ECE 461/661 - Test #3: Name ____________________

Digital Control & Frequemncy Domain techniques - Fall 2022

s to z conversion

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

$$G(s) = \left(\frac{100(s+2)}{(s+5)(s+2+j6)(s+2-j6)} \right)$$

Digital Compensators: K(z)

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

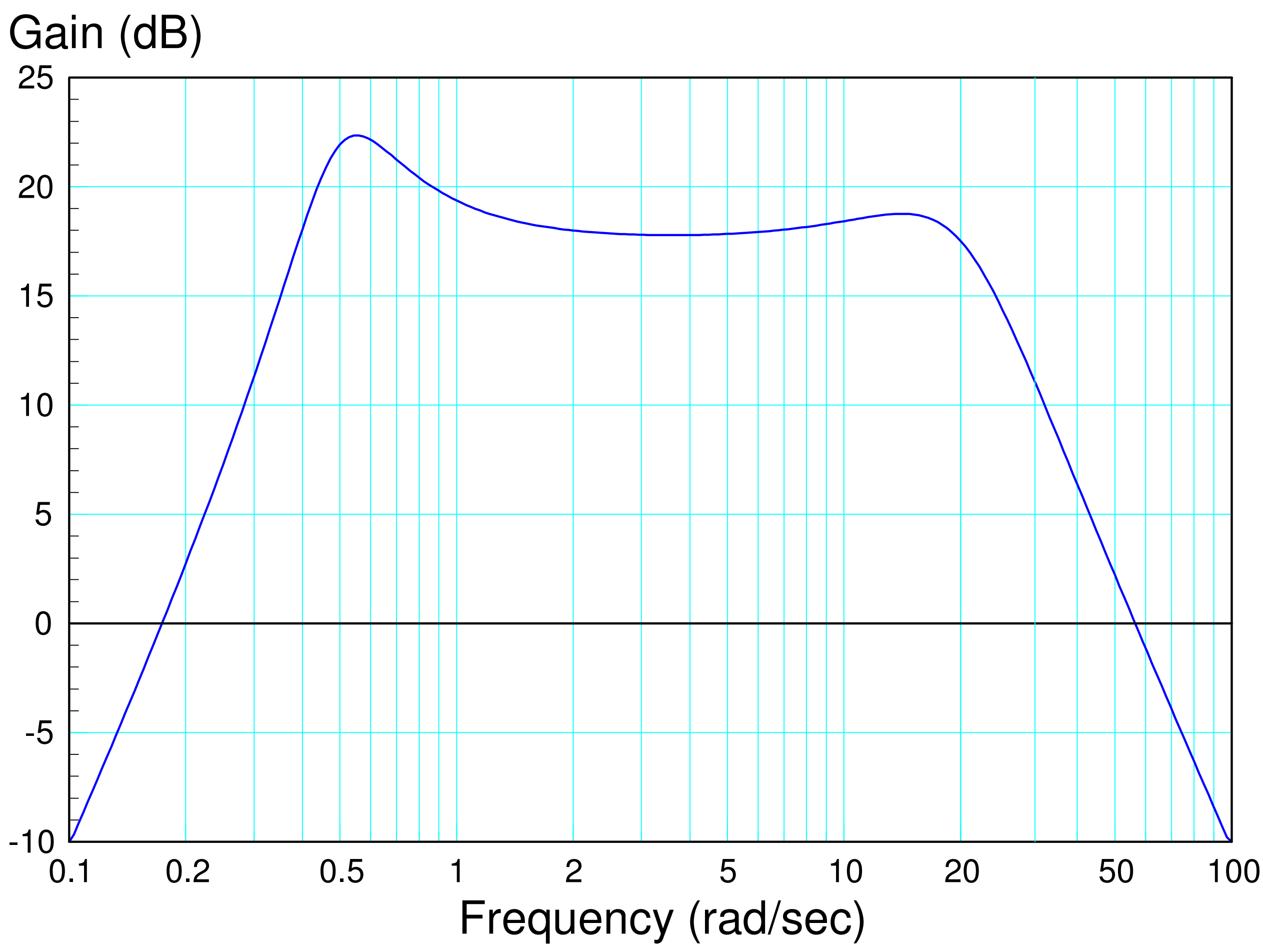
$$G(z) = \left(\frac{100z^2}{(z-0.95)(z-0.9)(z-0.8)} \right)$$

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

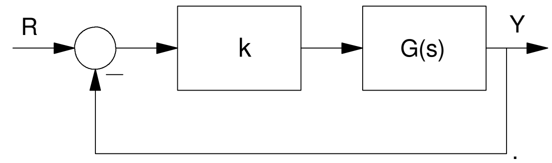
- No error for a step input,
- Closed-Loop Dominant poles at z = 0.8 + j0.2, and
- Is causal (the number of poles in K(z) is equal to or greater than the number of zeros)

3) Bode Plots

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



4) Nichols Charts

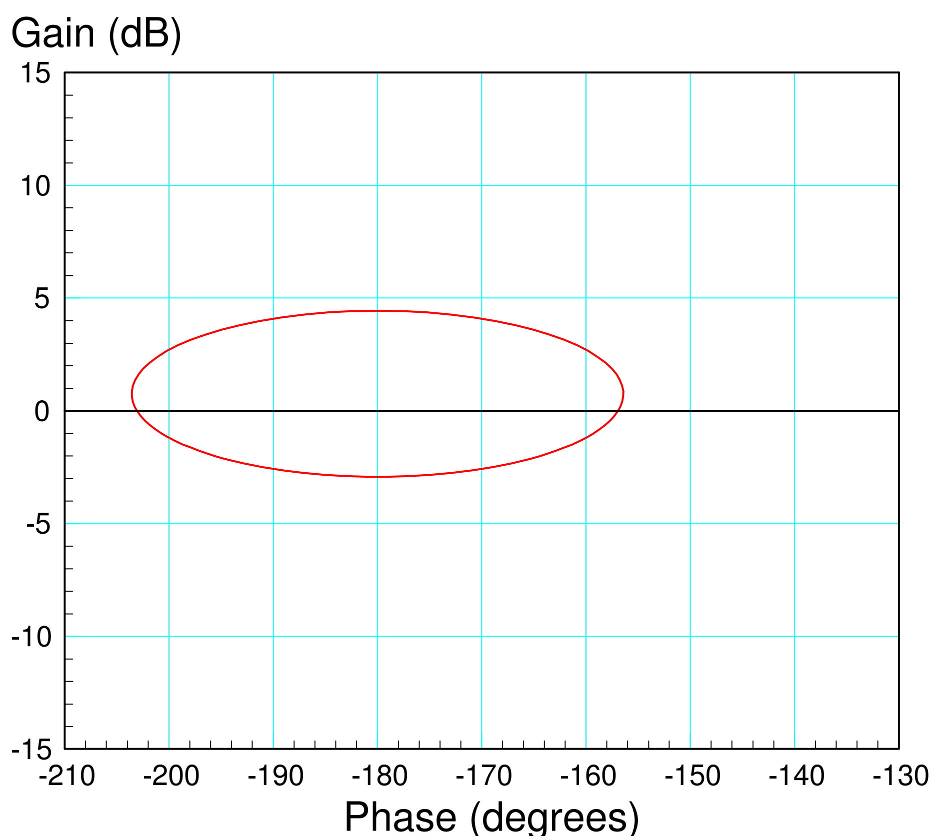


Assume a unity feedback system where the gain of G(s) is as follows:

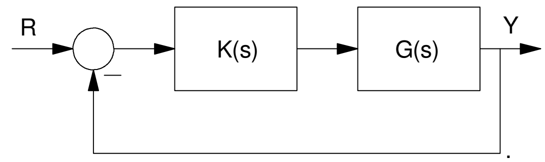
Determine

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

frequency (rad/sec)	7	8	9	10	12
Gain	10dB	8dB	2dB	-3dB	-11dB
Phase (degrees)	-130 deg	-150 deg	-170 deg	-190 deg	-210 deg



5) Analog Compensator (Bode Plots)



Assume a unity feedback system with

$$G(s) = \left(\frac{10}{(s+2)(s+10)(s+12)} \right)$$

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

- No error for a step input
- A phase margin of 40 degrees
- A 0dB gain frequency of 4 rad/sec