Type 14: Steady State Error

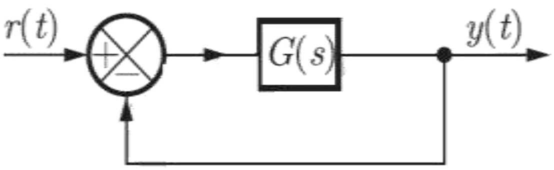
For Concept, refer to Control Systems K-Notes, Time Response Analysis

Common Mistake:
We do not need to convert a non-unity feedback system to a feedback one to find the steady state error using error constants.

Sample Problem 14:

A unity feedback is provided to the system $G(s) = \frac{1}{s(s+2)}$ to make it a closed loop system as shown in figure .For a unit step input r(t), the steady state error in the input will be

(A) 0
(B) 1
(C) 2
(D) 3



Solution: (A) is correct option

$$G(s) = \frac{1}{s(s+2)} \quad , H(s)=1$$

$$\text{Error to step input} = \frac{1}{1+K_p}$$

$$K_p = \lim_{s \to 0} G(s)H(s) = \infty$$

$$e_{ss} = \frac{1}{1+\infty} = 0$$

$$e_{ss} = 0$$

Unsolved Problems:

Q.1 The open loop transfer function of a system is $\dfrac{K}{s^2(s+1)(s+10)}$. Determine the value of 'k' such that steady state error due to unit acceleration input is 0.2

(A) 10 (B) 0.1 (C) 100 (D) 0.2

Q.2 The Bode plot of a OLTF is given below

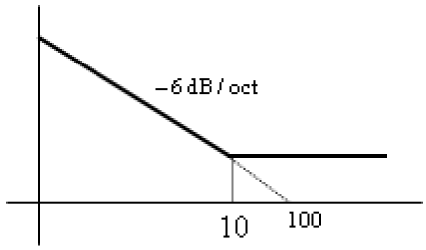
The steady state error for unit ramp input is

(A) 10

(B) 0.1

(C) 0.01

(D) 0.001



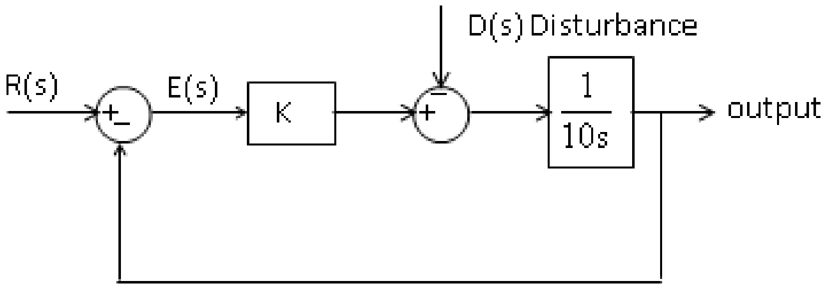
Q.3 Steady state error to both input $R(s)=\dfrac{1}{s}$ and disturbance $D(s)=\dfrac{1}{s}$ acting simultaneously is?

(A) $\dfrac{11}{K}$

(B) $\dfrac{1}{K}$

(C) $\dfrac{10}{K}$

(D) 0



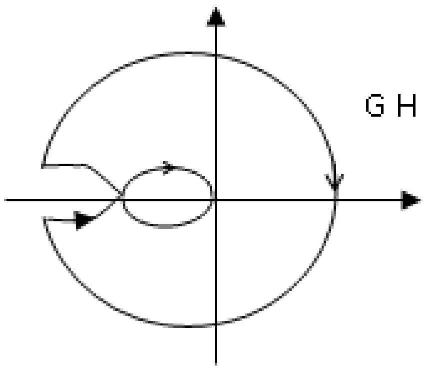
Q.4 Nyquist plot a certain stable system is given below. The acceleration error coefficient is

(A) 0

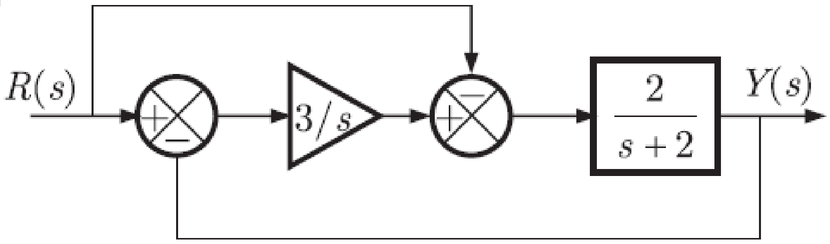
(B) ∞

(C) $-\infty$

(D) 10^2



Q.5 When subject to a unit step input, the closed loop control system shown in the figure will have a steady state error of



(A) -1.0
(B) -0.5
(C) 0
(D) 0.5