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WNDWBX: TEKTRONIX PLOTTING ON CDC

Ronald D. Anderson

September 1980



US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
BALLISTIC RESEARCH LABORATORY
ABERDEEN PROVING GROUND, MARYLAND

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) (c1t) WNDWBX is an interactive plotting program accessible through a single Fortran CALL. It uses given input data to generate curves and label axes. Titles, new axis dimensions, and curve labels can be supplied interactively. The user is not required to have plot software knowledge or experience.		

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I. INTRODUCTION

Due to increasing use of computer models and data manipulation by scientists, there has arisen a need for a plotting package which can show data curves on a computer terminal CRT, yet does not require the casual user to develop his own plotting software. Such a program is available for the Tektronix CRT's on the BRL CDC system.

II. DESCRIPTION

WNDWBX is a Fortran subroutine which uses the Tektronix PLOT10¹ software to generate point-to-point plotting of data vectors. Axes are initially scaled and labeled with parameters returned from the BRL FIXSCA subroutine.²

The user must supply data from some generating program; then through a single Fortran calling statement he can access the plotting routines. The required call is:

CALL WNDWBX (X, Y, M, N, NPTS),

where X = horizontal axis data vector,

Y = vertical axis data vector,

M = maximum number of data points to be plotted,

N = number of curves to be shown on the plotted surface (1 to 3),

NPTS = vector of size (3) containing respective number of data points in each curve. ($M \geq \text{Total of NPTS.}$)

The data-generating main program must define files PLB and KBI in its program statement (see test program listing in the Appendix). WNDWBX requires that the main program be supplied in relocatable form; this may be accomplished in one of two ways:

- A. (1) Attach a source-code file.
- (2) Compile the source code into LGO.
- (3) Attach the WNDWBX procedure.
- (4) Begin the WNDWBX procedure.

As an example, suppose file FORT (ID = FRED and CY = 1) contains the source code in the Appendix. Then,

¹TEKTRONIX Plotting (PLOT10) Package, BRL SPB-8-78, 14 July 1978.

²Monte W. Coleman and John V. Lanahan, "BRLESC Fortran Plotting Subroutines", ARDC Technical Report No. 6, p. 36, July 1970.

Step 1: ATTACH, FORT, ID = FRED, CY = 1.
Step 2: FTN (I = FORT, L = 0, B = LGO).
Step 3: ATTACH, WNDWBX.
Step 4: BEGIN, RUN, WNDWBX, LF = LGO.

or,

B. (1) Attach the WNDWBX procedure.
(2) Begin the procedure and provide to it a pre-compiled and catalogued main program.

For example, suppose after Step 2 of the previous case that the user decided to catalog his compiled code into file FORT, ID = FRED, CY = 2. (The command would have been: 'CATALOG, LGO, FORT, ID = FRED, CY = 2'.) Then a 'RETURN, LGO' would free the file. Next,

Step 1: ATTACH, WNDWBX.
Step 2: BEGIN, RUN, WNDWBX, PF = FORT, ID = FRED, CY = 2.

Both methods use a Cyber Control Language procedure to connect I/O files, attach libraries, load and execute the program, and return local files after execution. (Method A uses a copy of LGO to generate an executable program.)

The first time WNDWBX is called, it polls the user for a data transmission rate - either 30, 120, or 960 characters/second (corresponding to 300, 1200, and 9600 baud, respectively). The internal calls to the PLOT10 setup routines assume a screen size of 1024 by 780 addressable points; buffer size is arbitrarily set to 3. These parameters are reasonable in most cases and the user cannot change them.

III. SAMPLE CASE

A simple sine, cosine, and sine + cosine data-generating program is available for test use simply by attaching the WNDWBX procedure and executing the command: 'BEGIN, TEST, WNDWBX'.

The sample case first asks for an input from the user in order to start the data generation. Then a list of options will appear as in Figure 1. If option 1 is chosen (enter the number "1" through the keyboard), an unlabeled set of curves will be shown (Figure 2).

When the curves are shown, there is no screen prompt to tell the user what to do next. Entering any number from the keyboard will cause the graph to disappear and a list of options will appear (Figure 3). Axis and curve titles may be entered through options 5, 6, 7, and 8 (Figure 4). Then option 1 will show the plot with the new titles (Figure 5).

CURVE GENERATING ROUTINE

OPTIONS: 0 = STOP
 1 = PLOT
 2 = CHANGE DATA

OPTION? >1

Figure 1. Option Table in Test Plot Routine

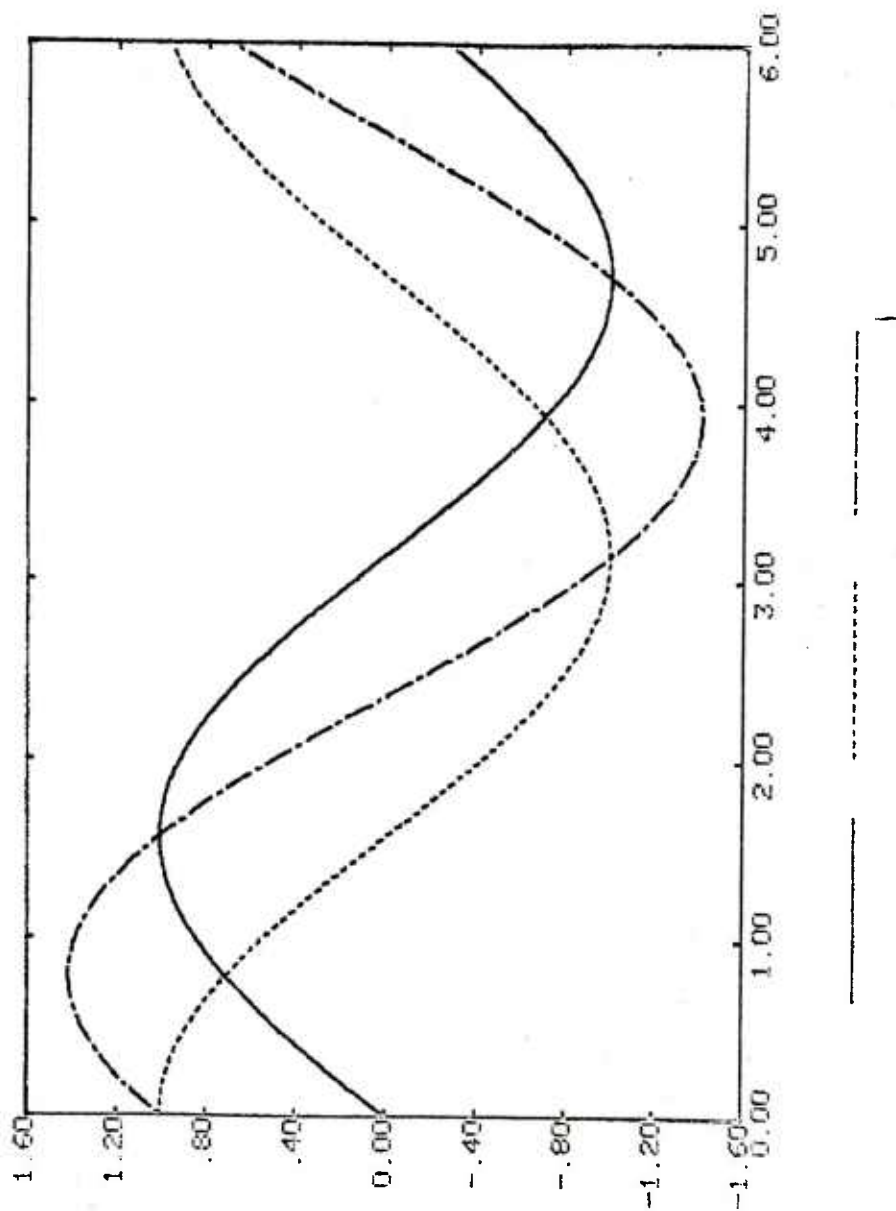


Figure 2. First Plot Using Default Values From Test Routine


```

OPTIONS:
0 = RETURN TO CALLING PROGRAM
1 = PLOT
2 = CHANGE HORIZONTAL AXIS PARAMETERS
3 = CHANGE VERTICAL AXIS PARAMETERS
4 = REVERT TO ORIGINAL AXIS PARAMETERS
5 = CHANGE TITLE *THIS IS WHERE OVERHEAD TITLE IS PLOTTED *
6 = CHANGE HORIZONTAL AXIS TITLE * HORIZONTAL TITLE *
7 = CHANGE VERTICAL AXIS TITLE * VERTICAL TITLE *
8 = CHANGE CURVE TITLE(S)
                                1 * SINE *
                                2 * COSINE *
                                3 * SIN + COS *

                                MIN      MAX      DEL
                                0.      6.00    1.00
                                -1.60    1.60    .400

```

OPTION? >

Figure 4. Option 5,6,7, and 8 Exercised From Figure 3

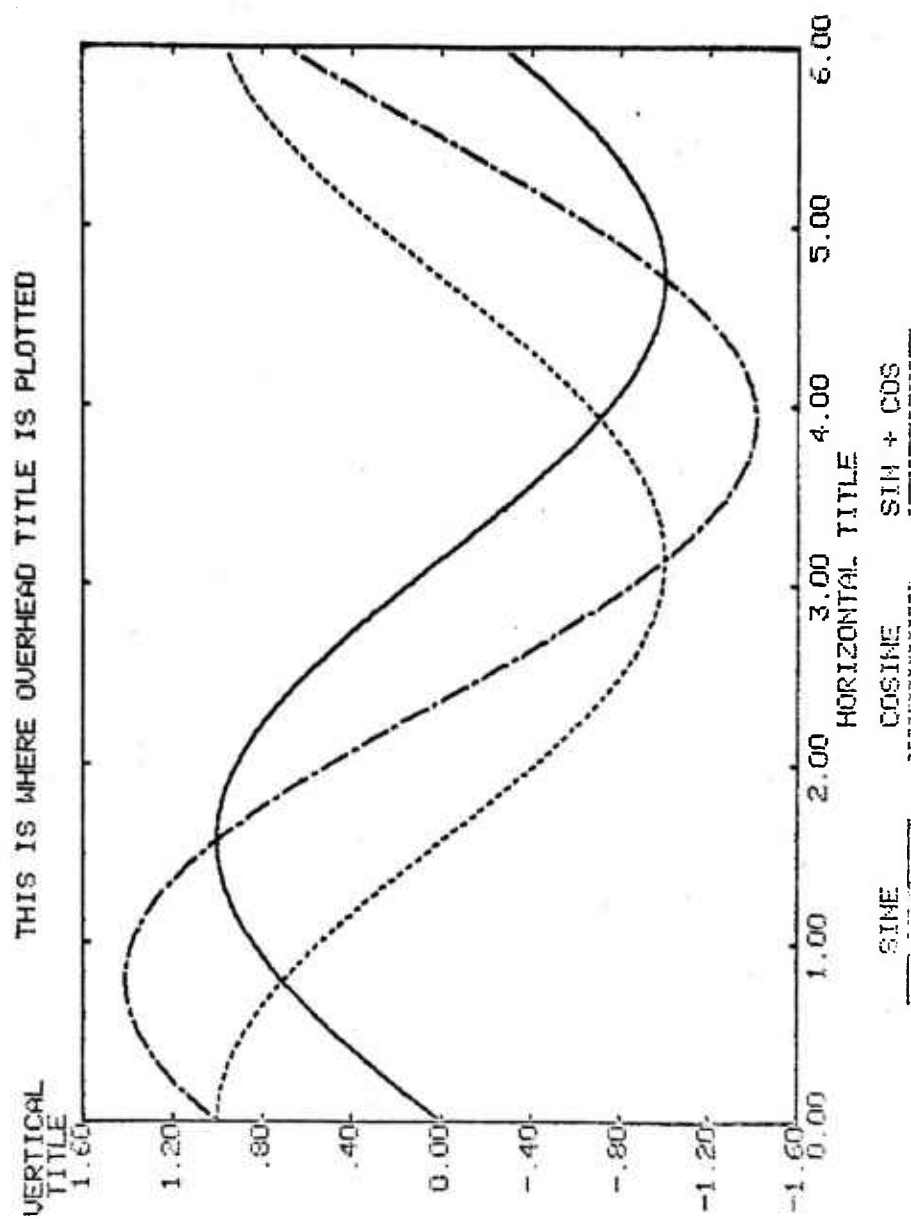


Figure 5. Test Curves with Titles

After entering another number to clear the screen, and choosing option 0 to return to the main program, the test case will allow the user to change the curves by entering different coefficients for the equations (Figure 6). The new data is plotted in Figure 7, showing the scientific notation style of axis labeling - three significant figures along the vertical axis and an exponent near the upper left hand corner. WNDWBX uses this style when the axis labels need to show more than three digits. The horizontal axis, too, has this option and the exponent is printed just below the lower left hand corner of the box.

Options 2 and 3 from the option table allow the user to choose a "window" from the original plot by setting new axis maximums and minimums. Figure 8 shows the option table and a new set of axis limits. The plot option at this time gives the graph shown in Figure 9. The intersection of the curves is now visible in much greater detail.

Option 4 returns the axis limits to show the whole curve at the time of the last WNDWBX call (Figure 10).

When using this set of plotting routines, an added feature is available to the programmer - a Fortran-callable screen erasure. A simple CALL ERS at the appropriate step in the generating routine will enable the user to clear the Tektronix screen. Comparing the interactive operation of the test plot program to its Fortran listing in the Appendix will show the value of this subroutine.

IV. SUMMARY

The WNDWBX routine is a powerful tool in modeling applications. It can plot one to three data curves without prior knowledge of the data limits. WNDWBX allows the scientist to inspect the data closely by using the "zoom" feature to select and enlarge any portion of the plotted data. The routines are available and easily used by means of a Cyber Control Language procedure which enters much of the command run-stream for the user.

```

CURVE GENERATING ROUTINE

OPTIONS:  0 = STOP
          1 = PLOT
          2 = CHANGE DATA

OPTION? >2

CURVE 1 = C1 * SIN(X)
CURVE 2 = C2 * COS(X)
CURVE 3 = C3 * ( C1 * SIN(X) + C2 * COS(X) )

NUMBER OF CURVES TO PLOT? >3

MULTIPLIER(S)

COEFFICIENT FOR SIN    CURVE? >1000

COEFFICIENT FOR COS    CURVE? >2000

COEFFICIENT FOR SIN + COS CURVE? >.5

```

Figure 6. Changing Curve Parameters in Generating Routine

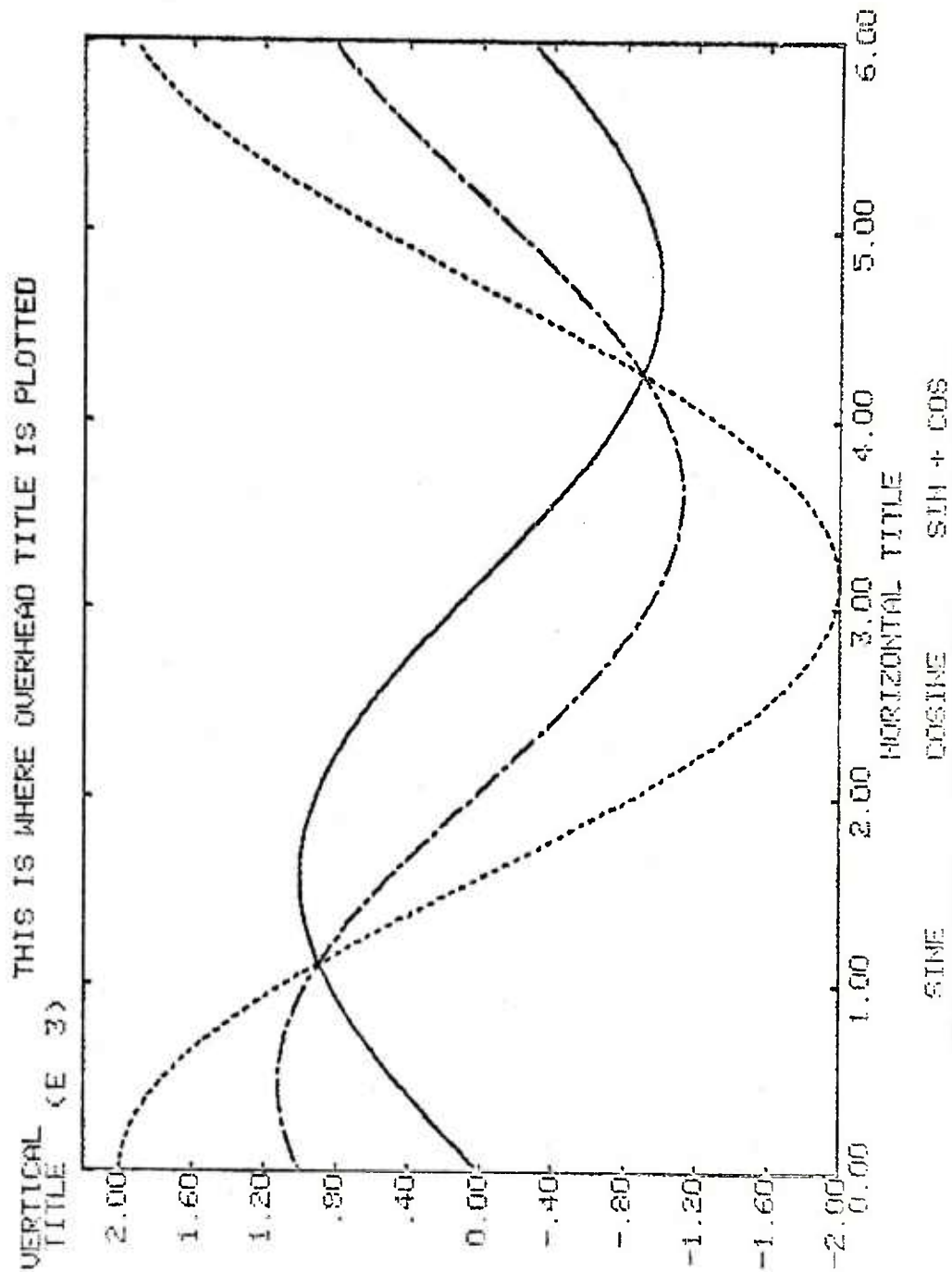


Figure 7. New Curves using Parameters from Figure 6

```

OPTIONS:
0 = RETURN TO CALLING PROGRAM
1 = PLOT
2 = CHANGE HORIZONTAL AXIS PARAMETERS      MIN      MAX      DEL
                                           1.00    1.25    .500E-01
3 = CHANGE VERTICAL AXIS PARAMETERS      850.    950.    10.0
4 = REVERT TO ORIGINAL AXIS PARAMETERS
5 = CHANGE TITLE *THIS IS WHERE OVERHEAD TITLE IS PLOTTED *
6 = CHANGE HORIZONTAL AXIS TITLE * HORIZONTAL TITLE *
7 = CHANGE VERTICAL AXIS TITLE * VERTICAL TITLE *
8 = CHANGE CURVE TITLE(S)      1 * SINE *
                                2 * COSINE *
                                3 * SIN + COS *

```

OPTION? >

Figure 8. Horizontal and Vertical Axis Parameters Changed to Provide "Zoom" Feature

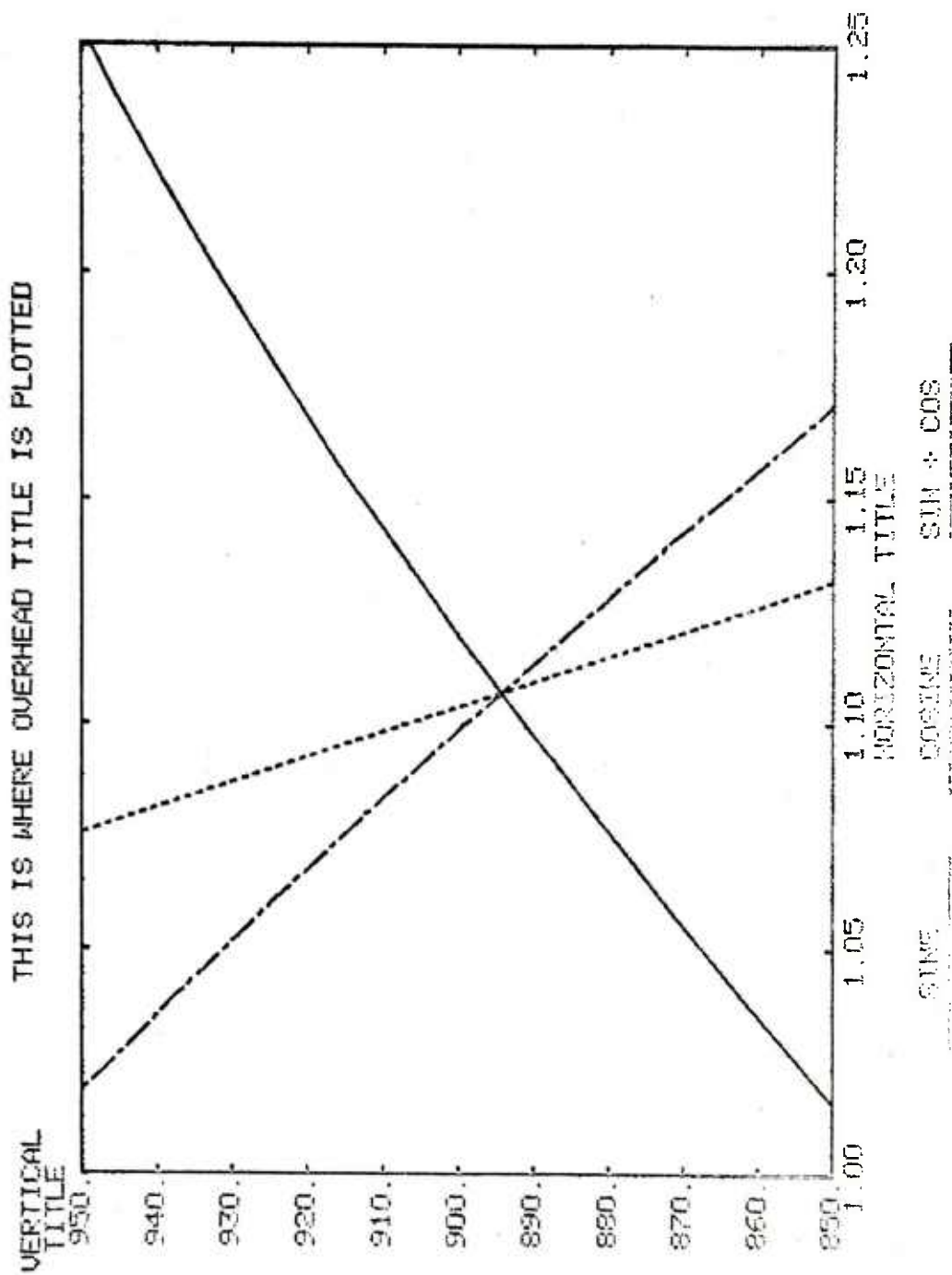


Figure 9. "Zoom" Window Using Axis Parameters from Figure 8

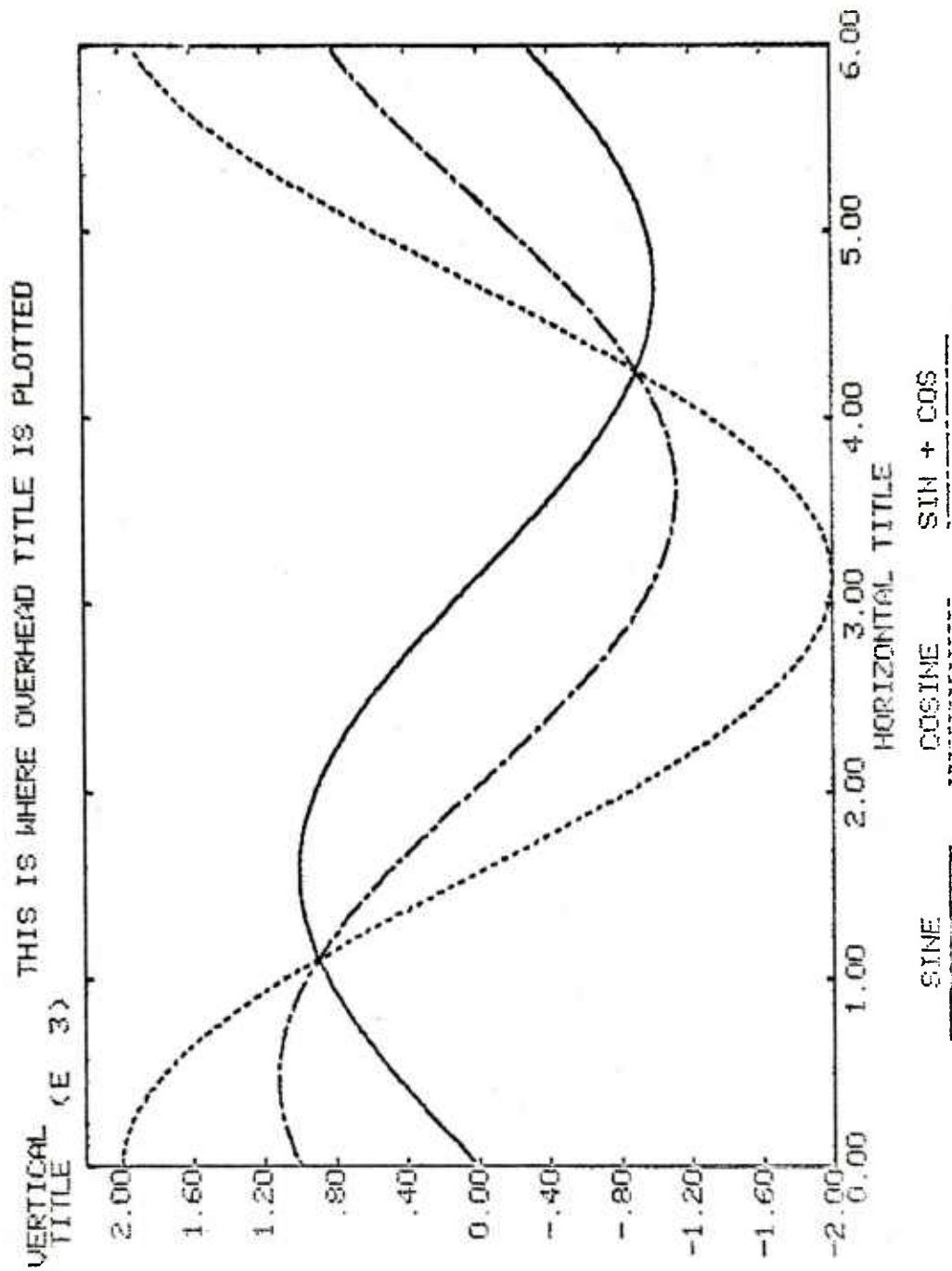


Figure 10. Option 4 Exercised - Return to Original Axis Parameters (Same as Figure 7)

APPENDIX

TEST PROGRAM LISTING

PROGRAM ONE	73/173 OPT=1 ROUND=+-*/	FTN 4.2+498	05/12/80 10.01.17
1	PROGRAM ONE(INPUT,OUTPUT,TAPE9=INPUT,PLH,KB1)		000100
	DIMENSION X(1000),Y(1000),NPTS(3),C1(3),S(3)		000110
	DATA NPTS,C1/300,300,300,3*1.0/		000120
	DATA S/9M SIN ,9M COS ,9H51N + COS/		000130
5	CALL ERS		000140
	PRINT *, ' '		000150
	PRINT *, ' TEST PLOT PROGRAM'		000160
	PRINT *, ' '		000170
	PRINT *, ' ENTER NUMBER TO BEGIN>'		000180
10	READ (9,10) I		000190
	10 FORMAT(11)		000200
	N=3		000210
	GO TO 45		000220
20	CALL EPS		000230
15	PRINT *, ' '		000240
	PRINT *, ' CURVE GENERATING ROUTINE'		000250
	PRINT *, ' '		000260
	PRINT *, ' OPTIONS: 0 = STOP'		000270
	PRINT *, ' 1 = PLOT'		000280
20	PRINT *, ' 2 = CHANGE DATA'		000290
	PRINT *, ' '		000300
15	PRINT *, ' OPTION? >'		000310
	READ *, IOPT		000320
	IF (IOPT.FQ.0) GO TO 99		000330
25	IF (IOPT.FQ.1) CALL WNOB(X,Y,1000,N,NPTS)		000340
	IF (IOPT.FQ.2) GO TO 30		000350
	IF (IOPT.LT.3.AND.IOPT.GT.0) GO TO 20		000360
	PRINT *, ' ERROR.... OPTION UNACCEPTABLE.. PLEASE RE-ENTER>'		000370
	GO TO 15		000380
30	PRINT *, ' CURVE 1 = C1 * SIN(X)'		000390
	PRINT *, ' CURVE 2 = C2 * COS(X)'		000400
	PRINT *, ' CURVE 3 = C3 * (C1 * SIN(X) + C2 * COS(X))'		000410
	PRINT *, ' '		000420
35	PRINT *, ' NUMBER OF CURVES TO PLOT? >'		000430
	READ *, N		000440
	PRINT *, ' '		000450
	PRINT *, ' MULTIPLIER(S)'		000460
	DO 21 I=1,N		000470
	PRINT 40,5(1)		000480
40	40 FORMAT(/' COEFFICIENT FOR ',A9,' CURVE? >')		000490
	READ *, P		000500
	C1(I)=P		000510
	21 CONTINUE		000520
45	00 22 I=1,300		000530
	XX=FLOAT(I-1)*.02		000540
	X(1)=XX		000550
	X(300+1)=XX		000560
	X(600+1)=XX		000570
	Y(1)=C1(1)*SIN(XX)		000580
50	Y(300+1)=C1(2)*COS(XX)		000590
	Y(600+1)=C1(3)*(Y(1)+Y(300+1))		000600
	22 CONTINUE		000610
	GO TO 20		000620
55	99 STOP		000630
	END		000640

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