```
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 = 1×5
        0      0.0004     0.0012    -0.0010    -0.0003
d = 1×5
    1.0000    -3.4807     4.5802    -2.6968     0.5991
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
tfinal=100;
t = 0:T_s:tfinal;
Priemss=primes(100);
u=zeros(numel(t),1);
% for i=15:numel(Priemss)
%      input_dummy=gensig('sine' , tfinal/Priemss(1,i) , tfinal ,T_s);
%      u=u+input_dummy;
% end
u = gensig('pulse' , tfinal/10 , tfinal ,T_s);
% Noise=0.01*rand(numel(t),1)
% u=u+Noise
y = lsim(sysd  ,u ,t);
% plot(t,u ,t , y ,'LineWidth',2) ;
% xlabel('Time (sec)') ;
% ylabel('V - position') ;
% title('square ressponse of Question 2') ;
% grid on
% legend(['U' , 'position']) ;
```

PA estimation

```
N = numel(y) ;
%choose number of parameters
Parameters_in_den=4
```

```
Parameters_in_den = 4
```

```matlab
Parameters_in_num=4
```

Parameters_in_num = 4

```matlab
Nv=Parameters_in_num+Parameters_in_den
```

Nv = 8

```matlab
theta(:,1:30) = 30*ones(Nv,30);
phi=[];

alfa=0.005
```

alfa = 0.0050

```matlab
gama=1
```

gama = 1

```matlab
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))']';
    error=gama*phi(:,i)*(y(i) - phi(:,i)'*theta(:,i-1))/(alfa+phi(:,i)'*phi(:,i));
    theta(:,i) = theta(:,i-1) +error;
    norm(error);
end
theta(:,i)
```

ans = 8×1
   0.2814
  -0.3051
  -0.0801
   0.8283
   0.0002
   0.0022
   0.0058
   0.0106

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

ident_dis =

  0.0001931 z^3 + 0.002225 z^2 + 0.005756 z + 0.0106
  ----
  z^4 - 0.2814 z^3 + 0.3051 z^2 + 0.0801 z - 0.8283

Sample time: 0.12914 seconds
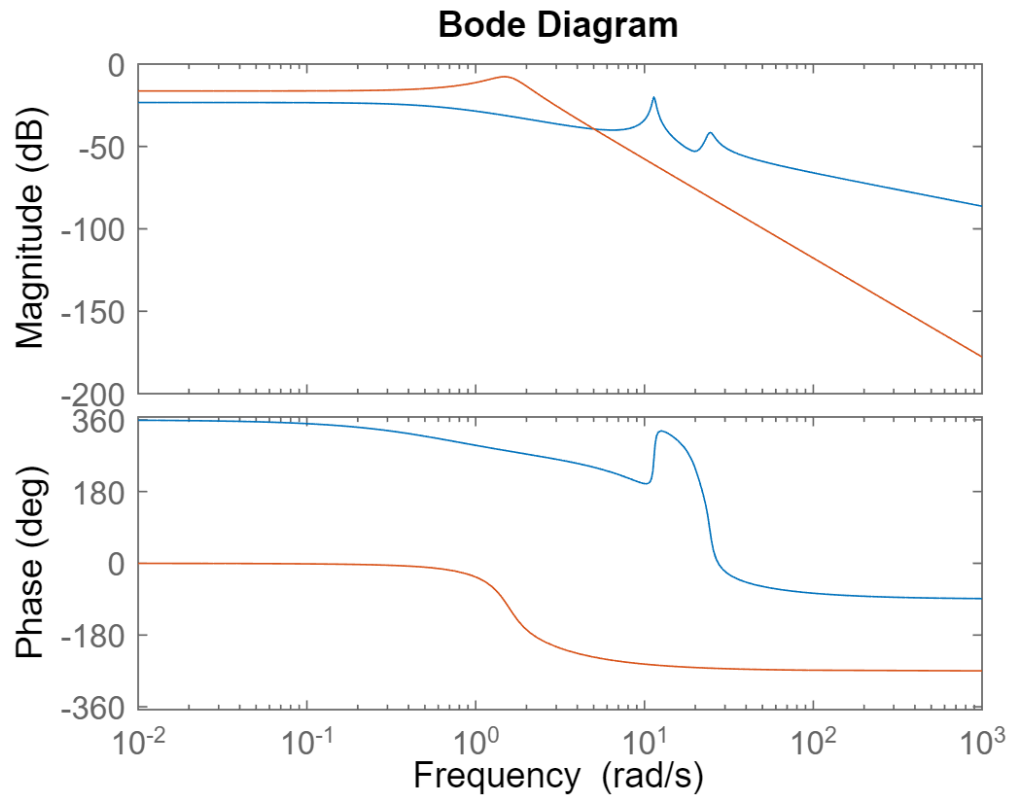Discrete-time transfer function.

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

Warning: The model order was increased to handle real negative poles.
ident_analog =

    0.04869 s^4 - 1.107 s^3 + 33.83 s^2 - 407.2 s + 3402
  ----
  s^5 + 2.767 s^4 + 723.4 s^3 + 512.1 s^2 + 7.705e04 s + 4.992e04

Continuous-time transfer function.

```
bode(ident_analog ,sys )
```

Bode Diagram


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

RLS convergence