

ECE 461/661 - Test #3: Name _____

Digital Control & Frequency Domain techniques

s to z conversion

Determine the discrete-time equivalent for $G(s)$. Assume a sampling rate of $T = 0.1$ second

$$G(s) = \left(\frac{100}{(s+3)(s+8)(s+12)} \right)$$

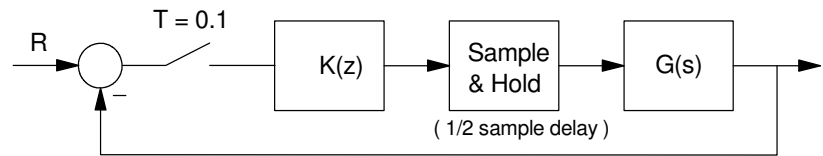
Digital Compensators: K(z)

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

$$G(s) = \left(\frac{100}{(s+3)(s+8)(s+12)} \right)$$

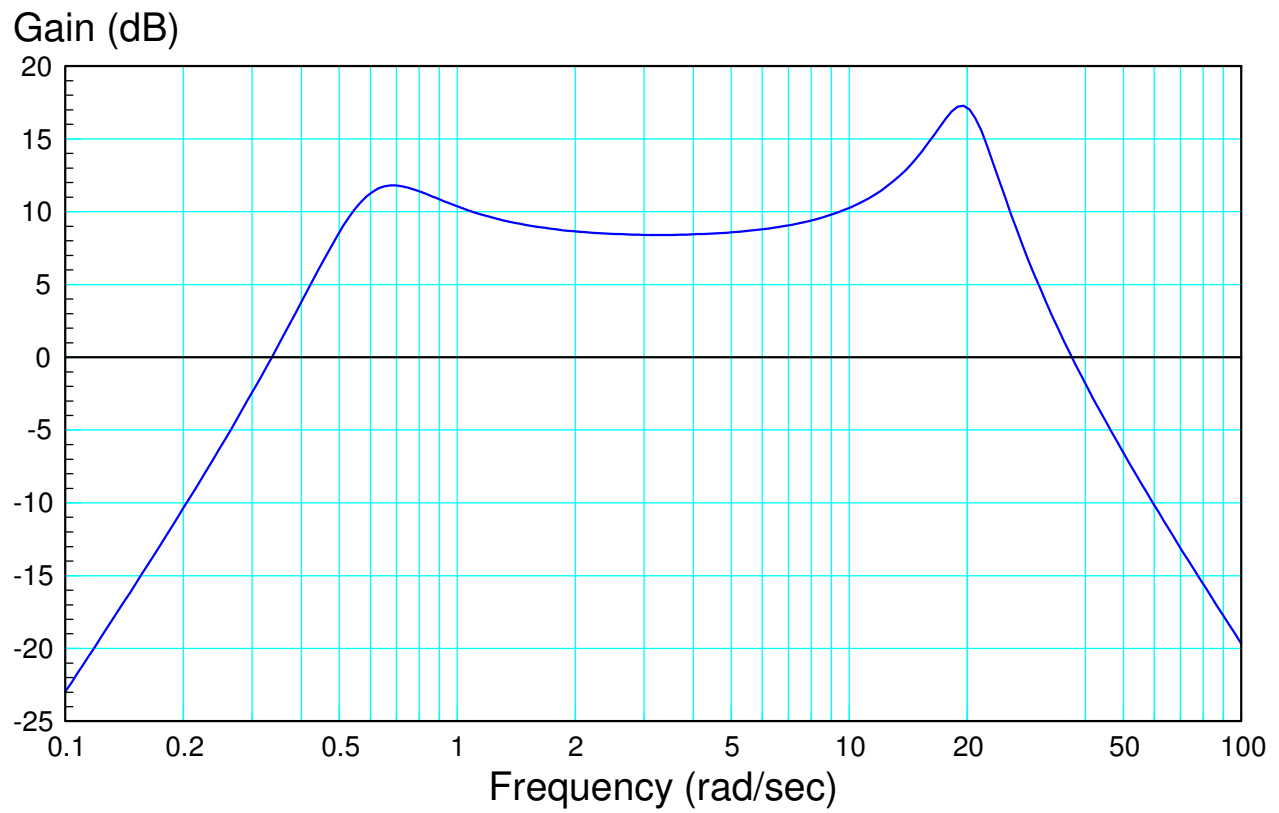
Design a digital compensator, $K(z)$, which results in

- No error for a step input
- 5% overshoot ($\zeta = 0.6901$), and
- A 2% settling time of 1.5 seconds



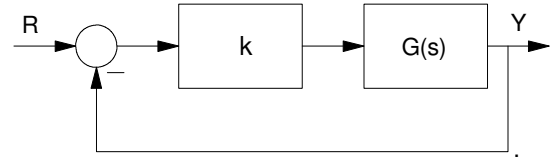
Bode Plots

Determine the system, $G(s)$, which has the following gain vs. frequency



Nichols Charts

Assume a unity feedback system where the gain of $G(s)$ is as follows:

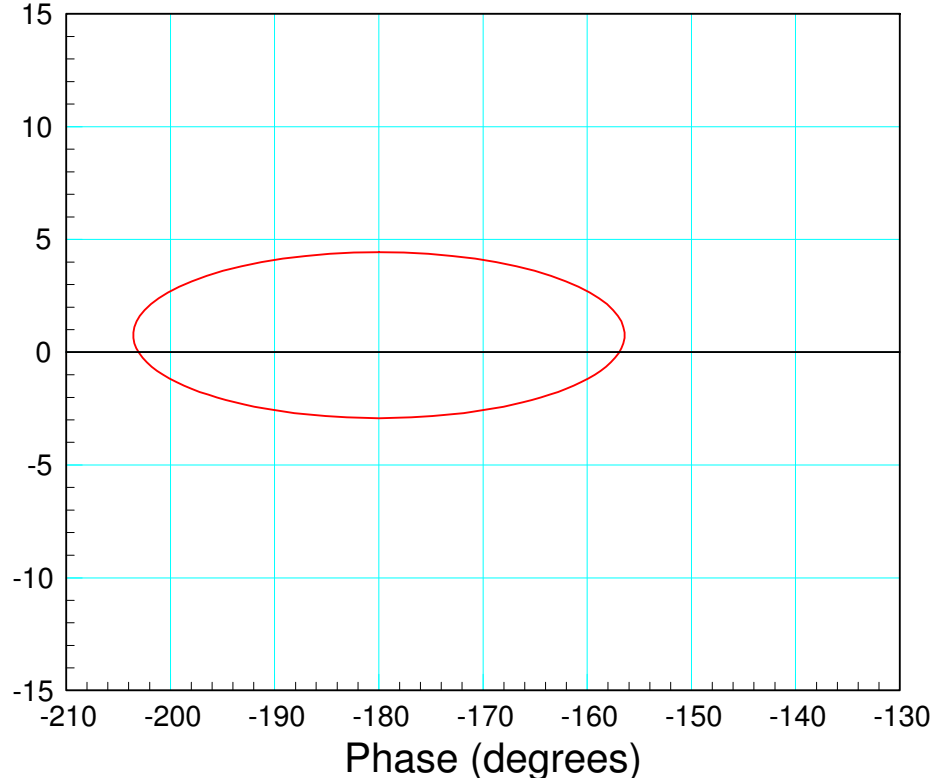


Determine

- The maximum gain, k , for stability
- k that results in a resonance of $M_m = 2.5$

freq (rad/sec)	7	8	9	10	12	15
Gain	10dB	2dB	-3dB	-8dB	-15dB	-22dB
Phase	-130 deg	-145 deg	-160 deg	-175 deg	-190 deg	-205 deg

Gain (dB)



Analog Compensator (Bode Plots)

Assume a unity feedback system with

$$G(s) = \left(\frac{10}{(s+3)(s+8)(s+12)} \right)$$

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

- No error for a step input
- A phase margin of 60 degrees
- A 0dB gain frequency of 3 rad/sec

