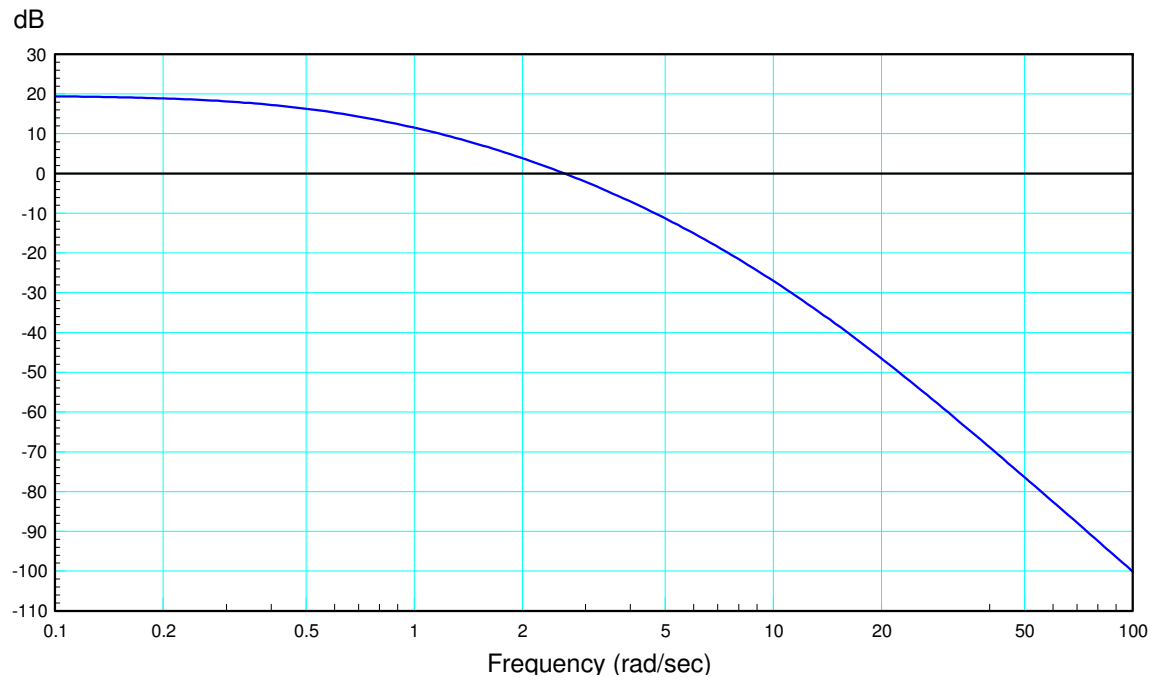


Homework #12: ECE 461/661

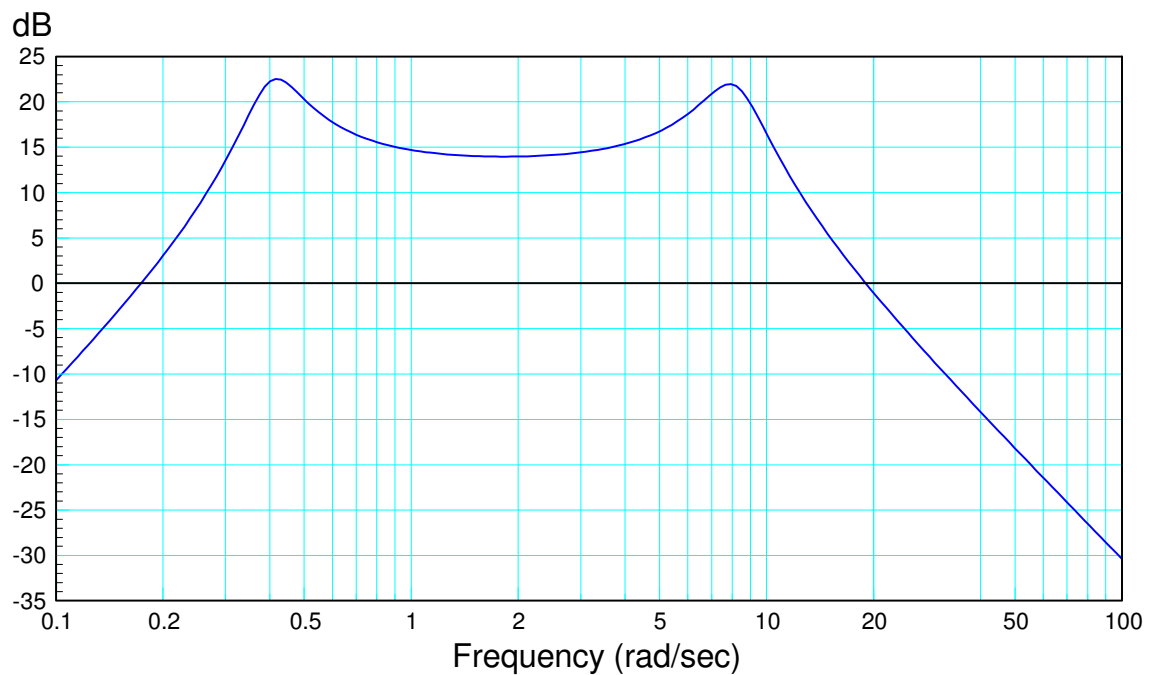
Bode Plots, Nichols charts and gain & lead compensation. Due Monday, December 2nd

Bode Plots

1) Determine the system, $G(s)$, with the following gain vs. frequency



2) Determine the system, $G(s)$, with the following gain vs. frequency



Nichols Charts

3) The gain vs. frequency of a system is measured

w (rad/sec)	2	3	4	5	6	10
Gain (dB)	9	6	2	-3	-7	-14
Phase (deg)	-140	-153	-168	-183	-197	-214

Using this data

- Transfer it to a Nichols chart
- Determine the maximum gain that results in a stable system
- Determine the gain, k , that results in a maximum closed-loop gain of $M_m = 1.5$

Gain and Lead Compensation

Problem 4 & 5) Assume

$$G(s) = \left(\frac{300}{s(s+3)(s+8)(s+12)} \right)$$

- 4) Design a gain compensator that results in a 40 degree phase margin.
 - Check the resulting step response in Matlab
- 5) Design a lead compensator that results in a 40 degree phase margin.
 - Check the resulting step response in Matlab

Problem 6 & 7) Assume a 200ms delay is added

$$G(s) = \left(\frac{300}{s(s+3)(s+8)(s+12)} \right) e^{-0.2s}$$

- 6) Design a gain compensator that results in a 40 degree phase margin.
 - Check the resulting step response in Matlab
- 7) Design a lead compensator that results in a 40 degree phase margin.
 - Check the resulting step response in Matlab