ECE 388

Automatic Control

LAB 4

Feedback Loop and Performance

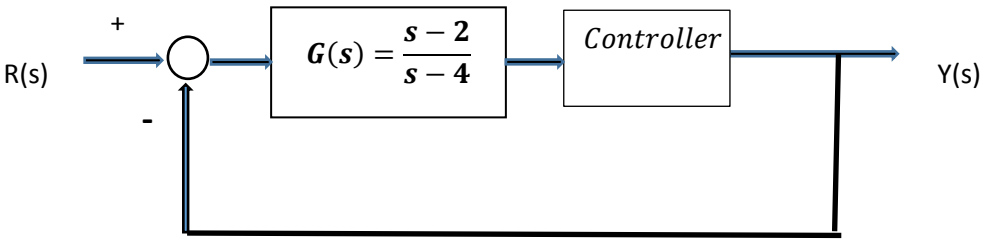
Objectives: The objective of this exercise is to study the stability of different systems whose transfer functions are given.

List of Equipment/Software

MATLAB, Simulink

TASKS:

1) **Determining the Stability**
   The following feedback loop is given



a) Determine (without computation) which of the following controller transfer functions lead to an instable feedback loop

$$C_1(s) = \frac{s-4}{s+2} \qquad C_2(s) = \frac{s+5}{s-2} \qquad C_3(s) = -1.5$$

b) Verify that the remaining controller transfer function leads to an internally stable feedback loop.

c) Simulate the feedback loop with the plant G(s) and C_1. Give a reference step r(t) = u(t) and measure the output y(t).

d) Simulate the feedback loop with the plant G(s) and C_2. Give a reference step r(t) = u(t) and measure the output y(t).

e) Simulate the feedback loop with the plant G(s) and C_3. Give a reference step r(t) = u(t) and measure the output y(t).

f) Compare your results.

2) Determining the steady state error

Consider the plant given by :

$$\boldsymbol{G(s) = \frac{s+4}{(s+7)(s^2+3s+3)}}$$

Assume that somebody designed a controller C(s) with the transfer function

$$\boldsymbol{C(s) = K\frac{s+7}{(s+1)s}}$$

a. Assume that K=1. Show that the basic feedback loop with is stable.
b. Which steady state error do you expect for the feedback loop?
c. Simulate the feedback loop, check the steady state error. (use step input)
d. Now simulate the feedback loop for K=10 and K=0.1. Compare your results.