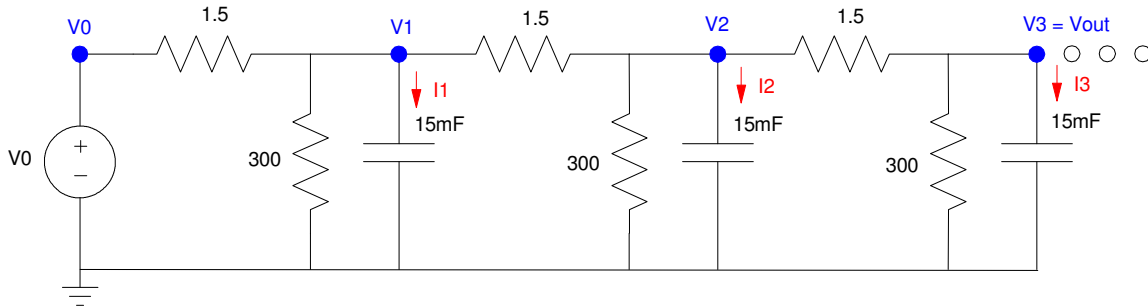


Homework #8: ECE 461/661

Gain, Lead, PID Compensation. Due Monday, October 16th

A 4th-order model for the following 10-stage RC filter is

$$G(s) = \left(\frac{9111}{(s+1.215)(s+9.025)(s+23.95)(s+44.67)} \right)$$



1) Design a gain compensator ($K(s) = k$) which results in

- The fastest system possible,
- With no overshoot for a step input (i.e. design for the breakaway point)

For this value of k , determine

- The closed-loop dominant pole(s)
- The 2% settling time,
- The error constant, K_p , and
- The steady-state error for a step input.

Check your design in Matlab or Simulink or VisSim

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

- The closed-loop dominant pole(s)
- The 2% settling time,
- The error constant, K_p , and
- The steady-state error for a step input.

Check your design in Matlab or Simulink or VisSim

3)) Design a lead compensator, $K(s) = k \left(\frac{s+a}{s+10a} \right)$, which results in 20% overshoot for a step input. For this $K(s)$, determine

- The closed-loop dominant pole(s)
- The 2% settling time,
- The error constant, K_p , and
- The steady-state error for a step input.

Check your design in Matlab or Simulink or VisSim

Give an op-amp circuit to implement $K(s)$

I Compensation

4) Design an I compensator, $K(s) = \frac{I}{s}$, which results in 20% overshoot for a step input. For this $K(s)$, determine

- The closed-loop dominant pole(s)
- The 2% settling time,
- The error constant, K_p , and
- The steady-state error for a step input.

Check your design in Matlab or Simulink or VisSim

Give an op-amp circuit to implement $K(s)$

PI Compensation

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

- The closed-loop dominant pole(s)
- The 2% settling time,
- The error constant, K_p , and
- The steady-state error for a step input.

Check your design in Matlab or Simulink or VisSim

Give an op-amp circuit to implement $K(s)$