

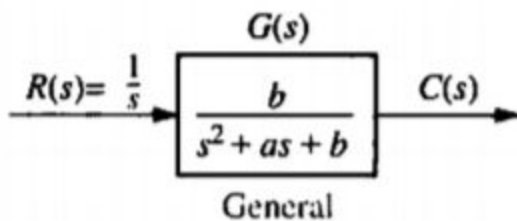
Experiment No. 1

AIM

Study of time response of a second order system subjected to step input under varying damping conditions.

OBJECTIVE

To plot the Step Response of the general transfer function with following parameter specifications:



- a). $a=9$, $b=9$ (overdamped)
- b). $a=2$, $b=9$ (underdamped)

Also plot the pole-zero relationship plot. Label the axis and provide title for the plots.

MATLAB Code and Output

a) $a=9$ & $b=9$ (Overdamped System)

Command Window

```
fx >> clc           % clear command window
      clear all      % clear workspace

      % Define Transfer Function G
      s = tf('s');
      % G = b/(s^2 + a*s + b);
      G1 = 9/(s^2 + 9*s + 9) % transfer function for Overdamped system
```

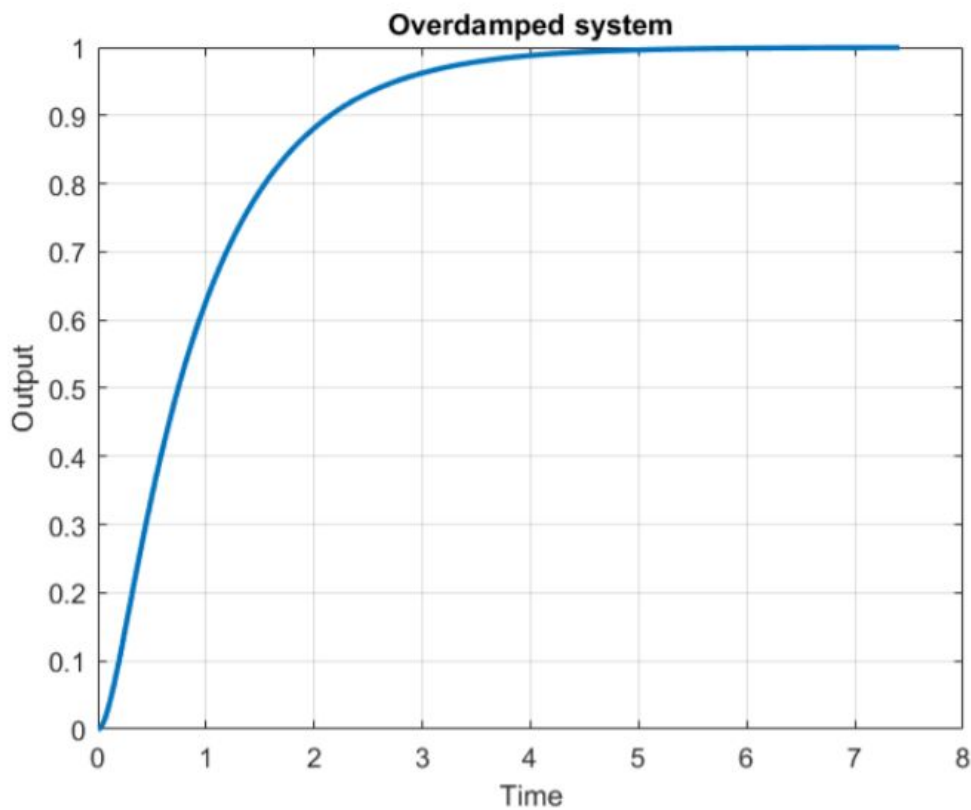
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G1 =

$$\frac{9}{s^2 + 9s + 9}$$

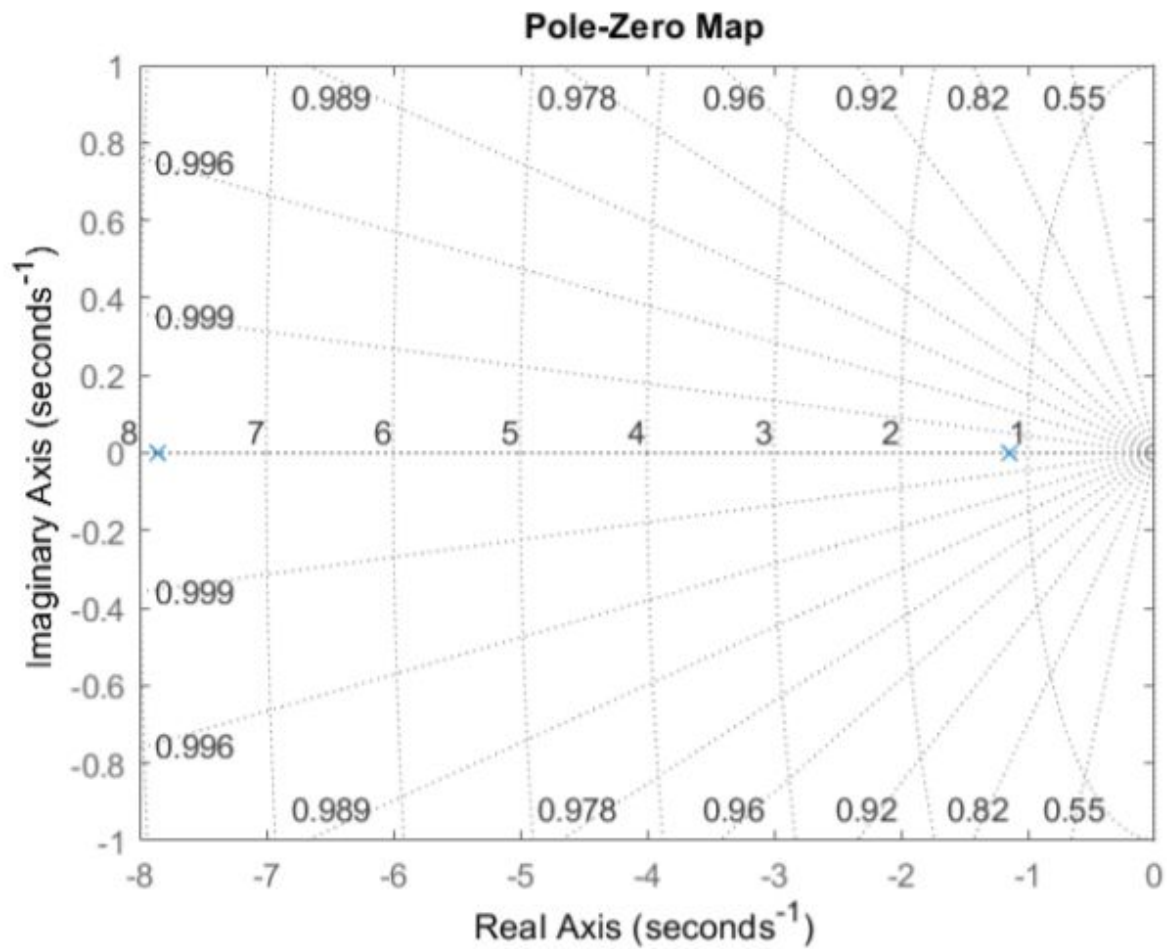
```
fx >> % Continuous-time transfer function
% Step Response Plot
[x1, t1] = step(G1);
plot(t1, x1, 'LineWidth', 2);
grid
title('Overdamped system') % title
xlabel('Time') % x-axis label
ylabel('Output') % y-axis label
```



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```
fx >> % Pole-Zero Plot  
pzmap(G1)  
grid
```



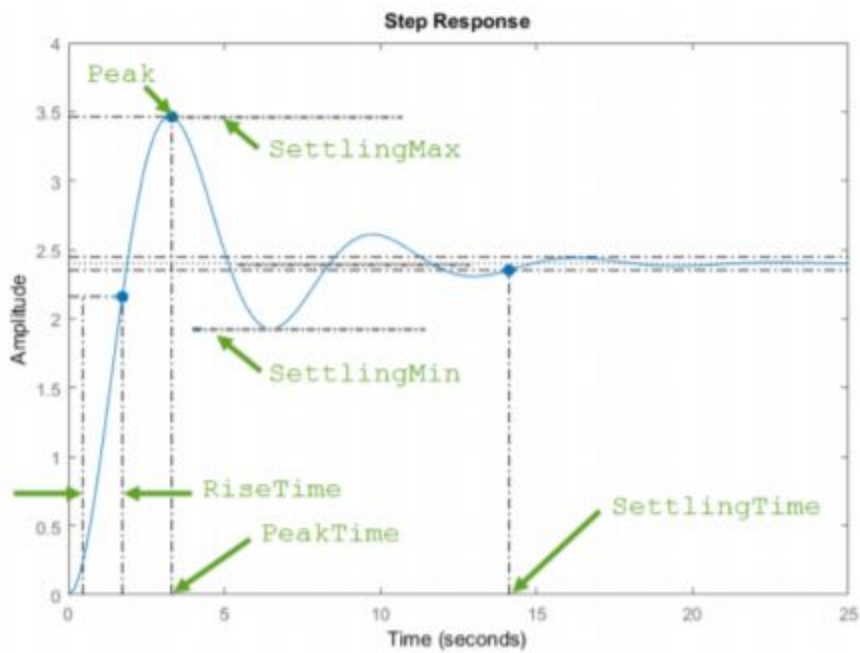
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```
fx >> stepinfo(G1) % step response specification
```

```
ans = struct with fields:
```

```
    RiseTime: 1.9528  
    SettlingTime: 3.5516  
    SettlingMin: 0.9012  
    SettlingMax: 0.9999  
    Overshoot: 0  
    Undershoot: 0  
    Peak: 0.9999  
    PeakTime: 8.6661
```

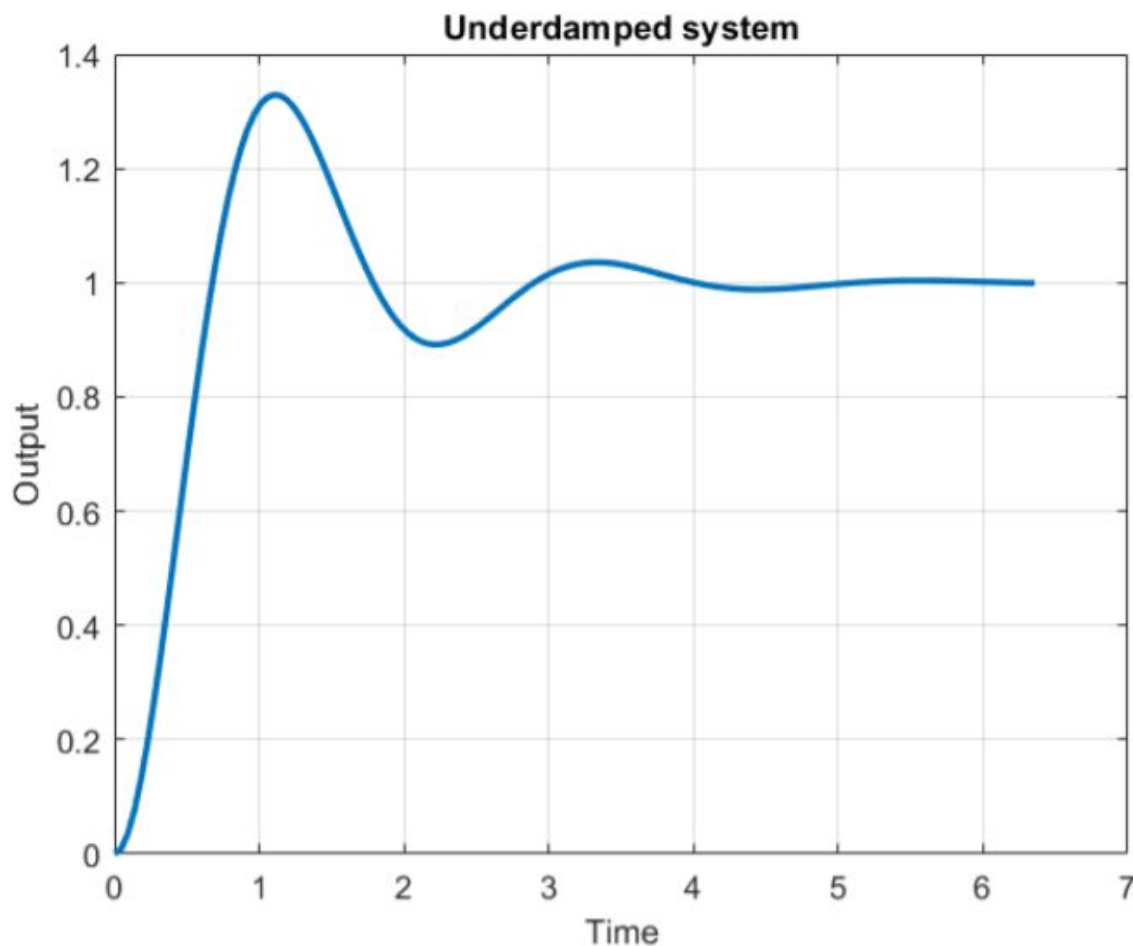


Experiment No. 1

b) $a=2$ & $b=9$ (Underdamped System)

```
fx >> G2 = 9/(s^2 + 2*s + 9) % Transfer function for underdamped system
```

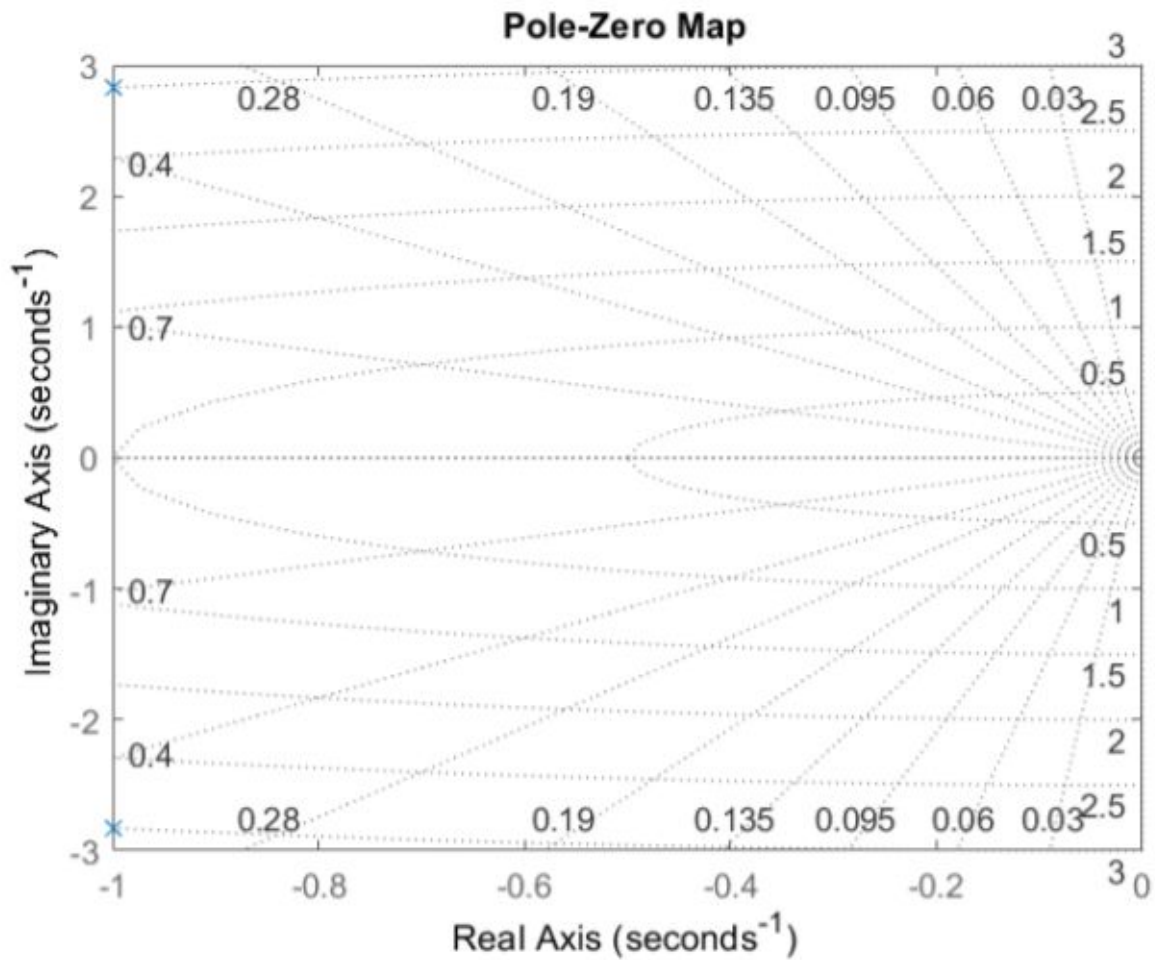
```
fx >> % Step Response Plot  
[x2, t2] = step(G2);  
plot(t2, x2, 'LineWidth', 2); % Plot command  
grid % grid lines  
title('Underdamped system')  
xlabel('Time')  
ylabel('Output')
```



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Experiment No. 1

```
fx >> % Pole-Zero Plot  
pzmap(G2)  
grid
```



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Experiment No. 1

```
|fx >> stepinfo(G2)|
```

```
ans = struct with fields:  
    RiseTime: 0.4568  
    SettlingTime: 3.7005  
    SettlingMin: 0.8916  
    SettlingMax: 1.3293  
    Overshoot: 32.9277  
    Undershoot: 0  
    Peak: 1.3293  
    PeakTime: 1.1052
```

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