BENHA UNIVERSITY
Mechanical engineering department

Automatic control

Faculty of engineering

4^{th} year (Power) 2013/2014

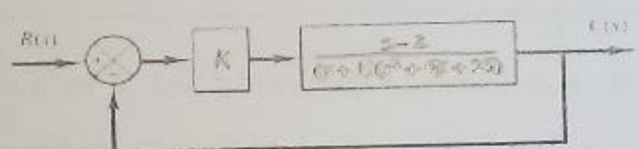
Assignment (5)

(1) Consider the following characteristic equation

$$Q(s) = S^4 + 2S^3 + (4+K)s^2 + 9s + 25 = 0$$

Using Routh Stability criterion, determine the range of K for stability, hence find the sustained frequency

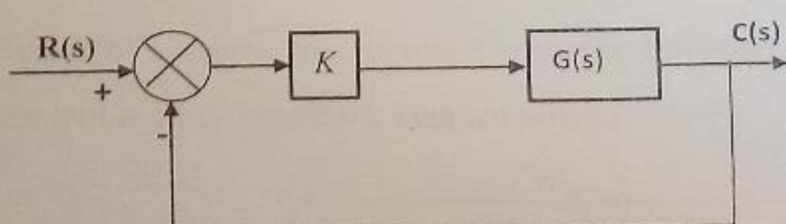
(2) Consider the closed-loop system shown in the following figure. determine the range of K for stability, hence obtain the sustained oscillation



(3) For the system represented by the block diagram of the following figure, if

$$G(s) = \frac{8}{(S+1)(S^2+2S+2)}$$

Find the range of the stability using Routh Criterion, and determine its sustained oscillation.

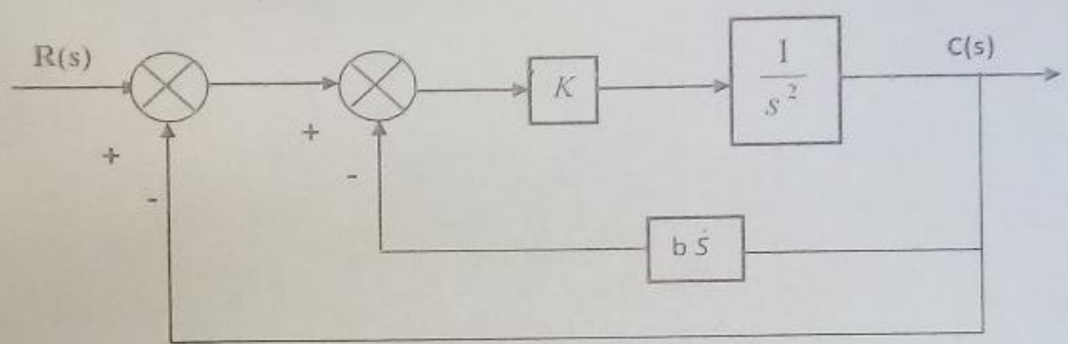


(4) The open loop transfer function of a unity feedback control system is given by

$$G(s) = K\frac{8}{(S+2)(S+4)(S^2+2S+2)}$$

Using Routh Criterion, determine the range of K for the system to be stable.

(5) The block diagram in figure (2) shows a possible way to control a train automatically. If the tachometer is not used in the feedback (That is b= 0), is it possible for the system to be stable for some value of K? If b = 0.2, Find the range of the system to be stable.



(6) Find the critical value of K for boundary stability (i.e. the closed-loop system should be on the boundary of stability) of a unity feedback control system whose open-loop transfer function is

$$G(s)=\frac{K}{S(0.5S+1)(0.1S+1)}$$

(7) Consider a unity feedback control system with the following open-loop transfer function $G(s)=\frac{10}{S(S-1)(2S+3)}$. Is that system stable?

(8) Consider control system, the forward transfer function is given by controller is used to control a unity feedback system whose

$$G(s)=\frac{K}{(s+10)(s+2)(s-1)}$$

(I) Find the range of the parameter K for which the system is stable.

(II) Find the value of K for which the system is marginally stable with a pair of imaginary roots.

(III) Compute the natural frequency in Hz of the imaginary roots in Part (II).