Homework #10: ECE 461/661

Root locus in the z-plane. Digital PID Control

Problem 1-3) Assume a sampling rate of 100ms (T = 0.1).

$$G(s) = \left(\frac{20}{(s+0.5)(s+2)(s+5)} \right)$$

Digital P Control: K(z) = k

1) Design a digital P controller (gain compensation) which results in 20% overshoot in the step response.

Provide the following

- Closed-loop poles in the s-plane
- Closed-loop poles in the z-plane
- The step response of the closed-loop system

note: For the step response, you may need ot use Simulink or use numerical integration with matlab.

Digital I Control: $K(z) = k\left(\frac{z}{z-1} \right)$

2) Design a digital P controller (gain compensation) which results in 20% overshoot in the step response.

Provide the following

- Closed-loop poles in the s-plane
- Closed-loop poles in the z-plane
- The step response of the closed-loop system

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

3) Design a digital PI controller (gain compensation) which results in 20% overshoot in the step response.

Provide the following

- Closed-loop poles in the s-plane
- Closed-loop poles in the z-plane
- The step response of the closed-loop system

Digital PID Control: $K(z) = k\left(\frac{(z-a)(z-b)}{z(z-1)} \right)$

4) Design a digital PID controller (gain compensation) which results in 20% overshoot in the step response.

Provide the following

- Closed-loop poles in the s-plane
- Closed-loop poles in the z-plane
- The step response of the closed-loop system