FORMAT—FORTRAN MATRIX ABSTRACTION TECHNIQUE

VOLUME VII—SUPPLEMENT I. DESCRIPTION OF DIGITAL COMPUTER PROGRAM—PHASE III—EXTENDED

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FOREWORD

This report was prepared by the Douglas Aircraft Company, Long Beach, California, under USAF Contract No. F33615-68-C-1633. The work was initiated under Project No. 1467 "Structural Analysis Methods", and Task No. 146705" Automatic Computer Methods of Analysis for Flight Vehicle Structures". The work was administered under the Air Force Flight Dynamics Laboratory, by Mr. J. R. Johnson, FDTR, Project Engineer.

The work reported herein was conducted during the period July 1968 through April 1970. This report was submitted by the author for publication in April 1970.

Within the Douglas Aircraft Company, Mr. P. H. Denke, Director, Scientific Computing was responsible for administration and technical progress. Mr. D. S. Warren, Manager, Advanced Design and Research, Structural Mechanics Section was principal investigator. Many other Douglas personnel contributed significantly to the project.

The general objective of the project was to update the FORMAT System documented in Volumes I through VII, as supplemented, by incorporation of additional basic capability and refinement of existing capability. The work is reported in Volume II - Supplement III, Volume V - Supplement I, Volume VI - Supplement I and Volume VII - Supplement I. A complete description of the current FORMAT System is contained in Volumes II, V, VI and VII, as supplemented (References 1 through 10). The supplements are the final reports of the investigation and conclude the work on Contract No. F33615-68-C-1633. The contractors report number is DAC-33569.

The report has been reviewed and is approved.

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ABSTRACT

The FORMAT System has been updated by the incorporation of additional basic capability and the refinement of existing capability. A simpler mode of updating case data and extended force method matrix generation capability has been incorporated in Phase I of the system. A refined "Structure Cutter" module, capabilities for matrix partitioning and instruction looping, and an additional eigenvalue/eigenvector extraction module have been incorporated in Phase II. Finally the limitations which existed in the matrix plotting capability in Phase III have been eliminated. Programming documentation for the extended capability of Phase III of the FORMAT System is presented in this report.

CONTENTS

SECTION I

INTRODUCTION

The FORMAT System has been updated to provide additional basic capability and refinements to the existing capability.

The modification to Phase III (the special output phase) of the system involves an extensive revision of the matrix plot module in order to provide complete generality in the plotting of matrix data in rectangular displays. All of the limitations which restricted the practical usage of the previous version have been eliminated and in addition a considerable reduction in execution time has been effected by modifying the mode of retrieval of the matrix data used in the plot.

This capability is an optional modification of the base capability of Phase III as described in Reference 9. User-oriented documentation is presented in Reference 6.

Section II of this report summarizes the steps required to implement the modification. Routine error messages, description, and overlay structure are contained in Appendices I, II and III respectively.

SECTION II

IMPLEMENTATION

Implementation of the revised matrix plot module in Phase III of the FORMAT system consists of the following steps.

(i) Replace the following 2 existing subroutines with the revised versions.

1. GRAPH (Deck P400)
2. PLOTXY (Deck P403)

The plot control modules were modified to accommodate the revised plot capability.

(ii) Insert the following 4 subroutines into the Phase III overlay structure.

1. MCOPY (Deck P405)
2. SORT (Deck P406)
3. SEARCH (Deck P407)
4. PLTXY1 (Deck P408)

APPENDIX I

PHASE III ERROR MESSAGES - EXTENDED

MATRIX PLOT MODULE

Error Message	Routine
TABLE SIZE LIMITS HAVE BEEN EXCEEDED	GRAPH
NSETS = ****. DUE TO SIZE LIMITS ONLY FIRST TEN VALUES WILL BE USED	PLOTXY
NORDS = ****. DUE TO SIZE LIMITS ONLY FIRST 100 VALUES WILL BE USED	PLOTXY
NUMCOL = ****. DUE TO SIZE LIMITS ONLY FIRST 10 COLS WILL BE USED	PLOTXY
NCASE = ****. DUE TO SIZE LIMITS ONLY FIRST 10 CASES WILL BE USED	PLOTXY
PLOTXY ERROR IN X-AXIS SCALING	PLOTXY
PLOTXY ERRIR IN Y-AXIS SCALING	PLOTXY
NCOL = ****. WARNING - THIS COL DOES NOT EXIST IN THE ****TH MATRIX	MCOPY
INCORRECT COPY CARD OR CARD NONEXISTENT	MCOPY
COPY ERROR - THE ****TH MATRIX COULD NOT BE FOUND	MCOPY
THE MAX NUMBER OF 100 COLS TO BE COPIED HAS BEEN EXCEEDED IN THE ABOVE LINE	MCOPY
PLXY03 MATRIX ****** COULD NOT BE FOUND	SEARCH
PLXY04 MATRIX ****** IS NOT AMONG ONE OF THE AVAILABLE INPUT MATRICES	SEARCH
PLXY05 ALL ELEMENTS IN COLUMN **** OF MATRIX ****** ARE ZERO OR THIS COLUMN NUMBER EXCEEDS THE MAXIMUM COLUMN NUMBER OF THE MATRIX	SEARCH

Error Message	Routine
THE MAXIMUM NO. OF COLS HAS BEEN EXCEEDED- ICOL = **** JMAX = ****	PLTXY1
THE MAXIMUM NO. OF ROWS HAS BEEN EXCEEDED - IROW = **** IMAX = ****	PLTXY1
COLUMN **** DOES NOT EXIST IN THIS MATRIX - ****** - IT WILL BE IGNORED ******	PLTXY1

APPENDIX II

PHASE III ROUTINES - EXTENDED

This appendix contains a detailed description of all subroutines that were significantly modified or added to Phase III in the FORMAT system. Each subroutine is divided into sections which are the following:

(a) Algorithm

(b) Input/Output

(c) Error

(d) Subroutines Required

(e) Argument List

(f) Subroutine Length

(g) Symbol List

The symbol list is divided into five fields which are described as follows:

i. The first field contains the symbol.

ii. The second field contains the letters I, L, or R denoting integer, logical, or real variable, respectively.

iii. The third field contains the letters A, C, D, or U denoting argument list, common, dimensioned, or undimensioned variable respectively. The hierarchy of the above letters is A, C, D, U.

iv. The fourth field contains the definition of the symbol.

v. The fifth field contains the name of the subroutine in which the symbol occurs.

TABLE I APPENDIX II - TABLE OF CONTENTS

1. SUBROUTINE GRAPH (DECK P400)

This routine acts as the control routine for the plot module.

a. Algorithm

"IWHICH" in the argument list is examined to determine which option has been requested. If "IWHICH" is not equal to two, the MATRIX option has been requested. The number of cases (frames), the number of x-values, and the number of sets of row numbers are then read in. Storage is allocated for, and control is passed to routine PLOTXY which plots the general matrix data.

If "IWHICH" is two, the GEOMetry option has been requested. The indicator for the vector option (IVECTR) is read in, subroutine TUTL3 is called to locate the specified case header on the master case data set, and subroutine TUTL7 is called to retrieve logical records from a specified table. After eliminating the duplicated bars, storage is allocated for, and control is passed to subroutine PLUT which plots structural geometry from the master case data set.

b. Input/Output

The number of cases, the number of x-values, the number of sets of row numbers and the indicator for the vector option are read from the system input data set.

c. Error

An error conditon results when an error is returned from a subroutine, the amount of working storage available is exceeded, or when the specified data set or the joint coordinate data can not be read.

d. Subroutines Required

TUTL3
TUTL7
PLOTXY
PLUT

e. Argument List

IWHICH - A variable indicating the option requested

ERROR - Logical error flag

NWORK - A variable defining the number of words of working storage available

IWORK - Is the working array

NAME - An array containing the name of the input case

f. Subroutine Length

1150 words (approximate)

SYMBOLS USED IN SUBROUTINE GRAPH

END	L	U	LOGICAL VARIABLE	GRAPH
ERROR	L	A	LOGICAL VARIABLE WHICH IS SET TO .TRUE. IF AN ERROR OCCURS	GRAPH
I	I	U	DO LOOP INDEX	GRAPH
IBLK	I	C	BLOCK SIZE OF MASTER CASE DATA SET	GRAPH
IK	I	U	INTERMEDIATE VARIABLE	GRAPH
IPANEL	I	D	ARRAY OF PANEL TABLE	GRAPH
ITABNO	I	U	THE NUMBER OF THE TABLE REQUESTED	GRAPH
IVECTR	I	U	VECTOR OPTION INDICATOR	GRAPH
IWHICH	I	A	INDICATOR TO LEAD EITHER PLOTXY OR PLOT	GRAPH
IWORK	I	A	THE WORKING ARRAY	GRAPH
J	I	U	INTERMEDIATE VARIABLE	GRAPH
JB	I	U	INTERMEDIATE VARIABLE	GRAPH
JBAR	I	U	FIRST LOCATION OF IBAR ARRAY	GRAPH
JB1	I	U	INTERMEDIATE VARIABLE	GRAPH
JCOOR	I	U	FIRST LOCATION OF COOR ARRAY	GRAPH
JJ	I	U	INTERMEDIATE VARIABLE	GRAPH
JK	I	U	DO LOOP INDEX	GRAPH
JLOAD	I	U	FIRST LOCATION OF VLOAD ARRAY	GRAPH
JREAC	I	U	FIRST LOCATION OF VREAC ARRAY	GRAPH
J1	I	U	FIRST LOCATION OF TEMP ARRAY	GRAPH
J2	I	U	FIRST LOCATION OF ITEMP ARRAY	GRAPH
J3	I	U	FIRST LOCATION OF X ARRAY	GRAPH
J4	I	U	FIRST LOCATION OF IRCW ARRAY	GRAPH
J5	I	U	FIRST LOCATION OF VTITLE ARRAY	GRAPH
J6	I	U	FIRST LOCATION OF HTITLE ARRAY	GRAPH
J7	I	U	FIRST LOCATION OF RCW ARRAY	GRAPH
J8	I	U	FIRST LOCATION OF INAME ARRAY	GRAPH
J9	I	U	FIRST LOCATION OF ICCL ARRAY	GRAPH
J10	I	U	FIRST LOCATION OF N ARRAY	GRAPH
J11	I	U	FIRST LOCATION OF LINE ARRAY	GRAPH
J12	I	U	FIRST LOCATION OF YMAX ARRAY	GRAPH
J13	I	U	FIRST LOCATION OF YMIN ARRAY	GRAPH

SYMBOLS USED IN SUBROUTINE GRAPH

J14	I	U	FIRST LOCATION OF NROWS ARRAY	GRAPH
J15	I	U	FIRST LOCATION OF INSPEC ARRAY	GRAPH
J16	I	U	FIRST LOCATION OF INMTAP ARRAY	GRAPH
J17	I	U	LAST LOCATION OF INMTAP ARRAY	GRAPH
K	I	U	INTERMEDIATE VARIABLE	GRAPH
KK	I	U	INTERMEDIATE VARIABLE	GRAPH
KONST	I	C	THE ORDER OF THE LARGEST MATRIX	GRAPH
L	I	U	INTERMEDIATE VARIABLE	GRAPH
LREC	I	U	ACTUAL LENGTH OF THE LOGICAL RECORD	GRAPH
MAXREC	I	U	THE LENGTH OF THE LONGEST LOGICAL RECORD IN THE CASE	GRAPH
MM	I	U	INTERMEDIATE VARIABLE	GRAPH
MWORK	I	C	THE LENGTH OF THE TABLE OF IWORK	GRAPH
NAME	I	A	NAME OF THE INPUT CASE	GRAPH
NBAR	I	U	NUMBER OF THE BARS	GRAPH
NCASE	I	U	NUMBER OF CASES	GRAPH
NJ8	I	U	FIRST LOCATION OF P ARRAY	GRAPH
NJOINT	I	U	NUMBER OF JOINTS	GRAPH
NLOAD	I	U	NUMBER OF APPLIED LOAD VECTORS	GRAPH
NM	I	U	INTERMEDIATE VARIABLE	GRAPH
NORDS	I	U	NUMBER OF X-VALUES	GRAPH
NP	I	D	ARRAY OF INTERMEDIATE VARIABLES	GRAPH
NPIT	I	C	LOGICAL DATA SET NUMBER OF THE SYSTEM INPUT UNIT	GRAPH
NPOT	I	C	LOGICAL DATA SET NUMBER OF THE SYSTEM OUTPUT UNIT	GRAPH
NREAC	I	U	NUMBER OF REACTION VECTORS	GRAPH
NSETS	I	U	NUMBER OF SETS OF ROW NUMBERS	GRAPH
NTAB	I	U	THE NUMBER OF TABLES IN THIS CASE	GRAPH
NTBAR	I	U	INTERMEDIATE VARIABLE	GRAPH
NTEMP	I	U	FIRST LOCATION OF CT ARRAY	GRAPH
NWORK	I	A	NUMBER OF WORDS OF WORKING STORAGE AVAILABLE	GRAPH

2. SUBROUTINE PLOTXY (DECK P403)

This routine plots general matrix data

a. Algorithm

After testing and initializaing variables, the matrix copy routine (MCOPY) is called to read the copy card and carry out the appropriate procedure. Upon returning the input table of x-values and sets of row numbers to be plotted is read in. At this point the table is sorted into appropriate arrays eliminating undesired x-values for a given set of row numbers. The number of columns to be plotted, extreme values for the x and y axes, their respective increments, and the vertical and horizontal titles are read in. In addition, for each column, the name of the matrix, the column number, the row set number and the line option is read in. At this point the sorting routine (SORT) is called to sort the input cases. Subroutine SEARCH is called to locate the maximum and minimum values in each column. PLTXY1 is then called to calculate the remaining necessary variables and to call the appropriate SC-4020 routines.

b. Input/Output

Sets of row numbers, x-values, number of columns to be plotted, extreme values and increment values for axes, axes titles, matrix name, column number, the row set number and the line option are read from the system input data set. SC-4020 plots are output onto the SC-4020 data set.

c. Error

When the size limit for the input value is exceeded, the limit will be used and an appropriate message printed.

An error condition results when an error is returned from a subroutine. This occurs when a copy error is detected, the specified matrix could not be found, or when every element of the column is zero.

d. Subroutines Required

MCOPY
SORT
FIND
SEARCH
PLTXY1
SCLSIZ
SC-4020

e. Argument List

TEMP	-	Temporary storage for input x-values
ITEMP	-	Temporary storage for the input sets of row numbers
X	-	An array containing x-values for a given row set
IROW	-	An array containing the row numbers to be plotted (row set)
VTITLE	-	Vertical axis title
HTITLE	-	Horizontal axis title
ROW	-	An array containing the row values of the matrix column to be plotted.
INAME	-	An array containing the matrix names of the columns to be plotted
ICOL	-	An array containing the number of the column to be plotted
N	-	An array containing row set numbers
LINE	-	An array containing for each column to be plotted either a 1 to denote that lines connecting the plotted points are desired or a 0 (zero) to denote the absence of lines
YMAX	-	An array containing the largest value in each column
YMIN	-	An array containing the smallest values in each column
NROWS	-	An array containing the number of row values to be plotted for each row set
INSPEC	-	Logical input data set numbers for input matrices
INMTAP	-	Names of input matrix data sets
NCASE	-	The number of cases (frames)
NORDS	-	Number of x-values
NSETS	-	Number of sets of row numbers
ERROR	-	Logical variable which is set to .TRUE. if an error occurs

f. Subroutine Length

1365 words (approximate)

SYMBOLS USED IN SUBROUTINE PLOTXY

ANY	R	U	DUMMY ARGUMENT	PLOTXY
COPIED	L	V	LOGICAL MATRIX COPY VARIABLE	PLOTXY
DX	R	U	DATA INCREMENT AT WHICH VERTICAL GRID LINES WILL BE DISPLAYED	PLOTXY
DY	R	U	DATA INCREMENT AT WHICH HORIZONTAL GRID LINES IS DISPLAYED	PLOTXY
ERROR	L	A	LOGICAL ERROR FLAG	PLOTXY
HTITLE	R	D	ARRAY TO BE USED FOR HORIZONTAL LABEL	PLOTXY
I	I	U	DO LOOP INDEX	PLOTXY
IBLK	I	C	BLOCK SIZE OF THE MASTER CASE DATA SET	PLOTXY
ICOL	I	A	ARRAY OF COLUMN NUMBERS TO BE PLOTTED	PLOTXY
II	I	U	DO LOOP INDEX	PLOTXY
IK	I	U	DO LOOP INDEX	PLOTXY
IM	I	U	INTERMEDIATE VARIABLE	PLOTXY
IMAX	I	U	NUMBER OF ROWS IN LOCATED MATRIX	PLOTXY
INAME	I	A	ARRAY OF THE NAMES OF THE MATRICES TO BE PLOTTED	PLOTXY
INMTAP	I	A	NAMES OF INPUT MATRICES DATA SETS	PLOTXY
INSPEC	I	A	LOGICAL DATA SET NUMBER OF INPUT MATRICES	PLOTXY
IROW	I	A	ARRAY OF ROW NUMBERS	PLOTXY
ISET	I	U	DATA SET WHICH CONTAINS MATRIX TO BE LOCATED	PLOTXY
ITCOL	I	D	TEMPORARY STORAGE	PLOTXY
ITEMP	I	D	TEMPORARY STORAGE	PLOTXY
ITNAME	I	D	TEMPORARY STORAGE	PLOTXY
J	I	U	DO LOOP INDEX	PLOTXY
JFIND	I	U	NUMBER OF THE MATRIX WHICH WAS LOCATED FIRST	PLOTXY
JJ	I	U	DO LOOP INDEX	PLOTXY
JMAX	I	U	NUMBER OF COLUMNS IN LOCATED MATRIX	PLOTXY
KODE	I	U	COLUMN COMPRESSION CODE	PLOTXY
KONST	I	C	THE ORDER OF THE LARGEST MATRIX	PLOTXY
LINE	I	A	INDICATOR TO CONNECT POINTS	PLOTXY
LINET	I	D	TEMPORARY STORAGE	PLOTXY
MWORK	I	C	THE LENGTH OF THE WORKING STORAGE AREA	PLOTXY
N	I	A	ARRAY OF ROW SET NUMBERS	PLOTXY
NCASE	I	A	NUMBER OF CASES	PLOTXY

SYMBOLS USED IN SUBROUTINE PLOTXY

NHT	I	U	THE RASTER COORDINATES FOR THE CENTER OF FIRST CHARACTER	PLOTXY
NORDS	I	A	NUMBER OF X-VALUES	PLOTXY
NPIT	I	C	LOGICAL DATA SET NUMBER OF THE SYSTEM INPUT UNIT	PLOTXY
NPUT	I	C	LOGICAL DATA SET NUMBER OF THE SYSTEM OUTPUT UNIT	PLOTXY
NROWS	I	A	ARRAY CONTAINING NUMBER OF ROW VALUES FOR EACH ROW SET	PLOTXY
NSETS	I	A	NUMBER OF SETS OF ROW NUMBERS	PLOTXY
NT	I	D	TEMPORARY STORAGE	PLOTXY
NUM	I	U	NUMBER OF ELEMENTS IN THE COLUMN	PLOTXY
NUMCOL	I	A	NUMBER OF THE COLUMNS TO BE PLOTTED ON SAME FRAME	PLOTXY
NUMIO	I	U	INTERMEDIATE VARIABLE	PLOTXY
NUMTOP	I	U	RASTER COORDINATE WHICH WILL POSITION FIRST CHARACTER	PLOTXY
NVT	I	U	THE RASTER COORDINATES FOR THE CENTER OF FIRST CHARACTER	PLOTXY
ROW	R	A	ARRAY WHERE ELEMENTS OF THE COLUMN TO BE STORED	PLOTXY
TEMP	I	A	TEMPORARY STORAGE	PLOTXY
VTITLE	R	D	ARRAY TO BE USED FOR VERTICAL LABEL	PLOTXY
X	I	A	ARRAY OF X-VALUES FOR EACH ROW SET	PLOTXY
XL	R	U	FLOATING POINT VALUE FOR THE LEFT-MOST LIMIT OF THE GRID	PLOTXY
XMAX	R	U	FLOATING POINT FINAL ROW NUMBER OF THE COLUMN	PLOTXY
XMIN	R	U	FLOATING POINT INITIAL ROW NUMBER OF THE COLUMN	PLOTXY
XR	R	U	FLOATING POINT VALUE FOR THE RIGHT-MOST LIMITS OF THE GRIDS	PLOTXY
YB	R	U	FLOATING POINT VALUE FOR THE BOTTOM LIMIT OF THE GRID	PLOTXY
YMAX	R	A	LARGEST ELEMENT VALUE OF THE COLUMN	PLOTXY
YMIN	R	A	SMALLEST ELEMENT VALUE OF THE COLUMN	PLOTXY
YT	R	U	FLOATING POINT VALUE FOR THE TOP LIMIT OF THE GRID	PLOTXY
ZMAX	R	U	LARGEST ELEMENT OF THE COLUMN	PLOTXY
ZMIN	R	U	SMALLEST ELEMENT OF THE COLUMN	PLOTXY

3. SUBROUTINE MCOPY (DECK P405)

This routine copies a matrix header, specified columns, and a matrix trailer onto a scratch data set.

a. Algorithm

The subroutine first locates an available utility data set and writes a data set header and trailer on it. Then the COPY card, which contains the copy option and the number of matrix copies to be made, is read in. If NOCOPY is specified the subroutine returns to the calling routine. If COPY is specified the matrix name, the number of columns to be copied, and the column numbers of that matrix to be copied are read in. The column numbers are sorted into ascending order and subroutine FIND is called to locate the specific matrix. A matrix header is written on the scratch data set and the specified columns are copied on to it. A matrix trailer is written, the copy flag is set, and after all copies are made the subroutine returns to the calling program.

b. Input/Output

The number of matrix copies, the matrix names, and columns to be copied are read from the system input data set. The data set number onto which the matrix copies were made is passed to calling routine.

c. Error

An error condition results when an error is returned from a subroutine, a matrix or column could not be found, or the COPY option card was found to be incorrect.

d. Subroutines Required

FIND
EUTL1
EUTL3
EUTL5
EUTL6

e. Argument List

MCOPY (ISET, TEMP, COPIED, ERROR)

ISET - Data set number onto which the matrix copies were made

TEMP - Temporary storage

COPIED - Logical copy flag

ERROR - Logical error flag

f. Subroutine Length

575 words (approximate)

SYMBOLS USED IN SUBROUTINE MCOPY

COPIED	L	A	LOGICAL VARIABLE	MCOPY
ERROR	L	A	LOGICAL VARIABLE	MCOPY
ICARD	I	D	ARRAY CONTAINING IMAGE OF INPUT COPY OPTION	MCOPY
ICHANG	I	U	INTERMEDIATE COUNTER	MCOPY
ICOPY	I	D	ARRAY CONTAINING COPY OPTIONS	MCOPY
II	I	U	INTERMEDIATE COUNTER	MCOPY
IMAX	I	U	MAXIMUM ROW LENGTH	MCOPY
IN	I	U	INTERMEDIATE COUNTER	MCOPY
ISET	I	A	DATA SET NUMBER ONTO WHICH THE COPY IS MADE	MCOPY
ITEM	I	U	TEMPORARY STORAGE	MCOPY
J	I	U	COLUMN NUMBER	MCOPY
JMAX	I	U	MAXIMUM COLUMN LENGTH	MCOPY
K	I	U	INTERMEDIATE COUNTER	MCOPY
KONFIG	I	D	CONFIGURATION ARRAY	MCOPY
L	I	U	INTERMEDIATE COUNTER	MCOPY
M	I	U	INTERMEDIATE COUNTER	MCOPY
MACARD	I	D	ARRAY CONTAINING A MATRIX NAME TO BE COPIED	MCOPY
NCOL	I	D	ARRAY CONTAINING COLUMN NUMBERS TO BE COPIED	MCOPY
NI	I	U	INTERMEDIATE COUNTER	MCOPY
NM	I	U	INTERMEDIATE COUNTER	MCOPY
NSET	I	U	DATA SET NUMBER OF LOCATED MATRIX	MCOPY
NUM	I	U	NUMBER OF COLUMNS TO BE COPIED	MCOPY
NUMBER	I	U	NUMBER OF REMAINING WORDS	MCOPY
NUMCOP	I	U	NUMBER OF MATRIX COPIES	MCOPY
NUMR	I	U	NUMBER OF AVAILABLE DATA SETS	MCOPY
TEMP	R	D	TEMPORARY STORAGE	MCOPY

4. SUBROUTINE SORT (DECK P406)

This routine sorts input cases for subroutine PLOTXY on a per case basis.

a. Algorithm

After initializing variables the array of names are sorted into groups of the same name while the other variables are stored into their associated arrays. The column numbers in a given group of names are sorted in ascending order. After all groups are sorted control is returned to the calling routine.

b. Input/Output

None

c. Error

None

d. Subroutines Required

None

e. Argument List

SORT (ITNAME, ITCOL, NT, LINET, NUMCOL, INAME, ICOL, N, LINE)

ITNAME - Array containing names to be sorted

ITCOL - Array containing column numbers to be sorted

NT - Array containing NSET numbers to be sorted

LINET - Array containing line options to be sorted

NUMCOL - Numbers of columns to be plotted

INAME - Array in which the sorted names are to be stored

ICOL - Array in which the sorted column numbers are to be stored

N - Array in which the sorted NSET numbers are to be stored

LINE - Array in which the sorted line options are to be stored

f. Subroutine Length

320 words (approximate)

SYMBOLS USED IN SUBROUTINE SORT

I	I	U	INTERMEDIATE COUNTER	SORT
ICOL	I	A	ARRAY IN WHICH THE SORTED COLUMN NUMBERS ARE TO BE STORED	SORT
IN	I	U	INTERMEDIATE COUNTER	SORT
INAME	I	A	ARRAY IN WHICH THE SORTED NAMES ARE TO BE STORED	SORT
IPOINT	I	U	INTERMEDIATE COUNTER	SORT
ITCOL	I	A	ARRAY CONTAINING COLUMN NUMBERS TO BE STORED	SORT
ITEM	I	U	TEMPRARY STORAGE	SORT
ITEST	I	U	INTERMEDIATE COUNTER	SORT
ITNAME	I	A	ARRAY CONTAINING NAMES TO BE SORTED	SORT
J	I	U	INTERMEDIATE COUNTER	SORT
JJ	I	U	INTERMEDIATE COUNTER	SORT
LINE	I	A	ARRAY IN WHICH TH SORTED LINE OPTIONS ARE TO BE STORED	SORT
LINET	I	A	ARRAY CONTAINING LINE OPTIONS TO BE SORTED	SORT
N	I	A	ARRAY IN WHICH THE SORTED NSET NUMBERS ARE TO BE STORED	SORT
NM	I	U	INTERMEDIATE COUNTER	SORT
NT	I	A	ARRAY CONTAINING NSET NUMBERS TO BE SORTED	SORT
NUM	I	U	INTERMEDIATE COUNTER	SORT
NUMCOL	I	A	NUMBERS OF COLUMNS TO BE PLOTTED	SORT
M	I	U	INTERMEDIATE COUNTER	SORT

5. SUBROUTINE SEARCH (DECK P407)

This routine locates the maximum and minimum values in columns to be plotted.

a. Algorithm

If a given matrix has not been found, EUTL3 is called to locate it. If a given column has not been found, the data set is read until it is located. The column is then searched for the maximum and minimum values. After finding these extremes control is returned to the calling routine.

b. Input/Output

The specified matrices and columns are read from the master input data sets.

c. Error

An error condition results if a matrix is not available or cannot be found. Also if a column are zero an error message is written.

d. Subroutines Required

PUTL2
EUTL3
EUTL9

e. Argument List

SEARCH (NUMCOL, ISET, INSPEC, INAME, ICOL, IROW, NROWS, YB, YT, ZMAX, ZMIN, NORDS, IFLAG, ERROR, COPIED, DY, N, ROW)

NUMCOL - Number of columns to be plotted

ISET - Data set number

INSPEC - Array containing data set numbers

INAME - Array containing matrix names

ICOL - Array containing column numbers

IROW - Array containing the row numbers to be plotted

NROWS - Array containing the number of row values to be plotted for each row set

YB - Floating point value for the bottom limit of grid

YT - Floating point value for the top limit of grid

ZMAX - Largest element of the column

ZMIN - Smallest element of the column

NORDS - Number of x-values

IFLAG - Integer flag

ERROR - Logical error flag

COPIED - Logical copy flag

DY - Data increment at which horizontal grid lines displayed

N - Array of row set numbers

ROW - Array containing row values

f. Subroutine Length

587 words (approximate)

SYMBOLS USED IN SUBROUTINE SEARCH

COPIED	L	V	LOGICAL MATRIX COPY VARIABLE	SEARCH
DY	R	U	DATA INCREMENT AT WHICH HORIZONTAL GRID LINES DISPLAYED	SEARCH
ERROR	L	A	LIGICAL ERROR FLAG	SEARCH
I	I	U	DO LOOP INDEX	SEARCH
ICOL	I	A	ARRAY OF COLUMN NUMBERS TO BE PLOTTED	SEARCH
IMAX	I	U	NUMBER OF ROWS IN LOCATED MATRIX	SEARCH
INAME	I	A	ARRAY OF THE NAMES OF THE MATRICES TO BE PLOTTED	SEARCH
INSPEC	I	A	LOCICAL DATA SET NUMBER OF INPUT MATRICES	SEARCH
IROW	I	A	ARRAY OF ROW NUMBERS	SEARCH
ISET	I	U	DATA SET WHICH CONTAINS MATRIX TO BE LOCATED	SEARCH
J	I	U	COLUMN NUMBER	SEARCH
JMAX	I	U	NUMBER OF COLUMNS IN LOCATED MATRIX	SEARCH
KODE	I	U	COLUMN COMPRESSION CODE	SEARCH
N	I	A	ARRAY OF ROW SET NUMBERS	SEARCH
NORDS	I	A	NUMBER OF X-VALUES	SEARCH
NPIT	I	C	LOGICAL DATA SET NUMBER OF THE SYSTEM INPUT UNIT	SEARCH
NPOT	I	C	LOGICAL DATA SET NUMBER OF THE SYSTEM OUTPUT UNIT	SEARCH
NROWS	I	A	ARRAY CONTAINING NUMBER OF ROW VALUES FOR EACH ROW SET	SEARCH
NUM	I	U	NUMBER OF ELEMENTS IN A COLUMN	SEARCH
NUMCOL	I	A	NUMBER OF THE COLUMNS TO BE PLOTTED ON THE SAME FRAME	SEARCH
ROW	R	A	ARRAY WHERE ELEMENTS OF THE COLUMN ARE TO BE STORED	SEARCH
YB	R	U	FLOATING POINT VALUE FOR THE BOTTOM LIMIT OF THE GRID	SEARCH
YMAX	R	A	LARGEST ELEMENT VALUE OF THE COLUMN	SEARCH
YMIN	R	A	SMALLEST ELEMENT VALUE OF THE COLUMN	SEARCH
YT	R	U	FLOATING POINT VALUE FOR THE TOP LIMIT OF THE GRID	SEARCH
ZMAX	R	U	LARGEST ELEMENT OF THE COLUMN	SEARCH
ZMIN	R	U	SMALLEST ELEMENT OF THE COLUMN	SEARCH

6. SUBROUTINE PLTXY1 (DECK P408)

This routine calls appropriate SC-4020 routines to plot the specified points.

a. Algorithm

After locating the specified matrices and columns, this routine intializes and sets the appropriate variables and then calls the required SC-4020 routines to plot the points desired. In order to save search time, this routine is designed to locate matrices and columns not previously located (provided SORT has been used).

b. Input/Output

The matrix names, and columns are extracted from the master input data sets. The matrix names, column numbers, nset numbers, line options, and plotted values are written on the system output unit.

c. Error

When a matrix cannot be found, or the maximum number of rows or columns is exceeded on error conditions results.

d. Subroutines Required

PUTL2
EUTL3
EUTL9
SC-4020

e. Argument List

PLTXY1 (NUMCOL, INAME, INSPEC, ICOL, N, NROWS, IROW, ROW, LINE, X, NORDS, LINES)

NUMCOL - Number of columns to be plotted

INAME - Array containing matrix names to be plotted

INSPEC - Logical data set number of input matrices

ICOL - Array of column numbers to be plotted

N - Array of row set numbers

NROWS - Array containing the number of row values to be plotted for each row set

IROW - Array containing the row numbers to be plotted

ROW - Array containing row values

LINE - Array containing line options

X - Array of x-values for each row set

NORDS - Number of x-values

LINES - Number of lines of output

f. Subroutine Length

725 words (approximate)

SYMBOLS USED IN SUBROUTINE PLTXY1

ANY	R	U	DUMMY ARGUMENT	PLTXY1
ERROR	L	A	LOGICAL ERROR FLAG	PLTXY1
I	I	U	DO LOOP INDEX	PLTXY1
ICOL	I	A	ARRAY OF COLUMN NUMBERS TO BE PLOTTED	PLTXY1
IMAX	I	U	NUMBER OF ROWS IN LOCATED MATRIX	PLTXY1
INAME	I	A	ARRAY OF THE NAMES OF THE MATRICES TO BE PLOTTED	PLTXY1
INSPEC	I	A	LOGICAL DATA SET NUMBER OF INPUT MATRICES	PLTXY1
IROW	I	A	ARRAY OF ROW NUMBERS	PLTXY1
ISET	I	U	DATA SET WHICH CONTAINS MATRIX TO BE LOCATED	PLTXY1
J	I	U	COLUMN NUMBER	PLTXY1
JMAX	I	U	NUMBER OF COLUMNS IN LOCATED MATRIX	PLTXY1
KODE	I	U	COLUMN COMPRESSION CODE	PLTXY1
LINE	I	U	INDICATOR TO CONNECT POINTS	PLTXY1
N	I	A	ARRAY OF ROW SET NUMBERS	PLTXY1
NHT	I	U	THE RASTER COORDINATES FOR THE CENTER OF FIRST CHARACTER	PLTXY1
NORDS	I	A	NUMBER OF X-VALUES	PLTXY1
NPIT	I	C	LOGICAL DATA SET NUMBER OF THE SYSTEM INPUT UNIT	PLTXY1
NPOT	I	C	LOGICAL DATA SET NUMBER OF THE SYSTEM OUTPUT UNIT	PLTXY1
NROWS	I	A	ARRAY CONTAINING NUMBER OF ROW VALUES FOR EACH ROW SET	PLTXY1
NUM	I	U	NUMBER OF ELEMENTS IN A COLUMN	PLTXY1
NUMCOL	I	A	NUMBER OF THE COLUMNS TO BE PLOTTED ON SAME FRAME	PLTXY1
NUMTOP	I	U	RASTER COORDINATE WHICH WILL POSITION FIRST CHARACTER	PLTXY1
NVT	I	U	THE RASTER COORDINATES FOR THE CENTER OF FIRST CHARACTER	PLTXY1
NX1	I	U	HORIZONTAL RASTER COORDINATE OF ONE END POINT	PLTXY1
NX2	I	U	HORIZONTAL RASTER COORDINATE OF THE OTHER END POINT	PLTXY1
NY1	I	U	VERTICAL RASTER COORDINATE OF ONE END POINT	PLTXY1
NY2	I	U	VERTICAL RASTER COORDINATE OF THE OTHER POINT	PLTXY1
ROW	R	A	ARRAY WHERE ELEMENTS OF THE COLUMN TO BE STORED	PLTXY1
X	I	A	ARRAY OF X-VALUES FOR EACH ROW SET	PLTXY1
YMAX	R	A	LARGEST ELEMENT VALUE OF THE COLUMN	PLTXY1
YMIN	R	A	SMALLEST ELEMENT VALUE OF THE COLUMN	PLTXY1

APPENDIX III

PHASE III OVERLAY STRUCTURE - EXTENDED
OVERLAY STRUCTURE FOR MATRIX PLOT MODULE

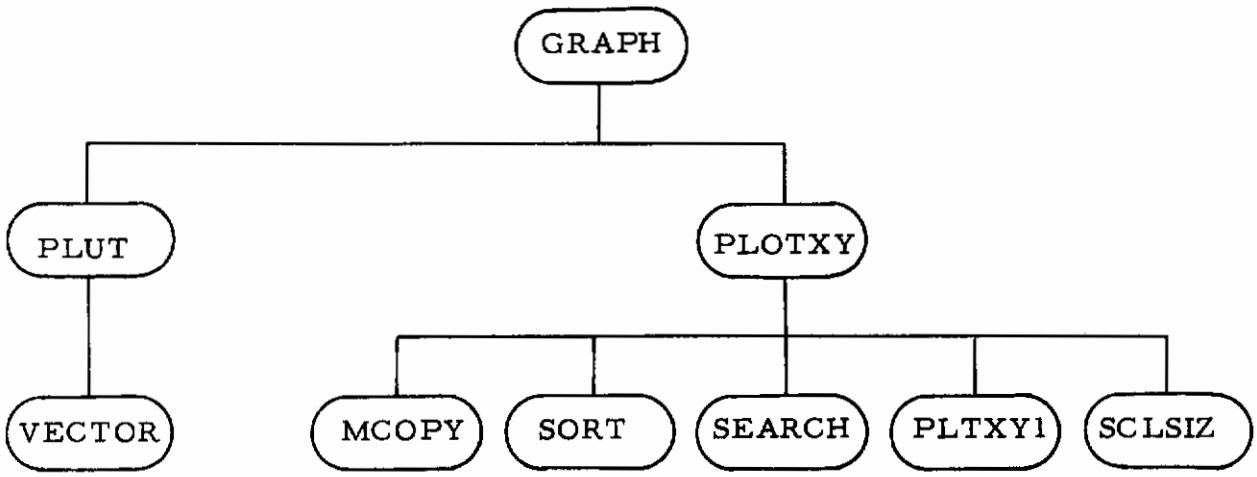

TABLE I. OVERLAY STRUCTURE – PHASE III (Continued)

SUBR.	NAME	DECK NAME		
27	OUT1		P120	CONTROL CARD
28	OUT11		P121	ANALYZER
$ORIGIN		FT1100		
29	DMSP		P200	
$ORIGIN		FT1110		
30	LABEL		P201	DISPLACEMENT METHOD SPECIAL PRINT MODULE
$ORIGIN		FT1110		
31	DPRINT		P202	
$ORIGIN		FT1110		
32	PPRINT		P203	
$ORIGIN		FT1100		
33	FMSP		P300	FORCE METHOD SPECIAL PRINT MODULE
$ORIGIN		FT1120		
34	RDRD		P301	
$ORIGIN		FT1120		
35	RPRTA		P302	
$ORIGIN		FT1120		
36	RPRTB		P303	
$ORIGIN		FT1100		
37	GRAPH		P400	
$ORIGIN		FT1130		
38	PLUT		P401	
39	VECTOR		P402	
$ORIGIN		FT1130		
40	PLOTXY		P403	
$ORIGIN		FT1140		
41	MCOPY		P405	PLOT MODULE
$ORIGIN		FT1140		
42	SORT		P406	
$ORIGIN		FT1140		
43	SEARCH		P407	
$ORIGIN		FT1140		
44	PLTXY1		P408	
$ORIGIN				
45	SCLSIZ		P404	

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13. ABSTRACT

The FORMAT System has been updated by the incorporation of additional basic capability and the refinement of existing capability. A simpler mode of updating case data and extended force method matrix generation capability has been incorporated in Phase I of the system. A refined "Structure Cutter" module, capabilities for matrix partitioning and instruction looping, and an additional eigenvalue/eigenvector extraction module have been incorporated in Phase II. Finally the limitations which existed in the matrix plotting capability in Phase III have been eliminated. Programming documentation for the extended capability of Phase III of the FORMAT System is presented in this report.

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