	17.694	3.32545E 04	-1.45584E 03	12	4.70428E 03	2.618	1.28018E 02	4.57628E 03
13	1.21211E 04	6.748	1.21774E 04	-5.62146E 01	13	6.03131E 03	3.356	6.02476E 01	5.97108E 03
14	7.55822E 04	42.102	7.57834E 04	-1.31212E 02	14	3.88285E 03	2.166	2.38538E 03	1.50784E 03
15	2.50451E 02	0.139	2.47878E 02	2.77331E 00	15	2.47372E 02	0.138	3.05443E 01	2.16828E 02
16	5.88992E 01	0.033	5.88854E 01	3.09825E-01	16	1.12060E 01	0.006	1.08146E 01	2.91524E-01
17	4.19285E 02	0.233	3.97858E 02	2.16274E 01	17	1.87556E 04	10.437	1.87487E 04	8.85515E 00
18	1.47707E 03	0.8[illegible]	1.22631E 03	2.45755E 02	18	4.73318E 01	0.026	5.10480E 01	-3.71432E 00
19	2.29[illegible]3E 02	0.1[illegible]	2.27404E 02	1.71892E 00	19	4.12090E 03	2.293	3.76726E 03	3.53645E 02
20	2.24[illegible]3E 03	1.24[illegible]	[illegible].48158E 03	7.61520E 02	20	6.45557E-01	0.000	3.37748E-01	3.07811E-01
21	3.52[illegible] 03	1.96	3.08038E 03	4.31774E 02	21	1.36324E 03	0.759	1.23467E 00	1.36201E 03
22	2.787[illegible] 03	1.55[illegible]	2.73320E 03	5.38258E 01	22	1.85302E 03	1.031	4.58772E 01	1.80334E 03
23	9.24048E 02	0.515	9.16785E 02	6.14955E 00	23	1.81452E 00	0.001	1.75385E 00	1.60552E-01
24	2.23223[illegible] 03	1.242	2.21884E 03	1.36378E 01	24	1.90032E 01	0.011	1.32670E 01	5.73818E 00
25	1.40[illegible]E 04	7.836	1.36542E 04	4.27185E 02	25	2.19779E 03	1.223	1.14278E 03	1.05504E 03
26	8.464[illegible]7 03	4.710	8.44875E 03	1.55582E 01	26	7.16838E 03	3.989	6.75442E 03	4.13566E 02
27	1.32349E 03	0.736	1.32102E 03	2.46930E 00	27	-1.32714E-06	-0.000	-1.32714E-06	0.
28	7.82468E 02	0.435	7.78098E 02	4.37214E 00	28	8.95501E-07	0.000	8.95501E-07	0
29	4.07551E 03	2.268	5.31308E 02	3.54420E 03	29	3.72767E 00	0.002	1.51761E 00	2.21018E 00
30	1.42638E 04	7.937	4.83871E 03	9.[illegible]723E 03	30	2.14842E 01	0.012	3.70608E 00	1.77881E 01

POTENTIAL ENERGY OF SPRINGS

SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT
2	5.31288E 02	0.296	*	4	1.15627E 04	6.434	*	3	5.47159E 03	3.045
91	6.47498E 02	0.360	*	1	1.55597E 02	0.087	*	5	1.08381E 04	6.031
52	3.54084E 03	1.970	*	51	7.58331E 02	0.422	*	101	9.83362E 02	0.547
81	6.68088E 02	0.372	*	53	1.08713E 04	6.049	*	102	3.93250E 03	2.188

V A S T
VIBRATION ANALYSIS SYSTEM U3342A

KINETIC AND POTENTIAL ENERGY

AT CRITICAL SPEED 4.06688E 03 RPM

TOTAL KINETIC ENERGY	TOTAL PE	PE SYSTEM	PE SPRINGS
2.23861E 05	2.23858E 05	1.57238E 05	6.66179E 04

SPAN	KINETIC ENERGY	PERCENT	TRANSLATION	ROTATION	SPAN	POTENTIAL ENERGY	PERCENT	FORCE	MOMENT
1	1.20984E 03	0.540	2.71341E 03	-1.50347E 03	1	2.79282E 01	0.012	-5.34244E 00	3.32687E 01
2	7.16708E 01	0.032	7.83555E 01	-6.68488E 00	2	1.05564E 02	0.047	9.68282E 01	8.73483E 00
3	5.29448E 01	0.024	5.53816E 01	-2.43687E 00	3	1.66471E 02	0.074	2.56976E 01	1.40773E 02
4	6.92113E 01	0.031	7.25381E 01	-3.32682E 00	4	2.82889E 02	0.126	1.14338E 02	1.68554E 02
5	1.22883E 03	0.549	1.22841E 03	4.24408E-01	5	2.27003E 03	1.014	-5.26003E 00	2.27629E 03
6	3.29404E 03	1.471	3.34050E 03	-4.64519E 01	6	1.35737E 02	0.061	1.34590E 02	1.14707E 00
7	9.58312E 02	0.428	1.03048E 03	-7.21497E 01	7	1.28718E 04	5.750	1.28718E 04	0.
8	4.16059E 03	1.859	4.48269E 03	-3.22107E 02	8	2.96477E 02	0.132	3.51708E 02	-5.52311E 01
9	8.13926E 03	3.636	1.18064E 04	-3.66718E 03	9	1.41180E 02	0.063	1.08626E 02	3.55340E 01
10	2.06879E 04	9.241	2.45385E 04	-3.85052E 03	10	1.56441E 02	0.070	1.56150E 02	2.90203E-01
11	9.72735E 03	4.345	9.86755E 03	-1.40201E 02	11	1.31402E 03	0.587	2.43943E 02	1.07008E 03
12	9.98016E 03	4.458	1.08102E 04	-8.30031E 02	12	8.48890E 02	0.379	-7.18811E 01	9.20351E 02
13	9.51877E 02	0.425	1.18236E 03	-2.30482E 02	13	1.12605E 03	0.503	3.12234E 02	8.13819E 02
14	4.76207E 02	0.213	2.98820E 03	-2.51200E 03	14	8.98125E 02	0.402	6.38581E 02	2.59756E 02
15	1.73522E 02	0.078	1.70412E 02	3.11018E 00	15	4.84120E 03	2.163	5.42113E 02	4.29918E 03
16	9.49653E 01	0.042	9.01044E 01	4.86088E 00	16	9.61760E-01	0.000	9.34588E-01	2.71712E-02
17	1.57176E 03	0.702	1.23012E 03	3.41643E 02	17	8.09506E 03	3.616	8.09209E 03	2.97485E 00
18	2.46641E 03	1.102	1.25023E 03	1.21614E 03	18	4.94489E 01	0.022	5.08741E 01	-1.52722E 00
19	4.05198E 03	1.810	3.98433E 03	6.76506E 01	19	1.36856E 03	0.620	1.30690E 03	6.16595E 01
20	3.95089E 03	1.765	1.65383E 03	2.29706E 03	20	3.43509E 00	0.002	7.65783E-01	2.66930E 00
21	5.61359E 03	2.508	4.33530E 03	1.27829E 03	21	3.25541E 04	14.542	6.34581E 02	3.19196E 04
22	3.23976E 03	1.447	3.22410E 03	1.56618E 01	22	3.88281E 04	17.345	1.72740E 03	3.71007E 04
23	6.62842E 02	0.285	6.55233E 02	7.60950E 00	23	3.43017E 00	0.002	2.89849E 00	5.31881E-01
24	1.03438E 03	0.462	1.01384E 03	2.05346E 01	24	1.08859E 01	0.005	8.83928E 00	2.04666E 00
25	1.25327E 04	5.598	2.30432E 03	1.02294E 04	25	3.10105E 04	13.853	8.20550E 03	2.28050E 04
26	1.18486E 04	5.293	8.11278E 03	3.73602E 03	26	1.82709E 04	8.509	1.31188E 04	5.15403E 03
27	6.53843E 03	2.921	5.53448E 03	1.00435E 03	27	1.33488E-05	0.000	1.33488E-05	0.
28	1.66254E 04	7.427	1.62840E 04	3.41487E 02	28	1.68878E-05	0.000	1.68878E-05	0.
29	3.11682E 04	13.914	1.12730E 04	1.98761E 04	29	7.48821E 01	0.033	4.69378E 01	2.79444E 01
30	6.10973E 04	27.293	8.56917E 03	5.25282E 04	30	4.64301E 02	0.207	2.34318E 02	2.28982E 02

POTENTIAL ENERGY OF SPRINGS

SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT
2	5.13275E 01	0.023	*	4	2.65518E 03	1.186	*	3	2.16442E 03	0.967
91	3.72473E 02	0.166	*	1	1.45677E 02	0.065	*	5	3.10322E 03	1.386
52	3.91129E 04	17.472	*	51	6.99283E 02	0.312	*	101	7.02787E 02	0.314
81	2.72326E 02	0.122	*	53	9.35742E 03	4.180	*	102	7.98092E 03	3.565

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V A S T
VIBRATION ANALYSIS SYSTEM — U3342A

KINETIC AND POTENTIAL ENERGY

AT CRITICAL SPEED 5.18305E 03 RPM

TOTAL KINETIC ENERGY	TOTAL PE	PE SYSTEM	PE SPRINGS
6.87943E 05	6.87945E 05	2.81381E 05	4.06555E 05

SPAN	KINETIC ENERGY	PERCENT	TRANSLATION	ROTATION	SPAN	POTENTIAL ENERGY	PERCENT	FORCE	MOMENT
1	1.93309E 04	2.810	2.24541E 04	-3.12328E 03	1	1.94857E 02	0.028	-1.21410E 02	3.18267E 02
2	5.13496E 02	0.085	5.33999E 02	-2.05030E 01	2	3.87028E 03	0.563	3.90547E 03	3.53807E 02
3	4.88269E 02	0.071	4.91800E 02	-5.33022E 00	3	1.23071E 02	0.018	4.72309E 01	7.58401E 01
4	3.86522E 02	0.056	3.91488E 02	-4.96654E 00	4	1.37338E 03	0.200	3.30989E 02	1.04238E 03
5	2.17073E 04	3.156	2.17080E 04	-7.62060E-01	5	4.65269E 03	0.676	7.27724E 02	3.92486E 03
6	2.05346E 04	2.985	2.05618E 04	-7.00852E 00	6	5.75748E 03	0.837	5.67392E 03	8.35555E 01
7	1.30516E 04	1.897	1.30828E 04	-1.12388E 01	7	2.52605E 04	3.672	2.52605E 04	0
8	3.13802E 04	4.561	3.17222E 04	-3.41971E 02	8	1.22385E 04	1.784	8.32875E 03	4.01072E 03
9	9.98920E 04	14.491	1.04434E 05	-4.74204E 03	9	2.73472E 03	0.398	2.40563E 03	3.29083E 02
10	1.30057E 05	18.907	1.35248E 05	-5.19063E 03	10	1.94578E 03	0.283	1.94308E 03	2.70554E 00
11	3.99578E 04	5.808	4.15825E 04	-1.62460E 03	11	4.89262E 03	0.711	7.25612E 02	4.16701E 03
12	2.12378E 04	3.087	2.78318E 04	-6.59402E 03	12	2.10835E 03	0.306	3.35931E 02	1.77142E 03
13	-8.92041E 02	-0.130	8.30269E 02	-1.72231E 03	13	4.29386E 03	0.624	3.68048E 03	6.04376E 02
14	-1.55802E 04	-2.265	1.29082E 03	-1.68710E 04	14	2.09854E 03	0.305	1.75970E 03	3.38832E 02
15	2.68182E 02	0.039	1.98449E 02	7.07332E 01	15	3.70277E 03	0.538	1.63427E 01	3.68643E 03
16	5.57834E 00	0.001	2.03413E 00	3.54421E 00	16	2.25232E 01	0.003	2.19270E 01	5.96250E-01
17	3.10207E 03	0.451	2.85361E 03	2.48864E 02	17	3.80679E 04	5.534	3.80541E 04	1.38851E 01
18	1.30187E 03	0.189	9.90588E 02	3.11087E 02	18	1.65287E 03	0.240	1.76782E 03	-1.04945E 02
19	1.76087E 03	0.256	1.27284E 03	4.88232E 02	19	5.53376E 04	8.044	5.05555E 04	4.78104E 03
20	2.65719E 02	0.039	2.51722E 02	1.39871E 01	20	4.88805E 00	0.001	4.58778E 00	3.00265E-01
21	1.93692E 02	0.028	1.82183E 02	3.15098E 01	21	1.90060E 04	2.763	5.24545E 01	1.89544E 04
22	8.50815E 02	0.124	4.72672E 02	3.78144E 02	22	2.50824E 04	3.783	2.03434E 02	2.55880E 04
23	5.61772E 02	0.082	3.87742E 02	1.84030E 02	23	2.35018E 00	0.000	2.32989E 00	2.02903E-02
24	4.04822E 03	0.589	3.81936E 03	4.28861E 02	24	1.72815E 02	0.025	1.00319E 02	7.24956E 01
25	1.13823E 05	16.546	4.65409E 04	6.72819E 04	25	2.46004E 04	3.576	-3.61612E 02	2.49622E 04
26	7.87778E 04	11.451	6.70278E 04	1.17500E 04	26	3.86878E 04	5.621	3.60773E 04	5.50324E 02
27	2.38108E 04	3.432	2.04199E 04	3.18084E 03	27	2.02800E-05	0.000	2.02800E-05	0.
28	1.19163E 04	1.732	1.00844E 04	1.85189E 03	28	2.34761E-05	0.000	2.34761E-05	0.
29	2.78055E 04	4.042	1.48093E 04	1.31863E 04	29	1.81802E 02	0.026	1.31201E 02	5.05014E 01
30	3.75782E 04	5.462	3.38087E 03	3.41864E 04	30	1.22124E 03	0.178	7.90386E 02	4.30847E 02

POTENTIAL ENERGY OF SPRINGS

SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT
2	1.02878E 03	0.150	*	4	5.54587E 03	0.808	*	3	9.75828E 03	1.418
81	1.28158E 03	0.201	*	1	5.19836E 03	0.756	*	5	1.39880E 05	20.333
52	6.89741E 04	10.026	*	51	5.78088E 03	0.867	*	101	2.06888E 01	0.003
61	8.21634E 03	1.194	*	53	1.46745E 05	21.331	*	102	1.30247E 04	1.893

V A S T
VIBRATION ANALYSIS SYSTEM — U3342A

KINETIC AND POTENTIAL ENERGY

AT CRITICAL SPEED 5.67814E 03 RPM

TOTAL KINETIC ENERGY	TOTAL PE	PE SYSTEM	PE SPRINGS
6.34888E 05	6.34888E 05	2.57986E 05	3.76702E 05

SPAN	KINETIC ENERGY	PERCENT	TRANSLATION	ROTATION	SPAN	POTENTIAL ENERGY	PERCENT	FORCE	MOMENT
1	3.24114E 05	51.058	3.82212E 05	-5.80988E 04	1	4.17437E 03	0.658	-2.40368E 03	6.57808E 03
2	6.04582E 02	[illegible]	5.48418E 03	-4.78373E 02	2	9.40664E 04	14.821	8.82222E 04	5.84418E 03
3	8.32195E 03	1.311	8.42275E 03	-1.00784E 02	3	1.50074E 03	0.236	5.29849E 01	1.44775E 03
4	5.69580E 03	0.897	5.84302E 03	-1.47138E 02	4	4.61186E 03	0.727	7.44792E 02	3.86717E 03
5	2.74307E 04	4.322	2.74803E 04	-4.95828E 01	5	1.81141E 04	2.854	6.20338E 02	1.74938E 04
6	7.77447E 02	0.122	8.12055E 02	-3.46082E 01	6	3.85286E 02	0.061	3.78517E 02	6.33887E 00
7	1.16761E 03	0.184	1.22098E 03	-5.34491E 01	7	7.32870E 03	1.154	7.32870E 03	0
8	1.40805E 03	0.222	1.46951E 03	-6.14627E 01	8	2.87201E 03	0.453	6.54050E 02	2.21798E 03
9	6.33622E 03	0.998	6.81808E 03	-4.81841E 02	9	2.11636E 02	0.033	2.08974E 02	2.66451E 00
10	2.84554E 03	0.448	3.33062E 03	-4.85083E 02	10	6.11208E 01	0.010	6.22878E 01	6.83302E 00
11	-9.25462E 01	-0.015	7.32564E 01	-1.65802E 02	11	4.23084E 02	0.067	1.82265E 02	2.41420E 02
12	8.30585E 02	0.131	9.83417E 02	-1.52832E 02	12	4.11830E 02	0.065	2.28026E 01	3.89038E 02
13	4.12154E 02	0.065	4.15022E 02	-2.86788E 00	13	4.97398E 02	0.078	7.41842E 00	4.89980E 02
14	2.01565E 03	0.318	2.07584E 03	-6.00874E 01	14	4.78851E 02	0.075	3.12658E 02	1.66438E 02
15	4.37660E 02	0.069	4.31151E 02	6.50908E 00	15	4.52680E 03	0.713	4.58384E 02	4.06842E 03
16	1.65132E 02	0.026	1.45056E 02	2.00795E 01	16	2.40280E 00	0.000	2.32845E 00	7.43435E-02
17	2.33764E 03	0.368	9.25835E 02	1.41180E 03	17	1.40408E 03	0.221	1.40360E 03	4.76094E-01
18	1.21356E 04	1.912	6.65876E 03	5.47618E 03	18	3.78451E 04	5.963	4.01518E 04	-2.30682E 03
19	5.53300E 02	0.087	2.75439E 02	2.77862E 02	19	2.97134E 03	0.468	2.68220E 03	3.09126E 02
20	3.65284E 03	0.576	2.56120E 03	1.09164E 03	20	6.30384E 00	0.001	4.47364E 00	1.83000E 00
21	6.07268E 03	0.957	5.46004E 03	6.12644E 02	21	8.25615E 03	1.301	4.57068E 03	3.68548E 03
22	6.73855E 03	0.983	5.22474E 03	1.38122E 01	22	2.02707E 04	3.194	2.88110E 03	1.73898E 04
23	2.21047E 03	0.333	2.09429E 03	1.61858E 01	23	2.25888E 01	0.004	1.81438E 01	3.44625E 00
24	3.04222E 03	0.479	3.00329E 03	2.88261E 01	24	9.19200E 01	0.014	7.30950E 01	1.88250E 01
25	3.90956E 04	6.160	9.64434E 03	2.95472E 04	25	3.31086E 04	5.216	-3.03828E 02	3.34104E 04
26	1.96570E 04	3.814	9.82055E 03	1.00372E 04	26	9.21848E 03	1.452	2.35719E 03	6.87874E 03
27	8.93160E 03	1.407	6.07949E 03	2.85212E 03	27	2.01879E-05	0.000	2.01879E-05	0
28	1.41338E 04	2.227	1.28032E 04	1.23052E 03	28	3.46187E-05	0.000	3.46187E-05	0
29	6.31780E 04	9.954	5.04860E 04	1.26920E 04	29	5.79835E 02	0.091	4.88533E 02	9.13011E 01
30	6.83168E 04	10.448	3.40182E 04	3.22988E 04	30	4.52578E 03	0.713	3.88238E 03	6.34392E 02

POTENTIAL ENERGY OF SPRINGS

SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT
2	1.33234E 02	0.021	*	4	1.48863E 03	0.235	*	3	4.59893E 02	0.072
81	1.52842E 01	0.002	*	1	1.25038E 05	19.701	*	5	7.76475E 03	1.222
52	1.36867E 05	21.532	*	51	9.76036E 04	15.379	*	101	3.54448E 02	0.056
61	4.10689E 03	0.629	*	53	3.97753E 03	0.627	*	102	2.79821E 03	0.441

V A S T
VIBRATION ANALYS SYSTEM U3342A

KINETIC AND POTENTIAL ENERGY

AT CRITICAL SPEED 8.54177E 03 RPM

TOTAL KINETIC ENERGY	TOTAL PE	PE SYSTEM	PE SPRINGS
2.26838E 05	2.26838E 05	1.87654E 05	3.90837E 04

SPAN	KINETIC ENERGY	PERCENT	TRANSLATION	ROTATION	SPAN	POTENTIAL ENERGY	PERCENT	FORCE	MOMENT
1	1.66145E 03	0.697	1.92420E 03	-3.42763E 02	1	3.90317E 01	0.017	-1.83316E 01	8.83633E 01
2	3.35304E 01	0.015	3.64617E 01	-2.83124E 00	2	5.85718E 02	0.259	5.31836E 02	5.48422E 01
3	3.85304E 01	0.017	4.02688E 01	-7.28442E-01	3	4.88788E 01	0.022	1.36173E 01	3.82626E 01
4	2.08119E 01	0.008	2.18085E 01	-6.87527E-01	4	2.22871E 02	0.088	7.88087E 01	1.43161E 02
5	9.73038E 02	0.428	8.71447E 02	1.89052E 00	5	1.69453E 03	0.703	1.30888E 02	1.46385E 03
6	8.20690E 02	0.362	8.83184E 02	-6.24742E 01	6	1.81774E 01	0.008	1.80621E 01	1.26347E-01
7	2.26804E 03	1.000	2.36888E 03	-9.88161E 01	7	3.28887E 04	14.493	3.28897E 04	0.
8	6.98646E 02	0.308	9.67645E 02	-2.67898E 02	8	7.68213E 02	0.339	1.76546E 02	5.81868E 02
9	-5.67518E 02	-0.250	2.20811E 03	-2.77563E 03	9	1.38734E 02	0.061	7.08027E 01	6.81318E 01
10	5.34273E 03	2.354	8.31836E 03	-2.97282E 03	10	2.46872E 02	0.109	2.38893E 02	6.87808E 00
11	1.24081E 05	54.680	1.38054E 05	-1.38838E 04	11	9.22781E 03	4.066	4.48857E 03	4.73834E 03
12	-9.78837E 03	-4.313	3.32868E 04	-4.30688E 04	12	1.04332E 04	4.597	1.01214E 04	3.11816E 02
13	6.53086E 02	0.288	5.47883E 03	-4.82384E 03	13	2.57050E 04	11.327	1.89152E 04	6.78874E 03
14	5.48218E 04	24.157	8.62898E 04	-3.14778E 04	14	2.75538E 03	1.214	1.05362E 03	1.70178E 03
15	2.04667E 02	0.090	2.01690E 02	3.07883E 00	15	1.00380E 03	0.442	6.88828E 02	3.14870E 02
16	2.99835E 01	0.013	2.44648E 01	5.51858E 00	16	4.02185E 00	0.002	3.90748E 00	1.14373E-01
17	1.25381E 04	5.525	1.21504E 04	3.87737E 02	17	7.68386E 04	33.859	7.68118E 04	2.77463E 01
18	3.88861E 02	0.171	3.18257E 02	7.07041E 01	18	2.17738E 02	0.096	2.33287E 02	-1.15588E 01
19	7.63021E 02	0.336	7.29588E 02	3.34314E 01	19	3.22186E 02	0.142	3.12868E 02	9.48857E 00
20	3.93317E 02	0.173	3.01812E 02	9.16048E 01	20	1.83238E 01	0.008	1.65488E 01	1.77497E 00
21	1.91568E 02	0.084	1.29075E 02	6.25910E 01	21	5.38128E 03	2.371	3.78088E 03	1.59031E 03
22	1.31557E 03	0.580	1.26048E 03	5.54761E 01	22	4.13178E 03	1.821	3.69071E 03	5.41036E 02
23	7.21802E 02	0.318	7.12588E 02	9.20593E 00	23	1.12100E 01	0.005	1.03417E 01	8.68302E-01
24	2.28137E 03	1.005	2.25910E 03	2.22678E 01	24	1.54814E 02	0.068	1.06063E 02	4.87614E 01
25	1.44078E 04	6.349	1.38651E 04	5.42438E 02	25	5.33192E 03	2.350	8.47418E 02	4.68451E 03
26	4.60672E 03	2.030	3.07727E 03	1.52944E 03	26	9.72844E 03	4.288	4.81438E 03	4.91106E 03
27	8.39373E 02	0.370	3.54371E 02	4.85002E 02	27	1.09445E-06	0.000	1.09445E-06	0.
28	4.55075E 03	2.005	4.38180E 02	1.88859E 02	28	-3.30890E-06	-0.000	-3.30890E-06	0.
29	5.86878E 02	0.258	6.53804E 01	5.21539E 02	29	3.86654E 00	0.002	1.45582E 00	2.41072E 00
30	2.12864E 03	0.938	7.99462E 02	1.33018E 03	30	2.21238E 01	0.010	2.93368E 00	1.91859E 01

POTENTIAL ENERGY OF SPRINGS

SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT	*	SPRING NUMBER	POTENTIAL ENERGY	PERCENT
2	1.88868E 02	0.083	*	4	5.77272E 03	2.544	*	3	1.67385E 04	7.376
51	3.14636E 03	1.386	*	1	7.77988E 02	0.343	*	5	6.24885E 02	0.275
52	3.83335E 03	1.689	*	81	3.46401E 03	1.522	*	101	7.38013E 00	0.003
81	1.43473E 02	0.063	*	53	4.21558E 03	1.902	*	102	6.96958E 01	0.031

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7.4 E^3 TETRA INPUT FILE

ORIGINAL PAGE IS
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90 $LIST1
100 NAME= ' SJ CLINE                  DATE 12-14-82 ',
110 ADDRES= ' BLDG 300          MAIL DROP H36   EXT 513-243-9912'.
120 IDENT1= ' EEE-TIB ICLS TRANSIENT ANALYSIS - BASELINE TETRA MODEL',
130 IDENT2= ' RUN #5   TIME 0.0 TO 0.20 SEC,   500 GM-IN UNBAL AT FAN ',
140 $ END
150 $LIST2
160 TITLE=  'EEE-ICLS LP ROTOR SUBSYSTEM VERTICAL',
170 TSUB= 1,
180 XREF=     0.    ,
190 YREF=     0.    ,
200 ZREF=     0.    ,
210 PTS=
220     1,  -166.991,     0.   ,     0.   ,
230     2,  -177.985,     0.   ,     0.   ,
240     3,  -172.156,     0.   ,     0.   ,
250     4,  -194.778,     0.   ,     0.   ,
260     5,  -230.808,     0.   ,     0.   ,
270     6,  -263.325,     0.   ,     0.   ,
280     7,  -269.475,     0.   ,     0.   ,
290     8,  -262.115,     0.   ,     0.   ,
300     9,  -269.995,     0.   ,     0.   ,
310    10,  -278.335,     0.   ,     0.   ,
320 XMODES=
330        52.6,    3.70153E 01,      0.,  1,
340        61.7,    4.25950E 01,      0.,  1,
350      1272.9,    1.17390E 04,      0.,  0,
360      2846.5,    1.14103E 05,      0.,  0,
370      8121.1,    8.12466E 04,      0.,  0,
380     16218.1,    3.86391E 05,      0.,  0,
390     28097.8,    1.00853E 06,      0.,  0,
400     37651.0,    3.04509E 06,      0.,  0,
410     40193.1,    3.45995E 06,      0.,  0,
420     43145.7,    7.54853E 06,      0.,  0,
430     50931.1,    4.25315E 06,      0.,  0,
440     57298.0,    1.36583E 07,      0.,  0,
450     69020.3,    1.09854E 07,      0.,  0,
460     87068.4,    9.70691E 06,      0.,  0,
470 VH(1,1,1)=
480     -9.01170E-01,    1.00744E-02,   -7.78847E 00,    -5.35686E 01,
490     -7.90414E-01,    1.00743E-02,   -3.51828E-07,     2.45438E-06,
500     -8.50588E-01,    9.78894E-03,    8.50588E 01,    -9.41513E-07,
510     -6.21365E-01,    1.00637E-02,   -7.09100E 00,    -2.73612E 02,
520     -2.59143E-01,    1.00470E-02,   -4.45320E 00,    -7.94277E 01,
530      6.75069E-02,    1.00467E-02,    0.          ,    0.          ,
540      1.29294E-01,    1.00467E-02,   -1.29294E 01,    -3.20065E-07,
550      5.53471E-02,    1.00475E-02,    0.          ,    0.          ,
560      1.34119E-01,    1.00474E-02,   -2.39527E 00,    -1.95149E 01,
570      2.18317E-01,    1.00475E-02,   -9.07141E-08,     0.          ,
580 VH(1,1,2)=
590      9.95809E-02,    7.94191E-03,    2.29829E 00,     4.16402E 01,
600      1.86895E-01,    7.94194E-03,    4.06959E-08,     1.01847E-06,
610      1.40598E-01,    7.94181E-03,   -1.40598E 01,     1.24909E-07,
620      3.20213E-01,    7.93711E-03,   -1.33332E-01,    -1.67524E 02,
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630      6.05905E-01,     7.92319E-03,     -3.65481E 00,     -1.01332E 02,
640      8.63468E-01,     7.92235E-03,      0.          ,     0.          ,
650      9.12188E-01,     7.92225E-03,     -9.12188E 01,     -1.84191E-06,
660      8.50892E-01,     8.51566E-03,      0.          ,     0.          ,
670      9.17653E-01,     8.51563E-03,     -3.00366E 01,      7.73532E 01,
680      9.89015E-01,     8.51568E-03,      6.52911E-08,      1.09208E-06,
690 VH(1,1,3)=
700      6.81305E-02,    -3.40098E-02,     -1.40174E 03,     -5.00992E 04,
710     -3.06364E-01,    -3.40417E-02,     -2.79200E-04,      6.92826E-03,
720     -1.07168E-01,    -3.39926E-02,      1.07167E 01,      7.20209E-06,
730     -7.61193E-01,    -2.23152E-02,      5.46354E 01,      3.85218E 05,
740     -9.07406E-01,     1.21541E-02,      3.12701E 03,      3.24192E 05,
750     -1.26403E-01,     3.59897E-02,      0.          ,     0.          ,
760      9.49461E-02,     3.59921E-02,     -9.49461E 00,      1.64279E-05,
770     -1.76347E-01,     3.73208E-02,      0.          ,     0.          ,
780      1.16228E-01,     3.73088E-02,      3.01370E 02,     -6.27325E 04,
790      4.29291E-01,     3.73182E-02,      6.84829E-05,      5.86181E-04,
800 VH(1,1,4)=
810      8.10259E-02,     3.54076E-02,      1.16643E 04,      3.02215E 05,
820      4.74167E-01,     3.56062E-02,      4.94044E-04,      8.82395E-03,
830      2.62342E-01,     3.52978E-02,     -2.62343E 01,     -2.23729E-04,
840      5.71814E-01,    -4.91938E-03,     -3.70529E 04,     -1.00471E 06,
850     -6.19833E-01,    -3.47851E-02,     -3.90910E 04,      4.53695E 05,
860     -6.35166E-01,     6.75855E-02,      0.          ,     0.          ,
870     -2.19530E-01,     6.75916E-02,      2.19530E 01,     -1.63720E-04,
880     -7.81359E-01,     8.00184E-02,      0.          ,     0.          ,
890     -1.52295E-01,     7.99184E-02,      3.22834E 04,     -7.79195E 05,
900      5.20933E-01,     7.99696E-02,      1.58574E-03,      1.10721E-02,
910 VH(1,1,5)=
920     -4.09414E-02,    -6.61501E-03,     -2.48800E 04,     -5.39851E 05,
930     -1.20998E-01,    -6.97884E-03,     -9.57468E-04,      4.65526E-03,
940     -7.31253E-02,    -6.41629E-03,      7.31247E 00,      9.73414E-05,
950      3.79934E-01,     3.11414E-02,      7.73844E 04,      3.00090E 05,
960      9.19192E-01,    -1.75669E-02,     -2.66863E 04,     -7.60902E 05,
970     -6.58489E-02,    -1.37342E-03,      0.          ,     0.
980     -7.45064E-02,    -1.40134E-03,      7.45068E 00,      2.27819E-04,
990     -1.23090E-01,     9.36704E-03,      0.          ,     0.          ,
1000     -4.67938E-02,     9.28994E-03,      4.85606E 04,     -8.07956E 05,
1010      3.39342E-02,     9.30818E-0[illegible],    -1.48730E-03,      4.81962E-03,
1020 VH(1,1,6)=
1030      4.15366E-02,     3.75047E-03,      8.75698E 04,      1.67503E 06,
1040      1.06847E-01,     4.91303E-03,     -1.49622E-03,     -1.00811E-01,
1050      5.71590E-02,     3.17839E-03,     -5.71581E 00,      6.51942E-04,
1060     -8.68553E-01,    -2.40783E-02,     -1.08791E 05,      1.89873E 06,
1070      7.96637E-01,     4.23875E-02,      7.44478E 04,     -1.68834E 06,
1080      2.09490E-02,    -1.75943E-02,      0.          ,     0.          ,
1090     -8.87048E-02,    -1.78452E-02,      8.87096E 00,      6.18443E-04,
1100     -9.10087E-02,     5.41985E 03,      0.          ,     0.          ,
1110     -3.90328E-02,     5.28401E-03,      1.49345E 05,     -2.01512E 06,
1120      1.18582E-02,     5.26224E-03,     -2.80764E-03,      2.05359E-02,
1130 VH(1,1,7)=
1140     -1.94890E-02,    -9.20135E-04,     -1.99605E 05,     -3.71644E 06,
1150     -8.56451E-02,    -3.59491E-03,      7.70003E-04,     -8.05717E-03,
1160     -2.02315E-02,    -9.13397E-05,      2.02313E 00,     -1.11670E-03,
1170      5.28601E-01,    -3.47161E-02,     -1.62795E 05,     -3.46149E 06,
1180     -2.60317E-01,     8.08325E-02,      3.22649E 05,      1.08486E 06,
1190      1.64673E-01,    -4.86127E-02,      0.          ,     0.          ,
1200     -1.43090E-01,    -5.02994E-02,      1.43097E 01,     -1.37415E-02,
1210     -9.66051E-02,     3.87156E-03,      0.          ,     0.          ,
1220     -3.31479E-02,     3.75433E-03,      4.51257E 05,     -5.04833E 06,
1230      2.21457E-02,     3.52160E-03,     -1.12937E-03,      0.          ,
1240 VH(1,1,8)=
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1250     -8.59818E-02,   -9.38703E-03,    3.49865E 06,    7.30779E 07,
1260      9.20982E-01,    4.43920E-02,   -6.49035E-03,   -3.52559E-01,
1270     -2.04736E-01,   -1.33217E-02,    2.04756E 01,   -4.51168E-03,
1280      6.00505E-02,    2.4121CE-02,    1.57315E 05,   -1.08044E 05,
1290     -2.33935E-01,   -1.58937E-03,    5.29473E 03,    1.24503E 06,
1300      1.08426E-01,   -2.82319E-02,    0.         ,    0.         ,
1310     -7.39486E-02,   -2.99528E-02,    7.39358E 00,   -9.99511E-04,
1320     -4.01606E-02,    4.67797E-04,    0.         ,    0.         ,
1330     -8.68251E-03,    7.13972E-04,    3.10774E 05,   -2.46604E 06,
1340      2.52738E-02,    4.77516E-04,    4.61006E-04,    1.18018E-02,
1350 VH(1,1,9)=
1360      3.76066E-02,    2.87132E-03,   -7.25656E 05,   -1.60832E 07,
1370     -1.74153E-01,   -9.01412E-03,   -2.91807E-03,   -1.21162E-01,
1380      7.01237E-02,    2.85323E-03,   -7.01284E 00,    1.87689E-03,
1390     -2.43039E-01,    7.44683E-02,    5.05610E 05,    3.36087E 06,
1400     -7.94694E-01,   -5.35415E-02,   -2.56437E 05,    4.47523E 06,
1410      5.04469E-01,   -1.28753E-01,    0.         ,    0.         ,
1420     -3.32710E-01,   -1.37709E-01,    3.32779E 01,   -7.63690E-04,
1430     -1.91437E-01,   -7.48542E-04,    0.         ,    0.         ,
1440     -3.57093E-02,    1.59702E-03,    1.66874E 06,   -9.89329E 06,
1450      1.53290E-01,    1.26413E-04,    5.77511E-03,    0.         ,
1460 VH(1,1,10)=
1470      3.18600E-03,    2.02585E-04,   -3.76427E 04,   -9.12978E 05,
1480     -8.27933E-03,   -4.74530E-04,   -7.31659E-04,    2.30707E-02,
1490      5.49522E-03,    1.39945E-04,   -5.49481E-01,   -8.94339E-04,
1500     -1.92289E-02,    1.01033E-02,    7.34515E 04,    3.51430E 05,
1510     -1.15597E-01,   -4.02847E-03,   -6.83470E 03,    6.30525E 05,
1520     -1.70336E-01,   -6.68409E-02,    0.         ,    0.         ,
1530     -6.45678E-01,   -7.70266E-02,    6.45796E 01,    6.96078E-02,
1540      9.84692E-01,    3.82641E-02,    0.         ,    0.         ,
1550      1.74557E-01,    1.07258E-02,   -1.01333E 07,    1.42040E 07,
1560     -4.01507E-01,    2.92743E-02,   -2.75060E-03,    3.52077E-01,
1570 VH(1,1,11)=
1580     -1.83803E-02,   -9.13875E-04,    8.79889E 04,    3.22583E 06,
1590      1.76645E-02,    1.48067E-03,    1.28286E-03,   -1.82768E-01,
1600     -3.32046E-02,   -1.22711E-04,    3.32139E 00,    1.77996E-03,
1610     -2.19366E-02,   -9.19192E-02,   -7.70495E 05,   -1.28171E 06,
1620      7.40864E-01,   -4.18277E-02,   -3.68476E 05,   -5.42963E 06,
1630      1.38860E-01,   -7.60158E-02,    0.         ,    0.         ,
1640     -3.94345E-01,   -8.76072E-02,    3.94376E 01,   -1.33744E-01,
1650      2.66447E-02,   -1.30370E-02,    0.         ,    0.         ,
1660     -2.07558E-02,   -6.14449E-03,    1.34747E 05,    2.38528E 07,
1670      3.47437E-01,   -2.61423E-03,   -2.47477E-02,   -6.88631E-02,
1680 VH(1,1,12)=
1690      2.03852E-02,    8.91619E-04,   -3.59305E 04,   -3.02244E 06,
1700     -9.83779E-03,   -1.32544E-03,   -1.28773E-02,   -2.38399E-01,
1710      4.65963E-02,   -4.42781E-05,   -4.66054E 00,    8.75495E-03,
1720      1.73320E-01,    1.19253E-01,    1.10275E 06,   -4.05311E 05,
1730     -4.73618E-01,    9.06093E-02,    8.46144E 05,    3.75570E 06,
1740     -8.14515E-01,    6.91939E-02,    0.         ,    0.         ,
1750     -4.22224E-01,    6.82724E-02,    4.22115E 01,   -1.05964E-01,
1760      3.17365E-01,   -4.58956E-02,    0.         ,    0.         ,
1770     -1.27589E-01,   -1.93337E-02,   -1.68304E 06,    1.22781E 08,
1780      7.88442E-01,    2.03371E-03,   -8.89706E-02,    0.         ,
1790 VH(1,1,13)=
1800      3.29643E-02,    1.18168E-03,    1.15892E 05,   -4.67559E 06,
1810     -3.76463E-04,   -2.01534E-03,   -2.08401E-02,   -1.50660E-02,
1820     -1.44307E-01,   -1.18870E-02,    1.44316E 01,    1.09613E-02,
1830      4.57845E-01,    ' 32288E-01,    1.40352E 06,   -5.96954E 06,
1840      6.22903E-01,     .26498E-02,    7.16325E 05,   -6.06684E 06,
1850      3.27570E-01,   -4.54824E-02,    0.         ,    0.         ,
1860      2.74332E-02,   -5.16429E-02,   -2.74333E 00,   -4.72134E-02,
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     -1.25038E-01,   -3.75561E-02,   0.          ,   0.          ,
      1.79515E-01,   -9.86882E-04,  -3.14419E 05,    6.31808E 07,
     -2.51881E-01,    3.72113E-02,   9.31162E-03,    7.44929E-02,
VH(1,1,14)=
      2.40046E-02,    7.55830E-04,   4.95567E 05,   -6.25034E 06,
      1.77421E-02,   -2.54281E-03,   4.68700E-02,   -2.50200E-01,
      9.80113E-03,   -7.15012E-03,  -9.80327E-01,    6.37044E-04,
      4.28386E-01,    2.20672E-02,   1.04682E 05,   -1.07308E 07,
      4.11269E-01,   -1.06370E-01,  -1.60979E 06,   -4.42671E 06,
     -6.59824E-02,    1.61992E-02,   0.          ,   0.          ,
      7.66610E-02,    2.43126E-02,  -7.65710E 00,   -3.79008E-02,
      1.55399E-01,    4.69702E-03,   0.          ,   0.          ,
     -1.61208E-01,   -1.49924E-03,   2.22851E 06,    1.94000E 07,
      8.40130E-02,    3.69431E-03,   1.05644E-02,   -8.45153E-02,
$END
$LIST2
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ISUB= 2,
XREF=    0.   ,
YREF=    0.   ,
ZREF=    0.   ,
PTS=
     1,  -166.991,    0.   ,    0.   ,
     2,  -177.985,    0.   ,    0.   ,
     3,  -172.156,    0.   ,    0.   ,
     4,  -194.778,    0.   ,    0.   ,
     5,  -230.808,    0.   ,    0.   ,
     6,  -263.325,    0.   ,    0.   ,
     7,  -269.475,    0.   ,    0.   ,
     8,  -262.115,    0.   ,    0.   ,
     9,  -269.995,    0.   ,    0.   ,
    10,  -278.335,    0.   ,    0.   ,
XMODES=
       52.6,   3.70153E 01,     0.,  1,
       61.7,   4.25950E 01,     0.,  1,
     1272.9,   1.17390E 04,     0.,  0,
     2846.5,   1.14103E 05,     0.,  0,
     8121.1,   8.12466E 04,     0.,  0,
    16218.1,   3.86391E 05,     0.,  0,
    28097.8,   1.00853E 06,     0.,  0,
    37651.0,   3.04509E 06,     0.,  0,
    40193.1,   3.45996E 06,     0.,  0,
    43145.7,   7.54853E 06,     0.,  0,
    50931.1,   4.25315E 06,     0.,  0,
    57298.0,   1.36583E 07,     0.,  0,
    69020.3,   1.09854E 07,     0.,  0,
    87068.4,   9.70691E 06,     0.,  0,
VH(1,1,1)=
     -9.01170E-01,    1.00744E-02,  -7.78847E 00,   -5.35686E 01,
     -7.90414E-01,    1.00743E-02,  -3.51826E-07,    2.45438E-06,
     -8.50588E-01,    9.78894E-03,   8.50588E 01,   -9.41513E-07,
     -6.21365E-01,    1.00637E-02,  -7.09100E 00,   -2.73612E 02,
     -2.59143E-01,    1.00470E-02,  -4.45320E 00,   -7.94277E 01,
      6.75069E-02,    1.00467E-02,   0.          ,   0.          ,
      1.29294E-01,    1.00467E-02,  -1.29294E 01,   -3.20065E-07,
      5.53471E-02,    1.00475E-02,   0.          ,   0.          ,
      1.34119E-01,    1.00474E-02,  -2.39527E 00,   -1.95149E 01,
      2.18317E-01,    1.00475E-02,  -9.07141E-08,    0.          ,
VH(1,1,2)=
      9.95809E-02,    7.94191E-03,   2.29829E 00,    4.16402E 01,
      1.86895E-01,    7.94194E-03,   4.06959E-08,    1.01847E-06,
      1.40598E-01,    7.9 181E-03,  -1.40598E 01,    1.24909E-07,
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2490      3.20213E-01,    7.93711E-03,   -1.33332E-01,   -1.67524E 02,
2500      6.05905E-01,    7.92319E-03,   -3.65481E 00,   -1.01332E 02,
2510      8.63468E-01,    7.92235E-03,    0.          ,   0.          ,
2520      9.12188E-01,    7.92225E-03,   -9.12188E 01,   -1.84191E-06,
2530      8.50892E-01,    8.51566E-03,    0.          ,   0.          ,
2540      9.17653E-01,    8.51563E-03,   -3.00366E 01,    7.73532E 01,
2550      9.89015E-01,    8.51568E-03,    6.52911E-08,    1.09208E-06,
2560 VH(1,1,3)=
2570      6.81305E-02,   -3.40098E-02,   -1.40174E 03,   -5.00992E 04,
2580     -3.06364E-01,   -3.40417E-02,   -2.79200E-04,    6.92826E-03,
2590     -1.07168E-01,   -3.39926E-02,    1.07167E 01,    7.20209E-06,
2600     -7.61193E-01,   -2.28152E-02,    5.46354E 01,    3.85218E 05,
2610     -9.07406E-01,    1.21541E-02,    3.12701E 03,    3.24192E 05,
2620     -1.26403E-01,    3.59897E-02,    0.          ,   0.          ,
2630      9.49461E-02,    3.59921E-02,   -9.49461E 00,    1.64279E-05,
2640     -1.76347E-01,    3.73208E-02,    0.          ,   0.          ,
2650      1.16228E-01,    3.73088E-02,    3.01370E 02,   -6.27325E 04,
2660      4.29291E-01,    3.73182E-02,    6.84829E-05,    5.86181E-04,
2670 VH(1,1,4)=
2680      8.10259E-02,    3.54076E-02,    1.16643E 04,    3.02215E 05,
2690      4.74167E-01,    3.56062E-02,    4.94044E-04,    8.82395E-03,
2700      2.62342E-01,    3.52978E-02,   -2.62343E 01,   -2.23729E-04,
2710      5.71814E-01,   -4.91938E-03,   -3.70529E 04,   -1.00471E 06,
2720     -6.19833E-01,   -3.47851E-02,   -3.90910E 04,    4.53685E 05,
2730     -6.35166E-01,    6.75855E-02,    0.          ,   0.          ,
2740     -2.19530E-01,    6.75916E-02,    2.19530E 01,   -1.63720E-04,
2750     -7.81359E-01,    8.00184E-02,    0.          ,   0.          ,
2760     -1.52295E-01,    7.99184E-02,    3.22834E 04,   -7.79195E 05,
2770      5.20933E-01,    7.99696E-02,    1.58574E-03,    1.10721E-02,
2780 VH(1,1,5)=
2790     -4.09414E-02,   -6.61501E-03,   -2.48800E 04,   -5.39851E 05,
2800     -1.20998E-01,   -6.97884E-03,   -9.57468E-04,    4.65526E-03,
2810     -7.31253E-02,   -6.41629E-03,    7.31247E 00,    9.73414E-05,
2820      3.79934E-01,    3.11414E-02,    7.73844E 04,    3.00090E 05,
2830      9.19192E-01,   -1.75669E-02,   -2.66863E 04,   -7.60902E 05,
2840     -6.58489E-02,   -1.37342E-03,    0.          ,   0.          ,
2850     -7.45064E-02,   -1.40134E-03,    7.45068E 00,    2.27819E-04,
2860     -1.23090E-01,    9.36704E-03,    0.          ,   0.          ,
2870     -4.67938E-02,    9.28994E-03,    4.85606E 04,   -8.07956E 05,
2880      3.39342E-02,    9.30818E-03,   -1.48730E-03,    4.81962E-03,
2890 VH(1,1,6)=
2900      4.15366E-02,    3.75047E-03,    8.75698E 04,    1.67503E 06,
2910      1.06847E-01,    4.91303E-03,   -1.49622E-03,   -1.00811E-01,
2920      5.71590E-02,    3.17839E-03,   -5.71581E 00,    6.51942E-04,
2930     -8.68553E-01,   -2.40783E-02,   -1.08791E 05,    1.89873E 06,
2940      7.96637E-01,    4.23875E-02,    7.44478E 04,   -1.68834E 06,
2950      2.09490E-02,   -1.75943E-02,    0.          ,   0.          ,
2960     -8.87048E-02,   -1.78452E-02,    8.87096E 00,    6.18443E-04,
2970     -9.10087E-02,    5.41985E-03,    0.          ,   0.          ,
2980     -3.90328E-02,    5.28401E-03,    1.49345E 05,   -2.01512E 06,
2990      1.18582E-02,    5.26224E-03,   -2.80764E-03,    2.05359E-02,
3000 VH(1,1,7)=
3010     -1.94890E-02,   -9.20135E-04,   -1.99605E 05,   -3.71644E 06,
3020     -8.56451E-02,   -3.59491E-03,    7.70003E-04,   -8.05717E-03,
3030     -2.02315E-02,   -9.13397E-05,    2.02313E 00,   -1.11670E-03,
3040      5.28601E-01,   -3.47161E-02,   -1.62795E 05,   -3.46149E 06,
3050     -2.60317E-01,    8.08325E-02,    3.22649E 05,    1.08486E 06,
3060      1.64673E-01,   -4.86127E-02,    0.          ,   0.          ,
3070     -1.43090E-01,   -5.02994E-02,    1.43097E 01,   -1.37415E-02,
3080     -9.66051E-02,    3.87156E-03,    0.          ,   0.          ,
3090     -3.31479E-02,    3.75433E-03,    4.51257E 05,   -5.04833E 06,
3100      2.21457E-02,    3.52160E-03,   -1.12937E-03,    0.          ,
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3110 VH(1,1,8)=
3120     -8.59818E-02,   -9.38703E-03,    3.49865E 06,    7.30779E 07,
3130      9.20982E-01,    4.43920E-02,   -6.49035E-03,   -3.52559E-01,
3140     -2.04736E-01,   -1.33217E-02,    2.04756E 01,   -4.51168E-03,
3150      6.00505E-02,    2.41210E-02,    1.57315E 05,   -1.08044E 05,
3160     -2.33935E-01,   -1.58937E-03,    5.29473E 03,    1.24503E 06,
3170      1.08426E-01,   -2.82319E-02,    0.          ,   0.          ,
3180     -7.39486E-02,   -2.99528E-02,    7.39358E 00,   -9.99511E-04,
3190     -4.01606E-02,    4.67797E-04,    0.          ,   0.          ,
3200     -8.68251E-03,    7.13972E-04,    3.10774E 05,   -2.46604E 06,
3210      2.52738E-02,    4.77516E-04,    4.61006E-04,    1.18018E-02,
3220 VH(1,1,9)=
3230      3.76066E-02,    2.87132E-03,   -7.25656E 05,   -1.60832E 07,
3240     -1.74153E-01,   -9.01412E-03,   -2.91807E-03,   -1.21162E-01,
3250      7.01237E-02,    2.85323E-03,   -7.01284E 00,    1.87689E-03,
3260     -2.43039E-01,    7.44683E-02,    5.06610E 05,    3.36087E 06,
3270     -7.94694E-01,   -5.35415E-02,   -2.56437E 05,    4.47523E 06,
3280      5.04469E-01,   -1.28753E-01,    0.          ,   0.          ,
3290     -3.32710E-01,   -1.37709E-01,    3.32779E 01,   -7.63690E-04,
3300     -1.91437E-01,   -7.48542E-04,    0.          ,   0.          ,
3310     -3.57093E-02,    1.59702E-03,    1.66874E 06,   -9.89329E 06,
3320      1.53290E-01,    1.26413E-04,    5.77511E-03,   0.          ,
3330 VH(1,1,10)=
3340      3.18600E-03,    2.02585E-04,   -3.76427E 04,   -9.12978E 05,
3350     -8.27933E-03,   -4.74530E-04,   -7.31659E-04,    2.30707E-02,
3360      5.49522E-03,    1.39945E-04,   -5.49481E-01,   -8.94339E-04,
3370     -1.92289E-02,    1.01033E-02,    7.34515E 04,    3.51430E 05,
3380     -1.15597E-01,   -4.02847E-03,   -6.83470E 03,    6.30525E 05,
3390     -1.70336E-01,   -6.68409E-02,    0.          ,   0.          ,
3400     -6.45878E-01,   -7.70266E-02,    6.45796E 01,    6.96078E-02,
3410      9.84692E-01,    3.82641E-02,    0.          ,   0.          ,
3420      1.74557E-01,    1.07258E-02,   -1.01333E 07,    1.42040E 07,
3430     -4.01507E-01,    2.92743E-02,   -2.75060E-03,    3.52077E-01,
3440 VH(1,1,11)=
3450     -1.83803E-02,   -9.13875E-04,    8.79889E 04,    3.22583E 06,
3460      1.76645E-02,    1.48067E-03,    1.28286E-03,   -1.82768E-01,
3470     -3.32046E-02,   -1.22711E-04,    3.32139E 00,    1.77996E-03,
3480     -2.19366E-02,   -9.19192E-02,   -7.70495E 05,   -1.28171E 06,
3490      7.40864E-01,   -4.18277E-02,   -3.68476E 05,   -5.42963E 06,
3500      1.38860E-01,   -7.60158E-02,    0.          ,   0.          ,
3510     -3.94345E-01,   -8.76072E-02,    3.94378E 01,   -1.33744E-01,
3520      2.66447E-02,   -1.30370E-02,    0.          ,   0.          ,
3530     -2.07558E-02,   -6.14449E-03,    1.34747E 05,    2.38528E 07,
3540      3.47437E-01,   -2.61423E-03,   -2.47477E-02,   -6.88631E-02,
3550 VH(1,1,12)=
3560      2.03852E-02,    8.91619E-04,   -3.59305E 04,   -3.02244E 06,
3570     -9.83779E-03,   -1.32544E-03,   -1.28773E-02,   -2.38399E-01,
3580      4.65963E-02,   -4.42781E-03,   -4.66054E 00,    8.75495E-03,
3590      1.73320E-01,    1.19253E-01,    1.10276E 06,   -4.05311E 05,
3600     -4.73618E-01,    9.06093E-02,    8.46144E 05,    3.75570E 06,
3610     -8.14515E-01,    6.91939E-02,    0.          ,   0.          ,
3620     -4.22224E-01,    6.82724E-02,    4.22115E 01,   -1.05964E-01,
3630      3.17365E-01,   -4.58956E-02,    0.          ,   0.          ,
3640     -1.27589E-01,   -1.93337E-02,   -1.68304E 06,    1.22781E 08,
3650      7.88442E-01,    2.03371E-03,   -8.89706E-02,   0.          ,
3660 VH(1,1,13)=
3670      3.29643E-02,    1.18168E-03,    1.15892E 05,   -4.67559E 06,
3680     -3.76463E-04,   -2.01534E-03,   -2.08401E-02,   -6.50660E-02,
3690     -1.44307E-01,   -1.18870E-02,    1.44316E 01,    1.09613E-02,
3700      4.57845E-01,    1.32288E-01,    1.40352E 06,   -5.96954E 06,
3710      6.22903E-01,    7.26498E-02,    7.16325E 05,   -6.06684E 06,
3720      3.27570E-01,   -4.54824E-02,    0.          ,   0.          ,
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     2.74332E-02,  -5.16429E-02,  -2.74333E 00,  -4.72134E-02,
    -1.25038E-01,  -3.75561E-02,   0.         ,   0.         ,
     1.79515E-01,  -9.86882E-04,  -3.14419E 05,   6.31808E 07,
    -2.51881E-01,   3.72113E-02,   9.31162E-03,   7.44929E-02,
VH(1,1,14)=
     2.40046E-02,   7.55830E-04,   4.95567E 05,  -6.25034E 06,
     1.77421E-02,  -2.54281E-03,   4.68700E-02,  -2.50200E-01,
     9.80113E-03,  -7.15012E-03,  -9.80327E-01,   6.37044E-04,
     4.28386E-01,   2.20672E-02,   1.04682E 05,  -1.07308E 07,
     4.11269E-01,  -1.06370E-01,  -1.60979E 06,  -4.42671E 06,
    -6.59824E-02,   1.61992E-02,   0.         ,   0.         ,
     7.66610E-02,   2.43126E-02,  -7.65710E 00,  -3.79008E-02,
     1.55399E-01,   4.69702E-03,   0.         ,   0.         ,
    -1.61208E-01,  -1.49924E-03,   2.22851E 06,   1.94000E 07,
     8.40130E-02,   3.69431E-03,   1.05644E-02,  -8.45153E-02,
$END
$LIST2
TITLE=  'EEE-ICLS CORE ROTOR SUBSYSTEM VERTICAL',
!SUB= 4,
XREF=    0.    ,
YREF=    0.    ,
ZREF=    0.    ,
PTS=
  11,  -201.040,      0.    ,      0.    ,
  12,  -207.670,      0.    ,      0.    ,
  13,  -217.010,      0.    ,      0.    ,
  14,  -223.000,      0.    ,      0.    ,
  15,  -228.010,      0.    ,      0.    ,
  16,  -235.070,      0.    ,      0.    ,
  17,  -238.395,      0.    ,      0.    ,
  18,  -250.865,      0.    ,      0.    ,
  19,  -255.465,      0.    ,      0.    ,
  20,  -263.325,      0.    ,      0.    ,
XMODES=
      73.0,   6.42149E 01,    -34.6,  1,
     138.9,   5.60683E 01,    -34.6,  1,
   16458.9,   7.56231E 05,    -34.6,  0,
   29833.1,   2.36088E 06,    -34.6,  0,
   38775.0,   1.86112E 06,    -34.6,  0,
   51786.9,   1.21177E 07,    -34.6,  0,
   66915.7,   4.53672E 07,    -34.6,  0,
   74533.8,   1.15269E 07,    -34.6,  0,
   87882.3,   3.56812E 07,    -34.6,  0,
VH(1,1,1)=
    -5.33097E-01,  -7.49852E-03,  -5.33097E 01,   0.         ,
    -5.82818E-01,  -7.49787E-03,  -4.40922E 01,   3.37913E 02,
    -6.52843E-01,  -7.49614E-03,  -3.71500E 01,   7.36234E 02,
    -6.97746E-01,  -7.49542E-03,  -3.41078E 01,   9.51651E 02,
    -7.35298E-01,  -7.49517E-03,  -1.69262E 01,   1.09199E 03,
    -7.88214E-01,  -7.49481E-03,   1.94916E 00,   1.17532E 03,
    -8.13140E-01,  -7.49314E-03,   8.21044E 00,   1.16859E 03,
    -9.06555E-01,  -7.50176E-03,   2.07577E 01,   1.00899E 03,
    -9.41056E-01,  -7.50118E-03,   9.54578E 01,   7.69175E 02,
    -1.00000E 00,  -7.49982E-03,   1.00000E 02,   0.         ,
VH(1,1,2)=
     9.34274E-01,  -2.29811E-02,   9.34274E 01,   0.         ,
     7.81918E-01,  -2.29820E-02,   4.45451E 01,  -4.71862E 02,
     5.67253E-01,  -2.29844E-02,   1.99317E 01,  -7.95917E 02,
     4.29574E-01,  -2.30125E-02,   1.19206E 01,  -8.79679E 02,
     3.14280E-01,  -2.30127E-02,  -1.95760E 01,  -7.97036E 02,
     1.51807E-01,  -2.30129E-02,  -3.76326E 01,  -5.45828E 02,
     7.52894E-02,  -2.30133E-02,  -3.99123E 01,  -4.03853E 02,
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4350     -2.11703E-01,    -2.30138E-02,    -3.47173E 01,     1.12434E 02,
4360     -3.17566E-01,    -2.30137E-02,     4.30570E 01,     3.60344E 02,
4370     -4.98446E-01,    -2.30130E-02,     4.98446E 01,    -6.70156E-06,
4380 VH(1,1,3)=
4390      8.60656E-01,    -4.87216E-02,     8.60656E 01,     0.          ,
4400      5.30890E-01,    -4.35582E-02,    -5.24815E 05,     2.35181E 06,
4410      9.04046E-02,    -3.18750E-02,    -6.34752E 05,     8.23814E 06,
4420     -1.65104E-01,    -2.40587E-02,    -6.25755E 05,     1.22529E 07,
4430     -2.93376E-01,    -2.08682E-02,    -3.37521E 05,     1.57874E 07,
4440     -4.38020E-01,    -1.55000E-02,     1.57187E 05,     1.78183E 07,
4450     -5.72323E-01,     8.57732E-03,     3.79120E 05,     1.71839E 07,
4460     -2.87347E-02,     4.78677E-02,     5.80522E 05,     1.04652E 07,
4470      2.51953E-01,     5.21433E-02,     1.05069E 05,     6.05626E 05,
4480      6.66847E-01,     5.22496E-02,    -6.66753E 01,    -1.55944E-0 ,
4490 VH(1,1,4)=
4500     -7.37859E-01,     9.16578E-02,    -7.37859E 01,     0.          ,
4510     -1.21056E-01,     7.36535E-02,     8.55278E 05,    -9.04679E 06,
4520      3.05388E-01,     2.50448E-02,     4.40018E 05,    -1.82636E 07,
4530      3.96130E-01,     7.26918E-03,     1.77827E 05,    -2.05856E 07,
4540      3.67500E-01,     1.48611E-03,    -1.33733E 06,    -1.86133E 07,
4550      2.16195E-01,    -2.68551E-03,    -2.45527E 06,    -6.08730E 06,
4560      5.09474E-02,     1.36152E-02,    -2.53286E 06,     1.74985E 06,
4570     -3.09766E-01,     5.47656E-02,    -1.86935E 06,     2.94465E 07,
4580     -2.19913E-03,     6.38095E-02,     1.80429E 05,     1.57649E 06,
4590      5.10593E-01,     6.46503E-02,    -5.10912E 01,    -4.36787E-01,
4600 VH(1,1,5)=
4610      5.90220E-01,    -1.43280E-01,     5.90220E 01,     0.          ,
4620     -3.48822E-01,    -1.10764E-01,     2.41619E 05,     1.80550E 07,
4630     -2.76298E-01,    -9.81117E-03,     1.33081E 06,     1.51261E 07,
4640      2.68899E-02,     5.83548E-03,     1.47381E 06,     6.61763E 06,
4650      1.44667E-01,     8.18295E-03,     8.21430E 05,    -1.64368E 06,
4660      2.31016E-01,     6.83852E-03,    -6.51375E 05,    -5.95549E 06,
4670      2.33641E-01,     5.09406E-03,    -1.15972E 06,    -3.93505E 06,
4680     -8.74141E-02,     1.35132E-02,    -1.15614E 06,     1.14515E 07,
4690     -2.02169E-02,     1.66488E-02,     5.38064E 04,     6.06043E 05,
4700      1.14652E-01,     1.70671E-02,    -1.14703E 01,     0.          ,
4710 VH(1,1,6)=
4720      4.49449E-01,     7.29916E-02,     4.49449E 01,     0.          ,
4730      8.42540E-01,     7.91258E-02,    -5.81228E 06,    -7.03927E 06,
4740     -4.51855E-01,     2.76093E-02,    -5.00784E 06,     4.37360E 07,
4750     -8.18916E-01,     6.57078E-02,    -3.53359E 06,     6.62295E 07,
4760     -3.77802E-01,     7.99993E-02,     3.36988E 06,     3.50489E 07,
4770      4.82792E-01,     8.40301E-02,     7.41345E 05,    -2.10483E 07,
4780      9.24794E-01,     4.62960E-02,    -2.73891E 06,    -2.76418E 07,
4790     -7.80921E-02,     2.44162E-02,    -4.09748E 06,     2.08900E 07,
4800     -1.39705E-01,     2.45559E-02,    -1.32174E 05,     6.28306E 05,
4810      5.35682E-02,     2.61569E-02,    -5.33076E 00,     3.11285E-01,
4820 VH(1,1,7)=
4830     -7.33964E-02,     5.73770E-02,    -7.33964E 00,     0.          ,
4840      2.63812E-01,     3.16223E-02,    -2.14157E 06,    -1.35713E 07,
4850     -4.92225E-01,    -3.33922E-02,     1.36776E 06,     1.03778E 07,
4860     -2.27735E-01,    -2.17793E-02,     2.91747E 06,     1.06531E 06,
4870     -6.37101E-02,    -1.81665E-02,     5.64458E 06,    -9. 5968E 06,
4880      2.06111E-01,    -2.56275E-02,     2.74223E 06,    -2.98152E 07,
4890      4.76695E-01,    -9.43368E-02,    -2.97868E 05,    -2.43595E 07,
4900     -9.51353E-01,    -1.18651E-01,     6.74165E 06,     1.82991E 05,
4910      9.37652E-01,    -2.89198E-02,     3.71352E 06,     1.10582E 07,
4920      8.41534E-01,    -3.84235E-02,    -8.42220E 01,     1.24341E 00,
4930 VH(1,1,8)=
4940     -1.67039E-01,     1.05058E-01,    -1.67039E 01,     0.          ,
4950      4.37864E-01,     4.34143E-02,    -4.18568E 06,    -2.73474E 07,
4960     -9.40852E-01,    -7.39350E-02,     5.54783E 06,     2.20893E 07,
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     3.62518E-02,   -4.66913E-02    7.99166E 06,   -1.02662E 07,
     2.18892E-01,   -4.15407E-02,   4.18646E 06,   -1.00619E 07,
     1.09423E-01,   -4.46193E-02,  -4.96671E 05,    9.52557E 06,
    -1.34157E-01,   -2.43627E-02,   4.52692E 05,    1.64859E 07,
     1.11610E-01,    1.26883E-02,   2.88797E 05,    6.50361E 06,
    -8.54912E-02,    4.78256E-03,  -3.90042E 05,   -9.38954E 05,
    -6.06280E-02,    6.08836E-03,   6.07513E 00,    0.          ,
 VH(1,1,9)=
    -6.98175E-01,    4.79252E-02,  -6.98175E 01,    0.          ,
    -2.60268E-01,   -7.60908E-02,   8.8[illegible]22E 06,   -4.83259E 06,
     5.27403E-01,   -8.79504E-02,  -1.45[illegible]62E 06,   -2.41834E 07,
    -4.29874E-01,   -1.03701E-01,  -1.39952E 06,    9.63344E 06,
    -5.50775E-01,   -8.77136E-02,   1.67718E 07,    8.95469E 07,
     4.15607E-01,   -7.00149E-02,   1.34540E 07,    4.59046E 07,
     9.20265E-01,   -1.32892E-01,   3.39450E 06,    3.81122E 07,
     5.33952E-02,    1.32201E-02,  -3.39056E 06,    6.88529E 07,
    -1.06714E-01,    3.15985E-02,   5.22096E 04,    4.42173E 06,
     1.64784E-01,    3.70958E-02,  -1.64158E 01,    0.          ,
 $END
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 YREF=    0.   ,
 ZREF=    0.   ,
 PTS=
    11,  -201.040,    0.   ,    0.   ,
    12,  -207.670,    0.   ,    0.   ,
    13,  -217.010,    0.   ,    0.   ,
    14,  -223.000,    0.   ,    0.   ,
    15,  -228.010,    0.   ,    0.   ,
    16,  -23[illegible].070,    0.   ,    0.   ,
    17,  -238.395,    0.   ,    0.   ,
    18,  -250.865,    0.   ,    0.   ,
    19,  -255.465,    0.   ,    0.   ,
    20,  -263.325,    0.   ,    0.   ,
 XMODES=
       73.0,    6.42149E [illegible],   -34.6,  1,
      138.9,    5.60683E [illegible],   -34.6.  1,
    16458.9,    7.56231E [illegible],   -34.6,  0,
    29[illegible]3.1,    2.36088E 06,   -34.6,  0,
    387[illegible].0,    1.86112E 06,   -34.6,  0,
    51786.9,    1.21177E 07,   -34.6,  0,
    66915.7,    4.53872E 07,   -34.6,  0,
    74533.8,    1.15269E 07,   -34.6,  0,
    87882.3,    3.56812E 07,   -34.6,  0,
 VH(1,1,1)=
    -5.33097E-01,   -7.49852E-03,  -5.33097E 01,    0.          ,
    -5.82818E-01,   -7.49787E-03,  -4.40922E 01,    3.37913E 02,
    -6.52843E-01,   -7.49614E-03,  -3.71500E 01,    7.36234E 02,
    -6.97746E-01,   -7.49542E-03,  -3.41078E 01,    9.51651E 02,
    -7.35298E-01,   -7.49517E-03,  -1.69262E 01,    1.09199E 03,
    -7.88214E-01,   -7.49481E-03,   1.94916E 00,    1.17532E 03,
    -8.12140E-01,   -7.49314E-03,   8.21044E 00,    1.16859E 03,
    -9.06555E-01,   -7.50176E-03,   2.07577E 01,    1.00899E 03,
    -9.41056E-01,   -7.50118E-03,   9.54578E 01     7.69175E 02,
    -1.00000E 00,   -7.49982E-03,   1.00003E 02,    0.          ,
 VH(1,1,2)=
     9.34274E-01,   -2.29811E-02,   9.34274E 01,    0.          ,
     7.81918E-01,   -2.29820E-02,   4.45451E 01,   -4.71862E 02,
     5.67253E-01,   -2.29844E-02,   1.99317E 0[illegible],   -7.95917E 02,
     4.29574E-01,   -2.30125E-02,   1.19206E [illegible]1,   -8.79679E 02,
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5590     3.14280E-01,   -2.30127E-02,   -1.95760E 01,   -7.97036E 02,
5600     1.51807E-01,   -2.30129E-02,   -3.76326E 01,   -5.45828E 02,
5610     7.52894E-02,   -2.30133E-02,   -3.99123E 01,   -4.03853E 02,
5620    -2.11703E-01,   -2.30138E-02,   -3.47173E 01,    1.12434E 02,
5630    -3.17566E-01,   -2.30137E-02,    4.30570E 01,    3.60344E 02,
5640    -4.98446E-01,   -2.30130E-02,    4.98446E 01,   -6.70156E-06,
5650 VH(1,1,3)=
5660     8.60656E-01,   -4.87216E-02,    8.60656E 01,    0.          ,
5670     5.30890E-01,   -4.35582E-02,   -5.24815E 05,    2.35181E 06,
5680     9.04046E-02,   -3.18750E-02,   -6.34752E 05,    8.23814E 06,
5690    -1.65104E-01,   -2.40587E-02,   -6.25755E 05,    1.22529E 07,
5700    -2.93376E-01,   -2.08682E-02,   -3.37521E 05.    1.57874E 07,
5710    -4.38020E-01,   -1.55000E-02,    1.57187E 05,    1.78183E 07,
5720    -5.72323E-01,    8.57732E-03,    3.79120E 05,    1.71839E 07,
5730    -2.87347E-02,    4.78677E-02,    5.80522E 05,    1.04652E 07,
5740     2.51953E-01,    5.21433E-02,    1.05069E 05,    6.05626E 05,
5750     6.66847E-01,    5.22496E-02,   -6.66753E 01,   -1.55944E-01,
5760 VH(1,1,4)=
5770    -7.37859E-01,    9.16578E-02,   -7.37859E 01,    0.          ,
5780    -1.21056E-01,    7.36535E-02,    8.55278E 05,   -9.04679E 06,
5790     3.05388E-01,    2.50448E-02,    4.40018E 05,   -1.82636E 07,
5800     3.96130E-01,    7.26918E-03,    1.77827E 05,   -2.05856E 07,
5810     3.67500E-01,    1.48611E-03,   -1.33733E 06,   -1.86133E 07,
5820     2.16195E-01,   -2.68551E-03,   -2.45527E 06,   -6.08738E 06,
5830     5.09474E-02,    1.36152E-02,   -2.53286E 06,    1.74985E 06,
5840    -3.09766E-01,    5.47656E-02,   -1.86935E C6,    2.94465E 07,
5850    -2.19913E-03,    6.38095E-02,    1.80429E 05,    1.57849E 06,
5860     5.10593E-01,    6.46503E-02,   -5.10912E 01,   -4.38787E-01,
5870 VH(1,1,5)=
5880     5.90220E-01,   -1.43280E-01,    5.90220E 01,    0.          ,
5890    -3.48822E-01,   -1.10764E-01,    2.41619E 05,    1.80550E 07,
5900    -2.76298E-01,   -9.81117E-03,    1.33081E 06,    1.51261E 07,
5910     2.68899E-02,    5.83548E-03,    1.47381E 06,    6.61763E 06,
5920     1.44667E-C1,    8.18295E-03,    8.21430E 05,   -1.64368E 06,
5930     2.31016E-01,    6.83852E-03,   -6.51375E 05,   -5.95549E 06,
5940     2.33641E-01,    5.09406E-03,   -1.15372E 06,   -3.93505E 06,
5950    -8.74141E-02,    1.35132E-02,   -1.15614E 06,    1.14515E 07,
5960    -2.0[illegible]169E-02,    1.66488E-02,    5.38064E 04,    6.06043E 05,
5970     1.14652E-01,    1.70671E-02,   -1.14703E 01,    0.          ,
5980 VH(1,1,6)=
5990     4.49449E-01,    7.29916E-02,    4.49449E 01,    0.          ,
6000     8.42540E-01,    7.91258E-02,   -5.81228E 06,   -7.03927E 06,
6010    -4.51855E-01,    2.76093E-02,   -5.00784E 06,    4.37360E 07,
6020    -8.18916E-01,    6.57078E-02,   -3.53359E 06,    6.62295E 07,
6030    -3.77802E-01,    7.99993E-02,    3.36988E 06,    3.50489E 07,
6040     4.82792E-01,    8.40301E-02,    7.41345E 05,   -2.10483E 07,
6050     9.24794E-01,    4.62960E-02,   -2.73891E 06,   -2.76418E 07,
6060    -7.80921E-02,    2.44162E-02,   -4.69748E 06,    2.08900E 07,
6070    -1.39705E-01,    2.45559E-02,   -1.32174E 05,    6.28306E 05,
6080     5.35682E-02,    2.61569E-02,   -5.33076E 00,    3.11285E-01,
6090 VH(1,1,7)=
6100    -7.33964E-02,    5.73770E-02,   -7.33964E 00,    0.          ,
6110     2.63812E-01,    3.16223E-02,   -2.14157E 06,   -1.35713E 07,
6120    -4.92225E-01,   -3.33922E-02,    1.36776E 06,    1.03778E 07,
6130    -2.27735E-01,   -2.17793E-02,    2.91747E 06,    1.065[illegible]1E 06,
6140    -6.37101E-02,   -1.81685E-02,    5.64458E 06,   -9.269[illegible]E 06,
6150     2.06111E-01,   -2.56275E-02,    2.74223E 06,   -2.98152E 07,
6160     4.7669[illegible]E-01,   -9.43368E-02,   -2.97868E 05,   -2.43595E 07,
6170    -9.51353E-01,   -1.18651E-01,    6.74165E 06,    1.82991E 05,
6180     9.37652E-01,   -2.89198E-02,    3.71352E 06,    1.10582E 07,
6190     8.41534E-01,   -3.84235E-02,   -8.42220E 01,    1.24341E 00,
6200 VH(1,1,8)=
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     -1.67039E-01,     1.05058E-01,     -1.67039E 01,     0.           ,
      4.37864E-01,     4.34143E-02,     -4.18568E 06,    -2.73474E 07,
     -9.40852E-01,    -7.39350E-02,      5.54783E 06,     2.20893E 07,
      3.62518E-02,    -4.66913E-02,      7.99166E 06,    -1.02662E 07,
      2.18892E-01,    -4.15407E-02,      4.18646E 06,    -1.00619E 07,
      1.09423E-01,    -4.46193E-02,     -4.96671E 05,     9.52557E 06,
     -1.34157E-01,    -2.43627E-02,      4.52692E 05,     1.64859E 07,
      1.11610E-01,     1.26883E-02,      2.88797E 05,     6.50361E 06,
     -8.54912E-02,     4.78256E-03,     -3.90042E 05,    -9.38954E 05,
     -6.06280E-02,     6.08836E-03,      6.07513E 00,     0.           ,
 VH(1,1,9)=
     -6.98175E-01,     4.79252E-02,     -6.98175E 01,     0.           ,
     -2.60268E-01,    -7.60908E-02,      8.84822E 06,    -4.83259E 06,
      5.27403E-01,    -8.79504E-02,     -1.45762E 06,    -2.41834E 07,
     -4.29874E-01,    -1.03701E-01,     -1.39952E 06,     9.63344E 06,
     -5.50775E-01,    -8.77136E-02,      1.67718E 07,     8.95469E 07,
      4.15607E-01,    -7.00149E-02,      1.34540E 07,     4.59046E 07,
      9.20265E-01,    -1.32892E-01,      3.39450E 06,     3.81122E 07,
      5.33952E-02,     1.32201E-02,     -3.39056E 06,     6.88529E 07,
     -1.06714E-01,     3.15985E-02,      5.22096E 04,     4.42173E 06,
      1.64784E-01,     3.70958E-02,     -1.64158E 01,     0.           ,
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 YREF=     0.    ,
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 PTS=
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    22,  -177.455,     0.    ,     0.    ,
    23,  -207.630,     0.    ,     0.    ,
    24,  -217.005,     0.    ,     0.    ,
    25,  -223.015,     0.    ,     0.    ,
    26,  -228.105,     0.    ,     0.    ,
    27,  -234.550,     0.    ,     0.    ,
    28,  -237.915,     0.    ,     0.    ,
    29,  -250.915,     0.    ,     0.    ,
    30,  -255.555,     0.    ,     0.    ,
    31,  -262.265,     0.    ,     0.    ,
    32,  -270.225,     0.    ,     0.    ,
    33,  -278.575,     0.    ,     0.    ,
    34,  -172.156,     0.    ,     0.    ,
    35,  -194.778,     0.    ,     0.    ,
    36,  -201.040,     0.    ,     0.    ,
    37,  -269.475,     0.    ,     0.    ,
 XMODES=
       718.1,    2.19719E 04,     15.,   1,
      1340.9,    2.88367E 04,     15.,   1,
      4351.0,    1.52823E 05,     15.,   0,
      8541.4,    4.25520E 05,     15.,   0,
     11476.1,    1.59057E 06,     15.,   0,
     13130.8,    3.34561E 06,     15.,   0,
     17010.9,    4.35692E 06,     15.,   0,
     18937.3,    1.36996E 06,     15.,   0,
     21254.7,    2.25565E 06,     15.,   0,
     24718.5,    2.40308E 06,     15.,   0,
     27767.5,    1.99155E 06,     15.,   0,
     28989.2,    2.40350E 06,     15.,   0,
     31862.5,    9.04811E 06,     15.,   0,
     38147.3,    3.02281E 07,     15.,   0,
     39415.9,    3.10641E 07,     15.,   0,
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6830   43312.3,   1.44536E 07,   15.,  0,
6840   46780.5,   3.11669E 07,   15.,  0,
6850   50137.3,   3.79795E 07,   15.,  0,
6860   53499.2,   7.37532E 06,   15.,  0,
6870   54900.8,   1.30214E 07,   15.,  0,
6880   59089.0,   4.92561E 06,   15.,  0,
6890   65253.4,   2.09262E 07,   15.,  0,
6900   71143.9,   1.71715E 08,   15.,  0,
6910   74501.5,   3.53742E 07,   15.,  0,
6920   75901.1,   6.22727E 07,   15.,  0,
6930   76633.7,   2.15732E 07,   15.,  0,
6940   78499.1,   2.18467E 08,   15.,  0,
6950 VH(1,1,1)=
6960     9.22622E-01,  -9.07348E-03,  -6.26115E 03,   8.80479E 04,
6970     8.20132E-01,  -8.87836E-03,  -1.77521E 03,   9.39965E 03,
6980     5.52484E-01,  -8.80280E-03,   1.33922E 04,   6.10279E 05,
6990     4.71475E-01,  -8.70364E-03,   1.23607E 04,   4.90747E 05,
7000     4.20028E-01,  -8.64608E-03,   1.17484E 04,   4.19212E 05,
7010     3.76536E-01,  -8.56820E-03,  -1.44231E 02,   4.05946E 02,
7020     3.21301E-01,  -8.56775E-03,  -3.59912E 02,   2.35667E 03,
7030     2.92863E-01,  -8.54820E-03,   3.57646E 02,   1.77274E 03,
7040     1.83727E-01,  -8.48683E-03,   8.69749E 03,   1.41783E 05,
7050     1.45026E-01,  -8.47158E-03,   8.46689E 03,   1.03461E 05,
7060     8.99227E-02,  -8.40968E-03,   7.64486E 03,   1.31058E 05,
7070     2.52872E-02,  -8.34548E-03,   7.48574E 03,   7.47013E 04,
7080    -4.27756E-02,  -8.32638E-03,   7.49549E 03,   1.77254E 04,
7090     8.67363E-01,  -8.89045E-03,   0.          ,  0.          ,
7100     6.65120E-01,  -9.11816E-03,   0.          ,  0.          ,
7110     6.10404E-01,  -8.88934E-03,  -2.36582E-04,   9.87605E-04,
7120     3.05529E-02,  -8.34156E-03,   0.          ,  0.          ,
7130 VH(1,1,2)=
7140     1.52489E-01,  -8.93432E-03,  -4.43123E 03,   2.18599E 05,
7150     5.12780E-02,  -8.52635E-03,  -5.26566E 02,   1.85894E 04,
7160    -2.06096E-01,  -8.36568E-03,   1.42434E 03,   1.30119E 06,
7170    -2.83383E-01,  -8.12734E-03,   3.17095E 03,   1.28483E 06,
7180    -3.31537E-01,  -7.96538E-03,   4.65219E 03,   1.26470E 06,
7190    -3.72595E-01,  -7.67315E-03,   4.70933E 02,   9.68582E 01,
7200    -4.22001E-01,  -7.67375E-03,   1.33967E 03,  -4.20868E 03,
7210    -4.47680E-01,  -7.62796E-03,  -2.82083E 03,  -2.57957E 04,
7220    -5.40243E-01,  -7.28592E-03,   2.21592E 04,   9.85807E 05,
7230    -5.71926E-01,  -7.18987E-03,   2.48710E 04,   8.80965E 05,
7240    -6.10956E-01,  -6.80933E-03,   3.96911E 04,   9.06997E 05,
7250    -6.51173E-01,  -6.39503E-03,   4.53105E 04,   5.75911E 05,
7260    -6.93656E-01,  -6.25887E-03,   5.26491E 04,   1.76509E 05,
7270     9.67029E-02,  -8.54877E-03,   0.          ,  0.          ,
7280    -9.64454E-02,  -8.58004E-03,   0.          ,  0.          ,
7290    -1.50417E-01,  -8.57278E-03,   4.60775E-05,  -9.83258E-05,
7300    -6.43715E-01,  -6.30396E-03,   0.          ,  0.          ,
7310 VH(1,1,3)=
7320     2.14681E-01,  -1.08090E-02,  -6.37535E 04,   2.82208E 06,
7330     3.82022E-03,  -5.49181E-03,  -1.31343E 0( ,   1.20760E 05,
7340    -1.56499E-01,  -3.71339E-03,   9.75354E 04,   1.45750E 07,
7350    -1.72625E-01,  -1.12891E-03,   1.10036E 05,   1.36200E 07,
7360    -1.67939E-01,   5.56411E-04,   1.18697E 05,   1.29347E 07,
7370    -1.65430E-01,   3.41572E-03,   2.32020E 03,  -6.20695E 03,
7380    -1.43210E-01,   3.40870E-03,   5.82468E 03,  -3.71087E 04,
7390    -1.26726E-01,   4.04730E-03,  -5.55080E 03,  -2.56072E 04,
7400    -1.83097E-02,   6.95566E-03,   1.61386E 05,   8.80139E 06,
7410     2.93175E-02,   7.79503E-03,   1.61163E 05,   8.00977E 06,
7420     1.26382E-01,   9.77587E-03,   1.42113E 05,   3.92383E 06,
7430     2.53187E-01,   1.13707E-02,   1.25099E 05,   2.69176E 06,
7440     3.74453E-01,   1.18813E-02,   8.98956E 04,   1.52984E 06,
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7450      3.45367E-02,   -5.64247E-03,    0.           ,    0.           ,
7460     -9.31808E-02,   -5.82646E-03,    0.           ,    0.           ,
7470     -1.29683E-01,   -5.82487E-03,   -4.32787E-05,      3.09201E-03,
7480      3.20578E-01,    1.21081E-02,    0.           ,    0.           ,
7490 VH(1,1,4)=
7500      3.99370E-02,   -5.56516E-03,   -6.22211E 04,      5.29189E 06,
7510     -1.58508E-01,    4.04085E-03,    5.10066E 04,     -4.55650E 05,
7520      2.58307E-02,    4.92407E-03,    8.21173E 05,      8.52753E 06,
7530      1.43751E 01,    5.67[illegible]8E-03,    7.96403E 05,      8.06420E 05,
7540      2.22142E-01,    5.43408E-03,    7.60663E 05,     -3.97099E 06,
7550      3.02850E-01,    3.07863E-03,   -1.57488E 04,      8.69369E 03,
7560      3.21165E-01,    3.10608E-03,   -4.33492E 04,      1.69797E 05,
7570      3.59708E-01,    3.06734E-03,    8.92473E 04,      7.81863E 05,
7580      3.93502E-01,   -2.23407E-03,    2.21355E 05,     -1.99562E 07,
7590      3.79658E-01,   -3.99102E-03,    1.44630E 05,     -2.07283E 07,
7600      2.74263E-01,   -8.78029E-03,   -2.06952E 05,     -1.27508E 07,
7610      8.28274E-02,   -1.34115E-02,   -2.77655E 05,     -1.00513E 07,
7620     -1.05959E-01,   -1.51702E-02,   -2.78697E 05,     -6.34278E 06,
7630     -1.88554E-01,    4.67999E-03,    0.           ,    0.           ,
7640     -7.76397E-02,    5.05125E-03,    0.           ,    0.           ,
7650     -4.60108E-02,    5.04989E-03,    5.87178E-03,     -1.28772E-02,
7660     -1.06133E-01,   -1.60689E-02,    0.           ,    0.           ,
7670 VH(1,1,5)=
7680     -1.12446E-01,   -1.23479E-03,    1.77953E 05,      1.11214E 06,
7690      2.60170E-02,   -6.14919E-04,   -1.52532E 04,      1.28352E 05,
7700      5.59418E-02,   -1.50387E-03,    8.53657E 05,     -7.34753E 06,
7710      1.04358E-01,   -3.71372E-03,    8.10721E 05,     -1.50750E 07,
7720      1.21345E-01,   -5.93831E-03,    7.70913E 05,     -1.97004E 07,
7730      1.53795E-01,   -1.21008E-02,   -1.60941E 04,      1.00789E 05,
7740      7.46016E-02,   -1.20173E-02,   -3.36289E 04,      3.98296E 05,
7750      5.12730E-02,   -1.42472E-02,   -2.86965E 04,     -7.21942E 05,
7760     -9.42849E-02,   -2.18204E-02,    7.21754E 05,     -3.44836E 07,
7770     -1.75904E-01,   -2.46911E-02,    7.69874E 05,     -3.69652[illegible],
7780     -1.52090E-01,   -1.93737E-02,    1.25217E 06,      2.37830[illegible]07,
7790      9.73635E-02,   -7.80591E-03,    1.28533E 06,      1.50803[illegible]07,
7800      3.01963E-01,   -4.18113E-03,    1.13528E 06,      5.89881E 06,
7810      3.21331E-02,   -8.22582E-04,    0.           ,    0.           ,
7820      1.19714E-02,   -9.56824E-04,    0.           ,    0.           ,
7830      5.97940E-03,   -9.56666E-04,   -9 34320E-04,     -8.55197E-03,
7840      9.95393E-01,   -3.54395E-03,    0.           ,    0.           ,
7850 VH(1,1,6)=
7860      5.94602E-01,    1.33626E-03,   -1.29366E 06,      3.64536E 06,
7870     -7.48054E-01,    1.75184E-02,    5.79284E 05,     -4.81769E 06,
7880     -1.03730E-01,    1.29668E-02,   -5.12506E 05,     -2.74309E 07,
7890     -4.12408E-02,    8.36956E-03,   -4.68400E 05,     -2.33804E 07,
7900     -2.56256E-02,    5.56690E-03,   -4.54184E 05,     -2.08652E 07,
7910     -1.38914E-02,    1.41149E-03,    1.95394E 03,     -1.47522E 04,
7920     -4.65790E-03,    1.39984E-03,    3.78827E 03,     -5.44847E 04,
7930     -1.63865E-02,    4.13678E-04,   -7.41460E 03,     -4.34602E 04,
7940     -1.12833E-01,   -3 17239E-03,   -3.22862E 05,     -8.86319E 06,
7950     -1.50414E-01,   -4.04429E-03,   -2.61739E 05,     -7.31007E 06,
7960     -1.57098E-01,   -2.70269E-03,    1.71568E 05,      8.79428E 06,
7970     -7.93752E-02,    8.02184E-04,    2.80749E 05,      7.03649E 06,
7980      4.02365E-03,    2.17926E-03,    3.27361E 05,      4.05889E 06,
7990     -9.63229E-01,    2.62653E-02,    0.           ,    0.           ,
8000     -3.08355E-01,    3.26022E-02,    0.           ,    0.           ,
8010     -1.04116E-01,    3.25966E-02,    4.74332E-02,     -1.65259E-01,
8020      2.04103E-01,    2.76574E-03,    0.           ,    0.           ,
8030 VH(1,1,7)=
8040     -1.17606E-01,   -4.94725E-03,    3.45418E 05,      1.59077E 07,
8050     -1.75274E-01,    2.00732E-02,    2.8[illegible]611E 05,     -7.30264E 06,
8060      4.47143E-01,    1.36572E-02,   -6.16900E 05,     -4.17116E 07,
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8070      4.73693E-01,    6.66598E-03,   -1.15723E 06,   -3.44155E 07,
8080      4.25129E-01,    2.77842E-03,   -1.50874E 06,   -2.67173E 07,
8090      3.71243E-01,   -1.11756E-03,   -7.79588E 04,    1.15425E 05,
8100      3.56779E-01,   -9.38300E-04,   -2.05178E 05,    1.01447E 06,
8110      2.94979E-01,    2.44578E-03,    3.23967E 05,    3.02975E 06,
8120     -2.14263E-01,    1.65704E-03,   -2.75652E 06,    3.72777E 07,
8130     -3.33708E-01,    4.29926E-03,   -2.54445E 06,    4.93225E 07,
8140     -4.08840E-01,    8.86959E-03,   -1.05177E 06,    2.49889E 07,
8150     -3.55561E-01,    1.40864E-02,   -4.77767E 05,    2.79473E 07,
8160     -2.08976E-01,    1.78520E-02,    4.65700E 04,    2.33756E 07,
8170     -6.23521E-01,    4.18431E-02,    0.          ,   0.          ,
8180      3.80799E-01,    7.08250E-02,    0.          ,   0.          ,
8190      8.26058E-01,    7.09077E-02,   -2.13531E-02,    6.59976E-02,
8200     -2.34059E-01,    2.18171E-02,    0.          ,   0.          ,
8210 VH(1,1,8)=
8220     -2.18343E-03,   -1.43600E-04,    6.74745E 03,    6.01845E 05,
8230     -1.37198E-02,    8.64072E-04,    2.51777E 04,   -4.14660E 05,
8240      1.86370E-02,   -1.31687E-05,    7.59753E 03,   -6.52813E 06,
8250      1.35027E-02,   -1.21242E-03,   -1.70015E 04,   -6.42049E 06,
8260      2.63972E-03,   -2.01271E-03,   -2.50089E 04,   -6.16636E 06,
8270     -5.96328E-03,   -3.46993E-03,    4.02223E 02,    6.22465E 04,
8280     -2.80471E-02,   -3.43296E-03,    8.28692E 03,    1.48205E 05,
8290     -5.38512E-02,   -5.21847E-03,   -1.33051E 05,   -1.73598E 06,
8300     -5.63970E-02,   -4.61981E-03,    3.38511E 05,   -4.65670E 06,
8310     -5.95034E-02,   -4.91252E-03,    3.95733E 05,   -5.82054E 06,
8320      6.38105E-02,    1.63318E-03,    7.06641E 05,    2.46580E 07,
8330      3.25264E-01,    1.07170E-02,    3.84650E 05,    1.82400E 07,
8340      4.34111E-01,    1.33159E-02,   -4.68293E 05,    1.34968E 07,
8350     -5.60644E-02,    2.97062E-03,    0.          ,   0.          ,
8360      1.80942E-02,    5.82219E-03,    0.          ,   0.          ,
8370      5.47088E-02,    5.82909E-03,   -7.48084E-03,   -4.80868E-03,
8380     -9.80657E-01,    1.48796E-02,    0.          ,   0.          ,
8390 VH(1,1,9)=
8400     -2.22800E-02,   -2.80029E-04,    1.23472E 05,    9.26716E 05,
8410      1.36868E-01,    4.91465E-05,   -2.80902E 05,    6.51707E 05,
8420     -2.33808E-02,   -2.15116E-03,   -1.39818E 06,   -2.14008E 07,
8430     -?.66433E-01,   -4.65829E-03,   -1.22815E 06,   -8.41626E 06,
8440      2.59999E-01,   -5.23750E-03,   -9.69581E 05,   -1.24441E 06,
8450     -3.71971E-01,   -3.28900E-03,    1.20218E 05,   -7.79490E 04,
8460     -3.81606E-01,   -3.50479E-03,    3.26688E 05,   -1.31651E 06,
8470     -4.91018E-01,   -1.48328E-02,   -1.11305E 06,   -1.24253E 07,
8480     -1.59611E-02,    2.62540E-04,    2.32962E 06,   -7.94586E 06,
8490      1.13371E-01,    1.76469E-04,    2.27644E 06,   -1.87155E 07,
8500      2.34284E-01,   -3.16350E-03,    1.09175E 06,   -3.20849E 07,
8510      2.00359E-01,   -1.04373E-02,    5.69153E 05,   -3.58363E 07,
8520      9.51926E-02,   -1.52564E-02,    1.40928E 05,   -3.09884E 07,
8530     -3.23768E-01,    1.94220E-02,    0.          ,   0.          ,
8540      1.67377E-01,    5.05234E-02,    0.          ,   0.          ,
8550      ?.36090E-01,    5.06008E-02,    2.40803E-02,    1.35257E-01,
8560      3.98582E-01,   -2.06693E-02,    0.          ,   0.          ,
8570 VH(1,1,10)=
8580     -7.68522E-03,   -7.21094E-04,    3.15660E 04,    5.31087E 06,
8590     -8.05997E-01,    1.12700E-02,    2.41049E 06,   -1.37680E 07,
8600      1.34653E-01,    4.06295E-03,   -4.30635E 05,   -2.52254E 07,
8610      1.07002E-01,   -9.48765E-05,   -7.38934E 05,   -2.01240E 07,
8620      5.29027E-02,   -2.33069E-03,   -8.73176E 05,   -1.50902E 07,
8630     -9.33984E-03,   -4.35337E-03,    1.68177E 03,    1.32083E 05,
8640     -3.67229E-02,   -4.27618E-03,    1.98154E 04,    3.05906E 05,
8650     -1.7?695E-01,   -1.40804E-02,   -8.66131E 05,   -1.16053E 07,
8660     -?.22573E-02,   -8.21684E-04,    5.04783E 05,    9.09759E 06,
8670     -8.83102E-03,    1.55396E-04,    5.50465E 05,    6.69647E 06,
8680      4.29077E-02,    2.28189E-04,    3.63277E 05,   -9.73023E 06,
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8690      4.92966E-02,  -1.91848E-03,   2.12569E 05,  -1.15550E 07,
8700      3.12007E-02,  -3.47745E-03,   5.72908E 04,  -1.04617E 07,
8710      3.01536E-01,  -8.02684E-03,   0.          ,  0.          ,
8720      4. 0585E-02,  -3.55904E-02,   0.          ,  0.          ,
8730     -1.79991E-01,  -3.56322E-02,   4.43653E-02,  -1.56004E-02,
8740      1.00311E-01,  -5.43797E-03,   0.          ,  0.          ,
8750 VH(1,1,11)=
8760      5.77356E-03,  -1.08860E-04,  -6.65321E 04,   1.40621E 06,
8770      2.79163E-01,   1.22559E-03,  -1.05193E 06,   1.46731E 06,
8780      9.13503E-02,   1.57146E-03,   1.04404E 06,  -5.82783E 06,
8790      1.70898E-01,  -4.86034E-04,   6.25227E 05,  -1.40529E 07,
8800      1.87515E-01,  -2.46277E-03,   2.50497E 05,  -1.65050E 07,
8810      2.25576E-01,  -7.62610E-03,  -1.31475E 05,   4.64152E 05,
8820      1.65279E-01,  -7.16271E-03,  -3.11323E 05,   2.35348E 06,
8830     -7.43865E-02,  -2.60679E-02,  -1.46709E 06,  -2.37443E 07,
8840      1.17544E-01,  -2.52158E-03,  -3.12651E 04,   1.35649E 07,
8850      1.06065E-01,  -1.31958E-03,  -2.67602E 05,   1.47543E 07,
8860      1.55875E-02,   9.20563E-04,  -1.34162E 06,   2.39162E 07,
8870     -1.14477E-01,   4.23825E-03,  -1.16676E 06,   3.25380E 07,
8880     -1.65819E-01,   8.13725E-03,  -5.12796E 05,   3.34717E 07,
8890     -1.28989E-01,   6.14888E-04,   0.          ,  0.          ,
8900     -8.57900E-02,  -2.54658E-02,   0.          ,  0.          ,
8910     -2.46758E-01,  -2.55328E-02,  -4.35042E-03,   2.33492E-02,
8920     -2.49841E-01,   1.52206E-02,   0.          ,  0.          ,
8930 VH(1,1,12)=
8940      1.02496E-03,  -3.86488E-04,  -3.59071E 04,   4.25558E 06,
8950      2.84501E-01,   5.32372E-03,  -1.14884E 06,  -2.38463E 06,
8960      1.24924E-01,   4.09690E-03,   1.66541E 05,  -1.46705E 07,
8970      1.47303E-01,   1.28416E-03,  -3.10456E 05,  -1.48263E 07,
8980      1.22701E-01,  -4.43544E-04,  -6.20305E 05,  -1.21120E 07,
8990      9.61349E-02,  -2.45506E-03,  -6.04761E 04,   1.81145E 05,
9000      7.50644E-02,  -2.26147E-03,  -1.46656E 05,   1.00291E 06,
9010      3.40453E-02,  -1.68234E-04,   1.57017E 05,   1.74462E 06,
9020     -2.00245E-01,  -8.76005E-05,  -5.31215E 05,   1.84852E 07,
9030     -2.03800E-01,   1.51896E-03,  -6.44906E 04,   1.96763E 07,
9040     -4.92166E-02,   8.65945E-04,   1.94481E 06,  -3.83668E 07,
9050      1.44551E-01,  -5.09298E-03,   1.77351E 06,  -5.22487E 07,
9060      2.33400E-01,  -1.14901E-02,   8.25340E 05,  -5.43533E 07,
9070     -1.98846E-01,   4.03927E-03,   0.          ,  0.          ,
9080     -6.85991E-02,  -4.96521E-02,   0.          ,  0.          ,
9090     -3.82317E-01,  -4.97679E-02,   7.24640E-04,   1.09064E-01,
9100      4.00737E-01,  -2.32687E-02,   0.          ,  0.          ,
9110 VH(1,1,13)=
9120     -2.73482E-02,  -7.09232E-04,   3.31143E 05,   7.20080E 06,
9130      4.88000E-02,   8.78981E-03,  -1.46372E 05,  -1.00420E 07,
9140     -3.53280E-02,   3.31517E-03,  -4.35954E 06,  -3.43543E 07,
9150     -3.56247E-01,   1.23488E-03,  -3.54628E 06,   3.17505E 06,
9160     -5.15688E-01,   2.89139E-03,  -2.34859E 06,   2.08180E 07,
9170     -7.91958E-01,   1.56426E-02,   5.98113E 05,  -1.56372E 06,
9180     -6.38465E-01,   1.38672E-02,   1.47026E 06,  -9.34188E 06,
9190     -2.97909E-01,   3.15508E-02,   9.80669E 05,   2.80668E 07,
9200      1.56154E-01,   4.03610E-03,   2.61554E 06,  -6.04388E 07,
9210      2.66775E-01,  -8.55084E-04,   2.03348E 06,  -7.18945E 07,
9220      1.63487E-01,  -2.92261E-03,  -1.67894E 06,   3.69125E 07,
9230     -6.27376E-02,   2.60411E-03,  -2.02925E 06,   5.27942E 07,
9240     -2.39622E-01,   8.90930E-03,  -1.17434E 06,   5.96007E 07,
9250     -4.38117E-01,   2.19233E-02,   0.          ,  0.          ,
9260      1.40968E-01,  -9.26286E-02,   0.          ,  0.          ,
9270     -4.44076E-01,  -9.28013E-02,  -4.31849E-02,   1.04887E-01,
9280     -4.16420E-01,   2.30900E-02,   0.          ,  0.          ,
9290 VH(1,1,14)=
9300      3.90274E-01,   2.43814E-03,  -8.02199E 06,   1.93135E 06,
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9310      6.29585E-01,    4.84176E-02,   -4.50673E 06,   -7.20296E 07,
9320      3.12261E-01,    2.83008E-02,   -3.95620E 06,   -1.02063E 08,
9330      1.18341E-01,    1.31427E-02,   -5.37194E 06,   -6.66023E 07,
9340     -1.36308E-01,    6.63829E-03,   -5.36812E 06,   -3.68644E 07,
9350     -6.07385E-01,    1.23807E-02,    6.59574E 05,   -1.75157E 06,
9360     -4.69881E-01,    1.04125E-02,    1.60115E 06,   -1.03019E 07,
9370     -3.87535E-01,    1.76769E-02,   -2.44258E 05,    1.85315E 07,
9380     -6.52261E-02,    2.73649E-03,    2.45761E 06,   -3.63086E 07,
9390      6.70377E-02,    9.58862E-05,    2.47342E 06,   -4.86735E 07,
9400      1.49018E-01,   -6.11068E-04,    9.56539E 04,    7.23735E 06,
9410      7.70649E-02,   -3.06945E-05,   -9.04622E 05,    1.12684E 07,
9420     -1.03902E-01,    7.61102E-04,   -9.50084E 05,    2.01104E 07,
9430      9.38110E-01,   -4.42073E-02,    0.          ,   0.          ,
9440     -4.20851E-01,    7.52320E-02,    0.          ,   0.          ,
9450      5.39595E-02,    7.52899E-02,    9.76562E-01,    7.95491E-01,
9460     -1.45327E-01,    7.48273E-03,    0.          ,   0.          ,
9470 VH(1,1,15)=
9480     -8.80630E-01,   -1.01729E-02,    1.89105E 07,    8.90588E 07,
9490      1.68366E-01,    1.70121E-02,   -1.23136E 06,   -2.82470E 07,
9500      1.68374E-01,    8.83628E-03,   -9.96441E 05,   -3.87026E 07,
9510      1.02403E-01,    2.74176E-03,   -1.92087E 06,   -2.75611E 07,
9520     -8.41002E-03,    8.65596E-06,   -2.13301E 06,   -1.56124E 07,
9530     -2.09043E-01,    2.00630E-03,    2.39231E 05,   -4.62615E 05,
9540     -1.74541E-01,    1.39651E-03,    5.98867E 05,   -3.31498E 06,
9550     -1.55372E-01,    5.68482E-03,   -7.16180E 04,    8.76392E 06,
9560     -5.19783E-02,    3.79682E-05,    1.17732E 06,   -8.87888E 06,
9570      1.44227E-02,   -4.16940E-04,    1.27040E 06,   -1.45998E 07,
9580      7.93572E-02,    2.18140E-04,    1.79099E 05,    2.20510E 06,
9590      5.17070E-02,    1.62226E-04,   -4.43506E 05,    3.12954E 06,
9600     -5.31128E-02,    1.14929E-04,   -5.42054E 05,    8.08736E 06,
9610      2.44892E-01,   -2.41492E-02,    0.          ,   0.          ,
9620     -3.41919E-01,    3.86477E-02,    0.          ,   0.          ,
9630     -9.88137E-02,    3.86158E-02,   -7.85464E-03,    3.87491E-01,
9640     -6.17626E-02,    3.21297E-03,    0.          ,   0.          ,
9650 VH(1,1,16)=
9660     -2.86319E-02,   -5.98973E-04,    7.23115E 05,    9.96041E 06,
9670      9.32566E-02,    9.76378E-03,   -9.15459E 05,   -1.96157E 07,
9680     -2.44398E-01,    9.64697E-03,   -4.72482E 06,    1.73793E 07,
9690     -4.23547E-01,    1.64043E-02,   -2.02195E 06,    4.34775E 07,
9700     -3.64035E-01,    2.20084E-02,    1.07347E 04,    4.19019E 07,
9710     -3.82090E-01,    3.67565E-02,    5.86612E 05,   -4.23775E 06,
9720     -1.04342E-01,    3.34063E-02,    1.10841E 06,   -1.55439E 07,
9730      6.74736E-02,    1.13230E-02,   -9.09714E 05,   -2.11327E 07,
9740      5.58244E-01,    1.69033E-02,   -4.38496E 06,   -6.28921E 07,
9750      2.58352E-01,    9.14973E-03,   -6.61266E 06,   -4.45234E 07,
9760     -6.55526E-01,   -1.36148E-02,   -5.09073E 06,    4.01523E 06,
9770     -7.67344E-01,   -9.00441E-03,    3.25542E 06,    3.27880E 07,
9780      4.85856E-01,    2.68077E-03,    6.58801E 06,   -1.72680E 07,
9790      1.42877E-01,    4.34713E-03,    0.          ,   0.          ,
9800      1.07141E-01,   -5.29669E-03,    0.          ,   0.          ,
9810      7.43258E-02,   -5.25654E-03,    4.42341E-05,    2.90952E-02,
9820      2.56122E-01,   -1.53058E-02,    0.          ,   0.          ,
9830 VH(1,1,17)=
9840     -5.37854E-02,   -1.13185E-03,    1.64159E 06,    2.15377E 07,
9850      2.00853E-01,    1.99454E-02,   -2.67299E 06,   -4.59547E 07,
9860     -5.34985E-01,    1.85198E-02,   -6.47760E 06,    2.96734E 07,
9870     -6.45908E-01,    2.78172E-02,   -8.75192E 05,    5.13411E 07,
9880     -4.12002E-01,    3.33706E-02,    2.32413E 06,    3.23168E 07,
9890     -5.72103E-02,    3.73935E-02,    1.67690E 05,   -4.35808E 06,
9900      1.83422E-01,    3.45559E-02,   -3.76652E 04,   -1.19583E 07,
9910      4.18451E-01,    8.37344E-03,    7.92823E 05,   -3.39153E 07,
9920      1.00606E-02,    9.26073E-03,   -4.13298E 06,   -4.29428E 07,
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9930    -2.07272E-01,    4.04635E-03,   -3.60123E 06,   -2.91402E 07,
9940     3.89464E-01,    1.67788E-02,    6.71787E 06,   -2.26149E 06,
9950     8.65486E-01,    1.59527E-02,   -2.05782E 06,   -6.03377E 07,
9960    -4.40958E-01,   -1.37905E-03,   -7.26848E 06,   -2.16903E 07,
9970     4.06338E-01,    2.53751E-02,    0.          ,   0.          ,
9980     4.59992E-01,   -2.35185E-02,    0.          ,   0.          ,
9990     3.14452E-01,   -2.33117E-02,    1.04195E-02,    3.19781E-01,
10000   -5.24439E-03,    5.12635E-03,    0.          ,   0.          ,
10010 VH(1,1,18)=
10020   -4.12063E-02,   -7.73115E-04,    1.53016E 06,    1.51822E 07,
10030    1.43279E-01,    1.10665E-02,   -2.77044E 06,   -2.68477E 07,
10040    4.28485E-02,    3.67569E-03,    6.69870E 06,   -4.03851E 07,
10050    4.89581E-01,   -9.94316E-03,    3.59349E 06,   -9.02048E 07,
10060    5.00264E-01,   -2.19298E-02,    1.11379E 05,   -9.32014E 07,
10070    8.51138E-01,   -6.03422E-02,   -1.70655E 06,    9.86712E 06,
10080    3.34923E-01,   -5.21016E-02,   -3.44370E 06,    3.89747E 07,
10090   -3.64077E-01,   -1.92725E-02,   -1.30419E 06,    3.38487E 07,
10100   -4.68709E-01,   -2.06712E-02,    7.22704E 06,    7.90403E 07,
10110   -1.17659E-02,   -1.04423E-02,    9.10701E 06,    5.23352E 07,
10120   -6.63707E-02,   -1.28518E-02,   -3.86450E 06,   -1.92079E 07,
10130   -5.16992E-01,   -1.76226E-02,    9.78846E 05,    3.41696E 07,
10140    2.62429E-01,   -5.21203E-03,    4.69818E 06,    3.39454E 07,
10150    4.22956E-01,    3.36285E-02,    0.          ,   0.          ,
10160    5.17771E-01,   -2.47608E-02,    0.          ,   0.          ,
10170    3.65224E-01,   -2.44838E-02,   -7.80533E-03,   -1.33486E-01,
10180   -2.67997E-01,    4.95160E-03,    0.          ,   0.          ,
10190 VH(1,1,19)=
10200    1.30447E-03,   -5.01004E-06,   -6.82076E 04,    6.59596E 05,
10210    1.58221E-03,    1.43969E-03,    7.37522E 04,   -5.28104E 06,
10220   -5.62334E-02,    3.90226E-05,   -1.53015E 06,   -4.62624E 06,
10230   -1.37904E-01,    4.50067E-04,   -2.92432E 05,    4.69011E 06,
10240   -1.19359E-01,    1.00593E-03,    7.39792E 05,    2.94928E 06,
10250   -9.35606E-02,    8.20417E-04,    1.98413E 05,   -3.72765E 05,
10260   -7.05886E-02,    3.26033E-04,    4.82451E 05,   -2.66986E 06,
10270    2.50083E-01,   -9.13756E-04,    2.78803E 06,   -1.01064E 07,
10280   -2.14437E-01,   -3.63572E-03,    1.65111E 06,    1.40835E 07,
10290   -8.02800E-02,   -1.52563E-03,    2.90079E 06,    5.43413E 06,
10300   -2.07587E-02,   -1.09388E-02,    1.08755E 06,   -7.59524E 07,
10310   -7.64575E-02,   -2.30819E-02,    2.31076E 06,   -4.36577E 07,
10320    1.69166E-01,   -2.08757E-02,    1.81877E 06,    1.66349E 07,
10330   -1.53240E-02,   -1.97817E-03,    0.          ,   0.          ,
10340   -2.69858E-02,    1.24017E-03,    0.          ,   0.          ,
10350   -1.93778E-02,    1.22341E-03,   -2.63441E-03,    6.70793E-03,
10360   -7.02990E-01,    1.52014E-02,    0.          ,   0.          ,
10370 VH(1,1,20)=
10380   -5.20245E-04,   -6.72525E-05,    2.61779E 03,    2.65847E 06,
10390    1.36699E-02,    3.80643E-03,   -1.49221E 05,   -1.38496E 07,
10400   -3.14436E-02,   -1.96902E-03,   -9.66779E 05,   -3.04386E 07,
10410   -1.16604E-01,   -6.48811E-03,   -2.61358E 04,   -2.09995E 07,
10420   -1.33893E-01,   -8.97125E-03,    1.03137E 06,   -1.88123E 07,
10430   -1.59672E-01,   -1.61984E-02,    3.07129E 05,    2.08421E 06,
10440   -2.26640E-01,   -1.53774E-02,    1.03781E 06,    2.19074E 06,
10450    3.75578E-01,   -8.62385E-03,    5.66529E 06,   -9.78733E 06,
10460   -3.23069E-01,   -1.46480E-02,    4.53815E 06,    4.40903E 07,
10470   -2.93968E-02,   -8.46665E-03,    6.18685E 06,    2.93204E 07,
10480    9.59077E-02,    5.78200E-03,   -3.24374E 06,    7.62109E 07,
10490   -1.82012E-01,    1.56859E-02,   -2.72977E 06,    7.46267E 07,
10500   -7.19922E-02,    2.08493E-02,    4.92383E 05,    9.28470E 06,
10510    1.36495E-02,   -7.86598E-05,    0.          ,   0.          ,
10520   -4.29572E-03,    2.37816E-04,    0.          ,   0.          ,
10530   -2.81988E-03,    2.36388E-04,    1.32392E-03,   -1.69408E-02,
10540    6.26415E-01,   -1.29828E-02,    0.          ,   0.          ,
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10550 VH(1,1,21)=
10560     1.28132E-03,  -2.73493E-05,  -1.02671E 05,   2.03941E 06,
10570     8.19146E-03,   3.67559E-03,   1.17133E 05,  -1.64916E 07,
10580    -2.13565E-01,   1.56101E-03,  -4.43713E 06,   3.48182E 06,
10590    -3.75929E-01,   5.27423E-03,   2.99669E 05,   2.20776E 07,
10600    -2.26344E-01,   7.26402E-03,   3.28477E 06,   6.21778E 06,
10610     9.23863E-01,  -2.49498E-02,  -2.45340E 06,   7.56531E 06,
10620     5.57048E-01,  -1.71080E-02,  -5.55078E 06,   3.96762E 07,
10630    -3.09407E-02,  -2.82757E-03,  -1.19297E 06,   2.64379E 06,
10640    -1.10912E-01,  -3.15951E-03,   1.07107E 06,   7.70546E 06,
10650    -2.97160E-02,  -1.86691E-03,   1.81622E 06,   3.48022E 06,
10660     2.59797E-02,  -5.01944E-05,  -3.58628E 05,   4.64654E 06,
10670    -3.50127E-02,   1.35957E-04,  -2.97313E 05,   8.18881E 06,
10680     3.18629E-03,   1.26489E-03,   2.72088E 05,   4.15155E 06,
10690    -2.86710E-02,  -3.48276E-03,   0.          ,  0.          ,
10700    -3.47255E-02,   1.45735E-03,   0.          ,  0.          ,
10710    -2.58980E-02,   1.42741E-03,  -4.90738E-03,  -1.27135E-02,
10720     2.93878E-02,  -4.60035E-04,   0.          ,  0.          ,
10730 VH(1,1,22)=
10740    -7.83249E-04,  -7.30686E-05,   1.88423E 04,   4.09682E 06,
10750     1.79580E-02,   6.56251E-03,  -2.68071E 05,  -3.54213E 07,
10760     9.53285E-02,  -8.92285E-03,   1.48683E 06,  -8.14487E 07,
10770     1.43804E-02,  -2.33140E-02,   1.31889E 05,  -6.76934E 07,
10780    -1.27199E-01,  -3.05050E-02,   8.15292E 05,  -4.49024E 07,
10790     7.90323E-01,  -8.31021E-02,  -2.81904E 06,   2.16177E 07,
10800     6.86949E-02,  -6.64819E-02,  -4.85741E 06    7.53374E 07,
10810    -1.17435E-01,  -1.83253E-02,   4.58573E 06,   1.04452E 07,
10820     6.42924E-01,  -1.70083E-03,  -5.72128E 06,   6.21961E 07,
10830     1.55366E-01,   1.34420E-03,  -1.08847E 07,   1.03729E 08,
10840    -1.84055E-01,   7.56587E-04,   8.90689E 05,  -1.55026E 07,
10850     1.55135E-01,   1.81172E-03,   1.83564E 06,  -3.75558E 07,
10860    -1.92945E-02,  -4.11625E-03,  -1.57261E 06,  -2.74509E 07,
10870     2.96756E-02,   2.55107E-03,   0.          ,  0.          ,
10880     7.82389E-03,  -3.65777E-04,   0.          ,  0.          ,
10890     5.60086E-03,  -3.58744E-04,   3.87239E-03,   4.95316E-03,
10900    -7.48831E-02,   2.90616E-04,   0.          ,  0.          ,
10910 VH(1,1,23)=
10920    -2.03195E-01,  -4.20088E-02,  -2.43757E 07,   3.18734E 09,
10930    -2.84942E-02,  -1.06546E-02,   1.46759E 05,   7.13333E 07,
10940     2.82173E-03,   4.30912E-04,  -5.19301E 04,  -6.74423E 05,
10950     1.12758E-04,   3.26977E-04,  -9.22111E 04,  -5.38552E 05,
10960    -3.01905E-03,   2.73104E-04,  -7.26085E 04,  -3.44882E 05,
10970     1.30504E-02,  -2.74826E-04,  -5.02931E 04,   1.35508E 05,
10980     7.05503E-03,  -1.27336E-04,  -1.11455E 05,   7.49561E 05,
10990    -3.60661E-03,   3.27220E-04,   4.07103E 04,  -2.23783E 04,
11000     9.70209E-04,   2.46001E-04,   1.45196E 04,  -1.13985E 06,
11010     1.48073E-03,   1.27125E-04,  -4.43845E 03,  -1.47507E 06,
11020    -3.78157E-04,  -1.88804E-05,  -1.37673E 03,   1.42879E 04,
11030     2.96727E-04,   4.13617E-06,   3.37007E 03,   3.30789E 04,
11040    -1.24997E-04,   5.96241E-06,  -5.38022E 03,   1.98087E 04,
11050     1.26022E-02,   1.28864E-03,   0.          ,  0.          ,
11060    -9.89320E-04,  -2.09616E-05,   0.          ,  0.          ,
11070    -1.15356E-03,  -2.31673E-05,   2.94946E-04,  -1.11766E-02,
11080     1.30891E-04,   4.24523E-06,   0.          ,  0.          ,
11090 VH(1,1,24)=
11100    -2.71932E-03,  -5.45656E-04,  -4.41595E 05,   4.70686E 07,
11110     1.13667E-01,   4.17670E-02,  -3.95442E 05,  -3.12713E 08,
11120    -1.30247E-01,  -8.65938E-03,   3.05919E 05,  -1.03074E 07,
11130    -7.02783E-02,  -1.03461E-02,   3.05940E 06,  -1.07633E 07,
11140     5.26723E-02,  -1.21876E-02,   3.24148E 06,  -1.71621E 07,
11150    -4.24239E-01,  -7.14600E-03,   1.71231E 06,  -1.78247E 05,
11160    -3.10668E-01,  -9.53845E-03.   4.21807E 06,  -1.51003E 07,
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      1.56761E-01,   -2.20481E-02,   -1.05488E 06,    2.56887E 06,
      3.67466E-02,   -1.62995E-02,   -1.48987E 06,    8.09276E 07,
     -6.13423E-02,   -8.19132E-03,   -1.27321E 06,    1.10273E 08,
     -2.27203E-02,    6.02946E-04,   -6.28833E 04,   -1.89459E 06,
      1.22442E-02,    3.93836E-04,    3.00412E 05,   -5.89325E 06,
     -8.56527E-05,   -5.42994E-04,   -1.66853E 05,   -5.62394E 06,
     -8.41412E-01,   -1.09983E-01,    0.          ,   0.          ,
      1.42176E-01,   -7.49397E-05,    0.          ,   0.          ,
      1.45639E-01,    1.85013E-04,   -1.74447E-01,    1.75073E-01,
     -8.78646E-03,   -2.67248E-04,    0.          ,   0.          ,
 VH(1,1,25)=
     -6.30607E-04,   -2.82097E-04,   -4.29355E 05,    2.73009E 07,
      8.59402E-02,    2.83799E-02,    2.65513E 05,   -2.23792E 08,
     -2.40435E-01,   -1.55178E-02,   -3.17609E 06,   -6.86614E 07,
     -3.54453E-01,   -2.41944E-02,    5.27672E 06,   -4.04041E 07,
     -8.14389E-02,   -2.99816E-02,    9.04563E 06,   -5.15333E 07,
     -9.98721E-01,   -3.16866E-02,    4.10661E 06,    4.03517E 06,
     -8.04292E-01,   -3.47872E-02,    1.05357E 07,   -2.58072E 07,
      4.93977E-01,   -6.58036E-02,   -2.90433E 06,    6.17331E 06,
      1.02594E-01,   -5.10866E-02,   -4.45479E 06,    2.49027E 08,
     -1.90241E-01,   -2.58601E-02,   -3.64472E 06,    3.42530E 08,
     -1.21160E-01,    8.62564E-05,   -6.90206E 05,   -6.83973E 06,
      7.09214E-02,    1.68982E-03,    1.65992E 06,   -1.67542E 07,
     -1.34336E-02,   -1.23326E-03,   -1.33016E 06,   -1.79269E 07,
      7.40008E-01,    1.07669E-01,    0.          ,   0.          ,
     -1.56535E-01,    6.77511E-04,    0.          ,   0.          ,
     -1.56584E-01,    3.87727E-04,    2.08020E-01,   -7.94858E-01,
     -1.59143E-02,   -3.11514E-04,    0.          ,   0.          ,
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      8.88556E-03,    3.05128E-03,    3.93721E 03,   -2.45551E 07,
      6.93512E-03,   -1.56331E-03,    2.52463E 05,   -5.89063E 06,
      2.09814E-03,   -2.54290E-03,    9.49982E 04,   -3.82573E 06,
     -7.87714E-03,   -2.85577E-03,    1.48970E 05,   -1.03904E 06,
     -1.83787E-03,   -4.71050E-03,   -1.84712E 04,    1.43634E 06,
     -2.85617E-02,   -3.84131E-03,    1.06158E 05,    3.46023E 06,
     -1.91510E-03,   -2.24375E-03,    5.59625E 04,    5.35155E 05,
      8.48804E-02,   -9.59047E-05,   -2.23566E 06,    5.06000E 06,
     -6.31052E-02,   -3.44518E-04,   -2.53302E 06,    1.76773E 07,
      8.03848E-01,    2.63822E-02,    6.82699E 06,    2.91500E 07,
     -5.30779E-01,   -6.02442E-03,   -1.14531E 07,   -1.03317E 07,
      1.95141E-01,   -4.78980E-03,    1.25510E 07,    9.61752E 06,
      2.92689E-02,    4.61654E-03,    0.          ,   0.          ,
     -6.10017E-03,    1.34584E-05,    0.          ,   0.          ,
     -6.19136E-03,    1.74014E-06,   -1.40738E-03,    6.18373E-03,
     -1.33840E-01,   -9.78779E-03,    0.          ,   0.          ,
 VH(1,1,27)=
     -4.46971E-03,   -1.09238E-03,   -1.70359E 06,    1.14283E 08,
      3.72608E-01,    1.22330E-01,    7.95328E 05,   -1.04583E 09,
      1.35624E-01,   -2.12933E-02,    1.04776E 07,    1.78759E 08,
      5.63891E-01,    4.98442E-03,    3.07691E 05,    1.32479E 08,
      3.93030E-01,    2.19395E-02,   -8.32326E 06,    1.38993E 08,
      9.14673E-01,    7.02359E-02,   -3.78754E 06,   -1.72369E 07,
      9.50851E-01,    6.51428E-02,   -1.10422E 07,   -7.36723E 06,
     -5.91074E-01,    9.13877E-02,    2.39993E 06,   -7.67129E 06,
     -2.29285E-01,    7.49332E-02,    7.24304E 06,   -3.61007E 08,
      2.73607E-01,    3.82754E-02,    6.78686E 06,   -5.11801E 08,
     -3.36146E-02,   -7.35109E-03,   -7.78364E 05,   -5.46628E 05,
      3.74487E-02,   -1.31261E-03,    6.79812E 05,    2.80411E 07,
     -3.22644E-02,    3.02309E-03,   -1.47736E 06,    2.61546E 07,
      6.35673E-01,    1.18224E-01,    0.          ,   0.          ,
     -1.63853E-01,    7.46395E-04,    0.          ,   0.          ,
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11790    -1.63998E-01,     4.20347E-04,     8.92158E-02,    -3.16519E-01,
11800     5.79801E-02,     3.83027E-03,     0.          ,     0.          ,
11810 $END
11820 $LIST2
11830 TITLE= 'EEE-TCLS STATIC STRUCTURE SUBSYSTEM HORIZONTAL ',
11840 ISUB= 8,
11850 XREF=    0.    ,
11860 YREF=    0.    ,
11870 ZREF=    0.    ,
11880 PTS=
11890    21,  -166.901,     0.    ,     0.    ,
11900    22,  -177.455,     0.    ,     0.    ,
11910    23,  -207.630,     0.    ,     0.    ,
11920    24,  -217.005,     0.    ,     0.    ,
11930    25,  -223.015,     0.    ,     0.    ,
11940    26,  -228.105,     0.    ,     0.    ,
11950    27,  -234.550,     0.    ,     0.    ,
11960    28,  -237.915,     0.    ,     0.    ,
11970    29,  -250.915,     0.    ,     0.    ,
11980    30,  -255.555,     0.    ,     0.    ,
11990    31,  -262.265,     0.    ,     0.    ,
12000    32,  -270.225,     0.    ,     0.    ,
12010    33,  -278.575,     0.    ,     0.    ,
12020    34,  -172.156,     0.    ,     0.    ,
12030    35,  -194.778,     0.    ,     0.    ,
12040    36,  -201.040,     0.    ,     0.    ,
12050    37,  -269.475,     0.    ,     0.    ,
12060 XMODES=
12070      718.1,    2.19719E 04,     15.,  1,
12080     1340.9,    2.88367E 04,     15.,  1,
12090     4351.0,    1.52823E 05,     15.,  0,
12100     8541.4,    4.25520E 05,     15.,  0,
12110    11476.1,    1.59057E 06,     15.,  0,
12120    13130.8,    3.34561E 06,     15.,  0,
12130    17010.9,    4.35692E 06,     15.,  0,
12140    18937.3,    1.36996E 06,     15.,  0,
12150    21254.7,    2.25565E 06,     15.,  0,
12160    24718.5,    2.40308E 06,     15.,  0,
12170    27767.5,    1.99155E 06,     15.,  0,
12180    28989.2,    2.40350E 06,     15.,  0,
12190    31862.5,    9.04811E 06,     15.,  0,
12200    38147.3,    3.02281E 07,     15.,  0,
12210    39415.9,    3.10641E 07,     15.,  0,
12220    43312.3,    1.44536E 07,     15.,  0,
12230    46780.5,    3.11669E 07,     15.,  0,
12240    50137.3,    3.79795E 07,     15.,  0,
12250    53499.2,    7.37532E 06,     15.,  0,
12260    54900.8,    1.30214E 07,     15.,  0,
12270    59089.0,    4.92561E 06,     15.,  0,
12280    65253.4,    2.09262E 07,     15.,  0,
12290    71143.9,    1.71715E 08,     15.,  0,
12300    74501.5,    3.53742E 07,     15.,  0,
12310    75901.1,    6.22727E 07,     15.,  0,
12320    76633.7,    2.15732E 07,     15.,  0,
12330    78499.1,    2.18467E 08,     15.,  0,
12340 VH(1,1,1)=
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12360     8.20132E-01,    -8.87836E-03,    -1.77521E 03,     9.39965E 03,
12370     5.52484E-01,    -8.80280E-03,     1.33922E 04,     6.10279E 05,
12380     4.71475E-01,    -8.70364E-03,     1.23607E 04,     4.90747E 05,
12390     4.20028E-01,    -8.64608E-03,     1.17484E 04,     4.19212E 05,
12400     3.76536E-01,    -8.56820E-03,    -1.44231E 02,     4.05946E 02,
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12410     3.21301E-01,   -8.56775E-03,   -3.59912E 02,    2.35667E 03,
12420     2.92863E-01,   -8.54820E-03,    3.57646E 02,    1.77274E 03,
12430     1.[illegible]727E-01,   -8.48683E-03,    8.69749E 03,    1.41783E 05,
12440     1.45026E-01,   -8.47158E-03,    8.46689E 03,    1.03461E 05,
12450     8.99227E-02,   -8.40968E-03,    7.64486E 03,    1.31058E 05,
12460     2.52872E-02,   -8.34548E-03,    7.48574E 03,    7.47013E 04,
12470    -4.27756E-02,   -8.32638E-03,    7.49549E 03,    1.77254E 04,
12480     8.67363E-01,   -8.89045E-03,    0.          ,    0.          ,
12490     6.65120E-01,   -9.11816E-03,    0.          ,    0.          ,
12500     6.10404E-01,   -8.88934E-03,   -2.36582E-04,    9.87605E-04,
12510     3.05529E-02,   -8.34156E-03,    0.          ,    0.          ,
12520 VH(1,1,2)=
12530     1.52489E-01,   -8.93432E-03,   -4.43123E 03,    2.18599E 05,
12540     5.12780E-02,   -8.52635E-03,   -5.26566E 02,    1.85894E 04,
12550    -2.06096E-01,   -8.36568E-03,    1.42434E 03,    1.30119E 06,
12560    -2.83383E-01,   -8.12734E-03,    3.17095E 03,    1.28493E 06,
12570    -3.31537E-01,   -7.96538E-03,    4.65219E 03,    1.26470E 06,
12580    -3.72595E-01,   -7.67315E-03,    4.70933E 02,    9.68582E 01,
12590    -4.22001E-01,   -7.67375E-03,    1.33967E 03,   -4.20868E 03,
12600    -4.47680E-01,   -7.62796E-03,   -2.82083E 03,   -2.57957E 04,
12610    -5.40243E-01,   -7.28592E-03,    2.21592E 04,    9.85807E 05,
12620    -5.71926E-01,   -7.18987E-03,    2.48710E 04,    8.80965E 05,
12630    -6.10956E-01,   -6.80933E-03,    3.96911E 04,    9.06997E 05,
12640    -6.51173E-01,   -6.39503E-03,    4.53105E 04,    5.75911E 05,
12650    -6.93656E-01,   -6.25887E-03,    5.26491E 04,    1.76509E 05,
12660     9.67029E-02,   -8.54877E-03,    0.          ,    0.          ,
12670    -9.64454E-02,   -8.58004E-03,    0.          ,    0.          ,
12680    -1.50417E-01,   -8.57278E-03,    4.60775E-05,   -9.83258E-05,
12690    -6.43715E-01,   -6.30396E-03,    0.          ,    0.          ,
12700 VH(1,1,3)=
12710     2.14681E-01,   -1.08090E-02,   -6.37535E 04,    2.82208E 06,
12720     3.82022E-03,   -5.49181E-03,   -1.31343E 03,    1.20760E 05,
12730    -1.56499E-01,   -3.71339E-03,    9.75354E 04,    1.45750E 07,
12740    -1.72625E-01,   -1.12891E-03,    1.10036E 05,    1.36200E 07,
12750    -1.67939E-01,    5.56411E-04,    1.18697E 05,    1.29347E 07,
12760    -1.65430E-01,    3.41572E-03,    2.32020E 03,   -6.20695E 03,
12770    -1.43210E-01,    3.40870E-03,    5.82468E 03,   -3.71087E 04,
12780    -1.26726E-01,    4.04730E-03,   -5.55080E 03,   -2.56072E 04,
12790    -1.83097E-02,    6.95566E-03,    1.61386E 05,    8.80139E 06,
12800     2.93175E-02,    7.79503E-03,    1.61163E 05,    8.00977E 06,
12810     1.26382E-01,    9.77587E-03,    1.42113E 05,    3.92383E 06,
12820     2.53187E-01,    1.13707E-02,    1.25099E 05,    2.69176E 06,
12830     3.74453E-01,    1.18813E-02,    8.98956E 04,    1.52984E 06,
12840     3.45367E-02,   -5.64247E-03,    0.          ,    0.          ,
12850    -3.31808E-02,   -5.82646E-03,    0.          ,    0.          ,
12860    -1.29683E-01,   -5.82487E-03,   -4.32787E-05,    3.09201E-03,
12870     3.20578E-01,    1.21081E-02,    0.          ,    0.          ,
12880 VH(1,1,4)=
12890     3.99370E-02,   -5.56516E-03,   -6.22211E 04,    5.29189E 06,
12900    -1.58508E-01,    4.04085E-03,    5.10066E 04,   -4.55650E 05,
12910     2.58307E-02,    4.92407E-03,    8.21173E 05,    8.52753E 06,
12920     1.43751E-01,    5.64988E-03,    7.96403E 05,    8.06420E 05,
12930     2.22142E-01,    5.43408E-03,    7.60663E 05,   -3.97099E 06,
12940     3.02850E-01,    3.07863E-03,   -1.57488E 04,    8.69369E 03,
12950     3.21165E-01,    3.10608E-03,   -4.33492E 04,    1.69797E 05,
12960     3.59708E-01,    3.06734E-03,    8.92473E 04,    7.81863E 05,
12970     3.93502E-01,   -2.23407E-03,    2.21355E 05,   -1.99562E 07,
12980     3.79658E-01,   -3.99102E-03,    1.44630E 05,   -2.07283E 07,
12990     2.74263E-01,   -8.78029E-03,   -2.06952E 05,   -1.27508E 07,
13000     8.28274E-02,   -1.34115E-02,   -2.77655E 05,   -1.00513E 07,
13010    -1.05959E-01,   -1.51702E-02,   -2.78697E 05,   -6.34278E 06,
13020    -1.88554E-01,    4.67999E-03,    0.          ,    0.          ,
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13090      5.59418E-02,  -1.50387E-03,   8.53657E 05,  -7.34753E 06,
13100      1.04358E-01,  -3.71372E-03,   8.10721E 05,  -1.50750E 07,
13110      1.21345E-01,  -5.93831E-03,   7.70913E 05,  -1.97004E 07,
13120      1.53795E-01,  -1.21008E-02,  -1.60941E 04,   1.00789E 05,
13130      7.46016E-02,  -1.20173E-02,  -3.36289E 04,   3.98296E 05,
13140      5.12730E-02,  -1.42472E-02,  -2.86965E 04,  -7.21942E 05,
13150     -9.42849E-02,  -2.18204E-02,   7.21754E 05,  -3.4483      ,
13160     -1.75904E-01,  -2.46911E-02,   7.69874E 05,  -3.6965
13170     -1.52090E-01,  -1.93737E-02,   1.25217E 06,   2.3783
13180      9.73635E-02,  -7.80591E-03,   1.28533E 06,   1.50803
13190      3.01963E-01,  -4.18113E-03,   1.13528E 06,   5.89881
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13210      1.19714E-02,  -9.56824E-04,   0.          ,  0.          ,
13220      5.97940E-03,  -9.56666E-04,  -9.34320E-04,  -8.55197E-03,
13230      9.95393E-01,  -3.54395E-03,   0.          ,  0.          ,
13240 VH(1,1,6)=
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13270     -1.03730E-01,   1.29668E-02,  -5.12506E 05,  -2.74309E 07,
13280     -4.12408E-02,   8.36956E-03,  -4.68400E 05,  -2.33804E 07,
13290     -2.56256E-02,   5.56690E-03,  -4.54184E 05,  -2.08652E 07,
13300     -1.38914E-02,   1.41149E-03,   1.95394E 03,  -1.47522E 04,
13310     -4.65790E-03,   1.39984E-03,   3.78827E 03,  -5.44847E 04,
13320     -1.63865E-02,   4.13678E-04,  -7.41460E 03,  -4.34602E 04
13330     -1.12833E-01,  -3.17239E-03,  -3.22862E 05,  -8.86319E 06,
13340     -1.50414E-01,  -4.04429E-03,  -2.61739E 05,  -7.31007E 06,
13350     -1.57098E-01,  -2.70269E-03,   1.71568E 05,   8.79428E 06,
13360     -7.93752E-02,   8.02184E-04,   2.80749E 05,   7.03649E 06,
13370      4.02365E-03,   2.17926E-03,   3.27361E 05,   4.05889E 06,
13380     -9.63229E-01,   2.62653E-02,   0.          ,  0.          ,
13390     -3.08355E-01,   3.26022E-02,   0.          ,  0.          ,
13400     -1.04[illegible]E-01,   3.25966E-02,   4.74352E-02,  -1.65259E-01,
13410      2.04103E-01,   2.76574E-03,   0.          ,  0.          ,
13420 VH(1,1,7)=
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13440     -1.75274E-01,   2.00732E-02,   2.82611E 05,  -7.30264E 06,
13450      4.47143E-01,   1.36572E-02,  -6.16900E 05,  -4.17116E 07,
13460      4.73693E-01,   6.66598E-03,  -1.15723E 06,  -3.44155E 07,
13470      4.25129E-01,   2.77842E-03,  -1.50874E 06,  -2.67173E 07,
13480      3.7[illegible]243E-01,  -1.11756E-03,  -7.79588E 04,   1.15425E 05,
13490      3.56779E-01,  -9.38300E-04,  -2.05178E 05,   1.01447E 06,
13500      2.94979E-01,   2.44578E-03,   3.23967E 05,   3.02975E 06,
13510     -2.14263E-01,   1.65704E-03,  -2.75652E 06,   3.72777E 07,
13520     -3.33708E-01,   4.29926E-03,  -2.54445E 06,   4.93225E 07,
13530     -4.08840E-01,   8.86959E-03,  -1.05177E 0[illegible],   2.49889E 07,
13540     -3.55561E-01,   1.40864E-02,  -4.77767E 05,   2.79473E 07,
13550     -2.08976E-01,   1.78520E-02,   4.65700E 04,   2.33756E 07,
13560     -6.23521E-01,   4.18431E-02,   0.          ,  0           ,
13570      3.80799E-01,   7.08250E-02,   0.          ,  [illegible]  ,
13580      8.26058E-01,   7.09077E-02,  -2.13531E-02,   6.59976E-02,
13590     -2.34059E-01,   2.18171E-02,   0.          ,  0.          ,
13600 VH(1,1,8)=
13610     -2.18343E-03,  -1.43600E-04,   6.74745E 03,   6.01845E 05,
13620     -1.37198E-02,   8.64072E-04,   2.51777E 04,  -4.14660E 05,
13630      1.86370E-02,  -1.31687E-05,   7.59753E 03,  -6.52813E 06,
13640      1.35027E-02,  -1.21242E-03,  -1.70015E 04,  -6.42049E 06,
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13650     2.63972E-03,   -2.01271E-03,   -2.50089E 04,   -6.16636E 06,
13660    -5.96328E-03,   -3.46993E-03,    4.02223E 02,    6.22465E 04,
13670    -2.80471E-02,   -3.43296E-03,    8.28692E 03,    1.462C[illegible] 05,
13680    -5.38512E-02,   -5.21847E-03,   -1.33051E 05,   -1.73598E 06,
13690    -5.63970E-02,   -4.61[illegible]1E-03,    3.38511E 05,   -4.65670E 06,
13700    -5.95034E-02,   -4.91252E-03,    3.95733E 05,   -5.82054E 06,
13710     6.38105E-02,    1.63318E-03,    7.06641E 05,    2.46580E 07,
13720     3.25264E-01,    1.07170E-02,    3.84650E 05,    1.82400E 07,
13730     4.34111E-01,    1.33159E-02,   -4.68293E 05,    1.34968E 07,
13740    -5.60644E-02,    2.97062E-03,    0          ,    0.         ,
13750     1.80942E-02,    5.82219E-03,    0.         ,    0.         ,
13760     5.47088E-02,    5.82909E-03,   -7.48084E-03,   -4.80868E-03,
13770    -9.80657E-01,    1.48796E-02,    0.         ,    0.         ,
13780 VH(1,1,9)=
13790    -2.22800E-02,   -2.80029E-04,    1.23472E 05,    9.26716E 05,
13800     1.36868E-01,    4.91465E-05,   -2.80902E 05,    6.51707E 05,
13810    -2.33808E-02,   -2.15116E-03,   -1.39818E 06,   -2.14008E 07,
13820    -1.66433E-01,   -4.65829E-03,   -1.22815E 06,   -8.41626E 06,
13830    -2.59999E-01,   -5.23750E-03,   -9.69581E 05,   -1.24441E 06,
13840    -3.71971E-01,   -3.28900E-03,    1.20218E 05,   -7.79490E 04,
13850    -3.81606E-01,   -3.50479E-03,    3.26688E 05,   -1.31651E 06,
13860    -4.91018E-01,   -1.48328E-02,    1.11305E 06,   -1.24253E 07,
13870    -1.59611E-02,    2.62540E-04,    2.32962E 06,   -7.94586E 06,
13880     1.13371E-01,    1.76439E-04,    2.27644E 06,   -1.87155E 07,
13890     2.34284E-01,   -3.16350E-03,    1.09175E 06,   -3.20849E 07,
13900     2.00359E-01,   -1.04373E-02,    5.69153E 05,   -3.58363E 07,
13910     9.51926E-02,   -1.52564E-02,    1.40928E 05,   -3.09884E 07,
13920    -3.23768E-01,    1.94220E-02,    0.         ,    0.         ,
13930     1.67977E-01,    5.05234E-02,    0.         ,    0.         ,
13940     4.86090E-01,    5.06008E-02,    2.40803E-02,    1.35257E-01,
13950     3.98582E-01,   -2.06693E-02,    0.         ,    0.         ,
13960 VH(1,1,10)=
13970    -7.68522E-03,   -7.21094E-04,    3.15660E 04,    5.31087E 06,
13980     3.05997E-01,    1.12700E-02,    2.41049E 06,   -1.37680E 07,
13990     1.34653E-01,    4.06295E-03,   -4.30635E 05,   -2.52254E 07,
14000     1.07002E-01,   -9.48765E-05,   -7.38934E 05,   -2.01240E 07,
14010     5.29027E-02,   -2.33069E-03,   -8.73176E 05,   -1.50902E 07,
14020    -9.33984E-03,   -4.35337E-03,    1.68177E 03,    1.32083E 05,
14030    -3.67229E-0[illegible]   -4.27618E-03,    1.98154E 04,    3.05906E 05,
14040    -1.77695E-01,   -1.40804E-02,   -8.66131E 05,   -1.16053E 07,
14050    -4.22573E-02,   -8.21684E-04,    5.04783E 05,    9.09759E 06,
14060    -8.83102E-03,    1.55396E-04,    5.50465E 05,    6.69647E 06,
14070     4.29077E-02,    2.28189E-04,    3.63277E 05,   -9.73023E 06,
14080     4.92966E-02,   -1.91848E-03,    2.12569E 05,   -1.15[illegible]0E 07,
14090     3.12007E-02,   -3.47745E-03,    5.72908E 04,   -1.[illegible]7E 07,
14100     3.01536E-01,   -8.02684E-03,    0.         ,    0.         ,
14110     4.40585E-02,   -3.55904E-02,    0.         ,    0.         ,
14120    -1.79991E-01,   -3.56322E-02,    4.43653E-02,   -1.56004E-02,
14130     1.00311E-01,   -5.43797E-03,    0.         ,    0.         ,
14140 VH(1,1,11)=
14150     5.77356E-03,   -1.08860E-04,   -6.65321E 04,    1.40621E 06,
14160     2.79163E-01,    1.22559E-03,   -1.05193E 06,    1.46731E 06,
14170     9.13503E-02,    1.57146E-03,    1.04404E 06,   -5.82783E 06,
14180     1.70898E-01,   -4.8[illegible]34E-04,    6.25227E 05,   -1.40529E 07,
14190     1.87515E-01,   -2.4[illegible]277E-03,    2.50497E 05,   -1.65050E 07,
14200     2.25576E-01,   -7.62610E-03,   -1.31475E 05,    4.64152E 05,
14210     1.65279E-01,   -7.16271E-03,   -3.11323E 05,    2.35348E 06,
14220    -7.43865E-02,   -2.60679E-02,   -1.46709E 06,   -2.37443E 07,
14230     1.17544E-01,   -2.52158E-03,   -3.12651E 04,    1.35649E 07,
14240     1.06065E-01,   -1.31958E-03,   -2.67602E 05,    1.47543E 07,
14250     1.55875E-02,    9.20563E-04,   -1.34162E 06,    2.39162E 07,
14260    -1.14477E-01,    4.23825E-03,   [illegible].16676E 06,    3.25380E 07,
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14270     -1.65819E-01,     8.13725E-03,    -5.12796E 05,     3.34717E 07,
14280     -1.28989E-01,     6.14888E-04,     0.          ,    0.          ,
14290     -8.57900E-02,    -2.54658E-02,     0.          ,    0.          ,
14300     -2.46758E-01,    -2.55328E-02,    -4.35042E-03,     2.33492E-02,
14310     -2.49841E-01,     1.52206E-02,     0.          ,    0.          ,
14320 VH(1,1,12)=
14330      1.02496E-03,    -3.86488E-04,    -3.59071E 04,     4.255[illegible]E 06,
14340      2.84501E-01,     5.32372E-03,    -1.14884E 06,    -2.38463E 06,
14350      1.24924E-01,     4.09690E-03,     1.66541E 05,    -1.46705E 07,
14360      1.47303E-01,     1.28416E-03,    -3.10456E 05,    -1.48263E 07,
14370      1.22701E-01,    -4.43544E-04,    -6.20305E 05,    -1.21120E 07,
14380      9.61349E-02,    -2.45506E-03,    -6.04761E 04,     1.81145E 05,
14390      7.50644E-02,    -2.26147E-03,    -1.46656E 05,     1.00291E 06,
14400      3.40453E-02,    -1.68234E-04,     1.57017E 05,     1.74462E 06,
14410     -2.00245E-01,    -8.76005E-05,    -5.31215E 05,     1.84852E 07,
14420     -2.03800E-01,     1.51896E-03,    -6.44906E 04,     1.96763E 07,
14430     -4.92166E-02,     8.65945E-04,     1.54481E 06,    -3.83668E 07,
14440      1.44551E-01,    -5.09298E-03,     1.77351E 06,    -5.22487E 07,
14450      2.33400E-01,    -1.14901E-02,     8.25340E 05,    -5.43533E 07,
14460     -1.98846E-01,     4.03927E-03,     0.          ,    0.          ,
14470     -6.85991E-02,    -4.96521E-02,     0.          ,    0.          ,
14480     -3.82317E-01,    -4.37679E-02,     7.24640E-04,     1.09064E-01,
14490      4.00737E-01,    -2.32687E-02,     0.          ,    0.          ,
14500 VH(1,1,13)=
14510     -2.73482E-02,    -7.09237E-04,     3.31143E 05,     7.20080E 06,
14520      4.88000E-02,     8.78981E-03,    -1.46372E 05,    -1.00420E 07,
14530     -3.53280E-02,     3.31517E-03,    -4.35954E 06,    -3.43543E 07,
14540     -3.56247E-01,     1.23488E-03,    -3.54628E 06,     3.17505E 06,
14550     -5.15688E-01,     2.89139E-03,    -2.34859E 06,     2.08180E 07,
14560     -7.91958E-01,     1.56426E-02,     5.98113E 05,    -1.56372E 06,
14570     -6.38465E-01,     1.38672E-02,     1.47026E 06,    -9.34188E 06,
14580     -2.97909E-01,     3.15508E-02,     9.80669E 05,     2.80668E 07,
14590      1.56154E-01,     4.03610E-03,     2.61554E 06,    -6.04388E 07,
14600      2.66775E-01,    -8.55084E-04,     2.03348E 06,    -7.18945E 07,
14610      1.63467E-01,    -2.92261E-03,    -1.67894E 06,     3.69125E 07,
14620     -6.27376E-02,     2.60411E-03,    -2.02925E 06,     5.27942E 07,
14630     -2.39622E-01,     8.90930E-03,    -1.17434E 06,     5.96007E 07,
14640     -4.38117E-01,     2.19233E-02,     0.          ,    0.          ,
14650      1.40968E-01,    -9.26286E-02,     0.          ,    0.          ,
14660     -4.44076E-01,    -9.28013E-02,    -4.31849E-02,     1.04887E-01,
14670     -4.16420E-01,     2.30900E-02,     0.          ,    0.          ,
14680 VH(1,1,14)=
14690      3.90274E-01,     2.43814E-03,    -8.02199E 06,     1.93135E 06,
14700      6.29585E-01,     4.84176E-02,    -4.50673E 06,    -7.20296E 07,
14710      3.12261E-01,     2.83008E-02,    -3.95620E 06,    -1.02063E 08,
14720      1.18341E-01,     1.31427E-02,    -5.37194E 06,    -6.66023E 07,
14730     -1.36308E-01,     6.63829E-03,    -5.36812E 06,    -3.68644E 07,
14740     -6.07385E-01,     1.23807E-02,     6.59574E 05,    -1.75157E 06,
14750     -4.69881E-01,     1.04125E-02,     1.60115E 06,    -1.03019E 07,
14760     -3.87535E-01,     1.76769E-02,    -2.44258E 05,     1.85315E 07,
14770     -6.52261E-02,     2.73649E-03,     2.45761E 06,    -3.63086E 07,
14780      6.70377E-02,     9.58862E-05,     2.47342E 06,    -4.86735E 07,
14790      1.49018E-01,    -6.11068E-04,     9.56539E 04,     7.23735E 06,
14800      7.70649E-02,    -3.06945E-05,    -9.04622E 05,     1.12684E 07,
14810     -1.03902E-01,     7.61102E-04,    -9.50084E 05,     2.01104E 07,
14820      9.38110E-01,    -4.42073E-02,     0.          ,    0.          ,
14830     -4.20851E-01,     7.52320E-02,     0.          ,    0.          ,
14840      5.39595E-02,     7.52899E-02,     9.76582E-01,     7.95491E-01,
14850     -1.45327E-01,     7.48273E-03,     0.          ,    0.          ,
14860 VH(1,1,15)=
14870     -8.80630E-01,    -1.01729E-02,     1.89105E 07,     8.90588E 07,
14880      1.68366E-01,     1.7[illegible]E-02,    -1.23136E 06,    -2.82470E 07,
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14890      1.68374E-01,     8.83628E-03,    -9.96441E 05,    -3.87026E 07,
14900      1 02403E-01,     2.74176E-03,    -1.92087E 06,    -2.75611E 07,
14910     -8.41002E-03,     8.65596E-06,    -2.13301E 06,    -1.56124E 07,
14920     -2.09043E-01,     2.00630E-03,     2.39231E 05,    -4.62615E 05,
14930     -1.74541E-01,     1.39651E-03,     5.98867E 05,    -3.31498E 06,
14940     -1.55372E-01.     5.68482E-03,    -7.16180E 04,     8.76392E 06,
14950     -5.19783E-02,     3.79682E-05,     1.17732E 06,    -8.87888E 06,
14960      1.44227E-02,    -4.16940E-04,     1.27040E 06,    -1.45998E 07,
14970      7.93572E-02,     2.18140E-04,     1.79099E 05,     2.20510E 06,
14980      5.17070E-02,     1.62226E-04,    -4.43506E 05,     3.12954E 06,
14990     -5.31128E-02,     1.14929E-04,    -5.42054E 05,     8.08736E 06,
15000      2.44892E-01,    -2.41492E-02,     0.          ,     0.          ,
15010     -3.41919E-01,     3.86477E-02,     0.          ,     0.          ,
15020     -9.88137E-02,     3.86158E-02,    -7.85464E-03,     3.87491E-01,
15030     -6.17626E-02,     3.21297E-03,     0.          ,     0.          ,
15040 VH(1,1,16)=
15050     -2.86319E-02,    -5.98973E-04,     7.23115E 05,     9.96041E 06,
15060      9.32566E-02,     9.76378E-03,    -9.15459E 05,    -1.96157E 07,
15070     -2.44398E-01,     9.64697E-03,    -4.72482E 06,     1.73793E 07,
15080     -4.23547E-01,     1.64043E-02,    -2.02195E 06,     4.34775E 07,
15090     -3.64035E-01,     2.20084E-02,     1.07347E 04,     4.19019E 07,
15100     -3.82090E-01,     3.67565E-02,     5.86612E 05,    -4.23775E 06,
15110     -1.04342E-01,     3.34063E-02,     1.10841E 06,    -1.55439E 07,
15120      6.74736E-02,     1.13230E-02,    -9.09714E 05,    -2.11327E 07,
15130      5.58244E-01,     1.69033E-02,    -4.38496E 06,    -6.28921E 07,
15140      2.58352E-01,     9.14973E-03,    -6.61266E 06,    -4.45234E 07,
15150     -6.55526E-01,    -1.36148E-02,    -5.09073E 06,     4.01523E 06,
15160     -7.67344E-01,    -9.00441E-03,     3.25542E 06,     3.27880E 07,
15170      4.85856E-01,     2.68077E-03,     6.58801E 06,    -1.72680E 07,
15180      1.42877E-01,     4.34713E-03,     0.          ,     0..         ,
15190      1.07141E-01,    -5.29869E-03,     0.          ,     0.          ,
15200      7.43258E-02,    -5.25654E-03,     4.42341E-05,     2.90952E-02,
15210      2.56122E-01,    -1.53058E-02,     0.          ,     0.          ,
15220 VH(1,1,17)=
15230     -5.37854E-02,    -1.13185E-03,     1.64159E 06,     2.15377E 07,
15240      2.00853E-01,     1.99454E-02,    -2.67299E 06,    -4.59547E 07,
15250     -5.34985E-01,     1.85198E-02,    -6.47760E 06,     2.96734E 07,
15260     -6.45908E-01,     2.78172E-02,    -8.75192E 05,     5.13411E 07,
15270     -4.12002E-01,     3.33706E-02,     2.32413E 06,     3.23168E 07,
15280     -5.72103E-02,     3.73935E-02,     1.67690E 05,    -4.35808E 06,
15290      1.83422E-01,     3.45559E-02,    -3.76652E 04,    -1.19583E 07,
15300      4.18451E-01,     8.37344E-03,     7.92823E 05,    -3.39153E 07,
15310      1.00606E-02,     9.26073E-03,    -4.13298E 06,    -4.29428E 07,
15320     -2.07272E-01,     4.04635E-03,    -3.60123E 06,    -2.91402E 07,
15330      3.89464E-01,     1.67788E-02,     6.71787E 06,    -2.26149E 06,
15340      8.65486E-01,     1.59527E-02,    -2.05782E 06,    -6.03377E 07,
15350     -4.40958E-01,    -1.37905E-03,    -7.26848E 06,    -2.16903E 07,
15360      4.06338E-01,     2.53751E-02,     0.          ,     0.          ,
15370      4.59992E-01,    -2.35185E-02,     0.          ,     0.          ,
15380      3.14452E-01,    -2.33117E-02,     1.04195E-02,     3.19781E-01,
15390     -5.24439E-03,     5.12635E-03,     0.          ,     0.          ,
15400 VH(1,1,18)=
15410     -4.12063E-02,    -7.73115E-04,     1.53046E 06,     1.51822E 07,
15420      1.43279E-01,     1.10665E-02,    -2.77044E 06,    -2.68477E 07,
15430      4.28485E-02,     3.67569E-03,     6.69870E 06,    -4.03851E 07,
15440      4.89581E-01,    -9.94316E-03,     3.59349E 06,    -9.02048E 07,
15450      5.00264E-01,    -2.19298E-02,     1.11379E 05,    -9.32014E 07,
15460      8.51138E-01,    -6.03422E-02,    -1.70655E 06,     9.86712E 06,
15470      3.34923E-01,    -5.21016E-02,    -3.44370E 06,     3.89747E 07,
15480     -3.64077E-01,    -1.92725E-02,    -1.30419E 06,     3.38487E 07,
15490     -4.68709E-01,    -2.06712E-02,     7.22704E 06,     7.90403E 07,
15500     -1.17659E-02,    -1.04423E-02,     9.10701E 06,     5.23352E 07,
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15510     -6.63707E-02,   -1.28518E-02,   -3.86450E 06,   -1.92079E 07,
15520     -5.16992E-01,   -1.76226E-02,    9.78846E 05,    3.41696E 07,
15530      2.62429E-01,   -5.21203E-03,    4.69818E 06,    3.39454E 07,
15540      4.22956E-01,    3.36285E-02,   0.           ,   0.           ,
15550      5.17771E-01,   -2.47608E-02,   0.           ,   0.           ,
15560      3.65224E-01,   -2.44838E-02,   -7.80533E-03,   -1.33486E-01,
15570     -2.67997E-01,    4.95160E-03,   0.           ,   0.           ,
15580 VH(1,1,19)=
15590      1.30447E-03,   -5.01004E-06,   -6.82076E 04,    6.59596E 05,
15600      1.58221E-03,    1.43969E-03,    7.37522E 04,   -5.28104E 06,
15610     -5.62334E-02,    3.90226E-05,   -1.53015E 06,   -4.62624E 06,
15620     -1.37904E-01,    4.50067E-04,   -2.92432E 05,    4.69011E 06,
15630     -1.19359E-01,    1.00593E-03,    7.39792E 05,    2.94978E 06,
15640     -9.35606E-02,    8.20417E-04,    1.98413E 05,   -3.72765E 05,
15650     -7.05886E-02,    3.26033E-04,    4.82451E 05,   -2.66986E 06,
15660      2.50083E-01,   -9.13756E-04,    2.78803E 06,   -1.01064E 07,
15670     -2.14437E-01,   -3.63572E-03,    1.65111E 06,    1.40835E 07,
15680     -8.02800E-02,   -1.52563E-03,    2.90079E 06,    5.43413E 06,
15690     -2.07587E-02,   -1.09388E-02,    1.08755E 06,   -7.59524E 07,
15700     -7.64575E-02,   -2.30819E-02,    2.31076E 06,   -4.36577E 07,
15710      1.69166E-01,   -2.08757E-02,    1.81877E 06,    1.66349E 07,
15720     -1.53240E-02,   -1.97817E-03,   0.           ,   0.           ,
15730     -2.69858E-02,    1.24017E-03,   0.           ,   0.           ,
15740     -1.93778E-02,    1.22341E-03,   -2.6344[illegible]E-03,    6.70793E-03,
15750     -7.02990E-01,    1.52014E-02,   0.           ,   0.           ,
15760 VH(1,1,20)=
15770     -5.20245E-04,   -6.72525E-05,    2.61779E 03,    2.65847E 06,
15780      1.36699E-02,    3.80643E-03,   -1.49221E 05,   -1.38496E 07,
15790     -3.14436E-02,   -1.96902E-03,   -9.66779E 05,   -3.04386E 07,
15800     -1.16604E-01,   -6.48811E-03,   -2.61358E 04,   -2.09995E 07,
15810     -1.33893E-01,   -8.97125E-03,    1.03137E 06,   -1.88123E 07,
15820     -1.59672E-01,   -1.61984E-02,    3.07129E 05,    2.08421E 06,
15830     -2.26640E-01,   -1.53774E-02,    1.03781E 06,    2.19074E 06,
15840      3.75578E-01,   -8.62385E-03,    5.66529E 06,   -9.78733E 06,
15850     -3.23069E-01,   -1.46480E-02,    4.53815E 06,    4.40903E 07,
15860     -2.93968E-02,   -8.46665E-03,    6.18685E 06,    2.93204E 07,
15870      9.59077E-02,    5.78200E-03,   -3.24374E 06,    7.62109E 07,
15880     -1.82012E-01,    1.56859E-02,   -2.72977E 06,    7.46267E 07,
15890     -7.19922E-02,    2.08493E-02,    4.92383E 05,    9.28470E 06,
15900      1.36495E-02,   -7.86[illegible]98E-05,   0.           ,   0.           ,
15910     -4.29572E-03,    2.378[illegible]6E-04,   0.           ,   0.           ,
15920     -2.81988E-03,    2.36388E-04,    1.32392E-03,   -1.69408E-02,
15930      6.26415E-01,   -1.29828E-02,   0.           ,   0.           ,
15940 VH(1,1,21)=
15950      1.28132E-03,   -2.73493E-05,   -1.02671E 05,    2.03941E 06,
15960      8.19146E-03,    3.67559E-03,    1.17133E 05,   -1.64916E 07,
15970     -2.13565E-01,    1.56101E-03,   -4.43713E 06,    3.48182E 06,
15980     -3.75929E-01,    5.27423E-03,    2.99669E 05,    2.20776E 07,
15990     -2.26344E-01,    7.26402E-03,   -3.28477E 06,    6.21778E 06,
16000      9.23863E-01,   -2.49498E-02,   -2.45340E 06,    7.56531E 06,
16010      5.57048E-01,   -1.71080E-02,   -5.55078E 06,    3.96762E 07,
16020     -3.09407E-02,   -2.82757E-03,   -1.19297E 06,    2.64379E 06,
16030     -1.10912E-01,   -3.15951E-03,    1.07107E 06,    7.70546E 06,
16040     -2.97160E-02,   -1.86691E-03,    1.81622E 06,    3.48022E 06,
16050      2.59797E-02,   -5.01944E-05,   -3.58628E 05,    4.64654E 06,
16060     -3.50127E-02,    1.35957E-04,   -2.97313E 05,    8.18881E 06,
16070      3.18629E-03,    1.26489E-03,    2.72088E 05,    4.15155E 06,
16080     -2.86710E-02,   -3.48276E-03,   0.           ,   0.           ,
16090     -3.47255E-02,    1.45735E-03,   0.           ,   0.           ,
16100     -2.58980E-02,    1.42741E-03,   -4.90738E-03,   -1.27135E-02,
16110      2.93878E-02,   -4.60035E-04,   0.           ,   0.           ,
16120 VH(1,1,22)=
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16130     -7.83249E-04,   -7.30686E-05,    1.88423E 04,    4.09682E 06,
16140      1.79580E-02,    6.56251E-03,   -2.68071E 05,   -3.54213E 07,
16150      9.53285E-02,   -8.92285E-03,    1.48683E 06,   -8.14487E 07,
16160      1.43804E-02,   -2.33140E-02,    1.31889E 05,   -6.76934E 07,
16170     -1.27199E-01,   -3.05050E-02,    8.15292E 05,   -4.49024E 07,
16180      7.90323E-01,   -8.31021E-02,   -2.81904E 06,    2.16177E 07,
16190      6.86949E-02,   -6.64819E-02,   -4.85741E 06,    7.53374E 07,
16200     -1.17435E-01,   -1.83253E-02,    4.58573E 06,    1.04452E 07,
16210      6.42924E-01,   -1.70083E-03,   -5.72128E 06,    6.21961E 07,
16220      1.55366E-01,    1.34420E-03,   -1.08847E 07,    1.03729E 08,
16230     -1.84055E-01,    7.56587E-04,    8.90689E 05,   -1.55026E 07,
16240      1.55135E-01,    1.81172E-03,    1.83564E 06,   -3.75558E 07,
16250     -1.92945E-02,   -4.11625E-03,   -1.57261E 06,   -2.74509E 07,
16260      2.96756E-02,    2.55107E-03,   0.            ,  0.           ,
16270      7.82389E-03,   -3.65777E-04,   0.            ,  0.           ,
16280      5.60086E-03,   -3.58744E-04,    3.87239E-03,    4.95316E-03,
16290     -7.48831E-02,    2.90616E-04,   0.            ,  0.           ,
16300 VH(1,1,23)=
16310     -2.03195E-01,   -4.20088E-02,   -2.43757E 07,    3.18734E 09,
16320     -2.84942E-02,   -1.06546E-02,    1.46759E 05,    7.13333E 07,
16330      2.82173E-03,    4.36912E-04,   -5.19301E 04,   -6.74423E 05,
16340      1.12758E-04,    3.26977E-04,   -9.22111E 04,   -5.38552E 05,
16350     -3.01905E-03,    2.73104E-04,   -7.26085E 04,   -3.44882E 05,
16360      1.30504E-02,   -2.74826E-04,   -5.02931E 04,    1.35508E 05,
16370      7.05503E-03,   -1.27336E-04,   -1.11455E 05,    7.49561E 05,
16380     -3.60661E-03,    3.27220E-04,    4.07103E 04,   -2.23783E 04,
16390      9.70209E-04,    2.46001E-04,    1.45196E 04,   -1.13985E 06,
16400      1.48073E-03,    1.27125E-04,   -4.43845E 03,   -1.47507E 06,
16410     -3.78157E-04,   -1.88804E-05,   -1.37673E 03,    1.42879E 04,
16420      2.96727E-04,    4.13617E-06,   -3.37007E 03,    3.30789E 04,
16430     -1.24997E-04,    5.96241E-06,   -5.38022E 03,    1.98087E 04,
16440      1.26022E-02,    1.28864E-03,   0.            ,  0.           ,
16450     -9.89320E-04,   -2.09616E-05,   0.            ,  0.           ,
16460     -1.15356E-03,   -2.31673E-05,    2.94946E-04,   -1.11766E-02,
16470      1.30891E-04,    4.24523E-06,   0.            ,  0.           ,
16480 VH(1,1,24)=
16490     -2.71932E-03,   -5.45656E-04,   -4.41595E 05,    4.70686E 07,
16500      1.13667E-01,    4.17670E-02,   -3.95442E 05,   -3.12713E 08,
16510     -1.30247E-01,   -8.65938E-03,    3.05919E 05,   -1.03074E 07,
16520     -7.02783E-02,   -1.03461E-02,    3.05940E 06,   -1.07633E 07,
15530      5.26723E-02,   -1.21876E-02,    3.24148E 06,   -1.71621E 07,
16540     -4.24239E-01,   -7.14600E-03,    1.71231E 06,   -1.78247E 05,
16550     -3.10668E-01,   -9.53845E-03,    4.21807E 06,   -1.51003E 07,
16560      1.56761E-01,   -2.20481E-02,   -1.05488E 06,    2.56887E 06,
16570      3.67466E-02,   -1.62995E-02,   -1.48987E 06,    8.09276E 07,
16580     -6.13423E-02,   -8.19132E-03,   -1.27321E 06,    1.10273E 08,
16590     -2.27203E-02,    6.02946E-04,   -6.28833E 04,   -1.89459E 06,
16600      1.22442E-02,    3.93836E-04,    3.00412E 05,   -5.89325E 06,
16610     -8.56527E-05,   -5.42994E-04,   -1.66853E 05,   -5.62394E 06,
16620     -8.41412E-01,   -1.09983E-01,   0.            ,  0.           ,
16630      1.42176E-01,   -7.49397E-05,   0.            ,  0.           ,
16640      1.45639E-01,    1.85013E-04,   -1.74447E-01,    1.75073E-01,
16650     -8.78646E-03,   -2.67248E-04,   0.            ,  0.           ,
16660 VH(1,1,25)=
16670     -6.30607E-04,   -2.82097E-04,   -4.29355E 05,    2.73009E 07,
16680      8.59402E-02,    2.83799E-02,    2.65513E 05,   -2.23792E 08,
16690     -2.40435E-01,   -1.55178E-02,   -3.17609E 06,   -6.86614E 07,
16700     -3.54453E-01,   -2.41944E-02,    5.27672E 06,   -4.04041E 07,
16710     -8.14389E-02,   -2.99816E-02,    9.04563E 06,   -5.15333E 07,
16720     -9.98721E-01,   -3.16866E-02,    4.10661E 06,    4.03517E 06,
16730     -8.04292E-01,   -3.47872E-02,    1.05357E 07,   -2.58072E 07,
16740      4.93977E-01,   -6.58036E-02,   -2.90433E 06,    6.17331E 06,
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OF POOR QUALITY

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16750     1.02594E-01,   -5.10866E-02,   -4.45479E 06,    2.49027E 08,
16760    -1.90241E-01,   -2.58601E-02,   -3.64472E 06,    3.42530E 08,
16770    -1.21160E-01,    8.62564E-05,   -6.90206E 05,   -6.83973E 06,
16780     7.09214E-02,    1.68982E-03,    1.65992E 06,   -1.67542E 07,
16790    -1.34336E-02,   -1.23326E-03,   -1.33016E 06,   -1.79269E 07,
16800     7.40008E-01,    1.07669E-01,   0.           ,   0.           ,
16810    -1.56535E-01,    6.77511E-04,   0.           ,   0.           ,
16820    -1.56584E-01,    3.87727E-04,    2.08020E-01,   -7.94858E-01,
16830    -1.59143E-02,   -3.11514E-04,   0.           ,   0.           ,
16840 VH(1,1,26)=
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16860     8.88556E-03,    3.05128E-03,    3.93721E 03,   -2.45551E 07,
16870     6.93512E-03,   -1.56331E-03,    2.52463E 05,   -5.89063E 06,
16880     2.09814E-03,   -2.54290E-03,    9.49982E 04,   -3.82573E 06,
16890    -7.87714E-03,   -2.85577E-03,    1.48970E 05,   -1.[illegible]9904E 06,
16900    -1.83787E-03,   -4.71050E-03,   -1.84712E 04,    1.43634E 06,
16910    -2.85617E-02,   -3.84131E-03,    1.06158E 05,   -3.[illegible]5023E 06,
16920    -1.91510E-03,   -2.24375E-03,    5.59625E 04,    5.35155E 05,
16930     8.48804E-02,   -9.59047E-05,   -2.23566E 06,    5.06000E 06,
16940    -6.31052E-02,   -3.44518E-04,   -2.53302E 06,    1.76773E 07,
16950     8.03848E-01,    2.63822E-02,    6.82699E 06,    2.91500E 07,
16960    -5.30779E-01,   -6.02442E-03,   -1.14531E 07,   -1.03817E 07,
16970     1.95141E-01,   -4.78980E-03,    1.25510E 07,    9.61752E 06,
16980     2.92689E-02,    4.61654E-03,   0.           ,   0.           ,
16990    -6.10017E-03,    1.34584E-05,   0.           ,   0.           ,
17000    -6.19136E-03,    1.74014E-06,   -1.40738E-03,    6.18373E-03,
17010    -1.33840E-01,   -9.78779E-03,   0.           ,   0.           ,
17020 VH(1,1,27)=
17030    -4.46971E-03,   -1.09238E-03,   -1.70359E 06,    1.14283E 08,
17040     3.72608E-01,    1.22330E-01,    7.95328E 05,   -1.04583E 09,
17050     1.35624E-01,   -2.12933E-02,    1.04776E 07,    1.78759E 08,
17060     5.63891E-01,    4.98442E-03,    3.07691E 05,    1.32479E 08,
17070     3.93030E-01,    2.19395E-02,   -8.32326E 06,    1.38993E 08,
17080     9.[illegible]4673E-01,    7.02359E-02,   -3.78754E 06,   -1.72369E 07,
17090     9.50851E-01,    6.51428E-02,   -1.10422E 07,   -7.36723E 06,
17100    -5.91074E-01,    9.13877E-02,    2.39993E 06,   -7.67129E 06,
17110    -2.29285E-01,    7.49332E-02,    7.24304E 06,   -3.61007E 08,
17120     2.73607E-01,    3.82754E-02,    6.78686E 06,   -5.11801E 08,
17130    -3.36146E-02,   -7.35109E-03,   -7.78364E 05,   -5.46628E 05,
17140     3.74487E-02,   -1.31261E-03,    6.79812E 05     2.80411E 07,
17150    -3.22644E-02,    3.02309E-03,   -1.47736E 06,    2.61546E 07,
17160     6.35673E-01,    1.18224E-01,   0.           ,   0.           ,
17170    -1.63853E-01,    7.46395E-04,   0.           ,   0.           ,
17180    -1.63998E-01,    4.20347E-04,    8.92158E-02,   -3.16519E-01,
17190     5.79801E-02,    3.83027E-03,   0.           ,   0.           ,
17200 $END
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ZS=4E6,
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ILEM=5,
JT=7,37,
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ZS=1.5E6,
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QFREQ=55.2,
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ILEM=6,
JT=1,21,
SK=1E6,
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CC=0,
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IPLMUL=20,
IROTI=1,
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A=1.1855718E-6,
B=-7.2149131E-3,
C=1.4332664E1,
D=2.0884198E3,
UNBAL=
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GYRO=
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2,42599,
3,2202,
4,620,
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6,4450,
7,512,
8,27727,
9,62440,
10,49497,
11,276,
12,5261,
13,4482,
14,5959,
15,9406,
16,6908,
17,4211,
18,20293,
19,18597,
20,466,
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18190 2,1,
18200 4,1,
18210 5,1,
18220 7,1,
18230 8,1,
18240 9,1,
18250 10,1,
18260 11,1,
18270 14,1,
18280 16,1,
18290 19,1,
18300 20,1,
18310 34,1,
18320 35,1,
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18470 20,3,
18480 34,3,
18490 35,3,
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18570 3,11,1,
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18680 2,35,3,
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18740 5,37,3,
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18760 6,21,3,
18770 $END
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7.5 E^3 TETRA TEST RUN OUTPUT

THE CURRENT PROGRAM LIMITS FOR THE INPUT VARIABLES ARE-

ORIGINAL PAGE IS OF POOR QUALITY

MAX NO. OF PHYSICAL POINTS NOT LOCATED ON THE MODAL SUBSYSTEMS= 10

SUBSYSTEM	MAX. NO. OF PHYSICAL POINTS	MAX NO. OF MODES
1	10	15
2	10	15
3	10	5
4	10	15
5	10	15
6	10	5
7	20	30
8	20	30
9	20	5
10	20	30
11	10	30

MAX. NO OF PHYSICAL POINTS FOR SUBSYSTEM 12 OTHER THAN THE C.G. POINT= 200
MAX. NO. OF PHYSICAL POINTS FOR SUBSYSTEM 13 OTHER THAN THE C.G. POINT= 200
NUMBER OF MODES FOR SUBSYSTEM 12 = 2
NUMBER OF MODES FOR SUBSYSTEM 13 = 2
MAX. NO. OF TYPE 1 PHYSICAL CONNECTING ELEMENTS= 5
MAX. NO. OF TYPE 2 PHYSICAL CONNECTING ELEMENTS= 10
MAX. NO. OF TYPE 3 PHYSICAL CONNECTING ELEMENTS= 10
MAX. NO. OF TYPE 4 PHYSICAL CONNECTING ELEMENTS= 4
MAX. NO OF TYPE 5 PHYSICAL CONNECTING ELEMENTS= 10
MAX. NO OF SPEED SEGMENTS= 10
MAX. NO. OF UNBALANCE BIRTH EVENTS= 20
MAX NO OF P=COS(WT) AND P=SIN(WT) LOADS= 30
MAX. NO. OF TIME-FORCE HISTORY LOADS= 30
MAX. NO. OF TIME-FORCE HISTORY TABLES= 10
MAX NO. OF (TIME-FORCE) PAIRS IN EACH HISTORY TABLE= 10
MAX. NO. OF GYROSCOPIC LOAD LOCATIONS= 30
MAX. NO. OF (POINT,DIRECTION) PAIRS FOR WHICH COORDINATES, DISPLACEMENTS, VELOCITIES, AND MODAL FORCES ARE WRITTEN TO THE PLOT FILE= 50
MAX. NO. OF (ELEMENT,POINT,DIRECTION) TRIOS FOR WHICH CONNECTING ELEMENT FORCES ARE WRITTEN TO THE PLOT FILE= 50

NUMBER OF PHYSICAL POINTS NOT ON MODAL SUBSYSTEMS= 0

DATA FOR MODAL SUBSYSTEM 1

EEE-ICLS LP ROTOR SUBSYSTEM VERTICAL

NUMBER OF SUBSYSTEM DIRECTIONS= 2

SUBSYSTEM DIRECTIONS-
Z (GLOBAL DIRECTION 1)
THETA-Y (GLOBAL DIRECTION 2)

COORDINATES OF REFERENCE POINT RELATIVE TO GLOBAL SYSTEM (IN.)
X= 0. Y= 0. Z= 0.

COORDINATES OF POINTS ON SUBSYSTEM (INCHES)

POINT NUMBER	LOCAL COORDINATE SYSTEM X	Y	Z	GLOBAL COORDINATE SYSTEM X	Y	Z
1	-166.951	0.	0.	-166.951	0.	0.
2	-177.885	0.	0.	-177.885	0.	0.
3	-172.155	0.	0.	-172.155	0.	0.
4	-194.778	0.	0.	-194.778	0.	0.
5	-230.808	0.	0.	-230.808	0.	0.
6	-263.325	0.	0.	-263.325	0.	0.
7	-265.475	0.	0.	-265.475	0.	0.
8	282.115	0.	0.	282.115	0.	0.
9	-268.985	0.	0.	-268.985	0.	0.
10	-278.335	0.	0.	-278.335	0.	0.

NUMBER OF SUBSYSTEM POINTS= 10

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	FREQUENCY RPM	POTENTIAL ENERGY	Q FACTOR	MODE TYPE 0=FLEXIBLE 1=RIGID BODY	GENERALIZED WEIGHT-LB	GENERALIZED STIFFNESS LB/IN	GENERALIZED DAMPING VALUE (LB-SEC)/IN
1	1	53	3.702E 01	0.	1	8.428E 02	0.	0.
2	2	62.	4.259E 01	0.	1	7.885E 02	0.	0.
3	3	1273.	1.174E 04	0.	0	5.108E 02	2.348E 04	0.
4	4	2647	1.141E 05	0.	0	9.924E 02	2.282E 05	0
5	5	8121.	8.125E 04	0.	0	8.881E 01	1.625E 05	0.
6	6	16218.	3.864E 05	0.	0	1.035E 02	7.728E 05	0
7	7	28098.	1.008E 06	0.	0	9.002E 01	2.017E 06	0.
8	8	37651	3.045E 06	0.	0	1.514E 02	6.090E 06	0.
9	9	40183	3.460E 06	0.	0	1.509E 02	6.920E 06	0
10	10	43146.	7.649E 06	0.	0	2.868E 02	1.510E 07	0.
11	11	60931	4.253E 06	0.	0	1.155E 02	8.508E 06	0.
12	12	57288	1.368E 07	0.	0	2.832E 02	2.732E 07	0.
13	13	59020.	1.088E 07	0.	0	1.825E 02	2.187E 07	0.
14	14	87068.	9.707E 06	0.	0	9.023E 01	1.941E 07	0.

NUMBER OF SUBSYSTEM MODES= 14

THE MODE SHAPES FOR THIS SUBSYSTEM ARE-

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	POINT NUMBER	MODAL DISPLACEMENTS GLOBAL DIRECTION 1 Z	2 THETA-Y	MODAL FORCES GLOBAL DIRECTION 1 Z	2 THETA-Y
1	1	1	-0.80117	0.01007	-7.788E 00	-5.387E 01
1	1	2	-0.72041	0.01007	-3.818E-07	2.484E-08
1	1	3	-0.88059	0.00878	6.508E 01	-8.418E-07

1	1	4	-0.42137	0.01005	-7.081E 00	-2.738E 02
1	1	5	-0.25814	0.01005	-4.483E 00	-7.043E 01
1	1	6	0.05751	0.01005	0.	0.
1	1	7	0.12828	0.01005	-1.283E 01	-3.201E-07
1	1	8	0.05538	0.01005	0.	0.
1	1	9	0.13412	0.01005	-2.385E 00	-1.551E 01
1	1	10	0.21832	0.01005	-9.071E-08	0.
2	2	1	0.09558	0.00784	2.388E 00	4.154E 01
2	2	2	0.18888	0.00784	4.070E-08	1.018E-06
2	2	3	0.14060	0.00784	-1.408E 01	1.248E-07
2	2	4	0.32021	0.00784	-1.333E-01	-1.875E 02
2	2	5	0.50580	0.00782	-3.855E 00	-1.013E 02
2	2	6	0.55347	0.00782	0	0.
2	2	7	0.51219	0.00782	-9.122E 01	-1.842E-08
2	2	8	0.35089	0.00852	0.	0.
2	2	9	0.51785	0.00852	-3.004E 01	7.728E 01
2	2	10	0.85801	0.00852	5.529E-08	1.082E-08
3	3	1	0.05812	-0.02401	-1.402E 03	-5.010E 04
3	3	2	-0.30836	-0.03404	-2.782E-04	5.828E-03
3	3	3	-0.10717	-0.03399	1.072E 01	7.202E-08
3	3	4	-0.75118	-0.02202	5.484E 01	3.852E 05
3	3	5	-0.50741	0.01215	3.127E 03	3.242E 05
3	3	6	-0.12540	0.03599	0.	0.
3	3	7	0.08485	0.03599	-8.488E 00	1.643E-05
3	3	8	-0.17838	0.02732	0.	0.
3	3	9	0.11823	0.03731	3.014E 02	-5.273E 04
3	3	10	0.42929	0.03732	5.848E-05	5.862E-04
4	4	1	0.08103	0.03841	1.188E 04	3.022E 05
4	4	2	0.47417	0.03561	4.840E-04	5.524E-03
4	4	3	0.28234	0.03530	-2.823E 01	-2.237E-04
4	4	4	0.57181	-0.00492	-3.705E 04	-1.005E 05
4	4	5	-0.51583	-0.03479	-3.009E 04	4.537E 05
4	4	6	-0.83517	0.06755	0.	0.
4	4	7	-0.21853	0.06758	2.105E 01	-1.537E-04
4	4	8	-0.78138	0.08002	0.	0.
4	4	9	-0.15230	0.07982	3.228E 04	-7.782E 05
4	4	10	0.52083	0.07987	1.888E-03	1.167E-02
5	5	1	-0.04064	-0.00592	-2.488E 04	-5.389E 05
5	5	2	-0.12100	-0.00588	-9.675E-04	4.658E-03
5	5	3	-0.07313	-0.00842	7.312E 00	5.734E-05
5	5	4	0.37993	0.03114	7.738E 04	3.001E 05
5	5	5	0.91919	-0.01757	-2.859E 04	-7.809E 05
5	5	6	-0.08585	-0.00137	0.	0.
5	5	7	-0.07451	-0.00140	7.451E 00	2.278E-04
5	5	8	-0.12309	0.00927	0.	0.
5	5	9	-0.04579	0.00929	4.858E 04	-8.080E 05
5	5	10	0.03383	0.00931	-1.487E-03	4.820E-03
6	6	1	0.04154	0.00375	8.757E 04	1.875E 06
6	6	2	0.10865	0.00491	-1.496E-03	-1.008E-01
6	6	3	0.05718	0.00318	-6.710E 00	6.519E-04
6	6	4	-0.85836	-0.02408	-1.058E 05	1.859E 06
6	6	5	0.79864	0.04239	7.445E 04	-1.888E 06
6	6	6	0.02085	-0.01759	0.	0.
6	6	7	-0.08870	-0.01785	5.871E 00	9.184E-06
6	6	8	-0.05101	0.00542	0.	0.
6	6	9	-0.03903	0.00528	1.493E 05	-2.018E 06
6	6	10	0.01185	0.00526	-3.505E-03	2.054E-02
7	7	1	-0.01849	-0.00092	-1.896E 05	-2.718E 06
7	7	2	-0.04585	-0.00359	7.700E-04	-8.057E-03
7	7	3	-0.02023	-0.00009	2.023E 00	-1.117E-03
7	7	4	0.52860	-0.03472	-1.828E 05	-1.481E 06
7	7	5	-0.28052	0.08083	3.226E 05	1.085E 06
7	7	6	0.16487	-0.04881	0.	0.
7	7	7	-0.14309	-0.05030	1.431E 01	-1.378E-02
7	7	8	-0.08851	0.00387	0.	0.
7	7	9	-0.03316	0.00375	4.513E 05	-5.048E 06
7	7	10	0.02215	0.00352	-1.128E-03	0.
8	8	1	-0.08588	-0.00939	3.488E 06	7.308E 07
8	8	2	0.82098	0.04439	-8.480E-03	-3.526E-01
8	8	3	-0.20474	-0.01332	2.046E 01	-4.512E-03
8	8	4	0.08005	0.02412	1.573E 05	-1.080E 06
8	8	5	-0.23394	-0.00155	5.285E 03	1.245E 06
8	8	6	0.10843	-0.02823	0.	0.
8	8	7	-0.07395	-0.02985	7.394E 00	-9.985E-04
8	8	8	-0.04015	0.00047	0.	0.
8	8	9	-0.00888	0.00071	3.108E 05	-2.488E 08
8	8	10	0.02527	0.00048	4.810E-04	1.180E-02
9	9	1	0.03781	0.00287	-7.287E 05	-1.808E 07
9	9	2	-0.17415	-0.00901	-2.518E-03	-1.212E-01
9	9	3	0.07012	0.00285	-7.013E 00	1.877E-03
9	9	4	-0.24304	0.07447	5.088E 05	3.381E 06
9	9	5	-0.78488	-0.05254	-2.584E 05	4.478E 06
9	9	6	0.50447	-0.12875	0.	0.
9	9	7	-0.33271	-0.13771	3.328E 01	-7.637E-04
9	9	8	-0.18144	-0.00075	0.	0.
9	9	9	-0.03571	0.00150	1.888E 06	-5.853E 06
9	9	10	0.16328	0.00013	5.776E-03	0.
10	10	1	0.00319	0.00020	-3.784E 04	-5.120E 05
10	10	2	-0.00828	-0.00047	-7.317E-04	2.307E-02
10	10	3	0.00550	0.00014	-5.485E-01	-6.843E-04
10	10	4	-0.01923	0.01010	7.345E 04	3.514E 05
10	10	5	-0.11580	-0.00403	-6.835E 03	5.305E 05
10	10	6	-0.17034	-0.05554	0.	0.
10	10	7	-0.84588	-0.07703	5.458E 01	5.951E-02
10	10	8	0.98468	0.03828	0.	0.
10	10	9	0.17455	0.01073	-1.013E 07	1.426E 07
10	10	10	-0.40151	0.02827	-2.751E-03	3.521E-01
11	11	1	-0.01838	-0.00081	8.785E 0[illegible]	3.228E 06
11	11	2	0.01768	0.00148	1.283E-02	-1.828E-01
11	11	3	-0.03320	-0.00012	3.321E 00	1.780E-03
11	11	4	-0.02184	-0.09192	-7.758E 05	-1.282E 06
11	11	5	0.74088	-0.04183	-3.885E 05	-5.430E 06
11	11	6	0.13858	-0.07802	0.	0.
11	11	7	-0.39435	-0.09781	3.944E 01	-1.337E-01
11	11	8	0.02884	-0.01204	0.	0.
11	11	9	-0.02078	-0.00614	1.347E 05	2.365E 07
11	11	10	0.34744	-0.00281	-2.475E-02	-8.888E-02
12	12	1	0.02039	0.00088	-2.583E 04	-3.022E 06
12	12	2	-0.00884	-0.00133	-1.288E-02	-2.284E-01
12	12	3	0.04860	-0.00004	-4.881E 00	8.755E-03
12	12	4	0.17332	0.11828	1.103E 05	-4.053E 05
12	12	5	-0.47382	0.08081	8.461E 05	3.758E 06
12	12	6	-0.81452	0.08918	0.	0.
12	12	7	-0.42222	0.09827	4.221E 01	-1.081E-01
12	12	8	0.31738	-0.04890	0.	0.
12	12	9	-0.12789	-0.01923	-1.882E 05	1.228E 05
12	12	10	0.78644	0.00203	-8.887E-02	0.

13	13	1	0.03298	0.00119	1.159E 05	-4.878E 05
13	13	2	-0.00036	-0.00202	-2.084E-02	-8.507E-02
13	13	3	-0.14431	-0.01188	1.443E 01	1.888E-02
13	13	4	0.48764	0.13228	1.404E 06	-5.870E 06
13	13	5	0.82280	0.07288	7.163E 05	-5.087E 06
13	13	6	0.32787	-0.04548	0.	0.
13	13	7	0.02743	-0.05184	-2.743E 00	-4.721E-02
13	13	8	-0.12604	-0.03788	0.	0.
13	13	9	0.17952	-0.00089	-3.144E 05	8.318E 07
13	13	10	-0.25186	0.03721	8.312E-03	7.849E-03
14	14	1	0.02400	0.00078	4.086E 05	-5.280E 05
14	14	2	0.01774	-0.00254	4.887E-02	-2.502E-01
14	14	3	0.00980	-0.00718	-9.803E-01	5.370E-04
14	14	4	0.42835	0.02207	1.847E 05	-1.073E 07
14	14	5	0.41127	-0.10837	-1.810E 08	-4.427E 06
14	14	6	-0.05588	0.01820	0.	0.
14	14	7	0.07868	0.02431	-7.887E 00	-3.780E-02
14	14	8	0.15540	0.00470	0.	0.
14	14	9	-0.1617'	-0.00150	2.228E 06	1.940E 07
14	14	10	0.08401	0.00368	1.058E-02	-8.452E-02

DATA FOR MODAL SUBSYSTEM 2

EEE-ICLS LP ROTOR SUBSYSTEM HORIZONTAL

NUMBER OF SUBSYSTEM DIRECTIONS= 2

SUBSYSTEM DIRECTIONS-
(GLOBAL DIRECTION 3)
THETA-Z (GLOBAL DIRECTION 4)

COORDINATES OF REFERENCE POINT RELATIVE TO GLOBAL SYSTEM (IN.)
X= 0. Y= 0. Z= 0.

COORDINATES OF POINTS ON SUBSYSTEM (INCHES)

POINT NUMBER	LOCAL COORDINATE SYSTEM X	Y	Z	GLOBAL COORDINATE SYSTEM X	Y	Z
1	-156.981	0.	0.	-156.981	0.	0.
2	-177.985	0.	0.	-177.985	0.	0.
3	-172.158	0.	0.	-172.158	0.	0.
4	-184.778	0.	0.	-184.778	0.	0.
5	-220.808	0.	0.	-220.808	0.	0.
6	-253.325	0.	0.	-253.325	0.	0.
7	-258.475	0.	0.	-258.475	0.	0.
8	262.115	0.	0.	262.115	0.	0.
9	-269.895	0.	0.	-269.895	0.	0.
10	-278.335	0.	0.	-278.335	0.	0.

NUMBER OF SUBSYSTEM POINTS= 10

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	FREQUENCY RPM	POTENTIAL ENERGY	Q FACTOR	MODE TYPE 0=FLEXIBLE 1=RIGID BODY	GENERALIZED WEIGHT-LB	GENERALIZED STIFFNESS LB/IN	GENERALIZED DAMPING VALUE (LB-SEC)/IN
1	15	53.	3.702E 01	0.	1	8.428E 02	0.	0.
2	16	82.	4.258E 01	0.	1	7.886E 02	0.	0.
3	17	1273.	1.174E 04	0.	0	5.108E 02	2.348E 04	0.
4	18	2847.	1.141E 05	0.	0	9.824E 02	2.282E 05	0.
5	19	5131.	5.125E 04	0.	0	5.551E 01	1.025E 05	0.
6	20	18218.	3.884E 05	0.	0	1.035E 02	7.728E 05	0.
7	21	28084.	1.009E 06	0.	0	5.002E 01	2.017E 06	0.
8	22	37881.	3.045E 06	0.	0	1.814E 02	6.090E 06	0.
9	23	40183.	3.460E 06	0.	0	1.609E 02	6.920E 06	0.
10	24	43148.	7.549E 06	0.	0	2.858E 02	1.510E 07	0.
11	25	50331.	4.253E 06	0.	0	1.155E 02	8.505E 06	0.
12	26	57288.	1.366E 07	0.	0	2.832E 02	2.732E 07	0.
13	27	58020.	1.085E 07	0.	0	1.825E 02	2.157E 07	0.
14	28	87068.	9.707E 06	0.	0	9.023E 01	1.941E 07	0.

NUMBER OF SUBSYSTEM MODES= 14

THE MODE SHAPES FOR THIS SUBSYSTEM ARE-
(SIGNS IN THETA-Z DIRECTION CHANGED TO OBTAIN RIGHT HAND COORDINATE SYSTEM)

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	POINT NUMBER	MODAL DISPLACEMENTS GLOBAL DIRECTION 3 Y	4 THETA-Z	MODAL FORCES GLOBAL DIRECTION 3 Y	4 THETA-Z
1	15	1	-0.80117	-0.01007	-7.768E 00	5.387E 01
1	15	2	-0.79041	-0.01007	-3.518E-07	-2.484E-08

ORIGINAL PAGE IS
OF POOR QUALITY

1	15	3	-0.85058	-0.00878	8.808E 01	9.415E-07
1	15	4	-0.82137	-0.01008	-7.081E 00	2.735E 02
1	15	5	-0.25914	-0.01008	-4.483E 00	7.843E 01
1	15	6	0.08751	-0.01005	0.	0.
1	15	7	0.12828	-0.01005	-1.282E 01	3.201E-07
1	15	8	0.08535	-0.01005	0.	0.
1	15	9	0.13412	-0.01005	-2.385E 00	1.881E 01
1	15	10	0.21832	-0.01005	-5.871E-08	0.
2	16	1	0.60858	-0.00794	2.208E 00	-4.184E 01
2	16	2	0.18648	-0.00794	4.070E-08	-1.018E-08
2	16	3	0.14050	-0.00794	-1.408E 01	-1.248E-07
2	16	4	0.32021	-0. 0794	-1.333E-01	1.878E 02
2	16	5	0.60590	-0.00792	-3.858E 00	1.013E 02
2	16	6	0.88347	-0.00792	0.	0.
2	16	7	0.81218	-0.00782	-5.128E 01	7.848E-08
2	16	8	0.88060	-0.00882	0.	0.
2	16	9	0.81785	-0.00882	-3.004E 01	-7.738E 01
2	16	10	0.88801	-0.00882	8.528E-08	-1.082E-08
3	17	1	0.08812	0.03401	-1.402E 03	5.010E 04
3	17	2	-0.30536	0.03404	-2.782E-04	-8.828E-03
3	17	3	-0.10717	0.03388	1.072E 01	-7.202E-08
3	17	4	-0.78118	0.03282	5.454E 01	-3.852E 08
3	17	5	-0.80741	-0.01218	3.127E 03	-3.242E 08
3	.7	6	-0.12840	-0.03888	0.	0.
3	17	7	0.08488	-0.03888	-6.488E 00	-1.863E-08
3	17	8	-0.17838	-0.03732	0.	0.
3	17	9	0.11823	-0.03731	3.014E 02	8.273E 04
3	17	10	0.42828	-0.03732	8.848E-08	-5.882E-04
4	18	1	0.08103	-0.03841	1.188E 04	-3.832E 08
4	18	2	0.47417	-0.03881	4.840E-04	-8.824E-03
4	18	3	0.28234	-0.03830	-2.823E 01	2.237E-04
4	18	4	0.87181	0.00482	-3.705E 04	1.005E 08
4	18	5	-0.81883	0.03478	-3.808E 04	-4.537E 08
4	18	6	-0.62517	-0.08758	0.	0.
4	18	7	-0.21863	-0.08758	2.108E 01	1.837E-04
4	18	8	-0.78128	-0.08002	0.	0.
4	18	9	-0.18230	-0.07882	3.228E 04	7.782E 08
4	18	10	0.82083	-0.07887	1.888E-03	-1.107E-02
5	19	1	-0.04084	0.00882	-2.488E 04	8.388E 08
5	19	2	-0.12100	0.00888	-8.875E-04	-4.888E-03
5	19	3	-0.07313	0.00842	7.312E 00	-8.734E-08
5	19	4	0.37883	-0.03114	7.738E 04	-3.001E 08
5	19	5	0.81818	0.01787	-2.888E 04	7.808E 08
5	19	6	-0.08848	0.00137	0.	0.
5	19	7	-0.07451	0.00140	7.451E 00	-2.278E-04
5	19	8	-0.12309	-0.00837	0.	0.
5	19	9	-0.04879	-0.00828	4.888E 04	8.080E 08
5	19	10	0.03393	-0.00831	-1.487E-03	-4.820E-03
6	20	1	0.04194	-0.00378	8.767E 04	-1.875E 08
6	20	2	0.10885	-0.00491	-1.488E-03	1.008E-01
6	20	3	0.08718	-0.00318	-8.718E 00	-8.818E-04
6	20	4	-0.88855	0.02408	-1.088E 08	-1.808E 08
6	20	5	0.78884	-0.04239	7.445E 04	1.888E 08
6	20	6	0.02 78	0.01788	0.	0.
6	20	7	-0.088 0	0.01788	8.871E 00	-8.188E-04
6	20	8	-0.09101	-0.00842	0.	0.
6	20	9	-0.03903	-0.00828	1.493E 05	2.018E 08
6	20	10	0.01188	-0.00828	-2.808E-03	-2.884E-02
7	21	1	-0.01848	0.00083	-1.888E 05	3.718E 08
7	21	2	-0.08585	0.00358	7.700E-04	8.087E-03
7	21	3	-0.02023	0.00008	2.023E 00	1.117E-03
7	21	4	0.82880	0.03472	-1.828E 05	3.461E 08
7	21	5	-0.28032	-0.08083	3.228E 05	-1.085E 08
7	21	6	0.18487	0.04881	0.	0.
7	21	7	-0.14308	0.05030	1.431E 01	1.374E-02
7	21	8	-0.09881	-0.00387	0.	0.
7	21	9	-0.03318	-0.00378	4.813E 05	8.048E 08
7	21	10	0.02218	-0.00382	-1.128E-03	0.
8	22	1	-0.08588	0.00838	3.488E 08	-7.308E 07
8	22	2	0.82088	-0.04439	-8.490E-03	3.828E-01
8	22	3	-0.20474	0.01332	2.048E 01	4.812E-03
8	22	4	0.08008	-0.02412	1.873E 05	1.080E 08
8	22	5	-0.23384	0.00189	8.288E 02	-1.248E 08
8	22	6	0.10843	0.02823	0.	0.
8	22	7	-0.07388	0.02888	7.384E 00	8.888E-04
8	22	8	-0.04018	-0.00047	0.	0.
8	22	9	-0.00858	-0.00071	3.108E 05	2.488E 08
8	22	10	0.02827	-0.00048	4.610E-04	-1.180E-02
9	23	1	0.03781	-0.00287	-7.287E 08	1.808E 07
9	23	2	-0.17418	0.00801	-2.018E-03	1.312E-01
9	23	3	0.07012	-0.00285	-7.013E 00	-1.877E-03
9	23	4	-0.24304	-0.07447	5.088E 05	-3.381E 08
9	23	5	-0.79489	0.05284	-2.884E 05	-4.478E 08
9	23	6	0.80447	0.12878	0.	0.
9	23	7	-0.33271	0.13771	3.328E 01	7.837E-04
9	23	8	-0.18144	0.00078	0.	0.
9	23	9	-0.03671	0.00150	1.689E 05	8.803E 08
9	23	10	0.18326	-0.00013	5.7[illegible]-03	0.
10	24	1	0.00318	-0.00020	-3.784E 04	8.130E 08
10	24	2	-0.00828	0.00047	-7.317E-04	-2.307E-02
10	24	3	0.00550	-0.00014	-6.485E-01	6.843E-04
10	24	4	-0.01823	-0.01010	7.348E 04	-3.618E 08
10	24	5	-0.11860	0.00403	-6.825E 04	-6.305E 08
10	24	6	-0.17034	0.06684	0.	0.
10	24	7	-0.64568	0.07703	6.458E 01	-9.981E-02
10	24	8	0.88468	-0.03828	0.	0.
10	24	9	0.17488	-0.01073	-1.013E 07	-1.420E 07
10	24	10	-0.40151	-0.03827	-2.751E-03	-3.821E-01
11	25	1	-0.01838	0.00081	8.709E 04	-3.226E 08
11	25	2	0.01788	-0.00148	1.232E-03	1.828E-01
11	25	3	-0.03320	0.00012	3.321E 00	-1.760E-03
11	25	4	-0.02184	0.08182	-7.708E 05	1.262E 08
11	25	5	0.74088	0.04183	-3.888E 05	6.430E 08
11	25	6	0.12888	0.07602	0.	0.
11	25	7	-0.38435	0.08751	3.844E 01	1.337E-01
11	25	8	0.02884	0.01304	0.	0.
11	25	9	-0.07[illegible]78	0.00814	1.347E 05	-2.368E 07
11	25	10	0.34744	0.00281	-3.478E-02	8.888E-02
12	26	1	0.02038	-0.00089	-3.883E 04	3.022E 08
12	26	2	-0.00884	0.00133	-1.288E-02	2.364E-01
12	26	3	0.08880	0.00004	-4.881E 00	-5.785E-03
12	26	4	0.17332	-0.11926	1.103E 06	4.013E 08
12	26	5	-0.47382	-0.00081	8.481E 06	-3.768E 08
12	26	6	-0.61152	-0.08819	0.	0.
12	26	7	-0.62332	-0.08827	4.221E 01	1.080E-01
12	26	8	0.31738	0.04580	0.	0.
12	26	9	-0.12789	0.01833	-1.883E 06	-1.228E 08

12	26	10	0.78644	-0.00203	-5.887E-02	0.
13	27	1	0.03286	-0.00118	1.189E 05	4.878E 08
13	27	2	-0.00036	0.00202	-2.084E-02	5.507E-02
13	27	3	-0.14431	0.01188	1.443E 01	-1.088E-02
13	27	4	0.45784	-0.13229	1.604E 06	5.970E 06
13	27	5	0.82280	-0.07285	7.183E 05	6.087E 08
13	27	6	0.32757	0.04648	-0.	0.
13	27	7	0.02743	0.05164	-2.743E 00	4.721E-02
13	27	8	-0.12504	0.03756	0.	0.
13	27	9	0.17852	0.00089	-3.144E 05	-5.318E 07
13	27	10	-0.25155	-0.03721	5.312E-03	-7.448E-02
14	28	1	0.02400	-0.00078	4.858E 05	6.250E 08
14	28	2	0.01774	0.00284	4.887E-02	2.502E-01
14	28	3	0.00850	0.00715	-8.803E-01	-6.370E-04
14	28	4	0.42838	-0.02207	1.047E 05	1.073E 07
14	28	5	0.41127	0.10837	-1.610E 05	4.427E 08
14	28	6	-0.08598	-0.01820	0.	0.
14	28	7	0.07855	-0.02431	-7.887E 00	3.780E-02
14	28	8	0.18540	-0.00470	0.	0.
14	28	9	-0.18121	0.00150	2.228E 06	-1.840E 07
14	28	10	0.08401	-0.00389	1.058E-02	8.482E-02

DATA FOR MODAL SUBSYSTEM 4

EEE-ICLS CORE ROTOR SUBSYSTEM VERTICAL

NUMBER OF SUBSYSTEM DIRECTIONS= 2

SUBSYSTEM DIRECTIONS-
Z (GLOBAL DIRECTION 1)
THETA-Y (GLOBAL DIRECTION 2)

COORDINATES OF REFERENCE POINT RELATIVE TO GLOBAL SYSTEM (IN.)
X= 0. Y= 0. Z= 0.

COORDINATES OF POINTS ON SUBSYSTEM (INCHES)

POINT	LOCAL COORDINATE SYSTEM			GLOBAL COORDINATE SYSTEM		
NUMBER	X	Y	Z	X	Y	Z
11	-201.040	0.	0.	-201.040	0.	0.
12	-207.570	0.	0.	-207.570	0.	0.
13	-217.010	0.	0.	-217.010	0.	0.
14	-223.000	0.	0.	-223.000	0.	0.
15	-228.010	0.	0.	-228.010	0.	0.
16	-235.070	0.	0.	-235.070	0.	0.
17	-238.385	0.	0.	-238.385	0.	0.
18	-250.885	0.	0.	-250.885	0.	0.
19	-255.485	0.	0.	-255.485	0.	0.
20	-263.325	0.	0.	-263.325	0.	0.

NUMBER OF SUBSYSTEM POINTS= 10

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	FREQUENCY RPM	POTENTIAL ENERGY	Q FACTOR	MODE TYPE 0=FLEXIBLE 1=RIGID BODY	GENERALIZED WEIGHT-LB	GENERALIZED STIFFNESS LB/IN	GENERALIZED DAMPING VALUE (LB-SEC)/IN
1	29	77.	5.421E 01	-35.	1	5.482E 02	0.	0.
2	30	139.	5.507E 01	-35.	1	2.048E 02	0.	0.
3	31	16459.	7.562E 05	-35.	0	1.987E 02	1.512E 06	-2.539E 01
4	32	28833.	2.361E 06	-35.	0	1.888E 02	4.722E 06	-4.389E 01
5	33	38775.	1.861E 06	-35.	0	8.723E 01	3.722E 06	-2.849E 01
6	34	51767.	1.212E 07	-35.	0	3.184E 02	2.424E 07	-1.282E 02
7	35	68916.	4.539E 07	-35.	0	7.143E 02	9.077E 07	-3.744E 02
8	36	74534.	1.153E 07	-35.	0	1.452E 02	2.308E 07	-8.537E 01
9	37	87882.	3.568E 07	-35.	0	3.256E 02	7.136E 07	-2.241E 02

NUMBER OF SUBSYSTEM MODES= 9

THE MODE SHAPES FOR THIS SUBSYSTEM ARE-

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	POINT NUMBER	MODAL DISPLACEMENTS GLOBAL DIRECTION 1 Z	MODAL DISPLACEMENTS GLOBAL DIRECTION 2 THETA-Y	MODAL FORCES GLOBAL DIRECTION 1 Z	MODAL FORCES GLOBAL DIRECTION 2 THETA-Y
1	29	11	-0.53310	-0.00750	-5.331E 01	0
1	29	12	-0.58262	-0.00750	-4.408E 01	[illegible]
1	29	13	-0.65264	-0.00750	-3.718E 01	7.367E 02
1	29	14	-0.69775	-0.00750	-3.811E 01	[illegible]
1	29	15	-0.73530	-0.00750	-1.693E 01	1.097E 03
1	29	16	-0.78821	-0.00748	[illegible]	[illegible]
1	29	17	-0.81314	-0.00749	[illegible]	1.199E 03
1	29	18	-0.90655	-0.00750	[illegible]	1.008E 03

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1	29	19	-0.84106	-0.00750	8.548E 01	7.893E 02
1	29	20	-1.00000	-0.00750	1.000E 02	0.
2	30	11	0.83427	-0.02288	8.343E 01	0.
2	30	12	0.78182	-0.02208	4.488E 01	-4.710E 02
2	30	13	0.56725	-0.02286	1.[illegible]93E 01	-7.858E 02
2	30	14	0.42857	-0.02301	1.1[illegible]2E 01	-8.787E 02
2	30	15	0.31426	-0.02301	-1.881E 01	-7.876E 02
2	30	16	0.15181	-0.02301	-2.713E 01	-5.458E 02
2	30	17	0.07528	-0.02301	-3.[illegible]E 01	-4.038E 02
2	30	18	-0.21170	-0.02301	-3.472E 01	1.124E 02
2	30	19	-0.31757	-0.02301	4.368E 01	3.803E 02
2	30	20	-0.48845	-0.02301	4.984E 01	-8.703E-08
3	31	11	0.88088	-0.04872	8.807E 01	0.
3	31	12	0.83088	-0.04388	-5.348E 05	2.383E 06
3	31	13	0.08040	-0.03187	-8.348E 05	8.238E 06
3	31	14	-0.18510	-0.02408	-8.288E 05	1.228E 07
3	31	15	-0.28336	-0.02087	-3.378E 05	1.670E 07
3	31	16	-0.43802	-0.01886	1.872E 05	1.783E 07
3	31	17	-0.57232	0.06858	3.781E 05	1.718E 07
3	31	18	-0.02873	0.04787	8.805E 05	1.047E 07
3	31	19	0.28188	[illegible]05214	1.081E 06	8.088E 06
3	31	20	0.88888	[illegible]05225	-8.888E 01	-1.888E-01
4	32	11	-0.73788	0.09188	-7.378E 01	0.
4	32	12	-0.12108	0.07385	8.863E 05	-8.047E 06
4	32	13	0.30839	0.02804	4.400E 05	-1.828E 07
4	32	14	0.39813	0.00727	1.778E 05	-2.088E 07
4	32	15	0.38750	0.00148	-1.337E 06	-1.881E 07
4	32	16	0.21820	-0.00288	-2.455E 06	-8.087E 06
4	32	17	0.86085	0.01383	-2.833E 06	1.780E 06
4	32	18	-0.30977	0.08477	-1.880E 06	2.048E 07
4	32	19	-0.00220	0.06381	1.804E 05	1.878E 06
4	32	20	0.81059	0.08[illegible]88	-8.109E 01	-4.388E-01
5	33	11	0.89022	-0.14328	8.902E 01	0.
5	33	12	-0.34882	-0.11078	2.418E 06	1.808E 07
5	33	13	-0.27630	-0.00981	1.331E 06	1.813E 07
5	33	14	0.02888	0.00884	1.474E 06	8.818E 06
5	33	15	0.14487	0.00818	8.214E 05	-1.844E 06
5	33	16	0.23102	0.00884	-6.514E 05	-8.988E 06
5	33	17	0.22384	0.00808	-1.160E 06	-3.938E 06
5	33	18	-0.08741	0.01381	-1.188E 06	1.148E 07
5	33	19	-0.02022	0.01888	8.381E 04	8.080E 05
5	33	20	0.11488	0.01707	-1.147E 01	0.
6	34	11	0.44845	0.07298	4.484E 01	0.
6	34	12	0.84284	0.07013	-8.812E 06	-7.0[illegible] 06
6	34	13	-0.48188	0.02761	-8.008E 06	9.374E 07
6	34	14	-0.81882	[illegible].0887[illegible]	-3.834E 06	8.823E 07
6	34	15	-0.37780	0.08000	3.370E 05	3.808E 07
6	34	16	0.48279	[illegible].08403	7.413E 05	-2.108E 07
6	34	17	0.82478	[illegible].04630	-2.738E 06	-2.784E 07
6	34	18	-0.07809	[illegible].02442	-4.887E 06	2.089E 07
6	34	19	-0.13871	0.02488	-1.322E 05	8.283E 05
6	34	20	0.05357	0.02818	-8.731E 00	3.113E-01
7	35	11	-0.07340	0.08738	-7.340E 00	0.
7	35	12	0.28381	0.03182	-2.142E 06	-1.387E 07
7	35	13	-0.49222	-0.03338	1.368E 06	1.038E 07
7	35	14	-0.22773	-0.0217[illegible]	2.817E 06	1.088E 06
7	35	15	-0.08371	-0.01617	8.848E 06	-8.270E 06
7	35	16	0.20811	-0.02883	2.743E 06	-2.982E 07
7	35	17	0.47870	-0.08434	-2.979E 06	-2.438E 07
7	35	18	-0.95135	-0.11888	8.742E 05	1.830E 05
7	35	19	0.83768	-0.02882	3.714E 06	1.108E 07
7	35	20	0.84183	-0.03842	-8.422E 01	1.245E 00
8	36	11	-0.18704	0.10808	-1.870E 01	0.
8	36	12	0.43788	0.04341	-4.188E 06	-2.738E 07
8	36	13	-0.94088	-0.07384	8.848E 06	3.[illegible]08E 07
8	36	14	0.03628	-0.04889	7.882E 06	-1.027E 07
8	36	15	0.21888	-0.34184	4.188E 06	-1.808E 07
8	36	16	0.10842	-[illegible].74482	-4.887E 06	8.[illegible]28E 06
8	36	17	-0.13416	-0.02438	8.827E 05	1.849E 07
8	36	18	0.11181	0.01289	2.888E 05	8.804E 06
8	36	19	-0.08848	0.00478	-3.800E 05	-8.380E 05
8	36	20	-0.00083	0.00808	8.078E 0[illegible]	0.
9	37	11	-0.88817	0.04793	-8.882E 01	0.
9	37	12	-0.28027	-0.07808	8.848E 06	-4.833E 06
9	37	13	0.82740	-0.08785	-1.488E 06	-2.418E 07
9	37	14	-0.42987	-0.10370	-1.400E 06	8.833E 06
9	37	15	-0.85077	-0.08771	1.877E 07	8.988E 07
9	37	16	0.41381	-0.07801	1.348E 07	4.890E 07
9	37	17	0.82028	-0.13289	3.388E 06	3.811E 07
9	37	18	0.08340	0.01322	-3.301E 06	8.888E 07
9	37	19	-0.10871	0.03160	8.221E 04	4.423[illegible] 06
9	37	20	0.18478	0.03710	-1.842E 01	0.

DATA FOR MODAL SUBSYSTEM 5

PRE-ICLS CORE ROTO. SYSTEM HORIZONTAL

NUMBER OF SUBSYSTEM DIRECTIONS= 2

SUBSYSTEM DIRECTIONS-
Y (GLOBAL DIRECTION 3)
THETA-Z (GLOBAL DIRECTION 4)

COORDINATES OF REFERENCE POINT RELATIVE TO GLOBAL SYSTEM (IN.)
X= 0. Y= 0. Z= 0.

COORDINATES OF POINTS ON SUBSYSTEM (INCHES)

POINT NUMBER	LOCAL COORDINATE SYSTEM X	Y	Z	GLOBAL COORDINATE SYSTEM X	Y	Z
11	-201.040	0.	0.	-201.040	0.	0.
12	-207.070	0.	0.	-207.070	0.	0.
13	-217.010	0.	0.	-217.010	0.	0.
14	-223.000	0.	0.	-223.000	0.	0.
15	-228.010	0.	0.	-228.010	0.	0.
16	-235.070	0.	0.	-235.070	0.	0.
17	-238.385	0.	0.	-238.385	0.	0.
18	-250.665	0.	0.	-250.665	0.	0.
19	-255.465	0.	0.	-255.465	0.	0.
20	-263.325	0.	0.	-263.325	0.	0.

NUMBER OF SUBSYSTEM POINTS= 10

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	FREQUENCY RPM	POTENTIAL ENERGY	Q FACTOR	MODE TYPE 0=FLEXIBLE 1=RIGID BODY	GENERALIZED WEIGHT-LB	GENERALIZED STIFFNESS LB/IN	GENERALIZED DAMPING VALUE (LB-SEC)/IN
1	38	73.	6.421E 01	-35.	1	6.462E 02	0.	0.
2	39	138.	5.807E 01	-35.	1	2.046E 02	0.	0.
3	40	10460.	7.562E 05	-35.	0	1.667E 02	1.612E 06	-2.636E 01
4	41	28633.	2.361E 06	-35.	0	1.669E 02	4.722E 06	-4.366E 01
5	42	36775.	1.861E 06	-35.	0	6.723E 01	3.722E 06	-2.648E 01
6	43	51767.	1.212E 07	-35.	0	3.184E 02	2.424E 07	-1.262E 02
7	44	68818.	4.638E 07	-35.	0	7.143E 02	9.077E 07	-3.744E 02
8	45	74534.	1.153E 07	-35.	0	1.402E 02	2.306E 07	-6.637E 01
9	46	87882.	3.566E 07	-35.	0	3.266E 02	7.132E 07	-2.341E 02

NUMBER OF SUBSYSTEM MODES= 9

THE MODE SHAPES FOR THIS SUBSYSTEM ARE-
(SIGNS IN THETA-Z DIRECTION CHANGED TO OBTAIN RIGHT HAND COORDINATE SYSTEM)

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	POINT NUMBER	MODAL DISPLACEMENTS GLOBAL DIRECTION 3 Y	4 THETA-Z	MODAL FORCES GLOBAL DIRECTION 3 Y	4 THETA-Z
1	38	11	-0.53310	0.00750	-5.331E 01	0.
1	38	12	-0.58282	0.00750	-4.409E 01	-3.379E 02
1	38	13	-0.56284	0.00750	-3.715E 01	-7.362E 02
1	38	14	-0.69776	0.00750	-3.411E 01	-8.517E 02
1	38	15	-0.72530	0.00750	-1.553E 01	-1.062E 03
1	38	16	-0.78821	0.00748	1.948E 00	-1.178E 03
1	38	17	-0.81314	0.00748	6.210E 00	-1.169E 03
1	38	18	-0.90555	0.00750	2.079E 01	-1.009E 03
1	38	19	-0.94108	0.00750	5.648E 01	-7.692E 02
1	38	20	-1.00000	0.00750	1.000E 02	0.
2	39	11	0.93427	0.02298	9.343E 01	0.
2	39	12	0.78102	0.02298	4.455E 01	4.719E 02
2	39	13	0.58726	0.02298	1.893E 01	7.959E 02
2	39	14	0.42957	0.02301	1.192E 01	8.757E 02
2	39	15	0.31428	0.02301	-1.858E 01	7.970E 02
2	39	16	0.15181	0.02301	-3.763E 01	5.458E 02
2	39	17	0.07528	0.02301	-2.991E 01	4.039E 02
2	39	18	-0.21170	0.02301	-3.472E 01	-1.124E 07
2	39	19	-0.31757	0.02301	6.309E 01	-3.903E 02
2	39	20	-0.48845	0.02301	4.884E 01	6.702E-06
3	40	11	0.86058	0.04872	8.807E 01	0.
3	40	12	0.53089	0.04356	-5.248E 05	-2.382E 06
3	40	13	0.09040	0.03187	-8.348E 05	-6.238E 06
3	40	14	-0.18510	0.02408	-8.268E 05	-1.225E 07
3	40	15	-0.28338	0.02087	-3.375E 05	-1.579E 07
3	40	16	-0.43802	0.01880	1.672E 05	-1.782E 07
3	40	17	-0.57232	-0.00858	3.791E 05	-1.718E 07
3	40	18	-0.02873	-0.04787	5.605E 05	-1.047E 07
3	40	19	0.25185	-0.05214	1.051E 05	-6.056E 06
3	40	20	0.66685	-0.05225	-6.668E 01	1.859E-01
4	41	11	-0.73788	-0.09188	-7.379E 01	0.
4	41	12	-0.12108	-0.07385	5.953E 05	5.047E 06
4	41	13	0.30539	-0.02504	4.400E 05	1.828E 07
4	41	14	0.39813	-0.00727	1.778E 05	2.059E 07
4	41	15	0.38750	0.00149	-1.337E 06	1.881E 07
4	41	16	0.21820	0.00289	-2.455E 05	5.067E 06
4	41	17	0.08085	-0.01362	-2.533E 06	-1.750E 06
4	41	18	-0.30977	-0.05477	-1.869E 06	-2.945E 07
4	41	19	-0.00220	-0.05381	1.804E 06	-1.678E 06
4	41	20	0.51055	-0.05455	-5.105E 01	4.355E-01
5	42	11	0.59022	0.14328	5.902E 01	0.
5	42	12	-0.24882	0.11078	2.418E 05	-1.809E 07
5	42	13	-0.27830	0.00581	1.331E 05	-1.613E 07
5	42	14	0.02868	-0.00584	1.474E 05	-8.618E 06
5	42	15	0.14457	-0.00818	8.214E 05	1.844E 06
5	42	16	0.23102	-0.00584	-8.514E 05	5.955E 06
5	42	17	0.23384	-0.00505	-1.180E 06	3.635E 06
5	42	18	-0.08741	-0.01351	-1.186E 06	-1.148E 07
5	42	19	-0.02022	-0.01665	5.381E 04	-8.060E 05
5	42	20	0.11465	-0.01707	-1.147E 01	0.
6	43	11	0.44948	-0.07299	4.494E 01	0.
6	43	12	0.84264	-0.07813	-9.612E 06	7.039E 06
6	43	13	-0.48169	-0.02781	-5.008E 06	-4.374E 07
6	43	14	-0.61852	-0.00571	-3.534E 06	-6.623E 07
6	43	15	-0.37780	-0.06000	3.370E 06	-3.509E 07
6	43	16	0.46279	-0.08403	7.613E 06	2.105E 07
6	43	17	0.92479	-0.04630	-2.739E 06	2.764E 07
6	43	18	-0.07508	-0.02442	-4.987E 06	-2.059E 07
6	43	19	-0.13971	-0.02459	-1.322E 06	-5.203E 06
6	43	20	0.06397	-0.02818	-6.331E 00	-3.113E-01
7	44	11	-0.07340	-0.05735	-7.340E 00	0.
7	44	12	0.28381	-0.03182	-2.142E 06	1.987E 07
7	44	13	-0.40222	0.03339	1.388E 06	-1.039E 07
7	44	14	-0.22773	0.02178	2.917E 06	-1.065E 06
7	44	15	-0.07371	0.01817	5.545E 06	5.270E 06
7	44	16	0.20611	0.02863	2.742E 06	3.982E 07
7	44	17	0.47670	0.08434	-3.978E 06	2.436E 07

7	44	18	-0.05135	0.11005	5.742E 06	-1.830E 06
7	44	19	0.37765	0.02882	3.714E 06	-1.108E 07
7	44	20	0.04183	0.02842	-8.422E 01	-1.343E 06
8	45	11	-0.15704	-0.10806	-1.879E 01	0.
8	45	12	0.43786	-0.04341	-4.188E 06	2.735E 07
8	45	13	-0.04088	0.07394	5.548E 06	-3.308E 07
8	45	14	0.03525	0.04088	7.882E 06	1.827E 07
8	45	15	0.21589	0.04154	4.155E 06	1.008E 07
8	45	16	0.10842	0.08452	-4.887E 06	-8.828E 06
8	45	17	-0.13418	0.02438	4.827E 06	-1.848E 07
8	45	18	0.11181	-0.07288	2.888E 06	-8.884E 06
8	45	19	-0.08848	-0.00478	-3.808E 06	8.308E 06
8	45	20	-0.08083	-0.00800	5.078E 00	0.
9	46	11	-0.08817	-0.04753	-8.982E 01	0.
9	46	12	-0.28027	0.07600	8.848E 06	4.833E 06
9	46	13	0.52740	0.08785	-1.488E 06	2.818E 07
9	46	14	-0.42887	0.10370	-1.400E 06	-8.833E 06
9	46	15	-0.58077	0.08771	1.877E 07	-8.888E 07
9	46	16	0.41881	0.07001	1.345E 07	-4.890E 07
9	46	17	0.52026	0.13288	3.388E 06	-3.811E 07
9	46	18	0.05340	-0.01322	-3.381E 06	-8.888E 07
9	46	19	-0.10871	-0.03180	5.221E 04	-4.422E 06
9	46	20	0.18478	-0.03710	-1.842E 01	0.

DATA FOR MODAL SUBSYSTEM 7

EEE-ICLS STATIC STRUCTURE SUBSYSTEM VERTICAL

NUMBER OF SUBSYSTEM DIRECTIONS= 2

SUBSYSTEM DIRECTIONS-
Z (GLOBAL DIRECTION 1)
THETA-Y (GLOBAL DIRECTION 2)

COORDINATES OF REFERENCE POINT RELATIVE TO GLOBAL SYSTEM (IN.)
X= 0. Y= 0. Z= 0.

COORDINATES OF POINTS ON SUBSYSTEM (INCHES)

POINT NUMBER	LOCAL COORDINATE SYSTEM X	Y	Z	GLOBAL COORDINATE SYSTEM X	Y	Z
21	-166.901	0.	0.	-166.901	0.	0.
22	-177.455	0.	0.	-177.455	0.	0.
23	-207.630	0.	0.	-207.630	0.	0.
24	-217.005	0.	0.	-217.005	0.	0.
25	-223.015	0.	0.	-223.015	0.	0.
26	-228.105	0.	0.	-228.105	0.	0.
27	-234.550	0.	0.	-234.550	0.	0.
28	-237.815	0.	0.	-237.815	0.	0.
29	-250.815	0.	0.	-250.815	0.	0.
30	-255.555	0.	0.	-255.555	0.	0.
31	-262.265	0.	0.	-262.265	0.	0.
32	-270.225	0.	0.	-270.225	0.	0.
33	-278.575	0.	0.	-278.575	0.	0.
34	-172.155	0.	0.	-172.155	0.	0.
35	-184.775	0.	0.	-184.775	0.	0.
36	-201.040	0.	0.	-201.040	0.	0.
37	-288.475	0.	0.	-288.475	0.	0.

NUMBER OF SUBSYSTEM POINTS= 17

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	FREQUENCY RPM	POTENTIAL ENERGY	Q FACTOR	MODE TYPE 0=FLEXIBLE 1=RIGID BODY	GENERALIZED WEIGHT-LB	GENERALIZED STIFFNESS LB/IN	GENERALIZED DAMPING VALUE (LB-SEC)/IN
1	47	718.	2.187E 04	15.	1	3.003E 03	0.	0.
2	48	1341.	[illegible].884E 04	15.	1	1.738E 03	0.	0.
3	49	4351.	1.828E 05	15.	0	5.880E 02	3.058E 06	4.473E 01
4	50	8541.	4.285E 05	15.	0	4.110E 02	8.810E 06	8.343E 01
5	51	11478.	1.581E 06	15.	0	8.811E 02	3.181E 06	1.785E 02
6	52	[illegible]131.	3.348E 06	15.	0	1.387E 03	8.881E 06	3.384E 02
7	53	[illegible].011.	4.357E 06	15.	0	1.081E 03	8.714E 06	2.281E 02
8	54	18937.	1.370E 06	15.	0	2.882E 02	2.740E 06	8.211E 01
9	55	21286.	2.258E 06	15.	0	3.810E 02	4.811E 06	1.381E 02
10	56	24718.	2.403E 06	15.	0	2.772E 02	4.808E 06	1.238E 02
11	57	27768.	1.882E 06	15.	0	1.820E 02	3.083E 06	8.132E 01
12	58	28889.	2.404E 06	15.	0	2.018E 02	4.807E 06	1.058E 02
13	59	31883.	9.048E 06	15.	0	5.281E 02	1.810E 07	3.510E 02
14	60	38147.	3.023E 07	15.	0	1.484E 03	6.048E 07	1.008E 03
15	61	38418.	3.106E 07	15.	0	1.408E 03	6.213E 07	1.003E 03
16	62	43312.	1.445E 07	15.	0	5.430E 02	2.881E 07	4.248E 02
17	63	48781.	3.117E 07	15.	0	1.004E 03	6.233E 07	8.483E 02
18	64	50137.	3.798E 07	15.	0	1.088E 03	7.588E 07	8.848E 02
19	65	53489.	7.375E 06	15.	0	1.818E 02	1.475E 07	1.785E 02
20	66	54801.	1.302E 07	15	0	2.044E 02	2.604E 07	2.020E 02

21	67	66066	4.826E 06	15	0	8.942E 01	8.851E 06	1.081E 02
22	68	66253	2.093E 07	15	0	3.463E 02	4.166E 07	4.063E 02
23	69	71144	1.717E 08	15	0	2.381E 03	3.434E 08	3.073E 03
24	70	74562	3.537E 07	15	0	4.491E 02	7.075E 07	5.045E 02
25	71	75801	6.227E 07	15	0	7.817E 02	1.245E 08	1.045E 03
26	72	78634	2.167E 07	15	0	[illegible] E 02	4.318E 07	3.564E 02
27	73	78488	2.185E 08	15	0	[illegible] 03	4.369E 08	3.543E 03

NUMBER OF SUBSYSTEM MODES: 27

THE MODE SHAPES FOR THIS SUBSYSTEM ARE-

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	POINT NUMBER	MODAL DISPLACEMENTS GLOBAL DIRECTION 1 Z	MODAL DISPLACEMENTS GLOBAL DIRECTION 3 THETA-Y	MODAL FORCES GLOBAL DIRECTION 1 Z	MODAL FORCES GLOBAL DIRECTION 2 THETA-Y
1	47	21	0.82262	-0.00807	-5.201E 03	8.808E 04
1	47	22	0.82013	-0.00888	-1.778E 03	8.400E 03
1	47	23	0.55248	-0.00880	1.338E 04	5.163E 05
1	47	24	0.47148	-0.00870	1.338E 04	4.807E 05
1	47	25	0.42003	-0.00868	1.178E 04	8.182E 05
1	47	26	0.37864	-0.00857	-1.442E 02	4.068E 02
1	47	27	0.32130	-0.00857	-3.588E 03	2.367E 03
1	47	28	0.20286	-0.00868	3.570E 02	1.773E 03
1	47	29	0.18373	-0.00848	5.687E 03	1.418E 05
1	47	30	0.14803	-0.00847	6.487E 03	1.035E 05
1	47	31	0.06882	-0.00841	7.485E 03	1.311E 05
1	47	32	0.02528	-0.00835	7.485E 03	7.470E 04
1	47	33	-0.04278	-0.00833	7.485E 03	1.773E 04
1	47	34	0.86738	-0.00888	0.	0.
1	47	35	0.85512	-0.00812	0.	0.
1	47	36	0.81040	-0.00888	-2.366E-04	8.078E-04
1	47	37	0.03055	-0.00834	0.	0.
2	48	21	0.15249	-0.00883	-4.431E 03	2.188E 05
2	48	22	0.05128	-0.00853	-5.286E 02	1.058E 04
2	48	23	-0.20810	-0.00837	1.424E 03	1.301E 06
2	48	24	-0.28336	-0.00813	3.171E 03	1.285E 06
2	48	25	-0.33164	-0.00787	4.852E 03	1.285E 05
2	48	26	-0.37250	-0.00787	4.708E 02	8.886E 01
2	48	27	-0.42200	-0.00787	1.340E 03	-4.208E 03
2	48	28	-0.46788	-0.00783	-2.821E 03	-2.880E 04
2	48	29	-0.54024	-0.00728	2.216E 04	8.856E 05
2	48	30	-0.57183	-0.00718	2.487E 04	8.810E 05
2	48	31	-0.61066	-0.00681	3.868E 04	8.870E 05
2	48	32	-0.65117	-0.00640	4.521E 04	5.788E 05
2	48	33	-0.65366	-0.00628	5.286E 04	1.756E 05
2	48	34	0.09870	-0.00885	0	0.
2	48	35	-0.09845	-0.00858	0.	0.
2	48	36	-0.15042	0.00857	4.808E-05	-8.823E-05
2	48	37	-0.54372	-0.00530	0	0.
3	49	21	0.21488	-0.01081	-8.378E 04	2.822E 06
3	49	22	0.00382	-0.00549	-1.313E 03	1.208E 05
3	49	23	-0.15550	-0.00371	8.784E 04	1.456E 07
3	49	24	-0.17282	-0.00113	1.100E 05	1.362E 07
3	49	25	-0.18784	0.03068	1.187E 05	1.203E 07
3	49	26	-0.18543	0.00342	2.320E 03	-8.207E 03
3	49	27	-0.14321	0.00341	5.826E 03	-3.711E 04
3	49	28	-0.12673	0.00405	-6.881E 03	-2.801E 04
3	49	29	-0.01831	0.00698	1.614E 05	8.801E 06
3	49	30	0.02832	0.00780	1.612E 05	5.016E 06
3	49	31	0.12638	0.00878	1.421E 05	3.824E 06
3	49	32	0.26319	0.01137	1.281E 06	2.802E 06
3	49	33	0.37448	0.01168	8.880E 04	1.830E 06
3	49	34	0.03464	-0.00884	0	0.
3	49	35	-0.09318	-0.00883	0	0.
3	49	36	-0.12868	-0.00582	-4.326E-05	3.092E-03
3	49	37	0.32058	0.01211	0.	0.
4	50	21	0.03994	-0.00587	-5.222E 04	5.202E 06
4	50	22	-0.15851	0.00404	5.101E 04	-4.557E 06
4	50	23	0.03583	0.00452	3.212E 06	8.628E 06
4	50	24	0.14378	0.00588	7.984E 06	8.084E 05
4	50	25	0.22214	0.00643	7.807E 05	-3.871E 06
4	50	26	0.30285	0.00308	-1.378E 04	8.884E 03
4	50	27	0.32118	0.00311	-4.338E 04	1.888E 05
4	50	28	0.36871	0.00307	8.828E 04	7.818E 06
4	50	29	0.35350	-0.00223	2.214E 05	-1.888E 07
4	50	30	0.37866	-0.00398	1.446E 05	-2.073E 07
4	50	31	0.27426	-0.00878	-2.070E 05	-1.278E 07
4	50	32	0.08283	-0.01341	-2.777E 05	-1.008E 07
4	50	33	-0.10588	-0.01517	-2.787E 05	-6.343E 06
4	50	34	-0.18855	0.00468	0.	0.
4	50	35	-0.07784	0.00505	0.	0.
4	50	36	-0.04801	0.00505	5.872E-03	-1.288E-02
4	50	37	-0.10613	-0.01807	0.	0.
5	51	21	-0.11245	-0.00123	1.760E 05	1.112E 05
5	51	22	0.02502	-0.00081	-1.528E 04	1.284E 05
5	51	23	0.05594	-0.00150	8.537E 05	-7.348E 06
5	51	24	0.10436	-0.00371	8.107E 05	-1.508E 07
5	51	25	0.12135	-0.00584	7.708E 05	-1.870E 07
5	51	26	0.15280	-0.01210	-1.509E 04	1.008E 05
5	51	27	0.07450	-0.01202	-3.363E 04	3.863E 05
5	51	28	0.02127	-0.01425	-2.870E 04	-7.218E 05
5	51	29	-0.09428	-0.02182	7.218E 05	-3.448E 07
5	51	30	-0.17590	-0.02469	7.898E 05	-3.887E 07
5	51	31	-0.15209	-0.01937	1.252E 06	2.378E 07
5	51	32	0.09736	-0.00781	1.285E 06	1.508E 07
5	51	33	0.30195	-0.00418	1.138E 06	5.898E 06
5	51	34	0.03213	-0.00082	0	0
5	51	35	0.01197	-0.00086	0	0.
5	51	36	0.00594	-0.00096	-9.343E-04	-8.852E-03
5	51	37	0.09539	-0.00354	0.	0.
6	52	21	0.59480	0.00134	-1.294E 06	3.845E 05
6	52	22	-0.74805	0.01752	5.793E 05	-4.818E 06
6	52	23	-0.10373	0.01287	-5.125E 05	-2.743E 07
6	52	24	-0.04124	0.00837	-4.884E 05	-2.338E 07
6	52	25	-0.02683	0.00587	-4.642E 05	-2.087E 07
6	52	26	-0.01389	0.00141	1.984E 03	-1.475E 04
6	52	27	-0.00455	0.00140	3.788E 03	-5.468E 04
6	52	28	-0.01639	0.00041	-7.418E 03	-4.348E 04
6	52	29	-0.11283	-0.00317	-3.229E 05	-8.863E 06
6	52	30	-0.18041	-0.00404	-2.817E 05	-7.310E 06
6	52	31	-0.15710	-0.00270	1.718E 05	8.784E 06
6	52	32	-0.07838	0.00080	2.807E 05	7.638E 06
6	52	33	0.00402	0.00218	3.274E 05	4.089E 06
6	52	34	-0.96323	0.02627	0	0
6	52	35	-0.30826	0.03260	0	0
6	52	36	-0.10412	0.03280	4.744E-02	-1.[illegible]E-01
6	52	37	0.20410	0.00277	0	0.
7	53	21	-0.11761	0.00455	3.454E 05	1.691E 07
7	53	22	-0.17527	0.02007	2.825E 05	-7.303E 06
7	53	23	0.44714	0.01366	-6.189E 05	-4.171E 07

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7	63	24	0.47369	0.00887	-1.157E 08	-3.442E 07
7	63	25	0.42513	0.00278	-1.508E 08	-2.872E 07
7	63	26	0.37124	-0.00112	-7.788E 04	1.154E 08
7	63	27	0.35578	-0.00084	-2.852E 05	1.018E 08
7	63	28	0.29488	0.00245	3.240E 05	3.030E 08
7	63	29	-0.21428	0.00165	-2.757E 05	3.728E 07
7	63	30	-0.33371	0.00430	-2.544E 08	4.833E 07
7	63	31	-0.40884	0.00887	-1.052E 08	2.488E 07
7	63	32	-0.38858	0.01409	-4.778E 05	2.788E 07
7	63	33	-0.20898	0.01785	4.557E 04	2.338E 07
7	63	34	-0.62352	0.04184	0.	0.
7	63	35	0.38080	0.07083	0.	0.
7	63	36	0.62805	0.07081	-2.136E-02	8.600E-02
7	63	37	-0.23405	0.02182	0.	0.
8	64	21	-0.00218	-0.00014	5.747E 03	6.018E 05
8	64	22	-0.01272	0.00068	2.518E 04	-4.167E 05
8	64	23	0.01864	-0.00001	7.508E 03	-8.528E 05
8	64	24	0.01350	-0.00121	-1.700E 04	-8.420E 05
8	64	25	0.00284	-0.00201	-2.501E 04	-8.188E 05
8	64	26	-0.00588	-0.00347	4.022E 02	8.228E 04
8	64	27	-0.02805	-0.00342	8.227E 03	1.482E 08
8	64	28	-0.05388	-0.00522	-1.331E 05	-1.738E 08
8	64	29	-0.05840	-0.00482	3.358E 05	-4.857E 05
8	64	30	-0.05850	-0.00481	3.857E 05	-5.521E 08
8	64	31	0.08381	0.00183	7.068E 08	3.408E 07
8	64	32	0.32828	0.01072	3.847E 05	1.824E 07
8	64	33	0.43411	0.01322	-4.883E 05	1.360E 07
8	64	34	-0.05606	0.00287	0.	0.
8	64	35	0.01805	0.00582	0.	0.
8	64	36	-0.05471	0.00583	-7.481E-03	-4.809E-03
8	64	37	-0.81088	0.01488	0.	0.
9	65	21	-0.02228	-0.00028	1.235E 05	9.257E 08
9	65	22	0.13587	0.00005	-2.808E 05	8.5[illegible]E 05
9	65	23	-0.02338	-0.00218	-1.388E 08	-2.143E 07
9	65	24	-0.18843	-0.00488	-1.228E 08	-5.415E 08
9	65	25	-0.28000	-0.00524	-8.588E 05	-1.244E 08
9	65	26	-0.37187	-0.00339	1.302E 05	-7.705E 04
9	65	27	-0.38161	-0.00350	3.287E 05	-1.317E 08
9	65	28	-0.48102	-0.01483	-1.113E 04	-1.243E 07
9	65	29	-0.01598	0.00025	2.330E 08	-7.848E 08
9	65	30	0.11337	0.00018	2.278E 08	-1.872E 07
9	65	31	0.23428	-0.00318	1.082E 08	-3.208E 07
9	65	32	0.20038	-0.01044	5.882E 08	-3.844E 07
9	65	33	0.08518	-0.01528	1.408E 05	-3.088E 07
9	65	34	-0.32377	0.01842	0.	0.
9	65	35	0.15788	0.08082	0.	0.
9	65	36	0.48809	0.08080	2.406E-02	1.382E-01
9	65	37	0.38858	-0.02087	0.	0.
10	66	21	-0.00788	-0.00072	3.167E 04	5.311E 05
10	66	22	-0.80800	0.01127	2.410E 08	-1.277E 07
10	66	23	0.13468	0.00406	-4.308E 05	-2.522E 07
10	66	24	0.10700	-0.00008	-7.380E 05	-2.012E 07
10	66	25	0.08280	-0.00233	-8.732E 05	-1.768E 07
10	66	26	-0.00834	-0.00438	1.882E 03	1.321E 08
10	66	27	-0.0367[illegible]	[illegible]00428	1.882E 04	3.068E [illegible]
10	66	28	-0.17[illegible]	[illegible]01408	-8.881E 05	-1.161E [illegible]
10	66	29	-0.04[illegible]	[illegible]00082	5.048E 05	5.088E 0[illegible]
10	66	30	-0.[illegible]	[illegible]00018	8.505E 05	8.858E 0[illegible]
10	66	31	0.[illegible]	[illegible]00023	3.633E 05	-9.730E 05
10	66	32	0.04[illegible]	[illegible]00182	2.128E 05	-1.155E 07
10	66	33	0.0312[illegible]	[illegible].00348	5.728E 04	-1.048E 07
10	66	34	0.301[illegible]	-0.00803	0.	0.
10	66	35	0.044[illegible]	[illegible]0.0[illegible]588	0.	0.
10	66	36	-0.17598	[illegible]03583	8.437E-02	-1.560E-02
10	66	37	0.1065[illegible]	[illegible]0574	0.	0.
11	67	21	0.00577	-0.00011	-5.552E 04	1.448E 08
11	67	22	0.27918	0.00123	-1.062E 08	1.487E 08
11	67	23	0.09125	0.00157	1.[illegible]44E 08	-5.828E 08
11	67	24	0.17080	-0.00048	8.252E 05	-1.408E 07
11	67	25	0.18751	-0.00248	2.505E 05	-1.851E 07
11	67	26	0.22588	-0.00763	-1.315E 05	4.842E 08
11	67	27	0.18528	-0.00718	-3.113E 05	2.352E 08
11	67	28	-0.07439	-0.02807	-1.487E 08	-2.374E 07
11	67	29	0.11754	-0.00282	-3.137E 04	1.358E 07
11	67	30	0.10607	-0.00132	-2.878E 05	1.478E 07
11	67	31	0.01558	0.00082	-1.342E 08	2.382E 07
11	67	32	-0.11448	0.00424	-1.187E 08	3.254E 07
11	67	33	-0.18582	0.00814	-5.128E 05	3.347E 07
11	67	34	-0.12889	0.00081	0.	0.
11	67	35	-0.08578	-0.02547	0.	0.
11	67	36	-0.24878	-0.02553	-4.350E-03	2.338E-02
11	67	37	-0.24584	0.01522	0.	0.
12	68	21	0.00102	-0.00038	-3.581E 04	4.258E 08
12	68	22	0.28450	0.00522	-1.148E 05	-2.385E 08
12	68	23	0.12482	0.00410	1.855E 05	-1.487E 07
12	68	24	0.14730	0.00128	-3.105E 08	-1.483E 07
12	68	25	0.12270	-0.00044	-8.203E 05	-1.211E 07
12	68	26	0.08813	-0.00248	-8.048E 04	1.811E 08
12	68	27	0.07508	-0.0027[illegible]	-1.487E 05	1.803E 08
12	68	28	0.03405	-0.00017	1.570E 05	1.745E 08
12	68	29	-0.20025	-0.00009	-5.312E 08	1.848E 07
12	68	30	-0.20380	0.00152	-5.448E 04	1.858E 07
12	68	31	-0.04522	0.00087	1.845E 08	-3.827E 07
12	68	32	0.14455	-0.00509	1.774E 08	-5.228E 07
12	68	33	0.23340	-0.01149	8.283E 05	-5.438E 07
12	68	34	-0.18885	0.00404	0.	0.
12	68	35	-0.08880	-0.04865	0.	0.
12	68	36	-0.28232	-0.04877	7.248E-04	1.081E-01
12	68	37	0.40074	-0.02327	0.	0.
13	69	21	-0.02735	-0.00071	3.311E 05	7.301E 05
13	69	22	0.04880	0.00879	-1.484E 05	-1.004E 07
13	69	23	-0.03533	0.00332	-4.380E 08	-3.435E 07
13	69	24	-0.35825	0.00123	-3.548E 08	3.178E 08
13	69	25	-0.51888	0.00288	-2.348E 08	2.082E 07
13	69	26	-0.79188	0.01884	5.881E 05	-1.584E 08
13	69	27	-0.83847	0.01387	1.470E 08	-8.242E 08
13	69	28	-0.29791	0.03188	8.807E 05	2.807E 07
13	69	29	0.18815	0.00404	2.818E 08	-5.084E 07
13	69	30	0.28878	-0.00088	2.033E 08	-7.108E 07
13	69	31	0.16349	-0.00282	-1.879E 05	3.891E 07
13	69	32	-0.06274	0.00280	-2.028E 05	5.278E 07
13	69	33	-0.23882	0.00881	-1.174E 08	5.560E 07
13	69	34	-0.43812	0.02182	0.	0.
13	69	35	0.14097	-0.09282	0.	0.
13	69	36	-0.44408	-0.09280	-4.318E-02	1.048E-01
13	69	37	-0.41842	0.02308	0.	0.
14	60	21	0.39527	0.00244	-8.022E 04	1.831E 06
14	60	22	0.82858	0.04842	-4.507E 08	-7.203E 07
14	60	23	0.31228	0.02830	-3.558E 08	-1.821E 08
14	60	24	0.11834	0.01314	-8.372E 08	-8.880E 07
14	60	25	-0.13631	0.00884	-5.388E 08	-3.888E 07

14	60	26	-0.80739	0.21228	5.805E 05	-1.782E 06
14	60	27	-0.48868	0.01041	1.801E 06	-1.030E 07
14	60	28	-0.38753	0.01788	-2.443E 06	1.863E 07
14	60	29	-0.08823	0.00274	2.455E 05	-3.831E 0[illegible]
14	60	30	0.05704	0.00010	2.473E 05	-4.887E 07
14	60	31	0.14802	-0.00081	8.888E 04	7.237E 06
14	60	32	0.07708	-0.00003	-5.045E 05	1.127E 07
14	60	33	-0.18350	0.00076	-5.501E 05	2.011E 07
14	60	34	0.83811	-0.04421	0.	0.
14	60	35	-0.42085	0.07823	0.	0.
14	60	36	0.05388	0.07828	5.768E-01	7.858E-01
14	60	37	-0.14833	0.00748	0.	0
15	61	21	-0.88053	-0.01017	1.891E 07	8.808E 07
15	61	22	0.19837	0.01701	-1.231E 06	-2.826E 07
15	61	23	0.15837	0.00844	-5.584E 05	-3.870E 07
15	61	24	0.10240	0.00274	-1.821E 06	-2.758E 07
15	61	25	-0.00841	0.00001	-2.133E 06	-1.861E 07
15	61	26	-0.20804	0.00201	2.392E 06	-4.826E 06
15	61	27	-0.17454	0.00140	5.888E 05	-3.315E 06
15	61	28	-0.15837	0.00888	-7.182E 04	8.784E 06
15	61	29	-0.05188	0.00004	1.177E 06	-6.870E 06
15	61	30	0.01442	-0.00042	1.270E 06	-1.480E 07
15	61	31	0.07835	0.00022	1.781E 06	3.205E 06
15	61	32	0.06171	0.00016	-4.438E 05	2.130E 06
15	61	33	-0.05211	0.00011	-5.421E 05	5.087E 06
15	61	34	0.24460	-0.02415	0.	0.
15	61	35	-0.34182	0.03855	0.	0.
15	61	36	-0.08881	0.03882	-7.858E-03	3.878E-01
15	61	37	-0.08178	0.00321	0.	0.
16	62	21	-0.02863	-0.00080	7.231E 05	5.850E 06
16	62	22	0.08328	0.00878	-5.169E 05	-1.882E 07
16	62	23	-0.24440	0.00855	-4.725E 06	1.738E 07
16	62	24	-0.42365	0.01840	-2.622E 06	4.348E 07
16	62	25	-0.35403	0.02201	1.073E 04	4.180E 07
16	62	26	-0.36209	0.03876	5.855E 05	-4.238E 06
16	62	27	-0.10434	0.02341	1.108E 06	-1.584E 07
16	62	28	0.08747	0.01132	-8.097E 05	-2.113E 07
16	62	29	0.55824	0.01850	-4.385E 06	-8.289E 07
16	62	30	0.25835	0.00815	-8.813E 06	-4.482E 07
16	62	31	-0.85563	-0.01381	-5.081E 06	4.018E 06
16	62	32	-0.76734	-0.00900	3.265E 06	3.278E 07
16	62	33	0.48855	0.00288	5.585E 05	-1.727E 07
16	62	34	0.14288	0.00435	0.	0.
16	62	35	0.10714	-0.00830	0.	0.
16	62	36	0.07433	-0.00526	4.423E-05	2.810E-02
16	62	37	0.25812	-0.01831	0.	0.
17	63	21	-0.08278	-0.00113	1.842E 06	2.184E 07
17	63	22	0.20085	0.01805	-2.873E 06	-4.895E 07
17	63	23	-0.53455	0.01862	-5.475E 05	2.857E 07
17	63	24	-0.84581	0.02782	-8.782E 05	5.134E 07
17	63	25	-0.41200	0.03337	2.324E 06	3.232E 07
17	63	26	-0.08721	0.03730	1.877E 06	-4.358E 06
17	63	27	0.18342	0.03458	-3.787E 04	-1.158E 07
17	63	28	0.41848	0.00837	7.828E 05	-3.302E 07
17	63	29	0.01008	0.00826	-4.133E 06	-4.284E 07
17	63	30	-0.20727	0.00408	-3.801E 06	-2.816E 07
17	63	31	0.38948	0.01878	5.718E 05	-2.281E 06
17	63	32	0.86540	0.01585	-2.058E 06	-8.034E 07
17	63	33	-0.44085	-0.00138	-7.288E 05	-3.169E 07
17	63	34	0.40834	0.02838	0.	0.
17	63	35	0.45890	-0.02352	0.	0.
17	63	36	0.31445	-0.02331	1.042E-02	3.188E-01
17	63	37	-0.00524	0.00513	0	0.
18	64	21	-0.04121	-0.00077	1.530E 06	1.618E 07
18	64	22	0.14328	0.01107	-2.770E 06	-2.885E 07
18	64	23	0.04285	0.00358	5.585E 05	-4.038E 07
18	64	24	0.48858	-0.00884	3.583E 04	-5.020E 07
18	64	25	0.50026	-0.02183	1.114E 06	-8.320E 07
18	64	26	0.88114	-0.08034	-1.707E 06	5.887E 06
18	64	27	0.33482	-0.05210	-3.444E 05	3.887E 07
18	64	28	-0.38408	-0.01827	-1.304E 06	3.385E 07
18	64	29	-0.48471	-0.02087	7.227E 06	7.004E 07
18	64	30	-0.01177	-0.01044	5.107E 06	5.234E 07
18	64	31	-0.08837	-0.01285	-3.585E 05	-1.821E 07
18	64	32	-0.51888	-0.01762	5.788E 05	3.417E 07
18	64	33	0.28243	-0.00521	6.888E 06	3.306E 07
18	64	34	0.42205	0.03383	0.	0.
18	64	35	0.51777	-0.02478	0.	0.
18	64	36	0.38522	-0.02448	-7.805E-03	-1.335E-01
18	64	37	-0.26800	0.00485	0.	0.
19	65	21	0.00130	-0.00001	-5.821E 04	4.558E 06
19	65	22	0.00188	0.00114	7.378E 04	-5.281E 06
19	65	23	-0.05823	0.00004	-1.530E 06	-4.828E 06
19	65	24	-0.13790	0.00045	-2.824E 05	8.890E 06
19	65	25	-0.11838	0.00101	7.358E 05	2.848E 06
19	65	26	-0.08388	0.00082	1.884E 05	-3.728E 05
19	65	27	-0.07058	0.00033	4.828E 05	-2.670E 06
19	65	28	0.28008	-0.00081	2.788E 05	-1.011E 07
19	65	29	-0.21444	-0.00364	1.851E 06	1.468E 07
19	65	30	-0.08028	-0.00153	2.801E 06	5.434E 06
19	65	31	-0.02076	-0.01094	1.068E 06	-7.585E 07
19	65	32	-0.07845	-0.02308	2.311E 06	-4.358E 07
19	65	33	0.18817	-0.02085	1.518E 06	1.883E 07
19	65	34	-0.01832	-0.00198	0	0.
19	65	35	-0.02858	0.00124	0.	0.
19	65	36	-0.01838	0.00122	-2.834E-03	5.708E-03
19	65	37	-0.70285	0.01520	0.	0.
20	66	21	-0.00052	-0.00007	2.818E 03	2.858E 06
20	66	22	0.01367	0.00381	-1.482E 05	-1.385E 07
20	66	23	-0.03144	-0.00187	-5.885E 05	-3.044E 07
20	66	24	-0.11880	-0.00848	-2.814E 04	-2.100E 07
20	66	25	-0.13389	-0.00887	1.031E 06	-1.881E 07
20	66	26	-0.15987	-0.01820	3.071E 05	2.084E 06
20	66	27	-0.22884	-0.01838	1.038E 06	2.181E 06
20	66	28	0.37858	-0.00882	5.805E 06	-8.787E 06
20	66	29	-0.32307	-0.01485	4.538E 06	4.408E 07
20	66	30	-0.02840	-0.00847	6.187E 06	2.832E 07
20	66	31	0.06731	0.00578	-3.344E 06	7.821E 07
20	66	32	-0.18701	0.01808	-2.730E 06	7.483E 07
20	66	33	-0.07108	0.02085	4.824E 05	9.288E 06
20	66	34	0.01365	-0.00008	0	0.
20	66	35	-0.00430	0.00024	0	0.
20	66	36	-0.00282	0.00024	1.324E-03	-1.894E-02
20	66	37	0.82841	-0.01288	0.	0.
21	67	21	0.00170	-0.00003	-1.627E 05	2.035E 06
21	67	22	0.00819	0.00368	1.771E 05	-1.843E 07
21	67	23	[illegible]	0.00153	-6.437E 05	3.482E 06
21	67	24	-0.37883	0.00827	2.887E 05	2.708E 07
21	67	25	[illegible]	[illegible]	3.285E 05	5.718E 05
21	67	26	0.82386	-0.02495	[illegible]	7.685E 06
21	67	27	0.88708	[illegible]	[illegible]	3.888E 07

21	67	28	-0.03094	-0.00283	-1.133E 06	2.844E 06
21	67	29	-0.11081	-0.00316	1.071E 05	7.708E 06
21	67	30	-0.02872	-0.00187	1.818E 06	2.480E 06
21	67	31	0.02888	-0.00008	-3.888E 05	4.847E 06
21	67	32	-0.02801	0.00014	-2.873E 05	5.180E 06
21	67	33	0.00318	0.00128	2.721E 05	4.182E 06
21	67	34	-0.02867	-0.00348	0.	0.
21	67	35	-0.02473	0.00148	0.	0.
21	67	36	-0.02880	0.00163	-4.907E-03	-1.271E-02
21	67	37	0.02838	-0.00046	0.	0.
22	68	21	-0.00078	-0.00007	1.884E 04	4.897E 06
22	68	22	0.01788	0.00088	-2.881E 05	-3.842E 07
22	68	23	0.00833	-0.00882	1.487E 06	-8.148E 07
22	68	24	0.01428	-0.02331	1.318E 08	-8.708E 07
22	68	25	-0.12720	-0.03080	3.183E 06	-4.488E 07
22	68	26	0.79032	-0.08310	-2.818E 08	2.182E 07
22	68	27	0.00888	-0.08848	-4.887E 08	7.834E 07
22	68	28	-0.11742	-0.01833	4.888E 08	1.048E 07
22	68	29	0.84382	-0.00176	-8.721E 08	8.228E 07
22	68	30	0.18837	0.00134	-1.088E 07	1.027E 08
22	68	31	-0.14406	0.00078	8.907E 05	-1.880E 07
22	68	32	0.18814	0.00181	1.838E 08	-3.788E 07
22	68	33	-0.01828	-0.00412	-1.873E 08	-2.748E 07
22	68	34	0.02888	0.00288	0.	0.
22	68	35	0.00782	-0.00037	0.	0.
22	68	36	0.00880	-0.00038	3.872E-02	4.883E-02
22	68	37	-0.07488	0.00028	0.	0.
23	69	21	-0.20320	-0.04201	-2.438E 07	3.187E 08
23	69	22	-0.02848	-0.01085	1.488E 05	7.133E 07
23	69	23	0.00282	0.00044	-8.183E 04	-8.744E 05
23	69	24	0.00011	0.00033	-9.221E 04	-8.388E 05
23	69	25	-0.00302	0.00027	-7.281E 04	-3.448E 06
23	69	26	0.01208	-0.00027	-5.028E 04	1.388E 08
23	69	27	0.00708	-0.00013	-1.118E 05	7.488E 05
23	69	28	-0.00381	0.00033	4.071E 04	-2.238E 04
23	69	29	0.00087	0.00028	1.482E 04	-1.140E 06
23	69	30	0.00148	0.00013	-4.438E 03	-1.478E 06
23	69	31	-0.00038	-0.00002	-1.377E 03	1.428E 04
23	69	32	0.00030	0.00000	3.370E 03	3.208E 04
23	69	33	-0.00012	0.00001	-5.380E 03	1.881E 04
23	69	34	0.01280	0.00128	0.	0.
23	69	35	-0.00088	-0.00002	0.	0.
23	69	36	-0.00118	-0.00002	2.848E-04	-1.118E-02
23	69	37	0.00013	0.00000	0.	0.
24	70	21	-0.00272	-0.00088	-4.418E 05	4.787E 07
24	70	22	0.11387	0.04177	-3.884E 08	-3.127E 08
24	70	23	-0.13028	-0.00888	3.088E 05	-1.021E 07
24	70	24	-0.07028	-0.01038	3.088E 06	-1.078E 07
24	70	25	0.08287	-0.01218	3.241E 06	-1.718E 07
24	70	26	-0.42424	-0.00718	1.712E 08	-1.782E 08
24	70	27	-0.31087	-0.00884	4.218E 08	-1.810E 07
24	70	28	0.18878	-0.02208	-1.088E 08	2.888E 08
24	70	29	0.03878	-0.01830	-1.480E 08	8.883E 07
24	70	30	-0.08134	-0.00318	-1.273E 08	1.103E 08
24	70	31	-0.02272	0.00080	-8.288E 04	-1.888E 08
24	70	32	0.01224	0.00038	3.004E 05	-8.803E 08
24	70	33	-0.00008	-0.00084	-1.888E 08	-8.828E 08
24	70	34	-0.84141	-0.10888	0.	0.
24	70	35	0.14218	-0.00007	0.	0.
24	70	36	0.14884	0.00018	-1.744E-01	1.781E-01
24	70	37	-0.00878	-0.00027	0.	0.
25	71	21	-0.00083	-0.00028	-4.384E 05	2.730E 07
25	71	22	0.08804	0.02838	2.888E 08	-2.238E 08
25	71	23	-0.24044	-0.01882	-3.178E 08	-8.888E 07
25	71	24	-0.35448	-0.02418	8.277E 08	-4.048E 07
25	71	25	-0.08144	-0.02888	8.048E 08	-8.183E 07
25	71	26	-0.88872	-0.03188	4.107E 08	4.038E 08
25	71	27	-0.80028	-0.03478	1.084E 07	-2.881E 07
25	71	28	0.48388	-0.08880	-2.804E 08	8.173E 08
25	71	29	0.10288	-0.08108	-8.888E 08	3.888E 08
25	71	30	-0.18024	-0.02888	-2.848E 08	3.428E 08
25	71	31	-0.12118	0.00000	-8.802E 05	-8.840E 08
25	71	32	0.07082	0.00188	1.880E 08	-1.878E 07
25	71	33	-0.01343	-0.00123	-1.330E 08	-1.783E 07
25	71	34	0.74001	0.10787	0.	0.
25	71	35	-0.18883	0.00088	0.	0.
25	71	36	-0.18888	0.00038	2.080E-01	-7.848E-01
25	71	37	-0.01881	-0.00031	0.	0.
26	72	21	-0.00013	-0.00003	-3.878E 04	2.888E 08
26	72	22	0.00888	0.00308	3.837E 03	-2.488E 07
26	72	23	0.00884	-0.00188	3.838E 08	-8.881E 08
26	72	24	0.00210	-0.00254	8.800E 04	-3.838E 08
26	72	25	-0.00788	-0.00288	1.480E 08	-1.038E 08
26	72	26	-0.00184	-0.00471	-1.847E 04	1.438E 08
26	72	27	-0.02888	-0.00384	1.882E 08	3.480E 08
26	72	28	-0.00182	-0.00224	8.888E 04	8.382E 08
26	72	29	0.08488	-0.00010	-2.238E 08	8.080E 08
26	72	30	-0.08311	-0.00034	-2.833E 08	1.788E 07
26	72	31	0.80388	-0.02838	8.827E 08	3.818E 07
26	72	32	-0.53078	-0.00802	-1.148E 07	-1.038E 07
26	72	33	0.18814	-0.00478	1.288E 07	8.818E 08
26	72	34	0.02327	0.00482	0.	0.
26	72	35	-0.00818	0.00001	0.	0.
26	72	36	-0.00818	0.00000	-1.487E-03	8.184E-03
26	72	37	-0.13384	-0.00878	0.	0.
27	73	21	-0.80447	-0.00108	-1.788E 08	-1.183E 08
27	73	22	0.37281	0.12233	7.883E 08	-1.048E 08
27	73	23	0.13882	-0.02128	1.048E 07	1.788E 08
27	73	24	0.88388	0.00408	3.077E 08	1.328E 08
27	73	25	0.38203	0.02184	-8.323E 08	-1.380E 08
27	73	26	0.81487	0.07024	-3.788E 08	-1.724E 07
27	73	27	0.88088	0.08814	-1.104E 07	-7.387E 08
27	73	28	-0.88107	0.08138	3.400E 08	-7.871E 08
27	73	29	-0.22828	0.07483	7.243E 08	-3.810E 08
27	73	30	0.27381	0.03828	8.787E 08	-8.118E 08
27	73	31	-0.03381	-0.00738	-7.784E 08	-8.488E 08
27	73	32	0.03748	-0.00131	8.788E 08	3.804E 07
27	73	33	-0.03228	0.00302	-1.477E 08	2.818E 07
27	73	34	0.83887	0.11822	0.	0.
27	73	35	-0.18288	0.00078	0.	0.
27	73	36	-0.18400	0.00042	8.832E-02	-3.188E-01
27	73	37	0.08788	0.00383	0.	0.

DATA FOR MODAL SUBSYSTEM 8

EEE-ICLS STATIC STRUCTURE SUBSYSTEM HORIZONTAL

NUMBER OF SUBSYSTEM DIRECTIONS= 2

SUBSYSTEM DIRECTIONS-
Y (GLOBAL DIRECTION 3)
THETA-Z (GLOBAL DIRECTION 4)

COORDINATES OF REFERENCE POINT RELATIVE TO GLOBAL SYSTEM (IN.)
X= 0 Y= 0. Z= 0

COORDINATES OF POINTS ON SUBSYSTEM (INCHES)

POINT	LOCAL COORDINATE SYSTEM			GLOBAL COORDINATE SYSTEM		
NUMBER	X	Y	Z	X	Y	Z
21	-186.901	0.	0	-186.901	0	0.
22	-177.485	0.	0	-177.485	0.	0.
23	-207.830	0.	0.	-207.830	0.	0
24	-217.905	0.	0	-217.005	0.	0.
25	-223.15	0.	0	-223.015	0.	0.
26	-228.105	0	0	-228.105	0.	0.
27	-234.560	0.	0.	-234.560	0.	0.
28	-227.815	0.	0	-237.815	0.	0.
29	-250.815	0.	0.	-250.815	0.	0.
30	-255.555	0	0	-255.555	0	0.
31	-262.285	0.	0.	-262.285	0.	0.
32	-270.225	0	0	-270.225	0.	0
33	-276.575	0.	0.	-276.575	0.	0
34	-172.186	0.	0	-172.186	0.	0.
35	-184.775	0.	0.	-184.775	0.	0
36	-201.040	0.	0	-201.040	0.	0.
37	-259.475	0.	0.	-259.475	0.	0.

NUMBER OF SUBSYSTEM POINTS= 17

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	FREQUENCY RPM	POTENTIAL ENERGY	Q FACTOR	MODE TYPE 0=FLEXIBLE 1=RIGID BODY	GENERALIZED WEIGHT-LB	GENERALIZED STIFFNESS LB/IN	GENERALIZED DAMPING VALUE (LB-SEC)/IN
1	74	718	2.197E 04	15	1	3.003E 03	0.	0.
2	75	1341	2.884E 04	15	1	1.130E 03	0.	0.
3	76	4361.	1.528E 05	15.	0	5.888E 02	3.065E 05	4.672E 01
4	77	8841.	4.255E 05	15.	0	4.110E 02	8.510E 05	8.343E 01
5	78	11476.	1.591E 06	15.	0	8.511E 02	3.181E 06	1.765E 02
6	79	13131.	3.348E 06	15	0	1.387E 03	6.691E 06	3.244E 02
7	80	17011.	4.357E 06	15.	0	1.001E 03	8.714E 06	3.281E 02
8	81	18837	1.370E 06	15	0	2.692E 02	2.740E 06	6.211E 01
9	82	21255.	2.256E 06	15.	0	3.519E 02	4.511E 06	1.381E 02
10	83	24718.	2.403E 06	15.	0	2.772E 02	4.806E 06	1.238E 02
11	84	27768.	1.992E 06	15.	0	1.620E 02	3.983E 06	8.122E 01
12	85	29989.	2.404E 06	15	0	2.015E 02	4.807E 06	1.066E 02
13	86	31683.	9.048E 06	15.	0	8.281E 02	1.810E 07	3.818E 02
14	87	35147.	3.023E 07	15	0	1.484E 03	6.046E 07	1.609E 03
15	88	38416	3.106E 07	15.	0	1.408E 02	6.213E 07	1.003E 03
16	89	43312.	1.445E 07	15.	0	5.430E 02	2.891E 07	4.249E 02
17	90	48781.	3.117E 07	15.	0	1.004E 03	6.233E 07	8.403E 02
18	91	50137.	3.788E 07	15.	0	1.095E 03	7.555E 07	9.545E 02
19	92	53499.	7.375E 06	15.	0	1.816E 02	1.475E 07	1.768E 02
20	93	54901.	1.302E 07	15.	0	3.044E 02	2.604E 07	3.020E 02
21	94	55038.	4.828E 06	15	0	9.842E 01	9.651E 06	1.061E 02
22	95	65283.	2.093E 07	15.	0	3.483E 02	4.185E 07	4.083E 02
23	96	71144.	1.717E 08	15	0	2.391E 03	3.434E 08	3.073E 03
24	97	74802.	3.537E 07	15.	0	4.491E 02	7.075E 07	8.045E 02
25	98	75801	6.227E 07	15.	0	7.617E 02	1.245E 08	1.045E 03
26	99	76524.	2.157E 07	15.	0	2.589E 02	4.315E 07	3.584E 02
27	100	78499.	2.195E 08	15.	0	2.498E 03	4.389E 08	3.643E 03

NUMBER OF SUBSYSTEM MODES= 27

THE MODE SHAPES FOR THIS SUBSYSTEM ARE-
(SIGNS IN THETA-Z DIRECTION CHANGED TO OBTAIN RIGHT HAND COORDINATE SYSTEM)

LOCAL MODE NUMBER	GENERALIZED COORDINATE NUMBER	POINT NUMBER	MODAL DISPLACEMENTS GLOBAL DIRECTION 3 Y	MODAL DISPLACEMENTS GLOBAL DIRECTION 4 THETA-Z	MODAL FORCES GLOBAL DIRECTION 3 Y	MODAL FORCES GLOBAL DIRECTION 4 THETA-Z
1	74	21	0.92282	0.00907	-8.281E 03	-8.905E 04
1	74	22	0.82013	0.00958	-1.775E 03	-5.400E 03
1	74	23	0.55245	0.00880	1.239E 04	-6.103E 05
1	74	24	0.47148	0.00870	1.238E 04	-4.907E 05
1	74	25	0.43003	0.00865	1.175E 04	-4.192E 05
1	74	26	0.37854	0.00857	-1.442E 02	-4.058E 02
1	74	27	0.22120	0.00857	-2.599E 02	-2.357E 03
1	74	28	0.29288	0.00856	3.576E 02	-1.773E 03
1	74	29	0.18373	0.00849	8.897E 03	-1.618E 05
1	74	30	0.14503	0.00847	8.497E 03	-1.035E 05
1	74	31	0.08992	0.00841	7.645E 03	-1.311E 05
1	74	32	0.02529	0.00835	7.488E 03	-7.470E 04
1	74	33	-0.04278	0.00833	7.495E 03	-1.773E 04
1	74	34	0.85736	0.00885	0.	0.
1	74	35	0.86512	0.00912	0.	0.
1	74	36	0.61040	0.00889	-2.389E-04	-9.876E-04
1	74	37	0.03055	0.00834	0.	0.
2	75	21	0.15249	0.00893	-4.431E 03	-2.188E 05
2	75	22	0.05128	0.00853	-5.288E 02	-1.859E 04
2	75	23	-0.20510	0.00837	1.424E 03	-1.301E 06
2	75	24	-0.26336	0.00813	3.775E 03	-1.285E 06
2	75	25	-0.33164	0.00797	4.652E 03	-1.265E 05
2	75	26	-0.37250	0.00787	4.709E 02	-9.688E 01
2	75	27	-0.42200	0.00787	1.340E 03	4.205E 03
2	75	28	-0.44755	0.00763	-2.821E 03	2.590E 04
2	75	29	-0.54024	0.00729	2.215E 04	-9.890E 05
2	75	30	-0.57193	0.00719	2.487E 04	-8.910E 05
2	75	31	-0.61098	0.00881	3.989E 04	-9.070E 05
2	75	32	-0.65117	0.00840	6.531E 04	-5.759E 05
2	75	33	-0.69386	0.00828	5.285E 04	-1.769E 05
2	75	34	0.09879	0.00855	0.	0.
2	75	35	-0.09845	0.00859	0.	0.
2	75	36	-0.15043	0.00857	6.909E-05	8.573E-05
2	75	37	-0.64372	0.00820	0.	0.
3	76	21	0.21468	0.01081	-8.375E 04	-2.822E 06
3	76	22	0.00362	0.00849	-1.313E 03	-1.208E 05
3	76	23	-0.15550	0.00371	8.784E 04	-1.458E 07
3	76	24	-0.17262	0.00113	1.100E 05	-1.362E 07
3	76	25	-0.15754	-0.00058	1.187E 05	-1.283E 07
3	76	26	-0.[illegible]563	-0.00242	2.320E 03	8.207E 03
3	76	27	-0.[illegible]321	-0.00341	5.825E 03	3.711E 04
3	76	28	-0.[illegible]973	-0.00406	-5.551E 03	2.681E 04
3	76	29	-0.[illegible]	-0.00688	1.514E 05	-8.[illegible]1E 06
3	76	30	0.[illegible]	-0.00780	1.612E 05	-8.[illegible]0E 06
3	76	31	0.12538	-0.00978	1.421E 05	-3.524E 06
3	76	32	0.25318	-0.01137	1.281E 05	-2.592E 06

3	76	33	0.37445	-0.01188	8.880E 04	-1.530E 06
3	76	34	0.03454	0.00884	0	0.
3	76	35	-0.08316	0.00583	0.	0.
3	76	36	-0.12883	0.00582	-4.328E-05	-3.082E-03
3	76	37	0.32058	-0.01211	0.	0.
4	77	21	0.03884	0.00557	-5.222E 04	-5.282E 06
4	77	22	-0.18851	-0.00401	5.161E 04	4.557E 05
4	77	23	0.02582	-0.00472	8.212E 05	-8.828E 06
4	77	24	0.14375	-0.00585	7.884E 05	-8.084E 06
4	77	25	0.22214	-0.00543	7.887E 05	3.971E 06
4	77	26	0.30285	-0.00308	-1.578E 04	-5.884E 03
4	77	27	0.22116	-0.00311	-4.335E 04	-1.808E 06
4	77	28	0.35871	-0.00307	6.825E 04	-7.810E 05
4	77	29	0.38350	0.00223	2.314E 05	1.088E 07
4	77	30	0.27888	0.00381	1.448E 05	2.873E 07
4	77	31	0.27428	0.00878	-2.070E 05	1.278E 07
4	77	32	0.08283	0.01341	-2.777E 05	1.008E 07
4	77	33	-0.10688	0.01517	-2.767E 05	8.343E 06
4	77	34	-0.18855	-0.00488	0.	0.
4	77	35	-0.07764	-0.06505	0.	0.
4	77	36	-0.04501	-0.00805	5.872E-03	1.288E-02
4	77	37	-0.10613	0.01807	0.	0.
5	78	21	-0.11245	0.00123	1.780E 05	-1.112E 08
5	78	22	0.02802	0.00081	-1.525E 04	-1.284E 08
5	78	23	0.05584	0.00150	8.537E 05	7.348E 06
5	78	24	0.16435	0.00371	8.167E 05	1.508E 07
5	78	25	0.12135	0.00504	7.708E 05	1.870E 07
5	78	26	0.15380	0.01210	-1.508E 04	-1.008E 06
5	78	27	0.07480	0.01202	-3.383E 04	-3.883E 05
5	78	28	0.05127	0.01425	-2.570E 04	7.218E 05
5	78	29	-0.08428	0.02182	7.218E 05	3.448E 07
5	78	30	-0.17580	0.02488	7.888E 05	3.807E 07
5	78	31	-0.15208	0.01837	1.252E 06	-2.378E 07
5	78	32	0.08735	0.00781	1.385E 06	-1.508E 07
5	78	33	0.30185	0.00418	1.135E 06	-5.893E 08
5	78	34	0.03213	0.00082	0.	0.
5	78	35	0.01187	0.00088	0.	0.
5	78	36	0.00583	0.00085	-5.343E-04	5.552E-03
5	78	37	0.08538	0.00364	0.	0.
6	79	21	0.88480	-0.00134	-1.294E 06	-3.845E 08
6	79	22	-0.74805	-0.01782	5.783E 06	4.818E 06
6	79	23	-0.10373	-0.01287	-5.128E 05	2.743E 07
6	79	24	-0.04124	-0.00837	-4.884E 05	2.338E 07
6	79	25	-0.02883	-0.00557	-4.542E 05	2.087E 07
6	79	26	-0.01388	-0.00141	1.884E 03	1.475E 04
6	79	27	-0.00485	-0.00140	3.788E 03	5.448E 04
6	79	28	-0.01530	-0.00041	-7.415E 03	4.340E 04
6	79	29	-0.11283	0.00317	-3.229E 05	8.883E 06
6	79	30	-0.15041	0.00404	-2.517E 05	7.310E 06
6	79	31	-0.15710	0.00270	1.718E 05	-6.784E 06
6	79	32	-0.07838	-0.00080	2.807E 05	-7.038E 06
6	79	33	0.00402	-0.00218	3.374E 05	-4.058E 06
6	79	34	-0.58325	-0.02827	0.	0.
6	79	35	-0.30835	-0.03280	0.	0.
6	79	36	-0.10412	-0.03280	4.744E-02	1.653E-01
6	79	37	0.20410	-0.00277	0.	0.
7	80	21	-0.11781	0.00485	3.454E 05	-1.881E 07
7	80	22	-0.17827	-0.02007	2.828E 05	7.303E 06
7	80	23	0.44714	-0.01388	-5.158E 05	4.171E 07
7	80	24	0.47389	-0.00887	-1.157E 06	3.442E 07
7	80	25	0.42813	-0.00378	-1.508E 06	2.872E 07
7	80	26	0.37124	0.00112	-7.788E 04	-1.184E 06
7	80	27	0.35878	0.00084	-2.052E 05	-1.014E 06
7	80	28	0.20495	-0.00348	3.240E 05	-3.030E 06
7	80	29	-0.21425	-0.00165	-2.787E 05	-3.728E 07
7	80	30	-0.33371	-0.00430	-2.544E 05	-4.832E 07
7	80	31	-0.40884	-0.00887	-1.052E 06	-2.488E 07
7	80	32	-0.35555	-0.01408	-4.778E 05	-2.795E 07
7	80	33	-0.20898	-0.01785	8.857E 04	-2.338E 07
7	80	34	-0.52352	-0.04184	0.	0.
7	80	35	0.38080	-0.07083	0.	0.
7	80	36	0.52808	-0.07081	-2.135E-02	-5.800E-02
7	80	37	-0.23405	-0.02182	0.	0.
8	81	21	-0.00218	0.00014	8.747E 03	-5.018E 05
8	81	22	-0.01372	-0.00088	2.518E 04	4.147E 05
8	81	23	0.01864	0.00001	7.898E 03	5.528E 06
8	81	24	0.01350	0.00121	-1.700E 04	5.420E 05
8	81	25	0.00284	0.00201	-2.501E 04	6.186E 06
8	81	26	-0.00598	0.00347	4.022E 02	-6.228E 04
8	81	27	-0.02805	0.00342	8.287E 02	-1.482E 05
8	81	28	-0.05385	0.00522	-1.331E 05	1.735E 06
8	81	29	-0.05540	0.00452	3.385E 05	4.857E 06
8	81	30	-0.05850	0.00481	3.857E 05	5.821E 06
8	81	31	0.05381	-0.00183	7.085E 05	-2.488E 07
8	81	32	0.32525	-0.01672	3.847E 05	-1.524E 07
8	81	33	0.43411	-0.01332	-4.883E 05	-1.350E 07
8	81	34	-0.05505	-0.00287	0.	0.
8	81	35	0.01808	-0.00582	0	0.
8	81	36	0.05471	-0.00583	-7.481E-03	4.808E-03
8	81	37	-0.88088	-0.01488	0.	0.
9	82	21	-0.02228	0.00028	1.235E 05	-8.287E 05
9	82	22	0.13887	-0.00008	-2.805E 06	-5.817E 06
9	12	23	-0.02338	0.00215	-1.388E 06	2.140E 07
9	82	24	-0.18643	0.00488	-1.228E 06	6.418E 06
9	82	25	-0.28000	0.00524	-9.888E 05	1.244E 06
9	82	26	-0.37187	0.00329	1.202E 05	7.785E 04
9	82	27	-0.38161	0.00380	3.287E 06	1.317E 06
9	82	28	-0.48102	0.01483	-1.113E 06	1.243E 07
9	82	29	-0.01588	-0.00028	2.330E 05	7.848E 06
9	82	30	0.11337	-0.00018	2.278E 05	1.873E 07
9	82	31	0.23428	0.00318	1.092E 06	3.208E 07
9	82	32	0.20038	0.01044	5.882E 05	3.584E 07
9	82	33	0.08510	0.01526	1.409E 05	3.088E 07
9	82	34	-0.32377	-0.01842	0.	0.
9	82	35	0.15788	-0.08052	0.	0.
9	82	36	0.48808	-0.05080	2.408E-02	-1.353E-01
9	82	37	0.38888	0.02087	0.	0.
10	83	21	-0.00788	0.00072	3.157E 04	-5.311E 06
10	83	22	-0.80800	-0.01127	2.410E 06	1.377E 07
10	83	23	0.13465	-0.00408	-4.306E 05	2.623E 07
10	83	24	0.10700	0.00008	-7.388E 05	2.012E 07
10	83	25	0.05280	0.00233	-8.732E 05	1.508E 07
10	83	26	-0.00834	0.00435	1.882E 03	-1.321E 06
10	83	27	-0.03872	0.00428	1.882E 04	-3.058E 05
10	83	28	-0.17778	0.01408	-5.551E 05	1.161E 07
10	83	29	-0.04228	0.00382	5.048E 05	-8.088E 06
10	83	30	-0.00883	-0.00018	5.505E 05	-8.884E 06
10	83	31	0.04281	-0.00023	3.833E 05	8.730E 06
10	83	32	0.04830	0.00152	2.128E 05	1.158E 07
10	83	33	0.03120	0.00348	5.728E 04	1.048E 07
10	83	34	0.30164	0.00803	0.	0.

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10	83	35	0.04408	0.03555	0.	0.
10	83	36	-0.17886	0.03563	6.427E-02	1.880E-02
10	83	37	0.10031	0.00544	0.	0.
11	84	21	0.00577	0.00011	-5.553E 04	-1.408E 06
11	84	22	0.27518	-0.00123	-1.052E 06	-1.457E 06
11	84	23	0.08135	-0.00157	1.044E 05	5.528E 06
11	84	24	0.17086	0.00041	5.252E 05	1.585E 07
11	84	25	0.18751	0.00246	2.508E 05	1.551E 07
11	84	26	0.22584	0.00763	-1.315E 05	-6.842E 06
11	84	27	0.18528	0.00716	-3.113E 05	-2.353E 06
11	84	28	-0.07438	0.02807	-1.457E 05	2.374E 07
11	84	29	0.11784	0.00282	-3.127E 04	-1.368E 07
11	84	30	0.10607	0.00132	-2.676E 05	-1.478E 07
11	84	31	0.01555	-0.00052	-1.342E 06	-3.352E 07
11	84	32	-0.11448	-0.00424	-1.157E 06	-3.364E 07
11	84	33	-0.15582	-0.00814	-5.128E 05	-3.347E 07
11	84	34	-0.12890	-0.00081	0.	0.
11	84	35	-0.08579	0.02547	0.	0.
11	84	36	-0.24575	0.02553	-4.350E-03	-2.335E-02
11	84	37	-0.24884	-0.01522	0.	0.
12	85	21	0.00102	0.00039	-3.581E 04	-4.288E 06
12	85	22	0.28450	-0.00532	-1.149E 06	2.385E 06
12	85	23	0.12482	-0.00410	1.808E 05	1.457E 07
12	85	24	0.14730	-0.00128	-3.105E 05	1.483E 07
12	85	25	0.12270	0.00044	-5.203E 05	1.211E 07
12	85	26	0.08513	0.00248	-5.948E 04	-1.511E 05
12	85	27	0.07506	0.00228	-1.487E 05	-1.003E 06
12	85	28	0.03408	0.00017	1.570E 05	-1.748E 06
12	85	29	-0.20028	0.00009	-5.312E 05	-1.849E 07
12	85	30	-0.20380	-0.00152	-5.448E 04	-1.555E 07
12	85	31	-0.04522	-0.00087	1.548E 05	3.537E 07
12	85	32	0.14455	0.00509	1.774E 05	5.225E 07
12	85	33	0.22340	0.01148	8.253E 05	5.425E 07
12	85	34	-0.15555	-0.00404	0.	0.
12	85	35	-0.08860	0.04985	0.	0.
12	85	36	-0.38232	0.04877	7.248E-04	-1.081E-01
12	85	37	0.40074	0.02327	0.	0.
13	86	21	-0.02735	0.00071	3.311E 05	-7.201E 06
13	86	22	0.04880	-0.00878	-1.484E 05	1.064E 07
13	86	23	-0.03533	-0.00332	-4.360E 06	3.435E 07
13	86	24	-0.35825	-0.00123	-3.548E 06	-2.175E 06
13	86	25	-0.51508	-0.00289	-2.340E 06	-2.082E 07
13	86	26	-0.78188	-0.01554	5.861E 05	1.564E 06
13	86	27	-0.53847	-0.01387	1.470E 06	9.342E 06
13	86	28	-0.28781	-0.03155	8.807E 05	-2.507E 07
13	86	29	0.15515	-0.00404	2.515E 05	6.044E 07
13	86	30	0.25578	0.00085	2.023E 06	7.188E 07
13	86	31	0.15348	0.00282	-1.579E 06	-3.691E 07
13	86	32	-0.05274	-0.00250	-2.025E 06	-5.278E 07
13	86	33	-0.23552	-0.00591	-1.174E 06	-8.860E 07
13	86	34	-0.43612	-0.02192	0	0.
13	86	35	0.14097	0.09283	0.	0.
13	86	36	-0.64408	0.08280	-6.318E-02	-1.048E-01
13	86	37	-0.41842	-0.02309	0	0.
14	87	21	0.39027	-0.00344	-8.022E 06	-1.931E 06
14	87	22	0.82555	-0.04542	-4.507E 06	7.203E 07
14	87	23	0.31228	-0.02830	-3.858E 06	1.021E 06
14	87	24	0.11834	-0.01314	-5.372E 06	8.860E 07
14	87	25	-0.13537	-0.00554	-5.368E 05	3.555E 07
14	87	26	-0.60739	-0.01238	6.598E 05	1.782E 06
14	87	27	-0.45988	-0.01041	1.601E 06	1.030E 07
14	87	28	-0.38753	-0.01758	-2.443E 05	-1.853E 07
14	87	29	-0.08523	-0.00274	2.488E 06	3.631E 07
14	87	30	0.05704	-0.00010	2.473E 06	6.857E 07
14	87	31	0.14802	0.00081	9.558E 04	-7.237E 06
14	87	32	0.07708	0.00003	-9.048E 05	-1.127E 07
14	87	33	-0.10280	-0.00078	-9.501E 05	-2.011E 07
14	87	34	0.53811	0.04421	0.	0.
14	87	35	-0.42088	-0.07523	0.	0.
14	87	36	0.05385	-0.07525	5.785E-01	-7.858E-01
14	87	37	-0.14533	-0.00748	0.	0.
15	88	21	-0.88083	0.01017	1.881E 07	-8.908E 07
15	88	22	0.15837	-0.01701	-1.231E 06	3.525E 07
15	88	23	0.15837	-0.00884	-9.984E 05	3.870E 07
15	88	24	0.10240	-0.00274	-1.021E 06	2.788E 07
15	88	25	-0.00841	-0.00001	-2.133E 05	1.561E 07
15	88	26	-0.20804	-0.00201	2.382E 05	4.528E 06
15	88	27	-0.17484	-0.00140	5.980E 05	3.318E 06
15	88	28	-0.18537	-0.00568	-7.182E 04	-8.784E 06
15	88	29	-0.05198	-0.00004	1.177E 06	8.878E 06
15	88	30	0.01442	0.00042	1.270E 06	1.480E 07
15	88	31	0.07826	-0.00022	1.781E 06	-2.205E 06
15	88	32	0.05171	-0.00018	-4.438E 05	-3.130E 06
15	88	33	-0.05211	-0.00011	-5.421E 05	-8.087E 06
15	88	34	0.24485	0.02415	0.	0.
15	88	35	-0.34192	-0.02888	0.	0.
15	88	36	-0.69881	-0.03862	-7.858E-03	-3.678E-01
15	88	37	-0.05178	-0.00321	0.	0.
16	89	21	-0.02863	0.00050	7.231E 05	-8.980E 06
16	89	22	0.05328	-0.00878	-9.185E 05	1.882E 07
16	89	23	-0.24440	-0.00985	-4.725E 06	-1.738E 07
16	89	24	-0.42355	-0.01540	-2.022E 06	-4.348E 07
16	89	25	-0.39403	-0.02201	1.073E 04	-4.180E 07
16	89	26	-0.34208	-0.03578	5.858E 05	4.238E 06
16	89	27	-0.10434	-0.03341	1.108E 06	1.854E 07
16	89	28	0.06787	-0.01132	-5.087E 05	2.113E 07
16	89	29	0.55824	-0.01890	-4.385E 06	6.288E 07
16	89	30	0.25836	-0.00915	-6.813E 06	4.452E 07
16	89	31	-0.65563	0.01361	-5.081E 06	-4.015E 06
16	89	32	-0.78734	0.00800	3.265E 06	-3.278E 07
16	89	33	0.48586	-0.00268	5.568E 06	1.727E 07
16	89	34	0.14288	-0.00435	0.	0.
16	89	35	0.10714	0.00530	0.	0.
16	89	36	0.07433	0.00525	4.423E-05	-2.910E-02
16	89	37	0.28612	0.01531	0.	0.
17	90	21	-0.05378	0.00113	1.642E 06	-2.184E 07
17	90	22	0.20085	-0.01885	-2.673E 06	4.585E 07
17	90	23	-0.53498	-0.01852	-6.478E 06	-2.987E 07
17	90	24	-0.64591	-0.02782	-6.782E 06	-8.134E 07
17	90	25	-0.41200	-0.03337	2.324E 06	-3.232E 07
17	90	26	-0.05721	-0.02735	1.577E 05	4.358E 06
17	90	27	0.18342	-0.03458	-3.767E 04	1.198E 07
17	90	28	0.41846	-0.00837	7.928E 05	3.392E 07
17	90	29	0.01006	-0.00926	-4.132E 06	4.294E 07
17	90	30	-0.20727	-0.00405	-3.551E 06	2.514E 07
17	90	31	0.38846	-0.01578	5.718E 06	2.261E 08
17	90	32	0.68548	-0.01585	-2.088E 06	8.034E 07
17	90	33	-0.44098	0.00138	-7.288E 06	2.198E 07
17	90	34	0.40834	-0.02535	0	0.
17	90	35	0.45899	0.02382	0.	0.
17	90	36	0.31448	0.02331	1.042E-07	-3.198E-01

17	80	37	-0.00524	-0.00512	0.	0.
18	81	21	-0.04121	0.00077	1.530E 06	-1.818E 07
18	81	22	0.14328	-0.01107	-2.770E 06	2.888E 07
18	81	23	0.04285	-0.00388	8.888E 06	4.038E 07
18	81	24	0.48858	0.00894	3.583E 06	8.020E 07
18	81	25	0.50028	0.02183	1.114E 05	8.320E 07
18	81	26	0.85114	0.05034	-1.707E 08	-5.587E 08
18	81	27	0.33482	0.05210	-3.444E 06	-3.887E 07
18	81	28	-0.38408	0.01927	-1.304E 06	-3.388E 07
18	81	29	-0.48871	0.02087	7.227E 06	-7.804E 07
18	81	30	-0.01177	0.01044	5.107E 06	-5.234E 07
18	81	31	-0.08837	0.01285	-3.885E 06	1.821E 07
18	81	32	-0.51889	0.01782	8.788E 05	-3.417E 07
18	81	33	0.28243	0.00821	4.888E 06	-3.308E 07
18	81	34	0.42288	-0.03383	0.	0.
18	81	35	0.51777	0.02478	0.	0.
18	81	36	0.38522	0.02448	-7.805E-03	1.338E-01
18	81	37	-0.28800	-0.00485	0.	0.
19	82	21	0.00130	0.00001	-5.821E 04	-8.508E 06
19	82	22	0.00158	-0.00144	7.375E 04	5.281E 06
19	82	23	-0.05823	-0.00004	-1.520E 05	4.028E 06
19	82	24	-0.13780	-0.00048	-2.924E 05	-4.880E 06
19	82	25	-0.11838	-0.00101	7.398E 05	-2.049E 06
19	82	26	-0.08388	-0.00082	1.884E 05	3.728E 05
19	82	27	-0.07059	-0.00033	4.825E 05	2.870E 06
19	82	28	0.25008	0.00081	2.788E 05	1.811E 07
19	82	29	-0.21444	0.00384	1.851E 06	-1.408E 07
19	82	30	-0.08028	0.00183	2.801E 06	-5.434E 06
19	82	31	-0.02078	0.01094	1.088E 05	7.888E 07
19	82	32	-0.07848	0.02308	2.311E 06	6.388E 07
19	82	33	0.18817	0.02088	1.819E 06	-1.883E 07
19	82	34	-0.01532	0.00198	0.	0.
19	82	35	-0.02889	-0.00124	0.	0.
19	82	36	-0.01838	-0.00122	-2.834E-03	-8.708E-03
19	82	37	-0.70289	-0.01820	0.	0.
20	83	21	-0.00052	0.00007	2.818E 03	-2.888E 06
20	83	22	0.01387	-0.00381	-1.482E 06	1.388E 07
20	83	23	-0.03144	0.00187	-8.868E 05	3.044E 07
20	83	24	-0.11860	0.00845	-2.814E 04	2.100E 07
20	83	25	-0.13389	0.00887	1.031E 05	1.881E 07
20	83	26	-0.18887	0.01820	3.071E 05	-2.084E 06
20	83	27	-0.22884	0.01838	1.038E 06	-2.181E 06
20	83	28	0.37588	0.00862	5.885E 06	8.787E 06
20	83	29	-0.32307	0.01485	4.838E 06	-4.408E 07
20	83	30	-0.02840	0.00847	5.187E 06	-2.932E 07
20	83	31	0.08891	-0.00878	-3.244E 06	-7.821E 07
20	83	32	-0.18201	-0.01589	-2.730E 06	-7.403E 07
20	83	33	-0.07198	-0.02085	4.824E 05	-9.288E 06
20	83	34	0.01385	0.00008	0.	0.
20	83	35	-0.00430	-0.00024	0.	0.
20	83	36	-0.00282	-0.00024	1.324E-03	1.804E-02
20	83	37	0.82841	0.01288	0.	0.
21	84	21	0.00128	0.00003	-1.027E 08	-2.038E 08
21	84	22	0.00818	-0.00388	1.171E 05	1.849E 07
21	84	23	-0.21356	-0.00158	-4.437E 06	-3.482E 08
21	84	24	-0.37893	-0.00827	2.387E 06	-2.208E 07
21	84	25	-0.22834	-0.00728	3.288E 06	-6.218E 08
21	84	26	0.82388	0.02405	-2.453E 06	-7.885E 06
21	84	27	0.55708	0.01711	-5.551E 06	-3.988E 07
21	84	28	-0.03084	0.00283	-1.183E 06	-2.844E 08
21	84	29	-0.11081	0.00318	1.071E 06	-7.708E 06
21	84	30	-0.02872	0.00187	1.818E 06	-3.480E 06
21	84	31	0.02538	0.00008	-3.580E 05	-4.947E 08
21	84	32	-0.03801	-0.00014	-3.873E 06	-8.180E 06
21	84	33	0.00318	-0.00126	2.721E 05	-4.182E 06
21	84	34	-0.02887	0.00348	0	0.
21	84	35	-0.03473	0.00148	0.	0.
21	84	36	-0.02890	-0.00143	-4.807E-03	1.271E-02
21	84	37	0.02838	0.00048	0.	0.
22	85	21	-0.00078	0.00007	1.853E 04	-4.087E 06
22	85	22	0.01786	-0.00858	-2.881E 05	3.542E 07
22	85	23	0.09833	0.00892	1.487E 06	8.148E 07
22	85	24	0.01438	0.02331	1.318E 06	8.788E 07
22	85	25	-0.12720	0.03050	8.153E 05	4.480E 07
22	85	26	0.78032	0.08310	-2.818E 06	-2.182E 07
22	85	27	0.05889	0.08848	-4.887E 06	-7.534E 07
22	85	28	-0.11783	0.01833	4.888E 06	-1.048E 07
22	85	29	0.84292	0.00170	-5.721E 05	-8.220E 07
22	85	30	0.15537	-0.00134	-1.088E 07	-1.037E 08
22	85	31	-0.18408	-0.00078	8.807E 05	1.880E 07
22	85	32	0.15814	-0.00181	1.838E 06	3.788E 07
22	85	33	-0.01826	0.00412	-1.873E 06	2.748E 07
22	85	34	0.02988	-0.00288	0.	0.
22	85	35	0.00782	0.00637	0.	0.
22	85	36	0.00880	0.00038	3.872E-03	-4.853E-03
22	85	37	-0.07488	-0.00028	0.	0.
23	86	21	-0.20320	0.04201	-2.438E 07	-3.187E 08
23	86	22	-0.02848	0.01088	1.488E 05	-7.133E 07
23	86	23	0.00282	-0.00044	5.193E 04	8.744E 05
23	86	24	0.00011	-0.00033	-8.221E 04	5.388E 05
23	86	25	-0.00302	-0.00027	-7.281E 04	3.449E 05
23	86	26	0.01308	0.00027	-5.028E 04	-1.388E 05
23	86	27	0.00706	0.00013	-1.118E 05	-7.488E 05
23	86	28	-0.00381	-0.00033	4.071E 04	2.238E 04
23	86	29	0.00097	-0.00028	1.482E 04	1.140E 05
23	86	30	0.00148	-0.00013	-4.438E 03	1.478E 05
23	86	31	-0.00038	0.00002	-1.377E 03	-1.428E 04
23	86	32	0.00030	-0.00000	3.370E 03	-3.308E 04
23	86	33	-0.00012	-0.00001	-5.380E 03	-1.981E 04
23	86	34	0.01280	-0.00128	0.	0.
23	86	35	-0.00098	0.00002	0.	0.
23	86	36	-0.00118	0.00002	2.848E-04	1.118E-02
23	86	37	0.00013	-0.00000	0	0.
24	87	21	-0.00272	0.00088	-4.418E 06	-4.707E 07
24	87	22	0.11307	-0.04177	-3.984E 05	3.127E 08
24	87	23	-0.13028	0.00888	3.058E 06	1.031E 07
24	87	24	-0.07028	0.01038	3.088E 06	1.078E 07
24	87	25	0.08287	0.01218	3.241E 06	1.718E 07
24	87	26	-0.42424	0.00718	1.712E 06	1.782E 08
24	87	27	-0.31067	0.00084	4.218E 06	1.810E 07
24	87	28	0.15678	0.02208	-1.088E 06	-2.688E 06
24	87	29	0.03878	0.01830	-1.480E 06	-8.083E 07
24	87	30	-0.08134	0.00818	-1.273E 06	-1.103E 08
24	87	31	-0.02272	-0.00080	-8.288E 04	1.898E 06
24	87	32	0.01224	-0.00038	3.004E 05	5.853E 06
24	87	33	-0.00008	0.00054	-1.888E 05	5.824E 06
24	87	34	-0.84141	0.10888	0.	0.
24	87	35	0.14218	0.00007	0.	0.
24	87	36	0.14884	-0.00018	-1.744E-01	-1.751E-01
24	87	37	-0.00870	0.00027	0.	0.

25	98	21	-0.00063	0.00028	-4.204E 05	-2.730E 07
25	98	22	0.06584	-0.02838	2.666E 06	3.338E 08
25	98	23	-0.34044	0.01652	-3.176E 08	6.868E 07
25	98	24	-0.38445	0.02418	5.277E 08	4.040E 07
25	98	25	-0.08144	0.03898	9.046E 08	5.183E 07
25	98	26	-0.99872	0.03180	4.107E 08	-4.038E 06
25	98	27	-0.60428	0.03470	1.054E 07	2.561E 07
25	98	28	0.48388	0.05580	-2.864E 08	-5.173E 08
25	98	29	0.10259	0.05109	-4.455E 08	-2.490E 08
25	98	30	-0.19024	0.02585	-3.845E 06	-3.425E 08
25	98	31	-0.13116	-0.00009	-6.802E 05	8.860E 08
25	98	32	0.07682	-0.00188	1.860E 08	1.875E 07
25	98	33	-0.01343	0.00123	-1.330E 06	1.783E 07
25	98	34	0.74001	-0.10787	0.	0.
25	98	35	-0.16653	-0.00068	0.	0.
25	98	36	-0.16658	-0.00038	2.080E-01	7.888E-01
25	98	37	-0.01881	0.00031	0.	0.
26	99	21	-0.00012	0.00003	-3.875E 04	-2.898E 05
26	99	22	0.06888	-0.00305	3.837E 03	2.488E 07
26	99	23	0.05684	0.00166	2.525E 05	5.881E 05
26	99	24	0.03210	0.00284	9.500E 04	3.828E 08
26	99	25	-0.00768	0.00288	1.490E 05	1.038E 08
26	99	26	-0.00184	0.00471	-1.847E 04	-1.438E 08
26	99	27	-0.02855	0.00384	1.082E 05	-3.460E 08
26	99	28	-0.00192	0.00224	5.596E 04	-8.382E 05
26	99	29	0.08488	0.00010	-2.238E 08	-5.080E 05
26	99	30	-0.05311	0.00034	-2.532E 05	-1.788E 07
26	99	31	0.80385	-0.02838	6.827E 08	-2.815E 07
26	99	32	-0.53078	0.00802	-1.148E 07	1.038E 07
26	99	33	0.19514	0.00478	[illegible].288E 07	-9.818E 08
26	99	34	0.62527	-0.00462	0.	0.
26	99	35	-0.00810	-0.00001	0.	0.
26	99	36	-0.00519	-0.00000	-1.407E-03	-6.184E-03
26	99	37	-0.13384	0.00879	0.	0.
27	100	21	-0.00447	0.00109	-1.704E 08	-1.143E 08
27	100	22	0.37281	-0.12233	7.853E 06	1.040E 09
27	100	23	0.13562	0.02128	1.048E 07	-1.788E 08
27	100	24	0.55388	-0.00488	3.077E 08	-1.328E 08
27	100	25	0.39303	-0.02184	-8.323E 06	-1.380E 08
27	100	26	0.81467	-0.07024	-3.788E 08	1.724E 07
27	100	27	0.95085	-0.05814	-1.104E 07	7.387E 06
27	100	28	-0.58107	-0.08138	2.460E 08	7.871E 08
27	100	29	-0.22828	-0.07483	7.243E 06	3.810E 08
27	100	30	0.27381	-0.03828	6.787E 06	5.118E 08
27	100	31	-0.03381	0.00735	-7.784E 05	5.488E 05
27	100	32	0.03745	0.00131	6.788E 05	-2.807E 07
27	100	33	-0.03228	-0.00202	-1.477E 06	-2.818E 07
27	100	34	0.53687	-0.11822	0.	0.
27	100	35	-0.16385	-0.00075	0.	0.
27	100	36	-0.18400	-0.00042	6.822E-02	3.188E-01
27	100	37	0.05788	-0.00383	0.	0.

TOTAL NUMBER OF SUBSYSTEMS: 6

TOTAL NUMBER OF MODES OR GENERALIZED COORDINATES: 100

SUMMARY OF THE MODES OR GENERALIZED COORDINATES-

GENERALIZED COORDINATE NUMBER	GENERALIZED WEIGHT	GENERALIZED STIFFNESS	GENERALIZED DAMPING VALUE
1	9.428E 02	0.	0.
2	7.885E 02	0.	0.
3	5.106E 02	2.348E 04	0.
4	9.924E 02	2.282E 05	0.
5	6.321E 01	1.626E 05	0.
6	1.035E 02	7.728E 05	0.
7	9.002E 01	2.017E 05	0
8	1.614E 02	5.080E 08	0.
9	1.509E 02	6.920E 08	0.
10	2.858E 02	1.510E 07	0.
11	1.165E 02	8.508E 06	0.
12	2.932E 02	2.732E 07	0.
13	1.626E 02	2.197E 07	0.
14	9.023E 01	1.841E 07	0.
15	9.428E 02	0.	0.
16	7.885E 02	0.	0.
17	5.106E 02	2.348E 04	0.
18	9.924E 02	2.282E 05	0.
19	6.881E 01	1.623E 05	0.
20	1.035E 02	7.728E 05	0.
21	9.002E 01	2.017E 05	0
22	1.614E 02	5.080E 08	0.
23	1.508E 02	6.920E 08	0.
24	2.858E 02	1.510E 07	0.
25	1.165E 02	8.508E 06	0.
26	2.932E 02	2.732E 07	0
27	1.626E 02	2.197E 07	0.
28	9.023E 01	1.841E 07	0.
29	6.492E 02	0.	0
30	2.048E 02	0.	0.
31	1.987E 02	1.512E 08	-2.536E 01
32	1.889E 02	4.722E 06	-4.368E 01
33	6.723E 01	3.722E 06	-2.648E 01
34	3.184E 02	2.424E 07	-1.282E 02
35	7.143E 02	9.077E 07	-3.744E 02
36	1.482E 02	2.305E 07	-6.537E 01
37	3.258E 02	7.138E 07	-2.241E 02
38	6.492E 02	0.	0.
39	2.048E 02	0.	0.
40	1.967E 02	1.512E 08	-2.536E 01
41	1.889E 02	4.722E 06	-4.368E 01
42	6.723E 01	3.722E 06	-2.648E 01
43	3.184E 02	2.424E 07	-1.282E 02
44	7.143E 02	9.077E 07	-3.744E 02
45	1.482E 02	2.305E 07	-6.537E 01
46	3.258E 02	7.138E 07	-2.241E 02
47	3.003E 03	0.	0
48	1.130E 03	0.	0.
49	5.689E 02	3.058E 05	4.472E 01
50	4.110E 02	5.510E 05	6.243E 01
51	8.511E 02	3.181E 06	1.785E 02
52	1.387E 03	5.891E 06	3.244E 02

53	1.081E 03	5.714E 06	3.281E 02
54	2.892E 02	2.740E 06	9.211E 01
55	3.519E 02	4.811E 06	1.351E 02
56	2.772E 02	4.808E 06	1.238E 02
57	1.820E 02	3.863E 06	9.132E 01
58	2.015E 02	4.807E 06	1.058E 02
59	6.281E 02	1.810E 07	3.818E 02
60	1.484E 03	6.045E 07	1.095E 03
61	1.408E 03	6.213E 07	1.003E 03
62	5.430E 02	2.881E 07	4.248E 02
63	1.004E 03	6.233E 07	8.483E 02
64	1.085E 03	7.598E 07	8.848E 02
65	1.818E 02	1.475E 07	1.785E 02
66	3.044E 02	2.504E 07	3.020E 02
67	9.842E 01	9.851E 06	1.081E 02
68	3.483E 02	4.185E 07	4.083E 02
69	2.381E 03	3.434E 08	3.073E 03
70	4.481E 02	7.075E 07	6.045E 02
71	7.617E 02	1.245E 08	1.045E 03
72	2.559E 02	4.315E 07	3.584E 02
73	2.488E 03	4.368E 06	3.543E 03
74	3.003E 03	0.	0.
75	1.130E 03	0.	0.
76	2.639E 02	3.088E 06	4.472E 01
77	4.110E 02	8.510E 06	6.343E 01
78	8.511E 02	3.181E 06	1.785E 02
79	1.367E 03	6.891E 06	3.244E 02
80	1.081E 03	5.714E 06	3.281E 02
81	2.892E 02	2.740E 06	9.211E 01
82	3.519E 02	4.811E 06	1.351E 02
83	2.772E 02	4.808E 06	1.238E 02
84	1.820E 02	3.863E 06	9.132E 01
85	2.015E 02	4.807E 06	1.058E 02
86	6.281E 02	1.810E 07	3.818E 02
87	1.484E 03	6.045E 07	1.095E 03
88	1.408E 03	6.213E 07	1.003E 03
89	5.430E 02	2.881E 07	4.248E 02
90	1.004E 03	6.233E 07	8.483E 02
91	1.085E 03	7.598E 07	8.848E 02
92	1.818E 02	1.475E 07	1.785E 02
93	3.044E 02	2.504E 07	3.020E 02
94	9.842E 01	9.851E 06	1.081E 02
95	3.483E 02	4.185E 07	4.083E 02
96	2.381E 03	3.434E 08	3.073E 03
97	4.481E 02	7.075E 07	6.045E 02
98	7.617E 02	1.245E 08	1.045E 03
99	2.559E 02	4.315E 07	3.584E 02
100	2.488E 03	4.368E 06	3.543E 03

SUMMARY OF THE COORDINATES FOR THE PHYSICAL POINTS-

POINT NUMBER	COORDINATES (INCHES)-GLOBAL SYSTEM X	Y	Z
1	-166.901	0.	0.
2	-177.555	0.	0.
3	-172.156	0.	0.
4	-184.778	0.	0.
5	-230.808	0.	0.
6	-263.325	0.	0.
7	-259.475	0.	0.
8	262.115	0.	0.
9	-265.555	0.	0.
10	-278.335	0.	0.
11	-201.040	0.	0.
12	-207.570	0.	0.
13	-217.010	0.	0.
14	-223.000	0.	0.
15	-228.010	0.	0.
16	-235.070	0.	0.
17	-238.385	0.	0.
18	-250.855	0.	0.
19	-255.465	0.	0.
20	-263.325	0.	0.
21	-166.901	0.	0.
22	-177.455	0.	0.
23	-207.830	0.	0.
24	-217.005	0.	0.
25	-223.015	0.	0.
26	-228.105	0.	0.
27	-234.550	0.	0.
28	-237.915	0.	0.
29	-250.915	0.	0.
30	-255.555	0.	0.
31	-262.285	0.	0.
32	-270.225	0.	0.
33	-278.575	0.	0.
34	-172.156	0.	0.
35	-184.778	0.	0.
36	-201.040	0.	0.
37	-259.475	0.	0.

PHYSICAL CONNECTING ELEMENT NUMBER 1

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```
ELEMENT TYPE= 5

NUMBER OF END POINTS= 2

POINT NUMBER AT I END= 3
POINT NUMBER AT J END= 34

NUMBER OF DIRECTIONS FOR POINT AT I END= 5

DIRECTIONS FOR POINT AT I END-
      X     (GLOBAL DIRECTION 5)
      Y     (GLOBAL DIRECTION 3)
      Z     (GLOBAL DIRECTION 1)
   THETA-Y (GLOBAL DIRECTION 2)
   THETA-Z (GLOBAL DIRECTION 4)

NUMBER OF DIRECTIONS FOR POINT AT J END= 5

DIRECTIONS FOR POINT AT J END-
      X     (GLOBAL DIRECTION 5)
      Y     (GLOBAL DIRECTION 3)
      Z     (GLOBAL DIRECTION 1)
   THETA-Y (GLOBAL DIRECTION 2)
   THETA-Z (GLOBAL DIRECTION 4)

SPRING CONSTANT IN X DIRECTION=    0.
SPRING CONSTANT IN Y DIRECTION=    4.000E 05
SPRING CONSTANT IN Z DIRECTION=    4.000E 05
SPRING CONSTANT IN THETA-Y DIRECTION=    0.
SPRING CONSTANT IN THETA-Z DIRECTION=    0.

Q-FACTOR=  15.0           FREQUENCY=      55.2 HERTZ

DAMPING CONSTANTS (CALCULATED BASED ON ABOVE Q-FACTOR AND FREQUENCY)-

DAMPING COEFFICIENT IN X DIRECTION=    0.
DAMPING COEFFICIENT IN Y DIRECTION=    7.688E 02
DAMPING COEFFICIENT IN Z DIRECTION=    7.688E 02
DAMPING COEFFICIENT IN THETA-Y DIRECTION=    0.
DAMPING COEFFICIENT IN THETA-Z DIRECTION=    0.
```

PHYSICAL CONNECTING ELEMENT NUMBER 2

```
ELEMENT TYPE= 5

NUMBER OF END POINTS= 2

POINT NUMBER AT I END= 4
POINT NUMBER AT J END= 35

NUMBER OF DIRECTIONS FOR POINT AT I END= 5

DIRECTIONS FOR POINT AT I END-
      X     (GLOBAL DIRECTION 5)
      Y     (GLOBAL DIRECTION 3)
      Z     (GLOBAL DIRECTION 1)
   THETA-Y (GLOBAL DIRECTION 2)
   THETA-Z (GLOBAL DIRECTION 4)

NUMBER OF DIRECTIONS FOR POINT AT J END= 5

DIRECTIONS FOR POINT AT J END-
      X     (GLOBAL DIRECTION 5)
      Y     (GLOBAL DIRECTION 3)
      Z     (GLOBAL DIRECTION 1)
   THETA-Y (GLOBAL DIRECTION 2)
   THETA-Z (GLOBAL DIRECTION 4)

SPRING CONSTANT IN X DIRECTION=    0.
SPRING CONSTANT IN Y DIRECTION=    1.888E 05
SPRING CONSTANT IN Z DIRECTION=    1.888E 05
SPRING CONSTANT IN THETA-Y DIRECTION=    0.
SPRING CONSTANT IN THETA-Z DIRECTION=    0.

Q-FACTOR=  15.0           FREQUENCY=      55.2 HERTZ

DAMPING CONSTANTS (CALCULATED BASED ON ABOVE Q-FACTOR AND FREQUENCY)-

DAMPING COEFFICIENT IN X DIRECTION=    0.
DAMPING COEFFICIENT IN Y DIRECTION=    3.288E 02
DAMPING COEFFICIENT IN Z DIRECTION=    3.288E 02
DAMPING COEFFICIENT IN THETA-Y DIRECTION=    0.
DAMPING COEFFICIENT IN THETA-Z DIRECTION=    0.
```

PHYSICAL CONNECTING ELEMENT NUMBER 3

ELEMENT TYPE= 5

NUMBER OF END POINTS= 2

POINT NUMBER AT I END= 11
POINT NUMBER AT J END= 20

NUMBER OF DIRECTIONS FOR POINT AT I END= 5

DIRECTIONS FOR POINT AT I END-
X (GLOBAL DIRECTION 5)
Y (GLOBAL DIRECTION 3)
Z (GLOBAL DIRECTION 1)
THETA-Y (GLOBAL DIRECTION 2)
THETA-Z (GLOBAL DIRECTION 4)

NUMBER OF DIRECTIONS FOR POINT AT J END= 5

DIRECTIONS FOR POINT AT J END-
X (GLOBAL DIRECTION 5)
Y (GLOBAL DIRECTION 3)
Z (GLOBAL DIRECTION 1)
THETA-Y (GLOBAL DIRECTION 2)
THETA-Z (GLOBAL DIRECTION 4)

SPRING CONSTANT IN X DIRECTION= 0.
SPRING CONSTANT IN Y DIRECTION= 2.308E 05
SPRING CONSTANT IN Z DIRECTION= 2.308E 05
SPRING CONSTANT IN THETA-Y DIRECTION= 0.
SPRING CONSTANT IN THETA-Z DIRECTION= 0.

Q-FACTOR= 15.0 FREQUENCY= 55.2 HERTZ

DAMPING CONSTANTS (CALCULATED BASED ON ABOVE Q-FACTOR AND FREQUENCY)-

DAMPING COEFFICIENT IN X DIRECTION= 0.
DAMPING COEFFICIENT IN Y DIRECTION= 4.430E 01
DAMPING COEFFICIENT IN Z DIRECTION= 4.430E 01
DAMPING COEFFICIENT IN THETA-Y DIRECTION= 0.
DAMPING COEFFICIENT IN THETA-Z DIRECTION= 0.

PHYSICAL CONNECTING ELEMENT NUMBER 4

ELEMENT TYPE= 5

NUMBER OF END POINTS= 2

POINT NUMBER AT I END= 20
POINT NUMBER AT J END= 6

NUMBER OF DIRECTIONS FOR POINT AT I END= 5

DIRECTIONS FOR POINT AT I END-
X (GLOBAL DIRECTION 5)
Y (GLOBAL DIRECTION 3)
Z (GLOBAL DIRECTION 1)
THETA-Y (GLOBAL DIRECTION 2)
THETA-Z (GLOBAL DIRECTION 4)

NUMBER OF DIRECTIONS FOR POINT AT J END= 5

DIRECTIONS FOR POINT AT J END-
X (GLOBAL DIRECTION 5)
Y (GLOBAL DIRECTION 3)
Z (GLOBAL DIRECTION 1)
THETA-Y (GLOBAL DIRECTION 2)
THETA-Z (GLOBAL DIRECTION 4)

SPRING CONSTANT IN X DIRECTION= 0.
SPRING CONSTANT IN Y DIRECTION= 2.466E 05
SPRING CONSTANT IN Z DIRECTION= 2.466E 05
SPRING CONSTANT IN THETA-Y DIRECTION= 0.
SPRING CONSTANT IN THETA-Z DIRECTION= 0.

Q-FACTOR= 15.0 FREQUENCY= 55.2 HERTZ

DAMPING CONSTANTS (CALCULATED BASED ON ABOVE Q-FACTOR AND FREQUENCY)-

DAMPING COEFFICIENT IN X DIRECTION= 0.
DAMPING COEFFICIENT IN Y DIRECTION= 4.784E 01
DAMPING COEFFICIENT IN Z DIRECTION= 4.784E 01
DAMPING COEFFICIENT IN THETA-Y DIRECTION= 0.
DAMPING COEFFICIENT IN THETA-Z DIRECTION= 0.

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                PHYSICAL CONNECTING ELEMENT NUMBER  5
ELEMENT TYPE:  5

NUMBER OF END POINTS: 2

POINT NUMBER AT I END:  7
POINT NUMBER AT J END: 37

NUMBER OF DIRECTIONS FOR POINT AT I END: 5

DIRECTIONS FOR POINT AT I END-
      X     (GLOBAL DIRECTION 5)
      Y     (GLOBAL DIRECTION 3)
      Z     (GLOBAL DIRECTION 1)
   THETA-Y  (GLOBAL DIRECTION 2)
   THETA-Z  (GLOBAL DIRECTION 4)

NUMBER OF DIRECTIONS FOR POINT AT J END: 5

DIRECTIONS FOR POINT AT J END-
      X     (GLOBAL DIRECTION 5)
      Y     (GLOBAL DIRECTION 3)
      Z     (GLOBAL DIRECTION 1)
   THETA-Y  (GLOBAL DIRECTION 2)
   THETA-Z  (GLOBAL DIRECTION 4)

SPRING CONSTANT IN X DIRECTION:    0
SPRING CONSTANT IN Y DIRECTION:    1.500E 06
SPRING CONSTANT IN Z DIRECTION:    1.500E 06
SPRING CONSTANT IN THETA-Y DIRECTION:    0
SPRING CONSTANT IN THETA-Z DIRECTION:    0.

Q-FACTOR:  15.0          FREQUENCY:     55.2 HERTZ

DAMPING CONSTANTS (CALCULATED BASED ON ABOVE Q-FACTOR AND FREQUENCY)-

DAMPING COEFFICIENT IN X DIRECTION:    0.
DAMPING COEFFICIENT IN Y DIRECTION:    2.883E [illegible]
DAMPING COEFFICIENT IN Z DIRECTION:    2.883E 02
DAMPING COEFFICIENT IN THETA-Y DIRECTION:    0.
DAMPING COEFFICIENT IN THETA-Z DIRECTION:    0.
```

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                PHYSICAL CONNECTING ELEMENT NUMBER  6
ELEMENT TYPE:  3

NUMBER OF END POINTS: 2

POINT NUMBER AT I END:  1
POINT NUMBER AT J END: 21

NUMBER OF DIRECTIONS FOR POINT AT I END: 2

DIRECTIONS FOR POINT AT I END-
       Y (GLOBAL DIRECTION 3)
       Z (GLOBAL DIRECTION 1)

NUMBER OF DIRECTIONS FOR POINT AT J END: 2

DIRECTIONS FOR POINT AT J END-
       Y (GLOBAL DIRECTION 3)
       Z (GLOBAL DIRECTION 1)

LOCAL RADIAL SPRING RATE:  1.00E 08 LB/IN
RADIAL DEAD BAND:  250.0 MILS
LOCAL DAMPING COEFFICIENT:  0.        (LB-SEC)/IN
```

NUMBER OF TYPE 1 PHYSICAL CONNECTING ELEMENTS= 0

NUMBER OF TYPE 2 PHYSICAL CONNECTING ELEMENTS= 0

NUMBER OF TYPE 3 PHYSICAL CONNECTING ELEMENTS= 1

NUMBER OF TYPE 4 PHYSICAL CONNECTING ELEMENTS= 0

NUMBER OF TYPE 5 PHYSICAL CONNECTING ELEMENTS= 5

TOTAL NUMBER OF PHYSICAL CONNECTING ELEMENTS= 6

THIS RUN IS NOT A RESTART RUN.

TIME STEP= 0.000005 SECONDS
FINAL TIME= 0.200000 SECONDS
PRINT MULTIPLE= 1500
PLOT MULTIPLE= 20

INDEPENDENT ROTOR NUMBER (ONE FOR WHICH SPEED-TIME HISTORY IS INPUT)= 1

BEGINNING TIME FOR FIRST SEGMENT= 0. SECONDS
BEGINNING SPEED FOR FIRST SEGMENT= 3311. RPM

SEGMENT	ENDING TIME SECONDS	ACCEL RATE RPM/SEC
1	1.000000	0.

TOTAL NUMBER OF SPEED SEGMENTS FOR INDEPENDENT ROTOR SPEED-TIME HISTORY= 1

DEPENDENT ROTOR NUMBER= 2

THE SPEED POLYNOMIAL COEFFICIENTS FOR THE DEPENDENT ROTOR ARE-
A= 0.119E-05 B= -0.721E-02 C= 14.3 D= 0.208E 04

SUMMARY OF UNBALANCE LOAD INPUT-

BIRTH TIME (SEC.)	POINT NUMBER	MAGNITUDE GM-IN	PHASE ANGLE DEGREES
0.	1	500	0.

TOTAL NUMBER OF UNBALANCE BIRTH EVENTS= 1

TOTAL NUMBER OF P*COS(WT) AND P*SIN(WT) LOADS= 0

TOTAL NUMBER OF TIME-FORCE HISTORY LOADS= 0

SUMMARY OF THE GYROSCOPIC LOAD INPUT-

POINT NUMBER	POLAR MOMENT OF INERTIA LB-IN**2
1	381881.
2	42889.
3	2202.
4	520.
5	271.
6	4450.
7	512.
8	27727.
9	52440.
10	49497.
11	276.
12	5261.
13	4482.
14	5858.
15	9406.
16	6906.
17	4211.
18	20283.
19	18597.
20	466.

TOTAL NUMBER OF GYRO LOAD LOCATIONS= 20

THIS RUN PRODUCES A PLOT FILE (FILE CODE 23).

TIMES, ROTOR SPEEDS, AND ROTOR ANGULAR DISPLACEMENTS (IF ANY) ARE WRITTEN ONTO THE PLOT FILE

DISPLACEMENTS, VELOCITIES, MODAL FORCES AND COORDINATES ARE WRITTEN ONTO THE PLOT FILE FOR THE FOLLOWING POINTS AND DIRECTIONS-

POINT NUMBER	GLOBAL DIRECTION NUMBER	DIRECTION
1	1	Z
2	1	Z
4	1	Z
5	1	Z
7	1	Z
8	1	Z
9	1	Z
10	1	Z
11	1	Z
14	1	Z
15	1	Z
18	1	Z
20	1	Z
34	1	Z
35	1	Z
36	1	Z
37	1	Z
1	3	Y
2	3	Y
4	3	Y
5	3	Y
7	3	Y
8	3	Y
9	3	Y
10	3	Y
11	3	Y
14	3	Y
15	3	Y
18	3	Y
20	3	Y
34	3	Y
35	3	Y
36	3	Y
37	3	Y

TOTAL NUMBER OF POINTS AND DIRECTIONS FOR DISPLACEMENT, VELOCITY MODAL FORCE, AND COORDINATE PLOT FILE OUTPUT= 34

THE RELATIVE DISPLACEMENT MAGNITUDE, CLEARANCE, AND FORCE MAGNITUDE IS WRITTEN TO THE PLOT FILE FOR ALL TYPE 3 PHYSICAL CONNECTING ELEMENTS (RUB ELEMENTS)(IF ANY).

PHYSICAL CONNECTING ELEMENT FORCES ARE WRITTEN ONTO THE PLOT FILE FOR THE FOLLOWING PHYSICAL CONNECTING ELEMENTS, POINTS, AND DIRECTIONS-

ELEMENT NUMBER	POINT NUMBER	DIRECTION NUMBER	DIRECTION
1	3	1	Z
1	3	3	Y
2	4	1	Z
2	4	3	Y
3	11	1	Z
3	11	3	Y
4	20	1	Z
4	20	3	Y
5	7	1	Z
5	7	3	Y
6	1	1	Z
6	1	3	Y
1	34	1	Z
1	34	3	Y
2	35	1	Z
2	35	3	Y
3	36	3	Y
3	36	1	Z
4	8	1	Z
4	8	3	Y
5	37	1	Z
5	37	3	Y
6	21	1	Z
6	21	3	Y

TOTAL NUMBER OF ELEMENTS, POINTS, AND DIRECTIONS FOR ELEMENT FORCE PLOT FILE OUTPUT= 24

SUMMARY OF THE CONNECTIONS BETWEEN THE PHYSICAL CONNECTING ELEMENTS
AND THE MODAL SUBSYSTEMS-

```
ELEMENT  1 IS CONNECTED TO SUBSYSTEM  1 AT POINT  2
ELEMENT  1 IS CONNECTED TO SUBSYSTEM  2 AT POINT  2
ELEMENT  1 IS CONNECTED TO SUBSYSTEM  7 AT POINT 34
ELEMENT  1 IS CONNECTED TO SUBSYSTEM  8 AT POINT 34
ELEMENT  2 IS CONNECTED TO SUBSYSTEM  1 AT POINT  4
ELEMENT  2 IS CONNECTED TO SUBSYSTEM  2 AT POINT  4
ELEMENT  2 IS CONNECTED TO SUBSYSTEM  7 AT POINT 35
ELEMENT  2 IS CONNECTED TO SUBSYSTEM  8 AT POINT 38
ELEMENT  3 IS CONNECTED TO SUBSYSTEM  4 AT POINT 11
ELEMENT  3 IS CONNECTED TO SUBSYSTEM  5 AT POINT 1.
ELEMENT  3 IS CONNECTED TO SUBSYSTEM  7 AT POINT 36
ELEMENT  3 IS CONNECTED TO SUBSYSTEM  8 AT POINT 36
ELEMENT  4 IS CONNECTED TO SUBSYSTEM  1 AT POINT  8
ELEMENT  4 IS CONNECTED TO SUBSYSTEM  2 AT POINT  8
ELEMENT  4 IS CONNECTED TO SUBSYSTEM  4 AT POINT 20
ELEMENT  4 IS CONNECTED TO SUBSYSTEM  5 AT POINT 20
ELEMENT  5 IS CONNECTED TO SUBSYSTEM  1 AT POINT  7
ELEMENT  5 IS CONNECTED TO SUBSYSTEM  2 AT POINT  7
ELEMENT  5 IS CONNECTED TO SUBSYSTEM  7 AT POINT 37
ELEMENT  5 IS CONNECTED TO SUBSYSTEM  8 AT POINT 37
ELEMENT  6 IS CONNECTED TO SUBSYSTEM  1 AT POINT  1
ELEMENT  6 IS CONNECTED TO SUBSYSTEM  2 AT POINT  1
ELEMENT  6 IS CONNECTED TO SUBSYSTEM  7 AT POINT 21
ELEMENT  6 IS CONNECTED TO SUBSYSTEM  8 AT POINT 21
```

SUMMARY OF THE GYRO LOAD LOCATIONS ON THE MODAL SUBSYSTEMS-

```
POINT  1 OF SUBSYSTEM  1 IS A GYRO LOAD LOCATION
POINT  1 OF SUBSYSTEM  2 IS A GYRO LOAD LOCATION
POINT  2 OF SUBSYSTEM  1 IS A GYRO LOAD LOCATION
POINT  2 OF SUBSYSTEM  2 IS A GYRO LOAD LOCATION
POINT  3 OF SUBSYSTEM  1 IS A GYRO LOAD LOCATION
POINT  3 OF SUBSYSTEM  2 IS A GYRO LOAD LOCATION
POINT  4 OF SUBSYSTEM  1 IS A GYRO LOAD LOCATION
POINT  4 OF SUBSYSTEM  2 IS A GYRO LOAD LOCATION
POINT  5 OF SUBSYSTEM  1 IS A GYRO LOAD LOCATION
POINT  5 OF SUBSYSTEM  2 IS A GYRO LOAD LOCATION
POINT  6 OF SUBSYSTEM  1 IS A GYRO LOAD LOCATION
POINT  6 OF SUBSYSTEM  2 IS A GYRO LOAD LOCATION
POINT  7 OF SUBSYSTEM  1 IS A GYRO LOAD LOCATION
POINT  7 OF SUBSYSTEM  2 IS A GYRO LOAD LOCATION
POINT  8 OF SUBSYSTEM  1 IS A GYRO LOAD LOCATION
POINT  8 OF SUBSYSTEM  2 IS A GYRO LOAD LOCATION
POINT  9 OF SUBSYSTEM  1 IS A GYRO LOAD LOCATION
POINT  9 OF SUBSYSTEM  2 IS A GYRO LOAD LOCATION
POINT 10 OF SUBSYSTEM  1 IS A GYRO LOAD LOCATION
POINT 10 OF SUBSYSTEM  2 IS A GYRO LOAD LOCATION
POINT 11 OF SUBSYSTEM  4 IS A GYRO LOAD LOCATION
POINT 11 OF SUBSYSTEM  5 IS A GYRO LOAD LOCATION
POINT 12 OF SUBSYSTEM  4 IS A GYRO LOAD LOCATION
POINT 12 OF SUBSYSTEM  5 IS A GYRO LOAD LOCATION
POINT 13 OF SUBSYSTEM  4 IS A GYRO LOAD LOCATION
POINT 13 OF SUBSYSTEM  5 IS A GYRO LOAD LOCATION
POINT 14 OF SUBSYSTEM  4 IS A GYRO LOAD LOCATION
POINT 14 OF SUBSYSTEM  5 IS A GYRO LOAD LOCATION
POINT 15 OF SUBSYSTEM  4 IS A GYRO LOAD LOCATION
POINT 15 OF SUBSYSTEM  5 IS A GYRO LOAD LOCATION
POINT 16 OF SUBSYSTEM  4 IS A GYRO LOAD LOCATION
POINT 16 OF SUBSYSTEM  5 IS A GYRO LOAD LOCATION
POINT 17 OF SUBSYSTEM  4 IS A GYRO LOAD LOCATION
POINT 17 OF SUBSYSTEM  5 IS A GYRO LOAD LOCATION
POINT 18 OF SUBSYSTEM  4 IS A GYRO LOAD LOCATION
POINT 18 OF SUBSYSTEM  5 IS A GYRO LOAD LOCATION
POINT 19 OF SUBSYSTEM  4 IS A GYRO LOAD LOCATION
POINT 19 OF SUBSYSTEM  5 IS A GYRO LOAD LOCATION
POINT 20 OF SUBSYSTEM  4 IS A GYRO LOAD LOCATION
POINT 20 OF SUBSYSTEM  5 IS A GYRO LOAD LOCATION
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TIME= 0 SECONDS

SPEED SEGMENT NUMBER= 1

ROTOR PROPERTIES FOR INDEPENDENT ROTOR (ROTOR 1)-

SPEED= 3311. RPM
ACCELERATION= 0 RPM/SEC
ANGULAR DISPLACEMENT= 0. REVOLUTIONS

ROTOR PROPERTIES FOR DEPENDENT ROTOR (ROTOR 2)-

SPEED= 13483 RPM
ACCELERATION= 0. RPM/SEC
ANGULAR DISPLACEMENT= 0 REVOLUTIONS

DISPLACEMENTS IN GIVEN DIRECTION

POINT NUMBER	X INCHES	Y INCHES	Z INCHES	THETA-X RADIANS	THETA-Y RADIANS	THETA-Z RADIANS
1	0.	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.	0.
3	0.	0.	0.	0.	0.	0.
4	0.	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.	0.
6	0.	0.	0.	0.	0.	0.
7	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.
9	0.	0.	0.	0.	0.	0.
10	0.	0.	0.	0.	0.	0.
11	0.	0.	0.	0.	0.	0.
12	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.
18	0.	0.	0.	0.	0.	0.
19	0.	0.	0.	0.	0.	0.
20	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.
25	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.
31	0.	0.	0.	0.	0.	0.
32	0.	0.	0.	0.	0.	0.
33	0.	0.	0.	0.	0.	0.
34	0.	0.	0.	0.	0.	0.
35	0.	0.	0.	0.	0.	0.
36	0.	0.	0.	0.	0.	0.
37	0.	0.	0.	0.	0.	0.

VELOCITIES IN GIVEN DIRECTION

POINT NUMBER	X IN/SEC	Y IN/SEC	Z IN/SEC	THETA-X RAD/SEC	THETA-Y RAD/SEC	THETA-Z RAD/SEC
1	0.	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.	0.
3	0.	0.	0.	0.	0.	0.
4	0.	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.	0.
6	0.	0.	0.	0.	0.	0.
7	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.
9	0.	0.	0.	0.	0.	0.
10	0.	0.	0.	0.	0.	0.
11	0.	0.	0.	0.	0.	0.
12	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.
18	0.	0.	0.	0.	0.	0.
19	0.	0.	0.	0.	0.	0.
20	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.
25	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.
31	0.	0.	0.	0.	0.	0.
32	0.	0.	0.	0.	0.	0.
33	0.	0.	0.	0.	0.	0.
34	0.	0.	0.	0.	0.	0.
35	0.	0.	0.	0.	0.	0.
36	0.	0.	0.	0.	0.	0.
37	0.	0.	0.	0.	0.	0.

FORCES CONTRIBUTED BY THE SUBSYSTEM MODE SHAPES
(POINTS ON PYLON AND POINTS NOT ON MODAL SUBSYSTEMS EXCLUDED)

POINT NUMBER	X POUNDS	Y POUNDS	Z POUNDS	THETA-X IN-LB	THETA-Y IN-LB	THETA-Z IN-LB
1	0.	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.	0.
3	0.	0.	0.	0.	0.	0.
4	0.	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.	0.
6	0.	0.	0.	0.	0.	0.
7	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.
9	0.	0.	0.	0.	0.	0.
10	0.	0.	0.	0.	0.	0.
11	0.	0.	0.	0.	0.	0.
12	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.
18	0.	0.	0.	0.	0.	0.
19	0.	0.	0.	0.	0.	0.
20	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.

22	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.
25	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.
31	0.	0.	0.	0.	0.	0.
32	0.	0.	0.	0.	0.	0.
33	0.	0.	0.	0.	0.	0.
34	0.	0.	0.	0.	0.	0.
35	0.	0.	0.	0.	0.	0.
36	0.	0.	0.	0.	0.	0.
37	0.	0.	0.	0.	0.	0.

THE FOLLOWING VALUES ARE FOR THE TYPE 3 PHYSICAL CONNECTING ELEMENTS
FORCES ARE THOSE THAT THE ELEMENT EXERTS ON THE ROTOR OR CASE-

ELEMENT NUMBER	RELATIVE DISPLACEMENT INCHES	DEAD BAND INCHES	CLEARANCE INCHES	I-END POINT NUMBER	JEND POINT NUMBER	FORCE IN Y DIRECTION I END POUNDS	FORCE IN Y DIRECTION J END POUNDS	FORCE IN Z DIRECTION I END POUNDS	FORCE IN Z DIRECTION J END POUNDS	FORCE MAGNITUDE POUNDS
6	0.	0.2500	0.2500	1	21	0.	0.	0.	0.	0.

THE FORCES THAT THE TYPL 6 PHYSICAL CONNECTING ELEMENTS (UNCOUPLED POINT
SPRING-DAMPER ELEMENTS) EXERT ON THE ENGINE COMPONENTS OR GROUND ARE-

ELEMENT NUMBER	END	POINT NUMBER	FORCE IN GIVEN DIRECTION X POUNDS	Y POUNDS	Z POUNDS	THETA-Y IN-LB	THETA-Z IN-LB
1	I	3	0.	0.	0.	0.	0.
1	J	34	0.	0.	0.	0.	0.
2	I	4	0.	0.	0.	0.	0.
2	J	35	0.	0.	0.	0.	0.
3	I	11	0.	0.	0.	0.	0.
3	J	36	0.	0.	0.	0.	0.
4	I	20	0.	0.	0.	0.	0.
4	J	6	0.	0.	0.	0.	0.
5	I	7	0.	0.	0.	0.	0.
5	J	37	0.	0.	0.	0.	0.

THE GYROSCOPIC FO?CES ACTING ON THE ROTOR(S) ARE-

POINT NUMBER	ROTOR NUMBER	POLAR MOMENT OF INERTIA LB-IN**2	Y-AXIS MOMENT IN-LB	Z-AXIS MOMENT IN-LB
1	1	351881.	0.	0.
2	1	42558.	0.	0.
3	1	2202.	0.	0.
4	1	820.	0.	0.
5	1	271.	0.	0.
6	1	4450.	0.	0.
7	1	612.	0.	0.
8	1	27727.	0.	0.
9	1	52440.	0.	0.
10	1	45457.	0.	0.
11	2	276.	0.	0.
12	2	5261.	0.	0.
13	2	4482.	0.	0.
14	2	5888.	0.	0.
15	2	9406.	0.	0.
16	2	6806.	0.	0.
17	2	4211.	0.	0.
18	2	20283.	0.	0.
19	2	18587.	0.	0.
20	2	455.	0.	0.

SUMMARY OF UNBALANCE FORCES-

BIRTH TIME SECONDS	POINT NUMBER	ROTOR NUMBER	MAGNITUDE GM-IN	PHASE ANGLE DEGREES	FORCE (LB.) Y-DIRECTION	FORCE (LB.) Z-DIRECTION
0.	1	1	500.	0.	382.855	0.

GENERALIZED COORDINATE NUMBER	GENERALIZED FORCE DUE TO APPLIED FORCES ONLY
1	0.
2	0.
3	0.
4	0.
5	0.
6	0.
7	0.
8	0.
9	0.
10	0.
11	0.
12	0.
13	0.
14	0.
15	-308.096
16	34.150
17	23.368
18	27.751
19	-14.043
20	14.247
21	-6.585
22	-25.451
23	12.809
24	1.083
25	-6.304
26	5.552
27	11.307
28	8.233
29	0.
30	0.
31	0.
32	0.
33	0.
34	0.
35	0.
36	0.
37	0.
38	0.
39	0.
40	0.
41	0.
42	0.
43	0.
44	0.

45	0.
46	0.
47	0.
48	0.
49	0.
50	0.
51	0.
52	0.
53	0.
54	0.
55	0.
56	0.
57	0.
58	0.
59	0.
60	0.
61	0.
62	0.
63	0.
64	0.
65	0.
66	0.
67	0.
68	0.
69	0.
70	0.
71	0.
72	0.
73	0.
74	0.
75	0.
76	0.
77	0.
78	0.
79	0.
80	0.
81	0.
82	0.
83	0.
84	0.
85	0.
86	0.
87	0.
88	0.
89	0.
90	0.
91	0.
92	0.
93	0.
94	0.
95	0.
96	0.
97	0.
98	0.
99	0.
100	0.

GENERALIZED COORDINATE NUMBER	GENERALIZED DISPLACEMENT	GENERALIZED VELOCITY	GENERALIZED FORCE	GENERALIZED WEIGHT POUNDS	GENERALIZED STIFFNESS LB/IN	GENERALIZED DAMPING VALUE (LB-SEC)/IN	GENERALIZED ACCELERATION
1	0	0	0.	9.428E 02	0.	0.	0.
2	0.	0	0.	7.885E 02	0.	0.	0.
3	0.	0	0.	5.106E 02	2.348E 04	0.	0.
4	0.	0	0.	9.824E 02	2.282E 05	0.	0.
5	0	0.	0	8.681E 01	1.825E 05	0.	0.
6	0	0.	0.	1.035E 02	7.728E 05	0.	0.
7	0	0.	0.	9.002E 01	2.017E 06	0.	0.
8	0	0.	0	1.514E 02	9.090E 06	0.	0.
9	0.	0.	0.	1.509E 02	6.920E 06	0.	0.
10	0.	0.	0.	2.858E 02	1.510E 07	0.	0.
11	0.	0.	0.	1.155E 02	8.506E 06	0.	0.
12	0.	0.	0.	2.832E 02	2.732[illegible]	0.	0.
13	0.	0.	0.	1.625E 02	2.187E [illegible]	0.	0.
14	0.	0.	0	9.023E 01	1.941E 0[illegible]	0.	0.
15	0.	0.	-308.098	9.428E 02	0.	0.	-126.8807
16	0.	0.	34.156	7.885E 02	0.	0.	18.7379
17	0.	0	23.388	5.106E 02	2.348E 04	0.	17.8853
18	0.	0.	27.791	9.824E 02	2.282E 05	0.	10.8208
19	0.	0.	-14.043	8.681E 01	1.825E 05	0.	-62.8030
20	0.	0.	14.247	1.035E 02	7.728E 05	0.	53.1782
21	0.	0.	-5.686	9.002E 01	2.017E 06	0.	-28.8819
22	0.	0.	-29.481	1.514E 02	9.090E 06	0.	-75.2789
23	0.	0	12.899	1.509E 02	6.920E 06	0.	23.0226
24	0.	0.	1.093	2.858E 02	1.810E 07	0.	1.4777
25	0.	0.	-6.304	1.155E 02	8.506E 06	0.	-21.0825
26	0.	0.	8.892	2.832E 02	2.732E 07	0.	8.2153
27	0.	0.	11.307	1.625E 02	2.187E 07	0.	26.8841
28	0.	0	8.233	9.023E 01	1.941E 07	0.	38.2872
29	0.	0.	0.	8.492E 02	0.	0.	0.
30	0.	0.	0	2.048E 02	0.	0.	0.
31	0.	0.	0.	1.867E 02	1.612E 06	-2.536E 01	0.
32	0	0.	0	1.468E 02	6.722E 06	-4.368E 01	0.
33	0.	0.	0.	8.723E 01	3.722E 06	-2.648E 01	0.
34	0.	0.	0.	3.184E 02	2.424E 07	-1.202E 02	0.
35	0.	0.	0.	7.143E 02	9.077E 07	-3.744E 02	0.
36	0.	0.	0.	1.482E 02	2.305E 07	-8.637E 01	0.
37	0.	0.	0.	3.258E 02	7.138E 07	-2.241E 02	0.
38	0.	0.	0.	8.492E 02	0.	0.	0.
39	0.	0.	0.	2.048E 02	0.	0.	0.
40	0.	0.	0	1.867E 02	1.612E 06	-2.538E 01	0.
41	0.	0.	0.	1.868E 02	4.722E 06	-4.368E 01	0.
42	0.	0.	0.	8.723E 01	3.722E 06	-2.648E 01	0.
43	0.	0.	0.	3.184E 02	2.424E 07	-1.202E 02	0.
44	0.	0.	0	7.143E 02	9.077E 07	-3.744E 02	0.
45	0.	0.	0.	1.482E 02	2.305E 07	-8.637E 01	0.
46	0.	0.	0.	3.258E 02	7.138E 07	-2.241E 02	0.
47	0.	0.	0.	3.003E 03	0.	0.	0.
48	0.	0.	0.	1.130E 03	0.	0.	0.
49	0.	0.	0.	5.885E 02	3.066E 05	4.472E 01	0.
50	0.	0.	0.	4.110E 02	8.510E 05	5.343E 01	0.
51	0.	0.	0.	8.611E 02	3.181E 06	1.768E 02	0.
52	0.	0.	0.	1.387E 03	6.881E 06	3.244E 02	0.
53	0.	0.	0.	1.081E 03	8.714E 06	3.281E 02	0.
54	0.	0.	0.	2.692E 02	2.740E 06	9.211E 01	0.
55	0.	0.	0.	3.619E 02	4.511E 06	1.351E 02	0.
56	0.	0.	0	2.772E 02	4.808E 06	1.338E 02	0.
57	0.	0.	0.	1.820E 02	3.933E 06	9.132E 01	0.
58	0.	0.	0.	2.018E 02	4.807E 06	1.088E 02	0.
59	0.	0.	0.	6.281E 02	1.810E 07	3.818E 02	0.
60	0.	0.	0.	1.464E 03	6.045E 07	1.008E 03	0.
61	0.	0.	0	1.409E 03	[illegible] 07	1.063E 03	0
62	0.	0.	0	8.430E 02	2.771E 07	4.249E 02	0
63	0	0.	0.	1.004E 03	5.338E 07	8.483E 02	0
64	0	0	0.	1.065E 03	7.566E 07	8.645E 02	0
65	0.	0.	0	1.875E 02	1.475E 07	1.755E 02	0
66	0.	0.	0	3.044E 02	2.604E 07	3.020E 02	0.
67	0.	0.	0	8.842E 01	9.451E 08	1.061E 02	0.

NUMBER	IN/SEC	IN/SEC	IN/SEC	RAD/SEC	RAD/SEC	RAD/SEC
1	0	-0.001613	0.087098	0	0.004418	-0.011308
2	0	0.040284	0.127811	0.	0.005014	-0.011871
3	0	-0.033807	0.105434	0.	0.004307	-0.011241
4	0	0.064648	0.118328	0.	-0.001309	-0.002278
5	0	0.072882	0.018803	0.	-0.002058	0.001588
6	0	-0.003718	-0.027713	0.	0.000401	0.001544
7	0	-0.020527	-0.018281	0.	0.000308	0.001831
8	0	-0.010186	-0.028112	0.	0.000082	0.001543
9	0	-0.021381	-0.017583	0.	0.000842	0.001677
10	0	-0.032525	-0.007347	0.	0.000554	0.001558
11	0	0.083308	0.102387	0	-0.002608	0.001138
12	0	0.075781	0.085088	0	-0.002850	0.001240
13	0	0.082128	0.060813	0	-0.002444	0.001835
14	0	0.053445	0.045854	0	-0.002377	0.001528
15	0.	0.044000	0.034018	0.	-0.002280	0.001857
16	0.	0.031783	0.017813	0.	-0.002318	0.001684
17	0	0.026874	0.008847	0	-0.002187	0.001808
18	0	0.001518	-0.015088	0	-0.001874	0.001877
19	0	-0.008312	-0.023887	0.	-0.001845	0.001888
20	0	-0.018408	-0.038817	0.	-0.001845	0.001884
21	0	0.073993	0.182842	0.	-0.002804	0.001271
22	0	0.040218	0.141818	0.	-0.001887	-0.000021
23	0	0.045338	0.082788	0.	-0.001942	-0.000040
24	0.	0.050781	0.085721	0.	-0.001857	0.000024
25	0	0.053818	0.054850	0.	-0.001875	0.000122
26	0	0.057788	0.045182	0.	-0.001882	0.000455
27	0	0.054818	0.034100	0.	-0.001890	0.000463
28	0	0.058118	0.027881	0.	-0.001883	0.000355
29	0	0.040178	0.003788	0.	-0.001824	0.001058
30	0	0.032478	-0.004888	0.	-0.001813	0.001238
31	0	0.014588	-0.016103	0.	-0.001785	0.001448
32	0	-0.008437	-0.026078	0.	-0.001782	0.001872
33	0	-0.031483	-0.042857	0.	-0.001762	0.002057
34	0	0.004881	0.130777	0.	-0.001358	-0.001804
35	0.	0.048158	0.108388	0.	-0.001338	-0.001818
36	0	0.054888	0.101387	0.	-0.001287	-0.001837
37	0	-0.018404	-0.022418	0.	-0.001795	0.002048

FORCES CONTRIBUTED BY THE SUBSYSTEM MODE SHAPES
(POINTS ON PYLON AND POINTS NOT ON MODAL SUBSYSTEMS EXCLUDED)

POINT NUMBER	X POUNDS	Y POUNDS	Z POUNDS	THETA-X IN-LB	THETA-Y IN-LB	THETA-Z IN-LB
1	0.	-20.580	13.889	0.	238.227	378.803
2	0.	0.000	-0.000	0.	0.000	0.000
3	0.	-0.023	-0.082	0.	-0.000	-0.000
4	0.	-24.630	30.241	0.	108.789	107.428
5	0	-5.888	2.336	0	73.300	16.871
6	0.	0.	0	0.	0.	0.
7	0.	0.005	0.002	0.	-0.000	-0.000
8	0.	0.	0.	0.	0.	0.
9	0.	-1.422	-4.182	0	372.433	342.708
10	0	0.000	-0.000	0.	-0.000	-0.000
11	0.	0.024	0.018	0.	0.	0.
12	0.	-15.278	-3.747	0.	82.088	-88.388
13	0.	-15.407	0.151	0.	138.830	-172.788
14	0	-18.084	1.817	0.	143.337	-247.382
15	0.	-13.481	7.712	0.	155.225	-214.414
16	0.	-11.881	13.623	0.	134.837	-210.082
17	0.	-10.056	14.812	0	101.813	-218.092
18	0.	-8.555	15.581	0.	-58.707	-255.817
19	0.	1.317	1.083	0.	0.385	-12.574
20	0.	0.008	0.007	0.	0.000	0.000
21	0.	-61.287	43.879	0.	-887.580	-1400.987
22	0.	-13.088	7.730	0.	-0.110	-41.561
23	0.	35.387	2.344	0.	3502.804	738.112
24	0.	27.280	7.822	0.	3465.713	1028.394
25	0.	20.852	12.808	0.	3383.833	1168.477
26	0.	-1.585	1.083	0.	-1.747	-3.174
27	0.	-4.024	2.833	0.	-14.580	-22.830
28	0.	4.889	-4.822	0.	-38.280	-38.080
29	0.	-10.880	42.008	0.	2824.874	1215.182
30	0.	-11.788	44.248	0.	2412.383	1151.833
31	0.	-10.488	49.313	0.	1108.280	828.884
32	0.	-6.780	48.882	0.	738.855	460.859
33	0.	1.838	43.813	0.	250.418	442.078
34	0.	0.	0.	0.	0.	0.
35	0.	0.	0.	0.	0.	0.
36	0.	-0.000	0.000	0.	0.000	0.000
37	0.	0.	0.	0.	0.	0.

THE FOLLOWING VALL . ARE FOR THE TYPE 3 PHYSICAL CONNECTING ELEMENTS.
FORCES ARE THOSE THAT THE ELEMENT EXERTS ON THE ROTOR OR CASE-

ELEMENT NUMBER	RELATIVE DISPLACEMENT INCHES	DEAD BAND INCHES	CLEARANCE INCHES	I-END POINT NUMBER	JEND POINT NUMBER	FORCE IN Y DIRECTION I END POUNDS	FORCE IN Y DIRECTION J END POUNDS	FORCE IN Z DIRECTION I END POUNDS	FORCE IN Z DIRECTION J END POUNDS	FORCE MAGNITUDE POUNDS
6	0.0005	0.2500	0.2495	1	21	0.	0.	0.	0.	0.

THE FORCES THAT THE TYPE 5 PHYSICAL CONNECTING ELEMENTS (UNCOUPLED POINT SPRING-DAMPER ELEMENTS) EXERT ON THE ENGINE COMPONENTS OR GROUND ARE-

ELEMENT NUMBER	END	POINT NUMBER	FORCE IN GIVEN DIRECTION X POUNDS	Y POUNDS	Z POUNDS	THETA-Y IN-LB	THETA-Z IN-LB
1	I	3	0.	382.270	-383.033	0.	0.
1	J	34	0.	-382.270	383.033	0.	0.
2	I	4	0.	-81.365	86.534	0.	0.
2	J	35	0.	81.365	-86.534	0.	0.
3	I	11	0.	13.811	11.888	0.	0.
3	J	36	0.	-13.811	-11.888	0.	0.
4	I	20	0.	8.501	7.332	0.	0.
4	J	8	0.	-8.501	-7.332	0.	0.
5	I	7	0.	-15.820	-13.056	0.	0.
5	J	37	0.	15.820	13.056	0.	0.

THE GYROSCOPIC FORCES ACTING ON THE ROTOR(S) ARE-

POINT NUMBER	ROTOR NUMBER	POLAR MOMENT OF INERTIA LB-IN**2	Y-AXIS MOMENT IN-LB	Z-AXIS MOMENT IN-LB
1	1	381881.	3676.665	1612.966
2	1	42539	465.170	191.686
3	1	2202	22.213	8.889
4	1	820	1.266	-0.728
5	1	271	-0.388	-0.664
6	1	4480	-7.723	1.33[illegible]
7	1	512	-0.887	0.183
8	1	27727	-38.399	24.430
9	1	82440	-84.337	62.[illegible]
10	1	49427	-76.221	38.311
11	2	276	-1.166	-2.622
12	2	5261	-23.845	-46.021

13	2	4462.	-25.133	-40.033
14	2	5859.	-35.448	-51.760
15	2	9408.	-56.836	-80.787
16	2	[illegible].	-42.867	-55.425
17	2	4211.	-26.135	-33.680
18	2	20283.	-124.288	-146.308
19	2	18697.	-113.324	-132.171
20	2	458.	-2.834	-3.312

UMMARY OF UNBALANCE FORCES-

STRTN TIME SECONDS	POINT NUMBER	ROTOR NUMBER	MAGNITUDE GM-IN	PHASE ANGLE DEGREES	FORCE (LB.) Y-DIRECTION	FORCE (LB.) Z-DIRECTION
.	1	1	500.	0	-254.614	175.635

GENERALIZED COORDINATE NUMBER	GENERALIZED FORCE DUE TO APPLIED FORCES ONLY
1	-159.178
2	17.555
3	12.024
4	14.312
5	-7.232
6	7.337
7	-3.442
8	-15.187
9	6.643
10	0.583
11	-3.247
12	3.801
13	5.823
14	4.240
15	264.588
16	-29.278
17	-20.021
18	-23.823
19	12.037
20	-12.212
21	5.730
22	25.280
23	-11.057
24	-0.837
25	5.404
26	-5.554
27	-8.892
28	-7.086
29	0.
30	0.
31	0.
32	0.
33	0.
34	0.
35	0.
36	0.
37	0.
38	0.
39	0.
40	0.
41	0.
42	0.
43	0.
44	0.
45	0.
46	0.
47	0.
48	0.
49	0.
50	0.
51	0.
52	0.
53	0.
54	0.
55	0.
56	0.
57	0.
58	0.
59	0.
60	0.
61	0.
62	0.
63	0.
64	0.
65	0.
66	0.
67	0.
68	0.
69	0.
70	0.
71	0.
72	0.
73	[illegible]
74	[illegible]
75	0.
76	0.
77	0.
78	0.
79	0.
80	0.
81	0.
82	0.
83	0.
84	0.
85	0.
86	0.
87	0.
88	0.
89	0.
90	0.
91	0.
92	0.
93	0.
94	0.
95	0.
96	0.
97	0.
98	0.
99	0.
100	0.

GENERALIZED COORDINATE NUMBER	GENERALIZED DISPLACEMENT	GENERALIZED VELOCITY	GENERALIZED FORCE	GENERALIZED WEIGHT POUNDS	GENERALIZED STIFFNESS LB/IN	GENERALIZED DAMPING VALUE (LB-SEC)/IN	GENERALIZED ACCELERATION
1	-0.00085232	-0.092843	147.737	9.428E 02	0.	0.	60.6480

2	0.00002458	0.013000	2.330	7.885E 02	0.	0.	1.1430
3	0.00082179	-0.078913	-185.840	5.108E 02	2.348E 04	0.	-127.0873
4	-0.00011503	0.053844	101.811	5.824E 02	2.282E 05	0.	48.8818
5	0.00015877	-0.058553	15.334	8.861E 01	1.828E 05	0.	-76.8131
6	-0.00007847	0.018264	-64.385	1.038E 02	7.728E 05	0.	23.4270
7	0.00001771	-0.004408	34.182	9.002E 01	2.017E 06	0.	-6.7288
8	0.00000778	0.010051	46.885	1.814E 02	8.090E 06	0.	-1.6880
9	-0.00000411	0.001537	-25.055	1.505E 02	5.520E 06	0.	5.8518
10	0.00000034	-0.000453	3.527	2.883E 02	1.510E 07	0.	-2.2302
11	0.00000108	-0.000220	10.402	1.155E 02	8.506E 06	0.	4.8730
12	0.00000053	0.000720	15.389	2.832E 02	2.732E 07	0.	1.4120
13	0.00000414	-0.002083	55.554	1.825E 02	2.187E 07	0.	-5.7287
14	0.00000164	-0.000441	29.888	9.023E 01	1.041E 07	0.	-0.1028
15	-0.00015345	0.087828	-57.889	9.428E 02	0.	0.	-23.8432
16	0.00004236	-0.001081	-24.318	7.885E 02	0.	0.	-11.9188
17	-0.00031500	-0.208555	30.035	5.108E 02	2.348E 04	0.	26.3855
18	0.00017778	0.072850	-13.282	9.834E 02	2.282E 05	0.	-20.9825
19	-0.00011087	-0.081981	-24.244	8.881E 01	1.828E 05	0.	-27.7251
20	0.00008557	0.042612	48.809	1.038E 02	7.728E 05	0.	-9.8874
21	-0.00001227	-0.008722	-25.177	9.002E 01	2.017E 06	0.	2.8418
22	-0.00000854	0.004851	-51.728	1.814E 02	8.090E 06	0.	0.7132
23	0.00000421	0.003488	28.940	1.508E 02	8.820E 06	0.	-0.4298
24	0.00000058	-0.001328	10.844	2.858E 02	1.510E 07	0.	0.4606
25	-0.00000028	-0.001713	6.887	1.155E 02	8.506E 06	0.	10.7241
26	0.00000054	0.000812	15.850	2.832E 02	2.732E 07	0.	1.0788
27	-0.00000425	-0.002344	-83.538	1.828E 02	2.187E 07	0.	-0.4444
28	-0.00000148	-0.001237	-26.880	9.023E 01	1.041E 07	0.	5.1480
29	-0.00000555	-0.005555	-10.180	5.482E 02	0.	0.	-4.5232
30	0.00015312	0.088343	17.831	2.048E 02	0.	0.	33.2881
31	0.00000884	0.008228	7.288	1.887E 02	1.812E 06	-2.538E 01	-3.0181
32	-0.00000480	-0.000602	-22.159	1.889E 02	4.722E 06	-4.388E 01	1.9389
33	0.00000154	0.000171	5.082	8.723E 01	3.722E 06	-2.848E 01	1.5033
34	-0.00000081	0.000183	-14.590	3.184E 02	2.424E 07	-1.282E 02	0.2180
35	0.00000023	0.000080	28.836	7.143E 02	8.077E 07	-3.744E 02	-0.4548
36	0.00000012	-0.000014	2.727	1.482E 02	2.305E 07	-8.537E 01	-0.1373
37	0.00000010	-0.000008	5.826	3.258E 02	7.138E 07	-2.241E 02	-0.0087
38	-0.00003868	-0.021981	-17.243	8.482E 02	0.	0.	-7.8458
39	0.00022427	0.082480	-3.788	2.048E 02	0.	0.	-7.1478
40	0.00001625	-0.002881	22.387	1.887E 02	1.812E 06	-2.538E 01	-4.4686
41	0.00000313	0.003481	15.081	1.889E 02	4.722E 06	-4.388E 01	0.8248
42	0.00000228	-0.000855	8.238	8.723E 01	3.722E 06	-2.848E 01	-1.4472
43	0.00000148	0.000207	34.828	3.184E 02	2.424E 07	-1.282E 02	-1.1228
44	-0.00000028	-0.000080	-24.890	7.143E 02	8.077E 07	-3.744E 02	0.3834
45	-0.00000043	-0.000005	-5.854	1.482E 02	2.305E 07	-8.537E 01	0.1032
46	-0.00000063	0.000004	-30.508	3.258E 02	7.138E 07	-2.241E 02	0.2308
47	0.00043138	0.178258	283.910	3.003E 03	0.	0.	23.9814
48	0.00014249	0.081434	34.873	1.130E 03	0.	0.	11.8222
49	0.00008201	0.022788	24.435	5.889E 02	3.088E 05	4.472E 01	-1.3030
50	-0.00011380	0.020487	-84.138	4.110E 02	8.510E 05	6.243E 01	29.8107
51	0.00000708	0.000832	23.795	8.811E 02	3.181E 06	1.785E 02	0.4985
52	-0.00005438	0.009358	-325.280	1.387E 03	5.881E 06	3.244E 02	10.0500
53	-0.00003378	0.008871	-364.382	1.081E 03	8.714E 06	3.261E 02	5.8838
54	-0.00001311	-0.000716	-34.888	2.892E 02	2.740E 06	8.211E 01	1.4348
55	-0.00003014	0.007885	-129.174	3.819E 02	4.511E 06	1.381E 02	8.3068
56	0.00002421	-0.005887	109.944	2.772E 02	4.806E 06	1.238E 02	-7.9513
57	-0.00001054	0.002108	-41.504	1.820E 02	3.983E 06	8.132E 01	3.1448
58	-0.00001251	0.003918	-67.834	2.018E 02	4.807E 06	1.058E 02	3.3820
59	-0.00000884	0.002180	-168.880	8.281E 02	1.810E 07	3.818E 02	5.2825
60	0.00000820	-0.002818	388.038	1.484E 03	8.048E 07	1.008E 03	-1.8711
61	0.00000181	-0.000731	111.889	1.408E 03	8.213E 07	1.003E 03	0.1878
62	0.00000182	-0.000808	47.218	5.430E 02	2.881E 07	4.248E 02	0.4844
63	0.00000182	-0.000588	113.174	1.004E 03	8.233E 07	8.483E 02	0.1850
64	0.00000147	-0.000523	111.340	1.085E 03	7.888E 07	5.845E 02	0.0828
65	-0.00000080	-0.000157	-12.720	1.818E 02	1.478E 07	1.785E 02	1.3881
66	0.00000084	0.000005	13.452	3.044E 02	2.804E 07	3.020E 02	-0.7134
67	-0.00000078	0.000234	-7.412	8.942E 01	8.851E 06	1.081E 02	0.0828
68	0.00000022	-0.000075	8.210	3.483E 02	4.188E 07	4.083E 02	-0.0242
69	0.00000001	-0.000003	4.888	2.391E 03	3.434E 08	3.072E 03	0.0005
70	-0.00000448	0.001117	-318.732	4.481E 02	7.075E 07	8.045E 02	0.3814
71	0.00000228	-0.000888	280.880	7.817E 02	1.248E 08	1.048E 03	-0.2383
72	0.00000022	-0.000077	8.388	2.588E 02	4.318E 07	3.584E 02	-0.0422
73	0.00000058	-0.000141	244.341	2.488E 03	4.388E 08	3.843E 03	-0.0701
74	0.00081430	0.071251	-313.888	3.003E 03	0.	0.	-40.4031
75	0.00013731	0.014428	-81.074	1.130E 03	0.	0.	-17.4408
76	0.00004407	-0.012134	-11.488	5.889E 02	3.088E 05	4.472E 01	-18.5840
77	0.00011883	0.080784	84.831	4.110E 02	8.510E 05	6.243E 01	-38.0874
78	-0.00000104	0.002882	3.878	8.811E 02	3.181E 06	1.785E 02	2.8832
79	0.00008828	0.013018	355.884	1.387E 03	5.881E 06	3.244E 02	-2.8838
80	0.00003408	0.018578	248.184	1.081E 03	8.714E 06	3.261E 02	-18.8218
81	0.00000128	-0.000503	6.881	2.892E 02	2.740E 06	8.211E 01	4.8088
82	0.00003002	0.007281	135.305	3.818E 02	4.511E 06	1.381E 02	-1.2288
83	-0.00002418	-0.012887	-111.888	2.772E 02	4.806E 06	1.238E 02	7.8861
84	0.00001188	0.001588	45.807	1.820E 02	3.983E 06	8.132E 01	-4.7838
85	0.00001824	0.002321	86.028	2.018E 02	4.807E 06	1.058E 02	-3.8601
86	0.00000871	0.004187	178.843	8.281E 02	1.810E 07	3.818E 02	0.7898
87	-0.00000848	-0.003881	-382.801	1.484E 03	8.048E 07	1.008E 03	0.8818
88	-0.00000192	-0.001082	-113.224	1.408E 03	8.213E 07	1.003E 03	1.8880
89	-0.00000173	-0.000481	-47.814	5.430E 02	2.881E 07	4.248E 02	1.8877
90	-0.00000223	-0.000588	-140.178	1.004E 03	8.233E 07	8.483E 02	-0.1848
91	-0.00000301	-0.000513	-145.551	1.085E 03	7.888E 07	5.845E 02	1.5488
92	-0.00000080	0.000278	-8.230	1.818E 02	1.478E 07	1.785E 02	8.4411
93	0.00000025	-0.000388	4.374	3.044E 02	2.804E 07	3.020E 02	-2.8884
94	0.00000108	0.000177	10.284	8.842E 01	8.851E 06	1.081E 02	-0.7498
95	-0.00000030	-0.000100	-12.801	3.483E 02	4.188E 07	4.083E 02	0.7042
96	-0.00000001	-0.000008	-4.878	2.391E 03	3.434E 08	3.073E 03	0.0014
97	0.00000474	0.001887	335.228	4.481E 02	7.078E 07	8.045E 02	-0.9880
98	-0.00000238	-0.000828	-288.428	7.817E 02	1.248E 08	1.048E 03	0.2850
99	-0.00000032	-0.000071	-13.827	2.588E 02	4.318E 07	3.584E 02	0.0851
100	-0.00000068	-0.000228	-254.808	2.488E 03	4.388E 08	3.843E 03	0.0551

ORIGINAL PAGE IS OF POOR QUALITY

TIME: 0.0150000 SECONDS

SPEED SEGMENT NUMBER: 1

ROTOR PROPERTIES FOR INDEPENDENT ROTOR (ROTOR 1)-

SPEED: 3311. RPM
ACCELERATION: 0. RPM/SEC
ANGULAR DISPLACEMENT: 0.82779854 REVOLUTIONS

ROTOR PROPERTIES FOR DEPENDENT ROTOR (ROTOR 2)-

SPEED: 13483. RPM
ACCELERATION: 0. RPM/SEC
ANGULAR DISPLACEMENT: 3.37081553 REVOLUTIONS

DISPLACEMENTS IN GIVEN DIRECTION

POINT NUMBER	X INCHES	Y INCHES	Z INCHES	THETA-X RADIANS	THETA-Y RADIANS	THETA-Z RADIANS
1	0.	0.00023945	0.00122608	0.	-0.00000545	0.00001498
2	0.	0.00005112	0.00115529	0.	-0.00000575	0.00001485
3	0.	0.00016170	0.00120051	0.	-0.00000502	0.00001494
4	0.	0.00000644	0.00089459	0.	-0.00001114	0.00000333
5	0.	-0.00000197	0.00044021	0.	-0.00001984	-0.00000207
6	0.	0.00005557	-0.00026111	0.	-0.00002024	0.00000083
7	0.	0.00005015	-0.00038539	0.	-0.00002021	0.00000050
8	0.	0.00005223	-0.00023863	0.	-0.00001981	0.00000025
9	0.	0.00005166	-0.00038560	0.	-0.00001892	0.00000016
10	0.	0.00004645	-0.00058335	0.	-0.00002004	0.00000003
11	0.	0.00003963	0.00095551	0.	-0.00001732	-0.00000287
12	0.	0.00005872	0.00084075	0.	-0.00001748	-0.00000276
13	0.	0.00008482	0.00067348	0.	-0.00001804	-0.00000259
14	0.	0.00010122	0.00056147	0.	-0.00001824	-0.00000248
15	0.	0.00011382	0.00047267	0.	-0.00001830	-0.00000244
16	0.	0.00013135	0.00034239	0.	-0.00001837	-0.00000237
17	0.	0.00014080	0.00028144	0.	-0.00001855	-0.00000187
18	0.	0.00016110	0.00004252	0.	-0.00001884	-0.00000124
19	0.	0.00018503	-0.00004579	0.	-0.00001880	-0.00000112
20	0.	0.00017368	-0.00019441	0.	-0.00001889	-0.00000112
21	0.	-0.00005768	0.00146627	0.	-0.00001726	-0.00000322
22	0.	0.00001892	0.00125711	0.	-0.00001574	-0.00000083
23	0.	0.00003714	0.00078072	0.	-0.00001588	-0.00000058
24	0.	0.00004285	0.00063172	0.	-0.00001637	-0.00000048
25	0.	0.00004610	0.00053359	0.	-0.00001687	-0.00000043
26	0.	0.00004920	0.00045127	0.	-0.00001725	-0.00000025
27	0.	0.00005103	0.00033986	0.	-0.00001725	-0.00000029
28	0.	0.00005248	0.00028231	0.	-0.00001738	-0.00000027
29	0.	0.00005365	0.00004894	0.	-0.00001807	-0.00000005
30	0.	0.00005312	-0.00003542	0.	-0.00001825	0.00000001
31	0.	0.00004809	-0.00017097	0.	-0.00001872	0.00000023
32	0.	0.00004173	-0.00032830	0.	-0.00001902	0.00000045
33	0.	0.00003808	-0.00049278	0.	-0.00001910	0.00000054
34	0.	0.00005535	0.00127735	0.	-0.00001424	0.00000113
35	0.	0.00002580	0.00088385	0.	-0.00001373	0.00000172
36	0.	0.00001471	0.00090144	0.	-0.00001337	0.00000173
37	0.	0.00004438	-0.00038752	0.	-0.00001908	0.00000084

VELOCITIES IN GIVEN DIRECTION

POINT NUMBER	X IN/SEC	Y IN/SEC	Z IN/SEC	THETA-X RAD/SEC	THETA-Y RAD/SEC	THETA-Z RAD/SEC
1	0.	-0.028487	0.164312	0.	-0.007912	0.002856
2	0.	-0.055184	0.079927	0.	-0.007789	0.002633
3	0.	-0.040325	0.123305	0.	-0.007677	0.002807
4	0.	-0.075530	0.010505	0.	-0.003750	0.001857
5	0.	-0.118290	-0.047784	0.	0.001175	-0.001997
6	0.	0.044930	-0.005029	0.	-0.003007	-0.005405
7	0.	0.077878	-0.023882	0.	-0.003044	-0.005355
8	0.	0.040718	0.001251	0.	-0.003731	-0.005442
9	0.	0.082487	-0.028577	0.	-0.003641	-0.005475
10	0.	0.128487	-0.057581	0.	-0.003565	-0.005545
11	0.	-0.082885	0.021310	0.	0.000356	-0.001183
12	0.	-0.084820	0.023889	0.	0.000323	-0.001312
13	0.	-0.070801	0.027080	0.	0.000304	-0.001647
14	0.	-0.060401	0.028383	0.	0.000293	-0.001784
15	0.	-0.051226	0.031065	0.	0.000290	-0.001803
16	0.	-0.038056	0.033555	0.	0.000279	-0.001849
17	0.	-0.031958	0.035141	0.	0.000182	-0.001955
18	0.	-0.002547	0.037325	0.	-0.000041	-0.002095
19	0.	0.007415	0.038718	0.	-0.000078	-0.002116
20	0.	0.024080	0.036065	0.	-0.000080	-0.002111
21	0.	-0.089957	-0.028435	0.	0.001047	-0.000881
22	0.	-0.070257	0.032541	0.	-0.000592	-0.000491
23	0.	-0.058847	0.010503	0.	-0.000708	-0.000647
24	0.	-0.048877	0.002048	0.	-0.000704	-0.000850
25	0.	-0.042502	-0.003305	0.	-0.000685	-0.000977
26	0.	-0.037089	-0.008231	0.	-0.000655	-0.001174
27	0.	-0.029480	-0.012033	0.	-0.000599	-0.001173
28	0.	-0.025078	-0.014626	0.	-0.000564	-0.001177
29	0.	-0.003662	-0.021957	0.	-0.000438	-0.001383
30	0.	0.005571	-0.023732	0.	-0.000384	-0.001422
31	0.	0.019177	-0.024387	0.	-0.000280	-0.001525
32	0.	0.035887	-0.024028	0.	-0.000196	-0.001600
33	0.	0.052598	-0.023902	0.	-0.000155	-0.001582
34	0.	-0.061345	0.075763	0.	-0.001505	-0.000145
35	0.	-0.085328	0.018882	0.	-0.002102	0.000185
36	0.	-0.085788	0.008732	0.	-0.002101	0.000220
37	0.	0.080836	-0.021823	0.	-0.000120	-0.001477

FORCES CONTRIBUTED BY THE SUBSYSTEM MODE SHAPES
(POINTS ON PYLON AND POINTS NOT ON MODAL SUBSYSTEMS EXCLUDED)

POINT NUMBER	X POUNDS	Y POUNDS	Z POUNDS	THETA-X IN-LB	THETA-Y IN-LB	THETA-Z IN-LB
1	0.	21.028	-21.837	0.	-430.082	-403.026
2	0.	-0.000	0.000	0.	0.000	-0.000
3	0.	-0.015	-0.120	0.	-0.000	0.000
4	0.	17.882	-7.117	0.	-72.790	-85.791
5	0.	3.886	-3.839	0.	-69.191	-8.028
6	0.	0.	0.	0.	0.	0.
7	0.	-0.005	0.028	0.	0.000	0.000
8	0.	0.	0.	0.	0.	0.
9	0.	-0.889	8.864	0.	-363.137	-128.003
10	0.	-0.000	0.000	0.	0.000	0.000
11	0.	0.004	0.095	0.	0.	0.
12	0.	7.108	5.653	0.	-99.491	38.021
13	0.	8.560	1.891	0.	-179.267	112.531
14	0.	8.908	0.482	0.	-199.410	184.574
15	0.	8.515	-5.401	0.	-237.234	202.455
16	0.	4.578	-13.830	0.	-220.470	243.910
17	0.	3.932	-15.381	0.	-189.023	287.290
18	0.	-3.187	-15.468	0.	-1.894	267.389
19	0.	-3.391	-2.221	0.	-5.811	18.174
20	0.	-0.017	0.019	0.	-0.000	-0.000
21	0.	68.242	-43.548	0.	895.786	1221.715

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22	0.	8.060	-10.818	0.	-0.221	34.882
23	0.	7.051	28.930	0.	-1882.008	387.127
24	0.	7.730	22.224	0.	-2235.705	477.122
25	0.	8.248	15.852	0.	-2345.880	531.403
26	0.	-0.202	-1.201	0.	2.502	0.824
27	0.	-0.813	-3.143	0.	17.884	-0.403
28	0.	2.863	4.858	0.	38.598	-27.442
29	0.	-1.840	-15.703	0.	-2335.124	718.158
30	0.	-3.415	-18.480	0.	-2227.208	707.658
31	0.	-10.443	-25.828	0.	-762.828	817.870
32	0.	-9.875	-24.809	0.	-445.986	530.082
33	0.	-7.385	-15.801	0.	-101.085	437.741
34	0.	0.	0.	0.	0.	0.
35	0.	0.	0.	0	0.	0
36	0.	0.000	-0.000	0.	-0.000	-0.000
37	0	0.	0.	0.	0.	0.

THE FOLLOWING VALUES ARE FOR THE TYPE 3 PHYSICAL CONNECTING ELEMENTS.
FORCES ARE THOSE THAT THE ELEMENT EXERTS ON THE ROTOR OR CASE-

ELEMENT NUMBER	RELATIVE DISPLACEMENT INCHES	DEAD BAND INCHES	CLEARANCE INCHES	I-END POINT NUMBER	JEND POINT NUMBER	FORCE IN Y DIRECTION I END POUNDS	FORCE IN Y DIRECTION J END POUNDS	FORCE IN Z DIRECTION I END POUNDS	FORCE IN Z DIRECTION J END POUNDS	FORCE MAGNITUDE POUNDS
6	0.0004	0.2500	0.2498	1	21	0.	0.	0.	0.	0.

THE FORCES THAT THE TYPE 5 PHYSICAL CONNECTING ELEMENTS (UNCOUPLED POINT SPRING-DAMPER ELEMENTS) EXERT ON THE ENGINE COMPONENTS OR GROUND ARE-

			FORCE IN GIVEN DIRECTION				
ELEMENT NUMBER	END	POINT NUMBER	X POUNDS	Y POUNDS	Z POUNDS	THETA-Y IN-LB	THETA-Z IN-LB
1	I	3	0.	-317.835	273.878	0.	0.
1	J	34	0.	317.835	-273.878	0.	0.
2	I	4	0.	32.252	-15.808	0.	0.
2	J	35	0.	-32.252	15.808	0.	0.
3	I	11	0.	-4.803	-13.189	0.	0.
3	J	36	0.	4.803	13.189	0.	0.
4	I	20	0.	-28.387	-18.883	0.	0.
4	J	6	0.	28.387	18.883	0.	0.
5	I	7	0.	-13.858	27.348	0.	0.
5	J	37	0.	13.858	-27.348	0.	0.

THE GYROSCOPIC FORCES ACTING ON THE ROTOR(S) ARE-

POINT NUMBER	ROTOR NUMBER	POLAR MOMENT OF INERTIA LB-IN**2	Y-AXIS MOMENT IN-LB	Z-AXIS MOMENT IN-LB
1	1	381881.	-810.235	-2711.418
2	1	42558.	-100.845	-287.770
3	1	2202.	-5.288	-15.888
4	1	820.	-1.033	-2.087
5	1	271.	0.488	0.288
6	1	4450.	21.588	-12.008
7	1	812.	2.481	-1.398
8	1	27727.	135.404	-82.843
9	1	62440.	305.794	-204.005
10	1	48487.	246.347	-158.354
11	2	278.	1.203	0.358
12	2	5261.	25.227	6.215
13	2	5452.	25.877	4.875
14	2	5958.	38.418	6.382
15	2	8405.	61.877	8.071
16	2	5908.	48.884	7.042
17	2	4211.	30.078	2.500
18	2	20283.	155.378	-3.078
19	2	18597.	143.885	-5.312
20	2	485.	3.584	-0.136

SUMMARY OF UNBALANCE FORCES-

BIRTH TIME SECONDS	POINT NUMBER	ROTOR NUMBER	MAGNITUDE GM-IN	PHASE ANGLE DEGREES	FORCE (LB.) Y-DIRECTION	FORCE (LB.) Z-DIRECTION
0.	1	1	500	0.	151.055	-302.825

GENERALIZED COORDINATE NUMBER	GENERALIZED FORCE DUE TO APPLIED FORCES ONLY
1	272.897
2	-30.158
3	-20.832
4	-24.837
5	12.398
6	-12.578
7	5.902
8	28.037
9	-11.386
10	-0.985
11	5.888
12	-5.173
13	-8.982
14	-7.285
15	-145.148
16	18.039
17	10.874
18	13.051
19	-8.594
20	8.690
21	-3.139
22	-13.849
23	8.057
24	0.513
25	-2.980
26	3.283
27	5.308
28	3.866
29	0.
30	0.
31	0.
32	0.
33	0.
34	0.
35	0.
36	0
37	0
38	0
39	0
40	0.
41	0.
42	0
43	0.
44	0.

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45	0.
46	0.
47	0.
48	0.
49	0.
50	0.
51	0.
52	0.
53	0.
54	0.
55	0.
56	0.
57	0.
58	0.
59	0.
60	0.
61	0.
62	0.
63	0.
64	0.
65	0.
66	0.
67	0.
68	0.
69	0.
70	0.
71	0.
72	0.
73	0.
74	0.
75	0.
76	0.
77	0.
78	0.
79	0.
80	0.
81	0.
82	0.
83	0.
84	0.
85	0.
86	0.
87	0.
88	0.
89	0.
90	0.
91	0.
92	0.
93	0.
94	0.
95	0.
96	0.
97	0.
98	0.
99	0.
100	0.

GENERALIZED COORDINATE NUMBER	GENERALIZED DISPLACEMENT	GENERALIZED VELOCITY	GENERALIZED FORCE	GENERALIZED WEIGHT POUNDS	GENERALIZED STIFFNESS LB/IN	GENERALIZED DAMPING VALUE (LB-SEC)/IN	GENERALIZED ACCELERATION
1	-0.00138289	-0.184426	81.285	9.428E 02	0.	0.	21.0187
2	-0.00018785	-0.027318	42.338	7.885E 02	0.	0.	20.7483
3	-0.00023812	0.102338	23.222	5.105E 02	2.348E 04	0.	21.7828
4	0.00008423	-0.084884	41.318	9.924E 02	2.282E 05	0.	11.2891
5	-0.00000082	-0.009121	-3.866	8.881E 01	1.828E 05	0.	-18.7397
6	0.00001897	-0.021602	13.857	1.038E 02	7.728E 05	0.	-2.8920
7	-0.00000312	0.005813	-8.048	9.002E 01	3.017E 06	0.	1.0814
8	-0.00000877	0.003502	-27.138	1.814E 02	8.090E 06	0.	38.9442
9	0.00000117	0.000552	7.328	1.809E 02	8.820E 06	0.	-1.8812
10	-0.00000043	-0.000075	-6.080	2.858E 02	1.510E 07	0.	0.8481
11	-0.00000180	0.001013	-16.787	1.155E 02	8.508E 06	0.	-4.8413
12	-0.00000118	-0.000117	-33.507	2.832E 02	2.732E 07	0.	-1.8780
13	-0.00000214	0.002078	-48.018	1.[illegible]E 02	2.187E 07	0.	-2.3108
14	-0.00000048	0.000285	-8.330	9.023E 01	1.041E 07	0.	0.5402
15	-0.00028771	0.045727	140.580	9.428E 02	0.	0.	57.8188
16	0.00004971	0.057732	21.748	7.885E 02	0.	0.	10.8874
17	0.00024817	0.114880	-88.853	5.105E 02	2.348E 04	0.	-57.2385
18	-0.00010000	0.005813	77.808	9.924E 02	2.282E 05	0.	38.0632
19	0.00008998	-0.020851	12.232	8.881E 01	1.828E 05	0.	-17.8492
20	-0.00003478	-0.022831	-23.891	1.038E 02	7.72[illegible]E 05	0.	11.1857
21	0.00001235	0.005231	24.338	9.002E 01	3.017E 06	0.	-2.8587
22	0.00000848	0.001184	44.783	1.814E 02	8.090E 06	0.	-17.8339
23	0.00000001	0.000457	-1.353	1.809E 02	8.820E 06	0.	-3.7181
24	0.00000078	0.001128	12.025	2.858E 02	1.510E 07	0.	0.3478
25	0.00000128	0.002185	10.088	1.155E 03	8.508E 06	0.	-2.8288
26	-0.00000098	0.000889	-28.017	2.832E 02	2.732E 07	0.	-1.2028
27	0.00000380	0.000587	78.144	1.825E 02	2.187E 07	0.	0.3479
28	0.00000070	0.000088	13.847	9.023E 01	1.041E 07	0.	1.3833
29	-0.00025888	-0.040773	21.585	8.482E 02	0.	0.	9.8218
30	0.00088148	0.002165	-15.320	2.048E 02	0.	0.	-28.9087
31	-0.00001111	-0.003848	-13.288	1.987E 02	1.812E 08	-2.836E 01	8.7088
32	0.00000448	-0.001834	21.446	1.889E 02	4.722E 08	-4.388E 01	0.4345
33	-0.00000203	-0.000888	-7.378	5.723E 01	3.722E 08	-2.848E 01	0.7321
34	0.00000068	-0.000248	18.128	3.184E 02	2.424E 07	-1.282E 02	-0.4828
35	-0.00000048	-0.000018	-43.418	7.143E 02	9.077E 07	-3.744E 02	-0.8834
36	-0.00000008	0.000201	-1.951	1.852E 02	2.205E 07	-8.837E 01	0.1804
37	-0.00000011	0.000123	-8.087	3.288E 02	7.138E 07	-2.241E 02	-0.3348
38	-0.00018888	0.025758	31.087	8.482E 02	0.	0.	14.1288
39	-0.00003811	-0.053700	10.518	2.048E 02	0.	0.	18.8484
40	-0.00001858	0.008780	-21.870	1.987E 02	1.812E 08	-2.836E 01	8.3837
41	-0.00000278	-0.003201	-11.278	1.889E 02	4.722E 08	-4.388E 01	3.8158
42	-0.00000145	0.000910	-6.231	8.723E 01	3.722E 08	-2.848E 01	0.9005
43	-0.00000022	-0.000261	-8.981	3.184E 02	2.424E 07	-1.282E 02	-0.7118
44	-0.00000027	0.000177	-23.387	7.143E 02	9.077E 07	-3.744E 02	0.4080
45	0.00000018	-0.000088	3.703	1.482E 02	2.205E 07	-8.837E 01	0.0834
46	0.00000003	0.000001	2.003	3.288E 02	7.138E 07	-2.241E 02	-0.0810
47	0.00184018	0.007488	-220.032	3.003E 03	0.	0.	-28.3148
48	0.00050448	0.007578	12.387	1.130E 03	0.	0.	-4.2247
49	-0.00017308	-0.071882	-21.378	8.889E 02	3.088E 05	4.472E 01	23.8847
50	0.00010842	-0.058883	52.733	4.110E 03	5.510E 05	6.343E 01	-30.8708
51	-0.00001238	0.003285	-38.758	8.511E 02	3.181E 08	1.788E 02	1.2784
52	0.00003848	-0.034884	252.071	1.387E 03	8.881E 08	3.244E 02	-0.2494
53	0.00002314	-0.014240	183.853	1.851E 03	8.714E 08	3.251E 02	-1.1103
54	0.00001848	-0.004088	43.174	2.882E 02	2.740E 08	9.211E 01	-2.2328
55	0.00001848	-0.014127	48.778	3.518E 02	4.811E 08	1.351E 02	0.8881
56	-0.00001853	0.011887	-87.018	2.772E 02	4.808E 08	1.238E 02	0.8810
57	0.00000881	-0.008284	37.880	1.820E 02	3.883E 08	8.132E 01	-0.2858
58	0.00000782	-0.007831	37.401	2.018E 02	4.807E 08	1.088E 02	0.3328
59	0.00000734	-0.005382	127.718	8.281E 02	1.810E 07	3.818E 02	-0.8810
60	-0.00000402	0.003320	-258.768	1.484E 03	8.048E 07	1.008E 03	-4.9812
61	-0.00000112	0.000877	-71.888	1.408E 03	8.213E 07	1.003E 03	-0.5177
62	-0.00000148	0.000715	-43.458	5.430E 02	2.881E 07	4.248E 02	-0.8308
63	-0.00000181	0.001021	-88.868	1.004E 03	8.233E 07	8.443E 02	-0.0821
64	-0.00000127	0.000815	-85.889	1.088E 03	7.888E 07	8.845E 02	0.0801
65	0.00000158	0.000437	27.748	1.818E 02	1.478E 07	1.788E 02	-1.8818
66	-0.00000083	-0.000185	-20.873	3.044E 02	2.804E 07	3.020E 02	0.7878
67	0.00000083	-0.000484	8.189	8.842E 01	8.851E 08	1.081E 02	0.2233

68	-0.00000014	0.000127	-5.864	3.483E 02	4.185E 07	4.083E 02	-0.0880
69	-0.00000001	0.000008	-3.416	2.381E 03	2.434E 08	3.073E 03	0.0008
70	0.00000334	-0.002181	234.808	4.481E 02	7.078E 07	6.048E 02	-0.1827
71	-0.00000187	0.001626	-208.728	7.817E 02	1.248E 08	1.045E 03	0.1843
72	-0.00000011	0.000027	-4.532	2.588E 02	4.318E 07	3.584E 02	-0.0270
73	-0.00000042	0.000258	-180.382	2.488E 03	4.388E 08	3.843E 03	0.0131
74	-0.00001382	-0.088800	287.841	3.003E 03	0.	0.	33.1417
75	-0.00012124	-0.038887	33.373	1.136E 03	0.	0.	8.3128
76	-0.00018322	0.058136	17.768	5.888E 02	3.068E 05	4.472E 01	42.1108
77	-0.00008810	-0.013021	-58.108	4.110E 02	8.810E 05	8.343E 01	-8.3012
78	0.00000988	0.008358	23.451	8.811E 02	3.181E 06	1.789E 02	-3.8888
79	-0.00005728	-0.012088	-283.881	1.387E 03	8.881E 08	3.244E 02	28.2234
80	-0.00002410	-0.007822	-200.014	1.081E 03	8.714E 06	2.281E 02	0.8384
81	-0.00001188	-0.008878	-31.848	2.882E 02	2.740E 06	9.211E 01	3.1878
82	-0.00002303	-0.001488	-100.874	3.818E 02	4.811E 08	1.381E 02	3.7379
83	0.00002048	0.002888	84.883	2.772E 02	4.808E 08	1.238E 02	-5.1088
84	-0.00001143	-0.001385	-43.791	1.320E 02	3.883E 08	9.132E 01	6.3883
85	-0.00001224	0.001031	-57.288	2.018E 02	4.867E 08	1.088E 02	2.7818
86	-0.00000863	-0.001888	-181.870	8.281E 02	1.810E 07	3.818E 01	3.1778
87	0.00000828	0.000888	310.088	1.484E 03	8.848E 07	1.009E 03	-2.1238
88	0.00000138	0.000208	87.888	1.409E 03	8.213E 07	1.003E 03	0.2872
89	0.00000182	0.000487	48.810	8.430E 02	2.881E 07	4.248E 02	-0.8282
90	0.00000187	0.000350	118.720	1.004E 03	8.233E 07	8.483E 02	-0.8808
91	0.00000183	0.000188	118.788	1.088E 03	7.888E 07	8.848E 02	-0.2118
92	-0.00000088	-0.001048	-13.891	1.818E 02	1.478E 07	1.788E 02	-1.1084
93	0.00000048	0.000884	13.018	3.044E 02	2.804E 07	3.020E 02	0.2288
94	-0.00000080	-0.000054	-7.713	8.842E 01	8.881E 08	1.081E 02	0.8077
95	0.00000020	-0.000004	8.188	3.483E 02	4.185E 07	4.083E 02	-0.0402
96	0.00000001	0.000003	4.035	2.381E 03	2.434E 08	3.073E 03	-0.9030
97	-0.00000388	-0.000870	-271.848	4.481E 02	7.078E 07	6.048E 02	1.1248
98	0.00000183	0.000430	230.388	7.817E 02	1.248E 08	1.045E 03	-0.8434
99	0.00000018	-0.000032	7.848	2.588E 02	4.318E 07	3.584E 02	-0.0803
100	0.00000048	0.000111	207.424	2.488E 03	4.388E 08	3.843E 03	-0.1811

TIME= 0.0225000 SECONDS

SPEED SEGMENT NUMBER= 1

ROTOR PROPERTIES FOR INDEPENDENT ROTOR (ROTOR 1)-

SPEED= 3311. RPM
ACCELERATION= 0. RPM/SEC
ANGULAR DISPLACEMENT= 1.24188812 REVOLUTIONS

ROTOR PROPERTIES FOR DEPENDENT ROTOR (ROTOR 2)-

SPEED= 13482. RPM
ACCELERATION= 0. RPM/SEC
ANGULAR DISPLACEMENT= 5.05822308 REVOLUTIONS

DISPLACEMENTS IN GIVEN DIRECTION

POINT NUMBER	X INCHES	Y INCHES	Z INCHES	THETA-X RADIANS	THETA-Y RADIANS	THETA-Z RADIANS
1	0.	0.00013420	0.00174034	0.	-0.00002740	0.00000488
2	0.	0.00008883	0.00144274	0.	-0.00002723	0.00000488
3	0.	0.00008848	0.00180100	0.	-0.00002880	0.00000488
4	0.	0.00003887	0.00088813	0.	-0.00002802	0.00000288
5	0.	-0.00005888	0.00018810	0.	-0.00001833	-0.00000137
6	0.	0.00017188	-0.00018087	0.	-0.00000811	-0.00001348
7	0.	0.00025484	-0.00018841	0.	-0.00000818	-0.00001350
8	0.	0.00018854	-0.00015388	0.	-0.00000580	-0.00001347
9	0.	0.00026188	-0.00018788	0.	-0.00000551	-0.00001348
10	0.	0.00037440	-0.00024327	0.	-0.00000538	-0.00001358
11	0.	-0.00007848	0.00094571	0.	-0.00001770	-0.00000011
12	0.	-0.00007785	0.00072838	0.	-0.00001762	-0.00000050
13	0.	-0.00008881	0.00058538	0.	-0.00001739	-0.00000138
14	0.	-0.00008217	0.00048148	0.	-0.00001732	-0.00000173
15	0.	-0.00005320	0.00037490	0.	-0.00001729	-0.00000184
16	0.	-0.00004002	0.00025321	0.	-0.00001728	-0.00000198
17	0.	-0.00003884	0.00018858	0.	-0.00001712	-0.00000258
18	0.	0.00000888	-0.00001427	0.	-0.00001887	-0.00000387
19	0.	0.00002488	-0.00008080	0.	-0.00001882	-0.00000371
20	0.	0.00005383	-0.00022270	0.	-0.00001882	-0.00000371
21	0.	0.00005911	0.00182211	0.	-0.00002247	0.00000043
22	0.	0.00004888	0.00137848	0.	-0.00002144	-0.00000018
23	0.	0.00005730	0.00073880	0.	-0.00002084	-0.00000088
24	0.	0.00008820	0.00058572	0.	-0.00001881	-0.00000131
25	0.	0.00008087	0.00044808	0.	-0.00001832	-0.00000174
26	0.	0.00008828	0.00038347	0.	-0.00001778	-0.00000243
27	0.	0.00010887	0.00023900	0.	-0.00001778	-0.00000243
28	0.	0.00011878	0.00018288	0.	-0.00001783	-0.00000288
29	0.	0.00018329	0.00001988	0.	-0.00001881	-0.00000324
30	0.	0.00018185	-0.00008817	0.	-0.00001837	-0.00000343
31	0.	0.00021388	-0.00017882	0.	-0.00001883	-0.00000381
32	0.	0.00025187	-0.00027783	0.	-0.00001497	-0.00000407
33	0.	0.00028811	-0.00038824	0.	-0.00001480	-0.00000418
34	0.	0.00007218	0.00184388	0.	-0.00002270	0.00000088
35	0.	0.00004806	0.00100208	0.	-0.00002388	0.00000128
36	0.	0.00004123	0.00088868	0.	-0.00002327	0.00000127
37	0.	0.00026435	-0.00022088	0.	-0.00001806	-0.00000426

VELOCITIES IN GIVEN DIRECTION

POINT	X	Y	Z	THETA-X	THETA-Y	THETA-Z

NUMBER	IN/SEC	IN/SEC	IN/SEC	RAD/SEC	RAD/SEC	RAD/SEC
1	0.	0.021600	0.128800	0.	-0.004810	-0.000580
2	0.	0.023161	0.078017	0.	-0.004555	-0.000522
3	0.	0.024425	0.108256	0.	-0.004565	-0.000577
4	0.	0.063208	0.035663	0.	-0.002307	-0.001786
5	0.	0.067701	-0.008837	0.	0.000072	0.001813
6	0.	-0.021070	0.008284	0.	0.000126	0.003110
7	0.	-0.040104	0.008747	0.	0.000164	0.003104
8	0.	-0.018481	0.011.87	0.	-0.000504	0.003035
9	0.	-0.042183	0.008747	0.	-0.000580	0.003084
10	0.	-0.055184	0.008548	0.	-0.000571	0.002182
11	0.	0.055250	-0.014722	0.	-0.000750	0.000880
12	0.	0.048888	-0.019740	0.	-0.000558	0.000807
13	0.	0.042733	-0.024883	0.	-0.000434	0.000780
14	0.	0.038555	-0.027073	0.	-0.000357	0.000762
15	0.	0.034807	-0.028728	0.	-0.000333	0.000733
16	0.	0.028821	-0.031018	0.	-0.000307	0.000773
17	0.	0.027500	-0.032483	0.	-0.000184	0.000888
18	0.	0.018261	-0.033173	0.	0.000062	0.001055
19	0.	0.010743	-0.032410	0.	0.000042	0.001127
20	0.	0.001832	-0.032028	0.	0.000041	0.001128
21	0.	0.082520	0.076222	0.	-0.001228	-0.000386
22	0.	0.084055	0.055808	0.	-0.001501	-0.000036
23	0.	0.084882	0.020851	0.	-0.001340	0.000108
24	0.	0.068827	0.007748	0.	-0.001074	0.000810
25	0.	0.053332	0.003823	0.	-0.000875	0.000704
26	0.	0.048521	-0.005857	0.	-0.000488	0.000882
27	0.	0.042141	-0.008884	0.	-0.000457	0.000870
28	0.	0.037234	-0.010810	0.	-0.000387	0.001048
29	0.	0.018814	-0.009057	0.	0.000161	0.001218
30	0.	0.0[illegible]134	-0.006811	0.	0.000360	0.001285
31	0.	-0.004137	0.002218	0.	0.000672	0.001353
32	0.	-0.018800	0.015181	0.	0.000882	0.001422
33	0.	-0.032536	0.028832	0.	0.001103	0.001424
34	0.	0.045555	0.051805	0.	-0.001887	-0.000536
35	0.	0.057108	0.038801	0.	-0.002278	-0.000588
36	0.	0.071088	0.025703	0.	-0.002280	-0.000619
37	0.	-0.031887	0.018363	0.	0.001210	0.001288

FORCES CONTRIBUTED BY THE SUBSYSTEM MODE SHAPES
(POINTS ON PYLON AND POINTS NOT ON MODAL SUBSYSTEMS EXCLUDED)

POINT NUMBER	X POUNDS	Y POUNDS	Z POUNDS	THETA-X IN-LB	THETA-Y IN-LB	THETA-Z IN-LB
1	0.	2.036	12.248	0.	233.286	-30.088
2	0.	0.000	-0.000	0.	0.000	-0.000
3	0.	-0.016	-0.150	0.	-0.050	0.000
4	0.	3.208	0.888	0.	8.728	58.814
5	0.	-1.387	1.327	0.	143.188	-128.830
6	0.	0.	0.	0.	0.	0.
7	0.	-0.025	0.030	0.	-0.080	0.000
8	0.	0.	0.	0.	0.	0.
9	0.	-7.563	-11.083	0.	325.878	-158.478
10	0.	0.000	0.000	0.	0.000	-0.000
11	0.	-0.008	0.085	0.	0.	0.
12	0.	-20.278	-3.788	0.	43.340	-189.777
13	0.	-18.270	-1.726	0.	84.268	-382.883
14	0.	-14.305	-1.105	0.	88.828	-448.807
15	0.	-8.384	2.308	0.	124.284	-455.278
16	0.	2.382	8.029	0.	128.343	-432.068
17	0.	8.223	5.310	0.	117.308	-408.383
18	0.	11.855	8.822	0.	81.307	-286.544
19	0.	3.740	2.018	0.	7.488	-10.427
20	0.	-0.008	0.022	0.	-0.000	0.000
21	0.	-1.172	1.808	0.	802.014	-382.141
22	0.	-0.325	7.570	0.	-10.038	-24.808
23	0.	37.785	81.778	0.	1850.710	-3 28.886
24	0.	39.802	86.480	0.	5779.884	-3485.223
25	0.	41.540	57.882	0.	5183.385	-3218.733
26	0.	0.288	0.201	0.	-1.123	1.380
27	0.	0.881	0.481	0.	-4.780	8.208
28	0.	0.158	0.508	0.	8.583	-8.530
29	0.	41.777	88.318	0.	2384.880	-1833.888
30	0.	38.728	88.824	0.	1810.871	-1732.887
31	0.	23.788	87.288	0.	1308.084	-882.882
32	0.	14.881	88.088	0.	588.483	-488.813
33	0.	1.880	83.280	0.	-183.787	-388.388
34	0.	0.	0.	0.	0.	0.
35	0.	0.	0.	0.	0.	0.
36	0.	0.000	0.000	0.	0.000	-0.000
37	0.	0.	0.	0.	0.	0.

THE FOLLOWING VALUES ARE FOR THE TYPE 3 PHYSICAL CONNECTING ELEMENTS.
FORCES ARE THOSE THAT THE ELEMENT EXERTS ON THE ROTOR OR CASE-

ELEMENT NUMBER	RELATIVE DISPLACEMENT INCHES	DEAD BAND INCHES	CLEARANCE INCH.	I-END POINT NUMBER	JEND POINT NUMBER	FORCE IN Y DIRECTION I END POUNDS	FORCE IN Y DIRECTION J END POUNDS	FORCE IN Z DIRECTION I END POUNDS	FORCE IN Z DIRECTION J END POUNDS	FORCE MAGNITUDE POUNDS
6	0.0001	0.2500	0.2499	1	21	0.	0.	0.	0.	0.

THE FORCES THAT THE TYPE 5 PHYSICAL CONNECTING ELEMENTS (UNCOUPLED POINT SPRING-DAMPER ELEMENTS) EXERT ON THE ENGINE COMPONENTS OR GROUND ARE-

FORCE IN GIVEN DIRECTION

ELEMENT NUMBER	END	POINT NUMBER	X POUNDS	Y POUNDS	Z POUNDS	THETA-Y IN-LB	THETA-Z IN-LB
1	I	3	0.	-88.842	-240.388	0.	0.
1	J	34	0.	88.842	240.388	0.	0.
2	I	4	0.	23.888	12.887	0.	0.
2	J	35	0.	-23.888	-12.887	0.	0.
3	I	11	0.	28.281	4.784	0.	0.
3	J	36	0.	-28.281	-4.784	0.	0.
4	I	20	0.	28.211	17.388	0.	0.
4	J	6	0.	-28.211	-17.388	0.	0.
5	I	7	0.	7.881	-31.888	0.	0.
5	J	37	0.	-7.881	31.868	0.	0.

THE GYROSCOPIC FORCES ACTING ON THE ROTOR(S) ARE-

POINT NUMBER	ROTOR NUMBER	POLAR MOMENT OF INERTIA LB-IN**2	Y-AXIS MOMENT IN-LB	Z-A[illegible]
1	1	381881.	188.028	-1810.[illegible]8
2	1	42588.	31.487	-178.328
3	1	2202.	1.140	-0.022
4	1	820.	0.884	-1.284
5	1	271.	-0.302	0.017
6	1	3450.	-12.457	0.801
7	1	512.	-1.428	0.075
8	1	27727.	-78.517	-14.788
9	1	82440.	-171.888	-32.478
10	1	45557.	-137.808	-28.378
11	2	278.	-0.880	-0.757
12	2	8281.	-17.438	-12.884

ORIGINAL PAGE IS OF POOR QUALITY

13	2	4482.	-12.768	-7.112
14	2	5858	-15.812	-7.788
15	2	8408.	-28.221	-11.488
16	2	5505.	-15.515	-7.745
17	2	4211.	-13.365	-2.883
18	2	20283	-60.484	0.170
19	2	18587.	-75.504	2.883
20	2	485.	-1.322	0.870

SUMMARY OF UNBALANCE FORCES-

[illegible]	POINT NUMBER	ROTOR NUMBER	MAGNITUDE GM-IN	PHASE ANGLE DEGREES	FORCE (LB.) Y-DIRECTION	FORCE (LB.) Z-DIRECTION
0.	1	1	560.	0.	17.882	342.528

GENERALIZED COORDINATE NUMBER	GENERALIZED FORCE DUE TO APPLIED FORCES ONLY
1	-306.876
2	34.165
3	23.337
4	27.764
5	-14.024
6	14.227
7	-5.676
8	-25.461
9	12.881
10	1.551
11	-5.286
12	5.882
13	11.281
14	5.222
15	-16.124
16	1.762
17	1.219
18	1.450
19	-0.733
20	0.743
21	-0.349
22	-1.535
23	0.573
24	0.057
25	-0.329
26	0.365
27	0.580
28	0.428
29	0.
30	0.
31	0.
32	0.
33	0.
34	0.
35	0.
36	0.
37	0.
38	0.
39	0.
40	0.
41	0.
42	0.
43	0.
44	0.
45	0.
46	0.
47	0.
48	0.
49	0.
50	0.
51	0.
52	0.
53	0.
54	0.
55	0.
56	0.
57	0.
58	0.
59	0.
60	0.
61	0.
62	0.
63	0.
64	0.
65	0.
66	0.
67	0.
68	0.
69	0.
70	0.
71	0.
72	0.
73	0.
74	0.
75	0.
76	0.
77	0.
78	0.
79	0.
80	0.
81	0.
82	0.
83	0.
84	0.
85	0.
86	0.
87	0.
88	0.
89	0.
90	0.
91	0.
92	0.
93	0.
94	0.
95	0.
96	0.
97	0.
98	0.
99	0.
100	0.

GENERALIZED COORDINATE NUMBER	GENERALIZED DISPLACEMENT	GENERALIZED VELOCITY	GENERALIZED FORCE	GENERALIZED WEIGHT POUNDS	GENERALIZED STIFFNESS LB/IN	GENERALIZED DAMPING VALUE (LB-SEC)/IN	GENERALIZED ACCELERATION

2	0.00002884	0.014828	-41.022	7.885E 02	0.	0.	-20.1020
3	0.00028871	0.070872	15.836	5.108E 02	2.344E 04	0.	5.5380
4	0.00003617	-0.024042	-33.584	9.824E 02	2.282E 05	0.	-18.3906
5	-0.00002845	0.004675	5.111	6.881E 01	1.625E 06	0.	51.3275
6	-0.00001381	-0.010884	-8.217	1.035E 02	7.728E 05	0.	5.7327
7	0.00000287	0.000382	5.567	9.002E 01	2.017E 05	0.	-0.8725
8	0.00000357	-0.000796	20.736	1.814E 02	6.000E 05	0.	-2.5681
9	-0.00000032	-0.001338	-3.405	1.509E 02	8.820E 05	0.	-2.0787
10	0.00000100	-0.000386	15.137	2.858E 02	1.810E 07	0.	-0.0022
11	0.00000170	-0.001788	14.727	1.186E 02	6.806E 06	0.	1.0214
12	0.00000122	-0.000035	31.306	2.832E 02	2.732E 07	0.	-2.8876
13	0.00000201	0.000814	44.651	1.828E 02	2.187E 07	0.	-0.0785
14	0.00000048	0.000212	9.381	9.023E 01	1.841E 07	0.	0.6823
15	-0.00008848	-0.034881	82.460	8.428E 02	0.	0.	25.5886
16	0.00027818	-0.034029	-5.810	7.885E 02	0.	0.	-2.7483
17	0.00022883	-0.053181	-50.325	5.108E 02	2.344E 04	0.	-48.8885
18	0.00004581	-0.008308	76.181	9.824E 02	2.282E 05	0.	26.5631
19	0.00001286	0.033384	4.948	6.881E 01	1.625E 06	0.	12.7278
20	-0.00002410	-0.004584	-18.908	1.035E 02	7.728E 05	0.	27.7740
21	0.00000278	0.001228	5.278	9.002E 01	2.017E 06	0.	-5.8745
22	0.00000082	0.004812	7.476	1.814E 02	6.000E 06	0.	6.2857
23	-0.00000288	-0.000885	-24.883	1.509E 02	8.820E 06	0.	1.1279
24	0.00000004	-0.000311	0.733	2.858E 02	1.810E 07	0.	0.2881
25	-0.00000078	-0.000872	-5.551	1.186E 02	6.806E 06	0.	0.3136
26	0.00000072	-0.000358	19.860	2.832E 02	2.732E 07	0.	0.2289
27	0.00000081	-0.000551	17.131	1.828E 02	2.187E 07	0.	-1.5892
28	0.00000087	-0.000018	12.837	9.023E 01	1.841E 07	0.	-0.1318
29	-0.00017125	0.038480	-17.535	8.432E 02	0.	0.	-5.1567
30	0.00078858	-0.001281	1.801	2.048E 02	0.	0.	3.8872
31	0.00060711	0.005478	10.088	1.887E 02	1.512E 06	-2.838E 01	-1.0087
32	-0.00000117	-0.000308	-6.027	1.888E 02	4.722E 06	-4.368E 01	-1.1338
33	0.00000108	0.001831	4.683	8.723E 01	3.722E 06	-2.648E 01	0.4858
34	-0.00000030	0.000088	-8.073	3.164E 02	2.424E 07	-1.282E 02	-1.0888
35	0.00000037	0.000172	28.537	7.143E 02	9.077E 07	-3.744E 02	-2.4573
36	-0.00000001	-0.000044	-0.102	1.482E 02	2.305E 07	-8.537E 01	0.2322
37	0.00000007	-0.000077	5.551	3.258E 02	7.130E 07	-2.241E 02	0.2767
38	0.00001859	-0.027843	-43.843	8.482E 02	0.	0.	-18.8588
39	-0.00010472	0.045332	11.271	2.048E 02	0.	0.	21.2860
40	0.00002752	-0.003158	41.857	1.887E 02	1.512E 06	-2.838E 01	-0.0548
41	-0.00000158	-0.002081	-5.387	1.888E 02	4.722E 06	-4.368E 01	2.5288
42	0.00000488	0.000804	18.503	8.723E 01	3.722E 06	-2.648E 01	-0.0104
43	0.00000073	-0.000087	17.815	3.164E 02	2.424E 07	-1.282E 02	-0.2248
44	0.00000023	-0.000102	21.119	7.143E 02	9.077E 07	-3.744E 02	0.2815
45	-0.00000033	-0.000008	-7.805	1.482E 02	2.305E 07	-8.537E 01	-0.2855
46	-0.00000027	-0.000107	-19.493	3.258E 02	7.130E 07	-2.241E 02	-0.2586
47	0.00182865	0.068470	187.985	3.003E 03	0.	0.	25.4783
48	0.00058828	0.008120	4.827	1.130E 03	0.	0.	1.8804
49	0.00023888	0.083278	20.289	5.888E 02	3.058E 05	4.472E 01	-37.9382
50	-0.00000804	-0.045587	-47.481	4.110E 02	6.510E 05	8.343E 01	-38.4868
51	0.00001821	-0.004752	38.081	8.511E 02	3.161E 06	1.765E 02	-8.3013
52	-0.00003182	-0.010134	-220.894	1.367E 03	6.881E 06	3.244E 02	-1.8130
53	-0.00001895	-0.005550	-155.128	1.081E 03	8.714E 06	3.281E 02	0.3338
54	-0.00001718	0.002385	-45.013	2.892E 02	2.740E 06	8.211E 01	2.5847
55	-0.00001480	-0.007022	-59.868	3.519E 02	4.811E 06	1.361E 02	-1.5587
56	0.00001868	0.003804	75.944	2.772E 02	4.808E 06	1.238E 02	0.2637
57	-0.00000528	-0.000152	-36.831	1.820E 02	3.983E 06	5.132E 01	0.8406
58	-0.00000889	-0.002883	-32.404	2.015E 02	4.807E 06	1.068E 02	0.0140
59	-0.00000856	-0.000847	-118.183	8.281E 02	1.810E 07	3.818E 02	0.5808
60	0.00000388	0.001884	225.080	1.484E 03	6.048E 07	1.009E 03	0.5328
61	0.00000102	0.000363	61.788	1.408E 03	5.213E 07	1.003E 03	-0.5308
62	0.00000139	0.000083	40.715	5.430E 02	2.881E 07	4.248E 02	0.3303
63	0.00000144	0.000278	80.073	1.004E 03	6.233E 07	8.483E 02	0.0891
64	0.00000111	0.000277	84.763	1.085E 03	7.855E 07	8.845E 02	-0.0127
65	-0.00000175	0.000203	-25.487	1.818E 02	1.475E 07	1.765E 02	0.5812
66	0.00000080	-0.000183	23.179	3.044E 02	2.804E 07	3.020E 02	-0.1616
67	-0.00000065	-0.000128	-5.380	8.842E 01	9.851E 06	1.081E 02	0.0443
68	0.00000011	0.000054	4.635	3.463E 02	4.185E 07	4.083E 02	0.0325
69	0.00000001	0.000002	3.082	2.391E 03	3.424E 08	3.073E 03	-0.0003
70	-0.00000289	-0.000722	-205.082	4.491E 02	7.075E 07	8.045E 02	-0.0832
71	0.00000144	0.000388	180.134	7.817E 02	1.245E 08	1.045E 03	0.0308
72	0.00000007	0.000072	2.807	2.888E 02	4.318E 07	3.884E 02	0.0448
73	0.00000036	0.000080	157.524	2.488E 03	4.388E 08	3.543E 03	0.0088
74	0.00008817	0.084781	43.876	3.003E 03	0.	0.	5.6482
75	-0.00028852	-0.005148	30.237	1.130E 03	0.	0.	5.8185
76	0.00023374	-0.085275	8.383	5.888E 02	3.058E 05	4.472E 01	-41.2850
77	-0.00001311	-0.010008	-12.777	4.110E 02	8.510E 05	8.343E 01	-0.8233
78	-0.00000087	-0.008052	-5.511	8.511E 02	3.181E 06	1.765E 02	-0.7820
79	-0.00001859	0.011885	-78.883	1.367E 03	6.881E 06	3.244E 02	5.8325
80	-0.00001128	0.007383	-65.471	1.081E 03	8.714E 06	3.281E 02	3.5873
81	0.00000038	0.005027	0.843	2.892E 02	2.740E 06	8.211E 01	-1.0800
82	-0.00001147	0.004738	-49.840	3.519E 02	4.811E 06	1.361E 02	1.5248
83	0.00000550	-0.005155	30.044	2.772E 02	4.808E 06	1.238E 02	-1.4308
84	-0.00000021	0.003458	-0.472	1.820E 02	3.983E 06	5.132E 01	0.1228
85	-0.00000188	0.002931	-8.423	2.015E 02	4.807E 06	1.068E 02	0.5839
86	-0.00000162	0.002308	-28.378	8.281E 02	1.810E 07	3.818E 02	1.2438
87	0.00000187	-0.001885	52.892	1.484E 03	6.048E 07	1.009E 03	-1.8085
88	0.00000084	-0.000877	33.101	1.408E 03	5.213E 07	1.003E 03	0.0888
89	0.00000019	-0.000840	8.030	5.430E 02	2.881E 07	4.248E 02	0.0148
90	0.00000026	-0.000862	18.497	1.004E 03	6.233E 07	8.483E 02	0.2532
91	0.00000023	-0.000410	17.175	1.085E 03	7.855E 07	8.845E 02	0.1489
92	0.00000038	0.000847	8.412	1.818E 02	1.475E 07	1.765E 02	-0.0188
93	-0.00000014	-0.000338	-3.587	3.044E 02	2.604E 07	3.020E 02	0.0783
94	-0.00000013	0.000280	-1.230	8.842E 01	9.851E 06	1.081E 02	-0.0824
95	0.00000007	-0.000043	2.888	3.463E 02	4.185E 07	4.083E 02	0.0018
96	0.00000000	-0.000003	1.175	2.391E 03	3.434E 08	3.073E 03	0.0009
97	-0.00000117	0.001026	-82.153	8.491E 02	7.075E 07	8.045E 02	-0.1416
98	0.00000080	-0.000508	73.988	7.817E 02	1.245E 08	1.045E 03	0.0543
99	0.00000008	-0.000021	3.183	2.888E 02	4.318E 07	3.884E 02	-0.0103
100	0.00000015	-0.000128	64.513	2.488E 03	4.388E 08	3.543E 03	0.0104

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