NATIONAL RADIO ASTRONOMY OBSERVATORY

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TITLE: A REVISED VAX FARANT SPLOT ROUTINE AND RELATED APPLE II
             PLOTTING PROGRAM

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RELATED APPLE II PLOTTING PROGRAM

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The purpose of this report is to describe some upgrades made to the VAX "SPLOT" routine and the related Apple plotting program described in reference [1]. The purpose of these upgrades is to allow the plotting of S-parameter magnitude and phase versus frequency. In the process of modification, auto-scaling of the data was also added.

The revised FARANT routine is named "SPLOT2" and is called from FARANT with the statement:

CALL SPLOT2(I,J,TITLE$,FILENAME$)

where I,J are the indexes of the S-parameter to be plotted, TITLE$ is a literal or string variable containing the plot title, and FILENAME$ is a literal or string variable containing the filename to which data will be written. The BASIC version of SPLOT2 is resident on the GBELEC VAX directory with the name "SPLOT2.BAS", and a compiled version under the name "SPLOT2.OBJ". A command file, "RUNFAR2", is also provided to link "SPLOT2.OBJ" to the rest of FARANT when $@RUNFAR2 filename is executed. Here "filename" is a user-edited version of "FARAFT.BAS" containing his circuit description.

Details of transferring "SPLOT" VAX files to the Apple are covered in references [1] and [2] and are not affected by this upgrade. Transferred "SPLOT2" files are plotted by booting the "VAX FARANT PLOTTER" disk and then typing EXEC FARPLOT<C/R>. "FARPLOT" loads various binary utilities needed and then runs the Applesoft program "PLOTTER1.A". The menu of "PLOTTER1.A" is ex-plained below.

G)ET FILE - Loads a data file into memory from disk. The
user is prompted for the filename.

C)LEAR - Erases the graphics screen without affecting data
in memory.

L)OAD PIC - Loads a graphics file onto the HGR screen. Two
graphics overlays are provided on the "VAX FARANT PLOTTER"
disk: "SMITH", a unit circle Smith chart overlay; and
"RECTANGLE", a rectangular overlay for plotting magnitude
and phase. Loading either of these overlays sets internal
flags that control how data is scaled and plotted.

A)UTOSCALE - Toggles the automatic scaling function on and off.
If "on", the word AUTOSCALE will flash. If "RECTANGLE" is
the most recent overlay loaded, then the magnitude plot is
scaled to the nearest 10 dB above and below the data mini-
mums and maximums. The phase plot is scaled to $\pm$ 180 de-
grees. If "SMITH" is the most recent overlay loaded, or
no overlay has been loaded, then data is scaled for the
unit circle.

P)LOT - Causes the data in memory to be plotted. The type of
plot produced is controlled by the most recent overlay
loaded. Scaling is controlled by the current status of the
autoscale function or by scale values input by the user.

H)ARDCOPY - Produces a printed copy of the graphics screen.

T)YPE - Allows the user to type on the graphics screen. Use of
this option is explained in reference [1].

V)IEW - Toggles display between the menu and the graphics screen.

S)CALE - Accepts inputs for scaling the plots. The type of in-
put requested by the program is controlled by which overlay
has most recently been loaded. Current scale values are dis-

S)CALE (Continued):

    played and are not changed if the user responds with

    just a carriage return. If any value is input, then

    the autoscale function is turned off.

E)XIT - Exits the program to Applesoft.

Compatibility

The "PLOTTER" Apple program described in reference [1] can read files generated by "SPLOT2" although the frequency, magnitude, and phase data will not be read. However, if "FARPLOT" tries to read a data file generated by "SPLOT", it will bomb. Hence, "SPLOT" is not on the GBELEC directory.

Acknowledgments

These programs are modifications of programs written by Stowe Keller. Assistance by Larry D'Addario is appreciated.

References

[1] Keller, Stowe, "Using the Apple II for Graphics Output from VAX FARANT", NRAO EDTN 113.

[2] Norrod, Roger, "Use of the VAX-11 FARANT Microwave Design Program from Green Bank", NRAO EDTN 115.

```
10 SUB SPLOT2(I,J,TITLE$,FILENAME$)
20 !WRITES DATA TO FILE SUITABLE FOR DOWNLOADING TO APPLE & PLOTTING
22  !FORMAT-FIELD 1:REAL MIN,REAL MAX,IMAG MIN, IMAG MAX
24  !FIELD 3: NUMBER POINTS
26  !FIELD 4 TO #PTS + 3: REAL,IMAG
27  !REPEAT FOR FREQ, MAGNITUDE, AND PHASE
28  CM$=","
30 COM NOGO%,Z0,F,DBNUM%,DB(101%,18%)
40 IF DB(51%,1%)<>4 THEN CALL PRT(-4,0)
50 C%=2-(I>1)*4-(J>1)*2   !COL. OF DATABASE WITH REAL PART OF S(I,J); NEGATIVE LO
GIC
60 !FIND EXTREMES
65 RLOW=9E30\ RHIGH=-9E30\ ILOW=9E30\ IHIGH=-9E30
70 MLOW=9E30\ MHIGH=-9E30\ ALOW=180\ AHIGH=-180\ FLOW=9E30\ FHIGH=0
75 !
80 FOR R%=1% TO DBNUM%
85  RE=DB(R%,C%)\IM=DB(R%,C%+1%)\ MG=RE\ AN=IM
90  CALL POLAR(MG,AN)  !CALC MAG & ANGLE IN DEGREES
95  IF RE<RLOW THEN RLOW=RE
100 IF RE>RHIGH THEN RHIGH=RE
105 IF IM<ILOW THEN ILOW=IM
110 IF IM>IHIGH THEN IHIGH=IM
115 IF MG<MLOW THEN MLOW=MG
117 IF MG>MHIGH THEN MHIGH=MG
120 IF AN<ALOW THEN ALOW=AN
125 IF AN>AHIGH THEN AHIGH=AN
135 IF DB(R%,1%)<FLOW THEN FLOW=DB(R%,1%)
140 IF DB(R%,1%)>FHIGH THEN FHIGH=DB(R%,1%)
145 NEXT R%
150 MLOW=20*LOG10(MLOW)\ MHIGH=20*LOG10(MHIGH)   !CONVERT TO DB
155 OPEN FILENAME$ FOR OUTPUT AS FILE #1, DEFAULTNAME ".DAT"
160 PRINT #1,RLOW;CM$;RHIGH;CM$;ILOW;CM$;IHIGH
162 PRINT #1,DBNUM%
163 FOR R%=1% TO DBNUM%
164 PRINT #1,DB(R%,C%);CM$;DB(R%,C%+1%)
165 NEXT R%
166 PRINT #1,TITLE$
168 PRINT #1,FLOW;CM$;FHIGH;CM$;MLOW;CM$;MHIGH;CM$;ALOW;CM$;AHIGH
169 PRINT #1,DBNUM%
170 FOR R%=1% TO DBNUM%
175 RE=DB(R%,C%)\ IM=DB(R%,C%+1%)\ MG=RE\ AN=IM
180 CALL POLAR(MG,AN)
185 MG=20*LOG10(MG)  !CONVERT MAGNITUDE TO DB
190 PRINT #1,DB(R%,1%);CM$;MG;CM$;AN
195 NEXT R%
200 PRINT #1,TITLE$
210 CLOSE #1
220 SUBEND
```

```
PROGRAM LENGTH= 5369 BYTES          VARIABLES= 35 BYTES
FREE MEMORY= 15075 BYTES
START=16385 LOMEM=21754 FREE=21789 STRING=36864 HIMEM=36864


20   REM   PROGRAM * * FARPLOT * *   FOR USE WITH FARANT SPLOT2FILES
30   REM   MODIFIED BY RDN   19SEPT82
40   REM PLOTTING PROGRAM 1/15/82 FRI
50   DIM A(125,4),CC(3):CC(0) = 2:CC(1) = 6:CC(2) = 1:CC(3) = 5
55   POKE  - 16300,0: REM    PRIMARY PAGE
57   ONERR  GOTO 1000
60   DEF  FN HC(X) = CC(2 * X - 4 *  INT (.5 * X))
62   DEF  FN R0(X) =  INT (X + .5)
63   DEF  FN R1(X) =  INT (10 * X + .5) / 10
65   SCALE= 1: ROT= 0: REM  DEFINE PLOTTING ORIENTATION
67  AS% = 1:F% = 0:LA$ = "N":T$ = "T":M% = 0: REM     DEFAULTS:AUTOSCALE,
 NO FILE, NO LABELS, TITLE AT TOP, NOT MAG/ANGLE PLOT
70   D$ =  CHR$ (4):CR$ =  CHR$ (13)
75  XH = 1.46073298:XL =  - XH:YH = 1.0:YL =  - YH:UH = XH:UL = XL:VH
 = YH:UL = YL: REM  DEFAULT SCALE TO UNIT CIRCLE
77  MH = 0:ML =  - 40:PH = 180:PL =  - 180:FL = 0:FH = 1: REM   DEFAULTS
 FOR MAG/PHASE PLOTS
80   HOME : POKE 35,22: INVERSE : VTAB 23: PRINT "G)ET FILE C)LEAR L)OAD
 PIC ";: IF AS% THEN  FLASH
82   PRINT "  A)UTOSCALE ": INVERSE
90   VTAB 24: PRINT "P)LOT H)ARDCOPY T)YPE V)IEW S)CALE E)XIT"
100   NORMAL : HOME
110   PRINT "READY ";: GET A$: PRINT A$
120   POKE  - 16303,0: REM


130   IF A$ <  > "G" THEN 240
140   INPUT "GET FILE:";A$: IF A$ = "" THEN  PRINT D$;"CATALOG": GOTO
 110
147   PRINT D$"OPEN"A$
150   PRINT D$"READ"A$: INPUT XM,XX,YM,YX: REM    READ MIN AND MAX VALUES
 OF REAL AND IMAG
155   INPUT NP: REM  READ NUMBER OF POINTS
160   FOR A = 0 TO NP - 1
165   INPUT A(A,0),A(A,1)
168   NEXT      170 INPUT TI$
172   INPUT FM,FX,MM,MX,AM,AX: REM  READ MIN AND MAX VALUES OF FREQ,MAG,AND
 PHASE
174   INPUT NP
176   FOR A = 0 TO NP - 1
178   INPUT A(A,2),A(A,3),A(A,4)
180   NEXT A

200   INPUT TI$
205  F% = 1: REM  FILE LOADED

220   PRINT  CHR$ (4);"CLOSE"
230   GOTO 110: REM


240   IF A$ <  > "A" THEN 300
250  AS% =  NOT AS%: REM  TOGGLE AUTOSCALE
260   GOTO 80: REM
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300   IF A$ < > "C" THEN 330
310   HGR : POKE  - 16303,0
315  V = 0
320   GOTO 80: REM


330   IF A$ <  > "L" THEN 380
340   INPUT "LOAD PIC NAME?";FI$
350   IF  NOT  LEN (FI$) THEN  PRINT D$;"CATALOG": GOTO 110
355   IF FI$ = "SMITH" THEN UH = 1.46073298:UL =  - UH:VH = 1.0:VL =
     - VH:M% = 0:T$ = "T":LA$ = "N": REM   SCALE FOR SMITHCHART
357   IF FI$ = "RECTANGLE" THEN M% = 1:T$ = "B":LA$ = "N"
360   PRINT D$"BLOAD"FI$",A8192": REM HGR1
365   POKE  - 16304,0: POKE  - 16297,0: POKE  - 16302,0:V = 1
370   GOTO 110: REM


380   IF A$ <  > "S" THEN 445
385   IF M% THEN 424: REM   CHECK FOR MAG/ANGLE PLOT
390   PRINT "XLOW /"XL"/ ";: INPUT A$: IF A$ <  > "" THEN XL =  VAL
   (A$):AS% = 0
400   PRINT "XHIGH /"XH"/ ";: INPUT A$: IF A$ <  > "" THEN XH =  VAL
   (A$):AS% = 0
410   PRINT "YLOW /"YL"/ ";: INPUT A$: IF A$ <  > "" THEN YL =  VAL
   (A$):AS% = 0
420   PRINT "YHIGH /"YH"/ ";: INPUT A$: IF A$ <  > "" THEN YH =  VAL
   (A$):AS% = 0
422   GOTO 430
424   PRINT "MAG LOW/";ML;"/ ";: INPUT A$: IF A$ <  > "" THEN ML =
   VAL (A$):AS% = 0
425   PRINT "MAG HIGH/";MH;"/ ";: INPUT A$: IF A$ <  > "" THEN MH =
   VAL (A$):AS% = 0
426   PRINT "PHASE LOW/";PL;"/ ";: INPUT A$: IF A$ <  > "" THEN PL =
   VAL (A$):AS% = 0
427   PRINT "PHASE HIGH/";PH;"/ ";: INPUT A$: IF A$ <  > "" THEN PH
   =  VAL (A$):AS% = 0
428   PRINT "FREQ LOW/";FL;"/ ";: INPUT A$: IF A$ <  > "" THEN FL =
   VAL (A$):AS% = 0
429   PRINT "FREQ HIGH/";FH;"/ ";: INPUT A$: IF A$ <  > "" THEN FH =
   VAL (A$):AS% = 0
430   REM :INPUT "LABELS (Y/N DEF=N)?";LA$
440   REM : INPUT "TITLE (TOP/BOTTOM/NONE DEF=TOP)?";T$
442   GOTO 80: REM


445   IF A$ <  > "P" THEN 530
447   IF  NOT F% THEN  PRINT "NO FILE TO PLOT": GOTO 110
450   POKE  - 16297,0: POKE  - 16304,0: POKE  - 16302,0:V = 1
455   IF M% THEN  GOSUB 800: GOTO 502: REM  PLOT MAGNITUDE/PHASE
457   IF AS% THEN XH = UH:XL = UL:YH = VH:YL = VL: REM   PLOT ON UNIT
   CIRCLE
460  DX = 279 / (XH - XL):DY = 191 / (YH - YL)
465  SH = 2: REM  DEFINE PLOT SHAPE
470   FOR J = 0 TO NP - 1
480  Y = (YH - A(J,1)) * DY + .5:X = (A(J,0) - XL) * DX + .5
490   IF Y >  = 0 AND Y <  = 191 AND X >  = 0 AND X <  = 279 THEN  HCOLOR=
   3: DRAW SH AT X,Y
500   NEXT
502   IF  LEFT$ (LA$,1) <  > "Y" OR LA$ = "" THEN 512
503   CALL 3072: POKE 792,0: PRINT  CHR$ (1): PRINT  CHR$ (17): REM
   HGR CHR GEN INITIALIZATION
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504   VTAB 24: HTAB 1: PRINT XL;
506   VTAB 24: HTAB 40 -  LEN ( STR$ (XH)): PRINT XH;
508   VTAB 1: HTAB 40 -  LEN ( STR$ (YH)): PRINT YH;
510   VTAB 23: HTAB 40 -  LEN ( STR$ (YL)): PRINT YL;: CALL 1013
512   IF  LEFT$ (T$,1) = "N" THEN 520
515   CALL 3072: POKE 792,0: PRINT  CHR$ (1): PRINT  CHR$ (17): REM
       HGR CHR GEN INITIALIZATION
517   VTAB 2 + 22 * (T$ = "B"): HTAB 2 + (T$ = "B") * (18 -  LEN (TI$)
      / 2): PRINT TI$;: CALL 1013
520   GOTO 80: REM


530   IF A$ <  > "H" THEN 560
540   POKE 1145,43: CALL  - 16038
550   GOTO 110: REM


560   IF A$ <  > "T" THEN 620
570   POKE  - 16304,0: POKE  - 16297,0:V = 1
578   CALL 3072: POKE 792,0: PRINT  CHR$ (1): PRINT  CHR$ (17): REM
       HGR CHR GEN INITIALIZATION
579   HTAB 20: VTAB 12
580   GET B$
590   IF  ASC (B$) = 13 OR  ASC (B$) = 24 THEN 610
600   PRINT B$;: GOTO 580
610   CALL 1013: GOTO 80: REM


620   IF A$ = "E" THEN  TEXT : END : REM  EXIT ROUTINE


622   IF A$ <  > "V" THEN 630: REM  TOGGLE TEXT & GRAPHICS SCREENS
624   V =  NOT V: IF  NOT V THEN  POKE  - 16303,0: GOTO 110
626   POKE  - 16304,0: POKE  - 16297,0: POKE  - 16302,0
628   GOTO 110: REM


630   PRINT  CHR$ (7)"ILLEGAL COMMAND"
635   GOTO 110: REM


800   REM  ROUTINE TO PLOT MAGNITUDE & PHASE
810   IF AS% THEN FL = FM:FH = FX: REM  AUTOSCALE FREQ
815   IF AS% THEN ML = 10 *  INT (MM / 10):MH = 10 *  INT (MX / 10 +
      1.0): REM  AUTOSCALE & ROUND LIMITS TO NEAREST 10DB
817   IF AS% THEN PH = 180:PL =  - 180: REM  AUTOSCALE PHASE AXIS
822 XL = FL:XH = FH: REM  SCALE FREQ AXIS
825   GOSUB 950: REM  LABEL VERT & HORZ AXIS
828 YL = ML:YH = MH: REM  SCALE MAG AXIS
830 DX = 220 / (XH - XL):DY = 170 / (YH - YL)
835   HCOLOR= 3:SH = 2: DRAW SH AT 4,100: REM  MAGNITUDE SHAPE
840   FOR J = 0 TO NP - 1: REM  PLOT MAGNITUDE
850 X = (A(J,2) - XL) * DX + 29.5:Y = (YH - A(J,3)) * DY + 4.5
855   IF X > 28 AND X < 250 AND Y > 3 AND Y < 175 THEN  DRAW SH AT X,Y
860   NEXT J
865 YL = PL:YH = PH: REM  SCALE PHASE AXIS
870 DY = 170 / (YH - YL)
875   HCOLOR= 3:SH = 1: DRAW SH AT 270,100: REM  PHASE SHAPE
880   FOR J = 0 TO NP - 1: REM  PLOT PHASE
890 X = (A(J,2) - XL) * DX + 29.5:Y = (YH - A(J,4)) * DY + 4.5
900   IF X > 28 AND X < 250 AND Y > 3 AND Y < 175 THEN  DRAW SH AT X,Y
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```
910    NEXT J
920    RETURN : REM


950    REM   LABEL VERT & HORZ AXIS
955    CALL 3072: POKE 792,0: PRINT  CHR$ (1): PRINT  CHR$ (17): REM
    HGR CHR GEN INITIALIZATION
960 LB =   FN R1(FL): VTAB 23: HTAB 3: PRINT LB
965 LB =   FN R1(FH): VTAB 23: HTAB 37 -  LEN ( STR$ (XH)): PRINT LB
970 LB =   FN R0(MH): VTAB 1: HTAB 1: PRINT LB
975 LB =   FN R0(ML): VTAB 22: HTAB 1: PRINT LB
980 LB =   FN R0(PH): HTAB 37: VTAB 1: PRINT LB
985 LB =   FN R0(PL): HTAB 37:: VTAB 22: PRINT LB
990    CALL 1013: RETURN : REM


1000   REM   ERROR HANDLING
1002   IF  PEEK (222) = 254 THEN  RESUME
1005   PRINT  CHR$ (7);"ERROR "; PEEK (222)
1010   POKE  - 16303,0
1015   GOTO 110: REM
```

```
***FARPLOT***
TEXT:HOME:INVERSE:HTAB10:PRINT"FARPLOT PROGRAM":NORMAL
BRUN BINARY LIB3.1
PRINT"LIBRARY VERSION ";PEEK(5375)/10
BLOAD HGR CHR GEN
BLOAD SHAPES,A8127
POKE 232,191:POKE 233,31:POKE 230,32
RUN PLOTTER1.A
```