VASAVI COLLEGE OF ENGINEERING

(AUTONOMOUS)
(Affiliated to Osmania University)
Hyderabad - 500 031.

DEPARTMENT OF : ECE

NAME OF THE LABORATORY : Control Systems

Name G.Sri Ganga Pranav Roll No. 1602-21-735-117 Page No.

4. Time Response of given System Subjected to Arbitrary input

Aim:- To analyze the time response of given system subjected to arbitrary inputs like step, impulse, sine, ramp and parabola signals

Apparatus:- PC loaded with MATLAB.

Theory:-

In control systems, understanding the time response helps analyze and design control systems to acheive desired performance criteria like stability, speed of response and steady state accuracy.

The time response is often characterised by several key parameters like Transient response, steady state response and overall response.

Analyzing the time response involves techniques like solving differential equations; laplace transforms, transfer functions, and frequency domain analysis. Experimentally, it often involves applying various inputs to the system and observing its output to gather data for analysis. Studying the time response of a specific system under various input conditions to gain insights into its dynamic behaviour and performance characteristics. This helps in understanding how the system will behave in real-world applications and in designing appropriate control strategies to acheive desired outcomes.

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Code:-

```
% Program 1
clc;
close all;
clear;
s= tf('s');
t = -10:0.01:10;        % Defining time
x1 = 5.*sin(t);         % Sine input
x2 = t;                 % Ramp
x3 = t.^2/2 ;           % Parabola

H1 = 25/(s^2+6*s+25)    % Transfer function of the system
subplot(2,2,1)
lsim(H1,'r--',x1,t)     % step respons % Sine response
title('Sine response - -1602-21-735-117')

subplot(2,2,2)
impulse(H1)             % impulse response
title('impulse response - -1602-21-735-117')
subplot(2,3,4)
step(H1)                % step response
title('step response - -1602-21-735-117')
```

```
subplot(2,3,5)
lsim(H,'r--',x2,t) % Ramp response.
title('Ramp response --1602-21-735-117')
subplot(2,3,6)
lsim(H,'r--',x3,t) % Parabola response
title('Parabola Response --1602-21-735-117')

% Program 2
clc;
close all;
clear;

s=tf('s');
t=-10:0.01:10 % Defining time
g1=10/(s+1);          % System 1 Transfer function. (open loop)
g2=10/(s*(s+1));      % System 2 Transfer function (open loop)
g3=10/(s^2*(s+1));    % System 3 Transfer function (open loop)
h1=feedback(g1,1,-1) % System 1 closed loop gain
h2=feedback(g2,1,-1) % System 2 closed loop gain
h3=feedback(g3,1,-1) % System 3 closed loop gain
```

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```
x1 = t.^2/2;
subplot(3,1,1)
step(h1)
title('step response of h1')
subplot(3,1,2)
impulse(h1)
title('impulse response of h1')
subplot(3,1,3)
lsim(h1,'r--',x1,t)
title('parabolic response of h1')
figure(2)
subplot(3,1,1)
step(h2)
title('step response of h2')
subplot(3,1,2)
impulse(h2)
title('impulse response of h2')
subplot(3,1,3)
lsim(h2,'r--',x1,t)
title('parabolic response of h2')
```

```
figure(3)
subplot(3,1,1)
step(h3)
title('step response of h3')
subplot(3,1,2)
impulse(h3)
title('impulse response of h3')
subplot(3,1,3)
lsim(h3,'r--',x1,t)
title('impulse response of h3')
```

Observation:-

$g_1(s) = \frac{10}{s+1}$ } order = 1, Type = 0 | $g_2(s) = \frac{10}{s(s+1)}$ } order = 2, Type = 1 | $g_3(s) = \frac{10}{s^2(s+1)}$ } order = 3, type = 2

In type 0 systems, steady state response is constant incase of step response, whereas it keeps increasing and reaches infinity in all other cases.

In type 1 systems, steady state response is constant incase of step response and ramp response, whereas it keeps increasing at reaches infinity in all other cases.

In type 2 systems, steady state ~~response~~ error is stable and constant in all the three cases i-e, for the inputs unit step, ramp and parabolic signals.

Result:- Analyzed the time response of a given system for various inputs.