Concordia University

Department of Computer Science and Software Engineering

SOEN 385-Control Systems and Applications

Assignment No. 4

Due date: March 31, 2011

This assignment is based on the textbook: Control Systems Engineering, 5th Edition, by N. S. Nise, John Wiley & Sons.

1) Do problems #3 (page 271) and #23 (part a, page 273) in Chapter 5.

2) Do problem #27 (page 274) in Chapter 5.

3) Do the following problems in Chapter 6:
   a) # 18 page 313
   b) # 41 page 315

4) Do the following problems in Chapter 7:
   a) #8 page 357
   b) #10 page 358 (excluding part e)

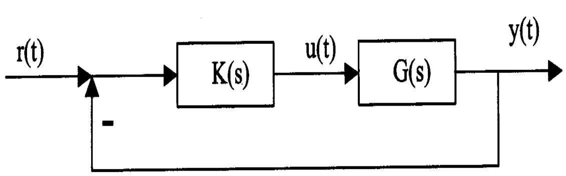
5) Do the following problems in Chapter 8:
   a) #3 page 418 (do parts a and b only)
   b) #5 page 418

6) Given the following transfer function:

$$G(s) = \frac{1}{s^2 - s + 1}$$

(a) Plot the poles of the transfer function on the complex s-plane.
(b) For a unit step input, find the open-loop response and plot the response by hand.
(c) What do you notice about the stability of the response?
(d) We now want to stabilize the plant by using a compensator of the type PD with the transfer function $K(s) = k_D s + k_P$.

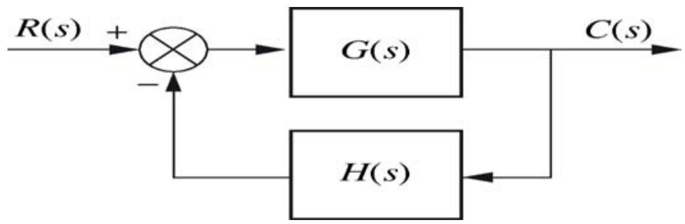
(1) The compensator is put in series with the plant as shown in the figure:



Assume that we want the following performance specifications: P.O = 3% and the settling time = 1 sec, find the values of k_D and k_p.

(2) Plot the response either by hand or by Matlab.

(3) The compensator is now put in parallel with the plant, i.e. it is on the feedback loop. Repeat parts (1) and (2) using this feedback compensation.



(4) Repeat part (1) with the controller (compensator) of the PID type, that is: $K(s) = k_I/s + k_D s + k_P$. Can you improve on the P.O? Plot the response.