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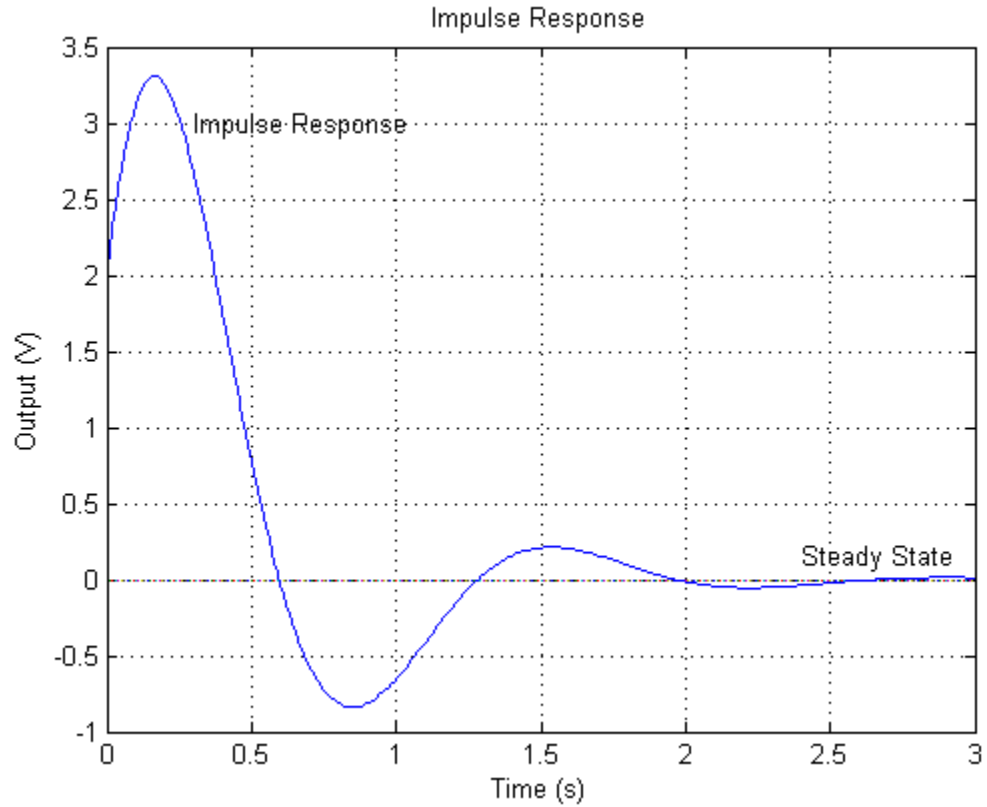
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```
%  
% Name:          Dr. Gregory Kriehn  
% Student ID:    XXX-XX-XXXX  
% Class:         ECE 155 - Control Systems  
% HW #:          Problem X.X  
% Due Date:      XX/XX/XX  
%  
% Worked With:   XXX XXX  
%
```

Transient Response Example

```
num = [2 25];  
den = [1 4 25];  
  
T = tf(num,den)           % Create Transfer Function  
  
figure;  
t=0:0.01:3;  
[yi,t]=impz(T,t);       % Call impuse reponse function  
plot(t,0,t,yi),grid;    % Plot Results and Label  
xlabel('Time (s)');  
ylabel('Output (V)');  
title('Impulse Response');  
text(2.4,0.15,'Steady State');  
text(0.3,3,'Impulse Response');
```

```
Transfer function:  
  2 s + 25  
-----  
s^2 + 4 s + 25
```

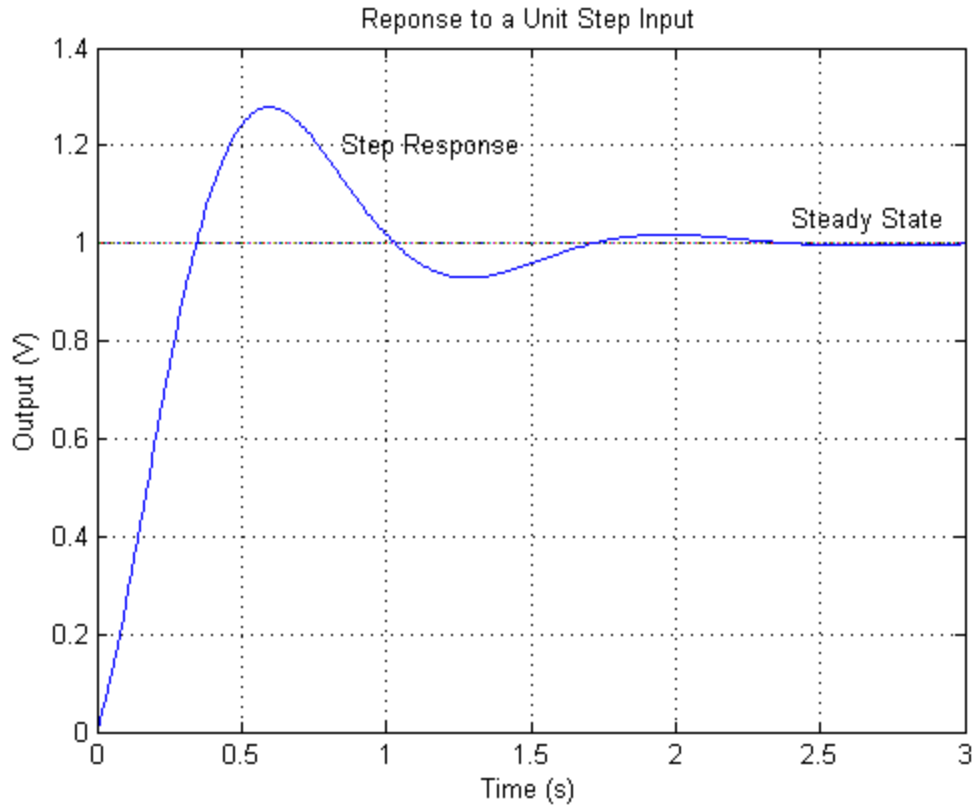
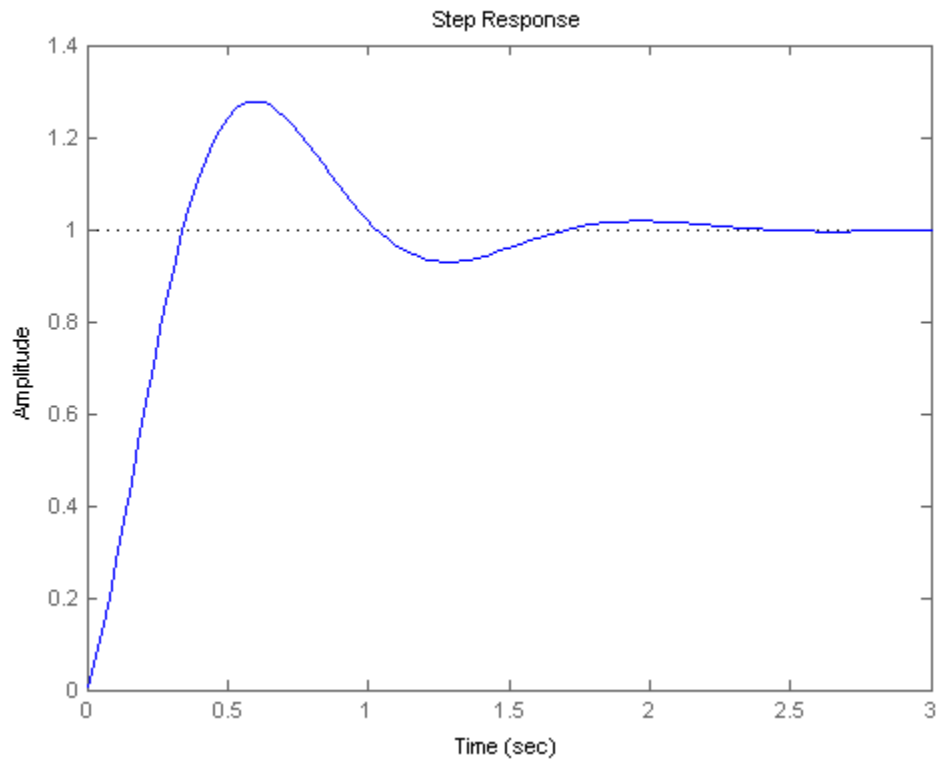


Step Response Example

```
figure;
step(T); % Call step function -- generate generic plot

t=0:0.01:3; % Setup plot by hand calling step function
[ys,t]=step(T,t);

figure;
plot(t,1,t,ys),grid; % Plot results
xlabel('Time (s)');
ylabel('Output (V)');
title('Reponse to a Unit Step Input');
text(2.4,1.05,'Steady State');
text(0.85,1.2,'Step Response');
```



Ramp Response Example

```
num2=[1];
den2=[1 0];
T2=tf(num2,den2)           % Cludge -- Create 1/s transfer function
Ti=series(T,T2)           % Multiply T by cluge

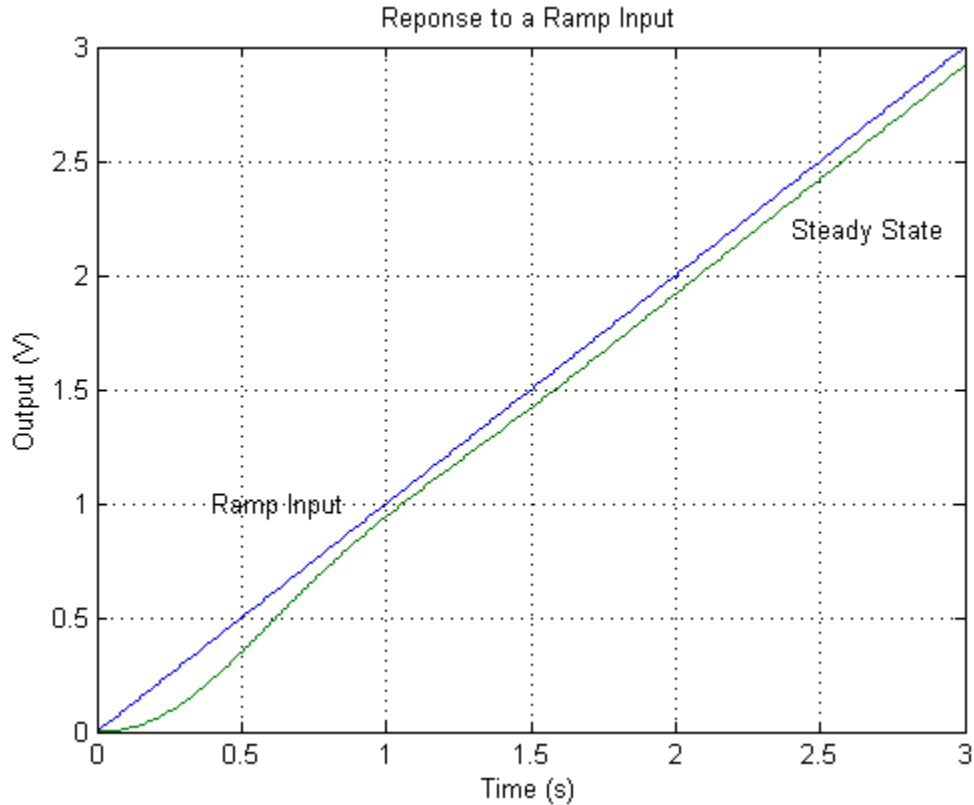
[yr,t]=step(Ti,t);        % Feed intermediate Ti into step function
                           % to produce an output that had a ramp input
                           % (1/s^2)

figure;                   % Plot input and output vs. t
plot(t,t,t,yr),grid;
xlabel('Time (s)');
ylabel('Output (V)');
title('Reponse to a Ramp Input');
text(0.4,1,'Ramp Input');
text(2.4,2.2,'Steady State');
```

Transfer function:
1
-
s

Transfer function:
2 s + 25

s^3 + 4 s^2 + 25 s



2nd Order System with Variable Damping Example

```

clear;
t=0:0.2:10; % 51 Time values
zeta=[0 0.2 0.4 0.6 0.8 1]; % Create an array of damping coefficients

for n=1:6; % Step through each damping coefficient
    num=[1];
    den=[1 2*zeta(n) 1]; % Create a new denominator
    [y(1:51,n),t]=step(tf(num,den),t); % Determine step response, feed
    % result into a 2-D array of y
    % values
end;

figure;
plot(t,y),grid; % Plot the 3D data on a 2D graph
xlabel('Time (s)');
ylabel('Step Response (V)');
title('Second Order Step Reponse to Various Damping Coefficients \zeta');
% Create a legend
hleg=legend('\zeta=0', '\zeta=0.2', '\zeta=0.4', '\zeta=0.6', '\zeta=0.8', '\zeta=1');
set(hleg, 'Location', 'SouthEast');

mesh(t,zeta,y'); % Create a 3D mesh plot
% Need to take the transpose of y here so that
% the rows and columns match time for x and
% zeta for y.

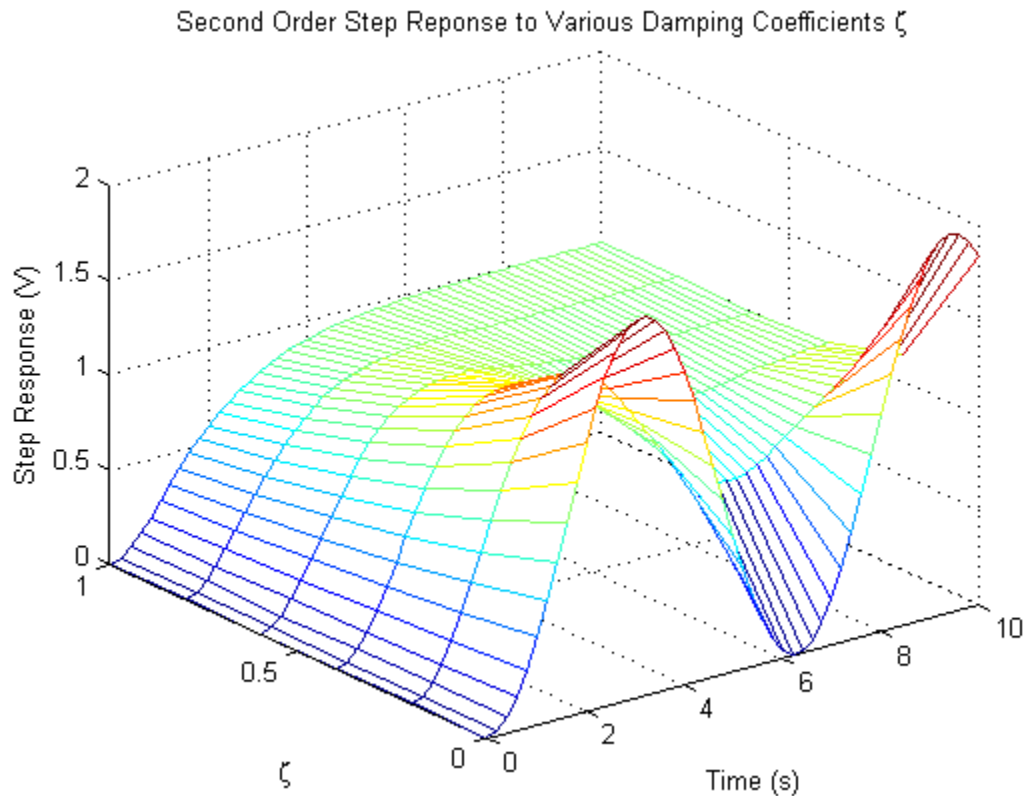
xlabel('Time (s)');

```

```

ylabel('\zeta');
zlabel('Step Response (V)');
title('Second Order Step Reponse to Various Damping Coefficients \zeta');

```



Arbitrary Input Examples

```

num = [2 1];
den = [1 1 1]; % Create a laplace transfer function num and den
t=[0:0.1:10];
r=t; % Create an input (true ramp)
y=lsim(num,den,r,t); % Determine time domain output!

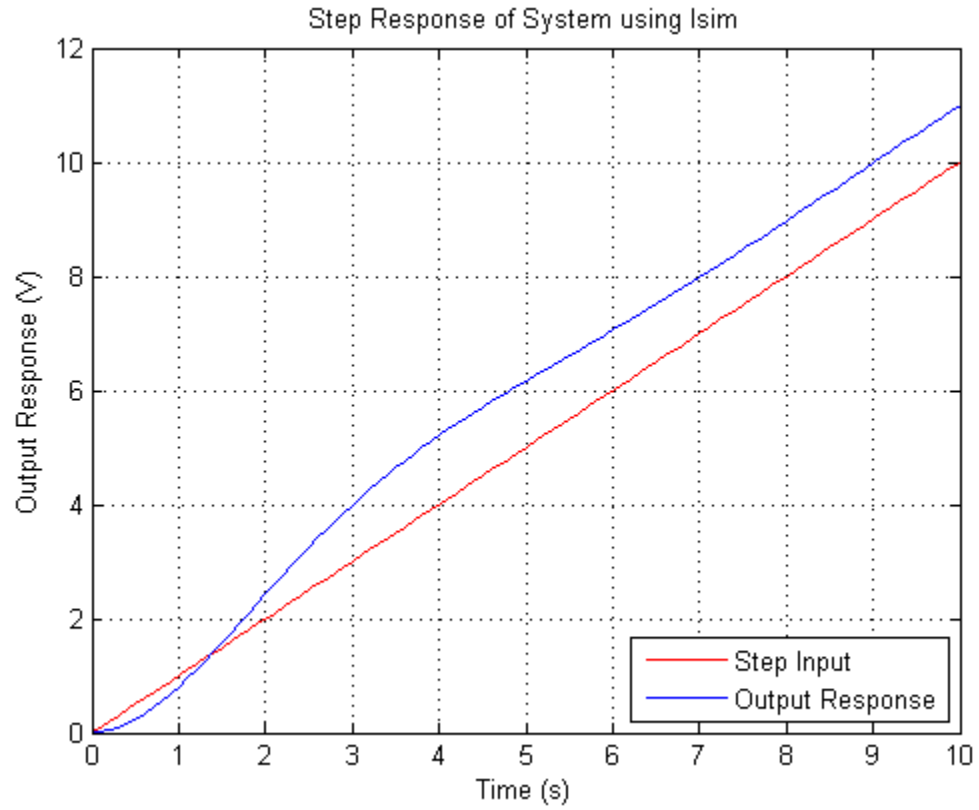
figure;
plot(t,r,'r',t,y,'b'),grid; % Plot input and output signals
title('Step Response of System using lsim');
xlabel('Time (s)');
ylabel('Output Response (V)');
hleg=legend('Step Input','Output Response');
set(hleg,'Location','SouthEast');

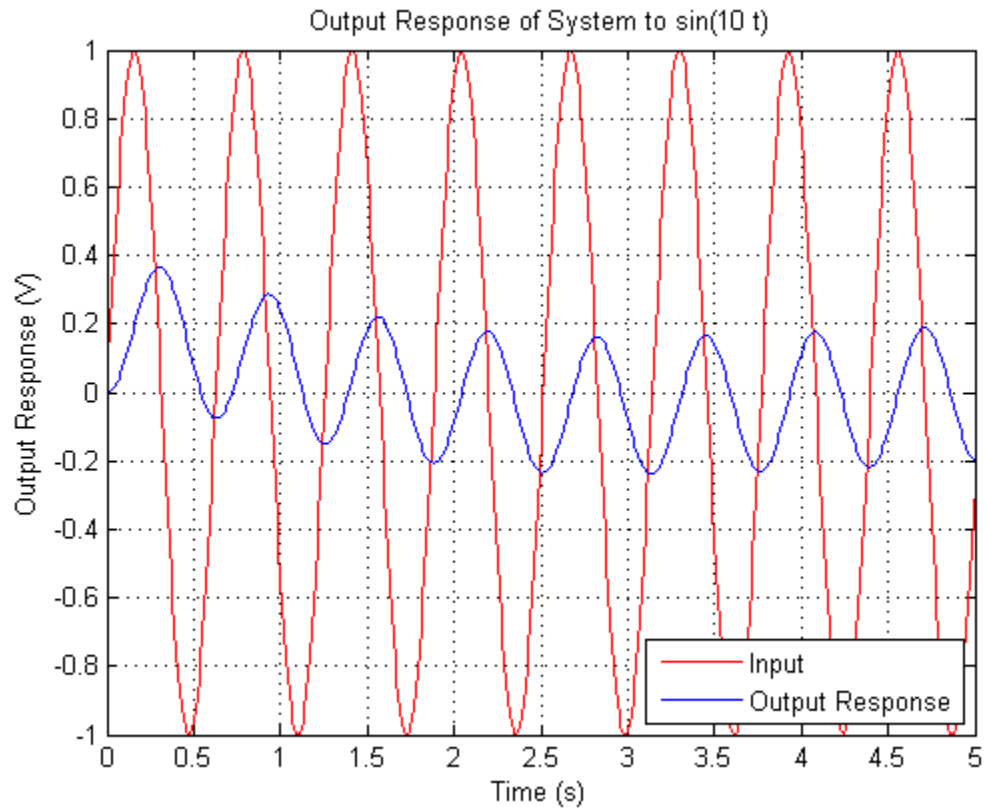
t=0:0.01:5;
r=sin(10*t); % Change input to a sine wave
y=lsim(num,den,r,t); % Repeat procedure...

figure;
plot(t,r,'r',t,y,'b'),grid;
title('Output Response of System to sin(10 t)');
xlabel('Time (s)');
ylabel('Output Response (V)');
hleg=legend('Input','Output Response');

```

```
set(hleg, 'Location', 'SouthEast');
```





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