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DEMONSTRATION PROBLEMS

COMPUTER PROGRAM SYSTEM FOR DYNAMIC SIMULATION AND STABILITY ANALYSIS OF PASSIVE AND ACTIVELY CONTROLLED SPACECRAFT

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FOREWORD

This report, prepared by the Dynamics and Loads Section, Martin Marietta Corporation, Denver Division, under Contract NAS5-11996, presents the results of a study whose purpose was to develop a computer program system for dynamic simulation and stability analysis of passive and actively controlled spacecraft. The study was performed from May 1973 to April 1975 and was administered by the National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Maryland, under the direction of Mr. Joseph P. Young.

The report is published in four volumes:

Volume I - Theory
Volume II - Program Users' Guide
Volume III - Demonstration Problems
Volume IV - Program Listing

ACKNOWLEDGEMENTS

The authors wish to acknowledge the assistance provided by Goddard Space Flight Center personnel. Mr. Harold Frisch and Mr. James Donohue contributed many valuable technical comments and suggestions throughout the program. In particular, they layed out the basic approach which was to be used for data input, defined exactly what should be included in the transfer function and stability analysis portion of the program and defined 8 of the 11 demonstration problems. They provided the associated data which was used to verify both the nonlinear time response and linear transfer function and stability analysis portions of the program. Mr. Raymond Welch provided the subroutine used in the generation of root locus plots. Dr. William Case provided valuable advice on the interfacing with NASTRAN output and also he generated the demonstration problem utilized to validate the interface subroutine (NASFOR). During the very early program development stage, Dr. James Mason offered significant advice on the need to compute internal forces at the interconnect points. Mr. Reginald Mitchell contributed invaluable advice on requirements for making the program compatible with the GSFC IBM 360/95 computer system. In addition, he supplied the contractor with a 360 system compatible plot package, furnished the contractor a self authored subroutine to read NASTRAN output, and was responsible for running all of the eleven demonstration problems on the 360/95 computer. Finally, the authors wish to acknowledge the encouragement and efforts of Mr. Joseph P. Young, Technical Monitor, who made numerous valuable comments and suggestions throughout the study.

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CONTENTS

APPENDIX

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Figure

Table

ABSTRACT

A theoretical development and associated digital computer program system for the dynamic simulation and stability analysis of passive and actively controlled spacecraft is presented. The dynamic system (spacecraft) is modeled as an assembly of rigid and/or flexible bodies not necessarily in a topological tree configuration. The computer program system may be used to investigate total system dynamic characteristics including interaction effects between rigid and/or flexible bodies, control systems, and a wide range of environmental loadings. Additionally, the program system may be used for design of attitude control systems and for evaluation of total dynamic system performance including time domain response and frequency domain stability analyses.

Volume I presents the theoretical developments including a description of the physical system, the equations of dynamic equilibrium, discussion of kinematics and system topology, a complete treatment of momentum wheel coupling, and a discussion of gravity gradient and environmental effects.

The development of synthesis and analysis techniques for the linearized system includes a discussion of the numerical linearization technique, procedures for definition of system transfer functions, and linear time domain response.

Volume II is a program users' guide and includes a description of the overall digital program code, individual subroutines and a description of required program input and generated program output.

Volume III presents the results of selected demonstration problems that illustrate all program system capabilities.

Volume IV contains a listing of the digital code.

I. INTRODUCTION

This volume documents the results of several demonstration problems selected to illustrate and verify the multiple analytical options available within the DISCOS program system. The demonstration problems, in the general sense, have been selected to verify the four general but distinct analytical capabilities which are available as user options. Three of the options are related to time domain analysis; the fourth is applicable to frequency domain analysis. By way of summary, the four options are:

i) nonlinear response in the time domain where the dynamic system is characterized as an assembly of rigid bodies connected by either linear or nonlinear springs and dashpots;

ii) nonlinear response in the time domain where the dynamic system is characterized as an assembly of either rigid or flexible bodies;

iii) linear response in the time domain where the dynamic system is characterized as an assembly of either rigid or flexible bodies and where the perturbed response is computed about either a calculated or user-prescribed steady-state motion; and

iv) general response in the frequency domain where the dynamic system is characterized in either of the above described forms and where the linearized form of the motion equations is implied.

In addition to an illustration of the above described general capabilities, the demonstration problems documented herein have been structured to illustrate various of the specific program capabilities.

In particular, the capability to consider either a lumped or consistent representation of inertial properties, several possible descriptions of the space functions which may be used to represent system vibrational characteristics, the ability to prescribe rheonomic constraint conditions and the implementation of a specific control law are presented.

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One demonstration problem is devoted to illustration of the DISCOS/NASTRAN data interface program through examination of a simple two-beam problem. A brief summary of the eleven problems described in the following text is presented in Table I-1. Note that six demonstration problems examine the ATS-F spacecraft and that two consider the AE-C spacecraft. These demonstration problems were agreed upon following discussion with Goddard Space Flight Center technical personnel.

Table I-1. Brief Description of Demonstration Problems	
Problem	Description
1	ATS-F modeled as six interconnected rigid bodies with four imbedded momentum wheels, active control system-qualifies nonlinear time domain response to initial attitude and rate errors.
2	ATS-F modeled as a single flexible body using a geometric representation for modes, three imbedded momentum wheels, active control system, consistent mass representation - qualifies nonlinear time domain response to initial attitude errors.
3	ATS-F modeled as a single flexible body using normal vibration modes, three imbedded momentum wheels, active control system, consistent mass representation - qualifies nonlinear time domain response to initial attitude errors.
4	ATS-F modeled as a single flexible body using a geometric representation for modes, three imbedded momentum wheels, active control system, lumped mass representation - qualifies nonlinear time domain response to initial attitude errors.
5	ATS-F modeled as six interconnected rigid bodies with four imbedded momentum wheels, active control system, prescribed (user) hinge motion to simulate rhenomic panel deployment - qualifies nonlinear time domain response to initial attitude errors.
6	ATS-F modeled as six interconnected rigid bodies with four imbedded momentum wheels (three are locked and the fourth represents reflector dynamics for high-order system response) - qualifies linearization algorithm and demonstrates that n-bodies can be coupled to reproduce system vibration properties.
7	Two simple beams coupled end-to-end and cantilevered at the root, five elastic modes for each beam, forced at the tip, input data generated via NASFOR program-qualifies both the DISCOS/NASTRAN interface program and the lumped mass representation of system inertial characteristics.

Table I-1. Brief Description of Demonstration Problems (Cont'd.)

Problem	Description
8	Two mechanical degree of freedom system with a two channel control law - qualifies linearization techniques, resonant frequency calculations and transfer function evaluation.
9	AE-C modeled as five interconnected rigid bodies with a multi-channel control system - qualifies linearization techniques, resonant frequency calculations, transfer function evaluation, frequency response, root locus and plot displays.
10	AE-C modeled as five interconnected rigid bodies with a multi-channel control system - qualifies linearized time domain response with plot output.
11	Two mechanical degree of freedom system with a two channel control law - qualifies polynomial transfer function input for control system.

II. THE ATS-F SPACECRAFT - DEMONSTRATION PROBLEMS 1 THROUGH 6

Demonstration problems 1 through 6 detail several program system options through examination of the ATS-F spacecraft. A schematic of the baseline configuration is shown in Figure II-1 where six subassemblies (bodies) are indicated and where two of the six are used to represent propellant. Also indicated are three momentum wheels used for spacecraft control. A fourth momentum wheel, used to simulate higher order response effects, is not shown on the schematic.

These six demonstrative examples are used primarily to indicate the versatility of the program system with regard to modeling capability and definition of the system characterizing inertial and vibration properties. However, all six examples use a common groundwork based upon inertial and geometric characteristics as defined in Tables II-1 and II-2. In Table II-1, we have indicated the inertial characteristics* of the assumed six bodies and four imbedded momentum wheels. Table II-2 indicates the appropriate geometric data and details the six hinge point locations in each of the body axis reference frames. Also indicated here is the location of the four sensor points required in conjunction with the four momentum wheels.

The ATS-F spacecraft is controlled by a three axis control system as indicated schematically in Figure II-2 where block diagrams of the roll, pitch and yaw axis controllers are shown.

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* Data described in this section are based upon data provided by H. P. Frisch, National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Maryland.

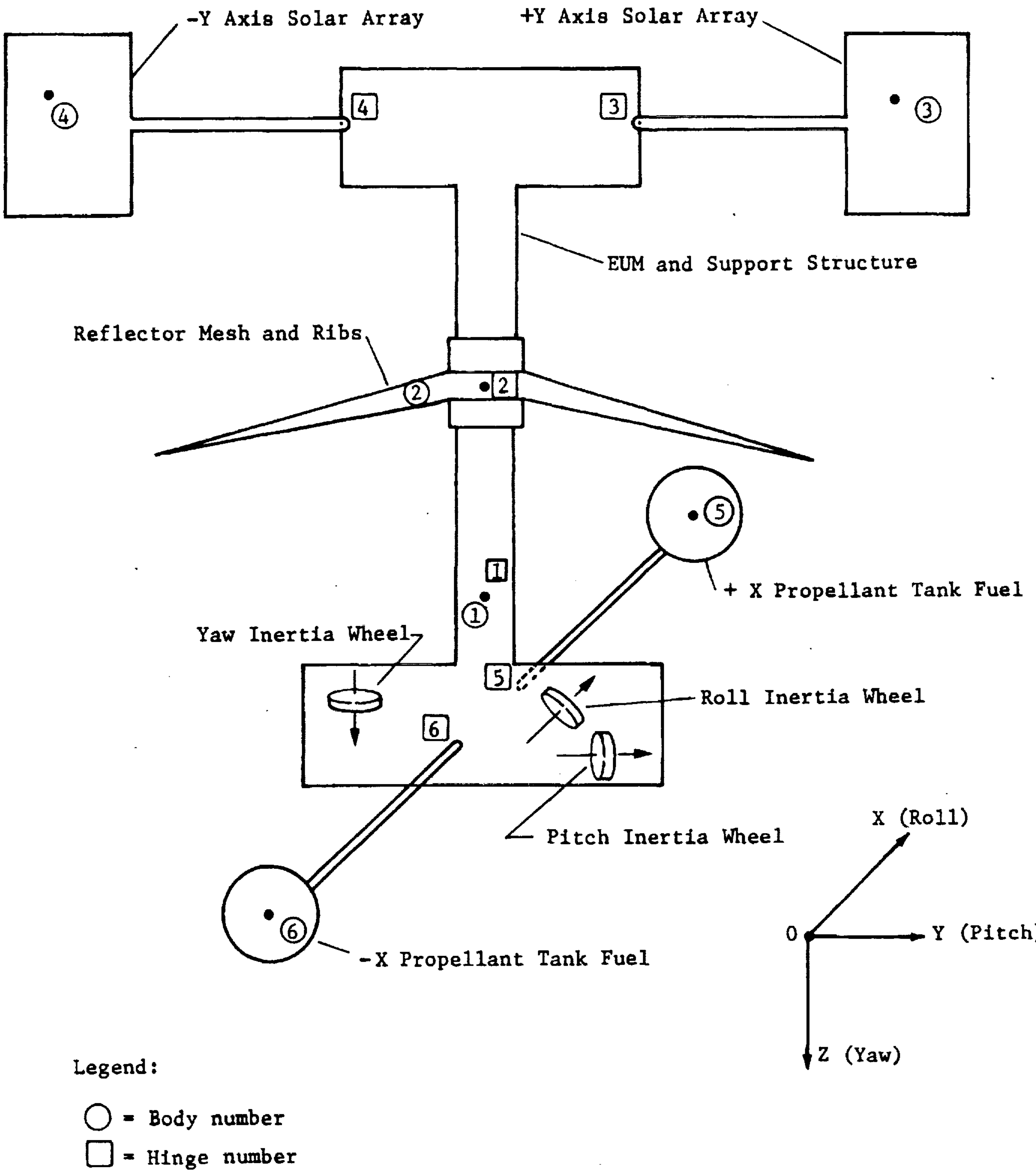

Figure II-1. ATS-F Spacecraft-Baseline Configuration

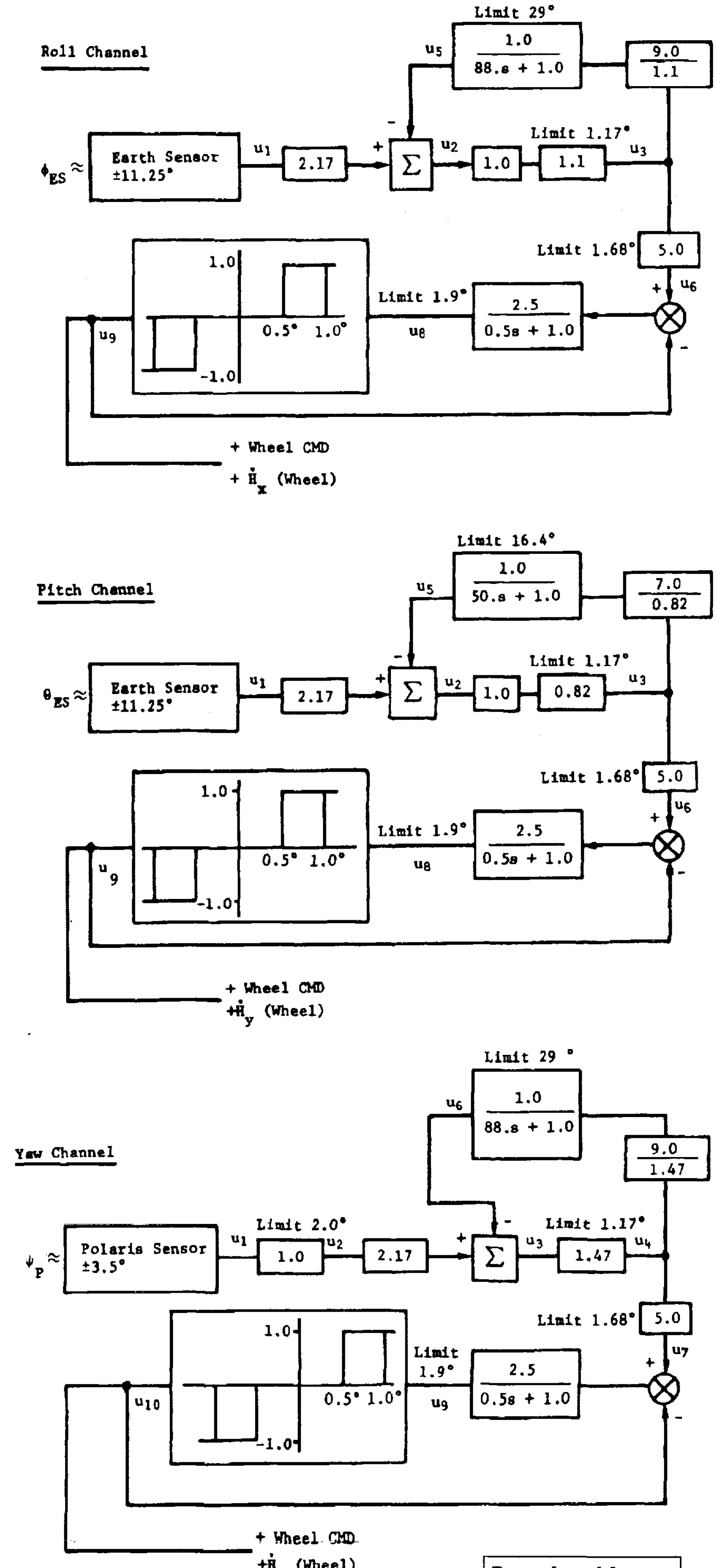

Figure II-2 ATS-F Control Block Diagram

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Table II-1. ATS-F Inertial Data

Body	Mass lb-sec^2/ft	Inertia lb-ft-sec^2					
		J_{xx}	J_{yy}	J_{zz}	J_{xy}	J_{xz}	J_{yz}
1	68.273	3713.7	3557.3	477.63	-5.0961	32.729	2.9104
2	3.5559	100.48	100.79	193.41	0	0	0
3	5.1553	168.96	40.091	145.07	-4.7689	.14296	-1.9592
4	5.1553	168.96	40.091	145.07	-4.7689	-.14296	1.9592
5	1.708	.79758	.79758	.79758	0.	0.	0.
6	1.7081	.79758	.79758	.79758	0.	0.	0.

Wheel	Inertia lb-ft-sec^2
1	.065
2	.065
3	.065
4	96.705

Table II-2. ATS-F Geometric Data

Hinge	Body	Location of Hinge Point - Body System, ft		
		x	y	z
2	1	.030197	.014451	-12.660
3	1	.030197	3.4312	-13.497
4	1	.030197	-3.4022	-13.497
5	1	1.2969	.014451	4.3140
6	1	-1.2365	.014451	4.3140
2	2	0.	0.	-1.3521
3	3	.36998	-15.809	-.070084
4	4	-.36998	15.809	-.070084
5	5	0.	0.	-.001
6	6	0.	0.	-.001

Sensor	Body	Location of Sensor Point - Body System, ft		
		x	y	z
1	1	0.	0.	0.
2	1	0.	0.	0.
3	1	0.	0.	0.
4	2	0.	0.	0.

Note: Body reference points (origin of body-axis system) at mass center of respective body.

Demonstration Problems 2 and 4 use so-called geometry modes such that the six interconnected bodies can be represented as a single flexible body. Geometry modes are not orthogonal with respect to a mass matrix and are developed through use of simple kinematic expressions (i.e., to express absolute appendage motion as that due to Body 1 absolute motion plus motion of all other bodies relative to Body 1).

These modes are developed in the form

(II-1) $U = AV$

(II-2) where $U = \lfloor U^{(1)} \quad U^{(2)} \quad U^{(3)} \quad U^{(4)} \quad U^{(5)} \quad U^{(6)} \quad U^{(7)} \rfloor^T$,

(II-3)
$$A = \begin{bmatrix} I & & & & & & \\ A_{21} & A_{22} & & & & & \\ A_{31} & & A_{33} & & & & \\ A_{41} & & & A_{44} & & & \\ A_{51} & & & & A_{55} & & \\ A_{61} & & & & & A_{66} & \\ A_{71} & A_{72} & & & & & A_{77} \end{bmatrix}$$

(II-4) $V = \lfloor U^{(1)} \quad \dot{\xi}^{(2)} \quad \dot{\xi}^{(3)} \quad \dot{\xi}^{(4)} \quad \dot{\xi}^{(5)} \quad \dot{\xi}^{(6)} \quad \dot{\xi}^{(7)} \rfloor^T$,

(II-5) and $U^{(i)} = \lfloor \omega_{x_i} \quad \omega_{y_i} \quad \omega_{z_i} \quad u_i \quad v_i \quad w_i \rfloor^T$ for $i = 1,2,\ldots,7$;

$\dot{\xi}^{(2)} = \lfloor \dot{\xi}_1 \quad \dot{\xi}_2 \quad \dot{\xi}_3 \rfloor^T$ (Demo 1, Hinge 2 rotations),

$\dot{\xi}^{(3)} = \lfloor \dot{\xi}_4 \quad \dot{\xi}_5 \rfloor^T$ (Demo 1, Hinge 3 rotations),

$\dot{\xi}^{(4)} = \lfloor \dot{\xi}_6 \quad \dot{\xi}_7 \rfloor^T$ (Demo 1, Hinge 4 rotations),

$\dot{\xi}^{(5)} = \lfloor \dot{\xi}_8 \quad \dot{\xi}_9 \rfloor^T$ (Demo 1, Hinge 5 rotations),

$\dot{\xi}^{(6)} = \lfloor \dot{\xi}_{10} \quad \dot{\xi}_{11} \rfloor^T$ (Demo 1, Hinge 6 rotations),

$\dot{\xi}^{(7)} = \dot{\theta}_{\text{wheel 4}}$ (simulates reflector torsion mode), and where

(II-6) $$A_{i+1,1} = \left[\begin{array}{ccc|ccc} 1 & & & & & \\ & 1 & & & & \\ & & 1 & & & \\ \hline & z_i & -y_i & 1 & & \\ -z_i & & x_i & & 1 & \\ y_i & -x_i & & & & 1 \end{array}\right] \text{ for } i=1,2,\ldots 5;$$

$$A_{71} = \left[\begin{array}{cc|cc} & 1 & & \\ \hline & & & \\ & & & \end{array}\right], \qquad A_{72} = \begin{bmatrix} \\ -1 \\ \\ \end{bmatrix},$$

$$A_{22} = \left[\begin{array}{ccc} -1 & & \\ & 1 & \\ & & -1 \\ \hline & z_6 & y_6 \\ z_6 & & -x_6 \\ -y_6 & -x_6 & \end{array}\right], \quad A_{33} = \left[\begin{array}{cc} -1 & \\ & \\ & 1 \\ \hline & -y_7 \\ z_7 & x_7 \\ -y_7 & \end{array}\right], \quad A_{44} = \left[\begin{array}{cc} 1 & \\ & \\ & 1 \\ \hline & -y_8 \\ -z_8 & x_8 \\ y_8 & \end{array}\right]$$

$$A_{55} = \left[\begin{array}{cc} & \\ 1 & \\ & 1 \\ \hline z_9 & -y_9 \\ & x_9 \\ -x_9 & \end{array}\right], \quad A_{66} = \begin{bmatrix} & \\ -1 & \\ & 1 \\ -z_{10} & -y_{10} \\ & x_{10} \\ x_{10} & \end{bmatrix}, \quad A_{77} = \begin{bmatrix} \\ \\ 1 \\ \\ \\ \\ \end{bmatrix}$$

The values of the coordinates (x, y and z) are given in Table II-3.

Table II-3. ATS-F Description of Geometric Modes

Point	x, ft	y, ft	z, ft
1	.030197	.014451	-11.3079
2	-.339783	19.2402	-13.426916
3	.400177	-19.2112	-13.426916
4	1.2969	.014451	4.3150
5	-1.2365	.014451	4.3150
6	.0	.0	1.3521
7	-.36998	15.809	.070084
8	.36998	-15.809	.070084
9	.0	.0	.001
10	.0	.0	.001

A. DEMONSTRATION PROBLEM 1

With reference to Table I-1, this demonstration problem assumes the dynamical system to be modeled as six interconnected rigid bodies with four imbedded momentum wheels. Three of the wheels are for control; the fourth is included to represent reflector dynamics for higher order structural response. A three channel active control system (Figure II-2) is assumed and the response to initial attitude and rate errors is developed. The intent of the problem is to qualify the program system's capability to model a dynamic system as a assembly of rigid bodies connected by either linear or nonlinear springs and dashpots and to provide the nonlinear time domain response.

With reference to Figure II-1 we realize that the topology indicated in Table II.A-1 describes the system.

The orientation of hinge triads and the nature of the constraints are shown in Table II.A-2. Note that 19 constraints are indicated.

The nonlinear time response corresponding to a three second real time simulation in the absence of gravitational effects is indicated in Appendix A.

Table II.A-1 Topology Description - Demonstration Problem 1

Body	Description
1	EUM and support structure
2	Reflector mesh and ribs
3	+Y-axis solar array
4	-Y-axis solar array
5	+X-propellant tank fuel
6	-X-propellant tank fuel
Hinge	
1	Body 1 to inertial reference
2	Body 2 to Body 1
3	Body 3 to Body 1
4	Body 4 to Body 1
5	Body 5 to Body 1
6	Body 6 to Body 1

Table II.A-2 Constraint Description - Demonstration Problem 1

Hinge	Euler Rotation Type	Coordinate					
		θ_1	θ_2	θ_3	x	y	z
1	1	0	0	0	0	0	0
2	1	0	0	0	1	1	1
3	1	0	1	0	1	1	1
4	1	0	1	0	1	1	1
5	1	1	0	0	1	1	1
6	1	1	0	0	1	1	1

Note: 0 = unconstrained
1 = constrained

B. DEMONSTRATION PROBLEM 2

With reference to Table I-1, this demonstration problem assumes the dynamical system to be modeled as a single flexible body* using a geometric representation for the vibration mode shapes. Three active momentum wheels are included and the system is operating under the influence of the three-axis controller described previously. The intent of the problem is to qualify the program system's capability to model a dynamic system as a single flexible body assuming a geometric representation of modal characteristics and a consistent representation of inertial properties and to provide the nonlinear time domain response.

With reference to Figure II-1, we realize that the topology indicated in Table II.B-1 describes the system..

Table II.B-1 Topology Description - Demonstration Problem 2

Body	Description
1 2	Dummy to satisfy program requirements Assembly of six bodies indicated in Table II.A-1
Hinge	
1 2	Body 1 to inertial reference Body 2 to Body 1

The orientation of hinge triads, and the initial hinge angles and displacements are shown in Table II.B-2.

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* and a single (dummy) rigid body to satisfy the program system requirement for a minimum of two hinge points and, therefore, two bodies.

Table II.B-2 Initial Hinge Orientations - Demonstration Problem 2

Hinge	Euler Rotation Type	Initial Orientation					
		θ_1	θ_2	θ_3	x	y	z
1	1	0.	0.	0.	0.	0.	0.
2	1	1.463E-3	1.962E-3	1.094E-3	-3.02E-2	-1.445E-2	2.435E+1

Body 2 is assumed to have 12 elastic modes. The values of spin axis inertia and specified initial momentum wheel rates are indicated in Table II.B-3.

Table II.B-3 Momentum Wheel Characteristics - Demonstration Problem 2

Wheel	Initial Rate rad/sec	Spin Axis Inertia $lb\text{-}ft\text{-}sec^2$
1	127.8	0.065
2	127.8	0.065
3	127.8	0.065

The nonlinear time response corresponding to a two second real time simulation in the absence of gravitational effects is indicated in Appendix A.

C. DEMONSTRATION PROBLEM 3

With reference to Table I-1, this demonstration problem assumes the dynamical system to be modeled as a single flexible body* using a normal mode representation for the vibration mode shapes. Three active momentum wheels are included and the system is operating under the influence of the three-axis controller described previously. The intent of the problem is to qualify the program system's capability to model a dynamic system as a single flexible body assuming a normal mode representation of modal characteristics and a consistent representation of inertial properties and to provide the nonlinear time domain response.

Body 2 is assumed to have 12 elastic modes and the system topology, initial hinge orientations, and momentum wheel characteristics are identical to the values given previously in Tables II.B-1 through II.B-3.

The nonlinear time response corresponding to a two second real time simulation in the absence of gravitational effects is indicated in Appendix A.

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* and a single (dummy) rigid body to satisfy the program system requirement for a minimum of two hinge points and, therefore, two bodies.

D. DEMONSTRATION PROBLEM 4

With reference to Table I-1, this demonstration problem assumes the dynamical system to be modeled as a single flexible body (see previous note) using a geometric representation for the vibration mode shapes. Three active momentum wheels are included and the system is operating under the influence of the three-axis controller described previously. The intent of the problem is to qualify the program system's capability to model a dynamic system as a single flexible body assuming a geometric representation of modal characteristics and a lumped representation of inertial properties and to provide the nonlinear time domain response.

Basic data is as described previously for Demonstration Problems 2 and 3 and the nonlinear time response corresponding to a two second real time simulation in the absence of gravitational effects is indicated in Appendix A.

E. DEMONSTRATION PROBLEM 5

With reference to Table I-1, this demonstration problem assumes the dynamical system to be modeled as six interconnected rigid bodies with four imbedded momentum wheels. Three of the wheels are for control; the fourth is included to represent reflector dynamics for higher order structural response. The three-axis controller described previously is included.

Demonstration Problem 5 differs from those described previously in that there is defined a prescribed hinge motion to simulate a rheonomic solar panel deployment. To facilitate this rheonomic panel deployment requires two control variables. These control variables are relative velocities obtained through intergration of prescribed accelerations:

a) For $t_1 \leq t \leq t_2$, Panel 1 (Body 3) is moved through 60° according to

(II-7) $$\ddot{\theta} = \left(\frac{\Delta\theta}{2}\right) K^2 \cos K\,(t-t_1)$$

where
$$\Delta\theta = \pi/3$$
$$K = \pi/(t_2-t_1)$$
$$t_1 = 0.2 \text{ sec}$$
$$t_2 = 1.2 \text{ sec}$$

b) For $t_3 \leq t \leq t_4$, Panel 2 (Body 4) is moved through 60° according to

(II-8) $$\ddot{\theta} = \left(\frac{\Delta\theta}{2}\right) K^2 \cos K\,(t-t_3)$$

where
$$\Delta\theta = \pi/3$$
$$K = \pi/(t_4-t_3)$$
$$t_3 = 0.7 \text{ sec}$$
$$t_4 = 1.7 \text{ sec}$$

The topology of the configuration is identical to that described in Table II.A-1 and the orientation of hinge triads and the nature of the constraints are shown in Table II.E-1. Note that 21 constraints are indicated.

Table II.E-1 Constraint Description - Demonstration Problem 5

Hinge	Euler Rotation Type	Coordinate					
		θ_1	θ_2	θ_3	x	y	z
1	1	0	0	0	0	0	0
2	1	0	0	0	1	1	1
3	1	2	1	0	1	1	1
4	1	2	1	0	0	0	0
5	1	1	0	0	1	1	1
6	1	1	0	0	1	1	1

Note: 0 = unconstrained
1 = constrained (fixed)
2 = constrained (rheonomic)

Momentum wheel data are identical to those described previously with the exception that the fourth wheel (used to represent reflector dynamics) has a specified inertia of 96.7 lb-ft-sec^2.

The nonlinear time response corresponding to a three second real time simulation and showing panel deployment and total system response to small initial attitude error is shown in Appendix A.

F. DEMONSTRATION PROBLEM 6

With reference to Table I-1, this demonstration problem assumes the dynamical system to be modeled as six interconnected rigid bodies with four imbedded momentum wheels. Three of the wheels are for control but, for this example, are locked; the fourth is included to represent reflector dynamics for higher order structural response.

Demonstration Problem 6 is intended to qualify the numerical linearization algorithm and to demonstrate that a set of n bodies can be coupled to reproduce total system vibration characteristics.

The topology of the system is identical to that shown in Table II.A-1 and the orientation of hinge triads and the nature of the constraints are as shown in Table II.A-2.

The linear system forward loop (plant) poles are presented in Appendix A. Table II.F-1 presents a comparison of numerical results from this demonstration problem with those obtained at Goddard Space Flight Center*.

Table II.F-1 Comparison of System Natural Frequencies

	Frequency, Hz	
Mode	MMC (DISCOS)	GSFC (Frisch)*
1	0.929226	.9304275
2	1.43161	1.431621
3	1.51287	1.512894
4	1.86227	1.862339
5	3.62141	3.621936
6	4.83878	4.99606
7	5.00001	5.000250
8	5.00001	5.000250
9	5.00096	5.001182
10	5.01624	5.018296
11	7.02780	7.025820
12	7.07268	7.036717

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* Data courtesy Mr. Harold P. Frisch, GSFC.

III. THE DISCOS/NASTRAN INTERFACE - DEMONSTRATION PROBLEM 7

This demonstration problem is intended to qualify the DISCOS/NASTRAN interface through examination of a simple physical system consisting of two connected uniform beams with a cantilever boundary condition at one end. The system is as indicated in Figure III-1.

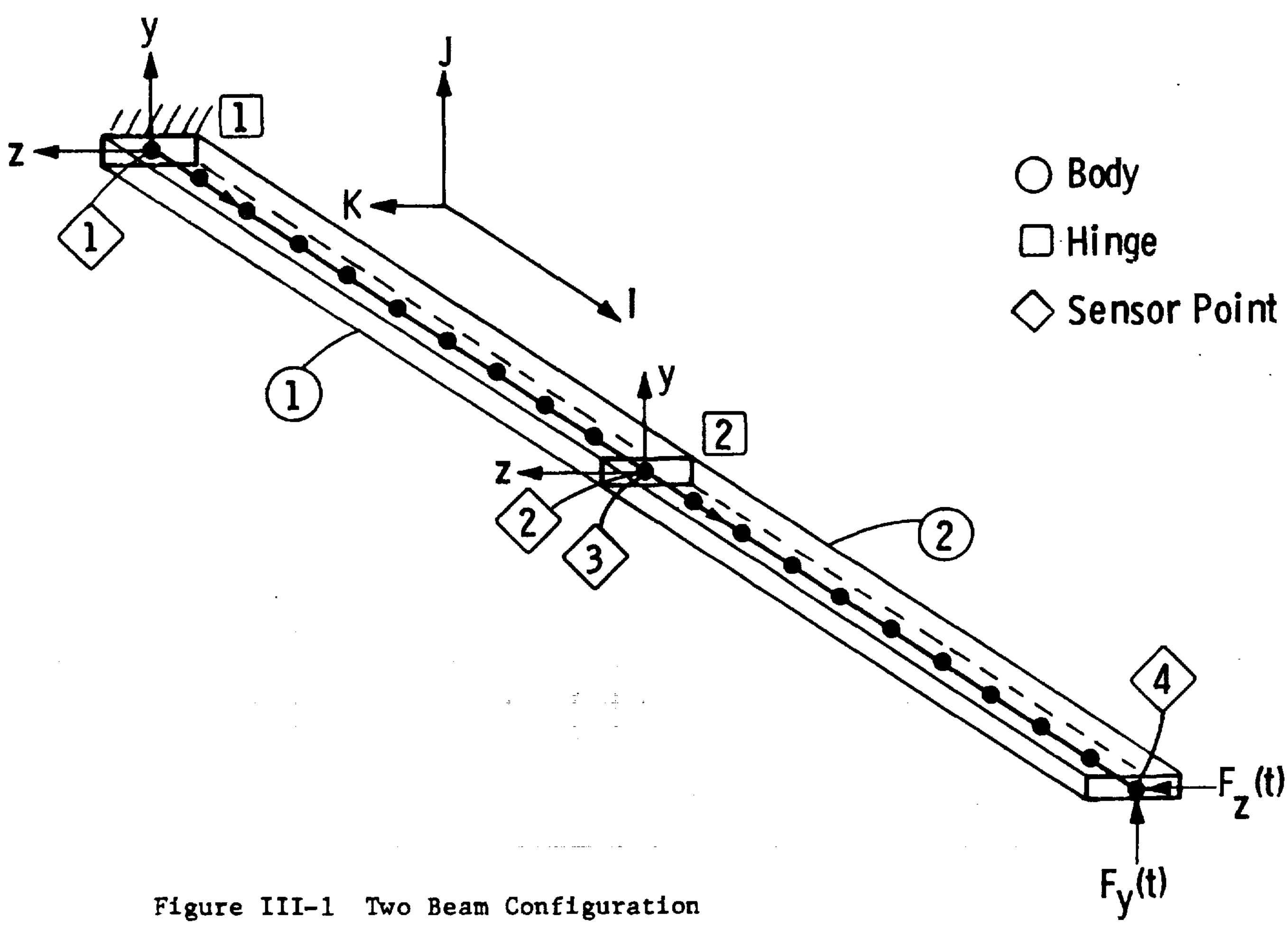

Figure III-1 Two Beam Configuration

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Each of the two beams is 1000 units in length with the inertial properties, modal amplitude and rotation characteristics, and stiffness and damping characteristics indicated in Appendix B. These data were originally generated using the NASTRAN code by W. Case of Goddard Space Flight Center and were transformed to appropriate DISCOS inputs through application of the NASFOR program as shown in Appendix B.

With reference to Figure III-1 we note that the topology for the system is as shown in Table III-1 while the orientation of the hinge triads and the nature of the constraints are as shown in Table III-2.

Table III-1. Topology Description - Demonstration Problem 7

Body	Description
1	Beam 1, cantilever at root
2	Beam 2, cantilever to Beam 1
Hinge	
1	Body 1 to inertial reference
2	Body 2 to Body 1

Table III-2. Constraint Description - Demonstration Problem 7

Hinge	Euler Rotation Type	Coordinate					
		θ_1	θ_2	θ_3	x	y	z
1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1

Note: 0=unconstrained
1=constrained

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The coupled system was forced at the tip by the functions

(III-1) $F_y = 10 \sin (800t) \qquad 0.0 \leq t \leq 0.01$ sec

$F_z = 20 \sin (600t) \qquad 0.0 \leq t \leq 0.01$ sec

and the time response is indicated in Appendix A.

IV. A TWO-BODY EXAMPLE - DEMONSTRATION PROBLEMS 8 AND 11

The primary purpose of this demonstration problem is to verify the general approach and theoretical basis employed in the frequency domain stability portion of the digital simulation. The verification is accomplished by choosing a problem that is simple enough to develop analytical closed form solutions, yet sufficient to exercise the many program capabilities. Many elements relating to transfer function aspects of the digital simulation can be qualified with this example problem.

The example problem consists of a free-free two mass system connected together by a single spring and dashpot combination. A multi-channel controller is introduced to complete the coupled plant/controller system. Although the system is initially linear, the governing equations are relinearized within the program to further validate the linearization technique.

A. CONFIGURATION DESCRIPTION

The problem consists of the mechanical system indicated in Figure IV-1.

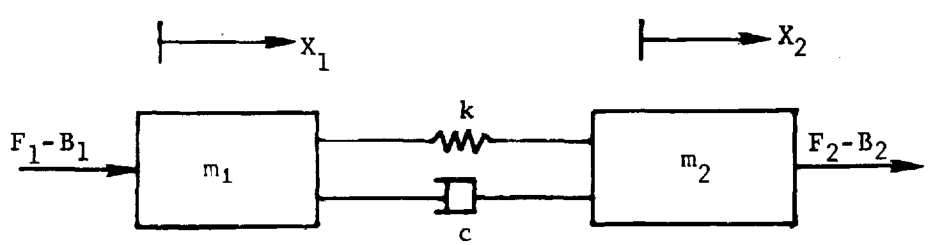

Figure IV-1. Mechanical System (Plant)

The controller depicted in Figure IV-2 represents a negative feedback two channel control system such as occurs for a spacecraft.

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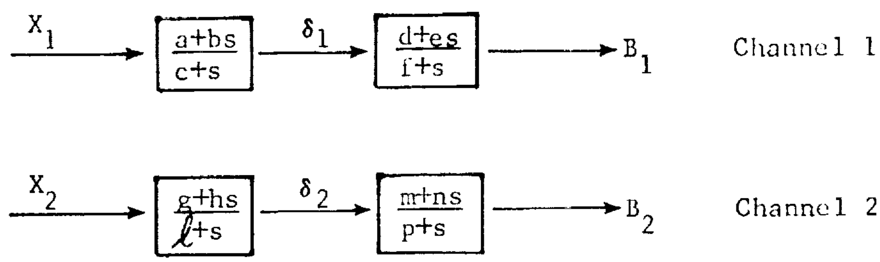

Figure IV-2. Control System (Controller)

The block diagram for the coupled system is given as Figure IV-3.

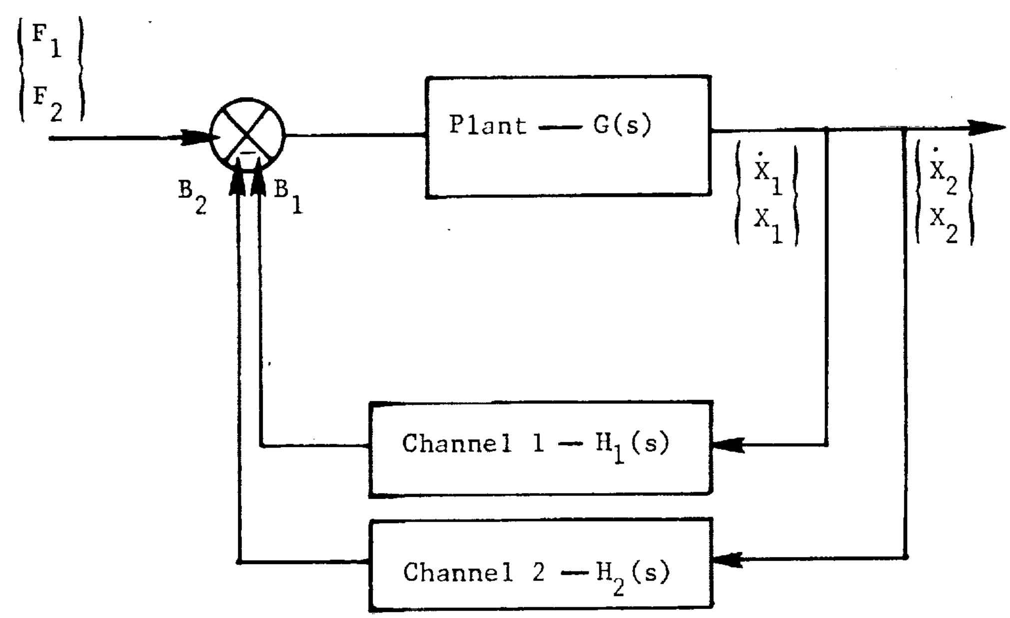

Figure IV-3. Block Diagram for Plant/Controller

The plant system can be isolated from the rest of the system via

(IV-1)
$$\begin{bmatrix} s+c/m_1 & -c/m_1 & k/m_1 & -k/m_1 \\ -c/m_2 & s+c/m_2 & -k/m_2 & k/m_2 \\ -1 & & s & \\ & -1 & & s \end{bmatrix} \begin{Bmatrix} \dot{X}_1(s) \\ \dot{X}_2(s) \\ X_1(s) \\ X_2(s) \end{Bmatrix} = \begin{bmatrix} 1/m_1 & \\ & 1/m_2 \\ & \\ & \end{bmatrix} \begin{Bmatrix} F_1(s) \\ F_2(s) \end{Bmatrix}$$

and we next wish to obtain the plant characteristic expression in s, G(s), such that

(IV-2)
$$Y^i(s) = G(s)_{ij} \; F^j(s).$$

We will establish this form as an analytical expression to compare with the digital simulation results.

B. ANALYTICAL FORMULATION

The system state space representation is written in terms of the symbols indicated in Figures IV-1 and IV-2 as

(IV-3)
$$\frac{d}{dt} \begin{Bmatrix} \dot{X}_1 \\ \dot{X}_2 \\ X_1 \\ X_2 \\ \delta_1 \\ \delta_2 \\ B_1 \\ B_2 \end{Bmatrix} = \left[\begin{array}{c|c} \overset{*}{A}_{11} & \overset{*}{A}_{12} \\ \hline \overset{*}{A}_{21} & \overset{*}{A}_{22} \end{array}\right] \begin{Bmatrix} \dot{X}_1 \\ \dot{X}_2 \\ X_1 \\ X_2 \\ \delta_1 \\ \delta_2 \\ B_1 \\ B_2 \end{Bmatrix} + \left[\begin{array}{c|c} 1/m_1 & 0 \\ 0 & 1/m_2 \\ \hline & \end{array}\right] \begin{Bmatrix} F_1 \\ F_2 \end{Bmatrix}$$

where

$$\overset{*}{A}_{11} = \begin{bmatrix} -c/m_1 & c/m_1 & -k/m_1 & k/m_1 \\ c/m_2 & -c/m_2 & k/m_2 & -k/m_2 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix},$$

$$\overset{*}{A}_{12} = \begin{bmatrix} 0 & 0 & -1/m_1 & 0 \\ 0 & 0 & 0 & -1/m_2 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix},$$

$$\overset{*}{A}_{21} = \begin{bmatrix} b & 0 & a & 0 \\ 0 & h & 0 & g \\ be & 0 & ae & 0 \\ 0 & hn & 0 & gn \end{bmatrix},$$

and

$$\overset{*}{A}_{22} = \begin{bmatrix} -c & 0 & 0 & 0 \\ 0 & -\ell & 0 & 0 \\ d-ce & 0 & -f & 0 \\ 0 & m-\ell n & 0 & -p \end{bmatrix}.$$

The transformed matrix of the form

$$\left(\begin{bmatrix} I \end{bmatrix} s - \begin{bmatrix} \overset{*}{A} \end{bmatrix}\right)\left\{q(s)\right\} = \begin{bmatrix} B \end{bmatrix}\left\{U(s)\right\}$$

is

$$
\text{(IV-4)} \qquad
\left[\begin{array}{c|c} S_{11} & S_{12} \\ \hline S_{21} & S_{22} \end{array}\right]
\left\{\begin{array}{c} \dot{X}_1(s) \\ \dot{X}_2(s) \\ X_1(s) \\ X_2(s) \\ \delta_1(s) \\ \delta_2(s) \\ B_1(s) \\ B_2(s) \end{array}\right\}
=
\left[\begin{array}{c|c} 1/m_1 & 0 \\ 0 & 1/m_2 \\ 0 & 0 \\ 0 & 0 \\ \hline 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{array}\right]
\left\{\begin{array}{c} F_1(s) \\ \dot{F}_2(s) \end{array}\right\}
$$

where

$$
S_{11} = \begin{bmatrix} s+c/m_1 & -c/m_1 & k/m_1 & -k/m_1 \\ -c/m_2 & s+c/m_2 & -k/m_2 & k/m_2 \\ -1 & & s & \\ & -1 & & s \end{bmatrix} ,
$$

$$
S_{12} = \begin{bmatrix} & & 1/m_1 & \\ & & & 1/m_2 \\ & & & \\ & & & \end{bmatrix} ,
$$

$$
S_{21} = \begin{bmatrix} -b & & -a & \\ & -h & & -g \\ -be & & -ae & \\ & -hn & & -gn \end{bmatrix} ,
$$

and

$$
S_{22} = \begin{bmatrix} s+c & & & \\ & s+\ell & & \\ ce-d & & s+f & \\ & \ell n-m & & s+p \end{bmatrix} .
$$

The plant and controller s-plane characteristic matrices, G(s) and H(s), can be established by first noting that with no B feedback we have

$$
\begin{bmatrix} s+c/m_1 & -c/m_1 & k/m_1 & -k/m_1 \\ -c/m_2 & s+c/m_2 & -k/m_2 & k/m_2 \\ -1 & & s & \\ & -1 & & s \end{bmatrix} \begin{Bmatrix} \dot{X}_1(s) \\ \dot{X}_2(s) \\ X_1(s) \\ X_2(s) \end{Bmatrix} = \begin{bmatrix} 1/m_1 & \\ & 1/m_2 \\ & \\ & \end{bmatrix} \begin{Bmatrix} F_1 \\ F_2 \end{Bmatrix} \tag{IV-5}
$$

and

$$
\begin{bmatrix} -b & & -a & & s+c & & & \\ & -h & & -g & & s+\ell & & \\ -be & & -ae & & ce-d & & s+f & \\ & -hn & & -gn & & \ell n-m & & s+p \end{bmatrix} \begin{Bmatrix} \dot{X}_1(s) \\ \dot{X}_2(s) \\ X_1(s) \\ X_2(s) \\ \delta_1(s) \\ \delta_2(s) \\ B_1(s) \\ B_2(s) \end{Bmatrix} = \begin{Bmatrix} 0 \end{Bmatrix} . \tag{IV-6}
$$

From the above we establish

$$
G(s) = \begin{bmatrix} s+c/m_1 & -c/m_1 & k/m_1 & -k/m_1 \\ -c/m_2 & s+c/m_2 & -k/m_2 & k/m_2 \\ -1 & & s & \\ & -1 & & s \end{bmatrix}^{-1} \begin{bmatrix} 1/m_1 & \\ & 1/m_2 \\ & \\ & \end{bmatrix} \tag{IV-7}
$$

which after carrying out the inversion, yields

$$G(s) = \frac{1}{D}\begin{bmatrix} \left(s^2 + \frac{c\,s}{m_2} + \frac{k}{m_2}\right)s & \left(\frac{c\,s}{m_1} + \frac{k}{m_1}\right)s \\ \left(\frac{c\,s}{m_2} + \frac{k}{m_2}\right)s & \left(s^2 + \frac{c\,s}{m_1} + \frac{k}{m_1}\right)s \\ \left(s^2 + \frac{c\,s}{m_2} + \frac{k}{m_2}\right) & \left(\frac{c\,s}{m_1} + \frac{k}{m_1}\right) \\ \left(\frac{c\,s}{m_2} + \frac{k}{m_2}\right) & \left(s^2 + \frac{c\,s}{m_1} + \frac{k}{m_1}\right) \end{bmatrix}\begin{bmatrix} 1/m_1 & 0 \\ 0 & 1/m_2 \end{bmatrix} \qquad \text{(IV-8)}$$

where

$$D = s^2\left(s^2 + c\,\frac{m_1 + m_2}{m_1\,m_2}\,s + k\,\frac{m_1 + m_2}{m_1\,m_2}\right).$$

From Equation (IV-6) we establish (for $B = H(s)\,X_{ss}(s)$) that $H(s)$ is given by the second two rows of the expression or

$$\begin{Bmatrix} \delta_1(s) \\ \delta_2(s) \\ B_1(s) \\ B_2(s) \end{Bmatrix} = -\begin{bmatrix} s+c & 0 & 0 & 0 \\ 0 & s+\ell & 0 & 0 \\ ce-d & 0 & s+f & 0 \\ 0 & \ell n-m & 0 & s+p \end{bmatrix}^{-1}\begin{bmatrix} -b & 0 & -a & 0 \\ 0 & -h & 0 & -g \\ -be & 0 & -ae & 0 \\ 0 & -hn & 0 & -gn \end{bmatrix}\begin{Bmatrix} \dot{X}_1(s) \\ \dot{X}_2(s) \\ X_1(s) \\ X_2(s) \end{Bmatrix}. \qquad \text{(IV-9)}$$

Carrying out the above indicated inversion yields

$$H(s) = \begin{bmatrix} \frac{d-ce}{(s+c)(s+f)} & 0 & \frac{1}{s+f} & 0 \\ 0 & \frac{m-\ell n}{(s+\ell)(s+p)} & 0 & \frac{1}{s+p} \end{bmatrix}\begin{bmatrix} b & 0 & a & 0 \\ 0 & h & 0 & g \\ be & 0 & ae & 0 \\ 0 & hn & 0 & gn \end{bmatrix}$$

and finally

$$H(s) = \begin{bmatrix} \frac{sbe+bd}{(s+c)(s+f)} & 0 & \frac{aes+ad}{(s+c)(s+f)} & 0 \\ 0 & \frac{shn+hm}{(s+\ell)(s+p)} & 0 & \frac{gns+gm}{(s+\ell)(s+p)} \end{bmatrix} . \quad \text{(IV-11)}$$

We now write the open-loop transfer function G(s) H(s) by first noting that

$$\begin{Bmatrix} \dot{X}_1(s) \\ \dot{X}_2(s) \\ X_1(s) \\ X_2(s) \end{Bmatrix} = \begin{bmatrix} G(s) \end{bmatrix} \begin{Bmatrix} F_1 \\ F_2 \end{Bmatrix} \quad \text{(IV-12)}$$

and

$$\begin{Bmatrix} B_1 \\ B_2 \end{Bmatrix} = \begin{bmatrix} H(s) \end{bmatrix} \begin{Bmatrix} \dot{X}_1(s) \\ \dot{X}_2(s) \\ X_1(s) \\ X_2(s) \end{Bmatrix} \quad \text{(IV-13)}$$

and it follows that

$$\begin{Bmatrix} B_1(s) \\ B_2(s) \end{Bmatrix} = \begin{bmatrix} H(s) \end{bmatrix} \begin{bmatrix} G(s) \end{bmatrix} \begin{Bmatrix} F_1 \\ F_2 \end{Bmatrix} . \quad \text{(IV-14)}$$

Carrying out the matrix multiplication gives the system transfer function (GH) such that $B^i = (GH)_{ij} F^j$ i,j=1,2

where the matrix $(GH)_{ij}$ is

$$\begin{bmatrix} T_{11} & T_{12} \\ T_{21} & T_{22} \end{bmatrix} \begin{bmatrix} 1/m_1 & 0 \\ 0 & 1/m_2 \end{bmatrix} \quad \text{(IV-15)}$$

where

$$T_{11} = \frac{\left(s^2 + \frac{c\,s}{m_2} + \frac{k}{m_2}\right)\left(bes^2 + (ae+bd)s + ad\right)}{s^2\,(s+c)(s+f)\left(s^2 + c\,\frac{m_1+m_2}{m_1\,m_2}\,s + k\,\frac{m_1+m_2}{m_1\,m_2}\right)}$$

$$T_{12} = \frac{\left(\frac{c\,s}{m_1} + \frac{k}{m_1}\right)\left(bes^2 + (ae+bd)\,s + ad\right)}{s^2\,(s+c)(s+f)\left(s^2 + c\,\frac{m_1+m_2}{m_1\,m_2}\,s + k\,\frac{m_1+m_2}{m_1\,m_2}\right)}$$

$$T_{21} = \frac{\left(\frac{c\,s}{m_2} + \frac{k}{m_2}\right)\left(hns^2 + (hm+gn)\,s + gm\right)}{s^2\,(s+\ell)(s+p)\left(s^2 + c\,\frac{m_1+m_2}{m_1\,m_2}\,s + k\,\frac{m_1+m_2}{m_1\,m_2}\right)}$$

$$T_{22} = \frac{\left(s^2 + \frac{c\,s}{m_1} + \frac{k}{m_1}\right)\left(hns^2 + (hm+gn)\,s + gm\right)}{s^2\,(s+\ell)(s+p)\left(s^2 + c\,\frac{m_1+m_2}{m_1\,m_2} + k\,\frac{m_1+m_2}{m_1\,m_2}\right)}$$

In the $(GH)_{ij}$ expression (Equation(IV-15)) it is possible to identify the poles, zeros, and Bode gain for each of the open-loop transfer functions, B^i/F^j (i,j=1,2), for the dynamical system. These transfer functions are classified as Type III as indicated in previous discussions (e.g., Volume I (Chapter III))

We next wish to identify the "quasi-open loop" transfer function whereby one channel of the controller is closed and the other channel is opened to prohibit feedback from the latter. An example would be to leave channel two (2) closed, open channel one (1) such that B_1 does not feed back and establish the transfer function designated as B_1/F_1. This transfer function is classified as a Type VII in Volume I.

First note that for this particular case we can write (with reference to Figure IV-3)

$$\left\{ y \right\} = \left[\left\{ G_1 \right\} \left\{ G_2 \right\} \right] \left\{ \begin{matrix} F_1 \\ -B_2 \end{matrix} \right\} \qquad \text{(IV-16)}$$

where

$$\left\{ y \right\} = \left\{ \begin{matrix} \dot{X}_1 \\ \dot{X}_2 \\ X_1 \\ X_2 \end{matrix} \right\} ,$$

and $\left\{ G_1 \right\}$ and $\left\{ G_2 \right\}$ are identified from Equation (IV-8) as part of G(s),

$$\left[G \right] = \left[\left\{ G_1 \right\} \left\{ G_2 \right\} \right] .$$

Additionally, we have

$$B_2 = \lfloor H_2 \rfloor \left\{ y \right\} \qquad \text{(IV-17)}$$

and therefore,

$$\left\{ y \right\} = \left(\left[I \right] - \left\{ G_2 \right\} \lfloor H_2 \rfloor \right)^{-1} \left\{ G_1 \right\} F_1 , \qquad \text{(IV-18)}$$

from which the closed form analytic expression becomes

$$B_1/F_1 = \lfloor H_1 \rfloor \left(\left[I \right] - \frac{1}{1 + \lfloor H_2 \rfloor \left\{ G_2 \right\}} \left\{ G_2 \right\} \lfloor H_2 \rfloor \right) \left\{ G_1 \right\} . \qquad \text{(IV-19)}$$

Table IV-1 summarizes the physical data that was used to obtain numerical values for Demonstration Problem 8.

Table IV-1. Summary of Data for Two-Mass Demonstration Problems

Item	Value
m_1	2.7
m_2	3.1
k	1424.286
c	.90673
a	450.
b	2.
c	450.
d	500.
e	3.
f	500.
g	450.
h	2.
ℓ	450.
m	500.
n	3.
p	500.

C. RESULTS AND COMPARISONS, DEMONSTRATION PROBLEM 8

The data presented in Table IV-1 is used in conjunction with the basic coupled mechanical/control system depicted in Figure IV-3 to establish results for both the analytical and digital program formulations for comparison purposes. For the analytical portion, all indicated matrix operations were carried out in symbollic form and the final results were obtained by direct substitution into the final form representing the particular result desired.

The same input data was then input into the DISCOS program to obtain the corresponding digital results. These results are summarized in comparison form in Table IV-2. The program output for Demonstration Problem 8 is contained within Appendix A.

Table IV-2. Comparison of Digital Results With Analytical Solution (Sheet 1 of 3)

Case 1 Plant Only ~G TFTYPE=1

		Results									
		Closed Form					DISCOS				
No.	I.D.	k_B	Zeros Real	Zeros Imag	Poles Real	Poles Imag	k_B	Zeros Real	Zeros Imag	Poles Real	Poles Imag
1	$\dot{X}_1/R_{T1}$	.1724	-.146	±21.4	-.314	±31.4	.1724	-.146	±21.4	-.314	±31.4
			0	0	0	0		0	0	0	0
					0	0				0	0
2	$\dot{X}_2/R_{T1}$	.1724	-1570.	0	-.314	±31.4	.1724	-1570.	0	-.314	±31.4
			0	0	0	0		0	0	0	0
					0	0				0	0
3	X_1/R_{T1}	.1724	-.146	±21.4	-.314	±31.4	.1724	-.146	±21.43	-.314	±31.4
					0	0				0	0
					0	0				0	0
4	X_2/R_{T1}	.1724	-1570.	0	-.314	±31.4	.1724	-1570.	0	-.314	±31.4
					0	0				0	0
					0	0				0	0
5	$\dot{X}_1/R_{T2}$	.1724	-1570.	0	-.314	±31.4	.1724	-1570.	0	-.314	±31.4
			0	0	0	0		0	0	0	0
					0	0				0	0
6	$\dot{X}_2/R_{T2}$	.1724	-.1679	±22.9	-.314	±31.4	.1724	-.1679	±22.9	-.314	±31.4
			0	0	0	0		0	0	0	0
					0	0				0	0
7	X_1/R_{T2}	.1724	-1570.	0	-.314	±31.4	.1724	-1570.	0	-.314	±31.4
					0	0				0	0
					0	0				0	0
8	X_2/R_{T2}	.1724	-.1679	±22.9	-.314	±31.4	.1724	-.1679	±22.9	-.314	±31.4
					0	0				0	0
					0	0				0	0

Table IV-2. Comparison of Digital Results With Analytical Solution (Sheet 2 of 3)

Case 2 Controller Only ~H TFTYPE=2

No.	I.D.	Results: Closed Form k_B	Zeros Real	Zeros Imag	Poles Real	Poles Imag	DISCOS k_B	Zeros Real	Zeros Imag	Poles Real	Poles Imag
9	$B_1/\dot{X}_1$	.0044	-167	0.	-500	0.	.0044	-500	0.	-500	0.
					-450	0.		-450	0.	-500	0.
								-167	0.	-450	0.
										-450	0.
10	$B_2/\dot{X}_1$	0.*					0.*				
11	$B_1/\dot{X}_2$	0.*					0.*				
12	$B_2/\dot{X}_2$	.0044	-500	0.	-500	0.	.0044	-500	0.	-500	0.
			-450	0.	-500	0.		-450	0.	-500	0.
			-167	0.	-450	0.		-167	0.	-450	0.
					-450	0.				-450	0.
13	B_1/X_1	1.0	-167	0.	-500	0.	1.0	-500	0.	-500	0.
					-450	0.		-450	0.	-500	0.
								-167	0.	-450	0.
										-450	0.
14	B_2/X_1	0.*					0.*				
15	B_1/X_2	0.*					0.*				
16	B_2/X_2	1.0	-167	0.	-500	0.	1.0	-500	0.	-500	0.
					-450	0.		-450	0.	-500	0.
								-167	0.	-450	0.
										-450	0.

Note: * roots for zero gain omitted

Table IV-2. Comparison of Digital Results With Analytical Solution (Sheet 3 of 3)

Case 3 Loop Gain ~ GH TFTYPE=3

		Results									
No.	I.D.	Closed Form					DISCOS				
			Zeros		Poles			Zeros		Poles	
		k_B	Real	Imag	Real	Imag	k_B	Real	Imag	Real	Imag
17	B_1/R_{T1}	.1724	-167	0.	-500	0.	.1724	-167	0.	-500	0.
			-225	0.	-450	0.		-225	0.	-500	0.
								-450	0.	-450	0.
								-500	0.	-450	0.
			-.146	±21.4	-.314	±31.4		-.146	±21.43	-.314	±31.4
					0.	0.				0.	0.
					0.	0.				0.	0.
18	B_1/R_{T2}	.1724	-167	0.	-500	0.	.1724	-167	0.	-500	0.
			-225	0.	-450	0.		-225	0.	-500	0.
			-1571	0.	-.314	±31.4		-450	0.	-450	0.
					0.	0.		-500	0.	-450	0.
					0.	0.		-1571	0.	-.314	±31.4
										0.	0.
										0.	0.
19	B_2/R_{T1}	.1724	-167	0.	-500	0.	.1724	-167	0.	-500	0.
			-225	0.	-450	0.		-225	0.	-500	0.
			-1570	0.	-.314	±31.4		-450	0.	-450	0.
					0.	0.		-500	0.	-450	0.
					0.	0.		-1570	0.	-.314	±31.4
										0.	0.
										0.	0.
20	B_2/R_{T2}	.1724	-167	0.	-500	0.	.1724	-167	0.	-500	0.
			-225	0.	-450	0.		-225	0.	-500	0.
			-.1679	±22.9	-.314	±31.4		-450	0.	-450	0.
					0.	0.		-500	0.	-450	0.
					0.	0.		-.1679	±22.9	-.314	±31.4
										0.	0.
										0.	0.

D. CONTROL SYSTEM - POLYNOMIAL TRANSFER FUNCTION INPUTS

In Chapter III of Volume I, a basis was established whereby the user could input his control law in the form of polynomial ratios for each control channel. Demonstration Problem 10 employs this approach in conjunction with the simple two mass problem depicted in Figure IV-1. The control law used for this example is given in Figure IV-4.

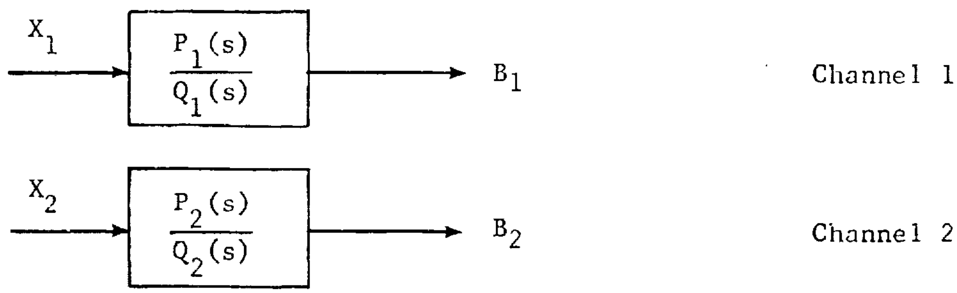

Figure IV-4. Control System - Polynomial Ratios

The results for this demonstration problem are summarized in Appendix A.

V. THE AE-C SPACECRAFT - DEMONSTRATION PROBLEMS 9 AND 10

The RCA/AE Solar Pointing System (SPS) provides the basis for Demonstration Problems 9 and 10. Demonstration Problem 9 is a linearized transfer function study and Demonstration Problem 10 exercises the linearized time response portion of Program DISCOS. A mechanical representation of the AE is depicted in Figure V-1.

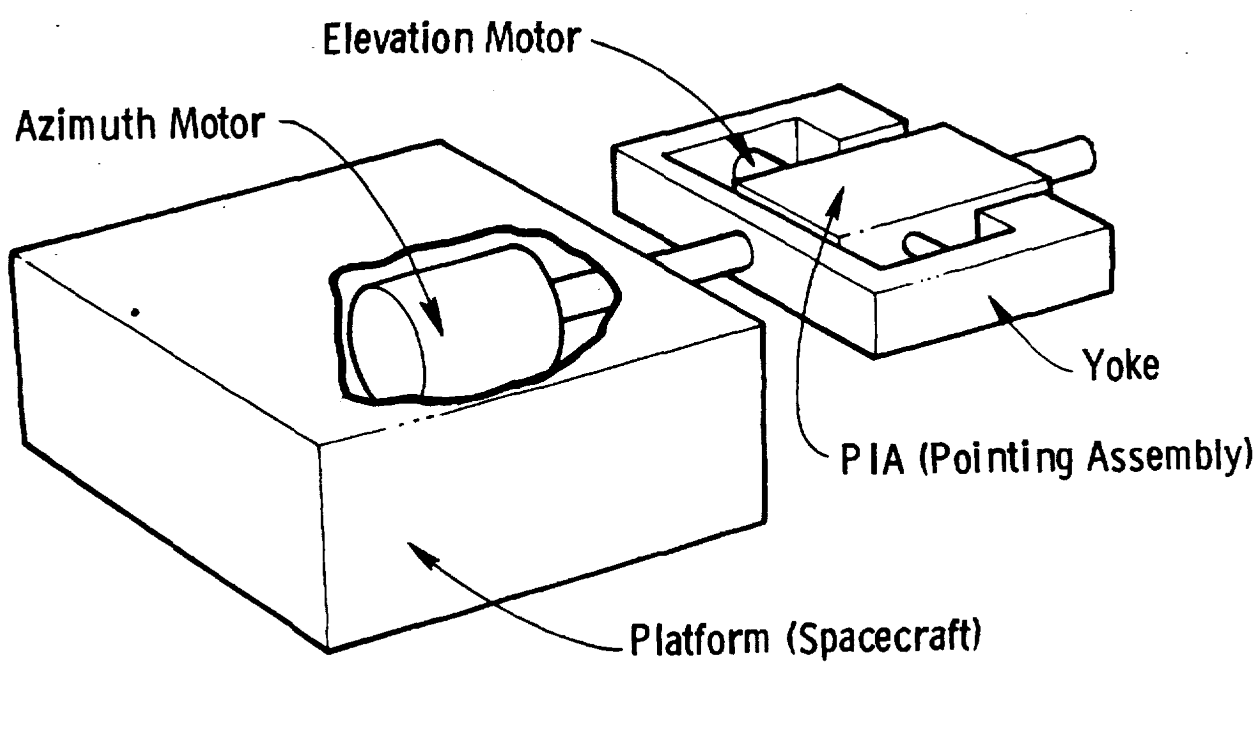

Figure V-1. Schematic of AE-C Spacecraft

The mathematical model consists of five (5) interconnected rigid bodies and a two channel controller. The two channel control law is presented in block diagram form in Figure V-2 and a schematic portraying mechanization of the system in terms of bodies, hinges, and relative locations is given in Figure V-3.

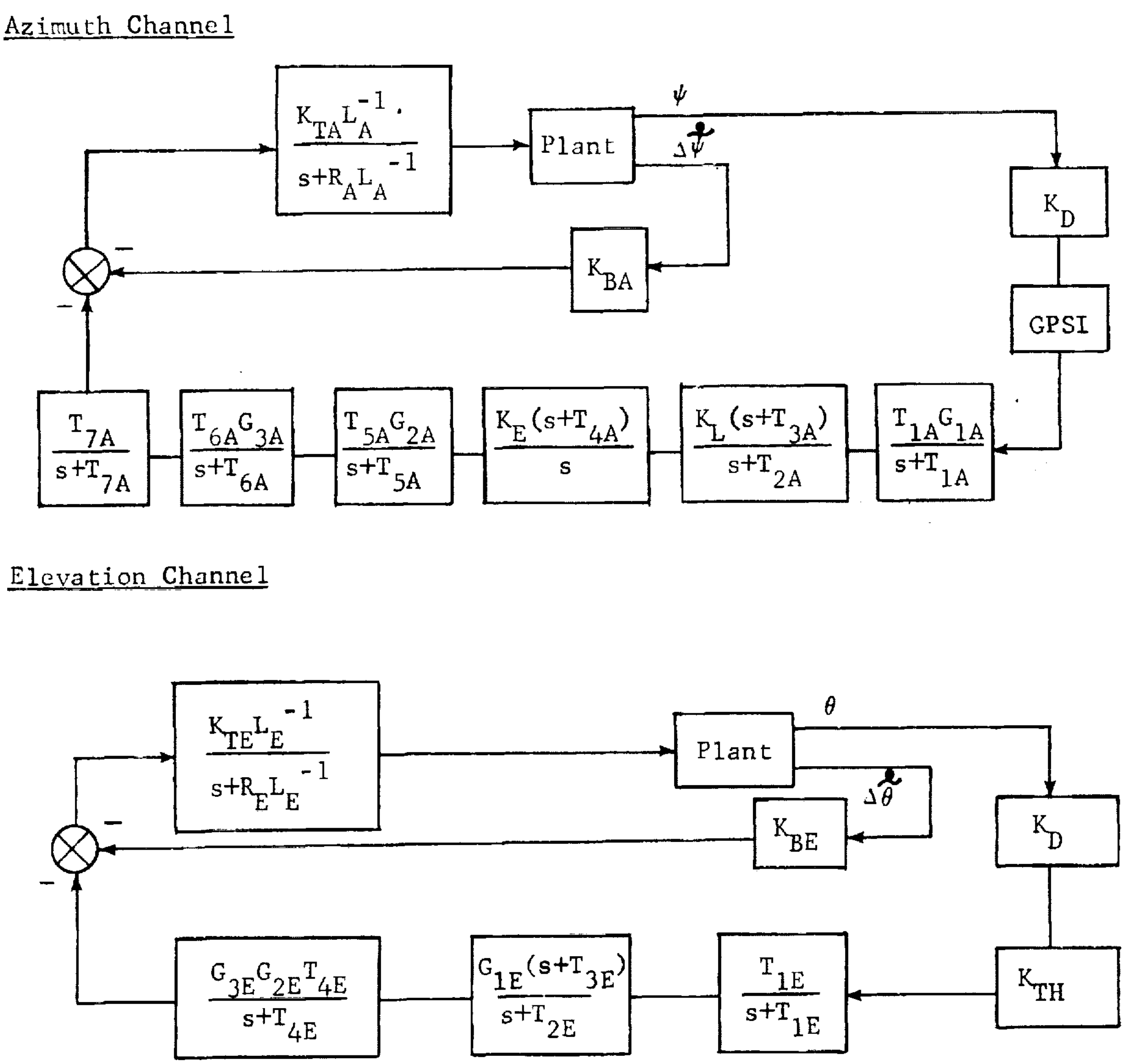

Figure V-2. AE-C Control System

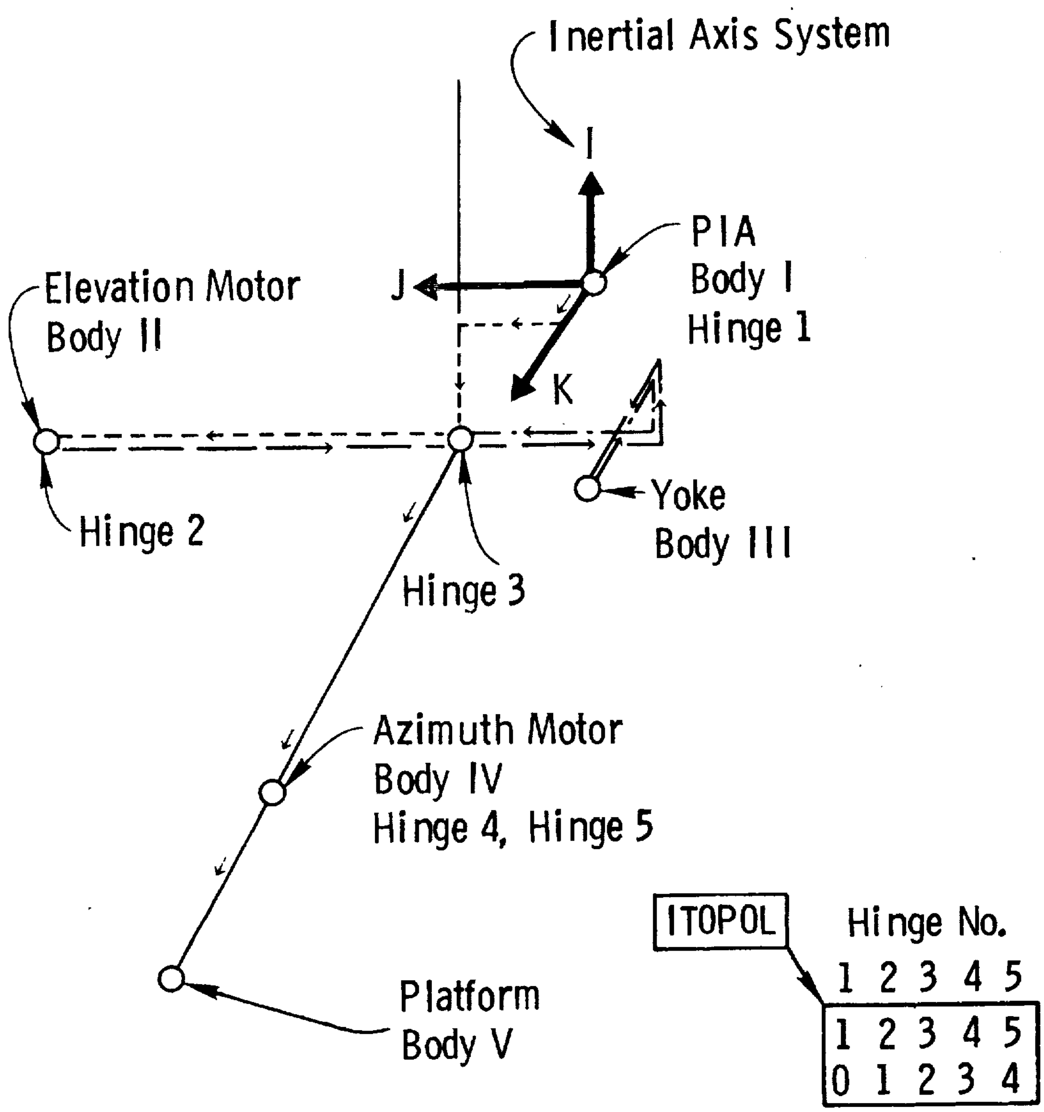

Figure V-3 Mechanization of AE-C Spacecraft

The block diagram algebra is synthesized into first order differential equations as depicted in Table V-1.

Table V-1. Control System Differential Equations

Azimuth Control

$$\dot{\delta}_1 = -T_{1A}\,\delta_1 + T_{1A}G_{1A}K_D(GPSI)\,\psi_{AZ}$$

$$\dot{\delta}_2 - K_L\,\dot{\delta}_1 = -T_{2A}\,\delta_2 + K_L T_{3A}\,\delta_1$$

$$\dot{\delta}_3 - K_E\,\dot{\delta}_2 = K_E T_{4A}\,\delta_2$$

$$\dot{\delta}_4 = -T_{5A}\,\delta_4 + T_{5A}G_{2A}\,\delta_3$$

$$\dot{\delta}_5 = -T_{6A}\,\delta_5 + G_{3A}T_{6A}\,\delta_4$$

$$\dot{\delta}_6 = -T_{7A}\,\delta_6 + T_{7A}\,\delta_5$$

$$\dot{\delta}_7 = -R_A L_A^{-1}\,\delta_7 - K_{TA}L_A^{-1}K_{BA}\,(\Delta\dot{\tilde{\psi}}) + K_{TA}L_A^{-1}\,\delta_6$$

Elevation Control

$$\dot{\delta}_1 = -T_{1E}\,\delta_1 + T_{1E}K_D K_{TH}\,\theta_{EL}$$

$$\dot{\delta}_2 - G_{1E}\,\dot{\delta}_1 = -T_{2E}\,\delta_2 + G_{1E}T_{3E}\,\delta_1$$

$$\dot{\delta}_3 = -T_{4E}\,\delta_3 + G_{3E}G_{2E}T_{4E}\,\delta_2$$

$$\dot{\delta}_4 = -R_E L_E^{-1}\,\delta_4 - K_{TE}L_E^{-1}\,\delta_3 - K_{TE}L_E^{-1}K_{BE}\,(\Delta\dot{\tilde{\theta}})$$

A. STATE VARIABLE ARRANGEMENT

The variable arrangement for the AE-C Spacecraft is discussed from various points of view that relate to different stages of the simulation. In particular, the system state variables (including dependent variables) that originally describe the system are identified as

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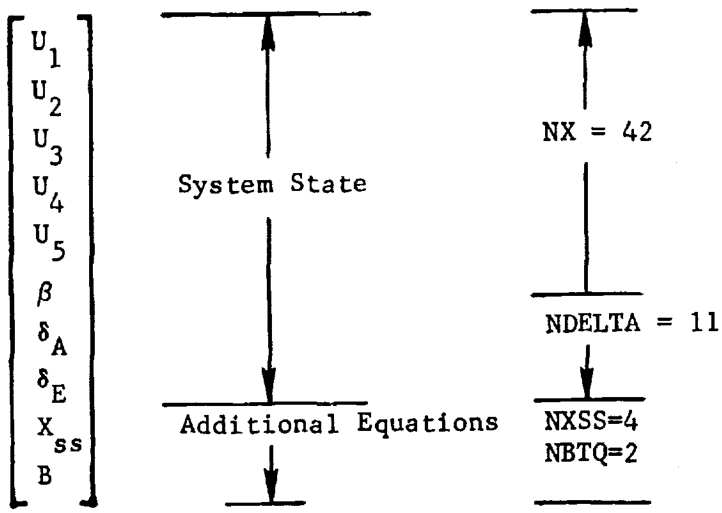

For the jth body we have

$$U_j^1 = \omega_{x_j}$$
$$U_j^2 = \omega_{y_j}$$
$$U_j^3 = \omega_{z_j}$$
$$U_j^4 = u_j$$
$$U_j^5 = v_j$$
$$U_j^6 = w_j$$

and, additionally

$$\left\{ X_{ss} \right\} = \left\{ \begin{array}{c} \Delta\dot{\theta} \\ \theta \\ \hline \Delta\dot{\psi} \\ \psi \end{array} \right\}$$

and

$\{\beta\} =$

row		
31	$\Delta\dot{\theta}_1$	PIA/Inertia
32	$\Delta\dot{\theta}_2$	PIA/Inertia
33	$\Delta\dot{\theta}_3$	PIA/Inertia
34	$\Delta\dot{x}$	PIA/Inertia
35	$\Delta\dot{y}$	PIA/Inertia
36	$\Delta\dot{z}$	
37	$\Delta\omega_y$	Elevator Motor/PIA
38	$\Delta\omega_y$	Yoke/Elevator Motor
39	$\Delta\omega_x$	Azimuth Motor/Yoke
40	$\Delta\omega_y$	Azimuth Motor/Yoke
41	$\Delta\omega_z$	Azimuth Motor/Yoke
42	$\Delta\omega_z$	Platform/Azimuth Motor

Next, the independent variables are determined and the independent state vector is arranged ahead of the additional equations as

$$Y = \begin{Bmatrix} y \\ \delta \\ X_{ss} \\ B \end{Bmatrix}$$

y	Plant Variables (NY)
δ	Controller Variables (NDELTA)
X_{ss}	Plant Sensor Signals (NXSS)
B	Control Output Variables (NBTQ)

This arrangement is also consistent with the system linearized coefficient matrix (-A-).

The similarity transformation is established within the program for further processing of the linearized system. The state space equations are then restructured and reordered such that the variable order becomes

$$\left\{\begin{matrix} \tilde{y} \\ X_{ss} \\ \tilde{\delta} \\ B \end{matrix}\right\}\quad \begin{matrix} \text{Plant Variables (NY2=NY-NXSS)} \\ \text{Plant Sensor Signals (NXSS)} \\ \text{Controller Variables (ND2=NDELTA-NBTQ)} \\ \text{Control Outputs (NBTQ).} \end{matrix}$$

This set represents a completely independent set of state-space variables that is utilized for all subsequent linearized analyses. The order can be used to identify the subpartitions of the system characteristic matrix, $\left[\overset{*}{A}\right]$. This form of the governing equations has been used for both the transfer function studies (Demonstration Problem 9) and the linearized time domain response (Demonstration Problem 10).

B. RESULTS

The results are summarized in Appendix A. Each different type within the transfer function package has been exercised as well as each mode of output display (i.e., Nichols, Nyquist, Bode, Root/Locus). The output consists of selected printed and plotted results for various AE-C system transfer functions. In all, twelve separate transfer functions were evaluated for the AE-C spacecraft. The reader is referred to Volume I (Chapter III) for a detailed description of the transfer function type classifications and to Volume II for an in depth discussion of the user supplied modules and program input/output descriptions. The linearized AE-C spacecraft was also used to exercise the linearized time domain response portion of the program. The choice of external forcing function was chosen quite arbitrarily (as given in user supplied subprogram LTORQL) in that the intent was to only exercise this aspect of the digital simulation.

Table V-2 provides a comparative summary between some early AE-C results (3-body simulation) and some recent results obtained with program DISCOS for a Type VII transfer function (pseudo-open loop azimuth torque/azimuth torque with elevation loop closed).

Table V-2. AE-C Pole-Zero Comparison

Poles				Zeros			
GSFC(1)		MMC(2) (DISCOS)		GSFC(1)		MMC(2) (DISCOS)	
Real	Imag	Real	Imag	Real	Imag	Real	Imag
-62800.		-62800.		-62800.		-62800.	
-62800.		-62800.		-6665.		-6665.	
-6666.		-6666.		-1098.		-1098.	
-6665.		-6665.		-300.		-300.	
-2514.		-2514.		-3.83	±22515.	-1.73	±22513.
-2514.		-2514.		-.00174	±183.1	-.0019	±188.7
-1098.		-1098.		-.00535	±182.2	-.073	±188.3
-1000.		-1000.		-45.	±55.	-45.	±55.
-559.		-560.		-49.8		-49.8	
-300.		-300.		-5.0		-5.0	
-3.83	±22515.	-3.82	±22513.	-2.87×10^{7}		-9400.	$\pm.73\times10^{6}$
-.402	±2596.	-.12	±2595.			0.	
-.00175	±183.1	-.002	±188.8			0.	
-.0058	±182.2	-.074	±188.3			0.	
-45.	±55.	-44.7	±55.6			0.	
		0.				0.	
		0.				0.	
		0.				0.	
		0.				0.	
		0.				0.	
		0.				0.	
		0.				0.	
		0.				0.	
		0.				(3)	
		0.					
		0.					
		0. (3)					

Notes: (1) Used a constrained platform
(2) Used a free-free platform (also IBM 370/155 Q-precision)
(3) The 12 zero poles represent the 6 rigid body modes of the free-free system.

APPENDIX A - DELINEATION OF USER-PAKS, INPUT AND OUTPUT FOR ELEVEN DEMONSTRATION PROBLEMS

This appendix contains, for all demonstration problems, the following items:

1. listing of user-pak - computer listing of the user-supplied subroutines required for the demonstration problem;

2. data input - computer listing of data used to generate results for the demonstration problem;

3. print output - representative print output sufficient for the user to validate the numerical results for the demonstration problem;

3. graphical output - representative graphical output sufficient for the user to validate the graphical results for the demonstration problem.

Demonstration Problem 1

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```
DEMO 1     CARL BODLEY
ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE
NAS5-11996 DEMONSTRATION PROBLEM NUMBER 1.


THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS F SPACECRAFT AS A
SYSTEM OF SIX INTERCONNECTED BODIES. THERE ARE 4 ACTIVE MOMENTUM
WHEELS (ONE REPRESENTS REFLECTOR DYNAMICS FOR HIGHER ORDER
STRUCTURAL RESPONSE) WHILE THE OTHER THREE ARE USED FOR CONTROL TORQUE.


THE PROBLEM STARTS WITH INITIAL ATTITUDE AND RATE ERRORS AND
SIMULATES NON LINEAR TIME DOMAIN RESPONSE.
0000000000
    6     6     4     4     7
ITOPOL    2     6
    1     1     1     2     3     4     5     6
    2     1     0     1     1     1     1     1
0000000000
IRGFLX    1     6
0000000000
IFTSMW    1     4
    1     1     1     1     1     2
0000000000
IHDATA    7     6
    1     1     1     1     1     1     1     1
    2     1     0     0     0     0     1     1
    3     1     0     0     1     1     0     0
    4     1     0     0     0     0     0     0
    5     1     0     1     1     1     1     1
    6     1     0     1     1     1     1     1
    7     1     0     1     1     1     1     1
0000000000
BETAH     6     6
    1     1  .0014626                    .04            .07                .09
    2     1  .0019621                    .05
    2     5     .11                    .13
    3     1   .0010945           .06                .08                .10
    3     5     .12                .14
    4     1  -.030197
    5     1  -.014451
    6     1  24.353
0000000000
BETAHD    6     6
    1     1     .01
    2     1     .02
    3     1     .03
0000000000
IMO       3     4
```

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```
    1     1     1     2     3     4
    2     1     1     2     3     3
    3     1     1     1     1     1
0000000000
AMO         2     4
    1     1    127.78              127.78              127.78              0.
    2     1     .065                .065                .065                96.705
0000000000
TMDATA      1     3
    1     1    0.                   0.0125              3.
0000000000
IPDATA      1     3
    1     1    20     1     0
0000000000
CNTDTA      1     47
    1     8    42888.                288.01
    1    12       0.                 0.                  0.
    1    15     209680.             207550.              6746.7
    1    18 117660.              0.                   78836.
    1    21 117660.                  0.                   78836.
    1    24       0.                787.18               787.18
    1    27       0.                787.18               787.18
    1    30       0.                 0.                   0.
    1    33     54.105               94.376              57.116
    1    36     261.9                0.                   212.67
    1    39     261.9                0.                   212.67
    1    42       0.                10.023               10.023
    1    45       0.                10.023               10.023
0000000000
GRAVIT      1     4
0000000000
MASS 1      1     4
    1     1    68.273
0000000000
INERAI      1     6
    1     1    3713.7               3557.3               477.63
    1     4    -5.0961               32.729              2.9104
0000000000
    2     1
   0.      3.14159265    0.
 .030197    .014451    -12.600
    3     1
   0.         0.       3.14159265
 .030197    3.4312     -13.497
    4     1
   0.         0.         0.
 .030197   -3.4022     -13.497
    5     1
   0.         0.         0.
 1.2969     .014451     4.3140
```

```
      6     1
   0.         0.      3.14159265
 -1.2365    .014451   4.3140
      1     1
    0.        0.        0.
    0.        0.        0.
      2     1
    0.        0.        0.
    0.        0.        0.
      3     1
    0.        0.        0.
    0.        0.        0.
MASS 2      1      4
      1     1     3.5559              0.              0.                    0.
0000000000
INERA2      1      6
      1     1    100.48              100.79          193.41
0000000000
      2     1
     0.     3.14159265    0.
    0.        0.       -1.3521
      4     1
    0.        0.        0.
    0.        0.        0.
MASS 3      1      4
      1     1    5.1553
0000000000
INERA3      1      6
      1     1    168.96             40.091           145.07
      1     4    -4.7689             .14296          -1.9592
0000000000
      3     1
    0.        0.      3.14159265
 .36998     -15.809   -.070084
MASS 4      1      4
      1     1     5.1553
0000000000
INERA4      1      6
      1     1   168.96               40.091        145.07
      1     4    -4.7689          -.14296          1.9592
0000000000
      4     1
    0.        0.        0.
 -.36998    15.809     -.070084
MASS 5      1      4
      1     1    1.708
0000000000
INERA5      1      6
      1     1    .79758              .79758           .79758
0000000000
```

```
    5     1
   0.          0.          0.
   0.          0.          -.001
MASS 6   1     4
    1    1    1.7081
0000000000
INERA6   1     6
    1    1   .79758              .79758            .79758
0000000000
    6    1
   0.          0.       3.14159265
   0.          0.          -.001
NAS5-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT
   11
   10    1
    1    2    3    4    5    6    7    8    9   10
    1    2    3    4
TIME      OMEGA1     BODY-1  ANGULAR VELOCITY VECTOR
    1    5    6    7
TIME       U-V-W     BODY-1 BODY REFERENCED VELOCITY VECTOR
    1    6    9   10
TIME      THEDOT     MOMENTUM WHEEL  1,2, AND 3 ANGULAR RATES
0000000000
    8    1
    1   11   12   13   14   15   16   17
    1    2    3    4
TIME      OMEGA2     BODY-2 ANGULAR VELOCITY VECTOR
    1    5    6    7
TIME       U-V-W     BODY-2 LINEAR VELOCITY VECTOR
    1    8
TIME      THEDOT     MOMENTUM WHEEL 4 ANGULAR RATE
0000000000
   13    1
    1   18   19   20   21   22   23   24   25   26   27   28   29
    1    2    3    4
TIME      OMEGA3     BODY-3 ANGULAR VELOCITY VECTOR
    1    5    6    7
TIME       U-V-W     BODY-3 LINEAR VELOCITY VECTOR
    1    8    9   10
TIME      OMEGA4     BODY-4 ANGULAR VELOCITY VECTOR
    1   11   12   13
TIME       U-V-W     BODY-4 LINEAR VELOCITY VECTOR
0000000000
   13    1
    1   30   31   32   33   34   35   36   37   38   39   40   41
    1    2    3    4
TIME      OMEGA5     BODY-5 ANGULAR VELOCITY VECTOR
    1    5    6    7
TIME       U-V-W     BODY-5 LINEAR VELOCITY VECTOR
    1    8    9   10
```

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```
TIME       OMEGA6    BODY-6 ANGULAR VELOCITY VECTOR
    1    11    12    13
TIME       U-V-W     BODY-6 LINEAR VELOCITY VECTOR
0000000000
   13     1
    1   42    43    44    45    46    47    48    49    50    51    52    53
    1    2     3     4
TIME       BETA      HINGE-1 EULER ANGLES
    1    5     6     7
TIME       XYZ-1     HINGE-1 INERTIAL XYZ POSITION
    1    8     9    10
TIME       BETA      HINGE-2 EULER ANGLES
0000000000
   13     1
    1   54    55    56    57    58    59    60    61    62    63    64    65
    1    7     8
TIME       DELTA     ROLL CHANNEL CONTROL VARIABLES
    1    9    10
TIME       DELTA     PITCH CHANNEL CONTROL VARIABLES
    1   11    12
TIME       DELTA     YAW CHANNEL CONTROL VARIABLES
0000000000
    5     1
    1   72    73    74    81
    1    2     3     4
TIME       THEDD     MOMENTUM WHEEL 1,2, AND 3-- ANGULAR ACCELERATIONS
0000000000
   13     1
    1  106   107   108   109   110   111   112   113   114   115   116   117
    1    2     3     4
TIME       BETAHDT   HINGE-1 EULER ANGLE RATES
    1    5     6     7
TIME       XYZ-DT    HINGE-1 INERTIAL REFERENCED VELOCITY VECTOR
    1    8     9    10
TIME       BETAHDT   HINGE-2 EULER ANGLE RATES
0000000000
   13     1
    1  118   119   120   121   122   123   124   125   126   127   128   129
    1    7     8
TIME       DELTADT   ROLL-CHANNEL
    1    9    10
TIME       DELTADT   PITCH-CHANNEL
    1   11    12
TIME       DELTADT   YAW CHANNEL
0000000000
   15     1
    1  130   131   132   133   134   135   136   137   138   139   140   141   142   143
    1    2     3     4
TIME       LAMBDA    HINGE-2 INTERCONNECTION FORCES
0000000000
```

```
   11     1
    1  144  145  146  147  148  243  244  245  246  247
    1    7    8
TIME      MOMENTUM  TOTAL ANGULAR AND LINEAR MOMENTUM
    1    9   10   11
TIME      ENERGY    KINETIC, POTENTIAL AND TOTAL ENERGY -- T + V    +
0000000000
STOP
```

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ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 10.58.16
THE CPU TIMER = 0.0

NAS5-11996 DEMONSTRATION PROBLEM NUMBER 1,

THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS F SPACECRAFT AS A
SYSTEM OF SIX INTERCONNECTED BODIES. THERE ARE 4 ACTIVE MOMENTUM
WHEELS (ONE REPRESENTS REFLECTOR DYNAMICS FOR HIGHER ORDER
STRUCTURAL RESPONSE) WHILE THE OTHER THREE ARE USED FOR CONTROL TORQUE.

THE PROBLEM STARTS WITH INITIAL ATTITUDE AND RATE ERRORS AND
SIMULATES NON LINEAR TIME DOMAIN RESPONSE.

ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 10.58.16
THE CPU TIMER = 3.9667E-01

SUMMARY OF DYNAMIC-SIMULATION-PROGRAM INPUT DATA * * * * * * * * * * *

ACTUAL SIZES		MAXIMUM SIZES		INTEGRATION DATA		GRAVITY GRADIENT DATA				MISC. DATA	
NB =	6	NPMAX =	6	STARTT =	0.0	G1 =	0.0	GAMA1 =	0.0	NOPRNT =	20
NH =	6	NHMAX =	6	DELTAT =	1.250D-02	G2 =	0.0	GAMA2 =	0.0	NOPLOT =	1
NSPT =	4	NSPMAX =	15	ENDT =	3.000D+00	G3 =	0.0	GAMA3 =	0.0	IFLNER =	0
NOFMO =	4	NMWMAX =	5			GMAG =	0.0	RCMAG =	0.0		
NDELTA =	7	NMWBOD =	4								
NU =	40	NMDBOD =	12								
NBETA =	17	KMU =	22								
NLAM =	19	KY =	250								
NEQ =	64	KU =	113								

THE TOPOLOGY ARRAY (ITOPOL) FOR THIS CASE FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	2	3	4	5	6
2	1	0	1	1	1	1	1

THE CONSTRAINT SPECIFICATIONS FOR THIS CASE FOLLOW

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	1	1	1	1	1
2	1	0	0	0	0	1	1
3	1	0	0	1	1	0	0
4	1	0	0	0	0	0	0
5	1	0	1	1	1	1	1
6	1	0	1	1	1	1	1
7	1	0	1	1	1	1	1

THE SPECIFIED INITIAL HINGE ANGLES AND DISPLACEMENTS (BETAH) FOLLOW

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.463D-03	4.000D-02	7.000D-02	9.000D-02	0.0	0.0
2	1	1.962D-03	5.000D-02	0.0	0.0	1.100D-01	1.300D-01
3	1	1.094D-03	6.000D-02	8.000D-02	1.000D-01	1.200D-01	1.400D-01
4	1	-3.020D-02	0.0	0.0	0.0	0.0	0.0
5	1	-1.445D-02	0.0	0.0	0.0	0.0	0.0
6	1	2.435D+01	0.0	0.0	0.0	0.0	0.0

THE SPECIFIED INITIAL HINGE RATES (BETAHD) FOLLOW

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.000D-02	0.0	0.0	0.0	0.0	0.0
2	1	2.000D-02	0.0	0.0	0.0	0.0	0.0
3	1	3.000D-02	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	0.0

ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 10.58.17
THE CPU TIMER = 5.5667E-01

THE NO. OF ELASTIC MODES/BODY ARRAY (IRGFLX) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0	0	0	0	0	0

THE NO. OF P/Q HINGE POINTS/BODY ARRAY (NHPOI) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	5	1	1	1	1	1

THE NO. OF SENSOR POINTS/BODY ARRAY (NSPOI) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3	1	0	0	0	0

THE MOM. WHEEL/BODY TABLE (NMOW) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3	1	0	0	0	0
2	1	3	1	0	0	0	0
3	1	1	4	0	0	0	0
4	1	2	0	0	0	0	0
5	1	3	0	0	0	0	0
6	1	0	0	0	0	0	0

THE STATE VECTOR LENGTH ARRAY (LENU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	1	9	7	6	6	6	6	0	0	0	0	0	0	17	7

THE STATE VECTOR LOCATION ARRAY (LOCU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	1	1	10	17	23	29	35	41	41	41	41	41	41	41	58

THE SPECIFIED SENSOR POINT/BODY CORRELATION ARRAY (IFTSMW) FOLLOWS

		(1)	(2)	(3)	(4)
1	1	1	1	1	2

ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 10.58.17
THE CPU TIMER = 6.7000E-01

THE FOLLOWING DATA IS SPECIFIED MOM. WHEEL INFORMATION (IF ANY) AND CONTROLLER INFORMATION

THE SPECIFIED MOM. WHEEL CONTROL ARRAY (IMO) FOLLOWS

		(1)	(2)	(3)	(4)
1	1	1	2	3	4
2	1	1	2	3	3
3	1	1	1	1	1

THE SPECIFIED MOM. WHEEL RATES AND INERTIAS (AMC) FOLLOW

		(1)	(2)	(3)	(4)
1	1	1.278D+02	1.278D+02	1.278D+02	0.0
2	1	6.500D-02	6.500D-02	6.500D-02	9.670D+01

THE SPECIFIED CONTROLLER INITIAL CONDITIONS AND CHARACTERISTICS FOLLOW
(THE FIRST NDELTA ARE INITIAL CONTROLLER STATE VARIABLES, THERE ARE 40 ADDITIONAL CONTROL PARAMETERS)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.289D+04	2.880D+02	0.0
1	11	0.0	0.0	0.0	0.0	2.097D+05	2.076D+05	6.747D+03	1.177D+05	0.0	7.884D+04
1	21	1.177D+05	0.0	7.884D+04	0.0	7.872D+02	7.872D+02	0.0	7.872D+02	7.872D+02	0.0
1	31	0.0	0.0	9.411D+01	9.438D+01	5.712D+01	2.619D+02	0.0	2.127D+02	2.619D+02	0.0
1	41	2.127D+02	0.0	1.002D+01	1.002D+01	0.0	1.002D+01	1.002D+01			

A-14

ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 10.58.17
THE CPU TIMER = 8.9667E-01

SUMMARY OF INPUT DATA FOR BODY 1 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3.714D+03	5.096D+00	-3.273D+01	0.0	0.0	0.0
2	1	5.096D+00	3.557D+03	-2.910D+00	0.0	0.0	0.0
3	1	-3.273D+01	-2.910D+00	4.776D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	6.827D+01	0.0	0.0
5	1	0.0	0.0	0.0	0.0	6.827D+01	0.0
6	1	0.0	0.0	0.0	0.0	0.0	6.827D+01

FOR BODY 1 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1
2	1	3	1
3	1	4	1
4	1	5	1
5	1	6	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	3.142D+00	0.0	3.020D-02	1.445D-02	-1.266D+01
2	1	0.0	0.0	3.142D+00	3.020D-02	3.431D+00	-1.350D+01
3	1	0.0	0.0	0.0	3.020D-02	-3.402D+00	-1.350D+01
4	1	0.0	0.0	0.0	1.297D+00	1.445D-02	4.314D+00
5	1	0.0	0.0	3.142D+00	-1.236D+00	1.445D-02	4.314D+00

FOR BODY 1 THE SENSOR POINT NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES(1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	1	1
2	1	2	1
3	1	3	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	1.445D-02	-1.266D+01
2	1	0.0	0.0	0.0	0.0	3.431D+00	-1.350D+01
3	1	0.0	0.0	0.0	0.0	-3.402D+00	-1.350D+01

ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 10.58.18
THE CPU TIMER = 1.1500E+00

SUMMARY OF INPUT DATA FOR BODY 2 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.005D+02	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.008D+02	0.0	0.0	0.0	0.0
3	1	0.0	0.0	1.934D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	3.556D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	3.556D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	3.556D+00

FOR BODY 2 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	3.142D+00	0.0	0.0	0.0	-1.352D+00

FOR BODY 2 THE SENSOR POINT NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES(1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	4	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	-1.352D+00

ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 10.58.18
THE CPU TIMER = 1.2933E+00

SUMMARY OF INPUT DATA FOR BODY 3 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.690D+02	4.769D+00	-1.430D-01	0.0	0.0	0.0
2	1	4.769D+00	4.009D+01	1.959D+00	0.0	0.0	0.0
3	1	-1.430D-01	1.959D+00	1.451D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	5.155D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	5.155D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	5.155D+00

FOR BODY 3 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	3	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	3.142D+00	3.700D-01	-1.581D+01	-7.008D-02

ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 10.58.18
THE CPU TIMER = 1.4067E+00

SUMMARY OF INPUT DATA FOR BODY 4 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.690D+02	4.769D+00	1.430D-01	0.0	0.0	0.0
2	1	4.769D+00	4.009D+01	-1.959D+00	0.0	0.0	0.0
3	1	1.430D-01	-1.959D+00	1.451D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	5.155D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	5.155D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	5.155D+00

FOR BODY 4 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	4	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	-3.700D-01	1.581D+01	-7.008D-02

ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 10.58.18
THE CPU TIMER = 1.5233E+00

SUMMARY OF INPUT DATA FOR BODY 5 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	7.976D-01	0.0	0.0	0.0	0.0	0.0
2	1	0.0	7.976D-01	0.0	0.0	0.0	0.0
3	1	0.0	0.0	7.976D-01	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.708D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	1.708D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.708D+00

FOR BODY 5 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	5	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	-1.0000D-03

ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 10.58.19
THE CPU TIMER = 1.6500E+00

SUMMARY OF INPUT DATA FOR BODY 6 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	7.976D-01	0.0	0.0	0.0	0.0	0.0
2	1	0.0	7.976D-01	0.0	0.0	0.0	0.0
3	1	0.0	0.0	7.976D-01	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.708D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	1.708D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.708D+00

FOR BODY 6 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	6	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	3.142D+00	0.0	0.0	-1.000D-03

THE FOLLOWING INTEGER ARRAY (INDEP) PRESCRIBES INDEPENDENT VARIABLES (1), AND DEPENDENT VARIABLES (0)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
1	1	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	0	0	0	1
1	21	1	1	0	0	0	1	0	1	0	1	1	0	1	0	0	1	1	1	1	0
1	41	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	61	1	1	1	1																

A-20

ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 10.58.22
THE CPU TIMER = 3.8667E+00

AT SIMULATION TIME, T = 0.0 *

THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.002D-02	1.999D-02	3.002D-02	4.163D-17	6.072D-18	-4.933D-18	1.278D+02	1.278D+02	1.278D+02	7.329D-03
1	11	1.925D-02	3.126D-02	-2.346D-01	1.024D-01	-8.024D-03	0.0	1.142D-02	1.698D-02	3.134D-02	-8.553D-01
1	21	1.504D-01	2.300D-01	1.223D-02	2.149D-02	2.810D-02	2.922D-01	1.581D-01	-2.481D-01	9.011D-03	1.905D-02
1	31	3.094D-02	8.698D-02	-1.483D-02	-1.620D-02	1.648D-02	1.786D-02	2.847D-02	7.624D-02	-9.191D-02	1.353D-02
1	41	1.463D-03	1.962D-03	1.094D-03	-3.020D-02	-1.445D-02	2.435D+01	4.000D-02	5.000D-02	6.000D-02	7.000D-02
1	51	8.000D-02	9.000D-02	1.000D-01	1.100D-01	1.200D-01	1.300D-01	1.400D-01	0.0	0.0	0.0
1	61	0.0	0.0	0.0	0.0						

AT SIMULATION TIME, T = 0.0 *

THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-1.239D-02	8.625D-01	3.391D+01	7.833D+00	4.767D+00	-1.408D+01	-8.590D-02	-9.608D-01	-3.401D+01	8.425D+01
1	11	-9.172D+01	4.186D+00	-1.273D+02	-1.079D+02	-1.403D+01	-4.186D+00	6.495D+00	-2.037D+00	-1.116D+01	5.700D+01
1	21	1.985D+01	8.820D+01	-8.235D+00	4.753D+00	-1.183D+01	-7.529D+01	-1.062D+01	1.139D+02	-1.671D+01	-1.074D+02
1	31	-1.184D+02	1.831D+01	4.695D+01	-1.389D+01	2.224D+01	1.264D+02	-1.382D+02	4.141D+00	-3.806D+01	-1.434D+01
1	41	1.000D-02	2.000D-02	3.000D-02	4.162D-17	6.124D-18	-5.006D-18	-7.947D-17	1.924D-17	3.469D-18	1.128D-18
1	51	-6.072D-18	5.204D-18	-3.383D-17	2.168D-17	0.0	-1.740D-17	-1.735D-18	3.413D-02	4.997D+00	1.395D-02
1	61	5.014D+00	1.863D-02	5.008D+00	0.0						

AT SIMULATION TIME, T = 0.0 *

THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.463D-03	4.000D-02	7.000D-02	9.000D-02	0.0	0.0
2	1	1.962D-03	5.000D-02	0.0	0.0	1.100D-01	1.300D-01
3	1	1.094D-03	6.000D-02	8.000D-02	1.000D-01	1.200D-01	1.400D-01
4	1	-3.020D-02	0.0	0.0	0.0	0.0	0.0
5	1	-1.445D-02	0.0	0.0	0.0	0.0	0.0
6	1	2.435D+01	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0 *

THE BETA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.000D-02	-7.947D-17	1.128D-18	5.204D-18	0.0	0.0
2	1	2.000D-02	1.924D-17	0.0	0.0	2.168D-17	-1.740D-17
3	1	3.000D-02	3.469D-18	-6.072D-18	-3.383D-17	0.0	-1.735D-18
4	1	4.162D-17	0.0	0.0	0.0	0.0	0.0
5	1	6.124D-18	0.0	0.0	0.0	0.0	0.0
6	1	-5.006D-18	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0 *

THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0 *

THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	1	3.413D-02	4.997D+00	1.395D-02	5.014D+00	1.863D-02	5.008D+00	0.0

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         AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  1   THE VELOCITIES ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)
  1    1      1.002D-02  1.999D-02  3.002D-02  4.163D-17  6.072D-18 -4.933D-18  1.278D+02  1.278D+02  1.278D+02
FOR BODY  1   THE CORRESPONDING MOMENTA ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)
  1    1      4.464D+01  7.938D+01  2.226D+01  2.842D-15  4.145D-16 -3.368D-16  8.306D+00  8.307D+00  8.308D+00
FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1      4.460D+01  7.939D+01  2.229D+01  2.841D-15  4.181D-16 -3.418D-16
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     1.59355394D+03 0.0

         AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)
  1    1      7.329D-03  1.925D-02  3.126D-02 -2.346D-01  1.024D-01 -8.024D-03  0.0
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)
  1    1      7.364D-01  1.940D+00  6.045D+00 -8.342D-01  3.640D-01 -2.853D-02  3.023D+00
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1     -4.220D+00 -8.463D+00  5.992D+00 -8.117D-01  4.126D-01 -2.314D-03
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     2.32438336D-01 0.0

         AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  3   THE VELOCITIES ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1      1.142D-02  1.698D-02  3.134D-02 -8.553D-01  1.504D-01  2.300D-01
FOR BODY  3   THE CORRESPONDING MOMENTA ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1      2.005D+00  7.967D-01  4.579D+00 -4.409D+00  7.756D-01  1.186D+00
FOR BODY  3   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1      1.930D+01 -4.069D+01  8.890D+01 -4.455D+00  4.961D-01  1.163D+00
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     2.17014102D+00 0.0

         AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  4   THE VELOCITIES ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1      1.223D-02  2.149D-02  2.810D-02  2.922D-01  1.581D-01 -2.481D-01
FOR BODY  4   THE CORRESPONDING MOMENTA ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1      2.173D+00  8.649D-01  4.036D+00  1.506D+00  8.151D-01 -1.279D+00
FOR BODY  4   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1      1.450D+01  1.642D+01  3.310D+01  1.414D+00  1.076D+00 -1.189D+00
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     5.22403109D-01 0.0

         AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  5   THE VELOCITIES ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1      9.011D-03  1.905D-02  3.094D-02  8.698D-02 -1.483D-02 -1.620D-02
FOR BODY  5   THE CORRESPONDING MOMENTA ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1      7.187D-03  1.519D-02  2.468D-02  1.486D-01 -2.533D-02 -2.768D-02
FOR BODY  5   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
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  1    1     2.127D-01  4.272D+00  1.557D-02  1.465D-01 -7.134D-03 -4.433D-02
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     7.43184927D-03 0.0

       AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  6   THE VELOCITIES ARE
            ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1     1.648D-02  1.786D-02  2.847D-02  7.624D-02 -9.191D-02  1.353D-02
FOR BODY  6,  THE CORRESPONDING MOMENTA ARE
            ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1     1.315D-02  1.425D-02  2.270D-02  1.302D-01 -1.570D-01  2.311D-02
FOR BODY  6   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
            ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1     3.941D+00  4.278D+00  1.977D-01  1.468D-01 -1.372D-01  4.198D-02
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     1.28929564D-02 0.0

       AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE INTERCONNECTION CONSTRAINT FORCES(LAMBDAS) ARE
            ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1    1     4.766D+02 -3.567D+02  1.184D+01 -7.770D+02 -2.848D+02 -1.569D+02  4.449D+02 -1.133D+03 -3.808D+02 -1.456D+02
  1   11     5.765D+02 -1.341D+01  1.871D+01  8.336D+01 -2.594D+01 -1.782D+01 -1.912D+01  6.339D+01 -2.221D+01

       AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
            ( 1)        ( 2)        ( 3)
  1    1     7.833D+01  5.520D+01  1.505D+02
THE TOTAL LINEAR MOMENTUM VECTOR IS
            ( 1)        ( 2)        ( 3)
  1    1    -3.560D+00  1.840D+00 -3.044D-02

THE TOTAL ANGULAR MOMENTUM =  1.78413248D+02
THE TOTAL LINEAR MOMENTUM  =  4.00749179D+00
THE TOTAL KINETIC ENERGY   =  1.59649924D+03
THE TOTAL POTENTIAL ENERGY =  1.87538333D+03
THE TOTAL ENERGY (T + V)   =  3.47188257D+03
```

ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 11.14.25
THE CPU TIMER = 7.3146E+02

AT SIMULATION TIME, T = 3.00000D+00* *
THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-4.232D-03	-2.522D-03	-7.446D-02	1.217D-01	7.273D-02	2.526D-01	1.289D+02	1.289D+02	1.290D+02	4.542D-01
1	11	-2.396D-01	-4.226D-01	-1.723D-01	-5.958D-01	2.544D-01	-1.568D-02	-9.603D-02	-5.272D-03	1.715D-01	-2.300D+00
1	21	-3.576D-02	-1.283D+00	1.734D-01	1.855D-03	1.306D-02	1.091D-01	-1.037D-02	-2.475D+00	-4.207D-03	-1.399D-02
1	31	-2.181D-01	1.119D-01	-5.382D-03	2.558D-01	-4.207D-03	-1.399D-02	-2.181D-01	1.116D-01	1.833D-01	2.495D-01
1	41	3.594D-02	6.427D-02	1.486D-01	-1.161D-02	-5.841D-03	2.409D+01	2.969D-03	1.100D-02	1.424D-02	-5.186D-02
1	51	1.153D-02	-6.189D-02	1.344D-03	8.959D-07	-1.757D-03	-9.302D-07	-1.757D-03	5.141D-01	1.696D+00	2.394D-01
1	61	1.698D+00	3.114D-01	1.698D+00	-8.587D-04						

AT SIMULATION TIME, T = 3.00000D+00* *
THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-2.618D-01	3.660D-01	2.400D+00	9.173D-01	8.688D-01	9.721D+00	6.434D-01	1.564D-02	-2.018D+00	5.508D+00
1	11	-2.098D+01	7.751D-01	-3.213D+01	-9.735D+00	9.613D+00	-3.476D-01	-4.685D+00	5.743D-01	-1.369D+00	9.407D+00
1	21	-1.278D+00	-6.492D+01	5.543D+00	1.810D-01	-3.186D-01	-8.873D-01	-3.699D+00	-7.727D+01	-2.609D-01	1.374D-01
1	31	3.539D+00	2.456D+00	5.131D+00	9.241D+00	-2.609D-01	1.374D-01	3.539D+00	2.440D+00	-9.483D-01	1.017D+01
1	41	-3.820D-03	-3.121D-03	-7.422D-02	1.256D-01	8.108D-02	2.482D-01	-4.542D-01	-2.437D-01	3.531D-01	9.173D-02
1	51	2.457D-01	1.777D-01	8.754D-02	-1.146D-02	-1.436D-01	1.146D-02	-1.436D-01	1.895D-01	7.328D-03	7.868D-02
1	61	4.555D-03	1.052D-01	4.666D-03	-1.568D-02						

AT SIMULATION TIME, T = 3.00000D+00* *
THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3.594D-02	2.969D-03	-5.186D-02	-6.189D-02	0.0	0.0
2	1	6.427D-02	1.100D-02	0.0	0.0	8.959D-07	-9.302D-07
3	1	1.486D-01	1.424D-02	1.153D-02	1.344D-03	-1.757D-03	-1.757D-03
4	1	-1.161D-02	0.0	0.0	0.0	0.0	0.0
5	1	-5.841D-03	0.0	0.0	0.0	0.0	0.0
6	1	2.409D+01	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 3.00000D+00* *
THE BETA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	-3.820D-03	-4.542D-01	9.173D-02	1.777D-01	0.0	0.0
2	1	-3.121D-03	-2.437D-01	0.0	0.0	-1.146D-02	1.146D-02
3	1	-7.422D-02	3.531D-01	2.457D-01	8.754D-02	-1.436D-01	-1.436D-01
4	1	1.256D-01	0.0	0.0	0.0	0.0	0.0
5	1	8.108D-02	0.0	0.0	0.0	0.0	0.0
6	1	2.482D-01	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 3.00000D+00* *
THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	1	5.141D-01	1.696D+00	2.394D-01	1.698D+00	3.114D-01	1.698D+00	-8.587D-04

AT SIMULATION TIME, T = 3.00000D+00* *
THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	1	1.895D-01	7.328D-03	7.868D-02	4.555D-03	1.052D-01	4.666D-03	-1.568D-02

```
          AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
 FOR BODY  1   THE VELOCITIES ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)
   1    1   -4.232D-03 -2.522D-03 -7.446D-02  1.217D-01  7.273D-02  2.526D-01  1.289D+02  1.289D+02  1.290D+02
 FOR BODY  1   THE CORRESPONDING MOMENTA ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)
   1    1   -4.915D+00 -4.018D-01 -2.704D+01  8.309D+00  4.966D+00  1.725D+01  8.376D+00  8.376D+00  8.378D+00
 FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
   1    1   -1.400D+02  2.066D+02 -2.671D+01  8.575D+00  5.536D+00  1.694D+01
 ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     1.62345644D+03 0.0


          AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
 FOR BODY  2   THE VELOCITIES ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)
   1    1    4.542D-01 -2.396D-01 -4.226D-01 -1.723D-01 -5.958D-01  2.544D-01 -1.568D-02
 FOR BODY  2   THE CORRESPONDING MOMENTA ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)
   1    1    4.564D+01 -2.415D+01 -8.325D+01 -6.126D-01 -2.119D+00  9.046D-01 -4.239D+01
 FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
   1    1    7.078D+01 -1.774D+01 -8.551D+01 -2.543D-01 -2.210D+00  8.573D-01
 ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     3.19805669D+01 0.0


          AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
 FOR BODY  3   THE VELOCITIES ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
   1    1   -9.603D-02 -5.272D-03  1.715D-01 -2.300D+00 -3.576D-02 -1.283D+00
 FOR BODY  3   THE CORRESPONDING MOMENTA ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
   1    1   -1.627D+01 -3.333D-01  2.488D+01 -1.186D+01 -1.844D-01 -6.614D+00
 FOR BODY  3   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
   1    1   -1.097D+02 -1.803D+02  2.666D+02 -1.213D+01 -1.521D+00 -5.913D+00
 ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     2.07938193D+01 0.0


          AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
 FOR BODY  4   THE VELOCITIES ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
   1    1    1.734D-01  1.855D-03  1.306D-02  1.091D-01 -1.037D-02 -2.475D+00
 FOR BODY  4   THE CORRESPONDING MOMENTA ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
   1    1    2.931D+01  8.758D-01  1.916D+00  5.622D-01 -5.348D-02 -1.276D+01
 FOR BODY  4   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
   1    1    2.675D+02  3.499D+01 -3.067D+00 -1.383D-01 -2.908D-01 -1.277D+01
 ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     1.83755169D+01 0.0


          AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
 FOR BODY  5   THE VELOCITIES ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
   1    1   -4.207D-03 -1.399D-02 -2.181D-01  1.119D-01 -5.382D-03  2.558D-01
 FOR BODY  5   THE CORRESPONDING MOMENTA ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
   1    1   -3.356D-03 -1.116D-02 -1.739D-01  1.911D-01 -9.192D-03  4.370D-01
 FOR BODY  5   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
```

```
  1     1   -9.497D-02  5.515D+00 -1.788D-01  2.181D-01  3.628D-03  4.243D-01
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     8.56703845D-02 0.0


       AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  6   THE VELOCITIES ARE
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1     1   -4.207D-03 -1.399D-02 -2.181D-01  1.116D-01  1.833D-01  2.495D-01
FOR BODY  6   THE CORRESPONDING MOMENTA ARE
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1     1   -3.356D-03 -1.116D-02 -1.739D-01  1.906D-01  3.130D-01  4.261D-01
FOR BODY  6   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1     1   -9.331D+00  5.237D+00 -4.259D-01  1.698D-01  3.224D-01  4.279D-01
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     1.11511252D-01 0.0


       AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE INTERCONNECTION CONSTRAINT FORCES(LAMBDAS) ARE
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)       (10)
  1     1    1.155D+02 -3.302D+01 -3.444D+01  1.929D+02 -4.867D+01 -8.664D+00 -3.347D+02  1.912D+02 -4.575D+00 -4.146D+01
  1    11   -3.966D+02 -2.166D-01  4.203D+00  8.716D+00  1.579D+01  2.062D-01 -4.227D+00  1.667D+00  1.737D+01


       AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
              ( 1)       ( 2)       ( 3)
  1     1    7.916D+01  5.429D+01  1.507D+02
THE TOTAL LINEAR MOMENTUM VECTOR IS
              ( 1)       ( 2)       ( 3)
  1     1   -3.557D+00  1.840D+00 -2.923D-02

THE TOTAL ANGULAR MOMENTUM =  1.78669901D+02
THE TOTAL LINEAR MOMENTUM  =  4.00475219D+00
THE TOTAL KINETIC ENERGY   =  1.69480352D+03
THE TOTAL POTENTIAL ENERGY =  4.03065442D+02
THE TOTAL ENERGY (T + V)   =  2.09786896D+03

                                 CPU TIME/STEP  CPU TIME/REAL TIME
                                   3.0895E+00         2.4716E+02
```

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ATS F -- 6 INTERCONNECTED RIGID BODIES, 4 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 11.14.31
THE CPU TIMER = 7.3519E+02

SUMMARY OF PLOTTING INFORMATION

NAS5-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

```
NSET     =  11
NRPLOT   =  242          NCPLOT   =  247
KRPLOT   = 1000          KCPLOT   =   16

ISET  =    1
JVPL  =    1    2    3    4    5    6    7    8    9   10

     NCI   =    1     NCD    =    2    3    4     NGRID =    1
     TIME          OMEGA1         BODY-1  ANGULAR VELOCITY VECTOR

     NCI   =    1     NCD    =    5    6    7     NGRID =    1
     TIME          U-V-W          BODY-1 BODY REFERENCED VELOCITY VECTOR

     NCI   =    1     NCD    =    8    9   10     NGRID =    1
     TIME          THEDOT         MOMENTUM WHEEL  1,2, AND 3 ANGULAR RATES

ISET  =    2
JVPL  =    1   11   12   13   14   15   16   17

     NCI   =    1     NCD    =    2    3    4     NGRID =    1
     TIME          OMEGA2         BODY-2 ANGULAR VELOCITY VECTOR

     NCI   =    1     NCD    =    5    6    7     NGRID =    1
     TIME          U-V-W          BODY-2 LINEAR VELOCITY VECTOR

     NCI   =    1     NCD    =    8    0    0     NGRID =    1
     TIME          THEDOT         MOMENTUM WHEEL 4 ANGULAR RATE

ISET  =    3
JVPL  =    1   18   19   20   21   22   23   24   25   26   27   28   29

     NCI   =    1     NCD    =    2    3    4     NGRID =    1
     TIME          OMEGA3         BODY-3 ANGULAR VELOCITY VECTOR

     NCI   =    1     NCD    =    5    6    7     NGRID =    1
     TIME          U-V-W          BODY-3 LINEAR VELOCITY VECTOR

     NCI   =    1     NCD    =    8    9   10     NGRID =    1
```

```
     TIME          OMEGA4       BODY-4 ANGULAR VELOCITY VECTOR

     NCI    =    1     NCD    =   11   12   13     NGRID =    1
     TIME          U-V-W        BODY-4 LINEAR VELOCITY VECTOR

ISET  =    4
JVPL  =    1   30   31   32   33   34   35   36   37   38   39   40   41

     NCI    =    1     NCD    =    2    3    4     NGRID =    1
     TIME          OMEGA5       BODY-5 ANGULAR VELOCITY VECTOR

     NCI    =    1     NCD    =    5    6    7     NGRID =    1
     TIME          U-V-W        BODY-5 LINEAR VELOCITY VECTOR

     NCI    =    1     NCD    =    8    9   10     NGRID =    1
     TIME          OMEGA6       BODY-6 ANGULAR VELOCITY VECTOR

     NCI    =    1     NCD    =   11   12   13     NGRID =    1
     TIME          U-V-W        BODY-6 LINEAR VELOCITY VECTOR

ISET  =    5
JVPL  =    1   42   43   44   45   46   47   48   49   50   51   52   53

     NCI    =    1     NCD    =    2    3    4     NGRID =    1
     TIME          BETA         HINGE-1 EULER ANGLES

     NCI    =    1     NCD    =    5    6    7     NGRID =    1
     TIME          XYZ-1        HINGE-1 INERTIAL XYZ POSITION

     NCI    =    1     NCD    =    8    9   10     NGRID =    1
     TIME          BETA         HINGE-2 EULER ANGLES

ISET  =    6
JVPL  =    1   54   55   56   57   58   59   60   61   62   63   64   65

     NCI    =    1     NCD    =    7    8    0     NGRID =    1
     TIME          DELTA        ROLL CHANNEL CONTROL VARIABLES

     NCI    =    1     NCD    =    9   10    0     NGRID =    1
     TIME          DELTA        PITCH CHANNEL CONTROL VARIABLES

     NCI    =    1     NCD    =   11   12    0     NGRID =    1
     TIME          DELTA        YAW CHANNEL CONTROL VARIABLES

ISET  =    7
JVPL  =    1   72   73   74   81
```

```
     NCI   =   1    NCD   =   2   3   4    NGRID =   1
     TIME       THEDD      MOMENTUM WHEEL 1,2, AND 3-- ANGULAR ACCELERATION

ISET  =   8
JVPL  =   1  106  107  108  109  110  111  112  113  114  115  116  117

     NCI   =   1    NCD   =   2   3   4    NGRID =   1
     TIME       BETAHDT    HINGE-1 EULER ANGLE RATES

     NCI   =   1    NCD   =   5   6   7    NGRID =   1
     TIME       XYZ-CT     HINGE-1 INERTIAL REFERENCED VELOCITY VECTOR

     NCI   =   1    NCD   =   8   9  10    NGRID =   1
     TIME       BETAHDT    HINGE-2 EULER ANGLE RATES

ISET  =   9
JVPL  =   1  118  119  120  121  122  123  124  125  126  127  128  129

     NCI   =   1    NCD   =   7   8   0    NGRID =   1
     TIME       DELTADT    ROLL-CHANNEL

     NCI   =   1    NCD   =   9  10   0    NGRID =   1
     TIME       DELTADT    PITCH-CHANNEL

     NCI   =   1    NCD   =  11  12   0    NGRID =   1
     TIME       DELTACT    YAW CHANNEL

ISET  =  10
JVPL  =   1  130  131  132  133  134  135  136  137  138  139  140  141  142  143

     NCI   =   1    NCD   =   2   3   4    NGRID =   1
     TIME       LAMBDA     HINGE-2 INTERCONNECTION FORCES

ISET  =  11
JVPL  =   1  144  145  146  147  148  243  244  245  246  247

     NCI   =   1    NCD   =   7   8   0    NGRID =   1
     TIME       MOMENTUM   TOTAL ANGULAR AND LINEAR MOMENTUM

     NCI   =   1    NCD   =   9  10  11    NGRID =   1
     TIME       ENERGY     KINETIC, POTENTIAL AND TOTAL ENERGY -- T + V   +
```

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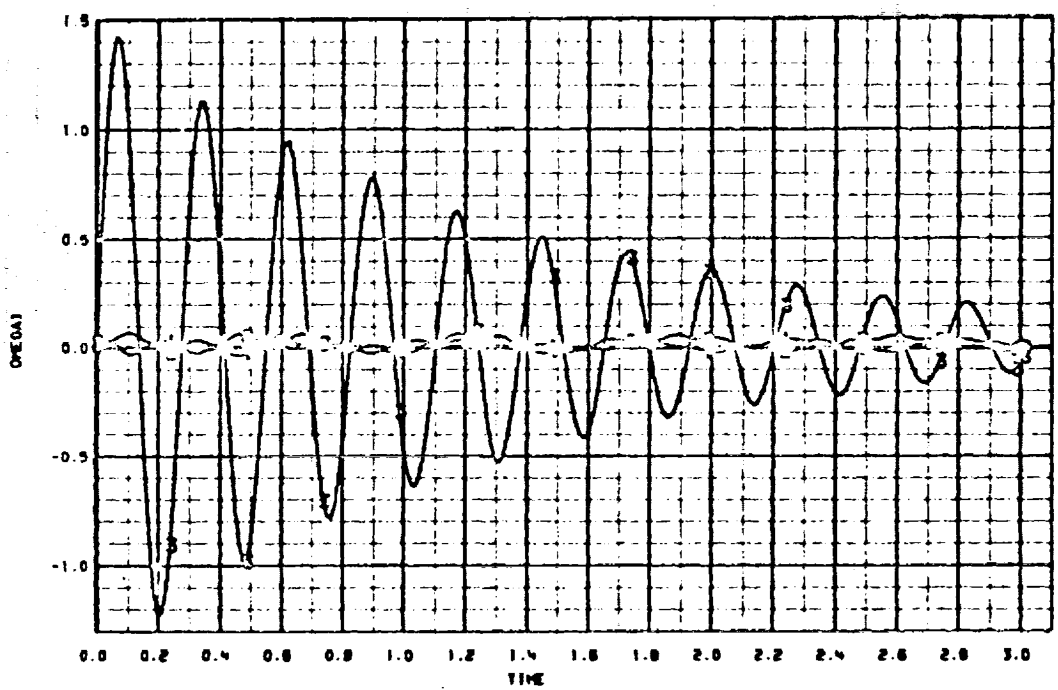
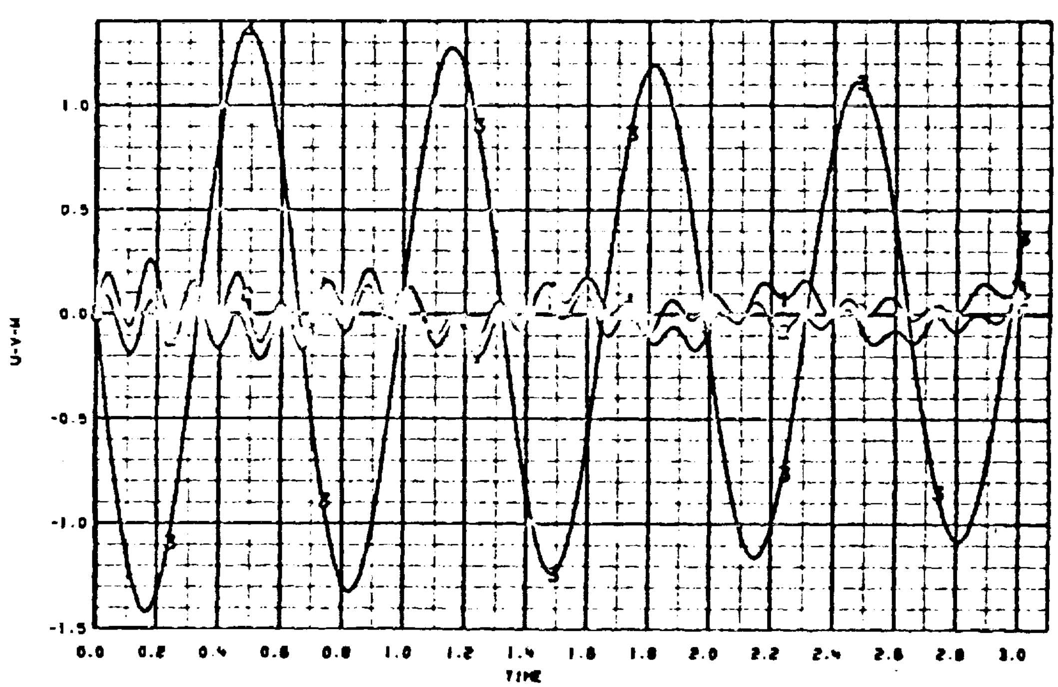


BODY-1 ANGULAR VELOCITY VECTOR

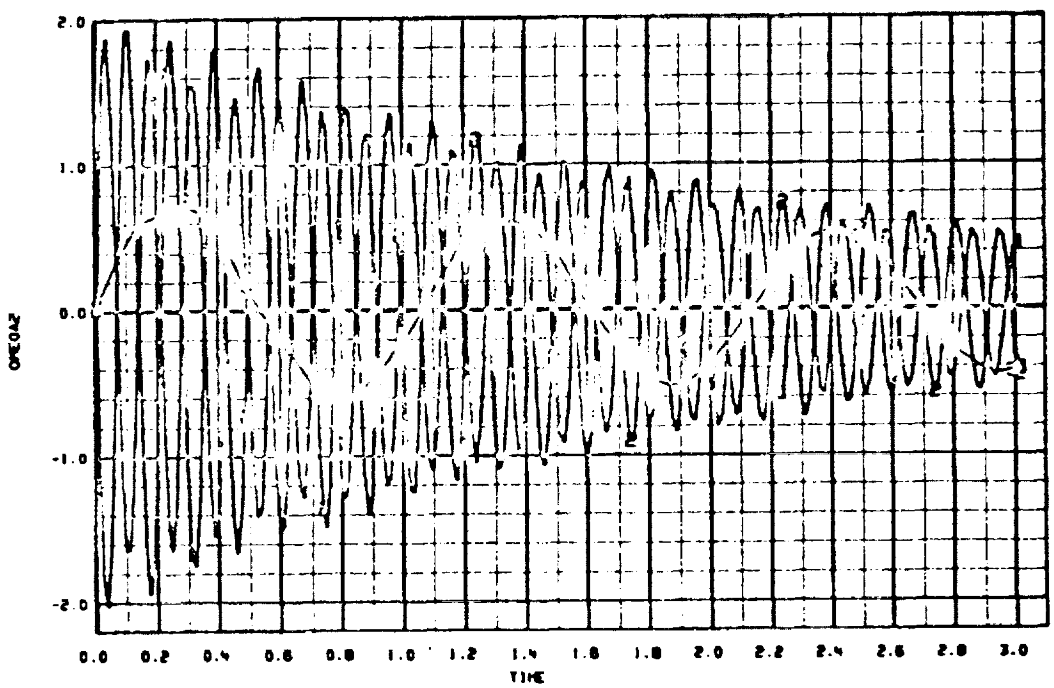


BODY-1 BODY REFERENCED VELOCITY VECTOR

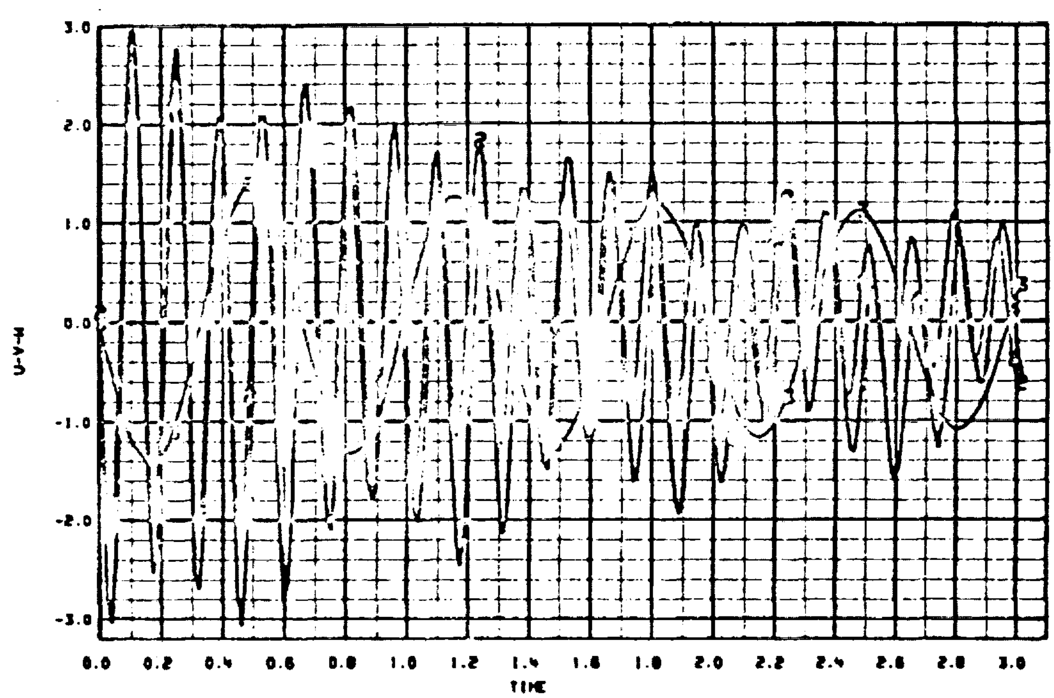
NAS5-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

DEMO 1 02/23/75 CARL BOOLEY

Figure A-1 Graphical Results, Demonstration Problem 1 (Sheet 1 of 11)



BODY-2 ANGULAR VELOCITY VECTOR

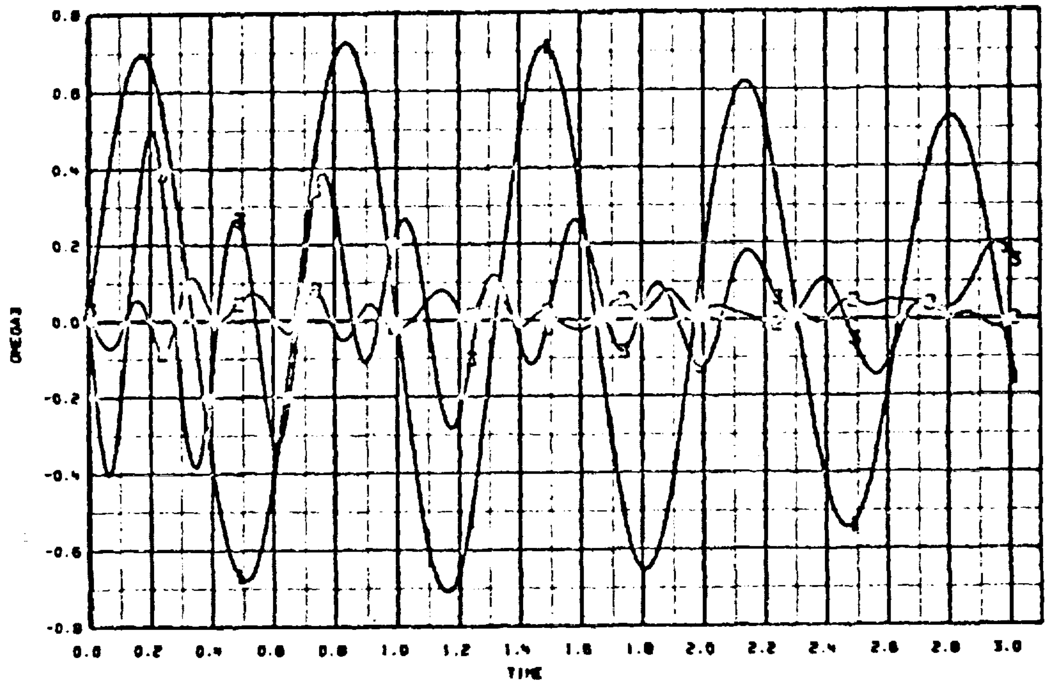


BODY-2 LINEAR VELOCITY VECTOR

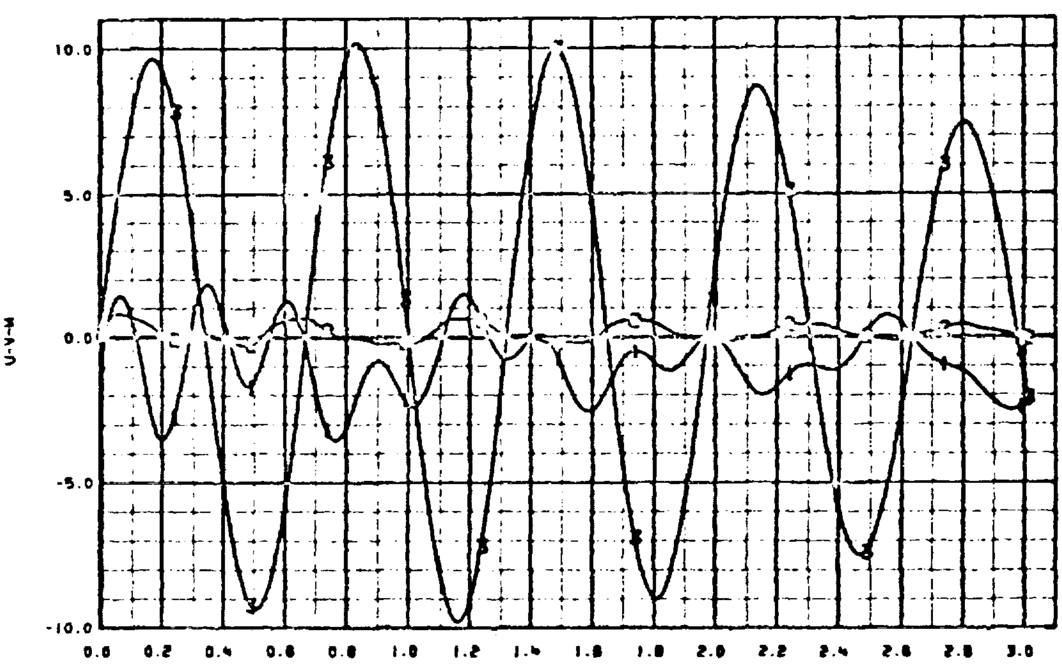
NAS5-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

DEMO 1 02/23/75 CARL BOOLEY

Figure A-1 Graphical Results, Demonstration Problem 1 (Sheet 2 of 11)



BODY-3 ANGULAR VELOCITY VECTOR

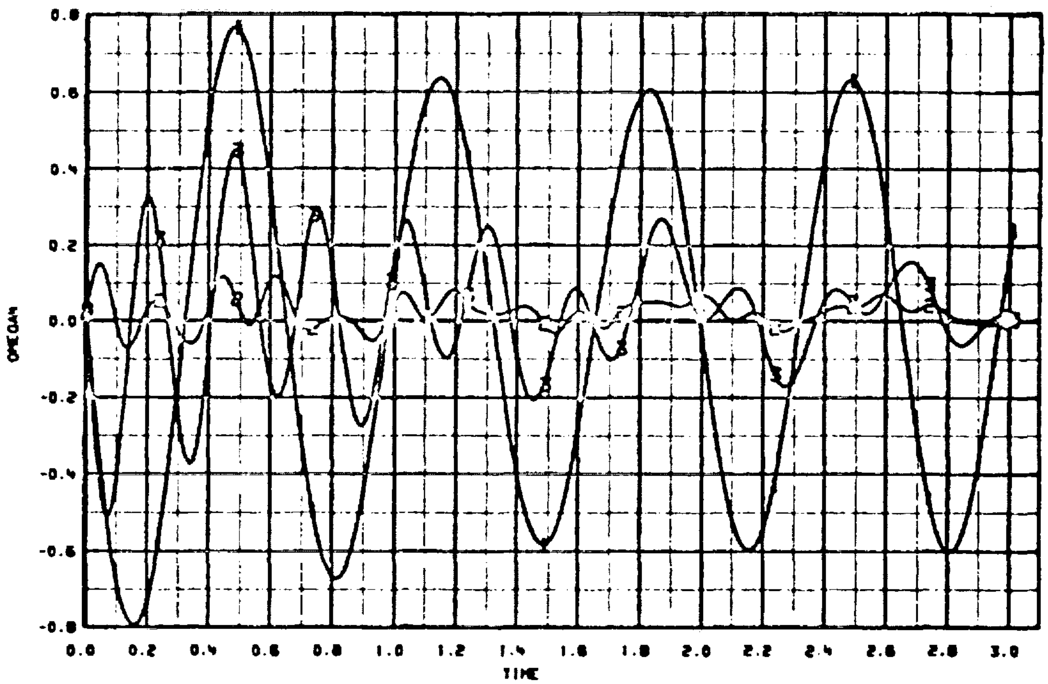


BODY-3 LINEAR VELOCITY VECTOR

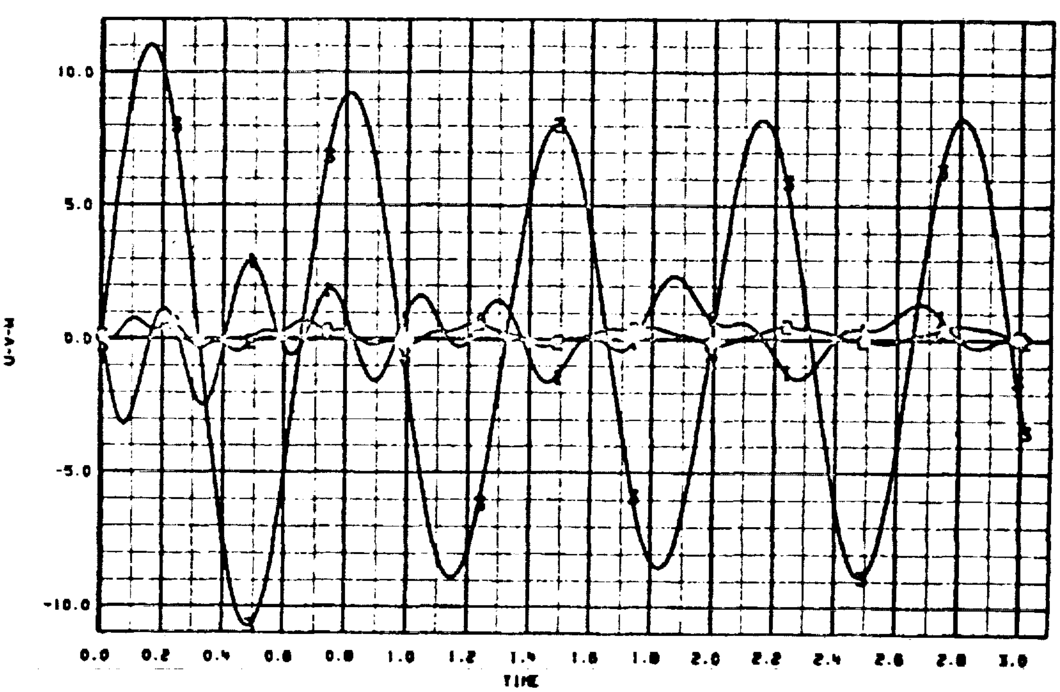
NAS5-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

DEMO 1 02/23/75 , CARL BODLEY

Figure A-1 Graphical Results, Demonstration Problem 1 (Sheet 3 of 11)



BODY-4 ANGULAR VELOCITY VECTOR

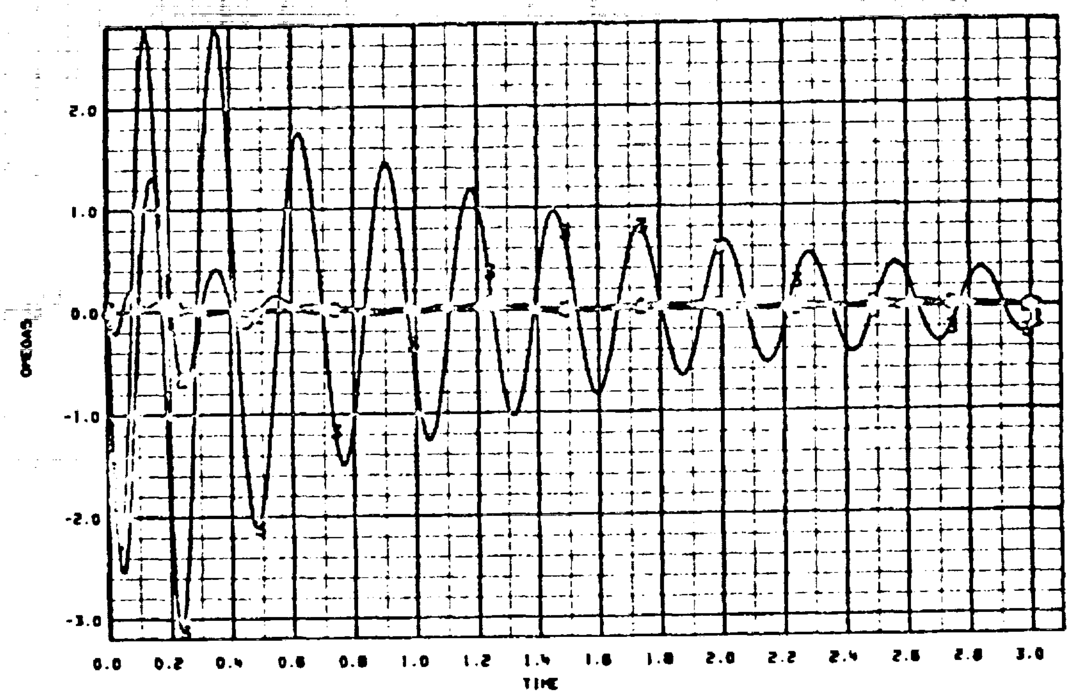


BODY-4 LINEAR VELOCITY VECTOR

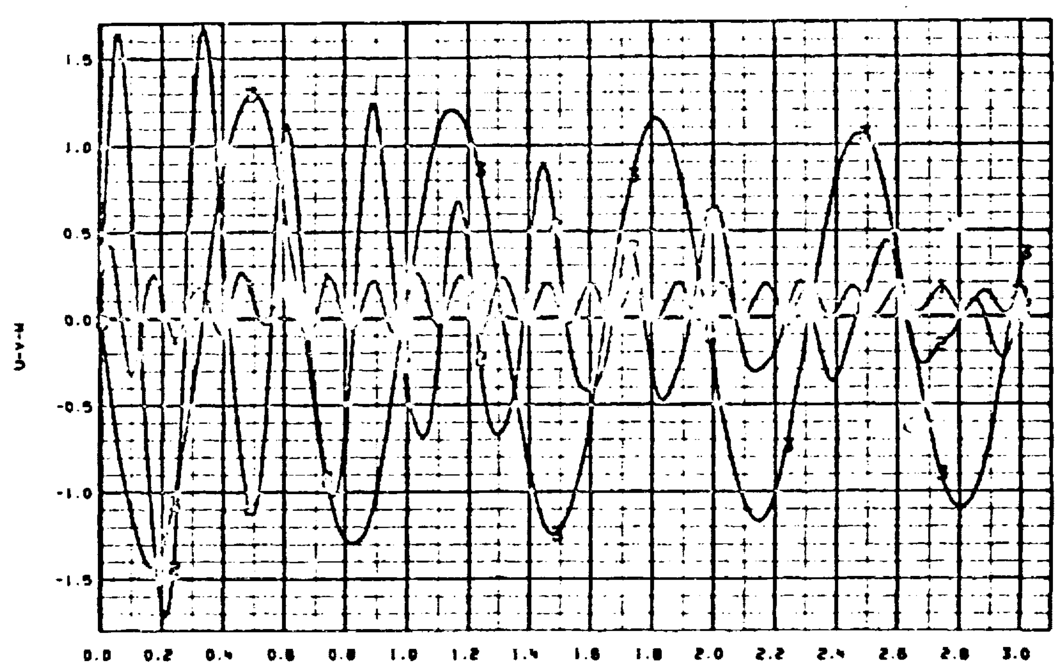
NAS5-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

DEMO 1 02/23/75 CARL BOOLEY

Figure A-1 Graphical Results, Demonstration Problem 1 (Sheet 4 of 11)



BODY-5 ANGULAR VELOCITY VECTOR

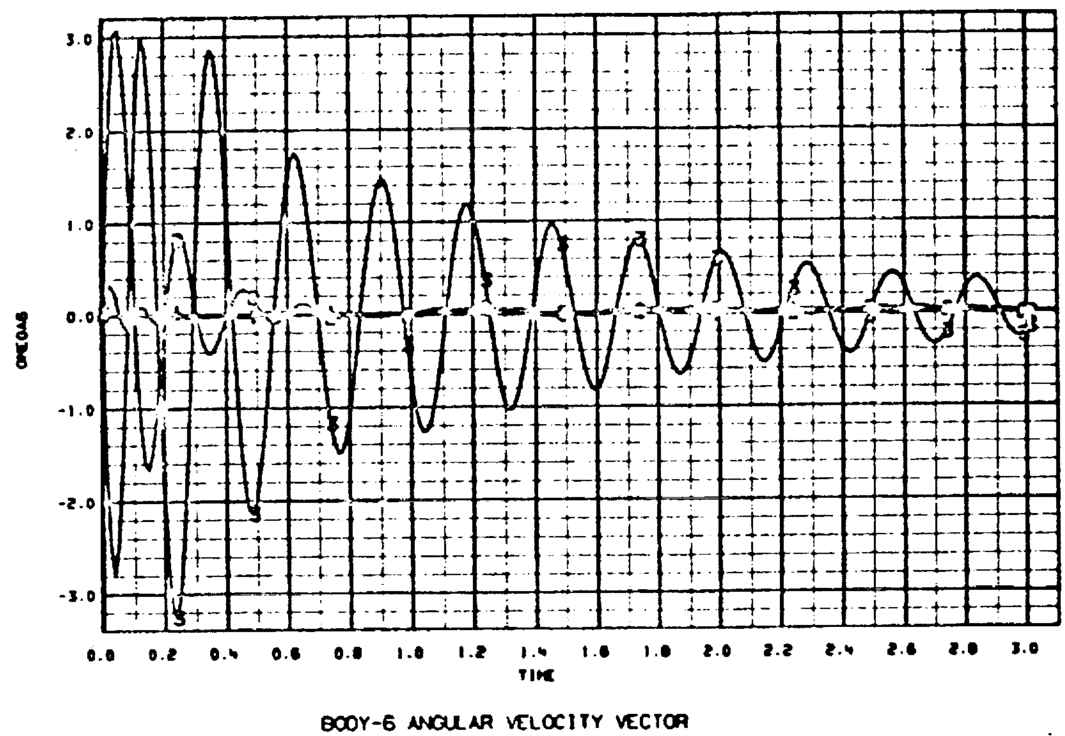


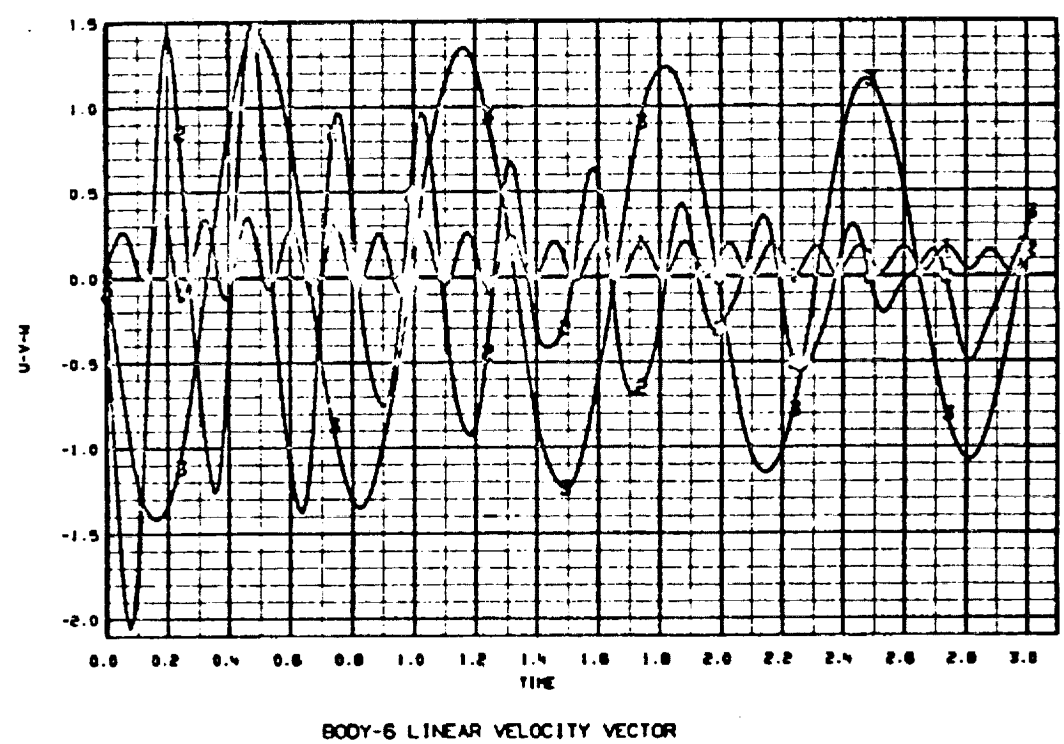
BODY-5 LINEAR VELOCITY VECTOR

NAS5-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

DEMO 1 02/23/75 CARL BOOLEY

Figure A-1 Graphical Results, Demonstration Problem 1 (Sheet 5 of 11)

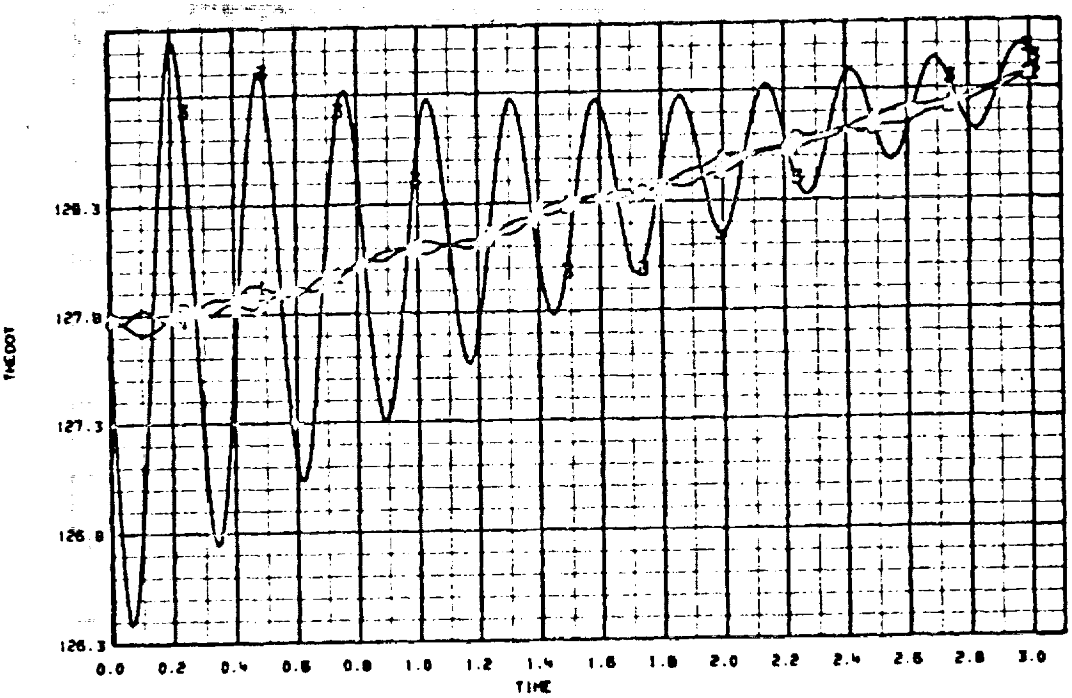




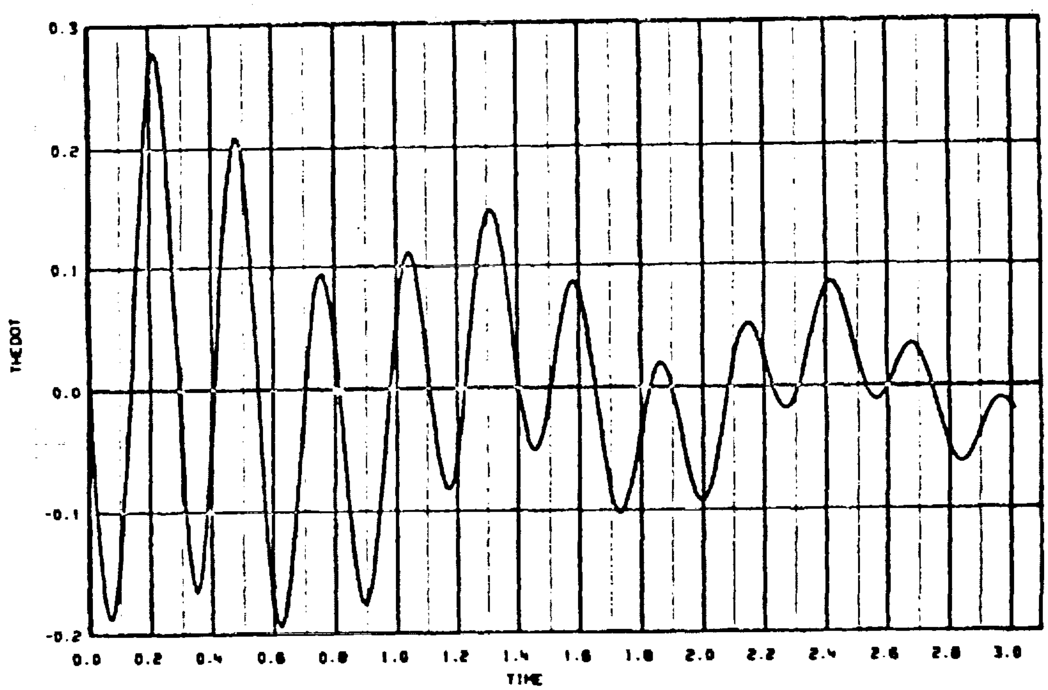
NASS-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

DEMO 1 02/23/75 CARL BOOLEY

Figure A-1 Graphical Results, Demonstration Problem 1 (Sheet 6 of 11)



MOMENTUM WHEEL 1, 2, AND 3 ANGULAR RATES

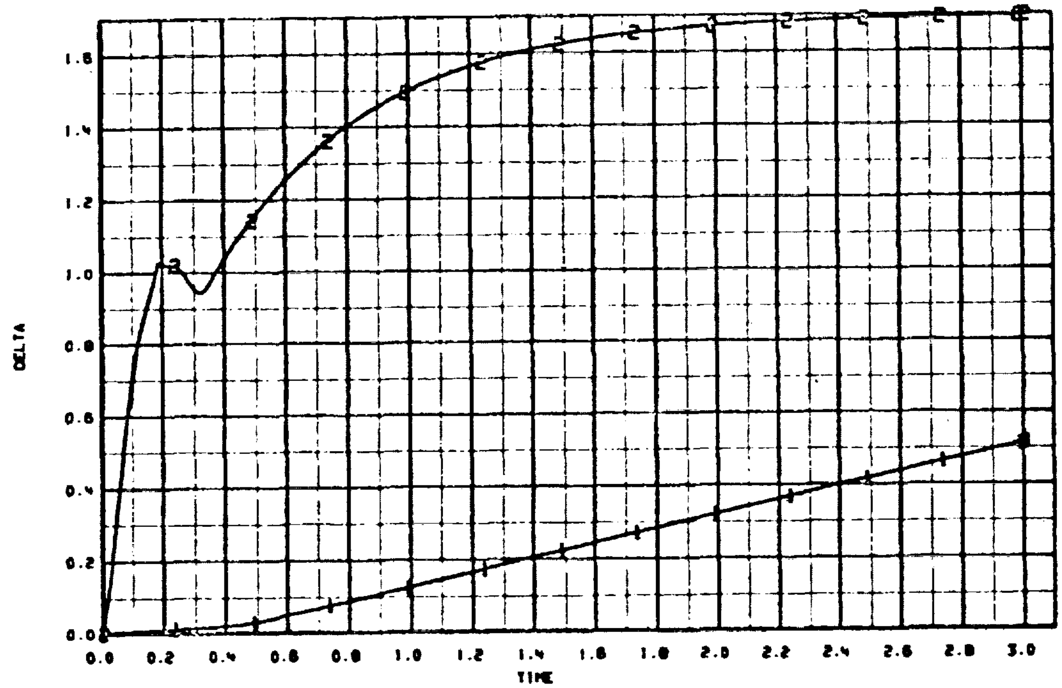


MOMENTUM WHEEL 4 ANGULAR RATE

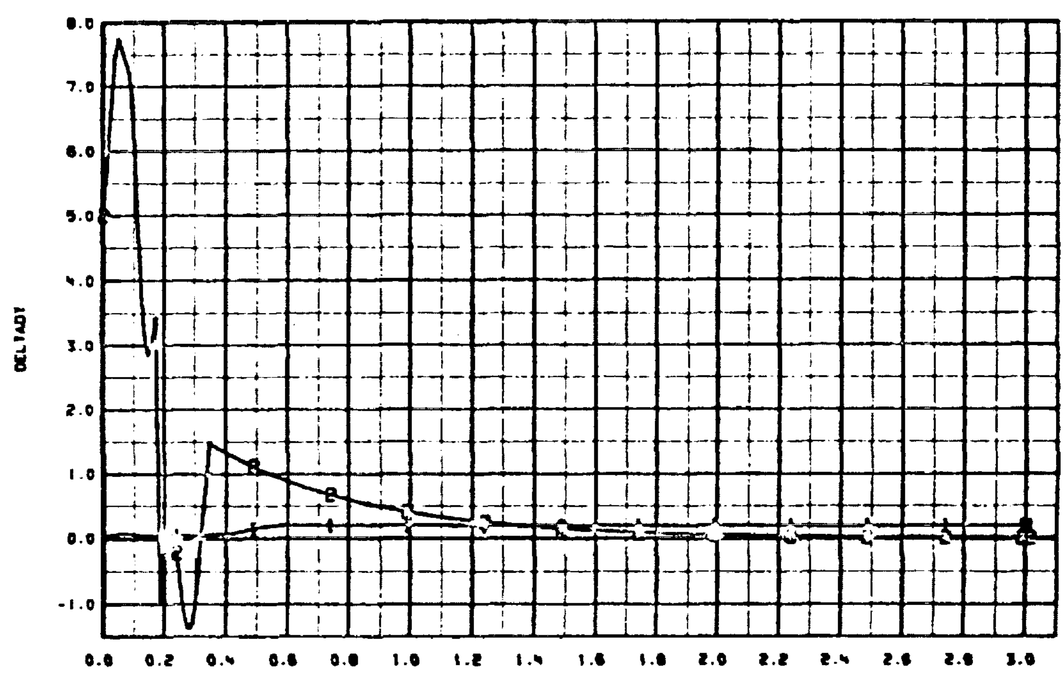
NAS5-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

DEMO 1 02/23/75 CARL BOOLEY

Figure A-1 Graphical Results, Demonstration Problem 1 (Sheet 7 of 11)



ROLL CHANNEL CONTROL VARIABLES

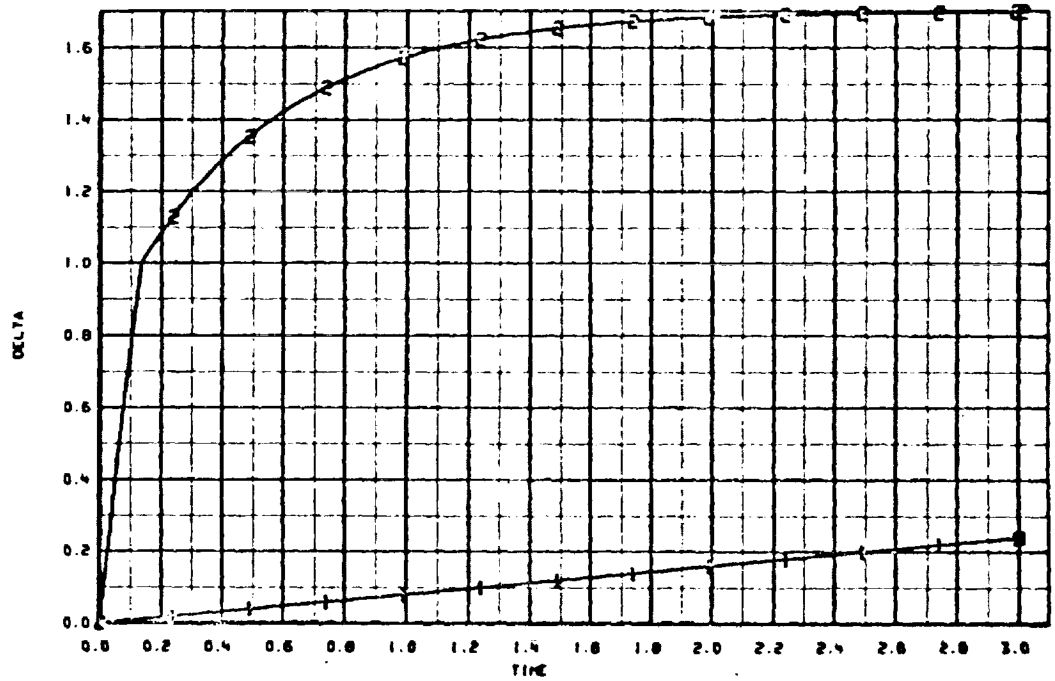


ROLL-CHANNEL

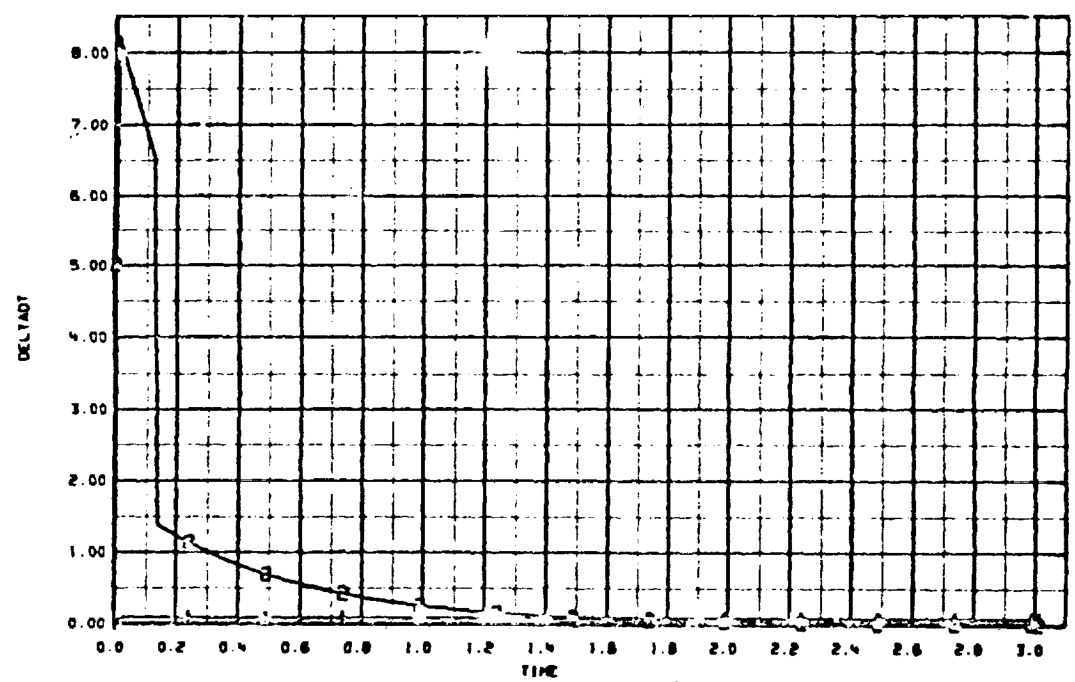
NAS5-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

DEMO 1 02/23/75 CARL BODLEY

Figure A-1 Graphical Results, Demonstration Problem 1 (Sheet 8 of 11)



PITCH CHANNEL CONTROL VARIABLES

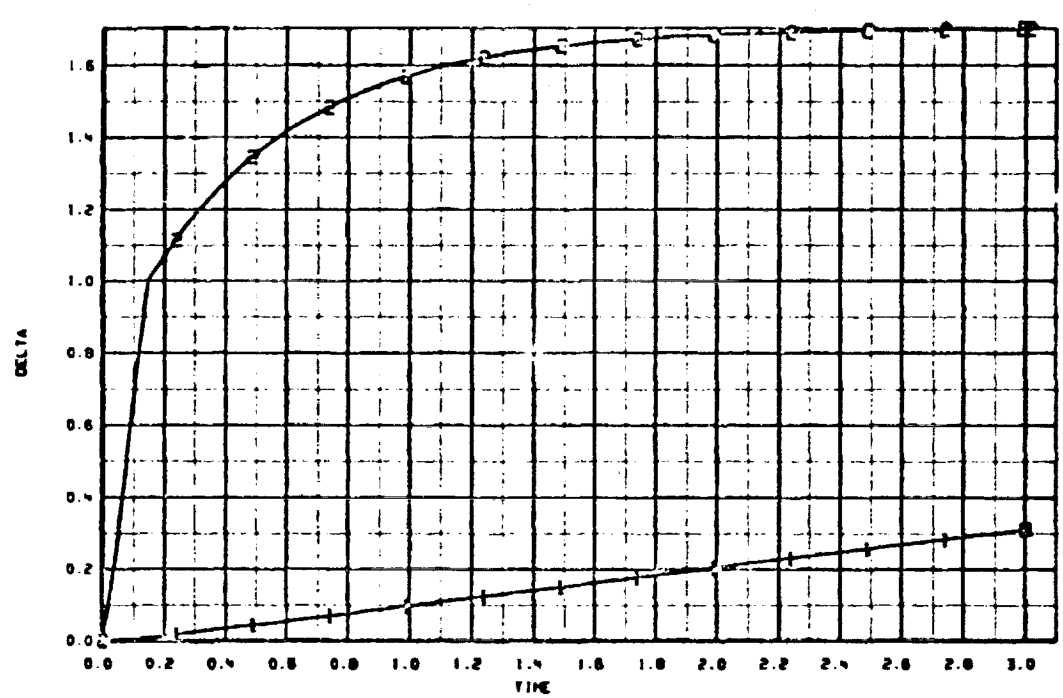


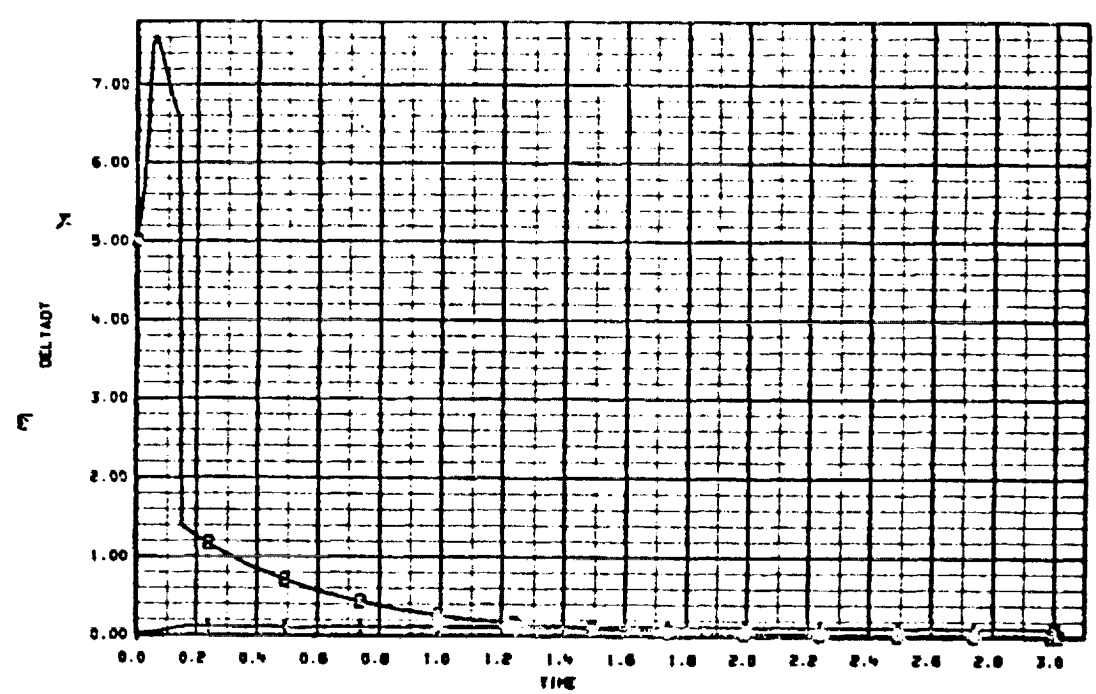
PITCH-CHANNEL

NASS-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

DEMO 1 02/23/75 CARL BOOLEY

Figure A-1 Graphical Results, Demonstration Problem 1 (Sheet 9 of 11)

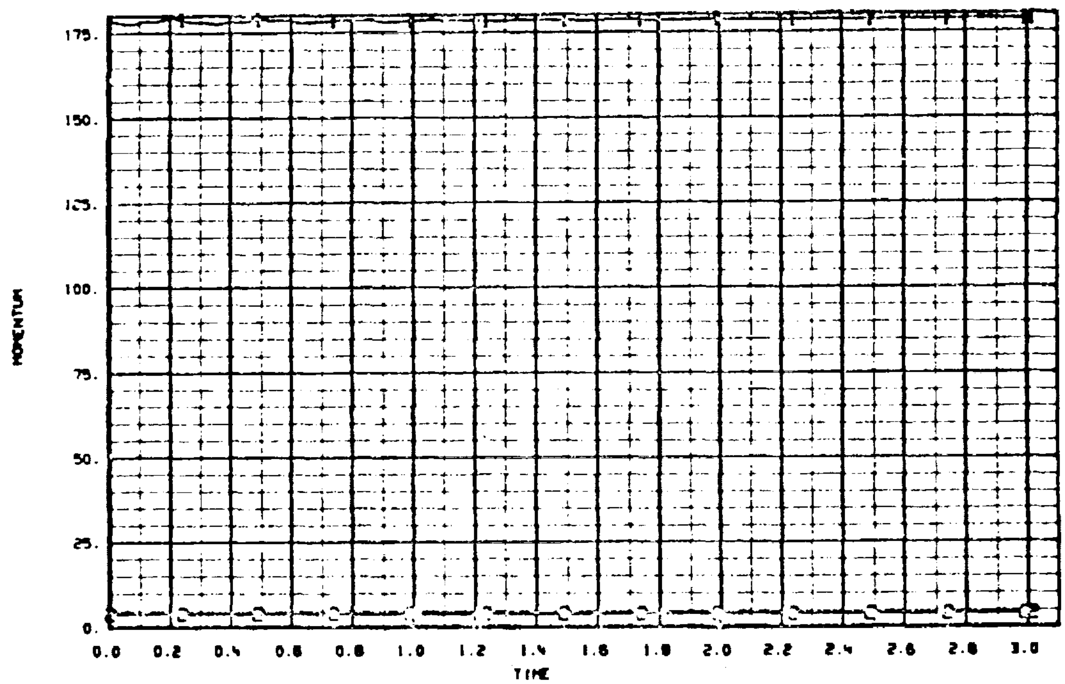




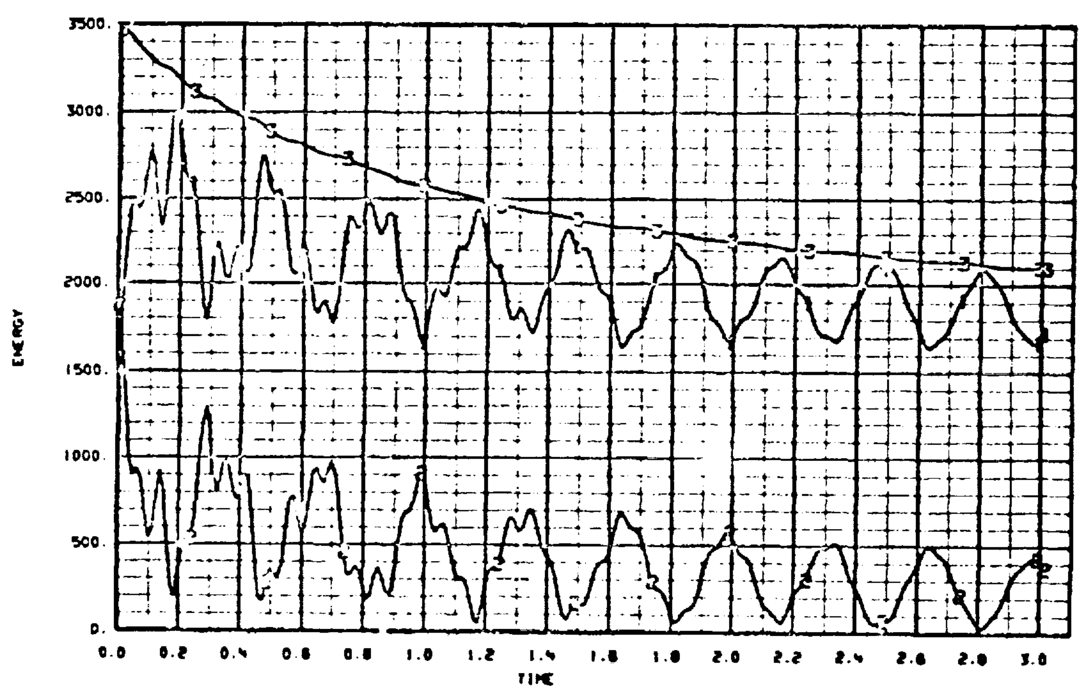
NAS5-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

DEMO 1 02/23/75 CARL BOOLEY

Figure A-1 Graphical Results, Demonstration Problem 1 (Sheet 10 of 11)



TOTAL ANGULAR AND LINEAR MOMENTUM



KINETIC, POTENTIAL AND TOTAL ENERGY -- T + V +

NAS5-11996 GSFC DEMONSTRATION PROB. 1 -- ATS-F CONTROLLED SPACECRAFT

DEMO 1 02/23/75 CARL BOOLEY

Figure A-1 Graphical Results, Demonstration Problem 1 (Sheet 11 of 11)

Demonstration Problem 2

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```
      SUBROUTINE CONTRL
      IMPLICIT REAL*8 (A-H,O-Z)
C
             COMMON /BHBSRD/
     *   BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)
             COMMON /CONPAR/
     *   CNTDTA(100)
      COMMON /LDSIZE/ NX,NY,NDLTA,NXSS,NBTQ,NJQ,NY2,ND2
             COMMON /SPECIF/
     *   BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
     *   DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
     *   NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),
     *   LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
             COMMON /TIMESS/
     *   STARTT,DELTAT,T,ENDT,TMST
             COMMON /VECTOR/
     *   Y(250),YDT(250)
CCCCCCC  THIS COMMON IS TRANSFER BETWEEN CONTRL AND SHAFTT ONLY ----
            COMMON /WHEEL /
     *   CLM(4)
C
      DIMENSION  TQ(6),TQD(6),RHD(3),THADW(3)
      DATA ICT4/0/, RHD / 0.D0, 0.D0, 0.D0 /
      DATA T1,T2,T3,T4,DTHE/
     *    .2D0, 1.2D0, .7D0, 1.7D0, 1.04719755D0 /
      ALIM(U,V) = DMAX1(-V,DMIN1(U,V))
C
CCCCCCCCCC
CCCCCCCCCC
CCC  THE FOLLOWING STATEMENTS MUST ALWAYS BE IN CONTRL..
      NDLTA = NDELTA
      NXSS = 3
      NBTQ = 3
      IF (NDELTA .EQ. 0) RETURN
CCCCCCCCCCC    CCC
CCCC----NOTE--THIS SUBROUTINE MUST ESTABLISH  NDLTA,NXSS AND NBTQ
CCCCCCCCCCC
C
CCCC  ESTABLISH THE D/DT(DELTAS)
C
      LDEL = LOCU(2*NB+2) - 1
      ICT4 = ICT4 + 1
      IA = (ICT4-1)/4
      IAA = (ICT4-2)/4
      IFLAG = IA - IAA
      DO 6 I=1,3
    6 THADW(I) = Y(6+I)
      DO 5 I=1,6
    5 TQ(I) = Y(LDEL+I)
C
```

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```
C          WHEEL 1 (ROLL INERTIA WHEEL CONTROL TORQUE)
C          DEFINE DIFFERENTIAL EQUATIONS FOR ROLL CONTROL LOOP
C
      U1 = 57.2958D0*ROL(3,2,2)/ROL(3,3,2)
      U5 = ALIM(TQ(5),29.D0)
      U2 = 2.17D0*U1 - U5
      U3 = ALIM(1.1D0*U2,1.17D0)
      TQD(5) = (1.D0/8.D0)*(-TQ(5) + (9/1.1D0)*U3)
      U6 = ALIM(5*U3,1.68D0)
      U8 = ALIM(TQ(6),1.9D0)
      IF (IFLAG .EQ. 0) GO TO 32
      U0 = DABS(U8)
      IF (U0.GT.1.D0) GO TO 30
      IF (U0.LT.0.5D0) GO TO 31
      U9 = RHD(1)
      GO TO 10
   30 U9 = U8/U0
      GO TO 10
   31 U9 = 0.D0
      GO TO 10
   32 U9 = RHD(1)
      GO TO 33
   10 RHD(1) = U9
   33 CONTINUE
      TQD(6) = (-TQ(6) + 2.5D0*(U6-U9))/.5D0
C
C  1500 RPM = 157.0795 RAD/SEC
C   6 INCH*OZ = .03125 FT*LBS
C
      IF (DABS(THADW(1)).GT. 157.0795D0) U9 = 0.D0
      CLM(1) = .03125D0*U9 - 5.D-05*THADW(1)
C
C          WHEEL 2 (PITCH INERTIA WHEEL CONTROL TORQUE)
C          DEFINE DIFFERENTIAL EQUATIONS IN PITCH CONTROL LOOP
C
      U1 = -57.2958D0*ROL(3,1,2)/ROL(3,3,2)
      U5 = ALIM(TQ(1),16.4D0)
      U2 = 2.17D0*U1 - U5
      U3 = ALIM(.82D0*U2,1.17D0)
      TQD(1) = (-TQ(1) + U3*(77.82D0))/50.D0
      U6 = ALIM(5*U3,1.68D0)
      U8 = ALIM(TQ(2),1.9D0)
      IF (IFLAG.EQ.0) GO TO 14
      U0 = DABS(U8)
      IF (U0.GT. 1.D0) GO TO 15
      IF (U0.LT.0.5D0) GO TO 16
      U9 = RHD(2)
      GO TO 12
   15 U9 = U8/U0
      GO TO 12
```

```
16 U9 = 0.D0
   GO TO 12
14 U9 = RHD(2)
   GO TO 13
12 RHD(2) = U9
13 CONTINUE
   TQD(2) = (-TQ(2) + 2.5D0*(U6 - U9))/7.5D0
   IF (DABS(THADW(2)).GE. 157.0795D0) U9 = 0
   CLM(2) = .03125D0*U9 - 5.D-05*THADW(2)
C
C        WHEEL 3 (YAW INERTIA WHEEL CONTROL TORQUE)
C        DEFINE DIFFERENTIAL EQUATIONS FOR YAW CONTROL LOOP
C
   U1 = 57.2958D0*ROL(2,1,2)/ROL(2,2,2)
   U2 = ALIM(U1,2.D0)
   U6 = ALIM(TQ(3),29.D0)
   U3 = 2.17D0*U2 - U6
   U4 = ALIM(1.47D0*U3,1.17D0)
   TQD(3) = (1.D0/68.D0)*(-TQ(3) + (9/1.47D0)*U4)
   U7 = ALIM(5*U4,1.68D0)
   U9 = ALIM(TQ(4),1.9D0)
   IF (IFLAG.EQ.0) GO TO 20
   U0 = DABS(U9)
   IF (U0.GT.1.D0) GO TO 21
   IF (U0.LT. 0.5D0) GO TO 22
   U10 = RHD(3)
   GO TO 18
21 U10 = U9/U0
   GO TO 18
22 U10 = 0.D0
   GO TO 18
20 U10 = RHD(3)
   GO TO 24
18 RHD(3) = U10
24 CONTINUE
   TQD(4) = (-TQ(4) + 2.5D0*(U7 - U10))/7.5D0
   IF (DABS(THADW(3)) .GT. 157.0795D0) U10 = 0.D0
   CLM(3) = .03125D0*U10 - 5.D-05*THADW(3)
C
   DO 34 I=1,6
34 YDT(LDEL+I) = TQD(I)
C
   RETURN
   END
```

```
DEMO 2     CARL BODLEY
ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOM. WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE  MSMODC
NAS5-11996  --  GSFC DEMONSTRATION PROBLEM NUMBER 2.


THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS-F SPACECRAFT AS A SINGLE
FLEXIBLE BODY AND A DUMMY RIGID BODY (THE PROGRAM MUST HAVE A MINIMUM OF
2-HINGES, THUS 2-BODIES). THERE ARE THREE ACTIVE MOMENTUM WHEELS USED
FOR CONTROL TORQUE.

THE PROBLEM STARTS WITH INITIAL ATTITUDE ERROR (NO RATE ERROR) AND
SIMULATES NONLINEAR TIME DOMAIN RESPONSE.
0000000000
    2     2     3     3     6
ITOPOL    2     2
    1     1     1     2
    2     1     0     1
0000000000
IRGFLA    1     2
    1     1     0    12
0000000000
IFTSMW    1     3
    1     1     2     2     2
0000000000
IHDATA    7     2
    1     1     1     1
    2     1     0     0
    3     1     0     0
    4     1     0     0
    5     1     0     0
    6     1     0     0
    7     1     0     0
0000000000
BETAM     6     2
    1     2   .0014626
    2     2   .0019621
    3     2   .0010945
    4     2   -.030197
    5     2   -.014451
    6     2   24.353
0000000000
BETAMD    6     2
0000000000
IMO       3     3
    1     1     1     2     3
    2     1     1     2     3
    3     1     1     1     1
0000000000
AMO       2     3
```

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```
    1     1    127.78              127.78              127.78
    2     1      .065                .065                .065
0000000000
TMDATA    1      3
    1     1       0.                 .0125               2.
0000000000
IPDATA    1      3
    1     1    10      1      0
0000000000
CNTDTA    1     12
0000000000
GGDATA    1      4
0000000000
MIDUM     1      4
    1     1      1.
0000000000
INRDUM    1      6
    1     1     1.                 1.                  1.
0000000000
    2     1
    0.         0.         0.
    0.         0.         0.
    2
    1     0      0
JDOF      7      6
    1     1      4     5     6     1     2     3
    2     1     10    11    12     7     8     9
    3     1     16    17    18    13    14    15
    4     1     22    23    24    19    20    21
    5     1     28    29    30    25    26    27
    6     1     34    35    36    31    32    33
    7     1     40    41    42    37    38    39
0000000000
JV        1     16
    1     1      1     2     3     4     5     6     7     8     9    10    11    12    13    14
    1    15     15    16    17    13
0000000000
MASS     42     42
    1     1    3713.7               5.0961             -32.729
    2     1       5.0961         3557.3                -2.9104
    3     1     -32.729            -2.9104            477.63
    4     4      68.273
    5     5      68.273
    6     6      68.273
    7     7     100.48                0.                  0.
    8     7       0.              100.79                  0.
    9     7       0.                0.                 96.705
   10    10      3.5559
   11    11      3.5559
   12    12      3.5559
```

```
13   13     168.96          4.7689        -.14296
14   13    4.7689           40.091        1.9592
15   13      -.14296        1.9592        145.07
16   16    5.1553
17   17    5.1553
18   18    5.1553
19   19    168.96           4.7689        .14296
20   19    4.7689          40.091         -1.9592
21   19    .14296          -1.9592        145.07
22   22   5.1553
23   23   5.1553
24   24   5.1553
25   25    .79758           0.            0.
26   25     0.              .79758        0.
27   25     0.              0.            .79758
28   28    1.7081
29   29    1.7081
30   30    1.7081
31   31    .79758           0.            0.
32   31    0.              .79758         0.
33   31     0.              0.            .79758
34   34     1.7081
35   35     1.7081
36   36     1.7081
39   39   96.705
0000000000
TR        42     18
 1    1     1.
 2    2     1.
 3    3     1.
 4    4     1.
 5    5     1.
 6    6     1.
 7    1     1.
 7    7    -1.
 8    2     1.
 8    8    1.
 9    3     1.
 9    9    -1.
10    2   -11.3079         -.014451       1.
10    8     1.3521          0.
11    1     11.3079         0.            .030197
11    5     1.
11    7    1.3521          0.            0.
12    1      .014451        -.030197
12    6      1.            0.             0.
13    4      1.
13   10     -1.
14    2      1.
15    3      1.
```

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15	11	1.		
16	2	-13.426916	-19.2402	1.
16	11	-15.8090		
17	1	13.426916	0.	-.339783
17	5	1.		
17	10	.070084	-.36998	
18	1	19.2402	.339783	
18	6	1.		
18	10	-15.809		
19	1	1.		
19	12	1.		
20	2	1.		
21	3	1.		
21	13	1.		
22	2	-13.426916	19.2112	1.
22	13	15.809		
23	1	13.426916	0.	.400177
23	5	1.		
23	12	-.070084	.36998	
24	1	-19.2112	-.400177	
24	6	1.		
24	12	-15.809		
25	1	1.		
26	2	1.		
26	14	1.		
27	3	1.		
27	15	1.		
28	2	4.3150	-.014451	1.
28	14	.001	0.	
29	1	-4.3150	0.	1.2969
29	5	1.		
29	15	0.		
30	1	.014451	-1.2969	
30	6	1.		
30	14	0.		
31	1	1.		
32	2	1.		
32	16	-1.		
33	3	1.		
33	17	1.		
34	2	4.3150	-.014451	1.
34	16	-.001	0.	
35	1	-4.3150	0.	-1.2365
35	5	1.		
35	17	0.		
36	1	.014451	1.2365	
36	6	1.		
36	16	0.		
39	3	1.		
39	9	-1.		

```
   39    18     1.
0000000000
   1
   0.         0.           0.
STIFR    42    42
   22    21    0.                 4.45000000E&05  -2.09680000E&05  -1.17660000E&05
   22    25   -1.17660000E&05    0.               0.               0.
   23    21    0.                -2.09680000E&05   2.09680000E&05   0.
   24    21    0.                -1.17660000E&05   0.               1.17660000E&05
   25    21    0.                -1.17660000E&05   0.               0.
   25    25    1.17660000E&05    0.               0.               0.
   29    29    2.09124360E&05   -2.07550000E&05   0.               0.
   29    33   -7.87180000E&02   -7.87180000E&02   0.               0.
   30    29   -2.07550000E&05    2.07550000E&05   0.               0.
   33    29   -7.87180000E&02    0.               0.               0.
   33    33    7.87180000E&02    0.               0.               0.
   34    29   -7.87180000E&02    0.               0.               0.
   34    33    0.                7.87180000E&02   0.               0.
   36    33    0.                0.               0.               1.65997060E&05
   36    37   -6.74670000E&03   -7.88380000E&04  -7.88380000E&04  -7.87180000E&02
   36    41   -7.87180000E&02    0.
   37    33    0.                0.               0.              -6.74670000E&03
   37    37    4.96347000E&04    0.               0.               0.
   37    41    0.               -4.28880000E&04
   38    33    0.                0.               0.              -7.88380000E&04
   38    37    0.                7.88380000E&04   0.               0.
   39    33    0.                0.               0.              -7.88380000E&04
   39    37    0.                0.               7.88380000E&04   0.
   40    33    0.                0.               0.              -7.87180000E&02
   40    37    0.                0.               0.               7.87180000E&02
   41    33    0.                0.               0.              -7.87180000E&02
   41    41    7.87180000E&02    0.
   42    37   -4.28880000E&04    0.               0.               0.
   42    41    0.                4.28880000E&04
0000000000
DAMPR    42    42
   22    21    0.                6.17905000E&02  -9.41050000E&01  -2.61900000E&02
   22    25   -2.61900000E&02    0.               0.               0.
   23    21    0.               -9.41050000E&01   9.41050000E&01   0.
   24    21    0.               -2.61900000E&02   0.               2.61900000E&02
   25    21    0.               -2.61900000E&02   0.               0.
   25    25    2.61900000E&02    0.               0.               0.
   29    29    1.14422000E&02   -9.43760000E&01   0.               0.
   29    33   -1.00230000E&01   -1.00230000E&01   0.               0.
   30    29   -9.43760000E&01    9.43760000E&01   0.               0.
   33    29   -1.00230000E&01    0.               0.               0.
   33    33    1.00230000E&01    0.               0.               0.
   34    29   -1.00230000E&01    0.               0.               0.
   34    33    0.                1.00230000E&01   0.               0.
   36    33    0.                0.               0.               5.02502000E&02
```

```
   36    37  -5.71160000E&01  -2.12670000E&02  -2.12670000E&02  -1.00230000E&01
   36    41  -1.00230000E&01   0.
   37    33   0.               0.               0.               -5.71160000E&01
   37    37   3.45126000E&02   0.               0.                0.
   37    41   0.              -2.88010000E&02
   38    33   0.               0.               0.               -2.12670000E&02
   38    37   0.               2.12670000E&02   0.                0.
   39    33   0.               0.               0.               -2.12670000E&02
   39    37   0.               0.               2.12670000E&02    0.
   40    33   0.               0.               0.               -1.00230000E&01
   40    37   0.               0.               0.                1.00230000E&01
   41    33   0.               0.               0.               -1.00230000E&01
   41    41   1.00230000E&01   0.
   42    37  -2.88010000E&02   0.               0.                0.
   42    41   0.               2.88010000E&02
0000000000
   0.         0.         0.         0.         0.         0.         0.         0.
   0.         0.         0.         0.
   0.         0.         0.         0.         0.         0.         0.         0.
   0.         0.         0.         0.
    2    1    1
   0.         0.         0.
    1    1    1
   0.         0.         0.
    2    1    1
   0.         0.         0.
    3    1    1
   0.         0.         0.
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 2, ATS-F CONTROLLED SPACECRAFT
    6
    7
    1    8    9   10   11   12   13
    1    2    3    4
TIME       OMEGA      ATS-F ANGULAR VELOCITY VECTOR
    1    5    6    7
TIME       UVW        ATS-F TRANSLATIONAL VELOCITY VECTOR
0000000000
   16
    1   14   15   16   17   18   19   20   21   22   23   24   25   26   27   28
    1    2    3    4
TIME       BETADOT    REFLECTOR HINGE ANGLE RATES
    1    5    6
TIME       BETADOT    &Y MOST PANEL, HINGE ANGLE RATES
    1    7    8
TIME       BETADOT    -Y MOST PANEL, HINGE ANGLE RATES
    1    9   10
TIME       BETADOT    &X MOST  SLOSH, HINGE ANGLE RATES
    1   11   12
TIME       BETADOT    -X MOST  SLOSH, HINGE ANGLE RATES
    1   13
```

```
TIME       TDOT-4    MOMENTUM WHEEL 4, ANGULAR RATE
   1    14    15    16
TIME       TDOT-123  MOMENTUM WHEELS 1-2-3, ANGULAR RATES
0000000000
   13
    1    29    30    31    32    33    34    35    36    37    38    39    40
    1     2     3     4
TIME       BETA      REFLECTOR HINGE ANGULAR DISPLACEMENT
   1     5     6
TIME       BETA      &Y MOST PANEL, HINGE ANGULAR DISPLACEMENT
   1     7     8
TIME       BETA      -Y MOST PANEL, HINGE ANGULAR DISPLACEMENT
   1     9    10
TIME       BETA      &X MOST SLOSH, HINGE ANGULAR DISPLACEMENT
   1    11    12
TIME       BETA      -X MOST SLOSH, HINGE ANGULAR DISPLACEMENT
   1    13
TIME       THE-4     MOMENTUM WHEEL 4, HINGE ANGULAR DISPLACEMENT
0000000000
   13
    1    47    48    49    50    51    52    53    54    55    56    57    58
    1     2     3     4
TIME       EULERS    EULER ANGLES THAT POSITION BODY WRT INERTIA
   1     5     6     7
TIME       POSITION  X Y AND Z POSITION COORDINATES WRT INERTIA
   1     8     9
TIME       DELTA     ROLL CHANNEL CONTROL VARIABLES
   1    10    11
TIME       DELTA     PITCH CHANNEL CONTROL VARIABLES
   1    12    13
TIME       DELTA     YAW CHANNEL CONTROL VARIABLES
0000000000
   10
    1    83    84    85   110   111   112   113   114   115
    1     2     3     4
TIME       MW-ACC    MOMENTUM WHEELS 1-2-3, ANGULAR ACCELERATION
   1     5     6
TIME       DELTADOT  ROLL CHANNEL CONTROL VARIABLES (DOTS)
   1     7     8
TIME       DELTADOT  PITCH CHANNEL CONTROL VARIABLES (DOTS)
   1     9    10
TIME       DELTADOT  YAW CHANNEL CONTROL VARIABLES (DOTS)
0000000000
    6
    1   165   166   167   168   169
    1     2     3
TIME       MOMENTUM  TOTAL ANGULAR AND LINEAR MOMENTUM
   1     4     5     6
TIME       ENERGY    KINETIC, POTENTIAL AND TOTAL ENERGY ( T + V)
0000000000
 STOP
```

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ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOM. WHEELS, CURRENT TIME = 19.22.23
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC THE CPU TIMER = 0.0

A-52

NAS5-11996 -- GSFC DEMONSTRATION PROBLEM NUMBER 2.

THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS-F SPACECRAFT AS A SINGLE FLEXIBLE BODY AND A DUMMY RIGID BODY (THE PROGRAM MUST HAVE A MINIMUM OF 2-HINGES, THUS 2-BODIES). THERE ARE THREE ACTIVE MOMENTUM WHEELS USED FOR CONTROL TORQUE.

THE PROBLEM STARTS WITH INITIAL ATTITUDE ERROR (NO RATE ERROR) AND SIMULATES NONLINEAR TIME DOMAIN RESPONSE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOM. WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC

CURRENT TIME = 19.22.23
THE CPU TIMER = 3.5667E-01

SUMMARY OF DYNAMIC-SIMULATION-PROGRAM INPUT DATA * * * * * * * * * *

ACTUAL SIZES

NB	=	2
NH	=	2
NSPT	=	3
NCFMO	=	3
NDELTA	=	6
NU	=	27
NBETA	=	12
NLAM	=	0
NEQ	=	57

MAXIMUM SIZES

NBMAX	=	6
NHMAX	=	6
NSPMAX	=	15
NMWMAX	=	5
NMWBOD	=	4
NMDBOD	=	12
KMU	=	22
KY	=	250
KU	=	113

INTEGRATION DATA

STARTT	=	0.0
DELTAT	=	1.2500-02
ENDT	=	2.0000+00

GRAVITY GRADIENT DATA

G1	=	0.0	GAMA1	=	0.0
G2	=	0.0	GAMA2	=	0.0
G3	=	0.0	GAMA3	=	0.0
GMAG	=	0.0	RCMAG	=	0.0

MISC. DATA

NOPRNT	=	10
NOPLOT	=	1
IFLNER	=	0

THE TOPOLOGY ARRAY (ITOPOL) FOR THIS CASE FOLLOWS

		(1)	(2)
1	1	1	2
2	1	0	1

THE CONSTRAINT SPECIFICATIONS FOR THIS CASE FOLLOW

		(1)	(2)
1	1	1	1
2	1	0	0
3	1	0	0
4	1	0	0
5	1	0	0
6	1	0	0
7	1	0	0

THE SPECIFIED INITIAL HINGE ANGLES AND DISPLACEMENTS (BETAH) FOLLOW

		(1)	(2)
1	1	0.0	1.463D-03
2	1	0.0	1.962D-03
3	1	0.0	1.094D-03
4	1	0.0	-3.020D-02
5	1	0.0	-1.445D-02
6	1	0.0	2.435D+01

THE SPECIFIED INITIAL HINGE RATES (BETAHD) FOLLOW

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

A-54 ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOM. WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC

CURRENT TIME = 19.22.24
THE CPU TIMER = 5.0000E-01

THE NO. OF ELASTIC MODES/BODY ARRAY (IRGFLX) FOLLOWS

		(1)	(2)
1	1	0	12

THE NO. OF P/Q HINGE POINTS/BODY ARRAY (NHPOI) FOLLOWS

		(1)	(2)
1	1	1	1

THE NO. OF SENSOR POINTS/BODY ARRAY (NSPOI) FOLLOWS

		(1)	(2)
1	1	0	3

THE MOM. WHEEL/BODY TABLE (NMOW) FOLLOWS

		(1)	(2)
1	1	0	3
2	1	0	3
3	1	0	1
4	1	0	2
5	1	0	3
6	1	0	0

THE STATE VECTOR LENGTH ARRAY (LENU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	6	21	0	12	12	6

THE STATE VECTOR LOCATION ARRAY (LOCU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	7	28	28	40	52

THE SPECIFIED SENSOR POINT/BODY CORRELATION ARRAY (IFTSMW) FOLLOWS

		(1)	(2)	(3)
1	1	2	2	2

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOM. WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC

CURRENT TIME = 19.22.24
THE CPU TIMER = 6.0000E-01

THE FOLLOWING DATA IS SPECIFIED MOM. WHEEL INFORMATION (IF ANY) AND CONTROLLER INFORMATION

THE SPECIFIED MOM. WHEEL CONTROL ARRAY (IMC) FOLLOWS

		(1)	(2)	(3)
1	1	1	2	3
2	1	1	2	3
3	1	1	1	1

THE SPECIFIED MOM. WHEEL RATES AND INERTIAS (AMO) FOLLOW

		(1)	(2)	(3)
1	1	1.278D+02	1.278D+02	1.278D+02
2	1	6.500D-02	6.500D-02	6.500D-02

THE SPECIFIED CONTROLLER INITIAL CONDITIONS AND CHARACTERISTICS FOLLOW
(THE FIRST NDELTA ARE INITIAL CONTROLLER STATE VARIABLES, THERE ARE 6 ADDITIONAL CONTROL PARAMETERS)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								

A-56 ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOM. WHEELS, CURRENT TIME = 19.22.24
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC THE CPU TIMER = 8.4333E-01

SUMMARY OF INPUT DATA FOR BODY 1 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0
3	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.0000D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	1.0000D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.0000D+00

FOR BODY 1 THE P-O HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOM. WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC

CURRENT TIME = 19.22.26
THE CPU TIMER = 1.0933E+00

SUMMARY OF INPUT DATA FOR BODY 2 WHICH IS FLEXIBLE W/CONSISTENT MASS MATRIX.

THE INTEGER PARAMETERS--- IFRBM,IFDIAK,IFDIAD ARE 1, 0, 0

THE JDOF TABLE FOLLOWS---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	4	5	6	1	2	3
2	1	10	11	12	7	8	9
3	1	16	17	18	13	14	15
4	1	22	23	24	19	20	21
5	1	28	29	30	25	26	27
6	1	34	35	36	31	32	33
7	1	40	41	42	37	38	39

THE MODE SELECTION VECTOR FOLLOWS---

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

FOR BODY NO. 2 THE POSITION VECTOR FROM THE BODY ORIGIN TO JOINT 1 IS
X = 0.0 Y = 0.0 Z = 0.0

THE CONSISTENT, REPARTITIONED MASS MATRIX IS--

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	6.827D+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0								
2	1	0.0	3.556D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	41	0.0	0.0								
3	1	0.0	0.0	5.155D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	41	0.0	0.0								
4	1	0.0	0.0	0.0	5.155D+00	0.0	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	41	0.0	0.0								
5	1	0.0	0.0	0.0	0.0	1.708D+00	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	41	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	1.708D+00	0.0	0.0	0.0	0.0
6	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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6	41	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	41	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.827D+01	0.0	0.0
8	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	41	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.556D+00	0.0
9	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	41	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.155D+00
10	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	41	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	5.155D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	41	0.0	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	1.708D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	41	0.0	0.0								
13	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	11	0.0	0.0	1.708D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	41	0.0	0.0								
14	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	41	0.0	0.0								
15	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	11	0.0	0.0	0.0	0.0	6.827D+01	0.0	0.0	0.0	0.0	0.0
15	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	41	0.0	0.0								
16	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	11	0.0	0.0	0.0	0.0	0.0	3.556D+00	0.0	0.0	0.0	0.0
16	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	41	0.0	0.0								
17	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	11	0.0	0.0	0.0	0.0	0.0	0.0	5.155D+00	0.0	0.0	0.0
17	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	41	0.0	0.0								
18	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.155D+00	0.0	0.0
18	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	41	0.0	0.0								
19	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.708D+00	0.0

19	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	41	0.0	0.0								
20	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.708D+00
20	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	41	0.0	0.0								
21	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	41	0.0	0.0								
22	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	21	0.0	3.714D+03	0.0	0.0	0.0	0.0	0.0	0.0	5.096D+00	0.0
22	31	0.0	0.0	0.0	0.0	0.0	-3.273D+01	0.0	0.0	0.0	0.0
22	41	0.0	0.0								
23	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	21	0.0	0.0	1.005D+02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	41	0.0	0.0								
24	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	21	0.0	0.0	0.0	1.690D+02	0.0	0.0	0.0	0.0	0.0	0.0
24	31	4.769D+00	0.0	0.0	0.0	0.0	0.0	0.0	-1.430D-01	0.0	0.0
24	41	0.0	0.0								
25	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	21	0.0	0.0	0.0	0.0	1.690D+02	0.0	0.0	0.0	0.0	0.0
25	31	0.0	4.769D+00	0.0	0.0	0.0	0.0	0.0	0.0	1.430D-01	0.0
25	41	0.0	0.0								
26	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	21	0.0	0.0	0.0	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0
26	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	41	0.0	0.0								
27	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	21	0.0	0.0	0.0	0.0	0.0	0.0	7.976D-01	0.0	0.0	0.0
27	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	41	0.0	0.0								
28	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	41	0.0	0.0								
29	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	21	0.0	5.096D+00	0.0	0.0	0.0	0.0	0.0	0.0	3.557D+03	0.0
29	31	0.0	0.0	0.0	0.0	0.0	-2.910D+00	0.0	0.0	0.0	0.0
29	41	0.0	0.0								
30	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.008D+02
30	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	41	0.0	0.0								
31	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	21	0.0	0.0	0.0	4.769D+00	0.0	0.0	0.0	0.0	0.0	0.0
31	31	4.009D+01	0.0	0.0	0.0	0.0	0.0	0.0	1.959D+00	0.0	0.0
31	41	0.0	0.0								

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32	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	21	0.0	0.0	0.0	0.0	4.769D+00	0.0	0.0	0.0	0.0	0.0
32	31	0.0	4.009D+01	0.0	0.0	0.0	0.0	0.0	0.0	-1.959D+00	0.0
32	41	0.0	0.0								
33	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	31	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	41	0.0	0.0								
34	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	31	0.0	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0	0.0	0.0
34	41	0.0	0.0								
35	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	41	0.0	0.0								
36	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	21	0.0	-3.273D+01	0.0	0.0	0.0	0.0	0.0	0.0	-2.910D+00	0.0
36	31	0.0	0.0	0.0	0.0	0.0	4.776D+02	0.0	0.0	0.0	0.0
36	41	0.0	0.0								
37	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	31	0.0	0.0	0.0	0.0	0.0	0.0	9.670D+01	0.0	0.0	0.0
37	41	0.0	0.0								
38	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	21	0.0	0.0	0.0	-1.430D-01	0.0	0.0	0.0	0.0	0.0	0.0
38	31	1.959D+00	0.0	0.0	0.0	0.0	0.0	0.0	1.451D+02	0.0	0.0
38	41	0.0	0.0								
39	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	21	0.0	0.0	0.0	0.0	1.430D-01	0.0	0.0	0.0	0.0	0.0
39	31	0.0	-1.959D+00	0.0	0.0	0.0	0.0	0.0	0.0	1.451D+02	0.0
39	41	0.0	0.0								
40	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.976D-01
40	41	0.0	0.0								
41	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	41	7.976D-01	0.0								
42	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	41	0.0	9.670D+01								

THE REPARTITIONED MODAL MATRIX IS——

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
2	1	0.0	-1.131D+01	-1.445D-02	1.0000D+00	0.0	0.0	0.0	1.352D+00	0.0	0.0

3	11	-1.561D+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
4	1	0.0	-1.343D+01	1.921D+01	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0	1.581D+01	0.0	0.0	0.0	0.0	0.0		
5	1	0.0	4.315D+00	-1.445D-02	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0	0.0	1.000D-03	0.0	0.0	0.0	0.0		
6	1	0.0	4.315D+00	-1.445D-02	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0
6	11	0.0	0.0	0.0	0.0	0.0	-1.000D-03	0.0	0.0		
7	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
8	1	0.0	0.0	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0
8	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
9	1	1.131D+01	0.0	3.020D-02	0.0	1.000D+00	0.0	1.352D+00	0.0	0.0	0.0
9	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
10	1	1.343D+01	0.0	-3.398D-01	0.0	1.000D+00	0.0	0.0	0.0	0.0	7.008D-02
10	11	-3.700D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
11	1	1.343D+01	0.0	4.002D-01	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0
11	11	0.0	-7.008D-02	3.700D-01	0.0	0.0	0.0	0.0	0.0		
12	1	-4.315D+00	0.0	1.297D+00	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0
12	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
13	1	-4.315D+00	0.0	-1.236D+00	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0
13	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
14	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
15	1	0.0	0.0	0.0	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0
15	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
16	1	1.445D-02	-3.020D-02	0.0	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0
16	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
17	1	1.924D+01	3.398D-01	0.0	0.0	0.0	1.000D+00	0.0	0.0	0.0	-1.561D+01
17	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
18	1	-1.921D+01	-4.002D-01	0.0	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0
18	11	0.0	-1.581D+01	0.0	0.0	0.0	0.0	0.0	0.0		
19	1	1.445D-02	-1.297D+00	0.0	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0
19	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
20	1	1.445D-02	1.236D+00	0.0	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0
20	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
21	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
22	1	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
23	1	1.000D+00	0.0	0.0	0.0	0.0	0.0	-1.000D+00	0.0	0.0	0.0
23	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
24	1	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.000D+00
24	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
25	1	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	11	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0		
26	1	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
27	1	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
28	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
29	1	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
30	1	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	1.000D+00	0.0	0.0
30	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
31	1	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
32	1	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
33	1	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	11	0.0	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0		
34	1	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

34	11	0.0	0.0	0.0	0.0	0.0	-1.000D+00	0.0	0.0		
35	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
36	1	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
37	1	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	-1.000D+00	0.0
37	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
38	1	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	11	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
39	1	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	11	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0		
40	1	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	11	0.0	0.0	0.0	0.0	1.000D+00	0.0	0.0	0.0		
41	1	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	11	0.0	0.0	0.0	0.0	0.0	0.0	1.000D+00	0.0		
42	1	0.0	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	-1.000D+00	0.0
42	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000D+00		

THE —UNDEFORMED— INERTIA MATRIX (MU) IS---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.034D+04	8.797D+01	-2.778D+01	0.0	1.639D+02	2.503D-01	-4.611D+01	0.0	0.0	-1.732D+03
1	11	-2.575D+01	1.730D+03	2.575D+01	0.0	0.0	0.0	0.0	0.0		
2	1	8.797D+01	6.124D+03	-5.350D-01	-1.639D+02	0.0	-5.219D-01	0.0	4.642D+01	0.0	-3.246D+01
2	11	1.096D+03	3.738D+01	-1.096D+03	8.050D-01	0.0	-8.050D-01	0.0	0.0		
3	1	-2.778D+01	-5.350D-01	4.781D+03	-2.503D-01	5.219D-01	0.0	1.452D-01	-6.948D-02	-1.934D+02	2.020D-02
3	11	1.714D+03	-1.626D-03	1.712D+03	-2.468D-05	7.976D-01	2.468D-05	7.976D-01	9.670D+01		
4	1	0.0	-1.639D+02	-2.503D-01	8.556D+01	0.0	0.0	0.0	4.808D+00	0.0	0.0
4	11	-8.150D+01	0.0	8.150D+01	1.708D-03	0.0	-1.708D-03	0.0	0.0		
5	1	1.639D+02	0.0	5.219D-01	0.0	8.556D+01	0.0	4.808D+00	0.0	0.0	3.613D-01
5	11	-1.907D+00	-3.613D-01	1.907D+00	0.0	0.0	0.0	0.0	0.0		
6	1	2.503D-01	-5.219D-01	0.0	0.0	0.0	8.556D+01	0.0	0.0	0.0	-8.150D+01
6	11	0.0	-8.150D+01	0.0	0.0	0.0	0.0	0.0	0.0		
7	1	-4.611D+01	0.0	1.452D-01	0.0	4.808D+00	0.0	1.070D+02	0.0	0.0	0.0
7	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
8	1	0.0	4.642D+01	-6.948D-02	4.808D+00	0.0	0.0	0.0	1.073D+02	0.0	0.0
8	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
9	1	0.0	0.0	-1.934D+02	0.0	0.0	0.0	0.0	0.0	1.934D+02	0.0
9	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-9.670D+01		
10	1	-1.732D+03	-3.246D+01	2.020D-02	0.0	3.613D-01	-8.150D+01	0.0	0.0	0.0	1.457D+03
10	11	9.285D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
11	1	-2.575D+01	1.096D+03	1.714D+03	-8.150D+01	-1.907D+00	0.0	0.0	0.0	0.0	9.285D-03
11	11	1.434D+03	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
12	1	1.730D+03	3.738D+01	-1.626D-03	0.0	-3.613D-01	-8.150D+01	0.0	0.0	0.0	0.0
12	11	0.0	1.457D+03	9.285D-03	0.0	0.0	0.0	0.0	0.0		
13	1	2.575D+01	-1.096D+03	1.712D+03	8.150D+01	1.907D+00	0.0	0.0	0.0	0.0	0.0
13	11	0.0	9.285D-03	1.434D+03	0.0	0.0	0.0	0.0	0.0		
14	1	0.0	8.050D-01	-2.468D-05	1.708D-03	0.0	0.0	0.0	0.0	0.0	0.0
14	11	0.0	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0		
15	1	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	11	0.0	0.0	0.0	0.0	7.976D-01	0.0	0.0	0.0		
16	1	0.0	-8.050D-01	2.468D-05	-1.708D-03	0.0	0.0	0.0	0.0	0.0	0.0
16	11	0.0	0.0	0.0	0.0	0.0	7.976D-01	0.0	0.0		
17	1	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	11	0.0	0.0	0.0	0.0	0.0	0.0	7.976D-01	0.0		
18	1	0.0	0.0	9.670D+01	0.0	0.0	0.0	0.0	0.0	-9.670D+01	0.0
18	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.670D+01		

THE A COEFFICIENTS ARE---

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

2	1	0.0	0.0	0.0	8.150D+01	0.0	8.150D+01	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	4.808D+00	0.0	0.0	3.613D-01	-1.907D+00	-3.613D-01	1.907D+00	0.0	0.0	0.0
3	11	0.0	0.0								
4	1	0.0	0.0	0.0	-8.150D+01	0.0	-8.150D+01	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	-4.808D+00	0.0	0.0	8.150D+01	0.0	-8.150D+01	-1.708D-03	0.0	1.708D-03
6	11	0.0	0.0								
7	1	-4.808D+00	0.0	0.0	-3.613D-01	1.907D+00	3.613D-01	-1.907D+00	0.0	0.0	0.0
7	11	0.0	0.0								
8	1	0.0	4.808D+00	0.0	0.0	-8.150D+01	0.0	8.150D+01	1.708D-03	0.0	-1.708D-03
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	11	0.0	0.0								

THE B COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	6.948D-02	0.0	0.0	1.101D+03	-3.670D+01	1.101D+03	-3.664D+01	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	0.0	1.452D-01	0.0	1.094D+03	2.769D+01	1.094D+03	3.261D+01	2.215D-03	0.0	2.112D-03
2	11	0.0	0.0								
3	1	6.948D-02	1.452D-01	0.0	6.952D+00	-9.006D+00	6.941D+00	-4.028D+00	2.215D-03	0.0	2.112D-03
3	11	0.0	0.0								
4	1	1.452D-01	6.948D-02	0.0	-1.228D-01	-1.567D+03	-1.446D-01	-1.565D+03	2.466D-05	0.0	-2.466D-05
4	11	0.0	0.0								
5	1	0.0	-5.437D+01	0.0	2.769D+01	1.094D+03	-3.261D+01	-1.094D+03	7.370D-03	0.0	-7.370D-03
5	11	0.0	0.0								
6	1	-5.437D+01	0.0	0.0	-1.573D+03	2.561D+01	1.571D+03	-2.561D+01	0.0	0.0	0.0
6	11	0.0	0.0								

THE COFXY COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	-6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0								
4	1	0.0	0.0	0.0	0.0	5.712D+00	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	-5.712D+00	0.0	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	0.0	5.712D+00	0.0	0.0	0.0
6	11	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	-5.712D+00	0.0	0.0	0.0	0.0
7	11	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	11	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	11	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	0.0	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	0.0								

THE COFXZ COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0								
4	1	0.0	0.0	0.0	0.0	1.288D+03	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	-1.288D+03	0.0	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	0.0	-1.288D+03	0.0	0.0	0.0
6	11	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	1.288D+03	0.0	0.0	0.0	0.0
7	11	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	11	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0
10	11	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	0.0	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	0.0								

THE COFYZ COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0								
4	1	0.0	0.0	0.0	2.220D-16	-3.015D+01	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	3.015D+01	0.0	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	-2.220D-16	3.015D+01	0.0	0.0	0.0
6	11	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	-3.015D+01	0.0	0.0	0.0	0.0
7	11	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	11	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	11	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	0.0	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	0.0								

THE C11 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

4	1	0.0	0.0	0.0	1.288D+03	-1.337D-01	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	-1.337D-01	7.057D-01	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	1.288D+03	-1.337D-01	0.0	0.0	0.0
6	11	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	-1.337D-01	7.057D-01	0.0	0.0	0.0
7	11	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	11	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	11	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	0.0	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	0.0								

THE C22 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	0.0	6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0								
4	1	0.0	0.0	0.0	1.288D+03	0.0	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	0.0	1.288D+03	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	1.288D+03	0.0	0.0	0.0	0.0
6	11	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	0.0	1.288D+03	0.0	0.0	0.0
7	11	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.708D-06	0.0	0.0
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	11	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.708D-06
10	11	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	0.0	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	0.0								

THE C33 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	0.0	6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0								
4	1	0.0	0.0	0.0	2.532D-02	-1.337D-01	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	-1.337D-01	1.289D+03	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	2.532D-02	-1.337D-01	0.0	0.0	0.0
6	11	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	-1.337D-01	1.289D+03	0.0	0.0	0.0

7	11	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.706D-06	0.0	0.0
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	11	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.706D-06
10	11	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	0.0	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	0.0								

THE C12 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0								
4	1	0.0	0.0	0.0	0.0	-5.712D+00	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	0.0	3.015D+01	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	0.0	-5.712D+00	0.0	0.0	0.0
6	11	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	0.0	3.015D+01	0.0	0.0	0.0
7	11	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	11	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	11	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	0.0	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	0.0								

THE C13 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0								
4	1	0.0	0.0	0.0	0.0	1.228D+03	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	0.0	-1.228D+03	0.0	0.0	0.0
6	11	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	11	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	11	0.0	0.0								
[illegible]	[illegible]	[illegible]	[illegible]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	0.0	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	0.0								

THE C23 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0								
4	1	0.0	0.0	0.0	-5.712D+00	3.015D+01	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	5.712D+00	-3.015D+01	0.0	0.0	0.0
6	11	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	11	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	11	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	11	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	0.0	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	0.0								

THE MODAL STIFFNESS MATRIX IS---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	2.097D+05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	0.0	2.076D+05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	0.0	0.0	6.747D+03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0								
4	1	0.0	0.0	0.0	1.177D+05	0.0	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	0.0	7.884D+04	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	1.177D+05	0.0	0.0	0.0	0.0
6	11	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	0.0	7.884D+04	0.0	0.0	0.0
7	11	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.872D+02	0.0	0.0
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.872D+02	0.0
9	11	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.872D+02
10	11	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	7.872D+02	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	4.269D+04								

THE MODAL DAMPING MATRIX IS---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	9.411D+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								
2	1	0.0	9.438D+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0								
3	1	0.0	0.0	5.712D+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0								
4	1	0.0	0.0	0.0	2.619D+02	0.0	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0								
5	1	0.0	0.0	0.0	0.0	2.127D+02	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	2.619D+02	0.0	0.0	0.0	0.0
6	11	0.0	0.0								
7	1	0.0	0.0	0.0	0.0	0.0	0.0	2.127D+02	0.0	0.0	0.0
7	11	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.002D+01	0.0	0.0
8	11	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.002D+01	0.0
9	11	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.002D+01
10	11	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	1.002D+01	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	2.880D+02								

THE INITIAL MODAL COORDINATE DISPLACEMENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								

THE INITIAL MODAL COORDINATE VELOCITIES ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								

FOR BODY 2 THE P-Q HINGE NO., THE EULER ROTATION TYPE AND THE JOINT NO. CORRESPONDING TO THE P-Q HINGE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)	(3)
1	1	2	1	1

		(1)	(2)	(3)
1	1	0.0	0.0	0.0

FOR BODY 2 THE SENSOR POINT NO., THE EULER ROTATION TYPE AND THE JOINT NO. CORRESPONDING TO THE SENSOR POINT APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)	(3)
1	1	1	1	1
2	1	2	1	1
3	1	3	1	1

		(1)	(2)	(3)
1	1	0.0	0.0	0.0
2	1	0.0	0.0	0.0
3	1	0.0	0.0	0.0

THE FOLLOWING INTEGER ARRAY (INDEP) PRESCRIBES INDEPENDENT VARIABLES (1), AND DEPENDENT VARIABLES (0)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	41	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOM. WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMUDC

CURRENT TIME = 19.22.50
THE CPU TIMER = 1.1153E+01

AT SIMULATION TIME, T = 0.0 *

THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	1.276D+02	1.278D+02	1.276D+02	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	1.463D-03	1.962D-03	1.094D-03	-3.020D-02	-1.445D-02
1	51	2.435D+01	0.0	0.0	0.0	0.0	0.0	0.0			

AT SIMULATION TIME, T = 0.0 *

THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	51	0.0	3.413D-02	4.997D+00	1.395D-02	5.014D+00	1.863D-02	5.006D+00			

AT SIMULATION TIME, T = 0.0 *

THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)
1	1	0.0	1.463D-03
2	1	0.0	1.962D-03
3	1	0.0	1.094D-03
4	1	0.0	-3.020D-02
5	1	0.0	-1.445D-02
6	1	0.0	2.435D+01

AT SIMULATION TIME, T = 0.0 *

THE BETA TIME DERIVATIVES ARE

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

AT SIMULATION TIME, T = 0.0 *

THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0 *

THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)

```
        AT SIMULATION TIME, T = 0.0         * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  1   THE VELOCITIES ARE
             ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1     1    0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  1   THE CORRESPONDING MOMENTA ARE
             ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1     1    0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
             ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1     1    0.0         0.0         0.0         0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     0.0             0.0

        AT SIMULATION TIME, T = 0.0         * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
             ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1     1    0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
  1    11    0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         1.278D+02   1.278D+02
  1    21    1.278D+02
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
             ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1     1    8.306D+00   8.306D+00   8.306D+00   0.0         0.0         0.0         0.0         0.0         0.0         0.0
  1    11    0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         8.306D+00   8.306D+00
  1    21    8.306D+00
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
             ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1     1    8.313D+00   8.303D+00   8.302D+00   0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     1.59195352D+03 0.0
FOR BODY  2   THE ELASTIC DEFLECTIONS ARE
             ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1     1    0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
  1    11    0.0         0.0

        AT SIMULATION TIME, T = 0.0         * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
             ( 1)        ( 2)        ( 3)
  1     1    8.313D+00   8.303D+00   8.302D+00
THE TOTAL LINEAR MOMENTUM VECTOR IS
             ( 1)        ( 2)        ( 3)
  1     1    0.0         0.0         0.0

THE TOTAL ANGULAR MOMENTUM =  1.43858944D+01
THE TOTAL LINEAR MOMENTUM  =  0.0
THE TOTAL KINETIC ENERGY   =  1.59195352D+03
THE TOTAL POTENTIAL ENERGY =  0.0
THE TOTAL ENERGY (T + V)   =  1.59195352D+03
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A-72 ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOM. WHEELS, CURRENT TIME = 19.32.06
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC THE CPU TIMER = 2.6961E+02

AT SIMULATION TIME, T = 2.0000D+00* *

THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	-3.411D-06	-5.128D-06	-8.226D-06	-1.097D-05
1	11	6.556D-06	-2.758D-08	1.065D-07	-2.128D-07	-9.744D-07	-3.426D-07	1.096D-06	3.360D-07	2.288D-06	7.467D-08
1	21	6.274D-08	-7.467D-08	6.274D-08	2.851D-08	1.283D+02	1.283D+02	1.283D+02	-2.875D-09	3.655D-09	-5.555D-08
1	31	-1.058D-07	8.252D-08	1.054D-07	-1.162D-07	-3.067D-09	4.849D-09	3.067D-09	4.849D-09	7.686D-09	0.0
1	41	0.0	0.0	0.0	0.0	0.0	1.459D-03	1.957D-03	1.088D-03	-3.021D-02	-1.444D-02
1	51	2.435D+01	5.635D-02	8.778D-01	2.491D-02	8.946D-01	3.330D-02	8.981D-01			

AT SIMULATION TIME, T = 2.0000D+00* *

THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	5.017D-06	2.754D-06	-5.512D-06	-9.420D-06
1	11	-1.053D-05	3.534D-08	8.176D-06	-7.655D-06	-2.556D-06	1.463D-05	-3.066D-06	-1.459D-05	1.280D-05	-6.710D-07
1	21	-2.062D-06	6.710D-07	-2.062D-06	-2.538D-06	-5.015D-06	-2.750D-06	3.519D-06	1.055D-07	-2.128D-07	-9.744D-07
1	31	-3.426D-07	1.096D-06	3.360D-07	2.288D-06	7.467D-08	6.274D-08	-7.467D-08	6.274D-08	2.351D-08	0.0
1	41	0.0	0.0	0.0	0.0	0.0	-3.406D-06	-5.131D-06	-8.219D-06	-1.098D-05	6.544D-06
1	51	3.448D-09	2.470D-02	2.032D+00	1.104D-02	2.276D+00	1.480D-02	2.285D+00			

AT SIMULATION TIME, T = 2.0000D+00* *

THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)
1	1	0.0	1.459D-03
2	1	0.0	1.957D-03
3	1	0.0	1.088D-03
4	1	0.0	-3.021D-02
5	1	0.0	-1.444D-02
6	1	0.0	2.435D+01

AT SIMULATION TIME, T = 2.0000D+00* *

THE BETA TIME DERIVATIVES ARE

		(1)	(2)
1	1	0.0	-3.406D-06
2	1	0.0	-5.131D-06
3	1	0.0	-8.219D-06
4	1	0.0	-1.098D-05
5	1	0.0	6.544D-06
6	1	0.0	3.448D-09

AT SIMULATION TIME, T = 2.0000D+00* *

THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	5.835D-02	8.778D-01	2.491D-02	8.948D-01	3.330D-02	8.961D-01

AT SIMULATION TIME, T = 2.0000D+00* *

THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	2.470D-02	2.032D+00	1.104D-02	2.278D+00	1.480D-02	2.285D+00

```
        AT SIMULATION TIME, T = 2.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  1   THE VELOCITIES ARE
             ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1     0.0          0.0          0.0          0.0          0.0          0.0
FOR BODY  1   THE CORRESPONDING MOMENTA ARE
             ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1     0.0          0.0          0.0          0.0          0.0          0.0
FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
             ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1     0.0          0.0          0.0          0.0          0.0          0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      0.0              0.0


        AT SIMULATION TIME, T = 2.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
             ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)         (10)
  1    1   -3.411D-06 -5.128D-06 -6.226D-06 -1.097D-05  6.556D-06 -2.758D-08  1.085D-07 -2.128D-07 -9.744D-07 -3.426D-07
  1   11    1.096D-06  3.360D-07  2.288D-06  7.467D-08  6.274D-08 -7.467D-08  6.274D-08  2.651D-08  1.283D+02  1.283D+02
  1   21    1.283D+02
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
             ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)         (10)
  1    1    8.306D+00  8.306D+00  8.306D+00  4.354D-17 -5.727D-16 -2.668D-17  1.992D-04 -3.130D-04  1.400D-03  5.581D-03
  1   11   -1.718D-02 -5.603D-03 -6.146D-03 -4.086D-06 -6.511D-06  4.086D-06 -6.511D-06 -6.985D-04  8.339D+00  8.337D+00
  1   21    8.339D+00
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
             ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1    8.313D+00  8.303D+00  8.302D+00  4.411D-17 -5.727D-16 -2.760D-17
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      1.60445651D+03 2.12580257D-09
FOR BODY  2   THE ELASTIC DEFLECTIONS ARE
             ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)         (10)
  1    1   -2.873D-09  3.655D-09 -5.553D-08 -1.058D-07  8.252D-08  1.054D-07 -1.162D-07 -3.067D-09  4.649D-09  3.067D-09
  1   11    4.849D-09  7.686D-09


        AT SIMULATION TIME, T = 2.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
             ( 1)         ( 2)         ( 3)
  1    1    8.313D+00  8.303D+00  8.302D+00
THE TOTAL LINEAR MOMENTUM VECTOR IS
             ( 1)         ( 2)         ( 3)
  1    1    4.411D-17 -5.727D-16 -2.760D-17

THE TOTAL ANGULAR MOMENTUM =  1.43856944D+01
THE TOTAL LINEAR MOMENTUM  =  5.75012729D-16
THE TOTAL KINETIC ENERGY   =  1.60445651D+03
THE TOTAL POTENTIAL ENERGY =  2.12580257D-09
THE TOTAL ENERGY (T + V)   =  1.60445651D+03

                                    CPU TIME/STEP   CPU TIME/REAL TIME
                                      1.4767E+00         1.1813E+02
```

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ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOM. WHEELS, CURRENT TIME = 19.32.06
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC THE CPU TIMER = 2.7142E+02

A-74

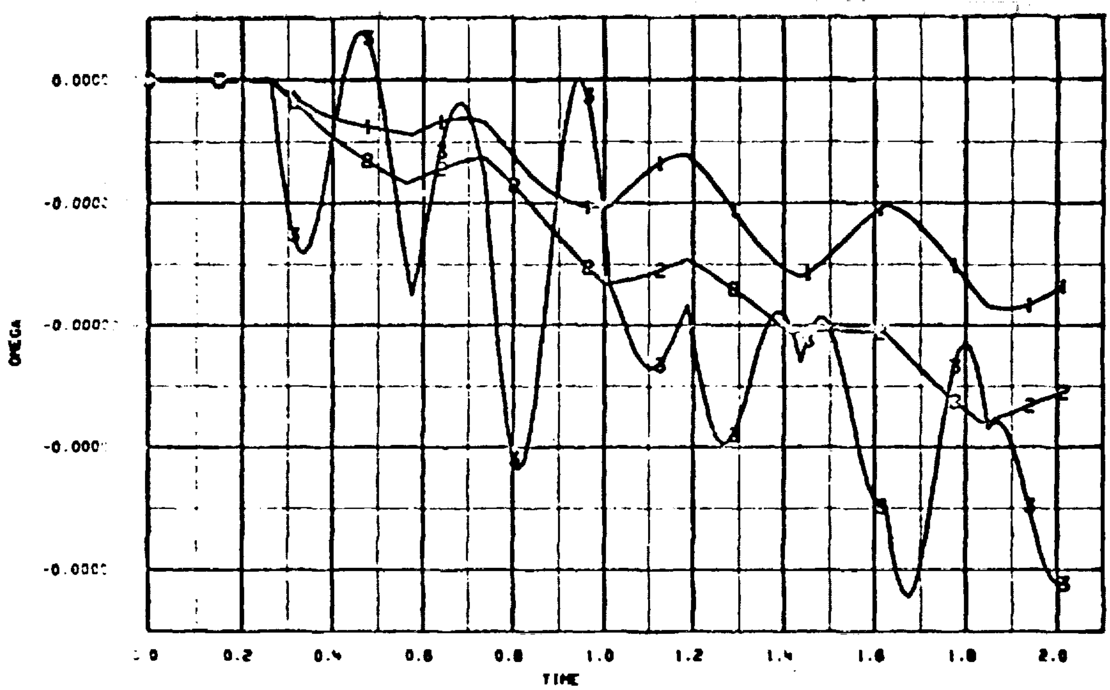
SUMMARY OF PLOTTING INFORMATION

NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 2, ATS-F CONTROLLED SPACECRAFT

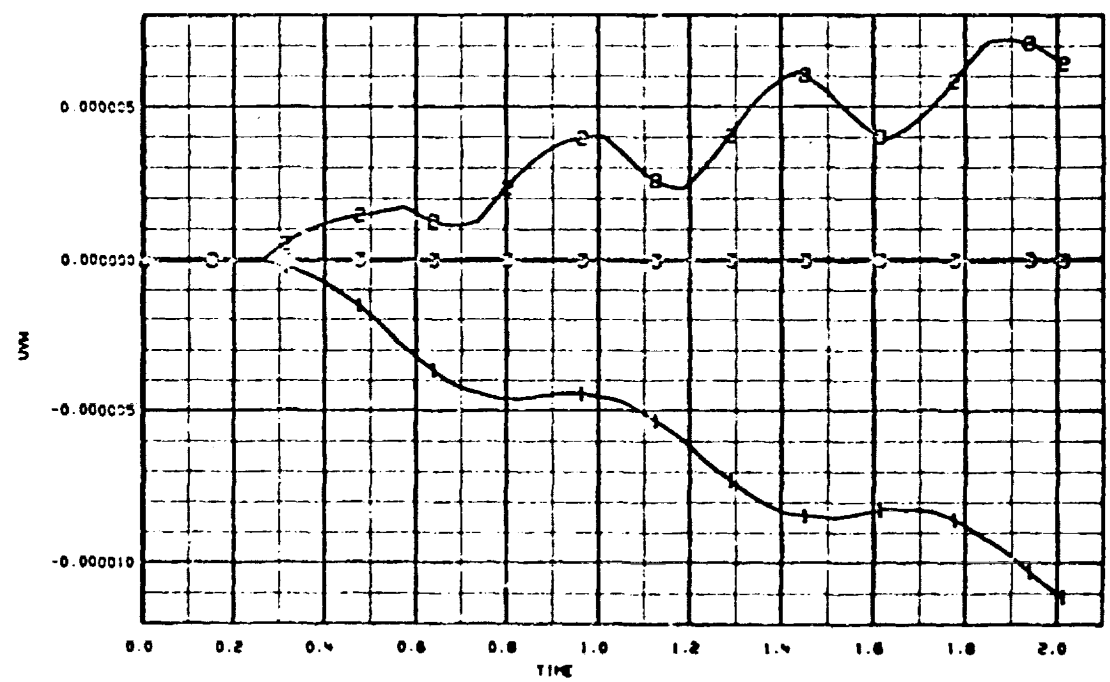
```
NSET    =    6
NRPLOT  =  162          NCPLOT   =  170
KRPLOT  = 1000          KCPLOT   =   16


ISET  =     1
JVPL  =     1    8    9   10   11   12   13

     NCI    =     1     NCD    =    2    3    4     NGRID =     1
     TIME             OMEGA          ATS-F ANGULAR VELOCITY VECTOR

     NCI    =     1     NCD    =    5    6    7     NGRID =     1
     TIME             UVW            ATS-F TRANSLATIONAL VELOCITY VECTOR

ISET  =     2
JVPL  =     1   14   15   16   17   18   19   20   21   22   23   24   25   26   27   28

     NCI    =     1     NCD    =    2    3    4     NGRID =     1
     TIME             BETADOT        REFLECTOR HINGE ANGLE RATES

     NCI    =     1     NCD    =    5    6    0     NGRID =     1
     TIME             BETADOT        &Y MOST PANEL, HINGE ANGLE RATES

     NCI    =     1     NCD    =    7    8    0     NGRID =     1
     TIME             BETADOT        -Y MOST PANEL, HINGE ANGLE RATES

     NCI    =     1     NCD    =    9   10    0     NGRID =     1
     TIME             BETADOT        &X MOST  SLOSH, HINGE ANGLE RATES

     NCI    =     1     NCD    =   11   12    0     NGRID =     1
     TIME             BETADOT        -X MOST  SLOSH, HINGE ANGLE RATES

     NCI    =     1     NCD    =   13    0    0     NGRID =     1
     TIME             TDOT-4         MOMENTUM WHEEL 4, ANGULAR RATE

     NCI    =     1     NCD    =   14   15   16     NGRID =     1
     TIME             TDOT-123       MOMENTUM WHEELS 1-2-3, ANGULAR RATES
```

```
ISET  =    3

JVPL  =    1   29   30   31   32   33   34   35   36   37   38   39   40

      NCI    =     1     NCD    =    2    3    4      NGRID =     1
      TIME            BETA            REFLECTOR HINGE ANGULAR DISPLACEMENT

      NCI    =     1     NCD    =    5    6    0      NGRID =     1
      TIME            BETA            &Y MOST PANEL, HINGE ANGULAR DISPLACEMENT

      NCI    =     1     NCD    =    7    8    0      NGRID =     1
      TIME            BETA            -Y MOST PANEL, HINGE ANGULAR DISPLACEMENT

      NCI    =     1     NCD    =    9   10    0      NGRID =     1
      TIME            BETA            &X MOST SLOSH, HINGE ANGULAR DISPLACEMENT

      NCI    =     1     NCD    =   11   12    0      NGRID =     1
      TIME            BETA            -X MOST SLOSH, HINGE ANGULAR DISPLACEMENT

      NCI    =     1     NCD    =   13    0    0      NGRID =     1
      TIME            THE-4           MOMENTUM WHEEL 4, HINGE ANGULAR DISPLACEMENT

ISET  =    4
JVPL  =    1   47   48   49   50   51   52   53   54   55   56   57   58

      NCI    =     1     NCD    =    2    3    4      NGRID =     1
      TIME            EULERS          EULER ANGLES THAT POSITION BODY WRT INERTIA

      NCI    =     1     NCD    =    5    6    7      NGRID =     1
      TIME            POSITION        X Y AND Z POSITION COORDINATES WRT INERTIA

      NCI    =     1     NCD    =    8    9    0      NGRID =     1
      TIME            DELTA           ROLL CHANNEL CONTROL VARIABLES

      NCI    =     1     NCD    =   10   11    0      NGRID =     1
      TIME            DELTA           PITCH CHANNEL CONTROL VARIABLES

      NCI    =     1     NCD    =   12   13    0      NGRID =     1
      TIME            DELTA           YAW CHANNEL CONTROL VARIABLES

ISET  =    5
JVPL  =    1   83   84   85  110  111  112  113  114  115

      NCI    =     1     NCD    =    2    3    4      NGRID =     1
      TIME            MW-ACC          MOMENTUM WHEELS 1-2-3, ANGULAR ACCELERATION

      NCI    =     1     NCD    =    5    6    0      NGRID =     1
      TIME            DELTADOT        ROLL CHANNEL CONTROL VARIABLES (DOTS)
```

```
      NCI    =     1      NCD    =    7    8    0      NGRID =     1
      TIME          DELTADOT      PITCH CHANNEL CONTROL VARIABLES (DOTS)

      NCI    =     1      NCD    =    9   10    0      NGRID =     1
      TIME          DELTADOT      YAW CHANNEL CONTROL VARIABLES (DOTS)

 ISET  =    6
 JVPL  =    1  165  166  167  168  169

      NCI    =     1      NCD    =    2    3    0      NGRID =     1
      TIME          MOMENTUM      TOTAL ANGULAR AND LINEAR MOMENTUM

      NCI    =     1      NCD    =    4    5    6      NGRID =     1
      TIME          ENERGY        KINETIC, POTENTIAL AND TOTAL ENERGY ( T + V)
```



ATS-F ANGULAR VELOCITY VECTOR

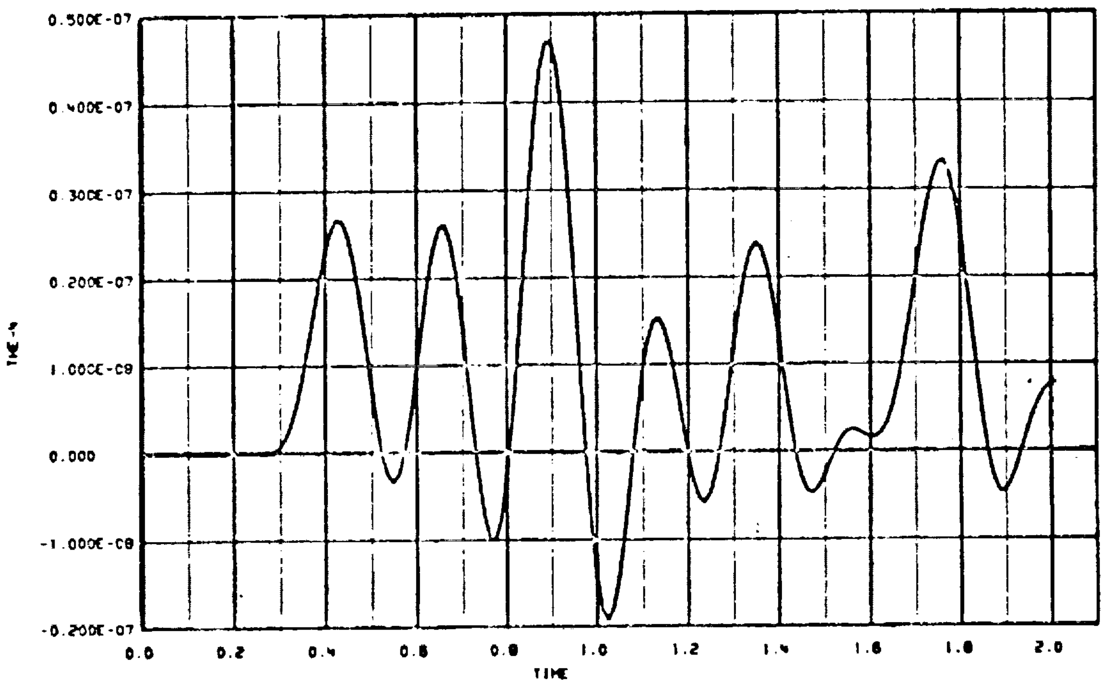


ATS-F TRANSLATIONAL VELOCITY VECTOR

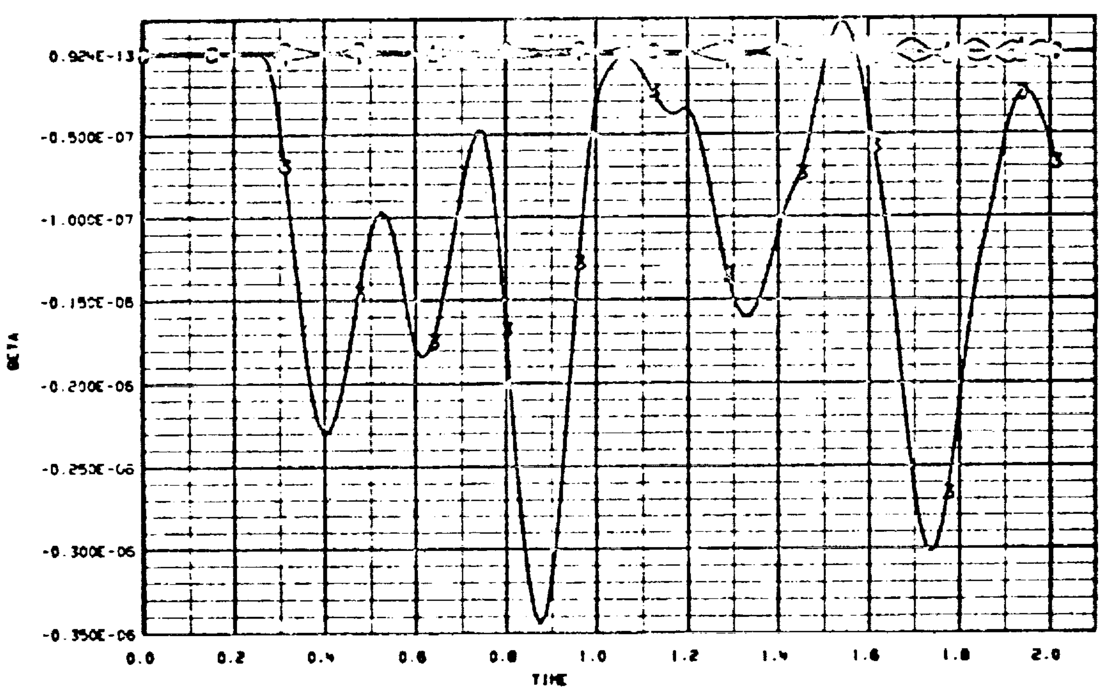
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 2, ATS-F CONTROLLED SPACECRAFT

DEMO 2 02/26/75 CARL BODLEY

Figure A-2 Graphical Results, Demonstration Problem 2 (Sheet 1 of 4)



MOMENTUM WHEEL 4. HINGE ANGULAR DISPLACEMENT

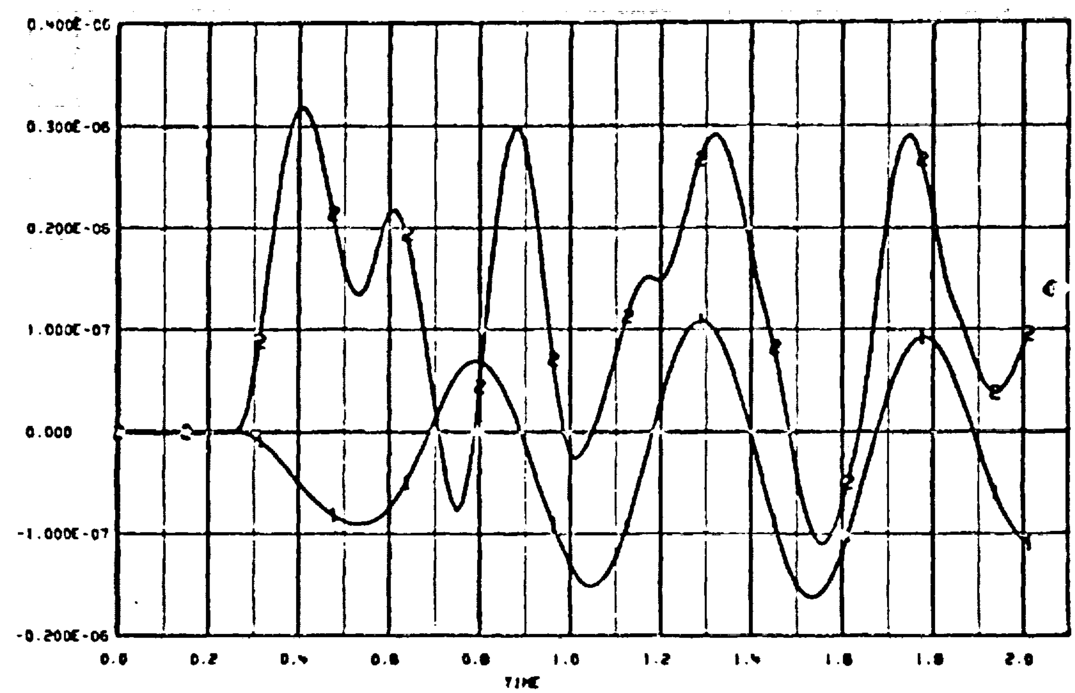


REFLECTOR HINGE ANGULAR DISPLACEMENT

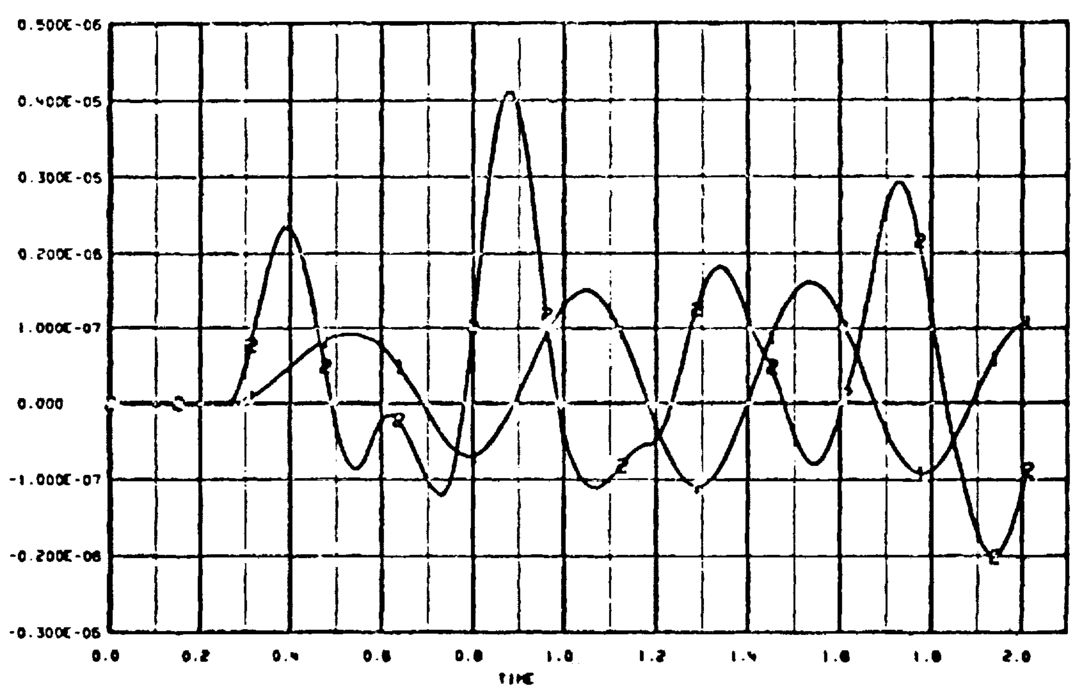
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 2, ATS-F CONTROLLED SPACECRAFT

DEMO 2 02/26/75 CARL BOOLEY

Figure A-2 Graphical Results, Demonstration Problem 2 (Sheet 2 of 4)



+Y MOST PANEL, HINGE ANGULAR DISPLACEMENT

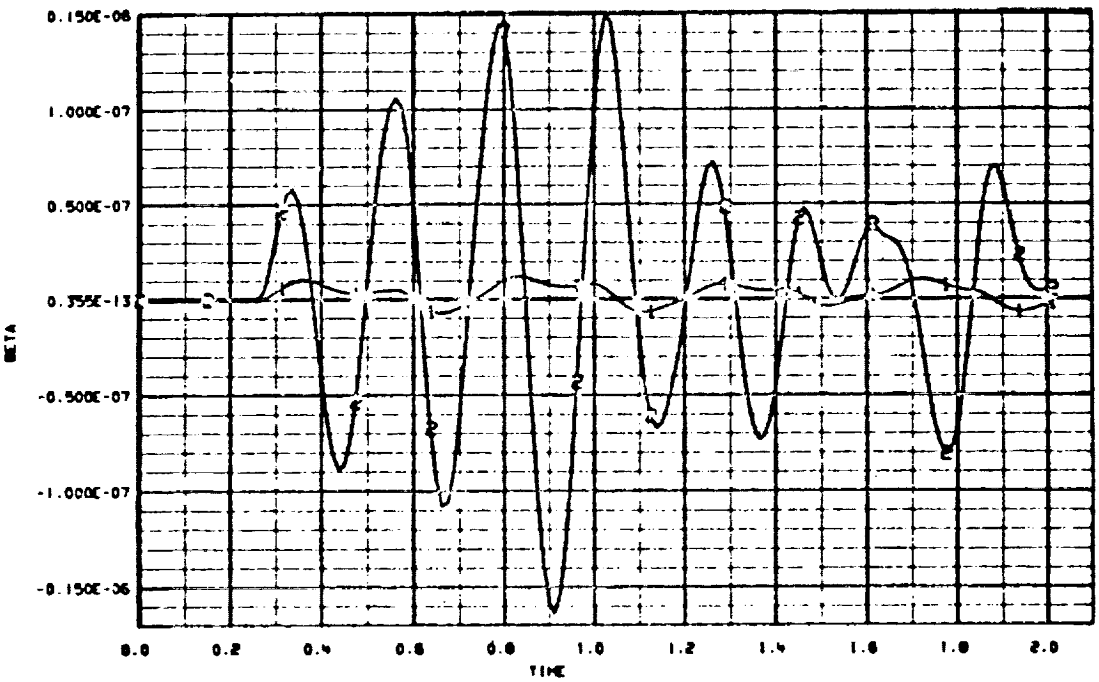


-Y MOST PANEL, HINGE ANGULAR DISPLACEMENT

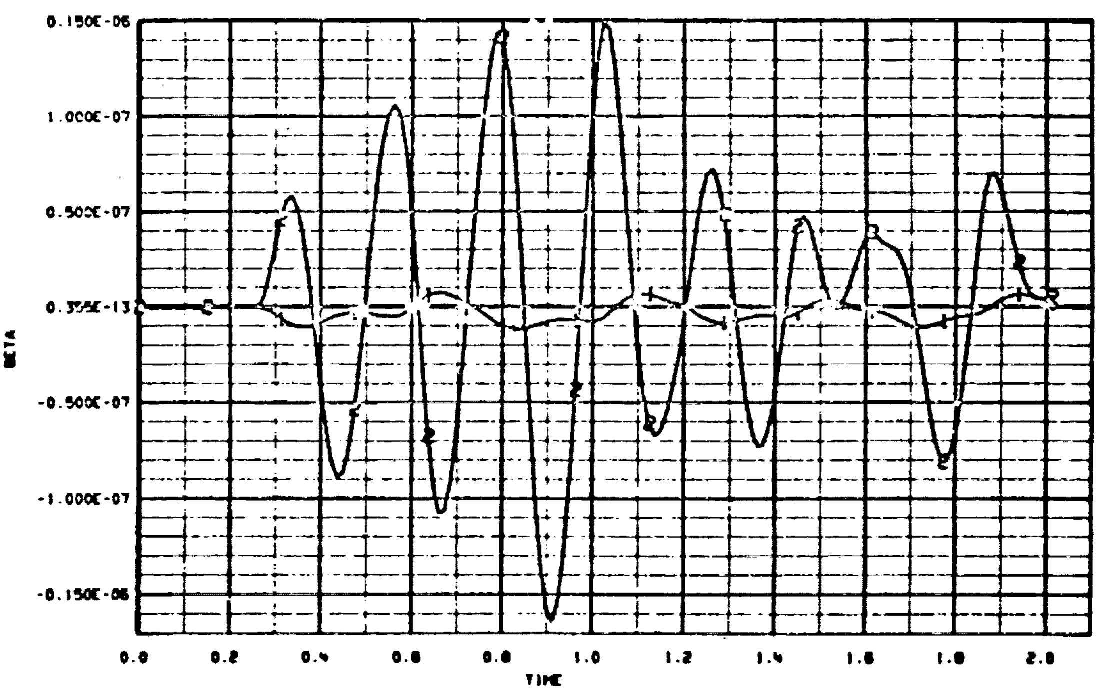
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 2, ATS-F CONTROLLED SPACECRAFT

DEMO 2 02/26/75 CARL BODLEY

Figure A-2 Graphical Results, Demonstration Problem 2 (Sheet 3 of 4)



+X MOST SLOSH, HINGE ANGULAR DISPLACEMENT



-X MOST SLOSH, HINGE ANGULAR DISPLACEMENT

NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 2, ATS-F CONTROLLED SPACECRAFT

DEMO 2 02/26/75 CARL BODLEY

Figure A-2 Graphical Results, Demonstration Problem 2 (Sheet 4 of 4)

Demonstration Problem 3

```
      SUBROUTINE CONTRL
      IMPLICIT REAL*8 (A-H,O-Z)
C
              COMMON /BHBSHD/
     *     BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)
              COMMON /CONPAR/
     *     CNTDTA(100)
      COMMON /LDSIZE/ NX,NY,NDLTA,NXSS,NBTQ,NJQ,NY2,ND2
              COMMON /SPECIF/
     *     BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
     *     DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
     *     NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),
     *     LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
              COMMON /TIMESS/
     *     STARTT,DELTAT,T,ENDT,TMST
              COMMON /VECTOR/
     *     Y(250),YDT(250)
CCCCCCC  THIS COMMON IS TRANSFER BETWEEN CONTRL AND SHAFTT ONLY ----
             COMMON /WHEEL /
     *    CLM(4)
C
      DIMENSION  TQ(6),TQD(6),RHD(3),THADW(3)
      DATA ICT4/0/, RHD / 0.D0, 0.D0, 0.D0 /
      DATA T1,T2,T3,T4,DTHE/
     *    .2D0, 1.2D0, .7D0, 1.7D0, 1.0471975500 /
      ALIM(U,V) = DMAX1(-V,DMIN1(U,V))
C
CCCCCCCCCC
CCCCCCCCCC
CCC  THE FOLLOWING STATEMENTS MUST ALWAYS BE IN CONTRL..
      NDLTA = NDELTA
      NASS = 3
      NBTQ = 3
      IF (NDELTA .EQ. 0) RETURN
CCCCCCCCCCC    CCC
CCCC----NOTE--THIS SUBROUTINE MUST ESTABLISH  NDLTA,NASS AND NBTQ
CCCCCCCCCCC
C
CCCC  ESTABLISH THE D/DT(DELTAS)
C
      LDEL = LOCU(2*NB+2) - 1
      ICT4 = ICT4 + 1
      IA = (ICT4-1)/4
      IAA = (ICT4-2)/4
      IFLAG = IA - IAA
      DO 6 I=1,3
    6 THADW(I) = Y(6+I)
      DO 5 I=1,6
    5 TQ(I) = Y(LDEL+I)
C
```

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```
C          WHEEL 1 (ROLL INERTIA WHEEL CONTROL TORQUE)
C          DEFINE DIFFERENTIAL EQUATIONS FOR ROLL CONTROL LOOP
C
      U1 = 57.2958D0*ROL(3,2,2)/ROL(3,3,2)
      U5 = ALIM(TQ(5),29.D0)
      U2 = 2.17D0*U1 - U5
      U3 = ALIM(1.1D0*U2,1.17D0)
      TQD(5) = (1.D0/88.D0)*(-TQ(5) + (9/1.1D0)*U3)
      U6 = ALIM(5*U3,1.68D0)
      U8 = ALIM(TQ(6),1.9D0)
      IF (IFLAG .EQ. 0) GO TO 32
      UU = DABS(U8)
      IF (UU.GT.1.D0) GO TO 30
      IF (UU.LT.0.5D0) GO TO 31
      U9 = RHD(1)
      GO TO 10
   30 U9 = U8/UU
      GO TO 10
   31 U9 = 0.D0
      GO TO 10
   32 U9 = RHD(1)
      GO TO 33
   10 RHD(1) = U9
   33 CONTINUE
      TQD(6) = (-TQ(6) + 2.5D0*(U6-U9))/.5D0
C
C  1500 RPM = 157.0795 RAD/SEC
C   6 INCH*OZ = .03125 FT*LBS
C
      IF (DABS(THADW(1)).GT. 157.0795D0) U9 = 0.D0
      CLM(1) = .03125D0*U9 - 5.D-05*THADW(1)
C
C          WHEEL 2 (PITCH INERTIA WHEEL CONTROL TORQUE)
C          DEFINE DIFFERENTIAL EQUATIONS IN PITCH CONTROL LOOP
C
      U1 = -57.2958D0*ROL(3,1,2)/ROL(3,3,2)
      U5 = ALIM(TQ(1),16.4D0)
      U2 = 2.17D0*U1 - U5
      U3 = ALIM(.82D0*U2,1.17D0)
      TQD(1) = (-TQ(1) + U3*(7/.82D0))/59.D0
      U6 = ALIM(5*U3,1.68D0)
      U8 = ALIM(TQ(2),1.9D0)
      IF (IFLAG.EQ.0) GO TO 14
      UU = DABS(U8)
      IF (UU.GT. 1.D0) GO TO 15
      IF (UU.LT.0.5D0) GO TO 16
      U9 = RHD(2)
      GO TO 12
   15 U9 = U8/UU
      GO TO 12
```

```
   16 U9 = 0.D0
      GO TO 12
   14 U9 = RHO(2)
      GO TO 13
   12 RHO(2) = U9
   13 CONTINUE
      TWD(2) = (-TQ(2) + 2.5D0*(U6 - U9))/.5D0
      IF (DABS(THADW(2)).GE. 157.0795D0) U9 = 0
      CLM(2) = .03125D0*U9 - 5.D-05*THADW(2)
C
C          WHEEL 3 (YAW INERTIA WHEEL CONTROL TORQUE)
C          DEFINE DIFFERENTIAL EQUATIONS FOR YAW CONTROL LOOP
C
      U1 = 57.2958D0*ROL(2,1,2)/ROL(2,2,2)
      U2 = ALIM(U1,2.D0)
      U6 = ALIM(TQ(3),29.D0)
      U3 = 2.17D0*U2 - U6
      U4 = ALIM(1.47D0*U3,1.17D0)
      TWD(3) = (1.D0/88.D0)*(-TQ(3) + (971.47D0)*U4)
      U7 = ALIM(5*U4,1.66D0)
      U9 = ALIM(TQ(4),1.9D0)
      IF (IFLAG.EQ.0) GO TO 20
      U0 = DABS(U9)
      IF (U0.GT.1.D0) GO TO 21
      IF (U0.LT. 0.5D0) GO TO 22
      U10 = RHO(3)
      GO TO 18
   21 U10 = U9/U0
      GO TO 18
   22 U10 = 0.D0
      GO TO 18
   20 U10 = RHO(3)
      GO TO 24
   18 RHO(3) = U10
   24 CONTINUE
      TWD(4) = (-TQ(4) + 2.5D0*(U7 - U10))/.5D0
      IF (DABS(THADW(3)) .GT. 157.0795D0) U10 = 0.D0
      CLM(3) = .03125D0*U10 - 5.D-05*THADW(3)
C
      DO 34 I=1,6
   34 YDT(LOEL+I) = TWD(I)
C
      RETURN
      END
```

```
DEMO 3    CARL BODLEY
ATS-F SINGLE FLEXIBLE BODY USING NORMAL VIBRATION MODES, 3 IMBEDDED MOM.
WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC
NAS5-11996  --  GSFC DEMONSTRATION PROBLEM NUMBER 3.


THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS-F SPACECRAFT AS A SINGLE
FLEXIBLE BODY AND A DUMMY RIGID BODY (THE PROGRAM MUST HAVE A MINIMUM OF
2-HINGES, THUS 2-BODIES). THERE ARE THREE ACTIVE MOMENTUM WHEELS USED
FOR CONTROL TORQUE.

THE PROBLEM STARTS WITH INITIAL ATTITUDE ERROR (NO RATE ERROR) AND
SIMULATES NONLINEAR TIME DOMAIN RESPONSE.
0000000000
    2     2     3     3     6
ITOPOL    2     2
    1     1     1     2
    2     1     0     1
0000000000
IRGFLX    1     2
    1     1     0    12
0000000000
IFTSMW    1     3
    1     1     2     2     2
0000000000
IHDATA    7     2
    1     1     1     1
    2     1     0     0
    3     1     0     0
    4     1     0     0
    5     1     0     0
    6     1     0     0
    7     1     0     0
0000000000
BETAH     6     2
    1     2   .0014626
    2     2   .0019621
    3     2   .0010945
    4     2  -.030197
    5     2  -.014451
    6     2   24.353
0000000000
BETAHD    6     2
0000000000
IMO       3     3
    1     1     1     2     3
    2     1     1     2     3
    3     1     1     1     1
0000000000
AMO       2     3
```

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    1     1    127.78              127.78              127.78
    2     1     .065                .065                .065
0000000000
IMDATA    1     3
    1     1      0.                .0125                2.
0000000000
IPDATA    1     3
    1     1    10      1      0
0000000000
CNTDTA    1    50
0000000000
GGDATA    1     4
0000000000
MIDUM     1     4
    1     1     1.
0000000000
INRDUM    1     6
    1     1    1.                  1.                  1.
0000000000
    2     1
    0.         0.          0.
    0.         0.          0.
    2
    1     0     0
JDOF      7     6
    1     1     4     5     6     1     2     3
    2     1    10    11    12     7     8     9
    3     1    16    17    18    13    14    15
    4     1    22    23    24    19    20    21
    5     1    28    29    30    25    26    27
    6     1    34    35    36    31    32    33
    7     1    40    41    42    37    38    39
0000000000
JV        1    18
    1     1     1     2     3     4     5     6     7     8     9    10    11    12    13    14
    1    15    15    16    17    18
0000000000
MASS     42    42
    1     1    3713.7               5.0961             -32.729
    2     1      5.0961          3557.3                 -2.9104
    3     1    -32.729             -2.9104             417.63
    4     4     68.273
    5     5     68.273
    6     6     68.273
    7     7     100.48                0.                  0.
    8     7       0.                100.79                0.
    9     7      0.                   0.                 96.705
   10    10     3.5559
   11    11     3.5559
   12    12     3.5559
```

13	13	168.96	4.7689	-.14296	
14	13	4.7689	40.091	1.9592	
15	13	-.14296	1.9592	145.07	
16	16	5.1553			
17	17	5.1553			
18	18	5.1553			
19	19	168.96	4.7689	.14296	
20	19	4.7689	40.091	-1.9592	
21	19	.14296	-1.9592	145.07	
22	22	5.1553			
23	23	5.1553			
24	24	5.1553			
25	25	.79758	0.	0.	
26	25	0.	.79758	0.	
27	25	0.	0.	.79758	
28	28	1.7081			
29	29	1.7081			
30	30	1.7081			
31	31	.79758	0.	0.	
32	31	0.	.79758	0.	
33	31	0.	0.	.79758	
34	34	1.7081			
35	35	1.7081			
36	36	1.7081			
39	39	96.705			
0000000000					
PHI	42	18			
1	1	9.83331621E-03	1.08700706E-04	3.88429209E-05	2.52567315E-05
1	5	1.74038153E-03	2.78367910E-06	2.67161700E-06	1.48119138E-04
1	9	1.92040661E-07	8.32707941E-03	2.34652766E-04	1.11031592E-05
1	13	4.39759055E-17	6.59783689E-17	1.66426041E-06	2.63996533E-05
1	17	3.05267419E-06	9.36891292E-04		
2	1	0.	-1.27794731E-02	7.05498834E-07	-2.97121848E-03
2	5	-2.63471656E-05	-9.75379869E-06	-1.37500913E-07	-7.33263828E-03
2	9	5.33494527E-05	1.39802119E-04	2.35045096E-05	1.12043383E-06
2	13	-7.65123905E-15	1.24041722E-18	-2.92896924E-04	2.83775629E-06
2	17	-1.07787726E-03	-4.75610517E-06		
3	1	0.	0.	1.44628709E-02	-5.99600142E-06
3	5	2.20927746E-05	1.46876123E-08	1.20740355E-03	5.27765859E-06
3	9	7.78247427E-08	-1.03637672E-04	4.21650085E-02	2.14014559E-03
3	13	9.76027383E-19	1.63613671E-15	1.56688010E-07	5.11818887E-03
3	17	9.55875861E-06	4.20292253E-05		
4	1	0.	0.	0.	-1.10996014E-01
4	5	-5.04115257E-05	-1.86863768E-05	4.91830808E-06	2.91135039E-02
4	9	-1.32991029E-04	4.08311928E-04	7.61060000E-05	4.09221390E-06
4	13	-3.93165901E-15	4.24779537E-18	-1.50421449E-04	9.93069071E-06
4	17	-6.63577970E-03	8.33106730E-06		
5	5	-1.09792445E-01	-5.33308833E-06	-1.24253581E-05	7.26671701E-04
5	9	-5.99030691E-06	-1.61346611E-02	-7.10191092E-04	-3.43787652E-05
5	13	1.83163425E-16	-1.37792772E-16	7.01093073E-06	-8.18660811E-05

5	17	1.94295994E-05	-7.25777919E-03		
6	5	0.	-1.08112438E-01	1.81783132E-08	-2.27378784E-04
6	9	-3.73323609E-02	9.10828052E-05	6.42743786E-10	-3.53631176E-09
6	13	-2.25186906E-17	-4.26996098E-16	-8.62060435E-07	-8.59623288E-09
6	17	-3.33190957E-06	-1.39989716E-06		
7	1	9.63331621E-03	1.08700706E-04	3.60429209E-05	2.52567315E-05
7	5	1.74038153E-03	2.70367910E-05	2.07280057E-06	1.49461594E-04
7	9	2.09047378E-07	8.65111658E-03	2.61877834E-04	1.41512643E-05
7	13	5.48281652E-17	7.08513311E-17	2.10113319E-06	3.47369783E-05
7	17	8.55737749E-03	-9.61032715E-02		
8	1	0.	-1.27794731E-02	7.05498834E-07	-2.97121848E-03
8	5	-2.03471656E-05	-9.75379869E-06	-1.48039726E-07	-7.41418232E-03
8	9	5.41884820E-05	1.49804406E-04	1.85581715E-05	4.63666601E-07
8	13	-1.13119625E-14	5.48843039E-19	-4.32031796E-04	1.13491287E-06
8	17	9.58462371E-02	7.89732316E-05		
9	1	0.	0.	1.44526709E-02	-5.90609142E-06
9	5	2.20927746E-05	1.46876123E-04	-6.75105600E-02	-1.34395167E-06
9	9	-4.04967651E-06	2.72616506E-05	1.11242602E-03	-7.45930105E-02
9	13	-6.48927406E-20	9.54843339E-16	-9.72524405E-08	-2.91509524E-03
9	17	-5.10625547E-07	-2.19948117E-06		
10	1	0.	1.44509004E-01	-2.16980657E-04	-7.73976864E-02
10	5	2.47200326E-04	9.15083912E-05	-1.09900948E-05	1.11913912E-01
10	9	-7.35127979E-04	-1.10293769E-03	-8.06454726E-04	-4.03927905E-05
10	13	7.76301088E-14	-3.43576076E-17	2.97350116E-03	-9.84642985E-05
10	17	1.35603705E-01	1.74722461E-04		
11	1	1.11194156E-01	1.22917672E-03	8.75967174E-04	2.85419533E-04
11	5	-9.01117179E-02	2.61449201E-05	5.42432761E-05	2.39993220E-03
11	9	-3.83937503E-06	7.75858597E-02	3.17960467E-03	1.51665701E-04
11	13	6.65794700E-16	6.51101714E-15	2.54974566E-05	3.59939611E-04
11	17	-5.73392058E-05	1.34545767E-01		
12	1	1.42101253E-04	3.87472565E-04	5.40015102E-07	9.00868695E-05
12	5	2.59458589E-05	-1.08112103E-01	6.09379056E-08	-3.81463653E-06
12	9	-3.73339771E-02	1.25221360E-04	2.60023237E-06	1.23081702E-07
12	13	2.09161271E-16	-2.37396446E-16	8.00028073E-06	2.87213431E-07
12	17	2.92608642E-05	1.22827390E-05		
13	1	9.63331621E-03	1.08700706E-04	3.60429209E-05	2.52567315E-05
13	5	1.74038153E-03	2.70367910E-05	4.90970658E-06	2.90105755E-04
13	9	1.95812423E-02	-1.55007918E-02	-9.03236793E-05	-3.37913116E-06
13	13	1.74125662E-16	-1.10123825E-16	6.00467787E-06	-7.61070547E-06
13	17	2.45140925E-05	-2.25776429E-04		
14	1	0.	-1.27794731E-02	7.05496634E-07	-2.97121848E-03
14	5	-2.03471656E-05	-9.75379869E-06	-1.37500913E-07	-7.33203826E-03
14	9	5.33494527E-05	1.34802114E-04	2.35545095E-05	1.12043383E-06
14	13	-7.05123905E-15	1.24041772E-18	-2.92696924E-04	2.83775629E-06
14	17	-1.07787726E-03	-4.75610517E-06		
15	1	0.	0.	1.44628709E-02	-5.90600142E-06
15	5	2.20927746E-05	1.46876123E-06	3.50191233E-03	2.26378034E-02
15	9	-1.23201938E-04	1.77207517E-04	-1.42161188E-02	-5.79403556E-04
15	13	5.95605056E-15	-4.22101546E-16	2.20026820E-04	-1.35730589E-03
15	17	4.57653899E-04	1.95367880E-05		

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16	1	0.	1.71588912E-01	-2.7827800[illegible]E-01	-7.09863493E-02
16	5	-1.21719747E-04	1.11994466E-04	-6.04403506E-02	-2.30330921E-01
16	9	1.99007129E-03	-1.91467143E-03	7.98257515E-02	1.80557199E-03
16	13	4.02568549E-15	1.04668388E-15	1.76607322E-04	3.86794756E-03
16	17	5.68439214E-04	-1.03063584E-04		
17	1	1.32031121E-01	1.45951525E-03	-4.39269702E-03	3.41157352E-04
17	5	-8.64319954E-02	3.20381465E-05	-1.25609120E-03	-5.66987679E-03
17	9	-1.33012332E-03	9.72951402E-02	8.99360442E-03	3.94711113E-04
17	13	-1.43938331E-15	9.66010741E-16	-5.50843388E-05	9.31727428E-04
17	17	-1.10120702E-04	5.40385853E-03		
18	1	1.69194971E-01	-2.25082439E-03	7.47565284E-04	-5.23624963E-04
18	5	3.34763304E-02	-1.90862194E-01	8.77344013E-05	2.37688837E-03
18	9	2.72246277E-01	-2.21292704E-01	-7.09032570E-04	-1.49463565E-05
18	13	2.61366237E-16	-1.51743105E-15	1.07599372E-05	-3.19413271E-05
18	17	2.84539925E-05	-3.57654113E-04		
19	1	9.83331621E-03	1.08700706E-04	3.80429209E-05	2.52567315E-05
19	5	1.74038153E-03	2.78367910E-05	4.99757355E-06	9.89025325E-05
19	9	-1.96091791E-02	-1.57745560E-02	-9.57531498E-05	-3.35592448E-06
19	13	1.99608861E-16	-1.13420115E-15	7.64305617E-06	-7.75683757E-06
19	17	2.79208728E-05	-2.24338676E-04		
20	1	0.	-1.27794731E-02	7.05496534E-07	-2.97121848E-03
20	5	-2.03471556E-05	-4.75379869E-20	-1.37505913E-07	-7.33263828E-03
20	9	5.33494527E-05	1.39802119E-04	2.35645096E-05	1.12043363E-06
20	13	-7.05123905E-15	1.24041722E-16	-2.92090924E-04	2.83775629E-06
20	17	-1.07707726E-03	-4.75610517E-06		
21	1	0.	0.	1.44626709E-02	-5.99600142E-06
21	5	2.20927746E-05	1.46876123E-04	3.56018091E-03	-2.26665585E-02
21	9	1.23590800E-04	2.90669196E-05	-1.41188525E-02	-5.74836386E-04
21	13	-5.95707852E-15	-4.16184259E-16	-2.28109734E-04	-1.34618762E-03
21	17	-4.02027984E-04	-2.11582397E-05		
22	1	0.	1.71588912E-01	2.77839032E-01	-7.12169039E-02
22	5	7.27778364E-04	1.12559226E-04	6.03974928E-02	-2.30749445E-01
22	9	1.10486208E-03	-1.36189235E-03	-7.99914397E-02	-1.81733607E-03
22	13	4.62875138E-15	-1.02539962E-15	1.76627250E-04	-3.89694949E-03
22	17	5.65108055E-04	-1.14307889E-04		
23	1	1.32431111E-01	1.45951525E-03	6.30924692E-03	3.36720551E-04
23	5	-8.04156477E-02	3.20490148E-05	1.37693688E-03	-5.66710971E-03
23	9	1.41601755E-03	9.73690979E-02	-1.48680622E-03	-3.23362187E-05
23	13	-1.44125350E-15	6.56092776E-16	-5.51633501E-05	-6.85148748E-05
23	17	-1.11978294E-04	5.39660616E-03		
24	1	-1.56909804E-01	3.02578021E-01	-7.46501447E-04	7.03801177E-04
24	5	-3.34242742E-02	-1.08162013E-01	-4.80275553E-05	6.39493338E-04
24	9	2.72647148E-01	2.21602730E-01	7.05996773E-04	1.48267336E-05
24	13	-2.05908116E-15	1.50480064E-15	-1.01658872E-05	3.16667435E-05
24	17	-2.39035795E-05	3.59581963E-04		
25	1	9.83331621E-03	1.08700705E-04	3.80429209E-05	2.52567315E-05
25	5	1.74038153E-03	2.78367910E-05	2.67161790E-06	1.48119136E-04
25	9	1.92040661E-07	8.32707941E-03	2.34052766E-04	1.11031592E-05
25	13	4.39759055E-17	5.59783689E-17	1.00426041E-06	2.63996533E-05
25	17	3.05267419E-06	4.36891292E-04		

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26	1	0.	-1.27794731E-02	7.05498834E-07	-2.97121848E-03
26	5	-2.03471656E-05	-9.75379869E-05	-1.43425217E-07	-7.98793864E-03
26	9	5.87469500E-05	1.62669941E-04	4.05456140E-05	1.69585386E-05
26	13	-7.91767023E-01	4.35414477E-14	7.91617088E-01	-4.18473059E-04
26	17	1.15378960E-03	4.80646977E-06		
27	1	0.	0.	1.44626709E-02	-5.99600142E-06
27	5	2.20927746E-05	1.46876123E-08	1.25059608E-03	5.74918027E-06
27	9	8.56678561E-08	-1.20330940E-04	8.06912108E-02	3.37195898E-02
27	13	3.08369072E-14	7.91767871E-01	-4.21564046E-04	-7.85927860E-01
27	17	-9.79795662E-06	-4.14904360E-05		
28	1	0.	-5.51434266E-02	-2.05958720E-04	-1.23816736E-01
28	5	-1.04418608E-04	-6.07742304E-05	-1.31232029E-05	-2.52756190E-03
28	9	9.72161319E-05	1.01307861E-03	-4.31514097E-04	-2.19845200E-05
28	13	-7.91767023E-04	2.95969914E-17	-6.22363957E-04	-5.22086490E-05
28	17	-1.12847265E-02	-1.27893283E-05		
29	1	-4.24307594E-02	-4.69043544E-04	1.05892900E-02	-1.16759011E-04
29	5	-1.17273539E-01	-1.73256153E-05	1.54192527E-03	9.43824757E-05
29	9	-6.71180314E-06	-5.22004165E-02	5.29610018E-02	2.69326592E-03
29	13	-5.32679076E-14	1.69941026E-15	-5.34442438E-08	6.44199855E-03
29	17	1.06540643E-05	-1.12445574E-02		
30	1	1.42101253E-04	1.05752696E-02	-3.53042387E-07	3.85373823E-03
30	5	5.93198926E-05	-1.08009748E-01	2.35110765E-07	9.24446327E-03
30	9	-3.74015530E-02	-5.10664635E-05	-2.71690027E-05	-1.29617519E-06
30	13	9.90100873E-15	-3.94520467E-15	3.79019099E-04	-3.30738097E-06
30	17	1.39461122E-03	1.83073117E-05		
31	1	9.03351621E-03	1.48700706E-04	3.88429239E-05	2.52567315E-05
31	5	1.74038153E-03	2.76367910E-05	2.67161700E-06	1.48119138E-04
31	9	1.92040601E-07	8.32707941E-03	2.34052706E-04	1.11031592E-05
31	13	4.39759035E-17	6.59783689E-17	1.00420041E-06	2.63946533E-05
31	17	3.05267419E-06	9.36891292E-04		
32	1	0.	-1.27794731E-02	7.05498834E-07	-2.97121848E-03
32	5	-2.03471656E-05	-9.75379864E-05	-1.43425217E-07	-7.98793864E-03
32	9	5.87469500E-05	1.62669941E-04	4.05456140E-05	1.69585386E-05
32	13	7.91767023E-01	-3.87909958E-14	7.91617088E-01	-4.18473059E-04
32	17	1.15378960E-03	4.80646977E-06		
33	1	0.	0.	1.44626709E-02	-5.99600142E-06
33	5	2.20927746E-05	1.46876123E-08	1.25059608E-03	5.74918027E-06
33	9	8.56678561E-08	-1.20330940E-04	8.06912108E-02	3.37195898E-02
33	13	-5.15956141E-14	-7.91767871E-01	-4.21564046E-04	-7.85927860E-01
33	17	-9.79795662E-06	-4.14904360E-05		
34	1	0.	-5.51434266E-02	-2.05958720E-04	-1.23816736E-01
34	5	-1.04418608E-04	-6.07742304E-05	-1.31232029E-05	-2.52756190E-03
34	9	9.72161319E-05	1.01307861E-03	-4.31514697E-04	-2.19845200E-05
34	13	7.91767023E-04	-5.28358521E-17	-6.22363957E-04	-5.22086490E-05
34	17	-1.12847265E-02	-1.27893283E-05		
35	1	-4.24307594E-02	-4.69043544E-04	-1.80509471E-02	-1.01568741E-04
35	5	-1.17329509E-01	-1.73628249E-05	-1.51590787E-03	8.10115438E-05
35	9	-6.91519266E-06	-5.14378608E-02	-5.30597500E-02	-2.72557892E-03
35	13	-7.79464453E-16	-2.44557247E-15	-4.50397648E-07	-6.52442112E-03
35	17	-5.56209472E-06	-1.13524342E-02		

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  36    1   1.42101253E-04  -1.58002477E-02   1.43356636E-06  -3.67354607E-03
  36    5  -7.42891675E-05  -1.08124458E-01  -1.13234029E-07  -9.29204555E-03
  36    9  -3.72603995E-02   3.02308226E-04   3.25293260E-05   1.54233167E-06
  36   13  -9.48264028E-15  -8.02731692E-14  -3.63005369E-04   3.88179081E-06
  36   17  -1.33608303E-03   6.25819485E-06
  39    1   0.               0.               1.44628709E-02  -5.99600142E-06
  39    5   2.20927746E-05   1.40876123E-08  -7.31317196E-02  -4.09016971E-06
  39    9  -5.08589404E-08   3.94369485E-05  -6.64422176E-03   6.88013441E-02
  39   13  -7.38049029E-20  -9.62814475E-16   7.93086921E-08   2.35184632E-03
  39   17   1.50337848E-07   6.30994323E-07
0000000000
   1
   0.          0.             0.
STIFR   42   42
  22   21   0.               4.45000000E&05  -2.09680000E&05  -1.17660000E&05
  22   25  -1.17660000E&05   0.               0.               0.
  23   21   0.              -2.09680000E&05   2.09680000E&05   0.
  24   21   0.              -1.17660000E&05   0.               1.17660000E&05
  25   21   0.              -1.17660000E&05   0.               0.
  25   25   1.17660000E&05   0.               0.               0.
  29   29   2.09124360E&05  -2.07550000E&05   0.               0.
  29   33  -7.87180000E&02  -7.87180000E&02   0.               0.
  30   29  -2.07550000E&05   2.07550000E&05   0.               0.
  33   29  -7.87180000E&02   0.               0.               0.
  33   33   7.87180000E&02   0.               0.               0.
  34   29  -7.87180000E&02   0.               0.               0.
  34   33   0.               7.87180000E&02   0.               0.
  36   33   0.               0.               0.               1.65997060E&05
  36   37  -6.74670000E&03  -7.88380000E&04  -7.88380000E&04  -7.87180000E&02
  36   41  -7.87180000E&02   0.
  37   33   0.               0.               0.              -6.74670000E&03
  37   37   4.96347000E&04   0.               0.               0.
  37   41   0.              -4.28880000E&04
  38   33   0.               0.               0.              -7.88380000E&04
  38   37   0.               7.88380000E&04   0.               0.
  39   33   0.               0.               0.              -7.88380000E&04
  39   37   0.               0.               7.88380000E&04   0.
  40   33   0.               0.               0.              -7.87180000E&02
  40   37   0.               0.               0.               7.87180000E&02
  41   33   0.               0.               0.              -7.87180000E&02
  41   41   7.87180000E&02   0.
  42   37  -4.28880000E&04   0.               0.               0.
  42   41   0.               4.28880000E&04
0000000000
DAMPR   42   42
  22   21   0.               6.17905000E&02  -9.41050000E&01  -2.61900000E&02
  22   25  -2.61900000E&02   0.               0.               0.
  23   21   0.              -9.41050000E&01   9.41050000E&01   0.
  24   21   0.              -2.61900000E&02   0.               2.61900000E&02
  25   21   0.              -2.61900000E&02   0.               0.
```

```
  25   25   2.61900000E+02   0.               0.               0.
  29   29   1.14422000E+02  -9.43760000E+01   0.               0.
  29   33  -1.00230000E+01  -1.00230000E+01   0.               0.
  30   29  -9.43750000E+01   9.43760000E+01   0.               0.
  33   29  -1.00230000E+01   0.               0.               0.
  33   33   1.00230000E+01   0.               0.               0.
  34   29  -1.00230000E+01   0.               0.               0.
  34   33   0.               1.00230000E+01   0.               0.
  36   33   0.               0.               0.               5.02502000E+02
  36   37  -5.71160000E+01  -2.12670000E+02  -2.12670000E+02  -1.00230000E+01
  36   41  -1.00230000E+01   0.
  37   33   0.               0.               0.              -5.71160000E+01
  37   37   3.45126000E+02   0.               0.               0.
  37   41   0.              -2.88010000E+02
  38   33   0.               0.               0.              -2.12570000E+02
  38   37   0.               2.12670000E+02   0.               0.
  39   33   0.               0.               0.              -2.12670000E+02
  39   37   0.               0.               2.12570000E+02   0.
  40   33   0.               0.               0.              -1.00230000E+01
  40   37   0.               0.               0.               1.00230000E+01
  41   33   0.               0.               0.              -1.00230000E+01
  41   41   1.00230000E+01   0.
  42   37  -2.88010000E+02   0.               0.               0.
  42   41   0.               2.88010000E+02
0000000000
   0.           0.           0.           0.           0.           0.           0.           0.
   0.           0.           0.           0.
   0.           0.           0.           0.           0.           0.           0.           0.
   0.           0.           0.           0.
    2     1     1
   0.           0.           0.
    1     1     1
   0.           0.           0.
    2     1     1
   0.           0.           0.
    3     1     1
   0.           0.           0.
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 3, ATS-F CONTROLLED SPACECRAFT
    6
    7
    1     8     9    10    11    12    13
    1     2     3     4
TIME        OMEGA       ATS-F ANGULAR VELOCITY VECTOR
    1     5     6     7
TIME        UVW         ATS-F TRANSLATIONAL VELOCITY VECTOR
0000000000
   16
    1    14    15    16    17    18    19    20    21    22    23    24    25    26    27    28
    1     2     3     4
TIME        VEL-ELAS  ELASTIC MODAL VELOCITIES, MODES 1,2,3
```

```
     1      5      6      7
TIME        VEL-ELAS  ELASTIC MODAL VELOCITIES, MODES 4,5,6
     1      8      9     10
TIME        VEL-ELAS  ELASTIC MODAL VELOCITIES, MODES 7,8,9
     1     11     12     13
TIME        VEL-ELAS  ELASTIC MODAL VELOCITIES, MODES 10,11,12
     1     14     15     16
TIME        TDOT-123  MOMENTUM WHEELS 1-2-3, ANGULAR RATES
0000000000
    13
     1    29    30    31    32    33    34    35    36    37    38    39    40
     1     2     3     4
TIME        DSP-ELAS  ELASTIC MODAL DISPL., MODES 1,2,3
     1      5      6      7
TIME        DSP-ELAS  ELASTIC MODAL DISPL., MODES 4,5,6
     1      8      9     10
TIME        DSP-ELAS  ELASTIC MODAL DISPL., MODES 7,8,9
     1     11     12     13
TIME        DSP-ELAS  ELASTIC MODAL DISPL., MODES 10,11,12
0000000000
    13
     1    47    48    49    50    51    52    53    54    55    56    57    58
     1     2     3     4
TIME        EULERS    EULER ANGLES THAT POSITION BODY WRT INERTIA
     1     5     6     7
TIME        POSITION  X Y AND Z POSITION COORDINATES WRT INERTIA
     1     8     9
TIME        DELTA     ROLL CHANNEL CONTROL VARIABLES
     1    10    11
TIME        DELTA     PITCH CHANNEL CONTROL VARIABLES
     1    12    13
TIME        DELTA     YAW CHANNEL CONTROL VARIABLES
0000000000
    10
     1    83    84    85   110   111   112   113   114   115
     1     2     3     4
TIME        MW-ACC    MOMENTUM WHEELS 1-2-3, ANGULAR ACCELERATION
     1     5     6
TIME        DELTADOT  ROLL CHANNEL CONTROL VARIABLES (DOTS)
     1     7     8
TIME        DELTADOT  PITCH CHANNEL CONTROL VARIABLES (DOTS)
     1     9    10
TIME        DELTADOT  YAW CHANNEL CONTROL VARIABLES (DOTS)
0000000000
     6
     1   165   166   167   168   169
     1     2     3
TIME        MOMENTUM  TOTAL ANGULAR AND LINEAR MOMENTUM
     1     4     5     6
TIME        ENERGY    KINETIC, POTENTIAL AND TOTAL ENERGY ( T + V)
0000000000
STOP
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ATS-F SINGLE FLEXIBLE BODY USING NORMAL VIBRATION MODES, 3 IMBEDDED MOM. WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC

CURRENT TIME = 12.08.05
THE CPU TIMER = 0.0

NAS5-11996 -- GSFC DEMONSTRATION PROBLEM NUMBER 3.

THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS-F SPACECRAFT AS A SINGLE FLEXIBLE BODY AND A DUMMY RIGID BODY (THE PROGRAM MUST HAVE A MINIMUM OF 2-HINGES, THUS 2-BODIES). THERE ARE THREE ACTIVE MOMENTUM WHEELS USED FOR CONTROL TORQUE.

THE PROBLEM STARTS WITH INITIAL ATTITUDE ERROR (NO RATE ERROR) AND SIMULATES NONLINEAR TIME DOMAIN RESPONSE.

ATS-F SINGLE FLEXIBLE BODY USING NORMAL VIBRATION MODES, 3 IMBEDDED MOM. WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC

CURRENT TIME = 12.08.06
THE CPU TIMER = 3.0667E-01

SUMMARY OF DYNAMIC-SIMULATION-PROGRAM INPUT DATA * * * * * * * * * *

ACTUAL SIZES		MAXIMUM SIZES		INTEGRATION DATA		GRAVITY GRADIENT DATA				MISC. DATA	
NB =	2	NBMAX =	6	STARTT =	0.0	G1 =	0.0	GAMA1 =	0.0	NOPRNT =	10
NH =	2	NHMAX =	6	DELTAT =	1.250D-02	G2 =	0.0	GAMA2 =	0.0	NOPLOT =	1
NSPT =	3	NSPMAX =	15	ENDT =	2.0000+00	G3 =	0.0	GAMA3 =	0.0	IFLNER =	0
NDFMO =	3	NMWMAX =	5			GMAG =	0.0	RCMAG =	0.0		
NDELTA =	6	NMWBOD =	4								
NU =	27	NMOBOD =	12								
NBETA =	12	KMU =	22								
NLAM =	0	KY =	250								
NEQ =	57	KU =	113								

THE TOPOLOGY ARRAY (ITOPOL) FOR THIS CASE FOLLOWS

		(1)	(2)
1	1	1	2
2	1	0	1

THE CONSTRAINT SPECIFICATIONS FOR THIS CASE FOLLOW

		(1)	(2)
1	1	1	1
2	1	0	0
3	1	0	0
4	1	0	0
5	1	0	0
6	1	0	0
7	1	0	0

THE SPECIFIED INITIAL HINGE ANGLES AND DISPLACEMENTS (BETAH) FOLLOW

		(1)	(2)
1	1	0.0	1.463D-03
2	1	0.0	1.962D-03
3	1	0.0	1.094D-03
4	1	0.0	-3.020D-02
5	1	0.0	-1.445D-02
6	1	0.0	2.435D+01

THE SPECIFIED INITIAL HINGE RATES (BETAHD) FOLLOW

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

ATS-F SINGLE FLEXIBLE BODY USING NORMAL VIBRATION MODES, 3 IMBEDDED MOM. WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC

CURRENT TIME = 12.08.06
THE CPU TIMER = 4.2667E-01

THE NO. OF ELASTIC MODES/BODY ARRAY (IPGFLX) FOLLOWS

		(1)	(2)
1	1	0	12

THE NO. OF P/Q HINGE POINTS/BODY ARRAY (NHPOI) FOLLOWS

		(1)	(2)
1	1	1	1

THE NO. OF SENSOR POINTS/BODY ARRAY (NSPOI) FOLLOWS

		(1)	(2)
1	1	0	3

THE MOM. WHEEL/BODY TABLE (NMOW) FOLLOWS

		(1)	(2)
1	1	0	3
2	1	0	3
3	1	0	1
4	1	0	2
5	1	0	2
6	1	0	0

THE STATE VECTOR LENGTH ARRAY (LENU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	6	21	0	12	12	6

THE STATE VECTOR LOCATION ARRAY (LOCU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	7	28	28	40	52

THE SPECIFIED SENSOR POINT/BODY CORRELATION ARRAY (IFTSMW) FOLLOWS

		(1)	(2)	(3)
1	1	2	2	2

ATS-F SINGLE FLEXIBLE BODY USING NORMAL VIBRATION MODES, 3 IMBEDDED MOM.
WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC

CURRENT TIME = 12.08.06
THE CPU TIMER = 5.1000E-01

THE FOLLOWING DATA IS SPECIFIED MOM. WHEEL INFORMATION (IF ANY) AND CONTROLLER INFORMATION

THE SPECIFIED MOM. WHEEL CONTROL ARRAY (IMO) FOLLOWS

		(1)	(2)	(3)
1	1	1	2	3
2	1	1	2	3
3	1	1	1	1

THE SPECIFIED MOM. WHEEL RATES AND INERTIAS (AMO) FOLLOW

		(1)	(2)	(3)
1	1	1.278D+02	1.278D+02	1.278D+02
2	1	6.500D-02	6.500D-02	6.500D-02

THE SPECIFIED CONTROLLER INITIAL CONDITIONS AND CHARACTERISTICS FOLLOW
(THE FIRST NDELTA ARE INITIAL CONTROLLER STATE VARIABLES, THERE ARE 44 ADDITIONAL CONTROL PARAMETERS)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

A-98

ATS-F SINGLE FLEXIBLE BODY USING NORMAL VIBRATION MODES, 3 IMBEDDED MOM. CURRENT TIME = 12.08.06
WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC THE CPU TIMER = 7.2000E-01

SUMMARY OF INPUT DATA FOR BODY 1 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0
3	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.0000D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	1.0000D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.0000D+00

FOR BODY 1 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

ATS-F SINGLE FLEXIBLE BODY USING NORMAL VIBRATION MODES, 3 IMBEDDED MOM. WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC

CURRENT TIME = 12.08.07
THE CPU TIMER = 9.1667E-01

SUMMARY OF INPUT DATA FOR BODY 2 WHICH IS FLEXIBLE W/CONSISTENT MASS MATRIX.

THE INTEGER PARAMETERS--- IFRBM,IFDIAK,IFDIAD ARE 1, 0, 0

THE JDOF TABLE FOLLOWS---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	4	5	6	1	2	3
2	1	10	11	12	7	8	9
3	1	16	17	18	13	14	15
4	1	22	23	24	19	20	21
5	1	28	29	30	25	26	27
6	1	34	35	36	31	32	33
7	1	40	41	42	37	38	39

THE MODE SELECTION VECTOR FOLLOWS---

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

FOR BODY NO. 2 THE POSITION VECTOR FROM THE BODY ORIGIN TO JOINT 1 IS
X = 0.0 Y = 0.0 Z = 0.0

THE CONSISTENT, REPARTITIONED MASS MATRIX IS--

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	6.827D+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0								
2	1	0.0	3.556D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	41	0.0	0.0								
3	1	0.0	0.0	5.155D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	41	0.0	0.0								
4	1	0.0	0.0	0.0	5.155D+00	0.0	0.0	0.0	0.0	0.0	0.0
4	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	41	0.0	0.0								
5	1	0.0	0.0	0.0	0.0	1.708D+00	0.0	0.0	0.0	0.0	0.0
5	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	41	0.0	0.0								
6	1	0.0	0.0	0.0	0.0	0.0	1.708D+00	0.0	0.0	0.0	0.0
6	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	41	0.0	0.0								

7	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	41	0.0	0.0								
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.827D+01	0.0	0.0
8	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	41	0.0	0.0								
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.556D+00	0.0
9	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	41	0.0	0.0								
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.155D+00
10	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	41	0.0	0.0								
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	11	5.155D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	41	0.0	0.0								
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	1.708D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	41	0.0	0.0								
13	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	11	0.0	0.0	1.708D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	41	0.0	0.0								
14	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	41	0.0	0.0								
15	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	11	0.0	0.0	0.0	0.0	6.827D+01	0.0	0.0	0.0	0.0	0.0
15	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	41	0.0	0.0								
16	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	11	0.0	0.0	0.0	0.0	0.0	3.556D+00	0.0	0.0	0.0	0.0
16	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	41	0.0	0.0								
17	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	11	0.0	0.0	0.0	0.0	0.0	0.0	5.155D+00	0.0	0.0	0.0
17	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	41	0.0	0.0								
18	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.155D+00	0.0	0.0
18	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	41	0.0	0.0								
19	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.708D+00	0.0
19	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

19	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	41	0.0	0.0								
20	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.708D+00
20	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	41	0.0	0.0								
21	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	41	0.0	0.0								
22	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	21	0.0	3.714D+03	0.0	0.0	0.0	0.0	0.0	0.0	5.096D+00	0.0
22	31	0.0	0.0	0.0	0.0	0.0	-3.273D+01	0.0	0.0	0.0	0.0
22	41	0.0	0.0								
23	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	21	0.0	0.0	1.005D+02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	41	0.0	0.0								
24	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	21	0.0	0.0	0.0	1.690D+02	0.0	0.0	0.0	0.0	0.0	0.0
24	31	4.769D+00	0.0	0.0	0.0	0.0	0.0	0.0	-1.430D-01	0.0	0.0
24	41	0.0	0.0								
25	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	21	0.0	0.0	0.0	0.0	1.690D+02	0.0	0.0	0.0	0.0	0.0
25	31	0.0	4.769D+00	0.0	0.0	0.0	0.0	0.0	0.0	1.430D-01	0.0
25	41	0.0	0.0								
26	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	21	0.0	0.0	0.0	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0
26	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	41	0.0	0.0								
27	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	21	0.0	0.0	0.0	0.0	0.0	0.0	7.976D-01	0.0	0.0	0.0
27	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	41	0.0	0.0								
28	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	41	0.0	0.0								
29	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	21	0.0	5.096D+00	0.0	0.0	0.0	0.0	0.0	0.0	3.557D+03	0.0
29	31	0.0	0.0	0.0	0.0	0.0	-2.910D+00	0.0	0.0	0.0	0.0
29	41	0.0	0.0								
30	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.008D+02
30	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	41	0.0	0.0								
31	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	21	0.0	0.0	0.0	4.769D+00	0.0	0.0	0.0	0.0	0.0	0.0
31	31	4.009D+01	0.0	0.0	0.0	0.0	0.0	0.0	1.959D+00	0.0	0.0
31	41	0.0	0.0								
32	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

32	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	21	0.0	0.0	0.0	0.0	4.769D+00	0.0	0.0	0.0	0.0	0.0
32	31	0.0	4.009D+01	0.0	0.0	0.0	0.0	0.0	0.0	-1.959D+00	0.0
32	41	0.0	0.0								
33	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	31	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	41	0.0	0.0								
34	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	31	0.0	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0	0.0	0.0
34	41	0.0	0.0								
35	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	41	0.0	0.0								
36	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	21	0.0	-3.273D+01	0.0	0.0	0.0	0.0	0.0	0.0	-2.910D+00	0.0
36	31	0.0	0.0	0.0	0.0	0.0	4.776D+02	0.0	0.0	0.0	0.0
36	41	0.0	0.0								
37	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	31	0.0	0.0	0.0	0.0	0.0	0.0	9.670D+01	0.0	0.0	0.0
37	41	0.0	0.0								
38	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	21	0.0	0.0	0.0	-1.430D-01	0.0	0.0	0.0	0.0	0.0	0.0
38	31	1.959D+00	0.0	0.0	0.0	0.0	0.0	0.0	1.451D+02	0.0	0.0
38	41	0.0	0.0								
39	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	21	0.0	0.0	0.0	0.0	1.430D-01	0.0	0.0	0.0	0.0	0.0
39	31	0.0	-1.959D+00	0.0	0.0	0.0	0.0	0.0	0.0	1.451D+02	0.0
39	41	0.0	0.0								
40	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.976D-01
40	41	0.0	0.0								
41	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	41	7.976D-01	0.0								
42	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	41	0.0	9.670D+01								

THE REPARTITIONED MODAL MATRIX IS---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	1.0000D+00	5.421D-20	6.776D-21	4.918D-06	2.911D-02	-1.330D-04	4.083D-04
1	11	7.611D-05	4.092D-06	-3.932D-15	4.248D-18	-1.504D-04	9.931D-06	-6.636D-03	8.331D-06		
2	1	0.0	-1.131D+01	-1.445D-02	1.0000D+00	-4.222D-12	-2.954D-13	-1.099D-05	1.119D-01	-7.351D-04	-1.163D-03
2	11	-8.065D-04	-4.039D-05	7.764D-14	-3.436D-17	2.974D-03	-9.846D-05	1.366D-01	1.747D-04		
3	1	0.0	-1.343D+01	-1.924D+01	1.0000D+00	-5.200D-12	3.001D-12	-6.045D-02	-2.303D-01	1.099D-03	-3.915D-03

3	11	7.983D-02	1.804D-03	4.626D-15	1.047D-15	1.769D-04	3.868D-03	5.689D-04	-1.031D-04		
4	1	0.0	-1.343D+01	1.921D+01	1.000D+00	-1.071D-13	-3.820D-12	6.040D-02	-2.307D-01	1.105D-03	-1.362D-03
4	11	-7.999D-02	-1.817D-03	4.629D-15	-1.025D-15	1.766D-04	-3.897D-03	5.651D-04	-1.193D-04		
5	1	0.0	4.315D+00	-1.445D-02	1.000D+00	-6.387D-12	-2.556D-12	-1.312D-05	-2.528D-03	9.722D-05	1.013D-03
5	11	-4.315D-04	-2.198D-05	-7.918D-04	2.960D-17	-6.224D-04	-5.221D-05	-1.128D-02	-1.279D-05		
6	1	0.0	4.315D+00	-1.445D-02	1.000D+00	-6.387D-12	-2.556D-12	-1.312D-05	-2.528D-03	9.722D-05	1.013D-03
6	11	-4.315D-04	-2.198D-05	7.918D-04	-5.284D-17	-6.224D-04	-5.221D-05	-1.128D-02	-1.279D-05		
7	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
8	1	0.0	0.0	0.0	0.0	1.000D+00	3.388D-21	-1.243D-05	7.267D-04	-5.990D-06	-1.613D-02
8	11	-7.102D-04	-3.438D-05	1.832D-16	-1.378D-16	7.011D-06	-8.187D-05	1.943D-05	-7.258D-03		
9	1	1.131D+01	-8.392D-10	3.020D-02	1.274D-11	1.000D+00	-1.144D-12	5.424D-05	2.400D-03	-3.839D-06	7.759D-02
9	11	3.180D-03	1.517D-04	6.658D-16	6.511D-16	2.550D-05	3.599D-04	-5.734D-05	1.345D-01		
10	1	1.343D+01	1.042D-10	-3.398D-01	-3.824D-13	1.000D+00	6.449D-13	-1.258D-03	-5.670D-03	-1.330D-03	9.730D-02
10	11	8.997D-03	3.947D-04	-1.439D-15	9.660D-16	-5.508D-05	9.317D-04	-1.101D-04	5.404D-03		
11	1	1.343D+01	1.042D-10	4.002D-01	-2.239D-12	1.000D+00	1.107D-13	1.377D-03	-5.667D-03	1.417D-03	9.737D-02
11	11	-1.487D-03	-3.234D-05	-1.441D-15	6.561D-16	-5.518D-05	-6.851D-05	-1.120D-04	5.397D-03		
12	1	-4.315D+00	1.659D-10	1.297D+00	-9.767D-14	1.000D+00	3.492D-13	1.542D-03	9.438D-05	-6.718D-06	-5.220D-02
12	11	5.296D-02	2.693D-03	-5.327D-18	1.699D-15	-5.344D-08	6.442D-03	1.865D-05	-1.125D-02		
13	1	-4.315D+00	1.659D-10	-1.237D+00	-2.630D-13	1.000D+00	3.032D-13	-1.517D-03	8.101D-05	-6.915D-06	-5.194D-02
13	11	-5.386D-02	-2.729D-03	-7.799D-18	-2.446D-15	-4.504D-07	-6.524D-03	-5.562D-06	-1.135D-02		
14	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
15	1	0.0	0.0	0.0	0.0	0.0	1.000D+00	1.818D-08	-2.274D-04	-3.733D-02	9.108D-06
15	11	8.427D-10	-3.536D-09	-2.252D-17	-3.290D-18	-8.627D-07	-8.596D-09	-3.332D-06	-1.400D-06		
16	1	1.445D-02	-3.020D-02	-9.029D-14	3.680D-12	2.995D-13	1.000D+00	6.094D-08	-3.815D-06	-3.733D-02	1.252D-04
16	11	2.680D-06	1.231D-07	2.092D-16	-2.374D-18	8.006D-06	2.872D-07	2.926D-05	1.228D-05		
17	1	1.924D+01	3.398D-01	-7.009D-11	-1.444D-11	6.857D-10	1.000D+00	8.770D-05	2.377D-03	2.722D-01	-2.213D-01
17	11	-7.096D-04	-1.495D-05	2.814D-16	-1.517D-15	1.076D-05	-3.194D-05	2.845D-05	-3.577D-04		
18	1	-1.921D+01	-4.002D-01	-1.434D-10	1.765D-11	1.336D-09	1.000D+00	-8.803D-05	6.395D-04	2.726D-01	2.210D-01
18	11	7.060D-04	1.483D-05	-2.659D-16	1.565D-15	-1.016D-05	3.167D-05	-2.390D-05	3.596D-04		
19	1	1.445D-02	-1.297D+00	3.308D-13	2.308D-10	2.152D-12	1.000D+00	2.351D-07	9.284D-03	-3.740D-02	-5.187D-05
19	11	-2.717D-05	-1.296D-06	9.901D-15	-3.945D-18	3.790D-04	-3.307D-06	1.395D-03	1.831D-05		
20	1	1.445D-02	1.237D+00	-1.706D-13	-5.523D-11	-2.405D-13	1.000D+00	-1.132D-07	-9.292D-03	-3.727D-02	3.023D-04
20	11	3.253D-05	1.542D-06	-9.483D-15	-8.027D-19	-3.630D-04	3.882D-06	-1.336D-03	6.258D-06		
21	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
22	1	1.000D+00	-8.674D-19	1.084D-18	0.0	-2.602D-18	-1.355D-20	2.672D-06	1.481D-04	1.920D-07	8.327D-03
22	11	2.347D-04	1.110D-05	4.398D-17	6.598D-17	1.684D-06	2.640D-05	3.053D-06	9.369D-04		
23	1	1.000D+00	-8.674D-19	1.084D-18	0.0	-2.602D-18	-1.355D-20	2.673D-06	1.495D-04	2.090D-07	8.651D-03
23	11	2.619D-04	1.416D-05	5.483D-17	7.085D-17	2.101D-06	3.474D-05	8.557D-05	-9.610D-02		
24	1	1.000D+00	-8.674D-19	1.084D-18	0.0	-2.602D-18	-1.355D-20	4.970D-06	2.902D-04	1.958D-02	-1.581D-02
24	11	-9.632D-05	-3.379D-06	1.741D-16	-1.101D-16	6.665D-06	-7.811D-06	2.451D-05	-2.258D-04		
25	1	1.000D+00	-8.674D-19	1.084D-18	0.0	-2.602D-18	-1.355D-20	4.998D-06	9.890D-05	-1.961D-02	-1.577D-02
25	11	-9.575D-05	-3.356D-06	1.996D-16	-1.134D-16	7.640D-06	-7.757D-06	2.793D-05	-2.243D-04		
26	1	1.000D+00	-8.674D-19	1.084D-18	0.0	-2.602D-18	-1.355D-20	2.672D-06	1.481D-04	1.920D-07	8.327D-03
26	11	2.347D-04	1.110D-05	4.398D-17	6.598D-17	1.684D-06	2.640D-05	3.053D-06	9.369D-04		
27	1	1.000D+00	-8.674D-19	1.084D-18	0.0	-2.602D-18	-1.355D-20	2.672D-06	1.481D-04	1.920D-07	8.327D-03
27	11	2.347D-04	1.110D-05	4.398D-17	6.598D-17	1.684D-06	2.640D-05	3.053D-06	9.369D-04		
28	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
29	1	0.0	1.000D+00	0.0	2.602D-18	2.033D-20	2.711D-20	-1.375D-07	-7.333D-03	5.335D-05	1.398D-04
29	11	2.356D-05	1.120D-06	-7.651D-15	1.240D-18	-2.929D-04	2.838D-06	-1.078D-03	-4.756D-06		
30	1	0.0	1.000D+00	0.0	2.602D-18	2.033D-20	2.711D-20	-1.486D-07	-7.414D-03	5.419D-05	1.458D-04
30	11	1.856D-05	4.637D-07	-1.131D-14	5.488D-19	-4.320D-04	1.105D-06	9.585D-02	7.898D-05		
31	1	0.0	1.000D+00	0.0	2.602D-18	2.033D-20	2.711D-20	-1.375D-07	-7.333D-03	5.335D-05	1.398D-04
31	11	2.356D-05	1.120D-06	-7.651D-15	1.240D-18	-2.929D-04	2.838D-06	-1.078D-03	-4.756D-06		
32	1	0.0	1.000D+00	0.0	2.602D-18	2.033D-20	2.711D-20	-1.375D-07	-7.333D-03	5.335D-05	1.398D-04
32	11	2.356D-05	1.120D-06	-7.651D-15	1.240D-18	-2.929D-04	2.838D-06	-1.078D-03	-4.756D-06		
33	1	0.0	1.000D+00	0.0	2.602D-18	2.033D-20	2.711D-20	-1.434D-07	-7.988D-03	5.875D-05	1.627D-04
33	11	4.855D-05	1.696D-05	-7.918D-01	4.364D-14	7.916D-01	-4.185D-04	1.154D-03	4.806D-06		
34	1	0.0	1.000D+00	0.0	2.602D-18	2.033D-20	2.711D-20	-1.434D-07	-7.988D-03	5.875D-05	1.627D-04
34	11	4.855D-05	1.696D-05	7.918D-01	-3.879D-14	7.916D-01	-4.185D-04	1.154D-03	4.806D-06		

35	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
36	1	0.0	0.0	1.000D+00	3.388D-21	-4.743D-20	-2.647D-23	1.207D-03	5.278D-06	7.782D-08	-1.036D-04
36	11	4.217D-02	2.140D-03	9.760D-19	1.636D-15	1.567D-07	5.118D-03	9.559D-06	4.203D-05		
37	1	0.0	0.0	1.000D+00	3.388D-21	-4.743D-20	-2.647D-23	-6.751D-02	-3.344D-06	-4.050D-08	2.726D-05
37	11	1.112D-03	-7.459D-02	-6.489D-20	9.548D-16	-9.725D-08	-2.916D-03	-5.106D-07	-2.199D-06		
38	1	0.0	0.0	1.000D+00	3.388D-21	-4.743D-20	-2.647D-23	3.562D-03	2.264D-02	-1.233D-04	1.772D-04
38	11	-1.422D-02	-5.794D-04	5.957D-15	-4.221D-16	2.280D-04	-1.357D-03	4.577D-04	1.964D-06		
39	1	0.0	0.0	1.000D+00	3.388D-21	-4.743D-20	-2.647D-23	3.560D-03	-2.267D-02	1.236D-04	2.907D-05
39	11	-1.412D-02	-5.748D-04	-5.957D-15	-4.162D-16	-2.281D-04	-1.346D-03	-4.620D-04	-2.116D-05		
40	1	0.0	0.0	1.000D+00	3.388D-21	-4.743D-20	-2.647D-23	1.251D-03	5.749D-06	8.567D-08	-1.203D-04
40	11	8.869D-02	3.372D-02	3.084D-14	7.918D-01	-4.216D-04	-7.859D-01	-9.798D-06	-4.199D-05		
41	1	0.0	0.0	1.000D+00	3.388D-21	-4.743D-20	-2.647D-23	1.251D-03	5.749D-06	8.567D-08	-1.203D-04
41	11	8.869D-02	3.372D-02	-5.160D-14	-7.918D-01	-4.216D-04	-7.859D-01	-9.798D-06	-4.199D-05		
42	1	0.0	0.0	1.000D+00	3.388D-21	-4.743D-20	-2.647D-23	-7.313D-02	-4.090D-06	-5.086D-08	3.944D-05
42	11	-6.644D-03	6.880D-02	-7.380D-20	-9.628D-16	7.931D-08	2.352D-03	1.503D-07	6.370D-07		

THE -UNDEFORMED- INERTIA MATRIX (MU) IS---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.034D+04	8.797D+01	-2.778D+01	-2.843D-09	1.639D+02	2.503D-01	-2.552D-10	-1.056D-09	5.267D-08	-3.233D-08
1	11	3.055D-10	-1.744D-11	7.146D-17	-5.798D-16	4.960D-12	-2.131D-10	-3.252D-11	-2.275D-08		
2	1	8.797D+01	6.124D+03	-5.350D-01	-1.639D+02	-2.460D-09	-5.219D-01	1.766D-09	8.726D-08	-2.200D-10	-2.799D-09
2	11	3.960D-09	4.902D-10	-3.275D-11	-3.209D-15	8.123D-10	-1.462D-10	9.393D-09	-3.740D-10		
3	1	-2.778D+01	-5.350D-01	4.781D+03	-2.503D-01	5.219D-01	-1.778D-09	-3.666D-08	4.038D-08	-9.231D-10	7.084D-11
3	11	1.882D-08	-3.163D-09	-5.781D-17	4.602D-13	-2.325D-12	3.244D-09	-8.127D-11	1.190D-10		
4	1	-2.843D-09	-1.639D+02	-2.503D-01	8.556D+01	-3.303D-11	3.155D-10	-2.706D-10	-1.044D-08	6.773D-11	-6.537D-11
4	11	-1.564D-10	-3.315D-11	5.536D-14	2.379D-16	4.705D-11	1.636D-11	4.106D-10	2.022D-12		
5	1	1.639D+02	-2.460D-09	5.219D-01	-3.303D-11	8.556D+01	1.043D-08	-1.412D-11	-1.606D-10	2.839D-09	7.347D-09
5	11	1.205D-10	-1.381D-13	-3.526D-19	-4.352D-18	-1.714D-12	-9.647D-12	-8.896D-12	7.913D-10		
6	1	2.503D-01	-5.219D-01	-1.778D-09	3.155D-10	1.043D-08	8.556D+01	-2.204D-12	1.123D-10	9.712D-09	1.318D-09
6	11	8.057D-12	-1.035D-15	6.857D-19	3.037D-18	8.318D-15	4.553D-13	-4.142D-12	6.202D-14		
7	1	-2.552D-10	1.766D-09	-3.666D-08	-2.706D-10	-1.412D-11	-2.204D-12	1.000D+00	3.664D-11	-1.789D-12	-3.184D-12
7	11	1.026D-10	2.831D-10	6.372D-18	4.462D-16	-1.547D-13	-2.393D-11	-6.108D-13	-1.576D-13		
8	1	-1.056D-09	8.726D-08	4.038D-08	-1.044D-08	-1.606D-10	1.123D-10	3.664D-11	1.000D+00	-1.072D-11	1.880D-11
8	11	-8.599D-11	5.324D-12	2.633D-13	-1.049D-16	-8.783D-12	5.166D-12	-3.102D-10	-4.420D-12		
9	1	5.267D-08	-2.200D-10	-9.231D-10	6.773D-11	2.839D-09	9.712D-09	-1.789D-12	-1.072D-11	1.000D+00	7.255D-10
9	11	6.011D-12	4.660D-14	-1.933D-15	-3.507D-17	9.473D-14	2.766D-13	9.488D-13	1.885D-12		
10	1	-3.233D-08	-2.799D-09	7.084D-11	-6.537D-11	7.347D-09	1.318D-09	-3.184D-12	1.880D-11	7.255D-10	1.000D+00
10	11	-6.672D-12	-4.922D-13	-5.311D-15	6.870D-15	1.001D-12	-2.835D-12	-4.221D-12	-3.452D-11		
11	1	3.055D-10	3.960D-09	1.882D-08	-1.564D-10	1.205D-10	8.057D-12	1.026D-10	-8.599D-11	6.011D-12	-6.672D-12
11	11	1.000D+00	1.133D-11	-1.605D-15	3.665D-14	-7.914D-13	4.033D-11	4.255D-13	-7.727D-12		
12	1	-1.744D-11	4.902D-10	-3.163D-09	-3.315D-11	-1.381D-13	-1.035D-15	2.831D-10	5.324D-12	4.660D-14	-4.922D-13
12	11	1.138D-11	1.000D+00	-5.622D-16	-1.151D-14	2.485D-14	2.493D-11	8.086D-14	-8.028D-13		
13	1	7.146D-17	-3.275D-11	-5.781D-17	5.536D-14	-3.526D-19	6.857D-19	6.372D-18	2.633D-13	-1.933D-15	-5.311D-15
13	11	-1.605D-15	-5.622D-16	1.000D+00	-6.599D-21	9.914D-15	1.300D-14	-3.896D-14	-1.592D-16		
14	1	-5.798D-16	-3.209D-15	4.602D-13	2.379D-16	-4.352D-18	3.037D-18	4.462D-16	-1.049D-16	-3.507D-17	6.870D-15
14	11	3.665D-14	-1.151D-14	-6.599D-21	1.000D+00	3.062D-15	3.764D-15	-1.358D-18	-1.702D-17		
15	1	4.960D-12	8.123D-10	-2.325D-12	4.705D-11	-1.714D-12	8.318D-15	-1.547D-13	-8.783D-12	9.473D-14	1.001D-12
15	11	-7.914D-13	2.485D-14	9.914D-15	3.062D-15	1.000D+00	-1.007D-13	-6.135D-12	2.292D-14		
16	1	-2.131D-10	-1.462D-10	3.244D-09	1.636D-11	-9.647D-12	4.553D-13	-2.393D-11	5.166D-12	2.766D-13	-2.835D-12
16	11	4.033D-11	2.493D-11	1.300D-14	3.764D-15	-1.007D-13	1.000D+00	5.328D-13	-1.486D-13		
17	1	-3.252D-11	9.393D-09	-8.127D-11	4.106D-10	-8.896D-12	-4.142D-12	-6.108D-13	-3.102D-10	9.488D-13	-4.221D-12
17	11	4.255D-13	8.086D-14	-3.896D-14	-1.358D-18	-6.135D-12	5.328D-13	1.000D+00	-7.121D-13		
18	1	-2.275D-08	-3.740D-10	1.190D-10	2.022D-12	7.913D-10	6.202D-14	-1.576D-13	-4.420D-12	1.885D-12	-3.452D-11
18	11	-7.727D-12	-8.028D-13	-1.592D-16	-1.702D-17	2.292D-14	-1.486D-13	-7.121D-13	1.000D+00		

THE A COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	9.698D-13	-2.291D-14	5.578D-12	-1.094D-11	2.520D-11	1.289D-12	-3.122D-26	9.122D-25	-1.123D-15	3.085D-12
1	11	3.226D-15	-1.510D-12								
2	1	5.143D-12	-9.702D-11	-7.293D-09	-3.725D-10	1.608D-11	1.233D-12	-6.857D-19	-3.037D-18	1.816D-12	2.492D-12

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2	11	1.177D-11	5.547D-11								
3	1	-5.850D-12	-2.528D-10	-1.715D-12	6.099D-09	4.613D-10	1.724D-11	-3.526D-19	-4.352D-18	-2.405D-12	3.194D-11
3	11	-6.678D-12	-1.376D-09								
4	1	-9.609D-12	9.537D-11	1.055D-08	1.683D-10	1.515D-11	1.759D-13	3.868D-13	3.037D-18	-9.300D-13	8.401D-13
4	11	-6.551D-12	-5.721D-13								
5	1	-2.023D-10	2.403D-09	-1.757D-11	2.902D-11	2.687D-10	6.133D-12	3.236D-15	3.401D-24	-1.843D-12	1.317D-11
5	11	-6.013D-12	1.195D-12								
6	1	-4.614D-11	1.059D-08	-7.854D-11	6.546D-11	5.390D-10	4.083D-11	3.369D-12	-2.379D-16	8.021D-12	-3.909D-13
6	11	2.604D-09	6.775D-12								
7	1	1.636D-11	2.613D-10	7.518D-12	-7.363D-09	-3.622D-10	-1.178D-11	-2.232D-16	4.352D-18	2.523D-12	-1.879D-11
7	11	1.534D-11	-1.640D-09								
8	1	6.360D-11	-7.332D-09	5.914D-11	-6.976D-11	-5.765D-10	-4.206D-11	2.086D-12	2.379D-16	3.811D-11	-2.456D-12
8	11	-3.740D-10	-1.331D-12								
9	1	-1.197D-13	-1.376D-12	5.579D-14	3.147D-14	5.351D-14	-1.632D-15	-6.215D-17	-1.571D-27	-1.231D-14	-4.766D-15
9	11	-5.663D-13	6.422D-14								

THE B COEFFICIENTS ARE——

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-2.611D-01	-2.097D-01	-3.704D+01	2.552D-02	1.040D+00	4.237D-02	-6.393D-15	2.764D-14	-2.423D-04	9.923D-02
1	11	-8.953D-04	7.431D-03								
2	1	2.305D-01	-2.695D-01	-3.677D+01	2.091D-02	-3.048D-01	-6.913D-03	-3.426D-03	-6.994D-15	6.449D-05	-1.482D-02
2	11	1.261D-02	-4.944D-04								
3	1	-3.067D-02	-6.181D-02	-2.720D-01	1.267D-02	7.348D-01	3.544D-02	-3.426D-03	2.708D-14	3.125D-04	8.439D-02
3	11	1.384D-02	7.829D-03								
4	1	-1.197D+01	1.118D-02	4.816D-03	-2.206D-01	1.605D+01	3.701D-01	4.002D-15	2.140D-13	1.585D-04	7.959D-01
4	11	6.936D-03	1.678D-02								
5	1	3.296D-03	2.742D+01	-4.412D-02	1.270D+00	4.011D-02	2.165D-03	-3.721D-12	5.616D-15	-1.516D-01	5.303D-03
5	11	-5.732D+00	9.575D-03								
6	1	7.194D-03	8.620D-01	-8.695D-03	-6.120D+01	-7.946D-01	-3.439D-02	2.261D-13	-4.495D-13	8.678D-03	-8.114D-02
6	11	2.297D-02	-6.395D+00								

THE COFXY COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	1.497D-04	8.549D-04	-2.280D-05	-2.181D-03	-1.085D-04	4.137D-06	-8.293D-17	-7.968D-07	-2.589D-04
1	11	-3.236D-05	-1.064D-05								
2	1	-1.497D-04	8.673D-19	-4.189D-05	-2.323D-01	-9.057D-03	-4.382D-04	1.808D-08	-1.938D-15	1.477D-04	-1.044D-03
2	11	-5.203D-04	2.637D-02								
3	1	-8.549D-04	4.189D-05	6.253D-22	1.016D-03	1.172D-03	2.762D-05	2.666D-10	2.330D-17	-8.693D-07	5.966D-05
3	11	-2.623D-06	-2.280D-04								
4	1	2.280D-05	2.323D-01	-1.016D-03	6.776D-21	1.375D-04	8.949D-06	-3.551D-07	-3.010D-17	-1.273D-03	2.261D-05
4	11	-4.757D-02	-8.745D-04								
5	1	2.181D-03	9.057D-03	-1.172D-03	-1.375D-04	1.084D-19	7.813D-05	1.445D-04	6.160D-17	-4.867D-05	2.025D-04
5	11	-1.905D-03	-4.063D-04								
6	1	1.085D-04	4.382D-04	-2.762D-05	-8.949D-06	-7.813D-05	3.970D-23	7.333D-06	8.631D-20	-2.322D-06	7.961D-07
6	11	-9.095D-05	-2.065D-05								
7	1	-4.137D-06	-1.808D-08	-2.666D-10	3.551D-07	-1.445D-04	-7.333D-06	-7.523D-37	-5.606D-18	-5.368D-10	-1.754D-05
7	11	-3.275D-08	-1.440D-07								
8	1	8.293D-17	1.938D-15	-2.330D-17	3.010D-17	-6.160D-17	-8.631D-20	5.606D-18	-1.971D-46	-1.058D-17	4.096D-19
8	11	-3.978D-16	-1.688D-17								
9	1	7.968D-07	-1.477D-04	8.693D-07	1.273D-03	4.867D-05	2.322D-06	5.368D-10	1.058D-17	3.469D-23	5.515D-06
9	11	-9.919D-06	1.531D-03								
10	1	2.589D-04	1.044D-03	-5.966D-05	-2.261D-05	-2.025D-04	-7.961D-07	1.754D-05	-4.096D-19	-5.515D-06	-3.375D-21
10	11	-2.160D-04	-5.040D-05								
11	1	3.236D-05	5.203D-04	2.623D-06	4.757D-02	1.905D-03	9.095D-05	3.275D-08	3.978D-16	9.919D-06	2.160D-04
11	11	5.294D-23	6.911D-02								
12	1	1.064D-05	-2.637D-02	2.280D-04	8.745D-04	4.063D-04	2.065D-05	1.440D-07	1.688D-17	-1.531D-03	5.040D-05
12	11	-6.911D-02	6.617D-23								

THE COFXZ COEFFICIENTS ARE---

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

1	1	-3.788D-21	5.422D-04	-4.685D-05	-1.378D-01	-3.686D-04	-7.633D-06	-4.711D-10	-9.591D-16	6.519D-06	-1.630D-05
1	11	1.633D-05	-2.234D-04								
2	1	-5.423D-04	2.711D-19	7.364D-01	6.864D-06	7.094D-04	1.592D-05	-2.512D-05	7.778D-17	4.336D-06	3.404D-05
2	11	1.107D-04	-7.224D-07								
3	1	4.685D-05	-7.364D-01	1.065D-19	-8.429D-03	-4.297D-04	-2.253D-05	1.828D-07	2.261D-17	5.645D-04	-5.434D-05
3	11	1.810D-03	-3.552D-04								
4	1	1.378D-01	-6.864D-06	8.429D-03	7.048D-19	-1.822D-01	-4.131D-03	4.790D-07	-2.382D-15	6.016D-07	-8.853D-03
4	11	4.718D-05	-2.292D-05								
5	1	3.686D-04	-7.094D-04	4.297D-04	1.822D-01	5.421D-20	-9.549D-07	8.074D-08	1.262D-15	-8.562D-06	-2.131D-06
5	11	-2.025D-05	2.955D-04								
6	1	7.633D-06	-1.592D-05	2.253D-05	4.131D-03	9.549D-07	0.0	3.839D-09	2.863D-17	-1.924D-07	-1.906D-09
6	11	-4.255D-07	6.700D-06								
7	1	4.711D-10	2.512D-05	-1.828D-07	-4.790D-07	-8.074D-08	-3.839D-09	7.704D-34	-4.250D-21	1.004D-06	-9.723D-09
7	11	3.693D-06	1.630D-08								
8	1	9.591D-16	-7.778D-17	-2.261D-17	2.382D-15	-1.262D-15	-2.863D-17	4.250D-21	1.752D-46	-1.075D-19	-6.136D-17
8	11	7.046D-20	3.673D-18								
9	1	-6.519D-06	-4.336D-06	-5.645D-04	-6.016D-07	8.562D-06	1.924D-07	-1.004D-06	1.075D-19	1.323D-23	4.117D-07
9	11	3.688D-06	-1.148D-07								
10	1	1.630D-05	-3.404D-05	5.434D-05	8.853D-03	2.131D-06	1.906D-09	9.723D-09	6.136D-17	-4.117D-07	2.642D-23
10	11	-8.990D-07	1.436D-05								
11	1	-1.633D-05	-1.107D-04	-1.810D-03	-4.718D-05	2.025D-05	4.255D-07	-3.693D-06	-7.046D-20	-3.688D-06	8.990D-07
11	11	0.0	-6.111D-06								
12	1	2.234D-04	7.224D-07	3.552D-04	2.292D-05	-2.955D-04	-6.700D-06	-1.630D-08	-3.673D-18	1.148D-07	-1.436D-05
12	11	6.111D-06	-2.640D-23								

THE COFYZ COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	3.783D-05	1.934D-04	3.003D-03	4.685D-06	6.472D-11	4.699D-17	2.080D-17	1.799D-06	-4.294D-08
1	11	6.788D-06	4.896D-06								
2	1	-3.783D-05	6.565D-21	-1.809D-02	-1.746D-03	-1.811D-03	-9.128D-05	2.570D-17	-8.344D-17	9.786D-07	-2.182D-04
2	11	1.626D-06	-1.967D-04								
3	1	-1.934D-04	1.809D-02	-5.433D-20	-3.077D-01	-1.196D-02	-5.774D-04	4.597D-15	-2.568D-15	1.760D-04	-1.376D-03
3	11	3.543D-04	-1.724D-02								
4	1	-3.003D-03	1.746D-03	3.077D-01	-1.388D-17	1.199D-02	4.887D-04	4.818D-17	3.835D-16	1.879D-06	1.145D-03
4	11	1.017D-05	-3.040D-05								
5	1	-4.685D-06	1.811D-03	1.196D-02	-1.199D-02	2.965D-21	7.724D-07	1.787D-15	-8.117D-17	6.839D-05	1.939D-06
5	11	2.511D-04	-1.910D-05								
6	1	-6.472D-11	9.128D-05	5.774D-04	-4.887D-04	-7.724D-07	8.272D-25	9.053D-17	-3.322D-18	3.465D-06	4.896D-09
6	11	1.273D-05	-7.745D-07								
7	1	-4.699D-17	-2.570D-17	-4.597D-15	-4.818D-17	-1.787D-15	-9.053D-17	1.752D-46	-6.996D-29	-5.091D-21	-2.165D-16
7	11	-3.276D-19	-1.054D-16								
8	1	-2.080D-17	8.344D-17	2.568D-15	-3.835D-16	8.117D-17	3.322D-18	6.996D-29	-8.751D-46	2.678D-18	7.784D-18
8	11	9.835D-18	-2.344D-18								
9	1	-1.799D-06	-9.786D-07	-1.760D-04	-1.879D-06	-6.839D-05	-3.465D-06	5.091D-21	-2.678D-18	0.0	-8.286D-06
9	11	-1.183D-08	-4.034D-06								
10	1	4.294D-08	2.182D-04	1.376D-03	-1.145D-03	-1.939D-06	-4.896D-09	2.165D-16	-7.784D-18	8.286D-06	-1.572D-23
10	11	3.044D-05	-1.811D-06								
11	1	-6.788D-06	-1.626D-06	-3.543D-04	-1.017D-05	-2.511D-04	-1.273D-05	3.276D-19	-9.835D-18	1.183D-08	-3.044D-05
11	11	2.482D-24	-1.491D-05								
12	1	-4.896D-06	1.967D-04	1.724D-02	3.040D-05	1.910D-05	7.745D-07	1.054D-16	2.344D-18	4.034D-06	1.811D-06
12	11	1.491D-05	-1.985D-22								

THE C11 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	2.603D-05	-2.779D-06	1.799D-05	-1.145D-04	2.107D-04	1.142D-05	-6.622D-19	8.051D-18	-2.476D-08	2.745D-05
1	11	-2.012D-08	3.484D-05								
2	1	-2.779D-06	7.173D-04	4.810D-03	-7.831D-03	-2.339D-04	-1.113D-05	4.094D-16	-6.218D-17	1.567D-05	-2.649D-05
2	11	5.061D-05	4.661D-04								
3	1	1.799D-05	4.810D-03	8.702D-01	4.465D-05	-7.661D-05	-3.089D-06	2.113D-17	7.695D-17	8.160D-07	-7.230D-06
3	11	6.827D-06	7.570D-06								
4	1	-1.145D-04	-7.831D-03	4.465D-05	6.504D-01	7.096D-03	2.973D-04	-2.092D-15	4.725D-15	-8.005D-05	6.994D-04

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
4	11	-2.103D-04	5.336D-02								
5	1	2.107D-04	-2.339D-04	-7.661D-05	7.096D-03	1.025D-02	5.167D-04	-5.981D-17	4.438D-16	-2.261D-06	1.235D-03
5	11	-3.970D-06	2.112D-03								
6	1	1.142D-05	-1.113D-05	-3.089D-06	2.973D-04	5.167D-04	2.608D-05	-2.836D-18	2.198D-17	-1.071D-07	6.234D-05
6	11	-1.808D-07	1.009D-04								
7	1	-6.622D-19	4.094D-16	2.113D-17	-2.092D-15	-5.981D-17	-2.836D-18	3.473D-28	-1.660D-29	1.329D-17	-6.756D-18
7	11	4.708D-17	1.470D-16								
8	1	8.051D-18	-6.218D-17	7.695D-17	4.725D-15	4.438D-16	2.198D-17	-1.660D-29	4.948D-29	-6.343D-19	5.247D-17
8	11	-1.588D-18	4.454D-16								
9	1	-2.476D-08	1.567D-05	8.160D-07	-8.005D-05	-2.261D-06	-1.071D-07	1.329D-17	-6.343D-19	5.089D-07	-2.552D-07
9	11	1.802D-06	5.634D-06								
10	1	2.745D-05	-2.649D-05	-7.230D-06	6.994D-04	1.235D-03	6.234D-05	-6.756D-18	5.247D-17	-2.552D-07	1.490D-04
10	11	-4.294D-07	2.397D-04								
11	1	-2.012D-08	5.061D-05	6.827D-06	-2.103D-04	-3.970D-06	-1.808D-07	4.708D-17	-1.588D-18	1.802D-06	-4.294D-07
11	11	6.548D-06	-4.356D-05								
12	1	3.484D-05	4.661D-04	7.570D-06	5.336D-02	2.112D-03	1.009D-04	1.470D-16	4.454D-16	5.634D-06	2.397D-04
12	11	-4.356D-05	6.871D-02								

THE C22 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	3.764D-02	-6.599D-05	7.896D-07	5.956D-04	-4.978D-02	-1.129D-03	-4.311D-18	-6.468D-16	-2.484D-07	-2.419D-03
1	11	-8.372D-06	-5.360D-06								
2	1	-6.599D-05	6.508D-01	1.636D-03	4.620D-03	1.961D-04	9.960D-06	1.239D-14	-4.162D-17	4.815D-04	2.345D-05
2	11	3.997D-02	3.475D-04								
3	1	7.896D-07	1.636D-03	8.702D-01	-3.630D-05	-6.365D-06	-2.192D-07	-9.281D-17	7.886D-17	-3.761D-06	-5.015D-07
3	11	-2.872D-04	2.018D-06								
4	1	5.956D-04	4.620D-03	-3.630D-05	5.044D-01	5.686D-04	1.047D-05	-1.186D-15	3.500D-15	-4.753D-05	2.232D-05
4	11	-8.649D-04	8.201D-04								
5	1	-4.978D-02	1.961D-04	-6.365D-06	5.686D-04	6.585D-02	1.493D-03	-2.513D-16	8.650D-16	-8.557D-06	3.199D-03
5	11	-4.088D-04	8.965D-06								
6	1	-1.129D-03	9.960D-06	-2.192D-07	1.047D-05	1.493D-03	3.384D-05	-1.265D-17	1.959D-17	-4.343D-07	7.254D-05
6	11	-2.064D-05	1.917D-07								
7	1	-4.311D-18	1.239D-14	-9.281D-17	-1.186D-15	-2.513D-16	-1.265D-17	2.142D-06	-1.115D-19	8.820D-16	-3.081D-17
7	11	3.957D-14	3.990D-17								
8	1	-6.468D-16	-4.162D-17	7.886D-17	3.500D-15	8.650D-16	1.959D-17	-1.115D-19	3.557D-29	-5.296D-19	4.199D-17
8	11	-1.851D-17	5.755D-18								
9	1	-2.484D-07	4.815D-04	-3.761D-06	-4.753D-05	-8.557D-06	-4.343D-07	8.820D-16	-5.296D-19	3.510D-05	-1.062D-06
9	11	1.539D-03	1.556D-06								
10	1	-2.419D-03	2.345D-05	-5.015D-07	2.232D-05	3.199D-03	7.254D-05	-3.081D-17	4.199D-17	-1.062D-06	1.555D-04
10	11	-5.035D-05	4.061D-07								
11	1	-8.372D-06	3.997D-02	-2.872D-04	-8.649D-04	-4.088D-04	-2.064D-05	3.957D-14	-1.851D-17	1.539D-03	-5.035D-05
11	11	6.981D-02	8.087D-05								
12	1	-5.360D-06	3.475D-04	2.018D-06	8.201D-04	8.965D-06	1.917D-07	3.990D-17	5.755D-18	1.556D-06	4.061D-07
12	11	8.087D-05	1.569D-06								

THE C33 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	3.767D-02	-7.035D-05	2.017D-05	8.819D-04	-4.957D-02	-1.117D-03	-5.481D-18	-6.360D-16	-2.926D-07	-2.391D-03
1	11	-8.442D-06	3.013D-05								
2	1	-7.035D-05	6.508D-01	-3.180D-03	7.659D-04	-2.316D-05	-8.079D-07	1.218D-14	-7.694D-17	4.734D-04	-2.238D-06
2	11	3.993D-02	8.196D-04								
3	1	2.017D-05	-3.180D-03	3.515D-05	2.041D-05	-7.430D-05	-2.989D-06	-1.154D-16	-1.638D-18	-4.634D-06	-6.987D-06
3	11	-2.942D-04	1.951D-06								
4	1	8.819D-04	7.659D-04	2.041D-05	1.462D-01	4.436D-03	2.399D-04	-2.019D-15	1.197D-15	-7.943D-05	5.767D-04
4	11	-9.542D-04	5.255D-02								
5	1	-4.957D-02	-2.316D-05	-7.430D-05	4.436D-03	7.609D-02	2.009D-03	-3.051D-16	1.286D-15	-1.059D-05	4.434D-03
5	11	-4.121D-04	2.116D-03								
6	1	-1.117D-03	-8.079D-07	-2.989D-06	2.399D-04	2.009D-03	5.992D-05	-1.531D-17	4.110D-17	-5.346D-07	1.349D-04
6	11	-2.080D-05	1.010D-04								
7	1	-5.481D-18	1.218D-14	-1.154D-16	-2.019D-15	-3.051D-16	-1.531D-17	2.142D-06	-1.115D-19	8.707D-16	-3.715D-17
7	11	3.952D-14	1.885D-16								

8	1	-6.360D-16	-7.694D-17	-1.638D-18	1.197D-15	1.286D-15	4.110D-17	-1.115D-19	3.606D-29	-8.277D-19	9.345D-17
8	11	-1.925D-17	4.398D-16								
9	1	-2.926D-07	4.734D-04	-4.634D-06	-7.943D-05	-1.059D-05	-5.346D-07	8.707D-16	-8.277D-19	3.467D-05	-1.301D-06
9	11	1.538D-03	7.251D-06								
10	1	-2.391D-03	-2.238D-06	-6.987D-06	5.767D-04	4.434D-03	1.349D-04	-3.715D-17	9.345D-17	-1.301D-06	3.045D-04
10	11	-5.073D-05	2.399D-04								
11	1	-8.442D-06	3.993D-02	-2.942D-04	-9.542D-04	-4.121D-04	-2.080D-05	3.952D-14	-1.925D-17	1.538D-03	-5.073D-05
11	11	6.980D-02	3.745D-05								
12	1	3.013D-05	8.196D-04	1.951D-06	5.255D-02	2.116D-03	1.010D-04	1.885D-16	4.398D-16	7.251D-06	2.399D-04
12	11	3.745D-05	6.870D-02								

THE C12 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	8.208D-04	-1.473D-04	6.893D-07	1.520D-05	-1.086D-03	-2.462D-05	-4.137D-06	-1.386D-17	7.812D-07	-5.278D-05
1	11	3.182D-05	-1.524D-07								
2	1	2.436D-06	1.587D-02	-7.725D-05	1.649D-04	4.662D-07	1.697D-07	-1.808D-08	-7.218D-19	7.396D-06	4.289D-07
2	11	8.000D-04	8.399D-06								
3	1	8.556D-04	-1.191D-04	5.941D-07	1.672D-05	-1.132D-03	-2.565D-05	-2.666D-10	-1.467D-17	1.125D-07	-5.498D-05
3	11	1.337D-06	-1.701D-07								
4	1	-7.606D-06	-2.321D-01	1.032D-03	-3.596D-03	-3.432D-04	-1.833D-05	3.551D-07	-1.825D-18	1.274D-03	-4.485D-05
4	11	4.757D-02	-7.028D-05								
5	1	-3.267D-02	-9.056D-03	4.049D-05	-2.056D-04	4.203D-03	9.705D-05	-1.445D-04	6.335D-17	4.872D-05	2.078D-04
5	11	1.906D-03	-2.274D-06								
6	1	-1.331D-04	-4.380D-04	1.962D-06	-9.385D-06	1.752D-04	3.947D-06	-7.333D-06	2.655D-18	2.325D-06	8.447D-06
6	11	9.099D-05	-1.144D-07								
7	1	-1.840D-19	4.053D-15	-1.977D-17	4.150D-17	1.053D-18	6.086D-20	-3.344D-21	-1.758D-31	2.548D-18	1.450D-19
7	11	2.323D-16	2.169D-18								
8	1	-9.680D-17	-1.939D-15	8.635D-18	-3.193D-17	1.249D-16	2.741D-18	-5.606D-18	1.931D-30	1.057D-17	5.827D-18
8	11	3.978D-16	-5.744D-19								
9	1	-1.559D-08	1.551D-04	-7.568D-07	1.588D-06	5.157D-08	2.584D-09	-5.368D-10	-6.565D-21	9.766D-08	6.096D-09
9	11	8.896D-06	8.305D-08								
10	1	-3.117D-04	-1.044D-03	4.678D-06	-2.224D-05	4.103D-04	9.243D-06	-1.754D-05	6.237D-18	5.521D-06	1.978D-05
10	11	2.161D-04	-2.740D-07								
11	1	-5.422D-07	2.797D-04	-1.286D-06	3.810D-06	1.116D-06	3.726D-08	-3.275D-08	1.182D-20	-1.022D-06	8.587D-08
11	11	-3.756D-05	1.025D-07								
12	1	-1.079D-05	2.638D-02	-2.282D-04	-9.448D-04	-4.085D-04	-2.076D-05	-1.440D-07	-1.746D-17	1.531D-03	-5.068D-05
12	11	6.911D-02	7.377D-05								

THE C13 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-5.474D-05	6.335D-07	-4.736D-09	-1.151D-06	7.239D-05	1.641D-06	-4.711D-10	9.386D-19	1.424D-10	3.517D-06
1	11	1.981D-08	7.589D-09								
2	1	-5.416D-04	-4.037D-03	1.918D-05	-5.879D-05	7.133D-04	1.607D-05	-2.512D-05	1.069D-17	5.052D-06	3.440D-05
2	11	1.101D-04	-1.788D-06								
3	1	4.684D-05	-7.363D-01	3.520D-03	-8.424D-03	-4.297D-04	-2.253D-05	1.828D-07	2.296D-17	5.645D-04	-5.434D-05
3	11	1.810D-03	-3.551D-04								
4	1	1.378D-01	-6.566D-05	4.518D-06	2.914D-03	-1.822D-01	-4.130D-03	4.790D-07	-2.362D-15	4.263D-07	-8.853D-03
4	11	4.666D-05	-1.828D-05								
5	1	4.410D-04	3.839D-06	-5.867D-09	9.363D-06	-5.832D-04	-1.322D-05	8.074D-08	-7.566D-18	1.844D-08	-2.634D-05
5	11	1.174D-06	-5.564D-08								
6	1	9.274D-06	1.509D-07	-4.885D-10	1.974D-07	-1.227D-05	-2.781D-07	3.839D-09	-1.592D-19	9.486D-10	-5.960D-07
6	11	5.600D-08	-1.109D-09								
7	1	-1.705D-16	1.888D-17	-1.930D-19	-4.580D-18	2.244D-16	5.058D-18	-2.621D-17	4.248D-30	2.013D-18	1.083D-17
7	11	1.038D-16	1.221D-19								
8	1	9.601D-16	-6.709D-17	3.499D-19	1.955D-17	-1.270D-15	-2.879D-17	4.250D-21	-1.646D-29	5.499D-20	-6.170D-17
8	11	5.369D-19	-1.595D-19								
9	1	-6.519D-06	7.167D-07	-7.360D-09	-1.752D-07	8.580D-06	1.934D-07	-1.004D-06	1.625D-19	7.705D-08	4.139D-07
9	11	3.973D-06	4.668D-09								
10	1	1.981D-05	3.525D-07	-1.198D-09	4.219D-07	-2.620D-05	-5.941D-07	9.723D-09	-3.403D-19	2.225D-09	-1.273D-06
10	11	1.309D-07	-2.345D-09								
11	1	-1.631D-05	-5.820D-07	-1.144D-08	-5.190D-07	2.142D-05	4.815D-07	-3.693D-06	4.664D-19	2.856D-07	1.030D-06

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
11	11	1.461D-05	1.459D-08								
12	1	2.234D-04	-1.065D-06	6.229D-09	4.646D-06	-2.955D-04	-6.701D-06	-1.630D-08	-3.832D-18	1.194D-07	-1.436D-05
12	11	6.126D-06	-2.484D-08								

THE C23 COEFFICIENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-1.193D-06	9.634D-09	-1.244D-06	-2.098D-07	4.774D-06	1.947D-07	3.618D-21	1.402D-19	1.510D-10	4.562D-07
1	11	1.047D-09	1.209D-08								
2	1	3.784D-05	-9.926D-05	-1.153D-05	1.759D-03	1.811D-03	9.128D-05	-2.520D-17	8.190D-17	-9.598D-07	2.182D-04
2	11	-1.635D-06	1.967D-04								
3	1	1.922D-04	-1.811D-02	1.410D-04	3.109D-01	1.197D-02	5.776D-04	-4.600D-15	2.590D-15	-1.761D-04	1.376D-03
3	11	-3.547D-04	1.725D-02								
4	1	3.003D-03	1.318D-05	3.131D-03	-5.891D-05	-1.199D-02	-4.887D-04	4.277D-19	-3.558D-16	-1.499D-08	-1.145D-03
4	11	-1.970D-06	3.425D-05								
5	1	9.459D-06	1.394D-07	1.002D-05	-1.280D-06	-4.374D-05	-1.837D-06	2.634D-20	-1.355D-18	8.930D-10	-4.316D-06
5	11	-6.417D-09	1.046D-06								
6	1	1.948D-07	4.587D-09	2.108D-07	-3.776D-08	-1.064D-06	-4.596D-08	9.831D-22	-3.417D-20	3.480D-11	-1.083D-07
6	11	-1.598D-10	5.175D-08								
7	1	4.699D-17	4.959D-19	-3.867D-18	4.861D-17	1.787D-15	9.053D-17	1.376D-31	6.955D-29	1.032D-20	2.165D-16
7	11	3.268D-19	1.054D-16								
8	1	2.094D-17	-1.547D-18	2.183D-17	2.775D-17	-8.252D-17	-3.357D-18	-4.133D-31	-2.247D-30	-1.604D-20	-7.861D-18
8	11	-4.588D-20	1.847D-18								
9	1	1.799D-06	1.882D-08	-1.478D-07	1.864D-06	6.839D-05	3.465D-06	5.230D-21	2.662D-18	3.936D-10	8.286D-06
9	11	1.251D-08	4.033D-06								
10	1	4.132D-07	1.051D-08	4.503D-07	-8.643D-08	-2.377D-06	-1.034D-07	2.283D-21	-7.703D-20	8.105D-11	-2.438D-07
10	11	-3.596D-10	1.211D-07								
11	1	6.789D-06	-8.992D-09	-3.689D-07	8.199D-06	2.511D-04	1.273D-05	-8.160D-22	9.789D-18	6.787D-10	3.044D-05
11	11	4.439D-08	1.490D-05								
12	1	4.908D-06	-1.204D-08	5.079D-06	3.847D-06	-1.806D-05	-7.228D-07	-6.449D-21	-4.963D-19	-2.939D-10	-1.690D-06
12	11	-8.375D-09	6.137D-06								

THE MODAL STIFFNESS MATRIX IS---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	3.409D+01	-6.222D-09	-2.770D-11	-1.436D-10	4.705D-08	1.135D-08	2.737D-16	1.529D-14	-1.401D-10	1.264D-08
1	11	-3.067D-10	-8.199D-11								
2	1	-6.222D-09	8.091D+01	-2.529D-09	1.405D-09	-1.585D-07	-5.401D-09	2.133D-11	-8.490D-15	1.869D-09	-5.205D-09
2	11	1.855D-08	-5.132D-09								
3	1	-2.770D-11	-2.529D-09	9.036D+01	-1.776D-07	1.766D-09	7.478D-11	-1.757D-13	-1.164D-13	5.015D-11	1.472D-10
3	11	6.512D-11	-7.988D-10								
4	1	-1.436D-10	1.405D-09	-1.776D-07	1.369D+02	-4.089D-09	8.189D-11	-7.447D-13	9.407D-13	9.792D-10	-6.218D-10
4	11	-3.475D-09	1.230D-07								
5	1	4.705D-08	-1.585D-07	1.766D-09	-4.089D-09	5.177D+02	5.489D-09	-8.030D-13	1.898D-11	3.633D-10	2.186D-08
5	11	1.942D-09	-7.435D-09								
6	1	1.135D-08	-5.401D-09	7.478D-11	8.189D-11	5.489D-09	9.243D+02	-5.171D-13	-1.064D-11	5.458D-11	2.332D-08
6	11	1.792D-11	-9.777D-10								
7	1	2.737D-16	2.133D-11	-1.757D-13	-7.447D-13	-8.030D-13	-5.171D-13	9.870D+02	1.035D-16	9.884D-12	1.292D-11
7	11	-7.318D-11	-3.111D-13								
8	1	1.529D-14	-8.490D-15	-1.164D-13	9.407D-13	1.898D-11	-1.064D-11	1.035D-16	9.870D+02	3.023D-12	3.762D-12
8	11	-2.647D-15	-3.361D-14								
9	1	-1.401D-10	1.869D-09	5.015D-11	9.792D-10	3.633D-10	5.458D-11	9.884D-12	3.023D-12	9.873D+02	-8.584D-11
9	11	-1.157D-08	1.184D-10								
10	1	1.264D-08	-5.205D-09	1.472D-10	-6.218D-10	2.186D-08	2.332D-08	1.292D-11	3.762D-12	-8.584D-11	9.934D+02
10	11	3.528D-10	1.374D-10								
11	1	-3.067D-10	1.855D-08	6.512D-11	-3.475D-09	1.942D-09	1.792D-11	-7.318D-11	-2.647D-15	-1.157D-08	3.528D-10
11	11	1.950D+03	-7.358D-10								
12	1	-8.199D-11	-5.132D-09	-7.988D-10	1.230D-07	-7.435D-09	-9.777D-10	-3.111D-13	-3.361D-14	1.184D-10	1.374D-10
12	11	-7.358D-10	1.975D+03								

THE MODAL DAMPING MATRIX IS---

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

1	1	2.812D-01	2.377D-05	3.607D-07	-3.557D-04	1.173D-01	6.633D-02	-3.610D-18	3.719D-15	1.441D-07	1.584D-02
1	11	2.677D-05	1.158D-04								
2	1	2.377D-05	2.183D-01	-2.080D-04	1.242D-04	1.636D-05	7.427D-06	5.731D-14	-4.667D-17	-8.204D-03	5.951D-07
2	11	3.656D-03	7.052D-05								
3	1	3.607D-07	-2.080D-04	2.011D-01	-6.815D-07	3.132D-07	1.053D-07	-4.440D-16	-1.569D-15	6.865D-05	-1.009D-07
3	11	-3.392D-05	4.837D-07								
4	1	-3.557D-04	1.242D-04	-6.815D-07	3.047D-01	-1.127D-03	-1.376D-04	-1.612D-15	2.055D-15	3.012D-04	8.583D-05
4	11	-2.208D-04	1.172D-02								
5	1	1.173D-01	1.636D-05	3.132D-07	-1.127D-03	1.507D+00	-4.586D-02	-9.795D-15	5.364D-14	2.608D-06	-5.757D-01
5	11	2.275D-04	1.208D-03								
6	1	6.633D-02	7.427D-06	1.053D-07	-1.376D-04	-4.586D-02	6.281D+00	-6.570D-15	-7.487D-14	-7.163D-06	-2.405D-01
6	11	6.685D-05	2.983D-04								
7	1	-3.610D-18	5.731D-14	-4.440D-16	-1.612D-15	-9.795D-15	-6.570D-15	1.257D+01	1.318D-18	1.223D-13	1.645D-13
7	11	-3.197D-14	-1.667D-16								
8	1	3.719D-15	-4.667D-17	-1.569D-15	2.055D-15	5.364D-14	-7.487D-14	1.318D-18	1.257D+01	3.849D-14	2.918D-14
8	11	1.103D-16	1.122D-16								
9	1	1.441D-07	-8.204D-03	6.865D-05	3.012D-04	2.608D-06	-7.163D-06	1.223D-13	3.849D-14	1.257D+01	-4.823D-07
9	11	3.420D-02	1.454D-04								
10	1	1.584D-02	5.951D-07	-1.009D-07	8.583D-05	-5.757D-01	-2.405D-01	1.645D-13	2.918D-14	-4.823D-07	1.257D+01
10	11	3.088D-04	1.444D-03								
11	1	2.677D-05	3.656D-03	-3.392D-05	-2.208D-04	2.275D-04	6.685D-05	-3.197D-14	1.103D-16	3.420D-02	3.088D-04
11	11	8.868D-01	1.269D-06								
12	1	1.158D-04	7.052D-05	4.837D-07	1.172D-02	1.208D-03	2.983D-04	-1.667D-16	1.122D-16	1.454D-04	1.444D-03
12	11	1.269D-06	8.869D-01								

THE INITIAL MODAL COORDINATE DISPLACEMENTS ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								

THE INITIAL MODAL COORDINATE VELOCITIES ARE---

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0								

FOR BODY 2 THE P-O HINGE NO., THE EULER ROTATION TYPE AND THE JOINT NO. CORRESPONDING TO THE P-O HINGE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)	(3)
1	1	2	1	1

		(1)	(2)	(3)
1	1	0.0	0.0	0.0

FOR BODY 2 THE SENSOR POINT NO., THE EULER ROTATION TYPE AND THE JOINT NO. CORRESPONDING TO THE SENSOR POINT APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)	(3)
1	1	1	1	1
2	1	2	1	1
3	1	3	1	1

		(1)	(2)	(3)
1	1	0.0	0.0	0.0
2	1	0.0	0.0	0.0
3	1	0.0	0.0	0.0

THE FOLLOWING INTEGER ARRAY (INDEP) PRESCRIBES INDEPENDENT VARIABLES (1), AND DEPENDENT VARIABLES (0)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
I	21	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
I	41	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I			

ATS-F SINGLE FLEXIBLE BODY USING NORMAL VIBRATION MODES, 3 IMBEDDED MOM. WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC

CURRENT TIME = 12.08.26
THE CPU TIMER = 1.1727E+01

AT SIMULATION TIME, T = 0.0 *

THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	1.278D+02	1.278D+02	1.278D+02	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	1.463D-03	1.962D-03	1.094D-03	-3.020D-02	-1.445D-02
1	51	2.435D+01	0.0	0.0	0.0	0.0	0.0	0.0			

AT SIMULATION TIME, T = 0.0 *

THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	51	0.0	3.413D-02	4.997D+00	1.395D-02	5.014D+00	1.863D-02	5.008D+00			

AT SIMULATION TIME, T = 0.0 *

THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)
1	1	0.0	1.463D-03
2	1	0.0	1.962D-03
3	1	0.0	1.094D-03
4	1	0.0	-3.020D-02
5	1	0.0	-1.445D-02
6	1	0.0	2.435D+01

AT SIMULATION TIME, T = 0.0 *

THE BETA TIME DERIVATIVES ARE

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

AT SIMULATION TIME, T = 0.0 *

THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0 *

THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3.413D-02	4.997D+00	1.395D-02	5.014D+00	1.863D-02	5.008D+00

```
        AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  1   THE VELOCITIES ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1     0.0        0.0        0.0        0.0        0.0        0.0
FOR BODY  1   THE CORRESPONDING MOMENTA ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1     0.0        0.0        0.0        0.0        0.0        0.0
FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1     0.0        0.0        0.0        0.0        0.0        0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     0.0            0.0

        AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)       (10)
  1    1     0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
  1   11     0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        1.278D+02  1.278D+02
  1   21     1.278D+02
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)       (10)
  1    1     8.306D+00  8.306D+00  8.306D+00  0.0        0.0        0.0        1.005D-02 -5.963D-02  4.453D-04  6.946D-02
  1   11     3.524D-01  1.788D-02 -6.318D-14  1.415D-14 -2.417D-03  4.275D-02 -8.848D-03  8.091D-03  8.306D+00  8.306D+00
  1   21     8.306D+00
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1     8.313D+00  8.303D+00  8.302D+00  0.0        0.0        0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     1.59195352D+03 0.0
FOR BODY  2   THE ELASTIC DEFLECTIONS ARE
             ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)       (10)
  1    1     0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
  1   11     0.0        0.0

        AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
             ( 1)       ( 2)       ( 3)
  1    1     8.313D+00  8.303D+00  8.302D+00
THE TOTAL LINEAR MOMENTUM VECTOR IS
             ( 1)       ( 2)       ( 3)
  1    1     0.0        0.0        0.0

THE TOTAL ANGULAR MOMENTUM =   1.43858944D+01
THE TOTAL LINEAR MOMENTUM  =   0.0
THE TOTAL KINETIC ENERGY   =   1.59195352D+03
THE TOTAL POTENTIAL ENERGY =   0.0
THE TOTAL ENERGY (T + V)   =   1.59195352D+03
```

ATS-F SINGLE FLEXIBLE BODY USING NORMAL VIBRATION MODES, 3 IMBEDDED MOM. WHEELS, ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODC

CURRENT TIME = 12.15.09
THE CPU TIMER = 2.0187E+02

AT SIMULATION TIME, T = 2.0000D+00* *

THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	-3.287D-06	-5.320D-06	-6.973D-06	-1.021D-05
1	11	6.340D-06	-2.284D-08	4.970D-06	-2.631D-05	2.847D-07	-1.378D-05	-2.960D-05	-1.138D-06	-2.657D-16	6.160D-23
1	21	7.916D-08	-1.865D-06	-2.219D-06	1.063D-06	1.283D+02	1.283D+02	1.283D+02	-9.901D-07	4.402D-06	-1.555D-08
1	31	-4.368D-06	2.386D-07	2.771D-08	-3.182D-16	-3.379D-24	-2.147D-10	9.059D-09	4.177D-08	-4.401D-08	0.0
1	41	0.0	0.0	0.0	0.0	0.0	1.459D-03	1.957D-03	1.088D-03	-3.021D-02	-1.444D-02
1	51	2.435D+01	5.836D-02	8.778D-01	2.491D-02	8.949D-01	3.330D-02	8.981D-01			

AT SIMULATION TIME, T = 2.0000D+00* *

THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	-4.038D-09	1.227D-08	-6.596D-09	2.349D-08
1	11	7.776D-09	8.665D-11	3.591D-05	-3.507D-04	1.343D-06	6.021D-04	-8.128D-05	-2.063D-05	9.990D-16	3.049D-21
1	21	-9.309D-07	-3.015D-06	-7.941D-05	8.614D-05	-5.016D-06	-2.748D-06	3.517D-06	4.970D-06	-2.631D-05	2.842D-07
1	31	-1.378D-05	-2.960D-05	-1.138D-06	-2.657D-16	6.160D-23	7.916D-08	-1.865D-06	-2.219D-06	1.063D-06	0.0
1	41	0.0	0.0	0.0	0.0	0.0	-3.406D-06	-5.131D-06	-8.219D-06	-1.098D-05	6.544D-06
1	51	3.450D-09	2.470D-02	2.032D+00	1.104D-02	2.278D+00	1.480D-02	2.285D+00			

AT SIMULATION TIME, T = 2.0000D+00* *

THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)
1	1	0.0	1.459D-03
2	1	0.0	1.957D-03
3	1	0.0	1.088D-03
4	1	0.0	-3.021D-02
5	1	0.0	-1.444D-02
6	1	0.0	2.435D+01

AT SIMULATION TIME, T = 2.0000D+00* *

THE BETA TIME DERIVATIVES ARE

		(1)	(2)
1	1	0.0	-3.406D-06
2	1	0.0	-5.131D-06
3	1	0.0	-8.219D-06
4	1	0.0	-1.098D-05
5	1	0.0	6.544D-06
6	1	0.0	3.450D-09

AT SIMULATION TIME, T = 2.0000D+00* *

THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	5.836D-02	8.778D-01	2.491D-02	8.949D-01	3.330D-02	8.981D-01

AT SIMULATION TIME, T = 2.0000D+00* *

THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	2.470D-02	2.032D+00	1.104D-02	2.278D+00	1.480D-02	2.285D+00

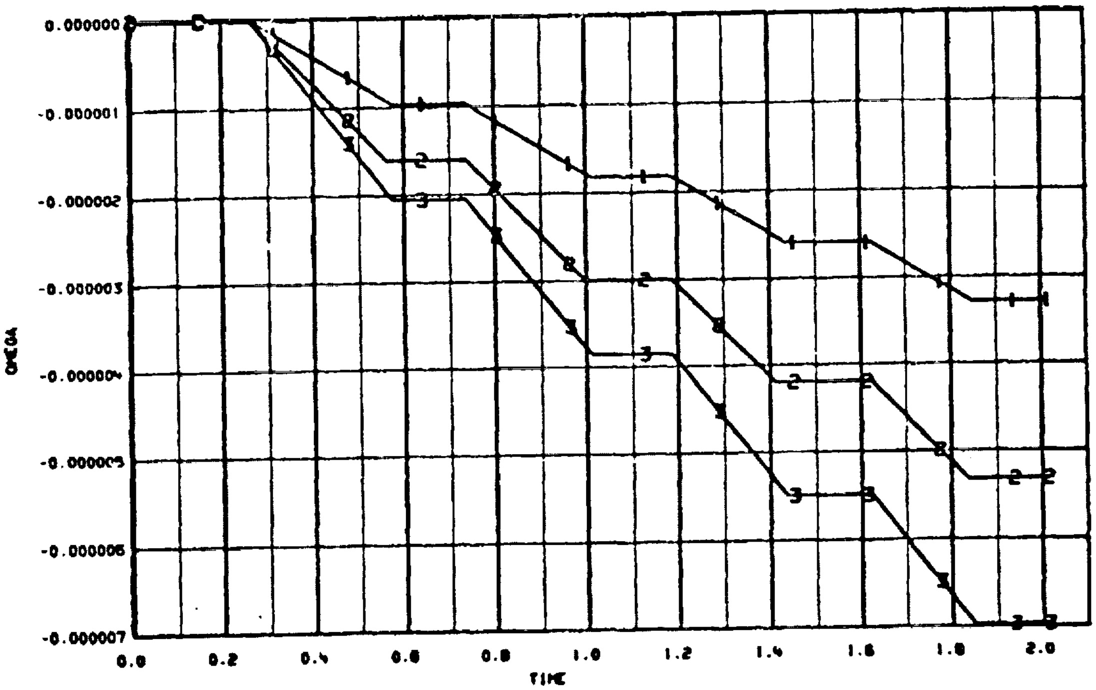
```
        AT SIMULATION TIME, T = 2.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  1   THE VELOCITIES ARE
            ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1    0.0        0.0        0.0        0.0        0.0        0.0
FOR BODY  1   THE CORRESPONDING MOMENTA ARE
            ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1    0.0        0.0        0.0        0.0        0.0        0.0
FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
            ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1    0.0        0.0        0.0        0.0        0.0        0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     0.0            0.0

        AT SIMULATION TIME, T = 2.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
            ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)       (10)
  1    1   -3.287D-06 -5.320D-06 -6.973D-06 -1.021D-05  6.340D-06 -2.284D-08  4.970D-06 -2.631D-05  2.842D-07 -1.378D-05
  1   11   -2.960D-05 -1.138D-06 -2.657D-16  6.160D-23  7.916D-08 -1.865D-06 -2.219D-06  1.063D-06  1.283D+02  1.283D+02
  1   21    1.283D+02
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
            ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)       (10)
  1    1    8.306D+00  8.306D+00  8.306D+00 -2.274D-18  3.549D-18  6.996D-21  1.009D-02 -5.988D-02  4.473D-04  6.973D-02
  1   11    3.537D-01  1.795D-02 -6.314D-14  1.420D-14 -2.426D-03  4.292D-02 -8.883D-03  8.125D-03  8.339D+00  8.337D+00
  1   21    8.339D+00
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
            ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1    8.313D+00  8.303D+00  8.302D+00 -2.278D-18  3.546D-18  1.663D-20
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     1.60445651D+03 2.12596609D-09
FOR BODY  2   THE ELASTIC DEFLECTIONS ARE
            ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)       (10)
  1    1   -9.901D-07  4.402D-06 -1.555D-08 -4.368D-06  2.386D-07  2.771D-08 -3.182D-16 -3.379D-24 -2.147D-10  9.059D-09
  1   11    4.177D-08 -4.401D-08

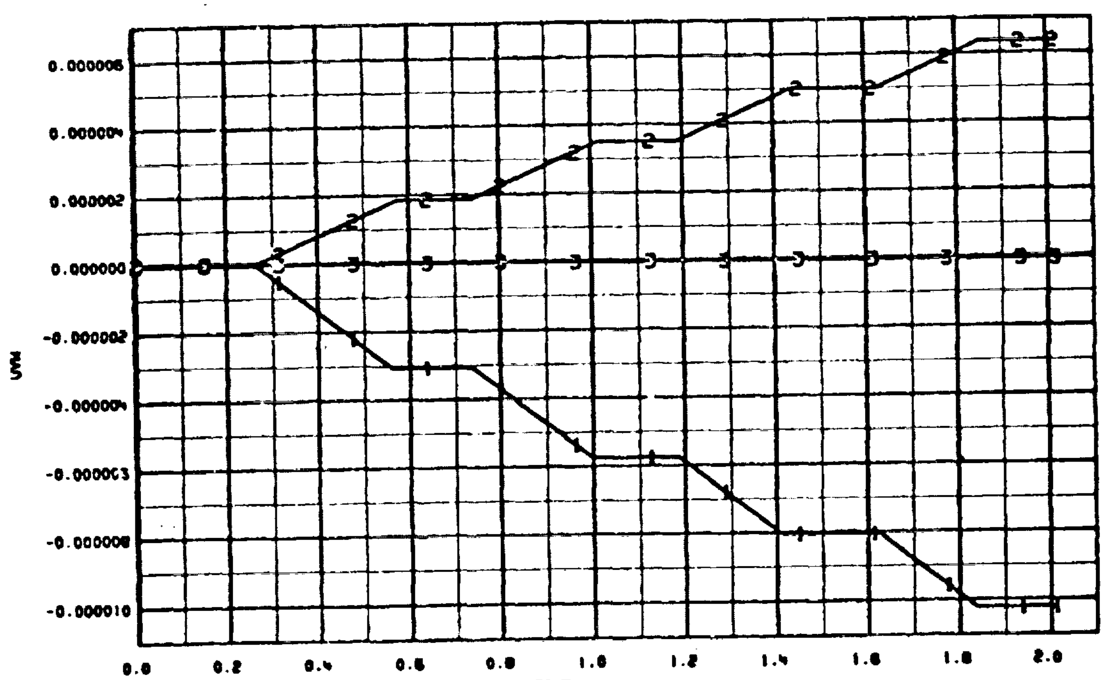
        AT SIMULATION TIME, T = 2.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
            ( 1)       ( 2)       ( 3)
  1    1    8.313D+00  8.303D+00  8.302D+00
THE TOTAL LINEAR MOMENTUM VECTOR IS
            ( 1)       ( 2)       ( 3)
  1    1   -2.278D-18  3.546D-18  1.663D-20

THE TOTAL ANGULAR MOMENTUM =  1.438589440+01
THE TOTAL LINEAR MOMENTUM  =  4.21499308D-18
THE TOTAL KINETIC ENERGY   =  1.60445651D+03
THE TOTAL POTENTIAL ENERGY =  2.12596609D-09
THE TOTAL ENERGY (T + V)   =  1.60445651D+03

                              CPU TIME/STEP  CPU TIME/REAL TIME
                                1.8473E+00          1.4779E+02
```



ATS-F ANGULAR VELOCITY VECTOR

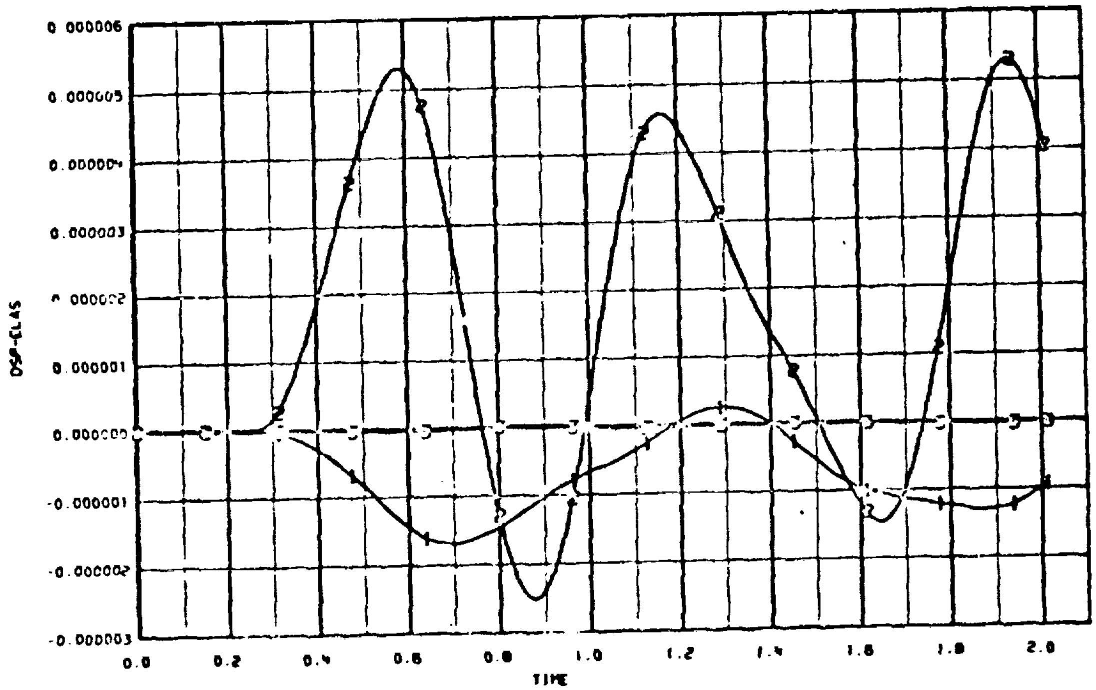


ATS-F TRANSLATIONAL VELOCITY VECTOR

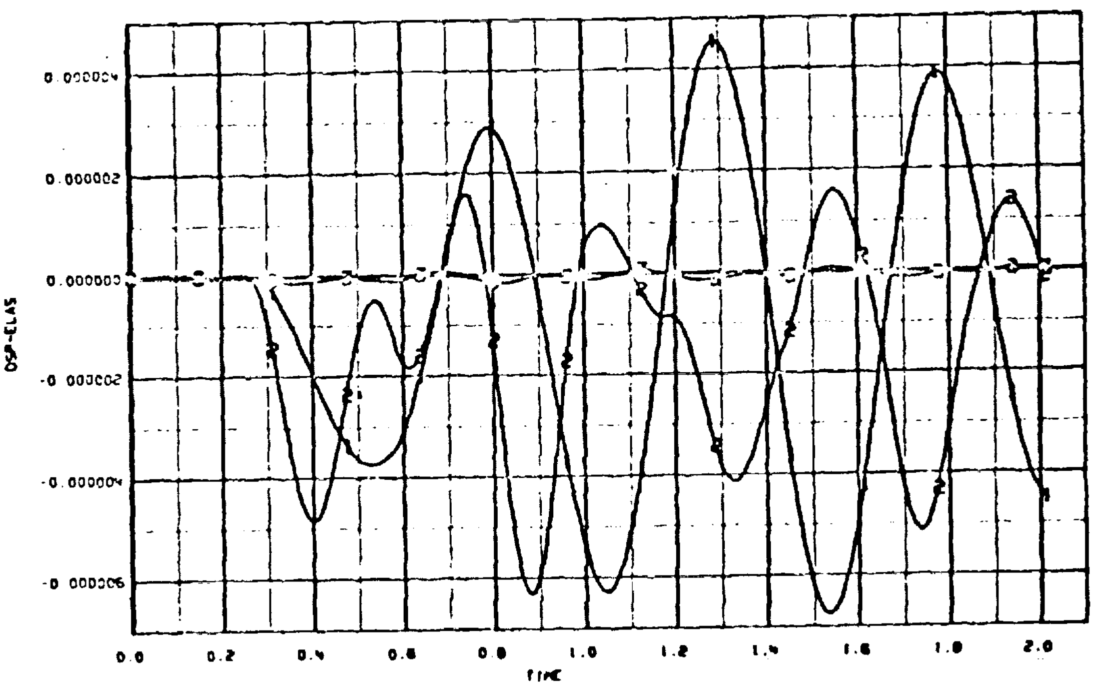
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 3, ATS-F CONTROLLED SPACECRAFT

DEMO 3 02/26/75 CARL BOOLEY

Figure A-3 Graphical Results, Demonstration Problem 3 (Sheet 1 of 5)



ELASTIC MODAL DISPL., MODES 1,2,3

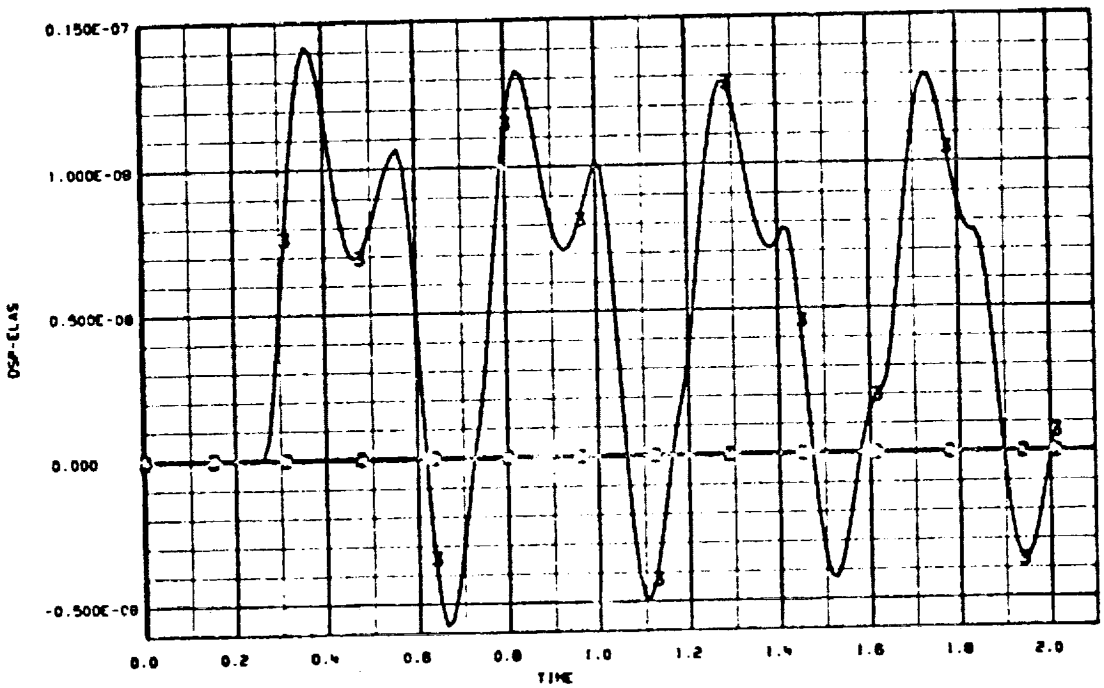


ELASTIC MODAL DISPL., MODES 4,5,6

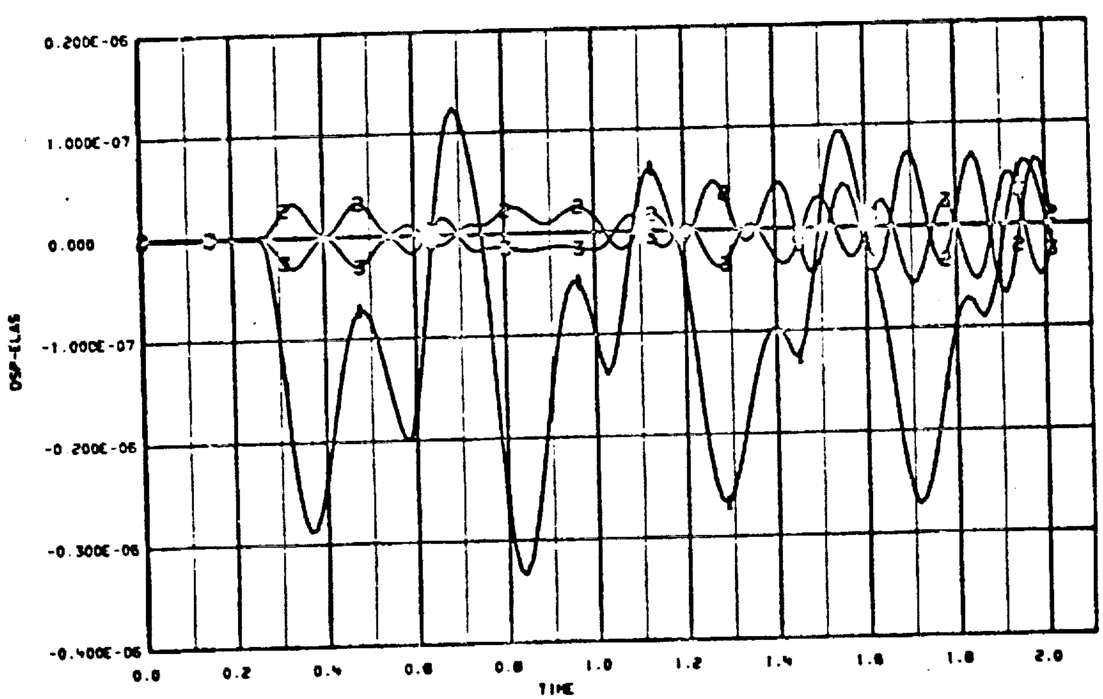
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 3. ATS-F CONTROLLED SPACECRAFT

DEMO 3 02/26/75 CARL BODLEY

Figure A-3 Graphical Results, Demonstration Problem 3 (Sheet 2 of 5)



ELASTIC MODAL DISPL., MODES 7,8,9

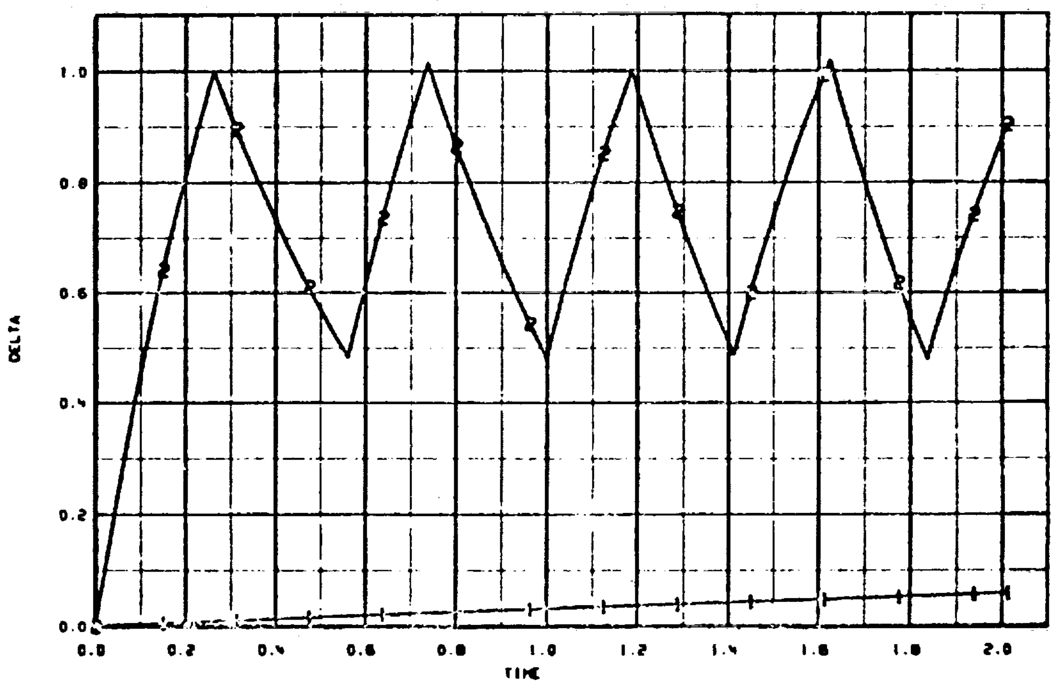


ELASTIC MODAL DISPL., MODES 10,11,12

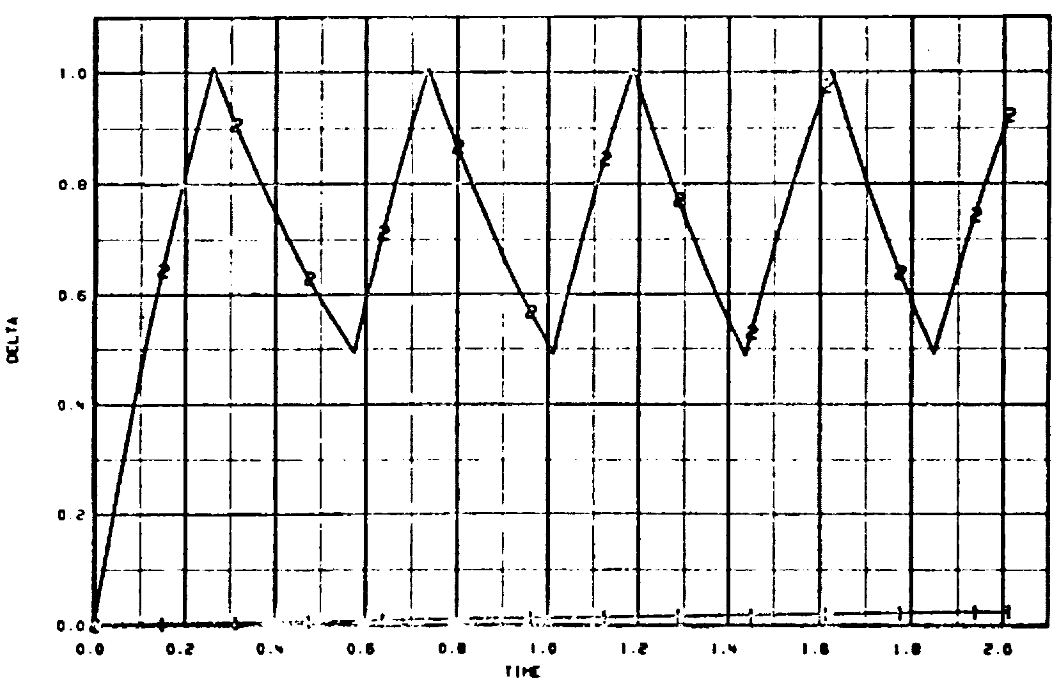
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 3, ATS-F CONTROLLED SPACECRAFT

DEMO 3 02/26/75 CARL BODLEY

Figure A-3 Graphical Results, Demonstration Problem 3 (Sheet 3 of 5)



ROLL CHANNEL CONTROL VARIABLES

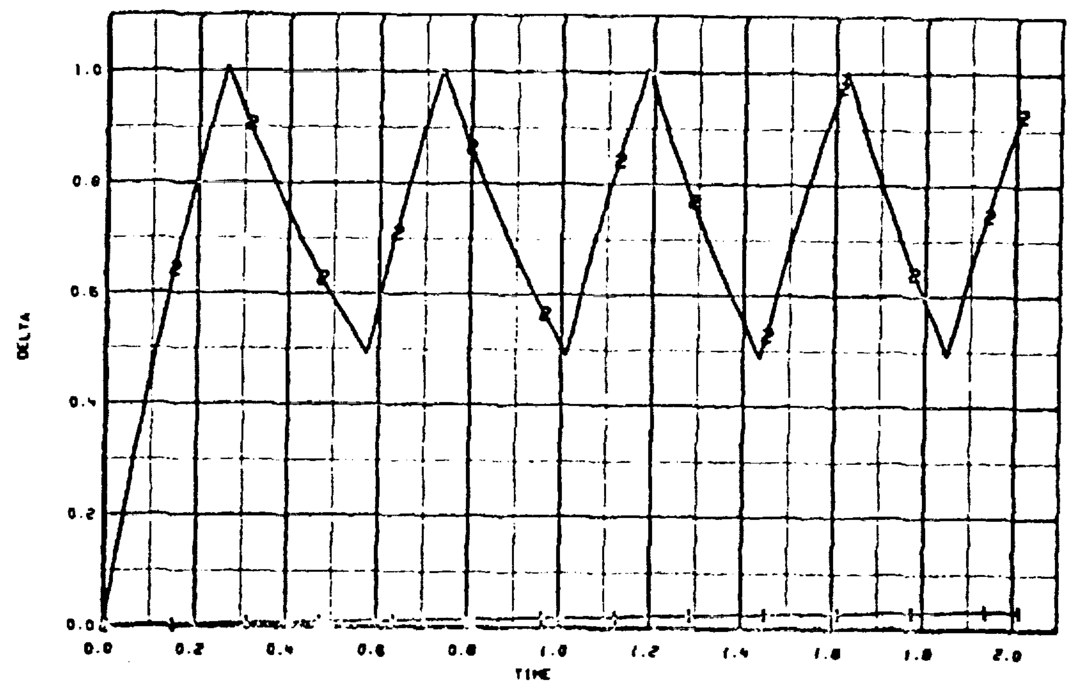


PITCH CHANNEL CONTROL VARIABLES

NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 3, ATS-F CONTROLLED SPACECRAFT

DEMO 3 02/26/75 CARL BOOLEY

Figure A-3 Graphical Results, Demonstration Problem 3 (Sheet 4 of 5)



YAW CHANNEL CONTROL VARIABLES

NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 3, ATS-F CONTROLLED SPACECRAFT

DEMO 3 02/26/75 CARL BOOLEY

Figure A-3 Graphical Results, Demonstration Problem 3 (Sheet 5 of 5)

Demonstration Problem 4

```
      SUBROUTINE CONTRL
      IMPLICIT REAL*8 (A-H,O-Z)
C
              COMMON /BHBSHD/
     *     BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)
              COMMON /CONPAR/
     *     CNTDTA(100)
      COMMON /LDSIZE/ NX,NY,NDLTA,NXSS,NBTQ,NJQ,NY2,NO2
              COMMON /SPECIF/
     *     BETAM(6, 6),BETAMD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
     *     DH(3,35),DS(3,30),IMO(3, 5),NMOM(6, 6),IFTSMW(15),
     *     NB,NM,NSPI,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),
     *     LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
              COMMON /TIMESS/
     *     STARTT,DELTAT,T,ENDT,TMST
              COMMON /VECTOR/
     *     Y(250),YDT(250)
CCCCCCC  THIS COMMON IS TRANSFER BETWEEN CONTRL AND SHAFTT ONLY ----
             COMMON /WHEEL /
     *    CLM(4)
C
      DIMENSION  TQ(6),TQD(6),RHD(3),THADW(3)
      DATA ICT4/0/, RHD / 0.D0, 0.D0, 0.D0 /
      DATA T1,T2,T3,T4,DTHE/
     *    .2D0, 1.2D0, .7D0, 1.7D0, 1.0471975D0 /
      ALIM(U,V) = DMAX1(-V,DMIN1(U,V))
C
CCCCCCCCCC
CCCCCCCCCC
CCC  THE FOLLOWING STATEMENTS MUST ALWAYS BE IN CONTRL..
      NDLTA = NDELTA
      NXSS = 3
      NBTQ = 3
      IF (NDELTA .EQ. 0) RETURN
CCCCCCCCCCC    CCC
CCCC----NOTE--THIS SUBROUTINE MUST ESTABLISH  NDLTA,NXSS AND NBTQ
CCCCCCCCCCC
C
CCCC  ESTABLISH THE D/DT(DELTAS)
C
      LDEL = LOCU(2*NB+2) - 1
      ICT4 = ICT4 + 1
      IA = (ICT4-1)/4
      IAA = (ICT4-2)/4
      IFLAG = IA - IAA
      DO 6 I=1,3
    6 THADW(I) = Y(6+I)
      DO 5 I=1,6
    5 TW(I) = Y(LDEL+I)
C
```

```
C
C         WHEEL 1 (ROLL INERTIA WHEEL CONTROL TORQUE)
C         DEFINE DIFFERENTIAL EQUATIONS FOR ROLL CONTROL LOOP
C
      U1 = 57.2958D0*ROL(3,2,2)/ROL(3,3,2)
      U5 = ALIM(TQ(5),29.D0)
      U2 = 2.17D0*U1 - U5
      U3 = ALIM(1.1D0*U2,1.17D0)
      TQD(5) = (1.D0/88.D0)*(-TQ(5) + (9/1.1D0)*U3)
      U6 = ALIM(5*U3,1.68D0)
      U8 = ALIM(TQ(6),1.9D0)
      IF (IFLAG .EQ. 0) GO TO 32
      UU = DABS(U8)
      IF (UU.GT.1.D0) GO TO 30
      IF (UU.LT.0.5D0) GO TO 31
      U9 = RHD(1)
      GO TO 10
   30 U9 = U8/UU
      GO TO 10
   31 U9 = 0.D0
      GO TO 10
   32 U9 = RHD(1)
      GO TO 33
   10 RHD(1) = U9
   33 CONTINUE
      TQD(6) = (-TQ(6) + 2.5D0*(U6-U9))/.5D0
C
C  1500 RPM = 157.0795 RAD/SEC
C   6 INCH*OZ = .03125 FT*LBS
C
      IF (DABS(THADW(1)).GT. 157.0795D0) U9 = 0.D0
      CLM(1) = .03125D0*U9 - 5.D-05*THADW(1)
C
C         WHEEL 2 (PITCH INERTIA WHEEL CONTROL TORQUE)
C         DEFINE DIFFERENTIAL EQUATIONS IN PITCH CONTROL LOOP
C
      U1 = -57.2958D0*ROL(3,1,2)/ROL(3,3,2)
      U5 = ALIM(TQ(1),16.4D0)
      U2 = 2.17D0*U1 - U5
      U3 = ALIM(.82D0*U2,1.17D0)
      TQD(1) = (-TQ(1) + U3*(7/.82D0))/50.D0
      U6 = ALIM(5*U3,1.68D0)
      U8 = ALIM(TQ(2),1.9D0)
      IF (IFLAG.EQ.0) GO TO 14
      UU = DABS(U8)
      IF (UU.GT. 1.D0) GO TO 15
      IF (UU.LT.0.5D0) GO TO 16
      U9 = RHD(2)
      GO TO 12
   15 U9 = U8/UU
      GO TO 12
```

```
16 U9 = 0.D0
   GO TO 12
14 U9 = RHO(2)
   GO TO 13
12 RHO(2) = U9
13 CONTINUE
   TWD(2) = (-TQ(2) + 2.5D0*(U6 - U9))/.5D0
   IF (DABS(THADW(2)).GE. 157.0795D0) U9 = 0
   CLM(2) = .03125D0*U9 - 5.D-05*THADW(2)
C
C        WHEEL 3 (YAW ENERTIA WHEEL CONTROL TORQUE)
C        DEFINE DIFFERENTIAL EQUATIONS FOR YAW CONTROL LOOP
C
   U1 = 57.2958D0*ROL(2,1,2)/ROL(2,2,2)
   U2 = ALIM(U1,2.D0)
   U6 = ALIM(TQ(3),29.D0)
   U3 = 2.17D0*U2 - U6
   U4 = ALIM(1.47D0*U3,1.17D0)
   TWD(3) = (1.D0/68.D0)*(-TQ(3) + (971.47D0)*U4)
   U7 = ALIM(5*U4,1.68D0)
   U9 = ALIM(TQ(4),1.9D0)
   IF (IFLAG.EQ.0) GO TO 20
   U0 = DABS(U9)
   IF (U0.GT.1.D0) GO TO 21
   IF (U0.LT. 0.5D0) GO TO 22
   U10 = RHO(3)
   GO TO 18
21 U10 = U9/U0
   GO TO 18
22 U10 = 0.D0
   GO TO 18
20 U10 = RHO(3)
   GO TO 24
18 RHO(3) = U10
24 CONTINUE
   TWD(4) = (-TQ(4) + 2.5D0*(U7 - U10))/.5D0
   IF (DABS(THADW(3)) .GT. 157.0795D0) U10 = 0.D0
   CLM(3) = .03125D0*U10 - 5.D-05*THADW(3)
C
   DO 34 I=1,6
34 YDT(LDEL+I) = TWD(I)
C
   RETURN
   END
```

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```
DEMO 4    CARL BODLEY
ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHEELS,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL
NAS5-11996  --  GSFC DEMONSTRATION PROBLEM NUMBER 4.


THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS-F SPACECRAFT AS A SINGLE
FLEXIBLE BODY AND A DUMMY RIGID BODY (THE PROGRAM MUST HAVE A MINIMUM OF
2-HINGES, THUS 2-BODIES). THERE ARE THREE ACTIVE MOMENTUM WHEELS USED
FOR CONTROL TORQUE.

THE PROBLEM IS TO DEMONSTRATE THE USE OF DATA FOR LARGE
QUASI-LUMPED STRUCTURAL SYSTEMS.


THE PROBLEM STARTS WITH INITIAL ATTITUDE ERROR (NO RATE ERROR) AND
SIMULATES NONLINEAR TIME DOMAIN RESPONSE.
0000000000
        2        2        3        3        6
ITOPOL  2        2
        1        1        1        2
        2        1        0        1
0000000000
IRGFLX  1        2
        1        1        0       12
0000000000
IFTSMW  1        3
        1        1        2        2        2
0000000000
IHDATA  7        2
        1        1        1        1
        2        1        0        0
        3        1        0        0
        4        1        0        0
        5        1        0        0
        6        1        0        0
        7        1        0        0
0000000000
BETAH   6        2
        1        2     .0014626
        2        2     .0019621
        3        2     .0010945
        4        2    -.030197
        5        2    -.014451
        6        2    24.353
0000000000
BETAHD  6        2
0000000000
IMO     3        3
        1        1        1        2        3
```

```
     2     1      1      2      1
     3     1      1      1      1
0000000000
AMO        2      3
     1     1    127.76                127.76               127.76
     2     1      .065                  .065                 .065
0000000000
TMDATA     1      3
     1     1      0.                   .0125                 2.
0000000000
IPDATA     1      3
     1     1    10      1      0
0000000000
CNTDTA     1    50
0000000000
GGDATA     1      4
0000000000
MIDUM      1      4
     1     1      1.
0000000000
INRDUM     1      6
     1     1     1.                   1.                   1.
0000000000
     2     1
     0.          0.          0.
     0.          0.          0.
     1
MASS       7      1
     1     1   68.273
     2     1    3.5559
     3     1    5.1553
     4     1    5.1553
     5     1    1.7081
     6     1    1.7081
     7     1    0.
0000000000
INER       7      6
     1     1    3.7137     +03    3.5573     +03  4.7763      +02
     1     4   -5.0961            3.2729     +01  2.9104
     2     1    1.0048     +02    1.0079     +02   .96705     +02
     2     4    0.                0.               0.
     3     1    1.6896     +02    4.0091     +01  1.4567      +02
     3     4   -4.7689            1.4296     -01 -1.9592
     4     1    1.6896     +02    4.0091     +01  1.4567      +02
     4     4   -4.7689           -1.4296     -01  1.9592
     5     1    7.9758     -01    7.9758     -01  7.9758      -01
     5     4    0.                0.               0.
     6     1    7.9758     -01    7.9758     -01  7.9758      -01
     6     4    0.                0.               0.
     7     1    0.                0.               9.6705      +01
```

```
      7     4    0.                   0.                   0.
0000000000
STAT        7      3
0000000000
GEOM        7      3
      1     1    0.                   0.                     0.
      2     1    3.0197      -02      1.4451       -02     -1.13079    +01
      3     1   -3.39783     -01      1.92402      +01     -1.3426916  +01
      4     1    4.00177     -01     -1.92112      +01     -1.3426916  +01
      5     1    1.2969               1.4451       -02      4.315
      6     1   -1.2365               1.4451       -02      4.315
      7     1    0.                   0.                     0.
0000000000
HX          7    12
      2     2    1.3521
      3     5  -15.809
      4     7   15.809
      5     9     .001
      6    10    -.001
0000000000
HY          7    12
      2     1    1.3521
      3     4     .070084            -.36998
      4     6    -.070084             .36998
0000000000
HZ          7    12
      3     4    -15.809
      4     6    -15.809
0000000000
SIGX        7    12
      2     1    -1.
      3     4    -1.
      4     6     1.
0000000000
SIGY        7    12
      2     2     1.
      5     8     1.
      6    10    -1.
0000000000
SIGZ        7    12
      2     3    -1.
      3     5     1.
      4     7     1.
      5     9     1.
      6    11     1.
      7     3    -1.
      7    12     1.
0000000000
STIF       12    12
      1     1   209680.
```

```
    2     2  207550.
    3     3    6746.7
    4     4  117660.
    5     5   78838.
    6     6  117660.
    7     7   78838.
    8     8      787.18
    9     9      787.18
   10    10      787.18
   11    11      787.18
   12    12   42688.
0000000000
DAMP     12    12
    1     1    94.11
    2     2    94.30
    3     3    57.12
    4     4   261.9
    5     5   212.7
    6     6   261.9
    7     7   212.7
    8     8    10.02
    9     9    10.02
   10    10    10.02
   11    11    10.02
   12    12   288.0
0000000000
    0.        0.        0.        0.        0.        0.        0.        0.
    0.        0.        0.        0.
    0.        0.        0.        0.        0.        0.        0.        0.
    0.        0.        0.        0.
     2     1     1
    0.        0.        0.
     1     1     1
    0.        0.        0.
     2     1     1
    0.        0.        0.
     3     1     1
    0.        0.        0.
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 4, ATS-F CONTROLLED SPACECRAFT
     6
     7
     1     8     9    10    11    12    13
     1     2     3     4
TIME       OMEGA      ATS-F ANGULAR VELOCITY VECTOR
     1     5     6     7
TIME       UVW        ATS-F TRANSLATIONAL VELOCITY VECTOR
0000000000
    16
     1    14    15    16    17    18    19    20    21    22    23    24    25    26    27    28
     1     2     3     4
```

```
TIME        BETADOT    REFLECTOR HINGE ANGLE RATES
    1     5     6
TIME        BETADOT    +Y MOST PANEL, HINGE ANGLE RATES
    1     7     8
TIME        BETADOT    -Y MOST PANEL, HINGE ANGLE RATES
    1     9    10
TIME        BETADOT    +X MOST  SLOSH, HINGE ANGLE RATES
    1    11    12
TIME        BETADOT    -X MOST  SLOSH, HINGE ANGLE RATES
    1    13
TIME        TDOT-4     MOMENTUM WHEEL 4, ANGULAR RATE
    1    14    15    16
TIME        TDOT-123  MOMENTUM WHEELS 1-2-3, ANGULAR RATES
0000000000
   13
    1    29    30    31    32    33    34    35    36    37    38    39    40
    1     2     3     4
TIME        BETA       REFLECTOR HINGE ANGULAR DISPLACEMENT
    1     5     6
TIME        BETA       +Y MOST PANEL, HINGE ANGULAR DISPLACEMENT
    1     7     8
TIME        BETA       -Y MOST PANEL, HINGE ANGULAR DISPLACEMENT
    1     9    10
TIME        BETA       +X MOST SLOSH, HINGE ANGULAR DISPLACEMENT
    1    11    12
TIME        BETA       -X MOST SLOSH, HINGE ANGULAR DISPLACEMENT
    1    13
TIME        THE-4      MOMENTUM WHEEL 4, HINGE ANGULAR DISPLACEMENT
0000000000
   13
    1    47    48    49    50    51    52    53    54    55    56    57    58
    1     2     3     4
TIME        EULERS     EULER ANGLES THAT POSITION BODY WRT INERTIA
    1     5     6     7
TIME        POSITION   X Y AND Z POSITION COORDINATES WRT INERTIA
    1     8     9
TIME        DELTA      ROLL CHANNEL CONTROL VARIABLES
    1    10    11
TIME        DELTA      PITCH CHANNEL CONTROL VARIABLES
    1    12    13
TIME        DELTA      YAW CHANNEL CONTROL VARIABLES
0000000000
   10
    1    83    84    85   110   111   112   113   114   115
    1     2     3     4
TIME        MW-ACC     MOMENTUM WHEELS 1-2-3, ANGULAR ACCELERATION
    1     5     6
TIME        DELTADOT  ROLL CHANNEL CONTROL VARIABLES (DOTS)
    1     7     8
TIME        DELTADOT  PITCH CHANNEL CONTROL VARIABLES (DOTS)
```


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```
    1     9    10
TIME      DELTADOT  YAW CHANNEL CONTROL VARIABLES (JETS)
0000000000
    6
    1  165  166  167  168  169
    1     2    3
TIME      MOMENTUM  TOTAL ANGULAR AND LINEAR MOMENTUM
    1     4    5     6
TIME      ENERGY    KINETIC, POTENTIAL AND TOTAL ENERGY ( T + V)
0000000000
STOP
```

RUN BY CARL BOOLEY

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.49.56
THE CPU TIMER = 0.0

NAS5-11996 -- GSFC DEMONSTRATION PROBLEM NUMBER 4,

THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS-F SPACECRAFT AS A SINGLE FLEXIBLE BODY AND A DUMMY RIGID BODY (THE PROGRAM MUST HAVE A MINIMUM OF 2-HINGES, THUS 2-BODIES). THERE ARE THREE ACTIVE MOMENTUM WHEELS USED FOR CONTROL TORQUE.

THE PROBLEM IS TO DEMONSTRATE THE USE OF DATA FOR LARGE QUASI-LUMPED STRUCTURAL SYSTEMS.

THE PROBLEM STARTS WITH INITIAL ATTITUDE ERROR (NO RATE ERROR) AND SIMULATES NONLINEAR TIME DOMAIN RESPONSE.

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ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMCOL

CURRENT TIME = 20.49.57
THE CPU TIMER = 3.3000E-01

A-132

SUMMARY OF DYNAMIC-SIMULATION-PROGRAM INPUT DATA * * * * * * * * * * *

ACTUAL SIZES		MAXIMUM SIZES		INTEGRATION DATA		GRAVITY GRADIENT DATA				MISC. DATA	
NB =	2	NBMAX =	6	STARTT =	0.0	G1 =	0.0	GAMA1 =	0.0	NOPPNT =	10
NH =	2	NHMAX =	6	DELTAT =	1.250D-02	G2 =	0.0	GAMA2 =	0.0	NOPLOT =	1
NSPT =	3	NSPMAX =	15	ENDT =	2.000D+00	G3 =	0.0	GAMA3 =	0.0	IFLNER =	0
NOFMO =	3	NMWMAX =	5			GMAG =	0.0	RCMAG =	0.0		
NDELTA =	6	NMWBOD =	4								
NU =	27	NMDBOD =	12								
NBETA =	12	KMU =	27								
NLAM =	0	KY =	250								
NEQ =	57	KU =	113								

THE TOPOLOGY ARRAY (ITOPOL) FOR THIS CASE FOLLOWS

		(1)	(2)
1	1	1	2
2	1	0	1

THE CONSTRAINT SPECIFICATIONS FOR THIS CASE FOLLOW

		(1)	(2)
1	1	1	1
2	1	0	0
3	1	0	0
4	1	0	0
5	1	0	0
6	1	0	0
7	1	0	0

THE SPECIFIED INITIAL HINGE ANGLES AND DISPLACEMENTS (BETAH) FOLLOW

		(1)	(2)
1	1	0.0	1.463D-03
2	1	0.0	1.962D-03
3	1	0.0	1.094D-03
4	1	0.0	-3.020D-02
5	1	0.0	-1.445D-02
6	1	0.0	2.435D+01

THE SPECIFIED INITIAL HINGE RATES (BETAHD) FOLLOW

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.49.57
THE CPU TIMER = 4.6000E-01

THE NO. OF ELASTIC MODES/BODY ARRAY (IRCFLX) FOLLOWS

		(1)	(2)
1	1	0	12

THE NO. OF F/Q HINGE POINTS/BODY ARRAY (NHPOI) FOLLOWS

		(1)	(2)
1	1	1	1

THE NO. OF SENSOR POINTS/BODY ARRAY (NSPOI) FOLLOWS

		(1)	(2)
1	1	0	3

THE MOM. WHEEL/BODY TABLE (NMOW) FOLLOWS

		(1)	(2)
1	1	0	3
2	1	0	3
3	1	0	1
4	1	0	2
5	1	0	3
6	1	0	0

THE STATE VECTOR LENGTH ARRAY (LENU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	6	21	0	12	12	6

THE STATE VECTOR LOCATION ARRAY (LOCU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	7	28	28	40	52

THE SPECIFIED SENSOR POINT/BODY CORRELATION ARRAY (IFTSMN) FOLLOWS

		(1)	(2)	(3)
1	1	2	2	2

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.49.57
THE CPU TIMER = 5.4333E-01

THE FOLLOWING DATA IS SPECIFIED MOM. WHEEL INFORMATION (IF ANY) AND CONTROLLER INFORMATION

THE SPECIFIED MOM. WHEEL CONTROL ARRAY (IMC) FOLLOWS

		(1)	(2)	(3)
1	1	1	2	3
2	1	1	2	3
3	1	1	1	1

THE SPECIFIED MOM. WHEEL RATES AND INERTIAS (AMO) FOLLOW

		(1)	(2)	(3)
1	1	1.278D+02	1.278D+02	1.278D+02
2	1	6.500D-02	6.500D-02	6.500D-02

THE SPECIFIED CONTROLLER INITIAL CONDITIONS AND CHARACTERISTICS FOLLOW
(THE FIRST NDELTA ARE INITIAL CONTROLLER STATE VARIABLES, THERE ARE 44 ADDITIONAL CONTROL PARAMETERS)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.49.56
THE CPU TIMER = 7.5333E-01

SUMMARY OF INPUT DATA FOR BODY 1 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.0000+00	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0
3	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.0000D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	1.0000D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.0000D+00

FOR BODY 1 THE P-O HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

A-136

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE. USE MSMODL

CURRENT TIME = 20.50.03
THE CPU TIMER = 2.3433E+00

OUTPUT MATRIX INERG (3 X 3)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.034D+04	6.797D+01	-2.778D+01							
2	1	0.0	6.124D+03	-5.350D-01							
3	1	0.0	0.0	4.781D+03							

END OF WRITE.

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ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMUDL

CURRENT TIME = 20.50.03
THE CPU TIMER = 2.3767E+00

OUTPUT MATRIX STATO (3 X 3)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	1.639D+02	2.503D-01							
2	1	-1.639D+02	0.0	-5.219D-01							
3	1	-2.503D-01	5.219D-01	0.0							

END OF WRITE.

A-138

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODELS, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.03
THE CPU TIMER = 2.4167E+06

OUTPUT MATRIX MASSO (3 X 3)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	8.556D+01	0.0	0.0							
2	1	0.0	8.556D+01	0.0							
3	1	0.0	0.0	8.556D+01							

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.05
THE CPU TIMER = 3.1600E+00

OUTPUT MATRIX DOCOEF (3 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-4.611D+01	0.0	0.0	-1.732D+03	-2.575D+01	1.730D+03	2.575D+01	0.0	0.0	0.0
2	1	0.0	4.642D+01	0.0	-3.246D+01	1.096D+03	3.738D+01	-1.096D+03	8.050D-01	0.0	-8.050D-01
3	1	1.452D-01	-6.948D-02	-1.934D+02	2.020D-02	1.714D+03	-1.626D-03	1.712D+03	-2.468D-05	7.976D-01	2.468D-05
3	11	7.976D-01	9.670D+01								

END OF WRITE.

A-140 ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE CURRENT TIME = 20.50.05
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL THE CPU TIMER = 3.2167E+00

OUTPUT MATRIX AOCOEF (3 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	4.808D+00	0.0	0.0	-8.150D+01	0.0	8.150D+01	1.708D-03	0.0	-1.708D-03
2	1	4.808D+00	0.0	0.0	3.613D-01	-1.907D+00	-3.613D-01	1.907D+00	0.0	0.0	0.0
3	1	0.0	0.0	0.0	-8.150D+01	0.0	-8.150D+01	0.0	0.0	0.0	0.0

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.16
THE CPU TIMER = 5.8400E+00

OUTPUT MATRIX ECOEF (12 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.070D+02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.073D+02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1	0.0	0.0	1.934D+02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	-9.670D+01								
4	1	0.0	0.0	0.0	1.457D+03	9.285D-03	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	9.285D-03	1.434D+03	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.457D+03	9.285D-03	0.0	0.0	0.0
7	1	0.0	0.0	0.0	0.0	0.0	9.285D-03	1.434D+03	0.0	0.0	0.0
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.976D-01	0.0	0.0
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.976D-01	0.0
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.976D-01
11	11	7.976D-01	0.0								
12	1	0.0	0.0	-9.670D+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	0.0	9.670D+01								

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.16
THE CPU TIMER = 5.9667E+00

OUTPUT MATRIX MUO (18 X 18)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.034D+04	8.797D+01	-2.778D+01	0.0	1.639D+02	2.503D-01	-4.611D+01	0.0	0.0	-1.732D+03
1	11	-2.575D+01	1.730D+03	2.575D+01	0.0	0.0	0.0	0.0	0.0		
2	1	8.797D+01	6.124D+03	-5.350D-01	-1.639D+02	0.0	-5.219D-01	0.0	4.642D+01	0.0	-3.246D+01
2	11	1.096D+03	3.738D+01	-1.096D+03	8.050D-01	0.0	-8.050D-01	0.0	0.0		
3	1	-2.778D+01	-5.350D-01	4.761D+03	-2.503D-01	5.219D-01	0.0	1.452D-01	-6.948D-02	-1.934D+02	2.020D-02
3	11	1.714D+03	-1.626D-03	1.712D+03	-2.468D-05	7.976D-01	2.468D-05	7.976D-01	9.670D+01		
4	1	0.0	-1.639D+02	-2.503D-01	8.556D+01	0.0	0.0	0.0	4.808D+00	0.0	0.0
4	11	-8.150D+01	0.0	8.150D+01	1.708D-03	0.0	-1.708D-03	0.0	0.0		
5	1	1.639D+02	0.0	5.219D-01	0.0	8.556D+01	0.0	4.808D+00	0.0	0.0	3.613D-01
5	11	-1.907D+00	-3.613D-01	1.907D+00	0.0	0.0	0.0	0.0	0.0		
6	1	2.503D-01	-5.219D-01	0.0	0.0	0.0	8.556D+01	0.0	0.0	0.0	-8.150D+01
6	11	0.0	-8.150D+01	0.0	0.0	0.0	0.0	0.0	0.0		
7	1	-4.611D+01	0.0	1.452D-01	0.0	4.808D+00	0.0	1.070D+02	0.0	0.0	0.0
8	1	0.0	4.642D+01	-6.948D-02	4.808D+00	0.0	0.0	0.0	1.073D+02	0.0	0.0
9	1	0.0	0.0	-1.934D+02	0.0	0.0	0.0	0.0	0.0	1.934D+02	0.0
9	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-9.670D+01		
10	1	-1.732D+03	-3.246D+01	2.020D-02	0.0	3.613D-01	-8.150D+01	0.0	0.0	0.0	1.457D+03
10	11	9.285D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
11	1	-2.575D+01	1.096D+03	1.714D+03	-8.150D+01	-1.907D+00	0.0	0.0	0.0	0.0	9.285D-03
11	11	1.434D+03	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
12	1	1.730D+03	3.738D+01	-1.626D-03	0.0	-3.613D-01	-8.150D+01	0.0	0.0	0.0	0.0
12	11	0.0	1.457D+03	9.285D-03	0.0	0.0	0.0	0.0	0.0		
13	1	2.575D+01	-1.096D+03	1.712D+03	8.150D+01	1.907D+00	0.0	0.0	0.0	0.0	0.0
13	11	0.0	9.285D-03	1.434D+03	0.0	0.0	0.0	0.0	0.0		
14	1	0.0	8.050D-01	-2.468D-05	1.708D-03	0.0	0.0	0.0	0.0	0.0	0.0
14	11	0.0	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0		
15	1	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	11	0.0	0.0	0.0	0.0	7.976D-01	0.0	0.0	0.0		
16	1	0.0	-8.050D-01	2.468D-05	-1.708D-03	0.0	0.0	0.0	0.0	0.0	0.0

ORIGINAL PAGE IS
OF POOR QUALITY

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.17
THE CPU TIMER = 6.2100E+00

OUTPUT MATRIX MUD (18 X 18) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
16	11	0.0	0.0	0.0	0.0	0.0	7.976D-01	0.0	0.0		
17	1	0.0	0.0	7.976D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	11	0.0	0.0	0.0	0.0	0.0	0.0	7.976D-01	0.0		
18	1	0.0	0.0	9.670D+01	0.0	0.0	0.0	0.0	0.0	-9.670D+01	0.0
18	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.670D+01		

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.18
THE CPU TIMER = 6.5033E+00

OUTPUT MATRIX ACOF (9 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2	1	0.0	0.0	0.0	8.150D+01	0.0	8.150D+01	0.0	0.0	0.0	0.0
3	1	4.808D+00	0.0	0.0	3.613D-01	-1.907D+00	-3.613D-01	1.907D+00	0.0	0.0	0.0
4	1	0.0	0.0	0.0	-8.150D+01	0.0	-8.150D+01	0.0	0.0	0.0	0.0
6	1	0.0	-4.808D+00	0.0	0.0	8.150D+01	0.0	-8.150D+01	-1.708D-03	0.0	1.708D-03
7	1	-4.808D+00	0.0	0.0	-3.613D-01	1.907D+00	3.613D-01	-1.907D+00	0.0	0.0	0.0
8	1	0.0	4.808D+00	0.0	0.0	-8.150D+01	0.0	8.150D+01	1.708D-03	0.0	-1.708D-03

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.20
THE CPU TIMER = 6.9000E+00

OUTPUT MATRIX BCOF (6 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	6.946D-02	0.0	0.0	1.101D+03	-3.670D+01	1.101D+03	-3.664D+01	0.0	0.0	0.0
2	1	0.0	1.452D-01	0.0	1.094D+03	2.769D+01	1.094D+03	3.261D+01	2.215D-03	0.0	2.112D-03
3	1	6.946D-02	1.452D-01	0.0	6.952D+00	-9.006D+00	6.941D+00	-4.028D+00	2.215D-03	0.0	2.112D-03
4	1	1.452D-01	6.948D-02	0.0	-1.228D-01	-1.567D+03	-1.446D-01	-1.565D+03	2.468D-05	0.0	-2.466D-05
5	1	0.0	-5.437D+01	0.0	2.769D+01	1.094D+03	-3.261D+01	-1.094D+03	7.370D-03	0.0	-7.370D-03
6	1	-5.437D+01	0.0	0.0	-1.573D+03	2.561D+01	1.571D+03	-2.561D+01	0.0	0.0	0.0

END OF WRITE.

A-146

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.26
THE CPU TIMER = 7.9867E+00

OUTPUT MATRIX CXY (12 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	-6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1	6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	0.0	5.712D+00	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	-5.712D+00	0.0	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	0.0	5.712D+00	0.0	0.0	0.0
7	1	0.0	0.0	0.0	0.0	0.0	-5.712D+00	0.0	0.0	0.0	0.0

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.29
THE CPU TIMER = 8.6000E+00

OUTPUT MATRIX CXZ (12 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
4	1	0.0	0.0	0.0	0.0	1.288D+03	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	-1.288D+03	0.0	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	0.0	-1.288D+03	0.0	0.0	0.0
7	1	0.0	0.0	0.0	0.0	0.0	1.288D+03	0.0	0.0	0.0	0.0

END OF WRITE.

A-148 ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.31
THE CPU TIMER = 9.1967E+00

OUTPUT MATRIX CYZ (12 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
4	1	0.0	0.0	0.0	2.220D-16	-3.015D+01	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	3.015D+01	0.0	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	-2.220D-16	3.015D+01	0.0	0.0	0.0
7	1	0.0	0.0	0.0	0.0	0.0	-3.015D+01	0.0	0.0	0.0	0.0

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.32
THE CPU TIMER = 9.7167E+00

OUTPUT MATRIX C11 (12 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.286D+03	-1.337D-01	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	-1.337D-01	7.057D-01	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.286D+03	-1.337D-01	0.0	0.0	0.0
7	1	0.0	0.0	0.0	0.0	0.0	-1.337D-01	7.057D-01	0.0	0.0	0.0

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.34
THE CPU TIMER = 1.0223E+01

OUTPUT MATRIX C22 (12 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2	1	0.0	6.5010D+06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.2880D+03	0.0	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	0.0	1.2880D+03	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.2880D+03	0.0	0.0	0.0	0.0
7	1	0.0	0.0	0.0	0.0	0.0	0.0	1.2880D+03	0.0	0.0	0.0
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.708D-06	0.0	0.0
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.708D-06

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.34
THE CPU TIMER = 1.0393E+01

OUTPUT MATRIX C33 (12 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0.0	6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	2.532D-02	-1.337D-01	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	-1.337D-01	1.289D+03	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	2.532D-02	-1.337D-01	0.0	0.0	0.0
7	1	0.0	0.0	0.0	0.0	0.0	-1.337D-01	1.289D+03	0.0	0.0	0.0
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.708D-06	0.0	0.0
10	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.708D-06

END OF WRITE.

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A-152 ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMOLL

CURRENT TIME = 20.50.35
THE CPU TIMER = 1.0717E+01

OUTPUT MATRIX C12 (12 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	6.501D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	0.0	-5.712D+00	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	0.0	3.015D+01	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	0.0	-5.712D+00	0.0	0.0	0.0
7	1	0.0	0.0	0.0	0.0	0.0	0.0	3.015D+01	0.0	0.0	0.0

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.35
THE CPU TIMER = 1.0833E+01

OUTPUT MATRIX C13 (12 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
4	1	0.0	0.0	0.0	0.0	1.268D+03	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	0.0	-1.286D+03	0.0	0.0	0.0

END OF WRITE.

A-154

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.35
THE CPU TIMER = 1.0933E+01

OUTPUT MATRIX C23 (12 X 12)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
4	1	0.0	0.0	0.0	-5.712D+00	3.015D+01	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	5.712D+00	-3.015D+01	0.0	0.0	0.0

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.36
THE CPU TIMER = 1.1063E+01

OUTPUT MATRIX XEO (1 X 12)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

END OF WRITE.

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL

CURRENT TIME = 20.50.36
THE CPU TIMER = 1.1097E+01

OUTPUT MATRIX XEOC (1 X 12)

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

END OF WRITE.

FOR BODY 2 THE P-G HINGE NO., THE EULER ROTATION TYPE AND THE JOINT NO. CORRESPONDING TO THE P-Q HINGE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)	(3)
1	1	2	1	1

		(1)	(2)	(3)
1	1	0.0	0.0	0.0

FOR BODY 2 THE SENSOR POINT NO., THE EULER ROTATION TYPE AND THE JOINT NO. CORRESPONDING TO THE SENSOR POINT APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)	(3)
1	1	1	1	1
2	1	2	1	1
3	1	3	1	1

		(1)	(2)	(3)
1	1	0.0	0.0	0.0
2	1	0.0	0.0	0.0
3	1	0.0	0.0	0.0

THE FOLLOWING INTEGER ARRAY (INDEP) PRESCRIBES INDEPENDENT VARIABLES (1), AND DEPENDENT VARIABLES (0)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	41	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE CURRENT TIME = 20.50.41
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL THE CPU TIMER = 1.3243E+01

AT SIMULATION TIME, T = 0.0 *
THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	1.278D+02	1.278D+02	1.278D+02	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	1.463D-03	1.962D-03	1.094D-03	-3.020D-02	-1.445D-02
1	51	2.435D+01	0.0	0.0	0.0	0.0	0.0	0.0			

AT SIMULATION TIME, T = 0.0 *
THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	51	0.0	3.413D-02	4.997D+00	1.395D-02	5.014D+00	1.863D-02	5.008D+00			

AT SIMULATION TIME, T = 0.0 *
THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)
1	1	0.0	1.463D-03
2	1	0.0	1.962D-03
3	1	0.0	1.094D-03
4	1	0.0	-3.020D-02
5	1	0.0	-1.445D-02
6	1	0.0	2.435D+01

AT SIMULATION TIME, T = 0.0 *
THE BETA TIME DERIVATIVES ARE

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

AT SIMULATION TIME, T = 0.0 *
THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0 *
THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3.413D-02	4.997D+00	1.395D-02	5.014D+00	1.863D-02	5.008D+00

```
          AT SIMULATION TIME, T = 0.0         * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  1   THE VELOCITIES ARE
                ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1      0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  1   THE CORRESPONDING MOMENTA ARE
                ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1      0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
                ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1      0.0         0.0         0.0         0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     0.0             0.0

          AT SIMULATION TIME, T = 0.0         * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
                ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1    1      0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
  1   11      0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         1.278D+02   1.278D+02
  1   21      1.278D+02
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
                ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1    1      8.306D+00   8.306D+00   8.306D+00   0.0         0.0         0.0         0.0         0.0         0.0         0.0
  1   11      0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         8.306D+00   8.306D+00
  1   21      8.306D+00
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
                ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1      8.313D+00   8.303D+00   8.302D+00   0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     1.591953520+03 0.0
FOR BODY  2   THE ELASTIC DEFLECTIONS ARE
                ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1    1      0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
  1   11      0.0         0.0

          AT SIMULATION TIME, T = 0.0         * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
                ( 1)        ( 2)        ( 3)
  1    1      8.313D+00   8.303D+00   8.302D+00
THE TOTAL LINEAR MOMENTUM VECTOR IS
                ( 1)        ( 2)        ( 3)
  1    1      0.0         0.0         0.0

THE TOTAL ANGULAR MOMENTUM =  1.436589440+01
THE TOTAL LINEAR MOMENTUM  =  0.0
THE TOTAL KINETIC ENERGY   =  1.591953520+03
THE TOTAL POTENTIAL ENERGY =  0.0
THE TOTAL ENERGY (T + V)   =  1.591953520+03
```

ATS-F SINGLE FLEXIBLE BODY USING GEOMETRY MODES, 3 IMBEDDED MOMENTUM WHE CURRENT TIME = 21.10.08
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE, USE MSMODL THE CPU TIMER = 2.6124E+02

AT SIMULATION TIME, T = 2.0000D+00* *
THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	-3.411D-06	-5.126D-06	-8.226D-06	-1.097D-05
1	11	6.556D-06	-2.758D-08	1.085D-07	-2.128D-07	-9.744D-07	-3.426D-07	1.096D-06	3.360D-07	2.288D-06	7.469D-08
1	21	6.304D-08	-7.469D-08	6.304D-08	2.850D-08	1.283D+02	1.283D+02	1.283D+02	-2.873D-09	3.655D-09	-5.553D-08
1	31	-1.056D-07	8.251D-08	1.054D-07	-1.162D-07	-3.067D-09	4.843D-09	3.067D-09	4.843D-09	7.686D-09	0.0
1	41	0.0	0.0	0.0	0.0	0.0	1.459D-03	1.957D-03	1.088D-03	-3.021D-02	-1.444D-02
1	51	2.435D+01	5.835D-02	8.778D-01	2.491D-02	8.948D-01	3.330D-02	8.981D-01			

AT SIMULATION TIME, T = 2.0000D+00* *
THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	5.017D-06	2.754D-06	-3.515D-06	-4.420D-06
1	11	-1.053D-05	3.534D-08	8.176D-06	-7.655D-06	-2.559D-06	1.463D-05	-3.063D-06	-1.459D-05	1.281D-05	-6.712D-07
1	21	-2.057D-06	6.712D-07	-2.057D-06	-2.537D-06	-5.015D-06	-2.750D-06	3.521D-06	1.085D-07	-2.128D-07	-9.744D-07
1	31	-3.426D-07	1.096D-06	3.360D-07	2.288D-06	7.469D-08	6.304D-08	-7.469D-08	6.304D-08	2.850D-08	0.0
1	41	0.0	0.0	0.0	0.0	0.0	-3.406D-06	-5.131D-06	-8.219D-06	-1.098D-05	6.544D-06
1	51	3.448D-09	2.470D-02	2.032D+00	1.104D-02	2.278D+00	1.480D-02	2.285D+00			

AT SIMULATION TIME, T = 2.0000D+00* *
THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)
1	1	0.0	1.459D-03
2	1	0.0	1.957D-03
3	1	0.0	1.086D-03
4	1	0.0	-3.021D-02
5	1	0.0	-1.444D-02
6	1	0.0	2.435D+01

AT SIMULATION TIME, T = 2.0000D+00* *
THE BETA TIME DERIVATIVES ARE

		(1)	(2)
1	1	0.0	-3.406D-06
2	1	0.0	-5.131D-06
3	1	0.0	-8.219D-06
4	1	0.0	-1.098D-05
5	1	0.0	6.544D-06
6	1	0.0	3.448D-09

AT SIMULATION TIME, T = 2.0000D+00* *
THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	5.835D-02	8.778D-01	2.491D-02	8.948D-01	3.330D-02	8.981D-01

AT SIMULATION TIME, T = 2.0000D+00* *
THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	2.470D-02	2.032D+00	1.104D-02	2.278D+00	1.480D-02	2.285D+00

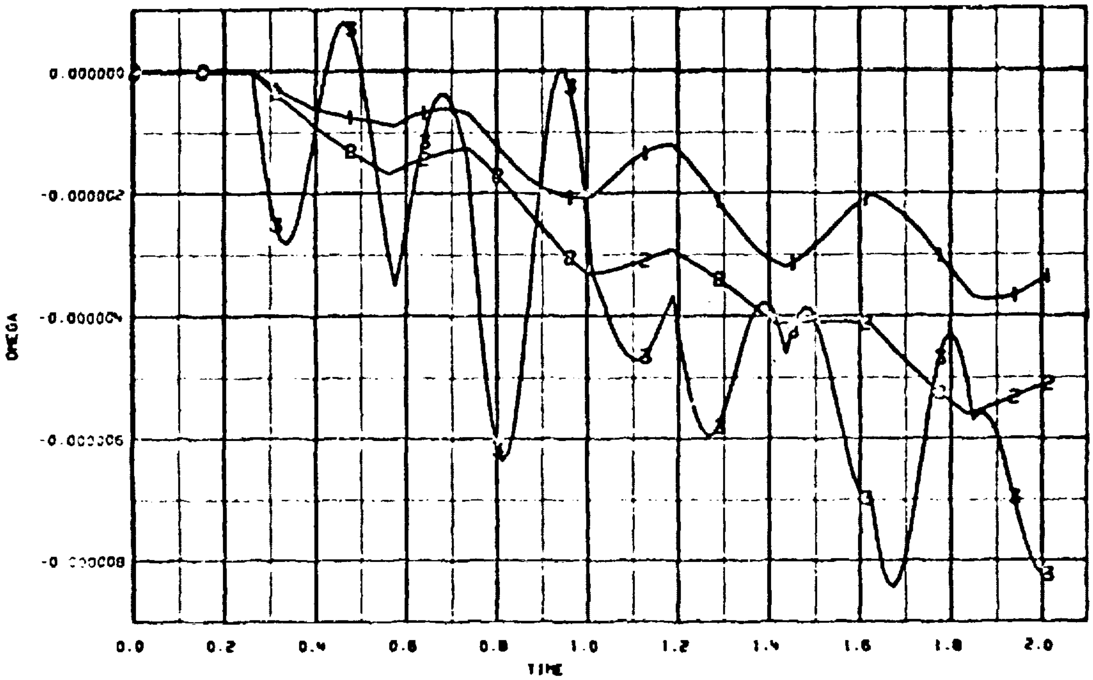
```
        AT SIMULATION TIME, T = 2.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  1   THE VELOCITIES ARE
                ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1     1     0.0          0.0          0.0          0.0          0.0          0.0
FOR BODY  1   THE CORRESPONDING MOMENTA ARE
                ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1     1     0.0          0.0          0.0          0.0          0.0          0.0
FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
                ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1     1     0.0          0.0          0.0          0.0          0.0          0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     0.0            0.0


        AT SIMULATION TIME, T = 2.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
                ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)         (10)
  1     1    -3.411D-06 -5.128D-06 -8.226D-06 -1.097D-05  6.556D-06 -2.758D-08  1.085D-07 -2.128D-07 -9.744D-07 -3.426D-07
  1    11     1.096D-06  3.360D-07  2.288D-06  7.469D-08  6.304D-08 -7.469D-08  6.304D-08  2.850D-08  1.283D+02  1.283D+02
  1    21     1.283D+02
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
                ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)         (10)
  1     1     8.306D+00  8.306D+00  8.306D+00  4.395D-17 -5.732D-16 -2.666D-17  1.992D-04 -3.130D-04  1.400D-03  5.581D-03
  1    11    -1.716D-02 -5.603D-03 -6.146D-03 -4.086D-06 -6.511D-06  4.086D-06 -6.511D-06 -6.985D-04  8.339D+00  8.337D+00
  1    21     8.339D+00
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
                ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1     1     8.313D+00  8.303D+00  8.302D+00  4.452D-17 -5.731D-16 -2.758D-17
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     1.60445651D+03 2.12579197D-09
FOR BODY  2   THE ELASTIC DEFLECTIONS ARE
                ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)         (10)
  1     1    -2.873D-09  3.655D-09 -5.553D-08 -1.058D-07  8.251D-08  1.054D-07 -1.162D-07 -3.067D-09  4.843D-09  3.067D-09
  1    11     4.843D-09  7.686D-09

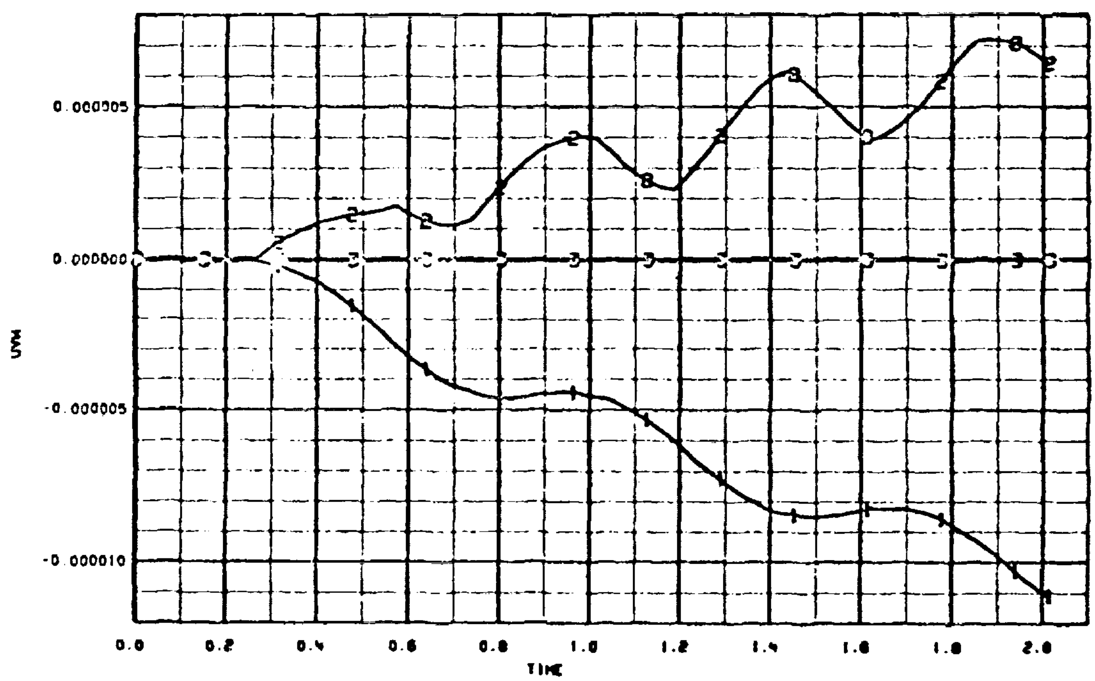

        AT SIMULATION TIME, T = 2.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
                ( 1)         ( 2)         ( 3)
  1     1     8.313D+00  8.303D+00  8.302D+00
THE TOTAL LINEAR MOMENTUM VECTOR IS
                ( 1)         ( 2)         ( 3)
  1     1     4.452D-17 -5.731D-16 -2.758D-17

THE TOTAL ANGULAR MOMENTUM =  1.43858944D+01
THE TOTAL LINEAR MOMENTUM  =  5.75465350D-16
THE TOTAL KINETIC ENERGY   =  1.60445651D+03
THE TOTAL POTENTIAL ENERGY =  2.12579197D-09
THE TOTAL ENERGY (T + V)   =  1.60445651D+03

                                         CPU TIME/STEP   CPU TIME/REAL TIME
                                            1.5370E+00          1.2296E+02
```



ATS-F ANGULAR VELOCITY VECTOR

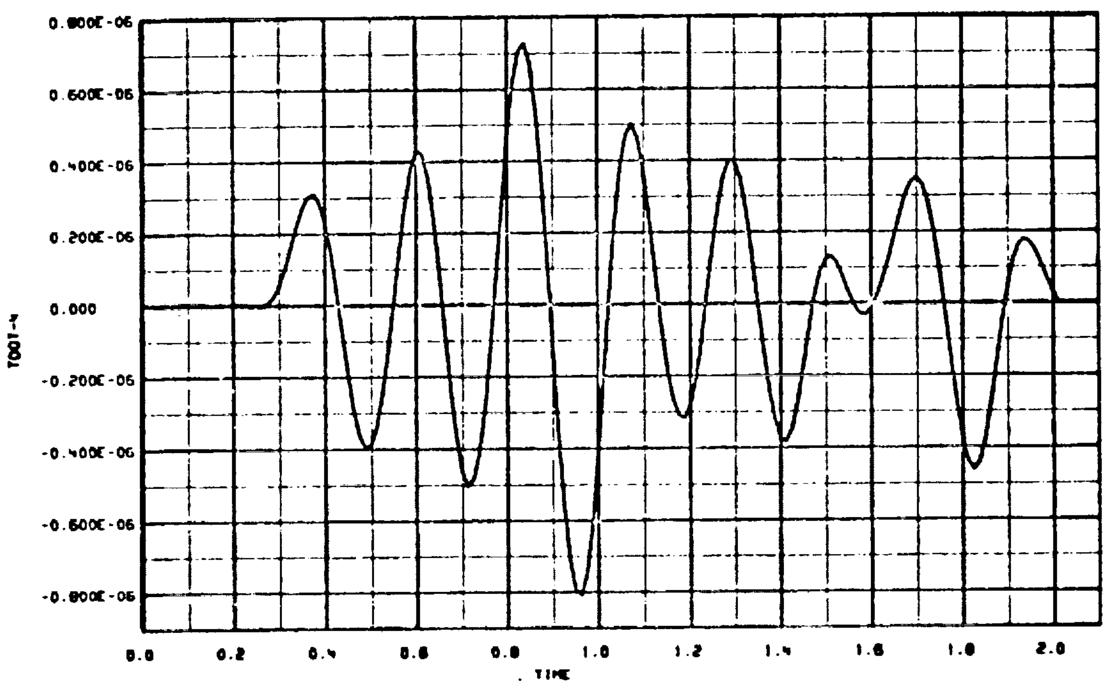


ATS-F TRANSLATIONAL VELOCITY VECTOR

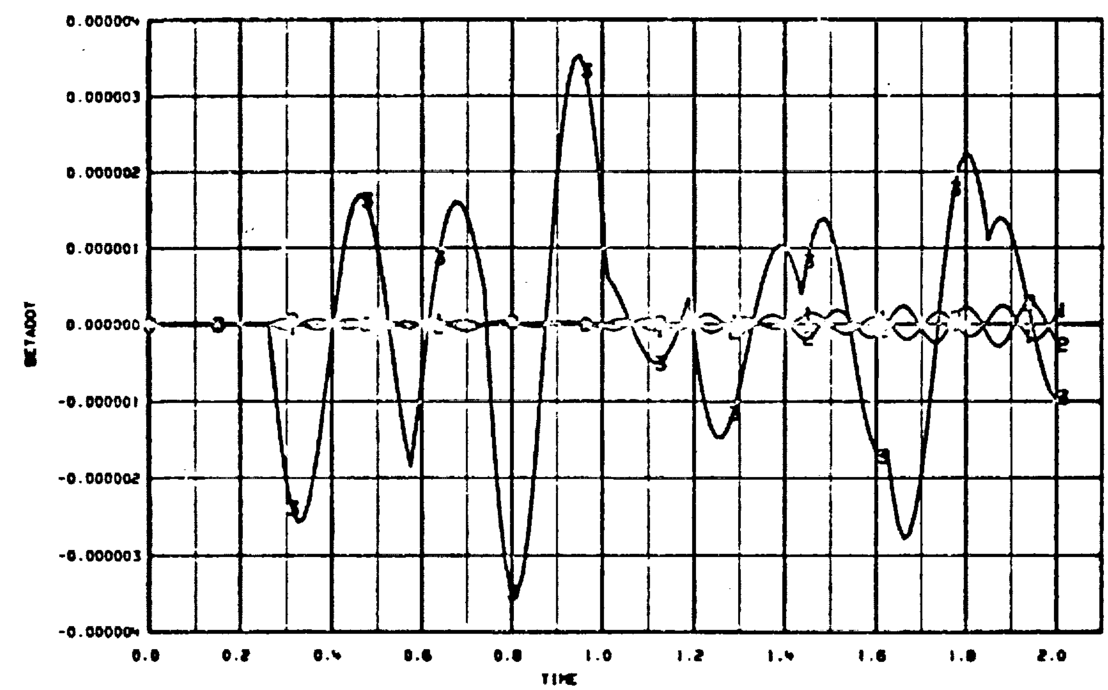
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 4, ATS-F CONTROLLED SPACECRAFT

DEMO 4 02/26/75 CARL BOOLEY

Figure A-4 Graphical Results, Demonstration Problem 4 (Sheet 1 of 5)



MOMENTUM WHEEL 4, ANGULAR RATE

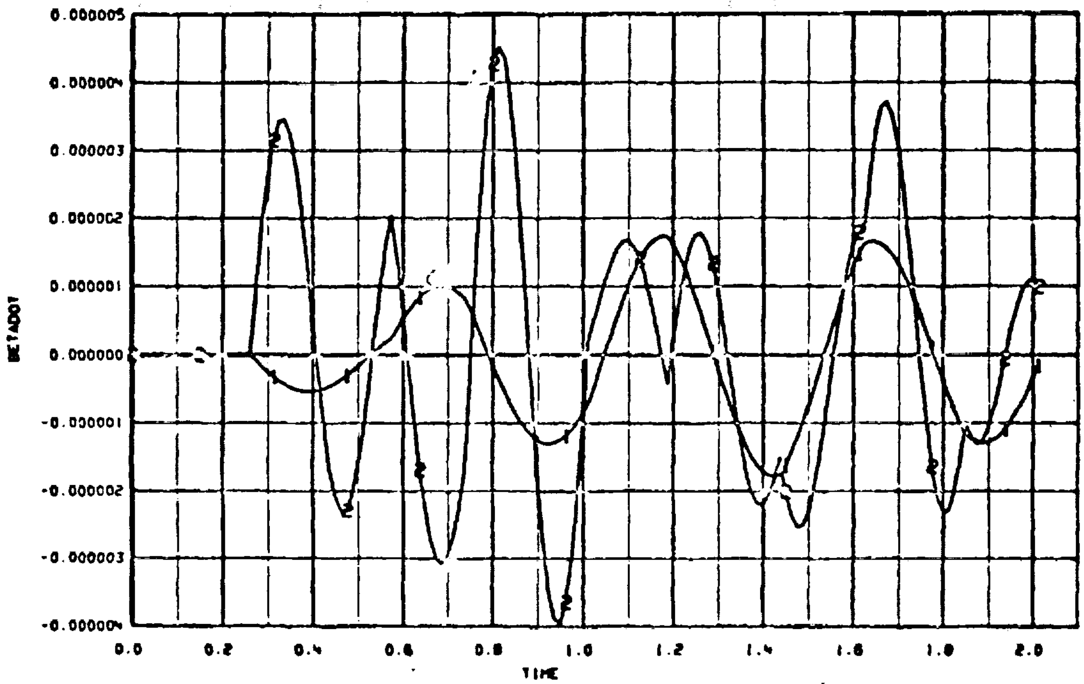


REFLECTOR HINGE ANGLE RATES

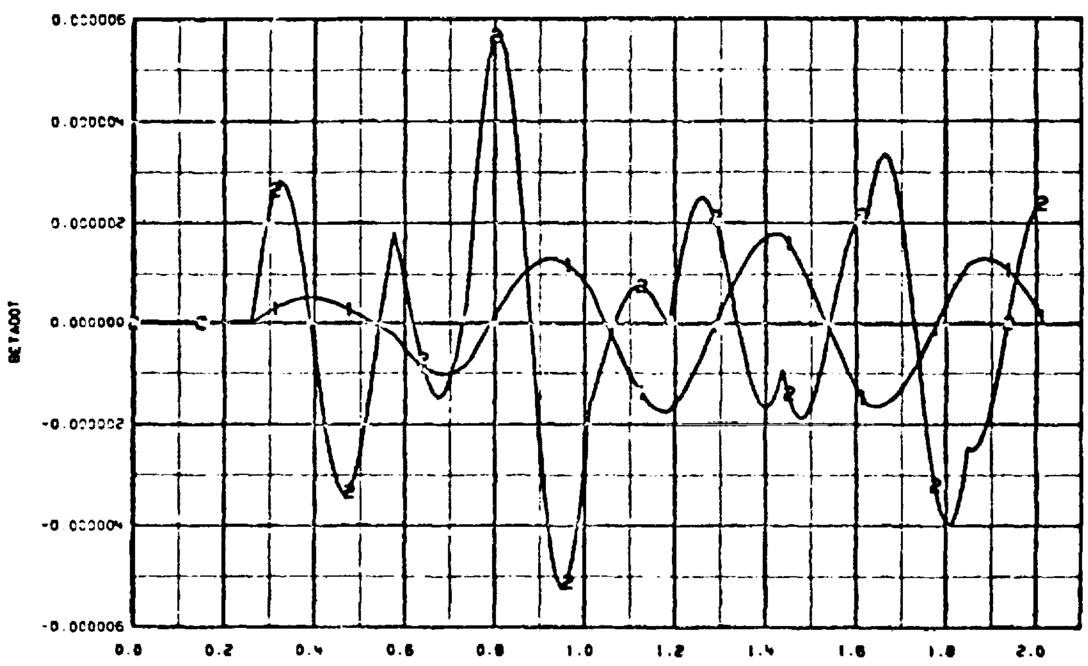
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 4, ATS-F CONTROLLED SPACECRAFT

DEMO 4 02/26/75 CARL BOOLEY

Figure A-4 Graphical Results, Demonstration Problem 4 (Sheet 2 of 5)



+Y MOST PANEL, HINGE ANGLE RATES

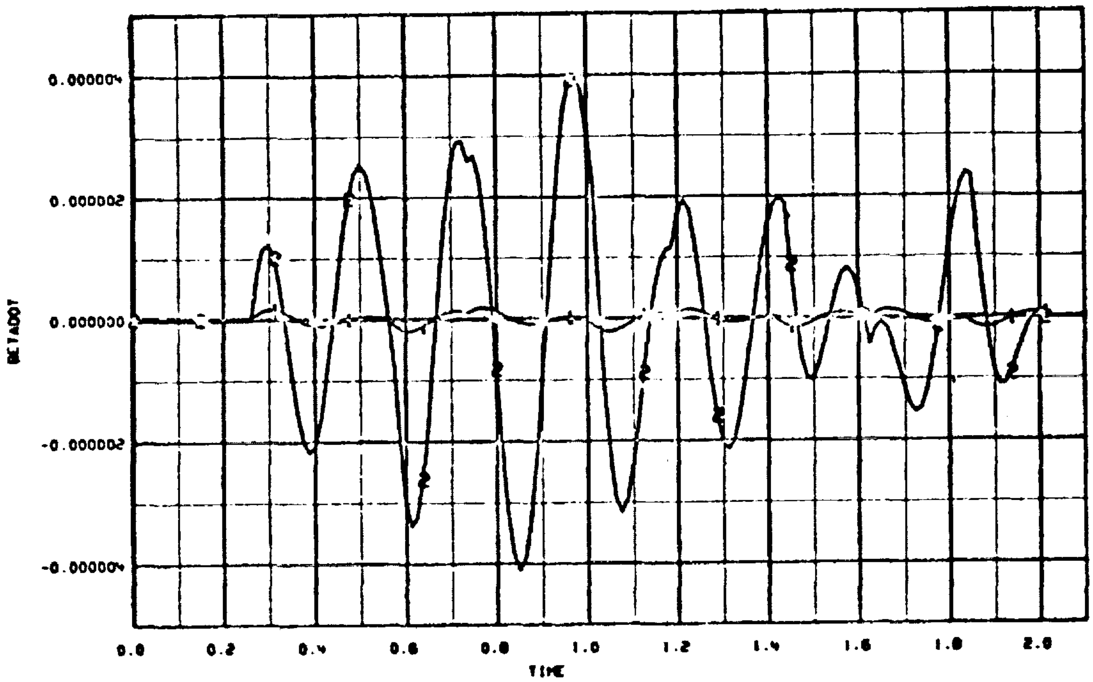


-Y MOST PANEL, HINGE ANGLE RATES

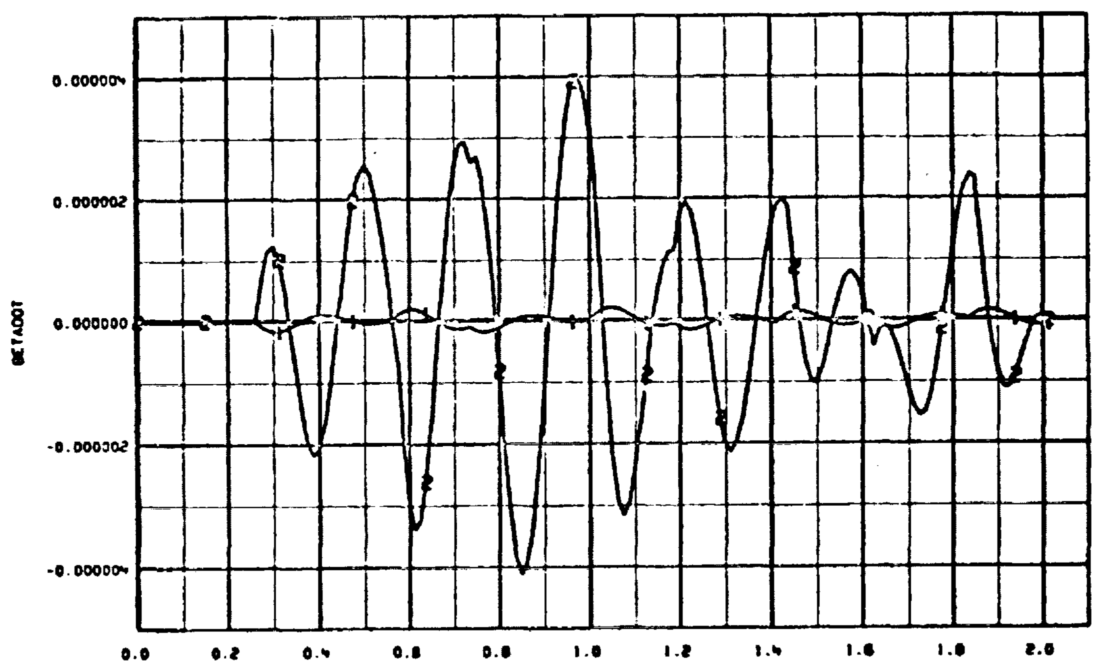
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 4, ATS-F CONTROLLED SPACECRAFT

DEMO 4 02/26/75 CARL BODLEY

Figure A-4 Graphical Results, Demonstration Problem 4 (Sheet 3 of 5)



+X MOST SLOSH, HINGE ANGLE RATES

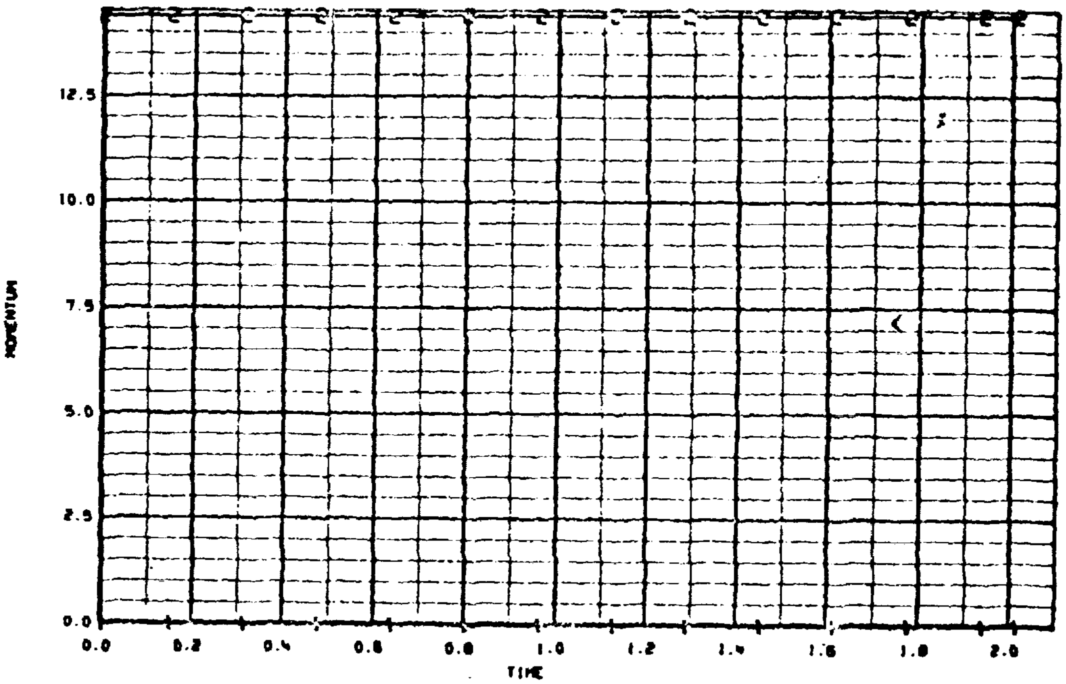


-X MOST SLOSH, HINGE ANGLE RATES

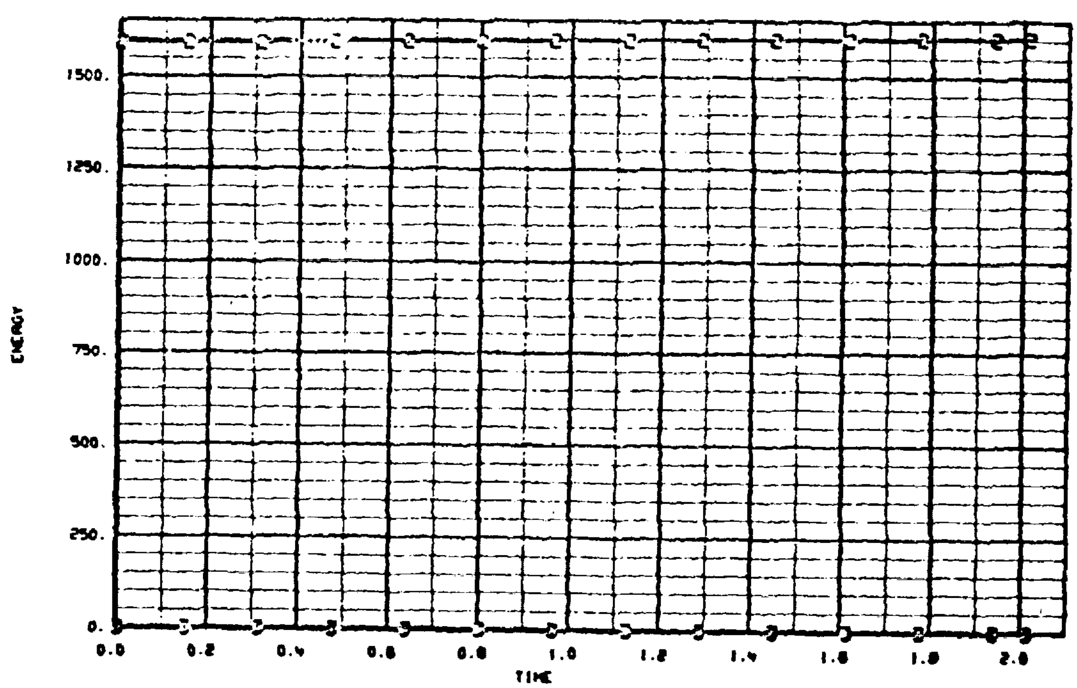
NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 4, ATS-F CONTROLLED SPACECRAFT

DEMO 4 02/26/75 CARL BODLEY

Figure A-4 Graphical Results, Demonstration Problem 4 (Sheet 4 of 5)



TOTAL ANGULAR AND LINEAR MOMENTUM



KINETIC, POTENTIAL AND TOTAL ENERGY (T + V)

NAS5-11996 -- GSFC DEMONSTRATION RUN NO. 4, ATS-F CONTROLLED SPACECRAFT

DEMO 4 02/26/75 CARL BOOLEY

Figure A-4 Graphical Results, Demonstration Problem 4 (Sheet 5 of 5)

Demonstration Problem 5

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```
      SUBROUTINE CONTRL
      IMPLICIT REAL*8 (A-H,O-Z)
C
            COMMON /BHBSHO/
     *      BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)
            COMMON /CONPAR/
     *      CNTDTA(100)
      COMMON /LDSIZE/ NX,NY,NDLTA,NXSS,NBTQ,NJQ,NY2,NDZ
            COMMON /SPECIF/
     *      BETAM(6, 6),BETAMD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
     *      NB,NM,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IMDATA(7, 6),
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
            COMMON /TIMESS/
     *      STARTT,DELTAT,T,ENDT,TMST
            COMMON /VECTOR/
     *      Y(250),YDT(250)
CCCCCCC  THIS COMMON IS TRANSFER BETWEEN CONTRL AND SHAFTT ONLY ----
           COMMON /WHEEL /
     *     CLM(4)
C
      DIMENSION  TQ(6),TQD(6),RMD(3),THADW(3)
      DATA ICT4/0/, RMD / 0.D0, 0.D0, 0.D0 /
      DATA T1,T2,T3,T4,DTHE/
     *     .2D0, 1.2D0, .7D0, 1.7D0, 1.04719755D0 /
      ALIM(U,V) = DMAX1(-V,DMIN1(U,V))
C
CCCCCCCCCC
CCCCCCCCCC
CCC  THE FOLLOWING STATEMENTS MUST ALWAYS BE IN CONTRL..
      NDLTA = NDELTA
      NXSS = 3
      NBTQ = 3
      IF (NDELTA .EQ. 0) RETURN
CCCCCCCCCCC    CCC
CCCC----NOTE--THIS SUBROUTINE MUST ESTABLISH  NDLTA,NXSS AND NBTQ
CCCCCCCCCCC
C
CCCC  ESTABLISH THE D/DT(DELTAS)
C
      LDEL = LOCU(2*NB+2) - 1
      ICT4 = ICT4 + 1
      IA = (ICT4-1)/4
      IAA = (ICT4-2)/4
      IFLAG = IA - IAA
      DO 6 I=1,3
    6 THADW(I) = Y(6+I)
      DO 5 I=1,6
    5 TQ(I) = Y(LDEL+I)
C
```

```
C          WHEEL 1 (ROLL INERTIA WHEEL CONTROL TORQUE)
C          DEFINE DIFFERENTIAL EQUATIONS FOR ROLL CONTROL LOOP
C
      U1 = 57.2958D0*ROL(3,2,1)/ROL(3,3,1)
      U5 = ALIM(TQ(5),29.D0)
      U2 = 2.17D0*U1 - U5
      U3 = ALIM(1.1D0*U2,1.17D0)
      TQD(5) = (1.D0/88.D0)*(-TQ(5) + (971.1D0)*U3)
      U6 = ALIM(5*U3,1.68D0)
      U8 = ALIM(TQ(6),1.9D0)
      IF (IFLAG .EQ. 0) GO TO 32
      UU = DABS(U8)
      IF (UU.GT.1.D0) GO TO 30
      IF (UU.LT.0.5D0) GO TO 31
      U9 = RHD(1)
      GO TO 10
   30 U9 = U8/UU
      GO TO 10
   31 U9 = 0.D0
      GO TO 10
   32 U9 = RHD(1)
      GO TO 33
   10 RHD(1) = U9
   33 CONTINUE
      TQD(6) = (-TQ(6) + 2.5D0*(U6-U9))/.5D0
C
C  1500 RPM = 157.0795 RAD/SEC
C   6 INCH*OZ = .03125 FT*LBS
C
      IF (DABS(THADW(1)).GT. 157.0795D0) U9 = 0.D0
      CLM(1) = .03125D0*U9 - 5.D-05*THADW(1)
C
C          WHEEL 2 (PITCH INERTIA WHEEL CONTROL TORQUE)
C          DEFINE DIFFERENTIAL EQUATIONS IN PITCH CONTROL LOOP
C
      U1 = -57.2958D0*ROL(3,1,1)/ROL(3,3,1)
      U5 = ALIM(TQ(1),16.4D0)
      U2 = 2.17D0*U1 - U5
      U3 = ALIM(.82D0*U2,1.17D0)
      TQD(1) = (-TQ(1) + U3*(7/.82D0))/50.D0
      U6 = ALIM(5*U3,1.68D0)
      U8 = ALIM(TQ(2),1.9D0)
      IF (IFLAG.EQ.0) GO TO 14
      UU = DABS(U8)
      IF (UU.GT. 1.D0) GO TO 15
      IF (UU.LT.0.5D0) GO TO 16
      U9 = RHD(2)
      GO TO 12
   15 U9 = U8/UU
      GO TO 12
```

```
   16 U9 = 0.D0
      GO TO 12
   14 U9 = RHD(2)
      GO TO 13
   12 RHD(2) = U9
   13 CONTINUE
      TWD(2) = (-TW(2) + 2.5D0*(U6 - U9))/.5D0
      IF (DABS(THADW(2)).GE. 157.0795D0) U9 = 0
      CLM(2) = .03125D0*U9 - 5.D-05*THADW(2)
C
C          WHEEL 3 (YAW INERTIA WHEEL CONTROL TORQUE)
C          DEFINE DIFFERENTIAL EQUATIONS FOR YAW CONTROL LOOP
C
      U1 = 57.2958D0*ROL(2,1,1)/ROL(2,2,1)
      U2 = ALIM(U1,2.D0)
      U6 = ALIM(TQ(3),24.D0)
      U3 = 2.17D0*U2 - U6
      U4 = ALIM(1.47D0*U3,1.17D0)
      TWD(3) = (1.D0/88.D0)*(-TW(3) + (9/1.47D0)*U4)
      U7 = ALIM(5*U4,1.68D0)
      U9 = ALIM(TQ(4),1.9D0)
      IF (IFLAG.EQ.0) GO TO 20
      UU = DABS(U9)
      IF (UU.GT.1.D0) GO TO 21
      IF (UU.LT. 0.5D0) GO TO 22
      U10 = RHD(3)
      GO TO 18
   21 U10 = U9/UU
      GO TO 18
   22 U10 = 0.D0
      GO TO 18
   20 U10 = RHD(3)
      GO TO 24
   18 RHD(3) = U10
   24 CONTINUE
      TWD(4) = (-TW(4) + 2.5D0*(U7 - U10))/.5D0
      IF (DABS(THADW(3)) .GT. 157.0795D0) U10 = 0.D0
      CLM(3) = .03125D0*U10 - 5.D-05*THADW(3)
C
      DO 34 I=1,6
   34 YDT(LDEL+I) = TWD(I)
      YDT(LDEL+7) = Y(16)
      SK4 = CNTDTA(NDELTA+1)
      DK4 = CNTDTA(NDELTA+2)
      CLM(4) =-(SK4*Y(LDEL+7) + DK4*YDT(LDEL+7))
C
      YDT(LDEL+8) = 0.D0
      YDT(LDEL+9) = 0.D0
      IF (T.LT.T1 .OR. T.GT.T2) GO TO 50
      FCT = 3.1415926D0/(T2-T1)
```

```
      ADOT = (DTHE/2.D0)*FCT**2*DCOS(FCT*(T-T1))                0 9430
      YOT(LDEL+8) = ADOT                                        0 9431
   50 IF (T.LT.T3 .OR. T.GT.T4) RETURN                          0 9432
      FCT = 3.1415926D0/(T4-T3)                                 0 9433
      ADOT = (DTHE/2.D0)*FCT**2*DCOS(FCT*(T-T3))                0 9434
      YOT(LDEL+9) = ADOT                                        0 9435
      RETURN                                                    0 9777
      END                                                       0 9778
```

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```
DEMO 5     CARL BODLEY
ATS-F -- 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE MOTION,
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE
NAS5-11996 GSFC DEMONSTRATION PROBLEM NUMBER 5.


THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS-F SPACECRAFT AS A SYSTEM
OF SIX INTERCONNECTED BODIES. THERE ARE FOUR ACTIVE MOMENTUM WHEELS
(ONE REPRESENTS REFLECTOR DYNAMICS FOR HIGHER ORDER STRUCTURAL RESPONSE)
WHILE THE OTHER THREE ARE USED FOR CONTROL TORQUES.


FOR TIME BETWEEN 0.2 AND 1.2 SECONDS, PANEL NO. 1 (BODY 3) IS MOVED
THROUGH 60-DEG.

FOR TIME BETWEEN 0.7 AND 1.7 SECONDS, PANEL NO. 2 (BODY 4) IS MOVED
THROUGH 60-DEG.

FOR THE RHEONOMIC HINGE MOTION, TWO CONTROL VARIABLES ARE EMPLOYED.
THEY ARE RELATIVE VELOCITIES (ALPHA*DOTS) THAT ARE OBTAINED BY INTEGRATING
PRESCRIBED ACCELERATIONS, (ALPHA*DOUBLE*DOTS), SEE CONTROL SUBROUTINE.

THE PROBLEM STARTS WITH A SLIGHT INITIAL ATTITUDE ERROR AND SIMULATES
NON-LINEAR TIME DOMAIN RESPONSE.
0000000000
    6    6    4    4    9
ITOPOL   2    6
    1    1    1    2    3    4    5    6
    2    1    0    1    1    1    1    1
0000000000
IRGFLX   1    6
0000000000
IFTSMW   1    4
    1    1    1    1    1    2
0000000000
IHDATA   7    6
    1    1    1    1    1    1    1    1
    2    1    0    0    2    2    1    1
    3    1    0    0    1    1    0    0
    4    1    0    0    0    0    0    0
    5    1    0    1    1    1    1    1
    6    1    0    1    1    1    1    1
    7    1    0    1    1    1    1    1
0000000000
BETAH    6    6
    1    1  .0014626
    2    1  .0019621
    3    1  .0010945
    4    1  -.030197
    5    1  -.014451
```

```
    6     1   24.353
0000000000
BETAMO    6     6
0000000000
IMO       3     4
    1     1     1     2     3     4
    2     1     1     2     3     3
    3     1     1     1     1     1
0000000000
AMO       2     4
    1     1   127.78            127.78            127.78            0.
    2     1     .065             .065              .065              96.705
0000000000
TMDATA    1     3
    1     1   0.                0.0125            3.
0000000000
IPDATA    1     3
    1     1   20    1     0
0000000000
CNTDTA    1     47
    1    10   42888.              288.01
    1    12     0.              0.                0.
    1    15    209680.          207550.           6746.7
    1    18        0.          0.                78836.
    1    21        0.           0.                78836.
    1    24     0.              787.18            787.18
    1    27     0.              787.18            787.18
    1    30     0.              0.                0.
    1    33    94.105           94.376            57.116
    1    36     0.              0.                212.67
    1    39     0.              0.                212.67
    1    42     0.              10.023            10.023
    1    45     0.              10.023            10.023
0000000000
GRAVIT    1     4
0000000000
MASS 1    1     4
    1     1    88.273
0000000000
INERA1    1     6
    1     1    3713.7           3557.3            477.63
    1     4   -5.0961            32.729           2.9104
0000000000
    2     1
   0.       3.14159265     0.
 .030197    .014451    -12.660
    3     1
   0.         0.        3.14159265
 .030197    3.4312     -13.497
    4     1
```

```
   0.           0.          0.
 .030197    -3.4022    -13.497
   5     1
  0.          0.          0.
1.2969     .014451     4.3140
   6     1
 0.           0.       3.14159265
-1.2365    .014451    4.3140
   1     1
  0.          0.          0.
  0.          0.          0.
   2     1
  0.          0.          0.
  0.          0.          0.
   3     1
  0.          0.          0.
  0.          0.          0.
MASS 2    1      4
   1     1     3.5559              0.              0.                0.
0000000000
INERA2    1      6
   1     1    100.48             100.79          193.41
0000000000
   2     1
   0.     3.14159265   0.
  0.          0.       -1.3521
   4     1
  0.          0.          0.
  0.          0.          0.
MASS 3    1      4
   1     1    5.1553
0000000000
INERA3    1      6
   1     1    166.96             40.091          145.07
   1     4    -4.7689             .14296         -1.9592
0000000000
   3     1
  0.          0.       3.14159265
 .36998     -15.809    -.070084
MASS 4    1      4
   1     1     5.1553
0000000000
INERA4    1      6
   1     1   168.96              40.091          145.07
   1     4    -4.7689          -.14296            1.9592
0000000000
   4     1
  0.          0.          0.
 -.36998    15.809     -.070084
MASS 5    1      4
```

```
    1    1     1.708
0000000000
INERA5   1     6
    1    1    .79758              .79758            .79758
0000000000
    5    1
   0.         0.         0.
   0.         0.        -.001
MASS 6   1     4
    1    1     1.7081
0000000000
INERA6   1     6
    1    1    .79758              .79758            .79758
0000000000
    6    1
   0.         0.      3.14159265
   0.         0.        -.001
NAS5-11996 GSFC DEMO. NO. 5, PRESCRIBED (RHEONOMIC) RELATIVE HINGE MOTION
   11
   10    1
    1    2    3    4    5    6    7    8    9   10
    1    2    3    4
TIME       OMEGA1     BODY-1  ANGULAR VELOCITY VECTOR
    1    5    6    7
TIME       U-V-W      BODY-1 BODY REFERENCED VELOCITY VECTOR
    1    8    9   10
TIME       THEDOT     MOMENTUM WHEEL  1,2, AND 3 ANGULAR RATES
0000000000
    8    1
    1   11   12   13   14   15   16   17
    1    2    3    4
TIME       OMEGA2     BODY-2 ANGULAR VELOCITY VECTOR
    1    5    6    7
TIME       U-V-W      BODY-2 LINEAR VELOCITY VECTOR
0000000000
   13    1
    1   18   19   20   21   22   23   24   25   26   27   28   29
    1    2    3    4
TIME       OMEGA3     BODY-3 ANGULAR VELOCITY VECTOR
    1    5    6    7
TIME       U-V-W      BODY-3 LINEAR VELOCITY VECTOR
    1    8    9   10
TIME       OMEGA4     BODY-4 ANGULAR VELOCITY VECTOR
    1   11   12   13
TIME       U-V-W      BODY-4 LINEAR VELOCITY VECTOR
0000000000
   13    1
    1   30   31   32   33   34   35   36   37   38   39   40   41
    1    2    3    4
TIME       OMEGA5     BODY-5 ANGULAR VELOCITY VECTOR
```

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```
   1     5     6     7
TIME      U-V-W      BODY-5 LINEAR VELOCITY VECTOR
   1     8     9    10
TIME      OMEGA6     BODY-6 ANGULAR VELOCITY VECTOR
   1    11    12    13
TIME      U-V-W      BODY-6 LINEAR VELOCITY VECTOR
0000000000
  13     1
   1    42    43    44    45    46    47    48    49    50    51    52    53
   1     2     3     4
TIME      BETA       HINGE-1 EULER ANGLES
   1     5     6     7
TIME      XYZ-1      HINGE-1 INERTIAL XYZ POSITION
   1     8     9    10
TIME      BETA       HINGE-2 EULER ANGLES
   1    11    13
TIME      ALPHDT     RHEONOMICALLY CONSTRAINED HINGE ANGLES
0000000000
  15     1
   1    54    55    56    57    58    59    60    61    62    63    64    65    66    67
   1     7     8
TIME      DELTA      ROLL CHANNEL CONTROL VARIABLES
   1     9    10
TIME      DELTA      PITCH CHANNEL CONTROL VARIABLES
   1    11    12
TIME      DELTA      YAW CHANNEL CONTROL VARIABLES
0000000000
   5     1
   1    74    75    76    83
   1     2     3     4
TIME      THEDD      MOMENTUM WHEEL 1,2, AND 3-- ANGULAR ACCELERATIONS
0000000000
  13     1
   1   108   109   110   111   112   113   114   115   116   117   118   119
   1     2     3     4
TIME      BETADOT    HINGE-1 EULER ANGLE RATES
   1     5     6     7
TIME      XYZ-DT     HINGE-1 INERTIAL REFERENCED VELOCITY VECTOR
   1     8     9    10
TIME      BETADOT    HINGE-2 EULER ANGLE RATES
0000000000
  15     1
   1   120   121   122   123   124   125   126   127   128   129   130   131   132   133
   1     7     8
TIME      DELTADT    ROLL-CHANNEL
   1     9    10
TIME      DELTADT    PITCH-CHANNEL
   1    11    12
TIME      DELTADT    YAW CHANNEL
0000000000
```

```
   15     1
    1  134  135  136  137  138  139  140  141  142  143  144  145  146  147
    1     2     3     4
TIME        LAMBDA     HINGE-2 INTERCONNECTION FORCES
    1     5    10
TIME        TORQUE     CONSTRAINT TORQUES TO CAUSE PANELS TO DEPLOY
0000000000
   13     1
    1  148  149  150  151  152  153  154  249  250  251  252  253
    1     9    10
TIME        MOMENTUM  TOTAL ANGULAR AND LINEAR MOMENTUM
    1    11    12    13
TIME        ENERGY     KINETIC, POTENTIAL AND TOTAL ENERGY -- T + V
0000000000
STOP
```

ATS-F — 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 20.39.44
THE CPU TIMER = 0.0

NAS5-11996 GSFC DEMONSTRATION PROBLEM NUMBER 5,

THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS-F SPACECRAFT AS A SYSTEM OF SIX INTERCONNECTED BODIES. THERE ARE FOUR ACTIVE MOMENTUM WHEELS (ONE REPRESENTS REFLECTOR DYNAMICS FOR HIGHER ORDER STRUCTURAL RESPONSE) WHILE THE OTHER THREE ARE USED FOR CONTROL TORQUES.

FOR TIME BETWEEN 0.2 AND 1.2 SECONDS, PANEL NO. 1 (BODY 3) IS MOVED THROUGH 60-DEG.

FOR TIME BETWEEN 0.7 AND 1.7 SECONDS, PANEL NO. 2 (BODY 4) IS MOVED THROUGH 60-DEG.

FOR THE RHEONOMIC HINGE MOTION, TWO CONTROL VARIABLES ARE EMPLOYED. THEY ARE RELATIVE VELOCITIES (ALPHA*DOTS) THAT ARE OBTAINED BY INTEGRATING PRESCRIBED ACCELERATIONS, (ALPHA*DOUBLE*DOTS), SEE CONTROL SUBROUTINE.

THE PROBLRM STARTS WITH A SLIGHT INITIAL ATTITUDE ERROR AND SIMULATES NON-LINEAR TIME DOMAIN RESPONSE.

ATS-F -- 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 20.39.46
THE CPU TIMER = 4.3667E-01

SUMMARY OF DYNAMIC-SIMULATION-PROGRAM INPUT DATA * * * * * * * * * * *

ACTUAL SIZES		MAXIMUM SIZES		INTEGRATION DATA		GRAVITY GRADIENT DATA				MISC. DATA	
NB =	6	NBMAX =	6	STARTT =	0.0	G1 =	0.0	GAMA1 =	0.0	NOPRNT =	20
NH =	6	NHMAX =	6	DELTAT =	1.2500-02	G2 =	0.0	GAMA2 =	0.0	NOPLOT =	1
NSPT =	4	NSPMAX =	15	ENDT =	3.000D+00	G3 =	0.0	GAMA3 =	0.0	IFLNER =	0
NOFMO =	4	NMWMAX =	5			GMAG =	0.0	RCMAG =	0.0		
NDELTA =	9	NMWBOD =	4								
NU =	40	NMDBOD =	12								
NBETA =	17	KMU =	22								
NLAM =	21	KY =	250								
NEQ =	66	KU =	113								

THE TOPOLOGY ARRAY (ITOPOL) FOR THIS CASE FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	2	3	4	5	6
2	1	0	1	1	1	1	1

THE CONSTRAINT SPECIFICATIONS FOR THIS CASE FOLLOW

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	1	1	1	1	1
2	1	0	0	2	2	1	1
3	1	0	0	1	1	0	0
4	1	0	0	0	0	0	0
5	1	0	1	1	1	1	1
6	1	0	1	1	1	1	1
7	1	0	1	1	1	1	1

THE SPECIFIED INITIAL HINGE ANGLES AND DISPLACEMENTS (BETAH) FOLLOW

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.463D-03	0.0	0.0	0.0	0.0	0.0
2	1	1.962D-03	0.0	0.0	0.0	0.0	0.0
3	1	1.094D-03	0.0	0.0	0.0	0.0	0.0
4	1	-3.020D-02	0.0	0.0	0.0	0.0	0.0
5	1	-1.445D-02	0.0	0.0	0.0	0.0	0.0
6	1	2.435D+01	0.0	0.0	0.0	0.0	0.0

THE SPECIFIED INITIAL HINGE RATES (BETAHD) FOLLOW

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0.0	0.0	0.0	0.0	0.0	0.0
3	1	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	0.0

A-180

ATS-F — 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 20.39.48
THE CPU TIMER = 5.9333E-01

THE NO. OF ELASTIC MODES/BODY ARRAY (IRGFLX) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0	0	0	0	0	0

THE NO. OF P/Q HINGE POINTS/BODY ARRAY (NHPOI) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	5	1	1	1	1	1

THE NO. OF SENSOR POINTS/BODY ARRAY (NSPOI) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3	1	0	0	0	0

THE MOM. WHEEL/BODY TABLE (NMOW) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3	1	0	0	0	0
2	1	3	1	0	0	0	0
3	1	1	4	0	0	0	0
4	1	2	0	0	0	0	0
5	1	3	0	0	0	0	0
6	1	0	0	0	0	0	0

THE STATE VECTOR LENGTH ARRAY (LENU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	1	9	7	6	6	6	6	0	0	0	0	0	0	17	9

THE STATE VECTOR LOCATION ARRAY (LOCU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	1	1	10	17	23	29	35	41	41	41	41	41	41	41	58

THE SPECIFIED SENSOR POINT/BODY CORRELATION ARRAY (IFTSMW) FOLLOWS

		(1)	(2)	(3)	(4)
1	1	1	1	1	2

ATS-F -- 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 20.39.48
THE CPU TIMER = 7.0000E-01

THE FOLLOWING DATA IS SPECIFIED MOM. WHEEL INFORMATION (IF ANY) AND CONTROLLER INFORMATION

THE SPECIFIED MOM. WHEEL CONTROL ARRAY (IMO) FOLLOWS

		(1)	(2)	(3)	(4)
1	1	1	2	3	4
2	1	1	2	3	3
3	1	1	1	1	1

THE SPECIFIED MOM. WHEEL RATES AND INERTIAS (AMO) FOLLOW

		(1)	(2)	(3)	(4)
1	1	1.278D+02	1.278D+02	1.278D+02	0.0
2	1	6.500D-02	6.500D-02	6.500D-02	9.670D+01

THE SPECIFIED CONTROLLER INITIAL CONDITIONS AND CHARACTERISTICS FOLLOW
(THE FIRST NDELTA ARE INITIAL CONTROLLER STATE VARIABLES, THERE ARE 38 ADDITIONAL CONTROL PARAMETERS)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.289D+04
1	11	2.880D+02	0.0	0.0	0.0	2.097D+05	2.076D+05	6.747D+03	0.0	0.0	7.884D+04
1	21	0.0	0.0	7.884D+04	0.0	7.872D+02	7.872D+02	0.0	7.872D+02	7.872D+02	0.0
1	31	0.0	0.0	9.411D+01	9.438D+01	5.712D+01	0.0	0.0	2.127D+02	0.0	0.0
1	41	2.127D+02	0.0	1.002D+01	1.002D+01	0.0	1.002D+01	1.002D+01			

A-182

ATS-F — 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 20.39.49
THE CPU TIMER = 9.8333E-01

SUMMARY OF INPUT DATA FOR BODY 1 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3.714D+03	5.096D+00	-3.273D+01	0.0	0.0	0.0
2	1	5.096D+00	3.557D+03	-2.910D+00	0.0	0.0	0.0
3	1	-3.273D+01	-2.910D+00	4.776D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	6.827D+01	0.0	0.0
5	1	0.0	0.0	0.0	0.0	6.827D+01	0.0
6	1	0.0	0.0	0.0	0.0	0.0	6.827D+01

FOR BODY 1 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1
2	1	3	1
3	1	4	1
4	1	5	1
5	1	6	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	3.142D+00	0.0	3.020D-02	1.445D-02	-1.266D+01
2	1	0.0	0.0	3.142D+00	3.020D-02	3.431D+00	-1.350D+01
3	1	0.0	0.0	0.0	3.020D-02	-3.402D+00	-1.350D+01
4	1	0.0	0.0	0.0	1.297D+00	1.445D-02	4.314D+00
5	1	0.0	0.0	3.142D+00	-1.236D+00	1.445D-02	4.314D+00

FOR BODY 1 THE SENSOR POINT NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES(1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	1	1
2	1	2	1
3	1	3	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0.0	0.0	0.0	0.0	0.0	0.0
3	1	0.0	0.0	0.0	0.0	0.0	0.0

ATS-F -- 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 20.39.49
THE CPU TIMER = 1.2433E+00

SUMMARY OF INPUT DATA FOR BODY 2 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.005D+02	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.008D+02	0.0	0.0	0.0	0.0
3	1	0.0	0.0	1.934D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	3.556D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	3.556D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	3.556D+00

FOR BODY 2 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	3.142D+00	0.0	0.0	0.0	-1.352D+00

FOR BODY 2 THE SENSOR POINT NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES(1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	4	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

A-184

ATS-F -- 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 20.39.50
THE CPU TIMER = 1.3900E+00

SUMMARY OF INPUT DATA FOR BODY 3 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.690D+02	4.769D+00	-1.430D-01	0.0	0.0	0.0
2	1	4.769D+00	4.009D+01	1.959D+00	0.0	0.0	0.0
3	1	-1.430D-01	1.959D+00	1.451D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	5.155D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	5.155D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	5.155D+00

FOR BODY 3 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	3	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	3.142D+00	3.700D-01	-1.581D+01	-7.008D-02

ATS-F — 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 20.39.50
THE CPU TIMER = 1.4967E+00

SUMMARY OF INPUT DATA FOR BODY 4 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.690D+02	4.769D+00	1.430D-01	0.0	0.0	0.0
2	1	4.769D+00	4.009D+01	-1.959D+00	0.0	0.0	0.0
3	1	1.430D-01	-1.959D+00	1.451D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	5.155D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	5.155D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	5.155D+00

FOR BODY 4 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	4	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	-3.700D-01	1.581D+01	-7.008D-02

A-186

ATS-F -- 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 20.39.50
THE CPU TIMER = 1.6067E+00

SUMMARY OF INPUT DATA FOR BODY 5 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	7.976D-01	0.0	0.0	0.0	0.0	0.0
2	1	0.0	7.976D-01	0.0	0.0	0.0	0.0
3	1	0.0	0.0	7.976D-01	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.708D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	1.708D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.708D+00

FOR BODY 5 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	5	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	-1.0000D-03

ATS-F — 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 20.39.50
THE CPU TIMER = 1.7100E+00

SUMMARY OF INPUT DATA FOR BODY 6 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	7.976D-01	0.0	0.0	0.0	0.0	0.0
2	1	0.0	7.976D-01	0.0	0.0	0.0	0.0
3	1	0.0	0.0	7.976D-01	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.708D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	1.708D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.708D+00

FOR BODY 6 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	6	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	3.142D+00	0.0	0.0	-1.000D-03

THE FOLLOWING INTEGER ARRAY (INDEP) PRESCRIBES INDEPENDENT VARIABLES (1), AND DEPENDENT VARIABLES (0)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
1	1	0	0	0	0	0	0	1	1	1	0	1	1	1	1	0	1	0	0	0	1
1	21	0	1	0	0	0	1	0	1	0	1	1	1	1	0	0	1	1	0	1	0
1	41	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	61	1	1	1	1	1	1														

ATS-F — 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 20.39.55
THE CPU TIMER = 4.1233E+00

AT SIMULATION TIME, T = 0.0

THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	1.278D+02	1.278D+02	1.278D+02	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	1.463D-03	1.962D-03	1.094D-03	-3.020D-02	-1.445D-02	2.435D+01	0.0	0.0	0.0	0.0
1	51	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	61	0.0	0.0	0.0	0.0	0.0	0.0				

AT SIMULATION TIME, T = 0.0

THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	6.588D-07	1.440D-06	1.294D-05	8.251D-07	-1.407D-06	6.853D-09	-9.829D-02	-9.829D-02	-9.831D-02	3.292D-07
1	11	7.881D-07	0.0	-1.652D-05	6.880D-06	-2.710D-08	0.0	6.588D-07	1.440D-06	-3.567D-06	-6.530D-06
1	21	9.150D-06	1.317D-05	6.588D-07	1.440D-06	-1.460D-06	2.461D-06	7.290D-06	-1.323D-05	6.588D-07	-1.467D-08
1	31	0.0	6.849D-06	1.254D-05	-1.851D-06	6.588D-07	-1.467D-08	0.0	6.849D-06	-2.026D-05	1.796D-06
1	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	51	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.413D-02	4.997D+00	1.395D-02
1	61	5.014D+00	1.863D-02	5.008D+00	0.0	0.0	0.0				

AT SIMULATION TIME, T = 0.0

THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.463D-03	0.0	0.0	0.0	0.0	0.0
2	1	1.962D-03	0.0	0.0	0.0	0.0	0.0
3	1	1.094D-03	0.0	0.0	0.0	0.0	0.0
4	1	-3.020D-02	0.0	0.0	0.0	0.0	0.0
5	1	-1.445D-02	0.0	0.0	0.0	0.0	0.0
6	1	2.435D+01	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0

THE BETA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0.0	0.0	0.0	0.0	0.0	0.0
3	1	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0

THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0

THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	1	3.413D-02	4.997D+00	1.395D-02	5.014D+00	1.863D-02	5.008D+00	0.0	0.0	0.0

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     AT SIMULATION TIME, T = 0.0       * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  1   THE VELOCITIES ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0         1.278D+02   1.278D+02   1.278D+02
FOR BODY  1   THE CORRESPONDING MOMENTA ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)
  1    1   8.306D+00   8.306D+00   8.306D+00   0.0         0.0         0.0         8.306D+00   8.306D+00   8.306D+00
FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   8.313D+00   8.303D+00   8.302D+00   0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      1.59195352D+03 0.0

     AT SIMULATION TIME, T = 0.0       * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      0.0            0.0

     AT SIMULATION TIME, T = 0.0       * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  3   THE VELOCITIES ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  3   THE CORRESPONDING MOMENTA ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  3   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      0.0            0.0

     AT SIMULATION TIME, T = 0.0       * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  4   THE VELOCITIES ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  4   THE CORRESPONDING MOMENTA ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  4   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      0.0            0.0

     AT SIMULATION TIME, T = 0.0       * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  5   THE VELOCITIES ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  5   THE CORRESPONDING MOMENTA ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  5   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
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  1    1   0.0         0.0         0.0         0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     0.0            0.0

       AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  6   THE VELOCITIES ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  6   THE CORRESPONDING MOMENTA ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
FOR BODY  6   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     0.0            0.0

       AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE INTERCONNECTION CONSTRAINT FORCES(LAMBDAS) ARE
           ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1    1   5.875D-05   2.446D-05   9.636D-08  -1.189D-03  -7.663D-05   3.366D-05  -4.717D-05   6.791D-05   1.193D-03   8.983D-05
  1   11   1.269D-05   3.758D-05  -6.818D-05   5.040D-07   1.170D-05   2.141D-05  -3.161D-06  -5.601D-07  -1.170D-05   3.460D-05
  1   21   3.069D-06

       AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
           ( 1)        ( 2)        ( 3)
  1    1   8.313D+00   8.303D+00   8.302D+00
THE TOTAL LINEAR MOMENTUM VECTOR IS
           ( 1)        ( 2)        ( 3)
  1    1   0.0         0.0         0.0

THE TOTAL ANGULAR MOMENTUM =  1.43858944D+01
THE TOTAL LINEAR MOMENTUM  =  0.0
THE TOTAL KINETIC ENERGY   =  1.59195352D+03
THE TOTAL POTENTIAL ENERGY =  0.0
THE TOTAL ENERGY (T + V)   =  1.59195352D+03
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ATS-F — 6 INTERCONNECTED BODIES, PRESCRIBED (RHEONOMIC) RELATIVE HINGE
ACTIVE CONTROLLER, NONLINEAR TIME DOMAIN RESPONSE

CURRENT TIME = 21.08.39
THE CPU TIMER = 8.1012E+02

AT SIMULATION TIME, T = 3.0000D+00* *

THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-8.890D-05	-7.042D-04	-3.022D-03	1.317D-03	1.288D-03	-2.233D-02	1.288D+02	1.287D+02	1.268D+02	1.396D-02
1	11	-6.079D-04	3.359D-03	9.454D-03	-1.878D-02	-2.231D-02	6.117D-04	2.144D-02	2.172D-03	2.908D-03	-2.465D-02
1	21	1.643D-02	3.275D-01	-2.162D-02	-2.948D-03	9.335D-05	1.823D-03	-1.707D-02	3.311D-01	-8.910D-05	-8.415D-04
1	31	-3.345D-03	-1.678D-03	-2.247D-03	-2.142D-02	-8.910D-05	-8.415D-04	-3.345D-03	-1.677D-03	5.409D-03	-2.320D-02
1	41	2.283D-02	2.711D-03	-8.825D-03	-2.444D-02	-1.007D-01	2.596D+01	9.896D-05	-3.453D-06	2.350D-03	9.977D-01
1	51	-6.704D-04	1.008D+00	-7.346D-04	-5.060D-07	2.282D-04	5.055D-07	2.282D-04	1.208D-01	8.158D-01	-1.382D-01
1	61	-1.683D+00	2.957D-01	1.697D+00	-2.117D-04	-2.153D-02	-2.153D-02				

AT SIMULATION TIME, T = 3.0000D+00* *

THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-1.287D-03	2.068D-03	-1.720D-01	-3.988D-03	1.578D-02	-6.721D-03	3.830D-01	3.797D-01	-4.063D-01	1.813D-01
1	11	8.343D-03	6.813D-02	-1.639D-02	-2.513D-01	-6.803D-03	2.395D-02	-1.374D-03	1.455D-01	6.824D-02	-5.103D-01
1	21	-1.942D-02	1.991D-02	-1.185D-03	-1.444D-01	7.572D-02	5.698D-01	2.224D-02	7.620D-02	-1.287D-03	2.209D-03
1	31	-2.212D-01	7.374D-03	-2.017D-01	-9.422D-03	-1.287D-03	2.209D-03	-2.212D-01	7.470D-03	2.340D-01	-4.182D-03
1	41	-9.511D-05	-7.034D-04	-3.022D-03	1.268D-03	1.786D-03	-2.230D-02	-1.405D-02	6.321D-05	-6.381D-03	-2.153D-02
1	51	5.139D-03	-2.153D-02	1.109D-03	-1.373D-04	-3.226D-04	1.373D-04	-3.226D-04	3.137D-02	-1.684D+00	-7.983D-02
1	61	-3.360D-02	1.054D-01	5.508D-03	6.117D-04	0.0	0.0				

AT SIMULATION TIME, T = 3.0000D+00* *

THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	2.283D-02	9.896D-05	9.977D-01	1.008D+00	0.0	0.0
2	1	2.711D-03	-3.453D-06	0.0	0.0	-5.060D-07	5.055D-07
3	1	-8.825D-03	2.350D-03	-6.704D-04	-7.346D-04	2.282D-04	2.282D-04
4	1	-2.444D-02	0.0	0.0	0.0	0.0	0.0
5	1	-1.007D-01	0.0	0.0	0.0	0.0	0.0
6	1	2.596D+01	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 3.0000D+00* *

THE BETA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	-9.511D-05	-1.405D-02	-2.153D-02	-2.153D-02	0.0	0.0
2	1	-7.034D-04	6.321D-05	0.0	0.0	-1.373D-04	1.373D-04
3	1	-3.022D-03	-6.381D-03	5.139D-03	1.109D-03	-3.226D-04	-3.226D-04
4	1	1.268D-03	0.0	0.0	0.0	0.0	0.0
5	1	1.786D-03	0.0	0.0	0.0	0.0	0.0
6	1	-2.230D-02	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 3.0000D+00* *

THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	1	1.208D-01	8.158D-01	-1.382D-01	-1.683D+00	2.957D-01	1.697D+00	-2.117D-04	-2.153D-02	-2.153D-02

AT SIMULATION TIME, T = 3.0000D+00* *

THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	1	3.137D-02	-1.684D+00	-7.983D-02	-3.360D-02	1.054D-01	5.508D-03	6.117D-04	0.0	0.0

```
      AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  1   THE VELOCITIES ARE
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)
  1    1  -8.890D-05 -7.042D-04 -3.022D-03  1.317D-03  1.288D-03 -2.233D-02  1.288D+02  1.287D+02  1.268D+02
FOR BODY  1   THE CORRESPONDING MOMENTA ARE
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)
  1    1   8.138D+00  5.867D+00  6.804D+00  8.994D-02  8.796D-02 -1.524D+00  8.372D+00  8.363D+00  8.242D+00
FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1   5.195D+00  7.849D+00  6.918D+00  8.657D-02  1.219D-01 -1.522D+00
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      1.59987849D+03 0.0

      AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)
  1    1   1.396D-02 -6.079D-04  3.359D-03  9.454D-03 -1.878D-02 -2.231D-02  6.117D-04
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)
  1    1   1.403D+00 -6.127D-02  7.087D-01  3.362D-02 -6.677D-02 -7.932D-02  3.839D-01
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1   2.347D+00  3.837D-01  6.990D-01  3.265D-02 -6.532D-02 -8.092D-02
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      1.27886584D-02 0.0

      AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  3   THE VELOCITIES ARE
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1   2.144D-02  2.172D-03  2.908D-03 -2.465D-02  1.643D-02  3.275D-01
FOR BODY  3   THE CORRESPONDING MOMENTA ARE
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1   3.633D+00  1.950D-01  4.231D-01 -1.271D-01  8.471D-02  1.688D+00
FOR BODY  3   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1   1.539D+01  7.626D-01  1.010D+00 -1.118D-01  1.446D+00  8.778D-01
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      3.18523234D-01 0.0

      AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  4   THE VELOCITIES ARE
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1  -2.162D-02 -2.948D-03  9.335D-05  1.823D-03 -1.707D-02  3.311D-01
FOR BODY  4   THE CORRESPONDING MOMENTA ARE
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1  -3.667D+00 -2.215D-01  1.623D-02  9.397D-03 -8.798D-02  1.707D+00
FOR BODY  4   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1  -1.451D+01 -2.418D-01 -4.679D-01 -1.560D-03 -1.510D+00  8.015D-01
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      3.23357963D-01 0.0

      AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  5   THE VELOCITIES ARE
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1  -8.910D-05 -8.415D-04 -3.345D-03 -1.678D-03 -2.247D-03 -2.142D-02
FOR BODY  5   THE CORRESPONDING MOMENTA ARE
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1  -7.106D-05 -6.712D-04 -2.668D-03 -2.866D-03 -3.838D-03 -3.658D-02
FOR BODY  5   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
          ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
```

```
  1    1     9.723D-02 -4.432D-02 -7.094D-03 -2.999D-03 -2.977D-03 -3.665D-02
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     4.031362240-04 0.0

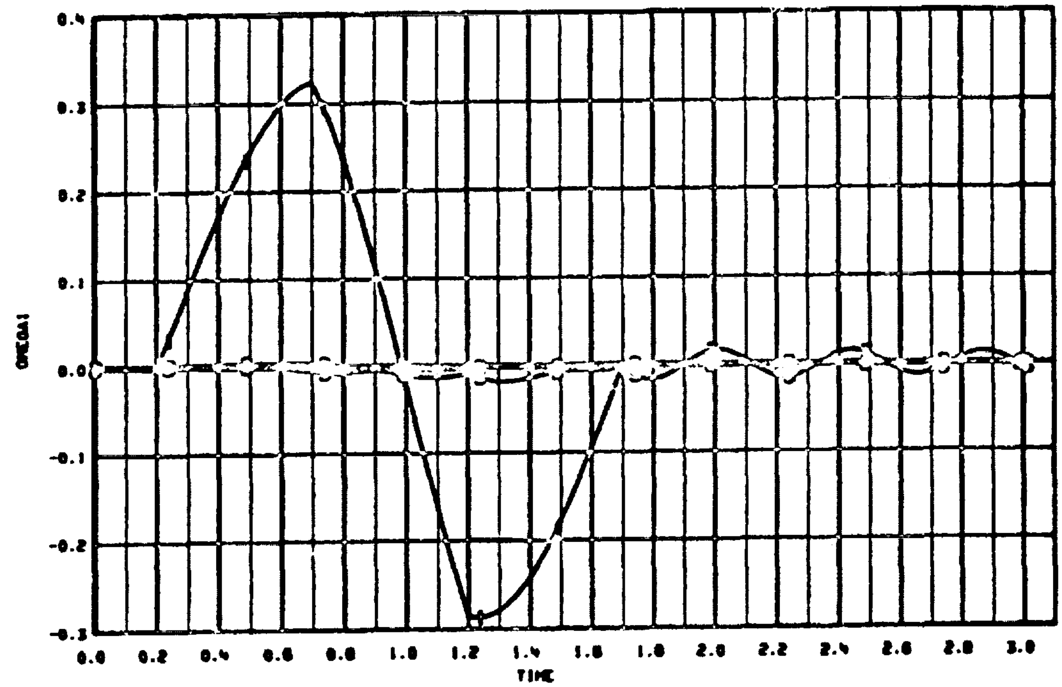
         AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  6   THE VELOCITIES ARE
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1    -8.910D-05 -8.415D-04 -3.345D-03 -1.677D-03  5.409D-03 -2.320D-02
FOR BODY  6   THE CORRESPONDING MOMENTA ARE
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1    -7.106D-05 -6.711D-04 -2.668D-03 -2.864D-03  9.239D-03 -3.963D-02
FOR BODY  6   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1    -3.010D-01 -1.374D-01 -1.588D-02 -2.892D-03  1.017D-02 -3.940D-02
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     4.918081870-04 0.0

         AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE INTERCONNECTION CONSTRAINT FORCES(LAMBDAS) ARE
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)       (10)
  1    1     6.011D-02 -8.924D-01  2.501D-02 -2.122D+00 -5.814D+00  2.627D+00 -1.484D-02  1.702D-01 -7.133D+00 -5.876D+00
  1   11     2.933D+00 -2.543D-01  3.369D-01 -6.823D-04  1.269D-02 -3.445D-01 -1.609D-02  1.427D-03 -1.273D-02 -3.997D-01
  1   21    -7.146D-03

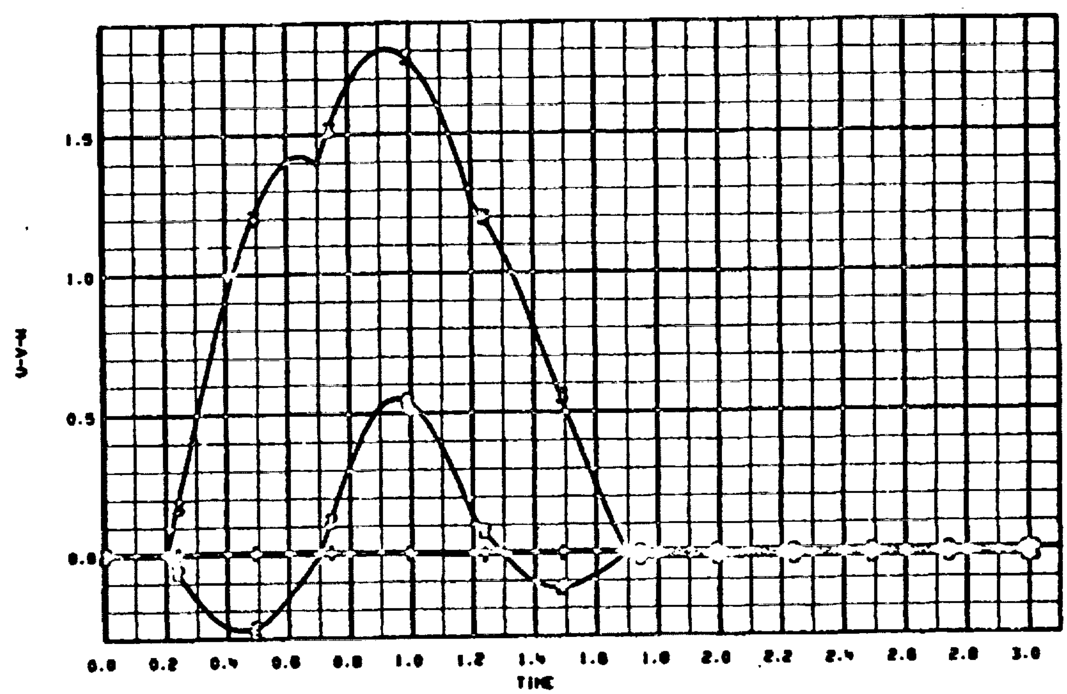
         AT SIMULATION TIME, T = 3.0000D+00* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
              ( 1)       ( 2)       ( 3)
  1    1     8.225D+00  8.572D+00  8.137D+00
THE TOTAL LINEAR MOMENTUM VECTOR IS
              ( 1)       ( 2)       ( 3)
  1    1    -7.775D-07 -1.105D-06  1.553D-04

THE TOTAL ANGULAR MOMENTUM =  1.439875830+01
THE TOTAL LINEAR MOMENTUM  =  1.553371070-04
THE TOTAL KINETIC ENERGY   =  1.600534060+03
THE TOTAL POTENTIAL ENERGY =  5.869630760-02
THE TOTAL ENERGY (T + V)   =  1.600592760+03

                         CPU TIME/STEP  CPU TIME/REAL TIME
                           3.5553E+00        2.8443E+02
```



BODY-1 ANGULAR VELOCITY VECTOR

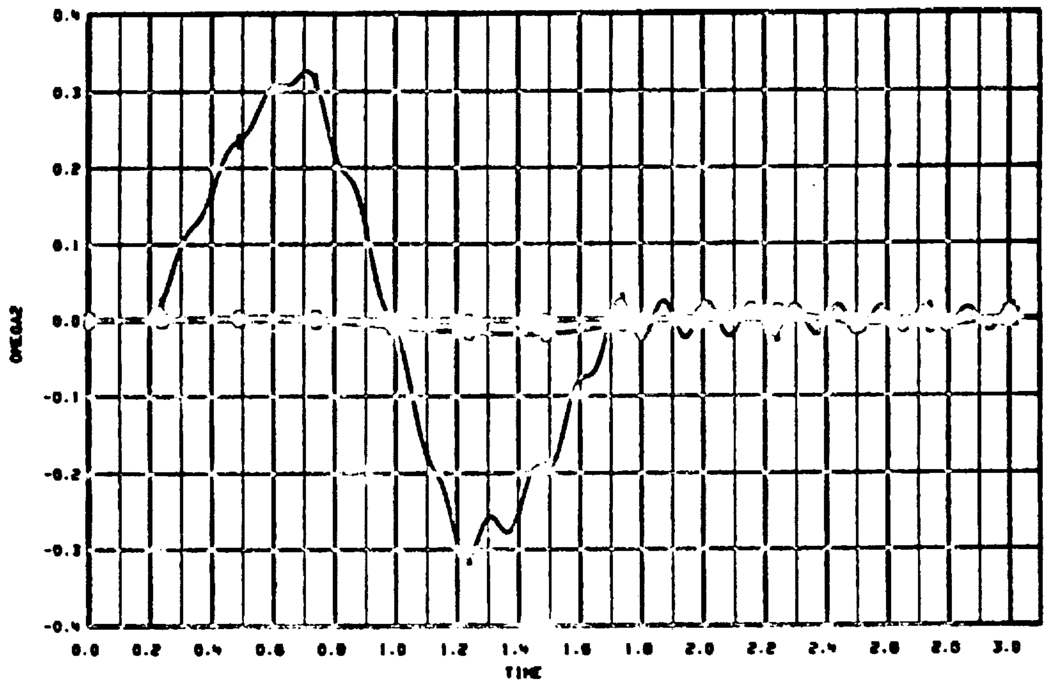


BODY-1 BODY REFERENCED VELOCITY VECTOR

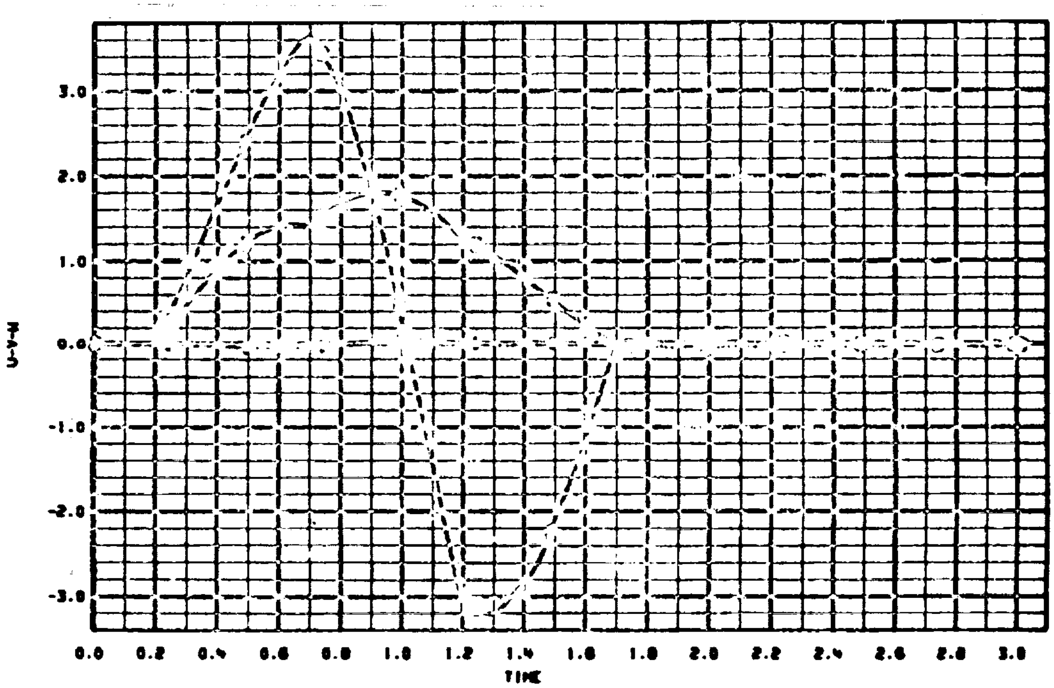
NAS5-11996 GSFC DEMO. NO. 5. PRESCRIBED (RHEONOMIC) RELATIVE HINGE MOTION

DEMO 5 02/27/75 CARL BOOLEY

Figure A-5 Graphical Results, Demonstration Problem 5 (Sheet 1 of 8)



BODY-2 ANGULAR VELOCITY VECTOR

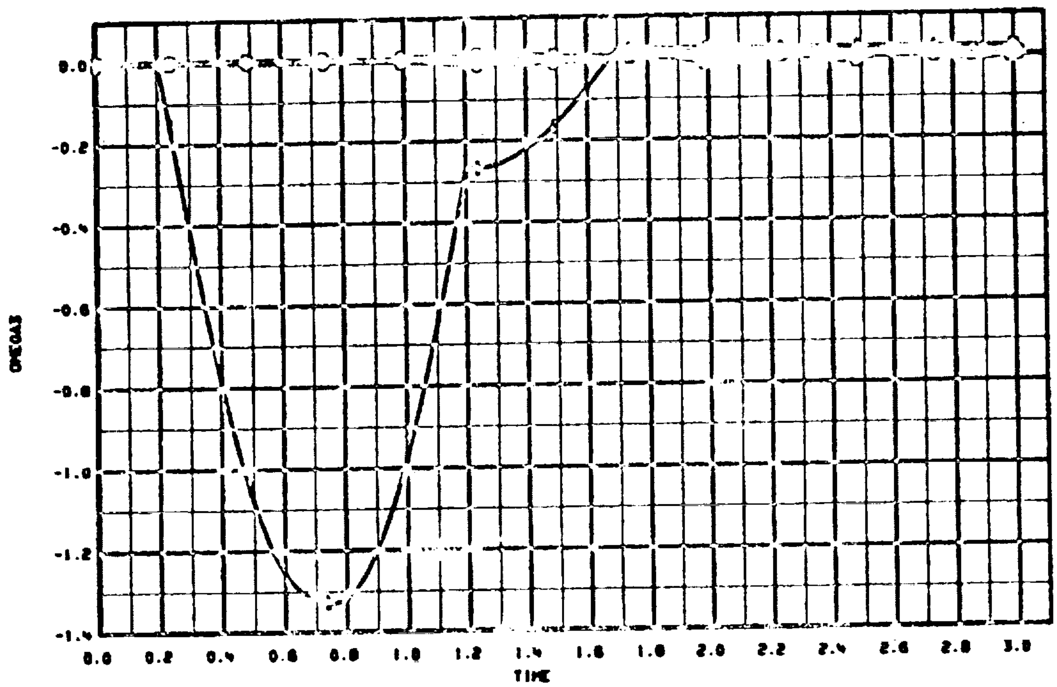


BODY-2 LINEAR VELOCITY VECTOR

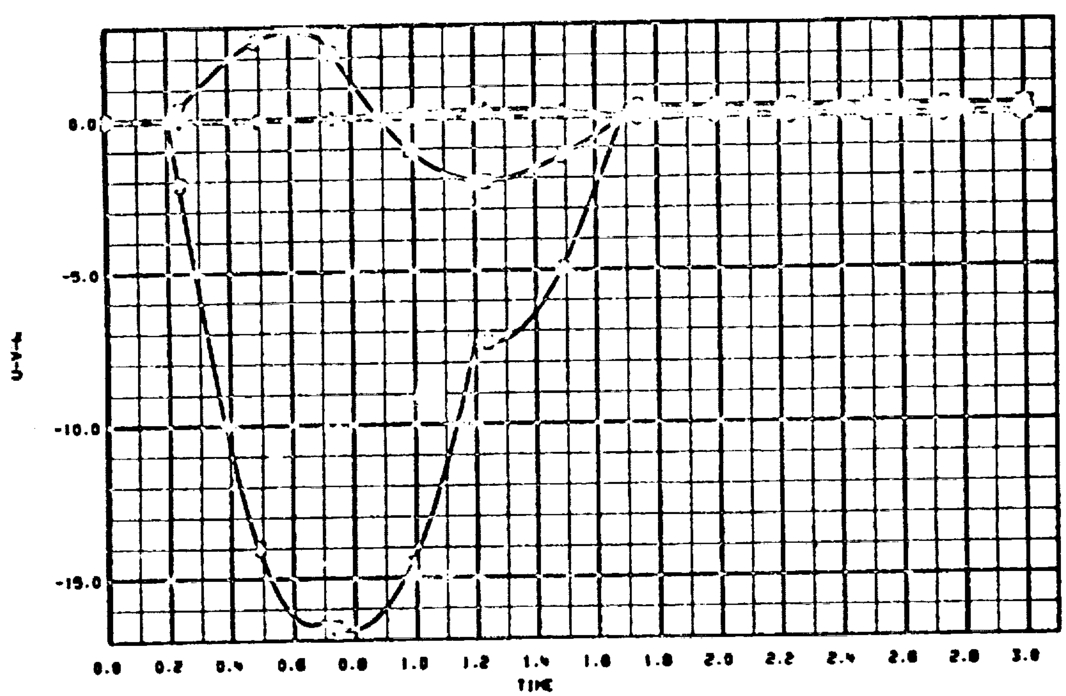
NAS5-11SS3 GSFC DEMO. NO. 5. PRESCRIBED (RHEONOMIC) RELATIVE HINGE MOTION

DEMO 5 02/27/75 CARL BODLEY

Figure A-5 Graphical Results, Demonstration Problem 5 (Sheet 2 of 8)



BODY-3 ANGULAR VELOCITY VECTOR

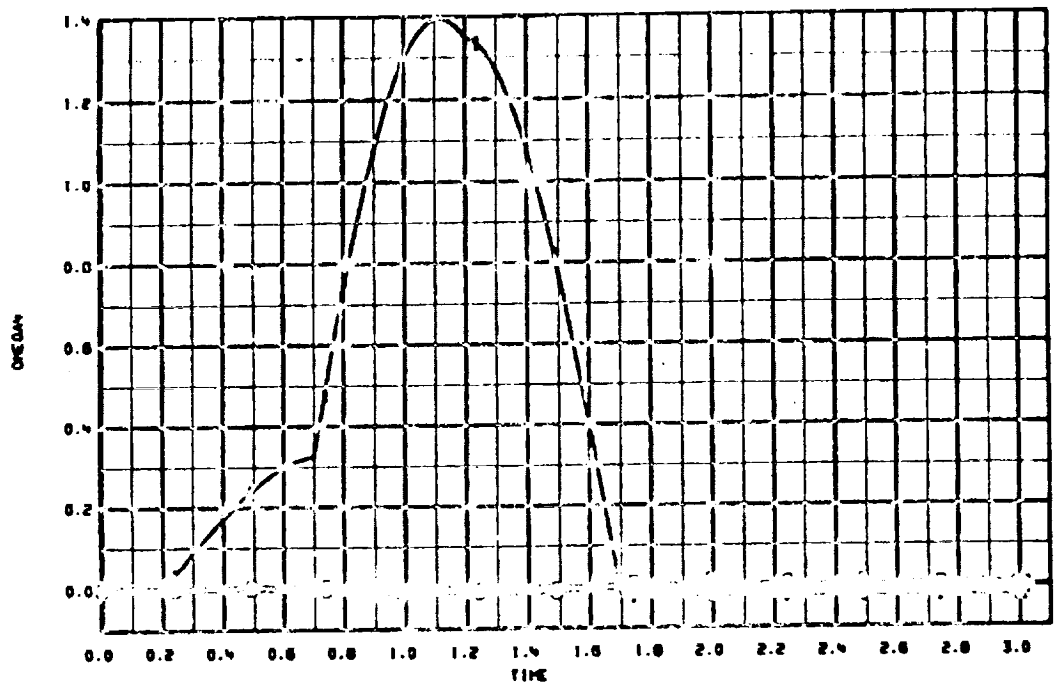


BODY-3 LINEAR VELOCITY VECTOR

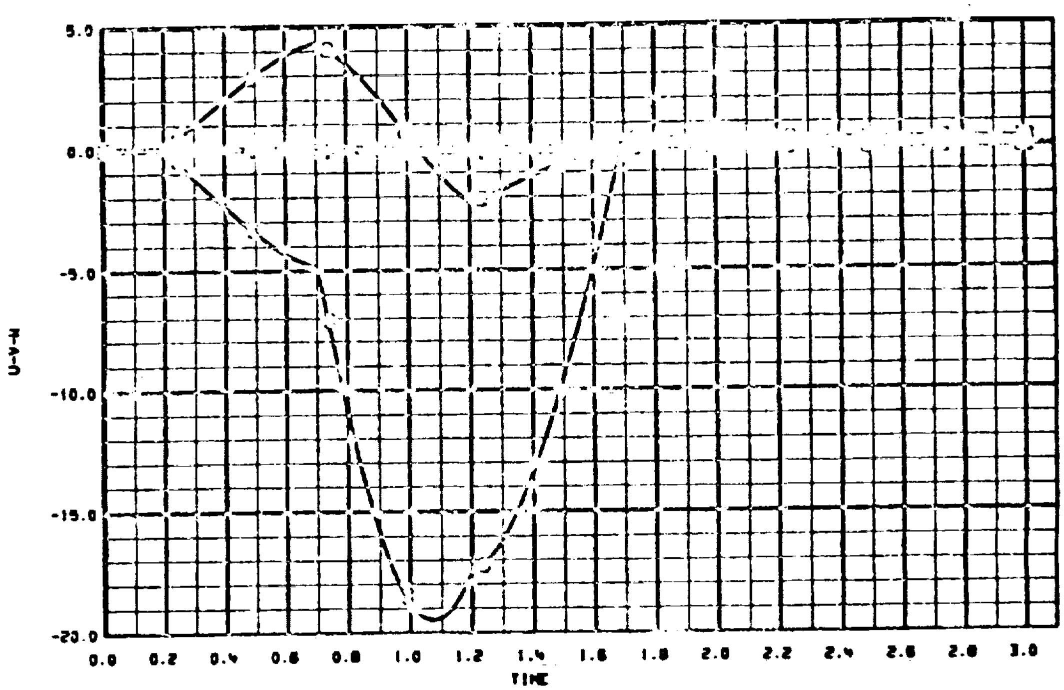
NAS5-11996 GSFC DEMO. NO. 5, PRESCRIBED (RHEONOMIC) RELATIVE HINGE MOTION

DEMO 5 02/27/75 CARL BODLEY

Figure A-5 Graphical Results, Demonstration Problem 5 (Sheet 3 of 8)



BODY-4 ANGULAR VELOCITY VECTOR

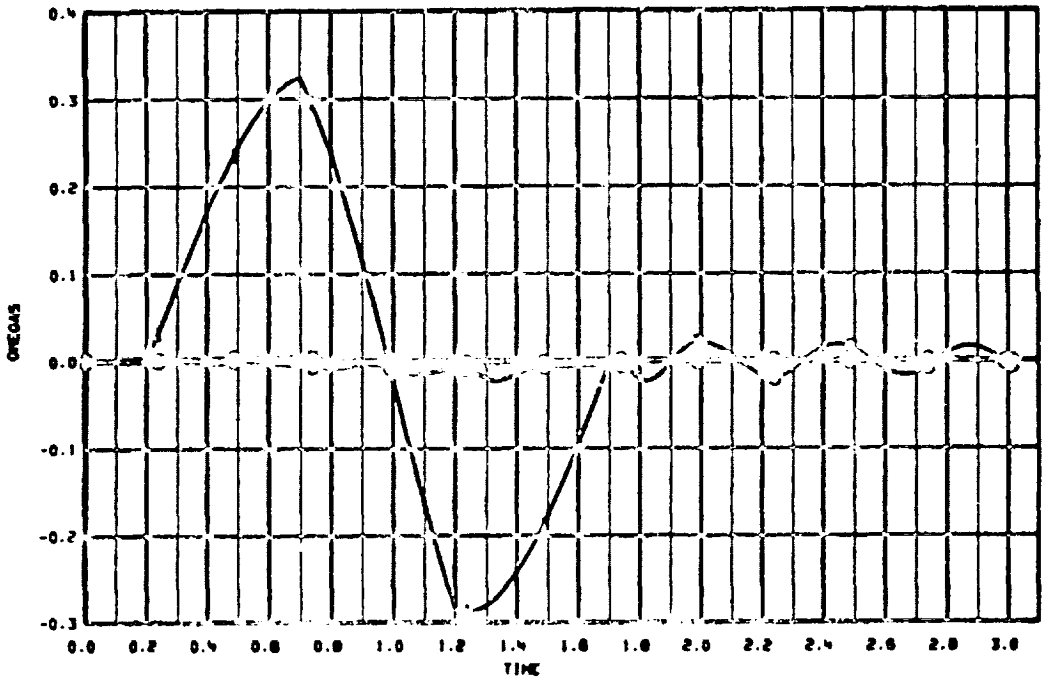


BODY-4 LINEAR VELOCITY VECTOR

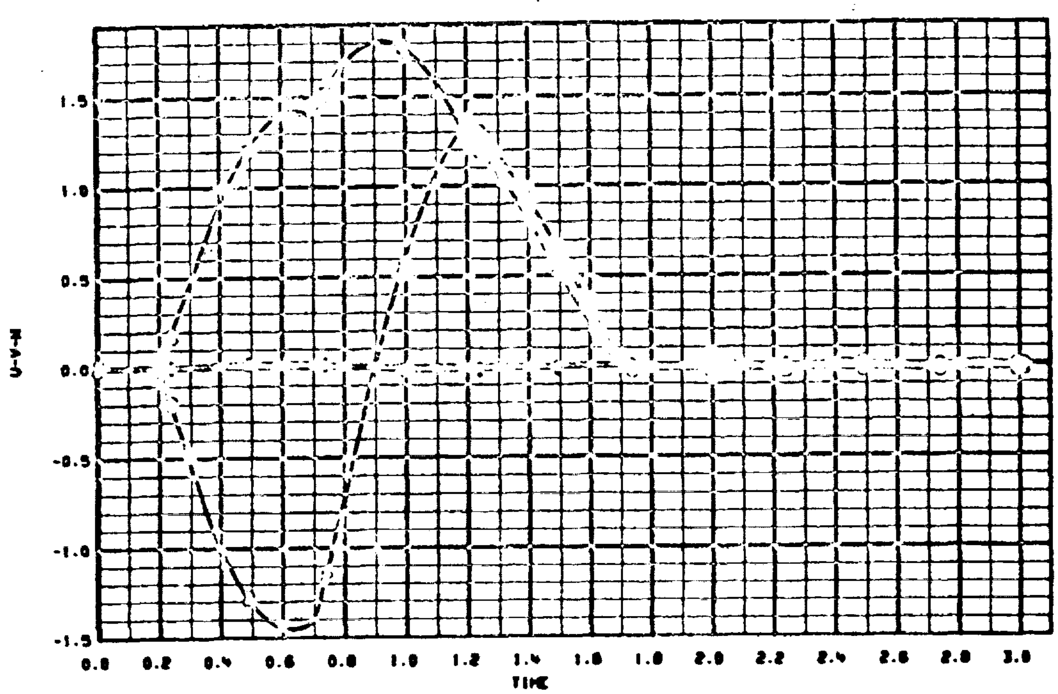
NAS5-11533 GSFC DEMO. NO. 5, PRESCRIBED (RHEONOMIC) RELATIVE HINGE MOTION

DEMO 5 02/27/75 CARL GOOLEY

Figure A-5 Graphical Results, Demonstration Problem 5 (Sheet 4 of 8)



CODY-5 ANGULAR VELOCITY VECTOR

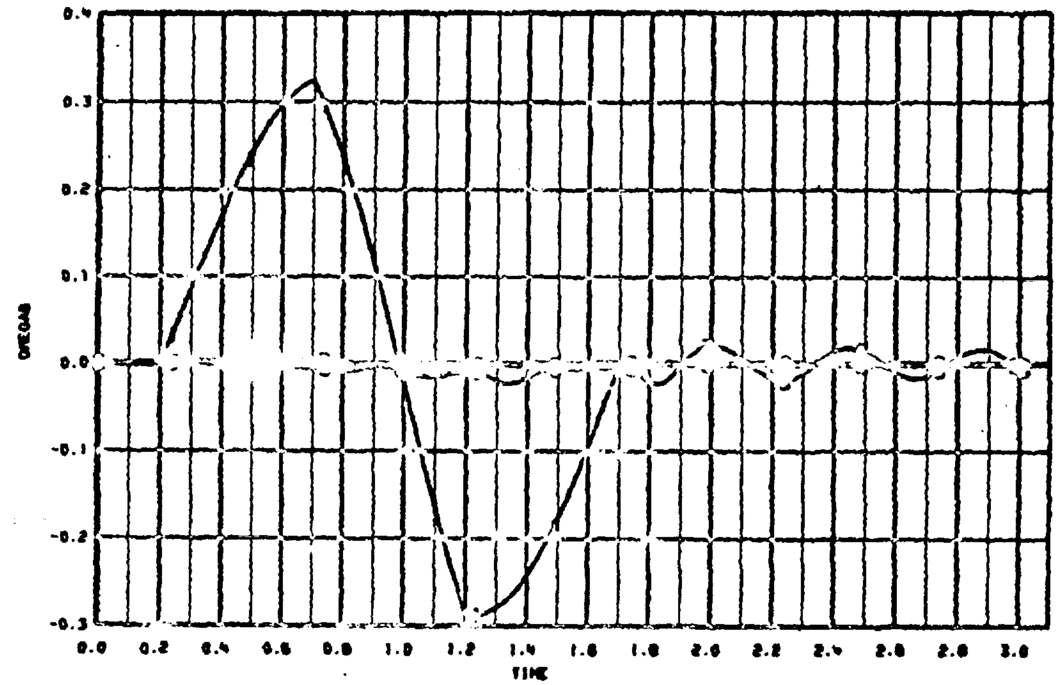


BODY-5 LINEAR VELOCITY VECTOR

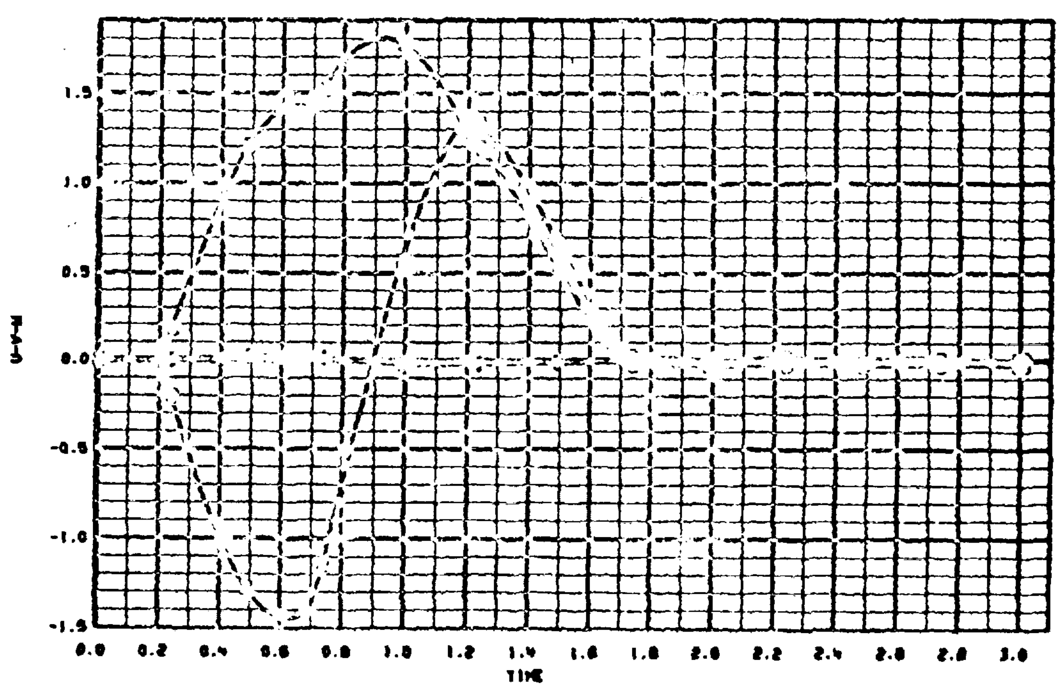
NAS5-11996 GSFC DEMO. NO. 5, PRESCRIBED (R-ECONOMIC) RELATIVE HINGE MOTION

DEMO 5 02/27/75 CARL BOOLEY

Figure A-5 Graphical Results, Demonstration Problem 5 (Sheet 5 of 8)



BODY-6 ANGULAR VELOCITY VECTOR

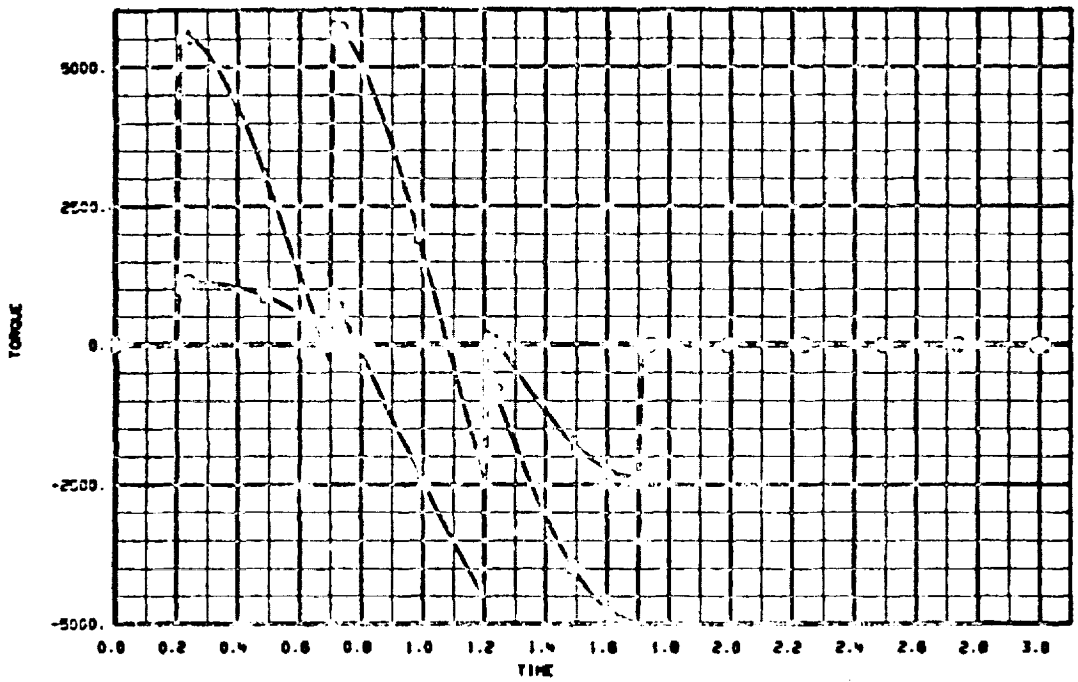


BODY-6 LINEAR VELOCITY VECTOR

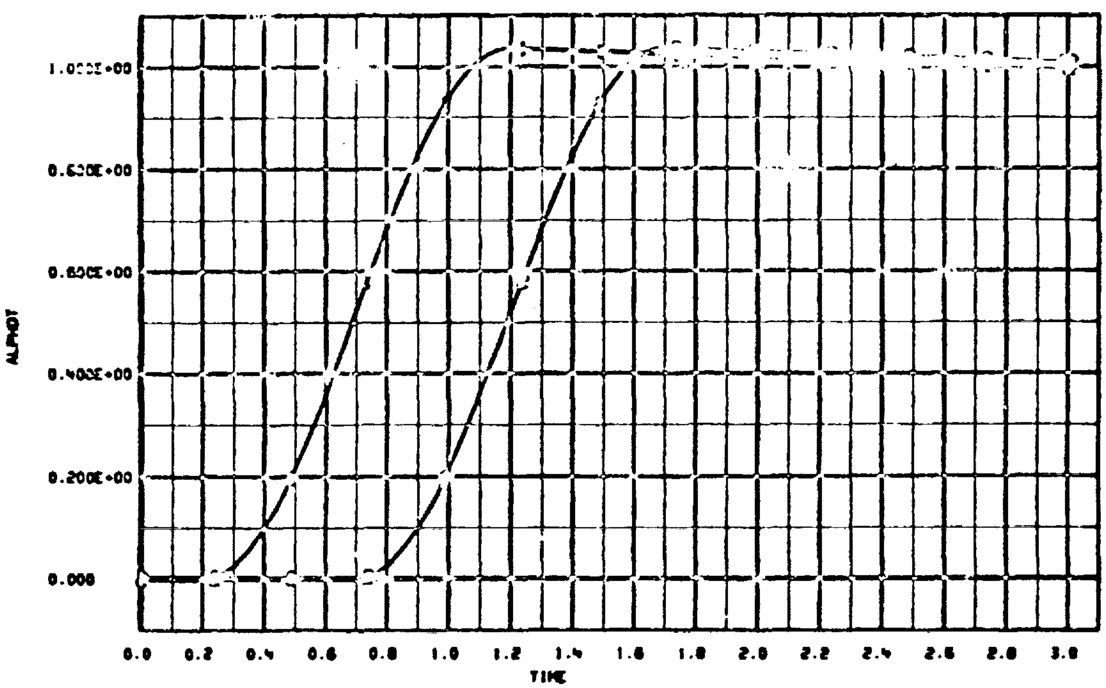
NAS5-11SC3 GSFC DEMO. NO. 5, PRESCRIBED (HARMONIC) RELATIVE HINGE MOTION

DEMO 5 02/27/75 CARL BODLEY

Figure A-5 Graphical Results, Demonstration Problem 5 (Sheet 6 of 8)



CONSTRAINT TORQUES TO CAUSE PANELS TO DEPLOY

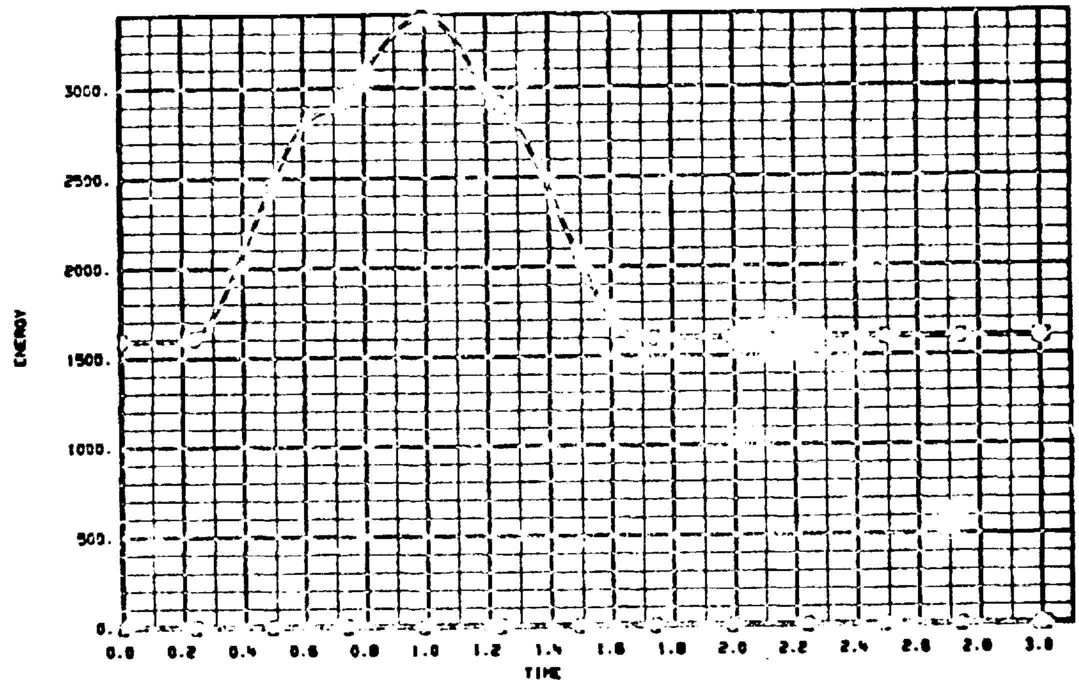


RHEONOMICALLY CONSTRAINED HINGE ANGLES

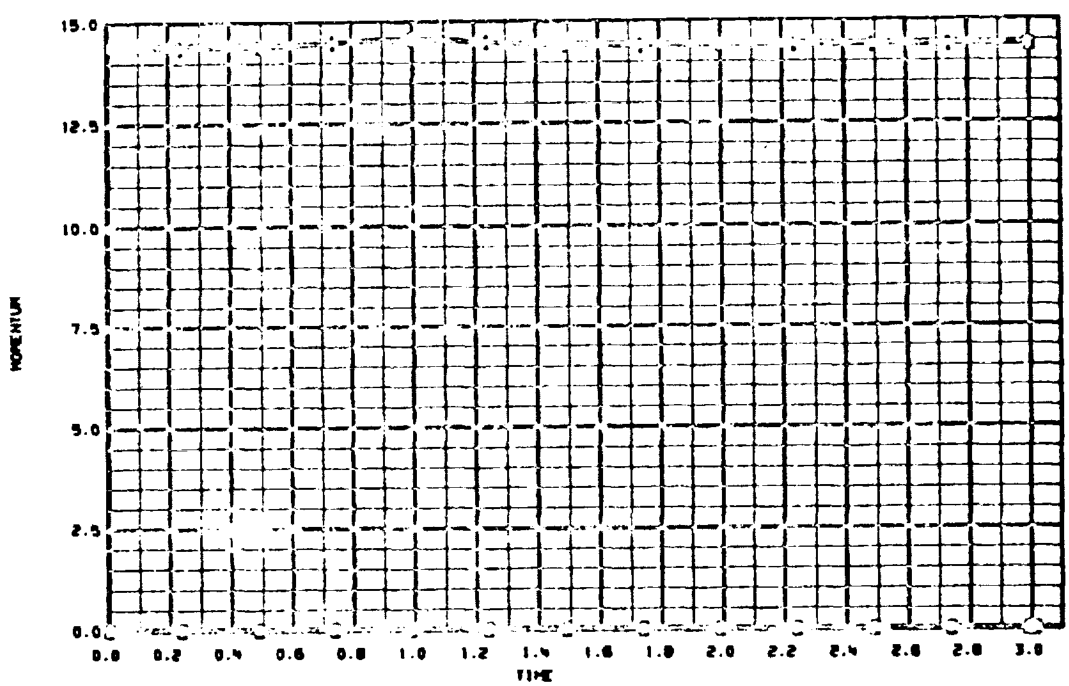
NAS5-11996 GSFC DEMO. NO. 5, PRESCRIBED (RHEONOMIC) RELATIVE HINGE MOTION

DEMO 5 02/27/75 CARL BOOLEY

Figure A-5 Graphical Results, Demonstration Problem 5 (Sheet 7 of 8)



KINETIC, POTENTIAL AND TOTAL ENERGY -- T + V



TOTAL ANGULAR AND LINEAR MOMENTUM

NAS5-11999 GSFC DEMO. NO. 5. PRESCRIBED (HARMONIC) RELATIVE HINGE MOTION

DEMO 5 02/27/75 CARL BOOLEY

Figure A-5 Graphical Results, Demonstration Problem 5 (Sheet 8 of 8)

Demonstration Problem 6

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```
      SUBROUTINE CONTRL
      IMPLICIT REAL*8 (A-H,O-Z)
C
              COMMON /BHBSRD/
     *     BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)
              COMMON /CONPAR/
     *     CNTDTA(100)
      COMMON /LDSIZE/ NX,NY,NDLTA,NXSS,NBTQ,NJQ,NY2,ND2
              COMMON /SPECIF/
     *     BETAH(6, 6),BETAMD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
     *     DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
     *     NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRBFLX( 6),IHDATA(7, 6),
     *     LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
              COMMON /TIMESS/
     *     STARTT,DELTAT,T,ENDT,THST
              COMMON /VECTOR/
     *     Y(250),YDT(250)
CCCCCCC  THIS COMMON IS TRANSFER BETWEEN CONTRL AND SHAFTT ONLY ----
             COMMON /WHEEL /
     *    CLM(4)
C
      DIMENSION  TQ(6),TQD(6),RHD(3),THADW(3)
      DATA ICT4/0/, RHD / 0.D0, 0.D0, 0.D0 /
      ALIM(U,V) = DMAX1(-V,DMIN1(U,V))
C
CCCCCCCCCC
CCCCCCCCCC
CCC  THE FOLLOWING STATEMENTS MUST ALWAYS BE IN CONTRL..
      NDLTA = NDELTA
      NXSS = 3
      NBTQ = 3
      IF (NDELTA .EQ. 0) RETURN
CCCCCCCCCCC     CCC
CCCC----NOTE--THIS SUBROUTINE MUST ESTABLISH  NDLTA,NXSS AND NBTQ
CCCCCCCCCCC
C
CCCC  ESTABLISH THE D/DT(DELTAS)
C
      LDEL = LOCU(2*NB+2) - 1
      ICT4 = ICT4 + 1
      IA = (ICT4-1)/4
      IAA = (ICT4-2)/4
      IFLAG = IA - IAA
      DO 6 I=1,3
    6 THADW(I) = 0.D 0
      DO 5 I=1,6
    5 TQ(I) = Y(LDEL+I)
C
C         WHEEL 1 (ROLL INERTIA WHEEL CONTROL TORQUE)
C         DEFINE DIFFERENTIAL EQUATIONS FOR ROLL CONTROL LOOP
```

```
C
      U1 = 57.2958D0*ROL(3,2,1)/ROL(3,3,1)
      U5 = ALIM(TQ(5),29.D0)
      U2 = 2.17D0*U1 - U5
      U3 = ALIM(1.1D0*U2,1.17D0)
      TQD(5) = (1.D0/88.D0)*(-TQ(5) + (9/1.1D0)*U3)
      U5 = ALIM(5*U3,1.68D0)
      U6 = ALIM(TQ(6),1.9D0)
      IF (IFLAG .EQ. 0) GO TO 32
      U0 = DABS(U8)
      IF (U0.GT.1.D0) GO TO 30
      IF (U0.LT.0.5D0) GO TO 31
      U9 = RHD(1)
      GO TO 10
   30 U9 = U8/U0
      GO TO 10
   31 U9 = 0.D0
      GO TO 10
   32 U9 = RHD(1)
      GO TO 33
   10 RHD(1) = U9
   33 CONTINUE
      TQD(6) = (-TQ(6) + 2.5D0*(U6-U9))/.5D0
C
C  1500 RPM = 157.0795 RAD/SEC
C   6 INCH*OZ = .03125 FT*LBS
C
      IF (DABS(THADW(1)).GT. 157.0795D0) U9 = 0.D0
      CLM(1) = .03125D0*U9 - 5.D-05*THADW(1)
C
C          WHEEL 2 (PITCH INERTIA WHEEL CONTROL TORQUE)
C          DEFINE DIFFERENTIAL EQUATIONS IN PITCH CONTROL LOOP
C
      U1 = -57.2958D0*ROL(3,1,1)/ROL(3,3,1)
      U5 = ALIM(TQ(1),16.4D0)
      U2 = 2.17D0*U1 - U5
      U3 = ALIM(.82D0*U2,1.17D0)
      TQD(1) = (-TQ(1) + U3*(7/.82D0))/50.D0
      U5 = ALIM(5*U3,1.68D0)
      U6 = ALIM(TQ(2),1.9D0)
      IF (IFLAG.EQ.0) GO TO 14
      U0 = DABS(U8)
      IF (U0.GT. 1.D0) GO TO 15
      IF (U0.LT.0.5D0) GO TO 16
      U9 = RHD(2)
      GO TO 12
   15 U9 = U8/U0
      GO TO 12
   16 U9 = 0.D0
      GO TO 12
```

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```
14 U9 = RHO(2)
   GO TO 13
12 RHO(2) = U9
13 CONTINUE
   TQD(2) = (-TQ(2) + 2.5D0*(U6 - U9))/.5D0
   IF (DABS(THAD*(2)).GE. 157.0795D0) U9 = 0
   CLM(2) = .03125D0*U9 - 5.D-05*THAD*(2)
C
C       WHEEL 3 (YAW INERTIA WHEEL CONTROL TORQUE)
C       DEFINE DIFFERENTIAL EQUATIONS FOR YAW CONTROL LOOP
C
   U1 = 57.2958D0*ROL(2,1,1)/ROL(2,2,1)
   U2 = ALIM(U1,2.D0)
   U6 = ALIM(TQ(3),29.D0)
   U3 = 2.17D0*U2 - U6
   U4 = ALIM(1.47D0*U3,1.17D0)
   TQD(3) = (1.D0/88.D0)*(-TQ(3) + (9/1.47D0)*U4)
   U7 = ALIM(5*U4,1.68D0)
   U9 = ALIM(TQ(4),1.9D0)
   IF (IFLAG.EQ.0) GO TO 20
   UU = DABS(U9)
   IF (UU.GT.1.D0) GO TO 21
   IF (UU.LT. 0.5D0) GO TO 22
   U10 = RHO(3)
   GO TO 18
21 U10 = U9/UU
   GO TO 18
22 U10 = 0.D0
   GO TO 18
20 U10 = RHO(3)
   GO TO 24
18 RHO(3) = U10
24 CONTINUE
   TQD(4) = (-TQ(4) + 2.5D0*(U7 - U10))/.5D0
   IF (DABS(THAD*(3)) .GT. 157.0795D0) U10 = 0.D0
   CLM(3) = .03125D0*U10 - 5.D-05*THAD*(3)
C
   DO 34 I=1,6
34 YDT(LDEL+I) = TQD(I)
   YDT(LDEL+7) = Y(13)
   SK4 = CNTDTA(NDELTA+1)
   DK4 = CNTDTA(NDELTA+2)
   CLM(4) =-(SK4*Y(LDEL+7) + DK4*YDT(LDEL+7))
C
   RETURN
   END
   SUBROUTINE EQADD
   IMPLICIT REAL*8 (A-H,O-Z)
C
            COMMON /BHBSRO/
```

```
*     BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)
         COMMON /DNAUX /
*     NAUX
         COMMON /MAXMUM/
*     NBMAX,NHMAX,NSPMAX,NHWMAX,NMWBOD,NMOBOD,KMU,KY,KU
         COMMON /SPECIF/
*     BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),QH(3,3,30),HS(3,3,30),
*     DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
*     NB,NH,NSPT,NOFMU,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IMDATA(7, 6),
*     LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
         COMMON /VECTOR/
*     Y(250),YDT(250)
C
      NAUX = 6
      LBETA = LOCU(2*NB + 1) - 1
      YDT(NEQ + 1) = YDT(LBETA + 7)
      YDT(NEQ + 2) = YDT(LBETA + 8)
      YDT(NEQ + 3) = YDT(LBETA + 9)
      YDT(NEQ + 4) =  ROL(3,2,1)/ROL(3,3,1)
      YDT(NEQ + 5) = -ROL(3,1,1)/ROL(3,3,1)
      YDT(NEQ + 6) =  ROL(2,1,1)/ROL(2,2,1)
      RETURN
      END
```

```
DEMO 6     CARL BODLEY
ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES
THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS-F SPACECRAFT AS A SYSTEM
OF SIX INTERCONNECTED RIGID BODIES. THERE ARE FOUR MOMENTUM WHEELS.
(ONE REPRESENTS REFLECTOR DYNAMICS FOR HIGHER ORDER STRUCTURAL RESPONSE),
WHILE THE OTHER THREE, NORMALLY USED FOR CONTROL TORQUES, ARE LOCKED.


THE RUN IS TO QUALIFY THE LINEARIZATION ALGORITHM AND TECHNIQUE, AS WELL AS
TO DEMONSTRATE THAT PROGRAM KINEMATICS/DYNAMICS ACCURATELY COUPLE N-BODIES
AND REPRODUCE SYSTEM VIBRATION PROPERTIES.
0000000000
     6     6     4     4     7
ITOPOL     2     6
     1     1     1     2     3     4     5     6
     2     1     0     1     1     1     1     1
0000000000
IRGFLX     1     6
0000000000
IFTSMW     1     4
     1     1     1     1     1     2
0000000000
IHDATA     7     6
     1     1     1     1     1     1     1     1
     2     1     0     0     0     0     1     1
     3     1     0     0     1     1     0     0
     4     1     0     0     0     0     0     0
     5     1     0     1     1     1     1     1
     6     1     0     1     1     1     1     1
     7     1     0     1     1     1     1     1
0000000000
BETAH      6     6
0000000000
BETAHD     6     6
0000000000
IMO        3     4
     1     1     1     2     3     4
     2     1     1     2     3     3
     3     1     0     0     0     1
0000000000
AMO        2     4
     2     1     .065            .065            .065            96.705
0000000000
TMDATA     1     3
     1     1     0.              0.0125          3.
0000000000
IPDATA     1     3
     1     1     20    1     1
0000000000
```

```
CNTUTA    1    47
    1    8    42888.              0.0
    1   12      0.             0.             0.
    1   15    209680.          207550.        6746.7
    1   18    117600.          0.             78838.
    1   21    117600.          0.             78838.
    1   24      0.             787.18         787.18
    1   27      0.             787.18         787.18
0000000000
GRAVIT    1    4
0000000000
MASS 1    1    4
    1    1    66.273
0000000000
INERA1    1    6
    1    1    3713.7           3557.3         477.63
    1    4    -5.0901          32.729         2.9104
0000000000
    2    1
   0.      3.14159265    0.
 .030197    .014451    -12.600
    3    1
   0.         0.       3.14159265
 .030197    3.4312     -13.497
    4    1
   0.         0.         0.
 .030197   -3.4022     -13.497
    5    1
   0.         0.         0.
 1.2969     .014451     4.3140
    6    1
  0.          0.       3.14159265
 -1.2365    .014451     4.3140
    1    1
   0.         0.         0.
   0.         0.         0.
    2    1
   0.         0.         0.
   0.         0.         0.
    3    1
   0.         0.         0.
   0.         0.         0.
MASS 2    1    4
    1    1    3.5559           0.             0.             0.
0000000000
INERA2    1    6
    1    1    100.48           100.79         193.41
0000000000
    2    1
    0.     3.14159265    0.
```

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```
   0.          0.       -1.3521
     4     1
   0.          0.          0.
   0.          0.          0.
MASS 3     1      4
     1     1   5.1553
0000000000
INERA3     1      6
     1     1   168.96              40.091            145.07
     1     4   -4.7689              .14296           -1.9592
0000000000
     3     1
   0.          0.       3.14159265
 .36998     -15.809    -.070084
MASS 4     1      4
     1     1     5.1553
0000000000
INERA4     1      6
     1     1  168.96                40.091         145.07
     1     4    -4.7689          -.14296            1.9592
0000000000
     4     1
   0.          0.          0.
 -.36998     15.809     -.070084
MASS 5     1      4
     1     1     1.708
0000000000
INERA5     1      6
     1     1   .79758              .79758            .79758
0000000000
     5     1
   0.          0.          0.
   0.          0.         -.001
MASS 6     1      4
     1     1     1.7081
0000000000
INERA6     1      6
     1     1   .79758            .79758            .79758
0000000000
     6     1
   0.          0.       3.14159265
   0.          0.         -.001
                                                    BLANK CARD  --
                                                    BLANK CARD  --
0000000000
STOP
```

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.24.12
THE CPU TIMER = 0.0

THIS DEMONSTRATION PROBLEM SYNTHESIZES THE ATS-F SPACECRAFT AS A SYSTEM OF SIX INTERCONNECTED RIGID BODIES. THERE ARE FOUR MOMENTUM WHEELS. (ONE REPRESENTS REFLECTOR DYNAMICS FOR HIGHER ORDER STRUCTURAL RESPONSE), WHILE THE OTHER THREE, NORMALLY USED FOR CONTROL TORQUES, ARE LOCKED.

THE RUN IS TO QUALIFY THE LINEARIZATION ALGORITHM AND TECHNIQUE, AS WELL AS TO DEMONSTRATE THAT PROGRAM KINEMATICS/DYNAMICS ACCURATELY COUPLE N-BODIES AND REPRODUCE SYSTEM VIBRATION PROPERTIES.

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.24.13
THE CPU TIMER = 3.0000E-01

SUMMARY OF DYNAMIC-SIMULATION-PROGRAM INPUT DATA * * * * * * * * * * *

ACTUAL SIZES		MAXIMUM SIZES		INTEGRATION DATA		GRAVITY GRADIENT DATA				MISC. DATA	
NB	= 6	NBMAX	= 6	STARTT	= 0.0	G1	= 0.0	GAMA1	= 0.0	NOPRNT	= 20
NH	= 6	NHMAX	= 6	DELTAT	= 1.2500D-02	G2	= 0.0	GAMA2	= 0.0	NOPLOT	= 1
NSPT	= 4	NSPMAX	= 15	ENDT	= 3.0000D+00	G3	= 0.0	GAMA3	= 0.0	IFLNER	= 1
NOFMO	= 4	NMWMAX	= 5			GMAG	= 0.0	RCMAG	= 0.0		
NDELTA	= 7	NMWBOD	= 4								
NU	= 37	NMOBOD	= 12								
NBETA	= 17	KMU	= 22								
NLAM	= 19	KY	= 250								
NEQ	= 61	KU	= 113								

THE TOPOLOGY ARRAY (ITOPOL) FOR THIS CASE FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	2	3	4	5	6
2	1	0	1	1	1	1	1

THE CONSTRAINT SPECIFICATIONS FOR THIS CASE FOLLOW

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	1	1	1	1	1
2	1	0	0	0	0	1	1
3	1	0	0	1	1	0	0
4	1	0	0	0	0	0	0
5	1	0	1	1	1	1	1
6	1	0	1	1	1	1	1
7	1	0	1	1	1	1	1

THE SPECIFIED INITIAL HINGE ANGLES AND DISPLACEMENTS (BETAH) FOLLOW

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0.0	0.0	0.0	0.0	0.0	0.0
3	1	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	0.0

THE SPECIFIED INITIAL HINGE RATES (BETAHD) FOLLOW

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0.0	0.0	0.0	0.0	0.0	0.0
3	1	0.0	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0	0.0

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.24.13
THE CPU TIMER = 4.5000E-01

THE NO. OF ELASTIC MODES/BODY ARRAY (IRGFLX) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0	0	0	0	0	0

THE NO. OF P/O HINGE POINTS/BODY ARRAY (NHPOI) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	5	1	1	1	1	1

THE NO. OF SENSOR POINTS/BODY ARRAY (NSPOI) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3	1	0	0	0	0

THE MOM. WHEEL/BODY TABLE (NMOW) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3	1	0	0	0	0
2	1	0	1	0	0	0	0
3	1	1	4	0	0	0	0
4	1	2	0	0	0	0	0
5	1	3	0	0	0	0	0
6	1	0	0	0	0	0	0

THE STATE VECTOR LENGTH ARRAY (LENU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	1	6	7	6	6	6	6	0	0	0	0	0	0	17	7

THE STATE VECTOR LOCATION ARRAY (LOCU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	1	1	7	14	20	26	32	38	38	38	38	38	38	38	55

THE SPECIFIED SENSOR POINT/BODY CORRELATION ARRAY (IFTSMW) FOLLOWS

		(1)	(2)	(3)	(4)
1	1	1	1	1	2

A-214

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.24.13
THE CPU TIMER = 5.4667E-01

THE FOLLOWING DATA IS SPECIFIED MOM. WHEEL INFORMATION (IF ANY) AND CONTROLLER INFORMATION

THE SPECIFIED MOM. WHEEL CONTROL ARRAY (IMO) FOLLOWS

		(1)	(2)	(3)	(4)
1	1	1	2	3	4
2	1	1	2	3	3
3	1	0	0	0	1

THE SPECIFIED MOM. WHEEL RATES AND INERTIAS (AMO) FOLLOW

		(1)	(2)	(3)	(4)
1	1	0.0	0.0	0.0	0.0
2	1	6.5000D-02	6.5000D-02	6.5000D-02	9.6700D+01

THE SPECIFIED CONTROLLER INITIAL CONDITIONS AND CHARACTERISTICS FOLLOW
(THE FIRST NDELTA ARE INITIAL CONTROLLER STATE VARIABLES, THERE ARE 40 ADDITIONAL CONTROL PARAMETERS)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2890+04	0.0	0.0
1	11	0.0	0.0	0.0	0.0	2.097D+05	2.076D+05	6.747D+03	1.177D+05	0.0	7.884D+04
1	21	1.177D+05	0.0	7.884D+04	0.0	7.872D+02	7.872D+02	0.0	7.872D+02	7.872D+02	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.24.14
THE CPU TIMER = 7.5667E-01

SUMMARY OF INPUT DATA FOR BODY 1 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3.714D+03	5.096D+00	-3.273D+01	0.0	0.0	0.0
2	1	5.096D+00	3.557D+03	-2.910D+00	0.0	0.0	0.0
3	1	-3.273D+01	-2.910D+00	4.776D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	6.827D+01	0.0	0.0
5	1	0.0	0.0	0.0	0.0	6.827D+01	0.0
6	1	0.0	0.0	0.0	0.0	0.0	6.827D+01

FOR BODY 1 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1
2	1	3	1
3	1	4	1
4	1	5	1
5	1	6	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	3.142D+00	0.0	3.020D-02	1.445D-02	-1.266D+01
2	1	0.0	0.0	3.142D+00	3.020D-02	3.431D+00	-1.350D+01
3	1	0.0	0.0	0.0	3.020D-02	-3.402D+00	-1.350D+01
4	1	0.0	0.0	0.0	1.297D+00	1.445D-02	4.314D+00
5	1	0.0	0.0	3.142D+00	-1.236D+00	1.445D-02	4.314D+00

FOR BODY 1 THE SENSOR POINT NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES(1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	1	1
2	1	2	1
3	1	3	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	1.445D-02	-1.266D+01
2	1	0.0	0.0	0.0	0.0	3.431D+00	-1.350D+01
3	1	0.0	0.0	0.0	0.0	-3.402D+00	-1.350D+01

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.24.14
THE CPU TIMER = 1.0100E+00

SUMMARY OF INPUT DATA FOR BODY 2 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.005D+02	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.008D+02	0.0	0.0	0.0	0.0
3	1	0.0	0.0	1.934D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	3.556D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	3.556D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	3.556D+00

FOR BODY 2 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	3.142D+00	0.0	0.0	0.0	-1.352D+00

FOR BODY 2 THE SENSOR POINT NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES(1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	4	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	-1.352D+00

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.24.14
THE CPU TIMER = 1.1500E+00

SUMMARY OF INPUT DATA FOR BODY 3 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.690D+02	4.769D+00	-1.430D-01	0.0	0.0	0.0
2	1	4.769D+00	4.009D+01	1.959D+00	0.0	0.0	0.0
3	1	-1.430D-01	1.959D+00	1.451D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	5.155D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	5.155D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	5.155D+00

FOR BODY 3 THE P-O HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	3	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	3.142D+00	3.700D-01	-1.581D+01	-7.008D-02

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE, CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.24.14
THE CPU TIMER = 1.2600E+00

SUMMARY OF INPUT DATA FOR BODY 4 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.690D+02	4.769D+00	1.430D-01	0.0	0.0	0.0
2	1	4.769D+00	4.009D+01	-1.959D+00	0.0	0.0	0.0
3	1	1.430D-01	-1.959D+00	1.451D+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	5.155D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	5.155D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	5.155D+00

FOR BODY 4 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	4	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	-3.700D-01	1.581D+01	-7.008D-02

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

SUMMARY OF INPUT DATA FOR BODY 5 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	7.976D-01	0.0	0.0	0.0	0.0	0.0
2	1	0.0	7.976D-01	0.0	0.0	0.0	0.0
3	1	0.0	0.0	7.976D-01	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.708D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	1.708D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.708D+00

FOR BODY 5 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH
IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE
HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	5	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	-1.000D-03

A-220

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.24.15
THE CPU TIMER = 1.4733E+00

SUMMARY OF INPUT DATA FOR BODY 6 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	7.976D-01	0.0	0.0	0.0	0.0	0.0
2	1	0.0	7.976D-01	0.0	0.0	0.0	0.0
3	1	0.0	0.0	7.976D-01	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.708D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	1.708D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.708D+00

FOR BODY 6 THE P-O HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	6	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	3.142D+00	0.0	0.0	-1.000D-03

THE FOLLOWING INTEGER ARRAY (INDEP) PRESCRIBES INDEPENDENT VARIABLES (1), AND DEPENDENT VARIABLES (0)

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		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
1	1	0	0	0	0	0	1	0	1	1	1	1	0	1	0	0	0	1	1	1	0
1	21	0	0	1	0	1	0	1	1	1	1	0	0	1	1	0	1	0	1	1	1
1	41	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	61	1																			

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.05
THE CPU TIMER = 8.8657E+01

OUTPUT MATRIX -A- (48 X 42)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	21	0.0	0.0	0.0	0.0	2.885D-02	6.963D-02	4.536D-05	-8.604D+01	4.260D-02	-8.611D+01
1	31	-4.312D-02	5.845D-04	-5.292D-06	-5.845D-04	-5.292D-06	0.0	0.0	0.0	0.0	0.0
2	21	0.0	0.0	0.0	0.0	5.932D-02	-1.928D+03	-1.135D-02	-1.829D-01	9.932D+00	2.269D-01
2	31	-9.615D+00	9.711D-02	1.324D-03	-9.711D-02	1.324D-03	0.0	0.0	0.0	0.0	0.0
3	21	0.0	0.0	0.0	0.0	7.784D-06	0.0	6.977D+01	0.0	0.0	0.0
3	41	0.0	4.435D+02								
4	21	0.0	0.0	0.0	0.0	-1.244D+00	-2.746D+03	2.378D-01	3.834D+00	-2.082D+02	-4.756D+00
4	31	2.016D+02	-2.036D+00	-2.775D-02	2.036D+00	-2.775D-02	0.0	0.0	0.0	0.0	0.0
5	21	0.0	0.0	0.0	0.0	-2.732D+03	-1.237D+00	-9.756D-01	-2.388D+02	8.766D+00	2.385D+02
5	31	1.846D+01	-1.691D-02	1.138D-01	1.691D-02	1.138D-01	0.0	0.0	0.0	0.0	0.0
6	21	0.0	0.0	0.0	0.0	-7.784D-06	0.0	-6.977D+01	0.0	0.0	0.0
6	41	0.0	-8.870D+02								
7	21	0.0	0.0	0.0	0.0	2.240D+00	-1.525D+01	4.780D+00	6.671D+00	7.795D+02	-6.777D+00
7	31	-4.386D+01	-2.303D-01	-5.578D-01	2.303D-01	-5.578D-01	0.0	0.0	0.0	0.0	0.0
8	21	0.0	0.0	0.0	0.0	-1.033D+02	1.912D+00	-2.079D+00	-2.806D+02	4.876D+01	2.739D+02
8	31	2.960D+01	2.995D-02	2.425D-01	-2.995D-02	2.425D-01	0.0	0.0	0.0	0.0	0.0
9	21	0.0	0.0	0.0	0.0	-7.760D+00	-2.979D-01	-3.033D-02	1.256D+03	1.135D-01	5.327D-01
9	31	7.275D-01	-2.698D-03	3.539D-03	2.698D-03	3.539D-03	0.0	0.0	0.0	0.0	0.0
10	21	0.0	0.0	0.0	0.0	1.815D+00	-1.535D+01	-4.682D+00	5.724D+00	4.259D+01	-5.812D+00
10	31	-7.809D+02	-2.298D-01	5.463D-01	2.298D-01	5.463D-01	0.0	0.0	0.0	0.0	0.0
11	21	0.0	0.0	0.0	0.0	7.704D+00	1.629D-01	3.069D-02	4.778D-01	-2.072D-01	1.256D+03
11	31	-6.549D-01	1.565D-03	-3.581D-03	-1.565D-03	-3.581D-03	0.0	0.0	0.0	0.0	0.0
12	21	0.0	0.0	0.0	0.0	-2.794D-04	-4.860D-01	-3.033D-04	5.793D-03	-6.320D-03	-6.633D-03
12	31	1.478D-02	-9.870D+02	3.539D-05	1.927D-03	3.539D-05	0.0	0.0	0.0	0.0	0.0
13	31	0.0	0.0	-9.870D+02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	21	0.0	0.0	0.0	0.0	1.305D-01	2.269D+02	1.416D-01	-2.705D+00	2.951D+00	3.097D+00
14	31	-6.904D+00	-8.702D-02	-1.652D-02	-8.999D-01	-1.652D-02	0.0	0.0	0.0	0.0	0.0
15	21	0.0	0.0	0.0	0.0	2.256D+02	-5.542D-02	-1.717D+01	1.477D+02	2.399D+02	-1.475D+02
15	31	2.392D+02	2.135D-03	2.003D+00	-2.135D-03	2.003D+00	0.0	0.0	0.0	0.0	0.0

A-222

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE, CURRENT TIME = 12.26.06
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES THE CPU TIMER = 8.8913E+01

OUTPUT MATRIX -A- (48 X 42) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
16	21	0.0	0.0	0.0	0.0	-2.793D-04	-4.860D-01	-3.033D-04	5.794D-03	-6.320D-03	-6.633D-03
16	31	1.479D-02	-1.927D-03	3.539D-05	9.870D+02	3.539D-05	0.0	0.0	0.0	0.0	0.0
17	31	0.0	0.0	0.0	0.0	-9.870D+02	0.0	0.0	0.0	0.0	0.0
18	21	0.0	0.0	0.0	0.0	2.271D+02	3.166D-01	1.734D+01	1.512D+02	-2.421D+02	-1.510D+02
18	31	-2.420D+02	2.821D-04	-2.024D+00	-2.821D-04	-2.024D+00	0.0	0.0	0.0	0.0	0.0
19	1	-2.487D-04	-1.862D-03	0.0	1.377D-03	0.0	0.0	-1.313D-03	5.609D-02	2.487D-04	0.0
19	11	0.0	6.429D-08	0.0	-6.429D-05	-2.982D-02	0.0	0.0	-2.628D-02	0.0	0.0
20	1	0.0	7.966D-02	0.0	-5.891D-02	0.0	0.0	0.0	0.0	0.0	0.0
20	11	0.0	-5.891D-05	0.0	5.891D-02	0.0	0.0	0.0	0.0	0.0	0.0
21	11	0.0	0.0	0.0	0.0	3.947D-01	0.0	0.0	-3.947D-01	0.0	0.0
22	1	0.0	-3.436D-01	0.0	2.542D-01	0.0	0.0	0.0	0.0	0.0	0.0
22	11	0.0	-7.458D-04	0.0	7.458D-01	5.704D-03	0.0	0.0	-5.704D-03	0.0	0.0
23	1	-1.073D-03	-8.034D-03	0.0	5.942D-03	0.0	0.0	-5.665D-03	2.420D-01	1.073D-03	0.0
23	11	0.0	2.774D-07	0.0	-2.774D-04	3.594D-01	0.0	0.0	3.985D-01	0.0	0.0
24	1	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	1	2.873D-03	2.151D-02	-3.590D-09	-1.591D-02	7.396D-01	0.0	1.517D-02	-6.481D-01	-2.873D-03	0.0
25	11	0.0	-7.429D-07	0.0	7.429D-04	-2.527D-02	0.0	0.0	-6.618D-02	0.0	0.0
26	1	0.0	9.203D-01	0.0	5.891D-02	0.0	0.0	0.0	0.0	0.0	0.0
26	11	0.0	5.891D-05	0.0	-5.891D-02	0.0	0.0	0.0	0.0	0.0	0.0
27	1	0.0	0.0	-1.000D+00	0.0	-2.655D-09	0.0	0.0	2.327D-09	0.0	0.0
27	11	0.0	0.0	0.0	0.0	3.947D-01	0.0	0.0	-3.947D-01	0.0	0.0
28	1	6.295D-02	-5.540D-04	0.0	4.097D-04	0.0	0.0	-1.598D-03	6.827D-02	-6.295D-02	0.0
28	11	0.0	-1.188D-06	0.0	1.188D-03	-3.629D-02	0.0	0.0	-3.198D-02	0.0	0.0
29	1	0.0	-8.939D-02	0.0	6.611D-02	0.0	0.0	-6.326D-02	0.0	0.0	0.0
29	11	0.0	2.858D-06	0.0	-2.858D-03	-4.800D-01	0.0	0.0	4.800D-01	0.0	0.0
30	1	6.356D-02	2.463D-04	0.0	-1.821D-04	0.0	0.0	1.595D-03	-6.817D-02	-3.022D-04	0.0
30	11	-6.326D-02	1.413D-06	0.0	-1.413D-03	3.623D-02	0.0	0.0	3.193D-02	0.0	0.0
31	1	0.0	8.939D-02	0.0	-6.611D-02	0.0	0.0	0.0	0.0	0.0	6.326D-02
31	11	0.0	-2.858D-06	0.0	2.858D-03	-4.800D-01	0.0	0.0	4.800D-01	0.0	0.0

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.06
THE CPU TIMER = 8.9180E+01

OUTPUT MATRIX -A- (48 X 42) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
32	1	0.0	-7.966D-02	0.0	5.891D-02	0.0	0.0	0.0	0.0	0.0	0.0
32	11	0.0	1.0000D+00	0.0	-5.891D-02	0.0	0.0	0.0	0.0	0.0	0.0
33	11	0.0	0.0	1.0000D+00	0.0	-3.947D-01	0.0	0.0	3.947D-01	0.0	0.0
34	1	0.0	7.966D-02	0.0	-5.891D-02	0.0	0.0	0.0	0.0	0.0	0.0
34	11	0.0	-5.891D-05	0.0	5.891D-02	0.0	-1.0000D+00	0.0	0.0	0.0	0.0
35	11	0.0	0.0	0.0	0.0	-3.947D-01	0.0	1.0000D+00	3.947D-01	0.0	0.0
36	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.741D+01
36	31	0.0	0.0	0.0	0.0	0.0	-1.600D-01	0.0	0.0	0.0	0.0
37	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.549D+03
37	31	0.0	0.0	0.0	0.0	0.0	-2.050D+01	-2.0000D+00	0.0	0.0	0.0
38	21	1.272D+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.136D-01	0.0	0.0
39	21	4.569D+03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.675D+01	-2.0000D+00	0.0
40	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.272D+01	0.0
40	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.136D-01
41	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.419D+03	0.0
41	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.750D+01
41	41	-2.0000D+00	0.0								
42	1	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0
43	1	2.873D-03	2.151D-02	-3.590D-09	-1.591D-02	7.396D-01	0.0	1.517D-02	-6.481D-01	-2.873D-03	0.0
43	11	0.0	-7.429D-07	0.0	7.429D-04	-2.527D-02	0.0	0.0	-6.618D-02	0.0	0.0
44	1	0.0	9.203D-01	0.0	5.891D-02	0.0	0.0	0.0	0.0	0.0	0.0
44	11	0.0	5.891D-05	0.0	-5.891D-02	0.0	0.0	0.0	0.0	0.0	0.0
45	1	0.0	0.0	-1.0000D+00	0.0	-2.655D-09	0.0	0.0	2.327D-09	0.0	0.0
45	11	0.0	0.0	0.0	0.0	3.947D-01	0.0	0.0	-3.947D-01	0.0	0.0
46	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0
47	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00

A-224

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.06
THE CPU TIMER = 8.9420E+01

OUTPUT MATRIX -A- (48 X 42) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
48	21	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

END OF WRITE.

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.12
THE CPU TIMER = 9.2263E+01

OUTPUT MATRIX -T- (42 X 42)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0.0	-6.401D-02	0.0	0.0	0.0	0.0	0.0	0.0	-6.401D-05	0.0
2	11	6.401D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.087D+00	0.0	0.0
3	1	1.031D-11	-6.206D-11	0.0	5.445D-11	1.388D-17	-1.031D-11	0.0	0.0	-7.610D-15	0.0
3	11	7.610D-12	3.947D-01	0.0	0.0	-3.947D-01	0.0	0.0	0.0	0.0	0.0
3	31	0.0	0.0	0.0	0.0	0.0	0.0	-3.590D-09	8.391D-11	-1.0000D+00	0.0
4	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1	-3.885D-03	2.338D-02	0.0	-2.051D-02	8.764D-01	3.885D-03	0.0	0.0	2.866D-06	0.0
5	11	-2.866D-03	3.416D-02	0.0	0.0	8.949D-02	0.0	0.0	0.0	0.0	0.0
5	31	0.0	0.0	0.0	0.0	0.0	0.0	1.352D+00	-3.161D-02	-4.854D-09	0.0
6	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0
8	1	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0
9	1	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0
10	1	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0
13	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00
14	11	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	11	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	11	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	11	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0
18	11	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0
19	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.13
THE CPU TIMER = 9.2473E+01

OUTPUT MATRIX -T- (42 X 42) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
20	41	1.0000D+00	0.0								
21	41	0.0	1.0000D+00								
22	11	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0
23	11	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0
24	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0
25	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0
26	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00
27	21	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	21	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	21	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	21	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0
31	21	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0
32	21	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0
33	21	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0
34	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0
35	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0
36	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00
37	31	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	31	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	31	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	31	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0
41	31	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.13
THE CPU TIMER = 9.2660E+01

OUTPUT MATRIX -T- (42 X 42) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
42	31	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0

END OF WRITE.

A-228

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.22
THE CPU TIMER = 9.7540E+01

OUTPUT MATRIX Y* (1 X 42)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

END OF WRITE.

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.32
THE CPU TIMER = 1.0226E+02

OUTPUT MATRIX -A*- (42 X 42)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.885D-02	6.963D-02
1	21	4.536D-05	-8.604D+01	4.260D-02	-8.611D+01	-4.312D-02	5.845D-04	-5.292D-06	-5.845D-04	-5.292D-06	0.0
2	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.244D+00	-2.746D+03
2	21	2.378D-01	3.834D+00	-2.082D+02	-4.756D+00	2.016D+02	-2.036D+00	-2.775D-02	2.036D+00	-2.775D-02	0.0
3	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-7.784D-06	0.0
3	21	-6.977D+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-8.870D+02	0.0
4	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.240D+00	-1.525D+01
4	21	4.780D+00	6.671D+00	7.795D+02	-6.777D+00	-4.386D+01	-2.303D-01	-5.578D-01	2.303D-01	-5.578D-01	0.0
5	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.033D+02	1.912D+00
5	21	-2.079D+00	-2.806D+02	4.876D+01	2.739D+02	2.960D+01	2.995D-02	2.425D-01	-2.995D-02	2.425D-01	0.0
6	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-7.760D+00	-2.979D-01
6	21	-3.033D-02	1.256D+03	1.135D-01	5.327D-01	7.275D-01	-2.698D-03	3.539D-03	2.698D-03	3.539D-03	0.0
7	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.815D+00	-1.535D+01
7	21	-4.682D+00	5.724D+00	4.259D+01	-5.812D+00	-7.809D+02	-2.298D-01	5.463D-01	2.298D-01	5.463D-01	0.0
8	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.704D+00	1.629D-01
8	21	3.069D-02	4.778D-01	-2.072D-01	1.256D+03	-6.549D-01	1.565D-03	-3.581D-03	-1.565D-03	-3.581D-03	0.0
9	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.794D-04	-4.860D-01
9	21	-3.033D-04	5.793D-03	-6.320D-03	-6.633D-03	1.478D-02	-9.870D+02	3.539D-05	1.927D-03	3.539D-05	0.0
10	21	0.0	0.0	0.0	0.0	0.0	0.0	-9.870D+02	0.0	0.0	0.0
11	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.305D-01	2.269D+02
11	21	1.416D-01	-2.705D+00	2.951D+00	3.097D+00	-6.904D+00	-8.702D-02	-1.652D-02	-8.999D-01	-1.652D-02	0.0
12	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.256D+02	-5.542D-02
12	21	-1.717D+01	1.477D+02	2.399D+02	-1.475D+02	2.392D+02	2.135D-03	2.003D+00	-2.135D-03	2.003D+00	0.0
13	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.793D-04	-4.860D-01
13	21	-3.033D-04	5.794D-03	-6.320D-03	-6.633D-03	1.479D-02	-1.927D-03	3.539D-05	9.870D+02	3.539D-05	0.0
14	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-9.870D+02	0.0
15	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.271D+02	3.166D-01
15	21	1.734D+01	1.512D+02	-2.421D+02	-1.510D+02	-2.420D+02	2.821D-04	-2.024D+00	-2.821D-04	-2.024D+00	0.0

A-230

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.32
THE CPU TIMER = 1.0251E+02

OUTPUT MATRIX -A*- (42 X 42) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
16	1	0.0	2.762D-01	0.0	0.0	0.0	0.0	0.0	0.0	-7.238D-04	0.0
16	11	7.238D-01	5.704D-03	0.0	0.0	-5.704D-03	0.0	0.0	0.0	0.0	0.0
16	31	0.0	0.0	0.0	-3.734D-01	0.0	0.0	0.0	0.0	0.0	0.0
17	1	-1.073D-03	6.456D-03	0.0	-5.665D-03	2.420D-01	1.073D-03	0.0	0.0	7.917D-07	0.0
17	11	-7.917D-04	3.594D-01	0.0	0.0	3.985D-01	0.0	0.0	0.0	0.0	0.0
17	31	0.0	0.0	0.0	-8.730D-03	0.0	0.0	0.0	0.0	0.0	0.0
18	1	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	1	0.0	-8.674D-19	0.0	8.674D-19	-1.388D-17	-5.421D-20	0.0	0.0	-3.970D-23	0.0
19	11	1.084D-19	-1.735D-18	0.0	0.0	-1.388D-17	0.0	0.0	0.0	0.0	0.0
19	31	0.0	0.0	1.0000D+00	0.0	4.136D-25	0.0	0.0	0.0	0.0	0.0
20	1	0.0	3.469D-18	0.0	0.0	0.0	0.0	0.0	0.0	3.388D-21	0.0
20	11	-3.469D-18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	31	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0
21	1	0.0	0.0	0.0	-3.231D-27	0.0	0.0	0.0	0.0	0.0	0.0
21	11	-2.019D-28	0.0	0.0	0.0	-1.388D-17	0.0	0.0	0.0	0.0	0.0
21	31	0.0	0.0	5.687D-25	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0
22	1	6.295D-02	4.452D-04	0.0	-1.598D-03	6.827D-02	-6.295D-02	0.0	0.0	-1.153D-06	0.0
22	11	1.153D-03	-3.629D-02	0.0	0.0	-3.198D-02	0.0	0.0	0.0	0.0	0.0
22	31	0.0	0.0	0.0	-6.019D-04	0.0	0.0	0.0	0.0	0.0	0.0
23	1	0.0	7.184D-02	0.0	-6.326D-02	0.0	0.0	0.0	0.0	8.580D-06	0.0
23	11	-8.580D-03	-4.800D-01	0.0	0.0	4.800D-01	0.0	0.0	0.0	0.0	0.0
23	31	0.0	0.0	0.0	-9.713D-02	0.0	0.0	0.0	0.0	0.0	0.0
24	1	6.356D-02	-1.979D-04	0.0	1.595D-03	-6.817D-02	-3.022D-04	0.0	-6.326D-02	1.397D-06	0.0
24	11	-1.397D-03	3.623D-02	0.0	0.0	3.193D-02	0.0	0.0	0.0	0.0	0.0
24	31	0.0	0.0	0.0	2.676D-04	0.0	0.0	0.0	0.0	0.0	0.0
25	1	0.0	-7.184D-02	0.0	0.0	0.0	0.0	6.326D-02	0.0	-8.580D-06	0.0
25	11	8.580D-03	-4.800D-01	0.0	0.0	4.800D-01	0.0	0.0	0.0	0.0	0.0
25	31	0.0	0.0	0.0	9.713D-02	0.0	0.0	0.0	0.0	0.0	0.0
26	1	0.0	6.401D-02	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0
26	11	-6.401D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	31	0.0	0.0	0.0	-8.655D-02	0.0	0.0	0.0	0.0	0.0	0.0
27	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00
27	11	0.0	-3.947D-01	0.0	0.0	3.947D-01	0.0	0.0	0.0	0.0	0.0

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.33
THE CPU TIMER = 1.0276E+02

OUTPUT MATRIX -A*- (42 X 42) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
28	1	0.0	-6.401D-02	0.0	0.0	0.0	0.0	0.0	0.0	-6.401D-05	0.0
28	11	6.401D-02	0.0	-1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	31	0.0	0.0	0.0	8.655D-02	0.0	0.0	0.0	0.0	0.0	0.0
29	11	0.0	-3.947D-01	0.0	1.0000D+00	3.947D-01	0.0	0.0	0.0	0.0	0.0
30	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.600D-01
30	41	1.741D+01	0.0								
31	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.050D+01
31	31	-2.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	41	2.549D+03	0.0								
32	31	0.0	-1.136D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	41	0.0	1.272D+01								
33	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.975D+03	-2.609D-02
33	21	-1.966D-02	-1.235D+01	1.931D-01	1.234D+01	3.556D-01	-3.227D-04	2.294D-03	3.227D-04	2.294D-03	0.0
33	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.592D-06	0.0
34	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.635D-02	-1.950D+03
34	21	-4.774D-03	2.169D-01	-3.299D+00	-2.539D-01	3.432D+00	-8.358D-02	5.570D-04	8.358D-02	5.570D-04	0.0
35	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.110D-01	-1.469D-01
35	21	-8.339D+01	-1.377D+00	1.903D+02	1.375D+00	1.900D+02	7.314D-04	1.590D+00	-7.314D-04	1.590D+00	0.0
35	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.435D+02	0.0
36	31	0.0	-3.675D+01	0.0	0.0	0.0	-2.000D+00	0.0	0.0	0.0	0.0
36	41	0.0	4.569D+03								
37	31	0.0	0.0	0.0	0.0	0.0	0.0	-1.136D-01	0.0	0.0	1.272D+01
38	31	0.0	0.0	0.0	0.0	0.0	0.0	-2.750D+01	-2.000D+00	0.0	3.419D+03
39	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	1	-2.487D-04	1.496D-03	0.0	-1.313D-03	5.609D-02	2.487D-04	0.0	0.0	1.835D-07	0.0
40	11	-1.835D-04	-2.982D-02	0.0	0.0	-2.628D-02	0.0	0.0	0.0	0.0	0.0
40	31	0.0	0.0	0.0	-2.023D-03	0.0	0.0	0.0	0.0	0.0	0.0
41	1	0.0	-6.401D-02	0.0	0.0	0.0	0.0	0.0	0.0	-6.401D-05	0.0
41	11	6.401D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	31	0.0	0.0	0.0	8.655D-02	0.0	0.0	0.0	0.0	0.0	0.0

A-232

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE,
CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.33
THE CPU TIMER = 1.0301E+02

OUTPUT MATRIX -A*- (42 X 42) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
42	11	0.0	3.947D-01	0.0	0.0	-3.947D-01	0.0	0.0	0.0	0.0	0.0

END OF WRITE.

ATS-F -- 6 INTERCONNECTED BODIES, LINEAR FREQUENCY DOMAIN RESPONSE, CONSTANT SPEED (ZERO) MOMENTUM WHEELS, FORWARD LOOP (PLANT) POLES

CURRENT TIME = 12.26.36
THE CPU TIMER = 1.0550E+02

	RT A		RTA*	
NO	REAL PART	IMAGINARY PART	REAL PART	IMAGINARY PART
1	-0.20000D+01	0.0	-0.20000D+01	0.0
2	-0.20000D+01	0.0	-0.20000D+01	0.0
3	-0.20000D+01	0.0	-0.20000D+01	0.0
4	-0.16000D+00	0.0	-0.16000D+00	0.0
5	-0.11364D+00	0.0	-0.11364D+00	0.0
6	-0.11364D+00	0.0	-0.11364D+00	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	-0.44157D+02
16	0.0	0.0	0.0	0.44157D+02
17	0.0	0.0	0.0	-0.44439D+02
18	0.0	0.0	0.0	0.44439D+02
19	0.0	-0.44157D+02	0.0	-0.31416D+02
20	0.0	0.44157D+02	0.0	0.31416D+02
21	0.0	-0.44439D+02	0.0	-0.31416D+02
22	0.0	0.44439D+02	0.0	0.31416D+02
23	0.0	-0.31416D+02	0.0	-0.31422D+02
24	0.0	0.31416D+02	0.0	0.31422D+02
25	0.0	-0.31416D+02	0.0	-0.31518D+02
26	0.0	0.31416D+02	0.0	0.31518D+02
27	0.0	-0.31422D+02	0.0	-0.30403D+02
28	0.0	0.31422D+02	0.0	0.30403D+02
29	0.0	-0.31518D+02	0.0	-0.22754D+02
30	0.0	0.31518D+02	0.0	0.22754D+02
31	0.0	-0.30403D+02	0.0	-0.11701D+02
32	0.0	0.30403D+02	0.0	0.11701D+02
33	0.0	-0.22754D+02	0.0	-0.95057D+01
34	0.0	0.22754D+02	0.0	0.95057D+01
35	0.0	-0.11701D+02	0.0	-0.89951D+01
36	0.0	0.11701D+02	0.0	0.89951D+01
37	0.0	-0.95057D+01	0.0	-0.58385D+01
38	0.0	0.95057D+01	0.0	0.58385D+01
39	0.0	-0.89951D+01	0.0	0.0
40	0.0	0.89951D+01	0.0	0.0
41	0.0	-0.58385D+01	0.0	0.0
42	0.0	0.58385D+01	0.0	0.0

Demonstration Problem 7

Preceding Page Blank

```
      SUBROUTINE EXTON  (TEX,ISPN,NTEX)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION TEX(6,1), ISPN(1)
C
             COMMON /MAXMUM/
     *   NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU
             COMMON /SPECIF/
     *   BETAM(6, 6),BETAMD(6, 6),AMD(2, 5),RH(3,3,30),RS(3,3,30),
     *   DH(3,35),DS(3,30),IMD(3, 5),NMOW(6, 6),IFTSMW(15),
     *   NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IMDATA(7, 6),
     *   LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
             COMMON /VECTOR/
     *   Y(250),YDT(250)
             COMMON /TIMESS/
     *   STARTT,DELTAT,T,ENDT,TMST
C
      DATA I1ST / 0 /
C
CCC ESTABLISH THE EXTERNAL FORCE/TORQUE (6-LONG VECTOR) AND NUMBER
CCC  THE CORRESPONDING SENSOR POINTS. ALSO ESTABLISH THE NUMBER OF
CCC  SIX-LONG VECTORS (NTEX).
C
      IF (I1ST .EQ. 1) GO TO 5
      I1ST = 1
      DO 10 I=1,6
      DO 10 J=1,NSPMAX
   10 TEX(I,J) = 0.D 0
C
    5 NTEX = 0
      NTEX # 1
      ISPN%1< # 4
      TEX%5,1< # 10.0D0*DSIN%800.0D0*T<
      TEX%6,1< # 20.0D0*DSIN%600.0D0*T<
      IF (T .GT. .01D 0) TEX(5,1) = 0.D0
      IF (T .GT. .01D 0) TEX(6,1) = 0.D0
C
      RETURN
      END
```

```
DEMO 7     A. C. PARK  X2461
  NASS-11996 DEMO PROBLEM 7
  W. CASE TWO BEAM PROBLEM
  DEMONSTRATION OF DYNAMO/NASTRAN INTERFACE
  TWO BEAMS HOOKED TOGETHER AND EXCITED BY A TIP FORCE
  USING TWO BEAM DATA GENERATED BY W. CASE USING NASTRAN
  CARD INPUT TO DYNAMO GENERATED USING MMC DEVELOPED
  PROGRAM NASFOR
0000000000
    2    2    4    0    0
ITOPOL   2    2
    1    1    1    2
    2    1    0    1
0000000000
IRGFL    1    2
    1    1    5    5
0000000000
IFTSMW   1    4
    1    1    1    1    2    2
0000000000
IHDAT    7    2
    1    1    1    1
    2    1    1    1
    3    1    1    1
    4    1    1    1
    5    1    1    1
    6    1    1    1
    7    1    1    1
0000000000
BETAM    6    2
0000000000
BETAMD   6    2
0000000000
TIMES    1    3
    1    1   0.0                .0004              .040
0000000000
IPDATA   1    3
    1    1   20    1    0
0000000000
CNTDAT   1  100
0000000000
GRAV     1    4
0000000000
    1       BODY 1 DATA FOLLOWS
MASS    11    1
    1    1   0.12954987D-02
    2    1   0.25909975D-02
    3    1   0.25909975D-02
    4    1   0.25909975D-02
    5    1   0.25909975D-02
```

Reproduced from best available copy

```
    6     1    0.25909975D-02
    7     1    0.25909975D-02
    8     1    0.25909975D-02
    9     1    0.25909975D-02
   10     1    0.25909975D-02
   11     1    0.12954987D-02
0000000000
INER     11      6
    1     1   .00001
    2     1   .00001
    3     1   .00001
    4     1   .00001
    5     1   .00001
    6     1   .00001
    7     1   .00001
    8     1   .00001
    9     1   .00001
   10     1   .00001
   11     1   .00001
0000000000
STAT     11      3
0000000000
GEOM1    11      3
    1     1    0.10000000D+04    0.0                0.0
    2     1    0.90000000D+03    0.0                0.0
    3     1    0.80000000D+03    0.0                0.0
    4     1    0.70000000D+03    0.0                0.0
    5     1    0.60000000D+03    0.0                0.0
    6     1    0.50000000D+03    0.0                0.0
    7     1    0.40000000D+03    0.0                0.0
    8     1    0.30000000D+03    0.0                0.0
    9     1    0.20000000D+03    0.0                0.0
   10     1    0.10000000D+03    0.0                0.0
0000000000
HX       11      5
0000000000
HY       11      5
    1     1   -0.12376922D+02    0.0                0.0               -0.12084707D+02
    1     5    0.11568521D+02
    2     1   -0.10669791D+02    0.0                0.0               -0.61861525D+01
    2     5    0.20278311D+01
    3     1   -0.89724188D+01    0.0                0.0               -0.62036224D+00
    3     5   -0.52997427D+01
    4     1   -0.73051090D+01    0.0                0.0                0.40810165D+01
    4     5   -0.80317001D+01
    5     1   -0.56991653D+01    0.0                0.0                0.73503780D+01
    5     5   -0.54244461D+01
    6     1   -0.41948481D+01    0.0                0.0                0.88008757D+01
    6     5    0.68391705D+00
    7     1   -0.28394232D+01    0.0                0.0                0.83771973D+01
```

```
     7     5    0.67053556D+01
     8     1   -0.16853228D+01   0.0              0.0              0.64233694D+01
     8     5    0.92938280D+01
     9     1   -0.78850138D+00   0.0              0.0              0.36655264D+01
     9     5    0.73203621D+01
    10     1   -0.20702684D+00   0.0              0.0              0.11256809D+01
    10     5    0.27407522D+01
0000000000
HZ        11     5
     1     1    0.0              0.12376922D+02  -0.12084707D+02   0.0
     2     1    0.0              0.10669791D+02  -0.61861525D+01   0.0
     3     1    0.0              0.89724198D+01  -0.62036228D+00   0.0
     4     1    0.0              0.73051090D+01   0.40610135D+01   0.0
     5     1    0.0              0.56991653D+01   0.73503780D+01   0.0
     6     1    0.0              0.41948481D+01   0.88008757D+01   0.0
     7     1    0.0              0.28394232D+01   0.83771973D+01   0.0
     8     1    0.0              0.16853228D+01   0.64233694D+01   0.0
     9     1    0.0              0.78850138D+00   0.36655264D+01   0.0
    10     1    0.0              0.20702684D+00   0.11256809D+01   0.0
0000000000
SIGX      11     5
0000000000
SIGY      11     5
     1     1    0.0             -0.17083937D+00   0.59459314D+00   0.0
     2     1    0.0             -0.17046039D+00   0.58038015D+00   0.0
     3     1    0.0             -0.16866992D+00   0.52318974D+00   0.0
     4     1    0.0             -0.16426460D+00   0.40701159D+00   0.0
     5     1    0.0             -0.15624772D+00   0.23998601D+00   0.0
     6     1    0.0             -0.14382279D+00   0.49002107D-01   0.0
     7     1    0.0             -0.12638376D+00  -0.12794867D+00   0.0
     8     1    0.0             -0.10349977D+00  -0.25045930D+00   0.0
     9     1    0.0             -0.74893708D-01  -0.28371541D+00   0.0
    10     1    0.0             -0.40414177D-01  -0.20398563D+00   0.0
0000000000
SIGZ      11     5
     1     1   -0.17083937D+00   0.0              0.0             -0.59459314D+00
     1     5    0.98891817D+00
     2     1   -0.17046039D+00   0.0              0.0             -0.58038015D+00
     2     5    0.88437079D+00
     3     1   -0.16866992D+00   0.0              0.0             -0.52318974D+00
     3     5    0.53407792D+00
     4     1   -0.16426460D+00   0.0              0.0             -0.40701159D+00
     4     5   -0.28230931D-02
     5     1   -0.15624772D+00   0.0              0.0             -0.23998601D+00
     5     5   -0.48537452D+00
     6     1   -0.14382279D+00   0.0              0.0             -0.49002107D-01
     6     5   -0.67036398D+00
     7     1   -0.12638376D+00   0.0              0.0              0.12794867D+00
     7     5   -0.47211010D+00
     8     1   -0.10349977D+00   0.0              0.0              0.25045930D+00
```

```
     8    5  -0.24168927D-01
     9    1  -0.74893708D-01   0.0               0.0               0.28371541D+00
     9    5   0.38428387D+00
    10    5   0.45295619D+00
 0000000000
 STIF     5     5
     1    1   0.47277921D+04   0.0               0.0               0.0
     2    1   0.0              0.47277921D+04    0.0               0.0
     3    1   0.0              0.0               0.18156949D+06    0.0
     4    1   0.0              0.0               0.0               0.18156949D+06
     5    5   0.13951687D+07
 0000000000
 DAMP     5     5
     1    1   0.34379472D+00   0.0               0.0               0.0
     2    1   0.0              0.34379472D+00    0.0               0.0
     3    1   0.0              0.0               0.21305486D+01    0.0
     4    1   0.0              0.0               0.0               0.21305486D+01
     5    5   0.59058617D+01
 0000000000
   0.0       0.0       0.0       0.0       0.0
   0.0       0.0       0.0       0.0       0.0
     2    1     1
   0.0        0.0       0.0
     1    1    11
   0.0        0.0       0.0
     2    1     1
   0.0        0.0       0.0
     1       BODY 2 DATA FOLLOWS
 MASS    11     1
     1    1   0.51819988D-02
     2    1   0.10363998D-01
     3    1   0.10363998D-01
     4    1   0.10363998D-01
     5    1   0.10363998D-01
     6    1   0.10363998D-01
     7    1   0.10363998D-01
     8    1   0.10363998D-01
     9    1   0.10363998D-01
    10    1   0.10363998D-01
    11    1   0.51819988D-02
 0000000000
 INER    11     6
     1    1  .00001
     2    1  .00001
     3    1  .00001
     4    1  .00001
     5    1  .00001
     6    1  .00001
     7    1  .00001
     8    1  .00001
```

```
     9     1   .00001
    10     1   .00001
    11     1   .00001
0000000000
STAT     11     3
0000000000
GEOM2    11     3
     1     1   0.10000000D+04   0.0               0.0
     2     1   0.90000000D+03   0.0               0.0
     3     1   0.80000000D+03   0.0               0.0
     4     1   0.70000000D+03   0.0               0.0
     5     1   0.60000000D+03   0.0               0.0
     6     1   0.50000000D+03   0.0               0.0
     7     1   0.40000000D+03   0.0               0.0
     8     1   0.30000000D+03   0.0               0.0
     9     1   0.20000000D+03   0.0               0.0
    10     1   0.10000000D+03   0.0               0.0
0000000000
HX       11     5
0000000000
HY       11     5
     1     1   0.0               -0.10000000D+01   0.0               -0.10000000D+01
     1     5   0.10000000D+01
     2     1   0.0               -0.86207139D+00   0.0               -0.51189923D+00
     2     5   0.17528868D+00
     3     1   0.0               -0.72493124D+00   0.0               -0.51334482D-01
     3     5  -0.45811749D+00
     4     1   0.0               -0.59022021D+00   0.0                0.33770090D+00
     4     5  -0.69427192D+00
     5     1   0.0               -0.46046710D+00   0.0                0.60823810D+00
     5     5  -0.46869710D+00
     6     1   0.0               -0.33892448D+00   0.0                0.72826546D+00
     6     5   0.59118792D-01
     7     1   0.0               -0.22941256D+00   0.0                0.69320643D+00
     7     5   0.57962078D+00
     8     1   0.0               -0.13616657D+00   0.0                0.53152871D+00
     8     5   0.80337209D+00
     9     1   0.0               -0.63707352D-01   0.0                0.30331928D+00
     9     5   0.63278282D+00
    10     1   0.0               -0.16726829D-01   0.0                0.93149245D-01
    10     5   0.23691463D+00
0000000000
HZ       11     5
     1     1   0.10000000D+01   0.0               -0.10000000D+01   0.0
     2     1   0.86207139D+00   0.0               -0.51189923D+00   0.0
     3     1   0.72493124D+00   0.0               -0.51334482D-01   0.0
     4     1   0.59022021D+00   0.0                0.33770090D+00   0.0
     5     1   0.46046710D+00   0.0                0.60823810D+00   0.0
     6     1   0.33892448D+00   0.0                0.72826546D+00   0.0
     7     1   0.22941256D+00   0.0                0.69320643D+00   0.0
```

```
    8     1    0.13616657D+00    0.0                 0.53152871D+00    0.0
    9     1    0.63707352D-01    0.0                 0.30331928D+00    0.0
   10     1    0.16726829D-01    0.0                 0.93149245D-01    0.0
0000000000
SIGX     11       5
0000000000
SIGY     11       5
    1     1   -0.13803066D-01    0.0                 0.49202114D-01    0.0
    2     1   -0.13772449D-01    0.0                 0.48026001D-01    0.0
    3     1   -0.13627767D-01    0.0                 0.43293535D-01    0.0
    4     1   -0.13271837D-01    0.0                 0.33679897D-01    0.0
    5     1   -0.12624128D-01    0.0                 0.19658649D-01    0.0
    6     1   -0.11620251D-01    0.0                 0.40548735D-02    0.0
    7     1   -0.10211233D-01    0.0                -0.10587645D-01    0.0
    8     1   -0.83623114D-02    0.0                -0.20725320D-01    0.0
    9     1   -0.60510827D-02    0.0                -0.23477220D-01    0.0
   10     1   -0.32652807D-02    0.0                -0.16879641D-01    0.0
0000000000
SIGZ     11       5
    1     1    0.0               -0.13803066D-01    0.0               -0.49202114D-01
    1     5    0.85483545D-01
    2     1    0.0               -0.13772449D-01    0.0               -0.44026001D-01
    2     5    0.76446306D-01
    3     1    0.0               -0.13627767D-01    0.0               -0.43293535D-01
    3     5    0.46106475D-01
    4     1    0.0               -0.13271837D-01    0.0               -0.33679897D-01
    4     5   -0.24402604D-03
    5     1    0.0               -0.12624128D-01    0.0               -0.19658649D-01
    5     5   -0.41956485D-01
    6     1    0.0               -0.11620251D-01    0.0               -0.40548735D-02
    6     5   -0.57947249D-01
    7     1    0.0               -0.10211233D-01    0.0                0.10587645D-01
    7     5   -0.40809886D-01
    8     1    0.0               -0.83623114D-02    0.0                0.20725320D-01
    8     5   -0.20891961D-02
    9     1    0.0               -0.60510827D-02    0.0                0.23477220D-01
    9     5    0.33218059D-01
   10     1    0.0               -0.32652807D-02    0.0                0.16879641D-01
   10     5    0.39154197D-01
0000000000
STIF      5       5
    1     1    0.30862645D+02    0.0                0.0                0.0
    2     1    0.0               0.30862645D+02     0.0                0.0
    3     1    0.0               0.0                0.12432861D+04     0.0
    4     1    0.0               0.0                0.0                0.12432861D+04
    5     5    0.10424881D+05
0000000000
DAMP      5       5
    1     1    0.89770585D-02    0.0                0.0                0.0
    2     1    0.0               0.89770585D-02     0.0                0.0
```

```
    3    1   0.0              0.0              0.583552000-01   0.0
    4    1   0.0              0.0              0.0              0.583552000-01
    5    5   0.176517490+00
0000000000
  0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      0.0
    2    1   11
   0.0      0.0      0.0
    3    1   11
   0.0      0.0      0.0
    4    1    1
   0.0      0.0      0.0
NAS5-11996 GSFC DEMO PROBLEM 7 -- W. CASE TWO BEAM NASTRAN MODEL
    4
   13
    1    2    3    4    5    6    7   13   14   15   16   17   18
    1    2    3    4
TIME      OMG1         BODY 1 ROT VEL
    1    5    6    7
TIME      UVW1         BODY 1 TRANS VEL
    1    8    9   10
TIME      OMG2         BODY 2 ROT VEL
    1   11   12   13
TIME      UVW2         BODY 2 TRANS VEL
0000000000
   13
    1   66   67   68   69   70   71   72   73   74   75   76   77
    1    2    3    4
TIME      LAM1R        HINGE 1 ROT CONSTRAINTS
    1    5    6    7
TIME      LAM1T        HINGE 1 TRANS CONSTRAINTS
    1    8    9   10
TIME      LAM2R        HINGE 2 ROT CONSTRAINTS
    1   11   12   13
TIME      LAM2T        HINGE 2 TRANS CONSTRAINTS
0000000000
   11
    1  112  113  114  115  116  117  118  119  120  121
    1    2    3    4
TIME      HTOTA        ANG MOMENTUM
    1    5    6    7
TIME      HTOTL        TRANS MOMENTUM
    1    8    9
TIME      KE           KINETIC ENERGY
    1   10   11
TIME      PE           POTENTILE ENERGY
0000000000
    6
    1  122  123  124  125  126
    1    2    3
```

Reproduced from best available copy

```
TIME       MOM            TOTAL MOMENTUM
    1    4    5    6
TIME       ENG            TOTAL ENERGY
0000000000
STOP
```

NAS5-11996 DEMO PROBLEM 7
W. CASE TWO BEAM PROBLEM

CURRENT TIME = 00.16.26
THE CPU TIMER = 0.0

DEMONSTRATION OF DISCOS/NASTRAN INTERFACE
TWO BEAMS HOOKED TOGETHER AND EXCITED BY A TIP FORCE
USING TWO BEAM DATA GENERATED BY W. CASE USING NASTRAN
CARD INPUT TO DISCOS GENERATED USING MMC DEVELOPED
PROGRAM NASFOR

A-246

NAS5-11996 DEMO PROBLEM 7
W. CASE TWO BEAM PROBLEM

CURRENT TIME = 00.16.27
THE CPU TIMER = 2.4000E-01

SUMMARY OF DYNAMIC-SIMULATION-PROGRAM INPUT DATA * * * * * * * * * * *

ACTUAL SIZES		MAXIMUM SIZES		INTEGRATION DATA		GRAVITY GRADIENT DATA				MISC. DATA	
NB =	2	NBMAX =	6	STARTT =	0.0	G1 =	0.0	GAMA1 =	0.0	NOPRNT =	20
NH =	2	NHMAX =	6	DELTAT =	4.0000D-04	G2 =	0.0	GAMA2 =	0.0	NOPLOT =	1
NSPT =	4	NSPMAX =	15	ENDT =	4.0000D-02	G3 =	0.0	GAMA3 =	0.0	IFLNER =	0
NOFMU =	0	NMWMAX =	5			GMAG =	0.0	RCMAG =	0.0		
NDELTA =	0	NMWBOD =	4								
NU =	22	NMDBOD =	12								
NBETA =	0	KMU =	22								
NLAM =	12	KY =	250								
NEQ =	32	KU =	113								

THE TOPOLOGY ARRAY (ITOPOL) FOR THIS CASE FOLLOWS

		(1)	(2)
1	1	1	2
2	1	0	1

THE CONSTRAINT SPECIFICATIONS FOR THIS CASE FOLLOW

		(1)	(2)
1	1	1	1
2	1	1	1
3	1	1	1
4	1	1	1
5	1	1	1
6	1	1	1
7	1	1	1

THE SPECIFIED INITIAL HINGE ANGLES AND DISPLACEMENTS (BETAH) FOLLOW

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

THE SPECIFIED INITIAL HINGE RATES (BETAHD) FOLLOW

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

NAS5-11996 DEMO PROBLEM 7
W. CASE TWO BEAM PROBLEM

CURRENT TIME = 00.16.27
THE CPU TIMER = 3.7333E-01

THE NO. OF ELASTIC MODES/BODY ARRAY (IRGFLX) FOLLOWS

		(1)	(2)
1	1	5	5

THE NO. OF P/Q HINGE POINTS/BODY ARRAY (NHPOI) FOLLOWS

		(1)	(2)
1	1	1	1

THE NO. OF SENSOR POINTS/BODY ARRAY (NSPOI) FOLLOWS

		(1)	(2)
1	1	2	2

THE MOM. WHEEL/BODY TABLE (NMOW) FOLLOWS

		(1)	(2)
1	1	0	0
2	1	0	0
3	1	0	0
4	1	0	0
5	1	0	0
6	1	0	0

THE STATE VECTOR LENGTH ARRAY (LENU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	11	11	5	5	0	0

THE STATE VECTOR LOCATION ARRAY (LOCU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	12	23	28	33	33

THE SPECIFIED SENSOR POINT/BODY CORRELATION ARRAY (IFTSMW) FOLLOWS

		(1)	(2)	(3)	(4)
1	1	1	1	2	2

A-248

NAS5-11996 DEMO PROBLEM 7
W. CASE TWO BEAM PROBLEM

CURRENT TIME = 00.16.27
THE CPU TIMER = 4.8333E-01

THE FOLLOWING DATA IS SPECIFIED MOM. WHEEL INFORMATION (IF ANY) AND CONTROLLER INFORMATION

THE SPECIFIED CONTROLLER INITIAL CONDITIONS AND CHARACTERISTICS FOLLOW
(THE FIRST NDELTA ARE INITIAL CONTROLLER STATE VARIABLES, THERE ARE 100 ADDITIONAL CONTROL PARAMETERS)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	51	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	61	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	81	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

NAS5-11996 DEMO PROBLEM 7
W. CASE TWO BEAM PROBLEM

CURRENT TIME = 00.18.15
THE CPU TIMER = 2.3277E+01

AT SIMULATION TIME, T = 0.0 *

THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0								

AT SIMULATION TIME, T = 0.0 *

THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0								

AT SIMULATION TIME, T = 0.0 *

THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

AT SIMULATION TIME, T = 0.0 *

THE BETA TIME DERIVATIVES ARE

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

AT SIMULATION TIME, T = 0.0 *

FOR BODY 1 THE VELOCITIES ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0									

FOR BODY 1 THE CORRESPONDING MOMENTA ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0									

FOR BODY 1 ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS 0.0 0.0

FOR BODY 1 THE ELASTIC DEFLECTIONS ARE

		(1)	(2)	(3)	(4)	(5)
1	1	0.0	0.0	0.0	0.0	0.0

```
         AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
               ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1     1      0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
  1    11      0.0
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
               ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1     1      0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
  1    11      0.0
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
               ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
  1     1      0.0         0.0         0.0         0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      0.0            0.0
FOR BODY  2   THE ELASTIC DEFLECTIONS ARE
               ( 1)        ( 2)        ( 3)        ( 4)        ( 5)
  1     1      0.0         0.0         0.0         0.0         0.0


         AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE INTERCONNECTION CONSTRAINT FORCES(LAMBDAS) ARE
               ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1     1      0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
  1    11      0.0         0.0


         AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
               ( 1)        ( 2)        ( 3)
  1     1      0.0         0.0         0.0
THE TOTAL LINEAR MOMENTUM VECTOR IS
               ( 1)        ( 2)        ( 3)
  1     1      0.0         0.0         0.0

THE TOTAL ANGULAR MOMENTUM =  0.0
THE TOTAL LINEAR MOMENTUM  =  0.0
THE TOTAL KINETIC ENERGY   =  0.0
THE TOTAL POTENTIAL ENERGY =  0.0
THE TOTAL ENERGY (T + V)   =  0.0
```

```
      NAS5-11996 DEMO PROBLEM 7                                                             CURRENT TIME = 00.29.43
      W. CASE TWO BEAM PROBLEM                                                              THE CPU TIMER = 2.0676E+02

     AT SIMULATION TIME, T = 4.00000-02* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE STATE VECTOR Y =
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)      (10)
  1    1     0.0        0.0        0.0        0.0        0.0        0.0       -4.173D-03 -5.411D-02 -1.964D-02 -2.235D-02
  1   11    -1.177D-02 -8.497D-08 -2.432D-03  2.367D-03  1.030D-05  1.656D-01 -4.324D-01 -2.215D+00  2.554D+00  8.624D-01
  1   21    -4.719D-01  1.927D-01  9.079D-05  1.212D-03  3.737D-04  2.267D-05  4.975D-05  1.233D-02  3.479D-03 -5.974D-03
  1   31    -2.366D-03  1.191D-03

     AT SIMULATION TIME, T = 4.00000-02* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE STATE VECTOR TIME DERIVATIVE YDT =
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)      (10)
  1    1     8.882D-15 -1.821D-14  4.492D-15  1.544D-16 -5.844D-13 -1.694D-12 -1.607D+01 -7.343D+00  3.438D+00 -3.405D+01
  1   11    -2.621D+01  1.111D-04  3.298D+00 -2.935D+00  7.596D-03  3.070D+02 -1.324D+02  3.939D+03 -2.860D+03  9.683D+02
  1   21     3.714D+02 -3.823D+02 -4.173D-03 -5.411D-02 -1.964D-02 -2.235D-02 -1.177D-02 -2.215D+00  2.554D+00  8.624D-01
  1   31    -4.719D-01  1.927D-01

     AT SIMULATION TIME, T = 4.00000-02* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE
              ( 1)       ( 2)
  1    1     0.0        0.0
  2    1     0.0        0.0
  3    1     0.0        0.0
  4    1     0.0        0.0
  5    1     0.0        0.0
  6    1     0.0        0.0

     AT SIMULATION TIME, T = 4.00000-02* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE BETA TIME DERIVATIVES ARE
              ( 1)       ( 2)
  1    1     0.0        0.0
  2    1     0.0        0.0
  3    1     0.0        0.0
  4    1     0.0        0.0
  5    1     0.0        0.0
  6    1     0.0        0.0

     AT SIMULATION TIME, T = 4.00000D-02* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  1   THE VELOCITIES ARE
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)      (10)
  1    1     0.0        0.0        0.0        0.0        0.0        0.0       -4.173D-03 -5.411D-02 -1.964D-02 -2.235D-02
  1   11    -1.177D-02
FOR BODY  1   THE CORRESPONDING MOMENTA ARE
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)      (10)
  1    1     7.761D-06  5.255D+00 -8.475D-03  0.0       -1.519D-03 -8.179D-03 -4.173D-03 -5.411D-02 -1.964D-02 -2.235D-02
  1   11    -1.177D-02
FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1     7.761D-06  5.255D+00 -8.475D-03  0.0       -1.519D-03 -8.179D-03
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      1.98436700D-05 1.79408927D-02
FOR BODY  1   THE ELASTIC DEFLECTIONS ARE
              ( 1)       ( 2)       ( 3)       ( 4)       ( 5)
  1    1     9.079D-05  1.212D-03  3.737D-04  2.267D-05  4.975D-05
```

```
        AT SIMULATION TIME, T = 4.0000D-02* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)         (10)
  1    1   -8.497D-08 -2.432D-03  2.367D-03  1.030D-05  1.856D-01 -4.324D-01 -2.215D+00  2.554D+00  8.624D-01 -4.719D-01
  1   11    1.927D-01
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)         (10)
  1    1   -1.697D-04 -5.470D-01  1.409D+01  6.085D-07  2.985D-02  1.112D-02 -3.260D-03 -1.105D-02  2.548D-02  2.908D-03
  1   11    1.272D-02
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)
  1    1   -2.675D-04 -1.167D+01  4.394D+01  1.736D-07  2.985D-02  1.112D-02
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     1.67504028D-02 3.55969212D-02
FOR BODY  2   THE ELASTIC DEFLECTIONS ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)
  1    1    1.233D-02  3.479D-03 -5.974D-03 -2.366D-03  1.191D-03


        AT SIMULATION TIME, T = 4.0000D-02* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE INTERCONNECTION CONSTRAINT FORCES(LAMBDAS) ARE
              ( 1)         ( 2)         ( 3)         ( 4)         ( 5)         ( 6)         ( 7)         ( 8)         ( 9)         (10)
  1    1   -2.717D-03  2.576D+03  1.083D+01  1.780D-03 -2.221D+00 -2.799D+00 -9.493D-03 -1.628D+02 -3.438D+01  1.796D-03
  1   11   -7.391D-01 -2.116D+00


        AT SIMULATION TIME, T = 4.0000D-02* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
              ( 1)         ( 2)         ( 3)
  1    1   -2.597D-04 -6.417D+00  4.393D+01
THE TOTAL LINEAR MOMENTUM VECTOR IS
              ( 1)         ( 2)         ( 3)
  1    1    1.738D-07  2.833D-02  2.946D-03

THE TOTAL ANGULAR MOMENTUM =  4.43960426D+01
THE TOTAL LINEAR MOMENTUM  =  2.84861984D-02
THE TOTAL KINETIC ENERGY   =  2.07347698D-02
THE TOTAL POTENTIAL ENERGY =  5.35378138D-02
THE TOTAL ENERGY (T + V)   =  7.42725836D-02


                                        CPU TIME/STEP  CPU TIME/REAL TIME
                                           1.8453E+00         4.6133E+03
```

NAS5-11996 DEMO PROBLEM 7
W. CASE TWO BEAM PROBLEM

CURRENT TIME = 00.29.44
THE CPU TIMER = 2.0713E+02

SUMMARY OF PLOTTING INFORMATION

NAS5-11996 GSFC DEMO PROBLEM 7 -- W. CASE TWO BEAM NASTRAN MODEL

```
NSET     =    4
NRPLOT   =  101          NCPLOT   =  126
KRPLOT   = 1000          KCPLOT   =   16

ISET  =     1
JVPL  =     1    2    3    4    5    6    7   13   14   15   16   17   18

     NCI   =     1     NCD   =     2    3    4     NGRID =     1
     TIME           OMG1                BODY 1 ROT VEL

     NCI   =     1     NCD   =     5    6    7     NGRID =     1
     TIME           UVW1                BODY 1 TRANS VEL

     NCI   =     1     NCD   =     8    9   10     NGRID =     1
     TIME           OMG2                BODY 2 ROT VEL

     NCI   =     1     NCD   =    11   12   13     NGRID =     1
     TIME           UVW2                BODY 2 TRANS VEL

ISET  =     2
JVPL  =     1   66   67   68   69   70   71   72   73   74   75   76   77

     NCI   =     1     NCD   =     2    3    4     NGRID =     1
     TIME           LAM1R               HINGE 1 ROT CONSTRAINTS

     NCI   =     1     NCD   =     5    6    7     NGRID =     1
     TIME           LAM1T               HINGE 1 TRANS CONSTRAINTS

     NCI   =     1     NCD   =     8    9   10     NGRID =     1
     TIME           LAM2R               HINGE 2 ROT CONSTRAINTS

     NCI   =     1     NCD   =    11   12   13     NGRID =     1
     TIME           LAM2T               HINGE 2 TRANS CONSTRAINTS

ISET  =     3
JVPL  =     1  112  113  114  115  116  117  118  119  120  121

     NCI   =     1     NCD   =     2    3    4     NGRID =     1
```

```
     TIMF          HTOTA            ANG MOMENTUM

     NCI   =    1     NCD    =     5    6    7     NGRID =    1
     TIME          HTOTL            TPANS MOMENTUM

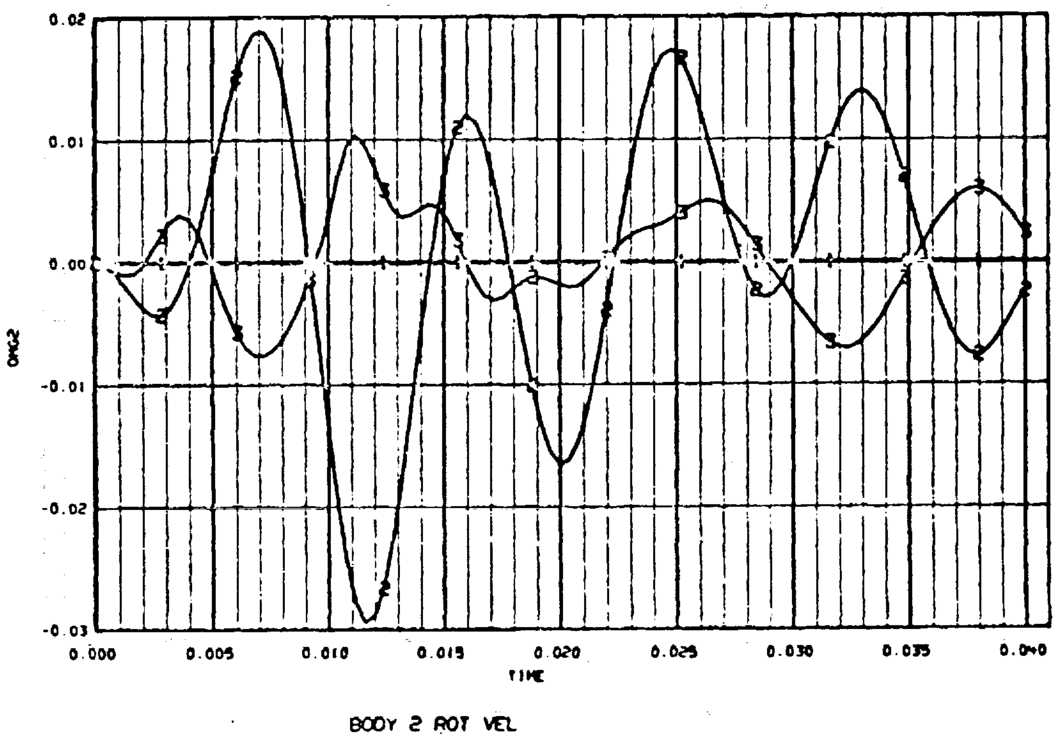
     NCI   =    1     NCD    =     8    9    0     NGRID =    1
     TIME          KE               KINETIC ENERGY

     NCI   =    1     NCD    =    10   11    0     NGRID =    1
     TIME          PE               POTENTILE ENERGY

ISET  =     4
JVPL  =     1  122  123  124  125  126

     NCI   =    1     NCD    =     2    3    0     NGRID =    1
     TIME          MOM              TOTAL MOMENTUM

     NCI   =    1     NCD    =     4    5    6     NGRID =    1
     TIME          ENG              TOTAL ENERGY
```



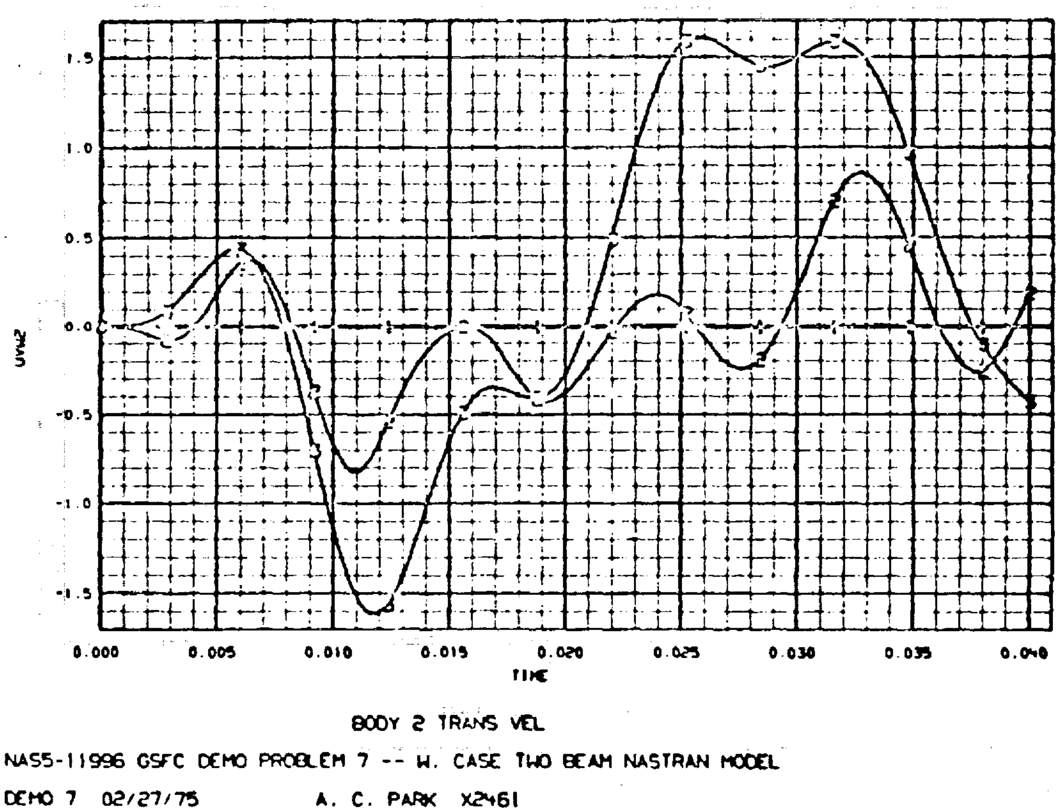
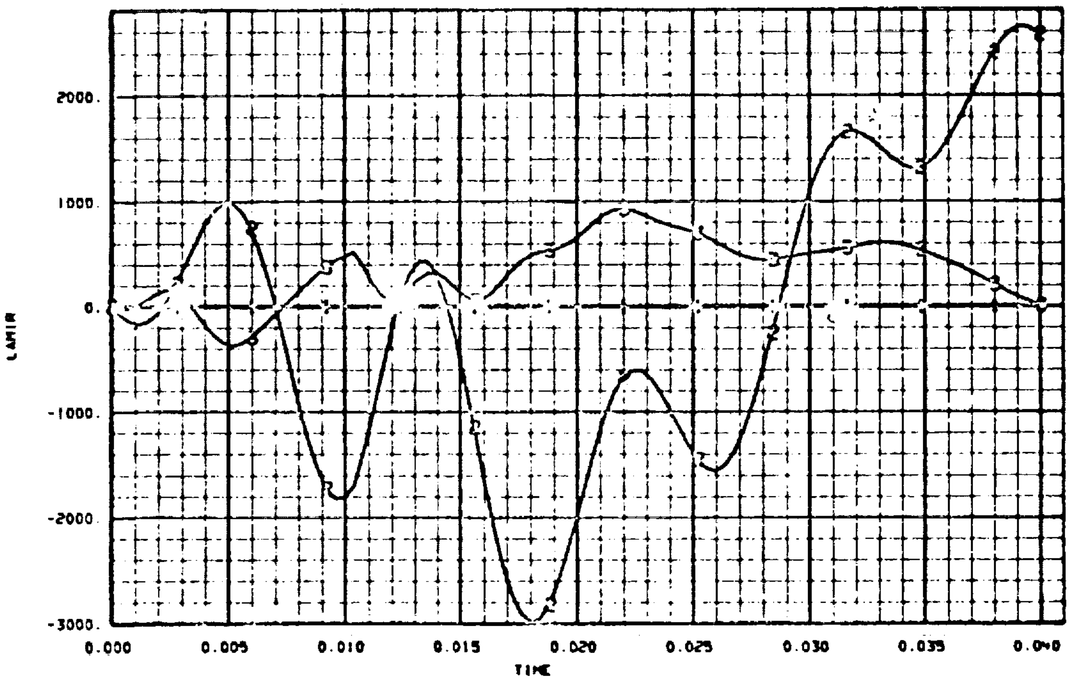
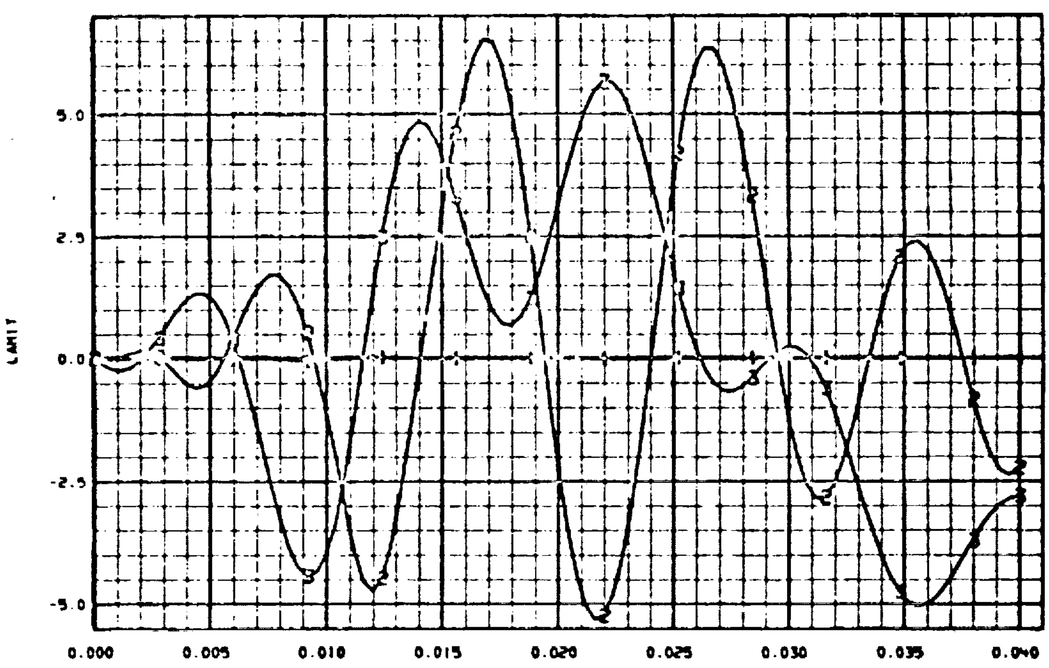


Figure A-6 Graphical Results, Demonstration Problem 7 (Sheet 1 of 4)



HINGE 1 ROT CONSTRAINTS

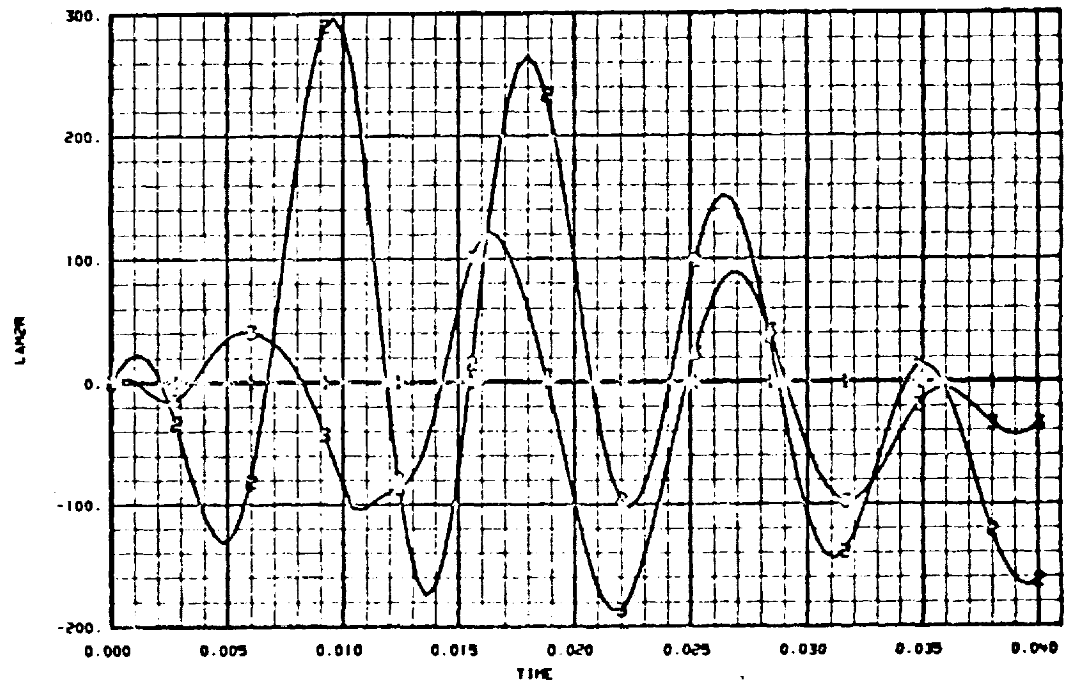


HINGE 1 TRANS CONSTRAINTS

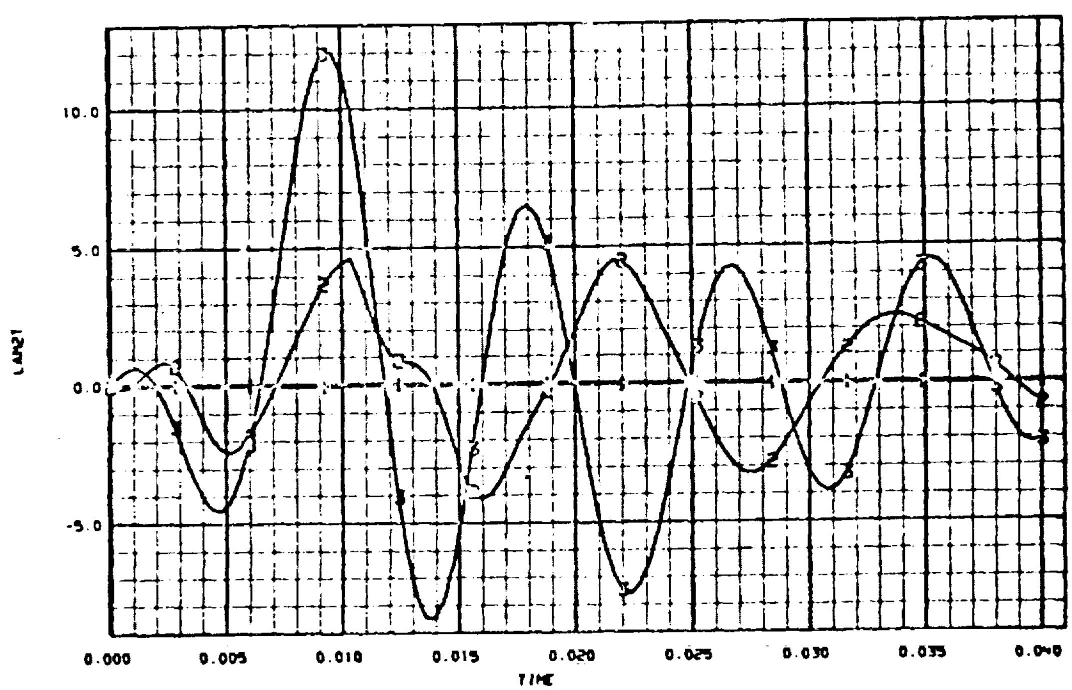
NAS5-11996 GSFC DEMO PROBLEM 7 -- H. CASE TWO BEAM NASTRAN MODEL

DEMO 7 02/27/75 A. C. PARK X2461

Figure A-6 Graphical Results, Demonstration Problem 7 (Sheet 2 of 4)



HINGE 2 ROT CONSTRAINTS

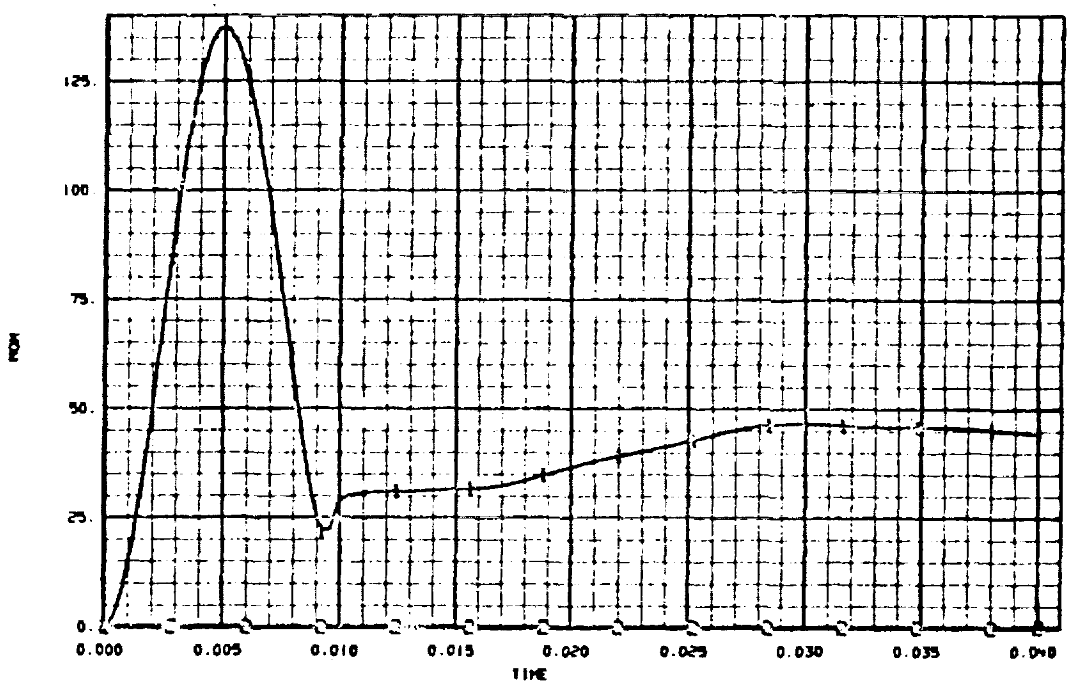


HINGE 2 TRANS CONSTRAINTS

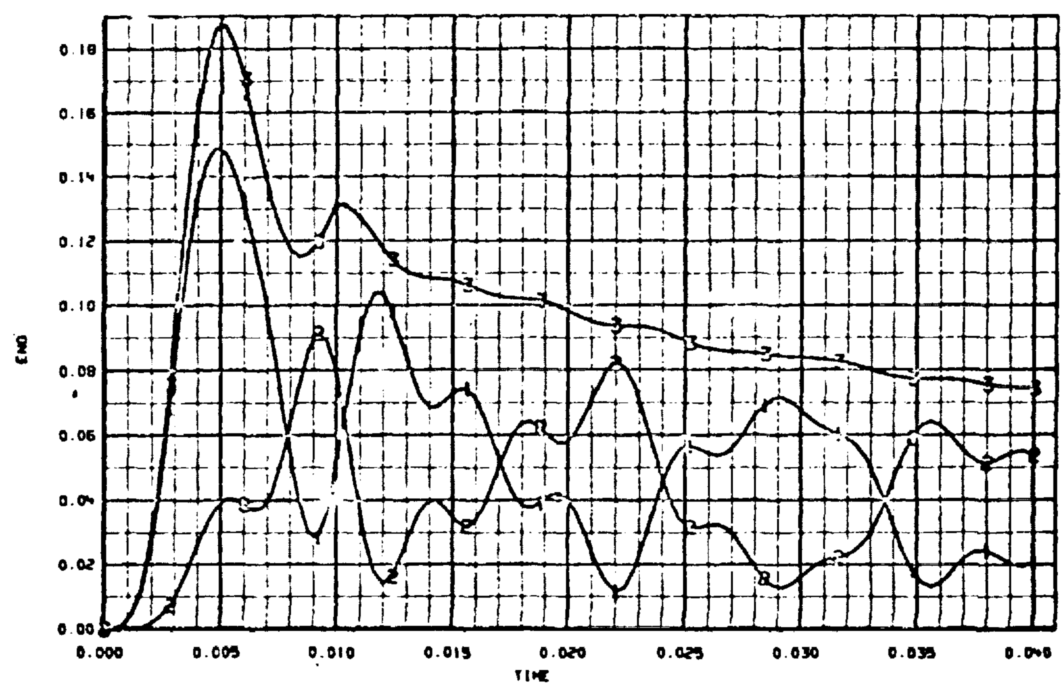
NAS5-11996 GSFC DEMO PROBLEM 7 -- W. CASE TWO BEAM NASTRAN MODEL

DEMO 7 02/27/75 A. C. PARK X2461

Figure A-6 Graphical Results, Demonstration Problem 7 (Sheet 3 of 4)



TOTAL MOMENTUM



TOTAL ENERGY

NAS5-11996 GSFC DEMO PROBLEM 7 -- W. CASE TWO BEAM NASTRAN MODEL

DEMO 7 02/27/75 A. C. PARK X2461

Figure A-6 Graphical Results, Demonstration Problem 7 (Sheet 4 of 4)

Demonstration Problem 8

```
      SUBROUTINE KHINGE (G)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION G(1)
      DIMENSION SK(3,6),DK(3,6),HNGT(3,6)
C
            COMMON /RHBSRD/                                              0 255
     *      BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)                2 255
            COMMON /CONPAR/
     *      CNTDTA(100)
            COMMON /MAXMUM/                                              0 415
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU            0 415
            COMMON /MOMENG/                                              0 3886
     *      P(113),PMOM(36),HTOT(3),TOTL(3),ENGKE( 6),ENGPE( 6),        11 3887
     *      TOTKE, TOTPE, TOTENG, AHTOT,ATOTL                            0 3888
            COMMON /SPECIF/                                              0 415
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),   16 415
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),          17 415
     *      NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6), 18 415
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ                         19 415
      COMMON /TWMTR/ F1, F2
C
      EQUIVALENCE (CNTDTA(61),SK(1)), (CNTDTA(81),DK(1))
C
      TOTPE = 0.D0
C
      DO 10 L=1,NH
      DO 10 I=1,3
      HNGT(I,L) = -(SK(I,L)*BETAH(I+3,L) + DK(I,L)*BETAHD(I+3,L))
   10 TOTPE = TOTPE + 0.5D0*SK(I,L)*BETAH(I+3,L)**2
      HNGT(1,1) = HNGT(1,1) -(F1+F2)
      HNGT(1,2) = HNGT(1,2) - F2
C
C
      LEQ = IRGFLX(1) + 6
      DO 15 I=1,3
      F = HNGT(I,1)
      DO 16 J=1,LEQ
   16 G(J) = G(J) + F*BH(I+3,J,1)
   15 CONTINUE
C
      DO 20 L=2,NH
      NOBQ = ITOPOL(1,L)
      NOBP = ITOPOL(2,L)
      LQ = 2*L - 2
      LP = LQ + 1
```

```
      LOQ = LOCU(NOBQ) - 1
      LOP = LOCU(NOBP) - 1
      LEQ = IRGFLX(NOBQ) + 5
      LEP = IRGFLX(NOBP) + 5
      DO 20 I=1,3
      F = HNGT(I,L)
      DO 25 J=1,LFQ
      LOQJ = LOQ + J
   25 G(LOQJ) = G(LOQJ) + F*HH(I+3,J,LQ)
      DO 26 J=1,LFP
      LOPJ = LOP + J
   26 G(LOPJ) = G(LOPJ) + F*HH(I+3,J,LP)
   20 CONTINUE
C
      RETURN
      END
      SUBROUTINE CONTRL                                                  048   1
      IMPLICIT REAL*8 (A-H,O-Z)                                            0 4046
C                                                                          0 4047
              COMMON /BHHSRD/                                              0 255
     *     BH(6,18,11),HS(6,18,15),POL(3,3, 6),DOL(3, 6)                   2 255
              COMMON /CONPAR/
     *     CNTDTA(100)
      COMMON /LDSIZE/ NX,NY,NDLTA,NXSS,NBTH,NJQ,NY2,ND2                    0 4048
              COMMON /SPECIF/                                              0 4049
     *     BETAH(6, 6),BETAHD(6, 6),AMD(2, 5),RH(3,3,30),RS(3,3,30),     16 4050
     *     DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),            17 4051
     *     NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6), 18 4052
     *     LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ                           19 4053
              COMMON /VECTOR/                                              0 4054
     *     Y(250),YDT(250)                                                20 405
      COMMON /TWMTR/ F1, F2
      COMMON /ASSDA/ XSS1, XSS2, XSS3, XSS4
C
      DIMENSION  TW(6),TOD(6),RMD(3),THADW(3)
C
      EQUIVALENCE (CNTDTA(41),ZA), (CNTDTA(42),ZB), (CNTDTA(43),ZC),
     1            (CNTDTA(44),ZD), (CNTDTA(45),ZE), (CNTDTA(46),ZF),
     2            (CNTDTA(47),ZG), (CNTDTA(48),ZH), (CNTDTA(49),ZL),
     3            (CNTDTA(50),ZM), (CNTDTA(51),ZN), (CNTDTA(52),ZP)
C
      DATA IIST/ 0 /
      IF (IIST .NE. 0) GO TO 10
      IIST = 1
CCCCCCCCCC
```

```
CCCCCCCCCC
CCC  THE FOLLOWING STATEMENTS MUST ALWAYS BE IN CONTRL..
      NDLTA = NDELTA
      NASS = 4
      NBTQ = 2
      IF (NDELTA .EQ. 0) RETURN
CCCCCCCCCCC    CCC
CCCC----NOTE--THIS SUBROUTINE MUST ESTABLISH  NDLTA,NASS AND NBTQ
CCCCCCCCCCC
C
      LDEL = LOCO(2*NB+2) - 1
C
C  **********
   10 CONTINUE
      XSS1 = YDT(13)
      XSS2 = YDT(13) + YDT(14)
      XSS3 = Y(13)
      XSS4 = Y(13) + Y(14)
C
CCCC  ESTABLISH THE D/DT(DELTAS)
C
      YDT(LDEL+1) = ZB*XSS1 + ZA*XSS3 - ZC*Y(LDEL+1)
      YDT(LDEL+2) = ZH*XSS2 + ZG*XSS4 - ZL*Y(LDEL+2)
      YDT(LDEL+3) = ZB*ZE*XSS1 + ZA*ZE*XSS3
     1            + (ZD-ZC*ZE) * Y(LDEL+1) - ZF*Y(LDEL+3)
      YDT(LDEL+4) = ZH*ZN*XSS2 + ZG*ZN*XSS4
     1            + (ZM-ZL*ZN) * Y(LDEL+2) - ZP*Y(LDEL+4)
C
C
C  COMPUTE TORQUES FOR USE IN KHINGE.
C
      F1 = Y(LDEL+3)
      F2 = Y(LDEL+4)
C
C
      RETURN
      END
      SUBROUTINE EXTOR  (TEX,ISPN,NTEX)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION TEX(6,1), ISPN(1)
C
              COMMON /MAXMUM/
     *     NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU
              COMMON /SPECIF/
     *     BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
```

```
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
     *      NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
            COMMON /VECTOR/
     *      Y(250),YDT(250)
C
      DATA IIST / 0 /
C
CCC ESTABLISH THE EXTERNAL FORCE/TORQUE (6-LONG VECTOR) AND NUMBER
CCC  THE CORRESPONDING SENSOR POINTS. ALSO ESTABLISH THE NUMBER OF
CCC  SIX-LONG VECTORS (NTEX).
C
      IF (IIST .EQ. 1) GO TO 5
      IIST = 1
      DO 10 I=1,6
      DO 10 J=1,NSPMAX
   10 TEX(I,J) = 0.D 0
C
    5 NTEX = 0
C
      RETURN
      END
      SUBROUTINE SHAFTT (TSHFT)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION TSHFT(1)
C
            COMMON /MAXMUM/
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NHWBOD,NMDBOD,KMO,KY,KU
            COMMON /SPECIF/
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
     *      NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
            COMMON /VECTOR/
     *      Y(250),YDT(250)
C
      DATA IIST / 0 /
C
      IF (IIST .EQ. 1) GO TO 10
      IIST = 1
      DO 5 I=1,NMWMAX
    5 TSHFT(I) = 0.D 0
C
   10 CONTINUE
      RETURN
```

```
      END                                                               0 4144
      SUBROUTINE EQADD                                                  051   1
      IMPLICIT REAL*8 (A-H,O-Z)                                         0 4147
C
            COMMON /BHBSRO/                                             0 255
     *      BH(6,18,11),BS(6,18,15),POL(3,3, 6),DOL(3, 6)               2 255
            COMMON /DNAUX /                                             0 414
     *      NAUX                                                        0 414
            COMMON /MAXMUM/                                             0 415
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU           0 415
            COMMON /SPECIF/                                             0 415
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),  16 415
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),         17 415
     *      NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6), 18 415
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ                        19 415
            COMMON /VECTOR/                                             0 415
     *      Y(250),YDT(250)                                            20 405
      COMMON /XSSDA/ XSS1, XSS2, XSS3, XSS4
      DATA IIST/ 0/
C                                                                       0 415
      IF (IIST .NE. 0) GO TO 5
      IIST = 1
      NAUX = 6
      LDEL = LOCU(2*NB+2) - 1
    5 CONTINUE
C
      XSS1 = YDT(13)
      XSS2 = YDT(13) + YDT(14)
      XSS3 = Y(13)
      XSS4 = Y(13) + Y(14)
C
      YDT(NEQ+1) = XSS1
      YDT(NEQ+2) = XSS2
      YDT(NEQ+3) = XSS3
      YDT(NEQ+4) = XSS4
      YDT(NEQ+5) = Y(LDEL+3)
      YDT(NEQ+6) = Y(LDEL+4)
      RETURN                                                            0 417
      END                                                               0 417
```

```
DEMO 6      D DEVERS
DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT.
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK
0000000000
    2     2     1     0     4
ITOPOL    2     2
    1     1     1     2
    2     1     0     1
0000000000
IRGFLA    1     2
0000000000
IFTSMW    1     1
    1     1     1
0000000000
IHDATA    7     2
    1     1     1     1
    2     1     1     1
    3     1     1     1
    4     1     1     1
    5     1     0     0
    6     1     1     1
    7     1     1     1
0000000000
BETAM     6     2
0000000000
BETAMD    6     2
0000000000
TMDATA    1     3
    1     1      0.                  .1                  .1
0000000000
IPDATA    1     3
    1     3     1
0000000000
CNTDTA    1   100
    1    41 450.             2.               450.               500.
    1    45 3.               500.             450.               2.
    1    49 450.             500.             3.                 500.
    1    64 1424.286
    1    84 0.90673
0000000000
GRAV      1     4
0000000000
MASSI     1     4
    1     1      2.7
0000000000
```

```
INERT1    1     6
   1      1      1.                 1.                1.
0000000000
   2      1
   0.           0.         0.
   5.           0.         0.
   1      1
  0.            0.         0.
  0.            0.         0.
MASS2     1     4
   1      1      3.1
0000000000
INERT2    1     6
   1      1      1.                   1.                1.
0000000000
   2      1
  0.            0.         0.
  -5.           0.         0.
FREQ
LRY       9    30
   1      1    -1    -1    -1    -1    -1    -1    -1    -1
   1      9     2     2     2     2     2     2     2     2    -3    -3    -3    -3
   1     21    -5    -5    -5    -5    -5    -5    -5    -5    -7    -7
   2      1     1     1     1     1     2     2     2     2
   2      9     1     1     2     2     3     3     4     4     1     2     1     2
   2     21     1     1     1     1     2     2     2     2     1     2
   3      1     1     2     3     4     1     2     3     4
   3      9     1     2     1     2     1     2     1     2     1     1     2     2
   3     21     1     2     3     4     1     2     3     4     1     2
   4      1     1     1     1     1     1     1     1     1     1     1     1
   4     12     1     1     1     1     1     1     1     1     1     1
   4     22     1     1     1     1     1     1     1     1     1
   6     29     1     1
   7     29     2     1
0000000000
IRY       3    30
   1      1    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5
   1     13    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5
   1     25    -5    -5    -5    -5    -5    -5
   3      1    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5
   3     13    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5
   3     25    -5    -5    -5    -5    -5    -5
0000000000
FORWARD LOOP TF       I      XIDOT/RT1
BONN
```

```
1.0        100.      -80.      20.       0.0       0.5
FORWARD LOOP TF      I      X200T/HT1
BONN
1.0        100.      -80.      20.       0.0       0.5
FORWARD LOOP TF      I         X1/HT1
BONN
1.0        100.      -100.     0.0       0.0       0.5
FORWARD LOOP TF      I         X2/HT1
BONN
1.0        100.      -100.     0.0       0.0       0.5
FORWARD LOOP TF      I      X100T/HT2
BONN
1.0        100.      -60.      40.       0.0       0.5
FORWARD LOOP TF      I      X200T/HT2
BONN
1.0        100.      -80.      20.       0.0       0.5
FORWARD LOOP TF      I         X1/HT2
BONN
1.0        100.      -100.     0.0       0.0       0.5
FORWARD LOOP TF      I         X2/HT2
BONN
1.0        100.      -100.     0.0       0.0       0.5
RETURN LOOP  TF     II         H1/X100T
BONN
1.0        100.      -60.      40.       0.0       0.1
RETURN LOOP  TF     II         H2/X100T
BONN
    1.         100.       -60.      40.       0.        10.
RETURN LOOP  TF     II         H1/X200T
BONN
    1.         100.       -60.      40.       0.        10.
RETURN LOOP  TF     II         H2/X200T
BONN
1.0        100.      -60.      0.0       0.0       0.01
RETURN LOOP  TF     II         H1/X1
BONN
1.0        100.      -60.      0.0       0.0       2.0
RETURN LOOP  TF     II         H2/X1
BONN
    1.         100.       -60.      40.       0.        10.
RETURN LOOP  TF     II         H1/X2
BONN
    1.         100.       -60.      40.       0.        10.
RETURN LOOP  TF     II         H2/X2
BONN
```

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```
1.0          100.        -60.        0.0         0.0         2.0
LOOP GAIN     TF    -III         B1/RT1
BONN
1.0          100.        -100.       0.0         0.0         0.5
LOOP GAIN     TF    -III         B1/RT2
BONN
1.0          100.        -100.       0.0         0.0         0.5
LOOP GAIN     TF    -III         B2/RT1
BONN
1.0          100.        -100.       0.0         0.0         0.5
LOOP GAIN     TF    -III         B2/RT2
BONN
1.0          100.        -100.       0.0         0.0         0.5
CLOSED LOOP   TF      -V     X1DOT/RT1
BONN
1.0          100.        -100.       0.0         0.0         0.5
CLOSED LOOP   TF      -V     X2DOT/RT1
BONN
1.0          100.        -80.        20.         0.0         0.5
CLOSED LOOP   TF      -V         X1/RT1
BONN
1.0          100.        -100.       0.0         0.0         0.5
CLOSED LOOP   TF      -V         X2/RT1
BONN
1.0          100.        -100.       0.0         0.0         0.5
CLOSED LOOP   TF      -V     X1DOT/RT2
BONN
1.0          100.        -100.       0.0         0.0         0.5
CLOSED LOOP   TF      -V     X2DOT/RT2
BONN
1.0          100.        -80.        20.         0.0         0.5
CLOSED LOOP   TF      -V         X1/RT2
BONN
1.0          100.        -100.       0.0         0.0         0.5
CLOSED LOOP   TF      -V         X2/RT2
BONN
1.0          100.        -100.       0.0         0.0         0.5
LOOP GAIN, (FEED BACK B2)    -VII    B1/RT1
BONN
1.0          100.        -100.       0.0         0.0         0.5
LOOP GAIN, (FEED BACK B1)    -VII    B2/RT2
BONNROOT
1.0          100.        -100.       0.0         0.0         0.5
IJM      2      2
    1      1      3      3
```

```
    2     1     5     7
G000000000
HLOTA     6     2
    1     1 -180.               -100.
    2     1 1.0                 1.0
    3     1 -1.0                -1.0
    4     1 -0.5                -0.1
    5     1 0.5                 0.1
    6     1 90.                 1.0
0000000000
STOP
```

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RUN BY D DEVERS

A-270

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.24.33
THE CPU TIMER = 0.0

SUMMARY OF DYNAMIC-SIMULATION-PROGRAM INPUT DATA * * * * * * * * * * *

ACTUAL SIZES		MAXIMUM SIZES		INTEGRATION DATA		GRAVITY GRADIENT DATA				MISC. DATA	
NB =	2	NBMAX =	6	STARTT =	0.0	G1 =	0.0	GAMA1 =	0.0	NOPRNT =	0
NH =	2	NHMAX =	6	DELTAT =	1.0000D-01	G2 =	0.0	GAMA2 =	0.0	NOPLOT =	0
NSPT =	1	NSPMAX =	15	ENDT =	1.0000-01	G3 =	0.0	GAMA3 =	0.0	IFLNER =	1
NOFMO =	0	NMMMAX =	5			GMAG =	0.0	RCMAG =	0.0		
NDELTA =	4	NMWBOD =	4								
NU =	12	NMDBOD =	12								
NBETA =	2	KMU =	22								
NLAM =	[illegible]	KY =	250								
NEQ =	[illegible]	KU =	113								

THE TOPOLOGY ARRAY (TOPOL) FOR THIS CASE FOLLOWS

		(1)	(2)
1	1	[illegible]	2
2	1	0	1

THE CONSTRAINT SPECIFICATIONS FOR THIS CASE FOLLOW

		(1)	(2)
1	1	1	1
2	1	1	1
3	1	1	1
4	1	1	1
5	1	0	0
6	1	1	1
7	1	1	1

THE SPECIFIED INITIAL HINGE ANGLES AND DISPLACEMENTS (BETAH) FOLLOW

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

THE SPECIFIED INITIAL HINGE RATES (BETAHD) FOLLOW

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.34.33
THE CPU TIMER = 1.2667E-01

THE NO. OF ELASTIC MODES/BODY ARRAY (IRGFLX) FOLLOWS

		(1)	(2)
1	1	0	0

THE NO. OF P/O HINGE POINTS/BODY ARRAY (NHPOI) FOLLOWS

		(1)	(2)
1	1	1	1

THE NO. OF SENSOR POINTS/BODY ARRAY (NSPOI) FOLLOWS

		(1)	(2)
1	1	1	0

THE MOM. WHEEL/BODY TABLE (NMCW) FOLLOWS

		(1)	(2)
1	1	0	0
2	1	0	0
3	1	0	0
4	1	0	0
5	1	0	0
6	1	0	0

THE STATE VECTOR LENGTH ARRAY (LENU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	6	6	0	0	2	4

THE STATE VECTOR LOCATION ARRAY (LOCU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	7	13	13	13	15

THE SPECIFIED SENSOR POINT/BODY CORRELATION ARRAY (IFTSMW) FOLLOWS

		(1)
1	1	1

A-272

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.34.33
THE CPU TIMER = 2.1667E-01

THE FOLLOWING DATA IS SPECIFIED MOM. WHEEL INFORMATION (IF ANY) AND CONTROLLER INFORMATION

THE SPECIFIED CONTROLLER INITIAL CONDITIONS AND CHARACTERISTICS FOLLOW
(THE FIRST NDELTA ARE INITIAL CONTROLLER STATE VARIABLES, THERE ARE 96 ADDITIONAL CONTROL PARAMETERS)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	4.5000D+02	2.0000D+00	4.5000D+02	5.0000D+02	3.0000D+00	5.0000D+02	4.5000D+02	2.0000D+00	4.5000D+02	5.0000D+02
1	51	3.0000D+00	5.0000D+02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	61	0.0	0.0	0.0	1.424D+03	0.0	0.0	0.0	0.0	0.0	0.0
1	71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	81	0.0	0.0	0.0	9.067D-01	0.0	0.0	0.0	0.0	0.0	0.0
1	91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.34.34
THE CPU TIMER = 4.7000E-01

SUMMARY OF INPUT DATA FOR BODY 1 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0
3	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0
4	1	0.0	0.0	0.0	2.7000D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	2.7000D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	2.7000D+00

FOR BODY 1 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	5.0000D+00	0.0	0.0

FOR BODY 1 THE SENSOR POINT NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES(1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	1	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

A-274

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.34.34
THE CPU TIMER = 6.1333E-01

SUMMARY OF INPUT DATA FOR BODY 2 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.0000+00	0.0	0.0	0.0	0.0
3	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0
4	1	0.0	0.0	0.0	3.1000D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	3.1000D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	3.1000D+00

FOR BODY 2 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	-5.0000D+00	0.0	0.0

THE FOLLOWING INTEGER ARRAY (INDEP) PRESCRIBES INDEPENDENT VARIABLES (1), AND DEPENDENT VARIABLES (0)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1	1	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	1	1

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.34.36
THE CPU TIMER = 1.2033E+00

AT SIMULATION TIME, T = 0.0 *
THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

AT SIMULATION TIME, T = 0.0 *
THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

AT SIMULATION TIME, T = 0.0 *
THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

AT SIMULATION TIME, T = 0.0 *
THE BETA TIME DERIVATIVES ARE

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

AT SIMULATION TIME, T = 0.0 *
THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)
1	1	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0 *
THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)
1	1	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0 *
FOR BODY 1 THE VELOCITIES ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

FOR BODY 1 THE CORRESPONDING MOMENTA ARE

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

FOR BODY 1 ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS

```
                ( 1)          ( 2)          ( 3)          ( 4)          ( 5)          ( 6)
   1     1     0.0           0.0           0.0           0.0           0.0           0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      0.0            0.0

        AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
                ( 1)          ( 2)          ( 3)          ( 4)          ( 5)          ( 6)
   1     1     0.0           0.0           0.0           0.0           0.0           0.0
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
                ( 1)          ( 2)          ( 3)          ( 4)          ( 5)          ( 6)
   1     1     0.0           0.0           0.0           0.0           0.0           0.0
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
                ( 1)          ( 2)          ( 3)          ( 4)          ( 5)          ( 6)
   1     1     0.0           0.0           0.0           0.0           0.0           0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      0.0            0.0

        AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE INTERCONNECTION CONSTRAINT FORCES(LAMBDAS) ARE
                ( 1)          ( 2)          ( 3)          ( 4)          ( 5)          ( 6)          ( 7)          ( 8)          ( 9)          (10)
   1     1     0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0

        AT SIMULATION TIME, T = 0.0        * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
                ( 1)          ( 2)          ( 3)
   1     1     0.0           0.0           0.0
THE TOTAL LINEAR MOMENTUM VECTOR IS
                ( 1)          ( 2)          ( 3)
   1     1     0.0           0.0           0.0

THE TOTAL ANGULAR MOMENTUM =  0.0
THE TOTAL LINEAR MOMENTUM  =  0.0
THE TOTAL KINETIC ENERGY   =  0.0
THE TOTAL POTENTIAL ENERGY =  0.0
THE TOTAL ENERGY (T + V)   =  0.0
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DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.34.48
THE CPU TIMER = 5.2833E+00

OUTPUT MATRIX -A- (14 X 8)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-3.358D-01	3.358D-01	0.0	5.275D+02	0.0	0.0	-3.704D-01	0.0		
2	1	2.925D-01	-2.925D-01	0.0	-4.594D+02	0.0	0.0	0.0	-3.226D-01		
3	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
4	1	-1.0000D+00	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0		
5	1	2.0000D+00	0.0	4.5000D+02	0.0	-4.5000D+02	0.0	0.0	0.0		
6	1	0.0	2.0000D+00	4.5000D+02	4.5000D+02	0.0	-4.5000D+02	0.0	0.0		
7	1	6.0000D+00	0.0	1.3500D+03	0.0	-8.5000D+02	0.0	-5.0000D+02	0.0		
8	1	0.0	6.0000D+00	1.3500D+03	1.3500D+03	0.0	-8.5000D+02	0.0	-5.0000D+02		
9	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
10	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0		
11	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0		
12	1	0.0	0.0	1.0000D+00	1.0000D+00	0.0	0.0	0.0	0.0		
13	1	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0		
14	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00		

END OF WRITE.

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A-278

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.34.53
THE CPU TIMER = 6.0333E+00

OUTPUT MATRIX -T- (8 X 8)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0		
2	1	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0		
3	1	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0		
4	1	0.0	0.0	0.0	0.0	-1.0000D+00	1.0000D+00	0.0	0.0		
5	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
6	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0		
7	1	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00	0.0		
8	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000D+00		

END OF WRITE.

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.35.15
THE CPU TIMER = 1.1170E+01

OUTPUT MATRIX -A*- (8 X 8)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-3.358D-01	3.358D-01	-5.275D+02	5.275D+02	0.0	0.0	-3.704D-01	0.0		
2	1	2.925D-01	-2.925D-01	4.594D+02	-4.594D+02	0.0	0.0	0.0	-3.226D-01		
3	1	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
4	1	0.0	1.000D+00	0.0	0.0	0.0	0.0	0.0	0.0		
5	1	2.000D+00	0.0	4.500D+02	0.0	-4.500D+02	0.0	0.0	0.0		
6	1	0.0	2.000D+00	0.0	4.500D+02	0.0	-4.500D+02	0.0	0.0		
7	1	6.000D+00	0.0	1.350D+03	0.0	-8.500D+02	0.0	-5.000D+02	0.0		
8	1	0.0	6.000D+00	0.0	1.350D+03	0.0	-8.500D+02	0.0	-5.000D+02		

END OF WRITE.

A-280

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.35.15
THE CPU TIMER = 1.1383E+01

	RT A		RTA*	
NO	REAL PART	IMAGINARY PART	REAL PART	IMAGINARY PART
1	-0.49999D+03	0.0	-0.49999D+03	0.0
2	-0.49998D+03	0.0	-0.49998D+03	0.0
3	-0.45001D+03	0.0	-0.45001D+03	0.0
4	-0.45001D+03	0.0	-0.45001D+03	0.0
5	-0.31525D+00	-0.31420D+02	-0.31525D+00	-0.31420D+02
6	-0.31525D+00	0.31420D+02	-0.31525D+00	0.31420D+02
7	-0.10728D-02	-0.58722D+00	-0.10728D-02	-0.58722D+00
8	-0.10728D-02	0.58722D+00	-0.10728D-02	0.58722D+00

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.35.37
THE CPU TIMER = 1.4010E+01

	NUM		DEN	
NO	REAL PART	IMAGINARY PART	REAL PART	IMAGINARY PART
1	-0.14625D+00	-0.21434D+02	-0.31416D+00	-0.31414D+02
2	-0.14625D+00	0.21434D+02	-0.31416D+00	0.31414D+02
3	0.0	0.0	0.0	0.0
4			0.0	0.0

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A-282

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.35.37
THE CPU TIMER = 1.4107E+01

OUTPUT MATRIX RRED (1 X 200)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	1.0000+00	0.0	0.0	1.0000D+00	1.0000D+00	1.724D-01	6.823D-03	2.143D+01	1.000D-02
1	11	3.142D+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

END OF WRITE.

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.35.37
THE CPU TIMER = 1.4150E+01

FORWARD LOOP TF I X1DOT/RT1

FREQ/RAD/SEC	FREQ/HERTZ	REAL	IMAG	AMP	DECIBELS	RAD	DEG
0.100000D+01	0.159155D+00	0.127947D-06	-0.172213D+00	0.172213D+00	-15.279	4.7124	270.0000
0.110000D+01	0.175070D+00	0.154882D-06	-0.156519D+00	0.156519D+00	-16.109	4.7124	270.0000
0.125000D+01	0.198944D+00	0.200146D-06	-0.137680D+00	0.137680D+00	-17.223	4.7124	270.0001
0.140000D+01	0.222817D+00	0.251266D-06	-0.122871D+00	0.122871D+00	-18.211	4.7124	270.0001
0.160000D+01	0.254648D+00	0.328584D-06	-0.107437D+00	0.107437D+00	-19.377	4.7124	270.0001
0.180000D+01	0.286479D+00	0.416439D-06	-0.954232D-01	0.954232D-01	-20.407	4.7124	270.0002
0.200000D+01	0.318310D+00	0.514918D-06	-0.858041D-01	0.858041D-01	-21.330	4.7124	270.0003
0.220000D+01	0.350141D+00	0.624116D-06	-0.779265D-01	0.779265D-01	-22.166	4.7124	270.0004
0.250000D+01	0.397887D+00	0.808254D-06	-0.684609D-01	0.684609D-01	-23.291	4.7124	270.0006
0.280000D+01	0.445634D+00	0.101717D-05	-0.610103D-01	0.610103D-01	-24.292	4.7124	270.0009
0.320000D+01	0.509296D+00	0.133508D-05	-0.532308D-01	0.532308D-01	-25.477	4.7124	270.0014
0.380000D+01	0.604789D+00	0.189897D-05	-0.445986D-01	0.445986D-01	-27.014	4.7124	270.0024
0.450000D+01	0.716197D+00	0.269513D-05	-0.373927D-01	0.373927D-01	-28.544	4.7125	270.0041
0.520000D+01	0.827606D+00	0.364991D-05	-0.320842D-01	0.320842D-01	-29.874	4.7125	270.0065
0.620000D+01	0.986761D+00	0.531414D-05	-0.265148D-01	0.265148D-01	-31.530	4.7126	270.0115
0.700000D+01	0.111408D+01	0.692736D-05	-0.231532D-01	0.231532D-01	-32.708	4.7127	270.0171
0.780000D+01	0.124141D+01	0.882252D-05	-0.204371D-01	0.204371D-01	-33.792	4.7128	270.0247
0.890000D+01	0.141648D+01	0.119559D-04	-0.174316D-01	0.174316D-01	-35.173	4.7131	270.0393
0.100000D+02	0.159155D+01	0.158096D-04	-0.150096D-01	0.150096D-01	-36.473	4.7134	270.0603
0.110000D+02	0.175070D+01	0.200684D-04	-0.131596D-01	0.131596D-01	-37.615	4.7139	270.0873
0.125000D+02	0.198944D+01	0.281600D-04	-0.108146D-01	0.108147D-01	-39.320	4.7150	270.1492
0.128602D+02	0.204677D+01	0.304728D-04	-0.103084D-01	0.103084D-01	-39.736	4.7153	270.1693
0.150036D+02	0.238790D+01	0.482318D-04	-0.759361D-02	0.759377D-02	-42.391	4.7187	270.3639
0.160753D+02	0.255846D+01	0.605440D-04	-0.635834D-02	0.635863D-02	-43.933	4.7219	270.5455
0.171470D+02	0.272903D+01	0.761425D-04	-0.515777D-02	0.515833D-02	-45.750	4.7271	270.8457
0.180043D+02	0.286548D+01	0.917501D-04	-0.420055D-02	0.420155D-02	-47.532	4.7342	271.2512
0.188617D+02	0.300193D+01	0.111027D-03	-0.322764D-02	0.322955D-02	-49.817	4.7468	271.9701
0.192903D+02	0.307015D+01	0.122386D-03	-0.272946D-02	0.273221D-02	-51.270	4.7572	272.5673
0.197190D+02	0.313838D+01	0.135132D-03	-0.222003D-02	0.222414D-02	-53.057	4.7732	273.4832
0.201477D+02	0.320661D+01	0.149485D-03	-0.169645D-02	0.170303D-02	-55.376	4.8003	275.0356
0.205764D+02	0.327483D+01	0.165714D-03	-0.115551D-02	0.116733D-02	-58.656	4.8548	278.1612
0.206835D+02	0.329189D+01	0.170101D-03	-0.101715D-02	0.103128D-02	-59.732	4.8781	279.4938
0.207907D+02	0.330894D+01	0.174631D-03	-0.877425D-03	0.894634D-03	-60.967	4.9088	281.2563
0.208979D+02	0.332600D+01	0.179310D-03	-0.736265D-03	0.757785D-03	-62.409	4.9513	283.6873
0.210050D+02	0.334306D+01	0.184144D-03	-0.593609D-03	0.621515D-03	-64.131	5.0132	287.2345
0.210908D+02	0.335670D+01	0.188128D-03	-0.478362D-03	0.514026D-03	-65.780	5.0871	291.4685
0.211765D+02	0.337035D+01	0.192220D-03	-0.362078D-03	0.409938D-03	-67.746	5.2004	297.9629
0.212194D+02	0.337717D+01	0.194307D-03	-0.303536D-03	0.360402D-03	-68.864	5.2818	302.6250
0.212622D+02	0.338399D+01	0.196422D-03	-0.244722D-03	0.313800D-03	-70.067	5.3887	308.7517
0.213051D+02	0.339081D+01	0.198566D-03	-0.185629D-03	0.271821D-03	-71.314	5.5314	316.9285
0.213480D+02	0.339764D+01	0.200739D-03	-0.126255D-03	0.237142D-03	-72.500	5.7217	327.8322
0.213909D+02	0.340446D+01	0.202942D-03	-0.665929D-04	0.213589D-03	-73.408	5.9661	341.8334
0.214080D+02	0.340719D+01	0.203832D-03	-0.426466D-04	0.208245D-03	-73.628	6.0769	348.1828
0.214230D+02	0.340958D+01	0.204614D-03	-0.216549D-04	0.205757D-03	-73.733	6.1777	353.9587
0.214284D+02	0.341043D+01	0.204895D-03	-0.141492D-04	0.205383D-03	-73.749	6.2142	356.0497
0.214316D+02	0.341094D+01	0.205063D-03	-0.964346D-05	0.205290D-03	-73.753	6.2362	357.3075
0.214320D+02	0.341101D+01	0.205085D-03	-0.904258D-05	0.205285D-03	-73.753	6.2391	357.4754
0.214324D+02	0.341108D+01	0.205108D-03	-0.844166D-05	0.205282D-03	-73.753	6.2420	357.6432
0.214329D+02	0.341115D+01	0.205130D-03	-0.784072D-05	0.205280D-03	-73.753	6.2450	357.8110
0.214333D+02	0.341121D+01	0.205153D-03	-0.723974D-05	0.205281D-03	-73.753	6.2479	357.9789

A-284

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT,
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK

CURRENT TIME = 07.35.39
THE CPU TIMER = 1.4627E+01

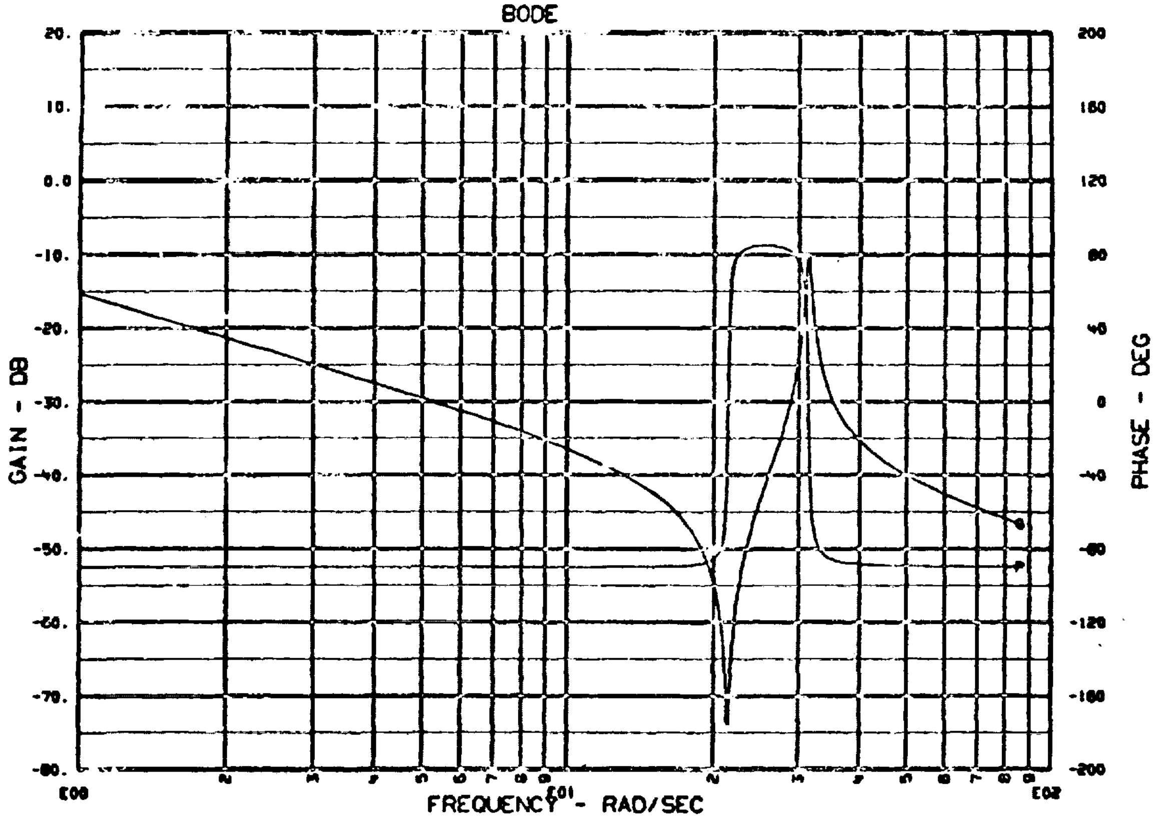
FORWARD LOOP TF I X1DOT/PT1

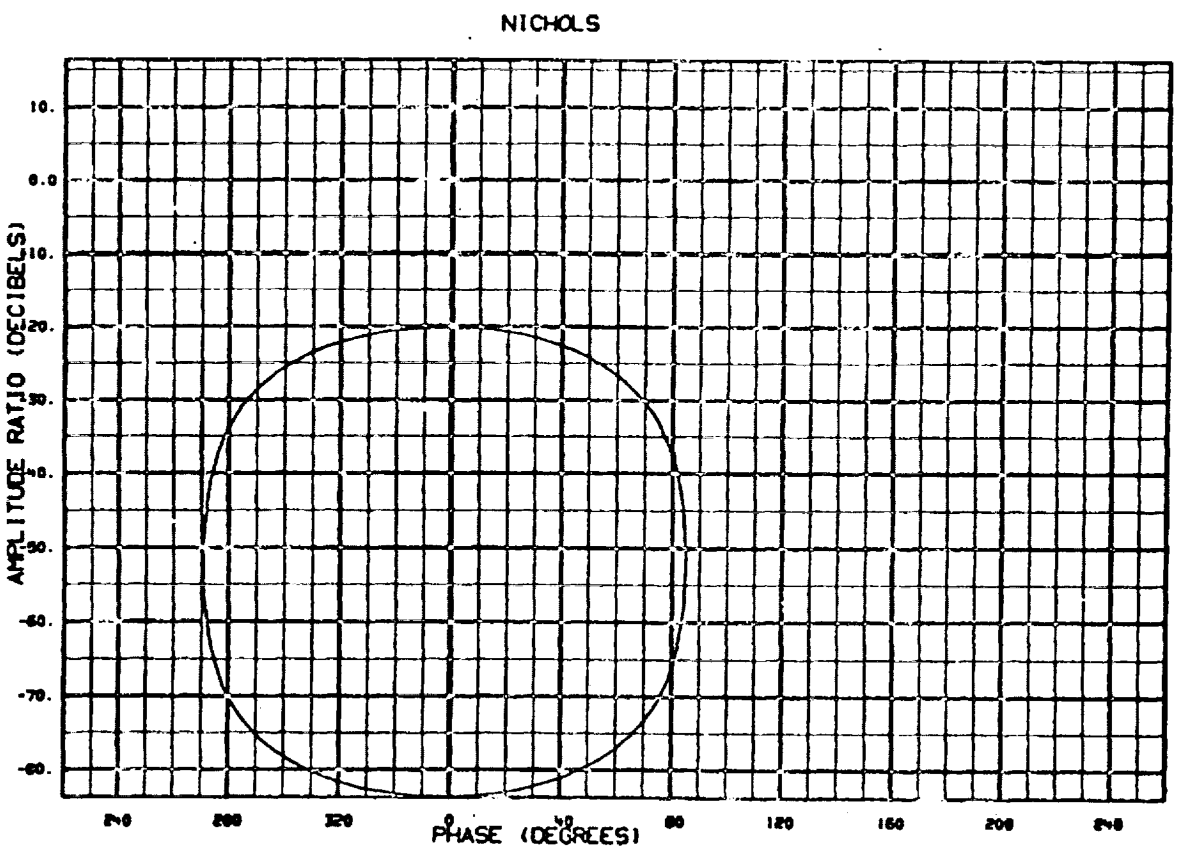
	FREQ/RAD/SEC	FREQ/HERTZ	REAL	IMAG	AMP	DECIBELS	RAD	DEG	
	0.214335D+02	0.341125D+01	0.205164D-03	-0.693925D-05	0.205281D-03	-73.753	6.2494	358.0628	
********	0.214337D+02	0.341128D+01	0.205175D-03	-0.663874D-05	0.205283D-03	-73.753	6.2508	358.1468	********
	0.214339D+02	0.341132D+01	0.205187D-03	-0.633822D-05	0.205285D-03	-73.753	6.2523	358.2307	
	0.214341D+02	0.341135D+01	0.205198D-03	-0.603769D-05	0.205287D-03	-73.753	6.2538	358.3146	
	0.214346D+02	0.341142D+01	0.205220D-03	-0.543659D-05	0.205292D-03	-73.753	6.2567	358.4825	
	0.214350D+02	0.341149D+01	0.205243D-03	-0.483544D-05	0.205300D-03	-73.752	6.2596	358.6504	
	0.214354D+02	0.341156D+01	0.205265D-03	-0.423422D-05	0.205309D-03	-73.752	6.2626	358.8183	
	0.214359D+02	0.341162D+01	0.205288D-03	-0.363297D-05	0.205320D-03	-73.751	6.2655	358.9861	
	0.214391D+02	0.341214D+01	0.205457D-03	0.878202D-06	0.205459D-03	-73.746	0.0043	0.2449	
	0.214444D+02	0.341299D+01	0.205739D-03	0.840356D-05	0.205910D-03	-73.726	0.0408	2.3390	
	0.214595D+02	0.341538D+01	0.206532D-03	0.295195D-04	0.208631D-03	-73.612	0.1420	8.1342	
	0.214767D+02	0.341812D+01	0.207444D-03	0.537337D-04	0.214290D-03	-73.380	0.2535	14.5220	
	0.215198D+02	0.342498D+01	0.209754D-03	0.114654D-03	0.239044D-03	-72.430	0.5002	28.6616	
	0.215631D+02	0.343187D+01	0.212105D-03	0.176133D-03	0.275701D-03	-71.191	0.6930	39.7064	
	0.216066D+02	0.343879D+01	0.214499D-03	0.238180D-03	0.320530D-03	-69.883	0.8277	47.9947	
	0.216502D+02	0.344574D+01	0.216937D-03	0.300808D-03	0.370874D-03	-68.615	0.9460	54.2016	
	0.216940D+02	0.345271D+01	0.219420D-03	0.364027D-03	0.425043D-03	-67.431	1.0284	58.9202	
	0.217822D+02	0.346675D+01	0.224526D-03	0.492287D-03	0.541071D-03	-65.335	1.1429	65.4828	
	0.218711D+02	0.348090D+01	0.229827D-03	0.623055D-03	0.664091D-03	-63.555	1.2174	69.7525	
	0.219833D+02	0.349875D+01	0.236742D-03	0.790198D-03	0.824900D-03	-61.672	1.2797	73.3219	
	0.220966D+02	0.351679D+01	0.243998D-03	0.961632D-03	0.992105D-03	-60.069	1.3223	75.7626	
	0.222111D+02	0.353501D+01	0.251620D-03	0.113758D-02	0.116508D-02	-58.673	1.3531	77.5277	
	0.223268D+02	0.355342D+01	0.259633D-03	0.131829D-02	0.134361D-02	-57.435	1.3763	78.8584	
	0.228018D+02	0.362902D+01	0.296196D-03	0.209421D-02	0.211505D-02	-53.494	1.4303	81.9498	
	0.232975D+02	0.370792D+01	0.341797D-03	0.297102D-02	0.299062D-02	-50.485	1.4563	83.4374	
	0.238152D+02	0.379031D+01	0.399793D-03	0.397633D-02	0.399637D-02	-47.967	1.4706	84.2586	
	0.243565D+02	0.387646D+01	0.475277D-03	0.514881D-02	0.517070D-02	-45.729	1.4787	84.7261	
	0.255163D+02	0.406105D+01	0.716205D-03	0.824742D-02	0.827846D-02	-41.641	1.4842	85.0369	
	0.263867D+02	0.419958D+01	0.102146D-02	0.113761D-01	0.114218D-01	-38.845	1.4812	84.8692	
	0.276433D+02	0.439956D+01	0.190293D-02	0.181742D-01	0.182736D-01	-34.764	1.4665	84.0226	
	0.282715D+02	0.449955D+01	0.279723D-02	0.234559D-01	0.236221D-01	-32.534	1.4521	83.1993	
	0.288998D+02	0.459954D+01	0.444659D-02	0.311980D-01	0.315133D-01	-30.030	1.4292	81.8884	
	0.295280D+02	0.469953D+01	0.798450D-02	0.436769D-01	0.444007D-01	-27.052	1.3900	79.6403	
	0.301563D+02	0.479952D+01	0.177443D-01	0.669160D-01	0.692287D-01	-23.194	1.3116	75.1486	
	0.303133D+02	0.482452D+01	0.228804D-01	0.760750D-01	0.794413D-01	-21.999	1.2786	73.2607	
	0.304704D+02	0.484951D+01	0.304652D-01	0.874553D-01	0.926097D-01	-20.667	1.2356	70.7941	
	0.306275D+02	0.487451D+01	0.422214D-01	0.101700D+00	0.110116D+00	-19.163	1.1773	67.4539	
	0.307845D+02	0.489951D+01	0.615039D-01	0.119277D+00	0.134201D+00	-17.445	1.0947	62.7227	
	0.309102D+02	0.491951D+01	0.866934D-01	0.135126D+00	0.160545D+00	-15.888	1.0004	57.3169	
	0.310358D+02	0.493951D+01	0.126948D+00	0.148976D+00	0.195729D+00	-14.167	0.8651	49.5646	
	0.310987D+02	0.494950D+01	0.155176D+00	0.151967D+00	0.217194D+00	-13.263	0.7750	44.4015	
	0.311615D+02	0.495950D+01	0.189641D+00	0.148688D+00	0.240981D+00	-12.360	0.6649	38.0982	
	0.312243D+02	0.496950D+01	0.229247D+00	0.134734D+00	0.265909D+00	-11.505	0.5313	30.4438	
	0.312871D+02	0.497950D+01	0.269565D+00	0.105228D+00	0.289376D+00	-10.771	0.3722	21.3237	
	0.313500D+02	0.498950D+01	0.301726D+00	0.579234D-01	0.307235D+00	-10.251	0.1897	10.8671	
	0.313751D+02	0.499350D+01	0.309815D+00	0.348034D-01	0.311764D+00	-10.123	0.1119	6.4095	
	0.313971D+02	0.499700D+01	0.313927D+00	0.133484D-01	0.314210D+00	-10.056	0.0425	2.4348	
	0.314049D+02	0.499825D+01	0.314672D+00	0.552478D-02	0.314720D+00	-10.042	0.0176	1.0059	
	0.314096D+02	0.499900D+01	0.314931D+00	0.809897D-03	0.314932D+00	-10.036	0.0026	0.1473	
	0.314103D+02	0.499910D+01	0.314955D+00	0.180520D-03	0.314955D+00	-10.035	0.0006	0.0328	
	0.314109D+02	0.499920D+01	0.314977D+00	-0.448981D-03	0.314977D+00	-10.034	6.2818	359.9183	

DYNAMO CHECKOUT OF TWO DEGREE OF FREEDOM PLANT, CURRENT TIME = 07.35.39
TWO CONTROL CHANNELS, RATE AND POSITION FEED-BACK THE CPU TIMER = 1.5117E+01

FORWARD LOOP TF I X1DOT/RT1

FREQ/RAD/SEC	FREQ/HERTZ	REAL	IMAG	AMP	DECIBELS	RAD	DEG
0.314115D+02	0.499930D+01	0.314995D+00	-0.107859D-02	0.314997D+00	-10.034	6.2798	359.8038
0.314122D+02	0.499940D+01	0.315012D+00	-0.170829D-02	0.315016D+00	-10.033	6.2778	359.6893
0.314125D+02	0.499945D+01	0.315019D+00	-0.202317D-02	0.315026D+00	-10.033	6.2768	359.6320
******** 0.314128D+02	0.499950D+01	0.315026D+00	-0.233807D-02	0.315034D+00	-10.033	6.2758	359.5748 ********
0.314131D+02	0.499955D+01	0.315032D+00	-0.265299D-02	0.315043D+00	-10.033	6.2748	359.5175
0.314134D+02	0.499960D+01	0.315037D+00	-0.296793D-02	0.315051D+00	-10.032	6.2738	359.4602
0.314140D+02	0.499970D+01	0.315046D+00	-0.359786D-02	0.315066D+00	-10.032	6.2718	359.3457
0.314147D+02	0.499980D+01	0.315052D+00	-0.422785D-02	0.315081D+00	-10.032	6.2698	359.2312
0.314153D+02	0.499990D+01	0.315056D+00	-0.485788D-02	0.315093D+00	-10.031	6.2678	359.1166
0.314159D+02	0.500000D+01	0.315057D+00	-0.548793D-02	0.315105D+00	-10.031	6.2658	359.0021
0.314206D+02	0.500075D+01	0.314986D+00	-0.102127D-01	0.315152D+00	-10.030	6.2508	358.1430
0.314285D+02	0.500200D+01	0.314554D+00	-0.180716D-01	0.315072D+00	-10.032	6.2258	356.7119
0.314505D+02	0.500551D+01	0.311286D+00	-0.397456D-01	0.313813D+00	-10.067	6.1562	352.7237
0.314757D+02	0.500952D+01	0.304058D+00	-0.633092D-01	0.310579D+00	-10.157	6.0779	348.2382
0.315389D+02	0.501958D+01	0.273315D+00	-0.112279D+00	0.295479D+00	-10.589	5.8934	337.6670
0.316024D+02	0.502968D+01	0.233335D+00	-0.143545D+00	0.273953D+00	-11.246	5.7317	328.4006
0.316661D+02	0.503982D+01	0.193381D+00	-0.158839D+00	0.250252D+00	-12.032	5.5955	320.6010
0.317301D+02	0.505000D+01	0.158311D+00	-0.162960D+00	0.227197D+00	-12.872	5.4833	314.1708
0.317943D+02	0.506022D+01	0.129467D+00	-0.160432D+00	0.206156D+00	-13.716	5.3914	308.9032
0.319236D+02	0.508079D+01	0.882607D-01	-0.146883D+00	0.171361D+00	-15.322	5.2535	301.0013
0.320539D+02	0.510153D+01	0.624901D-01	-0.131009D+00	0.145149D+00	-16.764	5.1575	295.5007
0.322182D+02	0.512769D+01	0.428026D-01	-0.113301D+00	0.121117D+00	-18.336	5.0736	290.6954
0.323843D+02	0.515412D+01	0.308287D-01	-0.989316D-01	0.103624D+00	-19.691	5.0145	287.3078
0.325521D+02	0.518083D+01	0.231200D-01	-0.874523D-01	0.904569D-01	-20.871	4.9708	284.8086
0.327217D+02	0.520781D+01	0.179092D-01	-0.782190D-01	0.802431D-01	-21.912	4.9375	282.8963
0.334179D+02	0.531862D+01	0.803503D-02	-0.548276D-01	0.554132D-01	-25.128	4.8579	278.3374
0.341443D+02	0.543424D+01	0.446772D-02	-0.423004D-01	0.425357D-01	-27.425	4.8176	276.0291
0.349031D+02	0.555500D+01	0.280782D-02	-0.345496D-01	0.346635D-01	-29.203	4.7935	274.6461
0.356963D+02	0.568125D+01	0.190889D-02	-0.292793D-01	0.293415D-01	-30.650	4.7775	273.7302
0.373962D+02	0.595179D+01	0.102382D-02	-0.225413D-01	0.225645D-01	-32.931	4.7578	272.6005
0.392660D+02	0.624937D+01	0.621675D-03	-0.183722D-01	0.183827D-01	-34.712	4.7462	271.9380
0.418837D+02	0.666600D+01	0.370183D-03	-0.149096D-01	0.149142D-01	-36.528	4.7372	271.4227
0.448754D+02	0.714214D+01	0.237374D-03	-0.124867D-01	0.124890D-01	-38.069	4.7314	271.0890
0.450000D+02	0.716197D+01	0.233575D-03	-0.124067D-01	0.124089D-01	-38.125	4.7312	271.0785
0.520000D+02	0.827606D+01	0.114035D-03	-0.930853D-02	0.930923D-02	-40.622	4.7246	270.7018
0.620000D+02	0.986761D+01	0.585626D-04	-0.707588D-02	0.707612D-02	-43.004	4.7207	270.4742
0.700000D+02	0.111408D+02	0.397982D-04	-0.600383D-02	0.600397D-02	-44.431	4.7190	270.3798
0.780000D+02	0.124141D+02	0.291248D-04	-0.523948D-02	0.523956D-02	-45.614	4.7179	270.3185
0.857143D+02	0.136419D+02	0.225899D-04	-0.467919D-02	0.467924D-02	-46.596	4.7172	270.2766
0.100000D+03	0.159155D+02	0.153104D-04	-0.392037D-02	0.392040D-02	-48.133	4.7163	270.2237





FORWARD LOOP TF I XIDOT/RTI
DEMO 8 02/26/75 D DEVERS

Figure A-7 Graphical Results, Demonstration Problem 8 (Sheet 1 of 11)

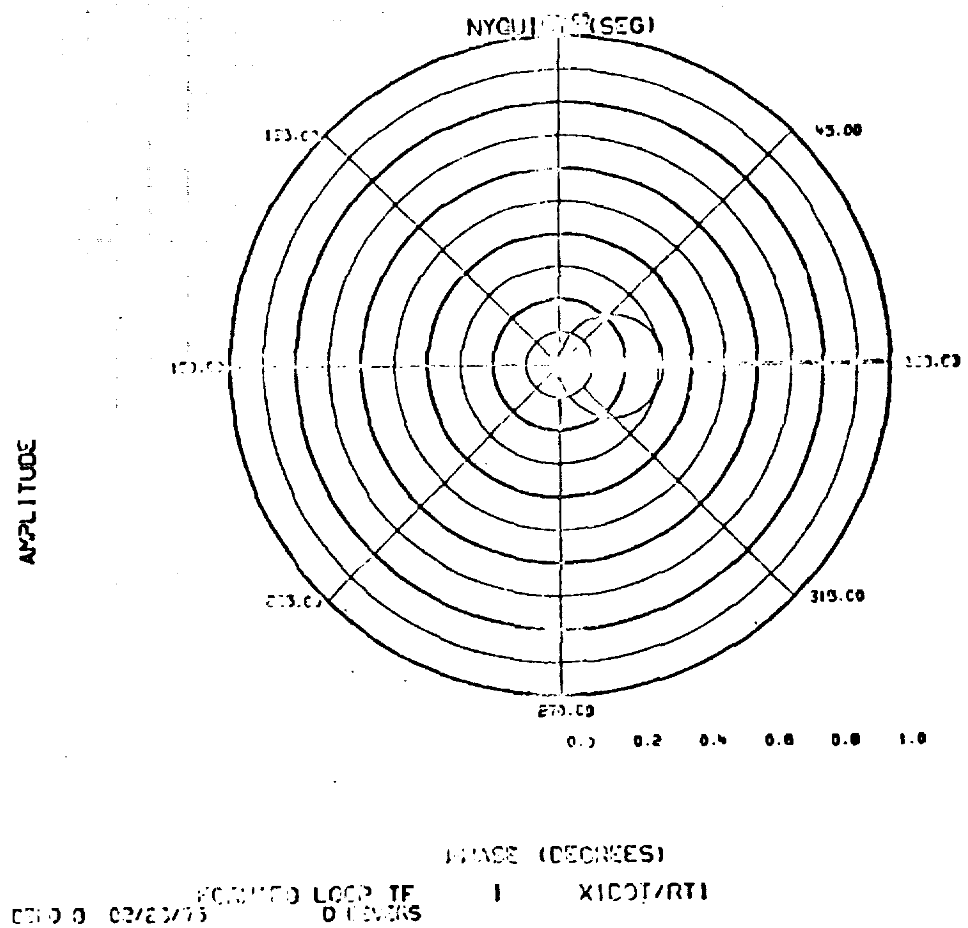


Figure A-7 Graphical Results, Demonstration Problem 8 (Sheet 2 of 11)

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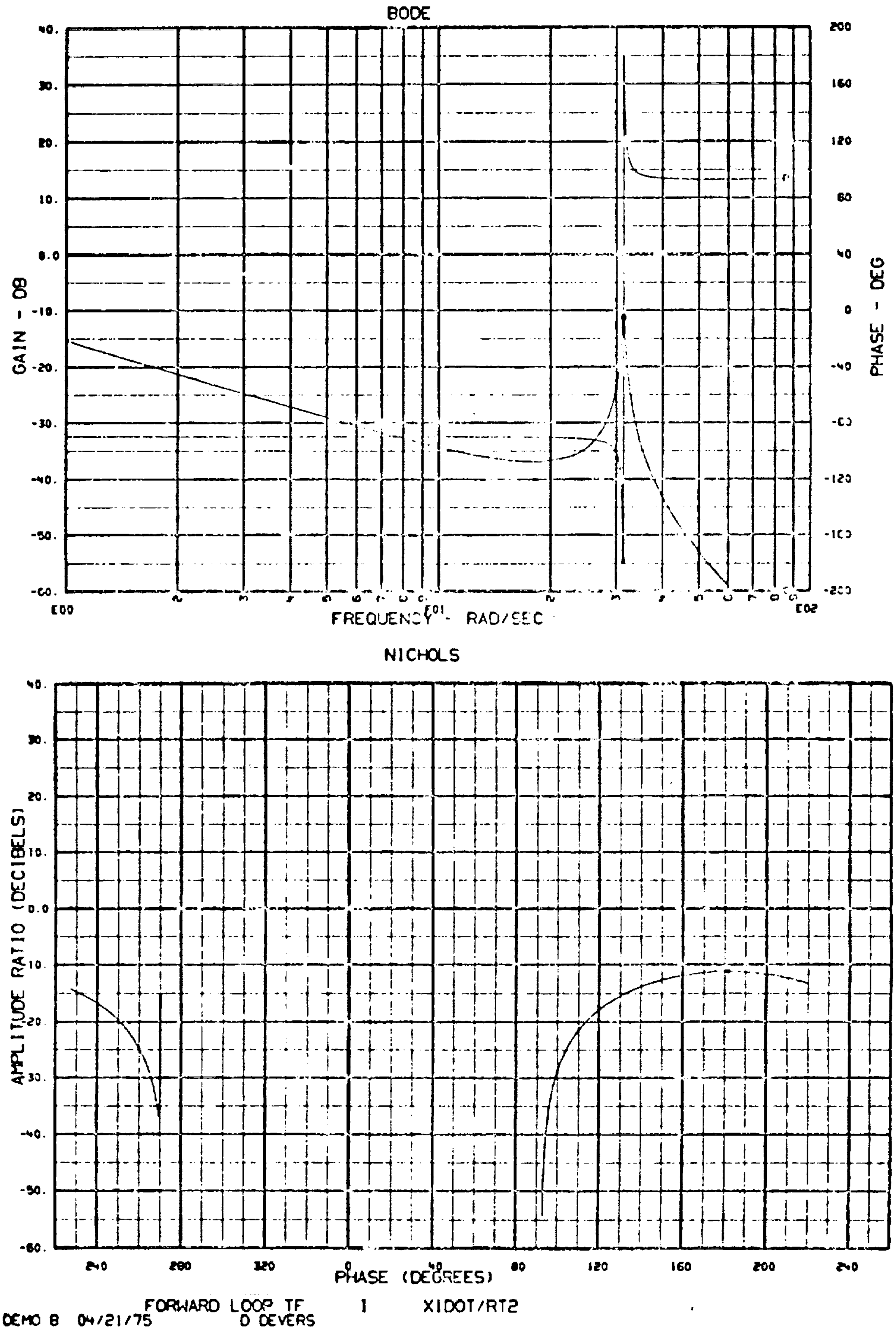


Figure A-7 Graphical Results, Demonstration Problem 8 (Sheet 3 of 11)

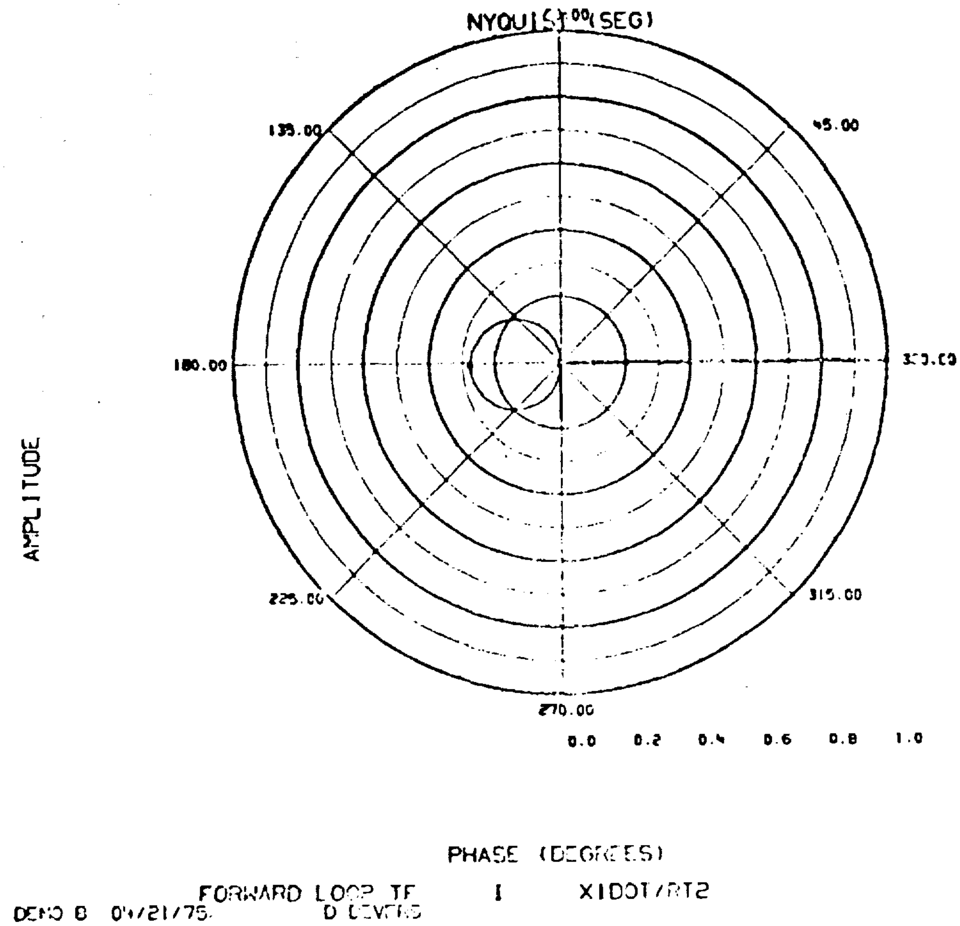
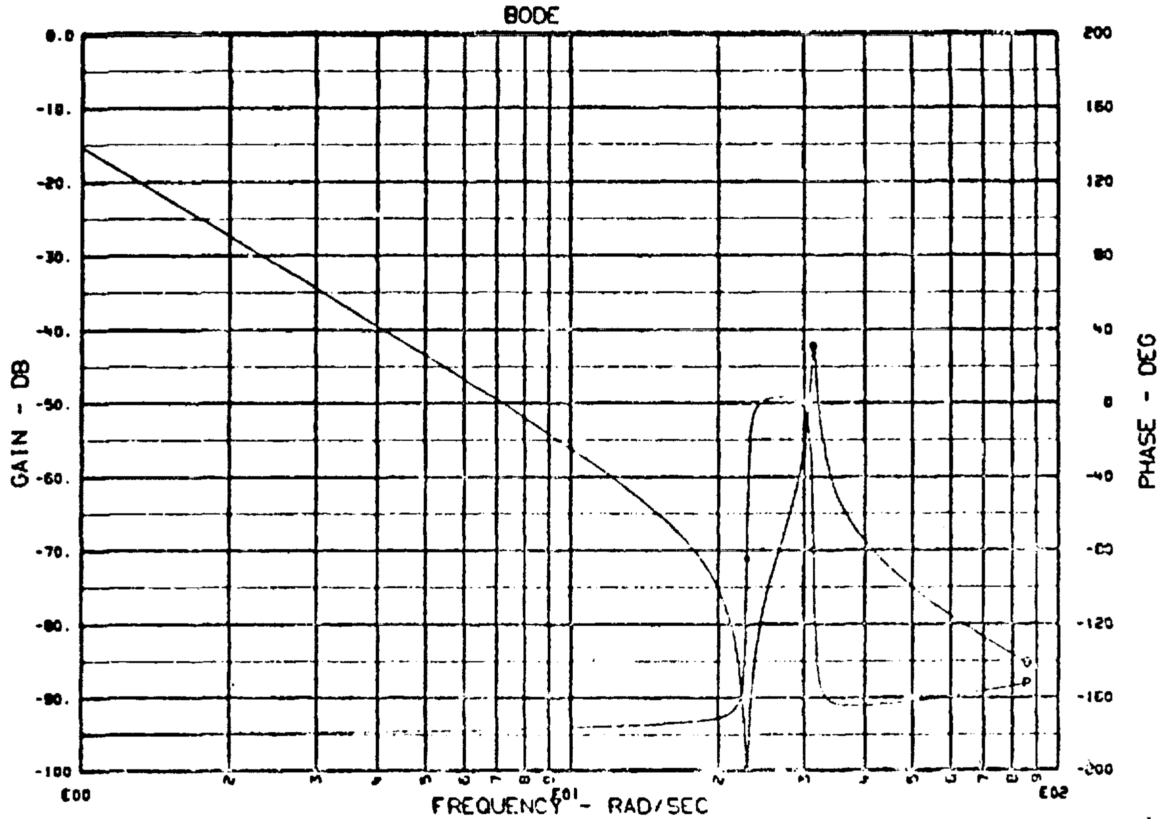


Figure A-7 Graphical Results, Demonstration Problem 8 (Sheet 4 of 11)



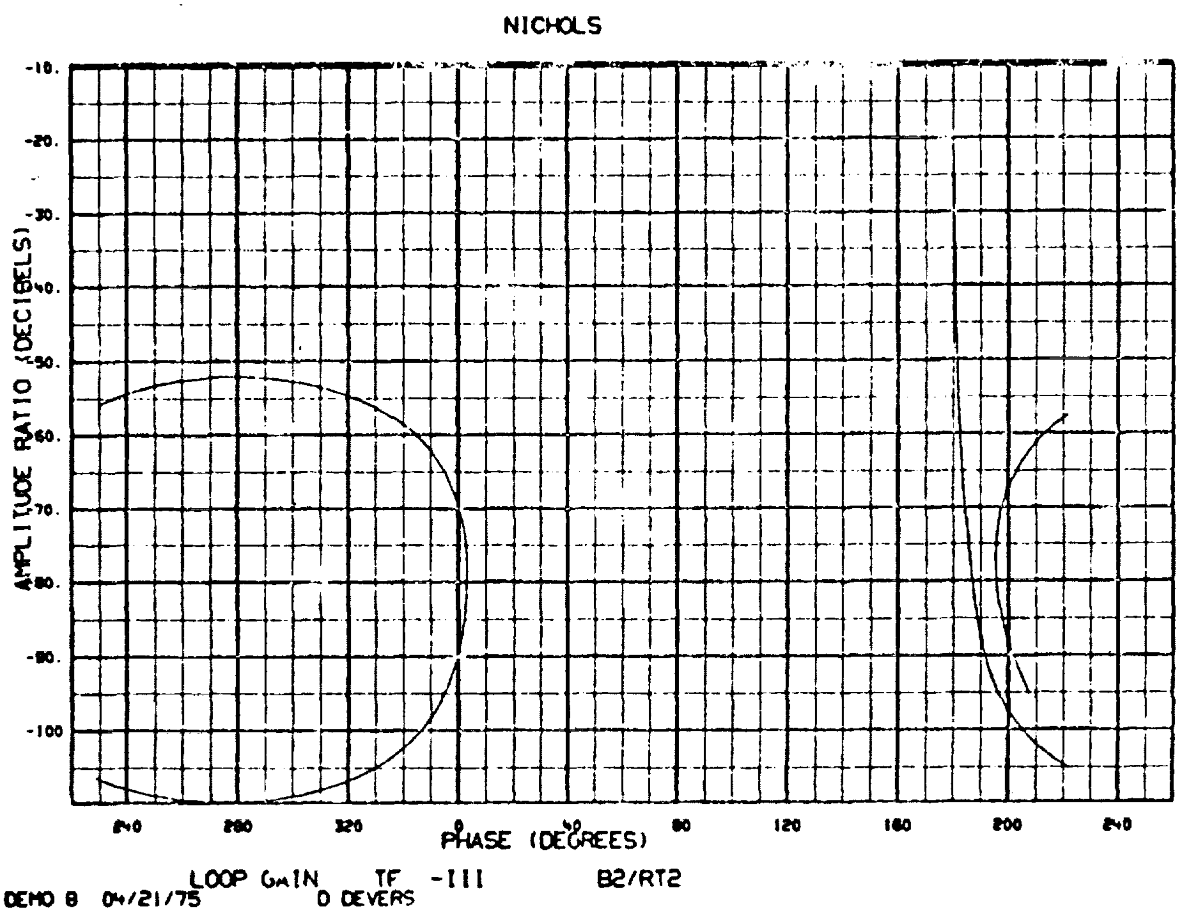
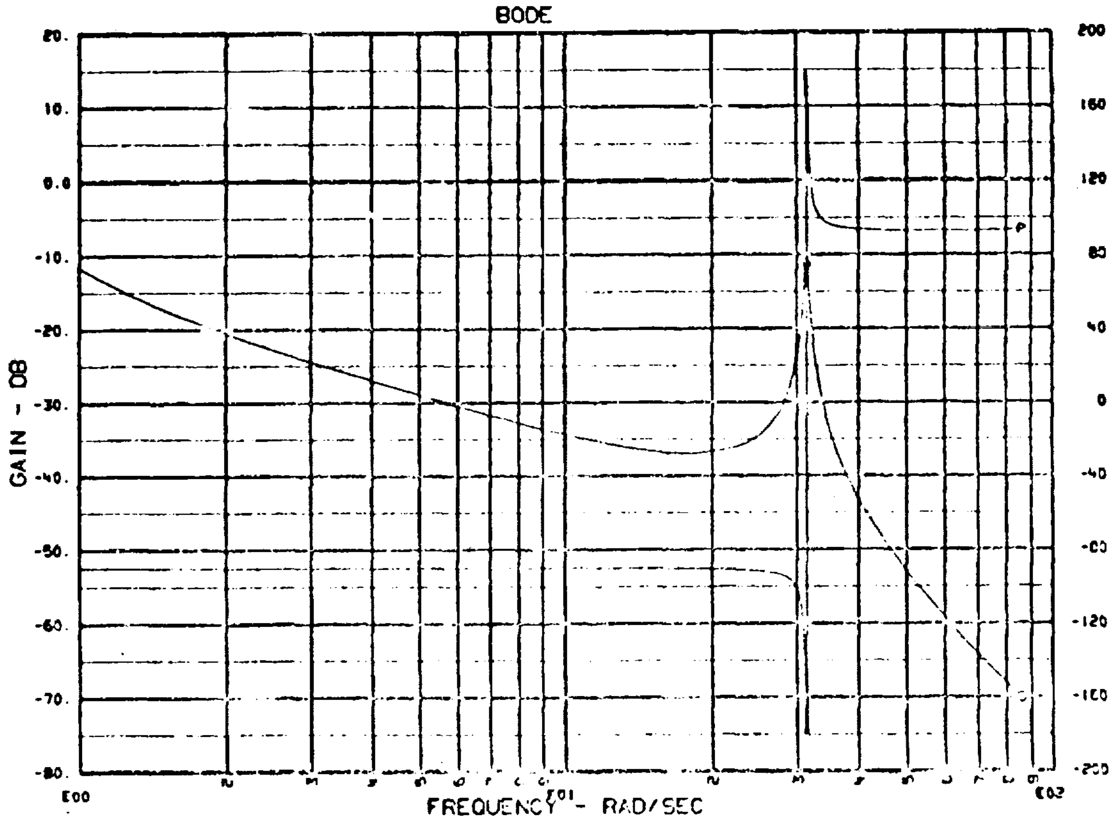
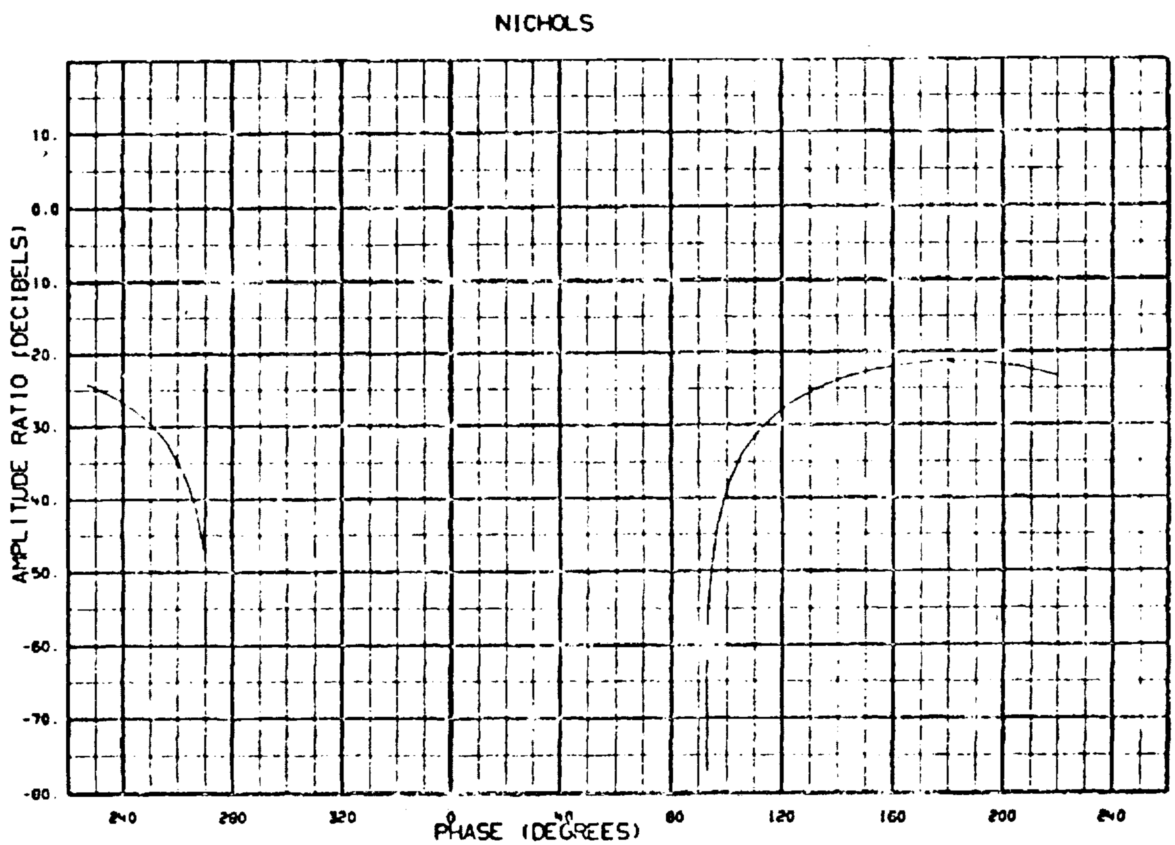


Figure A-7 Graphical Results, Demonstration Problem 8 (Sheet 5 of 11)





CLOSED LOOP TF -V X200T/RT1
DEMO 8 04/21/75 D DEVERS

Figure A-7 Graphical Results, Demonstration Problem 8 (Sheet 6 of 11)

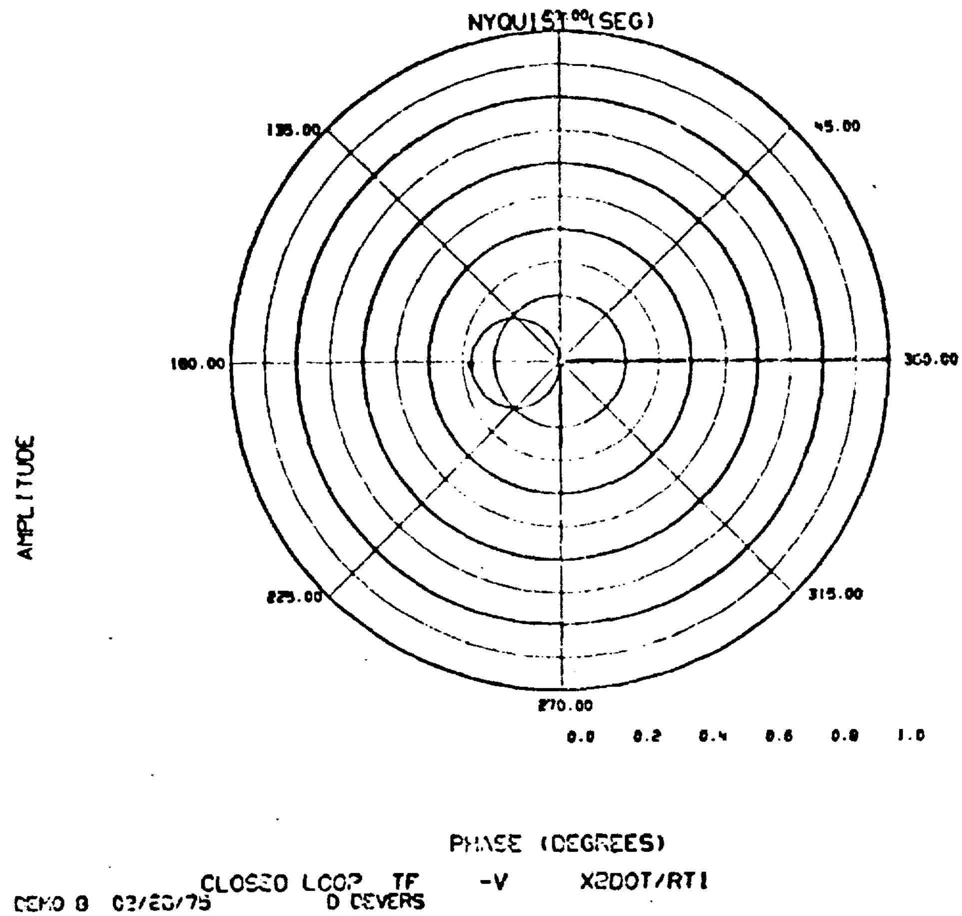
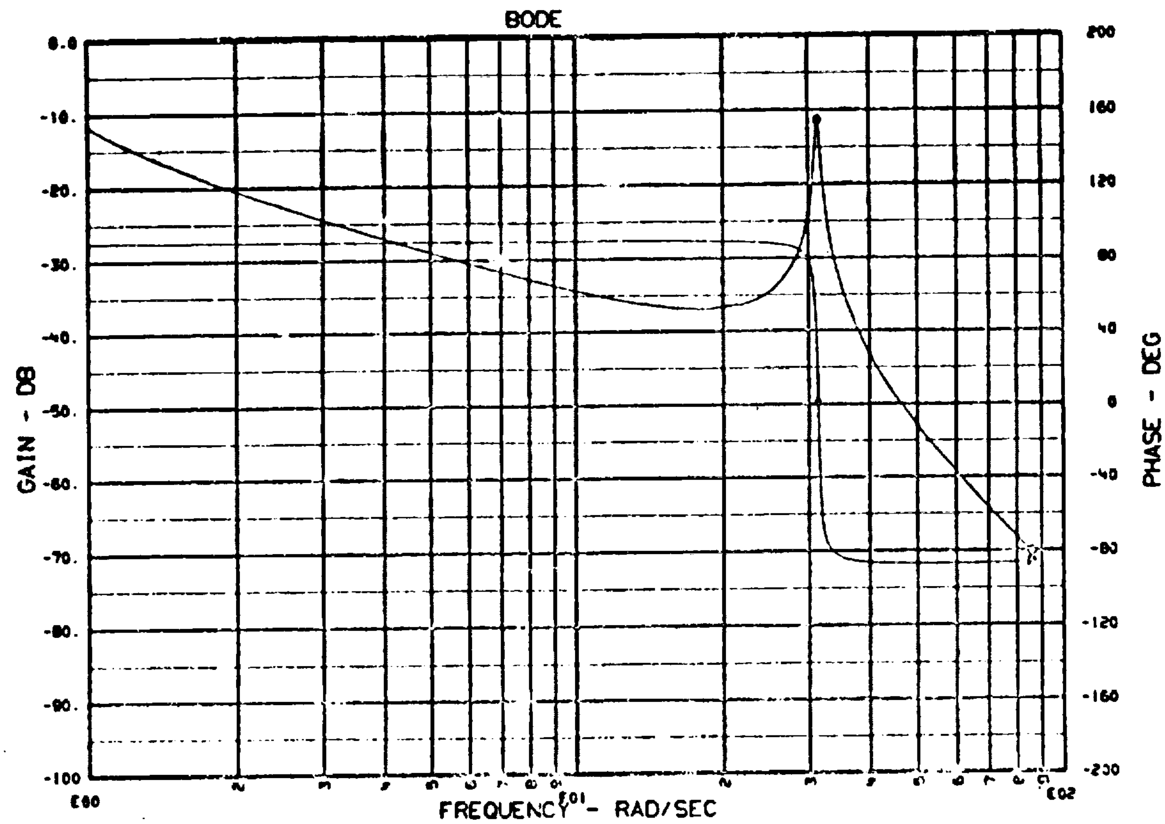
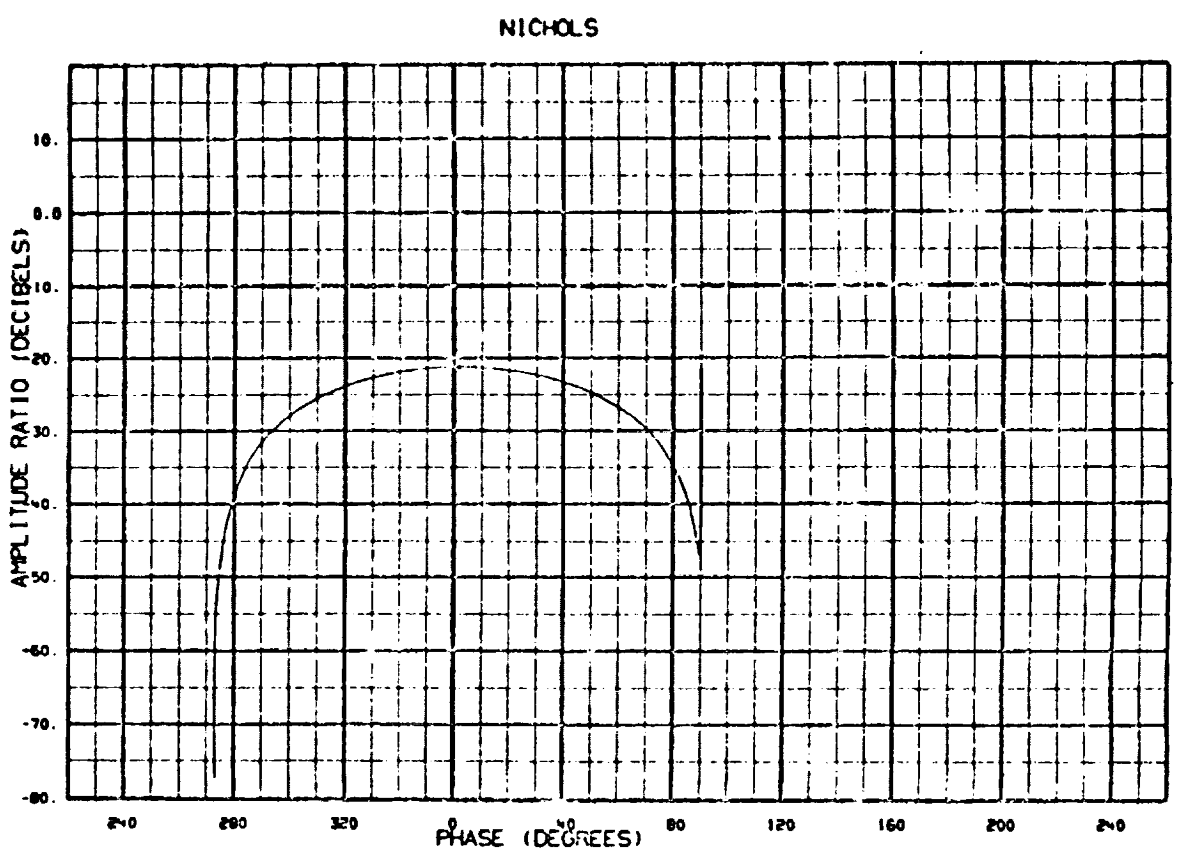


Figure A-7 Graphical Results, Demonstration Problem 8 (Sheet 7 of 11)





CLOSED LOOP TF -V XIDOT/RT2
DEMO 8 04/21/75 D DEVERS

Figure A-7 Graphical Results, Demonstration Problem 8 (Sheet 8 of 11)

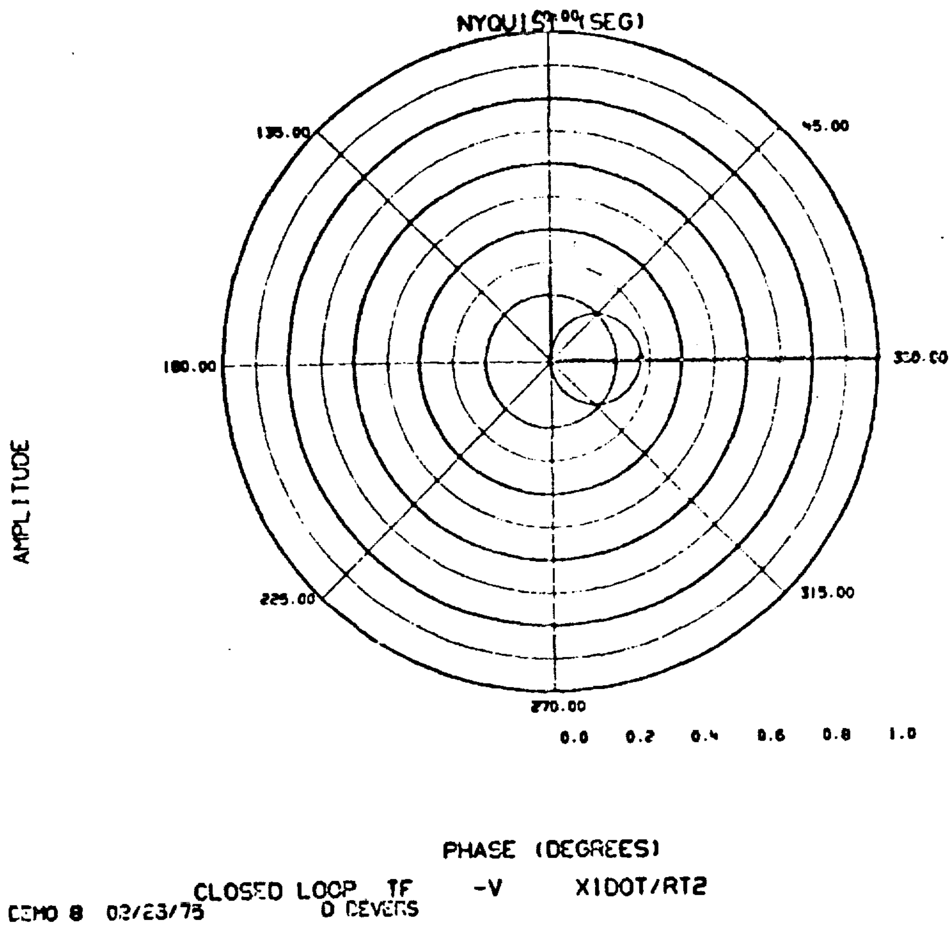
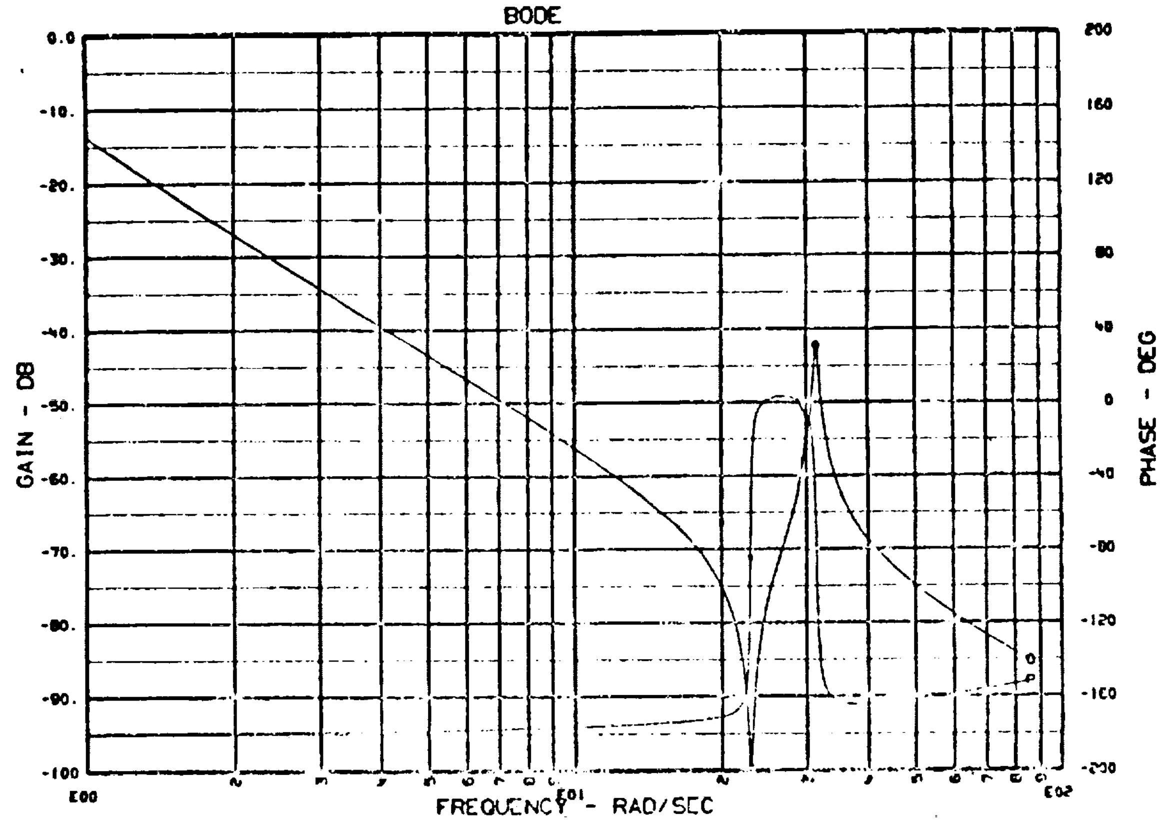
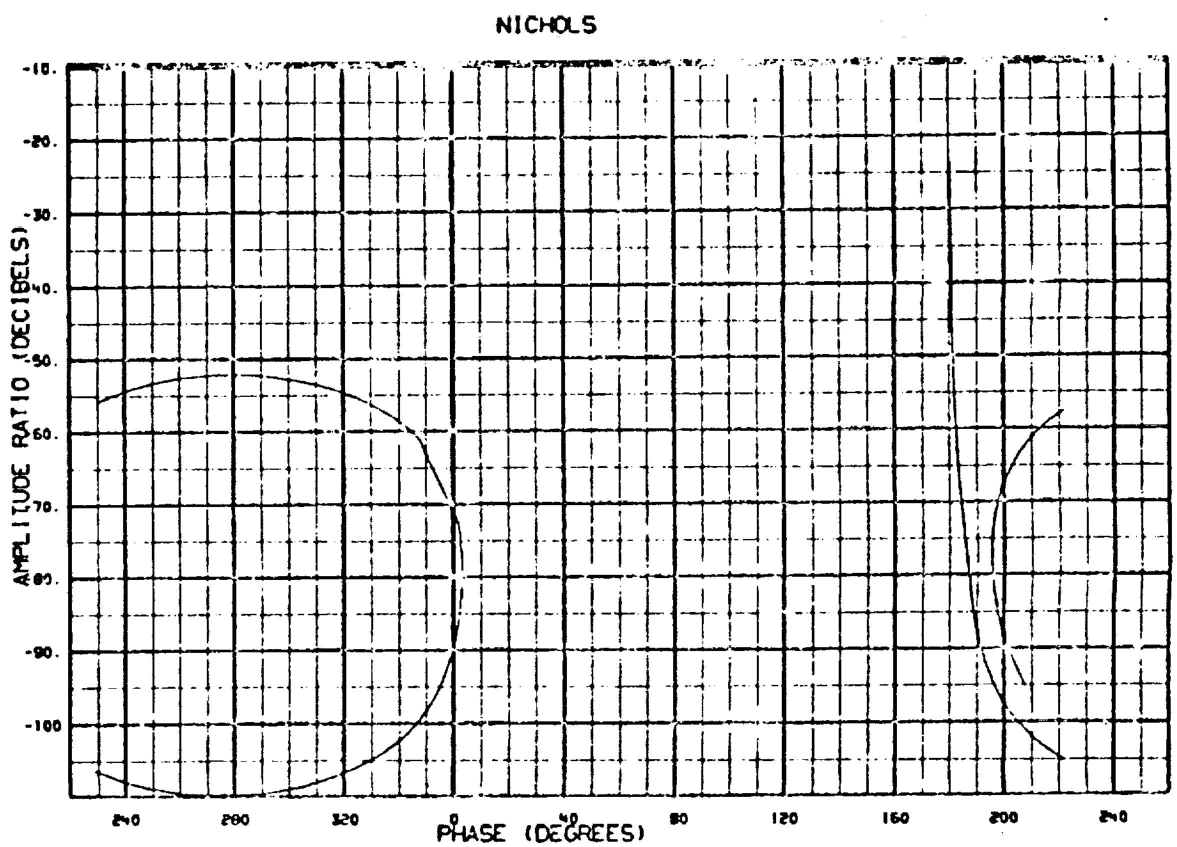


Figure A-7 Graphical Results, Demonstration Problem 8 (Sheet 9 of 11)





LOOP GAIN, (FEED BACK B1) -V11 B2/RT2
DEMO 8 04/21/75 D DEVERS

Figure A-7 Graphical Results, Demonstration Problem 8 (Sheet 10 of 11)

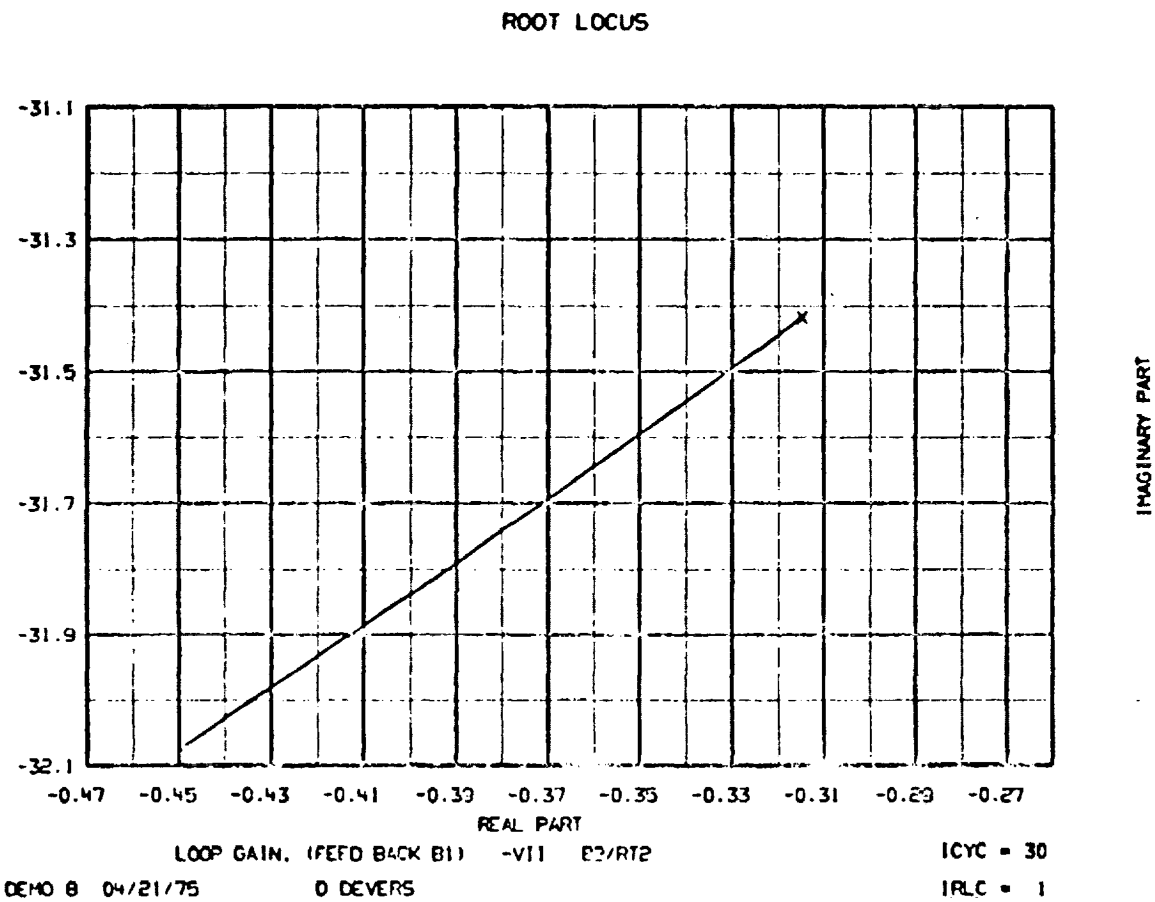


Figure A-7 Graphical Results, Demonstration Problem 8 (Sheet 11 of 11)

Demonstration Problem 9

```
      SUBROUTINE KHINGE (G)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION G(1)
      DIMENSION SK(3,6),DK(3,6),HNGT(3,6)

            COMMON /BHBSRD/                                                  0 255
     *      BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)                    2 255
            COMMON /CONPAR/
     *      CNTDTA(100)
            COMMON /MAXMUM/                                                  0 415
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU                0 415
            COMMON /MOMENG/                                                  0 3886
     *      P(113),PMOM(36),HTOT(3),TOTL(3),ENGKE( 6),ENGPE( 6),            11 3887
     *      TOTKE, TOTPE, TOTENG, AHTOT,ATOTL                                0 3888
            COMMON /SPECIF/                                                  0 415
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),       16 415
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),              17 415
     *      NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),   18 415
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ                             19 415
      COMMON /TQMTR/ TQAZ, TQEL

      EQUIVALENCE (CNTDTA(61),SK(1)), (CNTDTA(81),DK(1))

      TOTPE = 0.D0

      DO 10 L=1,NH
      DO 10 I=1,3
      HNGT(I,L) = -(SK(I,L)*BETAH(I,L) + DK(I,L)*BETAHD(I,L))
   10 TOTPE = TOTPE + 0.5D0*SK(I,L)*BETAH(I,L)**2
      HNGT(2,3) = HNGT(2,3) + TQEL
      HNGT(3,5) = HNGT(3,5) + TQAZ


      LEQ = IRGFLX(1) + 6
      DO 15 I=1,3
      F = HNGT(I,1)
      DO 16 J=1,LEQ
   16 G(J) = G(J) + F*BH(I,J,1)
   15 CONTINUE

      DO 20 L=2,NH
      NOBQ = ITOPOL(1,L)
      NOBP = ITOPOL(2,L)
      LQ = 2*L - 2
      LP = LQ + 1
```

```
      LOQ = LOCU(NOBQ) - 1
      LOP = LOCU(NOBP) - 1
      LEQ = IRGFLX(NOBQ) + 6
      LEP = IRGFLX(NOBP) + 6
      DO 20 I=1,3
      F = HNGT(I,L)
      DO 25 J=1,LEQ
      LOQJ = LOQ + J
   25 G(LOQJ) = G(LOQJ) + F*BH(I,J,LQ)
      DO 26 J=1,LEP
      LOPJ = LOP + J
   26 G(LOPJ) = G(LOPJ) + F*HH(I,J,LP)
   20 CONTINUE

      RETURN
      END
      SUBROUTINE CONTRL                                                  048  1
      IMPLICIT REAL*8 (A-H,O-Z)                                          0 4046
      REAL*8 KL, KE, KTA, LA, KBA, KTE, LE, KBE, KD
                                                                         0 4047
              COMMON /BHBSHD/                                            0 255
     *     BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)                 2 255
              COMMON /CONPAR/
     *     CNTDTA(100)
      COMMON /LDSIZE/ NX,NY,NDLTA,NXSS,NBTQ,NJQ,NY2,ND2                  0 4048
              COMMON /SPECIF/                                            0 4049
     *     BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),PH(3,3,30),HS(3,3,30),    16 4050
     *     DH(3,35),DS(3,30),IMU(3, 5),NMOW(6, 6),IFTSMW(15),           17 4051
     *     NB,NH,NSPT,NOFMU,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6), 18 4052
     *     LOCU(14),LENU(14),NU,NHETA,NLAM,NEQ                          19 4053
              COMMON /VECTOR/                                            0 4054
     *     Y(250),YDT(250)                                              20 405
      COMMON /TQMTR/ TQAZ, TQEL
      COMMON /XSSDA/ PSI, PSID, THTA, THTAD, E

      DIMENSION  TQ(6),TQD(6),RHD(3),THADW(3)

      EQUIVALENCE (CNTDTA(21), KD ), (CNTDTA(22), KL ),(CNTDTA(23),KBA),
     1             (CNTDTA(24),KTA ), (CNTDTA(25), LA ),(CNTDTA(26), RA),
     2             (CNTDTA(27),T1A ), (CNTDTA(28),T2A ),(CNTDTA(29),T3A),
     3             (CNTDTA(30),T4A ), (CNTDTA(31),T5A ),(CNTDTA(32),T6A),
     4             (CNTDTA(33),T7A ), (CNTDTA(34),GPSI),(CNTDTA(35),G1A),
     5             (CNTDTA(36),G2A ), (CNTDTA(37),G3A )
      EQUIVALENCE (CNTDTA(41), KBE), (CNTDTA(42), KTE),(CNTDTA(43), LE),
     1             (CNTDTA(44),  RE), (CNTDTA(45), T1E),(CNTDTA(46),T2E),
```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```
     2              (CNTDTA(47), T3E), (CNTDTA(48), T4E),(CNTDTA(49),GTH),
     3              (CNTDTA(50), G1E), (CNTDTA(51), G2E),(CNTDTA(52),G3E)
C
      DATA IIST/ 0 /
      IF (IIST .NE. 0) GO TO 10
      IIST = 1
CCCCCCCCCC
CCCCCCCCCC
CCC   THE FOLLOWING STATEMENTS MUST ALWAYS BE IN CONTRL..
      NDLTA = NDELTA                                                    0 4057
      NASS = 4
      NBTQ = 2
      IF (NDELTA .EQ. 0) RETURN                                         0 4060
CCCCCCCCCCC     CCC                                                     0 4061
CCCC----NOTE--THIS SUBROUTINE MUST ESTABLISH  NDLTA,NASS AND NBTQ       0 4062
CCCCCCCCCCC                                                             0 4063
C                                                                       0 4064
      LDEL = LOCD(2*NB+2) - 1                                           0 4075
C
      E = Y(31)
      CSE = DCOS(E)
      KE = 1.D0 / (G1A * CSE)
C
      A2 = KL
      A3 = KE
C
      B2 = KL * T3A
      B3 = KE * T4A
      B4 = G2A * T5A
      B5 = G3A * T6A
      B6 = T7A
      B7 = KTA / LA
C
      C1 = T1A
      C2 = T2A
      C3 = 0.D0
      C4 = T5A
      C5 = T6A
      C6 = T7A
      C7 = RA / LA
C
      CW1A = T1A * G1A * KD * GPSI
      CW7A = -KTA / LA * KBA
C
      A2E = G1E
```

```
C
      B2E = G1E * T3E
      B3E = G2E * G3E * T4E
      B4E = KTE / LE
C
      C1E = T1E
      C2E = T2E
      C3E = T4E
      C4E = RE / LE
C
      CQ1E = T1E * KD * GTH
      CQ4E = -KTE / LE * K3E
C
C  **********
   10 CONTINUE
      PSI   = Y(31) - E
      THTA  = Y(32)
      PSID  = YDT(38)
      THTAD = YDT(42)
C
      Q1A = CQ1A * THTA
CCCC  ESTABLISH THE D/DT(DELTAS)                                      U 4065
C                                                                     U 4066
      YDT(LDEL+ 1) = -C1 * Y(LDEL+1) + Q1A
      YDT(LDEL+ 2) = (B2-C1*A2) * Y(LDEL+1) - C2*Y(LDEL+2) + A2*Q1A
      YDT(LDEL+ 3) = (A3*B2-C1*A2*A3) * Y(LDEL+1)
     *               +(B3-C2*A3) * Y(LDEL+2) - C3*Y(LDEL+3)+A3*A2*Q1A
      YDT(LDEL+ 4) =  B4 * Y(LDEL+3) - C4*Y(LDEL+4)
      YDT(LDEL+ 5) =  B5 * Y(LDEL+4) - C5*Y(LDEL+5)
      YDT(LDEL+ 6) =  B6 * Y(LDEL+5) - C6*Y(LDEL+6)
      YDT(LDEL+ 7) =  B7 * Y(LDEL+ 6) - C7*Y(LDEL+7) + CQ7A*THTAD
C
      YDT(LDEL+ 8) = -C1E * Y(LDEL+8) + CQ1E * PSI
      YDT(LDEL+ 9) = (B2E-C1E*A2E) * Y(LDEL+8) - C2E*Y(LDEL+9)
     *               + A2E*CQ1E*PSI
      YDT(LDEL+10) = B3E * Y(LDEL+9) - C3E * Y(LDEL+10)
      YDT(LDEL+11) = B4E * Y(LDEL+10)- C4E * Y(LDEL+11) + CQ4E * PSID
C
C  COMPUTE TORQUES FOR USE IN RHINGE.
C
      TQAZ = Y(LDEL+7)
      TQEL = Y(LDEL+11)
C
C
      RETURN                                                          U 4080
```

```
      END
      SUBROUTINE FATOR  (TEX,ISPN,NTEX)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION TEX(6,1), ISPN(1)
C
              COMMON /MAXMUM/
     *        NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU
              COMMON /SPECIF/
     *        BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
     *        DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
     *        NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),
     *        LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
              COMMON /VECTOR/
     *        Y(250),YDT(250)
C
      DATA IIST / 0 /
C
CCC ESTABLISH THE EXTERNAL FORCE/TORQUE (6-LONG VECTOR) AND NUMBER
CCC  THE CORRESPONDING SENSOR POINTS. ALSO ESTABLISH THE NUMBER OF
CCC  SIX-LONG VECTORS (NTEX).
C
      IF (IIST .EQ. 1) GO TO 5
      IIST = 1
      DO 10 I=1,6
      DO 10 J=1,NSPMAX
   10 TEX(I,J) = 0.D 0
C
    5 NTEX = 0
C
      RETURN
      END
      SUBROUTINE SHAFTT (TSHFT)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION TSHFT(1)
C
              COMMON /MAXMUM/
     *        NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU
              COMMON /SPECIF/
     *        BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
     *        DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
     *        NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),
     *        LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
              COMMON /VECTOR/
     *        Y(250),YDT(250)
C
```

```
      DATA IIST / 0 /                                                   0 4136
C                                                                       0 4137
      IF (IIST .EQ. 1) GO TO 10                                         0 4138
      IIST = 1                                                          0 4139
      DO 5 I=1,NMWMAX                                                   0 4140
    5 TSHFT(I) = 0.D 0                                                  0 4141
C                                                                       0 4142
   10 CONTINUE
      RETURN
      END                                                               0 4144
      SUBROUTINE EQADD                                                  U51  1
      IMPLICIT REAL*8 (A-H,O-Z)                                         0 4147
C
              COMMON /RHBSRD/                                           0 255
     *      BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)               2 255
              COMMON /UNAUX /                                           0 414
     *      NAUX                                                        0 414
              COMMON /MAXMUM/                                           0 415
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOU,NMDBOU,KMU,KY,KU           0 415
              COMMON /SPECIF/                                           0 415
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),   16 415
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSHW(15),          17 415
     *      NB,NH,NSPT,NOFMU,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6), 18 415
     *      LOCU(14),LENU(14),NU,NHETA,NLAM,NEQ                         19 415
              COMMON /VECTOR/                                           0 415
     *      Y(250),YDT(250)                                             20 405
      COMMON /XSSDA/ PSI, PSID, THTA, THTAD, E
      DATA IIST/ 0/                                                     0 415
C
      IF (IIST .NE. 0) GO TO 5
      IIST = 1
      E = Y(31)
      NAUX = 6
      LDEL = LOCU(2*NB+2) - 1
    5 CONTINUE
C
      PSI = Y(31) - E
      THTA = Y(32)
      PSID = YDT(38)
      THTAD = YDT(42)
C
      YDT(NEQ+1) = PSID
      YDT(NEQ+2) = PSI
      YDT(NEQ+3) = THTAD
      YDT(NEQ+4) = THTA
```

```
      YOT(NEQ+5) = Y(LDEL+7)
      YOT(NEQ+6) = Y(LDEL+11)
      RETURN                                                          0 417
      END                                                             0 417
```

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DEMO 9   D. DEVERS
AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM   ---DATA MOD ON 3MAR1975

```
                              -----SCHEMATIC-----



YYY               YYY  YOKE  YYY              YYY

Y              TORSION                          Y
Y     * EL   -SPRING-     * PIA                 Y
Y      MOTOR    B1                              Y

Y                                               Y
 YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
                        Y
                        Y
                        Y
                        Y
                        Y
                        Y
                        Y
                        Y

                  ------ SPRINGS (B2,B3,B4)

                        *  AZIMUTH
                           MOTOR
```

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```
                                              ***   SPACECRAFT
                                              ***  (PLATFORM)
0000000000
    5    5     1     0    11                 NB, NH, NSPT, NOFMO, NDELTA
ITPOL    2     5
    1    1     1     2     3     4     5
    2    1     0     1     2     3     4
0000000000
IRGFLX   1     5     NO. FLEXIBLE MODES/BODY
0000000000
IFTSMW   1     1     NO. F. T. S. MW POINTS
    1    1     1
0000000000
IHDATA   7     5
    1    1     5     1     1     1     1
    2    1     0     1     1     0     1
    3    1     0     0     0     0     1
    4    1     0     1     1     0     0
    5    1     0     1     1     1     1
    6    1     0     1     1     1     1
    7    1     0     1     1     1     1
0000000000
BETAH    6     5     INITIAL BETA (HINGE)
    1    1 1.22173
    2    3-1.22173
0000000000
BETAHD   6     5
0000000000
TMDATA   1     3
0000000000
IPDATA   1     3
    1    3     1
0000000000
CNTDTA   1   100     MISC DATA PECULAR TO AC.
    1   21 3437.8         2.0              0.0              12.4992
    1   25 0.025          14.              62800.           1000.
    1   29 49.75          5.0              6666.              2514.
    1   33 2514.          0.122            11.577           100.
    1   37 3.11
    1   41 0.             2.50596          0.0212           22.
    1   45 62800.         450.             45.              6666.
```

```
    1    49 0.122              45.              3.11             5.0
    1    65 1.6355         +06
    1    70 5.040863       +05 4.43753      +05 6.08972      +05
    1    85 0.024673
    1    90 0.0553295         0.048707         0.021538
0000000000
GGDTA    1     4
0000000000
MASS     1     4      BODY 1 (PIA)
    1    1 0.05662
0000000000
INERT    1     6
    1    1 0.99995            0.93407          0.57412
    1    4 -.00257            0.05713          0.01198
0000000000
    2    1
 0.0
-.024     6.069     0.024
    1    1
 0.0
0.0
MASS     1     4      BODY 2 (ELE. MOTOR)
    1    1 0.003619
0000000000
INERT    1     6
    1    1 0.003899           0.003238         0.003899
0000000000
    2    1
 0.0
 0.0      0.0       0.0
    3    1
 0.0
 0.0     -5.926     0.0
MASS     1     4      BODY 3 (YOKE)
    1    1 0.024373
0000000000
INERT    1     6
    1    1 1.03375            0.37553          0.89120
    1    4 0.00125            0.00064          -.01941
0000000000
    3    1
 0.0
 -.024    0.529     -.081
    4    1
 0.0
```

```
-.024      0.529      12.189
MASS      1     4      BODY 4 (AZIMUTH MOTOR)
    1     1 0.01596
0000000000
INERT     1     6
    1     1 0.0001          0.0001          0.0946
0000000000
    4     1
 0.0
0.0        0.0        0.0
    5     1
 0.0
 0.0        0.0        0.0
MASS      1     4      BODY 5 (PLATFORM)
    1     1 3.6558
0000000000
INERT     1     6
    1     1 850.011         863.85          935.37
    1     5   2.8
0000000000
    5     1
 0.0
0.0        0.0        -8.749
FREQ
LRY       9    12      TRANSFER FUNCTION ID'S.
    1     1    -1    -1     2     2    -3    -3     4    -5    -5     6    -7    -7
    2     1     1     2     2     4     1     2     4     1     2     2     1     2
    3     1     3     1     2     1     1     2     3     1     2     2     1     2
    4     1     1     1     1     0     1     1     1     0     0     0     1     1
    6    11     1     1
    7    11     2     1
0000000000
IRY       3    12
    3     1    -8    -8    -8    -8    -8    -8    -8    -8    -8    -8    -8    -8
0000000000
  G (PLANT ONLY) TYPE1  BETA DOT-AZ / AZ TORQ
BONN
10.       1000.     -60.      40.       0.0       10.
  G (PLANY ONLY) 1 BETA DOT-EL / EL TORQ
BONN
10.       1000.     -60.      40.       0.0       10.
  H (CONTROL SYSTEM ONLY) TYPE2 T-EL/EL ERROR
BONN
10.       1000.     -60.      40.       0.0       10.
  H (CONTROL SYSTEM ONLY) TYPE2 T-AZ/AZ ERROR
```

```
BONN
10.        1000.      -60.       40.        0.0        10.
  GH (OPEN LOOP) TYPE3 T-AZ/T-AZ
BONN
10.        1000.      -60.       40.        0.0        10.
  GH (OPEN LOOP) TYPE3 TELZ/TELZ
BONN
10.        1000.      -60.       40.        0.0        10.
 HG (OPEN LOOP) TYPE4 BETA DOT-AZ/AZ ERROR
BONN
10.        1000.      -60.       40.        0.0        10.
  GH/(1+GH)  CLOSED LOOP) TYPE5 BETA DOT-EL/T-AZ
BONN
10.        1000.      -60.       40.        0.0        10.
  GH/(1+GH)  CLOSED LOOP) TYPE5 BETA    -EL/T-EL
BONN
10.        1000.      -60.       40.        0.0        10.
           CLOSED LOOP) TYPE6  EL ERROR/EL NOISE
BONN
10.        1000.      -60.       40.        0.0        10.
   OPEN LOOP WITH EL LOOP CLOSED) TYPE 7 T-AZ / T-AZ
BONNROOT
10.        1000.      -60.       40.        0.0        10.
IJM       2     4
    1     1     2     2     2     2
    2     1    17    19     3     1
0000000000
WARL      6     4
    1     1 -180.             -180.            -180.            -180.
    2     1 -1.0              -1.0             -1.0              -1.0
    3     1 -1.0              -1.0             -1.0             -1.0
    4     1 -0.1              -0.1             -10000.          -100000.
    5     1 0.1               0.1
    6     1 250.              250.             500.             500.
0000000000
   OPEN LOOP WITH AZ LOOP ACTIVE  TYPE 7 T-EL / T-EL
BONN
10.        1000.      -60.       40.        0.0        10.
STOP
```

A-310

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.29.24
THE CPU TIMER = 0.0

-----SCHEMATIC-----

```
YYY              YYY  YOKE  YYY              YYY

Y               TORSION                        Y
Y    * EL   -SPRING-     * PIA                 Y
Y      MOTOR    B1                             Y

Y                                              Y
 YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
                          Y

                          Y

                          Y

                          Y

                          Y

                          Y

                          Y

                          Y

                    ------ SPRINGS (B2,B3,B4)

                          *  AZIMUTH
                             MOTOR


                         ***   SPACECRAFT
                         ***  (PLATFORM)
```

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AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.29.25
THE CPU TIMER = 5.8333E-01

SUMMARY OF DYNAMIC-SIMULATION-PROGRAM INPUT DATA * * * * * * * * * * *

ACTUAL SIZES		MAXIMUM SIZES		INTEGRATION DATA		GRAVITY GRADIENT DATA				MISC. DATA	
NB =	5	NBMAX =	6	STARTT =	0.0	G1 =	0.0	GAMA1 =	0.0	NOPRNT =	0
NH =	5	NHMAX =	6	DELTAT =	0.0	G2 =	0.0	GAMA2 =	0.0	NOPLOT =	0
NSPT =	1	NSPMAX =	15	ENDT =	0.0	G3 =	0.0	GAMA3 =	0.0	IFLNER =	1
NOFMD =	0	NMWMAX =	5			GMAG =	0.0	RCMAG =	0.0		
NDELTA =	11	NMWBOD =	4								
NU =	30	NMDBOD =	12								
NBETA =	12	KMU =	22								
NLAM =	18	KY =	250								
NEQ =	53	KU =	113								

THE TOPOLOGY ARRAY (ITOP(L)) FOR THIS CASE FOLLOWS

		(1)	(2)	(3)	(4)	(5)
1	1	1	2	3	4	5
2	1	0	1	2	3	4

THE CONSTRAINT SPECIFICATIONS FOR THIS CASE FOLLOW

		(1)	(2)	(3)	(4)	(5)
1	1	5	1	1	1	1
2	1	0	1	1	0	1
3	1	0	0	0	0	1
4	1	0	1	1	0	0
5	1	0	1	1	1	1
6	1	0	1	1	1	1
7	1	0	1	1	1	1

THE SPECIFIED INITIAL HINGE ANGLES AND DISPLACEMENTS (BETAH) FOLLOW

		(1)	(2)	(3)	(4)	(5)
1	1	1.2220+00	0.0	0.0	0.0	0.0
2	1	0.0	0.0	-1.2220+00	0.0	0.0
3	1	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0

THE SPECIFIED INITIAL HINGE RATES (BETAHD) FOLLOW

		(1)	(2)	(3)	(4)	(5)
1	1	0.0	0.0	0.0	0.0	0.0
2	1	0.0	0.0	0.0	0.0	0.0
3	1	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.29.35
THE CPU TIMEE = 7.4667E-01

THE NO. OF ELASTIC MODES/BODY ARRAY (IRGFLX) FOLLOWS

		(1)	(2)	(3)	(4)	(5)
1	1	0	0	0	0	0

THE NO. OF P/Q HINGE POINTS/BODY ARRAY (NHPOI) FOLLOWS

		(1)	(2)	(3)	(4)	(5)
1	1	1	2	2	2	1

THE NO. OF SENSOR POINTS/BODY ARRAY (NSPOI) FOLLOWS

		(1)	(2)	(3)	(4)	(5)
1	1	1	0	0	0	0

THE MOM. WHEEL/BODY TABLE (NMOW) FOLLOWS

		(1)	(2)	(3)	(4)	(5)
1	1	0	0	0	0	0
2	1	0	0	0	0	0
3	1	0	0	0	0	0
4	1	0	0	0	0	0
5	1	0	0	0	0	0
6	1	0	0	0	0	0

THE STATE VECTOR LENGTH ARRAY (LENU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	1	6	6	6	6	6	0	0	0	0	0	12	11

THE STATE VECTOR LOCATION ARRAY (LOCU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	1	1	7	13	19	25	31	31	31	31	31	31	43

THE SPECIFIED SENSOR POINT/BODY CORRELATION ARRAY (IFTSMW) FOLLOWS

		(1)
1	1	1

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.29.35
THE CPU TIMER = 8.4667E-01

THE FOLLOWING DATA IS SPECIFIED MOM. WHEEL INFORMATION (IF ANY) AND CONTROLLER INFORMATION

THE SPECIFIED CONTROLLER INITIAL CONDITIONS AND CHARACTERISTICS FOLLOW
(THE FIRST NDELTA ARE INITIAL CONTROLLER STATE VARIABLES, THERE ARE 89 ADDITIONAL CONTROL PARAMETERS)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	3.4380+03	2.0000+00	0.0	1.2500+01	2.5000-02	1.4000+01	6.2800+04	1.0000+03	4.9750+01	5.0000+00
1	31	6.6660+03	2.5140+03	2.5140+03	1.2200-01	1.1580+01	1.0000+02	3.1100+00	0.0	0.0	0.0
1	41	0.0	2.5060+00	2.1200-02	2.2000+01	6.2800+04	4.5000+02	4.5000+01	6.6660+03	1.2200-01	4.5000+01
1	51	3.1100+00	5.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	61	0.0	0.0	0.0	0.0	1.6360+06	0.0	0.0	0.0	0.0	5.0410+05
1	71	4.4380+05	6.0900+05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	81	0.0	0.0	0.0	0.0	2.4670-02	0.0	0.0	0.0	0.0	5.5330-02
1	91	4.8710-02	2.1540-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.[illegible].36
THE CPU TIME = 1.0967E+00

A-314

SUMMARY OF INPUT DATA FOR BODY 1 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.0000+00	2.5700-03	-5.7130-02	0.0	0.0	0.0
2	1	2.5700-03	9.3410-01	-1.1980-02	0.0	0.0	0.0
3	1	-5.7130-02	-1.1980-02	8.7410-01	0.0	0.0	0.0
4	1	0.0	0.0	0.0	5.8620-02	0.0	0.0
5	1	0.0	0.0	0.0	0.0	5.8620-02	0.0
6	1	0.0	0.0	0.0	0.0	0.0	5.8620-02

FOR BODY 1 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	-2.4000-02	6.0690+00	2.4000-02

FOR BODY 1 THE SENSOR POINT NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES(1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	1	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.29.36
THE CPU TIMER = 1.2700E+00

SUMMARY OF INPUT DATA FOR BODY 2 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	3.8990-03	0.0	0.0	0.0	0.0	0.0
2	1	0.0	3.2380-03	0.0	0.0	0.0	0.0
3	1	0.0	0.0	3.8990-03	0.0	0.0	0.0
4	1	0.0	0.0	0.0	3.6190-03	0.0	0.0
5	1	0.0	0.0	0.0	0.0	3.6190-03	0.0
6	1	0.0	0.0	0.0	0.0	0.0	3.6190-03

FOR BODY 2 THE P-C HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1
2	1	3	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0.0	0.0	0.0	0.0	-5.9260+00	0.0

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.29.37
THE CPU TIMER = 1.4400E+00

SUMMARY OF INPUT DATA FOR BODY 3 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.054D+00	-1.250D-03	-6.640D-03	0.0	0.0	0.0
2	1	-1.250D-03	3.755D-01	1.941D-02	0.0	0.0	0.0
3	1	-6.640D-03	1.941D-02	8.912D-01	0.0	0.0	0.0
4	1	0.0	0.0	0.0	2.437D-02	0.0	0.0
5	1	0.0	0.0	0.0	0.0	2.437D-02	0.0
6	1	0.0	0.0	0.0	0.0	0.0	2.437D-02

FOR BODY 3 THE P-O HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	3	1
2	1	4	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	-2.400D-02	5.290D-01	-8.100D-02
2	1	0.0	0.0	0.0	-2.400D-02	5.290D-01	1.219D+01

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.29.37
THE CPU TIMER = 1.5900E+00

SUMMARY OF INPUT DATA FOR BODY 4 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.0000-04	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.0000-04	0.0	0.0	0.0	0.0
3	1	0.0	0.0	9.4600-02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	1.5960-02	0.0	0.0
5	1	0.0	0.0	0.0	0.0	1.5960-02	0.0
6	1	0.0	0.0	0.0	0.0	0.0	1.5960-02

FOR BODY 4 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	4	1
2	1	5	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0.0	0.0	0.0	0.0	0.0	0.0

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A-318

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.29.27
THE CPU TIMER = 1.7567E+10

SUMMARY OF INPUT DATA FOR BODY 5 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	8.5000+02	0.0	-2.8000+00	0.0	0.0	0.0
2	1	0.0	8.6380+02	0.0	0.0	0.0	0.0
3	1	-2.8000+00	0.0	9.3540+02	0.0	0.0	0.0
4	1	0.0	0.0	0.0	3.6560+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	3.6560+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	3.6560+00

FOR BODY 5 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	5	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	-8.7490+00

THE FOLLOWING INTEGER ARRAY (INDEP) PRESCRIBES INDEPENDENT VARIABLES (1), AND DEPENDENT VARIABLES (0)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
1	1	0	1	0	0	1	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0
1	21	1	1	1	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1
1	41	1	1	1	1	1	1	1	1	1	1	1	1	1							

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.29.49
THE CPU TIMER = 9.7100E+00

AT SIMULATION TIME, T = 0.0 *

THE STATE VECTOR Y =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	1.222D+00	0.0	0.0	0.0	0.0	0.0	0.0	-1.222D+00	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	51	0.0	0.0	0.0							

AT SIMULATION TIME, T = 0.0 *

THE STATE VECTOR TIME DERIVATIVE YDT =

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	51	0.0	0.0	0.0							

AT SIMULATION TIME, T = 0.0 *

THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE

		(1)	(2)	(3)	(4)	(5)
1	1	1.222D+00	0.0	0.0	0.0	0.0
2	1	0.0	0.0	-1.222D+00	0.0	0.0
3	1	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0 *

THE BETA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)
1	1	0.0	0.0	0.0	0.0	0.0
2	1	0.0	0.0	0.0	0.0	0.0
3	1	0.0	0.0	0.0	0.0	0.0
4	1	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	0.0

AT SIMULATION TIME, T = 0.0 *

THE DELTAS (CONTROL SYSTEM VARIABLES) ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0									

AT SIMULATION TIME, T = 0.0 *

THE DELTA TIME DERIVATIVES ARE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

```
   1   11    0.0


          AT SIMULATION TIME, T = 0.0          * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
   FOR BODY  1   THE VELOCITIES ARE
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   FOR BODY  1   THE CORRESPONDING MOMENTA ARE
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      0.0             0.0

          AT SIMULATION TIME, T = 0.0          * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
   FOR BODY  2   THE VELOCITIES ARE
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   FOR BODY  2   THE CORRESPONDING MOMENTA ARE
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      0.0             0.0

          AT SIMULATION TIME, T = 0.0          * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
   FOR BODY  3   THE VELOCITIES ARE
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   FOR BODY  3   THE CORRESPONDING MOMENTA ARE
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   FOR BODY  3   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      0.0             0.0

          AT SIMULATION TIME, T = 0.0          * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
   FOR BODY  4   THE VELOCITIES ARE
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   FOR BODY  4   THE CORRESPONDING MOMENTA ARE
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   FOR BODY  4   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS      0.0             0.0

          AT SIMULATION TIME, T = 0.0          * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
   FOR BODY  5   THE VELOCITIES ARE
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
   FOR BODY  5   THE CORRESPONDING MOMENTA ARE
                (1)          (2)          (3)          (4)          (5)          (6)
    1     1     0.0          0.0          0.0          0.0          0.0          0.0
```

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          ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)

  1    1   0.0         0.0         0.0         0.0         0.0         0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS    0.0            0.0

       AT SIMULATION TIME, T = 0.0       * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE INTERCONNECTION CONSTRAINT FORCES(LAMBDAS) ARE
          ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
  1    1   0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
  1   11   0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0

       AT SIMULATION TIME, T = 0.0       * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
          ( 1)        ( 2)        ( 3)
  1    1   0.0         0.0         0.0
THE TOTAL LINEAR MOMENTUM VECTOR IS
          ( 1)        ( 2)        ( 3)
  1    1   0.0         0.0         0.0

THE TOTAL ANGULAR MOMENTUM =  0.0
THE TOTAL LINEAR MOMENTUM  =  0.0
THE TOTAL KINETIC ENERGY   =  0.0
THE TOTAL POTENTIAL ENERGY =  0.0
THE TOTAL ENERGY (T + V)   =  0.0
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A-322 AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.29.29
THE CPU TIMES = 1.5572E+02

OUTPUT MATRIX -A- (41 X 35)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-2.6410-02	-3.4860-06	2.6410-02	3.8570-06	1.0600-05	-1.8450-05	7.6540-05	1.7060-05	2.3860-06	0.0
1	11	-9.8890-06	-4.9010-06	0.0	0.0	0.0	0.0	0.0	0.0	1.7510+04	0.0
1	21	3.9060+02	-7.8820+02	2.1640+03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	-2.4180-08	0.0	0.0	0.0	-1.7770-03					
2	1	-2.2440-04	-3.6450-03	2.2440-04	-2.2070-06	-6.0640-06	6.7040-06	-9.4110-05	-5.4110-07	8.7760-07	0.0
2	11	2.9000-07	-5.1280-03	0.0	0.0	0.0	0.0	0.0	0.0	1.4880+04	0.0
2	21	4.0880+05	2.3120+01	-2.6610+03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	31	4.0660-06	0.0	0.0	0.0	5.1410-05					
3	1	7.6200+00	0.0	-7.6200+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-5.0510+06	0.0
3	31	0.0	0.0	0.0	0.0	-3.0880+02					
4	1	9.3410-05	1.7260-03	-9.3410-05	-1.1600-03	-3.1880-03	2.1680-03	-2.1270-02	2.9600-03	-4.1520-02	0.0
4	11	-1.7360-03	2.4260-03	0.0	0.0	0.0	0.0	0.0	0.0	-6.1920+03	0.0
4	21	-1.9340+05	-1.3840+05	-6.0010+05	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	31	1.1980-05	0.0	0.0	0.0	-3.1200-01					
5	1	-5.3870-05	-6.2180-04	5.3870-05	-3.1790-03	-8.7350-03	5.9320-03	-5.8230-02	8.1230-03	1.4960-02	0.0
5	11	-4.7700-03	-8.7420-04	0.0	0.0	0.0	0.0	0.0	0.0	3.5710+03	0.0
5	21	6.9680+04	-2.6020+05	-1.6460+06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	31	-4.3380-06	0.0	0.0	0.0	-8.5720-01					
6	1	-5.8110-04	-3.4170-07	5.8110-04	2.0350-04	5.5920-04	-4.2400-03	5.7690-03	8.7170-03	9.2200-07	0.0
6	11	-5.0720-03	-4.8040-07	0.0	0.0	0.0	0.0	0.0	0.0	2.8520+04	0.0
6	21	3.8290+01	-4.0430+05	1.6310+05	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	31	-3.5750-10	0.0	0.0	0.0	-9.1140-01					
7	1	0.0	0.0	0.0	-1.2060-02	-3.3150-02	3.5490-02	-2.2770-01	-2.3430-04	0.0	0.0
7	21	0.0	0.0	-6.4370+06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	31	-1.0570+01	0.0	0.0	0.0	0.0					
8	1	-3.9990-07	-7.8020-09	3.9990-07	3.9990-06	1.0990-05	1.4250-04	-6.1110-06	-3.6920-04	1.8770-05	0.0
8	11	2.1490-04	-1.0970-08	0.0	0.0	0.0	0.0	0.0	0.0	2.6510+03	0.0
8	21	8.7440-01	1.7130+04	-1.7280+02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	31	0.0	0.0	0.0	0.0	2.8550-02					
9	1	7.0390-06	1.5990-04	-7.0390-06	-1.6350-07	-4.4930-07	4.7600-07	-7.9140-07	9.4620-09	-1.8480-04	0.0
9	11	-7.3580-09	2.2480-04	0.0	0.0	0.0	0.0	0.0	0.0	-4.6660+02	0.0
9	21	-1.7920+04	-5.8650-01	-2.2380+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	31	3.0500-05	0.0	0.0	0.0	-1.3030-06					
10	1	5.9650-10	2.5470-08	-5.9650-10	0.0	0.0	0.0	0.0	0.0	-6.1280-08	0.0

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.29.30
THE CPU TIMER = 2.5900E+02

OUTPUT MATRIX -A- (41 X 35) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
10	11	0.0	3.5810-08	0.0	0.0	0.0	0.0	0.0	0.0	-3.9540-02	0.0
10	21	-2.8540+00	-4.9700-05	-1.8960-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	31	1.0690-03	0.0	0.0	0.0	-1.1040-10					
11	1	-3.0210-07	-5.8930-09	3.0210-07	2.1640-06	5.9450-06	7.9600-05	-4.6150-06	-2.0570-04	1.4180-08	0.0
11	11	1.1980-04	-8.2860-09	0.0	0.0	0.0	0.0	0.0	0.0	2.0020+01	0.0
11	21	6.6040-01	9.5470+03	-1.3050+02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	31	0.0	0.0	0.0	0.0	2.1560-02					
12	1	5.2960-06	8.5490-05	-5.2960-06	-9.6570-08	-2.6530-07	2.8030-07	-5.9540-07	7.6330-09	-2.0570-04	0.0
12	11	-5.5360-09	1.2020-04	0.0	0.0	0.0	0.0	0.0	0.0	-3.5100+02	0.0
12	21	-9.5800+03	-4.4120-01	-1.6830+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	31	-2.3120-07	0.0	0.0	0.0	-9.8040-07					
13	1	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	1	0.0	7.6390-02	0.0	-1.8170-02	-4.9920-02	5.3480-02	0.0	-3.5300-04	-7.6390-02	0.0
15	1	0.0	2.7800-02	0.0	4.9740-02	1.3670-01	-1.4640-01	0.0	9.6650-04	-2.7800-02	0.0
16	1	-3.0760-02	0.0	0.0	2.0630-02	5.6670-02	9.4590-01	0.0	-6.2450-03	0.0	0.0
17	1	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	1	1.4340-02	-4.9340-01	0.0	-9.3930-01	3.4310-01	-1.1030-03	0.0	7.2820-06	4.9340-01	0.0
19	1	-1.0000+00	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	1	0.0	0.0	-1.0000+00	-2.2980-03	-6.3150-03	-7.5280-02	0.0	8.2000-02	0.0	0.0
21	1	0.0	-8.1360-02	0.0	6.1750-05	1.6970-04	-1.8160-04	0.0	1.2000-06	1.9560-01	0.0
21	11	0.0	-1.1430-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	1	0.0	0.0	0.0	2.2980-03	6.3150-03	7.5280-02	0.0	-1.9630-01	0.0	0.0
22	11	1.1430-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	1	0.0	0.0	0.0	5.2960-02	1.4550-01	-1.5540-01	1.0000+00	1.0290-03	0.0	0.0
24	1	0.0	0.0	0.0	0.0	0.0	0.0	-1.0000+00	0.0	0.0	1.0000+00
25	11	0.0	0.0	0.0	3.0490+08	0.0	0.0	0.0	0.0	0.0	0.0
25	21	0.0	0.0	0.0	0.0	-6.2800+04	0.0	0.0	0.0	0.0	0.0
26	11	0.0	0.0	0.0	6.0990+08	0.0	0.0	0.0	0.0	0.0	0.0

A-324

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.39.20
THE CPU TIMER = 3.5923E+02

OUTPUT MATRIX -A- (41 X 35) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
26	21	0.0	0.0	0.0	0.0	-1.2550+05	-1.0000+03	0.0	0.0	0.0	0.0
27	11	0.0	0.0	0.0	1.5400+08	0.0	0.0	0.0	0.0	0.0	0.0
27	21	0.0	0.0	0.0	0.0	-3.1700+04	-2.5130+02	0.0	0.0	0.0	0.0
28	21	0.0	0.0	0.0	0.0	0.0	0.0	6.6660+05	-6.6660+03	0.0	0.0
29	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8190+03	-2.5140+03	0.0
30	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5140+03	-2.5140+03
31	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0000+02
31	31	-5.6000+02	0.0	0.0	0.0	0.0					
32	11	0.0	0.0	2.6340+07	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	31	0.0	-6.2800+04	0.0	0.0	0.0					
33	11	0.0	0.0	1.1850+09	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	31	0.0	-2.8240+06	-4.5000+02	0.0	0.0					
34	31	0.0	0.0	1.0370+05	-6.6660+03	0.0					
35	31	0.0	0.0	0.0	1.1820+02	-1.0380+03					
36	1	0.0	0.0	-1.0000+00	-2.2980-02	-6.3150-03	-7.5280-02	0.0	8.200E-02	0.0	0.0
37	11	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	1	0.0	0.0	0.0	0.0	0.0	0.0	-1.0000+00	0.0	0.0	1.0000+00
39	11	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0
40	31	1.0000+00	0.0	0.0	0.0	0.0					
41	31	0.0	0.0	0.0	0.0	1.0000+00					

END OF WRITE.

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.40.14
THE CPU TIMER = 3.7903E+02

OUTPUT MATRIX -T- (35 X 35)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1	0.0	0.0	-2.2980-03	-6.3150-03	-7.5200-02	0.0	8.2000-02	0.0	0.0	0.0
3	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0000+00
4	1	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0
6	1	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0
7	1	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0
8	1	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0
9	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0
10	1	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0
10	31	0.0	1.0000+00	0.0	0.0	0.0					
11	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0
12	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00
13	31	1.0000+00	0.0	0.0	0.0	0.0					
14	31	0.0	0.0	1.0000+00	0.0	0.0					
15	11	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	11	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	11	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	11	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0
19	11	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0
20	11	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0
21	11	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0

A-326

AF-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.40.14
THE CPU TIME = 1.7927E+02

OUTPUT MATRIX -T- (35 X 35) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
22	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0
23	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0
24	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00
25	21	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	21	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	21	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	21	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0
29	21	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0
30	21	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0
31	31	0.0	0.0	0.0	1.0000+00	0.0					
32	21	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0	0.0
33	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0	0.0
34	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000+00	0.0
35	31	0.0	0.0	0.0	0.0	1.0000+00					

END OF WRITE.

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.40.41
THE CPU TIMER = 3.9420E+02

OUTPUT MATRIX Y* (1 X 35)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	31	0.0	0.0	0.0	1.2220+00	0.0					

END OF WRITE.

A-328

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.41.05
THE CPU TIMER = 4.0586E+02

OUTPUT MATRIX -A*- (35 X 35)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-2.641D-02	-3.486D-06	-5.685D-05	-1.562D-04	-2.007D-03	7.654D-05	2.183D-03	8.386D-06	-9.889D-06	-4.901D-06
1	11	0.0	0.0	0.0	0.0	1.751D+06	0.0	2.906D+02	-7.882D+02	2.164D+03	0.0
1	21	-2.641D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	-2.418D-08	-1.777D-03					
2	1	-2.244D-04	-3.648D-03	-2.723D-06	-7.481D-06	-1.019D-05	-9.411D-05	1.786D-05	9.776D-03	2.900D-07	-5.128D-03
2	11	0.0	0.0	0.0	0.0	1.488D+04	0.0	4.088D+05	2.312D+01	-2.661D+03	0.0
2	21	-2.244D-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	31	0.0	0.0	0.0	4.066D-06	5.141D-05					
3	1	9.341D-05	1.726D-03	-1.160D-03	-3.187D-03	2.175D-03	-2.122D-02	2.953D-03	-4.152D-03	-1.726D-03	2.426D-03
3	11	0.0	0.0	0.0	0.0	-6.192D+03	0.0	-1.934D+05	-1.384D+05	-6.001D+05	0.0
3	21	9.341D-05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	31	0.0	0.0	0.0	1.198D-05	-3.120D-01					
4	1	-5.387D-05	-6.218D-04	-3.179D-03	-8.735D-03	5.929D-03	-5.823D-02	8.137D-03	1.496D-03	-4.770D-03	-8.742D-04
4	11	0.0	0.0	0.0	0.0	3.571D+03	0.0	6.968D+04	-3.802D+05	-1.646D+06	0.0
4	21	-5.387D-05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	31	0.0	0.0	0.0	-4.338D-06	-8.572D-01					
5	1	-5.811D-04	-3.417D-07	2.022D-04	5.555D-04	-4.284D-03	5.769D-03	8.765D-03	8.270D-07	-5.072D-03	-4.804D-07
5	11	0.0	0.0	0.0	0.0	3.852D+04	0.0	3.829D+01	-4.043D+05	1.631D+05	0.0
5	21	-5.811D-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	31	0.0	0.0	0.0	-3.575D-10	-9.114D-01					
6	1	0.0	0.0	-1.206D-02	-3.313D-02	3.549D-02	-2.277D-01	-2.343D-04	0.0	0.0	0.0
6	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.437D+06	0.0
6	31	0.0	0.0	0.0	-1.057D+01	0.0					
7	1	-3.999D-07	-7.802D-09	3.998D-06	1.098D-05	1.425D-04	-6.111D-06	-3.691D-04	1.877D-06	2.149D-04	-1.097D-06
7	11	0.0	0.0	0.0	0.0	2.651D+01	0.0	6.744D-01	1.713D+04	-1.728D+02	0.0
7	21	-3.999D-07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	31	0.0	0.0	0.0	0.0	2.855D-02					
8	1	7.039D-06	1.599D-04	-1.474D-07	-4.049D-07	1.006D-06	-7.914D-07	-5.677D-07	-3.848D-04	-7.258D-09	2.248D-04
8	11	0.0	0.0	0.0	0.0	-4.666D+02	0.0	-1.792D+04	-5.865D-01	-2.238D+01	0.0
8	21	7.039D-06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	31	0.0	0.0	0.0	3.050D-05	-1.303D-06					
9	1	-3.021D-07	-5.893D-09	2.163D-06	5.943D-06	7.957D-05	-4.615D-06	-2.057D-04	1.418D-09	1.198D-04	-8.256D-09
9	11	0.0	0.0	0.0	0.0	2.002D+01	0.0	6.604D-01	9.547D+03	-1.305D+02	0.0
9	21	-3.021D-07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	31	0.0	0.0	0.0	0.0	2.156D-02					

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.41.05
THE CPU TIMER = 4.0612E+02

OUTPUT MATRIX -A*- (35 X 35) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
10	1	5.2960-06	8.5480-05	-8.4400-08	-2.3190-07	6.7890-07	-5.9540-07	-4.2660-07	-2.0570-04	-5.5360-09	1.2020-04
10	11	0.0	0.0	0.0	0.0	-3.5100+02	0.0	-9.5800+03	-4.4120-01	-1.6830+01	0.0
10	21	5.2960-06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	31	0.0	0.0	0.0	-2.3120-07	-9.8040-07					
11	1	0.0	2.7800-02	4.9740-02	1.3670-01	-1.4640-01	0.0	9.6650-04	-2.7800-02	0.0	0.0
12	1	-3.0760-02	0.0	2.0630-02	5.6670-02	9.4550-01	0.0	-6.2450-03	0.0	0.0	0.0
13	1	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	1	1.4340-02	-4.9340-01	-9.3930-01	3.4310-01	-1.1030-03	0.0	7.2820-06	4.9340-01	0.0	0.0
15	1	-1.0000+00	0.0	-2.2980-03	-6.3150-03	-7.5280-02	0.0	8.2000-02	0.0	0.0	0.0
15	21	-1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	1	0.0	0.0	-7.5230-37	-1.2040-35	-1.9260-34	0.0	1.9260-34	0.0	0.0	0.0
16	21	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	1	0.0	-8.1300-02	6.1750-05	1.6970-04	-1.8180-04	0.0	1.2000-06	1.9560-01	0.0	-1.1430-01
18	1	0.0	0.0	2.2980-03	6.3150-03	7.5280-02	0.0	-1.9630-01	0.0	1.1430-01	0.0
19	1	0.0	0.0	5.2960-02	1.4550-01	-1.5590-01	1.0000+00	1.0290-03	0.0	0.0	0.0
20	21	0.0	0.0	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	1	-7.6200+00	-1.4980-08	-1.7500-02	-4.8090-02	-5.7330-01	-1.8310-05	6.2410-01	3.6050-08	4.3360-04	-2.1070-08
21	11	0.0	0.0	0.0	0.0	5.0510+08	0.0	1.6790+00	3.4560+04	-5.1780+02	0.0
21	21	-7.6200+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	31	0.0	0.0	0.0	-1.0580-10	3.0890+02					
22	1	1.0000+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	1	5.9650-10	2.5470-08	1.2060-02	3.3120-02	-3.5490-02	2.2770-01	2.3430-04	-6.1280-08	0.0	3.5810-08
23	11	0.0	0.0	0.0	0.0	-2.9540-02	0.0	-2.8540+00	-4.9700-05	6.4370+06	0.0
23	21	5.9650-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	31	0.0	0.0	0.0	1.0570+01	-1.1040-10					
24	1	0.0	7.6350-02	-1.8170-02	-4.9920-02	5.3460-02	0.0	-3.5300-04	-7.6390-02	0.0	0.0
25	21	0.0	0.0	0.0	3.0490+08	-6.2800+04	0.0	0.0	0.0	0.0	0.0
26	21	0.0	0.0	0.0	6.0990+08	-1.2550+05	-1.0000+05	0.0	0.0	0.0	0.0

A-330

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.41.06
THE CPU TIMER = 4.0637E+02

OUTPUT MATRIX -A*- (35 X 35) CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
27	21	0.0	0.0	0.0	1.5400+08	-3.1700+04	-2.5130+02	0.0	0.0	0.0	0.0
28	21	0.0	0.0	0.0	0.0	0.0	0.0	6.6660+05	-6.6660+03	0.0	0.0
29	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8190+03	-2.5140+03	0.0
30	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5140+03	-2.5140+03
31	21	0.0	2.6340+07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	31	-6.2800+04	0.0	0.0	0.0	0.0					
32	21	0.0	1.1850+09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	31	-2.8240+06	-4.5000+02	0.0	0.0	0.0					
33	31	0.0	1.0370+05	-6.6660+03	0.0	0.0					
34	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0000+02
34	31	0.0	0.0	0.0	-5.6000+02	0.0					
35	31	0.0	0.0	1.1820+02	0.0	-1.0380+03					

END OF WRITE.

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.41.24
THE CPU TIME = 4.2231E+02

NO	RTA REAL PART	RTA IMAGINARY PART	RTA* REAL PART	RTA* IMAGINARY PART
1	-0.628000+05	0.0	-0.628000+05	0.0
2	-0.628000+05	0.0	-0.628000+05	0.0
3	-0.666590+04	0.0	-0.666590+04	0.0
4	-0.666490+04	0.0	-0.666490+04	0.0
5	-0.269460+04	0.0	-0.269460+04	0.0
6	-0.224790+04	0.0	-0.224790+04	0.0
7	-0.126850+04	0.0	-0.126850+04	0.0
8	-0.109840+04	0.0	-0.109840+04	0.0
9	-0.300390+03	0.0	-0.300390+03	0.0
10	-0.231400+03	0.0	-0.231400+03	0.0
11	-0.700790+02	-0.765960+02	-0.700790+02	-0.765960+02
12	-0.700790+02	0.765960+02	-0.700790+02	0.765960+02
13	-0.449450+02	-0.550140+02	-0.449450+02	-0.550140+02
14	-0.449450+02	0.550140+02	-0.449450+02	0.550140+02
15	-0.497510+01	0.0	-0.497510+01	0.0
16	-0.382320+01	-0.225130+05	-0.382320+01	-0.225130+05
17	-0.382320+01	0.225130+05	-0.382320+01	0.225130+05
18	-0.328300+00	-0.259690+04	-0.328300+00	-0.259690+04
19	-0.328300+00	0.259690+04	-0.328300+00	0.259690+04
20	-0.925160-01	-0.188840+03	-0.925160-01	-0.188840+03
21	-0.925160-01	0.188840+03	-0.925160-01	0.188840+03
22	-0.775850-01	-0.188260+03	-0.775850-01	-0.188260+03
23	-0.775850-01	0.188260+03	-0.775850-01	0.188260+03
24	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0

A-332

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.58.08
THE CPU TIMER = 1.0192E+03

	NUM		DEN	
NO	REAL PART	IMAGINARY PART	REAL PART	IMAGINARY PART
1	-0.50000Q+01	0.0	-0.62800Q+05	0.0
2	-0.49750Q+02	0.0	-0.62800Q+05	0.0
3	-0.44949Q+02	0.55014Q+02	-0.66660Q+04	0.0
4	-0.44949Q+02	-0.55014Q+02	-0.66649Q+04	0.0
5	-0.30036Q+03	0.0	-0.25141Q+04	0.0
6	-0.10984Q+04	0.0	-0.25139Q+04	0.0
7	-0.66649Q+04	0.0	-0.10984Q+04	0.0
8	-0.62800Q+05	0.0	-0.10000Q+04	0.0
9	-0.94007Q+04	0.72905Q+06	-0.56000Q+03	0.0
10	-0.94007Q+04	-0.72905Q+06	-0.30035Q+03	0.0
11	-0.17321Q+01	0.22513Q+05	-0.44671Q+02	-0.55635Q+02
12	-0.17321Q+01	-0.22513Q+05	-0.44671Q+02	0.55635Q+02
13	-0.73193Q-01	-0.18825Q+03	-0.38232Q+01	-0.22513Q+05
14	-0.73193Q-01	0.18825Q+03	-0.38232Q+01	0.22513Q+05
15	-0.19482Q-02	-0.18868Q+03	-0.11908Q+00	-0.25950Q+04
16	-0.19482Q-02	0.18868Q+03	-0.11908Q+00	0.25950Q+04
17	0.0	0.0	-0.73935Q-01	-0.18826Q+03
18	0.0	0.0	-0.73935Q-01	0.18826Q+03
19	0.0	0.0	-0.20607Q-02	-0.18879Q+03
20	0.0	0.0	-0.20607Q-02	0.18879Q+03
21	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0
29			0.0	0.0
30			0.0	0.0
31			0.0	0.0
32			0.0	0.0
33			0.0	0.0
34			0.0	0.0
35			0.0	0.0

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.58.08
THE CPU TIMER = 1.0194E+03

OUTPUT MATRIX RRED (1 X 200)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	4.0000+00	5.0000+00	0.0	8.0000+00	5.0000+00	3.0000+00	-2.6760+04	2.0000-01	2.0100-02	3.3290-03
1	11	9.1040-04	6.3270-01	7.1040+01	1.2890-02	7.2910+05	7.6930-05	2.2510+04	3.8880-04	1.8830+02	1.0330-05
1	21	1.8870+02	1.5920-05	1.5000-04	3.9780-04	3.9780-04	9.1040-04	1.0006-03	1.7860-02	3.3290-03	6.2610-01
1	31	7.1350+01	1.6980-04	2.2510+04	4.5890-05	2.5950+03	3.9770-04	1.8830+02	1.0920-05	1.8880+02	0.0

END OF WRITE.

A-334

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = [illegible]
THE CPU TIME = 1.02[illegible]+03

OPEN LOOP WITH EL LOOP CLOSED) TYPE 7 T-AZ / T-AZ

	FREQ/RAD/SEC	FREQ/HERTZ	REAL	IMAG	AMP	DECIBELS	RAD	DEG	
	0.6200000+02	0.9867610+01	0.1861550+01	0.1249500+01	0.2242020+01	7.0[illegible]	[illegible]	[illegible]	
	0.7000000+02	0.1114080+02	0.1536620+01	0.1113840+01	0.1897950+01	5.5[illegible]	0.6[illegible]	35.9[illegible]	
	0.7800000+02	0.1241410+02	0.1305120+01	0.9984560+00	0.1643250+01	4.31[illegible]	[illegible]	37.41[illegible]	
	0.8900000+02	0.1416480+02	0.1080710+01	0.8666800+00	0.1385310+01	2.831	0.6[illegible]	38.7280	
	0.1000000+03	0.1591550+02	0.9239270+00	0.7591800+00	0.1195820+01	1.5[illegible]	0.6[illegible]	39.4096	
	0.1100000+03	0.1750700+02	0.8195650+00	0.6775210+00	0.1062590+01	0.5[illegible]	0.6914	39.6144	
	0.1129510+03	0.1797660+02	0.7923990+00	0.6558170+00	0.1028590+01	0.24[illegible]	0.6914	39.612[illegible]	
	0.1317760+03	0.2097280+02	0.6620930+00	0.5373660+00	0.8527320+00	-1.384	[illegible]	[illegible]	
	0.1411860+03	0.2247080+02	0.6129470+00	0.4685190+00	0.7846900+00	-2.1[illegible]	0.6[illegible]	38.5094	
	0.1506010+03	0.2396890+02	0.5724210+00	0.4449240+00	0.7257990+00	-2.784	0.6[illegible]	37.8082	
	0.1581310+03	0.2516730+02	0.5452170+00	0.4132170+00	0.6841130+00	-3.297	0.6498	37.1533	
	0.1656610+03	0.2636570+02	0.5198910+00	0.3828600+00	0.6462470+00	-3.79[illegible]	0.6[illegible]	36.4402	
	0.1694260+03	0.2696500+02	0.5090510+00	0.3699110+00	0.6234500+00	-4.0[illegible]	0.629[illegible]	36.0583	
	0.1731910+03	0.2756420+02	0.4965760+00	0.3563310+00	0.6111950+00	-4.2[illegible]	0.6[illegible]	35.6623	
	0.1769560+03	0.2816340+02	0.4853040+00	0.3429470+00	0.5941680+00	-4.52[illegible]	0.6153	35.2511	
	0.1807210+03	0.2876260+02	0.4737860+00	0.3293210+00	0.5765860+00	-4.7[illegible]	0.6079	34.8309	
	0.1816620+03	0.2891240+02	0.4700240+00	0.3257420+00	0.5718660+00	-4.854	0.6[illegible]	34.72[illegible]	
	0.1826030+03	0.2906220+02	0.4665170+00	0.3220060+00	0.5668560+00	-4.9[illegible]	0.6[illegible]	34.6[illegible]	
	0.1835450+03	0.2921210+02	0.4626180+00	0.3180110+00	0.5613790+00	-5.0[illegible]	0.60[illegible]	34.5[illegible]	
	0.1844860+03	0.2936190+02	0.4580490+00	0.3135710+00	0.5550990+00	-5.11[illegible]	0.6003	34.3947	
	0.1852390+03	0.2948170+02	0.4535350+00	0.3094420+00	0.5490430+00	-5.20[illegible]	0.59[illegible]	34.3054	
	0.1859920+03	0.2960150+02	0.4475640+00	0.3043360+00	0.5412330+00	-5.3[illegible]	0.59[illegible]	34.2151	
	0.1863680+03	0.2966150+02	0.4435930+00	0.3011220+00	0.5361430+00	-5.414	0.5964	34.1656	
	0.1867450+03	0.2972140+02	0.4394640+00	0.2971350+00	0.5296660+00	-5.5[illegible]	0.59[illegible]	34.1244	
	0.1871210+03	0.2978130+02	0.4313540+00	0.2918370+00	0.5208030+00	-5.667	0.5948	34.0809	
	0.1874960+03	0.2984120+02	0.4203810+00	0.2840400+00	0.5073450+00	-5.[illegible]	0.5[illegible]	34.0458	
	0.1878750+03	0.2990120+02	0.3997510+00	0.2705360+00	0.4826910+00	-6.3[illegible]	0.5950	34.0886	
	0.1880250+03	0.2992510+02	0.3838790+00	0.2618770+00	0.4646960+00	-6.6[illegible]	0.5[illegible]	34.[illegible]	
	0.1881570+03	0.2994610+02	0.3576760+00	0.2553890+00	0.4394940+00	-7.141	0.6201	35.527[illegible]	
	0.1882040+03	0.2995360+02	0.3437770+00	0.2601480+00	0.4311150+00	-7.308	0.6478	37.1161	
	0.1882320+03	0.2995810+02	0.3386230+00	0.2683580+00	0.4320670+00	-7.2[illegible]	0.6701	38.3968	
	0.1882360+03	0.2995870+02	0.3384910+00	0.2696350+00	0.4327600+00	-7.275	0.67[illegible]	38.[illegible]	
	0.1882400+03	0.2995930+02	0.3385270+00	0.2709040+00	0.4335770+00	-7.259	0.6749	38.6[illegible]	
	0.1882430+03	0.2995990+02	0.3387230+00	0.2721280+00	0.4345040+00	-7.240	0.676[illegible]	38.7774	
	0.1882470+03	0.2996050+02	0.3391090+00	0.2732840+00	0.4355[illegible]+00	-7.2[illegible]	0.678[illegible]	38.8[illegible]49	
********	0.1882490+03	0.2996080+02	0.3393590+00	0.2738270+00	0.4360570+00	-7.209	0.67[illegible]	38.9[illegible]	
	0.1882510+03	0.2996110+02	0.3396470+00	0.2743420+00	0.4366050+00	-7.196	0.6794	38.9288	********
	0.1882530+03	0.2996140+02	0.3399730+00	0.2748270+00	0.4371630+00	-7.187	0.6796	38.9512	
	0.1882540+03	0.2996150+02	0.3401080+00	0.2750040+00	0.4373790+00	-7.1[illegible]	0.6805	38.9[illegible]	
********	0.1882550+03	0.2996180+02	0.3404810+00	0.2754410+00	0.4379440+00	-7.172	0.6802	38.9720	
	0.1882570+03	0.2996210+02	0.3408870+00	0.2758390+00	0.4385100+00	-7.160	0.6803	38.9791	********
	0.1882590+03	0.2996240+02	0.3413210+00	0.2761970+00	0.4390730+00	-7.149	0.6803	38.9798	
	0.1882610+03	0.2996270+02	0.3417810+00	0.2765120+00	0.4396280+00	-7.138	0.6802	38.9741	
	0.1882650+03	0.2996330+02	0.3427640+00	0.2770070+00	0.4407040+00	-7.117	0.6797	38.9437	
	0.1882690+03	0.2996390+02	0.3438070+00	0.2773130+00	0.4417080+00	-7.09[illegible]	0.6787	38.8[illegible]	
	0.1882720+03	0.2996450+02	0.3448830+00	0.2774230+00	0.4426150+00	-7.079	0.6774	38.8131	
	0.1882760+03	0.2996510+02	0.3459620+00	0.2773400+00	0.4434040+00	-7.0[illegible]	0.675[illegible]	38.7174	
	0.1883040+03	0.2996960+02	0.3519780+00	0.2716750+00	0.4446300+00	-7.040	0.657[illegible]	37.66[illegible]	
	0.1883520+03	0.2997710+02	0.3494180+00	0.2548320+00	0.4324730+00	-7.2[illegible]	0.63[illegible]	36.1[illegible]	
	0.1884550+03	0.2999360+02	0.3143930+00	0.2189490+00	0.3831210+00	-8.3[illegible]	0.60[illegible]	34.[illegible]	
	0.1885870+03	0.3001460+02	0.2129910+00	0.1484950+00	0.2596460+00	-11.71[illegible]	0.6[illegible]	[illegible]	

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```
        AE-C TRANSFER FUNCTION STUDY                                                                 CURRENT TIME = 04.58.38
        DONOHUE CHECK PROBLEM    ---DATA MOD ON 3MAR1975                                             THE CPU TIMER = 1.0434E+05

P(S) =
 + (-0.267560952285901Q+05)       + (-0.647917638129031Q+04)*S** 1 + (-0.246366056212227Q+03)*S** 2 + (-0.439124115467514Q+01)*S** 3
 + (-0.488683482940140Q-01)*S** 4 + (-0.331684062357465Q-03)*S** 5 + (-0.223283480777667Q-05)*S** 6 + (-0.880980361426675Q-08)*S** 7
+ (-0.314297337190174Q-10)*S** 8 + (-0.790534703309270Q-13)*S** 9 + (-0.512677431102760Q-16)*S**10 + (-0.158245900130008Q-21)*S**11
+ (-0.101123262524792Q-24)*S**12 + (-0.386689037071921Q-32)*S**13 + (-0.190033869405697Q-36)*S**14 + (

Q(S) =
 + ( 0.0                    )      + ( 0.0                        )*S** 1 + ( 0.0                        )*S** 2 + ( 0.100000000000000Q+01)*S** 3
 + ( 0.255410997551695Q-01)*S** 4 + ( 0.416813593363933Q-03)*S** 5 + ( 0.346104659238169Q-05)*S** 6 + ( 0.264147078543024Q-07)*S** 7
+ ( 0.141549271946409Q-09)*S** 8 + ( 0.591542565697300Q-12)*S** 9 + ( 0.202481557151501Q-14)*S**10 + ( 0.456180169293186Q-17)*S**11
+ ( 0.608718390870582Q-20)*S**12 + ( 0.486570087714253Q-23)*S**13 + ( 0.251286453986261Q-26)*S**14 + ( 0.951625303401033Q-30)*S**15
+ ( 0.273389499664915Q-33)*S**16 + ( 0.496455177459867Q-37)*S**17 + ( 0.419353433685640Q-41)*S**18 + ( 0.141570258497373Q-45)*S**19
+ ( 0.722810669390088Q-50)*S**20 + ( 0.932055765445636Q-55)*S**21 + (

STARTING POINT = (     -0.07393450250) + I(  -188.25738967169)

SCAN LIMITS:-0.1000000+00 < X <  0.1000000+00
            -0.2500000+03 < Y <  0.2500000+03
```

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.[illegible].38
THE CPU TIMER = 1.047[illegible]E+03

A-336

GAIN	ROOTS		ERROR	
SCALE FACTOR = 0.9065150+03				
-.3561070930-01	-.7387277020-01	-188.257311	-.5939555[illegible]-0[illegible]	-.77[illegible]1[illegible]40-08
-.7219222410-01	-.7381253830-01	-188.257251	-.1186210990-06	-.1[illegible]-07
-.128985668	-.7372416380-01	-188.257116	-.207[illegible]260-06	-.25[illegible]-07
-.218833725	-.7359757420-01	-188.256924	-.2297664110-06	-.54[illegible]0210-07
-.365374976	-.7342079650-01	-188.256636	-.536[illegible]070-06	-.10[illegible]-06
-.617012156	-.7319620410-01	-188.2561[illegible]	-.8266407220-06	-.192[illegible]-06
-1.09133202	-.7290653700-01	-188.255482	-.1246247950-05	-.[illegible]790-06
-2.17422548	-.7265717600-01	-188.254316	-.1927967140-05	-.77[illegible]770-06
-6.39412248	-.7268581620-01	-188.252662	-.2552325190-05	-.14[illegible]-05
-22.7062472	-.7296764400-01	-188.251559	-.1908101490-05	-.20[illegible]45[illegible]-05
-180.546569	-.7315919080-01	-188.251090	-.3029001670-05	-.21[illegible]16236-05

THE LAST POINT PRINTED IS WITHIN 0.00010 OF A ROOT.

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```
AE-C TRANSFER FUNCTION STUDY                                        CURRENT TIME = 04.59.17
DONOHUE CHECK PROBLEM   ---DATA MOD ON 3MAR1975                     THE CPU TIMER = 1.0684E+03

P(S) =
 + (-0.26756095228590100+05)       + (-0.64791763812903100+04)*S** 1 + (-0.24636605621222700+03)*S** 2 + (-0.43912411546751400+01)*S** 3
 + (-0.48868348294014000-01)*S** 4 + (-0.33168406235746500-03)*S** 5 + (-0.22328348077766700-05)*S** 6 + (-0.88098036142667500-08)*S** 7
+ (-0.31429733719017400-10)*S** 8 + (-0.79053470330927000-13)*S** 9 + (-0.51267743110276000-16)*S**10 + (-0.15824590013000800-21)*S**11
+ (-0.10112326252479200-24)*S**12 + (-0.38668903707192100-32)*S**13 + (-0.19003386940569700-36)*S**14 + (

Q(S) =
 + ( 0.0                      )       + ( 0.0                      )*S** 1 + ( 0.0                      )*S** 2 + ( 0.10000000000000000+01)*S** 3
 + ( 0.25541099755169500-01)*S** 4 + ( 0.41681259336393300-03)*S** 5 + ( 0.34610465923816900-05)*S** 6 + ( 0.26414707854302400-07)*S** 7
+ ( 0.14154927194640900-09)*S** 8 + ( 0.59154256569730000-12)*S** 9 + ( 0.20248155715150100-14)*S**10 + ( 0.45618016929318600-17)*S**11
+ ( 0.60871839087059200-20)*S**12 + ( 0.48657008771425300-23)*S**13 + ( 0.25128645398626100-26)*S**14 + ( 0.95182530340103500-30)*S**15
+ ( 0.27338949966491500-33)*S**16 + ( 0.49645517745986700-37)*S**17 + ( 0.41935343368564000-41)*S**18 + ( 0.14157025849737300-45)*S**19
+ ( 0.72281066939008800-50)*S**20 + ( 0.93205576544563600-55)*S**21 + (

STARTING POINT = (     -0.00206073882) + I(  -138.79296729890)

SCAN LIMITS:-0.1000000D+00 < X <  0.1000000D+00
           -0.2500000D+03 < Y <  0.2500000D+03
```

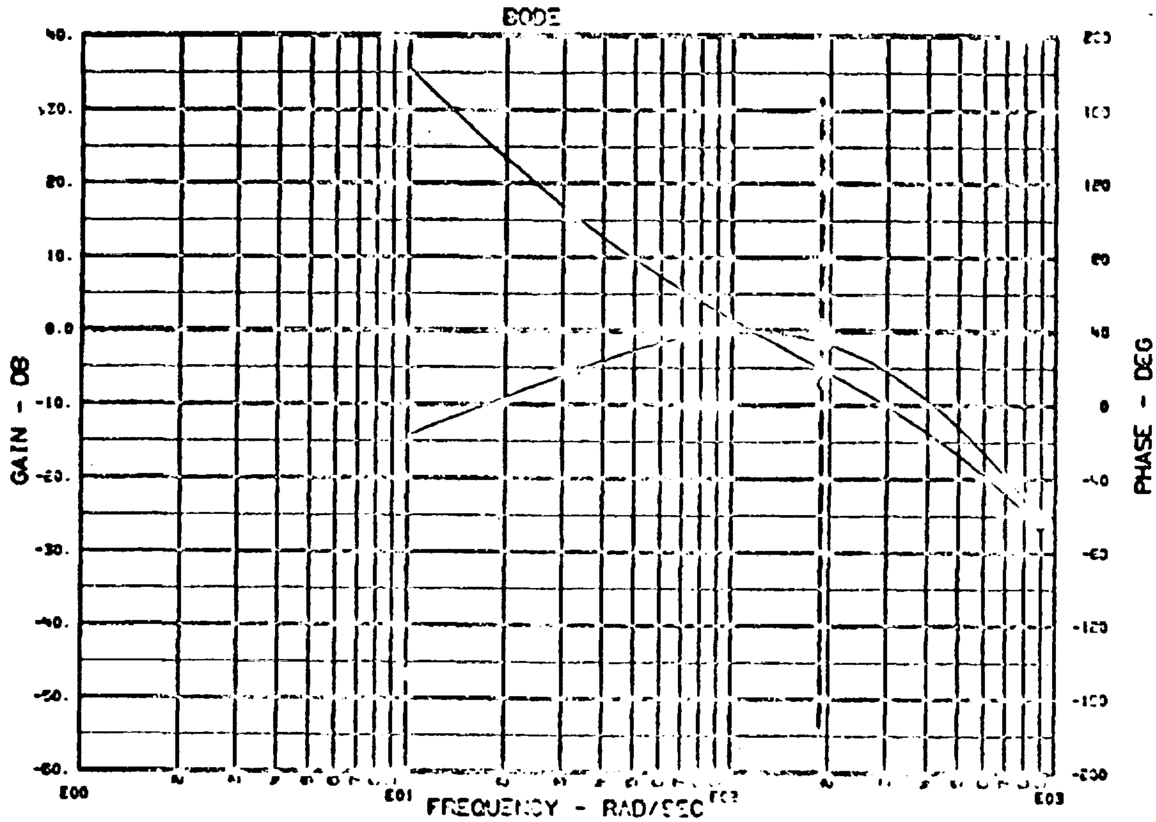
A-338

AE-C TRANSFER FUNCTION STUDY
DONOHUE CHECK PROBLEM ---DATA MOD ON 3MAR1975

CURRENT TIME = 04.59.17
THE CPU TIMEE = 1.0685E+02

GAIN	ROOTS		ERROR	
SCALE FACTOR = 0.9065150+03				
-.1601694100-02	-.2004685820-02	-188.792864	.5988349750-07	.1149495810-07
-.3205772200-02	-.1948715820-02	-188.792802	.1197357320-06	.2204154920-07
-.5616372910-02	-.1864916600-02	-188.792677	.2094552590-06	.4051111930-07
-.9242403310-02	-.1739568630-02	-188.792490	.2439015640-06	.6701770480-07
-.1470438040-01	-.1552337380-02	-188.792210	.5452696750-06	.1074560060-06
-.2294942100-01	-.1273273860-02	-188.791787	.9466366600-06	.1696544970-06
-.3543579290-01	-.8587054100-03	-188.791151	.1297121520-05	.2663061370-06
-.5443835100-01	-.2459609110-03	-188.790191	.1969246220-05	.4159093640-06
-.8357628840-01	.6525034650-03	-188.788737	.2969062130-05	.6446879870-06
-.128780651	.1953207630-02	-188.786529	.4449079320-05	.1070570530-05
-.200215891	.3796821980-02	-188.783156	.6671946160-05	.1760449820-05
-.316529317	.6315048710-02	-188.777968	.9766269040-05	.2969563130-05
-.515731662	.9519456860-02	-188.769934	.1419752200-04	.5136916910-05
-.889582246	.1298915080-01	-188.757432	.2013112720-04	.9070957980-05
-1.73619163	.1507043330-01	-188.738081	.2727970860-04	.1605107640-04
-4.95959104	.1102361670-01	-188.709170	.3402924490-04	.2730110540-04
-162.307781	-.1278457510-02	-188.682696	.3672042750-04	.3884862130-04
-2955.52728	-.1910811070-02	-188.681749	.3676169190-04	.3930737620-04

THE LAST POINT PRINTED IS WITHIN 0.00010 OF A ROOT.



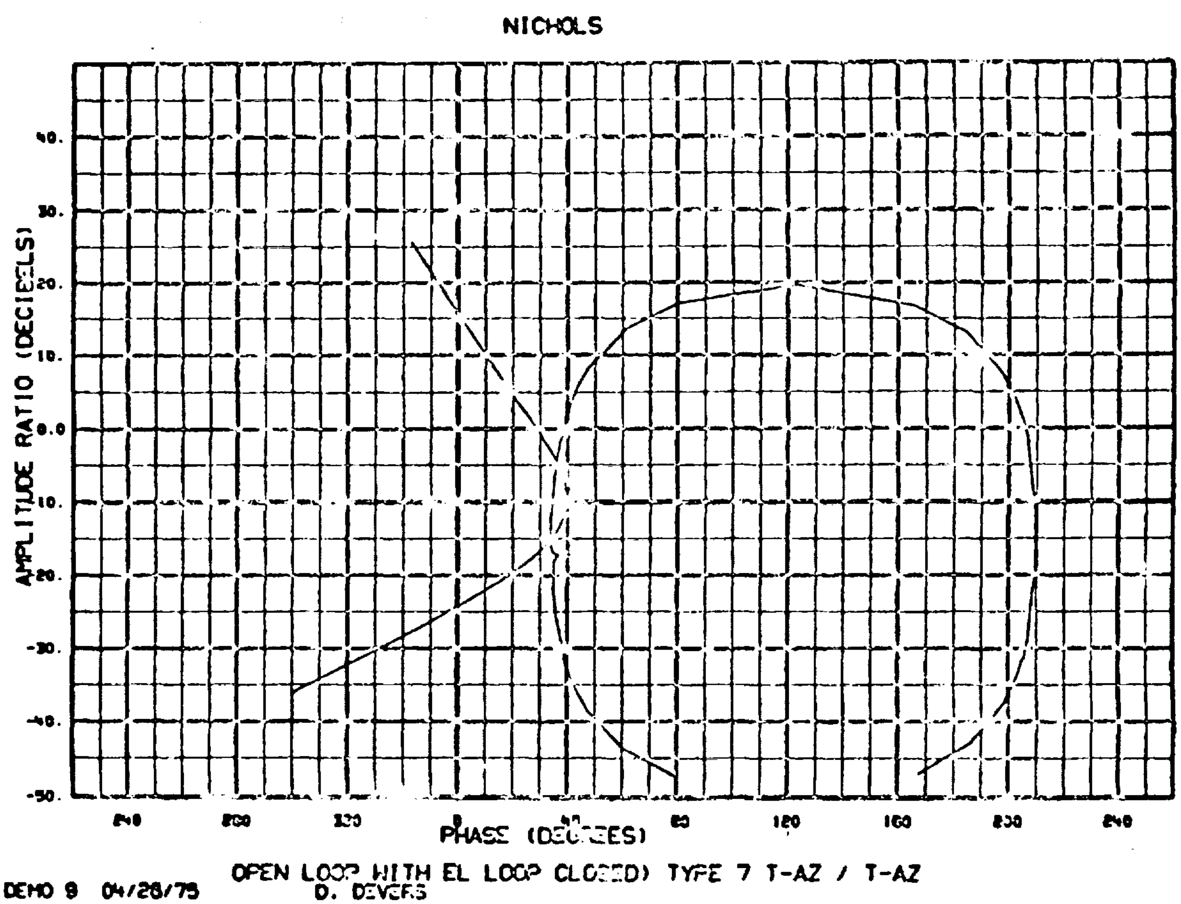


Figure A-8 Graphical Results, Demonstration Problem 9 (Sheet 1 of 9)

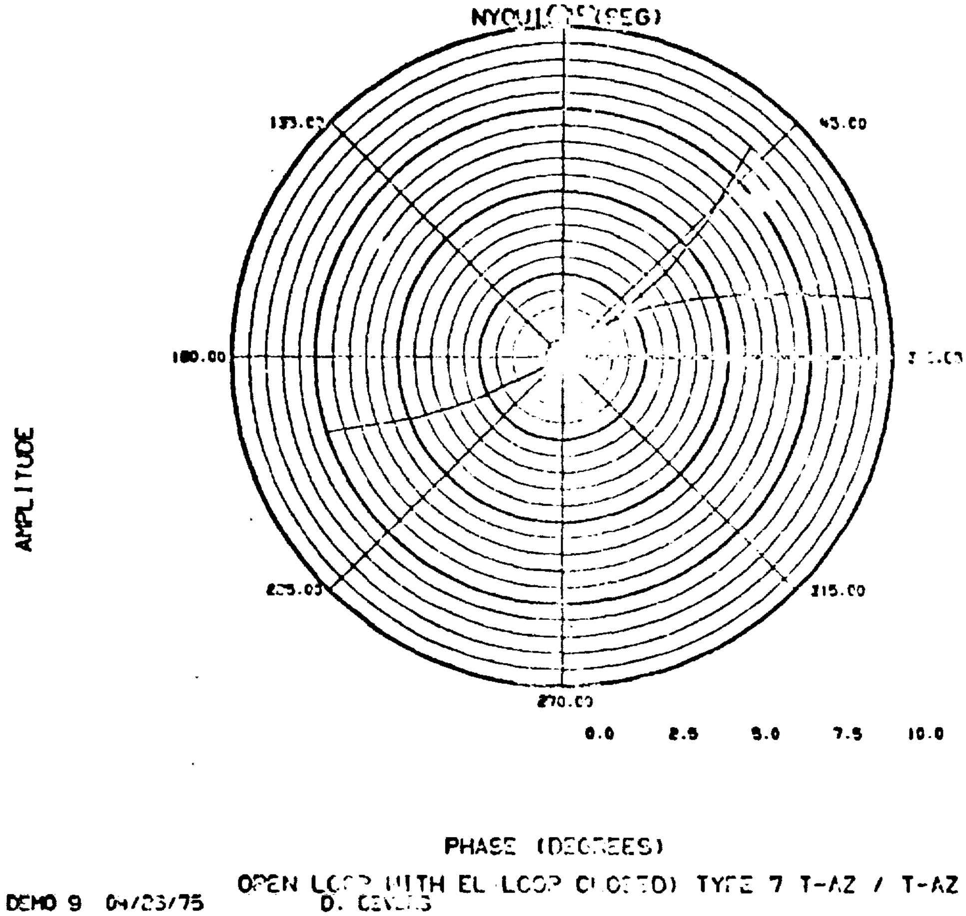


Figure A-8 Graphical Results, Demonstration Problem 9 (Sheet 2 of 9)

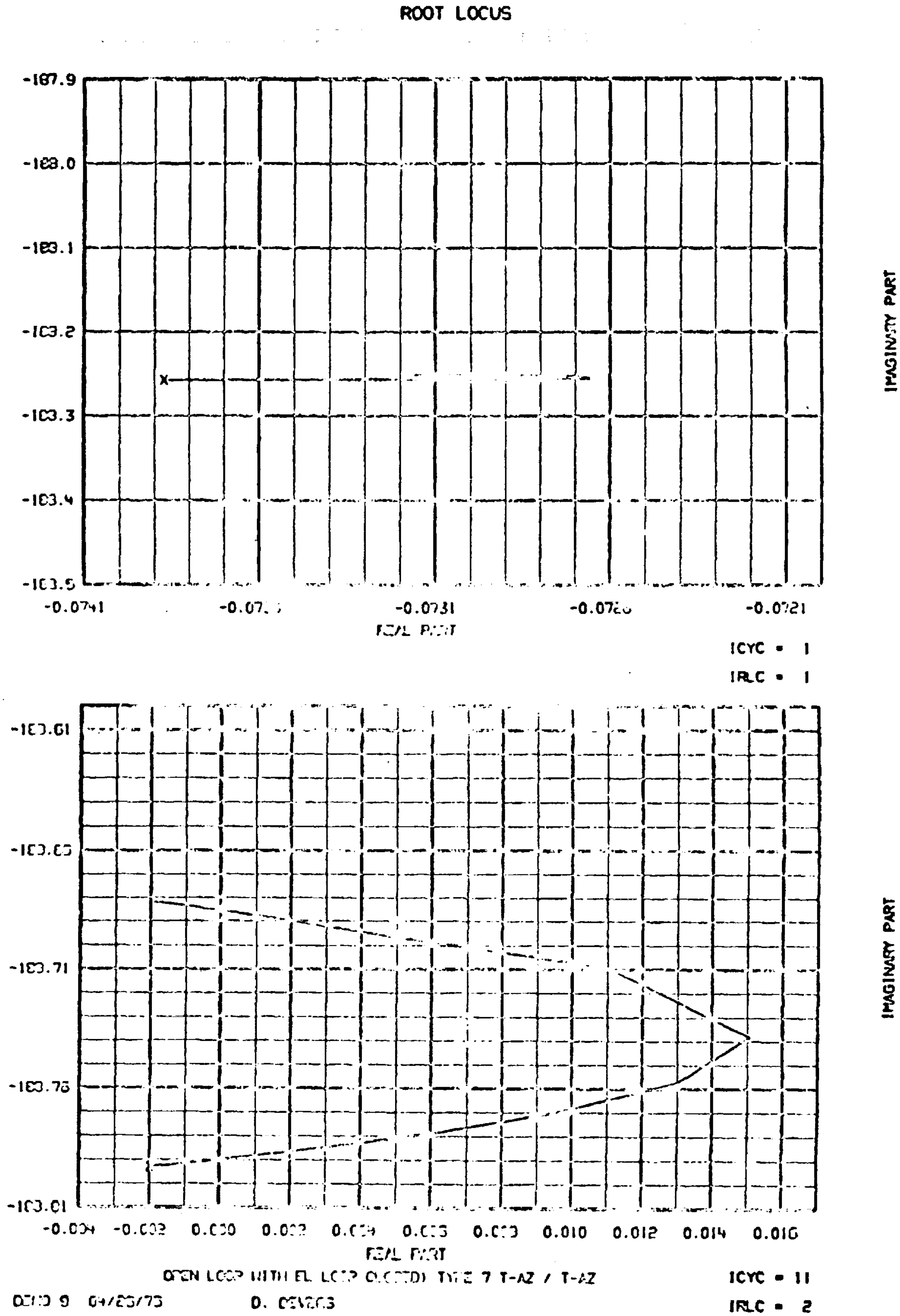
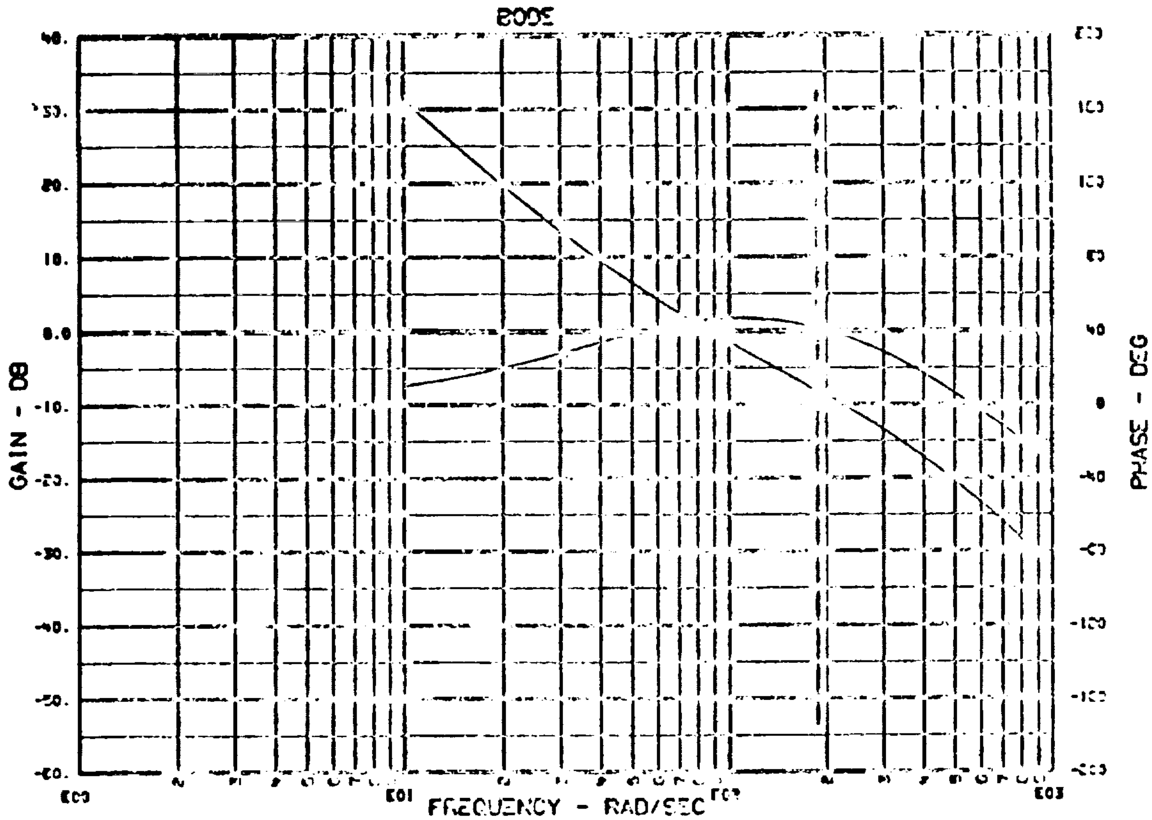
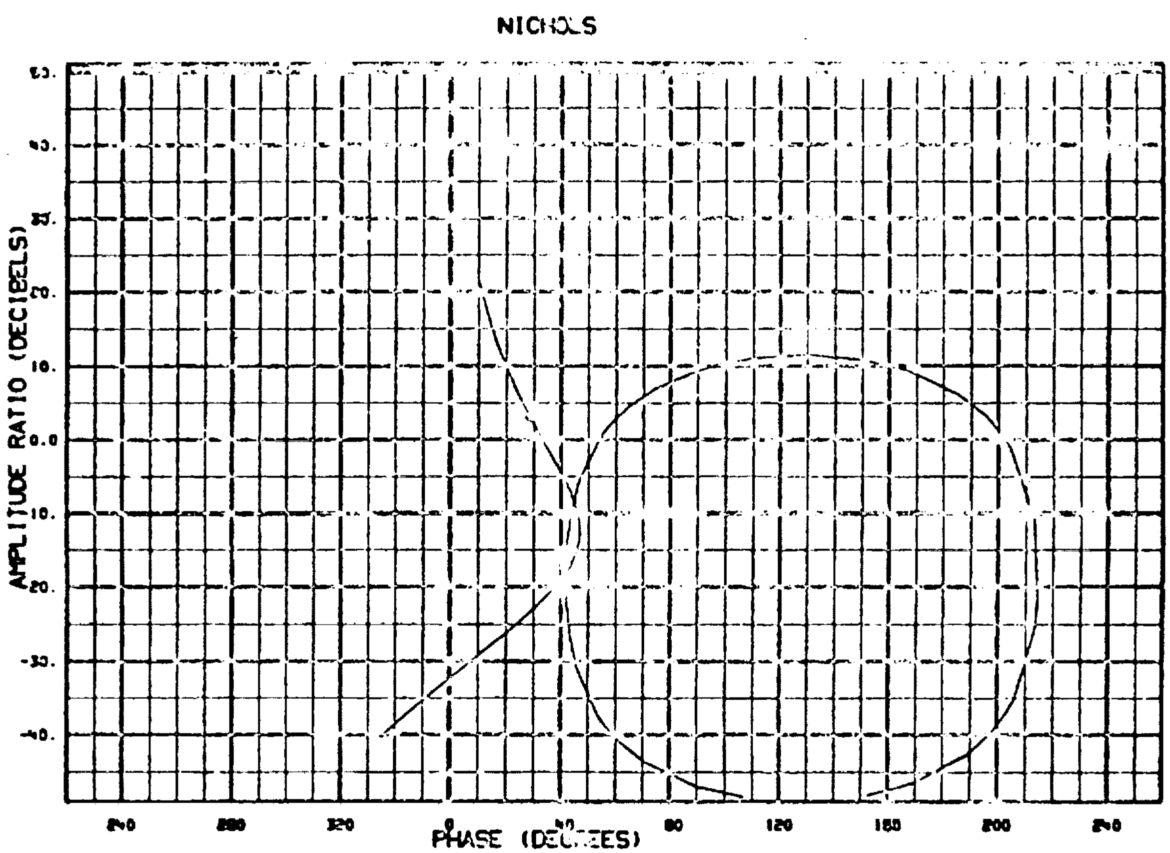


Figure A-8 Graphical Results, Demonstration Problem 9 (Sheet 3 of 9)





OPEN LOOP WITH AZ LOOP ACTIVE TYPE 7 T-EL / T-EL
DEMO 9 04/26/75 D. DEVERS

Figure A-8 Graphical Results, Demonstration Problem 9 (Sheet 4 of 9)

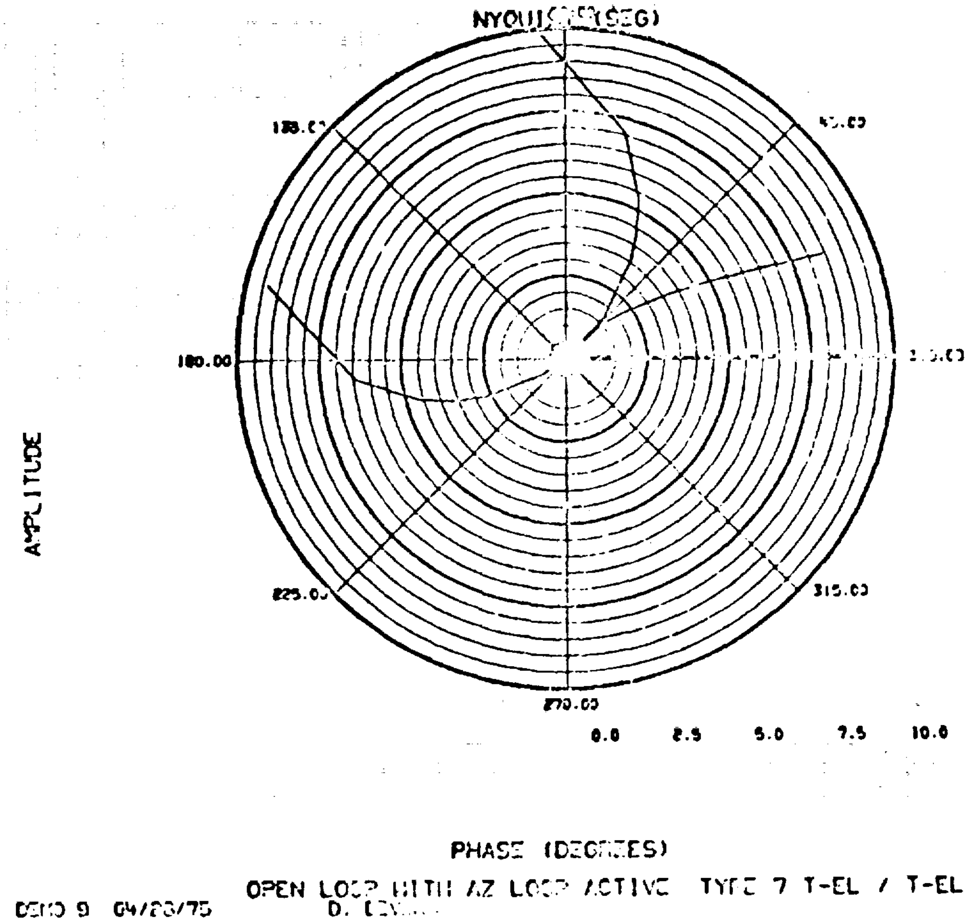
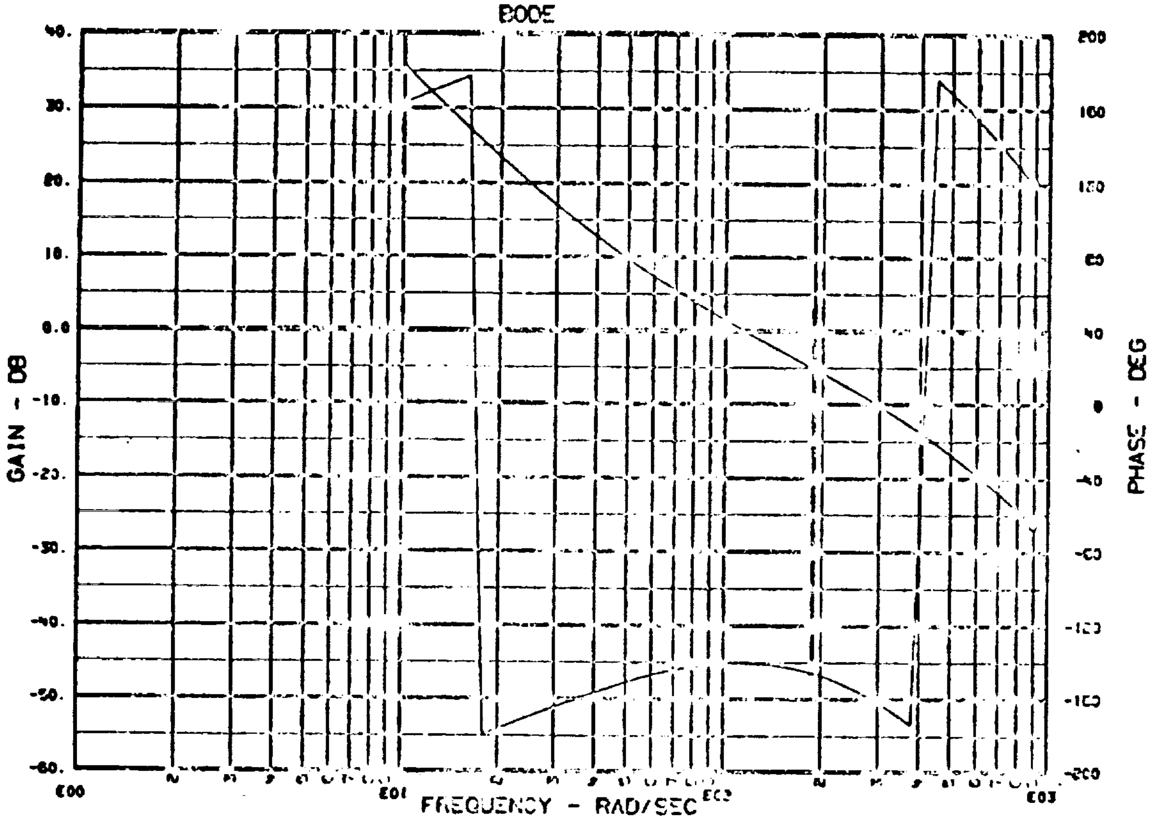
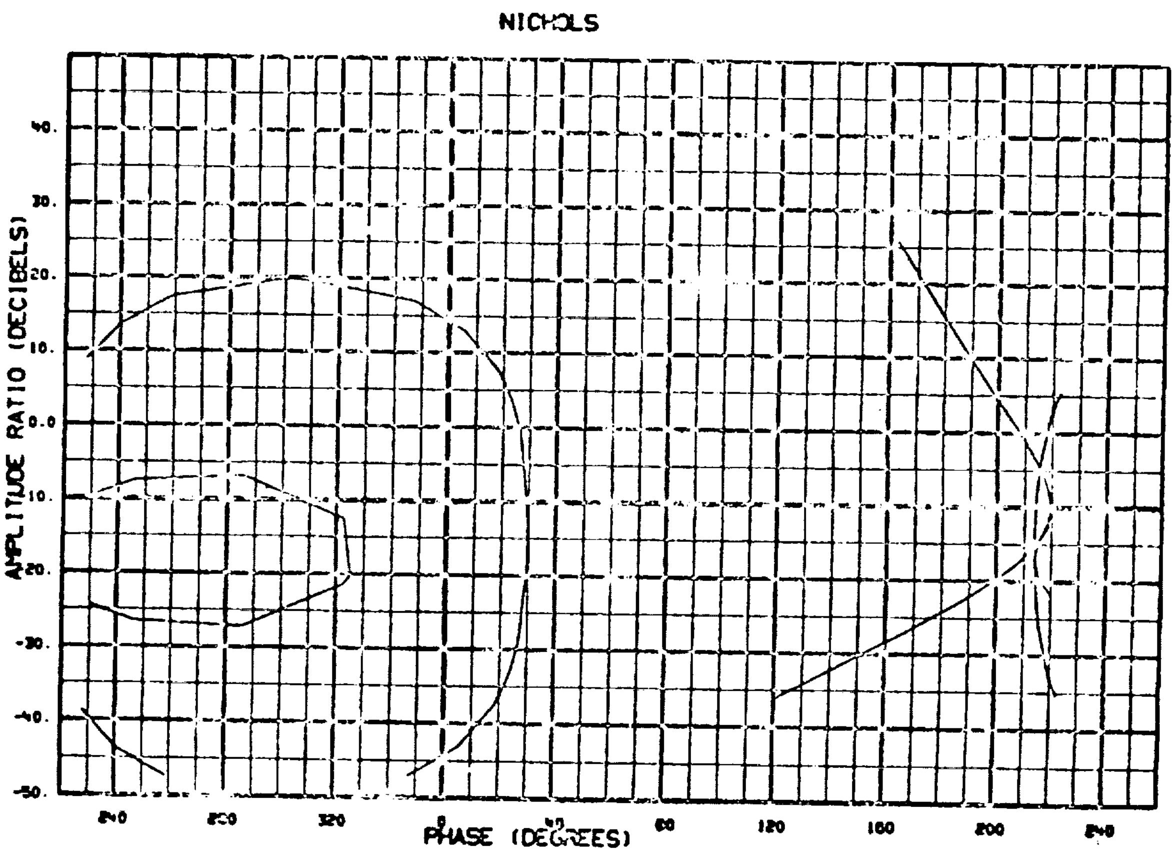


Figure A-8 Graphical Results, Demonstration Problem 9 (Sheet 5 of 9)





DEMO 9 04/26/75 GH (OPEN LOOP) TYPE3 T-AZ/T-AZ
D. DEVERS

Figure A-8 Graphical Results, Demonstration Problem 9 (Sheet 6 of 9)

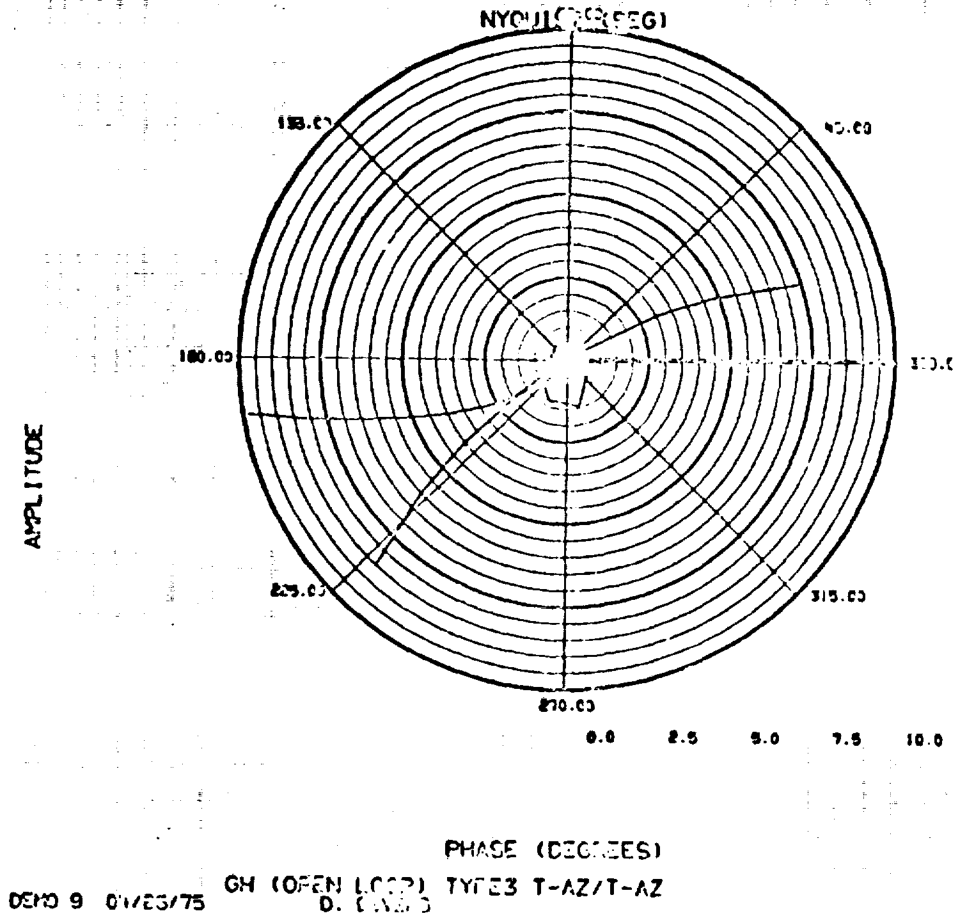
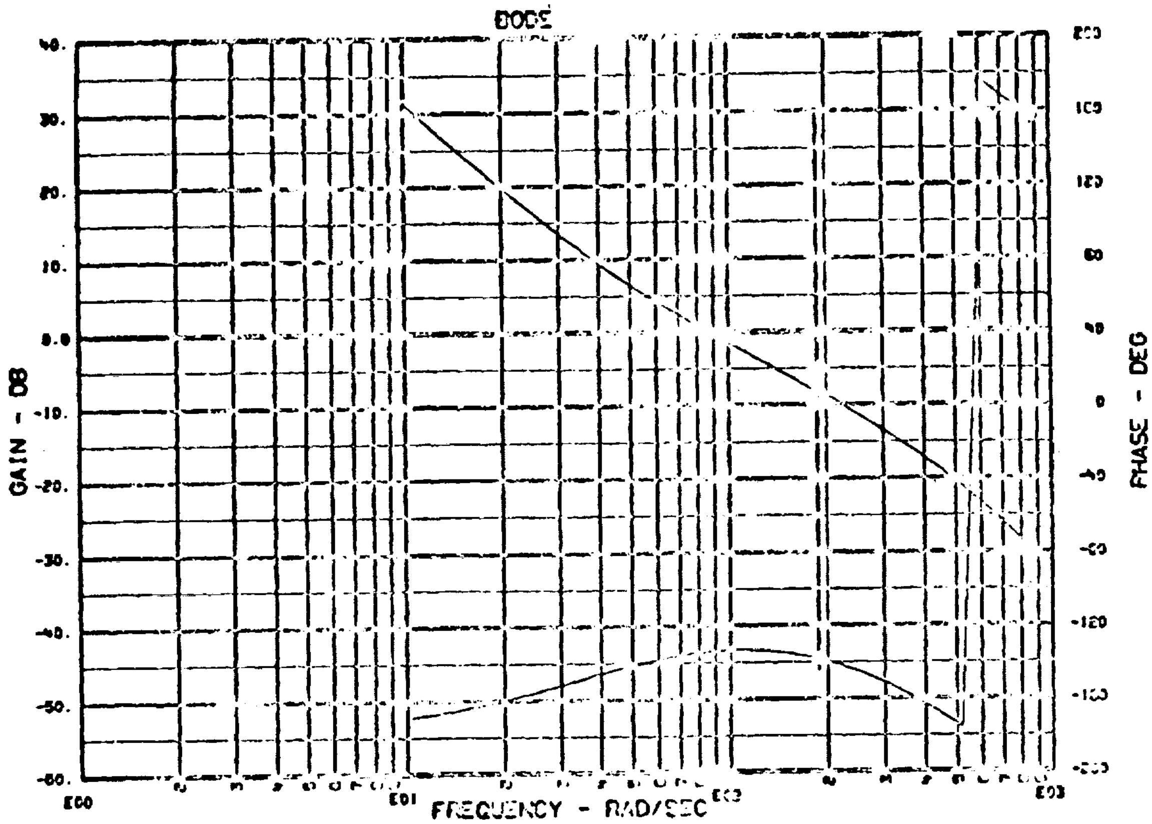


Figure A-8 Graphical Results, Demonstration Problem 9 (Sheet 7 of 9)



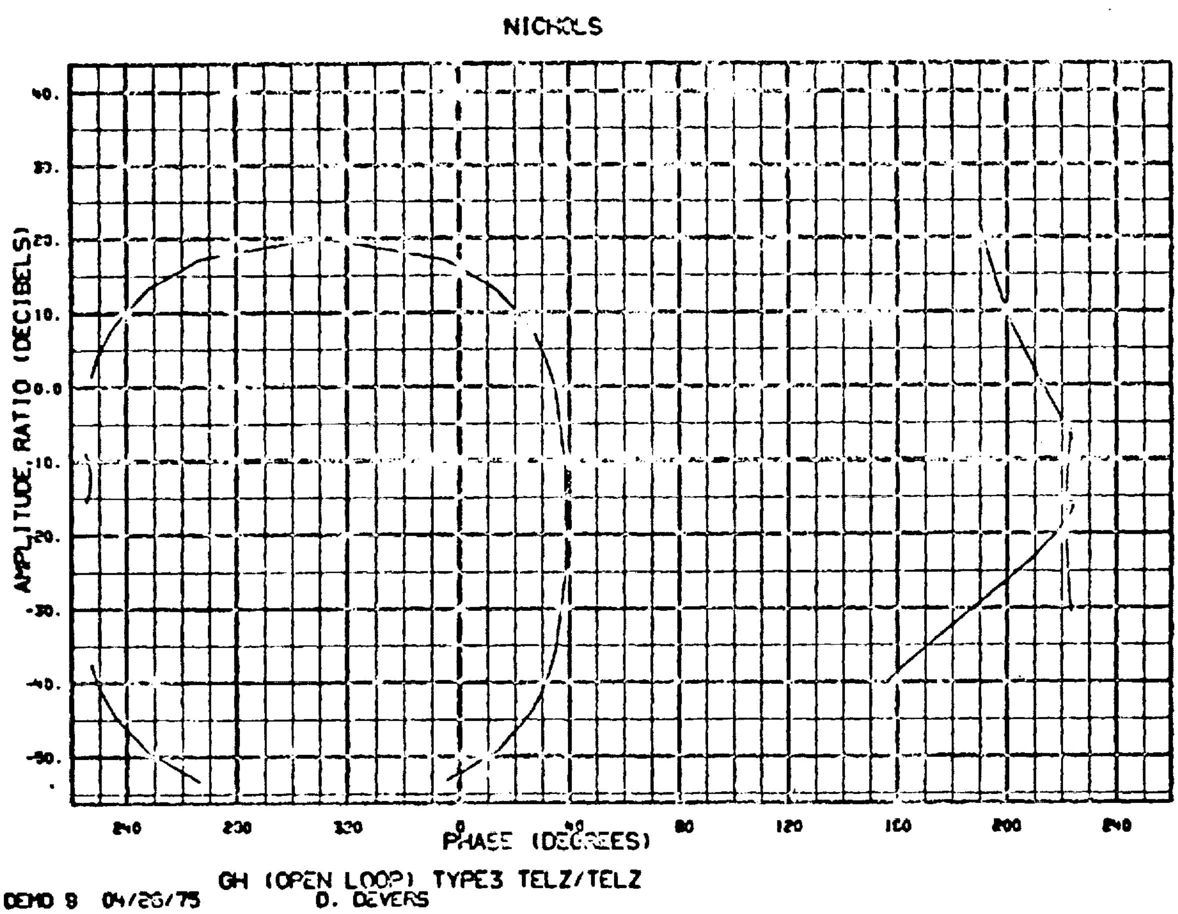


Figure A-8 Graphical Results, Demonstration Problem 9 (Sheet 8 of 9)

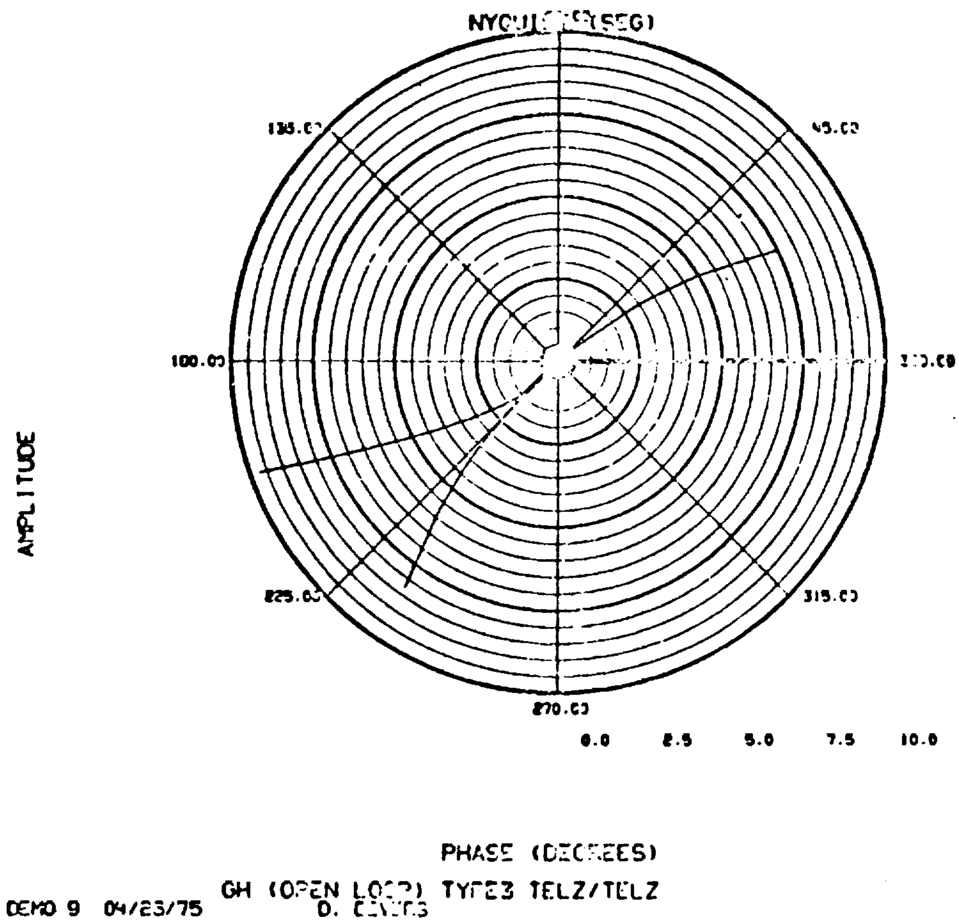


Figure A-8 Graphical Results, Demonstration Problem 9 (Sheet 9 of 9)

Demonstration Problem 10

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```
      SUBROUTINE KHINGE (G)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION G(1)
      DIMENSION SK(3,6),DK(3,6),HNGT(3,6)
C
            COMMON /BHBSHD/                                              0 255
     *      BH(6,18,11),BS(6,18,15),RGL(3,3, 6),DOL(3, 6)               2 255
            COMMON /CONPAR/
     *      CNTOTA(100)
            COMMON /MAXMUM/                                              0 415
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMOBOD,KMU,KY,KU            0 415
            COMMON /MOMENG/                                              0 3886
     *      P(113),PMOM(36),HTOT(3),TOTL(3),ENGKE( 6),ENGPE( 6),        11 3887
     *      TOTKE, TOTPE, TOTENG, AHTOT,ATOTL                            0 3888
            COMMON /SPECIF/                                              0 415
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),   16 415
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),          17 415
     *      NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6), 18 415
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ                         19 415
      COMMON /TQMTR/ TQAZ, TQEL
C
      EQUIVALENCE (CNTOTA(61),SK(1)), (CNTOTA(81),DK(1))
C
      TOTPE = 0.D0
C
      DO 10 L=1,NH
      DO 10 I=1,3
      HNGT(I,L) = -(SK(I,L)*BETAH(I,L) + DK(I,L)*BETAHD(I,L))
   10 TOTPE = TOTPE + 0.5D0*SK(I,L)*BETAH(I,L)**2
      HNGT(2,3) = HNGT(2,3) + TQEL
      HNGT(3,5) = HNGT(3,5) + TQAZ
C
C
      LEQ = IRGFLX(1) + 6
      DO 15 I=1,3
      F = HNGT(I,1)
      DO 16 J=1,LEQ
   16 G(J) = G(J) + F*BH(I,J,1)
   15 CONTINUE
C
      DO 20 L=2,NH
      NOBQ = ITOPOL(1,L)
      NOBP = ITOPOL(2,L)
      LQ = 2*L - 2
      LP = LQ + 1
```

```
      LOQ = LOCU(NOBQ) - 1
      LOP = LOCU(NOBP) - 1
      LEQ = IRGFLX(NOBQ) + 6
      LEP = IRGFLX(NOBP) + 6
      DO 20 I=1,3
      F = HNGT(I,L)
      DO 25 J=1,LEQ
      LOQJ = LOQ + J
   25 G(LOQJ) = G(LOQJ) + F*HH(I,J,LQ)
      DO 26 J=1,LEP
      LOPJ = LOP + J
   26 G(LOPJ) = G(LOPJ) + F*HH(I,J,LP)
   20 CONTINUE
C
      RETURN
      END
      SUBROUTINE CONTRL                                                 048   1
      IMPLICIT REAL*8 (A-H,O-Z)                                         0 4046
      REAL*8 KL, KE, KTA, LA, KBA, KTE, LE, KBE, KD
C                                                                       0 4047
            COMMON /BHBSHD/                                             0 255
     *      BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)               2 255
            COMMON /CONPAR/
     *      CNTDTA(100)
      COMMON /LDSIZE/ NX,NY,NDLTA,NXSS,NBTQ,NJQ,NY2,ND2                 0 4048
            COMMON /SPECIF/                                             0 4049
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),HS(3,3,30),  16 4050
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),         17 4051
     *      NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6), 18 4052
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ                        19 4053
            COMMON /VECTOR/                                             0 4054
     *      Y(250),YDT(250)                                            20 405
      COMMON /TQMTR/ TQAZ, TQEL
      COMMON /XSSDA/ PSI, PSID, THTA, THTAD, E
C
      DIMENSION  TQ(6),TQD(6),RHD(3),THADW(3)
C
      EQUIVALENCE (CNTDTA(21), KD ), (CNTDTA(22), KL ),(CNTDTA(23),KBA),
     1            (CNTDTA(24),KTA ), (CNTDTA(25), LA ),(CNTDTA(26), HA),
     2            (CNTDTA(27),T1A ), (CNTDTA(28),T2A ),(CNTDTA(29),T3A),
     3            (CNTDTA(30),T4A ), (CNTDTA(31),T5A ),(CNTDTA(32),T6A),
     4            (CNTDTA(33),T7A ), (CNTDTA(34),GPSI),(CNTDTA(35),G1A),
     5            (CNTDTA(36),G2A ), (CNTDTA(37),G3A )
      EQUIVALENCE (CNTDTA(41), KBE), (CNTDTA(42), KTE),(CNTDTA(43), LE),
     1            (CNTDTA(44),  RE), (CNTDTA(45), T1E),(CNTDTA(46),T2E),
```

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```
     2            (CNTDTA(47), T3E), (CNTDTA(48), T4E),(CNTDTA(49),GTH),
     3            (CNTDTA(50), G1E), (CNTDTA(51), G2E),(CNTDTA(52),G3E)
C
      DATA I1ST/ 0 /
      IF (I1ST .NE. 0) GO TO 10
      I1ST = 1
CCCCCCCCCC
CCCCCCCCCC
CCC   THE FOLLOWING STATEMENTS MUST ALWAYS BE IN CONTRL..
      NDLTA = NDELTA                                                    D 4057
      NXSS = 4
      NBTQ = 2
      IF (NDELTA .EQ. 0) RETURN                                         D 4060
CCCCCCCCCCC    CCC                                                      D 4061
CCCC----NOTE--THIS SUBROUTINE MUST ESTABLISH  NDLTA,NXSS AND NBTQ       D 4062
CCCCCCCCCCC                                                             D 4063
C                                                                       D 4064
      LDEL = LOCU(2*NB+2) - 1                                           D 4075
C
      E = Y(31)
      CSE = DCOS(E)
      KE = 1.D0 / (G1A * CSE)
C
      A2 = KL
      A3 = KE
C
      B2 = KL * T3A
      B3 = KE * T4A
      B4 = G2A * T5A
      B5 = G3A * T6A
      B6 = T7A
      B7 = KTA / LA
C
      C1 = T1A
      C2 = T2A
      C3 = 0.D0
      C4 = T5A
      C5 = T6A
      C6 = T7A
      C7 = RA / LA
C
      CW1A = T1A * G1A * KD * GPSI
      CW7A = -KTA / LA * KDA
C
      A2E = G1E
```

```
C
      B2E = G1E * T3E
      B3E = G2E * G3E * T4E
      B4E = KTE / LE
C
      C1E = T1E
      C2E = T2E
      C3E = T4E
      C4E = RE / LE
C
      CQ1E = T1E * KD * GTH
      CQ4E = -KTE / LE * KBE
C
C  **********
   10 CONTINUE
      PSI   = Y(31) - E
      THTA  = Y(32)
      PSID  = YDT(38)
      THTAD = YDT(42)
C
      Q1A = CQ1A * THTA
CCCC  ESTABLISH THE D/DT(DELTAS)                                         0 4065
C                                                                        0 4066
      YDT(LDEL+ 1) = -C1 * Y(LDEL+1) + Q1A
      YDT(LDEL+ 2) = (B2-C1*A2) * Y(LDEL+1) - C2*Y(LDEL+2) + A2*Q1A
      YDT(LDEL+ 3) = (A3*B2-C1*A2*A3) * Y(LDEL+1)
     *             +(B3-C2*A3) * Y(LDEL+2) - C3*Y(LDEL+3)+A3*A2*Q1A
      YDT(LDEL+ 4) =  B4 * Y(LDEL+3) - C4*Y(LDEL+4)
      YDT(LDEL+ 5) =  B5 * Y(LDEL+4) - C5*Y(LDEL+5)
      YDT(LDEL+ 6) =  B6 * Y(LDEL+5) - C6*Y(LDEL+6)
      YDT(LDEL+ 7) =  B7 * Y(LDEL+ 6) - C7*Y(LDEL+7) + CQ7A*THTAD
C
      YDT(LDEL+ 8) = -C1E * Y(LDEL+8) + CQ1E * PSI
      YDT(LDEL+ 9) = (B2E-C1E*A2E) * Y(LDEL+8) - C2E*Y(LDEL+9)
     *             + A2E*CQ1E*PSI
      YDT(LDEL+10) = B3E * Y(LDEL+9) - C3E * Y(LDEL+10)
      YDT(LDEL+11) = B4E * Y(LDEL+10)- C4E * Y(LDEL+11) + CQ4E * PSTD
C
C  COMPUTE TORQUES FOR USE IN KHINGE.
C
      TQAZ = Y(LDEL+7)
      TQEL = Y(LDEL+11)
C
C
      RETURN                                                             0 4080
```

```
      END
      SUBROUTINE EATOR   (TEX,ISPN,NTEX)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION TEX(6,1), ISPN(1)
C
              COMMON /MAXMUM/
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDHOD,KMU,KY,KU
              COMMON /SPECIF/
     *      BETAH(6, 6),BETAHD(6, 6),AMD(2, 5),RH(3,3,30),RS(3,3,30),
     *      DH(3,35),DS(3,30),IMU(3, 5),NMOW(6, 6),IFTSMW(15),
     *      NB,NH,NSPT,NOFMU,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
              COMMON /VECTOR/
     *      Y(250),YDT(250)
C
      DATA IIST / 0 /
C
CCC ESTABLISH THE EXTERNAL FORCE/TORQUE (6-LONG VECTOR) AND NUMBER
CCC  THE CORRESPONDING SENSOR POINTS. ALSO ESTABLISH THE NUMBER OF
CCC  SIX-LONG VECTORS (NTEX).
C
      IF (IIST .EQ. 1) GO TO 5
      IIST = 1
      DO 10 I=1,6
      DO 10 J=1,NSPMAX
   10 TEX(I,J) = 0.D 0
C
    5 NTEX = 0
C
      RETURN
      END
      SUBROUTINE SHAFTT (TSHFT)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION TSHFT(1)
C
              COMMON /MAXMUM/
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDHOD,KMU,KY,KU
              COMMON /SPECIF/
     *      BETAH(6, 6),BETAHD(6, 6),AMD(2, 5),RH(3,3,30),RS(3,3,30),
     *      DH(3,35),DS(3,30),IMU(3, 5),NMOW(6, 6),IFTSMW(15),
     *      NB,NH,NSPT,NOFMU,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
              COMMON /VECTOR/
     *      Y(250),YDT(250)
C
```

```
      DATA I1ST / 0 /                                                   0 4136
C                                                                       0 4137
      IF (I1ST .EQ. 1) GO TO 10                                         0 4138
      I1ST = 1                                                          0 4139
      DO 5 I=1,NMWMAX                                                   0 4140
    5 TSHFT(I) = 0.D 0                                                  0 4141
C                                                                       0 4142
   10 CONTINUE
      RETURN
      END                                                               0 4144
      SUBROUTINE EQADD                                                  051   1
      IMPLICIT REAL*8 (A-H,O-Z)                                         0 4147
C
               COMMON /RHBSHD/                                          0 255
     *    BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)                 2 255
               COMMON /ONAUX /                                          0 414
     *    NAUX                                                          0 414
               COMMON /MAXMUM/                                          0 415
     *    NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU             0 415
               COMMON /SPECIF/                                          0 415
     *    BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),     16 415
     *    DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),            17 415
     *    NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IHGFLX( 6),IHDATA(7, 6), 18 415
     *    LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ                           19 415
               COMMON /VECTOR/                                          0 415
     *    Y(250),YDT(250)                                               20 405
      COMMON /XSSDA/ PSI, PSID, THTA, THTAD, E
      DATA I1ST/ 0/
C                                                                       0 415
      IF (I1ST .NE. 0) GO TO 5
      I1ST = 1
      E = Y(31)
      NAUX = 6
      LDEL = LOCU(2*NB+2) - 1
    5 CONTINUE
C
      PSI = Y(31) - E
      THTA = Y(32)
      PSID = YDT(38)
      THTAD = YDT(42)
C
      YDT(NEQ+1) = PSID
      YDT(NEQ+2) = PSI
      YDT(NEQ+3) = THTAD
      YDT(NEQ+4) = THTA
```

```
      YOUT(NEQ+5) = Y(LDEL+7)
      YOUT(NEQ+6) = Y(LDEL+11)                                          U 417
      RETURN                                                            U 417
      END
```

DEMO10 D. DEVERS
AE-C LINEARIZED TIME RESPONSE
DONOHUE CHECK PROBLEM----DATA UPDATE ON 2 DEC 1974
-----SCHEMATIC-----

```
YYY                YYY  YOKE  YYY               YYY

Y              TORSION                            Y
Y     * EL    -SPRING-      * PIA                 Y
Y      MOTOR     B1                               Y

Y                                                 Y
 YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
                         Y
                         Y
                         Y
                         Y
                         Y
                         Y
                         Y
                         Y

                      ------ SPRINGS (B2,B3,B4)

                         *  AZIMUTH
                            MOTOR
```

```
                                   ***   SPACECRAFT
                                   ***  (PLATFORM)
0000000000
    5    5    1    0   11                NB, NH, NSPT, NOFMO, NDELTA
ITPOL    2    5
    1    1    1    2    3    4    5
    2    1    0    1    2    3    4
0000000000
IRGFLX   1    5     NO. FLEXIBLE MODES/BODY
0000000000
IFTSMW   1    1     NO. F, T, S, MW POINTS
    1    1    1
0000000000
IHDATA   7    5
    1    1    5    1    1    1    1
    2    1    0    1    1    0    1
    3    1    0    0    0    0    1
    4    1    0    1    1    0    0
    5    1    0    1    1    1    1
    6    1    0    1    1    1    1
    7    1    0    1    1    1    1
0000000000
BETAH    6    5     INITIAL BETA (HINGE)
    1    1 1.22173
    2    3-1.22173
0000000000
BETAHD   6    5
0000000000
TMDATA   1    3
    1    1 0.0             0.00001          0.001
0000000000
IPDATA   1    3
    1    1   10    1    1
0000000000
CNTDTA   1  100     MISC DATA PECULAR TO AE.
    1   21 3437.8          2.0              0.0              12.4992
    1   25 0.025           14.              62800.           1000.
    1   29 49.75           5.0              6666.              2514.
    1   33 2514.            .122            11.577           100.
    1   37 3.11
    1   41 0.              2.50596          0.0212           22.
```

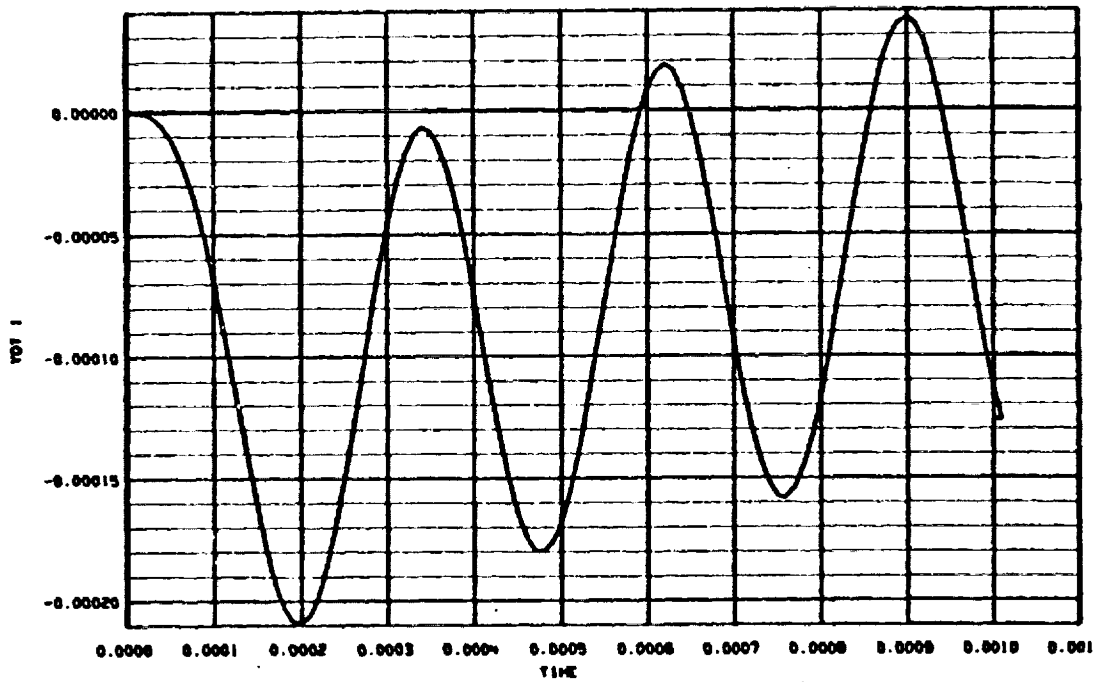
```
    1   45 62800.           450.            45.             6666.
    1   49 0.122            45.             3.11            5.0
    1   65 1.6355       +06
    1   70 5.040863     +05 4.43753     +05 6.08972     +05
    1   85 0.024673
    1   90 0.0553295        0.048707        0.021538
0000000000
GGDTA    1    4
0000000000
MASS     1    4      BODY 1 (PIA)
    1    1 0.05862
0000000000
INERT    1    6
    1    1 0.99995          0.93407         0.87412
    1    4 -.00257          0.05713         0.01198
0000000000
    2    1
 0.0
-.024     6.069      0.024
    1    1
 0.0
0.0
MASS     1    4      BODY 2 (ELE. MOTOR)
    1    1 0.003619
0000000000
INERT    1    6
    1    1 0.003899         0.003238        0.003899
0000000000
    2    1
 0.0
 0.0      0.0        0.0
    3    1
 0.0
 0.0     -5.926      0.0
MASS     1    4      BODY 3 (YOKE)
    1    1 0.024373
0000000000
INERT    1    6
    1    1 1.05375          0.37553         0.89120
    1    4 0.00125          0.00664         -.01941
0000000000
    3    1
 0.0
 -.024    6.455      -.081
    4    1
```

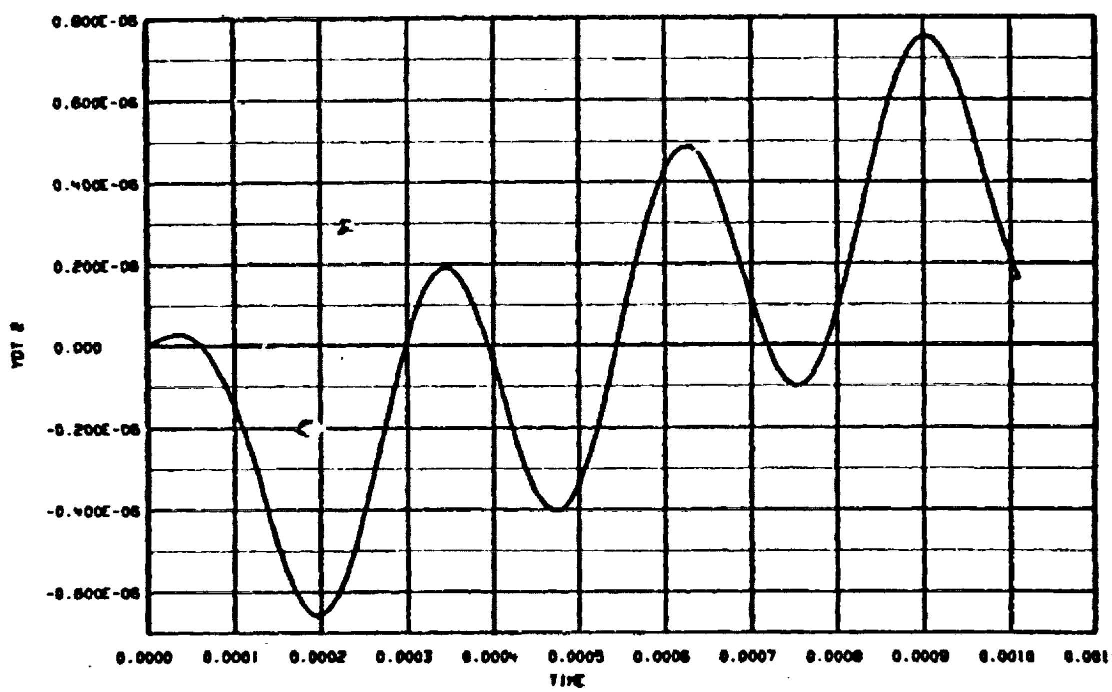
```
 0.0
-.024      0.529      12.189
MASS       1    4     BODY 4 (AZIMUTH MOTOR)
    1     1 0.01596
0000000000
INERT      1    6
    1     1 0.0001         0.0001          0.0946
0000000000
    4     1
 0.0
0.0        0.0        0.0
    5     1
 0.0
 0.0       0.0        0.0
MASS       1    4     BODY 5 (PLATFORM)
    1     1 3.6558
0000000000
INERT      1    6
    1     1 850.011        863.85          935.37
    1     5   2.8
0000000000
    5     1
 0.0
0.0        0.0        -8.749
TIME
         LINEARIZED AE-C TIME RESPONSE
    5
   16
    1     2    3    4    5    6    7    8    9   10   11   12   13   14   15   16
    1     2              1
TIME       YDT 1
    1     3              1
TIME     - YDT 2
    1     4              1
TIME       YDT 3
    1     5              1
TIME       YDT 4
    1     6              1
TIME       YDT 5
    1     7              1
TIME       YDT 6
    1     8              1
TIME       YDT 7
    1     9              1
TIME       YDT 8
```

```
   1    10                1
TIME        YDT 9
   1    11                1
TIME        YDT 10
   1    12                1
TIME        YDT 11
   1    13                1
TIME        YDT 12
   1    14                1
TIME        YDT 13
   1    15                1
TIME        YDT 14
   1    16                1
TIME        YDT 15
   0
  16
   1    17    18    19    20    21    22    23    24    25    26    27    28    29    30    31
   1     2                1
TIME        YDT 16
   1     3                1
TIME        YDT 17
   1     4                1
TIME        YDT 18
   1     5                1
TIME        YDT 19
   1     6                1
TIME        YDT 20
   1     7                1
TIME        YDT 21
   1     8                1
TIME        YDT 22
   1     9                1
TIME        YDT 23
   1    10                1
TIME        YDT 24
   1    11                1
TIME        YDT 25
   1    12                1
TIME        YDT 26
   1    13                1
TIME        YDT 27
   1    14                1
TIME        YDT 28
   1    15                1
TIME        YDT 29
```

```
     1    16                 1
TIME       YDT 30
     0
    16
     1    32    33    34    35    36    37    38    39    40    41    42    43    44    45    46
     1     2                 1
TIME       YDT 31
     1     3                 1
TIME       YDT 32
     1     4                 1
TIME       YDT 33
     1     5                 1
TIME       YDT 34
     1     6                 1
TIME       YDT 35
     1     7                 1
TIME           Y 1
     1     8                 1
TIME           Y 2
     1     9                 1
TIME           Y 3
     1    10                 1
TIME           Y 4
     1    11                 1
TIME           Y 5
     1    12
TIME           Y 6
     1    13                 1
TIME           Y 7
     1    14                 1
TIME           Y 8
     1    15                 1
TIME           Y 9
     1    16                 1
TIME           Y 10
     0
    16
     1    47    48    49    50    51    52    53    54    55    56    57    58    59    60    61
     1     2                 1
TIME           Y 11
     1     3                 1
TIME           Y 12
     1     4                 1
TIME           Y 13
     1     5                 1
```

```
TIME         Y 14
    1    6              1
TIME         Y 15
    1    7              1
TIME         Y 16
    1    8              1
TIME         Y 17
    1    9              1
TIME         Y 18
    1   10              1
TIME         Y 19
    1   11              1
TIME         Y 20
    1   12              1
TIME         Y 21
    1   13              1
TIME         Y 22
    1   14              1
TIME         Y 23
    1   15              1
TIME         Y 24
    1   16              1
TIME         Y 25
    0
   11
    1   62    63    64    65    66    67    68    69    70    71
    1    2              1
TIME         Y 26
    1    3              1
TIME         Y 27
    1    4              1
TIME         Y 28
    1    5              1
TIME         Y 29
    1    6              1
TIME         Y 30
    1    7              1
TIME         Y 31
    1    8              1
TIME         Y 32
    1    9              1
TIME         Y 33
    1   10              1
TIME         Y 34
    1   11              1
TIME         Y 35
    0
STOP
```

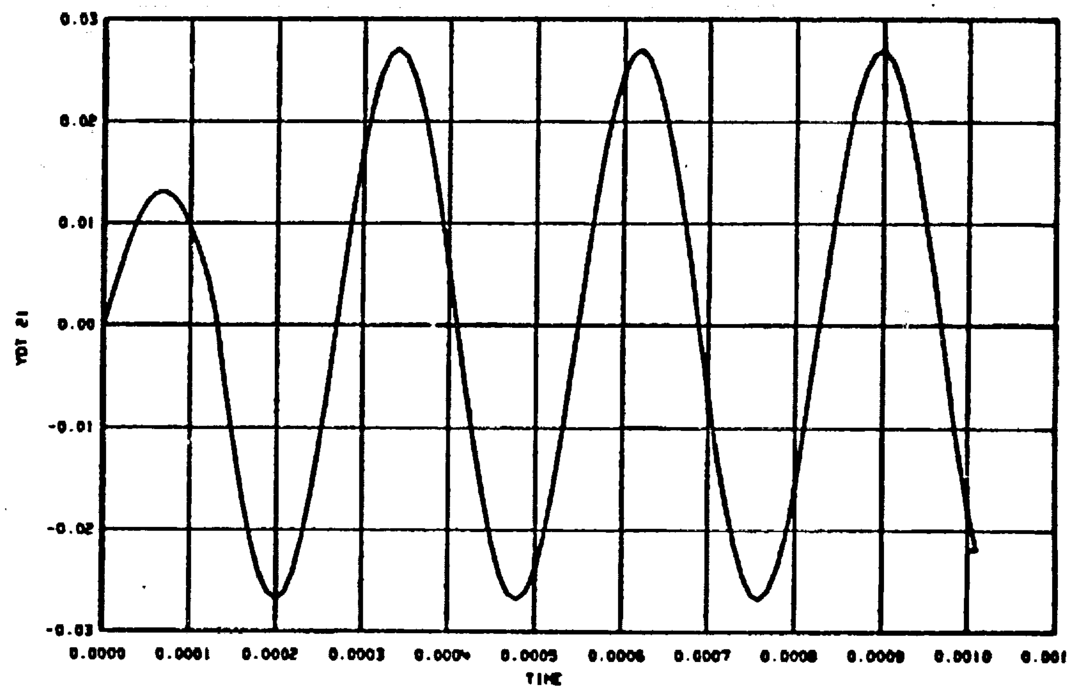


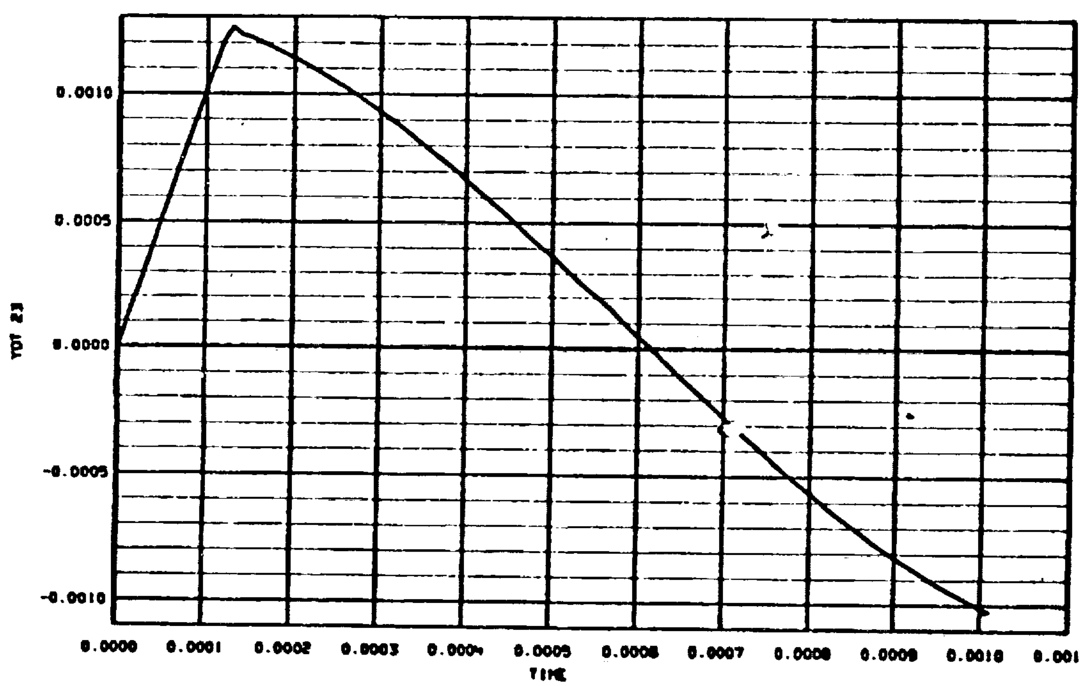


LINEARIZED AE-C TIME RESPONSE

DEMO10 03/03/75 D. DEVERS

Figure A-9 Graphical Results, Demonstration Problem 10 (Sheet 1 of 7)

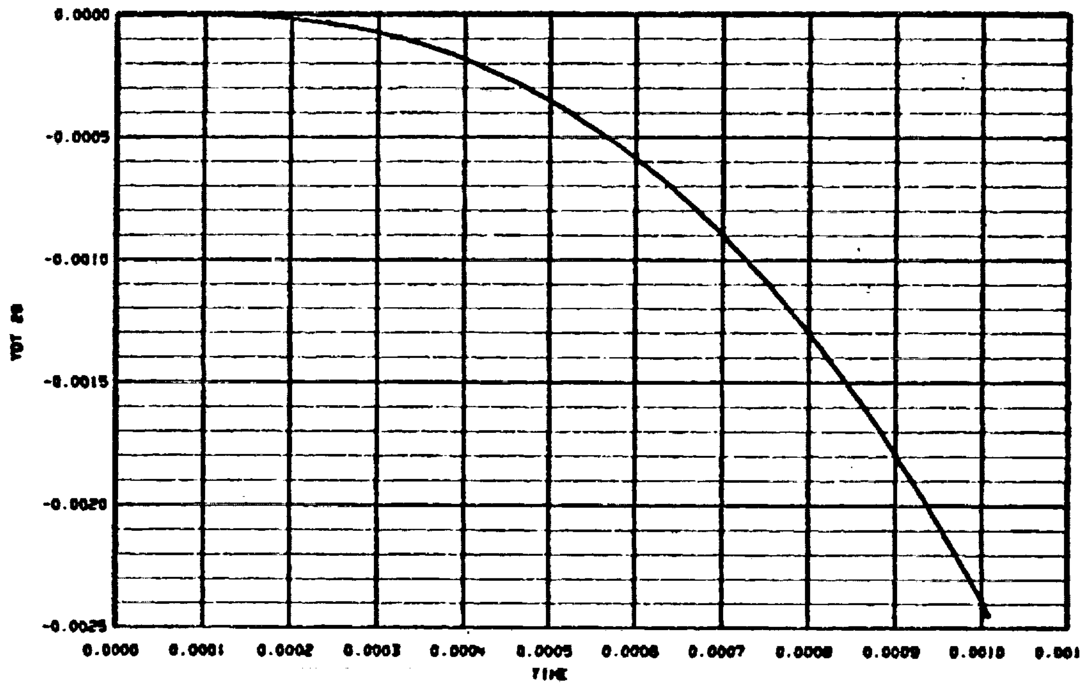


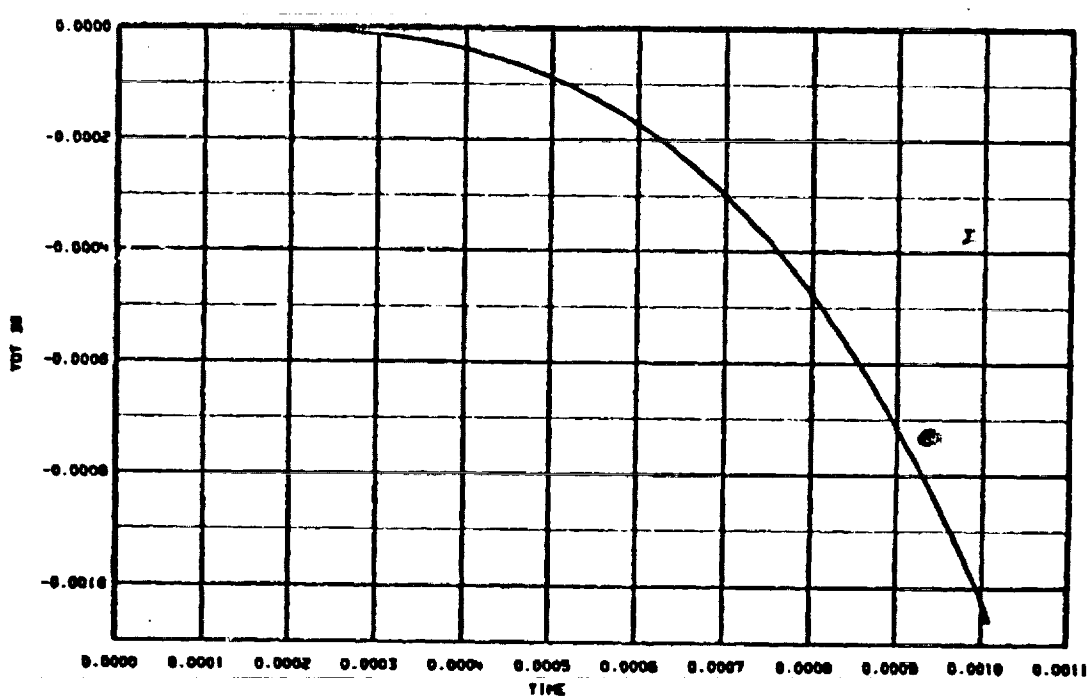


LINEARIZED AE-C TIME RESPONSE

DEMO10 03/03/75 D. DEVERS

Figure A-9 Graphical Results, Demonstration Problem 10 (Sheet 2 of 7)

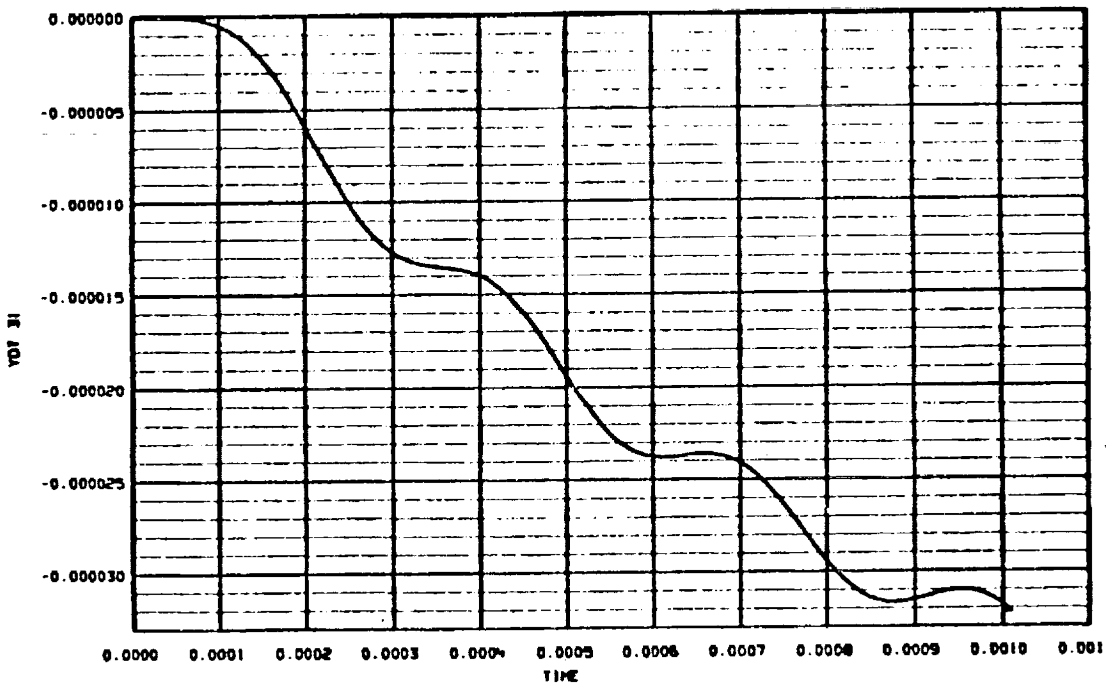


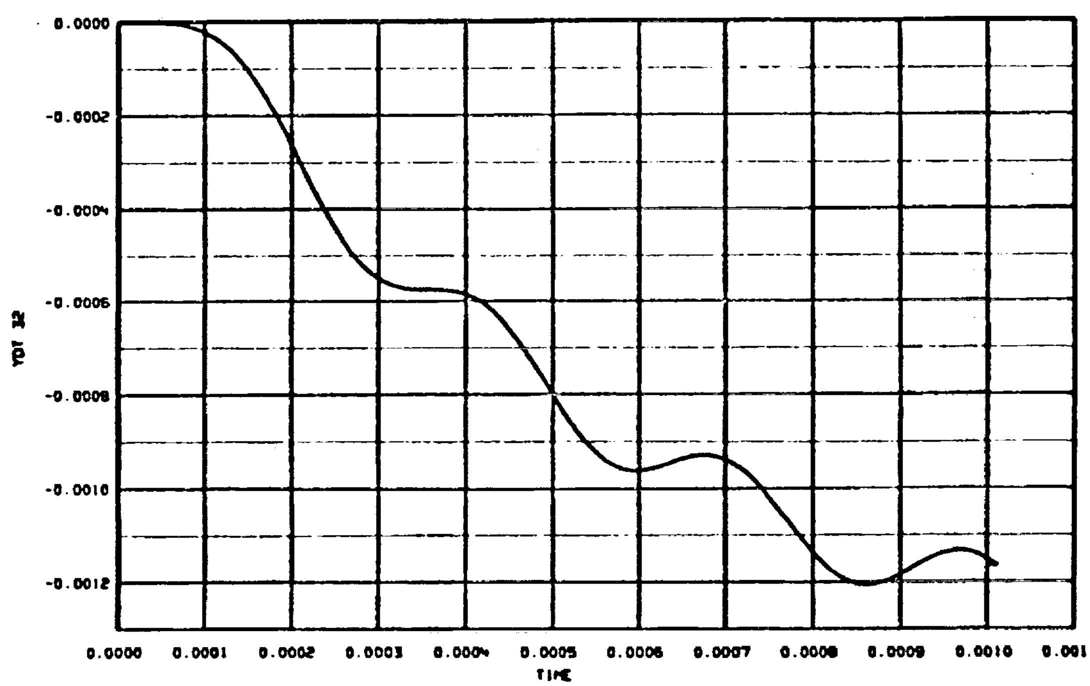


LINEARIZED AE-C TIME RESPONSE

DEMO10 03/03/75 D. DEVERS

Figure A-9 Graphical Results, Demonstration Problem 10 (Sheet 3 of 7)





LINEARIZED AE-C TIME RESPONSE

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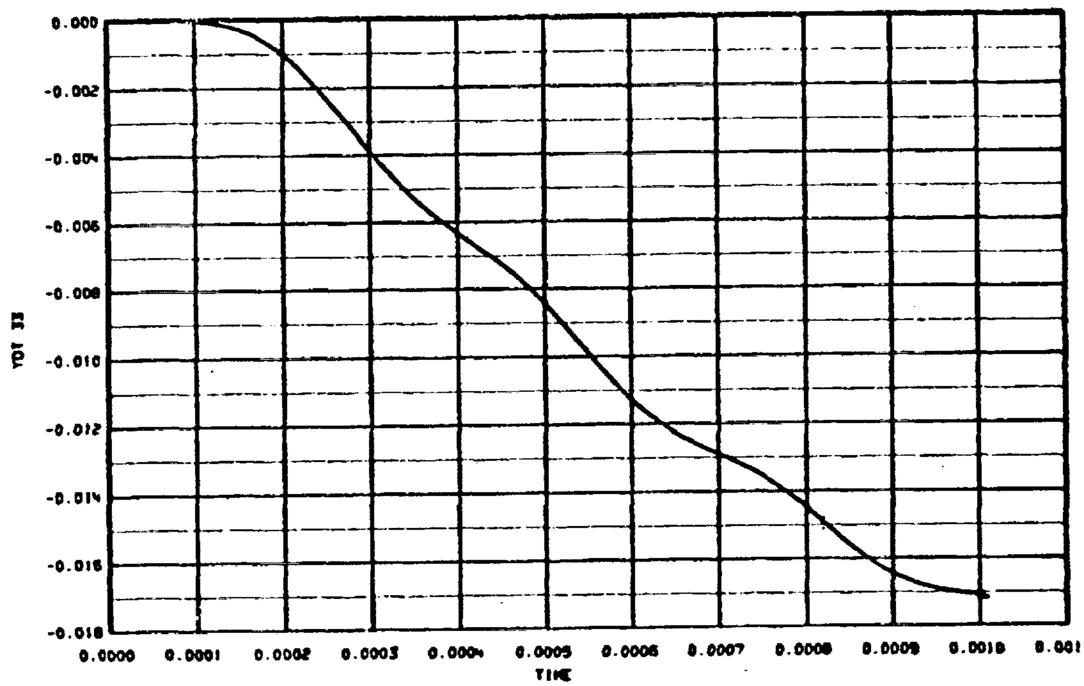
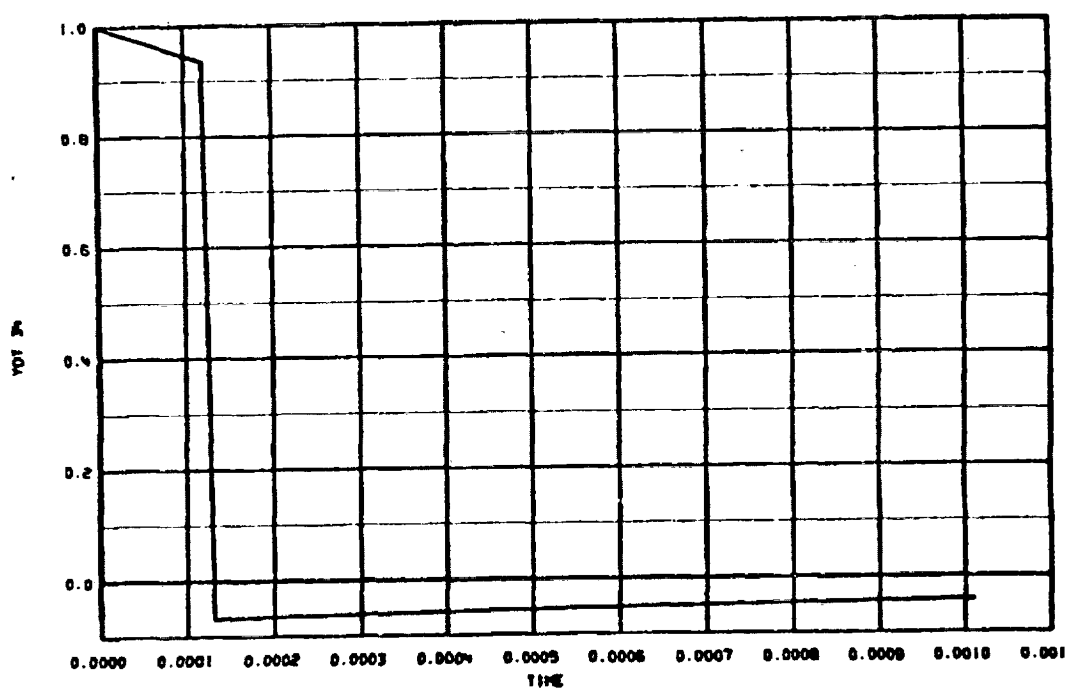
Figure A-9 Graphical Results, Demonstration Problem 10 (Sheet 4 of 7)





LINEARIZED AE-C TIME RESPONSE

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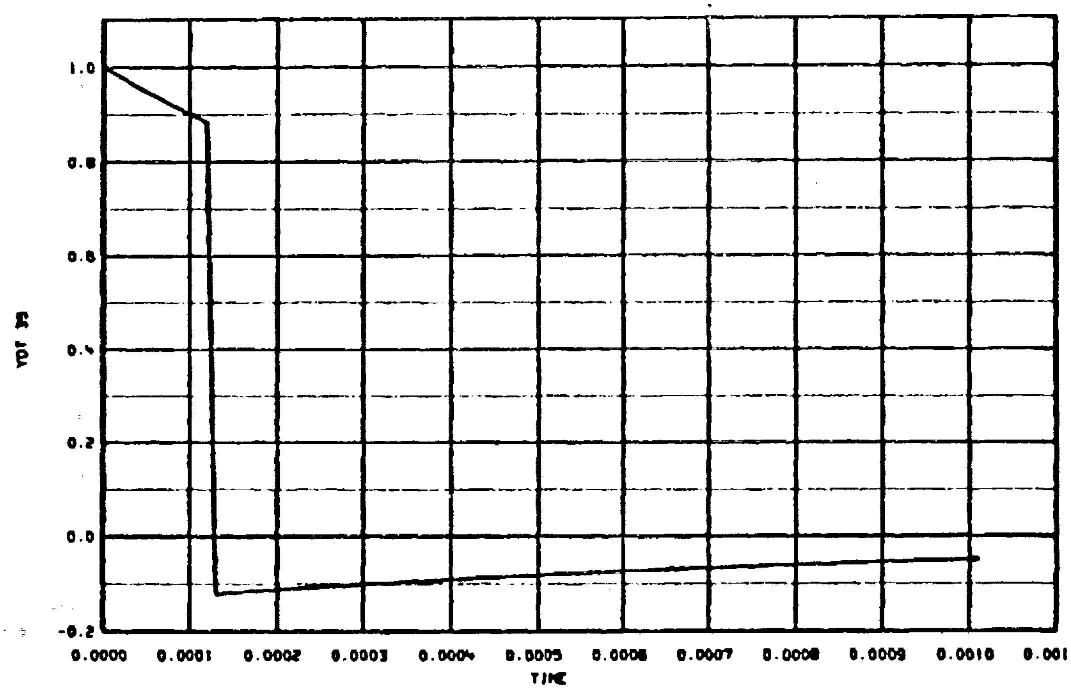
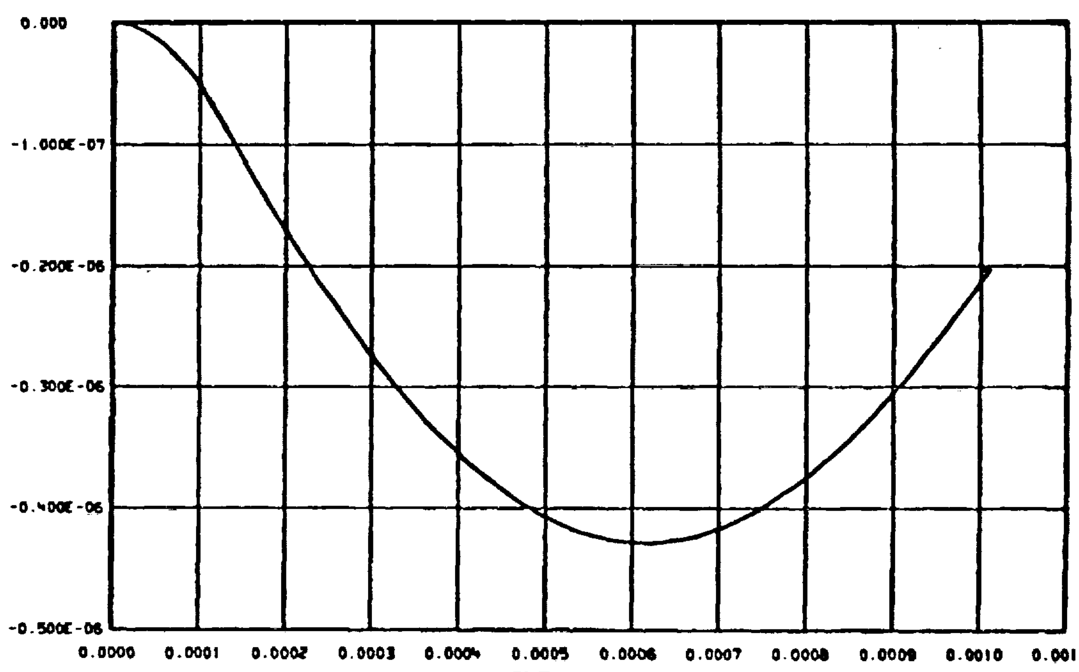
Figure A-9 Graphical Results, Demonstration Problem 10 (Sheet 5 of 7)

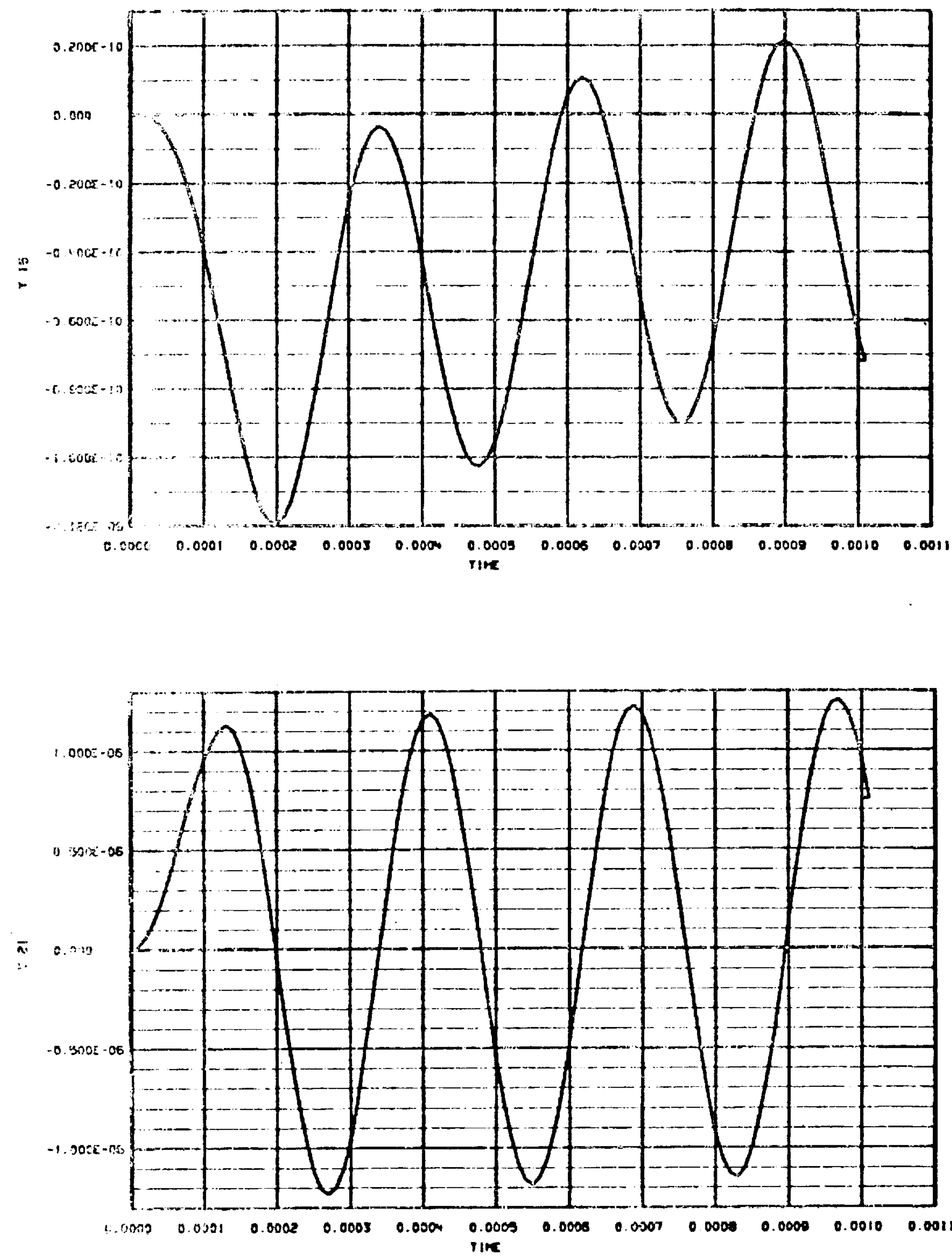




LINEARIZED AE-C TIME RESPONSE

DEMO10 03/03/75 D. DEVERS

Figure A-9 Graphical Results, Demonstration Problem 10 (Sheet 6 of 7)



LINEARIZED AE-C TIME RESPONSE

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Figure A-9 Graphical Results, Demonstration Problem 10 (Sheet 7 of 7)

Demonstration Problem 11

```
      SUBROUTINE KHINGE (G)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION G(1)
      DIMENSION SK(3,6),DK(3,6),HNGT(3,6)
C
            COMMON /BHBSRD/                                               0 255
     *      BH(6,18,11),BS(6,18,15),ROL(3,3, 6),DOL(3, 6)                 2 255
            COMMON /CONPAR/
     *      CNTDTA(100)
            COMMON /MAXMUM/                                               0 415
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU             0 415
            COMMON /MOMENG/                                               0 3886
     *      P(113),PMOM(36),HTOT(3),TOTL(3),ENGKE( 6),ENGPE( 6),         11 3887
     *      TOTKE, TOTPE, TOTENG, AHTOT,ATOTL                             0 3888
            COMMON /SPECIF/                                               0 415
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),    16 415
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),           17 415
     *      NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IHGFLX( 6),IHDATA(7, 6), 18 415
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ                          19 415
      COMMON /TQMTR/ F1, F2
C
      EQUIVALENCE (CNTDTA(61),SK(1)), (CNTDTA(81),DK(1))
C
      TOTPE = 0.D0
C
      DO 10 L=1,NH
      DO 10 I=1,3
      HNGT(I,L) = -(SK(I,L)*BETAH(I+3,L) + DK(I,L)*BETAHD(I+3,L))
   10 TOTPE = TOTPE + 0.5D0*SK(I,L)*BETAH(I+3,L)**2
      HNGT(1,1) = HNGT(1,1) -(F1+F2)
      HNGT(1,2) = HNGT(1,2) - F2
C
C
      LEQ = IHGFLX(1) + 6
      DO 15 I=1,3
      F = HNGT(I,1)
      DO 16 J=1,LEQ
   16 G(J) = G(J) + F*BH(I+3,J,1)
   15 CONTINUE
C
      DO 20 L=2,NH
      NOBQ = ITOPOL(1,L)
      NOBP = ITOPOL(2,L)
      LQ = 2*L - 2
      LP = LQ + 1
```

```
      LOQ = LOCU(NOBQ) - 1
      LOP = LOCU(NOBP) - 1
      LEQ = IRGFLX(NOBQ) + 6
      LEP = IRGFLX(NOBP) + 6
      DO 20 I=1,3
      F = HNGT(I,L)
      DO 25 J=1,LEQ
      LOQJ = LOQ + J
   25 G(LOQJ) = G(LOQJ) + F*BH(I+3,J,LQ)
      DO 26 J=1,LEP
      LOPJ = LOP + J
   26 G(LOPJ) = G(LOPJ) + F*BH(I+3,J,LP)
   20 CONTINUE
C
      RETURN
      END
      SUBROUTINE CONTRL                                                 048  1
      IMPLICIT REAL*8 (A-H,O-Z)                                         0 4046
C                                                                       0 4047
            COMMON /BHBSRD/                                             0 255
     *      BH(6,18,11),BS(6,18,15),BOL(3,3, 6),DOL(3, 6)               2 255
            COMMON /CONPAR/
     *      CNTDTA(100)
      COMMON /LDSIZE/ NX,NY,NDLTA,NXSS,NBTQ,NJQ,NY2,NU2                 0 4048
            COMMON /SPECIF/                                             0 4049
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),   16 4050
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),          17 4051
     *      NB,NH,NSPT,NOFMO,NDFLTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6), 18 4052
     *      LOCU(14),LENU(14),NU,NHETA,NLAM,NEQ                         19 4053
            COMMON /VECTUR/                                             0 4054
     *      Y(250),YDT(250)                                             20 405
       COMMON /TQMTR/ F1, F2
       COMMON /XSSDA/ XSS1, XSS2, XSS3, XSS4
C
       DIMENSION  TQ(6),TQD(6),RHD(3),THADW(3)
       DIMENSION CPLY(10,4), KPLY(2), UI(2)
C
       EQUIVALENCE (CNTDTA(41),ZA), (CNTDTA(42),ZB), (CNTDTA(43),ZC),
      1            (CNTDTA(44),ZD), (CNTDTA(45),ZE), (CNTDTA(46),ZF),
      2            (CNTDTA(47),ZG), (CNTDTA(48),ZH), (CNTDTA(49),ZL),
      3            (CNTDTA(50),ZM), (CNTDTA(51),ZN), (CNTDTA(52),ZP)
C
       DATA NPLY, KRY, KCY/ 2, 10, 4/
       DATA I1ST/ 0 /
       IF (I1ST .NE. 0) GO TO 10
```

```
      I1ST = 1
      IF (NPLY .EQ. 0) GO TO 6
      DO 5 K=1,NPLY
          K2=2*K-1
    5 CALL READ (CPLY(1,K2),KPLY(K),N2,KHY,KCY)
      CALL WRITE (CPLY,3,4,4HCPLY,KRY)
    6 CONTINUE
CCCCCCCCCC
CCCCCCCCCC
CCC   THE FOLLOWING STATEMENTS MUST ALWAYS BE IN CONTRL..        U 4057
      NDLTA = NDELTA
      NXSS = 4
      NBTQ = 2                                                    U 4060
      IF (NDELTA .EQ. 0) RETURN                                   U 4061
CCCCCCCCCCC    CCC                                                U 4062
CCCC----NOTE--THIS SUBROUTINE MUST ESTABLISH  NDLTA,NXSS AND NBTQ U 4063
CCCCCCCCCCC                                                       U 4064
C                                                                 U 4075
      LDEL = LOCU(2*NB+2) - 1
C
C   **********
   10 CONTINUE
      UI(1) = Y(13)
      UI(2) = Y(13) + Y(14)
      XSS1 = YDT(13)
      XSS2 = YDT(13) + YDT(14)
      XSS3 = Y(13)
      XSS4 = Y(13) + Y(14)
C                                                                 U 4065
CCCC  ESTABLISH THE D/DT(DELTAS)                                  U 4066
C
      L = LDEL+1
      DO 15 K=1,NPLY
         K2 = 2*K-1
      CALL TFPLY (CPLY(1,K2),CPLY(1,K2+1),UI(K),X,KPLY(K),L)
      IF (K .EQ. 1) F1 = X
      IF (K .EQ. 2) F2 = X
      L = L+KPLY(K) - 1
   15 CONTINUE
C
C  COMPUTE TORQUES FOR USE IN KHINGF.
C
C
C                                                                 U 4080
      RETURN
```

```
      END
      SUBROUTINE EXTOR  (TEX,ISPN,NTEX)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION TEX(6,1), ISPN(1)
C
            COMMON /MAXMUM/
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU
            COMMON /SPECIF/
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
     *      NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
            COMMON /VECTOR/
     *      Y(250),YDT(250)
C
      DATA IIST / 0 /
C
CCC ESTABLISH THE EXTERNAL FORCE/TORQUE (6-LONG VECTOR) AND NUMBER
CCC  THE CORRESPONDING SENSOR POINTS. ALSO ESTABLISH THE NUMBER OF
CCC  SIX-LONG VECTORS (NTEX).
C
      IF (IIST .EQ. 1) GO TO 5
      IIST = 1
      DO 10 I=1,6
      DO 10 J=1,NSPMAX
   10 TEX(I,J) = 0.0 0
C
    5 NTEX = 0
C
      RETURN
      END
      SUBROUTINE SHAFTT (TSHFT)
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION TSHFT(1)
C
            COMMON /MAXMUM/
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU
            COMMON /SPECIF/
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
     *      NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IRGFLX( 6),IHDATA(7, 6),
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
            COMMON /VECTOR/
     *      Y(250),YDT(250)
C
```

```
      DATA IIST / 0 /
C
      IF (IIST .EQ. 1) GO TO 10
      IIST = 1
      DO 5 I=1,NMWMAX
    5 TSHFT(I) = 0.D 0
C
   10 CONTINUE
      RETURN
      END
      SUBROUTINE EQADD
      IMPLICIT REAL*8 (A-H,O-Z)
C
            COMMON /BHBSRD/
     *      BH(6,18,11),BS(6,18,15),POL(3,3, 6),QOL(3, 6)
            COMMON /DNAUX /
     *      NAUX
            COMMON /MAXMUM/
     *      NBMAX,NHMAX,NSPMAX,NMWMAX,NMWBOD,NMDBOD,KMU,KY,KU
            COMMON /SPECIF/
     *      BETAH(6, 6),BETAHD(6, 6),AMO(2, 5),RH(3,3,30),RS(3,3,30),
     *      DH(3,35),DS(3,30),IMO(3, 5),NMOW(6, 6),IFTSMW(15),
     *      NB,NH,NSPT,NOFMO,NDELTA,ITOPOL(2, 6),IMGFLX( 6),IHDATA(7, 6),
     *      LOCU(14),LENU(14),NU,NBETA,NLAM,NEQ
            COMMON /VECTOR/
     *      Y(250),YDT(250)
      COMMON /XSSDA/ XSS1, XSS2, XSS3, XSS4
      COMMON /TUMTK/ F1, F2
      DATA IIST/ 0/
C
      IF (IIST .NE. 0) GO TO 5
      IIST = 1
      NAUX = 6
      LOEL = LOCU(2*NB+2) - 1
    5 CONTINUE
C
      XSS1 = YDT(13)
      XSS2 = YDT(13) + YDT(14)
      XSS3 = Y(13)
      XSS4 = Y(13) + Y(14)
C
      YDT(NEQ+1) = XSS1
      YDT(NEQ+2) = XSS2
      YDT(NEQ+3) = XSS3
      YDT(NEQ+4) = XSS4
```

```
      YOT(NEQ+5) = F1
      YOT(NEQ+6) = F2
      RETURN                                                     0 417
      END                                                        0 417
```

```
DEMO11     D DEVERS
POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8
0000000000
    2     2     1     0     4
ITOPOL    2     2
    1     1     1     2
    2     1     0     1
0000000000
IRWFLX    1     2
0000000000
IFTSMW    1     1
    1     1     1
0000000000
IHDATA    7     2
    1     1     1     1
    2     1     1     1
    3     1     1     1
    4     1     1     1
    5     1     0     0
    6     1     1     1
    7     1     1     1
0000000000
BETAH     6     2
0000000000
BETAHD    6     2
0000000000
TMDATA    1     3
    1     1      0.                  .1                   .1
0000000000
IPDATA    1     3
    1     3     1
0000000000
CNTDTA    1   100
    1    41 450.             2.                 450.               500.
    1    45 3.               500.               450.                2.
    1    49 450.             500.               3.                  500.
    1    64 1424.286
    1    84 0.90673
0000000000
GRAV      1     4
0000000000
MASS1     1     4
    1     1      2.7
0000000000
```

```
INERT1    1      6
   1      1      1.                  1.                 1.
0000000000
   2      1
   0.            0.           0.
  -5.            0.           0.
   1      1
  0.             0.           0.
  0.             0.           0.
MASS2     1      4
   1      1      3.1
0000000000
INERT2    1      6
   1      1      1.                  1.                 1.
0000000000
   2      1
  0.             0.           0.
 -5.             0.           0.
A.B 1     3      2      POLY 1 COEFFICIENTS
    1     1 225000.             225000.
    2     1 950.                2350.
    3     1 1.0                 6.0
0000000000
A.B 2     3      2      POLY 2 COEFFICIENTS
    1     1 225000.             950.
    2     1 950.                2350.
    3     1 1.0                 6.0
0000000000
FREW
LRY       9     30
    1     1     -1    -1    -1    -1    -1    -1    -1    -1
    1     9      2     2     2     2     2     2     2     2    -3    -3    -3    -3
    1    21     -5    -5    -5    -5    -5    -5    -5    -5    -7    -7
    2     1      1     1     1     1     2     2     2     2
    2     9      1     1     2     2     3     3     4     4     1     2     1     2
    2    21      1     1     1     1     2     2     2     2     1     2
    3     1      1     2     3     4     1     2     3     4
    3     9      1     2     1     2     1     2     1     2     1     1     2     2
    3    21      1     2     3     4     1     2     3     4     1     2
    4     1      1     1     1     1     1     1     1     1     1     1     1
    4    12      1     1     1     1     1     1     1     1     1     1
    4    22      1     1     1     1     1     1     1     1     1
    6    29      1     1
    7    29      2     1
0000000000
```

```
IRY       3   30
    1     1   -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5
    1    13   -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5    -5
    1    25   -5    -5    -5    -5    -5    -5
0000000000
FORWARD LOOP TF       I      X1DOT/RT1
BONN
1.0        100.       -80.       20.          0.0         0.5
FORWARD LOOP TF       I      X2DOT/RT1
BONN
1.0        100.       -80.       20.          0.0         0.5
FORWARD LOOP TF       I          X1/RT1
BONN
1.0        100.       -100.      0.0          0.0         0.5
FORWARD LOOP TF       I          X2/RT1
BONN
1.0        100.       -100.      0.0          0.0         0.5
FORWARD LOOP TF       I      X1DOT/RT2
BONN
1.0        100.       -60.       40.          0.0         0.5
FORWARD LOOP TF       I      X2DOT/RT2
BONN
1.0        100.       -80.       20.          0.0         0.5
FORWARD LOOP TF       I          X1/RT2
BONN
1.0        100.       -100.      0.0          0.0         0.5
FORWARD LOOP TF       I          X2/RT2
BONN
1.0        100.       -100.      0.0          0.0         0.5
RETURN LOOP   TF     II          B1/X1DOT
BONN
1.0        100.       -60.       40.          0.0         0.1
RETURN LOOP   TF     II          B2/X1DOT
BONN
    1.         100.       -60.       40.         0.        10.
RETURN LOOP   TF     II          B1/X2DOT
BONN
    1.         100.       -60.       40.         0.        10.
RETURN LOOP   TF     II          B2/X2DOT
BONN
1.0        100.       -60.       0.0          0.0         0.01
RETURN LOOP   TF     II          B1/X1
BONN
1.0        100.       -60.       0.0          0.0         2.0
RETURN LOOP   TF     II          B2/X1
```

```
BONN
   1.         100.        -60.       40.        0.         10.
RETURN LOOP   TF     II         B1/X2
BONN
   1.         100.        -60.       40.        0.         10.
RETURN LOOP   TF     II         B2/X2
BONN
1.0        100.      -60.      0.0        0.0        2.0
LOOP GAIN     TF   -III         B1/RT1
BONN
1.0        100.      -100.     0.0        0.0        0.5
LOOP GAIN     TF   -III         B1/RT2
BONN
1.0        100.      -100.     0.0        0.0        0.5
LOOP GAIN     TF   -III         B2/RT1
BONN
1.0        100.      -100.     0.0        0.0        0.5
LOOP GAIN     TF   -III         B2/RT2
BONN
1.0        100.      -100.     0.0        0.0        0.5
CLOSED LOOP   TF     -V     X1DOT/RT1
BONN
1.0        100.      -100.     0.0        0.0        0.5
CLOSED LOOP   TF     -V     X2DOT/RT1
BONN
1.0        100.      -80.      20.        0.0        0.5
CLOSED LOOP   TF     -V         X1/RT1
BONN
1.0        100.      -100.     0.0        0.0        0.5
CLOSED LOOP   TF     -V         X2/RT1
BONN
1.0        100.      -100.     0.0        0.0        0.5
CLOSED LOOP   TF     -V     X1DOT/RT2
BONN
1.0        100.      -100.     0.0        0.0        0.5
CLOSED LOOP   TF     -V     X2DOT/RT2
BONN
1.0        100.      -80.      20.        0.0        0.5
CLOSED LOOP   TF     -V         X1/RT2
BONN
1.0        100.      -100.     0.0        0.0        0.5
CLOSED LOOP   TF     -V         X2/RT2
BONN
1.0        100.      -100.     0.0        0.0        0.5
LOOP GAIN, (FEED BACK B2)    -VII    B1/RT1
```

```
BONN
1.0          100.        -100.       0.0         0.0         0.5
LOOP GAIN. (FEED BACK R1)   -VII   R2/RT2
BONNROO1
1.0          100.        -100.       0.0         0.0         0.5
IJM       2     2
    1     1     3     3
    2     1     5     7
0000000000
RLDTA     6     2
    1     1 -180.             -180.
    2     1 1.0               1.0
    3     1 -1.0              -1.0
    4     1 -0.5              -0.1
    5     1 0.5               0.1
    6     1 50.               1.0
0000000000
STOP
```

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.21.22
THE CPU TIMER = 0.0

SUMMARY OF DYNAMIC-SIMULATION-PROGRAM INPUT DATA * * * * * * * * * * *

ACTUAL SIZES		MAXIMUM SIZES		INTEGRATION DATA		GRAVITY GRADIENT DATA				MISC. DATA	
NB =	2	NBMAX =	6	STARTT =	0.0	G1 =	0.0	GAMA1 =	0.0	NOPRNT =	0
NH =	2	NHMAX =	6	DELTAT =	1.0000D-01	G2 =	0.0	GAMA2 =	0.0	NOPLOT =	0
NSPT =	1	NSPMAX =	15	ENDT =	1.0000D-01	G3 =	0.0	GAMA3 =	0.0	IFLNER =	1
NOFMO =	0	NMWMAX =	5			GMAG =	0.0	RCMAG =	0.0		
NDELTA =	4	NMWBOD =	4								
NU =	12	NMOBOD =	12								
NBETA =	2	KMU =	22								
NLAM =	10	KY =	250								
NEQ =	18	KU =	113								

THE TOPOLOGY ARRAY (ITOPOL) FOR THIS CASE FOLLOWS

		(1)	(2)
1	1	1	2
2	1	0	1

THE CONSTRAINT SPECIFICATIONS FOR THIS CASE FOLLOW

		(1)	(2)
1	1	1	1
2	1	1	1
3	1	1	1
4	1	1	1
5	1	0	0
6	1	1	1
7	1	1	1

THE SPECIFIED INITIAL HINGE ANGLES AND DISPLACEMENTS (BETAH) FOLLOW

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

THE SPECIFIED INITIAL HINGE RATES (BETAHD) FOLLOW

		(1)	(2)
1	1	0.0	0.0
2	1	0.0	0.0
3	1	0.0	0.0
4	1	0.0	0.0
5	1	0.0	0.0
6	1	0.0	0.0

A-384

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.21.22
THE CPU TIMER = 1.6667E-01

THE NO. OF ELASTIC MODES/BODY ARRAY (IRGFLX) FOLLOWS

		(1)	(2)
1	1	0	0

THE NO. OF P/Q HINGE POINTS/BODY ARRAY (NHPC1) FOLLOWS

		(1)	(2)
1	1	1	1

THE NO. OF SENSOR POINTS/BODY ARRAY (NSPO1) FOLLOWS

		(1)	(2)
1	1	1	0

THE MOM. WHEEL/BODY TABLE (NMOW) FOLLOWS

		(1)	(2)
1	1	0	0
2	1	0	0
3	1	0	0
4	1	0	0
5	1	0	0
6	1	0	0

THE STATE VECTOR LENGTH ARRAY (LENU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	6	6	0	0	2	4

THE STATE VECTOR LOCATION ARRAY (LOCU) FOLLOWS

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1	7	13	13	13	15

THE SPECIFIED SENSOR POINT/BODY CORRELATION ARRAY (IFTSMW) FOLLOWS

		(1)
1	1	1

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.21.22
THE CPU TIMER = 2.8000E-01

THE FOLLOWING DATA IS SPECIFIED MOM. WHEEL INFORMATION (IF ANY) AND CONTROLLER INFORMATION

THE SPECIFIED CONTROLLER INITIAL CONDITIONS AND CHARACTERISTICS FOLLOW
(THE FIRST NDELTA ARE INITIAL CONTROLLER STATE VARIABLES, THERE ARE 96 ADDITIONAL CONTROL PARAMETERS)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	41	4.500D+02	2.000D+00	4.500D+02	5.000D+02	3.000D+00	5.000D+02	4.500D+02	2.000D+00	4.500D+02	5.000D+02
1	51	3.000D+00	5.000D+02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	61	0.0	0.0	0.0	1.424D+03	0.0	0.0	0.0	0.0	0.0	0.0
1	71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	81	0.0	0.0	0.0	9.067D-01	0.0	0.0	0.0	0.0	0.0	0.0
1	91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

A-386

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.21.25
THE CPU TIMER = 5.8333E-01

SUMMARY OF INPUT DATA FOR BODY 1 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0
3	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0
4	1	0.0	0.0	0.0	2.7000D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	2.7000D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	2.7000D+00

FOR BODY 1 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	I	0.0	0.0	0.0	5.0000D+00	0.0	0.0

FOR BODY 1 THE SENSOR POINT NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES(1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE SENSOR TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	1	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	0.0	0.0	0.0

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.21.26
THE CPU TIMER = 7.3333E-01

SUMMARY OF INPUT DATA FOR BODY 2 WHICH IS RIGID.

THE 6X6 INERTIA MATRIX IS ---

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0
2	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0
3	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0
4	1	0.0	0.0	0.0	3.1000D+00	0.0	0.0
5	1	0.0	0.0	0.0	0.0	3.1000D+00	0.0
6	1	0.0	0.0	0.0	0.0	0.0	3.1000D+00

FOR BODY 2 THE P-Q HINGE NO. AND THE EULER ROTATION TYPE APPEAR IN THE FOLLOWING INTEGER ARRAY WHICH IS FOLLOWED BY AN ARRAY CONTAINING EULER ANGLES (1,2,3), AND POSITION VECTOR COMPONENTS (4,5,6) THAT POSITION THE HINGE TRIAD WRT THE BODY TRIAD

		(1)	(2)
1	1	2	1

		(1)	(2)	(3)	(4)	(5)	(6)
1	1	0.0	0.0	0.0	-5.0000D+00	0.0	0.0

A-388

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.21.28
THE CPU TIMER = 1.3667E+00

OUTPUT MATRIX CPLY (3 X 4)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	2.250D+05	2.250D+05	2.250D+05	9.500D+02						
2	1	9.500D+02	2.350D+03	9.500D+02	2.350D+03						
3	1	1.000D+00	6.000D+00	1.000D+00	6.000D+00						

END OF WRITE.

THE FOLLOWING INTEGER ARRAY (INDEP) PRESCRIBES INDEPENDENT VARIABLES (1), AND DEPENDENT VARIABLES (0)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1	1	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	1	1

```
      POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT                                     CURRENT TIME = 15.21.28
      USES TWO MASS PROBLEM FROM DEMO 8                                                THE CPU TIMER = 1.4600E+00

      AT SIMULATION TIME, T = 0.0      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  THE STATE VECTOR Y =
            ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
   1   1    0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
   1  11    0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0

      AT SIMULATION TIME, T = 0.0      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  THE STATE VECTOR TIME DERIVATIVE YDT =
            ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)        ( 7)        ( 8)        ( 9)        (10)
   1   1    0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
   1  11    0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0

      AT SIMULATION TIME, T = 0.0      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  THE BETAS (EULER ANGLES, POSITION COORDINATES) ARE
            ( 1)        ( 2)
   1   1    0.0         0.0
   2   1    0.0         0.0
   3   1    0.0         0.0
   4   1    0.0         0.0
   5   1    0.0         0.0
   6   1    0.0         0.0

      AT SIMULATION TIME, T = 0.0      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  THE BETA TIME DERIVATIVES ARE
            ( 1)        ( 2)
   1   1    0.0         0.0
   2   1    0.0         0.0
   3   1    0.0         0.0
   4   1    0.0         0.0
   5   1    0.0         0.0
   6   1    0.0         0.0

      AT SIMULATION TIME, T = 0.0      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  THE DELTAS (CONTROL SYSTEM VARIABLES) ARE
            ( 1)        ( 2)        ( 3)        ( 4)
   1   1    0.0         0.0         0.0         0.0

      AT SIMULATION TIME, T = 0.0      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  THE DELTA TIME DERIVATIVES ARE
            ( 1)        ( 2)        ( 3)        ( 4)
   1   1    0.0         0.0         0.0         0.0

      AT SIMULATION TIME, T = 0.0      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
  FOR BODY  1   THE VELOCITIES ARE
            ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
   1   1    0.0         0.0         0.0         0.0         0.0         0.0
  FOR BODY  1   THE CORRESPONDING MOMENTA ARE
            ( 1)        ( 2)        ( 3)        ( 4)        ( 5)        ( 6)
   1   1    0.0         0.0         0.0         0.0         0.0         0.0
  FOR BODY  1   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
```

```
           ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1   0.0        0.0        0.0        0.0        0.0        0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     0.0            0.0

      AT SIMULATION TIME, T = 0.0       * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
FOR BODY  2   THE VELOCITIES ARE
           ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1   0.0        0.0        0.0        0.0        0.0        0.0
FOR BODY  2   THE CORRESPONDING MOMENTA ARE
           ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1   0.0        0.0        0.0        0.0        0.0        0.0
FOR BODY  2   ITS CONTRIBUTION TO TOTAL ANGULAR AND LINEAR MOMENTUM IS
           ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)
  1    1   0.0        0.0        0.0        0.0        0.0        0.0
ITS CONTRIBUTION TO TOTAL KINETIC AND POTENTIAL ENERGIES IS     0.0            0.0

      AT SIMULATION TIME, T = 0.0       * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE INTERCONNECTION CONSTRAINT FORCES(LAMBDAS) ARE
           ( 1)       ( 2)       ( 3)       ( 4)       ( 5)       ( 6)       ( 7)       ( 8)       ( 9)       (10)
  1    1   0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0

      AT SIMULATION TIME, T = 0.0       * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
THE TOTAL ANGULAR MOMENTUM VECTOR IS
           ( 1)       ( 2)       ( 3)
  1    1   0.0        0.0        0.0
THE TOTAL LINEAR MOMENTUM VECTOR IS
           ( 1)       ( 2)       ( 3)
  1    1   0.0        0.0        0.0

THE TOTAL ANGULAR MOMENTUM =  0.0
THE TOTAL LINEAR MOMENTUM  =  0.0
THE TOTAL KINETIC ENERGY   =  0.0
THE TOTAL POTENTIAL ENERGY =  0.0
THE TOTAL ENERGY (T + V)   =  0.0
```

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.21.41
THE CPU TIMER = 6.0200E+00

OUTPUT MATRIX -A- (14 X 8)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-3.358D-01	3.358D-01	-2.222D+00	5.275D+02	-3.704D-01	0.0	0.0	0.0		
2	1	2.925D-01	-2.925D-01	-1.935D+00	-4.614D+02	0.0	0.0	-3.226D-01	0.0		
3	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
4	1	-1.0000D+00	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0		
5	1	0.0	0.0	-3.3500D+03	0.0	-9.5000D+02	1.0000D+00	0.0	0.0		
6	1	0.0	0.0	-1.1250D+06	0.0	-2.2500D+05	0.0	0.0	0.0		
7	1	0.0	0.0	-3.3500D+03	-3.3500D+03	0.0	0.0	-9.5000D+02	1.0000D+00		
8	1	0.0	0.0	-1.3490D+06	-1.3490D+06	0.0	0.0	-2.2500D+05	0.0		
9	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
10	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0		
11	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0		
12	1	0.0	0.0	1.0000D+00	1.0000D+00	0.0	0.0	0.0	0.0		
13	1	0.0	0.0	6.0000D+00	0.0	1.0000D+00	0.0	0.0	0.0		
14	1	0.0	0.0	6.0000D+00	6.0000D+00	0.0	0.0	1.0000D+00	0.0		

END OF WRITE.

A-392

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 6

CURRENT TIME = 15.21.44
THE CPU TIMER = 6.8467E+00

OUTPUT MATRIX -T- (8 X 8)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0		
2	1	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0	0.0		
3	1	0.0	0.0	0.0	0.0	1.0000D+00	0.0	0.0	0.0		
4	1	0.0	0.0	0.0	0.0	-1.0000D+00	1.0000D+00	0.0	0.0		
5	1	0.0	0.0	0.0	0.0	-6.0000D+00	0.0	1.0000D+00	0.0		
6	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
7	1	0.0	0.0	0.0	0.0	0.0	-6.0000D+00	0.0	1.0000D+00		
8	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0		

END OF WRITE.

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.22.00
THE CPU TIMER = 1.1640E+01

OUTPUT MATRIX -A*- (8 X 8)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-3.358D-01	3.358D-01	-5.275D+02	5.275D+02	0.0	0.0	-3.704D-01	0.0		
2	1	2.925D-01	-2.925D-01	4.594D+02	-4.594D+02	0.0	0.0	0.0	-3.226D-01		
3	1	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
4	1	0.0	1.0000D+00	0.0	0.0	0.0	0.0	0.0	0.0		
5	1	0.0	0.0	2.2500D+05	0.0	0.0	0.0	-2.2500D+05	0.0		
6	1	0.0	0.0	0.0	9.500D+02	0.0	0.0	0.0	-2.2500D+05		
7	1	6.0000D+00	0.0	2.3500D+03	0.0	1.0000D+00	0.0	-9.5000D+02	0.0		
8	1	0.0	6.0000D+00	0.0	2.3500D+03	0.0	1.0000D+00	0.0	-9.5000D+02		

END OF WRITE.

A-394

CURRENT TIME = 15.22.00
THE CPU TIMER = 1.1850E+01

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

	RT A		RTA*	
NO	REAL PART	IMAGINARY PART	REAL PART	IMAGINARY PART
1	-0.49999D+03	0.0	-0.49999D+03	0.0
2	-0.49998D+03	0.0	-0.49998D+03	0.0
3	-0.45001D+03	0.0	-0.45001D+03	0.0
4	-0.45001D+03	0.0	-0.45001D+03	0.0
5	-0.31556D+00	-0.31418D+02	-0.31556D+00	-0.31418D+02
6	-0.31556D+00	0.31418D+02	-0.31556D+00	0.31418D+02
7	-0.14354D-02	-0.41606D+00	-0.14354D-02	-0.41606D+00
8	-0.14354D-02	0.41606D+00	-0.14354D-02	0.41606D+00

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.25.12
THE CPU TIMER = 6.8567E+01

OUTPUT MATRIX -AR- (4 X 4)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	0.0	-2.250D+05	0.0						
2	1	0.0	0.0	0.0	-2.250D+05						
3	1	1.0000D+00	0.0	-9.500D+02	0.0						
4	1	0.0	1.0000D+00	0.0	-9.500D+02						

END OF WRITE.

A-396

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 6

CURRENT TIME = 15.25.12
THE CPU TIMER = 6.8613E+01

OUTPUT MATRIX.BCOL (1 X 4)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	2.2500+05	0.0	2.3500+03	0.0						

END OF WRITE.

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.25.16
THE CPU TIMER = 6.8983E+01

	R AR		RART	
NO	REAL PART	IMAGINARY PART	REAL PART	IMAGINARY PART
1	-0.50000D+03	0.0	-0.50000D+03	0.0
2	-0.50000D+03	0.0	-0.50000D+03	0.0
3	-0.45000D+03	0.0	-0.45000D+03	0.0
4	-0.45000D+03	0.0	-0.45000D+03	0.0

A-398

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.25.19
THE CPU TIMER = 6.9540E+01

OUTPUT MATRIX ANUM (4 X 4)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-9.574D+01	0.0	0.0	0.0						
2	1	0.0	0.0	-2.250D+05	0.0						
3	1	0.0	1.0000D+00	-9.500D+02	0.0						
4	1	-4.255D-04	0.0	0.0	1.0000D+00						

END OF WRITE.

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.25.19
THE CPU TIMER = 6.9583E+01

	NUM		DEN	
NO	REAL PART	IMAGINARY PART	REAL PART	IMAGINARY PART
1	-0.50000D+03	0.0	-0.50000D+03	0.0
2	-0.45000D+03	0.0	-0.50000D+03	0.0
3	-0.95745D+02	0.0	-0.45000D+03	0.0
4			-0.45000D+03	0.0

A-400

POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.25.20
THE CPU TIMER = 6.9677E+01

OUTPUT MATRIX RRED (1 X 200)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.0000D+00	0.0	0.0	2.0000D+00	0.0	0.0	1.0000D+00	1.0440D-02	2.0000D-03	2.2220D-03

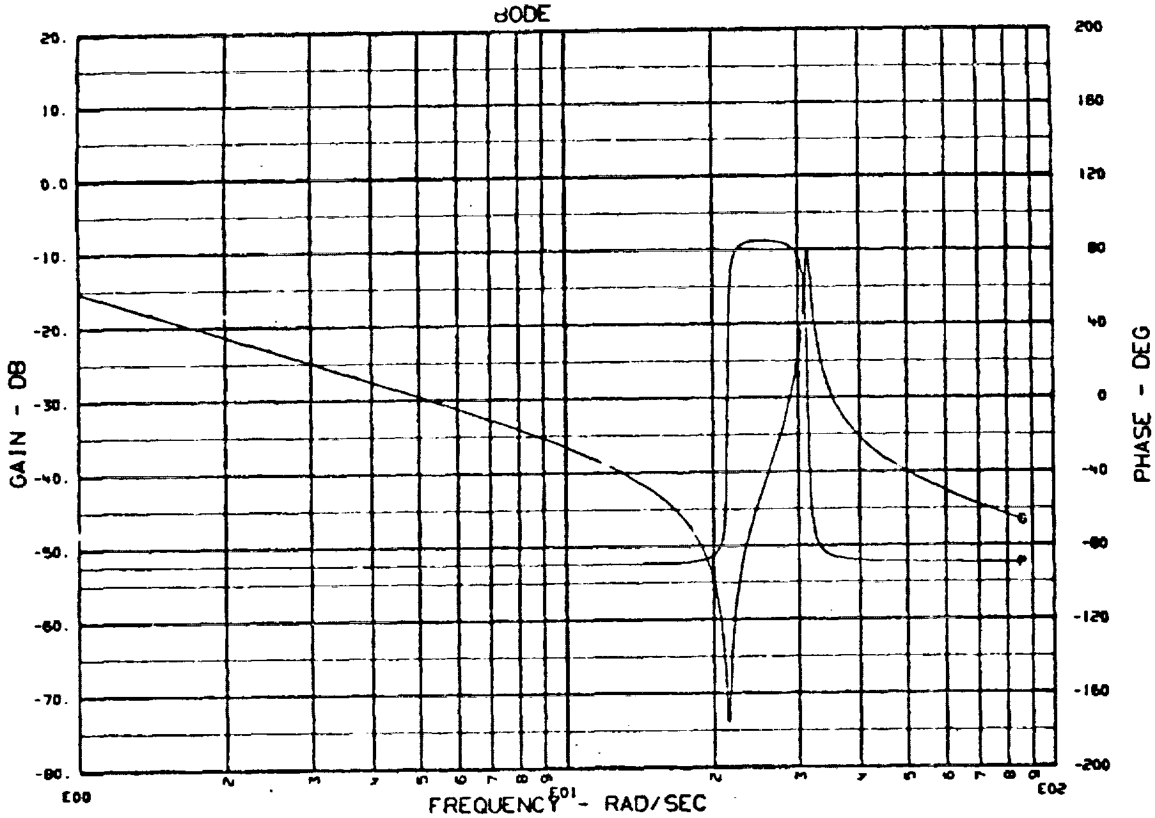
END OF WRITE.

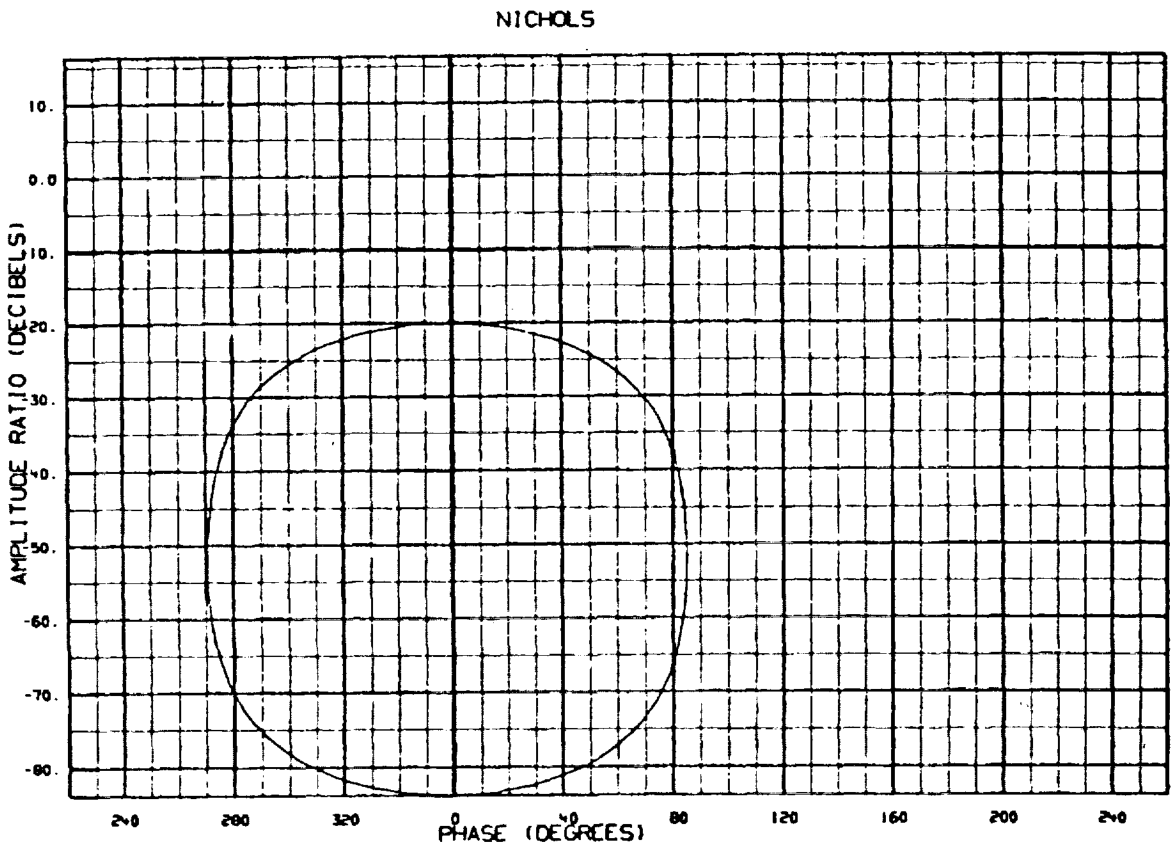
POLYNOMINAL TRANSFER FUNCTION INPUT CHECKOUT
USES TWO MASS PROBLEM FROM DEMO 8

CURRENT TIME = 15.25.20
THE CPU TIMER = 6.9713E+01

RETURN LOOP TF 11 B1/X1

FREQ/RAD/SEC	FREQ/HERTZ	REAL	IMAG	AMP	DECIBELS	RAD	DEG
0.100000D+01	0.159155D+00	0.100003D+01	0.622212D-02	0.100005D+01	0.000	0.0062	0.3565
0.110000D+01	0.175070D+00	0.100004D+01	0.684431D-02	0.100006D+01	0.001	0.0068	0.3921
0.125000D+01	0.198944D+00	0.100005D+01	0.777758D-02	0.100008D+01	0.001	0.0078	0.4456
0.140000D+01	0.222817D+00	0.100006D+01	0.871083D-02	0.100010D+01	0.001	0.0087	0.4991
0.160000D+01	0.254648D+00	0.100008D+01	0.995514D-02	0.100013D+01	0.001	0.0100	0.5703
0.180000D+01	0.286479D+00	0.100010D+01	0.111994D-01	0.100016D+01	0.001	0.0112	0.6416
0.200000D+01	0.318310D+00	0.100012D+01	0.124436D-01	0.100020D+01	0.002	0.0124	0.7128
0.220000D+01	0.350141D+00	0.100015D+01	0.136878D-01	0.100024D+01	0.002	0.0137	0.7841
0.250000D+01	0.397887D+00	0.100019D+01	0.155540D-01	0.100031D+01	0.003	0.0155	0.8909
0.280000D+01	0.445634D+00	0.100024D+01	0.174200D-01	0.100039D+01	0.003	0.0174	0.9978
0.320000D+01	0.509296D+00	0.100031D+01	0.199078D-01	0.100051D+01	0.004	0.0199	1.1401
0.380000D+01	0.604789D+00	0.100044D+01	0.236388D-01	0.100072D+01	0.006	0.0236	1.3536
0.450000D+01	0.716197D+00	0.100062D+01	0.279907D-01	0.100101D+01	0.009	0.0280	1.6023
0.520000D+01	0.827606D+00	0.100083D+01	0.323412D-01	0.100135D+01	0.012	0.0323	1.8508
0.620000D+01	0.986761D+00	0.100118D+01	0.385535D-01	0.100192D+01	0.017	0.0385	2.2053
0.700000D+01	0.111408D+01	0.100150D+01	0.435206D-01	0.100245D+01	0.021	0.0434	2.4882
0.780000D+01	0.124141D+01	0.100187D+01	0.484849D-01	0.100304D+01	0.026	0.0484	2.7706
0.890000D+01	0.141648D+01	0.100243D+01	0.553059D-01	0.100396D+01	0.034	0.0551	3.1579
0.100000D+02	0.159155D+01	0.100307D+01	0.621203D-01	0.100499D+01	0.043	0.0619	3.5438
0.110000D+02	0.175070D+01	0.100371D+01	0.683088D-01	0.100603D+01	0.052	0.0680	3.8933
0.125000D+02	0.198944D+01	0.100479D+01	0.775787D-01	0.100778D+01	0.067	0.0771	4.4150
0.140000D+02	0.222817D+01	0.100601D+01	0.868315D-01	0.100975D+01	0.084	0.0861	4.9331
0.160000D+02	0.254648D+01	0.100784D+01	0.991384D-01	0.101271D+01	0.110	0.0981	5.6179
0.180000D+02	0.286479D+01	0.100992D+01	0.111406D+00	0.101605D+01	0.138	0.1099	6.2950
0.200000D+02	0.318310D+01	0.101224D+01	0.123631D+00	0.101976D+01	0.170	0.1215	6.9634
0.220000D+02	0.350141D+01	0.101480D+01	0.135806D+00	0.102384D+01	0.205	0.1330	7.6224
0.250000D+02	0.397887D+01	0.101908D+01	0.153969D+00	0.103065D+01	0.262	0.1500	8.5916
0.280000D+02	0.445634D+01	0.102390D+01	0.171996D+00	0.103825D+01	0.326	0.1664	9.5356
0.320000D+02	0.509296D+01	0.103115D+01	0.195794D+00	0.104957D+01	0.420	0.1876	10.7513
0.380000D+02	0.604789D+01	0.104375D+01	0.230907D+00	0.106898D+01	0.579	0.2177	12.4746
0.450000D+02	0.716197D+01	0.106101D+01	0.270846D+00	0.109503D+01	0.789	0.2499	14.3202
0.520000D+02	0.827606D+01	0.108094D+01	0.309503D+00	0.112438D+01	1.018	0.2789	15.9779
0.620000D+02	0.986761D+01	0.111384D+01	0.362165D+00	0.117124D+01	1.373	0.3144	18.0120
0.700000D+02	0.111408D+02	0.114367D+01	0.401843D+00	0.121222D+01	1.672	0.3379	19.3595
0.780000D+02	0.124141D+02	0.117642D+01	0.439105D+00	0.125570D+01	1.978	0.3572	20.4683
0.890000D+02	0.141648D+02	0.122580D+01	0.486039D+00	0.131364D+01	2.403	0.3775	21.6288
0.100000D+03	0.159155D+02	0.127964D+01	0.527602D+00	0.138414D+01	2.824	0.3911	22.4066





FORWARD LOOP TF I XIDOT/RTI

DEMO11 02/26/75 0 DEVERS

Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 1 of 14)

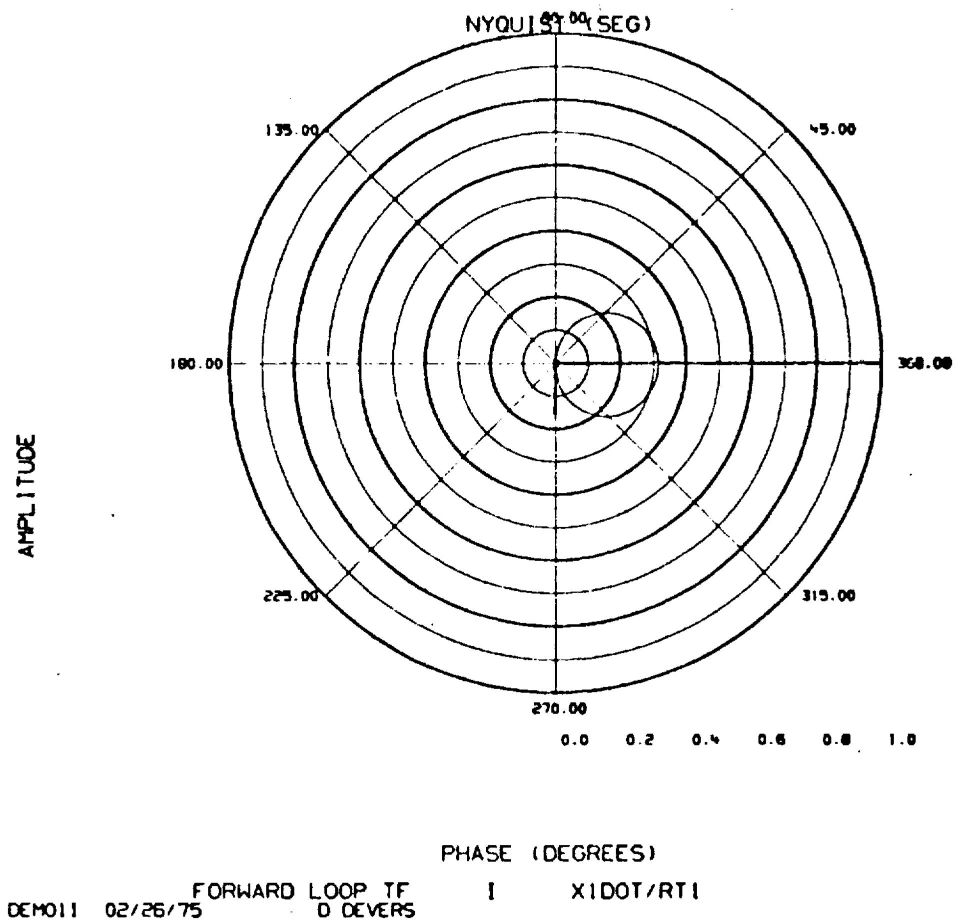
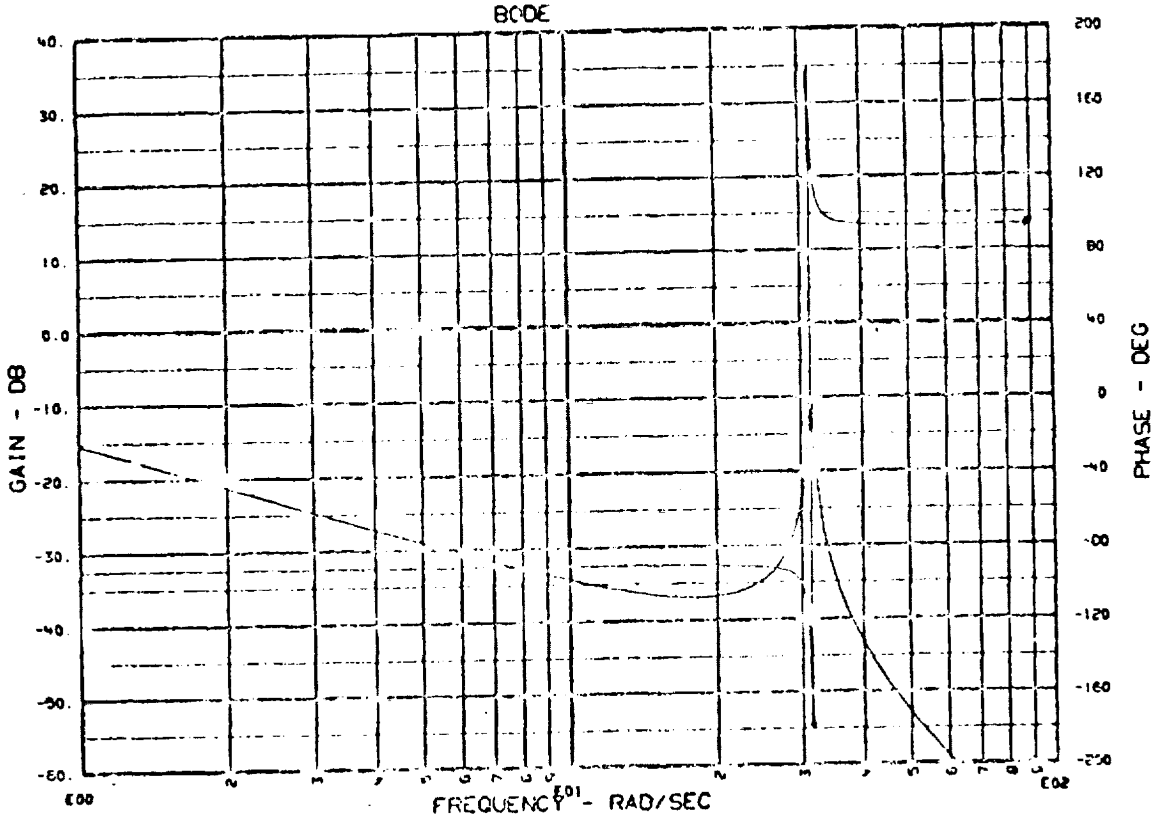
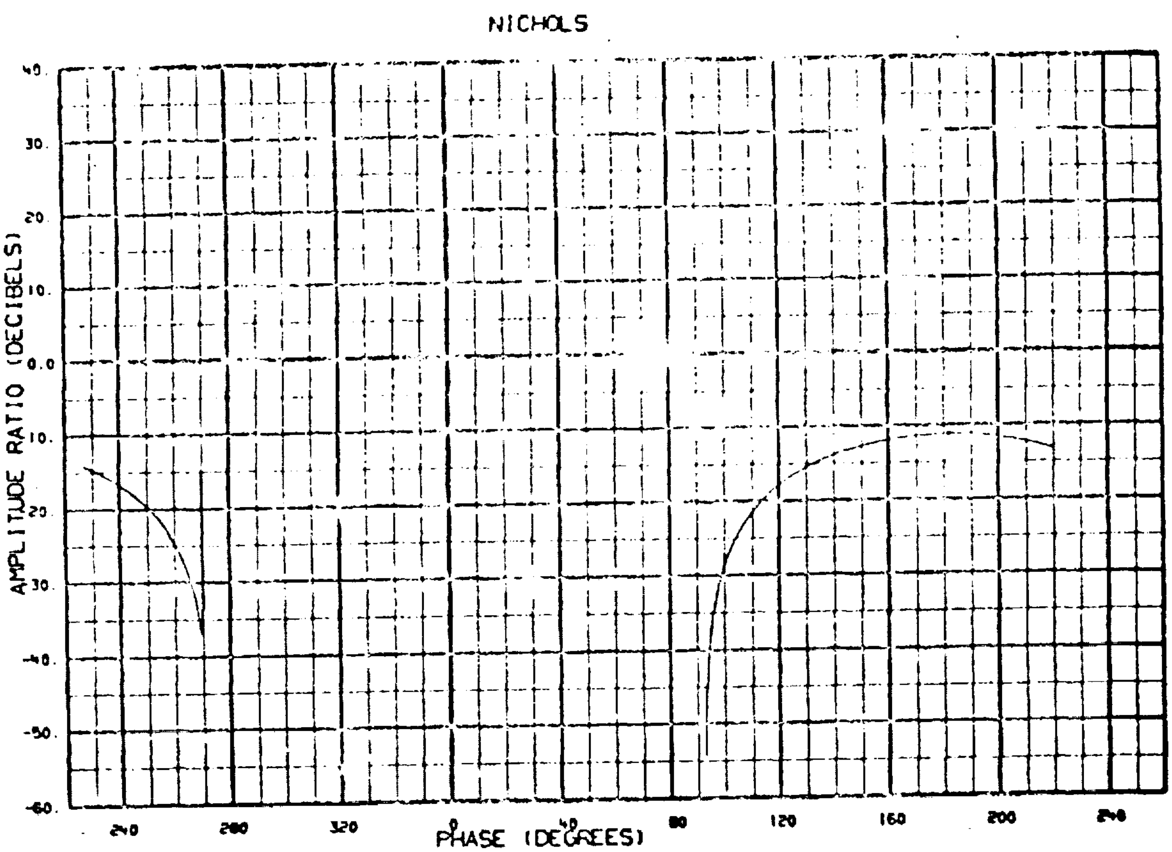


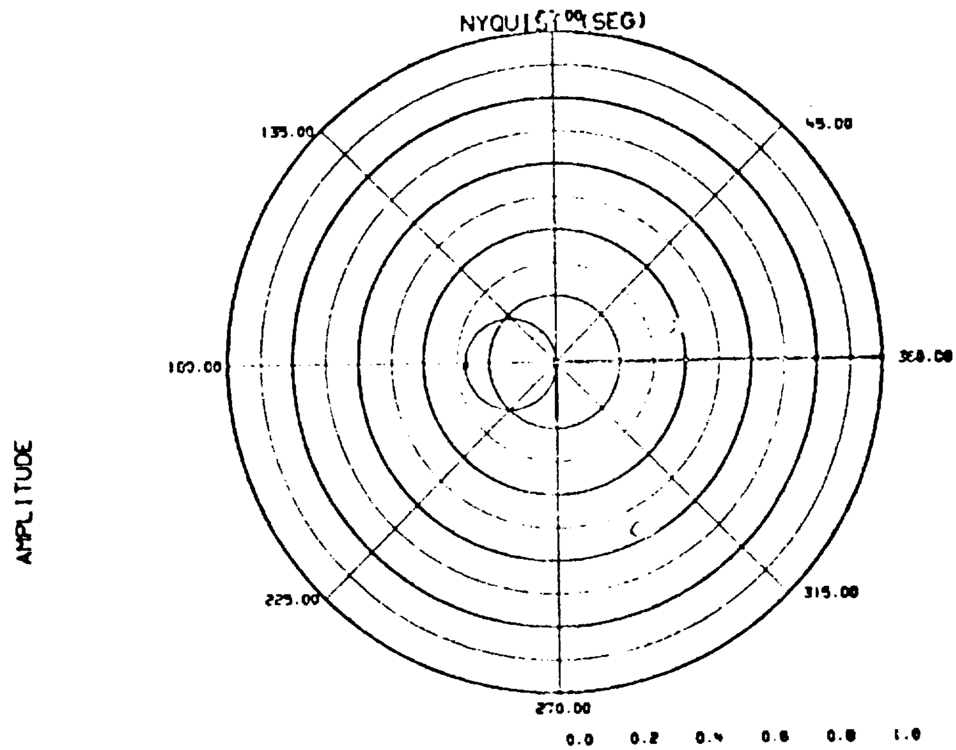
Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 2 of 14)





FORWARD LOOP TF 1 XIDOT/RT2
DEMO11 04/21/75 D DEVERS

Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 3 of 14)

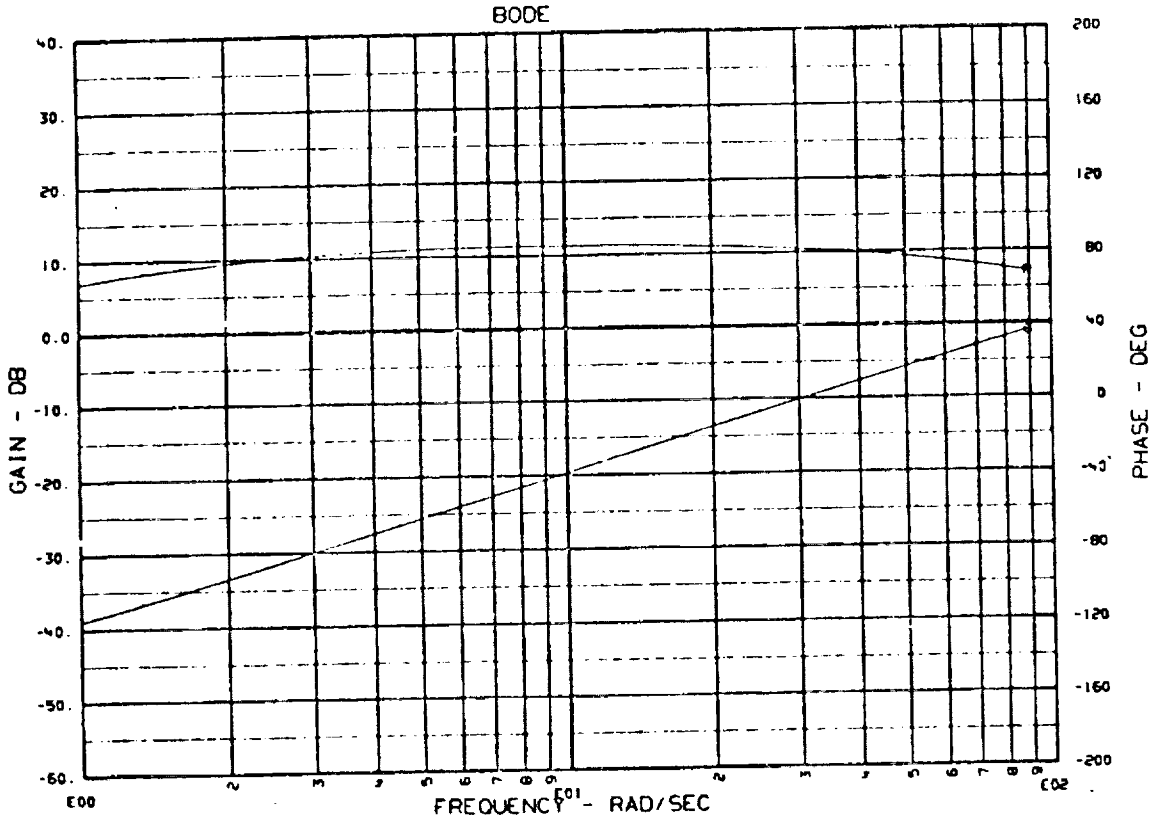


PHASE (DEGREES)

FORWARD LOOP TF   I   XIDOT/RT2

DEMO11 04/21/75   D DEVERS

Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 4 of 14)



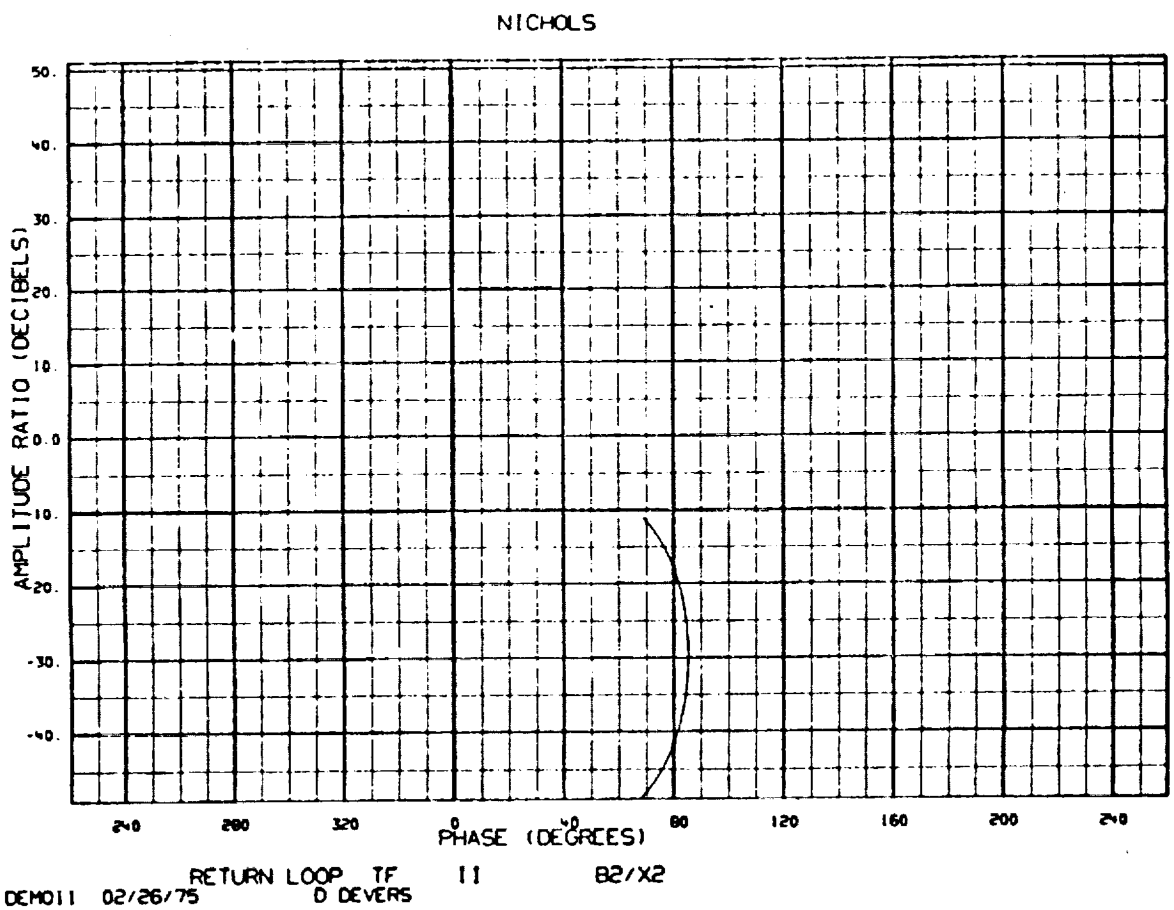


Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 5 of 14)

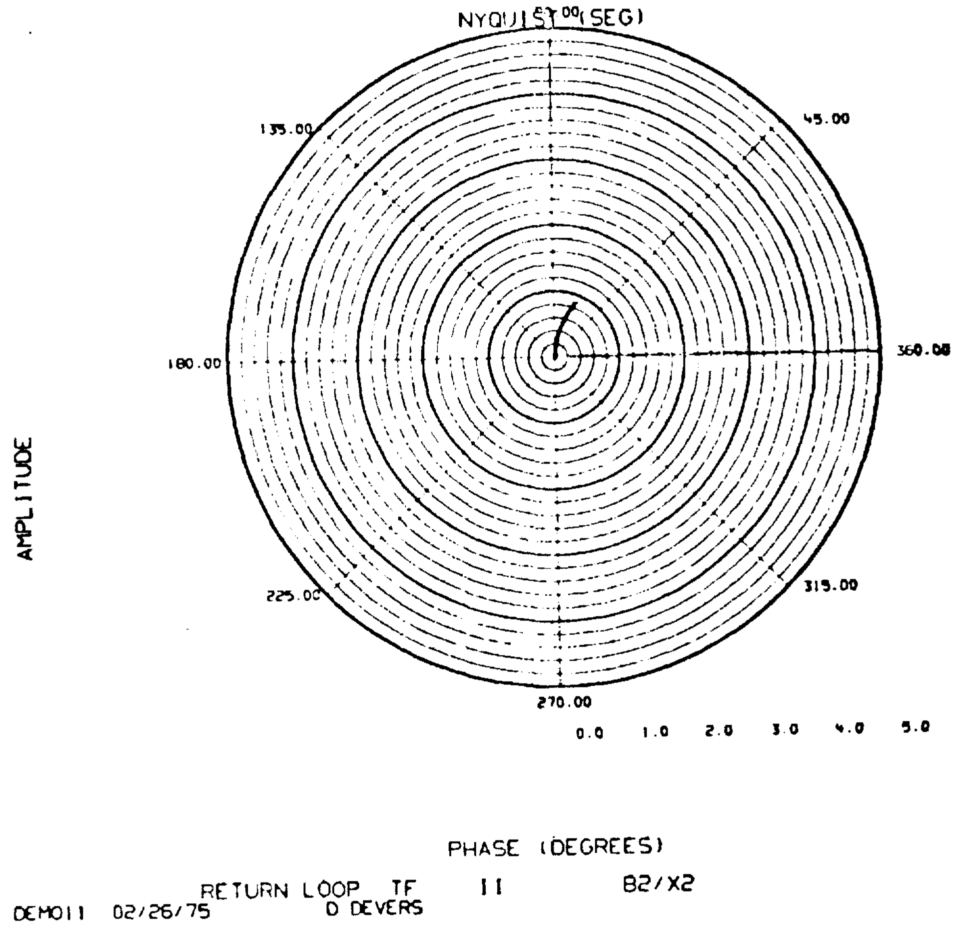


Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 6 of 14)

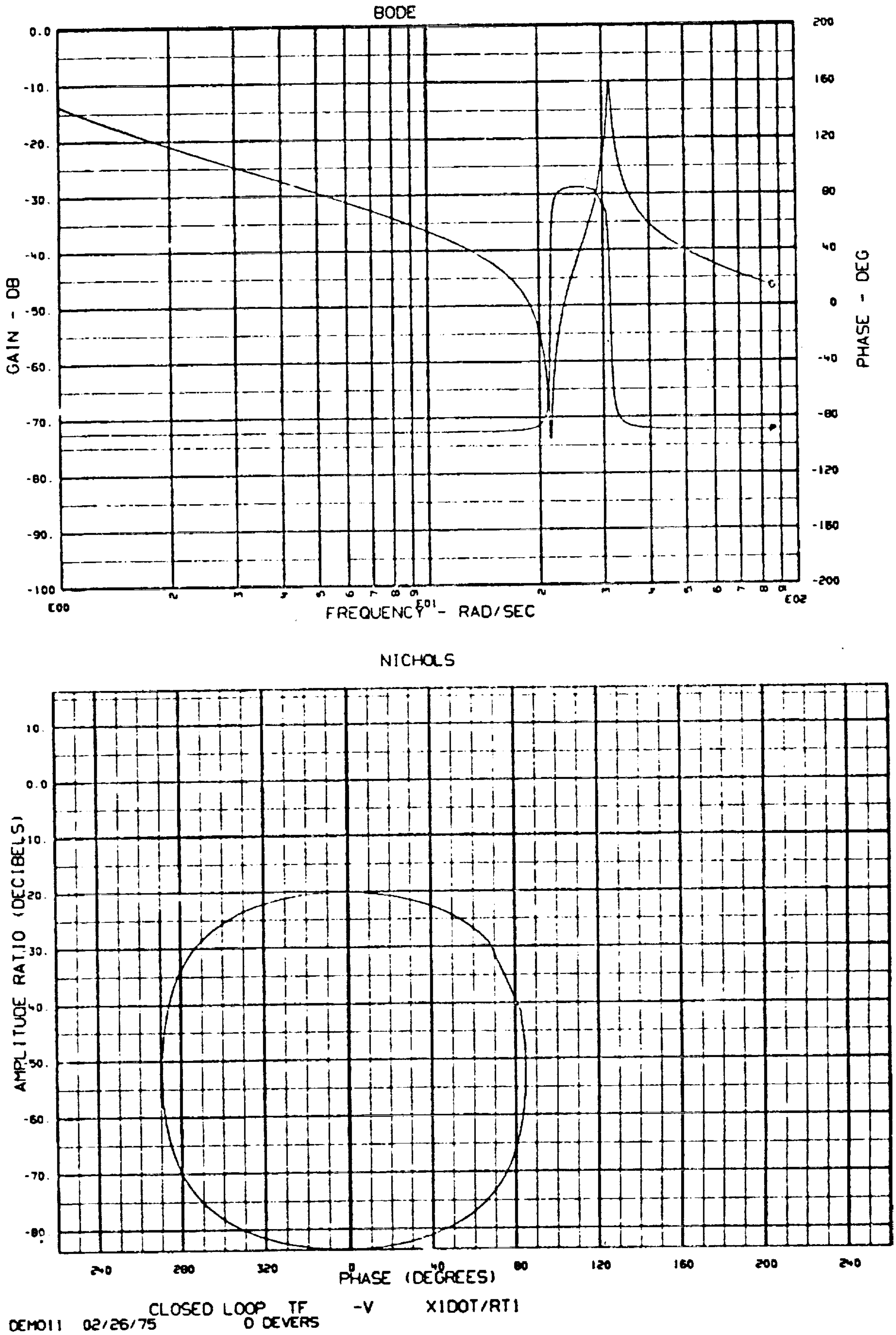


Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 7 of 14)

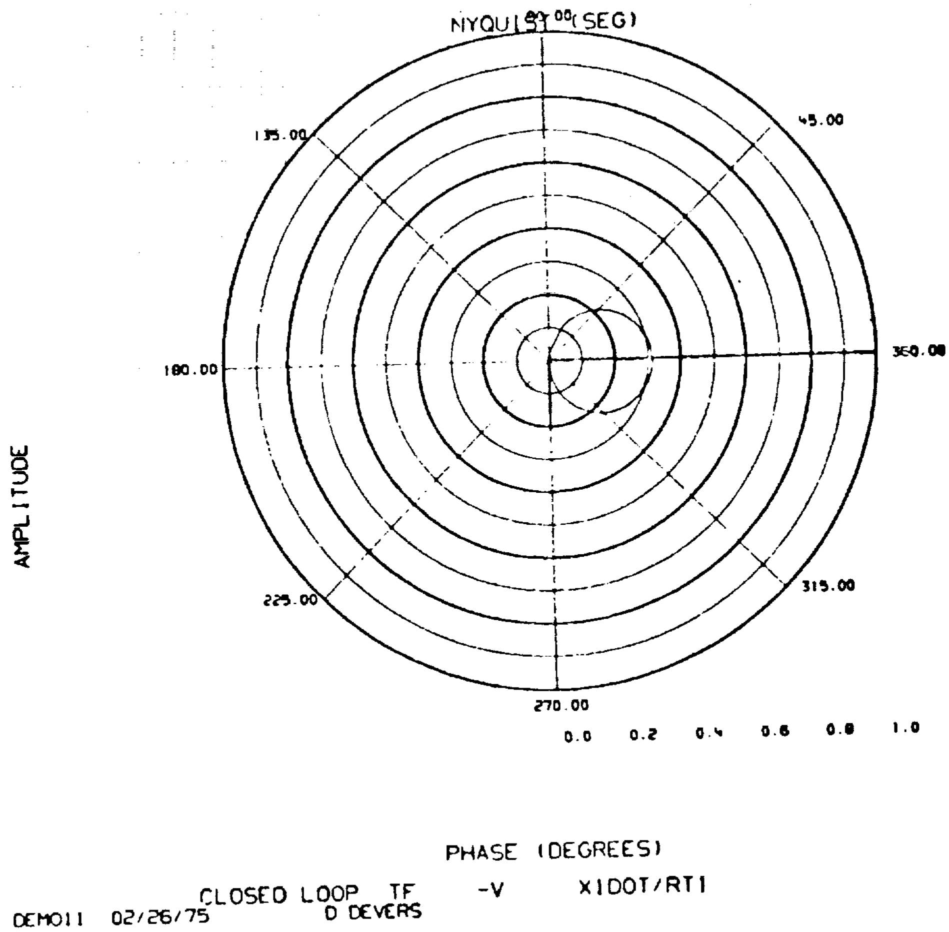


Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 8 of 14)

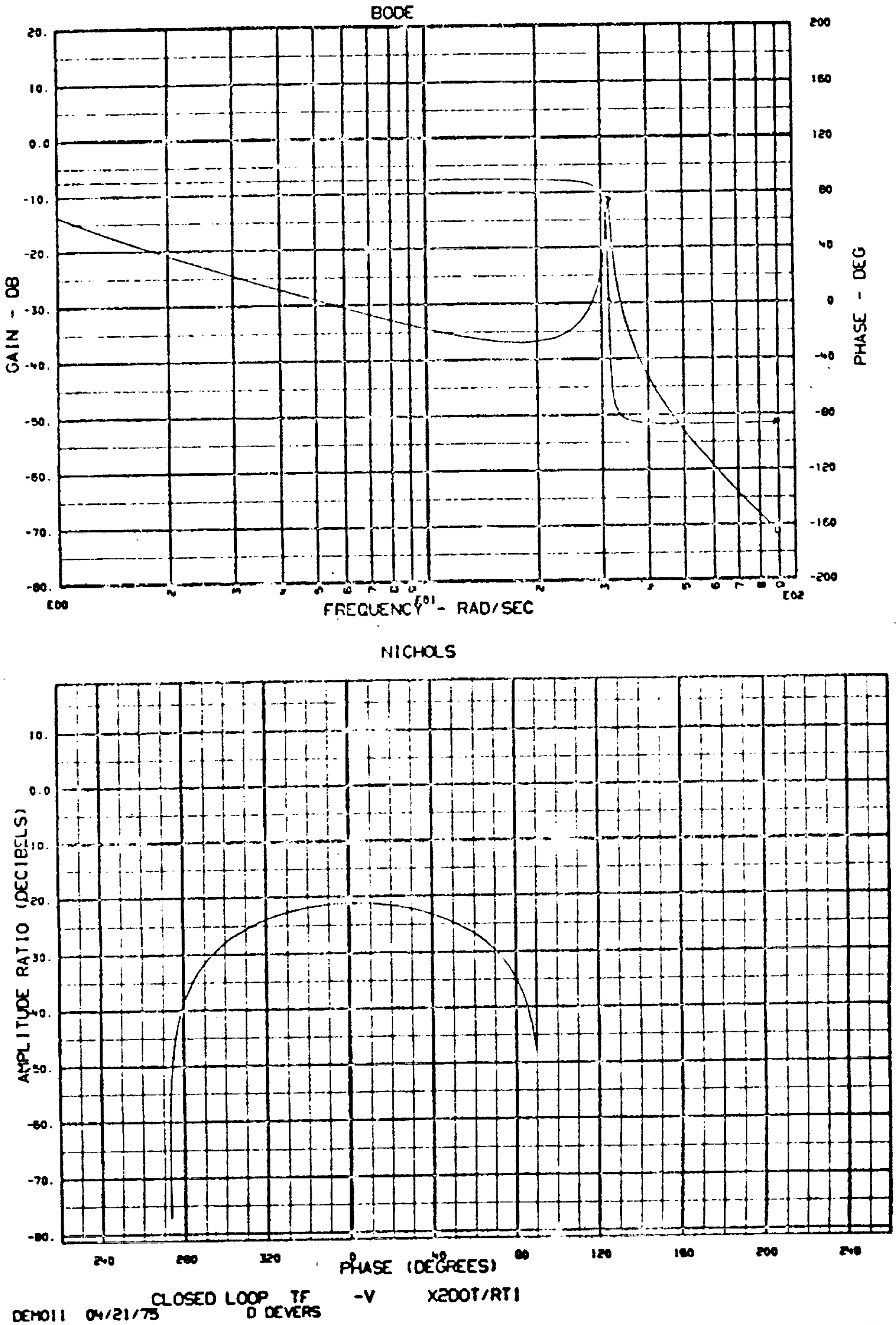


Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 9 of 14)

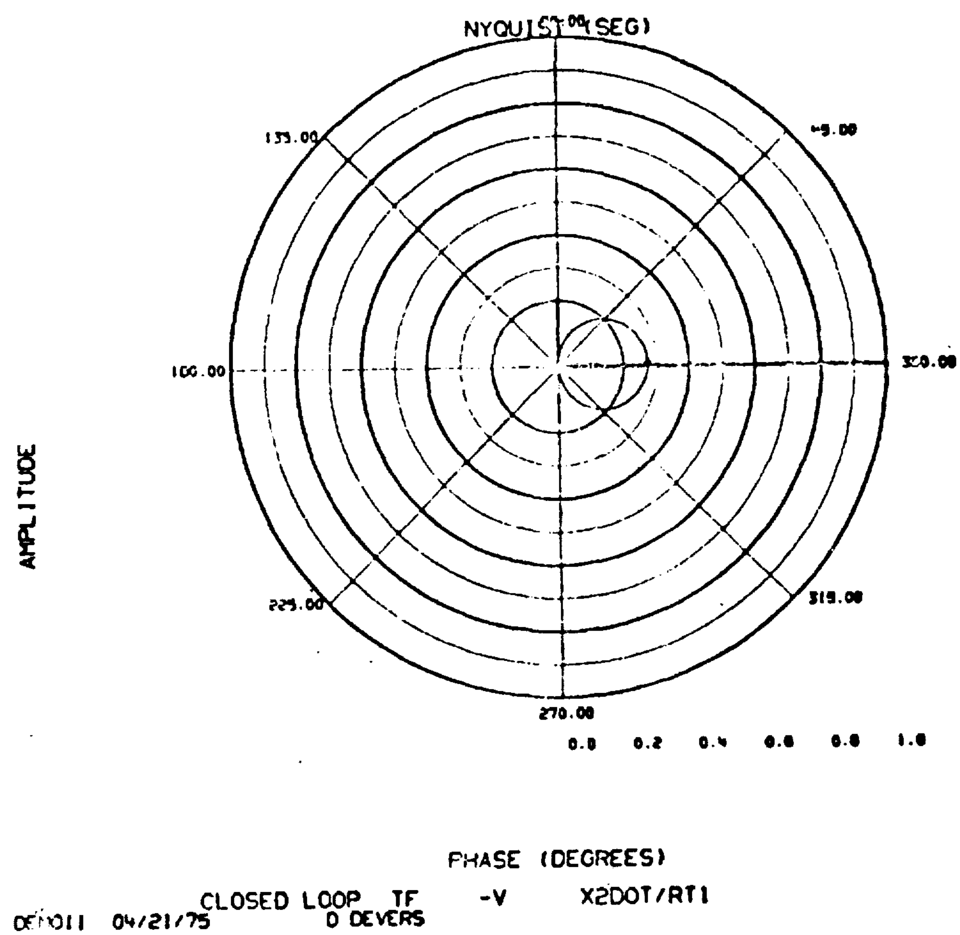
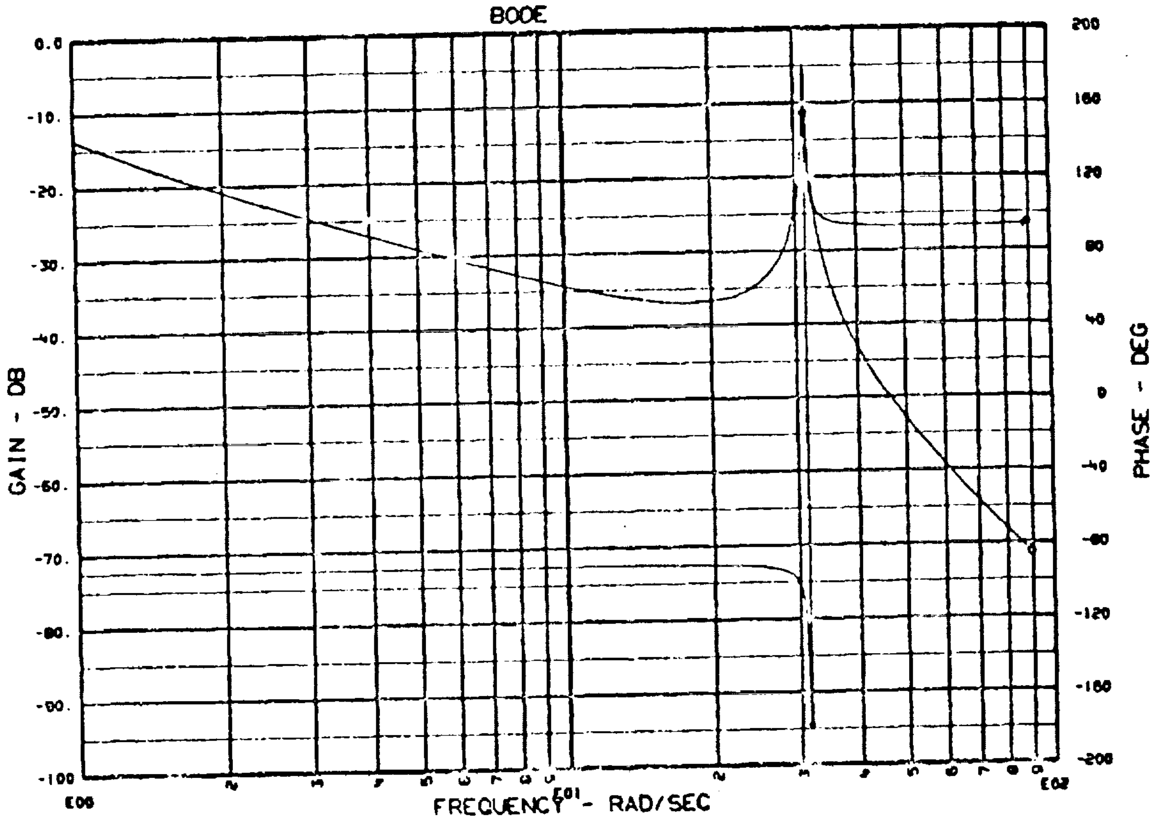
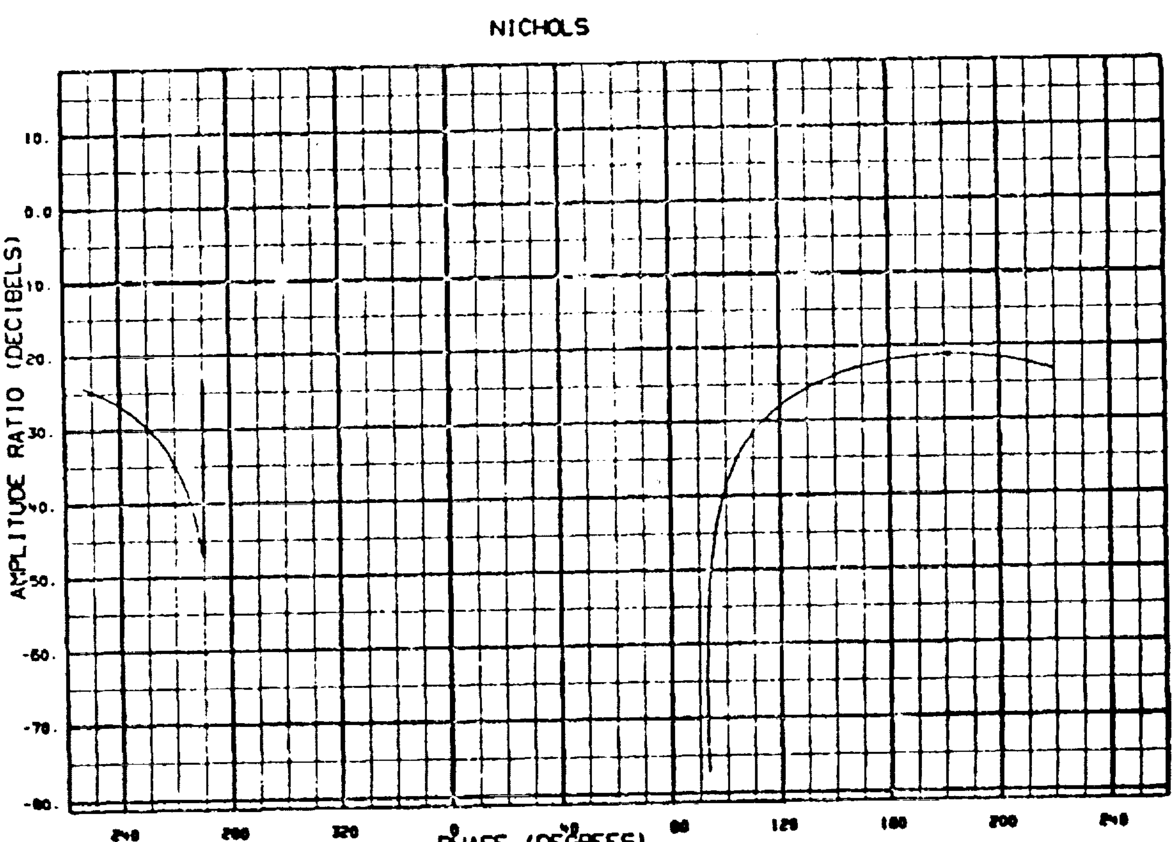


Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 10 of 14)





CLOSED LOOP TF -V XIDOT/RT2

DEMO11 04/21/75 0 DEVERS

Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 11 of 14)

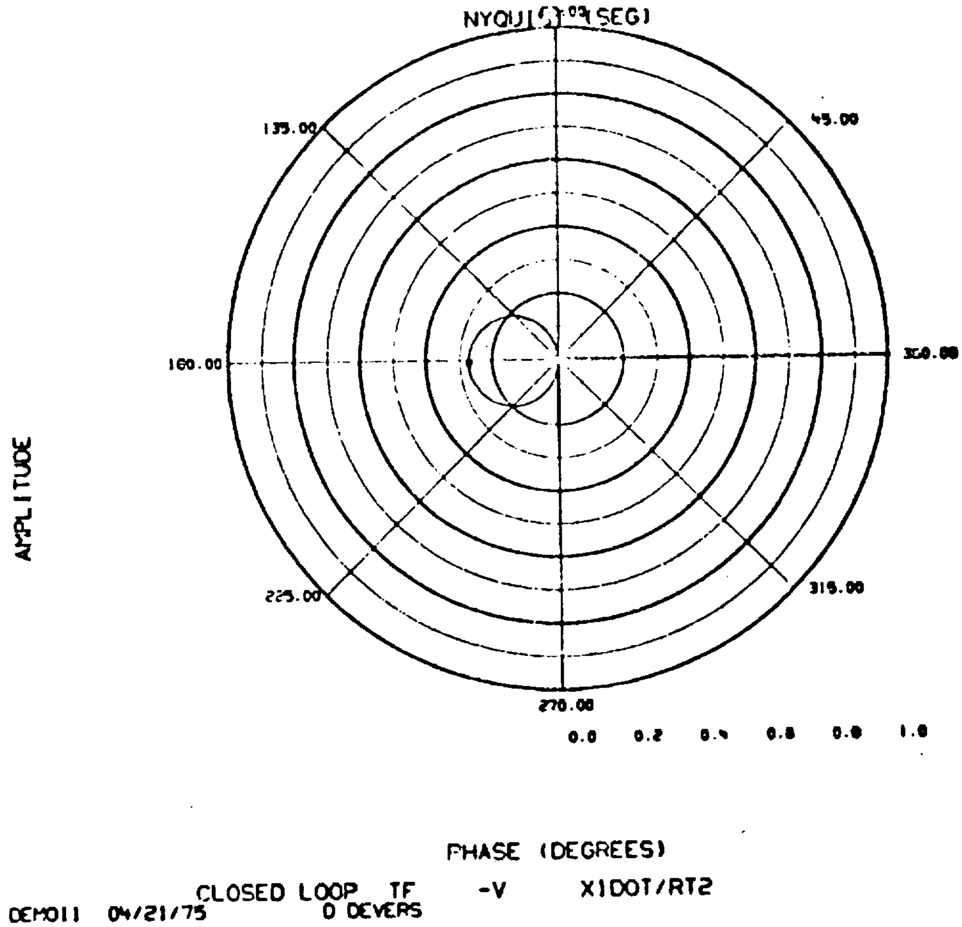
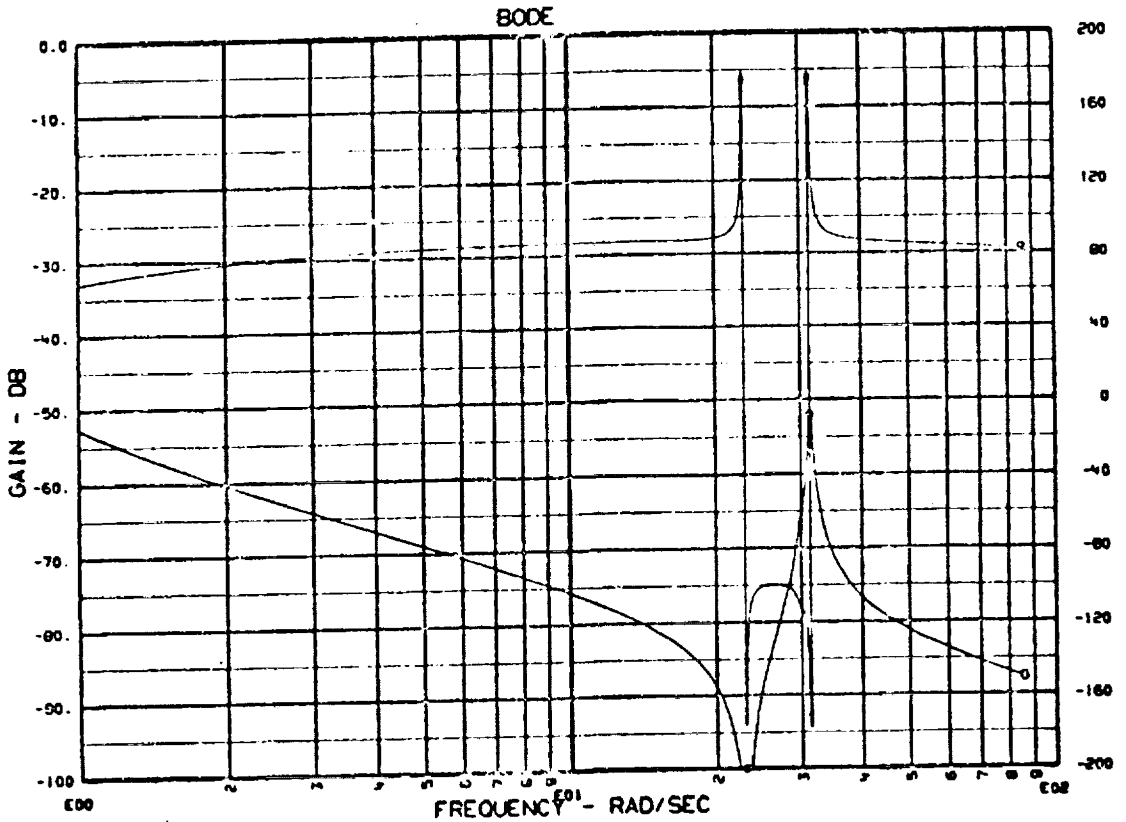


Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 12 of 14)



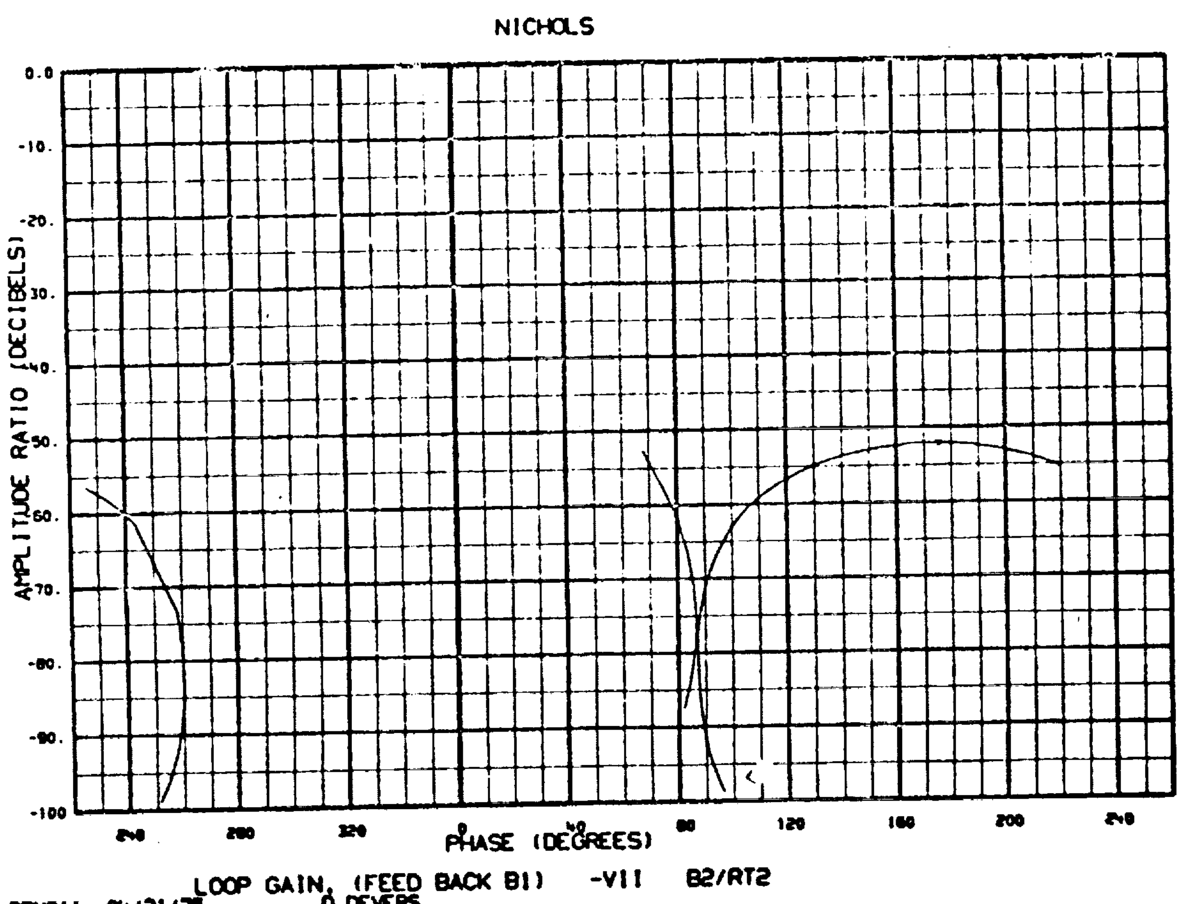
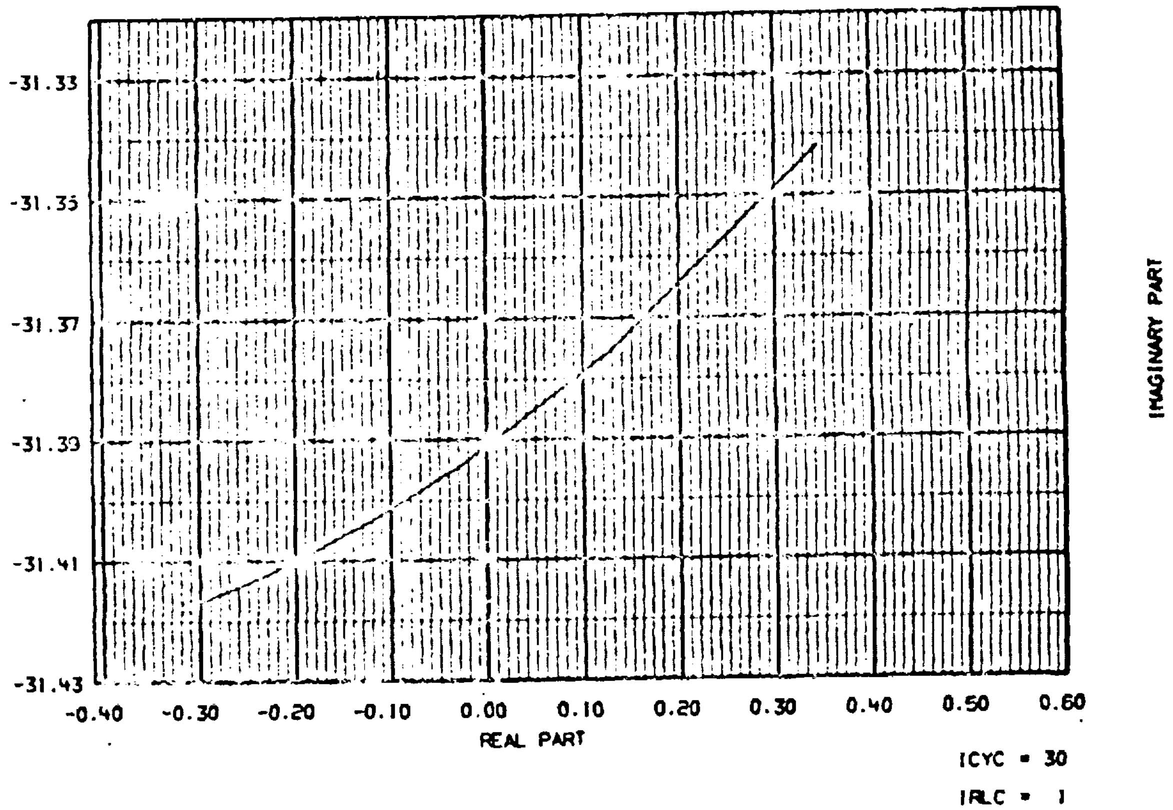


Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 13 of 14)

ROOT LOCUS



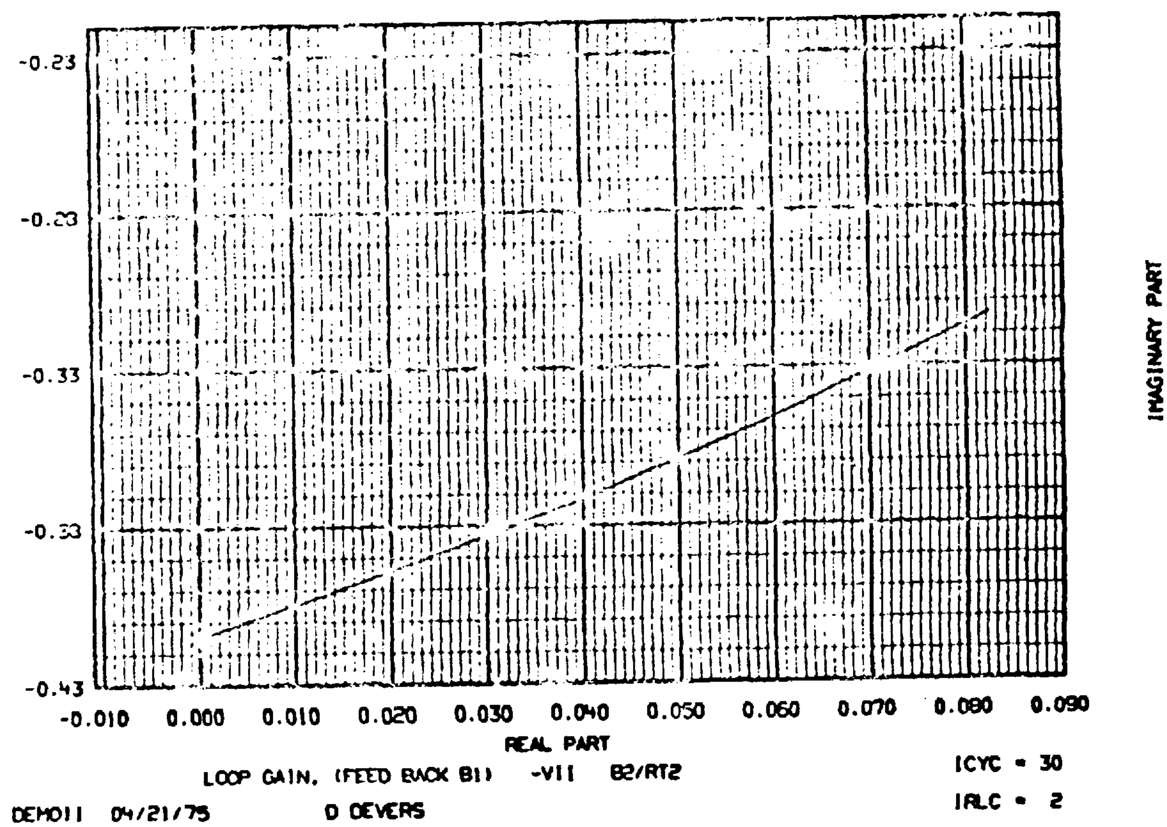


Figure A-10 Graphical Results, Demonstration Problem 11 (Sheet 14 of 14)

APPENDIX B - DELINEATION OF INPUT AND OUTPUT FOR PROGRAM NASFOR

This appendix contains the following items:

1. data input - computer listing of data used to generate re- results for the demonstration problem;

2. print output - representative print output sufficient for the user to validate the numerical results for the demonstration problem.

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```
NAS4          A. C. HORN  A2461
  TWO FLEX BODIES, EACH ONE IS A BEAM
  DEMONSTRATION RUN OF NASFOR
TEST INPUT DATA FOR NASFOR PROGRAM
USING INPUT FROM NASTRAN OUTPUT2 TAPE AND CARDS
TO CHECK RUN PROVIDED BY W. K. CASE OF GSFC
0000000000
   20    30    40
L1234
    1     1     1     1
    2
   11     5     0
GEOM        MASS        MODE        STIF        DAMP
CARD        TAPE        TAPE        TAPE        TAPE
GEOM1         11     3
                              1000.
                               900.
                               800.
                               700.
                               600.
                               500.
                               400.
                               300.
                               200.
                               100.
                                 0.
MASS        STAT        INER
MX          MY          MZ          SIGX        SIGY        SIGZ
STIF
DAMP
   11     2     0
GEOM        MASS        MODE        STIF        DAMP
CARD        TAPE        TAPE        TAPE        TAPE
GEOM2         11     3
                              1000.
                               900.
                               800.
                               700.
                               600.
                               500.
                               400.
                               300.
                               200.
                               100.
                                 0.
MASS        STAT        INER
MX          MY          MZ          SIGX        SIGY        SIGZ
STIF
DAMP
STOP
```


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best available copy

RUN NO. NAS4 DATE 11/25/74 PAGE NO. 1
RUN BY A. C. PARK X2461

CURRENT TIME = 14.39.31
THE CPU TIMER = 0.0

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

PROGRAM NASFOR

RUN NO. NAS4 DATE 11/25/74 PAGE NO. 2
RUN BY A. C. PARK X2461

CURRENT TIME = 14.39.31
THE CPU TIMER = 2.3333E-02

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

TEST INPUT DATA FOR NASFOR PROGRAM
USING INPUT FROM NASTRAN OUTPUT2 TAPE AND CARDS
TO CHECK RUN PROVIDED BY W. R. CASE OF GSFC

```
NTAPE1 =   20     NTAPE2 =   30
NTAPE3 =   40     TAPEID =L1234

IFPRT1 =    1     IFPRT2 =    1     IFPRT3 =    1
IFPNCH =    1
```

RUN NO. NAS4 DATE 11/25/74 PAGE NO. 3
RUN BY A. C. PARK X2461

CURRENT TIME = 14.39.32
THE CPU TIMER = 3.8333E-01

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

LOGICAL UNIT 30, TAPE L1234 , HAS BEEN INITIALIZED.

CURRENT TIME = 14.39.33
THE CPU TIMER = 4.0667E-01

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

BODY NUMBER = 1
NO. OF JOINTS = 11
NO. OF MODES = 5 (ELASTIC)
NO. OF MODES = 0 (RIGID BODY)

CURRENT TIME = 14.39.34
THE CPU TIMER = 6.9333E-01

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

OUTPUT MATRIX GFOM1 (11 X 3)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.0000D+03	0.0	0.0							
2	1	9.0000D+02	0.0	0.0							
3	1	8.0000D+02	0.0	0.0							
4	1	7.0000D+02	0.0	0.0							
5	1	6.0000D+02	0.0	0.0							
6	1	5.0000D+02	0.0	0.0							
7	1	4.0000D+02	0.0	0.0							
8	1	3.0000D+02	0.0	0.0							
9	1	2.0000D+02	0.0	0.0							
10	1	1.0000D+02	0.0	0.0							

END OF WRITE.

CURRENT TIME = 14.41.11
THE CPU TIMER = 3.5000E+00

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

OUTPUT MATRIX MU (11 X 10)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.295D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1	2.591D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1	2.591D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1	2.591D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1	2.591D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	1	2.591D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1	2.591D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1	2.591D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	1	2.591D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	1	2.591D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	1	1.295D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

END OF WRITE.

*** END OF FILE ***

CURRENT TIME = 14.41.17
THE CPU TIMER = 5.1067E+00

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

OUTPUT MATRIX HY (11 X 5)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-1.236D+01	0.0	0.0	-1.208D+01	1.157D+01					
2	1	-1.067D+01	0.0	0.0	-6.186D+00	2.028D+00					
3	1	-8.972D+00	0.0	0.0	-6.204D-01	-5.300D+00					
4	1	-7.205D+00	0.0	0.0	4.061D+00	-8.032D+00					
5	1	-5.699D+00	0.0	0.0	7.350D+00	-5.424D+00					
6	1	-4.195D+00	0.0	0.0	8.801D+00	6.839D-01					
7	1	-2.839D+00	0.0	0.0	8.377D+00	6.705D+00					
8	1	-1.685D+00	0.0	0.0	6.423D+00	9.294D+00					
9	1	-7.885D-01	0.0	0.0	3.666D+00	7.320D+00					
10	1	-2.070D-01	0.0	0.0	1.126D+00	2.741D+00					

END OF WRITE.

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.41.20
THE CPU TIMER = 5.6133E+00

OUTPUT MATRIX HZ (11 X 5)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	1.238D+01	-1.208D+01	0.0	0.0					
2	1	0.0	1.067D+01	-6.186D+00	0.0	0.0					
3	1	0.0	8.972D+00	-6.204D-01	0.0	0.0					
4	1	0.0	7.305D+00	4.081D+00	0.0	0.0					
5	1	0.0	5.699D+00	7.350D+00	0.0	0.0					
6	1	0.0	4.195D+00	8.601D+00	0.0	0.0					
7	1	0.0	2.839D+00	8.377D+00	0.0	0.0					
8	1	0.0	1.685D+00	6.423D+00	0.0	0.0					
9	1	0.0	7.885D-01	3.666D+00	0.0	0.0					
10	1	0.0	2.070D-01	1.126D+00	0.0	0.0					

END OF WRITE.

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.41.32
THE CPU TIMER = 6.5067E+00

OUTPUT MATRIX SIGY (11 X 5)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	-1.708D-01	5.946D-01	0.0	0.0					
2	1	0.0	-1.705D-01	5.804D-01	0.0	0.0					
3	1	0.0	-1.687D-01	5.232D-01	0.0	0.0					
4	1	0.0	-1.643D-01	4.070D-01	0.0	0.0					
5	1	0.0	-1.562D-01	2.400D-01	0.0	0.0					
6	1	0.0	-1.438D-01	4.900D-02	0.0	0.0					
7	1	0.0	-1.264D-01	-1.279D-01	0.0	0.0					
8	1	0.0	-1.035D-01	-2.505D-01	0.0	0.0					
9	1	0.0	-7.489D-02	-2.837D-01	0.0	0.0					
10	1	0.0	-4.041D-02	-2.040D-01	0.0	0.0					

END OF WRITE.

RUN NO. NAS4 DATE 11/25/74 PAGE NO. 12
RUN BY A. C. PARK X2461

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.41.34
THE CPU TIMER = 6.9933E+00

OUTPUT MATRIX SIG2 (11 X 5)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-1.708D-01	0.0	0.0	-5.946D-01	9.889D-01					
2	1	-1.706D-01	0.0	0.0	-5.804D-01	8.844D-01					
3	1	-1.687D-01	0.0	0.0	-5.232D-01	5.341D-01					
4	1	-1.643D-01	0.0	0.0	-4.070D-01	-2.822D-03					
5	1	-1.562D-01	0.0	0.0	-2.400D-01	-4.854D-01					
6	1	-1.438D-01	0.0	0.0	-4.900D-02	-6.704D-01					
7	1	-1.264D-01	0.0	0.0	1.279D-01	-4.721D-01					
8	1	-1.035D-01	0.0	0.0	2.505D-01	-2.417D-02					
9	1	-7.489D-02	0.0	0.0	2.837D-01	3.843D-01					
10	1	-4.041D-02	0.0	0.0	2.040D-01	4.530D-01					

END OF WRITE.

*** END OF FILE ***

RUN NO. NAS4 DATE 11/25/74 PAGE NO. 13
RUN BY A. C. PARK X2461

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.41.43
THE CPU TIMER = 7.2667E+00

OUTPUT MATRIX STIF (5 X 5)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	4.728D+03	0.0	0.0	0.0	0.0					
2	1	0.0	4.728D+03	0.0	0.0	0.0					
3	1	0.0	0.0	1.816D+05	0.0	0.0					
4	1	0.0	0.0	0.0	1.816D+05	0.0					
5	1	0.0	0.0	0.0	0.0	1.395D+06					

END OF WRITE.

*** END OF FILE ***

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.41.44
THE CPU TIMER = 7.4500E+00

OUTPUT MATRIX DAMP (5 X 5)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	3.438D-01	0.0	0.0	0.0	0.0					
2	1	0.0	3.438D-01	0.0	0.0	0.0					
3	1	0.0	0.0	2.131D+00	0.0	0.0					
4	1	0.0	0.0	0.0	2.131D+00	0.0					
5	1	0.0	0.0	0.0	0.0	5.906D+00					

END OF WRITE.

*** END OF FILE ***

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.41.44
THE CPU TIMER = 7.5167E+00

BODY NUMBER = 2
NO. OF JOINTS = 11
NO. OF MODES = 5 (ELASTIC)
NO. OF MODES = 0 (RIGID BODY)

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.41.44
THE CPU TIMER = 7.6200E+00

OUTPUT MATRIX GEOM2 (11 X 3)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	1.0000D+03	0.0	0.0							
2	1	9.0000D+02	0.0	0.0							
3	1	8.0000D+02	0.0	0.0							
4	1	7.0000D+02	0.0	0.0							
5	1	6.0000D+02	0.0	0.0							
6	1	5.0000D+02	0.0	0.0							
7	1	4.0000D+02	0.0	0.0							
8	1	3.0000D+02	0.0	0.0							
9	1	2.0000D+02	0.0	0.0							
10	1	1.0000D+02	0.0	0.0							

END OF WRITE.

B-10

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.41.51
THE CPU TIMER = 1.0157E+01

OUTPUT MATRIX MU (11 X 10)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	5.182D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1	1.036D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1	1.036D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1	1.036D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1	1.036D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	1	1.036D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1	1.036D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1	1.036D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	1	1.036D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	1	1.036D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	1	5.182D-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

END OF WRITE.

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TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.41.57
THE CPU TIMER = 1.1787E+01

OUTPUT MATRIX HY (11 X 5)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	-1.000D+00	0.0	-1.000D+00	1.000D+00					
2	1	0.0	-8.621D-01	0.0	-5.119D-01	1.753D-01					
3	1	0.0	-7.249D-01	0.0	-5.133D-02	-4.581D-01					
4	1	0.0	-5.902D-01	0.0	3.377D-01	-6.943D-01					
5	1	0.0	-4.605D-01	0.0	6.082D-01	-4.689D-01					
6	1	0.0	-3.389D-01	0.0	7.283D-01	5.912D-02					
7	1	0.0	-2.294D-01	0.0	6.932D-01	5.796D-01					
8	1	0.0	-1.362D-01	0.0	5.315D-01	8.034D-01					
9	1	0.0	-6.371D-02	0.0	3.033D-01	6.328D-01					
10	1	0.0	-1.673D-02	0.0	9.315D-02	2.369D-01					

END OF WRITE.

CURRENT TIME = 14.42.02
THE CPU TIMER = 1.3217E+01

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

OUTPUT MATRIX SIGY (11 X 5)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	-1.380D-02	0.0	4.920D-02	0.0	0.0					
2	1	-1.377D-02	0.0	4.803D-02	0.0	0.0					
3	1	-1.363D-02	0.0	4.329D-02	0.0	0.0					
4	1	-1.327D-02	0.0	3.368D-02	0.0	0.0					
5	1	-1.262D-02	0.0	1.986D-02	0.0	0.0					
6	1	-1.162D-02	0.0	4.055D-03	0.0	0.0					
7	1	-1.021D-02	0.0	-1.059D-02	0.0	0.0					
8	1	-8.362D-03	0.0	-2.073D-02	0.0	0.0					
9	1	-6.051D-03	0.0	-2.346D-02	0.0	0.0					
10	1	-3.265D-03	0.0	-1.688D-02	0.0	0.0					

END OF WRITE.

CURRENT TIME = 14.42.04
THE CPU TIMER = 1.3717E+01

TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

OUTPUT MATRIX SIGZ (11 X 5)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	0.0	-1.380D-02	0.0	-4.920D-02	8.548D-02					
2	1	0.0	-1.377D-02	0.0	-4.803D-02	7.645D-02					
3	1	0.0	-1.363D-02	0.0	-4.329D-02	4.617D-02					
4	1	0.0	-1.327D-02	0.0	-3.368D-02	-2.440D-04					
5	1	0.0	-1.262D-02	0.0	-1.986D-02	-4.196D-02					
6	1	0.0	-1.162D-02	0.0	-4.055D-03	-5.795D-02					
7	1	0.0	-1.021D-02	0.0	1.059D-02	-4.081D-02					
8	1	0.0	-8.362D-03	0.0	2.073D-02	-2.089D-03					
9	1	0.0	-6.051D-03	0.0	2.346D-02	3.322D-02					
10	1	0.0	-3.265D-03	0.0	1.688D-02	3.915D-02					

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TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.42.05
THE CPU TIMER = 1.3967E+01

OUTPUT MATRIX STIF (5 X 5)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	3.086D+01	0.0	0.0	0.0	0.0					
2	1	0.0	3.086D+01	0.0	0.0	0.0					
3	1	0.0	0.0	1.243D+03	0.0	0.0					
4	1	0.0	0.0	0.0	1.243D+03	0.0					
5	1	0.0	0.0	0.0	0.0	1.042D+04					

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TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.42.06
THE CPU TIMER = 1.4160E+01

OUTPUT MATRIX DAMP (5 X 5)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1	8.977D-03	0.0	0.0	0.0	0.0					
2	1	0.0	8.977D-03	0.0	0.0	0.0					
3	1	0.0	0.0	5.836D-02	0.0	0.0					
4	1	0.0	0.0	0.0	5.836D-02	0.0					
5	1	0.0	0.0	0.0	0.0	1.765D-01					

END OF WRITE.

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TWO FLEX BODIES, EACH ONE IS A BEAM
DEMONSTRATION RUN OF NASFOR

CURRENT TIME = 14.42.08
THE CPU TIMER = 1.4640E+01

LISTING OF MATRICES ON LOGICAL UNIT 30, TAPE L1234

NO.	RUN NO.	NAME	NROWS	NCOLS	DATE	NNZ	PARTITION
1	NAS4	GEOM1	11	3	11/25/		
2	NAS4	MASS	11	1	11/25/		
3	NAS4	STAT	11	3	11/25/		
4	NAS4	INER	11	6	11/25/		
5	NAS4	HX	11	5	11/25/		
6	NAS4	HY	11	5	11/25/		
7	NAS4	HZ	11	5	11/25/		
8	NAS4	SIGX	11	5	11/25/		
9	NAS4	SIGY	11	5	11/25/		
10	NAS4	SIGZ	11	5	11/25/		
11	NAS4	STIF	5	5	11/25/		
12	NAS4	DAMP	5	5	11/25/		
13	NAS4	GEOM2	11	3	11/25/		
14	NAS4	MASS	11	1	11/25/		
15	NAS4	STAT	11	3	11/25/		
16	NAS4	INER	11	6	11/25/		
17	NAS4	HX	11	5	11/25/		
18	NAS4	HY	11	5	11/25/		
19	NAS4	HZ	11	5	11/25/		
20	NAS4	SIGX	11	5	11/25/		
21	NAS4	SIGY	11	5	11/25/		
22	NAS4	SIGZ	11	5	11/25/		
23	NAS4	STIF	5	5	11/25/		
24	NAS4	DAMP	5	5	11/25/		
25	ECT						

END OF LIST.