% Carlos Lazo

% ECE 503

% Homework #8

% Due: 3/22/10

%% 2) MATLAB Programming and Filter Comparison

clear all; close all; clc;

% a. Chebyshev Filter Design & Comparison

% Design the 1st filter:

%

% N = 4 ; This is a 4th order filter

% R = 0.25 ; This is the ripple(dB) in the passband.

% Wp = ; 0 < Wp < 1.0, where the 1.0 maps to 1/2 Fs

% With Fs = 1000Hz, 1.0 maps to 500Hz.

% Wp = .35, which is the cutoff Fp (normalized)

% type = 'low'; Specying a lowpass filter.

[b1 a1] = cheby1(4,.25,.35,'low');

[H1, w1] = freqz(b1,a1,100);

h1 = real(ifft(H1));

% Design the 2nd filter:

%

% N = 4 ; This is a 4th order filter

% R = 5.00 ; This is the ripple(dB) in the passband.

% Wp = ; 0 < Wp < 1.0, where the 1.0 maps to 1/2 Fs

% With Fs = 1000Hz, 1.0 maps to 500Hz.

% Wp = .35, which is the cutoff Fp (normalized)

% type = 'low'; Specying a lowpass filter.

[b2 a2] = cheby1(4,5.0,.35,'low');

[H2, w2] = freqz(b2,a2,100);

h2 = real(ifft(H2));

figure;

subplot(2,2,1);

plot(w1,abs(H1));

xlabel('Frequency in radians');

ylabel('Magnitude');

title('Chebychev Filter #1');

grid on;

subplot(2,2,2);

stem(h1);

xlabel('Discrete-Time Index');

ylabel('Impulse Response');

title('Chebychev Filter #1');

grid on;

subplot(2,2,3);

plot(w2,abs(H2));

xlabel('Frequency in radians');

ylabel('Magnitude');

title('Chebychev Filter #2');

grid on;

subplot(2,2,4);

stem(h2);

xlabel('Discrete-Time Index');

ylabel('Impulse Response');

title('Chebychev Filter #2');

grid on;

%% 2) MATLAB Programming and Filter Comparison

clear all; close all; clc;

% b. Elliptical Filter Design & Comparison

% Design the 1st filter:

%

% N = 2 ; This is a 2nd order filter

% Rp = 1.00 ; This is the ripple(dB) in the passband

% Rs = 20 ; This is the minimum stopband attentuation (dB) passband

% Wp = .80 ; 0 < Wp < 1.0, where the 1.0 maps to 1/2 Fs.

% With Fs = 1000Hz, 1.0 maps to 500Hz.

% Wp = .80, which is the cutoff Fp (normalized).

% type = 'high'; Specying a highpass filter.

[b1 a1] = ellip(2,1,20,.8,'high');

[H1, w1] = freqz(b1,a1,25);

h1 = real(ifft(H1));

% Design the 2nd filter:

%

% N = 2 ; This is a 2nd order filter

% Rp = 0.25 ; This is the ripple(dB) in the passband

% Rs = 60 ; This is the minimum stopband attentuation (dB) passband

% Wp = .80 ; 0 < Wp < 1.0, where the 1.0 maps to 1/2 Fs.

% With Fs = 1000Hz, 1.0 maps to 500Hz.

% Wp = .80, which is the cutoff Fp (normalized).

% type = 'high'; Specying a highpass filter.

[b2 a2] = ellip(2,0.25,60,.8,'high');

[H2, w2] = freqz(b2,a2,25);

h2 = real(ifft(H2));

figure;

subplot(2,2,1);

plot(w1,mag2db(abs(H1)));

xlabel('Frequency in radians');

ylabel('Magnitude (in dB)');

title('Elliptical Filter #1 - Magnitude Response');

grid on;

subplot(2,2,2);

stem(h1);

xlabel('Discrete-Time Index');

ylabel('Impulse Response');

title('Elliptical Filter #1 - Impulse Response');

grid on;

subplot(2,2,3);

plot(w2,mag2db(abs(H2)));

xlabel('Frequency in radians');

ylabel('Magnitude (in dB)');

title('Elliptical Filter #2 - Magnitude Response');

grid on;

subplot(2,2,4);

stem(h2);

xlabel('Discrete-Time Index');

ylabel('Impulse Response');

title('Elliptical Filter #2 - Impulse Response');

grid on;