

Indian Institute of Information Technology, Allahabad
Department of Electronics and Communication Engineering

Course Name: Control System Lab

EXPERIMENT NO: 3

STUDY THE EFFECT OF ADDITION OF POLES and zeros TO THE FORWARD PATH TRANSFER FUNCTION OF A CLOSED LOOP SYSTEM.

Objective: Write a Matlab code to study the effect of addition of poles and zeros to the forward path transfer function of a closed loop system.

$$\text{Transfer function } t_1 = \frac{1}{s^2 + s + 4}$$

Materials Required: MATLAB Software.

MATLAB Code :

```
clc;
clear all;
close all;
n1=[1];
d1=[1 1 4];
t1=tf(n1,d1) % transfer function
step(t1,'r')
stepinfo(t1)
hold on

% addition of zeros at -2 in forward path of closed loop system
Tz=0.5; % add a zeros at -2
Z1=[Tz 1];
n2=conv(n1,Z1);
t2=tf(n2,d1) % transfer function after adding zeros
step(t2,'b')
stepinfo(t2)
hold on

% addition of poles at -2 in forward path of closed loop system
Tp=0.5; % add a pole at -2
P1=[Tp 1];
d3=conv(d1,P1) ;
t3=tf(n1,d3) % transfer function after adding pole
step(t3,'g')
stepinfo(t3)
legend('step response without addition of zeros','step response with
addition of zeros', 'step response with addition of pole' )
```

Result:

t1 =

$$\frac{1}{s^2 + s + 4}$$

t2 =

$$\frac{0.5 s + 1}{s^2 + s + 4}$$

t3 =

$$\frac{1}{0.5 s^3 + 1.5 s^2 + 3 s + 4}$$

Observation Table:

| Time domain specification | Rise Time | Peak time | Settling time | Overshoot (%) |
|---------------------------|-----------|-----------|---------------|---------------|
| Without adding Zeros | 0.6343 | 1.6579 | 7.0579 | 44.3235 |
| With adding zeros | 0.3731 | 1.1973 | 8.0296 | 68.5806 |
| With adding poles | 0.8666 | 2.1184 | 7.3047 | 27.6707 |

