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TITLE

PDP-8 OSCILLOSCOPE DISPLAY OF MATHEMATICAL
FUNCTIONS

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DATE

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SOURCE LANGUAGE

PDP-8 OSCILLOSCOPE DISPLAY OF MATHEMATICAL FUNCTIONS

DECUS Program Library Write-up

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These supplementary notes describe the procedures to be followed in using the Mathematical Display Program.

1. This program consists of two parts. The principal program is written in FORTRAN, and calculates and scales the table of values representing the function to be displayed. Display processing is carried out by a binary program which overlays the FORTRAN program. Transfers between both programs are automatically carried out.
2. The binary program (source written in PAL) is relocated by the FORTRAN program to occupy core locations above 7600, allowing a larger amount of data store. Because of this relocation the BIN loader will be clobbered. However RIM should remain untouched.
3. The loading procedure is as follows:
 - a) Load FORTRAN operating time system.
 - b) Load BINARY program through the FORTRAN operating system loader. This load will be OK even though there will be a check sum error. (Check sum in FORTRAN differs from that in PAL.)
 - c) Load FORTRAN OBJECT tape in usual way.
 - d) Begin FORTRAN program execution in usual way.
 - e) Allow about 1/2-minute for calculation of tabular values before display appears on oscilloscope.
4. The version of the FORTRAN program supplied is written to display a general fourth-order polynomial:

$$f(x) = Ax^4 + Bx^3 + Cx^2 + Dx + E$$

To display another function the user need only change this FORTRAN statement, which is line 90 of the FORTRAN program. If the function to be displayed does not require input variables A, B, C, D, E changes may be made in the input portions of the FORTRAN program which will allow longer function statements.

5. The display screen is treated as:

X-axis: mod 1000
Y-axis: mod 800

No attempt is made to obtain standard scale factors. Initially the user specifies the range of X, from which a scale factor for Y will be estimated. After viewing the display the user can respecify either X or Y ranges by typing CTRL F (simultaneously), which returns control back to the FORTRAN program.

```
C; A. E. SAPEGA, S. G. WELLCOME TRINITY COLLEGE, HARTFORD, CONN.  
C; TO RETURN TO FORTRAN PROGRAM FROM DISPLAY ROUTINE,  
C; TYPE CTRL/F.
```

```
DIMENSION IX(1), IY(1), NX(25), NY(25)
```

```
C; THIS CALL RELOCATES BINARY PROGRAM  
PAUSE 3828  
GO TO 8
```

```
C; THIS SECTION ALLOWS FOR CHANGE IN DISPLAY  
8; TYPE 81  
81; FORMAT (/,/, "NEW DELTA X? TYPE  
CHANGE Y SCALE? +1  
NEW VARIABLES? -1 ")  
ACCEPT 2, K  
2; FORMAT (I)  
IF (K) 8, 11, 82  
82; TYPE 83  
83; FORMAT (/,/, "TYPE IN YMIN, YMAX ")  
ACCEPT 2, YMIN, YMAX  
GO TO 9
```

```
C; THIS SECTION DATA INPUT  
8; TYPE 1  
1; FORMAT (/,/, "TYPE IN A, B, C, D, E ")  
ACCEPT 2, A, B, C, D, E  
2; FORMAT (E)
```

```
11; TYPE 11  
11; FORMAT (/,/, "TYPE IN XMIN, XMAX ")  
ACCEPT 2, XLFT, XRYT  
SIZE = XRYT - XLFT  
XSF = 1000./SIZE  
IX = -XLFT*XSF  
DELX = SIZE/10  
X = XLFT  
YMAX = 5.E10  
YMIN = 5.E10  
J = 1  
DO 7 K = 1, 11  
GO TO 100  
71; IF(YMAX-Y) 51, 7, 5  
51; YMAX = Y  
5; IF(YMIN-Y) 7, 7, 52  
52; YMIN = Y  
7; CONTINUE
```

```

90; DELY = YMAX-YMIN
YINC = DELY/8.
YSF = 800./DELY
IY0 = -YMIN*YSF
TYPE 201, XLFT, XRYT, DELX
201: FORMAT (/,/,"XMIN = ",E,"XMAX = ",E,"X/DIV. = ",E)
TYPE 21, YMIN, YMAX, YINC
21; FORMAT (/,/,"YMIN = ",E,"YMAX = ",E,"Y/DIV. = ",E)

```

```

C; DO LOOPS 5 & 6 SET UP SCALE MARKS ON AXES

```

```

J = 0
DO 5 K = 1, 22
NX(K) = J
NY(K) = IY0 - 10
K = K + 1
NX(K) = J
NY(K) = IY0 + 10
J = J + 1000
5; CONTINUE
J = 0
DO 6 K = 23, 40
NY(K) = J
NX(K) = IX0 - 10
K = K + 1
NY(K) = J
NX(K) = IX0 + 10
J = J + 1000
6: CONTINUE
DELX = SIZE / 210.
X = XLFT
J = 2
DO 7 K = 41, 250
1000; CONTINUE

```

```

C; STATEMENT OF FUNCTION TO BE DISPLAYED
C; THIS IS AT LINE 90

```

```

Y = X*(X*(X*(X*A+B)+C)+D)+E

```

```

X = X + DELX
GO TO (71, 72), J
72; XT = (X-XLFT)*XSF
YT = (Y-YMIN)*YSF
IF(YT) 10, 11, 11
11; IF(YT-800.) 9, 9, 10
9; NX(K) = XT
NY(K) = YT
GO TO 7
10; NY(K) = 1000
7; CONTINUE
PAUSE 3968
DELX = SIZE/10
GO TO 8
END

```

/A. E. SAPEGA, S. G. WELLCOME TRINITY COLLEGE
/PROGRAM TO DISPLAY FORTRAN DATA
/AND XY GRID WITH MONITOR CALL OPTION.
/THIS PROGRAM IS MOVED TO *7600 BY PROGRAM
/MOVE GIVEN BELOW SO LOCATIONS 7400-7576
/CAN BE USED FOR DATA STORAGE.

/PROGRAM TRANSFERS CONTENTS OF 7400-7576
/TO 7600-7676

*7364
MOVE, 0
CLA
TAD I PROG
DCA I TOP
ISZ PROG
ISZ TOP
ISZ COUNT
JMP.-5
JMP I MOVE
PROG, 7400
TOP, 7600
COUNT, -115

*7400
DISP, 0
CLA
TAD I XORIG
DCA DX /COORDINATES OF GRID CENTER FROM FORTRAN
TAD I YORIG
DCA DY
GRID, TAD XSET
DCA XCOUNT /INITIALIZE X VARIABLES
DCA IXD
TAD DY
DYL /SET Y BUFFER FOR X AXIS
CLA
DISPX, TAD IXD
DXS
TAD ADD
DCA IXD
ISZ XCOUNT /DRAW X AXIS, CHECK IF IT'S FINISHED
JMP DISPX
TAD YSET
DCA YCOUNT /INITIALIZE Y VARIABLES
DCA IYD
TAD DX
DXL /SET X BUFFER FOR Y AXIS
CLA
DISPY, TAD IYD
DYS
TAD ADD
DCA IYD
ISZ YCOUNT /END OF Y AXIS YET?
JMP DISPY

GRAPH, TAD ADRESX	/DISPLAY GRAPH POINTS CALCULATED
DCA XIND	/IN FORTRAN PROGRAM
TAD ADRESY	
DCA YIND	
LOOP, TAD I XIND	
DXL	
CLA	
TAD I YIND	
DYS	
CLA	
ISZ XIND	
ISZ YIND	
ISZ BTONT	/END OF GRAPH?
JMP LOOP	
TAD CNTSET	/FINISHED GRAPH, RESET POINT COUNT
DCA BTONT	
FLGCHK, KSF	/IS FLAG UP?
JMP GRID	/NO - DISPLAY AGAIN
KRB	/YES - READ TTY BUFFER
DCA IXD	/TEMPORARY STORAGE IN A CONVENIENT UNUSED BUFFER
TAD IXD	
TAD MCTRLF	/IS IT A CTRL/F?
SNA CLA	
JMP I DISP	/YES-RETURN TO FORTRAN
JMP GRID	/NO-DISPLAY AGAIN
XSET, -145	/X, Y AXIS LENGTH
YSET, -121	
MCTRLC, - 203	/ -CTRL/C
MCTRLF, - 206	/ -CTRL/F
DX, 0	/CENTER GRID COORDINATES, STORAGE
DY, 0	
ADD, 12	/GRID INCREMENT, 10 DECIMAL
XCOUNT, -145	/POINT COUNTS FOR AXES
YCOUNT, -121	
IXD, 0	
IYD, 0	
XORIG, 7576	/INDIRECT JMPS FOR DX, DY
YORIG, 7575	
ADRESX, 7203	/INDIRECT JMPS FOR GRAPH POINTS
ADRESY, 6611	
XIND, 7203	
YIND, 6611	
PTONT, -372	/OCTAL 250 DECIMAL
CNTSET, - 372	
DXL=6053	
DYL = 6063	
DXS=6057	
DYS=6067	
\$	