2.737 Mechatronics
Prelab Assignment 2: Analog Feedback Systems

Assigned: 3/1/06
Pre-lab due: 3/8/06 in class
Reports due: week of 3/13/06 in checkoffs
Reading: Feedback system notes Chapter 6, Apex Evaluation Kit specs

The problems from Roberge's text, "Operational Amplifiers: Theory and Practice', Wiley, 1972 are available on a separate handout.

Exercise 1: Roberge Problem P5.3

Exercise 2: Roberge Problem P5.4, parts a,b,c

Exercise 3: Complete all the paper calculations and Matlab simulations requested in the assignments section of lab 2. That is, we want you to predict the expected system performance on paper before you go into the lab to build it. For the purposes of this exercise, you may assume that the inductance has an incremental value of $L = 150$ mH at 0 A, and a value of $L = 30$ mH at 0.5 A. *Note: These are not the actual lab values!* Also assume that the inductance has a coil resistance of $R = 1\ \Omega$. Assume also that you are using a 10 Ω current sense resistor. You will later determine the values of these parameters for your hardware in the experimental portion of the lab, but use the values above for the purposes of the exercises below.

Specifically, we ask that you do the following:

- Predict the behavior of the design in section 3.1. Carry out the requested Matlab simulations.
- Predict and use Matlab to plot the expected frequency responses and step responses for the two values of inductors in section 3.2, using the parameters given above.
- Use the parameters given above to design the controller to meet the specifications in section 3.3. Clearly indicate the circuit elements and their values which go in the empty blocks in Fig. 4 in the lab handout. Draw a system block diagram, carry out the root locus plots, and predict the expected step and frequency responses. How does the changing inductance value affect your loop?

Lab work: Start the lab work portion! This lab is deceptively simple-looking, but will require you to think carefully about your designs and will require significant effort in the lab. Start early!