Digital Signal Processing
MATLAB HW1 - q3

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Clear recent data

```
clear; close all; clc;
```

Window

```
M1 = 10;
M2 = 50;
M3 = 101;
%%Plots of Rectangular Window for various values of M
figure(1);
myPlot(1,M1);
figure(2);
myPlot(1,M2);
figure(3);
myPlot(1,M3);

%%Plots of Bartlett Window for various values of M
figure(4);
myPlot(2,M1);
figure(5);
myPlot(2,M2);
figure(6);
myPlot(2,M3);

%%Plots of Hanning Window for various values of M
figure(7);
myPlot(3,M1);
figure(8);
myPlot(3,M2);
figure(9);
myPlot(3,M3);

%%Plots of Hamming Window for various values of M
figure(10);
myPlot(4,M1);
figure(11);
```

```
myPlot(4,M2);
figure(12);
myPlot(4,M3);

%%Plots of Blackman Window for various values of M
figure(13);
myPlot(5,M1);
figure(14);
myPlot(5,M2);
figure(15);
myPlot(5,M3);
```

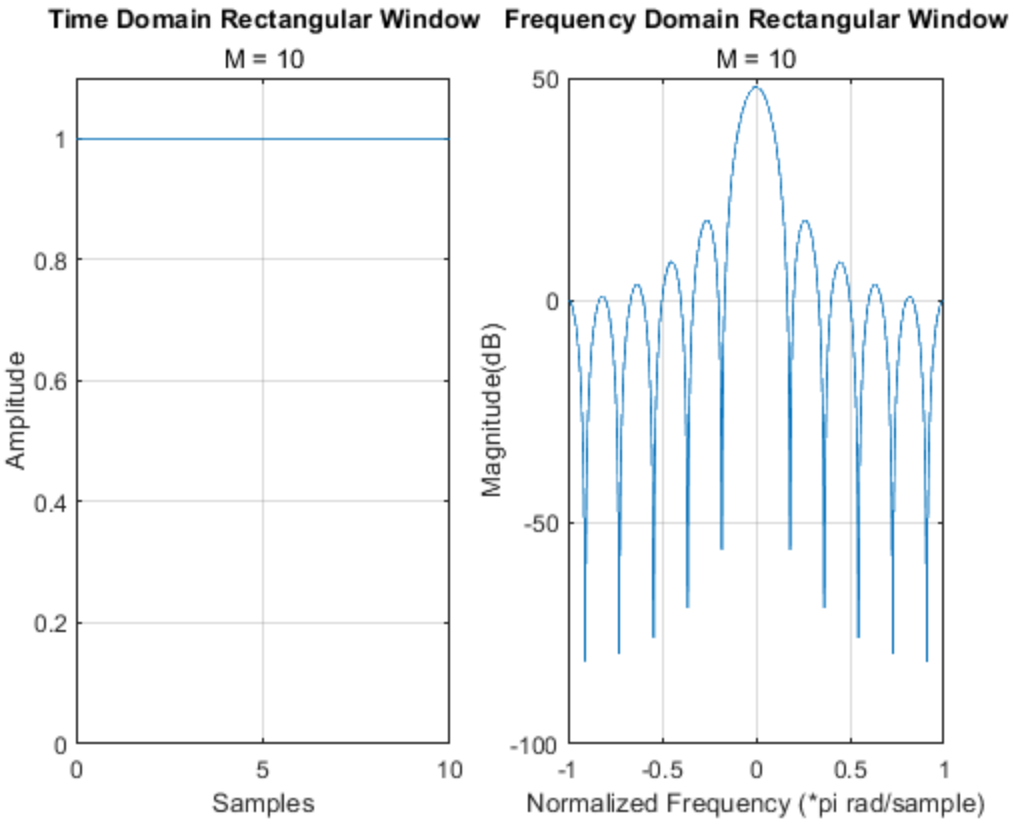
Functions

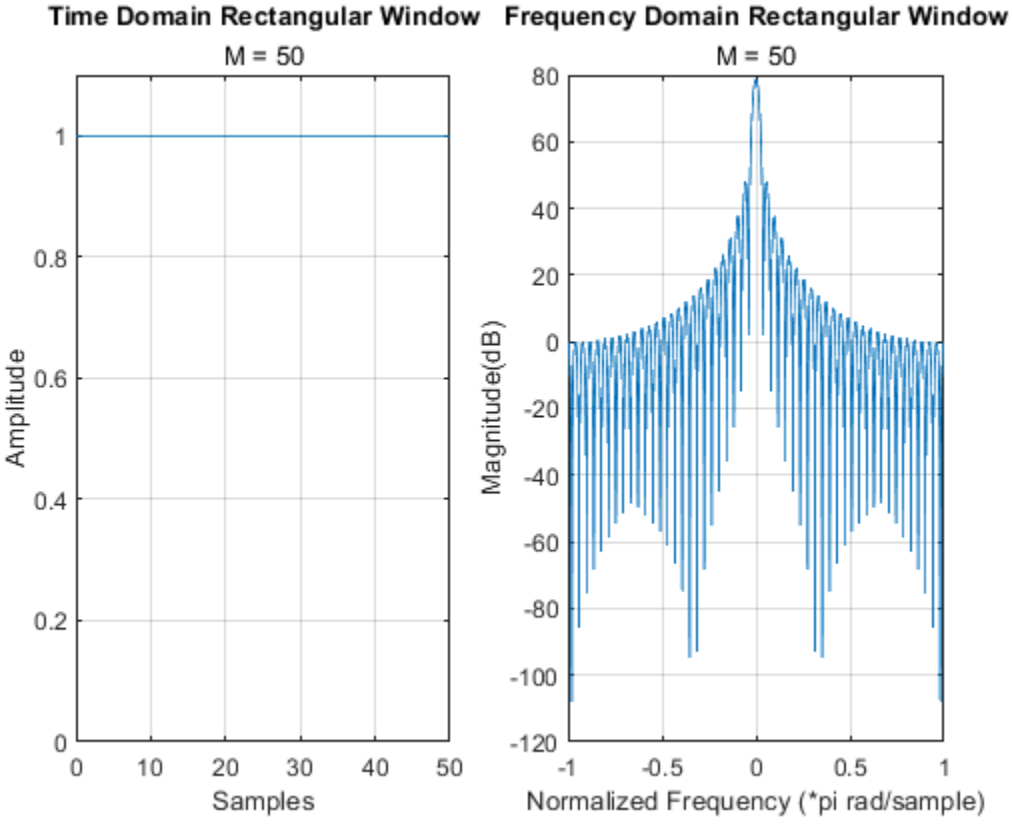
```
function R = myRect(M)
% Rectangular Window of Length M
 n=0:M;
 R=ones(1,length(n));
end


function B = myBartlett(N)
% Bartlett Window of Lenrth N
    n = 1:N;
    B = zeros(1,length(n)+1);
    for n = 1 : N
```

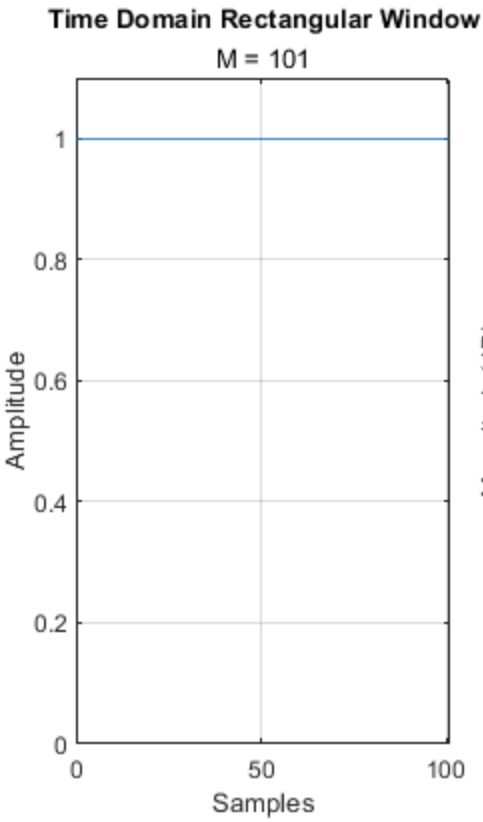
```
        if (n <= ((N)/2))
            B(n) = 2 *(n-1) /N ;
        end
        if ( n > (N)/2 )
            B(n) = 2 - 2 *(n-1) /N;
        end
    end


end

function C = myHanning(M)
% Hanning Window of Lenrth N
    n = 1:M;
    C = zeros(1,length(n)+1);
    for n = 1:length(n)
        C(n) = 0.5 *(1- cos(2*pi * (n-1)/(M-1)));
    end
end

function H = myHamming(M)
% Hamming Window of Lenrth N
    n = 1:M;
    H = zeros(1,length(n)+1);
    for n = 1:length(n)+1
        H(n) = (0.54- 0.46* cos(2*pi * (n-1)/(M-1)));
    end
end

function BL = myBlackman(M)
% Blackman Window of Lenrth N
    n = 1:M;
    BL = zeros(1,length(n)+1);
    for n = 1:length(n)+1
        BL(n)=(0.42- 0.5* cos(2*pi *(n-1)/(M-1)) +0.08*
 cos(4*pi*(n-1)/(M-1)));
    end
end


function myPlot(c,M1)

    t = 0:M1 ;

    switch c
        case 1
            %Plot Rectangular Window
            R = myRect(M1);
            subplot(1,2,1);
            plot(t, R);
            grid on;
            xlim([0,M1]);
            ylim([0, 1.1]);
            xlabel("Samples");
```

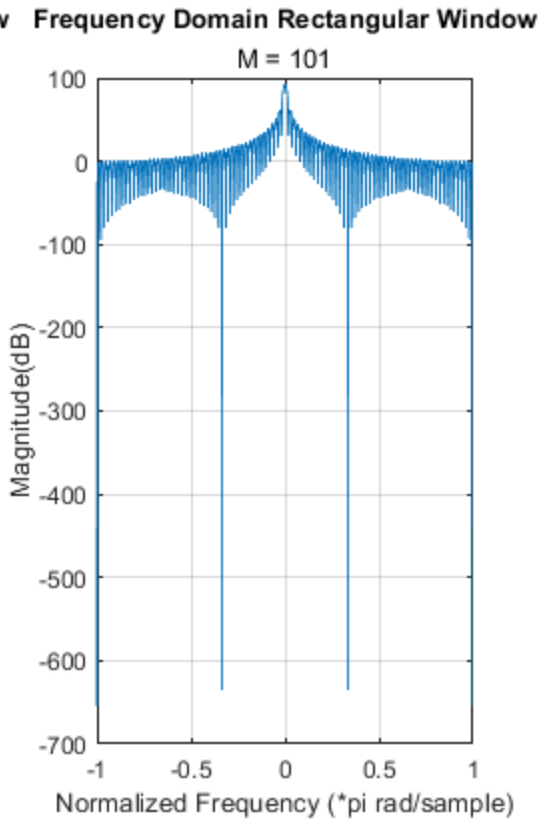
```
            ylabel("Amplitude");
            title("Time Domain Rectangular Window", "M = "+M1);
            WR = linspace(-pi,pi,1024);
            subplot(1,2,2);
%             [hR1, wR1] = freqz(R,1);
            HR = freqz(R,1,WR);
%             plot(wR1/pi,20*log10(abs(hR1)));
            plot(WR/pi,20*log(abs(HR)));
            grid on;
            xlabel("Normalized Frequency (*pi rad/sample)");
            ylabel("Magnitude(dB)");
            title("Frequency Domain Rectangular Window", "M = "+M1);

        case 2
            %Plot Bartlett Window
            Ba = myBartlett(M1);
            subplot(1,2,1);
            plot(t, Ba);
            grid on;
            xlim([0,M1]);
            ylim([0, 1.1]);
            xlabel("Samples");
            ylabel("Amplitude");
            title("Time Domain Bartlett Window","M = "+M1);
            WBa = linspace(-pi,pi,1024);
%             [hBa, wBa] = freqz(Ba,1);
            HBa = freqz(Ba,1,WBa);
            subplot(1,2,2);
%             plot(wBa/pi,20*log10(abs(hBa)));
            plot(WBa/pi,20*log(abs(HBa)));
            grid on;
            xlabel("Normalized Frequency (*pi rad/sample)");
            ylabel("Magnitude(dB)");
            title("Frequency Domain Bartlett Window","M = "+M1);

        case 3
            %Plot Hanning Window
            C = myHanning(M1);
            subplot(1,2,1);
            plot(t, C);
            grid on;
            xlim([0,M1]);
            ylim([0, 1.1]);
            xlabel("Samples");
            ylabel("Amplitude");
            title("Time Domain Hanning Window","M = "+M1);
            WC = linspace(-pi,pi,1024);
%             [hC, wC] = freqz(C,1);
            HC = freqz(C,1,WC);
            subplot(1,2,2);
%             plot(wC/pi,20*log10(abs(hC)));
            plot(WC/pi,20*log(abs(HC)));
            grid on;
            xlabel("Normalized Frequency (*pi rad/sample)");
```

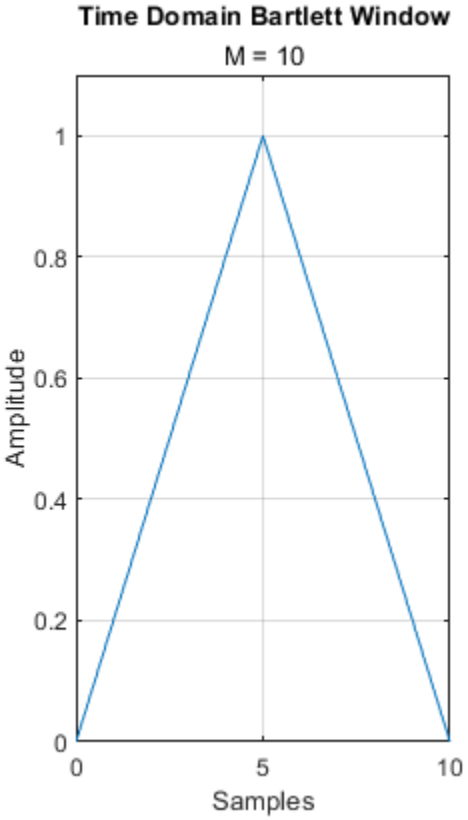
```
            ylabel("Magnitude(dB)");
            title("Frequency Domain Hanning Window","M = "+M1);

        case 4
            %Plot Hamming Window
            H = myHamming(M1);
            subplot(1,2,1);
            plot(t, H);
            grid on;
            xlim([0,M1]);
            ylim([0, 1.1]);
            xlabel("Samples");
            ylabel("Amplitude");
            title("Time Domain Hamming Window","M = "+M1);
            WH = linspace(-pi,pi,1024);
%             [hH, wH] = freqz(H,1);
            HH = freqz(H,1,WH);
            subplot(1,2,2);
%             plot(wH/pi,20*log10(abs(hH)));
            plot(WH/pi,20*log(abs(HH)));
            grid on;
            xlabel("Normalized Frequency (*pi rad/sample)");
            ylabel("Magnitude(dB)");
            title("Frequency Domain Hamming Window","M = "+M1);

        case 5
            %Plot Blackman Window
            BL = myBlackman(M1);
            subplot(1,2,1);
            plot(t, BL);
            grid on;
            xlim([0,M1]);
            ylim([0, 1.1]);
            xlabel("Samples");
            ylabel("Amplitude");
            title("Time Domain Blackman Window","M = "+M1);
            WBL = linspace(-pi,pi,1024);
%             [hBL, wBL] = freqz(BL,1);
            HBL = freqz(BL,1,WBL);
            subplot(1,2,2);
%             plot(wBL/pi,20*log10(abs(hBL)));
            plot(WBL/pi,20*log(abs(HBL)));
            grid on;
            xlabel("Normalized Frequency (*pi rad/sample)");
            ylabel("Magnitude(dB)");
            title("Frequency Domain Hamming Window","M = "+M1);

    end

end
```

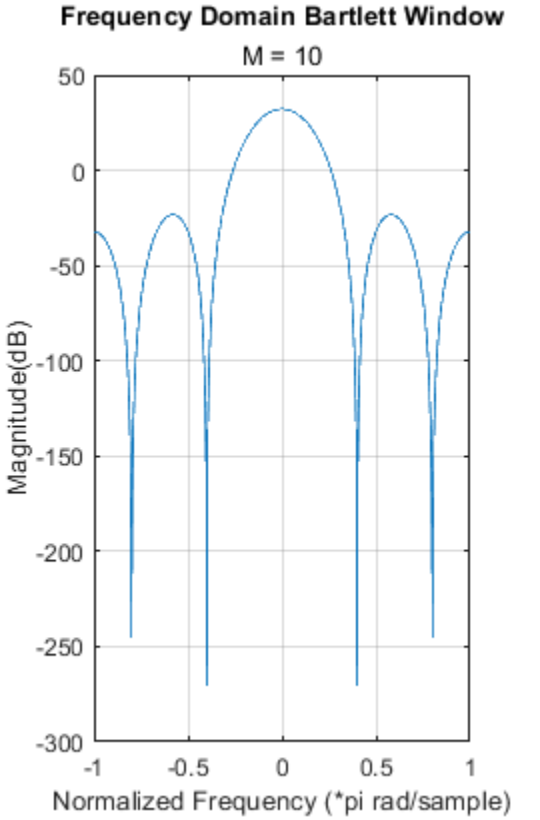

Time Domain Rectangular Window
M = 10
Amplitude
Samples
Frequency Domain Rectangular Window
M = 10
Magnitude(dB)
Normalized Frequency (*pi rad/sample)

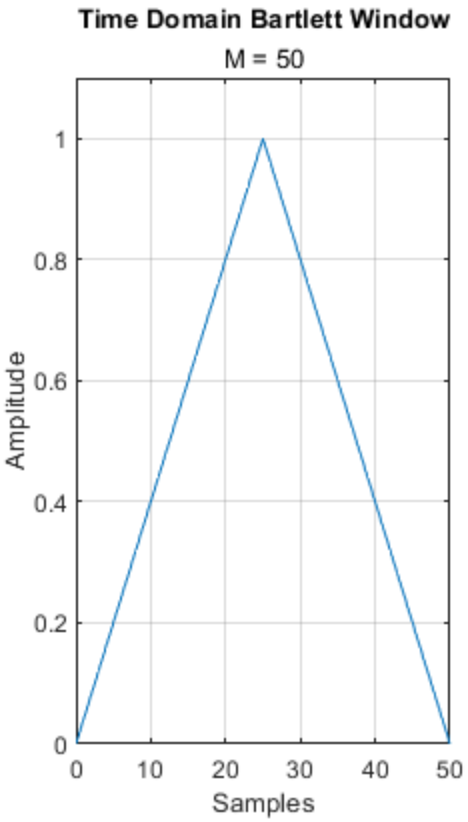

Time Domain Rectangular Window
M = 50
Amplitude
Samples
Frequency Domain Rectangular Window
M = 50
Magnitude(dB)
Normalized Frequency (*pi rad/sample)

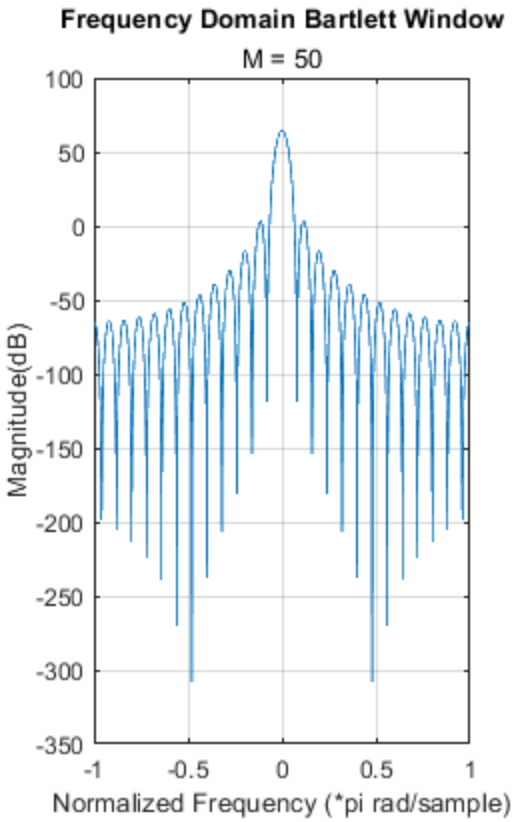

Time Domain Rectangular Window
M = 101
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
50
100

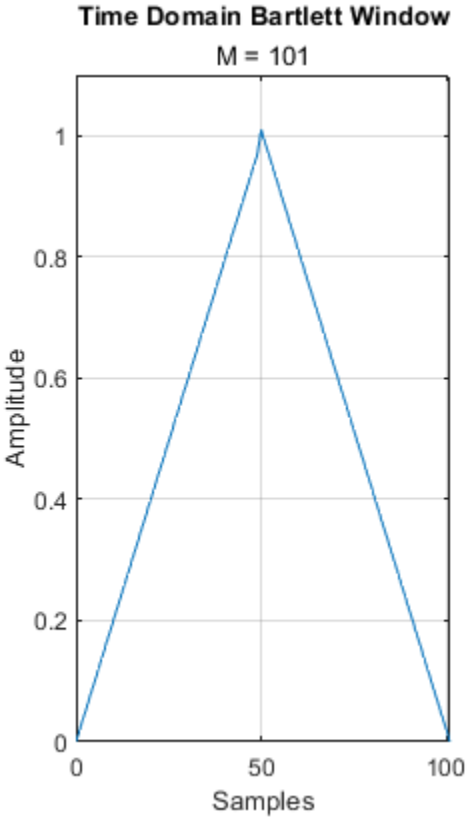

Frequency Domain Rectangular Window
M = 101
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
100
0
-100
-200
-300
-400
-500
-600
-700
-1
-0.5
0
0.5
1

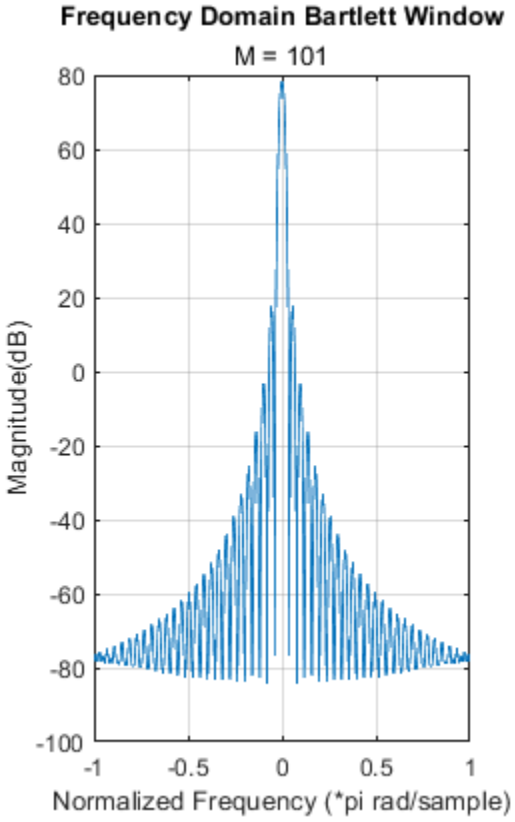

Time Domain Bartlett Window
M = 10
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
5
10

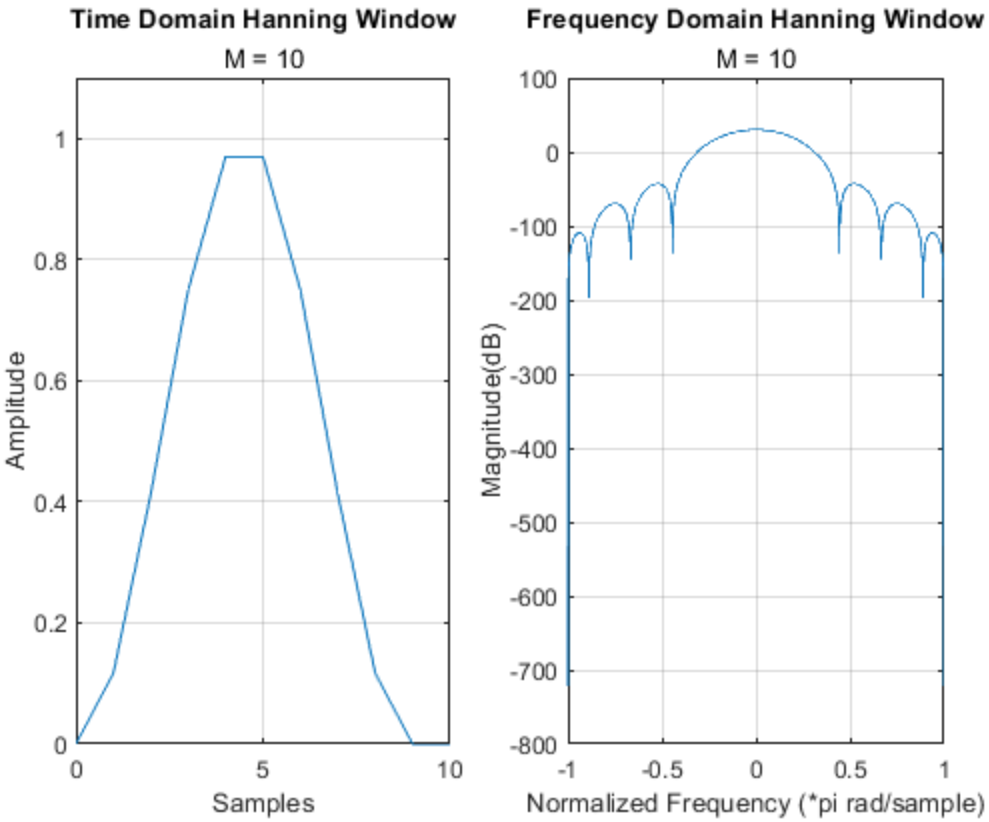

Frequency Domain Bartlett Window
M = 10
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
50
0
-50
-100
-150
-200
-250
-300
-1
-0.5
0
0.5
1

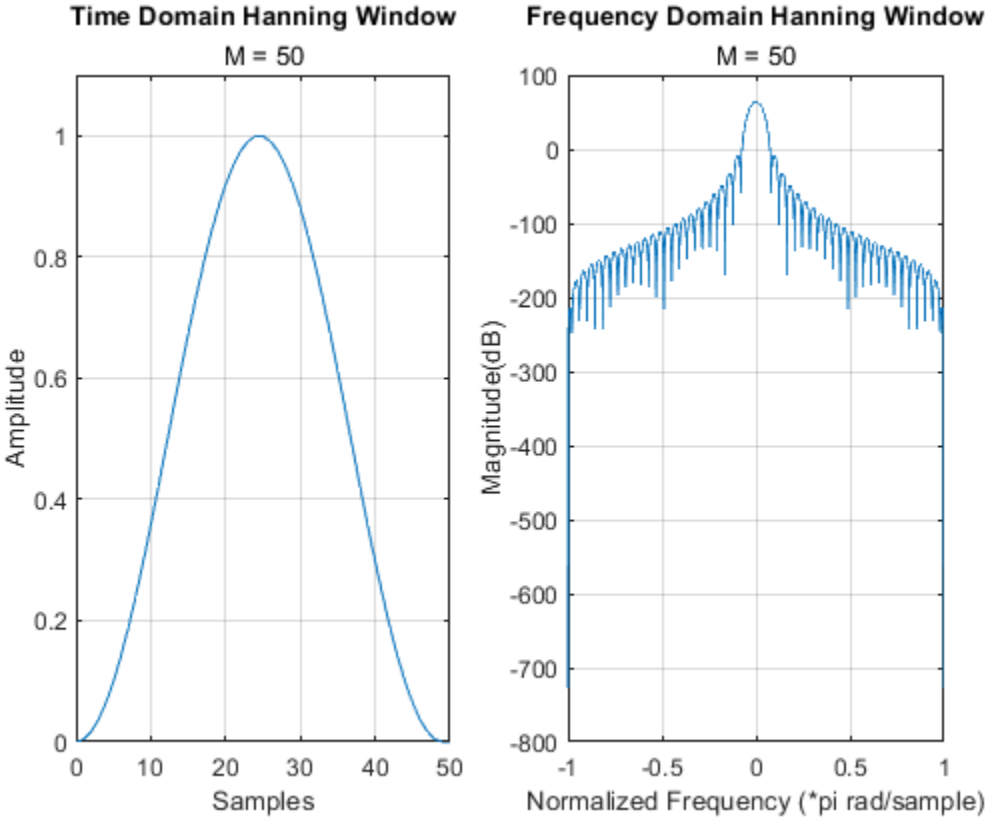

Time Domain Bartlett Window
M = 50
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50

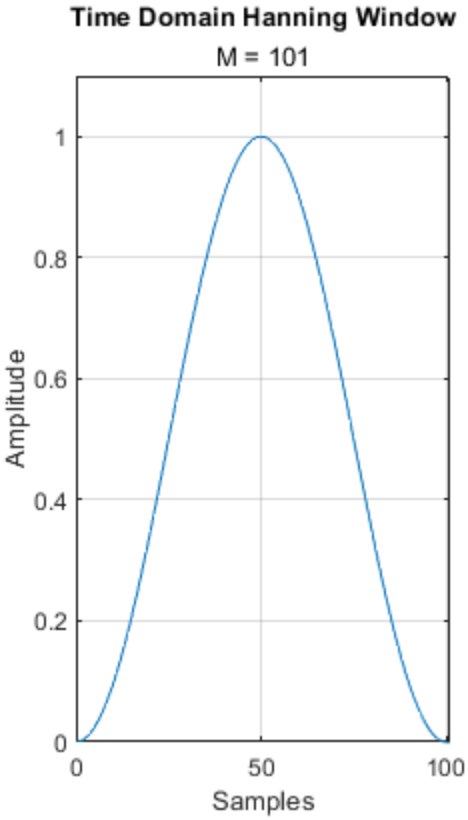

Frequency Domain Bartlett Window
M = 50
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
100
50
0
-50
-100
-150
-200
-250
-300
-350
-1
-0.5
0
0.5
1

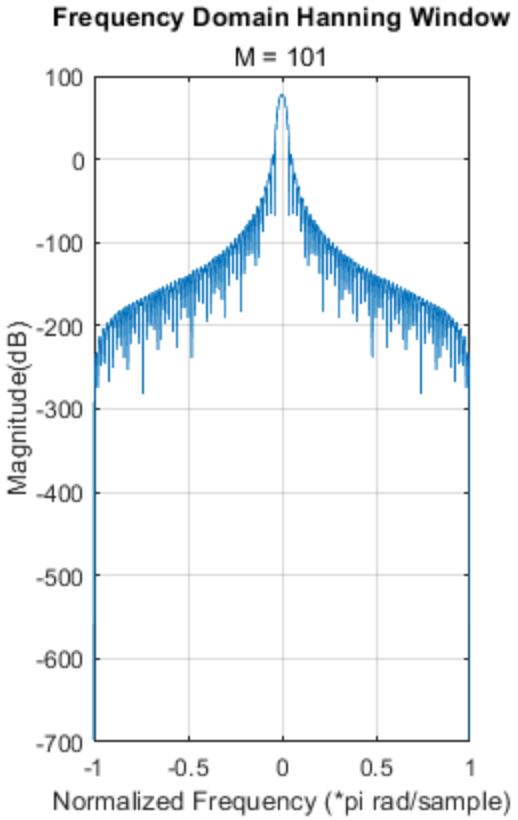

Time Domain Bartlett Window
M = 101
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
50
100

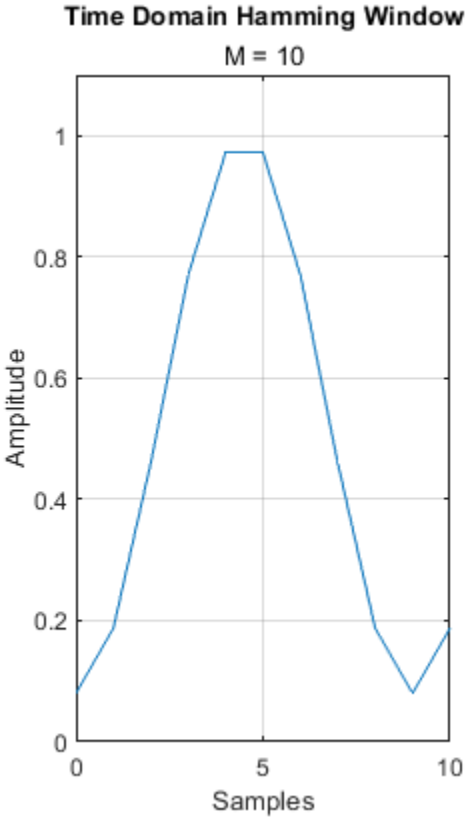

Frequency Domain Bartlett Window
M = 101
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
80
60
40
20
0
-20
-40
-60
-80
-100
-1
-0.5
0
0.5
1

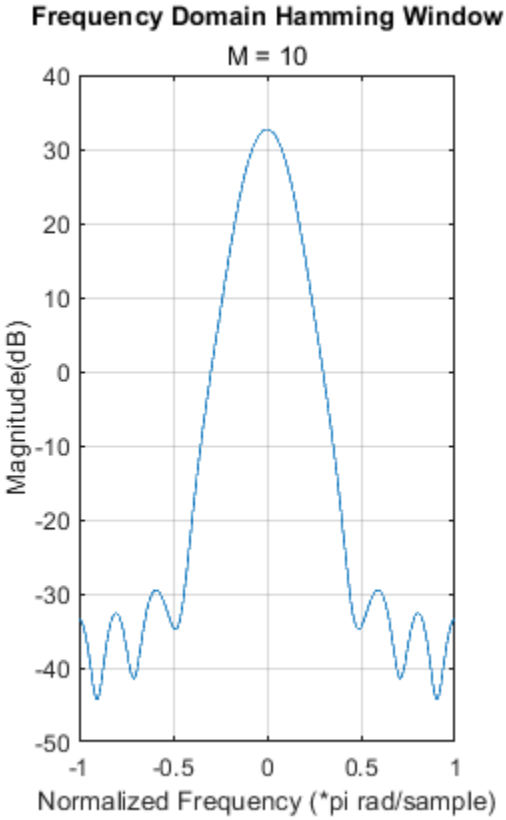

Time Domain Hanning Window
M = 10
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
5
10
Frequency Domain Hanning Window
M = 10
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-1
-0.5
0
0.5
1

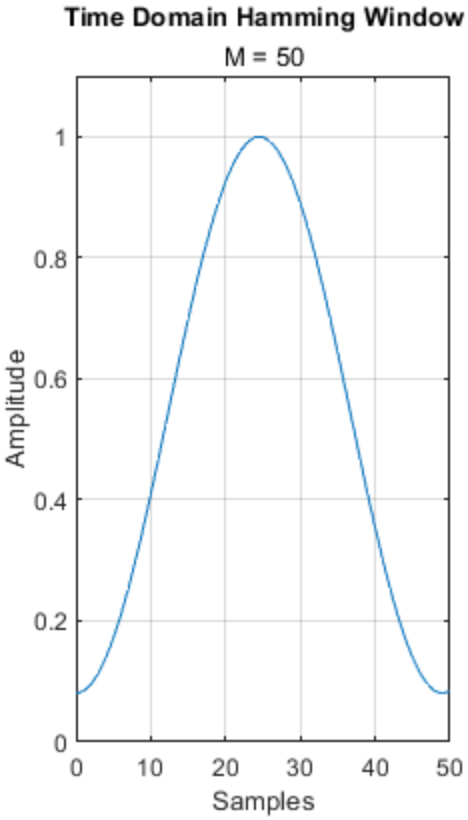

Time Domain Hanning Window
M = 50
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50
Frequency Domain Hanning Window
M = 50
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-1
-0.5
0
0.5
1

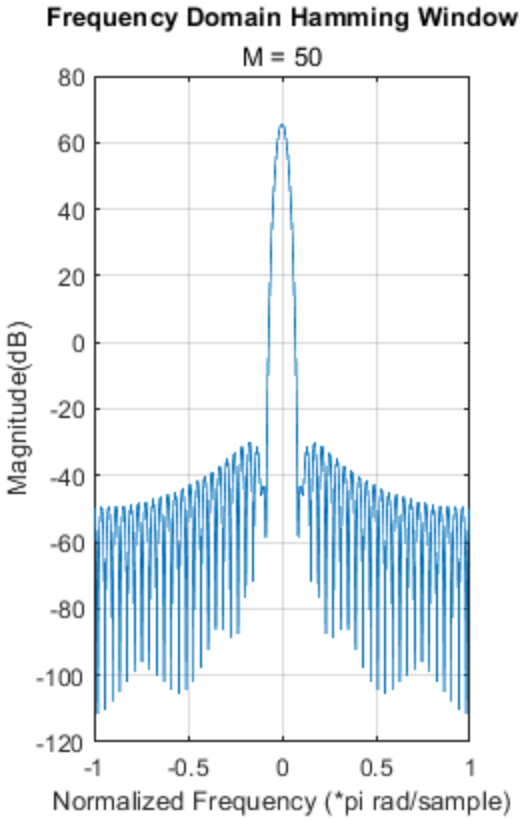

Time Domain Hanning Window
M = 101
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
50
100

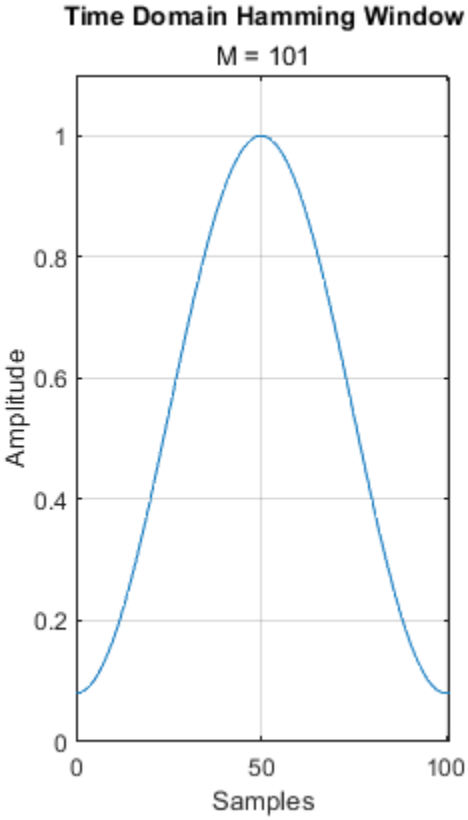

Frequency Domain Hanning Window
M = 101
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
100
0
-100
-200
-300
-400
-500
-600
-700
-1
-0.5
0
0.5
1

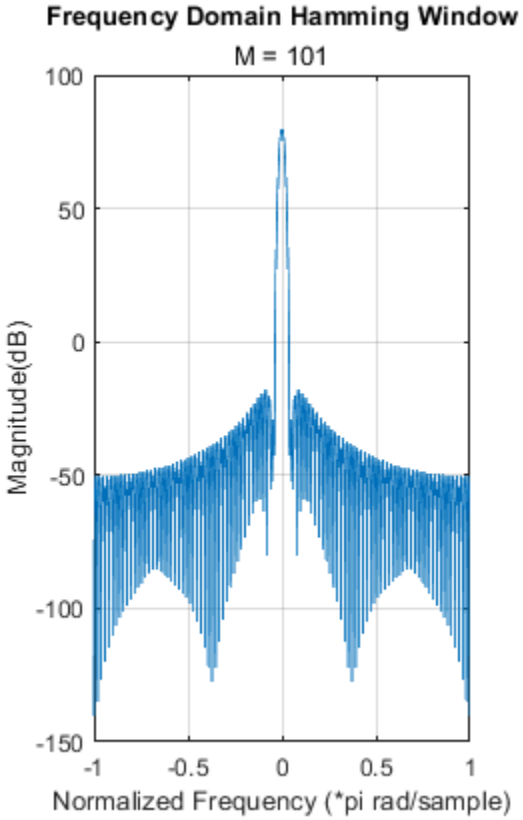

Time Domain Hamming Window
M = 10
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
5
10

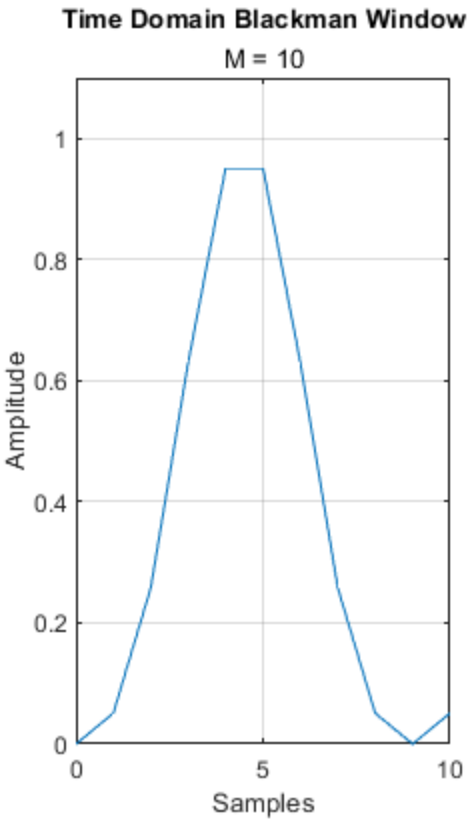

Frequency Domain Hamming Window
M = 10
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
40
30
20
10
0
-10
-20
-30
-40
-50
-1
-0.5
0
0.5
1

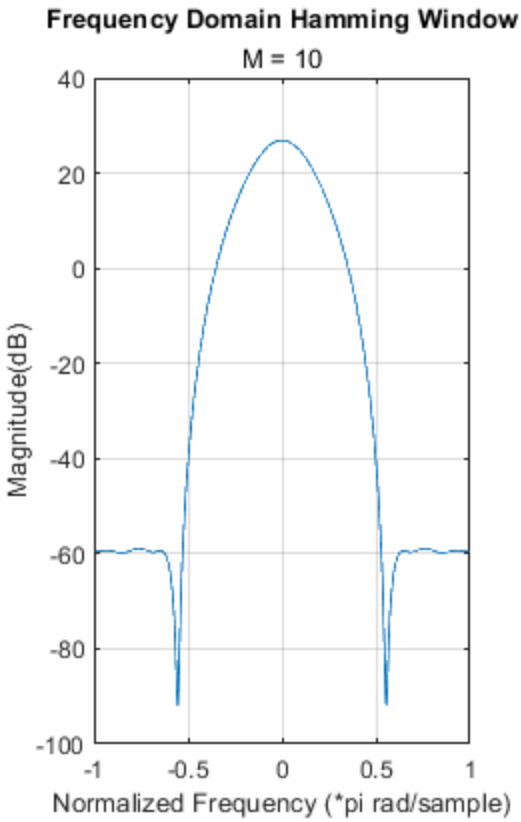

Time Domain Hamming Window
M = 50
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50

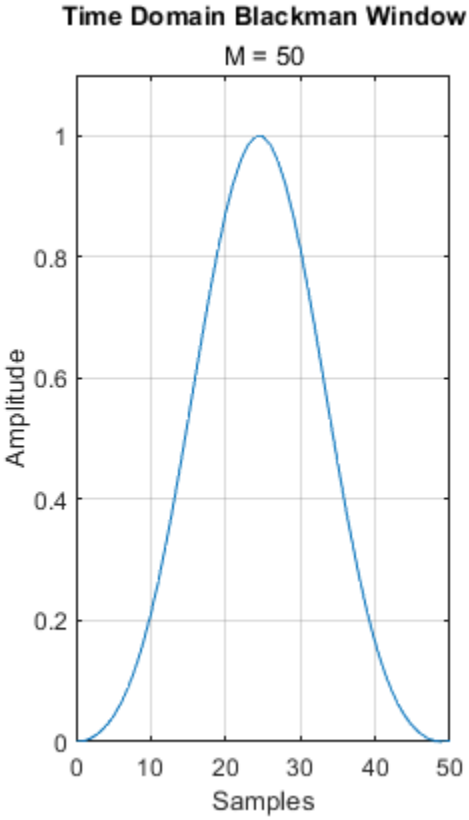

Frequency Domain Hamming Window
M = 50
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-1
-0.5
0
0.5
1

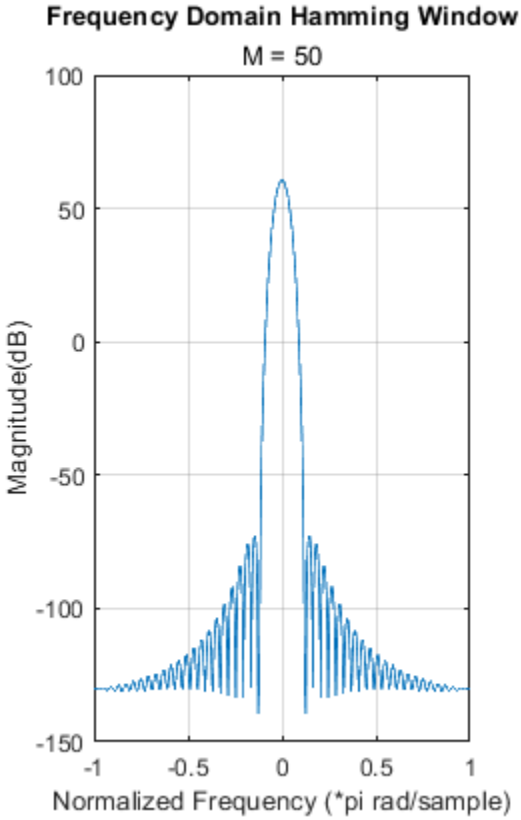

Time Domain Hamming Window
M = 101
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
50
100

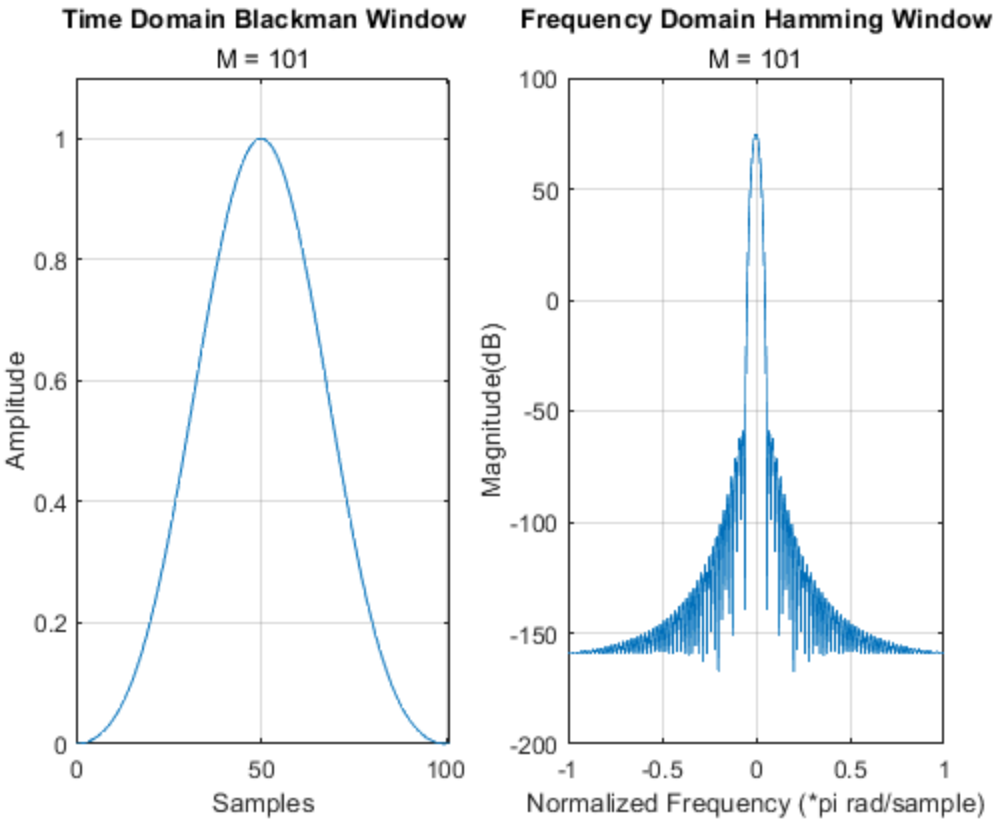

Frequency Domain Hamming Window
M = 101
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
100
50
0
-50
-100
-150
-1
-0.5
0
0.5
1


Time Domain Blackman Window
M = 10
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
5
10


Frequency Domain Hamming Window
M = 10
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
40
20
0
-20
-40
-60
-80
-100
-1
-0.5
0
0.5
1


Time Domain Blackman Window
M = 50
Amplitude
Samples
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50


Frequency Domain Hamming Window
M = 50
Magnitude(dB)
Normalized Frequency (*pi rad/sample)
100
50
0
-50
-100
-150
-1
-0.5
0
0.5
1



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