# Time Domain Specifications of a Second Order System

## Experiment Number: 03

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## Aim:

The objective of this exercise is to

1. Understand the step response (transient and steady state) of a second order system.

2. Know the time domain specifications like peak overshoot, rise time, settling time and steady state error.

3. Analyze the effect of additional poles and zeros on a second order system.

**PRACTICE:**

Commands Used

#sys1= tf ([num],[den1 coefficients])

#ltiview(sys)

#pole(sys)

#zero(sys)

#r=roots(sys)

#poly(-a1; r)

#sys2= tf ([num],[den2 coefficients])

#sys3= tf ([num],[den3 coefficients])

#ltiview(sys1,sys2,sys3)

**System #1**

1. $G(s) = \frac{25}{s^2+5s+25}$

2. Add a real pole near the dominant pole of G(s)

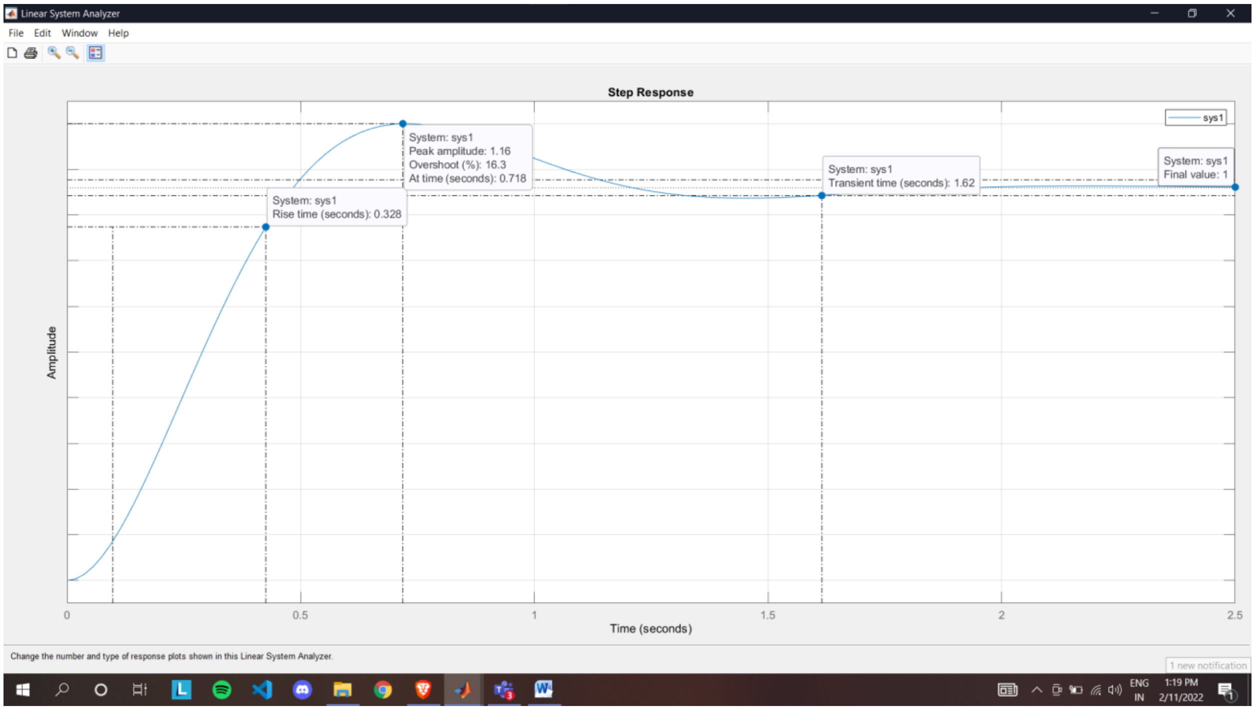
3. Add a real pole away the dominant pole of G(s)

**CODE:**

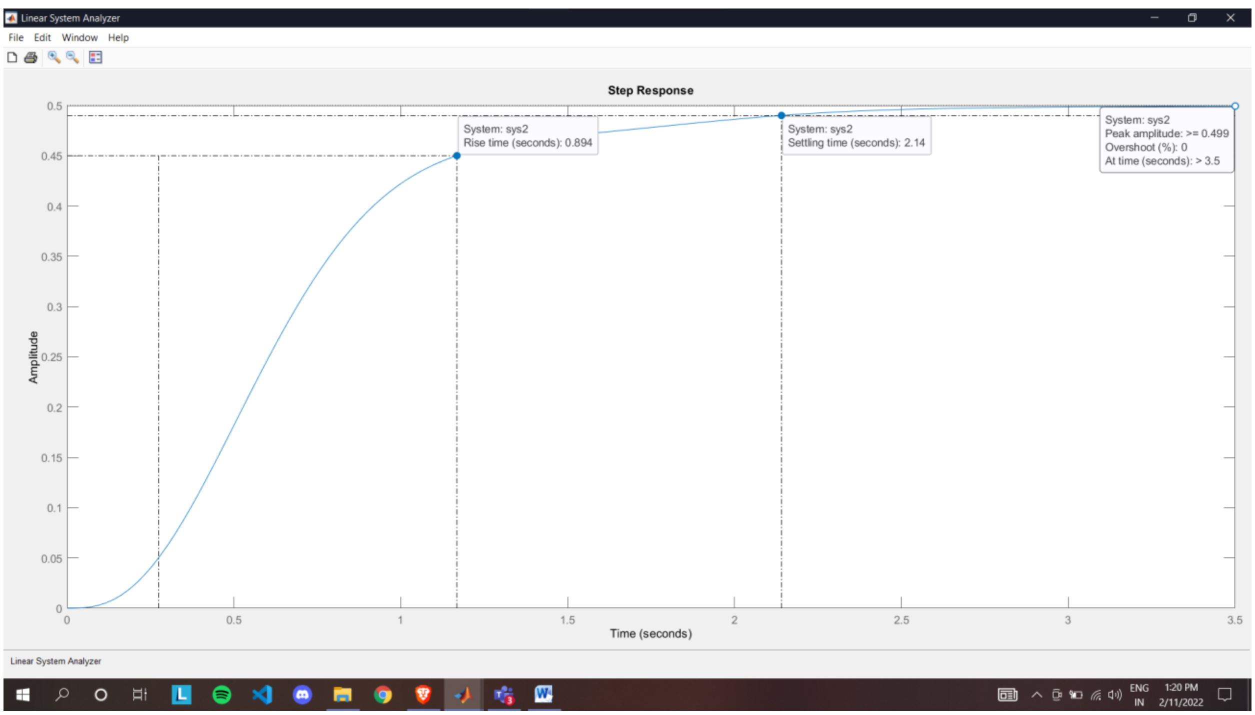
```
clc;
clear all;
num=[25]
den=[1 5 25]
sys1=tf(num,den)
P1 = pole(sys1)
Z1 = zero(sys1)
r=roots(den)
ltiview(sys1)
a=poly([-2;r])
num1=num/1
sys2= tf(num1,a)
P2 = pole(sys2)
ltiview(sys2)
num2=num/1
a1=poly([-4;r])
sys3=tf(num2,a1)
P3 = pole(sys3)
ltiview(sys3)
ltiview(sys1,sys2,sys3)
```

<u>**OUTPUT:**</u>

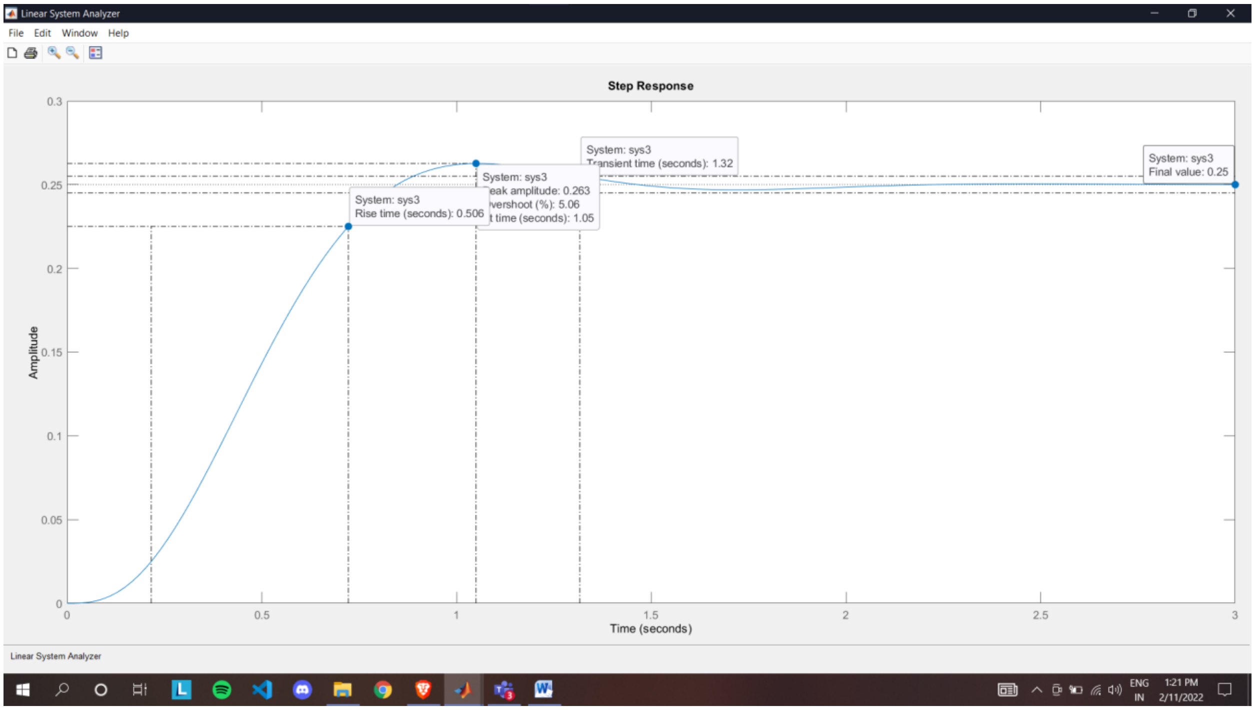
## System G(S)



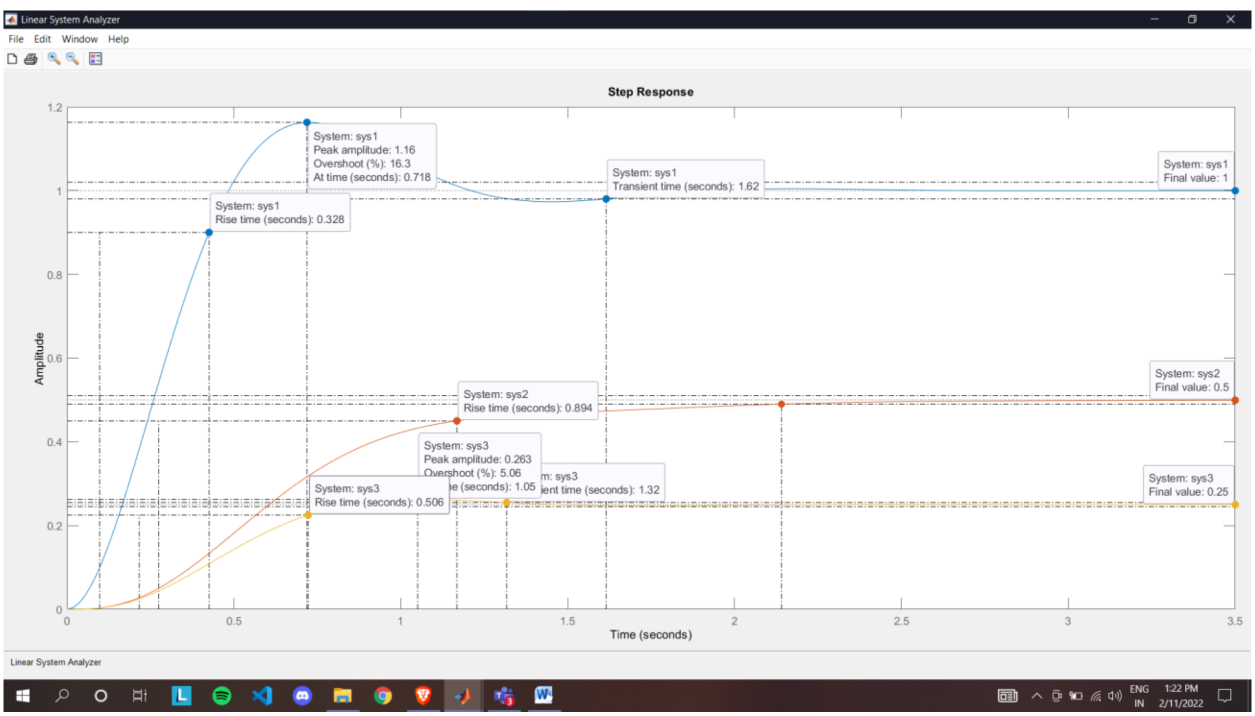

## Add a real pole near the dominant pole of G(s)



## Add a real pole away the dominant pole of G(s)




## LTI View of all three system

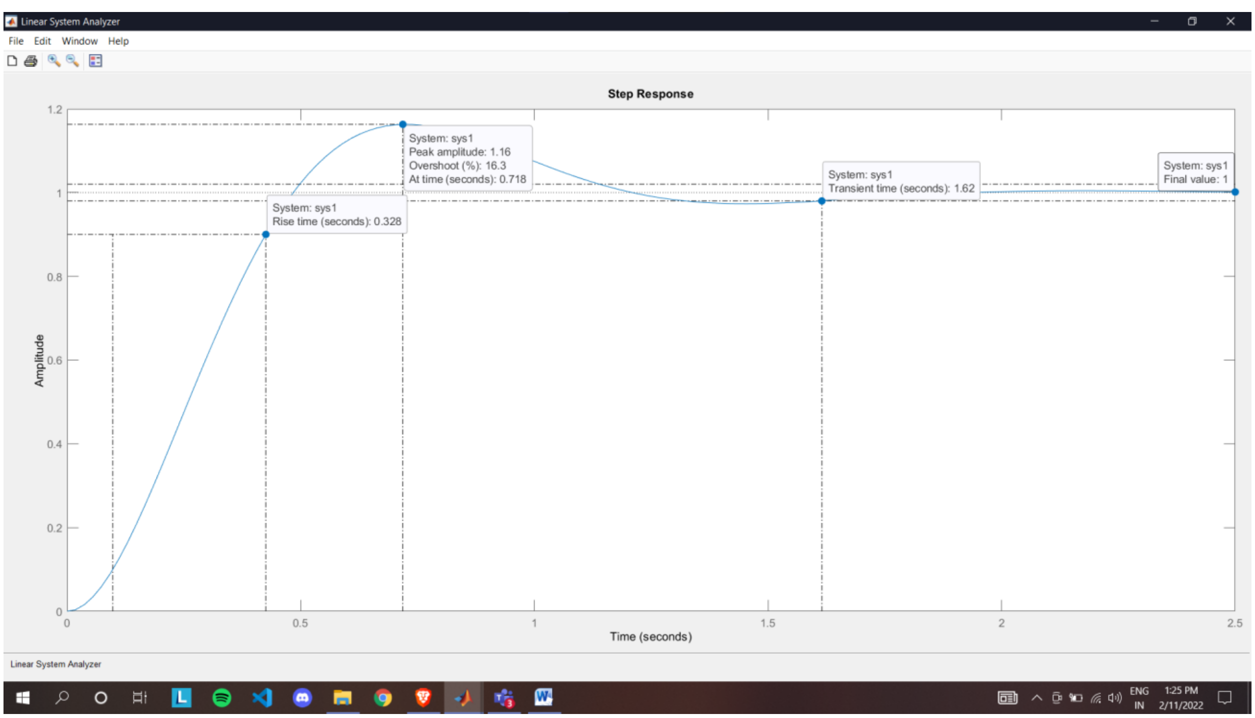


## CODE:

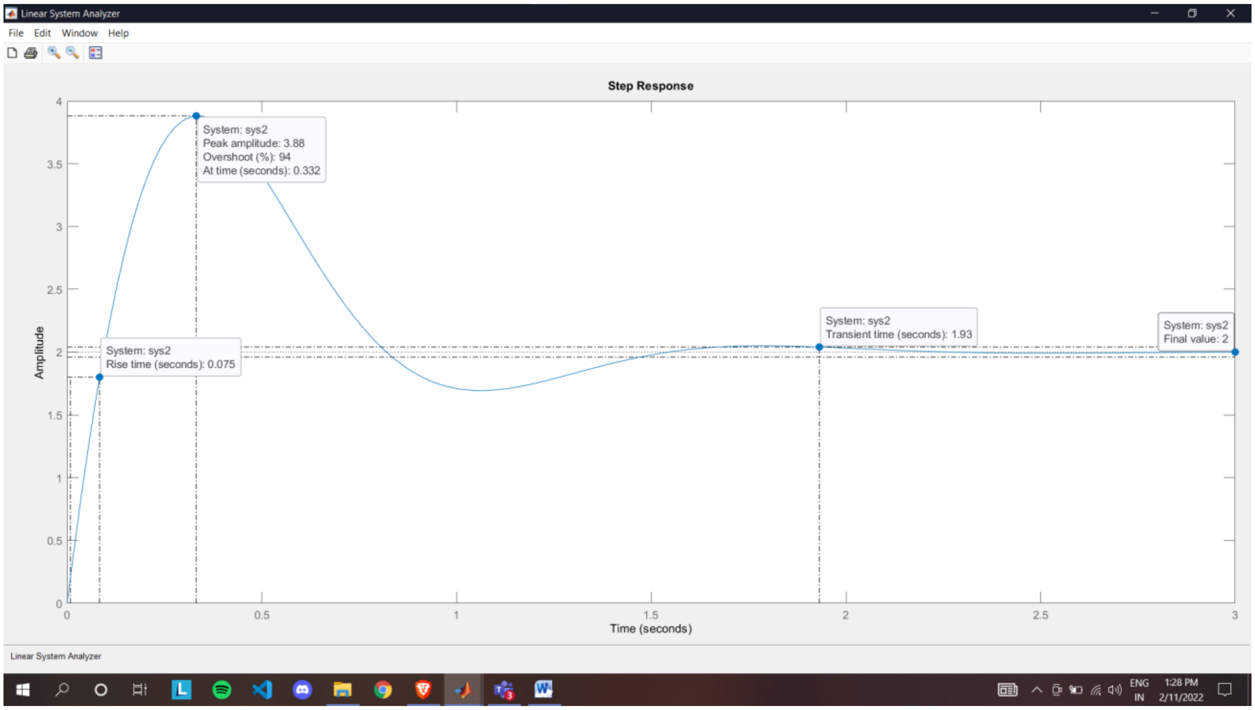
```
clc;
clear all;
num=[25]
den=[1 5 25]
sys1=tf(num,den)
P1= pole(sys1)
Z1= zero(sys1)
r=roots(den)
ltiview(sys1)
num1=[25 50]
sys2= tf(num1,den)
Z2 = zero(sys2)
ltiview(sys2)
num2=[25 100]
sys3=tf(num2,den)
Z3 = zero(sys3)
ltiview(sys3)
ltiview(sys1,sys2,sys3)
```

## OUTPUT:

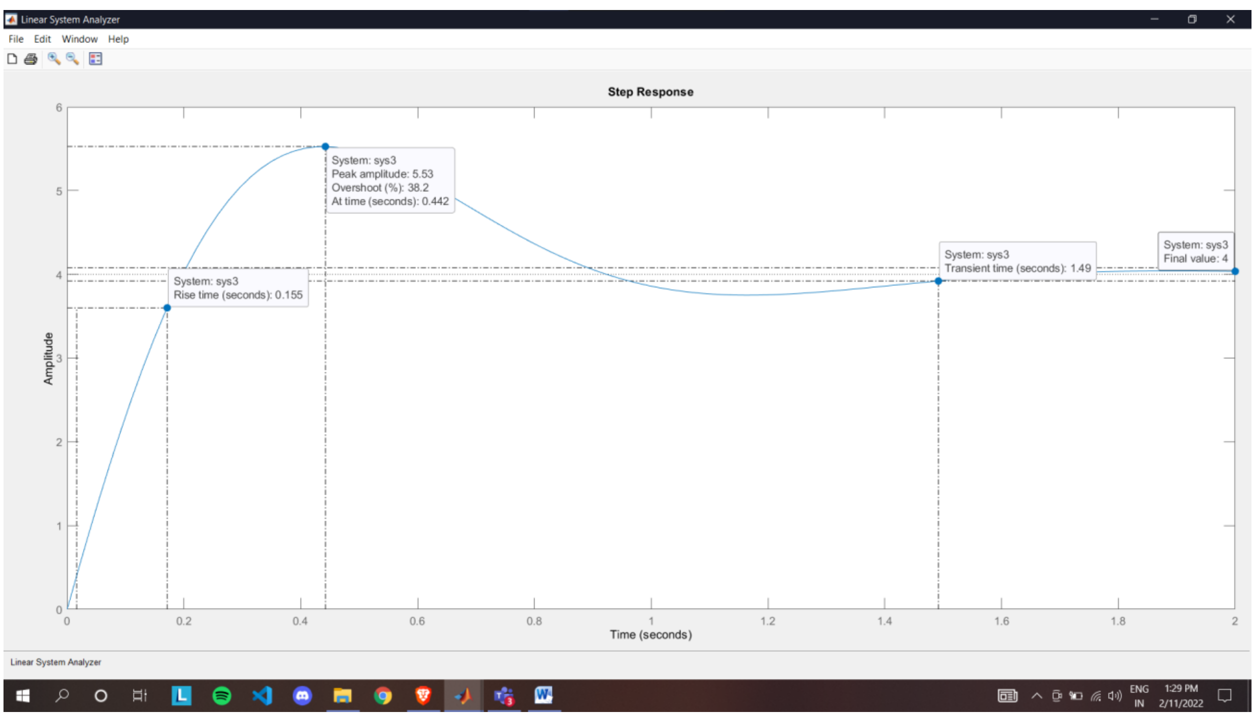
### System G(S)



## Add a real zero near the dominant zero of G(s)




## Add a real zero away the dominant zero of G(s)



## LTI View of all three systems