

Scilab Manual for  
DIGITAL SIGNAL PROCESSING  
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# Experiment: 1

## WRITE A SCILAB PROGRAM TO GENERATE COMMON DISCRETE TIME SIGNALS.

**Scilab code Solution 1.01** PROGRAM TO GENERATE COMMON DISCRETE TIME SIGNALS

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 // CAPTION: PROGRAM TO GENERATE COMMON DISCRETE TIME
  SIGNALS
4
5 clc;
6 clear;
7 close;
8
9 //UNIT IMPULSE SIGNAL
10 L=input('Enter the Length='); //SET LIMIT
11 n=-L:L;
```

```

12 x=[zeros(1,L),ones(1,1),zeros(1,L)];
13 subplot(2,4,1);
14 a=gca();
15 a.y_location =" origin";
16 a.foreground = 5;
17 a.font_color = 5;
18 a.font_style = 5;
19 plot2d3(n,x)
20 title('Unit Impulse Signal');
21 xlabel('Samples n');
22 ylabel('Amplitude');
23
24 // UNIT STEP SIGNAL
25 y=[zeros(1,L),ones(1,L+1)];
26 subplot(3,4,2);
27 b=gca();
28 b.y_location =" middle";
29 b.foreground = 5;
30 b.font_color = 5;
31 b.font_style = 5;
32 plot2d3(n,y)
33 title('Unit Step Signal');
34 xlabel('Samples n');
35 ylabel('Amplitude');
36
37 //UNIT RAMP SIGNAL
38 z=[zeros(1,L),0:L],
39 subplot(2,4,3)
40 c=gca();
41 c.y_location =" middle";
42 c.foreground = 5;
43 c.font_color = 5;
44 c.font_style = 5;
45 plot2d3(n,z)
46 title('Unit Ramp Signal');
47 xlabel('Samples n');
48 ylabel('Amplitude');
49

```

```

50 // EXPONENTIALLY INCREASING SEQUENCE
51
52 n=0:1:10;
53 x=exp(n);
54 subplot(2,4,4);
55 d=gca();
56 d.x_location="origin";
57 d.y_location="origin";
58 d.foreground = 5;
59 d.font_color = 5;
60 d.font_style = 5;
61 plot2d3(n,x)
62 title('Exponentially Increasing Sequence');
63 xlabel('Samples n');
64 ylabel('Amplitude');
65
66 // EXPONENTIALLY DECREASING SEQUENCE
67 n=0:1:10;
68 x=exp(-n);
69 subplot(2,4,5);
70 d=gca();
71 d.x_location="origin";
72 d.y_location="origin";
73 d.foreground = 5;
74 d.font_color = 5;
75 d.font_style = 5;
76 plot2d3(n,x)
77 title('Exponentially Decreasing Sequence');
78 xlabel('Samples n');
79 ylabel('Amplitude');
80
81 // SINE WAVE
82 t=0:0.04:1;
83 x=sin(2*pi*t);
84 subplot(2,4,6);
85 a=gca();
86 a.foreground = 5;
87 a.font_color = 5;

```

```
88 a.font_style = 5;
89 plot2d3(t,x);
90 title('Sine Wave')
91 xlabel('Samples n');
92 ylabel('Amplitude');
93
94 // COSINE WAVE
95 t=0:0.04:1;
96 x=cos(2*%pi*t);
97 subplot(2,4,7);
98 b=gca();
99 b.foreground = 5;
100 b.font_color = 5;
101 b.font_style = 5;
102 plot2d3(t,x);
103 title('Cosine Wave')
104 xlabel('Samples n');
105 ylabel('Amplitude');
106
107 //INPUT:
108 //Enter the Length=5
```

---

## Experiment: 2

**WRITE A SCILAB  
PROGRAM TO OBSERVE  
THE EFFECTS OF LOWER  
SAMPLING RATE AND  
HIGHER SAMPLING RATE  
ON C.T. SIGNAL(SAMPLING  
THM.)**

**Scilab code Solution 2.02** PROGRAM TO OBSERVE THE EFFECTS  
OF LOWER SAMPLING RATE AND HIGHER SAMPLING RATE ON  
CONTINUOUS TIME SIGNAL

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 //CAPTION: PROGRAM TO OBSERVE THE EFFECTS OF LOWER
  SAMPLING RATE AND
```

```

4 // HIGHER SAMPLING RATE ON C.T. SIGNAL(SAMPLING THM
    .)
5
6 clc;
7 clear;
8 close;
9 f=input('Enter continuous time signal frequency=');
    // f=0.1
10 a=input('Enter continuous time signal amplitude=');
    //a=1
11 t=0:0.01:100;
12 x=a*sin(2*%pi*f*t);
13 subplot(2,2,1);
14 b=gca();
15 b.x_location="origin";
16 b.y_location="origin";
17 b.foreground = 5;
18 b.font_color = 5;
19 b.font_style = 5;
20 plot(t,x);
21 title('Original Continuous time Signal');
22 xlabel('Time t');
23 ylabel('Amplitude');
24
25 // Sampling Rate=2*max frequency
26 fs1=input('Enter sampling frequency equal to 2*fs=')
    ;//fs1=0.2
27 fd=f/fs1;
28 n=0:0.01:100;
29 x1n=a*sin(2*%pi*f*n/fs1);
30 subplot(2,2,2);
31 b=gca();
32 b.x_location="origin";
33 b.y_location="origin";
34 b.foreground = 5;
35 b.font_color = 5;
36 b.font_style = 5;
37 plot2d3('gmn',n,x1n);

```

```

38 title('Reconstructed signal with sampling frequency
    equal 2*fs ');
39 xlabel('Time t ');
40 ylabel('Amplitude ');
41
42
43 // Sampling Rate<2*max frequency= Aliasing Effect
44 fs2=input('Enter sampling frequency less than 2*fs='
    ');//fs2=0.1
45 x2n=a*sin(2*%pi*f*n/fs2);
46 subplot(2,2,3);
47 b=gca();
48 b.x_location="origin";
49 b.y_location="origin";
50 b.foreground = 5;
51 b.font_color = 5;
52 b.font_style = 5;
53 plot2d3('gmn',n,x2n);
54 title('Reconstructed signal with sampling frequency
    Less than 2*fs=Aliasing effect ');
55 xlabel('Time t ');
56 ylabel('Amplitude ');
57
58 // Sampling Rate>2*max frequency=Perfect
    Reconstuction
59 fs3=input('Enter sampling frequency Greater than 2*
    fs=');//fs3=1
60 x3n=a*sin(2*%pi*f*n*fs3);
61 subplot(2,2,4);
62 b=gca();
63 b.x_location="origin";
64 b.y_location="origin";
65 b.foreground = 5;
66 b.font_color = 5;
67 b.font_style = 5;
68 plot2d3('gmn',n,x3n);
69 title('Perfect Reconstructed signal with sampling
    frequency greater than 2*fs ');

```

```
70 xlabel('Time t');
71 ylabel('Amplitude');
72
73 //INPUT:
74 //Enter continuous time signal frequency=0.1
75 //Enter continuous time signal amplitude=1
76 //Enter sampling frequency equal to 2*fs=0.2
77 //Enter sampling frequency less than 2*fs=0.1
78 //Enter sampling frequency Greater than 2*fs=1
```

---

## Experiment: 3

# WRITE A SCILAB PROGRAM TO COMPUTE LINEARITY PROPERTY OF A GIVEN SIGNAL.

**Scilab code Solution 3.03** PROGRAM TO COMPUTE LINEARITY PROPERTY OF GIVEN SIGNAL

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 // CAPTION: PROGRAM TO COMPUTE LINEARITY PROPERTY OF
  A GIVEN SIGNAL
4 //Input Sequence:    x1(n)=sin(2%pi0.1n) and x2(n)=
  cos(2%pi0.5n) and system y(n)=0.5x(n)
5 clc;
6 clear;
7 close;
8 n=0:10;
9 a=2;
10 b=3;
```

```

11 x1=sin(2*pi*0.1*n); // input sequence 1
12 x2=cos(2*pi*0.5*n); //input sequence 2
13 x=a.*x1+b.*x2; // homogeneity and superposition —op1
14 y=0.5*x; // system y=0.5*x
15 y1=0.5*x1;
16 y2=0.5*x2;
17 yt=a.*y1+b.*y2; // homogeneity and superposition —op2
18 d=y-yt; // op2-op1=difference
19 disp('Output of System y(n)=0.5x(n) is:');
20 if(d==0)
21     disp('System is linear');
22 else
23     disp('System is Non-linear');
24 end
25
26 //Input Sequence:    x1(n)=sin(2*pi*0.1n) and x2(n)=
    cos(2*pi*0.5n) and system y(n)=sqrt(x(n))
27 n=0:10;
28 a=2;
29 b=3;
30 x1=sin(2*pi*0.1*n); //input sequence 1
31 x2=cos(2*pi*0.5*n); //input sequence 2
32 x=a.*x1+b.*x2; // homogeneity and superposition —op1
33 y=sqrt(x); // system y=sqrt(x)
34 y1=sqrt(x1);
35 y2=sqrt(x2);
36 yt=a.*y1+b.*y2; // homogeneity and superposition —op2
37 d=y-yt; // op2-op1=difference
38 disp('Output of System y(n)=sqrt(x(n)) is:');
39 if(d==0)
40     disp('System is linear');
41 else
42     disp('System is Non-linear');
43 end
44
45
46 //OUTPUT:
47 //Output of System y(n)=0.5x(n) is :

```

```
48
49 //System is linear
50
51 //Output of System  $y(n)=\sqrt{x(n)}$  is :
52
53 // System is Non-linear
```

---

## Experiment: 4

# WRITE A SCILAB PROGRAM TO COMPUTE LINEAR CONVOLUTION OF TWO SEQUENCES USING BASIC EQUATION.

Scilab code Solution 4.04 PROGRAM TO COMPUTE LINEAR CONVOLUTION OF TWO SEQUENCES USING BASIC EQUATION

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 //CAPTION: PROGRAM TO COMPUTE LINEAR CONVOLUTION OF
  TWO SEQUENCES USING BASIC EQUATION
4 clc;
5 clear;
6 close;
7 //input sequences
8 x=input('Enter the Input Sequence x(n)=') //x=[1 2 3
  1]
```

```

 9 m=length(x);
10 x1=input('Enter the lower index of Input Sequence=')
    //0
11 xh=x1+m-1;
12 n=x1:1:xh;
13 subplot(3,1,1);
14 a=gca();
15 a.x_location="origin";
16 a.y_location="origin";
17 a.foreground = 5;
18 a.font_color = 5;
19 a.font_style = 5;
20 plot2d3('gnn',n,x);
21 title('Input Sequence x[n]');
22 xlabel('Samples n');
23 ylabel('Amplitude');
24
25 h=input('Enter the Impulse response Sequence h(n)=')
    ;//h=[1 2 1 -1]
26 l=length(h);
27 h1=input('Enter the lower index of Impulse response
    Sequence='); //-1
28 hh=h1+l-1;
29 g=h1:1:hh;
30 subplot(3,1,2);
31 a=gca();
32 a.x_location="origin";
33 a.y_location="origin";
34 a.foreground = 5;
35 a.font_color = 5;
36 a.font_style = 5;
37 plot2d3('gnn',n,h);
38 title('Impulse Response Sequence h[n]');
39 xlabel('Samples n');
40 ylabel('Amplitude');
41
42 nx=x1+h1; // range of k
43 nh=xh+hh; // range of n

```

```

44 x=[x,zeros(1,1)];
45 h=[h,zeros(1,m)];
46 y=zeros(1,m+1-1)// n1+n2-1=length of linear
    convolution
47 for i=1:m+1-1
48     y(i)=0;
49     for j=1:m+1-1
50         if(j<i+1)
51             y(i)=y(i)+x(j)*h(i-j+1);
52         end
53     end
54 end
55 disp('Linear Convolution using Equation is y(n):')
56 disp(y);
57 r=nx:nh;
58 subplot(3,1,3);
59 a=gca();
60 a.x_location="origin";
61 a.y_location="origin";
62 a.foreground = 5;
63 a.font_color = 5;
64 a.font_style = 5;
65 plot2d3('gnn',r,y);
66 title('Output Response Sequence of Linear
    Convolution using Equation y[n]');
67 xlabel('Samples n');
68 ylabel('Amplitude');
69 //INPUT:
70 //Enter the Input Sequence x(n)=[1 2 3 1]
71 //Enter the lower index of Input Sequence=0
72 //Enter the Impulse response Sequence h(n)=[1 2 1
    -1]
73 //Enter the lower index of Impulse response Sequence
    =-1
74
75 //OUTPUT:
76 //Linear Convolution using Equation is y(n):
77

```

78 // 1. 4. 8. 8. 3. - 2. - 1.

---

## Experiment: 5

# WRITE A SCILAB PROGRAM TO FIND AUTOCORRELATION AND CROSS CORRELATION OF THE GIVEN SEQUENCES.

Scilab code Solution 5.05 PROGRAM TO FIND AUTO CORRELATION AND CROSS CORRELATION OF THE GIVEN SEQUENCES

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 //CAPTION: PROGRAM TO FIND AUTOCORRELATION AND
  CROSSCORRELATION OF THE GIVEN SEQUENCES
4 clc;
5 clear;
6 close;
7 x=input('Enter the Input Sequence=') //x=[1 2 3 1]
8 m=length(x);
9 x1=input('Enter the lower index of Input Sequence=')
```

```

    //0
10  xh=xl+m-1;
11  n=xl:1:xh;
12  subplot(2,2,1);
13  a=gca();
14  a.x_location="origin";
15  a.y_location="origin";
16  a.foreground = 5;
17  a.font_color = 5;
18  a.font_style = 5;
19  plot2d3('gmn',n,x);
20  title('Input Sequence x[n]');
21  xlabel('Samples n');
22  ylabel('Amplitude');
23
24  h=input('Enter the Impulse response Sequence='); //h
    =[1 2 1 1]
25  l=length(h);
26  hl=input('Enter the lower index of impulse response
    Sequence='); //0
27  hh=hl+l-1;
28  g=hl:1:hh;
29  subplot(2,2,2);
30  a=gca();
31  a.x_location="origin";
32  a.y_location="origin";
33  a.foreground = 5;
34  a.font_color = 5;
35  a.font_style = 5;
36  plot2d3('gmn',g,h);
37  title('Impulse Response Sequence h[n]');
38  xlabel('Samples n');
39  ylabel('Amplitude');
40
41  // Autocorrelation
42  y=xcorr(x,x);
43  disp('Auto Correlation Of given Sequence y(n)=');
44  disp(y);

```

```

45 nx=x1+x1;
46 nh=xh+xh;
47 r=nx:nh;
48 subplot(2,2,3);
49 a=gca();
50 a.x_location="origin";
51 a.y_location="origin";
52 a.foreground = 5;
53 a.font_color = 5;
54 a.font_style = 5;
55 plot2d3('gnn',r,y);
56 title('Output of Auto Correlation of Sequence');
57 xlabel('Samples n');
58 ylabel('Amplitude');
59
60 //Cross correlation
61 z=xcorr(x,h);
62 disp('Cross Correlation of Sequence y(n)=');
63 disp(z);
64 subplot(2,2,4);
65 a=gca();
66 a.x_location="origin";
67 a.y_location="origin";
68 a.foreground = 5;
69 a.font_color = 5;
70 a.font_style = 5;
71 plot2d3('gnn',r,z);
72 title('Output of Cross correlation of Sequence');
73 xlabel('Samples n');
74 ylabel('Amplitude');
75
76 //INPUT:
77 //Enter the Input Sequence=[1 2 3 1]
78 //Enter the lower index of Input Sequence=0
79 //Enter the Impulse response Sequence=[1 2 1 1]
80 //Enter the lower index of impulse response Sequence
    =0
81

```

```
82 //OUTPUT:
83 //Auto Correlation Of given Sequence y(n)=
84
85 // 1.    5.    11.    15.    11.    5.    1.
86
87 //Cross Correlation of Sequence y(n)=
88
89 // 1.    3.    7.    9.    9.    5.    1.
```

---

## Experiment: 6

# WRITE A SCILAB PROGRAM TO FIND N-POINT DFT OF THE GIVEN SEQUENCE.

Scilab code Solution 6.06 PROGRAM TO FIND N POINT DFT OF  
THE GIVEN SEQUENCE

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 // CAPTION: PROGRAM TO FIND N-POINT DFT OF THE GIVEN
  SEQUENCE
4 clc;
5 clear;
6 close;
7 N=input('Enter the value of N='); //n-point
8 x=input('Enter the input sequence x(n)=');
9 subplot(3,2,1);
10 a=gca();
11 a.foreground = 5;
```

```

12 a.font_color = 5;
13 a.font_style = 5;
14 plot2d3(x);
15 title('Input sequence');
16 xlabel('Samples n');
17 ylabel('Amplitude');
18
19 //calculation of DFT
20 for k=1:N
21     y(k)=0;
22     for n=1:N
23         y(k)=y(k)+x(n).*exp(-%i*2*%pi*(k-1)*(n-1)/N)
24         ;
25         A=real(y);
26         B=imag(y);
27     end
28 end
29 mag=abs(y);
30 x1=atan(imag(y),real(y));
31 phase=x1*(180/%pi);
32 disp('The output DFT sequence is:');
33 disp(y);
34 subplot(3,2,2);
35 a=gca();
36 a.foreground = 5;
37 a.font_color = 5;
38 a.font_style = 5;
39 plot2d3(y);
40 title('Output DFT sequence');
41 xlabel('Samples n');
42 ylabel('Amplitude');
43
44 //REAL VALUE
45 disp('The resultant real value is:');
46 disp(A);
47 subplot(3,2,3);
48 a=gca();
49 a.foreground = 5;

```

```

49 a.font_color = 5;
50 a.font_style = 5;
51 plot2d3(A);
52 title('Real Value');
53 xlabel('Samples n');
54 ylabel('Amplitude');
55
56 //IMAGINARY VALUE
57 disp('The resultant imaginary value is:');
58 disp(B);
59 subplot(3,2,4);
60 a=gca();
61 a.foreground = 5;
62 a.font_color = 5;
63 a.font_style = 5;
64 plot2d3(B);
65 title('Imaginary Value');
66 xlabel('Samples n');
67 ylabel('Amplitude');
68
69 //MAGNITUDE RESPONSE
70 disp('The Magnitude response is:');
71 disp(mag);
72 subplot(3,2,5);
73 a=gca();
74 a.foreground = 5;
75 a.font_color = 5;
76 a.font_style = 5;
77 plot2d3(mag);
78 title('Magnitude Response');
79 xlabel('Samples n');
80 ylabel('Amplitude');
81
82 //PHASE RESPONSE
83 disp('The Phase response is:');
84 disp(phase);
85 subplot(3,2,6);
86 a=gca();

```

```

87 a.foreground = 5;
88 a.font_color = 5;
89 a.font_style = 5;
90 plot2d3(phase);
91 title('Phase Response');
92 xlabel('Samples n');
93 ylabel('Phase');
94
95
96
97 //INPUT:
98 //Enter the value of N=4
99 //Enter the input sequence x(n)=[1 2 3 4]
100
101 //OUTPUT:
102 //The output DFT sequence is:
103
104     // 10.
105     //- 2. + 2.i
106     //- 2. - 9.797D-16i
107     //- 2. - 2.i
108
109 //The resultant real value is:
110
111     // 10.
112     //- 2.
113     //- 2.
114     //- 2.
115
116 //The resultant imaginary value is:
117
118     // 0.
119     // 2.
120     //- 9.797D-16
121     //- 2.
122
123 //The Magnitude response is:
124

```

```
125     // 10.
126     //2.8284271
127     //2.
128     //2.8284271
129
130 //The Phase response is :
131
132     // 0.
133     // 135.
134     //- 180.
135     //- 135.
```

---

## Experiment: 7

# WRITE A SCILAB PROGRAM TO COMPUTE LINEAR CONVOLUTION OF TWO SEQUENCES USING DFT BASED APPROACH.

Scilab code Solution 7.07 PROGRAM TO COMPUTE LINEAR CONVOLUTION OF TWO SEQUENCES USING DFT BASED APPROACH

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 //CAPTION: PROGRAM TO COMPUTE LINEAR CONVOLUTION OF
  TWO SEQUENCES USING DFT BASED APPROACH
4 clc;
5 clear;
6 close;
7 x=input('Enter the input sequence x(n)=') //x=[1 2 3
      1]
8 m=length(x);
```

```

9  x1=input('Enter the lower index of input sequence=')
    //0
10  xh=x1+m-1;
11  n=x1:1:xh;
12  subplot(3,1,1);
13  a=gca();
14  a.x_location="origin";
15  a.y_location="origin";
16  a.foreground = 5;
17  a.font_color = 5;
18  a.font_style = 5;
19  plot2d3('gnn',n,x);
20  title('Input Sequence x[n]');
21  xlabel('Samples n');
22  ylabel('Amplitude');
23
24  h=input('Enter the impulse response sequence h(n)=')
    ;//h=[1 2 1 -1]
25  l=length(h);
26  h1=input('Enter the lower index of impulse response
    sequence=');// -1
27  hh=h1+l-1;
28  g=h1:1:hh;
29  subplot(3,1,2);
30  a=gca();
31  a.x_location="origin";
32  a.y_location="origin";
33  a.foreground = 5;
34  a.font_color = 5;
35  a.font_style = 5;
36  plot2d3('gnn',n,h);
37  title('Impulse Response Sequence h[n]');
38  xlabel('Samples n');
39  ylabel('Amplitude');
40
41  nx=x1+h1; // range of k
42  nh=xh+hh; // range of n
43  p=m+1-1;

```

```

44 x=[x,zeros(1,p-1)];
45 h=[h,zeros(1,p-m)];
46
47 // dft-idft
48 XK=fft(x,-1); // DFT of x
49 HK=fft(h,-1); // DFT of h
50 YK=XK.*HK; // Multiplication of DFT of x and h
51 yn=fft(YK,1); // Inverse DFT for obtaining yn
52 disp('Linear Convolution by DFT-IDFT Method is y(n):
      ');
53 disp(real(yn));
54 r=nx:nh;
55 subplot(3,1,3);
56 a=gca();
57 a.x_location="origin";
58 a.y_location="origin";
59 a.foreground = 5;
60 a.font_color = 5;
61 a.font_style = 5;
62 plot2d3('gnn',r,yn);
63 title('Output Response Sequence of Linear
      Convolution by DFT-IDFT Method y[n]');
64 xlabel('Samples n');
65 ylabel('Amplitude');
66
67 //INPUT:
68 //Enter the input sequence x(n)=[1 2 3 1]
69 //Enter the lower index of input sequence=0
70 //Enter the impulse response sequence h(n)=[1 2 1
      -1]
71 //Enter the lower index of impulse response sequence
      =-1
72
73 //OUTPUT:
74 //Linear Convolution by DFT-IDFT Method is y(n):
75
76 //1. 4. 8. 8. 3. - 2. - 1.

```

---

## Experiment: 8

# WRITE A SCILAB PROGRAM TO COMPUTE CIRCULAR CONVOLUTION OF TWO SEQUECNES USING BASIC EQUATION.

**Scilab code Solution 8.08** PROGRAM TO COMPUTE CIRCULAR CON-  
VOLUTION OF TWO SEQUENCES USING BASIC EQUATION

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 //CAPTION: PROGRAM TO COMPUTE CIRCULAR CONVOLUTION
  OF TWO SEQUENCES USING BASIC EQUATION
4 clc;
5 clear;
6 close;
7 x=input('Enter the input sequence=') //x=[1 1 2 2]
8 m=length(x);
9 x1=input('Enter the lower index of input sequence=')
```

```

    //0
10  xh=xl+m-1;
11  n=xl:1:xh;
12  subplot(3,1,1);
13  a=gca();
14  a.x_location="origin";
15  a.y_location="origin";
16  a.foreground = 5;
17  a.font_color = 5;
18  a.font_style = 5;
19  plot2d3('gnn',n,x);
20  title('Input Sequence x[n]');
21  xlabel('Samples n');
22  ylabel('Amplitude');
23
24  h=input('Enter the impulse response sequence='); //h
    =[1 2 3 4]
25  l=length(h);
26  hl=input('Enter the lower index of impulse response
    sequence='); //0
27  hh=hl+l-1;
28  g=hl:1:hh;
29  subplot(3,1,2);
30  a=gca();
31  a.x_location="origin";
32  a.y_location="origin";
33  a.foreground = 5;
34  a.font_color = 5;
35  a.font_style = 5;
36  plot2d3('gnn',g,h);
37  title('Impulse Response Sequence h[n]');
38  xlabel('Samples n');
39  ylabel('Amplitude');
40
41
42  // for making length of both signals equal
43  N=max(m,l);
44  p=m-1;

```

```

45 if(p>=0) then
46   h=[h,zeros(1,p)];
47 else
48   x=[x,zeros(1,-p)];
49 end
50 for i=1:N
51   y(i)=0;
52   for j=1:N
53     k=i-j+1;
54     if(k<=0)
55       k=N+k;
56     end
57     y(i)=y(i)+x(j)*h(k);
58   end
59 end
60 disp(' Circular convolution by equation is y[n]:');
61 disp(y);
62 nx=xl+hl;
63 r=nx:length(y)-1;
64 subplot(3,1,3);
65 a=gca();
66 a.x_location="origin";
67 a.y_location="origin";
68 a.foreground = 5;
69 a.font_color = 5;
70 a.font_style = 5;
71 plot2d3('gnn',r,y);
72 title('Output Response Sequence of Circular
        Convolution y[n] using Basic Equation');
73 xlabel('Samples n');
74 ylabel('Amplitude');
75
76 //INPUT:
77 //Enter the input sequence=[1 1 2 2]
78 //Enter the lower index of input sequence=0
79 //Enter the impulse response sequence=[1 2 3 4]
80 //Enter the lower index of impulse response sequence
    =0

```

```
81
82 //OUTPUT:
83 //Circular convolution by equation is y[n]:
84
85 //    15.
86 //    17.
87 //    15.
88 //    13.
```

---

## Experiment: 9

**WRITE A SCILAB  
PROGRAM TO COMPUTE  
CIRCULAR CONVOLUTION  
OF THE TWO SEQUENCES  
USING DFT BASED  
APPROACH.**

**Scilab code Solution 9.09** PROGRAM TO COMPUTE CIRCULAR CONVOLUTION OF THE TWO SEQUENCES USING DFT BASED APPROACH

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 //CAPTION:PROGRAM TO COMPUTE CIRCULAR CONVOLUTION OF
  THE TWO SEQUENCES USING DFT BASED APPROACH
4 clc;
5 clear;
6 close;
7 x=input('Enter the Input sequence=') //x=[1 1 2 2]
```

```

8 m=length(x);
9 x1=input('Enter the lower index of input sequence=')
  //0
10 xh=x1+m-1;
11 n=x1:1:xh;
12 subplot(3,1,1);
13 a=gca();
14 a.x_location="origin";
15 a.y_location="origin";
16 a.foreground = 5;
17 a.font_color = 5;
18 a.font_style = 5;
19 plot2d3('gnn',n,x);
20 title('Input Sequence x[n]');
21 xlabel('Samples n');
22 ylabel('Amplitude');
23
24 h=input('Enter the Impulse response sequence=');//h
  =[1 2 3 4]
25 l=length(h);
26 h1=input('Enter the lower index of impulse response
  sequence=');//0
27 hh=h1+l-1;
28 g=h1:1:hh;
29 subplot(3,1,2);
30 a=gca();
31 a.x_location="origin";
32 a.y_location="origin";
33 a.foreground = 5;
34 a.font_color = 5;
35 a.font_style = 5;
36 plot2d3('gnn',g,h);
37 title('Impulse Response Sequence h[n]');
38 xlabel('Samples n');
39 ylabel('Amplitude');
40
41 // for making length of both signals equal
42 N=max(m,l);

```

```

43 p=m-1;
44 if(p>=0) then
45   h=[h,zeros(1,p)];
46 else
47   x=[x,zeros(1,-p)];
48 end
49 XK=fft(x,-1);
50 HK=fft(h,-1);
51 YK=XK.*HK;
52 y=ifft(YK);
53 disp(' Circular convolution by DFT is y(n):');
54 disp(real(y));
55 nx=x1+h1;
56 r=nx:length(y)-1;
57 subplot(3,1,3);
58 a=gca();
59 a.x_location="origin";
60 a.y_location="origin";
61 a.foreground = 5;
62 a.font_color = 5;
63 a.font_style = 5;
64 plot2d3('gnn',r,y);
65 title('Output Response Sequence of Circular
        Convolution y[n] using DFT');
66 xlabel('Samples n');
67 ylabel('Amplitude');
68
69 //INPUT:
70 //Enter the Input sequence=[1 1 2 2]
71 //Enter the lower index of input sequence=0
72 //Enter the Impulse response sequence=[1 2 3 4]
73 //Enter the lower index of impulse response sequence
    =0
74
75 //OUTPUT:
76 //Circular convolution by DFT is y(n):
77
78 // 15.    17.    15.    13.

```



## Experiment: 10

# WRITE A SCILAB PROGRAM TO COMPUTE BLOCK CONVOLUTION USING OVERLAP ADD METHOD

**Scilab code Solution 10.10** PROGRAM TO COMPUTE BLOCK CONVOLUTION USING OVERLAP ADD METHOD

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 //CAPTION: PROGRAM TO COMPUTE BLOCK CONVOLUTION
  USING OVERLAP ADD METHOD
4 clc;
5 clear;
6 close;
7 x=input('Enter the input sequence=') //x=[1 2 -1 2 3
    -2 -3 -1 1 1 2 -1]
8 m=length(x);
```

```

9  x1=input('Enter the lower index of input sequence=')
    //0
10  xh=x1+m-1;
11  n=x1:1:xh;
12  subplot(3,1,1);
13  a=gca();
14  a.x_location="origin";
15  a.y_location="origin";
16  a.foreground = 5;
17  a.font_color = 5;
18  a.font_style = 5;
19  plot2d3('gnn',n,x);
20  title('Input Sequence x[n]');
21  xlabel('Samples n');
22  ylabel('Amplitude');
23
24  h=input('Enter the impulse response sequence=');//h
    =[1 2 3 -1]
25  l=length(h);
26  h1=input('Enter the lower index of impulse response
    sequence=');//0
27  hh=h1+l-1;
28  g=h1:1:hh;
29  subplot(3,1,2);
30  a=gca();
31  a.x_location="origin";
32  a.y_location="origin";
33  a.foreground = 5;
34  a.font_color = 5;
35  a.font_style = 5;
36  plot2d3('gnn',g,h);
37  title('Impulse Response Sequence h[n]');
38  xlabel('Samples n');
39  ylabel('Amplitude');
40
41  N=m+l-1;
42  h1=[h zeros(1,l-1)];
43  n3=length(h1);

```

```

44 y=zeros(1,N);
45
46 H=fft(h1);
47 for i=1:l:m
48     if i<=(m+1-1) then
49         x1=[x(i:i+n3-1) zeros(1,n3-1)];
50     else
51         x1=[x(i:m) zeros(1,n3-1)];
52     end
53     x2=fft(x1);
54     x3=x2.*H;
55     x4=round(ifft(x3));
56     if(i==1)
57         y(1:n3)=x4(1:n3);
58     else
59         y(i:i+n3-1)=y(i:i+n3-1)+x4(1:n3);
60     end
61 end
62
63 disp('Output sequence using Overlap add method y(n):
        ');
64 disp(y(1:N));
65 nx=x1+h1;
66 r=nx:length(y)-1;
67 subplot(3,1,3);
68 a=gca();
69 a.x_location="origin";
70 a.y_location="origin";
71 a.foreground = 5;
72 a.font_color = 5;
73 a.font_style = 5;
74 plot2d3('gnn',r,y);
75 title('Output sequence using Overlap add method y[n]
        ');
76 xlabel('Samples n');
77 ylabel('Amplitude');
78
79 //INPUT:

```

```

80 //Enter the input sequence=[1 2 -1 2 3 -2 -3 -1 1 1
    2 -1]
81 //Enter the lower index of input sequence=0
82 //Enter the impulse response sequence=[1 2 3 -1]
83 //Enter the lower index of impulse response sequence
    =0
84
85 //OUTPUT:
86 //Output sequence using Overlap add method y(n):
87
88
89 //      column 1 to 12
90
91 //  1.      4.      6.      5.      2.      11.      0.  - 16.
    - 8.      3.      8.      5.
92
93 //      column 13 to 15
94
95 //  3.  - 5.      1.

```

---

## Experiment: 11

# WRITE A SCILAB PROGRAM TO COMPUTE BLOCK CONVOLUTION USING OVERLAP SAVE METHOD.

**Scilab code Solution 11.11** PROGRAM TO COMPUTE BLOCK CONVOLUTION USING OVERLAP SAVE METHOD

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 //CAPTION: PROGRAM TO COMPUTE BLOCK CONVOLUTION
  USING OVERLAP SAVE METHOD
4 clc;
5 clear;
6 close;
7 x=input('Enter the input sequence=') //x=[1 2 -1 2 3
    -2 -3 -1 1 1 2 -1]
8 m=length(x);
```

```

9  x1=input('Enter the lower index of input sequence=')
    //0
10  xh=x1+m-1;
11  n=x1:1:xh;
12  subplot(3,1,1);
13  a=gca();
14  a.x_location="origin";
15  a.y_location="origin";
16  a.foreground = 5;
17  a.font_color = 5;
18  a.font_style = 5;
19  plot2d3('gnn',n,x);
20  title('Input Sequence x[n]');
21  xlabel('Samples n');
22  ylabel('Amplitude');
23
24  h=input('Enter the impulse response sequence=');//h
    =[1 2 3 -1]
25  l=length(h);
26  h1=input('Enter the lower index of impulse response
    sequence=');//0
27  hh=h1+l-1;
28  g=h1:1:hh;
29  subplot(3,1,2);
30  a=gca();
31  a.x_location="origin";
32  a.y_location="origin";
33  a.foreground = 5;
34  a.font_color = 5;
35  a.font_style = 5;
36  plot2d3('gnn',g,h);
37  title('Impulse Response Sequence h[n]');
38  xlabel('Samples n');
39  ylabel('Amplitude');
40
41  N=m+l-1;
42  h1=[h zeros(1,N-m)];
43  n3=length(h1);

```

```

44 y=zeros(1,N);
45 x1=[zeros(1,n3-1) x zeros(1,n3)];
46 H=fft(h1);
47 for i=1:l:N
48     y1=x1(i:i+(2*(n3-1)));
49     y2=fft(y1);
50     y3=y2.*H;
51     y4=round(iff(y3));
52     y(i:(i+n3-1))=y4(1:n3);
53 end
54 disp('Output sequence using overlap save method Y(n)
      :');
55 disp(y(1:N));
56 nx=x1+h1;
57 r=nx:length(y)-1;
58 subplot(3,1,3);
59 a=gca();
60 a.x_location="origin";
61 a.y_location="origin";
62 a.foreground = 5;
63 a.font_color = 5;
64 a.font_style = 5;
65 plot2d3('gmn',r,y);
66 title('Output sequence using Overlap save method y[n
      ]');
67 xlabel('Samples n');
68 ylabel('Amplitude');
69
70 //INPUT:
71 //Enter the input sequence=[1 2 -1 2 3 -2 -3 -1 1 1
      2 -1]
72 //Enter the lower index of input sequence=0
73 //Enter the impulse response sequence=[1 2 3 -1]
74 //Enter the lower index of impulse response sequence
      =0
75
76 //OUTPUT:
77 //Output sequence using overlap save method Y(n):

```

```
78
79
80 //      column 1 to 12
81
82 // 1.    4.    6.    5.    2.    11.    0.  - 16.
      - 8.    3.    8.    5.
83
84 //      column 13 to 15
85
86 // 3.  - 5.    1.
```

---

## Experiment: 12

# WRITE A SCILAB PROGRAM TO FIND FFT USING DECIMATION IN TIME(DIT) METHOD.

**Scilab code Solution 12.12** PROGRAM TO FIND FFT USING DECIMATION IN TIME METHOD

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 // CAPTION: PROGRAM TO FIND FFT USING DECIMATION IN
  TIME(DIT) METHOD
4 clc;
5 clear;
6 close;
7 x=input('Enter Input sequence='); // x=[0 1 2 3 4 5
   6 7] or x= [0 1 2 3]
8 N=length(x);
9
10 s=log2(N); // computing array size
11
12 //for sequence size 8
```

```

13 if (N==8) then
14 stage1=1;
15
16 x=[x(1) x(5) x(3) x(7) x(2) x(6) x(4) x(8)]; //
    stage1
17 for stage=1:s
18     for index=0:(2^stage):(N-1); //series of
        butterfly for each stage
19         for n=0:(stage1-1); // create butterfly
            and save result
20             pos=n+index+1; // index of data sample
21             pow=(2^(s-stage))*n; // part of power of
                complex multiplier
22             w=exp((-1*i)*(2*pi)*pow/N); // complex
                multiplier
23             a=x(pos)+x(pos+stage1).*w; // 1 st part
                of butterfly creating operations
24             b=x(pos)-x(pos+stage1).*w; // 2nd part of
                butterfly creating operation
25             x(pos)=a; // saving computation of 1st
                half
26             x(pos+stage1)=b; // saving computation
                of second part
27
28     end
29 end
30 stage1=2*stage1; // computing next stage
31 end
32
33 y=x;
34 disp('FFT of the given input sequence is y(n)=');
35 disp(y);
36
37 // for sequence size -4
38 else
39     stage1=1;
40 x=[x(1) x(3) x(2) x(4)]; // stage1
41 for stage=1:s

```

```

42     for index=0:(2^stage):(N-1); //series of
        butterfly for each stage
43         for n=0:(stage1-1); // create butterfly
            and save result
44             pos=n+index+1; // index of data sample
45             pow=(2^(s-stage))*n; // part of power of
                complex multiplier
46             w=exp((-1*i)*(2*pi)*pow/N); // complex
                multiplier
47             a=x(pos)+x(pos+stage1).*w; // 1 st part
                of butterfly creating operations
48             b=x(pos)-x(pos+stage1).*w; // 2nd part of
                butterfly creating operation
49             x(pos)=a; // saving computation of 1st
                half
50             x(pos+stage1)=b; // saving computation
                of second part
51
52     end
53 end
54 stage1=2*stage1; // computing next stage
55 end
56
57 y=x;
58 disp('FFT of the given input sequence y(n)=');
59 disp(y);
60 end
61
62 //INPUT:
63 //Enter Input sequence=[0 1 2 3 4 5 6 7]
64
65 //OUTPUT:
66 // FFT of the given input sequence is y(n)=
67
68
69 //      column 1 to 3
70
71 // 28. - 4. + 9.6568542i - 4. + 4.i

```

```

72
73 // column 4 to 5
74
75 // - 4. + 1.6568542i - 4.
76
77 // column 6 to 7
78
79 // - 4. - 1.6568542i - 4. - 4.i
80
81 // column 8
82
83 // - 4. - 9.6568542i
84
85 // INPUT:
86 //Enter Input sequence=[0 1 2 3]
87
88 //OUTPUT:
89 //FFT of the given input sequence y(n)=
90
91 // 6. - 2. + 2.i - 2. - 2. - 2.i

```

---

## Experiment: 13

# WRITE A SCILAB PROGRAM FOR DESIGNING OF FIR FILTER FOR LOW PASS, HIGH PASS, BANDPASS AND BAND REJECT RESPONSES.

**Scilab code Solution 13.13** PROGRAM FOR DESIGNING OF FIR FILTER FOR LOW PASS HIGH PASS BAND PASS AND BAND REJECT RESPONSES

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 //CAPTION: PROGRAM FOR DESIGNING OF FIR LOW PASS,
  HIGH PASS, BAND PASS AND BAND REJECT RESPONSES
4
5 // Filter length=5 , Order of filter=4 , Window=
  Rectangular
```

```

6  clc;
7  clear;
8  close;
9  xdel(winsid());
10 fc1=input('Enter the analog cutoff Frequency in Hz='
           '); // 250
11 fc2=input('Enter analog higher cutoff frequency in
           Hz='); //600
12 fs=input('Enter the analog sampling Frequency in Hz=
           '); //2000
13 M=input('Enter order of filter='); //4
14 w1=(2*%pi)*(fc1/fs);
15 w2=(2*%pi)*(fc2/fs);
16
17 // FIR LOW PASS FILTER
18 disp('DESIGNING OF FIR LOW PASS FILTER:');
19 disp(w1, 'Digital Cutoff Frequency in radians.cycles
           /samples');
20 wc1=w1/%pi;
21 disp(wc1, 'Normalized digital cutoff frequency in
           cycles/samples');
22 [wft,wfm,fr]=wfir('lp',M+1,[wc1/2,0], 're',[0,0]);
23 disp(wft, 'Impulse Response of LPF FIR filter:h(n)=')
           ;
24 //plotting magnitude response of LPF filter
25 subplot(2,4,1);
26 a=gca();
27 a.thickness=2;
28 a.foreground = 5;
29 a.font_color = 5;
30 a.font_style = 5;
31 plot(2*fr,wfm);
32 title('Magnitude Response of FIR LPF');
33 xlabel('Normalized Digital Frequency w');
34 ylabel('Magnitude |H(w)|');
35 xgrid(1)
36 subplot(2,4,2);
37 a=gca();

```

```

38 a.thickness=2;
39 a.foreground = 5;
40 a.font_color = 5;
41 a.font_style = 5;
42 plot(fr*fs,wfm);
43 title('Magnitude Response of FIR LPF');
44 xlabel('Analog frequency in Hz f');
45 ylabel('Magnitude |H(w)|');
46 xgrid(1)
47
48 //FIR HIGH PASS FILTER
49 disp('DESIGNING OF FIR HIGH PASS FILTER:')
50 disp(w1, 'Digital Cutoff Frequency in radians.cycles
        /samples');
51 wc1=w1/%pi;
52 disp(wc1,'Normalized digital cutoff frequency in
        cycles/samples');
53 [wft,wfm,fr]=wfir('hp',M+1,[wc1/2,0], 're',[0,0]);
54 disp(wft,'Impulse Response of HPF FIR filter:h(n)=')
    ;
55 //plotting magnitude response of HPF filter
56 subplot(2,4,3);
57 a=gca();
58 a.thickness=2;
59 a.foreground = 5;
60 a.font_color = 5;
61 a.font_style = 5;
62 plot(2*fr,wfm);
63 title('Magnitude Response of FIR HPF');
64 xlabel('Normalized Digital Frequency w');
65 ylabel('Magnitude |H(w)|');
66 xgrid(1)
67 subplot(2,4,4);
68 a=gca();
69 a.thickness=2;
70 a.foreground = 5;
71 a.font_color = 5;
72 a.font_style = 5;

```

```

73 plot(fr*fs,wfm);
74 title('Magnitude Response of FIR HPF');
75 xlabel('Analog frequency in Hz f');
76 ylabel('Magnitude |H(w)|');
77 xgrid(1)
78
79 // FIR BAND PASS FILTER
80 disp('DESIGNING OF FIR BAND PASS FILTER:');
81 disp(w1,'Digital lower cutoff frequency in radians
      cycles/samples');
82 disp(w2,'Digital higher cutoff frequency in radians
      cycles/samples');
83 wc1=w1/%pi;
84 wc2=w2/%pi;
85 disp(wc1,'Normalized digital lower cutoff frequency
      in cycles/samples');
86 disp(wc2,'Normalized digital higher cutoff frequency
      in cycles/samples');
87 [wft,wfm,fr]=wfir('bp', M+1,[wc1/2,wc2/2],'re',
      ,[0,0]);
88 disp(wft,'Impulse response of Bandpass Filter FIR
      filter:h(n)=');
89 //plotting the magnitude Response of HPF FIR filter
90 subplot(2,4,5);
91 a=gca();
92 a.thickness=2;
93 a.foreground = 5;
94 a.font_color = 5;
95 a.font_style = 5;
96 plot(2*fr, wfm);
97 xlabel('Normalized Digital Frequency w');
98 ylabel('Magnitude |H(W)|');
99 title('Magnitude Response of FIR BPF');
100 xgrid(1);
101 subplot(2,4,6);
102 a=gca();
103 a.thickness=2;
104 a.foreground = 5;

```

```

105 a.font_color = 5;
106 a.font_style = 5;
107 plot(fr*fs,wfm);
108 xlabel('Analog Frequency in Hz f');
109 ylabel('Magnitude |H(w)|');
110 title('Magnitude response of FIR BPF');
111 xgrid(1);
112
113 // FIR BAND REJECT FILTER
114 disp('DESIGNING OF FIR BAND REJECT FILTER:');
115 disp(w1,'Digital lower cutoff frequency in radians
        cycles/samples');
116 disp(w2,'Digital higher cutoff frequency in radians
        cycles/samples');
117 wc1=w1/%pi;
118 wc2=w2/%pi;
119 disp(wc1,'Normalized digital lower cutoff frequency
        in cycles/samples');
120 disp(wc2,'Normalized digital higher cutoff frequency
        in cycles/samples');
121 [wft,wfm,fr]=wfir('sb',M+1,[wc1/2,wc2/2],'re',
        ,[0,0]);
122 disp(wft,'Impulse response of Bandreject Filter FIR
        filter:h(n)=');
123 //plotting the magnitude Response of HPF FIR filter
124 subplot(2,4,7);
125 a=gca();
126 a.thickness=2;
127 a.foreground = 5;
128 a.font_color = 5;
129 a.font_style = 5;
130 plot(2*fr, wfm);
131 xlabel('Normalized Digital Frequency w');
132 ylabel('Magnitude |H(W)|');
133 title('Magnitude Response of FIR BRF');
134 xgrid(1);
135 subplot(2,4,8);
136 a=gca();

```

```

137 a.thickness=2;
138 a.foreground = 5;
139 a.font_color = 5;
140 a.font_style = 5;
141 plot(fr*fs,wfm);
142 xlabel('Analog Frequency in Hz f');
143 ylabel('Magnitude |H(w)|');
144 title('Magnitude response of FIR BRF');
145 xgrid(1);
146
147 //INPUT:
148 //Enter the analog cutoff Frequency in Hz=250
149 //Enter analog higher cutoff frequency in Hz=600
150 //Enter the analog sampling Frequency in Hz=2000
151 //Enter order of filter=4
152
153 //OUTPUT:
154 // DESIGNING OF FIR LOW PASS FILTER:
155
156 // Digital Cutoff Frequency in radians.cycles/
    samples
157
158 //    0.7853982
159
160 // Normalized digital cutoff frequency in cycles/
    samples
161
162 //    0.25
163
164 //Impulse Response of LPF FIR filter:h(n)=
165
166 //    0.1591549    0.2250791    0.25    0.2250791
        0.1591549
167
168 //DESIGNING OF FIR HIGH PASS FILTER:
169
170 // Digital Cutoff Frequency in radians.cycles/
    samples

```

```

171
172 // 0.7853982
173
174 //Normalized digital cutoff frequency in cycles/
    samples
175
176 // 0.25
177
178 //Impulse Response of HPF FIR filter:h(n)=
179
180 // - 0.1591549 - 0.2250791 0.75 - 0.2250791 -
    0.1591549
181
182 //DESIGNING OF FIR BAND PASS FILTER:
183
184 //Digital lower cutoff frequency in radians cycles/
    samples
185
186 // 0.7853982
187
188 //Digital higher cutoff frequency in radians cycles
    /samples
189
190 // 1.8849556
191
192 //Normalized digital lower cutoff frequency in
    cycles/samples
193
194 // 0.25
195
196 //Normalized digital higher cutoff frequency in
    cycles/samples
197
198 // 0.6
199
200 //Impulse response of Bandpass Filter FIR filter:h(
    n)=
201

```

```

202    // - 0.2527039    0.0776516    0.35    0.0776516    -
        0.2527039
203
204    // DESIGNING OF FIR BAND REJECT FILTER:
205
206    // Digital lower cutoff frequency in radians cycles/
        samples
207
208    // 0.7853982
209
210    // Digital higher cutoff frequency in radians cycles
        /samples
211
212    // 1.8849556
213
214    // Normalized digital lower cutoff frequency in
        cycles/samples
215
216    // 0.25
217
218    // Normalized digital higher cutoff frequency in
        cycles/samples
219
220    // 0.6
221
222    // Impulse response of Bandreject Filter FIR filter :
        h(n)=
223
224    // 0.2527039    - 0.0776516    0.65    - 0.0776516
        0.2527039

```

---

## Experiment: 14

# WRITE A SCILAB PROGRAM TO DESIGN DIGITAL IIR BUTTERWORTH LOW PASS FILTER.

Scilab code Solution 14.14 PROGRAM TO DESIGN DIGITAL IIR BUTTERWORTH LOW PASS FILTER

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 //CAPTION: PROGRAM TO DESIGN BUTTERWORTH LOW PASS
  FILTER
4 clc;
5 clear;
6 close;
7 xdel(winsid());
8 fc=input('Enter cutoff freq in Hz fc='); //1000
9 fs=input('Enter sampling freq in Hz fs='); //10000
```

```

10 N=input('Enter order of Butterworth filter N=');//4
11 Fp=2*fc/fs;
12 [Hz]=iir(N, 'lp', 'butt', [Fp/2,0],[0,0]);
13 [Hw,w]=firmag(Hz,256);
14 subplot(2,1,1);
15 a=gca();
16 a.thickness=2;
17 a.foreground = 5;
18 a.font_color = 5;
19 a.font_style = 5;
20 plot(2*w,abs(Hw));
21 title('Magnitude Response of IIR LPF');
22 xlabel('Normalized Digital frequency w');
23 ylabel('Magnitude |H(w)|');
24 xgrid(1);
25 subplot(2,1,2);
26 a=gca();
27 a.thickness=2;
28 a.foreground = 5;
29 a.font_color = 5;
30 a.font_style = 5;
31 plot(2*w*fs,abs(Hw));
32 title('Magnitude Response of IIR LPF');
33 xlabel('Analog Frequency in Hz f');
34 ylabel('Magnitude |H(w)|');
35 xgrid(1);
36
37 //INPUT:
38 //Enter cutoff freq in Hz fc=1000
39 //Enter sampling freq in Hz fs=10000
40 //Enter order of Butterworth filter N=4

```

---

## Experiment: 15

# WRITE A SCILAB PROGRAM TO DESIGN DIGITAL IIR CHEBYSHEW FILTER.

Scilab code Solution 15.15 PROGRAM TO DESIGN DIGITAL IIR CHEBYSHEW  
FILTER

```
1 // VERSION: Scilab: 5.4.1
2 // OS: windows 7
3 //CAPTION: PROGRAM TO DESIGN DIGITAL CHEBYSHEV IIR
  FILTER
4 clc;
5 clear;
6 close;
7 wp=input('Enter the Digital Pass Band edge Frequency
  ='); //0.2*%pi
8 ws=input('Enter the Digital Stop Band edge Frequency
  =');//0.6*%pi
9 t=input('Sampling Interval=');//1
```

```

10 del1=input('Enter the Pass Band Ripple=');//0.8
11 del2=input('Enter the Stop Band Ripple=');//0.2
12 disp(wp,'Wp=');
13 disp(ws,'Ws=');
14 del=sqrt(((1/del2)^2)-1);
15 disp(del,'Delta=');
16 epsilon=sqrt(((1/del1)^2)-1);
17 disp(epsilon,'Epsilon=');
18 N=(acosh(del/epsilon))/(acosh(ws/wp));
19 N=ceil(N);
20 disp(N,'N=');
21 wc=wp/((((1/del1)^2)-1)^(1/(2*N)));
22 [pols,gn]=zpchl(N,epsilon,wp);
23 hs=poly(gn,'s','coeff')/real(poly(pols,'s'));
24 z=poly(0,'z');
25 hz=horner(hs,((2/t)*((z-1)/(z+1))));
26 hw=frmag(hz(2),hz(3),512); // freq. response for 512
    points
27 w=0:%pi/511:%pi;
28 a=gca();
29 a.thickness=2;
30 a.foreground = 5;
31 a.font_color = 5;
32 a.font_style = 5;
33 plot(w/%pi,abs(hw));
34 xgrid(1);
35 title('Magnitude Response of Digital Chebyshev LPF
    IIR Filter');
36 xlabel('Normalized digital Frequency');
37 ylabel('Magnitude in db');
38
39 //INPUT:
40 //Enter the Digital Pass Band edge Frequency=0.2*%pi
41 //Enter the Digital Stop Band edge Frequency=0.6*%pi
42 //Sampling Interval=1
43 //Enter the Pass Band Ripple=0.8
44 //Enter the Stop Band Ripple=0.2
45

```

```
46 //OUTPUT:
47 //Wp=
48
49 // 0.6283185
50
51 //Ws=
52
53 // 1.8849556
54
55 //Delta=
56
57 // 4.8989795
58
59 // Epsilon=
60
61 // 0.75
62
63 //N=
64
65 2.
```

---