LPFILT***

Low-Pass Filter Design

Information Systems

G. E. I. S. Ltd.
Computer Time-Sharing

BASIC

Design a Low-Pass Filter

This program designs a low-pass filter using constant K prototype T section and M derived (M=0.6) termination L sections. Up to nine additional M derived T sections may be included to give high attenuation at specified frequencies in the stop band.

To use this program, enter data as:

10 DATA R, C, N, F(1), F(2),. . . . F(N)

where

R = Desired characteristics impedance in ohms.

C = Desired cut-off frequency in cycles per second.

N = Number of attenuators desired in stop band.

F(1) = Frequency for attenuator 1.

Then type RUN

Sample problem:

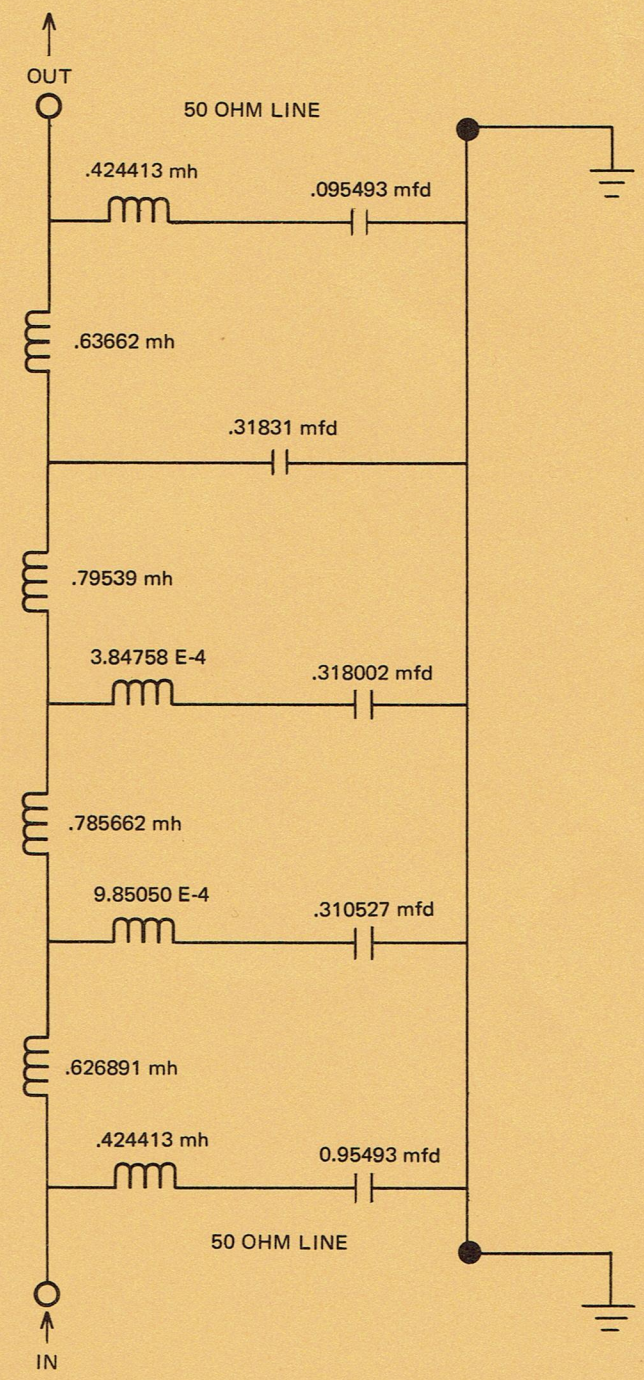
Design a low-pass filter with a 50 ohm impedance, 20 kc cut-off frequency, 2 attenuators in the stop band, 455 kc and 91 kc attenuators in the filter.

Sample data for above

10 DATA 50, 2E4, 2, 455000, 91E3

RUN

The output is a simulated schematic circuit.



TRANS$***
Laplace Transform Inversion

Information Systems

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BASIC

This program evaluates the transient response of a linear system.

Sample: The linear system being evaluated is shown in Figure 1 below.

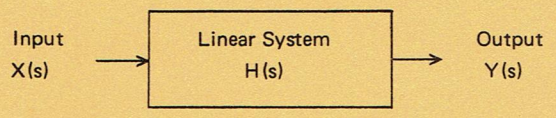


Figure 1.

The desired output equation as a Laplace transform in the ratio of two polynomials is expressed as follows:

$$Y(s) = H(s)\ X(s) = \frac{N(s)}{D(s)} \qquad . (1)$$

A more detailed description of the linear system is shown in Figure 2 below.

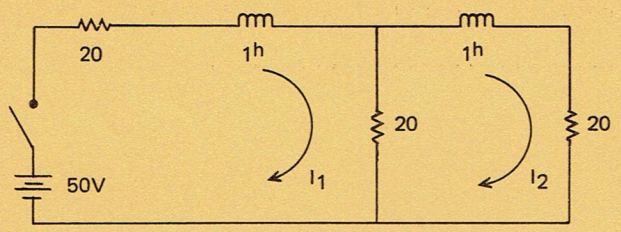


Figure 2.

The transform equations may be written in the following manner:

$$I_2(s) = \frac{1000}{s^3 + 80s^2 + 1200s}$$

This is referred to as Problem 1.

The transient response is desired of the following transform equation.

$$I = \frac{-4s^3 + 60s^2 - 360s + 840}{(s^5 + 16\,s^4 + 120s^3 + 480s^2 + 840s)}$$

This is referred to as Problem 2.

Data for Problem 2 is entered first, since it contains the denominator, polynomial of the highest order.

```
SYSTEM--BASIC
NEW OR OLD--OLD
OLD FILE NAME--TRANS$***
WAIT.

READY.

500 DATA 2
505 DATA 5
510 DATA 840,-360,60,-4,0
520 DATA 0,840,480,120,16
530 DATA 3
540 DATA 1000,0,0
550 DATA 0,1200,80
```

Line 500 — the number of transform equations to be analyzed.

Line 505 — the order of the denominator (5) of the transform equation in Problem 2.

Line 510 — the coefficients in the numerator of the transform equation in Problem 2.

Line 520 — the coefficients in the denominator of the transform equation in Problem 2.

Line 530 — the order of the denominator (3) of the transform equation in Problem 1.

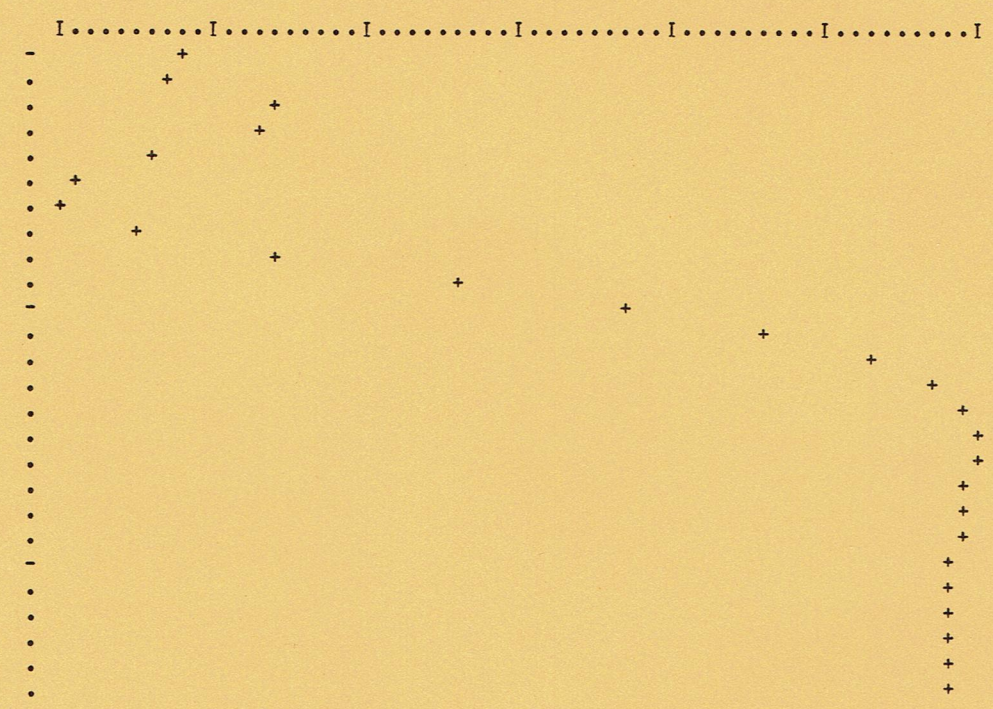
Line 540 — the coefficients in the numerator of the transform equation in Problem 1.

Line 550 — the coefficients in the denominator of the transform equation in Problem 1.

Type RUN and depress RETURN key.

Sample output shown on reverse side.

```
TRANSS     12:30   LNDN A 02/04/69

CASE 1

TIME INTERVAL (START,END,INCREMENT)=? 0,2.5,.1

TIME            OUTPUT

 0               0
 .1             -2.58523E-02
 .2              .103951
 .3              9.03538E-02
 .4             -3.53625E-02
 .5             -.146287
 .6             -.16073
 .7             -6.05279E-02
 .8              .12624
 .9              .352241
 1.              .572563
 1.1             .756448
 1.2             .890099
 1.3             .973764
 1.4             1.01644
 1.5             1.03062
 1.6             1.02837
 1.7             1.01913
 1.8             1.00907
 1.9             1.00131
 2.              .996736
 2.1             .995138
 2.2             .995432
 2.3             .996692
 2.4             .998163
 2.5             .999393

NEW TIME INTERVAL (YES=1,NO=0)? 0

DO YOU WANT A PLOT OF THE OUTPUT (YES=1,NO=0)? 1

FOR X:   TOP =  0  BOTTOM =  2.5    INCREMENT =  .1
FOR Y:  LEFT = -.16073    RIGHT =  1.03062   INCREMENT =  1.98559E-02
```




```
CASE 2

TIME INTERVAL (START,END,INCREMENT)=? S

RAN      25.00 SEC
```

DCNET$ ***
DC Linear Network Analysis

Information Systems

G. E. I. S. Ltd.
Computer Time-Sharing

FORTRAN

DCNET$ is a FORTRAN program available to users of G.E.I.S. Ltd. Computer Time-Sharing Service which analyses the D.C. response of a linear network.

Data is supplied by the user for resistors, circuit-controlled dependent current sources, independent voltage sources, and independent current sources.

By giving commands to the computer during the running of the program, the user can obtain five types of analysis:

Code 1 : General Analysis
2 : Part Modification
3 : Tolerance Analysis
4 : Monte Carlo Analysis
5 : Part Increment

and thus has the facility to modify and develop a circuit by interactive analysis on the computer.

EXAMPLE : the circuit shown in Figure 1 below is used to demonstrate DCNET$:

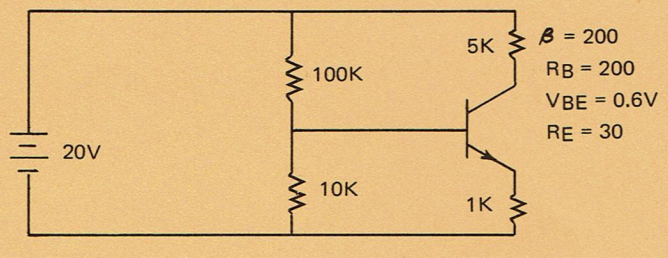


Figure 1

The first step, shown in Figure 2 following, is to draw the same circuit with nodes and branches numbered, and with the assumed current directions indicated:

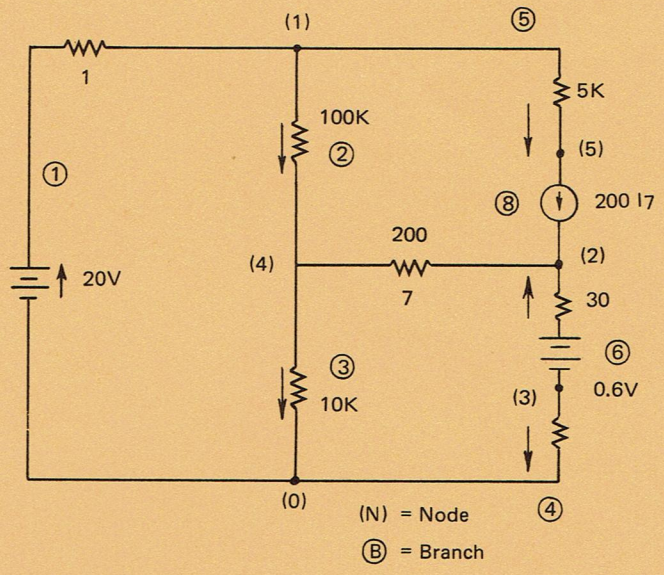


Figure 2

A data file named TAPEDC is now created on paper tape containing the data that describes the circuit:

```
1000 8,5
1010 1,0,1,0,1,10
1020 1,0,1,4,20
1030 2,1,4,0,100E3,10
1040 3,4,0,0,10E3,10
1050 4,3,0,0,1E3,10
1060 5,1,5,0,5E3,10
1070 6,3,2,0,30,10
1080 6,3,2,4,0.6
1090 7,4,2,0,200,10
1100 8,5,2,3,200,10,7
```

In line 1000 the number of branches (8) and number of nodes (5) are entered; lines 1010 to 1100 contain data on circuit elements in this order: branch, out-node, in-node, type, value, tolerance, control branch. A sample computer analysis is shown overleaf.

```
SYSTEM
NEW SYSTEM NAME--FORTRAN
READY.

NEW
NEW FILE NAME--TAPEDC
READY.

TAPE
READY.

1000 8,5
1010 1,0,1,0,1,10
1020 1,0,1,4,20
1030 2,1,4,0,100E3,10
1040 3,4,0,0,10E3,10
1050 4,3,0,0,1E3,10
1060 5,1,5,0,5E3,10
1070 6,3,2,0,30,10
1080 6,3,2,4,0.6
1090 7,4,2,0,200,10
1100 8,5,2,3,200,10,7

KEY
READY.

SAVE

READY.
```

```
OLD
OLD FILE NAME--DCNET$***

READY.

RUN

DCNET$    11:26   LNDN C 03/04/69

IN DCNT1$
IN .FIRST
IN DCNT2$
IN .FIRST

COMMAND? 1

GENERAL ANALYSIS

   NODE    NUMBER   BRANCH     BRANCH      BRANCH
   VOLTS            VOLTS    MILLIAMPS   MILLIWATTS

  20.00       1     -20.00       1.308      -26.17
  1.766       2      18.23       .1823       3.324
  1.132       3      1.767       .1767       .3122
  1.767       4      1.132       1.132       1.281
  14.37       5      5.631       1.126       6.341
              6     -.6340      -1.132       .7175
              7  .1126E-02   .5631E-02   .6341E-05
              8      12.60       1.126       14.19
```

```
COMMAND? 3

TOLERANCE ANALYSIS AT NODE NO. =? 2

NOMINAL VOLTAGE =       1.7657VOLTS

PART PARTIALS
-------------
NUMBER CODE VOLTS-PCT
  1    RES      -.01
  2    RES    -89.90
  3    RES     87.82
  4    RES      2.76
  5    RES       .00
  6    RES       .08
  7    RES      2.76
  8    BTA      2.79

   TYPE          MINIMUM   NOMINAL   MAXIMUM
UNIFORM DIST      1.381     1.766     2.150
WORST CASE        1.464     1.766     2.123
```

```
COMMAND? 4

MONTECARLO ANALYSIS
DESIRED NODE =? 2
NUMBER OF TRIALS = ? 25

NOMINAL =       1.7657 VOLTS

RESULTS        VOLTS
-------        -----
MEAN           1.7884
SIGMA          .12531

LIMITS         LOWER        UPPER
  5-PCT        1.5829       1.9939
  1-PCT        1.4964       2.0804
3-SIGMA        1.4125       2.1643
```

```
COMMAND? 5

PART INCREMENT, 10 STEPS
COMPONENT NUMBER, INITIAL VALUE, STEP SIZE =? 2,5E4,1E4

DESIRED NODE IS? 2

     VALUE      VOLTS
 .5000E+05      3.225
 .6000E+05      2.765
 .7000E+05      2.421
 .8000E+05      2.154
 .9000E+05      1.940
 .1000E+06      1.766
 .1100E+06      1.620
 .1200E+06      1.497
 .1300E+06      1.392
 .1400E+06      1.301
 .1500E+06      1.221
```

```
COMMAND? 2

PART MODIFICATION
COMPONENT NUMBER,CODE,AND VALUE =? 2,0,200E3
TOLERANCE =? 10
```

```
COMMAND? 1

GENERAL ANALYSIS

   NODE    NUMBER   BRANCH     BRANCH      BRANCH
   VOLTS            VOLTS    MILLIAMPS   MILLIWATTS

  20.00       1     -20.00       .4204      -8.408
  .9366       2      19.06    .9531E-01       1.817
  .3268       3      .9369    .9369E-01   .8777E-01
  .9369       4      .3268       .3268       .1068
  18.37       5      1.626       .3251       .5285
              6     -.6098      -.3268       .1993
              7  .3251E-03   .1626E-02   .5285E-06
              8      17.44       .3251       5.669
```