

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

## generate data

```
run ("Basics.m")
```

```
sys =
```

```

          1.3 s + 1.333
-----
s^4 + 3.967 s^3 + 8.41 s^2 + 10.62 s + 8.756
```

Continuous-time transfer function.

```
fb = 2.4327
```

```
sysd =
```

```

0.0004236 z^3 + 0.001167 z^2 - 0.000997 z - 0.0003069
-----
z^4 - 3.481 z^3 + 4.58 z^2 - 2.697 z + 0.5991
```

Sample time: 0.12914 seconds

Discrete-time transfer function.

```
c = 1x5
```

```
    0    0.0004    0.0012   -0.0010   -0.0003
```

```
d = 1x5
```

```
 1.0000  -3.4807   4.5802  -2.6968   0.5991
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
tfinal=200;
```

```
t = 0:T_s:tfinal;
```

```
u = gensig('sine' , tfinal/20 , tfinal ,T_s)+gensig('sine' , tfinal/50 , tfinal ,T_s)+gensig('sine' , tfinal/10 , tfinal ,T_s);
```

```
y = lsim(sysd ,u ,t);
```

```
plot(t,u ,t , y , 'LineWidth',2) ;
```

```
xlabel('Time (sec)') ;
```

```
ylabel('Value') ;
```

```
title('response of Question 2') ;
```

```
grid on
```

```
legend('Input' , 'OutPut') ;
```



```

tic
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));
    Error(i)=(Error(i-1)+(y(i)-phi(:,i)'*theta(:,i))^2);
end

```

## Code

```

ident_dis = tf(theta((Parameters_in_num+1):end,end)' , [1 -theta(1:Parameters_in_num ,end)'], T, 's');

```

```

ident_dis =

```

$$\frac{0.0004236 z^3 + 0.001167 z^2 - 0.000997 z - 0.0003069}{z^4 - 3.481 z^3 + 4.58 z^2 - 2.697 z + 0.5992}$$

Sample time: 0.12914 seconds  
Discrete-time transfer function.

```

ident_analog = d2c(ident_dis)

```

```

ident_analog =

```

$$\frac{8.915e-08 s^3 - 3.152e-06 s^2 + 1.3 s + 1.333}{s^4 + 3.967 s^3 + 8.409 s^2 + 10.62 s + 8.753}$$

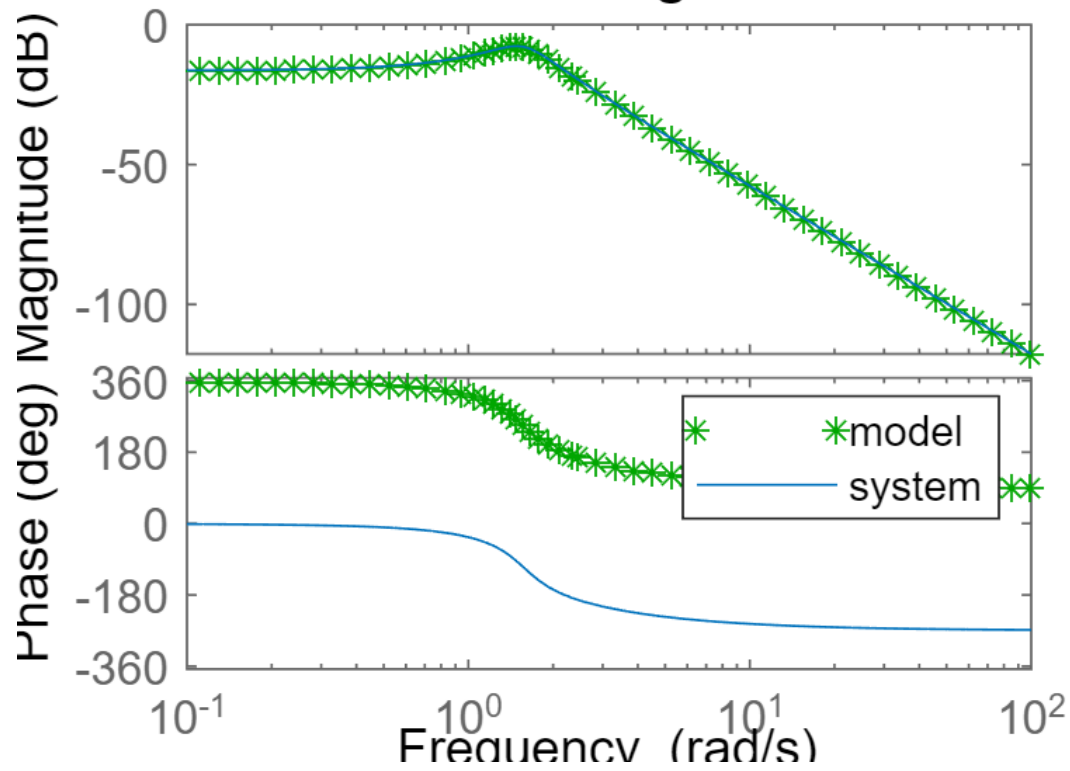
Continuous-time transfer function.

```

bode(ident_analog , 'g*',sys )
legend('model ', 'system')

```

## Bode Diagram



RLS Convergence

```
plot(t , theta(:,:) , 'LineWidth' , 2) ;
xlabel('Time (sec)') ;
ylabel('Parameters') ;
title('RLS convergence') ;
grid on
```

