Homework #10: ECE 461/661

Unstable Systems, z-Transform, Converting G(s) to G(z) Due Wednesday, November 14, 2018

Unstable Systems

Problem 1: Assume

$$G(s) = \left(\frac{200}{(s-2)(s+5)(s+10)(s+15)} \right)$$

Design a which results in the closed-loop system having

- 20% overshoot for a step input.
- No error for a step input, and
- A 2% settling time of 2 seconds

- Design an op-amp circuit to implement K(s)
- Determine the dominant poles of the closed-loop system
- Plot the step response of the closed-loop system using VisSim (or similar program)

z-Transform and Converting G(s) to G(z)

Problem 2: Given the following system

$$G(s) = \left(\frac{200}{(s+2)(s+5)(s+10)(s+15)} \right)$$

a) Determine a discrete-time system, G(z), which has approximately the same step response as G(s). Assume a sampling rate of 100ms

b) Plot the step response of G(s) and G(z) using VisSim (or similar program)

c) Write a program (c-like or matlab-like) to implement G(z)

Problem 3: Given the following system

$$G(s) = \left(\frac{200}{(s^2+2s+10)(s+10)} \right)$$

a) Determine a discrete-time system, G(z), which has approximately the same step response as G(s). Assume a sampling rate of 100ms

b) Plot the step response of G(s) and G(z) using VisSim (or similar program)

c) Write a program (c-like or matlab-like) to implement G(z)

Problem 4: Given the following feedback controller

$$K(s) = 6\left(\frac{(s+2)(s+5)}{s(s+20)} \right)$$

a) Determine a discrete-time system, K(z), which has approximately the same step response as K(s). Assume a sampling rate of 100ms

b) Plot the step response of K(s) and K(z) using VisSim (or similar program)

c) Write a program (c-like or matlab-like) to implement K(z)