ECE 348: Digital Signal Processing Lab, Spring 2023

Instructor: Dr.Yuqian Zhang

TA: Ashwini Subramanian, Spilios Evmorfos

General Instructions: Please submit a written report in the pdf format within 2 weeks of your lab session. The report must describe the purposes of the experiments, the methods used, including all graphs and Matlab code. The reports must be uploaded to Canvas within the allotted time frame.

LAB – 2

Problem 1 (CP 3.5)**.** A causal LTI system is characterized by the difference equation

$$y(n) = y(n-1) + y(n-2) + 2x(n) + x(n-1)$$

(a) Determine the system function $H(z)$.

(b) Plot the poles and zeros of $H(z)$ and indicate the region of convergence (ROC).

(c) From $H(z)$, determine the impulse response $h(n)$ of the system.

(d) Compute and plot $h(n)$ obtained from part (c) for $0 \leq n \leq 50$, and compare this result with the impulse response that is computed from the difference equation for $0 \leq n \leq 50$.

Problem 2 (CP 3.6)**.** Consider the LTI systems described by the system function

$$H_1(z) = \frac{1 + z^{-1} + z^{-2}}{1 + \frac{1}{2}z^{-1} - \frac{1}{4}z^{-2}}$$

$$H_2(z) = \frac{1}{1 - \frac{1}{4}z^{-1}} + \frac{1 - \frac{1}{2}z^{-1}}{1 + 2z^{-1}}$$

Note that these systems are stable. Determine (a) the impulse responses $h_1(n)$ and $h_2(n)$, and (b) the difference equation representations. Plot the poles and zeros of $H_1(z)$ and $H_2(z)$. Determine and plot their outputs $y_1(n)$ and $y_2(n)$ when the input is $x(n) = 3cos(\pi n/3)u(n)$. Compare the two outputs and comment on similarities and differences.