Understanding Systems with MATLAB

Experiment Number: 02

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Registration Number: 20BPS1022 Date: 04/02/2022

Aim:

The goal of this exercise is:

1. To learn the general shape of a second order system's transfer function.

2. The response of the second order system when the damping ratio varies.

3. System pole positioning owing to a change in damping ratio.

4. Find a first-order and a second-order system with the same step response.

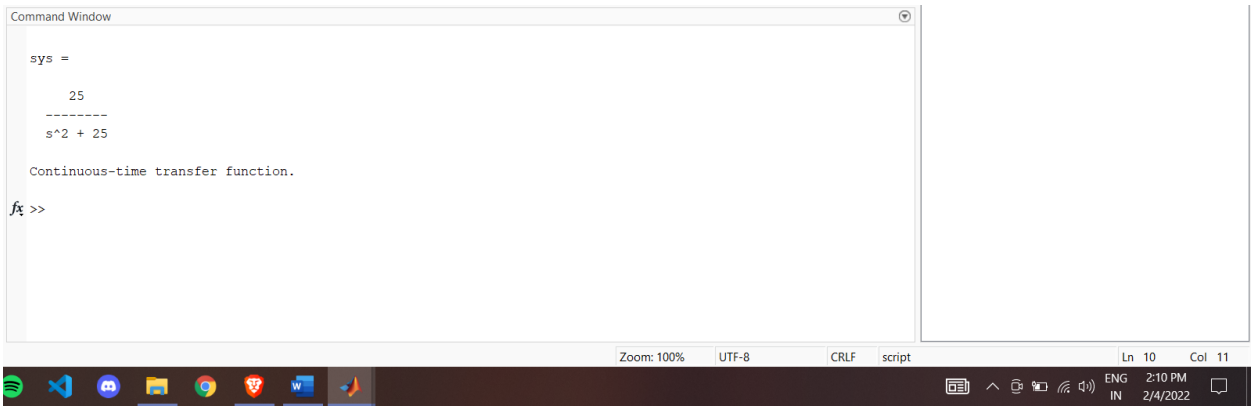
Draw the locus of roots of the system as the damping ratio changes increases. Write a MATLAB code to do plot the locus.

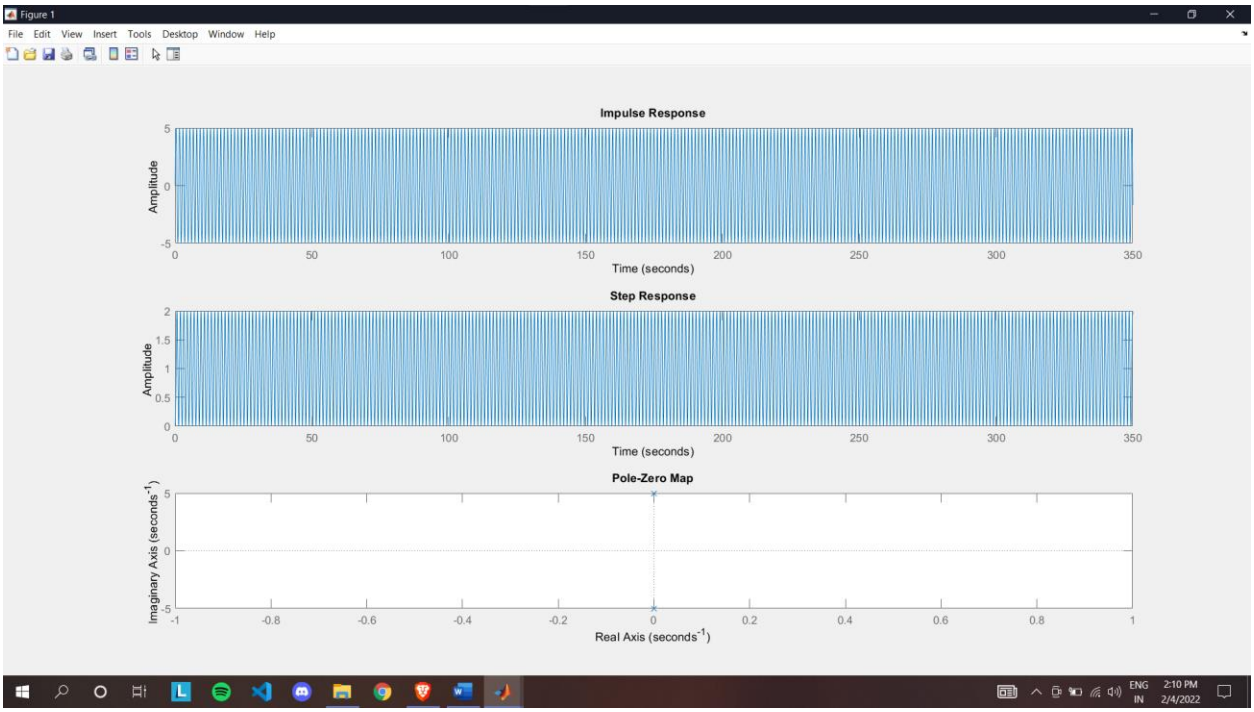
1.) Undamped System

Code:

```
clear all
clc
% undamped system
sys = tf([25],[1 0 25])
subplot(3,1,1)
impulse(sys)
subplot(3,1,2)
step(sys)
subplot(3,1,3)
pzmap(sys)
```

Output:





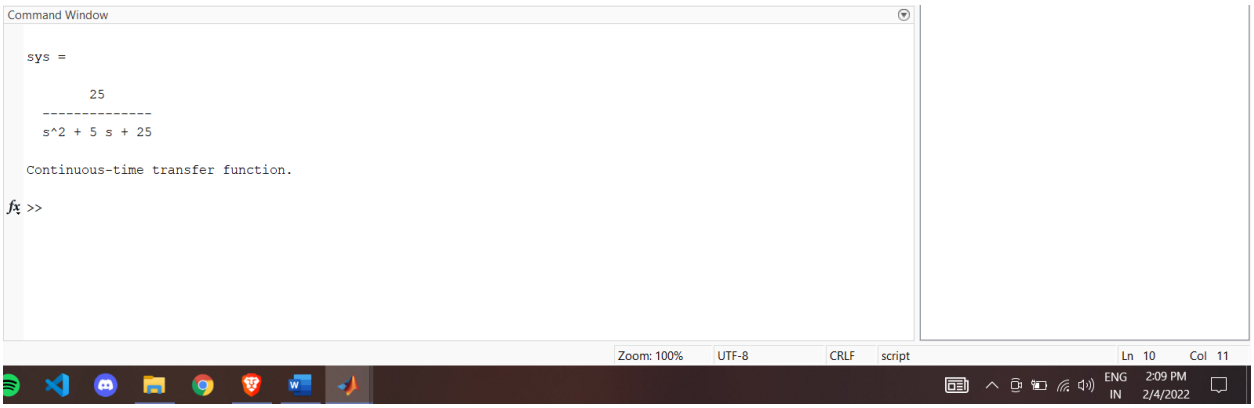
2.) Underdamped System

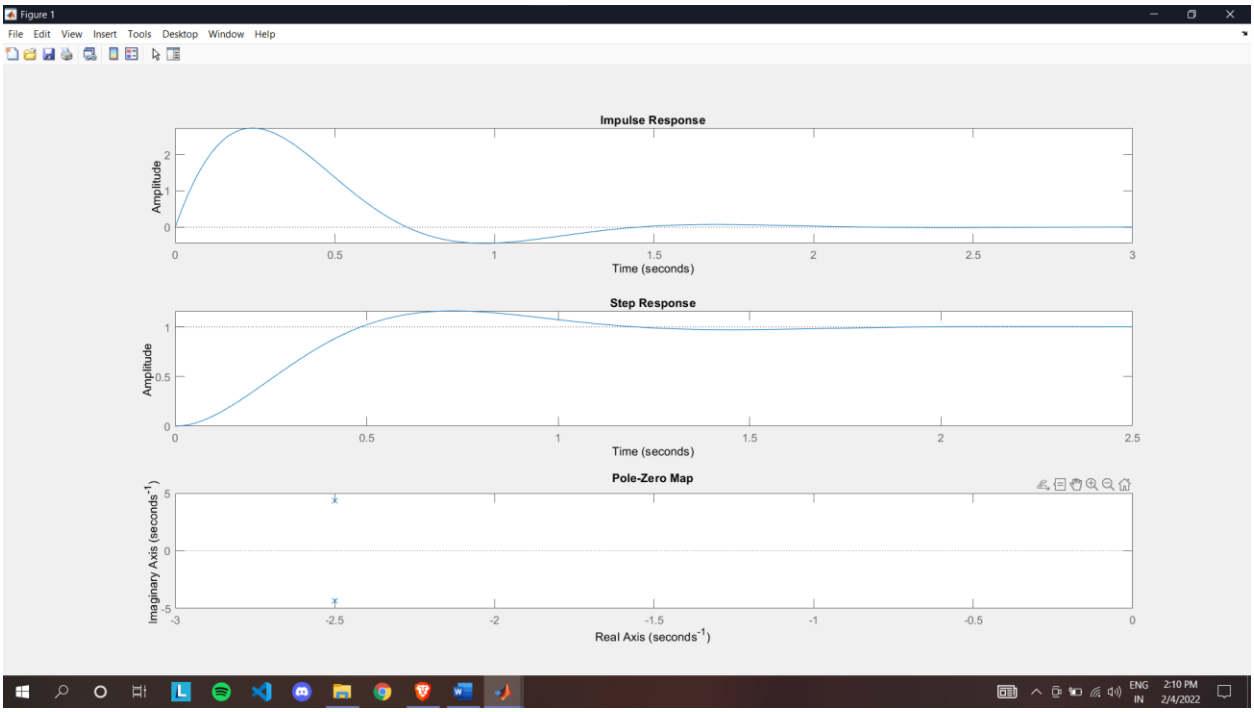
Code:

```
% underdamped system
clear all
clc
sys = tf([25],[1 5 25])
subplot(3,1,1)
impulse(sys)
subplot(3,1,2)
```

```
step(sys)
subplot(3,1,3)
pzmap(sys)
```

Output:



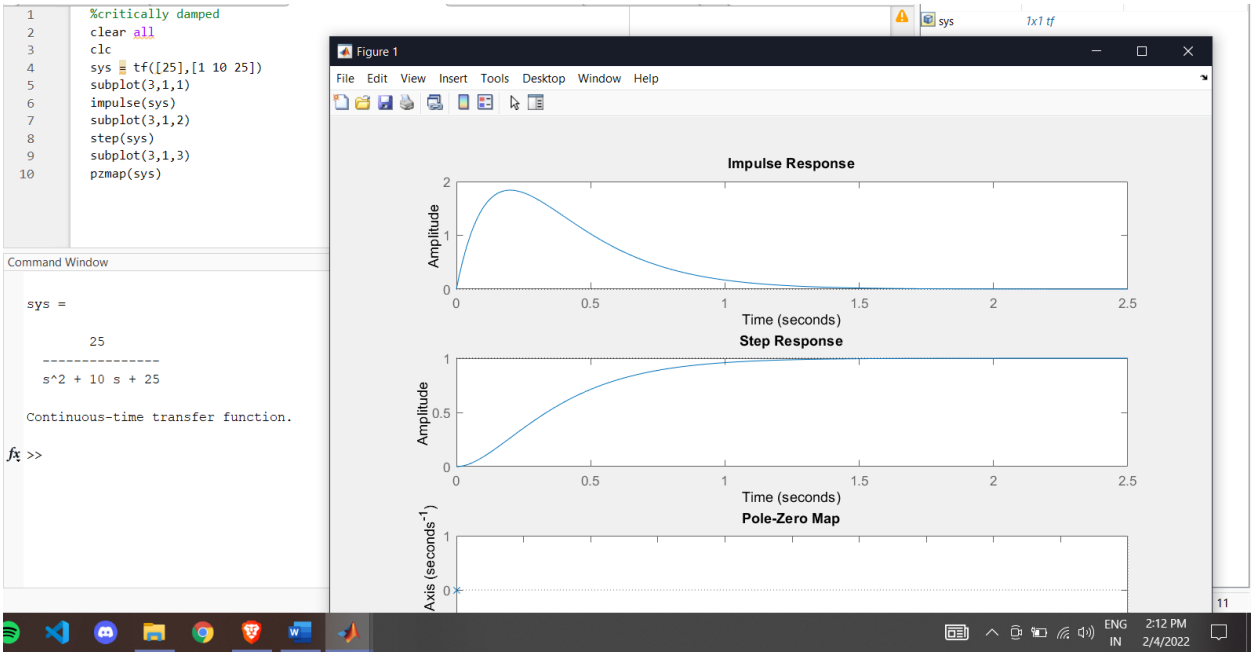


3.) Critically Damped System

Code:

```
%critically damped
clear all
clc
sys = tf([25],[1 10 25])
subplot(3,1,1)
impulse(sys)
subplot(3,1,2)
step(sys)
subplot(3,1,3)
pzmap(sys)
```

Output:

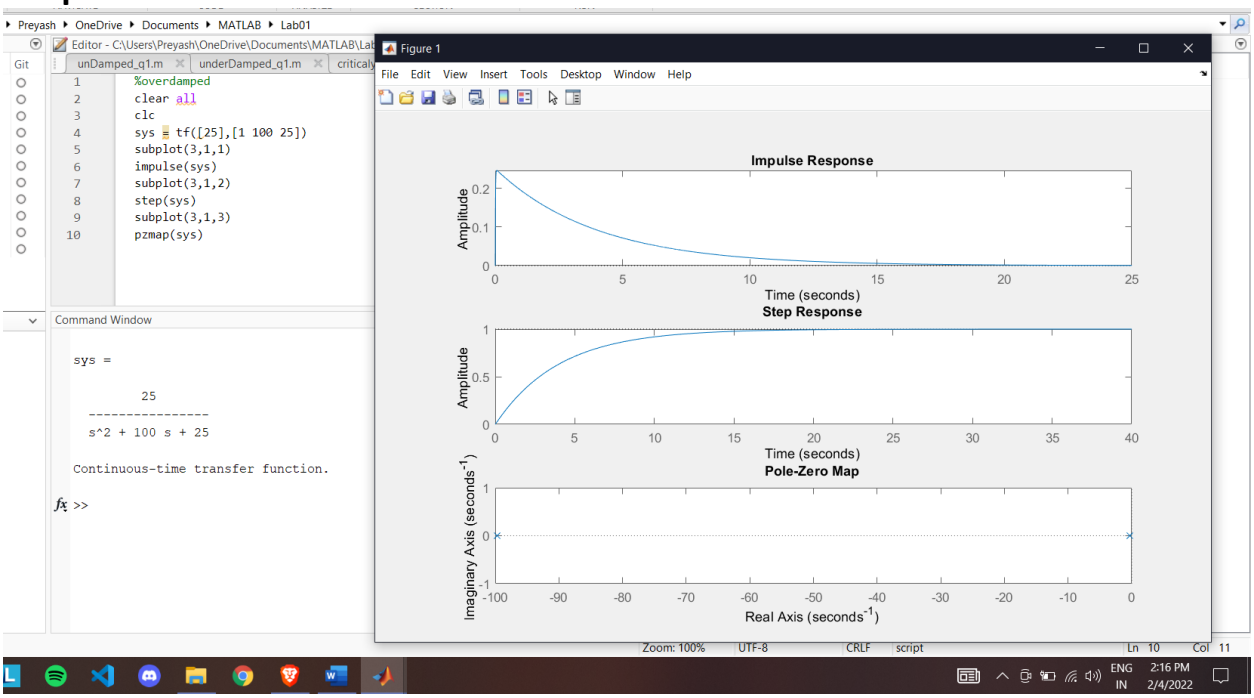


4.) Overdamped System

Code:

```
%overdamped
clear all
clc
sys = tf([25],[1 100 25])
subplot(3,1,1)
impulse(sys)
subplot(3,1,2)
step(sys)
subplot(3,1,3)
pzmap(sys)
```

Output:



5.) First Order System

Code:

```
%first order system
clear all
clc
sys = tf([0.2506],[1 0.2506])
subplot(3,1,1)
impulse(sys)
subplot(3,1,2)
step(sys)
subplot(3,1,3)
pzmap(sys)
```

Output: