CHBE 470 – Process Dynamics and Control – Fall 2007

Homework Set 7

Assigned: Friday, November 2 **Due:** Friday, November 8

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

Problem 1: For the transfer function:

$$G(s) = \frac{3}{(8s+1)(2s+1)(s+1)}$$

a) Derive explicit formulae for AR and ϕ
b) Determine the corner frequencies and asymptote slopes
c) Sketch the corresponding Bode diagrams

Problem 2: For the transfer functions:

$$G(s) = \frac{10s+1}{(0.3s+1)^2} \text{ and } G(s) = \frac{1-10s}{(0.3s+1)^2}$$

a) Derive explicit formulae for AR and ϕ
b) Determine the corner frequencies and asymptote slopes
c) Sketch the corresponding Bode diagrams

Problem 3: Consider the process: $G(s) = \frac{e^{-5s}}{(10s+1)}$. Develop PI and PID controllers using the Ziegler-Nichols controller tuning rules. Compare all controllers to each other using numerical simulations. Test and compare the performance of the two controllers for a unit step change in the input.