

**ME552 Lab 2: Magnetic Levitation System (Fall 2012)**

Homework Assignment 2A

Due: Friday, 3:00-5:00pm during the lab, September 21<sup>st</sup>

1. The most important deliverable of this HW assignment is to demonstrate a working magnetic levitation system to the instructor/GSI in the lab, next Friday. You should be able to show that the ball balances in air and has some robustness against minor disturbances applied to it (e.g. slight touch by the finger).
2. You will also be evaluated for the quality of your bread-board circuit layout and wiring. Please do a clean job so that your circuit and wiring looks uncluttered and well organized. Make use of color coding for your wiring as much as practically possible.
3. You will also be evaluated for the quality of your LabView code. Again, both the front panel and the block diagram should be uncluttered and well-organized.
4. In a written report, address the following:
  - a. Present a block-diagram (either hand sketched or drawn on a computer) of the closed-loop system, including the controller that you successfully implemented in the lab. Show all the necessary details on the block-diagram. Make sure you provide all numerical values relevant to the controller.
  - b. In your control system, what does the bias voltage signify? What is its physical and mathematical meaning? Is this bias voltage necessary for your control system to work as desired? Why?
  - c. Why is a buffer op-amp needed at the output of the sensor set-up? Is it really needed in your experiment? Why or why not? Provide proper technical justification.
  - d. What is the minimum value of resistance you can use in the emitter circuit? Comment on how the resistance value affects the sensing performance.
  - e. What is the maximum current that the electromagnetic coil could ever see if there are circuit failures? Provide physical and simple mathematical arguments. Would this high current damage the coil? What safety features would you recommend to avoid such damage?
  - f. What should be the saturation limits on the analog output of your LabView VI? Provide justification.
  - g. Does the polarity of the electromagnetic coil matter in the current driver circuit? Why or why not?
  - f. What purpose do the two capacitors used in your circuit serve? Try running your experiment with and without these capacitors in place. Report your observations.