

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

generate data

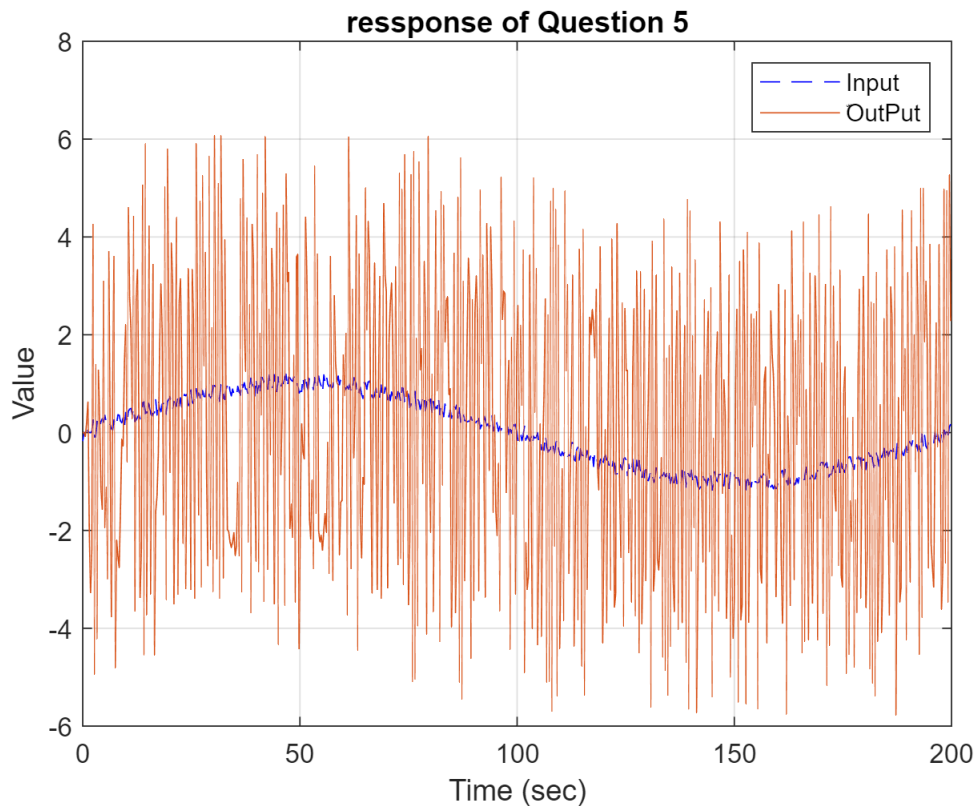
```
tfinal=200;  
T_s=0.3
```

```
T_s = 0.3000
```

```
t = 0:T_s:tfinal;  
u = zeros(numel(t),1);
```

General Input+white Noise

```
u = gensig('sine' , tfinal , tfinal ,T_s);  
Noise=-0.2+(0.2+0.2)*rand(numel(t),1);  
u=u+Noise;  
  
y(1:numel(t),1)=zeros(numel(t),1);  
for i=3:numel(t)  
    y(i)=-4*sin(2.2*y(i-2))+0.34*y(i-1)+u(i);  
end  
plot(t,u,'b--',t , y , 'LineWidth',0.5) ;  
xlabel('Time (sec)') ;  
ylabel('Value') ;  
title('response of Question 5') ;  
grid on  
legend('Input' , 'OutPut') ;
```



Recursive Least Square estimation

```
AIC=[];
```

```
N = numel(y) ;  
Trend=[]
```

```
Trend =
```

```
[]
```

```
for Degree=1:10:100  
    %number of parameters  
    Parameters_in_den=Degree*5;  
    Parameters_in_num=Degree*5+1;  
    Nv=Parameters_in_num+Parameters_in_den  
  
    phi=[];  
    Error=zeros(1,N);  
  
    theta(1:Nv,1:Nv) = zeros(Nv,Nv) ;  
    P = 1e12*eye(Nv) ;  
    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));  
    end
```

```

AIC(Degree)=N*log(norm(y(1:i)-theta(1:i))+2*Nv);
Trend(Nv)=AIC(end);
end

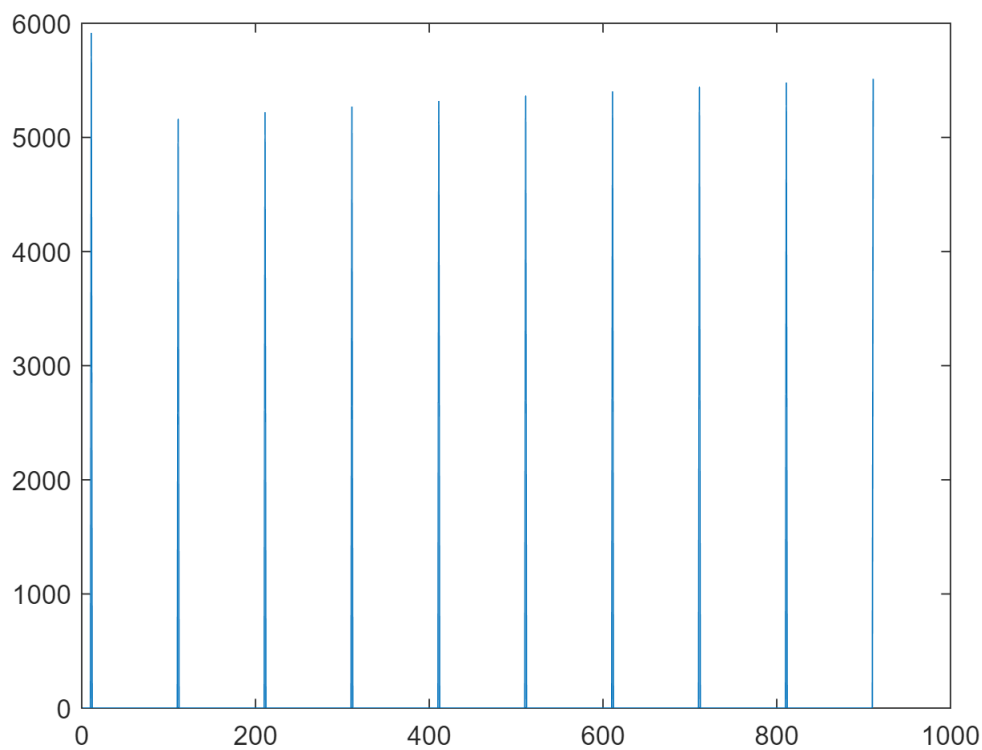
```

```

Nv = 11
Nv = 111
Nv = 211
Nv = 311
Nv = 411
Nv = 511
Nv = 611
Nv = 711
Nv = 811
Nv = 911

```

```
plot(1:Nv, Trend)
```



```

% % % % figure;
% % % % hold on;
% % % % for k1=1:1:(Nv);
% % % %     subplot(ceil((Nv)/2),2,k1);
% % % %     plot(theta(k1,:));
% % % % end
% % % % hold off;

```