SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A++ Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 19EEB301/ CONTROL SYSTEMS

III YEAR / V SEMESTER

Unit II – TIME RESPONSE

Topic : Steady State Error

Steady State error

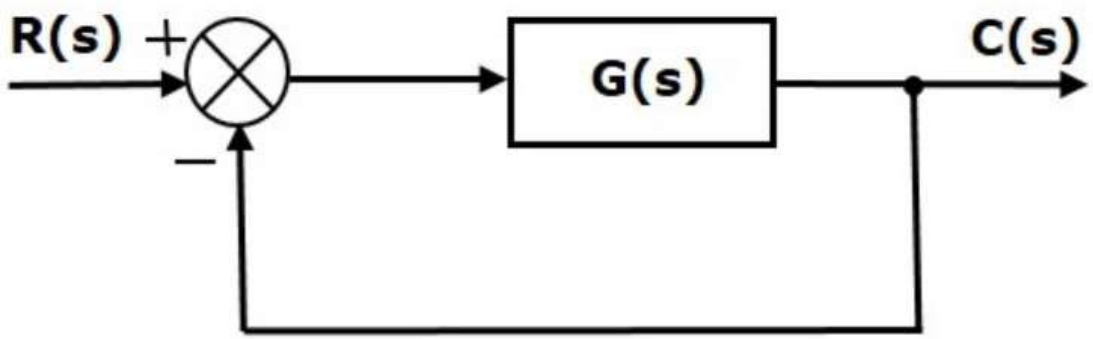
- The deviation of the output of control system from desired response during steady state is known as steady state error.
- It is represented as ess
- steady state error can find using the final value theorem as follows.

$$e_{ss} = \lim_{t \to \infty} e(t) = \lim_{s \to 0} sE(s)$$

where,

- E(s) is the Laplace transform of the error signal, e(t)

Steady State Errors for Unity Feedback Systems



Steady State error

- The transfer function of the unity negative feedback closed loop control system as

$$E(s) = \frac{R(s)}{1 + G(s)}$$

Input signal	Steady state error e_{ss}	Error constant
unit step signal	$\frac{1}{1+k_p}$	$K_p = \lim_{s\to 0} G(s)$
unit ramp signal	$\frac{1}{K_v}$	$K_v = \lim_{s\to 0} sG(s)$
unit parabolic signal	$\frac{1}{K_a}$	$K_a = \lim_{s\to 0} s^2G(s)$

- where, Kp, Kv and Ka are position error constant, velocity error constant and acceleration error constant respectively.

Steady State error

Type 0 system	Step Input	Ramp Input	Parabolic Input
Steady-State Error Formula	1/(1+Kp)	1/Kv	1/Ka
Static Error Constant	Kp = constant	Kv = 0	Ka = 0
Error	1/(1+Kp)	Infinity	infinity

Type 1 system	Step Input	Ramp Input	Parabolic Input
Steady-State Error Formula	1/(1+Kp)	1/Kv	1/Ka
Static Error Constant	Kp = infinity	Kv = constant	Ka = 0
Error	0	1/Kv	infinity

Type 2 system	Step Input	Ramp Input	Parabolic Input
Steady-State Error Formula	1/(1+Kp)	1/Kv	1/Ka
Static Error Constant	Kp = infinity	Kv = infinity	Ka = constant
Error	0	0	1/Ka

Thank You