SEOUL NATIONAL UNIVERSITY
SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING

SYSTEM CONTROL **Fall 2014**

Midterm Exam Solution **Date: October 21, 2014 (Tue)**
Closed book, closed note **11:00-12:10**

Student ID: _____ Name:_____

Problem	Points
1(15)	
2(10)	
3(10)	
4(15)	
5(15)	
Total (65)	

[1] (15 points) Describe followings:

(1) linear dynamic systems

(2) Control system

(3) Stability

[2] (10 points) Obtain the condition of K for stabilizing the following system using Routh's stability criterion.

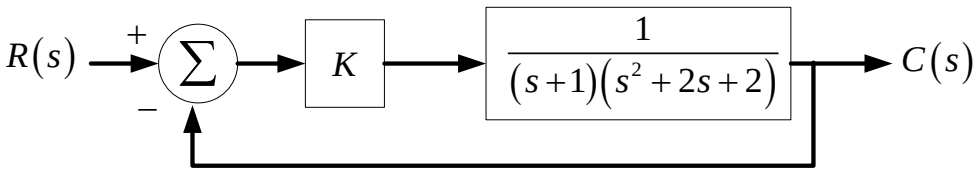

Fig.2 Feedback control system

[3] (10 points) Obtain the steady state values of the following equations if the values exist.

(1) $Y(s) = \dfrac{4}{s(s+1)(s+2)(s+3)}$

(2) $Y(s) = \dfrac{3}{s(s+1)^2(s-2)}$

[4] (15 points) Consider a system shown in the Fig.4 below.

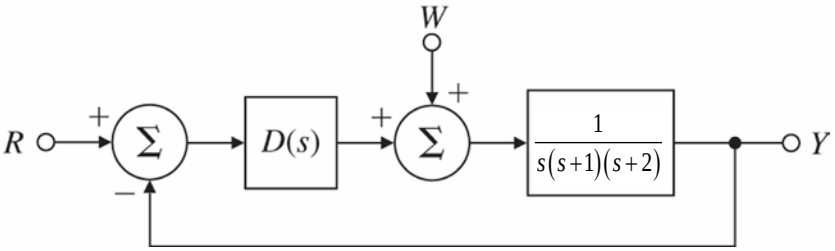

Fig.4 Feedback control system in the presence of disturbance

(1) When $D(s) = K$, i.e., proportional control, obtain the transfer function $G_W(s) = \dfrac{Y(s)}{W(s)}$.

(2) Obtain the steady state output for the unit step disturbance, i.e., $w(t) = 1$.

(3) Design a PI controller such that the steady state output for the unit step disturbance is zero.

[5] (15 points) Consider a feedback control systems in Fig.5-(a). The root loci of the system are shown in Fig.5-(b).

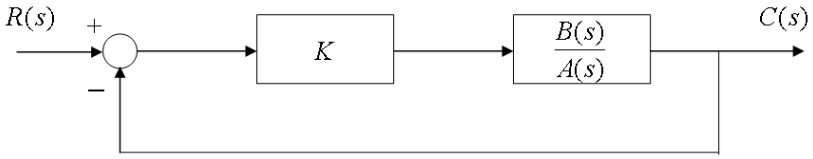

Fig.5-(a) Feedback control systems

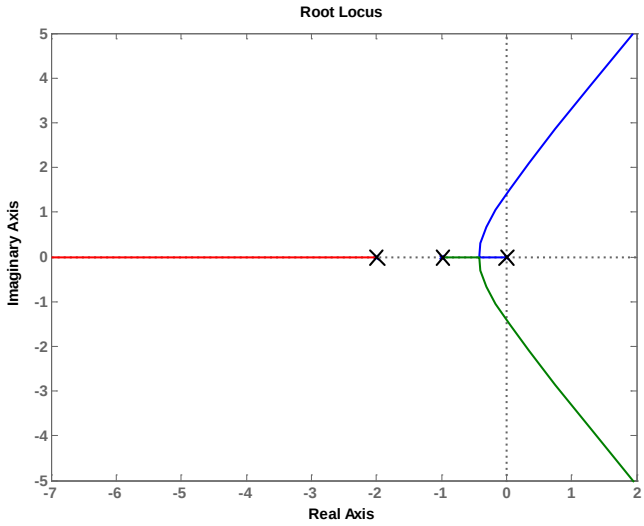

Fig.5-(b) Root locus of the feedback control systems

(1) Obtain the open-loop transfer function of the system, $\frac{B(s)}{A(s)}$, where $\left|\frac{B(1)}{A(1)}\right| = \frac{1}{6}$.

(2) Determine the angles of asymptotes of the root loci (as *s* approaches infinity).

(3) Determine the proportional gain, K, where the root loci across the imaginary axis **by use of Routh's stability criterion.**