```
load("y1.mat");
load("y2.mat");
load("y3.mat");
load("y4.mat");
load("y5.mat");
load("y6.mat");
load("y7.mat");
load("y8.mat");

plot(y1(:,1),y1(:,2));
hold on;
plot(y2(:,1),y2(:,2));
plot(y3(:,1),y3(:,2));
plot(y4(:,1),y4(:,2));
plot(y5(:,1),y5(:,2));
plot(y6(:,1),y6(:,2));
plot(y7(:,1),y7(:,2));
plot(y8(:,1),y8(:,2));
legend('\zeta = 2.0','\zeta = 1.5','\zeta = 1.0','\zeta = 0.8','\zeta =
0.7','\zeta = 0.5','\zeta = 0.3','\zeta = 0.2')
xlabel('Time \tau');
ylabel('Output Value y');
title ('Alex Ji, Sanay Doshi Lab 1 Plot')

% compute theoritical and actual value for each Mp, ts, tr:

omega_n = 1;

% \zeta = 2.0
zeta = 2.0;
theoretical_Mp = 0;
theoretical_tr = (4.7 .* zeta - 1.2)./omega_n;
theoretical_ts = (6.6 .* zeta - 1.6)./omega_n;
yss  = mean(y1(end-9:end,2));
ymax = max(y1(:,2));
actual_mp = (ymax - yss) / yss;
actual_mp_percent = actual_mp * 100;

S = stepinfo (y1(:,2), y1(:,1));
actual_tr = S.RiseTime;
actual_ts = S.SettlingTime;
fprintf(['\\zeta = %f, theoretical Mp value = %f, actual Mp value = %f,
theoretical' ...
    ' tr value = %f, actual tr value = %f, theoretical ts value = %f, actual
ts value = %f\n'] ...
    ,zeta, theoretical_Mp, actual_mp_percent, theoretical_tr, actual_tr,
theoretical_ts, actual_ts);

% \zeta = 1.5
zeta = 1.5;
theoretical_Mp = 0;
theoretical_tr = (4.7 .* zeta - 1.2)./omega_n;
```

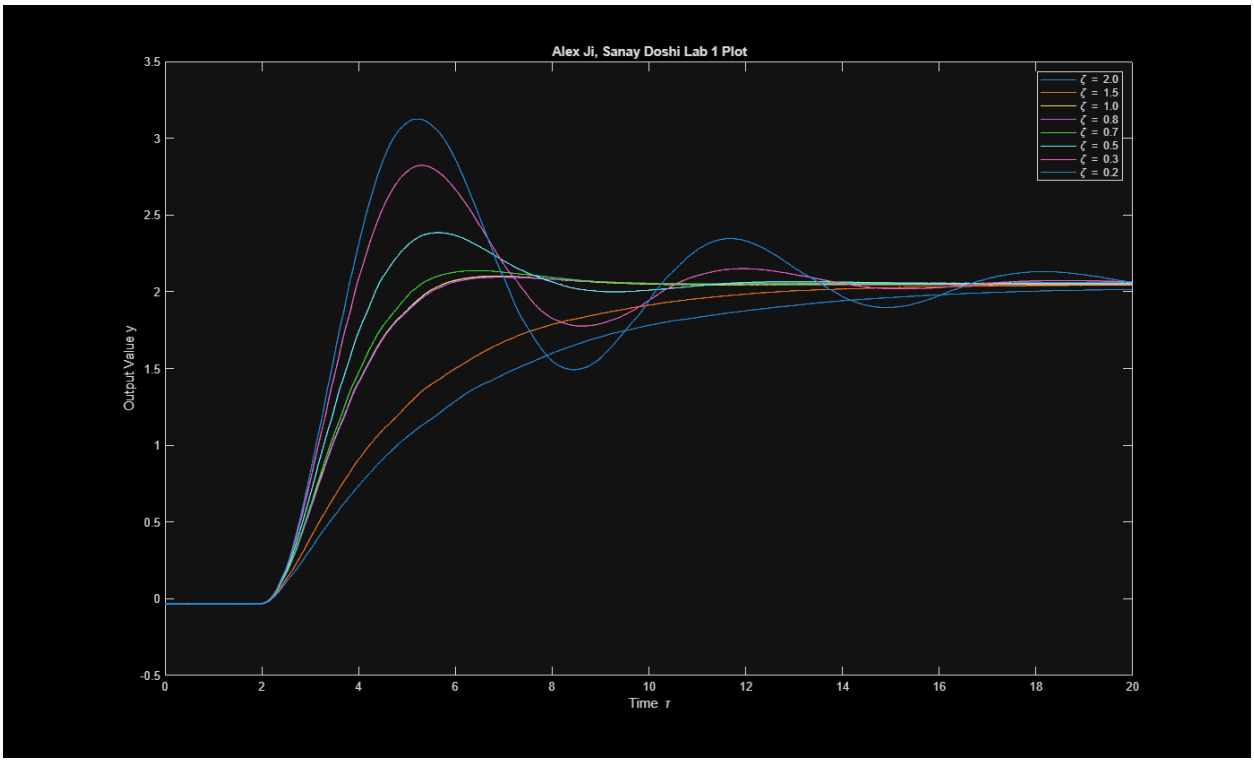
```
theoretical_ts = (6.6 .* zeta - 1.6)./omega_n;
yss  = mean(y2(end-9:end,2));
ymax = max(y2(:,2));
actual_mp = (ymax - yss) / yss;
actual_mp_percent = actual_mp * 100;

S = stepinfo (y2(:,2), y2(:,1));
actual_tr = S.RiseTime;
actual_ts = S.SettlingTime;
fprintf(['\\zeta = %f, theoretical Mp value = %f, actual Mp value = %f,
theoretical' ...
    ' tr value = %f, actual tr value = %f, theoretical ts value = %f, actual
ts value = %f\n'] ...
    ,zeta, theoretical_Mp, actual_mp_percent, theoretical_tr, actual_tr,
theoretical_ts, actual_ts);


% \zeta = 1.0
zeta = 1.0;
theoretical_Mp = 0;
theoretical_tr = (1.2 - 0.45 .* zeta + 2.6 .* zeta.^2)./omega_n;
theoretical_ts = (6.6 .* zeta - 1.6)./omega_n;
yss  = mean(y3(end-9:end,2));
ymax = max(y3(:,2));
actual_mp = (ymax - yss) / yss;
actual_mp_percent = actual_mp * 100;

S = stepinfo (y3(:,2), y3(:,1));
actual_tr = S.RiseTime;
actual_ts = S.SettlingTime;
fprintf(['\\zeta = %f, theoretical Mp value = %f, actual Mp value = %f,
theoretical' ...
    ' tr value = %f, actual tr value = %f, theoretical ts value = %f, actual
ts value = %f\n'] ...
    ,zeta, theoretical_Mp, actual_mp_percent, theoretical_tr, actual_tr,
theoretical_ts, actual_ts);


% \zeta = 0.8
zeta = 0.8;
theoretical_Mp = exp(-pi .* zeta ./ sqrt(1 - zeta.^2)) * 100;;
theoretical_tr = (1.2 - 0.45 .* zeta + 2.6 .* zeta.^2)./omega_n;
theoretical_ts = (6.6 .* zeta - 1.6)./omega_n;
yss  = mean(y4(end-9:end,2));
ymax = max(y4(:,2));
actual_mp = (ymax - yss) / yss;
actual_mp_percent = actual_mp * 100;

S = stepinfo (y4(:,2), y4(:,1));
actual_tr = S.RiseTime;
actual_ts = S.SettlingTime;
fprintf(['\\zeta = %f, theoretical Mp value = %f, actual Mp value = %f,
theoretical' ...
    ' tr value = %f, actual tr value = %f, theoretical ts value = %f, actual
```

```
ts value = %f\n'] ...
    ,zeta, theoretical_Mp, actual_mp_percent, theoretical_tr, actual_tr,
theoretical_ts, actual_ts);

% \zeta = 0.7
zeta = 0.7;
theoretical_Mp = exp(-pi .* zeta ./ sqrt(1 - zeta.^2)) * 100;;
theoretical_tr = (1.2 - 0.45 .* zeta + 2.6 .* zeta.^2)./omega_n;
theoretical_ts = (6.6 .* zeta - 1.6)./omega_n;
yss  = mean(y5(end-9:end,2));
ymax = max(y5(:,2));
actual_mp = (ymax - yss) / yss;
actual_mp_percent = actual_mp * 100;

S = stepinfo (y5(:,2), y5(:,1));
actual_tr = S.RiseTime;
actual_ts = S.SettlingTime;
fprintf(['\\zeta = %f, theoretical Mp value = %f, actual Mp value = %f,
theoretical' ...
    ' tr value = %f, actual tr value = %f, theoretical ts value = %f, actual
ts value = %f\n'] ...
    ,zeta, theoretical_Mp, actual_mp_percent, theoretical_tr, actual_tr,
theoretical_ts, actual_ts);


% \zeta = 0.5
zeta = 0.5;
theoretical_Mp = exp(-pi .* zeta ./ sqrt(1 - zeta.^2)) * 100;;
theoretical_tr = (1.2 - 0.45 .* zeta + 2.6 .* zeta.^2)./omega_n;
theoretical_ts = -0.5 ./ (zeta .* omega_n) .* log((1-zeta.^2)./400);
yss  = mean(y6(end-9:end,2));
ymax = max(y6(:,2));
actual_mp = (ymax - yss) / yss;
actual_mp_percent = actual_mp * 100;

S = stepinfo (y6(:,2), y6(:,1));
actual_tr = S.RiseTime;
actual_ts = S.SettlingTime;
fprintf(['\\zeta = %f, theoretical Mp value = %f, actual Mp value = %f,
theoretical' ...
    ' tr value = %f, actual tr value = %f, theoretical ts value = %f, actual
ts value = %f\n'] ...
    ,zeta, theoretical_Mp, actual_mp_percent, theoretical_tr, actual_tr,
theoretical_ts, actual_ts);


% \zeta = 0.3
zeta = 0.3;
theoretical_Mp = exp(-pi .* zeta ./ sqrt(1 - zeta.^2)) * 100;;
theoretical_tr = (1.2 - 0.45 .* zeta + 2.6 .* zeta.^2)./omega_n;
theoretical_ts = -0.5 ./ (zeta .* omega_n) .* log((1-zeta.^2)./400);
yss  = mean(y7(end-9:end,2));
ymax = max(y7(:,2));
actual_mp = (ymax - yss) / yss;
```

```
actual_mp_percent = actual_mp * 100;

S = stepinfo (y7(:,2), y7(:,1));
actual_tr = S.RiseTime;
actual_ts = S.SettlingTime;
fprintf(['\\zeta = %f, theoretical Mp value = %f, actual Mp value = %f,
theoretical' ...
    ' tr value = %f, actual tr value = %f, theoretical ts value = %f, actual
ts value = %f\n'] ...
    ,zeta, theoretical_Mp, actual_mp_percent, theoretical_tr, actual_tr,
theoretical_ts, actual_ts);


% \zeta = 0.2
zeta = 0.2;
theoretical_Mp = exp(-pi .* zeta ./ sqrt(1 - zeta.^2)) * 100;;
theoretical_tr = (1.2 - 0.45 .* zeta + 2.6 .* zeta.^2)./omega_n;
theoretical_ts = -0.5 ./ (zeta .* omega_n) .* log((1-zeta.^2)./400);
yss  = mean(y8(end-9:end,2));
ymax = max(y8(:,2));
actual_mp = (ymax - yss) / yss;
actual_mp_percent = actual_mp * 100;

S = stepinfo (y8(:,2), y8(:,1));
actual_tr = S.RiseTime;
actual_ts = S.SettlingTime;
fprintf(['\\zeta = %f, theoretical Mp value = %f, actual Mp value = %f,
theoretical' ...
    ' tr value = %f, actual tr value = %f, theoretical ts value = %f, actual
ts value = %f\n'] ...
    ,zeta, theoretical_Mp, actual_mp_percent, theoretical_tr, actual_tr,
theoretical_ts, actual_ts);
```

```
\zeta = 2.000000, theoretical Mp value = 0.000000, actual Mp value =
0.009691, theoretical tr value = 8.200000, actual tr value = 7.839200,
theoretical ts value = 11.600000, actual ts value = 15.667200
\zeta = 1.500000, theoretical Mp value = 0.000000, actual Mp value =
0.000000, theoretical tr value = 5.850000, actual tr value = 6.062667,
theoretical ts value = 8.300000, actual ts value = 12.781600
\zeta = 1.000000, theoretical Mp value = 0.000000, actual Mp value =
2.671756, theoretical tr value = 3.350000, actual tr value = 2.316833,
theoretical ts value = 5.000000, actual ts value = 7.760800
\zeta = 0.800000, theoretical Mp value = 1.516462, actual Mp value =
2.093245, theoretical tr value = 2.504000, actual tr value = 2.356750,
theoretical ts value = 3.680000, actual ts value = 7.039600
\zeta = 0.700000, theoretical Mp value = 4.598791, actual Mp value =
3.992396, theoretical tr value = 2.159000, actual tr value = 2.123500,
theoretical ts value = 3.020000, actual ts value = 7.899200
\zeta = 0.500000, theoretical Mp value = 16.303353, actual Mp value =
15.954418, theoretical tr value = 1.625000, actual tr value = 1.612321,
theoretical ts value = 6.279147, actual ts value = 10.178800
\zeta = 0.300000, theoretical Mp value = 37.232610, actual Mp value =
36.750524, theoretical tr value = 1.299000, actual tr value = 1.296167,
theoretical ts value = 10.142959, actual ts value = 15.737200
```

```
\zeta = 0.200000, theoretical Mp value = 52.662060, actual Mp value =
51.300231, theoretical tr value = 1.214000, actual tr value = 1.173000,
theoretical ts value = 15.080716, actual ts value = 19.178000
```



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