PB97-123624

Civil Engineering Study Structural Series 96-3

INRESB-3D-SUPII

User's Manual

GENERAL PURPOSE PROGRAM FOR INELASTIC ANALYSIS OF RC AND STEEL BUILDING SYSTEMS FOR 3D STATIC AND DYNAMIC LOADS AND SEISMIC EXCITATIONS (BASED ON SUPERCOMPUTER AND PC)

by

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Report Series Prepared for the National Science Foundation under Grants No. NSF BCS 9001494 and NSF MSS 9214664

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ABSTRACT

This report was prepared as a user's guide to the computer program INRESB-3D-SUPII for analyzing elastic and inelastic building systems subject to static loading, multi-component earthquake motion, and pseudo-static cyclic loading. Additionally, the program is capable of calculating inelastic post-buckling behavior of steel members and systems, natural frequency, and response spectrum. A joint-based system is used to define the geometry of a structure. Structural members may be elastic 3D prismatic beams, nonlinear reinforced concrete shear walls, nonlinear springs, inelastic 3D-beam-column elements, finite-segment elements, and nonlinear bracing elements.

System formulation has the following attributes: 1) joint-based degrees of freedom, 2) rigid body and planar constraints, 3) incremental nonlinear static solution, 4) unbalanced load correction for overshooting, 5) incremental nonlinear dynamic solution, 6) mass and stiffness proportional damping, 7) condensation to reduce the size of a dynamic problem, 8) energy balance, 9) damage index, and 10) ductility and excursion ratio for various definitions of displacement, constant strain energy, and variable strain energy. This program has been developed for achieving efficiency in both computation and data preparation. Output solutions include static results of member forces and joint displacements as well as dynamic results of member forces, joint displacements, ductility factors, excursion ratios, damage indices, seismic input energies, and dissipated energies.

Major features of the report include a description of the program, instructions for data preparation, and a guide to modify the program's dynamic storage.

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ACKNOWLEDGMENTS

This is the second of two final reports on a research project sponsored by the National Science Foundation under grant numbers NSF BCS 9001494 and NSF MSS 9214664. This support is gratefully acknowledged. The authors gratefully acknowledge excellent service at University of Missouri Rolla computer center and the Cornell National Supercomputer Facility. The authors also gratefully acknowledge the advice and encouragement from Dr. S. C. Liu and Dr. K. P. Chong.

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I. INTRODUCTION

INRESB-3D-SUPII is a general purpose computer program for elastic / inelastic analysis of reinforced concrete and steel structural systems under the action of static and dynamic loads. Such systems can be frame, truss, shear-wall or a combination of these. Material can be reinforced concrete, steel or both. The program has five main functions. They are

- 1. SOL01, elastic static analysis with multiple load cases.
- 2. SOL02, elastic or inelastic analysis of a structure subjected to multiple ground accelerations. The acting ground loading can be 3D ground motion.
- 3. SOL03, calculation of either natural frequencies and mode shape or buckling load and mode shape of an elastic structure.
- 4. SOL04, calculation of nonlinear static cyclic response for a given loading pattern that consists of joint loads, imposed displacements or element loads.
- 5. SOL05, calculation of maximum response of an elastic structure subject to pseudodynamic force obtained from the response spectrum.

Finite-segment element, provided by INRESB-3D-SUPII, uses either bilinear or Ramberg-Osgood stress-strain relationship. This element is applied only to steel material.

Calculation is not required for buckling loads and mode shapes of reinforced concrete structures, especially those with shear-walls. However, the program is capable of calculating these factors.

In this program, stress-strain relationships are obtained from experiments and research on steel or reinforced concrete. Nonlinear analysis is such applied only to these materials.

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Floor-slab is rigid in its plane but flexible out of it's plane. Shear panels are available for elastic analysis only.

INRESB-3D-SUPII pertains to analysis of building systems above ground level supported by fix, hinge, or spring. The unit system can be international or English. Units for output are corresponding to those for input. If units of input loads and structural dimensions are kip and inch, the units of output forces, stresses and displacements are likewise kip, kip/in² and inch. The problem solving capacity of the program is restricted by computer memory. The program automatically checks the memory requirement of a problem, and gives the relevant information (refer section D of Chapter III).

This publication serves as the user's manual for computer program INRESB-3D-SUPII (INelastic Analysis of <u>RE</u>inforced Concrete and <u>Steel Building</u> Systems for <u>3-D</u>imensional Ground Motions). Chapter II describes numerical procedures for the program. Chapter III discusses subroutines, program capacity, and the addition of materials, elements and solutions. Chapter IV contains detailed input instructions. Chapter V covers instructions for running the program under these environments: (1) CMS for IBM 4381 computer, (2) AIX/370 for IBM 3090S supercomputer, and (3) PC. Chapter VI uses four examples to illustrate the preparation of input data and the output of solutions for supercomputer. Chapter VII illustrate ten examples for PC applications. Ductility and excursion ratios are derived in Appendix A. An explanation of the damage index is given in Appendix B. The source codes of this program are in the report of UMR's Civil Engineering Study Series 96-32 on "INRESB-3D-SUPII — Program Listing".

II. DESCRIPTION OF INRESB-3D-SUPII COMPUTER PROGRAM

INRESB-3D-SUPII is capable of analyzing elastic and nonlinear 3D structures subject to static and seismic loadings. It is a modular computer program consisting of six primary blocks. STRUCT, the first block, defines the structural model. SOL01, SOL02, SOL03, SOL04 and SOL05, the remaining blocks, are independent solutions for static loading, seismic loading, natural frequency or buckling load, static cyclic loading, and response spectrum analysis, respectively. Numerical procedures for each program block are presented in this chapter.

A. STRUCT - DEFINITION OF STRUCTURAL MODEL

A structural model consists of an assemblage of elements. The point where two or more elements connect is called a joint. To model a structure, the location and orientation of each joint are first defined. Materials that describe the behavior of elements, elements that connect the joints, and orientation of element are then defined. For dynamic analysis, the lumped mass at each joint is also defined. All these definitions are in the program block STRUCT. Figure 1 shows the flow chart for STRUCT.

Step 1. <u>Define Joints and Determine DOF's</u> Coordinates of the joints and their orientation are determined by the user. Coordinates are defined in the global coordinate system (GCS). The orientation of each joint gives its joint coordinate system (JCS). Each joint initially has six degrees of freedom (DOF) in the JCS. The user also determines for each joint the DOFs that are restrained, constrained and condensed out. The program generates the structural degrees of freedom (21).

Step 2. <u>Define Material Properties</u> Material properties are input and initialized. Twelve different materials constitute the materials library and are discussed below.



Figure 1. Bolck STRUCT - Definition of Structural Model

Step 3. <u>Define Elements</u> Element data is input. Transformation matrices, initial element structural stiffness and initial element geometric stiffness are calculated. Seven different elements constitute the elements library and are discussed later.

Step 4. <u>Initialize Storage for Stiffness</u> Storage for the structural stiffness and geometric matrices is initialized.

Step 5. <u>Input and Store Mass</u> The lumped mass at each joint is input, and the structures mass matrix is stored.

1. Materials Library

The library consists of twelve models as follows.

a. <u>Elastic 3D Prismatic Beam</u> Elastic section properties of a 3D prismatic beam, A_x , J, I_y , I_z , and the material's modula E and G.

b. <u>R/C Axial Hysteresis Model</u> An axial hysteresis model developed for the reinforced concrete boundary columns of a shear wall (20). This hysteresis model is sketched in Figures 2 and 3 and discussed in Reference 21.

c. <u>Cheng-Mertz B1 Bending Hysteresis Model</u> A bending hysteresis model developed for bending deformations in low-rise reinforced concrete shear walls (21). The hysteresis model is sketched in Figure 4 and uses the multiple segment backbone curve shown in Figure 5.

d. <u>Cheng-Mertz S1 Shear Hysteresis Model</u> A shear hysteresis model developed for the shear deformations in low-rise reinforced concrete shear walls (21). This hysteresis model is sketched in Figure 6. and uses the multiple segment backbone curve shown in Figure 5.

e. <u>Takeda Hysteresis Model</u> A bending hysteresis model developed for the bending



Figure 2. Axial Hysteresis Model Before Tensile Yield







Figure 4. Low-Rise Shear Wall Cheng-Mertz Bending Hysteresis Model





Figure 5. Multiple Segment Backbone Curve



Figure 6. Low-Rise Shear Wall Cheng-Mertz Shear Hysteresis Model

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deformations of reinforced concrete members (25). This hysteresis model is sketched in Figure 7.

f. <u>Bilinear Hysteresis Model (BILINEAR)</u> A hysteresis model with a bilinear backbone curve and an elastic unloading and reloading curve. The model may also represent the elasto-plastic model by setting the post-yielding stiffness to zero. This hysteresis model is sketched in Figure 8.

g. <u>Bracing Member Hysteresis Model (BRACE)</u> A hysteresis model developed for the strut hysteretic behavior. This model is based on the original Jain-Goel-Hanson's hysteresis model (19) and can be applied to the box, angle, and wide flange members. This hysteresis model is sketched in Figure 9.

h. <u>Long-Direction Open-Web Joist Hysteresis Model (LONG-OWJG)</u> A hysteresis model developed for the bending deformations in the long-direction open-web joist girder in a 22-story steel building called Pino Suarez Tower which collapsed in the 1985 Mexico earthquake. This hysteresis model (17, 16) is sketched in Figure 10.

i. <u>Short-Direction Open-Web Joist Hysteresis Model (SHORT-OWJG)</u> A hysteresis model developed to model the bending deformations in the short-direction open-web joist girder in the Pino Suarez Tower. This hysteresis model (17) is sketched in Figure 11.

j. <u>Bilinear Hysteresis Model (IA-BILN)</u> Used only for inelastic 3D-beam-column element described later in the elements library. This model has a bilinear backbone curve and an elastic unloading and reloading curve. It may also represent the elasto-plastic model by setting the post-yielding stiffness to zero.

k. <u>Finite-Segment Stress-Strain Hysteresis Model (STABILITY)</u> Can be either bilinear stress-strain relationship or Ramberg-Osgood stress-strain relationship. This model is used only for the finite-segment element described later in the elements library. The Ramberg-Osgood



Figure 7. Takeda Hysteresis Model



Figure 8. Bilinear Hysteresis Model



Figure 9. Bracing Member Hysteresis Model



Figure 10. Long-Direction Open-Web Joist Hysteresis Model



Figure 11. Short-Direction Open-Web Joist Hysteresis Model

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stress-strain relationship is sketched in Figure 12. In the figure, parameter R controls the slope of stress-strain curves. If R approaches infinity, the stress-strain curve converges to the elasto-plastic stress-strain relationship.

L. <u>Perforated Shear Wall Hysteresis Model</u> A combined bending and shear hysteresis model developed for the hysteresis behavior of perforated shear walls. This model is sketched in Figure 13, and uses the multiple segment backbone curve shown in Figure 14.

2. Elements Library

This library consists of seven elements as follows.

a. <u>Elastic 3D Prismatic Beam Element</u> Figure 15 shows the elastic 3D prismatic beam element. This element connects the start and end joints. At the start end of the element, a rigid body of length XS is used to model the structural joint. A similar rigid body of length XE is used at the end joint. The beam's element coordinate system (ECS) X_e axis goes from end A toward end B. Orientation of the ECS Y_e axis is defined by a vector, \vec{V} , which lies on the ECS XY-plane. The ECS Z_e axis is perpendicular to the X_e and Y_e axes, right-hand rule. There are six internal forces F_X, F_Y, F_Z, M_X, M_Y and F_Z at end A in the ECS, and six at end B. All the internal forces are positive in the ECS direction.

The beam element considers axial, torsional, and bending deformations about the Y_e and Z_e axes. Warping torsion and shear deformation are not considered. Two formulations of geometric stiffness are also available. The 'lumped parameter' formulation only considers second order shears at the end of the beam while the 'consistent parameter' formulation considers second order moments and shears at the end of the beam. The 3D-beam material is used with the beam element.

b. <u>Spring Element</u> This element consist of an isolated spring that connects the start and end joints. At the start end of the spring, a rigid body of length XS is used to model the joint depth. A similar rigid body of length XE is used at the end joint. The spring element coordinate system (ECS) X_e axis goes from end A toward end B. Orientation of the ECS Y_e axis is defined by the

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Figure 12. Ramberg-Osgood Stress-Strain Relationship




Figure 14. Backbone Curve of Perforated Shear Wall



Figure 15. 3D Prismatic Beam Element



Figure 16. Spring Element: (a) Axial Spring and ECS, (b) Y-axis Shear Spring, (c) Z-axis Shear Spring, (d) Torsional Spring, (e) Y-axis Rotational Spring, (f) Z-axis Rotational Spring



Figure 17. Diagonal Bracing Member Modeled with an Axial Spring

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user. The ECS Z_e axis is perpendicular to the X_e and Y_e axes, right-hand rule. When the distance between the start and end joints is zero, orientation of the ECS is identical to the start joint's JCS. The distance between the start and end joints, less the length of the rigid bodies, is the length of the spring element. Optionally, the user may define the length of the spring element. Behavior of the spring element can be elastica or nonlinear, depending on the material properties used and the magnitude of forces acting on the spring. Second order P- Δ forces are not calculated for the spring element.

As shown in Figure 16, the spring may be orientated in one of six positions. Examples of axial, shear and rotational spring applications are shown in Figures 17, 18, and 19, respectively. The axial spring is parallel to the element's X_e axis. Rigid bodies at the ends of the spring reduce its length. The spring's axial force, F_x , at end A is positive in the X_e direction.

The Y-axis shear spring and Z-axis shear spring are oriented parallel to the axes of elements Y_e and Z_e , respectively. Rigid bodies at the ends of the spring reduce its length and induce moments at the joints. The spring's internal shears, F_Y and F_Z , at end A are positive in the Y_e and Z_e directions.

The torsional spring is parallel to the element's X_e axis. Rigid bodies at the end of the spring reduce its length. The spring's internal torsion, M_x , at end A is positive in the X_e direction.

The Y-axis and Z-axis rotational springs are about the Y_e and Z_e axes, respectively. Rigid bodies at the ends of the spring reduce its length. The spring's internal moments, M_Y and M_{Z_e} at end A, are positive in the Y_e and Z_e directions.

c. <u>Reinforced Concrete Shear Wall Element</u> As shown in Figure 20, this element consists of a panel linking four joints. Bending and shear deformations in the plane of the wall are



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Figure 18. Two-DOF Model With Shear Springs



Figure 19. Member End Rotation of an Elastic 3D Prismatic Beam Modeled with Rotational Spring

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Figure 20. Shear Wall Element



Figure 21. Inelastic 3D Beam-Column Element



Figure 22. Bracing Element

considered, along with axial deformation. Bending, shear and axial deformations are lumped into three springs. A rigid body, of length α , connects the joints at the top of the wall with the springs while a second rigid body, of length β , connects the joints at the bottom of the wall with the springs. Bending and shear stiffness perpendicular to the plane of the wall are neglected. A 'lumped parameter' formulation of geometric stiffness considers both in-plane and out-of-plane P- Δ effects.

As shown in Figure 20, the wall has 10 dof at the corner joints. Fixing the bottom of the shear wall and applying a positive load to degree of freedom 1 yields a positive moment and shear at end A of the springs. Fixing the bottom of the shear wall and applying a positive load to degrees of freedom 2 and 4 yields a positive axial load at end A of the spring.

Different materials are used to describe the stiffness of the bending, shear and axial springs. Typically the bending stiffness is defined by the B1 bending hysteresis model, the shear stiffness by the S1 shear hysteresis model, and the axial stiffness by the axial hysteresis model.

d. <u>Inelastic 3D Beam-Column Element</u> This element (IE3DBC), which connects a start and end joint, is shown in Figure 21. At the start end of the element, a rigid body of length XS is used to model the structural joint. A similar rigid body of length XE is used at the end joint. The beam's element coordinate system (ECS) X_e axis goes from end A toward end B. Orientation of the ECS Y_e axis is defined by a vector, \vec{V} , which lies on the ECS XY-plane. The ECS Z_e axis is perpendicular to the X_e and Y_e axes, right-hand rule. There are six internal forces F_X , F_Y , F_Z , M_X , M_Y and M_Z at end A in the ECS. Similarly, six at end B. All the internal forces are positive in the direction of the ECS.

The beam element considers axial deformation, torsional deformation, and bending deformations about the Y_e and Z_e axes. Warping torsion and shear deformation are not considered. Two formulations of geometric stiffness are also available. The 'lumped parameter' formulation only considers the second order shears at the end of the beam, while the 'consistent parameter' formulation considers the second order moments and shears at the end of the beam.



Figure 23. Finite-Segment Element

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Figure 24. Sectional Reference Coordinates (U, V, W)



(a) Perforated Shear Wall



(b) Modeling of Perforated Shear Wall

Figure 25. Perorated Shear Wall Element

LONG-OWJG, SHORT-OWJG, IA-BILN, and TAKEDA material can be used for bending deformations. IA-BILN material is also used for torsion and axial deformations.

e. <u>Bracing Element</u> This element, which connects a start and end joint, is shown in Figure 22. At the start end of the element, a rigid body of length XS is used to model the structural joint. A similar rigid body of length XE is used at the end joint. There is only one internal force F_x , at end A in the ECS, and only one at end B. All the internal forces are positive in the direction of the ECS.

The bracing element considers axial deformation about the X_e axis. Bending, warping torsion and shear deformation are not considered. Behavior of the bracing element may be elastica or nonlinear, depending on the magnitude of axial deformation of the member. A hysteresis model of the bracing member is used to represent the hysteresis behavior of axially loaded box, angle, and wide flange members. Further investigation is needed for bracing members with different cross sections in order to check the applicability of this element. Since second order P- Δ forces are considered in the hysteresis model, formulation of geometric stiffness is not.

f. <u>Finite-Segment Element</u> This element (18), which connects a start and end joint, is shown in Figure 23. At the start end of the element, a rigid body of length XS is used to model the structural joint. A similar rigid body of length XE is used at the end joint. The element coordinate system (ECS) X_e axis goes from end A toward end B. Orientation of the ECS Y_e axis is defined by a vector, \overline{V} , which lies on the ECS XY-plane. The ECS Z_e axis is perpendicular to the X_e and Y_e axes, right-hand rule. There are six internal forces F_X , F_Y , F_Z , M_X , M_Y and M_Z at end A in the ECS, and six at end B. All the internal forces are positive in the direction of the ECS.

The element considers axial, torsional, and bending deformations about the Y_e and Z_e axes. Warping torsion and shear deformation are not considered. The member is divided into several segments; the cross section of each segment is further divided into many small elements, and U, V, and W represent the segment's sectional reference coordinates as shown in Figure 24. In the analysis of a structural system, the degrees of freedom of an individual member should be reduced so that computational efficiency can be achieved. A substructural technique is applied to the finite segment element for which the internal degrees of freedom are condensed out by Gauss elimination. Only the degrees of freedom at both ends of the member are maintained. The STABILITY hysteresis material model is used for the finite segment element. Since second order P- Δ forces are considered in the hysteresis model, formulation of geometric stiffness is not considered.

g. <u>Perforated Shear Wall Element</u> This element consists of a panel linking four joints as shown in Figure 25(b). Bending and shear deformations in the plane of the wall are considered, along with axial deformation. Combined bending and shear deformations are lumped into one spring with stiffness K_s^* . Axial deformations are lumped into two springs at both sides of the wall. Bending and shear stiffness perpendicular to the plane of the wall are neglected. A 'lumped parameter' formulation of geometric stiffness considers both in-plane and out-of-plane P- Δ effects.

As shown in Figure 25(b), the wall has 10 dof at the corner joints. Combined bending and shear stiffness is defined by the perforated shear wall hysteresis model and axial stiffness is defined by the R/C axial hysteresis model.

B. SOL01 - ELASTIC STATIC ANALYSIS WITH MULTIPLE LOAD CASES

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This block performs the elastic static analysis with multiple load cases. The flow chart for SOL01 is shown in Figure 26.

Step 1. <u>Input Joint and Element Loadings</u> Joint loads and imposed displacements are input for each load case. Uniform and concentrated element loadings are input for each load case on the 3D-beam element.

Step 2. Form Structural Stiffness and Load Matrices The structural stiffness matrix is formed. Optionally, the geometric stiffness matrix, based on the user's input axial loads, is

subtracted from the structural stiffness matrix. Joint loadings are determined for the imposed displacements (support settlements) and combined with the input joint loadings and element loadings for each load case.

Step 3. <u>Calculate Displacements</u> Displacements for each load case are calculated by Gauss elimination.

Step 4. <u>Calculate Reactions</u> Reactions at restrained degrees of freedom and the summation of reactions are calculated for each load case.

Step 5. Calculate Element Forces Element forces are calculated for each load case.

C. <u>SOL02 - ELASTIC / NONLINEAR SEISMIC TIME HISTORY RESPONSE</u>

This block performs the elastic or nonlinear analysis of a structure subject to multiple ground accelerations. The flow chart for SOL02 is shown in Figure 27.

Step 1. <u>Input Ground Motions</u> Ground motions are input and stored. Transformation matrices to rotate the ground accelerations from the input coordinate system to the individual JCS are formed. The equation of motion for a dynamic loading is

$$\mathbf{M}\ddot{\mathbf{x}} + \mathbf{C}\dot{\mathbf{x}} + \mathbf{K}\mathbf{x} = \mathbf{F}(\mathbf{t}) = -\mathbf{M}^{T} \ddot{\mathbf{x}}_{\mathbf{q}}$$
(1)

For seismic analyses, M=M'. For nonseismic analyses the special mass matrix, M' and a pseudo-ground acceleration are input and stored. Thus the nonseismic forcing function is equal to

$$\mathbf{F}(\mathbf{t}) = -\mathbf{M}' \ddot{\mathbf{X}}_{\alpha} \tag{2}$$

Step 2. Form Dynamic Loading The dynamic loading matrix is formed and added to the unbalanced force matrix.

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Figure 26. Block SOL01 - Static Analysis



Figure 27. Block SOL02 - Elastic / Nonlinear Dynamic Analysis

Step 3. Form Structural Stiffness Structural stiffness is formed 1) for the first time step, 2) for every time step that an element's stiffness is modified, and 3) for every time step that the geometric stiffness is modified. The element's stiffness is only modified during nonlinear analysis.

Step 4. Form the Geometric Stiffness Geometric stiffness is formed 1) for the first time step, and 2) for every time step if the actual element axial loads are used to calculate the geometric stiffness.

Step 5. <u>Condensation</u> If condensed degrees of freedom exist, 1) the structural stiffness is condensed at each time step that is formed, 2) the geometric stiffness is condensed each time step that is formed, if condensation of the geometric stiffness is desired, 3) the mass matrix is condensed at the first time step, if needed, and 4) the dynamic loading matrix is condensed at each time step.

Step 6. <u>Numerical Integration</u> Incremental displacements, velocities and accelerations of free dof are calculated by either the linear or the average acceleration method.

Step 7. <u>Calculate Motion of Condensed DOF</u> Incremental displacements, velocities and accelerations of condensed dof are calculated.

Step 8. Incremental Reactions Incremental reactions are calculated.

Step 9. Incremental Element Forces Hysteresis models in the materials library are used to calculate the incremental element forces, given incremental displacements and previous loading history. For nonlinear analysis, if the element stiffness changes during incremental displacement, 1) the element's unbalanced forces are calculated, and 2) a flag to reform the structural stiffness in step 3 is put at the next time step. Elastic and plastic strain energies for each element are also calculated.

Step 10. <u>Energy Balance</u> Total input energy, kinetic energy, elastic strain energy, plastic strain energy and energy dissipated due to damping are calculated.

Step 11. <u>Total Response</u> Total displacements, velocities, accelerations, reactions, and element forces are calculated. The unbalanced force vector for nonlinear analysis is assembled from the element's unbalanced forces. If desired, selected results may be written to output files.

Go to step 2 for the next time step.

D. <u>SOL03 - ELASTIC NATURAL FREQUENCY / ELASTIC BUCKLING LOAD</u>

This block calculates either the natural frequencies and mode shape of an elastic structure or the buckling load and mode shape of that structure. Figure 28 shows the flow chart for SOL03.

Step 1. Form Structural Stiffness Matrix The structural stiffness matrix is formed.

Step 2. <u>Form Mass Matrix or Geometric Stiffness Matrix</u> For the buckling solution, the geometric stiffness matrix is formed. For the natural frequency solution, the mass matrix that was formed in block STRUCT is used.

Step 3. <u>Condensation</u> If condensed degrees of freedom exist, 1) the structural stiffness is condensed, 2) the geometric stiffness is condensed for buckling problems, if desired, and 3) the mass matrix is condensed for natural frequency problems, if needed.

Step 4. <u>Calculate Eigenvalue and Eigenvector</u> Eigenvalues and eigenvectors are calculated. Natural frequencies or buckling loads are extracted from the eigenvalues. The eigenvectors are normalized. Natural frequencies are printed along with each mode's shape, or buckling loads are printed along with the corresponding mode shape.



Figure 28. Block SOL03 - Natural Frequency / Elastic Buckling Load

E. SOL04 - NONLINEAR STATIC CYCLIC RESPONSE

This block calculates the nonlinear static cyclic response for a given loading pattern. A loading pattern consisting of joint loads, imposed displacements and element loads is defined and stored in the vector $\{Q\}$. The loading pattern, $\{Q\}$, is multiplied by positive and negative load factors to generate cyclic loading cycles. Define F_j as the loading factor for the current cycle and F_i as the loading factor for the previous cycle. Total loads on the structure for cycles i and j are $F_i\{Q\}$ and $F_j\{Q\}$, respectively. The loading from $F_i\{Q\}$ to $F_j\{Q\}$ is carried out in a series of steps. A variable number of steps, each one having incremental loads and displacements less than limiting values, may be used to load from $F_i\{Q\}$ to $F_j\{Q\}$ (loading option A). Alternately, a fixed number of equal load steps may be chosen to load from $F_i\{Q\}$ to $F_j\{Q\}$ (loading option B). Figure 29 shows the flow chart for SOL04.

Step 1. <u>Input Joint and Element Loadings</u> Joint loads and imposed displacements of the load pattern are input. Element loadings for the load pattern are input on the 3D-beam element.

Step 2. <u>Input Load Factors</u> For each loading cycle, a load factor and limits on the step size or the number of load steps are input.

Step 3. Form Load Matrix Loading matrix for option A is the difference between the load at the end of the cycle and the current load. Alternately, loading matrix for option B is the incremental load, $(F_i-F_i)^*{Q}/N$, where N is the number of load steps.

Step 4. Form the Structural Stiffness Structural stiffness is formed 1) for the first load step, 2) for every load step that an element's stiffness is modified, and 3) for every load step that the geometric stiffness is modified.

Step 5. Form the Geometric Stiffness Geometric stiffness is formed 1) for the first load step, and 2) for every load step if the actual element axial loads are used to calculate the geometric stiffness.



Figure 29. Block SOL04 - Nonlinear Static Cyclic Response

Step 6. <u>Calculate Displacements</u> Incremental displacements due to the applied loadings are calculated by Gauss elimination.

Step 7. <u>Scale the Solution</u> For loading option A, the response is scaled down such that the incremental loads and displacements for each step are less than the limiting values. This step is omitted for loading option B.

Step 8. <u>Calculate Displacements due to Unbalanced Forces</u> Incremental displacements due to unbalanced forces from the previous load step are calculated by Gauss elimination.

Step 9. <u>Combine Displacements</u> Scaled-down displacements due to the applied loadings and displacements due to the unbalanced loadings are added together.

Step 10. Incremental Reactions Incremental reactions are calculated.

Step 11. <u>Incremental Element Forces</u> Hysteresis models in the materials library are used to calculate the incremental element forces, given incremental displacements and previous loading history. For nonlinear analysis, if the element's stiffness changes during incremental displacement, 1) the element's unbalanced forces are calculated, and 2) a flag to reform the structural stiffness in step 4 is put at the next load step. Elastic and plastic strain energy for each element is also calculated.

Step 12. <u>Energy Balance</u> Total input energy, elastic strain energy and plastic strain energy are calculated.

Step 13. <u>Total Response</u> Total displacements, reactions, and element forces are calculated. The unbalanced force vector for nonlinear analysis is also calculated. If desired, selected results may be written to output files.

Go to step 3 for additional loading steps. Go to step 2 for the next loading cycle.

F. SOL05 - RESPONSE SPECTRUM ANALYSIS

This block calculates the maximum response of structure subject to dynamic force. Dynamic force is obtained from the response spectrum. Spectral values corresponding to structural natural frequencies represent the input forces. Equivalent earthquake forces and maximum member forces are also calculated. The modal combination in the analysis can be square-root-of-sum-of-square (SRSS) method or complete-quadratic-combination (CQC) method. Figure 30 shows the flow chart for SOL05.

Step 1. Input Modal Combination Method The modal combination method can be SRSS or CQC.

Step 2. <u>Input Number of Modes Considered</u> The more modes considered in the analysis, the more accurate the expected response.

Step 3. Form Structural Stiffness Structural stiffness is formed. Optionally, the geometric stiffness matrix, based on the user's input axial load, is subtracted from the structural stiffness matrix.

Step 4. <u>Calculate Eigenvalue and Eigenvector</u> Eigenvalues and eigenvectors are calculated. Optionally, they can be obtained from SOL03. Natural frequencies are extracted from the eigenvalues. The eigenvectors are normalized.

Step 5. <u>Input Response Spectral Values</u> The spectral value corresponding to each natural frequency is input. Input values can be accelerations or displacements.

Step 6. <u>Calculate Effective Mass for Each Mode</u> The effective mass for each mode is calculated. In general, to ensure solution accuracy, the summation of effective masses of total modes considered should be greater than 90% of the total structural mass. Effective masses of individual modes are also printed.



Figure 30. Block SOL05 - Response Spectrum Analysis

Step 7. <u>Calculate Maximum Displacements</u> Maximum structural displacements are calculated based on SRSS or CQC method.

Step 8. <u>Calculate Maximum Member Forces</u> Maximum member forces are calculated based on SRSS or CQC method.

Step 9. <u>Calculate Equivalent Earthquake Forces</u> Equivalent earthquake forces are calculated based on the maximum member forces.

Step 10. <u>Calculate Inertia Earthquake Forces</u> Maximum inertia earthquake forces are calculated.

III. DESCRIPTION OF PROGRAM

This chapter describes the computer program INRESB-3D-SUPII. A flow chart of the program is given in Figures 31 and 32.

A. MAIN PROGRAM AND COMMON BLOCKS

A brief description of the main program and three common blocks is presented below.

MAIN - Main Program This program 1) reads and echoes input data, 2) initializes data,
calls STRUCT to define the structural model, 4) calls SOLN to perform individual solutions,
calls COMDMP to dump contents of memory, 6) sets bug options to print stiffness matrices,
etc., 7) releases memory from previous solutions, and 8) stops execution of the program.

2. <u>Common Block DATA</u> This block consists of a linear array that contains the program's dynamically allocated memory. A real array, Z, and an integer array, NZ comprise the linear array. Integer array and real array share the same storage location in memory¹. Common block DATA is used by routines MAIN, CKSTOR, STRUCT, MATLIB, ELELIB, DMPDAT FORM, SOLN, SOL01, SOL02, SOL03, SOL04 and SOL05.

3. <u>Common Block ZDATA</u> This block contains flags which control the execution of the routines, the number of G-dof, joints, elements, etc. and the addresses of data in the Z array shared among different routines. ZDATA is used by routines MAIN, CKSTOR, STRUCT, MATLIB, ELELIB, DMPDAT, FORM, SOLN, SOL01, SOL02, SOL03, SOL04, SOL05, COMPT and COMDMP.

4. <u>Common Block ZDATAP</u> This block contains the title, bug options, and miscellaneous variables. ZDATAP is used by routines MAIN, CKSTOR, STRUCT, MATLIB, ELELIB, DMPDAT, FORM, SOLN, SOL01, SOL02, SOL03, SOL04, SOL05, COMPT and COMDMP.

¹ This is accomplished by the FORTRAN EQUIVALENCE statement.



Figure 31. Flow Chart for Program INRESB-3D-SUPII: Part A



Figure 32. Flow Chart for Program INRESB-3D-SUPII: Part B

B. DESCRIPTION OF ROUTINES

INRESB-3D-SUPII includes 94 routines. They are presented below in alphabetical order with a brief description.

1. <u>AVEACC</u> Along with LINACC, calculates dynamic response by the average acceleration method. Called by SOL02A.

2. <u>BMLOA</u> Calculates the fixed end moments and shears of a prismatic beam element for uniform and concentrated element loadings. Called by ELE01.

3. CKRNG A utility routine called by ELELOA that checks the location of element loadings.

4. <u>CKSTOR</u> A utility routine that aborts the program if the problem requires more storage than is available. Called by SOL02, DMPDAT, SOL03, SOL04 and SOL05.

5. <u>COMDMP</u> A utility routine that prints the contents of the dynamic memory. Called by MAIN.

6. <u>COMPT</u> A utility routine that initializes the addresses of the dynamic memory. Called by MAIN.

7. CROSS Vector cross product. Called by DYLOA and NODDOF.

8. <u>DIRECT</u> A utility routine called by HYST03 and HYST04 to determine the current direction of loading.

9. <u>DMPDAT</u> 1) Writes the results for user-defined output files. 2) Reads the results from output files and prints data. Called by SOL02, SOL02A, SOL04A, SOL04A, and MAIN.

10. DNE Calculates ductilities and excursion ratios for HYST02, HYST03, HYST04,

11. <u>DYLOA</u> Generates dynamic loadings due to base acceleration for multicomponent earthquakes. Called by SOL02A.

12. <u>ELELIB - Element Library</u> A controller that calls the members of the element library. All calls to the elements must pass through this subroutine. Called by MAIN, FORM, STRUCT, SOL01A, SOL02A. SOL04A SOL05A, ELELOA, ENERGY and DMPDAT.

13. <u>ELELOA</u> Calculates the element loads for the elastic 3D prismatic beam element. Called by SOL01A and SOL04A.

14. <u>ELE01 - Elastic 3D Prismatic Beam Element</u> Calculates the stiffness, geometric stiffness, element loads, displacements, forces, etc. for the elastic 3D prismatic beam element. Called by ELELIB.

15. <u>ELE02 - Spring Element</u> Calculates the stiffness, geometric stiffness, displacements, forces, unbalanced forces, etc. for the spring element. Called by ELELIB.

16. <u>ELE03 - Shear Wall Stiffness Element</u> Calculates the stiffness, geometric stiffness, displacements, forces, unbalanced forces, etc. for the shear wall stiffness element. Called by ELELIB.

17. <u>ELE08 - Bracing Element</u> Calculates stiffness, displacements, forces, unbalanced forces, etc. for the bracing element. Called by ELELIB.

18. <u>ELE09 - Inelastic 3D-Beam-Column Element</u> Calculates stiffness, geometric stiffness, displacements, forces, unbalanced forces, etc. for the inelastic 3D-beam-column element. Called by ELELIB.

19. ELE12 - Finite-Segment Element Calculates stiffness, displacements, forces, etc. for the

finite-segment element. Called by ELELIB.

20. <u>ELE14 - Perforated Shear Wall Element</u> Calculates stiffness, geometric stiffness, displacements, forces, unbalanced forces, etc. for the perforated shear wall element. Called by ELELIB.

21. ENERGY Calculates the energy balance. Called by SOL02A and SOL04A.

22. <u>ETMPLY</u> Performs multiplication, $\{\dot{x}\}^{t}[M]\{\dot{x}\}$, to calculate kinetic energy for an upper triangular mass matrix. Called by ENERGY.

23. FEMREL Modifies fixed end forces to account for end releases. Called by BMLOA.

24. FIRST Performs character manipulations. Called by GETCHR.

25. <u>FORM</u> Along with FORML, used to assemble structural and geometric stiffness matrices. Called by SOL01A, SOL02A, SOL03A, SOL04A, and SOL05A.

26. <u>FORML</u> 1) Adds element stiffness to global structural stiffness. 2) Adds element geometric stiffness to global geometric stiffness. 3) Adds joint mass to global mass matrix. Called by FORM and MFORM.

27. GETCHR A utility routine that extracts a character string from input. Called by MAIN.

28. <u>GETINT</u> A utility routine that extracts an integer from character input. Called by MAIN, LMATRX, SOLN, WMATRX and WMTRX2.

29. <u>HYST02 - Axial Hysteresis Model</u> Calculates axial stiffness of R/C elements based on current load and past loading history by the axial hysteresis model. Called by MAT02.

30. HYST03 - B1 Bending Hysteresis Model Calculates bending stiffness of R/C shear walls

based on current load and past loading history by the B1 bending hysteresis model. Called by MAT03.

31. <u>HYST04 - S1 Shear Hysteresis Model</u> Calculates shear stiffness of R/C shear walls based on current load and past loading history by the S1 shear hysteresis model. Called by MAT04.

32. <u>HYST06 - Takeda Hysteresis Model</u> Calculates bending stiffness of R/C elements based on current load and past loading history by the Takeda hysteresis model. Called by MAT06.

33. <u>HYST07 - Bilinear Hysteresis Model</u> Calculates stiffness based on current load and past loading history by the bilinear hysteresis model. This model is also capable of producing elasto-plastic behavior. Called by MAT06.

34. <u>HYST08 - Bracing Member Hysteresis Model</u> Calculates stiffness based on current load and past loading history by the bracing member hysteresis model. This model is also capable of producing post-buckling behavior. Called by MAT08.

35. <u>HYST09 - Long-Direction Open-Web Joist Hysteresis Model</u> Calculates stiffness based on current load and past loading history by the long-direction open-web joist hysteresis model. This model is also capable of producing post-buckling behavior. Called by MAT09.

36. <u>HYST11 - Short-Direction Open-Web Joist Hysteresis Model</u> Calculates stiffness based on current load and past loading history by the short-direction open-web joist hysteresis model. This model is also capable of producing post-buckling behavior. Called by MAT11.

37. <u>HYST12 - Hysteresis Model for Finite-Segment Element</u> Calculates stiffness based on current and past displacement history by the finite segment technique. This model is also capable of producing post-buckling behavior. Called by MAT12.

38. HYST14 - Hysteresis Model for Perforated Shear Wall Calculates the combined shear

and bending stiffness of R/C perforated shear walls based on current and past loading history. Called by MAT14.

39. <u>IDRECT</u> A utility routine that determines the current direction for HYST02 and HYST06.

40. <u>INTDVA</u> Reads and stores initial displacement, velocity and accelerations for dynamic solutions. Called by SOL02A.

41. <u>INTPO</u> Interpolates response spectral values for the response spectrum analysis. Called by SOL05A.

42. ITERS Checks local buckling of box column in Pino-Suarez Tower. Called by ELE09.

43. <u>ITERS2</u> Checks strength criteria of box column in Pino-Suarez Tower. Called by ELE09.

44. <u>INTSCT</u> A utility routine that determines the intersection of two lines in point slope form. Called by HYST02, HYST03 and HYST04.

45. <u>IQUICK</u> A utility routine that finds the program's internal joint number, given the joint's ID number. Called by NODDOF, ELE01, ELE02, ELE03, ELE08, ELE09, ELE12, JOILOA, INTDVA, DMPDAT and MFORM.

46. ISORT A utility routine that sorts the joint input. Called by NODDOF.

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47. JOIDSP Calculates and prints displacement, velocity, acceleration or eigenvector at each joint in the JCS and GCS. Called by SOL01A, SOL02A, SOL03A and SOL04A.

48. JOILOA Reads and calculates joint loads. Called by SOL01A and SOL04A.
49. <u>KMIN</u> A utility routine used by hysteresis models HYST03 and HYST04 to ensure that the stiffness is between zero and initial stiffness, SI.

50. <u>LINACC</u> Calculates dynamic response by linear acceleration method. Called by SOL02A and AVEACC.

51. <u>LMATRX</u> A utility routine that prints upper triangular mass, structural stiffness, element stiffness, geometric stiffness, etc. matrices. This routine is activated by user input bug options which are described later. Called by FORM, MFORM, ELE01, ELE02, ELE03, ELE08, ELE09, ELE12, SOL01A, SOL02A, SOL03A, SOL04A, SOL05A, MSOLL, TMPLY, ETMPLY, UTMPLY and MASSIN.

52. MASSIN Initializes storage for the mass matrix. Called by STRUCT and SOL02.

53. <u>MATLIB - Materials Library.</u> A subroutine serving as a controller that calls the members of the materials library. All calls to the materials and hysteresis models must pass through this subroutine. Called by STRUCT, ELE01, ELE02, ELE03, ELE08, ELE09, and ELE12.

54. <u>MAT01 - Elastic 3D Prismatic Beam Stiffness</u> A routine that reads and stores the stiffness of the elastic 3D prismatic beam element. Called by MATLIB.

55. <u>MATO2 - Axial Stiffness for R/C Elements</u> 1) Reads and stores axial input data. 2) Calculates axial stiffness with calls to the axial hysteresis model, HYST02. 3) Calculates strain energy with calls to STRENG. Called by MATLIB.

56. <u>MAT03 - Bending Stiffness for R/S Shear Walls</u> 1) Reads and stores bending input data.
2) Calculates bending stiffness with calls to the B1 bending hysteresis model, HYST03. 3) Calculates the strain energy with calls to STRENG. Called by MATLIB.

57. MAT04 - Shear Stiffness for R/C Shear Walls 1) Reads and stores shear input data. 2)

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Calculates shear stiffness with calls to the S1 shear hysteresis model, HYST04. 3) Calculates strain energy with calls to STRENG. Called by MATLIB.

58. <u>MAT06 - Bending Stiffness for R/C Elements</u> 1) Reads and stores bending input data.
2) Calculates bending stiffness with calls to the Takeda hysteresis model, HYST06. 3) Calculates strain energy with calls to STRENG. Called by MATLIB.

59. <u>MAT07 - Bilinear Material</u> 1) Reads and stores input data. 2) Calculates stiffness with calls to the bilinear hysteresis model, HYST07. 3) Calculates the strain energy with calls to STRENG. Called by MATLIB.

60. <u>MAT08 - Bracing Member Material</u> 1) Reads and stores input data. 2) Calculates stiffness with calls to the bracing member hysteresis model, HYST08. 3) Calculates strain energy with calls to STRENG. Called by MATLIB.

61. <u>MAT09 - Long-Direction Open-Web Joist Material</u> 1) Reads and stores input data. 2)
Calculates stiffness with calls to the long-direction open-web joist hysteresis model, HYST09.
3) Strain energy calculation not available. Called by MATLIB.

62. <u>MAT10 - Bilinear Material</u> 1) Reads and stores input data. 2) Calculates stiffness for ELE09 only. 3) The strain energy calculation not available. Called by MATLIB.

63. <u>MAT11 - Short-Direction Open-Web Joist Material</u> 1) Reads and stores input data. 2)
Calculates stiffness with calls to the short-direction open-web joist hysteresis model, HYST11.
3) Strain energy calculation not available. Called by MATLIB.

64. <u>MAT12 - Finite-Segment Element Material</u> 1) Reads and stores input data. 2) Calculates stiffness with calls to the finite-segment hysteresis model, HYST12. 3) Strain energy calculation not available. Called by MATLIB.

65. MAT14 - Material for R/C Perforated Shear Wall 1) Reads and stores input data. 2)

Calculates stiffness with calls to the perforated shear wall hysteresis model, HYST14. 3) Calculates strain energy with calls to STRENG. Called by MATLIB.

66. <u>MFORM</u> Reads joint masses and forms mass matrix with calls to FORML. Called by MASSIN, SOL02, SOL03 and SOL05.

67. <u>MSOLL</u> 1) Performs Gauss elimination of the stiffness matrix. 2) Condenses the mass matrix while performing Gauss elimination. 3) Condenses the geometric stiffness while performing Gauss elimination. 4) Reduces the load matrix. 5) Performs back substitution. 6) Operations 1 through 5 may be performed on partitioned matrices. 7) Stiffness, geometric stiffness and mass matrices are upper triangular matrices with skyline storage. Called by SOL01A, SOL02A, SOL03A, SOL04A, SOL05A and LINACC.

68. <u>NODDOF</u> Reads joints, constraints, restraints and condensation information, calculates JCS cosine matrices, and determines global degrees of freedom. Called by STRUCT.

69. <u>PBIT</u> A utility routine that prints the joint restraint and constraint code for each joint. Called by NODDOF.

70. <u>REACTN</u> 1) Modifies loading to include restraint displacements. 2) Solves for reactions.
3) Prints reactions in the JCS and GCS coordinate systems. 4) Calculates summation of reactions. Called by SOL01A, SOL02A, SOL03A, SOL04A and SOL05A.

71. <u>ROTXYZ</u> 1) Calculates local element cosine matrix. 2) Calculates transformation from ECS to JCS. 3) Calculates constraint transformation. 4) Calculates transformation for a rigid body at the end of the beam element. Called by ELE01, ELE02 and ELE03.

72. <u>SKYLIN</u> Determines skyline of the structural stiffness, geometric stiffness and mass matrices. Called by STRUCT, MFORM and MASSIN.

73. <u>SKYLN2</u> Determines skyline of the dynamic stiffness matrix. Called by SOL02.

74. <u>SMAX</u> A utility routine that determines and prints maximum and minimum input accelerations. Called by DYLOA.

75. <u>SOLN - Solution Library</u> A subroutine serving as a controller that calls the solution requested by the user. All calls to solutions must pass through this subroutine. Called by MAIN.

76. <u>SOL01 - Elastic Static Analysis with Multiple Load Cases</u> Initializes storage for elastic static analysis. Called by SOLN.

77. <u>SOL01A</u> Calculates elastic static response, as described in Section B of Chapter II. Called by SOL01.

78. <u>SOL02 - Dynamic Time History Response</u> Initializes storage for the dynamic time history response. Called by SOLN.

79. <u>SOL02A</u> Calculates dynamic time history response for both elastic and nonlinear structures, as described in Section C of Chapter II. Called by SOL02.

80. <u>SOL03 - Elastic Natural Frequency / Buckling Load</u> Initializes storage for elastic natural frequency or buckling load. Called by SOLN.

81. <u>SOL03A</u> Calls EIGZS to calculate elastic natural frequency or buckling load for elastic structures, as described in Section D of Chapter II. Called by SOL03.

82. <u>SOL04 - Nonlinear Static Cyclic Response</u> Initializes storage for static nonlinear analysis. Called by SOLN.

83. <u>SOL04A</u> Calculates static nonlinear response, as described in Section E of Chapter II. Called by SOL04.

84. SOL05 - Response Spectrum Analysis Initializes storage for response spectrum analysis.

85. <u>SOL05A</u> Calculates maximum structural response based on SRSS or CQC modal combination approach as described in Section F of Chapter II. Called by SOL05.

86. <u>STRENG</u> Calculates the elastic and plastic strain energy. Called by MAT02, MAT03, MAT04, MAT06, HYST07, and HYST08.

87. <u>STRUCT - Structural Definition</u> 1) Sets up storage for joints and calls NODDOF to input joint information and generate degrees of freedom. 2) Sets up storage for materials and calls MATLIB to input materials and initialize hysteresis models. 3) Sets up storage for elements and calls ELELIB to input elements and calculate initial element stiffness. 4) Calls SKYLIN to set up storage for the structural stiffness, geometric stiffness and mass matrices. 5) Reads and initializes mass matrix. These functions are described in greater detail in Section A of Chapter II. Called by MAIN.

88. <u>TEST</u> A utility routine that examines character input and sets a logical flag. Called by MAIN, STRUCT, SOL02, SOL03A, SOL04A, SOL05A, INTDVA and DMPDAT.

89. <u>TMPLY</u> A utility routine that performs multiplication for triangular matrices. Called by SOL02A, SOL04A and ETMPLY.

90. <u>VCOS</u> A utility subroutine that calculates the angle between two vectors. Called by ROTXYZ and ELE03.

91. VCROSS A utility subroutine that calculates the vector cross product. Called by ELE03.

92. WILSON Calculates dynamic response by the Wilson θ method. Called by SOL02A.

93. <u>WMATRX</u> A utility subroutine that prints a matrix. It is activated by user input bug options which are described later. Called by ELE01, ELE02, ELE03, ELE08, ELE09, ELE12, SOL01A, SOL04A, SOL05A, REACTN, MSOLL and DYLOA.

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94. <u>WMTRX2</u> A utility subroutine that prints a portion of a matrix. It is activated by user input bug options which are described later. Called by ELE02, ELE03, ELE08, ELE09, and ELE12.

C. DESCRIPTION OF MISCELLANEOUS ROUTINES

Other routines used by program INRESB-3D-SUPII are listed below.

1. <u>DG2CSP</u> An IMSL eigenvalue routine used to calculate natural frequency and buckling load. This routine is only required for SOL03 and SOL05. Its omission will not affect blocks STRUCT, SOL01, SOL02 or SOL04. Called by SOL03A or SOL05A.

2. <u>SDUMP</u> An IBM routine that prints contents of memory with bug option K. Called by COMDMP. Omission of this routine will only effect bug option K.

3. <u>CPUTIM, TIMEON and TIMEIT</u> Three routines on local UMR system used to print results of the analysis and abort SOL02 if the CPU time limit is close to being exceeded. Equivalent routines may be substituted on other systems, or these routines may be eliminated. Called by MAIN and SOL02A.

4. <u>TIME and DATE</u> Two routines on local UMR system used to print time and date of analysis on header. Equivalent routines may be substituted on other systems, or these routines may be eliminated. Called by MAIN.

D. DYNAMIC MEMORY MANAGEMENT

1. <u>Dynamic Memory Allocation</u> INRESB-3D-SUPII stores all joint, material, element, mass, stiffness, response, etc. data in a large linear array, Z, that resides in common block DATA. The Z array consists of real numbers. An integer array NZ is set equal to the Z array, by a Fortran EQUIVALENCE statement, to provide storage for integer variables. Index variables

beginning with IZ, such as IZxxxx, are used to store addresses of information in the Z array. A variable IZ is used to track the next available space in the Z array. The exact amount of space required to solve a specific problem is reserved in the Z array during execution of the program. This dynamic allocation of memory allows the program to use the computer's memory efficiently.

For example, assume that the Z array is empty and IZ=1. Joint ID numbers are integer variables stored in the NZ array. Thus the index for joint ID numbers is IZID=IZ=1, and NUMJOI joint numbers are stored in the NZ array. Once storage for the joint numbers is reserved, the next available storage location is IZ=IZ+NUMJOI. Then the joint coordinates are stored in the Z array, beginning at IZCORD=IZ. Joint coordinates require 3*NUMJOI storage locations. Once the storage for joint coordinates is reserved, the next available storage for joint coordinates is reserved, the next available storage for joint coordinates are stored in the Z array, beginning at IZCORD=IZ. Joint coordinates require 3*NUMJOI storage locations. Once the storage for joint coordinates is reserved, the next available storage location is IZ=IZ+3*NUMJOI. Figure 33 shows the Z array with joint numbers and coordinates.

2. <u>Compact Matrix Storage</u> Mass, stiffness, geometric stiffness and dynamic stiffness matrices are sparse symmetric matrices. Because the matrices are symmetric, only half (the upper triangular matrix) of each matrix needs to be stored. Furthermore, many of the terms in the upper triangular matrix are zero. Nonzero terms, in a given column, are typically found near the main diagonal. The level of the upper nonzero term in each column is the skyline. Thus only the terms below the skyline of the upper triangular matrix are stored in the Z array. Additionally, the linear array addresses of main diagonal elements are stored in the array MD. For example, let matrix B be the 5x5 full symmetric matrix.

$$\mathbf{B} = \begin{bmatrix} 1 & 3 & 0 & 0 & 12 \\ 3 & 2 & 5 & 0 & 11 \\ 0 & 5 & 4 & 7 & 10 \\ 0 & 0 & 7 & 6 & 9 \\ 12 & 11 & 10 & 9 & 8 \end{bmatrix}$$
(3)

where $B_{1,3}$, $B_{1,4}$ and $B_{2,4}$ are zero. Thus the terms in the upper triangular matrix below the skyline are

$$\mathbf{B}_{\text{upper triangular}} = \begin{bmatrix} 1 & 3 & 12 \\ 2 & 5 & 11 \\ 4 & 7 & 10 \\ 6 & 9 \\ 8 \end{bmatrix}$$
(4)

These elements are stored in the linear array by columns, beginning with the element on the main diagonal. Thus the B matrix in linear array form becomes.

$$\mathbf{A} = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ 11 \\ 12 \end{bmatrix}$$
(5)

and the array, MD, containing the addresses of the main diagonal elements, is

$$MD = \begin{bmatrix} 1\\2\\4\\6\\8\\13 \end{bmatrix}$$
(6)

Last row of the array is a dummy element with the value N+1 where N is the number of elements in the linear array. The i,j element of the linear array is addressed with the algorithm

This storage method was also presented by Bath and Wilson (2).



Figure 33. Dynamic Memory Example

3. Capacity of Dynamic Memory

The program's capacity is a function of the amount of memory available in the computer. Program instructions compiled in double precision on an IBM 4381 computer require about 0.8 megabytes of memory. Assuming 8 megabytes of total memory is available, the Z array may occupy 8-0.8=7.2 megabytes of memory. For double precision, on an IBM computer, each variable is 8 bytes long. Thus for 8 megabytes of memory, the Z array may contain up to $7.2*10^{6}/8=900,000$ variables.

The number of variables in the Z array required for a specific problem is a function of 1) number and orientation of the joints, 2) number of restraints, 3) the number of constraints, 4) number and types of material, 5) number and types of elements and the material each element uses, 6) number of joint masses, 7) amount of storage required by the structural stiffness, geometric stiffness, and mass matrices, which is a function of the band-width, 8) type of solution, 9) number of degrees of freedom, 10) number load cases for SOL01, 11) number of element loadings for SOL01 and SOL04, 12) number of free dof for SOL02 and SOL03, and 13) length of the ground acceleration record for SOL02. The actual number of variables used and the percentage of total memory used are printed out at the end of each block. For the example in Section C of Chapter V, the following message is printed in the output.

*	*
* MEMORY UTILIZATION	*
* IZ= 21965, MEM= 4.393%	*
*	*

This example required 21,965 variables. Four megabytes of memory are available for the Z array and the program is compiled in double precision on an IBM computer. Thus the Z array has a capacity of $4*10^{6}/8=500,000$ variables, and 21,965/500,000*100=4.393% of the available memory was used.

Capacity of the program is modified by changing the value of MAXZ in the PARAMETER statement

PARAMETER (MAXZ=500000, MAXDZ=MAXZ/2)

of file ZCOMN2 COPY. A macro library GEM3 is then regenerated and the program is recompiled.

E. ADDITION OF MATERIALS, ELEMENTS, AND SOLUTIONS

The modular form of INRESB-3D-SUPII allows for relatively easy addition of materials, elements and solutions. Changes necessary to add materials, elements and solutions are discussed below.

1. <u>Addition of Material to Materials Library</u> A subroutine with the name MATxx is written that contains additional material information. This subroutine must have the following options to be consistent with existing subroutines.

- IOPT=0 Determines the number of storage spaces required for each element utilizing this material. Such storage is typically used by a hysteresis model called by routine MATxx.
- IOPT=1 Inputs and stores data. Returns the amount of storage required for the material.
- IOPT=2 Calculates initial stiffness and initializes the hysteresis model.
- IOPT=3 Calculates current stiffness and load for an incremental displacement, given the previous loading history. Calculates strain energies, ductilities, and excursion ratios.
- IOPT=4 Calculates strain energies, ductilities, and excursion ratios.
- IOPT=5 Calculates damage index.

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For nonlinear materials, the subroutine MATxx calls a companion hysteresis model, subroutine HYSTxx.

A call to MATxx is added in routine MATLIB. All communication with subroutine MATxx is through routine MATLIB. Names of the material and material number (MATTYP=xx) are added to routine STRUCT.

2. <u>Addition of Element to Elements Library</u> A subroutine with the name ELExx is written that contains the element information. The subroutine must have the following options to be consistent with existing subroutines.

- IOPT=1 Interprets input data, calculates transformation matrices, initial structural stiffness and a unit load geometric stiffness. Determines actual amount of storage required.
- IOPT=2 Determines axial load used for the geometric stiffness.
- IOPT=3 Recalculates structural stiffness, if any of the components of stiffness has changed.
- IOPT=4 Calculates incremental forces, unbalanced forces and new components of stiffness.
- IOPT=5 Calculates total element forces and energies.
- IOPT=6 Calculates fixed end forces due to element loads, if applicable.
- IOPT=7 Writes element data to an output file.
- IOPT=8 Reads and prints element data from an output file.
- IOPT=9 Determines amount of storage required for the element's materials.

- IOPT=10 Determines strain energy.
- IOPT=11 Determines ductilities and excursion ratios.
- IOPT=12 Prints out maximum forces and/or displacements that the element was subjected to.
- IOPT=13 Sets internal forces and displacements equal to zero. Reinitializes the hysteresis models.
- IOPT=14 Calculates and prints the damage index.

A call to ELExx is added in routine ELELIB. All communication with subroutine ELExx is through routine ELELIB. The name of the element, the element number (NELTYP=xx), the number of variables input for the element, and the maximum amount of storage required for the element are added to routine STRUCT.

3. <u>Addition of a Solution</u> A subroutine with the name SOLxx is written to reserve and initialize storage required by the solution. SOLxx also calls CKSTOR to ensure that the program has enough storage to execute the solution. A call to SOLxx is added to routine SOLN. All communication with subroutine SOLxx is through routine SOLN.

Subroutine SOLxx calls subroutine SOLxxA which performs the actual solution. Subroutine SOLxxA may call other subroutines such as FORM to establish the stiffness matrix, JOILOA to generate joint loadings, MSOLL to solve for displacements or ELELIB to calculate element forces. The function of these and other subroutines are described in the previous section.

IV. INPUT DATA FOR PROGRAM INRESB-3D-SUPII

The input for INRESB-3D-SUPII is divided into several blocks. Each block is briefly described below. These blocks may be executed in any order, unless otherwise noted. Multiple solutions for the same structure are possible by using multiple solution blocks. Multiple structures may be analyzed by redefining the structure with the STRUCT block.

BLOCK DESCRIPTION

- STRUCT Definition of the structure to be analyzed. Joints, materials, elements, mass and damping are defined.
- SOL01 Elastic static solution of the structure with multiple load cases. SOL01 must be preceded by the block STRUCT.
- SOL02 Dynamic solution of linear and nonlinear structures subject to three-dimensional ground motion by numerical integration. SOL02 must be preceded by the block STRUCT.
- SOL03 Eigenvalue solution for the natural frequency or buckling load of an elastic structure. SOL03 must be preceded by the block STRUCT.
- SOL04 Incremental static solution of a nonlinear structure. SOL04 must be proceeded by the block STRUCT.
- SOL05 Response spectrum analysis of linear structure. SOL05 must be proceeded by the block STRUCT.

Secondary Blocks

- BUG Sets flags to print out detailed information.
- READ Reads results written to an output file during SOL02 or SOL04 and prints these results.
- NOECHO Inhibits input echo.
- DUMP Prints out contents of memory.
- RELEASE Releases memory used for previous solution.
- STOP Terminates execution of program.

NOTES ON INPUT

- 1) Input is free format, unless otherwise noted.
- 2) Input variables beginning with I-N are integers and should not contain a decimal point.
- 3) Input variables beginning with A-H and O-Z are real and may contain a decimal point.
- Logical variables are identified in the input description, and have the value .TRUE. or .FALSE.
- 5) Character variables are identified in the input description, and are enclosed in 'single quotes', except as noted.
- 6) Character and logical variables must be input in upper case.
- 7) Input data is read from unit 05, except as noted.
- 8) Output is printed on unit 06, except as noted.
- 9) Input cards are identified by a box. If that card is repeated, the entire box is repeated.

input card image.....

Data for one card may be input on one or more lines in the data file, provided that all of the character variables are on the first line.

 Consistent units are used throughout the program. Thus input in inches, kips, or seconds yields output in the same unit. Mixing units will yield unpredictable results. Units are indicated parenthetically where appropriate.

ExampleNote'BUG=K'(1)'STRUCT'(2).Structure input is omitted.'SOL04'(3)...Solution input is omitted.'READ UNIT=21'(4)'STOP'(5)

- (1) Bug option is set, which prints out the hysteresis model data for each time step.
- (2) Structure is defined.

- (3) A cyclic static solution of the structure is performed.
- (4) Data printed on unit 21 during SOL04 is read from the disk file and printed in a report.
- (5) Program is terminated.

A. STRUCTURE - DEFINITION OF STRUCTURAL MODEL

These cards define the structural model to be analyzed. The following cards are each input once.

'STRUCT'				
'TITLE'				

- STRUCT Signifies that the structural model is to be input. Character variable; enclose in single quotes.
- TITLE User input title, 80 characters maximum. Character variable; enclose in single quotes.

1. Joints and Degrees of Freedom These cards are used to define the coordinates of the joints, joint restraints, constraints and degrees of freedom to be condensed. The degree of freedom numbers are assigned by the program and printed in the output. The following card is input once.

NJOINT NCOS NSUPT NCOND NCONST SCALE						
	NJOINT	NCOS	NSUPT	NCOND	NCONST	SCALE

NJOINT Number of joints defined by joint coordinate cards.

NCOS Number of joint direction cosine cards input.

NSUPT Number of joint restraint cards input.

NCOND Number of joint condensation cards input.

NCONST Number of joint constraint cards input.

SCALE Scale factor that the joint coordinates are to be multiplied by. If SCALE=12, the

user inputs the joint coordinates in feet, and the structure is defined in inches.

a. <u>Joint Coordinates</u> These cards are used to define the coordinates of the joints, in the global coordinate system, GCS, and identify the direction cosine of the joint. Total number of joints defined in this section is less than or equal to NJOINT. The second card is only used when the preceding card has a value of IGEN that is greater than zero. These cards are repeated until 1) NJOINT joints have been defined, or 2) an input or generated joint ID number is less than or equal to zero.

ID	х	Y	Z	ICOS	IGEN
ΔID	۵X		ΔY	ΔZ	

- ID Joint identification number. ID numbers can be input in any convenient order and need not be consecutive. However, the band-width of the structural stiffness matrix is dependent on the joint ID numbers. An ID ≤ 0 terminates input of the joint coordinates.
- X GCS X coordinate of the joint. (length)
- Y GCS Y coordinate of the joint. (length)
- Z GCS Z coordinate of the joint.(length)
- ICOS Joint's direction cosine number.

IGEN Number of additional joints to be generated from this joint.

- ΔID Increment between the generated ID number and the previous joint's ID number. A generated ID ≤ 0 terminates input of the joint coordinates.
- ΔX Increment between the generated joint's GCS X coordinate and the previous joint's X coordinate. (length)
- ΔY Increment between the generated joint's GCS Y coordinate and the previous joint's Y coordinate. (length)
- ΔZ Increment between the generated joint's GCS Z coordinate and the previous joint's Z coordinate. (length)

Example NJOINT=7

<u>Note</u>

10 0	0. 0. 0.	1	2	(1,2)
10 0). 0. 3.			(2)
14	. 31.	2	0	(3)
-1 0	0 0	0	0	(4)

(1) Joint 10 has the coordinates (0,0,0) and uses direction cosine #1.

(2) Two joints are generated from joint 10: joint 20 (0,0,3) and joint 30 (0,0,6).

(3) Joint 1 has the coordinates (4,3,-1) and uses direction cosine #2.

(4) Input of the joint coordinates is terminated.

b. Joint Direction Cosines These cards are used to input the joint direction cosines, which in turn define the joint coordinate system, JCS. Joint direction cosines are numbered from 1 to NCOS. This card is repeated NCOS times.

Vxi Vxj Vxk Vyi Vyj Vyk

Vxi Projection on the GCS X axis of a unit vector parallel to the JCS X axis.

Vxj Projection on the GCS Y axis of a unit vector parallel to the JCS X axis.

Vxk Projection on the GCS Z axis of a unit vector parallel to the JCS X axis.

Vyi Projection on the GCS X axis of a unit vector parallel to the JCS Y axis.

Vyj Projection on the GCS Y axis of a unit vector parallel to the JCS Y axis.

Vyk Projection on the GCS Z axis of a unit vector parallel to the JCS Y axis.

c. Joint Restraints These cards are used to define the joint restraints. This card is repeated NSUPT times.

ID	ITX	ITY	ITZ	IRX	IRY	IRZ	IGEN	ΔID			

ID Joint identification number. An ID of zero indicates <u>that</u> all the joints are restrained by this card.

ITX Restraint flag for translation in the JCS X direction.

ITY Restraint flag for translation in the JCS Y direction.

ITZ Restraint flag for translation in the JCS Z direction.

IRX Restraint flag for rotation about the JCS X axis.

IRY Restraint flag for rotation about the JCS Y axis.

IRZ Restraint flag for rotation about the JCS Z axis.

IGEN Number of additional joints, with the same restraints, to be generated from this joint.

 ΔID Increment between the generated ID number and the last ID number.

- Valid joint restraint flags are:
- 0 Free or unrestrained degree of freedom.
- 1 Restrained degree of freedom.
- 2 Restrained degree of freedom. A restraint flag of 2 forces the program to assign the dof a higher number. This option can be used to reduce the band-width of the stiffness matrix.

Example NSUPT=2 Note

- (1) Rotation about the JCS Z axis of all joints is restrained.
- (2) Joint 1 has all six dofs restrained.

d. <u>Joint Condensation</u> These cards are used to identify which dof are condensed. This card is repeated NCOND times and is omitted if NCOND equals zero.

ID ITX ITY ITZ IRX IRY IRZ IGEN AID

- ID Joint identification number. An ID of zero indicates <u>that</u> all joints are affected by this card.
- ITX Condensation flag for translation in the JCS X direction.
- ITY Condensation flag for translation in the JCS Y direction.
- ITZ Condensation flag for translation in the JCS Z direction.
- IRX Condensation flag for rotation about the JCS X axis.
- IRY Condensation flag for rotation about the JCS Y axis.
- IRZ Condensation flag for rotation about the JCS Z axis.
- IGEN Number of additional joints, with the same condensation, to be generated from this

joint.

 ΔID Increment between the generated ID number and the last ID number. Valid condensation flags are:

0 Degree of freedom is not condensed.

1 Degree of freedom is condensed. Condensation of a restrained dof is ignored.

Example NCOND=1

30 0 0 0 1 1 1 0 0

Rotations of joint 30 are condensed. If the Z axis rotation had been previously restrained, only the X and Y axis rotations are condensed.

e. Joint Constraints These cards are used to identify which dof are constrained. This card is repeated NCONST times, and omitted if NCONST equals zero.

ITYPE MASTER ISLAVE IGEN AID

ITYPE Type of constraint.

- 0 Rigid body constraint. A rigid body constraint transfers all six joint dof from the slave to the master joint.
- 1 XY-planar constraint. An XY-planar constraint transfers the joint's JCS X and Y axes translational dof and the joint's JCS Z axis rotational dof from the slave to the master joint.

MASTER Joint identification number of the master joint.

ISLAVE Joint identification number of the slave joint.

IGEN Number of additional slave joints, constrained to the same master joint to be generated.

 ΔID Increment between the generated ID number and the previous ID number.

Note Both the slave and master joint must have the same joint direction cosine number (ICOS).

Example NCONST=1

Joint 20 is constrained in the JCS XY-plane to joint 10.

2. <u>Materials and Hysteresis Model Information</u> These cards are used to input the material and hysteresis model information. The first card is input once. The second card is repeated NMAT times.

NMAT				
TYPE	VALUE1	VALUE2		

NMAT Number of materials input.

- TYPE Material type. Valid types are discussed below. Character variable; enclose in single quotes.
- VALUEi Input required by a given material type. The values for each TYPE are discussed below. (real or integer)

Notes on material - element compatibility

- 1) Individual elements may not use all the information provided by a given material.
- 2) A given material may not be compatible with all the elements. For example, the Takeda hysteresis model may not be used with the elastic prismatic beam element. Compatible materials for each element are specified under element input.
 - a. <u>TYPE='3D-BEAM'</u> Material data for an elastic 3D-beam.

'3D-BEAM' E G AX AY AZ J IY IZ

- E Young's modulus. (force/length²)
- G Shear modulus. $(force/length^2)$
- AX Cross sectional area. (length²)
- AY Y axis shear area. $(length^2)$
- AZ Z axis shear area. (length²)

- J Torsional moment of inertia. (length⁴)
- IY Moment of inertia, about the Y axis. (length⁴)
- IZ Moment of inertia, about the Z axis. (length⁴)

b. <u>TYPE='AXLMOD'</u> AXLMOD axial hysteresis model for reinforced concrete as shown in Figures 2 and 3.

'AXLMOD' KC KT KT2 Fy α β μ f β DI

- Ks Compression stiffness of a unit length member (force/length).
- Kt Pre-yielding tensile stiffness of a unit length member (force/length).
- Kt2 Post-yielding tensile stiffness of a unit length member (force/length).
- Fy Yield force (force).
- α Unloading coefficient, usually 0.90.
- β Pinching coefficient, usually 0.20.
- μf Failure ductility.
- β DI Parameter for Ang's damage index discussed in Appendix B (1).

Stiffness terms Kc, Kt, and Kt2 are real variables and may contain a decimal point.

c. <u>TYPE='BEND1'</u> Material data for the B1 hysteresis model. Figure 4 shows the B1 which was developed to model the bending behavior of reinforced concrete shear walls. Figure 5 shows the input for the backbone curve.

'BEND1' NSEG	NI DY	βDI
P(1) P(2)	P(NSEG)	
D(1) D(2)	D(NSEG)	

NSEG Number of points on the backbone curve.

- NI Number of small amplitude loop reversal points that can be stored by the program at one time, usually 10.
- DY Rotation of a unit length member, corresponding to the yield point. Used to define the

ductility ratio. (radian/length)

- β DI Parameter for Ang's damage index discussed in Appendix B (1).
- P(i) Moment of a point on the backbone curve. (force*length)
- D(i) Rotation of a point on the backbone curve, where the rotation is based on a unit length member. (radian/length)

d. <u>TYPE='SHEAR1'</u> Material data for the S1 hysteresis model. Figure 6 shows the S1 which was developed to model the shear deformation of reinforced concrete shear walls. Figure 5 shows the input for the backbone curve.

' SHEA	R1'	NSEG	NI	DY	β DI		
P(1)	P(2)		P(NSEG)				
D(1)	D(2)		D(NSEG)		-		-

NSEG Number of points on the backbone curve.

- NI Number of small amplitude loop reversal points that can be stored by the program at one time, usually 10.
- DY Shear deformation of a unit length member, corresponding to the yield point. Used to define the ductility ratio. (length/length)
- β DI Parameter for Ang's damage index discussed in Appendix B (1).
- P(i) Shear of a point on the backbone curve. (force)
- D(i) Shear deformation of a point on the backbone curve where shear deformation is based on a unit length member. (length/length)

e. <u>TYPE='TAKEDA'</u> Material data for the TAKEDA hysteresis model. Figure 7 shows the TAKEDA which was developed to model the bending deformations in reinforced concrete members.

' TAKEDA '	ΕI	РC	DC	PY	DY	PU	DU	etadi	
------------	----	----	----	----	----	----	----	-------	--

EI Initial bending stiffness of the member (force/rad)

PC Cracking moment. (force*length)

- DC Cracking rotation for a unit length member. (radian/length)
- PY Yield moment. (force*length)
- DY Yield rotation for a unit length member. (radian/length)
- PU Ultimate moment. (force*length)
- DU Ultimate rotation, for a unit length member. (radian/length)
- β DI Parameter for Ang's damage index discussed in Appendix B (1).

f. <u>TYPE='BILINEAR'</u> Figure 8 shows the bilinear hysteresis model.

'BILINEAR' E PY SIE $\mu f \beta$ DI

- E Elastic stiffness. (force/length)
- PY Yield load. (force)
- SIE Inelastic stiffness. (force/length)
- μf Failure ductility.
- β DI Parameter for Ang's damage index discussed in Appendix B (1).

g. <u>TYPE='BRACE'</u> Figure 9 shows the bracing member hysteresis model.

'BRACE' E A R YS SHAPE μ f β DI

- E Elastic modulus. (force/length²)
- A Section area. (length²)
- R Ratio of gyration. (length²)
- YS Yielding stress. (force/length²)
- SHAPE Member cross section shape:
 - 1 For box or equal-leg angle section
 - 2 For I-shape section
- μf Failure ductility.
- β DI Parameter for Ang's damage index discussed in Appendix B (1).

h. <u>TYPE='LONG-OWJG'</u> Figure 10 shows Pino-Suarez Tower long-direction girder

hysteresis model.

TOUG-OUDG IN AN AL DDI				
------------------------	--	--	--	--

- HA First buckling displacement. (radius)
- VA First buckling load. (force*length)
- μf Failure ductility (if $\mu f < 1$, then failure ductility is not considered).
- β DI Parameter for Ang's damage index = 0 (currently not available). Discussed in Appendix B (1).
 - i. <u>TYPE='IA-BILN'</u> Figure 8 shows this bilinear hysteresis model.

'IA-BILN'	ELAS	SP	Ε	ΤI	TMP	μf	βDI	 	1
REDUCE									

- ELAS Index for elastic or nonlinear analysis:
 - 0 For elastic material property.
 - 1 For bilinear material property.
 - 2 For box column with consideration of local buckling (18).
 - 3 Same as ELAS=1, but strength criteria of box column is checked.
- SP Strain hardening ratio.
- E Elastic modulus.
- TI Section area, torsional rigidity, or moment of inertia.
- TMP Axial yielding load, torsional yielding load, or plastic moment.
- μf Failure ductility (if $\mu f < 1$, then failure ductility is not considered).
- β DI Parameter for Ang's damage index=0 (currently not available), discussed in Appendix B.

REDUCE Percentage of critical load, (if ELAS $\neq 2$, then omit this data input).

j. <u>TYPE='SHORT-OWJG'</u> Figure 11 shows Pino-Suarez Tower short-direction girder hysteresis model.

'SHORT-OWJG' HA VA RATIO $\mu f \beta DI$

HA First buckling displacement. (radius)

VA First buckling load. (force*length)

RATIO Strain hardening ratio.

- μf Failure ductility (if $\mu f < 1$, then failure ductility is not considered).
- β DI Parameter for Ang's damage index=0 (currently not available), discussed in appendix B.
 - k. <u>TYPE='STABILITY'</u> Material properties for finite-segment element.

'STABILITY' NSEG YS EM LIBN HH UU WW ZZ INEB INEH ST IREV1 IREV2 IREV3 IREV4 IECOP SMALL RATIX0 RATIY0 TOTA IAUTO IMATER RATIO3 IR G QRNEE ISTIF

NSEG	Number of	of segments	considered.	Maximum	number	of	NSEG	is	32.

- YS Material yielding stress. (force/length²)
- EM Elastic modulus.
- LIBN Cross section library number.
 - 1 Box section.
 - 2 Tube (one layer) section.
 - 3 Rectangular section.
 - 4 Wide-flange section.
 - 6 Tube (two layer) section.
 - 7 Equal leg angle section.
- HH Height for LIBN=1, 3, 4.Radius of tube for LIBN=2, 6.Angle leg length for LIBN=7.
- UU Width for LIBN=1, 3, 4. Dummy variable for LIBN=2, 6. Dummy variable for LIBN=7.

WW	U direction eccentricity from section reference coordinate origin to applied load
	location.
ZZ	V direction eccentricity from section reference coordinate origin to applied load
	location.
INEB	Total number of section elements in half width for LIBN = $1, 3$.
	Web thickness for LIBN=4.
	Total number of section elements in one quarter of a circle for LIBN = 2, 6.
	Dummy variable for LIBN=7.
INEH	Total number of section elements in half height for LIBN = 1, 3.
	Dummy variable for LIBN=2, 4, 6, and 7.
ST	Thickness for LIBN=1, 2, 6, and 7; flange thickness for LIBN=4 (length).
IREV1	IREV1 = 1 for LIBN = 1.
	Dummy variable for LIBN=2, 3, and 6.
	Number of rows in flange's U direction for LIBN=4.
	Number of columns in segment U direction for $LIBN = 7$.
IREV2	Dummy variable for LIBN = 1, 2, 3, and 6.
	Number of columns in flange's U direction for LIBN=4.
	Number of rows in segment U direction for $LIBN = 7$.
IREV3	Dummy variable for LIBN = 1, 2, 3, and 6.
	Number of columns in web's V direction for LIBN=4.
	Number of rows in segment V direction for LIBN=7.
IREV4	Dummy variable for LIBN = 1, 2, 3, and 6.
	Number of rows in web's V direction for $LIBN = 4$.
	Number of columns in segment V direction for LIBN=7.
IECOP	0 Eccentricity is not considered.
	1 Eccentricity is considered.
	<u>Note</u> If IECOP=0, WW and ZZ are ignored by program.
SMALL	Length of segments at two ends and center right and left sides.
RATIX0	Initial imperfection ratio in element coordinate X direction.
RATIY0	Initial imperfection ratio in element coordinate Y direction.
ΤΟΤΑ	Section gross area. (length ²)
	·

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.

- IAUTO 1 Element stiffness parameter and displacement norm are calculated.
 - 0 Element stiffness parameter and displacement norm are not calculated.
- IMATER 0 For bilinear stress-strain model shown in Figure 8.
 - 2 For Ramberg-Osgood stress-strain model.
 - 3 For elastic case.

RATIO3 Finite-segment element strain hardening ratio.

IR Parameter for Ramberg-Osgood stress-strain model.

G Shear modulus.

QRNEE Limitation of maximum displacement norm. (10⁻² to 10⁻⁵)

ISTIF Segment stiffness formulation index:

- 0 Exact approach.
- 1 Approximated approach.

<u>Note</u> Failure ductility and parameter for Ang's damage index are not considered.

1. <u>TYPE='SHEAR2'</u> Material data for the perforated shear wall hysteresis model.

'SHEAR2' NSEG	βDI
P(1) P(2) P(3	P(4)
D(1) D(2) D(3	D(4)
HO HS LWP AD	AV

NSEG Number of points on the backbone curve.

 β DI Parameter for Ang's damage index, discussed in Appendix B (1). β DI set to 0.4.

P(i) Total lateral force of a point on the backbone curve. (force*length)

D(i) Combined bending and shear deformation of a point on the backbone curve. (force*length)

HO Height of the opening. (see Figure 25(a))

HS Distance from the acting point to the bottom of the wall, usually called the shear span length. (see Figure 25(a))

LWP Ratio of the height of the opening to the width between the edge of the wall and the edge of the opening. LWP = L'/W'. (see Figure 25(a))

AD Cross-sectional area of the diagonal bar. (see Figure 25(a))

AV Cross-sectional area of the vertical bar. (see Figure 25(a))

3. <u>Geometric Stiffness Data</u> This card, used to determine the type of geometric stiffness in the analysis, is input once.

KGLOAD KGTYPE KGFORM KGCOND

KGLOAD Type of axial force used to calculate the geometric stiffness.

- 0 Geometric stiffness is omitted.
- 1 Axial force is equal to input force, magnified by ground acceleration in the global Z direction, if applicable.
- 2 Internal element force of the previous load step, used to generate the geometric stiffness.

KGTYPE Type of geometric stiffness formulation.

- 0 Geometric stiffness is omitted.
- 1 A 'lumped parameter' formulation is used for the element geometric stiffness.
- 2 A 'consistent parameter' formulation is used for the element geometric stiffness. If a consistent parameter formulation for an individual element is not available, the lumped parameter formulation is used. Refer to individual element specifications for applicability.

KGFORM Form of the geometric stiffness used.

- 0 Geometric stiffness is omitted.
- 1 Geometric stiffness is subtracted from structural stiffness.
- 2 Separate structural stiffness and geometric stiffness matrices are formed. Refer to individual solution for applicability.
- KGCOND A logical flag. If KGCOND=.TRUE., the geometric stiffness matrix is condensed when applicable. Logical variable.

4. <u>Element Data</u> These cards are used to define the elements. Elements are numbered by the program in the order they are input from 1 to NELMT. Element numbers are used to identify elements in the output. The first card is input once. Second and third cards (if used) are

repeated until 1) NELMT elements are input, or 2) a TYPE='END' is encountered. The third card follows each second card with a value of IGEN > 1.

NELMT				
TYPE NAME	VALUE1	VALUE2	 	IGEN
ΔVALUE1 Δ	VALUE2 .	• •		

NELMT	Number of elements input.
TYPE	Element type. Valid types are discussed below. Character variable; enclose in
	single quotes.
NAME	A user defined name. Character variable; enclose in single quotes.
VALUEi	Input required by a given element type. Values for each TYPE are discussed
	below. (real or integer)
IGEN	Number of additional elements to be generated from this element.
∆VALUEi	Incremental value used to generate subsequent elements.
	$VALUEi_{generated} = VALUEi_{previous} + \Delta VALUEi$

a. <u>TYPE='3D-BEAM'</u> This card is used to define element data for the elastic prismatic 3D-beam shown in Figure 15.

ά3D	-BEA	M'I	NAME	MAT	JOINTI	JOINTJ	٧ı	v2	V3	
XS	XE	PKG	IRE	LT I	GEN					

NAME A user defined name. Character variable; enclose in single quotes.

MAT Material number. This number must correspond to the material type '3D-BEAM'. The terms EAX, GJ, EIY and EIZ from material '3D-BEAM' are used to generate the element stiffness.

JOINTI Start joint ID number.

JOINTJ End joint ID number.

V1 Projection on the GCS X axis of a vector in the element's local XY plane. This vector defines the orientation of the element's local Y axis.

V2 Projection on the GCS Y axis of a vector in the element's local XY plane.

- V3 Projection on the GCS Z axis of a vector in the element's local XY plane.
- XS Offset distance from the start joint to the beginning of the element. Positive in the direction of the element's local X axis. (length)
- XE Offset distance from the end joint to the end of the element. Negative in the direction of the element's local X axis. (length)
- PKG Axial load used to calculate the geometric stiffness, if KGLOAD = 1. (force) Positive is compression.
- IRELT A six-digit release code that is used to release the rotational dof at both ends of the element. A nonzero value of the i'th digit signifies a released dof. <u>DIGIT</u>
 - 1 Releases the moment about the element's X axis at the start joint.
 - 2 Releases the moment about the element's Y axis at the start joint.
 - 3 Releases the moment about the element's Z axis at the start joint.
 - 4 Releases the moment about the element's X axis at the end joint.
 - 5 Releases the moment about the element's Y axis at the end joint.
 - 6 Releases the moment about the element's Z axis at the end joint.

IGEN Element generation parameter. See discussion under 'Element Data'.

b. <u>TYPE='SPRING'</u> This card is used to define element data for the one-dimensional spring shown in Figure 16.

,	SPI	RING	' I	NAME	MAT	JOINTI	JOINTJ	KTYPE	XLEN	V1	V2	_
V	73	XS	XE	IGE	N						-	

NAME A user-defined name. Character variable; enclose in single quotes.

MAT Material number.

JOINTI Start joint ID number.

JOINTJ End joint ID number.

KTYPE Type of spring.

- 1 Axial spring.
- 2 Shear spring in the element's local Y axis.
- 3 Shear spring in the element's local Z axis.

- 4 Torsional spring.
- 5 Rotational spring about the element's local Y axis.
- 6 Rotational spring about the element's local Z axis.

XLEN Length of the spring used to calculate the stiffness. (length)

- V1 Projection on the GCS X axis of a vector in the spring's local XY plane. This vector defines the orientation of the element's local Y axis.
- V2 Projection on the GCS Y axis of a vector in the spring's local XY plane.
- V3 Projection on the GCS Z axis of a vector in the spring's local XY plane.
- XS Offset distance from the start joint to the beginning of the spring. Positive in the direction of the element's local X axis. (length)
- XE Offset distance from the end joint to the end of the spring. Negative in the direction of the element's local X axis. (length)

IGEN Element generation parameter. See discussion under 'Element Data'.

<u>Notes</u>

- 1) Material specified for the spring element may consist of any of the following: 3D-BEAM, AXLMOD, BEND1, SHEAR1, TAKEDA, and ELSPLS.
- 2) Spring uses the axial stiffness from the 3D-BEAM material.
- 3) BEND1 and TAKEDA models are usually based on moment-rotation, (KTYPE=4 to KTYPE=6) but they can be used as translational springs (KTYPE=1 to KTYPE=3) by changing the material input from moment-rotation to force-translation.
- AXLMOD and SHEAR1 models are usually based on force-translation, and are valid models for KTYPE=1 to KTYPE=3.
- 5) Program does not check the user's choice of model.
- 6) If the distance between the start and end joints is zero, the spring is oriented such that the ECS is parallel to the start joints JCS.
- 7) Spring stiffness is for axial (force/length), lateral (force/length), torsional (force-length/rad) and rotational (force-length/rad) springs. For a given spring stiffness a, we need input E, A and XLEN of which the numbers are arbitrary and mainly to have the equivalence of a=EA/XLEN. Normally use E and A the same as the member properties and adjust XLEN.

c. <u>TYPE='SHEAR WALL'</u> This card is used to define element data for the reinforced concrete shear wall shown in Figure 20.

'SHEAR WALL'	NAME	MATB	MATS	MATA	J1	J2	J3	J4	ALPHA
PKG IGEN									

- NAME A user-defined name. Character variable; enclose in single quotes.
- MATB Bending hysteresis model material number.
- MATS Shear hysteresis model material number.
- MATA Axial hysteresis model material number.
- J1 Joint at the upper right-hand corner of the element.
- J2 Joint at the upper left-hand corner of the element.
- J3 Joint at the lower left-hand corner of the element.
- J4 Joint at the lower right-hand corner of the element.
- ALPHA Fraction of the length from the top of the element to the internal springs.
- PKG Axial load used to calculate the geometric stiffness, if KGLOAD=1. Positive is compression. (force)
- IGEN Element generation parameter. See discussion under 'Element Data'.
- <u>Notes</u>
- 1) Material specified for the shear wall element may consist of any of the following: 3D-BEAM, AXLMOD, BEND1, SHEAR1, TAKEDA, and ELSPLS.
- 2) BEND1 model is usually specified for the bending material.
- 3) SHEAR1 model is usually specified for the shear material.
- 4) AXLMOD model is usually specified for the axial material.
- 5) 3D-BEAM material's axial stiffness is used for the spring's stiffness if the 3D-BEAM material is specified.

Example

Note

5	(1)
'3D-BEAM' 'A1' 1 10 20 0. 0. 1. 0. 0. 0. 100000 2	(2, 3)
0 10 10 0. 0. 0. 0. 0. 0. 000000	(3)
'SPRING' 's1' 2 10 11 1 0. 0. 0. 1. 0. 0. 0	(4)
'SHEAR WALL' 'W1' 3 4 5 20 10 1 2 1. 35. 0	(5)

<u>Notes</u>

(1) Five elements are to be input.

- (2) A 3D-beam is input between joints 10 and 20.
- (3) Two more 3D-beams are generated from the first beam.
- (4) An axial spring is input between joints 10 and 11.
- (5) A shear wall element is input between joints 20, 10, 1 and 2.
 - d. <u>TYPE='BRACE'</u> This card is used to define element data for the bracing member.

	BRACE' IGEN	NAME	MAT	JOINTI	JOINTJ	KTYPE	SLK	V1	V2	V3	XS	XE
NAME	E Ause	er-defined	name.	Character	variable; en	close in si	ngle c	luote	es.			
MAT	Modi	fied Goel	's hyste	resis mode	l number.							
JOINT	I Start	joint ID 1	number									
JOINT	J Endj	oint ID n	umber.									
KTYP	E Equal	to 1.										
SLK	K fac	tor for sl	enderne	ss ratio.								
V 1	Proje	ction on t	the GCS	S X axis of	f a vector in	the mem	ber's	XY	plan	e.T	his v	vector
	define	es the ori	entation	of the elem	ment's local	Y axis.						
V2	Proje	ction on t	the GCS	S Y axis of	a vector in	the memb	er's Z	ΧY ϝ	olane	•		
V3	Proje	ction on t	the GCS	SZ axis of	a vector in	the memb	er's X	(Y p	lane	•		
XS	Offse	t distance	from	the start jo	int to the b	eginning	of the	stru	it. I	Posit	ive i	n the
	direct	ion of the	e eleme	nt's local 3	K axis. (leng	;th)						
XE	Offse	t distance	from t	he end join	t to the end	of the str	ut. N	egat	ive i	n the	e dire	ection
	of the	e element	's local	X axis. (le	ength)							
IGEN	Elem	ent gener	ation pa	rameter.	See discussion	on under '	Eleme	ent I	Data'	•		
<u>Notes</u>												
1) S	tiffness of	the braci	ng men	nber is base	ed on the 'B	RACE' m	ateria	l onl	у.			
2) C	Cross sectio	on of the	bracing	g member o	could be boy	k, angle,	or wie	le fl	ange	sect	tions	. The
el	element may not be applied to other cross sections.											

e. <u>TYPE='IE3DBEAM'</u> This card is used to define element data for the inelastic 3D-beam-column element.

'IE3DBEAM' NAME MATMYA MATMYB MATMZA MATMZB MATMXA MATFXA JOINTI JOINTJ V1 V2 V3 XS XE PKG IGEN

NAM	1E	A user-defined name. Character variable; enclose in single quotes.
MAT	ГМҮА	Bending hysteresis material number at the start joint in element's local Y axis.
MAT	ſMYB	Bending hysteresis material number at the end joint in element's local Y axis.
MAT	ſMZA	Bending hysteresis material number at the start joint in element's local Z axis.
MAT	ſMZB	Bending hysteresis material number at the end joint in element's local Z axis.
MAT	ГМХА	Torsional hysteresis material number at the start joint in element's local X axis.
MAT	ſFXA	Element axial hysteresis material number.
JOIN	ITI	Start joint ID number.
JOIN	ITJ	End joint ID number.
V1		Projection on the GCS X axis of a vector in the member XY plane. This vector
		defines the orientation of the element's local Y axis.
V2		Projection on the GCS Y axis of a vector in the member's XY plane.
V3		Projection on the GCS Z axis of a vector in the member's XY plane.
XS		Offset distance from the start joint to the beginning of the element. Positive in
		the direction of the element's local X axis. (length)
XE		Offset distance from the end joint to the end of the element. Negative in the
		direction of the element's local X axis. (length)
PKG	ì	Axial load used to calculate the geometric stiffness, if $KGLOAD=1$. (force)
		Positive is compression.
IGE	N	Element generation parameter. See discussion under 'Element Data'.
<u>Note</u>	<u>>s</u>	
1)	Bending	materials specified for inelastic 3D beam element may consist of any of the
	followin	g: LONG-OWJG, IA-BILN, SHORT-OWJG, and TAKEDA.

- 2) Bending hysteresis material number at the start joint in the element's local Y axis should be same as that at the end joint in the element's local Y axis.
- 3) Bending hysteresis material number at the start joint in the element's local Z axis should be same as that at the end joint in the element's local Z axis.
- 4) IA-BILN model is specified for the torsional and axial materials.

f. <u>TYPE='STABILITY'</u> This card is used to define element data for the finite-segment element.

STABILITY' NAME MAT JOINTI JOINTJ V1 V2 V3 XS XE IGEN

NAME A user-defined name. Character variable; enclose in single quotes.

MAT Material number.

- JOINTI Start joint ID number.
- JOINTJ End joint ID number.
- V1 Projection on the GCS X axis of a vector in the member's XY plane. This vector defines the orientation of the element's local Y axis.
- V2 Projection on the GCS Y axis of a vector in the member's XY plane.
- V3 Projection on the GCS Z axis of a vector in the member's XY plane.
- XS Offset distance from the start joint to the beginning of the element. Positive in the direction of the element's local X axis. (length)
- XE Offset distance from the end joint to the end of the element. Negative in the direction of the element's local X axis. (length)
- IGEN Element generation parameter. See discussion under 'Element Data'.

<u>Note</u> STABILITY material model is specified for this element.

g. <u>TYPE='SHEAR-OPEN'</u> This card is used to define element data for the perforated reinforced concrete shear wall.

'SHEAR-OPEN' NAME MATS MATA1 MATA2 J1 J2 J3 J4 ALPHA PKG IGEN

NAME A user-defined name. Character variable; enclose in single quotes.

MATS Perforated shear wall hysteresis model material number.

- MATA1 Axial hysteresis model material number for left-side wall.
- MATA2 Axial hysteresis model material number for right-side wall.

J1 Joint at the upper right-hand corner of the element.

- J2 Joint at the upper left-hand corner of the element.
- J3 Joint at the lower left-hand corner of the element.
J4 Joint at the lower right-hand corner of the element.

ALPHA Fraction of the length from the top of the element to the internal springs.

PKG Axial load used to calculate the geometric stiffness, if KGLOAD=1. Positive is compression. (force)

IGEN Element generation parameter. See discussion under 'Element Data'.

- <u>Notes</u>
- 1) SHEAR2 model is usually specified for the combined bending and shear material.
- 2) AXLMOD is usually specified for the axial material.

5. <u>Mass</u> These cards are used to input lumped masses at the joints. The first card is input once. The second card is repeated INMASS times, or until a joint ID \leq 0 is encountered. If INMASS is less than one, or FMASS is zero, omit the second card.

INMAS	s :	FMAS	S MC	OND						
ID PX	PY	PX	RXX	RYY	RZZ	RXY	RXZ	RYZ	IGEN	ΔID

INMASS Number of mass cards to be read.

FMASS	Mass	flag.	
-------	------	-------	--

- 0 Mass matrix is omitted.
- 1 Mass matrix due to concentrated joint masses is formed.
- MCOND A logical flag. If MCOND=.TRUE., the mass matrix is condensed when applicable. Logical variable.
- ID Identification number of the joint.
- PX Translational mass in the joint's JCS X direction. (mass)
- PY Translational mass in the joint's JCS Y direction. (mass)
- PZ Translational mass in the joint's JCS Z direction. (mass)
- RXX Rotational mass moment of inertia about the joint's JCS X axis. (mass*length²)
- RYY Rotational mass moment of inertia about the joint's JCS Y axis. (mass*length²)
- RZZ Rotational mass moment of inertia about the joint's JCS Z axis. (mass*length²)
- RXY Rotational mass product of inertia about the joint's JCS XY axis. (mass*length²)
- RXZ Rotational mass product of inertia about the joint's JCS XZ axis. (mass*length²)
- RYZ Rotational mass product of inertia about the joint's JCS YZ axis. (mass*length²)

IGEN Number of joints with identical mass, to be generated.

 ΔID Increment of joint ID number for generated values.

Example INMASS=1, FMASS=1,

Joint 10 has a translational mass of 8.0 in the X, Y and Z directions.

6. <u>Damping</u> This card is used to input proportional damping data.

ALPHA BETA

ALPHA Proportional damping coefficient for mass.

BETA Proportional damping coefficient for stiffness.

B. SOL01 - ELASTIC STATIC SOLUTION

This is an elastic solution with multiple load cases. The following cards are input once.

'SOL01	,	 _			
TITLE					
NLOAD	MAXELD				

SOL01 Signifies solution 1. Character variable; enclose in single quotes.

TITLE User input title, 80 characters maximum. Character variable; enclose in single quotes.

NLOAD Number of load cases.

MAXELD Maximum number of element loads.

<u>Notes</u>

 Condensation increases the band-width of the stiffness matrix for SOL01 without any other benefits. Condensation is not recommended for SOL01.

- A separate geometric stiffness (KGFORM=2) is not used by SOL01. The geometric stiffness may be included by using KGFORM=1.
- 3) If the geometric stiffness is included, the element axial loads must be input (KGLOAD=1).

1. Joint Loads These cards are used to apply loads to joints. Loads applied to restrained joints are considered as displacements, yielding, support settlement or displacement control solutions. Loads applied to constrained joints are transferred to their 'master' joints. If the 'master' joint is restrained, loads transferred to restrained dof are considered as displacements. Joint loads are cumulative. Applying two loads to the same joint results in the sum of the joint loads being considered. The following card is repeated until the value of DIR is 'END'.

LOAD ID IGEN AID DIR VALUE

- LOAD Number of the load case that the load is applied to.
- ID Joint ID number that the load is applied to.
- IGEN Number of identical joint loads to be generated.
- ΔID Increment of joint ID number for generated values.
- DIR Direction of load in the joint coordinate system. Valid directions and the units of VALUE are given below. Character variable; enclose in single quotes.
 - 'FX' Applied force in the joint's JCS X direction. (force)
 - 'FY' Applied force in the joint's JCS Y direction. (force)
 - 'FZ' Applied force in the joint's JCS Z direction. (force)
 - 'MX' Applied moment about the joint's JCS X axis. (force*length)
 - 'MY' Applied moment about the joint's JCS Y axis. (force*length)
 - 'MZ' Applied moment about the joint's JCS Z axis. (force*length)
 - 'END' Terminate the input of element loads.
- VALUE Magnitude of the applied load.

Example

1 2 2 1 'FZ' -3.00	(1)
2 7 0 0 'MX' 33.5	(2)
0000'END'0	(3)

Note

<u>Notes</u>

- (1) Joints 2, 3, and 4 have an applied force of -3.00 in the Z direction for load case 1.
- (2) Joints 7 has an applied moment of 33.50 in the X direction for load case 2.
- (3) Joint loading input is terminated.

2. <u>Element Loads</u> Cards here are used to apply element loads to the '3D-BEAM' element at the portion of the beam between points A and B (see Figure 15 in the ECS). These loads are transferred by the program to the start and end joints. The card below is included only if MAXELD > 0. This card is repeated MAXELD times, or until the value of TYPE is 'END'.

LOAD IELE IGEN AIELE TYPE DIR VALUE1, VALUE2, ...

- LOAD Load case number.
- IELE Element number.
- IGEN Number of similar element loads to be generated.
- Δ IELE Increment of element number for generated values.
- TYPE Type of load. Valid types are described in detail below. Character variable; enclose in single quotes.
 - 'CONC' Concentrated load applied in direction DIR. VALUE1 is the magnitude of the load (force or force*length). VALUE2 is the ratio of the distance to the load, divided by the flexible length of the member. Distance is measured from the beginning of the flexible length at the member's start end. VALUE2 is between 0 and 1. Only two values are input.
 - 'UNIF' Uniform load applied in direction DIR. VALUE1 is the magnitude of the load. Only one value is input. (force/length)
 - 'FEM' Input the fixed end forces on the end of the member. DIR is not used and may be set to any value. VALUE1 to VALUE12 are required.
 - VALUE1 Fixed end axial force, at point A of Figure 15, in the ECS X direction. (force)
 - VALUE2 Fixed end shear, at point A of Figure 15, in the ECS Y direction. (force)
 - VALUE3 Fixed end shear, at point A of Figure 15, in the ECS Z

direction. (force)

VALUE4	Fixed end torsion, at point A of Figure 15, about the ECS
	X axis. (force*length)

- VALUE5 Fixed end moment, at point A of Figure 15, about the ECS Y axis. (force*length)
- VALUE6 Fixed end moment, at point A of Figure 15, about the ECS Z axis. (force*length)
- VALUE7 Fixed end axial force, at point B of Figure 15, in the ECS X direction. (force)
- VALUE8 Fixed end shear, at point B of Figure 15, in the ECS Y direction. (force)
- VALUE9 Fixed end shear, at point B of Figure 15, in the ECS Z direction. (force)
- VALUE10 Fixed end torsion, at point B of Figure 15, about the ECS X axis. (force*length)
- VALUE11 Fixed end moment, at point B of Figure 15, about the ECS Y axis. (force*length)
- VALUE12 Fixed end moment, at point B of Figure 15, about the ECS Z axis. (force*length)
- 'END' Terminate the input of element loads.
- DIR Direction of load in element coordinate system. Valid directions given below. Character variable; enclose in single quotes.
 - 'FX' Axial load is applied.
 - 'FY' Force is applied in the local element's Y direction.
 - 'FZ' Force is applied in the local element's Z direction.
 - 'MX' Torque is applied.
 - 'MY' Moment is applied about the local element's Y axis.
 - 'MZ' Moment is applied about the local element's Z axis.

VALUEi Values used to calculate the element loads.

<u>Notes</u>

1) Multiple loads may be put on a single element.

- 2) 'UNIF' 'MY' and 'UNIF' 'MZ' are not available.
- 3) Element load TYPE='FEM' is not modified to reflect member end releases.

<u>Example</u> MAXELD=1,

1 13 0 0 'UNIF' 'FZ' -3.00

Element 13 has a uniform load of -3.00 applied in the element's local Z direction for load case 1.

C. SOL02 - DYNAMIC SOLUTION BY NUMERICAL INTEGRATION

This is a dynamic solution of the structure subject to ground accelerations. Both elastic and nonlinear behavior can be modeled. The following cards are input once.

'SOL02'	
TITLE	
INTEG THE	TA ELASTIC UNBAL
IPRINT IW	RITE MAXACC SLMASS
το Δτ τγ	GRAV

- SOL02 Signifies solution 2. Character variable; enclose in single quotes.
- TITLE User input title, 80 characters maximum. Character variable; enclose in single quotes.
- INTEG Type of numerical integration used. Valid values of INTEG are given below. Character variable; enclose in single quotes.

'LINEAR' Linear acceleration method is used.

'AVERAGE' Average acceleration method is used.

'WILSON' Wilson theta method is used.

THETA Value of theta used by Wilson theta method. Set THETA=0 if the Wilson theta method is not used.

- ELASTIC A logical flag. If ELASTIC = .TRUE., the structure is assumed to behave elastically. Logical variable.
- UNBAL A logical flag. If UNBAL=.TRUE., the unbalanced loads from the preceding step are added to the current dynamic loads for nonlinear analysis. Logical variable.
- IPRINT Step increment for printed output.
- IWRITE Step increment for data written to output files.
- MAXACC Maximum number of points in each ground acceleration record.
- SLMASS A logical flag. If SLMASS = . TRUE., a special mass matrix is input. This matrix is used with ground acceleration to generate loads. Logical variable.
- TO Initial time at the beginning of the solution. (time)
- ΔT Time step. (time)
- TF Final time at the end of the solution. (time)
- GRAV Gravitational acceleration constant. (length/sec²)

1. <u>Special Loading Mass</u> Cards here input the special loading mass matrix discussed in step 1 of Section C in Chapter II. If the special loading mass is input, the dynamic joint loads are ground acceleration times special loading mass. If the special loading mass is not input, the dynamic joint loads are ground acceleration times structural mass. The first card is input once. The second card is repeated INMASS times, or until an ID less than one is encountered. If INMASS is less than one, or FMASS is zero, omit the second card. Omit both cards if SLMASS=.FALSE..

INM	ASS	FMA	SS									
ID	PX	PY	PX	RXX	RYY	RZZ	RXY	RXZ	RYZ	IGEN	ΔID	

These cards are identical to the 'Mass' cards in the block STRUCT. Refer to STRUCT for a detailed description.

2. <u>Output Data to Disk Files</u> Cards control the data that is written to separate disk files. Such data is used to print reports and plot data. This card is repeated until the value of TYPE is 'END'.

TYPE NUMB IUNIT IGEN ANUMB AIUNIT

- TYPE Type of data to be written to output file. Valid types are given below. Character variable; enclose in single quotes.
 - 'DOF' Data is printed for a degree of freedom. The degree of freedom ID number, as assigned by the program, is used.
 - 'JOINT FX' Data is printed for the degree of freedom corresponding to the joint's JCS X translation.
 - 'JOINT FY' Data is printed for the degree of freedom corresponding to the joint's JCS Y translation.
 - 'JOINT FZ' Data is printed for the degree of freedom corresponding to the joint's JCS Z translation.
 - 'JOINT MX' Data is printed for the degree of freedom corresponding to the joint's JCS X rotation.
 - 'JOINT MY' Data is printed for the degree of freedom corresponding to the joint's JCS Y rotation.
 - 'JOINT MZ' Data is printed for the degree of freedom corresponding to the joint's JCS Z rotation.
 - 'ELE' Element data is printed.
 - 'ENERGY' Structure's energy balance is printed.
 - 'SUMRCT' Structure's summation of reactions is printed.
 - 'GROUND' Ground response is printed.
 - 'END' Terminate the input of element loads.
- NUMB Element, dof or joint number. Set NUMB=0 if TYPE='ENERGY'.
- IUNIT Output file unit number.
- IGEN Number of similar data groups to be printed.
- Δ NUMB Incremental element dof or joint number for generation.
- Δ IUNIT Incremental output file unit number for generation.

<u>Example</u>

'DOF' 5	10	000	(1)
'ELE' 32	11	111	(2)
'END' 0	0	000	(3)

<u>Notes</u>

- (1) Degree of freedom #5 data is written to file 10.
- (2) Element 32's data is written to file 11 and element 33's data is written to file 12.
- (3) Output requests are terminated.

3. <u>Initial Displacements, Velocities, Accelerations and Loads</u> This card, used to define initial conditions for dynamic analysis, repeated until OPTION has a value of 'END'.

ISP	1									 	
ID	IGEN	ΔID	OPTION	V1	V2	V3	V4	V5	V6	_	

ISP1	0 Response due to static loads is not considered.
	1 Response due to static loads is considered.
	<u>Note</u> If $ISP1=1$, omit the second input line.
ID	Joint ID number.

IGEN Number of joints with identical initial conditions.

 Δ ID Increment of the joint ID number for generation.

- OPTION Type of initial condition. Valid options are listed below. Character variable; enclose in single quotes.
 - 'DISPL' Initial displacements are given. V1, V2 and V3 are displacements (length) while V4, V5 and V6 are rotations (radians).
 - VEL' Initial velocities are given. V1, V2 and V3 are translational velocities (length/time) while V4, V5 and V6 are rotational velocities (radians/time).
 - 'ACC' Initial accelerations are given. V1, V2 and V3 are translational accelerations (length/time²) while V4, V5 and V6 are rotational accelerations (radians/time²).
 - 'LOA' Initial loads are given. V1, V2 and V3 are loads (force) while V4, V5 and V6 are moments (force*length).

- V1 Initial value of translation or force in the joint's JCS X direction.
- V2 Initial value of translation or force in the joint's JCS Y direction.
- V3 Initial value of translation or force in the joint's JCS Z direction.
- V4 Initial value of rotation or moment about the joint's JCS X axis.
- V5 Initial value of rotation or moment about the joint's JCS Y axis.
- V6 Initial value of rotation or moment about the joint's JCS Z axis.

<u>Notes</u>

- 1) If the acceleration at time TO is nonzero, initial conditions must be specified to ensure equilibrium.
- 2) Initial acceleration may be set equal to zero by one of the following methods.
 - a) Initial time at the beginning of the solution is equal to initial time of the acceleration record, (TO=TOG), set A(1) = 0.
 - b) Initial time at the beginning of the solution is less than initial time of the acceleration record, (TO < TOG), set A(1) $\neq 0$.
- 3) If the dynamic solution, SOL02, follows a static solution, SOL01, then the resulting displacements and element forces are automatically included as initial conditions for the dynamic solution. Results from the static solution may be excluded from the dynamic solution by releasing the memory between solutions.

Example	Note
2 2 1 'ACC' 3. 0 0 0 0 0	(1)
000'END' 000000	(2)

<u>Notes</u>

- (1) Joints 2, 3 and 4 have an initial acceleration of 3.0 in the X direction.
- (2) Initial conditions are terminated.

4. <u>Ground Acceleration Record.</u> Cards here are used to input the ground acceleration record and its orientation. The cards below are input once.

NA	ASCALE	TOG	ΔTG	PRIN	T			
Vxi	Vzj	Vxk	۲	Vyi	Vyj	Vyk		

NA Number of components of ground acceleration input.

ASCALE Ground acceleration amplitude scale factor.

TOG Time at the first point of the ground acceleration. (time)

 ΔTG Time increment for the input ground acceleration. (time)

PRINT A logical flag. If PRINT = . TRUE., then the 3D ground accelerations are printed.

- Vxi GCS X axis projection of a unit vector defining the X' axis of the input ground acceleration.
- Vxj GCS Y axis projection of a unit vector defining the X' axis of the input ground acceleration.
- Vxk GCS Z axis projection of a unit vector defining the X axis of the input ground acceleration.
- Vyi GCS X axis projection of a unit vector defining the Y' axis of the input ground acceleration.
- Vyj GCS Y axis projection of a unit vector defining the Y' axis of the input ground acceleration.
- Vyk GCS Z axis projection of a unit vector defining the Y axis of the input ground acceleration.

Below is a set of cards repeated NA times. The two FORMAT cards are used only if the value of FMT=.TRUE.. Both ATITLE cards and A() are input on unit=IN.

	IN	NPTS	IDIR	FMT	ЕСНО	REWIND			
	FOR	MAT1				_			
	FOR	MAT2							
	ATI	TLE2							
	ATI	TLE2							
	A(1) A(2)	A(3)						
							A (NPTS)	

T	
IN	Input unit number for acceleration record.
NPTS	Number of acceleration points to be read. NPTS \leq MAXACC.
IDIR	Direction of acceleration being read.
	1 Ground acceleration is in the X' direction.
	2 Ground acceleration is in the Y' direction.
	3 Ground acceleration is in the Z' direction.
FMT	A logical flag. If $FMT = .TRUE$, then the input acceleration is formatted and the
	corresponding Fortran format codes, FORMAT1 and FORMAT2, must be input.
	Logical variable.
ECHO	A logical flag. If ECHO=.TRUE., then the input acceleration is printed. Logical
	variable.
REWIND	A logical flag. If REWIND = . TRUE., then the acceleration input file is rewound
	before it is read. This allows the same acceleration input file to be read more than
	once. IF $IN = 5$, then set REWIND = .FALSE. Logical variable.
FORMAT1	Fortran format code capable of reading the two 80-character titles. (Character
	variable; <u>do not</u> enclose in single quote.)
FORMAT2	Fortran format code capable of reading the input ground accelerations. (Character
	variable; do not enclose in single quote.)
ATITLE1	Ground acceleration title. Read from unit IN. (Character variable; do not enclose
	in single quote.)
ATITLE2	Ground acceleration title. Read from unit IN. (Character variable; do not enclose
	in single quote.)
A()	Input ground acceleration. If $FMT = .FALSE.$, A() must be separated by blank
	spaces or commas. Otherwise, A() is input by the fixed format code FORMAT2.
	Read from unit IN. (g's)
Example	Note
<u></u>	

2 1.0 0.0 0.01 .FALSE.		(1)
100 010		(2)
5 5 1 .TRUEFALSE.		(3)
(A/A)		(4)
(8F9.6)		(5)
ELCENTRO- 1940 EQ DATA	FORMAT: (8F9.6)	(6)

ï

DT = 0.01 SEC + + + E-W DIRECTION + + +	(6)
-0.011848-0.008267-0.004687-0.002477-0.004856	(7)
5 5 2 .FALSEFALSE.	(8)
ELCENTRO- 1940 EQ DATA	(9)
DT = 0.01 SEC + + + N-S DIRECTION + + +	(9)
0.010966 0.008610	(10)
0.006255	(10)
0.003900 .001545	(10)

- (1) Two ground motions are to be input.
- (2) Vectors defining the X' and Y' axes are input.
- (3) Input the first ground motion in fixed format from unit 5.
- (4) Format code for titles.
- (5) Format code for acceleration data.
- (6) Titles.
- (7) Acceleration data.
- (8) Input the second ground motion in free format from unit 5.
- (9) Titles.
- (10) Acceleration data.

D. SOL03 - EIGENVALUE SOLUTION

This solution is used to calculate the elastic natural frequency and mode shape or the buckling load and mode shape. The cards below are input once.

'SOL03'							
TITLE			_		 	 	
OPTION	IPRINT	IPJT					

SOL03 Signifies solution 3. Character variable; enclose in single quotes.

TITLE User input title, 80 characters maximum. Character variable; enclose in single quotes.

OPTION Choice of natural frequency or buckling load. Character variable; enclose in single

	quotes.	
	'FREQ'	Solves for the natural frequency and mode shapes of the structure.
	'BUCK'	Solves for the buckling load and mode shapes of the structure.
IPRINT	Number of	modes to be printed.
IPJT	Number of	modes to be printed with detailed mode shape.

E. SOL04 - INCREMENTAL STATIC SOLUTION

This solution is used to calculate the static cyclic response of nonlinear structures.

The cards below are input once.

'SOL04'					
TITLE					
MAXELD	IPRINT	IWRITE	UNBAL		

SOL04 Signifies solution 4. Character variable; enclose in single quotes.

- TITLE User input title, 80 characters maximum. Character variable; enclose in single quotes.
- MAXELD Maximum number of element loads.
- **IPRINT** Step increment for printed output.
- IWRITE Step increment for data written to output files.
- UNBAL A logical flag. If UNBAL = .TRUE., the unbalanced loads from the preceding step are added to the current load. Logical variable.

<u>Note</u> The load case for this solution is always input as one.

1. <u>Output Data to Disk Files</u> Cards here control the data that is written to separate disk files and are used to print reports or plot data. They are identical to the 'Output Data to Disk File' cards in block SOL02. Refer to SOL02 for a detailed description. These cards are repeated until the value of TYPE is 'END'.

2. Joint Loads Cards here are used to apply loads to joints. These cards are identical to the 'Joint Load' cards in block SOL01. Refer to SOL01 for a detailed description. The card below is repeated until the value of DIR is 'END'.

LOAD ID IGEN AID DIR VALUE

3. <u>Element Loads</u> Cards here are used to apply element loads to the '3D-BEAM' element. These cards are identical to the 'Element Load' cards in block SOL01. Refer to SOL01 for a detailed description. The card below is only included if MAXELD > 0. This card is repeated MAXELD times, or until the value of TYPE is 'END'.

LOAD	IELE	IGEN	ΔIELE	TYPE	DIR	VALUE1,	VALUE2,		
------	------	------	-------	------	-----	---------	---------	--	--

4. Load Factors. Cards here contain the load factors used to generate incremental static loads. Two options are available to limit the size of the load step: 1) the results of each step are scaled such that joint loads and displacements on free dof are less than PMAX and DMAX; the step is repeated until the value of FACTOR is achieved (loading option A), or 2) each load step is subdivided into N steps (loading option B). This card is repeated until the value of STEP is 'END'.

STEP	FACTOR	PMAX	DMAX	N

STEP User input step name, 80 characters maximum. Character variable; enclose in single quotes. If STEP is 'END', the current solution is terminated.

FACTOR Load factor. The applied load at the end of the step is FACTOR. (applied joint and element loads).

PMAX Maximum value for a free dof joint load per load step. (force or force*length)

DMAX Maximum value for a free dof joint displacement per load step. (length or radians)

N Number of load steps between the previous and current factor. N is only used if

both PMAX and DMAX are equal to zero.

Example

<u>Note</u>

'LOAD'	10	.0 25	52	25)	(1)
'UNLOAD)'	0.0	0.	.0	20	(2)
'END'	0	0.	.0	0		(3)

<u>Notes</u>

- The structure is loaded to 10 times the joint and element loads in steps that do not have load increments greater than 25 or displacement increments greater than 0.25.
- (2) The structure is then unloaded with 20 equal size load steps.
- (3) SOL04 is terminated.

F. SOL05 - RESPONSE SPECTRUM ANALYSIS

This solution is used to calculate maximum structural response based on the response spectrum of

dynamic force. The cards below are input once.

	SOLO	5'					
[]	TLE						
	ICOM	NMODE	DAMP	NA	NAP	IPRT	
N	ISTEP	MEIG					

SOL05 Signifies solution 5. Character variable; enclose in single quotes.

- TITLE User input title, 80 characters maximum. Character variable; enclose in single quotes.
- ICOM Modal combination method used. Character variable; enclose in single quotes. 'SRSS' Square-root-of-square method is used.
 - 'CQC' Complete quadratic combination method is used.
- NMODE Number of modes considered.

DAMP Damping ratio for all modes.

NA Number of seismic components considered.

NAP Number of input points of response spectrum for individual seismic component.

IPRT Number of modes' for which information is to be printed.

NSTEP If NSTEP=1, calculate eigenpairs and store eigenpairs in the disk unit 'MEIG'. If NSTEP=2, read eigenpairs from the disk unit 'MEIG' and perform spectrum analysis. If NSTEP=3, calculate eigenpairs and perform spectrum analysis. Eigenpairs are not stored in the disk unit 'MEIG'.

MEIG Disk unit number for eigenpairs' solution.

1. <u>Direction of Seismic Component</u> Response spectral values corresponding to individual modes are read by the cards below. This set of cards can be omitted if NSTEP=1.

ASCA	LE	OPTION	PRINT			
Vxi	Vz	j Vxk	Vyi	Vyj	Vyk	

ASCALE Response spectral amplitude factor.

OPTION If OPTION='DISP', displacement spectral values are used. If OPTION='ACC', acceleration spectral values are used. Character variable; enclose in single quotes.

PRINT A logical flag. If PRINT = . TRUE. then the spectral information is printed.

- Vxi GCS X axis projection of a unit vector defining the X' axis of the input ground component.
- Vxj GCS Y axis projection of a unit vector defining the X' axis of the input ground component.
- Vxk GCS Z axis projection of a unit vector defining the X' axis of the input ground component.
- Vyi GCS X axis projection of a unit vector defining the Y axis of the input ground component.
- Vyj GCS Y axis projection of a unit vector defining the Y' axis of the input ground component.
- Vyk GCS Z axis projection of a unit vector defining the Y axis of the input ground component.

2. Response Spectral Values. The set of cards below is repeated NA times.

IDIR				
RSNP1	RSNP2	_		

IDIR Direction of ground component being read.

- 1 Ground spectrum is in the X' direction.
- 2 Ground spectrum is in the Y' direction.
- 3 Ground spectrum is in the Z direction.

RSNP1 Period value of response spectrum curve.

RSNP2 Spectral value corresponding to period RSNP1.

<u>Note</u>

- 1) The spectral value corresponding to the structural natural period will be calculated by linear interpolation of two RSNP2 values in the response spectrum curve.
- 2) Repeat the second block NAP times.
- 3) RSNP1 should be input in increasing order.

3. Effective Mass Limitation

XLIM	YI	MIL	$_{ m ZLI}$	М						

- XLIM Effective mass limitation in GCS X direction.
- YLIM Effective mass limitation in GCS Y direction.
- ZLIM Effective mass limitation in GCS Z direction.

<u>Note</u>

- If number of modes calculated based on XLIM, YLIM, or ZLIM is less than NMODE, the modes calculated based on XLIN, YLIM, or ZLIM are used for the modal combination in the response spectrum analysis.
- 2) If input value of XLIM, YLIM, or ZLIM is zero, NOMDE is used for the modal combination in the response spectrum analysis.

G. BUG - SET BUG OPTIONS

This card is used to set the bug options which print out the intermediate results listed below. Its entire statement is a character variable, and is enclosed in single quotes.

'BUG=options'

Option Description

- A Print element displacements.Print loads applied to degrees of freedom.
- B Not used.
- C Print plot data for program SEE to unit 07. SEE is a program that plots the structure on the UMR CALCOMP plotter. A listing of program SEE is given in Appendix C.
- D Print joint, element, and dynamic loading data.
- E Print numerical integration data for linear and average acceleration methods.
- F Print the element's structural and geometric stiffness.Print the global mass, structural stiffness, geometric stiffness, loads and displacements.
- G Print the condensed global mass, structural stiffness and geometric stiffness matrices.
- H Print the element transformations, structural and geometric stiffness, etc.
- I Print contents of memory for elements.
- J Print a skyline map for matrices.
- K Print the material data for each load step.
- L Print the energy balance.
- M Print the skyline data for matrices.
- N Print the contents of memory when DUMP is called.

<u>Notes</u>

- 1) Any number of options may be specified at one time.
- 2) Options specified with the last bug statement are the only options active.

H. READ - READ OUTPUT FILES

This card is used to read and print data written to output files during SOL02 and SOL04. The entire statement is a character variable and is enclosed in single quotes.

'READ INC=I UNIT=NO'

where NO is the unit number of the file that contains the data, and I is the increment of the steps printed out. Multiple UNIT=NO statements may exist on each read card.

I. NOECHO - INHIBIT INPUT ECHO

This card is used to inhibit the input echo. Character variable; enclose in single quotes.

'NOECHO'

J. <u>DUMP - PRINT MEMORY</u>

This card is used to print the addresses of the data in memory. If 'BUG=N' was previously specified, 'DUMP' also prints the nonzero values in the linear array. Character variable; enclose in single quotes.

'DUMP'

K. <u>RELEASE - RELEASE MEMORY</u>

This card is used to release or 'free up' memory used for previous solutions. Global displacements, velocities, etc. are reset to zero. Its entire statement is a character variable, and is enclosed in single quotes.

```
'RELEASE OPTION'
```

If OPTION='ELEMENT', the element forces, displacements and hysteresis models are also reset to their initial values.

Example	Note
'STRUCT'	(1)
Structure input is omitted.	
'SOL01'	(2)
Solution input is omitted.	
'RELEASE' 'SOL03'	(3) (4)
. Solution input is omitted.	
· 'STOP'	(5)

<u>Notes</u>

- (1) Structure is defined.
- (2) A static solution is performed.
- (3) Static solution is released as is memory required for load, displacement, stiffness, etc. Element forces are not released because the ELEMENT statement was omitted from the RELEASE card.
- (4) Natural frequencies or buckling loads are determined. For a buckling load solution, the geometric stiffness may be based on the axial load in the elements from SOL01. Releasing the memory after the static solution allows the same memory to be used for SOL03. If the memory is not released, then the total memory required would be the sum of the memory required for SOL01 and SOL03.
- (5) Terminate the program.

L. STOP - TERMINATE EXECUTION

This card is used to terminate execution of the program. Its statement is a character variable

and is enclosed in single quotes.

'STOP'

. .

V. RUNNING PROGRAM INRESB-3D-SUPII

This chapter contains instructions for running program INRESB-3D-SUPII in the VM/SP CMS environment on an IBM 4381 computer, in the AIX/370 environment on an IBM 3090S supercomputer, or on a PC.

Several steps compose these instructions. First, a macro library is generated that contains the common blocks. Second, the main program and each subroutine are compiled. Text files are stored on a disk in the user's account. Third, the program is executed. The first and second steps are done only once to install the program.

A. GENERATING COMMON BLOCK MACRO LIBRARY

1. In the CMS Environment Here the common block macro library, GEM, is generated with the following CMS statements

MACLIB	GEN	ZCOMN	GEM
MACLIB .	ADD	ZCOMN1	GEM
MACLIB .	ADD	ZCOMN2	GEM
MACLIB	ADD	ZCOMN3	GEM

where ZCOMN COPY, ZCOMN1 COPY, ZCOMN2 COPY and ZCOMN3 COPY are four CMS files that contain the common blocks. These files are listed with the program.

2. <u>In the AIX Environment</u> Here the common block macro library does not need be generated. However, ZCOMN COPY, ZCOMN1 COPY, ZCOMN2 COPY and ZCOMN3 COPY should be renamed zcomn, zcomn1, zcomn2, and zcomn3, respectively.

B. COMPILING PROGRAM

1. In the CMS Environment Program and subroutines are compiled with the following CMS commands.

GLOBAL MACLIB GEM FORTVS2 INRESB (OPT(2) AUTODBL(DBLPAD4)

The GLOBAL MACLIB GEM statement lets the compiler know where to locate the common blocks. Common blocks are put into the program by the Fortran INCLUDE statement, which is in the source code. For example, INCLUDE (ZCOMN).

To reduce execution time, compiler option OPT(2) specifies code optimization. Vectorization may also be used to reduce execution time if hardware and software are available.

Computer accuracy differs according to respective word length. Hence the program is written in single precision, and compiler options are used to convert the program to double precision when required. The IBM compiler option AUTODBL(DBLPAD4) automatically converts the program to double precision. Integer and real variables in the program share the same storage location. Thus the compiler option which converts the program to double precision must pad the length of integer variables so that they have same length as real variables. Failure to use the DBLPAD4 compiler option and equivalent compiler option on other systems leads to unpredictable results.

2. <u>In the AIX Environment</u> Program and subroutines are compiled with the following AIX commands.

fvs inresb -f'opt(2) autodbl(dblpad4) il(dim) vector' -xa
-limslib -lesslv -faux -o exec

Compiler option il(dim) specifies that the code for adjustable-dimension array is to be placed inline. While this inline code may result in faster processing, it does not check for dimensioning errors. Compiler option -xa causes the supercomputer to generate an XA-mode module which gives maximum storage to run a program, about 800 megabytes. Option -o creates the execution file called 'exec'. Commands -limslib and -lesslv link the IMSL libraries. The -faux command

loads the FORTRAN libraries needed to run the program. Common blocks are input into the program by the INCLUDE statement in the source code; for example, INCLUDE 'zcomn'.

C. RUNNING PROGRAM ON MAIN FRAME OR SUPERCOMPUTER

1. <u>In the CMS Environment</u> The program is run in the local CMS environment by the following commands.

GLOBAL TXTLIB VSF2LINK VSF2FORT CMSLIB IMSLDOUB UFORTLIB FILEDEF 5 DISK FN FT05 A (PERM LRECL 80 RECFM F FILEDEF 6 DISK FNFT06 A (PERM LRECL 132 RECFM F FILEDEF 10 DISK FN FT10 A (PERM LRECL 80 RECFM F FILEDEF 11 DISK FT11 A (PERM LRECL 80 RECFM F FNFILEDEF 92 DISK ELCENTRO EW Α FILEDEF 93 DISK ELCENTRO NS Ά LOAD INRESB (CLEAR RESET MAIN START NOMAP

GLOBAL TXTLIB command loads the Fortran libraries needed to run the program. IMSL library is required to link IMSL subroutine DG2CSP. UFORTLIB library contains the local routines CPUTIM, TIMEON, TIMEIT, TIME and DATE. Input is contained in files FN FT05 A, ELCENTRO EW A and ELCENTRO NS A. Output is written to files FN FT06 A, FN FT10 A, FN FT11 A, etc.

2. <u>In the AIX Environment</u> The program is run in the AIX environment by the following commands.

Input is contained in files fn.ft05, elcentro.ew and elcentro.ns. Output is written to files fn.ft06, fn.ft10, fn.ft11, etc.

D. <u>RUNNING PROGRAM ON PC</u>

When running program INRESB-3D-SUPII on a PC, the program is divided into five independent programs, SOL01, SOL02, SOL03, SOL04, and SOL05, due to the limitation of PC memory. All five programs have the same function as explained in Chapter II. They can run independently on a PC.

Input and output files on a PC have the same form and contents as those used or produced on an IBM 4381 computer or a supercomputer. If an input data file can be executed on a supercomputer, it can usually work on a PC, and vice versa. However, when running program SOL02 (elastic / nonlinear seismic time history response analysis), ground acceleration data must be input in the same file with other data. Thus only one input file exists; the input unit number for acceleration record "IN" is always 5.

A user can define any combination of characters and numbers to name an input or output file. It is not necessary for a user to compile programs. Programs which a user needs are EXE files, there are five.

- 1. SOL01.EXE
- 2. SOL02.EXE
- 3. SOL03.EXE
- 4. SOL04.EXE
- 5. SOL05.EXE

When a user runs one of them, such as SOL02, only the following commands are needed.

><u>SOL02</u> (<u>Enter</u>)

>Name of Input File: Input File Name (Enter)

>Name of output File: Output File Name (Enter)

.

Note Contents underlined are input by a user. Enter stands for the "Enter" key.

Note also that the PC solution capacity is limited by its memory. For a large scale engineering problem, it is insufficient. Because it only runs one program at a time and uses one main function of INRESB-3D-SUPII, the option "RELEASE" is ignored.

VI. EXAMPLE PROBLEMS

A. ANGLE-SECTION MEMBER

1. Description of Input Information

A single angle L2 x 2 x 1/4 is subjected to an eccentric load with $e_x = -0.41$ in and $e_y = 0.804$ in (see Figure 34). The member is assumed to be a finite-segment element and is divided into 16 segments. It is restrained about X-axis at the support and has no initial imperfection.

Buckling capacity and post-buckling behavior of the member are determined by the displacement control at joint 1 in the X direction. The axial load-axial deformation relationship at joint 1 in the X direction is written in the file with unit 11 and plotted in Figure 35.

2. Input Data

ECHO OF INPUT DATA LINE 0.30 60 2 0 0 1 C DIRECTION COSINE 1 1 0 1 0 C 1 1 0 1 0 C é 100 1 1 1 TY 16 50.9 29400 7 2 C -C.41 0.804 0 C 0.25 20 2 1 2. 0 3 0.9375 0 C 0.303 3 11300 C.01 1 FALSE. KG: AXL, FORM, ASSY 4 ELE MAT SJ EJ VYI.VYJ.VYK XS XE TYY 'ANGLE SEC. ELE.' 1 1 2 0 1 0 C 0 0 ALSE. MASS DAMP NMAT 1 //// 'STABILITY 21 2 20 2 0 0 0 .FALSE 11: NELEM

 SIARLLIT: 'ANGLE SEC. ELF.' 1 1 2 0 1 0 0 0

 0 3 .FALSE. MASS

 0 1 DAMP

 'SCL04 SCLUTICN'

 'SC000 SCLUTICN'

 'SC000 1 .FALSE 'MAXELD IFRINT INTITE UNPAL

 'GOINT FX' 1 11 0 0 0

 'END '2 16 0 0 1

 1 1 C 0 'FX' C.2

 0 0 0 'END' '5' 0 JOINT LCAD

 C 0 0 0 'END' 'FY' 0 0 'ELEMENT LOAL

 'DISP. FROM 0 TC 0.2 ' 1 0 0 100

 'END -F JISP. CONTROL ' 1 0 0 6C

 'READ UNIT-11'

 14 15 18: 19 20: 22: 23: 24: 25: 26 27



Figure 34. L2*2*1/4 Angle Section

3. Output

7 $\overline{}$ STRUCTURE : EXAMPLE : BUCKLING BEHAVIOR OF ANGLE SECTION MEMORE TIME. 23 37:38, DATE: 11/30/90 SOLUTION PROGRAM FEM DOUBLE PRECISION VERSION

NODE COORDINATES AND DEGREES OF FREEDOM

NUMBER OF DEGREES	OF FREEDCM	12						
OF DEGREES OF FRE	EDOM CONDENSED OUT.	C						
OF FRES DEGREES C	F FREEDOM	2						
CF RESTRAINED DEG	REES OF FREEDOM	10						
COS# X-COORD	Y-CCCRD	2 COORD	FX	FY	PZ	MX	MY	MZ
1 0 0C000E+	00 0.000C0E+C0	0 000C0E+C0	3 · R	4 · R	5 · R	€-R	1	7 - R
1 34.900	6.00002+00	0.00CC0E+00	8 - R	9 · R	10-R	11 · R	2	12 - R
VORD D DECORDARY	TO CHORES ON COLORADO	N 4						
NOIS: R · RESTRAIN	ED LEGREE OF FREEDO	275						
	NUMBER OF DEGREES OF DEGREES OF PRE OF PRES DEGREES C OF RESTRAINED DEG COS# X-COORD 1 0 0C00CE+ 1 34.90C	NCMBER OF DEGREES OF FREEDOM CONDENSED OUT OF DEGREES OF FREEDOM CONDENSED OUT OF FREE DEGREES OF FREEDOM CF RESTRAINED DEGREES OF FREEDOM COS# X-COORD Y-CCCRD 1 0 0C00CE+00 0.00002-00 1 34.90C 0.00002-00	NCMBER OF DEGREES OF FREEDOM 12 GF DEGREES OF FREEDOM COURNSED OUT 0 OF FREED DEGREES OF FREEDOM 2 CF RESTRAINED DEGREES OF FREEDOM 10 COS# X-COORD 2-COORD 1 0 000028+00 0.000028+00 0.000028+00 1 34.990 0.000028+00 0.000028+00	NCMBER OF DEGREES OF FREEDOM 12 GF DEGREES OF FREEDOM C OF FREED DEGREES OF FREEDOM 2 CF RESTRAINED DEGREES OF FREEDOM 10 COS# X-COORD Y-CCCRD 2-CCORD 1 0 000025+00 0.000025+00 0.000025+00 1 34-900 0.000025+00 0.000025+00	NCMBER CF DEGREES OF FREEDOM 12 GF DEGREES OF FREEDOM 0 OF FREED DEGREES OF FREEDOM 2 CF RESTRAINED DEGREES OF FREEDOM 10 COS# X-COORD Y-CCCRD 2-COORD 1 0 0C000E+00 0.00002E+00 0.00000E+00 3-R 1 24.990 0.00003E+00 0.00000E+00 8-R 9-R	NCMBER OF DEGREES OF FREEDOM 12 GF DEGREES OF FREEDOM C OF FREEDOM CONDENSED OUT. C OF FREEDOM CONDENSED OUT. 2 CF RESTRAINED DEGREES OF FREEDOM 10 COS# X-COORD Y-COCRD 2-COORD 1 0 CODCE+00 0.000022-00 0.000C0E+00 3-R 4-R 5-R 1 34-900 0.000022-00 0.000C0E+00 8-R 9-R 12-R	NCMBER OF DEGREES OF FREEDOM	NCM3ER OF DEGREES OF FREEDOM

DIRECTION COSINES ...

TOS(1) VX: 1.00000 I +0.00000 J -0.00000 K VY: 0.00000 I +1.00000 J +0 00000 K VZ: 0.00000 I +0 00000 J +1.00000 K STRUCTURE... : EXAMPLE 1: BUCKLING BEHAVIOR OF ANGLE-SECTION MEMBER SOLUTION....: 205 (

STABILITY ELEMENT PARAMETERS (BOX, TUBE, OR ANGLE)

MAT. NO	1 ANGLE	SECTION		
NSEG -	16	YS -	50.9	
EM -	2 940E+C4	LIBN -	7	
LAG LENGTH -	2 0 0	DUMMY VAR	0.000E+00	
ECCXC -	-0.410	ECCAD -	0.504	
LAG SEC.NO	С	DUMY VAR	c	
THICKNESS .	0.250	N C.IN U DIR-	21	
N.R.IN U DIR.	2	N.R IN V DIR-	20	
N C.IN V DIR-	2	I ECCP .	1	
NUMP -	92	SMALL	2.00	
RATIXO •	0.00CE+00	RATIYO -	0.000E+00	
TOTA -	0.938	TAUTO -	0	
IMATER -	0	RATIO3 -	3.000E-03	
IR -	0	G -	1.130E+04	
ORNZE -	1.000E-C2	ISTIF -	1	

STRUCTURE....: EXAMPLE 1: BUCKLING BEHAVIOR OF ANGLE-SECTION MEMBER SOLUTION....: TIME: 23-37:38, DATE: 11/30/90

ELEMENT 12, STABILITY ELEMENT

 # MATL
 START
 END
 LENGTH
 Y-AXIS
 START
 DIST
 END
 DIST

 1
 1
 2
 34.90
 C.60000 I +1.00000 J -0.00000 K C.0000E-00
 0.0002E-00
 0.0002E-ANGLE SEC. ELE.

ZERO MASS MATRIX

PROPORTIONAL CAMPING COLEFICIENTS ALPHA= 0.00000E+00 BETA= 0.00000E+00

.....

STRUCTURE...: EXAMPLE 1: BUCKLING BEHAVIOR OF ANGLE-SECTION MEMBER SOLUTION....: INCREMENTAL DISPLACEMENT CONTROL SOLUTION #4, STATIC NONLINEAR SOLUTION

UNBALANCED JOINT FORCES ARE NOT ADDED TO THE NEXT CYCLE

DATA WRITTEN TO FILES

DEGREE OF FREEDOM 4 3 IS WRITTEN TO UNIT 4 11 JOINT: 1 DIRECTION: FX APPLIED JOINT LOADS

LOAD CASE 1 JOINT 1 DIRECTION PX DCP(S) 3 MAGNITUDE 0.200000 STRUCTURE.... EXAMPLE 1 BUCKLING BEHAVIOR OF ANGLE-SECTION MEMBER SOLUTION ... INCREMENTAL DISPLACEMENT CONTROL ...JOINT DISPLACEMENT... TIME: 23:37.38, DATE. 11/30/90 TIME: 23:37.39, DATE: 11/30/90

TIME: 23:37:39, DATE: 11/30/90 TIME: 23:37:39, DATE: 11/30/90

. LOADING # 0 MAXIMUM DISPLACEMENTS

GCS DISPLACEMENTS NOTE: MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY

NODE	DX	DY	ΣC	RX	RY	RZ
2	0 200000	0.000000E+00	0 000000E+00	0.000002-00	6 812705E-02	0 CC00CCE+00
	0 00000E+00	0.000000E+00	9.000000E+00	0.000002-00	-6.8127C5E-C2	0 000C00E+00

STRUCTURE.	· · · · ·	INCREM	EMTAL DI	KLING BEN SPLACEMEN	AVIOR OF AND T CONTROL	GLE-SECT	ICN MEMBER			TIME TIME	23.37:38. DATE 23.37.39, DATE	: 11/30/90 : 11/30/90
, LOADING	5	0	MAXIMUN	REACTIO	is							
MAXIMUM GCS	S RES	TRAINT	REACTIO	INS M	TE. MAXIMUM	VALUES :	MAY NOT OCCU	R SIMULTANEOUS	LY			
NODE		7X		7 Y	FZ		MX	MY	MZ			
1 2	18 e 18.e	1292 1292	-5.92	00746E-11 83047E-11	2 2.99734641 2 3.77695101	E-12 7 E-12 7	9967110E-02 9967110E-02	0.00000002+00 0.00000002+00	10 99620 -10.99620			
MAX OF ALL GCS SUMM	0.309	0361E	12 -0.13	51838E-:	0.66742971	E·11 0	1599742	·0.131 81565 ·09	0.2065221	E-09		
MAXIMUM D STRUCTURE. SOLUTION.	RESU1	LTANT C EXAMPL INCREM	F REACTI E 1: BU(EMTAL DI	CNS, FO KLING BEI SPLACEMEI	DRCE- 1.3319 RAVIOR OF ANG AT CONTROL	SLZ SECT	MCMENT= 0.1 ICN MEMBER	600		TIME: TIME:	23:37.38, DATE 23:37 39, DATE	: 11/30/90 : 11/30/90
, LOADING COLU	r) M⊡N (0 LCAD)	PEAK EL	EMENT FO	RCES DF WHICH HAS	MAXIMUM	VALUE					
STABILI MAXII ELEMENT U	TY EI MUM V CAD	LEMENT VALUES	FORCES FOR ALL NODE	STEP3 AXIJ	NCTE: MAXIMUL	M VALUES FY	WITH THE OT FZ	HER DOFS FORCE TORSIO	S ARE PRINT	OUT AT	THE SAME TIME MZ	FL2.SP
1	:	FORCE FORCE	1 2	19.6129 -10.6129	- 3.406 - 3.723	563E-12 533E-12	1.473937E- 1.947044E-	12 4.9385688 12 4.9385666	-03 -1.444 -03 7.327	2122·14 1722·19	4.57195	
1	2	FORCE FORCE	1 2	13.0752 •13.0752	- 5, 590) - 5, 928.	075E-12 305E-12	2.897346E 3.776951E	12 7.9987118 12 7.9987118	E+02 -1.785 E+02 1.042	6052-14 2222-14	10.9962 -10.9962	
1	3	FORCE	1 2	13.0752 -13.0752	-5.59C	075E-12 305E-12	2.897346E 3.776951E	12 7.9987111 12 7.9987111	E-02 1.795 E-02 1.042	505E·14 222E-14	10.9962 •10.9962	
1	4	FORCE FORCE	2	13.0752 -13.0752	-5.59C) -5.928	075E-12 305E-12	2.897346E 3.776951E	12 7.9987118 12 7.9987118	2-02 -1.785 2-02 1.042	5052·14 2222·14	1C.9962 -10,9962	
L	5	FORCE	: 2	13.0752 -13.0752	- 5. 59C) - 5. 928.	075E-12 305E-12	2.897346E 3.776951E	12 7.999711F 12 7.998711F	2-02 -1.755 2-02 1.042	6052·14 222E·14	10.9962 -10.9962	
1	6	FORCE	2 2	13.0752 -13.0752	-5.59C	075E·12 305E·12	2.897346E 3.776951E	12 7 9987111 12 7,9987111	E-02 -1.785 E-02 1.042	6052·14 2222·14	10.9962 -10.9962	
1	7	FORCE FORCE	2	18.6125 -18.6129	3.406	563E·12 533E·12	1.473807E- 1.947044E-	12 4.8385681 12 4.8385681	2-03 -1.444 2-03 7.327	212E-14 472E-15	4.57195	
1	8	FORCE FORCE	: 2	13.0752 •13.0752	-5.59C -5.928	075E·12 305E·12	2.897346E- 3.776951E-	12 7.9987111 12 7.9987111	2-02 -1.785 2-02 1.042	605E-14 222E-14	10.9962 -10.9962	
1	э	FORCE	: 2	13.0752 -13.0752	• 5 . 59 C • 5 . 928	075E-12 305E-12	2.897346E 3.776951E	12 7.9987118 12 7.9987118	E-02 -1.785 E-02 1.042	603E·14 222E·14	10.9962	
1	10	FORCE FORCE	ż	13.0752 -13.0752	-5.59C -5.928	075E-12 305E-12	2.8973462 3.776951E	12 7.998711 12 7.998711	E-02 -1.785 E-02 1.042	605E-14 2222-14	10.9962 -10.9962	
1	11	FORCE FORCE	1	13.0752 •13.0752	5.59C 5.928	075E-12 305E-12	2.897346E 3.775951E	12 7.9987111 12 7.9987111	E-02 -1.785 E-02 1.042	605E-14 222E-14	10.9952 -10.9962	
1 STRUCTURE SOLUTION	12	FORCE FORCE EXAMPI INCREM	2 LE 1 BUG MENTAL D	13.0752 -13.0752 CKLING BE ISPLACEME	-5.59C -5.928 HAVICR OF AN NT CONTROL	075E·12 305E·12 GLE-SECT	2.3973462 3.7769512 ION MEMBER	12 7.9987111 12 7.9987111	E·02 ·1.785 E·02 1.042	605E-14 222E-14 TIME TIME	10.9962 10.9962 23:37:39, DATE 23.37:39, DATE	: 11/30/90 : 11/30/90
, LOADING STRUCTURE SOLUTION.	; # 	C EXAMPI INCREM	PEAK D LE 1: BU MEMTAL D	UCTILITIE UKLING BE ISPLACEME	S AND EXCURS HAVIOR OF AN NT CONTROL	ION RATI GLE-SECT	O'S Ion Member			TIME TIME	23-37:35, DATE 23.37:39, DATE	: 11/30/90 : 11/30/90

, LOADING # 0 DAMAGE INDEX

STRUCTURE DAMAGE INDEX- 0.00000E+00

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*	2LAP:	SED	CE	90	TIM	1E		1	0:		4	5	S	E	С			•	-	•
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STRUCTURE: EXAMPLE 1: BUCKLING BEHAVIOR OF ANGLE-SECTION MEMBER SOLUTION.....: INCREMENTAL DISPLACEMENT CONTROL

TIME:	23:37:38,	DATE:	11/30/90
TIME	23:37:39,	DATE:	11/30/90

DEGREE	OF FREEDOM #	3 IS READ FF	CM UNIT # 11	JOINT # 1,	DIRECTION: FX
STEP	TIME	LOAD	DISPLACEMENT	VELOCITY A	CCELERATION
0	C.00000E+00	0.00000E+CC	0.C000CE+CC	0 CC300E+00	0 00000E+00
1	C.000C0E+00	0.57476	2.C0000E-C3	0.0000E+00	0 00000E+00
2	C.000C0E+00	1.1430	4.00000E-03	0 CC000E+00	0 C0000E+00
3	0 000COE+00	1.7047	6 00000E-03	0.0C000E+00	0.C0000E+00
4	C.000COE+0C	2 2599	S.COOCOE.03	0.0000E+00	0 COOCOE+00
5	C.000C0E+0C	2.8085	L COOOOE-02	0.CC00CE+00	0.C000CE+00
6	C.000COE+0C	3.3500	1.20000E-02	0 CC00CE+00	0 C0C0CE+00
7	0.000COE+6C	3.8965	1.40000E-02	0.CC00CE+00	0.C000CE+00
8	C 000COE+0C	4 4159	1 60000E-02	0.0C00CE+00	0.000005+00
э	0.000COE+0C	4.9388	1.20002-02	0.0000E+00	0.0000CE+00
10	C 000COE+0C	5.4553	2.50000E-02	0.00002+00	0.C000CE+0C
11	9.000COE+0C	5.9655	2 2000E-02	0.CC00CE+00	0.COD0CE+00
12	0.000COE+0C	6.4693	2 400002-02	0.CC00GE+00	0.0000CE+0C
13	C.000COE+0C	6.9669	2 6000E-02	0.CC00CE+00	0.COO9CE+90
. 4	0.000C0E+0C	7.4581	2 80000E-02	O.CCOCCE+00	0.C000CE+00
15	0 000COE+0C	7.9432	3 00000E-02	0.CC00CE+00	0.0000CE+0C
16	C.000COE+0C	5.4220	3 2000GE+02	0.CC00CE+00	0.0000CE+0C
17	0.00000E+0C	8.8947	3.4C000E-02	0.CC00CE+00	0 COCOCE+00
19	0.000C0E+0C	9.3612	3 60000E.02	0.0C00CE+0C	0.C000CE+06
19	0.0000C+00	9.8217	3 80000E-02	C CCOCCE+00	0.0000CE+00
20	0.0000E+00	10 276	4 UCOOUE-02	0.0000CE+00	0.0000 0£+00
21	0.0000CE+00	10 725	4 20000E-02	0.0000 CE+0C	0.0000CE+0C
22	0.0000CE+00	11 167	4 4C000E 02	C.0C00CE+0C	0.0000CE+0C

23	0.00000E+00	11 604	4 600CCE-C2	0 000COÉ+CD	00000E+00
24	0.00002-00	12.034	4.800002-02	0.30C00E+00	0.00000E+00
25	0.00002+00	12.459	5.00C00E·02	G.30C00E+00	0.00000E+00
26	0.000002-00	12,973	5.200002-02	0.0000E+00	0.000002+00
27	0.0CC00E-C0	13.292	5.400002-02	0.0000E+00	0.000007+00
29	0.000002-00	13.699	5 600002-02	0.000002+00	0.00000E+00
29	0.000002-00	14.101	5 800002-02	0.0000000000	0.000002+00
35	0.000007-00	14 498	5 000002-02	0.000002+00	0.000002+00
11	0.00002-00	14 900	6.000005.02	0.00000E+00	0.00002-00
21	0.000002-00	14.007	8 200002-02	5.50000E+00	0.30000E+00
22	0.000002-00	15.279	8.40COUE J2	0.000005+00	0.J0000E+00
دد	0.000002-00	15.655	6.500002-02	0.00000E+00	0.0000E+00
34	0.000002-00	16.929	6 B0C002-02	0.30000E+00	0.00000E+00
35	0.00002-00	16.386	7.00C00E-02	0.00000E+00	0.00000E+00
36	C.0CC002-CO	16.725	7.200002-02	0.30C00E+00	0.00000E+00
37	0.000002+00	17.055	7.400002-02	6.00C00E+00	0.00000E+00
39	0.00002-00	17.356	7.600002-02	0.00000E+00	0.00000E+00
39	0.00002.00	17.636	7.800002-02	0.00005+00	0 000002+00
40	0.000007+00	7 879	6 000002-02	2 30C00E+00	0.000002+00
41	0.000002+00	3 189	8 200002-02	0.000002+00	0.000002+00
	0.000038.00	16.007	6 400000 00	0.000000000	0.300052-00
42	0.000002-00	10.257	3.400002-02	0.0000E+00	0.0000E+00
4.5	0.000302+00	16.411	8.500005-02	0.00C00E+00	0.J0000E+00
44	0.60639E+03	18.514	8.800002-02	6.00CD0E+00	0.00000E+00
45	0.0CC00E+C0	18.575	9.000002-02	0.000002+00	0.30000E+00
46	0.00C00E+C0	16.613	9.20C00E-02	0 00C00E+00	0.0000E+00
47	0.00000E-C0	18.605	9.40C00E-02	0.00C00E+00	0.0000E+00
49	0.000002-00	18.558	9.60002.02	0.00C00E+00	0.000002+00
49	0.00C00E+00	18.510	9.800002-02	0 00C00E+00	0.00000E-00
50	0.00000E+00	18.432	C 10000	0.000002+00	0 000008+00
51	0.000005-00	18 3.26	C 10700	6 20002400	0 000008+00
52	0.0000005+00	16 215	C 10400	0.300002+30	0.000002+00
52	0.000002-000	10.235	0.10400	0.30000E+00	0.000002-00
55	5 00050E+05	10.375	0.10655	0.00C00E+00	0.000002+00
54	0.00030E+03	17 930	C. 10800	G. 30000£+00	0.00002.00
50	0.00050E-05	17.776	C.11095	G.00C00E+00	0.30000E+00
56	3.C0030E+03	17.636	C.11200	G.COCCOE+00	0.00000E+00
57	0 COOD0E+00	17.479	C.11400	0.00CC0E+00	0.00000E+00
58	0.COC30E+09	17.33:	C.11600	C.30C00E+00	0.00000E+00
59	0.00000E+00	17 172	C.11800	6.C0C00E+00	0.0000E+00
6 Ū	0 COODUE+00	17.021	0.12000	0.00C00E+00	0.00000E+00
61	0 COODOE+00	16.375	C.12200	G.00C00E+00	0.00000E+00
62	0.C0000E+00	16.722	C. 12400	0.000002+00	0.00000E+00
61	0 COODDE+00	15 576	0.12600	0.000002+00	0.00000E+00
64	2 0000000000	16 136	C 12801	0.00C00E+00	0.000002+00
65	0 C0000 R+00	16 295	0.13033	0.00000E+00	0.0000002+00
66	0 606005+00	16.200	0 13200	0.000002+00	0.000002+00
00	5 COCOVE+00	10 104	0.13235	0.000002400	0.00002+00
67	5 60630E+03	16.335	0.13400	0.000002+00	0.000002+00
50	0.60000E+00	15.906	C.13600	0.00C00E+00	0.000002000
59	5 60G50E+G5	15.779	G.13890	0.00C00E+00	0.00002+00
70	0.00000E+00	15.655	0.14090	G.30G00E+00	0.000002+00
71	0 00C00E-00	15.537	C.14200	0.0000E+00	0.000002+00
72	0 00CODE+CO	15.423	C.14400	0.00G00E+00	0.000C0E+00
73	0 00C00E+C0	15.312	C.14600	0.0000 2+00	0.00003E-00
74	0.00C00E-C0	15.204	C.14800	0.0000E+00	0.000002+00
75	0.000002+00	15.130	C.15C00	0.30000E+00	0.00000E-00
76	0.000002+00	14.999	C.15200	0.00000E+00	0.000008+00
77	0 00000000000	14 996	0 15400	0.00000E+00	0.000007-00
79	0.00000000000	14.796	C. 15600	0.00000E+00	0 000002-00
70	0.000002.00	14 590	0 15800	0.00000E+00	0.000002+00
. 7	0.00000E700	14.077	0 16000	0.0000E+00	0.0000032-00
50	0.00000E+00	14.035	0.16000	0.00000£+00	0.000002-00
51	0.00000E+00	14.512	0.16200	0.0000E+00	0.000002+00
52	0 00000E+00	14.422	C.16400	0.0000E+00	0.000002+00
82	0.0000DE+00	14.332	C.16600	0.0000E+00	0.00002-00
84	0 C0000E+00	14.247	C.16800	0.0000E+00	0.00000E+00
85	0.00C30E+03	14.163	C.17COO	0.0000E+00	0.000C0E-00
86	0 0000005.00	14,380	C.17200	0.000000000	0.000C0E+00
87	0.0000000000	14.000	C.17400	0.0000E+00	0.000C0Z-00
88	0.0CC00E+00	13.921	0.17600	D.0000E+00	0.000001-00
89	0.00C00E+C0	13.843	C.17800	0.000000.00	0.000008-00
90	0.00000E+00	13.766	0.15000	0.000005+00	0.000002-00
91	0.000008+00	13 690	0 19200	0.0000005+00	0.000002-00
07	0.000002+00	13.090	6 18400	0.00000000000	0.000002-00
	0.00000E+00	13.012	0.15400	0.0000E+00	0.00060±-C0
23	0.0000005-00	13.342	0.19600	0.0000000.+00	0.00000E+C0
94	0.000002-00	1.470	6.19800	0.0000E+03	9.000002+00
95	0.00002+00	13.401	0.19000	0.000C0E+C0	0.000C0E+C0
9€	0.00CO0E+CO	13.334	0.19200	0.000C0E+00	0.000C0E+C0
97	0.000002-00	13.267	0.19400	0.00000E+C0	0 000C0E+C0
95	0.00C002-C0	13.202	0.19600	0.000C0E-00	0.00000E+00
99	0.0CC00E-C0	13.138	0.19500	0.000C0E-00	0.00000E+00
100	0.00C00Z-C0	13,075	0.20000	0.000C0E+C0	0.00000E+00
-					

*	•	••		
* MEMCRY UTILIZATION	• •	••	• •	
•··· 12= 60235, MEM= 8.605%	-		- •	
*	•	• •		
ELAFSED CFU TIME 0.14 SEC	•		- •	
* TOTAL CPU TIME 102.18 SEC	-		- •	
	-			

.



Figure 35. Axial Load-Axial Deformation Relationship

B. ONE-STORY STEEL BUILDING

1. Description of Input Information

Figure 36 shows a one-story steel building consisting of two columns and one beam. All members are tube-sections. Diameter, thickness, and length of each member are 24 in, 0.75 in, and 540 in, respectively. The material yielding stress is 36 ksi and the elastic modulus is assumed to be 29,000 ksi. Finite-segment elements are used for all members. Each member is divided into 16 segments and the initial inperfection is not considered in the calculation. Four joints are used to define the two-dimensional structural model. JCS for all the joints is parallel to the GCS.

At the base of the frame, joints 1 and 4 as well as all six degrees of freedom are restrained. Two constant axial loads with $P/P_y = 0.4$ are first applied to joints 2 and 3 in the negative X direction. Structural response due to constant axial loads is calculated by the elastic static solution.



Figure 36. One-Story Steel Building

By using incremental displacement control, the lateral load-displacement relationship at joint 3 in the Y direction is determined for the second solution. Thus the structural response due to the first solution becomes the initial condition for the second solution. Figure 37 shows the result of load-displacement relation at joint 3 in the Y direction.

2. Input Data

ECHO OF INPUT DATA

```
LINE
```

3. Output

STRUCTURE:	CNE-STORY EUILDING	TIME:	23:41:09,	DATE	11/30/90
*** PROGRAM FEM ***	DCUBLE PRECISION VERSION				

NODE COORDINATES AND DEGREES OF FREEDOM

TOTAL NUMBER OF DEGREES OF FREEDOM										
NODE	COS⊭	X - COORD	Y - COORD	Z - COORD	FX	FY	FZ	мх	MY	MZ
1	1	0.00000E+00	0 COODOE+00	0.000002+00	6-7	7 - R	5 - R	9 - R	10 - R	11-R
2	1	540.00	0.CON30E+00	000002+00	1	2	12 - R	13-R	14 - R	3
3	1	540.00	540 00	0.00000E+00	4	15-2	16 - R	17 - R	18-R	5
4	1	00+300000.0	546 00	0.00000E+00	19 - R	20-9	21-8	22-8	23-R	24 - R
1	NOTE . 9	R - RESTRAINED D	EGREE OF FREEDO	M						
	(CONSTRAINED	DEGREE OF FREED	OM						

DIRECTION COSINES .

COS(1) VX: 1.00000 I -0.00000 J +0.00000 K VY: 0.00000 I +1.00000 J +0.00000 K VZ: 0.00000 J +0.00000 K STRUCTURE....: EXAMPLE 2: ONE-STORY BUILDING TIME: 23:41:09, DATE: 11/30/90 SOLUTION....:

STABILITY ELEMENT PARAMETERS (BOX.TUBE, OR ANGLE)

MAT. NC.	 1 TUBE SEC 	TION	
NSEG	- 16	YS	- 36 C
EM	- 2.9002+04	LIBN	• 2
RADIUS	- 11.6	DUMMY VAR.	 0.000E-00
ECCXC	= 0 000E+00	ECCYO	 0.000E+00
1/4.5EC.NC.	- 10	DUMMY VAR.	- 10
THICKNESS	 0.750 	IREV1	- 9
IREV2	- 0	I REV3	- 0
IREV4	- c	IECOF	•
NUMP	- 40	SMALL	 30.0
RATIXO	 0.000E+00 	RATIYO	0.000E+C0
TOTA	 425. 	IAUTO	- 1
IMATER	- 1	RATICS	3.00CE 02
IR	- o	G	- 1.30CE-04
QRNEE	- 1.000E-02	ISTIF	• :

 MAT. NO.
 - 2
 TUBE SECTION

 NSFG
 - 16

 EM
 - 2.900E-04

 RADJUS
 - 11.6

 ECCX0
 - 0.000E+00

 1/4 SEC.NO.
 - 10

 THICKNESS
 - C.750

 IREV4
 - 0

 NUMP
 - 40

 PLTIN
 - 0.00E+00
 YS 35.0 LIBN 2 DUMMY VAR. 0.000E+00 ECCY9 0.000E+00 DUMMY VAR. 10 IREV1 0 IREV3 0 FECCP 0 DUMEY VAR. IREV1 - 0 IECCP - 0 SMALL - 30.0 RATIYO - 0 000E+00 IAUTO - 1 RATIO3 - 3.000E+02 G - 1.300E+04 TGTIF - 1 THICKNES IREV2 IREV4 NUMP RATIXO TOTA IMATER - 40 - 0.000E+00 - 425. - 1 0 - 1.000E-02 ÎR ORVER - 3 TUBE SECTION - 16 - 2.90CE-04 - 11 6 - 0 CC0E-0C MAT. NO NSEG - 36,0 -YS YS - 2 LIBN - 2 DCMMY VAR - 3.000E-00 ECCY3 - 3.000E+30 DUMMY VAR - 1C IREVI - C IREVI - C IREV3 - 0
 EM
 2.900E-04

 RADIU3
 11.6

 ECCN3
 3.060E-00

 ./4.82C.NC.
 .0

 THICKNESS
 0.750

 IREV4
 0

 NCMP
 40

 RATIX0
 0.000E-00

 TOTA
 425.

 IMATER
 1

 CQRNEE
 1.0002-02
 FM
 -3.000E+00

 DURMY VAR.
 16

 IREVI
 C

 IREV3
 C

 IREV4
 0.00

 SMALL
 30.0

 SMALL
 0.00E+00

 SMALL
 0.00E+01

 IAJTO
 0.00E+02

 G
 1.300E+02

 G
 1.300E+02

 ISTIF
 1
 IR ORNEE STRUCTURE. . .: EXAMPLE 2: ONE-STORY BUILDING TIME: 23:41:09, DATE: 11/30/90 SOLUTION ELEMENT 12, STABILITY ELEMENT
 # MATL
 START
 END
 LENGTH
 Y-AXIS
 START
 DIST
 END
 DIST

 1
 1
 2
 543 C
 0.00000 I -0.00000 J +1.00000 K
 0.0000E+00
 END DIST TUBE MEMBER 1 2 TUBE MEMBER 2 TUBE MEMBER 3 ZERO MASS MATRIX PROPERTIONAL DAMPING COLEFICIENTS ALPHA- 9.000002+00 BETA- 0.0000002+00 ···· ELAPSED CPU TIME 1.44 SEC ····· ···· TOTAL CPU TIME 1.44 SEC ····· STRUCTURE. : EXAMPLE 2: CNE-STORY BUILDING SCLUTION... : APPLY AXIAL LOAD AT JOINT 2 AND JOINT 3 TIME: 23:41:09, DATE: 11/30/90 TIME: 23:41:12, DATE: 11/30/90 SOLUTION #1. STATIC · ELASTIC ANALYSIS
 LOAD CASE:
 1
 JOINT:
 2
 DIRECTION:
 PX
 DOF(S)
 1
 MAGNITUDE:
 -788.850

 LOAD CASE:
 1
 JOINT:
 3
 DIRECTION:
 FX
 DOF(S)
 4
 MAGNITUDE:
 -768.850

 STRUCTURE....:
 EXAMPLE 2:
 CNE:STORY BUILDING
 50LJTION....:
 APPLY AXIAL LOAD AT JOINT 2
 AND JOINT 3
 TIME: 23:41:09, DATE: 11/30/90 TIME: 23:41:12, DATE: 11/30/90 GCS DISPLACEMENTS. LOADING # 1 NODE DX DY DΖ RX RY RZ TIME: 23:41:09, DATE: 11/30/90 TIME: 23:41:12, DATE: 11/30/90 GCS RESTRAINT REACTIONS, LOADING # 1 NCDE FX MZ FY FZ МΧ MY • ذ SUMMATION 1577 TCO -0.9814692E-25 0.3000000E+CC C.000C000E+00 0.000000E+0C -425979.0 STRUCTURE... EXAMPLE 2: ONE-STORY BJILDING SOLUTION...: APPLY AXIAL LOAD AT JOINT 2 AND JOINT 3 TIME: 23:41:09, DATE: 11/3C/90 TIME: 23:41:12, DATE: 11/30/90 STABILITY ELEMENT FORCES.... ELEMENT LOAD NODE AXIAL FY MY TORSION MZ FLP, SP FZ 1 1 DISPL 1 0.00000E+03) 00000E+00 0 00000E+00 0.000000E+00 0 0.00000E+00 0.000000E+00 DISPL 2 -0.268714 0 000000E+00 -3.976383E-16 0.000002+00 5.333907E-16 0.000000E+00 0.000E+00
1	1	FORCE	1 2	789.850 -795 850	0.000000E+00 0 000000E+00	·1.167324E·12 1.167324E·12	0.00000E+00 0.00000E+00	2.098275E-10 4.205276E-10	0.000000E+00 0 000000E+00	0.000E+0
2	1	DISPL DISPL	2 3	3.976383E-15 0.000000E-00	0.00C00CE+0C C.00C00CE+6C	-0.268714 -C.268714	C.300330E+3 C.300330E+3	5.333907E-16 5.513314E-16	0.00000CE+00 0.00000CE+00	0.000E+
2	1	FORCE	2 3	1.157324E·12 -1.167324E·12	C.00C00CE+0C G.0C000CE+0C	6.528748E·12 7.859743E·12	2 C.00C000E+00 2 C.00C000E+00	-4.205755E-10 4.433965E-10	C.000000E+00 C.000000E+00	0.30CE+
3	1	DISFL DISFL	4 3	9.000000E+00 -0 268714	0.000C00E+00 0.000C00E+00	0 000000E-00 0 000000E-00	0.000000E+00	0.000000E+0(-5.513314E-10	0.000C00E+00 0.000C00E+00	0.00CE+
3	:	FORCE	4	788.850	0.000C00E+00 0.000C00E+00	1 231674E·12	2 0.000000E+0	-2 217372E-1(0.000C00E+00	0.00054
THE STATICS	STR	AIN ENER	- 37 37	SYSTEM - 212	.0		•			
MEMORY	UT: 33355 5D CP CPU	LIZATION MEM U TIME TIME EXAMPLE	21.96 2.9 4.1 2: 01	SSEC	NG			TIME :	23:41:09, DATE:	11/30/90
SOLUTION. SOLUTION #	4. 5	INCREME TATIC NO	MTAL I NLINEA	SISPLACEMENT CO AR SOLUTION	NTROL AT JOINT	3		TIME:	23:41:15, DATE:	11/30/90
INTERVAL F INTERVAL F	OR F	RINTING D	DATA ATA TO) FILE	0C 2					
UNBA LANCED) JOI	NT FORCE	S ARE	NOT ADDED TO T	HE NEXT CYCLE					
DATA W	RITT	EN TO FI	LES							
DEGREE AFPLIED	CF F JOIN	TEEDOM TLOADS	4 19	5 IS WRITTEN TO)UNIT 4 11 3	POINT: 3	DIRECTION: FY			
LGAD CASE: STRUCTURE.		JCINT. EXAMPLE	2: CI	DIRECTION: FY	DOF(S) 15 NG	,	MAGNITUDE: 20	.0000J	DINT DISPLACEMENT 23.41:09, DATE:	11/30/90
, LOADING		0 S	MAXIM	JEPLACEMENT CO	NIKUL AT JOINT	د		TIME.	23.41.15, DATE:	11/30/80
איפרה איפרא	C.E.M.	NTS.								
JUS DISPLA	EM2		NOTE	MAXIMUM VALUE	S MAY NOT OCCU	R SIMULTANEOUS	LY			
NODE		DX		DY	DZ	RX	RY	RZ		
1 2 · 3 · 4 STRUCTURE.	0.00	00000E+00 19312 16647 00000E+00 EXAMPLE	0,0 -1: -2: 0,1 2: CI	000000E+CC 6. 9.9871 0. 0.00CC 0. 0C000CE+CO 0. NE-STORY BUILDO	000000E+00 0 000000E+00 0 000000E+00 0 000000E+00 0 NG	.000000E+00 00000E+00 000002+00 .000002+00	0.0000092+00 0.0000002+00 0.000002+00 0.000002+00 0.000002+00	D.0000002+00 1.171492E-02 1.3049112-02 0.000000E+00 TIME:	23:41.09, DATE	11/30/90
, LOADING) NCREME	MIAL I MAXIM	UM REACTIONS	NIROL AT JOINI	1		TIME:	23:41-15, DATE:	11/30/90
MAXIMUM GC	CS 83	ESTRAINT	REACT	IONS NOTE:	MAXIMUM VALUES	MAY NOT OCCUR	SIMULTANEOUSLY			
								117		
1	640	FA 0.2106	2	4.60287 0.	000000CE+0C 0	. 000000E-C0	ен 0.0000000E+C0	m2 14145 98		
2 3 4	0.00 0.00 788	000000E-C 000000E-C 8 3674	0 C. 0 ·5 2'	0000000E+0C 0. 2.07221 C. 7.53109 C.	00C00CCE+CC C 0CC00CCE+CC C 0CC00CCE+CC C	.0000000E+C0 .0000000E+C0 .0000000E+C0	G.20009COE+CO G.20033COE+CO C.00033COE+CO	C.000000000000 C.000000000000 14617.93		
MAX OF ALL- GCS SUMM.	157	7,700	0.	3947502E-CE C	000000E+00 0	.0000000E+00	G 00C0000E+00	-425600.4		
MAXIMUM STRUCTURE	RES	LTANT CF	REAC 2: 0	TICNS, FORCE NE-STORY BUILD	1578. ING	MCMENT= 4.25	80E+05	TIME:	23:41.09, DATE	11/30/90
SOLUTION.	 	INCREME	MTAL	DISPLACEMENT CO	NTROL AT JOINT	3		TIME	23:41.15. DATE	11/30/90
COL	ัสม	(LCAD) R	EPRES	ENTS THE DOP WI	(ICH HAS MAXIMU	M VALUE				
STABILI MAXI ELEMENT I	ITY N IMUM LOAD	VALUES F	FORCE CR AL NODE	S LSTEPS NOTE AXIAL	MAXIMUM VALUE. FY	S WITH THE CTH	ER DOFS FORCES TORSION	ARE PRINT OUT A	T THE SAME TIME MZ	FLP.SP
1	1	FORCE	1 2	840.211 - 640.211	0.000000E+00 C.000000E+00	• 16 . 3812 16 . 3832	0.000000E+0 0.000000E+0	0 14146 0	0.000000E+C0 0.0000C0E+C0	
1	3	FORCE	1	829.882	0.00000CE+00	-24 6029	G. 0000002+0	0 12149.7	0.00000E+00	
1	5	PORCE	1	34C.211	0.0000002+00	-15.3832	0.00C000E+0	0 14146-0	C.0CC00CE+00	
1	÷	FORCE	1	840.211	0.000000E+00	-16.3832	9.000000E+0	0 14146.0	0 0000002+00	
<u>1</u>	9	FORCE	2	-540.211 529 852	0 000000E+00	16.3832 -24.6029	0.000000 2+0 0.000000E+0	0 13673.5	6.000000E+00	
i	11	FORCE	2	829.852 840.211	0.000000E+C0	24.6329 -16.3532	0.000000E+0 0.000000E+0	0 10965.C 0 14146.C	0.000C00E+00 0.000C00E+C0	
2	,	FORCE	2	840 211 24.6029	0.000000E+00	16.5832	0 000000E+0	0 13673 5	0.000000E+C0	
-	1	FORCE	3	-24.6029	C. 0CC000E+0C	-41.0321	0.00000CE+0	C -11191 3	00+2000CCD C	
2	3	FORCE	2 3	16.3832 -16.3632	C.0CC00CE+0C C.0CC00CE+0C	51 3606 •51 3606	0.000000E+0 C.000000E+0	0 13673.5 C 14059.9	0 C00000E+8C 0.C00000E+8C	

2	5	FORCE	2 3	16.3832 -15.3832	C.00CC90E+90 C.0CC90E+90	51 3606 -51.3606	0.000003E+00 0.000000E+00	-13673.5 -14059.9	0.00000E+00 0.00000E+00	
2	7	FORCE	2 3	24.6C29 -24.6C29	0.000000E-00 0.000000E-00	41.0321 -41.0321	0 000000E-00 0 000000E-00	·10965.6 ·11191.3	0.000000E+05 0.000000E+00	
2	è	FORCE FORCE	2 3	16.3832 -16.3832	0 000000E+00 0.000000E+00	51.2606 -51.3606	0.000000E+C0 0.0000C0E+C0	-13673.5 -14059.9	C.0000002+00 G.0C000GE+00	
ž	11	FORCE	2 3	16 3832 -16 3832	0.0000002+00 0.0000002+00	51 3606 -51 3606	0.000000E+00 0.000000E+00	-13673.5 -14059.9	0.000000E+00 0.00000E+00	
3	1	FORCE	4 3	788.950 -788.850	G.000000E+00 C.00000E+00	1 231874E-12 1.231874E-12	C.300330E+30 0.300330E+30	-2.217372E-10 -4.434745E-10	0.000000E+C0 0.00000E+00	
٤	3	FORCE	43	747.051 -747.051	0.000000E+00 0.000000E+00	-27.5310 27.5310	0.00000CE+00 0.00000CE+00	12717.0 11402.4	0.000C00E+00 0.000C002+00	
3	5	FORCE	4 3	737.489 737 489	0.000002E+00 0 000000E+00	·22.0932 22.0832	0.000000E+00 0.000000E+00	14617.9 14059 9	0.000000E+00 C.000000E+00	
3	7	FORCE	4 3	783,850 783,850	0.000000E+00 0.000000E+00	1 231874E 12 1.231674E 12	0.000002+00 0.000002+00	-2.217372E-10 -4.434745E-10	C.OCC00GE+90 0.0CC00CE+90	
3	9	FCRCE FCRCE	4 3	747.061 -747.061	0.000000E+00 0 000000E+00	27 5310 27.5310	0.000000E+00 6.000000E+00	12717.0 11402.4	0 000000 E+0 0 0 00000 E+0 0	
3	11	FORCE	4	737.489 -737.489	C.0CC000E+00 0.000060E+00	-22.0832 22.0832	0.000000E-00 0.000000E-00	14617.9 14059.9	0.000000E-00 0.000000E+00	
TURE	· · · ·	EXAMPLE 2 INCREMENT	: ON AL D	E-STORY BUILD ISPLACEMENT C	ING CNTRCL AT JOINT	3		TIME. TIME: 2	23-41:09, DATE: 23.41:15, DATE	11/30/90

STRUCTURE . .: EXAMPLE 2: ONE-STORY BUILDING SOLUTION.....: INCREMENTAL DISPLACEMENT CONTROL AT JOINT ?

, LOADING #	0 PEAK DUCTILITIES AND EXCURSION RATIO'S
TRUCTURE	EXAMPLE 2. ONE-STORY BUILDING
SOLUTION	INCREMENTAL DISPLACEMENT CONTROL AT JOINT 3

. LOADING \$ 0 DAMAGE INDEX

STRUCTURE DAMAGE INDEX= 0.00000E-00

•	
MEMORY UTILIZATION	N+
IZ 153344, ME	1-21 906 8
····	
 BLAPSED CPU TIME 	625.60 SEC ····*
* TOTAL OFU TIME	629.99 SEC
*	 . .

STRUCTURE....: EXAMPLE 2: ONE-STORY BUILDING SOLUTION....: INCREMENTAL DISPLACEMENT CONTROL AT JOINT 3

DEGREE	CF FREEDOM #	15 IS READ F	ROM UNIT # 11	JCINT # 3,	DIRECTION: FY
STEP	TIME	LOAD	DISPLACEMENT	VELOCITY A	CCELERATION
0	C.000C9E+00	6.454938-1	4 0.000CCE-00	0.00000E+00	0.0000E+00
2	0.00600E+00	-1.5236	-0.20000	0.000COE+CO	0.00000E+60
4	0.0C000E+00	-3.0472	-0.40000	0.000C0E+C0	0.0000E+CO
e	0.00002-00	4.5707	-0.60000	0.00000E+00	0.000COE-CO
8	0.0CC002+00	-6.C941	-0.80000	0.0000E+00	0.000C0E+00
10	0.00000E+00	-7 6175	·1.0C00	0.0000E+00	0.00000E+00
12	0 00000£+00	-9 1408	-1.2000	C.00C00E+00	0.00002+00
14	0.00000E+00	-10.664	·1.4C00	0.000002+00	0.30000E+00
16	0 CD000E+00	12.157	-1,6000	C.00C00E+00	0.0000E+00
15	0.00000E+00	•13.711	-1.8000	C.000002+00	0.00C00E+00
20	0.00000000000	- 15.234	-2.0000	0.0000000+00	C. 0CG00E+00
22	0.00000000000		-2 2000	0.000002+00	C. 00000E+30
26	0 0000000000	-19 507	-2.4000	0.000002+00	0.000305+30
20	0.00000000000	- 19,203	-2 8300	0.0000E+00	0.0000002+00
20	0.0000002+00	- 22 849	-1 0000	0.000002+00	0 000000E+00
12	0 000C0E+00	- 24 172	-3 2000	2 000002+00	D_COD00E+00
34	0.00002+00	-25 895	-3 4000	0.00000E+00	0.00000E+00
36	0.000002-00	- 27 417	-3 6000	0.000008+00	0.00000E+C0
38	0.000002-00	28.940	-3.8000	0.000C0E+00	0 00000E+C0
40	0.00C00E+00	30.463	- 4 . 0000	0.00000E+00	0.00000E+C0
42	0.00C00E+C0	-31,986	-4.2000	0.0000E+00	0.000C0E-C0
44	0 00000E+00	33.501	-4.4000	0.0000E+00	0.000002-00
46	0 00000E+00	-34.962	-4.6000	0-00000E+00	0.000002-00
45	00+300000 C	-36.369	-4.9000	0.00COOE+00	0.0000 0E+0 0
50	0 COOOOE+00	27.704	-5.0000	0.00000E+00	0.00 00E+0 0
5 Z	0 00000E+00	-38.951	-5.2000	C.00C90E+30	0 06000E+00
54	9.0000C+00	40.132	5,4000	0.00000⊑+00	Q.90000E+00
56	0.00002+00	-41,260	-5 6000	C.000002+90	0.0000E+00
55	0.000002+30	42.294	-5.9000	0.00000E+00	G.00CD0E+00
66	0.00000E+00	43.274	-6.0000	C.00036E*00	C.0CC00E+J0
64	0.0000CE+00	44,100	6 2000	0.0000002+00	C.00000E+00
66	0.000002+00	49,909	-6 4000	0.000002+00	C.00000E+00
69	0.00000E+00	- 45 46	6 8000	0.00000000000	0.000002+00
70	0.000000E+00	45.401	-7 0000	0.000002+00	0.0000CE+0C
72	0.000C0E+00	47.692	-7.2000	0 COOCCE+00	0.C000CE+00
74	0.000C0E+00	48 243	-7.40CC	0 000COE+00	0.0000CE+00
76	C.00000E+00	48.742	-7,6000	0 00000E+C0	0.C000CE+00
79	0.00003+00	49.212	-7.8000	0.000002+00	0.0000CE+00
80	0.00C002+00	49.606	- 8 . DOOC	0.000C0E+C0	9 C0000E+00
82	0.00000E+00	49.967	8.2000	0.000C0E+C0	0 00000E+00
94	0 00C00E+C0	-50.309	-8,4000	0.000C0E-00	0.00000 E +CO
96	0 COCODE+00	-50.632	-8 6CDO	0 00000E+00	0.000C0E+C0
38	C COCOO E •00	5C.915	-8.8000	0.0000E+00	0.000002-00
90	3 COOSOE+OS	51.148	·9.0000	0.0000E+00	0.000002+00
92	0 COODOE+00	- 51 . 3 29	-9.2090	0.0000E+00	0.000002-00
94	0 00000E+00		-9.4000	0.000002+00	0.000002+00
96	0.000002400	.51.809	-9,8000	0.000002+00	6.066002-00
100	0.000002400	-51 287	-10 000	0.000002+00	0.000002+00
102	0.000002+00	-51.961	-10 200	G.000002+00	0.00000E+00
104	0.000002+00	-52.022	19,400	0.00000E+00	C.OCC00E+00
106	0.0000CE+00	-52.067	.10.500	0.00000E+00	C.0CC00E+00
108	0.00000E+00	-52.063	-10.900	0.0C000E+0C	C.00C00E+00
110	0.0000CE+00	52.029	-11.000	0.0000E+00	C.0CC00E+00
112	0.30000E+0C	-51.957	·11.200	D.CCOOCE+OC	0.00000E+00
114	0.000CDE+0C	-51.876	-11.400	0 CC00CE+00	0.60000E+00
:16	0.000CDE+0C	-51 797	-11.600	D CC00CE+00	0.00000E+00
119	C.000CDE+0C	-51.695	-11.9GC	0.0C00CE+00	0.00000E+0C

TIME: 23:41:09, DATE: 11/30/90 TIME: 23:41:15, DATE: 11/30/90

TIME: 23:41:09, DATE: 11/30/90 TIME: 23:41:15, DATE: 11/30/90

120	C.000C0E+0C	-51 591	·12 000	C.00C00E+00	0.00000E+00
122	0.0CC00E-C0	51.463	-12.200	0.0C00CE+00	0.0000E+90
124	0 000002-00	-51.116	-12.400	C.00000E+00	C.0CC00E+00
126	0.00002+00	-51.149	-12.600	C.00C00E+00	0.00000E+00
128	C.00000E+00	-50 975	-12.800	C.00C00E+00	0.00C00E+00
130	G. 000COF+00	-50 798	-13 000	0.0000000000	0 100007+00
132	0.000000+00	50 6 6	-15 200	0.0000000000000000000000000000000000000	0 100002+01
134	0.000002+00	-50 418	-13 400	0.000008-00	0.000002-00
136	3 COROOF+00	- 50 704	-11.600	0.0000002-00	0.000002-00
133	0.000008+00	- 40 GE7	11 600	0.00000E-00	0.000002.00
140	0.000008+00	49.30	-14 800	0.0000000000	0 00000E+00
- 4 2	0.00002+00	40 443	14.000	0 0000002-00	0.0000000000
	0.000002+00	43.445	1.200	0 000000-00	0 C0000E+00
145	C 300C08+00		-14.400	0.000002+00	0 0000000000
149	0.000002+00	140 3/0	11 000	0.000000400	0 000002400
140	0.00000E+00	10 5/2	-14.800	0.00000E+00	0.000002400
- = 0	0.0000002-00	17 975	-15.000	0.000002+00	0.00000E+00
102	0.0000002+00	47.925	-15 233	0.000002+00	C.OCCUDE+DO
154	0.0000002-00	47 595	-15 400	0.000002+00	0.0000E+00
130	0 0000000000	-4/.25	-12 633	0.33000E+00	0.00CUUE+00
108	0 COUDUE+00	- 46.900	-15 900	0 000CJE-00	0.00000E+00
160	J.COCJUE+0J	40.545	-15.000	0 000CJE-00	0.00002400
102	0.000002+00	46.190	16.200	3 000CUE-C3	0.00000E+C0
154	0.000002-00	45.925	16.400	0 00000E+C0	0.000002+00
100	0.000032-00	- 45 . 459	10.600	5 CUSOUE+00	0.00000E+00
-55	0.000002+00	45.084	-16.900	0.0000CE+00	0 C0000E+00
-70	C. 000C0E+0C	-44 /04	-17.000	0.CCDUCE+00	0.CD30CE+00
_ 2	0.JUULUE+UL	- 44 322	200	0.0000CE+00	0 000002+00
1/5	0.300002+00	43 930	-17.400	0.0000002+00	0.0000CE+00
1/5	0.000002+00	43 546	-17 800	0.000002+00	C.00036E+30
1/0	0.0000002+00	43.150	-17 800	6.30C0UE+30	C.00000E+00
100	0 000002+00	42.49	-18 000	0.00000E+00	C. OCCODE+UO
104	0 00000E+00	42.343	-18 200	0.00006+00	0.0000E+00
154	J CJ300E+00	-41.932	-18 400	0.00000E+00	0.000002+00
156	3 COOSUE+00	-41.515	-15 600	0.000C0E+00	0.000002-00
150	J COUSSEROS	-41.045	-18.800	0.000C0E+C0	0.000008+00
190	0.000002-00	-40.000	· 19.000	0 00000E+00	2 02000E+C0
192	0.000012-00	40.231	19.200	0.0000E+00	0 C0000E+00
194	C.00000E+00	39.794	19.400	0.000000000	0 COOOCE+00
195	C.000CJE+0C	- 39 356	-19.600	0.0C00CE+00	0.000002+00
198	C.300C0E+0C	-38 912	-19.800	C.CCOOCE+0C	0.0000CE+0C
200	0.0000E+00	- 39 465	-20.090	C.05036E+0C	C.00000E+00
MEMORY	UTILIZATION 3344. MEM-21 D CPU TIME CPU TIME 63	.906%			
• • • • • • • • • • • • •	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · ·	•		

<u>Notes</u>

- (1) Results for an individual step are written to the output file every 50,000th step. The choice of a large increment (50,000) suppresses the output for individual steps.
- (2) Ductility and excursion ratios are not available for finite-segment element.
- (3) Damage index is not available for finite-segment element.



Figure 37. Lateral Load-Displacement Relationship

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C. TWO-STORY TRUSS STRUCTURE

1. Description of Input Information

Figure 38 shows a two-story truss structure. In the structure, all members are box-shape struts. Table 1 gives and the material properties for two different size struts.

For all the members, the bracing member hysteresis model is used. Nonlinear response to the first 10 seconds of the 1940 El Centro earthquake, E-W component, is calculated. The east-west component of the El Centro earthquake is stored in the file accessed by unit 15. The hysteresis loops of member 8 are written in the file with unit 18 and plotted in Figure 39.

2. Input Data



Figure 38. Two-Story Truss Structure

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Member Size	A(in²)	E(ksi)	σ _y (ksi)	r (in)	L (in)	L/r	P _{max} (kips)
5x5x0.5	9	29000	36	1.8	72	40	307.8
4x4x0.5	7	29000	36	1.39	72	51.8	230.6
4x4x0.5	7	29000	36	1.39	101. B2	73.2	209.47

 Table 1.
 MATERIAL PROPERTIES OF STRUTS

.

3. Output

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STRUCTURE. ... TWO-STORY TRUSS STRUCTURE SCLUTION..... TIME: 13:49:05, DATE: 12/01/90 *** PROGRAM FEM *** DOUBLE FRECISION VERSION NODE COORDINATES AND DEGREES OF FREEDOM 23 ...COORD Y.COCRD Z-COCRD 1 0 CC0002+00 0.00006+00 0.00006+00 2 1 0.00002+00 12 9C0 0.00006+00 3 1 0.00002+00 144 C0 0 0.00006+00 4 1 72 000 72 900 0.00006+00 5 1 72.000 72 900 0.00006+00 6 1 72.000 144.00 0.00006+00 NOTE. R • RESTRAINED DEGREE OF FREEDOM C • CONSTRAINED DEGREE OF FREEDOM FY 1C-R 2 FZ 11 · R 15 · R 19 · R 25 · R 29 · R MX 12 - R 16 - R 20 - R 26 - R 30 - R MY 13 · R 17 · R 21 · R 27 · R 31 · R MZ 14 · R 18 · R 22 · R 28 · R 32 · R NOLF COS# FX 9 - R _____ 23-R 4 24 - R 5 б Э DIRECTION COSINES ... OSI 1) VX: 1.00000 I -0.00000 J +0.00000 K VY: 0.00000 I +1.00000 J +0.00000 K VZ: 0.00000 I +0.00000 J +1.00000 K STRUCTURE....: TWO-STORY TRUSS STRUCTURE SOLUTION.....: COS (1) BRACE HYSTERESIS MODEL PARAMETERS MAT. E 1 29000.0 SHAPE 2.00000 MAX DUC 20.0000 BETA 0.400000 35 0COO 9.00000 1 80000 2 29000.0 7.00000 1.39000 36 0000 2.0000 20.0000 0.400000 STRUCTURE. ..: TWO-STORY TRUSS STRUCTURE SOLUTION.....: TIME: 13:49:05, DATE: 12/01/90 ELEMENT 08, ONE (LOCAL) DOF STRUT ELEMENT
 Y+AKIS
 START DIST
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 1.00003
 I + C.00000
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 I + C.00000
 J + C.00000
 K 0
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 I + C.00000
 J + C.00000
 K 0.0002+00
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 I + C.00000
 J + C.00000
 K 0.0002+00
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 I + 1.00000
 J + C.00000
 K 0.0002+00
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 I + 1.00000
 J + C.00000
 K 0.0002+00
 0.0002+00

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 I + 0.0000
 J + C.00002
 K 0.0002+00
 0.0002+00

 0.00000
 I + 0.0000
 J + 1.00000
 K 0.0002+00
 0.0002+00

 0.00000
 I + 0.0000
 J + 1.00000
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 K 0.0002+00
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 LENGTH 72.00 72.00 72.00 72.00 72.00 72.00 72.00 MATL START END ... TYPE
 #
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 END

 MEM.
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 STRUCTURE...
 TWC-STORY
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 мх NODE MY м7 2 0.3000 5 0.3000 0.3009 0.3000 C.3000 C.3000 • THE MASS MATRIX IS NOT CONDENSED WITH THE STRUCTURAL STIFFNESS MATRIX. PROPORTIONAL DAMPING COIEFICIENTS ALPHA- 1.3060 BETA- 1.43000E-03 MEMORY UTILIZATION IZ- 1527, MEM- 0.213% ELAPSED CPU TIME C.15 SEC TOTAL CPU TIME C.15 SEC STRUCTURE..... TWO-STORY TRUSS STRUCTURE SCLUTION STRUCTURAL RESPONSE DUE TO 1940 EL CENTRO E-W COMPONENT TIM2: 13:49:05, DATE: 12/01/90 TIM2: 13:49:05, DATE: 12/01/90 SOLUTION #2, WILSON THETA METHOD OF NUMERICAL INTEGRATION
 THETA.
 1.40000

 INITIAL TIME
 0.000002+00

 TIME STEP
 1.000002-02

 FINAL TIME
 17 0000

 ACCELERATION DUE TO GRAVITY
 356 000

 STEP INTERVAL FOR PRINTING
 10000
 DATA WRITTEN TO FILES ELEMENT # 8 IS WRITTEN TO UNIT # 18 DEGREE OF FREEDOM # 7 IS WRITTEN TO UNIT # 27 JOINT: 6 DIRECTION: FX NOT INCLUDE STATICS CASE EXTERNAL DEFORMATIONS GROUND ACCELERATION RECORD

INPUTING TRANSLATIONAL ACCELERATION RECORD # 1, FROM UNIT. 15 1940 EL CENTRO EQ DATA FORMAT:/0F5.6) DT=0 0: SEC.. E-W DIRECTION 2400 DATA THE RECORD CONTAINS 2400 FOINTS, BEGINING AT TIME 1.300030E-32 WITH A TIME INCREMENT OF: 1.9000000E-32 DIRECTION OF ACCELERATION. 1 09000 I +0.90000 J -0.30000 K AVERAGE STANDARD DEV. 18.94396E-05 5 460000 MAXIMUN AT TIME 0.21490 1.8800 MINIMUN AT TIME 11 040 RMS INFUT ACCELERATION 5.46953E-02 5.46840E-02 ·0.16133 0.21490
 MAXIMUN AT TIME
 MINIMUN AT TIME
 AVERAGE
 STANDARD DEV
 RMS

 X-AXIS ACCELERATION
 0.21490
 1.8800
 -C.16138
 11.040
 -5.84395E-05
 5.46953E-02
 5.46940E-02

 Y-AXIS ACCELERATION
 0.2000E+00
 2.0000E+02
 C.00000E+02
 0.0000E+00
 0.000E+00
 0.000E+00 SYSTEM DISPLACEMENT (FIRST ELEMENT REACH TO CRITICAL LOAD FIRST REACH TO CRITICAL LOAD ... ·· SLEVENT GCS DISPLACEMENTS, LOADING # 1 STEP: 4446, TIME: 4.4460 NCDE DX DΥ DΖ RX. RY RZ 1 0.000002+00 0.0000002+00 0 000002+00 0.00002+00 0 2 -0.252931 -1.3169102-02 0.000002+00 0.000002+00 0 3 0.423502 -1.3560552-92 0.0000002+00 0.000002+00 0 4 0.000002+00 0.000002+00 0.000002+00 0.000020+00 0 5 -0.234845 5.3971412+02 0.000002+00 0.000002+00 0 5 -0.234845 5.3971412+02 0.000002+00 0.000002+00 0 5 -0.234845 5.3971412+02 0.000002+00 0.000002+00 0 5 -0.0414675 3.1053422+02 0.000002+00 0.000002+00 0 5TRUCTURE : TWO-STORY TRUSS STRUCTURE SOLUTION... : STRUCTURAL RESPONSE DUE TO 1940 EL CENTRO 2+W COMPONENT 0 G00CC0E+C0 0 G00C0E+00 0 G0000E+00 0 0C000CE-00 C 0C000CE-00 C 0C000CE+00 C 0C000CE+00 0 00000CE-CC 0.0000CE+C0 0.000000E+00 0.000000E+00 0.000000E+00 0.000000E+00 TIME: 13:49 05, DATE: 12/01/90 TIME: 13:49.05, DATE: 12/01/90 MAXIMUN VALUES FOR ALL STEPS GCS MAXIMUM DISPLACEMENTS NOTE: MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY NODE DY ħ7 RX DΧ RΥ RΖ 0 CC0000E-CC 0 CC00CCE+00 0.CC0000E+00 0.00000E+00 C.000000E+00 C.56C000E+05 TIME: 13:49:05, DATE: 12/C1/90 TIME: 13:49:05, DATE: 12/C1/90 MAXIMUN VALUES FOR ALL STEPS GCS MAXIMUM VELOCITIES NOTE: MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY DY DΖ RΧ NODE DX RY RZ 1 0 0C0000E+00 0 CC000CE+06 0.00000E+00 2 4.77518 0 066626 0.00000E+00 3 9.28774 0.51972 0.00000E+00 4 0.00000E+00 0.00000E+00 0.00000E+00 4 4.87756 1.43532 0.00000E+00 5 4.897356 0.143532 0.00000E+00 5 8.03170 2.14507 0.00000E+00 0 C000C02+00 0.000002+00 0.0000C02+00 0.0000C02+00 0.000CC02+00 0.0000C02+00 0.0000002+00 0.0000C02+00 0.0000C02+00 0.0000002+00 0.0000C02+00 0.0000C02+00 0.0000002+00 0.0000002+00 0.0000C02+00 C.000006000 C.000000000 TIME: 13:49:05, DATE: 12/01/90 TIME: 13:49:05, DATE: 12/01/90 0.00000E+00 0.00000CE+00 0.00000E+00 0.00000E+00 STRUCTURE . .: TWO-STORY TRUSS STRUCTURE SOLUTION.....: STRUCTURAL RESPONSE DUE TO 1940 EL CENTRO E-W COMPONENT MAXIMUN VALUES FOR ALL STEPS GCS MAXIMUM ACCELERATIONS NOTE: MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY DY D2 5.X NODE DX RY RΖ 1 0 0C0000E+00 3 CC00CGE+6C 0.000C00E+00 3.C00CC2-C3 3.C00CC02+C3 2 119.187 28.7199 3 000002E-03 3.5009CC2-C3 3 000CC02+C0 3 190.872 39 0954 3 000002E-C3 3.0009C02+C0 3.00000E+00 4 0.00C0002E+00 0.0000002E+00 0.000002E+00 0.00000E+00 5 118 098 -43.5181 0.000000E+00 0.000002E+00 0.00000E+00 6 182 681 +69.4972 C.00C000E+00 0.000002E+00 0.00000E+00 5 STRUCTURE...: TWO-STORY TRUES STRUCTURE SOLUTION..... STRUCTURAL RESPONSE DUE TO 1940 2L CENTRO E-W CCMPONENT 0.0000002+00 0.000002+00 0.00000E+00 B CC000CE-GC 0.00000CE+GC 0.00C000E+00 C.00C000E+00 0.00C000E+00 TIME: 13:49.05, DATE: 12/01/90 TIME: 13:49.05, DATE: 12/01/90 MAXIMUN VALUES FOR ALL STEPS MAXIMUM GCS RESTRAINT REACTIONS NOTE: MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY ۶x FY MХ NODE 72 M7 MY
 1
 14E.2414
 234.7425
 0.0500002E+00
 0.000002E+00
 0.0000002E+00
 0.0000002E+ MAX OF ALL. - 30 . 046 25 0.000000E+00 0 C000000E+0C 0.000000E+0C -17447.52 MAXIMUM RESULTANT OF REACTIONS, FORCE- 149.4 MCMENT- 1 74462-04 STRUCTURE.... TWO-STORY TRUSS STRUCTURE SOLUTION....: STRUCTURAL RESPONSE DUE TO 1940 EL CENTRO E-W COMPONENT TIME: 13 49:05, DATE: 12/01/90 TIME 13:49:05, DATE: 12/01/90

MAXIMUN VALUES FOR ALL STEPS

1.7500

 BRACE FORCES...
 MAXIMUM LCAD AND DISPL AT MAXIMUM LOAD NOTE MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY

 ELEMENT LCAD
 TYPE NODEL NOTEJ
 FORCE
 DISPLACMENT
 STIFFNESS

 1
 0
 AXIAL
 2
 -11.6577
 -3.215921E-33

 2
 0
 AXIAL
 1
 2
 -95.0451
 -2.62153E-02

 3
 0
 AXIAL
 5
 101.791
 3.61033E-02

 4
 0
 AXIAL
 5
 2.227
 8.59483E-02

 5
 0
 AXIAL
 5
 12.778
 1.249057E-02

 6
 0
 AXIAL
 2
 6
 119.566
 5.996358E-02

 7
 0
 AXIAL
 2
 6
 119.566
 5.996358E-02

 7
 0
 AXIAL
 5
 -203.665
 -0.446890
 TIME: 13:49:05, DATE

 STRUCTURE
 TWO-STORY TRUES STRUCTURE
 TIME: 13:49:05, DATE
 SUUTION....: STRUCTURAL RESPONSE DUE TO 1943 EL CENTRO E-W COMPONENT
 TIME: 13:49:05, DATE
 TIME: 13:49:05, DATE: 12/01/90 TIME: 13:49:05, DATE: 12/01/90 MAXIMUN VALUES FOR ALL STEPS

 STRUT DUCTILITIES AND EXCURSION RATIOS.

 ELEMENT 1- DUCTILITY DEFINATION #1 -:

 DUCTILITY EXCURSION

 1 C 0000C0E+C0 C.0000002+C0

 2 C.000002+C0 0.000002+C0

 3 0.000002+00 0.000002+00

 4 0.000002+00 0.000002+00

 5 0.000002+00 0.000002+00

 6 0.00002+00 0.000002+00

 7 0 C00002+00 0.000002+00

 8 3.48611

 2.2.88611

 STRUCTURE.
 : TWO-STORY TRUSS STRUCTURE

 SOLUTION.
 : STRUCTURAL RESPONSE DUE TO 1940 EL CENTRO E+W COMPONENT

 TIME: 13-49:05, DATE: 12/01/90 TIME: 13:49:05, DATE: 12/01/90 MAXIMUN VALUES FOR ALL STEPS
 NT
 DAMAGE INDEX
 F MAX
 D MAX
 ESE
 PSE

 1
 1.799030E-03
 -11.6577
 -3 2.5921E-03
 8.9203E5E-03
 0.0003000E+00

 2
 1.466745E-02
 95.0451
 -2.62193E+02
 4.89205E5E-03
 0.0003000E+00

 3
 2.194573E-02
 101.791
 3.611335E+02
 3.651702E+02
 3.000002E+00

 4
 4.908059E+02
 242.327
 9.594839E+02
 1.10011
 0.000002E+00

 5
 6.59916EE+03
 42.7626
 -1.179558E+02
 0.217745
 0.000002E+00

 6
 1.317567E+02
 119.776
 3.249057E+02
 0.217745
 0.000002E+00

 7
 2.719590E+02
 1.996335E 02
 0.125229
 0.000002E+00

 8
 0.243464
 -59.0398
 -0.440890
 2.30551
 109.995
 ELEMENT DAMAGE INDEX STRUCTURE DAMAGE INDEX- C.24080 STRUCTURE ... TWO-STORY TRUES STRUCTURE SOLUTION.....: STRUCTURAL RESPONSE DUE TO 1940 EL CENTRO E-W COMFONENT TIME: 13:49:05, DATE: 12/01/90 TIME: 13:49:05, DATE: 12/01/90 MAXIMUN VALUES FOR ALL STEES PEAK ENERGY VALUES

 PEAK ENERGY VALUES
 266.60

 MAX INPUT ENERGY.
 29.486

 MAX PLASTIC STRAIN ENERGY.
 112.48

 MAX MARTIC STRAIN ENERGY.
 12.48

 MAX DAMFING ENERGY
 104.60

 MEMORY UTILIZATION IZ- 12139, MEM- 1.7348 ELAPSED CFU TIME 218.32 SEC TOTAL CPU TIME 218.47 SEC STRUCTURE. : INO-STORY TRUSS STRUCTURE SOLUTION....: STRUCTURAL RESPONSE DUE TO 1940 EL CENTRO E-W COMPONENT TIME: 13:49:05, DATE: 12/01/90 TIME: 13:49:05, DATE: 12/01/90 ELEMENT # 8 IS READ FROM UNIT # 18 BRACE MEMBER FORCES. . NODEI: 2 NODEJ: 5 BRACE"S TYPE: AXIAL
 1
 NODEJ:
 5
 BRACE"S TYPE:
 AXIAL

 TIME
 FORCE
 DISPLACE"S TYPE:
 AXIAL

 0.00000E+00
 0.000002*00
 0.00002*01
 994.C

 1.00000E+02
 1.6570
 9.31360E+04
 1994.C

 1.00000E+02
 4.4930
 2.25390E+03
 1994.C

 0.30000E+02
 4.4930
 2.25390E+03
 1994.C

 0.30000E+02
 4.4930
 2.25390E+03
 1994.C

 0.30000E+02
 4.4930
 2.25390E+03
 1994.C

 0.30000E+03
 6.7020
 3.6196E+03
 1994.0

 0.25000
 6.77200
 3.19930E+03
 1994.0

 0.35000
 5.3900
 2.61530E+03
 1994.0

 0.40000
 11.9430
 5.99070E+03
 1994.0

 0.45000
 5.2140
 2.61530E+03
 1994.0

 0.45000
 1.9670
 -9.86840E+03
 1994.0

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 -9.86840E+03
 1994.0

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 7.6150
 3.813660E+03
 1994.0

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 PSE

 0.0002E+00
 0.0002E+00

 5.64650E+04
 3.79470E+19

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 0.00002E+00

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 0.00002E+00

 1.266E+02
 0.00002E+00

 1.2260E+02
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 3.57740E+02
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 5.15122E+04
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 9.76752E+04
 0.00002E+00

 3.57740E+02
 0.00002E+00

 9.76752E+04
 0.00002E+00

 3.5776E+02
 0.00002E+00

 9.76752E+04
 0.00002E+00

 1.45430E+02
 0.00002E+00

 3.56136CE+02
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 3.56145CE+02
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 3.5876E+02
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 1.1500 1.2900 1.2500 1.3000 1.3500 1.4009 1150 1200 1250 1300 1350 1350 1400 -450 1500 1550 1600 1650 1700 1750 1800 1 4000 1 4500 1.5000 1.5500 1.6500 1.6500 1.7000

	1850 1900	1 8500	-191 70 -207.50	-9.61690E-02 C.11310	1994 C 1984 D	9 2190	0.00000E+00
	1950	1.9500	141.30	7 77680E-02	1994.0	5.0070	1.4400
	2050	2.0500	86 350	3.74190E-C2	1994.0	0.19410	1.4400
	2100	2.1000	156 50	9.3404CE-C2	629.20	5 1450	4.6320
2285 1.2500 +5.420 +2.220C+21 394.0 1.7560 7.6990 2480 1.4000 +1.6400 -2.6400 1.2300 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.2560 1.25600 1.25600 <td>2200</td> <td>2.2000</td> <td>45 580</td> <td>5.5324CE-C2</td> <td>1994 0</td> <td>5 9440 C.52780</td> <td>7.4990</td>	2200	2.2000	45 580	5.5324CE-C2	1994 0	5 9440 C.52780	7.4990
1356 147.33 147.33 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 147.35 <td>2250</td> <td>2.2500</td> <td>-83.420</td> <td>-9.5292CE-C3</td> <td>1994.0</td> <td>1 7450</td> <td>7.4990</td>	2250	2.2500	-83.420	-9.5292CE-C3	1994.0	1 7450	7.4990
2400 2.4.200 7.1.470 1.6304C122 244.0 1 2.800 2.4.700 2550 2.500 3.4.70 1.4.85501-01 3.94 0 2.7500 2.700 2550 2.500 3.4.70 1.4.85501-01 3.94 0 2.7500 2.700 2550 2.500 3.4.70 1.4.85501-01 3.94 0 2.7500 2.700 2570 2.7000 7.6.60 3.4.37001-02 3.94 0 2.75001 2.760 2570 2.7000 7.6.60 3.4.37001-02 3.94 0 1.2.400 2.760 2600 3.6.60 2.94000 3.4.417001-02 3.94 0 1.6.410 2.760 29400 -4.4.40 3.145001-02 3.94 0 1.6420 2.760 29400 -4.4.40 3.145001-02 3.94 0 1.6420 2.760 31000 1.0000 2.770 1.760 3.994 0 1.6420 1.760 3	2350	2.3500	-83.190	-6.1375CE-02	1994.0	2 5379 1 7360	10 500
1300 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2400	2.4000	71.670	1.6304CE-02	1994.0	1 2980	12.760
2550 2 5600 34.270 2.445860-01 994.0 0 C.28450 2 760 2650 2 7600 76.300 76.460 2.934.0 0 C.275000 2.760 2750 2 7600 76.460 2.433000-02 994.0 0 2.75000 2.760 2850 2 9600 3.64000-03 1.994.0 0 1.94000 2.760 2850 2 9600 3.64000-03 1.994.0 0 1.2400 2.760 29500 3.6400 1.94000-03 1.994.0 0 1.6400 2.760 31000 3.1000 2 7.760 7.75200-03 1.994.0 0 1.990.0 2.760 1.760 31300 3.1000 2 7.760 7.752.0 3.994.0 0 1.950.0 1.760 31300 3.1000 2 7.772.0 1.000070331 1.994.0 0 1.950.0 1.760 3131000 1.950.0	2500	2 5000	63.140	1.2026CE-02	1394.0	2 1050 C.999990	12.760
1665 2 6400 12 12 14 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12	2550	2 5500	34.270	2.45850E-03	1994 0	C.29450	12.760
2700 13.450 1.439306-22 2944 0 2.756407 22.75647 22.75647 2800 2.7500 11.439306-22 1944 0 2.756407 22.7564 2800 2.7500 11.450 2.8500 2.75640 2.75640 2.7564 2800 2.8500 11.460 1.434007-02 1984 C 2.17640 2.7664 2800 2.8500 11.760 1.776 7.76507-02 1984 C 0.16407 2.760 2100 1.1000 27.776 7.76507-02 1984 C 0.16407 2.760 2100 1.1000 27.776 7.76507-02 1984 C 0.12207 1.760 2100 1.1000 27.776 7.7664070-02 1984 C 0.12207 1.760 21200 1.2500 1.776 1.35507 1.760 1.3550 1.760 21400 1.4500 1.9990 1.111507 1.111507 1.3550 1.760 21400<	2650	2 6500	-10,850	2.50560E-02	1994 0	C.61190 2.950602·32	12.760
2800 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 <th2< th=""> 2 2 2</th2<>	2700	2 7000	10.470	-1.43930E-02	1994 0	2.750402-02	12.760
2450 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2 5 3 5 0 0 2 5 1 5 0 0 1 1 5 0 1 1 5 0 0 1 5 0 0 1 5 0 0 1 5 5 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2800	2 6000	131.10	4.61370E-02	1994 C	4 3140	12.760
2955 2.9500 -44.470 5.19500-22 1941 C 1.14410 1.2.40 1100 1.1500 1.2.40 4.8500-22 1944 C 0.224570 1.2.760 1100 1.1500 1.2.40 4.8500-22 1944 C 1.4413 1.2.760 1100 1.1500 1.2.960 2.94200-22 1.944 C 1.4413 1.760 1100 1.1500 1.2.940 2.94200-22 1.944 C 1.4413 1.760 1100 1.1.950 1.940 2.94200-22 1.944 C 1.4413 1.770 1.1772 1110 1.1.950 1.944 C 1.4413 1.770 1.1772 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770 1.1770	2850 2900	2 6500	97 280 36 890	2.91470E-02	1994 C	2 3730	12.760
Johnson Johnson <t< td=""><td>2950</td><td>2.9500</td><td>64.43C</td><td>5 19650E-02</td><td>1994 C</td><td>1.0410</td><td>12.760</td></t<>	2950	2.9500	64.43C	5 19650E-02	1994 C	1.0410	12.760
1100 1.100 1.7 Tr0 5.7 T520E 53 1994 C 1.6 T53 1.9 Tr0 1.7 Tr0 <td< td=""><td>3000</td><td>3.00CO 3.05CO</td><td>-57.240</td><td>-4 83580E-02</td><td>1994 C</td><td>0.82180</td><td>12.760</td></td<>	3000	3.00CO 3.05CO	-57.240	-4 83580E-02	1994 C	0.82180	12.760
1210 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 12300 123000 12300 12300 <th< td=""><td>3100</td><td>3.1000</td><td>27 770</td><td>-5.71520E-03</td><td>1994.C</td><td>0.19340</td><td>12.760</td></th<>	3100	3.1000	27 770	-5.71520E-03	1994.C	0.19340	12.760
1350 1.36923.22 194.0 1.3663 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660 1.3660	3130 320C	3.2000	59.990 30,890	2 54920E-02 2.09220E-02	1994.C 1994 C	2.0310	12.760
1410 1.9400 42.780 12.760 14400 1.9400 -0.22400 12.760 14400 1.4500 -22.760 11.1302 12.760 1450 1.4500 -55.480 -6.71732 19.91.0 1.7139 12.760 1530 1.5500 -77.720 5.662325.22 1991.0 1.1130.12.760 1530 1.5500 -77.500 1.5630 12.760 1.760 1730 1.7500 1.5500 -77.500 1.5630 1.7700 1.760 1730 1.7500 1.56300 -1.77120 1.991.0 -0.461030 1.2760 1730 1.7500 1.56300 -1.72108.02 1.991.0 -0.461030 1.2760 1830 1.9500 -1.7500 1.543000.02 1.991.0 -0.461030 1.7760 1830 1.9500 1.7750 1.543000.02 1.991.0 1.343000.02 1.7760 1830 1.5200 1.7550 1.544000.02 1.991.0 1.345000.02 1.7760	325C	3.2500	65.200	1.30590E-02	1994.0	1.0650	12.760
1450 1.4300 -22.870 -3.111627.02 1994.0 0.12120 12.762 1330 1.5300 -77.93 12.762 1331 12.762 1330 1.5300 -77.93 12.762 1331 12.762 1330 1.5300 -77.93 12.762 1331 12.762 1350 1.7000 39.960 1.984.00 1.35533 12.762 1350 1.7000 39.960 1.984.00 1.35533 12.762 1360 1.6000 1.984.00 1.644.00 1.994.00 1.642.00 1.994.00 1.642.00 1.994.00 1.642.00 1.7760 1.7760 13800 1.6500 -7.752.0 5.383.00 1.994.00 1.843200.00 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 1.7760 <t< td=""><td>3350</td><td>3.3500</td><td>1.5590</td><td>- 4.7095JE-J3 - 2.34333E-32</td><td>1994.0 1994.0</td><td>0.22240 6.171905-04</td><td>12.760</td></t<>	3350	3.3500	1.5590	- 4.7095JE-J3 - 2.34333E-32	1994.0 1994.0	0.22240 6.171905-04	12.760
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3460	3.4000	-22 870	·3.11190E·02	1994.0	0.13120	12.760
1550 1.5300 -66 500 -5.05402.02 1994.0 1.1110 12.760 1530 1.5500 31.550 31.550 12.760 1.760 1530 1.5500 31.550 12.760 1.760 1.761 1530 1.5500 31.550 12.760 1.760 1.761 1540 1.5300 -7.520 5.43020.02 1.994.0 1.5370 12.760 1540 3.5300 -7.520 5.43020.02 1.994.0 1.5370 12.760 1540 3.5300 -7.520 5.43020.02 1.994.0 1.23700.02 12.760 1500 4.0500 6.9570 1.542000.02 1.994.0 1.21100.02 12.760 4130 4.1530 7.7530 2.34460.02 1.994.0 1.1110.012.02 12.760 4130 4.1530 6.4500 1.51110.01 1.7760 11.7760 12.760 4130 4.1530 6.02700.02 1.994.0 1.1110.02 12.760 1.7760 4130 4.1530 6.1300 7.750 1.11270.02 1.7760 <	3500	3.5000	-77 720	5.862902-02	1994.0	0.77190	12.76C 12.76C
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <th1< th=""> <th1< th=""> <th1< th=""> <th1< th=""></th1<></th1<></th1<></th1<>	3550	3.5500	-66 600	-5.30540E-02	1994.0	1.1130	12.76C
3750 3.7000 19 950 3.98302-04 1994.0 5.00040 12.760 3850 3.8000 -4.1850 4.186402-02 1994.0 5.634102-02 12.760 3950 3.9000 -4.3850 4.186402-02 1994.0 5.6340102-02 12.760 3950 3.9000 -4.3850 1.264002-02 1994.0 4.832902-02 12.760 4000 4.0000 6.0000 6.9570 -1.264002-02 1994.0 1.012500-02 12.760 4130 4.1050 6.97750 -1.644002-02 1994.0 1.012500-02 12.760 4230 4.2000 5.2400 2.644002-02 1994.0 1.012500-02 12.760 4300 4.3000 84.230 2.23500-02 1994.0 1.012500-02 12.760 4300 4.3000 84.230 2.23500-02 1994.0 1.7750 12.760 4300 4.400 7.43420-02 1.994.0 1.7750 12.760 4300 84.230 2.23500-02 1.9420 0.24170 4.1610 43000 84.230 0.24	3650	3.6500	37.650	·7.61440E-04	1994.0	8.629202-02	12.76C 12.76C
1430 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 1	3700	3.7000	39 960	3.95830E-04	1994.0	0.40040	12.76C
3850 3.8500 -7 520 5.853208-02 1994.0 3.29590 12.760 3850 3.9530 13.9530 13.9530 12.760 12.760 3850 3.9530 13.9530 12.26400-02 1994.0 4.82900-22 12.760 4130 4.1030 6.4560 1.64400-02 1994.0 1.031500-02 12.760 4130 4.1030 6.4560 1.44400-02 1994.0 0.58560 12.760 4200 4.2030 10.760 1.44400-02 1994.0 1.512107-02 12.760 4310 4.3000 84.237 2.23500-02 1994.0 1.512107-02 12.760 4430 4.4000 84.230 2.25500 12.760 12.760 12.760 4450 4.6000 91.500 -0.12670 10.640 1.4520 12.4430 4500 4.600 91.500 -0.24260 1.9640 1.4520 12.4430 4500 4.500 8.2840 0.40710 1944.0 1.3030	3800	3.8000	-44 180	4.130402-02	1994.0	6.261C0E-02 0 48940	12.760
1950 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <th1< th=""> <th1< th=""> <th1< th=""> <th1< th=""></th1<></th1<></th1<></th1<>	3850	3.8500	-77 520	5.85320E-02	1994.0	1.5070	12.760
4000 4.0030 54.973 7.928108-03 1994.0 0 7.5750 12.7760 4130 4.1030 6.4250 1.6452062.02 1994.0 1 0.12102-C2 12.760 4130 4.1030 6.4250 1.6452062.02 1994.0 1 0.12102-C2 12.760 4230 4.2030 107.62 1.44402-C2 1994.0 1.7580 12.7760 4330 4.3000 84.390 2.125302-C3 1994.0 1.7580 12.7760 4330 4.3000 84.39 2.125302-C3 1994.0 0 47410 12.7760 4453 4.4000 -81.00 -6.01270E-C2 1394.0 0 47410 12.430 4453 4.4000 -81.00 -6.02270E-C2 1394.0 0 1.4530 1.4530 4453 4.4000 -81.00 -6.02270E-C2 1394.0 0 1.4530 1.4530 1.4530 4453 4.6000 -81.00 -6.12400 1.8520 1.4530 1.4530 1.4530 1.4530 4550 -1.1770 -0.42420	3950	3 9500	13 950	-1.26470E-02	1994.0	4 89290E-C2	12 760
11504.100364.1001.1.413402-021.941.1.4100-021.2.40041504.150077532.334360-021.94.100-021.5.1610-021.2.76042304.200052.4006.56402-031.94.22.95301.2.76043304.300084.1302.253020-021.94.20.47401.2.76043304.300084.1302.253020-021.94.20.47401.2.76044434.400081.100-6.01270E-021.94.20.47401.2.76044504.6000-6.1270E-021.94.01.45501.2.4001.8.43345004.500-6.02076-106.400.022374.3334.53345034.500-6.02076-106.400.023274.3.63345034.500-6.1294.00.0234204.5634.63345034.5008.29400.04286-106.400.324204.56346034.6006.1390-7.16200-024.6.200.34204.56547034.70032.0960-0.246004.6.200.34204.56550005.000072.380-7.16200-021.9440.130506.49051005.000072.380-7.37601.9940.1.316505.49051005.000072.3807.730520-024.6.4905.216004.640051005.00007.23607.19700-021.9440.1.13506.49051005.00007.23607.19700-02 <td< td=""><td>4000</td><td>4.0000</td><td>54 970</td><td>7.92810E-03</td><td>1994.0</td><td>0 75790</td><td>12 760</td></td<>	4000	4.0000	54 970	7.92810E-03	1994.0	0 75790	12 760
4.150 4.1500 7.750 2.354400 2.231400 1.151600 1.2 750 4.250 4.2000 1.4 5.2 6.54500 1.944.0 2.9350 1.2 750 4.350 4.2000 1.4 1.5 1.4 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	4100	4.1000	6 4 6 0	1.64280E-02	1994.0	1 03250E-C2	12.760
	4150	4.1500	-7 7750	2.35450E-02 6.63630E-03	1994.0 1994.0	1 51630E-G2	12 760
4.30 4.303 84.333 2.25300-02 1994.0 1.7760 12.760 4435 4.303 4.303 2.25300-02 1994.0 1.650C 12.760 4435 4.400 81.000 -6.01270E-02 1994.0 1.650C 12.760 4455 4.600 -6.01270E-02 1994.0 0.9220C 12.400 4550 4.600 -6.01270E-02 1994.0 0.9220C 12.400 4550 4.600 8.2540 0.04260C 1994.0 0.7250C 4.613 4653 4.600 8.2400 0.4260C 46.510 0.5260C 4.630 4753 4.7003 32.650 0.13420 47.523 4.750 4.7526 6.550 4753 4.7003 32.450 0.77756C-02 118.00 1.3250 6.6.950 4753 4.7500 10.4460 1.13160 4.25100-02 6.4.930 1.3250 6.4.930 4753 4.7500 10.4460 1.31500 1.3250 6.4.930 1.2560 6.4.930 4950 4.9500 10.776 8.4560 </td <td>4250</td> <td>4.2500</td> <td>107.60</td> <td>3.43420E-02</td> <td>1994.0</td> <td>2.9050</td> <td>12 760</td>	4250	4.2500	107.60	3.43420E-02	1994.0	2.9050	12 760
4429 4.4000 -81.500 -6.13270E-02 1994.0 1.4500 10.4300 4500 4.500 -76.080 -0.2807C 106.40 2.100C 12.430 4500 4.500 -76.080 -0.2807C 106.40 0.323C 22.230 4600 4.600 -11.170 0.4245C 106.40 0.323C 22.470 4600 4.600 -31.170 0.4245C 106.40 0.1254CE 24.1633 4753 4.600 31.500 0.2417C 44.623 41.633 4753 4.700 31.500 0.2421C 44.653 44.653 4800 4.8000 13.300 7.7770C 194.00 1.31750E-02 64.405 5000 5.0500 7.330C 9.774.0702 1994.0 1.31750E-02 66.490 5100 5.1500 7.330C 9.774.0702 1994.0 1.31750E-02 66.490 5100 5.1500 7.330C 9.774.0702 1994.0 1.3150E-02 66.490 5100 5.1500 7.300 9.746.0702 1994.0 1.3150E-02	4350	4.3500	84.190 43 480	2 25630E-02 2.16320E-03	1994.0 1994.0	1.7780	12.760
4 4 50 4 4 500 -1.500 -0.13860 -106.40 2.1000 3.430 4 550 4 5000 -3.680 -0.2256 -106.40 0.21700 2.2370 4 550 4 5000 -3.170 -0.2256 -106.40 0.23700 2.2470 4 650 4 6000 -3.2400 -0.24000 45.210 0.124900 42.470 4 700 4 7000 2.4950 0.38100 45.210 0.124900 41.633 4 850 4.5000 8.300 7.46200-02 18.000 1.72500 5.3.480 4 950 4.9600 103.40 0.13460 1.3030 2.24600 5.3.733 5000 5.0000 72.380 0.126100 1.33500 2.6620 6.490 5100 5.0500 1.3740 9.79700-02 1994.0 0.135700-02 6.490 5100 5.0500 7.3300 7.97300-02 1994.0 0.13500 6.490 5100 5.0700 1.34520 1.0700 1.3310 6.490 </td <td>4400</td> <td>4.4000</td> <td>-81 100</td> <td>-6.0327CE-C2</td> <td>1994.0</td> <td>1.6500</td> <td>12.750</td>	4400	4.4000	-81 100	-6.0327CE-C2	1994.0	1.6500	12.750
	4500	4 5000	-76.080	-0.1358C -0.2807C	-106.40	2.100C 1.452C	19.430 32.230
************************************	4550	4 5500	-60.990	-0.42260	-106.40	0 93230	42.470
	4650	4 6500	8.2940	0.40710	1994.0	0.2437C 1.7254CE-02	43.630
1 and	4700	4 7000	24.050	0.38100	46.210	0.14500	44.050
4850 4.8500 61.290 2.97050E-02 118.00 1.7250 60.7220 4950 4.9500 103.40 0.13460 118.00 2.620 65.742 5050 5.0500 7.3310 9.2770E-02 1994.0 1.3350E-02 66.492 5150 5.1500 -10.770 9.46660E-02 1994.0 2.91150E-02 66.490 5150 5.1500 -10.770 9.46660E-02 1994.0 2.91150E-02 66.490 5200 5.2500 41.500 0.11090 1994.0 C.35100 66.490 53100 -2.6300 41.500 0.11090 1994.0 C.31500-02 66.490 53100 -2.64070 5.45500-22 1994.0 1.1260 66.490 53500 5.3300 -68.270 5.35500-22 1994.0 1.2760 67.400 5400 5.4300 -190 0.10270 1994.0 1.2760 67.400 5500 5.5300 61.270 0.194.0 0.3560 67.400 5500 5.5300 61.270 1994.0 1.4710 67.400	4800	4 8000	38.330	7.18620E-02	45.210	0.23420	44.820 53.460
***** ****** ******* ******* ******** ***************** \$9000 \$.09000 7.2.380 0.12830 19940 1.337508-02 66.490 \$100 \$.1000 7.3010 9.77404-02 19940 6.2137508-02 66.490 \$100 \$.1000 7.3010 9.77404-02 19940 6.21400-02 66.490 \$200 \$.2000 38.050 0.1020 19940 6.215100 66.490 \$200 \$.2000 38.050 0.1020 19940 6.41190 66.490 \$200 \$.2000 38.050 0.1020 19940 6.16270 66.490 \$300 \$.3000 -22.630 7.975408-02 19940 6.1.7650 67.400 \$460 \$.41800 0.16370 19940 1.1.7650 67.400 \$460 \$.5000 61.2750 19940 1.1.7650 67.400 \$560 \$.5000 \$1.2750 19940 0.33660 67.400 \$5700 \$5.5000	4850	4.5500	61.290	2.37050E-03	319 CO	0.94210	56.580
5000 5.0000 7.2380 3.12630 1994 0 1.3030 66.490 5105 5.0500 5.1000 15.740 9.7970E-02 1994 0 6.2460E-02 66.490 5100 5.1500 10.3750E-02 66.490 66.490 66.490 5200 5.2500 38.050 10220 1994.0 C.38150E-0 66.490 5300 5.3000 41.500 11990 1994.0 C.43190 66.490 5300 5.3000 66.470 5.8570E-02 1994.0 1.2690 66.490 5400 5.4500 7.2750 1994.0 1.2690 67.400 5550 5.5500 66.470 0.12750 1994.0 1.2760 67.400 5560 5.5500 67.400 1.2760 1994.0 1.3110 66.400 57100 5.7500 62.226308.02 7.190 1.3110 66.400 57100 5.8500 60.22309 1.994.0 0.25010 69.000 5800 5.220	4950	4.9500	103.40	0.13460	318.00	2 6820	65.740
51:00 5.5.5.00 5.5.5.00 5.5.7.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.8.5.00 5.5.5.5.00 5.5.5.5.00 5.5.5.5.00 5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.	50C0 5050	5.0000	72.080	0.12630 9.37640E.02	1994 C	1 3030	66.490
5120 5.1300 -10.77C 9.46560Er02 1994.0 2.51150E-32 66.490 5200 5.2200 41.500 0 11990 1994.0 0.51150E-32 66.490 5300 5.3300 -22.630 7.97540E-32 1994.0 0.16570 66.490 5355 5.3500 -76.630 1.8580 67.400 56.490 5460 5.4300 -76.750 1.944.0 9.22.502-02 67.400 5550 5.5500 95.520 0.12750 1994.0 9.22.560 67.400 5550 5.5500 95.520 0.12750 1994.0 0.35660 67.400 5560 5.5300 95.520 0.12750 1994.0 0.35660 67.400 5560 5.5300 95.7100 6.071202-02 1994.0 0.35660 67.400 5760 5.7500 83.450 1.2226102 -71.190 1.8313 68.440 5760 5.8500 -31.710 6.071202-02 1994.0 0.22450 69.030 5800 5.8500 60.720 9.13510E-02 1994.0	5100	5.1000	15.74C	9 79970E-02	1994 0	6.21460E-02	66.490
5220 5.2300 41.500 5.100 5.100 6.4530 6.4530 5300 5.3000 -20.630 -97540E-02 1994.0 0.4530 6.490 5300 5.4000 -96.070 3.64553E-02 -70.630 1.6890 6.490 5400 5.4300 -10.180 7.00082E-02 1994.0 9.22:50E-02 67.400 5350 5.3300 66.470 0.12430 1994.0 9.22:50E-02 67.400 5350 5.3500 91.520 0.12750 1994.0 0.35660 67.400 5450 5.4300 -37.10 6.071205-02 1994.0 0.35660 67.400 5730 5.7300 +85.450 2.22530E-02 1.194.0 0.3560 67.400 5730 5.7300 +85.450 2.22530E-02 1.940.0 0.23010 69.000 5800 5.3500 60.720 9.13810E-02 1994.0 0.23010 69.000 5950 5.9500 94.700 0.12420 1994.0	5150 5200	5.1500 5.2000	-10.770 38.050	9.46960E-02 0.10920	1994.0 1994.0	2.91150E-02 C 36310	66.490 66.490
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5250	5.2500	41.500	0 11090	1994 C	0.43190	65.490
	535C	5.350C	-68,270	7.97540E-02 5 58570E-02	1994.C 1994.C	0.10670	66.490 66.490
1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.000 1.1.0000 1.1.000 1.1.000 <	5400	5.4000	· 36 . 07 0	3.645502-02	-70.630	1.8580	67.400
555C 5.5300 95.520 0.12750 1994.0 0.2880 67.40C 5560 5.630C 37.710 6.071202-02 1994.0 0.35660 67.40C 5700 5.7300 95.450 2.226302-02 71.190 1.3310 68.440 5710 5.7300 95.450 2.226302-02 71.190 1.3410 69.000 5800 5.8300 31.580 4.50670E-02 1994.0 0.92460 69.000 5900 5.8500 60.720 9.13510E-02 1994.0 0.360E-02 69.000 5910 5.9500 94.700 C.10280 118.60 9.22490 69.020 6050 6.0500 8.642 6.59910E-02 1994.0 0.3260E-02 69.660 6100 -55.680 3.46210E-02 1994.0 0.7266C 69.660 6120 6.1000 -55.680 3.46210E-02 1994.0 0.7266C 69.660 6200 6.200 24.10 7.36280E-02 1994.0 0.17550	5500	5.5000	68.470	0.11400	1994.0	9.22.508-02	67.400
5550 5.5500 37.710 6.77202-02 1394.0 0.35540 6.7400 5710 5.7300 -85.450 2.226302-02 -71.190 1.3110 66.540 5710 5.7300 -85.450 2.226302-02 -71.190 1.3110 66.540 5730 5.7300 -81.360 1.99108-02 1994.0 0.7430 69.000 5800 5.8500 60.720 9.135108-02 1994.0 0.92460 69.000 5950 5.3500 84.700 C.10880 318.00 2.2490 69.660 6050 6.0000 8.8642 6.59910E-02 1994.0 0.72260 59.660 6100 -10600 -36.620 4.31770E-02 1994.0 0.72260 59.650 6150 6.1000 -25.430 4.8240E-02 1994.0 0.72260 59.650 6200 6.000 24.6110 7.36380E-02 1994.0 0.14370 65.660 6300 5.3600 44.110 7.36380E-02 1994.0	555C 560C	5.5500	95.520	0.12750	1994.0	2.2880	67.400
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	5650	5.650C	-37.710	6.07120E-02	1994.0 1994.0	0.35660	67.400
5800 5800 51 580 4.50670E.02 194.0 3.25010 65 000 5850 5.8500 60.720 9.13610E.02 1994.0 3.25010 65 000 5930 5.8500 60.720 9.13610E.02 1994.0 3.25010 69 000 5930 5.8500 81.370 0.10240 1994.3 1.6610 69 660 6030 6.0530 36.622 4.31770E.C2 1994.3 0.72260 90 60 65 660 65.660 65.660 65.660 65.660 65.660 65.660 65.660 65.650 6200 6.2600 4.62300 2.22400 90.72260 99 66.550 6200 6.2600 4.62300 2.32400 0.72560 99 660 6653 6250 6200 6.4000 25.7500 7.496300 2.1994.0 C.48130 69.060 64400 64.470 5.81100E-02 1994.0 C.48130 69.060 6550 6.500 2.6800 <td< td=""><td>5700 5750</td><td>5.7000</td><td>·85 450 ·87 360</td><td>2.22630E-02</td><td>-71.190</td><td>1.8310</td><td>68.540</td></td<>	5700 5750	5.7000	·85 450 ·87 360	2.22630E-02	-71.190	1.8310	68.540
5850 5.8500 60.720 9.13510E-02 1994.0 9.92460 69 000 59300 5.9000 5.9000 5.9000 2.2490 69 020 59300 5.9500 81.370 0.10240 1994.0 1.6610 69 060 6030 6.0000 8.6642 6.9910E-02 1994.0 0.3500 69.066 6050 6.0500 36.620 4.31770E-02 1994.0 0.72266 69.060 6130 6.1600 2.6430 4.6210E-02 1994.0 0.17526 69.060 6200 6.2000 4.6920 6.3699CE-02 1994.0 0.14370 69.060 6350 6.300 24.110 7.36126E-02 1994.0 0.14370 69.060 6450 6.4000 26.750 7.43630E-02 1994.0 0.14370 69.060 6450 6.4500 26.750 7.43630E-02 1994.0 0.14240E-02 69.060 6550 6.5500 23.350 4.4810E-02.0 1994.0 0.1270E-03	5800	5.8000	·31 580	4.50670E-02	1994.0	0.25010	69 000
9350 5.3500 81.370 0.10240 1992.0 1.3620 69 060 6030 6.0030 8.642 6.5910E-02 1994.0 1.97360E-02 69 060 6050 6.0030 -36.620 4.31770E-02 1994.0 0.33610 69.060 6150 6.1000 -26.430 4.6260E-02 1994.0 0.17520 69.060 6250 6.200 4.6920 6.3899C-02 1994.0 0.17520 69.060 6250 6.200 4.6920 6.3899C-02 1994.0 0.17520 69.060 6350 6.300 40.910 3.20630E-02 1994.0 0.41970 69.060 6450 6.4000 26.750 7.49630E-02 1994.0 0.17520 69.060 6550 6.5000 26.840 6.2810E-02 1994.0 0.12950 69.060 6550 6.5500 19.280 7.7540E-02 1994.0 0.25500 69.060 6550 6.5500 19.280 7.7540E-02 1994.0	5850 5900	5.8500	60.720 94.700	9.13610E-02 C.10880	1994.0 318.00	0.92460 2.2490	69 000 69 040
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	6050	6 0500	-36,620	4.31770E-C2	1994.0	1 97060E-02 0 33610	59 C60 59.C60
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	6100	6 1000	-53.680	3.4621CE-C2	1994.0	0 72260	59 C60
	6200	6 2000	4.6920	6.3899CE-02	1994.0	5.5222CE-03	59.060
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6250 6300	6 2500 6 3000	24.110	7.36380E-02	1994.0	C.14580	69.060
	6350	5.3500	43.790	8.35110E-02	1994 0	C.48100	69.060
6500 6.5000 13.350 4.481602.02 194.0 6.25400 6.3000 6550 6.5500 -20.850 5.108802.02 1994.0 6.10900 63.060 6550 6.6500 2.0840 6.281082.02 1994.0 6.10900 63.060 6600 6.6000 2.6840 6.281082.02 1994.0 0.25510 69.360 6600 6.6000 2.6840 6.281082.02 1994.0 9.25110 69.360 6750 6.7300 19.300 7.7544082.02 1994.0 9.25110 69.360 6750 6.7300 19.200 7.124082.02 1994.0 9.25210.20 69.360 6750 6.7300 20.2270 5.137932.02 1994.0 2.141302.03 69.060 6950 6.9900 26.790 7.598402.02 1994.0 2.141302.03 69.060 6950 6.9900 14.970 6.95502 1994.0 3.226693 69.060 7050 7.1000 12.700 6.7913082.02 199	64CO 6450	6.40C0 6.45C0	25.750	7.49630E-02 5.83310E-02	1994 0 1994 0	C.17950	69.060 69.060
6550 6.5500 20.850 5.108802.02 1994.0 6.10900 63.360 6600 6.6000 2.6840 6.28102.02 1994.0 1.807402.03 69.360 6600 6.6000 2.6840 6.28102.02 1994.0 9.21510 69.360 6700 6.7300 19.980 7.12402.02 1994.0 9.2102.02 69.360 6750 6.7300 -20.270 5.137932.02 1994.0 9.10100 69.360 6750 6.3300 -9.9300 5.702622.02 1994.0 0.1020 69.360 6950 6.9900 26.790 7.598402-02 1994.0 2.143302.03 69.060 6950 6.9900 14.370 6.95502 21.994.0 5.62250.42 69.060 7050 7.3000 12.700 6.791302.02 1994.0 5.62250.42 69.060 7150 7.1530 78.590 6.791302.02 1994.0 5.22450 69.060 7150 7.1530 78.590 6.140300 318.0	6500	6.5000	.33.350	4.48160E-02	1994.0	C 27900	69.060
6650 6.6300 31.900 7.75402.02 193.0 0.22510 69.060 6700 6.7000 19.280 7.121602.02 1994.0 9.22102.02 69.060 6750 6.7300 19.280 7.121602.02 1994.0 9.22102.02 69.060 5900 6.7300 19.9900 5.7006.02.1379.32.02 1994.0 0.10300 69.060 5900 6.3300 9.9900 5.7006.02.12.1994.0 2.143302.03 69.060 6950 6.9900 26.790 7.598402.02 1994.0 3.20780 69.060 6950 6.9900 14.970 6.95502 21.994.0 3.26690 69.060 7000 7.0900 32.633 4.518002.02 1994.0 3.26690 69.060 7100 7.0500 45.733 3.86702.02 1994.0 3.22680 69.060 7120 7.1030 19.2700 6.73130E.02 1994.0 3.52450 69.060 7120 7.1300 78.592 C.10250 1994.0	6550 6600	6.5500	-20,85C 2.684C	5.1C880E-02 6 28910E-02	1994.C 1994 C	G.1C900 1.90740E-03	69.060 69.060
0.700 6.7300 17.280 7.1216/08-32 1994.0 9.32112:02 68.366 6750 6.7300 -20.270 5.137932:02 1994.0 9.103103 69.966 5900 6.3300 -9.9900 5.702622:32 1994.0 2.143132:03 69.066 6950 6.3500 26.790 7.59402:02 1994.0 2.143132:03 69.066 6950 6.9900 25.790 7.59402:02 1994.0 2.143132:03 69.066 6950 6.9500 14.970 6.95502 20 1994.0 3.2252:02 69.066 7000 -3006 -32.610 4.518002:02 1994.0 3.26690 69.066 7050 7.3000 -32.610 4.518002:02 1994.0 3.26490 69.060 7150 7.1030 12.700 6.791306:02 1994.0 3.26490 69.060 7250 7.2530 66.230 0.10500 1994.0 1.5890 69.060 7250 7.2530 66.230 0.12600 <td>6650</td> <td>6.6500</td> <td>31.900</td> <td>7.75440E-02</td> <td>1994.C</td> <td>0.25510</td> <td>69.360</td>	6650	6.6500	31.900	7.75440E-02	1994.C	0.25510	69.360
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6750	6.7500	-20.270	5.137902-02	1994.0	9.32310E-02 0.10300	69.36C 69.36C
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	590C 6850	6.900C 6.850C	-9.9900	5 70360E-02	1994.0	2.026802.02	69 060
	6900	6.9000	26 790	7.59840E-02	1994.0	2.143351-03	69.060
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6950 7000	6.9500 7.0000	14 970 -32 630	6.90550E 02 4.51800E-02	1994.0 1994.0	5.62250E+02 0.26690	69.06C 69.060
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	7050	7.0500	-45.730	3.86C70E-02	1994.0) 52450	69 060
7200 7 2000 1.95 00 0.14030 318.00 2.7680 71 660 7250 7.2500 56.230 0.12660 1994.3 1.1090 72.300 7300 73500 56.500 6.01950E-02 1994.0 1.1090 72.300 7350 73500 56.500 6.01950E-02 1994.0 1.1090 72.300 7350 73500 54.500 2.56730E-02 1994.0 1.7910 74.480 7400 7.4000 79.20 5.05450E-02 69.380 1.5710 80.940 7450 7.4500 -23.400 -4.34250E-02 194.0 0.1373C 92.580 7550 7.5007 72.710 3.55910E-02 318.000 1.2860 84.640 7550 7.500 85.640 7.62750E-02 318.000 1.8400 87.363	7150	7.1000	12.700 79 590	6.79130E-02 C.10150	1994.0 1994 0	4 04200E-C2 1.5690	69 C60 69 C60
12.50 7.2.30 76.2.35 6.12080 1994.3 1.1000 72.300 7300 7 3600 -56.500 6.019505.22 1994.0 1.1000 72.300 7350 7 3500 -94.500 2.567362.02 1994.0 1.7910 74.080 7400 7 4.000 -79.220 -5.054562.02 -69.380 1.7910 74.480 7450 7 4.500 -23.400 -4.342506.02 1994.0 0.13736 92.580 7550 7 5500 7 5500 7550 7 5500 85.640 7.627562.02 318.00 1.8640 87.425	7200	7 2000	105 00	0.14030	318.00	2.7680	71 680
7350 73500 94,500 2.56730E+02 -69380 1.7510 74.480 7400 74000 74000 74000 74000 50450E+02 -69380 1.7510 80.940 7450 74500 -23.400 -4.34250E+02 194.0 0.13730 92.580 7550 7500 72.710 3.55910E+02 138.00 1.260 84.640 7550 7550 7550 7550 7520 85.640 7.62750E+02 138.00 1.280 84.640	7300	7 3030	56.5CO	6.01950E+C2	1994.0	1.1090	72 300
7450 7 4500 22.1400 4.84250F.C2 1394.0 0.1373C 92.580 75C9 7 5C00 72.710 3.5591CF.C2 138.C0 1.826C 84.660 7559 7 5500 85.640 7.6275CF.02 138.C0 1.8400 87 3c0	7350 7400	7 3500 7 4000	-84,5C0 -79,720	2.5673CE-C2	-69 380	1.7910	74.480
7500 7 5000 72.710 3.5591CE-02 319 CO 1 326C 84.640 7550 7 5500 85.640 7.6275CE-02 318.00 1.840C 87 340	7450	7 4500	23.400	4.3425CE-C2	1994.0	0.13730	92.580
	7550	9 5000 7 5500	72.710 85.640	7.6275CE-02	319 CO 315.CO	1 126C 1.840C	84.640 87 340

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7600	7.6000	101 10	0.12480	318.00	2 5620	91 150
7650	7.6500	43 820	9.889902-02	1994 C	0.49160	91.440
7706	7.7000	·42.310	5.56940E-02	1994 0	0.44900	91.440
775C	7.7500	-68.090	4.27700E-02	994 0	1 1620	91 440
7900	7.9900	- 94 . 16 0	2 068005.02	69 760	2 0430	92.360
7950	7 9500	-46 410	4 224308.02	-779 0	C 63366	02.300
7900	7 9000	10 650	7 524208-02	1729 0	1 273868.23	21.360 01 323
7950	7 9500	11 450	7 501005-02	1729.0	3.279802-32	92.365
2200	0.000	11.000	· 2019VE-02		3.922962-02	92.360
8000	0.0000	38.340	9.125008-02	1729.3	0.42510	92.385
8050	8.0500	0.57930	6.94IEUE-02	1729.0	3 7050CE-05	32.380
8100	3.1000	.5.860	5.991_CE-C2	1/29.3	7 27380E-02	35 360
8150	8.1500	-1.4840	6.8225CE.C2	1729.0	5.3675CE-06	9 2 36 0
8200	5.2000	·29 €00	5.1968CE-C2	1729.0	0 25330	92 380
8250	8.25CO	-23 900	5.52620E-02	1729.0	0 16520	92 390
S 3CO	8 3000	5.9540	6.564C0E-02	1729.0	1 025C0E-C2	92.38C
8350	5 3500	33.270	8.65910E-02	1729.0	0.26500	92.39C
9400	9 4000	83.BCO	C 11750	1729.0	2.0310	92.38C
8450	5 4500	98 930	C.13120	1994.0	2.4540	93.26C
8500	S 5000	33.930	9.859902-02	1994 C	0.28870	93.260
8550	9.5500	-9 6450	7.67440E-02	1994.0	2.33290E-02	93.260
8600	9.6000	-69.900	4.652102-02	1994 C	1.2250	93.260
6550	9.5500	·49 C70	5.665402.02	1991 0	C 6C470	93.270
6700	8.7000	49 800	0.10650	1991 0	0.62290	93,270
8750	8.7500	105.40	0.13590	315 00	2 7870	93.420
E800	8.8000	129.10	0 21030	319.00	4 1790	100 80
8850	8.8500	124 00	0.23920	: 294.0	3.8590	104 90
8900	8.900C	1,9250	0 17690	994.0	9.2969CE-04	134.90
8950	E 950C	·21.830	0 16500	1994.0	0 11950	154.90
9000	9.0000	.75.420	0.13810	1994.0	1.4260	104 90
9050	9.0500	-54.290	0.14970	1994.3	0 73910	104 90
3100	9.1000	10.990	0 8150	194.5	3 03060E-02	104 90
9140	9 1500	16 7 10	0 18440	1994 0	7 CIE40E-02	104 90
9200	9 2000	20 450	0 18620	1994 0	1 11490	104 90
9250	9 2500	9 2560	0 18060	1994 0	2 148608-02	104 90
6300	9 3000	-6 5100	0 17270	1994 0	1 06 250 8 . 02	104 90
6360	9 3500	. 20 . 27 0	0 16580	1004 0	3 13413	101.00
9400	9 4000	.12 710	C 15960	1994 0	0.26870	104.90
9460	F 4600	.22.735	0.15750	1004 0	0.20070	104.90
9500	9.5000	7 4760	0.12020	1934 0	1 401902.02	104.90
9550	0 6600	<pre>/ 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1</pre>	0.20760	1994.0	1.401952.02	104.90
9550	7.33JU	63 379	0.20/90	1994 0	1.0.33	104.90
9600	9.6000	56 350	0.20420	1994.0	0.79650	104.90
9650	9.6500	5.0/89	0.12030	1994 0	54530E-02	104.90
9700	9.7000	-56.920	0 14/40	1334 3	0 81260	104.90
3750	9 / 500	- 35 420	0 11260	62.520	1.9300	106.60
380C	a a000	-92.990	/ 3//30B-02	62.520	1.7280	110.00
9950	A 820C	19.810	0 12530	1394.0	9.344302-32	110.00
9960	9.9060	79.570	u 15520	394.0	1 5880	110.00
9950	₹.9500	95.170	3.16310	1994.0	2.2720	110 00
MA	XIMEN DUCTII	ITTES AND EXC	URSION RATICS			

DISPLACEMENT DEFINATION: J1- 3.488 E1-ENERGY DEFINATION 31: 32- 36.31 E2-ENERGY DEFINATION 32: J3- 2.938 E3-

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••••	MEMORY UTILIZATION	N
•	IZ- 12139, MEM	4= 1.734%*
*	· · · · · · · · · · · · · · · · · · ·	· · • • · · · · · · · · · • • • • • •
*	ELAPSED CPU TIME	0.52 SEC ·····
• • • •	TOTAL CPU TIME	218.98 SEC ····*
*		

STRUCTURE....: TWO-STORY TRUSS STRUCTURE SCLUTION.... STRUCTURAL RESPONSE DUE TO 1940 EL CENTRO E-W COMPONENT

7 IS REAL FROM UNIT # 27 LOAD DISPLACEMENT C.000C0E+00 3.60060E+00 0.66212 2.31228E-03 0.75374 9.31945E-03 0.75374 9.31945E-03 0.46752 1.86368E+02 1.6317 1.53898E+02 1.3193 1.28954E+02 2.4767 1.19398E+02 0.94643 2.13939E+02 1.6213 2.4566E+02 1.052 -7.43592+04 2.45644 -1.43509E+02 3.6530 3.195262-02 3.6530 3.195262-02 1.5196 1.065002+02 1.7250 2.898462+02 2.45664 -1.759932+02 3.6530 3.195262+02 1.5196 1.065502+02 3.6530 0.18952+02 4.6205 0.10885 -66275 0.15983 -55813 0.14804 -55116 -8.4156E+02 -1.3427 -121272-32 0.81464 3.23713E+02 -1 DEGREE OF FREEDOM = 7 IS READ FROM UNIT # 27 JCINT 4 6, DIRECTION: FX TIME C.009002+00 S.009002+02 1.000002-01 C.15000 C.25000 C.25000 C.35000 C.40000 C.40000 C.40000 D.40000 D.50000 D.50000 D.75000 D.75000 D.75000 D.85000 D.85000 D.95000 1.0000 1.0000 1.1000 1.1500 1.2000 VELOCITY 0.CC300E+00 8 86227E*02 3 01561E*02 4.30913E*02 4.34790E*02 0.26889 0.27073 0.54292 4.81462E*02 0.26889 0.32705 0.32105 0.32105 0.32105 0.32105 0.32105 0.32105 0.35109 1.4434 C.87773 C.33119 0.35125 0.73305 1.4434 C.87773 C.33119 0.35225 0.73305 2.6618 3.7538 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.54452 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.5458 0.54588 0 ACCELERATION 0.0000CE+00 1.485C -0.23063 STEP 0 50 100 150 ·1.8919 ·3.3528 200 250 -3.3528 1.3683 1.3112 4.9028 -1.9134 -14.642 5.5928 14.239 -3.890502-02 300 350 400 450 500 550 500 550 3.1335 3.5088 -22.301 -25.740 18.872 25.373 20.262 7.2428 6.4224 -11.339 -5.7713 -40.184 -44.272 2.9703 700 750 800 850 900 950 1000 1000 1050 1100 1150 1200 1.2500 1.300C 1250 1500 2.9703 45.458 19.203 57.884 37.670 -13.057 -63.455 -98.673 : 150 1400 1450 1550 1550 1600 0 46769 3 12929 3 67364E-C2 9 27143 0 48665 0 35622 0 20773 0 40926 0 40926 0 20773 0 40926 0 43225 0 21696 -98.673 •62.915 •6 6994 49 235 71.961 61.597 58.314 12.873 -41.702 -71.667 1700 1750 1600 1850 1900 1950 2000 -10.671 -0.51820 9 6346 13.904 2 2579 •9 3683 2050 2100 2150 -1.8303 -97.873 -81.274

TIME: 13:49:05, DATE: 12/01/90 TIME: 13:49:05, DATE: 12/01/90

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2 488 36.25 2.409

2250	2.2500	1.3047	-C.16400	-7.1891	79.689
2350	2.3500	5 0999	-0.17783	0.22650	177.36
2400	2 4000	-4 8895	0.11362	5 6543	-58.214
2450	2.4500	-12.250	0.25595	-7.70495E-02	-136.29
2550	2.5500	7 2526	-2.43282E-02	-1.8699	43 935
2600	2 6000	0.95906	-8.58412E-02	0.99368	6 28871E-02
2553	2 6500	5.8256	·0.11789	0.29750	60.115
2750	2.7500	9,1392	0 17193	3.4352	46.826
2800	2.8000	2.3417	0 29175	C.65513	- 57.059
2850	2.8500	6.8564	0 22452	-2 9439	-49.223
2950	2.9500	3.5817	-0 16593	- 4 2343	-5 8050
3000	3.0000	7.6104	0 23634	1 0387	99.025
3050	3.0500	-2.5555	-9 34594E-02	3 8245	C.10624
3150	3 1500	11.403	0 34996E-02 0.14540	2 2008	-34.072
3200	3.2000	5,9270	0.15700	-4.44889E-02	-47,484
3250	3.2500	4.5398	0.12405	2 2942	-23.267
3350	3.3500	C 76317	1.21801E-02	·1.6426	34.590
3400	3.4000	9.6981	-6.79161E-02	-1 0009	•22.336
3450	3.4500	9.9910	0.14463	-1 9479	0.41577
1500	3.5000	5 6923	-0.22119	-0.89238	39 583
3600	3.600C		-7.914192-02	3.2044	45./84
3650	3.6500	-4.804C	7.124292-32	2.2298	-50.337
3700	3,7000	-7.5248	0.10219	-1.1673	67 595
3800	3.8000	-9 8971	-C.12615	-2.5019	1.7097
3850	3 8500	4.0978	·C.21850	0.71232	69 718
3900	3,9000	5.3495	-0.16365	2.8511	63 667
4000	4.0000	-17.309	2./1318E-02 0.13620	3.8583 -9 91423E-02	- 37 455
4050	4.0500	5.6982	58764E.02	-3.6232	6.0270
4100	4 1000	12.791	-0.13058	0.42695	83 907
4200	4 1500	7 6105 9 3903	-3.65762E-02 8.57551E-02	2.4135	19 079
4250	4 2500	B C796	0.19767	1.8701	-35.082
4300	4 3000	0.40854	0.22117	-1.3115	-78.627
4350	4 3509	- 7.2625	6.823C4E+02	-4.4752	-41.410
4450	4 4500	-10.515	-0.42889	-3.4097	73.300
4500	4 5000	-16.990	0.52928	-1.3300	-4.4890
4550	4 5500	-4 0804	0.61446	-2.1517	-11.610
4650	4 6500	10.863	-0.62950	- 3 / 3 3 0 3	76.075 57 419
4700	4 7000	7 3232	0.42515	3.7505	-25.934
4/50	4 7500	8 1110	·0.27829	2.4536	6 00513E-02
4850	4 8500	9 6174	9.22361E-C2	4,9264	-12.305
4900	4 9000	-1 2022	0.27986	1.9324	- 35. 093
4950	4 9500	12.729	0.30471	-0.18886	1.7619
5050	5.0500	3.1580	0.18347	-3.0917	-9.8051
5100	5.1000	12.717	6 78695E-02	-0.68403	81.585
5150	5.1500	5.6120	0 11405	1.9378	14.348
5250	5.2500	-7.9988	0 23308	-0.60137	-58.570
5300	5.3000	-14 181	0.12315	-3.7289	49 147
5356	5.3500	· 3.0C89	-7 58678E-02	-3 2794	62.447
545C	5.4500	3,9531	3 569982-02	4 9626	31.204
550C	5.5000	3.5423	0.28123	4.0116	-69.072
5550	5.5500	5.9117	0.37231	-0.64153	-100.77
5650	5.6500	-8 3640	Z.49593E-02	4 5446	31.652
57.00	5.7000	5.1443	0.16279	2 0651	103.01
5750	5.7500	-2.9102	0.14495	2.3957	57.957
5850	5.8500	4.3860	0.19274	3.3456	15,290
5900	5.9000	1.2847	0.32216	1.3326	-69.976
5950	5.9500	-5.5402	0.29110	-2.6099	-74.971
6050	6.0500	4.8074	5.87240E-02	1.4161	71 241
6130	6.1000	2.9604	·5.23208E-02	1.2984	28 246
6200	6 2000	-1.5240	2.47599E-02 8 15612E-02	1.4019	-14 180
6250	€ 2500	3 1652	6-12812	0.94644	-0.96995
6300	E 3000	2 2796	0.16755	0.51169	14.076
6400	6 4000	-1 6947	0.17781	- 0 14988 - 2041	-18.325
€450	6.4500	-4.1419	6.4317CE-C2	1.8470	-3.6964
6500	5.5000	2 3579	-1.65421E-C2	-0 96477	43.001
6600	5.6000	-2.1196	•2.62012E•03	1.4345	25.452
6650	6.6500	-5,5134	0.15973	0.48218	-40.217
6700	6.7000	6.3982	0 13489	1.4154	34.241
5750	5.7500	1.8101	3 29826E·02	·2.1528	25.423
6850	6.8500	-1.5828	9.63896E·02	2 4511	-14.617
5900	6.900C	-11.544	0.17092	9.29186E·02	. 67.263
700C	5,9500	-2.6197	0.11229 5 8:651P-03	·1 9188	-11.231
7050	7.0500	11.679	-6.76043E-02	C.18513	90.702
7100	7.1000	12.335	5.20344E-02	4 3191	55.094
7200	7.2000	4.0147	0.40035	-1505 -5 159422-02	-36.446
7250	7.2500	10.558	0 28319	4.3965	-59.459
7330	7.3000	-5.4293	4.06128E-03	-5.9993	21.307
7400	7.4030	-1.8427	-C.20482	1.9278	41 291
7450	7.4500	7.577:	7.24450E-02	3.1958	19 773
7550	7 5000 T 5500	9.4921	C.11494 C.29323	4.1733	1 7688
7600	7.6000	1.1234	0 32288	1.0915	-58.610
7650	7.6500	-1.3694	0.21423	-3.0474	-32.927
7750	7,7500	·2.5643 -3 0220	2-86043E·02 -0.11369	-3.9681	16.905 68 545
7800	7 5000	-6 8087	· C. 10529	1.2559	26.709
7850	7.8500	-3 8740	·2.19781E·C2	2 0181	16.966
7950	7,9500	-5 9262 -3 9902	9.45/CCE·C2 0.16644	2,3524 0 30372	-42.802

8000	8.0000	0.25244	0 14899	0.61533	-2 6309
8050	8 0500	-3 3115	C. 10905	1.1449	·16.010
B100	9.1000	4.1308	4.576372-02	-0 93072	31,548
6150	8.1500	-2.3843	4.366062.02	C.73792	16.115
8200	3.2000	-11.636	7.16575E-02	C.14451	-44.C84
8250	a.2500	-1.1510	1.768692-02	-1.3667	25 215
8300	8.3000	13.158	1.97397E-02	1.939	73.918
8350	8.3500	1.5697	0 17164	3 1252	-2: 533
8400	8.4000	9.9647	D 29800	1 7517	-74 271
84.50	6.4500	2.1992	0 33758	-0.53726	-67.522
8500	8.5000	-2.4225	0 22881	3,5927	42.635
8550	8.5500	4.6673	3 96079E-02	3 0119	53 677
8600	8 600C	5.3.26	-5 20376E-CZ	-3 92739	3C. 627
8650	8.6500	13.007	-1.735C9E-C2	2 0264	59 494
8700	8.7000	10 522	0.16345	5.49CO	25,918
8760	8.7500	8.6097	0.41716	3.7623	-75.616
8800	8.8000	10 817	0.50945	0.17972	48 977
8850	9.8500	3.3905	0.47050	·1.6015	·34 7C7
8900	8.9000	- 3.2519	0.33389	4.0159	47 082
8950	a.9500	4.4522	0.12310	3,3621	73,610
9000	9 0000	0.54254	5 49165E-02	0.46509	57 477
9050	9.0500	-4 C157	0.12743	2.0541	15.744
9100	9.1000	-2 5324	C.24461	2.4432	-5.5542
9150	9 1500	-7 9523	0.33325	C.59812	-51.640
9200	9 2000	-7 79334E-02	C.29025	1 8416	-7 2360
9250	9.2500	7.3034	0.22811	-C.21896	38.713
9300	9.2020	-4.5624	0 24401	0.37222	-17.626
9350	9.3500	-11.224	0 22257	-1.417C	-32.090
9400	9.4000	2.4640	0 14537	·0.99671	47.652
9450	9 4500	3.1749	0 16440	1,6299	37.957
9500	9.5000	3.3900	0 27181	2.3166	·1.732C
9550	9.5500	1.7582	0 37994	1.7247	-29.954
960C	9.6000	4.6839	0 40976	-0.81513	-67.079
965C	9.6500	-9.3331	0,28734	3.8605	· 38.803
9700	9.7000	- 1.7896	8 E5879E-C2	-3.3501	43.640
9750	9.7500	- 11 301	2.069171.02	0609	19.146
3800	9.8000	5.0735	-1.754792-02	1.4219	61.590
9850	9.8500	8.2596	0.13738	4.5982	40,732
9960	9.9000	-6.3113	0.37230	3.7165	25.982
9950	9.9560	2.6609	0.43025	-1.255/	10.400
.					
MEMORY	UTILIZATION 2139. MEM	- 1.734%			
•	· · · · · · · · · · · · · · ·	•••••			
ELAPSEI	CPU TIME	C.31 SEC			
*··· TOTAL (IPU TIME	219.29 SEC			
*	• • • • • • • • • • • •	••••••			

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Note Gdof are printed for the six dof of each joint. Sffix -C denotes a constrained, 'slave' dof. Sffix -R denotes a restrained dof.



Figure 39. Hysteresis Loops of Member 8

D. FOUR-STORY SHEAR BUILDING

1. Description of Input Information

Figure 40 shows a four-story shear building. each column's moment of inertia of is 4838.85 in⁴. Modulus of elasticity is E=3600 ksi. Masses of individual floors are 0.252, 0.288, 0.288, and 0.29 k-sec²/in. for the fourth, third, second, and first floors, respectively.

Response spectrum analysis is performed on the structure with consideration of all modes. The SRSS modal combination method is used in the analysis.

2. Input Data

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ECHO OF INPUT DATA
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                             STRUCTURE
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       10
                                   2 0 1 1 1 1 3 1 | RESTRAINT

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'32-6EAM ' 3600 140C 11.8 0 0 0.95 9677 745 9677.745

0 0 0 FALSE. KG : AXL, FORM, ASSY

4 NELEM

'3D-6EAM' 'MEMBER 1' 1 1 2 0 1 C 0 C 1 000000

'3D-6EAM' 'MEMBER 2' 2 3 C 1 C 0 C 1 000000

'3D-6EAM' 'MEMBER 3' 1 3 4 0 1 0 0 0 1 C00000

'3D-6EAM' 'MEMBER 3' 1 3 4 0 1 0 0 0 1 C00000

'3D-6EAM' 'MEMBER 3' 1 4 5 0 1 0 0 0 1 C00000

'3D-6EAM' 'MEMBER 4' 1 4 5 0 1 0 0 0 1 C00000

4 1 .FALSE. MASS

2 0.29 0.29 C.29 0 0 0 0 0 0 0 1 C00000

4 3 .206 0.288 0.288 0 0 0 0 0 0 0 0 0

5 9 252 C.252 0.252 0.252 0 0 0 0 0 0 0 0

5 9 252 C.252 0.252 0.252 0 0 0 0 0 0 0 0 0

5 0 DAMPING

'SCLOS - SOLUTION'

'RESPONSE SFECTRUM ANALYSIS'

'SRSS METHOC' 4 C.05 1 5 4 .ICOM NMODE DAMP NA NAF IPRT

3 10 NSTEF MEIG

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37:
                                                   0 XLIN YLIM ZLIM
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Figure 40. Four-Story Shear Building

3. Output

STRUCTURE..... ENCOURS FOUR STORY SHEAR BUILDING SOLUTION. ...: TIME: 11:22-40, DATE: 09/29/93 *** PROGRAM FEM *** DOUBLE PRECISION VERSION NODE COORDINATES AND DEGREES OF FREEDOM TOTAL NUMBER OF DEGREES OF FREEDOM..... NUMBER OF DEGREES OF FREEDOM CONDENSED QUT.... NUMBER OF PREE DEGREES OF FREEDOM...... NUMBER OF RESTRAINED DEGREES OF FREEDOM...... 30 0 4 - 26 E COS# X-COORD Y-COORD Z-COORD 1 1 0.0000E+00 0.00006E+00 1.44.0C 2 1 0.0000E+00 0.00006E+00 144.0C 3 1 0.0000E+00 0.00006E+00 270.0C 4 1 0.0000E+00 0.0000E+00 352.00 5 _ 0.0000E+0C 0.0000E+00 522.00 NOTE R - RESTRAINED DEGREE OF FREEDOM C - CONSTRAINED DEGREE OF FREEDOM FY 6-R 11-R 16-R 21-R 26-R NODE COS# F2 7 · R 12 · R 17 · R 22 · R 27 · R MY 9-R 14-R 19-R 24-R 26-R FX 5 - R M2 1C·R 15·R 20·R 25·R 30-R 8-R 13-R 18-R 23-R 29-R ž 23 DIRECTION COSINES ... NOSI LI VX: 1.36000 I +0.60000 J +0.3000 X VY: 0.00000 I -1.00000 J +0.00000 K VZ. 3.000000 I +0.90000 J +1.00000 K STRUCTURE....: EXAMPLE S: FOUR STORY SHEAR BUILDING SCLUTION... : COST 3 -D ELASTIC BEAM ELEMENT MATL. E GAMMA AY AZ IX IY AX IZ 1 3 500E-C3 1 4C0E-03 11.8 0.000E+00 0.000E-00 0.950 9 678E+03 9.678E+03 STRUCTURE EXAMPLE 5 FOUR STORY SHEAR BUILDING TIME: 11:22.40, DATE 09/29/93 SOLUTION PLEMENT 98, 3D BEAM PLEMENT
 Y+AXIS
 START DIST
 END DIST
 PKG

 0.03000
 +1.03030
 Y
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 K
 0.00002+03
 C.00002+00
 1.030

 0.03000
 I+1.03000
 Y
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 K
 0.00002+03
 C.00002+00
 1.030

 0.03000
 I+1.03000
 J *0.00000
 K
 0.00000
 C.0002+03
 1.030

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 I+1.03000
 J *0.00000
 K
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 C.0002+03
 0.00002+00
 1.030

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 I+1.03000
 J *0.00000
 K
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 C.0002+03
 0.00002+00
 1.030

 0.03000
 I+1.03000
 J *0.00000
 TIME:
 11:22:40
 D
 22:9/2
 NATL START END REL CE LENGTH PKG 1.000 MEMBER 1 144.0 126.0 126.0 MEMBER 2 MEMBER 3 MEMBER 4 1.000 MEMBER 26.G STRUCTURE... TURE ... : EXAMPLE 5: FOUR STORY SHEAR BUILDING , 9 J LUMPED NODE MASSES NCDE MX 2 0 2900 3 0.2880 4 0.2980 5 0.2520 MY 0.2900 0.2850 0.2880 0.2880 0.2520
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 IYY
 IZZ
 IXY
 IYZ
 IYZ
 IGEN
 INC

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 0.00025+00 М7. 0 2900 0 2880 0 2880 0 2880 0.2520 - THE MASS MATRIX IS NOT CONDENSED WITH THE STRUCTURAL STIFFNESS MATRIX. FROPORTIONAL DAMPING COLEFICIENTS ALPHA- 0.00000E-00 BETA- 0.00000E+00 **.** * • • • • • • • • • STRUCTURE. ... EXAMPLE 5: FOUR STORY SHEAR BUILDING SOLUTION. ... RESPONSE SPECTRUM ANALYSIS TIME: 11:22:40, DATE: 39/23/93 TIME: 11:22:40, DATE: 09/29/93 ** RESPONSE SPECTRUM ANALYSIS ** NOTE: MODAL COMBINATION APPROACH CAN BE SRSS OR COC NOTE: MODAL STRUCTURE. ... SXAMELE 5: FOUR STORY SHEAR BUILDING SOLUTION... . RESPONSE SPECTRUM ANALYSIS TIME: 11:22 4C, DATE: 09/29/93 TIME: 11:22:4C, DATE: 09/29/93 SOLUTION #5, SRSS MODAL COMBINATION METHOD
 NUMBER OF MODES CONSIDERED
 4

 DAMPING RATIO FOR ALL MODES
 0.50CE+01

 NO. OF SPISHIC COMPONENTS CONSIDERED
 1

 NO. OF NPUT FOR SPOR SPECTRUM
 5

 MCDE:
 1

 FR20 (RAD/SEC):
 8.6933

 PERDUENCY (H2):
 1.3835

 PERIOD:
 C.72276

 C.24372
 0.15475

 DCF:
 1:

 DCF:
 1:

 DCF:
 1:

 DCF:
 1:

 C.34223
 1.0000
 50.469 8.0324 0.12450

·0.53637

DOF(21 C.72311 C.74774 -0.637 DOF(30 0,20868 -C.16932 -0.632 DOF(4) 1.0200 -0.95299 0.643 STRUCTURE EXAMPLE S: FOUR STORY SHEAR BUILDING SOLUTION SOLUTION RESPONSE SPECTRUM ANALYSIS	21 1 0006 52 -0.97358 11 0.470C6		TIME: TIME:	11.22:40, DATE: 09/29/93 11:22:40, DATE: 09/29/93
DICONNENT CREATEIN VALUES . INDUTING CREATER AT ON	21 4 1			
** DISPLACEMENT SPECIFIC VALUES (INPUTING RANSLATION	AL # .			
FERIOS	COCOCOCE 22			
C 124000 0 154000 C 222000 0 223000	0.3900302-31 0.6200002-01 0.155000 1.19000			
GLOBAL BASE ACCE. SPECTRUM VALUES IN THE \boldsymbol{X} DIRECTION				
89.89 102.8 1C3.5 1C3.3				
GLOBAL BASE ACCESPECTRUM VALUES IN THE \boldsymbol{Y} DIRECTION				
0.000CE+D6 0 CC00E+00 0 C00E+00 C.00CE+C0				
GLOBAL BASE ACCE. SPECTRUM VALUES IN THE 2 DIRECTION				
0.0000 6+00 0 CC00E+00 C.00C0E+C0 C.0000E+C0				
GLOBAL BASE DISPSPECTRUM VALUES IN THE X DIRECTION				
1.189 C.1547 6 2766E-02 3.9380E-02				
GLOBAL BASE DISF. SPECTRUM VALUES IN THE Y DIRECTION				
0.0002-C0 0.0000E+00 0.000CE+0C 0.000CE+0C				
GLOBAL BASE DISP. SPECTRUM VALUES IN THE Z DIRECTION				
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 STRUCTURE EXAMPLE 5: FOUR STORY SHEAR BUILDING SOLUTION RESPONSE SPECTRUM ANALYSIS			TIME · TIME :	11:22:40, DATE: 09/29/93 11 22:40, DATE: 09/29/93
EFFECTIVE MASS IN GCS" TRANSLATIONAL DIRECTIONS				
EPFECTIVE MASS LIMIT IN GCS" Y DIRECTION IS 0.0000 EFFECTIVE MASS LIMIT IN GCS" Z DIRECTION IS 0.000 NCTE: TOTAL STRUCTURAL MASS IN X DIRECTION IS 1 NCTE: TOTAL STRUCTURAL MASS IN X DIRECTION IS 0.000 MODE GCS X-DIRECTION (\$) 6.00 MODE GCS X-DIRECTION (\$) 1 1 0.9331 0.0002-C0 2 0.3752E-01 0.0002-C0 2 0.3752E-01 0.0002-C0 2 0.3752E-01 0.0002-C0 2 0.3752E-01 0.00002-C0 2 0.3752E-01 0.00002-C0 3 C.111E-02 0.00002-C0 5 STRUCTURE: EXAMPLE 5' FOUR STORY SHEAR BUILDING SOLUTION RESPONSE SPECTRUM ANALYSIS	COP+CO COP+CO 180C 180C 0000E+CC 0000E+CC 0CS 2-DIRECTION(\$) 9.CO0CE+C0 0.CO0CE+C0 0.CO0CE+C0 0.CO0CE+C0 0.CO0CE+C0		TIME: TIME:	11:22 4C. DATE 09/29/93 11:22:4C. DATE 09/29/93
TOTAL MAXIMUM STRUCTURAL RESPONSES				
DESTE DESTE DESTE DESTE DESTE	J.O.F. D.SPL	i		
1.009 1.455 STRUCTURE EXAMPLE 5. FOUR STORY SHEAR BUILDING SOLUTION RESPONSE SPECTRUM ANALYSIS	3 1.3.5		TIME: TIME:	11:22:40, DATE: 09/29/93 11:22:40, DATE: 09/29/93
TOTAL MAXIMUM EQUIVALENT EARTHQUAKE FORCES				
SOLF FORCE IN DICE. FORCE IN	D O.F FORCE			
4 152.9 STRUCTURE EXAMPLE 5: FOUR STORY SHEAR BUILDING SOLUTION : RESPONSE SPECTRUM ANALYSIS	3 29,16		TIME TIME	11:22:40, DATE: 09/29/93 11:22:40, DATE: 09/29/93
TOTAL MAXIMUM ELEMENT FORCES				
3D BEAM FORCES				
ELEMENT LOAD NODE AXIAL FY 1 FORCE 1 C.00000E-C0 0.00000 FORCE 2 C.00000E-C0 0.00000 2 PORCE 2 C.00000E-C0 0.00000 3 FORCE 3 C.00000E-C0 0.00000 3 FORCE 3 C.00000E-C0 0.00000 4 FORCE 4 C.00000E-C0 0.00000 FORCE 4 C.00000E-C0 0.00000 C.00000 FORCE 4 C.00000E-C0 0.00000 C.00000 FORCE 5 C.00000E-C0 0.00000 C.00000 FORCE 5 C.00000E-C0 0.00000 C.00000 FORCE 5 FOUR STORY SHEAR BUILDING SOLUTION RESFONSE SPECTRUM ANALYSIS	PZ DE+00 94.0134 DE+00 94.0134 DE+00 9.118 DE+00 79.1718 DE+00 75.0422 DE+00 57.0422 DE+00 28.7220 DE+00 28.7220	TORSION 6.00000E+00 6.00000E+00 6.00000E+00 6.00000E+00 6.00000E+00 6.0000E+00 6.0000E+00 6.0000E+00 0.00000E+00 0.00000E+00	MY 5755.97 4987.83 3593.66 3593.66 1809.49 1809.49 TIME: TIME:	MZ C.0CC0362+00 C.0C0392+00 C.0C0392+00 C.3C0392+00 C.3C00302+03 0.300C002+03 0.300C002+03 0.0000002+03 11:22:40, DATE: 09/25/93 11:22:40, DATE: 09/25/93
TOTAL REACTIONS AT GCS" CRIGIN FX FY FZ	MX	MY	MZ	

GCS SUMM STRUCTURE.	94 C1341 EXAMPLE 5	0.00060002+00 C.OCCOOCCE-00 S: FOUR STORY SHEAR BUILDING	0.0000002E+00	34072 17	0.0000000E+0C TIME	11.22:40.	DATE: 09/29/93
		Toes creat burner beilbing			PL	AI 66:4U.	URIE: 03/23/33

TIME: 11:22:40, DATE: 09/29/93

SOLUTION.....: RESPONSE SPECTRUM ANALYSIS

i.

TOTAL MAXIMUM INERTIA FORCES

: D 0.F	FORCE	D.O.F.	FORCE	:	D.O.F.	FORCE	;
1	17.59	2	23.91		3	28.88	

*	
* ··· MEMORY UTILIZATION	
···· IZ= 2603, MEM-	0 37 28
	·····
TOTAL CONTINE	C 25 CEC
*	C.2C 3EC

146

E. THREE-STORY FRAME-SHEAR WALL SPACE BUILDING

1. <u>Structural Configuration</u> For a three-story frame-shear wall space structure, Figure 41 shows the structural configuration.



Figure 41. Structural Configuration

Note In Figure 41, the number in a circle stands for element type, where

- 1 Box bracing member
- 2 Inelastic-3D beam-column (bilinear hysteresis model)
- 3 Finite-segment element (box-section, bilinear stress-strain)
- 4 Long-direction girder
- 5 Short-direction girder
- 6 Shear wall
- 7 Perforated shear wall
- 8 Elastic-3D beam-column
- 9 I-shape bracing member
- 10 Inelastic 3D beam-column (Takeda hysteresis model)
- 11 Spring element (bilinear hysteresis model)

12 Finite-segment element (tube-section, Ramberg-Osgood stress-strain)

2. Member Sizes and Material Properties

- Box bracing member 1 L(length) = 250 in, $\Box = 12*6*5/16$, A(area) = 10.6 in², r = 2.5, L/r = 99.62 Inelastic 3D beam-column (bilinear model) W12*65, $A = 19.1 \text{ in}^2$, $I_v = 533 \text{ in}^4$, $I_z = 174 \text{ in}^4$, $Z_v = 96.8 \text{ in}^3$ $Z_z = 44.1 \text{ in}^3$, $J_x = 2.18 \text{ in}^4$, $M_{pv} = 3484.8 \text{ k-in}$, $M_{pz} = 1587 \text{ k-in}$ 3 Finite-segment element (box section) \Box 12*12*3/8. Bilinear stress-strain model with strain hardening of 3%. 4 Long-direction girder First buckling displacement 0.004 rad First buckling load 2000 k-in 5 Short-direction girder First buckling displacement 0.005 rad First buckling load 2000 k-in Strain-hardening ratio 3%
- 6 RC shear wall

Axial stiffness

Compression $k_s = 7000$ k/in

Pre-yield tensile stiffness $k_t = 6000$ k/in

Post-yield tensile stiffness $k_{12} = 60$ k/in Yield force $F_y = 2000$ kips (for unit length) Bending hysteresis curve

NSEG (number of points on backbone curve) = 4



k-in	rad
7000	4.0*10 ⁻⁵
6500	1.7*10 ⁻⁵
5000	0.7*10-5
2700	0.2*10 ⁻⁵
(for un	it length)



k-in	in/in
200	5.0*10-3
180	2.3*10 ⁻³
150	1.1*10 ⁻³
80	0.3*10 ⁻³
(for un	it length)

Figure 43. Shear Hysteresis Curve

7 Perforated wall

Axial stiffness

Same as (6)

Shear hysteresis curve



Figure 44. Shear Hysteresis Curve (for true width)

L = 90 in, w = 75 in, AD = 0.2 in², AV = 0.11 in², LWP = L'/w'

8 Elastic 3D-beam-column

W12*65, A = 19.1 in², $I_y = 533$ in⁴, $I_z = 174$ in⁴, $J_x = 2.18$ in⁴

9 I-shape bracing member

W10*49, L= 250 in², A= 14.4 in², r= 2.54 in

10 Inelastic 3D beam-column (Takeda hysteresis model) In Figure 45, PC is the cracking moment and DC is the cracking rotation. PY and DY are the yield moment and the yield rotation, respectively. PU is the ultimate moment and DU is the ultimate rotation.



PC = 250 k-in DC = 0.00001 rad/length PY = 1500 k-in DY = 0.00015 rad/length PU = 1550 k-in DU = 0.00086 rad/length



11 Spring element (bilinear hysteresis model)

EI = 1,000,000 ksi, $M_p = 1000$ k-in, Strain hardening ratio 3% 12 Finite-segment element (Ramberg-Osgood stress-strain model)



Tube section: 12*1/2

Figure 46. Finite-Segment Element

3. Masses, Static and Dynamic Loads



Figure 47. Structural Concentrate Masses

Static loads

Dead load (DL) for all floors = 80 psf, for roof = 60 psf

Live load (LL) for all floors = 90 psf, for roof = 20 psf

(a) First floor

DL+LL= 140 psf, slab area = $600*200 = 120,000 \text{ in}^2 = 833.333 \text{ ft}^2$ Total load = 140*833.333 = 116,666.67 lbs = 116.67 kipsTotal beam number = 10 Uniform load for each beam = 116.67/(10*200) = 0.0583 k/in



Dynamic loads



Figure 48. Dynamic Load History

Note *Factor can be adjustable.

Load conditions

Elastic (1) Static loads

- (2) Static loads with P- Δ effect
- (3) Dynamic loads only
- (4) Dynamic loads and static loads
- (5) Dynamic loads and static loads with P- Δ effect

(6) Eigenvalues, buckling

<u>Inelastic</u> (7) Static increment displacement (8) Dynamic loads

4. Member and Joint Numbering



Figure 49. Member Numbering



Figure 50. Joint Numbering



Figure 51. Joint Translational Mass

	5.	Initial	Column	Load for	· Ρ-Δ	Effects
--	----	---------	--------	----------	-------	---------

<u>Element_No.</u>	Accumulated Mass (k-sec ² /in)	Force (kip)
15	0.01440	5.5584
16	0.01440	5.5584
17	0.01440	5.5584
18	0.03940	15.2084
19	0.01440	5.5584
20	0.03940	15.2084
21	0.01440	5.5584
22	0.03940	15.2084
23	0.01440	5.5584
24	0.03940	15.2084
25	0.01440	5.5584
26	0.01440	5.5584
41	0.13382	51.6540
42	0.13382	51.6540
45	0.00578	2.2310
52	0.17930	69.2100
53	0.17930	69.2100
54	0,10430	40.2598

6. Input Data

THREE STO	RY BUILD	NG '			WARE HOLE NOUR MONT MONT FOLD
1 0 00	- 6.00	30C	1	3 :	: ID X Y Z 100S 1GEN
1 200 0	0			. !	DID DX DY DZ
5 600 1 7200 C	200	300	1	2	: ID X Y Z ICOS IGEN : DID DX DY DZ
9 1 0 0	100	300	2	0	D X Y Z LOOS IGEN
10 500	100	300	÷	5	ID X Y 2 ICOS IGEN
11 400	C.CO D.D(225	1	0 :	ID X Y Z ICOS IGEN : TD X Y Z ICOS IGEN
13 600	200	225	ĩ	č	' IF X Y Z DOOS IGEN
14 400	200	225	1	ç i	12 X Y Z 1005 IGEN
15 500	100	225	1	3	TEXYZ COSIGEN TEXYZ COSIGEN
1 200 0	0	130	-	Ĩ.,	DID DX DY DZ
20 700	100	92.27	1	С С	ID X Y Z LCOS IGEN
21 600	200	150	1	د ا	
25 300	100	150	:	1	ID X Y Z ICOS IGEN
: 200 0	0				DID DX DY DZ
27 633 33	192	130 83	1	2	ID X Y Z ICOS IGEN I TR X Y Z ICOS IGEN
1 200 0	: C	0.50	,		2 DID DX EY DZ
32 500	200	C 00	1	3	ID X Y Z ICOS IGEN
1 200 0	C	6 03		2	DID DX DY DZ
37 788.6	100	0.00	Ξ.	5	ID X Y Z ICOS IGEN
: 6 0	016			-	VXI VXJ VXK VYI VYJ VYX
26 1 1 1	111	7			JOINT RESTRAINT
15 0 0 2	220	5 0			COINT RESTRAINT
25 C O 2	2 2 0	0 0		;	: JCINT RESTRAINT
26 C 0 1	110	0 0			I JOINT RESTRAINT
36 1 1 1	2 2 0	C 0			JOINT RESTRAINT
37 1 1 1	111	c c			JOINT RESTRAINT
0 0 0 1	1 1 0	00			JOINT CONDENSATION
36 UUU 1 9 1	11	00			JOINT CONDENSATION
1 9 7	: 1				CCINT CONSTRAINT
1 10 3	3 1				: JCINT CONSTRAINT
1 25 16	3 1				JOINT CONSTRAINT
1 25 2:	3 1				JOINT CONSTRAINT
1 25 26	C 0				JOINT CONSTRAINT
18	. NMAT				JUNI COPERAINI
BRACE #	29000	10 6	2.5	51	36 1 12 0.2
IA_BILN M	¥ # 2 ·	1 C	. 03		29000 533 3464.8 -2 0
'IA BILN M	2 # 3 *	0 0	.03		13000 2.18 0 -2 C
'IA_BILN F	K # S '	Č Č	. c 5		29000 19.: C -2 C
TAKEDA M	Y # 6 ' 2	5E07	250	1	. GE+5 1500 1.5E+4 1550 8.6E+4 0.2
'SIAD_SIII	ECY # 1	· 4	16		
2 0 0 3	0 0 37	5 C D	1.	44 [°]	0 0 0.03 0 13000 0.01 1
1 0 0 3 STABILITY	0 0 37 TUBE # 8	5 C D 4 35	1- 29	44 GO 0	2900 1 22 2 0 0 0.0 4 4 0.375 0 0 0.03 0 13000 0.01 1 0 2 5.5 0 0 0 8 0 0 5
1 0 6 3 'STABILITY 0 C 0 0 C	0 0 37 TUBE # 8 37.5 C	5 C D • 4 35 0 95 C3	1 29 1	44 000 2	2900 1 2 2 9 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
1 0 0 3 STABILITY 0 C C 0 C SD-BEAM LONG GWIG	0 0 37 TUBE # 8 37.5 C # 9 ' # 10'	5 C 0 4 35 0 95 C3 29000 1 0.004	1 29 1 300 2	44 600 2 0 11 260	2500 3 2 2 2 0 0 0.04 4 0.375 0 0 0.03 0 13000 0.01 1 2 5.5 0 0 0 8 0 0 5 0 0.03 2 0 13000 0.01 1 9.1 29.1 9.1 2.18 533 174 5 2 0.2
1 0 0 3 STABILITY 0 C 0 0 C 3D-BEAM LONG_GWUG SHORT_OWJG	0 0 37 TUBE # 8 37.5 C # 9 ' # 10' G # 11'	5 C 0 4 35 0 95 C3 29000 1 0.004 0.005	1 29 1 309 2 2	44 000 2 0 11 000 000	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
: 0 C 3 STABILITY 0 C 3 0 C 3D-BEAM LONG_GWJG SHCKT_GWJG BRACE =	0 0 37 TUBE # 8 37.5 C # 9 ' # 10' G # 11' 12' 2900	5 C 0 4 35 0 95 C3 29000 1 0.004 0.005 0 14 4	1 29 1 300 2 2 2	44 600 2 0 1 0 0 0 0 0 0 0 0 0 0	29003 1 22 0 0 0 0 0 4 4 0 375 6 0 0.03 0 13000 0.01 1 12 5.5 0 0 8 0 0 5 1 0.03 20 13000 0.01 1 9.1 29.1 .9.1 2.18 523 174 1 0.03 .2 0 2 1 36 2 12 0.2 1 36 2 12 0.2
: 0 0 3 STABILITY 0 C 0 0 C BD-BEAM LONG_OWEG SHORT_OWJ(BRACE = BILINEAR AXIMOD FOI	0 0 37 TUBE # 8 37.5 C # 9 ' # 13' G # 11' 12' 2400 SPRING #1 R WALL #1	5 C 0 4 35 0 95 C3 29000 1 0.004 0.005 0 14 4 3' 1000 4' 7000	1 29 300 2 2 2 2 000 60	44 500 2 500 500 54 50 54	25003 2 2 2 0 0 0 0 0 4 4 0 375 6 0 0.03 0 13000 0.01 1 9 2 5.5 0 0 8 0 0 5 9 0.03 20 13000 0.01 1 9 1 29 1 9 1 9 1 2 18 533 174 9 2 0.2 1 0.03 2 0 2 1 0.03 2 0 2 1 0 0 5 12 0 2 1 0 0 0 1.9 0.2 15 0.2
1 0 0 3 STABILITY 0 C 0 0 C 0 3D-BEAM LONG_GWUG SHORT_OWJC BRACE = 1 BILINEAR AXIMOD FOI BEND1 FOI	0 0 37 TUBE # 8 37.5 C # 9' G # 10' G # 11' 12' 2400 SPRING #1 R WALL #1 R WALL #1	5 C 0 4 35 0 95 03 29000 1 0.004 0.005 0 14 4 3' 1000 4' 7000 5' 4 1	1 29 1 300 2 2 2 0 0 0	44 500 2 5 5 5 10 5 4 5 4 5 4 5 4 5 4 5 4 5 4 5 4 5 5 4 5 5 4 5 5 5 5 5 5 5 5 5 5 5 5 5	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
2 0 0 3 STABILITY 2 C 3 0 0 3D-BEAM LONS_GWCG SHORT_OWJC BRACE = SHILINEAR AXIMOD FOI 27 30	0 0 37 TUBE # 8 37.5 C # 9 ' # 10' G # 11' 12' 2900 SPRING #1 R WALL #1 S000	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 29 300 2 2 2 00 60 0	44 500 21 500 500 500 500 500 500 500 50	25003 2 2 2 0 0 0 0 0 4 4 0 375 0 0 0 0 0 3 0 13000 0 0 0 1 9 0 0 2 0 13000 0 0 0 1 9 1 19 1 9 1 2 18 533 174 0 0 0 0 0 0 2 0 0 0 0 0 0 2 0 0 0 5 2 12 0 2 60 2300 19 0 0 2 15 0 2 10 0 0 0 0 19 0 2 15 0 2 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
STAPILITY C C 0 0 C SD-BEAM LONG_GWUG SHORT_OWJ BRACE BILINEAR AXIMCD FOI DENDI FOI 2700 C.22-C5 SEFARI FOI	0 0 37 TUBE # 8 37.5 C # 9 ' # 10' G # 11' 12' 2900 SPRING #1 R WALL #1 5000 0.7E-C5 B Wall #1	$5 \ C \ 0$ $4 \ 35$ $0 \ 95 \ C3$ $29000 \ 1$ 0.004 0.005 $0 \ 14 \ 4$ $3^{\circ} \ 1000$ $4^{\circ} \ 7000$ $5^{\circ} \ 4 \ 1$ $\epsilon \ 5 \ 0$ $1.7 \ \epsilon$	1 29 300 2 2 2 0 60 0 0	44 500 200 500 500 500 500 500 500	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
2 0 *STAPILITY 0 0 0 0 3D-BEAM LONG_GWCG *SHORT_0WJ(BRACE + BILINEAR *AXIMOD FO) *BELINEAR 0 0 27 00 0 22 CS *SHEAR1 FO)	0 0 37 TUBE # 8 37.5 C # 9 ' # 10' SPRING #1 R WALL #1 5000 0.7FcC5 R WALL 41 150	5 C 0 9 5 G 35 0 95 G 32 0 004 0 004 0 005 6 14 4 3' 1000 4' 7C00 5' 4 1 65 C0 1.7E 6' 4 1 1.8C	1 29 300 2 2 2 0 60 0 0 0 0 0 0 0 0 0 0 0 0	44 500 200 500 500 500 500 500 500	29003 _ 22 20 0 0 0 0 4 4 0 375 5 0 0 0 0 3 0 13000 0 0 1 1 9 1 29 1 9 1 2 18 533 174 9 2 0 2 9 0 0 3 12 0 2 10 0 0 3 12 0 2 5 0 0 3 12 0 2 5 0 0 0 1 2 0 2 5 0 0 0 1 2 0 2 5 0 0 0 1 2 0 2 5 0 0 0 0 1 2 0 2 5 0 0 0 0 1 2 0 2 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2 0 0. 'STAPLILITY 'STAPLILITY 'DOBEAM 'LONG_OWJG 'SHORT_OWJ 'BRACE' b 'BILINEAR 'AXLMCD FO! 'BENT1 FO! 2700 C.22-C5 'SHEAR1 FO! 0.32-03	0 0 37 TUBE # 8 37.5 (# 9 ' # 10' 507.5 (507.5 (5000 0.7E.05 R WALL #1 5000 0.7E.05 R WALL #1 150 1.1E.03	5 C 0 95 C 35 0 95 C 3 29000 1 0.004 0.005 C 14 4 3' 1000 4' 7C00 5' 4 1 1.7E 1.7E 1.8C 2.3E	1 29 300 2 2 2 00 60 0 0 0 0 0 0 0 0 0 0 0 0 0	44 500 200 500 500 500 500 500 500	29003 2 2 2 0 0 0 0 0 4 4 0 375 0 0 0 0 0 0 6 8 8 0 5 9 0 0 0 0 0 0 0 0 0 0 0 1 9 1 19 1 9 1 2 18 533 174 9 0 2 0 2 0 0 0 12 0 2 0 0 0 12 0 2 60 0 2000 19 0 0 2 15 0 2 10 0 0 0 19 0 0 2 10 0 0 0 0 0 0 10 0 0 0 0 10 0 0 0 0 10 0 0 0 10 0 0 10 0 0 10 0 0 10 0 0 10
1 0 0 STAPLILTY 9 C 3 0 C 30-BEAM LONG GWCG SHORT 0WJC BRACE 5 BLINEAR 1 BLINEAR 1 SLINEAR 2 7 30 0 (22-C5 SHEARI FO 85 0 38-03 AXLMOD FCI SHEAR2 FO	0 0 37 TUBE # 8 37.5 C # 9 ' G # 10' G # 11' 12' 2900 SPRING #1 5000 0.7E-C5 R WALL #1 150 1.1E-03 R OPEN-WA	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 29 300 2 20 600 60 0 5 0 3 0 3 7 0 4	44 500 200 54 50 54 50 54 55 55 55 55 55 55 55 55 55	2003 1 2 2 0 0 0 0 0 1 4 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 9 0 0 0 0 0 0 0 0 0 0 0 0 9 1 19 1 9 1 2 18 533 174 2 0 2 0 2 0 0 0 3 6 2 12 0 2 0 3 6 2 12 0 2 0 6 0 200 1 2 0 2 0 6 0 200 1 2 0 2 0 5 0 0 5
1 0 0 STABLILTY 0 C 0 0 0 10-BEAM 1LONG GWCG SHORT_0WJC BRLINEAR + AXLMCD FOI 27:00 0.22:C5 SHEAR1 FOI 0.32:03 * AXLMOD FOI - SHEAR2 FOI - SHE	0 0 37 TUBE # 8 37.5 C # 10' G # 11' 12' 2900 SPRING #1 12' 2900 SPRING #1 NALL #1 S000 0.7E-C5 R WALL #1 150 1.1E-03 R OPEN-WA SCPEN-WA 15C	5 C 0 6 4 35 7 95 03 29000 1 0.004 0.005 0 14 4 3' 1000 4' 7000 5' 4 1 100 1.7E- 6' 4 1 180 2 3E- 11 417 180 180 180 180 180 180 180 180	1 29 309 2 2 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	44 GOOO 2 C 11 GOOO 2 C 10 C 7 C 7 C 7 C 7 C 7 C 7 C 7 C 7	22003 1 22 20 0 0 0 0 4 4 0 375 0 0 0 0 0 3 0 13000 0 0 0 1 9 1 19 1 9 1 2 18 523 174 0 0 0 2 0 2 0 0 0 2 0 0 2 36 2 12 0 2 60 2000 1 2 0 2 60 2000 1 2 0 2 50 5 10 5
5TABLITY STABLITY 0 C 0 0 C 100-BEAM 1LONG_OKUG SHCKT_0WJ BRACE ± 15LINEAR 15LINEAR 15LINEAR 2730 0.22-C5 SHEAR1 FOI 0.32-03 0.32-03 15HEAR2 FOI 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0	0 0 37 TUBE # 8 37.5 C # 9 G # 11 12' 24:00 SPRING #1 R WALL #1 5000 0.7F-C5 R WALL #1 5000 1.1E-03 R WALL #1 1.50 1.1E-03 R OPEN-WA 150 0 22	5 C 0 4 35 0 95 03 29000 1 0.004 0.005 6 14 4 3' 1000 4' 7000 5' 4 1 6' 4 1 1.72 4' 7 1.80 0.46 0.46	1 299 1 300 2 2 2 2 000 600 0 5 5 5 7 5 4	44 GOOD 2000 540 COD 70 4E 5E 0 1 1 1 1 1 1 1 1 1 1 1 1 1	22003 _ 22 20 0 0 0 0 4 4 0 375 0 0 0 0 0 0 8 0 0 5 1 0 0 0 2 0 13000 0 0 0 1 9 1 19 1 9 1 2 18 533 174 1 2 0 2 1 3
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<pre>STABILITY STABILITY STABILITY B C 0 0 C 3D-BEAM ULONG OWUG SHACE + BEACE + BEACE + BEACE + SHALDE FO. C 22:05 SHEARI FO. C 22:05 SHEARI FO. B 0 06 30 15 SC 0 06 SC 0 06 SC</pre>	0 0 37 TUDE # 83 37.5 C # 9 3 112: 24 30 SPRING #1 WALL #1 5000 0.7E-C5 R WALL #1 150 0.7E-C5 R WALL #1 150 0.7E-C5 0.22 0.12 C.7ENDER WALL #1 150 0.7EN-WA R OPEN-WA R OPEN-WA 0.12 C.7ENDER WALL #1 MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER MEMBER	5 C 3532 C 357 C 352 C 357 C 357	100222200 200222200 5074 10346131111111111112122467299 10022220 5074 103461311111111111112122467299	400250040070E12E00110 400250040070E12E00110 400250040070E12E00110 400250040070E12E00110 400250040070E12E00110	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
1 0 0 5 TABLITY 9 C 0 0 C 10 - BEAM 10 - SCOT 00 - C 10 - BEAM 10 - SCOT 00 - C 10 - BEAM 10 - SCOT 00 - C 10 - SEAM 10 - BEAM 10	0 0 37 TUESE # 8 37.5 C # 9 3 # 13' # 13' # 13' SPRING #1 # WALL #1 SOUD 0.7E-C5 # WALL #1 # WALL #1 # WALL #1 SOUD 0.7E-C5 # WALL #1 SOUD 0.7E-C5 # WALL #1 NEMBER 'NEMBER 'NEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER 'MEMBER	5 C 3531 C 3531 C 3532 C 355 C 354 C 355 C 357 C 357	191022200 5 374 :X 0 0 1111111111111112222124572923	40 2 00 5 10 7 0 E 1 40 0 1 1 0 3 5 5 7 5 1 1 1 1 2 2 4 5 5 5 6 7 8 3 6 2 1 2 2 4 5 5 5 6 7 8 3 6 2 1 2 2 2 4 2 5 5 6 7 8 3 6 2 1 2 2 2 4 2 5 5 6 7 8 3 6 2 1 2 2 2 4 2 5 5 6 7 8 3 6 2 1 2 2 2 4 2 5 5 6 7 8 3 6 2 1 2 2 2 4 2 5 5 6 7 8 3 6 2 1 2 2 2 4 2 5 5 6 7 8 3 6 2 1 2 2 2 4 2 5 5 6 7 8 3 6 2 1 2 2 2 4 2 5 5 6 7 8 3 6 2 1 2 2 2 4 2 5 5 6 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 5 6 2 7 8 3 6 2 1 2 2 2 4 4 2 5 6 2 1 2 2 2 4 4 2 5 6 2 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 2 2 2 4 4 2 5 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
1 0 0 5 TABILITY 5 TABILITY 5 C 0 0 C 10-BEAM 10-MG GWCG 5 HACKT 0WJ 5 BRACE + 10-MG GWCG 5 HEART FO 2 7 30 0 5 BEAT FO 0 0 2 1 3 0 15 1 C C 3 0 15 1 C D EAM 1 C D BEAM 1 C D D C 1 C D	0 0 37 TUDE # 8 37.5 C # 9 37 5 G # 11 27.5 C 9 13 5 C 9 13 5 C 9 12 12 29 5 C 9 21 12 29 5 C 9 21 12 29 5 C 9 21 135 1.12 5 C 9 22 15 12 29 15 12 29 15 12 29 15 12 29 15 12 29 15 12 29 12 29 15 12 29 15 12 29 15 12 29 12 29	5 C 35 33 2 C 35 35 2 C 35 5 5 5 5 5 5 5 2 C 35 5 5 5 5 5 5 2 C 35 5 5 5 5 5 5 5 2 C 35 5 5 5 5 5 5 5 2 C 35 5 5 5 5 5 5 5 2 C 35 5 5 5 5 5 5 5 5 2 C 35 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	1910022200 3 000 0 0 0 0 0 11134 0 1111111111111111	40 2 100 40 70 E1 20 0 1 10 2 3 3 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4 4 2 3 4 4 4 4	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
<pre></pre>	0 0 37 TUDE # 83 37.5 C # 9 3 5 2 2 5 2 3 5 2 4 5 2 4 5 2 4 5 2 5 2 5 2 5	5 C 35 33 2 C 35 3 C 35 3	1919222000 50 74 11346131111111111111111111111111111111	40 210040 70E12E 0110 40 200510 70E12E 0110 40 200510 70E12E 0110 40 200510 70E12E 0110	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

STABLITY MEMBER 37' & 28 16 1 C C D C D C IE3DBEAM MEMBER 38' 2 2 3 3 4 5 35 24 1 0 C C O D C
"IEBDEEAM" (MEMBER 40" Z Z 3 3 4 5 34 23 1 C C C C C 0
"35-BEAM" MEMBER 41" 9 31 19 1 C 0 0 C 51.654 00000C 6 "20-BEAM" MEMBER 42" 5 32 21 1 0 C 0 C 51.654 000000 C
"3D-BEAM" MEMBER 43" 9 20 21 7071 7071 0 0 0 0 00000 0 "3E-BEAM" MEMBER 44" 9 20 197071 .7071 0 0 0 0 000000 0
'3E-BEAM' 'MEMBER 45' 9 36 20 0 1 0 C 0 2.231 000000 0 'SPRING' 'MEMBER 46' 13 37 36 5 C C 1 0 0 C 0
'BRACE' 'MEMBER 47' 12 29 16 1 1 C 1 C 0 C 0 'BRACE' 'MEMBER 45' 12 34 24 5 3 0 1 C 0 0 0
"ERACE" 'MEMBER (5' 1 29 23 1 1 1 0 0 0 0 0
'FRACE' 'MEMBER 51' 1 31 21 1 1 1 0 0 0 0 0
SHEAR WALL MEMBER 52 15 16 14 16 17 27 30 1 69 21 0 SHEAR WALL' 'MEMBER 53' 15 16 14 22 23 34 33 1 69.21 0
15 1 FALSE, INMASS FMASS MCOND
: 0.C144 0.C144 C 00000071 110.C25 CC25 C 0C00C031
16 0.03775 0.03775 0 0 0 0 0 0 0 1 1 18 0.02775 0 02775 0 0 0 0 0 0 0 0 0 0
19 0 09442 0 09442 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
21 0.09442 0 09442 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
23 0.03775 C.03775 C 0 C 0 0 0 C 1 1 26 C 7 C 2 C 0 C 0 C 0 C 0 C 0
Z7 C 0133 0.0123 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SOLO: SOLUTION
'ELASTIC STATIC ANALYSIS' 1 10 ' NLOAD MAXELD
0 0 C 0 'END' 0 : JOINT LOADS 2 1 3 2 'UNIF' 'FZ' -0 0278
1 4 1 4 'UNIF' 'FZ' -0 C278 1 9 1 1 'UNIF' 'FZ' -0 C278
1 11 3 1 'UNIF' 'FZ' -0.0486 1 27 1 1 'UNIF' 'FZ' -0.0593
1 29 2 1 'UNIF' 'FZ' -0.1548 1 32 3 1 'UNIF' 'FZ' -0.0583
1 36 C 0 UNIF' 'FZ' -0.1548
0 0 0 0 (END) (FZ) 0 0253
SOLOZ - SOLUTION'
LINEAR ACCELERATION RETAILS 'INTEG THE FUNCTION BAL?
0.00 1 4.0 366.4 TO DT TF GRAV
JOINT FX' 9 9 11 11 TYPE NOME TONIT
JGINT FX' 15 13 GCO : TYPE NUMB IUNIT 'JCINT FY' 15 14 0CO : TYPE NUMB IUNIT
JCINT FX 25 15 C 0 0 TYPE NUMB IUNIT . JCINT FY 25 16 C 0 G TYPE NUMB IUNIT .
'ELE' 2 17 0 0 0 'ELE' 9 18 0 0 0
'ELE' 37 19 1 2 1 'ELE' 22 21 0 0 0
'ELE' 27 22 0 C 0 'ELE' 29 23 0 C 0
'ELE' 36 24 C O O 'ELE' 46 25 C O O
'ELE' 47 26 0 0 0 'ELE' 55 27 0 0 0
ELE 52 26 0 0 0
1 1 C.OO I CO TRUE. NA, ASCALE, TO, DT, FRINT
5 5 1 FALSE. TRUE. FALSE : IN, NPTS, IDIR, FMT, ECHO. REWIND FRIMEWING FOR FUNCTIONS
DURATION IS 4 SECONDS
'FEAD UNIT-9 UNIT-10 UNIT-11 UNIT-12 UNIT-13 UNIT-14'
'READ UNIT-15 UNIT-15 UNIT-17 UNIT-16 UNIT-19 UNIT-20' 'READ UNIT-21 UNIT-22 UNIT-25 UNIT-26 UNIT-26'
'READ UNIT-27 UNIT-25 UNIT-29' 'RELEASE'
'SOLGA SOLUTION' 'NATURAL FREQUENCIES AND MODE SHAPES'
"EUCK" 5 5 "RELEASE"
'SOLC4 - INCREMENTAL STATIC SOLUTION' 'NONLINEAR CYCLE ANALYSIS WITH UNBALANCED FORCES'
C 500 1 TRUE.; MAXELD IPRINT IWRITE UNBAL
'ELE' # 15 0 C 0 'ELE' #7 19 1 2 1
'ELE 22 21 C 0 0
ELEY 24 23 0 0 0
ELE 46 25 0 0 0
ELE 6 20 0 0 0 ELE 50 27 0 0 0
ELE' 52 28 9 0 0 0
'END' 6 0 C 0 C 1 1 7 1 'FX' C.2222
C 0 G 0 'END' G ' JCINT LOADS 'LCAD' 200.0 C C 20
'END' O C C C

.

7. Output

(Case: SOL04 -- Nonlinear Cycle Analysis With Unbalanced Forces)

1 ECHO OF INPUT DATA

2	INE	
	2	THREE STORY BUILDING'
	4	1 C 00 0.00 30C 1 3 JD X Y Z DOS IGEN
	5: 6·	1 200 0 0 500 1 2 DID DX DY DZ 5 600 200 300 1 2 DD X Y Z JOOS IGEN
	-	2 - 200 G C DID DX DY DZ
	9. 7	1C 500 100 300 1 C ID X Y Z ICOS IGEN
	10	11 40C 0.0C 225 1 0 ID X Y Z ICOS IGEN 1Z 60C 0.0C 225 1 0 ID X Y Z ICOS IGEN
	12.	13 600 200 225 1 0 0 ID X Y Z JCC5 IGEN 14 400 200 225 1 0 0 ID X Y Z JCC5 IGEN
	14:	15 505 100 225 1 0 ID X Y Z ICCS IGEN
	15: 16:	16 0.00 C 00 150 1 3 I ID X Y Z JCCS IGEN 1 200 C 0 IDID DX DY DZ
	17	20 700 100 92.27 1 0 1D X Y Z ICOS IGEN
	19.	1 200 0 0 DID DX DY DZ
	20. 21:	25 300 100 150 1 1 1 ID X Y Z ICOS IGEN 1 200 0 0 DID DX DY 5Z
	22.	27 633.33 100 130 63 1 0 H ID X Y Z JCCS IGEN
	24	2 200 C 0 DID DX DY DZ
	25: 26	32 600 201 0.00 1 3 1D X Y Z ICOS JGEN 1 200 0 0 0 DID DX DY DZ
	27	36 786.6 10C 6 CO 1 O . ID X Y Z ICOS IGEN
	24	1 0 6 0 1 C VXI VXI VXI VYI VYJ VYK
	30: 31:	28 1 1 1 1 1 7 1 3 JCINT RESTRAINT 9 C C 2 2 2 0 1 1 3 JOINT RESTRAINT
	32:	15 C 0 2 2 2 0 0 0 JOINT RESTRAINT
	34:	26 0 0 1 1 1 0 0 C JOINT RESTRAINT
	35 36	27 0 0 2 2 2 0 0 0 3 JCINT RESTRAINT 35 1 1 1 0 1 0 0 3 JOINT RESTRAINT
	37	37 1 1 1 1 1 C O J JCINT RESTRAINT
	39:	36 C D G G I O D G G G G G G G G G G G G G G G G G G
	40:	1 9 1 1 1 JOINT CONSTRAINT 1 9 7 1 1 JOINT CONSTRAINT
	42:	1 10 3 3 1 JOINT CONSTRAINT
	43:	1 25 16 3 1 JOINT CONSTRAINT
	45. 46:	1 25 21 3 1 CONSTRAINT 1 25 26 0 C J CINT CONSTRAINT
	47:	0 27 19 2 1 ; JOINT CONSTRAINT
	49.	BRACE # 1' 29000 10.6 2.51 36 1 12 0.2
	50 51	'IA_BILN MY # 2 ' 1 0 03 29000 533 3434.5 •2 0 'IA BILN MZ # 3 ' 1 0.03 29000 174 1587.6 •2 0
	52	'IA_BILN MX # 4 ' C C.C3 13000 2 18 0 -2 0
	54:	TAKEDA MY # 6 ' 2.5E07 250 1 0E-5 1500 1 5E-4 1550 8.6E-4 0.2
	56:	STABILITY BOX # 7' 4 35 29600 1 12 12 6.0 6.0 4 4 0.375 1 0 0 0 0 37.5 6 0 144 0 0 6.03 0 13000 0.01 1
1	ECHC	OF INPUT DATA
L	INE	
	58:	0 0 C 0 3 37.5 C 0 5 C 3 1 2 G.C3 Z0 13CC0 C 0 1 1
	59: 60:	'3D-BEAM # 9 ' 29000 13000 19,1 19,1 19 1 2 18 553 174 'Long Gwug # 10' 0 004 2006 -2 0 2
	61 6 7	'SHORT_CWJG = 11' 0 005 2000 0.00 -2 0.2
	é 3	'EILINEAR SFRING #15' 1000000 1000 0 03 12 0.2
	€4 · €5 :	'AXIMCD FOR WALL #14' 7000 6000 60 2000 0.9 0.2 15 0 2 'BEND1 FOR WALL #15' 6 10 0 7E-05 0 2
	66:	2700 5000 6500 7000 0.25.05 0.75.05 1.75.05 45.05
	68:	SHEAR1 FCR WALL 416' 4 10 1.1E-03 0.2
	69. 70	80 150 180 200 C.32-C3 1.12-C3 2.3E-03 5E-03
	71	"AXIMCD FOR CPEN-WALL #17" 7000 6000 60 2000 0.9 0 2 15 0 2
	73:	30 150 180 100
	74. 75:	0 06 (22 0.46 1.0 30 150 1.2 0.2 0 11 ' HO HS LWF AD AV
	76.	1 0 C TRUE. : KG: AXL, FCRM, ASSY
	78:	3D-BEAM' 'MEMBER 1' 9 1 2 0 1 0 0 0 000000 0
	79 80	'IEBDEEAM' 'MEMBER 2'101053465230100000 '2D-BEAM' 'MEMBER 3'934011000000
	51	'3D-BEAM' MEMBER 4' 9 4 5 -1 0 0 0 0 0 000000 0
	93. 93.	'IE3DBEAM' 'MEMBER 6' 10 10 3 3 4 5 7 6 6 1 0 3 (0 C
	84: 85:	'3D-BEAM' 'MEMBER 7' 5 8 7 0 1 € 0 € 6 000000 € '3D-BEAM' 'MEMBER 8' 5 1 8 -1 6 € € 0 000000 €
	85	"IESDEEAN" "MEMBER 9" 11 11 3 3 4 5 2 7 1 5 0 6 0 5 0
	86	'JD-BEAM' MEMBER 11' 9 11 14 -1 0 0 0 0 0 0 00000 0
	89: 90.	'3D-BEAM' 'MEMBER 12' 9 11 12 C 1 0 0 C 0 00000 0 '3D-BEAM' 'MEMBER 13' 9 12 13 -1 0 0 0 0 0 00000 0
	91	'3D-BEAM' MEMBER 14' 9 14 13 0 1 0 0 0 0 000000 0
	92:	"3D-BEAM 'MEMBER 16' 9 17 2 1 6 0 0 6 5 558 000000 0
	94. 95	'ED-EEAM' 'MEMBER 17' 9 11 3 1 0 0 00 5.555 000000 0 'IE3DEEAM' 'MEMBER 18' 2 2 3 3 6 5 16 11 100 0 0 15.208 0
	96.	'3D-BEAM' 'MEMBER 19' 9 12 4 1 0 C C 3 5.558 000000 0
	92.	-1219EAM' MEMBER 21' 9 13 5 1 0 0 0 5 558 00000 0
	99. 100	'IE3DBEAM' 'MEMBER 22' 2 2 3 3 4 5 21 13 1 C 0 0 0 15.208 0 '3E-BEAM' 'MEMBER 23' 9 14 6 1 C 0 0 C 5 558 000000 0
	101	"TE3DEEAM" 'MEMBER 24' 2 2 3 3 4 5 22 14 1 0 9 0 0 15 206 0
	102	3D-3EAM' MEMBER 26' 9 23 1 1 0 0 0 0 5,558 000000 0
	104.	'IE3DBEAM' 'MEMBER 27' 6 6 3 3 4 5 16 17 0 1 0 0 0 0 '30-BEAM' 'MEMBER 28' 9 11 18 0 1 5 0 0 0 00000 0
	106.	'TE3DEFAM' 'MEMBER 29' 2 2 3 3 4 5 18 19 0 1 5 0 0 0 0 '25 F3M' 'MEMBER 29' 2 1 3 4 5 18 19 0 1 5 0 0 0
	4.4	SPERAM NEMBER 30, A 19 57 (1 C D S C C C)30000 G

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108: 'IEIDBEAM' 'MEMBEF 31' 2 2 3 2 4 5 22 21 0 1 0 0 0 0 0 105: 'JD-BEAM' 'MEMBEF 32' 9 23 22 0 1 0 0 0 0 0 0 0 110: 'IEDBEAM' 'MEMBEF 33' 6 6 3 3 4 5 24 23 0 1 0 0 5 0 0 111: 'JD-BEAM' 'MEMBEF 34' 9 16 24 1 0 0 0 0 0 0 00000 0 112 'JD-BEAM' 'MEMBER 35' 9 17 23 1 0 0 0 0 0 00000 0 ECHC OF INFUT DATA TIME: 16 45:06, DATE: 07/27/94 *** PROGRAM FEM *** DOUBLE PRECISION VERSION

NODE CONSTRAINTS

1

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XY FLANE		CONSTRAINT,	MASTER:	э	SLAVE :	1
XY FLANE		CONSTRAINT.	MASTER:	Э	SLAVE :	2
XY FLANE		CONSTRAINT,	MASTER	9	SLAVE:	7
XY · FLANE		CONSTRAINT.	MASTER:	9	SLAVE:	8
XY PLANE		CONSTRAINT,	MASTER:	10	SLAVE:	3
XY · PLANE		CONSTRAINT,	MASTER.	10	SLAVE.	4
XY PLANE		CONSTRAINT,	MASTER	10	SLAVE	5
XY PLANE		CONSTRAINT.	MASTER	10	SLAVE	6
XY-PLANE		CONSTRAINT,	MASTER	15	SLAVE	11
XY · PLANE		CONSTRAINT,	MASTER:	15	SLAVE.	12
XY · PLANE		CONSTRAINT,	MASTER:	15	SLAVE.	13
XY PLANE		CONSTRAINT,	MASTER:	:5	SLAVE:	14
XY PLANE		CONSTRAINT.	MASTER	25	SLAVE:	16
XY · PLANE		CONSTRAINT,	MASTER:	25	SLAVE.	17
XY FLANE		CONSTRAINT.	MASTER:	25	SLAVE:	18
XY FLANE		CONSTRAINT,	MASTER.	25	SLAVE:	19
XY-PLANE		CONSTRAINT.	MASTER	25	SLAVE	21
XY PLANE		CONSTRAINT.	MASTER	25	SLAVE	22
XY PLANE		CONSTRAINT,	MASTER.	25	SLAVE	23
XY PLANE		CONSTRAINT,	MASTER.	25	SLAVE	24
XY - PLANE		CONSTRAINT.	MASTER:	25	SLAVE.	26
3D-RIGID	BODY	CONSTRAINT,	MASTER:	27	SLAVE :	19
3D-RIGID	BODY	CONSTRAINT.	MASTER:	27	SLAVE :	20
3D-RIGID	BODY	CONSTRAINT,	MASTER	37	SLAVE:	21

NODE COORDINATES AND DEGREES OF FREEDOM

ICTAL N	NUMBER	OF DEGREES OF P	REEDOM	147
NUMBER	OF DEG	REES OF FREEDOM	CONDENSED CUT	- 55
NUMBER	OF FRE	E DEGREES OF FR	EEDOM	- 15
NUMBER	OF RES	TRAINED DEGREES	OF FREEDOM	- 77
NCDE	00 <i>5</i> #	X-COORL	Y-COORD	Z - COORD
	:	0 D0000E+00	C 000002+00	300 . 00

M2. 55-C FX FY 56-C 57-C FZ МХ 2 MY 5

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SOLUT	EL HYSTER	ESIS MODEL PA	RAMETERS							. 1.4	10.43.00,	DATE	C1/21/34
MAT.	Ξ	Å	R	YS	SHAPE	мах	DUC	BETA					
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1 STRUC SOLUT	TURE: ION	TEREE STORY	BUILDING							TIME:	16:45:06,	DATE:	07/27/94
BILINE	AR INTERA	CTIVE MATERIA	L PROFERTIES										
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1 STRUC SOLUT	TURE ION	THREE.STORY	BUILDING							TIME:	1€ 45:06,	DATE :	07/27/94

TAKEDA	HYSTERESIS	MCDEL · FOR	UNIT	LENGTH MEMBER

MAT.	BETA	EI	CRACK	YEILD	ULTIMATE		
6	6.200000	C.2500CCE+08	250.000 0.100000E 04	1500.C0 C.150002E-C3	1550.00 6.96000E-03		
: STRUCT	TURE THP	EE-STORY BUILDING				TIME: 16:45 06, DATE	07/27/94

1 STRUCTURE. . THREE-STORY BUILDING SOLUTION . .:

STABILITY ELEMENT

MAT NO.	 7 BOX SECTION 			
NSEG	- 4	YS	- 3€.C	
DK .	- 2 960E+04	LIBN	• :	
ECX FEIGTH	• 12 C	BOX WILTH	12.0	
ECCXI	- 0 000E+00	ECCYC	 0.000E+00 	
H W SEC NC	- 6.00	H H.SEC NO.	4.00	
THICKNESS	- 0.375	L B. FLAG	• ;	
IREV2	• C	IREV3	• ()	
IREVO	• c	IECOF	- 0	
NUMP	- 32	SMALL	 37.5 	
RATIXO	- 0 000E-00	RATIYO	- 0 000E+CC	
TOTA	• 144	IAUTO	• C	
IMATER	• 0	RATICI	3.CODE.C2	
IR	- 🤉	G	1 300E+C4	
ORNEE	1 00CE-32	ISTIF	• 1	

MAT NO 5 TUBE SECTION NSEG 4 YS 36.0 EM 2.900E+04 LIBN - RADIUS 5.50 DUMMY VAR. 0.000E+ ECCXC 0.00CE+03 ECCYC 0.000E+ 1/4 SEC.NC 9.00CE+03 ECCYC 0.000E+ 1/4 SEC.NC 9.00CE DUMMY VAR 0.000E+ 1/1 REV2 0 IREV3 - 0.000E+ IREV4 C IECOP - NMMF 32 SMALL 37.5 RATINO 6.002E+0C RATIYO C.002E+ C.002E+ - - TCTA 95.0 IAUTO - - - - TMATER 23 G - 3.002E+ - - - IF 23 G - 1.002E+ - - -	2 CC CC CC CC CC CC CC CC CC C				
1 STRUCTURE THREE-STORY BUILDING SOLUTION				TIME: 16.45:0	6, DATE: 07/27/94
3-D ELASTIC BEAM ELEMENT					
MATL E GAMMA AX AY AX	Z IX	IY	12		
9 2.900E+04 1.200E+C4 19 1 10 1 19.3	1 2.19	533. 3	.74.		
1 STRUCTURE THREE STORY BUILDING SCLUTION				TIME: 16 45:0	6, DATE: 07/27/94
PINC-SUAREZ TOWER LONG DIR. HYST MODEL PARAMETERS MAT HA VA MAX DUC BETA 10 0.400C002-C2 200C.06 -2 0CC00 0.200000 1 STRUCTURE: THREE-STORY BUILDING 07.27/94 SCLUTION:					TIME: 16:45 C6. DATE:
PINC-SUAREZ TOWER SHORT DIR. HYST MODEL PARAMETERS MAT. HA VA HATIG MAX DUC 11 0.500C000-02 2000.00 0.300C000-01-2 00000 1 STRUTURE THREE-STORY BUILDING 07/27/94 SOLUTION	₽₽~^ 0.200000				TIME: 16:45 06. DATE:
GOEL HYSTERESIS MODEL PARAMETERS					
MAT E A R YS 12,29000.0 14,4000 2,54000 36,6000	SHAPE 2 00000	MAX DUC	BETA		
1 STRUCTURE: THREE-STORY BUILDING 07,27/24 SCLUTION		1210920 011			TIME 16:45:06, DATE
BILINEAR HYSTERESIS MODEL PARAMETERS					
MAT. KE PY KIE 3 0100002E-07 1000 00 0.0000002E-01 1 STRUCTURE THREE-STORY PULLDING 67/27/94 SOLUTION	MAX DUCT 12.00CC	BETA 6.200000			TIME: 16:45-36, DATE
AXLMOL HYSTERESIS MODEL. FOR UNIT LENGTH MEMBER					
MAT SC ST1 ST2 14 700000 6000000 6000000	PY 2000.00	ALPHA 3 900000	2ETA 0 200000	MAX DUCT. 15 0000	BETA-DI 0.2000CC
1 STRUCTURE THREE-STORY BUILDING 07-27/94 SOLUTION:					TIME: 16.45 C6. DATE:
BENDI HYSTERESIS MODEL DATA - UNIT LENGTH MEMBER BACKBONE CURVE POINTS - MATL NI DY 15 10 0 700000E-05	ВЕТА С 2000СС	MOMENT 2700.00 5000.00 6500.00 7000.00	ROTATION 5.2055CCE+ 0.700300E+ 0.17000DE+ 0.400005E+(05 . 05 04	
1 STRUCTURE THREE-STORY PUILDING 07/27/94 SOLUTION:					TIME 16:45:00, DATE

SHEARI HYSTERESIS MODEL DATA - UNIT LENGTH MEMBER

BACKBONS	CURVE POINTS -	MAT NI 16 10	DY 0 1:0000E-	BETA 02 0.200000	STRESS 80 0000 150.000 180.000 200.000	STRAIN C.300000E- C 110000E- 0.230000E- 0.500000E-	03 C2 C2 C2	
1 STRUCTURE 67/27/94 SOLUTION	THREE-STORY	BUILDING						TIME 16:45 C6. DATE.
AXLMOI }	YSTERESIS MODEL	- FOR UNIT	LENGTH MEMBE	R •				
MAT 17 700	SC 00.00 600	ST: 0.0C	ST2 60.0900	PY 2000.00	ALFHA 0.900000	5.200000	MAK DUCT. 15.0000	BETA-DI 0.2000CC
1 STRUCTURE. C7/27/94 SCLUTION	.: THREE-STORY	BUILDING						TIME: 16: 45 .06, DATE:
SHEAR2 HYSTI BACKBONI	ERESIS MODEL DAT	A · FCR WHO MAT 18 O	CLE LENGTH ME Beta .400000	MBER STRESS 80.0000 150.000 160.000 100.000	STRAIN 0.60000CE-01 0.22000 0.46000 1.00000			
1 STRUCTURE. 07/27/94 SOLUTION.	THREE-STORY	BUILDING						TIME: 16 45°C6, DATE:
ELEMENT 05,	3D BEAM ELEMEN	Π						
MEMBER 1 1 STRUCTURE 07/27/94 SOLUTION	► MATL 1 9 THREE-STORY	START É 1 BUILDING	ND REL CD 2	LENGTH 200.0 C.	Y AXIS	J +0.00000 K C	TART DIST .0000 E+0 0 C	END DIST PKG .00002+C0 0 00C02-00 TIME: 16 45:06, DATE:
ELEMENT OS,	IE3DBEAM ELEME	NT						
MEMBER 2 1 STRUCTURE. 07/27/94 SCLUTION	¥ STA 2 2 MATERIAL # THREE-STORY	RT END 3 2 (FX) 5 BUILDING	LENGTH 90 0 0.0 . (MX / 4	Y-A 00CCD I +1 0CO ,(MY-A)-10 ,	XIS 30 J +0.00000 K (MY-P)-10 ,(MZ-A)	START DIST 5.0000E+00 0.0 -3. (M2-B)-3	EN⊃ DIST 900E+C0 0.C	PKG D00E+0C TIME: 16.45:06, DATE:
ELEMENT 08.	30 BEAM ELEMEN	r						
MEMBER 3	⊭ MATL 3 9	START E	ND REL CD	LENGTH	Y-AXIS 00000 I +1.00000	s J +0.00ссо к о	TART DIST	ENL DIST PKG .000000-00 0.000000-00
MEMBER 4 MEMBER 5 1 STRUCTURE 37/27/94 SOLUTION	4 9 <u>9</u> Three-story 	4 6 BUILDING	5	200.0 -1. 200.0 0.	00000 I +0 00000 00000 I +1.00000	J +0.00000 K 0 J +0 00000 K 0	0000E+00 0 0000E+00 0	0000E+00 0 CC00E+00 0CC0E+00 C.0000E+00 TIME 16+45:06, DATE
ELEMENT (9,	IE3DBEAM ELEME	NT						
MEMBER 6 1 STRUCTURE 07/27/94 SCLUTICN.	E STA 6 7 MATERIAL E THREE-STORY	RT END 6 2 (FX : 5 BUILDING	LENGTH 06 C 0 C , (MX +- 4	Y-А СОЭС I -1.СЭЭ ,(МҮ-А)-10 ,	XIS 66 J -C.00600 K (MY-B)-10 ,(MZ-A)	START DIST C.000CE+00 0.0 5 . (MZ-B) - 3	END DIST 600E+00 C.D	PKG 08C£+00 TIME 16:45:06, DATE
ELEMENT C6.	3D BEAM ELEMEN							
MEMBER 7 MEMBER 8 1 STRUCTORE 07/27/94 SOLUTION.	b MATL 7 9 8 9 Three-story	START E 5 1 BUILDING	NL REL CD 7 9	LENGTH 200 C 0 200 C -1	Y-AXIS 00000 I +1.00000 00000 I +0.00006	J +0 CC000 K 0 J +0 CC000 K 0	TART DIST 0000E+00 0 0000E+00 0	END DIST FKG 00002-00 C.00002+00 .00002-00 C.00002+00 TIME. 16:45:06, DATE
ELEMENT 09,	EDDEEAM ELEME	NT.						
MEMBER 9 MEMBER 10 1 STRUCTURE 07/27/94 SOLUTION	<pre>9 2 9 2 MATERIAL # . 10 3 MATERIAL #: TFREE-STORY</pre>	RT END 7 2 (FX - 5 6 2 (FX - 5 7 2 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	LENGTH 09.C -1 C , MX 4 CL.C -1 C , MX 4	Y-A C000 I +0.000 .(MY-A) 11 . C0000 I -0.000 .(MY-A)-11 .	XIS GO J -С.0000С К (MY-B)-11 . (MZ-А) СС J +0.00ССС К 'MY-B)-11 . (MZ-А)	START DIST C.000CE+00 C.C - 3 , (M2-B)- 3 C 0000E+0C 0 C - 3 , (M2-B)- 3	END D1ST 000E+00 C.D 000E-00 0 0	PKG 000E+00 600E+00 TIME, 16:45:06, DATE:
ELEMENT 05.	3D BEAM ELEMEN	ਜ						
MEMBER 11 MEMBER 12 MEMBER 13 MEMBER 14 MEMBER 14 MEMBER 16	<pre># MATL 11 9 12 9 13 9 14 9 15 9 16 9 </pre>	. START E 11 12 14 14 16 17	ND REL CD 14 12 13 13 1 2	LENGTH 200 0 1 200 0 1 200 0 0 200 0 0 200 0 0 150 0 0 150 0 1	YAXIS 00000 I -0 00000 00000 I -1 00000 00000 I -1 00000 00000 I +1 00000 00000 I +0 00000 00000 I +0 00000	J +0.00000 K 0 J +0.00000 F 0 J -0.00000 F 0 J -0.00000 K 0 Z +0.00000 K 0 C +0.00000 K 0	TART DIST 	END DIST FKG .0002E+30 C.0030E+00 .0002E-0C C.0030E+00 .0002E-0C 0.000CE+03 .0030E+00 0.00CE+03 .0030E+00 5.558
REMER 17 17 9 11 1 75 00 1.00000 I +0 00000 J +0 00000 K 0.0000E+00 0 0000E-00 5 558 1 STRUCTURE ...: THREE-STORY BUILDING 07/27/94 SOLUTION . .: TIME: 16:45 06, DATE: PKG TIME: 16 45 C6. DATE. ELEMENT 06, 3D BEAM ELEMENT SCLUTICN ... ELEMENT OS. IEBDBEAM ELEMENT END DIST P1 000E+60 15.21 PKG TIME 16:45:06, DATE SCLITION ELEMENT 08. 3D BEAM ELEMENT SCLUTICN..... ELEMENT 09. IEBDEEAM ELEMENT
 #
 START
 END
 LENGTH
 Y-AXIS
 START
 DIST
 END
 DIST

 MEMBER 22
 22
 21
 13
 75.00
 1.00000 I -0.00000 J -0.00000 Y 0.00000-00 C 00000-00
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 0.0000-0 END DIST PKG 15 21 TIME: 16:45:06, DATE. 07/27/94 SCLUTION ELEMENT CS. 3D BEAM ELEMENT INTER 23 23 9 14 6 1 STRUCTURE... THREE-STORY BUILDING 07/27/94 SOLUTION....
 3
 START
 END
 LENGTH
 Y-AXIS
 START
 DIST
 FKG

 MEMBER 24
 24
 22
 14
 75
 C
 1.00000 I +0.00000 C +0.000000 C +0.00000 C +0.00000 C +0.000000 C +0.00000 C +0.000000 C +0.00000 C +0.000000 C +0.0 . TIME: 16:45 06. DATE: SOLUTION ...
 # MATL START END REL CL LENGTH
 Y-AXIS
 START DIST
 END DIST
 PKG

 MEMBER 25
 25
 9
 23
 7
 150.0
 1.060000 I +0 00000 J +0 00000 K 0.00000E-80 0 00000E-90 5.556

 MEMBER 26
 26
 9
 24
 8
 150 0
 1.060000 I +0 00000 J +0 00000 G K 0.00000E-00 0 00000E-00 5.556

 1 STRUCTURE.
 : THREE-STORY BUILDING
 TIME: 16:25:06
 TIME: 16:25:06

 SOLUTION...
 :
 SOLUTION...
 SOLUTION...
 TIME: 16:45:06. DATE: ELEMENT 09. LE3DBEAM ELEMENT
 #
 START
 END
 LENGTH
 Y-AXIS
 START
 DIST
 FKG

 MEMBER 27
 27
 16
 1° 200.0
 0.000000 I -1.000000 J +0.500000 X 0.00000E-00
 0.00000E+00

 MATERIAL %
 1° 7X · · · 5 , IMX · · 4 , (MY-A)· 6 , (MY-B)· 6 , (MY-A)· 5 , (M2-B)· 3
 IMK
 1 STRUCTURE
 : THREE-STORY BUILDING
 TIME
 TIME 16:45:36, DATE 27794 SOLUTION TIME :6:45:06, DATE:

TIME: 16:45.06. DATE 7/27/94 SOLUTION.... ELEMENT 08. 3D BEAM ELEMENT
 MATL START END REL CD LENGTH
 Y-AXIS
 START DIST
 END DIST
 PKG

 MEMBER 32
 32
 9
 23
 22
 200 0
 0.000000 I *1.000000 J *0.000000 K C.00000E+00
 0.0000000 0.00000E+00

 1 STRUCTURE
 THREE-STORY BUILDING
 TIME: 15:45 06, DATE.
 07/27:94
 SOLUTION . . ELEMENT 09, IE3DBEAM ELEMENT TIME: 16 45-06, DATE: 07/27/94 SOLUTION...: ELEMENT 06, 3D BEAM ELEMENT
 # MATL START
 END
 REL
 CD
 LENGTH
 Y-AXIS
 START
 DIST
 END
 DIST
 PKG

 MEMBER 34
 34
 9
 16
 24
 200.0
 1.000C01
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 0.0000E+00
 0.0 STRUCTURE . .: THREE-STORY BUILDING TIME 16:45:06. DATE. 07/27/94 SOLUTION ELEMENT 12. STABILITY ELEMENT END DIST TIME, 16:45:06, DATE TIME: 16:45 06, DATE SOLUTION. . . : ELEMENT 12, STABILITY ELEMENT 07/27/94 SOLUTION . . . ELEMENT 09. IESOBEAN ELEMENT TIME, 16.45:06, DATE: 7/27-94 Solution..
 # MATL START
 END
 REL CD
 LENGTH

 MEMBER 41
 41
 9
 31
 19
 150.0

 MEMBER 42
 42
 9
 32
 21
 150.0

 MEMBER 43
 42
 9
 20
 21
 152.6

 MEMBER 44
 44
 9
 24
 15
 152.8

 MEMBER 44
 44
 9
 24
 15
 152.8

 MEMBER 5
 5
 9
 16
 20
 127.9

 1
 STRUCTURE
 ...:
 THREE-STORY BUILDING
 67/27.94

 SCLUTION

 SCLUTION

 ELEMENT 08. 3D BEAM ELEMENT
 Y-AXIS
 START DIST
 END DIST
 PKG

 1.00000 I +0.0000C J +0.0000C K C.0000E+00
 C.0000E+00
 51.65

 1.00000 I +0.0000 J +0.0000C K C.0000E+00
 C.0000E+00
 51.65

 0.70711 I +0.70711 J +0.0000 K C.0000E+00
 C.0000E+00
 0.0000E+00

 0.70711 I +0.70711 J +0.0000 K 0.0000E+00
 0.0000E+00
 0.0000E+00
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 0.70711 I +0.70711 J +0.0000 K 0.0000E+00
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 0.0000E+00

 0.70711 I +0.70711 J +0.0000 K 0.0000E+00
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 0.0000E+00
 2.231
 TIME 16:45:06, DATE:
 SCLUTION MATL START END ··TYPE··· LENGTH ······ Y-AXIS ····· START DIST END DIST
 MEMBER 46 46 13 37 36 BENDING-Y 1 000 0 C0000 I +1 00000 J +0 C0000 K 0 00000+00 C.00000+00
 1 STRUCTURE...: THREE-STORY BUILDING
 TIME: 16 45:00, DATE SCLUTION . ELEMENT C5, CNE LOCAL DOF STRUT ELEMENT

MEMBER 47 47 MEMBER 46 45 MEMBER 49 46 MEMBER 50 50 MEMBER 51 51 1 STRUCTURE THREE C7/27.94 SOLUTION	<pre># MAIL START 12 29 12 34 1 29 1 30 1 30 1 31 -STORY BUILDING</pre>	ENDTYPE 16 AXIAL 24 AXIAL 23 AXIAL 22 AXIAL 21 AXIAL 21 AXIAL	LENGTH 250 0 0.000 250 0 0.000 250.0 1.000 250.0 1.000 250.0 1.000	Y-AXIS CC3 I +1.9CC00 J -3 (CC3 I +1.9CC00 J -6 (CC3 I +0.9CC00 J -6 (CC3 I -0.9CC00 J -6 (CC3 I -0.9CC00 J -0 (CC3 I -0.9CC00 J -0.9CC00	START DIST 00000 X 0.0000E+00 0 00000 K 0.0000E+00 0 00000 K 0.0000E+00 0 00000 K 0.0000E+00 0 00000 K 0.0000E+00 0 TIM	END DIST .CODDE-CC .CODDE-CC .CODDE-CC .CODDE-CC .CODDE-CC .COODE-CC E: 16:45.C6, DATE:
ELEMENT C3. R/C SHEAF	WALL SLEMENT					
ELEN	SEND SHEAR AX MATL MATL M	IAL JOINT JOINT JOIN ATL 11 42 1	TJCINT LENG 3 ≈4	IH WIDTH	ALPHA PKG	
MEMBER 52 52 MEMBER 51 51 1 STRUCTURE THRES 07/27/94 SOLUTION	2 15 16 5 15 16 E-STORY BUILDING	14 15 17 2 14 22 23 3	15 20 150 4 23 150	.C 2CC 0 .C 2CC.0	1 COO 69 21 1.COO 65 21 TIN	E: 16:45.GE, DATE
ELEMENT 14, R/C SHEAF	WALL ELEMENT(SHEAR SPAN LENGTH RA	TID- 0.0000E-0			
	# MATL MATL	LI AXIALE JOINT JOIN . MATL #1 #2	F JOINT JCINT ‡3 ⊭4	LENGTH WIDTH	ALPKA PI	G
MEMBER 54 1 STRUCTURE THREE 07/27/94 SOLUTION	54 18 17 E-STORY BUILDING	1" 16 24	35 29 3	.50.0 200 0	1.000 40.26 TIN	16:43:0€, DATE
LUMPED NODE MASSES						
NODE MX 1 1 44050-02 11 2.50002-02 16 3.77502-02 18 8.77502-02 20 6 67302-03 21 9 44202-02 22 6.77502-02 23 3.77502-02 25 6.2000 27 1.33302-02 36 C.000302-00 15 C.000302-00 25 C.000000000000000000000000000000000000	MY 1 44032-C2 0 C 2 50032-C2 0 C 3 77502-C2 0 C 5 44202-C2 0 C 6 67002-C3 0 C 9 44202-C2 0 C 6 77502-C2 0 C 7 7502-C2 0 C 0 20002-C 0 C 0 C0032-CC 0 C 1 S NOT CONDENSE	MZ IXX CODE-CO 0 003DE+CO CODE-CO 0 003DE+CO CODE-CC 0 003DE+CO CODE-	IYY 2 C.0300E+00 3 C.3000E+00 3	IXY 0000E+CC 0.0002E+00	IYZ IYZ 0.00000000000000000000000000000000000	IGEN INC 00 7 1 00 3 1 00 1 1 00 0 0 00 0 0 00 0 0 00 0 0 00 0 0 00 0 0 00 0 0 00 0 0 00 0 0 00 0 0 00 0 0 00 0 0 00 0 0 000 0 0 000 0 0 000 0 0 000 0 0 000 0 0 000 0 0
PROPORTIONAL DAY	APING COIEFICIEN	ITS 00000CE-00				
MEMORY UTILIZAT 1Z= 43934, P ELAPSED CPU TIME TOTAL CPU TIME	ION 42M= 6.276% E 1 29 SEC - 1 39 SEC -	· · · · · · · · · · · · · · · · · · ·				
1 STRUCTURE THREE 37/27/54 SOLUTION NONL' SOLUTION #4. STATIC INTERVAL FOR PRINTIN INTERVAL FOR WRITIN' UNBALANCED JOINT FOR DATA WRITTEN TO	E-STORY BUILDING INEAR CYCLE ANAI NONLINEAR SOLUT NG DATA DATA TO FILE RCES ARE ADDED T FILES	USIS WITH UNBALANCED NON 500 110 10 10 10 10 10 10 10 10 10 10 10	PORCES		TINE 16:45:C8, :	4E 16:45 0€, DATE. DATE: 07/27/94
ELEMENT ± 2 ELEMENT ± 3 ELEMENT ± 3 ELEMENT ± 39 ELEMENT ± 22 ELEMENT ± 22 ELEMENT ± 27 ELEMENT ± 38 ELEMENT ± 46 ELEMENT ± 46 ELEMENT ± 50 ELEMENT ± 52 ELEMENT ± 52 ELEMENT ± 52	LS WRITTEN TO UN SS WRITTEN TO UN IS WRITTEN T	HT 5 17 HT 5 18 HT 6 19 HT 6 20 HT 6 21 HT 7 22 HT 6 23 HT 6 23 HT 7 23 HT 7 25 HT				
LOAD CASE : COINT LOAD CASE : COINT STRUCTURE; THRE	: 1 DIRECT: 2 DIRECT: 3 DIRECT: 4 DIRECT: 5 DIRECT: 6 DIRECT: 7 DIRECT: 6 DIRECT: 6 DIRECT: 6 DIRECT: 7 DIRECT: 7 DIRECT: 8 DIRECT: 8 DIRECT: 8 DIRECT: 7 DI	ION: FX DOF(5) 56	5. 5. 58 5. 6. 56 5. 9. 61 5. 12. 61 5. 13. 61 5. 13. 61 5. 21. 58 5. 24. 58	MAGNITUDE: C.222200 MAGNITUDE: C.222200 MAGNITUDE: C.222200 MAGNITUDE: C.222200 MAGNITUDE: C.222200 MAGNITUDE: C.222200 MAGNITUDE: C.222200 MAGNITUDE: C.222200 MAGNITUDE: C.222200		4E: 16:45:06. DATE:
SOLUTION NONE	INEAR CYCLE ANAL	LYSIS WITH UNBALANCED	PORCES		TIME: 16-45.08,	DATE 07/27/94
I SINCLIURE THRE	E-STORY BUILDING	i			TI	ME: 16:45:06, DATE:

(7/27/94						
SOLUTION : NONLINE	AR CYCLE ANALYSIS	WITH UNBALANCE	D FORCES		TIME.	16 45.08. DATE: 07/27/94
1 STRUCTURE : THREE-SD 07/27/94 SOLUTION : NONLINE/	FORY BUILDING AR CYCLE ANALYSIS	WITH UNBALANCE	D FORCES		TIME :	TIME, 16:45 0€, DATE, 16:45:06, DATE, 16:45:06, DATE: 07/27/94
1 STRUCTURE CHEFF.ST	OBY BUILDING					TIME 16:45 06 DATE
07 27 /96 SCLUTICN NONLINE	AR CYCLE ANALYSIS	WITE UNBALANCE	D FORCES		TIME:	16 45:08, DATE: 07/27/94
: STRUCTURE: THREE-ST	FORY PUBLDING					TIME: 16:45 06, PATE:
CT/27/94 SCLUTION NONLINE	AR CYCLE ANALYSIS	WITH UNBALANCE	D FORCES		TIME:	16 65:08, DATE: 07/27/96
· STRUCT"RE · THREE-ST	OBY BUILDING					TIME: 16:45 06. DATE:
C7/27/94	AR OVER ANALYSTS	WTTE INBALANCE	T. FORCES		TIME	16 45-08 DATE: 07/27/34
SOLUTION NONETHE		with onbiditie	D TORCES		TIME -	
1 STRUCTURE: THREE-SI 07/27/94	LORY EULIDING					11ME: 16 45.06, JALE:
SCLUTICN NONLINE	AR CYCLE ANALYSIS	WITH UNBALANCE	D FORCES		TIME:	16:45:38, DATE: 07/27/94
MORE THAN 5 CYCLES IN M MORE THAN 5 CYCLES IN M MORE THAN 5 CYCLES IN M MORE THAN 5 CYCLES IN M I STRUCTURE THREE-ST 07/27/54	ATOS, IELNC ATOS, IELNC ATOS, IELNC: ATOS, IELNC: TORY BUILDING	27 23 27 33				TIME: 16 45.06. DATE:
SOLUTION NONLINE	AR CYCLE ANALYSIS	WITH UNBALANCE	D FORCES		TIME:	16:45:08, DATE: 07/27/94
, LOADING # C :	MAXIMUM DISPLACEM	ENTS				
GCS DISPLACEMENTS		LURG MAY NOT OF		e: v		
	NOTE MAXIMUM VA	LUES MAY NUT OC	UUR SIMULTANEDU	110	P7	
1 3 31346	51 1201065-00	3 3305105-00	5 92350/F-A5	TI 365510F-15	5 4076358.05	
1 3.21269 2 3.21269 3 3.20967 3 3.20967 4 3.20967 5 3.19765 6 3 19765 7 3.20188 8 3 20188 9 3 201729 10 3 20376 11 2 43137 12 2 43137 13 2 40845 14 2 40845 15 2 4021 16 5.131998E-02 17 9 131998E-02 18 5 11998E-02 19 7.63754E-02 20 10846 21 9 511033E-02 22 0 110846 23 0 110846 24 0 11084 25 0 101051 27 5 574375E-02 28 0 00003E-00 30 0 00003E-00 31 0 00003E-00 32 0 00003E-00 34 0 00003E-00 35 0 00003E-00 35 0 00003E-00 36 0 00003E-00 37 0 60003E-00 36 0 00003E-00 36 0 00003E-00 37 0 60003E-00 36 0 00003E-00 36 0 00003E-00 37 0 60003E-00 36 0 00003E-00 37 0 60003E-00 36 0 00003E-00 37 0 60003E-00 36 0 00003E-00 37 0 60003E-00 37 0 60003E-00 38 0 00003E-00 37 0 60003E-00 37 0 60003E-00 37 0 60003E-00 38 0 00002E-00 37 0 60003E-00 37 0 60003E-00 38 0 60003E-00 39 0 60003E-00 30 0 60	-3 1823268: C2 -2 1CC799E: C2 -3 6CC029E: C2 -1 377986E: C2 -2 6CC029E: C2 -1 377986E: C2 -2 1CC799E: C2 -2 1CC799E: C2 -2 12 5222 -3 182326E: C2 -3 352256E: C2 -3 352256E: C2 -3 352256E: C2 -3 352256E: C2 -3 352256E: C2 -4 3456EE: C3 -3 352256E: C2 -4 3456EE: C3 -3 352256E: C2 -4 3456EE: C3 -3 352256E: C2 -4 3456EE: C3 -3 352256E: C2 -3 885899E: C3 -3 35254E: C2 -3 885899E: C3 -3 772456E: C3 -3 772456E: C3 -3 772456E: C3 -3 772456E: C3 -3 772456E: C3 -5 72456E: C3	3.393612E.C2 8.39622E.C3 C.130509 8.475560E.C3 C.124515 5.646703E.C3 3.681453E.C3 C.124515 5.646703E.C3 3.681453E.C3 C.124515 C.130500E.CC C.130535 4.5544751E.C3 0.124622 C.306000E.CC 2.423C24E.C2 8.554287E.C3 0.124622 C.30600E.CC 2.423C24E.C2 8.554287E.C3 0.122655 0.300C00E.C0 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC03E.00 0.00CC0	S .9238948.05 .4 .5907228.05 .1 .0977442.04 .6 .633518.05 .6 .633518.05 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .	7 3855192-33 1 9934212-03 1 9934212-03 5 6539672-03 5 6539672-03 2 639672-03 2 639672-03 2 639672-03 2 639672-03 2 639672-03 0 60030002-00 6 493452-03 0 60030002-00 8 493452-03 0 60030002-00 0 60030002-00 0 0000002-00 0 0000000-00 0 000000-00 0 0000000000	S 4C7635E:C5 6 11C213E:C5 6 11C213E:C5 6 11C213E:C5 6 11C213E:C5 5 4C7635E:C5 5 4C7635E:C5 5 4C7635E:C5 6 11C213E:C5 5 4C7635E:C5 6 11C213E:C5 1 176206E:C4 1 3763047E:C5 9 763047E:C5 9 763047E:C5 0 .C0000CE:00 0 .C0	TIME: 16 45 06. DATE: 16 45:05 DATE: 07/27/94
. LOADING # 0	MAXIMUM REACTIONS					
MAXIMUM GCS RESTRAINT	REACTIONS NOT	T. MAXIMUM VALU	ES MAY NOT DOOU	R SIMULTANEOUSL	Y	
NODE EV				10	112	
NUL PA		۲ <u>د</u> مردود موجود	MX	MY	M2	
3 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	C 1293601E 12	2:0002002:00 0:0002002:00 0:0002002:00 0:0002002:00 0:0002002:00 0:0002002:00 0:0002002:00 0:0002002:00 0:00020:00 0:00020:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0002:00 0:0000 0:0002:00 0:0000 0:0000 0:0002:00 0:0000 0:000 0:0000 0:00	C. J06000 3F+00 C. 306000 3F+00 C. 2000003E+00 C. 3000003E+00 F57 2136 9,72447 -6€ 74381 C. 3000003E+00 -16 01716 C. 3000002E+00 -18 328>61 -21.387€6 C. 3000002E+00 -63.54447	C.JD60003+C0 C.JD60003+C0 C.JD60003+C0 C.JD60003+C0 B86 6415 7732.6329 357.1839 C.JD60002+C0 102 7736 127.9861 C.JD60002+C0 193.8364 C.JD60002+C0 193.8364 C.JD60002+C0 193.8364 C.JD60002+C0 236.3053	0.000000E+00 0.000000E+00 0.0000000E+00 0.0000000E+00 0.000000E+00 4.443795 5.750468 0.000000E+00 1.765955E+02 1.765955E+02 1.8455649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.845649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.8455649E+02 1.84556649E+0200000000000000000000000000000000000	
MAXIMUM RESULTANT OF 1 STRUCTURE THRPF-ST	REACTIONS. FOR	CE- 355.5	MOMENT 1.0	099E+05		TIME 16 45 06, DATE
07/27,94 SOLUTION. NONLINE	AR CYCLE ANALYSIS	WITH UNBALANCE	D FORCES		TIME:	16 45:06, DATE: 07/27/94

2	6	FORCE FORCE	2 3	21,2635 -21,2635	0.120466	9.05746 9.05748	2.153567E-03 -2.153567E-03	820.179 991.317	11.8693 12.2239
2	7	FCRCE FCRCE	2 3	21.7547 21.7547	3.940799E-02 -3.940799E-02	-9,90774 9,90774	3.072046E-03 -3.072046E-03	908.296 1073.25	3.78269 4.09891
2	8	FORCE FORCE	2 3	21.2635 21.2635	C.120466 -C.120466	9.05748 9.05748	2 153567E-03 •2 153567E-03	820.179 991 317	11.8693 12 2239
2	9	FORCE FORCE	2 3	6.62003 -6.62003	-4.235913E-02 4 235813E-02	-14.9391 14.9391	1.008987E-02 -1.008987E-02	1575.60 1412.22	-4.50469 -3 96693
2	10	FORCE FCRCE	2 3	6.82003 6.82003	·4 235813E·02 4 235813E·02	14.9391 14.9391	1.008987E-02 1.008987E-02	1575.60 1412.22	-4.5C469 -3 96693
2	11	FORCE FORCE	2 3	6.82003 -6.82003	•4 235813E•02 4.235813E•02	14.9391 14.9391	1.008987E-02 -1.008987E-02	1575.6C 1412 22	-4 50469 -3 96693
2	12	FORCE FORCE	2 3 REDEFICE	21.2635 -21.2635	0.120466 -0.120466	-9.05748 9.05748	2.153567E-C3 -2.153567E-C3	820.179 991.317	11.8693 12.2239
	.0.414	LUAD /	KEFRESE	N.S INE DUP WH	ICH HAS MAXIMUM	VALUE			
32 B	EAM F	CRCES.							
MAX ELEMENT	LOAD	VALUES	FOR ALL NODE	STEPS NOTE AXIAL	MAXIMUM VALUES FY	WITH THE OTHER FZ	COFS FORCES ARE TORSION	FRINT OUT MY	AT THE SAME TIME MZ
3	2	FORCE	3	0.000000000000	2.364040E-17	12.0994	·1 38601CE-02	1018.64	2 278451E-15
٦		FORCE		0.000002+00	-2.084040E-1/	12.0994	1 386JICE-02	1401.24	2 313254E-15
-	-	FORCE	4	0.00C000E+C0	-1.422677E-17	17 9548	2 491198E-02	1650 59	1 161397F-15
3	4	FORCE	3	C.300003E+00	1 422677E 17	13 9548	·2 491198E-02	1110 38	1 1543502-15
		FORCE	4	C.3000C03E+0C	-1 422677E-17	12.9548	2 491198E-02	1650.58	1 :61397E-15
3	5	FORCE	3	C 000CC0E+0C	1 563623E-17	·12.525C	-1.750634E-02	1112.50	1.7510952-15
		FORCE	4	C.000CCDE+0C	·1 563623E-17	13.5250	1.750534E-02	1592.49	1.7858982-15
3	ę	FORCE	3	C.0000C0E-00	2 C54049E-17	12.0994	-1.386010E-02	1015.64	2.278451E-15
		FORCE	4	0.000CCDE+00	-2.084040E-17	12.0994	1.3860102-02	1401.24	2.313254E-15
3	5	FORCE	3	0.00000E+00	2.054040E-17	12.0994	·1 386010E-02	1018 64	2.278451E-15
-		FORCE	4	0.00000E+30	-2.054C40E-17	12 0994	1 396C10E C2	1401 24	2.313254E-15
3	7	FORCE	3	0.00000E+00	1.4226772.17	13 9549	-2.491198E-C2	1110 36	1.15435CE-15
-		FORCE	4	0.00000E+00	·1.422677E 17	13 5548	2.491198E-C2	1680 58	1.161397E-15
د	10	FORCE	3	0.CD0G0CE+00	1.422677E-17	13 5546	-2.491196E-02	1110 38	1.154350E-15
-	• •	FORCE	1	C.CC000265+00	1.422677E-17	12 9548	2.491198E-02	1680.58	1.161397E-15
2	- 1	FORCE	-	0.0000002+30	1.6226//E-1/	13.9548	2.491198E-02	1110.58	1.154350E-15
-	: 0	FORCE	4	0.0000002+00	-1.422677E-17	13.9548	2.491198E-02	1680.58	1.161397E-15
3	14	FORCE	1	0.0000002+00	2.084040E-17	12.0994	-1.38601CE.02	1018.64	2.278451E 15
*	2	FORCE	-	0.000000E+00	-2.08404CE-1/	12.0994	1 3860102.02	1401 24	2 313254E-15
•	•	FORCE		0 0000002+10	2.30-1000-10	0.168118	-1.6839601.02	-14 6116	2 2685 QE 14
4	3	FORCE	4	0 000000E+30	1 425 100E-10	- J. 168110 - 304947	1 6636602.J2	-10.2110	2 2/20061-14
-	-	FORCE	5	0 0000000000000000000000000000000000000	-1 425014E-16	-1 304942	1 6122012-32	-30 4842	1 3144677-14
4	4	FORCE	č	C. DODCCOF-DC	2 341165E-15	0 169479	-1 614149E-02	-16 6479	2 2685725-14
		FORCE	5	C.000CCDE-1C	-2 341165E-16	-0 169479	1 6141495-02	-16 9479	2 272054E-14
4	5	FORCE	ā	C.DOJCCOE-JC	1 425014E-16	0.564842	-1. € 2221E-02	-30 4542	-1.713782E-14
		FORCE	5	0.000C00E+00	·1.425014E-16	·0.3C484Z	1.6322015.02	30 4842	1.314487E-14
4	6	FORCE	4	6 000000E+00	2 341165E-16	C.169479	1.814149E C2	-16.9479	2.268574E-14
		FORCE	5	0.00000CE+00	2.241165E-18	·C.169479	1.5141492-02	-16.9479	2.272054E-14
4	8	FORCE	4	0.00000E+00	2.2€7186E·16	0.148119	-1.693850E-C2	14.8118	2.268574E-14
		FORCE	5	0.00000CE+00	·2.267156E·15	·C.148119	1.683850E-C2	-14.8118	2.272054E-14
4	э	FORCE	4	0.00000E+00	1.425014E-15	C.304842	-1.632201E-C2	-30 4B42	1.313762E-14
		FORCE	5	0.00000E+00	1.425014E-16	·C.304842	1.632201E-C2	30.4842	1 314487E-14
4	10	FORCE	4	0 COOD00E+00	2.341165E-16	6.169479	-1.814149E-02	- 6.9479	2 268574E-14
		FORCE	5	0 COOOCE+00	2.341165E-16	· 0.169479	1.814149E-02	-1€.9 4 79	2 272054E-14
4	12	FORCE	4	0.00000E+00	1 425034E-16	ŭ.304642	-1 532201E-02	30.4842	1 3137522-14
		FCRCE	5	0000000202+00	1.425014E-16	-0 304842	1 632201E-02	-30.4542	1 3144872-14
4	12	FORCE	4	0 000000E+CC	2.341165E-16	0.109479	1 614149E-52	-1€ 9 6 79	Z.265574E 14
		FURCE	5	5 0CC000E+00	-2 341165E-16	-3.159479	1 814149E-02	-16 9479	2.272054E-14

IE3D BEAM FORCES.. MAXIMUM VALUES FOR ALL STEPS NOTE: MAXIMUM VALUES WITH THE OTHER DOPS FORCES ARE PRINT OUT AT THE SAME TIME ELEMENT LOAD NODE AXIAL FY F2 TORSION MY MZ STEPAG 2 1 FORCE FORCE 3.940799E-02 -9.90774 -3.940799E-02 9.90774 2 21.7**54**7 3 -21.7**54**7 2 3 C72046E-03 905 296 -3.C72046E-03 1073.25

-4 235513E-02 -14.9391 4 235513E-02 14.9391

-4.2358152-02 -14 9391 4.2358132-02 14 9391

0.120466 9.05746

-9 05746 9 05746

·14.9391 14 9391

2.153567E-03 -2.153567E-03

1.008987E+C2 -1.008987E+C2

1.006987E-C2 -1.008987E-C2

1.008987E-C2 -1.008987E-C2

820 179 991 317

1575.€C 1412.22

1575.60 1412 22

1575.60 1412.22

0 120466 -0 120466

-4.235813E-02 4.235813E-02

5 76268 4 09891

11 8693 12 2239

·4.50469 ·3.96693

-4.50469 -3.96693

-4.50469 -3.96693

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33	3D BEAM FORCES.										
	MAXIMU	4 VALUES	FOR ALL	STEPS	NOTE	MAXIMUM VALUES	WITH THE CTHER	DOFS FORCES ARE	FRINT OUT AN	THE SAME TIME	
ELEME	NT LOAD	5	NODE	XA	TAL	FY	FZ	TORSION	MY	MZ	
	1 2	E FORCE	1	0.00000	0CE+03	4 €07659Ξ·18	9.25142	2.052586E-02	1107.10	€ 930220E-16	
		FORCE	2	0.0000	CE+03	-4.667859E-18	9 25142	-2.052586E-02	743.182	7 199102E-16	
	1 .	FORCE	1	0 0000	00E+C0	·1.136412E·18	23.0257	1 620256E-02	2652.32	1 379105E-16	
		FORCE	Z	0 00000	002+00	1.136412E-18	22.0257	-1 620256E-02	1952.83	3 9898645-17	
	1 6	FCRCE	1	0.0600:	C0-E•C0	4.607859E-18	9.25142	2 052586E-02	1107.10	€ 930220E-16	
		FCRCE	2	0 0000	00 E + C C	-4.607859E-18	9.25142	-2 C52556E-02	743 162	7 199102E·16	
	1	5 FORCE	1	0 00000	00E+CO	-1.133412E-18	23.0257	1 620256E-02	2652.32	1 379105E-16	
		FORCE	2	0 00000	03E+00	1.139412E-15	23 0257	-1 €2025€E-02	1952.83	3.969864E-17	
	1 6	FORCE	1	0.0000	00E+00	4.607859E-15	-9 25142	2 C5258€E-02	1107.10	6.93C220E-1€	
		FORCE	2	0.00000	C0E+00	4.607959E-18	9 25142	-2 C5258€E-02	743 182	7.199102E-16	
	1	B FORCE	1	C.300C0	C 3 E - 0 C	4 6C7859E-18	9 25142	2.C52586E-02	1107.10	6.93C220E-1€	
		FORCE	2	C.000C	COE•0C	·4 607859E·18	9 25142	-2.052586E-02	743.162	7.199102E-1€	
	1 9	PORCE	1	C.000C	CDE+OC	1 138412E 18	·23.C257	1.€20256E-02	2652.32	1.379105E-1€	
		FORCE	2	C.03000	00E+00	1 138412E-15	23 C257	-1.€2C256E-02	1952.83	3.989864E-17	
	: 13	PORCE	1	0.00004	00E+00	4.607859E-18	-9.25142	2.052586E-C2	1107 10	6.93022CE-16	
		FORCE	2	0 00000	00E+00	-4.607859E-18	9.25142	-2.052586E-C2	743.182	7.1991C2E-1€	
	1 11	L FORCE	1	0.00000	0CE+30	-1.138412E-15	-23 0257	1.62C256E-C2	2652 32	1.3791C5E-16	
		FORCE	2	0.0000	0CE+90	1.139412E-15	23 0257	-1.620256E-C2	1952.83	3.989864E-17	
	1 11	2 FORCE	1	0.0000	0CE+00	4.607859E-16	9.25142	2.052586E-C2	1107.10	6.930220E-16	
		FORCE	2	0.0000	0CE+00	4 607859E-18	9.25142	-2.052586E-02	743.182	7.199102E-16	
	COLUMN	(LOAD)	REPRESE	NTS THE	DOF W	HICH HAS MAXIMUM	VALUE				

. LCADING # C PEAK ELEMENT FORCES COLUMN (LOAD) REPRESENTS THE DOF WHICH HAS MAXIMUM VALUE

2 21.2635 3 -21.2635

2 6.82003 3 -6.82003

2 21,2635

6.92003 -6.92003

5.92003 -6.82003

2 3

2 3

2 2 FORCE FORCE

3 FORCE FORCE

4 FORCE FORCE

5 FORCE FORCE

6 FORCE

2

2

2

2

5	2	FCRCE	6	6 000000E+00	2.054049E-17	12 4826	1.38€C23E.02	1049 76	2.278451E-15
		FORCE	5	C.000CCOE-0C	2 08404CE-17	12.4826	1.306023E-02	1446.77	2.313254E-15
5	3	FORCE	6	C. 000CCOE-0C	1 422€77E·17	14.5348	·2 4912 3E 02	1165.23	1 154350E-15
-		FORCE	Ē	C.000CCOE-9C	-1.422€77E-17	14.5346	2 491213E-02	1741.73	1.161397E-15
5	4	FORCE	6	C.000CC0E-00	1.422€77E-17	14.5348	-2.4912:3E-02	:165.23	1.154350E-15
		FORCE	5	0.000000E-00	-1.422677E-17	14 5348	2.491213E.02	1741.73	1.161397E-15
5	5	FORCE	6	0.00000E+00	1.422677E-17	14 5348	-2.491213E-02	1165.23	1.15435CE-15
		FORCE	5	0.000002E+C0	-1.422677E-17	14 5346	2.491213E 02	1741.73	1.161297E-15
5	€	FORCE	6	0 000000E+C0	2.064C40E-17	·12 4825	-1.386023E 02	1049 76	2.278451E-15
		FCRCE	5	0 000000E+00	-2.094640E 17	12 4826	1.366023E.C2	1445 77	2.313254E-15
5	E	FORCE	e	0 000000E+60	2.0840402-17	·12 4826	1 386023E-C2	1049 76	2.278451E-15
		FORCE	5	D GCC000E+CO	-2.054C40E-17	12 4826	1.39€023E.C2	1446 77	2.3132542.15
5	9	FORCE	e	00+200000 C	1.422677E-17	14.5345	-2.491213E-C2	1165 23	1.154350E-15
		FORCE	5	0 000000E+00	-1.422677E-17	14.5345	2.491213E C2	1761 73	1.161397E-15
5	10	FORCE	F	5 000000E+00	1.422677E-17	-14.5346	-2.491213E-C2	1165 23	1.15435CE-15
		FORCE	5	0.00000CE+06	-1.422677E-17	14.5348	2.451213E-02	1741.73	1.161397E-15
5	11	FORCE	e	0.000000E-00	1.422577E-17	-14.5548	-2.491213E-C2	1165.23	1.154350E-15
		FORCE	5	0.C0000CE+00	-1 422677E-17	14.5346	2.491213E-02	1741.73	1.161397E-15
5	12	FORCE	- 6	6.00000E+00	2 C84040E-17	-12.4826	-1.386023E-02	1049.76	2.278451E-15
		FORCE	5	C.000000E+00	-2 C84040E-17	2.4826	1.386023E-02	1446.77	2.313254E-15
COLU	MN 1	1047	REPRESE	NTS THE DOE WE	TCH HAS MAXIMIM	VALUE			

IFID BEAM FORCES . MAXIMUM VALUES FOR ALL STEPS NOTE: MAXIMUM VALUES WITH THE OTHER DOES FORCES ARE PRINT OUT AT THE SAME TIME ELEMENT LOAD NODE AXIAL FY FZ TORSION MY MZ STEFAG

ē	1	FORCE FORCE	7 6	25.2260 -25.2260	3-940799E-02 -3.940799E-02	-9,94631 9,94631	1.992666E-03 1.992666E-03	907.33 4 1081.93	3.78268 4.09891	O
6	z	FORCE FORCE	7	25.1551 -25.1551	0.120466 -0.120466	-9,13764 9,13764	1.100529E-03 -1.100529E-03	623.212 1004.32	11.86 9 3 12.2239	G
e	3	FORCE FORCE	7 6	12.7230 -12.7230	-4.235813E-02 4.235813E-02	-15 C021 15.C021	8.919539E-C3 -8.819539E-C3	1574.14 1426 29	-4.50469 -3 96693	c
e	4	FORCE FORCE	7	12.7210 -12.7230	-4 235813E-92 4 235813E-92	15.0021 15.0021	8.819539E-03 -8.819539E-03	1574.14 1426.29	-4 50469 -3.96693	o
é	5	FORCE FORCE	-, 6	12 7230 -12.7230	4 235813E-02 4 235513E-02	-15.0021 15.0021	8.819539E-03 -9.819539E-03	1574.14 1426.29	-4.50469 -3.96693	۵
£	ć	FORCE FORCE	7	25 1551 -25 1551	0.120466 0.125466	-9 13764 9.13764	1 100529E-03 -1 100529E-03	923.212 1004.32	11.8693 12.2239	0
6	7	FORCE FORCE	é	25 2260 -25.2260	3.940799E-C2 -3.940799E-C2	-9,94631 9,94631	1.992666E+03 -1.992666E+03	907.334 1081.93	1.79268 4.09991	C
e	9	FORCE FORCE	7	25.1551 -25.1551	C.12C465 -0.12C466	-9.13764 9.13764	1.100529E-03 -1.100529E-03	623.212 1004 32	11.8693 12.2239	C
£	9	FORCE FORCE	7	12.723C -12.723C	•4.235813E•02 4.235813E•02	-15.C021 15.C021	8.919539E-C3 -6.819539E-C3	1574 14 1426 29	-4.50469 -3 96693	с
ć	15	FORCE FORCE	7 6	12 7230 •12 7230	-4 235813E-02 4 235813E-02	-15.0021 15.0021	8.8195392-03 -8.8195392-03	1574.14 1426.29	-4 50459 -3.96693	o
6	11	FORCE FORCE	7	12 7230 -12 7230	-4.235913E-02 4.235913E-02	-15.0021 15.0021	5.619539E-03 -8.819539E-03	1574.14 1426.29	-4.50469 -3.96693	o
б	:2	FORCE FORCE	7.6	25 1551 •25 1551	C.120466 -C.120466	9.13764 9.13764	1 100529E-03 -1 100529E-03	523.212 1004.32	11.6693 12.2239	0
COL	JMIN	LCAD)	REPRES	INTS THE DOF	WHICH HAS MAXIMUM	VALUE	1 1035252.03	1004.32	.2.4235	

 31 BEAM FORCES...
 MAXIMUM VALUES FOR ALL STEPS
 NOTE:
 MAXIMUM VALUES WITH THE OTHER DOFS FORCES ARE FRINT OUT AT THE SAME TIME

 ELEMENT LOAD
 NODE
 AXIAL
 FY
 FZ
 TORSION
 MY
 MZ

 7
 2
 FORCE
 6.0000005F:00
 4.6078592:18
 8.76772
 2.194247E:02
 1051.32
 6.930220E:16

 FORCE
 7
 0
 00000CE:00
 4.6078592:18
 8.76772
 -2.194247E:02
 702.224
 7.199102E:16
 676666760

		FORCE	7	0 00000CE+00	.€07859∑ 16	B. 6772	-2.194247E C2	702.224	7.1991C2E·1
7	3	FORCE	e	0.CODC0CE+00	-1.128412E-18	-21.9145	1.755101E-C2	2512 77	1.379105E+1
		FORCE	7	0.C0000CE+00	1.138412E-18	21.9145	-1.755101E-C2	1870 14	3.959664E-1
7	4	FORCE	8	0.00000E-00	4.6C7859E-15	-8 76772	2.1-42472-02	1051.32	6.93C22CE-1
		FORCE	5	0.000002-00	4 607859E-16	8 76772	2.1942475 02	702.224	7.199102E·1
7	5	FORCE	8	0.0000002+00	1 139412E 19	-2.3145	1.7551012.02	2512.77	1.379105E-1
		FORCE	7	C.000CC0E+0C	1 1384.2E 18	21.9145	-1.755101E-02	1670.14	3 969864E-1
7	e	FORCE	8	C.000CC0E+0C	4 6C7959E-15	-E.76772	2.194247E.02	1051.32	6 930220E+1
		FORCE	7	C 0050C0E+00	-4 607859E-15	E.76772	-2.194247E-02	702 224	7 199102E-1
7	е	FORCE	6	0.00000E+00	6 607859E-18	8.76772	2 194247E-02	1051.32	6 930220E-1
		FORCE	7	6.000CC0E+0C	4.507959E-18	6.76772	-2 194247E-02	702.224	7 199102E-1
7	9	FORCE	9	0 000000E+00	·1.139412E·16	21.9145	1 755101E-02	2512.77	1 379105E-1
		FORCE	7	0 000000E+00	1.138412E-16	21.9145	1 755101E-02	1876.14	3.9898€4E-1
7	10	FCRCE	ε	6 0CC000E+60	4.607859E-18	-8 76772	2 194247E-02	1051.32	6.930220E-1
		FORCE	7	0 000000E+00	4.607659E 16	8.76772	-2 194247E-02	702.224	7.199102E-1
-	:1	FORCE	ε	00+3600000 C	-1.136412E 18	21 9145	1.7551C1E+02	2512.77	1.379105E-1
		FORCE	7	0 00000E+C0	1.136412E-18	21 9:45	-1.7551C1E-02	1670 14	3.989964E-1
7	12	FORCE	5	0 •E000000 €	4 607859E 18	-8.7€772	2.194247E-C2	1051.32	5.930220E-1
		FORCE	7	0.000000E+00	-4.607859E-18	6 76772	-2.194247E-02	702.224	7 199102E-1
Б	2	FORCE	1	C.COC0002+C0	-1.54C109E-15	6.296090	1.698218E-02	29.5324	-1.502€17E-1
		FORCE	8	6.00000E-00	1.5401092-16	-C,29€0 3 0	1.696218E-C2	-29.6957	-1 499929E-1
5	3	FOFCE	1	C.C00000E+00	-9.242824E 17	C.376077	1.713242E-C2	37.4095	·8.908926E·1
		FORCE	6	0.00000E+00	9.242824E-17	-0.376077	1.713242E-02	-37.8059	-8.792038E-1
8	4	FORCE	1	0 C00000E+00	-6.€94949 <u>E</u> -17	0 249794	5.478925E C2	24 9369	-6.13C513E-1
		FORCE	E	0.00000CE+00	6.€94945E 17	0 249794	-5.478925E-C2	-25 0220	-6.228525E-1
3	5	FORCE	1	C.00000CE+00	9.242824E-17	0 376077	1.713242E-02	17.4095	-B.806926E-1
		FORCE	6	C.00000CE+00	9.242824E-17	0 276077	-1.713242E-02	-37 BC59	-6 782C38E-:
ō	6	FORCE	1	C.00000CE+00	1 540109E-16	0 296090	1.6982182.02	-29 5324	-1 502617E-:
		FORCE	E	C.000000CE+00	1 540105E-16	·0 29609C	·1.€982155.02	-29 6857	1.499929E
8	9	FORCE	1	6.00000E+00	-1 540109E-16	0 296090	1.€98213E·02	-29 5324	-1 5C2617E-1
		FORCE	8	C.000000E+00	1 S40109E-16	-0.29609C	-1 698218E-02	-29 E857	-1 499929E-1
8	9	FORCE	1	C.0100(0E-0C	-9 242524E-17	0.376077	1 713242E-02	-37.4095	-6 8C6926E-3
		FORCE	в	C.060000E+00	9 24252 4 E-17	·0 376077	1 713242E-02	-37.6059	- 3 782035E-1
5	10	FORCE	1	0.000CC0E+0C	-6 694948E-17	0.249794	5 470925E-02	24.9359	-6.130513E 1
		FORCE	6	0.000000E+00	6.694948E-17	-0.249794	·5 478925E·02	-25.0220	·€.226525E·1
8	11	FORCE	1	0 000000E~00	9.242824E-17	0.376077	1 713242E-32	37.4095	-6.80592éE-1
		FORCE	5	0 000000E+00	9.242824E-17	0.376077	-1 713242E-02	-37.8055	-6.782035E-1
8	12	FORCE	1	C 000000E+CO	-1 540109E 16	0.296090	1 696218E-02	29.5324	-1.502617E
		FORCE	Б	00+E000000 C	1.54C109E-16	-C.29€C90	·1.599218E-02	29.685	-1.499929E-1
COL	UMN	LOAD	REPRES	ENTS THE DOF WH	UCH HAS MAXIMUM	VALUE			

 TESD BEAM FORCES..

 MAXIMUM VALUES FOR ALL STEPS NOTE MAXIMUM VALUES WITH THE OTHER DOPS FORCES ARE PRINT OUT AT THE SAME TIME

 ELEMENT LOAD
 NODE
 AXIAL
 PY
 FZ
 TORSION
 MY
 MZ
 STBFAG

 9
 2
 FORCE
 2
 0
 CDD000CE-00
 1540105E-16
 -0.12145Z
 3
 150259E-03
 11.6373
 -1
 502617E-14

		FORCE	£	0 000000E-00	-1.425014E-16	0.319232	1.054729E-02	31.9233	1.314487E-14	0
						•				
10	: 10	FORCE	3	0 000000 0 +00	1.425014E 6	-0.319232	-1.054729E-02	31.9231	1.313782E-14	
		FORCE	E	0 00C000E+C0	1.425014E-16	0.319232	1.054729E-02	31.9233	1 314487E-14	0
			_							
10	: 11	FORCE	5	0.00000E+00	1.425014E-16	· 0 319232	-1.054729E-02	31.9231	1 313782E-14	
		FURLE	6	C. 0000C0E+0C	-1.425014E-16	0.319232	1 C54729E-02	31 9233	1 1144572-14	Ĵ
• •			-							
-0	12	PORCE	د	C.300CC9E+0C	2 341165E-16	0 240074	4 928993E 03	24 0074	2.2685742-14	
	-	TONCE	000000000	U. OUUUUUUUE+OU	·2 341165E-16	0 240074	4.928993E-03	24 0075	2.272C54E 14	0
	- OPTIN		REFRESE	NIS THE DUP WH	ICH HAS MAXIMUM	VALUE				
3-	BEAM R	02025								
MA	XIMUM	VALUES	FOR ALL	STERS NOTE	MAX"MIM VALUES	WITH THE OTH	TR DORS FORCES ARE	DELN'T OUT	AT THE CAME TIME	
ELEMENT	LOAD		NCDE	AXTAL	FY	F7	TORSION	WV	MI THE SAME TIME	
2.1	2	FORCE		0.0000007+00	2.770439E-16	-0.624563	-596062E-02	65 4567	2 1667708.14	
		FORCE	14	0 000000E+00	-2.3°0439E-16	0.624563	1.596062E-02	62.4563	2 371154E-14	
12	. 3	FORCE	11	0 000000E+C0	2.370439E-16	· 0.624563	-1 596062E-02	62.4563	2 365770E-14	
		FORCE	1:	0.00000E+00	-2.370439E-16	0.624363	1 596062E 02	62.4563	Z 371194E-14	
	. 4	FORCE	11	C.000CC0E+00	2 373439E-16	-0 E24563	-1 596062E-02	62.4563	2 366770E-14	
		FORCE	14	C.0000CC0E+0C	2 370439E-16	0 624563	1.596062E-02	62 4563	2 371194E-14	
11	. 5	FORCE	11	0.000000 E +00	2 370439E-16	0.624563	-1.596062E-02	62 4563	2.366770E-14	
		FORCE	14	0.00000E+00	·2 370439E-16	C.624563	1.596062E+02	62.4563	2.371194E-14	
11	. 5	FORCE	11	0 COODOCE+0C	2.37C439E-16	-C.624563	-1.596C62E-C2	62.4563	2.36677CE 14	
		FORCE	- 4	0 C00C0CE+0C	2.37C439E-16	C.624563	1.5960622.02	62.4563	2.371194E-14	
11	. 5	FORCE		0.000000E+00	2.37C439E-16	0.624563	·1.596062E·C2	62.4563	2.36677CE-14	
		FORCE		0 0000002+00	2.370439E-16	0.624563	1.59€062E.C2	62.4563	2.371194E-14	
11		PORCE	11	0 000000 <u>0</u> +00	2.3/0439E-16	-0.624563	1.59E062E 02	62.4563	2.36677CE-14	
	16	FORCE	11	0 0000000000000000000000000000000000000	-2.370439E-16	0.626563	1 596062E-02	62.4562	2.371194E-14	
	. 10	FORCE	- 2	0.3000000000000000000000000000000000000	2.3/04395.16	0 626563	-1 396 J62E-02	62 4563	2 356770E-14	
	1:	FORCE	11	C 056600E-00	2.3704392-16	0 624060	1 5965622.02	62.4063	2 3/11945.14	
		FORCE	. 4	C. 000000E+00	-2 370439E 16	0 624563	1 5940625-02	62.4563	2 300/102114	
11	12	FORCE	11	0.00060CE+06	2 370439E-16	-0.624563	1 596062E 02	62 4563	2 3667737.14	
		FORCE	14	0 C0000CE+30	-2 370439E-16	C.624563	1.5960622.02	52 4563	2.371194E 14	
12	2 2	FORCE	11	0.000500E+00	3 095736E-17	·32 1602	-3.456892E-C2	3295 26	2 469 7 9E	
		FORCE	:2	0 000000E+C0	-3.095736E-17	32 1602	3.456692E-C2	3136 78	2.513€14E-15	
12	ני	FORCE	11	00+2000000 C	2.958655E-17	-33.5848	·3.835371E-02	3445 06	2.364428E-15	
		FORCE	12	0 00 0000E+ 00	-2.958855E-17	33.5848	3.835371E.02	3271.90	2.408664E-15	
12	2 4	FORCE	11	0.00000E+00	2.958855E-17	-33.5848	-3 835371E-02	3445.06	2.364428E-15	
		FORCE	12	0 0000C0E-00	-2.958955E-17	23 5848	3 635371E-02	3271.90	2 4C8664E-15	
- 4	2 2	FORCE	11	C. 300CCOE+0C	2 959855E-17	32.5848	 3 835371E-32 	3445.06	2 364428E-15	
1.7		FORCE	12	C DUULCOE+0C	-2 9588555-17	33.5846	3.835371E-02	3271.90	2.408664E 15	
	5 5	FORCE	11	0.000C00E+00	2 905662E-17	26.885	-2.225936E-02	2721.53	2.539635E-15	
12	, E	FORCE	12	0.000000E+00	-2.903562E-17	25.585	2.225936E.U2	2555.60	2 551269E-15	
••		FORCE		6 C0050CE+00	-3 095736E-17	32 1602	3 4546922-02	3295 25	2.4593/95-15	
12	2 9	FCRCE		3 000000552+01	2 9566555-17	-33 5848	-3 835371E-C2	3130 78	2,5156142,15	
	-	FORCE	12	0.0000002+00	-2.958855E-17	33.5848	3.835371E-02	3271.90	2.408664E-15	
12	2 10	FORCE	11	0 000000E+C3	2 958855E-17	33.5848	-3.835371E-02	3445.06	2 364428F-15	
		FORCE	12	0 0000002+00	-2 955855E-17	33 5848	3 835371E-02	3271.90	2 408664E-15	
12	2 11	FORCE	11	0.00C000E+60	2 958855E-17	-33.5548	-3 835371E-02	3445.06	2 364429E-15	
		FORCE	12	0.00000E+90	-2.958855E-17	33.5848	3 835371E-02	3271.90	2.4086641-15	
12	2 12	FORCE	11	0.00000E+00	2.905662E-17	-26,6957	-2.225936E-02	2721.53	2 539635E-15	
		FORCE	12	0 000000E-00	-2 905662 E-1 7	26,8857	2.225936E-02	2555.60	2.581269E-15	
13	2	FORCE	12	C.000CC0E-00	2 370439E-16	0 496708	-1.258311E-02	49 070 8	2.366770E-14	
		FORCE	13	C.000CCOE-01	-2.370439E-16	-0.190708	1.2583112-02	49.0708	2.371194E-14	
13	5 J	FORCE	12	C.000000E+00	2.3 0.39E-16	C 490708	-1 258311E-C2	-49.0706	2.36€770E-14	
• •	· ·	FURGE	13	0 COOJOCE+00	2.37C439E-16	-C.490708	1.258311E-C2	49.0708	2.371194E.14	
	- 4	FORCE	12	U.CODUGCE+00	7 676151E-17	C. 27 8155	2.0201C1E-02	27.8155	E 174017E-15	
	, e	FORCE		0 000000±+00		-U.Z/8155	-2 020101E-02	-47.8155	8 215850E-15	
		FUNCE		0 0000002-00	710409E-10	5.450798	-1.2583112-02	149.0705	2 3667 UE-14	

				•						
		FORCE	7	C.0000CCE+00	1 540109E-16	0.121452	-3.150259E-C3	12.6531	-1.499929E-14	о
9	2	FORCE FORCE	2 7	0 000000E+00 0 000000E+00	-9.242624E-17 9.242824E-17	0.149581 0.149581	3.542979E-03 -3 542979E-03	14.4620 15.4535	-8.809926E-15 -8.782038E-15	С
9	4	FORCE FORCE	27	0.000000E+00 C.000C0E+0C	•5 274644E•17 5 274644E•17	-0.137186 0.137186	5 779339E-03 -5 779339E-03	13.1619 14.2753	-4 576201E-15 -4 549312E-15	G
e	5	FORCE FORCE	27	C 000000E+00 0.000000E+00	-9 262824E-17 9 242824E-17	-0 149561 0.149581	3 542979E-03 3 542979E-03	14 4626 15 4535	-5.8089262-15 -6.782038E-15	э
э	Ó	FORCE FORCE	27	0 C0000CE+00 0.C0000CE+00	-1.540109E-16 1.540109E-16	-C.121452 C.121452	3.150259£-03 -3.150259E-03	11 6373 12.6531	-1.502617E-14 -1 499929E-14	C
9	E	FORCE FORCE	2 7	0 000000E+00 0 000000E+00	-1.540109E-16 1.540109E-16	-0.121452 0.121452	3.150259E-03 -3.150259E-03	11.6372 12.6531	1.502617E-14 -1.499929E-14	0
9	9	FORC E FORCE	27	0.000000E+00 0.000000E+00	-9.242524E-17 9.242524E-17	-0.149581 0 149581	3 542979E-03 -3 542979E-03	14.462€ 15.4535	-0.809926E-15 -8 702033E-15	C
9	10	FORCE FORCE	2 7	C 0000CCCE+0C C 0000CCCE+0C	-5 274644E-17 5 274644E-17	·⊃ 137196 ○ 13718€	5 779339E-03 5.779339E-03	13.1619 14 2753	-4.5762012-15 -4.5493122-15	С
9	11	FORCE FORCE	2	0 000000E+00 0.000000E+00	-9.242824E-17 9.242624E-17	-C.149581 C.149581	3.542979E-03 3.542979E-03	14.4626 15.4535	-8.308925E-15 -8.792036E-15	с
9	12	FORCE FORCE	2 7	0 000000E+00 0 000000E+00	-1.540109E-16 1.540109E-16	-0.121452 0.121452	3.150259E-03 -3.150259E-03	11.6373 12.6531	-1.502617E-14 -1.499929E-14	0
:c	2	FORCE FORCE	3 6	0.00000 E+ 00 0.000000E-00	2.357186E-16 -2 357186E-1€	-0.197071 0 197071	-5.043353E-03 5.043353E-03	19.7071 19.7072	2 268574E-14 2 272054E-14	э
10	3	FORCE FORCE	3 5	C.000CCOE+0C 0.000CCOE+0C	1 425014E-1€ -1 425014E-16	-0 319232 0 319232	1 054729E-02 1 054729E-02	51 9231 51 9233	1.313782E-14 1.314487E-14	0
10	4	FORCE FORCE	3 6	0.00000E+00 0.00000CE+00	1.425014E-16 -1.425014E-15	-0.319232 C.319232	1.054729E-02 1.054729E-02	31 9231 31.9233	1.313782E-14 1.314487E-14	0
10	5	FORCE FORCE	3 6	0 000000E+00 0 000000E+00 0 000000E+00	1 425014E-16 -1.425014E-16	-0 319232 0.319232	-1.054729E-C2 1.054729E-C2	31.9231 31.9233	1.313782E-14 1.314487E-14	o
16	6	FORCE FORCE	Ē	0.00000E+00 0.00000E+00	2.341165E-16 -2.341165E-16	-0.240074 0.240074	4.929993E-03 4.929993E-03	24.0074 24.0075	2.268574E-14 2 272054E-14	۰
10	8	FORCE FORCE	3 E	C.0990C0E+9C G.090C00E+9C	2 367186E-16 -2.367156E-16	-0 197071 0 197071	-5.043353E-05 5.043353E-03	19.7071 19.7072	2 265574E-14 2 272054E-14	э
10	9	FORCE	:	0.00000 E+00	1.4250142-16	-0.319232	1.054729E-02	31.9231	1.313782E·14	
		FORCE	£	0 000000E-00	·1.425014E·16	Ū.319232	1.054729E-02	31.9233	1.314487E-14	o
10	10	FORCE FORCE	3 €	0 000000E+00 0 000000E+00	1.425014E-16 1.425014E-16	-0.319232 0.319232	•1.054729E-02 1.054729E-02	31,9231 31,9233	1.313782E-14 1.314487E-14	0
10	11	FORCE FORCE	5	0.000000E+00 C.0006C0E+00	1.425014E-1€ -1.425014E-1€	-0 319232 0.319232	•1.054729E•02 1 054729E•02	31.9231 31 9233	1 313782E-14 1 314487E-14	э
:0 COLU	12 MN (FORCE FORCE LOAD+	3 6 REPRES	C.000CCOE-0C C.000CCOE-0C ENTS THE DOF WH	2 341165E-16 -2 341165E-16 ICH HAS MAXIMUM	-0 240074 0 240074 VALUE	-4.928993E-03 4.928993E-03	24 0074 24 0075	2.2685742-14 2.272054E-14	0

	4	FORCE	13	0.000000E+00	·2 370439É-16	-3.490709 C 490708	1.258311E-C2	49.0708	2 371194E 14 2 366770E-14
• -	c	FORCE	13	C.000005+00	·2.370439E·16	0 490705	1 250311E-C2	49.0708	2.371194E-14
13	8	FORCE	12	C.000000E+00	2 370439E-16	0 490708	1.258311E-02	-49 0708	2.366770E-14 2.37119/F.14
13	9	FORCE	12	C.000CCOE-0C	2 370439E-16	0 490708	-1.258311E-02	49 0709	2 3667705-14
	.,	FCRCE	13	0.000CCOE-0C	-2.370439E-16	-0.490708	1 258311E-02	49 0708	2 371194E-14
13		FORCE	13	0.000000E+00	7.6761515-17	0.275155	2 C20101E-02	27.8155	ē 215650E-15
13	:1	FCRCE	12	0 000000000000	2 370439E-16	0.490708	1 258311E 02	45.0709	2 366770E-14
13	12	FORCE	12	5 0000005+C0 5 0000005+C0	-2 37C4342-16 2.37C439E-16	C.4907C8	-1 258311E-02	49.0708	2.3667702-14
		FORCE	13	0.600000E+00	-2.37C439E-16	-C.490708	1.258311E-02	49 0708	2.271194E-14
14	2	FORCE	14	C.COOCOCE+00 0.COOCOCE+00	3.395736E-17	-32.6960	3.456900E-C1 3.456900E-C2	3350 E6 3185 54	2.469379E-15 2.513614E-15
14	3	FORCE	14	G.00000E+00	2 958555E-17	-34.1917	3.835380E-02	3507.59	2 364425E-15
.,		FORCE	13	C.000000E-00	2 958855E-17	34.1917	3.5353802-02	3330.75	2.408664E 15
- 4	4	FORCE	13	0.000000E+00	·2.958855E ·17	34,1917	3 835380E-02	3330.75	2 4086642-15
14	5	FORCE	14	0 00C000E+C0	2.958855E-17	-34,1917	-3 835380E-02	3507.59	2.366428E-15
14	6	FORCE	13	5 000000E+00 3 000000E+00	2.905662E-17	34 1917	J 635380E-02 -2.225943E-02	333C.75 2716.92	2.408664E.15 2.539635E.15
		FORCE	13	0 0000002+00	2.9056622-17	26 6672	2.225943E-02	2620 5:	2.581269E-15
14	8	FORCE	14	0 COD00CE+00 0 COD00CE+00	3.095736E-17	-32 €960 32 6960	-3.456900E-02 3.456900E-02	3350 66 3188 54	2.469379E-15 2.513614E-15
14	9	FORCE	14	0.C0000CE+00	2 9588552-17	-34.1917	-3 535380E-C2	3507.59	2.364428E-15
• •	1.5	FORCE	13	C.000000E+00	-2 958655E-17	34 1917	3.835380E-02	3330.75	2.408664E·15
- 9	10	FORCE	13	C. 0000002-00	·2.958955E-17	34.1917	3.835380E-02	3330.75	2.4086642-15
14	11	FORCE	14	0 00000E+00	2.958855E-17	-34.1917	-3 635390E-02	3507.59	2 364428E-15
14	12	FORCE	13	0 0000005£+00	2.905662E 17	-26.6872	-2 225943E-02	2716.92	2 5396352-15
		FORCE	13	0000002+00	-2.905662E 17	26 6872	2.225943E-02	2626.51	2 581269E-15
15	1	FORCE	16	-22.7759	-35 CC89	C.325554	1.787783E-02 1.787783E-02	-23.8800	-2598 96
15	2	FORCE	16	22.7759	-35.0099	0.325554	-1.757783E-02	23.8800	2596 96
		FORCE	1	22.7759	35.0089	-0 325554	1 787783E-02	-24,9531	- 2652.37
15	3	FORCE	16	8.67534	14.6976	-0 509175	2.589984E-02	37 4300	-1107.12
15	4	FORCE	16	-8.87534	-14.6978	0.509175	-2.589984E-02	-38 9463	1097.55
٠е	5	FORCE	1	5.87534	14.6978 -14.6978	0.509175	2 589994E-02 -2 589984E-02	37.4300	-1207.12
	•	FORCE	1	8 87534	14.6978	-0.509175	2 589984E-02	37.4300	-1107.12
15	6	FORCE	16	-22.7759	·35 0089	0.325554	-1.787783E-02	23.6830	·2598 96
15	7	FORCE	16	22.7759	-35 CC89	C.325554	-1.787783E-02	23.8500	2598 96
		FORCE	1	22 7759	35.0089	·C.325554	1 787783E-C2	-24.9531	- 26 52 . 37
15		FORCE	16	22 7759	35.0089	-0 325554	1.757783E-C2	24 9531	- 2652.37
15	ę	FORCE	16	-8.87534	14.6976	0 509175	-2.539984E-02	·38 9463	-1097.55
15	10	FORCE	1	8.57534	14.6978	-0 509175	2.569984E-02 -2.569984E-02	·37 43C0 ·38,9463	-1107.12 -1097.55
		FORCE	ĩ	8.87534	14.6978	-0.509175	2 589984E-02	37.4300	1107.12
15	11	FORCE	16	-9 67534	-14.6978	0.509175	-2.589954E-02	38.9463	-1037.55
15	12	FORCE	ıé	-22.7759	-35 CC89	C. 325554	1.787793E-02	23.6900	-2598 96
		FORCE		22.7759	35 COB9	·C.325554	1.787783E-02	24.953.	-2652.37
16	T	FORCE	2	-7.97337	46.4407	0 339451	1.797783E-02	10 7337	3528.43
16	2	FORCE	17	7.97337	-46.4407	-0 33945:	-1.737783E-02	40 1840	-3437.67
16	7	FORCE	17	-7.97337 4 4361278-02	46.4407	0 339451	1.787793E-02 -2 569994E-02	10 7337	-3528.43
•••	•	FORCE	2	-4 436127E-02	20.0546	0.372722	2 589984E-02	14 4809	1563.36
15	4	FCRCE	17	4 436127E-C2	-20.6546	- U. 37 27 22	-2 589984E-02	41.4273	-1534.83
16	5	FORCE	:7	1,25622	-26.0256	•C 371436	-2.399397E-02	42,1898	- 1930 15
	-	FORCE	2	-1.25522	26 C286	C.371436	2.392597E.02	13.5256	1974 14
16	5	FORCE	17	7.97337	46.4407	-C.339451 C.339451	·1.787753E-C2 1.767753E-C2	40.1840	- 34 37 . 67
16	7	FORCE	17	7.97337	-46.4407	0 339451	1.797783E-C2	40 1840	-3437.67
	=	FORCE	17	-7.97327	46.4407	0 339451	1.7677832-02	10 7337	-3528.43
• •	5	FORCE	2	-7 97317	46.4407	0.239451	1 7E7793E-02	10.7337	3528 43
16	9	FORCE	17	4.436127E-02	20.6346	- 0 . 37 27 22	-2 589984E-02	41.4273	.1534.83
16	10	FORCE	17	4 436127E C2	-20.6546	-0.372722	-2 589984E-02	41.4273	-1534.83
• /		FORCE	2	-4 436127E-C2	20.6546	0.372722	2.589964E-02	14.4809	-1563 36
15	-1	FORCE	17	6.436127E-02	20 6546	- C. 372722 C. 372722	·2 589954E-02 2.589984E-02	41.4273	1532 83
16	12	FORCE	-7	7.97337	·46 4427	0.339451	-1.787783E C2	40.1840	3437.67
17	1	FORCE	2	-7.97337	46.44(7	0 339451	1.7577835-02	10.7337 9 26348	-3528.43
- ·	-	FORCE		3.28197	45.2936	0.443825	-2 135643E-02	24 0234	2009.95
17	2	FORCE	11	0.665033	-55.3764	-0 551056	3 655090E·02	9.37104	1630.64
17	3	FORCE	11	C 665C33	-55.3764	0.551056	3 655080E-02	5 37104	- 1630.64
		FORCE	3	-0 665033	55 3764	0.551056	·3 655080E-02	31.9581	- 2522.59
17	4	FORCE	11	-0 665033	-55 3764 55 3764	-0.551056	3 555080E-02 -3 655080E-02	9.3-104	- 2522 59
17	5	FORCE		-2.72421	-36 2957	C.140163	1.202479E-02	17.0213	-1149 68
17	6	FORCE	3	2.72421	36 2957	-0.140163	-1.202479E-C2	6.50902	-1572 50
-	-	FORCE		-0.665023	55.3764	0 551056	-3.655C80E-C2	31 9581	- 2522.59
17	7	FORCE	11	·3.28197	-45.2936	0 443825	2.1356432-02	9.26348	-1387 07
17	Ê	FORCE	11	C.665C33	-55.3764	0.551056	3 6550B0E-02	9.37104	-1630.64
17	£	FORCE	3	-0.665033	55.3764	0.551056	·3 655080E-02	31,9581	2522.55
17	э	FORCE	11	-C 665033	-55.3764	0.551056	3 655080E-02 -3 655080E-02	9 3/104 31,9581	- 2522,59
17	10	FORCE	11	0.665013	- 55 . 3764	0.551056	3.65508CE-02	9 37104	1630 64
17	: 1	FURCE	2	-0 665033 0 665033	55 3764	C 551056 -C.551056	-3.65508CE-02 3.655080F 02	31.9561 9.37104	· 2522 59 · 1630 64
-		FORCE	3	3.665033	55 3764	0 551056	-3 655080E-C2	31.9581	-2522.59
17	12	FORCE	11	0.665033	-55.3764	0.551056	3.655080E-02	9 37104	·163C.64
COLU	MN (LOAD	REPRESE	ENTS THE DOF WHI	CH HAS MAXIMUM	VALUE	3.0320802.02	27 2251	- 2322.37
קם הנקו	-2.M -	OBCER							
MAXI	MUM	VALUES .	FOR ALL	STEPS NOTE	MAXIMUM VALUES	WITH THE OTHE	A DOFS FORCES ARE	PRINT OUT	AT THE SAME TIME
ELEMENT 1	DA D		NCDE	AXIAL	FY	FZ	TORSION	MY	MZ STBF4G

ELEMENT LOAD	VALUES	NCDE	AXIAL	FY	WITH THE OTHER FZ	TORSION	PRINT OUT MY	AT THE SAME TIL MZ	ME STBF4G
16 1	FORCE FORCE	18 11	14,9689 34 9669	-43 192# 43 1929	-1.31714 1.31719	-7 778064E-02 7.778064E-02	50.9914 47.7978	1644.86 1594 eU	1

	1ō 4	FORCE	16	-13 2762	-44,7909 44,7909	-1 25087	-7 508934£-02	49.3853	-1704 16	
	18 5	FORCE	18	33 5443 33,5443	45 C9U1 45 C9U1	-1.47705	-7.633347E-C2 7.633347E-C2	57,6554	-1867.36 -1814.40	
	18 6	FORCE	÷ ē	-22 5442	49 (901	1.47705	-7.633347E-02	57.6554	-1567.36	-
	18 7	FCRCE	18	-34.9689 34.9689	-42 1929 45.1929	-1 31719	-7 778064E-02 7.778064E-02	SC 9914	-1644.80 -1594 60	,
	18 ā	FORCE	13	-33.5443	49.0901	-1.47705	-7 633347E-02	57.6554	-1867.36	•
	15 9	FORCE	:9	-33 5443	49.0901	1 47705	-7 633347E-02	57 6554	-1667 36	1
	13 10	FORCE	18	-33 2762	44.7909	-1 25067	-7.808914E-02	49 3653	-1704.16	1
	19 11	FORCE	18	-28.3586	-57 0330	1.44182	-4.672836E-C2	50.3859	1589 74	
	18 12	FORCE	18	-33.5443	-49 0901 49 0901	1.47705	-7.633347E-02	57 6554 53 1236	-1867 36	-
3	COLUMN D BRAM	LCAD	REPRESE	NTS THE DOF W	HICH HAS KAXIMUM	VALUE	/	55.2250	2014.40	1
ELEME	MAXIMUM NT LOAD	VALUES	FOR ALL NODE	. STEPS NOTE AXIAL	: MAXIMUM VALUES FY	WITH THE OTHER FZ	DOFS FORCES ARE TORSION	PRINT OUT	AT THE SAME TIME MZ	
	15 1	FORCE FORCE	12	14.2597 14.2597	41.5508 41.5508	0 593400 •0 593400	3 655080E-02 -3 655080E-02	-13 9959 -30 5091	-1435.74 -1680 57	
	19 2	FORCE	12	14 2597 14 2597	-41.5508 41.5508	0 59340C 0 59340C	3 655080E-02	-13 9959 -30 5091	-1435.74	
	19 3	FORCE	12	14 2597	41.5508	0.593400	3.655080E.02	-13 9959	-1435.74 -1680 53	
	19 4	FORCE	12	14 2597	41.5505	0.593400	3.655080E-02	-13.9959	-1435.74	
	19 5	FORCE	12	14.2597	41 5506	C.593400	3.6550802.02	13.9959	-1435.74	
	19 5	FORCE	12	14.2597	41 5508	-C.593400 C.593400	-3 655C80E-C2 3.655C80E-C2	-3C.5091 -13.9959	-1680 57 -1435 74	
	19 7	FORCE	12	14.2597	41 5508 •41 5508	·C.5934C0 0.5934C0	 3 655080E-C2 3.655080E-C2 	-30.5091 -13 9959	-1600 57 -1435 74	
	19 8	FORCE	4	14.2597 14.2597	41.5508 41.5508	-0.593400 0.593400	-3.655080E-02	-30.5091	-1680.57	
	15 6	FORCE	4	-14.2597	41.5508	-0.593400	-3.65508CE-02	-30.5091	-1680.57	
	10 10	FORCE	4	14 2597	41.5508	·C.593400	-3 65508CE-02	-30.5091	-1680.5	
	19 16	FORCE	12	14.2597	41.5508	0.593400 -0.593400	3 655380E-02	-13.9959 -30.5091	1435.74 -1680.57	
	19 1:	FORCE	12	14.2597 14.2597	41.55C8 41.55C8	0.59340C 0.59340C	3 655080E-02 -3 655080E-02	·13 9959 ·30 5091	-1435.74 -1660.57	
	19 12	FORCE	12	14 2597 14 2597	41.55CE 41.5508	0 59340C -0 59340C	3.655080E-02	·13 9959 ·30 5091	-1435.74 -1680.57	
	COLUMN	(LOAD)	REPRESE	NTS THE DOP W	HICH HAS MAXIMUM	VALUE				
IE3	D BEAM I MAXIMUM	FORCES. VALUES	EOF ALL	STEPS NOTE	· MANIMUM VALUES	WITH THE OTHER	DOES FORCES ARE	PRINT OUT	AT THE SAME TIME	
ELEME	NT LOAD		NODE	AXIAL	FY	FZ	TORSION	MY	MZ STBI	FAG
	20 1	FORCE FORCE	19 12	48 3352 -48.3352	49 6869 49 6869	1.51944 -1.51944	-7.453408E-C2 7.453408E-C2	-78.9445 -35.1132	-1890 36 -1836 14	1
	20 2	FORCE FORCE	29	48.3352 48.3352	49.6869 49 6869	1.51944 ·1 51944	-7.493408E-C2 7.483408E-C2	·78.8445 ·35 1132	-1890 38 -1836 14	1
	20 2	FORCE FORCE	19 12	45.3352 •43 3352	49.6369 49.6369	1.51944 ·1 51944	-7.483408E-02 7.483408E-02	-78.0445 -35.1132	-1890.2E -1836.14	:
	20 4	FORCE	19 12	44 6430 -44 6430	45.367C	1.19971 1.19971	·7 665332E·C2 7 665332E·C2	-62.2979 -27.6805	- 17 27 . 15 - 16 75 . 37	1
	20 5	FORCE FORCE	19 12	48 3352 •45 3352	49.6869 49.6869	1 51944 •1 51944	-7 483408E-02 7 483405E-02	-78 6445 -35 1132	-1890.35 -1836.14	1
	20 5	FORCE FORCE	19 12	48.3352 -48.3352	-45.6669 45.6869	3 51944 -1.51944	-7 483409E-02 7.483408E-02	-78 8445 -35 1132	-159C.38 -1536.14	1
	20 7	FORCE FORCE	19 12	46 3352 •48.3352	45 6809 49 6669	1.51944	-7.493408E-C2 7.483408E-C2	-76.6445 -35.1132	-1890.35 -1836.14	1
	2C 8	FCRCE FCRCE	15 12	48.3352 48.3352	-49 6859 49 6859	1.51944	·7.463408E-02 7.463408E-02	-78.8445 -35.1132	-1890 36 -1836 14	<u>.</u>
	20 9	FORCE FORCE	19 12	48 3352 -45 3352	- 49.0569 49.6369	1.51944 1.51944	-7.483408E-02 7.483408E-02	-78.6445 -35.1132	-1890.35 -1836.14	1
	20 10	FORCE FORCE	19 12	44 6430 -44 6430	-45,367C 45 3670	1 19971 -1 19971	-7 666332E-02 7 668332E-02	-62.2979 •27 €865	1727.15 -1675 37	1
	20 11	FORCE FORCE	19 12	36 1892 -36,1892	-39 2257 39 2257	1 44699 -1 44699	4 495410E-02 4.495415E-02	-67 2193 -41 3046	-1612.08 -1330.07	1
	20 12	FORCE	19	48.3352 /	49.5864	1 51944	-7.4834382-02	-78 8445	-199C.36	
	COLUMN	FORCE	12 REFRESE	-48.3252 INTS THE DOF V	49 6569 HICE HAS MAXIMUM	-1 51944 Value	7.4534382-02	-35.1:32	-1636 14	1
3										
	D BEAM	FORCES .								
ELEME	D BEAM MAXIMUM NT LOAD	FORCES. VALUES	FOR ALL NODE	. STEFS NOTE AXIAL	E MAXIMUM VALUES FY	WITH THE CTHER FZ	DOFS FORCES ARE TORSION	PRINT OUT	AT THE SAME TIME MZ	
ELEME	D BEAM MAXIMUM NT LOAD 21 :	FORCES. VALUES FORCE FORCE	FOR ALL NODE 13 5	. STEFS NOTE AXIAL 14.2300 -14.2300	E MAXIMUM VALUES FY -43 2295 43 2295	WITH THE CTHER F2 6 593400 6.593400	DOFS FORCES ARE TORSION 3 455086E+02 2 655086E+02	PRINT OUT MY -13.9955 -30 5091	AT THE SAME TIME M2 - 1500.47 1741.75	
ELEME	D BEAM MAXIMUM NT LOAD 21 1 21 2	FORCES. VALUES FORCE FORCE FORCE	FCR ALL NODE 13 5	. STEFS NOTE AXIAL 14.2300 -14.2300 14.2300 14.2300	E MAXEMUM VALUES FY 43 2295 43 2295 43 2295 43 2295	WITH THE CTHER F2 C 5934C0 C 5934C0 C 5934C0 C 5934C0	DOFS FORCES ARE TORSION 3 655086E-02 3 655080E-02 3 655080E-02	PRINT OUT MY -13.9955 -30 5091 -12.9955	AT THE SAME TIME M2 - 1500.47 - 1500.47 - 1500.47 - 1500.47	

18 2 FORCE 18 -33 5443 -49.0901 -1 47705 -7.633347E-02 57.6554 -1867 36 FORCE 11 33 5443 49.0501 1 47705 7 633347E-02 53 1236 -1814 40 1

-1867.36 -1814.40 1

18 3 FCRCE 18 -33 5443 -49.0901 -1 47705 -7.633347E-02 57.6554 FORCE 11 33 5443 49.0901 1 47705 7.633347E-02 \$3.1236

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- 2-	۷	FORCE	15	-14 2300 14 2300	43.2296	-C.5934CC 0 593400	-3.655080E-02 3.655080E-02	30.5091 13.9955	1741 75	
£		FORCE	5	14 2300	43.2296	-0.593400	3 655020E-02	30.5991	1741.75	
21	5	FORCE	13	14 2300	- 43.2296 43.2296	0.593400	3 655080E+02 -3 655060E+02	-13.9959 -20 5091	-1500 47	
21	6	FORCE	13	14 2300	43.2295	C.5934C0	3.65508CE-02	-13.3959	1500 47	
	-	FORCE	5	14.2300	43.2296	-C.5934C0	-3.655080E-02	· 30.5091	-1741.75	
21	;	FORCE	5	-14.2300	43.2296	-0 593400	-3.655080E-C2	-3C.5091	1741.75	
21	e	FCRCE	13	14.2300	-43 2296	0.593400	3.655080E-C2	•13.9959	-1500.47	
21	9	FORCE	5	14.2300	4 22.6	C.593400	3.655080E U2	-13.9959	1741.75	
••	-	FORCE	5	14.2306	4? 229€	0.593400	-3.635080E-02	-30 5091	-1741.75	
21	1 C	FORCE	13	14.2300	-43 2296	0 593400	3.655080E-02	-13 9959 -30 5091	-1500.47	
21	11	FORCE	13	14.2300	43.229€	0 593400	3.655060E-02	·13 9959	1500.47	
2.1		FORCE	5	-14.2100	43.225 6	-0 593400	·3.€550802.02	-30 5091	-1741.75	
21	12	FORCE	13	-14.2300	43.2296	-0.593400	3.655080E-02	-30.5091	- 1741.75	
COL	UMN (LOAD)	REPRESE	INTS THE DOF	WHICH HAS MAXIMU	VALUE				
LESD P	FAM F	OFCES								
MAX	MUMI	VALUES	FOR ALL	. STEPS NOT	E: MAXIMUM VALUES	S WITH THE OTHER	DOFS FORCES ARE	PRINT OUT	AT THE SAME TIM	Œ
ELEMENT	LCAD		NODE	AXIAL	FY	F2	TORSION	MY	MZ	STBFAG
22	:	FORCE	21	47.9305	-45 5186	1.51944	-7.4634C8E-02	-78.8445	·1883 62	
		PORCE	13	47.9309	49 5109	-1.51944	7.4834C8E-02	-35.1132	-1930.26	1
22	2	FORCE	21	47.9309	-45 5166	1 51944	-7.483408E-02	-75.8445	-1883.62	
	-	FORCE	13	47.9309	49 5138	-1.51944	7.483408E-C2	35.1132	-1930.25	1
22	,	FORCE	21	47 9309	. 49 512=	1 51974	-7 4834085-02	-78 8445	1281 67	
22	2	FORCE	13	47.9309	49.518â	1.51944	7.463408E-02	35 1132	-1630.28	1
								< > > > > > > > > > > > > > > > > > >		
22	4	FORCE	13	44.2620	45.1970	-1.19971	7.668332E-02	27 6805	- 1669.47	1
	_									
22	5	FORCE	21	47 9309	-49.5188	1.51544	-7 483406E-02 7 483408E-02	-78.8445	- 1883.62	1
										-
22	€	FORCE	21	47.9309	49.5188	1.51944	-7 4634C8E-02 7 4634C8E-02	-75.8445	-1963 62	
		TORCE	15	•/ 9303	•> 5100	1.51544	,	53.1132	1030 20	-
22	7	FORCE	21	47.9309	-49 5188	1.51944	7.4834C8E-02	-78.8445	1803.62	,
		FORCE			47 2155	-1.51944	2.683608E-C2	- 35.1132	1530.28	1
22	8	FORCE	2:	47.9309	49.5185	1 51944	7.483408E-C2	-78.9445	-1883.62	
		FORCE	13	-47.9309	49 5188	-1 51944	7,4834982-02	-35 1132	-1630.28	1
22	9	FORCE	21	47 9309	49.5188	1 51944	-7.463408E-02	-78 8445	1683.62	
		FORCE	13	·47 9309	49.5108	-1 51944	7.463403E-02	-35 1132	·1830.29	1
22	10	FORCE	21	44 2620	-45.1970	1 19971	·7 668332E-02	-62.2979	-1720.30	
		FORCE	13	44 2620	45.1970	-1.19971	7 668332E-02	27 6805	- 669 47	1
		FORCE			39,0107			6	1400 55	
22	11	FURLE.	21	15.5352	. 70 . 0125	1 44699	6 4956 GE C2	.e/.2193	-1508.38	
22	11	FORCE	13	-35.5352	36.0196	1 44699 •1.44699	4.495410E-02	-61.3046	- 1242.89	1
22	11	FORCE	13	-35.5352 -35.5352 47.9304	-49 5*88	1 44699 •1.44699 1 51944	4.495410E-02	-41.3046	- 1242.89	1
22 22	11	FORCE FORCE FORCE	21 13 21 13	47.9309 -47.9309	-49 5188 49 5188	1 44699 •1.44699 1.51944 •1.51944	-2.495210E-02 4.495410E-02 -7.483408E-02 7.483408E-02	-67.2193 -61.3046 -78.8445 -35.1132	- 1242.89 - 1863.62 - 1830.25	1
22 22 COL	11 12 .UMN :	FORCE FORCE FORCE FORCE LOAD)	21 13 21 13 REPRESE	47.9309 -47.9309 -47.9309 ENTS THE DOP	-49 5188 49 5188 WHICH HAS MAXIMU	1 44699 -1.44699 1.51944 -1.51944 M VALUE	-2.495210E-02 4.495410E-02 -7.483408E-02 7.483408E-02	-78.8445 -35.1132	- 1242.89 - 1242.89 - 1883.62 - 1830.25	1
22 22 COL 30 B	11 12 .UMN : 3EAM F	FORCE FORCE FORCE FORCE LOAD)	21 13 21 13 REPRESE	35.5352 -35.5352 47.9309 -47.9309 ENTS THE DOP	-49 5188 49 5188 Which Has Maximu	1 44699 -1.44699 1.51944 -1.51944 M VALUE	-2.495210E-02 4.495410E-02 -7.483408E-02 7.483408E-02	-78.8445 -35.1132	- 1262.85 - 1262.62 - 1863.62 - 1830.25	1 :
22 22 COL 30 B MAX	11 12 JUMN : SEAM F (IMUM	PORCE FORCE PORCE LCAD) ORCES VALUES	21 13 21 13 REPRESE	35.5352 -35.5352 47.9309 -47.9309 ENTS THE DOP	38.0196 -49 5188 49 5188 WHICH HAS MAXIMUN E MAXIMUN VALUE:	1 44699 -1.44699 1.51944 -1.51944 M VALUE S WITH THE CTHER	-4.495410E-02 4.495410E-02 -7.483408E-02 7.483408E-02 DOFS PORCES ARE	-61.2193 -41.3046 -78.8445 -35.1132 PRINT OUT	- 1242.85 - 1242.85 - 1863.62 - 1930 25 AT THE SAME TIM	1 : E
22 22 COL 35 E MAX ELEMENT 23	11 12 JUMN : SEAM F (IMUM LOAD 1	FORCE FORCE FORCE LOAD) ORCES VALUES FORCE	21 13 21 13 REPRESE FOR ALL NODE 14	35.5352 -35.5352 47.9309 -47.9309 ENTS THE DOP STEPS NOT AXIAL -3.16254	- 38.0196 - 49 5188 49 5188 WHICH HAS MAXIMUN E MAXIMUM VALUE: FY - 42.5553	1 44699 -1.44699 -1.51944 -1.51944 M VALUE S WITH THE CTHER FZ 7.452197E-02		-61.2193 -61.3046 -78.8445 -35.1132 PRINT OUT MY -15.9965	-1242.85 -1242.85 -1863.62 -1930 25 AT THE SAME TIM M2 -1359.42	1 : E
22 22 COL 3D E MAX ELEMENT 23	11 12 JUMN : SEAM F (IMUM LOAD 1	FORCE FORCE FORCE LOAD) ORCES VALUES FORCE FORCE	21 13 21 13 REPRESE FOR ALL NCDE 14 6	35.5352 47.9305 47.9309 2NTS THE DOP 2 STEPS NOT AXIAL 3.16254 3.16254	- 49 5188 49 5188 49 5188 WHICH HAS MAXIMU E MAXIMUM VALUE: FY - 42 5553 42 5553	1 44699 1.44699 1.51944 -1.51944 VALUE S WITH THE CTHER FZ 7.452197E-02 -7.452197E-02	-C.495610E-02 4.495610E-02 -7.48340BE-02 DOFS FORCES ARE TORSION 1.582773E-02 -1.582773E-02	-61.2193 -61.3046 -78.8445 -35.1132 PRINT OUT MY -15.9965 10.4073	-1500.58 -1222.09 -1862.62 -1930 28 AT THE SAME TIM MZ -1359.42 -1907.23	1 : E
22 22 COL 32 E MAX EL2MENT 23 23	11 12 JUMN : SEAM F LOAD 1 2	FORCE FORCE FORCE LOAD) ORCES VALUES FORCE FORCE FORCE FORCE	21 13 21 13 REPRESE FCR ALL NCDE 14 6 14		- 38.0196 - 49 5188 49 5188 WHICH HAS MAXIMU E MAXIMUM VALUE: FY - 42.5553 42.5553 43.5553 - 57.1463	1 44699 1.51944 1.51944 4 VALUE S WITH THE CTHER FZ 7.452197E-02 7.452197E-02 0 551026	- C. 495410E-02 4. 495410E-02 - 7. 48340E-02 7. 48340E-02 DOPS FORCES ARE TORSION 1.582773E-02 3. 65508DE-02 2. 65508DE-02	-61.2193 -41.3046 -78.8445 -35.1132 PRINT OUT MY -15.9965 10.4073 9.37010	-1508.58 -1242.89 -1882.62 -1850 25 AT THE SAME TIM M2 -1359.42 -1907.25 -1694.44 -2591 53	1 : :
22 22 COL 3D P MAX PLDY:ENT 23 23 23 23	11 12 JUMN : SEAM F (IMUM LOAD 1 2 2	FORCE FORCE FORCE LOAD) ORCES VALUES FORCE FORCE FORCE FORCE	21 13 21 13 REPRESE FCR ALLI NCDE 14 6 14 6 14	35.5352 -35.5352 47.9309 -47.9309 ENTS THE DOP STEPS NOT AXIA_ -3.16254 0.786579 0.786579 0.786579	-49 5188 49 5188 49 5188 WHICH HAS MAXIMUN E MAXIMUM VALUE: FY -42.5553 43.5553 -57.1663 -57.1663	1 44699 1.51944 1.51944 4 VALUE 5 WITH THE CTHER FZ 7.452197E-02 -0.551026 0.551026	- C. 435610E-02 4. 435610E-02 7. 483408E-02 7. 483408E-02 TORSION 1.5827732-02 1.5827732-02 3.655080E-02 3.655080E-02 3.655080E-02	-61.2193 -72.9445 -35.1132 PRINT OUT MY -15.9965 10.4073 9.37010 31.9570	- 1202.38 - 1202.29 - 1852.62 - 1930 25 AT THE SAME TIM MZ - 1359.42 - 1907.23 - 1694.44 - 2551.53 - 1694.44	1
22 22 COL 30 E MAX EL2XENT 23 23 23 23	11 12 JUMN : SEAM F IOAD 10 2 2 3	FORCE FORCE FORCE LCAD ORCES VALUES FORCE FORCE FORCE FORCE FORCE	21 13 21 13 REPRESE FCR ALLI NCDE 14 6 14 6 14		- 36.0196 - 49 5188 49 5188 49 5188 WHICH HAS MAXIMUN E MAXIMUM VALUE: FY - 42.553 43.5553 43.5553 - 37.1463 57.1463 57.1463 57.1463	1 44699 1.51944 -1.51944 -1.51944 M VALUE S WITH THE CTNER FZ 7.452197E-02 -7.452197E-02 -5.51026 0.551026 0.551028 0.551028	- C. 435C10E-02 4.4554CE-02 7.4834CBE-62 7.4834CBE-62 DOFS FORCES ARE TORSION 1.582773E-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.	213 	- 1500.58 - 1222.89 - 1882.62 - 1930 25 AT THE SAME TIM M2 - 1359.42 - 1907.25 - 1694.44 - 2591.53 - 1694.44 - 2591.53	1 : E
22 22 COL 3D MAX PL2XENT 23 23 23 23 23 23	11 12 JUMN : SEAM F (IMUM LOAD 1 2 2 3 4	FORCE FORCE PORCE LOAD) ORCES VALUES FORCE FORCE FORCE FORCE FORCE FORCE	21 13 21 13 REPRESE PCR ALL NCDE 14 6 14 6 14 6 14 6	- 51.5352 47.9305 -47.9309 ENTS THE DOP - 31.6254 3.16254 0.786579 - 0.786579 - 0.786579 - 0.786579 - 0.786579 - 0.786579 - 0.786579 - 0.786579		1 44699 1.51944 -1.51944 -1.51944 WALTE S WITH THE CTHER FZ 7.452197E-02 -7.452197E-02 -5.51028 0.551028 0.551028 0.551028 0.551028 0.551028	-C.435C10E-02 4.4554C2E-02 7.4834C8E-02 7.4834C8E-02 7.4834C8E-02 7.582773E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02	- 61.3046 -78.9445 -35.1132 PRINT OUT MY -15.9965 10.4073 9.37010 31.9570 5.37010 5.37010 31.9570	- 1500.58 - 1222.29 - 1882.62 - 1930 25 AT THE SAME TIM 	1 : E
22 22 COL 33 B MAX 23 23 23 23 23 23 23 23 23 23 23 23 23	11 12 JUMN : SEAM F (IMUM LOAD 1 2 2 4 5	FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	21 13 21 13 REPRESH FCR ALL NCDE 14 6 14 6 14	- STEPS NOT AX:AL - 35.5352 - 47.9309 - 47.9309 - STEPS NOT AX:AL - 3.16254 3.16254 3.16254 0.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.786579 C.7877777777777777777777777777777777777	- 38.0196 - 49 5188 49 5188 49 5188 WHICH HAS MAXIMUN E MAXIMUM VALUE: FY - 42.5553 43.5553 - 57.1463 - 57.1463	1 44699 1.51944 -1.51944 -1.51944 VALUE S WITH THE CTHER FZ 7.452197E-02 -7.452197E-02 -5.51028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.140276	-2.435610E-02 4.495610E-02 7.483408E-02 DOFS PORCES ARE TORSION 1.582773E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 2.655080E-02 2.202479E-02	 -61.3046 -78.8445 -35.1132 PRINT OUT MY -15.9965 10.4073 9.37010 31.9570 5.37010 31.9570 -17.0217 	- 1202.58 - 1222.29 - 1883.62 - 1936 28 AT THE SAME TIM M2 - 1359.42 - 1907.23 - 1694.44 - 2591.53 - 1694.44 - 2591.53 - 1694.44 - 2591.53	1 : E
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22 22 COL 33 E MAX ELEMENT 23 23 23 23 23 23 23 23 23 23 23 23 23	11 12 20MN : 3EAM F (2MUM 10AD 1 2 3 4 5 6 7	FORCE FORCE FORCE LCAD ORCES. VALUES FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	21 13 21 13 REPRESE NCDE 14 5 14 5 14 6 14 6 14 6 14 6 14 6 14	- 51.5352 47.9309 -47.9309 ENTS THE DOP - STEPS NOT - AXIAL - 3.16254 3.16254 0.786579 - 0.786579 - 786579 - 786579	- 36.0196 - 49 5188 49 5188 49 5188 WHICH HAS MAXIMUN E MAXIMUM VALUE: FY - 42.5553 43.5553 - 37.1463 - 57.1463 - 57.555 - 57.5555 - 57.5555 - 57.5555 - 57	1 44699 1.51944 -1.51944 -1.51944 WALTE S WITH THE CTNER FZ 7.452197E-02 -7.452197E-02 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.14076 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.5410276 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0		<pre>-e1.326 -78.8445 -35.1132 PRINT OUT MY -15.9965 10.4073 9.37010 31.9570 9.37013 31.9570 -17.0217 6.50646 9.37010 22.3370 -5.9965</pre>	- 1500.58 - 1222.29 - 1882.62 - 1930 25 AT THE SAME TIM MZ - 1359.42 - 1907.23 - 1694.44 - 2591.53 - 1695.44 - 1359.42 -	1
22 22 COL 3D E MAX PLDY:ENT 23 23 23 23 23 23 23 23 23 23 23 23 23	11 12 20MN : 3EAM F COMUM 10AD 1 2 3 4 5 6 7 5	FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	21 13 21 13 REPRESE NCDE 14 5 14 6 14 6 14 6 14 6 14 6 14 6 14 6	- 51.5352 -35.5352 -37.9309 -47.9309 ENTS THE DOP - STEPS NOT -3.16254 -3.16254 -3.16254 -7.86579 -0.786579 -0.786579 -0.786579 -2.83147 0.786579 -0.786579 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.16284 -3.1	49 5188 49 5188 49 5188 49 5188 49 5188 49 5188 49 5188 49 5188 49 5188 49 518 40 518 40 518 40 5553 40 5553	1 44699 1.51944 -1.51944 -1.51944 WALTE S WITH THE CTHER FZ 7.452197E-02 -7.452197E-02 -5.51028 0.551028 0.551028 0.551028 0.551028 0.40276 -0.140276 -0.140276 -0.551028 C.551028 C.551028 	-C.435C10E-02 4.4554C2E-02 7.4834C8E-02 7.4834C8E-02 7.4834C8E-02 1.582773E-02 3.655080E-02 3.655080E-02 3.655080E-02 2.655080E-02 2.655080E-02 2.202478E-02 3.655080E-02 2.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.656080E-02 3.655080E-02	<pre>- 42.3046 -72.8445 -35.1132 PRINT OUT MY -15.9965 10.4673 9.37010 31.9570 -17.0217 450646 9.37010 21.9570 -15.9965 10.4673 9.37010</pre>	- 1202.269 - 1802.62 - 1930 25 AT THE SAME TIM - 1359 42 - 1907.23 - 1694.44 - 2591.53 - 139.42 - 1907.23 - 1696.44	1
22 22 COL 3D B MAX PLDXENT 23 23 23 23 23 23 23 23 23 23 23 23 23	11 12 SEAM F (IMUM LOAD 1 2 3 4 5 6 7 6	FORCE FORCE PORCE ICAD ORCES. VALUES FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	21 13 21 13 REPRESE FCR ALL NCDE 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14	- 51.5352 -35.5352 -47.9309 -47.9309 ENTS THE DOP - STEPS NOT -3.16254 -3.16254 -3.16254 -3.16254 -7.86579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.786579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.78579 -7.79579 -7.79579 -7.79579 -7.79579 -7.7957	49 5188 49 5188 49 5188 49 5188 49 5188 49 5188 41 5188 41 555 37 1463 57 1463	1 44699 1.51944 -1.51944 -1.51944 VALTE S WITH THE CTNER FZ 7.452197E-02 -7.452197E-02 -7.452197E-02 -5.51028 0.551028 0.551028 0.551028 0.551028 0.440176 -6.140176 -6.551028 C.551028 551028 C.551028 551028 551028 551028 551028 551028 551028 551028 551028 551028 551028 551028	-C. 495610E-02 4. 495610E-02 7. 483408E-02 TORSION 1. 582773E-02 3. 655080E-02 4. 655080E-02 5. 655080E-02 5. 655080E-02 5. 655080E-02 5. 655080E-02 2. 202479E-02 3. 655080E-02 5. 655080E-02 5. 655080E-02 5. 655080E-02 5. 655080E-02 5. 582773E-02 3. 655080E-02 5. 582773E-02 5. 582773E-02 5. 582773E-02 5. 5826773E-02 5. 582773E-02 5. 5826773E-02 5. 5867752000E-02 5. 5867752000E-02 5. 586775000E-02 5. 586775000E-02 5. 586775000E-02 5. 5867750	<pre>- 61.3046 -78.8445 -35.1132 PRINT OUT MY -55.9965 -10.4073 9.37010 31.9570 -37010 31.9570 -17.0217 6 50646 9.37010 21.9570 -25.9965 10.4073 9.37010 21.9570</pre>	AT THE SAME TIM M222.89 -1882.62 -1930 28 AT THE SAME TIM M22 -1359.42 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1694.44 -2591.53 -1695.44 -2591.53 -1695.44 -2591.53 -1695.44 -2591.53 -1695.44 -2591.53 -1695.44 -2591.53 -1695.44 -2591.53 -1695.44 -2591.53 -1695.44 -2591.53 -1695.44 -2591.53 -1695.44 -2591.53 -1695.44 -2591.53 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.45 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55 -1695.55	1
22 22 COL MAX PLDMENT 23 23 23 23 23 23 23 23 23 23 23 23 23	11 12 SEAM F (IMUM LOAD 1 2 3 4 5 6 7 6 2 2 3 4 5 6 7 6 2	FORCE FORCE FORCE LCAD) ORCES. FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	21 13 21 13 REPRESE FOR ALL NODE 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14		- 49 5188 49 5188 49 5188 WHICH HAS MAXIMUN E MAXIMUM VALUE: - 42.5553 43.5553 - 57.1463 -	1 44699 1.51944 -1.51944 -1.51944 VALUE S WITH THE CTHER FZ 7.452197E-02 -3.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.55	-C.435CLCE-C2 4.4554LCE-C2 7.4834CBE-C2 7.4834CBE-C2 7.4834CBE-C2 7.582773E-C2 1.582773E-C2 1.582773E-C2 3.65508DE-02 3.65508DE-02 3.65508DE-02 2.202479E-02 3.65508DE-02 2.202479E-02 3.65508DE-02 2.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-02 3.65508DE-C2 3.65508DE-C2 3.65508DE-C2 3.65508DE-C2 3.65508DE-C2 3.65508DE-C2	<pre>-e1.326 -78.8445 -35.1132 PRINT OUT MY -15.9965 10.4673 9.37010 31.9570 -17.6217 6.50648 9.37010 21.9570 -25.9965 10.4673 9.37010 21.5570 9.37010 31.9570 9.37010</pre>	- 1262.85 - 1262.85 - 1862.62 - 1930 25 AT THE SAME TIM MZ - 1359.42 - 1907.23 - 1694.44 - 2591.53 - 1695.44 - 2591.53 -	1
22 22 COL 3D E MAX ELEMENT 23 23 23 23 23 23 23 23 23 23	11 12 JOHN : SEAM F IDAD 1 2 3 4 5 6 7 6 9 10	FORCE FORCE FORCE LOAD ORCES. VALUES FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	21 13 21 13 REPRESE FOR ALL NODE 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14			1 44699 1.51944 -1.51944 -1.51944 WALTE S WITH THE CTNER FZ 7.452197E-02 -7.452197E-02 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.14076 0.551028 7.452197E-02 -7.452197E-02 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.55108 0.55108 0.55108 0.551	- C. 495CLCE-C2 4. 495CLCE-C2 7. 4834CBE-C2 7. 4834CBE-C2 7. 4834CBE-C2 7. 4834CBE-C2 1. 582773E-C2 1. 582773E-C2 1. 582773E-C2 2. 65508DE-02 3. 65508DE-02 2. 65508DE-02 2. 65508DE-02 2. 65508DE-02 2. 65508DE-02 2. 65508DE-02 2. 65508DE-02 2. 65508DE-02 3. 6	<pre>-e1.2193 -e1.3046 -78.8445 -35.1132 PRINT OUT MX -15.9965 10.4073 9.37010 31.9570 -17.0217 45.0846 9.37010 31.9570 -17.0217 45.0846 9.37010 21.9570 -25.9965 10.4073 9.37010 31.9570 -3.7010 31.9570 -3.7010 31.9570 -3.7010 31.9570 -3.7010 31.9570 -3.7010 31.9570 -3.7010 31.9570 -3.7010 31.9570 -3.7010 31.9570 -3.7010 31.9570 -3.7010 31.9570 -3.7010 31.9570 -3.7010 31.9570 -3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.7010 3.70100 3.70100 3.70100000000000000000000000000000000000</pre>	- 1202.28 - 1202.28 - 1882.62 - 1930 25 AT THE SAME TIM M2 - 1359.42 - 1907.23 - 1694.44 - 2591.53 - 1694.44 - 2594.54 - 2594.55 -	1
22 22 COL 33 23 23 23 23 23 23 23 23 23	11 12 12 12 12 12 12 12 2 2 2 3 4 5 6 7 6 7 6 2 10 10 10 10 10 10 10 10 10 10	FORCE FORCE FORCE LCAD ORCES. VALUES FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	21 13 21 :3 REPRESE FCR ALL NODE 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14		- 36.0196 - 49 5188 49 5188 49 5188 WHICH WAS MAXIMUN E MAXIMUM VALUE: FY - 42.5553 - 37.1463 - 57.1463 - 57.14	1 44699 1.51944 -1.51944 -1.51944 WITH THE CTNER FZ 7.452197E-02 7.452197E-02 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028	-C. 495610E-02 4. 495410E-02 7. 48340EE-02 7. 48340EE-02 TORSION 1.582773E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.655080E-02 3.	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22 22 COL 33 E 23 23 23 23 23 23 23 23 23 23	11. 12. 12. 12. 12. 12. 12. 12.	FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	21 13 21 13 REPRESE FOR ALL NODE 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 6 14 7 7 7 7 7 7 7 7 7 7 7 7 7	- 51.5352 - 35.5352 - 35.5352 - 47.9309 - 47.9309 ENTS THE DOP - STEPS NOT - AXIAL - 3.16254 - 3.16254 - 3.16254 - 7.6579 - 7.76579 - 7.7805 - 7.27805 - 7.27805	 36.0196 38.0196 49 5188 41 5553 57 1463 57 1463	1 44699 1.44699 1.51944 -1.51944 -1.51944 WALTE S WITH THE CTNER FZ 7.452197E-02 7.452197E-02 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.551028 0.	- C. 435C10E-02 - 435C10E-02 - 435C10E-02 - 7. 4834C8E-62 - 7. 4834C8E-62 - 70RSION - 582773E-02 - 582773E-02 - 655080E-02 - 655080E-02 - 655080E-02 - 655080E-02 - 202479E-02 - 202479E-02 - 202479E-02 - 202479E-02 - 655080E-02 - 7778064E-02 - 763347E-02 - 7347E-02 - 763347E-02 - 763347E-0	<pre>-e1.2193 -e1.3046 -78.8445 -35.1132 PRINT OUT MX -15.9965 10.4673 9.37010 31.9570 -17.0217 9.37010 31.9570 -17.0217 -25.9965 0.37010 31.9570 -17.0217 9.37010 31.9570 -15.9965 0.37010 31.9570 -3.37010 31.9570 -3.37010 31.9570 -3.37010 31.9570 -3.37010 31.9570 -3.37010 31.9570 -3.37010 31.9570 -3.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.37010 5.370100000000000000000000000000000000000</pre>	AT THE SAME TIM 1242.88 1242.89 1862.62 1930 25 AT THE SAME TIM M2 1359.42 1907.23 1694.44 2591.53 1694.44 2591.53 1694.44 2591.53 1694.44 2591.53 1694.44 2591.53 1694.44 2591.53 1694.44 2591.53 1694.44 2591.53 1694.44 2591.53 1694.44 2591.53 1694.44 2591.53 1694.44 2591.53 1694.44 2591.53 1638.94 1638.94 1638.94 1638.94 1638.94 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.44 1653.41 1653.44 1653.44 1653.44 1653.41 1653.44 1653.44 1653.44 1653.41 1653.44 1653.41 1653.44 1653.41 1653.44 1653.44 1653.44 1653.41 1662.38	1 : 2 : 2 : 5 : 5 : 5 : 5 : 5 : 5 : 5 : 5

24	7	FORCE	22 14	-33 9483 31.9483	-43 0981 43 0981	1.31724 1.31724	7 778064E.02 7 778064E.02	50 9941 47.7988	1636.94 •1593 42	:
24	8	FORCE FORCE	22 14	-32.7805 32.7805	49 CC73 49 0073	-1.47710 1.47710	·7.633347E·02 7.633347E·02	57.6562 53.1246	·1962 38 ·1913.17	1
24	è	FORCE FORCE	22 14	-32.7805 32.7805	- 49.0073 49.0073	-1 47710 1 47710	-7.633347E-02 7.633347E-02	57 €582 53 1240	-1562.38 -1813.17	1
24	10	FORCE FORCE	22 14	- 32 4247 32 4247	44.6885 44.6885	1.25091 1.25091	-7 \$C\$934E-02 7 \$C\$934E-02	49.3879 44.430€	-1698 19 -1653.44	1
24	11	FORCE FORCE	22	- 27.0274 27.0274	·25 7645 35.7645	-1.44185	4.672836E-02 4.672836E-02	50 3877 57.7509	-1583 21 -1099 13	
24	12	FORCE FORCE	2 Z 1 4	32.7805 32.7805	49.0073 49.0073	-1.47710 1.47710	-7.633347E-C2 7.633347E-C2	57.6592 53.1246	-1862 38 -1613 17	:
CO.	LUMN (LOAD	REPRESE	INTS THE DOF #9	HICH HAS MAXIMUM	VALUE				
MA	XIMUM	VALUES	FOR ALL	STEPS NOTE	MAXIMUM VALUES	WITH THE OTHER	R DOFS FORCES ARE	PRINT OUT A	T THE SAME TIME	
ELEMENT Z 5	LOAD 1	FORCE	NODE 23	AXIAL 7 02566	FY -44.9022	FZ •0 400369	TORSION •1 7877932•02	MY 48 1235	M2 -3291.05	
25	2	FORCE	7 7 7	·7.62566 7.02566	44.9022	0 400369	1 787783E-C2	11 9316	3444.28	
		FORCE	1÷	7.02566	44.9022	0 400369	1 787753E-02	11.9316	-3444.28	
25	3	FORCE	23	C.558594 -0 558594	-25.2072 25.2072	· 0.428548 0.428548	·2 398597E·02	49,6332	-1856.82	
25	4	FORCE	23	-0.220337	20.1083	0.423226	2.589984E.02	48.0095	-1490.81	
25	5	FORCE	23	0 220337 0 858594	-25.2072	0.423226 0.425548	2.589984E-02 -2.398597E-02	49.6332	-1525.42	
25	e	FORCE		-0 858594	25.2072	0.425546	2.398597E-C2	14.6489	1924 26	
2,		FORCE	7	-7 02566	44 9022	C.400369	1.787783£-C2	11.9318	-3444 28	
25	7	FORCE	23	7.02566 -7.02566	·44 9022 44 9022	• C. 400359 C. 400359	1.787783E-02	48.1236	-3291 C5 -3444 28	
25	Б	FORCE	23	7.02566	44.9022	0.400369	-1.757753E-02	48 1235	-3291 05	
25	э	FORCE	23	0 858594	4.9022	0 400369	1.767793E+02 -2.298597E-02	11 9318 49 6332	-3444 26 -1656.82	
25	10	FORCE	7	· C. 859594	25.2072	0 428546	2 398597E-02	14.6489	-1924.26	
	10	FORCE		C.220337	20.1083	J 423226	2 589984E 32	15.4744	-1525.43	
25	11	FORCE	23	-C.220337 C.220337	-20.1063	-0 423226 0 423226	 2 5899848-02 2 5899848-02 	43.C095 15 4744	-1490.91	
25	12	FORCE	23	7 02566	-44.9022	0 400369	·1.787783E.02	48.1236	3291 05	
25	:	FORCE	24	22.1643	-31.2652	0.600369 0.329550	1.7877832-02	-24.3930	-3444.2E -2257 06	
26	2	FORCE	5 24	22.1643	31 8652	·0.329550	1.7877832.02	25.0395	-2512 71	
	-	FORCE	8	22.1643	31 8652	· C. 329550	1.787783E-C2	-25.0395	-2512 71	
26	3	FORCE	24	·9.14390 9.14380	·13 6647 13 6647	C.527705	·2 589984E-02 2 589984E-02	41.3278	-998 4C5 -105: 30	
2€	4	FORCE	24	-9.14380	13.6547	0 527705	-2.5899842-02	41.3278	-998.405	
26	5	FORCE	24	9.14380	-13.6647	0 527705	2.589984E-02	-37 8279	-1051.30 -998.405	
26	4	FORCE	8	9.14380 .22 1643	13.6647	0 527705	2.5699842.02	-37.8279	-1051.30	
20		FORCE	5	22 :643	31.9652	· 0. 329550	1 7877636-02	-25.0395	-2512.71	
26	7	FORCE	24 5	22.1643	·31.8€52 31.8€52	C 329550 -0.329550	·1 787783E·02 1 787783E·02	-24.3930 -25.C395	·2267.06 2512.71	
26	6	FORCE	24	22.1543	·31 5652	0 329550	1.7977636-02	24.3930	- 2267 06	
26	۹.	FORCE	3	22.1643	31.8652	-C.329550	1.787783E-C2	-25.0395	-2512 7:	
	-	FORCE	<u></u> 3	9.14330	13 6647	C.527705	2.599984E-C2	- 41. 3276 - 37. 8279	-1051 30	
26	10	FORCE	24	-9.14380 9.14380	·13 6647 13.6647	C.527705	-2.5899842-02 2.5899542-02	-41 3278 -17 9279	-998.405	
26	11	FORCE	24	·9 14380	13 5647	0.527705	-2.529984E-02	41 3278	958.405	
26	12	FORCE	24	-22 1643	13 5647	0 527705	2.5899945-02 -1 787783E-02	-37 8279 -14 3930	1051.30 -2267.36	
co	LUMN (FORCE LOAD:	REPRESE	22 1643 NTS THE DOF WH	31.8652 ICH HAS MAXIMUM	•0 329550 Value	1 7877835-02	-25 0395	-2512.73	
IE3D I MAI	BEAM F XIMUM	ORCES	FOR ALL	, STEPS NOTE -	MAXIMUM VALUES	WITH THE OTHER	DOFS FORCES ARE	FRINT OUT A	T THE SAME TIME	
ELEMENT	LCAD		NODE	AXIAL	FY	F2	TORSION	MY	M2 STBP	AG
21	2	FORCE	17	0.000000 2+ 00	-3.408461E-18 3.408461E-16	6 25565 6 25565	-2.517562E-C3 2.517562E-C3	741.959 509.272	-1.136244E-15 -1.229052E-15	С
27	3	FORCE FORCE	16	C.COODOC E+O O O.COOSOC E+O S	-3.4084612-18 3.4084612-18	-5 56661 - 56661	-3.308198E-C3 3.208198E-03	776.469 536.852	·1.150122E-15 -1.242929E-15	0
2-	4	FORCE FORCE	16 17	0.000000E+00 0.000000E+00	6 673617E-19 -6.673617E-19	3.06651 3 C0651	-4.814824£-03 4.814824£-03	337 113 200 169	-1.804112E-16 -1.804112E-16	0
27	5	FORCE FORCE	16 17	0.000060E+00 0.000060E+00	-3 4084611-16 3.4084611-15	€ 5666: € 5656:	-3 368198E-03 3 368198E-03	776 469 536.852	+1 1501222-15 +1 242929E-15	С
27	e	FORCE FORCE	15 17	C.000CC0E+0C C.000CC0E+0C	-3 408461E-18 3 408461E-18	€ 566€1 6 56661	-3 368196E-03 3 308196E-03	776.469 536.852	-1 150122E-15 -1 242929E-15	Ū
27	E	FORCE FORCE	$\frac{16}{1^{-1}}$	0.000000 E+C0 0.00000 E+C0	-3.403461E-18 5.405461E-18	-6 255€5 6.255€5	2 517562E-03 2 517562E-03	741.859 509 272	-1 136244E-15 -1,229052E-15	0
27	9	FORCE FORCE	16 17	00+2000000 C	-3.405461E-19 3.405461E-19	-6.56661	-3 309198E-C3	775.469 536 857	1.150122E.15	c
27	10	FORCE	ie	0.0000002+00 0.0000002+00	8.6736172-19 -5.6736172-19	-3.05651	-4 814624E-C3	337.113	1 804112E-16	۰ د
27	11	FORCE	15	0.600000E+00	-3.408461E-16	6.56561	4.5148242.03	200.189	•1.0J4112E-16	0
	13	FIRCE	• '	C 000000100	2 4004015.10	0.0000	3.2001365.03	53t 852	·1.242929E-15	0
27 CO:	LUMEN (FORCE LOAD:	16 17 REPRESE	C DUCCOE+OC C DUCCODE+CO NTS THE DOF WH	-3 4084€1E-18 3.405461E-13 ICE HAS MAXIMUM	-6 56661 C 56661 VALUE	-3 308198E-03 3 306198E-03	776 469 536 852	•1.150122E•15 •1.242929E-15	С

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:	26 3	FORCE	E 18 17	0 CCCCCCE+CC 0 0CCCCCE+CC	8.890455E-18 -8.666641E-18	10 2452	-2.418967E-02 3 654542E-02	11C3.37 1383.37	-1.793235E-1 -1.982789E-15	5
1	28 4	FORCE FORCE	18 17	0 000000E+00 0 000000E+00	8.666841E-18 -8.666341E-18	17.1357 -17.1357	·3 654542E·02 3 654542E·02	1543.77 1683.37	-2 C75597E-15 -1 9827892-15	
2	28 5	FORCE	15 17	C.000CC0E-0C C.000CC0E-0C	8 565341E-18 -8 566841E-18	17.1357 ·17.1357	3.654542E-02 3.€54542E-02	1543.77 1853.37	-2 0755972-15 -1.952769E-15	
:	212 E	FORCE	18 17	C.000CCOE+0C G.053G0OE+3C	5 666541E-13 5 665641E-15	17.1357	3.€54542E-02 3.€54542E-02	1543.77 1863 37	-2 075597E-15 -1 932769E-15	
:	28 S	FORCE	18 17	0.00000E+00 0.00000E+00	8 6668412-19 -8.8904582-18	17 1357 16.2452	3 #54542E.C2 2 410967E.C2	1543 77 945.€€5	-2.075597E-15 -1.706968E-15	
:	25 9	FORCE	18	0.00000CE+00 0.00000CE+00	8.290459E-18 -8.666841E-18	10 2452 •17 1357	2.418967E-C2 3.654542E 02	1663 37	1 790235E-15 -1.982789E-15	
:	28 10	FORCE FORCE	18	0.000000E+00 0.000000E+00	8.666841E-18 -5.666841E-18	17 1357	·).654542E-02 3.654542E-02	1543.77	2.075597E-15 -1.982769E-15	
:	28 11	FORCE	18	0000002+00 0000002+00	8.666641E-18 -8.666641E-18	17 1357 -17 1357	3.654542E-02 3.654542E-02	1543.77	·2.075597E·15 -1.962789E·15	
:	28 12	FORCE	15	0 000000E+00 0 00000E+00	8.666841E-18	17 1357	3 654542E.02 3 654542E.02	1543.77	-2 C75597E-15	
	COLUMN	(LOAD)	REPRESI	ENTS THE DOF WH	ICH HAS MAXIMUM	VALUE	3 6565422.52	1543.77	-2 0755972-15	
IESI	D BEAM	FORCES.	TOR ALL	STEPS NOTE	MAXINIM VALUES	WITH THE OTHER	DOES FORCES ARE	PRINT OUT LT	THE SAME TOME	
ELEME,	NT LOAD	VALCE 5	NODE	AXIAL	FY	F2	TORSION	MY	MZ ST	BFAG
:	29 1	FORCE FORCE	16 19	41.3531 -41.3931	-0.474804 0.474804	1 69597 1.69597	2.176200E·C2 2.176200E·C2	323.552 15.6414	-47 5806 -47.3803	c
:	29 2	FORCE	18 19	41.3831 •41.3831	-0.474804 0 474804	-1.69597 1.69597	-2.176200E-02 2.176200E-02	323.552 15.6414	-47.5806 -47.3803	0
:	29 B	FORCE FORCE	18 19	16.4993 -16.4993	-C 318074 C.315074	-3.23660 3.23660	·1 795247E-02 1 795247E-02	563.508 184.252	·31.9259 ·31.6890	c
:	29 4	FORCE FORCE	16 19	41 3831 -41 3831	-0.474804 0.474804	-1.69597 1.69597	2 176200E-02 2 176200E-02	323 552 15 6 416	- 47 5806 - 47 3805	o
:	29 5	FORCE FORCE	18 19	15.4993 16.4993	-0 318074 6 318074	3 7389C 2 7389C	1.795247E-02 1.795247E-02	563 5C8 184.252	-31,9259 -31,6 890	0
:	29 0	FORCE FORCE	18 19	41.3831 -41.3831	-5.474804 5.474894	1 69597 1.69597	-2.176200E-C2 2.176200E-C2	323 552 15.6414	-47 5806 -47.3803	с
:	7 (2	FORCE	16 19	41 3031 •41,3031	-0.474804 6.474804	1.69597 1.69597	-2.176200E-02 2.176200E-02	323.552 15.6414	- 47.5606 - 47.3803	с
:	29 8	FORCE FORCE	18 19	41.3631 •41.3831	-0.474804 0.474604	-1.€9597 1.€9597	-2.176200E-02 2.176200E-02	323.552 15.6414	-47.5806 -47.3903	Û
:	29 9	FORCE FORCE	18 19	16.4993 16 4993	·C.318074 C.318074	-3.73680 3.73860	·1 795247E·02 1 795247E·32	563.505 184.252	-31.9259 -31.6890	0
:	29 10	FORCE	18 19	41 3831 -41 3631	-0.4745C4 0 474504	-1,69597 1 69597	2 176200E-02 2 176200E-02	322 552 15 €414	47.5806 - 47.2803	э
:	29 11	FORCE FORCE	18 19	16.4993 -16.4993	-0 318074 0 318074	-3 73950 3 73886	-1.795247E-02 1.795247E-02	563 508 184 252	-31.9259 -31.6890	٥.
:	29 12 CCLUMIN	FORCE FORCE (LOAD)	18 19 REPRESI	41.3531 -41.3831 ENTS THE DOF WH	-0.474604 0.474804 ICH HAS MAXIMUM	-1.69597 1 69597 VALUE	-2.1762002-02 2.176200E-02	323.552 15.6414	47 5805 -47.3803	с
3	D BEAM	FORCES .			MAXIMUM VALUES	WITH THE COUPP	TOPS FORCES ARE	PRINT OUT AT	THE SAME TIME	
ELEME	NT LOAD	FCRCE	NGDE 19	AXIAL 0 0CC000F+C0	FY -4.225339E-17	FZ 6.000CCDF+8C	TCRSION 0.00206CE+00	MY 0 000000E+00	MZ •4.596150E•15	
	зс е	FORCE	21 19	0 0CC000E+C0 0.000000E+C0	4.225339E-17 -4.225339E-17	0.000000000000000000000000000000000000	0 CC000CE+00 0 CC000CE+00	0 000000E+00 0.00000E+00	-4.695025E-15 -4.596150E-15	
:	30 8	FORCE FORCE	21 19	0.000CC0E-00 C.000CC0E-00	4 225339E-17 •4 225339E-17	0.00000E+00 5.00000CE+00	C CCD000E+00 0.CCD000E+00	0 00C000E+00 C,000000E+00	-4 695029E-15 -4 595150E-15	
	30 12	FORCE FORCE	21 19	C.000000E+00	4 225339E-17 •4 225339E-17	0 00000CE+00 0 00000CE+00	0.600000E+00 0.600000E+00	C.000CC0E+0C C.000CC0E+0C	-4 695029E 15 -4.595150E-15	
(CCLUMN	FORCE (LOAD)	21 REPRESI	9.000000E+00 ENTS THE DOF WH	6.225339E-17 ICH HAS MAXIMUM	0 000000E+05 VALUE	0.0060002+00	C.000CC0E+0C	-4.695029E-15	
1 2 3	D BEAM	FORCES .								
ÊLEMEI	NT LOAD	VALUES	NODE	AXIAL	FY	F2	TORSION	MY	M2 ST	BFAG
:	31 1	FCRCE FORCE	22 21	43.5810 -43.5810	C.474804 C.474804	-1.25854 1.25654	2 176148E-02 2 176148E-02	2€0.689 •8 98101	-47.5806 -47.3903	e
:	31 Z	FORCE FORCE	22 21	43 5810 43 5810	-0.474804 0.474804	-1.25854 1 25854	·2 175148E·32 2 175143E·32	260.689 -6.96101	-47.580€ -47.3803	э
:	31 3	PORCE Porce	22 21	22.5748 -22.5748	-0 400470 0 400470	-3 97150 3 97158	-1.212585E-02 1.212586E-02	600 C 9 7 194 218	-4C.1970 -39 8970	o
	31 4	FORCE	22 21	43.581C -43 5810	-0.474804 0.474804	1 25854 1.25854	-2.176148E-C2 2.176148E-C2	260 689 -8.98101	·47 5806 ·47 3803	c
:	31 5	FORCE	22 21	22 5748 -22 5745	-0.400470 0.400470	-3.97 156 3.97 156	·1.212586E·C2 1 212588E·02	6C0.097 194.218	-40,1970 -39,8970	0
	3: 6	FORCE	22 21	43 5810 -43 5810	-C.4745C4 C 4745C4	-1.25854 1 25854	·2 176146E·02 2 176148E·32	260.689 -8.98101	-47.3806 -47.3802	0
	31 7	FORCE	22 21	43 5810 43 5810	-0 474804 0 474804	-1 25854 1 25854	-2 176145E-02 2.176149E-02	260.689 -8.98101	47.5806 -47.3803 -	С
:	31 6	FORCE	22	43.581C -43.581C	-0.474804 0.474504	-1 25854 1 25854	·2.176146E·02 2.176146E·02	260 689 •8.98101	-47 5806 -47 3803	0
:	÷ اد	FORCE	22 21	22.5748 ·22.5748	-0.400475 0.400475	-3,97158 3 97158	·1.212589E·C2 1.212588E·02	600.097 194.216	40.197C - 39.697C	o
	31 10	FORCE	22 2:	42 5510 43.5810	·0.474804 0.474804	1.25854 1.25854	-1 176148E-02 2 176148E-02	260.689 -E 98101	·47.5906 ·47.3863	0
	31 11	FORCE FORCE	22 21	22.5748 22.5748	-C 400476 C 400470	-3.97158 3.97155	-1 212585E-02 1 212585E-02	600. 097 194.218	-40.1970 -39 6970	С
:	31 12	FORCE	22	43 5810	0 474504	-1 25854	·2.176145E-02	260 689	47 5806	

COLU	MN (FORCE LOAD	21 REFRÉSEI	-43.5810 NTS THE DOF WH	C.CT48CC ICH HAS MAXIMUM	1.25854 Value	2.176148E-02	-8 98101	-47 3803
3D BE MAXI	EAM F	ORCES VALUES	FOR ALL	STEFS NOTE	MAXIMUM VALUES	WITH THE CTH	ER DOFS FORCES ARE	PRINT CUT	AT THE SAME TIME
ELEMENT I	OAL	FORCE	NCDE	LAIXA CO+Z00CD00 C	FY	FZ 11 2022	TORSION 7 697 86 2 F : 0 2	MY 102151	M2 -: 206969E-15
		FORCE	22	C. 300003E+00	8.890458E-16		-2 697562E-32	1218.93	-1 790235E-15
32	3	FORCE	23	C.000CCOE+0C C.0000COE+0C	·5 666841E-15 8.666841E-18	18.6095	3 990961E+02 •3.990961E-02	2120.18 1601.72	·1.982789E·15 ·2.075597E·15
32	4	FORCE	23	C.CODOOCE+00	-5.666841E-18	-18 60 9 5	3 9909612-02	2120 18	1.9827895-15
32	5	FORCE	22	0 COODDCE+00 0 0CC0D0E+00	8.666841E-18 8.666841E-18	18 6095	-3.990951E-C2 3.990961E-C2	1601 72 2120.18	-2.075597E-15 -1 982789E-15
	-	FORCE	22	0 00000E+00	8.65€841E-18	18.6095	-3 990961E-02	16C1.72	·2 C75597E-15
32	e	FORCE	23	0.000000E+90 C.000CCOE-9C	-8.556541E-15 5.666841E-15	18.6095	3 990961E+02 -3.990961E-02	2120.18	·1 982789E-15 -2.075597E-15
32	5	FORCE	23	C.000CCOE+0C	·8 890458E-18	·11.2022	2 697862E.02	1021.51	-1 706968E-15
32	э	FORCE	22	0.00000E+00 0.00000E+00	8.666841E-18	11.2022	3.9909612-02	1219.93	-1.982789E-15
		FORCE	22	0.C0090CE+00	8.6668412-18	18 6095	·3.990961E·C2	1601 72	-2.075597E-15
32	10	FORCE	¥ 3 2 2	0 000000E+00	8.666841E-18	18 6095	-3 990961E-02	1601.72	-2.075597E-15
32	::	FORCE	23	0.00C000E+00	-8 006541E-12	18.6095	3 990961E-02	2120.18	-1 982789E-15
32	12	FORCE	23	C.000CC0E-0C	5 666941E-15	18.6095	3 990961E-02	2120.10	-1 982789E-15
COLU	JMN .	FORCE LOAD)	22 REPRESE	C COUCCOE+OC NTS THE DOF WH	B 666841E-15 ICH HAS MAXIMUM	18.6095 VALUE	-3.990961E-02	1601.72	-2.075597E-15
IE3D BI	EAM F	ORCES.							
MAXI ELEMENT 1	IMUM LCAD	VALUES	FOR ALL NODE	STEPS NOTE AXIAL	MAXIMUM VALUES FY	WITH THE OTH FZ	ER DOFS FORCES ARE TORSION	PRINT OUT MY	AT THE SAME TIME MZ STEFA
2.3	2	FORCE	24	C. 000CC0E+0C	-3 409461E-15	-7 2330E	-6.211496E-03	875.060	1.136244E-15
		FORCE	23	C.0000C0E+0C	3 4C84€1£-18	7 23305	5.211496E-03	571.555	·1.229C52E-15
33	3	FORCE	24	0.000000E+00	·3.408461E·18	-7.71996	-6.868248E-03	936.256	1.150122E-15
		FORCE	23	0 000000E+C0	3.406461E-16	7.71998	6.868240E-03	607.740	·1.242929E-15
33	4	FORCE	24	C.300003E+00	-3.409461E-18	7.71958	-6 888246E-03	936.256	1 150122E-15
		PORCE	23	0.000000 E •90	2 MODMETE.12	11226	0.0002492-03	001 160	1.2443232.70
33	5	FORCE	24	0.000000E+00 0.000000E+00	-3.408461E-18	7.71993	6.859248E-03	936 255 607 740	-1.150122E-15
					5.1001012 10		0.0002002 00		1.0000000000000000000000000000000000000
33	6	FORCE	24	0 000000E+00 0 000000E+00	-3.408461E-18 3.406461E-18	-7,71998 7,71998	6.883248E-03 6.863246E-03	936.25€ €07.740	-1.150122E-15 -1.242929E-15
	•	FORCE	24	0.0000005.00	-3 408461E-18	-7 22328	.4 711/665.01	875 061	1 13624/2.15
	5	FORCE	23	C.0000C0E+0C	3 408461E-18	7.23308	6.211496E-03	571 555	1 229C52E-15
13	9	FORCE	24	0.0000002+00	·3.4084612·18	7.71999	-6 888248F-C3	936.256	-1.350122E-15
		FCRCE	23	G.CC00000E+00	3.408451E-18	7 71998	6.888248E.C3	607.740	·1.242929E ·15
53	10	FORCE	24	0 00000E+C0	·3.408461E-18	-7.71996	·6 885248E·02	936.25 6	·1 150122E-15
		FÓRCE	23	0.00000E-00	3 408461E-18	7.71998	€ 888248E+03	607.740	·: 242929E·15
33	11	FORCE	24	C.0000CDE+00	·3 408461E-15	-7 71998	·6.888249E-03	936 256	1.150122E-15
		FORCE	23	0.0000000000	3.408461E-18	7.71995	C.5682682.UJ	607.740	·1.242929E.15
33	:2	FORCE	24	0.000000E+00 0.000000E+00	3.408461E-18	-7 71996 7.71998	6.888248E-C3 6.888248E-C3	936.256 607.740	-1.150122E-15 -1.242929E-15
COL	UMIN :	LCAD)	REFRESE	NTS THE DOP VH	CE HAS MAXIMUN	VALUE			
3D BI MAX	EAM F	ORCES.		STEPS NOTE:	MANTNER VALUES	WITH THE OTH	PR DOES FORCES ARE	PRINTON	TT THE SAME TIME
ELEMENT I	LOA		NODE	AXIAL	FY	FZ	TORSION	МΥ	MZ
34	2	FORCE	16	0.000000E+00	5.854692E-18	C.186497 C.186497	-5.615C24E-C2 5.615C24E-C2	-18.6601 -18.6393	3.46944"E-16 3.469447E-16
34	2	FORCE	16	0 000000E+00	4.552649E-18	C.321330	-7.412100E-C2	- 12.6797	-1.276756E-15
34	4	FORCE	24 16	0 000000E+00	4.552649E-18	0.321230	7 412100E-02 -0 350086	-26,6475	-1 350023E-15 -1 215174E-15
14	e	FORCE	2	0.000000E+00	2 Z22614E-16	0 265300	0 150086	-26 4126	-1 307982E-15
3.4	2	FORCE	24	C.0000C0E+00	4.553649E-18	-0 321330	7.412100E-02	-31 5876	-1.360023E-15
34	6	FORCE	16	0.000000E+00 0.00000E+00	-4.770493E-18 4.770493E-19	C.274560 -C.274543	-9.130834E-02 8.130834E-02	-27.6672 -27.744P	-1.308E49E-15
34	6	FORCE	.6	5 000000E+00	5.954692E-18	0.196497	-5 615024E-CZ	16.6601	3.469447E-16
14	9	FORCE FORCE	24 16	0.000002+00 0.00000E+01	-5.854692E-16 -4.553649E-18	-0.186497 0.321230	5 615024E-02 •7 412100E+02	-18.6393 -32.6787	1.469447E-15 -1 27675EE-15
		FORCE	24	C 000000E-00	4 553649E-15	-0 321230	7 412100E-02	31.5874	-1 360023E-15
- 4	10	FORCE	15	0.000000E+00 0.00000CE+00	2 222614E-19 2.222614E-18	0 265±00 -0.265300	0.250086	-26 6475 -26 4126	-1.2151/4E-15 -1.307982E-15
34	11	FORCE	16	0.000000E-00	-4.553649E-18	0.321333	-7.412100E-C2	32.6757	-1.276756E-15
34	12	FORCE	24	C 0000002+00	4 770490E-18	0.274560	·9 130534E-02	27.6672	-1.309849E-15
15	,	FORCE	24	0 000000E+00 0.000000E+00	4 77049CE-15 5 854592E-15	-5.274560 0.459117	9 130634E+02 -1 964595E-02	27 2443	-1 401657E-15 3 469247E-16
	-	FORCE	23	C.0000C0E+00	5 854592E-16	-0 459:17	1.964595E-02	45 9553	3 4694472-16
35	3	FORCE	22	0 C0000CE+00 0.C0000CE+00	-2.222614E-18 2.222614F 18	C 613131 -C.613121	-0.128913 0.128913	59 4780 63 1483	-1.215174E-15 -1.307952E-15
35	÷	PORCE	17	0 0000062+00	2.2226142 18	C.513131	C.128913	59.4780	1.215174E-15
35	5	FORCE	23 17	0 00000E+00	2.222614E-18 -2.222614E-18	0.613131 0.613131	C.128913 -0.128913	63.1482 -59.4780	-1.30/962E-15 -1.215174E-15
1 5	2	FORCE	52	0.000000E-00	2 222614E-15	-0 613131	0 128913	·63.1483	1 3079322-15
	0	FORCE	23	0.000000E+00	4 770490E-16	0.536155	3.353434E-02	-55 1748	1.401657E 15
35	e	FORCE	17	5.00000E+00 0.00000E+00	5.854692E-18	C.459117	-1.9645952-02 1.9645957-02	-44 36E1	3.469447E-16 3.469447E-14
35	9	FORCE	1-	000000E+C0	-2.222614E 18	0 613131	-C.128913	-59.4780	1.215174E-15
35	10	FORCE FORCE	23 17	0 000000E+00 0.000000E+00	2 222€14E-18 -2 222€14E-18	-0.613131 5.613131	C 128913 -0 128913	-63.1483 -59.4780	-1 307982E-15 -1 215174E-15
		FORCE	23	0.0000002-00	2 222614E-18	·0 613131	0 126912	-63.1483	·1 3C7992E-15
د د	11	FORCE	23	0.000000E+0C	2 222614E-18 2 222514E-18	0 €13131 -0.€13131	-J.128913 0.128913	-59 478C -53.1483	-1.∠15174€-15 -1.307982E-15
35	12	FORCE	17	0.0000002+00	-4.770490E-18	0.536155	3.383434E-02	52.0561	1.3086492-15
36	2	FORCE	10	0.000000E+00	5.954692E 18	-0.435065	2.138706E-02	43.5364	3.459447E-16
36	1	FORCE	22 15	0000002+00 0000007+00	-5 654692E-16 -2,222614F-18	0.435063	-2 139706E-02 3 505636F-02	43.5061 57.597:	3 469447E-16 -1.215174F-15
	-	FORCE	22	0 0000000000	2.222614E-15	0 5759€8	-3 5C5635E-02	57.5965	-1.307982E-15
20	6	FORCE	22	C.0000C0E+0C	4.553649E-18	-0 397664 C 397664	4.567978E-02	39.7666 39.7662	-1 2/6/56E-15 -1.360023E-15
a -	=	FORCE	1.9	0.0000007.00	-7 772614F-18	575965	1 3036367-02	57 507-	1 215174E-15

36 36 36 36 36 36	6 8 9 10 11 12 22	FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	22 16 22 16 22 16 22 18 22 16 22 16 22 16 22 18 22 18 22 8 22	0.336000E+6C C.03000E+0C 0.36003E+0C 0.60030E+03 0.00300E+03 0.00300E+03 0.00300E+03 0.00300E+03 0.35000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.36000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.30000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E+06 0.3000E	2.222614F-16 -4 770490E-18 5.854692E-16 -5 854692E-16 2.222614E-18 4 553649E-18 4 553649E-18 2.222614E-18 2.222614E-18 2.222614E-18 2.222614E-18 2.222614E-18 4.770490E-18 4.770490E-18 4.770490E-18	0 575968 0 52469 0.435063 0.435063 0.435063 0.575968 0.575968 0.397664 0.397664 0.397664 0.575966 0.575966 0.575966 0.524469 VALUE	-3 5056382-02 1.12755E-02 -1 12735E-02 2.138706E-02 3.556538E-02 3.55638E-02 4.5679782-02 4.5679782-02 3.55638E-02 1.12785E-02 1.12785E-02	57 5965 52 4471 52 4466 43 5064 43 5064 43 5064 57 5965 39 7662 57 5971 57 5965 52 4671 52 4666	-1 2C7962E-15 -1 368649E-15 -1 4C1657E-15 3.469447E-16 3.469447E-16 1.215774E-15 -1.207982E-15 -1.276756E-15 -1.21574E-15 -1.21574E-15 -1.307982E-15 -1.308549E-15 1.401657E-15	
STABI MAJ ELEMENT	LITY B XIMUM LOAD	VALUES	FORCES FOR ALL NODE	STEPS NOTE AXIAL	MAKIMUM VALUES FY	WITH THE OTHER F2	DOFS FORCES ARE TORJION	PRINT OUT A	AT THE SAME TIME MZ F	'LF,3P
72	1	FORCE FORCE	28 16	-82.6114 82.6114	16 4665 16 4665	8.791081E-02 -8.791061E-02	4.44379 -4.33578	-9 72665 -2.75615	702.093 1775 73	
27	2	FORCE FORCE	28 16	-52 6114 52 6114	16.4666 16.4666	8 791081E-02 -5.791051E-02	4 44379 -6 33576	-9 92445 -2.76415	702.093 1775.71	
37	3	FORCE FORCE	28 16	82.6114 82.6114	16.4666 16.4665	8.791081E-02 -8.791081E-02	4.44379 -4.33576	-9.72445 -2.76415	702.053 1775 73	
37	4	FORCE FORCE	28 16	-82.6114 82 6114	16.4566 16.4566	6 791081E-02 -8 791081E-02	4.44379 -4 33578	-9.72445 -2.76415	702 093 1775.73	
37	5	FORCE FORCE	25 16	·52.€114 82.6114	16.4666 16.4656	8.791081E-02 8.‴91081E-02	4.44379 4.33578	-9.72445 -2.76415	702 C93 1775.73	
37	5	FORCE FORCE	28 16	·82.6114 82.6114	16 4665 ·16 4666	8.791081E-02 •8.791081E-02	4.44379 -4,33578	-9 72665 -2.76415	702 093 1775 73	
37	7	FORCE FORCE	28 16	-82.6114 62 6114	16.46€€ 16.4666	8 791091E-02 -8 791081E-02	4 44379 -6,33578	-9.72445 -2.76415	702.093 1775.73	
37	e	FORCE FORCE	25 16	62.6114 82.6114	16.4665 ·15.4666	8.791081E-02 -6.791081E-02	4,44379 -4,33576	-9.72445 -2 76415	702.093 1775.73	
37	э	FORCE FORCE	28 15	82.6114 82.6114	16 4666 16.4668	8.791081E-C2 -8 791081E-C2	4.44379 -4 33578	-9.72445 -2 76415	702.093 1775.73	
37	10	FORCE FORCE	28 16	82 6114 92 6114	15.4666 16.4666	8.791081E-02 -8.791061E-02	4.44379 4.3357ē	-9.72445 -2.76415	7C2.093 1775.73	
37	11	FORCE FORCE	25 16	46.5993 46.5893	5 24866 5 24866	-1.909424E-02 1 909424E-02	3,76748 -3,74988	-3.12123 6.26663	223 554 566.390	
37 00	12 LCMN	FORCE FORCE (LCAD)	28 16 REPRESE	-82 6114 52.6114 NTS THE DOF WH	16.4666 -15.4666 ICH HAS MAXIMUM	8.791091E-02 -5.791081E-02 VALUE	4.44379 4.33578	-9.72445 -2.76415	7C2.093 1775.73	
IESD I MAI	BEAM I XIMUM	FORCES	FOR ALL	STEFS NOTE	MAXIMUM VALUES	WITH THE OTHER	DOFS FORCES ARE	PRINT OUT /	AT THE SAME TIME	
ELEMENT 36	LOAD	FORCE	NODE 35	AXIAL •10€ 468	FY 12.3150	FZ 0.136014	TORSION 1 644565E-02	MY -15.3894	MZ STB 566.033	FAG
		FORCE	7 4							
38	2	FORCE	35	106.468	12.3150	C.136C14	-1 844565E-02 1.844565E-02	-2 0126€ -16.3894	1281.22 566 033	0
8 C 3 C	2 3	FORCE FORCE FORCE	35 24 35	106.468 -106.468 106.468 -106 468	12.3150 12.3150 12.3150 12.3150	C.136014 C.136014 C.136014	-1 844565E-02 1.844565E-02 -1.844565E-02 1.844565E-02	-2 G126€ -16.3894 -2.01266 -18 3894	1281.22 566 033 1261 22 566.033	o C
3E 3E 3E	2 3 4	FORCE FORCE FORCE FORCE FORCE	35 24 35 24 25	106.468 -106.468 -106.468 -106.468 -106.468	-12.2150 12.3150 -12.3150 -12.3150 -12.3150 12.3150	C. 136014 -C. 136014 -0. 136014 -0. 136014 -0. 136014	1 644565E-02 1.844565E-02 1.644565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02	-2 C1266 -16.3894 -2.01266 -18 3894 -2.01266 -18.3894	1281.22 565 023 1281 22 566.033 1281.22 566 033	0 C 0
38 32 38 38	2 3 6 5	FORCE FORCE FORCE FORCE FORCE FORCE	35 24 35 24 15 24 35	106.468 -106.468 -106.468 -106.468 -106.468 -106.468 -106.468	- 12.2.50 12 3150 -12 3150 -12 3150 -12 3150 -12 3150 -12 3150 -12 3150 -12 3150	C.136014 C.136014 D.136014 C.136014 C.136014 C.136014 C.136014	-1 644565E-32 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-03 1.944565E-02	-2 C1266 -16.3894 -2.01266 -18 3894 -2.01266 -18.3894 -2 01266 -18.3894	281.22 566.033 1281.22 566.033 1281.22 566.033 1281.22 566.033	0 C Q Q
96 38 38 38 38	2 3 5 5	FORCE FORCE FORCE FORCE FORCE FORCE FORCE	24 35 24 35 24 35 24 35 24 35	105.465 106.465 106.465 106.465 106.465 106.465 106.465 106.466 106.466 106.466 106.466	- 12.2150 12 3150 -12 3150	C.136014 C.136014 O.136014 O.136014 C.136014 C.136014 C.136014 O.136014 O.136014 O.136014	-1 644565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02	-2 C1266 -16.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894	281.22 566 033 1281 22 566.033 1281.22 566 033 1281 22 566.033 1281.22 566.033	0 C 0 0
8 3 3 3 5 3 5 3 5 3 5	2 3 5 5 6 7	FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	24 35 24 15 24 35 24 35 24 35 24 35	100,465 106,465 106,465 106,465 106,465 106,465 106,468 106,468 106,468 106,468 106,468	- 12.2.50 12 3150 -12 3150	C.136014 C.136014 O.136014 O.136014 C.136014 C.136014 C.136014 C.136014 O.136014 O.136014 C.136014 C.136014 C.136014	-1 644565E-02 844565E-02 844565E-02 844565E-02 844565E-02 844565E-02 844565E-02 844565E-02 844565E-02 844565E-02 844565E-02 844565E-02	-2 C1266 -16.3994 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894	281.22 566.033 1281.22 566.033 1281.22 566.033 1281.22 566.033 1281.22 566.033 1281.22 566.033 281.22 566.033	0 0 0 0 0
26 28 38 38 38 38 38 38	2 3 5 5 7 5	FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	24 35 24 35 24 35 24 35 24 35 24 35	100,465 106,466 106,466 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106	- 12.2.50 12 3150 12 3150	C.136014 C.136014 O.136014 O.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014	-1 644565E-32 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02 1.844565E-02	-2 C1266 -16.3994 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -16.3894 -2.01266 -18.3894 -2.01266 -18.3994 2.01266 -16.3894 -1.2266 -16.3894 -1.2266 -16.3894 -2.01266 -16.3894 -2.01266 -16.3894 -2.01266 -16.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894	1281.22 566 033 1281.22 566 033 1281.22 566 033 1281.22 566 033 1281.22 566 033 1281.22 566 033 1281.22 566 033 1281.22 566 033 1281.22 566 033 1281.22 566 033	0 0 0 0 0 0
38 32 32 32 32 35 35 35 35 35	2 3 5 6 7 5 9	FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	24 35 24 35 24 35 24 35 24 35 24 35 24 35 24 35 24 35	100,455 -106,466 106,466 106,468 -106,468 -106,468 106,468 106,468 106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468 -106,468-106,468 -106,468 -106,468 -106	- 12.2.50 12 3150 12 3150 - 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38 32 32 32 32 35 35 35 35 35 35	2 3 6 7 5 9 9	FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE FORCE	25 24 35 24 35 24 35 24 35 24 35 24 35 24 35 24 35 24 35	100,465 106,466 106,466 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106,468 106	- 12.2.50 12 3150 12 3150 -12 315	C.136014 C.136014 O.136014 O.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014 C.136014	-1 644565E.02 844565E.02 844565E.02 844565E.02 844565E.02 844565E.02 844565E.02 844565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02 84565E.02	-2 C1266 -16.3994 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3894 2.01266 -18.3894 -2.01266 -18.3894 -2.01266 -18.3394	1281.22 566 033 1281.22 566 033 1281.22 566 033 1281.22 566.033 1281.22 566.033 1281.22 566.033 1281.22 566 033 1281.22 566 033 1281.22 566 033 1281.22 565 033 565 033	0 0 0 0 0 0 0 0
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	42	2	FORCE	32	0 000000E-CO	1 70640	C.213562	1.769595E-C2	16.0172	127 980	
	42	3	FORCE	21	0 000005E-00 0 000005E-00	1.70640	-C.213562 0.213562	-1.769595E-C2 1.769595E-C2	-16.0172	-127 98C -127 98C	
			FORCE	21	0 0000002-00	1 70640	0.213562	1.769595E-C2	-16.0172	-127 980	
	42	4	FORCE	32 21	0 0000082+00	1.70640	0 213562	1 769595E-C2 1.769595E C2	-16.0172	-127.98C 127.98C	
	4 2	5	FORCE	32	0.00-100000 0	·1.7064C	0.213562	1.769595E-C2	-16 0172	-127 980	
	42	e	FORCE	21 32	0 000000E+00 0 000000E+00	1 7064C -1.7064C	· 0.213562 (.213562	1.769595E+02 1.769595E+02	16.0172	-127 980 -127 980	
		=	FORCE	21	0 000005E+C0	1.79€40	6.213562	1.769595E-02	-16.0172	-127.980	
	4 2	2	FORCE	21	0 000000E+C0	1.70640	0.213562	1 /69395E-02 -1.769395E-02	16.0172 -16.0172	-127 980 -127 980	
	42	ç	FORCE	32	0.000002+00	1.7066C	0.213562	1 7695955-02	-16.0172	-127.980	
	42	15	FORCE	21 32	0 J00000E+CO 0 000000E+CO	1 70640 -1.70640	-0.213562 6.213562	-1.769595E-02 769595E-02	-1€.0172 -1€.0172	-127.980 -127.980	
		17	FORCE	21	0 000000E+00	1.70640	0 213562	-1 769595E 02	-16.C172	-127.980	
	44	* 1	FORCE	21	0 000000E+00	1.70640	0.213562	1.759595E-02 1.769595E-02	-16.0172 -16.0172	-127.950 -127.950	
	42	12	FORCE	32	00+2000000 C	1,7064C	0 212562	1 769595E-C2	-16.C172	127.980	
	4 3	I	FORCE	2	5 564105E-15	5.801498E-17	3 949715E-17	0 000000E+00	-16.0172 -3 016607E-15	-127.960 3 948231E-15	
	43	2	FORCE	21	-5 504105E-15 5 504105E-15	5.801498E 1" 5.801498E 1"	-3.949715E-17	6 CODDGCE+00	-3.016607E-15	4.252675E-15	
		-	FORCE	21	-5 504105E-15	-5 801496E-17	-3 949715E-17	0 CC000GE+00	-3 016607E-15	4.2526752-15	

43	3	FORCE	20	55	041053	E-15	5.80	149 5 E	17 3	9497 9497	15E-17	C.0	00000E+00	-3.01660	7E-15	3.945	231E-15	
43	5	FORCE	20	5.50	04105E	15	5 803	1498E -	17 3	94913	15E 17	0.0	00000E+00	3.01660	7E-15	3 9482	231E-15	
43	£	FORCE	20	5.50	04105E	2-15	5 80	1498E -	17 3	.9497	15E-17	0.60	00000E+00	-3.01660	7E-15	3 9482	231E-15	
43	7	FORCE	20	5.50	C4105E	2-15	5 80.	1498E -	17 3	9497	15E-17	1 0	00000E+00	3.01660	7E-15	4.252	231E-15	
4.3	٤	FORCE	21	- 5.5	041058	2·15 2·15	5 80. 5 80	1498E - 1498E -	17 - 3	9497	155 17 155-17	0.0	20000E+00	-3.01660 -3.01660	7E-15	4 2526	675 <u>5</u> -15 2312-15	
43	e.	FORCE	2: 20	- 5.5(041058 041059	2·15 · 15	5 80. 5 80:	1498E - 1498E -	17 - 3	.9497: .9497:	15E-17 15E-17	0 CI 0 CI	10000E+00 10000E+00	-3 01660 -3 01660	TE 15 TE 15	4 2520	6752-15 2312-15	
43	11	FORCE	21	-5.5(04105E 04105E	5	5.80	1496E -		.9497 .9497	15E-17	0 01	00000E+00 00000E+00	-3 01660 -3 01660	7E-15	4 2526	5752·15 2312·15	
	• >	FORCE	21	·5 50	C4105E	- 15 -	5.80	498E-	17 3	.9497	SE-17	5.00	00+300000	-3 01660	7E-15	4 2526	575E 15	
• • •	••	FOPCE	2:	5 50	241051	- 15	5.50	14982.	17 - 3	.9497	15E · 17	0.00	000002+00	-3 01660	7E-15	4 2526	575E-15	
	1	FORCE	19 19	-3.14	452032	· 15	6.33	2418E- 2418E-	18 18 7	.3351	36 E · 17	() O	000CCE+00	-5 60227	12-15	-6.2199	964E-16	
44	2	FORCE FORCE	20 19	1.76	691768 691768	2·15 · 2·15	∋.540 ∋.540	C979E. C979E.	18 4 18 · 4	.2316:	38E·17 39E·17	C.0: C.0:	000CCE+00 00000E+00	· 3 23207 · 3 23207	9E-15 9E-15	-9.4361 -9.4361	896E·16 896E·16	
4 4	3	FORCE	2C 19	3.14 -3.14	65203E	· 15 · · 15	6.33	2419E· 2419E·	18 7 18 7	.3351	B6 E · 17 B6 E · 17	C.0: C.0:	00000E+00 00000E+0C	5.60227	1E·15 1E·15	·9.263	423E·16 984E·16	
44	5	FORCE	20	3.14	45203E	2-15 -	6.333	2418E-	18 7	.3351	B6 E · 17	¢.5	00000E+0C	-5.60227	1E-15	-9.263	123E-16	
44	6	FORCE	20		69176E	- 15	9 540	0975E.	18 4	2318	38E-17	¢.5	00000E-CC	-3.23207	9E-15	-9.4360	896E · 16	
44	7	FORCE	20	3.14	52035	-15	6 33	2418E ·	18 7	3351	B€ E · 17	0.00	OCCOOE-CC	-5.60227	1E · 15	9.263	423E-16	
44	5	FORCE	19 20	-3.14	69.76	· 15	6 33. 9 54:	2418E. 0979E.	18 -7	2316	56 2 · 1 58 2 · 17	0.00	00000E+00	-5.60227	1E-15 9E-15	-9.4364	884E-16 896E-16	
વાર	ç	FORCE	19	3.14	691768 452038	· 15 · 15	÷ 54: € 33:	C979E· 2418E·	15 · 4 15 -	2315: 3351	38E-17 86E-17	0.0	DCCODE-CO	-3.23207	9E-15 1E-15	-9.4361 -9.2€34	E96E·1∈ 423E·1ċ	
44	11	FORCE FORCE	19 20	·3.14 3.14	452C38 452C38	1-15 1-15 -	€ 33; € 33;	2418E· 2416E·	18 -7	3351	86 E · 17 86 E · 17	0.01	00+306000	-5.60227	1E-15 1E-15	5.2189 9.263	984E-16 423E·16	
41	12	FORCE	19 20	-3.14	452038 691768	-15 -15 -	6 332	2418E-	19 .7	2351 2318	86E-17	0.01	00-20000	-5.60227	1E-15 9E-15	-6.2189	984E·16	
		FORCE	19	-1.76	69176E	15	9.54	979E.	16 4	.2319	38E · 17	0.00	00000E+00	3.23207	9E-15	-9.4361	896E-16	
• •	-	FORCE	20	-257	.150		0.50	3373		4.141	33	-1.49	6732E-02	-293.41	6	34 7	569	
45	2	FORCE	20	- 257	7.150		C.50	3373		4.141	53 53	1 49	96732E.02 95732E.02	236.30	6	29.6.	369 549	
45	3	FORCE	36 20	257	7.150		C 50: C 50:	3 3 7 3 3 3 7 3		4.1414	53 63	149	96732E.02 96732E.02	·236.30 ·293.41	e	29.6 34.7	369 549	
45	4	FORCE FORCE	36 20	257	7.150		C.50 C.50	3373 3373		4.141	C 3 C 3	143	96732E-02 96732E-02	-236.30 -293.61	8 €	29 61 34.75	369 549	
45	5	FORCE	3€ 20	251	7.150 7.150	-	0.503	2373 2373		4.1410	23 23	- 43	96732E.02	-236.30	8	29.61 34.75	369 549	
≰5	6	FORCE	36	257	7.150		0.50	3373		<.141(/ 141)	3		6732E-02	-236.30	8	29.6	369	
45	7	FORCE	36	257	7.150		0.50	3373		4.1410	03		6732E-02	-236.30	8	29.6	369	
45	ŝ	FORCE	36	25	7.13C		0.50	3373	-	6.1410	03	1.49	6732E C2	-236.30	8	29.6	369	
45	e.	FORCE	2C 36	257	7.15C 7.15C	•	0.50	3373 3373	•	4 410	03 03	1.49	96732E-C2 96732E-C2	-293.41 -236.30	6 8	34.75	549 369	
45	10	FORCE FORCE	20 36	- 257 257	7.15C		0.50	3373 3373		4 1410 4 1410	03 03	-1.49 I.49	96732E-02 96732E-02	-293.41 -236 30	6 8	34.75 29 6	549 369	
4 4	11	FORCE	2C 36	- 257	7.150	-	0 5C	3373	•	4 :41:	22	1.49	6732E-02	-293 41 -236 30	6 8	34 75	549 169	
	••	FORCE	20	- 257	7.150	-	0 50	3373		c 141	22	-1.49	6732E.02	-293 41	6	34.75	549	
40	12	FORCE	20	- 257	.150		0 503	3373		e 141(03	1.49	6732E-02	-293 41	6 6	29.6.	549	
SPRIN	G FO	RCES .	М	AKIMU	M LOAD	AND	SPL	AT MA	XIMUM	LOAD	NOTE	MAXIM	M VALUES	MAY NOT C	CCUR S	SIMULTAN	EOUSLY	
ELEMENT L	CAD C	TYP BENDING-	PE NC • Y	DEI NO 37	DDEJ 36	FC 236.	BRCE 306	DI	SPLACM 2 3630	ENT 83E · 04	st:	IFFNES	5					
GOEL	FORC	ES .	MAX	KIMUM :	LOAD A	ND DIS	SPL AT	T MAXI	MUM LC	AD NO	DTE. M	MUMIXA	VALUES MA	Y NOT OCC	UR SIN	ULTANEO;	SLY	
ELEMENT L	DAD	TYF AX I A	FÉ NO Al	DEI NO 29	DDEJ 16	-97 7	AS2	51	SPLACM	ENT 64E-02	ST	IFFNESS	5					
48	Ċ	AXIA	AL AI	34	24	119	229	:	7.1377	50E - 01	2							
50	ò	AX IA	4L	30	22	41 9	547		3.4120	61E C	2							
51		AA14	- L	31	21.				3.138/	192-0.								
ELEMENT L	DAL	JNT : JN	NT - 2	JNT · ?	JNT - 4		MENT	DISPL	RCTA	TICN	LOADS	SHEAD	R SHE	AR DISFL	TNOI	AXIAL	AXIA	L DISFL
52	2	16	17	29	30	· 3634	65	- 6	. 04778	5E-04	:1	€821	€,57	1208E-03	2 6	2316	6 557	9C1E-02
53	z	22	23	54	33	• 3593.	55	- 5	.91432	ζE 04	• 39	.3444	-2.21	3121 E-3 2	2 4	14160	6 104	C12E-32
R/C SHEAL ELEMENT L	R WA. DAD	LL FORCES	5 NT-2	MZ JNT - 3	NUMIXA AXIMUM	LCADS	S AND SHEAR	DISPL	. AT MA SHEAR	XIMUM CISPL	LCADS	NOTE AXIAI	MAXIMUM LI AXI	VALUES MA Al displ	YNOT	AXIAL2	IMULTANEC AXIA	USLY L DISPL 2
54	2	16	24	35	28	6 644	10 E	4	.98304	sE·C3	0.4	84605	2.42	3024E-02	0 57	6645	2 883	227 E - 02
: STRUCTURE. 07/27/94	• •	THREE-ST	FORY	BOLIDI	ING											1	IME 16:	45:06, DATE.
SOLUTION .		NONLINE	AR CY	CLE AN	NALYSI	S WITH	(UNB)	ALANCE	D FORC	ES				Т	IME :	6.45 08.	DATE C	7/27/94
, LCADING	¢	с 7	PEAK	DUCTI	LITIES	AND E	XCUR	SION R	ATIO'S									
TESOBEAM	20	CTILITY (E	BASED	ON DE	EFINIT	ION 1	:											
ELEM# 2		IMYA UCCODU	D	OCCOD	ο.	1MZA: 00000	с	30900	.	MX 01-000	C (FX : 00000						
I EBOBEAM	Dυ	CTILITY (E	BASED	C ON DE	EFINI1	ICN 1												
ELEM#		(MYA) 500000	ο.	MYE: . 60000.	ο.	(M2A) 00000	o	(MZE)	, p	1MX 0000	э. •	FX : 20005						
LEADBEAM	DU		BASEL	ים אכ מ	דיאד=	TON 13				-	-							
ELEM#		: MYA -		MYE:		MZA	ò	MZE:		IMX CODA		FX						
10		0.00000	ő.	.00000	ə.	000000	õ	00000	6	00006	0.0	00000						
IE3DBEAM	DU	CTILITY (E	PASED) ON _01	EFINIT	ION 1.												
ELEM# 18		MYA: 0.00000	Ο.	1MYB 1	7	; MZA 42444	5	MZB .77259	о.	1 MX 00000	0.0	FX 20000						
I E3DBEAM	DU	CTILITY (E	BASEC	> ON DI	EFINIT	10N 10	:											
EL EM= 2.		- MYA: 6 00000	ς.	(MYB) 000000	-	:MZA1 98162	é	:MZP .106:/	c	:MX 00000	0 0	(FX : 20000						
ESDREAM	р.4	CT1177V/=		ים אס כ	 FFTNT-	NOT												
ELEM=	22	MYA		MYE		MZA!	•	IMZB -	,	(MX - 1)		FX :						
22		2 001.00		10.0.000		H 4/4+												

•

IE3DREAM DUCTILITY (BASED ON DEFINITION 1): :MYA MYP: MZA; 0.00000 0.00000 7.35037 HZE: EMX G FX : ELEM# 24 5.60697 0.00000 0 00000 . I ERDEEAM DUCTILITY (BASED ON DEFINITION 1) IMZE : 1 MX ELEM# (MYA. (MYB) (MZA) 5 00000 0 00000 0.00000 ¦≌χ 0.00000 0.00000 27 0.00000
 LE3DBEAM
 DJCTILITY(BASED ON DEFINITION 1):

 ELEM#
 MYA:
 IMYB:
 IMZA:

 25
 0.000000
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 1 MX 1 0.000.00 (FX) 0.00000 0.00000 IE3DBEAM DUCTILITY (BASED ON DEFINITION 1) : ELEM# .MX : 0 00000 IMZE. EFX : 0.00050 0.00000 IEBOBEAM DUCTILITY BASED ON DEFINITION 1): ELEM# I MY A 1 HYB. 1 MZ A MZE (1 MX : FX (MYA) (MYB (MZA 0.00000 0.00000 0.00000 0 00000 33 0 00000 0.00000 IE3DBEAM DUCTILITY (BASED ON DEFINITION 1): ELEM# 1MYA1 1MYB1 1MZA1 C.0000C 0.00000 0.00000 :MZE 1 MX FX 36 0 00000 0.0000 0.00000 IEROBEAM DUCTILITY (BASED ON DEFINITION 1) ELEM≭ 1MYA: 1MYB: 1MZA: 1MZB: C 0000G 0 00C00 0.00CC0 0.00C00 'MX 0.00000 (FX 0.00000 40
 STRUT DUCTILITIES AND EXCURSION RATIOS

 ELEMENT
 DUCTILITY DEFINATION #1 · !

 DUCTILITY
 EXCURSION

 47
 C.000CC0E-06
 0.000002+00

 48
 C.0000C0E+06
 0.000002+00

 49
 C.0000C0E+06
 0.000002E+00

 50
 C.00000E+00
 0.000002E+00

 51
 C.00000E+00
 0.000002E+00
 R/C SHEAR WALL DUCTILITY AND EXCURSION RATIOS 67 SOLUTION . .: NONLINEAR CYCLE ANALYSIS WITH UNBALANCED FORCES TIME: 16:45:08. DATE: 07/27/94 , LOADING # 0 DAMAGE INDEX ELEMENT DAMAGE INDEX DAMAGE INDEX F MAX 1.9632362-02 236.308 D MAX ESE PSE 2 363083E-C4 2.792080E C2 C.0000C02E+00 45
 ELEMENT
 DAMAGE INDEX
 F MAX

 47
 1
 5713122-02
 -97.7462

 48
 1
 9166152-02
 -115.225

 49
 5
 7007562-03
 -26.1349

 50
 1620172-02
 41.95447
 51
 8.3474662-03
 -3.82242

 D MAX
 ESE
 PSE

 5 951784E.02
 2.86601
 0.0000000000

 7 137753E.02
 4.25513
 0.000000000

 2 123043E.02
 0.277109
 1.526557E.16

 3.412051E.02
 0.715760
 4.024558E.16

 3.105719E.03
 5.941510E.03
 8.673617E.19

 Image: Stream of the
 SHEAR COMPONENT
 AXIAL COMPONENT

 ELEMA
 DAMAGE
 ESE
 FSE
 DAMAGE
 ESE
 FSE
 I

 54
 0.04983
 1.655352-02
 0.0000E+00
 0.00032
 6.70577E-05
 1.11825E-05
 0.00038 9 50057E-05 1.58343E-05 STRUCTURE DAMAGE INDEX- \$.30510E-04

MEXORY UTILIZATION
 IZ- 46473. MEM-6 6399
 ELAPSED CPU TIME 17.19 SEC
 TOTAL CPU TIME 16.56 SEC

8. Drawing of Internal Forces



Figure 52. Drawing of Internal Forces

VII. EXAMPLE PROBLEMS (For PC)

A. ELASTIC STATIC SOLUTION

Description of Input Information

Find the structural displacements and internal forces of the space frame (Fig. 53), which is subjected to vertical load. Structural members have the same cross-section area and material properties. Cross-sectional area is A=4.59 in²; torsional moment of inertia is J=24.5 in⁴; moments of inertia about bending are $I_{y}=11.7$ in⁴ and $I_{z}=22.1$ in⁴; Young's modulus is E=30000 ksi; and shear modulus is G=12000 ksi.



Figure 53. Space Frame Subjected to Vertical Loads

Input and Output

Input

```
ECHO OF INPUT DATA
LINE
                                                                                                     .. 76 . ...80
                                                 30.
                                                             .40 ...
                                                                         .. 50 .. 1.. 60. .
                                                  NNODE, NCCS, NSUET, NCOND, NCONST
1 C | NODES
1 C | NODES
                                           .00
22
12
50
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50
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c
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                                                            DIRECTION
                                                                          COSTNE
                                                                           RESTRAINTS
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12
13
14
15
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                                                                       24 5 11.7 22.1 4 4 2 4 4 2
                                         300
                                                                  G
                                   UBE'
                                                                     С
                                 KG
MAT SJ EJ
                                               VYI, VYG, VYK XS
                                                                         PKG
                                                                               KCDF
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1 0 0
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3
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C
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                       MEMBER.
                       'MEMBER
                                        î
   20
21
22
23
                 . PALSE
                                  MASS
DAMP
                             1
                    SOLUTION
         STATIC LOADING CASES ONE AND TWO - WITH CONDENSATION
   24
```

26 1 2 0 0 (FZ 10 27. 2 5 0 0 (FZ 10 28: 0 0 0 C (END) 0 29: STOP

<u>Output</u>

2 STRUCTURE : 3-D FRAME . WITH CONDENSATION SOLUTION :	TIME	9: 2 58, DATE	5/24/90
THE PROCRAM FER THE DOUBLE PRECISIC: VERSION			
NCDE COORDINATES AND DEGREES OF FREEDOM			
TOTAL NUMBER OF DEGREES OF FREEDOM			
NODE COSE X-COCRD Y-COORD Z-COORD FX FY FZ MX 1 1 .00005 48 6C0 12<005	MY 23 · R 2 5 E 29 · R	MZ 24 - R 3 6 9 3C - R	
DIRECTION COSINES			
CCS(1) VX 1 00000 I + 00000 J +.00000 K VY00000 I +1.00000 J +.00000 K VZ: 1 STRUCTURE: 3-D FRAME, WITH CONDENSATION SCLUTION :	.900C0 TIME	<pre>1 *.00000 J *1 9 2:58, DATE:</pre>	00000 K 5/24/96
3-D ELASTIC BEAM ELEMENT			
MACL. E GAMMA AX AY AZ IX IY IZ			
1 3.0005+04 1.200E+04 4.55 .000 .000 24.5 11.7 22.1	_		- 4-
1 STRUCTURE 3-D FRAME , WITH CONDENSATION SOLUTION	TIME	9. 2:58, DATE	5/24/96
ELEMENT CG, 3D BEAM ELEMENT			
MEMBER 4 MATL START ENE REL CD LENGTH Y-AXIS Control (C) Y-AXIS MEMBER 1 1 1 1 2 30 00 00000C I +.00030C J -100200 K MEMBER 2 2 1 2 3 42.00 25555 I 12778 J >95331 K MEMBER 3 3 1 3 4 24.00 03000 C +.00000 K MEMBER 4 4 1 4 5 26.05 1.00000 J +.00000 K	START D: CC20 .000C .000C .000C .00CC	IST END DIST CCD0 .000C DD00 .00C0 .00C0	PK3 0000 0000 .0000 .0000
ZERC MASS MATRIX			
PROFORTIONAL DAMPING COIFFICIENTS ALPHA - COOCC BETA00000			
1 STRUCTURE 3-D FRAME . WITH CONDENSATION SOLUTION STATIC LOADING CASES ONE AND INCO . WITH CONDENSATION	TIME.	9 2:58, DATE 9: 2 58, DATE	5/24/96 5/24/96
SOLUTION #1, STATIC - ELASTIC ANALYSIS			
NUMBER OF LOAD CASES			
LOAD CASE: 1 JOINT 2 DIRECTION, F2 DOF(5 12 MAGNITUDE: -10-0000 LOAD CASE: 2 COINT, 3 DIRECTION, F2 DOF(5, 15 MAGNITUDE: -10-0000 1 STRUCTURE 2-0 FRAME, WITH CONDENSATION SOLUTION STATIC LOADING CASES ONE AND TWG - WITH CONDENSATION	TIME: TIME	9: 2 56. DATE 9: 2:58, DATE:	5/24/96 5/24/96
GCS DISPLACEMENTS, LOADING # 1			
NODE DX DY DZ RX RY RZ			
1 00300C .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .000000 .000000 .00000 <td>) E-03 E-04 DE-04 TIME TIME</td> <td>9+ 1:58, DATE: 9- 2:58, DATE:</td> <td>5/24/96 5/24/96</td>) E-03 E-04 DE-04 TIME TIME	9+ 1:58, DATE: 9- 2:58, DATE:	5/24/96 5/24/96
GCS DISFLACEMENTS, LOADING # 2			
NCDE DX DY DZ RX RY RZ			
1 000000 .000000 000000 000000 000000 000000	E-04 E-04		

4 2	.627011E-02 -2 300330	. 378137E-C2 - .000000	1.098668E.03 C000C0	1 386143E-C3 C00000	-2.5718222-03 000006	4.530517E-04 .000000		
SCLUTION .	: STATIC LOAL	, WITH CONDENSA DING CASES ONE	AND TWO WITH	CONDENSATION		TIME	9 2:58, DATE: 9 2:58, DATE:	5/24/96 5/24/96
GCS RESTRAI	NT REACTIONS,	LOADING #	1					
NODE	FX	FY	FZ	мх	MY	MZ		
: 5 -	1 035081 1 035051	.2996552 2906559	8.525362 1 474544	-222.1165 -16 60200	25.86C23 29.40C39	30.23147 2.156929		
SUMMATICN	3004074E+C4	E854534E-06	10 00001	179.3595	5950925E 03	1292828E-03		/
SOLUTION	: I'E FRAME : STATIC LOAD	, WITH CONDENSA DING CASES ONE	AND TWO - WITH	CONDENSATION		TIME: TIME.	9: 2:58, DATE: 9: 2:58, DATE.	5/24/96
GCS RESTRAI	INT REACTIONS,	LOADING 4	2					
NCDE	FX	FY	F2	мх	мү	MZ		
: 5 -	4456985	2154300E-02 2152160E-02	2 435681 7 564327	-91.65842 -23.90530	4.516044	17.18910 6 733359		
SUMMATION	.4546838E-04	2138317E-05	10.00001	.22856152.04	- 359 9989	· 2014796E-03		
SCLUTION	3.0 FRAME STATIC LOA	. WITH CONDENSA DING CASES ONE	TION AND TWO - WITH	CONDENSATION		TIME	9 2:58, DATE. 9 2:58, DATE:	5/24/96 5/24/96
3D BEA	M FORCES							
ELEMENT L	DAD JAC	E AXIAL	ŦΥ	FZ	TORSION	MY	MZ	
1	1 FORCE FORCE	1.290655 2.290655	8.52536 -8.52536	-1.03808 1.03805	25.8602 25.8602	30 2315 .910964	222 116 33 6445	
± 2	2 FORCE FORCE	2 4.215430E-0	2.43569	.445695	4.51604 -4 51604 18 0155	3.81815	91.6584 -19.5890 -38 -764	
* 2	FORCE 2 FORCE	3 1.43566	1.11075	204270	-19.0155	4.15676	-8 47513	
3	FORCE 1 FORCE	3 .331961 3 1.03806	-2.4426€	.237020	15.3850 10.5889	1C.469C 9.13268	90.2394 14.7699	
3	FORCE 2 FORCE	4 -1.03806 3 .445656	1.47454 -7.56432	290556 -4.21530CE-	-10.5889 02 24.7463	2.15693 5.72169	-50.1614 -88.5164	
4	FORCE 1 FORCE	4 .445656 4] 17464	7.56432	4.21530CE- .290536	02 -24.7463 2 15693	6.73336 10 5689	-93.C273 50.1614	
4	2 FORCE ECRCE	5 1 4/464 4 7 56433 5 7 56433	.445651	-4 215232E-	C2 6.73336	26.7483	-29.4004 93.0274 -84.1144	
THE STATICS	STRAIN ENERGY	OF SYSTEM -	1967	1.2.50.00		20.0000		
								5 (5) (6)
SCLUTION.	STATIC LOA	DING CASES ONE	AND TWC - WITH	CONDENSATION		TIME: TIME:	9: 2:58, DATE: 9: 2:56, DATE:	5/24/96
MAXIMUN VAL	LUES FOR ALL LO	AD CASES						
GCS MAXIMUN	DISPLACEMENTS	- TF- MAYIMIN VAI	LIES MAY NOT OC	THE STATUTIONED	21 V			
NODE	DX	DY	DZ	RX	RY	RZ		
ı	. 200200	000000	000000	000000	000000	.000006		
2 - 2	2.544356E-02 2.619243E-02	6 332357E-05 · 2 459981E-03 ·	9 289331E-C2 934558E-O2	4 264672E-03 3 406416E-02	-2.638799E-03 -2 75346EE-03	-1.253013E-03 B.838654E-04		
1 9 5 1 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9	. 0000000	.000000 WITH CONDENS:	C000000	C9000C	.000000	.0000CC	0. 2 50 DATE	6/04/64
SOLUTION.	. STATIC LOA	DING CASES ONE	AND TWO - WITH	CONDENSATION		TIME	9: 2 58. DATE	5/24/96
MAXIMUN VAI	LUES FOR ALL LO	AD CASES						
MAXIMUM GC:	S RESTRAINT REA	CTIONS NOTE	MAXIMUM VALU	ES MAY NOT CCC.	R SIMULTANEOUSL	¥		
NODE	FX	FΥ	FZ	мх	MY	MZ		
1	1 039081	.2906552	8.525362	-222.1165	25.86023	30.22147		
MAX OF ALL	-1 036751	2300000	/.bt432	22 90520	84.11438	6 /3:359		
1 STRUCTURE. SOLUTION	3 D FRAME STATIC LOA	, WITH CONDENSA DING CASES CNE	ATION AND TWO · WITH	CONDENSATION	0556600	TIME: TIME	9: 2:58, DATE: 9: 2:58, DATE:	5/24/96 5/24/96
MAXIMUN VA	LUES FOR ALL LO	AD CASES						
COLUI DOF W	MN ' LOAD) REPR HICH HAS MAXIMU	ESENTS THE M VALUE						
3D BE MAXI	AM FORCES MUM VALUES FOR	ALL STEPS NOT	DEN MAXIMUM VAL	UES WITH THE CI	HER DOFS FORCES	ARE PRINT OUT AT	THE SAME TIME	
ELEMENT U	OAD NOD 1 FORCE	E AXIAL 1 290655	FY 8 52536	F2 - 1 C39C8	TORSION 25.8502	MY 30 2315	MZ 222.116	
:	FORCE 2 FORCE	2 - 29CE55 1 .29CE55	6 52536 8 52536	1 C3BC6 1 038C8	25.8502 -25 8602	.510964 33.2315	33.5 445 222.115	
:	3 FORCE	2 290655 1 290655 2 . 290655	8 52536 8 52536	1 03808	25 8602 -25 8602	.910964 30.2315	33.5445	
1	4 FORCE FORCE	2 290655 1 290655 2 291455	6 52536 6 52536	·1 03906	25 8602 -25 8602 25 8602	910964 30 2315 610344	222.116 222.445	
1	5 FORCE	1 290655	5 52530	-1 03509	25 8602	30 2315	222 116	

•

		FORCE	2	· 290655	• 6.52536	1.03809	25.8602	.910964	33.6445	
:	6	FORCE	1	.290655	8 52535	-1.03866	-25.8602	30 2315	222.116	
		FORCE	2	- 290655	-8.52536	1.03806	25 8602	.910764	33 6445	
1	7	FORCE	1	290655	8 52536	-1.03808	-25 8602	30 2315	222 116	
		FORCE	2	· 290655	·9.52536	1.03808	25.8602	.910564	33.6445	
1	6	FORCE	1	290655	8 52536	1 03808	·25 8602	30.2315	225 116	
-	v	FORCE	5	290655	· F 52536	1 03806	25 8602	910964	33.6445	
1	6	FORCE	ĩ	290465	5 57574	-1 (3905	25 8662	20 2115	772 116	
•		FORCE		. 290665	-9 67514	1 03865	25 6602	310964	17 6445	
		FORCE	-	220025	0 5 5 5 3 6	1 03000	75 36CD	30 3315	22.0442	
-	10	FORCE	-	290000	8.52036	-1 03908	-20,8662	30.2315	262.1.0	
		FURCE	2	290555	6 52536	1.03808	25.8602	.910964	33.6445	
-	11	PORCE	1	4.2.54.0E CZ	2 43568	445695	4.5.604	17.1851	91 4584	
		FORCE	2	4.21543CE-CZ	-2 43568	445695	-4.51604	·3 91 815	18 5560	
1	12	FORCE	1	290655	8.52S36	-1.03808	·25 8692	30 2315	222 11 0	
		FORCE	2	· 290655	·R 52536	1.03808	25 5602	910964	33 6445	
2	1	FORCE	2	1 43566	1.11075	·.20427C	15.0155	4 42059	-38 1764	
		FORCE	3	-1.43566	1.11075	204270	-18.0155	4.15376	·8 47513	
2	2	FORCE	2	331961	2.44266	237020	15.0680	514146	12.3521	
		FORCE	3	.331961	-2.44266	. 237 020	15.0850	10.4690	90.2394	
2	3	FORCE	2	·.331961	2 44266	- 237020	15.0880	514146	12.3521	
	•	FORCE	3	231961	2 44265	237020	15 0980	10 4690	90.2394	
>	6	FORCE	2	1 43566	1 11075	- 204270	18 0155	4.42059	- 35. 1764	
-		FORCE	-	1.43566	1 11075	204270	18 0155	4 15876	8 47513	
2	5	FORCE	2	1 43566	-1 11075	- 204 270	18 0155	4 42359	38 744	
~	2	FORCE	-	111111	1.11072	204276	18.0155	4 16876	- 47513	
~		PORCE	2			204270	16.0155	4 42050	. 25 1761	
2		FORCE		1 43525	1 11075	204270	18 3165	4 15674		
	_	FORCE	-	-1.42560	1.110/5	. 20 270	10.0100	4.15676		
4	1	FURCE		1.4:566	-1.11075	2042.0	10.0.05	6.62039	38.1.04	
-		FORCE	3	-1 43566	1 11075	.204270	-18.0155	4.15876	8.47513	
2	8	FORCE	2	33196.	2 46266	237020	-15.0880	51414€	12.3521	
		FORCE	3	.331961	2.44266	237020	15 0880	10.4690	90 2394	
2	9	FORCE	2	• 331961	2.44266	·.237C20	·15 C880	514146	12 3521	
		FORCE	3	331961	2.44266	.237020	15 0860	10.4690	90.2394	
2	10	FORCE	2	1.43566	11075	20427C	15.0155	4.42059	-39.1764	
		FORCE	3	-1.43566	1.11075	204270	18.0155	4.15876	-8 47513	
z	11	FORCE	2	331961	2.44266	237020	-15.0880	- 514146	12.3521	
		FORCE	3	.331961	-2.44266	. 237 020	15.0660	10.4630	90.2394	
2	12	FORCE	2	- 331961	2 44266	- 232020	5.0880	. 514146	12.3521	
-		FORCE	5	731961	-2 44266	237020	15.0880	10 4690	90.2794	
		FORCE	1	1 03506	1 47464	290656	10 5889	-9 11269	2 7699	
-	-	PORCE	ž	1 03806	1 47467	- 200656	.10 5680	7 16493	50 1614	
~	-	FORCE		146666	1 6/400	1 2163008.00	24 2483	.5 20160	.88 5164	
2	4	FORCE	2	443030	7 55432	4 2153000-32	24.7403	2012	-01 0273	
-	-	FORCE		03605	7 30432	9.21333002-02	10 5050	0,10,0	14 3650	
2	د	FORCE	2	03205	1.4 404	290636	10.0000	7 15603	.50 1614	
-		FURCE	4	03856	1 4 404	- 290536	10.0009	2.12033	- 50.1814	
3	4	FORCE		.445656	-7.56432	4.21530CE-02	24.7403	-=./2169	55.5164	
-	-	FORCE	-	442656	1.56432	6.215300E-C2	24.483	6.43335	-93.02/3	
3	5	FCRCE	3	1 03806	1.47464	. 29 36 56	10.5689	-9.13268	14.7699	
		FORCE	4	-1 03806	1 47464	290656	·1C.5869	2.15693	-50.1614	
3	6	FORCE	3	.445656	-7 56432	4.2153002-02	24.7483	-5 72169	·88 5164	
		FORCE	4	.445656	7 56432	4 215300E-02	24.7483	6.73336	-93 0273	
3	7	FORCE	3	1.03806	-1.47464	. 290656	10.5899	-9 13268	14 7699	
		FORCE	4	-1.03806	1.47464	290656	-10 5889	2.15693	-50.1614	
3	8	FORCE	3	.445656	·7.56432	-4.215300E-02	24.7483	-5.72169	-88 5164	
		FORCE	4	.445656	7.56432	4.21530CE-02	24.7483	6.73336	-53.0273	
3	9	FORCE	3	1.03600	-1.47464	. 299656	10.5889	-9.1326E	14.7699	
		FCRCE	4	·1.03806	1.47464	290655	-10.5889	2.15693	-50.1614	
3	1.0	PORCE	3	445656	-7 56472	4.215300E-02	24.7485	-5.72169	68.5164	
-		FORCE	4	445656	7 56412	4 215300E-02	-24.7483	6.73336	93 0273	
3	- •	FORCE	1	445656	-7 56412	-4 215300E:02	24 7487	-5 72169	·88 5164	
-		FORCE	ž	.445656	7.55432	4.2153D0E-32	24 748	6 73336	93 0273	
э	10	FORCE		445656	7 56410	-4.215100E-02	24.7487	-5 72169	88.5164	
-		FORCE	ē	- 445656	7 56432	4 2153008-02	24.748	6.73336	93.0273	
4	1	FORCE	3	7 56433	445651	-4 2:62325-02	6 73336	24 7493	63 0274	
		FORCE	1	7 56433			. 73336	.21 6651	- BA 1144	
٨	.,	FORCE	2	1 27/52	· A3605	200454	5 15401	·A ==05	50 1614	
*	2	FORCE		1.47404	1.03820	. 270520	2 10073	10.0865	JU. 1016 . 30 4004	
	-	PORCE	-	· 1.4/484	1.03805	290455	-2.10093	5 4623	-29.40U4	
•	-	FORCE	4	4/684	1.03805	290656	2.15595	10 5089	50.1614	
		FORCE	5	1 4/464	-1 C3805	290656	2.15693	16.4020	-23 4CO4	
4	4	FORCE	4	7.55433	.445651	-4.215232E.02	6.73336	24 7483	93 0274	
		FORCE	5	-7.56433	445651	4.215232E-02	-5.73236	-23 9053	84.1144	
4	5	FORCE	6	7.56433	445651	-4.215232E-02	6.73336	24 7483	93 0274	
		FORCE	5	·7 56633	445651	4.215232E-02	· E . 73336	-23.9053	·84.1144	
4	é	FORCE	4	7.56433	445651	-4.215232E-02	6 73236	24.7483	93.0274	
		FORCE	5	-7.56433	.445651	4.215232E-02	-6 73336	·23 9053	-84.1144	
4	7	FORCE	4	7.56433	.445651	·4.215232E·C2	6.73336	24.7483	93.0274	
		FORCE	5	7 56433	445551	4.2152322 02	6.73336	·23.9c53	-54.1144	
4	2	FORCE	Ă	1 47464	1 03805	290656	2 15693	10 5885	50 1614	
-		FORCE	2	1 47464	-1 01805	- 298656	-2 19691	-16 4020	29 40.04	
4	q	FORCE	2	1 47464	1 03905	250656	2 15691	10 5839	50 1614	
-		FORCE		1 47454	-1 03805	. 296656	-2 15663	-16 4020	29 4004	
6	1.0	FORCE	2	7 55433	146461	.4 3163336/03	2 71776	24 2483	23.0000	
•	10	FORCE	2	7 66/75	445651	4 2152325 02	C (333C	.21.0053	- BA 1144	
		PORCE	2	7 66433		4.2136325.02		- 23.9403	C3 0374	
	- 1	FORCE		7 56433		· · · · · · · · · · · · · · · · · · ·	0 /3336	24.403		
	• •	FORCE	2	1.00433			9111		- 34.1146	
	12	FORCE	4	1.56633	.44565.	• 4.215232E•C2	6.7334	24.7483	93.0274	
		FORCE	5	. 56433	445551	4.2152322-02	6.73336	-23.9053	-84,1144	

B. BUCKLING ANALYSIS

Description of Input Information

Perform the buckling analysis of a four-element column (Fig. 54), and find the buckling loads. Cross-sectional area of the element is $A = 11.8 \text{ in}^2$; torsional moment of inertia is J = 0.95 in⁴; moments of inertia about bending are $I_Y = 44.1$ in⁴ and $I_Z = 310.0$ in⁴; Young's modulus is E = 29000 ksi; and shear modulus G = 11600 ksi.



Figure 54. Buckling Analysis of Four-Element Column

Input and Output

<u>Input</u>

```
ECHC OF INPUT DATA
1
                             .: .:10... 1. 20.... 30... 1. 40 . .. 50. ...60...1. 70. .: 90

'STRUCTURE DEFINATION'

'FOUR ELEMENT COLUMN W/ PKG +1.0 '

5 1 2 1 0 1.00 NNODE,NCOS,NSUPT,NCOND.NCONST SCALE

1 0.01 5.00 0 001 4

1 0.02 5.00 60 00

1 0 0 0 1 0 ... COSINE
           LINE
                    4:
5:
6:7
                                        C 0
C 0
0 0
                 8
9
10
11
12
13
                                                                                                                      RESTRAINT
                                                                                                                      CONDENSE OUT FZ AND MZ (AXIAL AND TORSION
                          1 NMAT
"BE-BEAM W12X40" 29000 11600 11 8 0 6 0.95 44.1 310. 4 4 2 4 4 2
                 14
15:
                                 1 2 2 .FALSE KG : AXL, FORM, ASSY

    15:
    122
    .FALSE
    KG: AXL, FORM, ASSY

    16:
    17:
    4
    NELEM

    17:
    4
    NELEM
    1

    18:
    13:-BEAM'
    MEMBER
    1':
    1

    19:
    13:-BEAM'
    MEMBER
    1':
    1
    2

    10:
    13:-BEAM'
    MEMBER
    1':
    1
    3
    0
    0
    1
    000000

    20:
    13:-BEAM'
    MEMBER
    1':
    3
    4
    5
    0
    0
    1
    000000

    21:
    35:-BEAM'
    MEMBER
    4':
    4
    5
    0
    0
    1
    000000

                                                                                                                                                                                                                      0000
                 22
23: 0 C FALSE, MASS
24: 0 C DAMFING
25: 'SOLO3 - SOLUTION'
26: 'BUCKLING ANALYSIS'
27: 'BUCKLE' 2 C
28: 'STOP'
```

Output

- 1 STRUCTURE. FOUR ELEMENT COLUMN W/ PKG =1 C TIME: 9.4 54, DATE 5:24/56 SOLUTION ... -
- --- PROGRAM PEM --- DOUBLE PRECISION VERSION

NODE COURDINATES AND DEGREES OF FREEDOM

TOTAL NUMBER (NUMBER OF DEG NUMBER OF FRE NUMBER OF RES	CF DEGREES ON AEES OF FREE DEGREES OF TRAINED DEGRE	F FREEDOM. COM CONDENSED OUT FREEDOM EES OF FREEDOM	. 30 6 						
NGTE COS# 1 1 2 1 3 1 4 1 5 1 NGTE. R C	X COORD 00.00 00.00 	Y-COORD C000C .000C .000C0 .000C0 00C00 D DEGREE OF FREEC ED DEGREE OF FREEC	Z-006RD 00900 60 000 120.00 150 00 240 00 0M	FX 25 · R 11 15 16 29 · R	FY FZ 26-R 27*R 12 1 16 3 20 5 30-R 7	MX 9 13 27 21 23	MY 10 14 18 22 24	M2 25-P 2 6 6 6	
DIRECTION CO	SINES								
CC5(1) VX 1 STRUCTURE I SOLUTION :	1.00000 I + FOUR ELEMENT	00000 J00000 COLUMN: W/ PKG -1	с х ул - с	0000 1 +1.000	10600.+ 5 CO) K VZ	00000 (TIME)	I +.00000 J +1 9. 4 54, DATE	5/24/9
B-D ELASTIC (BEAM ELEMENT								
MATL E	GAMMA	ах ау	AZ	IX	IY IZ				
1 2.900E+0	4 1.160E+04	11 8 000	.000	.950 44	.1 310.				
1 STRUCTURE SOLUTION :	FOUR ELEMENT	COLUMN W/ PKG +1	с				TIME.	9: 4.54, DATE:	5/24/
GEOMETRIC S	TIFFNESS DAT	A							
KGDATA(1) = 1 KGDATA(2) = 2 KGDATA(3) = 2	, LOAD- F(IN) F(INPUT) I ACCEL IS P(, CONSISTENT , SEPERATE G	PUT)*(1.00*ACCEL) S POSITIVE IN COM DSITIVE GLOBAL 2-4 FORMULATION LOBAL KG IS FORME	PRESSION AXIS ACCELERA C	TION					
- THE GEOMET I STRUCTURE. : : SOLUTION:	RIC STIFFNES: FOUR ELEMENT	5 MATRIX IS NOT CO COLUMN W/ PKG •1	ONDENSED WITH	THE STRUCTUR	AL STIFFNESS	MATRIX	TIME	9 4:54, DATE:	5/24/5
ELEMENT OS. 3D 3	BEAM ELEMENT								
MEMBER 1 MEMBER 2 MEMBER 3	# MATL : 1 1 2 1 3 1	START END REL : 1 2 2 2 3 4	CD LENGTH 60 00 60.00 65.00	1 36 33 0. 1 30003 2 00002	Y-AXIS +1.00000 J +1.00000 J +1.00000 J	• 00000 K • 00000 K	START DIS CCD0 0000 .0000	ST END DIST CCOU .0000 .0000	FX3 1 000 1.600 1.600
FROFORTIONA	L DAMFING CC.	IEFICIENTS							
ALPHA 001 1 STRUCTURE	000 BE	TA- CODOC COLUMN W. FKG -1	. D				TIME	9- 4-54, DATE.	5/24/9
SOLUTION #3, DE	BUCKLING ANA: FERMINE EIGER	LYSIS NVALUES AND EIGEN ⁴	VECTORS				TIME	9 4:54, DATE	5/24/3
OPTION		ELASTIC BUCKLING :	LOAD						
NUMBER OF EIGEN MODE:	VALUES:	16 2	3	4		5	é	7	
EIGENVECTORS	219 25	583.14	1541 2 1 2050CE: 0	2037.9	6263	.0	6208.U	6544.2	
DOF. 10	1.30896E-0.	2 2 612942-02	.00000	3.79368E	-02 1.00	CO 9 F- 04	00000	- 10953	
LOF 12	00000	50000 50000	70711	.00000	.000	90 90	-1 CC00	.0000	
DCF 14	9.25577E-0	3 5 34140E-C9	.00000	2.682532	-02 -1.00		60000	7.76623E-	02
DOF(16)	00000	. 30000	1 0000	.00000	-1.032	10E-CE	8.94547E-0	coooc	
DOF' 17 DCF: 18'	CC000 7.41558E H	00000 C 2 61294E-02	1 C27 56E+C (0000	9 .00000 1 34253E	.000. 100 • • • • •	50 ·	00000	02 00000 3.54819E	6 8
DOF 15) DOF 20)	.70711	1 0000	C0060 .20711	70711	-9 456 000	18E-06 50	00000	70711 00730	
DOF 21	00000	.00000	9 253778-0	35000 0	000	C0	9.695C3E-	CH CONDC	
DOF 23	.00000	000000	1.20996£-0	2.662532	.02	00	2.61294E-1	00000	52
1 STRUCTURE.	FOUR ELEMENT BUCKLING ANA	COLUMN W/ PKG =1 LYSIS	c 0000	.3.793662	- 32 1 00	0	TIME: TIME	9: 4:54, DATE: 9: 4:54, DATE:	5/24/9 5/24/9
SOLUTION #3. SE	TERMINE FIGE	NVALUES AND EIGEN	VECTORS						
OPTION. NUMBER OF EIGEN	VALUES	ELASTIC FUCKLING . 16	LOAD						
MODE EIGENVALUE	8 11432	5 14325	10 17647	:1 21315	2996	12	13 46111	14 80362.	
EIGENVECTORS DOF	U00¢0	-3 79366E-C2	¢00C0	. 00000	1.00	0 0	10983	.15946	
DOF/ 10- DOF/ 11-	1.0000	00000	.31832 CC711	1 COOO 5 6 5 586E	-07 .000	0C CO	00000 00000	.00000 00000	

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DOF :	18)	15946	.00000	4.79983E-09	1 ¢000	.00000	00000	.00000	
DOF '	19`	·1.0000	.00000	.70711	1 95446E-C7	.00000	00000	. 00000	
DOF	20)	00000	-C-11	. 00000	00000	1.93115E-C6	· 70711	1.0000	
DOF /	21)	00000	·2.66253E-02	00000	00000	-1.0000	•7 76629E•02	-3.0 9910E -C9	
DOF (22:	4.124502-08	00000	.22509	1 0000	00000	00000	. 30000	
DOF (231	.00000	3.79366E+02	.00000	20000	1.0000	10953	. 15946	
DOF (241	- 1594ē	.00060	.31832	1.0000	00C00	.00000	.00000	
1 STRUCTURE	. :	FOUR ELEMENT C	DLUMN W/ PKG +1	0			TIME: 9:	4 54. DATE 9	5124/96
SOLUTION		SUCKLING ANALY	515				TIME: 9.	4 54. DATE 5	5/2-/96

SOLUTION #3. DETERMINE EIGENVALUES AND EIGENVECTORS

OPTICN			LASTIC BUCKLING	LOAD
NUMBER C	F EIGEN	ALCES	1e	
	MODE	15	15	
EIGEN	VALUE	1.24049E-C5	1 45833E+C5	
EIGENVE	CTORS			
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DOF	11.	.00000	00000	
DOF	12)	. 7 07 1 1	41371E-03	
DOF	13)	22509	1.0000	
DOF ·	14:	00000	00000	
DOF :	150	.00000	20000	
DCF ·	15)	1.0000	3 44156E-07	
DOF 1	173	-5.94418E-C6	1.0000	
DOF (16	00000	.00000	
DOF :	19)	00000	.00000	
DOF :	201	· 70711	3.62855E-07	
DOF (2.1	22509	1 0000	
DOF (221	0000	00000	
DOF	23)	71832	1 6600	
DOF	241	.00000	00000	

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C. NATURAL FREQUENCY AND MODE SHAPE ANALYSIS

Description of Input Information

Find the natural frequencies and mode shapes of the elastic plane shear frame (Fig. 55). Cross-sectional area of the column is A=6 in²; moment of inertia is I=166.66 in⁴; Young's modulus is E=30000 ksi. Structural transnational mass is M=0.01294 k-sec²/in; rotational mass moment of inertia is RXY=62.1118 k-sec²-in.



Figure 55. Plane Shear Frame

Input and Output

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'SOLO3 - SOLUTION'

'NATURAL FREQUENCIES AND MODE SHAPES'

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<u>Output</u>

1 STRUCTURE ONE STORY SCLUTION	- PLANE FRAME (GLOP	AL XY PLANE:				TIM⊒:	- 9: 5 45. DATE:	5/24/9€
*** PROGRAM FEM ***	DOUBLE PRECISION	VERSION						
NODE CONSTRAINTS								
XY-PLANE CONSTRAIN XY-PLANE CONSTRAIN	T, MASTER 5 SI T, MASTER 5 SI	AVE. 2 AVE: 4						
NODE COORDINATES AND D	EGREES OF FREEDOM							
TOTAL NUMBER OF DEGREES NUMBER OF DEGREES OF FR NUMBER OF FREE DEGREES NUMBER OF RESTRAINED DE	OF FREEDOM EEDOM CONDENSED OUT OF FREEDOM GREES OF FREEDOM	24 C 3 21						
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1 3.000E-04 .000	5 00 .000	C00	.000	.000 1	67			
1 STRUCTURE ONE STORY SOLUTION	- PLANE FRAME (GLO	BAL XY PLANE)				TIME	9 5-45, DATE:	5/24/96
ELEMENT 05, 3D BEAM ELEME	эrт							
MEMBER 1 1 MEMBER 2 2 STRUCTURE : ONE STORY SOLUTION:	L START END REL 1 1 2 1 3 4 - PLANE FRAME (GLO)	CD LENGTH 120.0 144.0 BAL XY PLANE)	1.C0000 1 C0000	Y-AXIS I + 00000 I - 00000	J00000 K J00000 K J00000 K	START DI .0000 0000 TIME:	ST ENE DIST CCD0 .0000 9: 5:45, DATE:	PKG .00C0 .00C0 5/24/96
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STRUCTURE ONE STORY SCLUTION NATURAL FR	- PLANE FRAME (GLO EQUENCIES AND MODE	BAL XY PLANE) SHAPES				TIME TIME	9 5:45, DATE 9 5:45, DATE	5/24/96 5/24/96
SOLUTION \$3. DETERMINE EI	GENVALUES AND EIGE	VECTORS						
OPTION:	NATURAL FREQUENC	IES						
MODE 1 FREO (RAL/SEC) 64.890 PREOUENCY (HZ) 10.329 PERIOD (SEC) 9.681911 ELGENVECTORS DOF' DOF' 1.0000	2 458.18 72.922 5.02 1.37133E-02 1.45063E-03	3 803 18 127 83 7.82252E-0 7.82230E-0	12					
DOF 2: -9-99416F DOF 3: -5-97976 I STRUCTURE ONE STORY SOLUTION NATURAL FF	2-04 1.0000 2-05 1.11644E-03 - Plane FRAME (GLO REQUENCIES AND MODE	-1 COOC 18656 BAL XY PLANE: SHAPES	-			TIME: TIME:	9: 5 45, DATE 9: 5 45, DATE	5/24/9e 5/24/9e
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GCS EIGEN NODE	DX 000000 17.942297E-02	NE + : DY .000000 23.3500	MODE # 3 FRI DZ .0000006 .000000	QUENCY 127 RX .000000 .000000	. 529 RY 000000 . 000000	RZ 0000000 - 186583	: 5·5·45, DATE	5/24/
CS EIGEN NODE	DX 000000 0,00000 0,00000	NG # 1 DY .000000 23.3900 .000000	MODE = 3 FRI D2 .000036 .000090	RX RX .000000 .000000 .000000	. 529 RY 000000 .00000 .00000	RZ 000000 - 186583 - 060000	: 5· 5·45, DATE	5/24/
UCS EIGEN NODE 1 2 3 4	DX 000006 -7.942297E-02 .000006 -7.942297E-02	NG 4 1 DY .000000 23.3500 .000000 .21.3900	MODE # 3 FRI D2 .000000 .000000 .000000 .000000 .000000	RX RX .000000 .000000 .000000 .000000	. 529 RY 000000 . 00000 . 00000 . 00000 . 00000 . 00000	RZ 000000 -186583 .00000 -186583	: 5· 5·45. DATE	5/24/

D. TWO-STORY PLANE SHEAR FRAME DYNAMIC ANALYSIS

Description of Input Information

.

A two-story plane shear frame (Fig. a) is subjected to triangular dynamic loading shown in (b) and (c) applied at mass m_1 and m_2 , respectively. Moment of inertia of the structural member is I=107 in⁴; the elastic modulus is E=30000 ksi; and structural masses are $m_1=m_2=0.414$ k-sec²/in. For the dynamic loading input, special loading mass concept given in Chapter II (pg. 35) and Chapter IV (pg. 97) is used. Let $F_1(t)=30k=m_1$ 'g and $F_2(t)=20k=m_2$ 'g, then the $m_1=0.07763975$ k-sec²/in and $m_2=0.05175983$ k-sec²/in. Before applying the triangular load, assume that the structure is in vibration with initial accelerations $a_1=72.4638$ in/s² at m_1 and $a_2=48.3092$ in/s² at m_2 . Time increment is DT=0.01 second for 25 time steps (TF=0.25 second).



Figure 56. Two-Story Shear Frame Subjected to Triangular Loading

Input and Output

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29	3.05175963 00000000000
29	'DOF' 1 13 0 C 0
30	'END' 6 C 6 C 6
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32.	2 0 0 'ACCELERATION' 72.4638 0 0 0 0 0
33:	3 0 0 'ACCELERATION' 49 3092 0 0 0 0 0 0
34 -	0 C 0 C C 0 C C
35:	1 -1 0.00 .4 TRUE NA, ASCALE, TO, DT, FRINT
36	10C 01C V1. V2
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38.	TRIANGULAR FORCING FUNCTION
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<u>Output</u>

1 STRUCTURE . . TWO STORY PLANE SHEAR FRAME SOLUTION ... TIME: 11:42 1. DATE: 5/24/96 PROGRAM FEM *** DOUBLE PRECISION VERSION NODE COORDINATES AND DEGREES OF FREEDOM TCTAL NUMBER OF DEGREES OF FREEDOM...... NUMBER OF DEGREES OF FREEDOM CONDENSED OCT... NUMBER OF FREE DEGREES OF FREEDOM...... NUMBER OF RESTRAINED DEGREES OF FREEDOM..... 19 0 2 16 Y-COORD Z-COORD 003000 30600 003000 180 00 003000 180 00 003000 300 00 NODE COS# X-COORD FY F2 MX 7·R 3·R 9·R 11·R 12·R 13·R 15·R 16·R 17·R FX 3 · R 1 2 MZ 1C·R 14·R 16-R MY 4-R 5-R 4-R
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 DIRECTION COSINES ... COS: 1: VX 1.00000 I +.00000 J +.00000 K VY- .00000 I +1.00000 J +.00000 K VZ: 1 STRUCTURE... TWO STORY PLANE SHEAR FRAME SOLUTION CC000 I +.00000 J +1 00000 K TIME: 11:42* 1. DATE 5/24/96 3-D ELASTIC BEAM ELEMENT MATL. E GAMMA AX AY 1 2 COOE+04 .000 .000 IX IY 12 CC3 107. .00C A2 600 1 STRUCTURE. . : TWO STORY PLANE SHEAR FRAME SOLUTION TIME: 11:42 1. DATE 5/24/96 ELEMENT 08, 3D BEAM ELEMENT
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 END DIST

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 FKG MEMBER 1 CC09 C000 .500C CC09 .6000 .500C CC09 .6000 .500C TIME: 11.42: 1. DATE 5/24/96 MEMBER INCREDA 2 2 1 2 3 1 STRUCTURE ... TWO STORY PLANE SHEAR FRAME SOUTTION..... LUMPED NODE MASSES NODE MX 2 4140 3 4140 MY 0000 6000 IXX 0000 0000 177 .5005 .5005 IXY 0000 0000 IY2 .0000 .0000 IY2 .0000 .0000 IGEN INC 3 3 3 3 MZ 122 0000 6006 .0000 · THE MASS MATRIX IS NOT CONDENSED WITH THE STRUCTURAL STIFFNESS MATRIX. PROPORTIONAL DAMPING COLEFICIENTS ALPHA- .000000 PETA- .00000 STRUCTURE TWO STORY FLAME SHEAR FRAME, SOLUTION ... AVERAGE ACCELERATION METHOD - TRIANGULAR FORCING FUNCTION TIME 11 42: 1, DATE: 5/24/96 TIME 11 42: 1, DATE: 5/24/96 SCLUTION #2, AVERAGE ACCELERATION METHOD OF NUMERICAL INTEGRATION . TIME: 11.42: 1, DATE 5/24/96 TIME: 11.42: 1, DATE: 5/24/96

LUMFED NODE MASSES

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GROUND	ACCELERAT	ION RECORD	00	000000		46.3072								
INPUTIN	G TRANSLAT	ICNAL ACCELE	RATION R	ECORD # 1	. FROM	UNIT. 105	5							
FEAK VA THE REC DIRECTI	LUE OF ONE ORD CONTAI ON OF ACCE	NS 16 PC	INTS, B 1.000	EGINING A CO I0	T TIME: 0000 J		000C X	WITH A	TIME INCREM	ENT CF.	.4000	00		
INPUT A 1 000	CCELERATIC 0000	N: .0000	.0	(g's) 00)	.0000	. 00	000	.0000	0000	1	.0000	0000		
INFUT ACC	ELERATION	MAXIMU 1 0000	N AT	TIME \$0000		MINIMUN COCCO	AT .	TIME 40000	AVERJ . 100(IGE IC	STAN⊃ARD 31623	DEV.	RMS . 3162	2
GLOBAL -1 000 .0000	BASE ACCEL CGOD DOCO	ERATION IN T CGOO .9009	HE X DIR C C	ECTION (g COJ COJ	'g) 0000. 0000	.00	000 000	.0000. 0000	. 0000 . 0000)	.0000 .0000	.0000. 2000.		
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X-AXIS AC Y-AXIS AC Z-AXIS AC STRUCTURE. SOLUTION	CELERATION CELERATION CELERATION TWO S AVERA	MAXIM .00000 .00000 .00000 .00000 TCRY PLANE S .GE ACCELERAT	IN AT	TIME .40000 .40000 .60000 ME OL TRIA	NGULAR	MINIMUN 1 0000 .00000 .00000 PORCING 1	AT FUNCTION	TIME 40000 40000 40000	AVERJ - 5.0000 0000 0000	AGE COE·C2 DO TIN TIN	STANDARD .22361 .00000 .00000 E: 11:42 E: 11:42	DEV. 1, DATE 1, DATE	RMS 2236 0000 0000 5/2 5/2	1 1C 1C 24/9
MAXIMUN VA	LUES FOR A	LL STEPS												
GCS MAXIMI	M DISPLACE	MENTS				E CIMPT	ANE OUCLA	,						
NODE	хс	D)		DZ		RX SINCLIN	ANECOSE.	R⊻	1	RZ				
1 2 3	000000 1.49603 1.32781	00000 00000 00000	10 10	000000 000000 000000		000000 000000 000000		000000 000000 000000	. C C O . O O O . D O O C	000 000				
SCLUTION	TWO S	TORY FLANE S GE ACCELERAT	HEAR FRA NION METH	ME OD · TRIA	NGCLAR	FORCING :	FINCTIC	:		73) 73)	E 11 42: E 11 42:	1, DATE 1, DATE	. 5/2 : 5/2	14796 14796
	LUES FOR A	UL SIEPS												
GCS MAXIMU	M VELOCITI	ES NOTE: MAI	(IMUM VAL	.UES MAY N	er cca	JR SIMULT	ANEOUSLY	ć						
NCDE	DX	D	r	DZ		RX		RY	I	RZ				
1 2 3 1 STRUCTURE. SCLUTION	000000 55088 9 88406 TWO 8 2 OWT	.0000 0000 .0000 TCRY PLANE & NGE ACCELERAT)))) SHEAR FRA [ION METH	.000000 .000000 .000000 ME ME - TRIA	NGULAR	.900000 .000000 .000000 FORCING 1	FUNCTION	000000 005000 005000	. 000 000 000	000 200 200 TIM TIM	Æ: 11.42 Æ: 11:42	1, DATE 1, DATE	: 5/1 : 5/1	24/9
MAXIMUN VA	LUES FOR A	LL STEPS									_		-	
GCS MAXIM	M ACCELER	TIONS									-			
		NCTE MAD	CIMUM VAL	UES MAY N	IDT OCCI	OF SIMULT.	ANECUSLY	ŕ						
NODE	DX DDCDDD	E	2	DZ		RX 0055005		250000		RZ				
2	70 4121 47 2280	00000.00000.00000	20	600060 200660		000000 000000 000000		. 000000 . 000000 . 000000	.000 .000 .000	500 500		-		

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1 STRUCTURE . SOLUTIÓN .	TWO STORY : AVERAGE AC	PLANE SHEAR FRAM CELERATION METHO	E D - TRIANGULAR	FORCING FUN	CTION	TIME TIME	11:42 1. DATE. 11:42 1. DATE	5/24/96 5/24/96
MAXIMUN VAL	JES FOR ALL ST	EFS						
MAXIMUM GCS	RESTRAINT REA	CTIONS NOTE	MAXIMUM VALUE	S MAY NOT OC	CUR SIMULTANECUSLY			
NODE	FX	FY	F2	МХ	MY	MZ		
: -:	0000000 0000000 0000000	0000000 0000000 0000000	0000000 00000000 00000000	00000000 0000000 0000000	-889 3073 -664 3168 266 2274	0000000 00000000 0000000		
MAX OF ALL- GCS SUMM S	.691194	.0000000	000000	.0000000	-1329 634	CC000C0		
MAXIMUM R STRUCTURE . SOLUTION	SULTANT OF RE. . TWO STORY . AVERAGE AD	ACTIONS, FORCE PLANE SHEAR FRAM CELERATION METHO	- 9.881 E D · TRIANGULAR	MOMENT.	1329. CTION	Ť I ME T I ME	- 11:42: 1, DATE: - 11 42: 1, DATE:	5/24/96. 5/24/96
MAXIMUN VALU	SES FOR ALL ST	EPS						
COLUME DOF WH	I (LOAD) REPR ICH HAS MAXIMU	ESENTS THE M VALUE						
2D BEAN MAXIM ELEMENT LOS : : : : : : : : : : : : : : : : : : :	<pre>/ FORCES IM VALUES FOR PORCE > FORCE FORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE PORCE STRAIN ENERGY STRAIN ENERGY STRAIN ENERGY ENERGY ; TWO STORY</pre>	ALL STEFS NOTE ATTAL 2 .000006 2 .000000 2 .000000 2 .000000 2 .000000 2 .000000 2 .000000 2 .000000 3 .000000 2 .0000000 2 .0000000 2 .000000 2 .0000000 2 .000000000000000000000000000000000000	 MAXIMUM VALUE FY -000000 -000000	ES WITH THE FZ 9 89119 9.85119 9.85119 9.85119 9.85119 9.85119 9.85119 9.85119 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43712 4.43	OTHER DOFS FCRCES TORSICN . 609600 . 00000 . 000000 . 0000000 . 00000000 . 000000 . 0000000000	ARE PRINT OUT MY -889 307 -889 227 266 227 27 266 227 27 266 227 27 266 227 27 267 27 267 27 267 27 27 27 27 27 27 27 27 27 2	AT THE SAME TIME MZ C00000 000000 000000 000000 000000 000000	5/24/96 5/24/96
SOLUTION.	: AVERAGE AC	CELERATION METHO	C · TRIANGULAR	FORCING FUN	CTICN	TIME	11-42-1, DATE:	5/24/96
STEP	TIME	LOAD DI	SPLACEMENT	VELOCITY	ACCELERATION			
C 1 2 3 4 5 6 7 6 7 6 9 10 11 12 13 14 15 14 19 20 21 22 23 24 25	.00000 1.00000000000 2.6000000000 5.0000000000 5.00000000000 7.0000000000	3C.00C 29.23C 28.560 27.750 27.600 25.500 24.00C 23.250 24.00C 23.250 22.500 22.500 22.500 22.500 22.500 22.500 22.500 25.500 25.500 26.250 19.500 16.500 16.500 16.500 11.250	00000 00000 1.42154E-02 2.165108-02 8.594582-02 8.594582-02 12221 26419 21153 22391 32030 33238 .44776 33238 .44776 33238 .44776 34151 .66603 .74161 .92123 .6699 1.1547 .2659 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699 1.5699	00000 1433 4071 20759 2,7186 3,3123 3,9181 4,6715 3,9181 4,6715 5,925 5,925 6,3448 6,7226 7,3708 6,0657 7,3708 7,6792 7,8713 6,0657 7,3708 5,220 5,3565 8,5595 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295 8,5295	72 464 70,412 68.129 65 627 62.518 6C 220 55 949 53 725 55.365 46.859 43.341 29.716 36 048 32.360 22.60 22.60 22.60 22.60 22.60 22.614 21.402 17.859 14.404 11.356 7.8336 4.7505 18.209 1.5339 5.8359 5.5359			

E. <u>NONLINEAR CYCLIC ANALYSIS WITH UNBALANCED FORCES AND ENERGY</u> <u>BALANCE</u>

Description of Input Information

An axial spring (Fig. 57-a) is analyzed to calculate the static cyclic response of a nonlinear element. A bilinear hysteresis model is assumed for this spring with elastic stiffness E=5 kips/in, yield load PY=20 kips, inelastic stiffness SIE=0.05 kips/in, failure ductility $\mu f=15$, and damage index DI=0.2. Length of the spring used to calculate the stiffness is XLEN=1 in. Loading condition is shown in Fig. 57-b.



Figure 57-a. Axial Bilinear Spring



Figure 57-b. Loading Conditions

Input and Output

<u>Input</u>

```
1
            ECHO OF INPUT DATA
          LINE
                              STRUCTURE DEFINATION
                                                                                                 'STRUCTURE DEFINATION'

'BLINEAR SPRING MODEL.

2 1 2 0 0 1.00 NNODE.NCOS.NSLPT.NCOND.NCONST SCALE

10 0.00 0.00 50 00 10

20 0.00 5.00 50 00 10

1 0 0 1 1 1 1 0 0 EFSTRAINTS

20 1 0 0 1 1 0 0 FESTRAINTS

1 NMAT
                                        NMAT
                         1 NMAT

"ELSPLS' 5 20 05 15 0 2

0 0 7ALSE. KG AXL, FORM ASSY

1 NELEM

"SPRING-3" 'FX 1 10 20 1 1.00 1 1

0 0 .FALSE. MARS

0 0 DAMFING

SCON
                10 :
                11
12
13
14
15
                                                                                                                   100 0.0.0
                16
17
                             SOL04
                         'SOL04 '
'NONLINEAR CYCLIC ANALYSIS W/O UNBALANCED FORCES, WITH ENERGY BALANCE'
C 50 1 FALSE NELOA, IFRINT, IWRITE, UNBAL
'ELE' 1 21 C 0 C
'JOINT F2' 10 22 0 C 0
'END' 0 C C 0 C 0
'END' 0 C 0 C 0 C 0
                                 NLINEAR CYCLIC AN

C 50 1 FALSE

'ELE' 1 21

'JOINT FZ' 10 22

'END' 0 0

1 20 0 0 'FZ' 1

0 0 0 0 'END' 1

1 CAD.A' 25 00 20
                15:
                19
20
21
22
24
25
26
26
26
26
                                                                        1.C
0
                                 LCAD-A' 25.00 3999 9939
LCAD-A' 26.03 3999 9939
LCAD-A' 26.03 3959 5939
'LCAD-A' .03 9959 5939
'RND' 0 C 0
'READ UNIT-21 UNIT-23'
                                                                                                        55
```

29 'STOF'

Output

1 STRUCTURE. ... EILINEAR SPRING MODEL SOLUTION. ... TIME: 9:10-57, DATE: 5/24/96 *** PROGRAM FEM *** DOUBLE PRECISION VERSION NODE COORDINATES AND DEGREES OF FREEDOM
 NODE
 COS#
 X+COORD
 Y+COORD
 Z+COORD
 J
 COORD
 COORD
 J
 COORD
 C FX 2 · R 6 · R
 FY
 FZ
 MX
 MY

 3 · R
 4 · R
 5 · R
 6 · R

 9 · R
 1
 10 · R
 11 · R
 MZ 7-R 12-R DIRECTION COSINES ... COS: 1) VX 1.00000 I -.00000 J + 00000 K VY: 00000 J + 00000 J + 00000 K VZ: .00000 I -.00000 J +1.00000 K 1 STRUCTURE ... BILINEAR SPRING MODEL TIME. 9.10:57, DATE 5/24/96 SOLUTION ... PILINEAR HYSTERESIS MODEL FARAMETERS MAT KE PY KIE MAX DUCT 2 5.00000 20.0000 .5000000000 15.0000 1 STRUCTURE...: BILINEAR SPRING MODEL SOLUTION..... BETA 200000 TIME: 9:10:57, DATE: 5/24/96 ELEMENT 92, ONE (LOCAL) DOF SPRING ELEMENT # MATL START END ···TYPE ·· 1 1 10 20 AXIAL ZERO MASS MATRIX FROPORTIONAL DAMPING COLEFICIENTS ALPHA- .00000 BETA- .00000 UNBALANCED JOINT FORCES ARE NOT ADDED TO THE NEXT CYCLE DATA WRITTEN TO FILES ELEMENT # 1 IS WRITTEN TO UNIT # 21 DEGREE OF FREEDOM # 4 IS WRITTEN TO UNIT # 23 JOINT 10 DIRECTION. FZ APPLIED JOINT LOADS LOAD CASE: 1 JOINT, 20 DIRECTION: FZ DOF(S 1 MAGNITUDE: 1 000 1 STRUCTURE: ... EILINEAR SPRING MODEL SCLUTION. ... NONLINEAR CYCLIC ANALYSIS W/G UNEALANCED FORCES, WITH ENERGY BALANCE MAGNITUDE: 1 00000 TIME: 9:10 57. DATE: 5/24/96 TIME: 9:10 57. DATE: 5/24/96 1 STRUCTURE . BILINEAR SPRING MODEL SOLUTION ... : NONLINEAR CYCLIC AMALYSIS W/O UNBALANCED FORCES. WITH ENERGY BALANCE TIME. 9 10-57, DATE: 5/24/96 TIME 9 10.57, DATE: 5/24/96 , LOADING 5 C MAXIMUM DISPLACEMENTS GCS DISPLACEMENTS NOTE: MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY EY DZ RX RY NODZ DX RZ 10 000000 .000000 .000000 000000 .000000 20 .000000 .000000 25 0000 .000000 .000000 STRUCTURE ... BILINER SPRING MODEL SOLUTION. ... NONLINEAR CYCLIC ANALYSIS W/O UNBALANCED FORCES. WITH ENERGY BALANCE 000000 TIME: 9 10:57, DATE: 5/24/96 TIME: 9:10:57, DATE: 5/24/96 , LOADING # 0 MAXIMUM REACTIONS . MAXIMUM GCS RESTRAINT REACTIONS NOTE: MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY NODE FX FY FZ MY MZ MX

.

		10 20	.0000000. .0000000		0000000	•26 C	33607 000C00	.000000 .000000	0	.0000000 .000000	0066000 0066000				
C.	CS SUM	M M	.0000000		c000000	- 25	00000	. 600000	3	.0000000	.0000000	••••			
	MAXI	MUM R	ESULTANT	OF REAC	TIONS,	FORCE-	26.00	MOMENT	- 00	90					
1	SOLUTI	CN	NCNL	NEAR SPR	CLIC ANAL	YSIS W/	C UNBALAN	CED FORCES,	WITH E	NERGY BALANCE		TIME.	9.10.57.	DATE:	5/24/96
	, LCA	DING	t 0	PEAK	ELEMENT H	ORCES									
	S Eleme	PRING	FORCES.	M TYPE NO	AXIMUM LO DEI NODEJ	AD AND	DISPL AT ORCE	MAXIMUM LOA DISPLACMENT	D NOTE	MAXIMUM VALU: TIFFNESS	ES MAY NOT	OCCCR S	SIMULTAKEO	USLY	
ı	STRUCT	URE.	: BILIN	XIAL SEAR SEE	10 20 ING MODEL	21	0500	25.0000				TIME	у 1C.57.	DATE:	5,124/96
	SOLUTI	:01: .	NONL)	INEAR CY	CLIC ANAI	.Y319 W.	C UNBALAN	CED FORCES.	WITH E	NERGY BALANCE		TIME	9 10:57,	DATE:	5/24/96
	. LOA	DING	4 C	FEAK	DUCTILITI	ES AND	EXCURSION	RATIO'S							
	SPRING ELEME	DUCT	ILITIES /	NE EXCU NY DEFIN	RSIGN RAT ATION #1	103	UCTILITY	DEFINATION	¥2 -: ;	· DUCTILITY D	FEINATION &	3			
		1	DUCTILI €.25000	EX EX	CURSION	D	UCTILITY 0 6302	EXCURSIO	8 0	DUCTILITY	EXCURSION CODOOC				
1	STRUCT	CRE.	BILIN	NEAR SPE	ING MCDEI				-			TIME:	9:10 57.	DATE	5/24/96
	101				CLIC ANA	.1315 #,		CED FORCES.	WIIN 1	NERGI BALANCE		(1M2)	9:20 37.	DATE	5/24/95
	, DON			Distance NEV			F 1/3 V	200		BGE					
	202196	1	.437786	.EX	21.0500	.2	5.0000	2.4502	5	426.715					
1	STRUCT SOLUTI	STR URE CN	UCTURE DA BILIN : NONLI	MAGE IN NEAR SPR	DEX- ING MODE: CLIC ANA:	.48779 YSIS W/	O UNBALAN	CED FORCES,	WITH E	NERGY BALANCE		TIME: TIME:	9:10:57. 9:10:57,	DATE: DATE:	5/24/96 5/24/96
	ELE	MENT	⊧ 1 IS	READ F	ROM UNIT	H 21									
	s	PRING	FORCES .												
	NOD	DEI ·	10	NODEJ.	20	SPRING	TYPE	AXIAL							
	SI	C EP	TIME . 0D000	F	DRCE 00000	DISFLAT	MENT ST	IFFNESS 5.000C	ESE 0000	PSE n nachi	n				
		1	.00000	2	0.350	ร้อวั	00	5 0000	40.20	0 19.62	Ū.				
		2	.00000	2	1.050	25 0	00 5	.0000CE-02	44.31	0 426.7	5				
		3		••	.9500	19.3	00	5 0000	2.450	U 4267	J				
		MAX	IMUN DOCT	TILITIES	AND EXC	RSION R	ATIOS								
			DISPLACE	MENT DE	FINATION	U1-	6.250	E1-	. 2000						
			ENERGY I	DEFINATI	CN #1	U2-	10.63	E2-	.0000						
1	STRUCT	URE .	ENERGY I	VEFINATI NEAR SPR	ON #2. ING MODE:	U3-	11.67	E3•	.0000			TIME	9:10 57.	DATE	5/24/96
	SCLUTI	ок	NONL	INEAR CY	CLIC ANAL	YSIS W/	C UNBALAN	CED FORCES,	WITH Z	NERGY BALANCE		TIME	9:10 57.	DATE.	5/24/9e
	DEC	GREE O	F FREEDON	6 16 - 4	IS READ	FROM UN	IT # 23	JCINT	ə 10.	DIRECTION · F	2				
	51	LEF.	L-ME		LOAD	DISP	LACEMENT	VELOCIT	Y እ	CCELERATION					
	SI	C C	.00000		LOAD .00000	DISP	LACEMENT	VELOCIT	Y A	CCELERATION .CODDC					
	SI	C 1 2	.00000		LOAD .00000 -25 000	DISP	LACEMENT . 00000 00000	VELOCIT .0000 .2000	Y A 0 0	CCELERATION . C000C . C000C					

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F. NONLINEAR HYSTERESIS MODEL

Description of Input Information

An axial spring system (Fig. 58-a) is analyzed to calculate the static cyclic response of the nonlinear element. TAKEDA, AXLMODA, BEND1, SHEAR1 and BILINEAR hysteresis models are assumed for this system. Length of the spring used to calculate the stiffness is XLEN=1. Loading condition is shown in Fig. 58-b with displacement control and consideration of unbalanced forces. Material properties are

Kt=33.3 kips/in , Kt2=0.01111 kips/in, Fy=5 kips, AXLMOD: $K_s = 111.1 \text{ kips/in},$ $\alpha = 0.9$, $\beta = 0.2$, DI = 0.2. $\mu f = 20.$ NSEG=8, NI=10, DY=0.16 1/in, DI=0.2. (Fig. 58-c) BEND1: P (kips-in): 9.950 12.01 13.67 15.49 15.91 30.0 6.12 8.080 D (1/in): 0.065 0.120 0.181 0.485 0.731 1.069 1.155 10.0 SHEAR1: NSEG=8, NI=10, DY=0.16 1/in, DI=0.2. (Fig. 58-c)

6.12 8.080 P (kips-in): 9.950 12.01 13.67 15.49 15.91 30.0 D (1/in): 0.065 0.120 0.181 0.485 0.731 1.069 1.155 10.0

TAKEDA: EI=2.5E7 kips, PC=6 kips-in, DC=0.1 1/in, PY=15 kips-in, DY=0.5 1/in, PU=30 kips-in, DU=10 1/in, DI=0.2.

BILINEAR: E=50 kips/in, PY=15 kips, SIE=0.5 kips/in, μ F=10, DI=0.2.



Figure 58. Axial Spring System

Input and Output

Input
1 ECHO OF INPUT DATA

2C C.00 P.CU 60.00 10
10 C C C C 0 P.
10 C C C C 0 P.
10 C C C C P.
10 C C C C P.
10 C C C C P.
11.1 33.1 .0111. 5.00 9 2 2C C.2
12. *AKLMOD' 11.1 33.1 .0111. 5.00 9 2 2C C.2
12. *BEND1 * 510 60 9.950 12 010 13.670 15.490 15.910 3C.
12. *0 055 0.120 0 181 C.485 C.731 1.069 1.155 1C.
13. *SHEAR1 * 6 1C 26 C 20
14. * 6 120 5.080 9 950 12.010 13.670 15.490 15.155 10.
15. *0 655 0.120 0 181 C.485 C.731 1.069 1.155 10.
16. *TAKEDA' 2 5E7 6 .1 15 .5 30 10 0 2C
17. *ELSPLS' 56 15 .5 10 0.20
18: C C O FALSE. KG AKL. FORM, ASSY
19: 5 NELEM
20. *SPRING-1' *FX' 1 1C 2C 1 1.00 1 0 C C .0 0
21. *SPRING-2' *FX' 2 1C 20 1 1.00 1 0 C 0 0 5.
22. *SPRING-1' *FX' 3 10 2C 1 1.00 1 0 C 0 0 5.
23. *SPRING-1' *FX' 5 10 2C 1 1.00 1 C 0 0 0.0
24. *SPRING-1' *FX' 5 10 2C 1 1.00 1 C 0 0 0.0
25. 0 C FALSE. MASS
26. 0 C FALSE MASS
27. *SOLO4 '
28. CYCLIC DISPL CONTROLL WITH UNBALANCED FORCES & ENERGY BALANCE'
28. CYCLIC DISPL CONTROLL WITH UNBALANCED FORCES & ENERGY BALANCE'
28. CYCLIC DISPL CONTROLL WITH UNBALANCED FORCES & ENERGY BALANCE'
29. 0 200 10 TRUE. / NCH.
20.0 0 0 0
33 1 2C 6 C *FZ' 1.0
34 0 C 0 C *ENO' 0
35. *LOAD-A' 1.00 0 C 50
36. *LOAD-A' 1.00 0 C 100
37. *COAD-A' 1.00 0 C 100
38. *LOAD-A' 1.20 C 0 100
39. *LOAD-A' 1.20 C 0 100
39. *LOAD-A' 1.20 C 0 00
30. *LOAD-A' 1.00 0 C 30
31.0 COAD-A' 1.00 0 C 30
34.0 COAD-A' 1.00 0 C 30
35. *LOAD-A' 1.00 0 C 30
36. *LOAD-A' 1.00 0 C 30
37. *LOAD-A' 1.00 0 C 30
38. *LOAD-A' 1.00 0 C 30
39. *LOAD-A' 1.00 0 C 30
39. *LOAD-A' 1.00 0 C 30
30.0 C 4. *READ VNIT+21 VNIT+33'
31. *STOP' .

Output

1 STRUCTURE. . NONLINEAR HYSTERESIS MODELS SOLUTION . TIME: 9:11-37, DATE 5/24/96 *** PROGRAM FEM *** DOUBLE PRECISION VERSION NODE COORDINATES AND DEGREES OF PREEDOM TCTAL NUMBER OF DEGREES OF FREEDOM. NUMBER OF DEGREES OF FREEDOM CONDENSED CUT. NUMBER OF FREE DEGREES OF FREEDOM. NUMBER OF RESTRAINED DEGREES OF FREEDOM. 20 12 NODE COSH X-COORE Y-CCCRD Z 16 1 .05005 .00005 2C 1 .05000 .00005 NOTE R RESTRAINED DEGREE OF FREEDOM C - CONSTRAINED DEGREE OF FFEEDOM Y-CCCRD Z-COORD .00000 .00000 .00000 60.000 FX 3 ⋅ R € - R FZ MX MY 1·K 5·R 6·R 2·R 10·R 11-R FY 4 · R 9 · R MZ 7 - R 12 - R DIRECTION COSINES COS' 1: VX 1,60000 I +.00000 J +.00000 K VY .60000 I +1.00000 J +.00600 K VZ STRUCTURE. . NONLINEAR HYSTERESIS MODELS Solution . . . cos · · · CC00C I +.00000 J +1.00000 K TIME: 9:11 37, DATE: 5/24/96 AXLMOD HYSTERESIS MODEL: FOR UNIT LENGTH MEMBER MAT SC ST1 1 111.100 33 3000 ST2 FY ALFHA 1111005-01 5.00000 .900000 BETA 2000CO MAX DUCT. BETA-DI 20.0000 .20000 .200000 1 STRUCTURE ... NONLINEAR MYSTERESIS MODELS SOLUTION... : TIME: 9 11:37, DATE: 5/24/96 BENDI HYSTERESIS MODEL DATA - UNIT LENGTH MEMBER BACKBONE CURVE POINTS - MATL NI Dr 2 10 .150000 MOMENT **BETA** ROTATION MOMENT 6 12000 6.03000 9.95000 12.0100 13 6700 15 4900 15 9100 .6500002-01 .120000 .151000 .485000 200000 .731000 1 06900 1 15500 30 0000 10.0000 : STRUCTURE. ..: NONLINEAR HYSTERESIS MODELS SOLUTION..... TIME: 9:11:37, DATE: 5/24/96 -

	SHEAR	1 HYSTERES	IS MODEL	DATA -	UNIT LEN	STH MEMBER	1							
	васкв	CNE CURVE E	POINTS -	MAT. N 3 10	.1	CY 500CO	BETA .200005	STRESS 5 12001 8 08000 5.95200 12.0100 13 6700 15.4900 15 9100 30 0000	2 C C O O O O O O O O	5TRAIN .650000F.0 120500 .81000 485000 .731050 1.06900 1.05900 1.15500 10.0000	1			
1 S' S:	TRUCTUR	E NONI	LINEAR H	YSTERESI	5 MODELS						TIME	9-11:37,	DATE:	5/24/96
	TAKED	A HYSTERESI	IS MODEL	. FOR UN	IT LENGT	h member								
м	AT.	BETA	EI			CRACK	YEILO	ULTIMA	TE					
	4	200000	. 25	0005E+05	6	.00060 100000	15 6000 .500000	30 CO 13.00	90 90					
2 ST S(TRUCTUR CLUTION	E : NONI . :	LINEAR H	YSTERESI	S MODELS						TIME:	9:11·37,	DATE:	5/24/96
	BILIN	EAR HYSTER	ESIS MOD	EL PARAM	ETERS									
1 S1	AT. 5 TRUCTUR OLUTION	KE 50 0600 E: NONI I:	:5 LINEAR H	PY DOOC STERESI	500 S MODELS	OCC VIE	MAX DUCT 10.0000	BETA . 200030			TIME.	9.11:37,	DATE :	5/24/96
EL	0 TREME	2, ONE (LOS	CAL) DOF	SFRING	EL EMENT									
FX FX FX FX FX			 MATL 1 2 2 3 3 4 4 5 5 	START 10 10 10 10 10	END · · · 20 20 20 20 20 20	TYPE AXIAL AXIAL AXIAL AXIAL AXIAL AXIAL	LENGTH 1 CO0 1 CO0 1.000 1.000 1.000	1.00000 I 1.00000 I 1.00000 I 1.00000 I 1.00000 I 1.90000 I	Y-AXIS 00000 00000 +.00000 +.00000 +.00000 +.00000	J +.0000 J0000 J +.0000 J +.0000 J +.00000 J +.0000	K K K K K K	ART DIST 0000 0000 0000 0000 0000 0000	END 0000 0000 0000 0000 0000	DIST
	ZERO	MASS MATR	x											
	FROP ALPHA	ORTICNAL D	AMFING C	OIEFICIS ETA-	NTS 20000									
1 50 50 50 11 11	TRUCTOR OLUTION OLUTION NTERVAL NTEPVAL	E NON: CYC: #4. STATIC FOR PRINT: FOR WRITIN	LINEAR H LIC DISP C NCNLIN ING DATA	YSTERESI C. CONTRO JEAR SOLU TO FILE.	S MCDELS CL WITH TION 25	UNBALANCE 00 10	ED FORCES & E	ENERGY BALANCI	E		TIME. TIME:	9 11:37, 9:11 37,	DATE DATE	5/24/96 5/24/96
ហ	NBALANC	ED JOINT FO	DRCES AR	E ADDED	TO THE N	EXT CYCLE								
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	ELEME Energ Applie	NT % 1 Y BALANCE : D JOINT LOJ	IS WRIT IS WRITT ADS	TEN TO UN	NIT # 3	21								
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MAXIMUM GCS RESTRAINT REACTIONS NOTE: MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY

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465	MAXIMUM	RESULTANT C	F REACTIONS.	PORCE- CODO	MOMENT	• .cooc					
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,	LOADING	# C	PEAK ELEMENT F	ORCES							
	SPRIN	G FORCES	MAXIMUM LO	AD AND DISPL A	T MAXIMUM LGA	D NOTE MA	XIMUM VALU	S MAY NOT OC	CUR S	IMULTANEOUSLY	
Ξ	LEMENT L	נ כגם גג 0	TYPE NODEL NODEJ (IAL 10 20	FCRCE 111 160	DISPLACMENT +1 00000	STIF	FNESS				
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sz	RING DUC	TILITIES AN	D EXCURSION FAT	105		40 . · N		-			
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	2	7 50000	18 5000	2 84045	5 1595	3 9	74521	25.0207			
	4	2.400CO	3.20000	3.366C;	£ 0426	5 3	. 16725	6.15131			
1 57	STRUCTURE.	4.0CCO0 NONLI	8.000CO NEAR HYSTERESIS	10.4060 MCDE_S	28.936	2 1	0.9165	30.3645	IME	9 11:37, DATE	5/24/96
sc	DLUTION .	CYCLIG	DISPL CONTROLL	WITH UNBALAN	CED FORCES &	ENERGY BAL	ANCE	T	IME:	9:11:37, DATE	5/24/96
•	LOADING	* 0	DAMAGE INDEX	F 1000	5-5						
2	CLEMENT 1	552130	5.01166	1.20000	.31825	2 1	1.4512				
	2	.100685 .108672	15.4372 15.9817	1.20000 1.20000	2.7445 1.5932	9 2 18 3	8.2375 1 9541				
	4	.160857 .777092	16.7882 15 4500	1.20000 1.20000	4 6717 1.0920	2 3 Z 8	10.6430 14.8456				
	ST	RUCTURE DAI	AGE INDEX-	45007							
1 ST 50	TRUCTURE. DLUTICN	: NONLII	HEAR HYSTERESIS I DISFL CONTROLL	MODELS . WITH UNBALAN	CED FORCES &	ENERGY BAL	ANCE	T. T.	IME: IME:	9:11:37, DATE 9:11:37, DATE	5/24/96 5/24/96
	ELEMENT	# 1 IS	READ FROM UNIT	# 21							
	SPRIN	G PORCES.	10787. 20								
	SOPE :	10 I	FORCE	DIGELAGMENT	AALAL	FSF	DOF				
	3.EF 0	.000000	00000 5 0010	00000	111.10	C0060	0000	C			
	20	.00000	5.0030	.43000	1.11130E-02	25980	1.365	2			
	40	00000	5.0970	80000	1 11100E-02	.49710	2 245	C			
	5C 6C	.00000.	5 0090 .97650	1 0000 .80000	1.111COE-02 20.160	.611C0 2.36470E-	4.018 02 4.006	с Э			
	70 60	00000. 00000	- 9461C -2 2030	.60000	6 2850 6.2350	2.21960E- .1204C	02 4.055 4.272	0 0			
	50 100	00000	-3.46CO 7.3570	.20000 2.55180E-07	6.2850	29690	4.662	C D			
	110	. 00000	-22.220	2C0CC	111.10	4.7290	3,753	0			
	130	60000	66.E6C	.50000	111 16	22.170	4 087	0			
	140	00000	-111.10	-1 0000	111.10	57.660	4.145	ç			
	160 170	00000	-87 770 -64.44C	79000 58000	111.10 111.10	36 590 20 500	4.333	0 0			
	180 196	00000	-41.11C -17.780	37000 16000	112 10	9 4220 3.0080	4 441 4 673	0 C			
	200 210	.00000	-3 0640 ,35850	5 00000£-02 .26000	20 160 6.2850	23590 3.18720E-	5.751 03 5.758	с 0			
	220	00000	1.67BC 2.9960	.47360	6 2950	6 58490E-	02 5.905	0 0			
	240	00000	4.3180	. 59000	6.2850	45230	6 772	c c			
	260	.000000	2 0490	94000	18.510	.1:350	7.570	6 6			
	280	00000	-1 1510	62000	5 7270 5.727C	2.04090£ 3.8038¢E-	03 7,575	0			
	290 300	00000 00000	-2 1080 -3 8246	46000 30000	S 7270 5.7270	12000 24710	7.838 2.122	0 0			
	310 320	.00000. c0000.	-2 9400 -3,0900	.14060 -2.00000E-02	5.7270 27.290	.41950 1 7680	8.506 8.104	0			
	33C 340	00000	20.000	19(00	111 10	4 5120	7 343	0			
	350	.00000	53 550	- 50000	111.10	16 290	7.652	0			
	370	00000	17.780	16000	111.10	3.2620	5.215	2			
	350	00000	9820 53590	9.95990E-03 18600	10.510 15.510	4284C 1 8876CE	9 492 -(2 5 492	6			
	400 410	.00000. 00000.	.71500 1.6890	35000 .52000	5.1270 5.7270	1 36110E- 7.70403E-	02 9.523	с 0			
	420 430	00000 00000.	2.662C 3.636C	.6900C 86C00	5 7270 5 7270	.19:50 .35720	9.920 10 29	0 C			
	44G 450	00000. 00000	4.6100	1.0300 1 2000	5.7270 1.11100E-02	.5741C 72450	10 77	c c			
	460	00000	3 3000	1.1000	17 110	.31530	11 45	c			
	M2	WIMON DUCT	ILITIES AND EXCL	RSION RATIOS							
		DISPLACE ENERGY D	MENT DEFINATION EFINATION #1.	U1• 7 992 U2• 7 567	E1- E2-	11 99 9.313					
1 5	TRUCTURE	ENERGY D NONLI	EFINATION #2: NEAR HYSTERESIS	UPH .1 69 MCDELS	E3•	15.57		Ŧ	1ME	9 11:37, DATI	8: 5/24/96

SOLUTION	;	CYCLIC	DISPL	CONTROLL	WITH	UNBALANCEL	FORCES	á:	ENERGY	BALANCE	

NERGY	DATA IS READ P	RCM JNIT #	23				
STEP	TIME	INPUT	ELASTIC STRAIN	KINETIC	PLASTIC STRAIN	DAMPINED	RELATIVE ERROR #
С	.00060	.00000	00000	.00000	. 00000	.00830	.0000
10	.00000	5.45BC	3 1748	.00000	2 (569	.00006	4.1466
20	.00000	15.792	6.6545	.00000	5 8825	,00000	1.6160
30	.00005	27.665	10.165	.00000	17.032	.00000	1 6829
40	.00000	40.214	12.058	.00000	27.690	00000	1 1557
5 C	.00000	53.300	13.858	.00000	38.976	00000	8742
60	.00000	43 532	4.9307	.00000	38.164	00000	1 0045
70	00000	39 654	1.5260	.00000	37.685	00000	1.1172
80	. 60000	40 442	2,3609	.00000	37.637	.00000	1.0994
90	00000	44 385	2.6411	CCDOC	41 082	C0000.	1 0399
100	00000	50.832	5.6110	00000	44 764	. 00000	.8963
110	60000	50 992	11.839	.00000	48 700	. 20002	7417
- 20	00000	76 854	20 666	00000	55 732	20000	5923
190	00000	46 116	11 768	00000	64 113	00000	4629
140	20000	125 04	50.695	.00000	73.887	.00000	364.2
150	10000	156 56	72 354	00000	84 049	00000	2974
160	20000	- 24 60	41 036	00000	BE C44	000000	3575
170		106 00	91.070	000000	64 554	.000000	4048
1.0		06 010	21.903	.000000	54.5CC		4705
100	.000000	20 212	11 013	.00000	54 642	.00000	.4050
190	.00000	24 366	3 3922	00000	56.507	00000	4750
20	00000	97 701	3.3736	.00000	92.844	.00000	.4944
210	00030	100 90	4.4911	.00000	98.921	00000	.4650
223	00000	112.09	6.5835	CC000	105.02	.00000	.4338
236	C000C	122.14	9 3963	06060	112 25	.09000	38.67
240	00006	134.04	12.929	00000	120 62	.00003	.3628
250	.00000	147.74	16.556	00000	130 43	.50000	.5111
260	00000	139 13	7 1144	00000	131.27	.00000	. 5299
27C	.00000	134 40	2 8730	.00000	130 79	. 20000	.5487
250	. 50000	132 9C	1.657	.00000	130.51	00000	. 5545
29 C	.000C 0	134 16	2.3 6 03	,00000	131.06	.00000	. 5552
30C	.00000	136.98	2.4613	.00000	133.77	.00000	. 5450
31C	00000	140 71	2.9526	00000	137.01	.00006	. 5304
320	.00000	145.60	4.9194	.00000	139.93	00000	.5116
330	.00000	152.28	8.5844	.00000	142.96	.00000	4815
34C	.00000	162.43	14.290	.00000	147,41	.00006	4515
35C	.00000	176.31	23 343	.00000	152.23	.00000	.4160
360	.00000	162.97	10 124	.00000	152 13	.00000	.4451
370	.00000	156.21	3.5582	.0000	151 92	.00000	.4656
380	00000	155 39	1.5460	00000	163.11	.00000	. 4733
390	coboc	156.02	2.6158	00000	:54 66	.00000	4708
400	00000	162.30	3.5001	00000	158 06	. 00000	.4584
410	.00060	167.84	4.9843	.00000	162 11	. 20022	.4433
420	00000	174.72	7 3052	00000	166.67	. 00005	.4258
430	03960	163 15	10 475	00000	17: 33	00000	4062
445	00000	193 15	4 456	20000	177 95	00000	1652
450	100000	204 51	7 386	200000	186 13	00000	4982
460	.00000	198 54	10.420	.00000	187.13	.000000	4985
	MAXIMUN	204.51	72.355	.00000	167.13		
	_	-					
	3	HOSE RE-	.5103%				

G. FOUR-STORY SHEAR BUILDING DYNAMIC ANALYSIS USING MEXICO EARTHQUAKE ACCELERATION DATA (E-W)

Description of Input Information

A four-story shear building (Fig. 59-a) is subjected to the 1985 Mexico earthquake loading (Fig. 59-b). Masses of the structure are $m_1 = .29$ k-sec²/in, $m_2 = .288$ k-sec²/in, $m_3 = .288$ k-sec²/in, and $m_4 = .252$ k-sec²/in. Young's modulus and shear modulus are 3600 ksi and 1400 ksi, respectively. Cross-sectional area, torsional moment and moment of inertia are 11.8 in², .95 in⁴, and 14000 in⁴, respectively. Find the dynamic response of the structure assuming the time increment is 0.02 second for time duration of 24.98 seconds with linear acceleration method.



Figure 59. Four-Story Shear Building

Input and Output

Input

ECHO OF INFUT DATA F INFUT DALA STRUCTURE DEFINATION' 'FOUR STORY SHEAR BUILDING' 5 1 2 1 0 1 00 NNODE.NCOS.NSUPT.NCOND.NCONST SCALE 1 0.00 C.00 144.05 1 C 2 0.02 C.00 144.05 1 C 3 0 00 C.00 144.05 1 C 3 0 00 C.00 140.05 1 C 4 0.00 0.01 396.00 1 0 5 0 0 0 0 522.00 1 0 5 0 0 0 0 SZ2.00 1 0 5 0 0 0 0 0 SZ2.00 1 0 5 0 0 0 0 0 SZ2.00 1 0 5 0 0 0 0 0 SZ2.00 1 0 5 0 0 0 0 0 SZ2.00 1 0 5 0 0 0 0 0 0 SZ2.00 1 0 5 0 0 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 5 0 0 0 0 0 0 5 0 0 0 0 0 0 5 0 0 0 0 0 0 5 0 0 0 0 0 0 5 0 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 5 0 0 0 0 0 0 5 0 0 0 0 0 0 0 5 0 0 0 0 0 0 5 0 0 0 LINE 6 -9 -10 -11. 12. 13. 14. 15 16 17 . 20. 21: 22 0 CONDENSATION C.95 14000 FORM, ASSY BEAM 1460 1 * . a ¢ 14000 0 FALSE AXL. C NELEM BEAM BEAM BEAM MEMBER 2 3 122 00000 ł 0 e 00000 1 1 1 00000 0 0 0 MEMBER 1 C 1 C 000000 3D-BEAM 3D BEAM MEMBER 4 MEMBER 4 ž i č 000000 0 25 FALSE. MASS 0 29 0 29 0 288 C.288 0 C 0 C 0 C C C C 0 29 000 9 9 C.258 C.298 00 23 286

25 :	5 0 252 0.252 0 252	0 0 0 0 0	0 0 0		
26 · 27.	D C DAMFING 'SOLOZ - SOLUTION'				
28	DYNAMIC ANALYSIS USE SC	T1 E-W COMPONENT '	40-60SEC)'		
30:	100000 100000 1250 .FALS	E. IPRINT IWRITE	MAXACC SLMASS		
32:	- 3 9 62 24.98 385 825 11 - END: 0 0 0 0 0 100TP	O DI TF GRAV UT UNIT			
33 · 74	0 [SP1 0 0 0 'END' 0 0 0 0 0 0 '	INITIAL DISE.VELO	AND ACCEL		
351	1 0.CO1C2 0 0 02 .FAL	SE INA ASCALE TO	DT PRINT		
37,	105 1250 1 .FALSE	FALSE.	FALSE. : IN NFS IDIR	FMT ECHC REWIND	
18: 39	1985 SEP 19 MEXICO EARTH DT-0 C2 SEC , E-W DIRECTI	QUAKE ACCELERATION ON, 1250 DATA(40	N DATA, SCT1 RECORDS TO 64.99 SEC. UNIT+IN	V/SEC++21	
40	7.345	13 541 50 065	21 661 54 546	25.614 55.457	36.779 60 123
42	61 467	61 951	52.956	64.717	65.851
43.	63.405	61.60C	66.738	69 611	60.322
45. 46'	59.003 64.295	59.771 65.642	60 557 66.047	51 529 64.157	64.069 64.452
47:	54 554 64 778	63 508 65 377	62.990 64 963	63.506	63.918
49	59.953	57.503	53 934	50.344	46 022
51:	42.668	21 139	14 668 17 C15	31.352	29.016 7.283
52: 53	2 329	-4 613 -23 672	·9.471 -26.963	-12.250 30 337	·15.648 ·32 901
54.	-35.601	-38.761	41 648	44.930	48.573
56.	-55.279	-67.752	-55.452	-71.977	-74.321
1 ECHO	CF INPUT DATA		~		
LINE 57		.30		. 170 1. 80 -87.096	-91.623
58.	-95.547	-97.518	-100.083	-102.245	· 1CC. 367
EC:	-95 958	- 89 .509 - 80 341	-80,157	- E0 160	-77 644
61 [.] 62	-73.847 -56 967	-71 324 -54.141	-69 642 -46 598	·71.443 -39.326	·69.233 ·37.562
- Ē 6	-29.104	-24.236	-19.167	12.151	-11.257
65:	5.032	17 530	26.509	35 520	45.871
65. 67	55.943 69.976	65.692 65.373	76 248 94.829	81 727 91,637	91.094 91.654
58: F9:	96 826 99 646	96 837 99 309	102.445	104 506	102.719
70.	106 014	105.381	105,997	103 126	99.337
72:	59.305	63.943	59.609	56.09:	51.466
74:	44.226 6.848	36 569	25.996	20.668 ·8 581	13.337
75 76	- 17.191 - 26.421	·20 C76 ·26.255	-23.230	25.481	26.193
77	-31.347	-33.775	-36 768	40.715	44.922
7 E : 79 ·	-60 189	-86.796	-92.595	96 245	-97.465
80 81	-98.495 -38.059	-95 940 -82.04C	-98 4C4 -75,208	-96.322 -67.627	·92.455 ·59.298
82. 82.	-50.616	42.985	-36.614	- 36.919	-26.178
84.	-11 711	-9 925	-10.191	-10 962	9 993
65. 66	-12.557	·14 584 ·7.911	-15.619 -6 133	-16.087 -2.805	-12 920 -1.43Ê
87 · 38 :	· 1.378 11.665	1.275	4.296	16.001 26.795	12.434 29.580
59:	33 739	36.127	36.561	40 225	42.378
. 91	39.293	37.095	36 306	36.31	41.398 36.967
52 93:	36.379 30 628	35 919 27 197	35.590 23.367	35.36C 19.147	34.051 14 646
94 .	11.540 3.749	9.124	5 752	3 84	3.594
9€.	3.653	3.903	4.581	4 504	3.172
98.	-12 126	-14 641	· 5.502 · 15.993	-16 638	-17 465
99; 100	-19.485	-21 613 -30 409	-24.555	- 27.157 - 28.432	-25.665
101.	-25.219	23 249	22.232	-20.609	17.106
102-	12 682	17 130	20.507	23 848	25 516
104:	25 964 24.089	26.591 23.151	26 522 21 940	25.905	25.224
105:	15.010 2.641	11.953	9.005	6.100	4.276
106:	1 803	2 784	3.520	3 747	3 713
109.	-6 555	-2 571	5 666	9.547	-12.593
111 112-	1758 -31.244	-22.058 -31.275	- 26 240 - 31,498	28.523	-30.219 -31 483
1 ECHG	OF INFUT DATA			•••••	
LINE	16	. 30:40	.!50: .EC	.170 180	
113. 114	-31,219 -31,675	21.291 -30.262	-31.271 -25.995	-31.270 -27.186	·31.290 24 930
115:	22 (98 8 369	-15 055 -7.096	-15,858	-12 408	-10 011
117	5 892	5.845	-7 290	-5.404	11.262
119	-2-3-9	-20 906	-22.504	-16.633 23.064	-23.205
12C - 121 -	21.975	20.235 -13 952	-18.059 -13.464	16 552 12 820	-15 770 - -11 239
122	·9 095	-6 972 11 633	3 902	-0 03E	4.011
124:	14.590	15 416	15.099	15.750	16 790
125:	18 C12 24 166	19 456 26 . 54 7	26.159 29.798	21 604 31 676	22 858 33 629
127.	37.832	43.162	47.427	50.439	53.653

128 129. 130. 131. 132. 133. 134. 135. 134. 135. 136. 127. 129. 140. 141. 142. 142. 142. 143. 145. 145. 145. 146. 155. 156. 155. 156. 155. 156. 155. 160. 161. 162. 163. 164. 165. 164. 165. 166. 167. 165. 166. 167. 165. 166. 167. 166. 167. 167. 168. 155. 156. 155. 160. 161. 162. 163. 164. 165. 166. 167. 165. 166. 167. 165. 166. 167. 166. 167. 166. 167. 166. 167. 166. 167. 166. 167. 166. 167. 166. 167. 166. 167. 166. 167. 167. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 157. 156. 155. 156. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 167. 168. 167. 167. 168. 167. 167. 168. 167. 167. 168. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 167. 166. 166. 177. 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5.72 10.420 15.486 5.72 10.420 15.486 5.72 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 10.420 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83.954 67.467 59.615 59.615 41.939 22 226 -1 622 -27.764 -55.164 -7.4 11.593 -44.257 -422 -27.764 -55.164 -7.4 11.593 -44.577 -42.575 -44.577 -42.575 -44.577 -42.575 -45.577 -42.575 -45.577 -42.575 -45.577 -42.575 -45.577 -42.575 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 -45.577 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LINE	.1020 .15.11 7.551 7.551 7.551 7.551 7.551 7.551 7.555 40.612 61.335 54.554 40.612 28.792 13.210 0.287 9.604 22.792 22.792 22.6166 16.736 1.6736 1.6736 2.416 7.3658 2.416 7.3658 2.3736 1.581 2.5757 2.97 1.585 2.416 7.582 2.155 54.585 1.585 2.416 7.582 2.416 7.582 2.416 7.582 2.416 7.582 2.416 7.552 1.555 54.689 7.5322 7.616 7.626 1.555 1.555 1.555 1.555 1.356 1.366 1.366 1.378 1.383 7.833 7.834 1.35 1.366 1.366 1.365 1.366 1.365 1.366 1.365 1.365 1.365 1.365 1.365 1.365 1.365 1.365 1.365 1.365 1.355 1.365 1.365 1.365 1.365 1.365 1.365 1.365 1.365 1.365 1.365 1.365 1.365 1.365 1.355 1.365 1.355 1.365 1.355 1.365 1.355 1.365 1.355 1.365 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.355 1.35				2.842 22.286 33.555 42.721 52.908 62.608 59.023 31.423 17.135 2.275 5.5.68 21.127 -5.9.809 -3.513 7.9916 24.086 52.639 34.140 24.086 52.639 34.140 24.086 52.639 34.140 24.086 52.639 34.140 24.086 52.639 34.140 24.085 51.713 -32.162 55.072 -71.336 -858 51.77 71.52 55.658 -11.713 -32.162 2.551 -25.162 -51.561 -56.723 -36.191 -30.077 71.625 125.657 136.777 105.455 125.857 136.777 105.455 125.857 136.777 116.443 92.946 54.718 -55.268 13.366 -56.291 -59.058 13.366 -56.291 -59.058 13.366 -56.291 -59.058 13.366 -56.291 -59.058 13.366 -56.291 -59.058 13.366 -56.291 -59.058 13.366 -56.291 -59.058 13.366 -56.291 -59.058 13.366 -56.291 -59.058 13.366 -56.291 -59.058 13.366 -56.291 -59.058 13.366 -56.291 -59.058 13.366 -56.291 -59.058 -56.291 -59.058 -50.286 -50.291 -59.058 -50.286 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -59.058 -50.291 -50.291 -50.205 -50.291 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -50.205 -	
225: 226: 227: 228: 229: 230:	50,839 73,204 96,016 145,002 153,399 144,612	60.536 71.277 106 764 145 985 154 561 142 772	71 4C2 70.011 115.991 152.524 146.441 140.204	78 727 75 597 125 906 155 061 144 442 140.272	81.133 64 579 136 365 157.517 143 535 141.644	

231	143.225	144.852	146 678	146.750	144 841	
0.3.0.	111 100	177 064	111 100	100 017	132 603	
4343	141.137	137 504	100 -00	120.04	122.070	
233	114 632	103.332	92.685	53 534	73,373	
234.	55 977	49.230	39,086	30 4 15	23.623	
215.		CA 647	11 376	7 764	2 526	
230:		29.297	11.2/0	, , 36	2 390 .	
236 :	-5.057	-12.482	19 899	-26.917	-34.874	
237	-43 549	51,930	-60.870	-70.312	-72.566	
218	- 84 743	. BC 577	-02 559	136 63	-97 421	
2.10			54.530	20.404	24 421	
235	97.528	101.149	-104.779	·109 362	-114 765	
240:	-117 720	-119.315	·122 75*	126.700	-129.957	
24 .	.132 871		136 660	141 625	.114 866	
	192 0/1		100.000		144 500	
24.2	147.535	·14 % 211	-150.044	·151 764	-149.61/	
243	154.621	+162 771	-161.414	-155.475	-150 982	
2:4	. 49 232	141 149	. 175 451	113 826	-101 518	
	70 734	60 CB7		. 35 867	0.445	
245.	- / 9 - 2 - 4	-52 997	- 3D . 2G I	25.897	.9 445	
246:	-1 C30	3 606	9.149	13.216	19.230	
247 -	30.015	39.799	45.494	49 996	52 795	
246	50.174	6.1 7.44	46 100	20 0 22	10 270	
240	=2.104	51.340	45 . 75	39.022	30.779	
249.	42.083	44.205	45.209	54.626	62.269	
250 -	72 772	83 929	91,144	97.693	104.550	
261	111 150	117 763	177 510	100 574	120 537	
224;	111.139	-1/ /94	122.530	+ 20 . 2 / 9	130 393	
252	134.534	137.849	142 943	147.923	150.549	
253:	151.990	151.247	147.666	143.102	139.357	
757	11 525	174 213	10 65-	65 754	77 663	
2 3 4 ;		124.233	-10.60-	52.550	//.003	
255-	67 186	EC.263	56.624	54 084	50 062	
256	45.314	37.965	28 771	19 527	11.478	
257	4 20.0	.2 071	11 469	.20 780		
2	4.276	2.771	11.433	20.280	27 33 3	
252.	-33 614	18.492	41.946	44.542	-47 839	
259:	-50 999	54 434	- 56 . 7 0 9	55 760	-54 915	
260	. 21 637	. 49 . 177	10 660	- EC B(7		
200			-43 660	30 90	55.500	
251	-61,573	-66.614	-71 293	77.046	-81.770	
262.	-85.650	-92.006	-98.676	-103.731	-108.€34	
263.	.113 080	.110 517	. 126 127	.133 535		
463.	-115.080	110.714	-126.157		-140 331	
264	144.046	-145.474	-147.980	-148 957	-146 234	
265:	-139 919	-131.515	-120 618	-106.369	-90.046	
266.	-73 071	.57 055	./2 561	- 27 6 29	417 413	
			42.555	27.035	14.413	
26 :	1 658	14.118	23.445	32.153	41,117	
268.	48.000	54.091	58 696	60 498	63.129	
269	58 116	56 6.1	56 1 54	E4 395	54 896	
10,	50.110	55.011	50 104	34.503	54.000	
270:	26.693	55.461	51.50:	65.521	68.104	
271:	70 519	73 223	73.869	75.626	78 397	
272-	76 311	86.178	82 751	65 955	89 890	
	04 404	00.430	02. 21			
4.3.	94.494	99.420	105 170	112.210	110.001	
274	114.521	105.963	95.322	83.549	76.103	
275:	56.902	45 416	37.628	23 244	30 437	
272.	20,100	20.202		25 264	22 100	
2 . 6 .	29 105	26.962	28,565	25 350	23.155	
277:	19.910	15.416	10 472	5,915	0.347	
278	6.504	13.685	-21 730	- 3 - 066	·4C.19C	
276		53.665		52.050		
2/9:	- 4 Q	52.642	- 50 . 4 5 5	- 58.976	·60./18	
280.	-61 636	·61 913	-60.954	59 C61	-56 223	
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LINE	. 10 20)	i 7C!§C		
			. 47 540	- 44 273	-42 252	
291	-53 376	-50.767				
291	-53 376	·50.767	-97.J49	. 16 661	.41 .421	
291	-53 376 -40.575	- 50.767 - 38 156	-37.817	- 39.651	41.421	
281 282 283	-53 376 -40.575 -44.531	-50.767 -38 156 -49.011	-37.817	- 39.651 -60.435	·41.421 ·65.645	
281 252 283 284:	-53 376 -40.575 -44.531 -70.930	-50,767 -38 156 -49.011 77 345	-37.81 -37.81 -54 421 -82.867	- 39.651 - 60.435 - 88.172	-41.421 -65.645 -92.253	
291 252 283 284: 285.	-53 376 -40.575 -44.531 -70.530	-50.767 -38 156 -49.011 77 045	-37.81 -37.81 -54.421 -82.887	- 39.651 - 60.435 - 88.172	-41.421 -65.645 -92.253	
291 252 283 284 : 285 :	-53 376 -40.575 -44.531 -70.930 -32 906	-50.767 -38 156 -49.011 77 045 -91.423	- 37.817 - 54.421 - 82.867 - 89.177	- 39.651 - 60.435 - 88.172 - 83.747	-41.421 -65.645 -92.253 -75.427	
291 252 283 284 : 285 : 286	-53 376 -40.575 -44.531 -70.930 -92 906 -65 635	-50,767 -38 156 -49,011 77 345 -91,423 -53 697	- 37. 38 - 37. 817 - 54. 421 - 82. 667 - 89. 177 - 39. 377	- 39.651 -60.435 -86.172 -83 747 -24.563	-41.421 -65.645 -92.253 -75.427 -10.821	
291 252 283 284: 255: 286 287.	- 53 376 - 40.575 - 44.531 - 70.930 - 32 906 - 65 635 2 585	-50,767 -38 156 -49.011 77 045 -91.423 -53 697 15.970	-37.817 -54.421 -82.667 -89.177 -39.377 28.305	- 39.651 +60.435 -86.172 -83.747 -24.563 38.580	-41.421 -65.645 -92.253 -75.427 -10.821 47.535	
291 282 283 284: 285: 286 287. 298.	- 53 376 -43.575 -44.531 -70.930 -92 906 -65 635 2 585 57 114	-50,767 -38 156 -49,011 77 045 -91,421 -53 697 15,970 65,233	- 37.917 -54.421 -82.667 -89.177 -39.377 28.305 72.263	- 39.651 -60.435 -88.172 -83.747 -24.563 38.580 78.542	-41.421 -65.645 -92.253 -75.427 -10.821 47.635 -83.674	
291 252 283 284: 285: 286 287. 298:	- 43,575 - 44,531 - 76,532 - 32,906 - 65,635 2,525 57,116	-50.767 -38 156 -49.011 77 045 -91.421 -53 697 -55.970 65.223	- 4 - , 32 - 37 , 327 - 54 421 - 82 , 867 - 89 , 177 - 39 , 377 - 28 , 305 - 72 , 263	- 39.651 -60.435 -88.172 -83.747 -24.563 38.580 78.542	- 41. 421 - 65. 645 - 92. 253 - 75 427 - 10. 821 47. 535 83. 874	
291 252 283 284; 285; 286 287, 298; 298; 279;	- 40.575 - 40.575 - 44.531 - 70.930 - 65 635 - 2525 57 116 86 640	-50.767 -38 156 -49.011 77 345 -91.421 -53 697 15.970 65.223 85.670	- 37. 327 - 54 421 - 82. 887 - 89. 177 - 39. 377 - 28. 305 72. 263 9. 264	- 39.651 -60.435 -88.172 -83.747 -24.563 38.580 78.542 74.431	-41.421 -65.645 -92.253 -75.427 -10.821 47.535 83.874 -70.103	

<u>Output</u>

1 STRUCTURE SOLUTION	· · · ·	FOUR STORY SH	EAR BUILDING						τı	IME: 11:42-40, DATE	5/24/
••• PROGRA	w. Fem	Di Di	DUBLE PRECISION	VERSICN							
NODE C	CORDIN	ATES AND DEGR	EES OF FREEDOM								
TOTAL N NUMBER NUMBER NUMBER	UMBER CF DEG CF FRE CF RES	OF DEGREES OF REES OF FREED E DEGREES OF TRAINED DEGRE	PREEDOM DM CONTENSED OF FREEDOM ES OF FREEDOM								
NODE 1 2	CCS 5 1 1	X - COORD CCODE 0000C	Y-COORD . 00000 00000	2 - COORD 00000 144.00	FX 9 - R 5	FY 10-R 15-R	FZ 11-R 16-R	MX 12 - R 17 - R	MY 13 · R 1	MZ 14 · R 19 · R	
4 5 7	CTE: R	COCOC OCCOC FESTRAINED CONSTRAINE	.00960 .06606 DEGREE OF FRE D DEGREE OF FRE	396 00 522 00 EDOM EEDOM	7 8	23-R 27-R	24 - R 28 - R 28 - R	25 - R 29 - R	4	26 - R 30 R	
DIRECT	TON CO	SINES									
CCS - 1: 1 STRUCTURE SOLUTION	vx ·	1 00000 I + - FOUR STORY SHI	DGODQ J (+.000) EAR BUILDING	00 К VY+ .3)	0000 I +1.0	0000C J	- 00000	K VZ:	OUCDO TIME.) I +.00000 C +1 00 11:42.40, DATE 5	000 K /24/96
3.D E	ASTIC	BEAM ELEMENT									
MATL	E	GAMMA	AX AY	AZ	IX	IY	1 Z.				

1 3 600E+03 1.40CE	+03 11.8 .00	c coo	950 1	400E+04 1.460E+0	4			
1 STRUCTURE FOUR STO SOLUTION	RY SHEAR BUILDING					TIME. :	1:42:40, DATE	5/24/96
ELEMENT 08, 30 PEAM ELE	MENT							
HEMBER 1 5 MEMBER 2 2 MEMBER 3 3 MEMBER 4 4 SCLUTION FOUR STO	ATL START END R 1 1 2 1 2 3 1 3 4 1 4 5 RY SHEAR BUILDING	EL CD LENGTH 144.0 125.0 125.0 126.0	00000. 00000 00000 00000	- Y-AXIS I -1.00000 J + 0 I -1.00000 J + 0 I -1.00000 J + 0 I +1.00000 J + 0 I +1.00000 C + 0	COOD K COOD K COOD K COOD K	TART DIS 00000 00000 00000 00000 00000 TIME 1	ET END DIST .0000 .0000 .0000 .0000 11 42.40, DATE	FKG 1.000 1.000 1.000 1.000 5/24/35
LUMPED NODE MASSES								
NCDE MX 2 .2990 3 .2880 4 .2890 5 .2320	MY MZ 1900 .2900 1880 .2880 1880 .2890 1520 .2520	1XX 0000 0000 0000 0000	YYI 0000 0000 0000 0000	122 IXV 000C .000 .000C .000 .000C .000 000C .000	0 1 0 1 0 1 0 1 0 1	TYZ 00000 0000 0000	1YZ .0000 .0000 .0000 .0000	IGEN INC 0 0 0 0 0 0 0 0 0 0
- THE MASS MATRIX IS	NOT CONDENSED WIT	H THE STRUCTUR	AL STIFFNESS	MATRIX.				
PROPORTICNAL DAMPIN	G COLEFICIENTS BETA000C0							
1 STRUCTURE : FOUR STO SOLUTION : DYNAMIC	RY SHEAR BUILDING ANALYSIS, USE SCT:	E W COMPONENT	(40-505EC.)			TIME:	11.42:40, DATE 11:42:40, DATE	: 5/24/96 : 5/24/96
SOLUTION #2, LINEAR ACC	ELERATION METHOD C	F NUMERICAL IN	TEGRATION					
INITIAL TIME TIME STEP FINAL TIME ACCELERATION DUE TO GR STEP INTERVAL FOR PRINT THE STRUCTURE IS ASSUMD		000 000E-02 800 926 CALLY						
DATA WRITTEN TO FIN	ES							
NOT INCLUDE STATICS CAN	E EXTERNAL DEFORMA	FICNS						
GROUND ACCELERATION	RECORD							
INPUTING TRANSLATION 1985 SEF 19 MEXICO DT-0 02 SEC., E-W D THE RECERD CONTAINS DIRECTION OF ACCELEN	AL ACCELERATION RE EARTHQUAKE ACCELER RECTION, 1250 DAT/ 1250 POINTS, BE RATION 1 000	CORD E 1. FROM NATION DATA, SC (46 TC 64.98 S SINING AT TIM O I +.CODCC	4 UNIT: 105 TT1 RECORDS SEC. UNIT-CM/S E: C00003 T - 00000 K	EC**2: WITH A TIME	INCREMENT	OF.	2.000000E-02	
INPUT ACCELERATION	MAXIMUN AT 158.40	TIME 15.900	MINIMUN AT 167.92	TIME 16.080	AVÉRAGE .80496	STA	NDARD DEV 71.189	RMS 71.165
X-AXIS ACCELERATION Y-AXIS ACCELERATION 2-AXIS ACCELERATION 1 STRUCTURE FOUR ST SCLUTION DYNAMIC	MAXIMUN AT 16157 CGOOC 2 CCOCC 2 CRY SHEAR BUILDING ANALYSIS USE SCT:	TIME 18.907 2.00000E-02 2.00000E-02 1 E-W COMPONENT	MINIMUN AT 17126 .00000 .00000	TIME 15.680 2.03000£•32 2.03000£•32	AVERAGE 8.21078E- 00000 .00000	STAI 04 7 TIME TIME	NDARD DEV. .26128E-02 00000 00000 11.42:40, DATE 11.42:40, DATE	RMS 7.25894E-C2 .00000 .00000 .5/24796 .5/24796
MAXIMUN VALUES FOR ALL	STEPS							
GCS MAXIMIM DISPLACEME	NTS NOTE. MAXIMUM VALU	JES MAY NOT CO	CUR SIMULTANES	DUSLY				
NCDE DX	DY	DZ	RX	RY	RZ			
1 .000000 2 3.28925 3 10 3397 4 20 2743 5 31 6544 1 STRUCTURE - FOUR ST	.050000 .000000 .000000 .000000 .000000 000000	C000C0 C00C00 C00C00 C00C00 C00C00 C00CC00	0¢30¢3 0633¢0 0633¢0 0633¢0 0¢3390	.000000 4.276600E-02 6.995925E-02 6.751189E-02 9.32309E-02	000000 000000 000000 000000 000000	TIME	11.42 40 DATE	: 5/24/96
MAXIMUN VALUES FOF ALL	STEPS	I E-W COMPONEN	I:4D-665EC .			I IME :	11.62.60, DATE	: :/24/90
GCS MAXIMUM VELOCITIES								
NODE DY	NOTE MAXIMUM VAL	JES MAY NOT DO	CCR SIMULTANE	CUSLY				
1 . 00000 2 -5.62952	000000 050000	000000 000000	.000000 .000000	.000000 114641	. 220022			
3 -26.4033 4 -45.3156 5 -67 5249 1 STRUCTURE FOUR ST	000000 000000 000000 CRY SHEAR BUILDING	.900000 .900000 900090	.000000 .000000 .000000	151512 207110 .234099	.050000 .090000 .090000	TIME	11 42.40, DATE	. 5/24/96
SOLUTION . : DYNAMIC MAXIMUN VALUES FOR ALL	ANALYSIS. USE SCT	1 E-W COMPOSEN	T(40-60SEC)			TIME	11 42:40, DATE	5/24/96

GCS MAXIMUM ACCELERATIONS NOTE MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY DY EJCN DZ RХ RY RZ DХ 1 00000 00000 00000 00000 2 -70.2211 000000 00000 00000 3 120 910 00000 00000 00000 00000 4 125.862 00000 00000 00000 00000 5 -150.356 00000 00000 00000 00000 5 TRUCTRE... FOUR STORY SHEAR BUILDING SOLUTION..... DYNAMIC ANALYSIS USE SUT1 F-W COMPONENT440-60SEC Y 000000 000000 - 603117 .432265 .945054 1 35436 0000000 000000 000000 000000 00000 TIME 11-42 40, DATE 5,24/96 TIME 11 42-40, DATE: 5/24/96 MAXIMUN VALUES FOR ALL STEPS MAXIMUM GCS RESTRAINT REACTIONS NOTE. MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY NODE PX FΥ FZ. МΧ MY MZ. -18246 34 0000000 0000000 0000000 0000000 1 -66 55920 0000000 0000000 00000000 0000000 000000 0000000 000000 000000 000000 0000000 0000000 0000000 0000000 -15246.34 00000CC .0000000 MAXIMUM RESULTANT OF REACTIONS. FORCE- 66.86 MOMENT- 1 STRUCTURE . .. FOUR STORY SHEAR BUILDING SOLUTION. ... DYNAMIC ANALYSIS. USE SCT: E-W COMPONENT(40-60SEC.) MOMENT - 1.8246E+04 TIME: 11:42:40, DATE 5/24/96 TIME: 11:42.40, DATE: 5/24/96 MAXIMUN VALUES FOR ALL STEPS COLUMN + LOAD + REPRESENTS THE DOP WHICH HAS MAXIMUM VALUE 3C BEAM FORCES. . MAXIMUM VALUES FOR ALL STEPS NOTE MAXIMUM VALUES WITH THE OTHER DOFS FORCES ARE PRINT OUT AT THE SAME TIME ELEMENT LOAD NODE AXIAL PY P2 TORSION MY M2 1 3 FORCE 1 .000000 .000000 66.8592 .000000 .11560.0 000000 TOTAL 2 .000000 .66.8592 .000000 1932.25 .000000 LOES WITH THE O P2 P2 49.0932 49.0932 49.0952 56.8592 56.8592 20.8950 20.8950 45.5442 35.2140 45.5442 35.2140 45.5442 27.8676 -27.8676 41.6176 FORCE FORCE 000000 1932.29 •18246 3 5 0.00000 .000000 000000 000000 000000 000000 000000 000000 -18246 3 11176.C -1156C.O 1932.29 -16293 1 13264.2 -1C726 9 FORCE FORCE FORCE 000000 000000 000000 000000 5 000000 .000000 0000000 1 9 11 1 FORCE FORCE FORCE 000000 .000c00 1225232 000000 000000 0000000. 3 2 .000000 000000 -10726 9 4989.38 -13264.28 -13264.28 -10726.9 4988 36 -13238.4 9727.11 -9481.45 FORCE FORCE FORCE FORCE FORCE FORCE 000000.000 000000 2 5 .000000 .000000 .000000 .000000 0000000 2 9 000000 2 11 . 000000 . 920000 FORCE 000000 000000 - 27.8678 41 6176 41.6176 41.0687 41.6176 41.6176 41.6176 40.7677 36.3248 36.3248 36.3248 36.3248 36.3249 28.8041 28.8041 .000000 .000000 3 3 FORCE 000000 000000 .0000000 . 200020 -9481.45 4237.64 -9727.11 4552.47 -9481.45 4237.64 -9713.65 4576.92 500000, 500000, 600000, 500000, 500000, 500000, 500000, FORCE \$ 000000 3 5 FORCE FORCE FORCE FORCE 0000000 434 3 9 000000 3 11 3 4 FORCE . 220629 306036 000000 000000 3 000000 000000 000000 000000 4 FORCE 000000 000000 .000000 000000 000000 000000 000000 0000000 1.451425E-02 -4576 92 FORCE . 000000 000000 000000 000000 ۷ 5 FORCE 4 -4576 92 1 451425E-02 -4576.92 1.451425E-02 -3629 32 1 976073E-02 FORCE 4 9 FORCE FORCE FORCE 000000 000000 000000 000000.0000 4 11 000000 600000 ·28.804: 000000 . 0000000 TIME: 11:42:40, DATE: 5/24/96 TIME: 11:42:40, DATE: 5/24/96 1 STRUCTURE SOLUTION .

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MAXIMUN VALUES FOR ALL STEPS PEAK ENERGY VALUES

MAX	INFUT ES	VERGY .		466.13
MAX	ELASTIC	STRAIN	ENERGY .	 535.73
MAX	PLASTIC	STRAIN	ENERGY	 0000
MAX	KINETIC	ENERGY.		 545 31
мах	DAMPING	ENERGY		 . 00000

INELASTIC DYNAMIC ANALYSIS Η.

Description of Input Information

A one-bay frame (Fig. 60) is subjected to inelastic dynamic analysis with linear acceleration method. Input force is $F(t) = 0.02\sin(\pi t)$ kips. Structural mass is equal to 0.0002 k-sec²/in at joint 3. Time increment is 0.01 second with time duration of 1.5 seconds. Gravitational acceleration constant is assumed as 1 in/s². Time increment for the input acceleration is 0.1 second. The element is IE3DBEAM. Its hysteresis material properties are bilinear hysteresis models (IA BILN) as follows.





Figure 60. Inelastic Dynamic Analysis of One-Bay Frame

Input and Output

Input

ECHO OF INPUT DATA

- LINE
 - 2:

4: 1 0.60 0.00 0.00 120 10
5: 2 0.00 0.00 120 10
5: 2 0.00 0.00 120 10
7: 4 243 0.00 0.00 120 10
7: 4 243 0.00 0.00 120 10
7: 4 243 0.00 0.00 120 10
7: 4 243 0.00 0.00 100 0.00 0.00 0.00
9: 1 1:1111 0.00 0.00 0.00 0.00 0.00
9: 1 1:111 0.00 0.00 0.00 0.00 0.00
1:1 0.00 0.00 0.00 0.00 0.00 0.00
1:1 0.00 0.00 0.00 0.00 0.00 0.00
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<u>Output</u>

: STRUCTURE. : INELASTIC DYNAMIC ANALYSIS SOLUTION..... TIME 11 57: 5, DATE: 5/24/96 --- PROGRAM FEM --- DOUBLE PRECISION VERSION NODE CONSTRAINTS NODE: 2 IS RESTRAINED, CONSTRAINT 2 IS IGNORED... NODE: 2 IS RESTRAINED, CONSTRAINT 6 IS IGNORED... XY-PLANE CONSTRAINT, MASTER 3 SLAVE: Z NODE COORDINATES AND DEGREES OF FREEDOM
 NODE
 COS #
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 FX 4 - R 3 - C FY 5-R 10-R 14-R 19-R FZ 6 · R 11 · R 15 · R 20 · R MDX 7 · R 12 · R 16 · R 21 · R MY 8 · R 1 MZ 9 · R 13 · F 17 · R 2 22 · E 4 246.30 DF003 DF009 NCTE. R - RESTRAINED DEGREE OF FREEDOM C - CONSTRAINED DEGREE OF FREEDOM 18 · R 23 · R DIRECTION COSINES ... CCS: 1. VX. 1.00000 I -.00000 J + 00000 K VY .00000 I +1.00000 J -.00000 K VZ .00000 I + 00000 J -1.00000 K I STRUCTURE . INELASTIC DYNAMIC ANALYSIS TIME: 11:57 5. DATE: 3/24/96 SOLUTION .. 1 STRUC 3.0 ELASTIC BEAM ELEMENT MATL E GAMMA AX A2 1X IY IZ AY 1 2 500E+04 1 115E+C4 1.06 1.00 1 60 1.00 4.000E-C2 4 000E-62 1 STRUCTURE. . INELASTIC DYNAMIC ANALYSIS SOLUTION .. : TIME: 11:57 5, DATE: 5/24/96 . EILINEAR INTERACTIVE MATERIAL PROPERTIES 3P E MAT ELAS TZ MP MAX DOC BETA REDU F 2 1 00000 .500000E-01 250h0.0 400000E-01 2000e0 200000 . 00 00 00 **0** 000000

.

3 1 CC00C .50C00CE-01 250C0 C .4CC00CE-01 200000 20000C C000C0 .000C00

4 .000000	.500000E-01 13	150.6 1	.00000	1.00000	200006	.000000	0000	00		
5 60000	5000008-01 1	ccooc 1	00000	1.00000	.200000	000000	.0000	00		
STRUCTURE	NELASTIC DYNAMI	C ANALYSIS						TIME, 11:	57: 5, DA	CE: 5/24/96
ELEMENT C9. IE3D	BEAM ELEMENT									
MEX. :	START	END LENGT	F	···· Y·AXIS	J + CS300	K CODE	T DIST	END DIST	PKG	
MA MEM 2	TERIAL + FX	5 MX) 4 , (MY 00000	A, 2, (M)	(·B·· 2 . (M	E-AI - 3 .	(M2+B) + 3	066	0100	
MEN 3	TERIAL # : (FX	5, MX	YM), A (MY	A 2 H	(+B) - 2 . (M	12 · A · · 3 .	(MZ+B) + 3	000	0000	
MA STRUCTURE I SOLUTION	TERIAL # (FX NELASTIC DYNAM)	C ANALYSIS	1-4, (MY	-Ai - 2 , (M)	(-B) · 2 , /M	IZ-A)- 2 ,	(MZ-B) - 3	TIME: 11:	.57: 5, D/	NTE: 5/24/96
LUMPED NODE MASS	E5									
NODE MX 3 2.0000E-	MY C4 2.00005-04	MZ 2 6000E-04	XXI 0000	IYY .000C	122 .0000	IXY .000	c	1Y2 0000	IYZ , 2000	IGEN INC 0 0
. THE MASS MA	ATRIX IS NOT CON	NDENSED WITH	THE STRUCT	URAL STIFFN	ESS MATRIX					
PROPORTIONAL Alpha .000	DAMPING COLEF:	CIENTS .000CO								
1 STRUCTURE I SOLUTION I	NELASTIC DYNAM: NELASTIC DYNAM:	IC ANALYSIS IC ANALYSIS						TIME: 11: TIME: 11.	57 5. DI 57 5. DI	ATE 5/24/96 ATE 5/24/96
SOLUTION \$2, LIN	EAR ACCELERATIO	ON METHOD OF	NUMERICAL	INTEGRATION	•					
INITIAL TIME TIME STEP FINAL TIME		0000 1.0000	000 000 E - 02							
ACCELERATION DUE STEP INTERVAL FO	TO GRAVITY	1.00C	:00							
DATA WRITTEN	TO FILES									
NOT INCLUDE STAT	TICS CASE EXTERN	NAL DEFORMAT	IONS							
GROUND ACCEL	ERATION RECORD									
INPUTING TRAN	SLATIONAL ACCE	LERATION REC	CRD = 1, FF	OM UNIT: 10	5					
USE F(T)=0.02 THEREFORE ACC THE RECORD CO DIRECTION OF	2*SIN(PI*T) AS (CELERATION A(T)- ONTAINS 16 D ACCELERATION:	THE EXTERNAL F(T)/MASS POINTS, BEG 1.00000	FORCE 100*SIN(PI INING AT TI I + 00000	(T) ME .000 J +.000	0000 WI	TH A TIME	INCREMENT	OF: 1	100000	
INPUT ACCELER .0000 30 .0000 -30	RATION. 0.90 58.70 0.97 58.70	5 80 9 8 • 80.9	;g's) ∞C 95. C -95.	11 100 11 -100	C.O 9 5. C	95.11	80 90	58 7B	30	90
INPUT ACCELERAT	MAXI MAXI 100.5	MUN AT	TIME 50000	MINIMUN -100 00	AT TIM 1.50	ΩE DCC	AVERAGE 16.606	STAND/ 70	ARD DEV. 988	RMS 70 711
GLOBAL BASE A	CCELERATION IN	THE X DIREC	TICN (g's)	11		5 11	. 20 90	.58 75	. 20	o <i>7</i> .
0000 30	58.7	8 80,9	0 95	11 100	c c		60.20	50. 0	20	
GLCBAL BASE A CCDC C	ACCELERATION IN	THE Y DIREC	TION 'g's) 0.00	. ei	000	0000	.0000	.00 0 0	. 01	000
	.000	J (L.			000					
GLOPAL BASE 3 .0000 .0 .0000 .0	ACCELÉRATION IN 2000 .000 2000 .000	THE Z DIREC C .000 C .000	TION (g's) C .00 D .00	00 .00 0. 000	500 . 50C	. C C D O	.0000	.0000	. 0	000
X-AXIS ACCELER/ Y AXIS ACCELER/	MAXI 100. COTA	MUN AT 00 L 00	TIME 5000	MINIMUN - 100 00	AT TIN .500	4E 100	AVERAGE - 16 . 606	STAND 70	ARD DEV .985	RMS 76.711 000/0
Z-AXIS ACCELERU SYSTEM DISPLACE	ATICH .CCO MENT ' FIRST EL	DC EMENT REACH	10000 TO CRITICA:	000000. 2000 C	. 100	555	.00000	. 31	0000	C0000
•• ELEMENT	FIRST REACH T	0 CRITICAL .	CAD							
GCS DISPLACEMENT	TS. LOADING #	: sti	SP. 25,	TIME .25	000					
NCDE	хс	DY	DZ	R.K		RY	RZ			
1 0000 2 6929	000 000 69 .000	900 . 900 .	0000000	0000000. 0000000	000 4.945	0005 97768-01	000000			
4 0000 1 STRUCTURE : :	00C .00C NELASTIC DYNAM	000 IC ANALYSIS	.900950 .900990	.000000 300000	4.949 .000	9600 9600	.000000 .000000	TIME. 11	:57,:5, D	ATE: 5/24/96
SOLUTION :	INELASTIC DYNAM 100 step	IC ANALYSIS	1.0000					TIME: 11	:57:5, D	ATE: 5/24/96
ENERGY I	PALANCE									
INP	JT ENERGY	INCR: 6 70	MENTAL 922E-03	TOTAL .33019						

		ELAST MINET PLAST DAMPI RELAT	IC STRAIN IC ENERG IC STRAI NG ENERG IVE ERRO	N ENERGY Y N ENERGY Y R	5.242 5.221 901 001	2682-03 8982-03 000 000 000	.24966 14599 00000 .00000 19.523	ŧ						
	GRO INCR	UND RE IMENTA GLOBA GLOBA GLOBA	SPONSE L VALUES L X AXIS L Y AXIS L Z AXIS	TRANSLAT TRANSLAT TRANSLAT	ICN . ICN . ICN	DISFLACEMEN - 63133 .00000 .00000	T VEI 1	.00ITY .54514E-02 .00000 00000	ACCELERATION 2 3 0902 .00000 .00000	1				
1	TOTA STRUCTURE SOLUTION	L VALU GLOBA GLOPA GLOPA IN IN	ES L X AXIS L Y AXIS L Z AXIS PLASTIC ELASTIC	TRANSLAT TRANSLAT TRANSLAT DYNAMIC # DYNAMIC #	TON. TON TON WALYSIS WALYSIS	31 569 .00000 00000	- 5	2 138 20000 20000	-3 31402E 00006 .00000	ū5	TIME: TIME:	11:57 11:57	5, DATE 5, DATE	5/24/9€ 5+24/9€
	GCS DISPLAC	EMENTS	, LOADI	NG 🌹 I	STE	P: 100, 7	IME: 1.	0000						
	NODE	5X		DY		DZ	R.X		RY	RZ				
1	: 2 3 4 STRUCTURE . SOLUTION	UC000 18.306 18.306 .00000 IN IN	C 4 6 6 ELASTIC ELASTIC	500000 500000 000000 000000 000000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 200000 2000000	NALYSIS NALYSIS	000000 00000 00000 00000 00000	000000 000000 000000 000000)))	600000 125665 125686 00000	000000 000000 000000 000000 000000	TIME. TIME:	11 57: 11:57:	5, DATE: 5, DATE	5/24/96 5/24/96
_	GCS VELOCIT	IZS.	LOADING	≒ 1	STEP	100. TIME	1.006	00						
	NODE	ЪX		DY		ΣC	RX		RY	RZ				
1	I 2 3 4 STRUCTURE SOLUTION	.00000 24 929 24.929 00000 . : IN IN	0 5 5 C ELASTIC ELASTIC	0000000 000000 000000 000000 000000 0000	WALYSIS WALYSIS	000000 000000 000000 000000	.000000 .00000 .00000 .00000		000000 167600 157600 600000	000000 000000 000000 000000	TIME: TIME	11.57; 11.57;	5, DATE: 5, DATE.	5/24/96 5/24/96
_	GCS ACCELER	ATIONS	LCADI	NG ‡ 1	STE	P. 10C, T	IME 1.	0000						
	NODE	DX		20		D2	RX		RY	RZ				
1	1 2 - 3 - 4 STRUCTURE SOLUTION	.00200 69.301 69.301 .00000 : IN IN	0 7 0 ELASTIC ELASTIC	CCOCCC CCOOCC .000000 .000CO0 DYNAMIC # DYNAMIC #	NALYSIS NALYSIS	00000 00000 00000 00000 00000	000000 000000 000000000000000000000000)	000000 514871 514971 900000	000000 000000 000000 000000 000000	TIME: TIME:	11:57: 11.57:	5. DATE: 5. DATE:	5/24/96 5/24/96
-	GCS RESTRAI	NT REA	CTIONS,	LOADING	a 1	STEP:	100, TIN	10E: 100	000					
	NODE	FX		FY		FZ	мх		MY	MZ				
	1 ·€ 2 3 4 ·6	. 57248 . 00000 . 00000 . 87248	402-C3 00 00 402-03	0000000. 00000000. 0000000000000000000	-2.	DCC006C 9552050E-03 9552C80E-03 0000C00	000000 000000 000000 000000	00 00 00 00	4700736 0000000 0000000 4700736	0000000 000000 000000 000000	• • • • •			
S	RESULTANT	. 13744 OF RE	97E-01	.0000000	1 2245	0000000 5.02 Nomey	.000000	- 0	649397	0000000				
1	STRUCTURE	. : IN . : IN	ELASTIC ELASTIC	DYNAMIC / DYNAMIC /	NALYSIS NALYSIS	E UZ MOMEN	1. 1.0	.,			TIME TIME	11 57 1 11 57.	5, DATE: 5, DATE	5/24/96 5/24/96
	IE3D BEA STEP- ELEMENT LO	M FORC 100, AD	ES. TIME: NOD	1.0000 2 /	U I AL	FY		FZ	TORSION		YIY		MZ STE	FAG
	1	: DI	SPL SPL	1 000 2 000	000	.000000 18.3064	00 . 03	00000	000000 900000	. 00C . 00C	000	- 13 - 2, 38	52553 56707E 02	
	1	1 FO FO	RCÉ RCÉ	1 000)COO (COO	-6 7916893- 6.7916893-	02 .00 03 .00	00000	.000000 000000	000 000	000 000	- 46	4145 50558	1
	2	: DI DI	SFL SPL	2 15 1 3 15 1	064	.000000. 000000.	.00	00000	.000000	. 000	000 000	- 12	25685	
	2	1 FO FO	RCE RCE	2 .000	000C 00CC	-2 923817E- 2 923817E-	03 00	00000	000000. 00000	.000	000 000	- 35	0852 0855	1
	ذ	1 DI DI	SPL SPL	4 .000	0000	0000000	. 00	0000 0000	000000	000 000	000	2 34	32553 367C7E-02	
1	2 STRUCTURE. SOLUTION	I FO FO : IN IN	RCE RCE ELASTIC ELASTIC	4 .000 3 000 DYNAMIC A DYNAMIC A	DUO DOU WALYSIS WALYSIS	-6.791689E- 6.791689E-	C3 .CC C3 CC	00000	.000000 000000	000 .000	000 000 TIME TIME.	46 35 11 57: 11.57	4145 50855 5. DATE 5. DATE	1 5/24/96 5/24/96
	IE3DEEAM ELEM 1 2 3	DUCTI 0 .0	LITY'BAS MYA: 0000 0000 0000 0000	ED ON DE: , MYB: .00000 .00000 00000	MITION MIA 38 1383 16 .0857 38 1383	1, (MZE) 4 5.89313 8 16.09579 4 5 88313	1 M2 . 36 (803 803	() 000 000 000 0000	FX (20000 20000 20000					
1.	STRUCTURE . SOLUTION	IN	ELASTIC ELASTIC	DYNAMIC A DYNAMIC A	WALYSIS WALYSIS						TIME: TIME:	11:57. 11:57	5, DATE 5. DATE	5/24/96 5/24/96

MAXIMUN VALUES FOR ALL STEPS

FORCE

FORCE

FORCE

43

4

3 2

3 6

.000000

000000

-7 427579E-03 7 427579E-03

-7 427579E-03 7 427579E-03

GCS MAXIMUM DISPLACEMENTS NOTE: MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY ΣY DZ. RX ĒΥ RZ NODE ъx 1 000000 .000000 2 21.5113 .000000 . 3 21.5113 000000 4 000000 .00000 1 STRUCTEL INELASTIC DYNAMIC ANALYSIS SOLUTION.... INELASTIC DYNAMIC ANALYSIS 000000 000000 000000 000000 .000000 000000 .360000 .360000 C00CC0 151575 151575 0006C0 000000 000000 000000 000000 TIME: 11:57 5, DATE: 5/24/96 TIME: 11:57 5, DATE: 5/24/96 MAXIMUN VALUES FOR ALL STEPS GCS MAXIMUM VELOCITIES NOTE. MAXIMUM VALUES MAY NOT OCCUR SIMULTANEOUSLY NCDE DY DZ RX RY RZ DX 1 .000009 000000 2 .32.6556 000000 3 .32.6558 000000 4 .009000 000000 1 STRUCTURE ... INELASTIC DYNAMIC ANALYSIS SOLUTION..... INELASTIC DYNAMIC ANALYSIS .0000000 - 222574 - 222574 .000000 .CO00CD .CO00CD 000000 .000000 000000 .0000000. 000000 .000000 .000000 TIME 11.57: 5, DATE: 5/24/96 TIME 11.57 5, DATE: 5/24/96 MAXIMUN VALUES FOR ALL STEPS GCS MAXIMUM ACCELERATIONS NOTE - MAXIMUM VALUES MAY NOT OCCUR SIMULTANECUSLY DZ NCDE ⊃x DY RX RY RZ 1 .000000 .000000 2 .145.965 .00000 3 .145.965 .00000 4 .00000 .000000 1 STRUCTURE ... INELASTIC DYNAMIC ANALYSIS SOLUTION ... INELASTIC DYNAMIC ANALYSIS .0000000 000000 000000 .000000 000000 -1 C6247 000000 .0000000 0000000 -1 C6247 00000 .0000000 0000000 00000 TIME: 11:57 5. DATE 5/24/96 TIME: 11:57 5. DATE 5/24/96 MAXIMUN VALUES FOR ALL STEPS MAXIMUM GOS RESTRAINT REACTIONS NOTE: MAXIMUM VALUES MAY NOT OCCUR SIMULTANECUSLY NCDE FX FY MŻ MY FZ MX - .5177653 .006000C .006000C - .5177633) .6009600) .3.1936650E-03) 3.1936650E-03) 000000 .00000000 .0000000 1 -7.5053740E-03 CC00CC0 00000000 00000000 000000000 .0000000 .000000000 .0000000 -1.802010 .0000000. . 0000000 MAXIMUM RESULTANT OF REACTIONS. FORCE-STRUCTURE. : INELASTIC DYNAMIC ANALYSIS SOLUTICN....: INELASTIC DYNAMIC ANALYSIS FORCE- 1.50175-02 MOMENT- 1.802 : STRU TIME 11:57: 5, DATE: 5/24/96 TIME: 11:57: 5, DATE: 5/24/96 MAXIMUN VALUES FOR ALL STEPS COLUMN : LCAD: REPRESENTS THE DOF WHICH HAS MAXIMUM VALUE 1830 BEAM FORCES. MAXIMUM VALUES FOR ALL STEPS NOTE. MAXIMUM VALUES WITH THE OTHER DOFS FORCES ARE FRINT OUT AT THE SAME TIME ENT LOAD NODE AXIAL FY FZ TORSICN MY M2 S ELEMENT LOAD STEFAG 000000 -7 427579E-03 7 427579E-03 000000 1 2 FORCE FORCE 000000 000000 -.511837 -.379473 1 2 : .000000 000000 -7 427579E-03 7 427579E-03 000000. 000000 000000 000000 -.511837 - 379473 1 6 FORCE FORCE 1 2 000000 000000 1 000000 FORCE -7.427579E-C3 7.427579E-C3 000005 000000 1 9 1 2 .ccoece. .0000000 511657 .0000000 1 FORCE FORCE -7.427579E-03 7.427579E 03 000000 .511**637** .379473 12 1 2 .000000 .000000 .000000 1 .0000000 .000000 000000 .000000 23 ·3.162276E-03 3.162276E-03 .0000000 .000000 379473 2 2 FORCE .000000 1 .0000000 .0000000 220000 2 FORCE . 96**00**00. 960000 -3.162276E-03 3.162276E-03 .000000 .000000 .000000 . 000000 . 000000 - 379473 - 379473 e 2 1 .000000 -3.1622762-03 3.1622762-03 4 2 3 FORCE . 000000 .000000 000003 000000 379473
379473 1 .000000 . 900000 900000 -3 162276E-03 3 162276E-03 . 000000 . 000000 -.379473 -.279473 2 12 FORCE 23 000600 000000 FORCE 0000000 000000 :

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. 060000 . 060000 ccoocc

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. cooocc

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·.511837 ·.379473

-.511037 -.379473 1

1

3	5 FORCE FORCE	4 000000 3 .000000	-7.427579E-03 7.427579E-03	.000000	000000	.000000	·.511837 ·.379473	1
2 1 SIRUCTURE. SOLUTION	12 FORCE FORCE : INFLASTI : INFLASTI	4 206029 3 .000000 C DYNAMIC ANALYSIS C DYNAMIC ANALYSIS	7.4275?9E·C3 7.427579E·C3	009909 000000	.000000 .00000	.0080000 .000000 TIME : TIME: 1	- 511837 379473 11 57: 5, DATE: 11:57: 5, DATE	1 5/24/96 5/24/95
MAXIMUN VAL	JES FOR ALL	STEFS						
IESDBEAM ELEM# 2 1 STRUCTURE SOLUTION MAXIMUN VAL	DUCTILITY(E. IMYA) 00000 00000 00000 INELASTI INELASTI UES FOR ALL 1	ASED CN DEFINITION MYB. MZJ .CC00C 44.815 .000C0 18 947 .03000 44 615 C DYNAMIC ANALYSIS STEPS	1): M23: 17 6.62360 18 13 94726 17 6 82360	.MX ; .Coacc .Coeco .Oocoo	(FX : .00000 30000 .00000	TIME: TIME: 1	11:57 5, DATE: 11:57: 5, DATE:	5/24/96 5/24/96
STR 1 STRUCTURE SOLUTION	UCTURE DAMAG INELASTI INELASTI	E INDEX• .00000 C DYNAMIC ANALYSIS C DYNAMIC ANALYSIS	2			TIME: TIME:	L1:57. 5, DATE: 11:57: 5, DATE:	5/24/96 5/24/96
MAXIMUN VAL PEAK ENERG MAX INPUT MAX ELASTI MAX PLASTI MAX KINETI MAX DAMFIN	UES FOR ALL : Y VALJES ENERGY C STRAIN ENE C STRAIN ENE C ENERGY G ENERGY	ETEPS 						

I. <u>ONE-BAY FRAME OF TUBE SECTION ELEMENT INCREMENT</u> DISPLACEMENT CONTROL

Description of Input Information

Find the structural member internal force of a one-bay frame (Fig. 61), which is subjected to displacement change. The structural member is modeled as a stability element of tube section, for which the finite-segment (STABILITY) has the following properties NSEG=1, YS=36 ksi, EM=29000 ksi, HH=11.6 in, INEB=10, INEH=10, ST=0.75 in, SMALL=30 in, TOTA=424.5 in², RATIO3=0.03, G=13000 ksi, and QRNEE=0.01.



Figure 61. One-Bay Frame of Tube Section Element

Input and Output

<u>Input</u>

```
:
         ECHO OF INFUT DATA
                        LINE
                                                                                               NNODE.NCCS . NSUPT, NCOND.NCCNST SCALE
0 CC .00 1 0
0 CC 00 1 0
54C .00 1 0
54C .00 1 0
54C .00 1 0
                                             € 1.
0.00
               5
                                             54 C
                                                                               . 60
60
                                             54 C
                                                 ¢¢
                                                             54C
                                      0.6
                                                                    010
                                                                                    DIRECTION COSINE
                                                    .
                                                            1 1
                                                               11
                                                                         1
C
0
                                                                                               0
                                                                                                  000
                                                   0 C I I I
0 I I I I
1 I I I I
             10:
11:
                                                                                               Ó
             12
13:
                                                                        1
                                                                                               ō
                                   INMAT
                           ٦
                    3 :NMAT

'STAPLLITY MAT#1' 1 36

D C D C O 3C O 3C O C 424.5

'STAPLLITY MAT#2' 1 36

D C D C O 3C O C 424.5

'STAPLLITY MAT#3' 1 36
             14.
15.
16.
17
                                                                                                  29000 2 11.6
                                                                                              1 6 1
                                                                      29000
             18:
19:
                                                                      29000 2 11.6 0 C
                                                                                                           0 10
                                                                                                                      10
                                                                                                                            0.75
                        C O C O 3C C
N O D FALSE.
NELEM
                                                 0 6 424.5
                                                                                                             .
D
                                                                                                                  13000 0 01
                                                                                                                                         2
                                                                        KG: AXL, FORM, ASSY
             20:
21.
                    " 0 J FACEL

"STABLITY" TUBE MEMBER 1 ' 1 1 2

'STABLITY" TUBE MEMBER 2 ' 2 2 3

'STABLITY' TUBE MEMBER 3 ' 3 C 3

C 0 FALSE. MASS

C 0 FALSE. MASSING AT JOINT 3'

1 50000 2 FALSE MASSING PRINT IWRITE UNBAL

'ELE' 2 10 0 0 G
             22
                                                                                                                              \begin{array}{ccc} 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{array}
                                                                                                                                            C 0
C 0
C 0
                                                                                                                                                           0
             23
             23:
24:
25:
26:
27:
             2ē :
29 :
             30:
```

 31
 'JOINT FY'
 3
 11
 0
 0

 32
 'END'
 2
 13
 0
 0
 0

 33
 1
 2
 0
 0
 FY'
 -20
 0

 34
 0
 0
 'END'
 0
 'JCINT LOAD

 35
 0
 0
 'EDD'
 'JCINT LOAD

 36:
 0
 0
 'EDEMENT LOAD

 36:
 'EDS' FROM 0
 TO -20'
 1
 0
 200

 36:
 'EAD OR DESE. CONTROL
 6
 0
 0
 0

 36:
 'EAD TNIT-10'UNIT-11'
 'STOP'
 0
 0
 0

DOUBLE PRECISION VERSION

<u>Output</u>

1 STRUCTURE ... EXAMPLE I: ONE-STOPY BUILDING SOLUTION

TIME: 9-18.33, DATE: 5/24/96

.

NOTE COCEDINATES AND DEGREES OF ERFEDOM

NODER	OCEDINA	TES AND DEGR	EES OF FREEDOM							
TOTAL N	NUMBER O	F DEGREES OF	FREEDOM.	24						
NUMBER	OF DEGR	EES OF FREED	OM CONDENSED OU	T e						
NUMBER	OF FREE	DEGREES OF	FREEDOM	5						
NUMBER	CF REST	RAINED DEGRE	ES OF FREEDOM							
										. –
NODE	COSF	X - COCRD	Y · COCRD	Z CORD	FX	FY	F2	MX	MY	MZ
	1	.00000	. 00000	. 300003	6 · R	7 · R	8 · R	9 · R	10 · R	11-R
2	<u>-</u>	540.00	.00000	. 00000	1	2	12 · R	13 · R	14 · R	3
3	1	540.00	540.00	.000000	4	15 · R	16 · R	17 · R	18/R	5
4	1	00000	540.00	C000C	19 · R	20 - R	21 - R	22 - F	23-R	24 - R
	NOTE: R	 RESTRAINED 	DEGREE OF FREE	20X						
	c	 CONSTRAINE 	D DEGREE OF FRE	EDOM						

DIRECTION COSINES . .

PROGRAM FEM ***

CCS: 1: VX: 1 00000 I + 00000 J +.00000 K VY: .00000 J +.00000 J +.00000 K VZ: .00000 I + 00000 J +1.00000 K 1 STRUCTURE...: EXAMPLE I ONE-STORY BUILDING SOLUTION....

STABILITY ELEMENT

MAT NO	-	1	TUBE	SECTION				
NSEG	-		1		٧C		36.0	
FH	-	2 900	F+C4		LIBN			2
RADTUS		11 6			DIMMY VAR		0.00	•
FOCYC	2	1000			DOMINI VAR		.0000	
LUCAL PEC NO		1000			ECCIU			
1/4.5EC.NU	-	10.0	,		DUMMI VAR.	•	10.9	-
THICKNESS	-	.750			IREVI	•		с
IREV2			0		IREVS	•		0
IREV4	•		0		I ECOP			9
NUMP	-		4.0		SMALL	•	30 0	
RATIXO	•	000)		RATIYC		.000	
ATOTA		425.			IAJTO			2
IMATER			1		RATION		3 00CE-	62
TR			ō		6		1 3005+	64
OENEE		1.000	E-07		Tette		1.5006	1
F101-6		1.000	02			-		1
MAT NO		2	TIRE	SECTION				
MCTC		-	101.1	3201104	V.C	-	14 0	
1220					15		36.0	-
	Ξ.	2.911	E 106		L_BN			2
RADIUS	•	11.6			DUMMY VAR.	•	.000	
EUCXO	-	000	,		ECCYO	•	.900	
1/4/SEC.NC.		10.0)		DUMMY VAR	•	10.0	
THICKNESS	•	.750			IREV1			5
IREV2	•		с		IREV3			0
I REV4	•		0		IECCP			¢
NOMP	-		40		SMALL	-	30 C	
RATIXO	•	. 000	1		RATIYO		.000	
TCTA		625.			LAUTC	-		2
MATER .	•		1		RATIO		3 6002-	<u>n2</u>
TR			- ñ		6	-	1 30017+	32
CENTE		1 002	F.02		Terre		1 3031	1
F.12121		1 000	·E·02		19176			1
רא דגא			THEF	SECTION				
NEEC		5	TODE	DECITOR	VC			
TM	1	3.303			13	1	36 0	
60 585702	Ξ.	2.900	2.04		LIEN NO	-		2
E DONA	۰.	11.0			DUMMY VAR.	-	0.00	
FICKO	•	660			ECCYD	•	.000	
174 SEC.NO		10.0			DUMMY VAR		16.0	
THICKNESS	٠	.750	,		TREV:	•		e
IREV2	-		0		IREV3			C.
IREV4	•		o		IECOP	-		с
NUMP			40		SMALL		30 C	
RATIXO	-	0.00			RATIYO		. 220	
TOTA	•	425.			TAPTO			1
IMATÉR	•		,		BATION	-	3 006F-	ารั
1 P			÷.		1	-	1 3175-	CA .
CENER	-	: 000	F . 15		10-15		1-300E*	<u>а</u>
		1.070			10.11			-

: STRUCTURE ... EXAMPLE I: CNE-STORY BUILDING SOLUTION ...

ELEMENT 12, STABILITY ELEMENT

TIME 9.18:33, DATE: 5/24/96

ти Ти Ти	IBE MEMBER IBE MEMBER IBE MEMBER	1 2 3	₹ 1 2 3	MATL 2 3	START 3 1 2 4	ENT LENGTH 2 540.0 3 540.0 3 540.0	Y-A .00000 I000 .00000 I - 000 .00000 I - 000	XIS 000 J +1 C0000 K 000 J +1 C0000 K 050 J +1 C0000 K	- START DIST 0000 .0000 .0000	END DIST 0000 0000 .0000	
	ZERO M	ASS MA	ATRIX								
	PROFER ALFMA	TIONAI 0C	DAMP1	ING COIL	EFICIENTS	c					
	STRUCTURE SOLUTION SOLUTION & INTERVAL F INTERVAL F	4 ST	EXAMPLI INCREMI ATIC NO INTING I	E 1: ONE EMTAL DI ONLINEAR DATA. DATA TO	STORY BU SPLACEMEN SCLUTICN	TLDING T CONTROL AT J 	OINT 3		T I ME T I ME	E 9 18-33, DATE E 9 18:34, DATE E 9 18:34, DATE	5 (24796 5 (24796
τ	UNBALANCED	JOIN	I FORCI	ES ARE 1	NOT ACDED	TO THE NEXT CY	CLE				
	DATA W	RITTE	N TO F	LES							
	ELEMENT DEGREE APPLIED	OF FRI JCINT	2 IS EEDOM LOADS	WRITTE: ∓ 15	N TO UNIT IS WRITTE	⊭ 10 N TO UNIT ⊨	11 JOINT: 3	DIRECTION FY			
L) 1 9 9	DAD CASE: STRUCTURE. SCLUTION	: J(OINT EXAMPLI INCREMI	3 1 E : ON EMTAL D:	DIRECTION. E-STORY BU ISPLACEMEN	FY DOF(S) ULLING IT CONTROL AT J	15 DINT 3	MAGNITUDE: -20	COOO TIME TIME	.JGINT DISPLACEMENT E: 9:18:32, DATE: E: 9:18:34, DATE:	5/24/96 5/24/96
1 9	STRUCTURE		EXAMPLI INCREM	E 1: ONI EMTAL DI	E-STORY BU ISPLACEMEN	VILEING AT CONTROL AT J	OINT 3		TIM	E- 9:18:53, DATE: E- 9.18:54, DATE:	5/24/96 5/24/96
	. LOADING	; F	٥	MAXIMU	M DISPLACE	MENTS					
-	GCS DISPLA	CEMEN	TS	NOTE	MAXIMUM V	ALUES MAY NOT	OCCUR SIMULTANEC	USLY			
	NODE		DX		DY	DZ	ŔX	RY	RZ		
1 5	: 2 3 4 STRUCTURE	.000 .399 .334 .000	CCO 738 750 000 EXAMPL	0 - 19 20 .0: E I. DN	00000 .9627 0000 00000 E-STORY BL	.000000 000000 000000 .000000 JILDING	.000000 .000000 .000000 .000000	.000000 .000000 .000000 .000000	000000 2.228548E-02 2.238449E-02 .000000 TIM	E. 9 18:13, DATE:	5/24/96
:	SOLUTION		I NCREM	EMTAL D	ISPLACEMEN	T CONTROL AT C	OINT 3		TIM	E· 9·18.34, DATE	5/24/95
	, ಎ.ಭಿA Nic	5 4	0	EAX.EU	M REACTION	15					
-	MAXIMUM GO	S RES	TRAINT	REACTI	ONS NO	DIE: MAXIMUM VA	LUES MAY NOT OCC	UR SIMULTANEQUEL)	r		
-	MAXIMUM GO NODE	S RES	TRAINT FX	REACTI	ons no Fy	DTE: MAXIMUM V7 FZ	LUES MAY NOT OCC	UR SIMULTANEOUSLY MY	MZ		
M.G	NODE 1 2 4 AX OF ALL- CS SUMM.	97 2 000 600 -97.2 .305	TRAINT FX 7026 0000 7023 17555-	10 .0 .22 11 C4 .1	ONS NO FY 9 6446 000000 7.0349 7.3995 007060E+C2	TE: MAXIMUM V7 FZ 1 3355900E-(2 9292230E-(3 0636130E-(2 7081510E-(2 4629527E-(HUES MAY NOT OCC MX MX 6 2 1285830E-05 6 15823840E-03 6 15481910E-03 77 2.1848340E-05 76 .1075247E-02	UR SIMULTANEOUSLA MY 1.3935460E-C3 9.59437C02-C4 9.99251102-C4 1.29570702-03 5149632E-02	MZ 54942 20 .000000 CC00CC0 25136.98 15.64099		
м. G:	MAXIMUM GC NODE 1 2 3 4 AX OF ALL- CS SUMM. MAXIMUM STRUCTURE SOLUTION.	97 2 000 97 2 000 97 2 97 2 97 2 97 2 97 2 97 2 97 2 97 2	TRAINT FX 7026 0000 7023 17555 TANT O EXAMPL INCREM	10 .0 .22 11 G4 - 1 F REACT E I: CN EMTAL D	0NS NO FY 9 6446 060000 7.0349 7.33995 007060E-02 IONS, FO E-STORY BI ISPLACEMEN	TE: MAXIMUM V7 FZ 1 3355909-(2 9282208-(3 06261308-(2 70615108-(2 4629527E-(2 4629527E-(2 4629527E-(2 10.0718-) 31110216 VT CGMTRCL AT .	MAY NOT OCC MX 6 2 12858505-05 6 15228405-03 6 15485405-05 7 2.18485405-05 7 2.18485405-05 7 2.18485405-05 7 3 HOMENT- 1 102NT 3	UR EIMULTANEOUSLY MY 1.3935460E-C3 9.59437C0E-C4 9.99291132-04 1.2957070E-03 5149632E-02 5.64	MZ 54942 20 .0000000 25136.98 15.64099 TIM TIM	E: 5-18:33, PATE: E 9.16:34, DATE:	5/24/96 5/24/96
м. G:	MAXIMUM GC NODE 1 2 3 AX OF ALL- CS SUMM. MAXIMUM STRUCTURE SOLUTION. , LOADING COLU MAXI	97 2 000 600 -97.2 	TRAINT FX 7026 0000 7023 17555- TANT O EXAMPL INCREM 0 LOAD: XLUE	REACTION 10 0 -22 11 C4 - 1 F REACT E I: ON EMTAL D PEAK S REFRESE	FY 9 6446 900000 7.0349 7.0349 7.3395 0070600-00 8.5707 IONS_F F0 E-STORY BUISPLACEMENT F0 LEMENT F0 NTS THE DO	TE: MAXIMUM V7 FZ 1 3355909-1 2 9292208-0 2 9626100-0 2 4629527E 0 2 4629527E 0 2 4629527E 0 2 2 4629527E 0 2 4629527E 0 2 4629527E 0 2 2 4629527E 0 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	LUES MAY NOT OCC MX 6 2 12858502-05 6 53238402-03 6 5.485402-05 7 2.18483402-05 7 2.18483402-05 7 3.40752472-02 03 MOMENT- 1 101NT 3	UR EIMULTANEOUEL) MY 1.39354602-03 9.5943702-04 9.99291132-04 1.29570702-03 51496322-02 5.64	MZ 54942 20 .0600600 cC00CC0 25136.98 15.64099 TIM TIM	E: 5-18:33, PATE: E 9.16:34, DATE:	5/24/96 5/24/96
м. G:	MAXIMUM GC NODE 1 2 3 4 AX OF ALL- CS SUMM. MAXIMUM STRUCTURE SOLUTION. , LCADING COLU MAXI STABILI MAXI STABILI MAXI ELEMENT 1	97 2 960 660 197.2 RESUL 	TRAINT FX 7026 0000 7023 17555 TANT O EXAMPL INCREM 0 LOAD: ALUE EMENT ALUES	REACTION 10 .0 -22 11 G4 · 1 F REACT E I: ON PEAK S REFRESE FCRCES FCRCES FOR ALL NODE	OKS NC FY 6 64 65 960305 7,0349 7,0349 7,3395 0070602-02 10NS, FC IONS, FC E-STORY BUISPLACEMEN LEMENT FOI NTS THE DO STEPS AXIAL	TTE: MAXIMUM V7 FZ 1 3355900E(2 9282200E(2 9282200E(2 9626130E(2 4629527E(2 4629527E(2 4629527E(2 4629527E(2 4629527E(2 10071E) TCCNTRCL AT RCES DF WHICH HAS	LUES MAY NOT OCC MX 12558362-05 61 12558362-05 162 1258402-03 163 1258402-03 17 2.18453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453402-03 16453400-03 16453400-03 16453400-03 16453400-03 16454000	UR EIMULTANEOUEL) MY 1.39354602-03 9.59437022-04 9.99291122-04 1.29570702-03 51498322-02 5.64 THER DOFS FORCES TORSION	MZ 54942 20 .000000 CC00CC0 25136.98 15.64095 TIM TIM ARE PRINT OUT MY	E: 5-16:33, DATE: E 9.16:34, DATE: AT THE SAME TIME M2 1	5/24/96 5/24/96 212,53
м. G:	MAXIMUM GC NODE 1 2 3 AX OF ALL- CS SUMM. MAXIMUM STROCTURE SOLUTION. , LOADING COLU MAXI STABILI MAXI ELEMENT I	97 2 960 600 97.2 	TRAINT FX 7026 9800 7023 17553 INCREM 0 LOAD ALUE EMENT ALUES FORCE FORCE	REACTI 10 22 11 C4 1 F REACTI E T: CN EMTAL D PEAK S REFRESE FCRCES FOR ALL NODE 1 2	OKS NC FY 9 6446 9 00000 7 7 3395 9 0070600-02 10N5 FC IONS FC 1391ACSME LEMENT FOI NTS THE K XIAI STEPS I AXIAI 97 2702 -97.2702	TE: MAXIMUM V7 FZ 1 33559095-0 2 9232200F-0 2 9625100F-0 2 9625100F-0 2 9625276-0 2 46295276-0 2 46295276-0 2 70615106 2 46295276-0 2 2 66295276-0 2 70615106 2 70615106 2 70615106 2 70615106 2 70615106 2 70615106 2 70615106 2 70615106 2 70615106 2 70615106 2 70615106 2 70615106 2 70615106 2 70616 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 2 70617 <	LUES MAY NOT OCC MX M2 M2 M2 M2 M2 M2 M2 M2 M2 M2	UR SIMULTANEOUSLA MY 1.3935460E-C3 9.99547C2E-C4 9.9951132-C4 1.2957072E-C3 5149632E-C2 5.64 THER DOFS FORCES TORSION 2.C59007E-1 1.410933E	MZ 54942 20 .0000000 CC00CCC 25136.98 15.64099 TIM TIM ARE PRINT OUT MY 05 34942.2 05 26195 6	E: 9-18:33, CATE: E 9.18:34, DATE: AT THE SAME TIME MZ 1 -1 293546E-C3 -5 5548570E-C4	5/24/96 5/24/96 PLP, 53
м. G:	MAXIMUM GC NODE 1 2 3 4 AX OF ALL- CS SUMM. STRUCTURE SOLUTION. . LCADING CCLL MAX1 STABILI STABILI STABILI STABILI 1 1	97 2 960 660 97.2 97.2 97.2 97.2 97.2 97.2 97.2 97.2	TRAINT FX 7026 0000 0000 17555 17555 17555 17555 17555 17555 17555 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 10501 100000000	REACTI 10 0 -22 11 11 F REACT F REACT F REACT F REACT F REACTI F	OKS NC FY 9 6446 260002 7.0349 7.0349 7.0349 7.0395 0070600-02 IONS, FC E-STORY BUISPLACEMEN ISPLACEMEN ISPLACEMEN FO NTS THE DO STEPS STEPS I ST2702 97.2702 97.2702 97.2702	TE: MAXIMUM V7 FZ 1 3355902F: 2 928220F: 2 9625197 2 4629527E: 2 4629527E: 2 4629527E: 2 4629527E: 2 4629527E: 2 708150E: NOTE: MAXIMUM V CONTE: MAXIMUM V 1 23559: 1 33559: 1 3 3559: 1 3 3559: 1 3 35	LUES MAY NOT OCC MX 125583620-05 12558420-03 16 1 5238420-03 16 1 528420-03 17 2 18453400-03 17 2 18453400-03 17 2 18453400-03 17 2 18453400-03 17 2 18453400-03 17 2 18453400-03 17 2 18453400-03 18 19 100-03 18 1	UR EIMULTANEOUEL) MY 1.39354602.03 9.9543702.04 9.9521132.04 1.29570732.03 51498322.02 5.64 TMER DOFS FORCES TORSION 2.059007E.1 2.039007E.1 1.405332.1 2.039007E.1	MZ 34942 20 .0600000 CC00CC0 35136.98 TIM TIM TIM ARE PRINT OUT MY 25 34942.2 26 25 26195.6	E: 9-18:33, DATE: E 9.18:34, DATE: AT THE SAME TIME MZ 1 -1 293546E-C3 -5 54870E-C4 -1.393546E-C3 -9.19364E-C3	5/24/96 5/24/96 21P,53
м. G:	MAXIMUM GC NODE 1 2 3 4 AX OF ALL- CS SUMM. STRUCTURE SOLUTION. , LCADING. COLU MAXI STABILI MAXI ELEMENT 1 1 1	97 2 960 97 2 97 2 960 97 2 960 97 2 97 2 960 97 2 97 2 960 97 2 97 2 97 2 97 2 97 2 97 2 97 2 97 2	TRAINT FX 7026 30806 30806 7023 17555- 17555- 17555- 17555- 17555- 10755 2020 2020 2020 2020 2020 2020 2020	REACTIN 10 .0 -22 11 C4 1 F REACT E I: ON PEAK E REFECSE FCRCES FOR ALL NODE 1 2 1 2	OKS NC FY 9 6446 9 00000 7 7 0349 7 7 0349 7 0076808-00 00000 0000 IONS FC 00000 FSTORY BUSPLACEMENT FO NTS THE IX STEPS I AXIAJ 97 97 2702 97 2702 97 2702 97 2702 97 2702 97 2702 97 2702	TE: MAXIMUM V7 FZ 1 33559090: 2 9282208-(2 9282208-(2 9282208-(2 962527E-(2 4629527E-(2 4629527E-(2 4629527E-(2 100718- 37100112- NOTE: MAXIMUM ' L FY 1 23559(1 33559) 1 33559(1 33559) 1 33559(1 33559)	LUES MAY NOT OCC MX MX <td< th=""><th>UR EIMULTANEOUEL) MY 1.3935460E-C3 9.59437C0E-C4 9.99291132-04 1.2957070E-03 5149632E-02 5.64 THER DOFS FORCES TORSION 2.C59007E-1 1.410933E-1 2.059007E-1 1.410933E-1 2.059007E-1 1.410933E-1 2.059007E-1 1.410933E-1 2.059007E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.4109</th><th>MZ 54942 20 .06000600 25136.98 15.64099 TIM 71M ARE PRINT OUT MY 25 34942.2 25 26195.6 25 34942.2 25 26195.6</th><th>E: 5-18:33, EATE: E 9.18:34, DATE: AT THE SAME TIME MZ 1 -1 393546E-03 -5 554670E-04 -1.393546E-03 -9.594670E-04 -1.393546E-03 -9.594670E-04</th><th>5/24/96 5/24/96 ?LP, ST</th></td<>	UR EIMULTANEOUEL) MY 1.3935460E-C3 9.59437C0E-C4 9.99291132-04 1.2957070E-03 5149632E-02 5.64 THER DOFS FORCES TORSION 2.C59007E-1 1.410933E-1 2.059007E-1 1.410933E-1 2.059007E-1 1.410933E-1 2.059007E-1 1.410933E-1 2.059007E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410933E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 1.410932E-1 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DATE: AT THE SAME TIME MZ 1 -1 393546E-03 -5 554670E-04 -1.393546E-03 -9.594670E-04 -1.393546E-03 -9.594670E-04	5/24/96 5/24/96 ?LP, ST
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м. G:	MAXIMUM OC NODE 1 2 3 4 AX OF ALL- CS SUMM. 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G	MAXIMUM GC NODE 1 2 4 AX OF ALL- CS SUMA STRUCTURE SOLUTION, COLL MAXIMUM MAXI STRUCTURE COLL COLL MAXI ELEMENT I 1 1 1 1	97 2 0000 600 400 400 400 400 400 400 400 400 400	TRAINT 7026 3000 3000 7023 17555- 7023 17555- 7023 17555- 7024 1000 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 2000 2010 <td< th=""><th>REACTIN 10 .0 -22 11 C4 1 F REFCT E I: ON PFARK E REFRESE FCRCES FOR ALL NODE 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 2 1 2 2 1 2 1 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2</th><th>OKS NC FY 9 6446 9 00000 7 7 0349 7 7 0349 7 7 3395 0070600-000 00005 FC 10N5 FC FC 10N5 IONS FC 10N5 ISPLACEMENT FOI NIX STEPS I AXIAI 97 2702 97 2702 97 2702 97 2702 97 2702 97 2702 97 2702 97 2702 97 2702 97 2702 97 2702 97 2702 97 2702 97 2702</th><th><pre>XTE: MAXIMUM V7 FZ I 33559000-0 2 9232200F(2 9232200F(2 9232200F(2 9232200F(2 92327E(2 4629527E(2 4629527E(2 4629527E(2 4629527E(2 100718- XTCCNTRCL AT XTCCNTRCL AT XTCCNTRCL AT XTCCNTRCL AT XTCCNTRCL AT XTCCNTRCL AT I, 23559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 33559(1 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м. G:	MAXIMUM GC NODE 1 2 3 4 AX OF ALL- CS SUMM. 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205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7 205.7	E: 5-18:33, DATE: E 9.18:34, DATE: MZ 1 -1 393546E-C3 -5 554670E-C4 -1.353546E-C3 -9.594670E-04 -1.393546E-C3 -9.3954670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -5.594670E-04 -1.393546E-C3 -5.594670E-04 -1.393546E-C3 -5.594670E-04 -1.393546E-C3 -5.594670E-04 -1.393546E-C3 -5.594670E-04 -1.393546E-C3 -5.594670E-04 -1.393546E-C3 -5.594670E-04 -1.393546E-C3 -5.594670E-04 -1.393546E-C3 -5.594670E-04 -1.393546E-03 -5.594670E-04 -1.393546E-03 -5.594670E-04 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м. G	MAXIMUM GC NODE 1 2 3 4 AX OF ALL- CS SUMM. 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12558362+05 106 153238402+03 16 153238402+03 107 107 17 2.18453402+03 107 107 17 2.18453402+03 107 107 101 MAMENT* 100 107 101 T 109 645 102 109 645 109 102 109 645 109 102 109 645 109 102 109 645 109 102 109 645 109 103 109 645 109 104 109 645 109 645 105 105 645 109 645 105 105 645 105 645 105 105 645 105 645</th> <th>UR SIMULTANEOUSLA MY 1.3935460E-C3 9.9951702-04 9.9951102-04 1.29570702-03 5149632E-02 5.64 THER DOFS FORCES TORSION 2.059007E-1 2.059007E-1 2.059007E-1 2.26565E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10935E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.</th> <th>MZ 54942 20 .0000000 CC000CC0 25136.98 TIM 25.64099 TIM ARE PRINT OUT MY 05 34942.2 25 26195.6 05 34942.2 26195.6 05 34945.2 05 34945.2 05 3</th> <th>E: 9-18:33, DATE: E 9-18:34, DATE: AT THE SAME TIME MZ 1 -1 293546E-C3 -5 544870E-C4 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -1.393546E-03 -1.393546E-03 -1.393546E-03 -1.393546E-03 -1.393546E-03</th> <th>5/24/96 5/24/96</th>	TE: MAXIMUM V7 FZ 1 33559020: 2 9292209: 2 9292209: 2 9622309: 2 9622209: 2 9622109: 2 4629527E: 2 4629527E: 2 4629527E: 2 4629527E: 2 4629527E: 2 4629527E: 2 4629527E: 2 4629527E: 2 100718: 1 00718: 1 00718:	LUES MAY NOT OCC MX MX MX 16 12558362+05 106 153238402+03 16 153238402+03 107 107 17 2.18453402+03 107 107 17 2.18453402+03 107 107 101 MAMENT* 100 107 101 T 109 645 102 109 645 109 102 109 645 109 102 109 645 109 102 109 645 109 102 109 645 109 103 109 645 109 104 109 645 109 645 105 105 645 109 645 105 105 645 105 645 105 105 645 105 645	UR SIMULTANEOUSLA MY 1.3935460E-C3 9.9951702-04 9.9951102-04 1.29570702-03 5149632E-02 5.64 THER DOFS FORCES TORSION 2.059007E-1 2.059007E-1 2.059007E-1 2.26565E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10933E-1 2.059007E-1 4.10935E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.0007E-1 4.	MZ 54942 20 .0000000 CC000CC0 25136.98 TIM 25.64099 TIM ARE PRINT OUT MY 05 34942.2 25 26195.6 05 34942.2 26195.6 05 34945.2 05 34945.2 05 3	E: 9-18:33, DATE: E 9-18:34, DATE: AT THE SAME TIME MZ 1 -1 293546E-C3 -5 544870E-C4 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -9.594670E-04 -1.393546E-C3 -1.393546E-03 -1.393546E-03 -1.393546E-03 -1.393546E-03 -1.393546E-03	5/24/96 5/24/96

		FORCE	2	·96 2969	-1.3C6579E-C6	108 585	1.4719802-05	25934 0	9 427321E-04	
:	11	FORCE	2	97 2702 •97 2702	1.53559CE-05 -1 33559CE-C6	109 645 109 645	2.059CC7E-C5 1.410933E-05	34942.2 26195.6	-1 393546E+03 -9 594870E+04	
1	:2	FORCE	1 2	97 2702 •97 2702	1.335590E-C6 1.335590E-C6	-109 645 109 645	2.059007E-05 1.410933E-05	34942.2 26195.€	-1 393546E-03 -9 594270E-04	
2	:	FORCE	2 3	109.645 109.645	4.263514E-06 -3.600521E-06	97.2702 97.2702	-4.997152E-08 -5.109543E-08	·26195 6 ·26234 4	1.515275E C3 1.526956E-03	
2	2	FORCE FORCE	2	109.645	4 263814E-06 -3 800521E-06	97 2752 97 2752	•4.997152E•08 •5.109543E•08	-26195.6 -26234.4	1 516275E-03 1 526956E-03	
2	3	FORCE	2	109 645 -109 645	4 203814E-06 -3 800821E-06	9°.2702 97.2702	-4 997152E-08 -5 109543E-08	-26193.6 -26234.4	1 5182752+03 1.526956E+03	
2	4	FORCE	2 3	109 115 •109.115	4.232787E-06 3.777460E-06	96.7816 96.7836	·5 016296E·C8 ·5.094366E·C8	·26064.8 ·26103.3	1.514204E-03 1.522610E-03	
2	5	FORCE	2 3	109.645 -109.645	4.263614E-C6 -3.800821E-C6	97.27C2 97.27C2	·4.9971522-08 ·5.1095432-08	·26195.6 ·26234.4	1 518275E-03 1 526956E-03	
2	6	FORCE	2	109.645 109.645	4 253514E-06 -3 600521E-06	97.2702 97.2702	-4.997152E-08 -5.109543E-08	26195 é 26236 4	1 518275E-03 1.526956E-03	
2	٦	FORCE	2	109.645 -109.645	4 263614E-06 -3 600621E-06	97 2702 97 2702	-4.997152E-08 -5.109542E-08	-26195.6 -26234 4	1.518275E-G3 1.526956E-O3	
2	9	FORCE	2	109.645	4.263814E-06 -3.600921E-06	97.2702 97.2702	-4.997152E-08 -5 109543E-08	26195.6 26234.4	1.5162752-03 1.5269562-03	
2	9	FORCE	2 3	109.645	4 263814E-05 -3.800821E-05	97.2762 -57.2762	-4.997152E-C8 -5 109543E-C8	26195.6 26234 4	1.518275E-03 1.526956E-03	
2	10	FORCE	2	109.645	4.263814E+C6 -3.600821E+C6	97.27C2 97.2702	-4.9971522-06 -5.1095432-08	-26195.6 -26234.4	1 518275E-03 1 526956E-03	
2	11	FORCE	2 3	109 645 109.645	4 253814E-06 -3 800821E-06	97.2702 97.2702	-4.997152E-08 -5.109543E-08	-26195.6 -26234.4	1.518275E C3 1.526956E+C3	
2	12	FORCE	2	109 645 -109 645	4 265814E-06 -3 800521E-06	97 2702 97 2702	-4.997152E-08 -5.109543E-08	-26195.6 -26234.4	1.518275E-03 1.526956E-03	
ŝ	1	FORCE	4 3	-97.2702 97.2702	€.2790982-08 -€.2790982-08	117.399 117.359	2 184903E-05 2 123384E-05	35137.0 26234.4	-1.295707E-03 -9.96C829E-04	
3	2	FORCE	4	-71 9694 71 9684	3.708151E-07 -3.706151E-07	- 86.1183 86.1183	1 279061E-C5 1 207246E-C5	25988.5 19418.4	-9.521103E-04 -7.393577E-04	
2	3	FORCE	4]	- 97.2762 97.2702	6.279098E-06 -6.279098E-08	-117 389 117 389	2.184803E-05 2.123584E-05	35137 0 26 236.4	-1 295707E-03 -9.960829E-04	
3	4	FORCE	4	-97.27C2 97.27C2	6.279098E-08 -6.279098E-09	-117.389 117.389	2.184803E-05 2.123584E-05	35137 0 26234 4	·1.295707E-C3 ·9.960829E-04	
3	5	FORCE	4	-97.2702	6 279098E+08 -6 279098E+08	-117.389	2.184803E-05 2.123584F-05	35137.0	-1.2957072-03 -9.960829E-04	
3	ć	FORCE	4	-97 2702 37 2762	6.279098E-08	· 117.339	2 184303E-05 2 123554E-05	35137.C 26234.4	-1.295707E-03 -9.96C829E-04	
3	7	FORCE	4	-97 2702 97 2702	6.279096E 06 -6.279096E-08	·117 369	2 184EC3E-C5 2.123584E-C5	35137.0	-1.295707E-03 -9.960829E-04	
3	8	FORCE	6 3	-71 9664 71 9684	3.706151E-07 -3.708151E-07	- 56.1163 96.1183	1.279661E-05 1.207246E-05	25958.5 19418.4	-9 521103E-04 7 393577E-04	
3	9	FORCE	4	97.27C2 97.27C2	6 279098E-08 -6 279098E-05	-117.364 117.389	2.184803E-05 2.123584E-05	35137 0 26234 4	1.2957C7E-C3 9.960829E-C4	
3	10	FORCE	4	·97.2702 97.2702	6 2750392·08	117.389	2.164503E 05 2.123584E+05	35137 0	1,295707E-03	
3	11	FORCE	4	-97.2702 97.2702	6.279096E-08	-117.359	2 184803E-05 2 123584E-05	35137.0 26 234.4	-1.295707E-03	
3	:2	FORCE	4	-96 7836 96 7836	5.600937E-08	·116 783	2.180644E-05 2.122793E-05	34961.0 26103.3	-1 294524E-03 -9.993421E-04	
1 STRUCTURE. SOLUTION	• •	EXAMPLE INCREMENT	ONE AL DI	STORY BUILDI	NG NTROL AT JOINT 3			TIME: TIME.	9 18:33, DATE: 9 16:34, DATE:	5/24/96 5/24/96
. LOADING 1 STRUCTURE SCLUTION		C PS EXAMPLE I INCREMENT	AK DU CNE	STILITIES AND STORY BUILDI	EXCURSION RATIO': NG NTEC: AT JOINT 3	5		TIME	9 18:33, DATE. 5 18:34 DATE	5/24/96 5/24/96
, LOADING		0 DA	MAGE	INDEX						
STRUCTURE	ruct	URE DAMAGE EXAMPLE I	INDE ONE	X00000 STORY BUILDI	NG			TIME	9:16 33, DATE	5/24/96
ELEMENT	R	2 IS REA	D FRC	MUNIT = 10						,
STABILI STEP	TY E TI	LEMENT FOR	CES NODE	AXIAL	FY	FZ	TORSION	MY	MZ	FLP.SP
c		00000	2	.000000	.000000 .000000	000000	003300 .003600	000000	.000000 .000000	00C
		I	ISP	.000000 .000000	000000. 000000	000000	000000000000000000000000000000000000000	000000	000000. 000000.	CC0
2		00000 I	2 152	2 1.13420 -1.13420 - 199610 - 200000	5.885950E+C8 -4.643750E+C8 .0000C0 C000C0	.972260 972260 -3.496040E+0 3.127100E+0	.000000 .000000 4 .000000 4 .000000	-262 370 -262 650 -2.223680E -2 231050E	1.235410E- 1.23416CE- -04 C00000 -04 .C00000	05 05 1.00 .000
4		00600	2	2.26770 -2.26770	6 709645E-08 4 645090E-08	1.94450 -1.94450	.000000 .000000	-524.720 -525.290	3.650350E- 3.651660E-	05 05 .251

		DISP	· 399230 · 400000	000000 000000	-7 7285502-04 5 5149102-04	.000000 .000000	4 447E40E-04 4 462240E-04	000000 000000	.000
£	00005	2 3 DISF	3 40040 -3.40046 595840 600000	1.062920£-07 -7 928690£-08 000000 .000000	2.91690 •2.91683 •1.269750E•33 7.163430E•34	000000 000000 000000 500000	-787 070 -787 930 -6.671890E-04 -6.693570E-04	5 1171002-05 5 119920E-05 .000000 .000000	112 000
8	00000	2 JISP	4.53230 4.53230 .795460 .800000	1.37984CE-07 -1.02513CE-07 .000000 000000	3 88910 -3.88910 1.840300E-03 8.072570E-04	000000 000000 000000 .000000	-1049 40 -1050 60 -8.896030E-04 -8.925040E-04	6.554050E-05 6.5571602-05 000000 000000	6.316E-02 CCJ
10	. 35963	DISP	5.66330 5.66330 - 938070 -1 00000	1 7810502 07 1.3535402+07 .002000 .000050	4.86140 -4.86140 -2.484500E-03 5.242620E-04	.000000 .000000 .000000 000000	-1311.70 -1313 20 -1.112020E-C3 -1 115670E-C3	8.011620E-05 8.017410E-05 .000000 .000000	4.058E-02 .000
12	.00000	Z J DISP	6.79370 -6.79370 -1.19770 -1 20000	2 196890E-07 -1 585980E-07 .000000 .000000	5.83370 -5.83370 -3.202350E-03 7.673300E-04	.000000 .000000 .000000 .000000	-1574.10 -1575.80 -1.334460E-03 -1.339840E-05	1.073940E-04 1.07500CE-04 .000000 .000000	2 828E-02 .00C
14	90000	2 DISF	7 92330 - 92330 1.39730 -1.40000	2 677046E+07 2 146350E+07 000000 .000000	f.E059C -6.3059C -3.993B40E-03 6.3645∌0E-04	000000 000000 000000 000000	-1835 40 -1838.40 -1.556900E-03 -1.562030E-03	1 - 164870E - 04 1 - 166620E - 04 000000 000000	Z.085E-C2 0C0
16	00005	2 J DISF	9 C5210 -9 C5210 1.59690 -1.60C00	2.67449CE+07 -2.14634CE+07 .090000 000000	7 77820 -7 77820 -4.858990E-83 4.316810E-04	000000 000000 000000 000000	-2098 70 -2101 CO -1.779340E-03 -1.78524CE-03	1.302030E-04 1.303370E-04 .000000 .000000	1.603 E -02 .000
13	00000	2 J DISP	10.1800 -10.1800 -1 79650 -1.80000	3.379940E-C7 -2.7C7130E-C7 .05000C .00000G	8.75050 -8.75050 -5.7977902-03 1.529650E-04	.000000 .000000 .000000 .000000	-2361.00 -2363.60 -2.091800E-03 -2.090450E-03	1.358770E-04 1.36032CE-04 .000000 000000	1 271E-02 .000
20	.00900	2 3 DISP	11 3070 -11.3073 -1.99613 -2.00300	4 057040E-07 -3 403680E-07 .000000 .000050	9.72290 •9.72290 •6.810250E•03 •1 996780E•04	000000 000000 000000 000000	-2623.20 -2626.20 -2.224270E-03 -2.231690E-03	1.5557502-04 1.5554802-04 000000 .000000	1.033E-02 CC0
22	.00000	2 J DISF	12.4340 12.4340 2.19580 2.20000	4.75246CE-07 -3 964500E-07 600003 600000	10.6950 -10.6950 -7 856360E-03 -6.262490E-04	000000 000000 000000 000000	-2885 50 -2888.70 -2.44674CE-03 -2.45493CE-03	1.635670E-04 1.637680E-04 000000 000000	8.564E-03 .000
24	.00050	2 DISF	13 5590 -13 5590 -2 39540 -2.40000	5.386520E-07 -4.52526CE-07 00CC00 .00CC00	11.6670 -11.6670 -9.056120E-C3 -1.12675CE-03	000000. 000000 000000 000000	-3147 80 -3151 30 -2 6592202-03 -2 6782002.03	1.80595CE-04 1.80847GE-04 .000000 .000000	7 226E-03 .000
26	CODOC	2 J DISP	14.6540 -14.6640 -2 59500 -2 60000	5.846520E-07 •6.949930E-07 000000 .000000	12.6400 -12.6400 -1 0289502-02 -1 701170E-03	000000 000000 000000 000000 000000	-3410 00 -3413.90 -2.891720E-03 -2.901470E-03	1 943110E-04 1 945900E-04 .000000 .000000	6.1782.C3 .000
28	. 06600	2 3 DISP	15 BC80 -15 BC80 -2.79460 -2.800C0	6.212130E-37 -5 182410E-07 -0000C0 .0000C0	13.6120 13.6120 -1.159660E-02 -2.349530E-03	000000 000000. 000000. 000000.	·3672.30 ·3676.40 ·3.114220E·03 ·3.124760E·02	2.165490E-04 2.168830E-04 .000000 C000C0	5.349E-03 .000
30	.00000	DISP	16.9320 •16.9320 •2.99420 •3.00000	6 37053CE - 67 - 5 18269CE - 67 050006 036000	14.5640 -14.5840 -1.297740£-62 -3.071610E-03	.000000 000000 000000 .00000 .00000	- 3934.50 - 3939 CO - 3.136730E-03 - 3.348070E-03	2 - 24629CE - 04 2 - 252280E - 04 - 000000 - 000000	4.675E-03 .000
32	00000	2 J DISP	18 0540 -16.0540 -5 19380 -3.20000	6.7063502-07 -5.64700002-07 .000000 .000000	15.5570 -15.5570 -1 443180E-02 -3.568010E-03	000000 000000 000000 000000	-4196.70 -4201.50 3 559250E-03 -3 \$71380E-03	2 422600E-04 2 426330E-04 .0000000	4 123E-03 .00C
34	0000	DISP	19 1760 19.1760 -3.39350 -3.40000	6 9156402-0" -5 7434202-0" .000000 .000000	16 5290 -16,5290 -1 595980E-02 -4 735150E-03	000000 000000 000000 000000	-4459 0C -4464.1C -3.7817705-03 -3.794720E-03	2 5765002-04 2 5810102-06 000000 .000000	3.658E+03 000
36	.00600	2 JISP	20.2970 -20.2970 -3.59310 -3.60000	7,461580E+07 -6 206159E+07 C00000 .000900	17.5020 17.5020 -1.756150E+02 -5.682210E+03	-1 865280E-10 -1 892150E-10 .000000 .000000	-4721.20 -4726.60 -4.004310E+03 -4.018070E+03	2.7309402-34 2.7358102-04 .000000 .000000	3.283E-03 .000
36	.00000	DISF	21.4170 -21.4170 -3.79275 -3.80000	7.54706CE 07 -6.440730E-07 000000 000000	18.4740 -18.4740 -1.923690E-62 -5.700210E-03	-1.885280E-10 -1.892150E-10 -00000 .000000	-4953.40 -4989 10 -4 226560£+03 -4 241430E+03	2.787070E-04 2.792510E-04 .000000 .000000	2.959E-03 .090
40	00000	2 3 DISP	22.5370 -22.5370 -3 99230 -4 60000	5.377290E-07 -5.905450E-07 .000000 .000000	19.4460 -19.4460 -2.098600E+C2 7.792130E+C3	-1.335260E-10 -1.392150E-10 .000000 000000	-5245.60 -5251.60 -4.449410E-03 -4.464810E-C3	3 C350702-C4 3 G41020E-G4 .00030C .300030	2 679 <u>2</u> .03
42	00000	2 BISP	23 6550 -23.6550 -4.19190 -4.20000	8 7470502-07 -7.234120E 07 -000000 -000000	20 4190 -20 4190 -2 280670E-02 -8 957980E-03	-1.6852868-10 -1 8921508-10 .000000 .000000	-5507.70 -5314 10 -4.671900E-03 -4.685200E-03	3.1659802-04 3.172320E-04 .000000 .000000	2 435E-03 CCO
44	6 0336.	2 3 DISP	24 7730 26 7730 4.39160 -4.40000	9 195510E.07 -7 562920E 07 -000000 .000000	21 3910 -21 3910 -2.476500E+02 -1 C19780E+02	1 885280E-10 -1.89215CE-1C .000006 .000000	-5769.90 -5776.60 -4.894550E+07 -4.911600E+03	3.31950CE+04 3.326620E+04 C000C0 .000000	2.232E+03 0C0
46	.00000	2] DISF	25,8900 -25,6900 4,59120 -4,60000	9 56323CE-07 -7.891600E-07 000000 000000	22.3630 -22.3630 -2.667510E.02 -1.151150E.02	-3.3855302-10 -3 399040E-10 .000000 .000000	-6032 10 -6035 10 -5.117130E-03 -5.135030E-03	3 - 559080E - 04 3 - 566790E - 04 - 0000C0 - C00000	2.051E-03 .005
48	00000	2	27.0070	1.000960E-06	23.3360	-4.630720E-10	-6294.20	3.678980E-04	

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		DISF 3	-27 C070 -4.79080 -4.80000	•8.22043CE-C7 .00063C .300000	-23.3360 -2 871860E-02 -1 289910E-02	-4 647940E-10 CC3000 .000C33	·6301.60 ·5.339720E·03 ·5.358460E·03	3 58748CE-C4 .000000 C000C0	1 889E-03 .000
50	.00000	2 3 DISF	28.1220 28 1220 4.99040 5 60000	1 C34230E-06 •8 549C70E-07 .00008C .0C0000	24 3080 -24.3080 -3 083620E-C2 -1.436070E-02	-4.63072CE-1C -4 647940E-16 .0000000 .000000	-6556 40 -6564 10 -5.5623202-03 -5.5819102-03	3.751440E-04 3.76004CE-04 CC00000 .000000	1 748E-03 206
52	.00000	2]]]	29.2370 29.2370 5.19030 5.20300	1 C44E30E-06 -8.64535CE-07 .000000 .000000	25 2910 -25.2810 -1.3027232-02 -1.5994202-02	-5 475476E-10 -6.499780E-10 .000000 .000000	-6818 50 -6826 60 -5.7849308-03 -5.8053808 03	3.978720E-04 3 687420E-04 000000 000000	1.623E-C3 .000
54	.04660	2 3 DISP	36 3511 -30 2510 -5 38970 -5.40000	1.090540E+06 -9.110140E+07 .000900 600600	26.2530 26.2530 -3.529190E+02 -1.75C56CE+02	-8 \$85260E-10 -8.9128530E-10 .500300 CC0060	-7090.50 -7089 DC -6.007550E+03 -6 C28860E+C3	4 170460E-04 4 179510E-04 .000000 .000000	1.511E-C3 .00 C
56	. 20002	2 3 DISP	31.4650 -31.4650 -5.58930 -5.60000	1.132030E-C6 -P 5351C0E-07 C00000 .000C00	27.2260 -27.2260 -3.763030E+02 -1.918900E+02	-9.9994002.10 -1.0037402.09 0000CC CC00C0	-7342.90 -7351.5C -6.230180E-C3 -6.252350E-03	4.474640E-06 4.484100E-04 .060000 .000000	1.409E-03 000
58	00000	2 3 DISP	32.5770 -32.5770 -5.78690 -5.80000	1.149170E-C6 -9 631500E-07 .000000 .000000	26.1980 -28 1980 -4 00424CE-02 -2 094620E-C2	-9 959400E-10 -1.003740E-09 .000000 .000000	•7604.90 •7614.00 •6 452820E•03 •6.475550E•03	4 541210F-04 4.551470E-04 .000000 .000000	1 319E-03 00C
50	.00000	2 3 DISF	33.6890 -33.6893 -5.92856 -5.0000	1 2052802-06 -1.0096602-06 .000000 .000000	23.1700 -24.1700 -4.252820£-02 -2.277750£-02	-1.304020E-09 1 309020E-09 .000000 .000000	-7867.DC -7875 40 -8.575450E-03 -6.6993902-03	4.7757402-04 4.787C20E-04 .0C0000 .00900C	1.238E-03 CCO
€2	.00000	2 3 DISP	34 8000 34.2000 -5 18810 -6,20000	1.243400E-06 -1.34254CE-06 .0033C0 C00003	30.1430 -30.1430 -4 5087602-02 -2.4682508-02	-1 62595CE-09 -1 632220E-09 000000 .000000	-8129.10 -2135.80 -6.898120E-03 -6.922920E-03	4.908040E-04 4.919940E-04 600000 .000600	1 165E-03
64	00000	2 3 DISP	35 9100 -35.9100 -6.38780 -6.40000	1.23611CE-06 -1.042530E-C6 -0000C0 .000C00	31.1150 -31.1150 -4.772070E+02 -2.66617CE-02	-1 950730E-09 -1.958300E-09 .000000 000000	-8391.20 -8401.30 -7.1207802-03 -7 1464502-03	5.032370E-04 5 C43790E-04 000000 .000000	1.096E-03 .000
66	.00000	2 J DISP	37.0200 -37.0200 -6.58740 -6.60090	1.273460E-C6 -1.075419E-06 .030C00 .30009C	32.0880 -32.0880 -5.04275CE:02 -2.871470E-02	-2.094870E-09 -2.103010E-09 000900 .000000	-0653.20 -8663.70 -7 343460E-03 -7 370050E-03	5 C64910E-04 5.076700E-C4 .000000 .000000	1.035E-03 .000
6 A	00000	2 3 DISP	38 1280 -38,1280 -6,79700 -5,500000	1.292820E-0e -1 C94670E-06 .000000 000000	33.0600 -33 0600 -5 32080CE-02 -3.084170E-02	-2.436300E-09 -2.572520E-09 CC0000 .000C00	-8915.3C -8925.10 -7 566140E-03 -7.5936302-03	5.1196002-C4 5.1314402-04 .000000 C00000	9.793E-04 .CCO
-0	00000	2 DISF	39.2360 -39.2360 -6.98560 7.00000	1 329390E-06 -1.127560E-06 .000000 .000000	34 C330 -34.0330 -5.606210E-C2 -3.394269E-02	-3.024640E-09 -3 039260E-09 .000000 .000000	-9177.40 -9188 50 -7.799840E-03 -7.917230E-03	5.3379302-04 5.3502202-04 .000000 .000000	9.266E-04 .000
72	00000	2 3 DISP	40 3440 -40.3440 -7 18630 -7 20000	1.360630E+06 -1.174040E+06 .000000 .000000	35.0050 -35.0050 -5.899000E+02 -3.531740E+02	-3 327120E-09 -3.301870E-09 .030000 .000000	-5439 40 -9451.00 -8 0115402-03 -8 04C84CE-03	5.438530E-04 5.44933CE-04 C000C0 .000C00	8 797E-04 000
74	.00000	2 J DISP	41 4500 -41.4500 -7.38590 -7 40000	1.41376CE-05 -1.220560E-06 000000 .000000	25.9760 -35.9780 -6 1991502 02 -3.76662CE-02	-3.593210E-09 -3.571070E-09 -000000 -000000	-9701.50 -9713.40 -8.23425CE-03 -8.264470E-03	5 63467CE-94 5.646350E 04 .000600 .000600	8.3652°04 .000
7E	00000	2 3 DISP	42.5560 42.5560 7.56550 7.60000	1.480610E-CE 1.276720E-CE 000CON .000COC	36.9500 -36.9500 -6.506670E-02 -4.008890E-02	-3.775340£-09 -3.751930£-09 .0000CC .000000	-9963.50 -9975.80 -8 456970E-03 -8 485120E-03	5 881660E-04 5 855640E-04 .060600 .060000	7.966E-04 CQC
75	00000	2 3 DISF	43.6610 43.6610 7.78510 7.80000	1.531230E-06 -1.332650E-06 .000000 .000000	37.9230 -37.9230 -6.92136CE-02 -4.259550E+02	-4 3909602-09 -4.3436402-09 ccoocc .000coc	-10226 C -10238.0 -8 679703E-C3 -8 7117702-03	5.967530E-C4 5.98C280E-04 .0C0000 C0000C	7.554E-04 .000
80	.00000	2 3 DISP	44.7650 -44.7650 -7 98480 -8 CC00C	1 592279E-06 1 399010E-96 .000000 .000000	38 8950 -39.8950 -7 1436202-02 -4.5156132-02	-4.918920E-09 -4 74575GE-09 .000C00 .000C00	-10498 C -10501.0 -8.9024402-03 -8.9354502-03	6.239570E-C4 6.253320E-04 00000C .6000C0	7.242E-04 .000
92	.00000	2 3 DISP	45.8650 45.8680 -8.18440 -5.20000	1 636690E-06 -1.43154CE-06 .000000 .000000	39.8680 -39.8680 -7 4734508-02 -4 7500608 02	-5 54°220E-09 5 235510E-09 000000 000000	-10750.0 -10763.0 9.125200E-03 -9.159140E-03	6.531590E-04 6.54598CE-04 .0006C0 .000C00	€ 925E-04 .000
56	. 30603	DISP	45 9710 •46.9710 •5 35400 •8.40000	1.649970E-06 -1.43156CE-06 600000 000000	40.8410 -40.9410 -7.810650E-02 -5.051910E-02	-6 003450E-09 -5.6459402-09 .000000 .000000	-11012.0 -11025.0 -9.34796CE-03 -9.382840E-03	6.706860E-04 6.721080E-04 .000600 .000600	6.6295-04 .000
36	.90000	2 3 DISF	48.0730 -48.0730 -8.58360 -8.60000	1.700930E-06 -1.479100E-06 -000000 -000000	41.9130 -41.2130 -9 154820E-02 -5.331150E-02	-6.229870E-09 -5.990000E-09 .000000 ccdocc	-11274.0 -11288 C -9 570730E-03 -9 606560E-03	<pre>6 86414CE-04 6 851120E-04 .000000 .000000</pre>	6.352E.C4 .000
85	.0000(DISF 3	49.1740 -49.1740 -8.78330 -8.80000	1 220580£-06 -1.5342803-06 000000 000000	42.7860 -42.7860 -8.50656CE-02 -5.617790E-02	-6.646050E-09 -6.316040E-09 .000500 CC3000	-11536.0 -11550 C -9.793510E-03 -9.630290E-03	6 917440E-04 6.935980E-04 1.000000 .000000	6.034E·C4 00C
90	00000	2 3 DISP	50 2740 -50 2740 -8.98290 -9 00000	1.8043305-66 -1.567180E-06 .000000 .000000	43.7580 43.7550 -8.966670E-02 -5.911820E-02	-6.9905602-09 -6.690002-09 CCOOCC .00000	-11798.0 -11812 C -1.001630E-02 -1.0054C3E-02	7.010860E-04 7.029490E-04 .000000 .000000	5.653 E-04 .000

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92	39969	2 JISF	51 3740 -51.3740 -9.13250 -9.20000	1 875960E-06 -1.636980E-06 006006 .006000	44.7310 -44 7310 -9.23215CE-C2 -6.213240E-02	7.321726E-09 7 622086E-69 .000000 .000000	12060.0 -12075 0 -1.023910E-02 -1.027790E-02	7 11633CE-04 7.135960E-04 c000C0 .c0000C	5.626E-04 CCO
94	.0906C	2 3 DISP	52.4720 -52.4720 -9.38210 -9.40000	1.881110E-06 -1.636990E-06 .300030 .000030	45.7030 -45.7030 -9.606000E-02 -6.522060E-02	-7.5307602-09 -7.2320302-09 000000 000000	-12321.0 -12317.0 -1 C46190E-62 -1 C5016CE-62	7.242540E-04 7.262920E-04 .000000 .000000	5.413E-04 .000
56	00000	2 3 DISE	53.5710 -53.5710 -9.58180 -9.60300	1 8965802-06 -1.660240E-05 .000000 .000000	46.6760 -46.6760 -9 9872302-02 -6 5392702-02	-7 754100E-09 -7 581190E-09 .005000 .005000	-12582 0 -12599.0 -1.068473E-C2 1 C72543E C2	7 355590E-04 7.37842CE-04 .000000 .000000	5 195E-04 .000
98	.00000		54 6680 -54 6680 -9.78140 -9.80000	1.952470E-36 -1 739700E-36 0000C3 .0000C3	47 6490 -47 6490 103760 -7.161880E-02	-6 61597CE-09 -8.09601CE-09 .000360 .090300	-12845 C -12862 C -1.090750E-02 -1.094920E-02	7.419330E-C4 7.4399C0E-04 .000000 .000000	5.0082-04 CCO
100	.00050	2 J DISP	55.7650 -55.7650 9 98100 10 0000	2.014240E-06 -1.786210E-06 .050000 .000000	46.6210 -48.6210 107720 -7.492880E-02	-9.457380E-09 -8.878080E-09 C00000 C000CC	-13107 0 -13124.0 -1 113040E-02 -1.117300E-02	7.506440E-04 7.524820E-04 .000000 .000000	4.833E-04 .000
102	0000 0	2 3 DISP	56.8600 -56.8600 -10.1810 -10.2000	2 0550002-06 -1 228760E-05 .000000 .000000	49.5940 -49.5940 - 111750 -7 531280E-C2	-9.794±96£-09 -9.422566£-09 .000000 .000000	-13369.0 -13386.0 -1.135320E-02 -1.139690E-02	7 631010E-04 7.649630E-04 .000000 .000006	4 666E-0¢ 00C
104	. 20000	2 3 CISP	57 9550 57 9550 -10 3600 -10.4000	2 067210E-06 -1 836400E-06 0000C0 0000C0	50 5670 -50.5670 - 118860 -5.177070E-02	-1 C1848CE-08 -9.95361CE-09 .00C000 .00C000	-13631.0 -13649 C -1.157510E-32 -1.162C70E-02	7.829680E-04 7 8467702-04 000000 .000000	4.509E-04 .000
165	.00000	2 J DISF	59.0500 -59.0500 -10.5800 -10.6009	2.13497CE-05 -1.894510E-06 .000CC0 C000C0	51.5390 •51.5390 •.120340 •8.530260E-02	-1.058270E-08 -1.048040E-08 .0000CC .0000CC	-13893.0 -13911.0 -1.179900E-02 -1.18446CE-02	7.984850E-04 8.005780E-04 .000000 .000000	4.360E-04 .000
108	00000	2 J DISP	60.1430 -60.1430 -19.780C -10.6000	2.164860E-C6 -1.91790CE-05 .06000C .000000	52.5120 -52.5120 - 124290 -8.890840E-02	-1.141310E-08 -1.135550E-08 .000000 000000	-14155.0 -14173.0 -1.202180E-C2 -1.206850E-C2	8.090920E-04 8.113120E-04 .000000 .000000	4 220E-04 .00C
110	00060	2 3 DISP	61.2360 -61.2360 -10.9790 -11.0000	2 237320E-06 -1 983753E-06 .000900 .000300	53 4850 •53 4850 •128620 •9.253823E-02	-1.21369CE-C8 -1.20572CE-C8 .00CD00 .00CD00	-14417 C -14436.0 -1.224470E-32 -1.229240E-02	5.343900E-C4 E 367790E-C4 C000C0 G0000C	4.087E-04 000
112	.00000	Z J DISF	62.3290 -62.3280 -11 1790 -11 2000	2,244630E-06 -2.007030E-06 000000 000000	54.4570 -54.4570 133020 -9.654200E-32	-1 280900E-08 -1.285760E-08 .000000 .000000	-14679.0 -14699.0 -1.24676CE 02 -1.25163CE-02	6.548550E-04 8.570C40E-04 .000000 0000C0	3.947E-04 .000
114	00000	2 JISP	63.4190 -63.4190 -11.375C -11.400C	2.315880E-06 •2.976850E-06 .300030 .000030	55.4300 -55.4300 - 137500 -,100170	-1.3126898-05 -1.3466902-08 .000000 000000	-14941.0 -1496C.0 -1 269050E-C2 -1 274020E-02	9.584260E-04 8.60678CE-04 .900000 .300000	3 827E-04 .000
116	.00000	2 JISP	64 5100 -64.5100 -11.5780 -11.6000	2 353940E-06 -2 100150E-06 .0090C0 .000060	56 4030 -56,4030 -142050 - 104070	-1.374280E-08 -1.446650E-08 .000000 .000000	•152C3 C •15223.0 •1.291350E•02 •1.296420E•02	8.804010E-C4 8.8290C0E-04 .C00000 .00000C	3.714E-C4 CDO
118	.00000	2 DISP	65.600C -65.600C -11 7780 -11 8000	2.42865CE+05 -2.170010E+06 .000000 000000	57.3760 -57.3760 146670 108050	1.425290E-08 1.500500E-08 .000000 .000000	-15464.0 -15485.0 -1.313640E-62 -1.31882CE-02	5.822140E-04 8.847950E-04 .000000 .000000	3.606E-04 .000
120	C000C	2 3 D1SP	66.6890 -66 5890 -11 9770 -12.0000	2 508740E-06 -2.249500E-06 .000000 .000000	58.3480 -58.3480 - 151370 - 112100	-1,527140E-05 -1,573320E-09 .000C00 .000C00	-15726.0 -15747.0 -1 335930E-C2 -1 341210E-C2	9 C78990E+04 9.10535CE+04 .90000C .300030	3 564E-04 .000
122	. 00000	2 J DISP	67 7770 -67 7770 -12 1770 -12,2000	2 563620E·06 -2.296090E·06 .000060 .000060	59 3210 -59.3210 - 156140 - 116220	-1.625970E-08 -1.649180E-08 .000000 .000000	-15988 C -16009.0 -1.358230E-02 -1.363610E-02	9.1909802-04 9.2189002-04 .000000 .000000	3.406E-C4 CCD
124	. 00 000	2 3 DISP	59.8550 -66 8650 -12.3770 -12.4000	2.623880E-06 -2.352320E-06 -00060 .000000	50.294C -60 294C .16C980 .12C420	-1 677100E-08 -1 72952CE-06 0000C0 .000000	-16250.0 -16272 0 -1.38C52CE-02 -1.386010E-02	9.365920E+04 9.395C40E+04 .000000 C000C0	3.312E+04 .000
126	.00000	2 J DISF	69.9520 -69.9520 -12 5760 -2.6000	2 705510E-06 12.421830E-06 000000 000000	61.2670 -61.2670 165900 124690	-1.714073E+05 -1 779940E+36 603000 600000	-16512.0 -16534.3 -1 402520E-62 -1.408420E-02	9.486800E.04 5.516490E.04 .000000 .000000	3.212E-04 .000
128	00000	2 3 DISF	71.0360 -71.0380 -12.7760 -12.8030	2 782590E-06 •2.49773CE-06 .000000 .000000	62.2400 62.2400 170890 .129030	-1 794200E-08 -1.861449E-05 .000C03 C00005	-16774.0 -15796.0 -1 425120E-02 -1 430820E-C2	9 527900E-04 9.555580E-04 .000000 .000000	3 128E-04 09C
:30	00000	2 3 D1S7	72.1230 -72.1230 -12.9750 -13.0000	2 847140E-06 2.544350E-06 000000 .000000	63 2120 -63 2120 -17 5965 -123450	1 874450E-08 -1.936900E-08 030000 .030000	-17036 C -17058.0 1.4474202-02 -1.4532302-02	9.671140E-C4 9 706770E C4 000000 .000000	3.047E-04 CCO
152	.90500	2 3 DISF	73 2080 -73 2080 -13.1750 -13.2000	2.871850E-06 2.56766CE-06 000000 .000000	64 1850 -54 1850 - 181100 - 137950	-1 959930E-08 -2 014340E-06 .000000 .000000	-17297.0 -17321 C -1.46972CE-02 -1.475640E-02	P.869540E-04 .905690E-04 000000 .000900	2 976E-54 002
134	.00000	2 3 DISP	74.2910 -74.2910 -13 3750 -13 4000	2.903320E-06 2.600590E-06 .000000 .000000	65.1580 -65.1580 185310 142310	-2.0535802-08 -2 1168602-08 000000 000000	-17359.0 -17583.0 -1 4920202-02 -1.4980402-02	1.012250E-03 1.015900E-03 .000000 .000000	2.896E-04 .000

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136	00000	2 3 DISF	75 3750 -75 3750 -13 5740 -13.66600	2 922250E-C5 -2.610250E-06 .000000 .000000	66.1310 66.1310 .191600 .147160	-2.132220E-06 -2.16977CE-06 -00000 -00000	17821.0 17845.0 1 514320E-C2 1 523453E-C2) 620910E-03 1.024650E-03 .000000 .000000	2.825E·04 .000
138	. 00000	DISE 2 2	76.4570 76.4570 13 7740 13 7600	2 955920E-06 -2 643202E-06 .000000 .000000	67 1040 -67 1040 - 196960 - 151870	-2.216080E-08 -2.273086E-08 -00000 .000000	-18063.0 -18107.0 -1.5366206.02 -1.5428706-02	1 034650E-03 1.036520E-03 .000000 .000000	2.757£-04 .00¢
140	00000	2 3 513F	77.5380 -77.5380 -13.9740 -14.0000	2 9830502-06 -2 6465102-06 000000 .000000	68.0770 -68.0770 - 202390 - 156660	-2.305610E-08 -2.379830E-08 036300 056300 0660000	18345 0 -16370.0 -1.558930E-02 -1.5652\$0E-02	1 049700E-03 1 053730E-03 .050000 .050000	2 6822-04 .000
142	.06000	2 3 DISP	75.6190 -7E 5190 -14.1730 -14.2000	3 060900B-00 -2.732430B-00 000505 .000000	49,0500 -69 0500 -1207900 -161520	-2.3445202-08 -2.1672322-08 .090206 .000200	-18606.0 -18632.9 -1.581230E-02 -1.587700E-02	1 065410E-03 1 069680E-03 .000060 .000000	2 6213-C4 .000
144	.00000	2 3 DISP	79.6990 -79.6990 -14.3730 -24.4000	3.098280E-06 •2.7557702-06 00000 000000	70.0220 -70.0220 213460 166460	-2.402530E-06 -2.527653E-08 .000000 .050300	-18866.0 -19894.0 -1 6035402-02 -1 6101102-02	1.08465CE-03 1.C89270E-03 .0000C0 .000000	2.561E+C4 .000
146	.00000	2 3 DISP	80.7790 -80.7790 -14.5720 -14.6000	3.132490E-05 -2.789720E-06 .000000 .000000	70 5950 -70,9950 219140 171470	-2 509160E-08 -2.619010E-05 .000000 .000000	-19130.0 -19156.0 -1.6258502-32 -1.6325302-02	1.096260E-03 1.100910E-03 000000 .000000	2 504E+04 .000
148	.00000	2 J DISP	81 8570 -81.8570 -14.7720 -14.8000	2.125130E-06 -2.835340E-06 000000 000000	71.9660 -71.9680 - 224870 - 176560	-2 559230E-08 -2.689330E-08 .000000 .000000	-19392.0 -19418.0 -1.648150E-02 -1.65495CE-02	1.119990E-03 1.12487CE-03 60000C 6000C0	2 449E-04 .000
150	. 30005	2 J DISP	62 9350 -62,9350 -14,9720 -15,0000	3.181990E-06 2.84496CE-06 .000060 .000060	72.9410 -72.9410 230670 181720	+2 66046CE+08 +2.780360E+08 .000000 .000000	-19654.0 -19681.0 -1.670466E-02 -1.677370E-92	1.125690E-03 1.134260E-03 000000 000000	2.396E-04 .6C0
152	.00000	2 3 DISP	84 0130 -84 0130 -15.1710 -15.2000	3 251890E-06 -2 91489CE-05 .0000C0	73.9140 -73.9140 236550 186950	-2 64172CE-08 -2 761530E-08 .000009 .00009	-19915.0 -19943.0 -1 692770E-02 -1.699800E-02	1.140080E-02 1.144650E-03 000000 .000000	2.345E-94 CCO
154	.00000	2 J DISP	85 0890 -85 0890 -15,3710 -15,4000	3.252700E+06 -2.91489CE+06 .000000 600000	74 8570 -74.8570 242500 192250	-2.66782CE-C6 -2 776360E-08 .009000 .330000	-20177.0 -20205.0 -1.715080E-02 -1.722220E-02	1.140990E-03 1.145580E-03 000000 000000	2.288E-34 .cc0
155	. 96605	2 3 DISP	86 1650 -86 1650 -15.5710 -15.6000	3 3096202-06 -2.9615202-06 .000000 .000000	75.8600 -75.8600 - 248520 - 197640	-2.77927CE-C8 -2.848520E-08 .009000 .000000	-20439.0 -20467.0 -1 737400E-02 -1 744650E-02	1.1495902-03 1.1544202-03 .800000 .000000	2.241E-04 CCO
156	.00000	2 3 DISP	87.2400 -87.2400 -15.7700 -15.8000	3.3973602-06 -3.0411002-06 -060000 .000000	76 8330 -76 8330 - 254620 - 203090	-2.800320E-08 -2.89938CE-08 000000 .009000	-20701.C -20729.0 -1.759710E-02 -1.767080E-02	1.171650E-C3 1.176500E-03 .000000 000000	2.196E-04 000
160	.00000	2 3 DISF	88.3140 -68.3140 -15.9700 -16.0000	E 408679E-06 -3.041150E-06 .00000C .00000C	77 8060 -77 8060 - 260790 - 209620	-2.879790E-08 -2.96291CE-08 -000000 .000000	-20962 C -20992.0 -1 782030E-C2 -1.785510E-62	1 191290E+C3 1.186670E+C3 .060006 .060006	2.153E·04 060
162	00000	2 J DISP	99.3870 -89.3870 -16.1700 -16.2000	3 4701102-06 -3 0974402-06 .000000 .000000	78 7790 -78 7790 267040 - 214230	-2.989610E-08 -3.108140E-08 -00006 .000000	-21224 C -21254 C -1 804340E-C2 -1.811940E-02	1.201000E-03 1.206550E-03 .000000 000000	2 110E-04 000
1ć4	00000	2 515F	90 4600 -90.4600 -16 3690 -16 4000	3 5410602-06 -3 1537702-06 .000000 .300000	79.7520 -73 7520 273360 - 219900	-3.104990E-08 -3.200070E-08 -00000 -00000	-21465.0 -21516 0 -1 826660E-02 -1 834370E 02	1 223940E-03 1.229680E-03 .000000 .000000	2 070E-04 00C
166	50000	2 JISP	91.5320 91.5320 16.5690 16.6000	3.555570E-06 3.163443E-06 030000 .000030	80.7250 -80 7250 279750 225650	-3.236000E-08 -3.326880E-08 .000000 CC0000	21747.0 -21778 C -1.648980E-02 -1.856910E-02	1 237280E+03 1.243395E+03 .000000 .000000	2.031E-04 .060
169	00000	2 3 DISP	92.6030 92.6030 -1: 7680 1: 9000	3.590900E-06 -3 196420E-06 000000 .030000	81.6990 -81.6990 286220 231490	-3.2976102-05 -3.354290E-05 .000006 .000000	-22009.0 -22040.0 -1 571290E-02 -1 679240E-02	1 261130E+03 1.267350E+03 .000000 000000	1.9932-04 .000
170	00000	2 3 DISP	93,6740 -53,6740 -16,9680 -17 0000	3.627730E-05 -3.229400E-06 000000 000000	E2.6720 -E2.6720 292756 237386	-3.3012105-06 -3.3879105-08 .000000 .000000	-22271.0 -22302 5 -1.893610E-02 -1.901660E-02	1 273700E+03 1 280050E+03 .0005009 .000009	1 956E-04 .000
172	.00000	z J DISP	94 7440 94.7440 17.1680 17.2000	3,6547602-06 3,2527302-06 ,000300 ,000300	93.6450 -33.6450 299360 .243350	 -3 368000£+08 -3.487530£+08 .000000 .000000 .000000 	-22532.0 -22565.0 -1.915940E-02 -1 92412CE-02	1.29109CE-03 1 29758CE-03 C000C0 .0000C0	1 921E-04 .000
174	.00000	2 Jisp	95 8130 -95 8130 -17,3670 -17 4000	3 6604802-06 -3.2527502-06 .000000 .000000	54.615C -54.6150 - 306070 .249400	-3 460730E-09 -3 588950E-08 .000000 .000000	-22794.0 -22827.5 1 935260£ 02 -1 946560£-02	1.312610E+03 1 31928CE+53 600000 000000	1 6746-04 .000
176	.00500	2 3 DISF	96 8810 96 8810 17 5676 17 6000	3 697950E-06 3 285746E-06 .000000 .000000	05 5910 -03.5910 - 312030 255520	-3 55370CE-C8 -3 67367CE-08 -003000 .003000	-23050 0 -23089 0 -1 960500E-02 -1 969010E-02	1.324730E-03 1.321530E-03 000000 000300	1 841E-04 .000
178	.00000	2 J DISP	97.9490 -97 9490 -17 7610 -17,8000	3 751000E-06 3 342040E-06 .000000 000000	85 5640 -B6.5640 -319670 251720	-3.666140E-08 -3.79277CE-C8 CCODCC .000C00	-23318 C -23351 C -1 982910E+02 1 991450E-02	1.331740E-C3 1.338460E-C3 .000C00 0C0000	1.810E-04 .000

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	150	00000	Z JISP	99.0160 -99.0160 -17.9660 -19.0000	3	788970E-C 365400E-0 00CCD0 00CCD0	6 57.537 6 -87 537 - 32655 -,26799	0 -3 8870502-09 0 -3.9855902-08 0 000006 0 000006	-23579.0 -23613.0 -2.005230E-02 -2.013900E-02	1.3443102-03 1 35146CE+03 C0000C C000CO	1 779E-04 .000
	182	C0000	2 3 DISP	100.080 -100.080 -18.1660 -18.2500	3 . - 3 . -	823196E-0 412026E-0 000000 000000	6 86.511 6 96.511 - 33356 - 27433	C -3 983930E-08 C -4 077770E-08 C 000000 C 000000	-23841 C -23675 C -2.02756CE-02 -2 C36340E+02	1 365310E-03 1.372140E-03 .000000 .000000	1.750E+C4 .000
	154	.00000	2 B DISP	101.150 101.150 -18.3660 18.4000	- 3 .	883990E-0 455710E-0 009000 000000	6 29.464 6 -85.484 34062 .28075	0 -4.09\$7302-08 5 -4.1932002-08 0 .000000 0 .000000	24103.0 -24137.0 -2 049890E-C2 -2.058790E-C2	1.382910E-03 1.390090E-03 000000 .000000	1.721E-04 .000
	196	00000	2 Josp	102 216 -102 210 -18 5650 -15 6000	3	962370E-0 538360E-0 000000 000000	€ 90.457 € 90.457 34775 .28724	0 -4.176930E-08 0 -4.296540E-08 0 .000308 0 .000308 0 .000308	-24364.0 -24400.0 -2.072210E-02 -2.0812502-02	1,399190E-03 1,39642CE-03 .000000 .000000	1 693E-04 .cco
	198	.00000	2 J DISP	103 280 -103 290 -15.7450 -15 E000	3. -3.	974010E-0 538390E-0 000000 000000	6 91 430 6 91 430 35495 29380	C -4 36217CE-C8 C -4 46014CE-C8 C CCOOCC C CCOOCC	·24626 C ·24662 C ·2.09454CE-02 ·2 103700E-02	1 418770E-03 1.426410E-03 .0000C0 .000000	1.6672-C4 .900
	190	.00005	2 3 D13¤	104.340 -104.340 -18.9640 -19.0000	4. 3.	03657CE-0 59474CE-0 000000 000000	6 52.404 6 92.404 93.404 93.404 93.404	0 -4 452780E-08 0 -4 592130E-08 0 .000000 0 .000000	-24867.0 -24924.0 -2 116880E-C2 -2.126150E-C2	1.435140E.03 1.443000E.03 .000000 .000000	1.641E-04 .000
	192	00960	2 3 DISP	105.400 105.400 19.1640 19.2000	4. • 5.	C76050E-C 627750E-C C000C0 C000C0	6 93.377 6 93.377 36959 30716	0 -4.571440E-08 0 -4.709130E-08 0 .000000 0 .000000	•25149.0 •25186.0 •2.139210E•02 •2.148610E•02	1.44564CE-03 1.45371CE-03 000000 000000	1 615E-04 .000
	194	.00000	2 3 DISF	106 460 106 460 19 3640 19 4000	4	119780E-0 674410E-0 006000 006000	6 94.350 6 -94 350 37701 31394	0 -4.665340E-08 0 -4.764650E-08 0 .000000 0 000000 0 000000	-25411 C -25446.C -2.16154CE-02 -2.17107CE-02	1.456790E-03 1.464780E-03 .000000 .000000	1.591E-04 200
	196	. 20000	2 J DISP	107.530 -107.530 -19.5630 -19.6000	4. ·3.	14C430E-0 694110E-0 000000 00000C	6 95.324 6 95.324 - 36451 - 32060	C -4 77729CE-08 C -4 873330E-08 C C00000 C .000C00	-25672.0 -25710.0 -2 183880E-C2 -2 193530E-C2	1.468650E-03 1.476990E-03 .000000 .000000	1.567E-34 00C
	198	. 00032	2 3 DISP	168 590 •108 590 •19.7630 •19.8000	4. 3.	20400CE-0 754110E-0 000000 600000	6 96.297 5 -96.297 - 39209 32774	0 •4.9240602-08 0 •5.0301602-09 5 000005 0 .000005	-25934.0 -25972.0 -2.206210E.02 -2.215990E.02	1.493580E-03 1.501780E-03 .000000 .000000	1 544E-04 CCO
	200	00000	2 3 DISP	109.650 -109.650 -19.9630	4	263510E-C 800820E-0 C000C0	6 97.270 6 97.270 39974	0 -4 997150E-08 0 -5.109540E-08 0 .000000	-26196.0 -26234.0 -2.22 8550E-0 2	1 515270E-03 1 526960E-03 000000	1.5222-04
: ST	RUCTURE .	: EXAMPL	E I ONE-S	TCRY BUILD	12G	000000	33475	000000.	2.23845CE-02 TIME 9 1	C000C0 8-13 DATE 5/	.000
i st sc	RUCTURE . LUTION	: EXAMPL : INCREM	E I ONE-S EMTAL DISP	STORY BUILD	ING OMTROL A	CO0000 T JOINT 5	33475	000000	-2.23845CE-02 TIME: 9.1 TIME: 9:1	C000CO 3-33. DATE 5/ 3-34. DATE 5/	.000 24/96 24/95
i st SC	RUCTURE . LUTION DEGREE CF	: EXAMPL : INCREM FRZEDOM	E I ONE-S EMTAL DISP # 15 IS	TCRY BUILD FLACEMENT C READ FROM	ING ONTROL A UNIT #	СЭССЭЭ ЛТ ЈЭІМТ 5 11 Ј	33475 01NT # 3	0 .000000 , direction: Fy	-2.23£65CE-02 TIME: 9.1 TIME: 9:1 TIME: 9:1	C000CO 8-33. DATE 5/ 8-34. DATE 5/	.000 24/96 24/96
i st sc	RUCTURE . LUTION DEGREE CF STEF 0	: EXAMPL : INCREM FRZEDOM TIME :00000	E I ONE-S EMTAL DISF # 15 IS LOAD .00	TCRY BUILD FLACEMENT C READ FROM D DI	ING ONTROL A UNIT # SPLACEME .00000	C00000 NT JOINT 3 11 J NT VE	33475 OINT # 3 LOCITY 00000	0 .000000 , DIRECTION: FY ACCELERATION .00000	-2.23&45CE-02 TIME: 9.11 TIME: 9:11	CODDCO B·J]. DATE 5/ B·34. DATE 5/	.000 24/96 24/95
: ST SC	RUCTURE . LUTION DEGREE CF STEF 2 4	2 EXAMPL 2 INCREM FRZEDOM TIME .00000 .00000 .00000	E I ONE-S EMTAL DISF # 15 IS LOAD .20 -2.2 -4.5	TCRY BUILD STCRY BUILD FLACEMENT C READ FROM D DI DCCO 2704 405	ING ONTROL A UNIT # SPLACEME .00000 .20000 .40000	COOGOO NT JOINT S 11 J INT VE	33475 OINT # 3 LOCITY 00000 .00000 .00000	0 .000000 , DIRECTION: FY ACCELERATION .00000 .00000	-2.23£45CE-02 TIME: 9.1 TIME: 9:1	CODOCO 8-33. DATE 5/ 3-34. DATE 5/	.000 24/96 24/95
: ST SC	RUCTURE . LUTION DEGREE CF STEF 0 2 4 6	2 EXAMPL 2 INCREM FRZEDOM TIME 000000 00000 00000 00000	E I ONE-S EMTAL DISE # 15 IS LOAD .20 -2.2 -4.5 -6.6	READ FROM DCC0 2704 405 112	ING DUTROL A UNIT # SPLACEME .00000 .20000 .20000 .60000	CODEOD IT JOINT S 11 J INT VE	33475 OINT # 3 LOCITY 00000 .00000 .00000 .00000 .00000	0 .000000 DIRECTION: FY ACCELERATION .00030 .00030 .00030 .00030	-2.236450E-02 TIME: 9.11 TIME: 9:11	000000 8-33. DATE 5/ 8-34, DATE 5/	.000 24/96 24/95
i st sc	RUCTURE . LUTION DEGREE CF STEF 0 2 4 6 8 10	: EXAMPL : INCREM FRZEDOM TIME .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000	E I ONE-S EMTAL DISF # 15 IS LOAD -20 -2.2 -4.5 -6.6 -9 C -11	TCRY BUILD FLACEMENT C READ FROM D DI CCC0 2704 4405 112 1814 352	ING DNTRDL A UNIT # SPLACEME .00000 .20000 .20000 .60000 .60000 .80000 .1.0000	COODOD TJOINT S 11 J INT VE	33475 OINT # 3 LOCITY 00000 .00000 .00000 .00000 .00000 .00000	0 .000000 , DIRECTION: FY ACCELERATION .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000	-2.232645CE-02 TJME: 9.1 TIME: 9:11	CODOCO 8-33. DATE 5/ 8-34, DATE 5/	.000 24/96 24/96 24/95
: st SC	RUCTURE . LUTION DEGREE CF STEF 0 2 4 6 8 10 12	2 EXAMPL 2 INCREM FRZEDOM TIME 00000 00000 00000 00000 00000 00000 0000	E I · ONE · S EMTAL DISF # 15 IS LOAD - 20 - 2.2 - 4.5 - 6.6 - 9 C - 11 - 12.	20.5050 TTCKY BUILD FLACEMENT C READ FROM D CCO 27 C4 34 C5 112 112 112 112 112 112 112 11	ING DETROL A UNIT # SPLACEME .00000 .20000 .20000 .20000 .60000 .80000 80000 80000 80000 12000	COOSOD NT JOINT 3 11 J NNT VE	33475 OINT # 3 DOCITY 00000 .00000 .00000 .00000 .00000 .00000 .00000	0 .000000 , DIRECTION: FY ACCELERATION .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .000000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .00000 .000000 .000000 .0000000 .00000000	-2.232645CE-02 TIME: 9.11 TIME: 9:11	000000 33.Date 5/ 3-34. date 5/	.000 24/96 24/96 24/96
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112	00000	+127.11	-11 200	.00000	00000
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138	.00000	-156 62	-13.BCC	.00000	.00000
140	.00000	-156 89	-14.000	.00000	.00000
142	.00000	·161 16	14.200	.00000	.00000
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tee		190 69	-0.BCL	.00000	.00000
170	.30900	-192 96	-17.500	. 00000	. 30000
172	.00000	-195.23	-17.200	.00000	.30000
174	.03000	-197.50	-17.400	.00000	.000000
176	.00000	-199.77	-17.600	.00000	.00000
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196	00000	215.67	·19.000	00000	.00000
192	00000	-217.95	-19.200	00000	00000
154	.00300	· 22C. 22	-19.400	.00000	.00000
19£	.000000	-222.49	-19.600	00000	.00000
198	00000	·224.7€	-19,800	00000	.00000
200	00000	-227.03	20.000	00000	00000
	00010			00000	

J. SHEAR WALL STATIC ANALYSIS

Description of Input Information

A shear wall structure (Fig. 62) is subjected to static loads. One shear wall and two 3DBEAM elements comprise the structural system. For 3DBEAM, elastic modulus is E=29000 ksi and shear modulus is G=13000 ksi. Cross-sectional area, torsional moment of inertia, and moment of inertia are A=19.1 in², J=2.18 in⁴, $I_Y=533$ in⁴, and $I_Z=174$ in⁴, respectively. For shear wall, bending, shear, and axial material properties are BEND1, SHEAR1, and AXLMOD, respectively. Fraction of the length from the top to the internal springs is 1.0, and the axial load used to calculate the geometric stiffness is 69.21.

AXLMOD:	Ks = 70	000 kips	s/in	Kt = 60	000 kip	s/in	Kt2=6	0 kips/in	i	Fy = 200	0 kips
	α=0.9)	$\beta = 0.2$	$\mu f = 1$	5	$\beta DI = 0$	0.2				
BEND1:	NSEG	=4	NI = 10		DY=0	.7E-5	l/in	$\beta DI = 0.2$	2		
P (kips-i	n):	2700		5000		6500		7000			
D (1/in)	:	0.2E-5		0.7E-:	5	1.7E-5	;	4E-5			
SHEAR1:	NSEG	=4	NI = 10		DY = 1	.0E-3	l/in	$\beta DI = 0.1$	2		
P (kips-i	n) :	80		150		180		200			
D (1/in)		0.3E-3	ł	1.1E-2	2	2.3E-3	5	5E-3			

Note: While the input data can be used for inelastic analysis, only the elastic properties of the materials are used in this example.



Figure 62. Shear Wall Static Analysis

Input and Output

<u>Input</u>

1 STRUCTURE ... SHEAR WALL STATIC ANALYSIS SOLUTION ... TIME: 17:29 1, DATE 5/29/96 ---- PROGRAM FEM ---- DOUBLE PRECISION VERSION NODE CONSTRAINTS NODE: 5 IS RESTRAINEL, CONSTRAINT 3 IS IGNOREL... NCDE: 5 IS RESTRAINED, CONSTRAINT 4 IS IGNORED... NCDE: 5 IS RESTRAINED, CONSTRAINT 5 IS IGNORED... JD-RIGID BODY CONSTRAINT, MASTER: 6 SLAVE: 5 NODE COORDINATES AND DEGREES OF FREEDOM Y-COORD 2-COORD C000C 0000C C000C 0000C C000C 0000C C000C 0000C 240 0C .0000C NODE COS# X-COCRD Y-COORD Z 1 1 .000C0 0000C 2 2 1 123.00 .0000C 2 4 .00000 240.00 240.00 240.00 5 .120.00 244.00 240.00 240.00 6 i 210.00 244.00 240.00 KCTE: K REFERAINED DESRES 05 FREEDOM C CONSTRAINED DESRES 05 FREEDOM FX 7 · R 13 · R 19 · R 1 4 · C 4 FY 8 · R 14 · R 20 · R 2 · C 5 · C FZ 9 · F 25 · F 25 · F 25 · F 28 · F 31 · F MX 10 · R 22 · R 26 · R 29 · R 32 R MY 11 - R 17 - R 23 - R 27 - R 30 - R 30 - R M2 12 · R 18 · R 24 · R 3 6 · C DIRECTION COSINES COS(1) VX. 1,00070 I + 00000 J + 00000 K VY+ .00000 J +100000 J +.00000 K VZ: .00000 I + 00000 J +1.00000 K I STRUCTURE ... SHEAR WALL STATIC ANALYSIS SOLUTION. .. 1 3-D ELASTIC BEAM ELEMENT MATL E GAMMA AX AY AZ IX IY ΙZ 1 2.900E-04 1 300E+04 19 1 19 1 19.1 2.18 53) 174 1 STRUCTURE . : SHEAR WALL STATIC ANALYSIS SOLUTION....: TIME: 17.29: 1, DATE: 5/29/96

AXLMOD HYSTERESIS MODEL- FOR UNIT LENGTH MEMBER MAT 50 ST1 2 7603.00 6000.00
 FY
 ALPHA
 EETA

 2000/09
 .900000
 .200000
 MAX DUCT. BETA-DI 15.0000 .200000 PETA 572 60.000 1 STRUCTURE ... SHEAR WALL STATIC ANALYSIS TIME: 17:29 1, DATE: 5/29/96 SOLUTION BENDI HYSTERESIS MODEL DATA - UNIT LENGTH MEMBER EACKBONE CURVE FOINTS - MATL N1 DY 3 10 .T00000E C5 MOMENT 2700 00 5000.00 6500.00 7000 00 ROTATION .200000E-05 .700000E-05 .170000E-04 BETA 200000 40000E-04 1 STRUCTURE. ...: SHEAR WALL STATIC ANALYSIS SOLUTION..... TIME: 17:29: 1, DATE: 5/29/96 SHEAR: WYSTERESIS MODEL DATA - UNIT LENGTH MEMBER BACKBONE CURVE FOINTS - MAT NI DY 4 10 .100005-02 BETA STRESS STRAIN 80 0000 150 000 180 000 200.000 .300000E-03 .110000E-02 .230000E-02 .50000E-02 200000 . 1 STRUCTURE ... SHEAR WALL STATIC ANALYSIS SOLUTION. TIME: 17.29 1 DATE: 5/29/96 GEOMETRIC STIFFNESS DATA KGDATA'1)= 1. LOAD= F(INPUT'+(1.66+ACCEL) F(INPUT) IS POSITIVE IN COMPRESSION ACCEL IS POSITIVE GLOBAL Z-AAKS ACCELERATION KGDATA(2)= 1. LOAPED FORMULATION KGDATA(3)= 1. KG IS SUBTRACTED FROM ELEMENT STIFFNESS THE GEOMETRIC STIFFNESS MATRIX IS NOT CONDENSED WITH THE STRUCTURAL STIFFNESS MATRIX.
 STRUCTURE SHEAR WALL STATIC ANALYSIS
 SCULTION..... TIME: 17:29: 1. DATE: 5/29/96 ELEMENT CS. 3D BEAM ELEMENT
 b
 MATL START
 END
 REL CD
 LENGTH
 Y=AXIS

 1
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 1 00000 I
 - 00000 J
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 120.0
 .00000 I
 +1 00000 J
 -.00000 K
 START DIST END DIST PKG .0000 0C00 CC00 .036C CC00 .CC03 .030C TIME- 17.23. 1, DATE 5/29/96 SEE STRUCTURE. . . SHEAR WALL STATIC ANALYSIS SCLUTICN ELEMENT 03. R/C SHEAR WALL ELEMENT ELEM BEND SHEAR AXIAL JOINT JOINT JOINT JOINT # MATL MATL MATL %1 #2 #3 #4 LENGTH WIDTH ALPHA PKG 3 3 4 2 6 5 2 3 240.0 SW1 90.00 1.000 69.21 ZERO MASS MATRIX PROPORTIONAL DAMPING COLEFICIENTS ALPHA- .00050 BETA- .00000 1 STRUCTURE ... SHEAF WALL STATIC ANALYSIS SOLUTION.... STATIC LOADING TIME 17 29: 1, DATE: 5/29/96 TIME 17:29: 1, DATE: 5/29/96 SOLUTION #1, STATIC - ELASTIC ANALYSIS NUMBER OF LOAD CASES . APPLIED JOINT LOADS . 1 LCAD CASE 1 JOINT 4 DIRECTION FY LCAD CASE: 1 JOINT 6 DIRECTION FX 1 STRUCTURE ... SHEAR WALL SIATIC ANALYSIS SOLUTION..... STRING LOADING DOF(S) 2 DOF(S) 4 MAGNITUDE 15.0000 100 000 MAGNITUPE TIME 17 29. 1, DATE 5/29/96 TIME 17 29. 1, DATE 5/29/96 GES DISPLACEMENTS. LOADING # 1 R2 C00600 CC000C 4.366651E-C3 4.065306E-C3 4.065306E-C3 TIME: 17 29: 1. DATE: 5/29/96 TIME: 17:29: 1. DATE: 5/29/96 DX NODE CY 52 RX ĒΥ 1 000000 00000 2 00000 000000 3 00000 000000 4 106311 5.324803E-03 5 1.06382 5.99970E-02 6 1.06382 ...75861 1 STRUCTURE ... SHEAR WALL STATIC ANALYSIS SCLUTION ... STATIC LOADING 000000 000000 000000 000000 000000 0000000 000000 000000 000000 000000 000000 000000 0000000 000000 000000 000000 .000000 GCS RESTRAINT REACTIONS, LOADING # 1 FX NCDE FY FZ MX Mì ΜZ

	THE STATICS	STR	AIN ENE	RGY CF	SYST	EM - 1	53 39						
	3	1	£	5	2	э -	22867 3	-4.065306E-03	- 97 , 9437	·8.814933E·02	2.71080	929	4173E-02
	R/C SHEAD ELEMENT LO	R WAS	L FORC	E5 JNT 2	JNT · 3	JNT · 4	MOMENT	ROTATION	SHEAR	SHEAR DISPL.	AXIAL	AX:	AL DISFL
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Drawing of Internal Forces



Figure 63. Drawing of Internal Forces

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APPENDIX A

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DUCTILITY AND EXCURSION RATIO

Three definitions of ductility are considered in this study. First and most common is the displacement definition shown in Figure A1. Let displacement ductility be defined as

$$\mu_1 = \frac{|\Delta_{\max}|}{\Delta_y} \tag{A-1}$$

when Δ_{max} represents maximum displacement, rotation or strain in the structure or element, and Δ_y is yield displacement, rotation or strain. Ductility for the elastic 3D prismatic beam element is not calculated. For the reinforced concrete shear wall element, ductility is calculated for the bending, shear and axial components of deformation. The type of spring element determines if ductility is calculated for axial, shear, torsional or rotational deformation.

Cheng et al. (14, 9) have proposed several energy-based ductility definitions. Both variable strain energy and constant strain energy formulations are used in this study. Figure A2 shows the variable strain energy definition of ductility which is defined as

$$\mu_2 = 1 + \frac{PSE}{ESE}$$
 (A-2)

where PSE corresponds to the plastic strain energy for the current half cycle. The constant strain energy definition of ductility is shown in Figure A3 and defined as

$$\mu_3 = 1 + \frac{PSE}{CSE}$$
 (A-3)

where CSE is the constant strain energy corresponding to displacement at yield.

For each ductility ratio, a corresponding excursion ratio exists; this ratio is given by

$$\varepsilon = \sum (\mu - 1)$$
 (A-4)

and the summation is carried out for each half cycle.


Figure A1. Displacement Definition of Ductility





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Figure A2. Variable Strain Energy Definition of Ductility



Figure A3. Constant Strain Energy Definition of Ductility

APPENDIX B

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DAMAGE INDEX

Damage index is a parameter developed by Ang et al. to assess the damage in a structure (22, 23, 1). Total damage or collapse is indicated by a damage index greater than 1.0. Let damage index be defined as

$$DI = \frac{\Delta_{\text{max}}}{\Delta_{\text{ult}}} + \frac{\beta}{F_y \Delta_{\text{ult}}} \int_0^t d(PSE)$$
 (A-5)

where Δ_{max} is maximum displacement, Δ_{ult} is failure displacement under monotonic loading, F_y is yield force, and β is a hysteretic energy coefficient. For RC shear walls, Sheu (24) determined $\beta = 0.20$, based or. NCKU walls SW1a through SW6.

For the elastic 3D prismatic beam element, the damage index is not calculated. For the reinforced concrete shear wall element, the damage index is calculated independently for the bending, shear and axial components of deformation. The type of spring element determines if damage index is calculated for axial, shear, torsional or rotational deformation. For each of the shear wall element's components and for the spring element, a damage index is printed in the output. For the entire structure, the damage index is calculated by taking a weighted average of each individual component's damage index where total strain energy, SE_i, for each component is used as the weighting factor. Thus

$$DI = \frac{\sum SE_i DI_i}{\sum SE_i}$$
(A-6)

where the summation is carried out for all members. A sample calculation of the damage index is included in Section B.1 of Chapter VI.

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188
Public reporting ourden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this information (to starting this burden information operations and Reports, 12/5 Jefferson - 4302, and to the Office of Management and Budget, Paperwork Reduction Project (CR-0-138), washington, DC 20503			
k)2. REPORT DATE3. REPORT TYPE ANDPB97-123624August 1996Final		D DATES COVERED	
 4. TITLE AND SUBTITLE INRESB-3D-SUPII User's Manual: General Purpose Program for Inelastic Analysis of RC and Steel Building Systems for 3D Static and Dynamic Loads and Seismic Excitations (Based on Supercomputer and PC) 6. AUTHOR(S) Franklin Y. Cheng, Jeng-Fuh Ger, Dan Li and J.S. Yang 			5. FUNDING NUMBERS (G) NSF BCS 9001494 NSF MSS 9214664
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Department of Civil Engineering University of Missouri-Rolla Rolla, MO 65409-0030			8. PERFORMING ORGANIZATION REPORT NUMBER 96-3
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) National Science Foundation 4201 Wilson Blvd. Arlington, VA 22230			10. SPONSORING / MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION / AVAILABILITY	STATEMENT		126. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 words; This report serves as a user's guide to the computer program INSRED-3D-SUPII for analyzing elastic an inelastic building systems subject to static loading, dynamic forces, multi-component earthquake motion, and pseudo-static cyclic loading. The program is also capable of calculating inelastic post-buckling behavior of steel members and systems as well as free vibration. A joint-based system is used to define the geometry of a structure. Structural members may be elastic 3D prismatic beams, nonlinear bracing elements. System formulation has the following attributes: 1) joint-based degrees of freedom, 2) rigid body and planar constraints, 3) incremental nonlinear static solution, 4) unbalanced load correction for overshooting, 5) incremental nonlinear dynamic solution, 6) mass and stiffness proportional damping, 7) condensation to reduce the size of a dynamic problem, 8) energy balance, 9) damage index, and 10) ductility and excursion ratio for various definitions of displacement, constant strain energy, and variable strain energy. This program allows efficiency in both computation and data preparation. Output solutions include static results of member forces and joint displacements, as well as dynamic results of member forces, joint displacements, ductility factors, excursion ratios, damage indices, seismic input energy, and dissipated energy. Major features of the report include a description of the program, instructions for data preparation, and a guide to modify the program's dynamic storage. 14. SUBJECT TERMS Inelastic analysis Shear wall Ductility Failure Ductili			
Unclassified	Unclassified	Unclassified	

Standard Form 298 (Rev. 2-89) Prescribed by ANSEStd. 739-13

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