DSP2 Week 5 experiment Report

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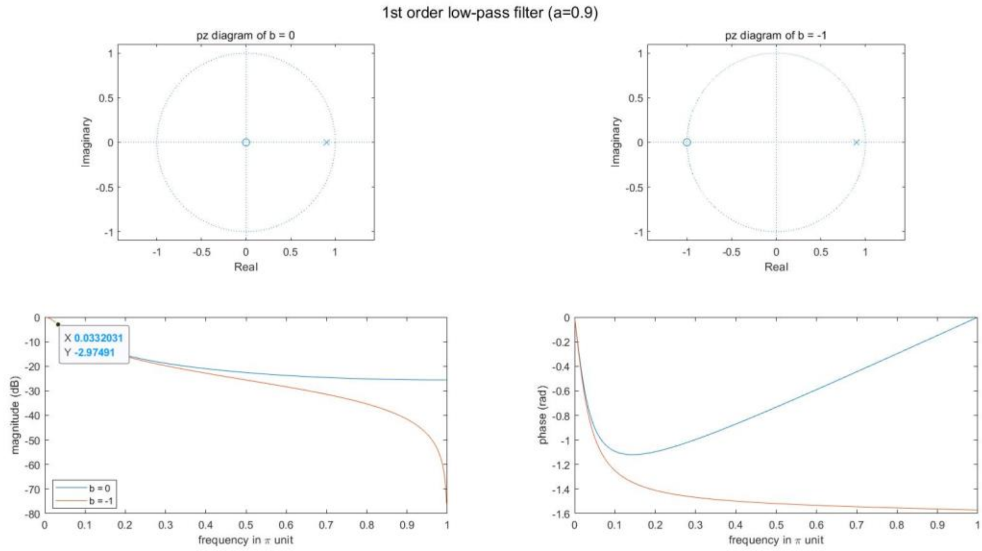
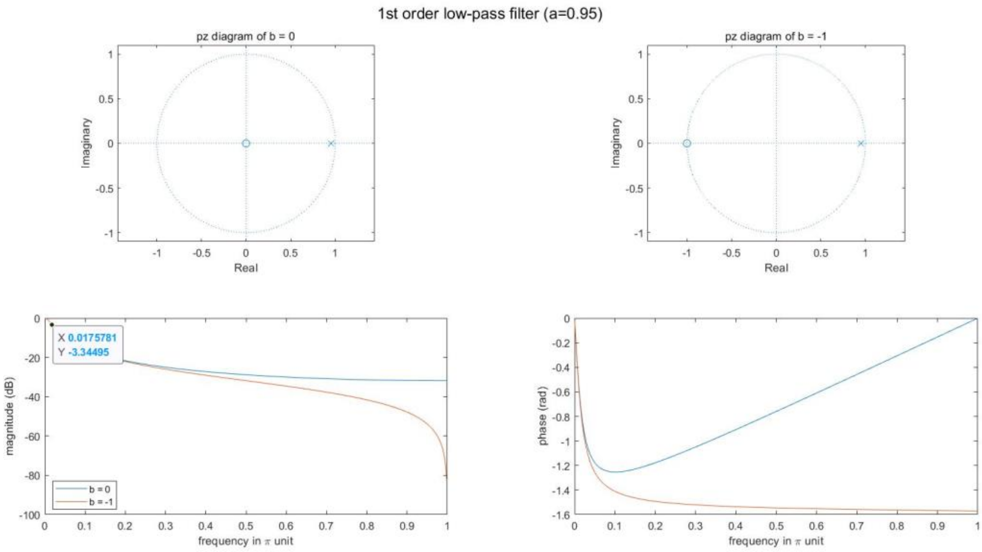
*All source codes are attached.

EXERCISE 1

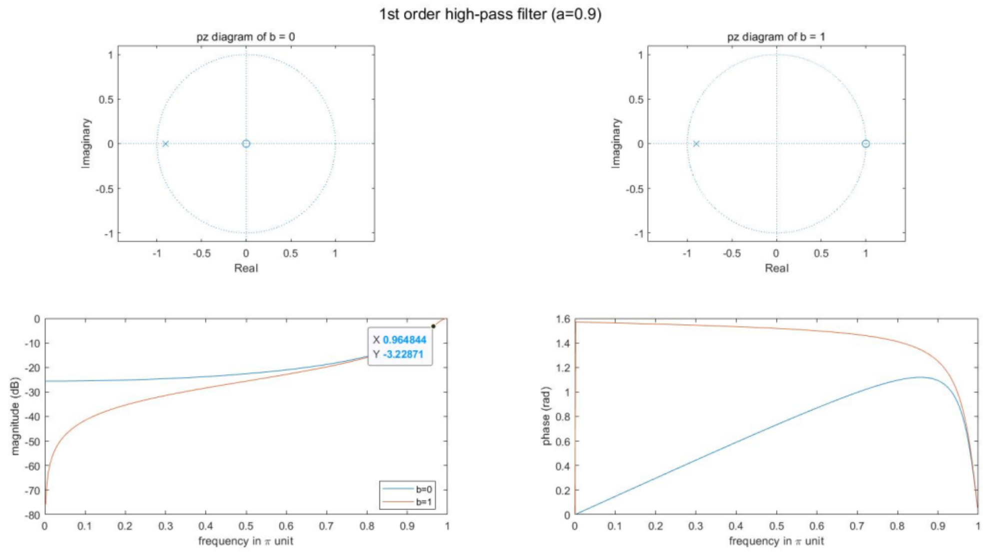
1. 1st order low-pass filter

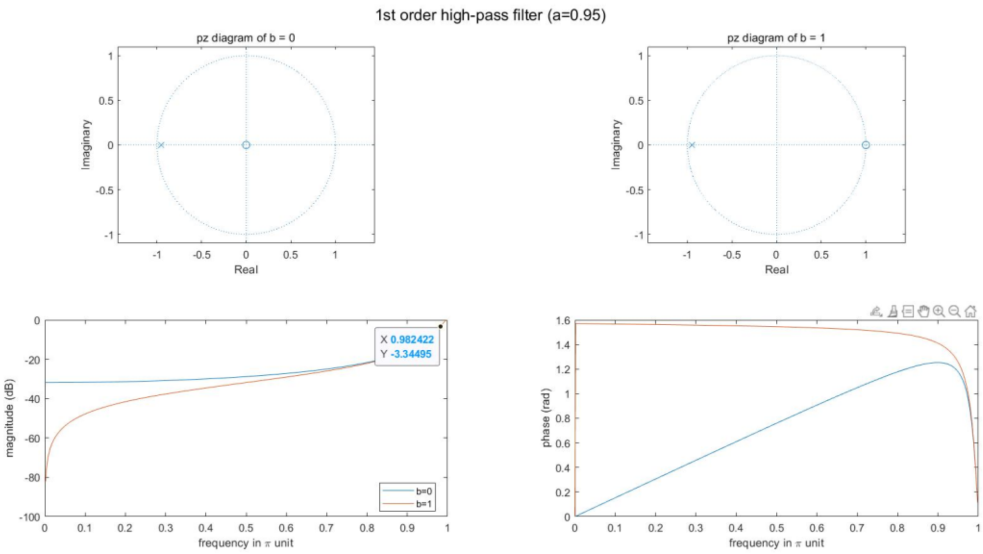




- Gain: G1 = (1-a/exp(j*0)) / (1-b(1)/exp(j*0));
  => G is the number in which H becomes 1 when 0 is put in the omega.
- Because these are the low-pass filter, they have high magnitude and rapid phase change around 0 frequency. When comparing *a*=0.9 and *a*=0.95, the more *a* gets closer to 1, the more sharpen the graphs become. The cut-off frequency of *a*=0.95 is way closer to 0 than that of *a*=0.9.
- When the zero is on the high frequency region (*b*=-1), the high frequency components are more attenuated than when the zero is on the origin.

2. 1st order high-pass filter



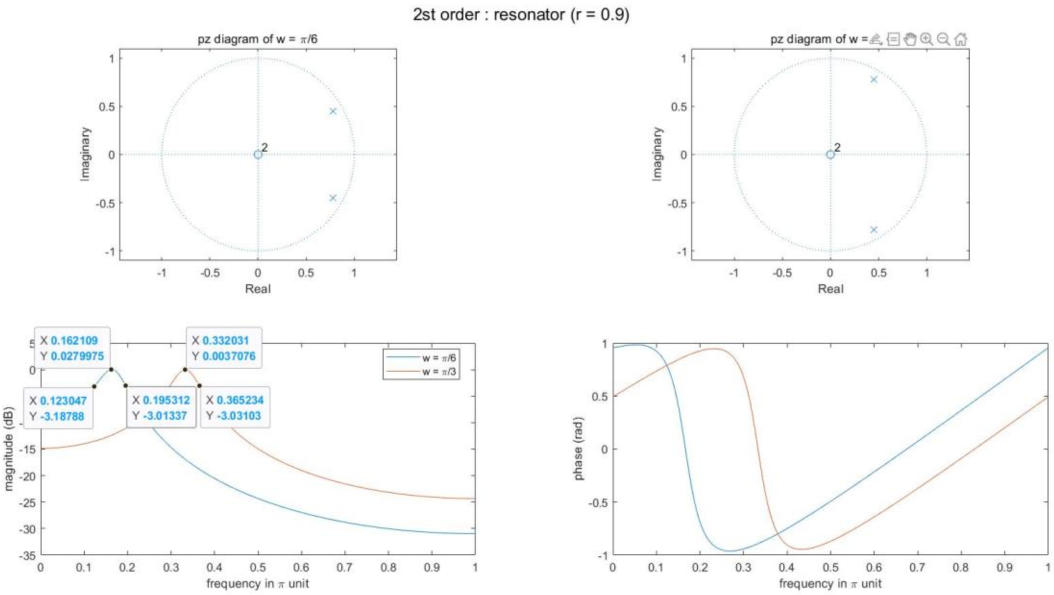


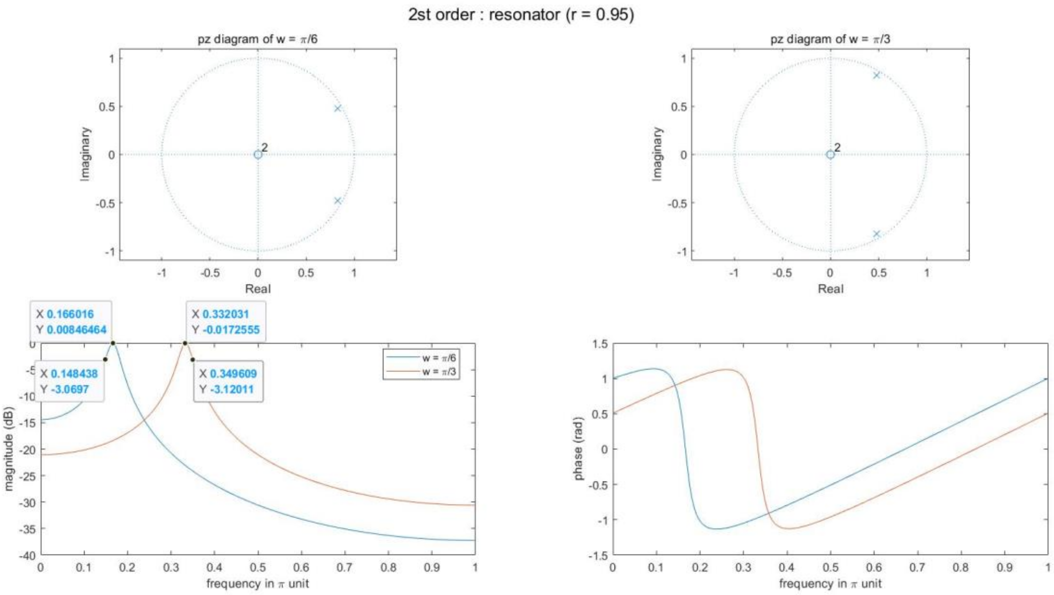
- Gain: G1 = (1-a/exp(j*pi)) / (1-b(1)/exp(j*pi));

  => G is the number in which H becomes 1 when pi is put in the omega.
- Because these are the high-pass filter, they have high magnitude and rapid phase change around pi. When comparing *a*=0.9 and *a*=0.95, the more *a* gets closer to 1, the more sharpen the graphs become. The cut-off frequency of *a*=0.95 is way closer to pi than that of *a*=0.9.
- When the zero is on the low frequency region (*b*=1), the low frequency components are more attenuated than when the zero is on the origin.

EXERCISE 2

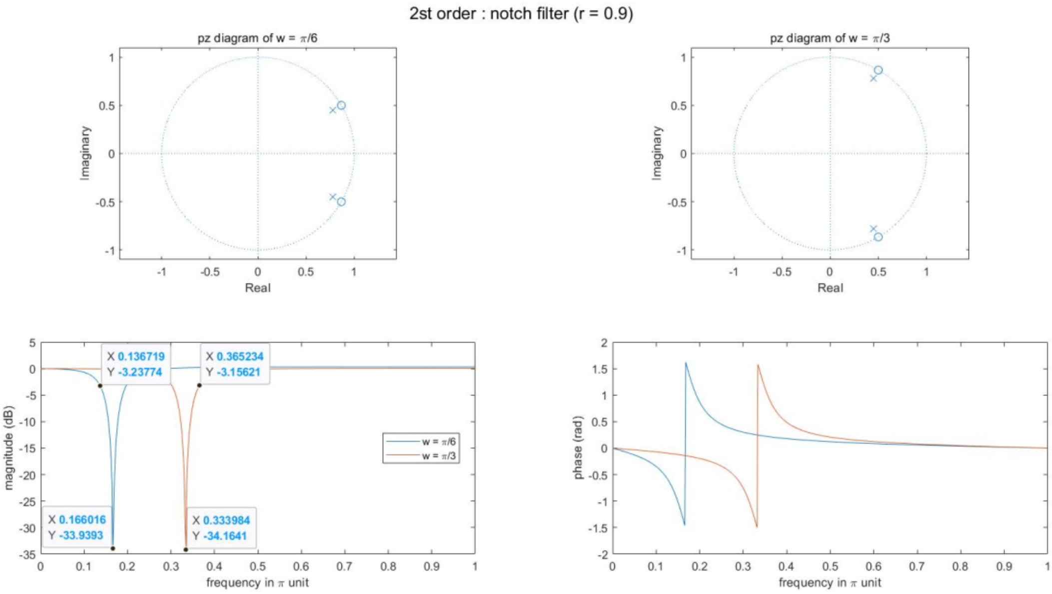
1. Resonator

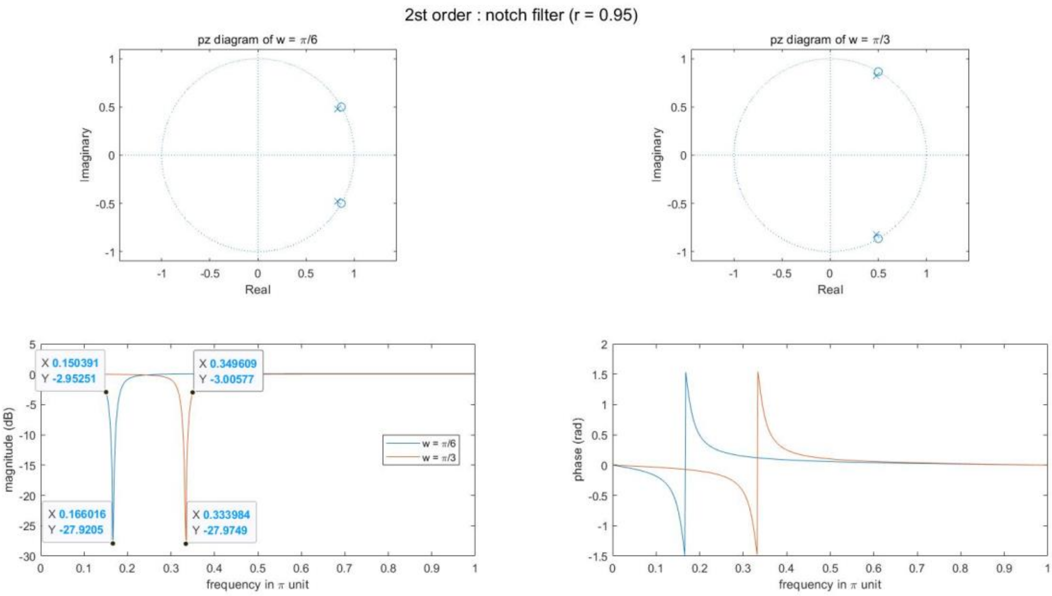




- Gain: G1 = 1 -2*r*cos(w0)/z + (r*r)/(z*z);
  => G is the number in which H becomes 1 when the frequency is the frequency of interest. (w0=pi/6 or pi/3)
- Because these are the band-pass filter, they have high magnitude and rapid phase change around interested frequencies, pi/6 and pi/3. When comparing *a*=0.9 and *a*=0.95, the more *a* gets closer to 1, the more sharpen the graphs become. The cut-off frequency of *a*=0.95 is way closer to the peak frequency than that of *a*=0.9.
- pi/6 is 1/6(=0.16666...) in pi unit, which is similar to the x data of the peak of w=pi/6. Also, pi/3 is 1/3(=0.33...) in pi unit, which is similar to the x data of the peak of w=pi/3.

2. Notch filter





- Gain: G1 = 1 -2*r*cos(0)/z + (r*r)/(z*z);
  => G is the number in which H becomes 1 when the frequency is 0.
- Because these are the band-stop filter, they have extremely low magnitude and rapid phase change around interested frequencies, pi/6 and pi/3. When comparing *a*=0.9 and *a*=0.95, the more *a* gets closer to 1, the more sharpen the graphs become. The cut-off frequency of *a*=0.95 is way closer to the peak frequency than that of *a*=0.9.
- pi/6 is 1/6(=0.16666...) in pi unit, which is similar to the x data of the peak of w=pi/6. Also, pi/3 is 1/3(=0.33...) in pi unit, which is similar to the x data of the peak of w=pi/3.