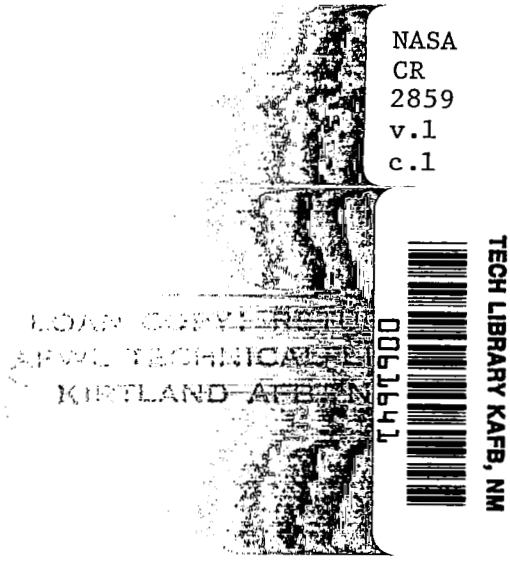

NASA Contractor Report 2859

Time History Solution Program - L225 (TEV126)

Volume I: Engineering and Usage

R. I. Kroll, A. Tornallyay, and R. E. Clemmons

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Volume I: Engineering and Usage

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Boeing Commercial Airplane Company
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Prepared for
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NASA
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and Space Administration

**Scientific and Technical
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1.0 SUMMARY

Program L225 (TEV126) calculates the time responses of a linear system by convoluting the impulsive response function with the time-dependent excitation. Fast Fourier transform (FFT) techniques are used to perform the convolution in the frequency domain and transform the results into the time domain.

The program accepts the frequency response functions of a linear system, multiplies them by the Fourier transform of the desired time-dependent excitation function, and performs the inverse Fourier transform of the product to determine the response time histories. The Cooley-Tukey algorithm is used to evaluate the Fourier transforms. The analysis procedures are subject to the following theoretical limitations:

- System being considered is linear.
- System is stable.
- System is initially in steady state equilibrium.
- Time response of the system is real.
- Time response is negligible beyond the maximum time of interest.
- Forcing function begins at time zero, is real and is negligible beyond the maximum time of interest.

Data are input to the program on both cards and magnetic files (tapes or disks). The user has the capability of using one of seven standard excitation functions contained in the program or of defining an arbitrary excitation function on cards or magnetic file.

Output from L225 consists of:

- Printed time histories
- Maximum and minimum values of the time responses
- Plotting vectors of the time histories
- Plotting vectors of convoluted responses in the frequency domain

The significant program limitations that restrict the size of the problem being analyzed are:

- The maximum number of response functions, either generalized coordinate responses or load responses, is 100.
- The maximum number of frequencies at which the input response functions are defined is 250.
- All interpolation of frequency response functions is linear.

2.0 INTRODUCTION

The computer program L225 (TEV126) was developed for use as either a standalone program or as a module of a program system called DYLOFLEX developed for NASA under contract NAS1-13918 (ref. 1). Because of the DYLOFLEX contract requirements defined in reference 2, a program was needed to calculate the time histories of different airplane responses to discrete excitations using frequency response data calculated in a power spectral density (PSD) solution. An existing program[1,2] was revised according to established specifications[3] to make it compatible with other modules of the DYLOFLEX system.

The purpose of this volume is to aid the person wishing to use the program to calculate response time histories. To meet this objective, the following items are discussed in detail:

- Theoretical formulation of the problem
- Design and structure of the program
- Guidelines to the actual use of the program

A sample problem is also presented in this volume to aid the user in execution of the program.

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[1]Smith, B. E.; and Johnson, M. R.: *Discrete Gust Convolution Program (TEV126)*. Boeing document D6-29668TN, January 1969.

[2]Every, J. S.: *Frequency Response Function Sorting Program (TEV126, LINK1, DIG1)*. Boeing document D6-29669TN, vol. II, April 1971.

[3]Clemmons, R. E.: *Programming Specifications for Modules of the Dynamic Loads System to Interface With FLEXSTAB*. NASA contract NAS1-13918), BCS-G0701, September 1975. (Internal document)

3.0 SYMBOLS AND ABBREVIATIONS

The following list contains items that appear in the discussion sections of this document.

Engineering notation	Definition
f	Cyclic frequency, cps.
F_a	Aliasing frequency, cps.
FFT	Fast Fourier transform
F_{HARM}	Maximum frequency for which the FFT is defined, cps.
F_{MAX0}	Maximum frequency for which the input frequency response functions are considered defined, cps.
F_{MAX1}	Cutoff frequency, cps.
f(t)	Forcing function expressed in the time domain.
$F(\omega)$	Forcing function expressed in n, the frequency domain.
h(t)	Impulsive response function.
$H(\omega)$	Input frequency response function (complex).
i	$\sqrt{-1}$
M	Power of 2 which is used to define the number of points to be used in the FFT.
N	Number of points used in the FFT.
t	time, sec.
T_{MAX}	Maximum time for which the response time history is calculated, sec.
x(t)	Response quantity expressed in the time domain.
$X(\omega)$	Response quantity expressed in the frequency domain.
y(t)	General time function.
$Y(\omega)$	General frequency response function (complex).
$Y^*(\omega)$	Complex conjugate of a general frequency response.

Δf	Frequency interval, cps.
Δt	Time interval, sec.
ω	Angular frequency, rad/sec.
$T[f(t)]$	Fourier transform of the forcing function, f(t).

4.0 ENGINEERING AND MATHEMATICAL DESCRIPTION

4.1 MATHEMATICAL FORMULATION

The motion of a linear system can be defined by a set of linear differential equations. The response of the system to a particular type of force is obtained from the solution of these equations with respect to that force. Of particular interest are the responses of a linear system to two particular types of forces: a harmonic excitation and an impulsive excitation.

The steady state response of the system (the response of the system after all transients have died out) to harmonic excitation is described by the function $H(\omega)$, called the frequency response function. This function is used extensively in airplane power spectral analysis and in dealing with frequency domain aerodynamics.

The solution of the system's differential equation to a unit impulse is described by the impulsive response function h(t). The value in the impulsive response function lies in its use with the principle of superposition, which is only valid for linear systems. Any arbitrary forcing function can be considered as an infinite set of impulses of varying magnitude. The responses of the system to the impulses can be added together to give the total response due to the arbitrary forcing function. This superposition process is mathematically written as the convolution integral

$$x(t) = \int_0^t h\,(t - \tau)\, f\,(\tau) d\tau \tag{1}$$

where f(t) is the arbitrary forcing function (ref. 3).

Therefore, having $H(\omega)$ and h(t) defined for a system, the response to both continuous and discrete excitation is defined. It would be advantageous, however, to be able to use one of the functions, $H(\omega)$ or h(t), to determine the other. Under certain conditions, Fourier transform analysis accomplishes this task.

A function, y(t), defined in the time domain, can be transformed or completely described in the frequency domain by applying the transform

$$Y(\omega) = \int_{-\infty}^{\infty} y(t) e^{-i\omega t} dt \tag{2}$$

Conversely, if $Y(\omega)$ is defined, the inverse transform can describe the function in the time domain.

$$Y(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} Y(\omega) e^{i\omega t} d\omega \tag{3}$$

These integrals exist provided the following condition is met, that

$$\int_{-\infty}^{\infty} \left| y(t) \right| dt \tag{4}$$

is finite. If this is so, then y(t) and $Y(\omega)$ are known as Fourier transform pairs.

For a stable system, Fourier transform theory (ref. 3) shows that the impulsive response function h(t) and the frequency response function $H(\omega)$ are transform pairs; i.e.,

$$H(\omega) = \int_{-\infty}^{\infty} h(t) e^{-i\omega t} dt \tag{5}$$

and

$$h(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} H(\omega)\, e^{i\omega t} d\omega \tag{6}$$

Therefore, once the system's response is determined by either h(t) or $H(\omega)$, the other function can be calculated.

Besides providing a link between the time domain and the frequency domain for a stable linear system, Fourier transform theory facilitates the evaluation of the convolution integral given by equation (1). In the frequency domain, convolution becomes a simple multiplication of functions (ref. 4), so that

$$X(\omega) = H(\omega)\, F(\omega) \tag{7}$$

where $X(\omega)$, $H(\omega)$, and $F(\omega)$ are transform pairs of x(t), h(t), and f(t), respectively.

Using the transform relationships and the frequency domain representation of the convolution integral, it becomes possible to develop the response of a linear system in the frequency domain and use the results to determine system's response to a discrete time function.

4.2 DIGITAL APPROXIMATION OF THE FOURIER INTEGRAL

The mathematical formulation dealt with continuous functions and infinite limits of integration. Digital computers are incapable of dealing with either, therefore; approximations must be introduced to be able to deal with Fourier transform integrals.

First, by placing restrictions on the type of functions which can be dealt with, the effect of introducing finite limits into the integrations of equations (2) and (3) can be minimized. The restrictions imposed on y(t) are:

- y(t) must be real
- y(t) must be zero for $t < 0$
- y(t) must be negligible for $t > T_{MAX}$

The last two restrictions enable equation (2) to be written with finite limits.

$$Y(\omega) = \int_0^{T_{MAX}} y(t)\, e^{-i\omega t} dt \tag{8}$$

The first restriction, y(t) must be real, results in the frequency domain property of

$$Y(-\omega) = Y^*(\omega) \tag{9}$$

where $Y^*(\omega)$ is the complex conjugate of $Y(\omega)$. This property coupled with the restriction that $Y(\omega)$ is negligible for $\omega > 2\pi F_{MAX1}$ enables the approximation of the inverse relationship by the equation

$$y(t) = 2\text{Real} \left\{ \frac{1}{2\pi} \int_0^{2\pi F_{MAX1}} Y(\omega) e^{-i\omega t} dt \right\} \tag{10}$$

The relationship between the maximum time T_{MAX} and the maximum frequency F_{MAX1} will be discussed in section 4.5.

The second variation from the exact formulation, which must be considered when dealing with digital computation, is the use of digitized functions rather than continuous functions. Using a function described by a discrete number of points is mathematically equivalent to time sampling a continuous function. Time sampling introduces an aberration into the transform process which must be taken into account. Figure 1 illustrates a time function y(t) and the Fourier transform Y(f).

Figure 1.—Function in Time and Frequency Domain

The sampling of y(t) may be regarded as multiplying y(t) by a series of unit impulses at intervals Δt. Figure 2 shows a series of impulses and the Fourier transform pairs.

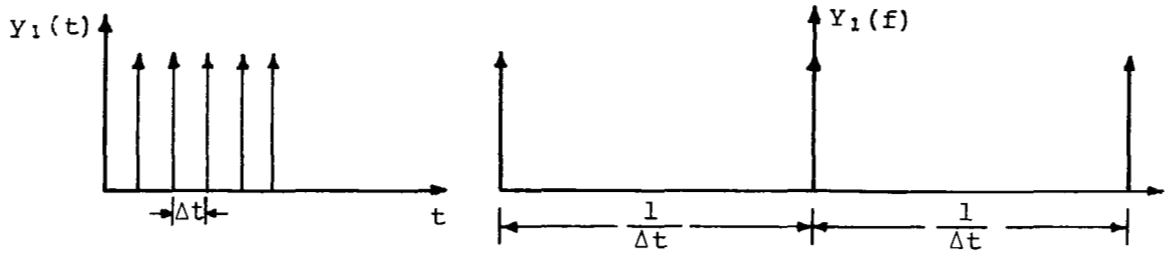


Figure 2.—Impulse Functions in Time and Frequency Domain

From Fourier transform theory, the transform of the product of two functions is the convolution of the transform pairs, or

$$\int_{-\infty}^{\infty} y(t)y_1(t)e^{-i\omega t}dt = Y(\omega)*Y_1(\omega) \tag{11}$$

The graphic result of equation (11) is shown in figure 3.

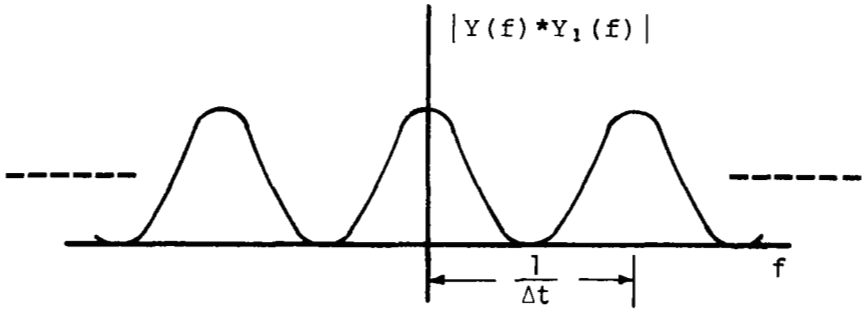


Figure 3.—Transform of Sampled Time Function

The result of sampling then is to make the transform function periodic with a period equal to $1/\Delta t$. This results in an overlapping or aliasing at the frequency $F_a = 1/2\Delta t$; therefore, caution should be exercised in choosing the size of the sampling interval Δt. Sampling in the frequency domain results in aliasing in the time domain. A further discussion of aliasing appears in section 4.2.2.

The digital forms of equations (8) and (10) are

$$Y(j\Delta f) = \Delta t \sum_{k=0}^{N-1} y(k\Delta t)\, e^{-i2\pi\,(j\Delta f\, k\Delta t)} \tag{12}$$

where $j = 0, 1, \ldots, N-1$ and

$$Y(k\Delta t) = 2\mathrm{Real}\left\{\Delta f \sum_{j=0}^{N-1} Y(j\Delta f)\, e^{i2\pi(j\Delta f\, k\Delta t)}\right\} \tag{13}$$

where K = 0, 1, . . ., N-1 and N is the number of sample points. Equations (12) and (13) were derived using the trapezoidal rule approximation.

The condition that the time response is zero for $t<0$ allows equation (13) to be evaluated by two independent methods. These can then be compared as a check on the correctness of the solution. Rewriting equation (13)

$$Y(k\Delta t) = 2\Delta f \sum_{j=0}^{N-1} \left[Y_R(j\Delta f) \cos(2\pi j\Delta f\, k\Delta t) - iY_I(j\Delta f) \sin(2\pi j\Delta f\, k\Delta t) \right] \tag{14}$$

where y(t) can be seen to be the sum of an even and an odd function of time. These add for $t>0$ and for $t<0$; they subtract to yield a zero result. Therefore, y(t) can be evaluated from either the real or the imaginary part of Y(f); i.e.,

$$Y(k\Delta t) = 4\Delta f \sum_{j=0}^{N-1} Y_R(j\Delta f) \cos(2\pi j\Delta f k\Delta t) \tag{15}$$

$$Y(k\Delta t) = 4\Delta f \sum_{j=0}^{N-1} Y_I(j\Delta f) \sin(2\pi j\Delta f k\Delta t) \tag{16}$$

4.3 ANALYSIS PROCEDURES

The purpose of the L225 (TEV126) program is to evaluate the convolution integral

$$x(t) = \int_0^{T_{MAX}} h(\tau) f(t-\tau) d\tau \tag{17}$$

using Fourier transform techniques. In the frequency domain, equation (17) is written as

$$X(\omega) = H(\omega)F(\omega) \tag{18}$$

The time history program accepts both the frequency response function and the forcing function defined in the time domain and performs the necessary transformations, multiplications, and inverse transformations.

Certain restrictions are assumed with regard to the impulsive response function h(t) and the forcing function f(t):

$$h(t) = \begin{cases} 0 & t<0 \\ \text{Nonzero} & 0 \leq t \leq T_{MAX} \\ \text{Negligible} & T_{MAX} < t \end{cases}$$

$$f(t) = \begin{cases} 0 & t<0 \\ \text{Nonzero} & 0 \leq t \leq T_{MAX} \\ \text{Negligible} & T_{MAX} < t \end{cases}$$

The restrictions are a result of the desire to minimize any error introduced by the approximations made in evaluating the transform integrals. (This last restriction concerning h(t) implies h(t) corresponds to a stable system.)

The process of obtaining the time response begins with the input of the frequency response function $H(\omega)$. The program can accept frequency response functions derived in either one of two ways. First, if the solution to the differential equation was of the form $e^{i\omega t}$, then this is equivalent to the impulsive response function - frequency response function relationship

$$H(\omega) = \int_{-\infty}^{\infty} h(t)\, e^{-i\omega t} dt \tag{19}$$

Second, if the solution assumed was of the form $e^{i\omega t}$, then the equivalent $h(t)$ - $H(\omega)$ relationship is

$$H(\omega) = \int_{-\infty}^{\infty} h(t)\, e^{i\omega t} dt \tag{20}$$

The program assumes the form given by equation (19); , therefore, if the $e^{-i\omega t}$ form of the solution was used to derive $H(\omega)$, the user can exercise the option to use the complex conjugate of $H(\omega)$ for the time history analysis. Thus, $H(\omega)$ will be defined consistently with the program assumption. The maximum frequency for which $H(\omega)$ is defined is denoted as F_{MAX0}. It is assumed that the value of $H(\omega)$ beyond F_{MAX0} is negligible. The program also assumes that the real part of $H(\omega)$ is an even function and that the imaginary part of $H(\omega)$ is an odd function.

Input of $H(\omega)$ may be at values of other than those used in the transform equations (15) and (16). Linear interpolation is used between input frequencies to obtain the values of $H(\omega)$ at the required integration frequencies. It is important to input $H(\omega)$ with a sufficient density to allow for accurate linear interpolation.

After defining the frequency response function, the next step is to determine the Fourier transform of the forcing function. The program has a number of internally defined forcing functions and also has the capability of accepting arbitrary functions via external input. With f(t) defined, the transform equation

$$F(\omega) = \int_{0}^{T_{MAX}} f(t) e^{-i\omega t} dt \tag{21}$$

is numerically evaluated.

The multiplication of equation (21) is performed, and the inverse transform

$$x_0(t) = 2\text{Real}\left\{ \frac{1}{2\pi} \int_{0}^{2\pi F_{MAX1}} x(\omega) e^{i\omega t} d\omega \right\} \tag{22}$$

is evaluated. Because of the restrictions placed on h(t) and f(t), the time response should be zero for $t<0$ and a real function. To check the accuracy of the numerical integrations and the validity of the assumptions, two alternate expressions may be used to evaluate x(t)

$$x_1(t) = \frac{4}{2\pi}\int_0^{2\pi F_{MAX1}} \text{Real}\{x(\omega)\}\cos\omega t d\omega \tag{23}$$

$$x_2(t) = -\frac{4}{2\pi}\int_0^{2\pi F_{MAX1}} \text{Imaginary}\{x(\omega)\}\sin\omega t d\omega \tag{24}$$

The assumption that the contribution of $X(\omega)$ to x(t) beyond the cutoff frequency F_{MAX1} is negligible has also been included in the expressions. Notice that $x_0(t)$ is the average of $x_1(t)$ and $x_2(t)$ which would all be equal if the program error was zero and the physical restrictions imposed on h(t) and f(t) were adhered to exactly by the program input functions.

Equations (21), (18), and (22) respectively, appear in digital form as:

$$T[f(j\Delta t)]_k = \Delta t \sum_{j=0}^{N-1} f(j\Delta t)e^{-ik\Delta\omega j\Delta t}$$

$$-\Delta t\left\{\frac{f(0)}{2} + f((MM-1)\Delta t)\right\}\frac{e^{-ik\Delta\omega(MM-1)\Delta t}}{2} \tag{25}$$

$$X(k\Delta\omega) = H(k\Delta\omega)T\left[f(j\Delta t)\right]_k \tag{26}$$

$$x_0(j\Delta t) = 2\,\text{Real}\left\{\frac{1}{2\pi}\Delta\omega\sum_{k=0}^{N-1} X(k\Delta\omega)e^{ik\Delta\omega j\Delta t}\right.$$

$$\left.-\frac{1}{2\pi}\Delta\omega\left(\frac{X(0)}{2} + X((MM-1)\Delta\omega)\right)\frac{e^{ij\Delta t(MM-1)\Delta\omega}}{2}\right\} \tag{27}$$

where:

$j = 0, 1, \ldots, N-1$

$k = 0, 1, \ldots, N-1$

$$x(k\Delta\omega) = \begin{cases} \text{Nonzero} & k = 0, 1, \ldots, NN \\ \text{Zero} & k = NN+1, \ldots, N-1 \end{cases}$$

$$f(j\Delta t) = \begin{cases} \text{Nonzero} & j = 0, 1, \ldots, NN \\ \text{Zero} & j = NN+, \ldots, N-1 \end{cases}$$

$$MM = NN+1 \quad \text{if } NN \leq N-1$$

$$MM = NN \quad \text{if } NN = N$$

The evaluation of equations (25), (26), and (27) is made using both the Cooley-Tukey and fast Fourier transform algorithms (ref. 4).

4.4 PROGRAM ACCURACY

The program accuracy is a function of the program input functions, the cutoff frequency, and the spacing in the time and frequency domains. For optimum conditions there should be no discontinuities in the input functions and appropriate spacing should be used in the time and frequency domains. However, the use of the time history for a variety of problems necessitates the user's understanding of the effects of the FFT approximations. Reference 4 gives a thorough explanation of FFT techniques and the impact of the various approximations made in the FFT process. A brief discussion of how to set up a time history solution follows.

4.4.1 CUTOFF FREQUENCY CONSIDERATIONS AND EFFECTS

In the program analysis, the product of the frequency response function H(f) and the transform of the forcing function T[f(t)] is assumed to be symmetric about the origin and negligible for frequencies beyond the cutoff frequency F_{MAX1} (see fig. 4).

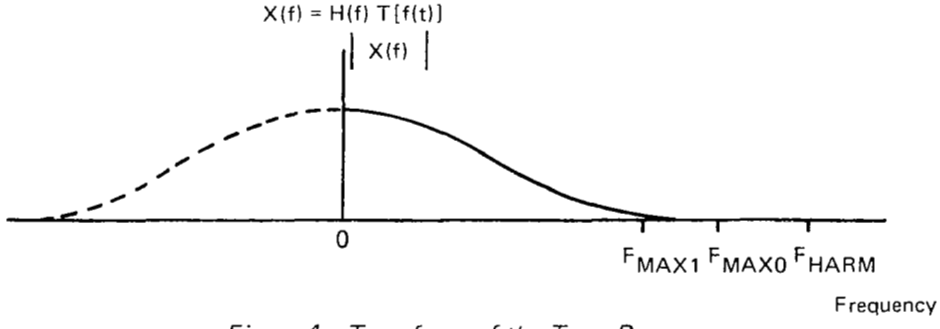


Figure 4.—Transform of the Time Response

The effects of truncation in the frequency domain are a superposition of waviness on the original time function x(t) and a possibility of causing small values of x(t) at t = 0. The amount of waviness and the magnitude of the initial value will depend on the type of function being considered and the value of F_{MAX1}. Functions with low frequency content, such as sine and cosine functions and gradual ramps, will show little effect of truncation. However, functions having high frequency content, such as steps and sharp ramps, will be affected more by the truncation function. Thus, it is important to pick a value of F_{MAX1} that will include as much of the frequency function as possible.

When considering a frequency response function and/or a particular excitation function for the first time, the user should exercise the option to obtain a plot of $|X(f)|$, where $|X(f)|$ is the magnitude of the complex function X(f). The range of f considered should be as high as possible while keeping in mind the frequency response function and forcing function used. This plot will give an indication as to what value of cutoff frequency will give suitable results. If the algorithm is to give accurate results, the values of $|X(f)|$ beyond the cutoff frequency should be negligible.

It is important to note that the approximation being introduced by assigning a cutoff frequency is that

$$E(t,F) = 2\text{Real}\left\{\int_F^\infty X(f)e^{i2\pi ft}\,df\right\} \tag{28}$$

is negligible when compared to

$$I(T,F) = 2\text{Real}\left\{\int_0^F X(f)e^{i2\pi ft}df\right\} \tag{29}$$

that is

$$\begin{aligned} x(t) &= I(t,F) + E(t,F) \\ &\approx I(t,F) \end{aligned} \tag{30}$$

Looking at the plot of $|X(f)|$ does not give an absolute indication as to whether or not a particular value of cutoff frequency will give satisfactory results. It should only serve as a guide.

To illustrate the effect of cutoff frequency, an input frequency response function of a constant value of one was convoluted with two forcing functions: a rectangular wave and a one-minus cosine wave. Three values of cutoff frequencies were considered, 2.5, 10, and 20 cps. Figure 5 shows the rectangular wave and how it is affected by the cutoff frequency. Figure 6 shows the effect of cutoff frequency on a one-minus cosine function. The two figures demonstrate that, for functions with sharp discontinuities, high values of cutoff frequency are needed, whereas, smooth functions do not require as large a frequency range. Functions with sharp discontinuities have high frequency components, whereas, smooth functions contain little contribution from frequencies beyond the fundamental frequency of the wave. This can be seen from the plot of the frequency functions for the two waves shown in figure 7. The rectangular wave contains significant contributions from frequencies above 10 cps. The one-minus cosine wave, however, shows little or no contribution beyond 10 cps. Thus, the accuracy of the calculated time response of a function will depend on its frequency content and whether or not the frequency range considered adequately accounts for the frequency content.

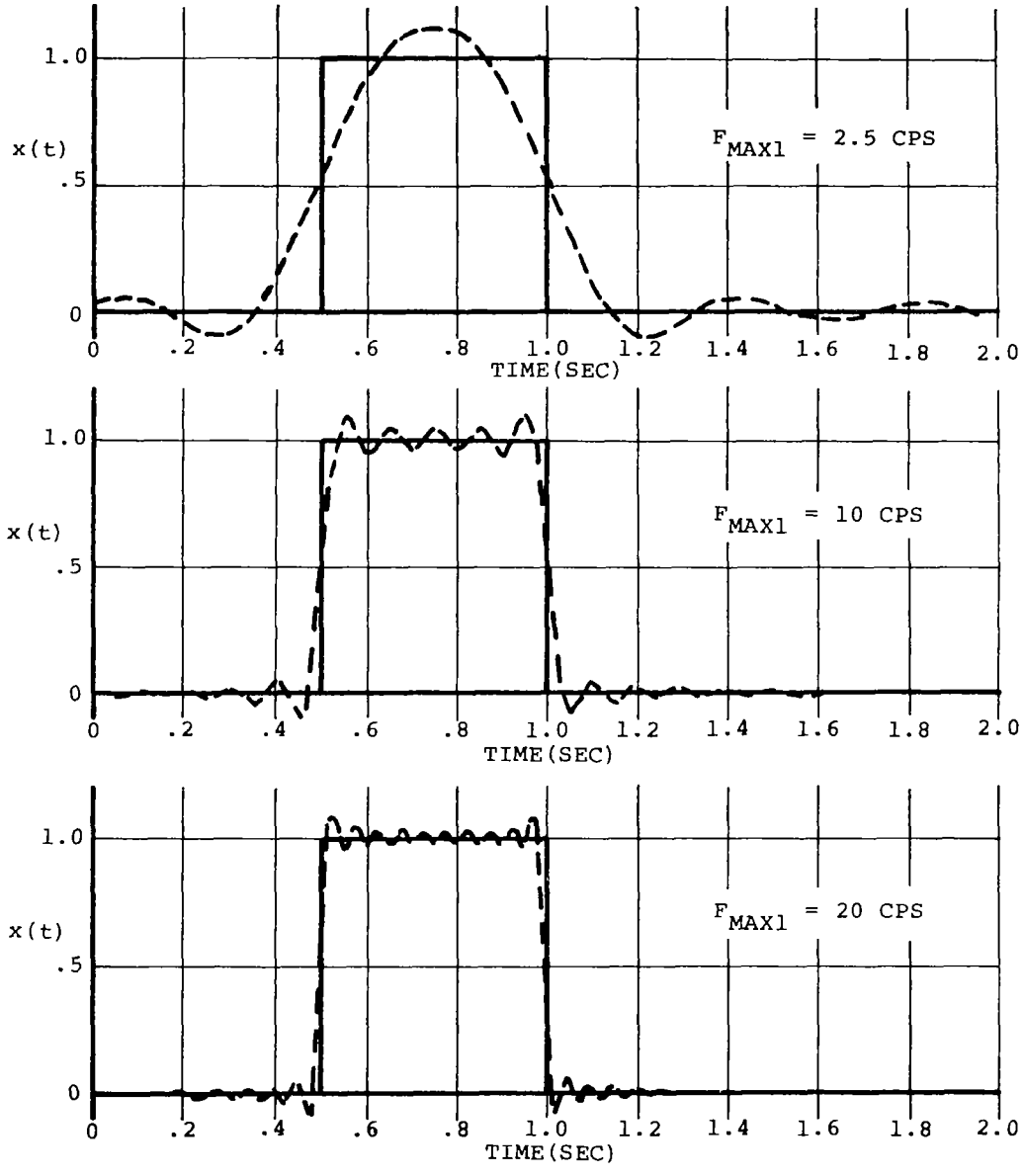


Figure 5.—Cutoff Frequency Effect on a Rectangular Wave

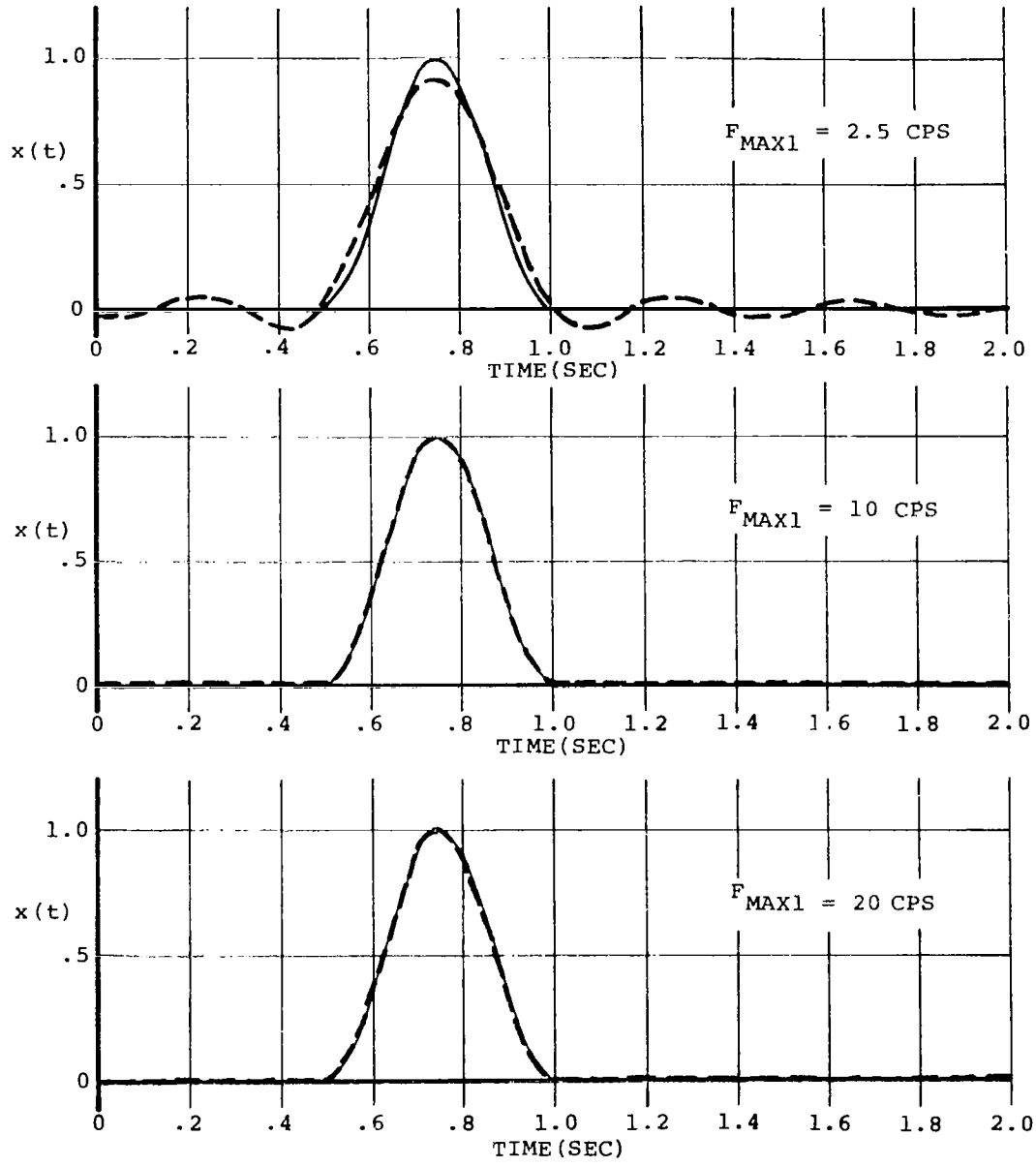


Figure 6.–Cutoff Frequency Effect on a One-Half (1 - cos) Wave

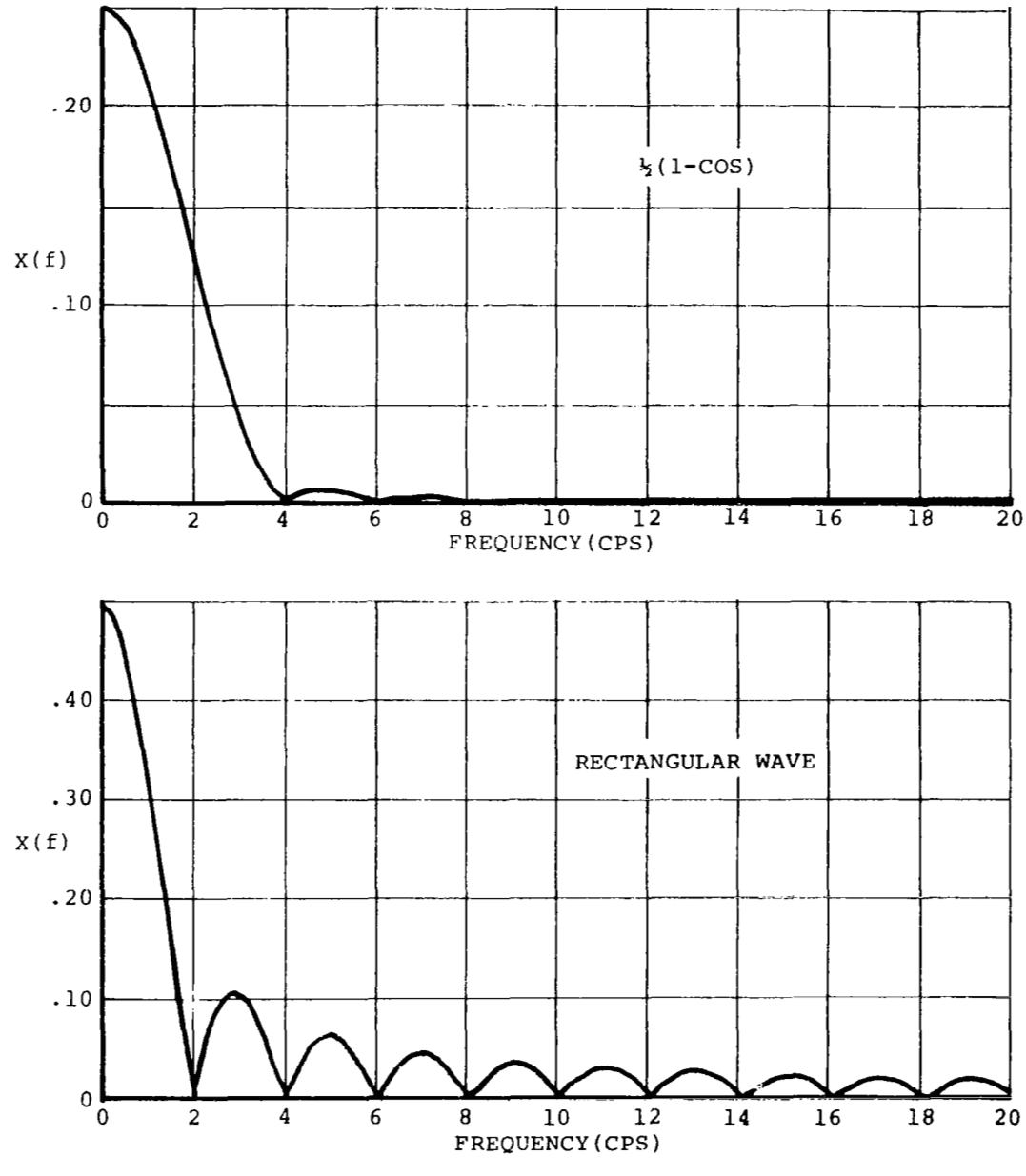


Figure 7.—Frequency Response Functions for a Rectangular and a One-Half (1 - cos) Wave

4.4.2 TIME AND FREQUENCY INTERVAL SIZE

Accuracy of the results obtained is also a function of the time and frequency interval size chosen. The interval size is dependent on the number of points, N, chosen to be used in the FFT, the maximum time of interest, T_{MAX}, and the maximum frequency which the input frequency response functions are considered defined, F_{MAX0}. The relationships of the variables will be discussed in section 4.5. It is the purpose of this section to illustrate the effect that interval size has on the results obtained.

It was mentioned in section 4.2 that digitizing a continuous function in one domain (time or frequency) results in an aliasing (or overlapping) effect in the other domain. This aliasing is directly related to interval size. As shown in figure 3, the sampling of a time function results in its transform point being repeated in the frequency domain at a frequency

$$F_a = 1/\Delta t \tag{31}$$

Similar sampling of a frequency function will result in a time repetition at

$$T_a = 1/\Delta f \tag{32}$$

To minimize the distortion of the frequency and/or time functions, the interval sizes should be such that the portion of the frequency function beyond $F_a/2$ or the portion of the time function beyond T_a should be negligible. Note that for the frequency functions, half F_a is the point of overlap because the frequency functions are symmetric about the origin (see fig. 3). On the other hand, the time functions have no values for $t < 0$, therefore, T_a is the point of overlapping.

To illustrate the aliasing effect, time responses of the first elastic mode and wingtip acceleration to a one-minus cosine forcing function were calculated using two different sample sizes. The first case used a frequency interval size of 0.0395 which gives an aliasing time T_a = 25.3 sec. The second case used an interval size of 0.289 which gives an aliasing time of 3.5 sec. Figures 8 and 9 show the time histories of these response quantities. Case one results show that the response of both quantities damp out beyond 8 sec, therefore, overlapping of the time function beyond 25.3 sec has no effect on the time history. However, both quantities show significant response between 3.5 and 7.0 sec. It would be expected, therefore, that any overlapping that occurs within this time frame would significantly distort the resulting time history. The results of case two show this to be true.

The analysis procedures used by L225 require the analyst to account for aliasing effects in both the time and frequency domain. Aliasing in the frequency domain must be considered with regard to the forcing function, f(t), since it is this function that is transformed from the time domain to the frequency domain. The choice of the size of the time sampling interval, Δt, must be made with regard to the nature of the forcing function. For example, a forcing function with sharp discontinuities may have significant high frequency content in its Fourier transform and thus may require a small time interval to ensure a large aliasing frequency. The frequency sampling size,

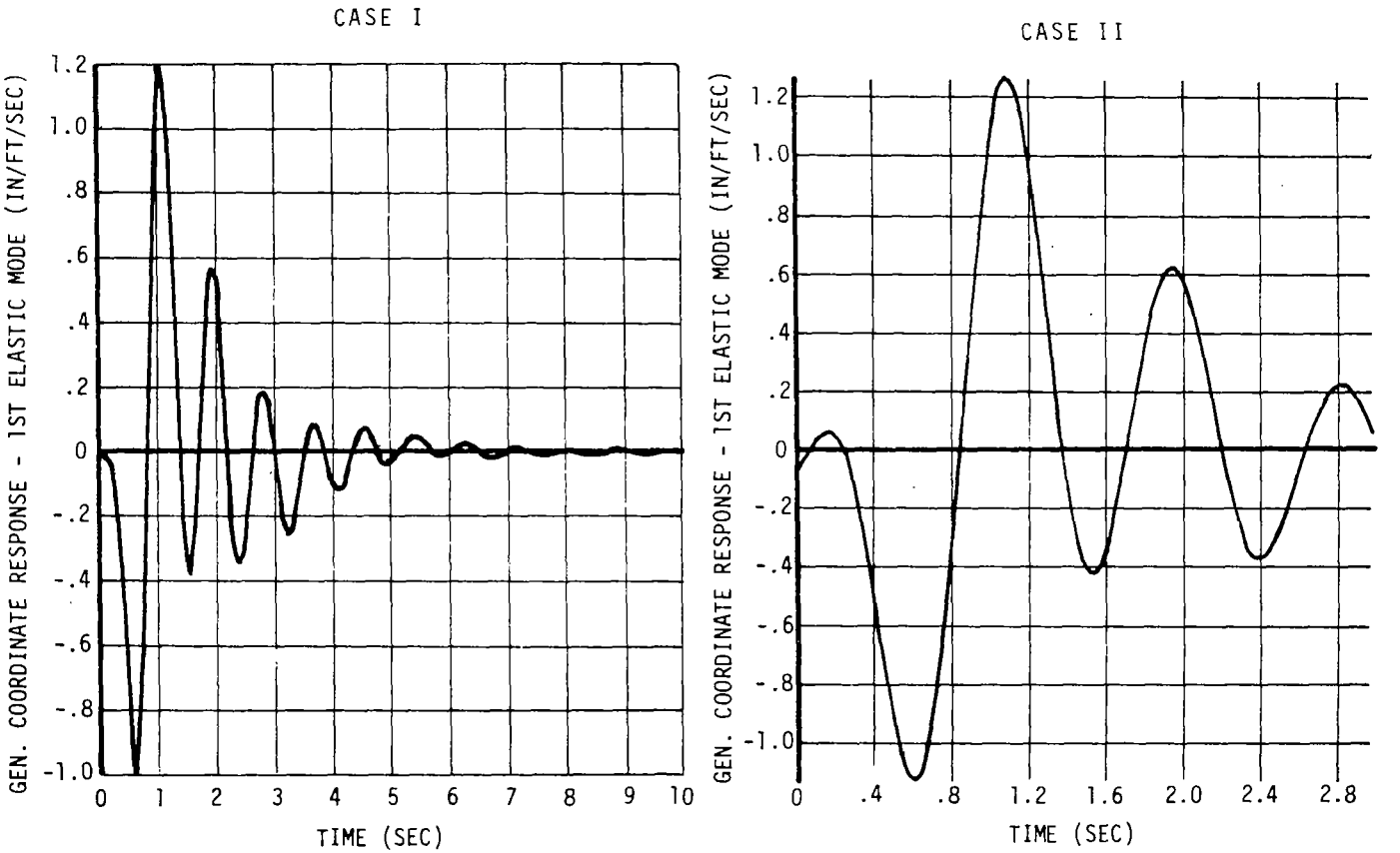


Figure 8.—Interval Spacing Effect on First Elastic Mode Response

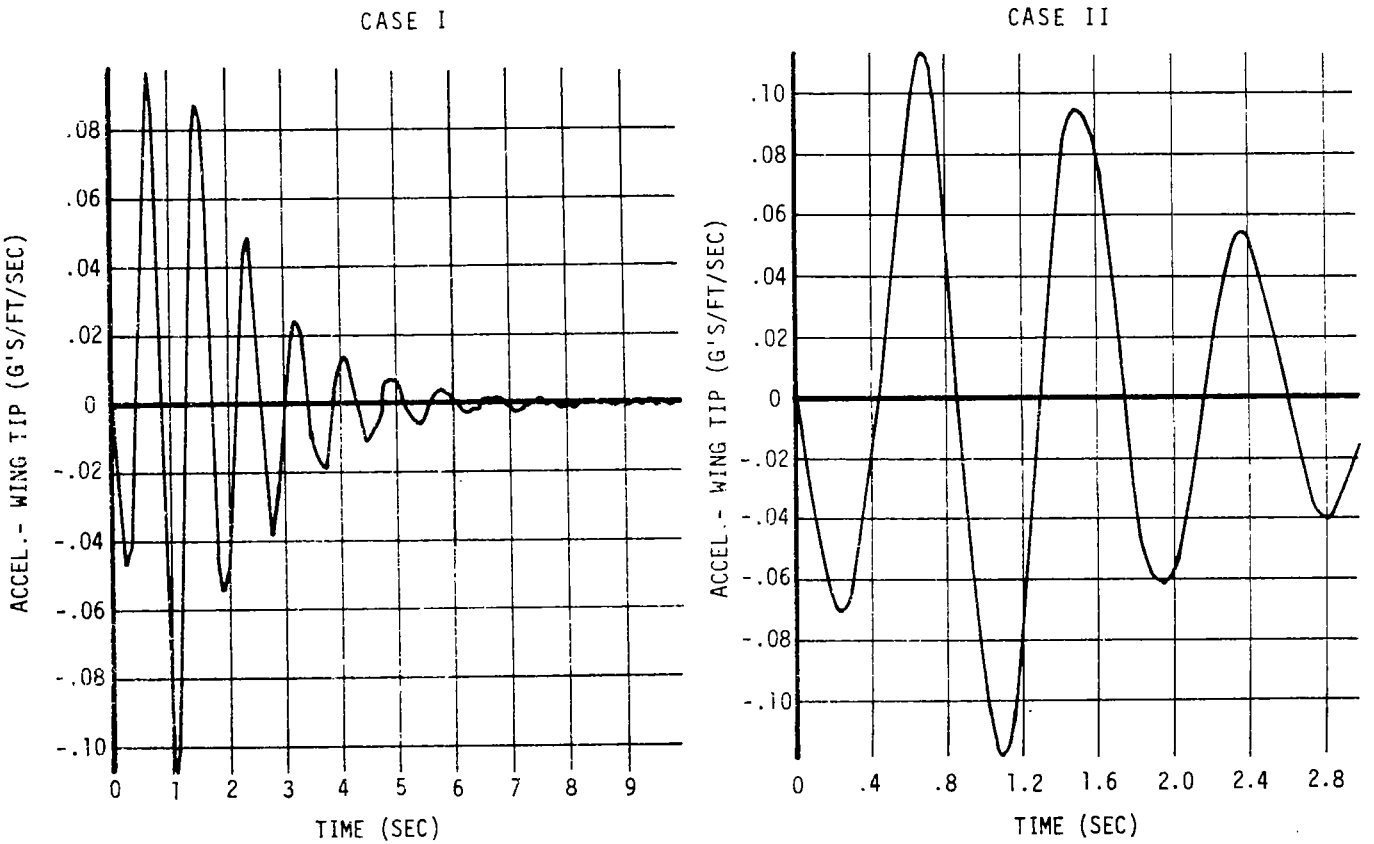


Figure 9.—Interval Spacing Effect on Acceleration Response

Δf, on the other hand, should be chosen with regard to the response quantity, x(f). High values of x(f) in the low frequency range may indicate that the resulting time function, x(t), could have significant magnitude at large values of time. Therefore, the size of the frequency interval should be such that the aliasing time, T_a, is well beyond the maximum time of interest, T_{MAX}.

4.4.3 SAMPLE RESULTS

As an illustration of the program accuracy, the results of a transport airplane analysis are presented. The airplane was subjected to three different forcing functions: a 25-chord one-half (1-cos) function, a 25-chord rectangular wave, and a gust digitized from record flight data. Shear at one of the wing stations was chosen as the response quantity to be presented. Figures 10 through 12 show the magnitude $|X(f)|$ of the frequency function of the convoluted shear. Figures 13 through 15 show the resulting time histories. Two different values of cutoff frequency were used. Note that the effect of cutoff frequency is more pronounced in the cases of the rectangular wave and the measured gust because in both of these cases there is significant response above 3.5 cps. Included in the time history figures are the results obtained using an initial value routine (a Runge-Kutta numerical integration method).

4.5 ANALYSIS PARAMETER SELECTION

As mentioned in section 4.4.2, the accuracy of results of an analysis will depend on the type of input functions (both forcing and response), the frequency and time interval spacing, and the cutoff frequency. The capability exists with card set 9.0 for the user to select one of several options to be used to calculate the analysis control data that will best suit the problem at hand.

The analysis parameters are calculated based on the following relationships

$$N = 2^M \qquad F_{HARM} = N * \Delta f \qquad T_{MAX} = NN * \Delta t \qquad (33)$$

$$F_{HARM} = 1/\Delta t \qquad F_{MAX1} = NN * \Delta f$$

where:

N = Number of points to be used in the Cooley-Tukey algorithm for the FFT calculation

M = Power of two used to define N

F_{HARM} = Largest frequency value for which the Fourier transform is defined

Δt = Time interval

Δf = Frequency interval

F_{MAX1} = Cutoff frequency

T_{MAX} = Maximum time for which the time response is calculated

NN = The number of points needed to achieve integration to F_{MAX1} or T_{MAX}

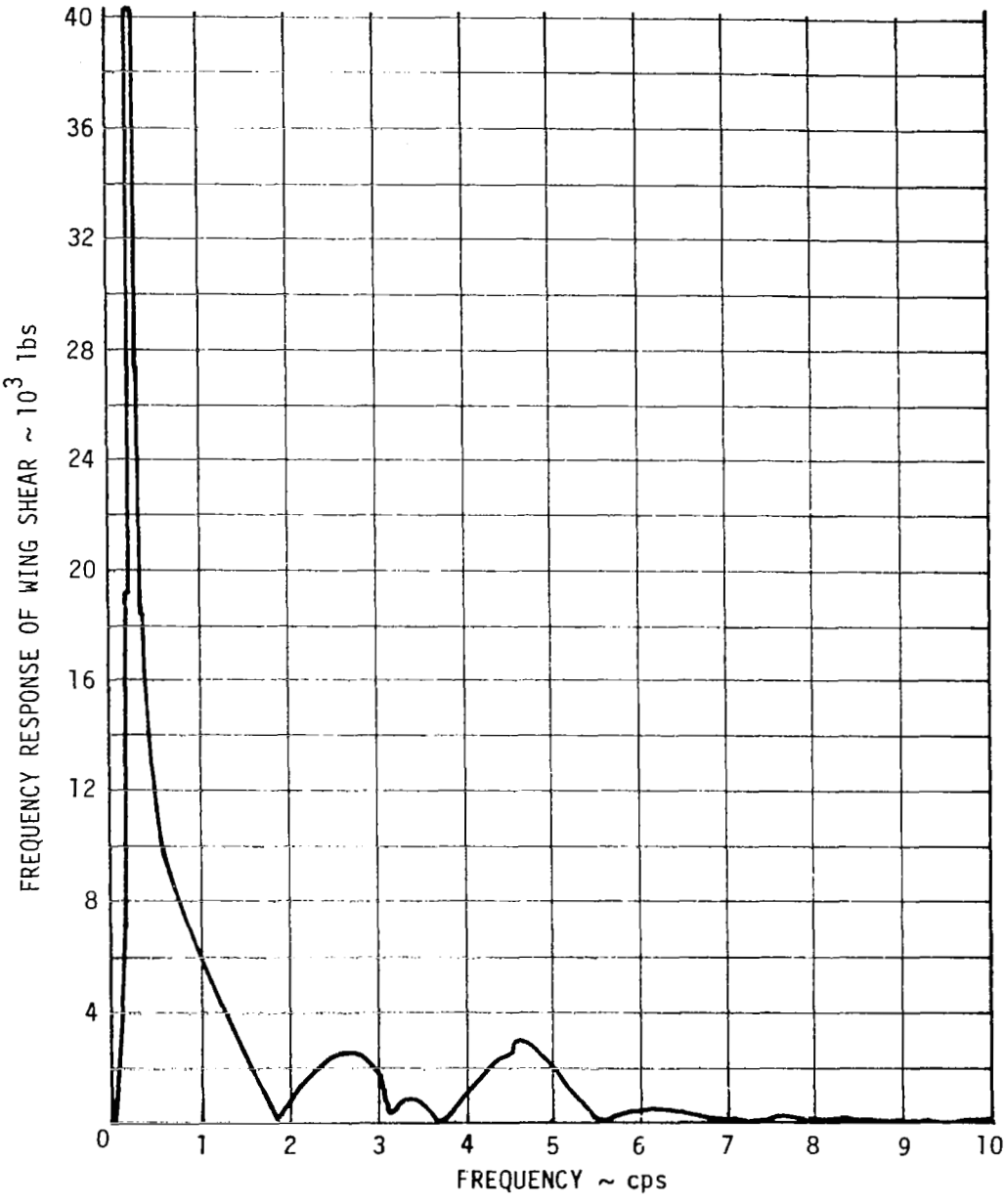


Figure 10.—Airplane Response to a 25-Chord Rectangular Wave in the Frequency Domain

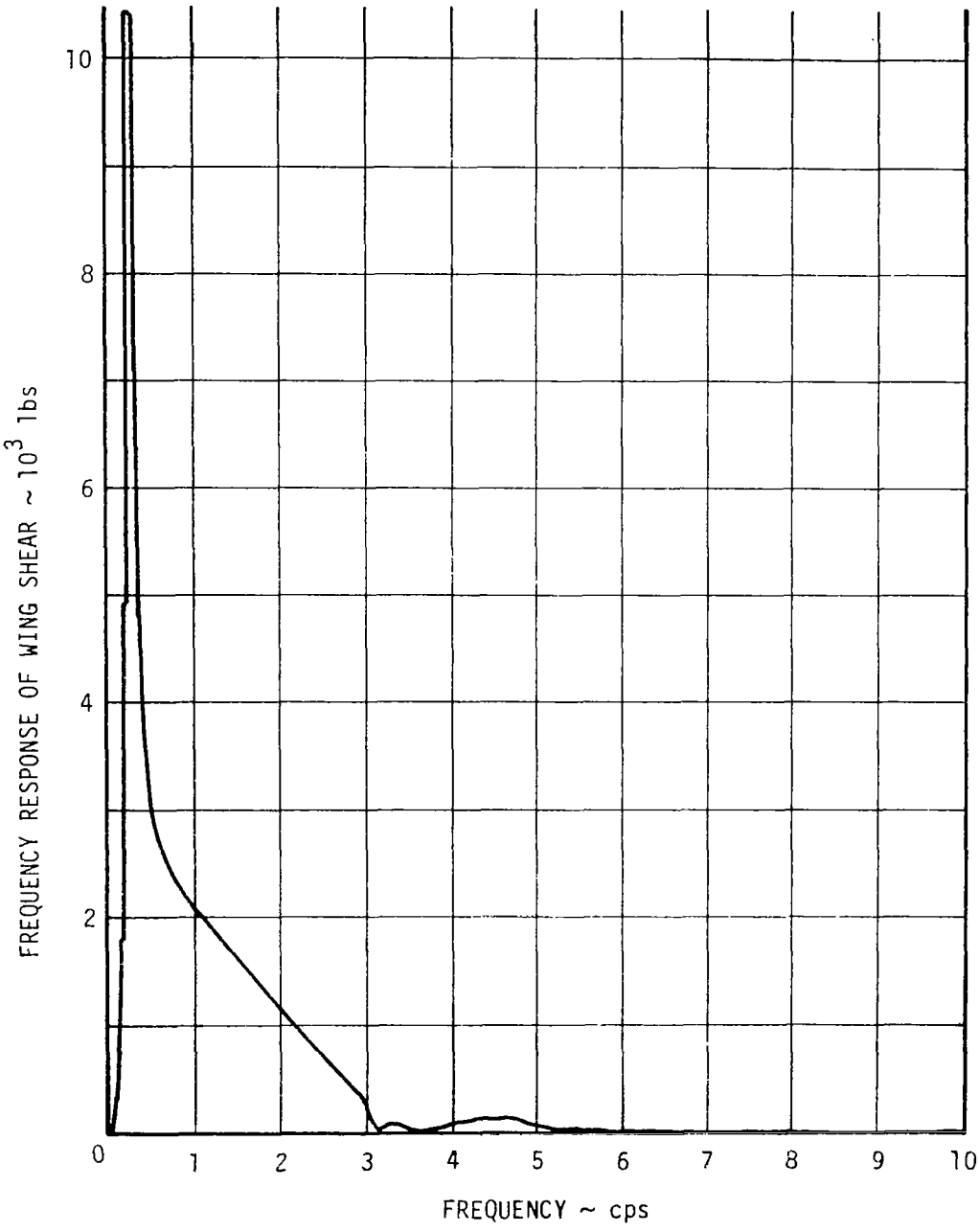


Figure 11.--Airplane Response to a 25-Chord One-Half (1 - cos) Wave in the Frequency Domain

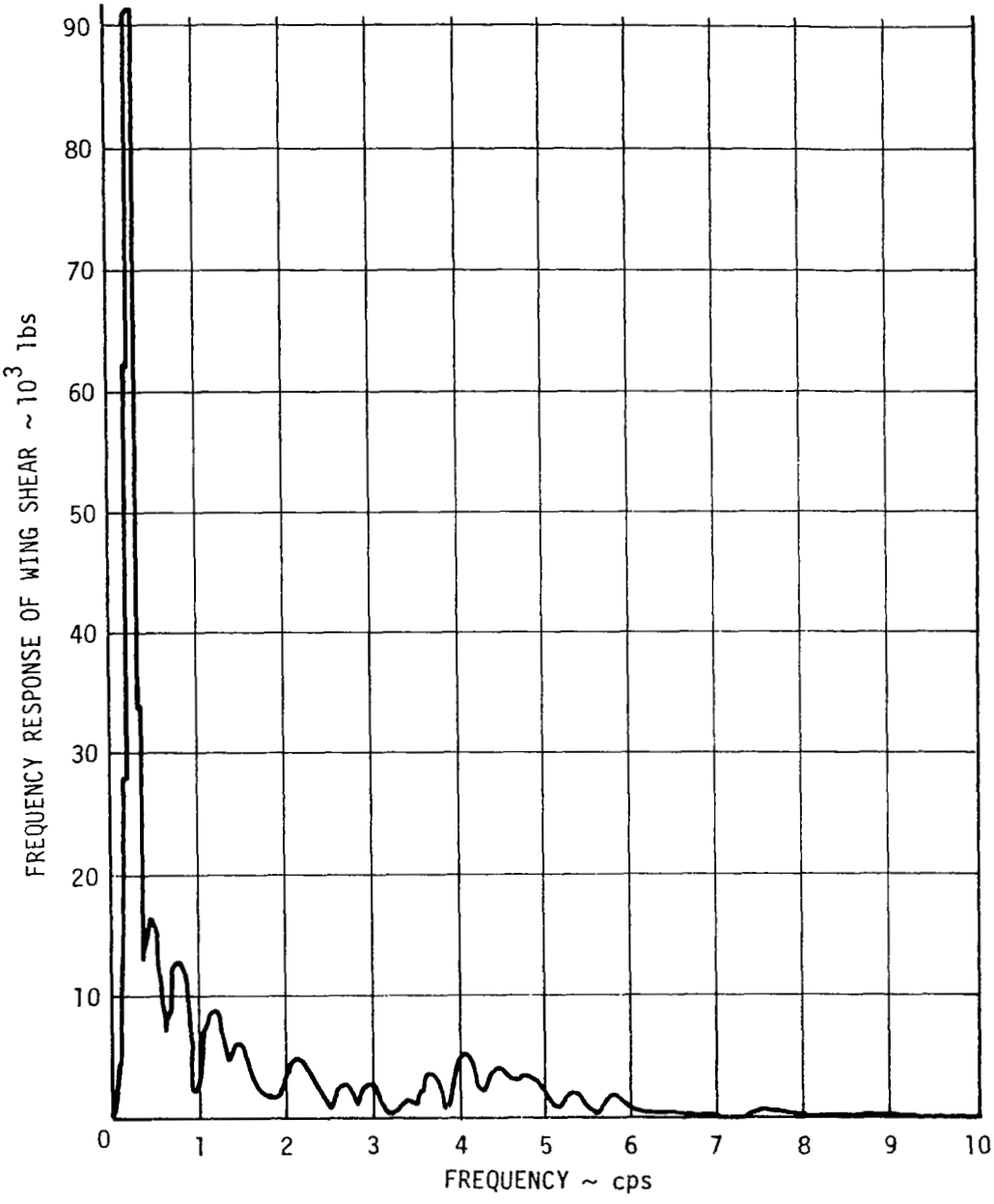


Figure 12.—Airplane Response to a Spanish Peak Gust in the Frequency Domain

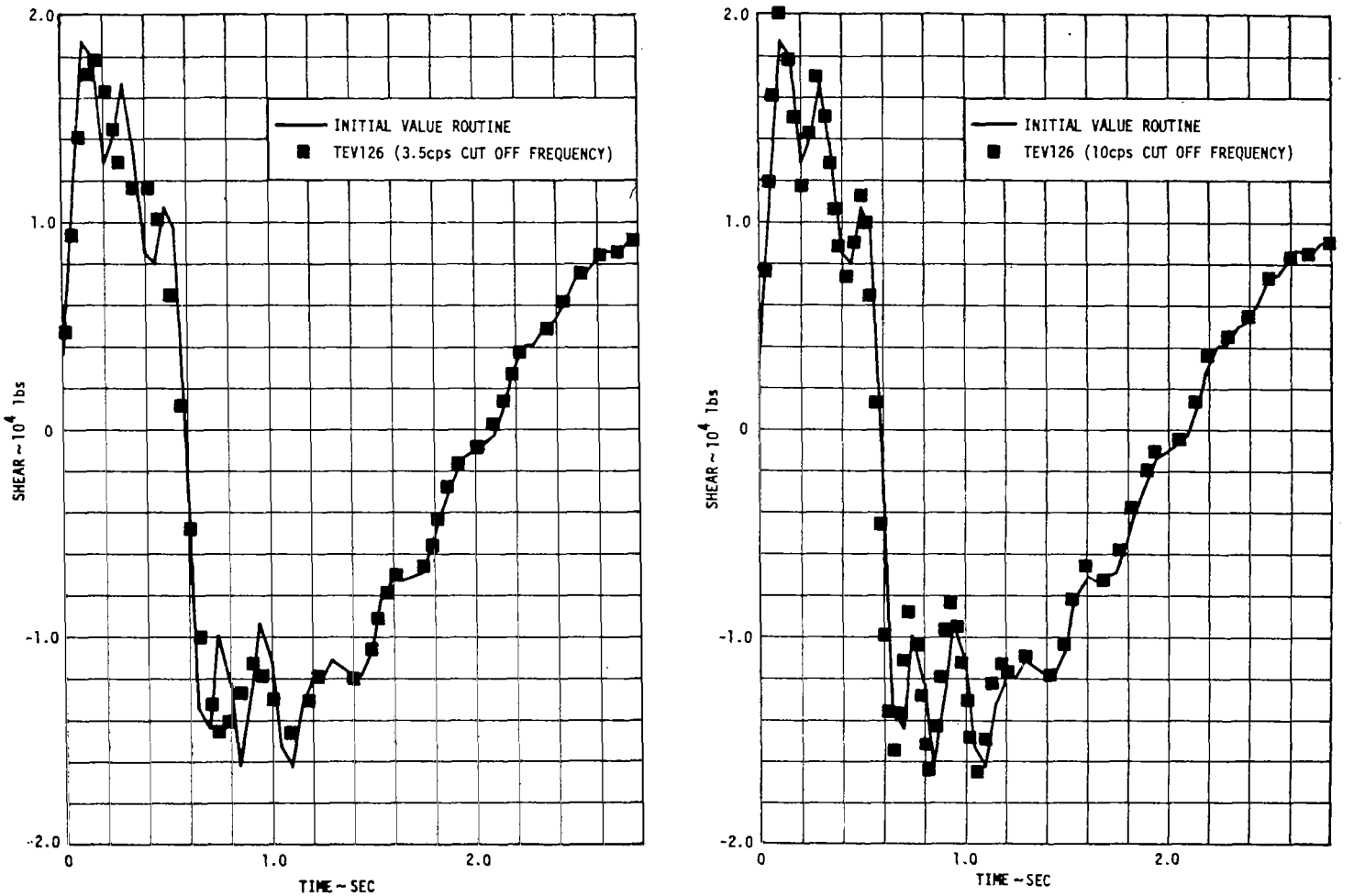


Figure 13.—Comparison of an Airplane Response to a 25-Chord Rectangular Wave in the Time Domain

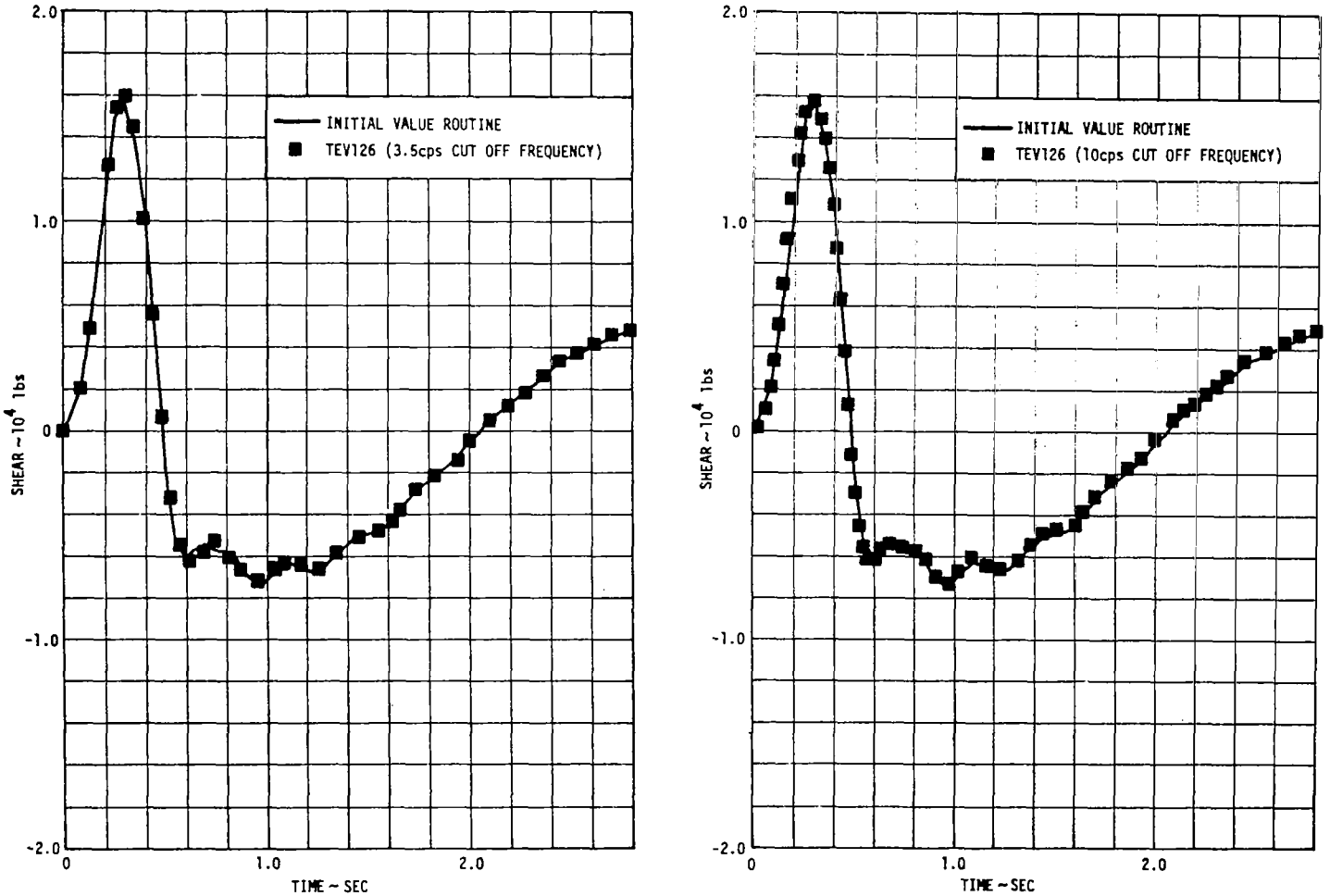


Figure 14.—Comparison of an Airplane Response to a 25-Chord One-Half (1 - cos) Wave in the Time Domain

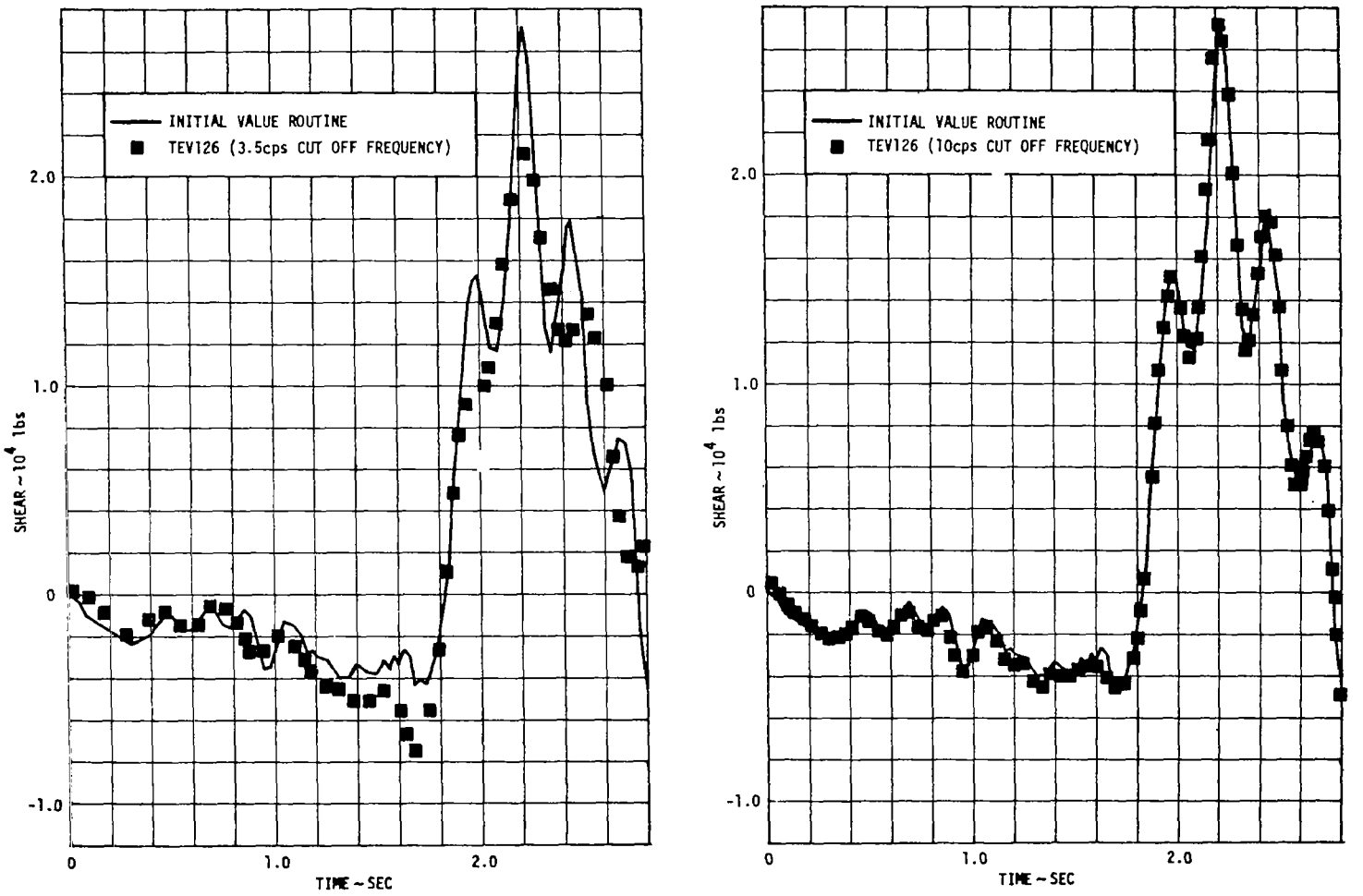


Figure 15.—Comparison of an Airplane Response to a Spanish Peak Gust in the Time Domain

Several options exist that enable the user to determine the parameters given in equation (33). All options require the user to define F_{MAX0}. Table 1 is a list of the options available; the input data required with each option; and the restrictions under which each option operates.

Table 1.—List of Analysis Parameter Options

Option	Input data	Restrictive conditions
1	None	$F_{HARM}=F_{MAX1}=F_{MAX0}$ M(1) = 10 $T_{MAX}=1024/F_{MAX0}$ $\Delta t= 1/F_{MAX0}$
2	M	$F_{HARM}=F_{MAX1}=F_{MAX0}$ $T_{MAX} =N/F_{MAX0}$ $\Delta t = 1/F_{MAX0}$
3	M,T_{MAX}	$F_{HARM}=F_{MAX},\leq F_{MAX0}$ $T_{MAX}\geq N/F_{MAX0}$ $\Delta t\geq 1/F_{MAX0}$
4	M,Δt	$F_{HARM}=F_{MAX1}\leq F_{MAX0}$ $T_{MAX}\geq N/F_{MAX0}$ $\Delta t\geq 1/F_{MAX0}$
5	M,Δt	$F_{HARM}=F_{MAX1}=F_{MAX0}$ IF $T_{MAX}<N/F_{MAX0}$(usual situation) $\Delta t<N/NN*F_{MAX0}$
6	M,T_{MAX}	or $F_{HARM}=F_{MAX1}\leq F_{MAX0}$ IF $T_{MAX}\geq N/F_{MAX0}$ $\Delta t\geq N/NN*F_{MAX0}$
7	M,T_{MAX},Δt	$F_{HARM}\geq F_{MAX1}$ $F_{MAX0}\geq F_{MAX1}$ Δt is changed only as a last resort
8	M,T_{MAX},Δt	$F_{HARM}\geq F_{MAX1}$ $F_{MAX0}\geq F_{MAX1}$ T_{MAX} is changed only as a last resort

The parameters are defined under the two basic restrictions that

$$F_{MAX1} \leq F_{HARM} \tag{34}$$

and

$$F_{MAX1} \leq F_{MAX0} \tag{35}$$

where

F_{MAX0} = Maximum frequency for which the input frequency response functions are considered defined.

Since the frequency function $X(\omega)$ is formed from the product of the input frequency response function, $H(\omega)$, and the Fourier transform of the forcing function, $F(\omega)$ (eq. 18), it makes no sense to integrate beyond the point where either $F(\omega)$ or $H(\omega)$ is adequately defined. The program restrictions stated in equations (34) and (35) result in such a check being present during parameter selection. If the user were to select a combination of parameters that would violate these restrictions, the program will automatically readjust the parameter so that the restrictions of (34) and (35) are met. The program does not, however, have any safeguards with regard to aliasing effects. It is the responsibility of the user to ensure that the selection of the analysis parameters given in table 1 will not introduce serious aliasing effects with regards to $F(\omega)$ or $x(t)$.

Options 1 through 4 are generally used to define the response for large values of time. When the maximum time of interest is small yet a large number of points are needed to properly define the transform, options 5 and 6 are recommended. These two options are normally selected in the majority of analyses. In options 7 and 8, the cutoff frequency is calculated from the relationship

$$F_{MAX1} = T_{MAX}/\Delta t^2 * N \tag{36}$$

which is derived from equation (33).

In options 3 through 6, the input variable Δt or T_{MAX} is subjected to change if the restrictive conditions are not met. The user has the option to have such changes printed.

5.0 PROGRAM DESIGN AND STRUCTURE

The time history program L225 (TEV126) consists of three overlays. Figure 16 shows the overlay structure used for this program. The main overlay is a small program used to drive either or both of the two remaining overlays. The function of the SORT overlay is to select and rearrange the frequency response functions input from the PSD program. Input to this overlay is via cards and magnetic files. Output from SORT is the magnetic file "SRTFRP" containing the chosen frequency response functions.

The ANAL overlay performs all convolutions and transformations. Card and magnetic file inputs are used. The user has the option to output printed time histories, a file of plotting vectors for the response time history, and/or a file of plotting vectors for the magnitudes of the output frequency response function $|X(f)|$.

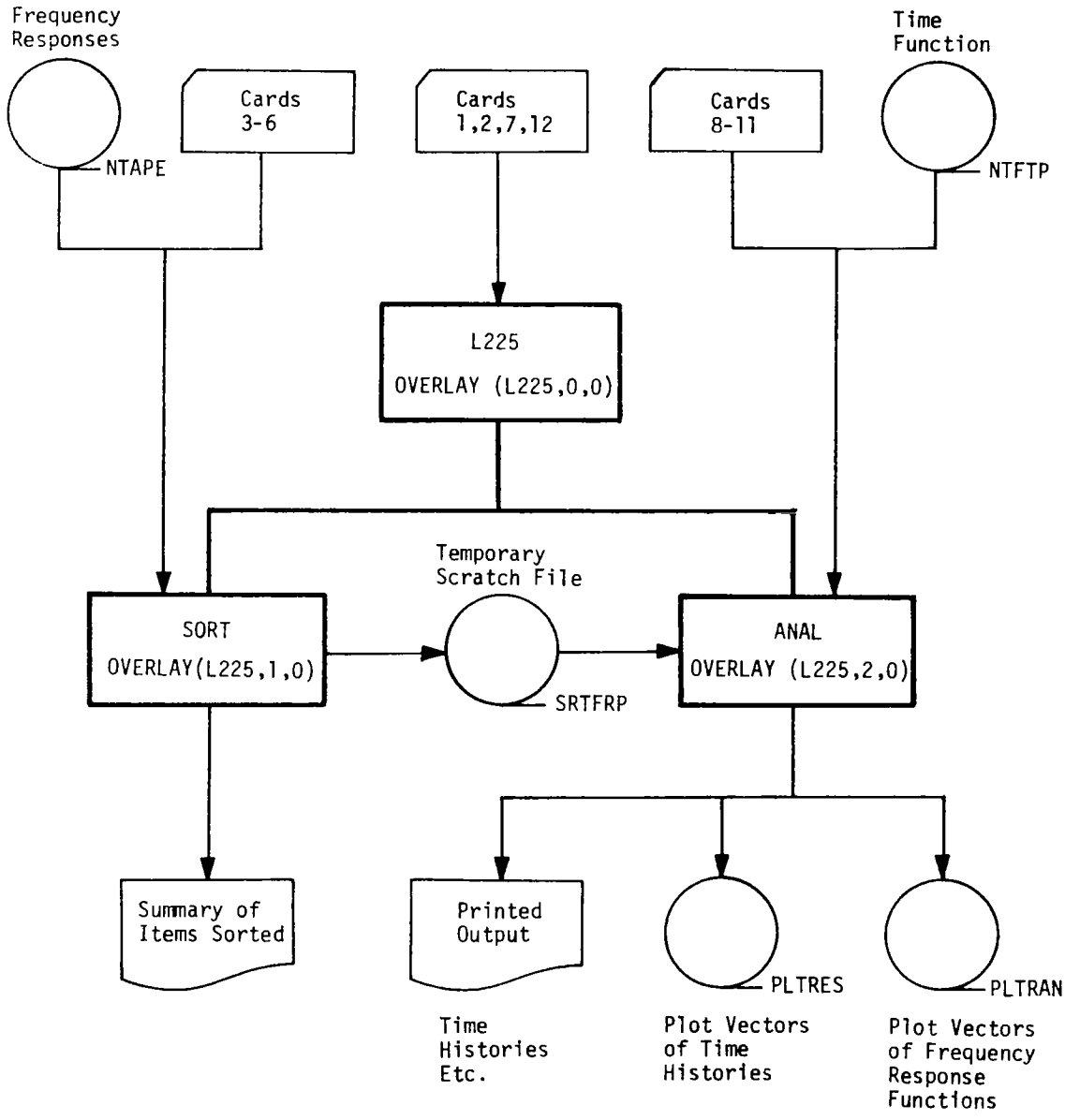


Figure 16.—L225 (TEV126) Overlay System

6.0 COMPUTER PROGRAM USAGE

6.1 MACHINE REQUIREMENTS

The machine requirements for an execution of the program L225 (TEV126) are:

Card reader	Read control cards and data cards
Printer	Print calculated results
Disk storage	Contain a temporary file of sorted frequencies and responses
Magnetic tape drive	Read the program file, frequencies and responses, time functions, and write plot data files

6.2 OPERATING SYSTEM

Program L225 (TEV126) is written in FORTRAN for the CDC 6600. It may be compiled with either the RUN or FTN compilers. L225 (TEV126) may be executed under the KRONOS 2.1 or NOS operating system.

6.3 CONTROL CARDS

L225 (TEV126) may be extracted from a master file and executed on the KRONOS 2.1 operating system with the following control cards and deck setup.

Job Card

Account Card

•
•
•

REQUEST (MASTER,F=I,LB=KL,VSN=66XXXX)

REWIND (MASTER)

SKIPF (MASTER)

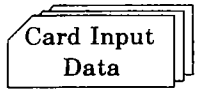
COPYBF (MASTER,L225)

} Retrieves the absolute binary overlays of L225

RETURN (MASTER)

```
•
•          { Prepare any input magnetic files
•
L225.
•
•          { Save any output magnetic files
•
EXIT.
```

DMP(1,115000)
--- End-of-record



--- End-of-file

6.4 RESOURCE ESTIMATES

Field Length

The field length required to load L225 (TEV126) is 100000 octal words. The minimum field length required to run the program is 115000 octal words. More may be required if the problem size is large. Estimate the field length needed with the following formula:

$$FL(\text{field length}) = 20000_{10} + 2(NFREQ + NRMAX)$$

where:

NFREQ = Number of frequencies

NRMAX = Number of responses to be read; larger of NDOF and NLD (see card set 3.0)

Note that FL must be changed to an octal base number before being placed on the job card.

Timing

The central processing time required to convolute one frequency response is approximately 2.5 sec.

Printout

The number of lines printed depends on the number of convolutions processed and the type of output requested. See cards 10.0 through 10.4. The maximum lines per convolution is approximately 2050.

Tape Driver

A magnetic tape drive will be required if the program is to be accessed from a master tape, or if the frequencies and responses are on tape, or if the time functions are to be read from tape.

Disk Storage

The disk storage requirement of L225 (TEV126) is small enough that the user need not be concerned about it. The scratch file "SRTFRP" written in SORT, overlay (L225,1,0), will contain a maximum of 55,000 words. For the length of the plot files written by ANAL, overlay (L225,2,0), see section 6.6.2.

6.5 INPUT DATA

Program L225 (TEV126) reads input data from two sources: cards and magnetic files. Program directives and constants are input via cards. The frequency responses to be processed may be input on either cards or magnetic files.

6.5.1 CARD INPUT DATA

Figure 17 provides an overall picture of the card input data flow. The content and format of each card are described in detail in section 6.5.2.

The task performed by L225 (TEV126) is broken into two subtasks, each with its own section of code known as a primary overlay. The two primary overlays are driven by a small program, the main overlay L225.

L225 reads program directive cards to:

- Assure that the data being read is intended for L225 (TEV126)
- Determine which section of code (primary overlay) is to be executed next.
- Terminate execution

Each primary overlay has its own card input data sets. The primary overlays and data set numbers are listed in table 2.

The following cards are all program directive cards read by L225. Note that they all begin with a keyword having "$" as the first character.

Card	Keyword	Card	Keyword
1.0	$TIME	2.0	$SORT
1.1	$TITLe	7.0	$ANALysis
1.2	$CHECk	12.0	$QUIT

Each card set is described in section 6.5.2.

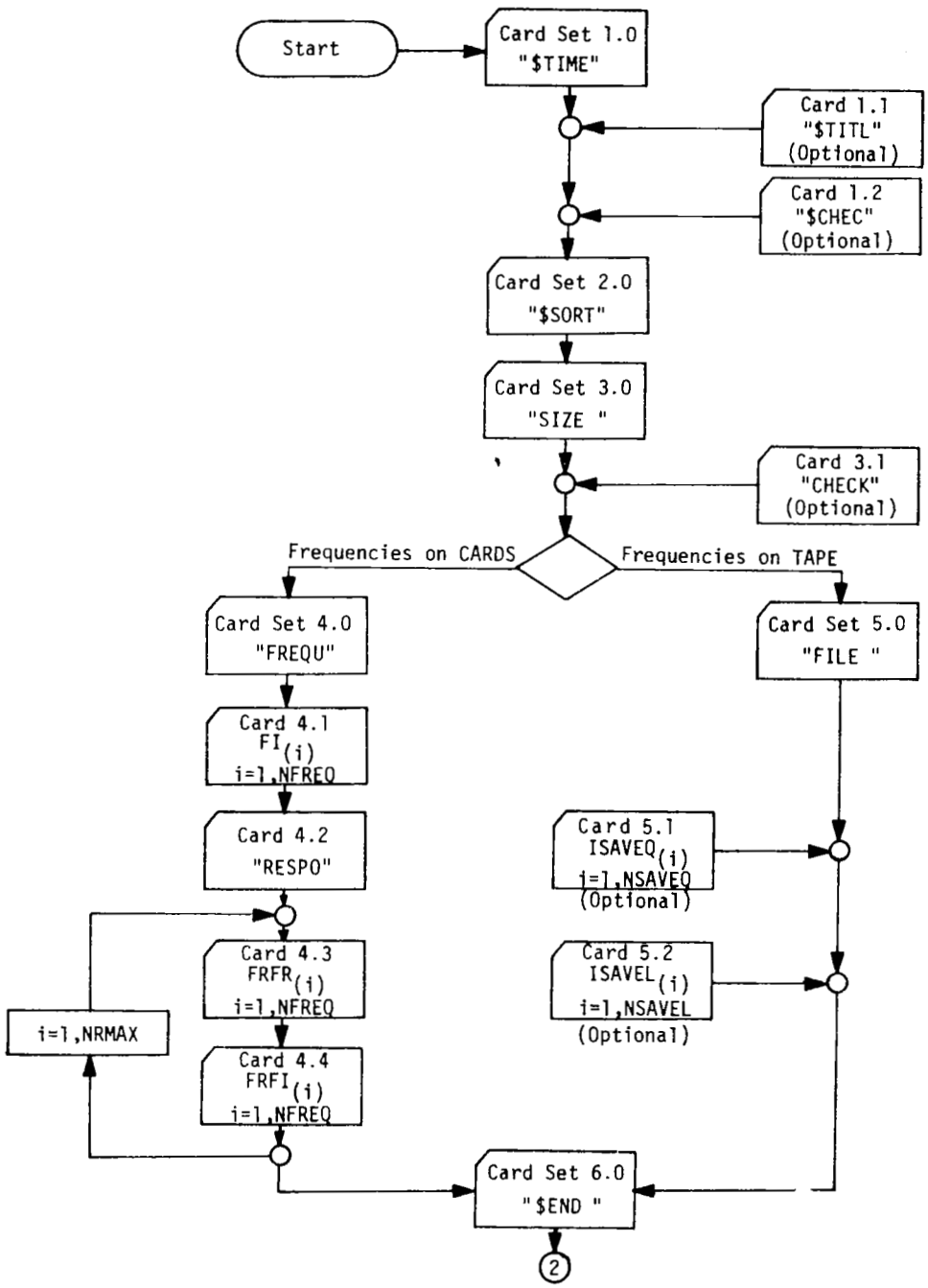


Figure 17.—Card Input Data Flow

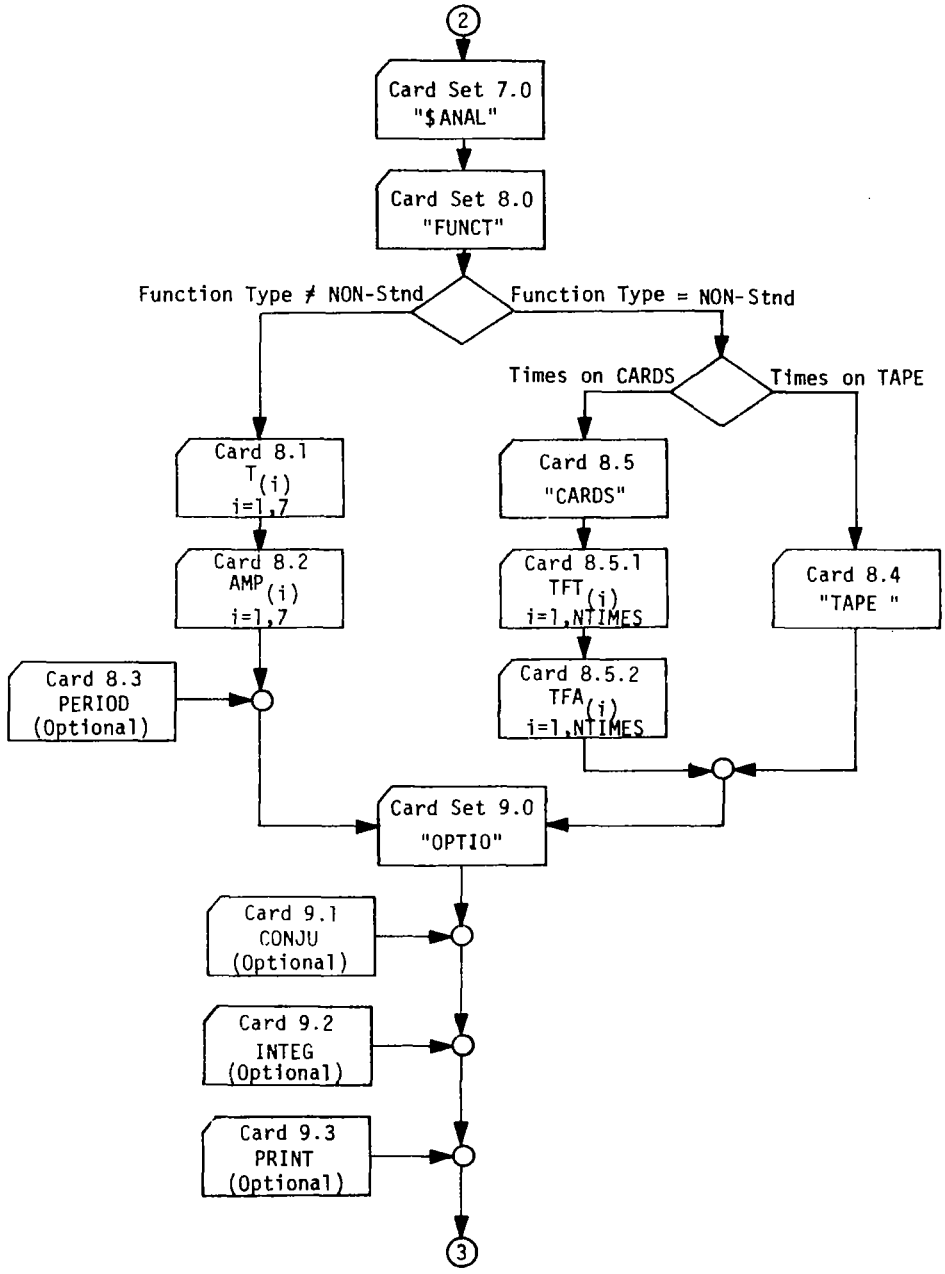


Figure 17.—(Continued)

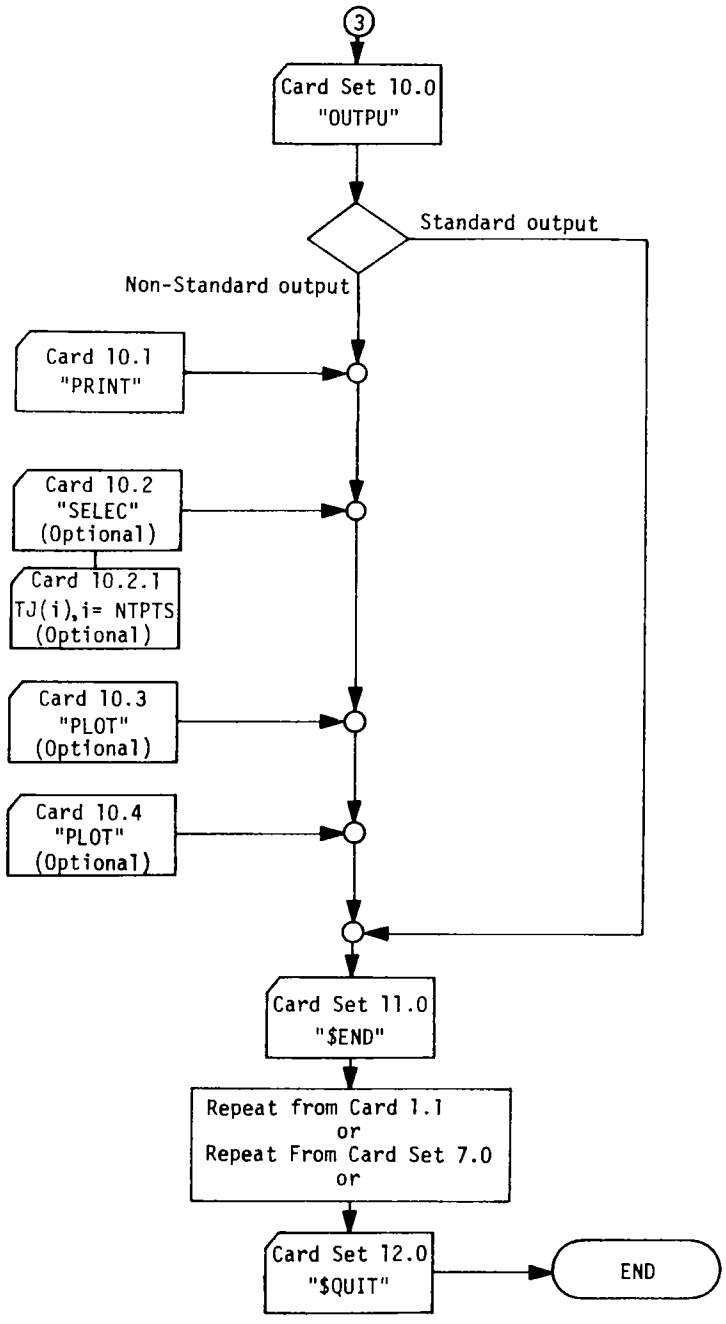


Figure 17.—(Concluded)

Table 2.–Primary Overlays and Data Set Numbers

Overlay		Data sets	Purpose of primary overlay
Number	Name		
1	SORT	3 through 6	Sort frequency responses read from magnetic file or cards and write on a scratch file those that are to be retained for analysis in ANAL.
2	ANAL	8 through 11	Convolute the frequency responses read from the scratch file (prepared by SORT) and generate time histories.

6.5.2 FORMAT OF CARD INPUT DATA

All card data are read in fixed fields – specific columns of the cards. The required card columns are defined next to each keyword or variable on the pages that follow. Note the following conventions are used throughout the program:

- All floating point variables are read with format E10.0
- All integer variables are read with format I5.
- All hollerith variables (keywords, etc.) are read with format A10

Therefore, all data fields end on a card column which is a multiple of five.

When the program is trying to recognize keywords, it checks only the first five characters. Any additional characters are ignored.

The main overlay of L225 (TEV126) reads cards to determine which program module (SORT or ANAL) is to be called into execution.

Note: Only the first five characters of any keyword are read to determine what is to be done. All underlined capital characters contained in the KEYWORD/VARIABLE field of the input card sets must be left justified and punched in the card columns specified in the COLS. field of the input card sets.

Card Set 1.0–Program Directive

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	$TIME	A10	This card must always be the first card for the Time History L225(TEV126) program. Note: For any card with only a keyword on it, the user may use card columns 6 - 72 for his comments.

Card 1.1–Title Card

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	$TITLe	A10	This card is used to label the program output and identify the problem. Any number of TITLE cards may be input. Columns 1-80 are printed.

Card 1.2–Program Checkout Card

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	$CHECk	A10	This card is not recommended for normal production runs. When used, the program tries to continue even after fatal errors are encountered.

Card Set 2.0–Sort Instruction Card

Note: **Card set 2.0 must be input at least once before card set 7.0, $ANAL, the analysis card.**

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	$SORT	A10	This card directs L225 (TEV126) to call SORT, the response function sorting overlay. Cards 3.0 through 6.0 will be read, response functions will be sorted, and control will be returned to the L225 (TEV126) main overlay.

Card Set 3.0–Size and Characteristics of Input Data

Card set 3.0 must follow card set 2.0

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	SIZE	A10	Keyword for the size of input.
11-15	NRMAX	I5	When the response functions are to be read from cards, NRMAX is the number of responses to be input. When the response functions are to be read from a magnetic file, NRMAX is the larger of the following two numbers: NDOF, the number of generalized coordinates (q's) on the file, and NLD, the number of loads on the file. (0 ≤ NRMAX ≤ 100)
16-20	NFREQ	I5	Number of frequencies to be read from cards or magnetic file. Note: All frequency response functions must be defined for the same array of frequencies. (0 < NFREQ ≤ 250)
21-30	FACTOR	E10.0	The frequencies read from cards or tape will be multiplied by FACTOR. FACTOR is used to convert the units of the input frequencies to Hertz. Default is 1.0. (FACTOR > 0)

Card 3.1–Program Checkout Option (Optional)

If not used, ICKPT1 will be set to zero.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	CHECKout	A10	This keyword is used for checkout of the SORT program. This card is used to print the input matrix data, or the data being passed between overlays.
11-15	ICKPT1	I5	= 0 for normal production run (Default) = 1 will print the frequency response functions input to the SORT routine. = 2 will print the input frequency response functions, output frequencies and output frequency response functions from SORT.

If the frequencies and frequency response functions are to be input on cards, card set 3.0 (and card 3.1 if used) will be followed by cards 4.0 through 4.4. If they are being input by magnetic file, cards 3.0 and 3.1 will be followed by cards 5.0 through 5.2.

Card Set 4.0–Frequencies and Frequency Response Functions Input From Cards

Omit cards 4.0 through 4.4 if frequencies and frequency response functions are on magnetic file.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	FREQUencies	A10	Keyword introducing the card set defining the input frequency array.

Card 4.1–Frequency Array

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	FI(1)	7E10.0	Elements of the frequency array.
11-20	FI(2)		FI(i), i = 1, NFREQ
	•		Note: FI(i) > FI(i-1) > 0.
	•		Repeat the card with 7 numbers per card until all elements are
	FI(NFREQ)		defined.

Card 4.2–Response Functions

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	RESPOnse	A10	Keyword introducing the response functions being input on cards.

Card 4.3–Frequency Response Function Array

Repeat cards 4.3 and 4.4 in pairs NRMAX times.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	FRFR(1)	7E10.0	Real part of the frequency response function array.
11-20	FRFR(2)		FRFR(i), i = 1, NFREQ
	•		Repeat the card with 7 numbers per card until all elements are
	•		defined.
	FRFR(NFREQ)		

Card 4.4–Frequency Response Function Array

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	FRFI(1)	7E10.0	Imaginary part of the frequency response function array FRFI(i), i = 1, NFREQ Repeat the card with 7 numbers per card until all elements are defined.
11-20	FRFI(2) • • • FRFI(NFREQ)		

Card Set 5.0–Frequencies and Frequency Response Functions Input From Magnetic File

Omit cards 5.0 through 5.2 if frequencies and frequency response functions are input on cards.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	FILE	A10	Keyword indicating the frequency array and responses are on a magnetic file.
11-20	NTAPE	A10	File name on which frequency array is found.
21-25	ISOL	I5	The number of the solution on NTAPE which is to be sorted. Default = 1.
26-30	NSAVEQ	I5	The number of generalized coordinates (q's) to be saved for analysis. Note: NSAVEQ ≤ NRMAX. Default: All generalized coordinates will be used in analysis.
31-35	NSAVEL	I5	The number of load frequency response functions (L's) to be saved for analysis. Default: All load responses will be used in the analysis. Note: NSAVEL ≤ NRMAX.

Card 5.1–Choose q's To Be Saved

Omit card 5.1 if NSAVEQ = 0 on card 5.0.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-5	ISAVEQ(1)	14I5	An array of numbers indicating which q's are to be saved for analysis.
6-10	ISAVEQ(2)		ISAVEQ(i), i = 1, NSAVEQ
	• • •		Repeat the card with 14 numbers per card until all elements are
	ISAVEQ(NSAVEQ)		defined.

Card 5.2–Choose L's To Be Saved

Omit card 5.2 if NSAVEL = 0 on card 5.0.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-5	ISAVEL(1)	14I5	An array of numbers indicating which loads are to be saved for
6-10	ISAVEL(2)		analysis.
	• • •		ISAVEL(i), i = 1, NSAVEL
	ISAVEL(NSAVEL)		Repeat the card with 14 numbers per card until all elements are
			defined.

Card Set 6.0–End of SORT Overlay

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	$END	A10	Keyword to indicate the end of data for the SORT overlay. Execution is returned to L225 (TEV126) main overlay.

Card Set 7.0–Analysis Card

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-5	$ANALysis	A10	This card directs L225 (TEV126) to call ANAL, the time history calculation overlay. Card sets 8.0 through 11.0 will be read, time histories calculated and printed, and execution will be returned to L225 (TEV126) main overlay.

Card set 8.0–Time Functions

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	FUNCTion	A10	Keyword indicating the type of time function to be used in the analysis.
11-15	TYPEX	A5	Keyword indicating the type of time function to use. First 5 characters of keyword are checked. This includes blank spaces. Where: TYPEX = { STEP function; TRIPLe step; IMPULse; SINE wave; ONE Minus cosine; THREE one minus cos.; RAMPS; NON-Standard } See Figure 18 for an illustration of the above time functions.

Note: Card 8.0 must be followed by cards 8.1 through 8.3 if TYPEX≠NON-Standard or by card 8.4 or 8.5 if TYPEX = NON-Standard.

Card 8.1–Time Array

Omit cards 8.1 through 8.3 if TYPEX = NON-Standard.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	T(1)	7E10.0	Array of times used to define the time function.
11-20	T(2)		T(i), i = 1, 7
	• • •		
61-70	T(7)		

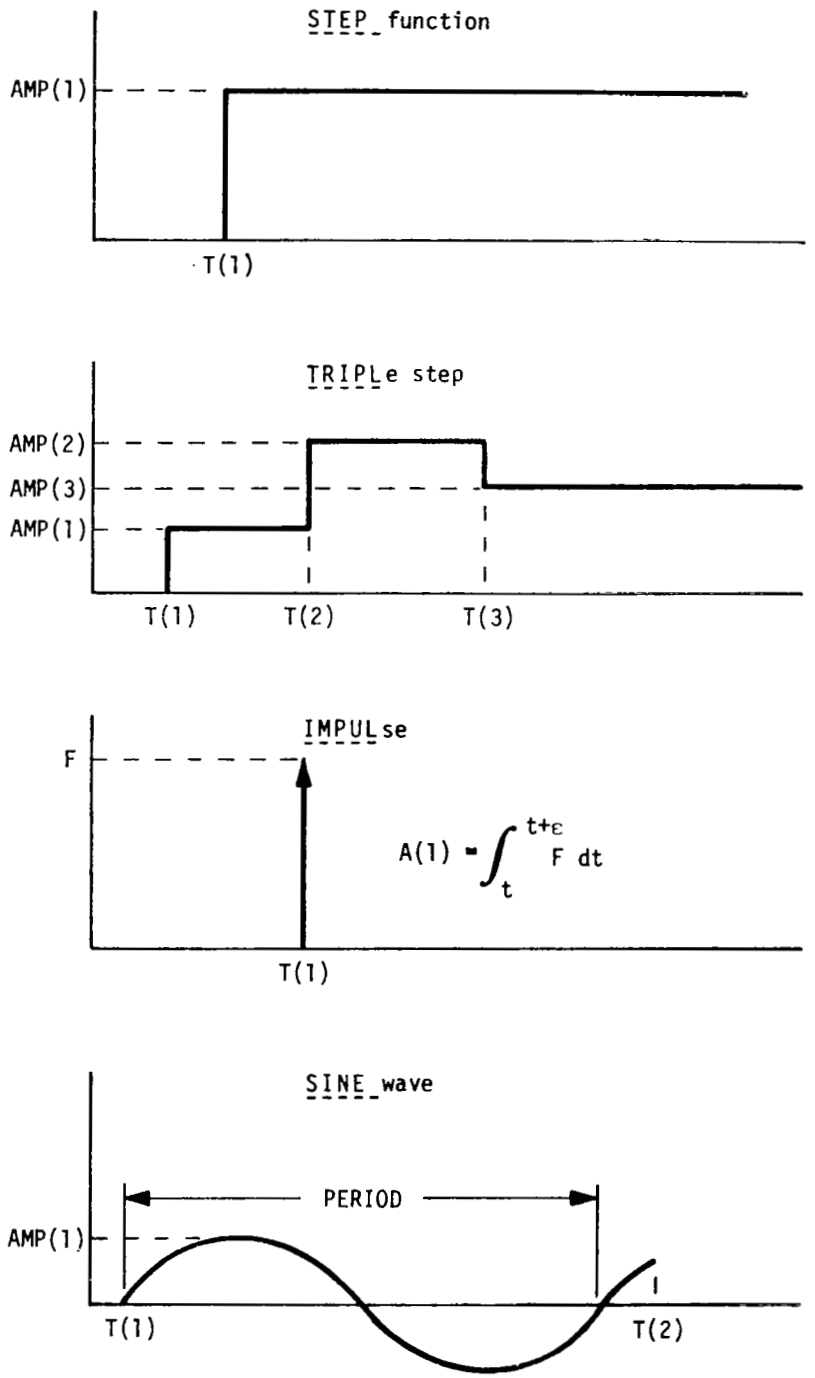


Figure 18.—Standard Time Functions in L225 (TEV126)

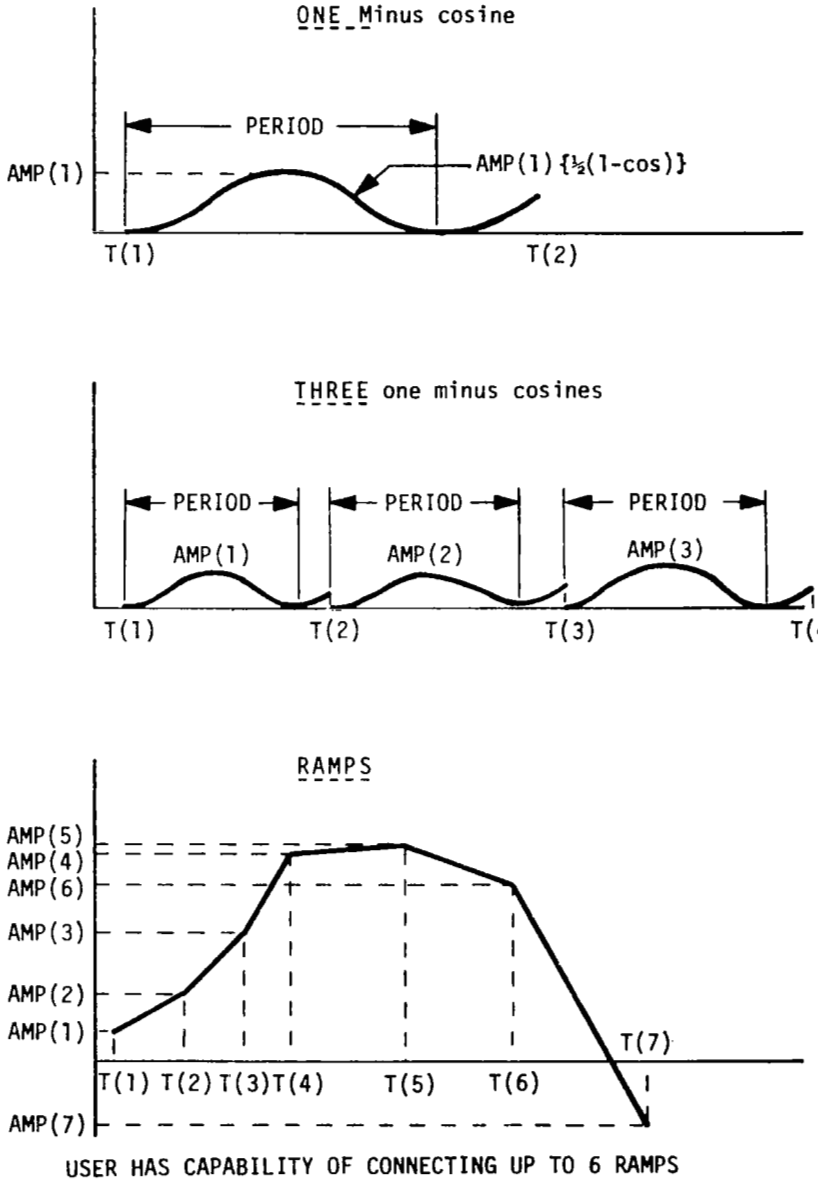


Figure 18.—(Concluded)

Card 8.2- Amplitude Array

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	AMP(1)	7E10.0	Array of amplitudes used to define the time function.
11-20	AMP(2)		AMP(i), i = 1, 7
	⋮		
61-70	AMP(7)		

Card 8.3–Period of Time Functions

Omit card 8.3 if the time function requested is not SINE wave, ONE Minus, or THREE one.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	PERIOD	E10.0	Period is used to define the periodic time functions. Required only if the Time Function name is: SINE wave, ONE Minus, or THREE one.

Card 8.4–Tape Containing the Time Functions

Omit cards 8.4 through 8.5.2 if TYPEX ≠ Non-Standard.

Omit card 8.4 if time function is on cards.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	TAPE	A10	Keyword indicating the Time Functions are on tape.
11-20	NTFTP	A10	Name of the tape containing the Time Function.
21-25	NFILTF	I5	The numbers of files to skip on NTFTP before trying to read the Time Function.
26-30	NMATTF	I5	The numbers of matrices to skip on NTFTP (after file spacing) before trying to read the Time Function.

Card 8.5–Cards Containing the Time Function

Omit card 8.5 if time function is on tape.

Card 8.5 must be followed by cards 8.5.1 and 8.5.2.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	CARDS	A10	Keyword indicating the Time Functions are on cards.
11-15	NTIMES	I5	Number of points in the Time and Amplitude arrays (≤ 1000)

Card 8.5.1–Time Function Array

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	TFT(1)	7E10.0	An array of times used to define the Time Function
11-20	TFT(2)		TFT(i), i = 1, NTIMES
	• • •		
	TFT(NTIMES)		Repeat the card with 7 numbers per card until all elements are defined.

Card 8.5.2–Amplitude Array

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	TFA(1)	7E10.0	An array of amplitudes used to define the Time Function
11-20	TFA(2)		TFA(i), i = 1, NTIMES
	• • •		
	TFA(NTIMES)		Repeat the card with 7 numbers per card until all elements are defined.

Card Set 9.0–Analysis Options

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	OPTIONs	A5,5X	Keyword designating the card set containing the analysis options.
11-15	IPTION	I5	See complete description and possible values for IPTION shown in table 3.
16-20	M	I5	M = 6, 7, 8, 9 or 10 is used to define the number of points (N) in subroutine HARM ($N = 2^M$), only if IPTION ≠ 1. See next page for more description.
21-30	TMAX	E10.0	Maximum time for which time response is calculated (only for IPTION = 3, 6, 7, 8)
31-40	DELTAT	E10.0	Time increment (only if IPTION = 4, 5, 7, 8)
41-50	FMAX0	E10.0	Maximum frequency for which the frequency response functions are considered to be defined.

A summary of the available options is shown in table 3. A discussion of the options is presented in section 5.3.

Card 9.1–Conjugate Response Function (Optional)

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	CONJUgate	A10	Keyword to cause the input frequency response functions to be conjugated before transform is performed. Default is no conjugation.

Table 3.—Summary of Available Parameter Options

Option	Input data	Restrictive conditions
1	None	$F_{HARM}=F_{MAX1}=F_{MAX0}$ $M(1) = 10$ $T_{MAX}=1024/F_{MAX0}$ $\Delta t= 1/F_{MAX0}$
2	M	$F_{HARM}=F_{MAX1}=F_{MAX0}$ $T_{MAX} =N/F_{MAX0}$ $\Delta t = 1/F_{MAX0}$
3	M,T_{MAX}	$F_{HARM}=F_{MAX1}\leqslant F_{MAX0}$ $T_{MAX}\geqslant N/F_{MAX0}$ $\Delta t\geqslant 1/F_{MAX0}$
4	$M,\Delta t$	$F_{HARM}=F_{MAX1}\leqslant F_{MAX0}$ $T_{MAX}\geqslant N/F_{MAX0}$ $\Delta t\geqslant 1/F_{MAX0}$
5	$M,\Delta t$	$F_{HARM}=F_{MAX1}=F_{MAX0}$ IF $T_{MAX}<N/F_{MAX0}$ (usual situation) $\Delta t<N/NN*F_{MAX0}$
6	M,T_{MAX}	or $F_{HARM}=F_{MAX1}\leqslant F_{MAX0}$ IF $T_{MAX}\geqslant N/F_{MAX0}$ $\Delta t\geqslant N/NN*F_{MAX0}$
7	$M,T_{MAX},\Delta t$	$F_{HARM}\geqslant F_{MAX1}$ $F_{MAX0}\geqslant F_{MAX1}$ Δt is changed only as a last resort
8	$M,T_{MAX},\Delta t$	$F_{HARM}\geqslant F_{MAX1}$ $F_{MAX0}\geqslant F_{MAX1}$ T_{MAX} is changed only as a last resort

Card 9.2–Integration Selector (Optional)

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	INTEGrate	A10	Keyword introducing the integration selector.
11-20	TYPEX	A10	The type of integration to be performed in taking the inverse transform where TYPEX must be one of the following keywords. TYPEX = { COMPLex (Default) ; REAL ; IMAGInary }

KEY WORD	EQUATION USED
COMPLex	$x(t) = 2\ \text{Real}\left\{ \frac{1}{2\pi} \int_0^{2\pi \cdot FMAX1} x(\omega) e^{i\omega t}\, d\omega \right\}$
IMAGInary	$x(t) = -4\ \frac{1}{2\pi} \int_0^{2\pi FMAX1} \text{Imag}\left\{ x(\omega) \right\} \sin \omega t\ \ d\omega$
REAL	$x(t) = 4\ \frac{1}{2\pi} \int_0^{2\pi FMAX1} \text{Real}\left\{ x(\omega) \right\} \cos \omega t\ \ d\omega$

Card 9.3–Print Parameter Changes

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	PRINT	A10	Keyword requesting printing of control data changes made by the program to TMAX or DELTAT. Default is not printing TMAX or DELTAT changes.

Card Set 10.0–Output Specifications

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	OUTPUt	A10	Keyword to specify output options.
11-20	STANDard or NON-Standard	A10	If keyword STANDARD is used the only output printed is Time Histories. Omit Cards 10.1 through 10.4. If keyword NON-STANDARD is used the desired options must be specified on Cards 10.1 through 10.4.
21-25	ICKPT2	I5	This variable is used for check out purposes in the program. = 0 for normal production run. = 1 will print input time functions from the analysis routine. = 2 will print input frequencies and input responses from the analysis routine.

Card 10.1–Print Options

Omit cards 10.1 through 10.4 if STANDard keyword is used on card 10.0.

Card 10.1 may be repeated with different keywords if more than one nonstandard output type is desired.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	PRINT	A10	Keyword for print options.
11-20	TYPEX	A10	Keyword to indicate the desired print option. TYPEX must be one of the following: TIME - time histories of the desired output functions with the time history of the forcing function printed with the first output quantity only. INTERpolated - print interpolated transfer functions used in convolution. ALL Transfer functions - print interpolated transfer functions, transformed forcing function and product of interpolated functions and forcing function. Note: ALL Transfer functions option includes INTERpolated option. MAXIMum - minimums - print maximum and minimum values of output functions along with times at which they occur.

Card 10.2–Selected Output Times (Optional)

Omit cards 10.2 and 10.2.1 if the time response is to be output at the times at which it was determined in the analysis.

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	SELECt	A10	Keyword indicating time responses to be printed at selected output times as specified by user.
11-15	NTPTS	I5	Numbers of time points at which the user chooses time responses to be printed (NTPTS $\leq$ 1024)
16-25	DELTO	E10.0	Value of Δt which user specifies along whith NTPTS to determine the output time array. TJ(i) = i * DELTO where i = 1, NTPTS

If DELTO = 0.0, user must read in time array on card 10.2.1.

Card 10.2.1–Time Array for Output

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	TJ(1)	7E10.0	Time array for output of time response.
11-20	TJ(2) • • • TJ(NTPTS)		TJ(i), i = 1, NTPTS Repeat the card with 7 numbers per card until all elements are defined.

Card 10.3–Plot Time History (Optional)

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	PLOT	A10	Keywords to indicate that the time histories are to be saved for possible plotting. (See tape PLTRES in Section 6.6.2).
11-20	TIME	A10	

Card 10.4–Plot Function (Optional)

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-15	PLOT	A10	Keywords to indicate that the output frequency response functions are to be saved for possible plotting. (See tape PLTRAN in Section 6.6.2).
11-20	TRANS	A10	

Card Set 11.0–End of Analysis

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	$END	A10	Keyword to indicate the end of data for the ANAL overlay. Execution is returned to L225 (TEV126) main overlay.

Card Set 12.0–End of Program

COLS.	KEYWORD/ VARIABLE	FORMAT	DESCRIPTION
1-10	$QUIT	A10	This is the last card input to L225 (TEV126). It terminates the execution of the program.

Requirements or Function	Keywords and/or Variables	Card Format	Reference Card Set (CS)
	$TIME $TITLe $CHECk $SORT	A10 A10 A10 A10	1.0 1.1 1.2 2.0
	Begin Sorting of Frequency Response Functions		
Input Data Size and Characteristics	SIZE NRMAX NFREQ FACTOR	A10,2I5 E10.0	3.0
Program Checkout (Optional)	CHECKout ICKPTI	A10,I5	3.1
	Omit Cards 4.0 through 4.4 if frequencies and response functions are on magnetic file		
Freq. Input on Cards	FREQUencies	A10	4.0
Frequency Array	FI(1) FI(2) . . . FI(NFREQ)	7E10.0	4.1
Response Functions Input on Cards	RESPOnse	A10	4.2
	Repeat Cards 4.3 and 4.4 **NRMAX** times		
Real Part of Response Functions	FRFR(1) FRFR(2) . . . FRFR(NFREQ)	7E10.0	4.3
Imaginary Part of Response Functions	FRFI(1) FRFI(2) . . . FRFI(NFREQ)	7E10.0	4.4
	Omit Cards 5.0 through 5.2 if frequencies and response functions are input on cards		
Magnetic File Options	FILE NTAPE ISOL NSAVEQ NSAVEL	2A10,3I5	5.0
NSAVEQ>0; CS 5.0	ISAVEQ(1) ISAVEQ(2) . . . ISAVEQ(NSAVEQ)	14I5	5.1
NSAVEL>0; CS 5.0	ISAVEL(1) ISAVEL(2) . . . ISAVEL(NSAVEL)	14I5	5.2
End of $SORT Overlay	$END	A10	6.0

Requirements or Function	Keywords and/or Variables	Card Format	Reference Card Set (CS)
	Begin Input of Analysis Parameters		
	$ANALysis	A10	7.0
Selection of Time Function	FUNCTion TYPEX	A10,A5	8.0
	Omit Cards 8.1 through 8.3 if TYPEX = NON-Standard; CS 8.0		
Time Array	T(1) T(2) . . . T(7)	7E10.0	8.1
Amplitude Array	AMP(1) AMP(2) . . . AMP(7)	7E10.0	8.2
	Omit Card 8.3 if TYPEX ≠ SINE wave, ONE Minus, or THREE one; CS 8.0		
Period of Time Function	PERIOD	E10.0	8.3
	Omit Cards 8.4 through 8.5.2 if TYPEX ≠ NON-Standard; CS 8.0		
	Omit Card 8.4 if time function is input on cards		
Time Function on Magnetic File	TAPE NTFTP NFILTF NMATTF	2A10,3I5	8.4
	Omit Cards 8.5 through 8.5.2 if time function is input on magnetic file		
Time Function on Cards	CARDS NTIMES	A10,I5	8.5
Array of Times	TFT(1) TFT(2) . . . TFT(NTIMES)	7E10.0	8.5.1
Array of Amplitudes	TFA(1) TFA(2) . . . TFA(NTIMES)	7E10.0	8.5.2

Requirements or Function	Keywords and/or Variables	Card Format	Reference Card Set (CS)
Analysis Options	OPTIOns IPTION M TMAX DELTAT FMAXO	A10,2I5 3E10.0	9.0
Conjugate Response Functions (Optional)	CONJUgate	A10	9.1
Integration Selector (Optional)	INTEGrate TYPEX	2A10	9.2
Print Parameter Changes (Optional)	PRINT	A10	9.3
Output Specifications	OUTPUt STANDard or NON-Standard ICKPT2	2A10,I5	10.0
	Omit Cards 10.1 through 10.4 if keyword STANDard appears on Card 10.0. Card 10.1 may be repeated with different keywords if more than one non-standard output type is desired		
Print Options	PRINT TYPEX	2A10	10.1
	Omit Cards 10.2 and 10.2.1 if time response is to be output at the times at which it was determined in the analysis		
Output Time Selection (Optional)	SELECt NTPTS DELTO	A10,I5 E10.0	10.2
Output Time Array DELTO=0; CS 10.2	TJ(1) TJ(2) . . . TJ(NTPTS)	7E10.0	10.2.1
Plot Time Histories (Optional)	PLOT TIME	2A10	10.3
Plot Output Response Functions (Optional)	PLOT TRANS	2A10	10.4
End of $ANALysis Overlay	$END	A10	11.0
End of Program	$QUIT	A10	12.0

6.5.4 MAGNETIC FILES (TAPE OR DISK)

Optionally, program L225 (TEV126) can read the frequencies and responses it processes from a magnetic file "NTAPE". Card set 5.0 (see sec. 6.5.2) is used to specify whether the responses are on cards or on "NTAPE", which is described in figure 19.

L225 (TEV126) may also read time functions from the magnetic file "NTFTP". Card 8.4 is used to indicate that the time functions are on "NTFTP". See figure 20 for a description of" NTFTP".

Both of the files must be written in the READTP/WRTETP format.[1]

"NTAPE"-Frequency Response Input Tape

"NTAPE" is a magnetic file (tape or disk) containing the frequency-dependent responses to be analyzed by program L225 (TEV126). "NTAPE" must be written in the READTP/WRTETP format. The file is usually generated by the program L221 (TEV156) of reference 5. "NTAPE" may contain several logical files, one for each solution on a "STANDARD" tape generated by L221 (TEV156). The contents of a typical logical file are displayed in figure 19.

"NTFTP"-Time Function Input Tape

"NTFTP" is a magnetic file (disk or tape) containing the time function used in the convolution with the frequency response functions. "NTFTP" is specified via card 8.4. The file must be written in the READTP/WRTETP format.

"NTFTP" may contain several logical files and matrices. The file and matrix skipping parameters on card 8.4 enable the program to read the two required matrices, the array of times, and the array of amplitudes. See figure 20 for the contents of "NTFTP".

---

[1]Clemmons, R. E.: *Programming Specifications for Modules of the Dynamic-Loads System to Interface With FLEXSTAB*. NASA contract NAS1-13918; BCS-G0701, September 1975. (Internal document)

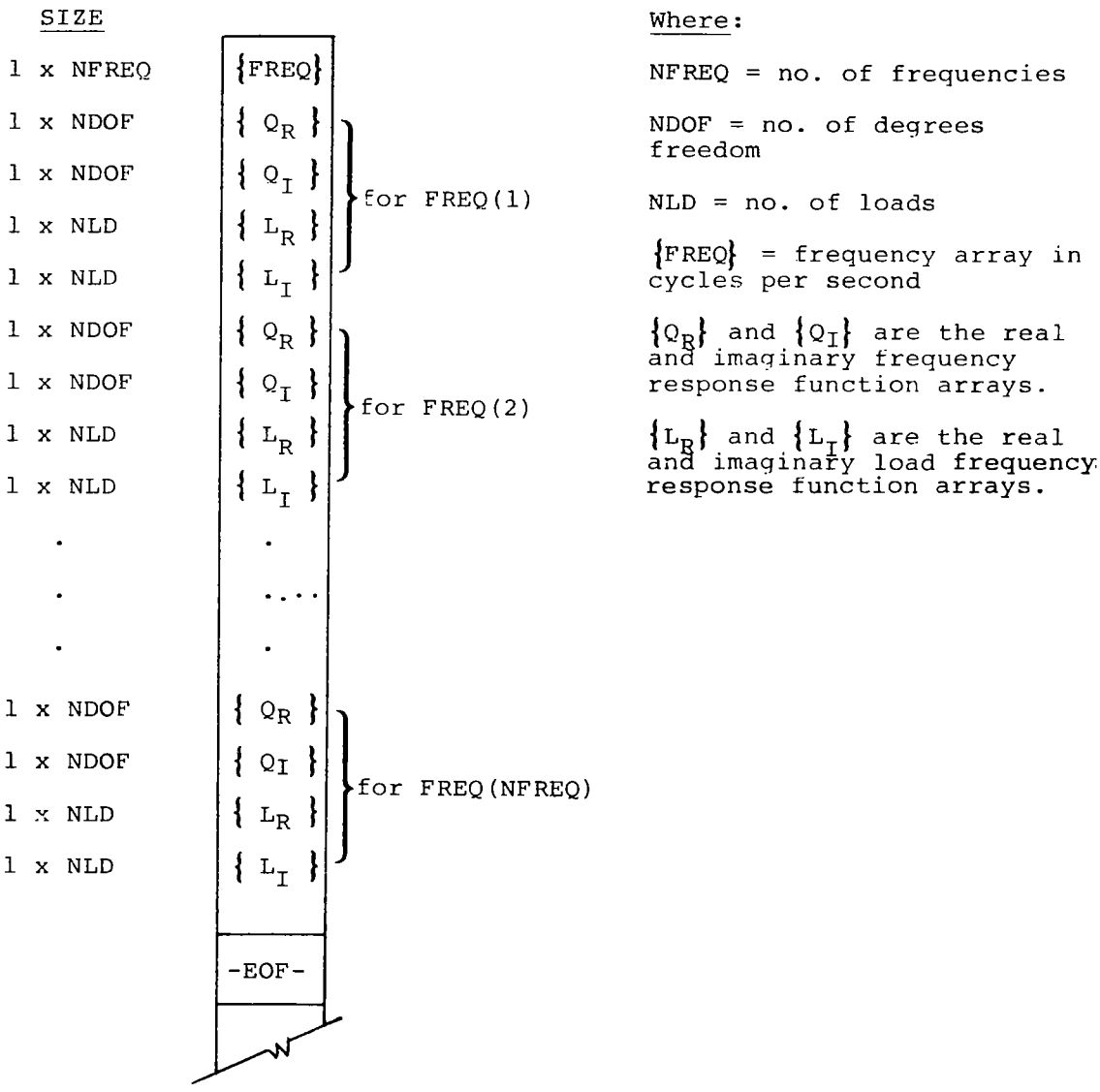


Figure 19.—"NTAPE"—Frequency and Response Input Tape

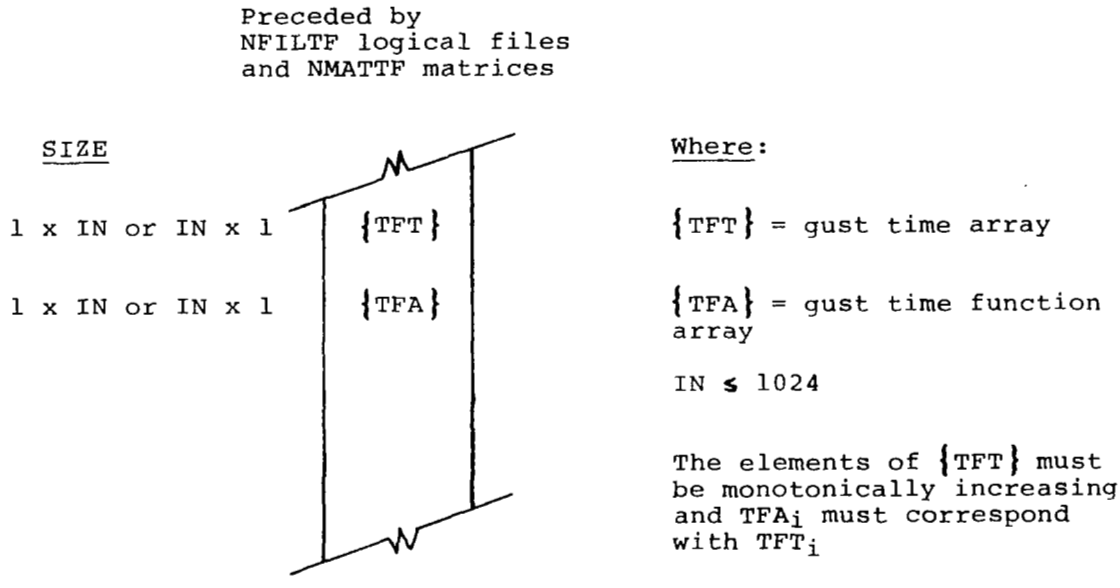


Figure 20.—"NTFTP"—Time Function Input Tape

6.6 OUTPUT DATA

L225 (TEV126) generates printed output and, optionally, magnetic files (disk or tape).

6.6.1 PRINTED OUTPUT

Each time L225 (TEV126) is executed, the following items will be printed:

- A one page block indicating the program name and version plus the current date and time
- All card input data plus interpretive comments
- Execution control data generated by the program
- Solution frequencies after being scaled according to card input
- Time histories
- A one page block indicating that the program execution has ended.

In addition, the following items may be printed if requested by card input.

- Changes made to the program control parameters TMAX and DELTAT (see card 9.3)
- Interpolated frequency response functions used in the convolutions (see card 10.1)
- All frequency functions: the interpolated frequency response functions, transformed input time functions, interpolated output frequency response functions, and interpolated input time functions (see card 10.1)
- The times at which minimums and maximums are attained

For checkout purposes, two other print options are provided:

- Card 3.1 requests the printing of intermediate data in SORT–the sorting overlay (L225,1,0)
- ICKPT2 of card set 10.0 requests the printing of intermediate calculations in ANAL–the analysis overlay (L225,2,0)

6.6.2 MAGNETIC FILES (TAPE OR DISK)

Optionally, L225 (TEV126) will write two magnetic files containing plot data: "PLTRES" and "PLTRAN".

Card 10.3 is used to request the preparation of the file "PLTRES" containing gust time functions and output time responses (see fig. 21).

Card 10.4 is used to request the preparation of the file "PLTRAN" containing transforms of the output convolutions (see fig. 22). The two files are both written in the READTP/WRTETP format.

Both the gust time functions and the output time responses are written on file "PLTRES" if requested by card 10.3. "PLTRES" will contain alternate arrays of independent and dependent variables suitable for plotting.

The absolute values of the transform of the output convolutions are written on "PLTRAN" if requested by card 10.4. "PLTRAN" will contain alternate arrays of independent and dependent variables suitable for plotting.

6.7 RESTRICTIONS

The limitations placed on input variables are described in detail with each data card in section 6.5.2. The primary restrictions are summarized in the following listing.

- SORT overlay must be executed before execution of the overlay ANAL.
- Maximum number of input response functions is 100.
- Maximum number of times and amplitudes used to define a standard time function is 100.
- "NON-STANDARD" type time function may be defined with up to 1000 time points.
- Maximum number of time points at which the time histories can be printed is 1000.

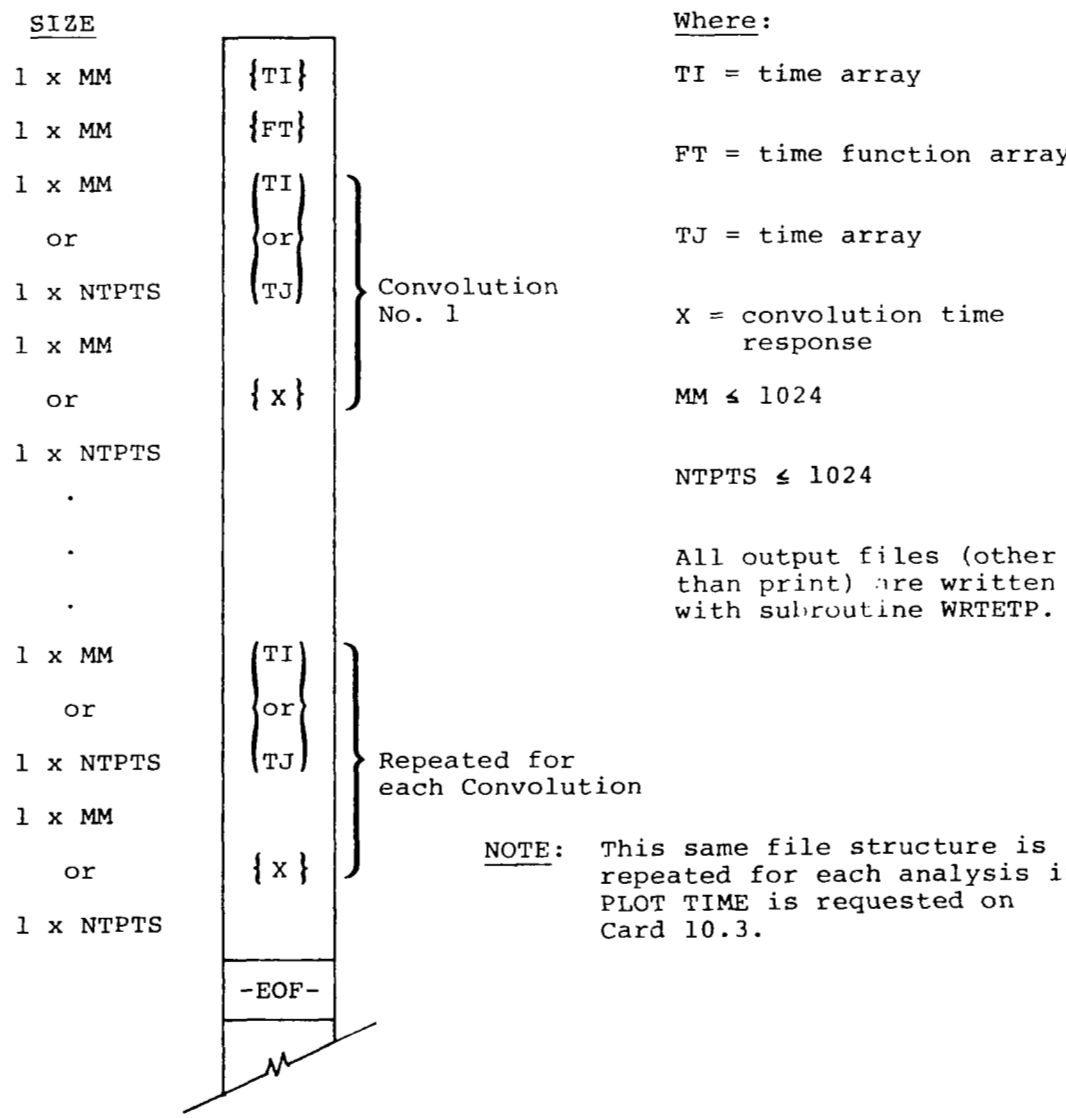
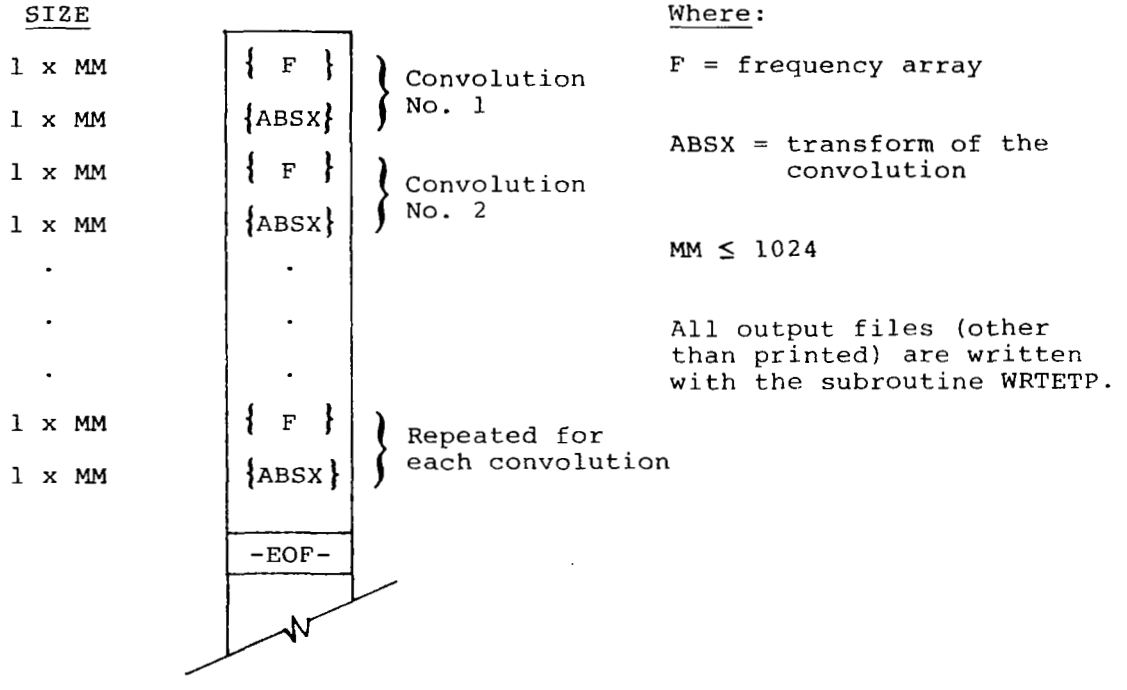


Figure 21.—"PLTRES"—File of Time Responses for Plotting



NOTE: This same file structure is repeated for each analysis if PLOT TRANS is requested on Card Set 10.4.

Figure 22.—"PLTRAN"—File of Response Frequency Functions for Plotting

6.8 DIAGNOSTICS

All errors detected by the program L225 (TEV126) will cause the program to print a diagnostic message. These messages are self-explanatory. The first line printed is in the format:

* * * * * * * * FATAL ERROR nn name

where nn is the error number (from 1 to 17), and name is the name of the routine in which the error was discovered.

The following list is a brief description of each error:

1 Premature end-of-file was encountered in the card input file.

2 Keyword is not appropriate.

3 NFREQ (number of frequencies) must be between 1 and 250.

4 NRMAX (maximum number of responses) must be between 1 and 100.

5 FACTOR (frequency scaling factor) must be greater than zero.

6 Data or option falls outside the permissible range.

7 ISAVEQ(i) (array of Q's to be saved) and ISAVEL(i) (array of loads to be saved) must fall inside the range:
$0<ISAVEQ(i) \leq NRMAX$
$0<ISAVEL(i) \leq NRMAX$

8 FI(i) (array of frequencies) must be increasing in magnitude $FI(i+1) > FI(i)$

9 Error returned from subroutine FETAD, error with file "NTAPE".

10 Error returned from subroutine READTP (see READTP error codes which follow).

11 Matrix read is not of the expected size.

12 Error returned from subroutine WRTETP (see WRTETP error codes which follow).

13 Field length too short.

14 Error returned from subroutine INITAL *.

15 Error returned from subroutine TFRESP *.

16 Error returned from subroutine CONVOL *

17 If FHARM (maximum frequency) is nonzero, then DELTAT (time increment) must be zero, or vice versa.

6.8.1 READTP ERROR CODES

IRR = 0	No errors were detected.
= 1000+i	End-of-information was encountered after skipping (NFILES-i) files of the "NFILES" files to be skipped.
= 2	Number of matrices to be skipped (NMATS) was less than zero.
= 3000+i	End-of-file was encountered after skipping (2 *NMATS-i) records of the (2 *NMATS) records to be skipped.
= 4	NROWS > NROWD, where NROWS is the actual number of rows in the matrix being read, and NROWD is the dimensioned row size of the array in core.
= 5	Name check failed.
= 6	Either NROWS *NCOLS = 0 or NROWS *NCOLS is greater than the allowable buffer size. NCOLS is the column size of the matrix being read.
= 7	End-of-file was read where the matrix was expected.

6.8.2 WRTETP ERROR CODES

IRR = 0	No error was detected.
= 1000+i	End-of- information was encountered after skipping (NFILES-i) files of the "NFILES" files to be skipped.
= 2	Number of matrices to be skipped (NMATS) was less than zero.
= 3000+i	End-of file was encountered after skipping (2 *NMATS-i) records of the (2 *NMATS) to be skipped.
= 4	Either NROWS *NCOLS = 0 or NROWS *NCOLS is greater than the allowable buffer size.

7.0 SAMPLE PROBLEM

7.1 PROBLEM DESCRIPTION

The sample problem presented in this section is a symmetric analysis of a large transport airplane. Two rigid body degrees of freedom, vertical translation and pitch, plus six elastic degrees of freedom constitute the eight generalized coordinates. Eleven load responses were considered, three wing shears, three wing bending moments, four wing accelerations, and the airplane acceleration at the center of gravity. Retained for the sample problem were the pitch and first elastic modal response (Q's 2 and 3), and a wing acceleration response (L 10). Frequency response functions were calculated at 210 frequency values. The airplane was subjected to a one-minus cosine wave of unit amplitude, having a period of 0.82 sec.

7.2 LISTING OF SAMPLE PROBLEM INPUT DECK

```
$TIME HISTORY ANALYSIS
$TITLE
$TITLE    L225(TEV126) DOCUMENT SAMPLE PROBLEM.
$TITLE
$SORT FREQUENCY RESPONSE FUNCTIONS
$TITLE    STANDARD INPUT TAPE FROM L221(TEV156) CONTAINS 19 FREQUENCY
$TITLE    RESPONSE FUNCTIONS (8 GEN. COORD. AND 11 LOADS).
$TITLE    THE 2ND AND 3RD COORDINATE RESPONSES
$TITLE    AND THE 10TH LOAD RESPONSE WILL BE RETAINED.
SIZE         11  210       1.0
FILE      IRTAPE         1    2    1
    2    3
   10
$END SORT OF FREQUENCY RESPONSE FUNCTIONS
$ANALYSIS OF TRANSFER FUNCTIONS
FUNCTION  SINE WAVE
0.0       .82
1.0
.82
OPTIONS        6   103.0       0.0       0.0       15.0
INTEGRATE COMPLEX
PRINT CHANGES IN CONTROL DATA
OUTPUT    NON-STAND.
PRINT     TIME HISTORIES
PRINT     ALL TRANSFER FUNCTIONS
PRINT     MAXIMUMS AND MINIMUMS
SELECT      100.03
$END ANALYSIS
$QUIT TIME HISTORY PROGRAM
```

7.3 LISTING OF SAMPLE PROBLEM PRINTED OUTPUT

```
*******************************************************
*                                                     *
*   PROGRAM L225B3  VERSION 76/09/20                  *
*   BEGINNING EXECUTION ON THE BCS 6600.              *
*   DATE OF RUN IS  76/11/03.                         *
*   TIME OF RUN IS  12.32.24.                         *
*                                                     *
*******************************************************

(STIME HISTORY ANALYSIS                                          )
(STITLE                                                          )
(STITLE     L225(TEV126) DOCUMENT SAMPLE PROBLEM.                )
(STITLE                                                          )
($SORT FREQUENCY RESPONSE FUNCTIONS                              )
```

```
-------- SORT   HAS BEEN ENTERED TO SORT FREQUENCY
         RESPONSES TO BE ANALYSED BY ANAL  .


 ($TITLE    STANDARD INPUT TAPE FROM L221(TEV156) CONTAINS 19 FREQUENCY          )
 ($TITLE    RESPONSE FUNCTIONS (8 GEN. COORD. AND 11 LOADS).                    )
 ($TITLE    THE 2ND AND 3RD COORDINATE RESPONSES                                )
 ($TITLE    AND THE 10TH LOAD RESPONSE WILL BE RETAINED.                        )
 ($SIZE        11  210       1.0                                                )

  THE MAXIMUM NUMBER OF INPUT RESPONSES IS    11
  THE NUMBER OF INPUT FREQUENCIES IS         210
  THE FREQUENCY SCALING FACTOR    IS      1.0000


  FILE      IRTAPE        1    2    1                                          )

  THE RESPONSES WILL BE READ FROM IRTAPE
  THE SOLUTION TO BE SORTED IS NUMBER     1

  THE  2 Q-S TO BE RETAINED FOR ANALYSIS ARE
     2    3

  THE  1 LOADS TO BE RETAINED FOR ANALYSIS ARE
    10

  THE CURRENT  FIELD LENGTH IS 115000
  THE REQUIRED FIELD LENGTH IS 055421
```

THE FREQUENCIES WRITTEN ON SRTFRP AFTER BEING MULTIPLIED BY A FACTOR OF 1.0000
FREQUENCIES ARE IN UNITS OF HERTZ

.7958E-02	.1592E-01	.3183E-01	.4775E-01	.6366E-01
.7162E-01	.7958E-01	.8754E-01	.9549E-01	.1035E+00
.1114E+00	.1273E+00	.1432E+00	.1592E+00	.1751E+00
.1910E+00	.2069E+00	.2228E+00	.2387E+00	.2546E+00
.2706E+00	.2865E+00	.3024E+00	.3183E+00	.3342E+00
.3501E+00	.3820E+00	.4297E+00	.4775E+00	.5252E+00
.5730E+00	.6207E+00	.6685E+00	.7162E+00	.7639E+00
.7958E+00	.8356E+00	.8754E+00	.9151E+00	.9549E+00
.9947E+00	.1035E+01	.1074E+01	.1114E+01	.1154E+01
.1194E+01	.1233E+01	.1273E+01	.1313E+01	.1353E+01
.1393E+01	.1432E+01	.1472E+01	.1512E+01	.1552E+01
.1592E+01	.1631E+01	.1671E+01	.1711E+01	.1751E+01
.1790E+01	.1830E+01	.1870E+01	.1910E+01	.1950E+01
.1989E+01	.2029E+01	.2069E+01	.2109E+01	.2149E+01
.2188E+01	.2228E+01	.2268E+01	.2308E+01	.2348E+01
.2387E+01	.2427E+01	.2467E+01	.2507E+01	.2546E+01
.2586E+01	.2626E+01	.2666E+01	.2706E+01	.2745E+01
.2785E+01	.2825E+01	.2865E+01	.2905E+01	.2944E+01
.2984E+01	.3024E+01	.3064E+01	.3104E+01	.3143E+01
.3183E+01	.3223E+01	.3263E+01	.3302E+01	.3342E+01
.3382E+01	.3422E+01	.3462E+01	.3501E+01	.3541E+01
.3581E+01	.3621E+01	.3661E+01	.3700E+01	.3740E+01
.3780E+01	.3820E+01	.3860E+01	.3899E+01	.3939E+01
.3979E+01	.4019E+01	.4058E+01	.4098E+01	.4138E+01
.4178E+01	.4218E+01	.4257E+01	.4297E+01	.4337E+01
.4377E+01	.4417E+01	.4456E+01	.4496E+01	.4536E+01
.4576E+01	.4615E+01	.4655E+01	.4695E+01	.4735E+01
.4775E+01	.4814E+01	.4854E+01	.4894E+01	.4934E+01
.4974E+01	.5013E+01	.5053E+01	.5093E+01	.5133E+01
.5173E+01	.5212E+01	.5252E+01	.5292E+01	.5332E+01
.5371E+01	.5411E+01	.5451E+01	.5491E+01	.5531E+01
.5570E+01	.5650E+01	.5730E+01	.5809E+01	.5889E+01
.5968E+01	.6048E+01	.6127E+01	.6207E+01	.6287E+01
.6366E+01	.6446E+01	.6525E+01	.6605E+01	.6685E+01
.6764E+01	.6844E+01	.6923E+01	.7003E+01	.7082E+01
.7162E+01	.7242E+01	.7321E+01	.7401E+01	.7480E+01
.7560E+01	.7639E+01	.7719E+01	.7799E+01	.7878E+01
.7958E+01	.8037E+01	.8117E+01	.8196E+01	.8276E+01
.8356E+01	.8435E+01	.8515E+01	.8594E+01	.8674E+01
.8754E+01	.8833E+01	.8913E+01	.8992E+01	.9072E+01
.9151E+01	.9231E+01	.9311E+01	.9947E+01	.1098E+02
.1194E+02	.1305E+02	.1401E+02	.1496E+02	.1592E+02

($END SORT OF FREQUENCY RESPONSE FUNCTIONS
($ANALYSIS OF TRANSFER FUNCTIONS

```
-------- ANAL HAS BEEN ENTERED TO ANALYSE
         FREQUENCIES AND RESPONSES FROM SORT.


(FUNCTION  SINE WAVE                                                    )

 THE TIME ARRAY IS
   0.          .8200E+00  0.          0.          0.          0.          0.

 THE AMPLITUDE ARRAY IS
    .1000E+01  0.          0.          0.          0.          0.          0.

 PERIOD OF TIME FUNCTIONS IS    .8200E+00

(OPTIONS       6   103.0       0.0       0.0       15.0                   )

 THE SELECTED ANALYSIS OPTIONS ARE
 OPTION SWITCH  (IPTION)       =  6
 (M)                           = 10
 MAXIMUM TIME RESPONSE (TMAX)  =   .3000E+01
 TIME INCREMENT (DELTAT)       =  0.
 MAXIMUM FREQUENCY (FHARM)     =  0.
 MAXIMUM FREQUENCY (FMAXO)     =   .1500E+02

(INTEGRATE COMPLEX                                                      )
(PRINT CHANGES IN CONTROL DATA                                          )
(OUTPUT     NON-STAND.                                                  )
(PRINT      TIME HISTORIES                                              )
(PRINT      ALL TRANSFER FUNCTIONS                                      )
(PRINT      MAXIMUMS AND MINIMUMS                                       )
(SELECT       100.03                                                    )
($END ANALYSIS                                                          )

      SUBROUTINE EQUAL
      TMAX   CHANGED FROM          .300000E+01  TO          .299685E+01  .
```

EXECUTION CONTROL DATA GENERATED BY THE PROGRAM

FREQUENCY INCREMENT	(DELTAF)	=	.7201576E-01
MAX. FREQUENCY	(FMAXI)	=	.1591548E+02
MAX. FFT FREQ.	(FHARM)	=	.7374414E+02
MAX. INPUT FREQ.	(FMAXO)	=	.1591548E+02
TIME INCREMENT	(DELTAT)	=	.1356040E-01
NO. OF INPUT FREQ	(NFREQ)	=	210
NO. OF TIME INTERVALS	(NN)	=	221
NO. OF TIME POINTS	(MM)	=	222
ELEMENTS IN ARRAY X	(N)	=	1024
ELEMENTS IN ARRAY TFT	(INT	=	0
NO. OF FREQ. POINTS	(NPOINT)	=	210

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* * * * * * * * * * * * * * * * * *
*  CONVOLUTION NUMBER     1    *
* * * * * * * * * * * * * * * * * *
```

I	FREQUENCY	INTERPOLATED INPUT FREQUENCY RESPONSE FUNCTION FRF		TRANSFORM OF THE GUST IMPULSE TIME FUNCTION TFRF		TRANSFORM OF THE TIME CONVOLUTION FRF * TFRF	
		REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
1	0.	-.922138E-03	-.482874E-06	-.175538E-03	0.	.161671E-06	.847630E-10
2	.720158E-01	-.917610E-03	.283428E-03	.874043E-02	.475066E-01	-.214850E-04	-.411152E-04
3	.144032E+00	-.816204E-03	.678459E-03	.346402E-01	.894867E-01	-.889865E-04	-.495374E-04
4	.216047E+00	-.322017E-03	.104504E-02	.750579E-01	.120921E+00	-.150537E-03	.394990E-04
5	.288063E+00	.283441E-03	.812136E-03	.126137E+00	.137759E+00	-.761264E-04	.141467E-03
6	.360079E+00	.393411E-03	.404931E-03	.182986E+00	.137284E+00	.163915E-04	.128115E-03
7	.432095E+00	.321203E-03	.184137E-03	.240127E+00	.118362E+00	.553345E-04	.822346E-04
8	.504110E+00	.240428E-03	.858034E-04	.291992E+00	.815378E-01	.632067E-04	.446576E-04
9	.576126E+00	.176836E-03	.347586E-04	.333429E+00	.289740E-01	.579551E-04	.167132E-04
10	.648142E+00	.130711E-03	.982620E-05	.360160E+00	-.357468E-01	.474282E-04	-.113377E-05
11	.720158E+00	.946493E-04	-.442628E-05	.369153E+00	-.107966E+00	.344621E-04	-.118529E-04
12	.792173E+00	.657707E-04	-.118424E-04	.358876E+00	-.182353E+00	.214441E-04	-.162434E-04
13	.864189E+00	.404146E-04	-.148000E-04	.329415E+00	-.253400E+00	.956283E-05	-.151104E-04
14	.936205E+00	.154516E-04	-.131071E-04	.282431E+00	-.315899E+00	.223479E-06	-.350299E-05
15	.100822E+01	-.114426E-04	-.239558E-05	.220992E+00	-.365384E+00	-.340439E-05	.365131E-05
16	.108024E+01	-.350693E-04	.297709E-04	.149270E+00	-.398500E+00	.662893E-05	.184190E-04
17	.115225E+01	-.160888E-04	.647071E-04	.721545E-01	-.413258E+00	.338450E-04	.127605E-04
18	.122427E+01	.409372E-04	.813195E-04	-.518858E-07	-.409159E+00	.330602E-04	-.171718E-04
19	.129628E+01	.584805E-04	.493462E-04	-.777033E-0:	-.387182E+00	.145563E-04	-.264799E-04
20	.136830E+01	.554715E-04	.279031E-04	-.141161E+00	-.349630E+00	.194650E-05	-.233421E-04
21	.144032E+01	.486292E-04	.161293E-04	-.191903E+00	-.299905E+00	-.449481E-05	-.176794E-04
22	.151233E+01	.420350E-04	.932501E-05	-.227689E+00	-.242108E+00	-.731324E-05	-.123042E-04
23	.158435E+01	.363807E-04	.525181E-05	-.247521E+00	-.180702E+00	-.805598E-05	-.787598E-05
24	.165636E+01	.315537E-04	.262436E-05	-.251709E+00	-.120088E+00	-.762718E-05	-.444960E-05
25	.172838E+01	.273926E-04	.898757E-06	-.241751E+00	-.642398E-01	-.656447E-05	-.197698E-05
26	.180039E+01	.237443E-04	-.221970E-06	-.220124E+00	-.163913E-01	-.523035E-05	-.340340E-06
27	.187241E+01	.204739E-04	-.899211E-06	-.189988E+00	.211819E-01	-.387076E-05	.634516E-06
28	.194443E+01	.174663E-04	-.118899E-05	-.154854E+00	.472811E-01	-.264852E-05	.100955E-05
29	.201644E+01	.145960E-04	-.107527E-05	-.118245E+00	.617944E-01	-.165945E-05	.102909E-05
30	.208846E+01	.117725E-04	-.404744E-06	-.833764E-01	.696041E-01	-.954994E-06	.800669E-06
31	.216047E+01	.904585E-05	.122437E-05	-.529006E-01	.604086E-01	-.552494E-06	.481677E-06
32	.223249E+01	.708345E-05	.452981E-05	-.287165E-01	.484812E-01	-.423023E-06	.213354E-06
33	.230450E+01	.848614E-05	.939929E-05	-.118746E-01	.323957E-01	-.405266E-06	.163301E-06
34	.237652E+01	.142312E-04	.103256E-04	-.257132E-02	.147467E-01	-.188862E-06	.183313E-06
35	.244854E+01	.173740E-04	.639949E-05	-.227595E-03	-.210540E-02	.951924E-08	-.386356E-07
36	.252055E+01	.169812E-04	.270570E-05	-.363806E-02	-.162417E-01	-.178333E-07	-.285647E-06
37	.259257E+01	.154702E-04	.510271E-06	-.111686E-01	-.263272E-01	-.159347E-06	-.412986E-06
38	.266458E+01	.138878E-04	-.724865E-06	-.209786E-01	-.316786E-01	-.314310E-06	-.424741E-06
39	.273660E+01	.124492E-04	-.144016E-05	-.312416E-01	-.322578E-01	-.435386E-06	-.356591E-06
40	.280861E+01	.111349E-04	-.187163E-05	-.403427E-01	-.285969E-01	-.502733E-06	-.242916E-06
41	.288063E+01	.989424E-05	-.208636E-05	-.470322E-01	-.216702E-01	-.510560E-06	-.116284E-06
42	.295265E+01	.870266E-05	-.204682E-05	-.505241E-01	-.127310E-01	-.465751E-06	-.737971E-08
43	.302466E+01	.767829E-05	-.164762E-05	-.505319E-01	-.313365E-02	-.393162E-06	.591962E-07
44	.309668E+01	.719450E-05	-.102780E-05	-.472464E-01	.503662E-02	-.333915E-06	.905516E-07
45	.316869E+01	.714067E-05	-.728907E-06	-.412595E-01	.131097E-01	-.285065E-06	.123686E-06
46	.324071E+01	.706747E-05	-.775977E-06	-.334502E-01	.179366E-01	-.222490E-06	.152723E-06
47	.331272E+01	.684858E-05	-.931167E-06	-.248483E-01	.199481E-01	-.151600E-06	.159754E-06

48	.338474E+01	.654100E-05	-.107285E-05	-.164928E-01	.191623E-01	-.873208E-07	.143035E-06
49	.345676E+01	.620072E-05	-.117462E-05	-.930299E-02	.159458E-01	-.389549E-07	.109803E-06
50	.352877E+01	.585692E-05	-.124131E-05	-.397548E-02	.109368E-01	-.970809E-08	.089906E-07
51	.360079E+01	.551989E-05	-.128115E-05	-.917262E-03	.494100E-02	.126697E-08	.284490E-07
52	.367280E+01	.519185E-05	-.129988E-05	-.220044E-03	-.118223E-02	-.267919E-08	-.365191E-08
53	.374482E+01	.487015E-05	-.130090E-05	-.167526E-02	-.663187E-02	-.167862E-07	-.301166E-07
54	.381684E+01	.456692E-05	-.128405E-05	-.482474E-02	-.107602E-01	-.357544E-07	-.427307E-07
55	.388885E+01	.428277E-05	-.124174E-05	-.903813E-02	-.131415E-01	-.543035E-07	-.446076E-07
56	.396087E+01	.379066E-05	-.114145E-05	-.136055E-01	-.136073E-01	-.671C58E-07	-.360508E-07
57	.403288E+01	.317189E-05	-.775184E-06	-.178326E-01	-.122478E-01	-.660573E-07	-.250253E-07
58	.410490E+01	.322403E-05	.105239E-05	-.211270E-01	-.938015E-02	-.582551E-07	-.524614E-07
59	.417691E+01	.524697E-05	-.617916E-06	-.230653E-01	-.549098E-02	-.124462E-06	-.145646E-07
60	.424893E+01	.442294E-05	-.113265E-05	-.234336E-01	-.116230E-02	-.104962E-06	.214014E-07
61	.432095E+01	.399106E-05	-.120019E-05	-.222395E-01	.300973E-02	-.851466E-07	.387035E-07
62	.439296E+01	.370372E-05	-.120147E-05	-.196949E-01	.649160E-02	-.651447E-07	.477067E-07
63	.446496E+01	.348029E-05	-.118626E-05	-.161743E-01	.887723E-02	-.457606E-07	.500623E-07
64	.453699E+01	.329231E-05	-.116545E-05	-.121556E-01	.992926E-02	-.284480E-07	.466576E-07
65	.460901E+01	.312813E-05	-.114242E-05	-.815132E-02	.959992E-02	-.145513E-07	.394420E-07
66	.468102E+01	.298026E-05	-.111862E-05	-.464046E-02	.802365E-02	-.485440E-08	.291035E-07
67	.475304E+01	.284503E-05	-.109404E-05	-.200891E-02	.548804E-02	.292029E-09	.178127E-07
68	.482506E+01	.272013E-05	-.107082E-05	-.503494E-03	.238694E-02	.118098E-08	.703404E-08
69	.489707E+01	.260395E-05	-.104736E-05	-.218439E-03	-.837088E-03	-.144553E-08	-.195499E-08
70	.496909E+01	.249552E-05	-.102441E-05	-.107383E-02	-.375300E-02	-.652436E-08	-.826563E-08
71	.504110E+01	.239373E-05	-.100207E-05	-.285500E-02	-.549629E-02	-.128428E-07	-.114926E-07
72	.511312E+01	.229788E-05	-.980406E-06	-.523910E-02	-.731222E-02	-.192067E-07	-.116647E-07
73	.518513E+01	.220673E-05	-.959471E-06	-.784516E-02	-.758230E-02	-.245871E-07	-.920489E-08
74	.525715E+01	.212030E-05	-.939320E-06	-.102869E-01	-.683172E-02	-.282264E-07	-.482264E-08
75	.532917E+01	.203793E-05	-.920018E-06	-.122230E-01	-.521777E-02	-.297100E-07	.611909E-09
76	.540118E+01	.195911E-05	-.901629E-06	-.133991E-01	-.300190E-02	-.289508E-07	.619963E-08
77	.547320E+01	.188314E-05	-.884156E-06	-.136757E-01	-.509860E-03	-.262040E-07	.111314E-07
78	.554521E+01	.180940E-05	-.867611E-06	-.130402E-01	.191452E-02	-.219340E-07	.147780E-07
79	.561723E+01	.173724E-05	-.852059E-06	-.116014E-01	.395468E-02	-.167958E-07	.167558E-07
80	.568924E+01	.166532E-05	-.837111E-06	-.956878E-02	.536169E-02	-.114468E+07	.169391E-07
81	.576126E+01	.159247E-05	-.822359E-06	-.721959E-02	.598292E-02	-.657686E-08	.154647E-07
82	.583328E+01	.151683E-05	-.806502E-06	-.485925E-02	.577703E-02	-.271C99E-08	.126822E-07
83	.590529E+01	.143610E-05	-.786964E-06	-.277973E-02	.481364E-02	-.203812E-09	.910041E-08
84	.597731E+01	.134842E-05	-.757508E-06	-.122200E-02	.325851E-02	.820571E-09	.531953E-08
85	.604932E+01	.125559E-05	-.706847E-06	-.346762E-03	.134705E-02	.516515E-09	.193029E-08
86	.612134E+01	.118010E-05	-.616269E-06	-.218304E-03	-.650055E-03	-.658236E-09	-.632596E-09
87	.619336E+01	.116361E-05	-.510972E-06	-.798675E-03	-.240408E-02	-.218864E-08	-.245903E-08
88	.626537E+01	.119200E-05	-.445695E-06	-.196042E-02	-.386443E-02	-.405873E-08	-.373145E-08
89	.633739E+01	.122092E-05	-.425688E-06	-.350475E-02	-.468233E-02	-.627222E-08	-.422480E-08
90	.640940E+01	.123075E-05	-.429661E-06	-.519311E-02	-.483946E-02	-.847075E-08	-.372469E-08
91	.648142E+01	.122248E-05	-.439303E-06	-.677939E-02	-.434470E-02	-.101963E-07	-.233311E-08
92	.655343E+01	.120333E-05	-.446973E-06	-.804288E-02	-.329364E-02	-.111504E-07	-.368402E-09
93	.662545E+01	.117878E-05	-.451153E-06	-.881612E-02	-.185105E-02	-.112273E-07	.179544E-08
94	.669747E+01	.115188E-05	-.452225E-06	-.900454E-02	-.226056E-03	-.104744E-07	.381169E-08
95	.676948E+01	.112426E-05	-.450906E-06	-.859564E-02	.135740E-02	-.905169E-08	.540190E-08
96	.684150E+01	.109679E-05	-.447797E-06	-.765695E-02	.269077E-02	-.719318E-08	.637955E-08
97	.691351E+01	.107000E-05	-.443393E-06	-.632367E-02	.360770E-02	-.516671E-08	.660412E-08
98	.698553E+01	.104407E-05	-.438168E-06	-.477783E-02	.400420E-02	-.323387E-08	.627415E-08
99	.705754E+01	.101912E-05	-.432375E-06	-.322224E-02	.364967E-02	-.161934E-08	.531649E-08
100	.712956E+01	.995228E-06	-.426212E-06	-.185280E-02	.318786E-02	-.485254E-09	.396234E-08
101	.720158E+01	.972453E-06	-.419843E-06	-.832900E-03	.212795E-02	.834488E-10	.241902E-08
102	.727359E+01	.950842E-06	-.413405E-06	-.273127E-03	.827405E-03	.823530E-10	.899043E-09
103	.734561E+01	.930445E-06	-.407030E-06	-.218820E-03	-.530836E-03	-.419667E-09	-.404847E-09

104	.741762E+01	.911325E-06	-.400856E-06	-.646702E-03	-.176360E-02	-.129631E-08	-.134798E-08
105	.748964E+01	.893563E-06	-.395043E-06	-.647071E-02	-.271174E-02	-.238543E-08	-.184211E-08
106	.756165E+01	.877264E-06	-.389798E-06	-.255590E-02	-.326023E-02	-.351303E-08	-.186380E-08
107	.763367E+01	.862724E-06	-.385542E-06	-.373822E-02	-.335170E-02	-.451727E-08	-.145035E-08
108	.770569E+01	.850028E-06	-.382308E-06	-.484738E-02	-.299172E-02	-.526566E-08	-.687435E-09
109	.777770E+01	.839233E-06	-.382462E-06	-.572968E-02	-.224568E-02	-.566742E-08	.306746E-09
110	.784972E+01	.830129E-06	-.385989E-06	-.626770E-02	-.122776E-02	-.567690E-08	.140066E-08
111	.792173E+01	.821491E-06	-.395697E-06	-.639453E-02	-.839979E-04	-.528629E-08	.240129E-08
112	.799375E+01	.809463E-06	-.414219E-06	-.610069E-02	.102835E-02	-.451232E-08	.339943E-08
113	.806576E+01	.785988E-06	-.441159E-06	-.543324E-02	.196206E-02	-.340488E-08	.393908E-08
114	.813778E+01	.742626E-06	-.467321E-06	-.448746E-02	.259913E-02	-.211788E-08	.402727E-08
115	.820930E+01	.681198E-06	-.475017E-06	-.339239E-02	.286536E-02	-.949790E-09	.356352E-08
116	.828181E+01	.622761E-06	-.453920E-06	-.229244E-02	.273865E-02	-.184514E-09	.274611E-08
117	.835383E+01	.585033E-06	-.419412E-06	-.132770E-02	.225000E-02	.166134E-09	.187455E-08
118	.842584E+01	.565427E-06	-.388528E-06	-.615391E-03	.147753E-02	.226103E-09	.107453E-08
119	.849786E+01	.552353E-06	-.364052E-06	-.235154E-03	.534420E-03	.646686E-10	.380797E-09
120	.856998E+01	.542395E-06	-.344880E-06	-.219739E-03	-.447400E-03	-.273465E-09	-.166864E-09
121	.864189E+01	.533647E-06	-.329586E-06	-.552295E-03	-.133542E-02	-.734867E-09	-.530616E-09
122	.871391E+01	.525289E-06	-.317013E-06	-.117032E-02	-.201422E-02	-.125329E-08	-.687042E-09
123	.878592E+01	.517004E-06	-.306351E-06	-.197554E-02	-.240023E-02	-.175668E-08	-.635721E-09
124	.885794E+01	.508695E-06	-.297057E-06	-.284820E-02	-.245177E-02	-.217718E-08	-.401126E-09
125	.892995E+01	.500352E-06	-.288759E-06	-.366373E-02	-.217319E-02	-.246070E-08	-.293865E-10
126	.900197E+01	.491995E-06	-.281239E-06	-.430950E-02	-.161273E-02	-.257381E-08	.416340E-09
127	.907399E+01	.483653E-06	-.274301E-06	-.469939E-02	-.854665E-03	-.250731E-08	.875085E-09
128	.914600E+01	.475363E-06	-.267865E-06	-.478442E-02	-.685179E-05	-.227617E-08	.127832E-08
129	.921802E+01	.467151E-06	-.261814E-06	-.455802E-02	.814386E-03	-.191607E-08	.157379E-08
130	.929003E+01	.459035E-06	-.256076E-06	-.405555E-02	.150005E-02	-.147751E-08	.172710E-08
131	.936205E+01	.451414E-06	-.251115E-06	-.334821E-02	.196275E-02	-.101855E-08	.172600E-08
132	.943406E+01	.443984E-06	-.246438E-06	-.253241E-02	.214768E-02	-.595077E-09	.157762E-08
133	.950608E+01	.436554E-06	-.241762E-06	-.171609E-02	.203867E-02	-.256246E-09	.130490E-08
134	.957810E+01	.429123E-06	-.237086E-06	-.100400E-02	.166011E-02	-.372516E-10	.950424E-09
135	.965011E+01	.421693E-06	-.232409E-06	-.483749E-03	.107050E-02	.448601E-10	.563849E-09
136	.972213E+01	.414263E-06	-.227733E-06	-.214719E-03	.355506E-03	-.798977E-11	.196171E-09
137	.979414E+01	.406832E-06	-.223056E-06	-.220968E-03	-.335287E-03	-.175838E-09	-.107459E-09
138	.986616E+01	.399402E-06	-.218380E-06	-.489111E-03	-.105189E-02	-.425065E-09	-.313310E-09
139	.993817E+01	.391972E-06	-.213704E-06	-.971247E-03	-.155729E-02	-.713499E-09	-.402653E-09
140	.100102E+02	.385971E-06	-.210160E-06	-.159239E-02	-.183862E-02	-.100106E-08	-.374900E-09
141	.100822E+02	.380174E-06	-.206820E-06	-.226131E-02	-.188491E-02	-.124539E-08	-.241307E-09
142	.101542E+02	.374377E-06	-.203481E-06	-.288316E-02	-.164020E-02	-.141311E-08	-.274453E-10
143	.102262E+02	.368580E-06	-.200101E-06	-.337231E-02	-.120201E-02	-.148349E-08	.231700E-09
144	.102983E+02	.362783E-06	-.196742E-06	-.366345E-02	-.615294E-03	-.145009E-08	.497530E-09
145	.103703E+02	.356987E-06	-.193382E-06	-.371979E-02	.369877E-04	-.132076E-08	.732945E-09
146	.104423E+02	.351190E-06	-.190023E-06	-.353707E-02	.665516E-03	-.111572E-08	.905846E-09
147	.105143E+02	.345393E-06	-.186663E-06	-.314324E-02	.118673E-02	-.864134E-09	.996514E-09
148	.105863E+02	.339596E-06	-.183304E-06	-.259379E-02	.153361E-02	-.599687E-09	.996326E-09
149	.106583E+02	.333799E-06	-.179944E-06	-.196352E-02	.166517E-02	-.355784E-09	.909156E-09
150	.107303E+02	.328002E-06	-.176585E-06	-.133602E-02	.156927E-02	-.161109E-09	.758346E-09
151	.108024E+02	.322206E-06	-.173225E-06	-.792225E-03	.126534E-02	-.360697E-10	.544934E-09
152	.108744E+02	.316409E-06	-.169866E-06	-.399652E-03	.799935E-03	.942847E-11	.320994E-09
153	.109464E+02	.310612E-06	-.166507E-06	-.203760E-03	.239935E-03	-.233396E-10	.108454E-09
154	.110184E+02	.305602E-06	-.163619E-06	-.222466E-03	-.336943E-03	-.123116E-09	-.665709E-10
155	.110904E+02	.301349E-06	-.161185E-06	-.444502E-03	-.852351E-03	-.271417E-09	-.183389E-09
156	.111624E+02	.297096E-06	-.158751E-06	-.831722E-03	-.124023E-02	-.443990E-09	-.236431E-09
157	.112345E+02	.292843E-06	-.156318E-06	-.132493E-02	-.145059E-02	-.614746E-09	-.217684E-09
158	.113065E+02	.288589E-06	-.153884E-06	-.185238E-02	-.146044E-02	-.759315E-09	-.130418E-09
159	.113785E+02	.284336E-06	-.151450E-06	-.233970E-02	-.127383E-02	-.858182E-09	-.784904E-11

160	.114505E+02	.280083E-06	-.149016E-06	-.271994E-02	-.921006E-03	-.899052E-09	.147356E-09
161	.115225E+02	.275830E-06	-.146582E-06	-.294231E-02	-.453713E-03	-.878084E-09	.306143E-09
162	.115945E+02	.271576E-06	-.144148E-06	-.297861E-02	.623227E-04	-.799935E-09	.446286E-09
163	.116666E+02	.267323E-06	-.141714E-06	-.282632E-02	.556559E-03	-.676668E-09	.549311E-09
164	.117386E+02	.263070E-06	-.139281E-06	-.250837E-02	.963213E-03	-.525719E-09	.602759E-09
165	.118106E+02	.258817E-06	-.136847E-06	-.206933E-02	.122995E-02	-.367262E-09	.601512E-09
166	.118826E+02	.254563E-06	-.134413E-06	-.156892E-02	.132455E-02	-.221355E-09	.546064E-09
167	.119546E+02	.250587E-06	-.132136E-06	-.107360E-02	.123870E-02	-.105355E-09	.452203E-09
168	.120266E+02	.247443E-06	-.130331E-06	-.647515E-03	.988510E-03	-.313903E-10	.328991E-09
169	.120986E+02	.244299E-06	-.128525E-06	-.343914E-03	.611738E-03	-.539422E-11	.193648E-09
170	.121707E+02	.241155E-06	-.126719E-06	-.198324E-03	.162162E-03	-.272777E-10	.642376E-10
171	.122427E+02	.238011E-06	-.124914E-06	-.224218E-03	-.298013E-03	-.905926E-10	-.429223E-10
172	.123147E+02	.234866E-06	-.123108E-06	-.411760E-03	-.706711E-03	-.183711E-09	-.115292E-09
173	.123867E+02	.231722E-06	-.121303E-06	-.729699E-03	-.101030E-02	-.291643E-09	-.145596E-09
174	.124587E+02	.228578E-06	-.119497E-06	-.113009E-02	-.117059E-02	-.398197E-09	-.136529E-09
175	.125307E+02	.225434E-06	-.117692E-06	-.155514E-02	-.116955E-02	-.488222E-09	-.880299E-10
176	.126028E+02	.222290E-06	-.115886E-06	-.194519E-02	-.101126E-02	-.549505E-09	.628620E-10
177	.126748E+02	.219145E-06	-.114081E-06	-.224675E-02	-.720780E-03	-.574592E-09	.983549E-10
178	.127468E+02	.216001E-06	-.112275E-06	-.241956E-02	-.340349E-03	-.560839E-09	.198140E-09
179	.128188E+02	.212857E-06	-.110470E-06	-.244102E-02	.767528E-04	-.511238E-09	.288602E-09
180	.128908E+02	.209713E-06	-.108664E-06	-.231177E-02	.473959E-03	-.433344E-09	.350225E-09
181	.129628E+02	.206568E-06	-.106858E-06	-.204926E-02	.797323E-03	-.338113E-09	.383883E-09
182	.130349E+02	.203424E-06	-.105053E-06	-.169078E-02	.100615E-02	-.233245E-09	.392297E-09
183	.131069E+02	.200980E-06	-.103591E-06	-.129502E-02	.107473E-02	-.146807E-09	.349011E-09
184	.131789E+02	.198513E-06	-.102226E-06	-.885946E-03	.997105E-03	-.739418E-10	.266505E-09
185	.132509E+02	.196142E-06	-.100861E-06	-.545378E-03	.787139E-03	-.275801E-10	.209399E-09
186	.133229E+02	.193772E-06	-.994960E-07	-.306097E-03	.476129E-03	-.119400E-10	.122716E-09
187	.133949E+02	.191401E-06	-.981310E-07	-.196314E-03	.108224E-03	-.269547E-10	.399768E-10
188	.134669E+02	.189031E-06	-.967661E-07	-.226221E-03	-.265799E-03	-.684830E-10	-.283537E-10
189	.135390E+02	.186660E-06	-.954011E-07	-.387030E-03	-.595509E-03	-.129055E-09	-.742348E-10
190	.136110E+02	.184290E-06	-.940361E-07	-.652593E-03	-.837581E-03	-.199029E-09	-.929903E-10
191	.136830E+02	.181919E-06	-.926711E-07	-.983305E-03	-.961455E-03	-.267901E-09	-.837327E-10
192	.137550E+02	.179549E-06	-.913061E-07	-.133173E-02	-.953137E-03	-.326137E-09	-.495395E-10
193	.138270E+02	.177178E-06	-.899412E-07	-.164914E-02	-.816720E-03	-.365649E-09	.361901E-11
194	.138990E+02	.174808E-06	-.885762E-07	-.189210E-02	-.573444E-03	-.381547E-09	.673524E-10
195	.139711E+02	.172437E-06	-.872112E-07	-.202817E-02	-.258392E-03	-.372266E-09	.132323E-09
196	.140431E+02	.170330E-06	-.859986E-07	-.204003E-02	.844571E-04	-.340215E-09	.189825E-09
197	.141151E+02	.168467E-06	-.849265E-07	-.192745E-02	.406369E-03	-.290029E-09	.232486E-09
198	.141871E+02	.166603E-06	-.838545E-07	-.170696E-02	.670187E-03	-.228187E-09	.254792E-09
199	.142591E+02	.164739E-06	-.827825E-07	-.140927E-02	.836055E-03	-.162952E-09	.254394E-09
200	.143311E+02	.162876E-06	-.817105E-07	-.107480E-02	.855753E-03	-.102684E-09	.232096E-09
201	.144032E+02	.161012E-06	-.806384E-07	-.748049E-03	.815126E-03	-.547145E-10	.191367E-09
202	.144752E+02	.159149E-06	-.795664E-07	-.471543E-03	.630285E-03	-.244186E-10	.138763E-09
203	.145472E+02	.157285E-06	-.784944E-07	-.280149E-03	.375629E-03	-.145784E-10	.810710E-10
204	.146192E+02	.155421E-06	-.774224E-07	-.196552E-03	.699932E-04	-.251293E-10	.260959E-10
205	.146912E+02	.153558E-06	-.763503E-07	-.228476E-03	-.238533E-03	-.532963E-10	-.191644E-10
206	.147632E+02	.151694E-06	-.752783E-07	-.367960E-03	-.503870E-03	-.940687E-10	-.494174E-10
207	.148352E+02	.149831E-06	-.742063E-07	-.592763E-03	-.704028E-03	-.141059E-09	-.614979E-10
208	.149073E+02	.147967E-06	-.731343E-07	-.869674E-03	-.830747E-03	-.187245E-09	-.548813E-10
209	.149793E+02	.146201E-06	-.721192E-07	-.115917E-02	-.787599E-03	-.226272E-09	-.315494E-10
210	.150513E+02	.144712E-06	-.712664E-07	-.142089E-02	-.668663E-03	-.253273E-09	.449039E-11
211	.151233E+02	.143222E-06	-.704136E-07	-.161909E-02	-.452164E-03	-.264433E-09	.473136E-10
212	.151953E+02	.141733E-06	-.695607E-07	-.172732E-02	-.197724E-03	-.258572E-09	.921244E-10
213	.152673E+02	.140244E-06	-.687079E-07	-.173160E-02	.878579E-04	-.236838E-09	.131310E-09
214	.153394E+02	.138755E-06	-.678551E-07	-.163301E-02	.355702E-03	-.202452E-09	.166163E-09
215	.154114E+02	.137266E-06	-.670023E-07	-.144534E-02	.570118E-03	-.160197E-09	.175099E-09

216	.154834E+02	.135777E-06	-.661494E-07	-.119485E-02	.703343E-03	-.115707E-09	.174536E-09
217	.155554E+02	.134287E-06	-.652966E-07	-.915521E-03	.739106E-03	-.746618E-10	.159033E-09
218	.156274E+02	.132798E-06	-.644438E-07	-.644551E-03	.674585E-03	-.421224E-10	.131121E-09
219	.156994E+02	.131309E-06	-.635909E-07	-.417258E-03	.520508E-03	-.216901E-10	.948812E-10
220	.157715E+02	.129820E-06	-.627381E-07	-.262380E-03	.299437E-03	-.152760E-10	.553341E-10
221	.158435E+02	.128331E-06	-.618853E-07	-.198344E-03	.424930E-04	-.228239E-10	.177277E-10
222	.159155E+02	.126841E-06	-.610325E-07	-.230990E-03	-.215005E-03	-.424214E-10	-.131737E-10

******** WARNING.
EXTRAPOLATION REQUIRED FOR , 1 TJ S.

J	TIME, TJ(J)	RESPONSE FUNCTION, X(J)
1	0.	.6993698E-07
2	.3000000E-01	-.2658985E-07
3	.6000000E-01	-.4972459E-06
4	.9000000E-01	-.1793572E-05
5	.1200000E+00	-.4321107E-05
6	.1500000E+00	-.8406048E-05
7	.1800000E+00	-.1424567E-04
8	.2100000E+00	-.2180131E-04
9	.2400000E+00	-.3094044E-04
10	.2700000E+00	-.4141172E-04
11	.3000000E+00	-.5288136E-04
12	.3300000E+00	-.6490292E-04
13	.3600000E+00	-.7699288E-04
14	.3900000E+00	-.8866676E-04
15	.4200000E+00	-.9945106E-04
16	.4500000E+00	-.1088571E-03
17	.4800000E+00	-.1165605E-03
18	.5100000E+00	-.1223047E-03
19	.5400000E+00	-.1259187E-03
20	.5700000E+00	-.1273199E-03
21	.6000000E+00	-.1264911E-03
22	.6300000E+00	-.1236734E-03
23	.6600000E+00	-.1191339E-03
24	.6900000E+00	-.1132369E-03
25	.7200000E+00	-.1064227E-03
26	.7500000E+00	-.9922701E-04
27	.7800000E+00	-.9221381E-04
28	.8100000E+00	-.8592075E-04
29	.8400000E+00	-.8083034E-04
30	.8700000E+00	-.7719954E-04
31	.9000000E+00	-.7487070E-04
32	.9300000E+00	-.7356521E-04
33	.9600000E+00	-.7296319E-04
34	.9900000E+00	-.7272032E-04
35	.1020000E+01	-.7246387E-04
36	.1050000E+01	-.7182909E-04
37	.1080000E+01	-.7048532E-04
38	.1110000E+01	-.6813467E-04
39	.1140000E+01	-.6450598E-04
40	.1170000E+01	-.5939058E-04
41	.1200000E+01	-.5274560E-04
42	.1230000E+01	-.4458186E-04
43	.1260000E+01	-.3499243E-04
44	.1290000E+01	-.2411413E-04
45	.1320000E+01	-.1220488E-04
46	.1350000E+01	.4262769E-06
47	.1380000E+01	.1345112E-04
48	.1410000E+01	.2651380E-04
49	.1440000E+01	.3921719E-04
50	.1470000E+01	.5119703E-04
51	.1500000E+01	.6212793E-04
52	.1530000E+01	.7173565E-04
53	.1560000E+01	.7979629E-04

I	TIME, TI(I)	FORCING FUNCTION, FT(I)
1	0.	0.
2	.1356040E-01	.1037186E+00
3	.2712080E-01	.2063185E+00
4	.4068120E-01	.3066929E+00
5	.5424160E-01	.4037593E+00
6	.6780200E-01	.4964700E+00
7	.8136240E-01	.5839258E+00
8	.9492280E-01	.6648840E+00
9	.1084832E+00	.7387703E+00
10	.1220436E+00	.8046878E+00
11	.1356040E+00	.8619255E+00
12	.1491644E+00	.9098653E+00
13	.1627248E+00	.9479917E+00
14	.1762852E+00	.9758926E+00
15	.1898456E+00	.9932657E+00
16	.2034060E+00	.9999254E+00
17	.2169664E+00	.9957999E+00
18	.2305268E+00	.9809315E+00
19	.2440872E+00	.9554834E+00
20	.2576476E+00	.9197235E+00
21	.2712080E+00	.8740528E+00
22	.2847684E+00	.8189490E+00
23	.2983288E+00	.7550115E+00
24	.3118892E+00	.6829305E+00
25	.3254496E+00	.6034826E+00
26	.3390100E+00	.5175244E+00
27	.3525704E+00	.4259545E+00
28	.3661308E+00	.3296496E+00
29	.3796912E+00	.2301567E+00
30	.3932516E+00	.1279813E+00
31	.4068120E+00	.2442531E-01
32	.4203724E+00	-.7939412E-01
33	.4339328E+00	-.1823571E+00
34	.4474932E+00	-.2833531E+00
35	.4610536E+00	-.3812927E+00
36	.4746140E+00	-.4751194E+00
37	.4881744E+00	-.5638212E+00
38	.5017348E+00	-.6464412E+00
39	.5152952E+00	-.7220685E+00
40	.5288556E+00	-.7899465E+00
41	.5424160E+00	-.8492836E+00
42	.5559764E+00	-.8994602E+00
43	.5695368E+00	-.9349345E+00
44	.5830972E+00	-.9702730E+00
45	.5966576E+00	-.9901395E+00
46	.6102180E+00	-.9993282E+00
47	.6237784E+00	-.9977389E+00
48	.6373388E+00	-.9853805E+00
49	.6508992E+00	-.9624645E+00
50	.6644596E+00	-.9293423E+00
51	.6780200E+00	-.8856586E+00
52	.6915804E+00	-.8327215E+00
53	.7051408E+00	-.7708622E+00

54	.1590000E+01	.8612765E-04
55	.1620000E+01	.9073780E-04
56	.1650000E+01	.9365249E-04
57	.1680000E+01	.9495853E-04
58	.1710000E+01	.9476788E-04
59	.1740000E+01	.9327806E-04
60	.1770000E+01	.9074995E-04
61	.1800000E+01	.8743445E-04
62	.1830000E+01	.8359033E-04
63	.1860000E+01	.7945945E-04
64	.1890000E+01	.7532391E-04
65	.1920000E+01	.7136351E-04
66	.1950000E+01	.6776710E-04
67	.1980000E+01	.6468512E-04
68	.2010000E+01	.6228587E-04
69	.2040000E+01	.6063097E-04
70	.2070000E+01	.5978552E-04
71	.2100000E+01	.5976987E-04
72	.2130000E+01	.6056730E-04
73	.2160000E+01	.6209909E-04
74	.2190000E+01	.6420646E-04
75	.2220000E+01	.6671667E-04
76	.2250000E+01	.6943617E-04
77	.2280000E+01	.7216014E-04
78	.2310000E+01	.7468464E-04
79	.2340000E+01	.7683241E-04
80	.2370000E+01	.7844805E-04
81	.2400000E+01	.7940261E-04
82	.2430000E+01	.7956485E-04
83	.2460000E+01	.7890315E-04
84	.2490000E+01	.7740405E-04
85	.2520000E+01	.7509234E-04
86	.2550000E+01	.7202276E-04
87	.2580000E+01	.6827557E-04
88	.2610000E+01	.6398909E-04
89	.2640000E+01	.5928670E-04
90	.2670000E+01	.5429634E-04
91	.2700000E+01	.4914774E-04
92	.2730000E+01	.4398152E-04
93	.2760000E+01	.3893298E-04
94	.2790000E+01	.3412865E-04
95	.2820000E+01	.2968241E-04
96	.2850000E+01	.2570687E-04
97	.2880000E+01	.2225994E-04
98	.2910000E+01	.1937539E-04
99	.2940000E+01	.1706453E-04
100	.2970000E+01	.1531819E-04
101	.3000000E+01	.1409391E-04

54	.7187012E+00	-.7005686E+00
55	.7322616E+00	-.6227781E+00
56	.7458226E+00	-.5382700E+00
57	.7593824E+00	-.4479557E+00
58	.7729428E+00	-.3528095E+00
59	.7865032E+00	-.2538576E+00
60	.8000636E+00	-.1521675E+00
61	.8136240E+00	-.4883604E-01
62	.8271844E+00	0.
63	.8407448E+00	0.
64	.8543052E+00	0.
65	.8678656E+00	0.
66	.8814260E+00	0.
67	.8949864E+00	0.
68	.9085468E+00	0.
69	.9221072E+00	0.
70	.9356676E+00	0.
71	.9492280E+00	0.
72	.9627884E+00	0.
73	.9763488E+00	0.
74	.9899092E+00	0.
75	.1003470E+01	0.
76	.1017030E+01	0.
77	.1030590E+01	0.
78	.1044151E+01	0.
79	.1057711E+01	0.
80	.1071272E+01	0.
81	.1084832E+01	0.
82	.1098392E+01	0.
83	.1111953E+01	0.
84	.1125513E+01	0.
85	.1139074E+01	0.
86	.1152634E+01	0.
87	.1166194E+01	0.
88	.1179755E+01	0.
89	.1193315E+01	0.
90	.1206876E+01	0.
91	.1220436E+01	0.
92	.1233996E+01	0.
93	.1247557E+01	0.
94	.1261117E+01	0.
95	.1274678E+01	0.
96	.1288238E+01	0.
97	.1301798E+01	0.
98	.1315359E+01	0.
99	.1328919E+01	0.
100	.1342480E+01	0.
101	.1356040E+01	0.
102	.1369600E+01	0.
103	.1383161E+01	0.
104	.1396721E+01	0.
105	.1410282E+01	0.
106	.1423842E+01	0.
107	.1437402E+01	0.
108	.1450963E+01	0.
109	.1464523E+01	0.

110	.1478084E+01	0.
111	.1491644E+01	0.
112	.1505204E+01	0.
113	.1518765E+01	0.
114	.1532325E+01	0.
115	.1545886E+01	0.
116	.1559446E+01	0.
117	.1573006E+01	0.
118	.1586567E+01	0.
119	.1600127E+01	0.
120	.1613688E+01	0.
121	.1627248E+01	0.
122	.1640808E+01	0.
123	.1654369E+01	0.
124	.1667929E+01	0.
125	.1681490E+01	0.
126	.1695050E+01	0.
127	.1708610E+01	0.
128	.1722171E+01	0.
129	.1735731E+01	0.
130	.1749292E+01	0.
131	.1762852E+01	0.
132	.1776412E+01	0.
133	.1789973E+01	0.
134	.1803533E+01	0.
135	.1817094E+01	0.
136	.1830654E+01	0.
137	.1844214E+01	0.
138	.1857775E+01	0.
139	.1871335E+01	0.
140	.1884896E+01	0.
141	.1898456E+01	0.
142	.1912016E+01	0.
143	.1925577E+01	0.
144	.1939137E+01	0.
145	.1952698E+01	0.
146	.1966258E+01	0.
147	.1979818E+01	0.
148	.1993379E+01	0.
149	.2006939E+01	0.
150	.2020500E+01	0.
151	.2034060E+01	0.
152	.2047620E+01	0.
153	.2061181E+01	0.
154	.2074741E+01	0.
155	.2088302E+01	0.
156	.2101862E+01	0.
157	.2115422E+01	0.
158	.2128983E+01	0.
159	.2142543E+01	0.
160	.2156104E+01	0.
161	.2169664E+01	0.
162	.2183224E+01	0.
163	.2196785E+01	0.
164	.2210345E+01	0.
165	.2223906E+01	0.

166	.2237466E+01	0.
167	.2251026E+01	0.
168	.2264587E+01	0.
169	.2278147E+01	0.
170	.2291708E+01	0.
171	.2305268E+01	0.
172	.2318828E+01	0.
173	.2332389E+01	0.
174	.2345949E+01	0.
175	.2359510E+01	0.
176	.2373070E+01	0.
177	.2386630E+01	0.
178	.2400191E+01	0.
179	.2413751E+01	0.
180	.2427312E+01	0.
181	.2440872E+01	0.
182	.2454432E+01	0.
183	.2467993E+01	0.
184	.2481553E+01	0.
185	.2495114E+01	0.
186	.2508674E+01	0.
187	.2522234E+01	0.
188	.2535795E+01	0.
189	.2549355E+01	0.
190	.2562916E+01	0.
191	.2576476E+01	0.
192	.2590036E+01	0.
193	.2603597E+01	0.
194	.2617157E+01	0.
195	.2630718E+01	0.
196	.2644278E+01	0.
197	.2657838E+01	0.
198	.2671399E+01	0.
199	.2684959E+01	0.
200	.2698520E+01	0.
201	.2712080E+01	0.
202	.2725640E+01	0.
203	.2739201E+01	0.
204	.2752761E+01	0.
205	.2766322E+01	0.
206	.2779882E+01	0.
207	.2793442E+01	0.
208	.2807003E+01	0.
209	.2820563E+01	0.
210	.2834124E+01	0.
211	.2847684E+01	0.
212	.2861244E+01	0.
213	.2874805E+01	0.
214	.2888365E+01	0.
215	.2901926E+01	0.
216	.2915486E+01	0.
217	.2929046E+01	0.
218	.2942607E+01	0.
219	.2956167E+01	0.
220	.2969728E+01	0.
221	.2983288E+01	0.

				222	.2996848E+01 0.

MAX X(I) = .9495850E-04 AT TIME .1680000E+01
MIN X(I) = -.1273199E-03 AT TIME .5700000E+00

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* * * * * * * * * * * * * * * * * *
*  CONVOLUTION NUMBER      2      *
* * * * * * * * * * * * * * * * * *
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I	FREQUENCY	INTERPOLATED INPUT FREQUENCY RESPONSE FUNCTION FRF		TRANSFORM OF THE GUST IMPULSE TIME FUNCTION TFRF		TRANSFORM OF THE TIME CONVOLUTION FRF • TFRF	
		REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
1	0.	-.694058E-03	.153553E-03	-.175538E-03	0.	.121834E-06	-.269545E-07
2	.720158E-01	.237721E-01	-.150500E+00	.874043E-02	.475066E-01	.735751E-02	-.186100E-03
3	.144032E+00	.364049E-01	-.428251E+00	.346402E-01	.894867E-01	.395838E-01	-.115770E-01
4	.216047E+00	-.252113E+00	-.829467E+00	.750579E-01	.120921E+00	.813771E-01	-.927438E-01
5	.288063E+00	-.835076E+00	-.816071E+00	.126137E+00	.137759E+00	.708673E-02	-.217970E+00
6	.360079E+00	-.110383E+01	-.496698E+00	.182986E+00	.137284E+00	-.133799E+00	-.242427E+00
7	.432095E+00	-.117394E+01	-.254353E+00	.240127E+00	.118362E+00	-.251756E+00	-.200027E+00
8	.504110E+00	-.120450E+01	-.979288E-01	.291992E+00	.815378E-01	-.343720E+00	-.126807E+00
9	.576126E+00	-.124376E+01	.240711E-01	.333429E+00	.289740E-01	-.415404E+00	-.280109E-01
10	.648142E+00	-.130687E+01	.135712E+00	.360160E+00	-.357486E-01	-.465830E+00	.935971E-01
11	.720158E+00	-.139713E+01	.258718E+00	.369153E+00	-.107966E+00	-.487820E+00	.246349E+00
12	.792173E+00	-.152543E+01	.417552E+00	.358876E+00	-.182353E+00	-.471300E+00	.426917E+00
13	.864189E+00	-.170227E+01	.656041E+00	.329415E+00	-.253400E+00	-.394511E+00	.647465E+00
14	.936205E+00	-.192557E+01	.105765E+01	.282431E+00	-.315899E+00	-.209816E+00	.907094E+00
15	.100822E+01	-.211669E+01	.160389E+01	.220992E+00	-.365384E+00	.193168E+00	.117315E+01
16	.108024E+01	-.179403E+01	.316616E+01	.149270E+00	-.398500E+00	.993921E+00	.116759E+01
17	.115225E+01	.296667E+00	.425291E+01	.721545E-01	-.413258E+00	.177896E+01	.154267E+00
18	.122427E+01	.214826E+01	.269391E+01	-.518958E-02	-.409159E+00	.109109E+01	-.892959E+00
19	.129628E+01	.209515E+01	.119389E+01	-.777633E-01	-.387182E+00	.299325E+00	-.904044E+00
20	.136830E+01	.163301E+01	.508078E+00	-.141161E+00	-.349636E+00	-.528747E-01	-.642679E+00
21	.144032E+01	.125433E+01	.214399E+00	-.191903E+00	-.299905E+00	-.176410E+00	-.417323E+00
22	.151233E+01	.983224E+00	.781246E-01	-.227689E+00	-.242108E+00	-.204955E+00	-.255834E+00
23	.158435E+01	.790231E+00	.116980E-01	-.247521E+00	-.180702E+00	-.193435E+00	-.145692E+00
24	.165636E+01	.645439E+00	-.234889E-01	-.251709E+00	-.120086E+00	-.165283E+00	-.719973E-01
25	.172838E+01	.533241E+00	-.416823E-01	-.241751E+00	-.642398E-01	-.131589E+00	-.241766E-01
26	.180039E+01	.443540E+00	-.497860E-01	-.220124E+00	-.163913E-01	-.984506E-01	.388691E-02
27	.187241E+01	.369533E+00	-.511496E-01	-.189988E+00	.211819E-01	-.691234E-01	.175452E-01
28	.194443E+01	.306726E+00	-.468541E-01	-.154854E+00	.472811E-01	-.452825E-01	.217579E-01
29	.201644E+01	.251251E+00	-.365079E-01	-.118245E+00	.617944E-01	-.274531E-01	.190428E-01
30	.208846E+01	.200972E+00	-.217475E-01	-.833704E-01	.656041E-01	-.156099E-01	.140416E-01
31	.216047E+01	.157204E+00	.164761E-01	-.529006E-01	.604786E-01	-.931146E-02	.862485E-02
32	.223249E+01	.132342E+00	.747253E-01	-.267165E-01	.464812E-01	-.742316E-02	.427026E-02
33	.230450E+01	.167280E+00	.147337E+00	-.118746E-01	.323957E-01	-.675947E-02	.360960E-02
34	.237652E+01	.260140E+00	.143170E+00	-.257132E-02	.147467E-01	-.278018E-02	.346838E-02
35	.244854E+01	.296781E+00	.694027E-01	-.227595E-03	-.210540E-02	.785746E-04	-.640039E-03
36	.252055E+01	.278034E+00	.102674E-01	-.363806E-02	-.162417E-01	-.844745E-03	-.455310E-02
37	.259257E+01	.246408E+00	-.215802E-01	-.111686E-01	-.263272E-01	-.332019E-02	-.624620E-02
38	.266458E+01	.216851E+00	-.380741E-01	-.209786E-01	-.316786E-01	-.575536E-02	-.607686E-02
39	.273660E+01	.191286E+00	-.470365E-01	-.312416E-01	-.322578E-01	-.749337E-02	-.473097E-02
40	.280861E+01	.168420E+00	-.522948E-01	-.403427E-01	-.285969E-01	-.826997E-02	-.270557E-02
41	.288063E+01	.146763E+00	-.548514E-01	-.470322E-01	-.216702E-01	-.809122E-02	-.860594E-03
42	.295265E+01	.125156E+00	-.537195E-01	-.505241E-01	-.127310E-01	-.700727E-02	.112078E-02
43	.302466E+01	.104961E+00	-.459247E-01	-.505319E-01	-.313365E-02	-.544778E-02	.199175E-02
44	.309668E+01	.938782E-01	-.317544E-01	-.472464E-01	.533662E-02	-.425007E-02	.204822E-02
45	.316869E+01	.928431E-01	-.216517E-01	-.412595E-01	.151097E-01	-.354419E-02	.211873E-02
46	.324071E+01	.934740E-01	-.191555E-01	-.334502E-01	.179366E-01	-.278314E-02	.231736E-02
47	.331272E+01	.919894E-01	-.198172E-01	-.248483E-01	.199481E-01	-.189046E-02	.232744E-02

48	.338474E+01	.887472E-01	-.211455E-01	-.164928E-01	.191623E-01	-.105849E-02	.204934E-02
49	.345676E+01	.846440E-01	-.222781E-01	-.930299E-02	.159458E-01	-.432199E-03	.155697E-02
50	.352877E+01	.802595E-01	-.230905E-01	-.397548E-02	.109368E-01	-.665341E-04	.969577E-03
51	.360079E+01	.758450E-01	-.236459E-01	-.917262E-03	.494100E-02	.472649E-04	.396440E-03
52	.367280E+01	.714949E-01	-.240297E-01	-.220044E-03	-.118223E-02	-.441406E-04	-.792356E-04
53	.374482E+01	.672152E-01	-.243316E-01	-.167526E-02	-.663167E-02	-.273967E-03	-.405001E-03
54	.381684E+01	.629277E-01	-.246547E-01	-.482474E-02	-.107602E-01	-.568900E-03	-.556163E-03
55	.388885E+01	.583802E-01	-.251533E-01	-.903813E-02	-.131415E-01	-.858199E-03	-.539804E-03
56	.396087E+01	.528338E-01	-.260645E-01	-.136055E-01	-.136073E-01	-.107356E-02	-.364307E-03
57	.403288E+01	.429824E-01	-.272232E-01	-.178326E-01	-.122478E-01	-.109991E-02	-.409835E-04
58	.410490E+01	.230376E-01	-.990011E-02	-.211276E-01	-.938015E-02	-.580142E-03	-.566829E-05
59	.417691E+01	.556735E-01	.633890E-03	-.230653E-01	-.549098E-02	-.128065E-02	-.326323E-03
60	.424893E+01	.538338E-01	-.100219E-01	-.234336E-01	-.116230E-02	-.127317E-02	.172279E-03
61	.432095E+01	.504259E-01	-.131166E-01	-.222395E-01	.300973E-02	-.108197E-02	.446476E-03
62	.439296E+01	.475181E-01	-.142705E-01	-.196949E-01	.649180E-02	-.843723E-03	.589535E-03
63	.446498E+01	.449974E-01	-.147205E-01	-.161743E-01	.887723E-02	-.597120E-03	.637547E-03
64	.453699E+01	.427493E-01	-.148464E-01	-.121556E-01	.992926E-02	-.372231E-03	.604936E-03
65	.460901E+01	.407143E-01	-.147961E-01	-.815132E-02	.959792E-02	-.189635E-03	.511462E-03
66	.468102E+01	.388413E-01	-.146502E-01	-.464046E-02	.802365E-02	-.626933E-04	.379633E-03
67	.475304E+01	.371027E-01	-.144462E-01	-.200891E-02	.548804E-02	.474557E-05	.232642E-03
68	.482506E+01	.354797E-01	-.142058E-01	-.505494E-03	.238694E-02	.159737E-04	.918695E-04
69	.489707E+01	.339570E-01	-.139427E-01	-.218439E-03	-.837088E-03	-.190890E-04	-.259606E-04
70	.496909E+01	.325202E-01	-.136659E-01	-.107383E-02	-.375300E-02	-.862177E-04	-.107464E-03
71	.504110E+01	.311795E-01	-.133818E-01	-.285500E-02	-.599629E-02	-.169259E-03	-.146796E-03
72	.511312E+01	.299014E-01	-.130949E-01	-.523910E-02	-.751222E-02	-.252439E-03	-.150640E-03
73	.518513E+01	.286964E-01	-.128080E-01	-.784916E-02	-.758230E-02	-.322165E-03	-.117028E-03
74	.525715E+01	.275277E-01	-.125229E-01	-.102869E-01	-.693172E-02	-.368726E-03	-.592430E-04
75	.532917E+01	.264194E-01	-.122409E-01	-.122230E-01	-.521777E-02	-.386793E-03	.117705E-04
76	.540118E+01	.253549E-01	-.119626E-01	-.133991E-01	-.300199E-02	-.375642E-03	.841747E-04
77	.547320E+01	.243252E-01	-.116874E-01	-.136757E-01	-.509808E-03	-.338623E-03	.147432E-03
78	.554521E+01	.233222E-01	-.114136E-01	-.130402E-01	.191452E-02	-.282276E-03	.195487E-03
79	.561723E+01	.223373E-01	-.111371E-01	-.116914E-01	.395408E-02	-.215101E-03	.217543E-03
80	.568924E+01	.213549E-01	-.108507E-01	-.956878E-02	.536169E-02	-.146103E-03	.216327E-03
81	.576126E+01	.203625E-01	-.105404E-01	-.721959E-02	.598292E-02	-.859406E-04	.197924E-03
82	.583328E+01	.193436E-01	-.101788E-01	-.485925E-02	.577703E-02	-.391931E-04	.161211E-03
83	.590529E+01	.182875E-01	-.971455E-02	-.277973E-02	.481364E-02	-.407199E-05	.115033E-03
84	.597731E+01	.172095E-01	-.905706E-02	-.122200E-02	.325851E-02	.848227E-05	.671450E-04
85	.604932E+01	.162103E-01	-.806908E-02	-.346762E-03	.134705E-02	.524508E-05	.246357E-04
86	.612134E+01	.157139E-01	-.665557E-02	-.218304E-03	-.650055E-03	-.775690E-05	-.876197E-05
87	.619336E+01	.160998E-01	-.543310E-02	-.798875E-03	-.246400E-02	-.262493E-04	-.355507E-04
88	.626537E+01	.168108E-01	-.503013E-02	-.196042E-02	-.386343E-02	-.523876E-04	-.556068E-04
89	.633739E+01	.172258E-01	-.521079E-02	-.350475E-02	-.468233E-02	-.847989E-04	-.623733E-04
90	.640940E+01	.172294E-01	-.557976E-02	-.519311E-02	-.463946E-02	-.116477E-03	-.544049E-04
91	.648142E+01	.169585E-01	-.588433E-02	-.677939E-02	-.434470E-02	-.140534E-03	-.337875E-04
92	.655343E+01	.165601E-01	-.607903E-02	-.804288E-02	-.329364E-02	-.153213E-03	-.565018E-05
93	.662545E+01	.161166E-01	-.616116E-02	-.881612E-02	-.185105E-02	-.153527E-03	.246015E-04
94	.669747E+01	.156658E-01	-.621704E-02	-.900454E-02	-.226056E-03	-.142469E-03	.524902E-04
95	.676943E+01	.152243E-01	-.620730E-02	-.859564E-02	.135740E-02	-.122437E-03	.740219E-04
96	.684150E+01	.147995E-01	-.616605E-02	-.769095E-02	.269077E-02	-.967274E-04	.870352E-04
97	.691351E+01	.143950E-01	-.610300E-02	-.632367E-02	.360770E-02	-.690114E-04	.905202E-04
98	.698553E+01	.140098E-01	-.602666E-02	-.477783E-02	.400420E-02	-.423047E-04	.849926E-04
99	.705754E+01	.136439E-01	-.594132E-02	-.322224E-02	.364967E-02	-.210916E-04	.710067E-04
100	.712956E+01	.132969E-01	-.585016E-02	-.185230E-02	.318786E-02	-.596096E-05	.532278E-04
101	.720158E+01	.129685E-01	-.575564E-02	-.832900E-03	.212795E-02	.144627E-05	.323962E-04
102	.727359E+01	.126585E-01	-.565974E-02	-.273127E-03	.627405E-03	.122552E-05	.120196E-04
103	.734561E+01	.123670E-01	-.556425E-02	-.218820E-03	-.530836E-03	-.565987E-05	-.534736E-05

104	.741762E+01	.120943E-01	-.547092E-02	-.646702E-03	-.176360E-02	-.174699E-04	-.177914E-04
105	.748964E+01	.118409E-01	-.538169E-02	-.147071E-02	-.271174E-02	-.320083E-04	-.241945E-04
106	.756165E+01	.116079E-01	-.529900E-02	-.255590E-02	-.326023E-02	-.469446E-04	-.243067E-04
107	.763367E+01	.113909E-01	-.522776E-02	-.373822E-02	-.335170E-02	-.601335E-04	-.186632E-04
108	.770569E+01	.112149E-01	-.517419E-02	-.484738E-02	-.299172E-02	-.698426E-04	-.847059E-05
109	.777770E+01	.110568E-01	-.514847E-02	-.572968E-02	-.224568E-02	-.749135E-04	.466914E-05
110	.784972E+01	.109229E-01	-.516827E-02	-.626770E-02	-.122776E-02	-.748066E-04	.169825E-04
111	.792173E+01	.108000E-01	-.526169E-02	-.639453E-02	-.839979E-04	-.695029E-04	.327559E-04
112	.799375E+01	.106442E-01	-.546233E-02	-.610069E-02	.102935E-02	-.593195E-04	.442699E-04
113	.806576E+01	.103597E-01	-.577068E-02	-.543324E-02	.196206E-02	-.449643E-04	.516798E-04
114	.813778E+01	.984074E-02	-.608339E-02	-.446746E-02	.259913E-02	-.283484E-04	.528763E-04
115	.820980E+01	.907736E-02	-.619009E-02	-.339239E-02	.286536E-02	-.131249E-04	.476664E-04
116	.828181E+01	.837183E-02	-.595508E-02	-.229244E-02	.278065E-02	-.288306E-05	.365792E-04
117	.835383E+01	.789066E-02	-.554344E-02	-.132770E-02	.245000E-02	.200758E-05	.251200E-04
118	.842584E+01	.761292E-02	-.517449E-02	-.615391E-03	.147753E-02	.296055E-05	.144327E-04
119	.849786E+01	.742446E-02	-.487237E-02	-.235154E-03	.564420E-03	.858001E-06	.511354E-05
120	.856988E+01	.727705E-02	-.463159E-02	-.219739E-03	-.447400E-03	-.367123E-05	-.223061E-05
121	.864189E+01	.714716E-02	-.443649E-02	-.552295E-03	-.133542E-02	-.987183E-05	-.709423E-05
122	.871391E+01	.702431E-02	-.427390E-02	-.117032E-02	-.201422E-02	-.168293E-04	-.914671E-05
123	.878592E+01	.690422E-02	-.413443E-02	-.197554E-02	-.240023E-02	-.235691E-04	-.940401E-05
124	.885794E+01	.678532E-02	-.401169E-02	-.284820E-02	-.245177E-02	-.291617E-04	-.920999E-05
125	.892995E+01	.666723E-02	-.390137E-02	-.366373E-02	-.217319E-02	-.329054E-04	-.855666E-05
126	.900197E+01	.655001E-02	-.380056E-02	-.430950E-02	-.161273E-02	-.343565E-04	-.581911E-05
127	.907399E+01	.643386E-02	-.370721E-02	-.469939E-02	-.854665E-03	-.334037E-04	-.119228E-04
128	.914600E+01	.631917E-02	-.362027E-02	-.478442E-02	-.685179E-05	-.302584E-04	.172776E-04
129	.921802E+01	.620612E-02	-.353831E-02	-.455602E-02	.814366E-03	-.254061E-04	.211819E-04
130	.929003E+01	.609482E-02	-.346042E-02	-.405555E-02	.150005E-02	-.195270E-04	.231704E-04
131	.936205E+01	.599127E-02	-.339286E-02	-.334821E-02	.196275E-02	-.134007E-04	.231194E-04
132	.943406E+01	.589066E-02	-.332910E-02	-.253241E-02	.214768E-02	-.776769E-05	.216819E-04
133	.950608E+01	.579005E-02	-.326534E-02	-.171609E-02	.203867E-02	-.327666E-05	.174058E-04
134	.957810E+01	.568944E-02	-.320157E-02	-.100400E-02	.166011E-02	-.397226E-06	.126594E-04
135	.965011E+01	.558883E-02	-.313781E-02	-.483749E-03	.107050E-02	.655432E-06	.750074E-05
136	.972213E+01	.548822E-02	-.307405E-02	-.214719E-03	.395506E-03	-.855837E-07	.261115E-05
137	.979414E+01	.538761E-02	-.301029E-02	-.220968E-03	-.365287E-03	-.235031E-05	-.141066E-05
138	.986616E+01	.528700E-02	-.294652E-02	-.469111E-03	-.105169E-02	-.506536E-05	-.412016E-05
139	.993817E+01	.518639E-02	-.288276E-02	-.971247E-03	-.155729E-02	-.952655E-05	-.527662E-05
140	.100102E+02	.510601E-02	-.283472E-02	-.159239E-02	-.183862E-02	-.133428E-04	-.487464E-05
141	.100822E+02	.502853E-02	-.278893E-02	-.226131E-02	-.186491E-02	-.165721E-04	-.397113E-05
142	.101542E+02	.495104E-02	-.274314E-02	-.280316E-02	-.164020E-02	-.187739E-04	-.211799E-05
143	.102262E+02	.487355E-02	-.269735E-02	-.317231E-02	-.120201E-02	-.196773E-04	.323825E-05
144	.102983E+02	.479606E-02	-.265156E-02	-.336345E-02	-.615294E-03	-.192016E-04	.676289E-05
145	.103703E+02	.471857E-02	-.260577E-02	-.371979E-02	.369877E-04	-.174557E-04	.986745E-05
146	.104423E+02	.464108E-02	-.255998E-02	-.353707E-02	.665916E-03	-.147121E-04	.121435E-04
147	.105143E+02	.456360E-02	-.251419E-02	-.314324E-02	.118673E-02	-.113601E-04	.133164E-04
148	.105863E+02	.448611E-02	-.246840E-02	-.259379E-02	.155381E-02	-.784995E-05	.132833E-04
149	.106583E+02	.440862E-02	-.242261E-02	-.196352E-02	.166517E-02	-.462236E-05	.120976E-04
150	.107303E+02	.433113E-02	-.237682E-02	-.133602E-02	.156027E-02	-.205661E-05	.997220E-05
151	.108024E+02	.425364E-02	-.233103E-02	-.792223E-03	.126534E-02	-.420280E-06	.722902E-05
152	.108744E+02	.417615E-02	-.228524E-02	-.399652E-03	.799939E-03	.159039E-06	.425395E-05
153	.109464E+02	.409867E-02	-.223945E-02	-.203769E-03	.239955E-03	-.297822E-06	.143972E-05
154	.110184E+02	.403189E-02	-.220017E-02	-.222466E-03	-.336943E-03	-.163829E-05	-.869356E-06
155	.110904E+02	.397542E-02	-.216713E-02	-.444502E-03	-.852851E-03	-.361532E-05	-.242714E-05
156	.111624E+02	.391894E-02	-.213409E-02	-.831722E-03	-.124023E-02	-.590624E-05	-.306543E-05
157	.112345E+02	.386246E-02	-.210106E-02	-.132493E-02	-.145059E-02	-.816520E-05	-.281910E-05
158	.113065E+02	.380599E-02	-.206802E-02	-.180523E-02	-.146044E-02	-.100703E-04	-.172766E-05
159	.113785E+02	.374951E-02	-.203498E-02	-.233970E-02	-.127383E-02	-.113649E-04	-.149999E-07

160	.114505E+02	.369304E-02	-.200194E-02	-.271994E-02	-.921006E-03	-.118886E-04	.204385E-05
161	.115225E+02	.363656E-02	-.196891E-02	-.294231E-02	-.453713E-03	-.115932E-04	.414319E-05
162	.115945E+02	.358008E-02	-.193587E-02	-.297861E-02	.623227E-04	-.105430E-04	.598931E-05
163	.116666E+02	.352361E-02	-.190283E-02	-.282632E-02	.556559E-03	-.889980E-05	.733911E-05
164	.117386E+02	.346713E-02	-.186979E-02	-.250837E-02	.963213E-03	-.689582E-05	.802971E-05
165	.118106E+02	.341065E-02	-.183676E-02	-.206933E-02	.122995E-02	-.479864E-05	.799578E-05
166	.118826E+02	.335418E-02	-.180372E-02	-.156892E-02	.132455E-02	-.287332E-05	.727265E-05
167	.119546E+02	.330142E-02	-.177284E-02	-.107360E-02	.123870E-02	-.134641E-05	.599278E-05
168	.120266E+02	.325981E-02	-.174942E-02	-.647515E-03	.938510E-03	-.392444E-06	.435449E-05
169	.120986E+02	.321821E-02	-.172401E-02	-.343914E-03	.611738E-03	-.521440E-07	.256161E-05
170	.121707E+02	.317661E-02	-.169960E-02	-.198324E-03	.362162E-03	-.354367E-06	.852195E-06
171	.122427E+02	.313500E-02	-.167518E-02	-.224218E-03	-.298013E-03	-.120215E-05	-.556665E-06
172	.123147E+02	.309340E-02	-.165077E-02	-.411760E-03	-.706711E-03	-.244055E-05	-.150642E-05
173	.123867E+02	.305179E-02	-.162636E-02	-.729699E-03	-.101030E-02	-.387003E-05	-.189049E-05
174	.124587E+02	.301019E-02	-.160194E-02	-.113009E-02	-.117059E-02	-.527701E-05	-.171337E-05
175	.125307E+02	.296858E-02	-.157753E-02	-.155514E-02	-.116955E-02	-.646157E-05	-.101864E-05
176	.126028E+02	.292698E-02	-.155311E-02	-.194519E-02	-.101126E-02	-.726411E-05	.611732E-07
177	.126748E+02	.288537E-02	-.152870E-02	-.224675E-02	-.720780E-03	-.758456E-05	.135488E-05
178	.127468E+02	.284377E-02	-.150429E-02	-.241950E-02	-.340349E-03	-.739204E-05	.267183E-05
179	.128188E+02	.280216E-02	-.147987E-02	-.244162E-02	.767528E-04	-.672824E-05	.382836E-05
180	.128908E+02	.276056E-02	-.145546E-02	-.231177E-02	.473595E-03	-.569247E-05	.467207E-05
181	.129628E+02	.271895E-02	-.143104E-02	-.204926E-02	.797323E-03	-.443085E-05	.510047E-05
182	.130349E+02	.267735E-02	-.140663E-02	-.169078E-02	.100615E-02	-.311151E-05	.507212E-05
183	.131069E+02	.263578E-02	-.138691E-02	-.128502E-02	.107473E-02	-.190676E-05	.462354E-05
184	.131789E+02	.261248E-02	-.136851E-02	-.885940E-03	.997105E-03	-.949972E-06	.381735E-05
185	.132509E+02	.258118E-02	-.135011E-02	-.545378E-03	.787159E-03	-.344996E-06	.278667E-05
186	.133229E+02	.254988E-02	-.133171E-02	-.306097E-03	.476129E-03	-.140445E-06	.162171E-05
187	.133949E+02	.251859E-02	-.131331E-02	-.196314E-03	.198224E-03	-.352302E-06	.530394E-06
188	.134669E+02	.248729E-02	-.129491E-02	-.226221E-03	-.265799E-03	-.906563E-06	-.368102E-06
189	.135390E+02	.245599E-02	-.127652E-02	-.387030E-03	-.595509E-03	-.171672E-05	-.968513E-06
190	.136110E+02	.242469E-02	-.125812E-02	-.652593E-03	-.837561E-03	-.263011E-05	-.120963E-05
191	.136830E+02	.239339E-02	-.123972E-02	-.983305E-03	-.961453E-03	-.354536E-05	-.108211E-05
192	.137550E+02	.236209E-02	-.122132E-02	-.133173E-02	-.953137E-03	-.430975E-05	-.624929E-06
193	.138270E+02	.233079E-02	-.120292E-02	-.164914E-02	-.816728E-03	-.482626E-05	.801642E-07
194	.138990E+02	.229949E-02	-.118452E-02	-.189210E-02	-.573444E-03	-.503612E-05	.922602E-06
195	.139711E+02	.226819E-02	-.116612E-02	-.202817E-02	-.258392E-03	-.490159E-05	.177901E-05
196	.140431E+02	.224039E-02	-.114980E-02	-.204003E-02	.844571E-04	-.447335E-05	.253465E-05
197	.141151E+02	.221582E-02	-.113538E-02	-.192745E-02	.408369E-03	-.380724E-05	.309325E-05
198	.141871E+02	.219124E-02	-.112096E-02	-.170696E-02	.670187E-03	-.298911E-05	.328199E-05
199	.142591E+02	.216667E-02	-.110655E-02	-.140927E-02	.836055E-03	-.212836E-05	.337088E-05
200	.143311E+02	.214210E-02	-.109213E-02	-.107480E-02	.885753E-03	-.133497E-05	.307119E-05
201	.144032E+02	.211752E-02	-.107771E-02	-.748049E-03	.815126E-03	-.705541E-06	.253223E-05
202	.144752E+02	.209295E-02	-.106329E-02	-.471543E-03	.636285E-03	-.310359E-06	.183108E-05
203	.145472E+02	.206838E-02	-.104886E-02	-.260149E-03	.375629E-03	-.185464E-06	.107079E-05
204	.146192E+02	.204380E-02	-.103446E-02	-.196552E-03	.699632E-04	-.329208E-06	.340378E-06
205	.146912E+02	.201923E-02	-.102004E-02	-.228476E-03	-.238533E-03	-.704660E-06	-.246598E-06
206	.147632E+02	.199466E-02	-.100563E-02	-.367900E-03	-.508376E-03	-.124519E-05	-.643995E-06
207	.148352E+02	.197009E-02	-.991211E-03	-.592768E-03	-.704028E-03	-.186564E-05	-.799437E-06
208	.149073E+02	.194551E-02	-.976795E-03	-.869674E-03	-.800747E-03	-.247413E-05	-.708371E-06
209	.149793E+02	.192223E-02	-.963150E-03	-.119917E-02	-.787599E-03	-.298676E-05	-.397495E-06
210	.150513E+02	.190261E-02	-.951702E-03	-.142089E-02	-.668083E-03	-.333977E-05	.800597E-07
211	.151233E+02	.188299E-02	-.940255E-03	-.161909E-02	-.462164E-03	-.348328E-05	.652105E-06
212	.151953E+02	.186337E-02	-.928807E-03	-.172732E-02	-.197724E-03	-.340228E-05	.123591E-05
213	.152673E+02	.184376E-02	-.917360E-03	-.173100E-02	.878579E-04	-.311241E-05	.175067E-05
214	.153394E+02	.182414E-02	-.905912E-03	-.163301E-02	.355702E-03	-.265660E-05	.212621E-05
215	.154114E+02	.180452E-02	-.894465E-03	-.144534E-02	.570116E-03	-.209220E-05	.232106E-05

216	.154834E+02	.178490E-02	-.883017E-03	-.119485E-02	.703343E-03	-.151162E-05	.231047E-05
217	.155554E+02	.176529E-02	-.871570E-03	-.915521E-03	.739106E-03	-.971973E-06	.210267E-05
218	.156274E+02	.174567E-02	-.860122E-03	-.644551E-03	.674585E-03	-.544946E-06	.173199E-05
219	.156994E+02	.172605E-02	-.848675E-03	-.417258E-03	.520508E-03	-.278466E-06	.125254E-05
220	.157715E+02	.170643E-02	-.837227E-03	-.262380E-03	.299437E-03	-.197037E-06	.730641E-06
221	.158435E+02	.168681E-02	-.825780E-03	-.198344E-03	.424930E-04	-.299479E-06	.233466E-06
222	.159155E+02	.166720E-02	-.814332E-03	-.230990E-03	-.215005E-03	-.560191E-06	-.170354E-06

******** WARNING.
EXTRAPOLATION REQUIRED FOR , 1 TJ S.

J	TIME, TJ(J)	RESPONSE FUNCTION, X(J)
1	0.	.5066605E-02
2	.3000000E-01	.3988277E-02
3	.6000000E-01	-.2179698E-02
4	.9000000E-01	-.1933396E-01
5	.1200000E+00	-.5260515E-01
6	.1500000E+00	-.1057752E+00
7	.1800000E+00	-.1904092E+00
8	.2100000E+00	-.2744197E+00
9	.2400000E+00	-.3837449E+00
10	.2700000E+00	-.5020458E+00
11	.3000000E+00	-.6209243E+00
12	.3300000E+00	-.7304766E+00
13	.3600000E+00	-.8207593E+00
14	.3900000E+00	-.8820437E+00
15	.4200000E+00	-.9055335E+00
16	.4500000E+00	-.8822606E+00
17	.4800000E+00	-.8088300E+00
18	.5100000E+00	-.6836514E+00
19	.5400000E+00	-.5077629E+00
20	.5700000E+00	-.2847137E+00
21	.6000000E+00	-.2093913E-01
22	.6300000E+00	.2718182E+00
23	.6600000E+00	.5809518E+00
24	.6900000E+00	.8918573E+00
25	.7200000E+00	.1187975E+01
26	.7500000E+00	.1451768E+01
27	.7800000E+00	.1667534E+01
28	.8100000E+00	.1820553E+01
29	.8400000E+00	.1898564E+01
30	.8700000E+00	.1892346E+01
31	.9000000E+00	.1804198E+01
32	.9300000E+00	.1640307E+01
33	.9600000E+00	.1409437E+01
34	.9900000E+00	.1123197E+01
35	.1020000E+01	.7946162E+00
36	.1050000E+01	.4417599E+00
37	.1080000E+01	.8109894E-01
38	.1110000E+01	-.2709868E+00
39	.1140000E+01	-.5984084E+00
40	.1170000E+01	-.8859892E+00
41	.1200000E+01	-.1123089E+01
42	.1230000E+01	-.1301009E+01
43	.1260000E+01	-.1413958E+01
44	.1290000E+01	-.1457359E+01
45	.1320000E+01	-.1432443E+01
46	.1350000E+01	-.1344107E+01
47	.1380000E+01	-.1198926E+01
48	.1410000E+01	-.1005962E+01
49	.1440000E+01	-.7752875E+00
50	.1470000E+01	-.5211548E+00
51	.1500000E+01	-.2567178E+00
52	.1530000E+01	.5152999E-02
53	.1560000E+01	.2520630E+00

54	.1590000E+01	.4719413E+00
55	.1620000E+01	.6563756E+00
56	.1650000E+01	.7984864E+00
57	.1680000E+01	.8936697E+00
58	.1710000E+01	.9336542E+00
59	.1740000E+01	.9336489E+00
60	.1770000E+01	.8823725E+00
61	.1800000E+01	.7893089E+00
62	.1830000E+01	.6604539E+00
63	.1860000E+01	.5022439E+00
64	.1890000E+01	.3237345E+00
65	.1920000E+01	.1337089E+00
66	.1950000E+01	-.5909901E-01
67	.1980000E+01	-.2459337E+00
68	.2010000E+01	-.4175410E+00
69	.2040000E+01	-.5666963E+00
70	.2070000E+01	-.6870791E+00
71	.2100000E+01	-.7738912E+00
72	.2130000E+01	-.8235200E+00
73	.2160000E+01	-.8343999E+00
74	.2190000E+01	-.8085499E+00
75	.2220000E+01	-.7486419E+00
76	.2250000E+01	-.6587991E+00
77	.2280000E+01	-.5438068E+00
78	.2310000E+01	-.4105657E+00
79	.2340000E+01	-.2663129E+00
80	.2370000E+01	-.1181355E+00
81	.2400000E+01	.2699692E-01
82	.2430000E+01	.1619607E+00
83	.2460000E+01	.2812378E+00
84	.2490000E+01	.3802851E+00
85	.2520000E+01	.4526940E+00
86	.2550000E+01	.5049988E+00
87	.2580000E+01	.5365577E+00
88	.2610000E+01	.5215502E+00
89	.2640000E+01	.4913615E+00
90	.2670000E+01	.4383930E+00
91	.2700000E+01	.3656202E+00
92	.2730000E+01	.2774535E+00
93	.2760000E+01	.1790244E+00
94	.2790000E+01	.7533433E-01
95	.2820000E+01	-.2800634E-01
96	.2850000E+01	-.1277045E+00
97	.2880000E+01	-.2175530E+00
98	.2910000E+01	-.2944557E+00
99	.2940000E+01	-.3553306E+00
100	.2970000E+01	-.3977955E+00
101	.3000000E+01	-.4205963E+00

MAX X(I) = .1898564E+01 AT TIME .8400000E+00
MIN X(I) = -.1457359E+01 AT TIME .1290000E+01

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* * * * * * * * * * * * * * * * 
*  CONVOLUTION NUMBER      3   *
* * * * * * * * * * * * * * * * 
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I	FREQUENCY	INTERPOLATED INPUT FREQUENCY RESPONSE FUNCTION FRF		TRANSFORM OF THE GUST IMPULSE TIME FUNCTION TFRF		TRANSFORM OF THE TIME CONVOLUTION FRF * TFRF	
		REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
1	0.	-.131924E-04	.333032E-05	-.175538E-03	0.	.231577E-08	-.585652E-09
2	.720158E-01	.462079E-03	-.373162E-02	.874043E-02	.475066E-01	.181316E-03	-.106642E-04
3	.144032E+00	.500673E-03	-.101535E-01	.346402E-01	.894067E-01	.925943E-03	-.306915E-03
4	.216047E+00	-.611609E-02	-.187781E-01	.750579E-01	.120921E+00	.181160E-02	-.214901E-02
5	.288063E+00	-.183975E-01	-.179761E-01	.126137E+00	.137759E+00	.156029E-03	-.480212E-02
6	.360079E+00	-.232826E-01	-.110686E-01	.182936E+00	.137284E+00	-.274086E-02	-.522173E-02
7	.432095E+00	-.238431E-01	-.621212E-02	.240127E+00	.118362E+00	-.499009E-02	-.431382E-02
8	.504110E+00	-.234988E-01	-.341599E-02	.291992E+00	.819376E-01	-.658292E-02	-.291548E-02
9	.576126E+00	-.232036E-01	-.153168E-02	.333429E+00	.289740E-01	-.769236E-02	-.118301E-02
10	.648142E+00	-.231541E-01	-.156996E-03	.360160E+00	-.357480E-01	-.834481E-02	.771139E-03
11	.720158E+00	-.233584E-01	.106838E-02	.369153E+00	-.107966E+00	-.850748E-02	.291632E-02
12	.792173E+00	-.238845E-01	.234241E-02	.358876E+00	-.182353E+00	-.814443E-02	.519004E-02
13	.864189E+00	-.248029E-01	.396709E-02	.329415E+00	-.253400E+00	-.716517E-02	.759186E-02
14	.936205E+00	-.261462E-01	.646273E-02	.282431E+00	-.315599E+00	-.534291E-02	.100645E-01
15	.100822E+01	-.275696E-01	.109959E-01	.220992E+00	-.365364E+00	-.207498E-02	.125356E-01
16	.108024E+01	-.264247E-01	.194230E-01	.149270E+00	-.398500E+00	.379504E-02	.134295E-01
17	.115225E+01	-.147139E-01	.274904E-01	.721545E-01	-.413258E+00	.102990E-01	.806421E-02
18	.122427E+01	-.254003E-02	.198230F-01	-.518858E-02	-.409159E+00	.812421E-02	.936422E-03
19	.129628E+01	-.160389E-02	.111340E-01	-.777633E-01	-.387182E+00	.443501E-02	-.244822E-03
20	.136830E+01	-.365264E-02	.692114E-02	-.141161E+00	-.849630E+00	.243549E-02	.300100E-03
21	.144032E+01	-.549203E-02	.505574E-02	-.191903E+00	-.299905E+00	.257018E-02	.676877E-03
22	.151233E+01	-.681243E-02	.417642E-02	-.227089E+00	-.242108E+00	.256226E-02	.698416E-03
23	.158435E+01	-.772368E-02	.374696E-02	-.247521E+00	-.180702E+00	.258830E-02	.466229E-03
24	.165636E+01	-.837301E-02	.351941F-02	-.251709E+00	-.120088E+00	.253022E-02	.119034E-03
25	.172838E+01	-.884112E-02	.339768E-02	-.241751E+00	-.642398E-01	.235562E-02	-.253441E-03
26	.180039E+01	-.918171E-02	.333181E-02	-.220124E+00	-.163913E-01	.207573E-02	-.552912E-03
27	.187241E+01	-.943202E-02	.329377E-02	-.189988E+00	.211619E-01	.172221E-02	-.825565E-03
28	.194443E+01	-.961829E-02	.326706F-02	-.154854F+00	.472811E-01	.133496E-02	-.960681E-03
29	.201644E+01	-.976739E-02	.324221E-02	-.118245E+00	.617944E-01	.954591E-03	-.986944E-03
30	.208846E+01	-.990560E-02	.322009E-02	-.833764E-01	.656841E-01	.614642E-03	-.918327E-03
31	.216047E+01	-.100629E-01	.322360E-02	-.529006F-01	.604086E-01	.337603E-03	-.775417E-03
32	.223249E+01	-.102534E-01	.333330F-02	-.287165E-01	.484812E-01	.132843E-03	-.596826E-03
33	.230450E+01	-.103245E-01	.371020E-02	-.118746E-01	.323957E-01	.240548E-05	-.376928E-03
34	.237652E+01	-.984861E-02	.410237E-02	-.257132E-02	.147467E-01	-.351724E-04	-.155703E-03
35	.244854E+01	-.914721E-02	.397612E-02	-.227595E-03	-.210540E-02	.104532E-04	.185306E-04
36	.252055E+01	-.860939E-02	.352409E-02	-.363806E-02	-.162417E-01	.885581E-04	.127010E-03
37	.259257E+01	-.818179E-02	.293666E-02	-.111686E-01	-.263272E-01	.168693E-03	.182035E-03
38	.266458E+01	-.777126E-02	.218200E-02	-.209786E-01	-.316786E-01	.232153E-03	.200466E-03
39	.273660E+01	-.736372E-02	.110771E-02	-.312416E-01	-.322578E-01	.265707E-03	.202931E-03
40	.280861E+01	-.700146E-02	-.499985E-03	-.403427E-01	-.285969E-01	.270500E-03	.222106E-03
41	.288063E+01	-.722293E-02	-.294387E-02	-.470322E-01	-.216702E-01	.275916E-03	.294979E-03
42	.295265E+01	-.879215E-02	-.635734E-02	-.505241E-01	-.127310E-01	.363280E-03	.433151E-03
43	.302466E+01	-.133530E-01	-.961194E-02	-.505319E-01	-.313365E-02	.644630E-03	.527555E-03
44	.309668E+01	-.204030E-01	-.877304E-02	-.472404E-01	.583662E-02	.101517E-02	.299411E-03
45	.316869E+01	-.247345E-01	-.385215E-02	-.412595F-01	.131097E-01	.107103E-02	-.163323E-03
46	.324071E+01	-.254730E-01	.969036E-03	-.334502E-01	.179366E-01	.834697E-03	-.489319E-03
47	.331272E+01	-.247808E-01	.416685E-02	-.248453E-01	.199481E-01	.532639E-03	-.597869E-03

48	.338474E+01	-.239908E-01	.616610E-02	-.164928E-01	.191623E-01	.277519E-03	-.561415E-03
49	.345676E+01	-.235152E-01	.753163E-02	-.930299E-02	.159458E-01	.986636E-04	-.445037E-03
50	.352877E+01	-.234288E-01	.864550E-02	-.397548E-02	.109368E-01	-.141320E-05	-.295606E-03
51	.360079E+01	-.237525E-01	.972680E-02	-.917262E-03	.494100E-02	-.262729E-04	-.126283E-03
52	.367280E+01	-.245483E-01	.109479E-01	-.220044E-03	-.118223E-02	.183446E-04	.266127E-04
53	.374482E+01	-.259539E-01	.125148E-01	-.167526E-02	-.663187E-02	.120476E-03	.151157E-03
54	.381684E+01	-.282807E-01	.147984E-01	-.482474E-02	-.107602E-01	.295082E-03	.232908E-03
55	.388885E+01	-.322406E-01	.187022E-01	-.903813E-02	-.131415E-01	.537170E-03	.254654E-03
56	.396087E+01	-.393854E-01	.268683E-01	-.136055E-01	-.136073E-01	.901463E-03	.170374E-03
57	.403288E+01	-.523996E-01	.524652E-01	-.178326E-01	-.122478E-01	.157701E-02	-.295606E-03
58	.410490E+01	-.370992E-02	.137624E+00	-.211270E-01	-.938019E-02	.136931E-02	-.287276E-02
59	.417691E+01	.729912E-01	.951416E-02	-.230653E-01	-.549096E-02	-.163132E-02	-.620240E-03
60	.424893E+01	.300029E-01	-.425127E-02	-.234336E-01	-.116230E-02	-.709016E-03	.647500E-04
61	.432095E+01	.149596E-01	-.341400E-02	-.222395E-01	.300973E-02	-.322416E-03	.120950E-03
62	.439296E+01	.791113E-02	-.198854E-02	-.196949E-01	.649180E-02	-.142900E-03	.950216E-04
63	.446498E+01	.389647E-02	-.849799E-03	-.161743E-01	.887723E-02	-.554789E-04	.483348E-04
64	.453699E+01	.132314E-02	.234872E-04	-.121596E-01	.992926E-02	-.163168E-04	.123523E-04
65	.460901E+01	-.439147E-03	.700276E-03	-.815132E-02	.959992E-02	-.314296E-05	-.992394E-05
66	.468102E+01	-.174083E-02	.124735E-02	-.464046E-02	.802365E-02	-.193009E-05	-.197501E-04
67	.475304E+01	-.274459E-02	.170306E-02	-.200891E-02	.548804E-02	-.583203E-05	-.184037E-04
68	.482506E+01	-.354530E-02	.209319E-02	-.505494E-03	.238094E-02	-.320421E-05	-.952054E-05
69	.489707E+01	-.420359E-02	.243635E-02	-.218439E-03	-.837083E-03	.295766E-05	.298654E-05
70	.496909E+01	-.475744E-02	.274578E-02	-.107383E-02	-.379300E-02	.154136E-04	.149322E-04
71	.504110E+01	-.523813E-02	.303363E-02	-.265500E-02	-.549629E-02	.331454E-04	.227464E-04
72	.511312E+01	-.566760E-02	.330973E-02	-.523910E-02	-.731222E-02	.538946E-04	.241528E-04
73	.518513E+01	-.606097E-02	.358241E-02	-.784516E-02	-.758230E-02	.747122E-04	.178515E-04
74	.525715E+01	-.643035E-02	.386005E-02	-.102869E-01	-.683172E-02	.925190E-04	.422255E-05
75	.532917E+01	-.678577E-02	.415223E-02	-.122230E-01	-.521777E-02	.104608E-03	-.153495E-04
76	.540118E+01	-.713655E-02	.447133E-02	-.133991E-01	-.300190E-02	.109045E-03	-.384863E-04
77	.547320E+01	-.749070E-02	.483110E-02	-.136757E-01	-.509303E-03	.104903E-03	-.622458E-04
78	.554521E+01	-.785449E-02	.525086E-02	-.130402E-01	.191452E-02	.923715E-04	-.835099E-04
79	.561723E+01	-.823380E-02	.577341E-02	-.116014E-01	.395468E-02	.726921E-04	-.995419E-04
80	.568924E+01	-.862271E-02	.642127E-02	-.959878E-02	.555169E-02	.480800E-04	-.107676E-03
81	.576126E+01	-.900553E-02	.726601E-02	-.721959E-02	.598292E-02	.215443E-04	-.106337E-03
82	.583328E+01	-.933044E-02	.840191E-02	-.485925E-02	.577703E-02	-.319925E-05	-.947292E-04
83	.590529E+01	-.946514E-02	.995633E-02	-.277973E-02	.481364E-02	-.216156E-04	-.732370E-04
84	.597731E+01	-.910974E-02	.120524E-01	-.122200E-02	.325851E-02	-.281407E-04	-.444122E-04
85	.604932E+01	-.766474E-02	.146551E-01	-.346962E-03	.134705E-02	-.170817E-04	-.154095E-04
86	.612134E+01	-.403049E-02	.167056E-01	-.218304E-03	-.650055E-03	.117394E-04	-.102680E-05
87	.619336E+01	.718532E-03	.158843E-01	-.798875E-03	-.246408E-02	.385662E-04	-.144001E-04
88	.626537E+01	.365968E-02	.126077E-01	-.196042E-02	-.396343E-02	.415346E-04	-.388554E-04
89	.633739E+01	.426689E-02	.914292E-02	-.350475E-02	-.468233E-02	.278488E-04	-.520321E-04
90	.640940E+01	.353980E-02	.662486E-02	-.519311E-02	-.483946E-02	.136782E-04	-.515343E-04
91	.648142E+01	.242801E-02	.510261E-02	-.677938E-02	-.434470E-02	.570888E-05	-.451415E-04
92	.655343E+01	.137053E-02	.424054E-02	-.804288E-02	-.329364E-02	.294378E-05	-.386602E-04
93	.662545E+01	.476619E-03	.376070E-02	-.881612E-02	-.185105E-02	.275931E-05	-.340370E-04
94	.669747E+01	-.256051E-03	.349081E-02	-.900454E-02	-.226056E-03	.310195E-05	-.314472E-04
95	.676948E+01	-.857814E-03	.336404E-02	-.859504E-02	.135740E-02	.280628E-05	-.300356E-04
96	.684150E+01	-.135311E-02	.331029E-02	-.765695E-02	.269077E-02	.145348E-05	-.289870E-04
97	.691351E+01	-.176509E-02	.330819E-02	-.632367E-02	.369773E-02	-.773404E-06	-.272877E-04
98	.698553E+01	-.211838E-02	.333937E-02	-.477763E-02	.400420E-02	-.325027E-05	-.244374E-04
99	.705754E+01	-.242553E-02	.339650E-02	-.322224E-02	.364967E-02	-.525974E-05	-.202618E-04
100	.712956E+01	-.269610E-02	.347576E-02	-.185280E-02	.318786E-02	-.608491E-05	-.150347E-04
101	.720158E+01	-.293745E-02	.357587E-02	-.832900E-03	.212795E-02	-.516269E-05	-.922969E-05
102	.727359E+01	-.315518E-02	.369753E-02	-.273127E-03	.827405E-03	-.219760E-05	-.362051E-05
103	.734561E+01	-.335340E-02	.384328E-02	-.218820E-03	-.530836E-03	.277394E-05	.939119E-06

104	.741762E+01	-.353477E-02	.401754E-02	-.646702E-03	-.176360E-02	.937129E-05	.363577E-05
105	.748964E+01	-.370032E-02	.422706E-02	-.147071E-02	-.271174E-02	.169048E-04	.381750E-05
106	.756165E+01	-.384886E-02	.448141E-02	-.255590E-02	-.326023E-02	.244478E-04	.109414E-05
107	.763367E+01	-.397257E-02	.480151E-02	-.373822E-02	-.335170E-02	.309435E-04	-.463424E-05
108	.770569E+01	-.405704E-02	.520758E-02	-.484738E-02	-.299172E-02	.352456E-04	-.131056E-04
109	.777770E+01	-.407140E-02	.572667E-02	-.572968E-02	-.224568E-02	.361880E-04	-.236689E-04
110	.784972E+01	-.395098E-02	.639083E-02	-.626770E-02	-.122776E-02	.326100E-04	-.352050E-04
111	.792173E+01	-.356939E-02	.721236E-02	-.639453E-02	-.839979E-04	.234304E-04	-.456198E-04
112	.799375E+01	-.271577E-02	.810366E-02	-.610069E-02	.102835E-02	.823466E-05	-.522366E-04
113	.806576E+01	-.119110E-02	.872229E-02	-.543324E-02	.196206E-02	-.106421E-04	-.497275E-04
114	.813778E+01	.850758E-03	.847297E-02	-.448746E-02	.259913E-02	-.258401E-04	-.358109E-04
115	.820980E+01	.262924E-02	.695558E-02	-.339239E-02	.286536E-02	-.288497E-04	-.166623E-04
116	.828181E+01	.315017E-02	.476248E-02	-.229244E-02	.273609E-02	-.262644E-04	-.229652E-05
117	.835383E+01	.255484E-02	.306430E-02	-.132770E-02	.225000E-02	-.102867E-04	.167993E-05
118	.842584E+01	.166445E-02	.213799E-02	-.615391E-03	.147753E-02	-.418317E-05	.114360E-05
119	.849786E+01	.855879E-03	.165695E-02	-.235194E-03	.534420E-03	-.108677E-05	.677011E-07
120	.856988E+01	.190906E-03	.142654E-02	-.219739E-03	-.447400E-03	.596287E-06	-.396870E-06
121	.864189E+01	-.338653E-03	.133028E-02	-.552295E-03	-.133542E-02	.196852E-05	-.282401E-06
122	.871391E+01	-.758943E-03	.130387E-02	-.117032E-02	-.201422E-02	.351449E-05	.273411E-06
123	.878592E+01	-.109545E-02	.131317E-02	-.197554E-02	-.240023E-02	.531601E-05	.351159E-07
124	.885794E+01	-.130842E-02	.134012E-02	-.284820E-02	-.245177E-02	.718322E-05	-.460167E-06
125	.892995E+01	-.159297E-02	.137514E-02	-.366373E-02	-.217319E-02	.882467E-05	-.157631E-05
126	.900197E+01	-.178018E-02	.141300E-02	-.430950E-02	-.161273E-02	.995060E-05	-.321873E-05
127	.907399E+01	-.193817E-02	.145120E-02	-.469939E-02	-.854665E-03	.103485E-04	-.510330E-05
128	.914600E+01	-.207148E-02	.148789E-02	-.478442E-02	-.685179E-05	.992102E-05	-.710451E-05
129	.921802E+01	-.218626E-02	.152247E-02	-.455802E-02	.814386E-03	.872512E-05	-.871993E-05
130	.929003E+01	-.228639E-02	.155477E-02	-.405555E-02	.150005E-02	.694033E-05	-.973512E-05
131	.936205E+01	-.235458E-02	.157912E-02	-.334821E-02	.196275E-02	.478420E-05	-.996806E-05
132	.943406E+01	-.241119E-02	.160050E-02	-.253241E-02	.214708E-02	.266877E-05	-.923153E-05
133	.950608E+01	-.246781E-02	.162187E-02	-.171609E-02	.203867E-02	.928202E-06	-.781462E-05
134	.957810E+01	-.252442E-02	.164325E-02	-.100400E-02	.166011E-02	-.193450E-06	-.584062E-05
135	.965011E+01	-.258103E-02	.166462E-02	-.483749E-03	.107050E-02	-.533401E-06	-.356825E-05
136	.972213E+01	-.263765E-02	.168600E-02	-.214719E-03	.355506E-03	-.330277E-07	-.129971E-05
137	.979414E+01	-.269426E-02	.170737E-02	-.220908E-03	-.385287E-03	.125317E-05	.666790E-06
138	.986616E+01	-.275087E-02	.172875E-02	-.489111E-03	-.105189E-02	.316394E-05	.204506E-05
139	.993817E+01	-.280749E-02	.175012E-02	-.971247E-03	-.155729E-02	.545220E-05	.267226E-05
140	.100102E+02	-.283204E-02	.175919E-02	-.159239E-02	-.183862E-02	.774421E-05	.240574E-05
141	.100822E+02	-.285202E-02	.176650E-02	-.226131E-02	-.166491E-02	.974365E-05	.132417E-05
142	.101542E+02	-.287199E-02	.177381E-02	-.288316E-02	-.164020E-02	.111898E-04	-.403517E-06
143	.102262E+02	-.289196E-02	.178112E-02	-.337231E-02	-.120201E-02	.118935E-04	-.253031E-05
144	.102983E+02	-.291194E-02	.178843E-02	-.366345E-02	-.615294E-03	.117682E-04	-.476012E-05
145	.103703E+02	-.293191E-02	.179574E-02	-.371979E-02	.309877E-04	.108397E-04	-.676826E-05
146	.104423E+02	-.295189E-02	.180305E-02	-.353707E-02	.665516E-03	.924106E-05	-.834202E-05
147	.105143E+02	-.297186E-02	.181036E-02	-.314324E-02	.118673E-02	.719267E-05	-.921716E-05
148	.105863E+02	-.299184E-02	.181767E-02	-.259379E-02	.153381E-02	.497223E-05	-.930393E-05
149	.106583E+02	-.301181E-02	.182498E-02	-.196352E-02	.166517E-02	.287436E-05	-.859554E-05
150	.107303E+02	-.303178E-02	.183228E-02	-.133602E-02	.156927E-02	.117518E-05	-.720516E-05
151	.108024E+02	-.305176E-02	.183959E-02	-.792225E-03	.126534E-02	.899604E-07	-.531559E-05
152	.108744E+02	-.307173E-02	.184690E-02	-.399652E-03	.799735E-03	-.249781E-06	-.319530E-05
153	.109464E+02	-.309171E-02	.185421E-02	-.203760E-03	.239935E-03	.185076E-06	-.111902E-05
154	.110184E+02	-.310485E-02	.185798E-02	-.222466E-03	-.356943E-03	.131676E-05	.633821E-06
155	.110904E+02	-.311143E-02	.185634E-02	-.444502E-03	-.852851E-03	.290793E-05	.162755E-05
156	.111624E+02	-.311801E-02	.185870E-02	-.831722E-03	-.124023E-02	.489854E-05	.232115E-05
157	.112345E+02	-.312460E-02	.186506E-02	-.132493E-02	-.145059E-02	.683406E-05	.206935E-05
158	.113065E+02	-.313118E-02	.185942E-02	-.165238E-02	-.146044E-02	.851570E-05	.112656E-05
159	.113785E+02	-.313776E-02	.185978E-02	-.253970E-02	-.127383E-02	.971645E-05	-.354346E-06

160	.114505E+02	-.314434E-02	.186014E-02	-.271994E-02	-.921006E-03	.102656E-04	-.216350E-05
161	.115225E+02	-.315092E-02	.186050E-02	-.294231E-02	-.453713E-03	.101151E-04	-.404456E-05
162	.115945E+02	-.315751E-02	.186086E-02	-.297861E-02	.623227E-04	.928699E-05	-.573955E-05
163	.116666E+02	-.316409E-02	.186122E-02	-.282632E-02	.556559E-03	.790685E-05	-.702140E-05
164	.117386E+02	-.317067E-02	.186158E-02	-.250837E-02	.963213E-03	.616011E-05	-.772355E-05
165	.118106E+02	-.317725E-02	.186194E-02	-.206933E-02	.122995E-02	.428468E-05	-.776062E-05
166	.118826E+02	-.318383E-02	.186230E-02	-.156892E-02	.132455E-02	.252847E-05	-.713893E-05
167	.119546E+02	-.318921E-02	.186193E-02	-.107360E-02	.123870E-02	.111758E-05	-.594944E-05
168	.120266E+02	-.319098E-02	.185940E-02	-.647515E-03	.988510E-03	.228169E-06	-.435630E-05
169	.120986E+02	-.319274E-02	.185687E-02	-.343914E-03	.611738E-03	-.378892E-07	-.259172E-05
170	.121707E+02	-.319451E-02	.185434E-02	-.198324E-03	.162162E-03	.332845E-06	-.885766E-06
171	.122427E+02	-.319627E-02	.185180E-02	-.224218E-03	-.298013E-03	.126853E-05	.537323E-06
172	.123147E+02	-.319804E-02	.184927E-02	-.411760E-03	-.706711E-03	.262373E-05	.149664E-05
173	.123867E+02	-.319981E-02	.184674E-02	-.729699E-03	-.101030E-02	.420066E-05	.186522E-05
174	.124587E+02	-.320157E-02	.184421E-02	-.113039E-02	-.117059E-02	.577689E-05	.166362E-05
175	.125307E+02	-.320334E-02	.184167E-02	-.155514E-02	-.116955E-02	.713552E-05	.882414E-06
176	.126028E+02	-.320510E-02	.183914E-02	-.194519E-02	-.101126E-02	.809436E-05	-.336295E-06
177	.126748E+02	-.320687E-02	.183661E-02	-.224675E-02	-.720780E-03	.852882E-05	-.181495E-05
.78	.127468E+02	-.320863E-02	.183408E-02	-.241956E-02	-.340349E-03	.838769E-05	-.334559E-05
179	.128188E+02	-.321040E-02	.183154E-02	-.244162E-02	.767528E-04	.769801E-05	-.471635E-05
180	.128908E+02	-.321216E-02	.182901E-02	-.231177E-02	.473595E-03	.655957E-05	-.574951E-05
181	.129628E+02	-.321393E-02	.182648E-02	-.204926E-02	.787323E-03	.512990E-05	-.630348E-05
182	.130349E+02	-.321570E-02	.182395E-02	-.169078E-02	.100615E-02	.360185E-05	-.631937E-05
183	.131069E+02	-.321588E-02	.182042E-02	-.128502E-02	.107473E-02	.217602E-05	-.579546E-05
184	.131789E+02	-.321563E-02	.181660E-02	-.885946E-03	.997105E-03	.103753E-05	-.431573E-05
185	.132509E+02	-.321537E-02	.181279E-02	-.545378E-03	.787139E-03	.326672E-06	-.351960E-05
186	.133229E+02	-.321511E-02	.180898E-02	-.306097E-03	.476129E-03	.122827E-06	-.208453E-05
187	.133949E+02	-.321486E-02	.180517E-02	-.196314E-03	.108224E-03	.435759E-06	-.702306E-06
188	.134669E+02	-.321460E-02	.180136E-02	-.226221E-03	-.265799E-03	.120601E-05	.446952E-06
189	.135390E+02	-.321434E-02	.179755E-02	-.387030E-03	-.595509E-03	.231450E-05	.121846E-05
190	.136110E+02	-.321408E-02	.179374E-02	-.652593E-03	-.837561E-03	.359989E-05	.152146E-05
191	.136830E+02	-.321383E-02	.178992E-02	-.983305E-03	-.961453E-03	.488110E-05	.132990E-05
192	.137550E+02	-.321357E-02	.178611E-02	-.133173E-02	-.953137E-03	.598201E-05	.684355E-06
193	.138270E+02	-.321331E-02	.178230E-02	-.164914E-02	-.816726E-03	.675485E-05	-.314859E-06
194	.138990E+02	-.321306E-02	.177849E-02	-.189210E-02	-.573444E-03	.709928E-05	-.152257E-05
195	.139711E+02	-.321280E-02	.177468E-02	-.202817E-02	-.258392E-03	.697466E-05	-.276919E-05
196	.140431E+02	-.321212E-02	.177061E-02	-.204003E-02	.844571E-04	.640326E-05	-.386338E-05
197	.141151E+02	-.321105E-02	.176630E-02	-.192745E-02	.408369E-03	.546782E+05	-.471575E-05
198	.141871E+02	-.320998E-02	.176200E-02	-.170696E-02	.670187E-03	.429845E+05	-.515896E-05
199	.142591E+02	-.320891E-02	.175769E-02	-.140927E-02	.836055E-03	.305271E-05	-.515990E-05
200	.143311E+02	-.320784E-02	.175339E-02	-.107480E-02	.885753E-03	.189472E-05	-.472590E-05
201	.144032E+02	-.320677E-02	.174908E-02	-.748049E-03	.815126E-03	.973102E-06	-.392232E-05
202	.144752E+02	-.320570E-02	.174477E-02	-.471543E-03	.636285E-03	.401456E-06	-.280246E-05
203	.145472E+02	-.320463E-02	.174047E-02	-.280149E-03	.375529E-03	.244003E-06	-.169134E-05
204	.146192E+02	-.320356E-02	.173616E-02	-.196552E-03	.699932E-04	.508147E-06	-.565473E-06
205	.146912E+02	-.320250E-02	.173186E-02	-.228476E-03	-.258533E-03	.114480E-05	.366214E-06
206	.147632E+02	-.320143E-02	.172755E-02	-.367960E-03	-.508370E-03	.205623E-05	.951639E-06
207	.148352E+02	-.320036E-02	.172324E-02	-.592768E-03	-.764028E-03	.311028E-05	.123166E-05
208	.149073E+02	-.319929E-02	.171894E-02	-.869674E-03	-.800747E-03	.415877E-05	.100691E-05
209	.149793E+02	-.319813E-02	.171459E-02	-.115917E-02	-.787599E-03	.505757E-05	.531348E-06
210	.150513E+02	-.319670E-02	.171011E-02	-.142089E-02	-.668663E-03	.569565E-05	-.292366E-06
211	.151233E+02	-.319528E-02	.170564E-02	-.161909E-02	-.462164E-03	.596173E-05	-.126464E-05
212	.151953E+02	-.319385E-02	.170117E-02	-.172732E-02	-.197724E-03	.555316E-05	-.230695E-05
213	.152673E+02	-.319243E-02	.169669E-02	-.173180E-02	.878579E-04	.537957E-05	-.321860E-05
214	.153394E+02	-.319101E-02	.169222E-02	-.163301E-02	.355702E-03	.460992E-05	-.389645E-05
215	.154114E+02	-.318958E-02	.168774E-02	-.144534E-02	.570116E-03	.364782E-05	-.425780E-05

216	.154834E+02	-.318816E-02	.168327E-02	-.119485E-02	.703343E-03	.262545E-05	-.425362E-05
217	.155554E+02	-.318673E-02	.167880E-02	-.915521E-03	.739106E-03	.167671E-05	-.389231E-05
218	.156274E+02	-.318531E-02	.167432E-02	-.644551E-03	.674585E-03	.923621E-06	-.322795E-05
219	.156994E+02	-.318389E-02	.166985E-02	-.417258E-03	.520508E-03	.459331E-06	-.235399E-05
220	.157715E+02	-.318246E-02	.166537E-02	-.262360E-03	.299437E-03	.336340E-06	-.138991E-05
221	.158435E+02	-.318104E-02	.166090E-02	-.198344E-03	.424930E-04	.560303E-06	-.464601E-06
222	.159155E+02	-.317961E-02	.165643E-02	-.230990E-03	-.215005E-03	.109060E-05	.301017E-06

******** WARNING.
EXTRAPOLATION REQUIRED FOR , 1 TJ S.

J	TIME, TJ(J)	RESPONSE FUNCTION, X(J)
1	0.	.4951544E-04
2	.3000000E-01	-.1154411E-02
3	.6000000E-01	-.3477775E-02
4	.9000000E-01	-.6413471E-02
5	.1200000E+00	-.9409495E-02
6	.1500000E+00	-.1181374E-01
7	.1800000E+00	-.1345452E-01
8	.2100000E+00	-.1428669E-01
9	.2400000E+00	-.1436232E-01
10	.2700000E+00	-.1376405E-01
11	.3000000E+00	-.1276971E-01
12	.3300000E+00	-.1153892E-01
13	.3600000E+00	-.1010072E-01
14	.3900000E+00	-.8301406E-02
15	.4200000E+00	-.5939925E-02
16	.4500000E+00	-.2687864E-02
17	.4800000E+00	.1467673E-02
18	.5100000E+00	.6089048E-02
19	.5400000E+00	.1041012E-01
20	.5700000E+00	.1384672E-01
21	.6000000E+00	.1627902E-01
22	.6300000E+00	.1793786E-01
23	.6600000E+00	.1902212E-01
24	.6900000E+00	.1962373E-01
25	.7200000E+00	.1982687E-01
26	.7500000E+00	.1952419E-01
27	.7800000E+00	.1856140E-01
28	.8100000E+00	.1665071E-01
29	.8400000E+00	.1447081E-01
30	.8700000E+00	.1266366E-01
31	.9000000E+00	.1112564E-01
32	.9300000E+00	.9817649E-02
33	.9600000E+00	.8445188E-02
34	.9900000E+00	.6807061E-02
35	.1020000E+01	.4647452E-02
36	.1050000E+01	.1872773E-02
37	.1080000E+01	-.1299310E-02
38	.1110000E+01	-.4296749E-02
39	.1140000E+01	-.6536308E-02
40	.1170000E+01	-.7731740E-02
41	.1200000E+01	-.7983992E-02
42	.1230000E+01	-.7657913E-02
43	.1260000E+01	-.7353784E-02
44	.1290000E+01	-.7648421E-02
45	.1320000E+01	-.8523035E-02
46	.1350000E+01	-.9326638E-02
47	.1380000E+01	-.9300216E-02
48	.1410000E+01	-.8102937E-02
49	.1440000E+01	-.5668301E-02
50	.1470000E+01	-.3150798E-02
51	.1500000E+01	-.5780752E-03
52	.1530000E+01	.1283729E-02
53	.1560000E+01	.2199370E-02

54	.1590000E+01	.2398745E-02
55	.1620000E+01	.2423903E-02
56	.1650000E+01	.2685094E-02
57	.1680000E+01	.3322201E-02
58	.1710000E+01	.4161454E-02
59	.1740000E+01	.4746934E-02
60	.1770000E+01	.4612715E-02
61	.1800000E+01	.3609037E-02
62	.1830000E+01	.2045967E-02
63	.1860000E+01	.4848607E-03
64	.1890000E+01	-.6693449E-03
65	.1920000E+01	-.1377996E-02
66	.1950000E+01	-.1854001E-02
67	.1980000E+01	-.2418300E-02
68	.2010000E+01	-.3352927E-02
69	.2040000E+01	-.4664862E-02
70	.2070000E+01	-.6050741E-02
71	.2100000E+01	-.7039902E-02
72	.2130000E+01	-.7244623E-02
73	.2160000E+01	-.6594272E-02
74	.2190000E+01	-.5392710E-02
75	.2220000E+01	-.4121313E-02
76	.2250000E+01	-.3242948E-02
77	.2280000E+01	-.2963094E-02
78	.2310000E+01	-.3033629E-02
79	.2340000E+01	-.2961672E-02
80	.2370000E+01	-.2350228E-02
81	.2400000E+01	-.1117912E-02
82	.2430000E+01	.4815195E-03
83	.2460000E+01	.1967495E-02
84	.2490000E+01	.2910344E-02
85	.2520000E+01	.3104251E-02
86	.2550000E+01	.2669570E-02
87	.2580000E+01	.2009187E-02
88	.2610000E+01	.1547514E-02
89	.2640000E+01	.1483875E-02
90	.2670000E+01	.1720274E-02
91	.2700000E+01	.1930801E-02
92	.2730000E+01	.1738291E-02
93	.2760000E+01	.9832683E-03
94	.2790000E+01	-.1858063E-03
95	.2820000E+01	-.1381449E-02
96	.2850000E+01	-.2184981E-02
97	.2880000E+01	-.2427700E-02
98	.2910000E+01	-.2236054E-02
99	.2940000E+01	-.1919054E-02
100	.2970000E+01	-.1803420E-02
101	.3000000E+01	-.2051444E-02

MAX X(I) = .1902687E-01 AT TIME .7200000E+00
MIN X(I) = -.1436232E-01 AT TIME .2400000E+00

$QUIT TIME HISTORY PROGRAM

8.0 REFERENCES

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2. **Miller, R. D.; Richard, M.;** and Rogers, J. T.: Feasibility of Implementing Unsteady *Aerodynamics Into the FLEXSTAB Computer Program System.* **NASA CR-132530, October 1974.**

3. **Etkin, B.:** ***Dynamics of Flight.*** **John Wiley and Sons, Inc.,** 1959.

4. Brigham, E. O.: *The Fast Fourier Transform.* Prentice-Hall, Inc., New Jersey, 1974 Jersey, 1974.

5. **Miller, R. D.;** and Graham, M. L.: Random Harmonic Analysis Program L221 *(TEV-156),* **Volume 1 – Engineering and** Usage; NASA CR-2857, 1979.

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16 Abstract

This document describes the usage of the convolution program L225 (TEV126). The program calculates the time responses of a linear system by convoluting the impulsive response functions with the time-dependent excitation function. The convolution is performed as a multiplication in the frequency domain. Fast Fourier transform (FFT) techniques are used to transform the product back into the time domain to obtain response time histories. A brief description of the analysis used is presented in volume I of this document. Volume II contains a description of the design and structure of the program to aid those persons who will maintain and/or modify the program in the future.

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