Due Th 10/29

1. Show the region where a dominant pole-pair should be placed to meet the step response criteria $t_{2\%} \leq 1$sec and $P.O. \leq 15\%$.

2. Use root-locus to design a PID controller (also investigate simpler versions such as P, PI, PD to see if they will work) for the magnetic-ball-suspension system that will meet the criteria provided above at the equilibria $(0.5m, 0m/s, -2.215A, 2.215V)$. Note that if a negative sign exists in the plant transfer function P(s) you will need to take it into account. Assume we want the steady-state error small (say less than 1%) and that our voltage supply can provide a peak input voltage of 12V. Test your controller (through simulation) on the nonlinear system remembering that the linearization process changes the variables to $\Delta u = u - u_o$ and $\Delta y = y - y_o$, so you'll have to include the operating point in your controller. Try a reference signal of $\Delta r = r - r_o = -0.02$m. Does your controller meet all the specifications?

3. Give some thought as to what system (DC motor, pendulum, magnetic ball, ...) and computational platform (FPGA, microcontroller, SBC, DSP, ...) you are considering for your final project. Prepare a short presentation ($\approx$ 8min) on the system (to include actuators, sensors, ...), computational platform (to include I/O, communications, speed, power, cost, development environment, ...) and closed-loop configuration.