Introduction to Controls Engineering
Homework #5
Assigned 3/6/13, Due: 3/13/13

Last PID problem

Design a PI controller for the first order system, $G_p = \frac{1}{(.4\,sec)s+1}$ that gives a rise time of $.5\,sec$ and a settling time of $4\,sec$.

Step One: cascade the PI controller, $G_c = K_P + \frac{K_I}{s}$ with the plant and determine the closed loop transfer function, $\frac{G_c G_p}{1+G_c G_p}$.

The denominator is second order, so equate coefficients between $s^2 + 2\zeta\omega_n s + \omega_n^2$ (with ζ and ω_n determined from your performance specs) to calculate your K_P and K_I .

Using the matlab commands:

plant = tf(num,den)

and

step(plant)

plot the open loop response.

Using the matlab commands

control = tf(num,den)

and

step((control*plant/(1+control*plant)))

plot the closed loop response.

NOTE: num and den are arrays of coefficients for the numerator and denominator of your transfer function. For instance num = [1 0], den = [2 1] translates into the transfer function $\frac{s}{2s+1}$. (Type "help tf" to get matlab's help on the function.)

How does your design compare against your performance specs?