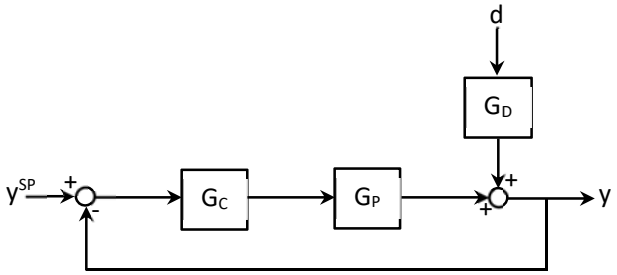
ChE381A: Process Dynamics and Control
Laboratory Assignment 4
Root Locus for PID Controller Design

Consider the SISO process in the Figure below.



where

$$G_P = \frac{2.5}{(5s+1)(2s+1)(s+1)(0.5s+1)}$$

$$G_D = \frac{1}{(10s+1)(5s+1)(2s+1)(s+1)}$$

$$G_C = K_C\left(\frac{\tau_I s+1}{\tau_I s}\right)\left(\frac{\tau_D s+1}{0.1\tau_D s+1}\right)$$

Use the root locus technique to obtain the controller gain, K_C, of a P, PI and PID controller, such that the dominant closed loop characteristic equation roots have $\xi = 0.5$. For a PI and PID controller, use the heuristic of setting τ_I and τ_D to respectively, the largest and the smallest time constant of the process transfer function G_P.

Obtain the servo and regulator responses for the tuning thus obtained.

Try alternative τ_I and τ_D values and sketch the root locus plots and justify to yourself as to why the heuristics for choosing τ_I and τ_D make sense.

Submit a short report on the exercise.

NOTE: Use the Matlab *rlocus* command to obtain the root locus plots.