

HEWLETT-PACKARD

Electrical Engineering

Engineering Software Solutions

SERIES 80

NO. 2 NET WEIGHT DISTRIBUTION

HP-85

HEWLETT-PACKARD 85

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LM: E D C B H

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* REQUIRES MATRIX ROM

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Low Pass Filter Design

File Name L P F L T R

Contributor's Name

Company (*if applicable*)

Address

City

State/Country

Zip Code/Mail Code

Machine Size: 16K ☒ 32K ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 2,096

Program Description: This program uses constant K prototype T section and M derived ($M=.6$) termination L section to design low pass filters. The program will give high attenuation at specified frequencies in the stop band by adding up to nine additional M derived T sections.

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PROGRAM DESCRIPTION II

Sample Problem

Design a low pass filter:

Characteristic impedance: 50 ohms

Cutoff frequency : 1 MHz (1000000)

Attenuators in stop band: 1

Frequency for attenuator: 1.5 MHz (1500000)

SOLUTION:

LOAD "LPFLTR".

RUN.

Enter input data as prompted.

```

0<----- 50 OHM LINE ----->0
+-8.488E-003MH + 1.910E-003MFD-+
|
| \
|  4.775E-003MH
| /
|
+----- 6.366E-003 MFD -----+
|
| \
|  1.389E-002MH
| /
|
+-2.373E-003MH + 4.745E-003MFD-+
|
| \
|  1.071E-002MH
| /
|
+-8.488E-003MH + 1.910E-003MFD-+
|
0<----- 50 OHM LINE ----->0

```

TERMINATING SECTIONS GIVE MAX
ATTENUATION AT 1250000 Hz

PROGRAM DESCRIPTION III

Operating Limits and Warnings

Reference(s)

Variables:

Name	Description	Length	Comments
R	Impedance		
F(1)	Cutoff frequency		
A	Number of attenuators		
F()	Frequencies for A attenuators		

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USER INSTRUCTIONS

STEP	INSTRUCTIONS
1	LOAD "LPFLTR" and press RUN.
2	Enter input data as prompted.
3	Results will be printed.

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PROGRAM LISTING

Listing

Comments

```

10 CLEAR
20 DIM M(10),L(10),S(10),C(10),
  F(10)
30 FOR I=1 TO 10 @ F(I)=0 @ NEX
  T I
40 DISP "ENTER THE CHARACTERIST
  IC IMPEDANCE IN OHMS"
  @ INPUT R
50 DISP @ DISP "ENTER THE CUTOF
  F FREQUENCY";@ INPUT F(1)
60 DISP @ DISP "ENTER THE NUMBE
  R OF ATTENUATORS IN THE STOP
  BAND";@ INPUT A
70 GOTO 170
80 FOR I=2 TO A+1
90 DISP @ DISP "FREQ. FOR ATTEN
  UATOR NO";I-1;@ INPUT F(I)
100 NEXT I
110 L=1000*R/(PI*F(1))
120 C=1000000/(PI*F(1)*R)
130 L(1)=.6*L/2
140 S(1)=.64*L/1.2
150 C(1)=.6*C/2
160 GOTO 200
170 PRINT
180 IF A=0 THEN 110
190 GOTO 80
200 FOR I=2 TO 10
210 IF F(I)=0 THEN 270
220 M(I)=SQR(1-F(1)/F(I)*F(1)/F(
  I))
230 L(I)=M(I)*L/2
240 S(I)=L*((1-M(I)*M(I))/(4*M(I)
  )))
250 C(I)=C*M(I)
260 NEXT I
270 PRINT
280 GOSUB 700
290 GOSUB 640
300 GOSUB 680
310 GOSUB 640
320 PRINT USING 330 ; L(1)
330 IMAGE " \",29X,"!",3X,D.DDDE
  ,"MH",16X,"!", " /",29X,"!"
340 GOSUB 640
350 PRINT USING 360 ; C
360 IMAGE "+-----",D.DDDE," M
  FD -----+"
370 GOSUB 640
380 I=2
390 IF F(I)=0 THEN 580
400 PRINT USING 330 ; L/2+L(I)
410 GOSUB 640
420 PRINT USING 430 ; S(2),C(2)
430 IMAGE "+-",D.DDDE,"MH + ",D.
  DDDE,"MFD-+"
440 GOSUB 640
450 FOR I=3 TO 10
460 IF F(I)=0 THEN 520
470 PRINT USING 330 ; L(I)+L(I-1
  )

```

Data entry

Print results

PROGRAM LISTING

Listing

Comments

```
480 GOSUB 640
490 PRINT USING 430 ; S(I),C(I)
500 GOSUB 640
510 NEXT I
520 PRINT USING 330 ; L(I-1)+L(1
)
530 GOSUB 640
540 GOSUB 680
550 GOSUB 640
560 GOSUB 700
570 GOTO 730
580 PRINT USING 330 ; L/2+L(1)
590 GOSUB 640
600 GOSUB 680
610 GOSUB 640
620 GOSUB 700
630 GOTO 730
640 FOR N=1 TO 2
650 PRINT " ";TAB(32);" ;"
660 NEXT N
670 RETURN
680 PRINT USING 430 ; S(1),C(1)
690 RETURN
700 PRINT USING 710 ; R
710 IMAGE "0<-----",DDD," OHM
    LINE ----->0"
720 RETURN
730 PRINT
740 PRINT
750 PRINT "TERMINATING SECTIONS
    GIVE MAX ATTENUATION AT";1
    .25*F(1);"Hz"
760 END
```

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I**Program Title** Ladder Network Analysis**File Name** A N A L A D**Contributor's Name****Company** (*if applicable*)**Address****City****State/Country****Zip Code/Mail Code****Machine Size:** 16K ☒ 32K ☐**Peripherals Required:** none**ROMs Required:** none**Number of Bytes:** 6,969

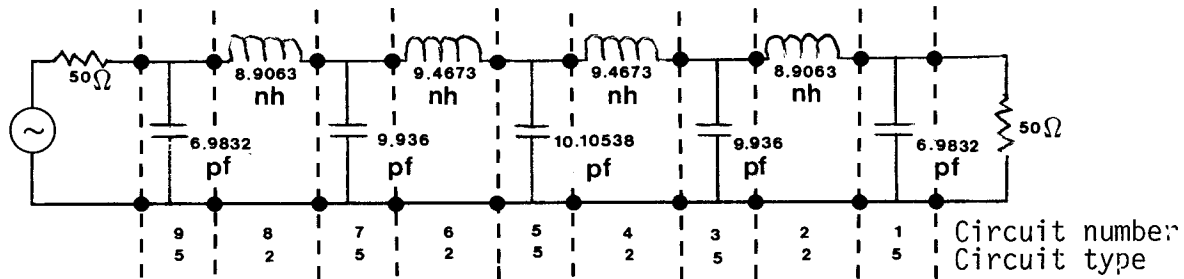
Program Description: This program will analyze circuits with a "Ladder" topology, (i.e., alternating series and shunt elements). The circuit can be made of R, L, C networks and lossless transmission lines. The size of the circuit is not restricted, only the topology. Output options include a table or graphs.

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PROGRAM DESCRIPTION II

Sample Problem

For illustration, the nine element, one dB ripple Chebyshev low pass filter with one GHz cutoff. For reference to this program, the circuit is shown below. The characteristic line impedance is 50 ohms.

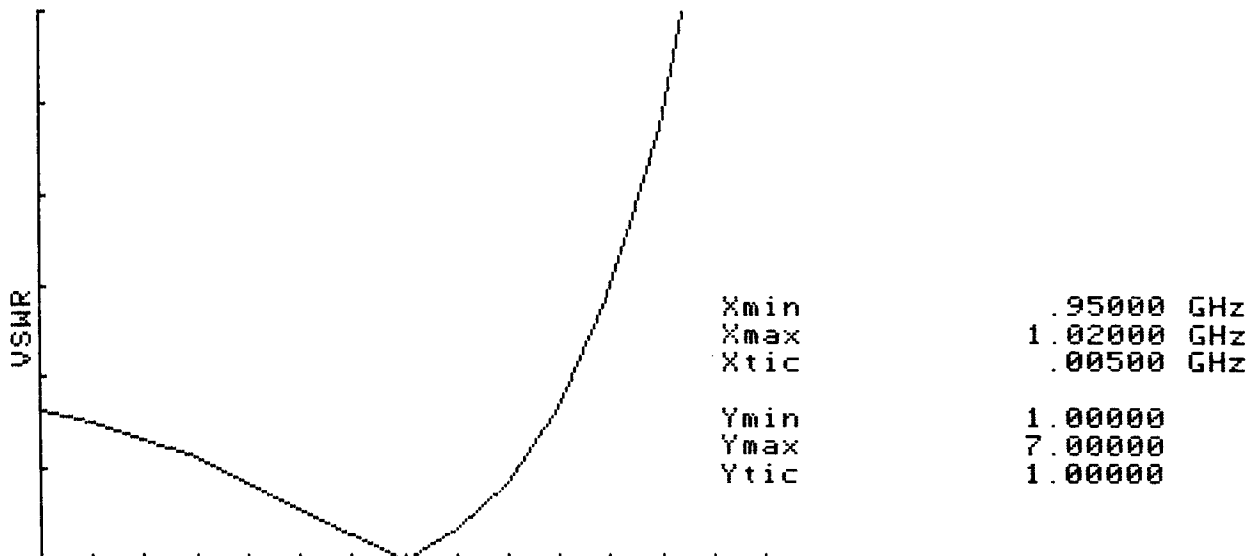


Lower bound for analysis: .95
 Upper bound for analysis: 1.02
 Frequency interval : .005
 Load resistance : 50
 Characteristic impedance
 for computing VSWR : 50
 Source impedance : 50

SOLUTION:

LOAD "ANALAD".
 RUN.

Enter input data as prompted.
 Select option #3 for following:



PROGRAM DESCRIPTION III

Operating Limits and Warnings Will currently handle up to 20 circuit elements.

Change the dimension of I(,) in line 40 to support larger circuit elements, (i.e., I(50,4) to handle 50 circuit elements).

Reference(s)

Variables:

Name	Description	Length	Comments
I(,)	Circuit element data		
F1	Lower bound of frequency analysis (GHz)		
F2	Upper bound of frequency analysis (GHz)		
F3	Interval for frequency analysis (GHz)		
R1	Load resistance		
R0	Source impedance		
Z0	Characteristic impedance		
N	Number of circuit elements		
Q0	Y min for graph		
Q1	Y max for graph		
Q6	Y tic for graph		
Q	Option		

SERIES 80 USERS' LIBRARY
USER INSTRUCTIONS

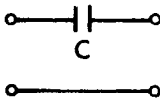
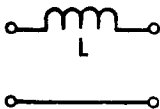
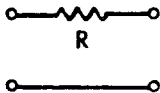
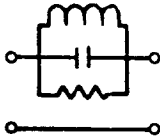
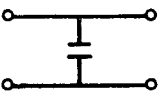
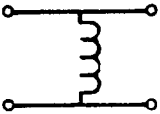
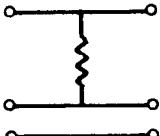
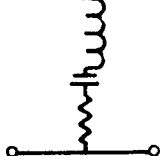
STEP**INSTRUCTIONS**

- 1 LOAD "ANALAD" and press RUN.
- 2 Enter input data as prompted.
- 3 Select option #3 and graph will be generated.

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

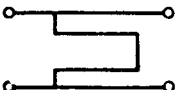
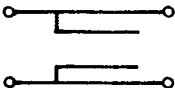
Circuit Catalog

NUMBER	DESCRIPTION	CIRCUIT	INPUT DATA LINE			
			NUMBER,	NUMBER,	NUMBER,	NUMBER,
1.	Series C		1	,	(<u>C</u> , pf)	
2.	Series L		2	,	(<u>L</u> , nh)	
3.	Series R		3	,	(<u>R</u> , Ω)	
4.	Series tank		4	,	(<u>L</u> , nh), (<u>C</u> , PF), (<u>G</u> , mho)	
5.	Shunt C		5	,	(<u>C</u> , pf)	
6.	Shunt L		6	,	(<u>L</u> , nh)	
7.	Shunt G		7	,	(<u>G</u> , mho)	
8.	Shunt tank		8	,	(<u>L</u> , nh), (<u>C</u> , pf), (<u>R</u> , ohms)	
9.	Transmission line		9	,	(<u>Zo</u> , Ω), (<u>L</u> , in), ($\sqrt{\epsilon}$)	

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USER INSTRUCTIONS

Circuit Catalog

<u>NUMBER</u>	<u>DESCRIPTION</u>	<u>CIRCUIT</u>	<u>INPUT DATA LINE</u>			
			<u>NUMBER,</u>	<u>NUMBER,</u>	<u>NUMBER,</u>	<u>NUMBER,</u>
10.	Series shorted stub		10	, (<u>Z₀, Ω</u>),	(<u>L, in</u>),	(<u>√ε</u>)
11.	Series open stub		11	, (<u>Z₀, Ω</u>),	(<u>L, in</u>),	(<u>√ε</u>)
12.	Shunt shorted stub		12	, (<u>Z₀, Ω</u>),	(<u>L, in</u>),	(<u>√ε</u>)
13.	Shunt open stub		13	, (<u>Z₀, Ω</u>),	(<u>L, in</u>),	(<u>√ε</u>)

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PROGRAM LISTING

Listing

Comments

```

10 COM M
20 CLEAR
30 OPTION BASE 1
40 DIM A(2,3),B(2,3),C(2,3),D(2
,3),I(20,4)
50 DISP "ENTER THE LOWER BOUND
FOR      ANALYSIS";
60 INPUT F1
70 DISP @ DISP "ENTER THE UPPER
BOUND FOR      ANALYSIS";
80 INPUT F2
90 DISP @ DISP "ENTER THE FREQU
ENCY INTERVAL";
100 INPUT F3
110 DISP @ DISP "ENTER THE LOAD
RESISTANCE";
120 INPUT R1
130 DISP @ DISP "ENTER THE CHARA
CTERISTIC      IMPEDANCE F
OR COMPUTING VSWR";
140 INPUT Z0
150 DISP @ DISP "ENTER THE SOURC
E IMPEDANCE";
160 INPUT R0
170 DISP @ DISP "NUMBER OF CIRCU
T ELEMENTS";
180 INPUT N
190 CLEAR
200 DISP "FOR EACH ELEMENT, ENTE
R DATA AS REQUESTED:"
210 FOR S=1 TO N
220 DISP @ DISP "ELEMENT";S;" "
230 DISP "CIRCUIT TYPE";
240 INPUT I(S,1)
250 ON I(S,1) GOTO 260,260,260,2
90,260,260,260,290,290,290,2
90,290,290
260 DISP "ENTER 1 DATA ELEMENT";
270 INPUT I(S,2)
280 GOTO 310
290 DISP "ENTER 3 DATA ELEMENTS"
;
300 INPUT I(S,2),I(S,3),I(S,4)
310 NEXT S
320 CLEAR
330 DISP "      ANALYSIS TYPES:"
340 DISP
350 DISP "      0) TABLE 1"
360 DISP "      1) TABLE 2"
370 DISP "      2) GRAPH 1"
380 DISP "      3) GRAPH 2"
390 DISP "      4) GRAPH 3"
400 DISP "      5) GRAPH 4"
410 DISP
420 DISP "      ENTER OPTION";
430 INPUT Q
440 CLEAR
450 Q6=1
460 IF Q=2 THEN Q0=1 @ Q1=1.6
470 IF Q=3 THEN Q0=1 @ Q1=7

```

Data entry

Set graph limits

PROGRAM LISTING

Listing

Comments

```

480 IF Q=4 THEN Q0=0 @ Q1=6
490 IF Q=5 THEN Q0=0 @ Q1=60 @ Q
    6=10
500 FOR F=F1 TO F2 STEP F3
510 A(1,1),D(1,1)=1
520 A(2,1),B(1,1),B(2,1),C(1,1),
    C(2,1),D(2,1)=0
530 FOR I=1 TO N
540 A(1,2),D(1,2)=1
550 A(2,2),B(1,2),B(2,2),C(1,2),
    C(2,2),D(2,2)=0
560 ON I(1,1) GOTO 570,600,630,6
    60,710,740,770,800,850,910,9
    40,970,1000
570 C=I(1,2)
580 B(2,2)=-500/(3.14159*F*C)
590 GOTO 1020
600 L=I(1,2)
610 B(2,2)=6.2832*F*L
620 GOTO 1020
630 R=I(1,2)
640 B(1,2)=R
650 GOTO 1020
660 L=I(1,2) @ C=I(1,3) @ G=I(1,
    4)
670 D1=G^2+(.0062832*F*C-1/(6.28
    32*F*L))^2
680 B(1,2)=G/D1
690 B(2,2)=-(.0062832*F*C-1/(6.2
    832*F*L))/D1
700 GOTO 1020
710 C=I(1,2)
720 C(2,2)=3.14159*F*C/500
730 GOTO 1020
740 L=I(1,2)
750 C(2,2)=-1/(6.2832*F*L)
760 GOTO 1020
770 G=I(1,2)
780 C(1,2)=G
790 GOTO 1020
800 L=I(1,2) @ C=I(1,3) @ R=I(1,
    4)
810 D1=R^2+(6.2832*F*L-500/(3.14
    159*F*C))^2
820 C(1,2)=R/D1
830 C(2,2)=- (6.2832*F*L-500/(3.1
    4159*F*C))/D1
840 GOTO 1020
850 Z=I(1,2) @ L=I(1,3) @ V=I(1,
    4)
860 A(1,2)=COS(.53197*F*L*V)
870 B(2,2)=SIN(.53197*F*L*V)*Z
880 C(2,2)=SIN(.53197*F*L*V)/Z
890 D(1,2)=COS(.53197*F*L*V)
900 GOTO 1020
910 Z=I(1,2) @ L=I(1,3) @ V=I(1,
    4)
920 B(2,2)=Z*TAN(.53197*F*L*V)
930 GOTO 1020
940 Z=I(1,2) @ L=I(1,3) @ V=I(1,
    4)

```

Frequency analysis loop

Circuit loop

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PROGRAM LISTING

Listing

Comments

```

950 B(2,2)=Z/TAN(.53197*F*L*V)
960 GOTO 1020
970 Z=I(I,2) @ L=I(I,3) @ V=I(I,
4)
980 C(2,2)=-1/(Z*TAN(.53197*F*L*
V))
990 GOTO 1020
1000 Z=I(I,2) @ L=I(I,3) @ V=I(I
,4)
1010 C(2,2)=TAN(.53197*F*L*V)/Z
1020 A(1,3)=A(1,2)*A(1,1)-A(2,2)
*A(2,1)+B(1,2)*C(1,1)-B(2,2)
*C(2,1)
1030 A(2,3)=A(1,2)*A(2,1)+A(2,2)
*A(1,1)+B(1,2)*C(2,1)+B(2,2)
*C(1,1)
1040 B(1,3)=A(1,2)*B(1,1)-A(2,2)
*B(2,1)+B(1,2)*D(1,1)-B(2,2)
*D(2,1)
1050 B(2,3)=A(1,2)*B(2,1)+A(2,2)
*B(1,1)+B(1,2)*D(2,1)+B(2,2)
*D(1,1)
1060 C(1,3)=C(1,2)*A(1,1)-C(2,2)
*A(2,1)+D(1,2)*C(1,1)-D(2,2)
*C(2,1)
1070 C(2,3)=C(1,2)*A(2,1)+C(2,2)
*A(1,1)+D(1,2)*C(2,1)+D(2,2)
*C(1,1)
1080 D(1,3)=C(1,2)*B(1,1)-C(2,2)
*B(2,1)+D(1,2)*D(1,1)-D(2,2)
*D(2,1)
1090 D(2,3)=C(1,2)*B(2,1)+C(2,2)
*B(1,1)+D(1,2)*D(2,1)+D(2,2)
*D(1,1)
1100 A(1,1)=A(1,3)
1110 A(2,1)=A(2,3)
1120 B(1,1)=B(1,3)
1130 B(2,1)=B(2,3)
1140 C(1,1)=C(1,3)
1150 C(2,1)=C(2,3)
1160 D(1,1)=D(1,3)
1170 D(2,1)=D(2,3)
1180 NEXT I
1190 M=A(1,1)*R1+B(1,1)
1200 U=C(1,1)*R1+D(1,1)
1210 O=A(2,1)*R1+B(2,1)
1220 P=C(2,1)*R1+D(2,1)
1230 E=(M+Z0*U)^2+(O+Z0*P)^2
1240 H=M^2-(Z0*U)^2+O^2-(Z0*P)^2
1250 S=2*Z0*(O*U-M*P)
1260 T1=SQR((H/E)^2+(S/E)^2)
1270 IF H>=0 THEN 1300
1280 IF S>=0 THEN 1320
1290 GOTO 1340
1300 N2=0
1310 GOTO 1350
1320 N2=1
1330 GOTO 1350
1340 N2=-1
1350 T2=360/6.2832*ATN(S/H)+N2*1
80

```

PROGRAM LISTING

Listing

Comments

```

1360 T3=(M*U+O*P)/(U^2+P^2)
1370 T4=(O*U-M*P)/(U^2+P^2)
1380 T5=4.3429*LOG(((M+R0*U)^2+(
      O+R0*P)^2)/(4*R0*R1))
1390 IF M+R0*U>=0 THEN 1420
1400 IF O+R0*P>=0 THEN 1440
1410 GOTO 1460
1420 N1=0
1430 GOTO 1470
1440 N1=1
1450 GOTO 1470
1460 N1=-1
1470 T6=360/(2*3.14159)*ATN((O+R
      0*P)/(M+R0*U))+N1*180
1480 T7=(1+T1)/(1-T1)
1490 T8=8.686*LOG(1/T1)
1500 ON Q+1 GOTO 1550,1640,1510,
      1510,1530,1530
1510 Y=T7
1520 GOTO 1720
1530 Y=T5
1540 GOTO 1720
1550 PRINT "FREQ: ";F;"GHz"
1560 PRINT
1570 PRINT USING 1900 ; "LOSS (d
      b)",T5
1580 PRINT USING 1900 ; "INS PHA
      SE, (deg)",T6
1590 PRINT USING 1900 ; "VSWR",T
      7
1600 PRINT USING 1900 ; "REFL PH
      ASE (deg)",T2
1610 PRINT
1620 PRINT
1630 GOTO 1780
1640 PRINT "FREQ: ";F;"GHz" @ PRI
      NT
1650 PRINT USING 1900 ; "R IN (o
      hms)",T3
1660 PRINT USING 1900 ; "X IN (o
      hms)",T4
1670 PRINT USING 1900 ; "REFL MA
      G",T1
1680 PRINT USING 1900 ; "REFL DB
      DOWN",T8
1690 PRINT
1700 PRINT
1710 GOTO 1780
1720 IF F#F1 THEN 1770
1730 PENUP @ GCLEAR
1740 SCALE F1,F2,Q0,Q1
1750 XAXIS Q0,F3,F1,F2
1760 YAXIS F1,Q6,Q0,Q1
1770 PLOT F,Y
1780 NEXT F
1790 IF Q=2 OR Q=3 THEN PRINT TA
      B(13);"VSWR"
1800 IF Q=4 OR Q=5 THEN PRINT TA
      B(9);"INS LOSS (DB)"
1810 IF Q<2 THEN 320

```

Output option 0

Output option 1

Set up graph options 2 - 5

Plot
End frequency loop
If graph, print axis bounds and
units

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```
1820 COPY
1830 PRINT @ PRINT USING 1910 ;
    "Xmin",F1,"GHz"
1840 PRINT USING 1910 ; "Xmax",F
    2,"GHz"
1850 PRINT USING 1910 ; "Xtic",F
    3,"GHz"
1860 PRINT @ PRINT USING 1910 ;
    "Ymin",Q0
1870 PRINT USING 1910 ; "Ymax",Q
    1
1880 PRINT USING 1910 ; "Ytic",Q
    6
1890 PRINT @ PRINT
1900 IMAGE 22A,M000.D0000
1910 IMAGE 12A,M000.D0000,X,3A
1920 GOTO 320
1930 END
```

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Active Filter Design

File Name A C T F I L

Contributor's Name

Company (*if applicable*)

Address

City

State/Country

Zip Code/Mail Code

Machine Size: 16K ☒ 32K ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 7,528

Program Description: ACTFIL designs Butterworth or Chebyshev filters with roll-offs of 12,24, or 36 db per octave (48 for Butterworth). Values of components are listed, and a schematic is drawn.

User accepts and uses this program material AT HIS/HER OWN RISK, in reliance solely upon his/her own inspection of the program material and without reliance upon any representation or description concerning the program material.
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PROGRAM DESCRIPTION II

Sample Problem

Design a high pass Butterworth filter with:

Cutoff frequency in Hz: 1000

C in microfarads: .001

DB of attenuation per octave: 48

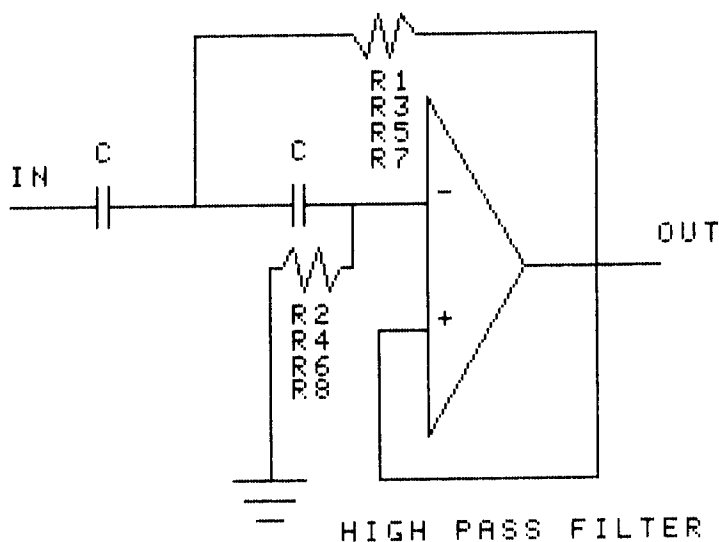
SOLUTION:

LOAD "ACTFIL".

RUN.

Enter input data as prompted.

R1= 31066.8789808
R2= 816174.622193
R3= 88471.3375796
R4= 286601.27572
R5= 132404.458599
R6= 191504.111593
R7= 156178.343949
R8= 162352.843383



THIS REPRESENTS ONE 12DB SECTION
FOR ONE SECTION USE R1 AND R2.
FOR TWO SECTIONS USE R1 & R2 FOR
THE FIRST- R3 & R4 FOR THE
SECOND, ETC.

PROGRAM DESCRIPTION III

Operating Limits and Warnings

Reference(s)

Variables:

Name	Description	Length	Comments
F	Cut-off frequency (Hz)		
Q\$	Filter type		
P	Low pass or high pass		
R	Resistor values (ohms)		
C	Capacitor values		
A	Attenuation in db/octave		
R1-R8	Resistor values		
R9	Number of resistor values used		
C1-C8	Capacitor values		
C9	Number of capacitor values used		

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

STEP	INSTRUCTIONS
------	--------------

- | | |
|---|-------------------------------|
| 1 | LOAD "ACTFIL" and press RUN. |
| 2 | Enter input data as prompted. |
| 3 | Results will be printed. |

PROGRAM LISTING

Listing

Comments

```

10 CLEAR
20 R9,C9=0
30 DISP "ENTER C FOR CHEBYSHEV
      B FOR BUTTER
      WORTH";
40 INPUT Q$
50 IF Q$="C" THEN T=1 @ GOTO 86
   0
60 IF Q$="B" THEN T=2 @ GOTO 80
70 GOTO 10
80 DISP @ DISP "ENTER 1 FOR LOW
      PASS      2 FOR
      HIGH PASS";
90 INPUT P
100 IF P=1 THEN 130
110 IF P=2 THEN 490
120 GOTO 80
130 DISP @ DISP "ENTER CUTOFF FR
      EQUENCY IN Hz";
140 INPUT F
150 DISP @ DISP "ENTER R IN OHMS
      ";
160 INPUT R
170 DISP @ DISP "ENTER DB OF ATT
      ENUATION PER      OCTAVE";
180 INPUT A
190 ON A/12 GOTO 210,250,310,390
200 GOTO 170
210 C2=.707/(6.28*F*R)
220 C1=1/(R*(6.28*F)*.707)
230 C9=2
240 GOTO 1550
250 C2=.3827/(6.28*F*R)
260 C1=1/(R*(6.28*F)*.3827)
270 C4=.9239/(6.28*F*R)
280 C3=1/(R*(6.28*F)*.9239)
290 C9=4
300 GOTO 1550
310 C2=.2588/(6.28*F*R)
320 C1=1/(R*(6.28*F)*.2588)
330 C4=.7071/(6.28*F*R)
340 C3=1/(R*(6.28*F)*.7071)
350 C6=.9659/(6.28*F*R)
360 C5=1/(R*(6.28*F)*.9659)
370 C9=5
380 GOTO 1550
390 C2=.1951/(6.28*F*R)
400 C1=1/(R*(6.28*F)*.1951)
410 C4=.5556/(6.28*F*R)
420 C3=1/(R*(6.28*F)*.5556)
430 C6=.8315/(6.28*F*R)
440 C5=1/(R*(6.28*F)*.8315)
450 C8=.9808/(6.28*F*R)
460 C7=1/(R*(6.28*F)*.9808)
470 C9=8
480 GOTO 1550
490 DISP @ DISP "ENTER CUTOFF FR
      EQUENCY IN Hz";
500 INPUT F
510 DISP @ DISP "ENTER C IN MICR
      OFARADS";

```

Butterworth

Low pass

High pass

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```

520 INPUT C
530 C=C*.000001
540 DISP @ DISP "ENTER DB OF ATT
    ENUATION PER      OCTAVE";
550 INPUT A
560 ON A/12 GOTO 580,620,680,760
570 GOTO 540
580 R1=.707/(12.56*F*C)*2
590 R2=1/(R1*C^2*(6.28*F)^2)
600 R9=2
610 GOTO 1550
620 R1=.3827/(12.56*F*C)*2
630 R2=1/(R1*C^2*(6.28*F)^2)
640 R3=.9239/(12.56*F*C)*2
650 R4=1/(R3*C^2*(6.28*F)^2)
660 R9=4
670 GOTO 1550
680 R1=.2588/(12.56*F*C)*2
690 R2=1/(R1*C^2*(6.28*F)^2)
700 R3=.7071/(12.56*F*C)*2
710 R4=1/(R3*C^2*(6.28*F)^2)
720 R5=.9656/(12.56*F*C)*2
730 R6=1/(R5*C^2*(6.28*F)^2)
740 R9=6
750 GOTO 1550
760 R1=.1951/(12.56*F*C)*2
770 R2=1/(R1*C^2*(6.28*F)^2)
780 R3=.5556/(12.56*F*C)*2
790 R4=1/(R3*C^2*(6.28*F)^2)
800 R5=.8315/(12.56*F*C)*2
810 R6=1/(R5*C^2*(6.28*F)^2)
820 R7=.9808/(12.56*F*C)*2
830 R8=1/(R7*C^2*(6.28*F)^2)
840 R9=8
850 GOTO 1550
860 DISP @ DISP "ENTER 1 FOR LOW
    PASS          2 FOR
    HIGH PASS";
870 INPUT P
880 IF P=1 THEN 910
890 IF P=2 THEN 1290
900 GOTO 860
910 DISP @ DISP "ENTER CUT OFF F
    REQUENCY IN Hz";
920 INPUT F
930 DISP @ DISP "ENTER R IN OHMS
    ";
940 INPUT R
950 DISP @ DISP "ENTER DB OF ATT
    ENUATION PER      OCTAVE";
960 INPUT A
970 ON A/12 GOTO 990,1050,1150
980 GOTO 950
990 B1=.579/(12.56*(F*1.231)*R)
1000 B2=1/(6.28*(F*1.231)*R)
1010 C2=B1+B2*SQR(.579^2/4)
1020 C1=1/(R^2*C2*(6.28*(F*1/231
    ))^2)
1030 C9=2
1040 GOTO 1550

```

Chebyshev

Low pass

PROGRAM LISTING

Listing

Comments

```

1050 M1=.17/(12.56*(F*1031)*R)
1060 M2=1/(6.28*(F*1.031)*R)
1070 C2=M1+M2*SQR(.17^2/4)
1080 C1=1/(R^2*C2*(6.28*(F*1.031)
))^2)
1090 N1=.709/(12.56*(F*.597)*R)
1100 N2=1/(6.28*(F*.579)*R)
1110 C4=N1+N2*SQR(.709^2/4)
1120 C3=1/(R^2*C4*(6.28*(F*1.231)
))^2)
1130 C9=4
1140 GOTO 1550
1150 M1=.077/(12.56*(F*1.011)*R)
1160 M2=1/(6.28*(F*1.011)*R)
1170 C2=M1+M2*SQR(.077^2/4)
1180 C1=1/(R^2*C2*(6.28*(F*1.011)
))^2)
1190 N1=.276/(12.56*(F*.768)*R)
1200 N2=1/(6.28*(F*.768)*R)
1210 C4=N1+N2*SQR(.276^2/4)
1220 C3=1/(R^2*C4*(6.28*(F*.768)
))^2)
1230 P1=.732/(12.56*(F*.396)*R)
1240 P2=1/(6.28*(F*.396)*R)
1250 C6=P1+P2*SQR(.732^2/4)
1260 C5=1/(R^2*C6*(6.28*(F*.396)
))^2)
1270 C9=6
1280 GOTO 1550
1290 DISP @ DISP "ENTER CUTOFF F
REQUENCY IN Hz";
1300 INPUT F
1310 DISP @ DISP "ENTER C IN MIC
ROFARADS";
1320 INPUT C
1330 C=C*.000001
1340 DISP @ DISP "ENTER DB OF AT
TENUATION";
1350 INPUT A
1360 ON A/12 GOTO 1380,1420,1480
1370 GOTO 1340
1380 R1=.579/(2*(6.28*(F*.815))*
C)*2
1390 R2=1/(R1*C^2*(6.28*(F*.815)
))^2)
1400 R9=2
1410 GOTO 1550
1420 R1=.17/(2*(6.28*(F*.97))*C)
*2
1430 R2=1/(R1*C^2*(6.28*(F*.97))
^2)
1440 R3=.709/(2*(6.28*(F*1.675))
*C)*2
1450 R4=1/(R3*C^2*(6.28*(F*1.675)
))^2)
1460 R9=4
1470 GOTO 1550
1480 R1=.077/(2*(6.28*(F*.989))*
C)*2
1490 R2=1/(R1*C^2*(6.28*(F*.989)
))^2)

```

High pass

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PROGRAM LISTING

Listing

Comments

```

1500 R3=.276/(2*(6.28*(F*1.31))*
      C)*2
1510 R4=1/(R3*C^2*(6.28*(F*1.31)
      )^2)
1520 R5=.732/(2*(6.28*(F*2.52))*
      C)*2
1530 R6=1/(R5*C^2*(6.28*(F*2.52)
      )^2)
1540 R9=6
1550 IF C9=0 THEN 1740
1560 PRINT "C1=";C1
1570 IF C9=1 THEN 1910
1580 PRINT "C2=";C2
1590 IF C9=2 THEN 1910
1600 PRINT "C3=";C3
1610 IF C9=3 THEN 1910
1620 PRINT "C4=";C4
1630 IF C9=4 THEN 1910
1640 PRINT "C5=";C5
1650 IF C9=5 THEN 1910
1660 PRINT "C6=";C6
1670 IF C9=6 THEN 1910
1680 PRINT "C7=";C7
1690 IF C9=7 THEN 1910
1700 PRINT "C8=";C8
1710 PRINT
1720 PRINT
1730 GOTO 1910
1740 PRINT "R1=";R1
1750 IF R9=1 THEN 1910
1760 PRINT "R2=";R2
1770 IF R9=2 THEN 1910
1780 PRINT "R3=";R3
1790 IF R9=3 THEN 1910
1800 PRINT "R4=";R4
1810 IF R9=4 THEN 1910
1820 PRINT "R5=";R5
1830 IF R9=5 THEN 1910
1840 PRINT "R6=";R6
1850 IF R9=6 THEN 1910
1860 PRINT "R7=";R7
1870 IF R9=7 THEN 1910
1880 PRINT "R8=";R8
1890 PRINT
1900 PRINT
1910 PRINT
1920 PEN 1 @ GCLEAR
1930 SCALE 0,60,0,26
1940 MOVE 16,17
1950 DRAW 16,25 @ DRAW 29,25
1960 IF P=2 THEN 2020
1970 DRAW 31,25
1980 MOVE 31,24 @ DRAW 31,26
1990 MOVE 32,24 @ DRAW 32,26
2000 MOVE 32,25
2010 GOTO 2030
2020 DRAW 30,24 @ DRAW 31,26 @ D
      RAW 32,24 @ DRAW 33,26 @ DR
      AW 34,25
2030 DRAW 49,25

```

Print component values

Low pass

High pass

Draw schematic

PROGRAM LISTING

Listing

Comments

```
2040 DRAW 49,4 @ DRAW 31,4 @ DRA
W 31,11
2050 DRAW 35,11
2060 MOVE 35,6 @ DRAW 35,22 @ DR
AW 43,14
2070 DRAW 54,14 @ MOVE 43,14 @ D
RAW 35,6
2080 MOVE 22,14 @ DRAW 22,4
2090 MOVE 19,4 @ DRAW 25,4
2100 MOVE 20,3 @ DRAW 24,3
2110 MOVE 21,2 @ DRAW 23,2
2120 MOVE 21,75,1 @ DRAW 22,25,1
2130 MOVE 54,15 @ LABEL "OUT"
2140 MOVE 1,18 @ LABEL "IN"
2150 MOVE 36,17 @ LABEL "-"
2160 MOVE 36,11 @ LABEL "+"
2170 MOVE 35,17 @ DRAW 29,17
2180 DRAW 29,14
2190 IF P=2 THEN 2440
2200 DRAW 26,14 @ MOVE 26,13
2210 DRAW 26,15 @ MOVE 25,13
2220 DRAW 25,15 @ MOVE 25,14
2230 DRAW 22,14
2240 MOVE 1,17 @ DRAW 7,17
2250 DRAW 8,18
2260 DRAW 9,16 @ DRAW 10,18
2270 DRAW 11,16 @ DRAW 12,17
2280 DRAW 22,17 @ DRAW 23,18
2290 DRAW 24,16 @ DRAW 25,18
2300 DRAW 26,16 @ DRAW 27,17
2310 DRAW 29,17
2320 MOVE 9,19 @ LABEL "R"
2330 MOVE 24,19 @ LABEL "R"
2340 MOVE 30.5,22.3 @ LABEL "C1"
2350 MOVE 30.5,21.1 @ LABEL "C3"
2360 MOVE 30.5,19.9 @ LABEL "C5"
2370 MOVE 30.5,18.7 @ LABEL "C7"
2380 MOVE 30,1
2390 MOVE 24,11.3 @ LABEL "C2"
2400 MOVE 24,10.1 @ LABEL "C4"
2410 MOVE 24,8.9 @ LABEL "C6"
2420 MOVE 24,7.7 @ LABEL "C8"
2430 GOTO 2660
2440 MOVE 29,14 @ DRAW 28,14
2450 DRAW 27,13 @ DRAW 26,15
2460 DRAW 25,13 @ DRAW 24,15
2470 DRAW 23,14 @ DRAW 22,14
2480 MOVE 1,17 @ DRAW 8,17
2490 MOVE 8,16 @ DRAW 8,18
2500 MOVE 9,16 @ DRAW 9,18
2510 MOVE 9,17 @ DRAW 24,17
2520 MOVE 24,16 @ DRAW 24,18
2530 MOVE 25,16 @ DRAW 25,18
2540 MOVE 25,17 @ DRAW 29,17
2550 MOVE 30.5,22.3 @ LABEL "R1"
2560 MOVE 30.5,21.1 @ LABEL "R3"
2570 MOVE 30.5,19.9 @ LABEL "R5"
2580 MOVE 30.5,18.7 @ LABEL "R7"
2590 MOVE 24,11.3 @ LABEL "R2"
2600 MOVE 24,10.1 @ LABEL "R4"
```

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PROGRAM LISTING

Listing

Comments

```
2610 MOVE 24,8.9 @ LABEL "R6"
2620 MOVE 24,7.7 @ LABEL "R8"
2630 MOVE 8,19 @ LABEL "C"
2640 MOVE 24,19 @ LABEL "C"
2650 MOVE 28,1 @ LABEL "HIGH PAS
      S FILTER"
2660 COPY @ CLEAR @ ALPHA
2670 PRINT
2680 IF P=2 THEN 2730
2690 PRINT "THIS REPRESENTS ONE
      12DB SECTIONFOR ONE SECTION
      USE C1 AND C2."
2700 PRINT "FOR TWO SECTIONS USE
      C1 & C2 FORTHE FIRST- C3 &
      C4 FOR THE"
2710 PRINT "SECOND, ETC."
2720 GOTO 2760
2730 PRINT "THIS REPRESENTS ONE
      12DB SECTIONFOR ONE SECTION
      USE 11 AND R2."
2740 PRINT "FOR TWO SECTIONS USE
      R1 & R2 FORTHE FIRST- R3 &
      R4 FOR THE"
2750 PRINT "SECOND, ETC."
2760 END
```

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Frequency Plot of Poles and Zeros in a Complex Plane

File Name K S W E E P

Contributor's Name

Company (*if applicable*)

Address

City

State/Country

Zip Code/Mail Code

Machine Size: 16K ☒ 32K ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 4,201

Program Description: This program lists and plots the frequency response of the poles and zeros in the complex plane. The poles and zeros may be that of a transfer, driving point or system function. The plot routine scales the gain and phase for an optimum plot. The resolution of the graph may be improved to .001 db by changing the sweep range. The numerator and denominator of the function must be reduced to simple, multiple, or complex roots.

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PROGRAM DESCRIPTION II

Sample Problem

```

Roots      : Rad
Poles and zeros #1: 1, 0, 0
              #2: 1, 0, 0
              #3: 1, 0, 0
              #4: 2, -2192.50, 62793.60
              #5: 2, -1143.65, 65609.40
              #6: 2, -1048.55, 60153.70
              #7: 3

```

Select (3) true log

Low and high frequencies: 6000,15000

How many steps : 40

0dB reference frequency : 10000

SOLUTION:

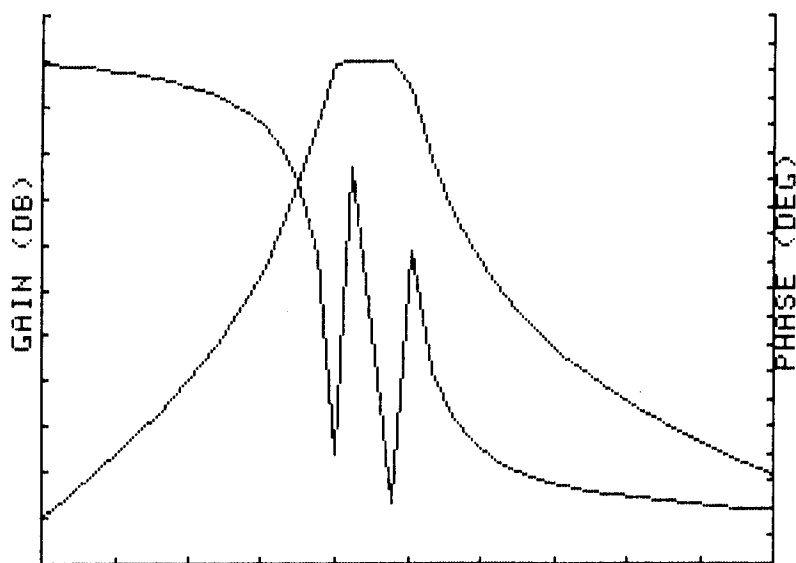
LOAD "KSWEAP".

RUN.

Enter input data as prompted.

Select option #1 to print table.

Select option #2 to plot.



PROGRAM DESCRIPTION II

FREQUENCY (HZ)	GAIN (DB)	PHASE (DEG)
6000.00	-65.929	82.485
6142.64	-64.599	82.090
6288.66	-63.212	81.656
6438.16	-61.762	81.177
6591.22	-60.242	80.645
6747.91	-58.643	80.050
6908.33	-56.954	79.381
7072.56	-55.162	78.620
7240.69	-53.253	77.750
7412.82	-51.208	76.741
7589.05	-49.003	75.560
7769.46	-46.608	74.154
7954.16	-43.984	72.451
8143.25	-41.078	70.344
8336.84	-37.818	67.663
8535.03	-34.096	64.125
8737.93	-29.752	59.218
8945.66	-24.521	51.883
9158.32	-17.926	39.465
9376.04	-9.152	12.752
9598.93	-.578	-60.181
9827.13	-.100	44.444
10060.75	-.024	-15.452
10299.92	-.006	-78.350
10544.78	-4.219	14.612
10795.46	-14.002	-29.523
11052.09	-21.538	-46.797
11314.83	-27.351	-56.072
11583.82	-32.082	-61.966
11859.20	-36.080	-66.080
12141.13	-39.548	-69.130
12429.75	-42.616	-71.489
12725.24	-45.369	-73.371
13027.76	-47.869	-74.910
13337.47	-50.162	-76.193
13654.53	-52.281	-77.280
13979.14	-54.253	-78.214
14311.46	-56.099	-79.025
14651.69	-57.836	-79.736
15000.00	-59.478	-80.365

PROGRAM DESCRIPTION III

Operating Limits and Warnings

Reference(s)

Variables:

Name	Description	Length	Comments
W()	Holds frequency data		
T()	Pole or zero		
R()	Real part		
I()	Imaginary part		
G	Gain		
H	Phase		
W9	ODB Reference frequency		

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USER INSTRUCTIONS

STEP	INSTRUCTIONS
------	--------------

- | | |
|---|-------------------------------|
| 1 | LOAD "KSWEEP" and press RUN. |
| 2 | Enter input data as prompted. |
| 3 | Results will be printed. |

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```

10 COM A
20 DIM W(100),T(50),R(50),I(50)
30 E,K,L=1
40 J,S,A=0
50 CLEAR @ DISP "ARE THE ROOTS
  IN HZ OR RADIANS (ENTER HZ
  OR RAD)";
60 INPUT Q$
70 IF Q$[1,2]<>"HZ" AND Q$[1,2]
  <>"RA" THEN 50
80 IF Q$[1,2]="HZ" THEN F1=1 EL
  SE F1=2*PI
90 CLEAR
100 DISP "NOW ENTER THE POLES AN
  D ZEROS. WHEN ALL DATA IS I
  N, ENTER 3 TO END DATA ENTRY
  "
110 DISP
120 DISP "ZERO(1) POLE(2) OR END
  (3)";
130 INPUT S@ T(J+1)=S-1
140 IF S<1 OR S>3 THEN 120
150 A=A+1 @ J=A
160 ON S GOTO 170,170,240
170 DISP "REAL PART";
180 INPUT R
190 R(J)=R/F1
200 DISP "IMAGINARY PART";
210 INPUT I
220 I(J)=ABS(I/F1)
230 GOTO 110
240 A=A-1 @ J=A @ CLEAR @ IF F1=
  1 THEN 270
250 PRINT "THE POLES & ZEROS IN
  RADIANS ARE"
260 GOTO 280
270 PRINT "THE POLES AND ZEROS I
  N HZ ARE"
280 PRINT
290 FOR J=1 TO A
300 R=F1*R(J)
310 I=F1*I(J)
320 IF T(J)=1 THEN 370
330 IMAGE 7A,X,MDDDD.DD," +-J ",
  MDDDD.DD
340 PRINT USING 330 ; "ZERO AT",
  R,I
350 IF R<=0 THEN 400
360 GOTO 390
370 PRINT USING 330 ; "POLE AT",
  R,I
380 IF R<=0 THEN 400
390 PRINT " *** IN THE RIGHT H
  ALF PLANE!"
400 PRINT
410 NEXT J
420 PRINT
430 CLEAR @ DISP "SWEEP SELECTIO
  N:"
440 DISP @ DISP "1) LINEAR"

```

Data entry

Sweep selection

PROGRAM LISTING

Listing

Comments

```

450 DISP "2) QUASI LOG"
460 DISP "3) TRUE LOG"
470 DISP "4) SELECTED FREQUENCIE
S"
480 DISP @ DISP "ENTER SELECTION
";
490 INPUT S6
500 B=1
510 IF S6=4 THEN 920
520 DISP "ENTER THE LOWEST AND H
IGHEST      FREQUENCIES IN Hz"
;
530 INPUT W1,W2@ W(1)=W1
540 ON S6 GOTO 550,650,830
550 DISP @ DISP "IN STEPS OF";
560 INPUT W3
570 IF (W2-W1)/W3<=100 THEN 600
580 DISP @ DISP "INCREASE STEP S
IZE!"
590 GOTO 550
600 B=B+1
610 W(B)=W(B-1)+W3
620 IF W(B)<W2 THEN 600
630 W(B)=W2
640 GOTO 990
650 IF W(1)#0 THEN 670
660 W(1),W1=1
670 S4=10^INT(LOG(W(1))/LOG(10))
680 B=2
690 FOR J=1 TO 3
700 W(B)=2^(J-1)*S4
710 GOSUB 790
720 NEXT J
730 S4=7*S4
740 GOSUB 790
750 S4=10*S4
760 GOTO 690
770 W(B)=W2
780 GOTO 990
790 IF W(B)<=W1 THEN 820
800 IF W(B)>=W2 THEN 770
810 B=B+1
820 RETURN
830 IF W1#0 AND W2#0 THEN 860
840 DISP "IN LOG SWEEP THE FREQU
ENCY CAN- NOT BE ZERO!" @ WA
IT 4000
850 GOTO 430
860 DISP @ DISP "IN HOW MANY STE
PS";
870 INPUT B
880 FOR K=1 TO B
890 W(K)=EXP(LOG(W2/W1)*(K-1)/(B
-1)+LOG(W1))
900 NEXT K
910 GOTO 990
920 CLEAR @ DISP "ENTER EACH FRE
QUENCY IN HZ.      WHEN THEY
ARE ALL ENTERED, TYPE -1 TO
STOP."

```

Linear plot

Quasi log

True log

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```

930 DISP
940 INPUT W(B)
950 IF W(B)<0 OR B=100 THEN 980
960 B=B+1
970 GOTO 940
980 B=B-1
990 CLEAR @ DISP "ENTER THE 0DB
REFERENCE FREQ";
1000 INPUT W9
1010 PRINT "0DB REF FREQ=";W9
1020 PRINT
1030 CLEAR @ DISP "      PROGRAM O
PTIONS:"
1040 DISP @ DISP "      1) GENERAT
E TABLE"
1050 DISP "      2) GENERATE PLOT"
1060 DISP "      3) CHANGE FREQUEN
CY DOMAIN"
1070 DISP "      4) END"
1080 DISP @ DISP "      ENTER OPTI
ON";
1090 INPUT O9
1100 IF O9<1 OR O9>4 THEN 1030
1110 CLEAR @ DISP "Computing..."
1120 ON O9 GOTO 1130,1290,430,22
30
1130 PRINT "FREQUENCY      GAIN
      PHASE"
1140 PRINT "      (HZ)      (DB)
      (DEG)"
1150 PRINT
1160 IMAGE DDDDDD.DD,3X,MDDD.DDD
,3X,MDDD.DDD
1170 W=ABS(W9)
1180 GOSUB 1920
1190 E=G
1200 FOR K=1 TO B
1210 W=W(K)
1220 GOSUB 1920
1230 G=INT(20000*LOG(G/E)/LOG(10
)+.5)/1000
1240 H=INT(ATN(TAN(H))*180/PI*10
00+.5)/1000
1250 PRINT USING 1160 ; W,G,H
1260 NEXT K
1270 PRINT
1280 GOTO 1030
1290 M1,R1=INF
1300 M2,R2=-INF
1310 W=ABS(W9)
1320 GOSUB 1920
1330 E=G
1340 FOR K=1 TO B
1350 W=W(K)
1360 GOSUB 1920
1370 G=20*LOG(G/E)/LOG(10)
1380 M1=MIN(G,M1)
1390 M2=MAX(G,M2)
1400 NEXT K
1410 M3=(M2-M1)/10

```

Option selection

Generate table

Generate plot

PROGRAM LISTING

Listing

Comments

```

1420 M1=M1-M3 @ M2=M2+M3
1430 R3=10
1440 R1=-100 @ R2=100
1450 PENUP @ GCLEAR
1460 SCALE W1,W2,M1,M2
1470 XAXIS M1,(W2-W1)/10
1480 YAXIS W1,M3
1490 W=ABS(W9)
1500 GOSUB 1920
1510 E=G
1520 FOR K=1 TO B
1530 W=W(K)
1540 GOSUB 1920
1550 PLOT W,20*LOG(G/E)/LOG(10)
1560 NEXT K
1570 PENUP @ SCALE W1,W2,R1,R2
1580 YAXIS W2,R3
1590 W=ABS(W9)
1600 GOSUB 1920
1610 E=G
1620 09=ATN(TAN(H))*180/PI
1630 FOR K=1 TO B
1640 W=W(K)
1650 GOSUB 1920
1660 08=ATN(TAN(H))*180/PI
1670 IF ABS(09-08)>120 THEN PENU
      P
1680 PLOT W,08 @ 09=08
1690 NEXT K
1700 PENUP
1710 PRINT TAB(14);"GAIN (DB)"
1720 COPY
1730 PRINT TAB(13);"PHASE (DEG)"
1740 PRINT @ PRINT
1750 PRINT "          SCALES:"
      @ PRINT
1760 PRINT "FREQUENCY:"
1770 PRINT "  MIN";W1
1780 PRINT "  MAX";W2
1790 PRINT "  INT";(W2-W1)/10
1800 PRINT
1810 PRINT "GAIN:"
1820 PRINT "  MIN";M1
1830 PRINT "  MAX";M2
1840 PRINT "  INT";M3
1850 PRINT
1860 PRINT "PHASE:"
1870 PRINT "  MIN";R1
1880 PRINT "  MAX";R2
1890 PRINT "  INT";R3
1900 PRINT @ PRINT
1910 GOTO 1030
1920 ! *** SWEEP ROUTINE ***
1930 G=1
1940 H=0
1950 FOR J=1 TO A
1960 X=-R(J)
1970 Y=W-I(J)
1980 IF Y#0 OR X#0 THEN 2020
1990 M=1.E-15

```

Sweep routine

PROGRAM LISTING

Listing

Comments

```
2000 P=0
2010 GOTO 2080
2020 M=SQR(X^2+Y^2)
2030 IF X#0 THEN 2050
2040 X=ABS(Y/100000000)
2050 P=ATN(Y/X)
2060 IF R(J)<=0 THEN 2080
2070 P=P+PI
2080 IF I(J)=0 THEN 2160
2090 Y=W+I(J)
2100 M=M*SQR(X^2+Y^2)
2110 IF X#0 THEN 2130
2120 X=ABS(Y/100000000)
2130 P=P+ATN(Y/X)
2140 IF R(J)<=0 THEN 2160
2150 P=P+PI
2160 IF T(J)=0 THEN 2190
2170 M=1/M
2180 P=-P
2190 G=G*M
2200 H=H+P
2210 NEXT J
2220 RETURN
2230 CLEAR @ END
```

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Passive Filter Design

File Name G E N F I L

Contributor's Name

Company (*if applicable*)

Address

City

State/Country

Zip Code/Mail Code

Machine Size: 16K ☒ 32K ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 2,286

Program Description: This program calculates the element values in henries and farads for matched Butterworth or Chebyshev filters. It will operate for low pass, high pass, or Cohn structure band pass.

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SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION II

Sample Problem

```

Chebyshev filter
Number of elements :      9
Allowed ripple     :      1.3
Filter type        :      0
Cutoff frequency   :    5000000
Terminating impedance:    75

```

SOLUTION:

```

LOAD "GENFIL".
RUN.

```

Enter input data as prompted.

LOW-PASS FILTER

C INPUT	L
1.0192E-009	2.5037E-006
1.4283E-009	2.6496E-006
1.4508E-009	2.6496E-006
1.4283E-009	2.5037E-006
1.0192E-009	

C	L INPUT
5.7332E-006	4.4511E-010
8.0341E-006	4.7104E-010
8.1606E-006	4.7104E-010
8.0341E-006	4.4511E-010
	5.7332E-006

PROGRAM DESCRIPTION III

Operating Limits and Warnings Maximum of 20 elements for low pass or high pass filters. Accuracy for Cohn structure deteriorates markedly above 5 resonators. Also note that in the band pass case, it is possible to choose a bad inductor, revealed when negative values for the end capacitors appear.

Reference(s)**Variables:**

Name	Description	Length	Comments
A\$	Filter response		
N	Number of elements		
E	Allowed ripple		
Z	Filter type		
W	Center or cutoff frequency		
R	Terminating impedance		
F	Required band width		
H	Intended inductor		

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

STEP	INSTRUCTIONS
------	--------------

- | | |
|---|-------------------------------|
| 1 | LOAD "GENFIL" and press RUN. |
| 2 | Enter input data as prompted. |
| 3 | Results will be printed. |

PROGRAM LISTING

Listing

Comments

```

10 CLEAR
20 DIM A(20),B(20),C(20),L(20),
   G(20),M(20)
30 DISP "BUTTERWORTH (B) OR CHE
   BYSHEV (C)"
40 INPUT A$
50 IMAGE XX,MD.DODDE,XXX,MD.DOD
   DE
60 IMAGE XX,MD.DODDE
70 IMAGE 17X,MD.DODDE
80 DISP @ DISP "NUMBER OF ELEME
   NTS";
90 INPUT N
100 IF A$[1,13]="C" THEN 150
110 FOR K=1 TO N
120 G(K)=2*SIN((2*K-1)*PI/(2*N))
130 NEXT K
140 GOTO 280
150 DISP @ DISP "WHAT IS ALLOWED
   RIPPLE";
160 INPUT E
170 E=E/17.37
180 B=LOG((2.718^E+2.718^(-E))/(
   2.718^E-2.718^(-E)))
190 D=((2.718^(B/(2*N))-2.718^(-B
   /(2*N)))/2
200 FOR K=1 TO N
210 A(K)=SIN((2*K-1)*PI/(2*N))
220 B(K)=D^2+SIN(K*PI/N)^2
230 NEXT K
240 G(1)=2*A(1)/D
250 FOR K=2 TO N
260 G(K)=4*A(K-1)*A(K)/(B(K-1)*G
   (K-1))
270 NEXT K
280 DISP @ DISP "      FILTER TYPE
   S:"
290 DISP @ DISP "      0) LOW-PASS
   "
300 DISP "      1) HIGH-PASS"
310 DISP "      2) COHN BAND-PASS"
320 DISP @ DISP "      ENTER FILTE
   R TYPE";
330 INPUT Z
340 DISP @ DISP "CENTER OR CUT-O
   FF FREQ.";
350 INPUT W
360 DISP @ DISP "TERMINATING IMP
   EDANCE";
370 INPUT R
380 W=2*PI*W
390 ON Z+1 GOTO 400,520,590
400 FOR I=1 TO N
410 C(I)=G(I)/(R*W)
420 L(I)=G(I)*R/W
430 NEXT I
440 PRINT
450 PRINT "      LOW-PASS FILTE
   R" @ PRINT
460 PRINT "      C INPUT
   L"

```

Data entry

Low pass

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```

470 FOR I=1 TO N-2 STEP 2 @ PRIN
T USING 50 ; C(I),L(I+1) @ N
EXT I @ PRINT USING 60 ; C(N
)
480 PRINT @ PRINT @ PRINT "
      C          L INPUT"
490 FOR I=1 TO N-2 STEP 2 @ PRIN
T USING 50 ; L(I),C(I+1) @ N
EXT I @ PRINT USING 70 ; L(N
)
500 PRINT
510 GOTO 10
520 FOR I=1 TO N
530 C(I)=1/(G(I)*R*W)
540 L(I)=R*1/G(I)/W
550 NEXT I
560 PRINT "          HIGH-PASS FIL
TER"
570 PRINT
580 GOTO 460
590 DISP @ DISP "REQUIRED BANDWI
DTH";
600 INPUT F
610 DISP @ DISP "INTENDED INDUCT
ANCE";
620 INPUT H
630 F=2*PI*F
640 W1=W+F/2
650 W2=W-F/2
660 W=W1+W2-SQR((W2-W1)^2+W1*W2)
670 F=(1/W2-1/W1)*W^2
680 P=1/(W^2*H)
690 X=1-F*P*R/G(1)
700 U=F*P/R*G(1)
710 Y=SQR(U)/(SQR(X)*W)
720 Z=SQR(U)*SQR(X)/W
730 M(1)=Y
740 FOR I=2 TO N
750 M(I)=F/W*(P/SQR(G(I-1)*G(I))
)
760 NEXT I
770 M(N+1)=M(1)
780 C(1)=P-(Z+M(2))
790 C(N)=C(1)
800 FOR I=2 TO N-1
810 C(I)=P-(M(I)+M(I+1))
820 NEXT I
830 PRINT
840 PRINT "COHN STRUCTURE BAND-P
ASS FILTER"
850 PRINT "RESONATOR INDUCTANCE=
";H @ PRINT
860 PRINT "          CAPACITIES"
870 PRINT "          RESONATOR          S
ERIES" @ PRINT
880 FOR I=1 TO N
890 PRINT USING 50 ; C(I),M(I)
900 NEXT I
910 PRINT USING 70 ; M(N+1)
920 PRINT @ GOTO 10

```

High pass

Band pass

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Mixer Spurious Response

File Name M I X S P R

Contributor's Name

Company (*if applicable*)

Address

City

State/Country

Zip Code/Mail Code

Machine Size: 16K ☒ 32K ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 3,791

Program Description: This program aids the identification and source of residual responses. The program applies the general equation for mixing to each converter and calculates the frequency of the spurious response. In addition, the harmonic numbers and frequencies involved are printed so that filter requirements can be determined.

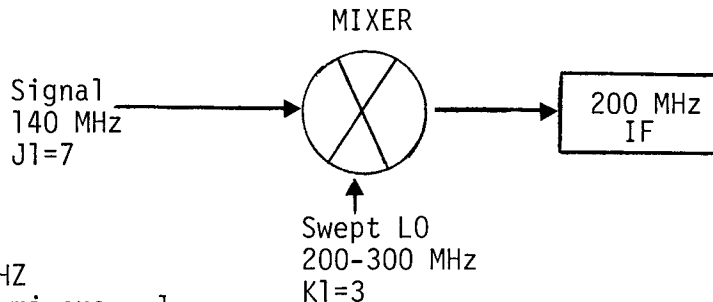
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SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION II

Sample Problem



Units: MHZ
 Number of mixers: 1
 Signal to mixer: 140
 Harmonic to input: 7
 Low LO frequency: 200
 High LO frequency: 300.1
 First harmonic: 3
 Intermediate frequency: 200

NOTE: An upper frequency of 300.1 MHz is used in this example to prevent computer round-off error from masking the spurious response at 100 MHz.

LOAD "MIXSPR".
RUN.

Enter input data as prompted.

LO	SIG	LO MHZ	SIG MHZ	SPUR MHZ
1	3	220.0	420.	20.00
2	2	480.0	280.	40.00
2	5	500.0	700.	50.00
3	3	620.0	420.	6.67
3	4	760.0	560.	53.33
3	5	900.0	700.	100.00
3	6	640.0	840.	13.33
3	7	780.0	980.	60.00

Spurious responses will occur over a 0 to 100 MHz range. The first line in the table indicates that a residual response (SPUR) will occur at 20 MHz if the LO and SIG frequencies of 220 MHz and 420 MHz are allowed to mix. (420MHz - 200 MHz = 200 MHz IF) These frequencies correspond to the fundamental and third harmonic of the LO and SIG, respectively, and are printed in the two left columns.

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION III

Operating Limits and Warnings

Reference(s)

Variables:

Name	Description	Length	Comments
X	Number of mixers		
X1	Input signal to mixer		
J1	Highest harmonic of input signal		
F3	Lowest first L0 frequency		
F4	Highest first L0 frequency		
K1	Highest harmonic of first L0		
I1	First IF frequency		
F5	Second IF frequency		
K2	Highest harmonic of second L0		
I2	Second IF frequency		
F7	Lowest third L0 frequency		
F8	Highest third L0 frequency		
K3	Highest harmonic of third L0		
I3	Third IF frequency		
U\$	Units		

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

STEP	INSTRUCTIONS
------	--------------

- | | |
|---|--------------------------------|
| 1 | LOAD "MIXSPR" and press RUN. |
| 2 | Enter input data as prompted. |
| 3 | Results table will be printed. |

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```

10 CLEAR
20 DISP "UNITS (GHZ,MHZ,KHZ)";
30 INPUT U$
40 DISP @ DISP "NUMBER OF MIXER
   S";
50 INPUT X
60 DISP @ DISP "INPUT SIGNAL TO
   MIXER";
70 INPUT S1
80 DISP @ DISP "HIGHEST HARMONI
   C OF INPUT SIGNAL"
90 INPUT J1
100 DISP @ DISP "LOWEST FIRST LO
   FREQUENCY";
110 INPUT F3
120 DISP @ DISP "HIGHEST FIRST L
   O FREQUENCY";
130 INPUT F4
140 DISP @ DISP "HIGHEST HARMONI
   C OF THE FIRST LOFREQ";
150 INPUT K1
160 DISP @ DISP "FIRST INTERMEDI
   ATE FREQUENCY";
170 INPUT I1
180 T=0
190 U=8
200 IF X=1 THEN 510
210 DISP @ DISP "SECOND LO FREQU
   ENCY";
220 INPUT F5
230 DISP @ DISP "HIGHEST HARMONI
   C OF SECOND LO";
240 INPUT K2
250 DISP @ DISP "SECOND INTERMED
   IATE FREQUENCY";
260 INPUT I2
270 U=U+1
280 IF X=2 THEN 430
290 DISP @ DISP "LOWEST THIRD LO
   FREQUENCY";
300 INPUT F7
310 DISP @ DISP "HIGHEST THIRD L
   O FREQUENCY";
320 INPUT F8
330 DISP @ DISP "HIGHEST HARMONI
   C OF THIRD LO";
340 INPUT K3
350 DISP @ DISP "THIRD INTERMEDI
   ATE FREQUENCY";
360 INPUT I3
370 IMAGE X,D,3X,DD,3X,4D,D,2X,4
   D,,2X,4D,DD
380 IMAGE "1ST 3RD 1ST LO 3RD
   LO SPUR"
390 IMAGE "1ST 2ND 1ST LO 2ND
   LO SPUR"
400 IMAGE "3RD 2ND 3RD LO 2ND
   LO SPUR"
410 IMAGE " LO LO ",3A,4X,3
   A,6X,3A

```

Calculations

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```

420 IMAGE 12X,3A,4X,3A,6X,3A
430 PRINT
440 PRINT "   RESIDUAL SPURIOUS R
      ESPONSES"
450 PRINT
460 PRINT "           FIRST MIXER"
470 PRINT
480 U=U+6
490 GOSUB 2080
500 GOSUB 2230
510 Q=0
520 P=1
530 F=0
540 M1=K1
550 I=I1
560 B1=F3
570 B2=F4
580 L1=(F3+F4)/2
590 L=L1
600 IF X>1 THEN 690
610 N1=J1
620 S=S1
630 PRINT
640 U=U+1
650 GOSUB 2290
660 GOSUB 1290
670 GOSUB 1530
680 STOP
690 N1=K2
700 L2=F5
710 S=L2
720 GOSUB 1290
730 GOSUB 1530
740 IF X=2 THEN 820
750 GOSUB 2130
760 GOSUB 2230
770 L3=(F7+F8)/2
780 S=L3
790 N1=K3
800 GOSUB 1290
810 GOSUB 1530
820 PRINT "           SECOND MIXER"
830 GOSUB 1790
840 PRINT
850 GOSUB 1790
860 GOSUB 2080
870 GOSUB 2230
880 L=L1
890 I=I2
900 S=L2
910 N1=K2
920 GOSUB 1290
930 GOSUB 1530
940 IF X=2 THEN 1280
950 GOSUB 2180
960 GOSUB 2230
970 L=L3
980 M1=K3
990 B1=F7
1000 B2=F8

```

Data entry

Display table

PROGRAM LISTING

Listing

Comments

```

1010 GOSUB 1290
1020 GOSUB 1530
1030 PRINT "          THIRD MIXER"
1040 GOSUB 1790
1050 PRINT
1060 GOSUB 1790
1070 GOSUB 2130
1080 GOSUB 2230
1090 L=L1
1100 M1=K1
1110 S=L3
1120 N1=K3
1130 I=I3
1140 B1=F3
1150 B2=F4
1160 GOSUB 1290
1170 GOSUB 1530
1180 GOSUB 2180
1190 GOSUB 2230
1200 L=L3
1210 M1=K3
1220 S=L2
1230 N1=K2
1240 B1=F7
1250 B2=F8
1260 GOSUB 1290
1270 GOSUB 1530
1280 STOP
1290 IF L>S THEN 1450
1300 IF I>S THEN 1380
1310 J=1
1320 K=1
1330 A1=B1+I
1340 A2=B2+I
1350 P=-1
1360 B=1
1370 GOTO 1520
1380 J=1
1390 K=-1
1400 A1=I-B2
1410 A2=I-B1
1420 P=1
1430 B=-1
1440 GOTO 1520
1450 IF I>L THEN 1380
1460 J=-1
1470 K=-1
1480 A1=B1-I
1490 A2=B2-I
1500 P=1
1510 B=1
1520 RETURN
1530 PRINT
1540 GOSUB 1790
1550 FOR M=1 TO M1
1560 FOR N=1 TO N1
1570 R=N/M*S+J*((M+K)/M)*I
1580 IF R>A2 THEN 1660
1590 IF R<A1 THEN 1660
1600 H1=M*(B*R+P*I)

```

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```

1610 H2=N*S
1620 R=R-A1 ! *** REF LINE ***
1630 PRINT USING 370 ; M,N,H1,H2
      ,R
1640 GOSUB 1790
1650 Q=1
1660 IF T=1 THEN 1700
1670 R=N/M*S+J*((M-K)/M)*I
1680 T=1
1690 GOTO 1580
1700 T=0
1710 NEXT N
1720 NEXT M
1730 IF Q=1 THEN 1750
1740 GOSUB 2260
1750 Q=0
1760 PRINT
1770 GOSUB 1790
1780 RETURN
1790 U=U+1
1800 IF U<60 THEN 2070
1810 IF F<1 THEN 1830
1820 F=0
1830 W1=65-U
1840 FOR W=1 TO W1
1850 PRINT
1860 NEXT W
1870 PRINT "- - - - -"
      - - - - -
1880 FOR W=1 TO 5
1890 PRINT
1900 NEXT W
1910 U=5
1920 IF A>0 THEN 1950
1930 GOSUB 2290
1940 GOSUB 2050
1950 IF A>1 THEN 1990
1960 GOSUB 2080
1970 GOSUB 2230
1980 GOTO 2050
1990 IF A>2 THEN 2030
2000 GOSUB 2130
2010 GOSUB 2230
2020 GOTO 2050
2030 GOSUB 2180
2040 GOSUB 2230
2050 PRINT
2060 U=U+1
2070 RETURN
2080 PRINT USING 390
2090 A=1
2100 U=U+1
2110 F=1
2120 RETURN
2130 PRINT USING 380
2140 A=2
2150 U=U+1
2160 F=1
2170 RETURN
2180 PRINT USING 400

```

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```
2190 A=3
2200 U=U+1
2210 F=1
2220 RETURN
2230 PRINT USING 410 ; U$,U$,U$
2240 U=U+1
2250 RETURN
2260 PRINT " * * * NO SPURIOUS R
      RESPONSES"
2270 GOSUB 1790
2280 RETURN
2290 PRINT "LO    SIG      LO    S
      IG      SPUR"
2300 PRINT USING 420 ; U$,U$,U$
2310 A=0
2320 U=U+1
2330 RETURN
2340 END
```

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Microwave Parameters Conversion

File Name M I C R O

Contributor's Name

Company *(if applicable)*

Address

City

State/Country

Zip Code/Mail Code

Machine Size: 16K ☒ 32K ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 4,759

Program Description: MICRO is a set of seven short programs for converting microwave parameters. Conversions available are:

1. Calculate mismatch uncertainty in db based on two VSWRs.
2. Convert Rho, VSWR, or return loss to other two parameters.
3. db to percent error conversion or visa versa.
4. Signal separation.
5. Theoretical noise level.
6. Convert Z and Theta to: Resistance and reactance, normalized R and X, reflection coefficient and angle, reflection coefficient (Rho) voltage standing wave ratio return loss.
7. Smithchart - convert Rho and angle to R and X.

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PROGRAM DESCRIPTION II

Sample Problem

Convert Z and Angle (Theta) to:

1. Resistance and reactance
2. Normalized R and X
3. Reflection coefficient and angle
4. Reflection coefficient (ρ)
5. VSWR
6. Return loss

$Z = 50$ Angle (Theta) = 36.9 Characteristic impedance = 50

SOLUTION:

LOAD "MICRO".
RUN.

Select option #6.
Enter input data as prompted.

```
R = 39.9846
X = 30.0206
R(N) = .799692
X(N) = .600412
REFLECTION COEFF = .3336
ANGLE = 89.9998
VSWR = 2.0013
RETURN LOSS = 9.5349
```

PROGRAM DESCRIPTION III

Operating Limits and Warnings

Reference(s)

Variables:

Name	Description	Length	Comments
I1	Program number		
V1-V3	Input data		
Y1-Y4	Output data		
P1-P7	Utility variables		

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

STEP	INSTRUCTIONS
------	--------------

- | | |
|---|--------------------------------|
| 1 | LOAD "MICRO" and press RUN. |
| 2 | Enter input data as prompted. |
| 3 | Select option #6 for printout. |

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```

10 CLEAR
20 V1,V2,V3,V4,V5,V6,V7=0
30 P1,P2,P3,P4,P5,P6,P7=0
40 DISP "DO YOU WANT A PROGRAM
   CATALOG";
50 INPUT Q$
60 IF Q$[1,1]="Y" THEN GOSUB 12
   0
70 CLEAR @ DISP "PROGRAM NUMBER
   ";
80 INPUT I1
90 ON I1 GOTO 280,410,740,1120,
   1270,1350,1800,2180
100 DISP "INVALID PROGRAM NUMBER
   "
110 GOSUB 70
120 PRINT "1) COMPUTE MISMATCH U
   NCERTAINTY   IN DB BASED ON
   TWO VSWRS."
130 PRINT "2) CONVERT RHO, VSWR,
   OR RETURN   LOSS TO OTHER
   TWO PARAMETERS"
140 PRINT "3) DB / PERCENT ERROR
   CONVERSION   OR VISA VERSA"
150 PRINT "4) SIGNAL SEPERATION"
160 PRINT "5) THEORETICAL NOISE
   LEVEL"
170 PRINT "6) CONVERT Z & THETA
   TO:"
180 PRINT "   1. RESISTANCE AND
   REACTANCE"
190 PRINT "   2. NORMALIZED R &
   X"
200 PRINT "   3. REFLECTION COEF
   FICIENT     AND ANGLE"
210 PRINT "   4. RETURN LOSS, RE
   FLECTION    COEFFICIENT
   (RHO), VSWR"
220 PRINT "7) SMITHCHART - CONVE
   RT RHO AND  ANGLE TO R AND
   X"
230 PRINT "8) END"
240 PRINT
250 PRINT
260 RETURN
270 !
280 DISP @ DISP "ENTER VSWR 1";
290 INPUT V1
300 P1=(V1-1)/(V1+1)
310 DISP @ DISP "ENTER VSWR 2";
320 INPUT V2
330 P2=(V2-1)/(V2+1)
340 Y1=20*.434294*LOG(1+P1*P2)
350 GOSUB 2120
360 PRINT "PLUS DB=";Y1
370 Y1=20*.434294*LOG(1-P1*P2)
380 GOSUB 2120
390 PRINT "MINUS DB=";Y1
400 GOTO 70
410 CLEAR @ DISP "   INPUT TYPE
   S:"

```

Select option

Print catalog

Option 1

Option 2

PROGRAM LISTING

Listing

Comments

```

420 DISP @ DISP "      1) RHO"
430 DISP "      2) VSWR"
440 DISP "      3) RETURN LOSS"
450 DISP @ DISP "      ENTER INPUT
    TYPE";
460 INPUT I1
470 CLEAR @ ON I1 GOTO 490,540,5
    90
480 GOTO 70
490 DISP "ENTER RHO";
500 INPUT V1
510 GOSUB 700
520 GOSUB 720
530 GOTO 630
540 DISP "ENTER VSWR";
550 INPUT V2
560  $V1 = (V2 - 1) / (V2 + 1)$ 
570 GOSUB 720
580 GOTO 630
590 DISP "ENTER RETURN LOSS";
600 INPUT V3
610  $V1 = 2.71828^{(-2.30259 * V3 / 20)}$ 
620 GOSUB 700
630 Y1=V1
640 Y2=V2
650 Y3=V3
660 GOSUB 2160
670 PRINT "RHO=";Y1 @ PRINT "VSW
    R=";Y2 @ PRINT "R.L.=";Y3
680 PRINT
690 GOTO 70
700  $V2 = -(V1 + 1) / (V1 - 1)$ 
710 RETURN
720  $V3 = -20 * .43429 * \text{LOG}(V1)$ 
730 RETURN
740 CLEAR @ DISP "INPUT IN DB (1
    ) OR PERCENT (2)";
750 INPUT I1
760 IF I1=1 THEN 790
770 IF I2=2 THEN 950
780 GOTO 70
790 DISP @ DISP "ENTER DB";
800 INPUT V1
810  $P2 = 2.71828^{(2.30259 * V1 / 10)}$ 
820  $P1 = \text{SQR}(P2)$ 
830 V7=P1
840 GOSUB 1090
850 Y1=V3
860 Y2=V4
870 V7=P2
880 GOSUB 1090
890 Y3=V3
900 Y4=V4
910 GOSUB 2100
920 PRINT "PERCENT VOLTAGE +";Y1
    @ PRINT "PERCENT VOLTAGE "
    ;Y2
930 PRINT @ PRINT "PERCENT POWER
    +";V3 @ PRINT "PERCENT POWE
    R ";V4

```

Option 3

PROGRAM LISTING

Listing

Comments

```

940 GOTO 70
950 DISP @ DISP "ENTER PERCENT";
960 INPUT V1
970 V3=20*.43429*LOG(1+V1/100)
980 V4=20*.43429*LOG(1-V1/100)
990 V5=V3/2
1000 V6=V4/2
1010 Y1=V3
1020 Y2=V4
1030 Y3=V5
1040 Y4=V6
1050 GOSUB 2100
1060 PRINT "DB VOLTAGE +";Y1 @ P
      PRINT "DB VOLTAGE -";Y2 @ PR
      INT
1070 PRINT "DB POWER +";Y3 @ PRI
      NT "DB POWER -";Y4
1080 GOTO 70
1090 V3=100*(V7-1)
1100 V4=-100*(V7-1)/V7
1110 RETURN
1120 DISP @ DISP "FIRST VECTOR Q
      TY (DB)";
1130 INPUT V1
1140 DISP @ DISP "SECOND VECTOR
      QTY (DB)";
1150 INPUT V2
1160 P1=2.71828^(-2.30259*V1/20)
1170 P2=2.71828^(-2.30259*V2/20)
1180 IF P1>P2 THEN 1220
1190 Y1=-20*.43429*LOG((P2-P1)/2
      )
1200 Y2=-20*.43429*LOG((P2+P1)/2
      )
1210 GOTO 1240
1220 Y1=-20*.43429*LOG((P1-P2)/2
      )
1230 Y2=-20*.43429*LOG((P1+P2)/2
      )
1240 GOSUB 2140
1250 PRINT "DB (A) =";Y1 @ PRINT
      "DB (B) =";Y2
1260 GOTO 70
1270 DISP @ DISP "BANDWIDTH (Hz)
      VALUE";
1280 INPUT V1
1290 DISP @ DISP "ENTER TEMP (C)
      ";
1300 INPUT V2
1310 V2=V2+273
1320 Y1=10*.43429*LOG(1.38*10^(-
      20)*V2*V1)
1330 PRINT "S(DBM)=";Y1
1340 GOTO 70
1350 DISP @ DISP "Z";
1360 INPUT V1
1370 DISP @ DISP "ANGLE";
1380 INPUT V2
1390 V2=V2*.017453
1400 Y1=V1*COS(V2)

```

Option 4

Option 5

Option 6

PROGRAM LISTING

Listing

Comments

```

1410 Y2=V1*SIN(V2)
1420 GOSUB 2140
1430 PRINT "R =";Y1
1440 PRINT "X =";Y2
1450 DISP @ DISP "CHARACTERISTIC
      IMPEDANCE";
1460 INPUT V3
1470 P1=Y1/V3
1480 P2=Y2/V3
1490 PRINT "R(N) =";P1 @ PRINT "
      X(N) =";P2
1500 P3=SQR((P1+1)^2+P2^2)
1510 IF P1+1>0 THEN 1540
1520 P4=ATN(P2/(P1+1))-PI
1530 GOTO 1550
1540 P4=ATN(P2/(P1+1))
1550 P4=P4*57.2958
1560 P5=SQR((P1-1)^2+P2^2)
1570 IF P1-1>0 THEN 1600
1580 P6=ATN(P2/(P1-1))-PI
1590 GOTO 1610
1600 P6=ATN(P2/(P1-1))
1610 P6=P6*57.2958
1620 V4=P5/P3
1630 V5=P6-P4
1640 IF V5>180 THEN 1690
1650 IF V5<-180 THEN 1670
1660 GOTO 1700
1670 V5=360+V5
1680 GOTO 1700
1690 V5=V5-360
1700 Y1=V4
1710 Y2=V5
1720 Y3=(V4+1)/(1-V4)
1730 Y4=-20*.43429*LOG(V4)
1740 GOSUB 2100
1750 PRINT "REFLECTION COEFF =";
      Y1 @ PRINT "ANGLE =";Y2
1760 PRINT "VSWR =";Y3
1770 PRINT "RETURN LOSS =";Y4
1780 PRINT
1790 GOTO 70
1800 DISP @ DISP "ENTER RHO";
1810 INPUT V1
1820 DISP @ DISP "ANGLE";
1830 INPUT V2
1840 V2=V2*.017453
1850 V3=V1*COS(V2)
1860 V4=V1*SIN(V2)
1870 IF V3+1>0 THEN 1900
1880 P2=(ATN(V4/(V3+1))-PI)*57.2
      958
1890 GOTO 1910
1900 P2=ATN(V4/(V3+1))*57.2958
1910 IF 1-V3>0 THEN 1940
1920 P3=(ATN(-V4/(1-V3))-PI)*57.
      2958
1930 GOTO 1950
1940 P3=ATN(-V4/(1-V3))*57.2958
1950 P1=SQR((1+V3)^2+V4^2)/SQR((
      1-V3)^2+V4^2)

```

Option 7

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```
1960 P4=(P2-P3)*.017453
1970 P5=P1*COS(P4)
1980 P6=P1*SIN(P4)
1990 Y1=P5
2000 Y2=P6
2010 GOSUB 2140
2020 PRINT "R(N)=";Y1 @ PRINT "X
      (N)=";Y2
2030 DISP @ DISP "ENTER CHARACTE
      RISTIC IMPEDANCE";
2040 INPUT V5
2050 Y1=V5*P5
2060 Y2=V5*P6
2070 GOSUB 2140
2080 PRINT "R=";Y1 @ PRINT "X=";
      Y2
2090 GOTO 70
2100 Y4=INT(10^4*Y4+.5)/10^4
2110 GOTO 2160
2120 Y1=INT(10^4*Y1+.5)/10^4
2130 RETURN
2140 Y2=INT(10^4*Y2+.5)/10^4
2150 GOTO 2120
2160 Y3=INT(10^4*Y3+.5)/10^4
2170 GOTO 2140
2180 CLEAR @ END
```

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title AC Circuit Analysis

File Name A C N O D E

Contributor's Name

Company (*if applicable*)

Address

City

State/Country

Zip Code/Mail Code

Machine Size: 16K ☒ 32K ☐

Peripherals Required: none

ROMs Required: MATRIX

Number of Bytes: 11,088

Program Description: This program computes node voltages by inverting an admittance matrix created from a nodal description of an electronic circuit. Circuit elements allowed include resistors, inductors, transformers, independent current sources, and voltage current sources.

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SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION II

Sample Problem

Comput node voltages for the following circuit:

Number of circuit elements: 20
 Highest numbered node : 10
 Output for how many nodes : 3 (1, 4, 10)
 Scale : LOG
 Start,end frequency : 1000,10100000
 Steps per decade : 2

Circuit type, data	#1: I 1,0,1,0	#11: R 5,6,50
	#2: R 1,0,1	#12: R 6,0,2000
	#3: R 1,2,100	#13: C 0,6,4.7E-07
	#4: R 2,3,375	#14: TRF 4,0,7,0,.1,.2,.9999
	#5: R 3,5,1625	#15: C 7,8,.000001
	#6: C 3,5,8.3E-11	#16: R 8,0,1000
	#7: R 3,4,1.4E+07	#17: R 8,9,1500
	#8: C 3,4,1.5E-12	#18: C 9,0,1.E-09
LOAD "ACNODE".	#9: IV 5,4,3,5,.08	#19: R 9,10,5000
RUN.	#10: R 4,5,71000	#20: C 10,0,3.E-10

Enter input data as prompted.

```

NODE          1
FREQUENCY     1.0000E+003
VOLTAGE       9.9999E-001
DB            0.0000E+000
PHASE         0.0000E+000
  
```

```

NODE          4
FREQUENCY     1.0000E+003
VOLTAGE       2.6857E-001
DB           -1.1419E+001
PHASE       -7.7260E+001
  
```

```

NODE         10
FREQUENCY    1.0000E+003
VOLTAGE      1.6980E+000
DB           4.5990E+000
PHASE      -6.9480E+001
  
```

. . . continued for rest of frequency span

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

STEP	INSTRUCTIONS
------	--------------

- | | |
|---|-------------------------------|
| 1 | LOAD "ACNODE" and press RUN. |
| 2 | Enter input data as prompted. |
| 3 | Results will be printed. |

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION III

Operating Limits and Warnings Maximum of 10 nodes.

Reference(s)**Variables:**

Name	Description	Length	Comments
J5	Number of nodes to print		
G()	Nodes to print		
L\$	Scale type		
F1,F2	Frequency span		
N	Highest numbered node		
M	Number of circuit elements		
Q\$	Circuit type		
F0	Frequency		
X1	Voltage		
X5	DB		
Y1	Phase		

PROGRAM LISTING

Listing

Comments

```

10 COM I
20 OPTION BASE 1
30 CLEAR
40 DIM A(10,10),B(20),C(10,10),
   D(20,20),F(10,10),G(10),X(10
   ),Y(10)
50 P=PI
60 DISP @ DISP "NUMBER OF CIRCU
   IT ELEMENTS";@ INPUT M
70 DISP @ DISP "HIGHEST NUMBERS
   D NODE";@ INPUT N
80 DISP @ DISP "ENTER NUMBER OF
   NODES FOR WHICH OUTPUT IS D
   ESIRE (0 FOR ALL NODES)";@
   INPUT J5
90 MAT A=ZER
100 MAT C=ZER
110 MAT F=ZER
120 MAT D=ZER
130 MAT B=ZER
140 MAT G=ZER
150 MAT X=ZER
160 MAT Y=ZER
170 ON SGN(J5)+2 GOTO 370,220,18
   0
180 J6=J5
190 FOR I=1 TO J6
200 DISP "PRINT NODE #";I;@ INPU
   T G(I)
210 NEXT I
220 DISP @ DISP "LOG OR LINEAR F
   REQUENCY SCALE";@ INPUT L$
230 DISP @ DISP "ENTER START FRE
   QUENCY, END FREQUENCY";@ INP
   UT F1,F2
240 DISP
250 IF L$[1,3]="LOG" THEN DISP "
   ENTER STEPS PER DECADE";ELSE
   DISP "ENTER FREQUENCY INCRE
   MENT";
260 INPUT S
270 F9=F1
280 FOR L=1 TO M
290 DISP @ DISP "ENTER CIRCUIT E
   LEMENT";@ INPUT Q$
300 Q$=Q$&" "
310 IF Q$[1,1]="C" THEN 390
320 IF Q$[1,1]="L" THEN 710
330 IF Q$[1,1]="R" THEN 800
340 IF Q$[1,2]="IV" THEN 580
350 IF Q$[1,1]="I" THEN 480
360 IF Q$[1,3]="TRF" THEN 890
370 DISP "DATA ERR"
380 STOP
390 DISP @ DISP "ENTER NODE1, NO
   DE2, FARADS";@ INPUT J,K,G
400 IF K=0 THEN 430
410 C(K,K)=C(K,K)+G
420 IF J=0 THEN 1240
430 C(J,J)=C(J,J)+G

```

Data entry

Circuit entry

Capacitor

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```

440 IF K=0 THEN 1240
450 C(J,K)=C(J,K)-G
460 C(K,J)=C(K,J)-G
470 GOTO 1240
480 DISP @ DISP "ENTER 'INTO' NO
DE, 'OUT OF' NODEREAL AND IM
AGINARY PARTS OF CURRENT
";
490 INPUT J,K,I1,I2
500 IF K=0 THEN 520
510 IF J=0 THEN 550
520 B(J)=B(J)+I1
530 B(J+N)=B(J+N)+I2
540 IF K=0 THEN 1240
550 B(K)=B(K)-I1
560 B(K+N)=B(K+N)-I2
570 GOTO 1240
580 DISP @ DISP "ENTER 'INTO' NO
DE, 'OUT OF' NODE POSITIVE CO
NTROL NODE, NEGATIVE"
590 DISP "CONTROL NODE, AND REAL
PART OF Gm (ohms)"; @ INPUT
N1,N2,N3,N4,M1
600 IF N1=0 THEN 650
610 IF N3=0 THEN 630
620 A(N1,N3)=A(N1,N3)-M1
630 IF N4=0 THEN 650
640 A(N1,N4)=A(N1,N4)+M1
650 IF N2=0 THEN 1240
660 IF N3=0 THEN 680
670 A(N2,N3)=A(N2,N3)+M1
680 IF N4=0 THEN 1240
690 A(N2,N4)=A(N2,N4)-M1
700 GOTO 1240
710 DISP @ DISP "ENTER NODE 1, N
ODE 2, HENRIES"; @ INPUT J,K,
G
720 IF K=0 THEN 750
730 F(K,K)=F(K,K)+1/G
740 IF J=0 THEN 1240
750 F(J,J)=F(J,J)+1/G
760 IF K=0 THEN 1240
770 F(J,K)=F(J,K)-1/G
780 F(K,J)=F(K,J)-1/G
790 GOTO 1240
800 DISP @ DISP "ENTER NODE1, NO
DE2 & OHMS"; @ INPUT J,K,G
810 IF K=0 THEN 840
820 A(K,K)=A(K,K)+1/G
830 IF J=0 THEN 1240
840 A(J,J)=A(J,J)+1/G
850 IF K=0 THEN 1240
860 A(K,J)=A(K,J)-1/G
870 A(J,K)=A(J,K)-1/G
880 GOTO 1240
890 DISP @ DISP "ENTER DOTTED PR
IMARY NODE, OTHER PRIMARY NOD
E"; @ INPUT N1,N2
900 DISP @ DISP "ENTER DOTTED SE
CONDARY NODE, OTHER SECON
DARY NODE"; @ INPUT N3,N4

```

Independent current source

Dependent current source

Inductor

Resistor

Transformer

PROGRAM LISTING

Listing

Comments

```

910 DISP @ DISP "ENTER PRIMARY I
      INDUCTANCE,      SECONDARY I
      INDUCTANCE & COUPLING COEFFIC
      IENT";
920 INPUT L1,L2,K1
930 M1=SQR(K1*K1*L1*L2)
940 R=1/(1-K1*K1)
950 R1=R*M1/(L1*L2)
960 R2=-R/L2
970 R3=-R/L1
980 IF N1=0 THEN 1090
990 F(N1,N1)=F(N1,N1)-R3
1000 IF N2=0 THEN 1030
1010 F(N1,N2)=F(N1,N2)+R3
1020 F(N2,N1)=F(N2,N1)+R3
1030 IF N3=0 THEN 1060
1040 F(N1,N3)=F(N1,N3)-R1
1050 F(N3,N1)=F(N3,N1)-R1
1060 IF N4=0 THEN 1090
1070 F(N1,N4)=F(N1,N4)+R1
1080 F(N4,N1)=F(N4,N1)+R1
1090 IF N2=0 THEN 1170
1100 F(N2,N2)=F(N2,N2)-R3
1110 IF N3=0 THEN 1130
1120 F(N2,N3)=F(N2,N3)+R1
1130 F(N3,N2)=F(N3,N2)+R1
1140 IF N4=0 THEN 1170
1150 F(N2,N4)=F(N2,N4)-R1
1160 F(N4,N2)=F(N4,N2)-R1
1170 IF N3=0 THEN 1220
1180 F(N3,N3)=F(N3,N3)-R2
1190 IF N4=0 THEN 1220
1200 F(N3,N4)=F(N3,N4)+R2
1210 F(N4,N3)=F(N4,N3)+R2
1220 IF N4=0 THEN 1240
1230 F(N4,N4)=F(N4,N4)-R2
1240 NEXT L
1250 F0=F1
1260 W1=2*P*F0
1270 FOR I6=1 TO N
1280 FOR I7=1 TO N
1290 D(I6,I7)=A(I6,I7)
1300 D(I6+N,I7+N)=A(I6,I7)
1310 D(I6+N,I7)=C(I6,I7)*W1-F(I6
      ,I7)/W1
1320 D(I6,I7+N)=-D(I6+N,I7)
1330 NEXT I7
1340 NEXT I6
1350 MAT D=INV(D)
1360 ! END OF MAT SOLUTION
1370 IF J5=0 THEN 1400
1380 I0=J6
1390 GOTO 1410
1400 I0=N
1410 FOR I9=1 TO I0
1420 IF J5>0 THEN 1450
1430 N1=I9
1440 GOTO 1460
1450 N1=G(I9)
1460 MAT X=ZER(N)

```

Frequency sweep

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

Comments

```

1470 MAT Y=ZER(N)
1480 FOR J8=1 TO 2*N
1490 X(N1)=X(N1)+D(N1,J8)*B(J8)
1500 Y(N1)=Y(N1)+D(N1+N,J8)*B(J8)
1510 NEXT J8
1520 X1=SQR(X(N1)^2+Y(N1)^2)
1530 IF X(N1)<>0 THEN 1590
1540 ON SGN(Y(N1))+2 GOTO 1550,1
610,1570
1550 Y1=-P/2
1560 GOTO 1620
1570 Y1=P/2
1580 GOTO 1620
1590 Y1=ATN(Y(N1)/X(N1))
1600 GOTO 1620
1610 Y1=0
1620 Y1=180*Y1/P
1630 IF X(N1)>=0 THEN 1680
1640 IF Y(N1)>0 THEN 1670
1650 Y1=Y1-180
1660 GOTO 1680
1670 Y1=Y1+180
1680 Y1=INT(Y1*100+.5)/100
1690 IF X1=0 THEN 1720
1700 X5=20*LOG(X1)/LOG(10)
1710 X5=INT(X5*1000+.5)/1000
1720 Y0=X1
1730 GOTO 1770
1740 Y0=X5
1750 GOTO 1770
1760 Y0=Y1
1770 !
1780 PRINT USING 1970 ; "NODE",N
1
1790 PRINT USING 1960 ; "FREQUEN
CY",F0
1800 PRINT USING 1960 ; "VOLTAGE
",X1
1810 PRINT USING 1960 ; "DB",X5
1820 PRINT USING 1960 ; "PHASE",
Y1
1830 PRINT
1840 NEXT I9
1850 IF L$="LOG" THEN 1880
1860 F0=F0+S
1870 GOTO 1890
1880 F0=F0*10^(1/S)
1890 IF J5=1 THEN 1920
1900 IF F9=F0 THEN 1920
1910 PRINT
1920 LET F9=F0
1930 IF F0<=F2 THEN 1260
1940 PRINT
1950 END
1960 IMAGE 17A,MD.DODDE
1970 IMAGE 17A,3D

```

Print routine

ELECTRICAL ENGINEERING

LOW PASS FILTER DESIGN
LADDER NETWORK ANALYSIS
ACTIVE FILTER DESIGN
FREQUENCY PLOT OF POLES AND ZEROS IN A COMPLEX PLANE
PASSIVE FILTER DESIGN
MIXER SPURIOUS RESPONSE
MICROWAVE PARAMETER CONVERSION
AC CIRCUIT ANALYSIS



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