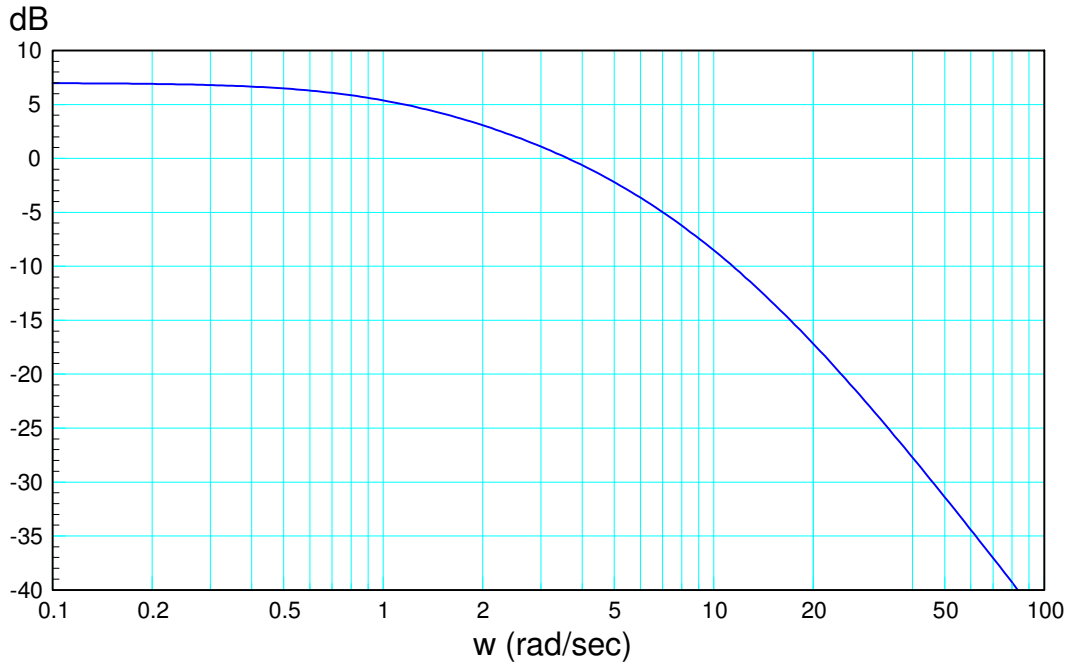
Homework #11: ECE 461/661

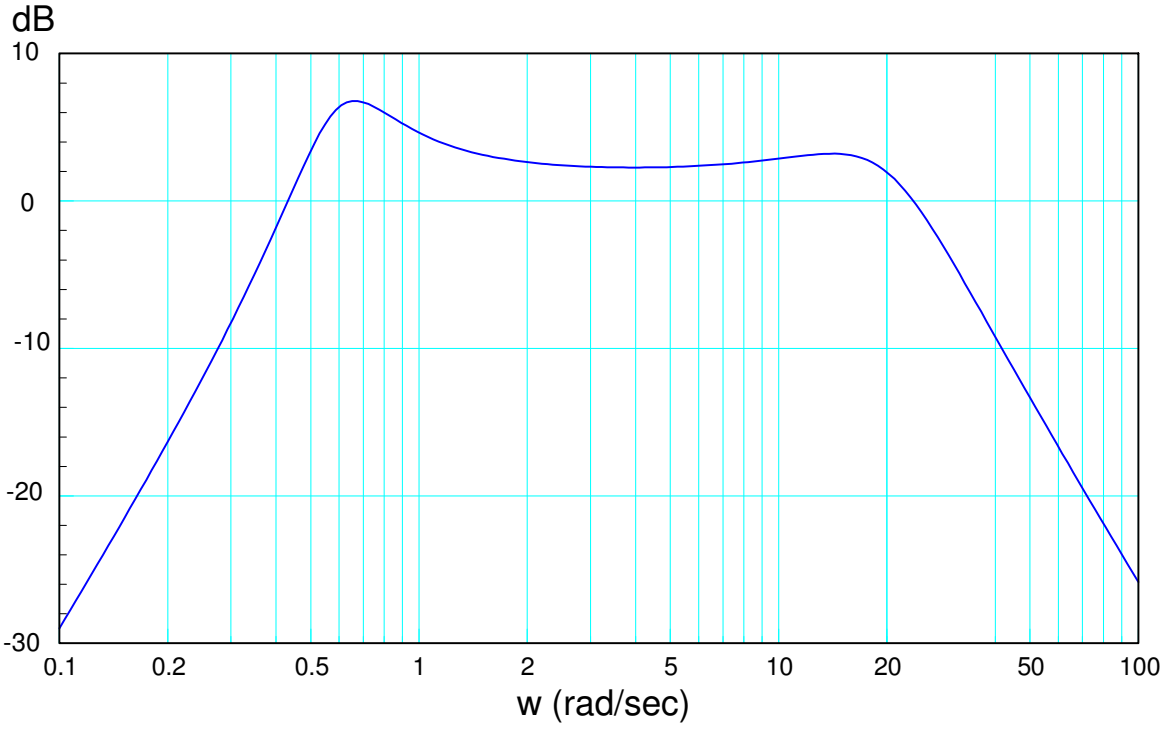
Bode Plots. Nichols charts and gain & lead compensation. Due Monday, November 23rd

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)	3.29	-0.97	-4.36	-7.25	-9.81	-17.56
Phase (deg)	-117.51	-129.49	-139.97	-149.04	-156.89	-180

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 Mm = 1.5

Gain and Lead Compensation

Problem 4 & 5) Assume

$$G(s) = \left(\frac{170}{(s+0.47)(s+3.40)(s+9.00)(s+16.77)} \right)$$

4) Design a gain compensator that results in a 50 degree phase margin.

- Check the resulting step response in Matlab

5) Design a lead compensator that results in a 50 degree phase margin.

- Check the resulting step response in Matlab

Problem 6 & 7) Assume a 500ms delay is added

$$G(s) = \left(\frac{170}{(s+0.47)(s+3.40)(s+9.00)(s+16.77)} \right) e^{-0.5s}$$

6) Design a gain compensator that results in a 50 degree phase margin.

- Check the resulting step response in Matlab

7) Design a lead compensator that results in a 50 degree phase margin.

- Check the resulting step response in Matlab