Portland State University

Electrical & Computer Engineering

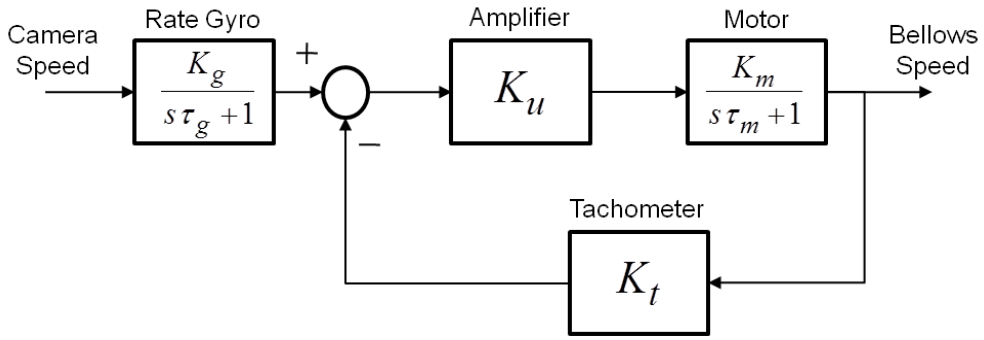
ECE 311 Feedback & Control

-Homework #4-

Text Problems: **B-5-20, B-5-21, B-5-26**

Problem 1:

A steadicam system to correct the wobbling of a picture is shown below.



A maximum scanning motion step change of 25% is expected. Let $K_g = K_t = 1$ and assume that τ_g is negligible.

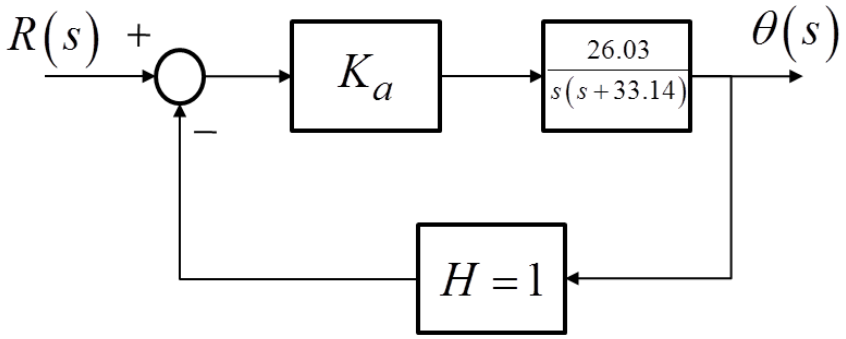
(a) Determine the steady-state error of the system

(b) Determine the necessary loop gain $K_u K_m K_t$ when a 1% steady state error is allowed

(c) The motor time constant is 0.4 sec. Determine the necessary loop gain so that the 2% settling time is less than or equal to 0.03 sec.

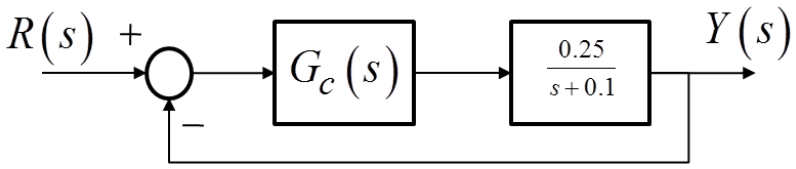
Problem 2:

Consider the motor control problem shown below.



Determine the maximum value of the amplifier gain K_a before the system becomes unstable.

Problem 3:
Consider the system shown below:

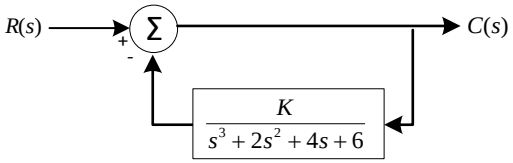


(a) Assume the controller is proportional, i.e. $G_c(s) = K$. Find the steady-state error to a step input with amplitude A

(b) Now assume the controller is PI given by $G_c(s) = K_P + \frac{K_I}{s}$. Find the steady-state error to a step input with amplitude A. Find the steady-state error to a unit ramp input

Fundamentals of Engineering Exam Problem 1:

A feedback control system is shown in the figure below.



The range of K for which this system is stable is most nearly:

(A) -6 < K < 0
(B) -6 < K < 2
(C) 0 < K < 6
(D) -4 < K < 6

Fundamentals of Engineering Exam Problem 2:

For the following second-order control system model

$$\frac{C(s)}{Y(s)} = \frac{250}{s^2 + 40s + 25}$$

the damping coefficient is most nearly:

(A) 4
(B) 10
(C) 25
(D) 5