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ON THE INTERACTION FORCES AND RESPONSES OF STRUCTURAL RINGS SUBJECTED TO FRAGMENT IMPACT

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Appendix in report titled "User Instructions For the Jet 2 Computer Program" including Fortran IV Program Listing for Jet 2

16. Abstract

A FORTRAN IV computer program, called JET 2, which can be used to predict the large two - dimensional elastic-plastic dynamic Kirchhoff deformations of a free, multilayer, hard-bonded, multimaterial, isothermal circular ring subjected to an initial impulse loading followed by an arbitrary time-dependent forcing function which can be defined to simulate the forces which result from the interaction of burst-rotor fragment or fragments and a containment ring is presented. Strain-hardening and strain-rate effects of the ring material are taken into account. Tests for interlayer bond failure can be made if desired.

A method which uses measured ring position vs. time data obtained from high-speed motion pictures to calculate the transient interaction forces resulting from a containment ring-fragment interaction, has been enlarged and improved over an earlier version. Plausible estimates of the external forces can be calculated, but improvements are required to provide acceptably accurate interaction-force predictions. Force vs. time results predicted by this analysis and employing data from two tests involving single-blade impact upon a circular metal ring are presented.

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FOREWORD

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SECTION 1

INTRODUCTION

1.1 Background

The uncontained failure of high-speed rotating turbojet engine parts remains at the present time a serious and unsolved problem. Since June 1968 personnel of the MIT Aeroelastic and Structures Research Laboratory have been developing and exploring analytical models which can be used to predict the transient responses and containment potentials of simple containment devices.

The primary objective of this continuing research effort is to provide designers in the aircraft engine industry the necessary analytical tools for the analysis of containment/deflection devices and ultimately, the development of computer programs which will enable the optimum design of containment/deflection devices to be carried out.

In a previous report [1]*, the problem of containment/deflection of burst turbojet engine parts was defined, and an approach to the problem was outlined. A computer program, JET 1, which is capable of predicting the large deflection, elastic-plastic response of a single-layer ring which may have an arbitrary specified time-varying temperature distribution was presented. The forces acting on the ring must be known and are specified as input to the program.

As stated in Ref. 1, perhaps the major problem in using programs such as JET 1 is that the forces resulting from a fragment-ring collision are not known a priori. To assist in overcoming this problem, a new method which uses measured position data from high speed photographs of spin-chamber tests carried out at the Naval Air Propulsion Test Center, (NAPTC) Philadelphia, Pennsylvania was advanced in Ref. 1 to calculate the forces acting on the containment ring. This method was implemented in a computer program termed TEJ 1 (JET 1 backwards), and tested by using "synthetic" position data produced by JET 1

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*Numbers in brackets, [ ], refer to references cited at the end of the text.

using known forces applied to a typical containment ring.

The TEJ 1 program was capable of satisfactorily predicting the forces acting on a ring of nominal 7.3-inch midsurface radius if the exact position data were perturbed with a probable error (PE) which was less than approximately 0.003 inch and were then used as input to TEJ 1. However, the best position data obtained by NAPTC has a PE of about 0.01 inch; therefore, it was concluded that the TEJ 1 program required some major improvements before it could be used to calculate the interaction forces occurring in an actual containment test. Research efforts seeking such improvements are described in this report.

1.2 Report Contents

The present report consists of three additional sections. The characteristics of the new computer program JET 2 which calculates the transient response of a multi-layer multi-material circular ring, subjected to short duration-type external forces are described in Section 2. Improvements in the method for calculating the external forces acting upon containment rings, using measured ring positions obtained from high speed motion pictures are presented in Section 3; as an illustrative application, this method is used to calculate the forces resulting from the impact interaction of a single T-58 turbine rotor blade with a 2024 aluminum containment ring. Section 4 is devoted to a summary of the work accomplished to date and recommended avenues of further study.

Appendix A describes the Gaussian quadrature method used in JET 2 to evaluate the inplane stress and moment resultants, and Appendix B presents the user's manual for the JET 2 program, including the program listing and three sample problems with input and resulting output.

SECTION 2

CAPABILITIES OF THE JET 2 COMPUTER PROGRAM

2.1 Introduction

JET 2 is the second of a series of computer programs which are intended to be made available to the aircraft industry for use in analyzing containment/ deflection devices.

The program uses a step-by-step numerical integration method* to compute the large Kirchhoff-deflection dynamic elastic-plastic response of a multi-layer, multi-material, hard-bonded circular ring (Fig. 1) that is subjected to an initial impulsive loading that may, if desired, be followed at any later time by an arbitrary, prescribed, time-dependent external forcing function. Although certain aspects of the program are especially tailored to predict the transient-ring response due to an impulsive initial loading and/or subsequent external time-dependent loading distribution (as might be caused by a fragment or fragments from burst high-speed rotating parts of jet engines colliding with the ring), there are no restrictions placed on either the initial impulsive loading or the subsequent time-dependent forcing function specified, except that in many cases the input procedure can be greatly simplified if one chooses "standard" distributions which allow the loadings to be described with a minimum number of parameters. Both the general methods and the special-case methods for describing the initial impulse and the subsequent forcing function are illustrated in Figs. 2 through 4.

The program assumes a planar (uniaxial) stress state** and can analyze a ring structure (not a long shell) which consists of up to three hard-bonded, different-material, concentric rings. Each ring material may be elastic, strain-hardening, and/or strain-rate sensitive.

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*The theoretical aspects of the solution method, other than some explanatory notes presented in Appendix A, are detailed in Ref. 1 and are not repeated in this report.

**The stresses vary with both circumferential location and through the thickness of the ring.

2.2 Description of the Program

2.2.1 Assumptions

The following conditions and/or assumptions are made for the JET 2 program:

1. The stress-strain curve corresponding to each layer of ring material is the same for both tension and compression.
2. The ring cross section is uniform around the circumference and is rectangular in shape.
3. Each ring is hard-bonded to the adjacent one, i.e., there is assumed to be infinite shear rigidity between layers. No provision is made for layer separation and/or subsequent collisions in the JET 2 program.
4. Each material behavior can be elastic, strain-hardening according to the mechanical sublayer (or subflange) model given in Ref. 2. Strain-rate effects are included (Fig. 5).
5. Plane sections remain plane in bending; Kirchhoff deformation behavior is assumed.

2.2.2 Program Capabilities

2.2.2.1 Types of External Loadings

The JET 2 program is capable of considering any general external loading desired including both an initial impulse type which is described by defining the initial velocity of desired portions of the ring and a subsequent time-dependent forcing function, described by defining both a space distribution and an amplitude time history of the desired forcing function. The options available to describe these loadings include special cases in which a minimum of input information is required. A code name is given in the left-hand margin to identify each possible loading condition as listed below.

1. The <u>initial impulse</u> is specified by reading in or calculating the mass point initial velocities in one of two ways (see Fig. 2):

IOTA=1 The discrete impulse on each mass point is fixed by prescribing initial velocity components.

IOTA=2 Sine-shaped velocity fields are specified to be distributed over given numbers of mass points oriented at constant given angles to the local ring tangent.

2. The subsequent time-dependent forcing function in JET 2 must be defined in two parts, (a) amplitude versus time and (b) amplitude versus location on the ring. These quantities are described in the program as follows:

   (a) Force amplitude versus time is presented as a series of coordinates in time which specify values of characteristic two-component forces on the force-versus-time curve. The program then linearly interpolates between points to obtain values of force at intermediate times (see Figs. 3 and 4).

   (b) The spatial distribution of the force acting on the ring is described by one of the following:

JOLT=1 If one of the following distributions has been specified, stating that JOLT=1 at a later time will repeat the distribution last specified.

JOLT=2 The completely arbitrary discrete force distribution in the y and z directions (or tangential and radial) is specified by reading in values of GTY(I), GRZ(I) which give the force amplitude at each mass point relative to the current nominal independent force for the y and the z direction (see Fig. 3); new spatial distributions may be inserted at any desired instant.

JOLT=3 One or more local half sinusoid-shaped force distributions are specified over given numbers of mass points (which can be used to represent discrete particle impact forcing functions). The positions on the ring at which these distributions can occur is arbitrary and each function can move at a desired rotational velocity to simulate a possible motion of each particle after its initial impact with the ring. Finally, the angle at which each force is applied is assumed to be constant in y,z space and is defined as an input quantity for each sinusoidal distribution (see Fig. 4).

2.2.2.2 Estimation of Bond Failure

Although it is assumed that the bond between layers is inelastic and of zero thickness, the program will compute, if desired, an estimate of the shear stresses and elongational strains in the circumferential direction between adjacent layers and these values are compared with input values of "bond failure stress and strain", respectively. If the failure values are exceeded by the calculated values at any time during the run, the program signals the time and location of each event in the output of the program. No other action is taken by the program, however, and the computation process proceeds until the end of the run as if the bond had not failed.

2.2.2.3 Program Capacity

The JET 2 program is capable of accommodating the following:

1. A maximum of three layers can be employed in the composite ring.
2. The multi-layer ring can be divided into a maximum of 100 mass (circumferential) stations.
3. The circumferential-normal stress resultant obtained from the normal stresses acting through the ring thickness at each mass station is calculated using a four-point Gaussian quadrature for each layer. Thus, a maximum of 12 thicknesswise control stations is used to represent the ring cross section.

4. The total number of mechanical sublayers* per control station to simulate a general stress-strain curve must not be more than five.

The number of memory locations required on the IBM 360-65 computer at MIT to run JET 2 as listed in Appendix B is approximately 128,000 bytes. This includes the locations required for the MIT computer library subroutines.

2.2.3 Program Contents and Arrangement

The JET 2 program is composed of a main program and 7 subroutines which appear in the program in the order listed. The names and functions of these programs are as follows:

MAIN — The MAIN program applies only to a free hard-bonded multilayer, circular ring. It reads the ring geometry and material property data and computes the quantities that are constant throughout the program. MAIN calculates the initial mass point coordinates, establishes the pertinent boundary conditions, and initializes most of the variables used in the subroutines. It will calculate a value of the finite-difference time interval required for computational stability, if desired. It controls the overall time cycle and calls the various subroutines when they are needed.

IDENT — The IDENT subroutine is used to print out at the beginning of the run the values of certain input parameters, and is used to identify the type of run that is being made.

IMPULS — The data for the initial impulsive loading is read in this subroutine and this information is then used to compute the initial velocities of the mass points.

FORCE — This subroutine reads the data pertaining to the subsequent

*Note that each control station of a given layer consists of up to 5 equally-strained mechanical sublayers of elastic, perfectly-plastic material; each mechanical sublayer has the same elastic modulus but a different yield stress in order to represent strain-hardening behavior of the material.

time-dependent forcing function and uses these data to compute the external forces acting on the ring at each time step.

STRAIN — This subroutine contains the strain-displacement relations described in Ref. 1.

STRESS — This subroutine contains the stress-strain relations. The STRESS subroutine can be used for materials that exhibit elastic, strain-hardening properties and for materials with elastic, strain-hardening, and/or strain-rate behavior. Testing for bond failure, if specified, is done in this subroutine.

EQUIL — This subroutine contains the dynamic equilibrium relations that are used throughout the run whether or not external forces are acting on the ring. It also computes the work done on the ring by the external forces.

PRINT — The PRINT subroutine evaluates the strains on the inner and the outer surfaces of the ring and computes the relevant energies. PRINT also controls the program output and format.

Further details are given in Appendix B.

SECTION 3

IMPROVEMENTS IN THE METHOD OF DETERMINING FRAGMENT-RING INTERACTION FORCES FROM EXPERIMENTALLY-OBTAINED POSITION DATA

3.1 Introduction

As noted in Ref. 1, computer programs such as JET 1 and JET 2 have been proven to be capable of predicting accurately the transient response of elastic-plastic strain-hardening material rings when acted upon by prescribed impulse-type or transient forcing functions. To assist in overcoming the difficulty of the lack of knowledge of the character of the forcing functions caused by burst rotor fragments interacting with a containment ring, a method was advanced in Ref. 1 which substituted measured positions obtained from high-speed motion pictures of spin-chamber fragment-ring interaction tests into the governing equations of motion to obtain estimates of the external force time history which caused the response. This method, which was implemented in a program called "TEJ 1" (JET 1 backwards), has since been considerably expanded and improved to produce a new program called TEJ 2 which has been used with some success to obtain the time-dependent forces resulting from two single-blade-interaction tests with containment rings.

The description of the basic method used in TEJ 1 and the improvements which have been made to yield TEJ 2 form the contents of Subsection 3.2. Force results for a single blade interaction obtained by substituting measured ring positions into TEJ 2, are described in Subsection 3.3. These results are then used in JET 2 to predict the transient response of the ring tested; the response results are then compared with the original measured position data to check the reasonableness of the final TEJ 2 forces.

3.2 Description of the Method Used to Calculate the Forces

3.2.1 Review of the Method Used in TEJ 1

3.2.1.1 The TEJ 1 Program

In the TEJ 1 method, the equations of motion as used in JET 1 (and JET 2) are reversed such that position-versus-time data of the ring are used to estimate the second time derivative of the positions (accelerations) of each of the finite-difference mass points. These derivatives are then used to determine the inertial forces acting on each finite-difference mass point and these, combined with the internal forces calculated from the smoothed positions, allow the resultant external forces acting on each mass point of the ring to be calculated.

In order to develop and evaluate the method, ring mass-point position data output from the example JET 1 run given in Appendix B of Ref. 1 was used as input to TEJ 1. The results showed that when exact positions were used, exact forces were calculated by TEJ 1. However, experimental position data obtained from high-speed films of the rotor-burst tests are not only too sparse in time (the current minimum interval between camera frames is 28 μsec and the finite-difference cycle time for a typical ring is about 1/10 this value) but also it is inevitable that reading errors and uncertainties are produced when the film records are reduced to provide digital ring position data. These errors can be demonstrated to have an approximate Gaussian distribution about a mean value, with a characteristic probable error (PE) inherent with the data reading and reduction process.

To investigate what effect varying degrees of error contained in the position data would have on the results from TEJ 1, the position-time data obtained from the JET 1 example of Ref. 1* (hereafter referred to as the "exact" data) were perturbed with a Gaussian set of random errors with a mean of zero, and a PE as low as 0.0001 inch. Linear interpolation was used initially to supply positions to TEJ 1 between the "supplied position data" which was spaced in time so that it simulated available film record data. The forces obtained from TEJ 1 using this simulated PE = 0.0001 inch perturbed, sparse position data (hereafter referred to as the "inexact" data) showed no recognizable correlation with the "exact" forces which were used as input data for JET 1. Since tests made on position data obtained from film records (discussed fully in

*The JET 1 example mentioned here and the JET 2 example 1 referred to in subsequent sections should be considered equivalent, when the JET 2 example 1 is the JET 1 example carried out by using the JET 2 program.

Subsection 3.2.2) showed that the actual minimum values of probable error are on the order of 0.01 inch, it was concluded that the position data would have to be improved substantially by smoothing techniques before they could be used to obtain a satisfactory estimate of the interaction forces.

3.2.1.2 Smoothing Methods

Of the various smoothing methods tried, the following method proved to be the most efficient and yielded the best results. The first step consisted of smoothing the position data for the ring at each instant of time, including assumed initial values before time zero. If at each time instant, each y,z mass point coordinate set is plotted against mass point number, it is possible to generate smooth curves which describe approximately the shape of the ring based upon the set of measured data, in a least squares sense. Because each curve is cyclic in nature (closed ring), Fourier coefficients, including both sine and cosine Fourier series were calculated at each time instant corresponding to the camera framing times to represent the instantaneous ring configuration.

The next step used Legendre polynomials to approximate (smooth) the time-variation of each Fourier coefficient calculated in the first step. Once the Legendre coefficients were calculated, the smoothed (in time) values of the Fourier series coefficients could be calculated at any time desired, and thus the smoothed x,y mass-point positions were obtained as required for the TEJ 1 program (see Subsections 3.2.4.1 and 3.2.4.2 for greater detail)

3.2.1.3 Results Using TEJ 1

The force versus time results obtained using smoothed "inexact" position data in TEJ 1 showed that forces which resembled the correct forces were obtained if the probable error inherent in the position data did not exceed a value of 0.003 inch. However, a probable error of less than about 0.0005 inch was required to obtain "good" forces. These values of probable error are considerably less than what can be obtained from the high-speed pictures at present. Thus the conclusion was made that the TEJ 1 program was not capable of calculating acceptable estimates of the interaction forces and that considerable improvement of the method and perhaps the accuracy of the measured position data was required.

3.2.2 Characteristics of the Position Data Obtained from High-Speed Motion Pictures of Spin-Chamber Tests

3.2.2.1 Description of Experimental Method

Spin-chamber tests have been performed successfully on a large variety of full-scale containment rings at the Naval Air Propulsion Test Center, Philadelphia, Penn. since 1965. The purpose of these tests has been the generation of excellent quality high-speed motion pictures of spin-chamber tests which could be used to illustrate clearly what happens during a high-energy fragment-ring collision. In order to fulfill the need for high quality position vs. time data to support MIT's analytic effort, tests by NAPTC have been made and films taken of various ring-fragment interaction tests. Of the several test results available, two single blade interaction tests, referred to hereafter as Tests 88 and 91 (Ref. 3) are discussed in detail in this report. Both tests involved the impact of a single 3.5-in. long T-58 turbine rotor blade, rotating before release at about 15,600 RPM, into a 17.6-inch diameter, 0.152-inch thick, 1.507-inch long 2024-T4 aluminum containment ring. In each case, high-speed motion pictures were taken of the event at a magnification of film-image size to full-scale size of about 0.011. A total of about 100 frames was taken of each test at a framing rate of about 33,000 pictures per second. Thus the total writing time in each test was about 0.002800 second, and the average time between frames was about 30 μsec.

Each ring was painted with black, nonreflecting paint before the test and radial lines were machined into one end of the ring corresponding to 72 equally-spaced mass-station locations. Thus, photographs of the mass-station locations, when viewed with the film reader, appear as dots which make up a "segmented ring".

3.2.2.2 Quality of the Position Data

Film positives were made of both test film records, and each was read on an automated large screen x,y viewer. This device has a manufacturer-specified sensitivity of 1 micron (0.00003937 inch) on the film plane. Thus, since the camera magnification was approximately 0.01, the overall sensitivity of the reader is about 0.004 inch on the full-scale ring. The film reader uses a 1-to-50 image magnifier to enable the operator to position the reticle at each mass station to be read. In all cases, this magnification is high enough for the film grains to be viewed on the screen. Thus the operator must position the reticle at each mass station using a pattern of varying density grains as a guide.

In an effort to determine the maximum accuracy obtainable using the equipment available at NAPTC, a still camera, with a lens system superior to the high-speed camera, was used to take a picture of a static ring at a larger magnification than used during the dynamic tests. The resulting film was then viewed in the film reader and a known characteristic length was read several times. These results were analyzed to find the probable error (PE) from a mean value. The PE value of 2.12 microns obtained on the film plane or 0.0045 inch on the full-scale ring, is presently considered to be the minimum PE obtainable for measuring the position data at NAPTC, given "perfect" photographs. It is recognized that the PE obtainable from less than perfect high-speed photographs will be greater.

An estimate of the average PE of the position data obtained from Tests 88 and 91 was obtained as follows. Each position on each film record was read a total of 4 times, and the x,y coordinates of each reading were automatically punched on IBM cards. Next, each set of 4 readings was averaged and a deviation for each separate reading from its mean value was calculated. These 4 deviations were then used to calculate a probable error for each point. Finally, the arithmetic average of all the probable errors thus calculated was found. The average PE for both tests was essentially the same and was equal to approximately 3.5 microns on the film plane or about 0.012 inch* on the full-scale ring. This value of average PE is in general lower than that found on previous tests mentioned in Ref. 1. The improvement in the PE of the position data is attributed to better quality pictures and experience in reading the film.

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*This value of the probable error is approximated by PE = 0.01 in the rest of the report.

Although the arithmetic average of the PE of the mass point position data has been determined as just described, it is useful to estimate the PE of the location of the mean-position data (average of the four readings cited) since only the mean-position data are finally employed in the TEJ-type analysis which is discussed later. Such an estimate for the effective PE of the mean-position data is given by:

$$(PE)_{effective} = \frac{(PE)_{reading}}{\sqrt{n}} \tag{1}$$

where

$(PE)_{reading}$ is the probable error of each individual reading

n is the number of readings averaged

$(PE_{effective}$ is the resultant effective PE of the average of n readings

In Eq. 1 it is now assumed that the PE of each reading is equal to the arithmetic average PE. Thus, for the mean position data obtained from Tests 88 and 91, the effective PE is approximately $0.012/\sqrt{4} = 0.006$ inch.

3.2.3 Use of JET 1 Results to Develop and Test TEJ 2

The JET 1 example chosen to generate position data for developing and testing TEJ 2 was a 7.3375-in. midsurface-radius circular ring, 0.125-in. thick, 1.0-in. long, made of 6061-T6 aluminum. The forcing function chosen was a triangularly-shaped pulse, lasting 400 microseconds with a peak value of 10,000 pounds at t = 200 microseconds. The total force was distributed over a 25-degree segment of the ring in the shape of a half-sine wave at an angle of 21 deg. to the local tangent. The complete ring was finite-differenced into 72 equal-mass segments.

In order to approximate the NAPTC position data characteristics, random numbers with a mean of zero and a Gaussian distribution such that the probable error from the mean was 0.01 inch to conform to the results described in Subsection 3.2.2.2 for the nonaveraged data were generated and added to the JET 1 example exact position data. This set of "inexact" data does not perfectly represent the actual NAPTC data since it is known that the PE of the experimental data varies with both time and position on the ring. However, the exact nature of the position errors and how they vary is not well enough known to justify employing a more sophisticated error representation of the NAPTC data.

These data were then used in TEJ 2 with associated programs (to be described) and the "final forces" calculated therefrom were compared with the "exact" forces used originally in JET 1, in order to evaluate and to guide the development of the method for deducing the ring-fragment interaction forces.

3.2.4 Analytical Smoothing of the Position Data

3.2.4.1 Method Used to Smooth the Position Data

The method used to smooth (and approximate) the position data for use in TEJ 2 was essentially the same as that used in TEJ 1 as summarized in Subsection 3.2.1.2. The averaged y,z mass station coordinates at each time step corresponding to the high-speed film records of the NAPTC tests were each plotted against mass station number. The curves thus created were smoothed in space using Fourier series* (including both sine and cosine terms) since both the y and the z coordinates are cyclic in nature. The new space smoothed ring shape is thus based on the set of measured data in a least squares sense.

Gram orthogonal polynomials* were then used to generate a smooth time-variation curve of each Fourier coefficient in the above step. Gram polynomials replaced the Legendre polynomials used in the TEJ 1 program because Gram polynomials are orthogonal under summation whereas Legendre polynomials are orthogonal under integration. Since the positions are discrete data (not functions), summation rather than integration is proper.

Once the Gram coefficients are calculated, the time-smoothed values of the Fourier series coefficients can be calculated at any time desired and the Fourier coefficients can then be used to generate the doubly-smoothed** values of position as required for the TEJ 2 program.

3.2.4.2 Method Used to Find the Optimum Number of Polynomials to be Used in Smoothing the Data

The smoothing process described above accomplishes two things:

1. It improves the "inexact" position data by decreasing the effective probable error.
2. It allows the calculation of intermediate (interpolated) values of positions required by the TEJ 2 program.

However, it is not obvious how many Fourier and Gram polynomials should be used

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*All smoothing (or approximate-fit) methods mentioned in this report are described in detail in Ref. 4.

**That is, first in space and then in time.

to obtain a set of optimally-smoothed positions.

In order to determine systematically the optimum numbers of polynomials to use, "inexact" position data were smoothed with successively increasing numbers of polynomials (where the number of Fourier and the Gram terms used were varied one at a time) and the results for each case were compared with the "exact" results. It is obvious that for a deformed ring, the smoothed positions will not closely approximate the true positions for low numbers of polynomials. In other words, the "smoothed" positions should improve as more polynomials are used. What is perhaps not obvious is that the use of too many polynomials can give poorer results. Thus as higher numbers of polynomials were incorporated, the smoothed positions started to degrade due to the smooth curve's attempting to follow the errors rather than smooth them out. Using a trial and error method for a PE = 0.01 inch "inexact" position data, where the criterion for optimization of the number of Fourier harmonics was the minimization of the overall average PE between the inexact position data and the resulting smooth curve approximation at a number of selected instants in time, the "optimum" number of Fourier harmonics was found to be approximately 15. By the procedure described in subsection 3.3.3 it was determined that the optimum number of Gram polynomials for time smoothing is about 7.

The process used to arrive at the optimum number of Fourier coefficients is illustrated in Fig. 8 where the overall average probable error between the JET 2 example 1 synthetic position data and the space smoothed data is plotted against the number of Fourier coefficients used to smooth the "data" at various times during the ring response. This figure shows that the choice of 15 coefficients is a compromise between varying requirements for the different profile shapes and is a true optimum value only for the JET 2 ring profile occurring around the response time of 300 μsec. In a strict sense, these values should be considered applicable only to the "inexact" data used with their associated PE, the number of mass stations used, and the type of forcing functions chosen. (The optimum number of Fourier harmonics was found to be dependent in varying degrees upon the shape of the ring which was being smoothed. For example, if the ring is undeformed, i.e., a circle, then the optimum number of spatial harmonics would be 1.) However, since the transient deformation shapes of the rings tested at NAPTC were similar to the shapes calculated in the JET 1 example, and the average PE of the "inexact" data was the same as that calculated for the NAPTC data, it was assumed that the "optimum" number of smoothing terms found above was applicable to the NAPTC data; hence, all succeeding calculations involving smoothing of position data in space and time, used 15 Fourier harmonics in space and 7 Gram polynomials in time. Extrapolating these results to position data in which the PE is either more or less than 0.01 inch, one would find that for a PE less than 0.01 inch, the optimum number of smoothing terms would be greater than required for a PE = 0.01 inch, and conversely, for a PE greater than 0.01 inch, a lesser number of terms would be required to obtain the optimum smoothed curve.

3.2.5 Use of a Scalar Kalman Filter to Find the Optimum Forces

3.2.5.1 Introduction

If the dynamics of an ideal system with exact known conditions are completely understood and if some measurements of the system with their associated errors and uncertainties are available, then, on the basis of all the measurements obtained up to a given (the present) time, it is possible to determine the most likely values of the state of the system. The process of determining these most likely values is called smoothing, filtering, or prediction, depending on whether, respectively, past, present, or future estimates of the state of the system are to be found [5].

In this study, a filtering procedure was used to calculate at the present instant in time an optimum value of the external force acting at each of 72 points marked on two aluminum rings impacted by single rotor blade fragments in NAPTC tests, based on two values of force at each mass point (one calculated and one estimated) and their associated levels of confidence.

The Kalman filter [6] enables one to calculate in a straightforward manner optimum values of a quantity, given several measurements and/or estimates and their associated confidence levels. The optimum value thus calculated will have a confidence level which will always be greater than any of the measurement/estimate values which were used as input to calculate the optimum value.

3.2.5.2 Description of a Scalar Kalman Filter

The scalar Kalman filter formula for the variance* after a discrete measurement or estimate is incorporated is [5]:

$$\sigma_k^2 = \frac{\sigma_{k-1}^2 \, \sigma_{m_k}^2}{\sigma_{k-1}^2 + \sigma_{m_k}^2} \tag{2}$$

where

σ_{k-1}^2 and σ_k^2 are the variances associated with somehow-known values before and after the incorporation of the kth measurement, respectively,

and $\sigma_{m_k}^2$ is the variance of the kth measurement or kth piece of information from any source

Equation 2 is also called the "maximum likelihood formula" for combining the variances of a quantity which contains two independent error sources.

The Kalman filter can be expressed also in terms of both the measurements and the variances:

$$R_k = P\left(\frac{R_{k-1}}{\sigma_{k-1}^2} + \frac{R_{m_k}}{\sigma_{m_k}^2}\right) \tag{3}$$

where

$$P = \frac{\sigma_{k-1}^2 \, \sigma_{m_k}^2}{\sigma_{k-1}^2 + \sigma_{m_k}^2}$$

R_{k-1} and R_k are the "optimum" values of a quantity before and after the inclusion of the kth measurement, respectively

and R_{m_k} is the kth measurement value.

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* The variance σ^2 of a subset, x_i, is the name given to the square of the standard deviation σ of the subset and is approximated by $\sigma^2 = \frac{\sum_{n=1}^{k} (x_n^2 - k\bar{x}^2)}{(k-1)}$ where k is the number of variables in the subset and $\bar{x}$ is the average of all the x_n's.

Note that the resulting value of R_k depends on the ratio between σ^2_{k-1} and $\sigma^2_{m_k}$. Thus, for example, if the confidence level of the new measurement R_{m_k} is low (i.e., R_{m_k} is known to have a high error associated with it) then $\sigma^2_{m_k}$ will be much larger than σ^2_{k-1} and $R_k \approx R_{k-1}$. In other words, the inclusion of R_{m_k} into the estimation of R_k adds little to the accuracy of the "estimated optimum" value. On the other hand, if $\sigma^2_{m_k}$ is low compared with σ^2_{k-1}, then $R_k \approx R_{m_k}$ and the new value would be greatly affected by the new reading.

As a numerical example of the above, suppose one is given a resistor with a color code which indicates that its resistance is 100Ω with a 5% uncertainty. From this information $R_o = 100\Omega$ and $\sigma^2_{k-1} = (.05)^2 = 25 \times 10^{-4}$. Now suppose that the resistor is measured on an ohm meter which has an uncertainty of 1%. The meter measures the resistance to be $105\Omega = R_{m_k}$, where $\sigma^2_{m_k} = 1 \times 10^{-4}$. Substituting these values into Eq. 3, the best estimate of the resistance is calculated to be equal to about 104.8. The variance associated with this optimum value is calculated from Eq. 2 and is equal to about 0.962×10^{-4}. Note that this value is an improvement over that of the meter reading alone.

Thus, the Kalman filter can be used to calculate the "optimum value" of a quantity in a simple and straightforward manner when one is given several independent measurements of the quantity and that the optimum value thus obtained will have an uncertainty value lower than any of the measurements (or estimates) used to obtain the value.

3.2.5.3 Methods Used to Estimate the Forces

Estimates of the several forces acting upon the ring caused by the impact of the rotor blade were made from two major sources of information. The first and most important source was the high-speed photographs taken of the ring-fragment interaction during the test, and the second came from the (known) initial conditions of the fragment as it impacts the ring.

Several items of information were derived from the photographs:

(a) Since the impact of the single blade into the ring was non-symmetric (i.e., the overall summation of the external forces acting on the ring did not equal zero) it was possible to average the inertial positions of all the mass station positions for each picture and thus obtain y and z position-time loci of the c.g. of the ring. These two curves were then smoothed in time using Gram polynomials. The resulting smoothed y and z position-time curves were differentiated twice to obtain estimates of the c.g. acceleration versus time of each ring. Knowing the mass of each ring and the time between photographs, the overall forces acting on each ring could then be calculated. Since 72 points were averaged to obtain the c.g. of the ring as a function of time, the error involved with the c.g. location is considerably less than the error associated with each mass station position reading. This supposition is confirmed by Eq. 1 in Subsection 3.2.2.2 when calculating the variance associated with the average of the readings. Thus, these overall force estimates have a relatively low error level associated with them compared with other values of interest.

(b) Information such as a general estimate of the direction of the force vector can be made from the pictures. The area of application of the forces is also obtained by noting the location of the fragment (or fragments) in each photograph. Conversely, and of perhaps more importance, areas where the external forces are known to be zero can easily be noted (i.e., areas obviously not in contact with the fragment).

(c) Finally, it is sometimes possible to calculate the overall forces acting on the fragment (or fragments) by measuring the fragment c.g. vs. time locus as described above for the ring. This method was not useful in the case of the single blade impact since for practical application the fragment must, in general, be nondeforming and large enough so that fragment position measurements can be made accurately.

The second source of information (the initial conditions of the fragment as it impacts the ring) includes such items as the dimensions and weight, the initial translational and angular velocity, and the calculated values of kinetic energy and momentum of the fragment. While these quantities do not yield quantitative values for forces, they are useful for giving insight into the phenomenon and can be used to check force estimates obtained in other ways.

3.2.5.4 Methods Used to Estimate the Variances for Use in the Kalman Filter

The Kalman filter requires a value of the variance for each piece of "information" used in the calculation of an optimum quantity. In the case of TEJ 2, (to be described in Subsection 3.2.6) the Kalman filter is used to find the optimum impact forces acting on a containment ring, given (1) an estimate of the forces (as discussed in Subsection 3.2.5.3) and (2) a calculated value obtained from using the reversed equations of motion as discussed in Subsection 3.2.1 for TEJ 1. Unfortunately, the values of these variances are not known for the case where experimentally measured containment ring position data are used in TEJ 2. Therefore it was necessary to estimate these variance values on the basis of studies conducted using the "data" obtained from the JET 1 example described earlier.

VARIANCE ASSOCIATED WITH THE APPLIED EXTERNAL FORCES

To find the variance associated with the TEJ 1 type calculated force, the 15 Fourier harmonics and 7 Gram polynomials - smoothed PE = .01 in. "inexact" position data from the reference JET 1 example were substituted into TEJ 1, and calculated forces were obtained for each of the 72 mass stations. Next, the forces calculated for the area on the ring where the exact forces had been applied in JET 1 to obtain the original "exact" positions were compared with the "inexact" forces, and the differences between the "exact" and calculated force values were used to obtain an average value of the variance for the calculated forces.

The estimated forces were obtained from the inexact position data by differentiating twice with respect to time the 7 Gram polynomial smoothed center-of-gravity locus obtained from the JET 1 "inexact" data to obtain an estimate of the overall acceleration, and thus the external forces acting on the ring. The overall external forces obtained were "assumed" to be distributed in a half sine wave fashion over five mass stations and the resulting individual forces were compared with the "exact" forces which also were prescribed to have a half sine wave distribution over these same five mass stations. The deviations between the "exact" and the "estimated" values were then used to calculate an average value of variance for the estimated forces.

The average values of the rms deviation obtained for the calculated and estimated forces in the area where external forces are applied were 5000 and 1000 pounds, respectively; these values are based on a peak total force equal to 10,000 pounds (see Subsection 3.2.3). Note that the calculated values of force appear to be much less reliable than the estimated values. There are at least two reasons for this result. First, the c.g. locus upon which the estimated forces are based is actually an average of 72 mass positions at each instant of time, and thus should be considerably more reliable than each individual position vs. time. Second, the individual forces acting upon each individual mass station include not only the externally applied forces but also internal elastic forces as well. The degree to which the external forces are correctly estimated depends to a great extent on how well the internal forces are calculated. These internal forces are directly proportional to the strains present in the ring and thus an accurate estimate of the strains is required.

Since the elastic limit in aluminum occurs at a strain level of about 0.005 inch/inch, or at an elongation of about 0.004 inch between mass stations for the example ring, a sensitivity of at least 1/5 of the maximum elastic limit strain or 0.0008 inch is required in order to make even a rough estimate of the internal forces. Although the smoothing process used presently improves the PE = 0.01-inch position data to some extent, the improvement is not yet sufficient to obtain the PE $\cong$ 0.0002 inch position data required to obtain

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*The standard deviation σ, with which the variance σ^2 is associated, is assumed hereinafter to be equivalent to the average rms deviation, $\sqrt{\frac{\sum_{n=1}^{K} (\delta x_n)^2}{K}}$, where δx_n is the deviation of a variable from the exact value, and K is the number of variables under consideration.

accurate calculated forces.* Thus, the optimum forces calculated from the estimated and the calculated forces are mostly dependent upon the estimated force values.

VARIANCE ASSOCIATED WITH THE FORCES OCCURRING ON THE NON-LOADED PORTIONS OF THE RING

The portions of the ring not subject to external loading can easily be identified from the high-speed photographs by noting the position of the impacting fragment. Obviously, at all locations which are not being impacted, the external forces must be zero. Thus, when the optimum forces are calculated for these areas, the variance for the estimated forces (which are equal to zero) is set to 0 (certainty), and the variance for the calculated forces is set equal to infinity (zero confidence level).

3.2.6 Application of the Smoothing Method and the Kalman Filter in the TEJ 2 Program

The organization of the TEJ 2 program** is illustrated by the flow chart given in Fig. 6. The following sequence is used for each finite difference time cycle in TEJ 2. The sequence starts for the J+1st cycle by defining three positions for each mass station of the ring: one each at cycle J-1 and J (which are smoothed optimum positions and have been calculated previously in the manner to be discussed for the J+1 positions) and the J+1 position (which results from smoothed photo positions obtained directly from the input values of the position test data at time J+1). These 3 sets of positions are substituted into the central-differenced TEJ 1 equations of motion, and the external forces acting on the ring are calculated (see Subsection 3.2.1). These forces are hereafter termed the calculated external forces at time J. Next, the TEJ 2

*From Ref. 7, 99% of all the deviations from the average value of all the readings will be within 2.6 standard deviations (σ) or in other words, the largest deviation in a set will be equal to about 2.6σ. Since PE = $.6745\sigma$, the largest deviation will be approximately 3.9 PE, or if the largest deviation desired is .0008 inch, the PE desired is about $.0008/3.9 \cong .0002$ inch.

**The TEJ 2 program differs from the TEJ 1 program mainly in that the Kalman filter and some additional computational loops including TEJ 1 have been added as Fig. 6 shows.

program reads in values of the estimated external forces (see Subsection 3.2.5.3) and these estimated external forces and the calculated values above are then substituted into the Kalman filter with their associated variances. The resulting optimum forces are termed the trial values of optimum external forces at time J. These trial optimum forces are then substituted into the JET 1 equations of motion along with the smoothed optimum positions at times J-1 and J, and new positions, termed the optimum positions at time J+1, are calculated (in essence, these optimum positions are the positions that the ring must assume at the J+1 time cycle in order to yield the trial values of the optimum external forces at time J). The last two steps are necessary to insure that the final shape of the ring is smooth. Thus, the optimum positions at time J+1 are smoothed in space in exactly the same manner as the original position data was space smoothed (see Subsection 3.2.4) using 15 Fourier harmonics. Finally, these smoothed optimum positions at time J+1 are substituted into the TEJ 1 equations of motion to obtain the final calculated optimum external forces at time J.

In addition to the input quantities such as the smoothed positions and the estimated forces, assumptions relating to the size of the area in the ring over which the external forces appear (from the photographs) to act, and the assumed initial shape of the ring before the external forces are applied must also be considered.

Regarding the first consideration, the area over which the values of the external force are not known with certainty, hereafter termed the assumed zone of loading uncertainty, must be defined in TEJ 2 so that the current variance values can be assigned to the different parts of the ring. For initial TEJ 2 runs, the assumed zone of loading uncertainty was made equal to the area over which the nonzero estimated external forces were assumed to act as shown in Fig. 7a. During subsequent runs, the assumed zone of loading uncertainty was increased significantly (while keeping the assumed loading distribution the same) to investigate the effect of changing this important parameter (see Subsection 3.5 and Fig. 7b).

Regarding the assumed initial shape of the ring, two possibilities exist. First, one can assume a perfect circle with a radius equal to the known initial radius of the test ring. This condition is exactly true for the JET 2 example ring and only approximately true for the NAPTC test rings. (The approximation is a good one, however, since several diametrical measurements made of the test rings before testing showed that each ring was out of round by at most a few thousandths of an inch.) The second possibility is to initialize the ring shape at time equals zero to the smoothed shape of the ring. This has two opposite effects. On the negative side, some information is being discarded, i.e., it is known what the initial ring shape is, and this fact is not being used. On the positive side, the initial shape of the ring now does not lead to the false supposition of initial stresses in TEJ 2 since the ring-shape transition from the initial shape and the smoothed profile is smooth.

For the initial TEJ 2 runs, the initial shape of the ring was set equal to a perfect circle; for subsequent runs, the initial ring shape was set equal to the initial smoothed shape. This is discussed further in Subsection 3.5.

3.3 Assessment through Comparison of External Forces Predicted by TEJ 2 with the Known Forces Used in JET 2

3.3.1 Introduction

In order to evaluate the analysis procedure embodied in the TEJ 2 program and to assess the effects of various uncertainties, a "typical" example involving a ring which is subjected to known transient external forces was devised (see Example 1 of Appendix B). The resulting transient response was predicted by the JET 2 program. Through some exploratory calculations, the externally-applied transient forces were chosen so as to produce transient deformations whose character and magnitude closely resembled those observed in some preliminary NAPTC single blade-ring impact tests performed prior to Tests 88 and 91*.

To simulate the fact that experimental ring deformation data will be available only at spaced instants in time from high-speed motion picture records, the predicted ring deformation profile information was recorded at

*Typical experimentally-observed deformation profiles from Tests 88 and 91 are shown in Figs. 15a and 15b, respectively.

chosen time instants (30 μsec apart) to match typical time instants or time spacings in the experimental data. This "exact" deformation profile information was then perturbed by adding to it random errors having a Gaussian distribution, a mean of zero, and a PE of 0.01 inch; this PE value is perhaps of the order of that of the experimental data, since preliminary estimates had suggested a value of this order. With this manufactured deformation information termed "inexact" position data, the various procedures in TEJ 2 were applied in an attempt to deduce therefrom the known externally-applied forces used in this example problem. This study, including a description of the procedures employed and the uncertainty factors examined, is discussed in the remainder of this subsection where the steps in the analysis of the manufactured data are, in order of implementation, smoothing of the position data, estimation of the overall forces acting on the ring, and finally substitution of these results and the ring parameters into the TEJ 2 program.

3.3.2 Smoothing of the Simulated Position Data

A profile at time = 570 μsec of the Example 1 ring analyzed and discussed in Appendix B is presented in Fig. 9 showing the exact positions obtained from JET 2. (Note that the profile shape is not unlike the profile measured for NAPTC Tests 88 and 91 and presented in Figs. 15a and 15b)

Figures 10 and 11 show the position-time locus in the y and z directions of mass stations 1 and 38 respectively, for the exact positions, the inexact PE = 0.01-inch position data, and the smoothed inexact positions using 15 Fourier harmonics in space and 7 Gram polynomials in time for JET 2 Example 1 of Appendix B. The data for mass station 1 is typical of that for all stations except for station 38 which is an extreme example. It was seen that except for station 38, the smoothing process considerably improves upon the inexact position data.

The approximation to the mass station 38 locus could be improved easily by using higher numbers of polynomials in the least-square curve fit, but this would be partially defeating since, as mentioned previously, position errors could also be included with higher polynomial fits, and the overall error for the entire ring would be worse. Finally, as will be shown, the results obtained from TEJ 2 using the smoothed synthetic data shown in Figs. 10 and 11 are quite satisfactory* in spite of the poor fit obtained for the mass station 38 locus.

3.3.3 Estimation of the Overall Forces Acting on the Ring

In order to obtain an estimate of the external forces acting on the ring for use in the Kalman filter in TEJ 2, the locus of the ring's center of gravity (cg) is required. Taking the average of the smoothed inexact ring positions to simulate the NAPTC test data would not be entirely correct, however, since the NAPTC data are not exactly positioned in inertial space for each profile (only four background points are used in the NAPTC data reduction to position each profile in inertial space). Since each of four NAPTC reference points was read four times, 16 readings are used to define the NAPTC ring position in each direction in space; thus, since the PE of each reading is about 0.01 inch, the probable error of the inertial space reference, using Eq. 1, is about 0.01/4 = 0.0025 inch. Therefore, the inexact cg positions for this synthetic example were obtained by averaging the 72 PE = 0.01 inch inexact position coordinates in both the y and z directions (only the results in the z direction are presented here) to obtain the cg of the ring at each time, and then random errors with a mean of zero and a PE of 0.0025 inch were added to each cg value to simulate the errors in the position of each experimentally-obtained profile. This procedure was also used in the results depicted in Figs. 10 and 11 by adding the PE = 0.0025 inch for each picture to the value of 0.01 inch used for each data point in the position data. The smoothed curve of the inexact ring cg z-locus shown in Fig. 12 is a least-square fit of the cg locations using 7 Gram polynomials over the 25-point (or time instant) interval.

Figure 13 shows the resultant overall force <u>estimates</u> obtained by differentiating the 6, 7, 8, and 9 Gram polynomial curve fits of the cg locus (as

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*As can be seen in Figs. 16 and 17, the deformation for NAPTC ring 91 (and also NAPTC ring 88 which is similar) is considerably less severe than that of the JET 2 example so that a least-square fit using 15 Fourier harmonics and 7 Gram polynomials is considered adequate to approximate the position loci of the test rings.

shown in Fig. 12 for the 7 polynomial fit) twice with respect to time and multiplying the results by the mass of the ring. When these force estimates are compared with the exact overall force used in JET 2 Example 1, it is seen that the 8 polynomial fit gives the most accurate representation of the exact forces. It was found that using higher polynomial fits of the cg position locus results in poorer representations of the overall force estimate.

The 7 polynomial fit, while not giving as accurate a representation of the overall force, was used instead of the 8 polynomial fit to estimate the forces in the final TEJ 2 runs. This was done for two reasons: the first is that the cg loci results of NAPTC ring Tests 88 and 91 show considerably more scatter than is evident in the synthetic data (only the results for Test 91 are presented; see Fig. 18). This fact is surprising since the PE of the synthetic data is approximately the same as for the average PE of the NAPTC data. Thus, it was felt that a lower order curve fit would probably give better results for the NAPTC test data.

Secondly, the 7 polynomial fit was chosen in order to investigate the effect of using a less-than-perfect estimate of the overall forces in TEJ 2 (the 8 polynomial fit gives essentially exact overall forces for the synthetic data as shown in Subsection 3.3.4). Also, it was felt that this procedure would hopefully give added insight into the quality of the results obtained from the NAPTC test data.

Finally, note that all of the overall-force-approximation curves either increase or decrease without bound at each end of the force versus time curve. This characteristic results from the fact that the curvature at each end of the curve is poorly defined since the position data is defined only between these limits. Although one can generalize by saying that the forces in the center of the curve are fairly representative, and those at the ends should be disregarded, there is no clear cut method for determining where the overall forces are well estimated and where the point exists where the estimated forces become unreliable. Because the cg time locus of the NAPTC ring appears, in general, to fit a straight line in the final time portion of the response (see Fig. 18b for example), the estimated overall force (as shown later) were "assumed" to be zero for use in the TEJ 2 program.

3.3.4 Results from TEJ 2 Using Simulated Position Data

The final step in the calculation of the external forces acting upon the ring using simulated PE = 0.01-inch inexact position data is to substitute the ring's dimensional parameters, material properties, estimated external forces, and the smoothed position data into the TEJ 2 program. As mentioned in Subsection 3.2.5.4, the standard deviation (σ) assigned to (a) the TEJ 1 type calculated force (σ_{cal}) and (b) the overall estimated forces (σ_{est}) in order to obtain the optimum forces, are 5000 pounds and 1000 pounds, respectively, based on a peak total force of 10,000 pounds.

The results obtained from inputting the synthetic example-problem data into TEJ 2 are illustrated in Fig. 14a where the resulting estimated force, calculated force, optimum forces before and after space-position-smoothing, and exact force are plotted versus mass station number at time equals 210 μsec; this time corresponds approximately to the time of peak force. Since these results are representative of the results obtained for the complete TEJ 2 run (including the latter part where the optimum force equals the calculated force which equals zero) only the forces in the y-direction at the time of peak force are presented. Figure 14a shows that the resulting final optimum external forces from TEJ 2 are fairly close to the exact forces used in JET 2 to obtain the original exact position data. The fact that plausible forces were calculated from TEJ 2 is not surprising since the overall forces calculated from the cg_y loci results were essentially exact, and the assumed spatial distribution of the overall forces in both TEJ 2 and JET 2 were the same.* Similar results were noted for other instants of time.

In order to see the effect of changing the variances (i.e., the confidence levels of the calculated and estimated forces, respectively) so that the calculated values of force were emphasized, TEJ 2 was run with the aforementioned data except that the values were reversed so that the standard deviation for the calculated force (σ_{cal}) equalled 1000 lbs, and for the estimated force (σ_{est}) equalled 5000 lbs. The results from this run are illustrated in Fig. 14b which presents the calculated force, optimum forces before and after space-position smoothing in the y-direction, and the exact force versus mass station number at

*The influence of assuming a different size of the zone of loading uncertainty is discussed in Subsection 3.5.

time equals 210 μsec. Note that the final optimum forces are fairly well representative of the exact forces and are an improvement to the TEJ 1 type calculated forces.

The Fig. 14b final optimum force results compared with those of Fig. 14a show little difference except that the latter provides better agreement with the exact result at the peak-load point and less spurious overshoot in the vicinity of mass station 40; however, the Fig. 14b results exhibit somewhat smaller values than for those of Fig. 14a over those mass stations on which the externally-applied forces are known to be exactly zero.

It can be concluded from the foregoing results that if the position data obtained from spin-chamber tests can be characterized as having Gaussian errors, with a value of PE equal to 0.01 inch or less associated with them, TEJ 2 can be expected to provide good estimates of the forces acting upon the ring during the test, assuming that a valid assumption can be made for the size and location of the "loading zone" and that other important but unrecognized factors are not present to affect the experimental data.

3.4 Preliminary Results Using Data from Two Single-Blade Interaction Tests with 2024-T4 Aluminum Containment Rings

3.4.1 Description of Tests and Data Reduction

Two examples involving experimental data from NAPTC spin-chamber tests (88 and 91) are discussed in this subsection. Both pertain to the interaction of a single 3.5-inch long T-58-turbine blade with a 2024-T4 aluminum containment ring: 17.6-inch diameter, 0.152-inch thick, and 1.507-inch long. The pertinent information [3] which characterizes NAPTC Tests 88 and 91 are shown in Table 1. High-speed photographic measurements and data reduction as described in Subsections 3.2.2.1 and 3.2.2.2, respectively, were carried out.

The position data as received from NAPTC for Tests 88 and 91 consisted of four readings each of 4 background reference points and 72 mass stations* marked on the ring for each of about 40 frames of high-speed motion picture film with about 30 μsec spacing. These data for each of the two tests were checked for "gross errors" using a specially written computer program which (1) averaged each set of 4 readings, (2) found the standard deviation of each set, and (3)

*For identification of the test ring, mass station locations at 72 equidistant circumferential locations were numbered 1-72 prior to the test; this number tagging is retained in the data reduction and in the discussion herein.

compared the deviation from the mean of each reading with the average standard deviation. For those readings where the deviation exceeded 4 times the standard deviation, a warning was printed, which allowed for a quick check of the data involved. In most cases, the data were not corrected and large deviations were attributed to poor definition on the film negative. In the few cases where it was obvious that a wrong point had been read, the data were corrected by using an average of the 3 remaining points of each set. After this checking procedure, the probable errors of individual readings of each mass point position from the mean position defined by these readings were averaged and were found to be approximately 3.5 microns on the film plane (about 0.01 inch on the full-scale rings).

The position data were then averaged and converted from the film reader coordinates to inertial coordinates using the 4 reference points in each picture to define the inertial coordinate system. These data, all referenced to a common coordinate system were next smoothed as discussed in Subsection 3.4.2.1.

3.4.2 Calculation of the Input Data for Use in TEJ 2

In the following, the Test 91 results are used to illustrate the results obtained from calculations made with the experimental data; since Tests 88 and 91 were very similar, it would be needlessly repetitive to describe in detail all of the results obtained from both sets of test data.

3.4.2.1 Least-Square Smoothing of the Experimental Position Data

The step-by-step calculations made on the NAPTC Test 91 data were exactly the same as made on the simulated data described in Subsection 3.3.2.

Profiles of both rings NAPTC 88 and NAPTC 91 are presented in Figs. 15a and 15b, respectively, at time = 570 μsec*, for example, showing the NAPTC position data and the to-be-described results from JET 2 using forces obtained from TEJ 2 analyses of the test data. Note that the deflection resulting from the single blade interaction in both cases is much less severe than that used in the example problem discussed in Subsection 3.2.

Inertial position loci of mass stations 19 and 55 for NAPTC Test 91 versus time are presented, for example, in Figs. 16 and 17, respectively, for both the original averaged data and the smoothed position data using 15 Fourier harmonics in space and 7 Gram polynomials in time. Note that the scatter in

*This time is chosen arbitrarily but provides profiles which are representative of large deflections.

the unsmoothed position data is considerably greater than that evident in the previously-discussed manufactured or synthetic data (Figs. 10 and 11). This is unexpected since the average PE of both sets of data are both believed to be approximately equal to 0.01 inch.

3.4.2.2 Estimation of the Overall Forces Acting on the Ring

The averaged positions obtained from the NAPTC test data were next used to find the cg locus vs time. Tests were run at NAPTC to determine the time between initial fragment-ring contact and the first high-speed picture. The results of these tests showed that the delay time was approximately equal to the time for two camera frames for the camera framing rate used during Tests 88 and 91. Thus, for the cg locus curves, the first-picture results were assumed to apply for time equals zero until 2 Δt_c, where Δt_c is the time between camera frames. Since it is known that the interaction forces are zero before time equals zero, mass point location at 4 "frames" before zero time were assumed so that an approximate zero acceleration condition at time before zero would result. These results are presented for the y and z directions of test ring 91 in Fig. 18a and 18b, respectively. A 7 Gram polynomial least-square fit was next calculated and the results are shown in Figs. 18a and 18b. Note again that the scatter evident in the cg locus is much greater than that calculated from the example-problem data shown in Fig. 12.

Figures 19a and 19b present the total estimated external forces acting through the test ring 91 cg vs time using 6 to 9 Gram polynomial approximations of the cg locus data presented in Figs. 18a and 18b. The most interesting result to note here is that the different polynomial approximations do not seem to give a single estimate of a characteristic overall force. In other words, different polynomial approximations of the same cg locus yield entirely different overall force estimates. This is especially true in the case of the forces in the y-direction, (Fig. 19a), where the overall force estimates from different polynomial fits are actually of opposite sign during the time studied. The reason for this behavior can possibly be attributed to one or more incompletely understood characteristics of the NAPTC data, such as, for example, an actual PE which varies both in space and time and which may be larger than the presently assumed value of 0.01 inch PE. Further analysis of the NAPTC data characteristics, as suggested in Subsection 3.6, should produce a fuller explanation of the results presented in Fig. 19a.

3.4.2.3 Additional Input Data and Initial Conditions

In addition to the smoothed ring positions and the estimated external forces as discussed in Subsections 3.4.2.1 and 3.4.2.2, the ring parameters, the material properties, and the variances must be specified for input to the TEJ 2 program. The ring parameters used in the TEJ 2 run are those presented in Table 1, and the standard deviations used are the same as used in the synthetic-data example using JET 2 position output (that is, σ_{cal} = 5,000 lbs and σ_{est} = 1,000 lbs)*. The uniaxial static, room temperature, stress-strain properties used with both the NAPTC 88 and 91 test data to characterize the 2024-T4 material were obtained from Ref. 8 and can be represented by the following stress-strain coordinates (σ,ε): (0 psi, 0 in/in); 0.005, 50000.); (0.030, 56000.); (0.080, 62000.). The material mass density used for aluminum was 0.0002524 $(\text{lb-sec}^2)/\text{in}^4$. As was mentioned in Subsection 3.2.6 for the preliminary TEJ 2 runs, the initial shape of the ring was assumed to be a perfect circle, and the zone of loading uncertainty, over which the external forces were "observed" to act, was set equal to 7 mass points and was placed on the area over which the external forces were assumed to act; the effect of assuming a larger zone of loading uncertainty is discussed in Subsection 3.5.

3.4.3 Prediction of Optimum Forces

3.4.3.1 Optimum Forces Obtained from TEJ 2 Using Position Data from NAPTC Tests 88 and 91

The preliminary optimum-force results obtained from inputting the data pertaining to NAPTC Tests 88 and 91 into TEJ 2 are presented in Tables 2 and 3, respectively. All forces not specified in the table are equal to zero and all forces occurring after the final time listed also have zero magnitude.

These TEJ 2 runs incorporate the same assumptions used in the TEJ 2 runs with the JET 2 example problem data. These include the assumption that the original shape of the ring is a perfect circle, and also that the assumed zone of loading uncertainty (area where the external forces are not known to be zero) is assumed in each case to be 7 mass points in area with the center of contact observed from the test photographs made coincident with the center of the assumed zone of loading uncertainty.

*These standard deviation values while based upon limited studies and attendant assumptions employed in conjunction with the example problem studied in Subsection 3.3 represent only a heuristic first approximation to those unknown standard deviation values which are presumed to apply to the experimental data of NAPTC Tests 88 and 91. The applicable standard deviation values in such situations may depend upon time and spatial location around the ring as well as upon the value of the characterizing peak amplitude of the loading. It is tentatively assumed, however, that these dependencies are weak, but further investigation of this matter is needed.

To illustrate the sequence of steps shown in Fig. 6 and the attendant results from using the TEJ 2 program to obtain the final optimum forces presented in Tables 2 and 3, the calculated, estimated, and final optimum forces in the y and z directions at time equals 210 μsecs, are plotted versus mass station number for Test 91 data TEJ 2 results in Fig. 20.

From Fig. 20, which shows forces that are representative of the forces calculated in TEJ 2 at a sequence of time instants, note that the final optimum forces (⊡) are very close to the estimated forces (⊙) obtained from differentiating the cg locus versus time. This is a natural result of the variance values used, which greatly accentuate the estimated forces as was demonstrated for the JET 2 example problem data. Note also that the calculated forces show significant scatter over the whole ring and appear to have little similarity to a plausible external force distribution expected from ring interaction with a single blade. Finally, note that the final optimum forces are fairly well behaved except for occasional oscillatory low amplitude peaks at locations away from the assumed zone of loading uncertainty (ring-fragment interaction zone). These spurious forces do not exist at the beginning of the run, and are observed generally to grow with time during the TEJ 2 run. However, they can be observed to some degree in all TEJ 2 runs, their nature (growing, fluctuating, or decreasing) and severity varies greatly from run to run depending upon the data and the values of variances used.* From the results obtained from the TEJ 2 runs using the example-problem (synthetic) data, it appears that they can be safely ignored by deliberately setting them equal to zero (as was done for Tables 2 and 3) until, perhaps, improvements in the method will remove their cause and appearance.

3.4.3.2 Comparison of TEJ 2 Optimum Positions with the Smoothed Position-Time Data

In order to determine the quality of the results obtained from TEJ 2 for Tests 88 and 91, these forces were inputted into JET 2 with the appropriate ring and material parameters, and the transient response was calculated for each ring case. The results of these JET 2 runs are illustrated in Figs. 15a and 15b for NAPTC Tests 88 and 91, respectively, where the measured and calculated profile for each ring is plotted for time equals 570 μsec.

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*These oscillatory peaks occur during the final step in the TEJ 2 program when the final optimum trial positions are smoothed in space and thus appear to be an indication that the optimum trial ring profiles are not smooth in the latter portions of the TEJ 2 run.

A comparison of the calculated and measured ring profiles for each ring shows that while the calculated profiles have the same general shape as the measured profiles, the difference between them in the area of contact with the blade is much greater than one can attribute to reading errors in the position data. Thus, while it is felt that the TEJ 2 final optimum forces may be representative of the actual forces encountered during the blade impact, attempts should be made to improve TEJ 2 so that better force predictions can be made. Some studies which are proposed for seeking such improved predictions are offered in Subsection 3.6.

3.5 Influence of Some Uncertainty Factors

The calculations discussed in Subsection 3.3 for the example problem (synthetic or manufactured data) and in Subsection 3.4 for the NAPTC Test 91 experimental data represent "baseline" calculations. In each of these two cases one is required to make choices concerning the assumed size and location of the loading uncertainty zone, the proper number of fitting polynomials, etc. In order to explore the consequences of changes in these choices, a brief series of calculations was carried out and is described in this subsection.

A total of 5 different variations in TEJ 2 was explored singly and in combination, in an effort to improve the TEJ 2 results using the NAPTC Test 91 position data. These variations can be summarized as follows:

(1) The values of the variances used in the Kalman filter were interchanged so that the calculated forces were emphasized in the assumed zone of loading uncertainty. (The trial values of force outside this area were still set equal to zero, however.)

(2) The assumed size of the zone of loading uncertainty was increased for some runs from 7 mass stations to 15.

(3) The yield stress of the stress-strain curve for one TEJ 2 run was decreased by 25%.

(4) The initial profile of the ring for the nonstressed condition was taken to be the smoothed position data at time equals zero, rather than a perfect circle.

(5) Nine rather than 7 Gram polynomials were used to define the timewise behavior of the estimated forces.

These changes were implemented in TEJ 2 only for the synthetic data and the NAPTC 91 test data. A variety of combinations of changes was used, but a lack of time prevented a thorough investigation of the effects of implementing all the possible combinations. Thus, only general effects can be described since complete quantitative results are not available at the present time.

Table 4 presents a description of the different TEJ 2 runs made to investigate the effects of implementing the above changes. Accompanying the list of parameters used is a short description of the results obtained for each run. Two major observations can be seen from these results. The first is that for the JET 2 example problem (synthetic) data, both acceptable forces and acceptable positions (obtained by inputting TEJ 2 forces in JET 2) are obtained for all of the variations tried, including that in which the calculated forces are emphasized in the Kalman filter. The second observation is that in general, for the NAPTC 91 data either the TEJ 2 forces or the subsequent JET 2 positions or both are judged to be lower in quality than desired, although they are considerably better than the calculated forces (which are equivalent to the earlier TEJ 1 forces).

From the summary presented in Table 4 and the detailed results from the computer runs, the following trends can be seen from each of the variations:

1. Emphasizing the calculated (TEJ 1) forces in the assumed zone of loading uncertainty tends to improve the predicted JET 2 positions resulting from using the TEJ 2 optimum forces. This is true for both the synthetic data (Run 1 vs. Run 2) and the Test 91 data (Run 6 vs. Run 7). However, the "acceptability" of the TEJ 2 forces, as far as their overall appearance and plausibility is concerned decreases. For

the example-problem data, this degradation is not great, and the force results, when smoothed with a 5-point smoothing formula, appear to be a good estimate of the exact forces. However, the plausibility of the Test 91 TEJ 2 predicted forces appears to degrade considerably more than the synthetic data results. If these forces are smoothed, the forces look more reasonable but the resulting JET 2 positions using the smoothed TEJ 2 forces are considerably worse than the positions obtained from the basic TEJ 2 run (Run 6 in Table 4).

2. Increasing the size of the assumed zone of loading uncertainty (Runs 3 and 8) yields the same trends as described in item 1, although the degradation of the appearance of the optimum forces is not as great.

3. Decreasing the yield stress for the ring material's stress-strain curve (Run 10) resulted in optimum forces which were somewhat different, but their overall appearance was essentially unchanged. When these forces were substituted into JET 2, however, the resulting positions tended to be considerably worse than those obtained from Run 6 (the "baseline run" for Test 91).

4. Using the smoothed position data to define the ring shape at time equals zero improved the position results obtained from the Test 91 data (Run 13), but essentially made little difference in those for the example problem synthetic data (Run 4). Conversely, the plausibility of the optimum forces was considerably worse for both sets of data when compared with the baseline runs for each case.

5. Using a higher order Gram polynomial overall timewise force fit for the estimated forces for the Test 91 data (Run 11) did not make a very significant difference in either the optimum forces or the resulting JET 2 position predictions. The trend was found to be slightly degrading for the

positions; the plausibility of the optimum forces was essentially unchanged.

Since this examination of the influence of various uncertainty factors has not been comprehensive, only very limited conclusions can be drawn; a more extensive study is considered to be advisable. Within the studied range of variation of each of these uncertainty factors, little or no improvement in the plausibility of the TEJ 2 predicted interaction forces has been found; a more extensive study may reveal more pronounced effects.

It is clear that the present status of development of TEJ 2 is adequate for both the type of information and the type and extent of information uncertainties conceived of and examined in the example problem. These included factors appear to represent an incomplete conceptual/mathematical model of the actual experimental situation represented, for example, by NAPTC Tests 88 and 91. That is, the information ingredients employed in TEJ 2 at the present time ((a) force estimates from cg motion, (b) force estimates from individual mass-point motion data, together with hopefully plausible estimates of the PE of these data, and (c) the data smoothing methods) may not be adequate to permit the desired resolution and accuracy of the predicted interaction forces in view of the quality and quantity of the available experimental data in a given test. It is conceivable that the use of (1) additional experimental information such as transient strain measurements, for example, (2) a semi-independent estimate, based upon momentum and energy considerations, of the interaction forces (thus providing a third input to the Kalman filter loop), and/or (3) a more effective yet-to-be-conceived means for processing the present type of experimental position-time data may result in significant improvements to the predicted interaction forces. Also, the improving of experimental measurement accuracy and resolution must be reexamined.

3.6 Suggested Studies to Improve the Transient Force Prediction Capability of a TEJ-Type Program

It is convenient to categorize, in the following three groupings, the various matters which suggest themselves for further study and/or development in a quest for improving fragment-ring interaction force predictions from a

TEJ type analysis; these groupings and some associated avenues which merit study follow:

(1) Basic TEJ-Type Analysis Developments

(a) The current TEJ 2 program utilizes measured position data for a complete circumferential set of mass points of a fragment-impacted ring at discrete successive instants in time; these data are processed to deduce "two preliminary estimates" of the external forces acting on each mass point of the ring as a function of time. These "two preliminary force estimates" are then fed into a Kalman filter block together with chosen weighting factors; the resulting output from the Kalman filter calculation produces a "better" prediction of the external forces acting on the ring. The introduction of a third "preliminary force estimate" such as from a semi-independent estimate from a simplified fragment-ring interaction model which utilizes momentum and energy considerations, for example, would improve the current TEJ 2 type (Kalman filter) prediction of the sought forces, and should be pursued.

(b) Data smoothing techniques [5] which utilize most if not all of the earlier-time data in order to predict the external forces acting on each mass-point location at any given time should be examined and incorporated if feasible.

(c) The cause of the spurious oscillating peaks in the forces predicted in some of the TEJ 2 calculations involving the use of the example-problem data should be sought and removed if possible.

(d) The cause of the time asymmetry of the F_z component of the external forces predicted by TEJ 2 for the example problem (see Fig. 13) should be searched out and remedied.

(2) Study of the Effects of Various Factors in TEJ 2 by Application to a Well-Defined Problem

In the present study, Example Problem 1 of Appendix B has been employed (as a reliable source of mass point position-time data, subsequently perturbed in various ways) to assess the plausibility, reliability, and accuracy of the forces predicted by utilizing this information in TEJ 2. That examination, however, has covered only a small part of the spectrum of conditions and choices which must be explored if a satisfactory understanding and assessment of this question is to be reached. Among the matters which deserve further study to assess their effect in the TEJ 2 force predictions via the vehicle of example-problem data similar to but more comprehensive than that utilized in the present study are:

(a) The effect of various sizes of mass-point position probable errors (PE), where the PE is taken to be the same for all mass points and all instants of time.

(b) The effect of both space-varying and time-varying probable errors of the mass point positions.

(c) A more comprehensive examination of the effect of using the actual pre-impact ring mass-point positions for the unstressed state of the ring in TEJ 2 rather than the smoothed pre-impact positions.

(d) The effect of the extent and the location of the zone of loading uncertainty (see Fig. 7).

(e) The effect of the size of the ratio of the variance to the peak applied load, for each of the types of "preliminary force estimates" which are being supplied to the Kalman filter block of TEJ 2.

(f) The effect of altering the type of assumed spatial distribution for each component of the estimated forces (see Subsection 3.4.2.2) currently supplied to the Kalman filter block.

(3) Studies of Various Factors Pertaining to the Experimental Data

(a) A thorough assessment of the data from both Tests 88 and 91 should be carried out to determine the probable error in the position data (compared with a meaningful reference utilized in TEJ 2 such as the smooth-position location) as a function of both circumferential location and time.

(b) Since Tests 88 and 91 were conducted under closely similar (although not duplicate) conditions, the data from these two tests should be carefully cross-correlated in order to assess their similar and dissimilar features. This is pertinent since similar TEJ 2 type analyses of these two sets of data predicted widely differing external forces acting on these two rings.

(c) One should reexamine the advisability of changes in the type and quality of the experimental transient response data needed as input to a TEJ-type program.

SECTION 4

SUMMARY

Research into the theoretical aspects of containment/deflection devices has been continued during this past year and the general approach towards obtaining an understanding of the fragment containment/deflection phenomena has been expanded. A new computer program, called JET 2, which can be used to predict accurately both small and large Kirchhoff deformation transient responses of a multilayer, hard-bonded, multimaterial ring if the transient externally-applied forces, the ring geometry, and the material properties are known, has been developed, and is presented in Appendix B. The program has the capability of taking into account any arbitrary prescribed time-dependent forcing function; it can account for elastic-plastic, strain-hardening, strain-rate dependent material properties.

As reported in Ref. 1, a program termed TEJ 1 was written, which embodied a new method designed to deduce the resultant forces acting upon a containment ring due to ring-fragment interaction, by analyzing position-time data for the ring measured from high-speed photographs taken of the event. The accuracy required of position-time data so that TEJ 1 could determine acceptably accurate estimates of the transient external forces was found to be approximately PE = 0.003 inch for a ring of nominal 7.3-inch midsurface radius. However, available information from error analyses made of experimental position data supplied by the NAPTC indicates that the best accuracy currently obtainable from the high-speed photographs is about PE = 0.01 inch for repeated readings of the inertial position of any given point on a test ring at a given instant in time. Thus, it was concluded that the TEJ 1 program was incapable of predicting satisfactorily the external forces. Accordingly, improvements in that method were desirable and have been carried out in the present study.

A new computer program TEJ 2, which is an outgrowth of the original TEJ 1 program has been developed (but is not documented because of its incomplete state) and improves upon the transient external force predictions of the TEJ 1 program. This program has been demonstrated to be able to predict satisfactorily the external forces acting upon the ring due to fragment-ring interaction if the position data can be characterized as having a PE less than or equal to 0.01 inch, with a Gaussian distribution. However, the final optimum force results obtained from TEJ 2, using experimental containment ring position-time data obtained from NAPTC high-speed photographs, do not as yet appear to be accurate enough for present purposes; it appears possible that the position-time test data obtained from NAPTC contains additional errors which have not yet been taken into account properly. Thus, it is concluded that either further improvements must be made to TEJ 2 or improved experimental position-time data must be obtained or both, in order to obtain satisfactory interaction force predictions from TEJ 2. This effort represents one facet of an attack on the central problem of determining the interaction forces produced by fragment impingement upon containment/deflection structures.

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TABLE 1

DATA CHARACTERIZING NAPTC RING TESTS 88 AND 91

Ring Data	Test 88	Test 91
Material	2024-T4 Aluminum	2024-T4 Aluminum
Diameter (O.D. inches)	17.619	17.619
Radial Thickness (inches)	0.153	0.152
Axial Length (inches)	1.506	1.506
Fragment Data		
Type	T-58 Single Blade	T-58 Single Blade
Material	LAPELLOY C	LAPELLOY C
Outer Radius (inches)	7.0	7.0
Fragment Centroid (inches)	4.812	4.812
Fragment Weight (lbs)	0.084	0.084
Blade Length (inches)	3.5	3.5
Failure Speed (RPM)	15374.3	15644.4
Blade Tip Velocity(ips)	11270.	11467.
Centroidal Velocity (ips)	7748.	7884.
Fragment Translational KE (in-lb)	6525.	6756.
Fragment Rotational KE (in-lb)	280.4	290.3
Camera Data		
Framing Rate (pps)	33950	33225
Individual Frame Interval time (μsec)	29.4	30.1

TABLE 2

FINAL OPTIMUM FORCES* CALCULATED BY TEJ 2 FOR NAPTC RING TEST 88 WITH σ_{est} = 1000 LBS, σ_{cal} = 5000 LBS, USING FORCE FITS WITH 15 FOURIER CO-EFFICIENTS IN SPACE AND 7 GRAM POLYNOMIALS IN TIME

Time	Mass Point Number (see Fig.15a)													
μsec	39		40		41		42		43		44		45	
	FY	FZ	FY	FZ	FY	FZ	FY	FZ	FY	FZ	FY	FZ	FY	FZ
29.4	116	171	128	850	197	1320	47	798	-17	114	0	0	0	0
58.9	191	99	24	416	428	735	107	420	103	99	0	0	0	0
76.6	307	106	15	304	557	618	79	291	118	84	0	0	0	0
88.4	254	96	10	214	553	506	111	205	147	100	0	0	0	0
117.8	76	37	245	135	467	268	246	113	112	79	0	0	0	0
147.3	-25	-13	321	76	478	84	295	71	120	50	0	0	0	0
176.7	0	0	202	17	562	68	238	38	127	40	-49	0	0	0
206.2	0	0	-120	-72	391	91	350	0	315	78	31	0	0	0
235.6	0	0	6	-24	271	96	373	93	260	121	77	25	0	0
265.1	0	0	-36	2	246	115	275	169	317	300	-19	-15	0	0
294.5	0	0	-180	3	235	133	269	332	329	226	57	143	0	0
323.9	0	0	-109	16	166	208	304	407	104	177	132	183	0	0
353.4	0	0	141	73	-34	238	305	458	-36	186	128	150	0	0
382.9	0	0	28	64	83	283	176	549	25	222	63	156	0	0
412.3	0	0	-118	69	147	314	79	631	7	238	82	192	0	0
441.8	0	0	24	98	-49	336	135	700	-122	265	152	222	0	0
471.2	0	0	0	0	-165	340	164	713	-156	289	146	204	-96	-144
500.7	0	0	0	0	38	86	4	402	17	659	11	408	24	94
530.1	0	0	0	0	54	99	-31	346	47	610	-19	344	-4	43
559.6	0	0	0	0	-188	104	206	352	-171	502	136	383	-99	-48
589.0	0	0	0	0	-89	140	49	214	-41	534	-49	138	175	255
618.5	0	0	0	0	206	253	-313	-20	525	842	-495	-253	616	686
647.9	0	0	0	0	341	294	-330	-78	584	759	-433	-220	505	539
677.4	0	0	0	0	251	303	-241	-139	473	591	-258	-121	347	307
706.8	0	0	0	0	305	272	-330	-235	627	602	-441	-378	577	584
736.3	0	0	0	0	314	154	-247	-151	444	409	-276	-308	335	434
765.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Forces are given in pounds

TABLE 3

FINAL OPTIMUM FORCES* CALCULATED BY TEJ 2 FOR NAPTC RING TEST 91 WITH σ_{est} = 1000 LBS, σ_{cal} = 5000 LBS, USING FORCE FITS WITH 15 FOURIER CO-EFFICIENTS IN SPACE AND 7 GRAM POLYNOMIALS IN TIME

Time	Mass Point Number (see Fig.15b)													
µsec	53		54		55		56		57		58		59	
	FY	FZ	FY	FZ	FY	FZ	FY	FZ	FY	FZ	FY	FZ	FY	FZ
30.1	20	56	50	147	78	295	43	170	14	25	0	0	0	0
60.2	32	99	67	304	145	515	61	270	47	30	0	0	0	0
90.3	27	111	99	443	159	691	95	427	24	74	0	0	0	0
120.4	13	58	111	504	143	794	118	537	-9	99	0	0	0	0
150.5	13	92	104	561	140	868	107	558	-4	108	0	0	0	0
180.6	7	104	74	546	141	902	72	559	22	113	0	0	0	0
210.7	0	0	7	58	85	599	92	949	74	633	-16	124	0	0
240.8	0	0	3	60	51	602	83	898	42	627	17	66	0	0
270.9	0	0	3	0	18	580	64	881	-13	714	16	81	0	0
301.0	0	0	11	17	0	557	24	853	-19	668	-4	140	0	0
331.1	0	0	0	54	-8	490	-29	767	0	508	-13	108	0	0
361.2	0	0	-19	71	-20	463	-67	668	-15	456	-15	85	0	0
391.3	0	0	-17	32	-52	413	-79	553	-52	417	- 1	43	0	0
421.4	0	0	0	0	-18	66	-51	321	-116	537	-51	324	-21	66
451.5	0	0	0	0	-23	31	-66	282	-120	430	-72	289	-12	55
481.6	0	0	0	0	-23	66	-82	190	-131	354	-79	210	-23	64
511.7	0	0	0	0	-12	61	-94	153	-137	282	-79	143	-14	21
541.8	0	0	0	0	-5	27	-91	150	-140	247	-99	171	-20	38
571.9	0	0	0	0	-3	5	-74	97	-135	210	-98	150	-27	67
602.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Forces are given in pounds

TABLE 4

SUMMARY OF VARIATIONS EXPLORED WITH THE TEJ 2 PROGRAM, AND THE RESULTING EFFECTS ON THE PREDICTED EXTERNAL FORCES AND DISPLACEMENTS

RUN NO.	DATA USED		FORCE EMPHASIZED IN KALMAN FILTER		STRESS-STRAIN YIELD STRESS PERCENT		INITIAL RING PROFILE		ZONE OF LOADING UNCERTAINTY* (NO. OF MASS POINTS)		TIMEWISE GRAM POLYNOMIAL FORCE FIT		TREND IN RESULTS COMPARED WITH BASIC TEJ 2 RUNS		QUALITY OF RESULTS ASSOCIATED WITH TEJ 2 PREDICTED FORCES	
	EX. PROB.	TEST 91	CALCULATED (TEJ 1)	ESTIMATED (CG)	100	75	CIRCLE	SMOOTHED DATA	7	15	7	9	JET 2 POSITION PREDICTIONS	PLAUSIBILITY OF OPTIMUM FORCES	JET 2 POSITION PREDICTIONS	PLAUSIBILITY OF OPTIMUM FORCES
1	X			X	X		X		X		X		BASIC EXAMPLE-PROBLEM RUN			
2	X		X		X		X		X		X		Same	Worse	Good	Fair
3	X		X		X		X			X	X		Slightly Improved	Much Worse	Good	Poor
4	X			X	X			X		X	X		Same	Slightly Worse	Good	Fair
5	X		X		X			X		X	X		Slightly Improved	Much Worse	Good	Poor
6		x		x	x		x		x		x		BASIC NAPTC TEST 91 RUN			
7		x	x		x		x		x		x		Worse	Worse	Poor	Poor
8		x	x		x		x			x	x		Improved	Much Worse	Good	Poor
9		x		x	x		x			x	x		Same	Same	Fair	Good
10		x	x			x	x			x	x		Worse	Much Worse	Poor	Poor
11		x		x	x		x			x		x	Worse	Same	Fair	Good
12		x	x		x			x		x	x		Much Improved	Much Worse	Good	Poor
13		x		x	x			x		x	x		Improved	Much Worse	Good	Poor

*Only 5 mass points are loaded at any given instant of time (see Table 3, and Fig. 7)

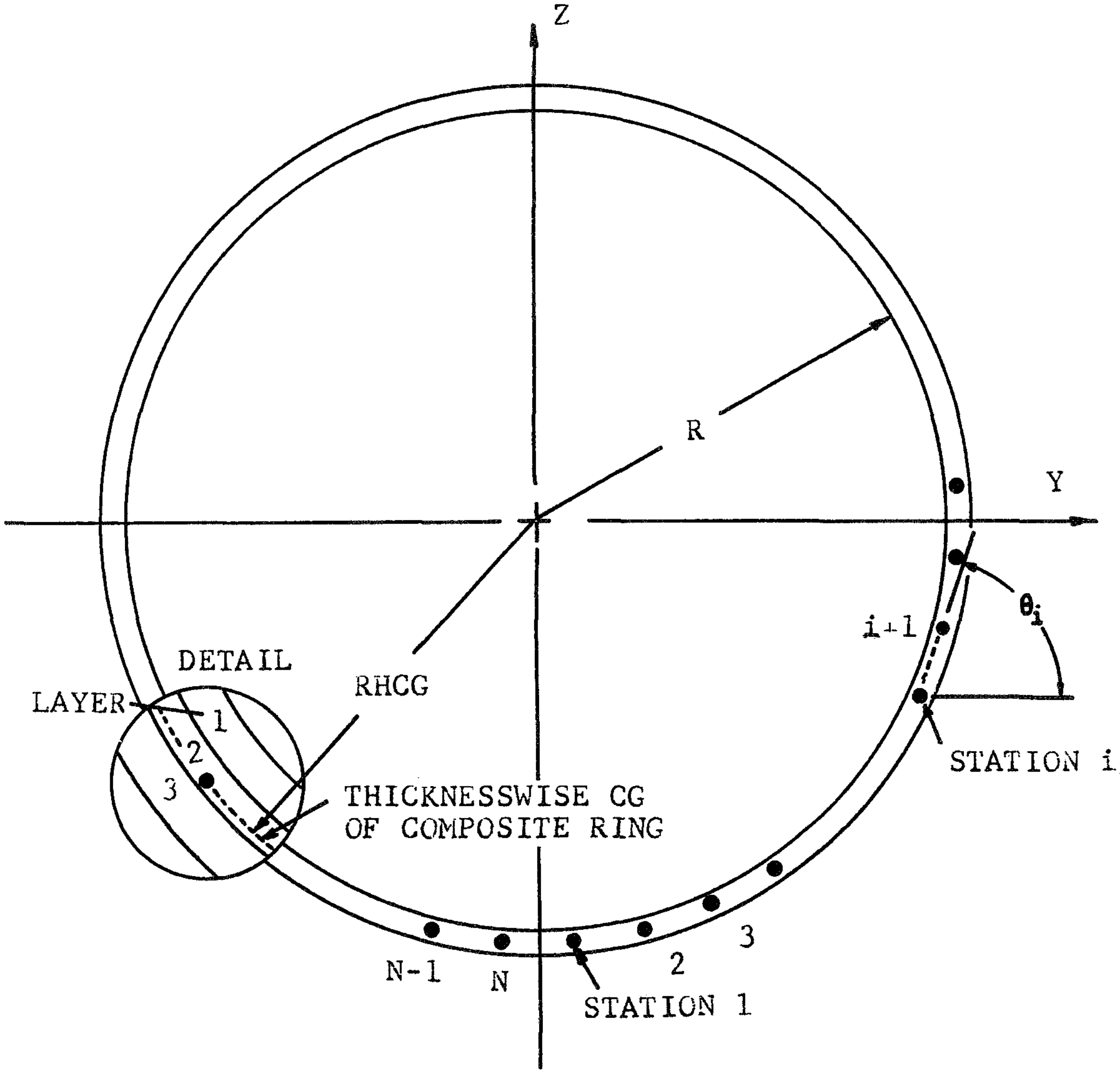
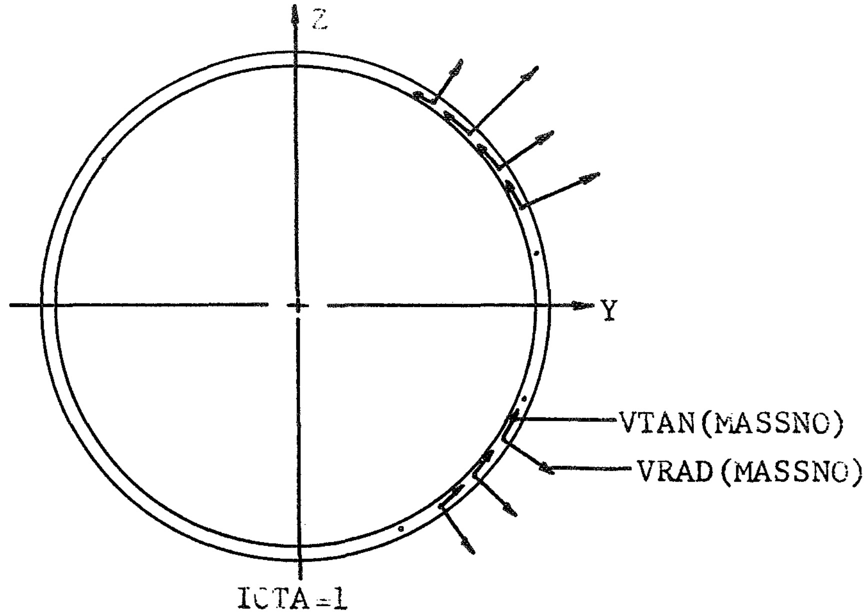
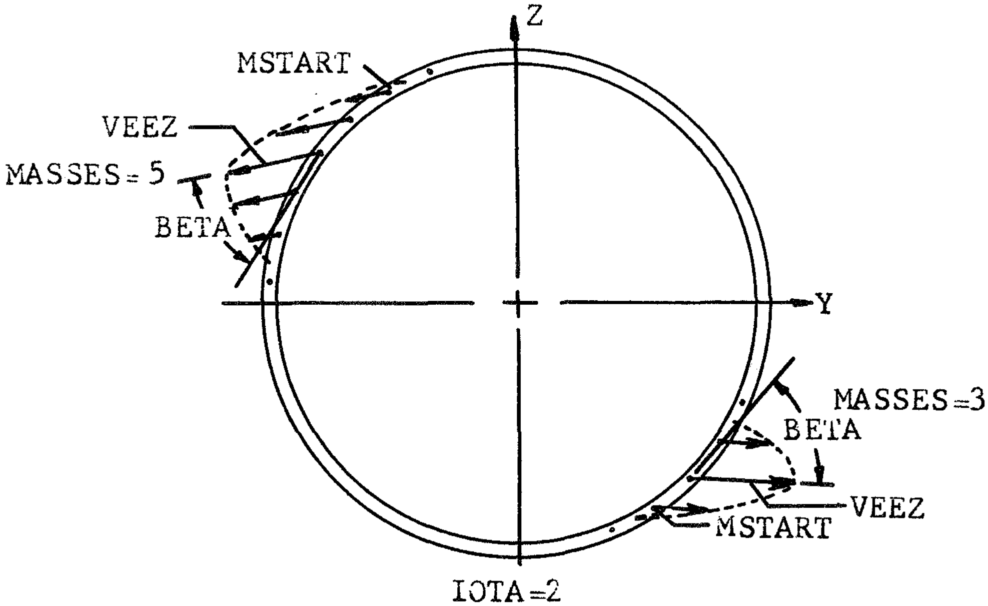


FIG. 1 FINITE-DIFFERENCE MODEL AND NOMENCLATURE FOR MULTILAYER RING

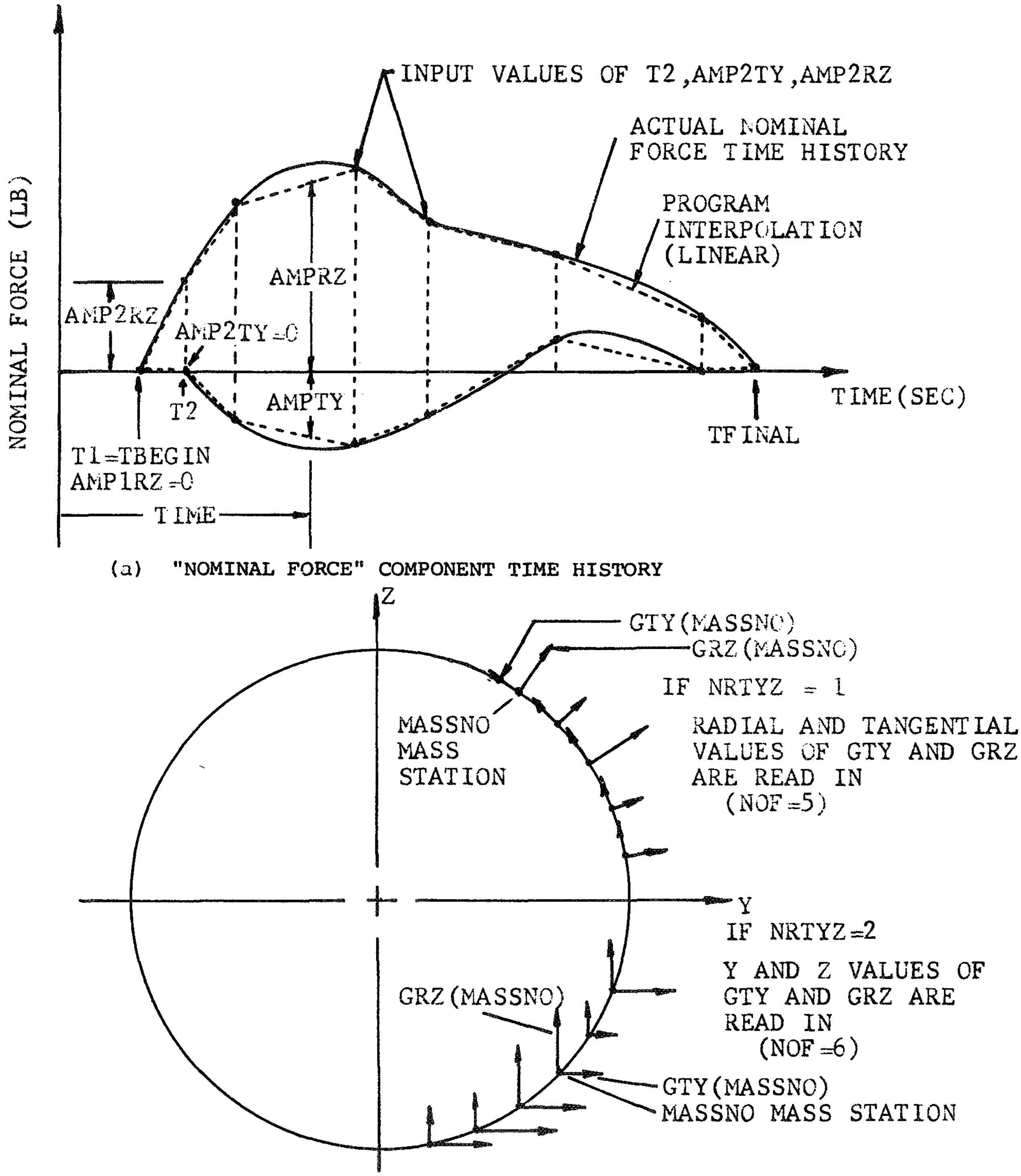


(a) ARBITRARY LOADING



(b) LOCAL SINUSOIDAL DISTRIBUTION SPECIFICATION FOR NV = 2

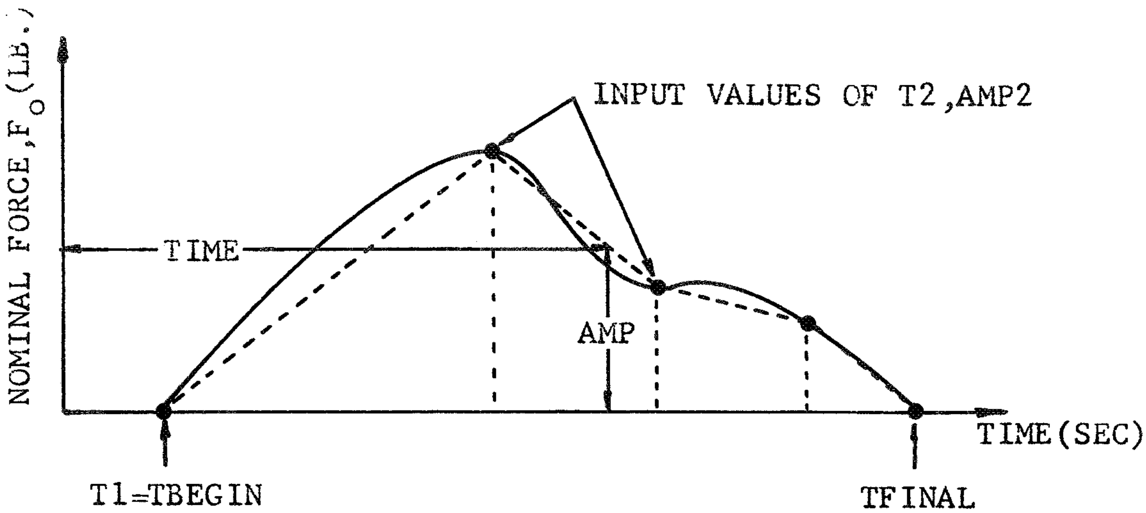
FIG. 2 CIRCUMFERENTIAL DISTRIBUTION OF THE INITIAL VELOCITY CORRESPONDING TO SPECIFIC VALUES OF IOTA



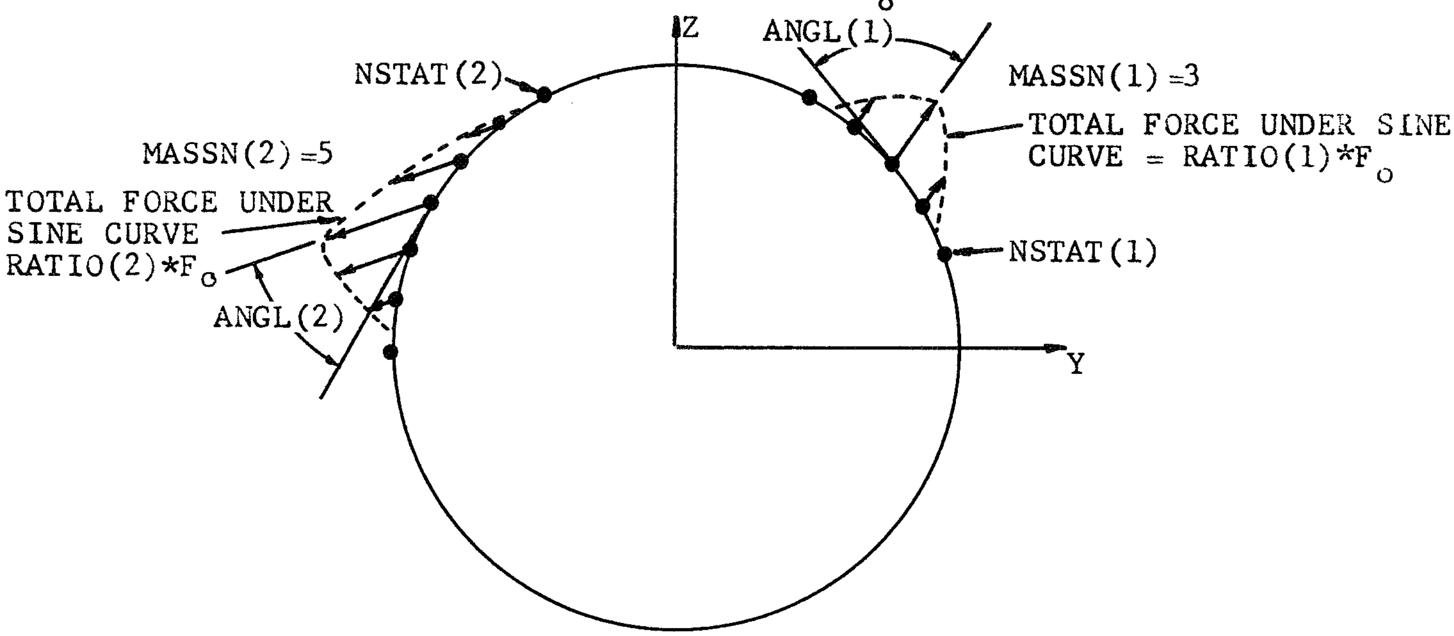
(a) "NOMINAL FORCE" COMPONENT TIME HISTORY

(b) SPATIAL FORCE DISTRIBUTION

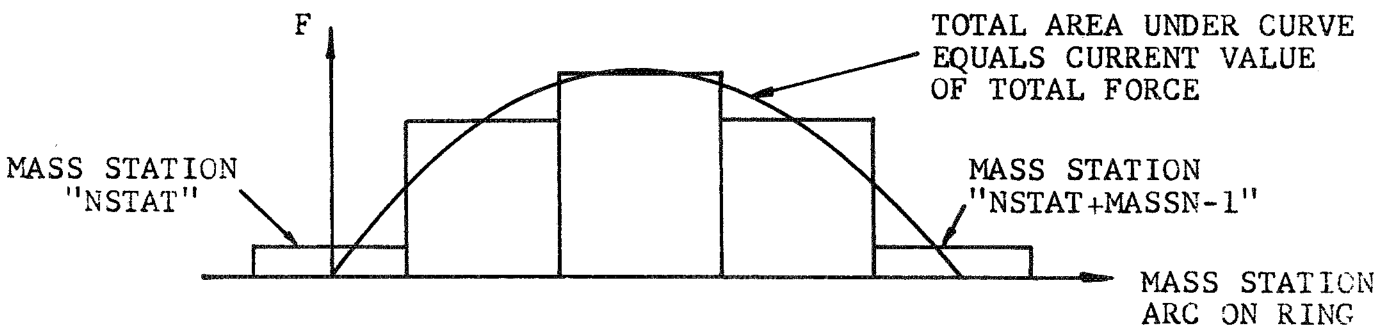
FIG. 3 TIME HISTORY AND SPATIAL DISTRIBUTION METHOD CORRESPONDING TO JOLT = 2



(a) "NOMINAL FORCE" (F_o) TIME HISTORY



(b) SPATIAL FORCE DISTRIBUTION



(c) DETAIL OF LOCAL HALF SINE FORCE DISTRIBUTION FOR MASSN=5

FIG. 4 TIME HISTORY AND SPATIAL DISTRIBUTION METHOD
CORRESPONDING TO JOLT = 3

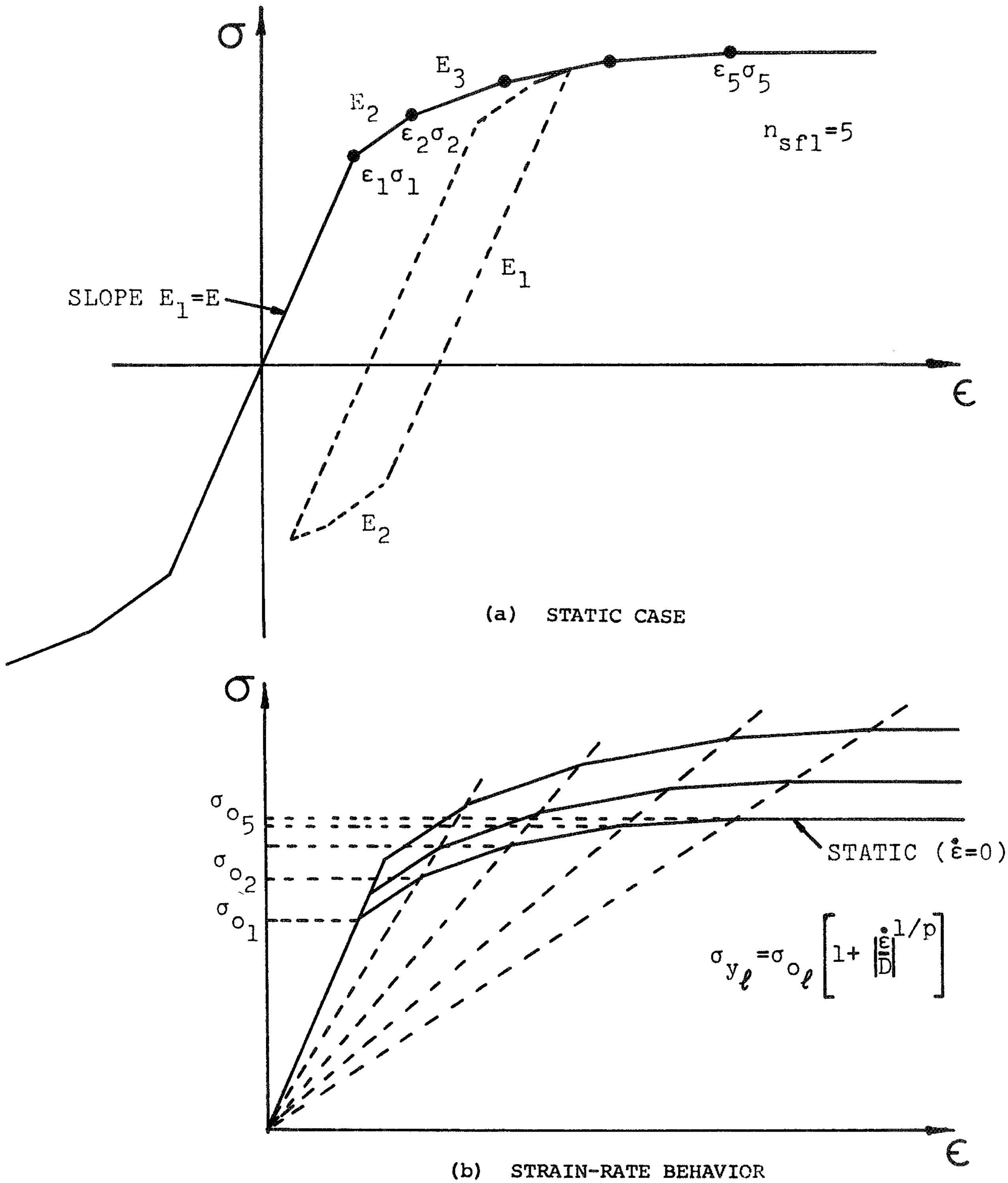


FIG. 5 IDEALIZED STRESS-STRAIN RELATIONS

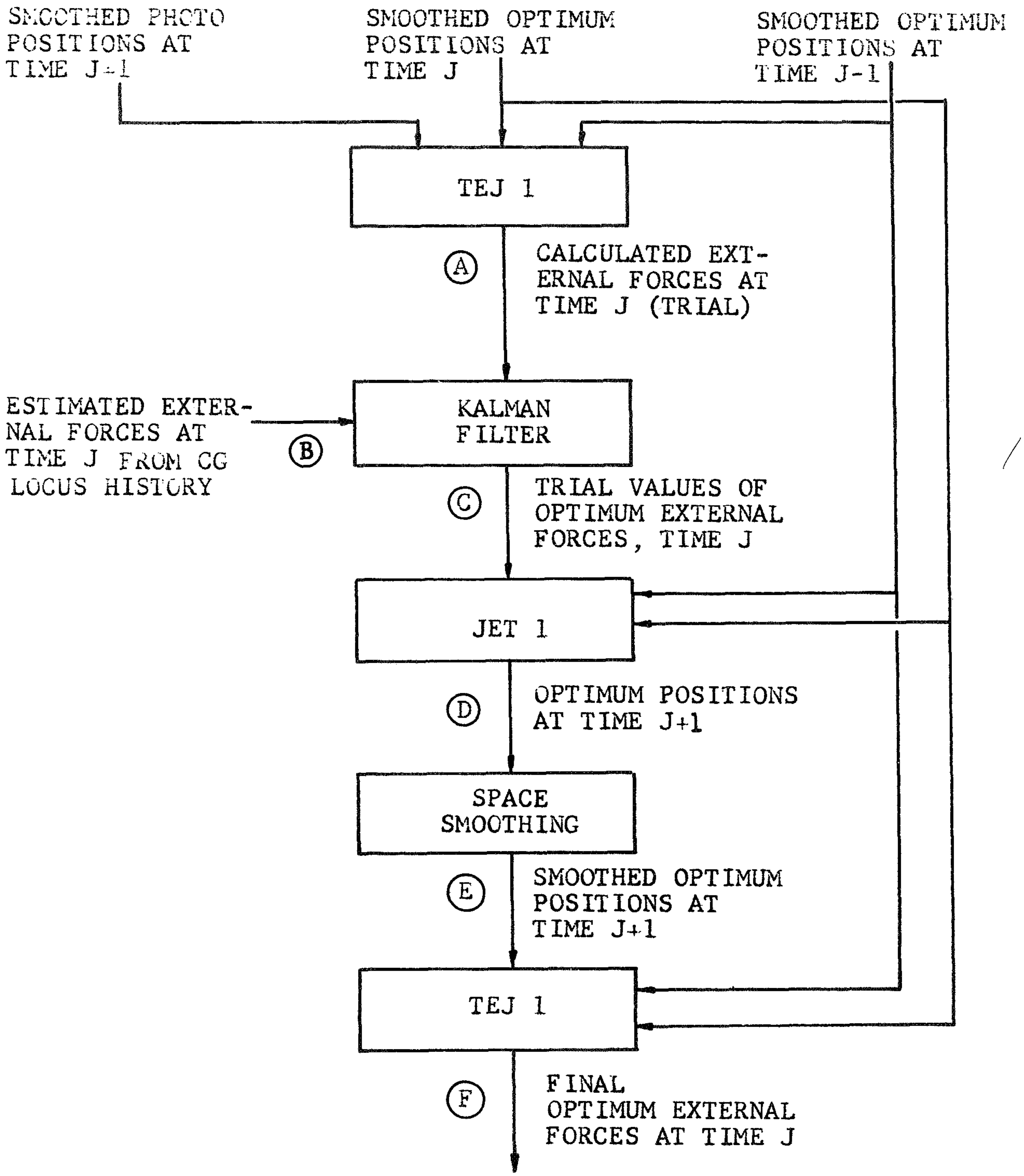
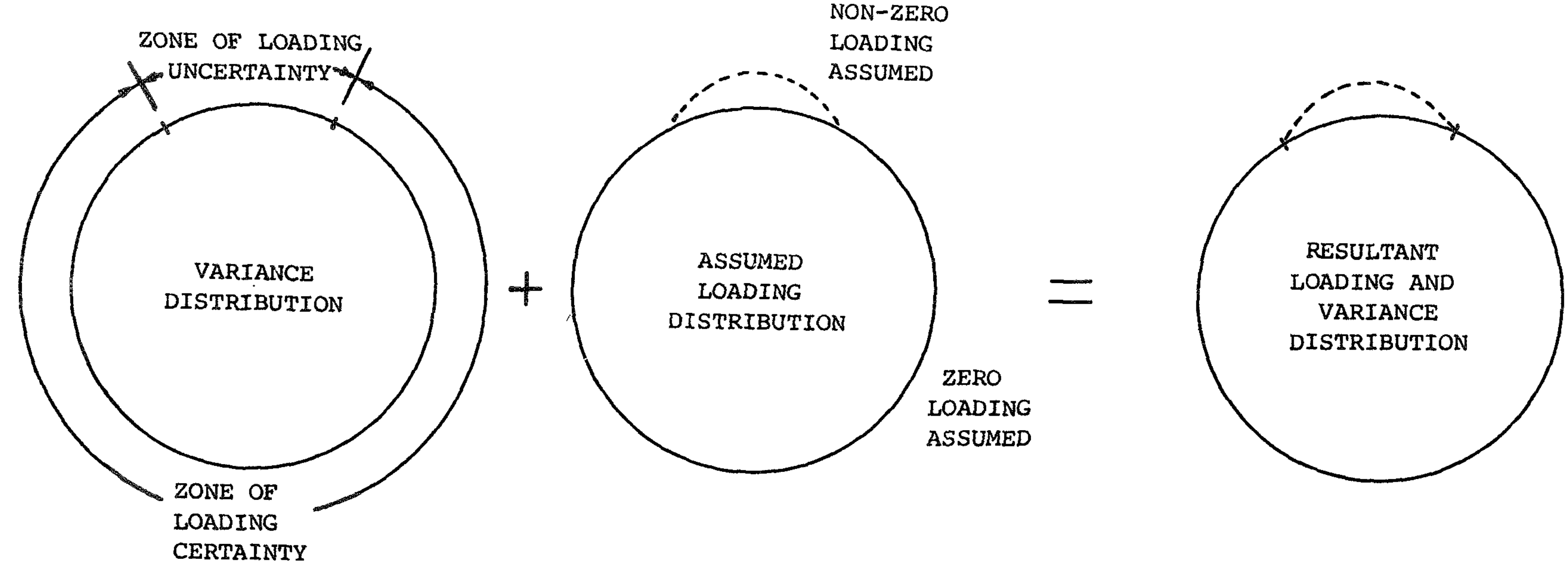
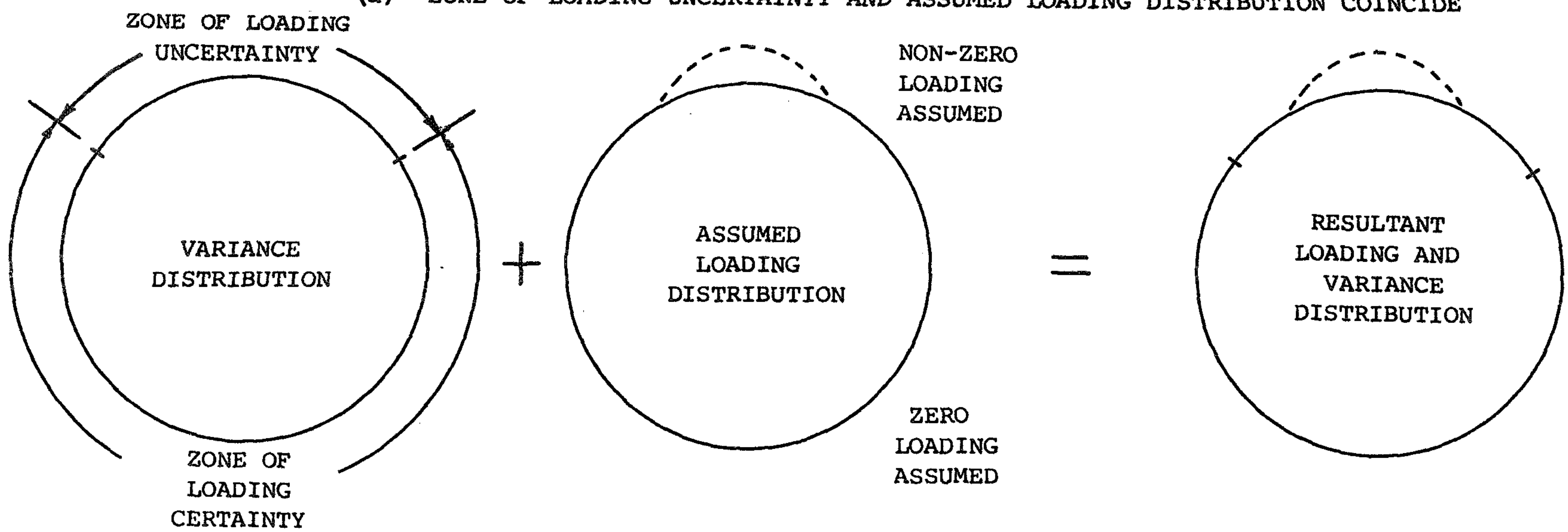


FIG. 6 FLOW CHART OF METHOD USED IN TEJ 2 TO OBTAIN THE OPTIMUM EXTERNAL FORCES ACTING ON A CONTAINMENT RING USING MEASURED POSITIONS VS TIME



(a) ZONE OF LOADING UNCERTAINTY AND ASSUMED LOADING DISTRIBUTION COINCIDE



(b) ZONE OF LOADING UNCERTAINTY IS LARGER THAN THE ASSUMED LOADING DISTRIBUTION

FIG. 7 SCHEMATIC OF THE VARIANCE AND LOADING DISTRIBUTIONS USED IN THE TEJ 1 PROGRAM

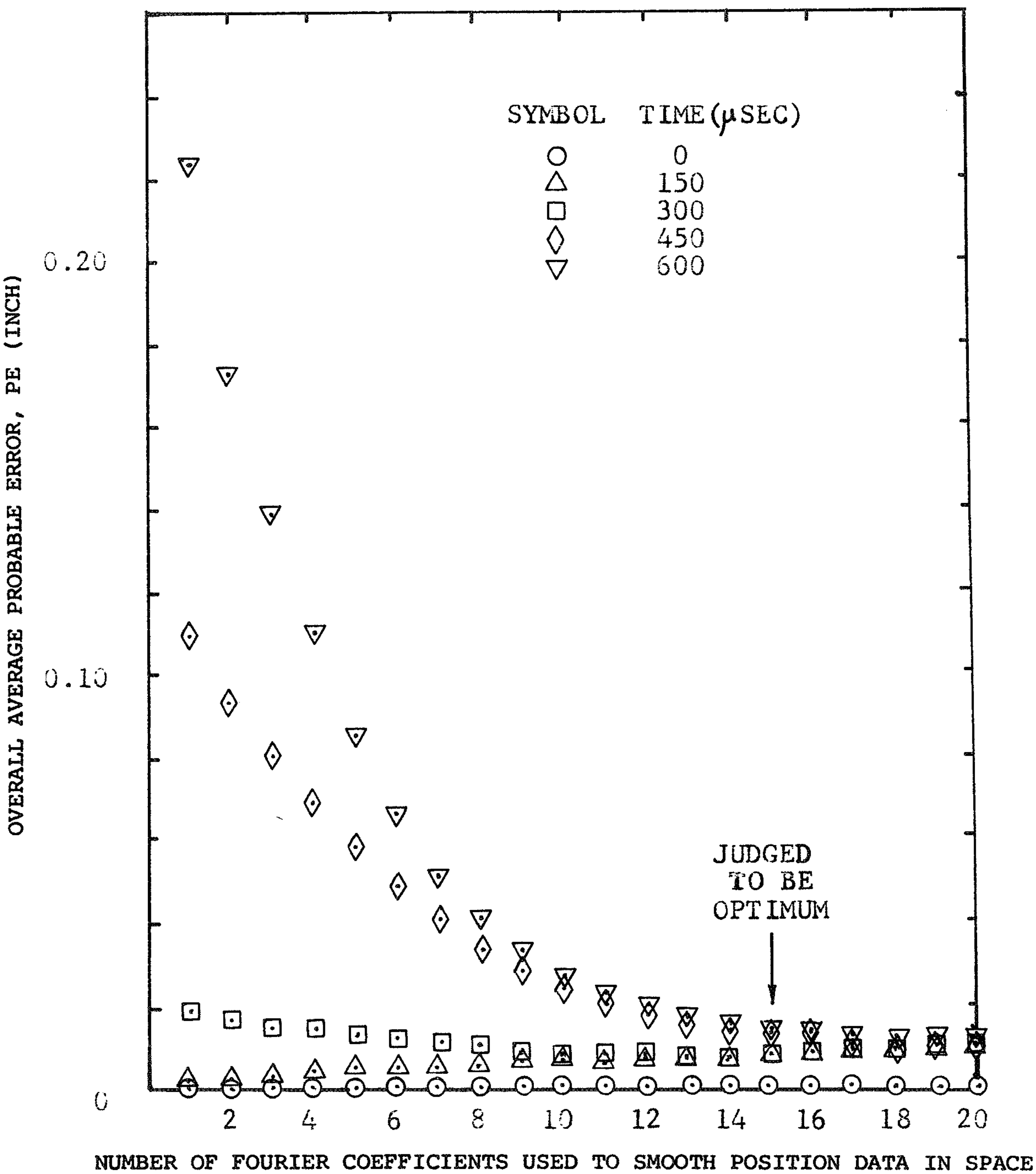


FIG. 8 OVERALL AVERAGE PROBABLE ERROR BETWEEN JET 2 EXAMPLE 1 SYNTHETIC PE = 0.01-INCH POSITION DATA AND SPACE SMOOTHED DATA VS NUMBER OF FOURIER COEFFICIENTS AT CHOSEN TIMES DURING RING RESPONSE

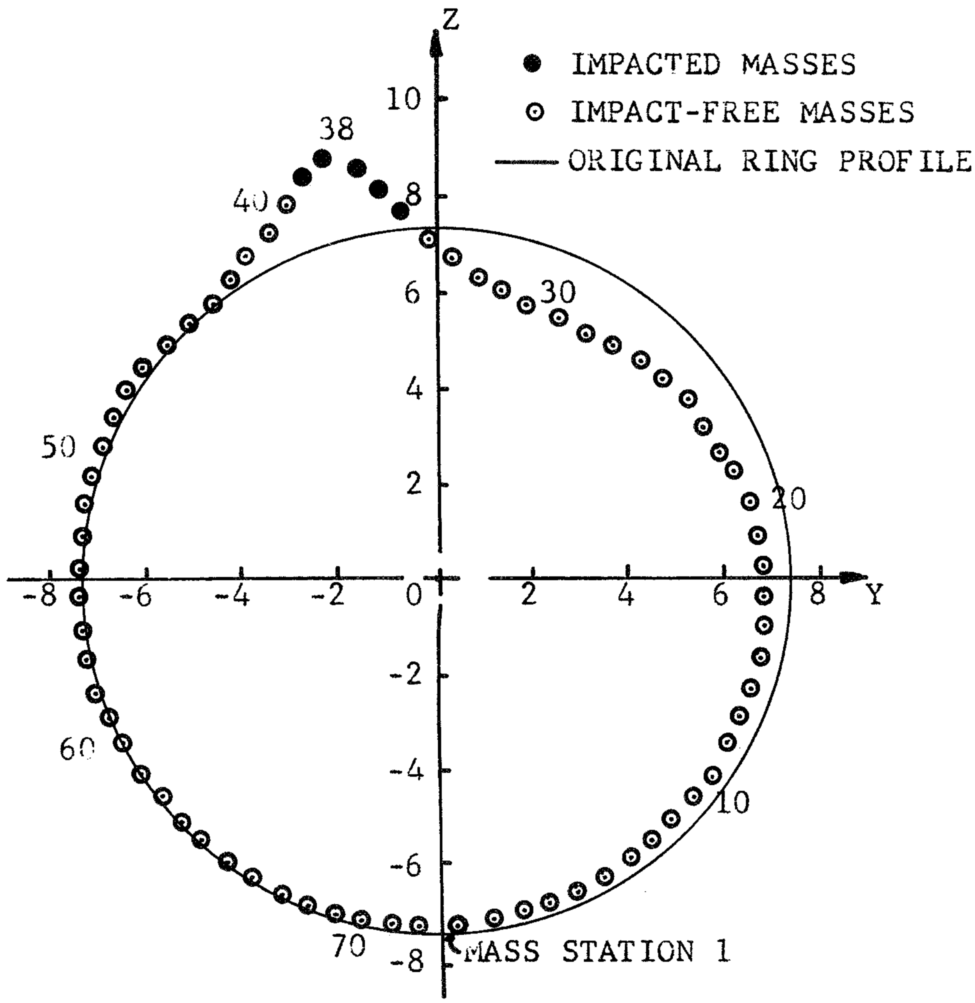


FIG. 9 EXAMPLE RING PROFILE AT TIME = 570 μSEC USING INEXACT PE = 0.01-INCH POSITION DATA FROM JET 2 EXAMPLE 1 IN APPENDIX B, REFERRED TO INERTIAL COORDINATES

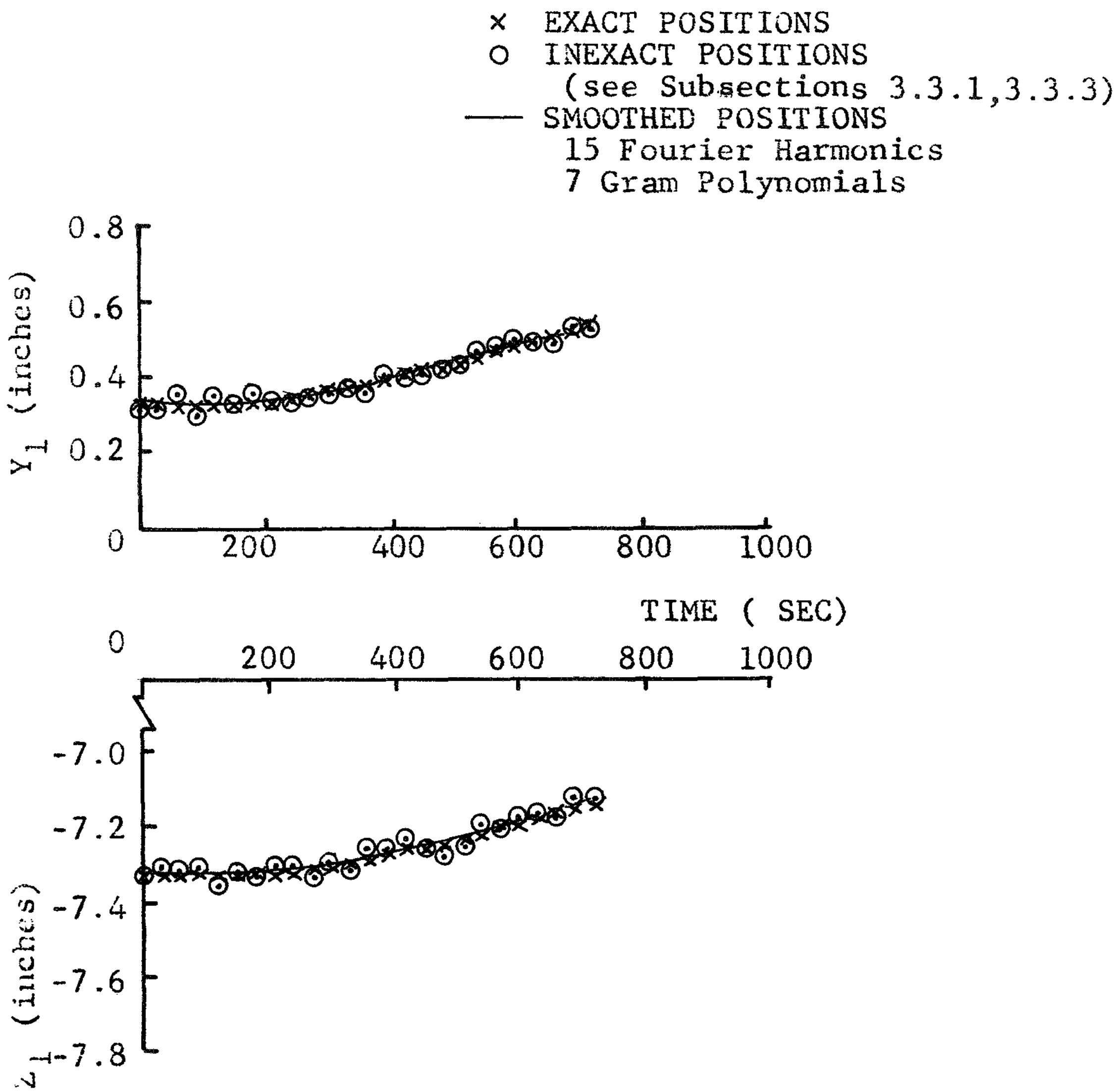


FIG.10 MASS STATION 1 INERTIAL POSITION VS TIME FOR JET 2 EXAMPLE 1 IN APPENDIX B

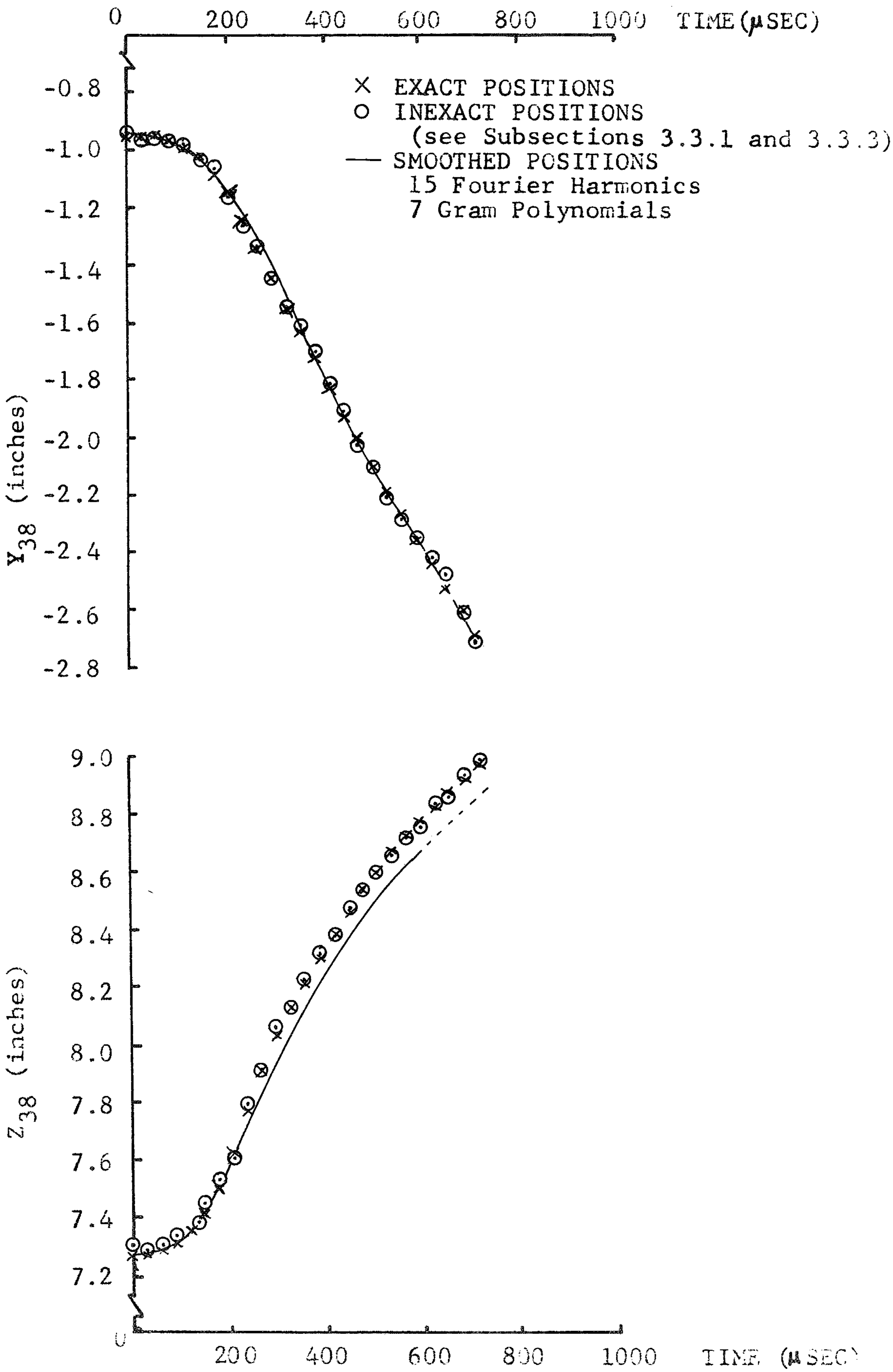


FIG. 11 MASS STATION 38 INERTIAL POSITION VS TIME FOR JET 2 EXAMPLE 1 IN APPENDIX B

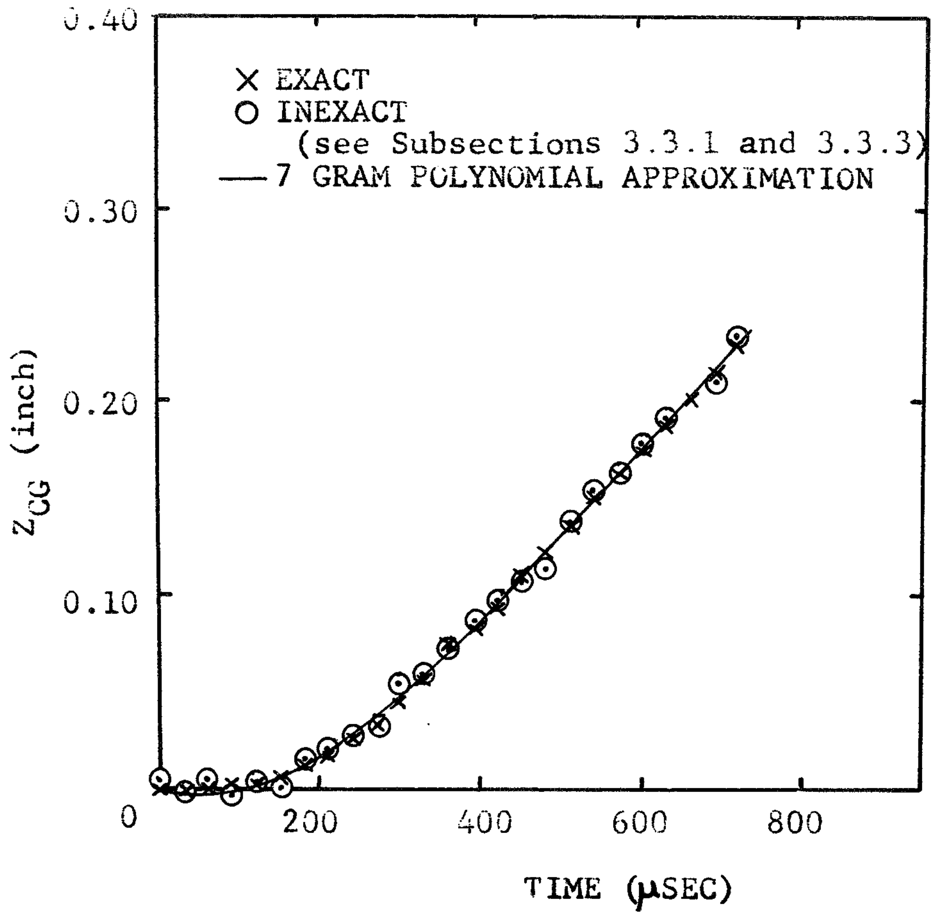


FIG. 12 CG LOCUS OF CONTAINMENT RING IN THE Z DIRECTION VS TIME USING INEXACT POSITION DATA FROM JET 2 EXAMPLE 1 IN APPENDIX B

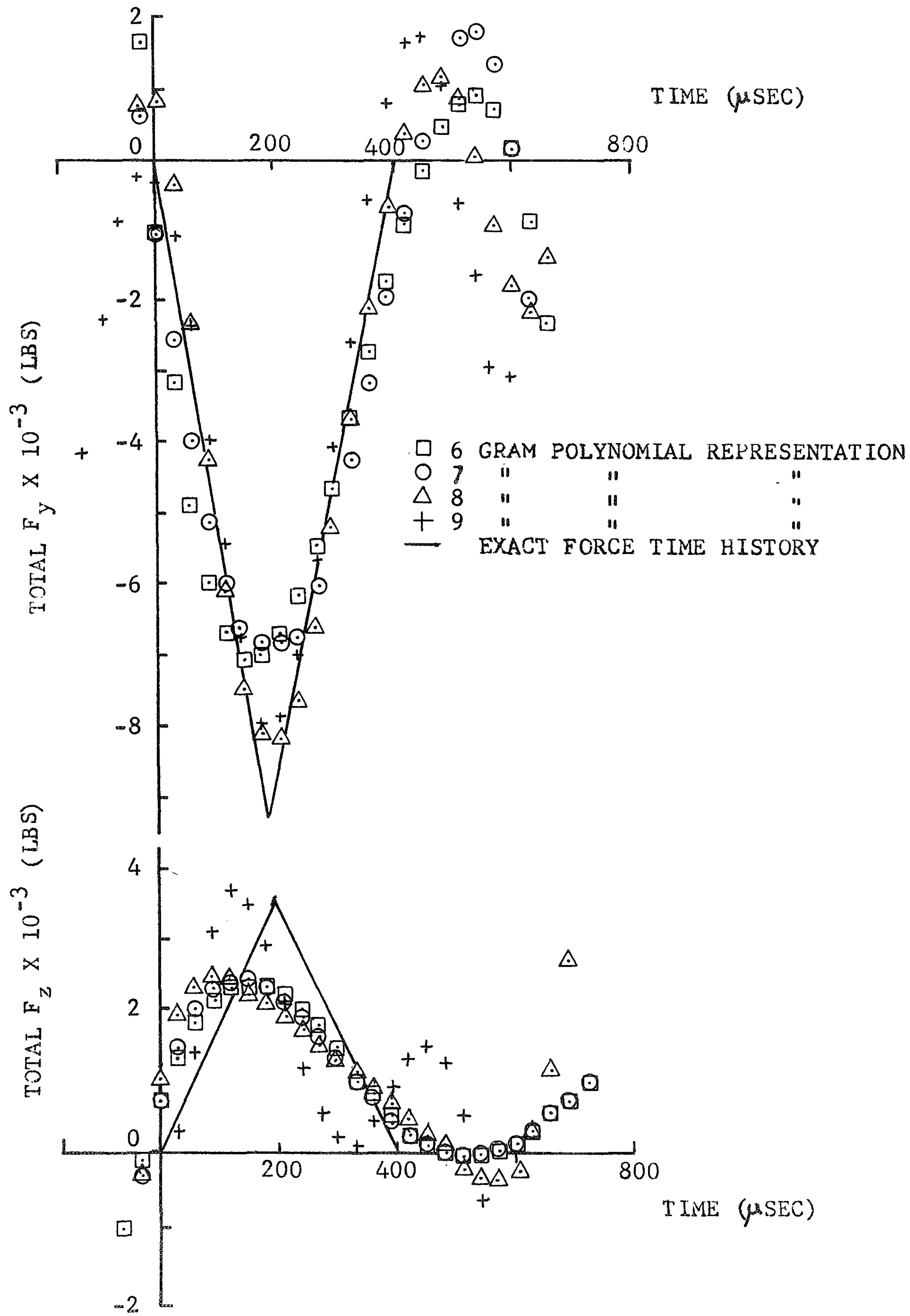
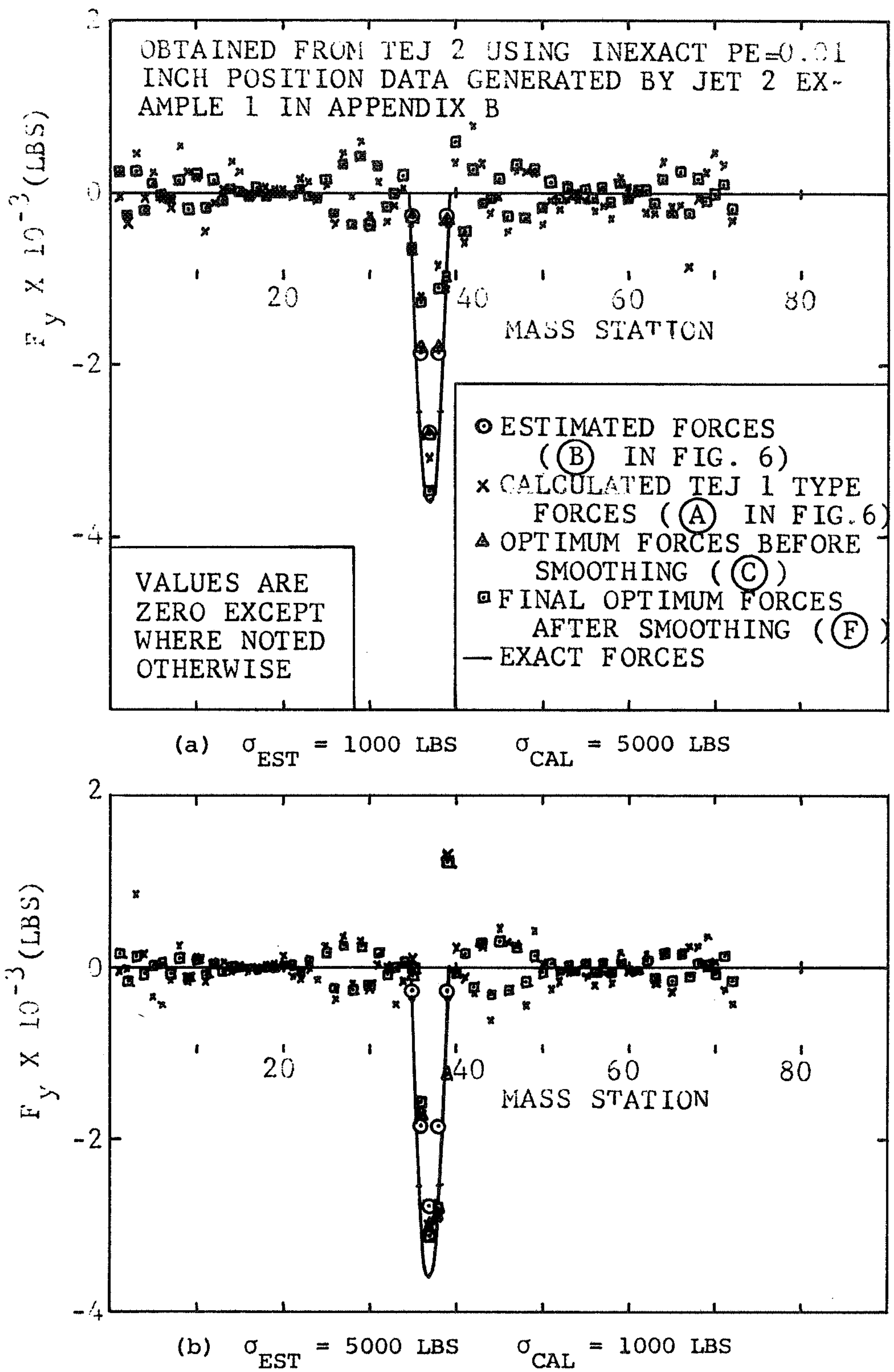


FIG. 13 TOTAL ESTIMATED EXTERNAL FORCE ACTING ON RING CG VS TIME USING INEXACT CG POSITION DATA FROM JET 2 EXAMPLE 1 IN APPENDIX B



(a) σ_{EST} = 1000 LBS σ_{CAL} = 5000 LBS

(b) σ_{EST} = 5000 LBS σ_{CAL} = 1000 LBS

FIG. 14 ESTIMATED, OPTIMUM, AND EXACT FORCES IN THE Y DIRECTION VS MASS STATION NUMBER OBTAINED FROM TEJ 2 AT TIME EQUALS 210 μSEC FOR THE EXAMPLE PROBLEM, COMPARED WITH CALCULATED TEJ 1 TYPE FORCES

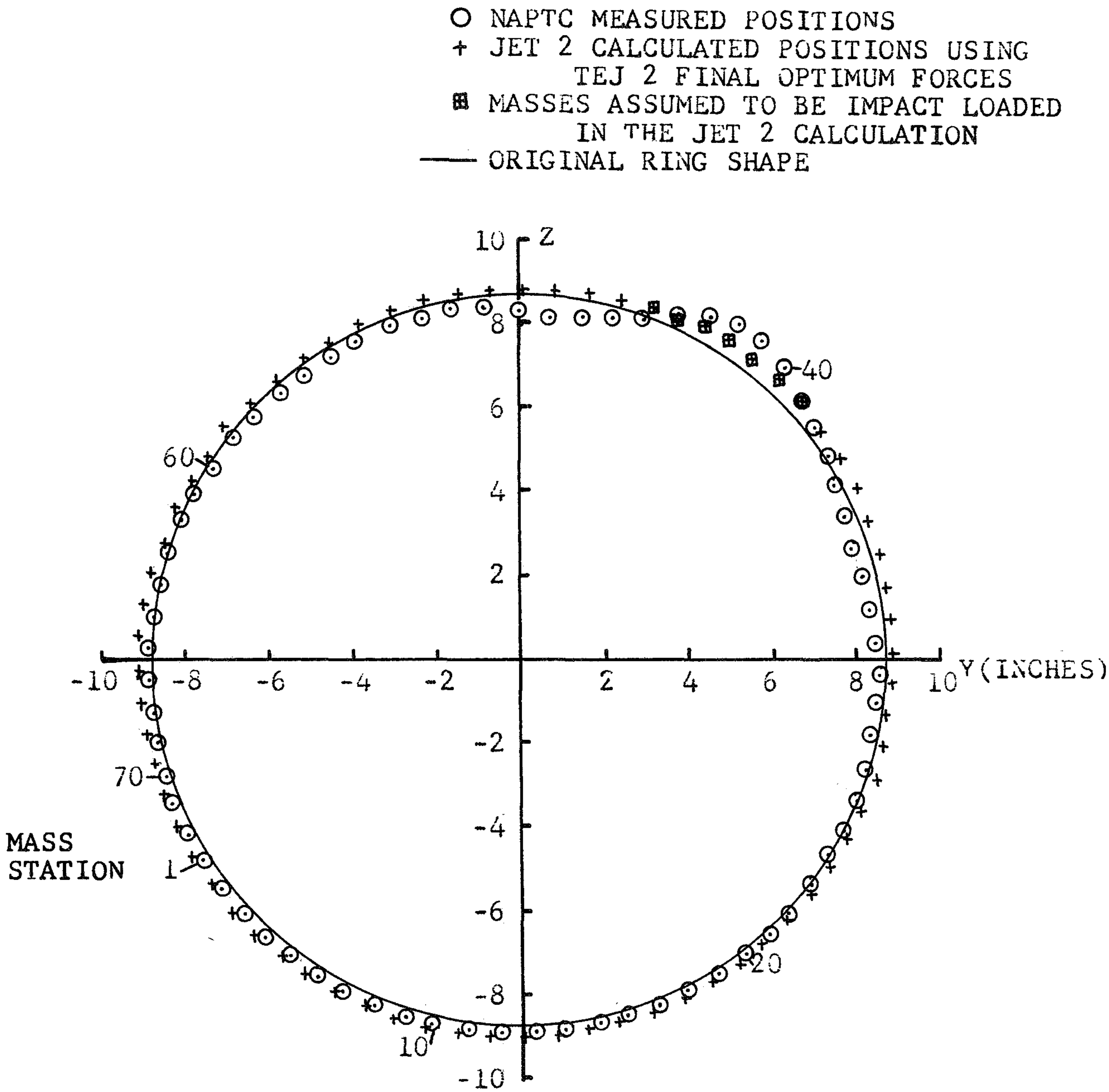


FIG. 15a PROFILE OF NAPTC TEST RING 88 AT TIME = 570 μSEC, REFERRED TO INERTIAL COORDINATES

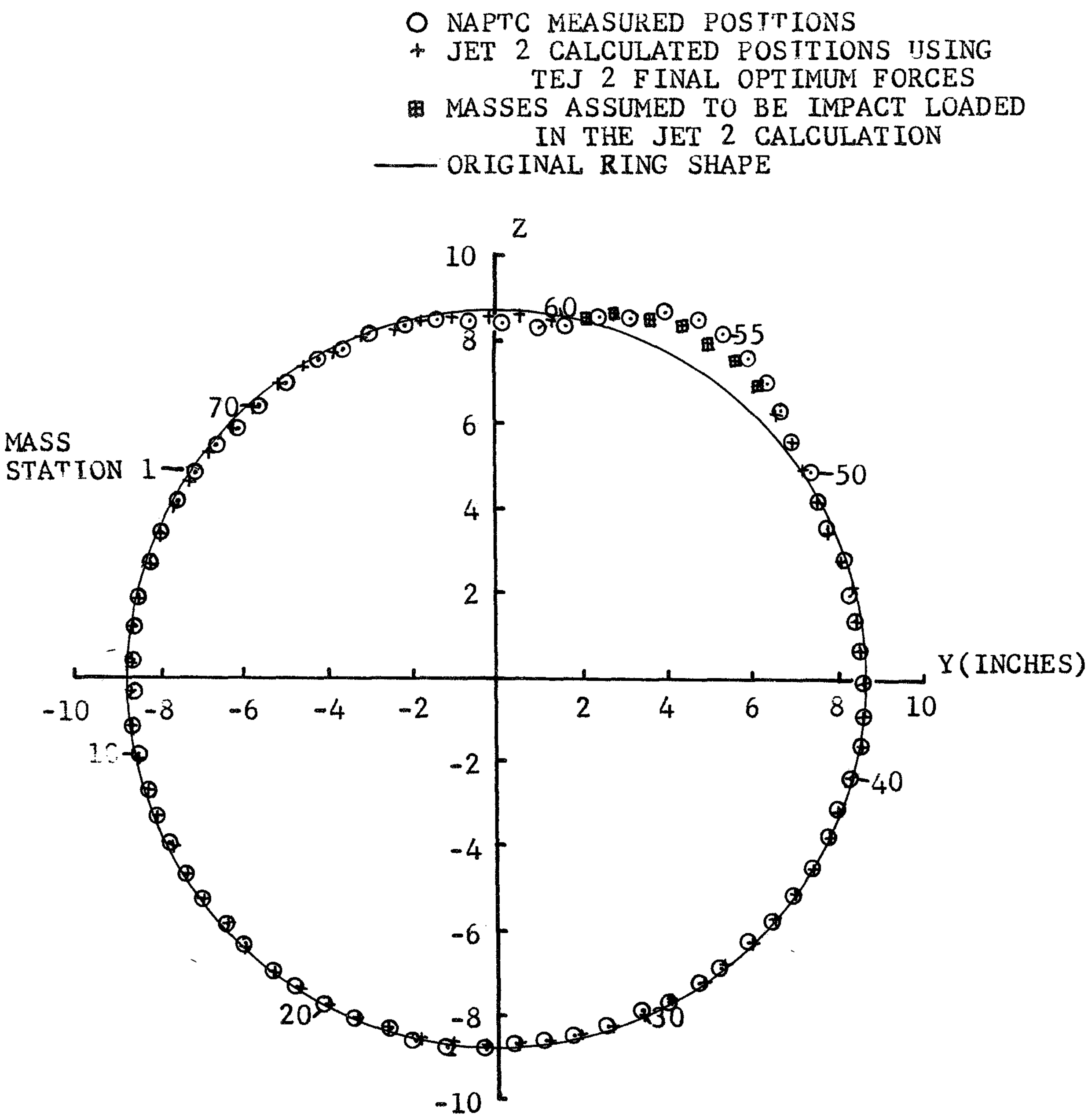


FIG. 15b PROFILE OF NAPTC TEST RING 91 AT TIME = 570 μSEC, REFERRED TO INERTIAL COORDINATES

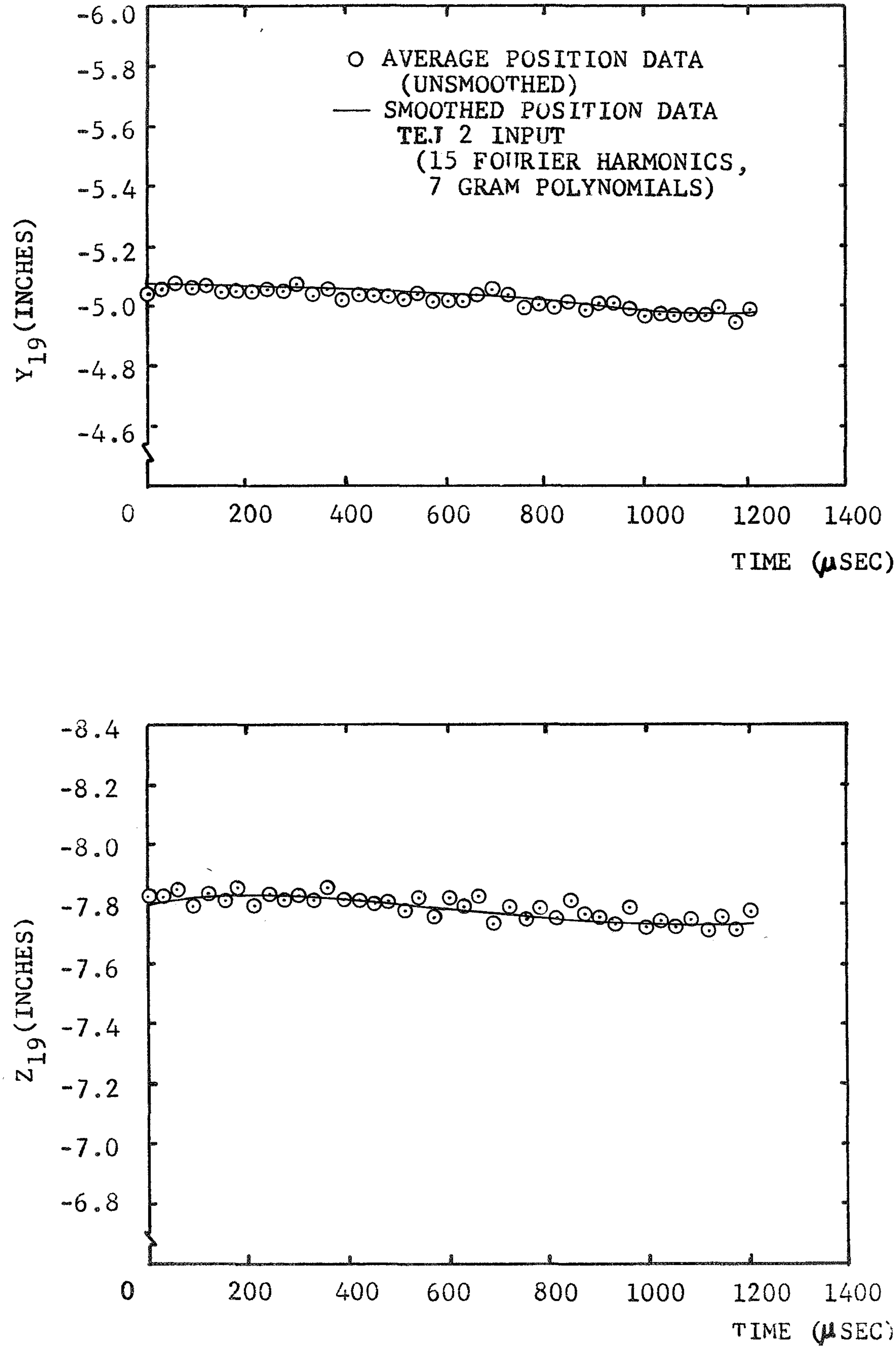


FIG. 16 MASS STATION 19 INERTIAL POSITION VS TIME FOR NAPTC TEST RING 91

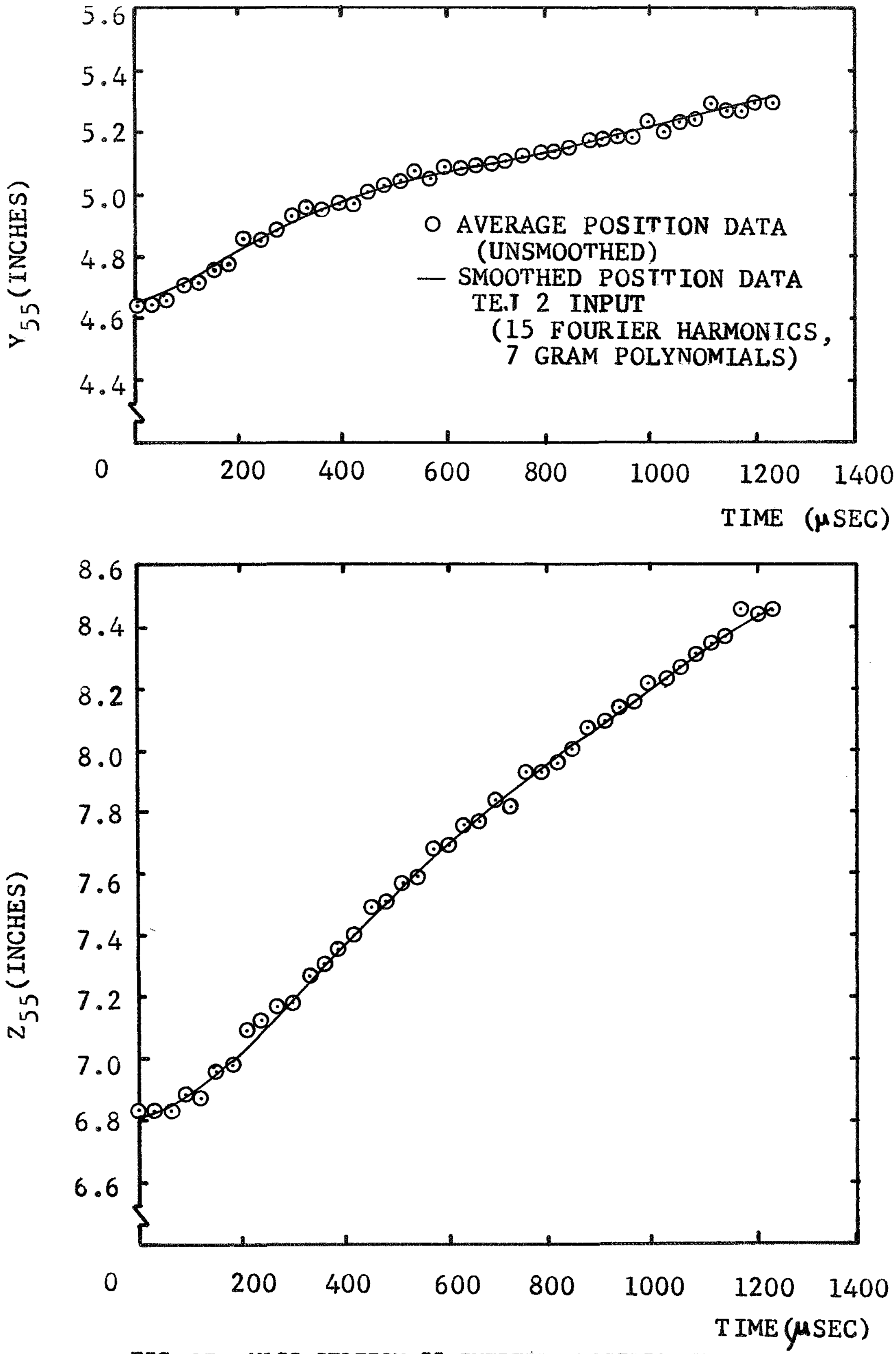


FIG. 17 MASS STATION 55 INERTIAL POSITION VS TIME FOR NAPTC TEST RING 91

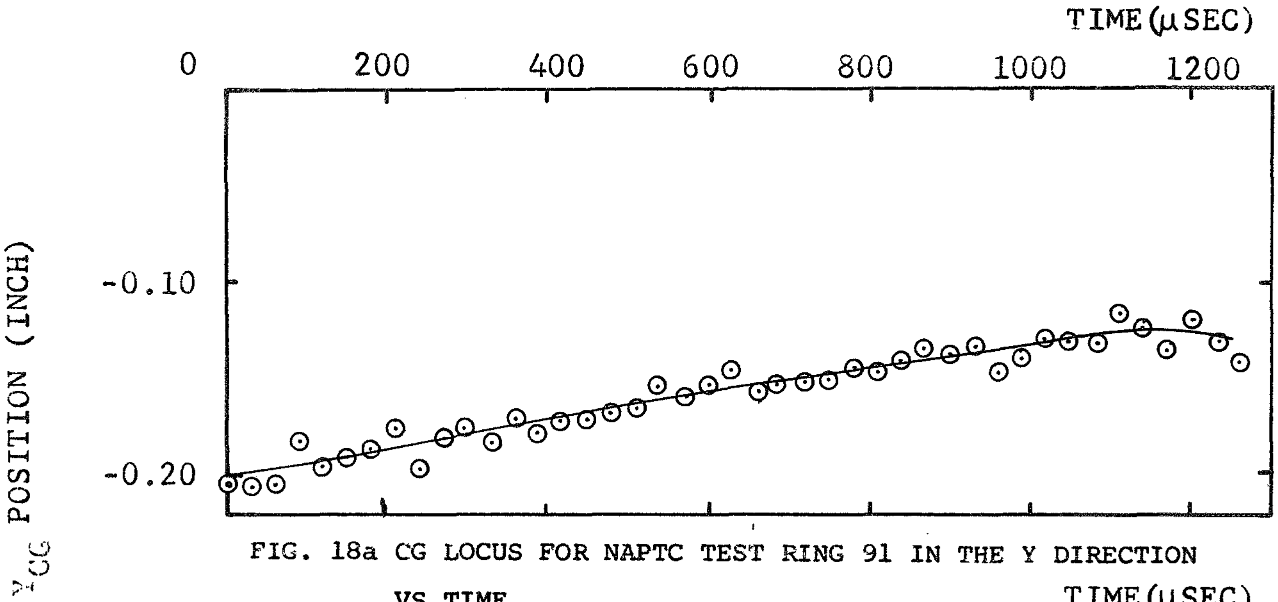


FIG. 18a CG LOCUS FOR NAPTC TEST RING 91 IN THE Y DIRECTION VS TIME

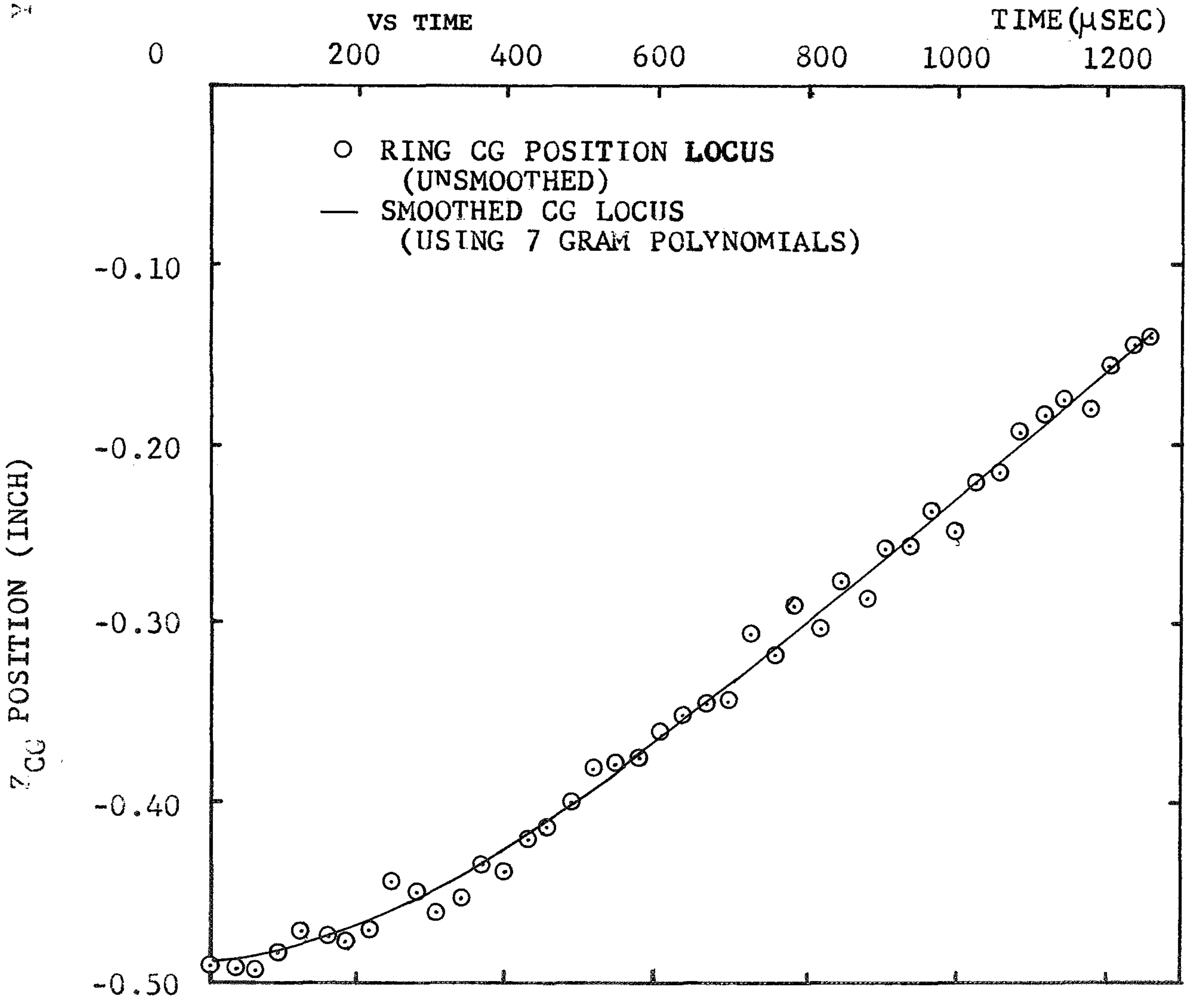


FIG. 18b CG LOCUS FOR NAPTC TEST RING 91 IN THE Z DIRECTION VS TIME

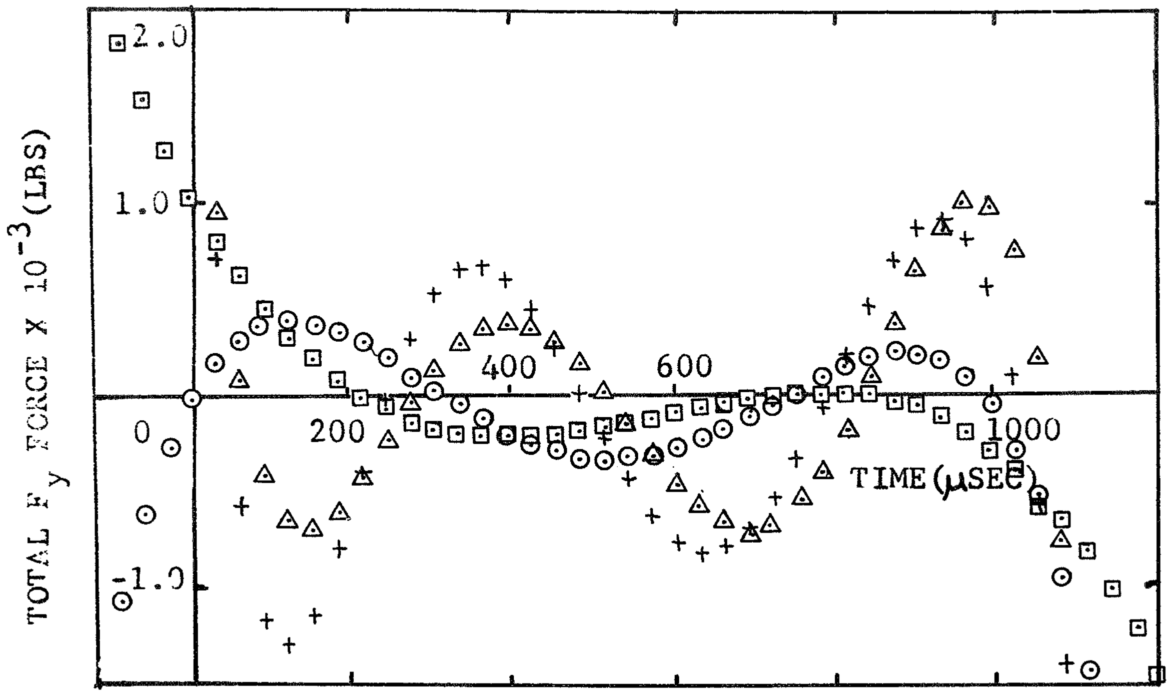


FIG. 19a TOTAL ESTIMATED EXTERNAL FORCE IN THE Y DIRECTION ACTING ON THE RING CG VS TIME USING AVERAGED POSITION DATA FROM NAPTC RING TEST 91

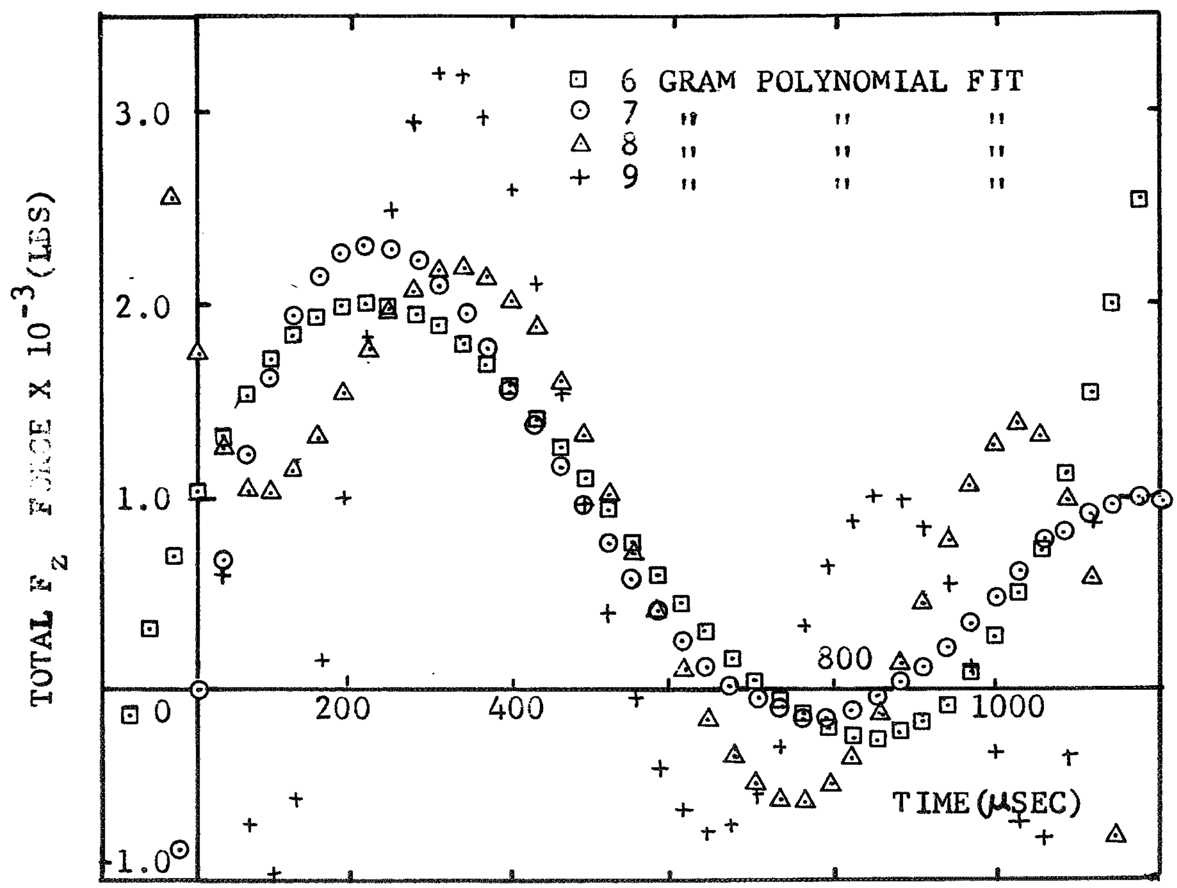


FIG. 19b TOTAL ESTIMATED EXTERNAL FORCE IN THE Z DIRECTION ACTING ON THE RING CG VS TIME USING AVERAGED POSITION DATA FROM NAPTC RING TEST 91

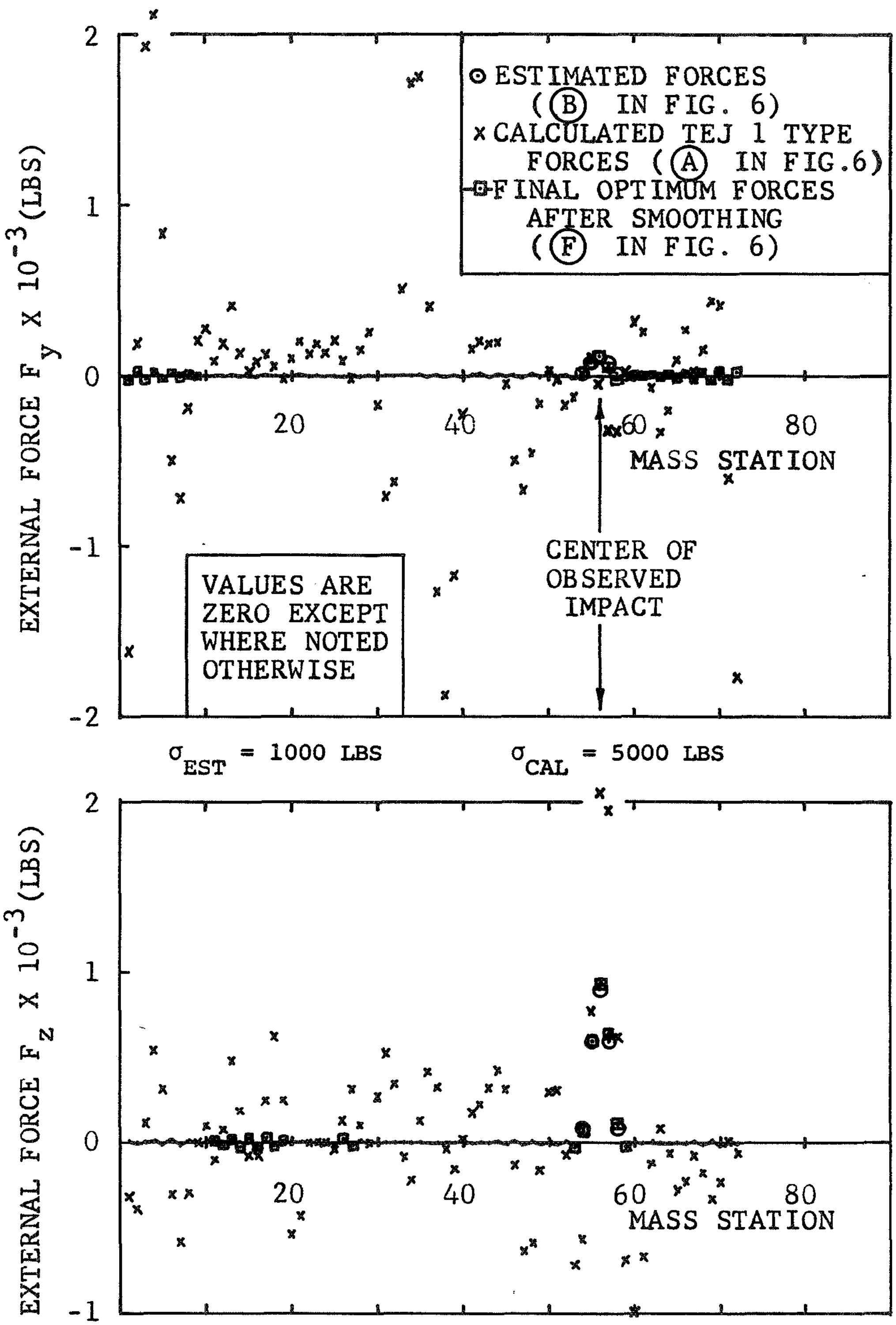


FIG. 20 FINAL OPTIMUM FORCES IN THE Y AND Z DIRECTIONS VS MASS STATION NUMBER OBTAINED FROM TEJ 2 AT TIME EQUALS 210 μSEC FOR NAPTC TEST RING 91, COMPARED WITH CALCULATED TEJ 1 TYPE FORCES AND WITH CG-LOCUS ESTIMATED FORCES

Appendix A

EVALUATION OF FORCES AND MOMENTS BY THE GAUSSIAN QUADRATURE METHOD

In the finite-difference formulation of the equilibrium equations used to calculate the transient response of the ring structure, it is necessary to evaluate the inplane stress and moment resultants at specific points around the ring. Since the structure can undergo elastic-plastic deformations, the thicknesswise state of plane stress assumed can be calculated conveniently only at a finite number of locations through the thickness. A numerical integration (or quadrature) scheme is then employed to evaluate the inplane stress and moment resultants.

Of the various classical quadrature methods available for use, Gaussian quadrature is probably the most efficient and popular of the methods used. This method requires, in general, abscissa values to be supplied at thicknesswise locations specified by irrational numbers, but the Gaussian quadrature method has been proven to be capable of supplying a comparable accuracy (compared to other numerical integration methods such as the center-value rule, or Simpson's rule) with half the number of terms.

All quadrature methods evaluate the following integral in the following manner [9]:

$$\int_{-1}^{1} f(x)\,dx \cong \sum_{j=1}^{N} W_j f(x_j)$$

where W_j are weighting factors whose values depend upon the location x_j and the method used, and $f(x_j)$ are the values of the function (stress, for example) at each x_j. The inplane forces and moments to be evaluated involve integrals of the form

$$\int_{-h/2}^{h/2} g(\zeta)\,d\zeta$$

Thus, by setting $x = 2\zeta/h$, the integral becomes:

$$\int_{-h/2}^{h/2} g(\zeta)\,d\zeta \cong \frac{h}{2}\sum_{j=1}^{N} W_j\, g(x_j)$$

Example calculations made in other elastic-plastic response studies [10] using a finite-difference method similar to that used in JET 2 with 4-point, 6-point, and 8-point Gaussian integrations, has shown that the difference in the transient deformation and strain results between using 4-point integration, and the 6- and 8-point integrations, was negligible. That study indicated that a 4-point Gaussian quadrature is sufficient for most problems of interest. Therefore, because of the lower computation time and simplicity in programming, it was decided to fix the number of stations used in the Gaussian quadrature for each layer of the multi-layer ring at 4 in the JET 2 program.

For a 4-point Gaussian quadrature, the values for x_j and W_j are tabulated as follows [9]:

j	x_j	W_j
1	+ 0.86113 63115 94053	0.34785 48451 37454
2	- 0.33998 10435 84856	0.65214 51548 62546
3	+ 0.33998 10435 84856	0.65214 51548 62546
4	- 0.86113 63115 94053	0.34785 48451 37454

APPENDIX B

USER INSTRUCTIONS FOR THE JET 2 COMPUTER PROGRAM

B.1 Introduction

This appendix presents the detailed information required to use the JET 2 program*, from a description of the required input to the presentation of three sample runs, with input and resultant output which can be employed by the user for checking the adaptation of the program to his computing facility. Included also are a partial list and explanation of the variable names used in the program and the FORTRAN IV listing of the JET 2 program.

B.2 Data Input Procedure

B.2.1 Input Data Required

The information required to punch a set of data cards for a run is presented in a step-by-step manner in the following. The variables to be punched on the nth data card are outlined in a box; to the right is the format to be used for that card; and finally, the definition and limits for each variable are given directly below. This is done for each card, in turn, until all are described.

Cards 1 through 6 are used to describe the ring geometry, the ring model makeup, and the program constants.

Card 1	Format
R , B , DELTAT	3E15.6

where

R — is the radius to the inner surface of the composite ring, in inches (see Fig. 1).

B — is the width of the composite ring in inches.

*Although the JET 2 program treats hard-bonded multi-layer rings having up to 3 layers each of different material, JET 2 may also be employed to analyze the transient responses of single-layer rings.

DELTAT is the time interval per cycle to be used in the running of the program. As noted in Ref. 2, DELTAT cannot be chosen arbitrarily, but is subject to the following stability criterion: DELTAT should be chosen so that it is slightly less (about 5%) than the smaller of the following two times:

$$\Delta T_{Long} = \frac{\Delta S}{\sqrt{\dfrac{\sum_{i=1}^{NRING} E_i h_i}{\sum_{i=1}^{NRING} \rho_i h_i}}} \tag{B.1}$$

$$\Delta T_{Lat} = \frac{\frac{1}{2}\Delta S^2}{\sqrt{\dfrac{\sum_{i=1}^{NRING} E_i I_i}{\sum_{i=1}^{NRING} \rho_i h_i}}} \tag{B.2}$$

where

ΔS is the distance between mass stations ($\approx 2\pi R/N$), $E_i = \sigma_1/\varepsilon_1$ of layer i, ρ_i and h_i are the density and thickness of layer i, respectively, and I_i is the area moment of inertia of each layer about the center-of-gravity axis of the total cross section divided by the ring width B, where NRING equals the number of layers in the composite ring. The program will compute and print out both times and choose a stable value for DELTAT if the value for DELTAT is set equal to zero in Card 1.

Card 2

N, NRING, M, M1, M2, IND	6I5

where

N	is the number of mass stations used to describe the composite ring (see Fig. 1). This number should be evenly divisible by 4 and cannot exceed 100.*
NRING	is the number of layers of different material used in the composite ring. This number cannot be greater than 3.
M	corresponds to the computation cycle number at which the run is to stop.
M1	is the cycle number at which regular printout is to begin.
M2	is the number of cycles between regular printout (i.e., print every M2 cycles).
IND	The bond(s)** will be tested for failure if IND=1; if IND=0, no tests will be made.

Card 3

NSFL(1),...., NSFL(NRING)	3I5

where

NSFL(1)	equals the number of mechanical sublayers in the strain-hardening model for the first layer and equals

---

*This limitation, and others which follow, apply to the program as listed in Appendix B. These limitations may be extended by altering the variable dimensions in the program.

**It is assumed that there is an inelastic, zero thickness bond between all layers in the multi-layer ring. If IND=1 is specified, the program computes, for each link, the shear stresses and strains in the circumferential direction between adjacent layers and compares them with SFAIL and AFAIL (given on data card 4), respectively.

the number of coordinate pairs $(\sigma_\ell, \epsilon_\ell)$ defining the polygonal approximation of the stress-strain curve for that material (see Fig. 5). The first layer of the maximum of 3 ring layers is defined to be the inside layer of the ring (see Fig. 1). NSFL(1) cannot exceed 5.

NSFL(2) equals the number of mechanical sublayers at any point in the second ring layer (second from the inside).

Continue until NSFL(NRING) is specified, where NRING is the total number of layers in the composite ring.

If IND on Card 2 equals 1, Card 4 must be punched. If IND=0, go directly to Card 5.

Card 4 presents the longitudinal strain and the shearing stress allowable for the bonds (all the bond strengths are assumed to be equal).

Card 4

AFAIL, SFAIL	2E15.6

where

AFAIL equals that value of bond extensional strain in the circumferential direction at which the bond(s) will "fail" (in/in).

SFAIL equals that value of bond shear stress at which the bond(s) will "fail" (psi).

Cards 5 and 6 describe the thickness and material constants for each layer.

Card 5a (for layer #1)

H(1), RHO(1), D(1), P(1)	4E15.6

where

H(1)	is the thickness of the first layer (in)
RHO(1)	is the mass density of the first layer ($lb\text{-}sec^2/in^4$)
D(1), P(1)	are the constants used in the strain-rate formula

$$\sigma_{y_\ell} = \sigma_{o_\ell}\left(1 + \left|\frac{\dot{\epsilon}}{D}\right|^{1/P}\right) \tag{B.3}$$

for the first ring layer (1); where (D) = (1/sec), σ_{Y_ℓ} is the rate dependent yield stress of mechanical sublayer (or subflange) ℓ, and σ_{o_ℓ} is the "static" yield stress of subflange ℓ, where $\sigma_{o_\ell} = E\varepsilon_{o_\ell}$ (see Ref. 2). If the material in ring layer 1 does not exhibit strain-rate sensitivity, set D(1)=0, and leave P(1) blank. Note that D and P are treated as unchanged from one mechanical sublayer to the next in each ring layer.

Card 6aa(still for layer #1)

EPSIL(1,1), SIGMA(1,1), EPSIL(2,1), SIGMA(2,1)	4E15.6

where

EPSIL(1,1), SIGMA(1,1)	make up the first coordinate pair of strain and stress in the first ring layer, which is used to define the polygonal approximation of the first layer's stress-strain diagram (see Fig. 5). The stress-strain diagram from which these values and those following are obtained must be upwardly-convex with nonnegative slopes ($\varepsilon(\ell, IR)$ = in/in and $\sigma(\ell, IR) = lb/in^2$), where IR refers to ring layer.

EPSIL(2,1) SIGMA(2,1)	make up the second coordinate pair in the first layer

Additional Cards 6ab and 6ac are punched in exactly the same manner as Card 6aa until the number of coordinate pairs equals NSFL(1) punched on Card 3 for layer 1. The total number of coordinate pairs must not exceed 5 for any layer. Do not include any unneeded (blank) cards.

Cards 5 through 6 are repeated for each additional layer in the composite ring until the number of sets of cards equals NRING (given in Card 2). The total number of sets of cards must not exceed 3.

Cards 7 through 9 are used to describe the initial impulse.

Card 7

IOTA, NV	2I5

where

IOTA	can equal 0, 1, or 2, depending on the type of impulse distribution in the ring's circumference (see Fig. 2).	
	If IOTA=0,	then no initial impulse is to be introduced.
	If IOTA=1,	the impulse will be defined at pertinent mass stations by defining appropriate initial velocities of each mass in data cards 8 which follow.
	If IOTA=2,	an impulse distribution, made up of one or more local sine-shaped initial velocity fields is specified. The peak velocity, the angle of inclination and the number of mass points over which each impulse is to be distributed, is specified below.
NV	If IOTA=0,	NV is not used and can be set = 0
	If IOTA=1,	NV is the total number of masses for which the velocity components are to be specified

in Cards 8a, 8b, ... , etc. (All other mass points not specified will have zero initial velocities)

If IOTA=2, NV is the number of local sine-shaped velocity fields to be specified in Cards 9a, 9b, etc.

If there is to be no impulse in the run, set IOTA=0, NV=0, and skip to Card 10.

If IOTA=1, then the following No. 8 card(s) must be included:

Card 8a

MASSNO, VRAD, VTAN	I5,2EI5.6

where

MASSNO — is the station (mass point) number at which the velocity components VRAD and VTAN are to be applied.

VRAD, VTAN — are the radial and the tangential velocities, respectively, applied to MASSNO (in/sec). VRAD is positive directed out, VTAN is positive directed counterclockwise (see Fig. 2).

Additional cards (8b, 8c, ...) are punched in the same manner until the total number of cards specifying the initial velocity equals NV given in Card 7. It is not necessary to list those mass points which have zero initial velocity.

Cards 9a, 9b, ... are included <u>only</u> if IOTA=2 in Card 7.

Card 9a

MASSES, MSTART, VEEZ, BETA	2I5,2E15.6

where

MASSES — is the number of mass stations over which the first sine-shaped impulse is to be distributed.

This number must be odd (see Fig. 2).

MSTART — is the number of the first mass in the group over which the sine-shaped impulse is to be distributed (i.e., the impulse is to be applied to mass points (MSTART), through and including (MSTART + MASSES - 1)).

VEEZ — is the peak value of the sine-shaped impulse distribution in inches per second. Thus the total impulse (lb-sec) imparted to the ring segment, due to this velocity distribution, will be:

$$I_{Tot} = \frac{2\ VEEZ}{\pi} \frac{RING\ MASS}{N} (MASSES - 1) \qquad (B.4)$$

BETA — is the angle at which this velocity distribution is applied to the ring referenced to the counterclockwise directed tangent in degrees (see Fig. 2).

Cards 9b, 9c are punched until the total number of No. 9 cards equals NV on Card 17.

The remaining cards (10 through 15) specify the amplitude, duration, and distribution of the subsequent forcing function.

The amplitude(s) of the forcing function (henceforth termed the nominal force(s))is specified by listing the coordinates of the forces versus time curves which describe the time-history of the forcing function. The program then linearly interpolates between these points to obtain the required force values at intermediate incremental times.

Card 10

TBEGIN, TFINAL, AMP1TY AMP1RZ	4E15.6

where

TBEGIN, TFINAL — are the times (in seconds) which define the beginning and the end, respectively, of the complete forcing function; i.e., the complete forcing function starts at TBEGIN and ends at TFINAL. If there is to be no forcing function during the run, set both TBEGIN and TFINAL equal to zero.

AMP1TY, AMP1RZ — are the initial Y and Z components, respectively, of the nominal force time history at time TBEGIN, in pounds if JOLT on Card 11a equals 2. If JOLT equals 3 on Card 11, only AMP1TY is used (leave AMP1RZ blank) and is the nominal force time history on the sinusoidal-shaped force distributions.

Card 10 will be the last data card if no forcing function is to be specified.

Card 11a

T2, JOLT, AMP2TY, AMP2RZ	E15.6, I5, 2E15.6

where

T2 — is the time of the second point to be specified on the nominal force versus time curve in seconds (see Figs. 3 and 4).

JOLT — on this card can equal 2 or 3 depending upon the method to be used to describe the distribution of the forcing function on the ring during the time lapse between T2 on this card and T1 read on Card 10. JOLT=1 must not be used on Card 11a. This is explained later.

AMP2TY, AMP2RZ — are the nominal force amplitudes of the second point to be specified. (If JOLT equals 3, only AMP2TY is used).

The circumferential force distribution resulting from the use of each value of JOLT is as follows (see Figs. 3 and 4):

If JOLT=2, the circumferential force distribution on the ring is to be specified at each loaded mass station by data input cards which follow this card (see Cards 13a, 13b, ...)

If JOLT=3, the circumferential force distribution is assumed to be one or more sine-shaped local force distributions applied to the ring at desired locations.

Cards 11b, 11c, ... , etc. have the same format as 11a and read successive values of T2, JOLT, AMP2TY, and AMP2RZ. T2, AMP2TY and AMP2RZ on each card give the coordinates of each succeeding point on the pressure versus time curve, and the value of JOLT on each card describes the method for describing the force distribution on the ring during the time between the value of T2 on that card and the value specified on the previous card. If JOLT is set equal to 1 on any card from 11b on, the program will use the distribution given by the last value of JOLT specified.

If JOLT=2 on any No. 11 card, then the following set of cards must follow directly. These specify GTY(MASS) and GRZ(MASS) at each loaded mass point (it is not necessary to specify zero forces), where GRZ(MASS) and GTY(MASS) are the ratios of either (a) the radial and tangential or (b) the z and y forces, respectively (depending on the value of NRTYZ given in the following card) at the (MASS) mass point, to the current nominal force interpolated by the program from values of AMP1TY, AMP1RZ and AMP2TY, AMP2RZ given in Cards 10 and 11a, b, ... The values of GRZ and GTY are henceforth termed "the normalized values of force" at each loaded mass station.

Card 12

NOF, NRTYZ	2I5

where

NOF is the number of mass stations on the ring at which forces are to be specified (all mass stations not specified will have zero forces)

NRTYZ — should be set equal to 2 if values of FZ and FY are to be read in. NYZRT should be set equal to 1 if values of radial and tangential forces are to be read in.

Card(s) 13a, b, ...

MASSNO, GTY(MASSNO), GRZ(MASSNO)	I5,2E15.6

where

MASSNO — is the mass station number at which the forces are to be applied.

GTY(MASSNO)
GRZ(MASSNO) — If NRTYZ equals 1, GRZ and GTY are the normalized values of force with respect to AMP2TY and AMP2RZ given in Card 11 in the radial and tangential directions, respectively at the MASSNO mass point. Radial is plus outwards, tangential is plus in the counter-clockwise tangential direction (see Fig. 3b). If NRTYZ equals 2, then GRZ and GTY are the normalized values of force with respect to AMP2TY and AMP2RZ given in Card 11 in the z and y directions, respectively, acting upon the (MASSNO) mass station.

Cards 13b, c, ... are repeated until the total number of No. 13 cards equals NOF given in Card 12.

If JOLT=3 on any No. 11 card, then the following set of cards must follow directly. These specify the local sine-shaped force distributions illustrated in Fig. 4.

Card 14

NUMS, RPM	I5,E15.6

where

NUMS — is the total number of sine-shaped distributions which are to be specified.

RPM — is the revolutions per minute, positive in the counterclockwise direction, at which all the sine-shaped forcing functions are traveling. If the forcing functions are stationary with time on the ring, set RPM=0.0.

Card 15a

NSTAT, MASSN, ANGL, RATIO	2I5, 2E15.6

where

NSTAT — is the first mass station at the beginning of the first forcing function (see Fig. 4). If RPM, specified on Card 14, is nonzero, then the forcing function position will start at NSTAT, where the pulse travel distance is based on elapsed time from the time at which JOLT=3 is first used.

MASSN — is the number of masses over which the first sine-shaped forcing function is distributed. This number must be odd.

ANGL — is the angle between the externally-applied force resultant vector and the counterclockwise-directed tangent (see Fig. 4), in degrees.

RATIO — is the ratio of the total externally-applied force (to be sine-distributed) to the current value of nominal force interpolated by the program from values of AMP1TY and AMP2TY given in Cards 10 and 11a, b, ...

Thus using RATIO and AMP1TY, AMP2TY, etc., one specifies the total force acting on the ring and the program distributes this in a half-sine fashion.

Cards 15b, 15c, ... are punched in the same manner until the total number of No. 15 cards equals NUMS on Card 14.

There is no limit to the number of No. 11 cards that can be used when specifying the total forcing function by coordinates of the force versus time curve. However, it is important that the final No. 11 card specify the nominal force at a time equal to or greater than TFINAL specified on Card 10, otherwise computation will stop and an error message will be printed out stating that further force data is required.

B.2.2 Input for Special Cases of the General Stress-Strain Relations

In the following, which apply to each layer in the composite ring, the specific data for three special cases of the general elastic, strain hardening constitutive relation handled by the computer program are given. Only the relevant data are noted:

(1) Purely Elastic Case

Set NSFL(layer)=1 on Card 3, and make EPSIL(1,layer) and SIGMA(1,layer) sufficiently high so that no plastic deformation occurs; for example,

EPSIL(1,layer)= 1.0, SIGMA(1,layer)=E(layer)

(2) Elastic, Perfectly-Plastic Case

Set NSFL(layer)=1 on Card 3 and make EPSIL(1,layer)= SIGMA(1,layer)/E(layer) on Card 6.

(3) Elastic, Linear Strain-Hardening Case

Set NSFL(layer)=2 on Card 3 and set
EPSIL(1, layer)= SIGMA(1,layer)/E_1(layer).
Also EPSIL(2,layer) and SIGMA(2,layer) on Card 6 are taken sufficiently high in order to avoid plastic deformation in

the second subflange. For example, EPSIL(2,layer)=1.0, and SIGMA(2,layer)=1.-EPSIL(2,layer)/E_2(layer) + SIGMA(1,layer).

B.3 Output

The printed output begins with a partial reiteration of the program input which identifies the problem solved. The information presented varies with the type of problem analyzed. Example outputs are presented at the end of this appendix in Subsections B.6.1.2, B.6.2.2, and B.6.3.2.

After the initial printout has been completed, the following information is printed out (this is done before the first cycle (J=0), after cycle M1 has been completed, and at every M2 cycle thereafter:

```
J = [J]      TIME = [TIME]

TOTAL ENERGY INPUT (in-lb) = [CINETT]
    KINETIC ENERGY (in-lb) = [CINET]
    ELASTIC ENERGY (in-lb) = [ELAST]
    PLASTIC WORK (in-lb)   = [PLAST]

The force distribution during this cycle is [...]

I     V     W     N     M     STRAIN     STRAIN
                               (in)       (out)
1
2
.
.
.
.
N
```

where

J = Cycle number

TIME = Elapsed time corresponding to the end of cycle J

CINETT = Total work done* by the impulse and subsequent forcing function on the entire ring (in-lb)

CINET = The current value of kinetic energy present in the ring (includes both the rigid body and relative kinetic energies)

ELAST = Elastic strain energy, energy stored in the entire ring (in-lb)

PLAST** = Plastic work done on entire ring (in-lb)

I = Mass point station number

V = The y-location V_i, of the ith mass point in inertial space* (in)

W = The z-location, W_i, of the ith mass point in inertial space* (in)

N = Axial force N_i in the ith link (lb)

M = Bending moment M_i at the ith mass point station (in-lb)

STRAIN(IN) = Strain on the inner surface of the ring at the ith mass point station.

STRAIN(OUT) = Strain on the outer surface of the ring at the ith mass point station.

---

*The coordinates V and W of the mass stations are measured from the original (time = 0) center of mass position of the ring. CINETT includes both the energy input into the ring (such as elastic energy relative to kinetic energy and plastic energy) and the energy used to accelerate the "rigid body" mass of the ring in the inertial coordinate system.

**The plastic work absorbed by the ring is estimated by subtracting the sum of the elastic and kinetic energies present in the ring from the total input energy (due to the impulse and subsequent forcing function). It should be mentioned that the approximate nature of this numerical calculation will sometimes yield impossible results such as negative values of plastic work or values greater than zero when the ring has not yet reached a plastic condition; thus the value of plastic work should be considered only approximate, and spurious results as noted above should be ignored.

Asterisks are printed to the right of the strain printout corresponding to the composite ring layer number whenever plastic yielding occurs in any of the control station mechanical subflanges in the layer at that station. T's and S's are also printed to denote bond failure in tension and shear, respectively, when IND is set equal to 1.

At the conclusion of each run, a statement FIRST YIELDING AT TIME = ... is printed out. This statement gives the time of the first plastic deformation ever to occur during the response. At that time, a printout of the above-illustrated kind is made (independent of the values of M1 and M2). If the response is purely elastic, no such statements or printouts are made. Similar printouts are made for the initial bond shear stress failure and the bond extensional-strain failure times when IND is set equal to 1.

B.4 Partial List of Variable Names Used in the JET 2 Program

SYMBOL	DESCRIPTION
ADDEN1	Work done on ring by external force(s) during current cycle.
AFAIL	Critical value of bond strain which will cause longitudinal bond failure.
AITCH(K)	Weighting factors (W_j) used in Gaussian Quadrature method for evaluating the stress and moment resultants (see Appendix A).
AMP1TY, AMP1RZ	Initial nominal force amplitudes in the tangential and radial or the y and z directions, respectively.
AMP	Current total interpolated value of the resultant nominal force amplitude
ASFL(L,IR)	Stress weighting factor of Lth subflange in IRth layer
B	Width of ring
BIGM(I)	Bending moment at the Ith mass station
BIGN(I)	The longitudinal force at the Ith mass station
C1(IR)	Young's Modulus of the IRth layer divided by the original link length

C2	DELTAT squared divided by the segment mass
C5(IR)	Equals 1.0/P(IR) if the material in the IRth layer is strain-rate dependent
C6(IR)	Equals 1.0/(D(IR)*DELTAT*E(1,IR))
CINETO	Initial total kinetic energy of ring
CINET	Kinetic energy of the sum of all the masses in the composite ring during the Jth cycle
CINETT	Total work done by all external forces and loadings up to the Jth cycle
CØST(I)	Cosine of the angle each link makes with the y-axis
CZETA(KNF)	Equals E(1, IR*ZETA(KNF)/DSO used to calculate stresses due to bending, where KNF refers to flange number
D(IR)	Constant used in strain rate formula, B3, for the IRth layer
DDS(I)	Circumferential change in the length of the Ith link during the Jth cycle
DDTH(I)	Incremental change of the angle between the Ith and the Ith+1 links during the Jth cycle, (+) if ring bends to increase ring curvature
DDV(I) } DDW(I) }	Elongation of the Ith link in the horizontal (y) and vertical (z) direction, respectively, during the Jth cycle
DELT1	2π/N
DELT2	π/N
DELTAT	Time interval per cycle
DS(I)	Current length of the Ith link
DSN	Total stress on the KNFth flange for the Ith mass due to both axial and bending strains

DSO	Initial link length
DTH(I)	Total link bending angle (curvature) summed from time = 0 between the Ith and the Ith+1 links
DTX(I)	Change in angle the Ith link makes with the horizontal from one time cycle to the next. Positive if link rotates counterclockwise
DV(I) } DW(I) }	Incremental change in position of the Ith mass point in the horizontal (y) and vertical (z) direction (respectively) during the Jth cycle
E(L,IR)	Young's Modulus of the Lth subflange in the IRth layer
EH(L,IR)	Young's Modulus times the thickness of the IRth layer. Used to calculate the number of flanges required per layer.
EHBIG	Maximum value of E(1,IR)*H(IR) of all the layers in the composite ring
EI	Sum of Young's Modulus times the moment of inertia of all the layers in the composite ring
ELAST	Total elastic energy present in the composite ring during the Jth cycle
EPSI(I)	Strain on the inner surface of the composite ring at the Ith mass station
EPSIL(L,IR)	Abscissa of the stress-strain curve for the Lth subflange in the IRth layer
EPSØN(I)	Strain on the outer surface of the composite ring at the Ith mass station
ECKS(K)	Distance constants x_j used in Gaussian quadrature method for evaluating stress and moment resultants (see Appendix A).

FY(I), FZ(I)	External force acting on the Ith mass segment in the horizontal and vertical direction, respectively.
H(IR)	Thickness of the IRth layer
HALFH(IR)	Half the thickness of the IRth layer
HCG	Distance from the inner surface to the center of gravity of the composite ring
HH(KNF)	Distance from the inner surface of the ring to the KNFth flange
HSUM	Sum of all the layer thicknesses = total thickness of the composite ring
HRHØ	Thickness times the density of the IRth layer
I	Subscript referring to mass station
IØTA	Used to specify type of initial impulse
IND	If IND equals one, program will test for bond failure
IR	Subscript referring to ring layer
J	Current cycle number
JBEGIN	Cycle number during which the forcing function begins to act
JØLT2	Dummy variable equal to the last value of JØLT given, other than 1
JØLT	Used to specify the pressure distribution function over the ring surface
LASTPR	Value of JØLT other than 1 that was last printed
LØAD	Equal 1 means forces are acting; equal 2 means not acting
MREAD, MWRITE, MPUNCH	Numbers for the data input tape unit, printed output tape unit and the punched output tape unit, respectively. These names must be assigned numbers in

	MAIN corresponding to the user's computing facility requirements
M	Cycle at which run is to stop
MRIP	Cycle during which first bond shear failure occurred
MSNAP	Cycle during which first longitudinal bond failure occurred
MTAPE	The printed output tape unit name; this must be assigned a number (in DESI) according to the user's computing facility
MYIELD	The cycle during which first yielding occurred
M1	Cycle at which regular printing starts
M2	Printout will occur every M2 cycles
M3	M3 greater than zero signifies a continuation run
N	Total number of mass points in the ring
NBØND	Number of bonds in composite ring = NRING - 1
NFL	Total number of control stations used in each layer which forms the composite ring
NGIVEN	A variable equal to the value of JOLT, other than 1, last read
NHALF	N/2
NREAD	Dummy variable which controls the reading-in of force-time data
NRING	Total number of layers in the composite ring
NSFIR NSFL(IR)	Total number of subflanges in each flange in the IRth layer
NSNAP	Calls PRINT in MAIN when the first bond tension failure occurs

NRIP	Calls PRINT in MAIN when the first bond shear failure occurs
NYIELD	A dummy variable which calls PRINT when yielding first occurs
N1	N + 1
N2	N
P(IR)	Constant used in strain-rate formula, Eq. B.3 for the IRth layer
PLAST	Total plastic work done up to Jth cycle
PULSEN	Total work done by external forces on the semi-ring up to the Jth cycle
Q(I)	Shear force acting on the Ith mass
R	Distance from the ring's center to its undeformed inner surface
RHCG	Distance from the center of the ring to the undeformed composite ring's cross-sectional center of gravity (see Fig. 1)
RHØ(IR)	Density of the material used in the IRth layer
RIP(NB,I)	Prints out an "S" when the shear stress in the NBth bond at the Ith mass station exceeds a specified value
SFAIL	Critical value of bond stress which will cause bond shear failure
SIGMA(L,IR)	Ordinate of the stress-strain curve for the Lth mechanical sublayer in the IRth layer
SINT(I)	Sine of the angle the Ith link makes with the y-axis
SNAP(NB,I)	Prints out a "T" when the longitudinal strain in the NBth bond at the Ith mass station exceeds a specified value

SNDS	Stress on the flanges of the IRth ring due to axial strain
SNO(L,IR)	Yield stress of the Lth subflange in the IRth layer
SNY	Yield stress taking strain-rate effects into account
SN1(K,IR,I)	Stress on the Lth mechanical sublayer in the KKth flange of the IRth layer at the Ith mass station, where K = (KK-1)*NSFIR + L
STRANE	The current elongation of the Ith link
TB	Shear force on the NBth bond at the Ith station
TBEGIN TFINAL	Times when overall forcing function starts acting and stops acting, respectively
TEST	Bond shear stress between the IRth and IRth + 1 layers at the Ith mass station
THETA	Angle of the Ith initial mass radius with respect to the z-axis
TIME	Current time (= J*DELTAT)
T1, T2	Times at which a straight line segment of the force versus time curve starts and stops acting, respectively
V(I),W(I)	Horizontal and vertical distance from the z-axis and y-axis to Ith mass point, respectively
XTRA(100)	Extra locations reserved in blank common for convenience purposes
YIELD	Controls whether a blank or asterisk is printed according to an elastic or strain-hardened control-station condition, respectively
ZETAB	Distance from the composite ring's center of gravity to the NBth bond

ZMP Mass per unit length of circumference of the composite ring times R

ZØØM1
ZØØM2 The calculated values of DELTAT based on the longitudinal and lateral vibration

B.5 FORTRAN IV Program Listing for JET 2

The following program and subroutines are listed in this subsection in the following order:

1. JET 2 MAIN Program
2. IDENT
3. IMPULS
4. FORCE
5. STRESS
6. STRAIN
7. EQUIL
8. PRINT

```
C     JET 2 PROGRAM
      COMMCN AFAIL,AITCH(4),AMP1TY,AMP1RZ,AMP,ASFL(5,3),BIGM(101),
     1BIGN(101),B,C1(3),C2,C5(3),C6(3),CINETO,CINETT,COST(101),CZETA(12)
     2,D(3),DDS(101),DDTH(101),DELT2,DELTAT,DSO,DS(101),DTH(101),DTX(101
     3),DV(101),DW(101),E(6,3),EHBIG,EH(6,3),EPSIL(5,3),EPSI(101),
     4EPSO(101),ECKS(4),FY(101),FZ(101),HALFH(3),HCG,HH(12),H(3),HSUM,
     5P(3),PIE,PULSEN,Q(101),RIP(2,101),RHCG,RHC(3),R,SFAIL,SIGMA(5,3),
     6SINT(101),SMIN,VDEL(101),WDEL(101),SNO(5,3),SN1(6C,3,101),
     7SNAP(2,101),T1,T2,TB(3),TBEGIN,TFINAL,TIME,V(101),W(101),
     8YIELD(3,101),ZETAB(3),ZETA(12),ZMP,ZOOM1,ZCOM2,XTRA(100),FNIR2(3)
      COMMCN I2,IND,IOTA,J,JOLT2,JOLT,LASTPR,LOAD,M3,MM3,M,MPUNCH,
     1MREAD,MRIP,MSNAP,MWRITE,MYIELD,N1,N2,NBOND,NFL,NGIVEN,NHALF,
     2NLIM,NREAD,NRING,NRIP,NSNAP,N,NSFL(3),NV,NYIELD
      DATA BLANK/' '/
      MREAD=5
      MWRITE=6
      MPUNCH=7
      PIE=3.14159265
C     DEFINE THE CONSTANTS TO BE USED FOR THE GAUSSIAN QUADRATURE
      AITCH(1)=0.347855
      AITCH(2)=C.652145
      AITCH(3)=0.652145
      AITCH(4)=C.347855
      ECKS(1)=-0.861136
      ECKS(2)=-C.339981
      ECKS(3)=+C.339981
      ECKS(4)=+0.861136
      READ(MREAD,1) R,B,DELTAT,N,NRING,M,M1,M2,IND,(NSFL(IR),IR=1,NRING)
    1 FORMAT(3E15.6/6I5/3I5)
      IF(IND.GT.C) READ(MREAD,88) AFAIL,SFAIL
   88 FORMAT(4E15.6)
      DO 2 IR=1,NRING
      NSFIR = NSFL(IR)
    2 READ(MREAD,88) H(IR),RHO(IR),D(IR),P(IR),
     1 (EPSIL(L,IR), SIGMA(L,IR), L = 1,NSFIR)
      FMOM=H(1)**2*RHO(1)/2.0
      HRHO=H(1)*RHO(1)
      VCG=H(1)/2.0
      HSUM=H(1)
      IF(NRING.EQ.1)  GO TO 4
      DO 3 IR=2,NRING
      VCG=VCG+(H(IR)+H(IR-1))/2.0
      FMOM=FMOM+VCG*H(IR)*RHO(IR)
      HSUM=HSUM+H(IR)
    3 HRHO=HRHO+H(IR)*RHO(IR)
    4 HCG=FMOM/HRHO
      RHCG=R+HCG
      DO 5 IR=1,NRING
      E(1,IR)=SIGMA(1,IR)/EPSIL(1,IR)
    5 EH(1,IR)=E(1,IR)*H(IR)
      NFL=4
      NYIELD=C
      NSNAP=0
      NRIP=0
      NHALF= N/2
      NHALF1=NHALF+1
      DELT2=PIE/N
      DELT1=DELT2*2.0
      DSO=2.0*RHCG*SIN (DELT2)
      NBOND=NRING-1
```

```
      ZMP=0.0
      DO 12 IR=1,NRING
      FNIR2(IR)=0.0
      HALFH(IR)=H(IR)/2.0
      C1(IR)=E(1,IR)/DSO
      ZMP=ZMP+RHO(IR)*RHCC*B*H(IR)
      NSFIR=NSFL(IR)
      IF(NSFL(IR)-1) 34,11,9
    9 DO 10 L=2,NSFIR
   10 E(L,IR)=(SIGMA(L,IR)-SIGMA(L-1,IR))/(EPSIL(L,IR)-EPSIL(L-1,
     1IR))
   11 E(NSFIR+1,IR)=0.0
      DO 12  L=1,NSFIR
      ASFL(L,IR)=HALFH(IR)*B*(E(L,IR)-E(L+1,IR))/E(1,IR)
   12 SNO(L,IR)=E(1,IR)*EPSIL(L,IR)
      HZ = 0.0
      NF = 0
      DO 16 IR=1,NRING
      DO 15 K=1,NFL
      KNF  =  K + NF
      HH(KNF)=HZ+HALFH(IR)*(1.-FCKS(K))
      ZETA(KNF)=HCG-HH(KNF)
   15 CZETA(KNF)   = -C1(IR) * ZETA(KNF)
      NF=NF+NFL
      HZ = HZ + H(IR)
   16 ZETAB(IR)=HCG-HZ
      ZOOM1=0.0
      IF(DELTAT.GT.0.0) GO TO 121
C     DETERMINATICN CF DELTAT IF NOT GIVEN
C     FINC EFFECTIVE EI
      TOP=0.0
      BOTTCM=C.C
      EI=0.0
      NF=0
      DO 113 IR=1,NRING
      TOP=TOP+E(1,IR)*H(IR)
      BOTTOM=BOTTOM + RHO(IR)*H(IR)
      DO 112 K=1,NFL
  112 EI=EI+E(1,IR)*HALFH(IR)*AITCH(K)*ZETA(K+NF)**2
  113 NF=NF+NFL
C     TIME INTERVAL BASED ON THE LONGITUDINAL VIBRATICN EQUATICN
      ZOCM1=DSO/SQRT (TOP/BOTTOM)
C     TIME INTERVAL BASED CN THE LATERAL VIBRATICN EQUATION
      ZOOM2=0.5*DSO**2/SQRT (EI/(BOTTOM*B))
      DELTAT=ZOOM1
      IF(ZOOM1.GT.ZOOM2) DELTAT=ZOOM2
      MP=0
   17 DELTAT=DELTAT*10.
      MP=MP+1
      IF(DELTAT.LT.10) GO TO 17
      DELTAT=INT(DELTAT*.95)*10.**(-MP)
  121 C2=DELTAT**2/ZMP/DELT1
      DO 8 IR=1,NRING
      IF(D(IR).EQ.0.0) GO TC 8
      C5(IR)=1.0/P(IR)
      C6(IR)=1.0/D(IR)/DELTAT/E(1,IR)
    8 CONTINUE
      DO 18 IR=1,NRING
      TB(IR)=0.C
      DO 18 I=1,N
```

```
 18 YIELD(IR,I)=BLANK
    MYIFLD= 0
    MSNAP=0
    MRIP=0
    J= 0
    TIME =  0.0
    PULSEN= 0.0
    N4=N/4
    THETA=-DELT2
    THETA2=-DELT1
    N34=3*N4
    DO 180 I=1,N4
    THETA=THETA+DELT1
    NIT2=NHALF1-I
    NIT3=NHALF+I
    NIT4=N-I+1
    V(I)=RHCG*SIN(THETA)
    W(I)=-RHCG*COS(THETA)
    V(NIT2)=V(I)
    W(NIT2)=-W(I)
    V(NIT3)=-V(I)
    W(NIT3)=W(NIT2)
    V(NIT4)=V(NIT3)
    W(NIT4)=W(I)
    THETA2=THETA2+DELT1
    COST(I)=COS(THETA2)
    SINT(I)=SIN(THETA2)
    COST(I+N4)=-SINT(I)
    SINT(I+N4)=COST(I)
    COST(I+NHALF)=-COST(I)
    SINT(I+NHALF)=-SINT(I)
    COST(I+N34)=SINT(I)
180 SINT(I+N34)=-COST(I)
    DO 20 I=1,N
    FY(I)= 0.0
    FZ(I)= 0.0
    DV(I)= 0.0
    DW(I)= 0.0
    DS(I)= DS0
    DTH(I) = 0.0
    EPSI(I) = 0.0
    EPSC(I) = 0.0
    BIGN(I) = 0.0
    BIGM(I) = 0.0
    IF(NBOND.EQ.0) GO TO 19
    DO 181 IB=1,NBOND
    RIP(IB,I)=BLANK
181 SNAP(IB,I)=BLANK
 19 DO 20 IR=1,NRING
    NSFIR=NSFL(IR)
    DO 20 KK=1,NFL
    DO 20 L=1,NSFIR
    K=(KK-1)*NSFIR+L
 20 SN1(K,IR,I) = 0.0
    CALL IMPULS
    READ(MREAD,88) TBEGIN,TFINAL,AMP1TY,AMP1RZ
    NGIVEN=1
    NREAD=0
    LASTPR=0
    JOLT2=1
```

```
      T1=TBEGIN
      LOAD =2
      IF(TBEGIN.GT.0.0.OR.TFINAL.EQ.0.0) GO TO 24
      LOAD=1
      CALL FORCE
   24 CALL PRINT
      IF(LOAD.EQ.1) CALL EQUIL
   25 J= J+1
      CALL STRAIN
      CALL STRESS
      TIME=DELTAT*J
      LCAD=2
      IF(TIME.LT.TBEGIN.OR.TIME.GT.TFINAL) GC TO 26
      LCAD=1
      CALL FORCE
   26 CALL EQUIL
   30 IF(J-M1) 31,32,301
  301 M1=J+M1-1
   31 IF(NYIELD) 33,311,33
  311 IF(NSNAP) 33,312,33
  312 IF(NRIP) 33,35,33
   32 M1=M1+M2
   33 TIME=DELTAT*J
      CALL PRINT
      NYIELC=0
      NSNAP=C
      NRIP=C
   35 IF(J-M) 25,36,36
   36 IF(MYIELC) 37,391,37
C     PRINTED CUTPUT AT CONCLUSION OF RUN.
   37 TIME=DELTAT*MYIELD
      WRITE(MWRITE,38) TIME
   38 FCRMAT(28H0     FIRST YIELDING AT TIME=F10.6)
  391 IF(IND) 40,40,392
  392 IF(MSNAP)393,395,393
  393 TIME=DELTAT*MSNAP
      WRITE(MWRITE,394) TIME
  394 FORMAT(41H0      TIME OF FIRST BCND TENSION FAILURE =F10.7)
  395 IF(MRIP) 396,40,396
  396 TIME=DELTAT*MRIP
      WRITE(MWRITE,397) TIME
  397 FORMAT(39H0      TIME OF FIRST BOND SHEAR FAILURE =F10.7)
   40 CCNTINUE
   34 CALL EXIT
      END
      SUBRCUTINE IDENT
      COMMON AFAIL,AITCH(4),AMP1TY,AMP1RZ,AMP,ASFL(5,3),BIGM(101),
     1BIGN(101),B,C1(3),C2,C5(3),C6(3),CINETO,CINETT,COST(101),CZETA(12)
     2,D(3),DDS(101),DDTH(101),DELT2,DELTAT,DSO,DS(101),DTH(101),DTX(1C1
     3),DV(101),DW(101),E(6,3),EHBIG,EH(6,3),EPSIL(5,3),EPSI(101),
     4EPSO(101),ECKS(4),FY(101),FZ(101),HALFH(3),HCG,HH(12),H(3),HSUM,
     5P(3),PIE,PULSEN,Q(101),RIP(2,101),RHCG,RHC(3),R,SFAIL,SIGMA(5,3),
     6SINT(1C1),SMIN,VDEL(101),WDEL(101),SNO(5,3),SN1(6C,3,101),
     7SNAP(2,101),T1,T2,TB(3),TBEGIN,TFINAL,TIME,V(1C1),W(101),
     8YIELD(3,101),ZETAB(3),ZETA(12),ZMP,ZOOM1,ZCCM2,XTRA(100),FNIR2(3)
      COMMON I2,IND,IOTA,J,JOLT2,JOLT,LASTPR,LOAD,M3,MM3,M,MPUNCH,
     1MREAD,MRIP,MSNAP,MWRITE,MYIELD,N1,N2,NBOND,NFL,NGIVEN,NHALF,
     2NLIM,NREAD,NRING,NRIP,NSNAP,N,NSFL(3),NV,NYIELD
      WRITE(MWRITE,805) R,B,HSUM,HCG,N,NRING
  805 FORMAT(63H1    JET 2     A PROGRAM USED TC CALCULATE THE RESPCNSE OF
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   1 A FREE/63H     CIRCULAR MULTI-LAYERED RING WITH THE FOLLOWING PARA
   2METERS.-/
   3/52H     RADIUS OF RING TO INNER SURFACE  (IN.)          = F10.5
   4/52H     WIDTH  OF RING      (IN.)                       = F10.5
   5/52H     THICKNESS OF RING  (IN.)                        = F10.5
   6/52H     CENTROIDAL DISTANCE FROM INNER SURFACE  (IN.) = F10.5    /
   7/52H     NUMBER OF MASS POINTS USED IN THE RING          = I6/
   8/52H     NUMBER OF LAYERS USED IN RING CROSS SECTION     = I6     /)
    DO 8052 IR=1,NRING
8051 FORMAT('      NUMBER OF CONTROL STATIONS USED IN LAYER',I2,4X,
   1'=',I7//4X,'NUMBER OF MECHANICAL SUBLAYERS AT EACH'/5X,
   2'CONTROL STATION IN LAYER',I2,19X,'=',I7/
   3/22H     THICKNESS OF LAYER,I2,26X,2H= F10.5//)
8052 WRITE(MWRITE,8051) IR,NFL    ,IR,NSFL(IR),IR,H(IR)
    IF(ZCOM1.GT.0.0) WRITE(MWRITE,8062) ZCOM2,ZCOM1
8062 FORMAT(55H0   TIME INTERVAL BASED ON LATERAL VIBRATION EQUATION =
   1E16.8/ ,60H    TIME INTERVAL BASED ON LONGITUDINAL VIBRATION EQUAT
   2ION =  E16.8/)
    WRITE(MWRITE,8061) DELTAT
8061 FORMAT(  52H    TIME INTERVAL PER CYCLE USED IN PROGRAM (SEC) =
   1E18.8/)
    IF(IOTA.GT.0) GO TO (3,4),IOTA
    WRITE(MWRITE,2)
  2 FORMAT(31H0   THERE IS NO INITIAL IMPULSE)
    GO TO 820
  3 WRITE(MWRITE,807)
 807 FORMAT ('0   AN ARBITRARY IMPULSE LOADING HAS BEEN SPECIFIED AS DE
   1SCRIBED BY INPUT CARDS')
    GO TO 5
  4 WRITE(MWRITE,809)
 809 FORMAT ('0   LOCALIZED SINE SHAPED IMPULSE LOADING(S) HAS (HAVE) B
   1EEN SPECIFIED')
  5 WRITE(MWRITE,98)
 98 FORMAT('0   THE INITIAL VELOCITY INPUT IS AS FOLLOWS..'// '     MAS
   1S',5X,'V DOT',8X,'W DOT',8X,'MASS',5X,'V DOT',8X,'W DOT'//)
    DO 99 I=1,NHALF
    II=I+NHALF
 99 WRITE(MWRITE,100) I,VDEL(I),WDEL(I),II,VDEL(II),WDEL(II)
 100 FORMAT(I7,2E13.4,I9,2E13.4)
 820 JBEGIN=TBEGIN/DELTAT
    IF(M-JBEGIN)838,838,835
 835 PLEN=TFINAL-TBEGIN
    WRITE(MWRITE,836)             TBEGIN,TFINAL,PLEN
 836 FORMAT('0   STARTING TIME OF FORCING FUNCTION (SEC)  =',F10.7
   1/'     STOPPING TIME OF FORCING FUNCTION (SEC)  =',F10.7
   2/'     DURATION OF THE  FORCING FUNCTION (SEC)  =',F10.7)
    RETURN
 838 WRITE(MWRITE,839)
 839 FORMAT('0   THERE IS NO TIME DEPENDENT FORCE DISTRIBUTION DURING T
   1HIS RUN')
    RETURN
    END
    SUBROUTINE IMPULS
    COMMON AFAIL,AITCH(4),AMP1TY,AMP1RZ,AMP,ASFL(5,3),BIGM(101),
   1BIGN(101),B,C1(3),C2,C5(3),C6(3),CINETO,CINETT,COST(101),CZETA(12)
   2,D(3),DDS(101),DDTH(101),DELT2,DELTAT,DSO,DS(101),DTH(101),DTX(101
   3),DV(101),DW(101),E(6,3),EHBIG,EH(6,3),EPSIL(5,3),EPSI(101),
   4EPSO(101),ECKS(4),FY(101),FZ(101),HALFH(3),HCG,HH(12),H(3),HSUM,
   5P(3),PIE,PULSEN,Q(101),RIP(2,101),RHCG,RHO(3),R,SFAIL,SIGMA(5,3),
   6SINT(101),SMIN,VDEL(101),WDEL(101),SNO(5,3),SN1(60,3,101),
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     7SNAP(2,101),T1,T2,TB(3),TBEGIN,TFINAL,TIME,V(101),W(101),
     8YIELD(3,101),ZFTAB(3),ZETA(12),ZMP,ZOOM1,ZOOM2,XTRA(100),FNIR2(3)
      COMMON I2,IND,IOTA,J,JOLT2,JOLT,LASTPR,LOAD,M3,MM3,M,MPUNCH,
     1MREAD,MRIP,MSNAP,MWRITE,MYIELD,N1,N2,NBOND,NFL,NGIVEN,NHALF,
     2NLIM,NREAD,NRING,NRIP,NSNAP,N,NSFL(3),NV,NYIELD
      READ(MREAD,95) IOTA,NV
      IF(IOTA.EQ.0)  RETURN
      DO 2 I=1,N
      VDEL(I)=0.0
    2 WDEL(I)=0.0
      GO TO (90,94),IOTA
   90 DO 93 IMAZ=1,NV
      READ(MREAD,92) MASSNO,VRAD,VTAN
   92 FORMAT(I5,2E15.6)
      IF(MASSNO.GT.N) GO TO 101
      THETA=DELT2*(2*MASSNO-1)
      VDEL(MASSNO)=(VRAD*SIN(THETA)+VTAN*COS(THETA))
   93 WDEL(MASSNO)=(-VRAD*COS(THETA)+VTAN*SIN(THETA))
      GO TO 97
C     ASSUME SINE DISTRIBUTION, NOTE..., NO. OF MASSES MUST BE ODD
   94 DO 96 NFR=1,NV
      READ(MREAD,95) MASSES,MSTART,VEEZ,BETA
   95 FORMAT(2I5,2E15.6)
      BETA=BETA*PIE/180.
      DTETA=PIE/((MASSES-1)*2)
      WIDTH=2.*PIE/(MASSES-1)
      ALESS=0
      MASS2=1+MASSES/2
      THETA=DELT2*(2*(MASS2+MSTART)-1)
      DO 96 KAREA=1,MASS2
      MAZZ=MSTART-1+KAREA
      MAZZA=MSTART+MASSES-KAREA
      IF(MAZZ.GT.N) MAZZ=MAZZ-N
      IF(MAZZA.GT.N) MAZZA=MAZZA-N
      TATA=((KAREA-1)*2+1)*DTETA
      VCITY=VEEZ*(1-COS(TATA))/WIDTH-ALESS
      ALESS=ALESS+VCITY
      VTAN=VCITY*COS(BETA)
      VRAD=VCITY*SIN(BETA)
      VDEL(MAZZ)=VDEL(MAZZ)+VRAD*SIN(THETA)+VTAN*COS(THETA)
      WDEL(MAZZ)=WDEL(MAZZ)-VRAD*COS(THETA)+VTAN*SIN(THETA)
      VDEL(MAZZA)=VDEL(MAZZA)+VRAD*SIN(THETA)+VTAN*COS(THETA)
   96 WDEL(MAZZA)=WDEL(MAZZA)-VRAD*COS(THETA)+VTAN*SIN(THETA)
   97 DO 105 I=1,N
      DV(I)=VDEL(I)*DELTAT
  105 DW(I)=WDEL(I)*DELTAT
      GO TO 103
  101 WRITE(MWRITE,102)
  102 FORMAT('1THERE IS AT LEAST ONE MASS NUMBER GIVEN FOR IMPULSE INITI
     1AL VELOCITY WHICH IS GREATER THAN THE STATED NUMBER OF MASSES,'/,
     2'PLEASE CHECK YOUR DATA...')
      CALL EXIT
  103 RETURN
      END
      SUBROUTINE FORCE
      COMMON AFAIL,AITCH(4),AMP1TY,AMP1RZ,AMP,ASFL(5,3),BIGM(101),
     1BIGN(101),B,C1(3),C2,C5(3),C6(3),CINETO,CINETT,COST(101),CZETA(12)
     2,D(3),DDS(101),DDTH(101),DELT2,DELTAT,DSO,DS(101),DTH(101),DTX(101
     3),DV(101),DW(101),E(6,3),EHBIG,EH(6,3),EPSIL(5,3),EPSI(101),
     4EPSO(101),ECKS(4),FY(101),FZ(101),HALFH(3),HCG,HH(12),H(3),HSUM,
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     5P(3),FIE,PULSEN,Q(101),RIP(2,101),RHCG,RHO(3),R,SFAIL,SIGMA(5,3),
     6SINT(101),SMIN,VDEL(101),WDEL(101),SNO(5,3),SN1(60,3,101),
     7SNAP(2,101),T1,T2,TB(3),TBEGIN,TFINAL,TIME,V(101),W(101),
     8YIELD(3,101),ZETAB(3),ZETA(12),ZMP,ZOOM1,ZOOM2,XTRA(100),FNIR2(3)
      COMMON I2,IND,IOTA,J,JOLT2,JOLT,LASTPR,LOAD,M3,MM3,M,MPUNCH,
     1MREAD,MRIP,MSNAP,MWRITE,MYIELD,N1,N2,NBOND,NFL,NGIVEN,NHALF,
     2NLIM,NREAD,NRING,NRIP,NSNAP,N,NSFL(3),NV,NYIELD
      DIMENSION GRZ(101),GTY(101),CANG(10),SANG(10),ANGL(10),RATIO(10),
     1PIEP(10),NSTAT(10),MASSN(10),MA(101)
      DIMENSION RESULT(100)
      IF(NREAD.GT.0) GO TO 15
    1 READ(MREAD,2) T2,JOLT,AMP2TY,AMP2RZ
    2 FORMAT(E15.6,I5,2E15.6)
      NREAD=1
      SLOPEY=(AMP2TY-AMP1TY)/(T2-T1)
      SLOPEZ=(AMP2RZ-AMP1RZ)/(T2-T1)
      IF(JOLT.NE.3) GO TO 10
      NGIVEN=3
      DSZH=DSC/2.
      CIRC=2.*PIE*RHCG/60.
      READ(MREAD,3) NUMS,RPM,(NSTAT(I),MASSN(I),ANGL(I),RATIO(I),I=1,NUM
     1S)
    3 FORMAT(I5,E15.6/(2I5,2E15.6))
      IF(NREAD.EQ.1) TBEG=TIME
      NREAD=2
      CIRCR=CIRC*RPM
      JOLT2=3
      DO 5 I=1,NUMS
      TILT=ANGL(I)*PIE/180.
      STILT=SIN(TILT)
      CTILT=COS(TILT)
      PIEP(I)=PIE/DSC/(MASSN(I)-1)
      MAV=NSTAT(I)+MASSN(I)/2
      IF(MAV.GT.N) MAV=MAV-N
      ANG=(2.*MAV-1)*DELT2
      SYN=SIN(ANG)
      QCS=COS(ANG)
      SANG(I)=SYN*CTILT-QCS*STILT
    5 CANG(I)=QOS*CTILT+SYN*STILT
      GO TO 15
   10 IF(JOLT.EQ.1) GO TO 15
      NGIVEN=1
      JOLT2=2
   15 IF(TIME.LE.T2) GO TO 18
      T1=T2
      AMP1TY=AMP2TY
      AMP1RZ=AMP2RZ
      GO TO 1
   18 AMPTY=AMP1TY+(TIME-T1)*SLOPEY
      AMPRZ=AMP1RZ+(TIME-T1)*SLOPEZ
      AMP=SQRT(AMPTY**2+AMPRZ**2)
      IF(NGIVEN.EQ.2) GO TO 30
      GO TO (20,25,35),JOLT2
   20 WRITE(MWRITE,21) TIME
   21 FORMAT('OFORCE DISTRIBUTION ON RING NOT DEFINED, CHECK YOUR DATA A
     1ROUND T=',E15.6,' SECONDS')
      CALL EXIT
   25 NGIVEN=2
      DO 26 I=1,N
      GRZ(I)=0.0
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26 GTY(I)=0.0
   READ(MREAD,27) NOF,NRTYZ
27 FORMAT(2I5)
   DO 29 IN=1,NOF
28 FORMAT(I5,2E15.6)
29 READ(MREAD,28) MA(IN),GTY(MA(IN)),GRZ(MA(IN))
30 DO 31 IN=1,NOF
   MAN=MA(IN)
   FY(MAN)=AMPTY*GTY(MAN)
31 FZ(MAN)=AMPRZ*GRZ(MAN)
   IF(NRTYZ.EQ.2) RETURN
   DO 32 IN=1,NOF
   MAN=MA(IN)
   ANG=(2.*MAN-1)*DELT2
   QOS=COS(ANG)
   SYN=SIN(ANG)
   FYMAN=FY(MAN)
   FY(MAN)=FZ(MAN)*SYN+FY(MAN)*QOS
32 FZ(MAN)=FYMAN*SYN-FZ(MAN)*QOS
   RETURN
35 ARCL=CIRCR*(TIME-TBEG)
   NMASS=(ARCL+DSZH)/DSO
   BIT=ARCL-NMASS*DSO+DSZH
   DO 40 I=1,NUMS
   KSTAT=NSTAT(I)+NMASS-1
   FATOR=AMPTY*RATIO(I)/2.
   TOTAL=0.0
   MEND=MASSN(I)
   DO 40 MM=1,MEND
   MAZ=KSTAT+MM
   IF(MAZ.GT.N) MAZ=MAZ-N
   ANGLE=PIEP(I)*(BIT+DSO*(MM-1))
   IF(ANGLE.GT.PIE) ANGLE=PIE
   FS=1.-COS(ANGLE)-TOTAL
   TOTAL=TOTAL+FS
   FY(MAZ)=FY(MAZ)+FS*CANG(I)*FATOR
40 FZ(MAZ)=FZ(MAZ)+FS*SANG(I)*FATOR
   RETURN
   END
   SUBROUTINE STRESS
   COMMON AFAIL,AITCH(4),AMP1TY,AMP1RZ,AMP,ASFL(5,3),BIGM(101),
  1BIGN(101),B,C1(3),C2,C5(3),C6(3),CINETO,CINETT,COST(101),CZETA(12)
  2,D(3),DDS(101),DDTH(101),DELT2,DELTAT,DSO,DS(101),DTH(101),DTX(101
  3),DV(101),DW(101),E(6,3),EHBIG,EH(6,3),EPSIL(5,3),EPSI(101),
  4EPSO(101),ECKS(4),FY(101),FZ(101),HALFH(3),HCG,HH(12),H(3),HSUM,
  5P(3),PIE,PULSEN,Q(101),RIP(2,101),RHCG,RHO(3),R,SFAIL,SIGMA(5,3),
  6SINT(101),SMIN,VDEL(101),WDEL(101),SNO(5,3),SN1(60,3,101),
  7SNAP(2,101),T1,T2,TB(3),TBEGIN,TFINAL,TIME,V(101),W(101),
  8YIELD(3,101),ZETAB(3),ZETA(12),ZMP,ZOOM1,ZOOM2,XTRA(100),FNIR2(3)
   COMMON I2,IND,IOTA,J,JOLT2,JOLT,LASTPR,LOAD,M3,MM3,M,MPUNCH,
  1MREAD,MRIP,MSNAP,MWRITE,MYIELD,N1,N2,NBOND,NFL,NGIVEN,NHALF,
  2NLIM,NREAD,NRING,NRIP,NSNAP,N,NSFL(3),NV,NYIELD
   DIMENSION FNIR1(3)
   DATA ASTER/'*'/,BLANK/' '/,ESS/'S'/,TEEE/'T'/
   DO 32 I=1,N
   BIGN(I)= 0.0
   BIGM(I)= 0.0
   NF = 0
   IF(IND) 9,9,1
 1 IF(I-1) 4,4,2
```

```
  2 DO 3 IR=1,NRING
  3 FNIR1(IR)=FNIR2(IR)
  4 DO 5 IR=1,NRING
  5 FNIR2(IR)=0.0
    STRANE=DS(I)-DSO
    DO 8 NB=1,NBOND
    DBOND=(STRANE-DTH(I)*ZETAB(NB))/DSO
    IF(DBOND-AFAIL)8,6,6
  6 SNAP(NB,I)=TEEE
    IF(MSNAP)8,7,8
  7 MSNAP=J
    NSNAP=1
  8 CONTINUE
  9 DO 26 IR=1,NRING
    YIELD(IR,I)=BLANK
    SNDS=C1(IR)*DDS(I)
    DO 25 KK=1,NFL
    KNF=KK+NF
    FN = 0.0
    NSFIR=NSFL(IR)
    DSN=SNDS+DDTH(I)*CZETA(KNF)
    IF(D(IR).GT.0.0) RFACTR=1.+(C6(IR)*ABS(DSN))**C5(IR)
    DO 23 L=1,NSFIR
    K=(KK-1)*NSFIR+L
    SN1( K,IR,I)=SN1( K,IR,I)+DSN
    IF(D(IR).EQ.0.0) GO TO 16
 10 IF(SN1(K,IR,I)-SNO(L,IR)) 13,22,11
 11 SNY=SNO(L,IR)*RFACTR
    IF(SN1(K,IR,I)-SNY) 22,22,12
 12 SN1(K,IR,I)=SNY
    GO TO 20
 13 IF(SN1(K,IR,I)+SNO(L,IR)) 14,22,22
 14 SNY=SNO(L,IR)*RFACTR
    IF(SN1(K,IR,I)+SNY) 15,22,22
 15 SN1(K,IR,I)=-SNY
    GO TO 20
 16 IF(SN1(K,IR,I)-SNO(L,IR)) 18,22,17
 17 SN1(K,IR,I)=SNO(L,IR)
    GO TO 20
 18 IF(SN1(K,IR,I)+SNO(L,IR)) 19,22,22
 19 SN1(K,IR,I)=-SNO(L,IR)
 20 YIELD(IR,I)=ASTER
    IF(MYIELD) 22,21,22
 21 MYIELD=J
    NYIELD= 1
 22 FN=FN+SN1(K,IR,I)*ASFL(L,IR)*AITCH(KK)
 23 CONTINUE
    BIGN(I)= BIGN(I)+FN
    BIGM(I)=BIGM(I)+FN*ZETA(KNF)
    IF(IND)25,25,24
 24 FNIR2(IR)=FNIR2(IR)+FN
 25 CONTINUE
    NF = NF + NFL
 26 CONTINUE
    IF(IND) 32,32,27
 27 IF(I-1) 32,32,28
 28 DO 31 IR=1,NBOND
    NN=IR+1
    TB(NN)= FNIR2(IR)-FNIR1(IR)+TB(IR)
    TEST=ABS(TB(NN)/(DS(I)*B))
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```
      IF(TEST-SFAIL) 31,29,29
   29 RIP(IP,I)=ESS
      IF(MRIP)31,30,31
   30 MRIP=J
      NRIP=1
   31 CONTINUE
   32 CONTINUE
      RETURN
      END
      SUBROUTINE STRAIN
      COMMON AFAIL,AITCH(4),AMP1TY,AMP1RZ,AMP,ASFL(5,3),BIGM(101),
     1BIGN(101),B,C1(3),C2,C5(3),C6(3),CINETO,CINETT,COST(101),CZETA(12)
     2,D(3),DDS(101),DDTH(101),DELT2,DELTAT,DSO,DS(101),DTH(101),DTX(101
     3),DV(101),DW(101),E(6,3),EHBIG,EH(6,3),EPSIL(5,3),EPSI(101),
     4EPSO(101),ECKS(4),FY(101),FZ(101),HALFH(3),HCG,HH(12),H(3),HSUM,
     5P(3),PIE,PULSEN,Q(101),RIP(2,101),RHCG,RHO(3),R,SFAIL,SIGMA(5,3),
     6SINT(101),SMIN,VDEL(101),WDEL(101),SNO(5,3),SN1(60,3,101),
     7SNAP(2,101),T1,T2,TB(3),TBEGIN,TFINAL,TIME,V(101),W(101),
     8YIELD(3,101),ZETAB(3),ZETA(12),ZMP,ZOOM1,ZOOM2,XTRA(100),FNIR2(3)
      COMMON I2,IND,IOTA,J,JOLT2,JOLT,LASTPR,LOAD,M3,MM3,M,MPUNCH,
     1MREAD,MRIP,MSNAP,MWRITE,MYIELD,N1,N2,NBOND,NFL,NGIVEN,NHALF,
     2NLIM,NREAD,NRING,NRIP,NSNAP,N,NSFL(3),NV,NYIELD
      IF(SINT(1).LT.1E-08) SINT(1)=0.0
      DO 402 I=1,N
      K=I-1
      IF(K.EQ.0) K=N
      DDV=DV(I)-DV(K)
      DDW=DW(I)-DW(K)
      DDS(I)= DDV*COST(I)+DDW*SINT(I)
      SINTI = SINT(I)
      DTX(I)= (DDW*COST(I)-DDV*SINT(I))/DS(I)
      SINT(I)= SINTI+COST(I)*DTX(I)
  402 COST(I)= COST(I)-SINTI*DTX(I)
      DO 403 I=1,N
      K=I+1
      IF(K.GT.N) K=1
      DDTH(I)=DTX(K)-DTX(I)
  403 DTH(I) = DTH(I)+DDTH(I)
      DO 404 I=1,N
      V(I) = V(I)+DV(I)
      W(I) = W(I)+DW(I)
  404 DS(I)= DS(I)+DDS(I)
      RETURN
      END
      SUBROUTINE EQUIL
      COMMON AFAIL,AITCH(4),AMP1TY,AMP1RZ,AMP,ASFL(5,3),BIGM(101),
     1BIGN(101),B,C1(3),C2,C5(3),C6(3),CINETO,CINETT,COST(101),CZETA(12)
     2,D(3),DDS(101),DDTH(101),DELT2,DELTAT,DSO,DS(101),DTH(101),DTX(101
     3),DV(101),DW(101),E(6,3),EHBIG,EH(6,3),EPSIL(5,3),EPSI(101),
     4EPSO(101),ECKS(4),FY(101),FZ(101),HALFH(3),HCG,HH(12),H(3),HSUM,
     5P(3),PIE,PULSEN,Q(101),RIP(2,101),RHCG,RHO(3),R,SFAIL,SIGMA(5,3),
     6SINT(101),SMIN,VDEL(101),WDEL(101),SNO(5,3),SN1(60,3,101),
     7SNAP(2,101),T1,T2,TB(3),TBEGIN,TFINAL,TIME,V(101),W(101),
     8YIELD(3,101),ZETAB(3),ZETA(12),ZMP,ZOOM1,ZOOM2,XTRA(100),FNIR2(3)
      COMMON I2,IND,IOTA,J,JOLT2,JOLT,LASTPR,LOAD,M3,MM3,M,MPUNCH,
     1MREAD,MRIP,MSNAP,MWRITE,MYIELD,N1,N2,NBOND,NFL,NGIVEN,NHALF,
     2NLIM,NREAD,NRING,NRIP,NSNAP,N,NSFL(3),NV,NYIELD
      ADDEN1=0.0
      DO 2 I=1,N
      K=I-1
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      IF(K.EQ.0) K=N
    2 Q(I)=(BIGM(I)-BIGM(K))/DS(I)
      IF(J.GT.0) GO TO 3
      DO 4 I=1,N
      FY(I)=FY(I)/2.
    4 FZ(I)=FZ(I)/2.
    3 DO 5 I=1,N
      K=I+1
      IF(K.GT.N) K=1
      DV(I)=DV(I)+C2*(BIGN(K)*COST(K)-BIGN(I)*COST(I)-Q(K)*SINT(K)+
     1Q(I)*SINT(I)+FY(I))
      DW(I)=DW(I)+C2*(BIGN(K)*SINT(K)-BIGN(I)*SINT(I)+Q(K)*COST(K)-
     1Q(I)*COST(I)+FZ(I))
      ADDEN1=ADDEN1+FY(I)*DV(I)+FZ(I)*DW(I)
      FY(I)=0.0
    5 FZ(I)=0.0
C     CALCULATION OF THE QUANTITY USED IN DETERMINING THE WORK PERFORMED
C      BY THE FORCES ACTING ON THE RING
      PULSEN=PULSEN+ADDEN1
      RETURN
      END
      SUBROUTINE PRINT
      COMMON AFAIL,AITCH(4),AMP1TY,AMP1RZ,AMP,ASFL(5,3),BIGM(101),
     1BIGN(101),B,C1(3),C2,C5(3),C6(3),CINETO,CINETT,COST(101),CZETA(12)
     2,D(3),DDS(101),DDTH(101),DELT2,DELTAT,DSO,DS(101),DTH(101),DTX(101
     3),DV(101),DW(101),E(6,3),EHBIG,EH(6,3),EPSIL(5,3),EPSI(101),
     4EPSO(101),ECKS(4),FY(101),FZ(101),HALFH(3),HCG,HH(12),H(3),HSUM,
     5P(3),PIE,PULSEN,Q(101),RIP(2,101),RHCG,RHO(3),R,SFAIL,SIGMA(5,3),
     6SINT(101),SMIN,VDEL(101),WDEL(101),SN0(5,3),SN1(60,3,101),
     7SNAP(2,101),T1,T2,TB(3),TBEGIN,TFINAL,TIME,V(101),W(101),
     8YIELD(3,101),ZETAB(3),ZETA(12),ZMP,ZCCM1,ZCCM2,XTRA(100),FNIR2(3)
      COMMON I2,IND,IOTA,J,JOLT2,JOLT,LASTPR,LOAD,M3,MM3,M,MPUNCH,
     1MREAD,MRIP,MSNAP,MWRITE,MYIELD,N1,N2,NBOND,NFL,NGIVEN,NHALF,
     2NLIM,NREAD,NRING,NRIP,NSNAP,N,NSFL(3),NV,NYIELD
      DIMENSION RITE(3)
      DATA BLANK/' '/,WON/'1'/,TEW/'2'/,TREE/'3'/
C     CALCULATION OF RELATIVE ENERGIES AND PLASTIC WORK EXPERIENCED.
      IF(J.EQ.0) CALL IDENT
      CINET=0.0
      DO 711 I=1,N
  711 CINET=CINET+DV(I)*DV(I)+DW(I)*DW(I)
      CINET=CINET/C2/2.0
      IF(J.EQ.0) CINETO=CINET
      ELAST=0.0
      DO 716 IR=1,NRING
      NSFIR=NSFL(IR)
      DO 716 L=1,NSFIR
      SUM= 0.0
      DO 715 KK=1,NFL
      K=(KK-1)*NSFIR+L
      DO 715 I=1,N
  715 SUM= SUM+SN1( K,IR,I)*SN1( K,IR,I)*AITCH(KK)
  716 ELAST=ELAST+SUM*ASFL(L,IR)/C1(IR)/2.
      DO 717 I=1,N
      ES= DS(I)-DSO
      ETI=HCG*DTH(I)
      ETO=(HSUM-HCG)*DTH(I)
      EPSI(I)=(ES-ETI)/DSO
  717 EPSO(I)=(ES+ETO)/DSO
  718 CINETT=CINETO+PULSEN
```

```
      PLAST=CINETT-CINET-ELAST
  730 WRITE(MWRITE,731) J,TIME,CINETT,CINET,ELAST,PLAST
  731 FORMAT('1     J=',I5,'  TIME=',F10.7/'       TOTAL ENERGY INPUT (IN.-
     1LB.) =',F10.3/'         KINETIC ENERGY (IN.-LB.)  =',F10.3/'
     2 ELASTIC ENERGY (IN.-LB.)  =',F10.3/   '        PLASTIC WORK   (IN
     3.-LB.)  =',F10.3)
      GO TO (34,1),LOAD
    1 WRITE(MWRITE,2)
    2 FORMAT('0    NO FORCING FUNCTION IS ACTING DURING THIS CYCLE')
      NGIVEN=1
      GO TO 19
   34 WRITE(MWRITE,4) AMP
    4 FORMAT('0    THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS',F12
     1.4,' LBS'/'0    THE FORCE DISTRIBUTION DURING THIS CYCLE')
      IF(NGIVEN)42,42,40
   40 IF(LASTPR-NGIVEN)41,17,41
   41 LASTPR=NGIVEN
      GO TO (42,13,16),NGIVEN
   42 WRITE(MWRITE,6)
    6 FORMAT(34H      IS UNDEFINED, CHECK YOUR DATA)
      CALL EXIT
   13 WRITE(MWRITE,131)
  131 FORMAT('      IS DEFINED BY NORMALIZED INPUT VALUES OF GY(I), AND G
     1Z(I)')
      GO TO 19
   16 WRITE(MWRITE,161)
  161 FORMAT('      IS COMPOSED OF ONE OR MORE SINE SHAPED FORCE DISTRIBU
     1TIONS'/6X,'ACTING AT SPECIFIED LOCATIONS ON THE RING')
      GO TO 19
   17 WRITE(MWRITE,18)
   18 FORMAT(32H      IS THE SAME AS LAST PRINTED)
   19 IF(IND.GT.0) IF(J) 10,10,11
      WRITE(MWRITE,7) (I,I=1,NRING)
    7 FORMAT('0I',6X,'V',8X,'W',8X,'N',7X,'M     STRAIN   STRAIN    LAYER'
     1/40X,'(IN)     (OUT)    ' ,3I2)
      DO 8  I=1,N
    8 WRITE(MWRITE,9) I,V(I),W(I),BIGN(I),BIGM(I),EPSI(I),EPSO(I),
     1(YIELD(IR,I),IR=1,NRING)
    9 FORMAT(I3,2F9.4,F9.1,F7.1,2F8.4,3X,3A2)
      RETURN
   10 RITE(1)=WON
      RITE(2)=BLANK
      RITE(3)=BLANK
      IF(NRING.GE.2) RITE(2)=TEW
      IF(NRING.EQ.3) RITE(3)=TREE
   11 WRITE(MWRITE,12) (RITE(I),I=1,3),(I,I=1,NBOND)
   12 FORMAT('0I',6X,'V',8X,'W',8X,'N',7X,'M     STRAIN   STRAIN   LAYER'
     1,5X,'BOND'/40X,'(IN)     (OUT)    ',3A2,2I5)
      DO 14  I=1,N
   14 WRITE(MWRITE,15) I,V(I),W(I),BIGN(I),BIGM(I),EPSI(I),EPSO(I),
     1(YIELD(IR,I),IR=1,3),(RIP(IB,I),SNAP(IB,I),IB=1,NBOND)
   15 FORMAT(I3,2F9.4,F9.1,F7.1,2F8.4,3X,3A2,3X,2A2,1X,2A2)
      RETURN
      END
```

B.6 Illustrative Examples

The following three examples are presented to assist the user in checking the adaptation of JET 2 to his computer facility.

B.6.1 Example 1: A Single-Layer Ring with a Simplified Local Space-Sinusoidal Forcing Function

In this example, a 7.3375-inch midsurface radius, 0.125-inch thick, 6061-T6 single-layer aluminum ring, 1.0-inch long is acted upon by a timewise triangularly-shaped forcing function lasting 400 μsec with a peak value of 10,000 pounds at t = 200 μsec acting at an angle of 21° to the local tangent. The total force is assumed to be distributed over a 25° segment of the ring with its amplitude defined by the shape of a half-sine wave over this sector.

The stress-strain curve for 6061-T6 aluminum can be approximated by the following stress-strain coordinates (σ,ε): (0 psi, 0 in/in); (42,000, .00425); (50,000, .030); and (65,000, .140). Strain-rate effects are considered to be negligible, and the density is taken to be 0.25×10^{-3} (lb-sec^2)/in^4.

The number of mass points to be used to describe the complete ring is 72.

The incremental time interval ΔT for this run is obtained by using the smaller of the two critical times from Eqs. B1 and B2. These are calculated as follows:

$$\Delta T_{long} = \frac{\Delta S}{\sqrt{\frac{E}{\rho}}} = \frac{2\pi R}{N}\sqrt{\frac{\rho \epsilon_1}{\sigma_1}} = 0.320 \times 10^{-5} \text{ sec.}$$

$$\Delta T_{lat} = \frac{\frac{1}{2}(\Delta S)^2}{\sqrt{\frac{E_1 I}{\rho H}}} = \frac{\sqrt{3}\,\Delta S}{H}\,\Delta T_{long} = 2.96\,\Delta T_{long}$$

Since ΔT_{Long} is the smaller of the two, a value less than this and easily compared with instants corresponding to the framing rate of the NAPTC high-speed camera is desired; thus, $\Delta T = .30 \times 10^{-5}$ sec is chosen, which means that every 10 program cycles will be equivalent to each camera frame (that is, at 30 μsec spacing). Let the program calculate 240 cycles (.000720 seconds); print-out is desired at 10 cycles, and every 10 cycles thereafter.

B.6.1.1 Input Data

The values to be punched on the data cards are as follows:

		Format
Card 1		3E.15.6
	R = +0.727500E+01 (Radius to inner surface)	
	B = +0.100000E+01	
	DELTAT = +0.300000E-05	
Card 2		6I5
	N = 72	
	NRING = 1	
	M = 240	
	M1 = 10	
	M2 = 10	
	IND = 0 (no bonds to test)	
Card 3		I5
	NSFL(1) = 3	
Card 4 is not used since IND = 0		
Card 5		
	H = +0.125000E+00	
	RHO = +0.250000E-03	
	D = +0.000000E+00 } Strain-rate effects are considered to be negligible	
	P = +0.000000E+00 }	
Card 6aa		4E15.6
	EPSIL(1,1) = +0.425000E-02	
	SIGMA(1,1) = +0.425000E+05	
	EPSIL(2,1) = +0.300000E-01	
	SIGMA(2,1) = +0.500000E+05	

	Format
Card 6ab	2E15.6

EPSIL(3,1) = +0.140000E+00

SIGMA(3,1) = +0.650000E+05

Card 7	2I5

IOTA = 0 } no initial impulse loading

NV = 0 } is specified

Cards 8 and 9 are not required since IOTA = 0

Card 10	3E15.6

TBEGIN = +0.000000E+00 } Total forcing function

TFINAL = +0.400000E-03 } lasts 400 μsecs

AMP1 = +0.000000E+00 } Forcing function has zero amplitude at t = 0

Card 11a	E15.6,I5, E15.6

T2 = +0.200000E-03

JOLT = 3

AMP2TY = +0.100000E+05

Cards 12 and 13 are not used since JOLT = 3

Card 14	I5,E15.6

NUMS = 1 (only one sine distribution is specified)

RPM = +0.000000E+00 (the distribution does not move with time)

Card 15	2I5,2E15.6

NSTAT = 35 (start of the forcing function distribution)

MASSN = 5

ANGL = +0.210000E+02 (inclination angle, deg)

RATIO = +0.100000E+01

Card 11b

T2 = +0.400000E-03

JOLT = 1 (repeat last distribution)

AMP2TY = +0.000000E+00

The input data deck for this example problem should appear as follows:

```
+0.727500E+01   +0.100000E+01   +0.300000E-05
 72     1  240    10    10     0
  3
+0.125000E+00   +0.250000E-03   +0.000000E+00   +0.000000E+00
+0.425000E-02   +0.425000E+05   +0.300000E-01   +0.500000E+05
+0.140000E+00   +0.650000E+05
  0     0
+0.000000E+00   +0.400000E-03   +0.000000E+00   +0.000000E+00
+0.200000E-03     3   +0.100000E+05
  1   +0.000000E+00
 35     5   +0.210000E+02   +0.100000E+01
+0.401000E-03     1   +0.000000E+00
```

B.6.1.2 Solution Output for Example 1

The solution output for this example is as follows:

```
JET 2     A PROGRAM USED TO CALCULATE THE RESPONSE OF A FREE
CIRCULAR MULTI-LAYERED RING WITH THE FOLLOWING PARAMETERS.-

RADIUS OF RING TO INNER SURFACE  (IN.)             =     7.27500
WIDTH  OF RING      (IN.)                          =     1.00000
THICKNESS OF RING  (IN.)                           =     0.12500
CENTROIDAL DISTANCE FROM INNER SURFACE  (IN.)      =     0.06250

NUMBER OF MASS POINTS USED IN THE RING             =      72

NUMBER OF LAYERS USED IN RING CROSS SECTION        =       1

NUMBER OF CONTROL STATIONS USED IN LAYER 1         =       4

NUMBER OF MECHANICAL SUBLAYERS AT EACH
 CONTROL STATION IN LAYER 1                        =       3

THICKNESS OF LAYER 1                               =     0.12500


TIME INTERVAL PER CYCLE USED IN PROGRAM (SEC) =      0.29999992E-05

THERE IS NO INITIAL IMPULSE

STARTING TIME OF FORCING FUNCTION (SEC)  = 0.0
STOPPING TIME OF FORCING FUNCTION (SEC)  = 0.0004000
DURATION OF THE  FORCING FUNCTION (SEC)  = 0.0004000
```

J= 0 TIME= 0.0
TOTAL ENERGY INPUT (IN.-LB.) = 0.0
KINETIC ENERGY (IN.-LB.) = 0.0
ELASTIC ENERGY (IN.-LB.) = 0.0
PLASTIC WORK (IN.-LB.) = 0.0

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 0.0 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS COMPOSED OF ONE OR MORE SINE SHAPED FORCE DISTRIBUTIONS
ACTING AT SPECIFIED LOCATIONS ON THE RING

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3201	-7.3305	0.0	0.0	0.0	0.0	
2	0.9577	-7.2747	0.0	0.0	0.0	0.0	
3	1.5881	-7.1636	0.0	0.0	0.0	0.0	
4	2.2064	-6.9979	0.0	0.0	0.0	0.0	
5	2.8079	-6.7790	0.0	0.0	0.0	0.0	
6	3.3881	-6.5084	0.0	0.0	0.0	0.0	
7	3.9424	-6.1884	0.0	0.0	0.0	0.0	
8	4.4668	-5.8212	0.0	0.0	0.0	0.0	
9	4.9571	-5.4098	0.0	0.0	0.0	0.0	
10	5.4098	-4.9571	0.0	0.0	0.0	0.0	
11	5.8212	-4.4668	0.0	0.0	0.0	0.0	
12	6.1884	-3.9424	0.0	0.0	0.0	0.0	
13	6.5084	-3.3881	0.0	0.0	0.0	0.0	
14	6.7790	-2.8079	0.0	0.0	0.0	0.0	
15	6.9979	-2.2064	0.0	0.0	0.0	0.0	
16	7.1636	-1.5881	0.0	0.0	0.0	0.0	
17	7.2747	-0.9578	0.0	0.0	0.0	0.0	
18	7.3305	-0.3201	0.0	0.0	0.0	0.0	
19	7.3305	0.3201	0.0	0.0	0.0	0.0	
20	7.2747	0.9578	0.0	0.0	0.0	0.0	
21	7.1636	1.5881	0.0	0.0	0.0	0.0	
22	6.9979	2.2064	0.0	0.0	0.0	0.0	
23	6.7790	2.8079	0.0	0.0	0.0	0.0	
24	6.5084	3.3881	0.0	0.0	0.0	0.0	
25	6.1884	3.9424	0.0	0.0	0.0	0.0	
26	5.8212	4.4668	0.0	0.0	0.0	0.0	
27	5.4098	4.9571	0.0	0.0	0.0	0.0	
28	4.9571	5.4098	0.0	0.0	0.0	0.0	
29	4.4668	5.8212	0.0	0.0	0.0	0.0	
30	3.9424	6.1884	0.0	0.0	0.0	0.0	
31	3.3881	6.5084	0.0	0.0	0.0	0.0	
32	2.8079	6.7790	0.0	0.0	0.0	0.0	
33	2.2064	6.9979	0.0	0.0	0.0	0.0	
34	1.5881	7.1636	0.0	0.0	0.0	0.0	
35	0.9577	7.2747	0.0	0.0	0.0	0.0	
36	0.3201	7.3305	0.0	0.0	0.0	0.0	
37	-0.3201	7.3305	0.0	0.0	0.0	0.0	
38	-0.9577	7.2747	0.0	0.0	0.0	0.0	
39	-1.5881	7.1636	0.0	0.0	0.0	0.0	
40	-2.2064	6.9979	0.0	0.0	0.0	0.0	
41	-2.8079	6.7790	0.0	0.0	0.0	0.0	
42	-3.3881	6.5084	0.0	0.0	0.0	0.0	
43	-3.9424	6.1884	0.0	0.0	0.0	0.0	
44	-4.4668	5.8212	0.0	0.0	0.0	0.0	
45	-4.9571	5.4098	0.0	0.0	0.0	0.0	
46	-5.4098	4.9571	0.0	0.0	0.0	0.0	
47	-5.8212	4.4668	0.0	0.0	0.0	0.0	
48	-6.1884	3.9424	0.0	0.0	0.0	0.0	
49	-6.5084	3.3881	0.0	0.0	0.0	0.0	
50	-6.7790	2.8079	0.0	0.0	0.0	0.0	
51	-6.9979	2.2064	0.0	0.0	0.0	0.0	
52	-7.1636	1.5881	0.0	0.0	0.0	0.0	
53	-7.2747	0.9578	0.0	0.0	0.0	0.0	
54	-7.3305	0.3201	0.0	0.0	0.0	0.0	
55	-7.3305	-0.3201	0.0	0.0	0.0	0.0	
56	-7.2747	-0.9578	0.0	0.0	0.0	0.0	
57	-7.1636	-1.5881	0.0	0.0	0.0	0.0	
58	-6.9979	-2.2064	0.0	0.0	0.0	0.0	
59	-6.7790	-2.8079	0.0	0.0	0.0	0.0	
60	-6.5084	-3.3881	0.0	0.0	0.0	0.0	
61	-6.1884	-3.9424	0.0	0.0	0.0	0.0	
62	-5.8212	-4.4668	0.0	0.0	0.0	0.0	
63	-5.4098	-4.9571	0.0	0.0	0.0	0.0	
64	-4.9571	-5.4098	0.0	0.0	0.0	0.0	
65	-4.4668	-5.8212	0.0	0.0	0.0	0.0	
66	-3.9424	-6.1884	0.0	0.0	0.0	0.0	
67	-3.3881	-6.5084	0.0	0.0	0.0	0.0	
68	-2.8079	-6.7790	0.0	0.0	0.0	0.0	
69	-2.2064	-6.9979	0.0	0.0	0.0	0.0	
70	-1.5881	-7.1636	0.0	0.0	0.0	0.0	
71	-0.9577	-7.2747	0.0	0.0	0.0	0.0	
72	-0.3201	-7.3305	0.0	0.0	0.0	0.0	

J= 10 TIME= 0.0000300
TOTAL ENERGY INPUT (IN.-LB.) = 2.377
KINETIC ENERGY (IN.-LB.) = 1.547
ELASTIC ENERGY (IN.-LB.) = 0.531
PLASTIC WORK (IN.-LB.) = 0.299

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 1499.9990 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3201	-7.3305	0.0	0.0	0.0	0.0	
2	0.9577	-7.2747	0.0	0.0	0.0	0.0	
3	1.5881	-7.1636	0.0	0.0	0.0	0.0	
4	2.2064	-6.9979	0.0	0.0	0.0	0.0	
5	2.8079	-6.7790	0.0	0.0	0.0	0.0	
6	3.3881	-6.5084	0.0	0.0	0.0	0.0	
7	3.9424	-6.1884	0.0	0.0	0.0	0.0	
8	4.4668	-5.8212	0.0	0.0	0.0	0.0	
9	4.9571	-5.4098	0.0	0.0	0.0	0.0	
10	5.4098	-4.9571	0.0	0.0	0.0	0.0	
11	5.8212	-4.4668	0.0	0.0	0.0	0.0	
12	6.1884	-3.9424	0.0	0.0	0.0	0.0	
13	6.5084	-3.3881	0.0	0.0	0.0	0.0	
14	6.7790	-2.8079	0.0	0.0	0.0	0.0	
15	6.9979	-2.2064	0.0	0.0	0.0	0.0	
16	7.1636	-1.5881	0.0	0.0	0.0	0.0	
17	7.2747	-0.9578	0.0	0.0	0.0	0.0	
18	7.3305	-0.3201	0.0	0.0	0.0000	-0.0000	
19	7.3305	0.3201	0.0	0.0	0.0000	-0.0000	
20	7.2747	0.9578	-0.0	-0.0	-0.0000	0.0000	
21	7.1636	1.5881	-0.0	0.0	0.0000	-0.0000	
22	6.9979	2.2064	0.0	-0.0	-0.0000	0.0000	
23	6.7790	2.8079	-0.0	0.0	0.0000	-0.0000	
24	6.5084	3.3881	0.0	-0.0	-0.0000	0.0000	
25	6.1884	3.9424	-0.0	0.0	0.0000	-0.0000	
26	5.8212	4.4668	0.0	-0.0	-0.0000	0.0000	
27	5.4098	4.9571	1.7	-0.0	0.0000	0.0000	
28	4.9571	5.4098	17.9	-0.0	0.0000	0.0000	
29	4.4667	5.8213	67.0	-0.0	0.0001	0.0001	
30	3.9423	6.1884	140.1	-0.1	0.0001	0.0001	
31	3.3879	6.5085	218.4	-0.1	0.0002	0.0002	
32	2.8076	6.7791	296.5	-0.1	0.0002	0.0002	
33	2.2058	6.9980	377.6	-0.2	0.0003	0.0003	
34	1.5873	7.1636	464.7	0.3	0.0004	0.0004	
35	0.9566	7.2747	553.8	2.8	0.0005	0.0003	
36	0.3187	7.3312	595.3	0.3	0.0005	0.0005	
37	-0.3216	7.3319	297.9	-3.5	0.0001	0.0004	
38	-0.9592	7.2760	-151.3	-3.8	-0.0003	0.0000	
39	-1.5891	7.1638	-447.0	2.9	-0.0002	-0.0005	
40	-2.2071	6.9978	-432.6	1.1	-0.0003	-0.0004	
41	-2.8084	6.7788	-375.5	0.1	-0.0003	-0.0003	
42	-3.3884	6.5083	-314.8	0.1	-0.0002	-0.0003	
43	-3.9426	6.1883	-254.8	0.1	-0.0002	-0.0002	
44	-4.4669	5.8212	-193.2	0.1	-0.0002	-0.0002	
45	-4.9572	5.4097	-125.8	0.0	-0.0001	-0.0001	
46	-5.4098	4.9571	-59.9	0.0	-0.0000	-0.0000	
47	-5.8212	4.4668	-15.7	0.0	-0.0000	-0.0000	
48	-6.1884	3.9424	-1.4	0.0	-0.0000	-0.0000	
49	-6.5084	3.3881	-0.0	-0.0	-0.0000	0.0000	
50	-6.7790	2.8079	0.0	0.0	0.0000	-0.0000	
51	-6.9979	2.2064	-0.0	-0.0	-0.0000	0.0000	
52	-7.1636	1.5881	0.0	0.0	0.0000	-0.0000	
53	-7.2747	0.9578	-0.0	-0.0	-0.0000	0.0000	
54	-7.3305	0.3201	0.0	0.0	0.0000	-0.0000	
55	-7.3305	-0.3201	-0.0	-0.0	-0.0000	0.0000	
56	-7.2747	-0.9578	0.0	0.0	0.0000	-0.0000	
57	-7.1636	-1.5881	0.0	0.0	0.0	0.0	
58	-6.9979	-2.2064	0.0	0.0	0.0	0.0	
59	-6.7790	-2.8079	0.0	0.0	0.0	0.0	
60	-6.5084	-3.3881	0.0	0.0	0.0	0.0	
61	-6.1884	-3.9424	0.0	0.0	0.0	0.0	
62	-5.8212	-4.4668	0.0	0.0	0.0	0.0	
63	-5.4098	-4.9571	0.0	0.0	0.0	0.0	
64	-4.9571	-5.4098	0.0	0.0	0.0	0.0	
65	-4.4668	-5.8212	0.0	0.0	0.0	0.0	
66	-3.9424	-6.1884	0.0	0.0	0.0	0.0	
67	-3.3881	-6.5084	0.0	0.0	0.0	0.0	
68	-2.8079	-6.7790	0.0	0.0	0.0	0.0	
69	-2.2064	-6.9979	0.0	0.0	0.0	0.0	
70	-1.5881	-7.1636	0.0	0.0	0.0	0.0	
71	-0.9577	-7.2747	0.0	0.0	0.0	0.0	
72	-0.3201	-7.3305	0.0	0.0	0.0	0.0	

J= 20 TIME= 0.0000600
TOTAL ENERGY INPUT (IN.-LB.) = 23.242
KINETIC ENERGY (IN.-LB.) = 16.790
ELASTIC ENERGY (IN.-LB.) = 4.925
PLASTIC WORK (IN.-LB.) = 1.527

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 2999.9985 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3201	-7.3305	-0.0	0.0	0.0000	-0.0000	
2	0.9577	-7.2747	0.0	-0.0	-0.0000	0.0000	
3	1.5881	-7.1636	-0.0	0.0	0.0000	-0.0000	
4	2.2064	-6.9979	0.0	-0.0	-0.0000	0.0000	
5	2.8079	-6.7790	-0.0	0.0	0.0000	-0.0000	
6	3.3881	-6.5084	0.0	-0.0	-0.0000	0.0000	
7	3.9424	-6.1884	-0.0	0.0	0.0000	-0.0000	
8	4.4668	-5.8212	0.0	-0.0	-0.0000	0.0000	
9	4.9571	-5.4098	-0.0	0.0	0.0000	-0.0000	
10	5.4098	-4.9571	0.0	-0.0	-0.0000	0.0000	
11	5.8212	-4.4668	-0.0	0.0	0.0000	-0.0000	
12	6.1884	-3.9424	0.0	-0.0	-0.0000	0.0000	
13	6.5084	-3.3881	-0.0	0.0	0.0000	-0.0000	
14	6.7790	-2.8079	0.0	-0.0	-0.0000	0.0000	
15	6.9979	-2.2064	-0.0	0.0	0.0000	-0.0000	
16	7.1636	-1.5881	0.0	-0.0	-0.0000	0.0000	
17	7.2747	-0.9578	0.5	-0.0	0.0000	0.0000	
18	7.3305	-0.3201	6.0	-0.0	0.0000	0.0000	
19	7.3305	0.3201	30.9	-0.0	0.0000	0.0000	
20	7.2747	0.9578	87.2	-0.0	0.0001	0.0001	
21	7.1635	1.5883	161.0	-0.1	0.0001	0.0001	
22	6.9978	2.2067	232.2	-0.1	0.0002	0.0002	
23	6.7787	2.8083	301.0	-0.1	0.0002	0.0002	
24	6.5080	3.3886	371.1	-0.2	0.0003	0.0003	
25	6.1878	3.9431	443.6	-0.2	0.0003	0.0004	
26	5.8203	4.4675	517.0	-0.2	0.0004	0.0004	
27	5.4085	4.9580	594.1	-0.2	0.0005	0.0005	
28	4.9554	5.4106	675.3	-0.3	0.0005	0.0006	
29	4.4645	5.8221	760.0	-0.3	0.0006	0.0006	
30	3.9396	6.1891	852.3	-0.4	0.0007	0.0007	
31	3.3845	6.5089	948.9	-0.4	0.0007	0.0008	
32	2.8036	6.7791	1055.5	-0.8	0.0008	0.0009	
33	2.2012	6.9974	1168.5	-0.7	0.0009	0.0010	
34	1.5820	7.1623	1294.5	5.9	0.0013	0.0008	
35	0.9510	7.2741	1431.4	20.1	0.0019	0.0004	
36	0.3131	7.3354	1464.9	2.7	0.0013	0.0011	
37	-0.3274	7.3417	818.5	-27.1	-0.0004	0.0017	
38	-0.9650	7.2853	-139.5	-26.4	-0.0011	0.0009	
39	-1.5937	7.1671	-777.7	15.9	-0.0000	-0.0012	
40	-2.2107	6.9983	-809.6	10.2	-0.0003	-0.0010	
41	-2.8116	6.7789	-758.5	0.9	-0.0006	-0.0006	
42	-3.3912	6.5081	-707.7	-0.1	-0.0006	-0.0006	
43	-3.9451	6.1878	-660.5	0.2	-0.0005	-0.0005	
44	-4.4689	5.8205	-613.0	0.3	-0.0005	-0.0005	
45	-4.9588	5.4090	-569.7	0.2	-0.0004	-0.0005	
46	-5.4111	4.9563	-525.1	0.2	-0.0004	-0.0004	
47	-5.8222	4.4660	-483.1	0.2	-0.0004	-0.0004	
48	-6.1891	3.9418	-439.9	0.2	-0.0003	-0.0004	
49	-6.5089	3.3875	-396.2	0.1	-0.0003	-0.0003	
50	-6.7793	2.8075	-352.2	0.1	-0.0003	-0.0003	
51	-6.9981	2.2061	-304.5	0.1	-0.0002	-0.0002	
52	-7.1636	1.5879	-255.1	0.1	-0.0002	-0.0002	
53	-7.2748	0.9576	-203.3	0.1	-0.0002	-0.0002	
54	-7.3305	0.3200	-143.9	0.0	-0.0001	-0.0001	
55	-7.3305	-0.3201	-78.1	0.0	-0.0001	-0.0001	
56	-7.2747	-0.9578	-27.4	0.0	-0.0000	-0.0000	
57	-7.1636	-1.5881	-5.2	0.0	-0.0000	-0.0000	
58	-6.9979	-2.2064	-0.4	0.0	-0.0000	-0.0000	
59	-6.7790	-2.8079	-0.0	-0.0	-0.0000	0.0000	
60	-6.5084	-3.3881	0.0	0.0	0.0000	-0.0000	
61	-6.1884	-3.9424	-0.0	-0.0	-0.0000	0.0000	
62	-5.8212	-4.4668	0.0	0.0	0.0000	-0.0000	
63	-5.4098	-4.9571	-0.0	-0.0	-0.0000	0.0000	
64	-4.9571	-5.4098	0.0	0.0	0.0000	-0.0000	
65	-4.4668	-5.8212	-0.0	-0.0	-0.0000	0.0000	
66	-3.9424	-6.1884	0.0	0.0	0.0000	-0.0000	
67	-3.3881	-6.5084	-0.0	-0.0	-0.0000	0.0000	
68	-2.8079	-6.7790	0.0	0.0	0.0000	-0.0000	
69	-2.2064	-6.9979	-0.0	-0.0	-0.0000	0.0000	
70	-1.5881	-7.1636	0.0	0.0	0.0000	-0.0000	
71	-0.9577	-7.2747	-0.0	-0.0	-0.0000	0.0000	
72	-0.3201	-7.3305	0.0	0.0	0.0000	-0.0000	

J= 30 TIME= 0.0000900
TOTAL ENERGY INPUT (IN.-LB.) = 93.916
KINETIC ENERGY (IN.-LB.) = 72.321
ELASTIC ENERGY (IN.-LB.) = 17.403
PLASTIC WORK (IN.-LB.) = 4.192

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 4499.9922 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3201	-7.3305	-0.0	0.0	0.0000	-0.0000	
2	0.9577	-7.2747	0.0	-0.0	-0.0000	0.0000	
3	1.5881	-7.1636	-0.0	0.0	0.0000	-0.0000	
4	2.2064	-6.9979	0.0	-0.0	-0.0000	0.0000	
5	2.8079	-6.7790	-0.0	0.0	0.0000	-0.0000	
6	3.3881	-6.5084	0.0	-0.0	-0.0000	0.0000	
7	3.9424	-6.1884	0.1	-0.0	0.0000	0.0000	
8	4.4668	-5.8212	1.9	-0.0	0.0000	0.0000	
9	4.9571	-5.4098	12.6	-0.0	0.0000	0.0000	
10	5.4098	-4.9571	46.1	-0.0	0.0000	0.0000	
11	5.8213	-4.4667	107.4	-0.1	0.0001	0.0001	
12	6.1885	-3.9423	178.2	-0.1	0.0001	0.0001	
13	6.5085	-3.3878	240.5	-0.1	0.0002	0.0002	
14	6.7791	-2.8075	298.7	-0.1	0.0002	0.0002	
15	6.9980	-2.2058	357.7	-0.1	0.0003	0.0003	
16	7.1636	-1.5872	415.5	-0.2	0.0003	0.0003	
17	7.2746	-0.9566	472.9	-0.2	0.0004	0.0004	
18	7.3302	-0.3186	531.3	-0.2	0.0004	0.0004	
19	7.3299	0.3218	591.7	-0.3	0.0005	0.0005	
20	7.2737	0.9598	653.3	-0.3	0.0005	0.0005	
21	7.1621	1.5905	718.9	-0.3	0.0006	0.0006	
22	6.9958	2.2091	787.7	-0.4	0.0006	0.0006	
23	6.7762	2.8108	860.8	-0.4	0.0007	0.0007	
24	6.5048	3.3910	940.2	-0.5	0.0007	0.0008	
25	6.1838	3.9454	1024.3	-0.5	0.0008	0.0008	
26	5.8156	4.4697	1117.3	-0.6	0.0009	0.0009	
27	5.4029	4.9599	1216.4	-0.6	0.0009	0.0010	
28	4.9489	5.4121	1326.4	-0.7	0.0010	0.0011	
29	4.4570	5.8229	1445.0	-0.8	0.0011	0.0012	
30	3.9311	6.1892	1576.1	-0.9	0.0012	0.0013	
31	3.3751	6.5081	1718.8	-1.5	0.0013	0.0014	
32	2.7931	6.7770	1875.7	-3.1	0.0014	0.0016	
33	2.1896	6.9935	2048.7	1.4	0.0017	0.0016	
34	1.5695	7.1569	2242.1	27.5	0.0028	0.0007	
35	0.9386	7.2725	2454.6	53.9	0.0040	-0.0001	
36	0.3015	7.3462	2501.4	5.7	0.0022	0.0018	
37	-0.3391	7.3655	1514.7	-79.3	-0.0018	0.0043	
38	-0.9768	7.3090	53.1	-76.3	-0.0029	0.0030	
39	-1.6030	7.1784	-904.2	31.2	0.0005	-0.0019	
40	-2.2176	7.0013	-966.8	37.6	0.0007	-0.0022	
41	-2.8178	6.7801	-912.2	7.4	-0.0004	-0.0010	
42	-3.3972	6.5091	-863.6	-1.6	-0.0008	-0.0006	
43	-3.9506	6.1883	-815.0	-0.2	-0.0007	-0.0006	
44	-4.4740	5.8204	-769.0	0.5	-0.0006	-0.0006	
45	-4.9634	5.4084	-727.5	0.5	-0.0006	-0.0006	
46	-5.4151	4.9553	-688.6	0.4	-0.0005	-0.0006	
47	-5.8257	4.4647	-654.0	0.4	-0.0005	-0.0005	
48	-6.1921	3.9402	-620.3	0.3	-0.0005	-0.0005	
49	-6.5115	3.3858	-590.8	0.3	-0.0005	-0.0005	
50	-6.7814	2.8057	-561.3	0.3	-0.0004	-0.0005	
51	-6.9997	2.2043	-535.1	0.3	-0.0004	-0.0004	
52	-7.1649	1.5861	-508.7	0.2	-0.0004	-0.0004	
53	-7.2757	0.9559	-483.8	0.2	-0.0004	-0.0004	
54	-7.3312	0.3184	-459.3	0.2	-0.0004	-0.0004	
55	-7.3309	-0.3215	-433.8	0.2	-0.0003	-0.0004	
56	-7.2749	-0.9589	-409.0	0.2	-0.0003	-0.0003	
57	-7.1636	-1.5891	-381.8	0.1	-0.0003	-0.0003	
58	-6.9978	-2.2072	-353.3	0.1	-0.0003	-0.0003	
59	-6.7788	-2.8085	-322.8	0.1	-0.0003	-0.0003	
60	-6.5083	-3.3885	-288.1	0.1	-0.0002	-0.0002	
61	-6.1883	-3.9427	-249.3	0.1	-0.0002	-0.0002	
62	-5.8211	-4.4669	-208.2	0.1	-0.0002	-0.0002	
63	-5.4097	-4.9572	-158.2	0.0	-0.0001	-0.0001	
64	-4.9571	-5.4098	-96.1	0.0	-0.0001	-0.0001	
65	-4.4668	-5.8212	-41.1	0.0	-0.0000	-0.0000	
66	-3.9424	-6.1894	-11.1	0.0	-0.0000	-0.0000	
67	-3.3881	-6.5084	-1.6	0.0	-0.0000	-0.0000	
68	-2.8079	-6.7790	-0.1	0.0	-0.0000	-0.0000	
69	-2.2064	-6.9979	-0.0	-0.0	-0.0000	0.0000	
70	-1.5881	-7.1636	0.0	0.0	0.0000	-0.0000	
71	-0.9577	-7.2747	-0.0	-0.0	-0.0000	0.0000	
72	-0.3201	-7.3305	0.0	0.0	0.0000	-0.0000	

J= 32 TIME= 0.0000960
TOTAL ENERGY INPUT (IN.-LB.) = 117.732
KINETIC ENERGY (IN.-LB.) = 91.505
ELASTIC ENERGY (IN.-LB.) = 21.198
PLASTIC WORK (IN.-LB.) = 5.030

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 4799.9922 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3201	-7.3305	-0.0	0.0	0.0000	-0.0000	
2	0.9577	-7.2747	0.0	-0.0	-0.0000	0.0000	
3	1.5881	-7.1636	-0.0	0.0	0.0000	-0.0000	
4	2.2064	-6.9979	0.0	-0.0	-0.0000	0.0000	
5	2.8079	-6.7790	0.1	-0.0	-0.0000	0.0000	
6	3.3881	-6.5084	1.5	-0.0	0.0000	0.0000	
7	3.9424	-6.1884	10.4	-0.0	0.0000	0.0000	
8	4.4668	-5.8212	39.9	-0.0	0.0000	0.0000	
9	4.9572	-5.4097	97.5	-0.0	0.0001	0.0001	
10	5.4099	-4.9570	167.7	-0.1	0.0001	0.0001	
11	5.8214	-4.4665	230.1	-0.1	0.0002	0.0002	
12	6.1886	-3.9420	286.2	-0.1	0.0002	0.0002	
13	6.5086	-3.3875	342.9	-0.1	0.0003	0.0003	
14	6.7791	-2.8071	398.2	-0.2	0.0003	0.0003	
15	6.9980	-2.2053	452.5	-0.2	0.0004	0.0004	
16	7.1635	-1.5867	507.1	-0.2	0.0004	0.0004	
17	7.2744	-0.9560	563.2	-0.2	0.0004	0.0005	
18	7.3299	-0.3180	620.3	-0.3	0.0005	0.0005	
19	7.3295	0.3225	680.1	-0.3	0.0005	0.0006	
20	7.2732	0.9605	743.4	-0.3	0.0006	0.0006	
21	7.1615	1.5912	809.5	-0.4	0.0006	0.0007	
22	6.9950	2.2098	881.7	-0.4	0.0007	0.0007	
23	6.7752	2.8115	957.8	-0.5	0.0007	0.0008	
24	6.5037	3.3917	1041.5	-0.5	0.0008	0.0009	
25	6.1824	3.9461	1131.4	-0.6	0.0009	0.0009	
26	5.8139	4.4703	1229.7	-0.7	0.0010	0.0010	
27	5.4010	4.9603	1337.4	-0.8	0.0010	0.0011	
28	4.9468	5.4123	1454.4	-0.9	0.0011	0.0012	
29	4.4547	5.8230	1583.9	-0.9	0.0012	0.0013	
30	3.9284	6.1890	1724.2	-1.0	0.0013	0.0014	
31	3.3721	6.5076	1880.1	-1.9	0.0014	0.0016	
32	2.7899	6.7761	2049.0	-3.8	0.0015	0.0018	
33	2.1861	6.9920	2237.9	3.0	0.0019	0.0017	
34	1.5658	7.1551	2447.3	34.4	0.0033	0.0006	
35	0.9351	7.2722	2678.1	62.0	0.0045	-0.0002	
36	0.2982	7.3493	2728.5	5.8	0.0024	0.0020	
37	-0.3424	7.3721	1643.2	-90.8	-0.0022	0.0049	*
38	-0.9801	7.3159	110.7	-90.1	-0.0034	0.0035	
39	-1.6056	7.1821	-907.4	33.1	0.0005	-0.0020	
40	-2.2194	7.0023	-975.1	45.6	0.0010	-0.0025	
41	-2.8193	6.7804	-918.7	10.3	-0.0003	-0.0011	
42	-3.3988	6.5094	-871.2	-2.0	-0.0008	-0.0006	
43	-3.9521	6.1885	-821.2	-0.5	-0.0007	-0.0006	
44	-4.4754	5.8205	-775.8	0.6	-0.0006	-0.0006	
45	-4.9647	5.4083	-732.7	0.6	-0.0006	-0.0006	
46	-5.4163	4.9552	-695.0	0.5	-0.0005	-0.0006	
47	-5.8268	4.4645	-659.2	0.4	-0.0005	-0.0005	
48	-6.1931	3.9399	-627.3	0.4	-0.0005	-0.0005	
49	-6.5123	3.3854	-597.4	0.3	-0.0005	-0.0005	
50	-6.7821	2.8053	-569.8	0.3	-0.0004	-0.0005	
51	-7.0003	2.2038	-544.7	0.3	-0.0004	-0.0004	
52	-7.1654	1.5856	-520.1	0.3	-0.0004	-0.0004	
53	-7.2761	0.9554	-498.3	0.2	-0.0004	-0.0004	
54	-7.3315	0.3180	-475.6	0.2	-0.0004	-0.0004	
55	-7.3311	-0.3220	-454.9	0.2	-0.0004	-0.0004	
56	-7.2750	-0.9594	-433.4	0.2	-0.0003	-0.0004	
57	-7.1637	-1.5895	-411.5	0.2	-0.0003	-0.0003	
58	-6.9979	-2.2076	-389.4	0.2	-0.0003	-0.0003	
59	-6.7788	-2.8088	-364.8	0.1	-0.0003	-0.0003	
60	-6.5082	-3.3888	-338.8	0.1	-0.0003	-0.0003	
61	-6.1882	-3.9429	-310.3	0.1	-0.0002	-0.0003	
62	-5.8210	-4.4671	-277.1	0.1	-0.0002	-0.0002	
63	-5.4096	-4.9573	-239.9	0.1	-0.0002	-0.0002	
64	-4.9570	-5.4099	-199.9	0.1	-0.0002	-0.0002	
65	-4.4667	-5.8213	-149.1	0.0	-0.0001	-0.0001	
66	-3.9424	-6.1884	-87.2	0.0	-0.0001	-0.0001	
67	-3.3881	-6.5084	-35.5	0.0	-0.0000	-0.0000	
68	-2.8079	-6.7790	-9.1	0.0	-0.0000	-0.0000	
69	-2.2064	-6.9979	-1.3	0.0	-0.0000	-0.0000	
70	-1.5881	-7.1636	-0.1	0.0	-0.0000	-0.0000	
71	-0.9577	-7.2747	-0.0	-0.0	-0.0000	0.0000	
72	-0.3201	-7.3305	0.0	0.0	0.0000	-0.0000	

J= 40 TIME= 0.0001200
TOTAL ENERGY INPUT (IN.-LB.) = 259.697
KINETIC ENERGY (IN.-LB.) = 207.998
ELASTIC ENERGY (IN.-LB.) = 37.956
PLASTIC WORK (IN.-LB.) = 13.742

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 5999.9961 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3201	-7.3305	-50.0	-0.0	-0.0000	-0.0000	
2	0.9579	-7.2747	70.3	-0.0	0.0001	0.0001	
3	1.5883	-7.1635	171.8	-0.1	0.0001	0.0001	
4	2.2067	-6.9977	238.7	-0.1	0.0002	0.0002	
5	2.8064	-6.7787	289.7	-0.1	0.0002	0.0002	
6	3.3886	-6.5080	337.4	-0.1	0.0003	0.0003	
7	3.9431	-6.1877	381.1	-0.2	0.0003	0.0003	
8	4.4675	-5.8203	422.8	-0.2	0.0003	0.0003	
9	4.9579	-5.4085	464.2	-0.2	0.0004	0.0004	
10	5.4105	-4.9555	505.3	-0.2	0.0004	0.0004	
11	5.8219	-4.4647	546.6	-0.2	0.0004	0.0004	
12	6.1889	-3.9399	589.1	-0.3	0.0005	0.0005	
13	6.5087	-3.3851	633.8	-0.3	0.0005	0.0005	
14	6.7789	-2.8044	679.9	-0.3	0.0005	0.0006	
15	6.9974	-2.2023	730.1	-0.4	0.0006	0.0006	
16	7.1625	-1.5835	783.0	-0.4	0.0006	0.0006	
17	7.2729	-0.9525	840.7	-0.5	0.0007	0.0007	
18	7.3278	-0.3143	903.5	-0.5	0.0007	0.0007	
19	7.3268	0.3264	971.2	-0.6	0.0008	0.0008	
20	7.2697	0.9645	1046.6	-0.6	0.0008	0.0009	
21	7.1571	1.5952	1127.6	-0.7	0.0009	0.0009	
22	6.9898	2.2137	1218.2	-0.8	0.0009	0.0010	
23	6.7690	2.8152	1316.2	-0.9	0.0010	0.0011	
24	6.4964	3.3952	1425.3	-1.0	0.0011	0.0012	
25	6.1741	3.9491	1544.3	-1.1	0.0012	0.0013	
26	5.8044	4.4727	1675.7	-1.2	0.0013	0.0014	
27	5.3902	4.9620	1819.9	-1.4	0.0014	0.0015	
28	4.9347	5.4132	1964.3	-1.5	0.0015	0.0016	
29	4.4412	5.8226	2106.4	-1.4	0.0016	0.0017	
30	3.9137	6.1873	2278.7	-2.0	0.0017	0.0019	
31	3.3561	6.5042	2479.0	-5.3	0.0018	0.0022	
32	2.7723	6.7701	2696.3	-6.3	0.0019	0.0024	
33	2.1669	6.9827	2938.0	17.4	0.0030	0.0017	
34	1.5462	7.1460	3224.2	59.8	0.0053	0.0001	*
35	0.9165	7.2714	3431.5	71.6	0.0069	-0.0006	*
36	0.2814	7.3659	3559.3	5.2	0.0030	0.0026	
37	-0.3590	7.4057	2240.2	-116.2	-0.0035	0.0083	*
38	-0.9970	7.3510	323.1	-135.2	-0.0056	0.0064	*
39	-1.6193	7.2027	-924.8	33.6	0.0005	-0.0020	
40	-2.2288	7.0088	-1055.9	83.6	0.0024	-0.0041	
41	-2.8268	6.7821	-986.1	31.4	0.0004	-0.0020	
42	-3.4063	6.5112	-881.2	-2.9	-0.0008	-0.0006	
43	-3.9596	6.1902	-831.6	-3.6	-0.0008	-0.0005	
44	-4.4823	5.8214	-777.8	0.5	-0.0006	-0.0006	
45	-4.9711	5.4066	-703.7	1.0	-0.0005	-0.0006	
46	-5.4221	4.9549	-653.2	0.7	-0.0005	-0.0006	
47	-5.8321	4.4637	-616.6	0.6	-0.0005	-0.0005	
48	-6.1979	3.9387	-584.2	0.6	-0.0004	-0.0005	
49	-6.5166	3.3839	-554.8	0.5	-0.0004	-0.0005	
50	-6.7859	2.8035	-528.2	0.5	-0.0004	-0.0004	
51	-7.0037	2.2019	-505.1	0.4	-0.0004	-0.0004	
52	-7.1683	1.5835	-483.4	0.4	-0.0004	-0.0004	
53	-7.2785	0.9532	-465.4	0.4	-0.0004	-0.0004	
54	-7.3335	0.3157	-447.9	0.3	-0.0003	-0.0004	
55	-7.3327	-0.3242	-434.0	0.3	-0.0003	-0.0004	
56	-7.2763	-0.9616	-420.2	0.3	-0.0003	-0.0003	
57	-7.1646	-1.5917	-409.0	0.3	-0.0003	-0.0003	
58	-6.9984	-2.2097	-398.5	0.2	-0.0003	-0.0003	
59	-6.7791	-2.8108	-388.7	0.2	-0.0003	-0.0003	
60	-6.5083	-3.3906	-380.4	0.2	-0.0003	-0.0003	
61	-6.1880	-3.9446	-371.3	0.2	-0.0003	-0.0003	
62	-5.8207	-4.4686	-363.4	0.2	-0.0003	-0.0003	
63	-5.4092	-4.9586	-354.4	0.2	-0.0003	-0.0003	
64	-4.9565	-5.4110	-344.7	0.1	-0.0003	-0.0003	
65	-4.4661	-5.8222	-334.3	0.1	-0.0003	-0.0003	
66	-3.9418	-6.1891	-321.4	0.1	-0.0003	-0.0003	
67	-3.3875	-6.5089	-306.0	0.1	-0.0002	-0.0002	
68	-2.8075	-6.7793	-288.5	0.1	-0.0002	-0.0002	
69	-2.2060	-6.9981	-266.1	0.1	-0.0002	-0.0002	
70	-1.5878	-7.1637	-237.3	0.1	-0.0002	-0.0002	
71	-0.9576	-7.2748	-202.6	0.1	-0.0002	-0.0002	
72	-0.3199	-7.3305	-146.6	0.0	-0.0001	-0.0001	

J= 50 TIME= 0.0001500
TOTAL ENERGY INPUT (IN.-LB.) = 585.007
KINETIC ENERGY (IN.-LB.) = 479.768
ELASTIC ENERGY (IN.-LB.) = 58.959
PLASTIC WORK (IN.-LB.) = 46.280

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 7499.9922 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3228	-7.3303	159.2	-0.1	0.0001	0.0001	
2	0.9605	-7.2740	181.3	-0.1	0.0001	0.0001	
3	1.5909	-7.1623	205.8	-0.1	0.0002	0.0002	
4	2.2092	-6.9961	234.0	-0.1	0.0002	0.0002	
5	2.8107	-6.7766	264.7	-0.2	0.0002	0.0002	
6	3.3907	-6.5054	302.5	-0.2	0.0002	0.0002	
7	3.9448	-6.1847	349.3	-0.2	0.0003	0.0003	
8	4.4689	-5.8168	400.6	-0.3	0.0003	0.0003	
9	4.9590	-5.4046	463.3	-0.3	0.0004	0.0004	
10	5.4112	-4.9511	546.7	-0.4	0.0004	0.0005	
11	5.8221	-4.4599	644.2	-0.5	0.0005	0.0005	
12	6.1985	-3.9346	732.8	-0.5	0.0006	0.0006	
13	6.5077	-3.3792	804.9	-0.6	0.0006	0.0007	
14	6.7772	-2.7981	869.1	-0.6	0.0007	0.0007	
15	6.9948	-2.1956	933.1	-0.7	0.0007	0.0008	
16	7.1589	-1.5764	1004.1	-0.8	0.0008	0.0008	
17	7.2683	-0.9451	1080.9	-0.9	0.0008	0.0009	
18	7.3220	-0.3067	1163.7	-1.0	0.0009	0.0010	
19	7.3196	0.3341	1239.2	-1.1	0.0009	0.0010	
20	7.2610	0.9722	1313.8	-1.2	0.0010	0.0011	
21	7.1468	1.6028	1414.4	-1.3	0.0011	0.0012	
22	6.9778	2.2210	1537.0	-1.5	0.0012	0.0013	
23	6.7551	2.8220	1663.8	-1.6	0.0013	0.0014	
24	6.4804	3.4012	1809.3	-1.8	0.0014	0.0015	
25	6.1560	3.9542	1961.8	-2.0	0.0015	0.0016	
26	5.7841	4.4765	2081.6	-2.2	0.0016	0.0017	
27	5.3676	4.9641	2227.3	-2.4	0.0017	0.0019	
28	4.9097	5.4132	2449.6	-2.4	0.0019	0.0020	
29	4.4139	5.8202	2643.9	-2.5	0.0020	0.0022	
30	3.8841	6.1821	2847.0	-6.5	0.0020	0.0025	
31	3.3239	6.4951	3145.8	-12.8	0.0020	0.0030	
32	2.7370	6.7551	3441.0	3.4	0.0029	0.0026	
33	2.1298	6.9639	3796.7	43.6	0.0050	0.0012	*
34	1.5090	7.1313	4160.0	51.1	0.0088	0.0003	*
35	0.8804	7.2716	4590.3	44.1	0.0120	0.0001	*
36	0.2498	7.3950	4749.1	6.1	0.0040	0.0036	
37	-0.3903	7.4647	3092.3	-104.0	-0.0042	0.0153	*
38	-1.0289	7.4144	615.6	-163.5	-0.0096	0.0112	*
39	-1.6450	7.2423	-901.2	29.7	0.0004	-0.0019	
40	-2.2462	7.0241	-999.1	119.6	0.0041	-0.0061	*
41	-2.8394	6.7848	-945.3	80.1	0.0023	-0.0038	
42	-3.4184	6.5128	-909.1	6.8	-0.0005	-0.0010	
43	-3.9723	6.1929	-879.9	-12.0	-0.0012	-0.0002	
44	-4.4945	5.8234	-790.9	-2.5	-0.0007	-0.0005	
45	-4.9822	5.4093	-699.5	2.1	-0.0005	-0.0006	
46	-5.4323	4.9547	-635.4	1.6	-0.0004	-0.0006	
47	-5.8414	4.4627	-546.9	1.0	-0.0004	-0.0005	
48	-6.2063	3.9371	-486.5	0.9	-0.0004	-0.0004	
49	-6.5242	3.3818	-507.3	0.8	-0.0004	-0.0004	
50	-6.7927	2.8010	-484.7	0.8	-0.0004	-0.0004	
51	-7.0097	2.1990	-410.8	0.7	-0.0003	-0.0004	
52	-7.1737	1.5805	-381.1	0.6	-0.0003	-0.0003	
53	-7.2832	0.9500	-358.3	0.6	-0.0003	-0.0003	
54	-7.3375	0.3124	-317.6	0.5	-0.0002	-0.0003	
55	-7.3362	-0.3277	-287.2	0.5	-0.0002	-0.0002	
56	-7.2792	-0.9651	-271.1	0.4	-0.0002	-0.0002	
57	-7.1670	-1.5951	-260.9	0.4	-0.0002	-0.0002	
58	-7.0003	-2.2130	-251.3	0.4	-0.0002	-0.0002	
59	-6.7806	-2.8141	-245.0	0.3	-0.0002	-0.0002	
60	-6.5093	-3.3938	-238.7	0.3	-0.0002	-0.0002	
61	-6.1887	-3.9476	-233.9	0.3	-0.0002	-0.0002	
62	-5.8210	-4.4715	-223.6	0.2	-0.0002	-0.0002	
63	-5.4091	-4.9614	-199.2	0.2	-0.0002	-0.0002	
64	-4.9561	-5.4135	-152.3	0.2	-0.0001	-0.0001	
65	-4.4654	-5.8245	-90.4	0.1	-0.0001	-0.0001	
66	-3.9408	-6.1912	-37.3	0.1	-0.0000	-0.0000	
67	-3.3862	-6.5109	1.1	0.1	0.0000	-0.0000	
68	-2.8059	-6.7810	33.8	0.0	0.0000	0.0000	
69	-2.2042	-6.9995	65.4	0.0	0.0001	0.0001	
70	-1.5857	-7.1647	91.7	-0.0	0.0001	0.0001	
71	-0.9552	-7.2754	114.4	-0.0	0.0001	0.0001	
72	-0.3174	-7.3308	137.3	-0.0	0.0001	0.0001	

J= 60 TIME= 0.0001800
TOTAL ENERGY INPUT (IN.-LB.) = 1151.893
KINETIC ENERGY (IN.-LB.) = 950.074
ELASTIC ENERGY (IN.-LB.) = 82.060
PLASTIC WORK (IN.-LB.) = 119.760

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 8999.9922 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3268	-7.3293	351.2	-0.2	0.0003	0.0003	
2	0.9645	-7.2723	361.1	-0.2	0.0003	0.0003	
3	1.5949	-7.1599	373.3	-0.3	0.0003	0.0003	
4	2.2130	-6.9929	387.9	-0.3	0.0003	0.0003	
5	2.8143	-6.7726	405.8	-0.4	0.0003	0.0003	
6	3.3940	-6.5006	426.6	-0.4	0.0003	0.0004	
7	3.9477	-6.1790	452.2	-0.5	0.0003	0.0004	
8	4.4713	-5.8103	481.0	-0.5	0.0004	0.0004	
9	4.9606	-5.3973	508.5	-0.6	0.0004	0.0004	
10	5.4120	-4.9430	528.9	-0.7	0.0004	0.0004	
11	5.8220	-4.4511	550.1	-0.7	0.0004	0.0005	
12	6.1874	-3.9251	599.0	-0.8	0.0004	0.0005	
13	6.5054	-3.3692	665.1	-0.9	0.0005	0.0006	
14	6.7735	-2.7875	731.6	-1.1	0.0005	0.0006	
15	6.9897	-2.1846	813.3	-1.2	0.0006	0.0007	
16	7.1522	-1.5650	896.5	-1.3	0.0007	0.0008	
17	7.2598	-0.9335	953.5	-1.4	0.0007	0.0008	
18	7.3116	-0.2949	1048.8	-1.6	0.0008	0.0009	
19	7.3071	0.3458	1218.7	-1.8	0.0009	0.0010	
20	7.2464	0.9838	1370.1	-2.0	0.0010	0.0012	
21	7.1297	1.6139	1524.8	-2.2	0.0011	0.0013	
22	6.9580	2.2315	1745.6	-2.5	0.0013	0.0015	
23	6.7326	2.8316	1938.9	-2.8	0.0014	0.0017	
24	6.4549	3.4096	2139.1	-3.1	0.0016	0.0018	
25	6.1273	3.9609	2381.3	-3.4	0.0018	0.0020	
26	5.7520	4.4812	2607.8	-3.9	0.0019	0.0022	
27	5.3320	4.9662	2855.8	-3.8	0.0021	0.0024	
28	4.8706	5.4122	3086.2	-3.3	0.0023	0.0026	
29	4.3715	5.8157	3356.4	-7.1	0.0024	0.0030	
30	3.8379	6.1727	3632.2	-17.2	0.0022	0.0036	
31	3.2731	6.4781	3909.7	-8.1	0.0028	0.0034	
32	2.6828	6.7313	4227.9	28.7	0.0046	0.0022	*
33	2.0745	6.9398	4602.7	32.8	0.0076	0.0016	*
34	1.4533	7.1139	5038.9	26.3	0.0140	0.0015	*
35	0.8263	7.2740	5437.0	12.8	0.0194	0.0025	*
36	0.2012	7.4330	5422.6	0.7	0.0082	0.0063	*
37	-0.4352	7.5432	3633.9	-103.9	-0.0056	0.0229	*
38	-1.0765	7.5037	907.4	-164.9	-0.0139	0.0213	*
39	-1.6820	7.2971	-848.5	39.9	0.0009	-0.0022	
40	-2.2710	7.0479	-975.4	143.0	0.0060	-0.0084	*
41	-2.8565	6.7905	-859.2	121.9	0.0043	-0.0060	*
42	-3.4329	6.5129	-777.5	41.2	0.0010	-0.0022	
43	-3.9881	6.1951	-715.7	-18.5	-0.0013	0.0001	
44	-4.5108	5.8262	-671.8	-13.8	-0.0011	-0.0000	
45	-4.9972	5.4106	-647.3	1.6	-0.0005	-0.0006	
46	-5.4458	4.9544	-602.0	3.8	-0.0003	-0.0006	
47	-5.8537	4.4614	-506.8	1.9	-0.0003	-0.0005	
48	-6.2175	3.9350	-423.6	1.2	-0.0003	-0.0004	
49	-6.5343	3.3790	-395.1	1.2	-0.0003	-0.0004	
50	-6.8017	2.7976	-375.7	1.2	-0.0003	-0.0003	
51	-7.0177	2.1953	-370.3	1.1	-0.0003	-0.0003	
52	-7.1807	1.5764	-371.7	1.0	-0.0003	-0.0003	
53	-7.2893	0.9458	-316.1	0.9	-0.0002	-0.0003	
54	-7.3428	0.3080	-228.9	0.8	-0.0002	-0.0002	
55	-7.3407	-0.3320	-148.3	0.7	-0.0001	-0.0001	
56	-7.2830	-0.9695	-23.3	0.6	0.0000	-0.0000	
57	-7.1701	-1.5996	73.7	0.5	0.0001	0.0000	
58	-7.0028	-2.2175	66.4	0.5	0.0001	0.0000	
59	-6.7824	-2.8186	84.0	0.4	0.0001	0.0001	
60	-6.5106	-3.3982	153.9	0.3	0.0001	0.0001	
61	-6.1893	-3.9519	191.2	0.3	0.0002	0.0001	
62	-5.8211	-4.4756	212.8	0.2	0.0002	0.0002	
63	-5.4086	-4.9653	247.8	0.2	0.0002	0.0002	
64	-4.9551	-5.4172	279.1	0.1	0.0002	0.0002	
65	-4.4639	-5.8279	295.0	0.1	0.0002	0.0002	
66	-3.9387	-6.1942	304.9	0.1	0.0002	0.0002	
67	-3.3837	-6.5134	311.7	0.0	0.0002	0.0002	
68	-2.8030	-6.7831	317.7	0.0	0.0003	0.0003	
69	-2.2009	-7.0010	323.8	-0.0	0.0003	0.0003	
70	-1.5822	-7.1657	329.2	-0.1	0.0003	0.0003	
71	-0.9515	-7.2758	335.7	-0.1	0.0003	0.0003	
72	-0.3135	-7.3305	342.7	-0.1	0.0003	0.0003	

J= 100 TIME= 0.0003000
TOTAL ENERGY INPUT (IN.-LB.) = 4797.137
KINETIC ENERGY (IN.-LB.) = 3722.895
ELASTIC ENERGY (IN.-LB.) = 196.160
PLASTIC WORK (IN.-LB.) = 878.082

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 5024.8828 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3537	-7.3104	125.0	-1.2	0.0001	0.0001	
2	0.9909	-7.2485	217.7	-1.4	0.0001	0.0002	
3	1.6202	-7.1309	233.6	-1.6	0.0001	0.0002	
4	2.2368	-6.9585	213.9	-1.8	0.0001	0.0002	
5	2.8359	-6.7226	260.8	-2.0	0.0001	0.0003	
6	3.4128	-6.4548	323.2	-2.3	0.0002	0.0003	
7	3.9630	-6.1273	412.2	-2.6	0.0002	0.0004	
8	4.4823	-5.7526	507.5	-2.9	0.0003	0.0005	
9	4.9664	-5.3334	573.0	-3.2	0.0003	0.0006	
10	5.4116	-4.8730	618.2	-3.6	0.0004	0.0006	
11	5.8144	-4.3750	740.4	-4.0	0.0004	0.0007	
12	6.1714	-3.8431	913.2	-4.4	0.0006	0.0009	
13	6.4798	-3.2816	1045.1	-4.9	0.0006	0.0010	
14	6.7369	-2.6947	1132.8	-5.4	0.0007	0.0012	
15	6.9406	-2.0872	1284.6	-5.9	0.0008	0.0013	
16	7.0892	-1.4638	1320.7	-6.5	0.0008	0.0013	
17	7.1812	-0.8297	1406.7	-7.2	0.0008	0.0014	
18	7.2158	-0.1897	1554.4	-7.9	0.0009	0.0015	
19	7.1925	0.4509	1679.5	-8.7	0.0010	0.0017	
20	7.1113	1.0868	1880.7	-9.5	0.0011	0.0019	
21	6.9726	1.7128	2142.4	-10.4	0.0013	0.0021	
22	6.7774	2.3237	2359.4	-11.9	0.0014	0.0023	
23	6.5268	2.9142	2548.0	-13.6	0.0015	0.0026	
24	6.2227	3.4791	2748.4	-12.0	0.0017	0.0027	
25	5.8679	4.0137	2992.2	-9.1	0.0020	0.0027	
26	5.4660	4.5141	3245.1	-22.0	0.0017	0.0034	
27	5.0179	4.9738	3527.9	-41.6	0.0012	0.0044	
28	4.5245	5.3848	3863.4	-22.3	0.0022	0.0039	
29	3.9938	5.7467	4240.8	12.7	0.0039	0.0029	
30	3.4350	6.0639	4630.9	23.5	0.0049	0.0027	*
31	2.8525	6.3384	5055.3	19.8	0.0095	0.0022	*
32	2.2539	6.5849	5566.1	6.0	0.0191	0.0033	*
33	1.6452	6.8310	6077.5	7.1	0.0362	0.0152	*
34	1.0334	7.0932	5778.4	-8.2	0.0490	0.0302	
35	0.4140	7.3654	5458.2	-9.0	0.0639	0.0492	
36	-0.2110	7.6312	5324.5	36.8	0.0698	0.0510	
37	-0.8075	7.8915	3917.9	67.9	0.0053	0.0261	*
38	-1.4478	8.0328	1691.0	-185.4	-0.0496	0.0963	*
39	-1.9712	7.6625	263.0	-135.9	-0.0058	0.0064	*
40	-2.4353	7.2171	177.7	159.3	0.0258	-0.0199	
41	-2.9579	6.8448	115.8	180.2	0.0193	-0.0157	*
42	-3.5113	6.5226	209.6	134.1	0.0063	-0.0057	*
43	-4.0561	6.1862	360.0	77.5	0.0033	-0.0027	
44	-4.5809	5.8193	432.0	18.2	0.0010	-0.0004	
45	-5.0748	5.4116	461.5	-41.8	-0.0012	0.0020	
46	-5.5237	4.9550	495.7	-45.2	-0.0013	0.0021	
47	-5.9224	4.4538	547.8	1.2	0.0005	0.0004	
48	-6.2761	3.9199	584.3	20.2	0.0012	-0.0003	
49	-6.5864	3.3597	579.0	8.2	0.0008	0.0001	
50	-6.8485	2.7754	566.2	0.3	0.0005	0.0004	
51	-7.0588	2.1706	561.2	1.4	0.0005	0.0004	
52	-7.2160	1.5497	581.6	2.6	0.0006	0.0004	
53	-7.3191	0.9177	612.3	2.3	0.0006	0.0004	
54	-7.3672	0.2790	683.1	1.9	0.0006	0.0005	
55	-7.3601	-0.3614	712.7	1.6	0.0006	0.0005	
56	-7.2975	-0.9988	695.8	1.4	0.0006	0.0005	
57	-7.1800	-1.6284	770.2	1.2	0.0007	0.0006	
58	-7.0083	-2.2456	847.9	1.0	0.0007	0.0006	
59	-6.7837	-2.8454	818.8	0.9	0.0007	0.0006	
60	-6.5080	-3.4236	849.4	0.7	0.0007	0.0007	
61	-6.1830	-3.9756	919.3	0.5	0.0008	0.0007	
62	-5.8112	-4.4972	851.9	0.4	0.0007	0.0007	
63	-5.3955	-4.9845	680.2	0.3	0.0006	0.0005	
64	-4.9391	-5.4336	478.5	0.2	0.0004	0.0004	
65	-4.4454	-5.8412	254.9	0.1	0.0002	0.0002	
66	-3.9181	-6.2042	89.9	0.0	0.0001	0.0001	
67	-3.3612	-6.5199	3.5	-0.1	-0.0000	0.0000	
68	-2.7789	-6.7858	-19.8	-0.3	-0.0000	-0.0000	
69	-2.1757	-6.9998	30.4	-0.5	0.0000	0.0000	
70	-1.5560	-7.1604	67.3	-0.6	0.0000	0.0001	
71	-0.9246	-7.2662	66.5	-0.8	0.0000	0.0001	
72	-0.2865	-7.3163	75.9	-1.0	0.0000	0.0001	

J= 190 TIME= 0.000570

TOTAL ENERGY INPUT (IN.-LB.) = 5766.098
KINETIC ENERGY (IN.-LB.) = 4538.262
ELASTIC ENERGY (IN.-LB.) = 175.046
PLASTIC WORK (IN.-LB.) = 1052.790

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4637	-7.2091	122.6	-6.8	-0.0002	0.0004	
2	1.0985	-7.1264	26.3	-7.6	-0.0003	0.0003	
3	1.7230	-6.9868	-217.9	-8.4	-0.0005	0.0001	
4	2.3324	-6.7913	-249.2	-9.3	-0.0006	0.0001	
5	2.9215	-6.5412	-323.6	-10.3	-0.0007	0.0001	
6	3.4854	-6.2386	-317.3	-11.3	-0.0007	0.0002	
7	4.0191	-5.8855	-300.1	-12.5	-0.0007	0.0002	
8	4.5182	-5.4847	-139.0	-13.8	-0.0006	0.0004	
9	4.9781	-5.0394	-10.6	-15.2	-0.0006	0.0006	
10	5.3945	-4.5533	4.4	-16.5	-0.0006	0.0006	
11	5.7636	-4.0303	27.7	-18.0	-0.0007	0.0007	
12	6.0818	-3.4748	-9.5	-20.6	-0.0008	0.0008	
13	6.3456	-2.8915	68.7	-22.6	-0.0008	0.0009	
14	6.5523	-2.2857	32.2	-21.1	-0.0008	0.0008	
15	6.7002	-1.6628	116.4	-22.0	-0.0008	0.0009	
16	6.7877	-1.0285	186.5	-35.6	-0.0012	0.0015	
17	6.8107	-0.3887	239.1	-43.2	-0.0015	0.0018	
18	6.7670	0.2501	342.9	-22.0	-0.0006	0.0011	
19	6.6622	0.8819	380.4	-11.3	-0.0001	0.0007	
20	6.5001	1.5014	428.8	-40.1	-0.0012	0.0019	
21	6.2750	2.1010	525.9	-58.4	-0.0018	0.0027	
22	5.9854	2.6722	515.3	-62.8	-0.0020	0.0028	
23	5.6337	3.2076	573.5	-91.4	-0.0031	0.0040	
24	5.2188	3.6957	596.3	-101.2	-0.0034	0.0044	
25	4.7455	4.1274	538.7	-55.0	-0.0017	0.0025	
26	4.2280	4.5050	531.1	10.5	0.0008	0.0000	
27	3.6809	4.8384	432.4	79.5	0.0034	-0.0026	
28	3.1159	5.1404	314.2	132.8	0.0065	-0.0056	*
29	2.5435	5.4280	300.3	124.7	0.0087	-0.0074	
30	1.9697	5.7129	313.4	142.1	0.0106	-0.0094	
31	1.3988	6.0072	422.0	146.3	0.0150	-0.0085	*
32	0.8352	6.3213	324.3	169.1	0.0268	-0.0110	*
33	0.3009	6.6984	288.8	149.8	0.0410	0.0015	
34	-0.1935	7.1400	134.9	73.6	0.0481	0.0216	
35	-0.6744	7.6127	167.5	-12.8	0.0595	0.0451	
36	-1.1634	8.0803	110.6	-118.3	0.0584	0.0534	
37	-1.6586	8.4984	50.1	-179.3	-0.0150	0.0374	*
38	-2.2718	8.7199	-127.4	-205.4	-0.0773	0.1123	*
39	-2.7570	8.3030	387.8	-170.9	-0.0248	0.0207	*
40	-3.0887	7.7517	385.4	-109.2	0.0123	-0.0061	*
41	-3.4226	7.2039	765.6	11.5	0.0198	-0.0185	
42	-3.8127	6.6968	1069.5	42.3	0.0128	-0.0157	
43	-4.2330	6.2120	1306.5	145.6	0.0193	-0.0159	*
44	-4.6963	5.7684	1411.9	138.4	0.0119	-0.0082	*
45	-5.1660	5.3322	1587.7	103.2	0.0058	-0.0030	*
46	-5.6168	4.8765	1509.3	52.8	0.0032	-0.0008	
47	-6.0362	4.3920	1393.3	-16.2	0.0005	0.0017	
48	-6.4084	3.8704	1442.6	-56.5	-0.0010	0.0033	
49	-6.7215	3.3112	1422.1	-66.0	-0.0014	0.0037	
50	-6.9693	2.7203	1182.6	-46.9	-0.0009	0.0027	
51	-7.1534	2.1067	1002.3	-7.1	0.0005	0.0011	
52	-7.2815	1.4790	885.5	25.0	0.0017	-0.0003	
53	-7.3607	0.8435	767.9	47.6	0.0024	-0.0012	
54	-7.3961	0.2040	661.1	34.1	0.0018	-0.0008	
55	-7.3843	-0.4363	620.2	-12.4	0.0000	0.0010	
56	-7.3136	-1.0729	719.5	-24.4	-0.0004	0.0015	
57	-7.1817	-1.6995	663.0	1.7	0.0006	0.0005	
58	-6.9960	-2.3125	620.1	13.2	0.0010	-0.0000	
59	-6.7608	-2.9082	753.8	3.7	0.0007	0.0005	
60	-6.4753	-3.4816	776.7	-2.4	0.0005	0.0007	
61	-6.1405	-4.0276	762.6	-0.9	0.0006	0.0006	
62	-5.7591	-4.5422	782.3	0.2	0.0006	0.0006	
63	-5.3344	-5.0216	712.3	-0.6	0.0005	0.0006	
64	-4.8695	-5.4621	628.3	-1.4	0.0004	0.0006	
65	-4.3677	-5.8600	505.2	-1.9	0.0003	0.0005	
66	-3.8330	-6.2123	411.3	-2.4	0.0002	0.0004	
67	-3.2694	-6.5161	381.9	-2.9	0.0002	0.0004	
68	-2.6812	-6.7689	217.5	-3.4	0.0000	0.0003	
69	-2.0729	-6.9686	225.5	-4.1	0.0000	0.0003	
70	-1.4493	-7.1136	266.7	-4.7	0.0000	0.0004	
71	-0.8153	-7.2026	197.7	-5.4	-0.0001	0.0004	
72	-0.1759	-7.2345	143.5	-6.1	-0.0001	0.0003	

J= 230 TIME= 0.0006900
TOTAL ENERGY INPUT (IN.-LB.) = 5766.098
KINETIC ENERGY (IN.-LB.) = 4462.289
ELASTIC ENERGY (IN.-LB.) = 194.025
PLASTIC WORK (IN.-LB.) = 1109.784

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER
1	0.5160	-7.1543	-220.0	-9.7	-0.0006	0.0002	1
2	1.1493	-7.0616	0.1	-10.9	-0.0004	0.0004	
3	1.7715	-6.9113	124.6	-12.1	-0.0004	0.0006	
4	2.3774	-6.7044	185.8	-13.3	-0.0004	0.0007	
5	2.9617	-6.4425	293.6	-14.8	-0.0003	0.0008	
6	3.5191	-6.1273	472.1	-16.5	-0.0003	0.0010	
7	4.0447	-5.7613	604.2	-17.6	-0.0002	0.0012	
8	4.5335	-5.3475	656.0	-18.5	-0.0002	0.0012	
9	4.9811	-4.8893	755.8	-22.2	-0.0003	0.0014	
10	5.3827	-4.3903	877.2	-27.2	-0.0003	0.0017	
11	5.7337	-3.8544	774.3	-23.6	-0.0003	0.0015	
12	6.0313	-3.2873	690.1	-16.9	-0.0001	0.0012	
13	6.2744	-2.6947	790.9	-31.7	-0.0006	0.0018	
14	6.4574	-2.0808	826.1	-53.9	-0.0014	0.0027	
15	6.5728	-1.4507	727.3	-40.2	-0.0010	0.0021	
16	6.6227	-0.8121	734.8	-18.9	-0.0001	0.0013	
17	6.6120	-0.1718	668.9	-30.2	-0.0006	0.0017	
18	6.5381	0.4644	545.1	-34.6	-0.0009	0.0018	
19	6.4004	1.0900	521.8	-32.8	-0.0008	0.0017	
20	6.2009	1.6985	596.9	-71.9	-0.0023	0.0032	
21	5.9325	2.2801	643.7	-115.0	-0.0039	0.0050	*
22	5.5892	2.8212	690.4	-123.6	-0.0044	0.0058	*
23	5.1739	3.3091	723.8	-109.1	-0.0036	0.0048	
24	4.6987	3.7391	795.9	-47.3	-0.0012	0.0024	
25	4.1807	4.1165	881.1	37.0	0.0021	-0.0007	
26	3.6367	4.4553	915.1	74.4	0.0036	-0.0021	
27	3.0740	4.7619	909.8	103.7	0.0047	-0.0032	
28	2.4974	5.0417	808.9	129.0	0.0070	-0.0054	*
29	1.9144	5.3075	631.6	144.6	0.0100	-0.0085	
30	1.3334	5.5777	507.0	166.9	0.0126	-0.0108	*
31	0.7600	5.8675	393.9	179.0	0.0254	-0.0182	*
32	0.2293	6.2336	287.7	181.0	0.0304	-0.0168	*
33	-0.2456	6.6832	175.0	109.7	0.0394	0.0030	
34	-0.6799	7.1842	161.9	33.7	0.0466	0.0232	
35	-1.1050	7.7076	33.4	-47.9	0.0581	0.0464	
36	-1.5458	8.2208	50.1	-116.5	0.0581	0.0534	
37	-1.9972	8.6838	-96.6	-182.5	-0.0237	0.0415	*
38	-2.6020	8.9237	-129.0	-211.5	-0.0855	0.1163	*
39	-3.0736	8.4921	-238.1	-182.6	-0.0261	0.0208	*
40	-3.3839	7.9290	-167.2	-122.2	0.0093	-0.0045	*
41	-3.6836	7.3623	-150.0	-56.5	0.0163	-0.0165	
42	-4.0268	6.8230	-125.8	-13.7	0.0097	-0.0145	
43	-4.3904	6.2950	-15.4	93.0	0.0163	-0.0149	
44	-4.7909	5.7948	255.3	146.9	0.0132	-0.0117	
45	-5.2108	5.3113	297.5	152.5	0.0099	-0.0095	*
46	-5.6364	4.8330	244.6	122.8	0.0050	-0.0046	*
47	-6.0435	4.3387	318.3	56.8	0.0024	-0.0019	
48	-6.4176	3.8191	247.1	-3.0	0.0001	0.0003	
49	-6.7443	3.2685	270.2	-46.1	-0.0016	0.0020	
50	-7.0113	2.6866	201.5	-78.4	-0.0029	0.0032	
51	-7.2079	2.0773	233.4	-67.3	-0.0024	0.0028	
52	-7.3340	1.4495	341.2	-29.8	-0.0009	0.0014	
53	-7.3975	0.8125	386.1	11.1	0.0007	-0.0001	
54	-7.4080	0.1722	384.2	45.3	0.0020	-0.0014	
55	-7.3741	-0.4672	409.8	50.4	0.0023	-0.0016	
56	-7.2971	-1.1029	414.6	31.6	0.0015	-0.0009	
57	-7.1728	-1.7309	247.8	-8.4	-0.0001	0.0005	
58	-6.9923	-2.3452	244.1	-39.8	-0.0013	0.0017	
59	-6.7496	-2.9375	90.7	-16.0	-0.0005	0.0007	
60	-6.4526	-3.5046	51.1	22.0	0.0009	-0.0008	
61	-6.1121	-4.0466	-73.2	16.2	0.0006	-0.0007	
62	-5.7289	-4.5592	-245.6	-6.8	-0.0005	0.0001	
63	-5.3013	-5.0353	-295.1	-8.9	-0.0006	0.0001	
64	-4.8324	-5.4706	-553.0	-1.1	-0.0005	-0.0004	
65	-4.3270	-5.8632	-432.1	-0.3	-0.0004	-0.0003	
66	-3.7894	-6.2102	-487.9	-3.4	-0.0005	-0.0003	
67	-3.2232	-6.5082	-506.8	-4.8	-0.0006	-0.0002	
68	-2.6326	-6.7547	-352.7	-5.1	-0.0005	-0.0001	
69	-2.0225	-6.9475	-451.3	-5.7	-0.0006	-0.0002	
70	-1.3975	-7.0850	-453.0	-6.7	-0.0006	-0.0001	
71	-0.7627	-7.1658	-168.9	-7.7	-0.0004	0.0002	
72	-0.1231	-7.1891	-152.5	-8.7	-0.0005	0.0002	

J= 240 TIME= 0.0007200

TOTAL ENERGY INPUT (IN.-LB.) = 5766.098

KINETIC ENERGY (IN.-LB.) = 4435.605

ELASTIC ENERGY (IN.-LB.) = 202.048

PLASTIC WORK (IN.-LB.) = 1128.444

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.5342	-7.1417	439.1	-10.5	-0.0001	0.0007	
2	1.1672	-7.0456	348.6	-11.7	-0.0002	0.0007	
3	1.7886	-6.8917	149.8	-12.8	-0.0004	0.0006	
4	2.3931	-6.6813	15.3	-14.2	-0.0005	0.0006	
5	2.9756	-6.4157	88.6	-16.0	-0.0006	0.0007	
6	3.5307	-6.0969	18.6	-17.2	-0.0007	0.0007	
7	4.0533	-5.7274	-80.0	-17.7	-0.0008	0.0006	
8	4.5390	-5.3102	116.8	-20.5	-0.0007	0.0009	
9	4.9827	-4.8488	106.4	-26.8	-0.0010	0.0011	
10	5.3792	-4.3462	-10.3	-26.2	-0.0010	0.0010	
11	5.7250	-3.8074	125.4	-16.3	-0.0005	0.0007	
12	6.0188	-3.2385	220.1	-23.6	-0.0007	0.0011	
13	6.2564	-2.6440	252.3	-50.3	-0.0017	0.0021	
14	6.4292	-2.0274	280.5	-48.8	-0.0017	0.0021	
15	6.5355	-1.3960	324.7	-24.6	-0.0007	0.0012	
16	6.5801	-0.7571	506.7	-28.9	-0.0007	0.0015	
17	6.5616	-0.1169	619.0	-35.9	-0.0009	0.0019	
18	6.4785	0.5182	688.6	-24.4	-0.0004	0.0015	
19	6.3342	1.1424	833.5	-47.6	-0.0012	0.0025	
20	6.1248	1.7477	716.9	-95.5	-0.0031	0.0042	
21	5.8416	2.3223	554.3	-117.3	-0.0043	0.0054	
22	5.4825	2.8531	695.3	-128.5	-0.0048	0.0063	
23	5.0510	3.3268	762.3	-92.2	-0.0029	0.0042	
24	4.5643	3.7437	747.2	-15.1	0.0000	0.0012	
25	4.0410	4.1136	725.8	36.0	0.0020	-0.0008	
26	3.4921	4.4442	624.2	74.0	0.0033	-0.0024	
27	2.9250	4.7422	485.3	115.8	0.0048	-0.0040	
28	2.3458	5.0160	449.3	131.4	0.0068	-0.0057	
29	1.7604	5.2763	469.5	151.1	0.0101	-0.0089	
30	1.1773	5.5427	537.9	167.5	0.0143	-0.0115	*
31	0.6047	5.8359	590.4	177.9	0.0295	-0.0197	*
32	0.0866	6.2198	610.2	158.6	0.0299	-0.0157	
33	-0.3771	6.6815	711.0	106.1	0.0396	0.0036	
34	-0.7995	7.1929	656.7	39.9	0.0472	0.0233	
35	-1.2109	7.7275	703.9	-51.1	0.0585	0.0470	
36	-1.6389	8.2518	545.9	-127.5	0.0581	0.0542	
37	-2.0809	8.7242	399.8	-182.2	-0.0235	0.0423	*
38	-2.6815	8.9748	170.8	-218.2	-0.0872	0.1183	*
39	-3.1529	8.5420	170.1	-180.5	-0.0263	0.0229	*
40	-3.4557	7.9745	334.2	-120.6	0.0096	-0.0037	
41	-3.7463	7.4026	577.9	-72.8	0.0160	-0.0145	
42	-4.0742	6.8533	694.8	32.5	0.0121	-0.0156	
43	-4.4325	6.3211	895.5	46.5	0.0152	-0.0124	
44	-4.8188	5.8092	1013.0	141.2	0.0140	-0.0111	
45	-5.2256	5.3135	1157.8	145.0	0.0122	-0.0091	*
46	-5.6430	4.8272	1111.8	123.2	0.0066	-0.0043	*
47	-6.0450	4.3284	1058.0	82.3	0.0040	-0.0023	
48	-6.4190	3.8082	1065.9	13.6	0.0014	0.0003	
49	-6.7492	3.2592	1010.1	-42.4	-0.0008	0.0024	
50	-7.0206	2.6788	989.4	-75.3	-0.0021	0.0037	
51	-7.2224	2.0709	867.3	-82.0	-0.0025	0.0038	
52	-7.3503	1.4432	850.2	-44.7	-0.0010	0.0024	
53	-7.4119	0.8058	809.8	3.0	0.0008	0.0005	
54	-7.4184	0.1652	811.3	40.9	0.0022	-0.0009	
55	-7.3793	-0.4742	825.2	53.7	0.0027	-0.0014	
56	-7.2980	-1.1095	944.6	35.9	0.0021	-0.0006	
57	-7.1705	-1.7373	981.1	8.5	0.0011	0.0004	
58	-6.9908	-2.3521	875.2	-26.0	-0.0003	0.0017	
59	-6.7521	-2.9466	931.3	-35.6	-0.0006	0.0021	
60	-6.4546	-3.5139	900.0	1.9	0.0008	0.0006	
61	-6.1091	-4.0534	1062.8	26.7	0.0019	-0.0002	
62	-5.7232	-4.5649	1148.1	6.3	0.0012	0.0007	
63	-5.2955	-5.0418	1110.4	-13.1	0.0004	0.0014	
64	-4.8254	-5.4773	1195.9	-7.8	0.0006	0.0012	
65	-4.3181	-5.8686	1183.5	-0.2	0.0009	0.0009	
66	-3.7785	-6.2141	1116.7	-2.1	0.0008	0.0010	
67	-3.2107	-6.5108	1145.9	-5.6	0.0007	0.0011	
68	-2.6186	-6.7556	1074.4	-6.4	0.0006	0.0011	
69	-2.0070	-6.9463	1033.4	-6.5	0.0006	0.0011	
70	-1.3808	-7.0814	902.4	-7.4	0.0004	0.0010	
71	-0.7452	-7.1595	763.0	-8.5	0.0003	0.0009	
72	-0.1050	-7.1797	686.1	-9.5	0.0002	0.0009	

FIRST YIELDING AT TIME= 0.000096

B.6.2 Example 2: A Single-Layer Ring with Forcing Function Provided by TEJ 2

In this example, a 2024-T4 aluminum ring, duplicating the dimensions of the test ring used in NAPTC containment ring Test 91, is acted upon by the external forces calculated by TEJ 2 as described in Subsection 3.4. The following dimensions and characteristics are those of the ring used in Test 91:

Radius to inner surface = 8.657 in.
Radial thickness = 0.152 in.
Axial length = 1.506 in.

The forcing function is that described in Table 3, except that the mass station numbers at which the time-dependent forces are applied have been changed so that mass station number 1 can occur at $\theta = 0$ as it does for the JET 2 program.

The stress-strain curve for 2024-T4 aluminum can be approximated by the following stress-strain coordinates: (σ, ε): (0 psi, 0 in/in); (50,000, 0.005); (56000, 0.030); (62000,0.080). Strain-rate effects are considered to be negligible, and the density is 0.2524×10^{-3} $(\text{lb-sec}^2)/\text{in}^4$.

The number of mass points used to describe the complete ring is 72.

The critical time interval for this ring is obtained by using the smaller of the two critical times from Eqs. B1 and B2. These are calculated as follows:

$$\Delta T_{long} = \frac{\Delta S}{\sqrt{\frac{E_1}{\rho}}} = \frac{2\pi R}{N}\sqrt{\frac{\rho \epsilon_1}{\sigma_1}} = 0.383 \times 10^{-5} \text{ sec}$$

where

$$\Delta S = \frac{2\pi R}{N} = 0.762$$

$$\Delta T_{lat} = \frac{\frac{1}{2}(\Delta S)^2}{\sqrt{\frac{E_1 I}{\rho H}}} = \frac{\sqrt{3}\,(\Delta S)^2}{H\sqrt{\frac{E_1}{\rho}}} = \frac{\sqrt{3}\;\Delta S}{H}\,\Delta T_{long}$$

Since ΔT_{Long} is the smaller of the two, a value for ΔT chosen must be less than this. The time between camera frames in the high-speed motion pictures of Test 91 was 30.1 μsec. Therefore, a value of $\Delta T = .301 \times 10^{-5}$ sec is chosen. Thus, every 10 computation cycles will conform to each camera frame.

Let the program compute 800 cycles (about .002400 sec.); a printout, conforming to the camera framing times, is desired at 10 cycles and every 10 cycles thereafter.

B.6.2.1 Input Data

The values to be punched on the data cards are as follows:

	Format
Card 1	3E15.6
R = +0.865700E+01 (Radius to inner surface)	
B = +0.150600E+01	
DELTAT = +0.301000E-05	
Card 2	6I5
N = 72	
NRING = 1	
M = 300	
M1 = 10	
M2 = 10	
IND = 0 (no bonds to test)	
Card 3	I5
NSFL(1) = 3	
Card 4 is not used since IND = 0	
Card 5	4E15.6
H = +0.152000E+00	
RHO = +0.252400E+00	
D = +0.000000E+00 } Strain-rate effects are considered to be negligible	
P = +0.000000E+00 }	

Format

Card 6aa — 4E15.6

EPSIL(1,1) = +0.500000E-02

SIGMA(1,1) = +0.500000E+05

EPSIL(2,1) = +0.300000E-01

SIGMA(2,1) = +0.560000E+05

Card 6ab — 2E15.6

EPSIL(3,1) = +0.800000E-01

SIGMA(3,1) = +0.620000E+05

Card 7 — 2I5

IOTA = 0 }
NV = 0 } No initial impulse loading is specified

Cards 8 and 9 are not required since IOTA = 0

Card 10 — 4E15.6

TBEGIN	= +0.000000E+00	Total forcing function
TFINAL	= +0.600000E-03	lasts 600 μsecs.
AMP1TY	= +0.000000E+00	Forcing function has zero
AMP1RZ	= +0.000000E+00	amplitude at t = 0

Card 11a — E15.6,I5, 2E15.6

T2	= +0.301000E-04	
JOLT	= 2	Indicates that the force distribution to be defined by cards which follow.
AMP2TY	= +0.780000E+02	These define the nominal forces amplitudes at the second force vs time coordinate
AMP2RZ	= +0.295000E+03	

Card 12 — 2I5

NOF = 5 (Number of mass points which are acted upon by external forces)

NRTYZ = 2 (Indicates that the input values of force are y,z directed, not radial and tangential)

Format

Card 13a I5,2E15.6

MASSNO = 27

GTY(MASSNO) = +0.190000E+00
GRZ(MASSNO) = +0.260000E+00

} These are the ratios of the forces acting on mass station 27 to those acting on mass station 29 which will be used as the normalizing force values

Card 13b I5,2E15.6

MASSNO = 28

GTY(MASSNO) = +0.500000E+00

GRZ(MASSNO) = +0.640000E+00

Card 13c I5,2E15.6

MASSNO = 29

GTY(MASSNO) = +0.100000E+01

GRZ(MASSNO) = +0.100000E+01

Card 13d I5,2E15.6

MASSNO = 30

GTY(MASSNO) = +0.580000E+00

GRZ(MASSNO) = +0.550000E+00

Card 13e I5,2E15.6

MASSNO = 31

GTY(MASSNO) = +0.080000E+00

GRZ(MASSNO) = +0.170000E+00

Cards 11 through 13 are repeated for each force vs time coordinate as listed in Table 3 until the last Card No. 11 gives zero amplitude at time = +0.600000E-03

The total input data deck for this example problem should appear as follows:

```
+0.865700E+01   +0.150600E+01   +0.301000E-05
 72     1   300    10     10      0
  5
+0.152000E+00   +0.252400E-03   +0.000000E+00   +0.000000E+00
+0.500000E-02   +0.500000E+05   +0.300000E-01   +0.560000E+05
+0.800000E-01   +0.620000E+05
  0      0
+0.000000E+00   +0.500000E-03   +0.000000E+00   +0.000000E+00
+0.301000E-04      2   +0.780000E+02   +0.295000E+03
  5      2
 27   +0.190000E+00   +0.260000E+00
 28   +0.500000E+00   +0.640000E+00
 29   +0.100000E+01   +0.100000E+01
 30   +0.580000E+00   +0.550000E+00
 31   +0.080000E+00   +0.170000E+00
+0.602000E-04      2   +0.145000E+03   +0.515000E+03
  5      2
 27   +0.190000E+00   +0.220000E+00
 28   +0.590000E+00   +0.460000E+00
 29   +0.100000E+01   +0.100000E+01
 30   +0.520000E+00   +0.420000E+00
 31   +0.060000E+00   +0.320000E+00
+0.903000E-04      2   +0.159000E+03   +0.691000E+03
  5      2
 27   +0.160000E+00   +0.170000E+00
 28   +0.640000E+00   +0.620000E+00
 29   +0.100000E+01   +0.100000E+01
 30   +0.620000E+00   +0.600000E+00
 31   +0.120000E+00   +0.150000E+00
+0.120400E-03      2   +0.143000E+03   +0.794000E+03
  5      2
 27   +0.070000E+00   +0.090000E+00
 28   +0.630000E+00   +0.780000E+00
 29   +0.100000E+01   +0.100000E+01
 30   +0.680000E+00   +0.830000E+00
 31   +0.120000E+00   -0.060000E+00
+0.150500E-03      2   +0.140000E+03   +0.868000E+03
  5      2
 27   +0.110000E+00   +0.090000E+00
 28   +0.650000E+00   +0.740000E+00
 29   +0.100000E+01   +0.100000E+01
 30   +0.640000E+00   +0.760000E+00
 31   +0.120000E+00   -0.030000E+00
+0.180600E-03      2   +0.141000E+03   +0.902000E+03
  5      2
 27   +0.120000E+00   +0.050000E+00
 28   +0.610000E+00   +0.520000E+00
 29   +0.100000E+01   +0.100000E+01
 30   +0.620000E+00   +0.510000E+00
 31   +0.130000E+00   +0.160000E+00
+0.210700E-03      2   +0.925000E+02   +0.949000E+03
  7      2
 28   +0.060000E+00   +0.080000E+00
 29   +0.630000E+00   +0.920000E+00
 30   +0.100000E+01   +0.100000E+01
 31   +0.670000E+00   +0.800000E+00
 32   +0.130000E+00   -0.170000E+00
```

+0.240800E-03	2	+0.830000E+02	+0.898000E+03
5	2		
28	+0.070000E+00	+0.040000E+00	
29	+0.670000E+00	+0.610000E+00	
30	+0.100000E+01	+0.100000E+01	
31	+0.700000E+00	+0.500000E+00	
32	+0.070000E+00	+0.200000E+00	
+0.270900E-03	2	+0.638000E+02	+0.881000E+03
5	2		
28	+0.000000E+00	+0.040000E+00	
29	+0.660000E+00	+0.290000E+00	
30	+0.100000E+01	+0.100000E+01	
31	-0.200000E+00	+0.810000E+00	
32	+0.090000E+00	+0.250000E+00	
+0.301000E-03	2	+0.242000E+02	+0.853000E+03
5	2		
28	+0.020000E+00	+0.460000E+00	
29	+0.650000E+00	-0.060000E+00	
30	+0.100000E+01	+0.100000E+01	
31	+0.780000E+00	-0.770000E+00	
32	+0.160000E+00	+0.180000E+00	
+0.331100E-03	2	-0.289000E+02	+0.767000E+03
5	2		
28	+0.070000E+00	+0.000000E+00	
29	+0.640000E+00	+0.260000E+00	
30	+0.100000E+01	+0.100000E+01	
31	+0.660000E+00	-0.040000E+00	
32	+0.140000E+00	+0.460000E+00	
+0.361200E-03	2	-0.667000E+02	+0.668000E+03
5	2		
28	+0.110000E+00	+0.280000E+00	
29	+0.690000E+00	+0.310000E+00	
30	+0.100000E+01	+0.100000E+01	
31	+0.680000E+00	+0.230000E+00	
32	+0.130000E+00	+0.220000E+00	
+0.391300E-03	2	-0.788000E+02	+0.553000E+03
5	2		
28	+0.060000E+00	+0.220000E+00	
29	+0.750000E+00	+0.660000E+00	
30	+0.100000E+01	+0.100000E+01	
31	+0.750000E+00	+0.660000E+00	
32	+0.080000E+00	+0.020000E+00	
+0.421400E-03	2	-0.116000E+03	+0.537000E+03
5	2		
29	+0.120000E+00	+0.160000E+00	
30	+0.600000E+00	+0.440000E+00	
31	+0.100000E+01	+0.100000E+01	
32	+0.600000E+00	+0.440000E+00	
33	+0.120000E+00	+0.180000E+00	
+0.451500E-03	2	-0.120000E+03	+0.430000E+03
5	2		
29	+0.070000E+00	+0.190000E+00	
30	+0.660000E+00	+0.550000E+00	
31	+0.100000E+01	+0.100000E+01	
32	+0.670000E+00	+0.600000E+00	
33	+0.130000E+00	+0.100000E+00	
+0.481600E-03	2	-0.131000E+03	+0.354000E+03

29	+0.190000E+00	+0.170000E+00	
30	+0.540000E+00	+0.630000E+00	
31	+0.100000E+01	+0.100000E+01	
32	+0.600000E+00	+0.600000E+00	
33	+0.180000E+00	+0.170000E+00	
+0.511700E-03	2	-0.137000E+03	+0.282000E+03
5	2		
29	+0.220000E+00	+0.090000E+00	
30	+0.540000E+00	+0.690000E+00	
31	+0.100000E+01	+0.100000E+01	
32	+0.510000E+00	+0.570000E+00	
33	+0.070000E+00	+0.100000E+00	
+0.541800E-03	2	-0.140000E+03	+0.247000E+03
5	2		
29	+0.110000E+00	+0.040000E+00	
30	+0.610000E+00	+0.650000E+00	
31	+0.100000E+01	+0.100000E+01	
32	+0.690000E+00	+0.710000E+00	
33	+0.160000E+00	+0.150000E+00	
+0.571900E-03	2	-0.135000E+03	+0.210000E+03
5	2		
29	+0.020000E+00	+0.020000E+00	
30	+0.460000E+00	+0.550000E+00	
31	+0.100000E+01	+0.100000E+01	
32	+0.720000E+00	+0.730000E+00	
33	+0.320000E+00	+0.200000E+00	
+0.601000E-03	1	+0.000000E+00	+0.000000E+00

B.6.2.2 Solution Output for Example 2

The solution printout is as follows:

```
JET 2     A PROGRAM USED TO CALCULATE THE RESPONSE OF A FREE
CIRCULAR MULTI-LAYERED RING WITH THE FOLLOWING PARAMETERS.-

RADIUS OF RING TO INNER SURFACE  (IN.)              =    8.65700
WIDTH  OF RING      (IN.)                           =    1.50600
THICKNESS OF RING  (IN.)                            =    0.15200
CENTROIDAL DISTANCE FROM INNER SURFACE   (IN.)      =    0.07600

NUMBER OF MASS POINTS USED IN THE RING              =     72

NUMBER OF LAYERS USED IN RING CROSS SECTION         =      1

NUMBER OF CONTROL STATIONS USED IN LAYER 1          =      4

NUMBER OF MECHANICAL SUBLAYERS AT EACH
 CONTROL STATION IN LAYER 1                         =      3

THICKNESS OF LAYER 1                                =    0.15200


TIME INTERVAL PER CYCLE USED IN PROGRAM (SEC) =      0.30099991E-05


THERE IS NO INITIAL IMPULSE

STARTING TIME OF FORCING FUNCTION (SEC)  = 0.0
STOPPING TIME OF FORCING FUNCTION (SEC)  = 0.0006000
DURATION OF THE  FORCING FUNCTION (SEC)  = 0.0006000
```

J= 0 TIME= 0.0
TOTAL ENERGY INPUT (IN.-LB.) = 0.0
KINETIC ENERGY (IN.-LB.) = 0.0
ELASTIC ENERGY (IN.-LB.) = 0.0
PLASTIC WORK (IN.-LB.) = 0.0

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 0.0 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS DEFINED BY NORMALIZED INPUT VALUES OF GY(I), AND GZ(I)

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3809	-8.7247	0.0	0.0	0.0	0.0	
2	1.1399	-8.6583	0.0	0.0	0.0	0.0	
3	1.8902	-8.5260	0.0	0.0	0.0	0.0	
4	2.6261	-8.3288	0.0	0.0	0.0	0.0	
5	3.3420	-8.0682	0.0	0.0	0.0	0.0	
6	4.0324	-7.7463	0.0	0.0	0.0	0.0	
7	4.6922	-7.3653	0.0	0.0	0.0	0.0	
8	5.3163	-6.9284	0.0	0.0	0.0	0.0	
9	5.8999	-6.4386	0.0	0.0	0.0	0.0	
10	6.4386	-5.8999	0.0	0.0	0.0	0.0	
11	6.9284	-5.3163	0.0	0.0	0.0	0.0	
12	7.3653	-4.6922	0.0	0.0	0.0	0.0	
13	7.7463	-4.0325	0.0	0.0	0.0	0.0	
14	8.0682	-3.3420	0.0	0.0	0.0	0.0	
15	8.3288	-2.6261	0.0	0.0	0.0	0.0	
16	8.5260	-1.8902	0.0	0.0	0.0	0.0	
17	8.6583	-1.1399	0.0	0.0	0.0	0.0	
18	8.7247	-0.3810	0.0	0.0	0.0	0.0	
19	8.7247	0.3810	0.0	0.0	0.0	0.0	
20	8.6583	1.1399	0.0	0.0	0.0	0.0	
21	8.5260	1.8902	0.0	0.0	0.0	0.0	
22	8.3288	2.6261	0.0	0.0	0.0	0.0	
23	8.0682	3.3420	0.0	0.0	0.0	0.0	
24	7.7463	4.0325	0.0	0.0	0.0	0.0	
25	7.3653	4.6922	0.0	0.0	0.0	0.0	
26	6.9284	5.3163	0.0	0.0	0.0	0.0	
27	6.4386	5.8999	0.0	0.0	0.0	0.0	
28	5.8999	6.4386	0.0	0.0	0.0	0.0	
29	5.3163	6.9284	0.0	0.0	0.0	0.0	
30	4.6922	7.3653	0.0	0.0	0.0	0.0	
31	4.0324	7.7463	0.0	0.0	0.0	0.0	
32	3.3420	8.0682	0.0	0.0	0.0	0.0	
33	2.6261	8.3288	0.0	0.0	0.0	0.0	
34	1.8902	8.5260	0.0	0.0	0.0	0.0	
35	1.1399	8.6583	0.0	0.0	0.0	0.0	
36	0.3809	8.7247	0.0	0.0	0.0	0.0	
37	-0.3809	8.7247	0.0	0.0	0.0	0.0	
38	-1.1399	8.6583	0.0	0.0	0.0	0.0	
39	-1.8902	8.5260	0.0	0.0	0.0	0.0	
40	-2.6261	8.3288	0.0	0.0	0.0	0.0	
41	-3.3420	8.0682	0.0	0.0	0.0	0.0	
42	-4.0324	7.7463	0.0	0.0	0.0	0.0	
43	-4.6922	7.3653	0.0	0.0	0.0	0.0	
44	-5.3163	6.9284	0.0	0.0	0.0	0.0	
45	-5.8999	6.4386	0.0	0.0	0.0	0.0	
46	-6.4386	5.8999	0.0	0.0	0.0	0.0	
47	-6.9284	5.3163	0.0	0.0	0.0	0.0	
48	-7.3653	4.6922	0.0	0.0	0.0	0.0	
49	-7.7463	4.0325	0.0	0.0	0.0	0.0	
50	-8.0682	3.3420	0.0	0.0	0.0	0.0	
51	-8.3288	2.6261	0.0	0.0	0.0	0.0	
52	-8.5260	1.8902	0.0	0.0	0.0	0.0	
53	-8.6583	1.1399	0.0	0.0	0.0	0.0	
54	-8.7247	0.3810	0.0	0.0	0.0	0.0	
55	-8.7247	-0.3810	0.0	0.0	0.0	0.0	
56	-8.6583	-1.1399	0.0	0.0	0.0	0.0	
57	-8.5260	-1.8902	0.0	0.0	0.0	0.0	
58	-8.3288	-2.6261	0.0	0.0	0.0	0.0	
59	-8.0682	-3.3420	0.0	0.0	0.0	0.0	
60	-7.7463	-4.0325	0.0	0.0	0.0	0.0	
61	-7.3653	-4.6922	0.0	0.0	0.0	0.0	
62	-6.9284	-5.3163	0.0	0.0	0.0	0.0	
63	-6.4386	-5.8999	0.0	0.0	0.0	0.0	
64	-5.8999	-6.4386	0.0	0.0	0.0	0.0	
65	-5.3163	-6.9284	0.0	0.0	0.0	0.0	
66	-4.6922	-7.3653	0.0	0.0	0.0	0.0	
67	-4.0324	-7.7463	0.0	0.0	0.0	0.0	
68	-3.3420	-8.0682	0.0	0.0	0.0	0.0	
69	-2.6261	-8.3288	0.0	0.0	0.0	0.0	
70	-1.8902	-8.5260	0.0	0.0	0.0	0.0	
71	-1.1399	-8.6583	0.0	0.0	0.0	0.0	
72	-0.3809	-8.7247	0.0	0.0	0.0	0.0	

J= 10 TIME= 0.0000301
TOTAL ENERGY INPUT (IN.-LB.) = 0.483
KINETIC ENERGY (IN.-LB.) = 0.406
ELASTIC ENERGY (IN.-LB.) = 0.019
PLASTIC WORK (IN.-LB.) = 0.057

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 305.1372 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3809	-8.7247	0.0	0.0	0.0	0.0	
2	1.1399	-8.6583	0.0	0.0	0.0	0.0	
3	1.8902	-8.5260	0.0	0.0	0.0	0.0	
4	2.6261	-8.3288	0.0	0.0	0.0	0.0	
5	3.3420	-8.0682	0.0	0.0	0.0	0.0	
6	4.0324	-7.7463	0.0	0.0	0.0	0.0	
7	4.6922	-7.3653	0.0	0.0	0.0	0.0	
8	5.3163	-6.9284	0.0	0.0	0.0	0.0	
9	5.8999	-6.4386	0.0	0.0	0.0	0.0	
10	6.4386	-5.8999	-0.0	0.0	0.0000	-0.0000	
11	6.9284	-5.3163	0.0	0.0	0.0000	-0.0000	
12	7.3653	-4.6922	-0.0	-0.0	-0.0000	0.0000	
13	7.7463	-4.0325	0.0	0.0	0.0000	-0.0000	
14	8.0682	-3.3420	-0.0	-0.0	-0.0000	0.0000	
15	8.3288	-2.6261	0.0	0.0	0.0000	-0.0000	
16	8.5260	-1.8902	-0.0	-0.0	-0.0000	0.0000	
17	8.6583	-1.1399	0.0	0.0	0.0000	-0.0000	
18	8.7247	-0.3810	-0.0	-0.0	-0.0000	0.0000	
19	8.7247	0.3810	0.0	-0.0	-0.0000	0.0000	
20	8.6583	1.1399	0.6	-0.0	0.0000	0.0000	
21	8.5260	1.8902	3.5	-0.0	0.0000	0.0000	
22	8.3288	2.6261	12.3	-0.0	0.0000	0.0000	
23	8.0682	3.3420	29.9	-0.0	0.0000	0.0000	
24	7.7462	4.0325	54.6	-0.0	0.0000	0.0000	
25	7.3653	4.6923	81.6	-0.0	0.0000	0.0000	
26	6.9283	5.3164	111.5	1.3	0.0001	0.0000	
27	6.4387	5.9001	147.1	1.1	0.0001	0.0000	
28	5.9001	6.4391	155.6	1.1	0.0001	0.0000	
29	5.3168	6.9292	124.9	-6.1	-0.0001	0.0002	
30	4.6925	7.3659	24.5	-0.9	-0.0000	0.0000	
31	4.0325	7.7464	-27.9	2.8	0.0000	-0.0001	
32	3.3419	8.0683	-30.3	0.8	-0.0000	-0.0000	
33	2.6260	8.3288	-31.7	0.0	-0.0000	-0.0000	
34	1.8901	8.5260	-29.2	0.0	-0.0000	-0.0000	
35	1.1399	8.6583	-23.4	0.0	-0.0000	-0.0000	
36	0.3809	8.7247	-13.3	0.0	-0.0000	-0.0000	
37	-0.3809	8.7247	-4.4	0.0	-0.0000	-0.0000	
38	-1.1399	8.6583	-0.7	0.0	-0.0000	-0.0000	
39	-1.8902	8.5260	-0.0	0.0	-0.0000	-0.0000	
40	-2.6261	8.3288	0.0	-0.0	-0.0000	0.0000	
41	-3.3420	8.0682	-0.0	0.0	0.0000	-0.0000	
42	-4.0324	7.7463	0.0	-0.0	-0.0000	0.0000	
43	-4.6922	7.3653	-0.0	0.0	0.0000	-0.0000	
44	-5.3163	6.9284	0.0	-0.0	-0.0000	0.0000	
45	-5.8999	6.4386	-0.0	0.0	0.0000	-0.0000	
46	-6.4386	5.8999	0.0	-0.0	-0.0000	0.0000	
47	-6.9284	5.3163	-0.0	-0.0	-0.0000	0.0000	
48	-7.3653	4.6922	0.0	0.0	0.0000	-0.0000	
49	-7.7463	4.0325	0.0	0.0	0.0	0.0	
50	-8.0682	3.3420	0.0	0.0	0.0	0.0	
51	-8.3288	2.6261	0.0	0.0	0.0	0.0	
52	-8.5260	1.8902	0.0	0.0	0.0	0.0	
53	-8.6583	1.1399	0.0	0.0	0.0	0.0	
54	-8.7247	0.3810	0.0	0.0	0.0	0.0	
55	-8.7247	-0.3810	0.0	0.0	0.0	0.0	
56	-8.6583	-1.1399	0.0	0.0	0.0	0.0	
57	-8.5260	-1.8902	0.0	0.0	0.0	0.0	
58	-8.3288	-2.6261	0.0	0.0	0.0	0.0	
59	-8.0682	-3.3420	0.0	0.0	0.0	0.0	
60	-7.7463	-4.0325	0.0	0.0	0.0	0.0	
61	-7.3653	-4.6922	0.0	0.0	0.0	0.0	
62	-6.9284	-5.3163	0.0	0.0	0.0	0.0	
63	-6.4386	-5.8999	0.0	0.0	0.0	0.0	
64	-5.8999	-6.4386	0.0	0.0	0.0	0.0	
65	-5.3163	-6.9284	0.0	0.0	0.0	0.0	
66	-4.6922	-7.3653	0.0	0.0	0.0	0.0	
67	-4.0324	-7.7463	0.0	0.0	0.0	0.0	
68	-3.3420	-8.0682	0.0	0.0	0.0	0.0	
69	-2.6261	-8.3288	0.0	0.0	0.0	0.0	
70	-1.8902	-8.5260	0.0	0.0	0.0	0.0	
71	-1.1399	-8.6583	0.0	0.0	0.0	0.0	
72	-0.3809	-8.7247	0.0	0.0	0.0	0.0	

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J=   20  TIME= 0.0000602
TOTAL ENERGY INPUT (IN.-LB.) =      5.372
   KINETIC ENERGY (IN.-LB.)  =      4.583
   ELASTIC ENERGY (IN.-LB.)  =      0.438
   PLASTIC WORK   (IN.-LB.)  =      0.351
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THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS   535.0229 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3809	-8.7247	0.0	0.0	0.0000	-0.0000	
2	1.1399	-8.6583	-0.0	-0.0	-0.0000	0.0000	
3	1.8902	-8.5260	0.0	0.0	0.0000	-0.0000	
4	2.6261	-8.3288	-0.0	-0.0	-0.0000	0.0000	
5	3.3420	-8.0682	0.0	0.0	0.0000	-0.0000	
6	4.0324	-7.7463	-0.0	-0.0	-0.0000	0.0000	
7	4.6922	-7.3653	0.0	0.0	0.0000	-0.0000	
8	5.3163	-6.9284	-0.0	-0.0	-0.0000	0.0000	
9	5.8999	-6.4386	0.0	-0.0	-0.0000	0.0000	
10	6.4386	-5.8999	0.0	-0.0	-0.0000	0.0000	
11	6.9284	-5.3163	0.1	-0.0	-0.0000	0.0000	
12	7.3653	-4.6922	0.7	-0.0	0.0000	0.0000	
13	7.7463	-4.0325	3.2	-0.0	0.0000	0.0000	
14	8.0682	-3.3420	10.5	-0.0	0.0000	0.0000	
15	8.3288	-2.6261	25.5	-0.0	0.0000	0.0000	
16	8.5260	-1.8902	48.0	-0.0	0.0000	0.0000	
17	8.6583	-1.1399	74.0	-0.0	0.0000	0.0000	
18	8.7247	-0.3809	100.7	-0.1	0.0000	0.0000	
19	8.7247	0.3811	130.5	-0.1	0.0001	0.0001	
20	8.6582	1.1401	165.6	-0.1	0.0001	0.0001	
21	8.5259	1.8904	206.4	-0.1	0.0001	0.0001	
22	8.3286	2.6264	256.3	-0.1	0.0001	0.0001	
23	8.0679	3.3424	303.1	-0.2	0.0001	0.0001	
24	7.7458	4.0329	335.7	-0.5	0.0001	0.0002	
25	7.3647	4.6927	382.5	0.9	0.0002	0.0002	
26	6.9276	5.3169	433.9	9.4	0.0004	0.0000	
27	6.4387	5.9014	492.1	11.5	0.0004	0.0000	
28	5.9018	6.4421	502.0	1.3	0.0002	0.0002	
29	5.3199	6.9341	379.7	-41.4	-0.0005	0.0009	
30	4.6943	7.3690	203.5	-5.5	-0.0000	0.0002	
31	4.0329	7.7471	96.8	17.5	0.0003	-0.0003	
32	3.3420	8.0682	102.2	7.5	0.0002	-0.0001	
33	2.6260	8.3288	74.7	0.2	0.0000	0.0000	
34	1.8901	8.5260	43.2	-0.3	0.0000	0.0000	
35	1.1398	8.6583	27.2	-0.0	0.0000	0.0000	
36	0.3809	8.7247	16.4	0.0	0.0000	0.0000	
37	-0.3810	8.7247	7.2	0.0	0.0000	0.0000	
38	-1.1399	8.6583	-7.4	0.0	-0.0000	-0.0000	
39	-1.8902	8.5260	-21.2	0.0	-0.0000	-0.0000	
40	-2.6261	8.3288	-27.4	0.0	-0.0000	-0.0000	
41	-3.3420	8.0682	-29.1	0.0	-0.0000	-0.0000	
42	-4.0325	7.7463	-27.6	0.0	-0.0000	-0.0000	
43	-4.6922	7.3653	-20.5	0.0	-0.0000	-0.0000	
44	-5.3163	6.9284	-10.7	0.0	-0.0000	-0.0000	
45	-5.8999	6.4386	-3.7	0.0	-0.0000	-0.0000	
46	-6.4386	5.8999	-0.8	0.0	-0.0000	-0.0000	
47	-6.9284	5.3163	-0.1	0.0	-0.0000	-0.0000	
48	-7.3653	4.6922	-0.0	0.0	0.0000	-0.0000	
49	-7.7463	4.0325	0.0	-0.0	-0.0000	0.0000	
50	-8.0682	3.3420	0.0	-0.0	-0.0000	0.0000	
51	-8.3288	2.6261	-0.0	0.0	0.0000	-0.0000	
52	-8.5260	1.8902	0.0	-0.0	-0.0000	0.0000	
53	-8.6583	1.1399	-0.0	0.0	0.0000	-0.0000	
54	-8.7247	0.3810	0.0	-0.0	-0.0000	0.0000	
55	-8.7247	-0.3810	-0.0	0.0	0.0000	-0.0000	
56	-8.6583	-1.1399	0.0	-0.0	-0.0000	0.0000	
57	-8.5260	-1.8902	-0.0	0.0	0.0000	-0.0000	
58	-8.3288	-2.6261	0.0	-0.0	-0.0000	0.0000	
59	-8.0682	-3.3420	-0.0	0.0	0.0000	-0.0000	
60	-7.7463	-4.0325	0.0	-0.0	-0.0000	0.0000	
61	-7.3653	-4.6922	-0.0	0.0	0.0000	-0.0000	
62	-6.9284	-5.3163	0.0	-0.0	-0.0000	0.0000	
63	-6.4386	-5.8999	-0.0	0.0	0.0000	-0.0000	
64	-5.8999	-6.4386	0.0	-0.0	-0.0000	0.0000	
65	-5.3163	-6.9284	-0.0	0.0	0.0000	-0.0000	
66	-4.6922	-7.3653	-0.0	-0.0	-0.0000	0.0000	
67	-4.0324	-7.7463	0.0	0.0	0.0000	-0.0000	
68	-3.3420	-8.0682	-0.0	-0.0	-0.0000	0.0000	
69	-2.6261	-8.3288	0.0	0.0	0.0000	-0.0000	
70	-1.8902	-8.5260	-0.0	-0.0	-0.0000	0.0000	
71	-1.1399	-8.6583	0.0	0.0	0.0000	-0.0000	
72	-0.3809	-8.7247	-0.0	-0.0	-0.0000	0.0000	

J= 30 TIME= 0.0000903
TOTAL ENERGY INPUT (IN.-LB.) = 21.982
KINETIC ENERGY (IN.-LB.) = 18.337
ELASTIC ENERGY (IN.-LB.) = 2.634
PLASTIC WORK (IN.-LB.) = 1.010

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 709.0566 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3809	-8.7247	0.0	-0.0	-0.0000	0.0000	
2	1.1399	-8.6583	0.0	-0.0	-0.0000	0.0000	
3	1.8902	-8.5260	0.1	-0.0	-0.0000	0.0000	
4	2.6261	-8.3288	0.7	-0.0	0.0000	0.0000	
5	3.3420	-8.0682	3.0	-0.0	0.0000	0.0000	
6	4.0325	-7.7463	9.1	-0.0	0.0000	0.0000	
7	4.6922	-7.3653	21.9	-0.0	0.0000	0.0000	
8	5.3163	-6.9283	42.0	-0.0	0.0000	0.0000	
9	5.9000	-6.4386	66.5	-0.0	0.0000	0.0000	
10	6.4387	-5.8999	91.5	-0.0	0.0000	0.0000	
11	6.9284	-5.3162	117.1	-0.1	0.0000	0.0001	
12	7.3654	-4.6921	146.8	-0.1	0.0001	0.0001	
13	7.7463	-4.0322	182.0	-0.1	0.0001	0.0001	
14	8.0683	-3.3417	221.8	-0.1	0.0001	0.0001	
15	8.3288	-2.6256	262.6	-0.1	0.0001	0.0001	
16	8.5260	-1.8896	294.5	-0.2	0.0001	0.0001	
17	8.6582	-1.1392	320.5	-0.2	0.0001	0.0001	
18	8.7245	-0.3802	360.5	-0.2	0.0002	0.0002	
19	8.7243	0.3819	406.8	-0.2	0.0002	0.0002	
20	8.6577	1.1410	449.8	-0.3	0.0002	0.0002	
21	8.5252	1.8914	501.6	-0.3	0.0002	0.0002	
22	8.3277	2.6274	553.2	-0.3	0.0002	0.0002	
23	8.0668	3.3434	620.8	-1.0	0.0003	0.0003	
24	7.7443	4.0339	696.6	-1.6	0.0003	0.0003	
25	7.3627	4.6936	784.5	5.7	0.0004	0.0002	
26	6.9257	5.3179	883.0	29.5	0.0009	-0.0001	
27	6.4388	5.9044	957.9	42.1	0.0011	-0.0003	
28	5.9066	6.4500	993.6	-20.8	0.0001	0.0008	
29	5.3272	6.9451	810.8	-99.0	-0.0014	0.0021	
30	4.6994	7.3770	547.7	-28.2	-0.0002	0.0007	
31	4.0346	7.7494	400.7	45.7	0.0010	-0.0006	
32	3.3424	8.0678	349.9	29.3	0.0007	-0.0004	
33	2.6263	8.3284	305.5	2.9	0.0002	0.0001	
34	1.8904	8.5259	262.0	-1.7	0.0001	0.0001	
35	1.1401	8.6582	221.2	-0.4	0.0001	0.0001	
36	0.3811	8.7247	189.8	-0.0	0.0001	0.0001	
37	-0.3808	8.7247	150.5	-0.0	0.0001	0.0001	
38	-1.1398	8.6583	124.1	-0.1	0.0001	0.0001	
39	-1.8901	8.5260	113.9	-0.0	0.0000	0.0000	
40	-2.6261	8.3288	94.2	-0.0	0.0000	0.0000	
41	-3.3420	8.0683	66.8	-0.0	0.0000	0.0000	
42	-4.0325	7.7463	43.3	-0.0	0.0000	0.0000	
43	-4.6923	7.3653	29.0	-0.0	0.0000	0.0000	
44	-5.3164	6.9283	20.7	-0.0	0.0000	0.0000	
45	-5.9000	6.4386	8.7	0.0	0.0000	0.0000	
46	-6.4387	5.8999	-7.0	0.0	-0.0000	-0.0000	
47	-6.9284	5.3163	-18.3	0.0	-0.0000	-0.0000	
48	-7.3654	4.6922	-24.6	0.0	-0.0000	-0.0000	
49	-7.7463	4.0324	-27.7	0.0	-0.0000	-0.0000	
50	-8.0682	3.3420	-25.3	0.0	-0.0000	-0.0000	
51	-8.3288	2.6261	-17.5	0.0	-0.0000	-0.0000	
52	-8.5260	1.8902	-8.8	0.0	-0.0000	-0.0000	
53	-8.6583	1.1399	-3.2	0.0	-0.0000	-0.0000	
54	-8.7247	0.3810	-0.9	0.0	-0.0000	-0.0000	
55	-8.7247	-0.3810	-0.2	0.0	-0.0000	-0.0000	
56	-8.6583	-1.1399	-0.0	0.0	-0.0000	-0.0000	
57	-8.5260	-1.8902	-0.0	0.0	0.0000	-0.0000	
58	-8.3288	-2.6261	-0.0	0.0	0.0000	-0.0000	
59	-8.0682	-3.3420	0.0	-0.0	-0.0000	0.0000	
60	-7.7463	-4.0325	0.0	-0.0	-0.0000	0.0000	
61	-7.3653	-4.6922	-0.0	0.0	0.0000	-0.0000	
62	-6.9284	-5.3163	0.0	-0.0	-0.0000	0.0000	
63	-6.4386	-5.8999	-0.0	0.0	0.0000	-0.0000	
64	-5.8999	-6.4386	0.0	-0.0	-0.0000	0.0000	
65	-5.3163	-6.9284	-0.0	0.0	0.0000	-0.0000	
66	-4.6922	-7.3653	0.0	-0.0	-0.0000	0.0000	
67	-4.0324	-7.7463	-0.0	0.0	0.0000	-0.0000	
68	-3.3420	-8.0682	0.0	-0.0	-0.0000	0.0000	
69	-2.6261	-8.3288	-0.0	0.0	0.0000	-0.0000	
70	-1.8902	-8.5260	0.0	-0.0	-0.0000	0.0000	
71	-1.1399	-8.6583	0.0	-0.0	-0.0000	0.0000	
72	-0.3809	-8.7247	0.0	-0.0	-0.0000	0.0000	

J= 40 TIME= 0.0001204
TOTAL ENERGY INPUT (IN.-LB.) = 54.569
KINETIC ENERGY (IN.-LB.) = 44.020
ELASTIC ENERGY (IN.-LB.) = 8.666
PLASTIC WORK (IN.-LB.) = 1.883

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 806.7742 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER
1	0.3810	-8.7247	59.3	-0.0	0.0000	0.0000	1
2	1.1400	-8.6583	82.9	-0.0	0.0000	0.0000	
3	1.8903	-8.5259	105.7	-0.1	0.0000	0.0000	
4	2.6262	-8.3287	130.4	-0.1	0.0001	0.0001	
5	3.3421	-8.0681	159.8	-0.1	0.0001	0.0001	
6	4.0327	-7.7461	193.1	-0.1	0.0001	0.0001	
7	4.6925	-7.3651	226.6	-0.1	0.0001	0.0001	
8	5.3166	-6.9280	254.5	-0.1	0.0001	0.0001	
9	5.9002	-6.4381	274.2	-0.1	0.0001	0.0001	
10	6.4389	-5.8993	296.5	-0.2	0.0001	0.0001	
11	6.9286	-5.3155	332.1	-0.2	0.0001	0.0001	
12	7.3655	-4.6912	368.5	-0.2	0.0002	0.0002	
13	7.7464	-4.0312	400.0	-0.2	0.0002	0.0002	
14	8.0682	-3.3405	440.6	-0.3	0.0002	0.0002	
15	8.3286	-2.6244	486.7	-0.3	0.0002	0.0002	
16	8.5255	-1.8883	541.6	-0.4	0.0002	0.0002	
17	8.6575	-1.1377	608.7	-0.4	0.0003	0.0003	
18	8.7236	-0.3785	672.8	-0.5	0.0003	0.0003	
19	8.7231	0.3836	736.5	-0.5	0.0003	0.0003	
20	8.6562	1.1428	788.1	-0.5	0.0003	0.0004	
21	8.5233	1.8932	847.2	-0.5	0.0004	0.0004	
22	8.3254	2.6293	911.5	-1.0	0.0004	0.0004	
23	8.0640	3.3452	985.3	-3.4	0.0004	0.0005	
24	7.7407	4.0355	1087.0	-2.7	0.0004	0.0005	
25	7.3582	4.6948	1178.3	18.5	0.0008	0.0002	
26	6.9217	5.3197	1305.8	67.6	0.0017	-0.0006	
27	6.4392	5.9099	1402.9	84.0	0.0021	-0.0008	
28	5.9150	6.4635	1473.7	-69.3	-0.0006	0.0018	
29	5.3387	6.9624	1265.3	-163.4	-0.0023	0.0034	
30	4.7088	7.3915	924.9	-83.6	-0.0010	0.0018	
31	4.0386	7.7543	768.2	78.7	0.0017	-0.0010	
32	3.3435	8.0669	671.3	72.2	0.0015	-0.0010	
33	2.6271	8.3266	627.2	15.8	0.0005	-0.0000	
34	1.8913	8.5249	563.7	-4.7	0.0002	0.0003	
35	1.1409	8.6577	496.0	-2.5	0.0002	0.0003	
36	0.3819	8.7243	442.0	-0.2	0.0002	0.0002	
37	-0.3801	8.7245	384.8	-0.1	0.0002	0.0002	
38	-1.1392	8.6582	347.5	-0.2	0.0001	0.0002	
39	-1.8896	8.5260	317.3	-0.2	0.0001	0.0001	
40	-2.6256	8.3288	291.7	-0.1	0.0001	0.0001	
41	-3.3416	8.0683	257.3	-0.1	0.0001	0.0001	
42	-4.0322	7.7463	224.3	-0.1	0.0001	0.0001	
43	-4.6920	7.3654	198.6	-0.1	0.0001	0.0001	
44	-5.3162	6.9284	162.7	-0.1	0.0001	0.0001	
45	-5.8998	6.4387	131.7	-0.1	0.0001	0.0001	
46	-6.4386	5.9000	118.3	-0.0	0.0000	0.0001	
47	-6.9283	5.3163	106.9	-0.0	0.0000	0.0000	
48	-7.3653	4.6922	86.8	-0.0	0.0000	0.0000	
49	-7.7463	4.0324	61.8	-0.0	0.0000	0.0000	
50	-8.0683	3.3420	42.2	-0.0	0.0000	0.0000	
51	-8.3288	2.6260	32.2	-0.0	0.0000	0.0000	
52	-8.5260	1.8901	23.0	-0.0	0.0000	0.0000	
53	-8.6583	1.1399	8.7	0.0	0.0000	0.0000	
54	-8.7247	0.3809	-5.4	0.0	-0.0000	-0.0000	
55	-8.7247	-0.3810	-15.7	0.0	-0.0000	-0.0000	
56	-8.6583	-1.1399	-23.0	0.0	-0.0000	-0.0000	
57	-8.5260	-1.8902	-26.1	0.0	-0.0000	-0.0000	
58	-8.3288	-2.6261	-22.7	0.0	-0.0000	-0.0000	
59	-8.0682	-3.3420	-14.9	0.0	-0.0000	-0.0000	
60	-7.7463	-4.0325	-7.5	0.0	-0.0000	-0.0000	
61	-7.3653	-4.6922	-2.9	0.0	-0.0000	-0.0000	
62	-6.9284	-5.3163	-0.8	0.0	-0.0000	-0.0000	
63	-6.4386	-5.8999	-0.2	0.0	-0.0000	-0.0000	
64	-5.8999	-6.4386	-0.0	0.0	-0.0000	-0.0000	
65	-5.3163	-6.9284	-0.0	-0.0	-0.0000	0.0000	
66	-4.6922	-7.3653	0.0	-0.0	-0.0000	0.0000	
67	-4.0324	-7.7463	0.2	-0.0	-0.0000	0.0000	
68	-3.3420	-8.0682	0.8	-0.0	0.0000	0.0000	
69	-2.6261	-8.3288	2.7	-0.0	0.0000	0.0000	
70	-1.8902	-8.5260	8.0	-0.0	0.0000	0.0000	
71	-1.1399	-8.6583	18.9	-0.0	0.0000	0.0000	
72	-0.3809	-8.7247	36.7	-0.0	0.0000	0.0000	

J= 50 TIME= 0.0001505
TOTAL ENERGY INPUT (IN.-LB.) = 102.331
KINETIC ENERGY (IN.-LB.) = 80.555
ELASTIC ENERGY (IN.-LB.) = 19.093
PLASTIC WORK (IN.-LB.) = 2.683

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 879.2175 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER
							1
1	0.3814	-8.7245	233.6	-0.1	0.0001	0.0001	
2	1.1404	-8.6580	245.9	-0.1	0.0001	0.0001	
3	1.8908	-8.5256	266.8	-0.2	0.0001	0.0001	
4	2.6267	-8.3282	296.2	-0.2	0.0001	0.0001	
5	3.3427	-8.0675	320.8	-0.2	0.0001	0.0001	
6	4.0332	-7.7453	343.2	-0.2	0.0001	0.0002	
7	4.6930	-7.3641	376.9	-0.2	0.0002	0.0002	
8	5.3170	-6.9269	416.7	-0.3	0.0002	0.0002	
9	5.9006	-6.4369	461.4	-0.3	0.0002	0.0002	
10	6.4392	-5.8978	512.4	-0.4	0.0002	0.0002	
11	6.9288	-5.3138	554.1	-0.4	0.0002	0.0002	
12	7.3655	-4.6893	588.3	-0.4	0.0002	0.0003	
13	7.7461	-4.0291	620.4	-0.5	0.0003	0.0003	
14	8.0677	-3.3382	656.2	-0.5	0.0003	0.0003	
15	8.3278	-2.6219	705.9	-0.6	0.0003	0.0003	
16	8.5244	-1.8856	762.1	-0.6	0.0003	0.0003	
17	8.6560	-1.1349	833.9	-0.7	0.0004	0.0004	
18	8.7215	-0.3756	899.7	-0.8	0.0004	0.0004	
19	8.7206	0.3866	967.2	-0.9	0.0004	0.0004	
20	8.6530	1.1458	1044.1	-0.8	0.0004	0.0005	
21	8.5195	1.8963	1126.0	-0.8	0.0005	0.0005	
22	8.3210	2.6322	1235.2	-3.2	0.0005	0.0006	
23	8.0586	3.3479	1303.8	-8.4	0.0004	0.0007	
24	7.7339	4.0376	1406.4	-1.1	0.0006	0.0006	
25	7.3501	4.6964	1513.0	46.8	0.0015	-0.0001	
26	6.9155	5.3227	1636.8	126.2	0.0029	-0.0015	
27	6.4407	5.9193	1769.9	103.3	0.0026	-0.0010	
28	5.9257	6.4816	1788.1	-110.4	-0.0011	0.0027	
29	5.3540	6.9860	1525.3	-251.2	-0.0037	0.0050	
30	4.7216	7.4114	1130.9	-144.2	-0.0020	0.0030	
31	4.0455	7.7634	971.8	88.9	0.0020	-0.0011	
32	3.3460	8.0659	898.4	131.7	0.0027	-0.0019	
33	2.6284	8.3227	839.5	49.4	0.0012	-0.0005	
34	1.8929	8.5222	759.5	-4.9	0.0002	0.0004	
35	1.1426	8.6562	720.6	-8.7	0.0002	0.0005	
36	0.3835	8.7232	670.7	-1.6	0.0003	0.0003	
37	-0.3785	8.7236	636.2	0.1	0.0003	0.0003	
38	-1.1377	8.6575	592.2	-0.2	0.0003	0.0003	
39	-1.8882	8.5255	541.0	-0.4	0.0002	0.0002	
40	-2.6244	8.3286	515.3	-0.3	0.0002	0.0002	
41	-3.3405	8.0682	481.0	-0.3	0.0002	0.0002	
42	-4.0312	7.7464	441.9	-0.2	0.0002	0.0002	
43	-4.6912	7.3655	395.3	-0.2	0.0002	0.0002	
44	-5.3155	6.9286	349.1	-0.2	0.0001	0.0002	
45	-5.8992	6.4389	309.9	-0.2	0.0001	0.0001	
46	-6.4381	5.9002	282.9	-0.1	0.0001	0.0001	
47	-6.9279	5.3166	267.7	-0.1	0.0001	0.0001	
48	-7.3650	4.6925	243.1	-0.1	0.0001	0.0001	
49	-7.7461	4.0327	216.9	-0.1	0.0001	0.0001	
50	-8.0681	3.3422	198.0	-0.1	0.0001	0.0001	
51	-8.3287	2.6262	170.4	-0.1	0.0001	0.0001	
52	-8.5259	1.8903	138.5	-0.1	0.0001	0.0001	
53	-8.6583	1.1400	119.2	-0.0	0.0001	0.0001	
54	-8.7247	0.3810	110.5	-0.0	0.0000	0.0000	
55	-8.7247	-0.3809	99.4	-0.0	0.0000	0.0000	
56	-8.6583	-1.1399	79.1	-0.0	0.0000	0.0000	
57	-8.5260	-1.8902	56.6	-0.0	0.0000	0.0000	
58	-8.3288	-2.6261	42.6	-0.0	0.0000	0.0000	
59	-8.0682	-3.3420	34.6	-0.0	0.0000	0.0000	
60	-7.7463	-4.0325	24.0	-0.0	0.0000	0.0000	
61	-7.3653	-4.6923	11.7	-0.0	0.0000	0.0000	
62	-6.9283	-5.3163	3.5	-0.0	0.0000	0.0000	
63	-6.4386	-5.9000	2.4	-0.0	0.0000	0.0000	
64	-5.8999	-6.4387	10.1	-0.0	0.0000	0.0000	
65	-5.3163	-6.9284	28.5	-0.0	0.0000	0.0000	
66	-4.6922	-7.3654	54.8	-0.0	0.0000	0.0000	
67	-4.0323	-7.7463	82.9	-0.0	0.0000	0.0000	
68	-3.3418	-8.0683	109.9	-0.1	0.0000	0.0000	
69	-2.6259	-8.3288	137.7	-0.1	0.0001	0.0001	
70	-1.8899	-8.5260	167.1	-0.1	0.0001	0.0001	
71	-1.1396	-8.6582	195.5	-0.1	0.0001	0.0001	
72	-0.3805	-8.7246	218.4	-0.1	0.0001	0.0001	

J= 54 TIME= 0.0001625

TOTAL ENERGY INPUT (IN.-LB.) = 124.644

KINETIC ENERGY (IN.-LB.) = 97.534

ELASTIC ENERGY (IN.-LB.) = 24.106

PLASTIC WORK (IN.-LB.) = 3.004

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 892.7095 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3817	-8.7243	273.8	-0.2	0.0001	0.0001	
2	1.1407	-8.6578	296.0	-0.2	0.0001	0.0001	
3	1.8911	-8.5253	314.7	-0.2	0.0001	0.0001	
4	2.6270	-8.3279	344.2	-0.2	0.0001	0.0002	
5	3.3430	-8.0670	381.1	-0.3	0.0002	0.0002	
6	4.0335	-7.7448	420.1	-0.3	0.0002	0.0002	
7	4.6933	-7.3635	464.0	-0.3	0.0002	0.0002	
8	5.3173	-6.9261	499.4	-0.4	0.0002	0.0002	
9	5.9008	-6.4360	524.3	-0.4	0.0002	0.0002	
10	6.4393	-5.8969	549.6	-0.4	0.0002	0.0002	
11	6.9287	-5.3128	577.9	-0.5	0.0002	0.0003	
12	7.3654	-4.6882	619.3	-0.5	0.0003	0.0003	
13	7.7459	-4.0279	669.0	-0.6	0.0003	0.0003	
14	8.0673	-3.3369	727.1	-0.7	0.0003	0.0003	
15	8.3272	-2.6205	785.8	-0.7	0.0003	0.0004	
16	8.5236	-1.8841	837.2	-0.8	0.0004	0.0004	
17	8.6550	-1.1334	903.9	-0.9	0.0004	0.0004	
18	8.7203	-0.3740	972.5	-1.0	0.0004	0.0004	
19	8.7190	0.3883	1059.2	-1.1	0.0004	0.0005	
20	8.6512	1.1474	1124.2	-0.8	0.0005	0.0005	
21	8.5174	1.8978	1190.8	-1.0	0.0005	0.0005	
22	8.3185	2.6337	1288.5	-5.0	0.0005	0.0006	
23	8.0556	3.3493	1363.6	-11.1	0.0004	0.0008	
24	7.7300	4.0386	1482.2	1.7	0.0007	0.0006	
25	7.3458	4.6971	1590.4	65.1	0.0018	-0.0004	
26	6.9126	5.3245	1736.7	151.1	0.0034	-0.0018	
27	6.4418	5.9243	1850.1	102.0	0.0026	-0.0010	
28	5.9305	6.4899	1869.2	-121.9	-0.0013	0.0029	
29	5.3610	6.9969	1567.2	-291.9	-0.0044	0.0057	*
30	4.7275	7.4206	1173.7	-164.6	-0.0023	0.0033	
31	4.0492	7.7684	1009.1	83.3	0.0019	-0.0010	
32	3.3475	8.0659	949.5	155.6	0.0031	-0.0023	
33	2.6291	8.3205	909.9	70.2	0.0016	-0.0008	
34	1.8936	8.5204	827.4	-2.0	0.0003	0.0004	
35	1.1435	8.6552	767.1	-12.5	0.0001	0.0005	
36	0.3844	8.7225	709.1	-3.1	0.0003	0.0004	
37	-0.3776	8.7230	663.8	0.3	0.0003	0.0003	
38	-1.1368	8.6570	635.3	-0.2	0.0003	0.0003	
39	-1.8874	8.5252	594.1	-0.4	0.0003	0.0003	
40	-2.6236	8.3283	571.6	-0.4	0.0002	0.0003	
41	-3.3398	8.0681	528.5	-0.3	0.0002	0.0002	
42	-4.0305	7.7463	490.2	-0.3	0.0002	0.0002	
43	-4.6906	7.3655	467.1	-0.3	0.0002	0.0002	
44	-5.3149	6.9287	440.5	-0.3	0.0002	0.0002	
45	-5.8988	6.4390	408.0	-0.2	0.0002	0.0002	
46	-6.4377	5.9004	366.4	-0.2	0.0002	0.0002	
47	-6.9276	5.3168	325.6	-0.2	0.0001	0.0001	
48	-7.3648	4.6927	287.7	-0.1	0.0001	0.0001	
49	-7.7458	4.0329	264.6	-0.1	0.0001	0.0001	
50	-8.0679	3.3424	252.0	-0.1	0.0001	0.0001	
51	-8.3286	2.6264	229.5	-0.1	0.0001	0.0001	
52	-8.5258	1.8905	207.5	-0.1	0.0001	0.0001	
53	-8.6582	1.1401	191.2	-0.1	0.0001	0.0001	
54	-8.7246	0.3811	165.4	-0.1	0.0001	0.0001	
55	-8.7247	-0.3808	135.4	-0.1	0.0001	0.0001	
56	-8.6583	-1.1398	116.9	-0.0	0.0000	0.0001	
57	-8.5260	-1.8901	109.7	-0.0	0.0000	0.0000	
58	-8.3288	-2.6260	102.4	-0.0	0.0000	0.0000	
59	-8.0682	-3.3420	88.4	-0.0	0.0000	0.0000	
60	-7.7463	-4.0325	76.6	-0.0	0.0000	0.0000	
61	-7.3653	-4.6923	78.7	-0.0	0.0000	0.0000	
62	-6.9283	-5.3164	91.1	-0.0	0.0000	0.0000	
63	-6.4386	-5.9000	101.7	-0.0	0.0000	0.0000	
64	-5.8998	-6.4387	107.9	-0.0	0.0000	0.0000	
65	-5.3162	-6.9284	114.8	-0.1	0.0000	0.0001	
66	-4.6920	-7.3654	126.4	-0.1	0.0001	0.0001	
67	-4.0322	-7.7463	143.7	-0.1	0.0001	0.0001	
68	-3.3416	-8.0683	165.7	-0.1	0.0001	0.0001	
69	-2.6256	-8.3288	188.4	-0.1	0.0001	0.0001	
70	-1.8897	-8.5259	207.2	-0.1	0.0001	0.0001	
71	-1.1393	-8.6582	223.6	-0.1	0.0001	0.0001	
72	-0.3802	-8.7245	245.8	-0.1	0.0001	0.0001	

J= 60 TIME= 0.0001806
TOTAL ENERGY INPUT (IN.-LB.) = 161.471
KINETIC ENERGY (IN.-LB.) = 125.898
ELASTIC ENERGY (IN.-LB.) = 30.536
PLASTIC WORK (IN.-LB.) = 5.036

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 912.9536 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3823	-8.7239	324.2	-0.2	0.0001	0.0001	
2	1.1413	-8.6572	361.2	-0.3	0.0002	0.0002	
3	1.8917	-8.5246	399.9	-0.3	0.0002	0.0002	
4	2.6276	-8.3271	424.5	-0.3	0.0002	0.0002	
5	3.3436	-8.0661	440.2	-0.4	0.0002	0.0002	
6	4.0340	-7.7437	459.7	-0.4	0.0002	0.0002	
7	4.6937	-7.3622	484.2	-0.4	0.0002	0.0002	
8	5.3176	-6.9247	520.7	-0.5	0.0002	0.0002	
9	5.9010	-6.4344	563.2	-0.5	0.0002	0.0003	
10	6.4394	-5.8951	607.3	-0.6	0.0003	0.0003	
11	6.9286	-5.3108	648.8	-0.7	0.0003	0.0003	
12	7.3651	-4.6861	687.5	-0.7	0.0003	0.0003	
13	7.7453	-4.0256	742.1	-0.8	0.0003	0.0003	
14	8.0665	-3.3345	798.5	-0.9	0.0003	0.0004	
15	8.3260	-2.6179	855.6	-1.0	0.0004	0.0004	
16	8.5221	-1.8814	897.6	-1.1	0.0004	0.0004	
17	8.6530	-1.1306	948.2	-1.2	0.0004	0.0004	
18	8.7179	-0.3712	1025.0	-1.3	0.0004	0.0005	
19	8.7161	0.3911	1079.6	-1.3	0.0004	0.0005	
20	8.6478	1.1502	1169.9	-0.8	0.0005	0.0005	
21	8.5134	1.9006	1247.5	-1.8	0.0005	0.0006	
22	8.3139	2.6363	1335.8	-9.0	0.0004	0.0007	
23	8.0499	3.3515	1429.4	-15.6	0.0004	0.0009	
24	7.7228	4.0401	1518.7	10.5	0.0008	0.0005	
25	7.3380	4.6982	1617.1	100.6	0.0024	-0.0010	
26	6.9082	5.3280	1708.3	182.6	0.0039	-0.0024	
27	6.4439	5.9328	1874.6	95.9	0.0025	-0.0008	
28	5.9381	6.5034	1855.9	-138.1	-0.0016	0.0032	
29	5.3721	7.0144	1566.2	-326.3	-0.0053	0.0070	*
30	4.7368	7.4357	1154.5	-193.5	-0.0028	0.0038	
31	4.0555	7.7774	984.7	67.7	0.0016	-0.0007	
32	3.3503	8.0666	935.2	185.8	0.0036	-0.0028	
33	2.6303	8.3165	896.1	108.9	0.0023	-0.0015	
34	1.8949	8.5167	857.1	8.7	0.0005	0.0002	
35	1.1451	8.6530	808.8	-18.9	0.0000	0.0007	
36	0.3861	8.7211	746.0	-7.2	0.0002	0.0004	
37	-0.3760	8.7217	716.8	0.3	0.0003	0.0003	
38	-1.1352	8.6560	669.0	0.2	0.0003	0.0003	
39	-1.8859	8.5244	637.2	-0.5	0.0003	0.0003	
40	-2.6221	8.3277	588.7	-0.6	0.0002	0.0003	
41	-3.3384	8.0676	551.5	-0.5	0.0002	0.0002	
42	-4.0292	7.7461	528.0	-0.4	0.0002	0.0002	
43	-4.6894	7.3654	498.4	-0.4	0.0002	0.0002	
44	-5.3138	6.9287	486.3	-0.3	0.0002	0.0002	
45	-5.8978	6.4392	460.1	-0.3	0.0002	0.0002	
46	-6.4368	5.9006	428.2	-0.3	0.0002	0.0002	
47	-6.9268	5.3170	407.0	-0.3	0.0002	0.0002	
48	-7.3641	4.6930	391.3	-0.2	0.0002	0.0002	
49	-7.7453	4.0332	371.9	-0.2	0.0002	0.0002	
50	-8.0675	3.3427	342.1	-0.2	0.0001	0.0002	
51	-8.3282	2.6268	309.0	-0.2	0.0001	0.0001	
52	-8.5256	1.8908	272.4	-0.1	0.0001	0.0001	
53	-8.6580	1.1405	246.3	-0.1	0.0001	0.0001	
54	-8.7245	0.3815	239.9	-0.1	0.0001	0.0001	
55	-8.7246	-0.3805	233.5	-0.1	0.0001	0.0001	
56	-8.6582	-1.1395	227.8	-0.1	0.0001	0.0001	
57	-8.5260	-1.8899	233.7	-0.1	0.0001	0.0001	
58	-8.3288	-2.6259	237.4	-0.1	0.0001	0.0001	
59	-8.0682	-3.3419	229.9	-0.1	0.0001	0.0001	
60	-7.7462	-4.0324	223.6	-0.1	0.0001	0.0001	
61	-7.3653	-4.6923	231.2	-0.1	0.0001	0.0001	
62	-6.9282	-5.3164	248.5	-0.1	0.0001	0.0001	
63	-6.4384	-5.9001	259.8	-0.1	0.0001	0.0001	
64	-5.8996	-6.4388	257.9	-0.1	0.0001	0.0001	
65	-5.3159	-6.9285	251.1	-0.1	0.0001	0.0001	
66	-4.6917	-7.3655	247.4	-0.1	0.0001	0.0001	
67	-4.0318	-7.7464	248.6	-0.1	0.0001	0.0001	
68	-3.3412	-8.0683	255.6	-0.1	0.0001	0.0001	
69	-2.6251	-8.3287	263.2	-0.2	0.0001	0.0001	
70	-1.8891	-8.5258	264.8	-0.2	0.0001	0.0001	
71	-1.1387	-8.6579	271.0	-0.2	0.0001	0.0001	
72	-0.3797	-8.7241	292.9	-0.2	0.0001	0.0001	

J= 70 TIME= 0.0002107
TOTAL ENERGY INPUT (IN.-LB.) = 229.938
KINETIC ENERGY (IN.-LB.) = 180.652
ELASTIC ENERGY (IN.-LB.) = 41.553
PLASTIC WORK (IN.-LB.) = 7.733

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 953.4971 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3836	-8.7227	412.2	-0.4	0.0002	0.0002	
2	1.1427	-8.6557	432.4	-0.4	0.0002	0.0002	
3	1.8930	-8.5228	445.6	-0.5	0.0002	0.0002	
4	2.6289	-8.3250	455.4	-0.5	0.0002	0.0002	
5	3.3447	-8.0637	467.3	-0.6	0.0002	0.0002	
6	4.0350	-7.7410	489.6	-0.6	0.0002	0.0002	
7	4.6945	-7.3592	510.4	-0.7	0.0002	0.0002	
8	5.3181	-6.9213	522.6	-0.7	0.0002	0.0002	
9	5.9012	-6.4307	541.6	-0.8	0.0002	0.0002	
10	6.4393	-5.8910	574.9	-0.9	0.0002	0.0003	
11	6.9281	-5.3064	624.8	-1.0	0.0003	0.0003	
12	7.3641	-4.6814	661.0	-1.1	0.0003	0.0003	
13	7.7438	-4.0206	708.5	-1.2	0.0003	0.0003	
14	8.0643	-3.3292	762.6	-1.3	0.0003	0.0004	
15	8.3232	-2.6124	795.4	-1.5	0.0003	0.0004	
16	8.5184	-1.8757	850.3	-1.6	0.0003	0.0004	
17	8.6485	-1.1247	874.2	-1.8	0.0003	0.0004	
18	8.7124	-0.3653	909.5	-2.0	0.0004	0.0004	
19	8.7096	0.3969	972.3	-1.3	0.0004	0.0004	
20	8.6402	1.1560	1056.1	-0.6	0.0004	0.0005	
21	8.5049	1.9060	1065.0	-5.6	0.0004	0.0006	
22	8.3040	2.6413	963.2	-20.0	0.0001	0.0008	
23	8.0373	3.3552	973.1	-20.6	0.0001	0.0008	
24	7.7069	4.0422	1135.3	45.5	0.0013	-0.0003	
25	7.3230	4.7008	1376.9	170.3	0.0035	-0.0023	
26	6.9017	5.3361	1497.4	204.7	0.0042	-0.0029	
27	6.4479	5.9488	1621.6	74.9	0.0020	-0.0006	
28	5.9499	6.5262	1705.8	-146.2	-0.0018	0.0033	
29	5.3900	7.0442	1752.7	-356.6	-0.0061	0.0084	*
30	4.7553	7.4664	1551.9	-275.8	-0.0041	0.0054	
31	4.0695	7.7994	1266.1	3.2	0.0006	0.0005	
32	3.3575	8.0717	1166.2	227.0	0.0044	-0.0034	
33	2.6334	8.3095	1048.5	190.5	0.0037	-0.0028	
34	1.8974	8.5076	1027.9	49.5	0.0013	-0.0004	
35	1.1481	8.6473	954.2	-25.8	-0.0000	0.0009	
36	0.3893	8.7177	727.0	-20.9	-0.0000	0.0007	
37	-0.3728	8.7183	550.3	-2.2	0.0002	0.0003	
38	-1.1319	8.6535	503.4	1.6	0.0002	0.0002	
39	-1.8826	8.5223	504.4	-0.3	0.0002	0.0002	
40	-2.6189	8.3261	487.6	-0.9	0.0002	0.0002	
41	-3.3354	8.0664	502.9	-0.8	0.0002	0.0002	
42	-4.0264	7.7452	492.3	-0.6	0.0002	0.0002	
43	-4.6867	7.3649	477.9	-0.6	0.0002	0.0002	
44	-5.3113	6.9284	455.1	-0.5	0.0002	0.0002	
45	-5.8955	6.4392	435.7	-0.5	0.0002	0.0002	
46	-6.4347	5.9008	428.4	-0.5	0.0002	0.0002	
47	-6.9249	5.3174	405.2	-0.4	0.0002	0.0002	
48	-7.3624	4.6935	397.9	-0.4	0.0002	0.0002	
49	-7.7438	4.0338	396.9	-0.4	0.0002	0.0002	
50	-8.0661	3.3434	401.0	-0.3	0.0002	0.0002	
51	-8.3271	2.6275	418.2	-0.3	0.0002	0.0002	
52	-8.5246	1.8915	428.1	-0.3	0.0002	0.0002	
53	-8.6572	1.1412	427.6	-0.3	0.0002	0.0002	
54	-8.7238	0.3821	429.0	-0.3	0.0002	0.0002	
55	-8.7240	-0.3800	442.3	-0.3	0.0002	0.0002	
56	-8.6577	-1.1391	452.3	-0.3	0.0002	0.0002	
57	-8.5255	-1.8895	447.0	-0.3	0.0002	0.0002	
58	-8.3284	-2.6256	431.0	-0.2	0.0002	0.0002	
59	-8.0678	-3.3416	403.8	-0.2	0.0002	0.0002	
60	-7.7458	-4.0322	384.6	-0.2	0.0002	0.0002	
61	-7.3648	-4.6921	388.6	-0.2	0.0002	0.0002	
62	-6.9277	-5.3162	392.3	-0.2	0.0002	0.0002	
63	-6.4379	-5.8999	386.7	-0.2	0.0002	0.0002	
64	-5.8990	-6.4386	394.4	-0.2	0.0002	0.0002	
65	-5.3152	-6.9283	412.6	-0.3	0.0002	0.0002	
66	-4.6909	-7.3653	418.4	-0.3	0.0002	0.0002	
67	-4.0309	-7.7461	413.4	-0.3	0.0002	0.0002	
68	-3.3402	-8.0679	409.8	-0.3	0.0002	0.0002	
69	-2.6241	-8.3282	405.7	-0.3	0.0002	0.0002	
70	-1.8880	-8.5252	402.1	-0.3	0.0002	0.0002	
71	-1.1375	-8.6571	399.9	-0.3	0.0002	0.0002	
72	-0.3784	-8.7231	399.4	-0.4	0.0002	0.0002	

J= 80 TIME= 0.0002408
TOTAL ENERGY INPUT (IN.-LB.) = 312.436
KINETIC ENERGY (IN.-LB.) = 247.732
ELASTIC ENERGY (IN.-LB.) = 52.375
PLASTIC WORK (IN.-LB.) = 12.329

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 901.8274 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3851	-8.7207	429.0	-0.6	0.0002	0.0002	
2	1.1441	-8.6534	419.2	-0.7	0.0002	0.0002	
3	1.8944	-8.5202	418.5	-0.7	0.0002	0.0002	
4	2.6301	-8.3221	428.9	-0.8	0.0002	0.0002	
5	3.3458	-8.0604	443.7	-0.9	0.0002	0.0002	
6	4.0359	-7.7373	458.7	-0.9	0.0002	0.0002	
7	4.6952	-7.3551	469.6	-1.0	0.0002	0.0002	
8	5.3185	-6.9169	459.4	-1.1	0.0002	0.0002	
9	5.9012	-6.4258	462.0	-1.2	0.0002	0.0002	
10	6.4388	-5.8858	457.6	-1.3	0.0002	0.0002	
11	6.9271	-5.3008	454.4	-1.4	0.0002	0.0002	
12	7.3625	-4.6754	490.7	-1.5	0.0002	0.0002	
13	7.7415	-4.0143	470.2	-1.6	0.0002	0.0002	
14	8.0612	-3.3226	371.3	-1.7	0.0001	0.0002	
15	8.3192	-2.6057	263.8	-1.9	0.0001	0.0001	
16	8.5135	-1.8689	328.9	-2.2	0.0001	0.0002	
17	8.6426	-1.1179	513.4	-2.6	0.0002	0.0003	
18	8.7053	-0.3585	625.1	-2.4	0.0002	0.0003	
19	8.7014	0.4036	684.8	-0.4	0.0003	0.0003	
20	8.6309	1.1625	754.4	-1.3	0.0003	0.0003	
21	8.4945	1.9123	875.3	-15.5	0.0001	0.0006	
22	8.2912	2.6468	947.1	-36.6	-0.0002	0.0010	
23	8.0201	3.3592	1069.1	-10.8	0.0003	0.0007	
24	7.6867	4.0447	1156.2	109.3	0.0024	-0.0014	
25	7.3073	4.7058	1251.2	223.3	0.0044	-0.0033	
26	6.8961	5.3477	1381.8	191.3	0.0039	-0.0027	
27	6.4506	5.9664	1464.5	50.0	0.0015	-0.0002	
28	5.9580	6.5483	1550.8	-123.5	-0.0015	0.0028	
29	5.4049	7.0735	1611.1	-341.8	-0.0059	0.0081	
30	4.7765	7.5055	1401.8	-355.9	-0.0062	0.0081	*
31	4.0879	7.8324	1079.9	-113.5	-0.0015	0.0024	
32	3.3683	8.0839	906.3	251.8	0.0047	-0.0039	
33	2.6385	8.3037	917.4	282.1	0.0053	-0.0045	
34	1.9008	8.4952	849.5	123.2	0.0025	-0.0018	
35	1.1522	8.6377	709.2	-14.6	0.0001	0.0006	
36	0.3938	8.7125	709.6	-41.5	-0.0004	0.0010	
37	-0.3683	8.7154	663.1	-13.0	0.0001	0.0005	
38	-1.1275	8.6502	673.1	2.8	0.0003	0.0002	
39	-1.8783	8.5194	668.6	1.3	0.0003	0.0003	
40	-2.6148	8.3238	592.5	-1.3	0.0002	0.0003	
41	-3.3315	8.0646	614.3	-1.4	0.0002	0.0003	
42	-4.0227	7.7438	671.4	-1.1	0.0003	0.0003	
43	-4.6833	7.3639	587.3	-0.9	0.0002	0.0003	
44	-5.3081	6.9277	405.7	-0.8	0.0002	0.0002	
45	-5.8925	6.4387	323.9	-0.7	0.0001	0.0002	
46	-6.4319	5.9036	308.1	-0.7	0.0001	0.0001	
47	-6.9223	5.3174	325.6	-0.6	0.0001	0.0002	
48	-7.3600	4.6937	359.1	-0.6	0.0001	0.0002	
49	-7.7416	4.0341	379.6	-0.6	0.0002	0.0002	
50	-8.0642	3.3438	391.3	-0.5	0.0002	0.0002	
51	-8.3253	2.6279	377.7	-0.5	0.0002	0.0002	
52	-8.5230	1.8921	376.4	-0.5	0.0002	0.0002	
53	-8.6557	1.1417	385.6	-0.4	0.0002	0.0002	
54	-8.7224	0.3827	382.4	-0.4	0.0002	0.0002	
55	-8.7227	-0.3793	377.1	-0.4	0.0002	0.0002	
56	-8.6566	-1.1384	371.9	-0.4	0.0002	0.0002	
57	-8.5244	-1.8888	379.4	-0.4	0.0002	0.0002	
58	-8.3274	-2.6249	400.9	-0.4	0.0002	0.0002	
59	-8.0668	-3.3410	420.3	-0.4	0.0002	0.0002	
60	-7.7448	-4.0316	423.9	-0.4	0.0002	0.0002	
61	-7.3638	-4.6915	412.0	-0.4	0.0002	0.0002	
62	-6.9267	-5.3156	400.9	-0.4	0.0002	0.0002	
63	-6.4368	-5.8993	400.4	-0.4	0.0002	0.0002	
64	-5.8979	-6.4380	410.0	-0.4	0.0002	0.0002	
65	-5.3141	-6.9276	421.5	-0.4	0.0002	0.0002	
66	-4.6897	-7.3645	421.5	-0.4	0.0002	0.0002	
67	-4.0297	-7.7452	409.7	-0.4	0.0002	0.0002	
68	-3.3389	-8.0669	402.6	-0.5	0.0002	0.0002	
69	-2.6227	-8.3271	408.1	-0.5	0.0002	0.0002	
70	-1.8866	-8.5238	417.1	-0.5	0.0002	0.0002	
71	-1.1360	-8.6556	429.0	-0.6	0.0002	0.0002	
72	-0.3769	-8.7214	437.1	-0.6	0.0002	0.0002	

J= 90 TIME= 0.0002709
TOTAL ENERGY INPUT (IN.-LB.) = 372.417
KINETIC ENERGY (IN.-LB.) = 290.217
ELASTIC ENERGY (IN.-LB.) = 57.953
PLASTIC WORK (IN.-LB.) = 24.248

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 883.3069 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3866	-8.7179	275.0	-0.9	0.0001	0.0001	
2	1.1455	-8.6504	246.4	-0.9	0.0001	0.0001	
3	1.8957	-8.5169	225.6	-1.0	0.0001	0.0001	
4	2.6313	-8.3184	217.5	-1.1	0.0001	0.0001	
5	3.3468	-8.0564	216.5	-1.1	0.0001	0.0001	
6	4.0366	-7.7329	136.9	-1.2	0.0000	0.0001	
7	4.6955	-7.3504	18.4	-1.3	-0.0000	0.0000	
8	5.3184	-6.9118	13.2	-1.4	-0.0000	0.0000	
9	5.9007	-6.4204	140.9	-1.6	0.0000	0.0001	
10	6.4378	-5.8800	276.9	-1.8	0.0001	0.0001	
11	6.9256	-5.2946	283.5	-1.9	0.0001	0.0002	
12	7.3603	-4.6689	293.4	-2.1	0.0001	0.0002	
13	7.7386	-4.0074	364.0	-2.3	0.0001	0.0002	
14	8.0575	-3.3154	422.6	-2.5	0.0001	0.0002	
15	8.3146	-2.5981	459.2	-2.7	0.0002	0.0002	
16	8.5079	-1.8610	485.0	-3.3	0.0002	0.0003	
17	8.6357	-1.1098	519.0	-3.7	0.0002	0.0003	
18	8.6971	-0.3502	529.1	-1.8	0.0002	0.0003	
19	8.6919	0.4119	618.1	1.3	0.0003	0.0002	
20	8.6204	1.1706	666.4	-6.3	0.0002	0.0004	
21	8.4822	1.9200	732.6	-35.2	-0.0003	0.0009	
22	8.2748	2.6534	839.8	-49.8	-0.0005	0.0012	
23	7.9981	3.3635	942.3	30.5	0.0009	-0.0001	
24	7.6641	4.0487	1057.8	180.9	0.0036	-0.0027	
25	7.2924	4.7141	1042.7	238.5	0.0046	-0.0037	
26	6.8904	5.3617	1053.5	164.6	0.0033	-0.0024	
27	6.4510	5.9846	1186.1	43.5	0.0013	-0.0002	
28	5.9633	6.5705	1229.1	-85.3	-0.0009	0.0020	
29	5.4183	7.1040	1257.6	-295.5	-0.0053	0.0071	
30	4.8002	7.5502	969.9	-411.3	-0.0104	0.0117	*
31	4.1065	7.8659	583.0	-125.0	-0.0019	0.0024	
32	3.3826	8.1044	860.4	178.0	0.0034	-0.0027	
33	2.6462	8.3017	801.0	340.9	0.0068	-0.0058	*
34	1.9055	8.4809	864.5	221.5	0.0042	-0.0034	
35	1.1568	8.6237	820.5	28.0	0.0008	-0.0001	
36	0.3990	8.7043	717.1	-58.3	-0.0007	0.0013	
37	-0.3631	8.7109	781.1	-36.5	-0.0003	0.0010	
38	-1.1224	8.6463	737.2	-0.9	0.0003	0.0003	
39	-1.8731	8.5156	552.2	5.1	0.0003	0.0001	
40	-2.6098	8.3206	538.5	-0.4	0.0002	0.0002	
41	-3.3266	8.0622	479.5	-2.3	0.0002	0.0002	
42	-4.0181	7.7419	415.5	-1.6	0.0002	0.0002	
43	-4.6789	7.3625	409.0	-1.2	0.0002	0.0002	
44	-5.3040	6.9268	378.0	-1.2	0.0001	0.0002	
45	-5.8886	6.4381	409.5	-1.1	0.0002	0.0002	
46	-6.4284	5.9002	448.3	-1.0	0.0002	0.0002	
47	-6.9191	5.3172	399.2	-1.0	0.0002	0.0002	
48	-7.3570	4.6937	369.4	-0.9	0.0001	0.0002	
49	-7.7388	4.0342	464.1	-0.9	0.0002	0.0002	
50	-8.0616	3.3439	482.0	-0.8	0.0002	0.0002	
51	-8.3229	2.6282	356.0	-0.7	0.0001	0.0002	
52	-8.5207	1.8924	221.1	-0.6	0.0001	0.0001	
53	-8.6535	1.1421	138.6	-0.6	0.0000	0.0001	
54	-8.7204	0.3832	114.5	-0.5	0.0000	0.0001	
55	-8.7208	-0.3787	113.0	-0.5	0.0000	0.0001	
56	-8.6547	-1.1377	140.6	-0.5	0.0001	0.0001	
57	-8.5226	-1.8881	180.2	-0.5	0.0001	0.0001	
58	-8.3256	-2.6241	194.4	-0.5	0.0001	0.0001	
59	-8.0651	-3.3401	207.2	-0.5	0.0001	0.0001	
60	-7.7432	-4.0307	218.5	-0.5	0.0001	0.0001	
61	-7.3622	-4.6905	218.5	-0.5	0.0001	0.0001	
62	-6.9251	-5.3146	223.0	-0.5	0.0001	0.0001	
63	-6.4352	-5.8982	229.4	-0.5	0.0001	0.0001	
64	-5.8963	-6.4368	225.4	-0.5	0.0001	0.0001	
65	-5.3125	-6.9264	217.7	-0.5	0.0001	0.0001	
66	-4.6881	-7.3631	222.0	-0.6	0.0001	0.0001	
67	-4.0281	-7.7437	237.5	-0.6	0.0001	0.0001	
68	-3.3373	-8.0652	248.5	-0.6	0.0001	0.0001	
69	-2.6211	-8.3253	254.4	-0.7	0.0001	0.0001	
70	-1.8849	-8.5218	263.6	-0.7	0.0001	0.0001	
71	-1.1344	-8.6534	276.3	-0.8	0.0001	0.0001	
72	-0.3753	-8.7189	287.8	-0.8	0.0001	0.0001	

J= 100 TIME= 0.0003010
TOTAL ENERGY INPUT (IN.-LB.) = 463.041
KINETIC ENERGY (IN.-LB.) = 358.536
ELASTIC ENERGY (IN.-LB.) = 65.212
PLASTIC WORK (IN.-LB.) = 39.293

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 853.3430 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3878	-8.7148	-212.2	-1.1	-0.0001	-0.0001	
2	1.1466	-8.6470	-36.1	-1.2	-0.0000	0.0000	
3	1.8967	-8.5133	40.5	-1.3	-0.0000	0.0000	
4	2.6321	-8.3144	21.7	-1.4	-0.0000	0.0000	
5	3.3474	-8.0521	41.0	-1.5	-0.0000	0.0000	
6	4.0370	-7.7283	127.3	-1.7	0.0000	0.0001	
7	4.6957	-7.3453	167.3	-1.8	0.0000	0.0001	
8	5.3184	-6.9062	194.3	-2.0	0.0000	0.0001	
9	5.9003	-6.4144	204.0	-2.1	0.0000	0.0001	
10	6.4369	-5.8734	196.5	-2.3	0.0000	0.0001	
11	6.9241	-5.2876	215.9	-2.5	0.0000	0.0001	
12	7.3581	-4.6614	267.5	-2.8	0.0001	0.0002	
13	7.7355	-3.9995	318.8	-3.0	0.0001	0.0002	
14	8.0535	-3.3070	359.0	-3.2	0.0001	0.0002	
15	8.3055	-2.5893	468.7	-3.8	0.0001	0.0003	
16	8.5015	-1.8519	496.5	-4.8	0.0001	0.0003	
17	8.6279	-1.1004	466.5	-4.1	0.0001	0.0003	
18	8.6678	-0.3408	393.2	0.9	0.0002	0.0002	
19	8.6814	0.4212	398.8	2.2	0.0002	0.0001	
20	8.6089	1.1797	525.8	-21.3	-0.0001	0.0006	
21	8.4678	1.9286	522.0	-62.8	-0.0009	0.0013	
22	8.2540	2.6600	560.2	-39.9	-0.0004	0.0009	
23	7.9723	3.3681	727.8	99.8	0.0020	-0.0014	
24	7.6417	4.0549	912.7	227.8	0.0043	-0.0035	
25	7.2737	4.7251	1121.6	225.5	0.0044	-0.0034	
26	6.8837	5.3770	1183.3	144.3	0.0030	-0.0020	
27	6.4488	6.0031	1180.3	61.2	0.0016	-0.0005	
28	5.9672	6.5941	1371.4	-37.9	-0.0001	0.0012	
29	5.4321	7.1376	1423.0	-276.5	-0.0049	0.0069	
30	4.8234	7.5975	1081.1	-437.0	-0.0133	0.0161	*
31	4.1251	7.9031	854.2	-131.1	-0.0019	0.0026	
32	3.3977	8.1303	487.2	101.5	0.0020	-0.0015	
33	2.6560	8.3063	518.6	348.6	0.0071	-0.0064	*
34	1.9112	8.4677	532.9	322.1	0.0058	-0.0053	*
35	1.1618	8.6056	419.5	109.0	0.0021	-0.0017	
36	0.4047	8.6919	442.4	-54.0	-0.0007	0.0011	
37	-0.3571	8.7048	286.3	-69.4	-0.0011	0.0013	
38	-1.1164	8.6422	235.3	-17.3	-0.0002	0.0004	
39	-1.8671	8.5113	305.5	8.9	0.0003	-0.0000	
40	-2.6037	8.3167	285.4	3.7	0.0002	0.0001	
41	-3.3208	8.0591	357.1	-2.8	0.0001	0.0002	
42	-4.0126	7.7396	390.2	-2.9	0.0001	0.0002	
43	-4.6737	7.3607	308.9	-1.8	0.0001	0.0002	
44	-5.2991	6.9254	411.2	-1.6	0.0001	0.0002	
45	-5.8841	6.4371	412.8	-1.5	0.0002	0.0002	
46	-6.4241	5.8996	273.6	-1.4	0.0001	0.0001	
47	-6.9151	5.3169	206.5	-1.3	0.0001	0.0001	
48	-7.3532	4.6936	138.4	-1.1	0.0000	0.0001	
49	-7.7353	4.0344	100.8	-1.1	0.0000	0.0001	
50	-8.0583	3.3444	101.1	-1.0	0.0000	0.0001	
51	-8.3198	2.6288	78.9	-0.9	0.0000	0.0000	
52	-8.5178	1.8931	88.4	-0.9	0.0000	0.0001	
53	-8.6509	1.1429	163.4	-0.9	0.0001	0.0001	
54	-8.7179	0.3840	147.3	-0.8	0.0000	0.0001	
55	-8.7185	-0.3779	95.9	-0.8	0.0000	0.0001	
56	-8.6525	-1.1369	164.7	-0.8	0.0001	0.0001	
57	-8.5205	-1.8873	230.0	-0.8	0.0001	0.0001	
58	-8.3235	-2.6234	177.1	-0.7	0.0001	0.0001	
59	-8.0631	-3.3393	45.8	-0.7	0.0000	0.0000	
60	-7.7412	-4.0298	-61.0	-0.6	-0.0000	-0.0000	
61	-7.3602	-4.6895	-106.8	-0.6	-0.0001	-0.0000	
62	-6.9231	-5.3135	-125.6	-0.6	-0.0001	-0.0000	
63	-6.4333	-5.8969	-107.4	-0.6	-0.0001	-0.0000	
64	-5.8944	-6.4354	-74.7	-0.7	-0.0000	-0.0000	
65	-5.3106	-6.9248	-69.2	-0.7	-0.0000	-0.0000	
66	-4.6862	-7.3614	-78.0	-0.7	-0.0000	-0.0000	
67	-4.0262	-7.7419	-81.0	-0.7	-0.0001	-0.0000	
68	-3.3355	-8.0632	-80.2	-0.8	-0.0001	-0.0000	
69	-2.6193	-8.3231	-92.4	-0.8	-0.0001	-0.0000	
70	-1.8832	-8.5194	-137.2	-0.8	-0.0001	-0.0000	
71	-1.1329	-8.6507	-243.5	-0.9	-0.0001	-0.0001	
72	-0.3740	-8.7160	-317.2	-0.9	-0.0002	-0.0001	

J= 110 TIME= 0.0003311

TOTAL ENERGY INPUT (IN.-LB.) = 550.103
KINETIC ENERGY (IN.-LB.) = 421.906
ELASTIC ENERGY (IN.-LB.) = 78.776
PLASTIC WORK (IN.-LB.) = 49.421

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 767.5442 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3897	-8.7118	-135.1	-1.4	-0.0001	-0.0000	
2	1.1484	-8.6436	-103.6	-1.5	-0.0001	-0.0000	
3	1.8983	-8.5095	-95.0	-1.6	-0.0001	-0.0000	
4	2.6337	-8.3102	-53.5	-1.8	-0.0001	0.0000	
5	3.3488	-8.0474	0.2	-1.9	-0.0000	0.0000	
6	4.0381	-7.7231	35.9	-2.1	-0.0000	0.0000	
7	4.6965	-7.3396	69.7	-2.3	-0.0000	0.0001	
8	5.3187	-6.9000	115.4	-2.5	0.0000	0.0001	
9	5.9001	-6.4076	101.4	-2.7	-0.0000	0.0001	
10	6.4361	-5.8661	20.7	-2.9	-0.0000	0.0001	
11	6.9225	-5.2798	12.2	-3.1	-0.0001	0.0001	
12	7.3557	-4.6530	53.4	-3.4	-0.0000	0.0001	
13	7.7322	-3.9907	136.2	-3.6	-0.0000	0.0001	
14	8.0491	-3.2978	131.9	-4.0	-0.0000	0.0001	
15	8.3040	-2.5798	201.6	-5.3	-0.0000	0.0002	
16	8.4946	-1.8420	404.5	-6.3	0.0001	0.0003	
17	8.6194	-1.0903	504.4	-2.4	0.0002	0.0003	
18	8.6778	-0.3305	590.6	5.8	0.0004	0.0002	
19	8.6706	0.4316	597.4	-3.6	0.0002	0.0003	
20	8.5966	1.1900	621.8	-51.6	-0.0006	0.0012	
21	8.4500	1.9379	797.1	-82.9	-0.0011	0.0018	
22	8.2283	2.6671	900.0	6.6	0.0005	0.0003	
23	7.9447	3.3745	992.2	168.0	0.0033	-0.0025	
24	7.6204	4.0643	1181.6	239.5	0.0046	-0.0036	
25	7.2648	4.7386	1242.6	203.9	0.0041	-0.0030	
26	6.8745	5.3935	1318.3	142.0	0.0030	-0.0019	
27	6.4440	6.0226	1376.7	102.8	0.0024	-0.0012	
28	5.9708	6.6204	1455.0	-9.3	0.0005	0.0008	
29	5.4462	7.1740	1449.4	-290.4	-0.0051	0.0071	
30	4.8449	7.6443	1122.9	-438.8	-0.0143	0.0181	*
31	4.1471	7.9509	814.9	-294.7	-0.0047	0.0054	
32	3.4137	8.1584	693.8	125.7	0.0025	-0.0019	
33	2.6682	8.3175	667.3	320.9	0.0067	-0.0059	
34	1.9191	8.4584	637.7	352.0	0.0073	-0.0065	*
35	1.1677	8.5856	600.5	213.5	0.0039	-0.0034	
36	0.4110	8.6749	384.7	-12.0	-0.0000	0.0004	
37	-0.3507	8.6962	316.7	-99.0	-0.0016	0.0018	
38	-1.1104	8.6381	258.6	-51.4	-0.0006	0.0010	
39	-1.8609	8.5074	27.5	5.0	0.0001	-0.0001	
40	-2.5974	8.3123	-3.5	12.1	0.0002	-0.0002	
41	-3.3146	8.0553	-49.5	-0.4	-0.0000	-0.0000	
42	-4.0066	7.7368	-63.8	-4.6	-0.0001	0.0000	
43	-4.6680	7.3586	32.6	-2.9	-0.0000	0.0001	
44	-5.2936	6.9239	-51.7	-1.8	-0.0001	0.0000	
45	-5.8788	6.4361	-115.5	-1.7	-0.0001	-0.0000	
46	-6.4192	5.8991	-84.1	-1.7	-0.0001	-0.0000	
47	-6.9104	5.3168	-130.7	-1.6	-0.0001	-0.0000	
48	-7.3489	4.6938	-15.6	-1.5	-0.0000	0.0000	
49	-7.7313	4.0349	34.4	-1.4	-0.0000	0.0000	
50	-8.0546	3.3450	-54.2	-1.3	-0.0000	-0.0000	
51	-8.3165	2.6296	14.9	-1.3	-0.0000	0.0000	
52	-8.5148	1.8940	86.9	-1.2	0.0000	0.0001	
53	-8.6481	1.1438	49.9	-1.1	-0.0000	0.0000	
54	-8.7153	0.3850	-6.1	-1.0	-0.0000	0.0000	
55	-8.7160	-0.3769	-73.9	-1.0	-0.0001	-0.0000	
56	-8.6502	-1.1358	-133.8	-0.9	-0.0001	-0.0000	
57	-8.5184	-1.8861	-145.1	-0.9	-0.0001	-0.0001	
58	-8.3215	-2.6220	-200.8	-0.8	-0.0001	-0.0001	
59	-8.0612	-3.3379	-245.7	-0.8	-0.0001	-0.0001	
60	-7.7394	-4.0284	-173.0	-0.8	-0.0001	-0.0001	
61	-7.3585	-4.6882	-152.1	-0.8	-0.0001	-0.0001	
62	-6.9215	-5.3121	-244.8	-0.8	-0.0001	-0.0001	
63	-6.4317	-5.8955	-311.6	-0.8	-0.0002	-0.0001	
64	-5.8928	-6.4339	-294.0	-0.8	-0.0001	-0.0001	
65	-5.3090	-6.9233	-211.7	-0.9	-0.0001	-0.0001	
66	-4.6846	-7.3598	-117.4	-1.0	-0.0001	-0.0000	
67	-4.0245	-7.7401	-113.3	-1.0	-0.0001	-0.0000	
68	-3.3338	-8.0614	-216.0	-1.0	-0.0001	-0.0001	
69	-2.6176	-8.3210	-292.4	-1.0	-0.0001	-0.0001	
70	-1.8816	-8.5172	-252.4	-1.1	-0.0001	-0.0001	
71	-1.1311	-8.6483	-162.6	-1.2	-0.0001	-0.0001	
72	-0.3721	-8.7133	-140.4	-1.3	-0.0001	-0.0000	

J= 120 TIME= 0.0003612
TOTAL ENERGY INPUT (IN.-LB.) = 629.920
KINETIC ENERGY (IN.-LB.) = 477.385
ELASTIC ENERGY (IN.-LB.) = 90.689
PLASTIC WORK (IN.-LB.) = 61.846

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 671.3223 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3920	-8.7089	188.3	-1.8	0.0000	0.0001	
2	1.1507	-8.6403	30.9	-1.9	-0.0000	0.0000	
3	1.9005	-8.5057	-147.0	-2.0	-0.0001	-0.0000	
4	2.6357	-8.3059	-210.8	-2.1	-0.0001	-0.0001	
5	3.3505	-8.0426	-194.5	-2.3	-0.0001	-0.0000	
6	4.0396	-7.7177	-175.9	-2.5	-0.0001	-0.0000	
7	4.6975	-7.3337	-140.4	-2.7	-0.0001	-0.0000	
8	5.3193	-6.8935	-34.3	-3.0	-0.0001	0.0000	
9	5.9002	-6.4004	166.3	-3.3	0.0000	0.0001	
10	6.4355	-5.8583	218.8	-3.6	0.0000	0.0002	
11	6.9213	-5.2713	221.1	-3.9	0.0000	0.0002	
12	7.3536	-4.6438	256.2	-4.2	0.0000	0.0002	
13	7.7290	-3.9808	303.2	-4.4	0.0001	0.0002	
14	8.0448	-3.2873	451.8	-5.5	0.0001	0.0003	
15	8.2982	-2.5687	468.2	-7.7	0.0001	0.0003	
16	8.4871	-1.8304	495.2	-6.7	0.0001	0.0003	
17	8.6100	-1.0784	631.5	3.5	0.0003	0.0002	
18	8.6674	-0.3185	661.5	9.6	0.0005	0.0001	
19	8.6596	0.4436	686.8	-25.5	-0.0001	0.0007	
20	8.5821	1.2017	757.8	-90.3	-0.0012	0.0019	
21	8.4271	1.9479	791.3	-70.8	-0.0009	0.0016	
22	8.1987	2.6751	940.1	77.0	0.0017	-0.0009	
23	7.9172	3.3834	1071.8	207.8	0.0040	-0.0031	
24	7.5997	4.0764	1195.0	227.9	0.0044	-0.0034	
25	7.2494	4.7534	1245.1	188.0	0.0038	-0.0027	
26	6.8625	5.4103	1257.2	168.4	0.0034	-0.0024	
27	6.4381	6.0436	1341.5	146.9	0.0031	-0.0020	
28	5.9753	6.6494	1444.5	-16.2	0.0003	0.0009	
29	5.4597	7.2114	1432.4	-288.6	-0.0051	0.0071	
30	4.8659	7.6918	1122.7	-441.4	-0.0153	0.0200	*
31	4.1688	8.0001	682.7	-358.4	-0.0069	0.0078	*
32	3.4314	8.1928	579.5	94.0	0.0019	-0.0014	
33	2.6821	8.3327	532.9	310.3	0.0065	-0.0058	
34	1.9293	8.4531	694.6	365.8	0.0083	-0.0074	*
35	1.1758	8.5671	543.4	294.6	0.0053	-0.0048	
36	0.4188	8.6535	434.1	74.6	0.0015	-0.0011	
37	-0.3426	8.6835	371.7	-102.6	-0.0016	0.0019	
38	-1.1029	8.6335	335.9	-98.7	-0.0016	0.0018	
39	-1.8539	8.5047	384.5	-17.0	-0.0001	0.0005	
40	-2.5902	8.3086	276.8	19.9	0.0005	-0.0002	
41	-3.3075	8.0517	249.7	7.6	0.0002	-0.0000	
42	-4.0001	7.7341	249.4	-5.5	0.0000	0.0002	
43	-4.6619	7.3567	48.4	-5.3	-0.0001	0.0001	
44	-5.2880	6.9225	47.5	-2.6	-0.0000	0.0001	
45	-5.8736	6.4352	46.8	-2.0	-0.0000	0.0001	
46	-6.4143	5.8985	-120.5	-2.1	-0.0001	-0.0000	
47	-6.9059	5.3166	-177.3	-2.0	-0.0001	-0.0000	
48	-7.3448	4.6939	-277.9	-1.8	-0.0002	-0.0001	
49	-7.7274	4.0353	-328.8	-1.7	-0.0002	-0.0001	
50	-8.0510	3.3457	-230.3	-1.6	-0.0001	-0.0001	
51	-8.3131	2.6304	-305.8	-1.4	-0.0002	-0.0001	
52	-8.5117	1.8950	-344.1	-1.3	-0.0002	-0.0001	
53	-8.6452	1.1451	-355.9	-1.2	-0.0002	-0.0001	
54	-8.7127	0.3864	-462.8	-1.2	-0.0002	-0.0002	
55	-8.7137	-0.3753	-429.4	-1.1	-0.0002	-0.0002	
56	-8.6481	-1.1342	-405.8	-1.1	-0.0002	-0.0002	
57	-8.5166	-1.8844	-443.7	-1.0	-0.0002	-0.0002	
58	-8.3199	-2.6204	-287.0	-1.1	-0.0001	-0.0001	
59	-8.0597	-3.3364	-34.0	-1.2	-0.0000	0.0000	
60	-7.7380	-4.0270	24.9	-1.1	-0.0000	0.0000	
61	-7.3572	-4.6868	-45.9	-1.1	-0.0000	-0.0000	
62	-6.9202	-5.3109	-89.3	-1.1	-0.0001	-0.0000	
63	-6.4303	-5.8943	-90.7	-1.1	-0.0001	-0.0000	
64	-5.8914	-6.4328	-66.6	-1.1	-0.0001	-0.0000	
65	-5.3075	-6.9221	-126.0	-1.1	-0.0001	-0.0000	
66	-4.6831	-7.3585	-194.7	-1.2	-0.0001	-0.0001	
67	-4.0230	-7.7388	-124.3	-1.2	-0.0001	-0.0000	
68	-3.3321	-8.0599	-45.6	-1.3	-0.0000	-0.0000	
69	-2.6158	-8.3194	-27.4	-1.4	-0.0000	0.0000	
70	-1.8796	-8.5153	-14.8	-1.5	-0.0000	0.0000	
71	-1.1290	-8.6461	57.0	-1.6	-0.0000	0.0000	
72	-0.3699	-8.7108	185.8	-1.7	0.0000	0.0001	

J= 130 TIME= 0.0003913
TOTAL ENERGY INPUT (IN.-LB.) = 696.557
KINETIC ENERGY (IN.-LB.) = 523.094
ELASTIC ENERGY (IN.-LB.) = 99.823
PLASTIC WORK (IN.-LB.) = 73.640

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 558.5859 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3941	-8.7061	89.4	-2.1	-0.0000	0.0001	
2	1.1528	-8.6371	187.9	-2.3	0.0000	0.0001	
3	1.9027	-8.5020	244.2	-2.5	0.0001	0.0001	
4	2.6378	-8.3016	234.5	-2.7	0.0001	0.0001	
5	3.3526	-8.0377	258.2	-2.9	0.0001	0.0002	
6	4.0414	-7.7121	314.5	-3.2	0.0001	0.0002	
7	4.6992	-7.3273	490.8	-3.5	0.0001	0.0003	
8	5.3206	-6.8862	569.1	-3.8	0.0002	0.0003	
9	5.9009	-6.3923	548.8	-4.1	0.0002	0.0003	
10	6.4356	-5.8493	576.8	-4.5	0.0002	0.0003	
11	6.9204	-5.2615	433.4	-4.8	0.0001	0.0003	
12	7.3516	-4.6332	345.1	-4.8	0.0001	0.0002	
13	7.7259	-3.9695	380.3	-5.4	0.0001	0.0003	
14	8.0402	-3.2754	391.6	-7.9	0.0000	0.0003	
15	8.2919	-2.5561	469.5	-10.3	0.0000	0.0004	
16	8.4787	-1.8173	553.1	-3.0	0.0002	0.0003	
17	8.5999	-1.0650	577.4	13.6	0.0005	0.0000	
18	8.6569	-0.3051	608.8	2.3	0.0003	0.0002	
19	8.6478	0.4569	601.4	-67.5	-0.0009	0.0014	
20	8.5634	1.2143	696.0	-113.5	-0.0017	0.0023	
21	8.3987	1.9584	796.8	-19.8	0.0000	0.0007	
22	8.1673	2.6846	865.1	139.0	0.0028	-0.0020	
23	7.8905	3.3947	958.4	216.7	0.0042	-0.0033	
24	7.5786	4.0902	1020.0	208.3	0.0040	-0.0032	
25	7.2315	4.7688	1044.4	193.4	0.0038	-0.0029	
26	6.8484	5.4278	1098.9	215.5	0.0042	-0.0032	
27	6.4328	6.0668	1191.0	159.5	0.0033	-0.0022	
28	5.9798	6.6799	1224.2	-24.7	0.0001	0.0010	
29	5.4724	7.2493	1234.9	-278.6	-0.0050	0.0068	
30	4.8863	7.7394	907.3	-449.7	-0.0167	0.0219	*
31	4.1890	8.0470	572.1	-368.9	-0.0077	0.0084	*
32	3.4500	8.2335	376.4	-21.8	-0.0002	0.0005	
33	2.6970	8.3522	584.5	309.1	0.0065	-0.0057	
34	1.9412	8.4510	501.8	381.3	0.0093	-0.0086	*
35	1.1858	8.5516	512.6	330.0	0.0061	-0.0055	*
36	0.4279	8.6303	455.6	172.7	0.0032	-0.0028	
37	-0.3333	8.6653	396.9	-58.0	-0.0008	0.0012	
38	-1.0943	8.6263	369.7	-140.7	-0.0023	0.0026	
39	-1.8461	8.5027	258.3	-62.4	-0.0010	0.0012	
40	-2.5823	8.3061	270.6	16.6	0.0004	-0.0002	
41	-3.2993	8.0482	353.5	22.1	0.0005	-0.0002	
42	-3.9922	7.7314	251.8	-1.1	0.0001	0.0001	
43	-4.6548	7.3553	181.5	-8.8	-0.0001	0.0002	
44	-5.2815	6.9220	81.2	-4.6	-0.0000	0.0001	
45	-5.8676	6.4352	77.8	-2.2	-0.0000	0.0001	
46	-6.4088	5.8989	161.9	-2.3	0.0000	0.0001	
47	-6.9010	5.3174	8.6	-2.5	-0.0000	0.0000	
48	-7.3404	4.6950	-45.9	-2.3	-0.0001	0.0000	
49	-7.7236	4.0365	-9.6	-2.1	-0.0000	0.0000	
50	-8.0476	3.3471	-74.9	-2.0	-0.0001	-0.0000	
51	-8.3102	2.6319	77.5	-1.9	-0.0000	0.0001	
52	-8.5091	1.8964	179.3	-1.8	0.0000	0.0001	
53	-8.6430	1.1464	23.7	-1.6	-0.0000	0.0000	
54	-8.7108	0.3876	-46.8	-1.5	-0.0001	0.0000	
55	-8.7119	-0.3742	-131.7	-1.4	-0.0001	-0.0000	
56	-8.6465	-1.1332	-147.7	-1.4	-0.0001	-0.0000	
57	-8.5150	-1.8836	-89.4	-1.4	-0.0001	-0.0000	
58	-8.3184	-2.6196	-147.4	-1.3	-0.0001	-0.0000	
59	-8.0583	-3.3356	-128.2	-1.3	-0.0001	-0.0000	
60	-7.7366	-4.0262	-109.0	-1.3	-0.0001	-0.0000	
61	-7.3558	-4.6859	-195.4	-1.2	-0.0001	-0.0001	
62	-6.9188	-5.3100	-131.6	-1.3	-0.0001	-0.0000	
63	-6.4289	-5.8934	15.7	-1.3	-0.0000	0.0000	
64	-5.8899	-6.4319	8.7	-1.4	-0.0000	0.0000	
65	-5.3059	-6.9211	9.0	-1.4	-0.0000	0.0000	
66	-4.6814	-7.3575	33.5	-1.4	-0.0000	0.0000	
67	-4.0212	-7.7376	-11.8	-1.5	-0.0000	0.0000	
68	-3.3302	-8.0585	11.6	-1.6	-0.0000	0.0000	
69	-2.6138	-8.3178	42.1	-1.6	-0.0000	0.0000	
70	-1.8775	-8.5135	8.9	-1.7	-0.0000	0.0000	
71	-1.1269	-8.6440	-2.8	-1.8	-0.0000	0.0000	
72	-0.3678	-8.7084	31.0	-2.0	-0.0000	0.0000	

J= 140 TIME= 0.0004214
TOTAL ENERGY INPUT (IN.-LB.) = 751.820
KINETIC ENERGY (IN.-LB.) = 558.481
ELASTIC ENERGY (IN.-LB.) = 108.951
PLASTIC WORK (IN.-LB.) = 84.388

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 549.3857 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.3970	-8.7030	362.4	-2.6	0.0001	0.0002	
2	1.1557	-8.6334	397.9	-2.8	0.0001	0.0002	
3	1.9056	-8.4976	536.7	-3.0	0.0002	0.0003	
4	2.6406	-8.2966	500.8	-3.2	0.0002	0.0003	
5	3.3551	-8.0319	406.9	-3.5	0.0001	0.0002	
6	4.0437	-7.7056	467.8	-3.8	0.0001	0.0003	
7	4.7010	-7.3200	438.1	-4.1	0.0001	0.0003	
8	5.3218	-6.8782	417.8	-4.4	0.0001	0.0003	
9	5.9014	-6.3835	385.7	-4.8	0.0001	0.0002	
10	6.4352	-5.8397	373.5	-5.3	0.0001	0.0002	
11	6.9190	-5.2510	444.2	-5.4	0.0001	0.0003	
12	7.3491	-4.6220	450.3	-5.4	0.0001	0.0003	
13	7.7222	-3.9576	475.6	-7.3	0.0001	0.0003	
14	8.0350	-3.2627	584.0	-11.9	0.0000	0.0005	
15	8.2847	-2.5427	663.4	-10.7	0.0001	0.0005	
16	8.4692	-1.8033	757.3	7.9	0.0005	0.0002	
17	8.5897	-1.0507	738.3	21.1	0.0007	-0.0000	
18	8.6468	-0.2909	635.2	-28.1	-0.0002	0.0008	
19	8.6339	0.4711	566.8	-114.8	-0.0017	0.0022	
20	8.5395	1.2272	535.4	-98.1	-0.0015	0.0019	
21	8.3670	1.9695	533.2	47.4	0.0010	-0.0006	
22	8.1364	2.6958	481.1	173.2	0.0032	-0.0028	
23	7.8645	3.4076	414.2	206.2	0.0037	-0.0034	
24	7.5563	4.1046	455.7	196.8	0.0036	-0.0032	
25	7.2114	4.7841	611.2	229.3	0.0042	-0.0037	
26	6.8346	5.4465	637.2	249.2	0.0046	-0.0040	
27	6.4288	6.0917	744.4	147.9	0.0029	-0.0022	
28	5.9839	6.7106	774.2	-32.7	-0.0002	0.0009	
29	5.4834	7.2858	744.9	-266.4	-0.0050	0.0064	
30	4.9042	7.7839	665.6	-456.3	-0.0177	0.0229	*
31	4.2081	8.0944	484.9	-380.4	-0.0086	0.0092	*
32	3.4684	8.2780	468.3	-136.1	-0.0021	0.0025	
33	2.7128	8.3787	327.5	253.9	0.0054	-0.0049	
34	1.9541	8.4523	453.0	401.8	0.0107	-0.0101	*
35	1.1969	8.5387	485.9	346.3	0.0068	-0.0062	*
36	0.4381	8.6082	472.0	237.8	0.0043	-0.0039	
37	-0.3231	8.6427	354.2	27.0	0.0006	-0.0003	
38	-1.0844	8.6142	158.6	-147.5	-0.0025	0.0026	
39	-1.8378	8.5002	94.6	-123.9	-0.0021	0.0022	
40	-2.5743	8.3052	70.7	-10.8	-0.0002	0.0002	
41	-3.2905	8.0454	55.3	36.0	0.0006	-0.0006	
42	-3.9833	7.7284	167.1	12.8	0.0003	-0.0002	
43	-4.6468	7.3537	283.5	-10.0	-0.0001	0.0003	
44	-5.2744	6.9216	406.3	-9.3	0.0000	0.0003	
45	-5.8611	6.4354	475.6	-3.3	0.0001	0.0003	
46	-6.4029	5.8996	295.9	-2.2	0.0001	0.0002	
47	-6.8957	5.3185	303.9	-2.9	0.0001	0.0002	
48	-7.3358	4.6963	450.1	-3.0	0.0001	0.0002	
49	-7.7195	4.0381	456.1	-2.7	0.0001	0.0002	
50	-8.0442	3.3487	416.6	-2.4	0.0001	0.0002	
51	-8.3071	2.6335	274.7	-2.2	0.0001	0.0002	
52	-8.5065	1.8981	284.8	-2.2	0.0001	0.0002	
53	-8.6408	1.1481	432.1	-2.1	0.0001	0.0002	
54	-8.7089	0.3892	371.0	-2.0	0.0001	0.0002	
55	-8.7103	-0.3729	415.4	-1.9	0.0001	0.0002	
56	-8.6451	-1.1320	508.1	-1.8	0.0002	0.0002	
57	-8.5137	-1.8826	359.3	-1.7	0.0001	0.0002	
58	-8.3172	-2.6188	316.1	-1.7	0.0001	0.0002	
59	-8.0570	-3.3349	229.2	-1.6	0.0001	0.0001	
60	-7.7353	-4.0255	93.6	-1.5	0.0000	0.0001	
61	-7.3544	-4.6854	142.3	-1.5	0.0000	0.0001	
62	-6.9173	-5.3094	68.2	-1.5	0.0000	0.0001	
63	-6.4274	-5.8928	-30.9	-1.5	-0.0000	0.0000	
64	-5.8883	-6.4312	12.3	-1.6	-0.0000	0.0000	
65	-5.3042	-6.9204	83.4	-1.7	0.0000	0.0001	
66	-4.6795	-7.3566	229.7	-1.8	0.0001	0.0001	
67	-4.0191	-7.7366	278.2	-1.8	0.0001	0.0001	
68	-3.3280	-8.0573	110.9	-1.8	0.0000	0.0001	
69	-2.6115	-8.3163	61.4	-1.9	-0.0000	0.0001	
70	-1.8750	-8.5117	234.7	-2.1	0.0001	0.0001	
71	-1.1242	-8.6418	312.7	-2.3	0.0001	0.0002	
72	-0.3650	-8.7058	322.6	-2.4	0.0001	0.0002	

J= 150 TIME= 0.0004515
TOTAL ENERGY INPUT (IN.-LB.) = 802.698
KINETIC ENERGY (IN.-LB.) = 590.044
ELASTIC ENERGY (IN.-LB.) = 116.726
PLASTIC WORK (IN.-LB.) = 95.928

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 446.4302 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4003	-8.6992	259.8	-3.0	0.0001	0.0002	
2	1.1590	-8.6290	353.8	-3.2	0.0001	0.0002	
3	1.9086	-8.4926	187.3	-3.4	0.0000	0.0001	
4	2.6433	-8.2909	124.8	-3.7	-0.0000	0.0001	
5	3.3575	-8.0255	197.3	-4.0	0.0000	0.0002	
6	4.0457	-7.6983	261.5	-4.3	0.0000	0.0002	
7	4.7024	-7.3120	301.8	-4.7	0.0000	0.0002	
8	5.3226	-6.8694	276.3	-5.1	0.0000	0.0002	
9	5.9014	-6.3739	298.1	-5.7	0.0000	0.0002	
10	6.4344	-5.8292	371.9	-6.1	0.0001	0.0003	
11	6.9172	-5.2397	409.6	-5.8	0.0001	0.0003	
12	7.3462	-4.6100	430.8	-6.4	0.0001	0.0003	
13	7.7179	-3.9448	377.8	-11.1	-0.0000	0.0004	
14	8.0289	-3.2492	294.4	-16.0	-0.0002	0.0004	
15	8.2761	-2.5285	155.5	-3.6	0.0000	0.0001	
16	8.4590	-1.7889	12.7	25.1	0.0004	-0.0004	
17	8.5801	-1.0367	77.9	11.4	0.0002	-0.0002	
18	8.6366	-0.2770	220.4	-80.5	-0.0013	0.0015	
19	8.6161	0.4848	245.5	-138.6	-0.0023	0.0025	
20	8.5112	1.2394	246.3	-48.0	-0.0007	0.0009	
21	8.3347	1.9807	328.5	101.0	0.0019	-0.0016	
22	8.1070	2.7078	378.9	181.0	0.0033	-0.0030	
23	7.8389	3.4211	543.0	188.8	0.0035	-0.0030	
24	7.5322	4.1188	624.4	212.4	0.0039	-0.0034	
25	7.1907	4.8001	680.9	275.0	0.0050	-0.0044	
26	6.8224	5.4673	635.2	253.6	0.0046	-0.0041	
27	6.4254	6.1179	546.4	134.6	0.0026	-0.0021	
28	5.9877	6.7417	555.0	-52.3	-0.0007	0.0011	
29	5.4918	7.3208	481.8	-253.3	-0.0049	0.0061	
30	4.9177	7.8248	436.2	-430.1	-0.0173	0.0224	
31	4.2263	8.1453	275.8	-408.8	-0.0107	0.0111	*
32	3.4857	8.3247	43.5	-203.2	-0.0035	0.0035	
33	2.7286	8.4124	100.9	149.1	0.0035	-0.0032	
34	1.9679	8.4593	92.0	417.1	0.0115	-0.0114	*
35	1.2089	8.5271	260.0	365.6	0.0080	-0.0077	*
36	0.4494	8.5884	387.0	267.8	0.0048	-0.0045	
37	-0.3120	8.6185	424.8	109.3	0.0021	-0.0017	
38	-1.0736	8.5965	372.2	-102.5	-0.0016	0.0019	
39	-1.8288	8.4948	296.2	-174.9	-0.0029	0.0031	
40	-2.5668	8.3053	343.6	-68.0	-0.0010	0.0013	
41	-3.2825	8.0438	445.3	34.0	0.0008	-0.0004	
42	-3.9746	7.7249	444.7	35.4	0.0008	-0.0004	
43	-4.6386	7.3510	468.2	-2.8	0.0002	0.0002	
44	-5.2672	6.9203	484.8	-15.1	-0.0001	0.0005	
45	-5.8546	6.4350	391.1	-7.1	0.0000	0.0003	
46	-6.3969	5.8997	357.6	-2.1	0.0001	0.0002	
47	-6.8902	5.3189	363.6	-2.6	0.0001	0.0002	
48	-7.3307	4.6972	360.8	-3.4	0.0001	0.0002	
49	-7.7150	4.0392	429.3	-3.2	0.0001	0.0002	
50	-8.0400	3.3500	334.0	-2.8	0.0001	0.0002	
51	-8.3035	2.6351	295.5	-2.6	0.0001	0.0002	
52	-8.5033	1.8998	321.9	-2.4	0.0001	0.0002	
53	-8.6379	1.1498	231.0	-2.3	0.0001	0.0001	
54	-8.7063	0.3910	306.2	-2.2	0.0001	0.0002	
55	-8.7081	-0.3710	379.1	-2.1	0.0001	0.0002	
56	-8.6431	-1.1302	404.1	-2.1	0.0001	0.0002	
57	-8.5120	-1.8809	563.3	-2.1	0.0002	0.0003	
58	-8.3157	-2.6172	546.3	-2.0	0.0002	0.0003	
59	-8.0556	-3.3335	539.9	-2.0	0.0002	0.0003	
60	-7.7339	-4.0243	615.4	-1.9	0.0002	0.0003	
61	-7.3531	-4.6843	490.6	-1.9	0.0002	0.0002	
62	-6.9159	-5.3084	572.3	-2.0	0.0002	0.0003	
63	-6.4257	-5.8920	727.7	-2.0	0.0003	0.0003	
64	-5.8864	-6.4304	665.7	-2.0	0.0003	0.0003	
65	-5.3020	-6.9196	645.8	-2.1	0.0002	0.0003	
66	-4.6771	-7.3557	598.8	-2.1	0.0002	0.0003	
67	-4.0165	-7.7355	552.3	-2.2	0.0002	0.0003	
68	-3.3251	-8.0559	589.0	-2.3	0.0002	0.0003	
69	-2.6083	-8.3146	438.0	-2.3	0.0001	0.0002	
70	-1.8717	-8.5095	285.7	-2.5	0.0001	0.0002	
71	-1.1209	-8.6392	341.6	-2.6	0.0001	0.0002	
72	-0.3616	-8.7026	252.6	-2.8	0.0001	0.0002	

J= 160 TIME= 0.0004816
TOTAL ENERGY INPUT (IN.-LB.) = 842.913
KINETIC ENERGY (IN.-LB.) = 611.320
ELASTIC ENERGY (IN.-LB.) = 122.503
PLASTIC WORK (IN.-LB.) = 109.090

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 377.4614 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4033	-8.6949	405.3	-3.5	0.0001	0.0002	
2	1.1619	-8.6242	341.3	-3.7	0.0001	0.0002	
3	1.9114	-8.4871	388.8	-4.0	0.0001	0.0002	
4	2.6460	-8.2847	310.3	-4.3	0.0001	0.0002	
5	3.3599	-8.0185	214.3	-4.6	0.0000	0.0002	
6	4.0476	-7.6906	95.0	-4.9	-0.0000	0.0001	
7	4.7038	-7.3034	-129.4	-5.2	-0.0002	0.0000	
8	5.3232	-6.8601	-227.5	-5.8	-0.0002	-0.0000	
9	5.9012	-6.3638	-129.5	-6.5	-0.0002	0.0000	
10	6.4332	-5.8184	-43.0	-6.3	-0.0001	0.0001	
11	6.9149	-5.2282	-87.8	-5.7	-0.0001	0.0001	
12	7.3427	-4.5979	-139.9	-8.8	-0.0002	0.0001	
13	7.7130	-3.9321	-86.7	-17.4	-0.0003	0.0003	
14	8.0218	-3.2357	-43.2	-16.1	-0.0003	0.0003	
15	8.2666	-2.5142	-51.3	14.4	0.0002	-0.0003	
16	8.4495	-1.7747	-12.0	36.4	0.0006	-0.0006	
17	8.5720	-1.0227	111.3	-27.4	-0.0004	0.0005	
18	8.6249	-0.2627	195.8	-133.1	-0.0022	0.0024	
19	8.5938	0.4987	263.6	-122.7	-0.0020	0.0022	
20	8.4805	1.2521	238.7	11.0	0.0003	-0.0001	
21	8.3033	1.9932	332.9	129.9	0.0024	-0.0021	
22	8.0785	2.7213	356.5	170.0	0.0031	-0.0028	
23	7.8120	3.4351	291.6	185.2	0.0033	-0.0031	
24	7.5065	4.1331	271.6	255.7	0.0045	-0.0043	
25	7.1711	4.8173	275.6	300.7	0.0053	-0.0051	
26	6.8119	5.4894	410.5	246.3	0.0044	-0.0041	
27	6.4229	6.1447	438.4	116.3	0.0022	-0.0018	
28	5.9908	6.7725	515.7	-67.8	-0.0009	0.0014	
29	5.4985	7.3548	685.9	-246.1	-0.0047	0.0060	
30	4.9283	7.8632	736.2	-353.7	-0.0159	0.0212	
31	4.2435	8.1981	583.5	-447.0	-0.0132	0.0140	*
32	3.5017	8.3728	434.7	-247.2	-0.0041	0.0044	
33	2.7433	8.4499	377.7	63.6	0.0021	-0.0016	
34	1.9814	8.4747	382.2	383.5	0.0112	-0.0108	
35	1.2205	8.5169	285.5	398.2	0.0103	-0.0100	*
36	0.4605	8.5699	199.4	292.8	0.0051	-0.0050	
37	-0.3011	8.5951	218.6	157.9	0.0028	-0.0026	
38	-1.0627	8.5746	221.1	-27.7	-0.0004	0.0006	
39	-1.8192	8.4841	192.0	-181.8	-0.0031	0.0032	
40	-2.5597	8.3047	171.9	-140.9	-0.0024	0.0025	
41	-3.2756	8.0439	165.6	0.5	0.0001	0.0001	
42	-3.9661	7.7218	157.3	56.2	0.0010	-0.0009	
43	-4.6295	7.3472	90.7	18.7	0.0004	-0.0003	
44	-5.2592	6.9182	29.7	-16.7	-0.0003	0.0003	
45	-5.8476	6.4343	54.7	-14.8	-0.0002	0.0003	
46	-6.3903	5.8995	120.3	-3.7	-0.0000	0.0001	
47	-6.8839	5.3191	212.4	-1.6	0.0001	0.0001	
48	-7.3250	4.6978	255.4	-3.4	0.0000	0.0002	
49	-7.7098	4.0402	253.6	-3.8	0.0000	0.0002	
50	-8.0354	3.3512	447.4	-3.4	0.0001	0.0002	
51	-8.2993	2.6363	617.5	-3.1	0.0002	0.0003	
52	-8.4994	1.9011	492.6	-2.9	0.0002	0.0003	
53	-8.6344	1.1511	393.3	-2.7	0.0001	0.0002	
54	-8.7031	0.3923	311.1	-2.6	0.0001	0.0002	
55	-8.7051	-0.3697	363.1	-2.5	0.0001	0.0002	
56	-8.6404	-1.1289	494.5	-2.4	0.0002	0.0003	
57	-8.5094	-1.8795	401.0	-2.3	0.0001	0.0002	
58	-8.3131	-2.6158	394.3	-2.3	0.0001	0.0002	
59	-8.0532	-3.3321	477.0	-2.2	0.0002	0.0002	
60	-7.7316	-4.0229	427.1	-2.2	0.0001	0.0002	
61	-7.3507	-4.6829	415.2	-2.2	0.0001	0.0002	
62	-6.9135	-5.3070	340.1	-2.2	0.0001	0.0002	
63	-6.4234	-5.8904	362.8	-2.3	0.0001	0.0002	
64	-5.8841	-6.4287	585.1	-2.3	0.0002	0.0003	
65	-5.2997	-6.9178	446.7	-2.3	0.0002	0.0002	
66	-4.6747	-7.3537	337.7	-2.4	0.0001	0.0002	
67	-4.0140	-7.7333	441.4	-2.5	0.0001	0.0002	
68	-3.3226	-8.0535	302.7	-2.6	0.0001	0.0002	
69	-2.6058	-8.3120	386.3	-2.8	0.0001	0.0002	
70	-1.8690	-8.5066	518.0	-2.9	0.0002	0.0003	
71	-1.1181	-8.6359	462.2	-3.1	0.0001	0.0003	
72	-0.3587	-8.6989	504.2	-3.3	0.0002	0.0003	

J= 170 TIME= 0.0005117
TOTAL ENERGY INPUT (IN.-LB.) = 872.136
KINETIC ENERGY (IN.-LB.) = 621.921
ELASTIC ENERGY (IN.-LB.) = 127.001
PLASTIC WORK (IN.-LB.) = 123.215

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 313.5171 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4054	-8.6901	-184.1	-3.8	-0.0002	-0.0000	
2	1.1638	-8.6190	-65.2	-4.1	-0.0001	0.0000	
3	1.9132	-8.4814	-28.4	-4.5	-0.0001	0.0001	
4	2.6475	-8.2785	20.5	-4.8	-0.0001	0.0001	
5	3.3612	-8.0118	44.7	-5.2	-0.0001	0.0001	
6	4.0486	-7.6832	93.2	-5.6	-0.0001	0.0001	
7	4.7044	-7.2954	161.2	-6.2	-0.0000	0.0002	
8	5.3234	-6.8512	120.9	-7.0	-0.0001	0.0002	
9	5.9007	-6.3541	126.7	-7.3	-0.0001	0.0002	
10	6.4319	-5.8078	223.5	-6.1	-0.0000	0.0002	
11	6.9128	-5.2168	221.6	-6.5	-0.0000	0.0002	
12	7.3397	-4.5857	156.8	-15.0	-0.0002	0.0003	
13	7.7082	-3.9188	137.2	-24.3	-0.0004	0.0005	
14	8.0142	-3.2211	41.7	-4.9	-0.0001	0.0001	
15	8.2576	-2.4992	-20.2	39.4	0.0007	-0.0007	
16	8.4423	-1.7601	2.6	23.7	0.0004	-0.0004	
17	8.5649	-1.0081	65.9	-87.8	-0.0015	0.0015	
18	8.6099	-0.2477	-25.6	-156.8	-0.0027	0.0027	
19	8.5679	0.5131	-25.3	-77.8	-0.0014	0.0013	
20	8.4496	1.2657	101.1	56.7	0.0010	-0.0009	
21	8.2733	2.0070	249.6	134.7	0.0024	-0.0022	
22	8.0501	2.7355	444.4	154.9	0.0029	-0.0025	
23	7.7832	3.4493	376.1	212.1	0.0038	-0.0035	
24	7.4805	4.1486	358.5	298.4	0.0053	-0.0050	
25	7.1531	4.8367	489.8	306.7	0.0055	-0.0051	
26	6.8022	5.5132	597.5	236.2	0.0043	-0.0038	
27	6.4204	6.1728	557.5	90.0	0.0018	-0.0013	
28	5.9922	6.8032	490.4	-78.1	-0.0011	0.0016	
29	5.5026	7.3877	511.9	-217.9	-0.0043	0.0055	
30	4.9372	7.9013	468.4	-305.4	-0.0152	0.0203	
31	4.2584	8.2484	165.3	-460.8	-0.0152	0.0162	*
32	3.5162	8.4209	13.3	-305.6	-0.0053	0.0053	
33	2.7570	8.4881	47.6	24.9	0.0013	-0.0010	
34	1.9948	8.4981	133.0	268.7	0.0091	-0.0089	
35	1.2329	8.5101	6.2	433.6	0.0126	-0.0126	*
36	0.4722	8.5522	-33.0	337.7	0.0059	-0.0059	*
37	-0.2893	8.5726	-28.6	187.5	0.0032	-0.0033	
38	-1.0509	8.5513	137.4	34.0	0.0006	-0.0005	
39	-1.8083	8.4681	251.1	-139.8	-0.0023	0.0025	
40	-2.5518	8.3012	205.6	-195.6	-0.0033	0.0035	
41	-3.2696	8.0458	152.4	-67.5	-0.0011	0.0012	
42	-3.9586	7.7207	163.5	55.7	0.0010	-0.0009	
43	-4.6204	7.3431	212.7	51.1	0.0010	-0.0008	
44	-5.2506	6.9148	187.0	-5.7	-0.0000	0.0002	
45	-5.8406	6.4327	73.0	-24.1	-0.0004	0.0004	
46	-6.3840	5.8988	54.6	-10.1	-0.0002	0.0002	
47	-6.8779	5.3186	96.5	-0.9	0.0000	0.0001	
48	-7.3192	4.6975	131.8	-2.4	0.0000	0.0001	
49	-7.7044	4.0402	125.0	-4.3	-0.0000	0.0001	
50	-8.0303	3.3516	48.9	-4.0	-0.0001	0.0001	
51	-8.2945	2.6370	18.1	-3.4	-0.0001	0.0001	
52	-8.4950	1.9020	60.5	-3.2	-0.0000	0.0001	
53	-8.6302	1.1522	43.9	-3.0	-0.0000	0.0001	
54	-8.6992	0.3935	36.4	-2.9	-0.0000	0.0001	
55	-8.7014	-0.3684	62.8	-2.8	-0.0000	0.0001	
56	-8.6369	-1.1275	25.2	-2.7	-0.0000	0.0001	
57	-8.5060	-1.8780	128.8	-2.6	0.0000	0.0001	
58	-8.3099	-2.6143	177.1	-2.6	0.0000	0.0001	
59	-8.0501	-3.3305	122.3	-2.5	0.0000	0.0001	
60	-7.7285	-4.0212	140.6	-2.4	0.0000	0.0001	
61	-7.3477	-4.6811	-12.4	-2.4	-0.0001	0.0000	
62	-6.9106	-5.3050	-19.3	-2.4	-0.0001	0.0000	
63	-6.4205	-5.8884	121.6	-2.5	0.0000	0.0001	
64	-5.8812	-6.4265	-15.0	-2.5	-0.0001	0.0000	
65	-5.2969	-6.9153	7.2	-2.6	-0.0000	0.0000	
66	-4.6719	-7.3511	40.4	-2.7	-0.0000	0.0001	
67	-4.0113	-7.7305	-16.3	-2.8	-0.0001	0.0000	
68	-3.3198	-8.0505	86.1	-2.9	-0.0000	0.0001	
69	-2.6031	-8.3086	-46.6	-3.0	-0.0001	0.0000	
70	-1.8664	-8.5029	-89.2	-3.2	-0.0001	0.0000	
71	-1.1156	-8.6319	-0.1	-3.4	-0.0001	0.0001	
72	-0.3564	-8.6944	-155.5	-3.5	-0.0001	-0.0000	

J= 180 TIME= 0.0005418
TOTAL ENERGY INPUT (IN.-LB.) = 897.509
KINETIC ENERGY (IN.-LB.) = 628.192
ELASTIC ENERGY (IN.-LB.) = 134.680
PLASTIC WORK (IN.-LB.) = 134.637

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 283.9172 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4078	-8.6854	-272.2	-4.3	-0.0002	-0.0001	
2	1.1661	-8.6137	-202.8	-4.7	-0.0002	-0.0000	
3	1.9153	-8.4756	-45.0	-5.0	-0.0001	0.0001	
4	2.6495	-8.2721	-149.4	-5.4	-0.0002	0.0000	
5	3.3628	-8.0048	-190.2	-5.8	-0.0002	0.0000	
6	4.0498	-7.6755	-22.2	-6.3	-0.0001	0.0001	
7	4.7052	-7.2870	8.0	-7.1	-0.0001	0.0001	
8	5.3236	-6.8420	-6.3	-7.9	-0.0001	0.0001	
9	5.9002	-6.3441	8.9	-7.1	-0.0001	0.0001	
10	6.4305	-5.7971	-15.3	-5.1	-0.0001	0.0001	
11	6.9106	-5.2055	54.9	-10.1	-0.0002	0.0002	
12	7.3363	-4.5736	161.0	-25.3	-0.0004	0.0005	
13	7.7024	-3.9054	327.3	-24.1	-0.0003	0.0006	
14	8.0059	-3.2064	493.3	21.5	0.0006	-0.0002	
15	8.2501	-2.4845	565.1	53.6	0.0012	-0.0007	
16	8.4372	-1.7459	418.6	-22.4	-0.0002	0.0006	
17	8.5564	-0.9933	364.5	-142.0	-0.0023	0.0026	
18	8.5909	-0.2321	477.6	-142.8	-0.0023	0.0027	
19	8.5400	0.5283	404.6	-27.9	-0.0003	0.0007	
20	8.4195	1.2806	398.6	80.2	0.0016	-0.0012	
21	8.2442	2.0221	313.0	121.2	0.0022	-0.0020	
22	8.0201	2.7504	235.2	159.9	0.0029	-0.0027	
23	7.7530	3.4640	272.3	258.3	0.0046	-0.0043	
24	7.4557	4.1656	340.2	322.0	0.0057	-0.0054	
25	7.1364	4.8575	369.8	308.8	0.0055	-0.0052	
26	6.7938	5.5381	377.2	216.0	0.0039	-0.0036	
27	6.4176	6.2009	324.4	63.8	0.0012	-0.0010	
28	5.9921	6.8330	223.5	-76.7	-0.0012	0.0014	
29	5.5051	7.4195	228.7	-165.3	-0.0035	0.0044	
30	4.9467	7.9407	219.8	-322.2	-0.0156	0.0204	
31	4.2715	8.2949	-12.1	-464.3	-0.0160	0.0173	*
32	3.5294	8.4678	-100.0	-340.8	-0.0062	0.0060	*
33	2.7697	8.5291	65.4	-45.6	0.0001	0.0002	
34	2.0075	8.5239	89.5	190.3	0.0077	-0.0076	
35	1.2454	8.5105	171.6	449.0	0.0139	-0.0137	*
36	0.4839	8.5356	184.4	358.7	0.0075	-0.0072	*
37	-0.2778	8.5504	13.2	224.2	0.0039	-0.0039	
38	-1.0392	8.5282	-180.7	68.9	0.0011	-0.0013	
39	-1.7969	8.4488	-187.6	-83.1	-0.0015	0.0013	
40	-2.5426	8.2929	-76.2	-202.1	-0.0035	0.0034	
41	-3.2638	8.0473	-73.3	-146.8	-0.0026	0.0025	
42	-3.9528	7.7222	-97.7	16.5	0.0002	-0.0003	
43	-4.6118	7.3401	-157.9	79.7	0.0013	-0.0014	
44	-5.2411	6.9107	-172.9	24.3	0.0003	-0.0005	
45	-5.8326	6.4306	-60.7	-26.7	-0.0005	0.0004	
46	-6.3775	5.8982	30.1	-22.6	-0.0004	0.0004	
47	-6.8717	5.3183	25.9	-3.6	-0.0001	0.0001	
48	-7.3132	4.6974	-6.5	0.0	-0.0000	-0.0000	
49	-7.6988	4.0403	-57.4	-3.9	-0.0001	0.0000	
50	-8.0252	3.3520	-135.7	-5.0	-0.0002	0.0000	
51	-8.2897	2.6376	-259.7	-4.0	-0.0002	-0.0001	
52	-8.4905	1.9028	-313.6	-3.4	-0.0002	-0.0001	
53	-8.6260	1.1532	-293.7	-3.3	-0.0002	-0.0001	
54	-8.6952	0.3947	-297.0	-3.2	-0.0002	-0.0001	
55	-8.6976	-0.3671	-285.4	-3.1	-0.0002	-0.0001	
56	-8.6332	-1.1261	-257.7	-2.9	-0.0002	-0.0001	
57	-8.5026	-1.8765	-368.0	-2.8	-0.0002	-0.0001	
58	-8.3066	-2.6126	-409.5	-2.7	-0.0002	-0.0001	
59	-8.0469	-3.3287	-362.9	-2.7	-0.0002	-0.0001	
60	-7.7255	-4.0193	-443.3	-2.7	-0.0002	-0.0002	
61	-7.3448	-4.6791	-355.8	-2.7	-0.0002	-0.0001	
62	-6.9077	-5.3029	-355.0	-2.6	-0.0002	-0.0001	
63	-6.4177	-5.8861	-509.0	-2.6	-0.0003	-0.0002	
64	-5.8786	-6.4241	-527.6	-2.7	-0.0003	-0.0002	
65	-5.2943	-6.9128	-517.6	-2.8	-0.0003	-0.0002	
66	-4.6694	-7.3484	-364.4	-3.0	-0.0002	-0.0001	
67	-4.0087	-7.7276	-196.6	-3.1	-0.0001	-0.0000	
68	-3.3173	-8.0473	-274.6	-3.2	-0.0002	-0.0001	
69	-2.6005	-8.3052	-350.0	-3.3	-0.0002	-0.0001	
70	-1.8639	-8.4993	-316.2	-3.5	-0.0002	-0.0001	
71	-1.1131	-8.6279	-335.9	-3.8	-0.0002	-0.0001	
72	-0.3540	-8.6901	-290.6	-4.0	-0.0002	-0.0001	

J= 190 TIME= 0.0005719
TOTAL ENERGY INPUT (IN.-LB.) = 918.603
KINETIC ENERGY (IN.-LB.) = 632.179
ELASTIC ENERGY (IN.-LB.) = 142.139
PLASTIC WORK (IN.-LB.) = 144.285

THE NOMINAL FORCE AMPLITUDE DURING THIS CYCLE IS 249.6497 LBS

THE FORCE DISTRIBUTION DURING THIS CYCLE
IS THE SAME AS LAST PRINTED

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4107	-8.6810	-238.2	-4.8	-0.0002	-0.0000	
2	1.1691	-8.6087	-91.4	-5.2	-0.0001	0.0000	
3	1.9181	-8.4700	-125.5	-5.6	-0.0002	0.0000	
4	2.6521	-8.2658	-116.1	-6.0	-0.0002	0.0000	
5	3.3652	-7.9976	-6.8	-6.4	-0.0001	0.0001	
6	4.0518	-7.6676	27.9	-7.1	-0.0001	0.0001	
7	4.7067	-7.2781	112.3	-8.4	-0.0001	0.0002	
8	5.3244	-6.8322	21.8	-8.5	-0.0001	0.0001	
9	5.9002	-6.3333	-72.3	-5.5	-0.0001	0.0001	
10	6.4297	-5.7856	53.9	-5.5	-0.0001	0.0001	
11	6.9090	-5.1933	95.8	-19.7	-0.0003	0.0004	
12	7.3327	-4.5602	-67.9	-35.1	-0.0006	0.0006	
13	7.6955	-3.8903	-52.2	-6.5	-0.0001	0.0001	
14	7.9978	-3.1909	80.8	54.4	0.0010	-0.0009	
15	8.2448	-2.4702	108.2	36.4	0.0007	-0.0006	
16	8.4326	-1.7318	173.3	-87.0	-0.0014	0.0016	
17	8.5441	-0.9781	90.6	-163.7	-0.0028	0.0029	
18	8.5679	-0.2166	155.7	-103.7	-0.0017	0.0019	
19	8.5117	0.5433	241.7	10.0	0.0003	-0.0001	
20	8.3907	1.2955	216.8	76.5	0.0014	-0.0013	
21	8.2147	2.0369	286.2	108.9	0.0020	-0.0018	
22	7.9883	2.7645	379.8	194.3	0.0035	-0.0032	
23	7.7233	3.4789	403.8	295.4	0.0053	-0.0049	
24	7.4325	4.1833	454.6	330.9	0.0060	-0.0056	*
25	7.1214	4.8790	518.4	304.2	0.0055	-0.0050	
26	6.7864	5.5635	568.2	185.8	0.0034	-0.0030	
27	6.4142	6.2286	607.6	45.3	0.0010	-0.0005	
28	5.9903	6.8620	519.9	-46.1	-0.0006	0.0010	
29	5.5080	7.4524	395.1	-144.7	-0.0030	0.0042	
30	4.9556	7.9800	329.1	-353.2	-0.0161	0.0210	
31	4.2825	8.3385	70.9	-461.0	-0.0161	0.0178	
32	3.5410	8.5138	-60.3	-350.4	-0.0068	0.0067	*
33	2.7811	8.5725	-92.2	-158.3	-0.0019	0.0020	
34	2.0193	8.5498	-70.7	196.2	0.0078	-0.0077	
35	1.2579	8.5196	-218.8	390.9	0.0127	-0.0128	
36	0.4961	8.5204	-202.3	391.8	0.0095	-0.0098	*
37	-0.2657	8.5287	-217.8	263.7	0.0044	-0.0046	
38	-1.0270	8.5052	-292.3	100.9	0.0016	-0.0019	
39	-1.7849	8.4286	-326.6	-45.0	-0.0009	0.0006	
40	-2.5322	8.2805	-280.7	-170.1	-0.0031	0.0028	
41	-3.2571	8.0464	-182.5	-199.6	-0.0035	0.0034	
42	-3.9483	7.7259	-139.0	-58.4	-0.0011	0.0009	
43	-4.6050	7.3399	-197.9	80.4	0.0013	-0.0015	
44	-5.2316	6.9067	-314.2	67.9	0.0010	-0.0013	
45	-5.8237	6.4275	-445.5	-11.2	-0.0004	-0.0000	
46	-6.3707	5.8975	-483.8	-36.4	-0.0008	0.0004	
47	-6.8659	5.3186	-447.1	-13.6	-0.0004	0.0000	
48	-7.3073	4.6978	-394.9	1.8	-0.0001	-0.0002	
49	-7.6930	4.0410	-387.5	-1.1	-0.0002	-0.0002	
50	-8.0200	3.3531	-487.3	-5.4	-0.0003	-0.0001	
51	-8.2850	2.6390	-549.3	-5.1	-0.0003	-0.0002	
52	-8.4862	1.9044	-475.6	-3.9	-0.0003	-0.0001	
53	-8.6221	1.1548	-384.3	-3.6	-0.0002	-0.0001	
54	-8.6916	0.3963	-264.6	-3.6	-0.0002	-0.0001	
55	-8.6944	-0.3655	-320.7	-3.4	-0.0002	-0.0001	
56	-8.6302	-1.1244	-471.7	-3.2	-0.0003	-0.0002	
57	-8.4998	-1.8748	-535.9	-3.1	-0.0003	-0.0002	
58	-8.3040	-2.6109	-581.9	-3.0	-0.0003	-0.0002	
59	-8.0445	-3.3270	-509.1	-3.0	-0.0003	-0.0002	
60	-7.7231	-4.0176	-439.7	-3.0	-0.0002	-0.0001	
61	-7.3425	-4.6773	-468.6	-2.9	-0.0003	-0.0002	
62	-6.9055	-5.3012	-488.5	-3.0	-0.0003	-0.0002	
63	-6.4154	-5.8843	-467.3	-3.0	-0.0003	-0.0002	
64	-5.8762	-6.4223	-465.1	-3.0	-0.0003	-0.0002	
65	-5.2918	-6.9109	-478.1	-3.1	-0.0003	-0.0002	
66	-4.6669	-7.3464	-430.0	-3.2	-0.0002	-0.0001	
67	-4.0061	-7.7253	-410.3	-3.4	-0.0002	-0.0001	
68	-3.3146	-8.0449	-365.7	-3.6	-0.0002	-0.0001	
69	-2.5978	-8.3025	-314.4	-3.7	-0.0002	-0.0001	
70	-1.8611	-8.4962	-340.7	-3.9	-0.0002	-0.0001	
71	-1.1102	-8.6245	-302.8	-4.2	-0.0002	-0.0001	
72	-0.3510	-8.6862	-294.3	-4.5	-0.0002	-0.0001	

J= 200 TIME= 0.0006020
TOTAL ENERGY INPUT (IN.-LB.) = 926.700
KINETIC ENERGY (IN.-LB.) = 624.975
ELASTIC ENERGY (IN.-LB.) = 147.444
PLASTIC WORK (IN.-LB.) = 154.281

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4145	-8.6768	-93.2	-5.3	-0.0001	0.0000	
2	1.1727	-8.6039	-223.8	-5.7	-0.0002	-0.0000	
3	1.9216	-8.4644	-178.4	-6.1	-0.0002	0.0000	
4	2.6553	-8.2593	-97.1	-6.4	-0.0002	0.0001	
5	3.3680	-7.9903	-213.7	-6.9	-0.0002	0.0000	
6	4.0542	-7.6595	-222.6	-8.2	-0.0002	0.0000	
7	4.7084	-7.2691	-170.5	-9.5	-0.0002	0.0001	
8	5.3253	-6.8222	-155.0	-7.4	-0.0002	0.0001	
9	5.9004	-6.3224	11.5	-3.1	-0.0001	0.0001	
10	6.4294	-5.7741	31.5	-10.9	-0.0002	0.0002	
11	6.9075	-5.1810	5.1	-35.2	-0.0006	0.0006	
12	7.3282	-4.5458	13.4	-33.3	-0.0006	0.0006	
13	7.6880	-3.8743	-169.4	29.9	0.0004	-0.0006	
14	7.9916	-3.1756	-89.8	70.3	0.0012	-0.0013	
15	8.2420	-2.4561	-93.3	-15.2	-0.0003	0.0002	
16	8.4267	-1.7170	-156.6	-140.2	-0.0025	0.0023	
17	8.5280	-0.9620	-15.6	-151.7	-0.0026	0.0026	
18	8.5432	-0.2003	57.2	-60.5	-0.0010	0.0011	
19	8.4839	0.5594	63.9	26.6	0.0005	-0.0004	
20	8.3622	1.3114	92.6	60.9	0.0011	-0.0010	
21	8.1832	2.0520	114.4	121.8	0.0021	-0.0021	
22	7.9555	2.7791	208.6	237.8	0.0042	-0.0040	
23	7.6945	3.4950	291.7	317.2	0.0056	-0.0054	
24	7.4105	4.2020	182.7	340.5	0.0063	-0.0060	*
25	7.1083	4.9015	197.5	280.6	0.0049	-0.0048	
26	6.7792	5.5888	247.4	155.8	0.0028	-0.0026	
27	6.4092	6.2549	25.6	53.1	0.0009	-0.0009	
28	5.9885	6.8901	-61.6	-9.3	-0.0002	0.0001	
29	5.5128	7.4858	-28.0	-175.4	-0.0038	0.0045	
30	4.9636	8.0164	-98.5	-352.3	-0.0162	0.0208	
31	4.2927	8.3789	-191.1	-447.9	-0.0160	0.0175	
32	3.5527	8.5602	-220.3	-372.0	-0.0084	0.0081	*
33	2.7924	8.6135	-133.4	-201.3	-0.0027	0.0028	
34	2.0310	8.5797	8.3	161.8	0.0072	-0.0071	
35	1.2702	8.5340	8.5	311.4	0.0114	-0.0114	
36	0.5088	8.5087	-120.8	423.7	0.0119	-0.0120	*
37	-0.2530	8.5081	-192.0	312.1	0.0053	-0.0055	
38	-1.0143	8.4821	-204.9	141.7	0.0023	-0.0025	
39	-1.7725	8.4084	-259.7	-20.2	-0.0005	0.0002	
40	-2.5210	8.2663	-271.4	-137.0	-0.0025	0.0022	
41	-3.2490	8.0422	-300.3	-207.6	-0.0037	0.0034	
42	-3.9440	7.7303	-421.1	-137.3	-0.0026	0.0022	
43	-4.6002	7.3435	-447.1	37.5	0.0004	-0.0008	
44	-5.2229	6.9049	-398.7	104.3	0.0016	-0.0020	
45	-5.8139	6.4243	-426.3	28.3	0.0003	-0.0007	
46	-6.3633	5.8967	-500.4	-40.5	-0.0009	0.0005	
47	-6.8606	5.3197	-485.6	-32.0	-0.0008	0.0003	
48	-7.3022	4.6991	-444.8	-2.0	-0.0002	-0.0002	
49	-7.6879	4.0423	-450.7	3.5	-0.0001	-0.0003	
50	-8.0153	3.3545	-359.5	-4.0	-0.0002	-0.0001	
51	-8.2810	2.6406	-301.3	-6.5	-0.0003	-0.0000	
52	-8.4827	1.9060	-323.1	-4.8	-0.0002	-0.0001	
53	-8.6189	1.1566	-377.7	-3.8	-0.0002	-0.0001	
54	-8.6888	0.3982	-464.8	-3.7	-0.0003	-0.0001	
55	-8.6919	-0.3636	-424.1	-3.7	-0.0003	-0.0001	
56	-8.6280	-1.1226	-347.8	-3.6	-0.0002	-0.0001	
57	-8.4978	-1.8731	-323.4	-3.5	-0.0002	-0.0001	
58	-8.3022	-2.6093	-343.6	-3.4	-0.0002	-0.0001	
59	-8.0427	-3.3255	-367.4	-3.3	-0.0002	-0.0001	
60	-7.7215	-4.0162	-202.5	-3.3	-0.0002	-0.0000	
61	-7.3408	-4.6761	-92.6	-3.4	-0.0001	0.0000	
62	-6.9037	-5.3001	-29.3	-3.4	-0.0001	0.0000	
63	-6.4135	-5.8833	20.7	-3.4	-0.0001	0.0001	
64	-5.8741	-6.4213	-35.7	-3.5	-0.0001	0.0000	
65	-5.2895	-6.9098	-94.7	-3.5	-0.0001	0.0000	
66	-4.6644	-7.3452	-177.9	-3.6	-0.0001	-0.0000	
67	-4.0034	-7.7239	-173.1	-3.8	-0.0001	-0.0000	
68	-3.3117	-8.0432	-127.3	-4.0	-0.0001	0.0000	
69	-2.5946	-8.3005	-69.0	-4.2	-0.0001	0.0000	
70	-1.8577	-8.4938	52.5	-4.5	-0.0001	0.0001	
71	-1.1066	-8.6215	52.7	-4.7	-0.0001	0.0001	
72	-0.3473	-8.6827	-28.7	-5.0	-0.0001	0.0001	

J= 210 TIME= 0.0006321
TOTAL ENERGY INPUT (IN.-LB.) = 926.700
KINETIC ENERGY (IN.-LB.) = 609.691
ELASTIC ENERGY (IN.-LB.) = 151.594
PLASTIC WORK (IN.-LB.) = 165.415

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4180	-8.6729	80.6	-5.8	-0.0001	0.0001	
2	1.1762	-8.5992	31.1	-6.3	-0.0001	0.0001	
3	1.9251	-8.4590	52.0	-6.6	-0.0001	0.0001	
4	2.6586	-8.2531	-30.3	-6.9	-0.0001	0.0001	
5	3.3711	-7.9833	-5.6	-7.9	-0.0001	0.0001	
6	4.0568	-7.6514	-114.8	-9.9	-0.0002	0.0001	
7	4.7104	-7.2600	-152.0	-9.7	-0.0002	0.0001	
8	5.3266	-6.8120	-17.2	-3.8	-0.0001	0.0001	
9	5.9011	-6.3117	-157.5	-2.7	-0.0001	-0.0000	
10	6.4295	-5.7629	-103.0	-25.4	-0.0005	0.0004	
11	6.9055	-5.1681	-46.3	-48.5	-0.0009	0.0008	
12	7.3225	-4.5305	-33.5	-8.6	-0.0002	0.0001	
13	7.6814	-3.8585	28.2	69.2	0.0012	-0.0012	
14	7.9887	-3.1614	-83.2	49.9	0.0008	-0.0009	
15	8.2402	-2.4423	-82.8	-79.9	-0.0014	0.0013	
16	8.4179	-1.7014	-14.5	-162.5	-0.0028	0.0028	
17	8.5092	-0.9451	-65.9	-120.3	-0.0021	0.0020	
18	8.5184	-0.1833	6.7	-28.8	-0.0005	0.0005	
19	8.4573	0.5762	-3.2	19.0	0.0003	-0.0003	
20	8.3328	1.3276	-317.1	53.3	0.0008	-0.0011	
21	8.1501	2.0671	-384.5	157.5	0.0025	-0.0029	
22	7.9233	2.7943	-338.9	269.8	0.0045	-0.0048	
23	7.6672	3.5116	-468.1	331.5	0.0056	-0.0061	*
24	7.3906	4.2214	-436.1	337.0	0.0061	-0.0065	*
25	7.0968	4.9242	-378.3	243.8	0.0040	-0.0044	
26	6.7717	5.6131	-408.4	140.9	0.0022	-0.0026	
27	6.4038	6.2802	-419.1	89.5	0.0014	-0.0017	
28	5.9891	6.9192	-433.0	-13.4	-0.0004	0.0000	
29	5.5186	7.5188	-429.8	-205.3	-0.0045	0.0048	
30	4.9713	8.0513	-416.8	-348.7	-0.0163	0.0206	
31	4.3019	8.4164	-435.9	-414.9	-0.0155	0.0168	
32	3.5638	8.6049	-363.3	-400.1	-0.0105	0.0100	*
33	2.8031	8.6506	-333.0	-159.7	-0.0020	0.0020	
34	2.0419	8.6145	-346.7	34.2	0.0048	-0.0051	
35	1.2825	8.5498	-190.4	290.2	0.0110	-0.0111	
36	0.5222	8.5027	-193.9	440.3	0.0130	-0.0132	*
37	-0.2396	8.4892	-122.7	347.1	0.0065	-0.0066	*
38	-1.0007	8.4591	-118.4	189.5	0.0032	-0.0033	
39	-1.7592	8.3876	-129.5	10.2	0.0001	-0.0002	
40	-2.5088	8.2516	-132.7	-120.3	-0.0021	0.0020	
41	-3.2354	8.0355	-173.1	-191.9	-0.0034	0.0032	
42	-3.9387	7.7332	-167.4	-184.7	-0.0033	0.0031	
43	-4.5971	7.3500	-72.2	-38.2	-0.0007	0.0006	
44	-5.2167	6.9066	30.9	105.8	0.0018	-0.0018	
45	-5.8042	6.4216	56.6	82.4	0.0014	-0.0014	
46	-6.3548	5.8951	-26.8	-20.7	-0.0004	0.0003	
47	-6.8554	5.3208	-83.9	-52.1	-0.0009	0.0009	
48	-7.2984	4.7010	-29.1	-17.0	-0.0003	0.0003	
49	-7.6838	4.0438	-33.5	6.6	0.0001	-0.0001	
50	-8.0113	3.3560	-69.5	1.0	-0.0000	-0.0001	
51	-8.2776	2.6422	-19.1	-7.1	-0.0001	0.0001	
52	-8.4799	1.9077	-24.2	-6.7	-0.0001	0.0001	
53	-8.6165	1.1582	-36.5	-4.3	-0.0001	0.0001	
54	-8.6867	0.3997	-60.9	-3.9	-0.0001	0.0000	
55	-8.6900	-0.3622	-11.5	-4.1	-0.0001	0.0001	
56	-8.6263	-1.1214	130.4	-4.1	-0.0000	0.0001	
57	-8.4962	-1.8721	156.6	-3.9	-0.0000	0.0001	
58	-8.3006	-2.6085	184.0	-3.8	0.0000	0.0001	
59	-8.0411	-3.3248	146.8	-3.7	-0.0000	0.0001	
60	-7.7198	-4.0156	67.8	-3.6	-0.0000	0.0001	
61	-7.3391	-4.6755	77.8	-3.6	-0.0000	0.0001	
62	-6.9019	-5.2995	132.5	-3.7	-0.0000	0.0001	
63	-6.4115	-5.8827	192.6	-3.7	0.0000	0.0001	
64	-5.8719	-6.4206	221.6	-3.8	0.0000	0.0002	
65	-5.2872	-6.9090	82.1	-3.8	-0.0000	0.0001	
66	-4.6618	-7.3441	-83.9	-3.9	-0.0001	0.0000	
67	-4.0007	-7.7227	-62.3	-4.1	-0.0001	0.0000	
68	-3.3088	-8.0417	54.4	-4.4	-0.0001	0.0001	
69	-2.5915	-8.2986	162.8	-4.6	-0.0000	0.0001	
70	-1.8545	-8.4915	126.6	-4.9	-0.0000	0.0001	
71	-1.1033	-8.6188	148.3	-5.2	-0.0000	0.0001	
72	-0.3438	-8.6794	210.6	-5.5	-0.0000	0.0002	

J= 220 TIME= 0.0006622
TOTAL ENERGY INPUT (IN.-LB.) = 926.700
KINETIC ENERGY (IN.-LB.) = 594.758
ELASTIC ENERGY (IN.-LB.) = 159.474
PLASTIC WORK (IN.-LB.) = 172.468

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4212	-8.6689	76.9	-6.3	-0.0001	0.0001	
2	1.1794	-8.5946	-15.9	-6.7	-0.0001	0.0001	
3	1.9281	-8.4536	34.5	-7.0	-0.0001	0.0001	
4	2.6615	-8.2471	258.6	-7.5	-0.0000	0.0002	
5	3.3738	-7.9764	270.1	-9.7	-0.0001	0.0003	
6	4.0592	-7.6436	335.4	-11.7	-0.0001	0.0003	
7	4.7122	-7.2510	317.8	-7.2	0.0000	0.0003	
8	5.3279	-6.8022	234.7	1.0	0.0001	0.0001	
9	5.9023	-6.3015	157.2	-10.9	-0.0001	0.0002	
10	6.4297	-5.7518	20.9	-47.2	-0.0008	0.0008	
11	6.9024	-5.1542	-27.0	-44.3	-0.0008	0.0007	
12	7.3163	-4.5146	-65.0	36.7	0.0006	-0.0007	
13	7.6770	-3.8437	-312.7	85.3	0.0013	-0.0016	
14	7.9883	-3.1485	-381.3	-2.8	-0.0002	-0.0001	
15	8.2374	-2.4286	-274.5	-129.4	-0.0024	0.0021	
16	8.4062	-1.6858	-482.3	-154.8	-0.0029	0.0025	
17	8.4894	-0.9287	-530.4	-85.6	-0.0017	0.0012	
18	8.4950	-0.1671	-486.8	-21.0	-0.0006	0.0001	
19	8.4315	0.5920	-487.5	1.6	-0.0002	-0.0002	
20	8.3023	1.3426	-412.1	71.6	0.0010	-0.0014	
21	8.1172	2.0815	-481.0	193.5	0.0031	-0.0036	
22	7.8927	2.8094	-501.6	292.6	0.0048	-0.0053	
23	7.6417	3.5285	-403.0	343.6	0.0060	-0.0066	*
24	7.3733	4.2414	-289.9	321.4	0.0059	-0.0062	
25	7.0859	4.9470	-128.5	213.2	0.0036	-0.0037	
26	6.7634	5.6372	-167.5	156.1	0.0026	-0.0028	
27	6.3999	6.3068	-280.4	113.6	0.0018	-0.0021	
28	5.9919	6.9502	-248.3	-47.8	-0.0009	0.0007	
29	5.5242	7.5520	-307.3	-211.1	-0.0045	0.0050	
30	4.9789	8.0865	-463.8	-350.2	-0.0164	0.0206	
31	4.3108	8.4539	-435.3	-410.0	-0.0154	0.0167	
32	3.5735	8.6456	-445.4	-408.6	-0.0113	0.0107	
33	2.8127	8.6891	-439.5	-180.4	-0.0024	0.0023	
34	2.0517	8.6482	-420.2	-45.1	0.0034	-0.0037	
35	1.2939	8.5683	-395.6	268.4	0.0105	-0.0108	
36	0.5348	8.5031	-127.3	437.6	0.0131	-0.0133	
37	-0.2264	8.4721	-7.6	369.8	0.0081	-0.0081	*
38	-0.9874	8.4368	-48.1	233.2	0.0040	-0.0041	
39	-1.7460	8.3658	-24.0	51.3	0.0009	-0.0009	
40	-2.4966	8.2356	-75.0	-106.1	-0.0019	0.0018	
41	-3.2294	8.0270	-58.9	-182.4	-0.0032	0.0031	
42	-3.9323	7.7330	26.6	-194.7	-0.0034	0.0034	
43	-4.5946	7.3563	100.4	-109.1	-0.0018	0.0019	
44	-5.2133	6.9116	229.3	59.8	0.0011	-0.0009	
45	-5.7960	6.4207	288.4	123.3	0.0022	-0.0020	
46	-6.3451	5.8924	328.3	28.9	0.0006	-0.0004	
47	-6.8489	5.3208	365.5	-57.3	-0.0008	0.0011	
48	-7.2949	4.7029	387.8	-43.2	-0.0006	0.0009	
49	-7.6805	4.0457	502.1	0.6	0.0002	0.0002	
50	-8.0074	3.3574	437.8	8.7	0.0003	0.0000	
51	-8.2741	2.6436	409.8	-4.1	0.0001	0.0002	
52	-8.4771	1.9091	477.4	-9.0	0.0000	0.0004	
53	-8.6141	1.1595	423.4	-6.0	0.0001	0.0003	
54	-8.6845	0.4008	498.2	-4.1	0.0001	0.0003	
55	-8.6879	-0.3612	565.3	-4.3	0.0002	0.0003	
56	-8.6244	-1.1205	485.8	-4.5	0.0001	0.0003	
57	-8.4943	-1.8713	373.3	-4.2	0.0001	0.0002	
58	-8.2988	-2.6077	236.2	-4.0	0.0000	0.0002	
59	-8.0394	-3.3241	194.0	-4.0	0.0000	0.0001	
60	-7.7180	-4.0149	187.3	-3.9	0.0000	0.0001	
61	-7.3372	-4.6748	126.1	-3.9	-0.0000	0.0001	
62	-6.8999	-5.2987	92.2	-3.9	-0.0000	0.0001	
63	-6.4095	-5.8818	117.9	-4.0	-0.0000	0.0001	
64	-5.8698	-6.4196	252.9	-4.1	0.0000	0.0002	
65	-5.2848	-6.9080	391.9	-4.2	0.0001	0.0002	
66	-4.6592	-7.3430	341.3	-4.4	0.0001	0.0002	
67	-3.9979	-7.7213	236.2	-4.5	0.0000	0.0002	
68	-3.3058	-8.0400	203.7	-4.7	0.0000	0.0002	
69	-2.5884	-8.2966	59.3	-4.9	-0.0001	0.0001	
70	-1.8513	-8.4890	-22.0	-5.2	-0.0001	0.0001	
71	-1.1000	-8.6158	51.9	-5.5	-0.0001	0.0001	
72	-0.3406	-8.6759	59.9	-5.9	-0.0001	0.0001	

J= 230 TIME= 0.0006923
TOTAL ENERGY INPUT (IN.-LB.) = 926.700
KINETIC ENERGY (IN.-LB.) = 582.999
ELASTIC ENERGY (IN.-LB.) = 165.050
PLASTIC WORK (IN.-LB.) = 178.650

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4246	-8.6646	338.2	-6.9	0.0000	0.0003	
2	1.1828	-8.5897	269.0	-7.1	-0.0000	0.0002	
3	1.9314	-8.4480	146.9	-7.1	-0.0001	0.0002	
4	2.6645	-8.2407	19.8	-8.6	-0.0001	0.0001	
5	3.3763	-7.9693	-203.3	-11.9	-0.0003	0.0001	
6	4.0611	-7.6355	-320.9	-11.1	-0.0003	0.0000	
7	4.7133	-7.2420	-216.0	-0.4	-0.0001	-0.0001	
8	5.3288	-6.7931	-169.2	1.7	-0.0001	-0.0001	
9	5.9030	-6.2925	-365.0	-31.7	-0.0007	0.0004	
10	6.4283	-5.7409	-435.3	-63.3	-0.0013	0.0009	
11	6.8970	-5.1404	-205.1	-11.8	-0.0003	0.0001	
12	7.3103	-4.5004	-156.0	80.2	0.0013	-0.0015	
13	7.6756	-3.8319	-38.8	63.2	0.0011	-0.0011	
14	7.9888	-3.1374	45.6	-63.6	-0.0011	0.0011	
15	8.2324	-2.4155	-16.4	-151.5	-0.0026	0.0026	
16	8.3927	-1.6707	40.1	-130.1	-0.0022	0.0023	
17	8.4705	-0.9128	13.4	-63.8	-0.0011	0.0011	
18	8.4735	-0.1510	-40.9	-36.8	-0.0007	0.0006	
19	8.4052	0.6079	12.8	-1.0	-0.0000	0.0000	
20	8.2710	1.3577	-45.9	104.8	0.0018	-0.0018	
21	8.0852	2.0966	-68.4	221.4	0.0038	-0.0039	
22	7.8635	2.8255	-35.7	315.0	0.0054	-0.0055	
23	7.6180	3.5466	-95.8	349.1	0.0066	-0.0068	*
24	7.3580	4.2627	-83.6	281.8	0.0053	-0.0054	
25	7.0741	4.9697	-225.6	214.4	0.0036	-0.0038	
26	6.7551	5.6615	-228.1	188.6	0.0031	-0.0034	
27	6.3987	6.3350	-88.2	94.2	0.0016	-0.0017	
28	5.9955	6.9814	-132.3	-67.6	-0.0012	0.0011	
29	5.5301	7.5852	-48.9	-213.7	-0.0044	0.0051	
30	4.9866	8.1216	-53.5	-350.2	-0.0162	0.0208	
31	4.3197	8.4914	-187.1	-436.6	-0.0158	0.0173	
32	3.5820	8.6823	-19.4	-371.2	-0.0104	0.0102	
33	2.8213	8.7299	37.8	-294.8	-0.0042	0.0045	
34	2.0609	8.6781	96.7	-23.0	0.0041	-0.0039	
35	1.3037	8.5901	188.7	212.2	0.0098	-0.0096	
36	0.5460	8.5095	240.1	391.7	0.0124	-0.0124	
37	-0.2142	8.4571	134.1	398.4	0.0102	-0.0101	*
38	-0.9749	8.4157	139.5	269.0	0.0047	-0.0046	
39	-1.7334	8.3433	103.8	94.8	0.0017	-0.0016	
40	-2.4848	8.2173	132.9	-79.4	-0.0013	0.0014	
41	-3.2198	8.0163	55.0	-181.9	-0.0031	0.0032	
42	-3.9257	7.7296	12.6	-193.9	-0.0033	0.0033	
43	-4.5919	7.3600	90.8	-147.3	-0.0025	0.0026	
44	-5.2123	6.9178	134.8	-12.1	-0.0002	0.0003	
45	-5.7909	6.4219	270.7	121.3	0.0022	-0.0020	
46	-6.3353	5.8888	343.0	91.9	0.0017	-0.0014	
47	-6.8403	5.3182	386.2	-30.0	-0.0004	0.0007	
48	-7.2905	4.7035	361.8	-69.1	-0.0010	0.0013	
49	-7.6776	4.0472	230.3	-21.0	-0.0003	0.0005	
50	-8.0035	3.3585	234.7	13.1	0.0003	-0.0001	
51	-8.2697	2.6446	216.1	4.6	0.0002	0.0000	
52	-8.4733	1.9103	218.5	-9.0	-0.0001	0.0002	
53	-8.6110	1.1609	321.4	-8.9	-0.0000	0.0003	
54	-8.6816	0.4023	291.9	-4.7	0.0000	0.0002	
55	-8.6853	-0.3596	302.2	-4.0	0.0001	0.0002	
56	-8.6220	-1.1189	417.1	-4.6	0.0001	0.0003	
57	-8.4921	-1.8698	477.6	-4.7	0.0001	0.0003	
58	-8.2967	-2.6063	485.6	-4.5	0.0001	0.0003	
59	-8.0373	-3.3228	439.4	-4.3	0.0001	0.0003	
60	-7.7160	-4.0137	371.0	-4.3	0.0001	0.0002	
61	-7.3351	-4.6737	368.8	-4.2	0.0001	0.0002	
62	-6.8978	-5.2976	281.6	-4.2	0.0000	0.0002	
63	-6.4073	-5.8807	235.1	-4.3	0.0000	0.0002	
64	-5.8674	-6.4184	257.1	-4.4	0.0000	0.0002	
65	-5.2824	-6.9066	227.9	-4.5	0.0000	0.0002	
66	-4.6567	-7.3414	272.4	-4.7	0.0000	0.0002	
67	-3.9953	-7.7195	239.8	-4.8	0.0000	0.0002	
68	-3.3031	-8.0379	191.7	-5.1	-0.0000	0.0002	
69	-2.5855	-8.2942	235.5	-5.3	0.0000	0.0002	
70	-1.8482	-8.4863	183.7	-5.6	-0.0000	0.0002	
71	-1.0968	-8.6127	206.3	-6.0	-0.0000	0.0002	
72	-0.3373	-8.6723	339.4	-6.5	0.0000	0.0003	

J= 240 TIME= 0.0007224
TOTAL ENERGY INPUT (IN.-LB.) = 926.700
KINETIC ENERGY (IN.-LB.) = 571.158
ELASTIC ENERGY (IN.-LB.) = 170.525
PLASTIC WORK (IN.-LB.) = 185.017

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4272	-8.6602	-95.2	-7.2	-0.0002	0.0001	
2	1.1851	-8.5848	-182.0	-7.0	-0.0002	0.0000	
3	1.9335	-8.4426	-163.1	-7.5	-0.0002	0.0001	
4	2.6665	-8.2348	-102.6	-11.1	-0.0002	0.0001	
5	3.3780	-7.9626	-140.2	-14.2	-0.0003	0.0002	
6	4.0622	-7.6278	-160.2	-6.0	-0.0002	0.0000	
7	4.7144	-7.2338	61.6	7.4	0.0001	-0.0001	
8	5.3303	-6.7853	163.5	-10.5	-0.0001	0.0002	
9	5.9039	-6.2837	255.8	-60.8	-0.0009	0.0012	
10	6.4257	-5.7286	283.9	-55.9	-0.0008	0.0011	
11	6.8915	-5.1255	187.8	40.6	0.0008	-0.0006	
12	7.3073	-4.4871	113.8	95.6	0.0017	-0.0016	
13	7.6770	-3.8209	62.1	12.4	0.0002	-0.0002	
14	7.9887	-3.1257	42.4	-109.6	-0.0019	0.0019	
15	8.2249	-2.4014	100.2	-146.8	-0.0025	0.0026	
16	8.3782	-1.6551	32.0	-101.9	-0.0018	0.0018	
17	8.4526	-0.8969	-72.6	-66.9	-0.0012	0.0011	
18	8.4517	-0.1351	-28.9	-55.0	-0.0010	0.0009	
19	8.3773	0.6232	19.6	18.5	0.0003	-0.0003	
20	8.2394	1.3725	264.4	134.8	0.0024	-0.0022	
21	8.0539	2.1116	491.2	249.4	0.0045	-0.0041	
22	7.8360	2.8419	588.2	329.2	0.0061	-0.0055	*
23	7.5970	3.5655	641.8	336.9	0.0069	-0.0063	*
24	7.3428	4.2839	400.7	254.6	0.0050	-0.0048	
25	7.0615	4.9921	415.0	243.3	0.0044	-0.0040	
26	6.7483	5.6869	434.5	200.9	0.0036	-0.0033	
27	6.3991	6.3642	365.3	59.4	0.0012	-0.0009	
28	5.9989	7.0128	399.1	-71.6	-0.0011	0.0014	
29	5.5359	7.6184	202.5	-222.9	-0.0045	0.0054	
30	4.9936	8.1563	110.1	-362.3	-0.0163	0.0211	
31	4.3268	8.5263	56.1	-427.8	-0.0155	0.0172	
32	3.5895	8.7186	-79.6	-381.8	-0.0107	0.0104	
33	2.8290	8.7662	-48.1	-324.6	-0.0051	0.0051	*
34	2.0689	8.7083	71.6	-28.1	0.0040	-0.0038	
35	1.3126	8.6136	158.9	168.1	0.0090	-0.0088	
36	0.5563	8.5205	165.8	317.7	0.0111	-0.0111	
37	-0.2020	8.4458	186.8	423.8	0.0121	-0.0118	*
38	-0.9623	8.3957	289.6	314.1	0.0055	-0.0053	
39	-1.7206	8.3205	437.2	134.7	0.0025	-0.0021	
40	-2.4726	8.1970	438.9	-42.6	-0.0006	0.0009	
41	-3.2095	8.0031	301.8	-172.7	-0.0029	0.0031	
42	-3.9186	7.7243	163.8	-203.1	-0.0034	0.0036	
43	-4.5884	7.3611	93.0	-162.2	-0.0028	0.0028	
44	-5.2119	6.9233	21.9	-71.3	-0.0012	0.0012	
45	-5.7888	6.4257	-30.9	74.7	0.0013	-0.0013	
46	-6.3271	5.8866	12.1	133.9	0.0023	-0.0023	
47	-6.8298	5.3141	-5.2	30.4	0.0005	-0.0005	
48	-7.2838	4.7023	-72.2	-73.3	-0.0013	0.0012	
49	-7.6746	4.0484	-64.1	-56.3	-0.0010	0.0009	
50	-8.0002	3.3596	4.0	4.0	0.0001	-0.0001	
51	-8.2650	2.6453	11.0	16.5	0.0003	-0.0003	
52	-3.4687	1.9111	-28.4	-3.3	-0.0001	0.0000	
53	-8.6072	1.1620	-4.2	-12.1	-0.0002	0.0002	
54	-8.6783	0.4035	19.7	-7.3	-0.0001	0.0001	
55	-8.6820	-0.3583	-71.6	-3.7	-0.0001	0.0000	
56	-8.6189	-1.1174	-121.4	-4.2	-0.0001	0.0000	
57	-8.4892	-1.8682	22.8	-4.9	-0.0001	0.0001	
58	-8.2940	-2.6046	65.6	-4.8	-0.0001	0.0001	
59	-8.0348	-3.3211	97.8	-4.5	-0.0000	0.0001	
60	-7.7135	-4.0119	180.7	-4.5	-0.0000	0.0001	
61	-7.3328	-4.6719	194.4	-4.5	-0.0000	0.0002	
62	-6.8954	-5.2958	264.9	-4.6	0.0000	0.0002	
63	-6.4049	-5.8789	294.0	-4.6	0.0000	0.0002	
64	-5.8650	-6.4166	287.0	-4.7	0.0000	0.0002	
65	-5.2799	-6.9047	351.9	-4.9	0.0001	0.0002	
66	-4.6541	-7.3394	284.2	-5.0	0.0000	0.0002	
67	-3.9925	-7.7173	206.0	-5.2	-0.0000	0.0002	
68	-3.3003	-8.0355	135.6	-5.4	-0.0000	0.0001	
69	-2.5827	-8.2914	12.9	-5.6	-0.0001	0.0001	
70	-1.8454	-8.4832	-77.3	-5.9	-0.0001	0.0001	
71	-1.0941	-8.6091	-167.8	-6.3	-0.0002	0.0000	
72	-0.3346	-8.6683	-75.3	-6.8	-0.0002	0.0001	

J= 250 TIME= 0.0007525
TOTAL ENERGY INPUT (IN.-LB.) = 926.700
KINETIC ENERGY (IN.-LB.) = 560.743
ELASTIC ENERGY (IN.-LB.) = 175.516
PLASTIC WORK (IN.-LB.) = 190.441

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4295	-8.6559	243.0	-7.5	-0.0000	0.0002	
2	1.1876	-8.5800	276.6	-7.1	-0.0000	0.0002	
3	1.9361	-8.4374	301.1	-9.4	-0.0000	0.0003	
4	2.6689	-8.2289	210.3	-15.1	-0.0002	0.0003	
5	3.3801	-7.9555	245.4	-13.0	-0.0001	0.0003	
6	4.0640	-7.6195	242.6	4.7	0.0002	0.0000	
7	4.7163	-7.2259	190.6	7.7	0.0002	-0.0001	
8	5.3325	-6.7776	192.4	-39.3	-0.0006	0.0008	
9	5.9038	-6.2735	204.0	-78.7	-0.0013	0.0014	
10	6.4214	-5.7144	133.6	-15.7	-0.0002	0.0003	
11	6.8867	-5.1111	152.6	85.8	0.0015	-0.0014	
12	7.3072	-4.4757	210.0	72.9	0.0013	-0.0012	
13	7.6790	-3.8106	237.6	-43.8	-0.0007	0.0009	
14	7.9863	-3.1133	399.4	-130.8	-0.0021	0.0024	
15	8.2152	-2.3865	499.1	-125.0	-0.0019	0.0024	
16	8.3638	-1.6391	534.7	-89.5	-0.0013	0.0018	
17	8.4350	-0.8804	538.7	-88.4	-0.0013	0.0018	
18	8.4281	-0.1184	541.8	-54.6	-0.0007	0.0012	
19	8.3477	0.6394	552.9	44.7	0.0010	-0.0005	
20	8.2073	1.3883	431.7	163.2	0.0030	-0.0026	
21	8.0230	2.1277	412.6	279.6	0.0050	-0.0047	
22	7.8100	2.8594	453.1	338.4	0.0063	-0.0058	
23	7.5777	3.5852	354.5	301.6	0.0062	-0.0058	
24	7.3259	4.3043	304.7	275.2	0.0053	-0.0052	
25	7.0493	5.0143	177.1	267.1	0.0047	-0.0045	
26	6.7438	5.7124	139.0	181.0	0.0032	-0.0031	
27	6.3996	6.3923	220.1	48.8	0.0009	-0.0008	
28	6.0030	7.0429	216.8	-84.6	-0.0014	0.0015	
29	5.5421	7.6501	245.5	-237.5	-0.0047	0.0057	
30	5.0002	8.1885	267.5	-367.4	-0.0163	0.0212	
31	4.3332	8.5584	188.5	-400.4	-0.0150	0.0168	
32	3.5967	8.7542	193.7	-419.8	-0.0115	0.0118	*
33	2.8357	8.7966	119.9	-271.5	-0.0042	0.0043	
34	2.0756	8.7404	16.5	-98.0	0.0027	-0.0026	
35	1.3203	8.6384	10.7	129.7	0.0083	-0.0082	
36	0.5657	8.5329	-94.8	276.4	0.0103	-0.0105	
37	-0.1906	8.4403	-49.2	432.5	0.0126	-0.0126	*
38	-0.9498	8.3774	-19.3	346.2	0.0064	-0.0065	*
39	-1.7074	8.2975	-139.7	179.9	0.0030	-0.0032	
40	-2.4594	8.1752	-154.3	-4.8	-0.0002	0.0000	
41	-3.1977	7.9872	-105.9	-148.4	-0.0026	0.0025	
42	-3.9101	7.7172	-100.0	-213.5	-0.0037	0.0036	
43	-4.5836	7.3611	-147.0	-180.5	-0.0032	0.0030	
44	-5.2102	6.9279	-182.5	-103.9	-0.0019	0.0017	
45	-5.7879	6.4313	-216.6	14.6	0.0001	-0.0004	
46	-6.3215	5.8875	-50.7	130.5	0.0022	-0.0023	
47	-6.8189	5.3104	18.0	98.2	0.0017	-0.0017	
48	-7.2744	4.6998	-80.4	-39.5	-0.0007	0.0006	
49	-7.6706	4.0490	-27.0	-88.3	-0.0015	0.0015	
50	-7.9981	3.3612	64.8	-25.7	-0.0004	0.0005	
51	-8.2613	2.6462	29.8	22.4	0.0004	-0.0004	
52	-8.4639	1.9118	-72.1	10.2	0.0001	-0.0002	
53	-8.6031	1.1628	-102.7	-11.7	-0.0003	0.0001	
54	-8.6750	0.4045	-70.8	-12.1	-0.0002	0.0002	
55	-8.6788	-0.3574	-87.2	-5.0	-0.0001	0.0000	
56	-8.6156	-1.1165	-197.9	-3.4	-0.0002	-0.0000	
57	-8.4861	-1.8671	-240.0	-4.8	-0.0002	-0.0000	
58	-8.2910	-2.6035	-194.8	-5.2	-0.0002	-0.0000	
59	-8.0318	-3.3198	-284.0	-4.8	-0.0002	-0.0000	
60	-7.7106	-4.0105	-351.4	-4.6	-0.0002	-0.0001	
61	-7.3299	-4.6703	-317.6	-4.6	-0.0002	-0.0001	
62	-6.8927	-5.2940	-446.5	-4.6	-0.0003	-0.0001	
63	-6.4023	-5.8769	-559.5	-4.7	-0.0003	-0.0002	
64	-5.8626	-6.4143	-487.8	-4.8	-0.0003	-0.0001	
65	-5.2776	-6.9022	-368.8	-5.0	-0.0003	-0.0001	
66	-4.6519	-7.3367	-374.2	-5.1	-0.0003	-0.0001	
67	-3.9905	-7.7145	-364.7	-5.4	-0.0003	-0.0001	
68	-3.2983	-8.0325	-203.6	-5.7	-0.0002	0.0000	
69	-2.5807	-8.2883	-125.3	-6.0	-0.0002	0.0000	
70	-1.8433	-8.4799	-80.7	-6.3	-0.0002	0.0001	
71	-1.0919	-8.6056	15.1	-6.9	-0.0001	0.0001	
72	-0.3323	-8.6645	173.4	-7.5	-0.0001	0.0002	

J= 260 TIME= 0.0007826
TOTAL ENERGY INPUT (IN.-LB.) = 926.700
KINETIC ENERGY (IN.-LB.) = 551.519
ELASTIC ENERGY (IN.-LB.) = 180.151
PLASTIC WORK (IN.-LB.) = 195.029

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4327	-8.6513	-121.1	-6.9	-0.0002	0.0001	
2	1.1906	-8.5749	-75.7	-7.4	-0.0002	0.0001	
3	1.9388	-8.4318	-73.7	-13.3	-0.0003	0.0002	
4	2.6713	-8.2223	15.5	-17.9	-0.0003	0.0003	
5	3.3820	-7.9475	177.6	-4.1	-0.0000	0.0001	
6	4.0658	-7.6114	333.1	15.8	0.0004	-0.0001	
7	4.7188	-7.2187	435.5	-10.4	0.0000	0.0004	
8	5.3343	-6.7694	454.3	-74.6	-0.0011	0.0015	
9	5.9018	-6.2609	398.9	-65.8	-0.0010	0.0013	
10	6.4164	-5.6989	429.6	41.4	0.0009	-0.0005	
11	6.8845	-5.0976	460.9	99.0	0.0019	-0.0015	
12	7.3092	-4.4649	477.3	25.0	0.0006	-0.0002	
13	7.6801	-3.7993	422.0	-86.3	-0.0013	0.0017	
14	7.9811	-3.0993	316.8	-126.4	-0.0021	0.0023	
15	8.2041	-2.3707	257.3	-103.0	-0.0017	0.0019	
16	8.3494	-1.6227	242.8	-101.5	-0.0017	0.0018	
17	8.4157	-0.8637	216.7	-103.5	-0.0017	0.0019	
18	8.4019	-0.1019	142.3	-38.3	-0.0006	0.0007	
19	8.3168	0.6553	125.5	68.1	0.0012	-0.0011	
20	8.1749	1.4037	77.7	197.4	0.0034	-0.0034	
21	7.9933	2.1437	50.4	305.1	0.0053	-0.0052	
22	7.7864	2.8770	181.1	324.8	0.0060	-0.0057	
23	7.5583	3.6041	281.6	284.7	0.0059	-0.0056	
24	7.3086	4.3240	409.0	315.2	0.0061	-0.0058	
25	7.0389	5.0367	348.8	267.7	0.0048	-0.0045	
26	6.7403	5.7378	230.7	157.6	0.0028	-0.0026	
27	6.4002	6.4196	-55.1	50.0	0.0008	-0.0009	
28	6.0076	7.0726	-243.7	-108.4	-0.0020	0.0018	
29	5.5479	7.6806	-218.2	-255.4	-0.0052	0.0058	
30	5.0056	8.2181	-298.1	-346.3	-0.0162	0.0206	
31	4.3357	8.5897	-332.0	-413.0	-0.0154	0.0168	
32	3.6035	8.7856	-503.7	-416.3	-0.0123	0.0117	
33	2.8427	8.8260	-543.9	-243.9	-0.0040	0.0035	
34	2.0826	8.7714	-425.4	-143.8	0.0017	-0.0020	
35	1.3280	8.6649	-283.6	56.7	0.0069	-0.0071	
36	0.5755	8.5455	-159.4	291.7	0.0105	-0.0108	
37	-0.1792	8.4411	-103.5	396.4	0.0119	-0.0121	
38	-0.9369	8.3615	-64.9	365.3	0.0078	-0.0079	*
39	-1.6938	8.2752	-83.2	226.6	0.0039	-0.0040	
40	-2.4457	8.1526	-173.2	37.2	0.0006	-0.0007	
41	-3.1853	7.9697	-250.0	-120.0	-0.0022	0.0020	
42	-3.9008	7.7081	-189.7	-211.7	-0.0037	0.0036	
43	-4.5785	7.3602	-212.1	-207.9	-0.0037	0.0035	
44	-5.2083	6.9316	-190.7	-127.6	-0.0023	0.0021	
45	-5.7877	6.4368	-98.6	-27.7	-0.0005	0.0004	
46	-6.3190	5.8909	-149.9	91.5	0.0015	-0.0017	
47	-6.8101	5.3085	-172.5	137.6	0.0023	-0.0025	
48	-7.2632	4.6961	-141.7	26.8	0.0004	-0.0005	
49	-7.6642	4.0484	-247.0	-91.3	-0.0017	0.0015	
50	-7.9964	3.3629	-271.8	-70.0	-0.0013	0.0011	
51	-8.2590	2.6478	-294.9	9.4	0.0000	-0.0003	
52	-8.4594	1.9130	-469.2	27.1	0.0003	-0.0007	
53	-8.5986	1.1641	-451.4	-2.4	-0.0002	-0.0002	
54	-8.6716	0.4060	-365.7	-16.7	-0.0005	0.0001	
55	-8.6761	-0.3558	-450.3	-9.2	-0.0004	-0.0000	
56	-8.6129	-1.1148	-415.4	-3.0	-0.0002	-0.0001	
57	-8.4835	-1.8654	-277.9	-3.9	-0.0002	-0.0001	
58	-8.2886	-2.6019	-220.4	-5.6	-0.0002	-0.0000	
59	-8.0295	-3.3182	-336.9	-5.4	-0.0002	-0.0001	
60	-7.7084	-4.0089	-418.9	-4.9	-0.0003	-0.0001	
61	-7.3278	-4.6688	-260.2	-4.9	-0.0002	-0.0000	
62	-6.8905	-5.2926	-229.1	-5.0	-0.0002	-0.0000	
63	-6.4000	-5.8754	-320.7	-5.1	-0.0002	-0.0001	
64	-5.8602	-6.4128	-248.7	-5.2	-0.0002	-0.0000	
65	-5.2750	-6.9006	-160.9	-5.4	-0.0002	0.0000	
66	-4.6492	-7.3350	-140.7	-5.6	-0.0002	0.0000	
67	-3.9875	-7.7126	-162.0	-5.8	-0.0002	0.0000	
68	-3.2951	-8.0303	-88.5	-6.1	-0.0002	0.0001	
69	-2.5774	-8.2858	-97.4	-6.3	-0.0002	0.0001	
70	-1.8400	-8.4769	-166.5	-6.7	-0.0002	0.0000	
71	-1.0885	-8.6021	-129.7	-7.4	-0.0002	0.0001	
72	-0.3291	-8.6604	-187.7	-7.7	-0.0002	0.0000	

J= 270 TIME= 0.0008127
TOTAL ENERGY INPUT (IN.-LB.) = 926.700
KINETIC ENERGY (IN.-LB.) = 543.071
ELASTIC ENERGY (IN.-LB.) = 185.424
PLASTIC WORK (IN.-LB.) = 198.205

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4367	-8.6467	38.1	-6.3	-0.0001	0.0001	
2	1.1946	-8.5698	-81.8	-10.1	-0.0002	0.0001	
3	1.9427	-8.4257	-1.5	-19.2	-0.0003	0.0003	
4	2.6747	-8.2146	80.1	-14.7	-0.0002	0.0003	
5	3.3849	-7.9387	-12.9	12.3	0.0002	-0.0002	
6	4.0689	-7.6034	-78.0	14.6	0.0002	-0.0003	
7	4.7221	-7.2114	-189.1	-48.0	-0.0009	0.0007	
8	5.3349	-6.7589	-219.0	-92.2	-0.0017	0.0015	
9	5.8979	-6.2456	-208.1	-18.6	-0.0004	0.0002	
10	6.4122	-5.6836	-178.4	86.2	0.0014	-0.0016	
11	6.8845	-5.0859	-216.3	77.1	0.0012	-0.0014	
12	7.3113	-4.4549	-198.9	-26.1	-0.0005	0.0004	
13	7.6785	-3.7875	-146.8	-104.9	-0.0019	0.0017	
14	7.9735	-3.0851	-140.6	-106.9	-0.0019	0.0018	
15	8.1927	-2.3554	-5.0	-100.7	-0.0017	0.0017	
16	8.3345	-1.6068	64.2	-123.7	-0.0021	0.0022	
17	8.3943	-0.8473	55.0	-101.3	-0.0017	0.0018	
18	8.3743	-0.0857	-22.7	-21.8	-0.0004	0.0004	
19	8.2851	0.6709	-187.3	96.6	0.0016	-0.0018	
20	8.1428	1.4192	-173.8	235.0	0.0040	-0.0041	
21	7.9658	2.1602	-229.5	310.9	0.0053	-0.0055	
22	7.7641	2.8948	-221.7	294.8	0.0053	-0.0053	
23	7.5374	3.6222	-185.7	316.8	0.0062	-0.0063	
24	7.2931	4.3437	-221.3	327.7	0.0060	-0.0063	
25	7.0304	5.0588	-205.8	258.5	0.0044	-0.0046	
26	6.7374	5.7621	-202.0	155.2	0.0026	-0.0028	
27	6.4025	6.4465	-228.0	32.3	0.0004	-0.0007	
28	6.0129	7.1012	-260.7	-128.1	-0.0023	0.0021	
29	5.5539	7.7096	-363.3	-255.1	-0.0053	0.0057	
30	5.0121	8.2478	-308.7	-343.6	-0.0162	0.0206	
31	4.3469	8.6205	-201.9	-440.2	-0.0159	0.0173	
32	3.6100	8.8142	-208.3	-376.0	-0.0114	0.0111	
33	2.8492	8.8575	-53.0	-286.7	-0.0045	0.0045	
34	2.0891	8.8003	-123.6	-148.4	0.0018	-0.0018	
35	1.3350	8.6906	-195.1	5.5	0.0061	-0.0062	
36	0.5841	8.5613	-132.6	278.8	0.0103	-0.0106	
37	-0.1689	8.4453	-217.6	353.1	0.0111	-0.0114	
38	-0.9245	8.3484	-165.3	382.9	0.0089	-0.0092	*
39	-1.6804	8.2543	-264.9	269.2	0.0045	-0.0048	
40	-2.4319	8.1294	-411.0	88.2	0.0013	-0.0017	
41	-3.1724	7.9508	-499.7	-90.1	-0.0018	0.0013	
42	-3.8907	7.6971	-537.2	-201.0	-0.0037	0.0032	
43	-4.5727	7.3579	-412.5	-229.3	-0.0041	0.0038	
44	-5.2064	6.9351	-330.6	-160.3	-0.0029	0.0026	
45	-5.7873	6.4424	-357.3	-53.0	-0.0011	0.0007	
46	-6.3181	5.8960	-328.3	49.9	0.0007	-0.0010	
47	-6.8044	5.3096	-361.5	133.9	0.0021	-0.0025	
48	-7.2520	4.6933	-440.0	94.1	0.0014	-0.0018	
49	-7.6548	4.0468	-365.0	-51.6	-0.0011	0.0007	
50	-7.9937	3.3646	-350.2	-106.8	-0.0020	0.0017	
51	-8.2586	2.6504	-374.1	-29.1	-0.0007	0.0003	
52	-8.4567	1.9149	-254.8	34.4	0.0005	-0.0007	
53	-8.5943	1.1656	-241.4	17.2	0.0002	-0.0004	
54	-8.6683	0.4075	-171.7	-15.6	-0.0004	0.0002	
55	-8.6740	-0.3543	-148.1	-16.8	-0.0004	0.0002	
56	-8.6110	-1.1134	-199.0	-5.2	-0.0002	-0.0000	
57	-8.4814	-1.8641	-10.1	-2.4	-0.0001	0.0000	
58	-8.2866	-2.6006	20.4	-5.2	-0.0001	0.0001	
59	-8.0276	-3.3171	-129.4	-6.1	-0.0002	0.0000	
60	-7.7065	-4.0079	-92.4	-5.5	-0.0001	0.0000	
61	-7.3258	-4.6678	-35.1	-5.2	-0.0001	0.0001	
62	-6.8884	-5.2916	25.8	-5.4	-0.0001	0.0001	
63	-6.3978	-5.8745	27.9	-5.5	-0.0001	0.0001	
64	-5.8577	-6.4119	65.1	-5.6	-0.0001	0.0001	
65	-5.2724	-6.8996	108.5	-5.8	-0.0001	0.0001	
66	-4.6463	-7.3338	92.7	-6.0	-0.0001	0.0001	
67	-3.9844	-7.7111	9.5	-6.2	-0.0001	0.0001	
68	-3.2919	-8.0285	-69.0	-6.4	-0.0001	0.0001	
69	-2.5740	-8.2835	89.1	-6.8	-0.0001	0.0001	
70	-1.8363	-8.4742	155.6	-7.5	-0.0001	0.0002	
71	-1.0847	-8.5989	123.5	-8.1	-0.0001	0.0002	
72	-0.3251	-8.6565	98.8	-7.5	-0.0001	0.0002	

J= 280 TIME= 0.0008428
TOTAL ENERGY INPUT (IN.-LB.) = 926.700
KINETIC ENERGY (IN.-LB.) = 534.128
ELASTIC ENERGY (IN.-LB.) = 191.835
PLASTIC WORK (IN.-LB.) = 200.737

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4404	-8.6423	44.4	-6.8	-0.0001	0.0001	
2	1.1982	-8.5648	-25.6	-16.4	-0.0003	0.0003	
3	1.9460	-8.4195	-186.0	-22.7	-0.0005	0.0003	
4	2.6774	-8.2067	-209.7	-0.7	-0.0001	-0.0001	
5	3.3875	-7.9308	-187.0	26.7	0.0004	-0.0006	
6	4.0724	-7.5973	-252.2	-10.3	-0.0003	0.0001	
7	4.7249	-7.2041	-291.6	-88.3	-0.0017	0.0014	
8	5.3337	-6.7463	-244.0	-74.9	-0.0014	0.0012	
9	5.8937	-6.2299	-308.4	40.0	0.0005	-0.0008	
10	6.4104	-5.6702	-399.8	99.8	0.0015	-0.0019	
11	6.8867	-5.0757	-447.0	35.4	0.0004	-0.0008	
12	7.3131	-4.4446	-585.0	-64.4	-0.0014	0.0008	
13	7.6756	-3.7747	-631.1	-100.4	-0.0020	0.0014	
14	7.9660	-3.0706	-631.9	-93.2	-0.0019	0.0013	
15	8.1823	-2.3403	-691.0	-118.9	-0.0024	0.0017	
16	8.3187	-1.5910	-623.3	-135.2	-0.0026	0.0020	
17	8.3715	-0.8312	-627.3	-92.7	-0.0019	0.0013	
18	8.3457	-0.0700	-585.9	-4.2	-0.0003	-0.0002	
19	8.2531	0.6862	-491.6	136.6	0.0021	-0.0026	
20	8.1126	1.4347	-419.6	261.3	0.0043	-0.0047	
21	7.9407	2.1768	-352.4	288.6	0.0048	-0.0051	
22	7.7412	2.9121	-346.4	296.4	0.0053	-0.0054	
23	7.5170	3.6401	-250.0	347.9	0.0068	-0.0070	*
24	7.2797	4.3640	-109.4	319.2	0.0059	-0.0061	
25	7.0229	5.0813	-129.5	254.3	0.0043	-0.0045	
26	6.7352	5.7868	-166.5	158.4	0.0026	-0.0028	
27	6.4059	6.4739	-70.7	-0.6	-0.0001	-0.0000	
28	6.0178	7.1296	-147.4	-135.1	-0.0024	0.0023	
29	5.5596	7.7386	-160.3	-244.2	-0.0050	0.0056	
30	5.0195	8.2786	-201.8	-380.8	-0.0168	0.0213	
31	4.3530	8.6490	-305.1	-419.3	-0.0156	0.0169	
32	3.6162	8.8429	-179.2	-360.0	-0.0111	0.0108	
33	2.8555	8.8885	-287.5	-320.7	-0.0052	0.0050	*
34	2.0958	8.8287	-318.4	-169.6	0.0013	-0.0015	
35	1.3424	8.7138	-333.5	24.4	0.0063	-0.0066	
36	0.5922	8.5817	-437.6	188.0	0.0086	-0.0092	
37	-0.1584	8.4511	-270.7	350.2	0.0111	-0.0113	
38	-0.9119	8.3392	-353.2	391.7	0.0096	-0.0100	*
39	-1.6666	8.2355	-232.3	311.7	0.0053	-0.0055	
40	-2.4175	8.1068	-132.1	141.4	0.0024	-0.0025	
41	-3.1588	7.9311	-182.5	-51.8	-0.0010	0.0008	
42	-3.8798	7.6850	-188.8	-190.0	-0.0034	0.0032	
43	-4.5662	7.3543	-184.9	-238.9	-0.0042	0.0040	
44	-5.2044	6.9384	-242.0	-196.3	-0.0035	0.0033	
45	-5.7877	6.4483	-152.4	-82.4	-0.0015	0.0013	
46	-6.3183	5.9017	-85.6	24.0	0.0004	-0.0005	
47	-6.8017	5.3129	-106.6	107.2	0.0018	-0.0019	
48	-7.2435	4.6923	-202.7	128.7	0.0021	-0.0023	
49	-7.6441	4.0443	-248.4	16.3	0.0002	-0.0004	
50	-7.9885	3.3648	-35.9	-108.1	-0.0019	0.0018	
51	-8.2592	2.6526	52.0	-82.1	-0.0014	0.0014	
52	-8.4564	1.9167	69.0	16.4	0.0003	-0.0003	
53	-8.5909	1.1667	228.5	39.5	0.0008	-0.0006	
54	-8.6646	0.4085	168.3	-1.7	0.0000	0.0001	
55	-8.6717	-0.3534	96.0	-23.3	-0.0004	0.0004	
56	-8.6094	-1.1127	164.2	-12.1	-0.0001	0.0003	
57	-8.4795	-1.8634	39.3	-1.7	-0.0000	0.0000	
58	-8.2845	-2.5998	8.0	-3.3	-0.0001	0.0001	
59	-8.0256	-3.3164	109.3	-6.4	-0.0001	0.0002	
60	-7.7045	-4.0073	93.7	-6.4	-0.0001	0.0001	
61	-7.3237	-4.6672	90.6	-5.6	-0.0001	0.0001	
62	-6.8861	-5.2910	231.2	-5.6	-0.0000	0.0002	
63	-6.3953	-5.8738	251.2	-5.8	-0.0000	0.0002	
64	-5.8551	-6.4110	222.7	-6.0	-0.0000	0.0002	
65	-5.2695	-6.8985	213.9	-6.1	-0.0000	0.0002	
66	-4.6433	-7.3325	44.1	-6.3	-0.0001	0.0001	
67	-3.9813	-7.7095	-30.9	-6.5	-0.0001	0.0001	
68	-3.2885	-8.0265	37.1	-6.7	-0.0001	0.0001	
69	-2.5705	-8.2812	131.2	-7.3	-0.0001	0.0002	
70	-1.8327	-8.4714	55.1	-8.2	-0.0001	0.0002	
71	-1.0810	-8.5955	-5.4	-8.3	-0.0002	0.0001	
72	-0.3214	-8.6525	41.8	-6.3	-0.0001	0.0001	

J= 290 TIME= 0.0008729
TOTAL ENERGY INPUT (IN.-LB.) = 926.700
KINETIC ENERGY (IN.-LB.) = 525.303
ELASTIC ENERGY (IN.-LB.) = 197.966
PLASTIC WORK (IN.-LB.) = 203.431

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4435	-8.6383	-99.3	-11.0	-0.0002	0.0001	
2	1.2011	-8.5601	-256.3	-24.7	-0.0005	0.0003	
3	1.9485	-8.4129	-448.7	-16.7	-0.0005	0.0001	
4	2.6796	-8.1991	-425.9	21.8	0.0002	-0.0006	
5	3.3903	-7.9251	-413.6	23.1	0.0002	-0.0006	
6	4.0757	-7.5929	-406.8	-55.1	-0.0011	0.0008	
7	4.7259	-7.1960	-293.0	-105.6	-0.0020	0.0017	
8	5.3307	-6.7328	-229.7	-26.7	-0.0006	0.0004	
9	5.8905	-6.2160	-134.8	82.6	0.0014	-0.0015	
10	6.4110	-5.6598	-223.4	83.4	0.0013	-0.0015	
11	6.8857	-5.0672	-251.1	-8.0	-0.0003	0.0000	
12	7.3141	-4.4346	-141.6	-80.1	-0.0015	0.0013	
13	7.6724	-3.7623	-251.1	-86.5	-0.0016	0.0014	
14	7.9603	-3.0570	-280.3	-101.3	-0.0019	0.0016	
15	8.1728	-2.3255	-303.4	-139.8	-0.0026	0.0023	
16	8.3026	-1.5749	-337.3	-136.8	-0.0025	0.0022	
17	8.3486	-0.8145	-322.4	-87.0	-0.0017	0.0013	
18	8.3167	-0.0535	-336.4	27.0	0.0003	-0.0006	
19	8.2221	0.7025	-278.5	178.6	0.0029	-0.0032	
20	8.0850	1.4517	-220.9	258.9	0.0044	-0.0046	
21	7.9162	2.1946	-257.6	269.8	0.0045	-0.0048	
22	7.7173	2.9300	-363.1	325.7	0.0058	-0.0061	*
23	7.4982	3.6595	-346.3	351.0	0.0069	-0.0073	
24	7.2672	4.3854	-378.4	316.5	0.0057	-0.0062	
25	7.0162	5.1046	-347.5	256.2	0.0043	-0.0046	
26	6.7346	5.8125	-459.9	141.2	0.0022	-0.0026	
27	6.4090	6.5012	-512.0	-17.5	-0.0005	0.0001	
28	6.0227	7.1578	-406.3	-132.0	-0.0025	0.0021	
29	5.5663	7.7682	-453.2	-259.6	-0.0054	0.0058	
30	5.0265	8.3083	-432.3	-401.3	-0.0172	0.0215	
31	4.3589	8.6766	-355.8	-381.4	-0.0149	0.0163	
32	3.6228	8.8730	-369.9	-387.3	-0.0117	0.0112	
33	2.8621	8.9176	-271.9	-320.9	-0.0053	0.0050	
34	2.1024	8.8564	-241.3	-187.9	0.0011	-0.0012	
35	1.3496	8.7377	-94.3	27.2	0.0065	-0.0065	
36	0.5998	8.6023	5.7	122.0	0.0077	-0.0078	
37	-0.1487	8.4597	-49.6	329.5	0.0108	-0.0109	
38	-0.9000	8.3332	26.3	401.6	0.0104	-0.0104	*
39	-1.6534	8.2192	148.3	339.0	0.0061	-0.0059	*
40	-2.4034	8.0849	87.2	192.6	0.0033	-0.0033	
41	-3.1451	7.9103	139.4	-5.5	-0.0000	0.0001	
42	-3.8685	7.6711	85.1	-173.3	-0.0030	0.0030	
43	-4.5590	7.3489	84.2	-244.4	-0.0042	0.0042	
44	-5.2020	6.9402	75.7	-222.5	-0.0038	0.0039	
45	-5.7887	6.4542	44.3	-122.2	-0.0021	0.0021	
46	-6.3195	5.9075	234.6	2.9	0.0001	0.0000	
47	-6.8008	5.3168	355.9	85.4	0.0016	-0.0013	
48	-7.2382	4.6928	376.1	126.6	0.0023	-0.0020	
49	-7.6338	4.0416	393.5	76.7	0.0015	-0.0012	
50	-7.9802	3.3629	224.0	-64.0	-0.0010	0.0012	
51	-8.2582	2.6535	182.7	-120.6	-0.0020	0.0022	
52	-8.4581	1.9183	239.4	-31.6	-0.0004	0.0006	
53	-8.5891	1.1677	218.4	47.0	0.0009	-0.0007	
54	-8.6603	0.4092	265.4	25.6	0.0005	-0.0003	
55	-8.6685	-0.3527	238.4	-20.2	-0.0003	0.0004	
56	-8.6076	-1.1121	85.9	-23.1	-0.0004	0.0004	
57	-8.4777	-1.8628	-6.7	-5.4	-0.0001	0.0001	
58	-8.2823	-2.5991	27.8	-0.5	-0.0000	0.0000	
59	-8.0233	-3.3156	60.7	-5.2	-0.0001	0.0001	
60	-7.7022	-4.0066	202.0	-7.4	-0.0000	0.0002	
61	-7.3213	-4.6665	263.2	-6.4	-0.0000	0.0002	
62	-6.8837	-5.2902	144.0	-5.7	-0.0000	0.0002	
63	-6.3927	-5.8728	123.5	-5.9	-0.0001	0.0001	
64	-5.8524	-6.4099	-21.7	-6.2	-0.0001	0.0001	
65	-5.2668	-6.8972	-93.9	-6.4	-0.0002	0.0001	
66	-4.6405	-7.3309	-55.4	-6.5	-0.0001	0.0001	
67	-3.9783	-7.7076	-100.0	-6.7	-0.0002	0.0001	
68	-3.2855	-8.0244	-136.6	-7.0	-0.0002	0.0001	
69	-2.5674	-8.2787	-161.9	-7.9	-0.0002	0.0001	
70	-1.8296	-8.4684	-160.4	-8.8	-0.0002	0.0001	
71	-1.0779	-8.5920	-161.8	-7.2	-0.0002	0.0000	
72	-0.3183	-8.6487	-93.6	-4.8	-0.0001	0.0000	

J= 300 TIME= 0.0009030
TOTAL ENERGY INPUT (IN.-LB.) = 926.700
KINETIC ENERGY (IN.-LB.) = 518.141
ELASTIC ENERGY (IN.-LB.) = 201.977
PLASTIC WORK (IN.-LB.) = 206.581

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

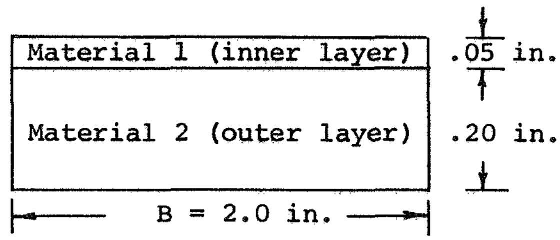
I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1
1	0.4460	-8.6349	-167.0	-20.5	-0.0004	0.0003	
2	1.2035	-8.5553	-133.0	-28.9	-0.0006	0.0004	
3	1.9507	-8.4062	-58.6	3.5	0.0000	-0.0001	
4	2.6821	-8.1930	-40.6	38.8	0.0006	-0.0007	
5	3.3940	-7.9217	16.9	-8.8	-0.0002	0.0001	
6	4.0790	-7.5883	-71.3	-98.7	-0.0017	0.0017	
7	4.7256	-7.1854	-72.4	-85.4	-0.0015	0.0014	
8	5.3278	-6.7187	51.2	29.5	0.0005	-0.0005	
9	5.8897	-6.2042	1.7	95.8	0.0016	-0.0017	
10	6.4138	-5.6513	-59.8	48.7	0.0008	-0.0009	
11	6.8927	-5.0588	-75.6	-38.2	-0.0007	0.0006	
12	7.3140	-4.4240	-2.8	-73.3	-0.0013	0.0013	
13	7.6658	-3.7503	71.8	-83.2	-0.0014	0.0015	
14	7.9555	-3.0440	1.3	-124.2	-0.0022	0.0021	
15	8.1628	-2.3109	64.3	-151.0	-0.0026	0.0026	
16	8.2859	-1.5589	162.8	-139.9	-0.0024	0.0025	
17	8.3246	-0.7981	84.4	-72.7	-0.0012	0.0013	
18	8.2872	-0.0371	3.3	72.6	0.0012	-0.0013	
19	8.1932	0.7190	-13.0	199.5	0.0034	-0.0035	
20	8.0593	1.4689	-97.6	237.0	0.0040	-0.0041	
21	7.8910	2.2119	-60.2	284.3	0.0049	-0.0049	
22	7.6944	2.9479	-91.7	344.7	0.0064	-0.0065	*
23	7.4811	3.6792	-183.9	349.0	0.0069	-0.0072	
24	7.2556	4.4069	-175.6	325.2	0.0060	-0.0062	
25	7.0112	5.1285	-207.4	250.6	0.0042	-0.0044	
26	6.7353	5.8387	-100.1	111.4	0.0019	-0.0020	
27	6.4118	6.5285	-51.4	-9.2	-0.0002	0.0001	
28	6.0283	7.1870	-39.1	-139.6	-0.0024	0.0024	
29	5.5738	7.7989	-59.6	-299.3	-0.0059	0.0066	
30	5.0319	8.3370	-214.5	-371.4	-0.0166	0.0211	
31	4.3648	8.7064	-112.5	-390.6	-0.0150	0.0165	
32	3.6285	8.9026	-52.0	-401.0	-0.0118	0.0116	
33	2.8677	8.9454	-87.9	-320.3	-0.0052	0.0051	
34	2.1081	8.8824	-38.0	-171.2	0.0014	-0.0014	
35	1.3551	8.7641	72.5	-39.5	0.0054	-0.0053	
36	0.6068	8.6204	175.2	136.8	0.0080	-0.0080	
37	-0.1405	8.4714	134.4	270.0	0.0099	-0.0098	
38	-0.8895	8.3308	217.9	404.3	0.0108	-0.0105	*
39	-1.6411	8.2050	302.6	349.4	0.0069	-0.0065	*
40	-2.3899	8.0643	260.9	233.8	0.0041	-0.0039	
41	-3.1314	7.8886	194.3	44.1	0.0008	-0.0007	
42	-3.8565	7.6545	240.1	-143.4	-0.0024	0.0026	
43	-4.5509	7.3408	108.6	-246.9	-0.0042	0.0043	
44	-5.1987	6.9398	64.7	-241.1	-0.0041	0.0042	
45	-5.7897	6.4588	210.8	-159.6	-0.0027	0.0028	
46	-6.3216	5.9132	191.5	-29.7	-0.0004	0.0006	
47	-6.8009	5.3209	296.9	72.3	0.0014	-0.0011	
48	-7.2346	4.6944	411.7	113.4	0.0021	-0.0018	
49	-7.6250	4.0400	260.6	104.8	0.0019	-0.0017	
50	-7.9692	3.3603	87.5	2.3	0.0001	-0.0000	
51	-8.2531	2.6533	42.2	-116.9	-0.0020	0.0020	
52	-8.4596	1.9200	19.9	-91.5	-0.0016	0.0016	
53	-8.5895	1.1692	93.4	22.0	0.0004	-0.0003	
54	-8.6564	0.4104	231.1	53.5	0.0010	-0.0008	
55	-8.6639	-0.3516	233.2	0.5	0.0001	0.0001	
56	-8.6050	-1.1111	180.9	-31.4	-0.0005	0.0006	
57	-8.4761	-1.8620	105.8	-16.2	-0.0002	0.0003	
58	-8.2802	-2.5982	32.8	0.3	0.0000	-0.0000	
59	-8.0208	-3.3146	35.8	-1.7	-0.0000	0.0000	
60	-7.6999	-4.0055	-53.8	-7.3	-0.0002	0.0001	
61	-7.3191	-4.6654	-54.3	-7.6	-0.0002	0.0001	
62	-6.8814	-5.2889	-107.4	-6.0	-0.0002	0.0000	
63	-6.3905	-5.8714	-243.3	-5.9	-0.0002	-0.0000	
64	-5.8502	-6.4084	-280.3	-6.3	-0.0002	-0.0000	
65	-5.2645	-6.8955	-285.0	-6.6	-0.0002	-0.0000	
66	-4.6382	-7.3291	-249.4	-6.7	-0.0002	-0.0000	
67	-3.9760	-7.7056	-203.2	-6.8	-0.0002	0.0000	
68	-3.2831	-8.0222	-253.7	-7.5	-0.0002	0.0000	
69	-2.5649	-8.2752	-289.7	-9.0	-0.0003	0.0000	
70	-1.8270	-8.4655	-157.5	-8.6	-0.0002	0.0001	
71	-1.0753	-8.5888	-189.0	-4.7	-0.0002	-0.0000	
72	-0.3157	-8.6454	-184.7	-5.5	-0.0002	0.0000	

FIRST YIELDING AT TIME= 0.000163

SUMMARY OF ERRORS FOR THIS JOB ERROR NUMBER NUMBER OF ERRORS

B.6.3 Example 3: A Multilayer Ring with a Tri-Symmetric Initial Impulse

A 16-inch ID 2-layer ring with the following cross section is analyzed for the third example (not to scale):



The stress-strain curve of material 1 is represented by the following stress-strain coordinates (σ,ε): (0 psi, 0 in/in); (40,000, .017); (80,000, .05 in/in). The density of this hypothetical material is taken to be 0.00020 (lb-sec^2)/in^4. Strain-rate effects are included by setting D = .820E+14 and p = 12. in Eq. B.3.

The stress-strain curve of material 2 is represented by the following stress-strain coordinates (σ,ε): (0 psi, 0 in/in) (120,000, .004); (160,000, .010). The density of material 2 is taken to be .000719 (lb-sec^2)/in^4, and strain-rate effects are included by setting D = 40.4 and p = 5.0 in Eq. B.3.

The forcing function applied to the ring will be described as 3 equal impulses, acting 120 degrees apart, each distributed over a 25-degree sector of the ring in the shape of a half-sine wave, inclined at an angle of 80° to the local tangent. The impulse for each sector is chosen to be 1.0 (lb-sec). Solving Eq. B.4 for VEEZ, using 72 mass points to represent the total ring, one obtains

$$\text{VEEZ} = \frac{\pi I_{TOT} N}{(2)(\text{RING MASS})(\text{MASSES-1})} = 1840 \text{ in/sec}$$

where N = 72

Ring mass $= \pi DB\,(H_1\rho_1 + H_2\rho_2) = .0154\ \dfrac{\text{lb-sec}^2}{\text{in}^4}$

MASSES-1 = 4 (five mass stations comprise a 25-deg sector)

This is the peak value of the sine-shaped initial velocity distribution to be applied to 3 equi-spaced locations on the ring.

The incremental time interval ΔT to be used for this example will be calculated by the program by setting ΔT = 0.0. Printout is desired every 20 cycles, and the total run will be 200 cycles.

The bond between the two layers will be checked for failure. Assume that the ultimate bond shear stress is 1000 lb/in^2 and that the ultimate allowable strain is 3%.

B.6.3.1 Input Data

The values to be punched on the data cards are as follows:

	Format
Card 1	3E15.6

R = +0.800000E+01

B = +0.200000E+01

DELTAT = +0.000000E+00 (to be calculated by the program)

Card 2	6I5

N = 72

NRING = 2

M = 200

M1 = 20

M2 = 20

IND = 1 (the bond will be checked for failure)

Card 3	3I5

NSFL(1) = 2

NSFL(2) = 2

Card 4	2E15.6

AFAIL = +0.300000E-01

SFAIL = +0.100000E+04

Format

Card 5a (for the first layer) 4E15.6

H(1) = +0.500000E-01

RHO(1) = +0.200000E-03

D(1) = +0.820000E+14

P(1) = +0.120000E+02

Card 6a 4E15.6

EPSIL(1,1) = +0.170000E-01

SIGMA(1,1) = +0.400000E+05

EPSIL(2,1) = +0.500000E-01

SIGMA(2,1) = +0.800000E+05

Card 5b (for the second layer) 4E15.6

H(2) = +0.200000E+00

RHO(2) = +0.719000E-03

D(2) = +0.404000E+02

P(2) = +0.500000E+01

Card 6b 4E15.6

EPSIL(1,2) = +0.400000E-02

SIGMA(1,2) = +0.120000E+06

EPSIL(2,2) = +0.100000E-01

SIGMA(2,2) = +0.160000E+06

Card 7 2I5

IOTA = 2 (sine-shaped impulse distributions)

NV = 3 (three local velocity fileds are to be specified)

Card 9a 2I5,2E15.6

MASSES = 5 (5 mass stations form a 25-deg sector)

MSTART = 1 (to be equally spaced, the 3 distributions will start at mass stations 1, 25, and 49)

VEEZ = +0.184000E+04 (peak velocity)

BETA = +0.800000E+02 (inclination angle in degrees)

Card 9b Format

MASSES = 5

MSTART = 25

VEEZ = +0.184000E+04

BETA = +0.800000E+02

Card 9c

MASSES = 5

MSTART = 49

VEEZ = +0.184000E+04

BETA = +0.800000E+02

Card 10 4E15.6

TBEGIN = +0.000000E+00
TFINAL = +0.000000E+00
AMP1TY = +0.000000E+00
AMP1RZ = +0.000000E+00

} There is no subsequent forcing function.

The input deck for this example problem should look as follows:

```
+0.800000E+01   +0.200000E+01   +0.000000E+00
 72      2  200    20     20      1
  2      2
+0.600000E-02   +0.150000E+04
+0.500000E-01   +0.200000E-03   +0.820000E+14   +0.120000E+02
+0.170000E-01   +0.400000E+05   +0.500000E-01   +0.800000E+05
+0.200000E+00   +0.719000E-03   +0.404000E+02   +0.500000E+01
+0.400000E-02   +0.120000E+06   +0.100000E-01   +0.160000E+06
  2      3
  5      1   +0.184000E+04   +0.800000E+02
  5     25   +0.184000E+04   +0.800000E+02
  5     49   +0.184000E+04   +0.800000E+02
+0.000000E+00   +0.000000E+00   +0.000000E+00   +0.000000E+00
```

B.6.3.2 Solution Output for Example 3

The solution output for this example is as follows:

JET 2   A PROGRAM USED TO CALCULATE THE RESPONSE OF A FREE CIRCULAR MULTI-LAYERED RING WITH THE FOLLOWING PARAMETERS.-

RADIUS OF RING TO INNER SURFACE (IN.)	=	8.00000
WIDTH OF RING (IN.)	=	2.00000
THICKNESS OF RING (IN.)	=	0.25000
CENTROIDAL DISTANCE FROM INNER SURFACE (IN.)	=	0.14187
NUMBER OF MASS POINTS USED IN THE RING	=	72
NUMBER OF LAYERS USED IN RING CROSS SECTION	=	2
NUMBER OF CONTROL STATIONS USED IN LAYER 1	=	4
NUMBER OF MECHANICAL SUBLAYERS AT EACH CONTROL STATION IN LAYER 1	=	2
THICKNESS OF LAYER 1	=	0.05000
NUMBER OF CONTROL STATIONS USED IN LAYER 2	=	4
NUMBER OF MECHANICAL SUBLAYERS AT EACH CONTROL STATION IN LAYER 2	=	2
THICKNESS OF LAYER 2	=	0.20000

TIME INTERVAL BASED ON LATERAL VIBRATION EQUATION = 0.29808827E-04
TIME INTERVAL BASED ON LONGITUDINAL VIBRATION EQUATION = 0.35613893E-05

TIME INTERVAL PER CYCLE USED IN PROGRAM (SEC) = 0.32999988E-05

LOCALIZED SINE SHAPED IMPULSE LOADING(S) HAS (HAVE) BEEN SPECIFIED

THE INITIAL VELOCITY INPUT IS AS FOLLOWS..

MASS	V DOT	W DOT	MASS	V DOT	W DOT
1	0.4117E 02	-0.7909E 02	37	0.0	0.0
2	0.2927E 03	-0.5623E 03	38	0.0	0.0
3	0.8279E 03	-0.1590E 04	39	0.0	0.0
4	0.2927E 03	-0.5623E 03	40	0.0	0.0
5	0.4117E 02	-0.7909E 02	41	0.0	0.0
6	0.0	0.0	42	0.0	0.0
7	0.0	0.0	43	0.0	0.0
8	0.0	0.0	44	0.0	0.0
9	0.0	0.0	45	0.0	0.0
10	0.0	0.0	46	0.0	0.0
11	0.0	0.0	47	0.0	0.0
12	0.0	0.0	48	0.0	0.0
13	0.0	0.0	49	-0.8908E 02	0.3889E 01
14	0.0	0.0	50	-0.6333E 03	0.2765E 02
15	0.0	0.0	51	-0.1791E 04	0.7821E 02
16	0.0	0.0	52	-0.6333E 03	0.2765E 02
17	0.0	0.0	53	-0.8908E 02	0.3889E 01
18	0.0	0.0	54	0.0	0.0
19	0.0	0.0	55	0.0	0.0
20	0.0	0.0	56	0.0	0.0
21	0.0	0.0	57	0.0	0.0
22	0.0	0.0	58	0.0	0.0
23	0.0	0.0	59	0.0	0.0
24	0.0	0.0	60	0.0	0.0
25	0.4791E 02	0.7520E 02	61	0.0	0.0
26	0.3406E 03	0.5347E 03	62	0.0	0.0
27	0.9634E 03	0.1512E 04	63	0.0	0.0
28	0.3406E 03	0.5347E 03	64	0.0	0.0
29	0.4791E 02	0.7520E 02	65	0.0	0.0
30	0.0	0.0	66	0.0	0.0
31	0.0	0.0	67	0.0	0.0
32	0.0	0.0	68	0.0	0.0
33	0.0	0.0	69	0.0	0.0
34	0.0	0.0	70	0.0	0.0
35	0.0	0.0	71	0.0	0.0
36	0.0	0.0	72	0.0	0.0

STARTING TIME OF FORCING FUNCTION (SEC) = 0.0
STOPPING TIME OF FORCING FUNCTION (SEC) = 0.0
DURATION OF THE FORCING FUNCTION (SEC) = 0.0

J= 0 TIME= 0.0
TOTAL ENERGY INPUT (IN.-LB.) = 1322.718
KINETIC ENERGY (IN.-LB.) = 1322.718
ELASTIC ENERGY (IN.-LB.) = 0.0
PLASTIC WORK (IN.-LB.) = 0.0

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1 2	BOND 1
1	0.3551	-8.1341	0.0	0.0	0.0	0.0		
2	1.0627	-8.0722	0.0	0.0	0.0	0.0		
3	1.7622	-7.9489	0.0	0.0	0.0	0.0		
4	2.4483	-7.7650	0.0	0.0	0.0	0.0		
5	3.1158	-7.5221	0.0	0.0	0.0	0.0		
6	3.7595	-7.2219	0.0	0.0	0.0	0.0		
7	4.3746	-6.8668	0.0	0.0	0.0	0.0		
8	4.9565	-6.4594	0.0	0.0	0.0	0.0		
9	5.5006	-6.0028	0.0	0.0	0.0	0.0		
10	6.0028	-5.5006	0.0	0.0	0.0	0.0		
11	6.4594	-4.9565	0.0	0.0	0.0	0.0		
12	6.8668	-4.3746	0.0	0.0	0.0	0.0		
13	7.2219	-3.7595	0.0	0.0	0.0	0.0		
14	7.5221	-3.1158	0.0	0.0	0.0	0.0		
15	7.7650	-2.4483	0.0	0.0	0.0	0.0		
16	7.9489	-1.7622	0.0	0.0	0.0	0.0		
17	8.0722	-1.0627	0.0	0.0	0.0	0.0		
18	8.1341	-0.3552	0.0	0.0	0.0	0.0		
19	8.1341	0.3552	0.0	0.0	0.0	0.0		
20	8.0722	1.0627	0.0	0.0	0.0	0.0		
21	7.9489	1.7622	0.0	0.0	0.0	0.0		
22	7.7650	2.4483	0.0	0.0	0.0	0.0		
23	7.5221	3.1158	0.0	0.0	0.0	0.0		
24	7.2219	3.7595	0.0	0.0	0.0	0.0		
25	6.8668	4.3746	0.0	0.0	0.0	0.0		
26	6.4594	4.9565	0.0	0.0	0.0	0.0		
27	6.0028	5.5006	0.0	0.0	0.0	0.0		
28	5.5006	6.0028	0.0	0.0	0.0	0.0		
29	4.9565	6.4594	0.0	0.0	0.0	0.0		
30	4.3746	6.8668	0.0	0.0	0.0	0.0		
31	3.7595	7.2219	0.0	0.0	0.0	0.0		
32	3.1158	7.5221	0.0	0.0	0.0	0.0		
33	2.4483	7.7650	0.0	0.0	0.0	0.0		
34	1.7622	7.9489	0.0	0.0	0.0	0.0		
35	1.0627	8.0722	0.0	0.0	0.0	0.0		
36	0.3551	8.1341	0.0	0.0	0.0	0.0		
37	-0.3551	8.1341	0.0	0.0	0.0	0.0		
38	-1.0627	8.0722	0.0	0.0	0.0	0.0		
39	-1.7622	7.9489	0.0	0.0	0.0	0.0		
40	-2.4483	7.7650	0.0	0.0	0.0	0.0		
41	-3.1158	7.5221	0.0	0.0	0.0	0.0		
42	-3.7595	7.2219	0.0	0.0	0.0	0.0		
43	-4.3746	6.8668	0.0	0.0	0.0	0.0		
44	-4.9565	6.4594	0.0	0.0	0.0	0.0		
45	-5.5006	6.0028	0.0	0.0	0.0	0.0		
46	-6.0028	5.5006	0.0	0.0	0.0	0.0		
47	-6.4594	4.9565	0.0	0.0	0.0	0.0		
48	-6.8668	4.3746	0.0	0.0	0.0	0.0		
49	-7.2219	3.7595	0.0	0.0	0.0	0.0		
50	-7.5221	3.1158	0.0	0.0	0.0	0.0		
51	-7.7650	2.4483	0.0	0.0	0.0	0.0		
52	-7.9489	1.7622	0.0	0.0	0.0	0.0		
53	-8.0722	1.0627	0.0	0.0	0.0	0.0		
54	-8.1341	0.3552	0.0	0.0	0.0	0.0		
55	-8.1341	-0.3552	0.0	0.0	0.0	0.0		
56	-8.0722	-1.0627	0.0	0.0	0.0	0.0		
57	-7.9489	-1.7622	0.0	0.0	0.0	0.0		
58	-7.7650	-2.4483	0.0	0.0	0.0	0.0		
59	-7.5221	-3.1158	0.0	0.0	0.0	0.0		
60	-7.2219	-3.7595	0.0	0.0	0.0	0.0		
61	-6.8668	-4.3746	0.0	0.0	0.0	0.0		
62	-6.4594	-4.9565	0.0	0.0	0.0	0.0		
63	-6.0028	-5.5006	0.0	0.0	0.0	0.0		
64	-5.5006	-6.0028	0.0	0.0	0.0	0.0		
65	-4.9565	-6.4594	0.0	0.0	0.0	0.0		
66	-4.3746	-6.8668	0.0	0.0	0.0	0.0		
67	-3.7595	-7.2219	0.0	0.0	0.0	0.0		
68	-3.1158	-7.5221	0.0	0.0	0.0	0.0		
69	-2.4483	-7.7650	0.0	0.0	0.0	0.0		
70	-1.7622	-7.9489	0.0	0.0	0.0	0.0		
71	-1.0627	-8.0722	0.0	0.0	0.0	0.0		
72	-0.3551	-8.1341	0.0	0.0	0.0	0.0		

J= 5 TIME= 0.0000165

TOTAL ENERGY INPUT (IN.-LB.) = 1322.718
KINETIC ENERGY (IN.-LB.) = 1022.071
ELASTIC ENERGY (IN.-LB.) = 322.008
PLASTIC WORK (IN.-LB.) = -21.362

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1 2	BOND 1
1	0.3579	-8.1350	3704.0	672.9	0.0026	-0.0013		
2	1.0671	-8.0821	14292.6	466.8	0.0030	-0.0001		
3	1.7691	-7.9741	3671.6	-2628.5	-0.0085	0.0064		S
4	2.4521	-7.7759	13823.9	344.4	0.0026	0.0001		S
5	3.1165	-7.5237	4294.2	664.2	0.0027	-0.0013		
6	3.7602	-7.2216	14190.9	66.4	0.0017	0.0008		
7	4.3753	-6.8664	-159.7	2.9	-0.0000	-0.0000		
8	4.9566	-6.4593	-10812.7	65.3	-0.0009	-0.0009		
9	5.5006	-6.0028	-2519.1	15.3	-0.0002	-0.0002		
10	6.0028	-5.5006	-158.3	0.9	-0.0000	-0.0000		
11	6.4594	-4.9565	-1.8	0.0	-0.0000	-0.0000		
12	6.8668	-4.3746	0.0	-0.0	-0.0000	0.0000		
13	7.2219	-3.7595	-0.0	0.0	0.0000	-0.0000		
14	7.5221	-3.1158	0.0	0.0	0.0000	-0.0000		
15	7.7650	-2.4483	0.0	0.0	0.0	0.0		
16	7.9489	-1.7622	-0.0	0.0	0.0000	-0.0000		
17	8.0722	-1.0627	0.0	0.0	0.0000	-0.0000		
18	8.1341	-0.3552	-0.0	-0.0	-0.0000	0.0000		
19	8.1341	0.3552	0.1	0.0	0.0000	-0.0000		
20	8.0722	1.0627	-17.2	-0.3	-0.0000	-0.0000		
21	7.9489	1.7623	1131.6	-10.1	0.0001	0.0001		
22	7.7649	2.4488	7710.1	-59.1	0.0006	0.0007		
23	7.5213	3.1173	20000.1	-133.2	0.0016	0.0017		
24	7.2204	3.7615	12315.7	65.6	0.0015	0.0007		
25	6.8661	4.3774	3708.2	673.5	0.0027	-0.0013		
26	6.4658	4.9652	14293.8	466.6	0.0030	-0.0001		
27	6.0212	5.5191	3671.9	-2628.6	-0.0085	0.0064		S
28	5.5081	6.0115	13824.6	344.4	0.0026	0.0001		S
29	4.9575	6.4608	4294.2	664.2	0.0027	-0.0013		
30	4.3740	6.8672	14190.9	66.4	0.0017	0.0008		
31	3.7588	7.2223	-159.7	2.9	-0.0000	-0.0000		
32	3.1156	7.5222	-10812.7	65.3	-0.0009	-0.0009		
33	2.4483	7.7650	-2519.1	15.3	-0.0002	-0.0002		
34	1.7622	7.9489	-158.3	0.9	-0.0000	-0.0000		
35	1.0627	8.0722	-1.8	0.0	-0.0000	-0.0000		
36	0.3551	8.1341	0.0	-0.0	-0.0000	0.0000		
37	-0.3551	8.1341	-0.0	0.0	0.0000	-0.0000		
38	-1.0627	8.0722	0.0	0.0	0.0000	-0.0000		
39	-1.7622	7.9489	0.0	0.0	0.0	0.0		
40	-2.4483	7.7650	-0.0	0.0	0.0000	-0.0000		
41	-3.1158	7.5221	0.0	0.0	0.0000	-0.0000		
42	-3.7595	7.2219	-0.0	-0.0	-0.0000	0.0000		
43	-4.3746	6.8668	0.1	0.0	0.0000	-0.0000		
44	-4.9565	6.4594	-17.2	-0.3	-0.0000	-0.0000		
45	-5.5006	6.0028	1131.6	-10.1	0.0001	0.0001		
46	-6.0031	5.5002	7710.1	-59.1	0.0006	0.0007		
47	-6.4603	4.9550	20000.1	-133.2	0.0016	0.0017		
48	-6.8677	4.3724	12315.6	65.6	0.0015	0.0007		
49	-7.2240	3.7576	3708.1	673.5	0.0027	-0.0013		
50	-7.5329	3.1169	14293.8	466.6	0.0030	-0.0001		
51	-7.7903	2.4550	3671.8	-2628.6	-0.0085	0.0064		S
52	-7.9602	1.7644	13824.6	344.4	0.0026	0.0001		S
53	-8.0740	1.0629	4294.1	664.2	0.0027	-0.0013		
54	-8.1342	0.3544	14190.9	66.4	0.0017	0.0008		
55	-8.1341	-0.3560	-159.7	2.9	-0.0000	-0.0000		
56	-8.0722	-1.0629	-10812.8	65.3	-0.0009	-0.0009		
57	-7.9489	-1.7623	-2519.1	15.3	-0.0002	-0.0002		
58	-7.7650	-2.4483	-158.3	0.9	-0.0000	-0.0000		
59	-7.5221	-3.1158	-1.8	0.0	-0.0000	-0.0000		
60	-7.2219	-3.7595	0.0	-0.0	-0.0000	0.0000		
61	-6.8668	-4.3746	-0.0	0.0	0.0000	-0.0000		
62	-6.4594	-4.9565	0.0	0.0	0.0000	-0.0000		
63	-6.0028	-5.5006	0.0	0.0	0.0	0.0		
64	-5.5006	-6.0028	-0.0	0.0	0.0000	-0.0000		
65	-4.9565	-6.4594	0.0	0.0	0.0000	-0.0000		
66	-4.3746	-6.8668	-0.0	-0.0	-0.0000	0.0000		
67	-3.7595	-7.2219	0.1	0.0	0.0000	-0.0000		
68	-3.1158	-7.5221	-17.2	-0.3	-0.0000	-0.0000		
69	-2.4482	-7.7651	1131.6	-10.1	0.0001	0.0001		
70	-1.7617	-7.9490	7709.0	-59.1	0.0006	0.0007		
71	-1.0610	-8.0723	19997.8	-133.4	0.0016	0.0017		
72	-0.3527	-8.1338	12312.8	66.2	0.0015	0.0007		

J= 20 TIME= 0.0000660

TOTAL ENERGY INPUT (IN.-LB.) = 1322.718

KINETIC ENERGY (IN.-LB.) = 725.659

ELASTIC ENERGY (IN.-LB.) = 627.827

PLASTIC WORK (IN.-LB.) = -30.768

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1 2	BOND 1
1	0.3658	-8.1517	4612.7	121.1	0.0009	0.0000		
2	1.0752	-8.1167	1680.2	-1660.4	-0.0054	0.0040		
3	1.7762	-8.0010	4284.4	-1175.6	-0.0035	0.0030		S
4	2.4608	-7.8118	1538.3	-1738.2	-0.0057	0.0042		S
5	3.1194	-7.5450	4774.9	-29.1	0.0004	0.0004		
6	3.7523	-7.2217	3156.9	1922.5	0.0068	-0.0043		
7	4.3663	-6.8637	6831.3	605.1	0.0027	-0.0010		
8	4.9511	-6.4596	10425.3	-284.6	0.0001	0.0014		
9	5.4972	-6.0036	19783.0	-242.7	0.0012	0.0019		
10	6.0005	-5.5007	21359.9	-133.7	0.0017	0.0018		
11	6.4575	-4.9563	7956.1	-48.1	0.0006	0.0007		
12	6.8654	-4.3740	10933.0	-75.1	0.0009	0.0009		
13	7.2209	-3.7582	13637.1	-92.0	0.0011	0.0011		
14	7.5212	-3.1137	13034.7	-86.5	0.0010	0.0011		
15	7.7640	-2.4456	9804.7	-69.6	0.0008	0.0008		
16	7.9476	-1.7585	15661.1	-104.8	0.0012	0.0013		
17	8.0704	-1.0582	11653.4	-80.2	0.0009	0.0010		
18	8.1316	-0.3499	12026.9	-84.3	0.0009	0.0010		
19	8.1306	0.3613	15647.2	-101.2	0.0012	0.0013		
20	8.0674	1.0697	16087.4	-98.5	0.0013	0.0013		
21	7.9429	1.7690	-810.7	-102.7	-0.0004	0.0002		
22	7.7568	2.4543	-2314.6	-220.9	-0.0010	0.0004		
23	7.5089	3.1201	2157.0	584.0	0.0022	-0.0012		
24	7.2102	3.7649	3141.1	1987.4	0.0070	-0.0044		
25	6.8767	4.3924	5303.6	147.6	0.0010	0.0000		
26	6.4916	4.9893	2271.6	-1664.0	-0.0054	0.0041		
27	6.0410	5.5386	4816.8	-1183.8	-0.0035	0.0031		S
28	5.5349	6.0370	1998.1	-1741.7	-0.0057	0.0042		S
29	4.9745	6.4740	5151.2	-31.9	0.0004	0.0004		
30	4.3781	6.8605	3446.5	1920.5	0.0068	-0.0043		
31	3.7610	7.2132	7045.2	603.8	0.0028	-0.0009		
32	3.1186	7.5176	10571.9	-285.5	0.0001	0.0014		
33	2.4507	7.7625	19880.7	-243.3	0.0012	0.0019		
34	1.7635	7.9470	21420.2	-134.1	0.0017	0.0018		
35	1.0635	8.0705	7992.6	-48.3	0.0006	0.0007		
36	0.3553	8.1326	10954.1	-75.2	0.0009	0.0009		
37	-0.3557	8.1326	13648.5	-92.1	0.0011	0.0011		
38	-1.0641	8.0704	13041.7	-86.6	0.0010	0.0011		
39	-1.7641	7.9466	9808.1	-69.7	0.0008	0.0008		
40	-2.4509	7.7621	15662.2	-104.8	0.0012	0.0013		
41	-3.1188	7.5183	11654.1	-80.2	0.0009	0.0010		
42	-3.7628	7.2171	12027.3	-84.3	0.0009	0.0010		
43	-4.3782	6.8606	15647.2	-101.2	0.0012	0.0013		
44	-4.9601	6.4518	16087.3	-98.5	0.0013	0.0013		
45	-5.5034	5.9943	-810.7	-102.7	-0.0004	0.0002		
46	-6.0038	5.4904	-2314.5	-220.9	-0.0010	0.0004		
47	-6.4565	4.9429	2157.0	584.0	0.0022	-0.0012		
48	-6.8656	4.3617	3141.1	1987.4	0.0070	-0.0044		
49	-7.2423	3.7592	5303.6	147.6	0.0010	0.0000		
50	-7.5667	3.1273	2271.7	-1664.0	-0.0054	0.0041		
51	-7.8171	2.4623	4816.8	-1183.8	-0.0035	0.0031		S
52	-7.9956	1.7749	1998.0	-1741.7	-0.0057	0.0042		S
53	-8.0939	1.0711	5151.2	-31.9	0.0004	0.0004		
54	-8.1304	0.3613	3446.5	1920.5	0.0068	-0.0043		
55	-8.1273	-0.3495	7045.0	603.8	0.0028	-0.0009		
56	-8.0697	-1.0580	10571.1	-285.5	0.0001	0.0014		
57	-7.9479	-1.7589	19878.5	-243.3	0.0012	0.0019		
58	-7.7640	-2.4463	21417.3	-134.1	0.0017	0.0018		
59	-7.5210	-3.1142	7988.1	-48.3	0.0006	0.0007		
60	-7.2207	-3.7586	10945.8	-75.2	0.0009	0.0009		
61	-6.8651	-4.3744	13634.2	-92.0	0.0011	0.0011		
62	-6.4571	-4.9567	13017.7	-86.4	0.0010	0.0011		
63	-6.0000	-5.5010	9766.9	-69.4	0.0008	0.0008		
64	-5.4967	-6.0036	15595.8	-104.3	0.0012	0.0013		
65	-4.9517	-6.4601	11549.1	-79.5	0.0009	0.0010		
66	-4.3688	-6.8672	11869.6	-83.3	0.0009	0.0010		
67	-3.7524	-7.2219	15421.7	-99.6	0.0012	0.0013		
68	-3.1074	-7.5215	15778.1	-96.1	0.0013	0.0013		
69	-2.4396	-7.7633	-1206.9	-100.6	-0.0005	0.0002		
70	-1.7531	-7.9447	-2804.6	-222.4	-0.0010	0.0003		
71	-1.0525	-8.0629	1595.5	584.9	0.0021	-0.0013		
72	-0.3448	-8.1265	2531.3	2019.2	0.0071	-0.0046		

J= 30 TIME= 0.0000990

TOTAL ENERGY INPUT (IN.-LB.) = 1322.718
KINETIC ENERGY (IN.-LB.) = 795.358
ELASTIC ENERGY (IN.-LB.) = 580.715
PLASTIC WORK (IN.-LB.) = -53.355

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1 2	BOND 1
1	0.3704	-8.1665	24239.9	-1012.7	-0.0010	0.0040		
2	1.0798	-8.1241	7162.8	-856.1	-0.0022	0.0025		
3	1.7813	-8.0107	6788.3	-1671.6	-0.0050	0.0044		S
4	2.4661	-7.8182	19688.4	-967.7	-0.0013	0.0036		S
5	3.1278	-7.5576	15801.2	-955.9	-0.0016	0.0033		
6	3.7589	-7.2318	-2596.6	344.3	0.0009	-0.0010		
7	4.3616	-6.8552	2264.7	2160.0	0.0075	-0.0049		
8	4.9434	-6.4482	-4817.4	679.4	0.0018	-0.0019		
9	5.4927	-5.9976	3573.3	-528.2	-0.0014	0.0015		
10	5.9964	-5.4968	639.2	-222.3	-0.0007	0.0006		
11	6.4526	-4.9522	1280.8	21.3	0.0002	0.0000		
12	6.8599	-4.3702	2031.5	2.0	0.0002	0.0001		
13	7.2150	-3.7550	961.3	-18.1	0.0000	0.0001		
14	7.5151	-3.1111	1657.3	-23.5	0.0001	0.0002		
15	7.7577	-2.4435	1645.0	-21.9	0.0001	0.0002		
16	7.9411	-1.7572	1688.1	-24.7	0.0001	0.0002		
17	8.0638	-1.0574	1906.3	-26.6	0.0001	0.0002		
18	8.1249	-0.3496	2710.5	-6.0	0.0003	0.0002		
19	8.1241	0.3608	2069.3	19.4	0.0003	0.0001		
20	8.0618	1.0685	3467.6	-229.0	-0.0004	0.0008		
21	7.9357	1.7677	4267.6	-570.1	-0.0015	0.0016		
22	7.7430	2.4517	4458.3	523.7	0.0022	-0.0009		
23	7.4971	3.1193	16763.5	2112.7	0.0088	-0.0038		T
24	7.2173	3.7732	15263.1	437.7	0.0030	0.0000		
25	6.8868	4.4035	23728.6	-924.9	-0.0007	0.0038		
26	6.4955	4.9967	6528.7	-846.6	-0.0022	0.0024		
27	6.0468	5.5476	6261.1	-1671.4	-0.0050	0.0043		S
28	5.5378	6.0445	19336.7	-974.1	-0.0013	0.0036		S
29	4.9813	6.4873	15609.6	-954.8	-0.0017	0.0033		
30	4.3836	6.8710	-2609.6	341.1	0.0009	-0.0010		
31	3.7562	7.2047	2411.8	2157.5	0.0075	-0.0049		
32	3.1128	7.5051	-4521.6	679.2	0.0018	-0.0019		
33	2.4479	7.7555	3978.8	-530.4	-0.0014	0.0015		
34	1.7623	7.9413	1111.4	-225.7	-0.0007	0.0006		
35	1.0626	8.0642	1775.9	17.9	0.0002	0.0001		
36	0.3549	8.1259	2507.2	-1.2	0.0002	0.0002		
37	-0.3555	8.1259	1389.7	-20.9	0.0001	0.0001		
38	-1.0632	8.0638	2016.5	-25.9	0.0001	0.0002		
39	-1.7627	7.9401	1930.6	-23.8	0.0001	0.0002		
40	-2.4488	7.7558	1901.3	-26.0	0.0001	0.0002		
41	-3.1161	7.5122	2057.5	-27.6	0.0001	0.0002		
42	-3.7597	7.2112	2812.3	-6.6	0.0003	0.0002		
43	-4.3745	6.8553	2133.8	19.0	0.0003	0.0001		
44	-4.9563	6.4475	3507.6	-229.2	-0.0004	0.0008		
45	-5.4987	5.9887	4290.6	-570.2	-0.0015	0.0016		
46	-5.9947	5.4798	4470.9	523.7	0.0022	-0.0009		
47	-6.4500	4.9330	16770.5	2112.7	0.0088	-0.0038		T
48	-6.8764	4.3638	15264.8	437.7	0.0030	0.0000		
49	-7.2569	3.7624	23727.0	-924.9	-0.0007	0.0038		
50	-7.5750	3.1270	6524.7	-846.6	-0.0022	0.0024		
51	-7.8278	2.4629	6252.6	-1671.3	-0.0050	0.0043		S
52	-8.0036	1.7736	19321.3	-974.0	-0.0013	0.0036		S
53	-8.1088	1.0703	15583.6	-954.7	-0.0017	0.0033		
54	-8.1423	0.3609	-2653.6	341.3	0.0009	-0.0010		
55	-8.1175	-0.3494	2341.0	2158.0	0.0075	-0.0049		
56	-8.0560	-1.0568	-4630.8	679.9	0.0018	-0.0019		
57	-7.9404	-1.7578	3817.8	-529.4	-0.0014	0.0015		
58	-7.7585	-2.4444	886.0	-224.2	-0.0007	0.0006		
59	-7.5151	-3.1118	1475.2	19.9	0.0002	0.0001		
60	-7.2147	-3.7556	2129.2	1.4	0.0002	0.0001		
61	-6.8596	-4.3707	941.0	-17.9	0.0000	0.0001		
62	-6.4520	-4.9526	1516.2	-22.5	0.0001	0.0002		
63	-5.9951	-5.4965	1413.2	-20.3	0.0001	0.0001		
64	-5.4925	-5.9985	1404.0	-22.7	0.0001	0.0001		
65	-4.9479	-6.4547	1636.4	-24.8	0.0001	0.0002		
66	-4.3655	-6.8615	2516.1	-4.5	0.0002	0.0002		
67	-3.7499	-7.2161	2008.0	21.1	0.0003	0.0001		
68	-3.1059	-7.5161	3525.2	-229.0	-0.0004	0.0008		
69	-2.4373	-7.7565	4384.5	-579.9	-0.0015	0.0017		
70	-1.7486	-7.9316	4703.6	512.8	0.0022	-0.0009		
71	-1.0474	-8.0523	17183.6	2110.1	0.0089	-0.0038		T
72	-0.3412	-8.1368	15752.6	521.1	0.0034	-0.0001		

J= 40 TIME= 0.0001320

TOTAL ENERGY INPUT (IN.-LB.) = 1322.718

KINETIC ENERGY (IN.-LB.) = 810.475

ELASTIC ENERGY (IN.-LB.) = 509.220

PLASTIC WORK (IN.-LB.) = 3.022

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1 2	BOND 1
1	0.3727	-8.1701	-4450.9	-459.9	-0.0020	0.0008		
2	1.0814	-8.1288	-3782.9	-1316.1	-0.0048	0.0028		
3	1.7815	-8.0107	-5108.1	-738.9	-0.0030	0.0014		S
4	2.4664	-7.8234	-2633.1	-1249.5	-0.0045	0.0027		S
5	3.1272	-7.5634	-4023.8	-530.9	-0.0022	0.0010		
6	3.7600	-7.2411	-2649.5	-190.1	-0.0009	0.0003		
7	4.3611	-6.8629	-2529.4	600.4	0.0018	-0.0016		T
8	4.9313	-6.4389	254.8	2226.9	0.0076	-0.0052		
9	5.4788	-5.9866	-3730.2	572.2	0.0016	-0.0016		
10	5.9894	-5.4927	3096.3	-870.4	-0.0026	0.0023		
11	6.4475	-4.9499	1226.0	-324.7	-0.0010	0.0008		
12	6.8535	-4.3672	-2711.5	116.7	0.0001	-0.0005		
13	7.2086	-3.7511	14152.9	-56.1	0.0012	0.0011		
14	7.5089	-3.1066	13056.2	-116.2	0.0009	0.0012		
15	7.7514	-2.4382	13296.2	-114.7	0.0010	0.0012		
16	7.9341	-1.7520	-3227.7	-9.5	-0.0004	-0.0002		
17	8.0559	-1.0526	-5585.8	70.3	-0.0003	-0.0005		
18	8.1168	-0.3455	-9921.3	169.4	-0.0004	-0.0011		
19	8.1170	0.3650	3113.8	-319.2	-0.0008	0.0010		
20	8.0520	1.0719	-4885.4	-853.0	-0.0034	0.0017		
21	7.9155	1.7687	-6328.6	498.5	0.0010	-0.0016		
22	7.7239	2.4528	-732.4	2254.6	0.0075	-0.0053		
23	7.4980	3.1259	-6149.7	740.4	0.0019	-0.0022		T
24	7.2217	3.7801	-3907.0	-77.8	-0.0007	-0.0001		
25	6.8885	4.4070	-4753.0	-370.4	-0.0017	0.0005		
26	6.4981	5.0001	-4030.3	-1225.3	-0.0046	0.0026		
27	6.0463	5.5477	-5377.0	-774.1	-0.0032	0.0014		S
28	5.5419	6.0474	-2990.0	-1260.8	-0.0046	0.0028		S
29	4.9865	6.4897	-4365.4	-537.4	-0.0023	0.0010		
30	4.3910	6.8766	-3095.9	-190.6	-0.0010	0.0002		
31	3.7629	7.2081	-3068.8	602.8	0.0017	-0.0016		T
32	3.1106	7.4898	-287.2	2231.0	0.0075	-0.0053		
33	2.4452	7.7378	-4340.4	578.2	0.0015	-0.0017		
34	1.7622	7.9331	2390.0	-865.3	-0.0027	0.0022		
35	1.0631	8.0585	490.0	-320.8	-0.0010	0.0008		
36	0.3556	8.1187	-3359.6	120.4	0.0001	-0.0005		
37	-0.3555	8.1182	13640.4	-52.9	0.0012	0.0011		
38	-1.0638	8.0561	12699.7	-114.0	0.0009	0.0011		
39	-1.7639	7.9320	13102.4	-113.6	0.0009	0.0012		
40	-2.4495	7.7471	-3256.2	-9.5	-0.0004	-0.0002		
41	-3.1162	7.5029	-5458.7	69.3	-0.0003	-0.0005		
42	-3.7590	7.2021	-9668.9	167.5	-0.0004	-0.0011		
43	-4.3744	6.8471	3452.6	-321.6	-0.0007	0.0010		
44	-4.9542	6.4373	-4509.0	-855.1	-0.0033	0.0017		
45	-5.4894	5.9708	-5961.0	496.2	0.0011	-0.0016		
46	-5.9860	5.4627	-416.8	2251.8	0.0076	-0.0053		
47	-6.4560	4.9305	-5921.3	739.0	0.0019	-0.0021		T
48	-6.8844	4.3642	-3790.9	-78.2	-0.0006	-0.0001		
49	-7.2608	3.7622	-4761.6	-370.1	-0.0017	0.0005		
50	-7.5792	3.1276	-4163.0	-1224.4	-0.0046	0.0026		
51	-7.8276	2.4625	-5622.8	-772.2	-0.0032	0.0014		S
52	-8.0081	1.7758	-3324.9	-1259.0	-0.0046	0.0027		S
53	-8.1135	1.0737	-4755.1	-535.1	-0.0023	0.0009		
54	-8.1509	0.3646	-3497.3	-189.3	-0.0010	0.0002		
55	-8.1238	-0.3451	-3431.6	606.7	0.0017	-0.0017		T
56	-8.0418	-1.0509	-556.3	2235.0	0.0075	-0.0053		
57	-7.9239	-1.7511	-4463.6	577.7	0.0015	-0.0017		
58	-7.7516	-2.4402	2434.5	-866.5	-0.0027	0.0022		
59	-7.5106	-3.1084	672.4	-321.4	-0.0010	0.0008		
60	-7.2090	-3.7513	-3094.6	119.0	0.0001	-0.0005		
61	-6.8531	-4.3669	14035.3	-55.4	0.0012	0.0011		
62	-6.4452	-4.9493	13258.7	-117.5	0.0009	0.0012		
63	-5.9876	-5.4936	13703.0	-117.3	0.0010	0.0012		
64	-5.4847	-5.9950	-2668.5	-13.4	-0.0003	-0.0002		
65	-4.9399	-6.4503	-4844.9	65.6	-0.0003	-0.0005		
66	-4.3579	-6.8566	-9110.8	166.5	-0.0004	-0.0010		
67	-3.7428	-7.2121	3930.6	-323.0	-0.0007	0.0010		
68	-3.0980	-7.5093	-4042.0	-864.6	-0.0033	0.0018		
69	-2.4264	-7.7396	-5611.5	476.0	0.0010	-0.0015		
70	-1.7380	-7.9155	-75.5	2203.3	0.0074	-0.0052		
71	-1.0419	-8.0557	-5604.1	825.2	0.0022	-0.0023		T
72	-0.3373	-8.1438	-3461.4	12.8	-0.0003	-0.0003		

J= 60 TIME= 0.0001980

TOTAL ENERGY INPUT (IN.-LB.) = 1322.718

KINETIC ENERGY (IN.-LB.) = 665.879

ELASTIC ENERGY (IN.-LB.) = 703.615

PLASTIC WORK (IN.-LB.) = -46.777

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1	LAYER 2	BOND 1
1	0.3782	-8.1799	-1200.2	-535.0	-0.0019	0.0012			
2	1.0862	-8.1344	-13276.2	-825.3	-0.0041	0.0010			
3	1.7861	-8.0170	-11350.8	-617.7	-0.0032	0.0007			S
4	2.4713	-7.8314	-6033.9	-1200.6	-0.0047	0.0024			S
5	3.1327	-7.5735	-5626.7	-468.4	-0.0022	0.0007			
6	3.7661	-7.2539	-15033.0	-471.0	-0.0031	0.0001			
7	4.3666	-6.8744	1246.2	61.8	0.0003	-0.0001			T
8	4.9324	-6.4445	2081.3	858.7	0.0031	-0.0019			
9	5.4647	-5.9749	-9388.6	1005.1	0.0024	-0.0030			
10	5.9620	-5.4683	-9640.0	1903.5	0.0055	-0.0051			
11	6.4291	-4.9346	-19309.7	174.6	-0.0014	-0.0017			
12	6.8487	-4.3625	-11508.5	-1427.9	-0.0060	0.0026			
13	7.2018	-3.7473	-14850.5	-315.8	-0.0026	-0.0003			
14	7.4960	-3.1014	-10862.9	405.1	0.0003	-0.0017			
15	7.7364	-2.4338	-13054.5	314.8	-0.0003	-0.0016			
16	7.9205	-1.7484	-10650.9	425.4	0.0004	-0.0017			
17	8.0482	-1.0505	-12486.8	-274.6	-0.0022	-0.0002			
18	8.1106	-0.3436	-8214.0	-1485.6	-0.0059	0.0029			
19	8.0935	0.3661	-8575.3	-37.0	-0.0010	-0.0005			
20	8.0135	1.0722	3012.5	1773.6	0.0063	-0.0040			
21	7.8927	1.7720	-3232.7	1008.3	0.0031	-0.0026			
22	7.7224	2.4616	-1846.4	1038.1	0.0033	-0.0026			
23	7.5042	3.1367	-14826.2	313.6	-0.0004	-0.0018			T
24	7.2305	3.7913	-13619.4	-453.7	-0.0029	0.0001			
25	6.8949	4.4172	-648.3	-471.7	-0.0017	0.0011			
26	6.5019	5.0080	-12641.3	-973.2	-0.0046	0.0014			
27	6.0494	5.5547	-10701.2	-545.8	-0.0029	0.0005			S
28	5.5458	6.0551	-5311.2	-1075.8	-0.0042	0.0022			S
29	4.9924	6.4999	-5001.9	-554.6	-0.0024	0.0010			
30	4.3991	6.8888	-14546.9	-520.5	-0.0032	0.0002			
31	3.7700	7.2189	1582.8	71.9	0.0004	-0.0001			T
32	3.1148	7.4938	2212.7	867.8	0.0032	-0.0019			
33	2.4420	7.7200	-9461.0	1012.0	0.0025	-0.0030			
34	1.7546	7.8974	-9906.0	1906.0	0.0054	-0.0052			
35	1.0589	8.0351	-19721.9	171.5	-0.0014	-0.0018			
36	0.3537	8.1124	-11958.7	-1427.0	-0.0060	0.0025			
37	-0.3557	8.1106	-15294.7	-310.6	-0.0026	-0.0003			
38	-1.0620	8.0425	-11182.4	407.8	0.0002	-0.0017			
39	-1.7604	7.9169	-13184.1	314.6	-0.0003	-0.0016			
40	-2.4460	7.7336	-10617.9	425.7	0.0004	-0.0017			
41	-3.1143	7.4952	-12251.5	-273.9	-0.0022	-0.0002			
42	-3.7578	7.1958	-7889.2	-1488.8	-0.0058	0.0030			
43	-4.3638	6.8262	-8116.3	-45.1	-0.0010	-0.0005			
44	-4.9353	6.4038	3626.6	1770.2	0.0063	-0.0039			
45	-5.4810	5.9492	-2685.6	1011.0	0.0031	-0.0026			
46	-5.9931	5.4570	-1404.3	1036.3	0.0034	-0.0025			
47	-6.4687	4.9305	-14436.2	307.6	-0.0004	-0.0017			T
48	-6.8987	4.3661	-13419.8	-456.6	-0.0029	0.0002			
49	-7.2730	3.7625	-680.1	-470.0	-0.0017	0.0011			
50	-7.5880	3.1267	-12768.3	-971.6	-0.0046	0.0014			
51	-7.8352	2.4615	-10981.7	-545.0	-0.0030	0.0005			S
52	-8.0168	1.7753	-5807.3	-1074.8	-0.0042	0.0021			S
53	-8.1253	1.0736	-5589.4	-550.4	-0.0024	0.0009			
54	-8.1654	0.3654	-15159.3	-511.3	-0.0033	0.0002			
55	-8.1368	-0.3445	1059.8	76.9	0.0004	-0.0001			T
56	-8.0473	-1.0493	1878.6	867.4	0.0031	-0.0019			
57	-7.9068	-1.7451	-9643.7	1008.3	0.0024	-0.0030			
58	-7.7167	-2.4291	-9847.5	1904.0	0.0054	-0.0051			
59	-7.4881	-3.1004	-19472.4	174.4	-0.0014	-0.0017			
60	-7.2024	-3.7498	-11555.7	-1427.4	-0.0060	0.0026			
61	-6.8462	-4.3633	-14759.9	-316.0	-0.0026	-0.0003			
62	-6.4340	-4.9410	-10649.1	402.6	0.0003	-0.0017			
63	-5.9760	-5.4830	-12661.5	311.3	-0.0002	-0.0016			
64	-5.4744	-5.9851	-10255.2	425.1	0.0004	-0.0017			
65	-4.9338	-6.4447	-12071.7	-268.6	-0.0021	-0.0002			
66	-4.3529	-6.8524	-7953.1	-1474.0	-0.0058	0.0029			
67	-3.7299	-7.1926	-8386.9	-82.7	-0.0011	-0.0004			
68	-3.0783	-7.4761	3168.5	1689.5	0.0060	-0.0037			
69	-2.4114	-7.7203	-3257.2	1140.2	0.0035	-0.0029			
70	-1.7291	-7.9179	-2032.5	1113.0	0.0036	-0.0028			
71	-1.0356	-8.0676	-15087.0	167.3	-0.0010	-0.0014			T
72	-0.3319	-8.1572	-14017.4	-381.5	-0.0027	-0.0001			

J= 80 TIME= 0.0002640

TOTAL ENERGY INPUT (IN.-LB.) = 1322.718
KINETIC ENERGY (IN.-LB.) = 911.298
ELASTIC ENERGY (IN.-LB.) = 468.064
PLASTIC WORK (IN.-LB.) = -56.645

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1 2	BOND 1
1	0.3832	-8.1984	15461.8	-618.5	-0.0005	0.0025		
2	1.0932	-8.1518	22745.0	-955.8	-0.0009	0.0038		
3	1.7949	-8.0340	20214.9	-853.9	-0.0008	0.0034		S
4	2.4802	-7.8476	-50.8	-1008.1	-0.0034	0.0024		S
5	3.1424	-7.5914	-5613.8	-489.7	-0.0022	0.0008		
6	3.7770	-7.2731	-4394.8	-812.9	-0.0032	0.0016		
7	4.3767	-6.8922	1231.5	-14.1	0.0001	0.0001		T
8	4.9408	-6.4604	858.2	432.8	0.0015	-0.0010		
9	5.4682	-5.9852	-8046.0	736.8	0.0017	-0.0023		
10	5.9584	-5.4709	1134.6	1479.3	0.0051	-0.0034		
11	6.4151	-4.9268	-341.9	660.5	0.0022	-0.0016		
12	6.8286	-4.3497	-8033.9	614.9	0.0013	-0.0020		
13	7.1961	-3.7418	2153.0	-347.8	-0.0010	0.0010		
14	7.5055	-3.1029	-5922.6	-809.8	-0.0033	0.0015		
15	7.7491	-2.4357	-1213.4	-255.6	-0.0010	0.0005		
16	7.9306	-1.7493	-3681.0	-848.5	-0.0032	0.0017		
17	8.0417	-1.0478	166.0	-422.6	-0.0014	0.0010		
18	8.0863	-0.3392	-6387.4	506.1	0.0011	-0.0016		
19	8.0744	0.3714	4572.0	603.6	0.0025	-0.0011		
20	8.0080	1.0785	-3564.3	1598.0	0.0050	-0.0040		
21	7.8981	1.7802	-1287.1	785.3	0.0025	-0.0019		
22	7.7361	2.4724	8690.6	385.6	0.0022	-0.0003		
23	7.5193	3.1489	1287.3	61.0	0.0003	-0.0001		T
24	7.2450	3.8045	5631.6	-588.2	-0.0014	0.0018		
25	6.9086	4.4311	16415.2	-554.1	-0.0002	0.0024		
26	6.5143	5.0235	23656.4	-1187.7	-0.0016	0.0044		
27	6.0605	5.5715	21082.0	-777.9	-0.0005	0.0033		S
28	5.5561	6.0716	695.4	-1028.7	-0.0034	0.0025		S
29	5.0027	6.5165	-4954.6	-463.4	-0.0021	0.0007		
30	4.4096	6.9067	-3905.7	-679.5	-0.0027	0.0013		
31	3.7805	7.2368	1486.0	-111.6	-0.0002	0.0004		T
32	3.1246	7.5097	871.1	362.8	0.0013	-0.0008		
33	2.4492	7.7283	-8155.4	778.5	0.0018	-0.0024		
34	1.7586	7.8956	854.8	1498.0	0.0051	-0.0035		
35	1.0591	8.0191	-662.1	652.5	0.0021	-0.0016		
36	0.3527	8.0887	-8333.2	613.9	0.0012	-0.0020		
37	-0.3576	8.1029	1892.9	-340.0	-0.0010	0.0009		
38	-1.0655	8.0515	-6009.4	-808.3	-0.0033	0.0015		
39	-1.7651	7.9289	-1180.8	-262.3	-0.0010	0.0005		
40	-2.4503	7.7428	-3501.2	-848.9	-0.0032	0.0017		
41	-3.1134	7.4882	506.3	-417.9	-0.0014	0.0010		
42	-3.7494	7.1726	-5978.8	502.1	0.0011	-0.0016		
43	-4.3589	6.8071	5058.8	597.0	0.0025	-0.0011		
44	-4.9381	6.3959	-3039.3	1592.5	0.0051	-0.0039		
45	-5.4909	5.9498	-804.9	780.6	0.0026	-0.0019		
46	-6.0093	5.4633	9144.2	386.3	0.0022	-0.0003		
47	-6.4867	4.9373	1581.3	64.4	0.0004	-0.0000		T
48	-6.9174	4.3720	5792.7	-588.4	-0.0014	0.0018		
49	-7.2919	3.7674	16424.8	-560.0	-0.0002	0.0024		
50	-7.6077	3.1297	23494.1	-1191.7	-0.0017	0.0044		
51	-7.8553	2.4627	20816.9	-774.5	-0.0005	0.0032		S
52	-8.0361	1.7758	263.0	-1020.7	-0.0034	0.0024		S
53	-8.1447	1.0742	-5388.2	-456.1	-0.0021	0.0007		
54	-8.1862	0.3654	-4383.5	-677.3	-0.0027	0.0013		
55	-8.1575	-0.3444	1025.4	-111.3	-0.0003	0.0003		T
56	-8.0660	-1.0489	538.5	358.7	0.0013	-0.0008		
57	-7.9175	-1.7431	-8429.9	778.1	0.0018	-0.0024		
58	-7.7170	-2.4247	747.1	1504.2	0.0052	-0.0035		
59	-7.4743	-3.0923	-618.6	660.0	0.0022	-0.0016		
60	-7.1813	-3.7389	-8185.4	610.5	0.0012	-0.0020		
61	-6.8386	-4.3611	2140.2	-354.2	-0.0010	0.0010		
62	-6.4399	-4.9485	-5666.9	-816.0	-0.0033	0.0015		
63	-5.9838	-5.4930	-886.6	-234.4	-0.0009	0.0005		
64	-5.4802	-5.9934	-3233.3	-806.6	-0.0031	0.0017		
65	-4.9286	-6.4410	669.6	-500.6	-0.0016	0.0012		
66	-4.3371	-6.8337	-6028.3	399.9	0.0007	-0.0014		
67	-3.7151	-7.1775	4819.8	736.2	0.0030	-0.0014		
68	-3.0695	-7.4736	-3434.6	1625.3	0.0051	-0.0041		
69	-2.4070	-7.7298	-1412.0	776.1	0.0025	-0.0019		
70	-1.7267	-7.9359	8343.3	478.6	0.0025	-0.0006		
71	-1.0328	-8.0877	548.8	-157.1	-0.0005	0.0004		T
72	-0.3279	-8.1768	4709.4	-523.4	-0.0013	0.0015		

J= 92 TIME= 0.0003036

TOTAL ENERGY INPUT (IN.-LB.) = 1322.718

KINETIC ENERGY (IN.-LB.) = 455.917

ELASTIC ENERGY (IN.-LB.) = 878.748

PLASTIC WORK (IN.-LB.) = -11.947

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1	LAYER 2	BOND 1
1	0.3864	-8.2081	-864.0	-639.0	-0.0023	0.0014			
2	1.0953	-8.1613	3224.0	-857.2	-0.0026	0.0022			
3	1.7962	-8.0433	7971.0	-763.4	-0.0018	0.0023			S
4	2.4815	-7.8568	-1460.3	-778.0	-0.0028	0.0017			S
5	3.1450	-7.6026	5505.7	-919.3	-0.0026	0.0025			
6	3.7795	-7.2823	8395.3	-484.3	-0.0008	0.0017			
7	4.3807	-6.9039	178.4	-212.2	-0.0007	0.0005			T
8	4.9455	-6.4722	8936.3	60.9	0.0011	0.0005			
9	5.4715	-5.9938	11123.3	936.1	0.0043	-0.0014			
10	5.9622	-5.4794	9594.9	403.9	0.0023	-0.0003			
11	6.4103	-4.9276	6666.1	909.0	0.0037	-0.0017			
12	6.8180	-4.3444	20049.0	927.4	0.0052	-0.0008			
13	7.1838	-3.7338	24229.9	1161.1	0.0064	-0.0011			
14	7.5086	-3.1003	26809.6	-876.1	-0.0003	0.0039			
15	7.7688	-2.4385	19692.7	-3395.7	-0.0095	0.0094		*	
16	7.9335	-1.7468	13080.7	-970.9	-0.0020	0.0032			
17	8.0270	-1.0423	4702.6	1147.0	0.0043	-0.0024			
18	8.0723	-0.3332	2962.9	1049.4	0.0038	-0.0023			
19	8.0679	0.3774	3060.2	1004.0	0.0037	-0.0021			
20	8.0133	1.0864	12312.0	404.1	0.0026	-0.0001			
21	7.9027	1.7885	5639.5	979.6	0.0039	-0.0019			
22	7.7427	2.4807	2499.4	221.9	0.0010	-0.0004			
23	7.5255	3.1572	3147.0	-13.2	0.0003	0.0002			T
24	7.2502	3.8125	8851.2	-435.7	-0.0006	0.0016			
25	6.9151	4.4387	-1111.1	-678.5	-0.0024	0.0015			
26	6.5200	5.0292	2881.5	-719.5	-0.0021	0.0019			
27	6.0685	5.5780	7577.1	-973.3	-0.0025	0.0028			S
28	5.5636	6.0775	-1807.1	-782.8	-0.0028	0.0017			S
29	5.0110	6.5242	5200.2	-813.2	-0.0022	0.0023			
30	4.4164	6.9135	8138.3	-510.8	-0.0009	0.0018			
31	3.7880	7.2447	-69.5	-80.8	-0.0003	0.0002			T
32	3.1323	7.5192	8653.6	14.9	0.0009	0.0006			
33	2.4552	7.7362	10767.3	809.8	0.0038	-0.0012			
34	1.7642	7.9032	9226.4	436.9	0.0024	-0.0004			
35	1.0622	8.0148	6215.7	959.7	0.0039	-0.0018			
36	0.3534	8.0765	19558.5	928.0	0.0051	-0.0008			
37	-0.3583	8.0881	23638.2	1157.3	0.0063	-0.0011			
38	-1.0692	8.0526	26209.4	-872.3	-0.0003	0.0038			
39	-1.7725	7.9471	19165.1	-3400.8	-0.0096	0.0093			
40	-2.4538	7.7439	12462.1	-968.8	-0.0020	0.0031			
41	-3.1106	7.4726	4137.1	1156.4	0.0043	-0.0024			
42	-3.7474	7.1573	2384.2	1057.2	0.0038	-0.0023			
43	-4.3606	6.7983	2547.2	1004.7	0.0037	-0.0022			
44	-4.9473	6.3967	11799.4	401.0	0.0025	-0.0001			
45	-5.5000	5.9498	5178.1	979.9	0.0038	-0.0019			
46	-6.0195	5.4651	2125.6	226.3	0.0010	-0.0004			
47	-6.4968	4.9388	2823.6	-6.4	0.0003	0.0002			T
48	-6.9267	4.3727	8684.3	-431.2	-0.0006	0.0016			
49	-7.3015	3.7695	-1179.3	-681.6	-0.0024	0.0015			
50	-7.6154	3.1321	2938.7	-726.1	-0.0022	0.0019			
51	-7.8649	2.4667	7764.6	-972.5	-0.0025	0.0028			S
52	-8.0450	1.7797	-1536.2	-778.2	-0.0028	0.0017			S
53	-8.1556	1.0778	5547.5	-812.2	-0.0022	0.0023			
54	-8.1957	0.3682	8530.7	-517.9	-0.0009	0.0018			
55	-8.1683	-0.3417	345.8	-91.2	-0.0003	0.0002			T
56	-8.0781	-1.0468	9106.3	8.4	0.0009	0.0006			
57	-7.9274	-1.7417	11240.8	814.2	0.0039	-0.0011			
58	-7.7265	-2.4236	9717.6	443.5	0.0025	-0.0004			
59	-7.4723	-3.0874	6726.4	955.5	0.0039	-0.0018			
60	-7.1714	-3.7322	20046.3	907.2	0.0051	-0.0008			
61	-6.8255	-4.3544	24171.0	1143.4	0.0063	-0.0010			
62	-6.4391	-4.9522	26706.9	-823.7	-0.0001	0.0038			
63	-5.9963	-5.5088	19360.2	-3333.3	-0.0094	0.0093		*	
64	-5.4803	-5.9978	12907.3	-1091.5	-0.0024	0.0034			
65	-4.9165	-6.4306	4518.2	1105.7	0.0042	-0.0023			
66	-4.3244	-6.8235	2754.6	1165.6	0.0042	-0.0025			
67	-3.7070	-7.1752	2878.3	965.4	0.0036	-0.0021			
68	-3.0657	-7.4822	12086.2	516.9	0.0030	-0.0004			
69	-2.4027	-7.7384	5508.2	982.3	0.0039	-0.0019			
70	-1.7235	-7.9470	2407.1	15.0	0.0003	0.0001			
71	-1.0288	-8.0960	3146.4	115.6	0.0007	-0.0001			T
72	-0.3237	-8.1854	9034.2	-480.7	-0.0007	0.0017			

J= 100 TIME= 0.0003300

TOTAL ENERGY INPUT (IN.-LB.) = 1322.718

KINETIC ENERGY (IN.-LB.) = 463.976

ELASTIC ENERGY (IN.-LB.) = 896.591

PLASTIC WORK (IN.-LB.) = -37.849

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1 2	BOND 1
1	0.3881	-8.2118	9286.9	-607.0	-0.0011	0.0021		
2	1.0975	-8.1659	10133.2	-987.1	-0.0023	0.0030		
3	1.7984	-8.0477	9621.1	-808.7	-0.0018	0.0026		S
4	2.4843	-7.8604	12871.3	-939.0	-0.0019	0.0031		S
5	3.1477	-7.6047	12229.2	-679.6	-0.0011	0.0024		
6	3.7833	-7.2858	14618.7	-793.9	-0.0012	0.0029		
7	4.3846	-6.9055	18871.4	-86.9	0.0016	0.0015		T
8	4.9505	-6.4746	16926.9	33.5	0.0018	0.0011		
9	5.4774	-5.9973	9394.7	268.7	0.0019	0.0000		
10	5.9635	-5.4786	8714.7	497.0	0.0026	-0.0006		
11	6.4068	-4.9240	-6999.2	868.1	0.0022	-0.0025		
12	6.8087	-4.3374	8307.8	2424.6	0.0090	-0.0051		T
13	7.1824	-3.7327	8627.1	324.1	0.0020	-0.0002		
14	7.5055	-3.1004	-1901.3	-1620.9	-0.0057	0.0037		
15	7.7548	-2.4354	200.2	-1298.3	-0.0044	0.0031		
16	7.9306	-1.7470	5394.8	-1821.2	-0.0056	0.0046		
17	8.0253	-1.0426	7444.4	158.8	0.0013	0.0001		
18	8.0605	-0.3329	-585.1	2500.1	0.0084	-0.0059		T
19	8.0626	0.3778	5433.3	905.7	0.0036	-0.0018		
20	8.0135	1.0878	22931.6	320.7	0.0034	0.0008		
21	7.9080	1.7909	11397.5	315.4	0.0022	0.0000		
22	7.7458	2.4835	15465.4	292.1	0.0025	0.0004		
23	7.5282	3.1601	7673.7	40.0	0.0009	0.0004		T
24	7.2534	3.8155	5868.2	-565.0	-0.0013	0.0017		
25	6.9170	4.4417	9005.9	-500.5	-0.0008	0.0018		
26	6.5230	5.0333	9918.8	-1028.6	-0.0025	0.0031		
27	6.0703	5.5813	9395.6	-719.0	-0.0015	0.0023		S
28	5.5659	6.0824	12519.7	-1158.2	-0.0027	0.0036		S
29	5.0118	6.5279	11777.4	-618.1	-0.0009	0.0023		
30	4.4174	6.9181	14048.5	-685.3	-0.0009	0.0026		
31	3.7877	7.2491	18170.4	-104.1	0.0015	0.0015		T
32	3.1316	7.5238	16160.3	132.6	0.0021	0.0008		
33	2.4553	7.7427	8457.9	187.2	0.0015	0.0001		
34	1.7631	7.9045	7841.8	393.5	0.0021	-0.0004		
35	1.0610	8.0102	-7782.5	936.6	0.0024	-0.0027		
36	0.3522	8.0646	7695.4	2481.5	0.0092	-0.0053		T
37	-0.3583	8.0863	8177.9	314.0	0.0019	-0.0002		
38	-1.0674	8.0502	-2212.8	-1636.7	-0.0058	0.0037		
39	-1.7680	7.9335	103.5	-1302.9	-0.0044	0.0031		
40	-2.4521	7.7416	5373.1	-1822.4	-0.0056	0.0046		
41	-3.1095	7.4713	7628.9	161.4	0.0013	0.0001		
42	-3.7417	7.1470	-331.5	2502.2	0.0084	-0.0059		T
43	-4.3583	6.7935	5810.9	904.8	0.0036	-0.0017		
44	-4.9487	6.3961	23361.7	313.7	0.0034	0.0009		
45	-5.5049	5.9531	11804.4	308.1	0.0022	0.0001		
46	-6.0236	5.4663	15869.0	290.5	0.0026	0.0004		
47	-6.5008	4.9395	7951.9	40.4	0.0009	0.0004		T
48	-6.9309	4.3739	5978.4	-566.4	-0.0013	0.0017		
49	-7.3051	3.7695	8903.9	-498.9	-0.0008	0.0018		
50	-7.6204	3.1325	9644.5	-1025.5	-0.0025	0.0031		
51	-7.8686	2.4664	8925.4	-715.7	-0.0015	0.0023		S
52	-8.0504	1.7791	11935.3	-1152.3	-0.0027	0.0035		S
53	-8.1592	1.0766	11163.6	-611.3	-0.0009	0.0022		
54	-8.2001	0.3667	13447.5	-687.2	-0.0010	0.0025		
55	-8.1718	-0.3441	17620.6	-108.0	0.0014	0.0015		T
56	-8.0817	-1.0496	15709.8	138.9	0.0021	0.0007		
57	-7.9331	-1.7447	8448.4	197.7	0.0015	0.0001		
58	-7.7272	-2.4251	7896.6	397.4	0.0021	-0.0004		
59	-7.4678	-3.0860	-7597.5	919.6	0.0023	-0.0027		
60	-7.1605	-3.7272	8108.9	2454.1	0.0091	-0.0052		T
61	-6.8237	-4.3532	8574.4	356.1	0.0021	-0.0003		
62	-6.4380	-4.9494	-1547.9	-1558.9	-0.0054	0.0035		
63	-5.9876	-5.4985	700.5	-1403.7	-0.0048	0.0035		
64	-5.4790	-5.9948	6184.7	-1891.8	-0.0058	0.0049		
65	-4.9156	-6.4282	8420.9	249.7	0.0017	-0.0000		
66	-4.3186	-6.8136	610.7	2458.1	0.0084	-0.0057		T
67	-3.7039	-7.1705	6635.0	997.1	0.0040	-0.0019		
68	-3.0648	-7.4837	24118.4	374.5	0.0037	0.0008		
69	-2.4036	-7.7453	12481.3	94.9	0.0016	0.0006		
70	-1.7224	-7.9502	16182.4	375.2	0.0029	0.0002		
71	-1.0276	-8.1001	8240.6	-6.8	0.0008	0.0006		T
72	-0.3226	-8.1893	6261.5	-465.1	-0.0009	0.0015		

J= 120 TIME= 0.0003960
TOTAL ENERGY INPUT (IN.-LB.) = 1322.718
KINETIC ENERGY (IN.-LB.) = 903.873
ELASTIC ENERGY (IN.-LB.) = 467.055
PLASTIC WORK (IN.-LB.) = -48.210

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1 2	BOND 1
1	0.3920	-8.2077	-4478.4	-133.0	-0.0009	0.0000		
2	1.1002	-8.1644	-10498.7	-1127.5	-0.0049	0.0019		
3	1.8006	-8.0459	634.1	-822.2	-0.0027	0.0020		S
4	2.4847	-7.8579	-12934.6	-807.6	-0.0040	0.0010		S
5	3.1470	-7.6012	-1024.8	-434.6	-0.0016	0.0009		
6	3.7817	-7.2834	-7722.8	-75.0	-0.0010	-0.0004		
7	4.3858	-6.9101	-3432.3	-221.9	-0.0011	0.0003		T
8	4.9533	-6.4835	-4445.1	-1067.3	-0.0041	0.0022		
9	5.4729	-5.9997	-8159.9	392.5	0.0005	-0.0015		
10	5.9517	-5.4747	982.9	1993.9	0.0068	-0.0046		
11	6.4011	-4.9244	1891.6	861.0	0.0031	-0.0019		T
12	6.8089	-4.3430	-3804.1	375.4	0.0009	-0.0011		T
13	7.1682	-3.7299	4237.0	-157.6	-0.0001	0.0007		
14	7.4714	-3.0871	7928.6	-396.1	-0.0005	0.0015		
15	7.7136	-2.4190	5409.7	-363.7	-0.0007	0.0013		
16	7.8926	-1.7318	-4070.0	-157.8	-0.0009	0.0001		
17	8.0089	-1.0316	-8686.6	-41.6	-0.0010	-0.0005		
18	8.0627	-0.3237	-7502.3	182.6	-0.0001	-0.0009		T
19	8.0562	0.3865	-2924.6	835.2	0.0025	-0.0022		T
20	7.9973	1.0939	-11007.4	2201.1	0.0063	-0.0059		
21	7.9014	1.7972	-9846.7	544.8	0.0008	-0.0020		
22	7.7499	2.4910	-2763.9	-818.9	-0.0031	0.0017		
23	7.5295	3.1658	-7296.8	-119.1	-0.0011	-0.0002		T
24	7.2494	3.8181	-6490.3	-51.1	-0.0008	-0.0003		
25	6.9125	4.4432	-3452.1	-287.0	-0.0013	0.0004		
26	6.5196	5.0343	-9511.4	-985.6	-0.0043	0.0017		
27	6.0670	5.5818	1709.7	-730.8	-0.0023	0.0018		S
28	5.5631	6.0814	-12166.5	-966.8	-0.0045	0.0014		S
29	5.0094	6.5263	-246.4	-356.2	-0.0012	0.0008		
30	4.4171	6.9176	-7242.6	-229.2	-0.0015	0.0000		
31	3.7913	7.2531	-3173.5	-218.9	-0.0011	0.0003		T
32	3.1376	7.5303	-4267.3	-888.3	-0.0034	0.0018		
33	2.4592	7.7393	-8223.4	330.6	0.0003	-0.0013		
34	1.7652	7.8918	899.7	2024.3	0.0069	-0.0047		
35	1.0640	8.0064	1588.7	825.6	0.0029	-0.0018		T
36	0.3567	8.0691	-4236.2	263.3	0.0005	-0.0009		T
37	-0.3539	8.0726	3840.3	-80.2	0.0001	0.0004		
38	-1.0621	8.0135	7535.1	-318.4	-0.0003	0.0013		
39	-1.7619	7.8897	5180.7	-403.0	-0.0009	0.0013		
40	-2.4465	7.7014	-4152.7	-190.7	-0.0011	0.0002		
41	-3.1111	7.4518	-8780.9	-34.5	-0.0010	-0.0005		
42	-3.7510	7.1443	-7455.3	190.2	-0.0001	-0.0010		T
43	-4.3628	6.7836	-2792.8	838.7	0.0025	-0.0022		T
44	-4.9460	6.3788	-10867.9	2205.0	0.0064	-0.0059		
45	-5.5072	5.9442	-9520.6	543.6	0.0009	-0.0019		
46	-6.0324	5.4662	-2473.6	-829.6	-0.0031	0.0018		
47	-6.5065	4.9379	-7039.2	-129.7	-0.0012	-0.0002		T
48	-6.9313	4.3690	-6288.4	-51.1	-0.0008	-0.0003		
49	-7.3041	3.7646	-3489.4	-278.7	-0.0013	0.0004		
50	-7.6196	3.1289	-9596.5	-976.4	-0.0043	0.0016		
51	-7.8675	2.4632	1363.9	-725.3	-0.0023	0.0018		S
52	-8.0483	1.7771	-12521.6	-973.8	-0.0046	0.0014		S
53	-8.1568	1.0752	-668.6	-367.8	-0.0013	0.0008		
54	-8.1994	0.3666	-7569.9	-226.7	-0.0015	0.0000		
55	-8.1769	-0.3432	-3382.2	-198.3	-0.0010	0.0002		T
56	-8.0902	-1.0478	-4338.8	-872.6	-0.0034	0.0017		
57	-7.9323	-1.7399	-8172.7	299.5	0.0002	-0.0013		
58	-7.7172	-2.4172	1004.1	1975.1	0.0068	-0.0046		
59	-7.4653	-3.0815	1788.4	893.1	0.0032	-0.0020		
60	-7.1659	-3.7255	-4007.1	350.5	0.0008	-0.0011		T
61	-6.8147	-4.3432	4245.7	-190.0	-0.0002	0.0007		
62	-6.4093	-4.9270	7806.1	-356.9	-0.0004	0.0014		
63	-5.9519	-5.4709	5364.0	-375.0	-0.0008	0.0014		
64	-5.4461	-5.9692	-4087.6	-247.7	-0.0013	0.0003		
65	-4.8969	-6.4191	-8528.9	152.8	-0.0004	-0.0009		
66	-4.3113	-6.8204	-7469.2	207.3	-0.0001	-0.0010		T
67	-3.6936	-7.1709	-2977.1	686.7	0.0020	-0.0018		T
68	-3.0513	-7.4732	-11189.2	2273.0	0.0065	-0.0061		
69	-2.3944	-7.7420	-10084.7	386.1	0.0003	-0.0016		
70	-1.7174	-7.9563	-3141.3	-722.7	-0.0028	0.0015		
71	-1.0227	-8.1024	-7890.6	34.4	-0.0027	-0.0006		T
72	-0.3180	-8.1872	-7194.5	-186.4	-0.0014	-0.0001		

J= 140 TIME= 0.0004620

TOTAL ENERGY INPUT (IN.-LB.) = 1322.718
KINETIC ENERGY (IN.-LB.) = 822.773
ELASTIC ENERGY (IN.-LB.) = 572.331
PLASTIC WORK (IN.-LB.) = -72.387

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1	LAYER 2	BOND 1	
1	0.3953	-8.2145	-11303.2	-289.0	-0.0021	-0.0001				
2	1.1026	-8.1613	-16476.0	-362.6	-0.0029	-0.0003				
3	1.8014	-8.0415	-22416.5	-180.3	-0.0029	-0.0011			S	
4	2.4872	-7.8576	-4931.4	-576.3	-0.0025	0.0010			S	
5	3.1515	-7.6082	-12001.9	-521.1	-0.0030	0.0004				
6	3.7883	-7.2958	-15494.2	-1439.6	-0.0064	0.0023				
7	4.3863	-6.9141	-15299.3	-364.2	-0.0028	-0.0002				T
8	4.9463	-6.4770	-1245.6	1143.1	0.0037	-0.0028				
9	5.4749	-6.0025	-798.1	766.8	0.0025	-0.0019				
10	5.9667	-5.4895	4900.4	43.6	0.0006	0.0002				
11	6.4123	-4.9365	-3632.6	167.6	0.0002	-0.0006				T
12	6.8095	-4.3477	-683.7	-333.2	-0.0012	0.0007				T
13	7.1503	-3.7249	-7544.4	10.5	-0.0007	-0.0005				
14	7.4352	-3.0745	-7209.9	1082.0	0.0029	-0.0030				
15	7.6738	-2.4053	2640.2	369.4	0.0015	-0.0006				
16	7.8572	-1.7195	-9764.9	873.0	0.0020	-0.0027				
17	7.9895	-1.0214	2104.4	35.3	0.0003	0.0001				
18	8.0610	-0.3147	794.7	-223.5	-0.0007	0.0006				T
19	8.0681	0.3954	-4960.3	149.9	0.0000	-0.0007				T
20	8.0146	1.1034	-4102.9	260.1	0.0005	-0.0009				
21	7.9025	1.8040	-16197.0	859.2	0.0013	-0.0031				
22	7.7383	2.4943	-15096.6	1392.9	0.0032	-0.0043				
23	7.5290	3.1719	-19761.8	-35.3	-0.0021	-0.0013				T
24	7.2597	3.8285	-8775.8	-1652.7	-0.0065	0.0033				
25	6.9169	4.4499	-11299.3	-448.8	-0.0027	0.0003				
26	6.5165	5.0354	-16335.9	-308.3	-0.0027	-0.0004				
27	6.0632	5.5806	-22414.7	-223.6	-0.0030	-0.0010			S	
28	5.5605	6.0821	-4901.0	-474.8	-0.0021	0.0008			S	
29	5.0127	6.5331	-12074.4	-402.6	-0.0026	0.0001				
30	4.4248	6.9299	-15608.8	-1673.0	-0.0072	0.0029				
31	3.7949	7.2562	-15546.2	-327.7	-0.0027	-0.0003				T
32	3.1362	7.5222	-1395.7	1120.6	0.0036	-0.0027				
33	2.4607	7.7420	-874.5	755.8	0.0025	-0.0018				
34	1.7703	7.9107	4752.5	254.3	0.0013	-0.0003				
35	1.0689	8.0217	-3809.1	89.4	-0.0001	-0.0005				T
36	0.3605	8.0719	-836.7	-395.4	-0.0014	0.0009				T
37	-0.3492	8.0555	-7556.3	4.8	-0.0008	-0.0005				
38	-1.0548	7.9769	-7127.3	998.1	0.0026	-0.0028				
39	-1.7536	7.8479	2770.2	450.5	0.0018	-0.0008				
40	-2.4392	7.6637	-9466.5	956.5	0.0023	-0.0029				
41	-3.1102	7.4301	2488.3	-34.5	0.0001	0.0002				
42	-3.7581	7.1388	1325.7	-273.6	-0.0008	0.0007				T
43	-4.3764	6.7895	-4227.7	175.1	0.0002	-0.0007				T
44	-4.9629	6.3891	-3317.1	275.1	0.0006	-0.0009				
45	-5.5137	5.9417	-15552.9	847.3	0.0013	-0.0031				
46	-6.0295	5.4544	-14464.3	1381.5	0.0032	-0.0042				
47	-6.5117	4.9343	-19002.3	-41.8	-0.0021	-0.0012				T
48	-6.9456	4.3727	-8315.8	-1653.8	-0.0064	0.0033				
49	-7.3123	3.7651	-10954.3	-446.2	-0.0026	0.0003				
50	-7.6192	3.1256	-16247.5	-307.4	-0.0027	-0.0004				
51	-7.8647	2.4604	-22355.3	-231.9	-0.0030	-0.0010			S	
52	-8.0476	1.7744	-5034.7	-481.8	-0.0021	0.0008			S	
53	-8.1641	1.0744	-12325.4	-382.2	-0.0025	0.0000				
54	-8.2139	0.3670	-15971.4	-1642.4	-0.0072	0.0028				
55	-8.1818	-0.3417	-15919.7	-370.8	-0.0029	-0.0002				T
56	-8.0827	-1.0451	-1794.1	1052.1	0.0034	-0.0026				
57	-7.9345	-1.7398	-1301.6	845.6	0.0027	-0.0021				
58	-7.7354	-2.4220	4639.9	342.3	0.0016	-0.0005				
59	-7.4818	-3.0853	-3937.8	9.1	-0.0004	-0.0003				
60	-7.1712	-3.7240	-795.3	-390.9	-0.0014	0.0009				T
61	-6.8023	-4.3306	-7510.5	-58.3	-0.0010	-0.0004				
62	-6.3810	-4.9021	-7091.0	918.1	0.0024	-0.0026				
63	-5.9187	-5.4418	2913.3	663.5	0.0024	-0.0012				
64	-5.4169	-5.9439	-9377.0	945.3	0.0022	-0.0029				
65	-4.8795	-6.4086	2513.6	-53.2	0.0001	0.0003				
66	-4.3034	-6.8243	1358.5	-232.1	-0.0007	0.0006				T
67	-3.6922	-7.1859	-4347.0	-53.9	-0.0006	-0.0002				T
68	-3.0514	-7.4920	-3424.2	397.6	0.0010	-0.0012				
69	-2.3885	-7.7449	-15770.2	937.7	0.0016	-0.0033				
70	-1.7087	-7.9485	-14708.4	1328.6	0.0030	-0.0041				
71	-1.0172	-8.1060	-19295.9	19.0	-0.0019	-0.0014				T
72	-0.3141	-8.2017	-8653.3	-1795.7	-0.0070	0.0036				

J= 160 TIME= 0.0005280
TOTAL ENERGY INPUT (IN.-LB.) = 1322.718
KINETIC ENERGY (IN.-LB.) = 985.471
ELASTIC ENERGY (IN.-LB.) = 370.320
PLASTIC WORK (IN.-LB.) = -33.073

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1 2	BOND 1
1	0.4004	-8.2266	135.6	-856.2	-0.0029	0.0020		
2	1.1086	-8.1783	-5913.0	-1011.0	-0.0040	0.0020		
3	1.8090	-8.0564	10075.6	-57.0	0.0008	0.0008		S
4	2.4951	-7.8742	-5706.0	-1220.8	-0.0047	0.0025		S
5	3.1587	-7.6189	12523.5	-930.9	-0.0019	0.0030		
6	3.7928	-7.2980	5544.5	-326.7	-0.0006	0.0011		
7	4.3945	-6.9203	1470.9	95.1	0.0004	-0.0001		T
8	4.9616	-6.4925	-826.3	701.8	0.0023	-0.0017		
9	5.4947	-6.0228	2089.4	204.8	0.0009	-0.0003		
10	5.9867	-5.5101	5039.7	-928.0	-0.0026	0.0025		
11	6.4241	-4.9499	6844.2	-271.2	-0.0002	0.0011		T
12	6.8088	-4.3524	4550.9	-176.1	-0.0001	0.0007		T
13	7.1384	-3.7226	7019.7	329.5	0.0018	-0.0003		
14	7.4159	-3.0679	9575.9	1432.6	0.0058	-0.0027		
15	7.6515	-2.3972	8649.3	639.5	0.0030	-0.0009		
16	7.8354	-1.7104	8765.6	1500.2	0.0060	-0.0029		
17	7.9763	-1.0137	6755.1	340.9	0.0018	-0.0003		
18	8.0603	-0.3079	8321.2	-115.7	0.0004	0.0008		T
19	8.0817	0.4027	8684.5	-210.3	0.0002	0.0011		T
20	8.0392	1.1118	3780.5	-609.0	-0.0017	0.0017		
21	7.9283	1.8138	4437.2	256.5	0.0013	-0.0003		
22	7.7598	2.5043	6149.9	427.0	0.0021	-0.0006		
23	7.5369	3.1793	8699.2	225.1	0.0016	0.0001		T
24	7.2589	3.8334	5757.8	-160.1	0.0000	0.0008		
25	6.9239	4.4597	-317.0	-710.4	-0.0024	0.0016		
26	6.5289	5.0495	-6387.0	-1089.6	-0.0043	0.0021		
27	6.0733	5.5952	9459.8	-201.8	0.0003	0.0011		S
28	5.5714	6.0973	-6011.3	-1091.7	-0.0043	0.0021		S
29	5.0185	6.5443	12402.5	-912.1	-0.0018	0.0030		
30	4.4236	6.9331	5438.7	-332.6	-0.0006	0.0011		
31	3.7957	7.2655	1444.1	212.7	0.0009	-0.0004		T
32	3.1423	7.5441	-871.7	479.4	0.0015	-0.0012		
33	2.4687	7.7701	2254.3	205.0	0.0009	-0.0003		
34	1.7784	7.9389	5001.5	-825.5	-0.0023	0.0023		
35	1.0746	8.0378	6979.7	-317.9	-0.0004	0.0012		T
36	0.3649	8.0718	4637.4	-20.3	0.0004	0.0004		T
37	-0.3454	8.0438	7099.2	258.6	0.0016	-0.0001		
38	-1.0511	7.9575	9702.8	1296.5	0.0054	-0.0024		
39	-1.7497	7.8253	8781.9	679.4	0.0032	-0.0010		
40	-2.4363	7.6408	8895.7	1475.5	0.0059	-0.0029		
41	-3.1099	7.4138	6980.2	401.8	0.0020	-0.0005		
42	-3.7632	7.1337	8336.5	-28.6	0.0007	0.0006		T
43	-4.3898	6.7978	8462.9	-292.4	-0.0001	0.0013		T
44	-4.9828	6.4065	3548.6	-677.7	-0.0019	0.0018		
45	-5.5348	5.9590	3855.2	304.6	0.0014	-0.0005		
46	-6.0484	5.4678	5695.9	464.9	0.0021	-0.0007		
47	-6.5216	4.9373	8134.4	222.2	0.0016	0.0000		T
48	-6.9492	4.3697	5300.8	-160.9	-0.0000	0.0007		
49	-7.3242	3.7665	-737.7	-720.3	-0.0025	0.0016		
50	-7.6375	3.1295	-6760.9	-1112.0	-0.0044	0.0021		
51	-7.8820	2.4620	9307.9	-176.5	0.0003	0.0010		S
52	-8.0658	1.7763	-6239.0	-1032.5	-0.0041	0.0020		S
53	-8.1771	1.0741	12116.1	-959.3	-0.0020	0.0031		
54	-8.2165	0.3646	5059.8	-414.2	-0.0009	0.0013		
55	-8.1894	-0.3453	974.5	288.8	0.0011	-0.0006		T
56	-8.1040	-1.0504	-1312.3	528.5	0.0016	-0.0013		
57	-7.9633	-1.7468	1706.6	185.4	0.0008	-0.0003		
58	-7.7646	-2.4290	4529.8	-755.7	-0.0021	0.0021		
59	-7.4993	-3.0884	6572.9	-444.4	-0.0008	0.0015		
60	-7.1734	-3.7198	4297.6	-91.2	0.0001	0.0005		T
61	-6.7930	-4.3203	7021.4	413.5	0.0021	-0.0005		
62	-6.3657	-4.8886	9729.8	1255.2	0.0052	-0.0023		
63	-5.9019	-5.4275	8975.7	789.0	0.0035	-0.0011		
64	-5.3994	-5.9306	9149.7	1476.2	0.0059	-0.0028		
65	-4.8667	-6.4012	7237.5	182.1	0.0013	0.0001		
66	-4.2965	-6.8257	8762.4	90.8	0.0012	0.0004		T
67	-3.6923	-7.2002	9074.1	-302.5	-0.0001	0.0013		T
68	-3.0568	-7.5180	4109.0	-651.1	-0.0018	0.0018		
69	-2.3932	-7.7724	4673.5	430.6	0.0019	-0.0007		
70	-1.7114	-7.9732	6656.0	310.1	0.0017	-0.0003		
71	-1.0153	-8.1177	9017.6	126.3	0.0013	0.0003		T
72	-0.3098	-8.2031	6291.9	-35.5	0.0005	0.0005		

J= 180 TIME= 0.0005940

TOTAL ENERGY INPUT (IN.-LB.) = 1322.718

KINETIC ENERGY (IN.-LB.) = 622.329

ELASTIC ENERGY (IN.-LB.) = 757.998

PLASTIC WORK (IN.-LB.) = -57.609

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1 2	BOND 1
1	0.4034	-8.2214	5284.0	-37.6	0.0004	0.0004		
2	1.1133	-8.1843	12287.7	-1553.6	-0.0040	0.0045		
3	1.8146	-8.0686	8378.5	-1300.1	-0.0036	0.0036		S
4	2.4995	-7.8783	9554.3	-1694.8	-0.0048	0.0046		S
5	3.1582	-7.6112	7427.1	208.5	0.0014	0.0006		
6	3.7930	-7.2902	15420.7	1257.9	0.0058	-0.0019		
7	4.4048	-6.9287	2737.1	-69.0	0.0000	0.0003		T
8	4.9821	-6.5151	-737.2	-1362.7	-0.0047	0.0031		
9	5.5107	-6.0407	-347.8	-629.2	-0.0022	0.0014		
10	5.9908	-5.5170	2497.8	-423.8	-0.0012	0.0012		
11	6.4197	-4.9506	752.8	21.7	0.0001	-0.0000		T
12	6.7982	-4.3485	13874.5	50.4	0.0016	0.0008		T
13	7.1239	-3.7168	6279.6	494.0	0.0023	-0.0007		
14	7.3990	-3.0616	1297.3	1494.1	0.0052	-0.0034		
15	7.6324	-2.3901	7840.4	838.3	0.0036	-0.0014		
16	7.8161	-1.7034	6112.3	1650.9	0.0062	-0.0035		
17	7.9586	-1.0066	13241.6	426.9	0.0028	-0.0001		
18	8.0454	-0.3013	5885.2	484.4	0.0022	-0.0007		T
19	8.0764	0.4084	-801.1	134.2	0.0004	-0.0004		T
20	8.0469	1.1187	11614.7	-653.1	-0.0010	0.0023		
21	7.9490	1.8228	9560.5	-443.9	-0.0005	0.0017		
22	7.7855	2.5150	15795.9	-1399.8	-0.0031	0.0044		
23	7.5480	3.1856	18834.8	-113.9	0.0015	0.0015		T
24	7.2528	3.8329	17033.2	1334.8	0.0062	-0.0020		
25	6.9172	4.4595	5873.7	252.7	0.0014	-0.0002		
26	6.5309	5.0563	12765.9	-1582.7	-0.0041	0.0046		
27	6.0805	5.6062	8647.4	-1322.3	-0.0036	0.0037		S
28	5.5735	6.1044	9855.6	-1731.9	-0.0049	0.0047		S
29	5.0128	6.5414	7646.0	61.4	0.0010	0.0004		
30	4.4164	6.9292	15659.4	1382.2	0.0062	-0.0022		
31	3.7974	7.2781	2928.7	46.2	0.0004	0.0001		T
32	3.1510	7.5722	-697.0	-1466.4	-0.0050	0.0034		
33	2.4758	7.7927	-491.8	-528.5	-0.0018	0.0012		
34	1.7825	7.9477	2308.9	-575.0	-0.0017	0.0015		
35	1.0775	8.0352	219.8	-42.9	-0.0001	0.0001		T
36	0.3668	8.0604	13365.4	251.3	0.0022	0.0003		T
37	-0.3431	8.0275	5549.9	436.4	0.0020	-0.0007		
38	-1.0479	7.9381	527.1	1563.1	0.0053	-0.0036		
39	-1.7463	7.8054	7133.0	826.4	0.0035	-0.0014		
40	-2.4330	7.6218	5324.1	1492.9	0.0056	-0.0031		
41	-3.1073	7.3957	12587.0	495.5	0.0029	-0.0003		
42	-3.7614	7.1178	5257.8	527.9	0.0023	-0.0009		T
43	-4.3915	6.7899	-1281.8	142.8	0.0003	-0.0004		T
44	-4.9920	6.4092	11107.7	-587.7	-0.0009	0.0021		
45	-5.5532	5.9730	9282.3	-501.7	-0.0008	0.0018		
46	-6.0710	5.4855	15515.8	-1460.1	-0.0034	0.0045		
47	-6.5326	4.9441	18863.7	-70.3	0.0017	0.0014		T
48	-6.9456	4.3647	17291.6	1343.2	0.0063	-0.0020		
49	-7.3204	3.7608	6363.3	261.8	0.0015	-0.0002		
50	-7.6443	3.1278	13557.3	-1538.7	-0.0038	0.0045		
51	-7.8961	2.4631	9658.7	-1396.5	-0.0038	0.0039		S
52	-8.0740	1.7749	10982.9	-1810.5	-0.0050	0.0050		S
53	-8.1713	1.0706	9024.7	116.1	0.0013	0.0003		
54	-8.2087	0.3602	16997.9	1379.4	0.0064	-0.0021		
55	-8.2012	-0.3504	4326.8	88.6	0.0007	0.0001		T
56	-8.1332	-1.0574	726.7	-1397.6	-0.0047	0.0033		
57	-7.9880	-1.7527	665.4	-713.8	-0.0024	0.0017		
58	-7.7748	-2.4305	3302.0	-607.3	-0.0017	0.0016		
59	-7.4971	-3.0844	965.2	19.4	0.0002	0.0000		
60	-7.1634	-3.7124	13969.9	207.3	0.0021	0.0005		T
61	-6.7793	-4.3104	6045.8	640.4	0.0028	-0.0011		
62	-6.3508	-4.8773	739.6	1490.9	0.0051	-0.0035		
63	-5.8873	-5.4162	7015.6	673.3	0.0029	-0.0010		
64	-5.3841	-5.9183	5087.1	1591.0	0.0059	-0.0034		
65	-4.8511	-6.3890	12133.1	398.2	0.0026	-0.0001		
66	-4.2827	-6.8156	4624.0	648.8	0.0027	-0.0012		T
67	-3.6837	-7.1973	-2100.5	275.4	0.0007	-0.0008		T
68	-3.0546	-7.5284	10240.5	-725.7	-0.0014	0.0024		
69	-2.3962	-7.7963	8263.8	-526.0	-0.0009	0.0018		
70	-1.7151	-8.0005	14606.5	-1454.8	-0.0035	0.0044		
71	-1.0154	-8.1291	17785.2	-95.4	0.0015	0.0014		T
72	-0.3072	-8.1963	16177.2	1627.2	0.0071	-0.0027		

J= 200 TIME= 0.0006600
TOTAL ENERGY INPUT (IN.-LB.) = 1322.718
KINETIC ENERGY (IN.-LB.) = 728.821
ELASTIC ENERGY (IN.-LB.) = 611.960
PLASTIC WORK (IN.-LB.) = -18.063

NO FORCING FUNCTION IS ACTING DURING THIS CYCLE

I	V	W	N	M	STRAIN (IN)	STRAIN (OUT)	LAYER 1 2	BOND 1
1	0.4025	-8.2215	-1782.1	-270.9	-0.0011	0.0005		
2	1.1102	-8.1613	-1823.0	26.0	-0.0001	-0.0002		
3	1.8103	-8.0398	4543.0	-438.1	-0.0010	0.0013		S
4	2.4955	-7.8533	-5787.5	125.1	-0.0002	-0.0007		S
5	3.1625	-7.6086	1032.4	-146.0	-0.0004	0.0004		
6	3.8046	-7.3054	-2121.8	-1275.4	-0.0045	0.0028		
7	4.4103	-6.9347	-4137.8	-42.5	-0.0006	-0.0002		T
8	4.9810	-6.5118	-1561.3	-181.3	-0.0008	0.0003		
9	5.5110	-6.0394	-5758.8	-828.1	-0.0034	0.0015		
10	5.9902	-5.5161	-11066.7	-1351.8	-0.0057	0.0024		
11	6.4094	-4.9427	-1432.1	-32.5	-0.0003	-0.0000		T
12	6.7764	-4.3350	-10039.0	1334.2	0.0035	-0.0038		T
13	7.1019	-3.7049	-20944.8	992.8	0.0012	-0.0038		
14	7.3804	-3.0529	-26249.3	1243.9	0.0015	-0.0047		
15	7.6131	-2.3828	-18047.5	835.2	0.0010	-0.0032		
16	7.7947	-1.6966	-11249.4	1557.4	0.0041	-0.0044		
17	7.9328	-0.9996	638.6	828.3	0.0029	-0.0019		
18	8.0193	-0.2945	-355.2	1468.9	0.0049	-0.0035		T
19	8.0608	0.4143	-7660.1	192.8	-0.0001	-0.0010		T
20	8.0421	1.1234	-12449.1	-1403.4	-0.0060	0.0024		
21	7.9447	1.8270	-1017.7	-633.5	-0.0023	0.0014		
22	7.7793	2.5175	-5178.0	-83.3	-0.0008	-0.0002		
23	7.5530	3.1905	-5315.3	67.3	-0.0003	-0.0005		T
24	7.2692	3.8416	-1201.7	-1062.2	-0.0037	0.0024		
25	6.9191	4.4595	-2778.7	-341.5	-0.0014	0.0006		
26	6.5129	5.0421	-2934.3	-86.2	-0.0006	-0.0000		
27	6.0564	5.5867	3879.7	-179.5	-0.0002	0.0007		S
28	5.5533	6.0877	-6581.7	112.8	-0.0003	-0.0007		S
29	5.0087	6.5439	583.0	-274.2	-0.0009	0.0007		
30	4.4248	6.9481	-2308.1	-1266.6	-0.0045	0.0028		
31	3.8008	7.2870	-4006.0	-125.9	-0.0008	0.0000		T
32	3.1487	7.5687	-1237.1	-90.2	-0.0004	0.0001		
33	2.4745	7.7913	-5036.0	-654.4	-0.0027	0.0012		
34	1.7821	7.9466	-10130.4	-1531.0	-0.0062	0.0029		
35	1.0758	8.0228	-425.8	-30.8	-0.0002	0.0009		T
36	0.3661	8.0368	-8856.4	1284.1	0.0034	-0.0036		T
37	-0.3424	8.0031	-19855.2	884.6	0.0010	-0.0034		
38	-1.0461	7.9166	-25128.6	1484.3	0.0025	-0.0052		
39	-1.7430	7.7842	-17228.0	807.5	0.0010	-0.0030		
40	-2.4284	7.5992	-10648.6	1495.8	0.0040	-0.0042		
41	-3.1012	7.3706	1176.7	829.8	0.0029	-0.0019		
42	-3.7552	7.0932	117.3	1297.1	0.0044	-0.0030		T
43	-4.3891	6.7733	-7179.0	269.1	0.0002	-0.0011		T
44	-4.9936	6.4019	-12200.8	-1264.8	-0.0055	0.0021		
45	-5.5548	5.9665	-921.9	-683.8	-0.0024	0.0015		
46	-6.0703	5.4782	-5155.1	-119.7	-0.0009	-0.0001		
47	-6.5399	4.9456	-5610.4	66.2	-0.0004	-0.0005		T
48	-6.9618	4.3743	-1529.9	-1056.6	-0.0037	0.0024		
49	-7.3217	3.7621	-3371.9	-335.6	-0.0015	0.0005		
50	-7.6231	3.1191	-3500.6	-72.7	-0.0006	-0.0001		
51	-7.8665	2.4515	3040.0	-199.5	-0.0004	0.0007		S
52	-8.0486	1.7653	-7401.8	53.2	-0.0006	-0.0006		S
53	-8.1704	1.0654	-301.2	-143.6	-0.0005	0.0003		
54	-8.2291	0.3579	-3258.8	-1183.9	-0.0043	0.0025		
55	-8.2119	-0.3521	-4978.6	-275.2	-0.0014	0.0003		T
56	-8.1295	-1.0574	-2293.0	-62.5	-0.0005	-0.0000		
57	-7.9850	-1.7525	-6091.9	-700.8	-0.0030	0.0012		
58	-7.7725	-2.4295	-11191.7	-1548.8	-0.0064	0.0029		
59	-7.4845	-3.0788	-1413.8	210.5	0.0006	-0.0006		
60	-7.1431	-3.7012	-9804.1	1183.5	0.0030	-0.0035		T
61	-6.7601	-4.2982	-20665.8	862.5	0.0008	-0.0034		
62	-6.3335	-4.8644	-25908.7	1512.2	0.0025	-0.0053		
63	-5.8707	-5.4021	-17699.5	642.7	0.0003	-0.0026		
64	-5.3665	-5.9018	-10845.7	1664.2	0.0045	-0.0047		
65	-4.8322	-6.3702	1409.2	912.0	0.0032	-0.0021		
66	-4.2655	-6.7988	502.8	1214.1	0.0041	-0.0028		T
67	-3.6717	-7.1879	-6606.8	290.8	0.0003	-0.0011		T
68	-3.0479	-7.5262	-11254.3	-1387.1	-0.0058	0.0025		
69	-2.3898	-7.7936	194.8	-721.3	-0.0024	0.0017		
70	-1.7087	-7.9946	-3894.2	119.0	0.0000	-0.0006		
71	-1.0129	-8.1366	-4122.1	-68.9	-0.0007	-0.0001		T
72	-0.3072	-8.2164	-53.2	-1121.7	-0.0038	0.0026		

FIRST YIELDING AT TIME= 0.000304

TIME OF FIRST BOND TENSION FAILURE = 0.0000990

TIME OF FIRST BOND SHEAR FAILURE = 0.0000165