Contents

Experiment 8 : Time Response specifications of second order systems.

```
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%Batch : Entc EB2

clc;
clear all;
close all;
```
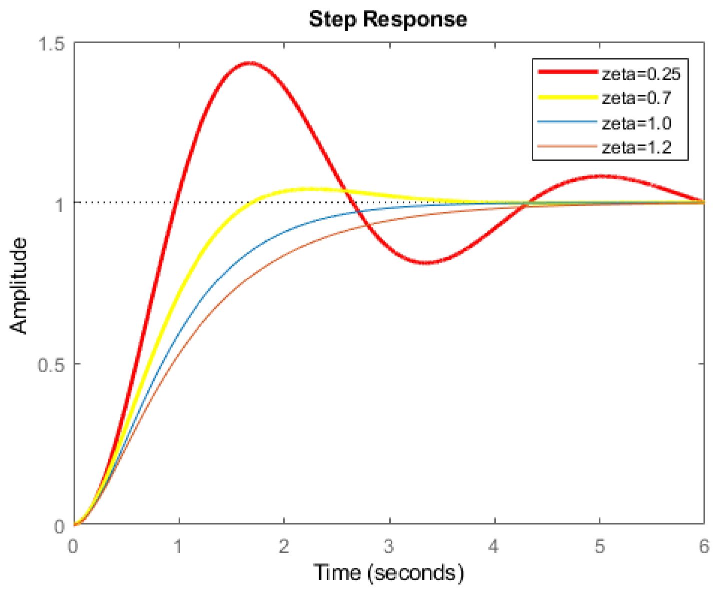

Plot step response of second order system

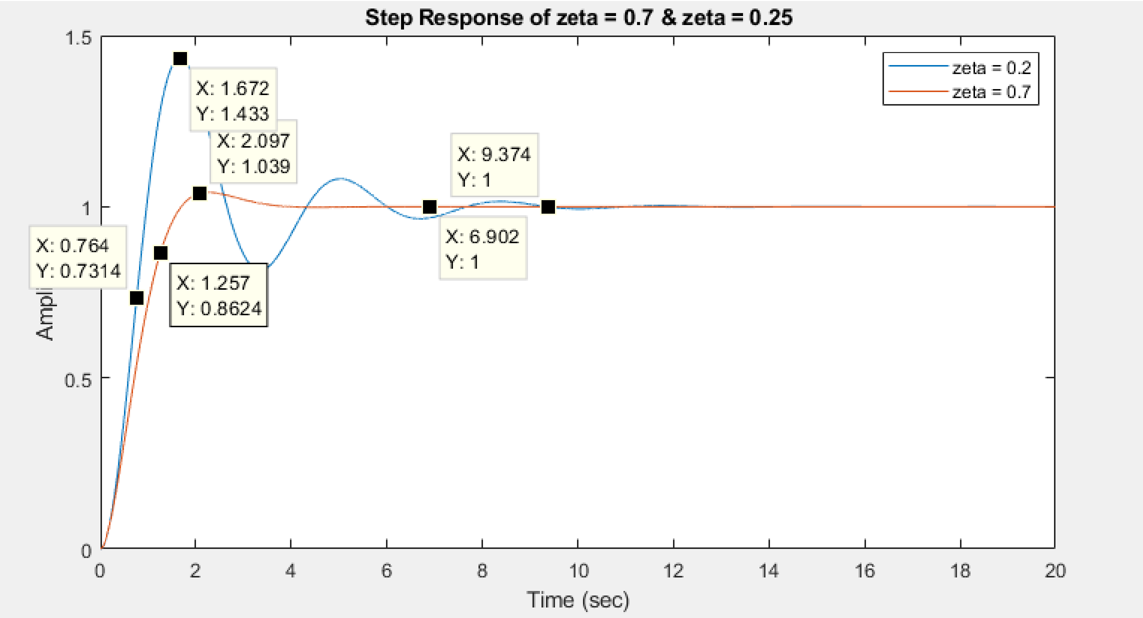
```
t=0:0.001:20;
w_n=2;

% For zeta = 0.25
zeta=0.25;
theta=atan(sqrt(1-zeta^2)/zeta);

w_d=w_n*sqrt(1-zeta^2);
C=1-((exp(-zeta.*w_n.*t).*(sin(sqrt(1-zeta^2)*w_d.*t+theta)))./sqrt(1-zeta^2));

figure()
plot(t,C,'r','LineWidth',2); hold on;

%For zeta = 0.7
zeta=0.7;
theta=atan(sqrt(1-zeta^2)/zeta);
D=1-((exp(-zeta.*w_n.*t).*(sin(sqrt(1-zeta^2)*w_d.*t+theta)))/sqrt(1-zeta^2));
plot(t,D,'y','LineWidth',2); hold on;

% For zeta = 1.0
zeta=1.0;
N1=[(w_n)^2];
D1=[1 (2*zeta*w_n) (w_n*w_n)];

M1=tf(N1,D1)
stepplot(M1); hold on;

% For zeta = 1.2
zeta=1.2;
N2=[(w_n)^2];
D2=[1 (2*zeta*w_n) (w_n*w_n)];

M2=tf(N2,D2)
stepplot(M2); hold on;
legend('zeta=0.25','zeta=0.7','zeta=1.0','zeta=1.2');
```

```
M1 =

        4
  -------------
  s^2 + 4 s + 4

Continuous-time transfer function.


M2 =

         4
  ---------------
  s^2 + 4.8 s + 4

Continuous-time transfer function.
```




```
stepinfo(C)
stepinfo(D)
figure()

b = imread('exp0801.PNG');
imshow(b)

%plot(t,C);
%titlehold on
%plot(t,D);
```

```
ans =

  struct with fields:

        RiseTime: 653.7972
    SettlingTime: 7.2429e+03
     SettlingMin: 0.8128
     SettlingMax: 1.4327
       Overshoot: 43.2754
      Undershoot: 0
            Peak: 1.4327
        PeakTime: 1672


ans =

  struct with fields:

        RiseTime: 1.0981e+03
    SettlingTime: 3.0134e+03
     SettlingMin: 0.9001
     SettlingMax: 1.0416
       Overshoot: 4.1581
      Undershoot: 0
            Peak: 1.0416
        PeakTime: 2261
```



Conclusion :

```
%In this experiment I plotted the step response of second order system with
%given parameters using step function and further calculated characteristics
%of system. Further, I used stepinfo to verify the results.
% 1. When 0<zeta<1, the system is underdamped.
% 2. When zeta>1, system is overdamped.
% 3. As zeta increases, the response becomes progressively less
% oscillatory till it becomes critically damped for zeta = 1, and becomes
% overdamped for zeta > 1.
```

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