Homework #8: ECE 461/661

Root Locus with Complex Poles, Gain, Lead. Due Monday, October 21st

Root Locus with Complex Poles & Zeros

Sketch the root locus plot for the following systems for 0 < k < infinity. Also plot the

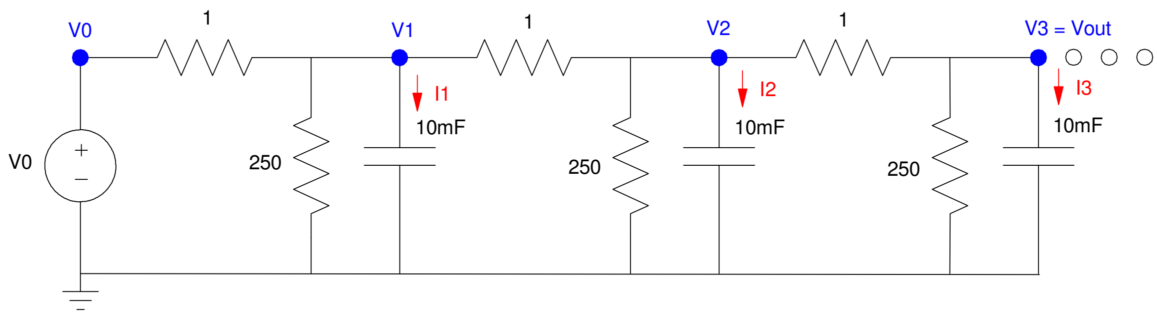
- real axis loci, break away points, jw crossings (if any), asymptotes, and departure/approach angle

1) $$G(s) = \left(\frac{100}{s(s+20)(s+2+j5)(s+2-j5)} \right)$$

2) $$G(s) = \left(\frac{(s+j3)(s-j3)}{(s-1)(s+4)(s+5)(s+6)} \right)$$

A 3rd-order model for the following 10-stage RC filter is

$$G(s) = \left(\frac{2331}{(s+2.6338)(s+30.2062)(s+53.7896)} \right)$$



3) 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, Kp, and
- The steady-state error for a step input.

Check your design in Matlab or Simulink or VisSim

4) 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, Kp, and
- The steady-state error for a step input.

Check your design in Matlab or Simulink or VisSim

5)) 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, Kp, 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)