Department of Mechanical Engineering
Massachusetts Institute of Technology
2.14 Analysis and Design of Feedback Control Systems
Fall 2004
Assignment #7
Distributed Friday October 29
Due: **Wednesday, November 3** by 5pm in 35-231 Drop Box

Reading: Reading: Nise Chapter 10

Problem 1

We are given the forward loop transfer function:

$G(s) = \dfrac{K}{s^2 + 0.5s + 1}$ and the feedback transfer function *H(s)* = 1:

a) Sketch an asymptotic bode diagram for the case of K=1 and then fare-in the region around the resonance.

b) On that plot indicate the unity gain line for three loop gain values K = 0.1, 3 and 10:

c) For each case what is:

- The frequency range of region I?
- The frequency range of region III?
- The crossover frequency?

d) Based on c) sketch the approximate closed-loop bode diagram using $|T(s)| \cong \dfrac{|G(s)|}{1+|G(s)|}$ as discussed in class. You can put all three sketches on the same axes, but please delineate each clearly.

e) Looking at each closed-loop plot, how does it coincide with what you expect from a root locus plot of this system?

e) Compare that approximation to the exact plot for each gain produced by using MATLAB.

f) Comment on why the approximation deviated from the actual, and see if you can develop a "rule" for using this approximation.

Problem 2

Nise Problem 10-1

Problem 3

Nise Problem 10-3

Problem 4

Nise Problem 10-5