ICE503 DSP-Homework#13

1. We know that any rational system can be expressed as

$$H(\mathrm{z}) = H_{\min}(z)H_{\mathrm{ap}}(z),$$

Where $H_{\min}(z)$ is minimum phase system and $H_{\mathrm{ap}}(z)$ is an all-pass system. For each of the following system, please specify and plot pole and zero for the $H_{\min}(z)$, $H_{\mathrm{ap}}(z)$ and make sure $|H(z)| = |H_{\min}(z)|$.

(a) $H_1(z) = \frac{(1+3z^{-1})}{1+\frac{1}{2}z^{-1}}$

(b) $H_2(z) = \frac{(1+\frac{3}{2}e^{\frac{j\pi}{4}}z^{-1})(1+\frac{3}{2}e^{\frac{-j\pi}{4}}z^{-1})}{1+\frac{1}{3}z^{-1}}$

2. Consider the causal LTI system with the system function

$$H(z) = \frac{D - Mz^{-1}}{(C - Hz^{-1} + Iz^{-2})(A + Nz^{-1})},$$

Where $\mathrm{C} = 1, \mathrm{H} = \frac{1}{2}, I = \frac{1}{3}, A = 1, N = \frac{1}{4}, D = 1, M = \frac{1}{5}$.

(a) Draw the signal flow graphs in each of the following.

I. Direct form I

II. Direct form II

III. Cascade form with first- and second-order sections of direct form II

IV. Parallel form with first- and second-order sections of direct form II

V. Transposed direct form I

VI. Transposed direct form I

(b) Write the different each for the flow graph of (a)-VI, and show this system has the correct system function.

3. Matlab simulation

(a) Use matlab fvtool to plot and analyze the system 1.(a), $H_1(z), H_{1,\min}(z)$ *and* $H_{1,\mathrm{AP}}(z)$, respectively.

(b) Use matlab fvtool to plot and analyze comb filter of $H_1(z)$ for $\mathrm{L} = 4$.