CÓDIGO MATLAB 1

% Linear phase lowpass FIR filter design using a

% rectangular window

% The ideal lowpass filter has a cutoff

% frequency of pi/4 rad

% The impulse response of the ideal LPF is

% (1/4)sin(n pi/4)/(n pi/4)

% The length-9 FIR filter is obtained by

% truncating the ideal impulse response to +- 4

% samples and shifting it to the right by 4 samples

%

clear

%Wc = pi/4;% cutoff frequency

Wc = pi/2;

N = 9; % filter length

M = (N-1)/2;

n = 0:N-1;

h = (Wc/pi)\* sinc((n-M)\*Wc/pi);% length-N impulse response

A = zeros(size(h)); A(1) = 1.0;

figure, stem(n,h,'k')

ylabel('Amplitude'), xlabel('Sample index(n)')

[H,W] = freqz(h,A,256);

figure,plot(W,20\*log10(abs(H)/max(abs(H))),'k')

ylabel('Magnitude (dB)')

xlabel('Frequency(rad)')

figure,plot(W,(180/pi)\*unwrap(angle(H)),'k')

ylabel('Phase(deg)'), xlabel('Frequency(rad)')

%

N1 = 25;

M1 = (N1-1)/2;

m = 0:N1-1;

h1 = (Wc/pi)\* sinc((m-M1)\*Wc/pi);

A1 = zeros(size(h1)); A1(1) = 1.0;

H1 = freqz(h1,A1,W);

figure, stem(m,h1,'k')

ylabel('Amplitude'), xlabel('Sample index(n)')

figure,plot(W,20\*log10(abs(H)/max(abs(H))))

hold on

plot(W,20\*log10(abs(H1)/max(abs(H1))),'r--')

hold off

ylabel('Magnitude (dB)')

xlabel('Frequency(rad)')

legend(['Length-' int2str(N)], ['Length-' int2str(N1)])

figure,plot(W,(180/pi)\*unwrap(angle(H)))

hold on

plot(W,(180/pi)\*unwrap(angle(H1)),'r--')

ylabel('Phase(deg)'), xlabel('Frequency(rad)')

legend(['Length-' int2str(N)], ['Length-' int2str(N1)])

figure,plot(W,abs(H)/max(abs(H)))

hold on

plot(W,abs(H1)/max(abs(H1)),'r')

hold off

ylabel('Magnitude')

xlabel('Frequency(rad)')

legend(['Length-' int2str(N)], ['Length-' int2str(N1)])

CÓDIGO MATLAB 2

% Design of windowed LPF with different windows

%

clear

Wc = pi/2;

%N = 17;

N = 9;

M = (N-1)/2;

n = 0:N-1;

h = (Wc/pi)\* sinc((n-M)\*Wc/pi);

%

w1 = window(@bartlett,N);

w2 = window(@hann,N);

w3 = window(@hamming,N);

w4 = window(@blackman,N);

wr = ones(N,1);% rectangular window

A = zeros(size(w1));

A(1) = 1;

[H1,Wz] = freqz(h.\*w1',A,256);

H2 = freqz(h.\*w2',A,Wz);

H3 = freqz(h.\*w3',A,Wz);

H4 = freqz(h.\*w4',A,Wz);

H5 = freqz(h.\*wr',A,Wz);

%

figure,plot(Wz,20\*log10(abs(H1)/max(abs(H1))))

hold on

plot(Wz,20\*log10(abs(H2)/max(abs(H2))),'r')

plot(Wz,20\*log10(abs(H3)/max(abs(H3))),'b--')

plot(Wz,20\*log10(abs(H4)/max(abs(H4))),'k.-')

plot(Wz,20\*log10(abs(H5)/max(abs(H5))),'m-.')

hold off

title(['Length-' int2str(N) ' windowed LP FIR filter'])

ylabel('Magnitude(dB)')

xlabel('Frequency(rad)')

legend('Bartlett', 'Haan', 'Hamming', 'Blackman', 'Rect')

CÓDIGO MATLAB 3

% Design of a LP FIR filter using

% Dolph-Chebyshev window

% The minimum stopband attenuation can be adjusted

% by changing the relative sidelobe amplitude gamma

clear

Wp = 0.3\*pi; % passband edge of LPF

Ws = 0.5\*pi; % stopband edge of LPF

a = 60; % minimum stopband attenuation

dW = Ws - Wp; % transition width;

% Filter order using Dolph-Chebyshev formula

%Ndc = ceil((2.05\*a-16.4)/(2.285\*dW));

N = 21;

w1 = chebwin(N,10);% gamma = 10 dB

w2 = chebwin(N,30); % gamma = 30 dB

A = zeros(size(w1)); A(1) = 1;

[W1,Wz] = freqz(w1,A,256);

W2 = freqz(w2,A,Wz);

figure,plot(Wz,20\*log10(abs(W1)/max(abs(W1))))

hold on

plot(Wz,20\*log10(abs(W2)/max(abs(W2))),'r')

hold off

title(['length-' int2str(N) ' Dolph-Chebyshev window'])

ylabel('Magnitude(dB)'),xlabel('Frequency(rad)')

legend('Gamma = 10 dB','Gamma = 30 dB')

%

% compute the windowed impulse response of the

% lowpass FIR filter

M = (N-1)/2; n = 0:N-1;

h1 = (Wp/pi)\* sinc((n-M)\*Wp/pi).\*w1';

h2 = (Wp/pi)\* sinc((n-M)\*Wp/pi).\*w2';

%

figure, subplot(2,1,1),stem(n,w1)

title(['Length-' int2str(N) ' Dolph-Chebyshev window'])

ylabel('Amplitude'),legend('Gamma = 10 dB')

subplot(2,1,2),stem(n,h1,'r')

title('Windowed LPF impulse response')

ylabel('Amplitude'), xlabel('Sample index(n)')

%

figure, subplot(2,1,1),stem(n,w2)

title(['Length-' int2str(N) ' Dolph-Chebyshev window'])

ylabel('Amplitude'),legend('Gamma = 30 dB')

subplot(2,1,2),stem(n,h2,'r')

title('Windowed LPF impulse response')

ylabel('Amplitude'), xlabel('Sample index(n)')

%

H1 = freqz(h1,A,Wz);

H2 = freqz(h2,A,Wz);

figure,plot(Wz,20\*log10(abs(H1)/max(abs(H1))))

hold on

plot(Wz,20\*log10(abs(H2)/max(abs(H2))),'r')

hold off

title('Freq. response of windowed LP FIR filter')

ylabel('Magnitude(dB)'),xlabel('Frequency(rad)')

legend('Gamma = 10 dB','Gamma = 30 dB')