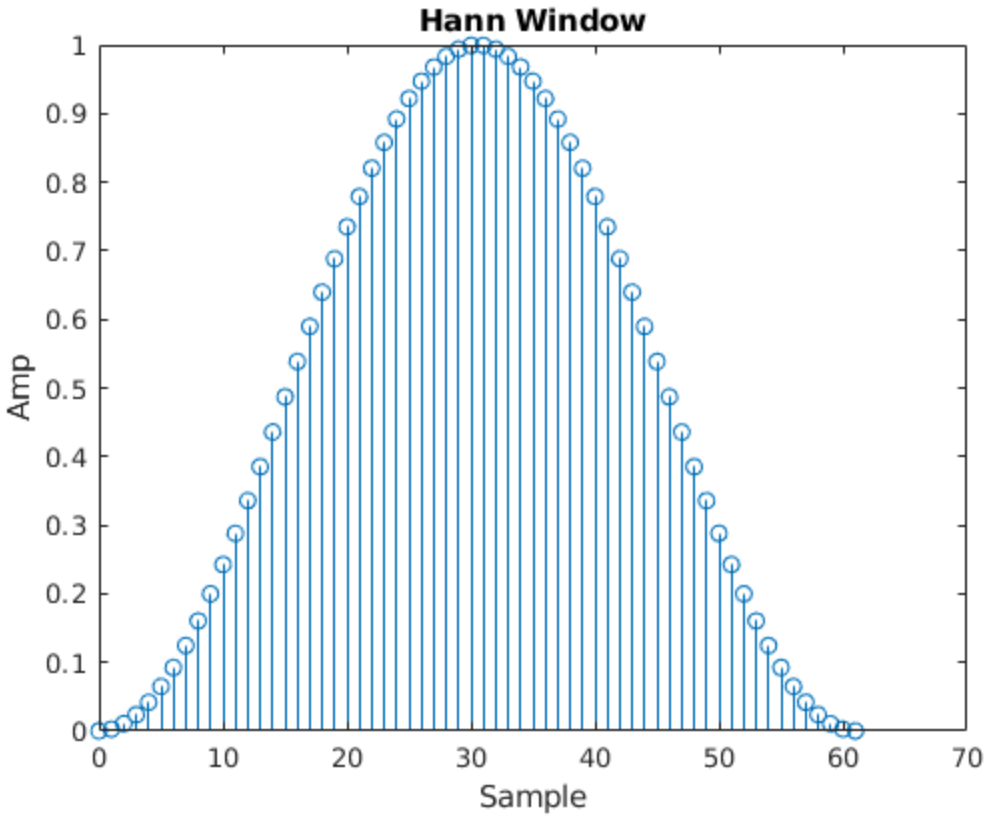
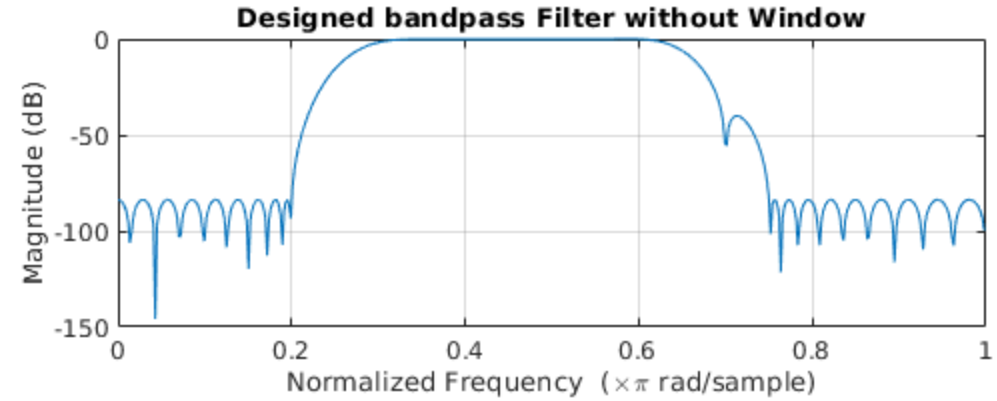
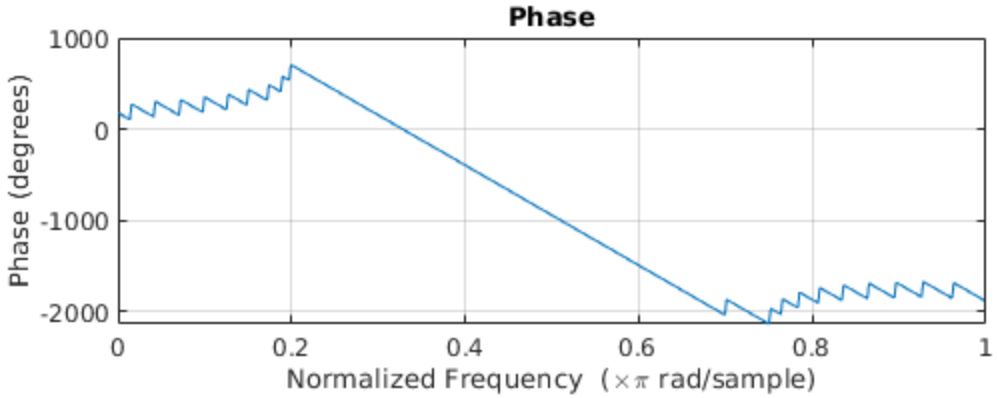
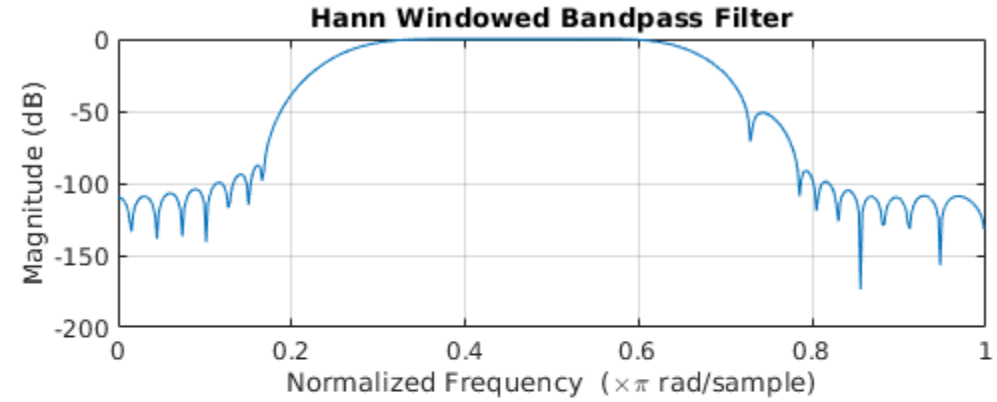
```
%!-------------------------------------------------------------------------
%! DSP HW10
%!  - Create Hann Bandpass Filter and plot
%!  - Create Hamming Bandstop Filter and plot
%!-------------------------------------------------------------------------

%!--------------------
%! #1
%!--------------------
%! Enviorment
close all; clear;
coeff = load('hw10_1coeff.mat');
L = length(coeff.Num);

%! Windowing
window = hann(L).';
filter = coeff.Num .* window;

% Plot
figure()
stem(0:L-1, window)
title('Hann Window')
ylabel('Amp')
xlabel('Sample')

figure()
freqz(coeff.Num)
title('Designed bandpass Filter without Window')

figure()
freqz(filter)
title('Hann Windowed Bandpass Filter')

%!--------------------
%! #2
%!--------------------
coeff = load('coeff2.mat');

%! Window
L = length(coeff.Num);
window = hamming(L).';
filter = coeff.Num .* window;

% Plot
figure()
stem(0:L-1, window)
title('Hamming Window')
ylabel('Amp')
xlabel('Sample')

figure()
freqz(coeff.Num)
```

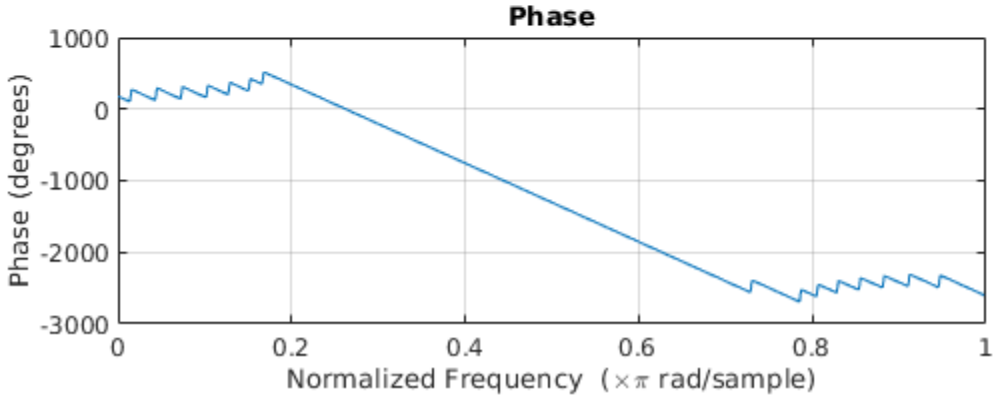
```
title('Designed Bandstop Filter without Window')

figure()
freqz(filter)
title('Hamming Windowed Bandstop Filter')
```

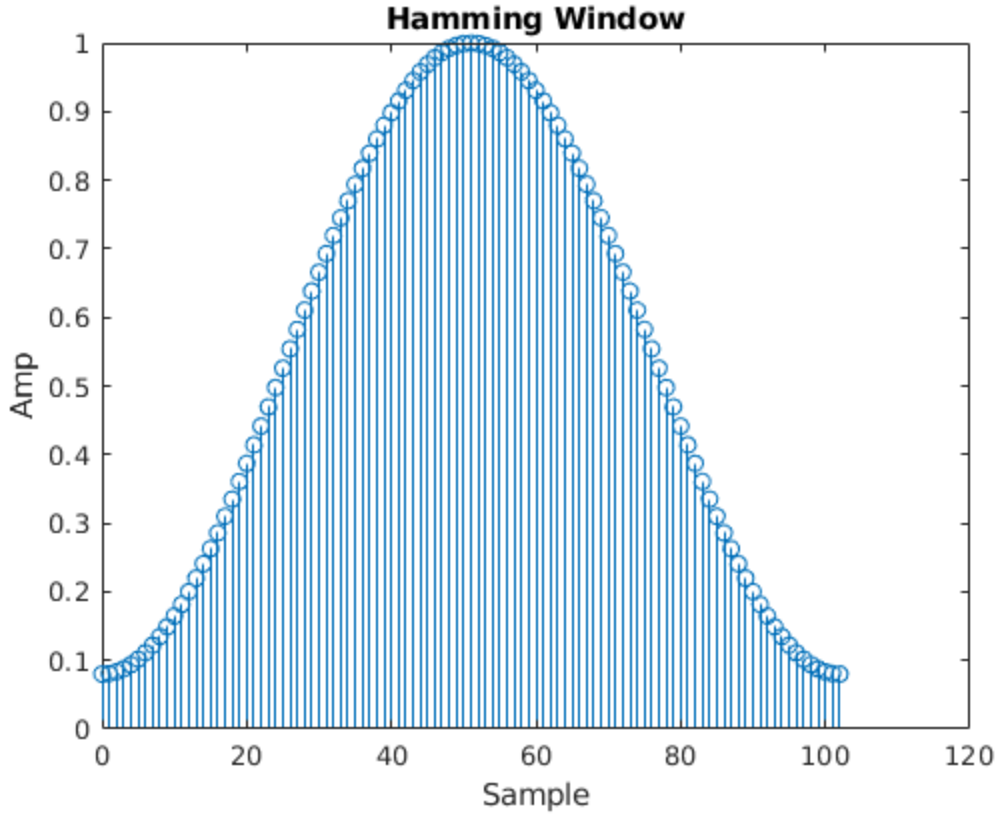


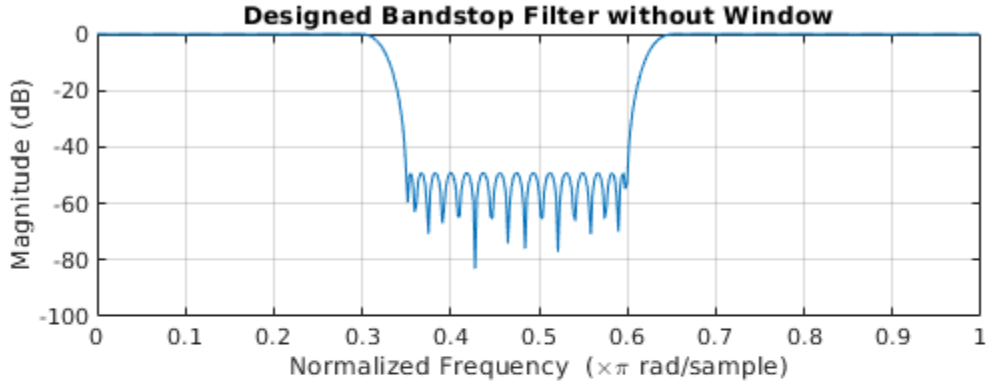

Designed bandpass Filter without Window
Magnitude (dB)
0
-50
-100
-150
0
0.2
0.4
0.6
0.8
1
Normalized Frequency (×π rad/sample)

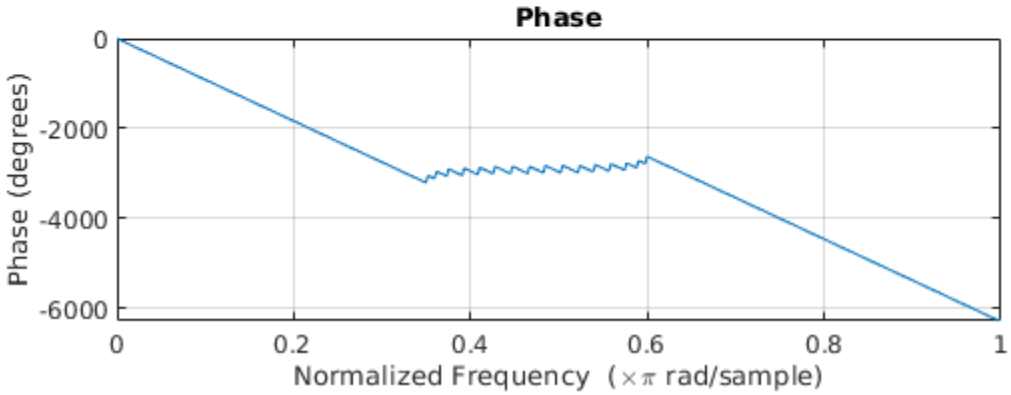

Phase
Phase (degrees)
1000
0
-1000
-2000
0
0.2
0.4
0.6
0.8
1
Normalized Frequency (×π rad/sample)

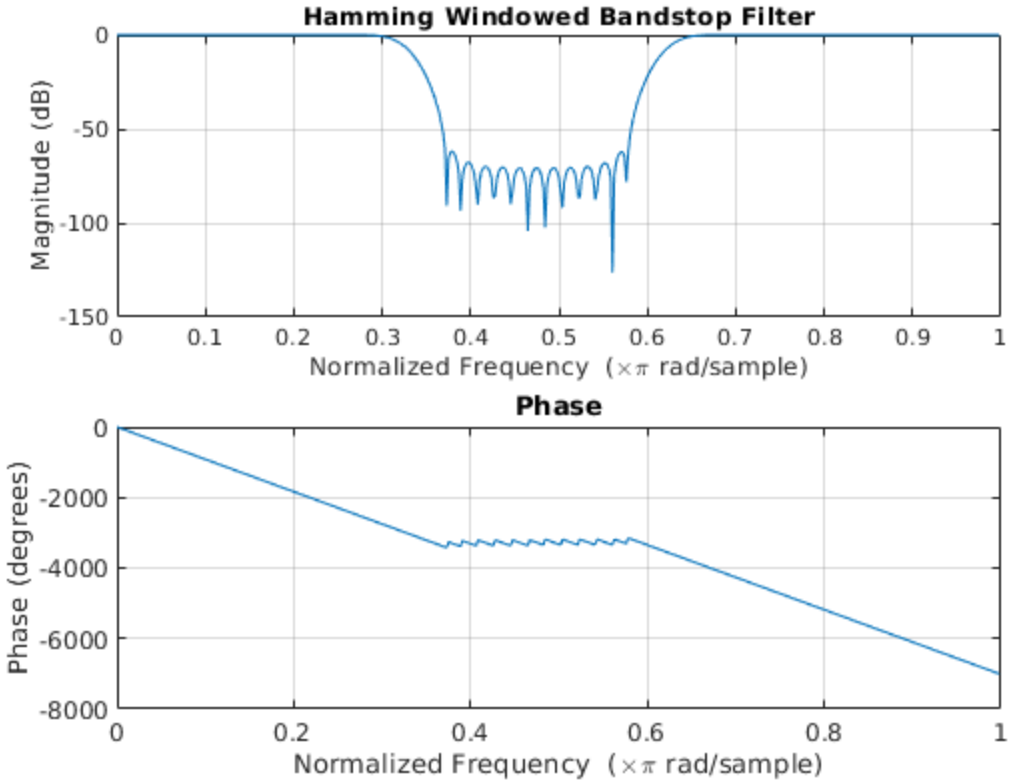

Hann Windowed Bandpass Filter
Magnitude (dB)
0
-50
-100
-150
-200
0
0.2
0.4
0.6
0.8
1
Normalized Frequency (×π rad/sample)


Phase
Phase (degrees)
1000
0
-1000
-2000
-3000
0
0.2
0.4
0.6
0.8
1
Normalized Frequency (×π rad/sample)


Hamming Window
Amp
Sample
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
20
40
60
80
100
120


Designed Bandstop Filter without Window
Magnitude (dB)
Normalized Frequency (×π rad/sample)
0
-20
-40
-60
-80
-100
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Phase
Phase (degrees)
Normalized Frequency (×π rad/sample)
0
-2000
-4000
-6000
0
0.2
0.4
0.6
0.8
1



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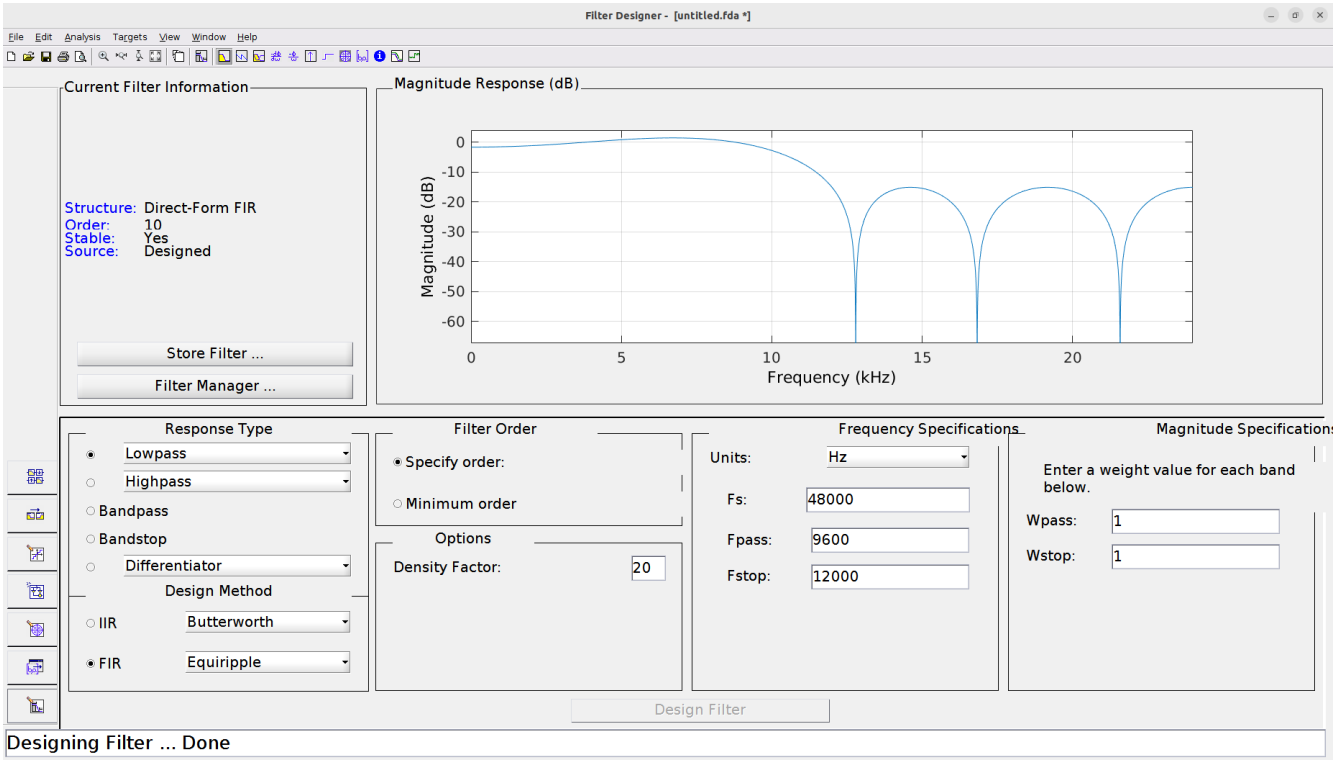
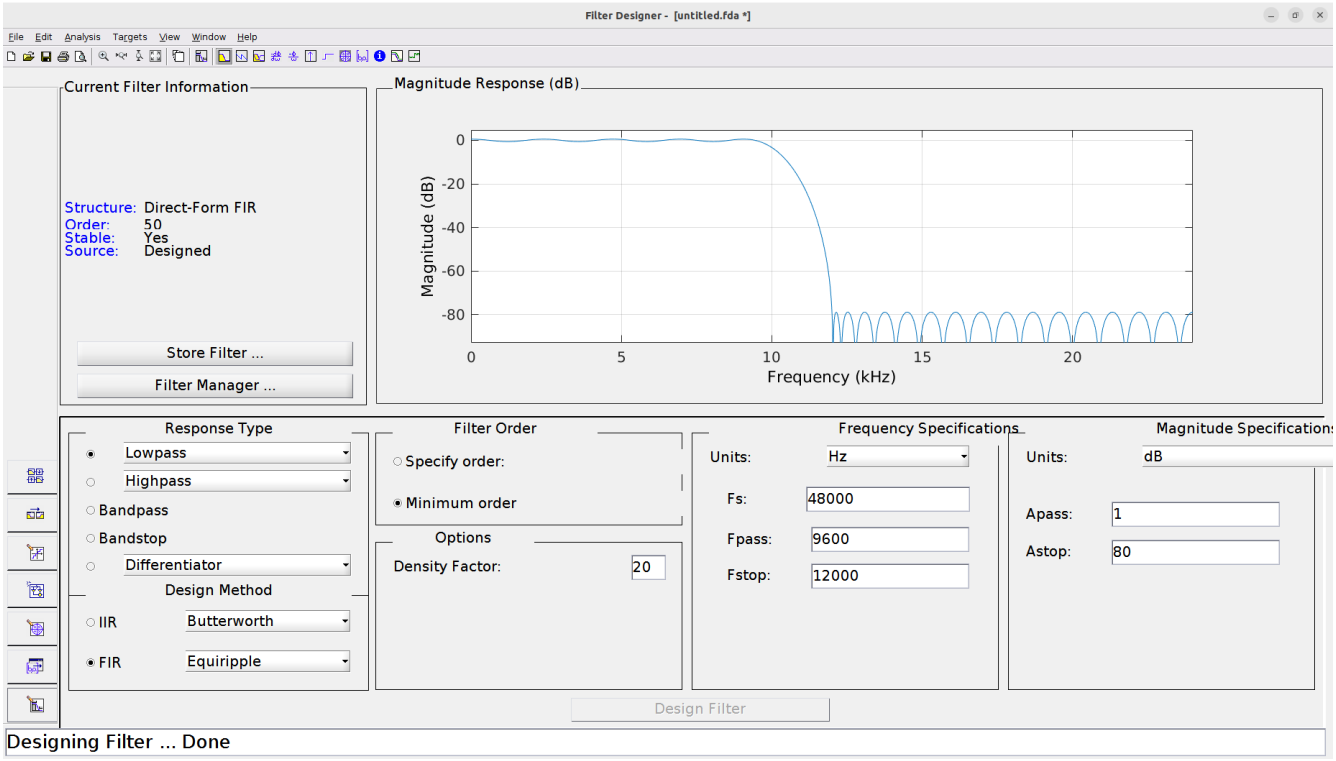
DSP HW10

3) Why are second order sections important in filters?

There are a couple reasons why second order sections are important in filter design. The biggest reason is that when using second order sections the filter is more resilient to finite values and quantization. It also uses less resources than the direct form.

4)
This is a low pass filter with an order of 10.

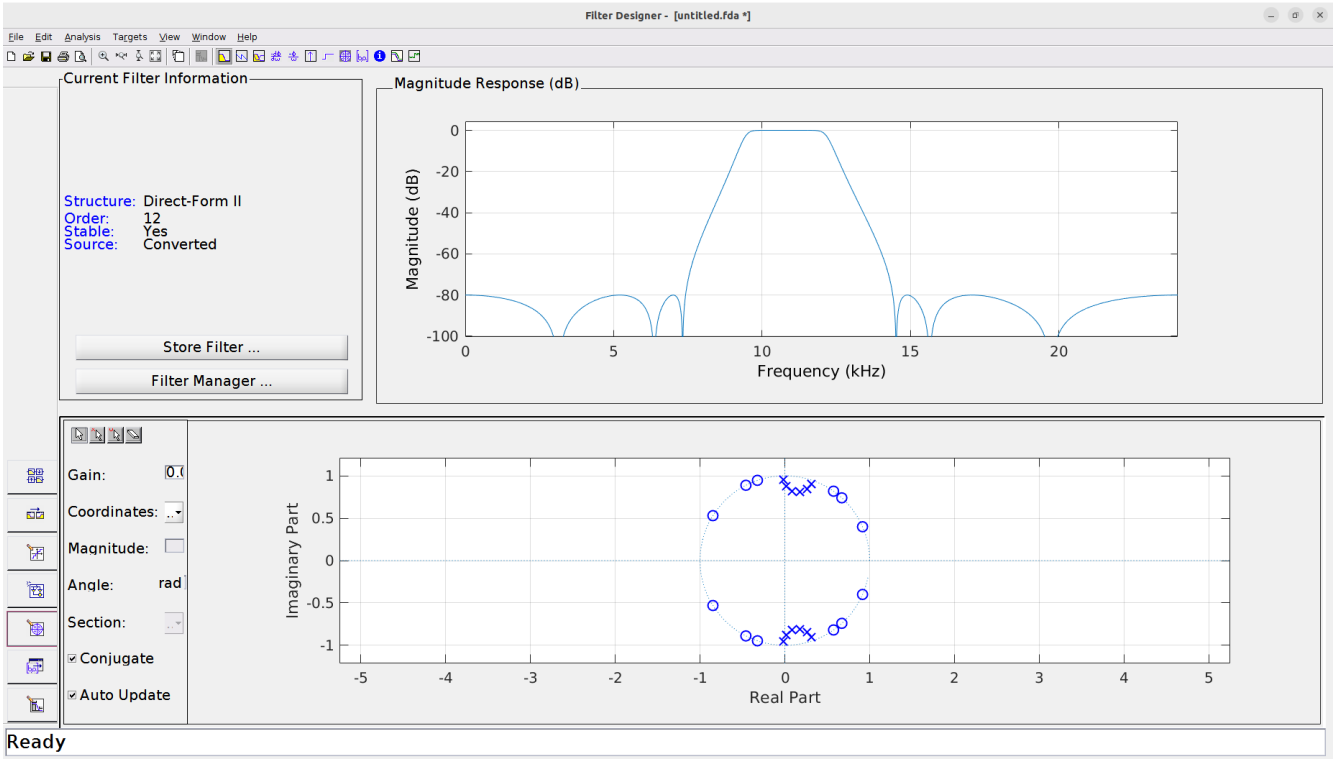




This is the same filter with an order of 50. As you can see the passband ripple is much smaller and the attenuation in the stop band is much higher. Another plus to having more orders is the faster dropoff in the transition band.

5)

This I had to do a little different because for some reason my matlab gui was having issues opening the quantization panel. I exported the coefficients from the original filter and then rounded the values using round(). I then imported them back into filterDesigner and plotted the frequency response.



Stable.

Unstable