ECE 461/661 - Homework Set #11

Root Locus in the z-plane - Due Monday, November 21st
20 points per problem

A 4th-order model for the 10-stage RC filter from homework #6 is

$$G(s) \approx \left(\frac{22}{(s+10.2)(s+5.539)(s+2.181)(s+0.4234)} \right)$$

Assume a sampling rate of 0.1 second (T = 0.1);

1) Gain Compensation: Design a digital compensator

$$K(z) = k$$

which results in 20% overshoot for a step input. For this value of K(z), give

- The resulting closed-loop dominant pole
- The step response of the closed-loop system.

2) Lead Compensation: Design a digital compensator

$$K(z) = k\left(\frac{z-a}{z-b} \right)$$

which results in 20% overshoot for a step input. For this value of K(z), give

- The resulting closed-loop dominant pole(s)
- The step response of the closed-loop system, and

3) I Compensation: Design a digital compensator

$$K(z) = k\left(\frac{z}{z-1} \right)$$

which results in 20% overshoot for a step input. For this value of K(z), give

- The resulting closed-loop dominant pole(s)
- The step response of the closed-loop system, and

4) PI Compensator: Designa digital compensator

$$K(z) = k\left(\frac{z-a}{z-1} \right)$$

which results in 20% overshoot for a step input. For this value of K(z), give

- The resulting closed-loop dominant pole(s)
- The step response of the closed-loop system, and