SEOUL NATIONAL UNIVERSITY
SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING

SYSTEM CONTROL **Fall 2014**

Quiz #3
Due: October 14(Tu)

Student ID#_____ Name:_____

[1] Consider the closed-loop system shown in Figure below. Determine the range of K for stability. Assume that $K > 0$.

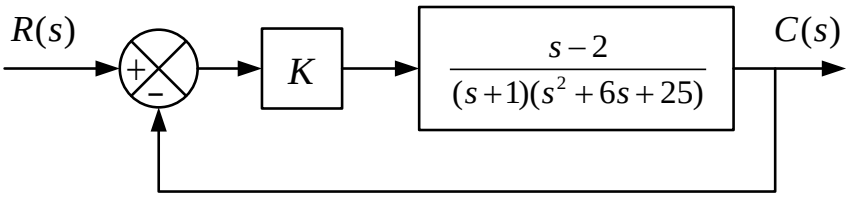

Figure: Closed-loop system.

Solution:

The closed-loop transfer function is

$$\frac{C(s)}{R(s)} = \frac{K(s-2)}{(s+1)(s^2+6s+25)+K(s-2)}$$
$$= \frac{K(s-2)}{s^3+7s^2+(31+K)+25-2K}$$

To make this system stable, above transfer function must have poles on the left-half plane. For the characteristic equation

$$s^3+7s^2+(31+K)s+25-2K=0$$

The Routh array becomes as follows :

s^3	1	$31+K$
s^2	7	$25-2K$
s^1	$\frac{192+9K}{7}$	0
s^0	$25-2K$	

Since K is assumed to be positive, for stability, we require

$$0 < K < 12.5$$