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User's Manual for Programs FILXYZ and FUNXYZ

E. D. Holbrook

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E. D. Holbrook
Data Processing Division 8411
Sandia Laboratories

ABSTRACT

Program FILXYZ prepares an input file for program FUNXYZ by merging together subfiles of data for a specified test configuration or set of test conditions based upon one, two, or three independent variables. Program FUNXYZ computes the function of one, two, or three variables of a set of empirical or test data to provide a file with values that are equally spaced over the independent variables. The programs are written in FORTRAN for use on the CDC 6600.

ACKNOWLEDGEMENTS

The basic subroutine of the program FUNXYZ was developed by R. E. Humphrey, Division 8158. I wish to thank Mr. Humphrey for the use of the subroutine and for his help and suggestions in the development of program FUNXYZ.

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USER'S MANUAL FOR PROGRAMS FILXYZ AND FUNXYZ

1. Introduction

Programs FILXYZ and FUNXYZ were developed to process wind tunnel data using Sandia's master disc file format. The programs can be used for data which are a function of three independent variables, two independent variables, or one independent variable to produce a final file of data equally spaced over these variables.

Program FILXYZ builds a file for input into program FUNXYZ. It restructures the subfiles so that all data pertaining to a specified configuration or test condition is merged into one subfile. The capability is provided to insert an independent variable which is constant of the run and not recorded with the test data. The file format is the word-addressable master disc file used by Division 8411 in the secondary processing of test data.

Program FUNXYZ with the necessary input parameters performs the numerical computations for the dependent variables at points over an equally spaced, rectangular grid of values of the independent variables. The output is the word-addressable master disc file of the equally gridded data. The technique for fitting the data and performing the interpolation and extrapolation was researched by R. E. Humphrey, 8158.[1] Subroutine FITF, developed by Humphrey, is incorporated as a part of program FUNXYZ to perform the computations.

The programs are written in extended FORTRAN for the CDC 6600 and exist on a permanent library known as MACHLIB.

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[1] R. E. Humphrey, An Approximation Technique for Functions of Several Variables, Sandia Laboratories, Livermore, SAND76-8038, August 1976.

2. File Structure

2.1 Master Disc File

The master disc file is a word-addressable file as described in User's Guide for CDC 6000 Computer Systems for Cyber Record Manager.

Word-Addressable File - General

The word-addressable file is one of several file formats that is available in the Record Manager System used by FORTRAN extended. This file can be considered as one continuous string of data starting with word 1 at the beginning of the file and ending with word n, the last word in the file (see Figure 1). Every word is uniquely identified by a number from 1 to n. The word-addressable files can be accessed randomly or sequentially and can only exist on mass storage. The user must do all of the bookkeeping to read or write data.

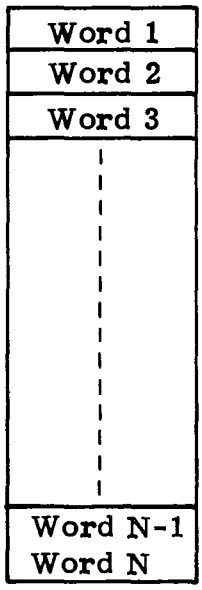

Figure 1.

The word-addressable files used by the data reduction programs are specified record type U. This means that the records are not defined and the user must specify a record length on both read and write operations. The Record Manager System cannot determine where the U type record begins or ends on a file. There are no ENDFILE indicators written on the files and they would be ignored if written.

The logical file names are defined in the program and are not listed in the program statement. With a few exceptions, the input file is named MDF and the output file is named MDF1. If any

external file is attached, the user must be sure that the file has been renamed to conform to the logical file name internal to the program. This is done by using a FILE card and a LDSET card.

FILE (ℓfn old, LFN = ℓfn new)

LDSET (FILES = ℓfn old)

Word-Addressable File - Data Reduction

The following is a brief description of the word-addressable file (WAF) used by the Data Reduction Secondary Processing Libraries. The structure maintains the original format of the master disc file (MDF) with modifications necessary to make the file word-addressable.

The first 900 words are reserved for the word address table that is maintained by the user for read and write operations. The first data entry is at address 901 and is always the IDT record for the first data channel. An IDT record is entered for each channel of data in a frame (or data node) for the subfile. The IDT records must be written out in the same sequence as the sequence of the data in the data frame.

Following the IDT records is the data. The first word of the data record is a key word (DTA) followed by a second word which normally indicates the number of words in the record, but for the word-addressable file, it is not used. The data follows these two words in one continuous string to the end.

A terminator record is written at the end of the data and is usually referred to as an END record, which consists of three words, END, 1, 0. This constitutes a subfile, and the number of subfiles that can be written is dependent upon the space available in the word address table.

If the WAF is written with one channel of data per subfile, 149 channels of data may be written. This means that there is room for only 149 unique identifiers in the word address table. However, if the WAF is written with 16 channels per frame, a maximum of 384 channels of data can be written out; these are located in a total of only 24 subfiles. Figure 2 illustrates the file structure.

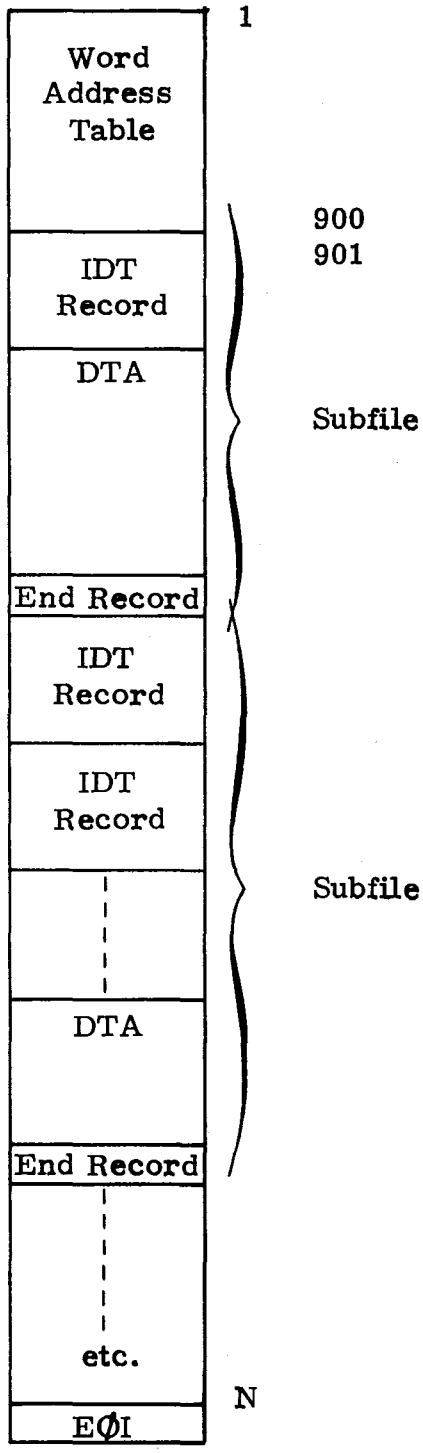
1
Word
Address
Table
900
901
IDT
Record
DTA
Subfile
End Record
IDT
Record
IDT
Record
Subfile
DTA
End Record
etc.
N
EØI

Figure 2.

2.2 The IDT Record

The IDT record is a 128-word record which identifies a single channel of information in the MDF. The record also has the necessary parameters and labeling information to generate a plot of that data without reading in additional parameter cards. The description of the IDT record follows.

WORD	CHAR	FORMAT	ITEM	ORIGIN	COMMENTS
1	1-3	BCD	RECORD LABEL	PROG	ALWAYS IDT
2	1-10	FXP	NUMBER OF WORDS	PROG	ALWAYS 126
3	1-8	BCD	PARAMETER IDENTIFICATION	IDT	BLANKS REMOVED
4	1-10	FXP	THT FILE NUMBER	PROG	
5	1-10	FXP	THT REEL NUMBER	LABEL	
6	1-10	FXP	KEYWORD	PROG	INITIALLY ZERO
7	1-10	FLP	INTERPOLATE DELTA TIME	PROG	
8	1-10	FXP	NUMBER OF TIME GAPS	PROG	
9-18	1-100	FLP	SCALE TIME OF TIME GAPS	PROG	
19-28	1-100	FLP	MAGNITUDE OF TIME GAPS	PROG	
29	1-10	BCD	DATA BASE REEL NO.	LBL	
30	1-10	BCD	DATA BASE ISSUE NO.	LBL	
31	1-10	FXP	TYPE DATA FLAG	--	PICKED UP FROM COMMON
32	1-10	FXP	NO. POINTS IN TRANSFORM / FOURID OR OUTPUT POINTS FROM FILTER		
33	1-5	BCD	TEST NUMBER	LBL	
34	1	BCD	TEST NUMBER SUFFIX	LBL	
35	1-3	BCD	TEST RUN NUMBER	LBL	
36	1-8	BCD	TEST DATE	LBL	
37-38	1-16	BCD	CHARGE NUMBER	LBL	
39-40	1-20	BCD	TPE NAME	LBL	
41	1-4	BCD	TPE ORGANIZATION	LBL	
42-43	1-20	BCD	DATA ANALYST	LBL	
44-45	1-16	BCD	TEST ITEM	LBL	
46	1-5	BCD	RECORDING SOURCE	PICKED UP FROM IND. PROG.	
47-49	1-40	FXP	UNUSED SPACE	PROG	ALWAYS ZERO
50	1-8	BCD	PARAMETER IDENTIFICATION	PLT	UNCHANGED FROM THT
51	1-10	BCD	PARAMETER UNITS	PLT	
52	1-10	BCD	PLOT DATA UNITS	PLT	
53	1-10	FLP	PLOT CONVERSION FACTOR	PLT	
54	1-4	BCD	PLOT CLASSIFICATION	PLT	
55	1-4	BCD	PLOT SIZE CODE	PLT	
56	1-10	FLP	PLOT GRID SIZE	PLT	
57	1-10	FXP	PLOT AXIS CODE	PLT	
58	1-10	FXP	PLOT SYMBOL CODE	PLT	
59-62	1-40	BCD	PLOT Y ANNOTATION	PLT	
63-66	1-40	BCD	PLOT TIME ANNOTATION	PLT	
67	1-10	BCD	PLOT TIME UNITS	PLT	
68	1-10	FLP	PLOT TIME CONVERSION	PLT	
69	1-10	FLP	FILTER DELAY CORRECTION	PLT	
70	1-10	FLP	PLOT REFERENCE TIME	PLT	
71-78	1-80	BCD	PLOT TITLE	PLT	
79	1-10	FLP	PLOT START TIME	PLT	
80	1-10	FLP	PLOT STOP TIME	PLT	
81	1-10	FLP	PLOT DATA MINIMUM	PLT	
82	1-10	FLP	PLOT DATA MAXIMUM	PLT	
83	1-10	FXP	TAPE TRACK NO.	PLT	

84	1-10	FLP	VCO CENTER FREQ. (KHZ)	PLT	
85	1-10	FLP	VCO DEVIATION (KHZ)	PLT	
86-87	1-20	FXP	UNUSED SPACE	PROG	ALWAYS ZERO
88	1-10	FLP	STATIC CORRECTION	NOR	
89	1-10	FLP	STATIC VALUE	NOR	
90	1-10	FLP	STD. DEV. STATIC CORR.	NOR	
91	1-10	FXP	NO. SAMPLES STATIC CORR.	NOR	
92	1-10	FLP	HIGH BAND EDGE	NOR	
93	1-10	FLP	CENTER BAND	NOR	
94	1-10	FLP	LOW BAND EDGE	NOR	
95	1-10	FLP	UPPER CAL. LEVEL	NOR	
96	1-10	FLP	LOWER CAL. LEVEL	NOR	
97	1-10	FLP	CAL. STD. DEV.	NOR	
98	1-10	FLP	STD. DEV. UPPER CAL.	NOR	
99	1-10	FLP	STD. DEV. LOWER CAL.	NOR	
100	1-10	FXP	NO. SAMPLES UPPER CAL.	NOR	
101	1-10	FXP	NO. SAMPLES LOWER CAL.	NOR	
102	1-10	FXP	NO. DATA SAMPLES / SEGMENT (PSD)		
103	1-10	FLP	DUPL. OF WD 95 - NOR INFO ZERO'D AT TIMES OR		
104	1-10	FLP	DUPL. OF WD 96 - USED FOR COMMENTS (SEE BELOW)		
105-106	1-40	FXP	UNUSED SPACE	PROG	ALWAYS ZERO
107-112	1-60	FXP	RUN START TIME	RUN	
113	1-10	FLP	DATA MINIMUM VALUE	MMX	
114	1-10	FLP	DATA MAXIMUM VALUE	MMX	
115	1-10	FXP	NO. OF ERRORS	MMX	
116	1-10	FXP	NUMBER OF OPERATIONS	MMX	
117-128	1-120	BCD	OPERATIONS	MMX	

SOME SECONDARY PROCESSING PROGRAMS PLACE A COMMENT IN THE NOR AREA.

```
WORD 88 - 'COMMENT    ' OR 'WNDTNL    '  (LEFT JUSTIFIED)
WORD 89
THRU 100- MESSAGE AREA
WORD 101- BLANK AS ARE ANY UNUSED WORDS ABOVE
```

3. Parameter Card Description

a. Control information may be entered in one of three card formats:

(1) The fixed-field card-identifier format consists of a 1-to-5-character card identifier beginning in Column 1, followed by one or more fixed data fields as defined by the program.

(2) The free-field card-identifier format corresponds to a fixed-field card and has the following syntax:

ID = data field, data field, ..., data field

where the card identifier ID may begin in any column. Blank fields are appended or surplus fields deleted from the right, if necessary, so that a free-field card defines the same parameters as the fixed-field card with the same identifier.

(3) The parameter-identifier format has the following syntax:

$$ID_1 = \text{data field},\ ID_2 = \text{data field},\ \ldots,\ ID_n = \text{data field}$$

where ID_j is a 1-to-10-character parameter identifier defined by the program.

b. Three types of data fields are used.

(1) Integer - A number written in I format may appear anywhere in the field.

(2) Real - A number written in I, F, or E format may appear anywhere in the field.

(3) Name - A 1-to-10-character alphanumeric parameter may appear anywhere in the field.

Internal blank characters are ignored in all three types of fields.

4. Parameter Cards for Program FILXYZ

Program FILXYZ uses eight parameter cards with the following card identifiers: CHAN, CHAN1, CHAN2, FILE, REPL, REPL1, RUN, and PASS. The information for all the cards except the RUN and PASS cards may be entered in any of the three formats described in Section 3. The PASS and RUN cards use only the fixed-field format. Each card is described in the fixed-field card-identifier format.

4.1 CHAN Card - To identify up to seven channels of data to be selected for input.

Card Column	Parameter Identifier	Type	Description
1-4	--	--	CHAN
5-10	--	--	Blank
11-20	ID1	Name	Channel name
21-30	ID2	"	"
31-40	ID3	"	"
41-50	ID4	"	"
51-60	ID5	"	"

Card Column	Parameter Identifier	Type	Description
61-70	ID6	Name	Channel name
71-80	ID7	"	"

4.2 CHAN1 card (first continuation card of CHAN) - To identify up to seven more data channels to be selected for input.

Card Column	Parameter Identifier	Type	Description
1-5	--	--	CHAN1
6-10	--	--	Blank
11-20	ID8	Name	Channel name
21-30	ID9	"	"
31-40	ID10	"	"
41-50	ID11	"	"
51-60	ID12	"	"
61-70	ID13	"	"
71-80	ID14	"	"

4.3 CHAN2 card (second continuation of CHAN) - To identify up to seven additional data channels to be selected for input.

Card Column	Parameter Identifier	Type	Description
1-5	--	--	CHAN2
6-10	--	--	Blank
11-20	ID15	Name	Channel name
21-30	ID16	"	"
31-40	ID17	"	"
41-50	ID18	"	"
51-60	ID19	"	"
61-70	ID20	"	"
71-80	ID21	"	"

4.4 FILE card - This card names the run number, the channel identification, and values of up to three independent variables to be filled in or to replace the original data.

Card Column	Parameter Identifier	Type	Description
1-4	--	--	FILE
5-10	--	--	Blank
11-20	IRUN	Integer	The run number of data in the subfile.
21-30	IDX	Name	Channel identifier of X parameter.
31-40	XVAL	Real	The value to be filled in for the X parameter.
41-50	IDY	Name	Channel identifier for the Y parameter.
51-60	YVAL	Real	The value to be filled in for the X parameter.
61-70	IDZ	Name	Channel identifier for the Z parameter.
71-80	ZVAL	Real	The value to be filled in for the Z parameter.

4.5 REPL card - The card is used to inform the program if data from a second file is added to data from the first file. Portions of the data in the original file can be deleted at the option of the user.

Card Column	Parameter Identifier	Type	Description
1-4	--	--	REPL
5-10	--	--	Blank
11-20	IFLG	Integer	0 - No data added from 2nd file. 1 - Data to be added from 2nd file. Default = 0
21-30	IRX	Name	Channel identifier of X parameter for deletion of data.

Card Column	Parameter Identifier	Type	Description
31-40	RXMN	Real	Minimum value to commence deletion of X data.
41-50	RXMX	Real	Maximum value to end deletion of X data.
51-60	IRY	Name	Channel identifier of Y parameter for deletion of data.
61-70	RYMN	Real	Minimum value to commence deletion of Y data.
71-80	RYMX	Real	Maximum value to end deletion of Y data.

4.6 REPL1 card - Continuation of REPL card listing of the Z parameters.

Card Column	Parameter Identifier	Type	Description
1-5	--	--	REPL1
6-10	--	--	Blank
11-20	IRZ	Name	Channel identifier of Z parameter for deletion of data.
21-30	RZMN	Real	Minimum value to commence deletion of Z data.
31-40	RZMX	Real	Maximum value to end deletion of Z data.
51-80	--	--	Blank

4.7 RUN card - Signifies a set of parameter cards for a subfile of a specified configuration or test condition. This card functions in a manner similar to that of a PASS card, except that the pass card completes the output file.

Card Column	Parameter Identifier	Type	Description
1-5	--	--	RUN
6-10	--	Integer	Number of fatal errors to be allowed. Default = 10
11-15	--	Integer	Number of nonfatal errors to be allowed. Default = 20
16-80	--	--	Blank

4.8 PASS card - The PASS signifies to the program that one complete set of parameter cards has been processed and completes the subfile on the master disc file.

Card Column	Parameter Identifier	Type	Description
1-5	--	--	PASS
6-10	--	Integer	Number of fatal errors allowed. Default = 10
11-15	--	Integer	Number of nonfatal errors allowed. Default = 20
16-80	--	--	Blank

5. Parameter Cards for Program FUNXYZ

Program FUNXYZ uses nine parameter cards with the following card identifiers: CHAN, CHAN1, CHAN2, TIME, PAR, GRIDX, GRIDY, GRIDZ, and PASS. The information for all the cards except the PASS card may be entered in any of the three formats described in Section 3. The PASS card uses the fixed-field format. Each card is described in the fixed-field card-identifier format.

5.1 CHAN card - To identify up to seven channels of data to be selected for input.

Card Column	Parameter Identifier	Type	Description
1-4	--	--	CHAN
5-10	--	--	Blank
11-20	ID1	Name	Channel name
21-30	ID2	"	"
31-40	ID3	"	"
41-50	ID4	"	"
51-60	ID5	"	"
61-70	ID6	"	"
71-80	ID7	"	"

5.2 CHAN1 card (first continuation card of CHAN) - To identify up to seven additional channels of data to be selected for input.

Card Column	Parameter Identifier	Type	Description
1-5	--	--	CHAN1
6-10	--	--	Blank
11-20	ID8	Name	Channel name
21-30	ID9	"	"
31-40	ID10	"	"
41-50	ID11	"	"
51-60	ID12	"	"
61-70	ID13	"	"
71-80	ID14	"	"

5.3 CHAN2 card (second continuation card of CHAN) - To identify up to seven additional data channels to be selected for input.

Card Column	Parameter Identifier	Type	Description
1-5	--	--	CHAN2
6-10	--	--	Blank

Card Column	Parameter Identifier	Type	Description
11-20	ID15	Name	Channel name
21-30	ID16	"	"
31-40	ID17	"	"
41-50	ID18	"	"
51-60	ID19	"	"
61-70	ID20	"	"
71-80	ID21	"	"

5.4 TIME card - To define data of interest and the time increment between data frames.

Card Column	Parameter Identifier	Type	Description
1-4	--	--	TIME
5-10	--	--	Blank
11-20	START	Real	Time to begin selection of data. Default = 1st data point.
21-30	STOP	Real	Time to end the selection of data. Default = last data point.
31-40	DELT	Real	Time increment between data points used for interpolation. Default = 0, no interpolation.
41-50	NPT	Integer	Number of points to be acquired (not implemented).
51-80	--	--	Blank

5.5 PAR card - This card defines the degrees of the polynomials for fitting the data and parameters used for the weighting function.

Card Column	Parameter Identifier	Type	Description
1-3	--	--	PAR
4-10	--	--	Blank
11-20	II	Integer	The degree of X variable. Default = 2
21-30	JJ	Integer	The degree of Y variable. Default = 2
31-40	KK	Integer	The degree of Z variable. Default = 2
41-50	ALP	Real	Weighting constant for X variable. Default = 0.0
51-60	BET	Real	Weighting constant for Y variable. Default = 0.0
61-70	GAM	Real	Weighting constant for Z variable. Default = 0.0
71-80	DEL	Real	Power of the weighted difference equation Default = 0.0

5.6 GRIDX card - This card defines the range of the X variable.

Card Column	Parameter Identifier	Type	Description
1-5	--	--	GRIDX
6-10	--	--	Blank
11-20	NX	Integer	The number of X data points to be computed.
21-30	XMIN	Real	The minimum value of the X variable.

Card Column	Parameter Identifier	Type	Description
31-40	XMAX	Real	The maximum value of the X variable.
41-80	--	--	Blank

5.7 GRIDY card - This card defines the range of the Y variable.

Card Column	Parameter Identifier	Type	Description
1-5	--	--	GRIDY
6-10	--	--	Blank
11-20	NY	Integer	The number of Y data points to be computed.
21-30	YMIN	Real	The minimum value of the Y variable.
31-40	YMAX	Real	The maximum value of the Y variable.
41-80	--	--	Blank

5.8 GRIDZ card - This card defines the range of the Z variable.

Card Column	Parameter Identifier	Type	Description
1-5	--	--	GRIDZ
6-10	--	--	Blank
11-20	NZ	Integer	The number of Z data points to be computed.
21-30	ZMIN	Real	The minimum value of the Z variable.
31-40	ZMAX	Real	The maximum value of the Z variable.
41-80	--	--	Blank

5.9 PASS card - The PASS card indicates the end of a set of parameter cards.

Card Column	Parameter Identifier	Type	Description
1-4	--	--	PASS
5	--	--	Blank
6-10	--	Integer	Fatal error limit. Default = 10
11-15	--	Integer	Nonfatal error limit. Default = 20
16-25	--	Name	(COEF) if printout of coefficients is desired.

6. Parameter Card Organization

The parameter cards are organized into a set using any or all of the cards described above and terminated by the PASS card. The cards are order-independent. The parameters read in for a PASS remain until they are redefined by a succeeding set of parameter cards. Parameters associated with continuation cards (CHAN1 and CHAN2) are blanked when the primary card CHAN is read.

7. Diagnostic Messages

All diagnostic information is listed on a file named TAPE61. Program DUMP61 lists and summarizes the diagnostic information.

Errors are classified into two types, "fatal" and "nonfatal." A fatal error is one which prevents the processing of the data because of missing data channels or missing parameters. A nonfatal error is one which can be corrected by the substitution of a default option. The data is processed, but the desired parameters may not have been used.

The first and second fields on the PASS card are the fatal and nonfatal error limits, respectively. If either limit is reached, the program "exits" that pass and proceeds to the next pass (if there is one). If these parameters are not specified, the default values of 10 fatal errors and 20 nonfatal errors are used.

8. Execution of Program FILXYZ

Program FILXYZ is used to prepare an input data file to program FUNXYZ. The primary function of program FILXYZ is to merge into one data file subfiles of wind tunnel data or any data with one, two, or three independent variables that have the same test configuration.

There are several ways in which program FILXYZ can be used. These are described and an example of a set of parameter cards is listed for each.

8.1 Merging of Subfiles of Original Data

Merging subfiles of original data of a specified configuration or test conditions into a single file is accomplished in the following way. Assume five subfiles are to be merged into one and the data files have data which are a function of three independent variables. The first three channels of data named must be the independent variables in the order desired. Only the first three characters are named on the CHAN cards. (The system of channel identification used with wind tunnel data is three characters with a (/) and a three-digit run number, e.g., ALP/001.)

```
CHAN = ALP,BET,MCH,CNB,CAB,CMB,CYB
CHAN1 = CRM,CYM
IRUN = 1
RUN
IRUN = 2
RUN
IRUN = 3
RUN
IRUN = 4
RUN
IRUN = 5
PASS
```

The data identifier parameters on the CHAN cards are combined with the IRUN parameter on the FILE card to form the unique channel identifiers for each subfile.

The RUN card has a function similar to that of the PASS card. The RUN card signifies the set of parameter cards for the subfile being selected and the PASS card signifies the end of the runs or subfiles to be merged into one file.

8.2 Adding Independent Variables

One or more of the independent variables can be added if missing from the data subfiles, or the value may be replaced by a value from the parameter card. Assume that the third independent variable MCH (Mach) is not available in the subfiles.

```
CHAN = ALP, BET, CNB, CAB, CMB, CYB, CRM
CHAN1 = CYM
IRUN = 2, IDZ = MCH, ZVAL = 0.8            (FILE Card)
RUN
IRUN = 3, ZVAL = 1.0
RUN
IRUN = 4, ZVAL = 1.2
RUN
IRUN = 5, ZVAL = 1.4
PASS
```

The output file will have nine data channels, since the data channel MCH was added.

8.3 Adding Subfiles to a Merged File

Data subfiles from the second master disc file may be added to data that has been merged and exists on the first master disc file. Following is an example of the set of parameter cards.

```
CHAN = ALP, BET, MCH, CNB, CAB, CMB, CYB
CHAN1 = CRM, CYM
FILE = 1
REPL = 1
RUN
CHAN = ALP, BET, CNB, CAB, CMB, CYB, CRM
CHAN1 = CYM
IRUN = 1, IDZ = MCH, ZVAL = 0.6
REPL
RUN
IRUN = 2, ZVAL = 0.8
RUN
IRUN = 3, ZVAL = 1.0
RUN
IRUN = 4, ZVAL = 1.2
RUN
IRUN = 5, ZVAL = 1.4
PASS
```

In this example, the IFLG parameter on the REPL card in the first set of run parameters indicates to the program that data subfiles are going to be added. You will note that in the set of parameters for the first file to be added, the IFLG parameter must be reset. This is the reason for the blank REPL card. In this use the channel identifier parameters for the first or merged file must be the identifiers of the channels as they exist in the file.

8.4 Merging Two Merged Files

It is also possible to take data in two existing merged files and merge them into a single file. An example of the parameter cards is as follows:

```
CHAN = ALP, BET, MCH, CNB, CAB, CMB, CYB
CHAN1 = CRM, CYM
FILE = 1
REPL = 1
RUN
CHAN = ALP-2, BET-2, MCH-2, CNB-2, CAB-2, CMB-2, CYB-2
CHAN1 = CRM-2, CYM-2
FILE = 1
REPL = 1
PASS
```

8.5 Adding Subfiles to an Equally Gridded File

An equally gridded data file from program FUNXYZ may also be used as an input file. Portions of this file may be deleted and data from a second file added for another run into program FUNXYZ. An example of the parameter cards follows.

```
CHAN = ALP, BET, MCH, CNB, CAB, CMB, CYB
CHAN1 = CRM, CYM
IRUN = 1
REPL = 1
REPL1 = MCH, 1.5, 2.5
RUN
CHAN = ALP, BET, CNB, CAB, CMB, CYB, CRM
CHAN1 = CYM
IRUN = 1, IDZ = MCH, ZVAL = 2.0
REPL
RUN
IRUN = 2
RUN
IRUN = 3
RUN
IRUN = 4
RUN
IRUN = 5
PASS
```

This set of parameter cards deletes a section of data from the first file based upon the range of the third independent variable MCH and adds five runs or subfiles from the second file.

8.6 Input Files for FILXYZ

In cases where data is selected from one file and additional data is added from the second file, the two disc files must be attached. All the data must be selected from the first file, which must be closed before the second file is opened. The file names are internal to the program, so the user must use these names in the SCOPE cards. For example:

Case 1 - one file only

```
ATTACH(MDFI1, W489GRD, ID = B77DTA, CY = 1)
```

Case 2 - two files required

```
ATTACH(MDFI1, W489GRD, ID = B77DTA, CY = 1)

ATTACH(MDFI2, W489RIT37, ID = B77DTA, CY = 2)
```

8.7 Output from FILXYZ

The output file is the standard word-addressable master disc file as described in Section 2. It has an internal file name of MDF1. If the user desires to use this file for input to another program in the job sequence, the file must have a file name the same as the name internal to the program. For example, if the name internal to the program is MDF, then the following SCOPE cards are necessary.

```
FILE(MDF, LFN = MDF1)
.
.
LDSET(FILES = MDF)
EXECUTE
```

9. Execution of Program FUNXYZ

Program FUNXYZ computes the values of test data at the values of the independent variables specified by the input parameters and outputs these equally gridded values in a word-addressable master disc file format which can be used as input to other programs. The data input to FUNXYZ is the output file prepared by program FILXYZ.

9.1 Loading Program FUNXYZ

Program FUNXYZ exists on a permanent disc file named MACHLIB and is loaded into the CDC 6600. The program also uses subroutines that are on DRWALIB. Therefore both libraries must be attached as follows.

```
ATTACH(MLIB, MACHLIB, ID = EDHDR)
ATTACH(WALIB, DRWALIB, ID = EDHDR)
:
LIBRARY(MLIB)
:
LIBLOAD(MLIB, FUNXYZ)
LDSET(LIB = WALIB)
EXECUTE
```

9.2 Extended Core

Extended core is used for storage and quick access to the data. Therefore the user must specify extended core on the job card by using the EC parameter. This is set as follows:

```
JOB, T300, EC500, KUNC
```

9.3 Parameter Input

The parameters II, JJ, KK on the PAR card set the degrees of the polynomials. These values default to 2. The parameters ALP, BET, and GAM are real constants used by the exponential weighting function.[2]

Care must be exercised in selecting these constants because of the limitation of the exponential function, e^A, in the CDC 6600 FORTRAN package ($-675.84 \leqq A \leqq 741.67$). In selecting ALP, BET, and GAM, the user must have some knowledge of the data input to the program and the weighting function. The weighting function is

$$W_n \triangleq \begin{cases} e^{-[\alpha^2 (x - x_n)^2 + \beta^2 (y - y_n)^2 + \gamma^2 (z - z_n)^2]^{\delta/2}}, & \delta > 0 \\ 1, & \delta = 0 \end{cases}$$

There is no general rule that can be followed. The data interval over which the weighting function is applied must be taken into consideration. The user can get a preliminary value by examining each variable individually. For example

$$\gamma^2 (z - z_n)^2 = 1$$

$$\gamma^2 = \frac{1}{(z - z_n)^2}$$

[2] Ibid., Section 2.

If we choose an interval $(z - z_n)$ of 0.2, then $\gamma = 5$. As γ is made larger, the interval is decreased, and as γ is made smaller, the interval increases.

The GRIDX, GRIDY, and GRIDZ cards must contain the minimum and maximum values for each independent variable respectively. For three independent variables all three cards are necessary. For two independent variables the GRIDX and GRIDY cards are used, and for one independent variable only the GRIDX card is used. The NX, NY, and NZ parameters specify the number of equally spaced intervals between the minimum and maximum values.

9.4 Polynomial Coefficients

The polynomial coefficients may be listed if the user desires. This is accomplished by inserting the parameter COEF in the field consisting of columns 16 through 25 on the PASS card.

9.5 Execution Time

Program FUNXYZ uses considerable CDC 6600 time in computing the approximating functions when three independent variables are used. For example:

> 134 frames of input data consisting of 3 independent variables and 6 dependent variables with an output of 240 frames using second degree polynomials requires approximately 400 seconds of CDC 6600 computer time. To process 276 frames of input data with the same dimensions and conditions requires 780 seconds of CDC 6600 computer time. With these examples the user can get some indication of the amount of computer time required for the job.

9.6 Input and Output Files

Since the CDC 6600 operating system uses the Cyber Record Manager, all secondary data processing programs use the word-addressable file structure. The input and output files are named internally by the program; hence the appropriate logical file name must be used when the input data file is attached. For program FUNXYZ the input file is named MDF and the output file is named MDF1.

If the attached file or the input file does not have the logical file name, MDF, it is necessary to use the FILE and LDSET cards, as described in Section 8.7.

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