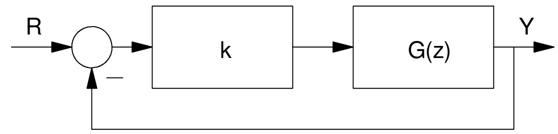
ECE 461/661 - Test #3: Name ____________________

Digital Control & Frequemncy Domain techniques - Fall 2020

Root Locus in the z-Plane



1) Assume a unity feedback system

$$G(z) = \left(\frac{0.04z}{(z-0.9)(z-0.8)}\right)$$

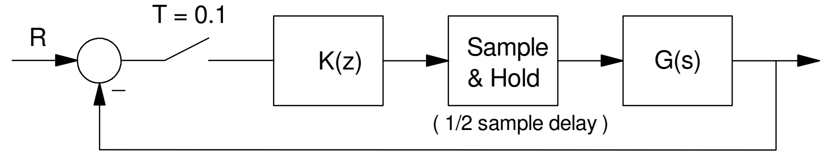
Determine a gain compesator, K(z) = k, which results in 10% overshoot for a step input $(\zeta = 0.5910)$. Specify

- The resulting gain, k
- The closed-loop dominant pole(s)
- The resulting 2% settling time (in terms of samples), and
- The error constant, Kp

Compensator Design in the z-Plane

2) Assume a unity feedback system with a sampling rate of T = 0.1 second

$$G(s) = \left(\frac{10}{(s+2)(s+10)}\right)$$



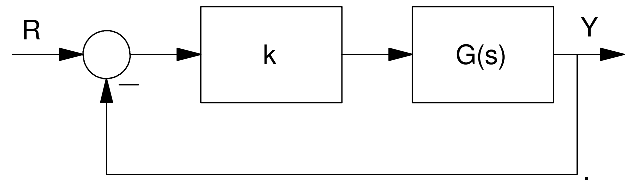
Design a digital compensator, K(z), which results in

- No error for a step input
- 10% overshoot ($\zeta = 0.5910$), and
- A 2% settling time of 2 seconds

Nichols Charts

3) Assume a unity feedback system with

$$G(s) = \left(\frac{10}{s(s+2)(s+10)}\right)$$



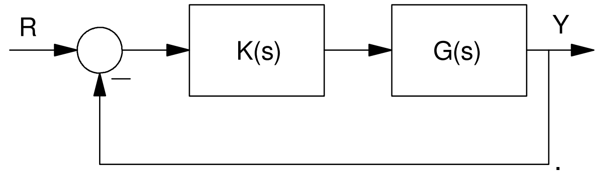
Determine a gain compensator, K(s) = k, which results in a resonance of Mm = 1.3 (2.279dB).

Plot the resulting Nichols chart for the G(s) * k

Compensator Design in the Frequency Domain

4) Assume a unity feedback system with

$$G(s) = \left(\frac{10}{s(s+2)(s+10)}\right)$$



Determine a compensator, K(s), which results in

- No error for a step input (closed-loop gain at DC = 1.000)
- A 60 degree phase margin, and
- A 0dB gain frequency of 2 rad/sec