Digital Signal Processing LAB
Lab Assignment - 7

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Question 2

• **Approach:** Here, I have taken N = 4, low cut off frequency = 0.3pi , high cutoff frequency = 0.6pi , ripple = 0.11, Time = 0.1 . Then I have found sampling frequency. Then I calculated bandwidth and center frequency . After that I have used cheby1 to find transfer function coefficients. Then using that coefficients and centre frequency and bandwidth I converted it from lowpass to bandpass filter. Then converted analog bandpass to digital filter by impinvar and then plotted zeros and poles and frequency response. Now for N = 2, I have find the co-efficients from handwritten analysis and plotted its frequency response and zeros and poles.

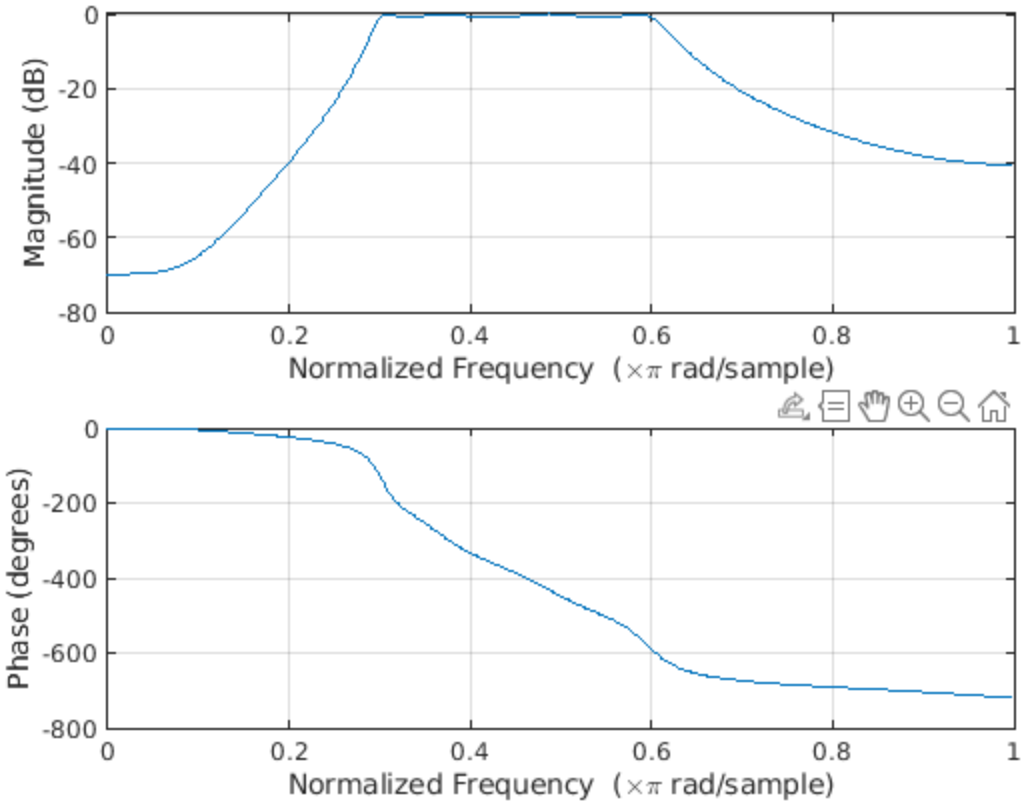
• **Code:**

```
clear all;
close all;
clc;

N = 4;
low_freq = 0.3*pi; % Low cutoff frequency
high_freq = 0.6*pi; % High cutoff frequency
ripple = 0.11; % Ripple
Time = 0.1; % Sampling Time
sampling_frequency = 1/Time; % Sampling frequency

Wo = sqrt(low_freq*high_freq)/Time; % Center frequency

Bw = (high_freq - low_freq)/Time; % Bandwidth

Rp = -20*log10(1-ripple); % Converting ripple to dB
```

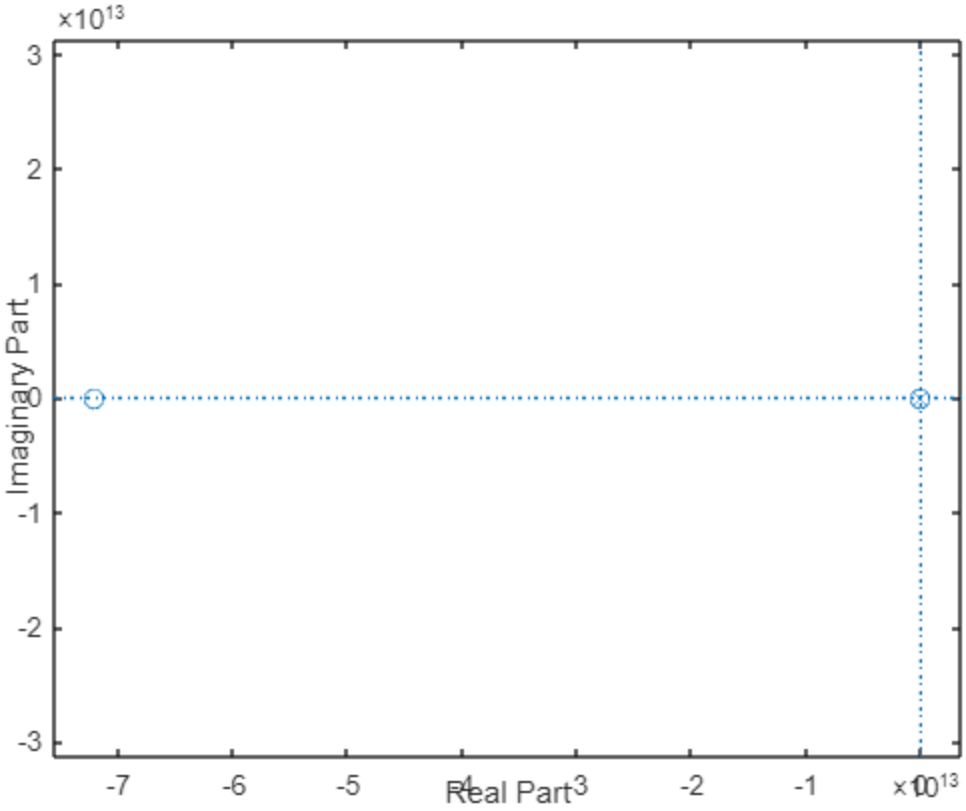
```
[b,a] = cheby1(N,Rp,1,'s'); % Returns transfer function co-efficients

[bt,at] = lp2bp(b,a,Wo,Bw); % Transform analog filter lowpass filter into bandpass
filter

[bz,az] = impinvar(bt,at,sampling_frequency); % Converting from analog to digital

figure;
freqz(bz,az); % frequency response for N = 4

figure;
zplane(bz,az); % zeros and poles for N = 4

figure;
% frequency response for N = 2
freqz([0 1.7952 -5.293 2.4429], [1 -0.6454 0.901 -0.2692 0.3576]);

figure;
% zeros ane poles for N = 2
zplane([0 1.7952 -5.293 2.4429], [1 -0.6454 0.901 -0.2692 0.3576]);
```

- **Result:**

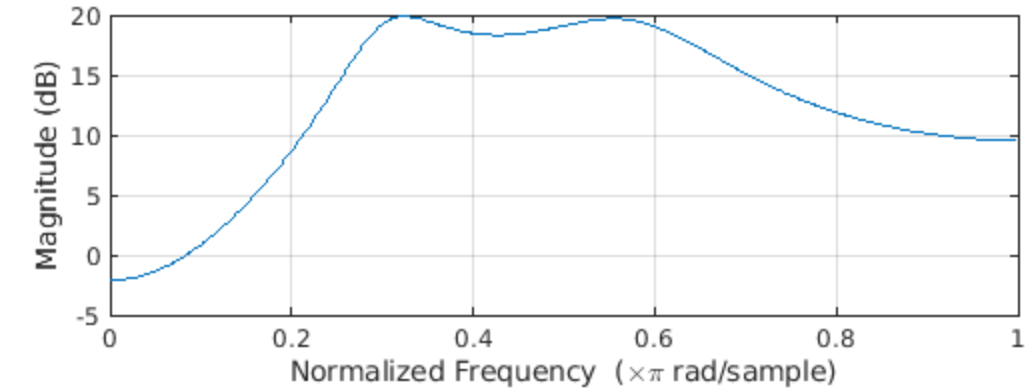
  ➔ Frequency Response for N = 4

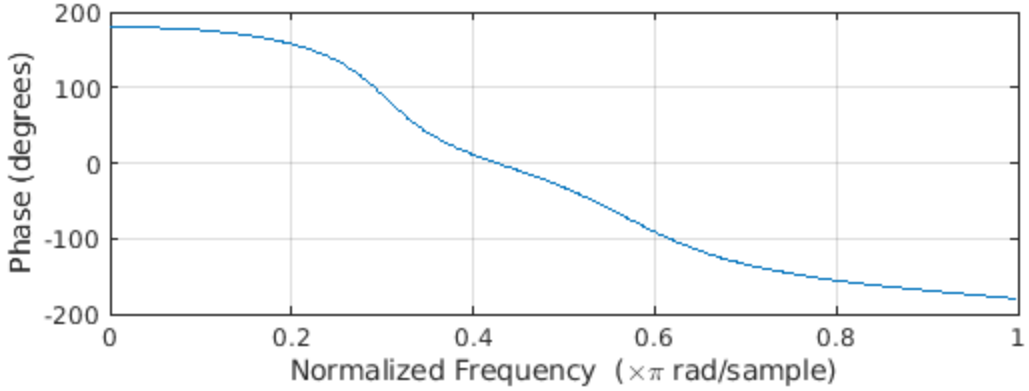


➔ Zeros and Poles for N = 4

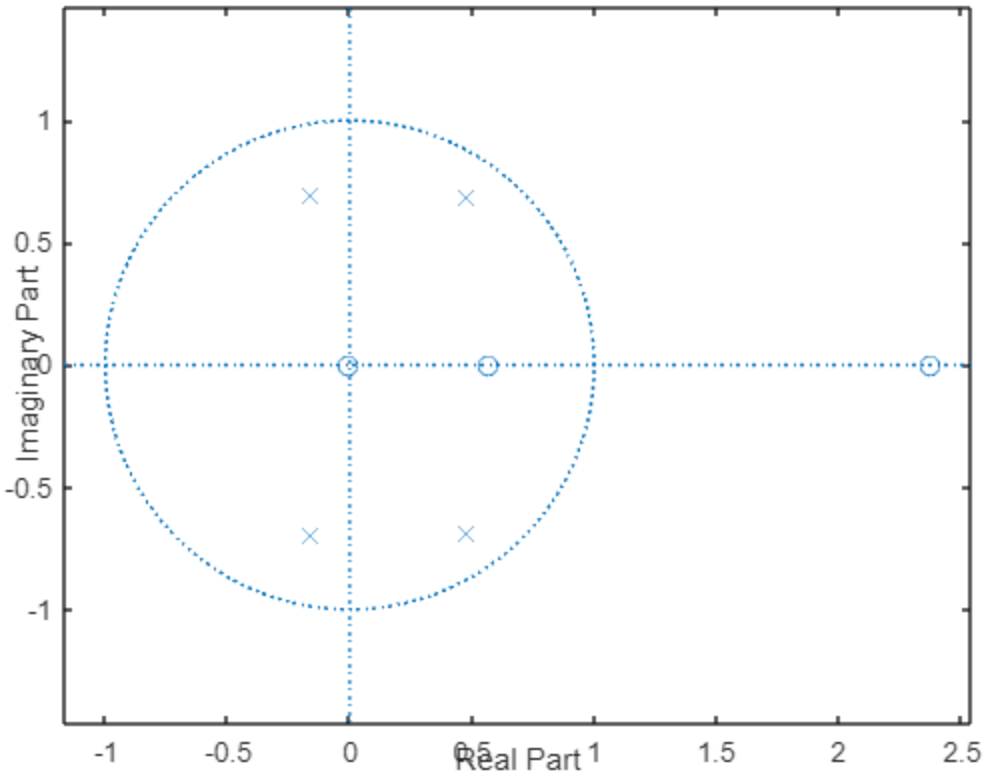


➔ Frequency Response for N = 2





➔ Zeros and Poles for N = 2


1
0.5
0
-0.5
-1
Imaginary Part
-1
-0.5
0
0.5
1
1.5
2
2.5
Real Part