ECE 461/661 - Homework Set #8

Gain, Lead, PID Compensators - Due Monday, October 31st 20pt / problem

A 4th-order model for the 10-stage RC filter from homework #6 is

$$G(s) \approx \left(\frac{22}{(s+10.2)(s+5.539)(s+2.181)(s+0.4234)}\right)$$

1) Design a gain compensator, K(s) = k, which results in 20% overshoot for a step input. For this value of K(s), give

- The resulting closed-loop dominant pole(s)
- The error constant, Kp
- The step response of the closed-loop system.

2) Design a lead compensatro, $K(s) = k\left(\frac{s+a}{s+10a}\right)$, which results in 20% overshoot for a step input. For this value of K(s), give

- The resulting closed-loop dominant pole(s)
- The error constant, Kp
- The step response of the closed-loop system, and
- A circuit to implement K(s)

3) Design a I compensator, $K(s) = \left(\frac{k}{s}\right)$, which results in 20% overshoot for a step input. For this value of K(s), give

- The resulting closed-loop dominant pole(s)
- The error constant, Kp
- The step response of the closed-loop system, and
- A circuit to implement K(s)

4) Design a PI compensator, $K(s) = k\left(\frac{(s+a)}{s}\right)$, which results in 20% overshoot for a step input. For this value of K(s), give

- The resulting closed-loop dominant pole(s)
- The error constant, Kp
- The step response of the closed-loop system, and
- A circuit to implement K(s)

5) Design a PID compensator, $K(s) = k\left(\frac{(s+a)(s+b)}{s}\right)$, which results in 20% overshoot for a step input. For this value of K(s), give

- The resulting closed-loop dominant pole(s)
- The error constant, Kp
- The step response of the closed-loop system, and
- A circuit to implement K(s)