ICE503 DSP-Homework#11

1. The convolution of discrete-time system with an impulse response h[n] is given by:

$$y[n] = \sum_{k=-\infty}^{\infty} h[k]x[n-k],$$

   derive the z-transforms of transfer function $Y(z) = H(z)X(z)$ step by step.

2. A causal linear time-invariant system has the system function

$$H(z) = \frac{(1 - 1.5z^{-1} - z^{-2})(1 + 0.9z^{-1})}{(1 - z^{-1})(1 + 0.7jz^{-1})(1 - 0.7jz^{-1})}$$

   (a) Write the difference equation that characterizes the system with $x[n]$ and $y[n]$.

   (b) Plot the pole-zero diagram and indicate the region of convergence for the system function.

3. Matlab Simulation

   Separate the following information in frequency.

$$x[n] = A\cos(\omega 1n) + B\cos(\omega 2n)$$

   with construct $H(e^{j\omega})$

$$H(e^{j\omega}) = \begin{cases} |H(e^{j\omega_1})| & \sim & 1, \\ |H(e^{j\omega_2})| & \sim & 0, \end{cases}$$

   Where $\omega_1 = 0.1$ and $\omega_2 = 0.4$. Consideer a 3 pt FIR filters with $h[n] = \{\alpha \ \beta \ \alpha\}$. Sketch the frequency response and compare the output signal with input signals.