

SPAR-R.1175

ISSUE A

USERS GUIDE TO PROGRAMS FOR THE OPTIMAL
STATIONKEEP AND ATTITUDE CONTROL OF FLEXIBLE
SPACECRAFT

P
91
C655
R63
1984

SPAR

Derry
P
91
C655
R63
1984

SPAR-R.1175

ISSUE A

USERS GUIDE TO PROGRAMS FOR THE OPTIMAL
STATIONKEEP AND ATTITUDE CONTROL OF FLEXIBLE
SPACECRAFT

Prepared for:

DEPARTMENT OF COMMUNICATIONS

Reference:

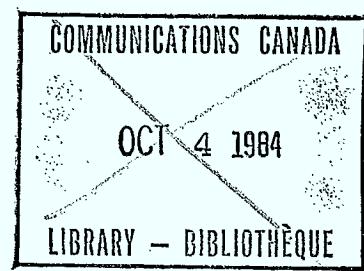
DSS FILE 06ST.36001-3-2484,
S/N OST83-00215

Industry Canada
Library Queen

JUL 22 1998

Industrie Canada
Bibliothèque Queen

FEBRUARY, 1984



FOR USAGE SEE EPP 2-34, 2-38, 2-40

SPAR FORM 5-2421(06/81)

Spar Aerospace Limited
Remote Manipulator Systems Division
1700 Ormont Drive, Weston, Ontario, Canada M9L 2W7



Space &
Electronics Group

TEL (416) 745-9680

TELEX 065-27360 SPARORM TOR

TWX 610-491-1503

CABLE-SPARORM TOR

SPAR LIBRARY - TORONTO
COPY NUMBER 13

SPAR-R, 1175

ISSUE A

APPROVALS

R. Ravindran *Ravindran*
Section Chief, Controls and
Analysis

H.F. Barker *H. F. Barker*
Manager, Controls and
Analysis

S.S. Sachdev
Manager, Systems, Controls
and Analysis Engineering

P.A. McIntyre *A. McIntyre*
Director of Engineering

PREPARED BY N. Roger *[Signature]*

REASON FOR RE-ISSUE _____

DATE February, 1984

Spar Aerospace Limited

Space Aerospace Systems
Remote Manipulator Systems Division

Remote Manipulator Systems Division
1700 Ormont Drive, Weston, Ontario, Canada M9L 2W7



Space & Electronics Group



Government of Canada Gouvernement du Canada

Department of Communications

DOC CONTRACTOR REPORT

DOC-CR-84-022

DEPARTMENT OF COMMUNICATIONS - OTTAWA - CANADA

SPACE PROGRAM

TITLE: / USERS GUIDE TO PROGRAMS FOR THE OPTIMAL STATIONKEEP
AND ATTITUDE CONTROL OF FLEXIBLE SPACECRAFT /

AUTHOR(S): (N.A.C. (P) Roger)

ISSUED BY CONTRACTOR AS REPORT NO: SPAR-R.1175

PREPARED BY:
Spar Aerospace Limited
1700 Ormont Drive
Weston, Ontario
Canada M9L 2W7

DEPARTMENT OF SUPPLY AND SERVICES CONTRACT NO: 06ST.36001-3-2484,
S/N OST83-00215

DOC SCIENTIFIC AUTHORITY: A.H. Reynaud

CLASSIFICATION: Unclassified

This report presents the views of the author(s). Publication of this report does not constitute DOC approval of the reports findings or conclusions. This report is available outside the department by special arrangement.

DATE: February 1984

P
91

C655

R63

1984

DD 4831357
DL 4831392

3/MCS653/3

SPAR-R.1175
ISSUE A

PREFACE

This document is a users' guide to the programs referred to in the document:
SPAR-R.1135, Optimal Stationkeep and Attitude Control of Flexible Spacecraft,
Part 2: Design Verification.

The work was performed by Spar Aerospace Limited under DSS contract no. DSS File
06ST.36001-3-2484, S/N OST83-00215.

TABLE OF CONTENTS

SECTION	TITLE	PAGE
1.0	INTRODUCTION	1
2.0	THE FDCSIM PROGRAM	1
	2.1 Modules Required by Program FDCSIM	1
	2.2 Input/Output Files Required by Program FDCSIM	1
	2.3 Program FDCSIM Output	2
3.0	THE PLOT1 PROGRAM	12
4.0	THE RICQ PROGRAM	13
	4.1 Modules Required by Program RICQ	13
	4.2 Input/Output Files Required by Program RICQ	13
	4.3 Program RICQ Output	13
5.0	THE CON52 PROGRAM	17
	5.1 Modules Required by Program CON52	17
	5.2 Input/Output Files Required by Program CON52	17
	5.3 Program CON52 Output	17
6.0	THE DECOBR PROGRAM	21
	6.1 Modules Required by Program DECOBR	21
	6.2 Input/Output Files Required by Program DECOBR	21
	6.3 Program DECOBR Output	21
7.0	THE STABF PROGRAM	25
	7.1 Modules Required by Program STABF	25
	7.2 Input/Output Files Required by Program STABF	25
	7.3 Program STABF Output	25
8.0	THE STABFO PROGRAM	29
	8.1 Modules Required by Program STABFO	29
	8.2 Input/Output Files Required by Program STABFO	29
	8.3 Program STABFO Output	29
9.0	REFERENCES	34

TABLE OF CONTENTS - continued

Appendix A	Transfer of Programs to CRC Honeywell Computer
Appendix B	Example Data Files and Command Files

LIST OF TABLES

TABLE	TITLE	PAGE
2-1	FDCSIM MAIN DATA	2
2-2	FDCSIM CHANGE FILE	6
2-3	FDCSIM VECTOR VC	7
2-4	SIMULATION OUTPUT	10
3-1	PLOT1 CONTROL DATA	12
4-1	RICQ DATA	14
5-1	CON52 DATA	18
6-1	DECOCR DATA	22
7-1	STABF DATA	26
8-1	STABFO DATA	30

1.0 INTRODUCTION

This users guide gives a brief description of how to use the programs referred to in the document reference [2]. There are seven programs: FDGSIM, PLOT1, RICQ, ~~CONS2~~, DECOBR, STABF, STABFO. The programs were designed to be used on the Multiple Access computer system, and are written in FORTRAN. The programs have since been transferred to the CRC Honeywell computer, as described in Appendix A. At present, the programs reside on magnetic tape at Spar, and on the Honeywell computer.

2.0 THE FDGSIM PROGRAM

This program simulates the MSAT spacecraft dynamics, and outputs the time history of certain selected variables. The program is described in Section 3.1 of reference [2]. The program occupies 18240 60-bit words on the M.A. computer.

2.1 MODULES REQUIRED BY PROGRAM FDGSIM

The program is divided into two modules (or files). One module, called FDGSIM, contains the main program, subroutine INTEG which performs the integration of equations, and the date and time display subroutines. The other module, called CONFGN, contains subroutine CONFIG and all other routines required.

These two modules are intended to be compiled separately and then linked into one executable program.

2.2 INPUT/OUTPUT FILES REQUIRED BY PROGRAM FDGSIM

The program needs two input files and produces one output file. The 'main' data file contains the program data as specified in Table 2-1, in free-format, i.e., the numerical values are separated by commas. This data file actually consists of three separate files, which are automatically merged by the Multiple Access operating system. The first file contains the spacecraft data (records 1 to x in Table 2-1). The second file is produced by the RICQ program, and contains the control matrix F data (records x + 1 to z + NG + NT + 2 in Table 2-1). The third file is produced by the DECOBR program, and contains the observer matrices (records z + NG + NT + 3 to W + 3*NOBS + 8 in Table 2-1). This data is read in on unit 1 by the FDGSIM program.

The 'change' data file is read in by the FDGSIM program after the main data file, on unit number 3. The data is specified in Table 2-2, and is read in in free-format. This file is used to change small amounts of data that were input from the main data file (which saves editing the main data file), or to change the VC data, which is set by a DATA statement in the program (see Table 2-3).

All program output is sent to the file connected to unit number 2.

2.3 PROGRAM FDCSIM OUTPUT

A complete list of the program data is written to the output file, for later reference. Also, the date and time at which the program was run, is printed on the output file to assist in later identification. The files containing the control matrix F and the observer matrices (produced by RICQ and DECOBR respectively), also contain some identification information at the top of files, and this information is also printed on the FDCCSIM output file to assist the user in determining which control matrix and which observer matrices were used for that run.

The simulation results are printed at regular intervals of NPSTEP timesteps and also whenever the thrusters fire. The output data is specified in Table 2-4. Six periods are printed, in columns one to six, immediately prior to the regular output (not the output triggered by thruster firings). These periods are used by the plotting program (PLOT1) to plot the simulation results at regular intervals.

TABLE 2-1
FDCCSIM MAIN DATA

RECORD NUMBER	VALUES	COMMENTS
1	NR, NF, NU	NR = no. of rigid modes NF = no. of flexible modes NU = no. of control inputs
2	ignored	
3	ignored	
4	BH(1,1), ... , BH(1,NU)	{ B matrix
.	.	
.	.	
.	.	
NR + NF + 3	BH(NR+NF,1), ..., BH(NR+NF,NU)	
NR + NF + 4	ignored	
NR + NF + 5	ignored	
NR + NF + 6	CH(1,1), ... , CH(1,NF)	{ C matrix
.	.	
.	.	
.	.	

TABLE 2-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
NR + 2NF + 5	CH(NF,1), ..., CH(NF,NF)	
NR + 2NF + 6	ignored	
NR + 2NF + 7	ignored	
NR + 2NF + 8	OMEGA(1), ..., OMEGA(NF)	modal frequencies
NR + 2NF + 9	ignored	
NR + 2NF + 10	ignored	
NR + 2NF + 11	AA, AR, AB, VA, VR, VB	} solar disturbance data
NR + 2NF + 12	PA, PBY, PBZ, PRY, PRZ	
NR + 2NF + 13	PBAY, PBAZ, PBRY, PBRZ	
NR + 2NF + 14	ignored	
NR + 2NF + 15	ignored	
NR + 2NF + 16	i, j, E _{ij}	} non-zero values of matrix E (dimension: 14 x NR + NF)
.	.	
.	.	
.	.	
x	0, 0, 0.0	end of E data
x + 1	ignored	records ignored until one record found containing ten periods, in columns one to ten inclusive
.		
.		
.		
y	"....."	
y + 1	NG, NT, TP	NG = no. of gimbal inputs NT = no. of thruster inputs TP = control period
y + 2	NRC, NNRC(1), ..., NNRC(NRC)	NRC = no. of rigid controlled modes NNRC() = mode numbers of rigid controlled modes

TABLE 2-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
y + 3	NEC, NNEC(1), ..., NNEC(NEC)	NEC = no. of flexible controlled modes NNEC() = mode numbers of flexible controlled modes
y + 4	F(1,1), ..., F(1,2*(NRC+NEC)) • • • • •	{ control matrix F
y + NG + NT + 3	F(NG+NT,1),...,F(NG+NT,2*(NRC+NEC))	
y + NG + NT + 4	ignored	
y + NG + NT + 5	ignored	
y + NG + NT + 6	QC(1,1),...,QC(1,2*(NRC+NEC)) • • •	{ cost function Q _C matrix
y + NG + NT + 2 +(NRC + NEC) + 5 = z	QC(2*(NRC+NEC),1), ... ,QC(2+(NRC+NEC),2*(NRC+NEC))	
z + 1	ignored	
z + 2	ignored	
z + 3	RBAR(1,1),...,RBAR(1,NG+NT) • • • •	{ cost function R̄ matrix
z + NG + NT + 2	RBAR(NG+NT,1),...,RBAR(NG+NT,NG+NT)	
z + NG + NT + 3	ignored	records ignored until one record found containing ten periods, in columns one to ten
• • •		
w	"....."	

TABLE 2-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
w + 1	NOBS, NUOBS, MOP	NOBS = order of observer NUOBS = no. of control inputs (= NG + NT) MOP = no. of sensor measurements (= 13)
w + 2	If NOBS=0 then end-of-file LEC, LLEC(1), ..., LLEC(LEC)	should correspond to NEC, NNEC(). Used to check if correct observer matrices are used
w + 3	ignored	observer A_O matrix
w + 4	ignored	
w + 5	AOBS(1,1), ..., AOBS(1,NOBS)	
.	.	
.	.	
w + NOBS + 4	AOBS(NOBS,1), ..., AOBS(NOBS,NOBS))	
w + NOBS + 5	ignored	observer K_O matrix
w + NOBS + 6	ignored	
w + NOBS + 7	AKOBS(1,1), ..., AKOBS(1,MOP)	
.	.	
.	.	
w + 2NOBS + 6	AKOBS(NOBS,1), ..., AKOBS(NOBS,MOP))	
w + 2NOBS + 7	ignored	observer B_O matrix
w + 2NOBS + 8	ignored	
w + 2NOBS + 9	BOBS(1,1), ..., BOBS(1,NUOBS)	
.	.	
.	.	
w + 3NOBS + 8	BOBS(NOBS,1), ..., BOBS(NOBS,NUOBS))	
	End of file	

TABLE 2-2
FDCSIM CHANGE FILE

RECORD NUMBER	VALUES	COMMENTS
1	I, VC(I)	
.	.	
.	.	
.	.	
a	0, 0.0	
		}
a + 1	I, J, BH(I,J)	
	.	
	.	
b	0, 0, 0.0	
		}
b + 1	I, J, CH(I,J)	
	.	
	.	
c	0, 0, 0.0	
		}
c + 1	I, OMEGA(I)	
	.	
	.	
d	0, 0.0	
	end-of-file	

TABLE 2-3
FDCCSIM VECTOR VC

INDEX	CODE	MEANING	DEFAULT VALUE	UNITS
1	TSTART	Simulation start time	0.0	secs
2	TEND	Simulation end time	0.0	secs
3	DT	Simulation stepsize	0.01	secs
4	IPRT	1 = print initial data 0 = no print	1	
5	NPSTEP	Number of steps per simulation printout	10	
6	not used		0	
7	NVC	length of VC vector	150	
8	INT	0 = Euler integration 1 = 4th order Runge-Kutta integration	0	
9	IDBUG	# 0, debugging printout during run 0, no printout	0	
10	IVC1	Start location in vector VC for state vector initial conditions	90	
11	NDI	Number of disturbance inputs ud	12	
12	not used		10.0	
13	QBC	Q/C, solar energy constant	4.51E-6	N/m ²
14	GAMMA0	initial value of γ , where γ is the orbital position relative to the sun	0.0	rads
15	WO	orbit rate	7.2722E-5	rads/sec
16	IDIST	1 = no external disturbance, ud = 0 0 = normal disturbance	0	

TABLE 2-3 - Continued

INDEX	CODE	MEANING	DEFAULT VALUE	UNITS
17	UMULT(1)	modify computed control inputs (thruster and gimbal) by factor UMULT	1.0	
.	.		.	
.	.		.	
.	.		.	
26	UMULT(10)		1.0	
27	DEAD(1)	rigid mode deadbands	-1.0	
.	.		.	
.	.		.	
.	.		.	
33	DEAD(7)		-1.0	
34	REFTIM	Time at which bias EREF is applied	0.0	secs
35	EREF(1)	bias applied to rigid modes at time REFTIM	0.0	
.	.		.	
.	.		.	
41	EREF(7)		0.0	
42	NEG	0 = eliminate negative thruster firings 1 = negative thruster firings allowed	0	
43	IDIAG	0 = full \hat{C} used 1 = diagonalized \hat{C} used 2 = block diagonal \hat{C} used	0	
44	KILL	number of flexible modes to be 'killed', i.e., held at their initial values	0	
45	KKILL(1)	flexible mode numbers of modes to be 'killed'	0	
.	.		.	
.	.		.	
.	.		.	
55	KKILL(11)		0	
56	TSTIME	detailed printout when time > TSTIME	1.0E6	secs
57	NCLOSE	0 = direct state-vector feedback 1 = observer feedback	0	

TABLE 2-3 - Continued

INDEX	CODE	MEANING	DEFAULT VALUE	UNITS
58	not used		0.0	
.	.		.	
.	.		.	
.	.		.	
89	not used		0.0	
90(IVC1)	V(1)	rigid modal coordinates, η_r	0.0	
.	.		.	
.	.		.	
.	.		.	
V(NR)			0.0	
V(NR+1)			0.0	
.		flexible modal coordinates, η_e	.	
.			.	
.			.	
V(NR+NF)			0.0	
V(NR+NF+1)			0.0	
.			.	
.			.	
V(2NR+NF)			0.0	
V(2NR+NF+1)			0.0	
.			.	
.			.	
.			.	
V(2NR+2NF)			0.0	
V(2NR+2NF+1)			0.0	
.		observer output \hat{x}	.	
.			.	
V(2NR+2NF+NOBS)			0.0	

TABLE 2-4
SIMULATION OUTPUT

LINE NUMBER	VARIABLES	COMMENTS
1	TIME, U(1), ..., U(8)	TIME = simulation time, secs U(1) to U(8) = control input
2	U(9), U(10), SX(1), SX(2), SX(3), SX(4), CJ1, CJ2	U(9), U(10) = control input SX(1) = RSS of rigid modes SX(2) = RSS of controlled flexible modes SX(3) = RSS of residual flexible modes SX(4) = RSS of all modes CJ1 = cost due to modes CJ2 = cost due to control input u
3 4 5 6 7	V(1), ..., V(8) V(9), ..., V(16) V(17), ..., V(24) V(25), ..., V(32) V(33), ..., V(38)	} State vector η_r , η_e , $\dot{\eta}_r$, $\dot{\eta}_e$
8 9 10	V(39), ..., V(46) V(47), ..., V(54) V(55), ..., V(60)	} observer output, only if NOBS \neq 0
8 or 11 9 or 12	Y(1), ..., Y(8) Y(9), ..., Y(14)	} sensor outputs
10 or 13	UD(1), ..., UD(8)	external disturbance
11 or 14	UD(9), ..., UD(12) GAMMA, NFIRE, TFIRE, CJ	UD() = external disturbance GAMMA = orbital position relative to the sun, degrees NFIRE = count of thruster firings TFIRE = last time thrusters fired, seconds CJ = total cost function

TABLE 2-4 - Continued

LINE NUMBER	VARIABLES	COMMENTS
12 or 15	ERROBS(1),...,ERROBS(8) ERROBS(9),...,ERROBS(16) • . • . • . ERROBS(NOBS)	error in observer output only printed if NOBS ≠ 0

3.0 THE PLOT1 PROGRAM

This program produces a character-plot of the simulation results generated by the program FDGSIM. The PLOT1 program is not explicitly described in reference [2], but some example plots are given in Appendix B.

The program is stand-alone, i.e., no other modules are required.

The control data file, specified in Table 3-1, is read in from unit number 1. The simulation data is read from unit 3, and the plot results are produced on unit number 2.

The program occupies 11392 60-bit words on the M.A. computer.

TABLE 3-1

PLOT1 CONTROL DATA

RECORD NUMBER	VALUES	COMMENTS
1	NPLOT IHELP, TEND	NPLOT = number of separate plots IHELP = 0 no debugging printout ≠ 0 - debugging printout TEND = plot length not to exceed TEND seconds
2	NV,NOS(1),...,NOS(NV)	NV = no. of variables to be plotted NOS() = location of variable to be plotted in simulation output block
3	SYMBOL(1),...,SYMBOL(NV)	Plot symbols (format 2X,A1)
4	VMIN(1),...,VMIN(NV)	minimum values of plot variables
5	VMAX(1),...,VMAX(NV)	maximum values of plot variables
6	ISPACE, IDBUG	ISPACE = no. of spaces between plot points IDBUG = 0 - no debugging printout ≠ 0 = debugging printout
Block repeated NPLOT times		

4.0 THE RICQ PROGRAM

This program computes the control matrix F, and is described in Section 3.2 of reference [2]. The program occupies 37248 60-bit words on the M.A. computer.

4.1 MODULES REQUIRED BY PROGRAM RICQ

The main program and most of the subroutines are contained in the file RICQ. Three other modules are required, which can be compiled separately and linked with RICQ to form a complete executable program. The three other modules (files) are MATRX2, EIGENP and CINVRT. Module MATRX2 supplies the double-precision matrix inversion subroutine MTINV2, module EIGENP supplies the eigenvalue/eigenvector subroutine EIGENP, and module CINVRT supplies the double-precision complex matrix inversion subroutine MINVDC.

4.2 INPUT/OUTPUT FILES REQUIRED BY PROGRAM RICQ

One input and two output files are required by the program. The input data file is specified in Table 4-1, and is read in by the program on unit number 1. The 'main' output file (containing the program results in a readable form) is connected to the program unit number 2, and the 'second' output file (containing the results in a form to be input to another program) is connected to unit number 4.

4.3 PROGRAM RICQ OUTPUT

The program prints all the input data on the 'main' output file, and the date and time of the run to assist in later identification. The program also prints two error values at each stage of the Riccati iteration (sum of the absolute difference of matrix elements between current F and P matrices and previous F and P matrices) which allows the user to see how well the Riccati iteration converges. The value of the cost function J_k is also displayed, for the particular F matrix. If the stability analysis is required (NSTAB≠0) the eigenvalues of the controlled modes (using the computed feedback matrix F directly, with no observer) and the residual modes are displayed.

A small amount of the input data is copied to the 'second' output file which can be copied by another program to help identify the F matrix being used. The F, Q, and R matrices are also output to the 'second' output file in free-format form (values separated by commas), so that another program can easily pick up the data.

TABLE 4-1
RICQ DATA (1)

RECORD NUMBER	VALUES	COMMENTS
1	ignored	
2	TP,UMULT,LOOP,NEG,IPRT1,IPRT2, IPRT3,IDBUG	TP = control period T , secs UMULT: not used LOOP: not used NEG: not used IPRT1≠0: print program results =0: no printout IPRT2: not used IPRT3: not used IDBUG≠0: print debugging information =0: no debugging printout
3	NSTAB,IC,NDIST,KK,NQC,ND3,IDIAG	NSTAB=0: no stability analysis =1: perform stability analysis IC=0: no checks performed =1: checks are performed NDIST: not used KK=no. of Riccati iterations NQC=0: Q_c , Q_{ck} as read in =1: Q_c , Q_{ck} reset to identity =2: Q_c , Q_{ck} diagonalized ND3: not used IDIAG=0: \mathbf{C} array used =1: full \mathbf{C} matrix used =2: diagonalized \mathbf{C} used
4	ignored	
5	NU,NT,NG,NR,NF	NU = no. of control inputs NT = no. of thruster inputs NG = no. of gimbal inputs NR = no. of rigid modes NF = no. of flexible modes
6	ignored	

TABLE 4-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
7	NRC, NNRC(1), ..., NNRC(NRC)	NRC = no. of controlled rigid modes NNRC() = mode numbers of controlled rigid modes
8	ignored	
9	NEC, NNEC(1), ..., NNEC(NEC)	NEC = no. of controlled flexible modes NNEC() = mode numbers of controlled flexible modes
10	ignored	
11	NER, NNER(1), ..., NNER(NER)	NER = no. of residual flexible modes NNER() = mode numbers of residual flexible modes
12	ignored	
13	QC(1,1), ..., QC(1,NCTOT2) • • • • • • 12+NCTOT2 QC(NCTOT2,1), ..., QC(NCTOT2,NCTOT2)	} cost matrix Q_C , where $NCTOT2 = 2*(NRC + NEC)$
13+NCTOT2	ignored	
14+NCTOT2	QCK(1,1), ..., QCK(1,NCTOT2) • • • • 13+2*NCTOT2 QCK(NCTOT2,1), ..., QCK(NCTOT2,NCTOT2)	} cost matrix Q_{CK} , where $NCTOT2 = 2*(NRC + NEC)$
14+2*NCTOT2	ignored	
15+2*NCTOT2	R(1), ..., R(NG+NT)	Diagonal elements of cost matrix R
16+2*NCTOT2	ignored	

TABLE 4-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
17+2*NCTOT2	RR(1),...,RR(2*NER)	diagonal elements of cost matrix R_R
18+2*NCTOT2	ignored	
19+2*NCTOT2	OMEGA(1),...,OMEGA(NF)	modal frequencies, rads/sec
20+2*NCTOT2	ignored	
21+2*NCTOT2	ZETA(1),...,ZETA(NF)	diagonalized modal damping factors
22+2*NCTOT2	ignored	
23+2*NCTOT2	BH(1,1),...,BH(1,NU)	matrix $\hat{B} = \begin{pmatrix} B_r \\ B_e \end{pmatrix}$
.	.	
.	.	
.	.	
22+2*NCTOT2 +NR+NF (= x)	BH(NR+NF,1),...,BH(NR+NF,NU)	
x+1	ignored	
x+2	CH(1,1),...,CH(1,NF)	matrix \hat{C}
.	.	
.	.	
.	.	
x+1+NF	CH(NF,1),...,CH(NF,NF)	
	end of file	

5.0 THE CON52 PROGRAM

This program calculates the \tilde{Q} matrix, as described in section 3.3 of reference [2]. The program occupies 25920 60-bit words on the M.A. computer.

5.1 MODULES REQUIRED BY PROGRAM CON52

Program CON52 requires two modules to be linked in to make a complete executable program. The two modules are EIGENP and CINVRT, which contain the eigenvalue/eigenvector subroutine EIGENP and the double precision complex matrix inversion subroutine MINVDC respectively.

5.2 INPUT/OUTPUT FILES REQUIRED BY PROGRAM CON52

One input and two output files are required by the program. The input data file, specified in Table 5-1, is connected to unit number 1. The main output file is connected to unit 2, and the 'second' output file (containing the \tilde{Q} matrix) in a form to be easily picked up by another program) is connected to unit 4.

5.3 PROGRAM CON52 OUTPUT

A complete list of the input data is printed on the 'main' output file, and also the date and time of the run to assist in later identification. Various intermediate results and debugging information may also be printed, if requested by flags IPRT and IDBUG, and the final result \tilde{Q} .

The date and time are also printed on the 'second' output file, and the resulting \tilde{Q} in a form which can easily be picked up by another program.

TABLE 5-1
CON52 DATA

RECORD NUMBER	VALUES	COMMENTS
1	ignored	
2	TP, IC, IPRT, IDBUG, NPHYS	TP = control period γ , secs IC = 0: no checks done = 1: check performed IPRT=0: no intermediate printout =1: intermediate results printout IDBUG=0: no debugging printout =1: debugging printout NPHYS=0: read in Q_C matrix =1: compute Q_C to control physical coordinates
3	ignored	
4	NR, NF	NR = no. of rigid modes NF = no. of flexible modes
5	ignored	
6	NRC, NNRC(1), ..., NNRC(NRC)	NRC = no. of controlled rigid modes NNRC() = mode number of controlled rigid modes
7	ignored	
8	NEC, NNEC(1), ..., NNEC(NEC)	NEC = no. of controlled flexible modes NNEC() = mode numbers of controlled flexible modes
9	ignored	
10	NER, NNER(1), ..., NNER(NER)	NER = no. of residual flexible modes NNER() = mode numbers of residual flexible modes

TABLE 5-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
11	ignored	
	<u>If NPHYS = 0</u>	
12	QC(1,1),...,QC(1,NMD2)	
	.	
	.	
x=11+NMD2	QC(NMD2,1),...,QC(NMD2,NMD2)	
	<u>If NPHYS ≠ 0</u>	
12	QW(1),...,QW(14)	diagonal elements of Q_w matrix
13	ignored	
14	MAXT1,MAXT2	maximum dimensions of E matrix
15	I,J,VALUE	
.	.	
.	.	
x	0,0,0.0	
		end of E data
x+1	ignored	
x+2	OMEGA(1),...,OMEGA(NF)	modal frequencies, rads/sec
x+3	ignored	
x+4	NU,NG,NT	NU = no. of control inputs NG = no. of gimbal inputs NT = no. of thruster inputs
x+5	ignored	

TABLE 5-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
x+6	BH(1,1),...,BH(1,NU)	matrix \hat{B} , where NMD = NR + NF
.	.	
.	.	
.	.	
x+NMD+5	BH(NMD,1),...,BH(NMD,NU)	
x+NMD+6	ignored	
x+NMD+7	CH(1,1),...,CH(1,NF)	matrix \hat{C}
.	.	
.	.	
x+NMD+NF+6	CH(NF,1),...,CH(NF,NF)	
	end of file	

6.0 THE DECOBR PROGRAM

This program computes the observer matrices A_o , B_o and K_o for either a coupled or decoupled observer. The program is described in Section 3.4 of reference [2]. The program occupies 45248 60-bit words on the M.A. computer.

6.1 MODULES REQUIRED BY PROGRAM DECOBR

The main program and subroutines are contained in the file DECOBR. However, three extra modules must be linked in to produce a complete executable program. These are MATRX2, which contains the double precision inversion subroutine MTINV2, module EIGENP which contains the eigenvalue/eigenvector subroutine EIGENP, and module ASINEV which contains the eigenvalue assignment subroutine ASINEV.

6.2 INPUT/OUTPUT FILES REQUIRED BY PROGRAM DECOBR

This program requires one input and two output files. The input file is specified in Table 6-1, and is read in on unit 1. The 'main' output file is produced on unit 2, and the 'second' output file (containing the observer matrices in a form which can be easily picked up by another program) produced on unit 4.

6.3 PROGRAM DECOBR OUTPUT

A complete list of the input data is printed on the 'main' output file and also the date and time of the run to assist in later identification. Debugging information may be printed if specified by flag IDBUG and various intermediate results and the final observer matrices will be printed if specified by flag IPRT.

The date and time and certain input data are also printed on the 'second' output file, and the resulting observer matrices in a form which can be picked up directly by another program.

TABLE 6-1
DECOBR DATA

RECORD NUMBER	VALUES	COMMENTS
1	ignored	
2	IC, IPRT, IDBUG, ND3, X1, X2	IC = 0: no checks done = 1: checks performed IPRT = 0: no printout = 1: print intermediate and final results IDBUG = 0: no debugging output = 1: print debugging information ND3: not used X1: used by ASINEV. Random numbers in array AKOT in range -X1/2.0 to X1/2.0 X2: used by ASINEV. Random numbers in array V in range -X2/2.0 to X2/2.0
3	ignored	
4	ME, NU, NUOBS, NR, NF	ME = no. of measured elastic modes NU = total number of control inputs (wheel, gimbals + thrusters) NUOBS = no. of observer inputs (gimbals + thrusters) NR = no. of rigid modes NF = no. of flexible modes
5	ignored	
6	NRC, NNRC(1), ..., NNRC(NRC)	NRC = no. of rigid controlled modes NNRC() = mode numbers of rigid controlled modes
7	ignored	

TABLE 6-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
8	NEC, NNEC(1), ..., NNEC(NEC)	NEC = no. of flexible controlled modes NNEC() = mode numbers of flexible controlled modes
9	ignored	
10	NER, NP, NNP(1), ..., NNP(NP)	NER = no. of flexible residual modes NP = no. of suppressed residual modes NNP() = mode numbers of suppressed residual modes
11	ignored	
12	NREV	NREV = no. of rigid mode eigenvalues
13	RER(1), CER(1)	
.	.	
.	.	
12+NREV	RER(NREV), CER(NREV)	
13+NREV	ignored	
14+NREV	NFEV	NFEV = no. of flexible mode eigenvalues
15+NREV	REF(1), CEF(1)	
.	.	
14+NREV+NFEV	REF(NFEV), CEF(NFEV)	real and imaginary parts of flexible mode eigenvalues
15+NREV+NFEV	ignored	
16+NREV+NFEV	OMEGA(1), ..., OMEGA(NF)	OMEGA(i) = ith modal frequency, rads/sec
17+NREV+NFEV	ignored	
18+NREV+NFEV	ZETA(1), ..., ZETA(NF)	ZETA(i) = ith modal damping

TABLE 6-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
19+NREV+NFEV	ignored	
20+NREV+NFEV	BH(1,1),...,BH(1,NU)	matrix \hat{B} , NMD = NR + NF
.	.	
.	.	
.	.	
19+NREV+NFEV +NR+NF = x	BH(NMD,1),...,BH(NMD,NU)	
x+1	ignored	
x+2	MAXT1, MAXT2	maximum dimensions of E matrix
x+3	I,J,VALUE	$E_{I,J} = \text{VALUE}$ (elements not set are zero)
.	.	
.	.	
.	.	
y	0,0,0.0	end of E data
	end of file	

7.0 THE STABF PROGRAM

This program calculates the eigenvalues of the closed loop system consisting of the spacecraft dynamics plus controller. The spacecraft modes are fed directly to the controller without an observer in the system. The program is described in section 3.5 of reference [2]. The program occupies 30528 60-bit words on the M.A. computer.

7.1 MODULES REQUIRED BY PROGRAM STABF

Three extra modules are required to be linked in to produce a complete executable program. These are MATRX2, which contains the double precision matrix inversion subroutine MTINV2, module EIGENP which contains the eigenvalue/eigenvector subroutine EIGENP, and module CINVRT which contains the double precision complex matrix subroutine MINVDC.

7.2 INPUT/OUTPUT FILES REQUIRED BY PROGRAM STABF

The STABF program requires one input and one output file. The input file is specified in Table 7-1, and is read in on unit number 1. The input file actually consists of two separate files, which are automatically merged by the Multiple Access operating system. The first file extends from record 1 to record 10+NMD+NF, and contains the spacecraft data. The second file extends from record 11+NMD+NF to x+NGNT+5 and contains the controller data, as generated by the RICQ program. The output is generated on unit number 2.

7.3 PROGRAM STABF OUTPUT

A complete list of the input data is printed on the output file, and also the date and time of the run to assist in later identification. Debugging information may be printed if specified by flag IDBUG, and various intermediate results and the closed loop eigenvalues will be printed if specified by flag IPRT.

TABLE 7-1

STABF DATA

RECORD NUMBER	VALUES	COMMENTS
1	ignored	
2	ITEST, IDIAG, IC, IPRT, IDBUG	If ITEST nonzero, then data changed to: NRC=1, NEC=1, NER=1, NG=1, NT=1 and CH diagonal, for test purposes IDIAG = 0: full C used = 1:C diagonalized = 2:C block diagonal IC = 0: no checks = 1: automatic checks performed IPRT = 0: printout suppressed = 1: printout on IDBUG = 0: no debug prntout = 1: debugging printout
3	ignored	
4	UMULT(1),...,UMULT(10)	control inputs U_i multiplied by UMULT(i), to allow optional modification
5	ignored	
6	NR, NF, NU	NR = no. of rigid modes NF = no. of flexible modes NU = no. of control inputs
7	ignored	
8	OMEGA(1),...,OMEGA(NF)	OMEGA(i) = i th modal frequency w_i , rads/sec
9	ignored	

TABLE 7-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
10	BH(1,1),...,BH(1,NU)	{ matrix \hat{B} NMD = NR + NF
9+NMD	BH(NMD,1),...,BH(NMD,NU)	
10+NMD	ignored	
11+NMD	CH(1,1),...,CH(1,NF) . . .	{ matrix \hat{C}
10+NMD+NF	CH(NF,1),...,CH(NF,NF)	
11+NMD+ND	ignored	
.	.	
.	.	
x-1	ignored	
x	"....."	
x+1	NG,NT,TP	NG = no. of gimbal inputs NT = no. of thruster inputs TP = control period, seconds
x+2	NRC,NNRC(1),...,NNRC(NRC)	NRC = no. of rigid controlled modes NNRC() = mode numbers of rigid controlled modes
x+3	NEC,NNEC(1),...,NNEC(NEC)	NEC = no. of flexible controlled modes NNEC() = mode numbers of flexible controlled modes
x+4	ignored	
x+5	ignored	

TABLE 7-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
x+6	F(1,1),...,F(1,NCTOT2) . . .	} control matrix F NCTOT2 = 2*(NRC + NEC)
x+NGNT+5	F(NGNT,1),...,F(NGNT,NCTOT2) end of file	NGNT = NG + NT

8.0 THE STABFO PROGRAM

The STABFO program calculates the eigenvalues of the closed loop system consisting of the spacecraft, observer and controller. The program is described in Section 3.6 of Reference [2]. The program occupies 41920 60-bit words on the M.A. computer.

8.1 MODULES REQUIRED BY PROGRAM STABFO

Three modules must be linked in to produce a complete executable program. These are MATRX2, which contains the double precision matrix inversion subroutine MTINV2, module EIGENP which contains the eigenvalue/eigenvector subroutine EIGENP, and module CINVRT which contains the double precision complex matrix inversion subroutine MINVDC.

8.2 INPUT/OUTPUT FILES REQUIRED BY PROGRAM STABFO

The STABFO program requires one input and one output file. The input file is specified in Table 8-1, and is read in on unit number 1. The input file actually consists of three separate files, which are automatically merged together for the run by the Multiple Access operating system. The first file extends from record 1 to record w, and contains the spacecraft data. The second file extends from record w+1 to x+NGNT+5, and consists of the controller data as generated by the RICQ program. The third file extends from record x+NGNT+6 to y+2*NOBS+6 (or y+1) and consists of the observer data as generated by the DECOBR program. The output is generated on unit number 2.

8.3 PROGRAM STABFO OUTPUT

A complete list of the input data is printed on the output file, and also the date and time of the run. Debugging information may be printed if specified by flag IDBUG, and various intermediate results and the final closed-loop eigenvalues will be printed if specified by flag IPRT.

TABLE 8-1
STABFO DATA

RECORD NUMBER	VALUES	COMMENTS
1	ignored	
2	TV, ITEST, IDIAG, IC, IPRT, IDBUG	TV = test value, normally zero ITEST = 0: normal = 1: observer eliminated IDIAG = 0: full \hat{C} used = 1: \hat{C} diagonal = 2: \hat{C} block diagonal IC = 0: no checks done = 1: calculations checked IPRT = 0: printout suppressed = 1: normal printout IDBUG = 0: no debugging printout = 1: debugging printout on
3	ignored	
4	UMULT(1), ..., UMULT(10)	control inputs u_i multiplied by UMULT(i) to allow modification
5	NER, NNER(1), ..., NNER(NER)	NER = no. of residual modes NNER() = mode numbers of residual modes
6	ignored	
7	NR, NF, NU	NR = no. of rigid modes NF = no. of flexible modes NU = no. of control inputs
8	ignored	
9	OMEGA(1), ..., OMEGA(NF)	modal frequencies w_i , rads/sec
10	ignored	

TABLE 8-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
11	BH(1,1),...,BH(1,NU)	
	.	
	.	
	.	
10+NMD	BH(NMD,1),...,BH(NMD,NU)	
11+NMD	ignored	
12+NMD	CH(1,1),...,CH(1,NF)	
	.	
	.	
	.	
11+NMD+NF	CH(NF,1),...,CH(NF,NF)	
12+NMD+NF	ignored	
13+NMD+NF	MAXT1,MAXT2	maximum dimensions of E matrix
14+NMD+NF	I,J,VALUE	
.	.	
.	.	
w	0,0,0.0	
w+1	ignored	
	.	
	.	
x-1	ignored	
x	"....."	
x+1	NG,NT,TP	NG = no. of gimbal inputs NT = no. of thruster inputs TP = control period
x+2	NNRC(1),...,NNRC(NRC)	NRC = no. of rigid controlled modes NNRC() = mode numbers of rigid controlled modes

TABLE 8-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
x+3	NEC, NNEC(1), ..., NNEC(NEC)	NEC = no. of flexible controlled modes NNEC() = mode numbers of flexible controlled modes
x+4	ignored	
x+5	ignored	
x+6	F(1,1), ..., F(1,NCTOT2)	control matrix F NCTOT2 = 2*(NRC + NEC) NGNT = NG + NT
.	.	
.	.	
.	.	
x+NGNT+5	F(NGNT,1), ..., F(NGNT,NCTOT2)	
x+NGNT+6	ignored	records ignored until 10 periods encountered in columns 1 to 10
.	.	
.	.	
.	.	
y-1	ignored	
y	"....."	
y+1	NOBS, NUOBS, MOP	NOBS = order of observer NUOBS = no. of control inputs to observer MOP = no. of measured outputs
	(If NOBS = 0 THEN end-of-file)	
y+2	LEC, LLEC(1), ..., LLEC(LEC)	LEC = no. of observed flexible modes LLEC() = mode numbers of observed flexible mode NOTE: these modes should equal NEC, NNEC()
Y+3	ignored	
y+4	ignored	

TABLE 8-1 - Continued

RECORD NUMBER	VALUES	COMMENTS
y+5	AOBS(1,1),...,AOBS(1,NOBS) . . .	{ observer matrix A_o
y+NOBS+4	AOBS(NOBS,1),...,AOBS(NOBS,NOBS)	
y+NOBS+5	ignored	
y+NOBS+6	ignored	
y+NOBS+7	AKOBS(1,1),...,AKOBS(1,MOP) . . .	{ observer matrix K_o
y+2*NOBS+6	AKOBS(NOBS,1),...,AKOBS(NOBS,MOP)	
	(end-of-file)	

9.0 REFERENCES

1. Yuan, J.S-C., "Optimal Stationkeep and Attitude Control of Flexible Spacecraft, Part 1: Theoretical Development", SPAR-R.1134, October, 1982.
2. Roger, N.A.C., "Optimal Stationkeep and Attitude Control of Flexible Spacecraft, Part 2: Design Verification", SPAR-R.1135, February, 1983.

Appendix A - Transfer of Programs to CRC Honeywell Computer

The seven programs FDCCSIM, PLOT1, RICQ, CON52, DECOBR, STABF and STABFO were to be transferred from the Multiple Access computer and converted to run on the Honeywell DPS8/52 computer at the Communications Research Centre in Ottawa.

However, time allowed only three of these programs to be successfully converted - FDCCSIM, RICQ and DECOBR. The main modifications to the FORTRAN source code have been made to the remaining programs, but they have not actually been compiled or run.

There are also five other programs (or modules) which contain one or more subroutines required by the above programs. These program modules are to be compiled separately and linked into the other programs to make a complete executable program. The five program modules are called CONFGN, ASINEV, MATRX2, EIGENP and MINVDC. These modules have all been compiled and run successfully with the above three programs that were converted.

The original set of files (unconverted programs, data etc.) are stored on the Honeywell computer under account STM0110, in the 23 files called: CRCTAP.X01, CRCTAP.X02, . . . , CRCTAP.X23. The converted programs, binary images, data files etc. are stored in account STM0240X.

The source and object files for the five modules are given below:

- a) Module CONFGN
This module is the configuration module required only by program FDCCSIM. The FORTRAN source is contained in file CONFGN:FTN, and the compilation object code is in file CONFGN:OBJ.
- b) Module ASINEV
This is the eigenvalue assignment module. The FORTRAN source is in file ASINEV:FTN, and object code is in file ASINEV:OBJ.
- c) Module MATRX2
This module contains a number of matrix manipulation subroutines, the only one used in the real matrix inversion subroutine MTINV2. The FORTRAN source is in file MATRX2:FTN, and object code in file MATRX2:OBJ.
- d) Module EIGENP
This module calculates the eigenvalues of a matrix. The FORTRAN source is in file EIGENP:FTN, and object code in file EIGENP:OBJ.
- e) Module MINVDC
This module calculates the inverse of a complex matrix. The FORTRAN source is in file MINVDC:FTN, and object code in file MINVDC:OBJ.

The files for the three programs which have been converted to the Honeywell are given below, plus information on running the programs.

a) Program FDCTSTR

This is the simulation program. The FORTRAN source is contained in the file FDCTSTR:FTN, and compilation object code in the file FDCTSTR:OBJ. One module has to be linked in, module CONFIGN. The (executable) binary image is contained in the file FDCTSTR:TSK.

A total of four data files are required to run the program. The file FDCTSTR:EVL contains the physical parameters of the system (evaluation model), RICQ:OP2 contains the control matrix F as produced by the RICQ program, DECOBR:OP2 contains the observer matrices as produced by the DECOBR program, and file FDCTSTR:DAT contains any 'change' data.

The command file FDCTSTR:CMD may be used to run the program. This command file will automatically merge the three data files FDCTSTR:EVL, RICQ:OP2, DECOBR:OP2 into the temporary file *TEMP, thus forming the 'main data' file, and assigns it to the FORTRAN unit number 1. The 'change' data file FDCTSTR:DAT is assigned to unit 3, and the output file FDCTSTR:OUT to unit 2. If FDCTSTR:OUT does not exist, it will be created, and if it does already exist, it will be overwritten. The command file will then start execution of the program.

Therefore, once the above data files have been set up, all the user need do to run the program is type in the command: XEQ FDCTSTR:CMD.

The output file FDCTSTR:OUT may be listed on the user's terminal or on a line-printer.

b) Program RICQ

This program calculates the control matrix F. The FORTRAN source is contained in the file RICQ:FTN, and the compilation object code in file RICQ:OBJ. Three modules have to be linked in: modules MATRX2, EIGENP and MINVDC. The (executable) binary image is contained in file RICQ:TSK.

One data file is required by the program, to be assigned to the FORTRAN unit number 1. The RICQ:DAT data file may be used to generate the RICQF F matrix, or RICQ:DTL may be used to generate the RICMATT F matrix.

Two output files are generated by the program, the 'main' output file on unit 2 and the 'second' output file on unit 4. The user must assign a file through the CP-6 operating system, e.g. RICQ:OUT for the 'main' file and RICQ:OP2 for the 'second' file. If the output files do not

already exist, they will be created, and if they already exist, they will be overwritten. The 'main' output file is intended to be listed on a terminal or line-printer, and the 'second' output file is intended to be read by another program (e.g. FDCSIM above).

Therefore, to run the program, the following CP-6 commands may be used:

```
SET F$1 RICQ:DAT
SET F$2 RICQ:OUT
SET F$4 RICQ:OP2
START RICQ:TSK
```

c) Program DECOBR

This program calculates the observer matrices. The FORTRAN source is contained in the file DECOBR:FTN, and the compilation object code in file DECOBR:OBJ. Three modules have to be linked in: modules ASINEV, MATRIX2 and EIGENP. The (executable) binary image is contained in the file DECOBR:TSK.

One data file is required by the program to be assigned to the FORTRAN unit number 1, e.g. DECOBR:DAT. Two output files are generated by the program; the 'main' output file on unit 2, e.g. DECOBR:OUT, and the 'second' output file on unit 4, e.g. DECOBR:OP2. If the user specifies an output file which already exists, then it will be overwritten. The 'main' output file is intended to be listed on a line-printer or terminal, and the 'second' output file is intended to be read by another program (e.g. FDCSIM above).

If the data and output files mentioned above are used, then the user may use the command file DECOBR:CMD to run the program. The command: XEQ DECOBR:CMD will run the program.

The files containing the programs which have not been fully converted are described below:

a) Program PLOT1

This program produces a plot of the simulation results from program FDCSIM. The FORTRAN source is contained in the file PLOT1:FTN, and is stand-alone, i.e. no other modules are required. No data file was transferred, since only a small amount of data is required, which is easily defined by the user.

b) Program CON52

This program computes the \bar{Q} matrix, which may be used by the RICQ program as a weighting matrix. The FORTRAN source is contained in the file CON52:FTN. When it is compiled, it will require modules EIGENP and MINVDC to be linked in. Two data files are available, CON52:DAT defines a particular modal weighting matrix Q_c to be used, while CON52:DTL weights the physical coordinates.

c) Program STABF

This program computes the stability of the spacecraft plus controller system. The FORTRAN source is in file STABF:FTN. When it is compiled, it will require modules MATRX2, EIGENP and MINVDC to be linked in.

The data file is contained in the file STABF:DAT. The 'second' output file from the RICQ program must be appended to this data file to create the complete data file, which is to be assigned to the FORTRAN unit number 1.

d) Program STABFO

This program computes the stability of the spacecraft plus controller plus observer system. The FORTRAN source is contained in the file STABFO:FTN. When it is compiled, it will require modules MATRIX2, EIGENP and MINVDC to be linked in.

The data file is still in its original form on account STM0110 in file CRCTAP:X23. When this file has been suitably modified, the 'second' output files from the RICQ and DECOBR programs must be appended to create the complete data file, which is then assigned to unit 1.

Appendix B - Example Data Files and Command Files

The following example data files are stored on the CRC Honeywell computer, under account STM0240X. The line-numbers shown may be ignored.

10.000 TF,IC,IPRT,IDEBUG,NPHYS
 11.000 10.0, 1, 1, 1, 0,
 12.000 NR, NF
 13.000 8, 11,
 14.000 NRC, NNRC()
 15.000 7, 1,2,4,5,6,7,8,
 16.000 NEC, NNEC()
 17.000 4, 1,3,4,6,
 18.000 NER, NNER()
 19.000 7, 2,5,7,8,9,10,11,
 20.000 QBH :2*(NR+NF) X 2*(NR+NF)
 21.000 1.000E-06, 0., 0., 0., 0., 0., 0., 0.
 22.000 0., 0., 0., 0., 0., 0., 0., 0.
 23.000 0., 0., 0., 0., 0., 0., 0., 0.
 24.000 0., 0., 0., 0., 0., 0., 0., 0.
 25.000 0., 0., 0., 0., 0., 0., 0., 0.
 26.000 0., 0., 0., 0., 0., 0., 0., 0.
 27.000 0., 0., 0., 0., 0., 0., 0., 0.
 28.000 0., 0., 1.000E-06, 0., 0., 0., 0., 0.
 29.000 0., 0., 0., 0., 0., 0., 0., 0.
 30.000 0., 0., 0., 0., 0., 0., 0., 0.
 31.000 0., 0., 0., 0., 0., 0., 0., 0.
 32.000 0., 0., 0., 0., 0., 0., 0., 0.
 33.000 0., 0., 0., 0., 0., 0., 0., 0.
 34.000 0., 0., 0., 0., 0., 0., 0., 0.
 35.000 0., 0., 0., 0., 0., 0., 0., 0.
 36.000 0., 0., 0., 0., 0., 0., 0., 0.
 37.000 0., 0., 0., 0., 0., 0., 0., 0.
 38.000 0., 0., 0., 0., 0., 0., 0., 0.
 39.000 0., 0., 0., 0., 0., 0., 0., 0.
 40.000 0., 0., 0., 0., 0., 0., 0., 0.
 41.000 0., 0., 0., 0., 0., 0., 0., 0.
 42.000 0., 0., 0., 0., 1.654E-06, -7.019E-10, -1.684E-09,
 43.000 -1.669E-10, 1.281E-05, 0., 0., 0., 0., 0., 0.
 44.000 0., 0., 0., 0., 0., -4.923E-10, -3.820E-07,
 45.000 -1.237E-06, -3.737E-10, -7.363E-10, -4.531E-09, 8.791E-06, 3.103E-09,
 46.000 -5.642E-06, 1.666E-09, -6.046E-10, 0., 0., 0., 0., 0.
 47.000 0., 0., 0., 0., 0., 0., 0., 0.
 48.000 0., 0., 0., 0., 0., 0., 0., 0.
 49.000 0., 0., 0., 0., 0., -7.019E-10, 2.193E-06, 1.535E-06,
 50.000 -1.388E-05, -5.342E-09, 0., 0., 0., 0., 0., 0.
 51.000 0., 0., 0., 0., 0., -3.452E-07, 2.107E-09,
 52.000 1.122E-09, -7.123E-07, -2.598E-07, -6.014E-06, -1.360E-07, -3.532E-06,
 53.000 7.196E-09, 5.983E-06, 1.010E-05, 0., 0., 0., 0., 0.
 54.000 0., 0., 0., 0., 0., 0., 0., 0.
 55.000 0., 0., 0., 0., 0., 0., 0., 0.
 56.000 0., 0., 0., 0., 0., -1.684E-09, 1.535E-06, 5.891E-06,
 57.000 -9.374E-06, -1.244E-08, 0., 0., 0., 0., 0., 0.
 58.000 0., 0., 0., 0., 0., 0., 2.539E-06, -3.467E-08,
 59.000 1.565E-08, -1.476E-05, 7.295E-06, -3.550E-06, -2.157E-07, -3.170E-06,
 60.000 7.267E-08, 3.866E-06, 7.286E-06, 0., 0., 0., 0., 0.
 61.000 0., 0., 0., 0., 0., 0., 0., 0.
 62.000 0., 0., 0., 0., 0., 0., 0., 0.
 63.000 0., 0., 0., 0., 0., -1.669E-10, -1.388E-05, -9.374E-06,
 64.000 1.791E-04, -9.717E-10, 0., 0., 0., 0., 0., 0.
 65.000 0., 0., 0., 0., 0., -3.295E-06, 2.529E-08,
 66.000 -3.628E-09, 2.724E-06, -1.197E-06, -3.001E-06, -3.335E-08, 1.188E-05,
 67.000 -1.961E-08, -8.364E-05, -1.247E-04, 0., 0., 0., 0., 0.
 68.000 0., 0., 0., 0., 0., 0., 0., 0.
 69.000 0., 0., 0., 0., 0., 0., 0., 0.
 70.000 0., 0., 0., 0., 0., 1.281E-05, -5.342E-09, -1.244E-08,
 71.000 -9.717E-10, 1.999E-04, 0., 0., 0., 0., 0., 0.
 72.000 0., 0., 0., 0., 0., 0., 4.331E-09, -7.973E-07,
 73.000 -5.198E-06, -1.999E-08, 9.290E-09, -9.630E-09, -2.116E-07, -2.909E-09,
 74.000 -1.402E-06, -9.229E-11, 1.677E-08, 0., 0., 0., 0., 0.
 75.000 0., 0., 0., 0., 0., 0., 0., 0.
 76.000 0., 0., 0., 0., 0., 0., 0., 0.
 77.000 0., 0., 0., 0., 0., 0., 0., 0.
 78.000 0., 0., 0., 0., 0., 0., 0., 0.
 79.000 0., 0., 0., 0., 0., 0., 0., 0.
 80.000 0., 0., 0., 0., 0., 0., 0., 0.
 81.000 0., 0., 0., 0., 0., 0., 0., 0.
 82.000 0., 0., 0., 0., 0., 0., 0., 0.
 83.000 0., 0., 0., 0., 0., 0., 0., 0.
 84.000 0., 0., 0., 0., 0., 0., 0., 0.
 85.000 0., 0., 0., 0., 0., 0., 0., 0.
 86.000 0., 0., 0., 0., 0., 0., 0., 0.
 87.000 0., 0., 0., 0., 0., 0., 0., 0.
 88.000 0., 0., 0., 0., 0., 0., 0., 0.
 89.000 0., 0., 0., 0., 0., 0., 0., 0.
 90.000 0., 0., 0., 0., 0., 0., 0., 0.

91.000	0.	,	0.	,	0.	,	0.	,	0.	,
92.000	0.	,	0.	,	0.	,	0.	,	0.	,
93.000	0.	,	0.	,	0.	,	0.	,	0.	,
94.000	0.	,	0.	,	0.	,	0.	,	0.	,
95.000	0.	,	0.	,	0.	,	0.	,	0.	,
96.000	0.	,	0.	,	0.	,	0.	,	0.	,
97.000	0.	,	0.	,	0.	,	0.	,	0.	,
98.000	0.	,	0.	,	0.	,	0.	,	0.	,
99.000	0.	,	0.	,	0.	,	0.	,	0.	,
100.000	0.	,	0.	,	0.	,	0.	,	0.	,
101.000	0.	,	0.	,	0.	,	0.	,	0.	,
102.000	0.	,	0.	,	0.	,	0.	,	0.	,
103.000	0.	,	0.	,	0.	,	0.	,	0.	,
104.000	0.	,	0.	,	0.	,	0.	,	0.	,
105.000	0.	,	0.	,	0.	,	0.	,	0.	,
106.000	0.	,	0.	,	0.	,	0.	,	0.	,
107.000	0.	,	0.	,	0.	,	0.	,	0.	,
108.000	0.	,	0.	,	0.	,	0.	,	0.	,
109.000	0.	,	0.	,	0.	,	0.	,	0.	,
110.000	0.	,	0.	,	0.	,	0.	,	0.	,
111.000	0.	,	0.	,	0.	,	0.	,	0.	,
112.000	0.	,	0.	,	0.	,	0.	,	0.	,
113.000	0.	,	0.	,	0.	,	0.	,	0.	,
114.000	0.	,	0.	,	0.	,	0.	,	0.	,
115.000	0.	,	0.	,	0.	,	0.	,	0.	,
116.000	0.	,	0.	,	0.	,	0.	,	0.	,
117.000	0.	,	0.	,	0.	,	0.	,	0.	,
118.000	0.	,	0.	,	0.	,	0.	,	0.	,
119.000	0.	,	0.	,	0.	,	0.	,	0.	,
120.000	0.	,	0.	,	0.	,	0.	,	0.	,
121.000	0.	,	0.	,	0.	,	0.	,	0.	,
122.000	0.	,	0.	,	0.	,	0.	,	0.	,
123.000	0.	,	0.	,	0.	,	0.	,	0.	,
124.000	0.	,	0.	,	0.	,	0.	,	0.	,
125.000	0.	,	0.	,	0.	,	0.	,	0.	,
126.000	0.	,	0.	,	0.	,	0.	,	0.	,
127.000	0.	,	0.	,	0.	,	0.	,	0.	,
128.000	0.	,	0.	,	0.	,	0.	,	0.	,
129.000	0.	,	0.	,	0.	,	0.	,	0.	,
130.000	0.	,	0.	,	0.	,	0.	,	0.	,
131.000	0.	,	0.	,	0.	,	0.	,	0.	,
132.000	0.	,	0.	,	0.	,	0.	,	0.	,
133.000	0.	,	0.	,	-4.923E-10,	-3.452E-07,	2.539E-06,			
134.000	-3.295E-06,	4.331E-09,	0.	,	0.	,	0.	,	0.	,
135.000	0.	,	0.	,	0.	,	2.014E-06,	-2.356E-08,		
136.000	8.746E-09,	-8.075E-06,	4.569E-06,	3.891E-06,	6.772E-10,	8.033E-07,				
137.000	4.060E-08,	1.723E-06,	2.325E-06,	0.	0.	,	0.	,	0.	,
138.000	0.	,	0.	,	0.	,	0.	,	0.	,
139.000	0.	,	0.	,	0.	,	0.	,	0.	,
140.000	0.	,	0.	,	-3.820E-07,	2.107E-09,	-3.467E-08,			
141.000	2.529E-08,	-7.973E-07,	0.	,	0.	,	0.	,	0.	,
142.000	0.	,	0.	,	0.	,	-2.356E-08,	1.350E-07,		
143.000	3.797E-07,	1.066E-07,	-5.779E-08,	-2.685E-08,	-3.498E-06,	-3.746E-09,				
144.000	2.212E-06,	-1.308E-08,	-1.888E-03,	0.	0.	,	0.	,	0.	,
145.000	0.	,	0.	,	0.	,	0.	,	0.	,
146.000	0.	,	0.	,	0.	,	0.	,	0.	,
147.000	0.	,	0.	,	-1.237E-06,	1.122E-09,	1.565E-08,			
148.000	-3.628E-09,	-5.198E-06,	0.	,	0.	,	0.	,	0.	,
149.000	0.	,	0.	,	0.	,	8.746E-09,	3.797E-07,		
150.000	1.115E-06,	-4.195E-08,	2.283E-08,	5.237E-09,	-9.548E-06,	-6.353E-09,				
151.000	6.061E-06,	-6.187E-10,	5.420E-09,	0.	0.	,	0.	,	0.	,
152.000	0.	,	0.	,	0.	,	0.	,	0.	,
153.000	0.	,	0.	,	0.	,	-3.737E-10,	-7.123E-07,	-1.476E-05,	
154.000	0.	,	0.	,	0.	,	0.	,	0.	,
155.000	2.724E-06,	-1.999E-08,	0.	,	0.	,	0.	,	0.	,
156.000	0.	,	0.	,	0.	,	0.	,	0.	,
157.000	-4.195E-08,	4.247E-05,	-2.203E-05,	3.417E-07,	-8.075E-06,	1.066E-07,				
158.000	-1.951E-07,	-6.067E-07,	-3.412E-06,	0.	0.	,	0.	,	0.	,
159.000	0.	,	0.	,	0.	,	0.	,	0.	,
160.000	0.	,	0.	,	0.	,	0.	,	0.	,

161.000	0.	,	0.	,	0.	,	-7.363E-10	, -2.598E-07	, 7.295E-06
162.000	-1.197E-06	,	9.290E-09	, 0.	,	0.	,	0.	,
163.000	0.	,	0.	,	0.	,	4.569E-06	, -5.779E-08	,
164.000	2.283E-08	,	-2.203E-05	, 1.176E-05	, 3.262E-06	,	-1.431E-07	, -2.774E-07	,
165.000	1.064E-07	,	4.860E-07	, 1.393E-06	, 0.	,	0.	,	0.
166.000	0.	,	0.	,	0.	,	0.	,	0.
167.000	0.	,	0.	,	0.	,	0.	,	0.
168.000	0.	,	0.	,	0.	,	-4.531E-09	, -6.014E-06	, -3.550E-06
169.000	-3.001E-06	,	-9.630E-09	, 0.	,	0.	,	0.	,
170.000	0.	,	0.	,	0.	,	3.891E-06	, -2.685E-08	,
171.000	5.237E-09	,	3.417E-07	, 3.262E-06	, 3.514E-05	,	6.943E-07	, 1.429E-05	,
172.000	1.941E-08	,	4.186E-06	, -2.256E-07	, 0.	,	0.	,	0.
173.000	0.	,	0.	,	0.	,	0.	,	0.
174.000	0.	,	0.	,	0.	,	8.791E-06	, -1.360E-07	, -2.157E-07
175.000	0.	,	0.	,	0.	,	0.	,	0.
176.000	-3.335E-08	,	-2.116E-07	, 0.	,	0.	,	0.	,
177.000	0.	,	0.	,	0.	,	6.772E-10	, -3.498E-06	,
178.000	-9.548E-06	,	3.966E-07	, -1.431E-07	, 6.943E-07	,	9.314E-05	, 3.628E-07	,
179.000	-5.872E-05	,	9.675E-08	, -5.715E-08	, 0.	,	0.	,	0.
180.000	0.	,	0.	,	0.	,	0.	,	0.
181.000	0.	,	0.	,	0.	,	0.	,	0.
182.000	0.	,	0.	,	0.	,	3.103E-09	, -3.532E-06	, -3.170E-06
183.000	1.188E-05	,	-2.909E-09	, 0.	,	0.	,	0.	,
184.000	0.	,	0.	,	0.	,	8.033E-07	, -3.746E-09	,
185.000	-6.353E-09	,	3.299E-06	, -2.774E-07	, 1.429E-05	,	3.628E-07	, 6.982E-06	,
186.000	-3.936E-08	,	-4.356E-06	, -9.337E-06	, 0.	,	0.	,	0.
187.000	0.	,	0.	,	0.	,	0.	,	0.
188.000	0.	,	0.	,	0.	,	0.	,	0.
189.000	0.	,	0.	,	0.	,	-5.642E-06	, 7.196E-09	, 7.267E-08
190.000	-1.961E-08	,	-1.402E-06	, 0.	,	0.	,	0.	,
191.000	0.	,	0.	,	0.	,	4.060E-08	, 2.212E-06	,
192.000	6.061E-06	,	-1.951E-07	, 1.064E-07	, 1.941E-08	,	-5.872E-05	, -3.936E-08	,
193.000	3.704E-05	,	-5.049E-09	, 3.233E-08	, 0.	,	0.	,	0.
194.000	0.	,	0.	,	0.	,	0.	,	0.
195.000	0.	,	0.	,	0.	,	0.	,	0.
196.000	0.	,	0.	,	0.	,	1.666E-09	, 5.983E-06	, 3.866E-06
197.000	-8.364E-05	,	-9.229E-11	, 0.	,	0.	,	0.	,
198.000	0.	,	0.	,	0.	,	1.723E-06	, -1.308E-08	,
199.000	-6.187E-10	,	-6.067E-07	, 4.860E-07	, 4.1B6E-06	,	9.675E-08	, -4.356E-06	,
200.000	-5.049E-09	,	3.930E-05	, 5.806E-05	, 0.	,	0.	,	0.
201.000	0.	,	0.	,	0.	,	0.	,	0.
202.000	0.	,	0.	,	0.	,	0.	,	0.
203.000	0.	,	0.	,	0.	,	-6.046E-10	, 1.010E-05	, 7.286E-06
204.000	-1.247E-04	,	1.677E-08	, 0.	,	0.	,	0.	,
205.000	0.	,	0.	,	0.	,	0.	,	0.
206.000	5.420E-09	,	-3.412E-06	, 1.393E-06	, -2.256E-07	,	-5.715E-08	, -9.337E-06	,
207.000	3.233E-08	,	5.806E-05	, 8.709E-05	, 0.	,	0.	,	0.
208.000	0.	,	0.	,	0.	,	0.	,	0.
209.000	0.	,	0.	,	0.	,	0.	,	0.
210.000	0.	,	0.	,	0.	,	0.	,	0.
211.000	0.	,	0.	,	0.	,	0.	,	0.
212.000	0.	,	0.	,	0.	,	0.	,	0.
213.000	0.	,	0.	,	0.	,	0.	,	0.
214.000	0.	,	0.	,	0.	,	0.	,	0.
215.000	0.	,	0.	,	0.	,	0.	,	0.
216.000	0.	,	0.	,	0.	,	0.	,	0.
217.000	0.	,	0.	,	0.	,	0.	,	0.
218.000	0.	,	0.	,	0.	,	0.	,	0.
219.000	0.	,	0.	,	0.	,	0.	,	0.
220.000	0.	,	0.	,	0.	,	0.	,	0.
221.000	0.	,	0.	,	0.	,	0.	,	0.
222.000	0.	,	0.	,	0.	,	0.	,	0.
223.000	0.	,	0.	,	0.	,	0.	,	0.

224.000	0.	,	0.	,	0.	,	0.	,	0.	,
225.000	0.	,	0.	,	0.	,	0.	,	0.	,
226.000	0.	,	0.	,	0.	,	0.	,	0.	,
227.000	0.	,	0.	,	0.	,	0.	,	0.	,
228.000	0.	,	0.	,	0.	,	0.	,	0.	,
229.000	0.	,	0.	,	0.	,	0.	,	0.	,
230.000	0.	,	0.	,	0.	,	0.	,	0.	,
231.000	0.	,	0.	,	0.	,	0.	,	0.	,
232.000	0.	,	0.	,	0.	,	0.	,	0.	,
233.000	0.	,	0.	,	0.	,	0.	,	0.	,
234.000	0.	,	0.	,	0.	,	0.	,	0.	,
235.000	0.	,	0.	,	0.	,	0.	,	0.	,
236.000	0.	,	0.	,	0.	,	0.	,	0.	,
237.000	0.	,	0.	,	0.	,	0.	,	0.	,
238.000	0.	,	0.	,	0.	,	0.	,	0.	,
239.000	0.	,	0.	,	0.	,	0.	,	0.	,
240.000	0.	,	0.	,	0.	,	0.	,	0.	,
241.000	0.	,	0.	,	0.	,	0.	,	0.	,
242.000	0.	,	0.	,	0.	,	0.	,	0.	,
243.000	0.	,	0.	,	0.	,	0.	,	0.	,
244.000	0.	,	0.	,	0.	,	0.	,	0.	,
245.000	0.	,	0.	,	0.	,	0.	,	0.	,
246.000	0.	,	0.	,	0.	,	0.	,	0.	,
247.000	0.	,	0.	,	0.	,	0.	,	0.	,
248.000	0.	,	0.	,	0.	,	0.	,	0.	,
249.000	0.	,	0.	,	0.	,	0.	,	0.	,
250.000	0.	,	0.	,	0.	,	0.	,	0.	,
251.000	0.	,	0.	,	0.	,	0.	,	0.	,
252.000	0.	,	0.	,	0.	,	0.	,	0.	,
253.000	0.	,	0.	,	0.	,	0.	,	0.	,
254.000	0.	,	0.	,	0.	,	0.	,	0.	,
255.000	0.	,	0.	,	0.	,	0.	,	0.	,
256.000	0.	,	0.	,	0.	,	0.	,	0.	,
257.000	0.	,	0.	,	0.	,	0.	,	0.	,
258.000	0.	,	0.	,	0.	,	0.	,	0.	,
259.000	0.	,	0.	,	0.	,	0.	,	0.	,
260.000	0.	,	0.	,	0.	,	0.	,	0.	,
261.000	0.	,	0.	,	0.	,	0.	,	0.	,
262.000	0.	,	0.	,	0.	,	0.	,	0.	,
263.000	0.	,	0.	,	0.	,	0.	,	0.	,
264.000	0.	,	0.	,	0.	,	0.	,	0.	,
265.000	0.	,	0.	,	0.	,	0.	,	0.	,
266.000	0.	,	0.	,	0.	,	0.	,	0.	,
267.000	0.	,	0.	,	0.	,	0.	,	0.	,
268.000	0.	,	0.	,	0.	,	0.	,	0.	,
269.000	0.	,	0.	,	0.	,	0.	,	0.	,
270.000	0.	,	0.	,	0.	,	0.	,	0.	,
271.000	0.	,	0.	,	0.	,	0.	,	0.	,
272.000	0.	,	0.	,	0.	,	0.	,	0.	,
273.000	0.	,	0.	,	0.	,	0.	,	0.	,
274.000	0.	,	0.	,	0.	,	0.	,	0.	,
275.000	0.	,	0.	,	0.	,	0.	,	0.	,
276.000	0.	,	0.	,	0.	,	0.	,	0.	,
277.000	0.	,	0.	,	0.	,	0.	,	0.	,
278.000	0.	,	0.	,	0.	,	0.	,	0.	,
279.000	0.	,	0.	,	0.	,	0.	,	0.	,
280.000	0.	,	0.	,	0.	,	0.	,	0.	,
281.000	0.	,	0.	,	0.	,	0.	,	0.	,
282.000	0.	,	0.	,	0.	,	0.	,	0.	,
283.000	0.	,	0.	,	0.	,	0.	,	0.	,
284.000	0.	,	0.	,	0.	,	0.	,	0.	,
285.000	0.	,	0.	,	0.	,	0.	,	0.	,
286.000	0.	,	0.	,	0.	,	0.	,	0.	,

Data file CON52:DAT ... (4)

287.000 OMEGA (RAD/S/SEC)
 288.000 1.24349528468889490E-1,
 289.000 1.5117997270041770E-1,
 290.000 2.3952489001995300E-1,
 291.000 5.5629553169353050E-1,
 292.000 6.9020123559092970E-1,
 293.000 7.7963639163B21000E-1,
 294.000 1.5532815257B21910E-0,
 295.000 3.1368829630482690E-0,
 296.000 3.9572089569016590E-0,
 297.000 9.9489251639172970E-0,
 298.000 1.4008315775600510E+1,
 299.000 NU,NG,NT
 300.000 13,2,B,
 301.000 BH : (NR+NF) X NU
 302.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 303.000 -8.410E-3,-8.410E-3,-8.410E-3,-8.410E-3,-8.410E-3,-8.410E-3,
 304.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 305.000 1.457E-2,-1.457E-2,-1.457E-2, 1.457E-2, 1.457E-2,-1.457E-2,
 306.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 307.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 308.000 9.094E-4, 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 309.000 -5.729E-3, 5.729E-3,-2.869E-2, 2.869E-2, 2.869E-2,-2.869E-2,
 310.000 -3.859E-7, 1.047E-3, 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 311.000 -3.806E-3,-3.811E-3,-1.906E-2,-1.906E-2, 1.906E-2, 1.906E-2,-1.906E-2,
 312.000 -9.257E-7, 7.331E-4, 2.003E-3, 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 313.000 7.133E-3,-1.027E-2, 9.299E-3, 9.284E-3,-9.299E-3,-9.284E-3,
 314.000 -9.174E-8, 1.210E-4, 1.441E-4, 6.944E-3, 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 315.000 -4.112E-5,-1.293E-3,-2.675E-4,-2.702E-4, 2.675E-4, 2.702E-4,-2.702E-4,
 316.000 -4.708E-5, 1.119E-7, 2.213E-7, 6.791E-8, 6.921E-3,-8.075E-4, 8.081E-4,
 317.000 8.094E-4,-8.100E-4, 9.735E-4,-9.725E-4,-9.735E-4, 9.725E-4,
 318.000 -8.282E-7,-5.856E-4, 1.157E-3,-5.553E-4,-2.199E-6, 6.530E-3,-3.478E-3,
 319.000 3.488E-3,-6.539E-3,-4.826E-2,-4.783E-2, 4.826E-2, 4.783E-2,
 320.000 -3.625E-4, 3.905E-6,-1.515E-5, 5.403E-6,-6.851E-4, 1.044E-3,-1.055E-3,
 321.000 -1.175E-3, 1.186E-3,-5.105E-2, 5.178E-2, 5.105E-2,-5.178E-2,
 322.000 -9.888E-4, 2.133E-7, 5.812E-6,-1.500E-6,-2.577E-3,-3.368E-3, 3.370E-3,
 323.000 3.419E-3,-3.421E-3,-1.087E-1, 1.085E-1, 1.087E-1,-1.085E-1,
 324.000 8.859E-7,-3.964E-4,-5.932E-3, 8.518E-4, 1.731E-6,-2.485E-2, 2.639E-2,
 325.000 -2.653E-2, 2.499E-2, 5.095E-2, 5.079E-2,-5.095E-2,-5.079E-2,
 326.000 -1.407E-6,-3.743E-4, 3.110E-3, 1.688E-5,-8.184E-7, 1.358E-2,-1.328E-2,
 327.000 1.336E-2,-1.365E-2,-4.925E-2,-4.909E-2, 4.925E-2, 4.909E-2,
 328.000 -4.329E-6,-5.918E-3, 2.746E-4, 4.838E-3,-2.422E-6,-6.475E-4,-3.014E-3,
 329.000 3.025E-3, 6.358E-4,-2.410E-1,-2.413E-1, 2.418E-1, 2.413E-1,
 330.000 9.650E-3,-1.270E-4,-4.746E-5, 8.906E-5,-2.665E-3, 4.183E-3,-4.251E-3,
 331.000 -4.594E-3, 4.662E-3, 2.639E-1,-2.724E-1,-2.639E-1, 2.724E-1,
 332.000 3.582E-6,-2.459E-3,-2.900E-4,-1.641E-2,-3.707E-6,-1.505E-3, 9.903E-4,
 333.000 -1.007E-3, 1.521E-3, 3.403E-1, 3.403E-1,-3.403E-1,-3.403E-1,
 334.000 -6.085E-3,-2.712E-6, 2.644E-5, 9.890E-6,-5.304E-3,-1.833E-3, 1.826E-3,
 335.000 2.062E-3,-2.055E-3,-4.154E-1, 4.144E-1, 4.154E-1,-4.144E-1,
 336.000 1.817E-6,-5.308E-4,-1.342E-4, 1.197E-1,-9.102E-7,-5.342E-4, 6.243E-4,
 337.000 -6.283E-4, 5.383E-4,-2.861E-0,-2.862E-0, 2.861E-0, 2.862E-0,
 338.000 -1.854E-6, 3.178E-4, 8.974E-5, 1.803E-1, 2.451E-4, 3.438E-4,-3.829E-4,
 339.000 4.334E-4,-3.943E-4,-4.259E-0,-4.278E-0, 4.259E-0, 4.278E-0,
 340.000 CH (DE) :NF X NF
 341.000 1.846E-3,-5.509E-6, 2.519E-6,-1.700E-3, 1.237E-3, 3.255E-3,
 342.000 4.718E-5, 1.500E-3, 1.057E-5,-1.173E-3,-2.607E-3,
 343.000 -5.509E-6, 1.706E-3, 3.644E-4, 2.246E-5,-1.446E-5,-2.771E-5,
 344.000 -3.210E-3,-1.495E-5, 2.151E-3, 1.330E-5, 2.564E-5,
 345.000 2.519E-6, 3.644E-4, 3.409E-3,-6.900E-6, 5.243E-6, 1.146E-5,
 346.000 -8.921E-3, 7.907E-8, 6.351E-3,-7.460E-6,-3.086E-5,
 347.000 -1.700E-3, 2.246E-5,-6.900E-6, 1.711E-2,-6.647E-3,-4.585E-3,
 348.000 -2.764E-5,-1.707E-3,-2.617E-5, 4.837E-3, 8.077E-3,
 349.000 1.237E-3,-1.446E-5, 5.243E-6,-6.647E-3, 1.109E-2, 5.880E-3,
 350.000 7.188E-5, 2.124E-3, 2.508E-5,-2.683E-4,-1.308E-3,
 351.000 3.255E-3,-2.771E-5, 1.146E-5,-4.585E-3, 5.880E-3, 4.215E-2,
 352.000 6.426E-4, 1.163E-2, 7.470E-5, 2.760E-2, 3.694E-2,
 353.000 4.718E-5,-3.210E-3,-8.921E-3,-2.764E-5, 7.188E-5, 6.426E-4,
 354.000 1.501E-1, 3.174E-4,-8.721E-2, 5.814E-4, 6.131E-4,
 355.000 1.500E-3,-1.495E-5, 7.907E-8,-1.707E-3, 2.124E-3, 1.163E-2,
 356.000 3.174E-4, 5.610E-2,-2.360E-5,-1.229E-1,-1.896E-1,
 357.000 1.057E-5, 2.151E-3, 6.351E-3,-2.617E-5, 2.508E-5, 7.470E-5,
 358.000 -8.721E-2,-2.360E-5, 1.056E-1, 6.325E-5,-1.322E-4,
 359.000 -1.173E-3, 1.330E-5,-7.460E-6, 4.837E-3,-2.683E-4, 2.760E-2,
 360.000 5.814E-4,-1.229E-1, 6.325E-5, 1.055E-0, 1.446E-0
 361.000 -2.607E-3, 2.564E-5,-3.086E-5, 8.077E-3,-1.308E-3, 3.694E-2,
 362.000 6.131E-4,-1.896E-1,-1.322E-4, 1.446E-0, 2.342E-0

Command file FDCSIM:CMD

```
1.000 !ECHO
2.000 !COPY FDCSIM:EVL OVER *TEMP
3.000 !EINIT
3.500 MERGE RICQ:OP2 INTO *TEMP,10000
4.000 MERGE DECOBR:OP2 INTO *TEMP,20000
5.000 E
6.000 !SET F$1 *TEMP
7.000 !SET F$3 FDCSIM:DAT
8.000 !SET F$2 FDCSIM:OUT
9.000 !START FDCSIM:TSK
```

Data file FDCSIM:DAT

```
2.000 16, 0.0, 'IDIST'
3.000 9, 0.0, 'IDBUG'
4.000 2, 0.2, 'TEND'
5.000 3, 0.05, 'DT'
6.000 8, 1.0, 'INT - R.K.'
7.000 5, 20.0, 'NPSTEP'
8.000 90, 0.1, 'I/C'
9.000 91, 0.1,
10.000 93, 0.1,
11.000 94, 0.1,
12.000 95, 0.1,
13.000 96, 0.1,
14.000 97, 0.1,
15.000 0, 0.0, 'END OF VC CHANGES'
16.000 0, 0, 0.0, 'END OF BH CHANGES'
17.000 0, 0, 0.0, 'END OF CH CHANGES'
18.000 0, 0.0, 'END OF OMEGA CHANGES'
```

15.000 B, 11, 13, 11
 16.000 EVALUATION MODEL FOR M-SAT
 17.000 RH !(NR+NF) X NI
 18.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 8.410E-3, 8.410E-3,
 19.000 -8.410E-3,-8.410E-3, 8.410E-3, 8.410E-3,-8.410E-3,-8.410E-3,
 20.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,-1.457E-2, 1.457E-2,
 21.000 1.457E-2,-1.457E-2,-1.457E-2, 1.457E-2, 1.457E-2,-1.457E-2,
 22.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 23.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 24.000 9.094E-4, 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 5.729E-3,-5.729E-3,
 25.000 -5.729E-3, 5.729E-3,-2.869E-2, 2.869E-2, 2.869E-2,-2.869E-2,
 26.000 -3.859E-7, 1.047E-3, 0.0 , 0.0 , 0.0 , 0.0 , 3.806E-3, 3.811E-3,
 27.000 -3.806E-3,-3.811E-3,-1.906E-2,-1.908E-2, 1.906E-2, 1.908E-2,
 28.000 -9.257E-7, 7.331E-4, 2.003E-3, 0.0 , 0.0 , 0.0 , 1.022E-2,-7.078E-3,
 29.000 7.133E-3,-1.027E-2, 9.299E-3, 9.284E-3,-9.299E-3,-9.284E-3,
 30.000 -9.174E-8, 1.210E-4, 1.441E-4, 6.944E-3, 0.0 , 0.0 , 1.209E-3, 4.539E-5,
 31.000 -4.112E-5,-1.293E-3,-2.675E-4,-2.702E-4, 2.675E-4, 2.702E-4,
 32.000 -4.708E-5, 1.119E-7, 2.213E-7, 6.791E-8, 6.921E-3,-8.075E-4, 8.081E-4,
 33.000 8.094E-4,-8.100E-4, 9.735E-4,-9.725E-4,-9.735E-4, 9.725E-4,
 34.000 -8.282E-7,-5.856E-4, 1.157E-3,-5.553E-4,-2.199E-6, 6.530E-3,-3.478E-3,
 35.000 3.488E-3,-6.539E-3,-4.826E-2,-4.783E-2, 4.826E-2, 4.783E-2,
 36.000 -3.625E-4, 3.905E-6,-1.515E-5, 5.403E-6,-6.851E-4, 1.044E-3,-1.055E-3,
 37.000 -1.175E-3, 1.186E-3,-5.105E-2, 5.178E-2, 5.105E-2,-5.178E-2,
 38.000 -9.888E-4, 2.133E-7, 5.812E-6,-1.500E-6,-2.577E-3,-3.368E-3, 3.370E-3,
 39.000 3.419E-3,-3.421E-3,-1.087E-1, 1.085E-1, 1.087E-1,-1.085E-1,
 40.000 8.859E-7,-3.964E-4,-5.932E-3, 8.516E-4, 1.731E-6,-2.485E-2, 2.639E-2,
 41.000 -2.653E-2, 2.499E-2, 5.095E-2, 5.079E-2,-5.095E-2,-5.079E-2,
 42.000 -1.407E-6,-3.743E-4, 3.110E-3, 1.688E-5,-8.184E-7, 1.358E-2,-1.328E-2,
 43.000 1.336E-2,-1.365E-2,-4.925E-2,-4.909E-2, 4.925E-2, 4.909E-2
 44.000 -4.329E-6,-5.918E-3, 2.746E-4, 4.838E-3,-2.422E-6,-6.475E-4,-3.014E-3,
 45.000 3.025E-3, 6.358E-4,-2.418E-1,-2.413E-1, 2.418E-1, 2.413E-1,
 46.000 9.650E-3,-1.270E-4,-4.746E-5, 8.906E-5,-2.665E-3, 4.163E-3,-4.251E-3,
 47.000 -4.594E-3, 4.662E-3, 2.639E-1,-2.724E-1,-2.639E-1, 2.724E-1,
 48.000 3.582E-6,-2.459E-3,-2.900E-4,-1.641E-2,-3.707E-6,-1.505E-3, 9.903E-4,
 49.000 -1.007E-3, 1.521E-3, 3.403E-1, 3.403E-1,-3.403E-1,-3.403E-1,
 50.000 -6.085E-3, 2.712E-6, 2.644E-5, 9.890E-6,-5.304E-3,-1.833E-3, 1.826E-3,
 51.000 2.062E-3,-2.055E-3,-4.154E-1, 4.144E-1, 4.154E-1,-4.144E-1,
 52.000 1.817E-6,-5.5308E-4,-1.342E-4, 1.197E-1,-9.102E-7,-5.342E-4, 6.243E-4,
 53.000 -6.282E-4, 5.383E-4,-2.861E-0,-2.862E-0, 2.861E-0, 2.862E-0,
 54.000 -1.854E-6, 3.178E-4, 8.974E-5, 1.803E-1, 2.451E-4, 3.438E-4,-3.829E-4,
 55.000 4.334E-4,-3.943E-4,-4.259E-0,-4.278E-0, 4.259E-0, 4.278E-0,
 55.500 CH (DE) !NF X NF
 57.000 1.846E-3,-5.509E-6, 2.519E-6,-1.700E-3, 1.237E-3, 3.255E-3,
 58.000 4.718E-5, 1.500E-3, 1.057E-5,-1.173E-3,-2.607E-3,
 59.000 -5.509E-6, 1.706E-3, 3.644E-4,-2.246E-5,-1.446E-5,-2.771E-5,
 60.000 -3.210E-3,-1.495E-5, 2.151E-3, 1.330E-5, 2.564E-5,
 61.000 2.519E-6, 3.644E-4, 3.409E-3,-6.900E-6, 5.243E-6, 1.146E-5,
 62.000 -8.921E-3, 7.907E-8, 6.351E-3,-7.460E-6,-3.086E-5,
 63.000 -1.700E-3, 2.246E-5,-6.900E-6, 1.711E-2,-6.647E-3,-4.585E-3,
 64.000 -2.764E-5,-1.707E-3,-2.617E-5, 4.837E-3, 8.077E-3,
 65.000 1.237E-3,-1.446E-5, 5.243E-6,-6.647E-3, 1.109E-2,-5.880E-3,
 66.000 7.188E-5, 2.124E-3, 2.508E-5,-2.683E-4,-1.308E-3,
 67.000 3.255E-3,-2.771E-5, 1.146E-5,-4.585E-3, 5.880E-3, 4.215E-2,
 68.000 6.426E-4, 1.163E-2, 7.470E-5, 2.760E-2, 3.694E-2,
 69.000 4.718E-5,-3.210E-3,-8.921E-3,-2.764E-5, 7.188E-5, 6.426E-4,
 70.000 1.501E-1, 3.174E-4,-8.721E-2, 5.814E-4, 6.131E-4,
 71.000 1.500E-3,-1.495E-5, 7.907E-8,-1.707E-3, 2.124E-3, 1.163E-2,
 72.000 3.174E-4, 5.610E-2,-2.360E-5,-1.229E-1,-1.896E-1,
 73.000 1.057E-5, 2.151E-3, 6.351E-3,-2.617E-5, 2.508E-5, 7.470E-5,
 74.000 -8.721E-2,-2.360E-5, 1.056E-1, 6.325E-5,-1.322E-4,
 75.000 -1.173E-3, 1.330E-5,-7.460E-6, 4.837E-3,-2.683E-4, 2.760E-2,
 76.000 5.814E-4,-1.229E-1, 6.325E-5, 1.055E-0, 1.446E-0
 77.000 -2.607E-3, 2.564E-5,-3.086E-5, 8.077E-3,-1.308E-3, 3.694E-2,
 78.000 6.131E-4,-1.896E-1,-1.322E-4, 1.446E-0, 2.342E-0

170.000
 171.000 OMEGA (RAD/SEC) :NF X 1
 172.000 1.2434952868889490E-1
 173.000 1.5117997270041770E-1
 174.000 2.3952489001995300E-1
 175.000 5.5629553169353050E-1
 176.000 6.9020123559092970E-1
 177.000 7.7963639163821000E-1
 178.000 1.5532815257821910E-0
 179.000 3.1368829630482690E-0
 180.000 3.9572089569016590E-0
 181.000 9.9489251639172970E-0
 182.000 1.4008315775600510E+1
 185.000
 186.000 SOLAR PRESSURE DATA
 187.000 152.1, 1418.6, 43.24, 0.5, 0.5, 0.5,
 188.000 27.45, -0.1, -0.8, -0.036, 0.057,
 189.000 27.45, 1.7, -23.5, -41.8,
 189.500
 190.000 T-MATRIX (E-MATRIX) :14 X (NR+NF)
 191.000 1, 1, 1.682E-2
 192.000 2, 2, 1.682E-2
 193.000 3, 3, 1.682E-2
 194.000 2, 4, -6.615E-3
 195.000 3, 4, 9.961E-4
 196.000 4, 4, 9.094E-4
 197.000 1, 5, 7.617E-3
 198.000 2, 5, 2.807E-6
 199.000 3, 5, -1.348E-5
 200.000 4, 5, -3.859E-7
 201.000 5, 5, 1.047E-3
 202.000 1, 6, 3.139E-3
 203.000 2, 6, 3.172E-5
 204.000 3, 6, -1.016E-5
 205.000 4, 6, -9.257E-7
 206.000 5, 6, 7.331E-4
 207.000 6, 6, 2.003E-3
 208.000 1, 7, 1.334E-3
 209.000 2, 7, 2.464E-6
 210.000 3, 7, -1.609E-6
 211.000 4, 7, -9.174E-8
 212.000 5, 7, 1.210E-4
 213.000 6, 7, 1.441E-4
 214.000 7, 7, 6.944E-3
 215.000 1, 8, 5.777E-7
 216.000 2, 8, 9.338E-4
 217.000 3, 8, -2.016E-4
 218.000 4, 8, -4.708E-5
 219.000 5, 8, 1.119E-7
 220.000 6, 8, 2.213E-7
 221.000 7, 8, 6.791E-8
 222.000 8, 8, 6.921E-3
 223.000 1, 9, 3.051E-3
 224.000 2, 9, 5.393E-6
 225.000 3, 9, 3.738E-5
 226.000 4, 9, -8.282E-7
 227.000 5, 9, -5.856E-4
 228.000 6, 9, 1.157E-3
 229.000 7, 9, -5.553E-4
 230.000 8, 9, -2.199E-6
 231.000 9, 9, -7.672E-2
 232.000 10, 9, -1.057E-4
 233.000 11, 9, 9.647E-5
 234.000 12, 9, 4.200E-6
 235.000 13, 9, 5.736E-5
 236.000 14, 9, 3.335E-3

237.000	1,11, 1.986E-6
238.000	2,11, 3.920E-3
239.000	3,11, 4.209E-3
240.000	4,11,-9.888E-4
241.000	5,11, 2.133E-7
242.000	6,11, 5.812E-6
243.000	7,11,-1.500E-6
244.000	8,11,-2.577E-3
245.000	9,11,-1.386E-4
246.000	10,11,-2.193E-2
247.000	11,11, 7.066E-2
248.000	12,11, 3.425E-3
249.000	13,11, 1.776E-6
250.000	14,11, 8.002E-6
251.000	1,12, 1.541E-3
252.000	2,12,-8.289E-5
253.000	3,12,-5.252E-6
254.000	4,12, 8.859E-7
255.000	5,12,-3.964E-4
256.000	6,12,-5.932E-3
257.000	7,12, 8.518E-4
258.000	8,12, 1.731E-6
259.000	9,12, 1.218E-1
260.000	10,12,-5.374E-5
261.000	11,12,-4.218E-5
262.000	12,12,-2.497E-6
263.000	13,12,-1.050E-3
264.000	14,12,-6.323E-3
265.000	1,14,-3.661E-3
266.000	2,14, 6.760E-6
267.000	3,14, 6.496E-5
268.000	4,14,-4.329E-6
269.000	5,14,-5.918E-3
270.000	6,14, 2.746E-4
271.000	7,14, 4.838E-3
272.000	8,14,-2.422E-6
273.000	9,14,-2.709E-1
274.000	10,14,-1.934E-4
275.000	11,14, 1.590E-4
276.000	12,14, 6.796E-6
277.000	13,14,-1.114E-2
278.000	14,14,-6.592E-4
279.000	1,10,-1.135E-5
280.000	2,10,-1.287E-3
281.000	3,10, 5.527E-3
282.000	4,10,-3.625E-4
283.000	5,10, 3.905E-6
284.000	6,10,-1.515E-5
285.000	7,10, 5.403E-6
286.000	8,10,-6.851E-4
287.000	9,10, 6.574E-4
288.000	10,10,-2.616E-2
289.000	11,10, 2.728E-2
290.000	12,10, 1.211E-3
291.000	13,10,-2.287E-6
292.000	14,10,-3.071E-5
293.000	1,13, 2.933E-4
294.000	2,13, 4.152E-5
295.000	3,13, 1.037E-5
296.000	4,13,-1.407E-6
297.000	5,13,-3.743E-4
298.000	6,13, 3.110E-3
299.000	7,13, 1.688E-5
300.000	8,13,-8.184E-7
301.000	9,13,-9.070E-2
302.000	10,13,-2.032E-5

Data file FDCCSIM:EVL ... (3)

303.000	11,13, 4.595E-5
304.000	12,13, 2.209E-6
305.000	13,13,-5.249E-4
306.000	14,13, 3.207E-3
307.000	1,15,-6.865E-5
308.000	2,15,-5.107E-3
309.000	3,15,-6.523E-4
310.000	4,15, 9.650E-3
311.000	5,15,-1.270E-4
312.000	6,15,-4.746E-5
313.000	7,15, 8.906E-5
314.000	8,15,-2.665E-3
315.000	9,15,-4.319E-3
316.000	10,15, 4.341E-1
317.000	11,15,-2.046E-1
318.000	12,15,-7.090E-3
319.000	13,15,-2.104E-4
320.000	14,15,-3.270E-5
321.000	1,16,-5.147E-4
322.000	2,16,-9.540E-6
323.000	3,16, 7.605E-6
324.000	4,16, 3.582E-6
325.000	5,16,-2.459E-3
326.000	6,16,-2.900E-4
327.000	7,16,-1.641E-2
328.000	8,16,-3.707E-6
329.000	9,16,-1.008E-1
330.000	10,16, 1.553E-4
331.000	11,16,-6.829E-5
332.000	12,16, 9.175E-8
333.000	13,16, 1.367E-2
334.000	14,16,-3.466E-3
335.000	1,17,-7.681E-6
336.000	2,17, 2.245E-3
337.000	3,17, 5.077E-4
338.000	4,17,-6.085E-3
339.000	5,17, 2.712E-6
340.000	6,17, 2.644E-5
341.000	7,17, 9.890E-6
342.000	8,17,-5.304E-3
343.000	9,17,-5.008E-4
344.000	10,17,-2.652E-1
345.000	11,17, 1.337E-1
346.000	12,17, 1.134E-2
347.000	13,17,-8.302E-6
348.000	14,17, 2.847E-5
349.000	1,18, 9.009E-5
350.000	2,18,-2.352E-6
351.000	3,18, 1.096E-6
352.000	4,18, 1.817E-6
353.000	5,18,-5.308E-4
354.000	6,18,-1.342E-4
355.000	7,18, 1.197E-1
356.000	8,18,-9.102E-7
357.000	9,18,-2.117E-2
358.000	10,18, 7.903E-5
359.000	11,18,-3.800E-5
360.000	12,18,-8.927E-7
361.000	13,18,-1.178E-1
362.000	14,18, 2.352E-2
363.000	1,19,-3.916E-5
364.000	2,19, 2.916E-5
365.000	3,19, 5.202E-6
366.000	4,19,-1.854E-6
367.000	5,19, 3.178E-4
368.000	6,19, 8.974E-5
369.000	7,19, 1.803E-1
370.000	8,19, 2.451E-4
371.000	9,19, 1.470E-2
372.000	10,19,-1.073E-5
373.000	11,19, 6.639E-5
374.000	12,19,-2.431E-4
375.000	13,19,-1.769E-1
376.000	14,19, 3.307E-2
377.000	0, 0, 0.0

Data file FDCSIM:EVL ... (4)

Command file DECOBR:CMD

```
1.000 !SET F$1 DECOBR:DAT
2.000 !SET F$2 DECOBR:OUT
3.000 !SET F$4 DECOBR:OP2
4.000 !START DECOBR:TSK
```

Data file DECOBR:DAT ... (1)

```
10.000 IC,IPRT,IDEBUG,ND3,X1,X2 (DECOBR DATA - PRODUCES DECMATS)
11.000 1, 1, 1, 1, 20.0, 20.0
12.000 ME,NU,NUOBS,NR,NF
13.000 6, 13, 10, 8, 11
13.500 NRC, NNRC()
13.600 7, 1, 2, 4, 5, 6, 7, 8
14.000 NEC,NNEC()
15.000 4, 1, 3, 4, 6
16.000 NER, NF, NNP()
17.000 7, 3, 2,5,7
18.000 RER,CER (MUST BE REAL OR COMPLEX CONJ PAIRS)
19.000 14
20.000 -0.2700, 0.1308
21.000 -0.2700,-0.1308
22.000 -0.2700, 0.1308
23.000 -0.2700,-0.1308
24.000 -0.2700, 0.1308
25.000 -0.2700,-0.1308
26.000 -0.2700, 0.1308
27.000 -0.2700,-0.1308
28.000 -0.2700, 0.1308
29.000 -0.2700,-0.1308
30.000 -0.2700, 0.1308
31.000 -0.2700,-0.1308
32.000 -0.2700, 0.1308
33.000 -0.2700,-0.1308
34.000 REF,CEF (MUST BE REAL OR COMPLEX CONJ PAIRS)
35.000 8
36.000 -0.2700, 0.1308
37.000 -0.2700,-0.1308
38.000 -0.2700, 0.1308
39.000 -0.2700,-0.1308
40.000 -0.2700, 0.1308
41.000 -0.2700,-0.1308
42.000 -0.2700, 0.1308
43.000 -0.2700,-0.1308
44.000 OMEGA (RAD/S/SEC)
45.000 1.2434952868889490E-1
46.000 1.5117997270041770E-1
47.000 2.3952489001995300E-1
48.000 5.5629553169353050E-1
49.000 6.9020123559092970E-1
50.000 7.7963639163821000E-1
51.000 1.5532815257821910E-0
52.000 3.1368829630482690E-0
53.000 3.9572089569016590E-0
54.000 9.9489251639172970E-0
55.000 1.4008315775600510E+1
```

56.000 ZETA
 57.000 7.423E-3, 5.642E-3, 7.116E-3, 1.538E-2, 8.034E-3, 2.703E-2,
 58.000 4.832E-2, 8.942E-3, 1.334E-2, 5.302E-2, 8.359E-2
 59.000 RH : (NRC+NEC+NER) X NU
 60.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 61.000 -8.410E-3,-8.410E-3, 8.410E-3, 8.410E-3,-8.410E-3,-8.410E-3,
 62.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 63.000 1.457E-2,-1.457E-2,-1.457E-2, 1.457E-2, 1.457E-2,-1.457E-2,
 64.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 65.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 66.000 9.094E-4, 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 67.000 -5.729E-3, 5.729E-3,-2.869E-2, 2.869E-2, 2.869E-2,-2.869E-2,
 68.000 -3.859E-7, 1.047E-3, 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 69.000 -3.806E-3,-3.811E-3,-1.906E-2,-1.908E-2, 1.906E-2, 1.908E-2,
 70.000 -9.257E-7, 7.331E-4, 2.003E-3, 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 71.000 7.133E-3,-1.027E-2, 9.299E-3, 9.284E-3,-9.299E-3,-9.284E-3,
 72.000 -9.174E-8, 1.210E-4, 1.441E-4, 6.944E-3, 0.0 , 0.0 , 1.289E-3, 4.539E-5,
 73.000 -4.112E-5,-1.293E-3,-2.675E-4,-2.702E-4, 2.675E-4, 2.702E-4,
 74.000 -4.708E-5, 1.119E-7, 2.213E-7, 6.791E-8, 6.921E-3,-8.075E-4, 8.081E-4,
 75.000 8.094E-4,-8.100E-4, 9.735E-4,-9.725E-4,-9.735E-4, 9.725E-4,
 76.000 -8.282E-7,-5.856E-4, 1.157E-3,-5.553E-4,-2.199E-6, 6.530E-3,-3.478E-3,
 77.000 3.488E-3,-6.539E-3,-4.826E-2,-4.783E-2, 4.826E-2, 4.783E-2,
 78.000 -3.625E-4, 3.905E-6,-1.515E-5, 5.403E-6,-6.851E-4, 1.044E-3,-1.055E-3,
 79.000 -1.175E-3, 1.186E-3,-5.105E-2, 5.178E-2, 5.105E-2,-5.178E-2,
 80.000 -9.888E-4, 2.133E-7, 5.812E-6,-1.500E-6,-2.577E-3,-3.368E-3, 3.370E-3,
 81.000 3.419E-3,-3.421E-3,-1.087E-1, 1.085E-1, 1.087E-1,-1.085E-1,
 82.000 8.859E-7,-3.964E-4,-5.932E-3, 8.510E-4, 1.731E-6,-2.485E-2, 2.639E-2,
 83.000 -2.653E-2, 2.499E-2, 5.095E-2, 5.079E-2,-5.095E-2,-5.079E-2,
 84.000 -1.407E-6,-3.743E-4, 3.110E-3, 1.688E-5,-8.184E-7, 1.358E-2,-1.328E-2,
 85.000 1.336E-2,-1.365E-2,-4.925E-2,-4.909E-2, 4.925E-2, 4.909E-2
 86.000 -4.329E-6,-5.918E-3, 2.746E-4, 4.838E-3,-2.422E-6,-6.475E-4,-3.014E-3,
 87.000 3.025E-3, 6.358E-4,-2.418E-1,-2.413E-1, 2.418E-1, 2.413E-1,
 88.000 9.650E-3,-1.270E-4,-4.746E-5, 8.906E-5,-2.665E-3, 4.183E-3,-4.251E-3,
 89.000 -4.594E-3, 4.662E-3, 2.639E-1,-2.724E-1,-2.639E-1, 2.724E-1,
 90.000 3.582E-6,-2.459E-3,-2.900E-4,-1.641E-2,-3.707E-6,-1.505E-3, 9.903E-4,
 91.000 -1.007E-3, 1.521E-3, 3.403E-1, 3.403E-1,-3.403E-1,-3.403E-1,
 92.000 -6.085E-3, 2.712E-6, 2.644E-5, 9.890E-6,-5.304E-3,-1.833E-3, 1.826E-3,
 93.000 2.062E-3,-2.055E-3,-4.154E-1, 4.144E-1, 4.154E-1,-4.144E-1,
 94.000 1.817E-6,-5.308E-4,-1.342E-4, 1.197E-1,-9.102E-7,-5.342E-4, 6.243E-4,
 95.000 -6.283E-4, 5.383E-4,-2.861E-0,-2.862E-0, 2.861E-0, 2.862E-0,
 96.000 -1.854E-6, 3.178E-4, 8.974E-5, 1.803E-1, 2.451E-4, 3.438E-4,-3.829E-4,
 97.000 4.334E-4,-3.943E-4,-4.259E-0,-4.278E-0, 4.259E-0, 4.278E-0,
 98.000 T-MATRIX (E-MATRIX) :14 X (NR+NEC+NER)
 99.000 14, 19

100.000 1, 1, 1.682E-2
 101.000 2, 2, 1.682E-2
 102.000 3, 3, 1.682E-2
 103.000 2, 4,-6.615E-3
 104.000 3, 4, 9.961E-4
 105.000 4, 4, 9.094E-4
 106.000 1, 5, 7.617E-3
 107.000 2, 5, 2.807E-6
 108.000 3, 5,-1.348E-5
 109.000 4, 5,-3.859E-7
 110.000 5, 5, 1.047E-3
 111.000 1, 6, 3.139E-3
 112.000 2, 6, 3.172E-5
 113.000 3, 6,-1.016E-5
 114.000 4, 6,-9.257E-7
 115.000 5, 6, 7.331E-4
 116.000 6, 6, 2.003E-3
 117.000 1, 7, 1.334E-3
 118.000 2, 7, 2.464E-6
 119.000 3, 7,-1.609E-6
 120.000 4, 7,-9.174E-8
 121.000 5, 7, 1.210E-4
 122.000 6, 7, 1.441E-4
 123.000 7, 7, 6.944E-3
 124.000 1, 8, 5.777E-7
 125.000 2, 8, 9.338E-4
 126.000 3, 8,-2.016E-4
 127.000 4, 8,-4.708E-5
 128.000 5, 8, 1.119E-7
 129.000 6, 8, 2.213E-7
 130.000 7, 8, 6.791E-8
 131.000 8, 8, 6.921E-3

132.000	1, 9, 3.051E-3
133.000	2, 9, 5.393E-6
134.000	3, 9, 3.738E-5
135.000	4, 9,-8.282E-7
136.000	5, 9,-5.856E-4
137.000	6, 9, 1.157E-3
138.000	7, 9,-5.553E-4
139.000	8, 9,-2.199E-6
140.000	9, 9,-7.672E-2
141.000	10, 9,-1.057E-4
142.000	11, 9, 9.647E-5
143.000	12, 9, 4.200E-6
144.000	13, 9, 5.736E-5
145.000	14, 9, 3.335E-3
146.000	1,11, 1.986E-6
147.000	2,11, 3.920E-3
148.000	3,11, 4.209E-3
149.000	4,11,-9.888E-4
150.000	5,11, 2.133E-7
151.000	6,11, 5.812E-6
152.000	7,11,-1.500E-6
153.000	8,11,-2.577E-3
154.000	9,11,-1.386E-4
155.000	10,11,-2.193E-2
156.000	11,11, 7.066E-2
157.000	12,11, 3.425E-3
158.000	13,11, 1.776E-6
159.000	14,11, 8.002E-6
160.000	1,12, 1.541E-3
161.000	2,12,-8.289E-5
162.000	3,12,-5.252E-6
163.000	4,12, 8.859E-7
164.000	5,12,-3.944E-4
165.000	6,12,-5.932E-3
166.000	7,12, 8.518E-4
167.000	8,12, 1.731E-6
168.000	9,12, 1.218E-1
169.000	10,12,-5.374E-5
170.000	11,12,-4.218E-5
171.000	12,12,-2.497E-6
172.000	13,12,-1.050E-3
173.000	14,12,-6.323E-3
174.000	1,14,-3.661E-3
175.000	2,14, 6.760E-6
176.000	3,14, 6.496E-5
177.000	4,14,-4.329E-6
178.000	5,14,-5.918E-3
179.000	6,14, 2.746E-4
180.000	7,14, 4.838E-3
181.000	8,14,-2.422E-6
182.000	9,14,-2.709E-1
183.000	10,14,-1.934E-4
184.000	11,14, 1.590E-4
185.000	12,14, 6.796E-6
186.000	13,14,-1.114E-2
187.000	14,14,-6.592E-4
188.000	1,10,-1.135E-5
189.000	2,10,-1.287E-3
190.000	3,10, 5.527E-3
191.000	4,10,-3.625E-4
192.000	5,10, 3.905E-6
193.000	6,10,-1.515E-5
194.000	7,10, 5.403E-6
195.000	8,10,-6.851E-4
196.000	9,10, 6.574E-4
197.000	10,10,-2.616E-2
198.000	11,10, 2.728E-2
199.000	12,10, 1.211E-3
200.000	13,10,-2.287E-6
201.000	14,10,-3.071E-5

Data file DECOBRR:DAT ... (3)

202.000	1,13, 2.933E-4
203.000	2,13, 4.152E-5
204.000	3,13, 1.037E-5
205.000	4,13,-1.407E-6
206.000	5,13,-3.743E-4
207.000	6,13, 3.110E-3
208.000	7,13, 1.688E-5
209.000	8,13,-8.184E-7
210.000	9,13,-9.070E-2
211.000	10,13,-2.032E-5
212.000	11,13, 4.595E-5
213.000	12,13, 2.209E-6
214.000	13,13,-5.249E-4
215.000	14,13, 3.207E-3
216.000	1,15,-6.865E-5
217.000	2,15,-5.107E-3
218.000	3,15,-6.523E-4
219.000	4,15, 9.650E-3
220.000	5,15,-1.270E-4
221.000	6,15,-4.746E-5
222.000	7,15, 8.906E-5
223.000	8,15,-2.665E-3
224.000	9,15,-4.318E-3
225.000	10,15, 4.341E-1
226.000	11,15,-2.046E-1
227.000	12,15,-7.090E-3
228.000	13,15,-2.104E-4
229.000	14,15,-3.270E-5
230.000	1,16,-5.147E-4
231.000	2,16,-9.540E-6
232.000	3,16, 7.605E-6
233.000	4,16, 3.582E-6
234.000	5,16,-2.459E-3
235.000	6,16,-2.900E-4
236.000	7,16,-1.641E-2
237.000	8,16,-3.707E-6
238.000	9,16,-1.008E-1
239.000	10,16, 1.553E-4
240.000	11,16,-6.828E-5
241.000	12,16, 9.175E-8
242.000	13,16, 1.367E-2
243.000	14,16,-3.466E-3
244.000	1,17,-7.681E-6
245.000	2,17, 2.245E-3
246.000	3,17, 5.077E-4
247.000	4,17,-6.085E-3
248.000	5,17, 2.712E-6
249.000	6,17, 2.644E-5
250.000	7,17, 9.890E-6
251.000	8,17,-5.304E-3
252.000	9,17,-5.008E-4
253.000	10,17,-2.652E-1
254.000	11,17, 1.337E-1
255.000	12,17, 1.134E-2
256.000	13,17,-8.302E-6
257.000	14,17, 2.847E-5
258.000	1,18, 9.009E-5
259.000	2,18,-2.352E-6
260.000	3,18, 1.096E-6
261.000	4,18, 1.817E-6
262.000	5,18,-5.308E-4
263.000	6,18,-1.342E-4
264.000	7,18, 1.197E-1
265.000	8,18,-9.102E-7
266.000	9,18,-2.117E-2
267.000	10,18, 7.903E-5
268.000	11,18,-3.800E-5
269.000	12,18,-8.927E-7
270.000	13,18,-1.178E-1
271.000	14,18, 2.352E-2

Data file DECOBR:DAT ... (4)

272.000 1,19,-3.916E-5
273.000 2,19, 2.916E-5
274.000 3,19, 5.202E-6
275.000 4,19,-1.854E-6
276.000 5,19, 3.178E-4
277.000 6,19, 8.974E-5
278.000 7,19, 1.803E-1
279.000 8,19, 2.451E-4
280.000 9,19, 1.470E-2
281.000 10,19,-1.073E-5
282.000 11,19, 6.639E-5
283.000 12,19,-2.431E-4
284.000 13,19,-1.769E-1
285.000 14,19, 3.307E-2
286.000 0, 0, 0.0
287.000 \$\$\$\$\$\$\$\$\$\$\$\$\$\$ END OF DECOBR DATA (PRODUCES DECMATS) \$\$\$\$\$\$\$\$\$\$

Data file DECOBR:DAT ... (5)

Command file RICQ:CMD

```
1.000 !ECHO  
2.000 !SET F$1 RICQ:DAT  
3.000 !SET F$2 RICQ:OUT  
4.000 !SET F$4 RICQ:OP2  
5.000 !START RICQ:TSK
```

Data file RICQ:DAT ... (1)

```
10.000 TP,UMULT,LOOP,NEG,IPRT1,IPRT2,IPRT3,IDRUG (PRODUCES RICQF MATRIX)  
11.000 10.0, 1.0, 1, 0, 1, 1, 1, 1  
12.000 NSTAB,IC,NVIST,KN,NQC,ND3,IDIAG  
13.000 1, 1, 0, 25, 0, 0, 1,  
14.000 NU,NT,NG,NR,NF  
15.000 13, 8, 2, 8, 11  
16.000 CONTROLLED RIGID MODES; NRC, NNRC()  
17.000 7, 1,2,4,5,6,7,8  
18.000 CONTROLLED FLEXIBLE MODES; NEC, NNEC()  
19.000 4, 1, 3, 4, 6  
20.000 RESIDUAL FLEXIBLE MODES; NER, NNER()  
21.000 7, 2, 5, 7, 8, 9, 10, 11  
22.000 QC :2*(NRC+NEC) X 2*(NRC+NEC)  
23.000 1.0000E-05, 0., , 0., , 0., , 0., ,  
24.000 0., , 0., , 5.0000E-05, 0., , 0., ,  
25.000 0., , 0., , 0., , 0., , 0., ,  
26.000 0., , 0., , 0., , 0., , 0., ,  
27.000 0., , 0., ,  
28.000 0., , 1.0000E-05, 0., , 0., , 0., ,  
29.000 0., , 0., , 0., , 5.0000E-05, 0., ,  
30.000 0., , 0., , 0., , 0., , 0., ,  
31.000 0., , 0., , 0., , 0., , 0., ,  
32.000 0., , 0., ,  
33.000 0., , 0., , 1.6540E-05, -7.0190E-09, -1.6840E-08,  
34.000 -1.6690E-09, 1.2810E-04, 0., , 0., , 8.2700E-05,  
35.000 -3.5095E-08, -8.4200E-08, -8.3450E-09, 6.4050E-04, -3.7840E-09,  
36.000 -3.5737E-06, 7.2936E-10, -5.5032E-09, -2.0984E-08, -3.7020E-05,  
37.000 -3.9324E-10, -6.8484E-09,  
38.000 0., , 0., , -7.0190E-09, 2.1930E-05, 1.5350E-05,  
39.000 -1.3880E-04, -5.3420E-08, 0., , 0., , -3.5095E-08,  
40.000 1.0965E-04, 7.6750E-05, -6.9400E-04, -2.6710E-07, -2.6509E-06,  
41.000 3.0554E-09, 7.7970E-07, -6.6778E-06, -1.4879E-05, 3.3824E-08,  
42.000 -5.5182E-07, -9.1555E-06,  
43.000 0., , 0., , -1.6840E-08, 1.5350E-05, 5.8910E-05,  
44.000 -9.3740E-05, -1.2440E-07, 0., , 0., , -8.4200E-08,  
45.000 7.6750E-05, 2.9455E-04, -4.6870E-04, -6.2200E-07, 1.9404E-05,  
46.000 4.5872E-08, 1.5622E-05, -3.6060E-06, 1.1014E-04, 4.6618E-07,  
47.000 -1.4995E-05, -5.0231E-06,  
48.000 0., , 0., , -1.6690E-09, -1.3880E-04, -9.3740E-05,  
49.000 1.7910E-03, -9.7170E-09, 0., , 0., , -8.3450E-09,  
50.000 -6.9400E-04, -4.6870E-04, 8.9550E-03, -4.8585E-08, -2.5147E-05,  
51.000 -1.0856E-08, -2.6766E-06, -3.7561E-06, -1.4348E-04, -1.0724E-07,  
52.000 2.7479E-06, -4.5600E-06,  
53.000 0., , 0., , 1.2810E-04, -5.3420E-08, -1.2440E-07,  
54.000 -9.7170E-09, 1.9990E-03, 0., , 0., , 6.4050E-04,  
55.000 -2.6710E-07, -6.2200E-07, -4.8585E-08, 9.9950E-03, 3.3003E-08,  
56.000 -1.5017E-05, 2.2339E-08, -1.1925E-08, 1.8972E-07, -1.5556E-04,  
57.000 -2.0666E-08, -1.4009E-08,
```

58.000	5.0000E-05	0.	0.	0.	0.	0.	,
59.000	0.	0.	0.	3.3333E-04	0.	0.	,
60.000	0.	0.	0.	0.	0.	0.	,
61.000	0.	0.	0.	0.	0.	0.	,
62.000	0.	0.	0.	0.	0.	0.	,
63.000	0.	5.0000E-05	0.	0.	0.	0.	,
64.000	0.	0.	0.	0.	3.3333E-04	0.	,
65.000	0.	0.	0.	0.	0.	0.	,
66.000	0.	0.	0.	0.	0.	0.	,
67.000	0.	0.	0.	0.	0.	0.	,
68.000	0.	0.	8.2700E-05	-3.5095E-08	-8.4200E-08	,	
69.000	-8.3450E-09	6.4050E-04	0.	0.	0.	5.5133E-04	,
70.000	-2.3397E-07	-5.6133E-07	-5.5633E-08	4.2700E-03	-1.6146E-08	,	
71.000	1.8058E-06	6.4504E-09	-4.3493E-08	-1.3618E-07	-2.1688E-04	,	
72.000	1.0500E-08	-2.9948E-09	,	,	,	,	
73.000	0.	0.	-3.5095E-08	1.0965E-04	7.6750E-05	,	
74.000	-6.9400E-04	-2.6710E-07	0.	0.	0.	-2.3397E-07	,
75.000	7.3100E-04	5.1167E-04	-4.6267E-03	-1.7807E-06	-1.1292E-05	,	
76.000	-2.7932E-09	8.2944E-06	-5.3863E-05	-9.6978E-05	1.9593E-07	,	
77.000	2.0019E-05	-3.5994E-06	,	,	,	,	
78.000	0.	0.	-8.4200E-08	7.6750E-05	2.9455E-04	,	
79.000	-4.6870E-04	-6.2200E-07	0.	0.	0.	-5.6133E-07	,
80.000	5.1167E-04	1.9637E-03	-3.1247E-03	-4.1467E-06	8.2463E-05	,	
81.000	-1.8048E-08	1.8066E-04	-3.2504E-05	7.1427E-04	2.7335E-06	,	
82.000	3.7748E-04	2.2409E-06	,	,	,	,	
83.000	0.	0.	-8.3450E-09	-6.9400E-04	-4.6870E-04	,	
84.000	8.9550E-03	-4.8585E-08	0.	0.	0.	-5.5633E-08	,
85.000	-4.6267E-03	-3.1247E-03	5.9700E-02	-3.2390E-07	-1.0675E-04	,	
86.000	2.6279E-09	-3.2224E-05	-2.9094E-05	-9.3021E-04	-6.2927E-07	,	
87.000	-6.9193E-05	-2.4076E-06	,	,	,	,	
88.000	0.	0.	6.4050E-04	-2.6710E-07	-6.2200E-07	,	
89.000	-4.8585E-08	9.9950E-03	0.	0.	0.	4.2700E-03	,
90.000	-1.7807E-06	-4.1467E-06	-3.2390E-07	6.6633E-02	1.3993E-07	,	
91.000	7.5880E-06	2.5240E-07	-9.7466E-08	1.2306E-06	-9.1134E-04	,	
92.000	5.1148E-07	-1.2787E-09	,	,	,	,	
93.000	0.	0.	-3.7840E-09	-2.6509E-06	1.9404E-05	,	
94.000	-2.5147E-05	3.3003E-08	0.	0.	0.	-1.6146E-08	,
95.000	-1.1292E-05	8.2463E-05	-1.0675E-04	1.3993E-07	1.2613E-05	,	
96.000	2.9533E-08	4.6573E-06	1.8640E-06	5.8045E-05	1.8620E-07	,	
97.000	-2.4870E-05	5.6591E-06	,	,	,	,	
98.000	0.	0.	-3.5737E-06	3.0554E-09	4.5872E-08	,	
99.000	-1.0856E-08	-1.5017E-05	0.	0.	0.	1.8058E-06	,
100.000	-2.7932E-09	-1.8048E-08	2.6279E-09	7.5880E-06	2.9533E-08	,	
101.000	4.3832E-06	-2.7524E-08	-2.0281E-09	6.6849E-09	4.7220E-06	,	
102.000	-2.7525E-07	6.8956E-09	,	,	,	,	
103.000	0.	0.	7.2936E-10	7.7970E-07	1.5622E-05	,	
104.000	-2.6766E-06	2.2339E-08	0.	0.	0.	6.4504E-09	,
105.000	8.2944E-06	1.8066E-04	-3.2224E-05	2.5240E-07	4.6573E-06	,	
106.000	-2.7524E-08	1.7976E-04	3.3367E-06	9.2437E-05	3.9994E-07	,	
107.000	3.6559E-05	3.3644E-06	,	,	,	,	
108.000	0.	0.	-5.5032E-09	-6.6778E-06	-3.6060E-06	,	
109.000	-3.7561E-06	-1.1925E-08	0.	0.	0.	-4.3493E-08	,
110.000	-5.3863E-05	-3.2504E-05	-2.9094E-05	-9.7466E-08	1.8640E-06	,	
111.000	-2.0281E-09	3.3367E-06	1.4615E-04	2.5843E-05	1.4850E-08	,	
112.000	-7.1476E-06	2.8740E-05	,	,	,	,	
113.000	0.	0.	-2.0984E-08	-1.4879E-05	1.1014E-04	,	
114.000	-1.4348E-04	1.8972E-07	0.	0.	0.	-1.3618E-07	,
115.000	-9.6978E-05	7.1427E-04	-9.3021E-04	1.2306E-06	5.8045E-05	,	
116.000	6.6849E-09	9.2437E-05	2.5843E-05	4.8062E-04	1.3186E-06	,	
117.000	1.4860E-04	8.8677E-07	,	,	,	,	
118.000	0.	0.	-3.7020E-05	3.3824E-08	4.6618E-07	,	
119.000	-1.0724E-07	-1.5556E-04	0.	0.	0.	-2.1688E-04	,
120.000	1.9593E-07	2.7335E-06	-6.2927E-07	-9.1134E-04	1.8620E-07	,	
121.000	4.7220E-06	3.9994E-07	1.4850E-08	1.3186E-06	1.1495E-04	,	
122.000	1.6715E-07	-2.9431E-09	,	,	,	,	
123.000	0.	0.	-3.9324E-10	-5.5182E-07	-1.4995E-05	,	
124.000	2.7479E-06	-2.0666E-08	0.	0.	0.	1.0500E-08	,
125.000	2.0019E-05	3.7748E-04	-6.9193E-05	5.1148E-07	-2.4870E-05	,	
126.000	-2.7525E-07	3.6559E-05	-7.1476E-06	1.4860E-04	1.6715E-07	,	
127.000	6.8155E-04	7.2173E-06	,	,	,	,	
128.000	0.	0.	-6.8484E-09	-9.1555E-06	-5.0231E-06	,	
129.000	-4.5600E-06	-1.4009E-08	0.	0.	0.	-2.9948E-09	,
130.000	-3.5994E-06	2.2409E-06	-2.4076E-06	-1.2787E-09	5.6591E-06	,	
131.000	6.8956E-09	3.3644E-06	2.8740E-05	8.8677E-07	-2.9431E-09	,	
132.000	7.2173E-06	2.3383E-04	,	,	,	,	

Data file RICQ:DAT ... (2)

	QCK	:2*(NRC+NEC)	X	2*(NRC+NEC)			
133.000	1.0000E-05	0.	,	0.	,	0.	,
134.000	0.	,	0.	, 5.0000E-05,	0.	,	0.
135.000	0.	,	0.	, 0.	, 0.	,	0.
136.000	0.	,	0.	, 0.	, 0.	,	0.
137.000	0.	,	0.	, 0.	, 0.	,	0.
138.000	0.	,	0.	,	,	,	
139.000	0.	,	1.0000E-05,	0.	, 0.	,	0.
140.000	0.	,	0.	, 0.	, 5.0000E-05,	0.	,
141.000	0.	,	0.	, 0.	, 0.	,	0.
142.000	0.	,	0.	, 0.	, 0.	,	0.
143.000	0.	,	0.	,	,	,	
144.000	0.	,	0.	, 1.6540E-05,	-7.0190E-09,	-1.6840E-08,	
145.000	-1.6690E-09,	1.2810E-04,	0.	,	0.	, 8.2700E-05,	
146.000	-3.5095E-08,	-8.4200E-08,	-8.3450E-09,	6.4050E-04,	-3.7840E-09,		
147.000	-3.5737E-06,	7.2936E-10,	-5.5032E-09,	-2.0984E-08,	-3.7020E-05,		
148.000	-3.9324E-10,	-6.8484E-09,					
149.000	0.	,	0.	, -7.0190E-09,	2.1930E-05,	1.5350E-05,	
150.000	-1.3880E-04,	-5.3420E-08,	0.	,	0.	, -3.5095E-08,	
151.000	1.0965E-04,	7.6750E-05,	-6.9400E-04,	-2.6710E-07,	-2.6509E-06,		
152.000	3.0554E-09,	7.7970E-07,	-6.6778E-06,	-1.4879E-05,	3.3824E-08,		
153.000	-5.5182E-07,	-9.1555E-06,					
154.000	0.	,	0.	, -1.6840E-08,	1.5350E-05,	5.8910E-05,	
155.000	-9.3740E-05,	-1.2440E-07,	0.	,	0.	, -8.4200E-08,	
156.000	7.6750E-05,	2.9455E-04,	-4.6870E-04,	-6.2200E-07,	1.9404E-05,		
157.000	4.5872E-08,	1.5622E-05,	-3.6060E-06,	1.1014E-04,	4.6618E-07,		
158.000	-1.4995E-05,	-5.0231E-06,					
159.000	0.	,	0.	, -1.6690E-09,	-1.3880E-04,	-9.3740E-05,	
160.000	1.7910E-03,	-9.7170E-09,	0.	,	0.	, -8.3450E-09,	
161.000	-6.9400E-04,	-4.6870E-04,	8.9550E-03,	-4.8585E-08,	-2.5147E-05,		
162.000	-1.0856E-08,	-2.6766E-06,	-3.7561E-06,	-1.4348E-04,	-1.0724E-07,		
163.000	2.7479E-06,	-4.5600E-06,					
164.000	0.	,	0.	, 1.2810E-04,	-5.3420E-08,	-1.2440E-07,	
165.000	-9.7170E-09,	1.9990E-03,	0.	,	0.	, 6.4050E-04,	
166.000	-2.6710E-07,	-6.2200E-07,	-4.8585E-08,	9.9950E-03,	3.3003E-08,		
167.000	-1.5017E-05,	2.2339E-08,	-1.1925E-08,	1.8972E-07,	-1.5556E-04,		
168.000	-2.0666E-08,	-1.4009E-08,					
169.000	5.0000E-05,	0.	,	0.	, 0.	, 0.	
170.000	0.	,	0.	, 3.3333E-04,	0.	, 0.	
171.000	0.	,	0.	, 0.	, 0.	, 0.	
172.000	0.	,	0.	, 0.	, 0.	, 0.	
173.000	0.	,	0.				
174.000	0.	,	5.0000E-05,	0.	, 0.	, 0.	
175.000	0.	,	0.	, 3.3333E-04,	0.	, 0.	
176.000	0.	,	0.	, 0.	, 0.	, 0.	
177.000	0.	,	0.	, 0.	, 0.	, 0.	
178.000	0.	,	0.				
179.000	0.	,	0.	, 8.2700E-05,	-3.5095E-08,	-8.4200E-08,	
180.000	-8.3450E-09,	6.4050E-04,	0.	,	0.	, 5.5133E-04,	
181.000	-2.3397E-07,	-5.6133E-07,	-5.5633E-08,	4.2700E-03,	-1.6146E-08,		
182.000	1.8058E-06,	6.4504E-09,	-4.3493E-08,	-1.3618E-07,	-2.1688E-04,		
183.000	1.0500E-08,	-2.9948E-09,					
184.000	0.	,	0.	, -3.5095E-08,	1.0965E-04,	7.6750E-05,	
185.000	-6.9400E-04,	-2.6710E-07,	0.	,	0.	, -2.3397E-07,	
186.000	7.3100E-04,	5.1167E-04,	-4.6267E-03,	-1.7807E-06,	-1.1292E-05,		
187.000	-2.7932E-09,	8.2944E-06,	-5.3863E-05,	-9.6978E-05,	1.9593E-07,		
188.000	2.0019E-05,	-3.5994E-06,					
189.000	0.	,	0.	, -8.4200E-08,	7.6750E-05,	2.9455E-04,	
190.000	-4.6870E-04,	-6.2200E-07,	0.	,	0.	, -5.6133E-07,	
191.000	5.1167E-04,	1.9637E-03,	-3.1247E-03,	-4.1467E-06,	8.2463E-05,		
192.000	-1.8048E-08,	1.8066E-04,	-3.2504E-05,	7.1427E-04,	2.7335E-06,		
193.000	3.7748E-04,	2.2409E-06,					
194.000	0.	,	0.	, -8.3450E-09,	-6.9400E-04,	-4.6870E-04,	
195.000	8.9550E-03,	-4.8585E-08,	0.	,	0.	, -5.5633E-08,	
196.000	-4.6267E-03,	-3.1247E-03,	5.9700E-02,	-3.2390E-07,	-1.0675E-04,		
197.000	2.6279E-09,	-3.2224E-05,	-2.9094E-05,	-9.3021E-04,	-6.2927E-07,		
198.000	-6.9193E-05,	-2.4076E-06,					
199.000	0.	,	0.	, 6.4050E-04,	-2.6710E-07,	-6.2200E-07,	
200.000	-4.8585E-08,	9.9950E-03,	0.	,	0.	, 4.2700E-03,	
201.000	-1.7807E-06,	-4.1467E-06,	-3.2390E-07,	6.6633E-02,	1.3993E-07,		
202.000	7.5880E-06,	2.5240E-07,	-9.7466E-08,	1.2306E-06,	-9.1134E-04,		
203.000	5.1148E-07,	-1.2787E-09,					

Data file RICQ:DAT ... (3)

249.000 0. , 0. , -3.7840E-09, -2.6509E-06, 1.9404E-05,
 .000 -2.5147E-05, 3.3003E-08, 0. , 0. , -1.6146E-08,
 .000 -1.1292E-05, 8.2463E-05, -1.0675E-04, 1.3993E-07, 1.2613E-05,
 .000 2.9533E-08, 4.6573E-06, 1.8640E-06, 5.8045E-05, 1.8620E-07,
 .000 -2.4870E-05, 5.6591E-06,
 .000 0. , 0. , -3.5737E-06, 3.0554E-09, 4.5872E-08,
 .000 -1.0856E-08, -1.5017E-05, 0. , 0. , 1.8058E-06,
 .000 -2.7932E-09, -1.8048E-08, 2.6279E-09, 7.5880E-06, 2.9533E-08,
 .000 4.3832E-06, -2.7524E-08, -2.0281E-09, 6.6849E-09, 4.7220E-06,
 .000 -2.7525E-07, 6.8956E-09,
 .000 0. , 0. , 7.2936E-10, 7.7970E-07, 1.5622E-05,
 .000 -2.6766E-06, 2.2339E-08, 0. , 0. , 6.4504E-09,
 .000 8.2944E-06, 1.8066E-04, -3.2224E-05, 2.5240E-07, 4.6573E-06,
 .000 -2.7524E-08, 1.7976E-04, 3.3367E-06, 9.2437E-05, 3.9994E-07,
 .000 3.6559E-05, 3.3644E-06,
 .000 0. , 0. , -5.5032E-09, -6.6778E-06, -3.6060E-06,
 .000 -3.7561E-06, -1.1925E-08, 0. , 0. , -4.3493E-08,
 .000 -5.3863E-05, -3.2504E-05, -2.9094E-05, -9.7466E-08, 1.8640E-06,
 .000 -2.0281E-09, 3.3367E-06, 1.4615E-04, 2.5843E-05, 1.4850E-08,
 .000 -7.1476E-06, 2.8740E-05,
 .000 0. , 0. , -2.0984E-08, -1.4879E-05, 1.1014E-04,
 .000 -1.4348E-04, 1.8972E-07, 0. , 0. , -1.3618E-07,
 .000 -9.6978E-05, 7.1427E-04, -9.3021E-04, 1.2306E-06, 5.8045E-05,
 .000 6.6849E-09, 9.2437E-05, 2.5843E-05, 4.8062E-04, 1.3186E-06,
 .000 1.4860E-04, 8.8677E-07,
 .000 0. , 0. , -3.7020E-05, 3.3824E-08, 4.6618E-07,
 .000 -1.0724E-07, -1.5556E-04, 0. , 0. , -2.1688E-04,
 .000 1.9593E-07, 2.7335E-06, -6.2927E-07, -9.1134E-04, 1.8620E-07,
 .000 4.7220E-06, 3.9994E-07, 1.4850E-08, 1.3186E-06, 1.1495E-04,
 .000 1.6715E-07, -2.9431E-09,
 .000 0. , 0. , -3.9324E-10, -5.5182E-07, -1.4995E-05,
 .000 2.7479E-06, -2.0666E-08, 0. , 0. , 1.0500E-08,
 .000 2.0019E-05, 3.7748E-04, -6.9193E-05, 5.1148E-07, -2.4870E-05,
 .000 -2.7525E-07, 3.6559E-05, -7.1476E-06, 1.4860E-04, 1.6715E-07,
 .000 6.8155E-04, 7.2173E-06,
 .000 0. , 0. , -6.8484E-09, -9.1555E-06, -5.0231E-06,
 .000 -4.5600E-06, -1.4009E-08, 0. , 0. , -2.9948E-09,
 .000 -3.5994E-06, 2.2409E-06, -2.4076E-06, -1.2787E-09, 5.6591E-06,
 .000 6.8956E-09, 3.3644E-06, 2.8740E-05, 8.8677E-07, -2.9431E-09,
 .000 7.2173E-06, 2.3383E-04,
 .000 ZETA
 .000 1.0E-6, 1.0E-6, 1.0E-6, 1.0E-6, 1.0E-6, 1.0E-6,
 .000 1.0E-6, 1.0E-6, 1.0E-6,
 .000 RR (2*NER)
 .000 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
 .000 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
 .000 OMEGA (RAD/S/SEC)
 .000 1.2434952868889490E-1
 .000 1.5117997270041770E-1
 .000 2.3952489001995300E-1
 .000 5.5629553169353050E-1
 .000 6.9020123559092970E-1
 .000 7.7963639163821000E-1
 .000 1.5532815257821910E-0
 .000 3.1368829630482690E-0
 .000 3.9572089569016590E-0
 .000 9.9489251639172970E-0
 .000 1.4008315775600510E+1
 .000 ZETA
 .000 7.423E-3, 5.642E-3, 7.116E-3, 1.538E-2, 8.034E-3, 2.703E-2,
 .000 4.832E-2, 8.942E-3, 1.334E-2, 5.302E-2, 8.359E-2

265.000 BH : (NR+NF) X NU
 266.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 8.410E-3, 8.410E-3,
 267.000 -8.410E-3,-8.410E-3, 8.410E-3, 8.410E-3,-8.410E-3,-8.410E-3,
 268.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , -1.457E-2, 1.457E-2,
 269.000 1.457E-2,-1.457E-2,-1.457E-2, 1.457E-2, 1.457E-2,-1.457E-2,
 270.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 271.000 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
 272.000 9.094E-4, 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 5.729E-3,-5.729E-3,
 273.000 -5.729E-3, 5.729E-3,-2.869E-2, 2.869E-2, 2.869E-2,-2.869E-2,
 274.000 -3.859E-7, 1.047E-3, 0.0 , 0.0 , 0.0 , 0.0 , 3.806E-3, 3.811E-3,
 275.000 -3.806E-3,-3.811E-3,-1.906E-2,-1.908E-2, 1.906E-2, 1.908E-2,
 276.000 -9.257E-7, 7.331E-4, 2.003E-3, 0.0 , 0.0 , 0.0 , 1.022E-2,-7.078E-3,
 277.000 7.133E-3,-1.027E-2, 9.299E-3, 9.284E-3,-9.299E-3,-9.284E-3,
 278.000 -9.174E-8, 1.210E-4, 1.441E-4, 6.944E-3, 0.0 , 0.0 , 1.289E-3, 4.539E-5,
 279.000 -4.112E-5,-1.293E-3,-2.675E-4,-2.702E-4, 2.675E-4, 2.702E-4,
 280.000 -4.708E-5, 1.119E-7, 2.213E-7, 6.791E-8, 6.921E-3,-8.075E-4, 8.081E-4,
 281.000 8.094E-4,-8.100E-4, 9.735E-4,-9.725E-4,-9.735E-4, 9.725E-4,
 282.000 -8.282E-7,-5.856E-4, 1.157E-3,-5.553E-4,-2.199E-6, 6.530E-3,-3.478E-3,
 283.000 3.488E-3,-6.539E-3,-4.824E-2,-4.783E-2, 4.826E-2, 4.783E-2,
 284.000 -3.625E-4, 3.905E-6,-1.515E-5, 5.403E-6,-6.851E-4, 1.044E-3,-1.055E-3,
 285.000 -1.175E-3, 1.186E-3,-5.105E-2, 5.178E-2, 5.105E-2,-5.178E-2,
 286.000 -9.888E-4, 2.133E-7, 5.812E-6,-1.500E-6,-2.577E-3,-3.368E-3, 3.370E-3,
 287.000 3.419E-3,-3.421E-3,-1.087E-1, 1.085E-1, 1.087E-1,-1.085E-1,
 288.000 8.859E-7,-3.964E-4,-5.932E-3, 8.518E-4, 1.731E-6,-2.485E-2, 2.639E-2,
 289.000 -2.653E-2, 2.499E-2, 5.095E-2, 5.079E-2,-5.095E-2,-5.079E-2,
 290.000 -1.407E-6,-3.743E-4, 3.110E-3, 1.688E-5,-8.184E-7, 1.358E-2,-1.328E-2,
 291.000 1.336E-2,-1.365E-2,-4.925E-2,-4.909E-2, 4.925E-2, 4.909E-2
 292.000 -4.329E-6,-5.918E-3, 2.744E-4, 4.838E-3,-2.422E-6,-6.475E-4,-3.014E-3,
 293.000 3.025E-3, 6.358E-4,-2.418E-1,-2.413E-1, 2.418E-1, 2.413E-1,
 294.000 9.650E-3,-1.270E-4,-4.746E-5, 8.906E-5,-2.665E-3, 4.183E-3,-4.251E-3,
 295.000 -4.594E-3, 4.662E-3, 2.639E-1,-2.724E-1,-2.639E-1, 2.724E-1,
 296.000 3.582E-6,-2.459E-3,-2.900E-4,-1.641E-2,-3.707E-6,-1.505E-3, 9.903E-4,
 297.000 -1.007E-3, 1.521E-3, 3.403E-1, 3.403E-1,-3.403E-1,-3.403E-1,
 298.000 -6.085E-3, 2.712E-6, 2.644E-5, 9.890E-6,-5.304E-3,-1.833E-3, 1.826E-3,
 299.000 2.062E-3,-2.055E-3,-4.154E-1, 4.144E-1, 4.154E-1,-4.144E-1,
 300.000 1.817E-6,-5.308E-4,-1.342E-4, 1.197E-1,-9.102E-7,-5.342E-4, 6.243E-4,
 301.000 -6.283E-4, 5.383E-4,-2.861E-0,-2.862E-0, 2.861E-0, 2.862E-0,
 302.000 -1.854E-6, 3.178E-4, 8.974E-5, 1.803E-1, 2.451E-4, 3.438E-4,-3.829E-4,
 303.000 4.334E-4,-3.943E-4,-4.259E-0,-4.278E-0, 4.259E-0, 4.278E-0,
 304.000 CH (DE) :NF X NF
 305.000 1.846E-3,-5.509E-6, 2.519E-6,-1.700E-3, 1.237E-3, 3.255E-3,
 306.000 4.718E-5, 1.500E-3, 1.057E-5,-1.173E-3,-2.607E-3,
 307.000 -5.509E-6, 1.706E-3, 3.644E-4, 2.246E-5,-1.446E-5,-2.771E-5,
 308.000 -3.210E-3,-1.495E-5, 2.151E-3, 1.330E-5, 2.564E-5,
 309.000 2.519E-6, 3.644E-4, 3.409E-3,-6.900E-6, 5.243E-6, 1.146E-5,
 310.000 -8.921E-3, 7.907E-8, 6.351E-3,-7.460E-6,-3.086E-5,
 311.000 -1.700E-3, 2.246E-5,-6.900E-6, 1.711E-2,-6.647E-3,-4.585E-3,
 312.000 -2.764E-5,-1.707E-3,-2.617E-5, 4.837E-3, 8.077E-3,
 313.000 1.237E-3,-1.446E-5, 5.243E-6,-6.647E-3, 1.109E-2, 5.880E-3,
 314.000 7.188E-5, 2.124E-3, 2.508E-5,-2.683E-4,-1.308E-3,
 315.000 3.255E-3,-2.771E-5, 1.146E-5,-4.585E-3, 5.880E-3, 4.215E-2,
 316.000 6.426E-4, 1.163E-2, 7.470E-5, 2.760E-2, 3.694E-2,
 317.000 4.718E-5,-3.210E-3,-8.921E-3,-2.764E-5, 7.188E-5, 6.426E-4,
 318.000 1.501E-1, 3.174E-4,-8.721E-2, 5.814E-4, 6.131E-4,
 319.000 1.500E-3,-1.495E-5, 7.907E-8,-1.707E-3, 2.124E-3, 1.163E-2,
 320.000 3.174E-4, 5.610E-2,-2.360E-5,-1.229E-1,-1.896E-1,
 321.000 1.057E-5,-2.151E-3, 6.351E-3,-2.617E-5, 2.508E-5, 7.470E-5,
 322.000 -8.721E-2,-2.360E-5, 1.056E-1, 6.325E-5,-1.322E-4,
 323.000 -1.173E-3, 1.330E-5,-7.460E-6, 4.837E-3,-2.683E-4, 2.760E-2,
 324.000 5.814E-4,-1.229E-1, 6.325E-5, 1.055E-0, 1.446E-0
 325.000 -2.607E-3, 2.564E-5,-3.086E-5, 8.077E-3,-1.308E-3, 3.694E-2,
 326.000 6.131E-4,-1.896E-1,-1.322E-4, 1.446E-0, 2.342E-0
 ***** END OF RICD DATA *****

Data file STABF.DAT

```

9.000   ITEST,IDIAG,IC,IPRT,IDBUG
10.000  0, 0, 1, 1, 0
11.000  UMULT (1 - 10)
12.000  1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0
13.000  NR,NF,NU
14.000  8, 11, 13
15.000  OMEGA (RADS/SEC)
16.000  1.2434952868889490E-1
17.000  1.5117997270041770E-1
18.000  2.3952489001995300E-1
19.000  5.5629553169353050E-1
20.000  6.9020123559092970E-1
21.000  7.7963639163821000E-1
22.000  1.5532815257821910E-0
23.000  3.1368829630482690E-0
24.000  3.9572089569016590E-0
25.000  9.9489251639172970E-0
26.000  1.4008315775600510E+1
27.000  BH !(NRC+NEC+NER) X NU
28.000  0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 8.410E-3, 8.410E-3,
29.000  -8.410E-3,-8.410E-3, 8.410E-3, 8.410E-3,-8.410E-3,-8.410E-3,
30.000  0.0 , 0.0 , 0.0 , 0.0 , 0.0 , -1.457E-2, 1.457E-2,
31.000  1.457E-2,-1.457E-2,-1.457E-2, 1.457E-2,-1.457E-2,-1.457E-2,
32.000  0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
33.000  0.0 , 0.0 , 0.0 , 0.0 , 0.0 , 0.0 ,
34.000  9.094E-4, 0.0 , 0.0 , 0.0 , 0.0 , 5.729E-3,-5.729E-3,
35.000  -5.729E-3, 5.729E-3,-2.869E-2, 2.869E-2, 2.869E-2,-2.869E-2,
36.000  -3.859E-7, 1.047E-3, 0.0 , 0.0 , 0.0 , 3.806E-3, 3.811E-3,
37.000  -3.806E-3,-3.811E-3,-1.906E-2,-1.908E-2, 1.906E-2, 1.908E-2,
38.000  -9.257E-7, 7.331E-4, 2.003E-3, 0.0 , 0.0 , 1.022E-2,-7.078E-3,
39.000  7.133E-3,-1.027E-2, 9.299E-3, 9.284E-3,-9.299E-3,-9.284E-3,
40.000  -9.174E-8, 1.210E-4, 1.441E-4, 6.944E-3, 0.0 , 1.289E-3, 4.539E-5,
41.000  -4.112E-5,-1.293E-3,-2.675E-4,-2.702E-4, 2.675E-4, 2.702E-4,
42.000  -4.708E-5, 1.119E-7, 2.213E-7, 6.791E-8, 6.921E-3,-8.075E-4, 8.081E-4,
43.000  8.094E-4,-8.100E-4, 9.735E-4,-9.725E-4,-9.735E-4, 9.725E-4,
44.000  -8.282E-7,-5.539E-4, 1.157E-3,-5.553E-4,-2.199E-6, 6.530E-3,-3.478E-3,
45.000  3.488E-3,-6.539E-3,-4.826E-2,-4.783E-2, 4.826E-2, 4.783E-2,
46.000  -3.625E-4, 3.905E-6,-1.515E-5, 5.403E-6,-6.851E-4, 1.044E-3,-1.055E-3,
47.000  -1.175E-3, 1.186E-3,-5.105E-2, 5.178E-2, 5.105E-2,-5.178E-2,
48.000  -9.888E-4, 2.133E-7, 5.812E-6,-1.500E-6,-2.577E-3,-3.368E-3, 3.370E-3,
49.000  3.419E-3,-3.421E-3,-1.087E-1, 1.085E-1, 1.087E-1,-1.085E-1,
50.000  8.859E-7,-3.964E-4,-5.932E-3, 8.518E-4, 1.731E-6,-2.485E-2, 2.639E-2,
51.000  -2.653E-2, 2.499E-2, 5.095E-2, 5.079E-2,-5.095E-2,-5.079E-2,
52.000  -1.407E-6,-3.743E-4, 3.110E-3, 1.688E-5,-8.184E-7, 1.358E-2,-1.328E-2,
53.000  1.336E-2,-1.365E-2,-4.925E-2,-4.909E-2, 4.925E-2, 4.909E-2
54.000  -4.329E-6,-5.918E-3, 2.746E-4, 4.838E-3,-2.422E-6,-6.475E-4,-3.014E-3,
55.000  3.025E-3, 6.358E-4,-2.418E-1,-2.413E-1, 2.418E-1, 2.413E-1,
56.000  9.650E-3,-1.270E-4,-4.746E-5, 8.906E-5,-2.665E-3, 4.183E-3,-4.251E-3,
57.000  -4.594E-3, 4.662E-3, 2.639E-1,-2.724E-1,-2.639E-1, 2.724E-1,
58.000  3.582E-6,-2.459E-3,-2.900E-4,-1.641E-2,-3.707E-6,-1.505E-3, 9.903E-4,
59.000  -1.007E-3, 1.521E-3, 3.403E-1, 3.403E-1,-3.403E-1,-3.403E-1,
60.000  -6.085E-3, 2.712E-6, 2.644E-5, 9.890E-6,-5.304E-3,-1.833E-3, 1.826E-3,
61.000  2.062E-3,-2.055E-3,-4.154E-1, 4.144E-1, 4.154E-1,-4.144E-1,
62.000  1.817E-6,-5.308E-4,-1.342E-4, 1.197E-1,-9.102E-7,-5.342E-4, 6.243E-4,
63.000  -6.283E-4, 5.383E-4,-2.861E-0,-2.862E-0, 2.861E-0, 2.862E-0,
64.000  -1.854E-6, 3.178E-4, 8.974E-5, 1.803E-1, 2.451E-4, 3.438E-4,-3.829E-4,
65.000  4.334E-4,-3.943E-4,-4.259E-0,-4.278E-0, 4.259E-0, 4.278E-0,
66.000  CH (DE) :NF X NF
67.000  1.846E-3,-5.509E-6, 2.519E-6,-1.700E-3, 1.237E-3, 3.255E-3,
68.000  4.718E-5, 1.500E-3, 1.057E-5,-1.173E-3,-2.607E-3,
69.000  -5.509E-6, 1.706E-3, 3.644E-4, 2.246E-5,-1.446E-5,-2.771E-5,
70.000  -3.210E-3,-1.495E-5, 2.151E-3, 1.330E-5, 2.564E-5,
71.000  2.519E-6, 3.644E-4, 3.409E-3,-6.900E-6, 5.243E-6, 1.146E-5,
72.000  -8.921E-3, 7.907E-8, 6.351E-3,-7.460E-6,-3.086E-5,
73.000  -1.700E-3, 2.246E-5,-6.900E-6, 1.711E-2,-6.647E-3,-4.585E-3,
74.000  -2.764E-5,-1.707E-3,-2.617E-5, 4.837E-3, 8.077E-3,
75.000  1.237E-3,-1.446E-5, 5.243E-6,-6.647E-3, 1.109E-2, 5.880E-3,
76.000  7.188E-5, 2.124E-3, 2.508E-5,-2.683E-4,-1.308E-3,
77.000  3.255E-3,-2.771E-5, 1.146E-5,-4.585E-3, 5.880E-3, 4.215E-2,
78.000  6.426E-4, 1.163E-2, 7.470E-5, 2.760E-2, 3.694E-2,
79.000  4.718E-5,-3.210E-3,-8.921E-3,-2.764E-5, 7.188E-5, 6.426E-4,
80.000  1.501E-1, 3.174E-4,-8.721E-2, 5.814E-4, 6.131E-4,
81.000  1.500E-3,-1.495E-5, 7.907E-8,-1.707E-3, 2.124E-3, 1.163E-2,
82.000  3.174E-4, 5.610E-2,-2.360E-5,-1.229E-1,-1.896E-1,
83.000  1.057E-5, 2.151E-3, 6.351E-3,-2.617E-5, 2.508E-5, 7.470E-5,
84.000  -8.721E-2,-2.360E-5, 1.056E-1, 6.325E-5,-1.322E-4,
85.000  -1.173E-3, 1.330E-5,-7.460E-6, 4.837E-3,-2.683E-4, 2.760E-2,
86.000  5.814E-4,-1.229E-1, 6.325E-5, 1.055E-0, 1.446E-0
87.000  -2.607E-3, 2.564E-5,-3.086E-5, 8.077E-3,-1.308E-3, 3.694E-2,
88.000  6.131E-4,-1.896E-1,-1.322E-4, 1.446E-0, 2.342E-0
89.000  $$$$$$$$$$$$$$ END OF STABF DATA $$$$$$$$$$$$$$
```

CACC / CCAC
82604

ROGER, N.A.C.
--Users guide to programs for
the optimal stationkeep and . . .

P
91
C655
R63
1984

DATE DUE
DATE DE RETOUR

MAY 14 1991
MAI 14 1991

LOWE-MARTIN No. 1137

