# Homework #10: ECE 461/661

z-Transforms, s to z conversion, Root Locus in the z-Domain. Due Monday, November 7th

## z-Transforms

1) Determine the difference equation that relates X and Y

$$Y = \left( \frac{0.05z}{(z-0.9)(z-0.8)(z-0.5)} \right) X$$

2) Determine y(k) assuming

$$Y = \left( \frac{0.05z}{(z-0.9)(z-0.8)(z-0.5)} \right) X \qquad x(t) = 5\cos(2t) + 2\sin(2t)$$

$$T = 0.01$$

3) Determine y(k) assuming

$$Y = \left( \frac{0.05z}{(z-0.9)(z-0.8)(z-0.5)} \right) X \qquad x(k) = u(k)$$

## s to z conversion

3) Determine the discrete-time equivalent of G(s). Assume T = 0.1 seconds

4) Determine the discrete-time equivalent of G(s). Assume T = 0.01 seconds

$$G(s) = \left( \frac{903}{(s+0.81)(s+5.20)(s+13.59)(s+25.25)} \right)$$

## Root Locus in the z-Domain

Assume T = 0.1 seconds.

$$G(s) = \left( \frac{903}{(s+0.81)(s+5.20)(s+13.59)(s+25.25)} \right)$$

5) Draw the root locus for G(z)

6) Find k for no overshoot in the step response

- Simulate the closed-loop system's step response

7) Find k for 20% overshoot for a step response (damping ratio = 0.4559)

- Simulate the closed-loop system's step response

8) Find k for a damping ratio of 0.00

- Simulate the closed-loop system's step response