

CM3310 Project 3.
Due: April 15, 2008

I. Stability Margins

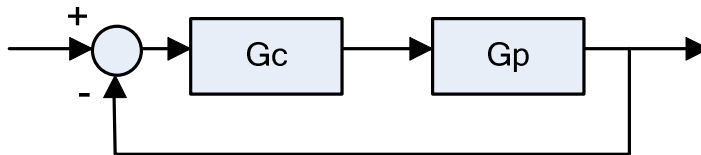
From the modeling exercise in Project 2, it was found for SYSTEM B that the process can be modeled by a transfer function

$$G_P(s) = \frac{0.273s - 0.121}{s^2 + 0.21s + 0.121}$$

Further, using the performance criteria based on Integrated Absolute Error (IAE), the tuning parameters for a PI controller was found to be $K_c = -0.0543$ and $\tau_{int} = 0.6855$.

For the feedback control shown in Figure 1, implementing the PI control found using IAE,

- Draw the Nyquist and Bode plots of $H(s) = G_c(s)G_P(s)$
- Determine the gain stability margin and the phase stability margin



(You can use either MathCAD, Matlab or Excel to obtain Nyquist plots and Bode plots. You can link to www.chem.mtu.edu/~tbco/cm416/freqresp.pdf www.chem.mtu.edu/~tbco/cm416/freqexcel.html for tips on using MathCAD and Excel methods)

II. (Bonus: 20pts) Data Filtering

- Obtain the power spectrum of the noisy data given in www.chem.mtu.edu/~tbco/cm416/noisydata.zip
- From the power spectrum, determine the cutoff frequency, ω_c , such that the power values will be less than 0.1 for frequencies greater than ω_c .
- Implement a third order Butterworth filter on the noisy data and plot the filter data and original noisy data together in one graph. Discuss the effects of the filter.

(You can link to www.chem.mtu.edu/~tbco/cm416/filterTut2k8.pdf for sample procedure.)