# Homework #10: ECE 461/661

z-Transforms, s to z conversion, Root Locus in the z-Domain. Due Monday, November 10th

## z-Transforms

1) Determine the difference equation that relates X and Y

$$Y = \left( \frac{0.005z}{(z-0.98)(z-0.95)(z-0.8)} \right) X$$

2) Determine y(k) assuming

$$Y = \left( \frac{0.005z}{(z-0.98)(z-0.95)(z-0.8)} \right) X \qquad x(t) = 2\cos(3t) + 4\sin(3t)$$

$$T = 0.1$$

3) Determine y(k) assuming

$$Y = \left( \frac{0.005z}{(z-0.98)(z-0.95)(z-0.8)} \right) X \qquad x(k) = u(k)$$

## s to z conversion

4) Determine the discrete-time equivalent of G(s). Assume T = 0.5 second

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

$$G(s) = \left( \frac{170}{(s+0.47)(s+3.40)(s+9.00)(s+16.77)} \right)$$

## Root Locus in the z-Domain

Assume T = 0.1 seconds.

$$G(s) = \left( \frac{170}{(s+0.47)(s+3.40)(s+9.00)(s+16.77)} \right)$$

6) Draw the root locus for G(z)

7) Find k for no overshoot in the step response

- Simulate the closed-loop system's step response

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

- Simulate the closed-loop system's step response

9) Find k for a damping ratio of 0.00

- Simulate the closed-loop system's step response