Feedback Control System	Steady State Error	IIEE
6th Semester	Institute of Industrial Electronics Engineering	LAB-04

OBJECTIVE
To find steady state error of different type of Control system with different inputs.

THEORY:
Any physical control system inherently suffers steady-state error in response to certain types of inputs. A system may have no steady-state error to a step input, but the same system may exhibit nonzero steady-state error to a ramp input. Whether a given system will exhibit steady-state error for a given type of input depends on the type of open-loop transfer function of the system. Control systems may be classified according to their ability to follow step inputs, ramp inputs, parabolic inputs, and so on. The magnitudes of the steady-state errors due to these individual inputs are indicative of the goodness of the system. It is represented as $\mathbf{e_{ss}}$. We can find steady state error using the final value theorem as follows:

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

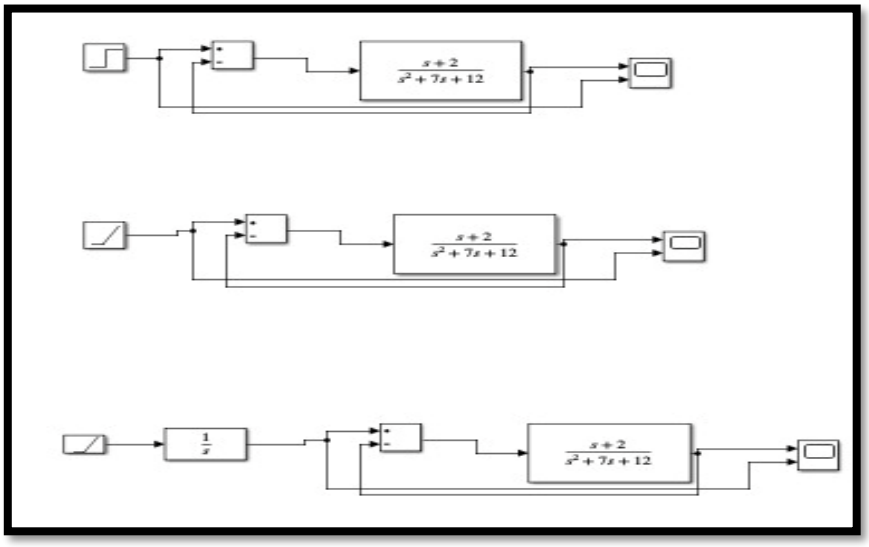
Where,
E(s) is the Laplace transform of the error signal, e(t).
The following table shows the steady state errors and the error constants for standard input signals like unit step, unit ramp & unit parabolic signals:

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

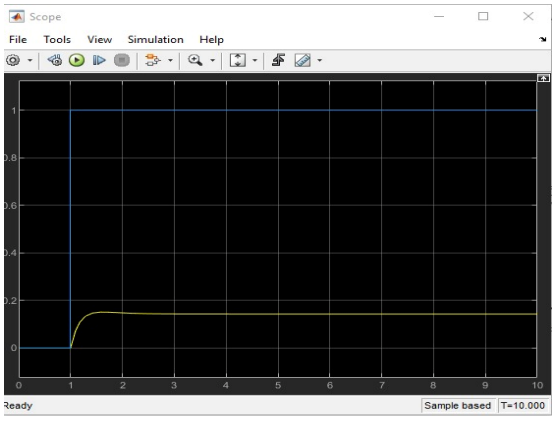
Where K_p, K_v and K_a are position error constant, velocity error constant and acceleration error constant respectively

PROCEDURE:
- Consider four control system of Type 0, Type 1, Type 2 and Type 3.
- Using Simulink, simulate the control system using different input signal such as unit step, unit ramp and unit parabolic.
- Observe the steady state error on the scope and calculate the error constant on different input signal respectively.
- Conclude your results.

TYPE:0

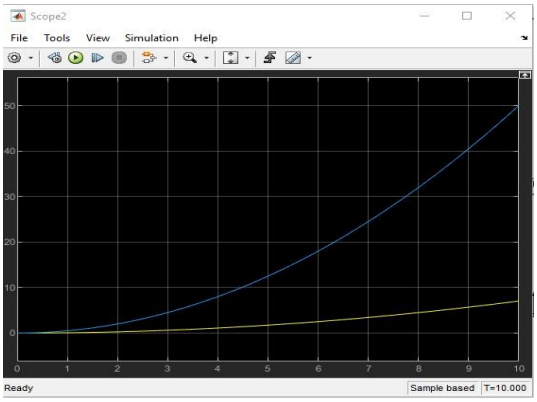


STEP INPUT:

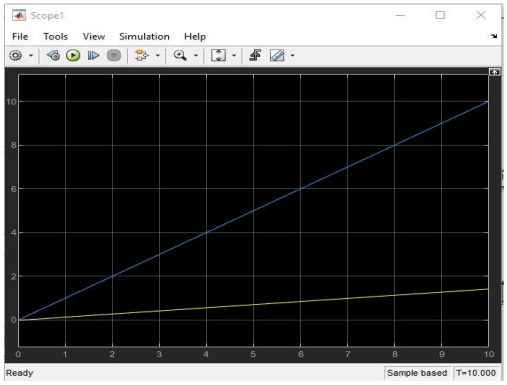


.

PARABOLIC INPUT:

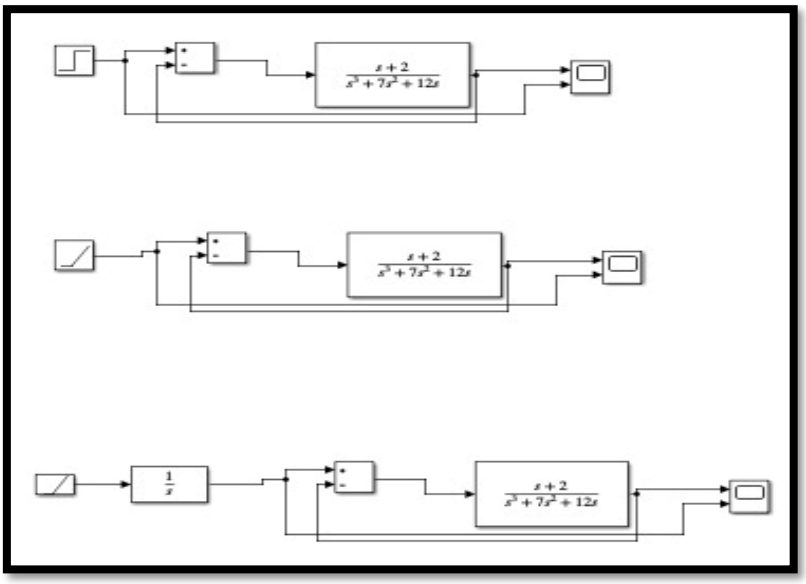


RAMP INPUT:

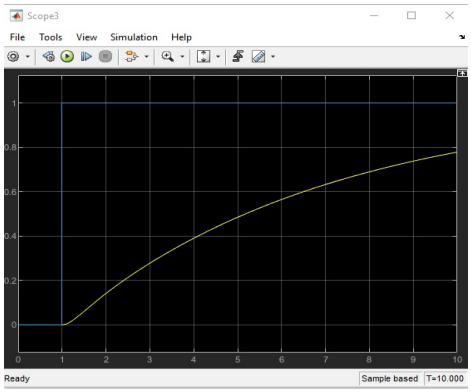


TYPE:1

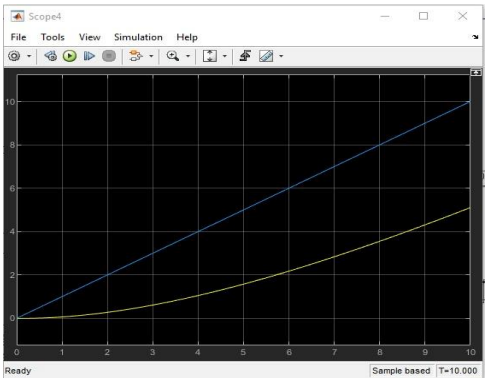
A Type 1 system includes one integrator in its open-loop transfer function. The addition of an integrator significantly improves its ability to follow certain input types:



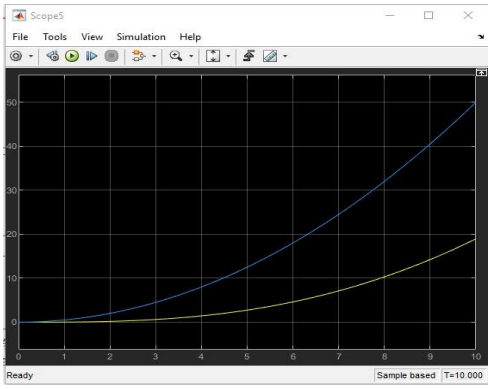
STEP INPUT:



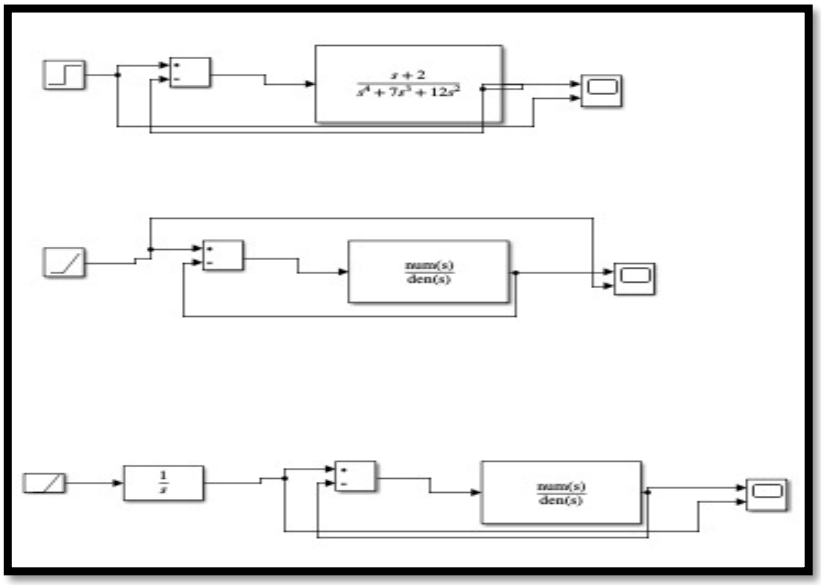
RAMP INPUT:



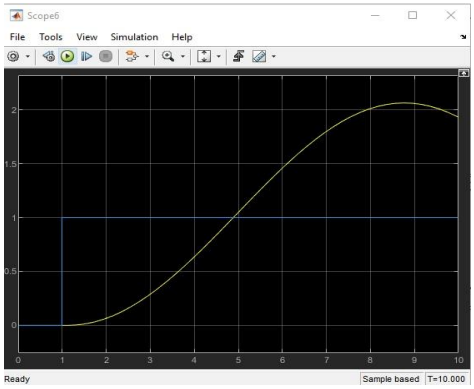
PARABOLIC INPUT:



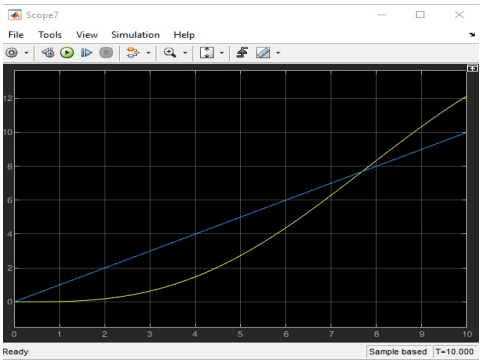
TYPE:2



STEP INPUT:



RAMP INPUT:



PARABOLIC INPUT: