

SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

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Department of Biomedical Engineering

Course Name: Biocontrol System

II Year : IV Semester

Unit II -Time Response Analysis

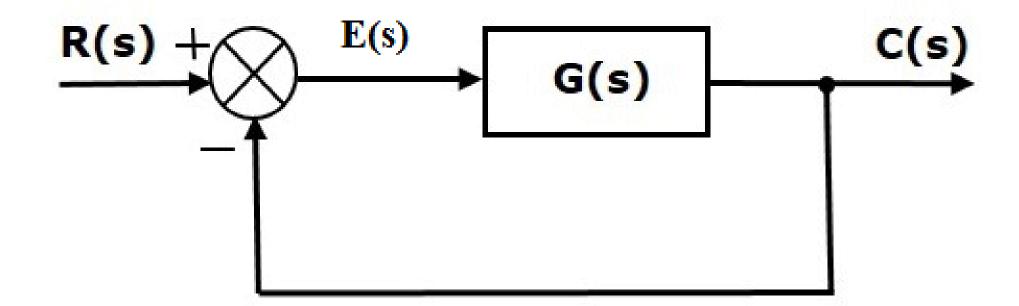
Topic: Steady State Errors

Introduction

The deviation of the output of control system from desired response during steady state is known as steady state error. It is represented as $e_{\rm ss}$.

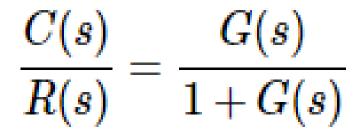
$$e_{ss} = \lim_{t \to \infty} e(t) = \lim_{s \to 0} E(s)$$

Vision Title 3





Steady State Errors



$$\Rightarrow C(s) = rac{R(s)G(s)}{1+G(s)}$$

$$E(s) = R(s) - C(s)$$

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

$$e_{ss} = \lim_{s o 0} rac{sR(s)}{1+G(s)}$$



Vision Title 3

Steady State Errors

The following table shows the steady state errors and the error constants for standard input signals like unit step, unit ramp & unit parabolic signals.

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

 Where Kp, Kv, Ka are the position error constant, velocity error constant and acceleration error constant respectively.



Steady State Errors



Input	Steady-state error formula	Type 0		Type 1		Type 2	
		Static error constant	Error	Static error constant	Error	Static error constant	Error
Step, u(t)	$\frac{1}{1+K_p}$	$K_p =$ Constant	$\frac{1}{1+K_p}$	$K_p = \infty$	0	$K_p = \infty$	0
Ramp, $tu(t)$	$\frac{1}{K_v}$	$K_v = 0$	90	$K_{\nu} =$ Constant	$\frac{1}{K_{\nu}}$	$K_v = \infty$	0
Parabola, $\frac{1}{2}t^2u(t)$	$\frac{1}{K_a}$	$K_a = 0$	00	$K_a = 0$	00	$K_a =$ Constant	$\frac{1}{K_a}$