ECE 461/661 - Test #3: Name _____

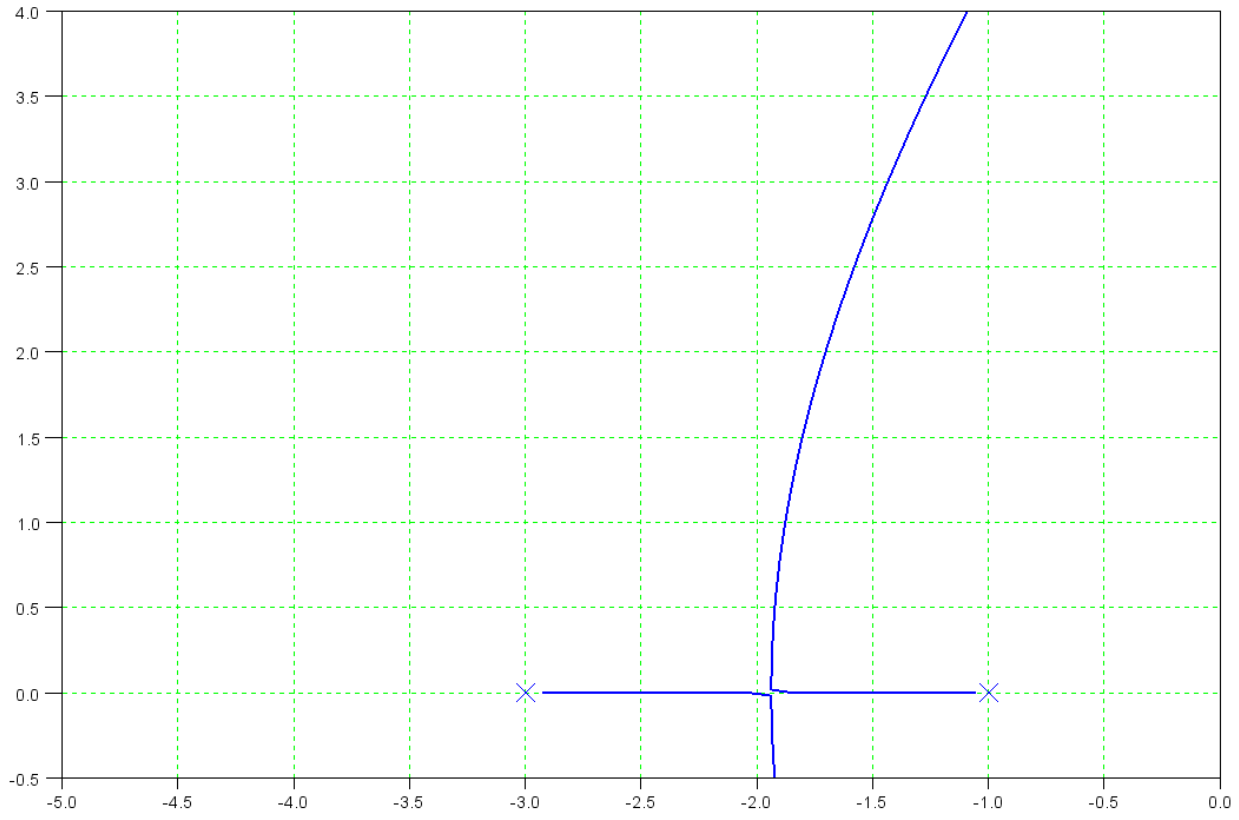
November 21, 2018

1) The root locus for

$$G(s) = \left(\frac{100}{(s+1)(s+3)(s+10)} \right)$$

is shown below. Determine the gain, k, which results in a damping ratio of 0.4. For the value of k, determine the following:

k for a damping ratio of 0.4	
For this value of k, what will be the closed-loop system's...	
Dominant Pole(s)	
Closed-Loop DC gain	
2% Settling Time	

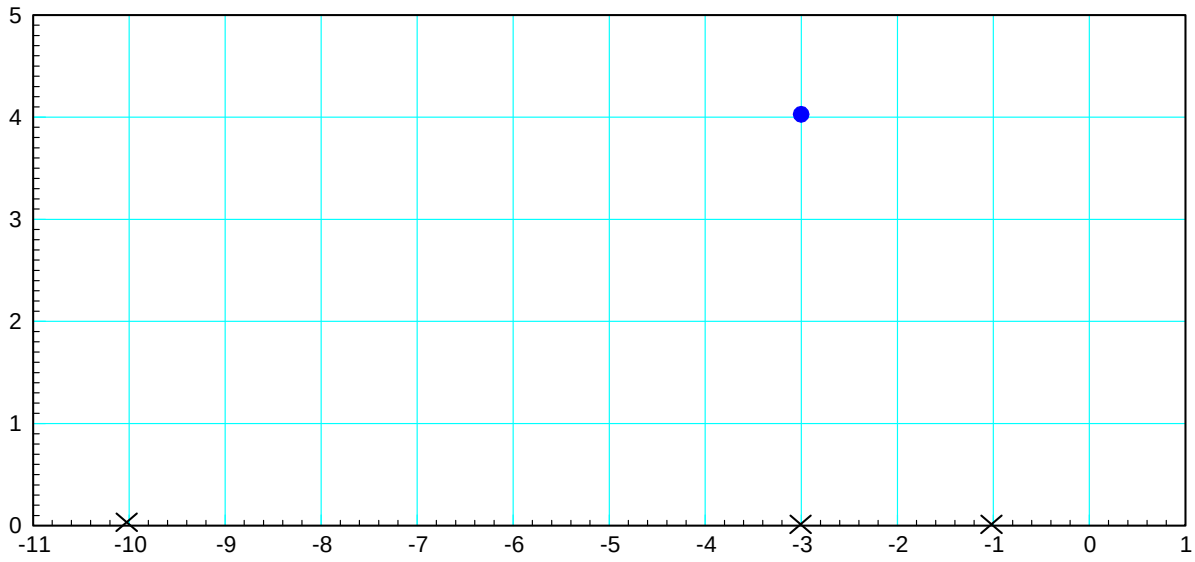


2) Assume the transfer function for a system is:

$$G(s) = \left(\frac{100}{(s+1)(s+3)(s+10)} \right)$$

Design a **continuous-time** compensator,K(s), so that the closed-loop system has

- No error for a step input, and
- Closed-loop dominant poles at **s = -3 + j4**



3) Assume the transfer function for a system is:

$$G(s) = \left(\frac{100}{(s+1)(s+3)(s+10)} \right)$$

Design a **discrete-time** compensator,K(z), so that the closed-loop system has

- No error for a step input, and
- Closed-loop dominant poles at **s = -3 + j4**
- A sampling rate of 100ms (T = 0.1)

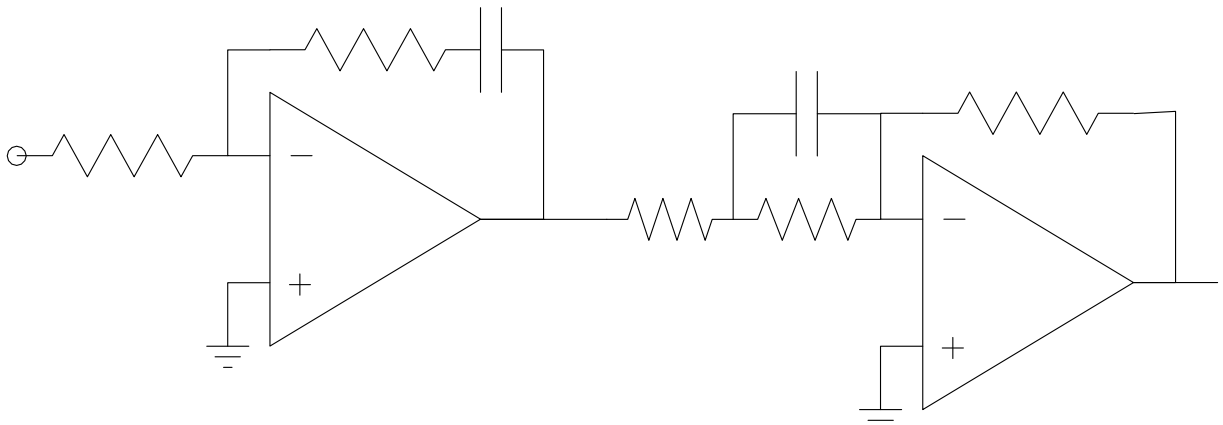
Closed-Loop Dominant Poles in in the z-plane	K(z)

4a) Determine G(z): a discrete-time transfer function with approximately the same step response as G(s). Assume a sampling rate of 100ms (T = 0.1)

$$G(s) = \left(\frac{100}{(s+1)(s+3)(s+10)} \right)$$

4b) Design a circuit to implement K(s)

$$K(s) = \left(\frac{50(s+2)(s+7)}{s(s+15)} \right)$$



Industrial Hemp Bonus! There are 10 essential amino acids that we must have in our food: our body cannot make them (8) or has extreme difficulty making (2). How many of these 10 essential amino acids are in hemp seeds?