EE-154/CMPE-241
Winter 2008
Due: 6PM, 28-Feb-2008

Homework #7: Bode Plots.

1. Sketch the Bode diagrams (frequency response plots) for the following systems. First sketch the asymptotes, and then add the values at the key break points on the plots.

   a. $G(s) = \dfrac{1}{s(s+5)}$

   b. $G(s) = \dfrac{(s+1)}{(s+5)(s+10)}$

2. A lead compensator is defined by, $D(s) = K\dfrac{(s+a)}{(s+b)} = K\dfrac{\left(s+\dfrac{\omega}{\sqrt{\alpha}}\right)}{(s+\sqrt{\alpha}\omega)}$ where the center frequency is ω and the ratio of pole location to zero location is α, i.e.: $\alpha = \dfrac{b}{a}$

   a. Plot the magnitude and phase plots for the lead compensator, $D(s) = \dfrac{s+0.5}{s+2}$. Note that the peak in the phase occurs at the center frequency (on a log scale): $\omega = \sqrt{(0.5*2)} = 1$. In this case, $\dfrac{b}{a} = 4$ and ω =1.

   b. Find the value of the peak in phase lead for $\dfrac{b}{a}$ values of 2, 4, 10, and 50. (I suggest just evaluating the complex number rather than trying to do it graphically, and its OK to use MATLAB).

3. In Problem Set #6, you designed a lead (plus notch) compensator for the plant: $G(s) = \dfrac{36}{(s^2+1)(s^2+0.5s+36)}$. Your lead compensator was probably $D(s) = 4(s+1.75)$ (ignoring the notch for now):

    a. Sketch the Bode plot for your loop gain *D(s)G(s)*. Do it by hand, and then check your answer in MATLAB.

    b. What is the DC gain of your system?

    c. What is the value of the phase when the amplitude equals 1?