CHBE470 – Process Dynamics and Control – Fall 2007

Homework Set 6

Assigned: Wednesday, October 22 **Due:** Wednesday, October 29

Note: Please staple your papers and include your name in the first page

Problem 1: Consider the general closed-loop block diagram with $G_c(s) = K_c(1+3/s)$, $G_f(s) = 1$, $G_m(s) = 2$ and $G_p(s) = 1/(0.2s^2 + 0.4s + 1)$. Using the Routh-Hurwitz stability criterion, determine the stability of the closed-loop system when Kc=2.

Problem 2: Consider the general closed-loop block diagram with $G_c(s) = K_c$, $G_f(s) = G_m(s) = 1$ and $G_p(s) = 1/(s+1)^3$. Find the value of Kc for which the system is on the verge of instability. The controller is then replaced by a PD controller, for which the transfer function is $G_c(s) = K_c(1+\tau_D s)$. If Kc=10, determine the range of τ_D for which the system is stable.

Problem 3: Consider the general closed-loop block diagram with $G_c(s) = K_c$, $G_f(s) = 1$, $G_m(s) = 1/(s+1)$ and $G_p(s) = 1/(s+1)^3$.

a) Determine the value of Kc above which the system is unstable

b) Determine the value of Kc for which two of the roots are on the imaginary axis and determine the values of these imaginary roots.