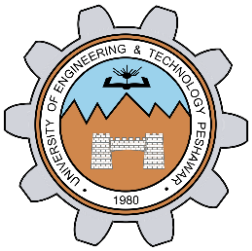
Steady State Error Analysis using Simulink

LAB # 09



Fall 2024

CSE-310L Control Systems Lab

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Class Section: **C**

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Submitted to:

Dr. Muniba Ashfaq

Date:

10th **December 2024**

Department of Computer Systems Engineering

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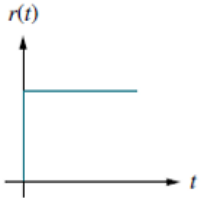
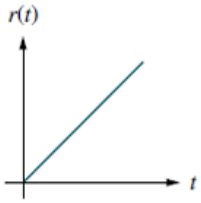
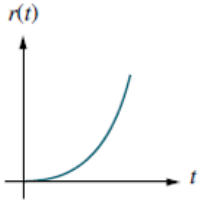
Objectives:

To analyze the steady state error analysis for different test signals in Simulink

Steady state error:

Steady state error is the difference between the input and the output for the prescribed test input as t (time) approaches to infinity. The objective of this lab to analyze the steady state error analysis for different test signals in Simulink.

Following are the test signals that will be used for analysis of steady state error.

Waveform	Name	Physical interpretation	Time function	Laplace transform
	Step	Constant position	1	$\frac{1}{s}$
	Ramp	Constant velocity	t	$\frac{1}{s^2}$
	Parabola	Constant acceleration	$\frac{1}{2}t^2$	$\frac{1}{s^3}$

Task 1:

Setup negative feedback system for the following system

$G(s)=K(s+6)/(s+4)(s+7)(s+9)(s+12)$

$H(s)=1$

Plot on graph the error signal for the input of **5u(t)** with different values of **k=50,500,1000,5000.**

MATLAB:

Code:

```
4       p = poly([-4 -7 -9 -12]);
5       display(p);
```

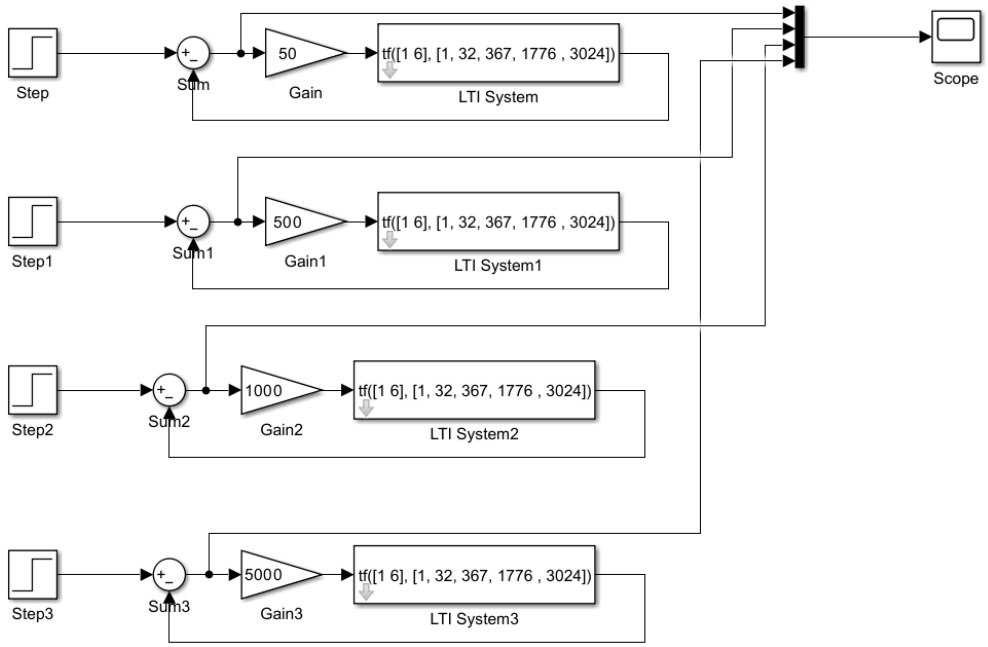
Output:

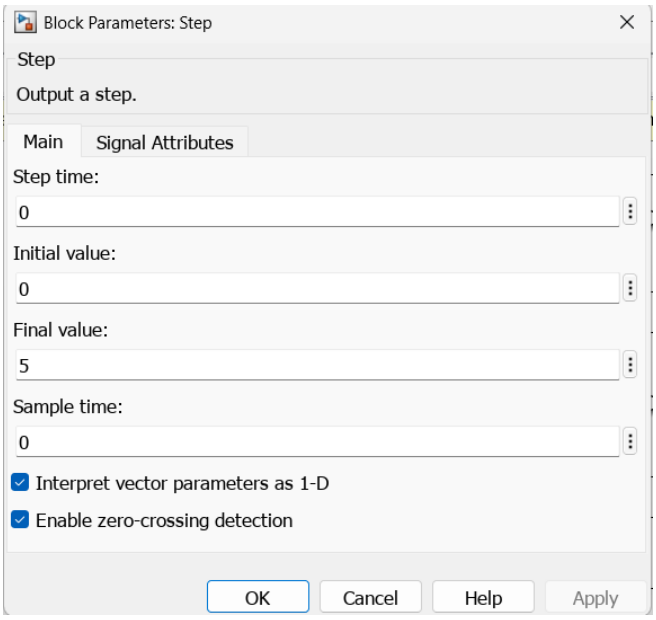
```
p =

          1          32         367        1776        3024
```

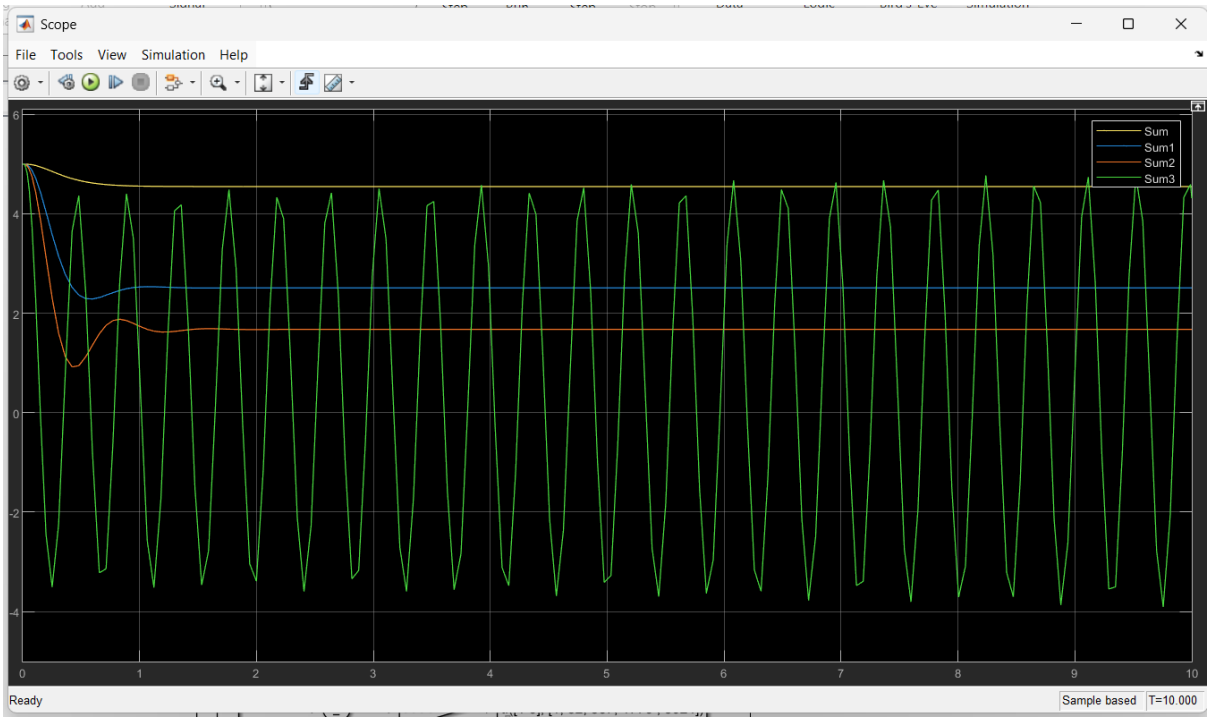
Simulink:

Block Diagram:





Output:

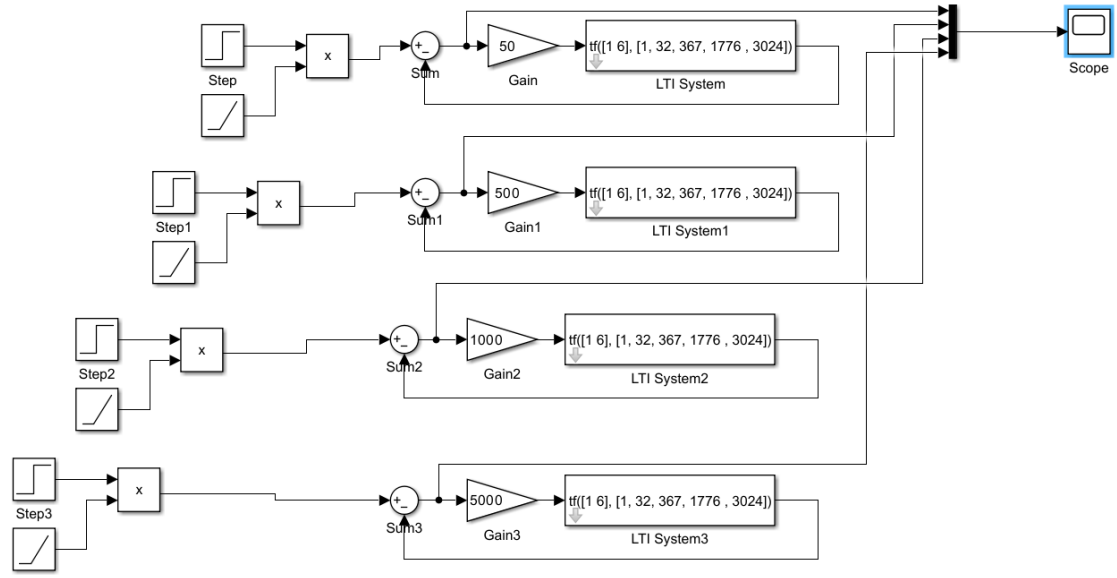


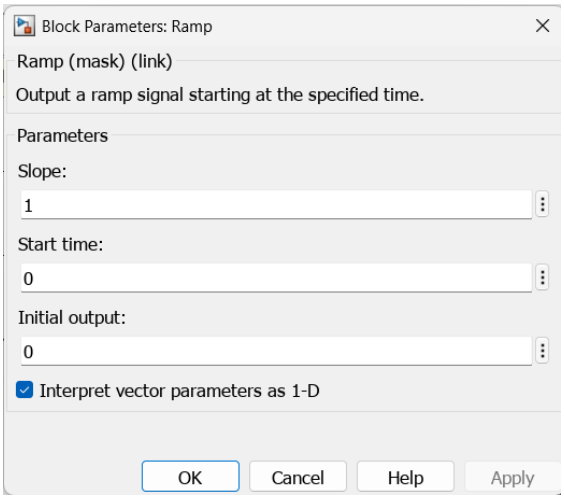
We can see that for **k=1000,** i.e sum3 wave has the least value indicating least error for the model.

Task 2:

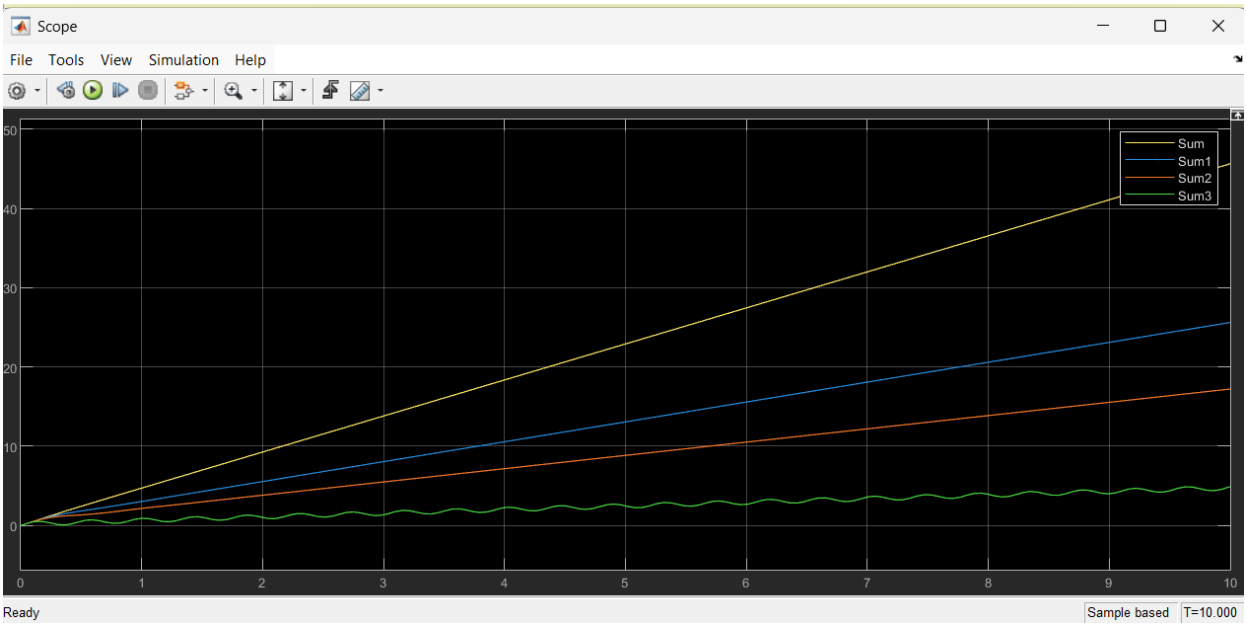
Plot on one graph Plot on graph the error signal for the input of **5tu(t)** with different values of **k=50,500,1000,5000.**

Model:





Output:

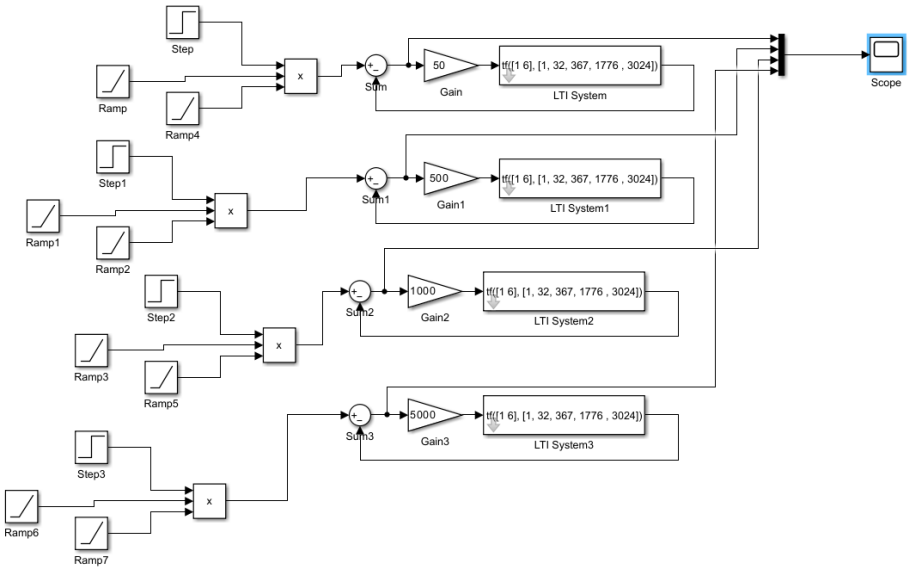


We can see from the waves that the minium value is of the sum3 value which is for k = 5000, so for this k, the system shows steady state error.

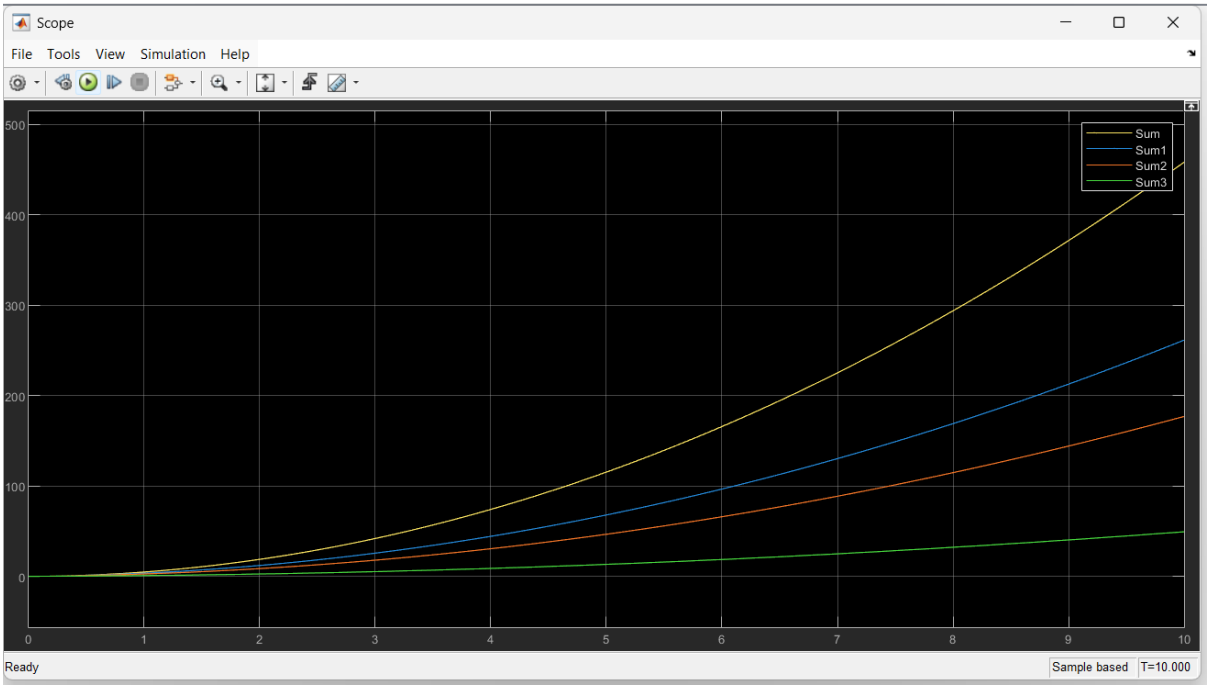
Task 3:

Plot on one graph Plot on graph the error signal for the input of 5t2u(t) with different values of **k=50,500,1000,5000.**

Code:



Output:



We can see from the waves that the minium value is of the sum3 value which is for k = 5000, so for this k, the system shows steady state error.