EECS 360 Lab 12

Z-Transform

The bilateral or two-sided Z-transform of a discrete-time signal x[n] is the function X(z) defined as

$$X(z) = Z\{x[n]\} = \sum_{n=-\infty}^{\infty} x[n] z^{-n}$$

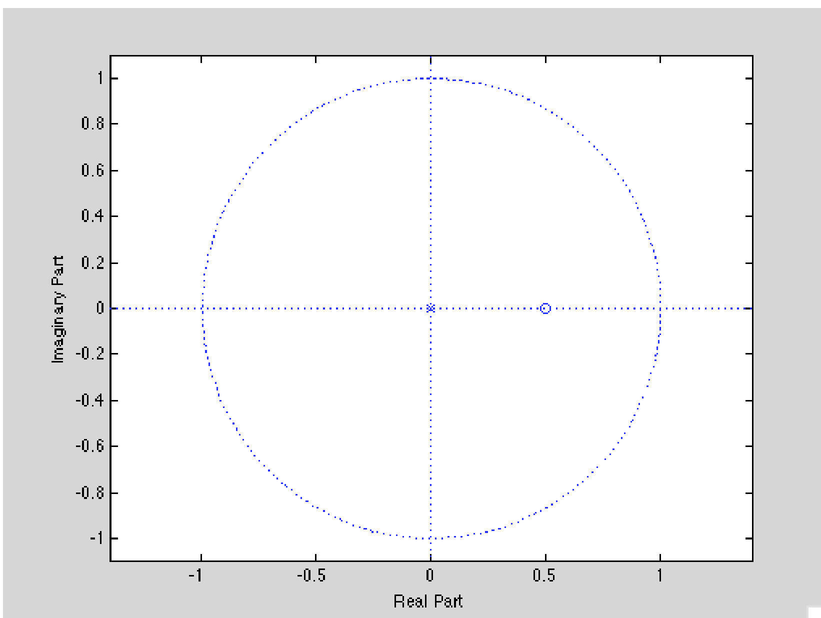
Let $x[n] = 0.5^n u[n]$. Expanding on the interval $(-\infty, \infty)$, it becomes

$$x[n] = \left\{ \ldots, 0.5^{-3}, 0.5^{-2}, 0.5^{-1}, 1, 0.5^{1}, 0.5^{2}, 0.5^{3}, \ldots \right\}$$

Looking at the sum

$$\sum_{n=-\infty}^{\infty} x[n] z^{-n} = \sum_{n=0}^{\infty} 0.5^n z^{-n} = \sum_{n=0}^{\infty} \left(\frac{0.5}{z} \right)^n = \frac{1}{1 - 0.5 z^{-1}}$$

Using Matlab function *zplane* to generate the pole-zero diagram



First, follow the same procedure as lab 11 (Laplace transform) to generate the pole-zero diagram, and then plot the magnitude and phase of the system using *freqz* function for the following system functions:

1. $H(z) = \dfrac{z+1}{z^2 - 0.9z + 0.81}$

2. $H(z) = \dfrac{2z^2 + 5z + 12}{z^2 + 2z + 10}$

3. $H(z) = \dfrac{2z^2 + 5z + 12}{(z^2 + 2z + 10)(z + 2)}$

4. $H(z) = \dfrac{z^2 + 0.49z + 0.7}{(z + 0.4)(z + 0.33)(z - 0.75)}$

Note: for your lab report, you only have to provide your Matlab code and figures generated for those four system functions (4 pole-zero diagrams and 4 frequency responses).