

Scilab Manual for
Digital Signal Processing
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April 17, 2026

¹Funded by a grant from the National Mission on Education through ICT, <http://spoken-tutorial.org/NMEICT-Intro>. This Scilab Manual and Scilab codes written in it can be downloaded from the "Migrated Labs" section at the website <http://scilab.in>

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Experiment: 1

Generation of elementary Discrete-Time sequences

Scilab code Solution 1.1 Unit Sample Sequence

```
1 //1.GENERATION OF ELEMENTARY DISCRETE TIME SEQUENCE
2 //1.1 Caption:Unit Sample Sequence
3 clear;
4 clc;
5 close;
6 L = 4; //Upperlimit
7 n = -L:L;
8 x = [zeros(1,L),1,zeros(1,L)];
9 b = gca();
10 b.y_location = "middle";
11 plot2d3('gnn',n,x)
12 a=gce();
13 a.children(1).thickness =4;
14 xtitle('Graphical Representation of Unit Sample
        Sequence ','n','x[n]');
```

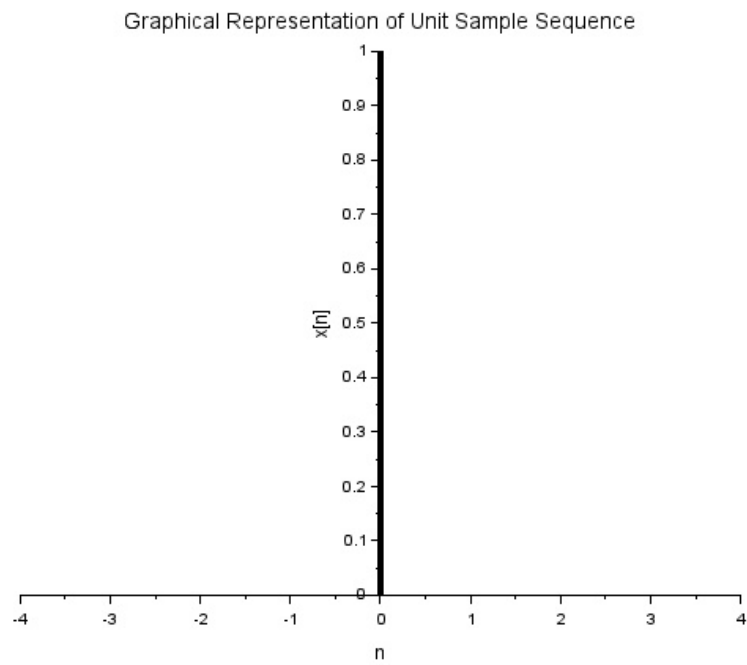


Figure 1.1: Unit Sample Sequence

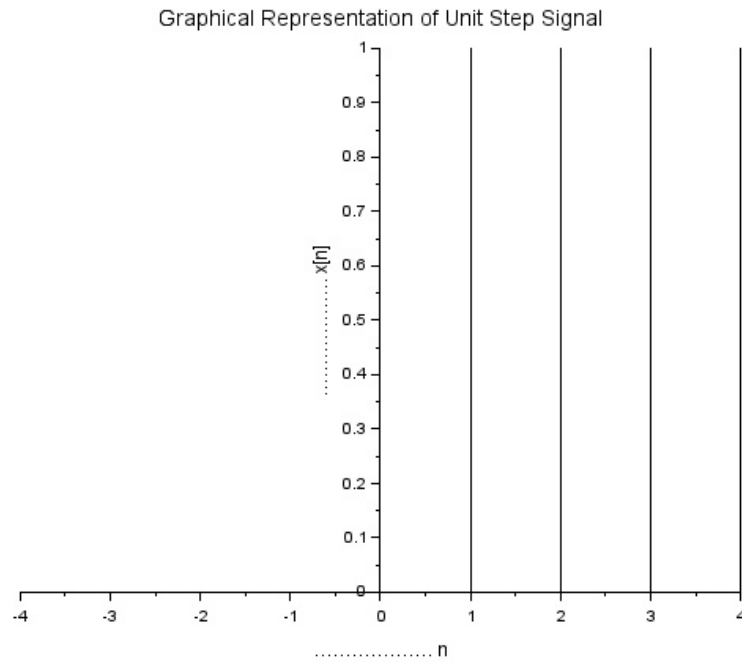


Figure 1.2: Unit Step Sequence

Scilab code Solution 1.2 Unit Step Sequence

```

1 // 1.GENERATION OF ELEMENTARY DISCRETE TIME SEQUENCE
2 //1.2 Caption: Unit Step Sequence
3 clear;
4 clc;
5 close;
6 L = 4; //Upperlimit
7 n = -L:L;
8 x = [zeros(1,L), ones(1,L+1)];

```

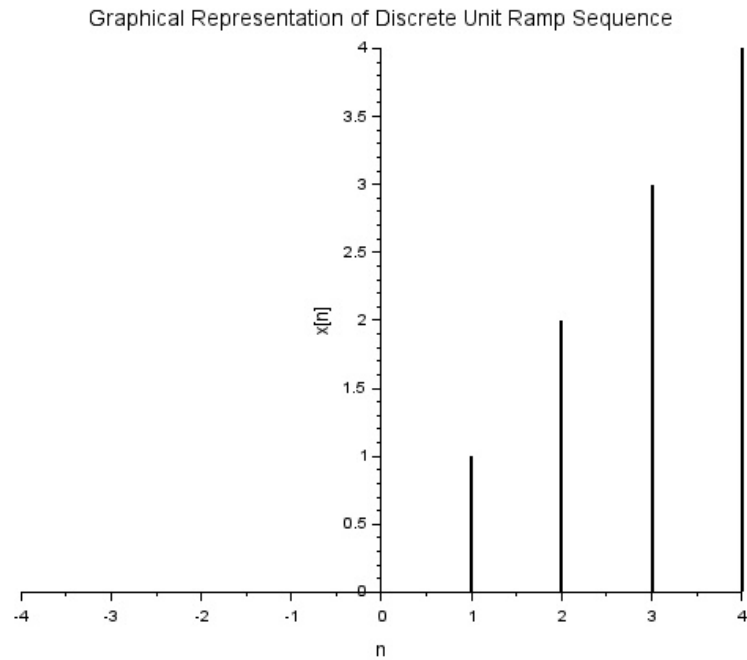


Figure 1.3: Discrete Ramp Sequence

```

9 a=gca();
10 a.y_location = "middle";
11 plot2d3('gnn',n,x)
12 title('Graphical Representation of Unit Step Signal'
13       )
13 xlabel('          . n');
14 ylabel('          . x[n]');

```

Scilab code Solution 1.3 Discrete Ramp Sequence

```

1 // 1.GENERATION OF ELEMENTARY DISCRETE TIME SEQUENCE

```

```

2 //1.3 Caption: Discrete Ramp Sequence
3 clear;
4 clc;
5 close;
6 L = 4; //Upperlimit
7 n = -L:L;
8 x = [zeros(1,L),0:L];
9 b = gca();
10 b.y_location = 'middle';
11 plot2d3('gnn',n,x)
12 a=gce();
13 a.children(1).thickness =2;
14 xtitle('Graphical Representation of Discrete Unit
        Ramp Sequence', 'n', 'x[n]');

```

Scilab code Solution 1.4 Exponent Increasing Signal

```

1 //1.GENERATION OF ELEMENTARY DISCRETE TIME SEQUENCE
2 //1.4 Caption: Exponentially Increasing Signal
3 clear;
4 clc;
5 close;
6 a =1.5;
7 n =1:10;
8 x = (a)^n;
9 a=gca();
10 a.thickness = 2;
11 plot2d3('gnn',n,x)
12 xtitle('Graphical Representation of Exponentially
        Increasing Signal', 'n', 'x[n]');

```

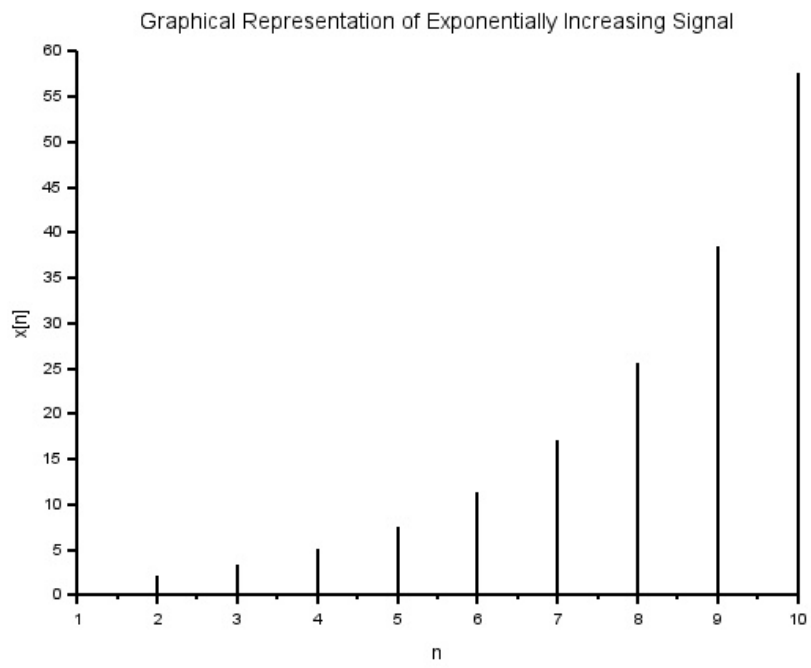


Figure 1.4: Exponent Increasing Signal

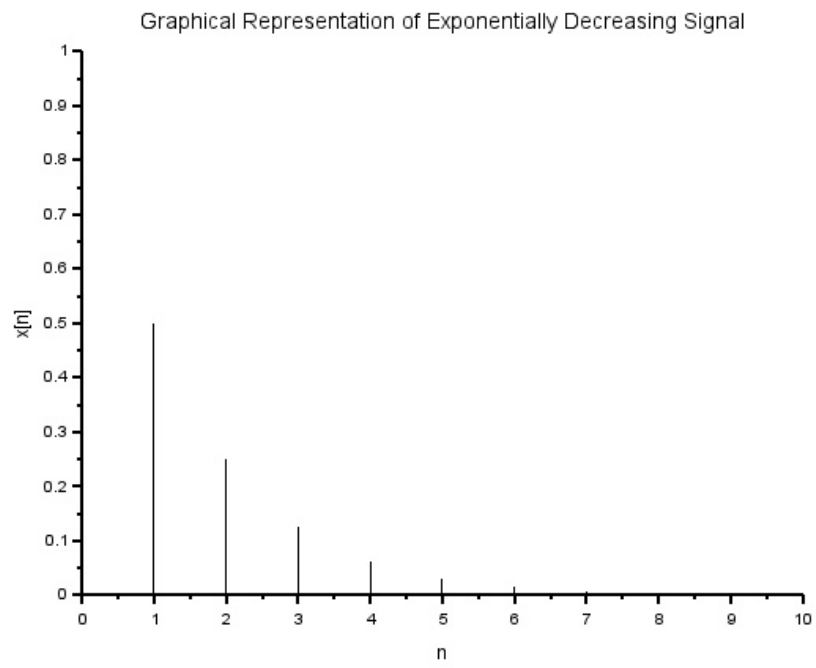


Figure 1.5: Exponential Decreasing Signal

Scilab code Solution 1.5 Exponential Decreasing Signal

```
1 //1.GENERATION OF ELEMENTARY DISCRETE TIME SEQUENCE
2 //Caption: Exponentially Decreasing Signal
3 clear;
4 clc;
5 close;
6 a =0.5;
7 n = 0:10;
8 x = (a)^n;
9 a=gca();
10 a.x_location = "origin";
11 a.y_location = "origin";
12 plot2d3('gnn',n,x)
13 a.thickness = 2;
14 xtitle('Graphical Representation of Exponentially
        Decreasing Signal','n','x[n]');
```

Experiment: 2

Linear and Circular convolutions

Scilab code Solution 2.1 Linear Convolution

```
1 //Caption:Program for Linear Convolution
2 clc;
3 clear all;
4 close ;
5 x = input('enter x seq');
6 h = input('enter h seq');
7 m = length(x);
8 n = length(h);
9 //Method 1 Using Direct Convolution Sum Formula
10 for i = 1:n+m-1
11     conv_sum = 0;
12     for j = 1:i
13         if (((i-j+1) <= n)&(j <= m))
14             conv_sum = conv_sum + x(j)*h(i-j+1);
15         end;
16     y(i) = conv_sum;
17 end;
```

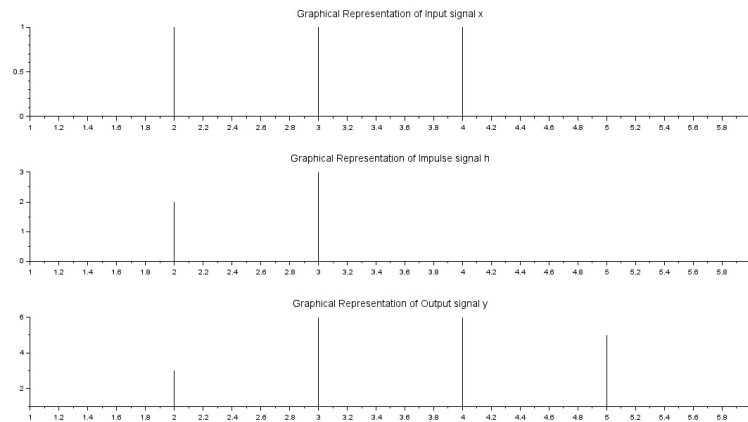


Figure 2.1: Linear Convolution

```

18 end;
19 disp('y', 'Convolution Sum using Direct Formula Method
      =')
20 //Method 2 Using Inbuilt Function
21 f = convol(x,h)
22 disp(f, 'Convolution Sum Result using Inbuilt Funtion
      =')
23 //Method 3 Using frequency Domain multiplication
24 N = n+m-1;
25 x = [x zeros(1,N-m)];
26 h = [h zeros(1,N-n)];
27 f1 = fft(x)
28 f2 = fft(h)
29 f3 = f1.*f2; // freq domain multiplication
30 f4 = ifft(f3)
31 disp(f4, 'Convolution Sum Result DFT – IDFT method =')
32 )
33 //f4 = real(f4)
34 subplot(3,1,1);
35 plot2d3('gnn',x)
36 xtitle('Graphical Representation of Input signal x')
37 ;
38 subplot(3,1,2);

```

```

37 plot2d3('gmn',h)
38 xtitle('Graphical Representation of Impulse signal h
        ');
39 subplot(3,1,3);
40 plot2d3('gmn',y)
41 xtitle('Graphical Representation of Output signal y'
        ');
42
43
44 //OUTPUT Test case
45
46 //enter x seq [1,1,1,1]
47 //enter h seq [1,2,3]
48
49 //Result
50 //  1.   3.   6.   6.   5.   3.
51 //   " Convolution Sum using Direct Formula Method ="
52 //  1.   3.   6.   6.   5.   3.
53 //   " Convolution Sum Result using Inbuilt Funtion ="
54 //  1.   3.   6.   6.   5.   3.
55 //   " Convolution Sum Result DFT – IDFT method ="

```

Scilab code Solution 2.2 Circular Convolution

```

1 //Caption: Program to find the Circular Convolution
  of given discrete sequences
2 clear all;
3 clc;
4 x1 = input('Enter the first sequence x1[n]=')
5 x2 = input('Enter the second sequence x2[n]=')
6 //x1 = [1,3,5,7];
7 //x2 = [2,4,6,8];
8
9 //Method 1: Circular Convolution using built-in fft
  function

```

```

10 X1 = fft(x1,-1); //fft of x1
11 X2 = fft(x2,-1); //fft of x2
12 X3 = X1.*X2; //X1(k)*X2(K)
13 x3 = fft(X3,1); //ifft of X3(K)
14 disp('Circular Convolution using built-in fft
      function:')
15 disp(x3)
16
17
18
19 //Method 2: Circular Convolution of two sequences
      using direct formula
20 m = length(x1)
21 n = length(x2)
22 a = zeros(1,max(m,n))
23 if (m >n)
24     for i = n+1:m
25         x2(i) = 0;
26     end
27 elseif (n>m)
28     for i = m+1:n
29         x1(i) = 0;
30     end
31 end
32 N = length(x1)
33 x3 = zeros(1,N);
34 a(1) = x2(1);
35 for j = 2:N
36     a(j) = x2(N-j+2);
37 end
38 for i =1:N
39     x3(1) = x3(1)+x1(i)*a(i);
40 end
41 for k = 2:N
42     for j =2:N
43         x2(j) = a(j-1);
44     end
45     x2(1) = a(N);

```

```

46     x2
47     for i = 1:N
48         a(i) = x2(i);
49         x3(k) = x3(k)+x1(i)*a(i);
50     end
51 end
52 disp('Circular Convolution using Direct formula
      method:')
53 disp('Circular Convolution Result x3 = ')
54 disp(x3)
55
56 //OUTPUT Test case
57 //Enter the first sequence x1[n]=[1,2,3,4]
58 //
59 //Enter the second sequence x2[n]=[1,1,1,1]
60 //
61 //
62 // "Circular Convolution using built-in fft
      function:"
63 //
64 //    10.    10.    10.    10.
65 //
66 // "Circular Convolution using Direct formula
      method:"
67 //
68 // "Circular Convolution Result x3 = "
69 //
70 //    10.    10.    10.    10.

```

Experiment: 3

Auto correlation and Cross Correlation

Scilab code Solution 3.1 Auto Correlation

```
1 //Caption: Program to find the Autocorrelation of a
   given Input Sequence
2 clear all;
3 clc;
4 x = input('Enter the given discrete time sequence');
5 L = length(x);
6 h = zeros(1,L);
7 for i = 1:L
8     h(L-i+1) = x(i);
9 end
10 N = 2*L-1;
11 Rxx = zeros(1,N);
12 for i = L+1:N
13     h(i) = 0;
14 end
15 for i = L+1:N
16     x(i) = 0;
17 end
18
```

```

19 for n = 1:N
20     for k = 1:N
21         if(n >= k)
22             Rxx(n) = Rxx(n)+x(n-k+1)*h(k);
23         end
24     end
25 end
26 disp('Auto Correlation Result is ')
27 disp(Rxx)
28
29
30 //OUTPUT Test case
31 //Enter the given discrete time sequence [1,2,3,4]
32 //Result
33 //"Auto Correlation Result is"
34 //4.    11.    20.    30.    20.    11.    4.

```

Scilab code Solution 3.2 Cross Correlation

```

1 //Caption: Program to find the Cross-correlation of
  two Sequences
2 clear all;
3 clc;
4 x = [1,2,1,1];
5 L = length(x);
6 h1 = [1,1,2,1];
7 disp('The input sequence 1 =')
8 disp(x)
9 disp('The input sequence 2=')
10 disp(h1)
11
12 //Cross Correlation using Built-in function xcorr()
13
14 Y = xcorr(x,h1)
15 disp('Cross Correlation using built-in function

```

```

        xcorr():')
16 disp(Y)
17
18 //Cross Correlation using Direct Formula Method
19 for i = 1:L
20     h(L-i+1) = h1(i);
21 end
22 N = 2*L-1;
23 Rxy = zeros(1,N);
24 for i = L+1:N
25     h(i) = 0;
26 end
27 for i = L+1:N
28     x(i) = 0;
29 end
30
31 for n = 1:N
32     for k = 1:N
33         if(n >= k)
34             Rxy(n) = Rxy(n)+x(n-k+1)*h(k);
35         end
36     end
37 end
38
39 disp('Cross Correlation Result using direct formula
        method is ')
40 disp(Rxy)
41
42
43 //OUTPUT Test Case
44 //Result
45 //"The input sequence 1 ="
46 //
47 //     1.     2.     1.     1.
48 //
49 //     "The input sequence 2="
50 //
51 //     1.     1.     2.     1.

```

```
52 //
53 // "Cross Correlation using built-in function xcorr
    // ("):"
54 //
55 // 1. 4. 6. 6. 5. 2. 1.
56 //
57 // "Cross Correlation Result using direct formula
    // method is"
58 //
59 // 1. 4. 6. 6. 5. 2. 1.
```

Experiment: 4

Frequency Analysis using DFT

Scilab code Solution 4.0 Spectrum Using DFT

```
1 //Caption: Discrete Periodic Spectrum Plot of N-point
   Sequece
2 clear all;
3 clc;
4 x=[0,1,2,3];
5 //Computing DFT and IDFT
6 X=fft(x,-1);
7 disp('The DFT of given sequence x[n] is X(k)=')
8 disp(X)
9 Phase=atan(imag(X),real(X));
10 figure
11 subplot(2,1,1)
12 a=gca();
13 a.data_bounds=[0,0;5,6];
14 a.x_location='origin'
15 a.y_location='origin'
16 plot2d3('gnn',[0:length(x)-1],abs(X))
17 poly1=a.children(1).children(1);
18 poly1.thickness=2;
```

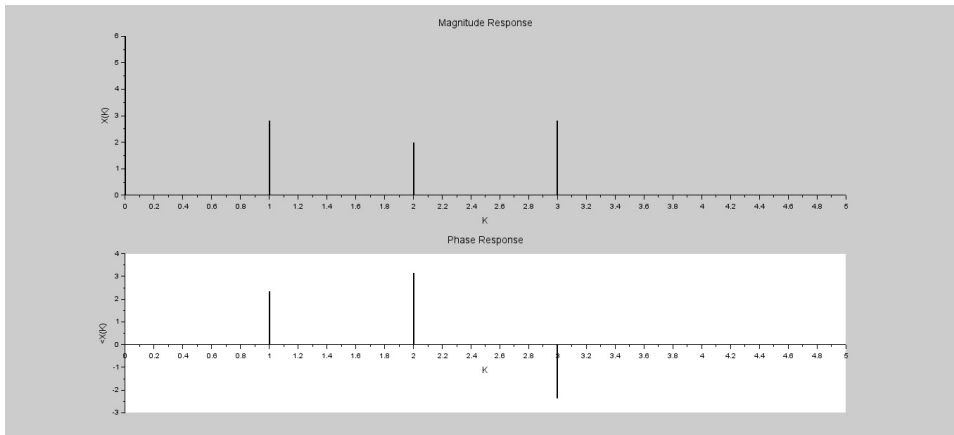


Figure 4.1: Spectrum Using DFT

```

19 xtitle('Magnitude Response', 'K', 'X(K)');
20 subplot(2,1,2)
21 a=gca();
22 a.data_bounds=[0,0;5,2];
23 a.x_location='origin'
24 a.y_location='origin'
25 plot2d3('gnn',[0:length(x)-1],Phase)
26 poly1=a.children(1).children(1);
27 poly1.thickness=2;
28 xtitle('Phase Response', 'K', '<X(K)');
29 disp('The Magnitude Response is |X(k)|=')
30 disp(abs(X))
31 disp('The Phase Response is <X(K)=')
32 disp(Phase)
33
34
35 //OUTPUT Test case
36 //Result
37 //"The DFT of given sequence x[n] is X(k)="
38 //
39 //    6. + 0.i   -2. + 2.i   -2. + 0.i   -2. - 2.i
40 //
41 //    "The Magnitude Response is |X(k)|="

```

```
42 //  
43 // 6. 2.8284271 2. 2.8284271  
44 //  
45 // "The Phase Response is  $\angle X(K)=$ "  
46 //  
47 // 0. 2.3561945 3.1415927 -2.3561945
```

Experiment: 5

Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation

Scilab code Solution 5.1 FIR LPF

```
1 //Caption: Program to Design FIR Low Pass Filter
2 clc;
3 close;
4 M = input('Enter the Odd Filter Length =');
      //Filter length
5 Wc = input('Enter the Digital Cutoff frequency =');
      //Digital Cutoff frequency
6 Tuo = (M-1)/2 //Center Value
7 for n = 1:M
8     if (n == Tuo+1)
9         hd(n) = Wc/%pi;
10    else
11        hd(n) = sin(Wc*((n-1)-Tuo))/(((n-1)-Tuo)*%pi)
```

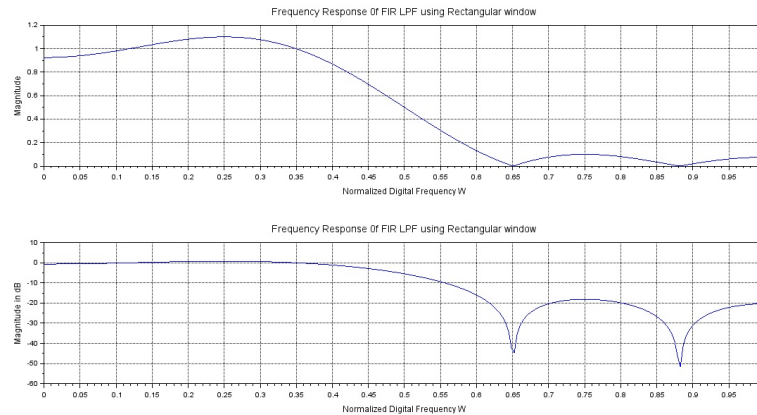


Figure 5.1: FIR LPF

```

;
12     end
13 end
14 //Rectangular Window
15 for n = 1:M
16     W(n) = 1;
17 end
18 //Windowing Filter Coefficients
19 h = hd.*W;
20 disp('Filter Coefficients are')
21 disp(h)
22
23 [hzm,fr]=fsmag(h,256);
24 hzm_dB = 20*log10(hzm)./max(hzm);
25 subplot(2,1,1)
26 plot(2*fr,hzm)
27 xlabel('Normalized Digital Frequency W');
28 ylabel('Magnitude');
29 title('Frequency Response of FIR LPF using
        Rectangular window')
30 xgrid(1)
31 subplot(2,1,2)
32 plot(2*fr,hzm_dB)

```

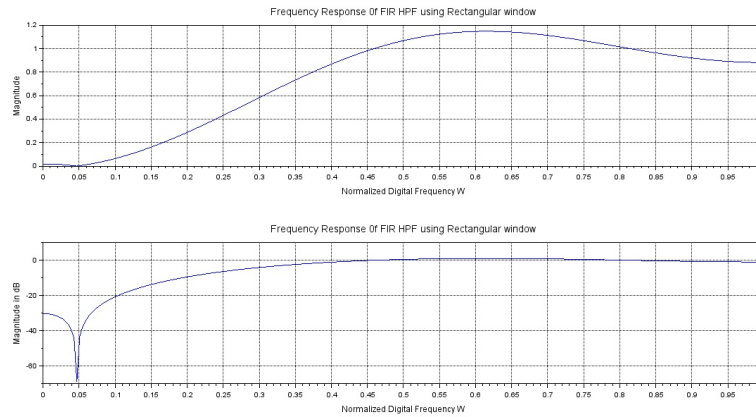


Figure 5.2: FIR HPF

```

33 xlabel('Normalized Digital Frequency W');
34 ylabel('Magnitude in dB');
35 title('Frequency Response of FIR LPF using
    Rectangular window')
36 xgrid(1)
37
38 //OUTPUT Test case
39 //Enter the Odd Filter Length = 7
40 //Enter the Digital Cutoff frequency = %pi/2
41 //Result
42 // "Filter Coefficients are"
43 // -0.1061033
44 // 1.949D-17
45 // 0.3183099
46 // 0.5
47 // 0.3183099
48 // 1.949D-17
49 // -0.1061033

```

Scilab code Solution 5.2 FIR HPF

```
1 //Caption: Program to Design FIR High Pass Filter
2 clear;
3 clc;
4 close;
5 M = input('Enter the Odd Filter Length =');
   //Filter length
6 Wc = input('Enter the Digital Cutoff frequency =');
   //Digital Cutoff frequency
7 Tuo = (M-1)/2 //Center Value
8 for n = 1:M
9     if (n == Tuo+1)
10        hd(n) = 1-Wc/%pi;
11     else
12        hd(n) = (sin(%pi*((n-1)-Tuo)) -sin(Wc*((n-1)-
           Tuo)))/(((n-1)-Tuo)*%pi);
13     end
14 end
15 //Rectangular Window
16 for n = 1:M
17     W(n) = 1;
18 end
19 //Windowing Filter Coefficients
20 h = hd.*W;
21 disp('Filter Coefficients are')
22 disp(h)
23 [hzm,fr]=frmag(h,256);
24 hzm_dB = 20*log10(hzm)./max(hzm);
25 subplot(2,1,1)
26 plot(2*fr,hzm)
27 xlabel('Normalized Digital Frequency W');
28 ylabel('Magnitude');
29 title('Frequency Response of FIR HPF using
       Rectangular window')
30 xgrid(1)
31 subplot(2,1,2)
32 plot(2*fr,hzm_dB)
```

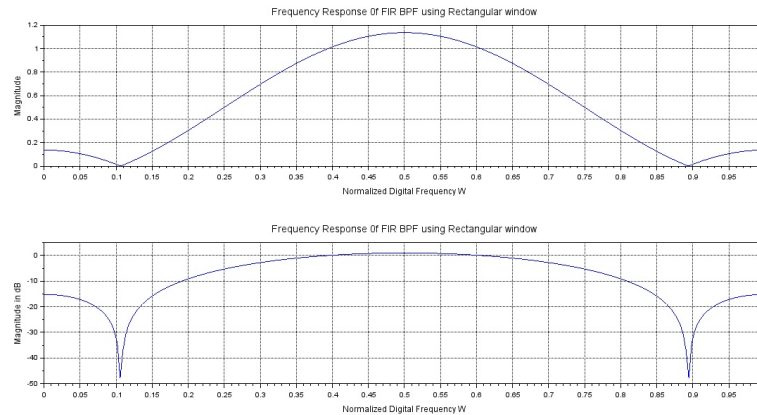


Figure 5.3: FIR BPF

```

33 xlabel('Normalized Digital Frequency W');
34 ylabel('Magnitude in dB');
35 title('Frequency Response Of FIR HPF using
    Rectangular window')
36 xgrid(1)
37
38 //OUTPUT Test case
39 //Enter the Odd Filter Length = 5
40 //Enter the Digital Cutoff frequency = %pi/4
41 //” Filter Coefficients are”
42 //  -0.1591549
43 //  -0.2250791
44 //   0.75
45 //  -0.2250791
46 //  -0.1591549

```

Scilab code Solution 5.3 FIR BPF

```

1 //Caption: Program to Design FIR Band Pass Filter

```

```

2 clear;
3 clc;
4 close;
5 M = input('Enter the Odd Filter Length =');
      // Filter length
6 //Digital Cutoff frequency [Lower Cutoff, Upper
      Cutoff]
7 Wc = input('Enter the Digital Cutoff frequency =');
8 Wc2 = Wc(2)
9 Wc1 = Wc(1)
10 Tuo = (M-1)/2 //Center Value
11 hd = zeros(1,M);
12 W = zeros(1,M);
13 for n = 1:M
14     if (n == Tuo+1)
15         hd(n) = (Wc2-Wc1)/%pi;
16     else
17         n
18         hd(n) = (sin(Wc2*((n-1)-Tuo)) - sin(Wc1*((n-1)-
      Tuo)))/(((n-1)-Tuo)*%pi);
19     end
20     if(abs(hd(n)) < (0.00001))
21         hd(n)=0;
22     end
23 end
24 hd;
25 //Rectangular Window
26 for n = 1:M
27     W(n) = 1;
28 end
29 //Windowing Filter Coefficients
30 h = hd.*W;
31 disp('Filter Coefficients are')
32 disp(h)
33 [hzm,fr]=frmag(h,256);
34 hzm_dB = 20*log10(hzm) ./max(hzm);
35 subplot(2,1,1)
36 plot(2*fr,hzm)

```

```

37 xlabel('Normalized Digital Frequency W');
38 ylabel('Magnitude');
39 title('Frequency Response of FIR BPF using
        Rectangular window')
40 xgrid(1)
41 subplot(2,1,2)
42 plot(2*fr,hzm_dB)
43 xlabel('Normalized Digital Frequency W');
44 ylabel('Magnitude in dB');
45 title('Frequency Response of FIR BPF using
        Rectangular window')
46 xgrid(1)
47
48
49 //OUTPUT Test case
50 //Enter the Odd Filter Length = 11
51 //Enter the Digital Cutoff frequency = [%pi/4,3*%pi
    /4]
52 //Result
53 // " Filter Coefficients are"
54 // 0.    0.    0.  -0.3183099    0.    0.5    0.
    -0.3183099    0.    0.    0.

```

Scilab code Solution 5.4 FIR BSF

```

1 //Caption: Program to Design FIR Band Reject Filter
2 clear ;
3 clc;
4 close;
5 M = input('Enter the Odd Filter Length =');
    //Filter length
6 //Digital Cutoff frequency [Lower Cutoff, Upper
    Cutoff]

```

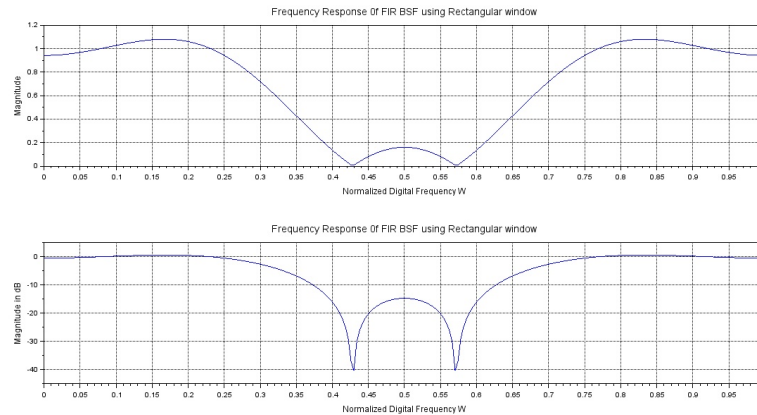


Figure 5.4: FIR BSF

```

7 Wc = input('Enter the Digital Cutoff frequency =');
8 Wc2 = Wc(2)
9 Wc1 = Wc(1)
10 Tuo = (M-1)/2 //Center Value
11 hd = zeros(1,M);
12 W = zeros(1,M);
13 for n = 1:M
14     if (n == Tuo+1)
15         hd(n) = 1-((Wc2-Wc1)/%pi);
16     else
17         hd(n)=(sin(%pi*((n-1)-Tuo))-sin(Wc2*((n-1)-Tuo))+
18             sin(Wc1*((n-1)-Tuo)))/(((n-1)-Tuo)*%pi);
19     end
20     if(abs(hd(n))<(0.00001))
21         hd(n)=0;
22     end
23 end
24 //Rectangular Window
25 for n = 1:M
26     W(n) = 1;
27 end
28 //Windowing Filtler Coefficients

```

```

29 h = hd.*W;
30 disp('Filter Coefficients are')
31 disp(h)
32 [hzm,fr]=frmag(h,256);
33 hzm_dB = 20*log10(hzm)./max(hzm);
34 subplot(2,1,1)
35 plot(2*fr,hzm)
36 xlabel('Normalized Digital Frequency W');
37 ylabel('Magnitude');
38 title('Frequency Response Of FIR BSF using
        Rectangular window')
39 xgrid(1)
40 subplot(2,1,2)
41 plot(2*fr,hzm_dB)
42 xlabel('Normalized Digital Frequency W');
43 ylabel('Magnitude in dB');
44 title('Frequency Response Of FIR BSF using
        Rectangular window')
45 xgrid(1)
46
47 //OUTPUT Test case
48 //Enter the Odd Filter Length = 11
49 //Enter the Digital Cutoff frequency = [%pi/3,2*%pi
        /3]
50 //Result
51 // " Filter Coefficients are"
52 // 0.   -0.1378322   0.   0.2756644   0.   0.6666667
        0.   0.2756644   0.   -0.1378322   0.

```

Experiment: 6

Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations

Scilab code Solution 6.1 Butterworth IIR LPF

```
1 //IIR Butterworth LPF Filter
2 clear;
3 clc;
4 n=3;
5 ftype='lp';
6 fdesign = 'butt';
7 frq=[0.15,0.25];
8 delta=[0.08,0.02]
9 hz=iir(n,ftype,fdesign,frq);
10 [hzm,fr]=frmag(hz,256);
11 plot2d(fr',hzm')
```

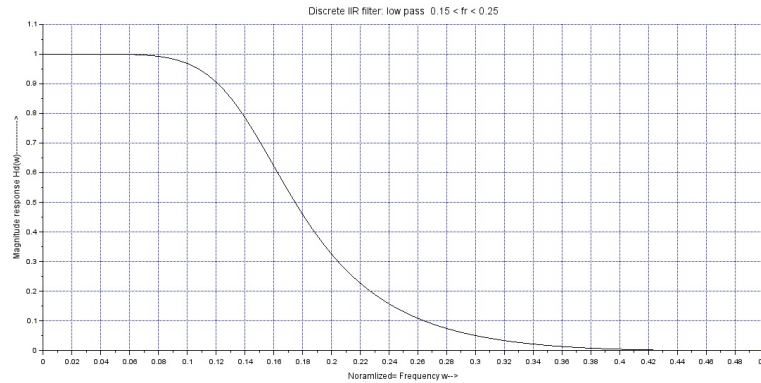


Figure 6.1: Butterworth IIR LPF

```

12 xtitle('Discrete IIR filter: low pass 0.15 < fr <
        0.25 ',' ',' ');
13 xlabel('Normalized= Frequency w-->')
14 ylabel('Magnitude response Hd(w)----->')
15 xgrid(2)

```

Scilab code Solution 6.2 Butterworth IIR HPF

```

1 //IIR Butterworth HPF Filter
2
3 clear;
4 clc;
5 n=3;
6 ftype='hp';
7 fdesign = 'butt';
8 frq=[0.15,0.25];
9 delta=[0.08,0.02]
10
11 hz=iir(n,ftype,fdesign,frq);

```

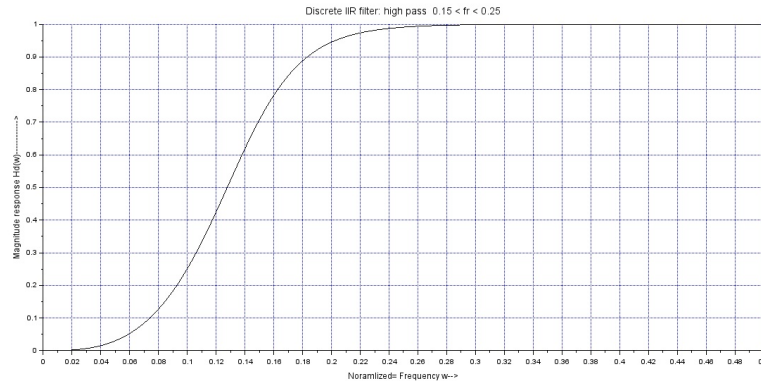


Figure 6.2: Butterworth IIR HPF

```

12 [hzm,fr]=frmag(hz,256);
13 plot2d(fr',hzm')
14 xtitle('Discrete IIR filter: high pass 0.15 < fr <
    0.25 ',' ',' ',' ');
15 xlabel('Noramlized= Frequency w-->')
16 ylabel('Magnitude response Hd(w)----->')
17 xgrid(2)

```

Scilab code Solution 6.3 Butterworth IIR BPF

```

1 //IIR Butterworth BPF Filter
2 clear all;
3 clc;
4 n=3;
5 ftype='bp';
6 fdesign = 'butt';
7 frq=[0.15,0.25];
8 delta=[0.08,0.02]
9 hz=iir(n,ftype,fdesign,frq);

```

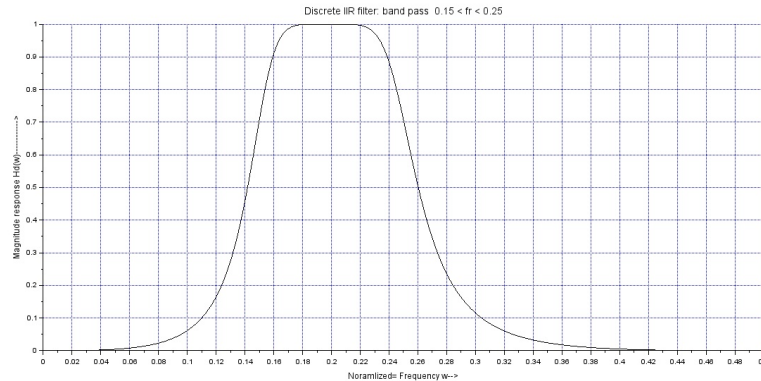


Figure 6.3: Butterworth IIR BPF

```

10 [hzm,fr]=frmag(hz,256);
11 plot2d(fr',hzm')
12 xtitle('Discrete IIR filter: band pass 0.15 < fr <
    0.25 ',' ',' ',' ');
13 xlabel('Noramlized= Frequency w-->')
14 ylabel('Magnitude response Hd(w)----->')
15 xgrid(2)

```

Scilab code Solution 6.4 Butterworth IIR BSF

```

1 //IIR Butterworth BSF Filter
2 clear;
3 clc;
4 n=3;
5 ftype='sb';
6 fdesign = 'butt';
7 frq=[0.15,0.25];
8 delta=[0.08,0.02]
9 hz=iir(n,ftype,fdesign,frq);

```

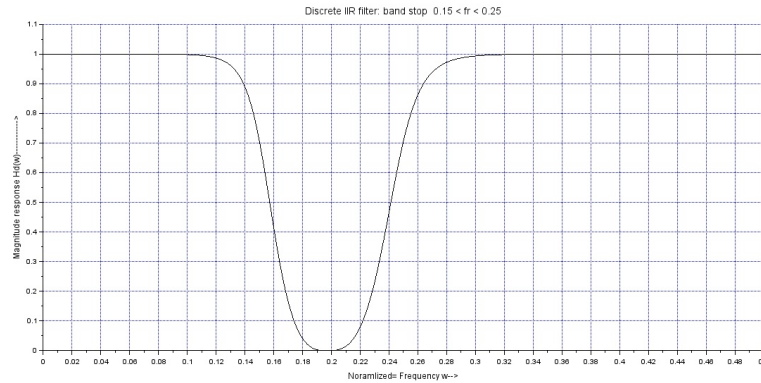


Figure 6.4: Butterworth IIR BSF

```

10 [hzm,fr]=frmag(hz,256);
11 plot2d(fr',hzm')
12 xtitle('Discrete IIR filter: band stop 0.15 < fr <
    0.25 ',' ',' ',' ');
13 xlabel('Noramlized= Frequency w-->')
14 ylabel('Magnitude response Hd(w)----->')
15 xgrid(2)

```

Scilab code Solution 6.5 Chebyshev IIR LPF

```

1 //IIR Chebyshev LPF Filter
2 clear;
3 clc;
4 n=3;
5 ftype='lp';
6 fdesign = 'cheb1';
7 frq=[0.15,0.25];
8 delta=[0.08,0.02]
9 hz=iir(n,ftype,fdesign,frq);

```

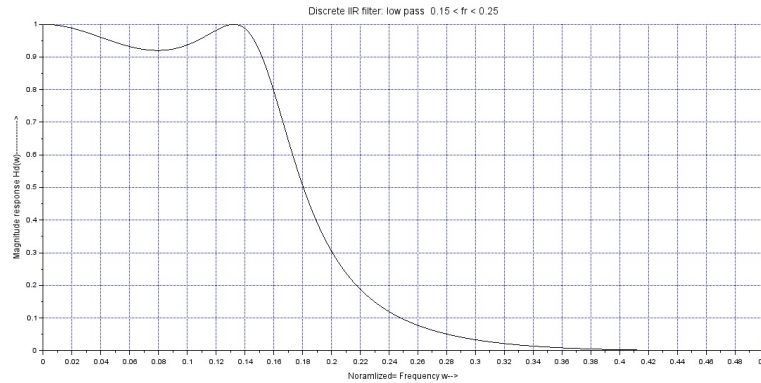


Figure 6.5: Chebyshev IIR LPF

```

10 [hzm, fr]=frmag(hz, 256);
11 plot2d(fr', hzm')
12 xtitle('Discrete IIR filter: low pass 0.15 < fr <
        0.25 ', ' ', ' ');
13 xlabel('Normalized= Frequency w-->')
14 ylabel('Magnitude response Hd(w)----->')
15 xgrid(2)

```

Scilab code Solution 6.6 Chebyshev IIR HPF

```

1 //IIR Chebyshev HPF Filter
2
3 clear;
4 clc;
5 n=3;
6 ftype='hp';
7 fdesign = 'cheb1';
8 frq=[0.15,0.25];
9 delta=[0.08,0.02]

```

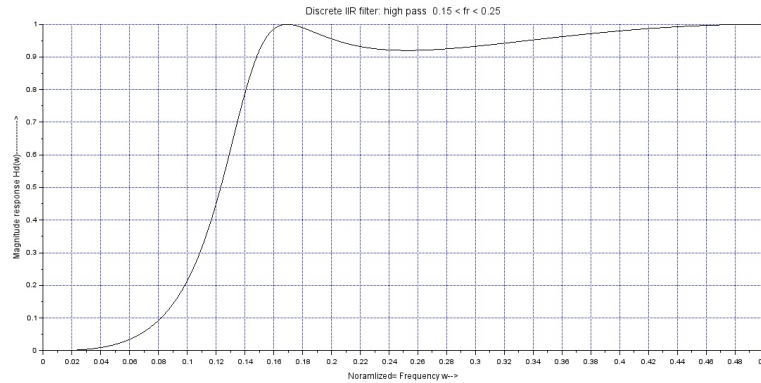


Figure 6.6: Chebyshev IIR HPF

```

10
11 hz=iir(n,ftype,fdesign,frq);
12 [hzm,fr]=frmag(hz,256);
13 plot2d(fr',hzm')
14 xtitle('Discrete IIR filter: high pass 0.15 < fr <
        0.25 ',' ',' ');
15 xlabel('Noramlized= Frequency w-->')
16 ylabel('Magnitude response Hd(w)----->')
17 xgrid(2)

```

Scilab code Solution 6.7 Chebyshev IIR BPF

```

1 //IIR Chebyshev BPF Filter
2 clear all;
3 clc;
4 n=3;
5 ftype='bp';
6 fdesign = 'cheb1';
7 frq=[0.15,0.25];

```

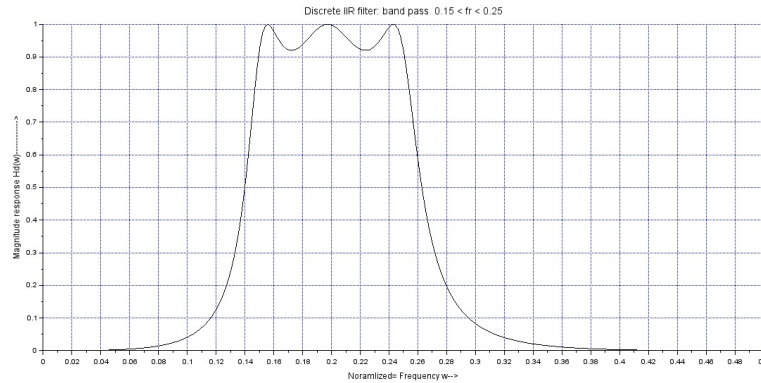


Figure 6.7: Chebyshev IIR BPF

```

8 delta=[0.08,0.02]
9 hz=iir(n,ftype,fdesign,frq);
10 [hzm,fr]=frmag(hz,256);
11 plot2d(fr',hzm')
12 xtitle('Discrete IIR filter: band pass 0.15 < fr <
        0.25 ',' ',' ',' ');
13 xlabel('Noramlized= Frequency w-->')
14 ylabel('Magnitude response Hd(w)----->')
15 xgrid(2)

```

Scilab code Solution 6.8 Chebychev IIR BSF

```

1 //IIR Chebyshev BSF Filter
2 clear;
3 clc;
4 n=3;
5 ftype='sb';
6 fdesign = 'cheb1';
7 frq=[0.15,0.25];

```

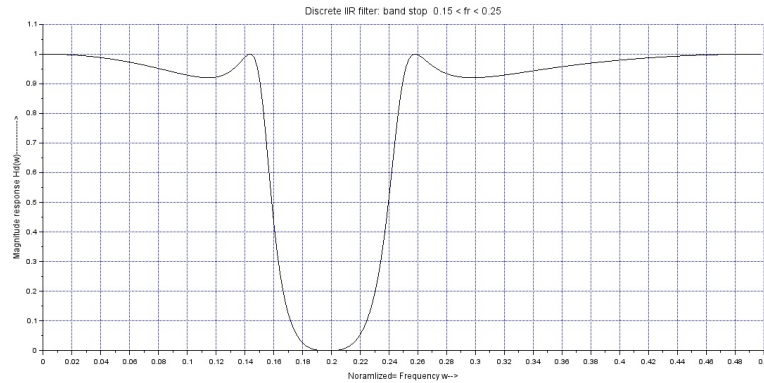


Figure 6.8: Chebychev IIR BSF

```

8 delta=[0.08,0.02]
9 hz=iir(n,ftype,fdesign,frq);
10 [hzm,fr]=frmag(hz,256);
11 plot2d(fr',hzm')
12 xtitle('Discrete IIR filter: band stop 0.15 < fr <
        0.25 ',' ',' ');
13 xlabel('Noramlized= Frequency w-->')
14 ylabel('Magnitue response Hd(w)----->')
15 xgrid(2)

```
