```
clc;
clear all;
close all;
```

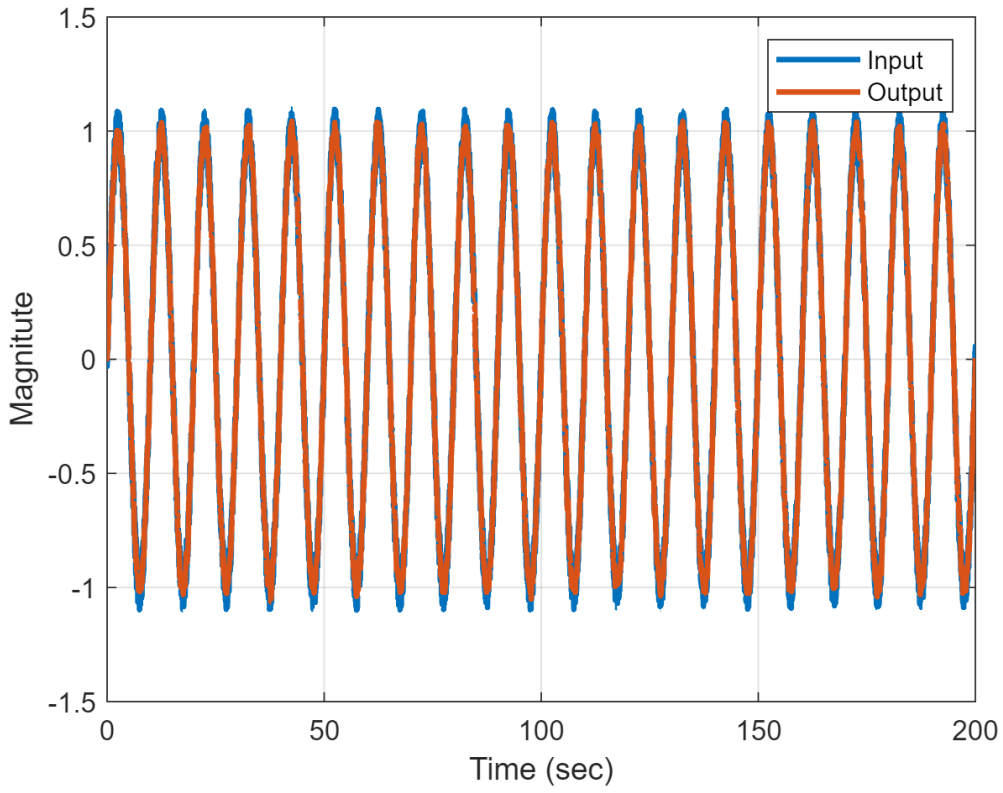
generate data

```
tic
```

```
run('Q310_Basic.mlx')
```

```
sys_dis_open =

   0.1604 z^2 - 0.1958 z + 0.07861
  ---------------------------------
  z^3 - 1.937 z^2 + 1.122 z - 0.1421

Sample time: 0.24388 seconds
Discrete-time transfer function.
c = 1×4
         0    0.1604   -0.1958    0.0786
d = 1×4
    1.0000   -1.9367    1.1220   -0.1421
sys_cont_close =

     7.8 s^3 + 205.7 s^2 + 601.4 s + 1276
  ----------------------------------------
  s^4 + 15.8 s^3 + 212.7 s^2 + 608.4 s + 1276

Continuous-time transfer function.


sys_dis_close =

  0.1328 z^3 - 0.3505 z^2 + 0.3048 z - 0.08705
  --------------------------------------------
  z^4 - 3.73 z^3 + 5.24 z^2 - 3.288 z + 0.778

Sample time: 0.015887 seconds
Discrete-time transfer function.
c1 = 1×5
         0    0.1328   -0.3505    0.3048   -0.0871
d1 = 1×5
    1.0000   -3.7296    5.2395   -3.2878    0.7780
```

```
tfinal=200;
t = 0:T_s_close:tfinal;
u = gensig('sine' , tfinal/20 , tfinal ,T_s_close);
Noise=(-0.2+(0.2+0.2)*rand(numel(t),1))/2;
u=u+Noise;
y = lsim(sys_dis_close ,u ,t);
plot(t,u ,t , y ,'LineWidth',2) ;
xlabel('Time (sec)') ;
ylabel('Magnitute') ;
grid on
legend('Input','Output') ;
```




```
N = numel(y) ;
Parameters_in_den=4
```

```
Parameters_in_den = 4
```

```
Parameters_in_num=4
```

```
Parameters_in_num = 4
```

```
Nv=Parameters_in_num+Parameters_in_den;
theta(:,1:Nv) = zeros(Nv , Nv) ;
P = 1e12*eye(Nv) ;
phi=[];
eror(1:Nv,1:N)=zeros(Nv,N);
for i = (max(Parameters_in_num,Parameters_in_den)+1):N
    phi(:,i) = [[y(i-1:-1:i-Parameters_in_den)]' , [u(i-1:-1:i-Parameters_in_num)]']';
    K = P*phi(:,i)*(1+phi(:,i)'*P*phi(:,i))^(-1) ;
    P = (eye(Nv) - K*phi(:,i)')*P ;
    theta(:,i) = theta(:,i-1) + K*(y(i) - phi(:,i)'*theta(:,i-1));
    eror(:,i)=theta(:,i)-[-d1(2:end),c1(2:end)]';
end
```

Bode

```
ident_dis = tf(theta((Parameters_in_num+1):end,end)' ,[1 -theta(1:Parameters_in_num ,end)'], T_
```

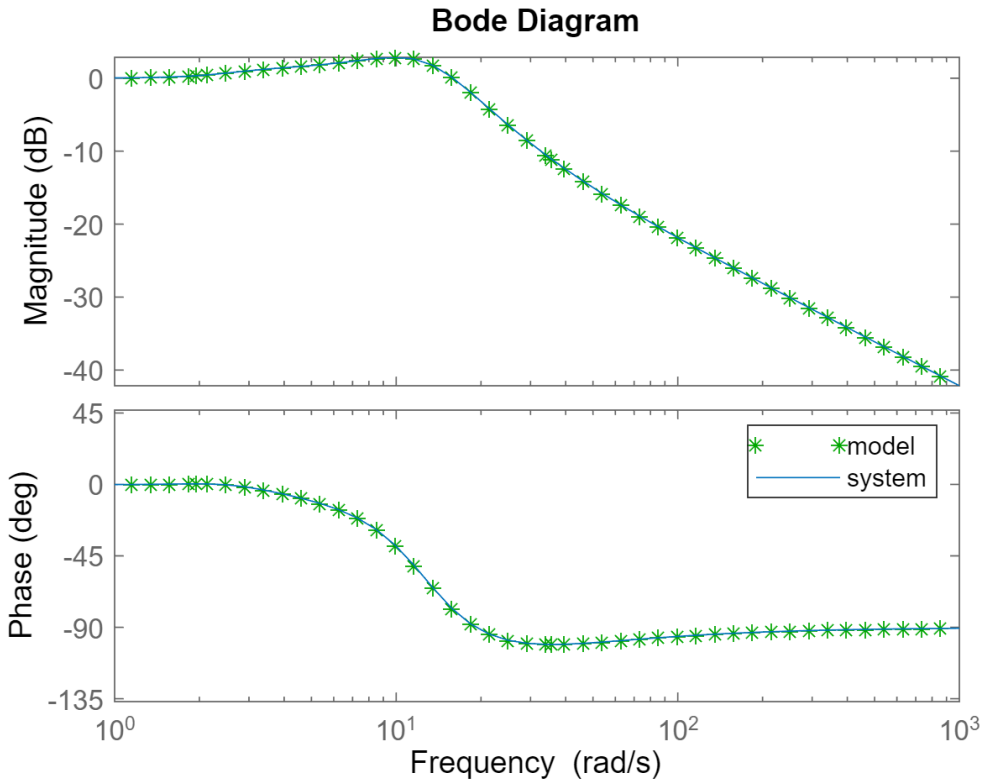
```
ident_dis =
```

```
  0.1328 z^3 - 0.3504 z^2 + 0.3047 z - 0.08702
  ---------------------------------------------
  z^4 - 3.729 z^3 + 5.238 z^2 - 3.287 z + 0.7777

Sample time: 0.015887 seconds
Discrete-time transfer function.
```

```
ident_analog = d2c(ident_dis)
```

```
ident_analog =

      7.8 s^3 + 205.9 s^2 + 606.8 s + 1294
  ----------------------------------------
  s^4 + 15.82 s^3 + 213.1 s^2 + 613.9 s + 1294

Continuous-time transfer function.
```

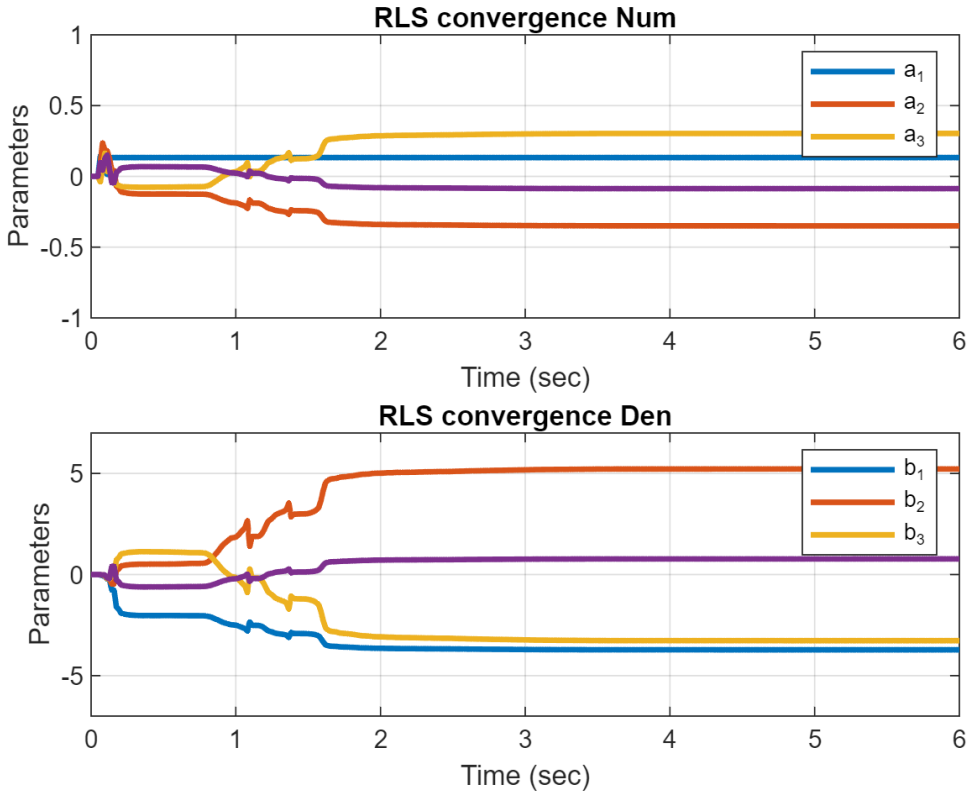
```
bode(ident_analog ,'g*',sys_cont_close)
legend('model ','system')
```



RLS Convergence

```
subplot(2,1,1)
plot(t , theta((Parameters_in_num+1):end,:) , 'LineWidth' , 2) ;
xlabel('Time (sec)') ;
ylabel('Parameters') ;
title('RLS convergence Num') ;
grid on
legend('a_1','a_2','a_3')
xlim([0 6])
```

```
ylim([-1 1])
%-------------------------------------------------------------
subplot(2,1,2)
plot(t , -theta(1:Parameters_in_num ,:) , 'LineWidth' , 2) ;
xlabel('Time (sec)') ;
ylabel('Parameters') ;
title('RLS convergence Den') ;
grid on
legend('b_1','b_2','b_3')
xlim([0 6])
ylim([-7  7])
```




```
toc
```

```
Elapsed time is 10.352161 seconds.
```