

Homework Assignment #5

1. Are the following systems BIBO stable? Justify your answer.

- (a) $(E^2+3E+2)y(k) = x(k)$ (b) $(10E^2+3E+2)y(k) = (E-2)\{x(k)\}$
 (c) $(E^2+1.2E+0.2)y(k) = x(k)$ (d) $(E^3+3E^2+3E+1)y(k) = (E^2-0.1E)\{x(k)\}$

2. (a) Plot the impulse response and the step response of the discrete-time system whose operational transfer function is

$$H_1(E) = \frac{E}{E - 0.5}.$$

(b) Plot the impulse response and the step response of the discrete-time system whose operational transfer function is

$$H_2(E) = \frac{E^4 + 0.5E^3 + 0.25E^2 + 0.125E + 0.0625}{E^4}.$$

3. Find the simulation diagrams and transfer functions of the systems having the following impulse responses:

- (a) $h(k) = \begin{cases} 1, & k = 2 \\ 0, & k \neq 2 \end{cases}$ (b) $h(k) = \begin{cases} 1, & k \geq 0 \\ 0, & k < 0 \end{cases}$
 (c) $h(k) = \begin{cases} 1, & k \geq 1 \\ 0, & k < 1 \end{cases}$ (d) $h(k) = \begin{cases} 1, & k \geq 2 \\ 0, & k < 2 \end{cases}$
 (e) $h(k) = \begin{cases} 1, & k = 1 \\ -2, & k = 2 \\ 3, & k = 3 \\ 0 & \text{otherwise} \end{cases}$

2. Use a convolutional sum to find the zero-state response of an LTI system to a unit step sequence if the system impulse response is

- (a) $h(k) = \begin{cases} 1, & k \geq 0 \\ 0, & k < 0 \end{cases},$ (b) $h(k) = \begin{cases} 1, & k = 1 \\ -2, & k = 2 \\ 3, & k = 3 \\ 0 & \text{otherwise} \end{cases},$

- (c) $h(k) = \begin{cases} (0.9)^k, & k \geq 0 \\ 0, & k < 0 \end{cases}.$ [Ans: $y(k) = 10 - 9(0.9)^k, k = 0, 1, 2, \dots$]