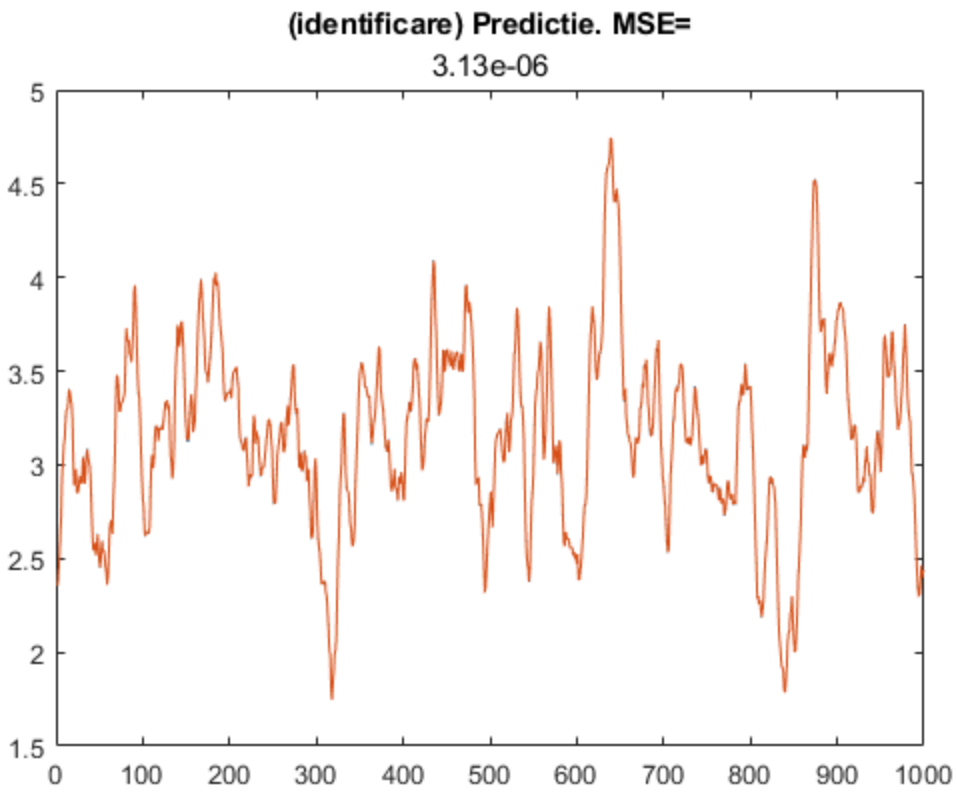
```
clear all, close all
load('iddata-18.mat')

u=id.u;
y=id.y;

% u=val.u;
% y=val.y;

Nmax=3; Mmax=5;
na=Nmax; nb=Nmax; n=na+nb;
m=1;
nk=1;
b=1;
erori1=ones(Nmax,Mmax);
erori2=ones(Nmax,Mmax);


for na = 1:Nmax
    nb = na;
    n = na+nb;
    for m = 1:Mmax
        clear P;
        x=zeros(length(y),na+nb);
        [Y{1:1:n}] = ndgrid(0:m);
        Pi = reshape(cat(n+1,Y{:}),[],n);
        sumPi = sum(Pi,2);
        l = 1;
        for i = 1:length(sumPi)
            if(sumPi(i) <= m)
                P(:,l) = Pi(i,:);
                l = l + 1;
            end
        end
        P=P';
for k=1:length(y)
    x1=zeros(1,na);
    x2=zeros(1,nb);
    for i=1:na
        if(k>i)
            x1(i)=y(k-i);
            x2(i)=u(k-i);
        end
    end
    x(k,:)=[x1 x2];
end

phi=zeros(length(y),length(P));

% generare phi, yhat
for k=1:length(y)
    for i=1:length(P)
```

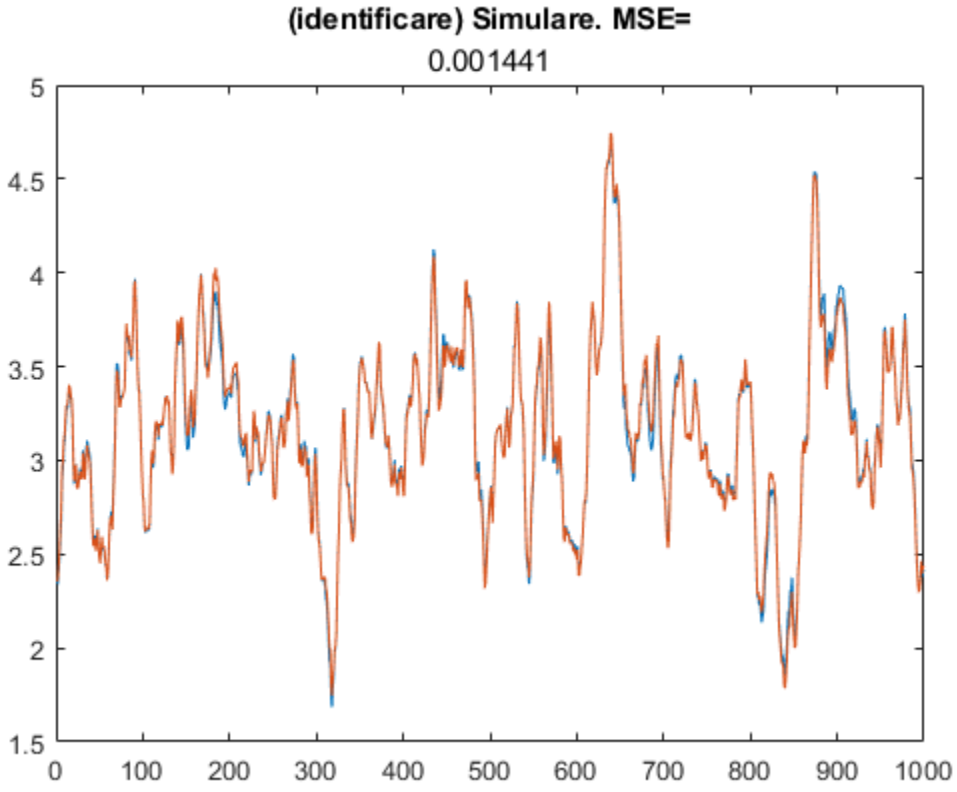
```
        phi(k,i)=prod(x(k,:).^P(i,:),"all");
    end
end
    %Marime_phi=size(phi)

teta=phi\y;
yhat=phi*teta;

% figure,
% plot(yhat)
% hold on;
% plot(y);

MSE=0;
for i=1:length(yhat)
MSE=MSE+(y(i)-yhat(i))^2;
end
MEP2=MSE/length(yhat);
%title(MEP2);
erori1(na,m)=MEP2;

%simulare

yhatnou=zeros(1,length(y));
xsim=zeros(length(y),na+nb);

for k=1:length(y)
    x1sim=zeros(1,na);
    x2sim=zeros(1,nb);
    for i=1:na
        if(k>i)
        x1sim(i)=yhatnou(k-i);
        x2sim(i)=u(k-i);
        end
    end
    xsim(k,:)=[x1sim x2sim];
    linie=xsim(k,:);
    w=[];

        for i=1:length(P)
            p=1;
            for j=1:na+nb
                p=p*linie(j).^P(i,j);
            end
            w(i)=p;
        end
        yhatnou(k)=w*teta;
end
yhatvector(b,:)=yhatnou;
b=b+1;
MSE=0;
for i=1:length(yhatnou)
MSE=MSE+(y(i)-yhatnou(i))^2;
end
```

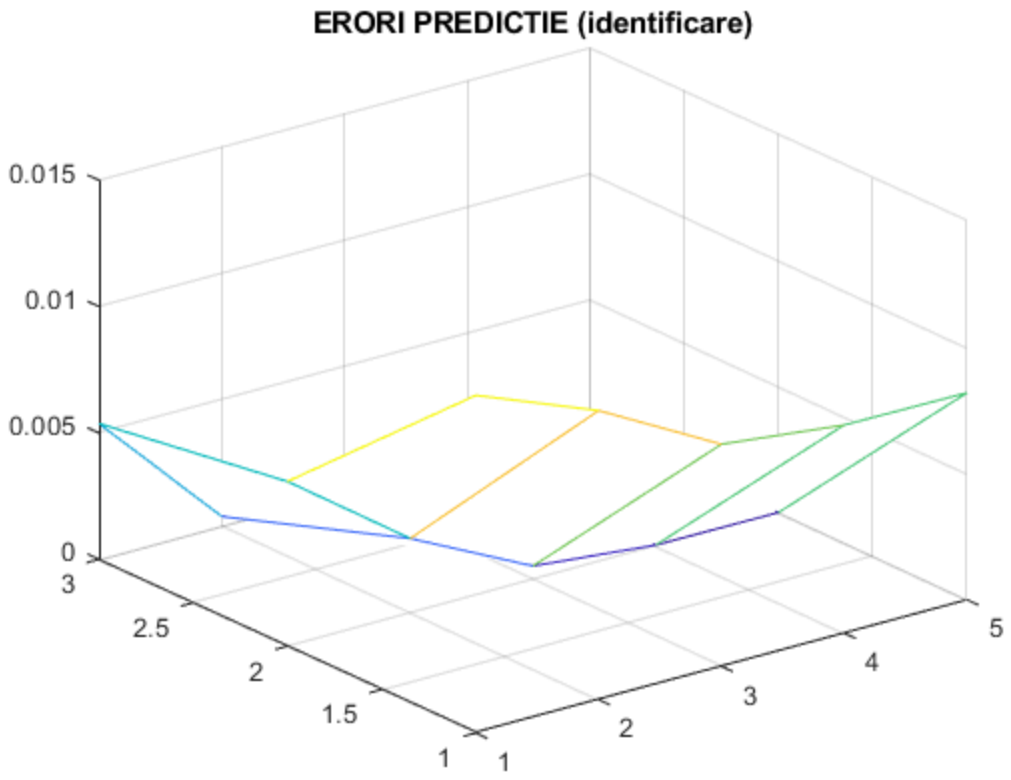
```
MEP3=MSE/length(yhatnou);
%title(MEP2);
erori2(na,m)=MEP3;
    end
end

min1 = Mmax;
for i = 1:Nmax
    for j = 1:Mmax
        if (erori1(i,j)<min1)
            min1 = erori1(i,j);
            nap=i;
            nbp=j;
        end
    end
end

min2 = Mmax;
for i = 1:Nmax
    for j = 1:Mmax
        if (erori2(i,j)<min2)
            min2 = erori2(i,j);
            nas=i;
            nbs=j;
        end
    end
end


na=nap;
nb=na;
n=na+nb;
m=nbp;
clear P;
        x=zeros(length(y),na+nb);
        [Y{1:1:n}] = ndgrid(0:m);
        Pi = reshape(cat(n+1,Y{:}),[],n);
        sumPi = sum(Pi,2);
        l = 1;
        for i = 1:length(sumPi)
            if(sumPi(i) <= m)
                P(:,l) = Pi(i,:);
                l = l + 1;
            end
        end
        P=P';
        for k=1:length(y)
            x1=zeros(1,na);
            x2=zeros(1,nb);
            for i=1:na
                if(k-i>0)
                    x1(i)=y(k-i);
                    x2(i)=u(k-i);
                end
```

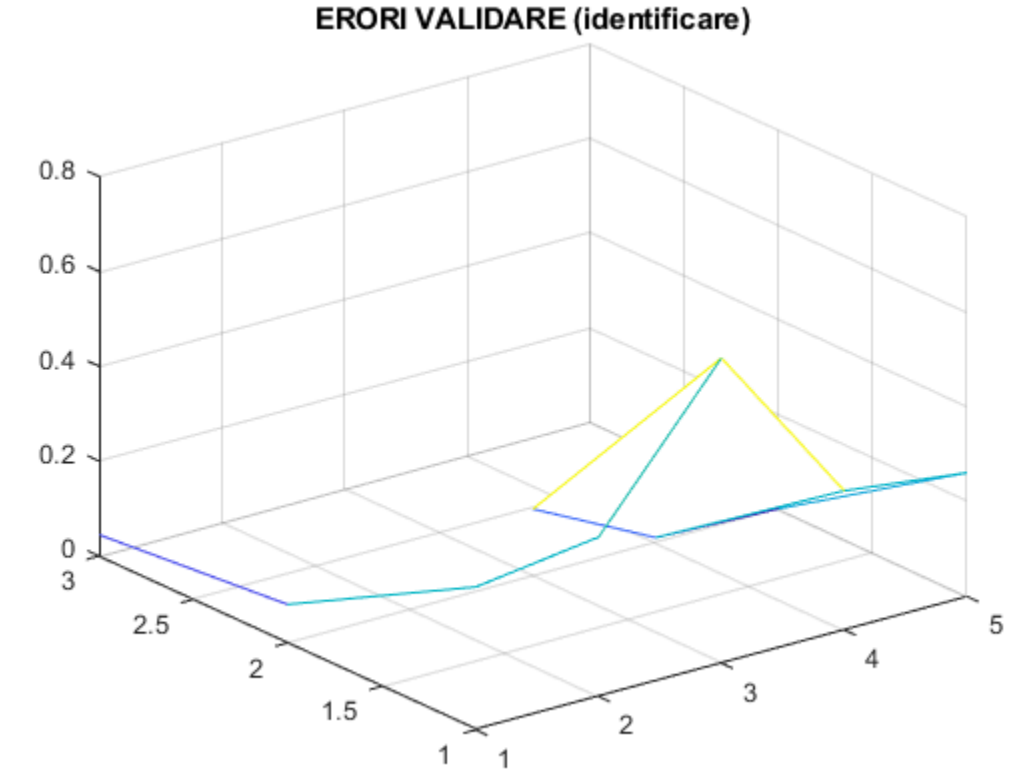
```
            end
            x(k,:)=[x1 x2];
        end

phi=zeros(length(y),length(P));


% generare phi, yhat
for k=1:length(y)
    for i=1:length(P)
        phi(k,i)=prod(x(k,:).^P(i,:),"all");
    end
end

yhat=phi*teta;

figure,
plot(yhat)
hold on;
plot(y);
title('(identificare) Predictie. MSE=',min1)

na=nas;
nb=na;
n=na+nb;
m=nbs;

figure,
plot(yhatvector(na*m,:))
hold on;
plot(y);
title('(identificare) Simulare. MSE=',min2);


figure,
mesh(erori1);
title('ERORI PREDICTIE (identificare)');

figure,
mesh(erori2);
title('ERORI VALIDARE (identificare)')
```

```
Warning: Updating objects saved with previous MATLAB version...
Resave your MAT files to improve loading speed.
Warning: Rank deficient, rank = 457, tol =  3.537366e-09.
```


(identificare) Predictie. MSE=
3.13e-06
5
4.5
4
3.5
3
2.5
2
1.5
0
100
200
300
400
500
600
700
800
900
1000


(identificare) Simulare. MSE=
0.001441
5
4.5
4
3.5
3
2.5
2
1.5
0
100
200
300
400
500
600
700
800
900
1000


ERORI PREDICTIE (identificare)
0.015
0.01
0.005
0
3
2.5
2
1.5
1
1
2
3
4
5


ERORI VALIDARE (identificare)
0.8
0.6
0.4
0.2
0
3
2.5
2
1.5
1
1
2
3
4
5

validare

u=id.u; y=id.y;

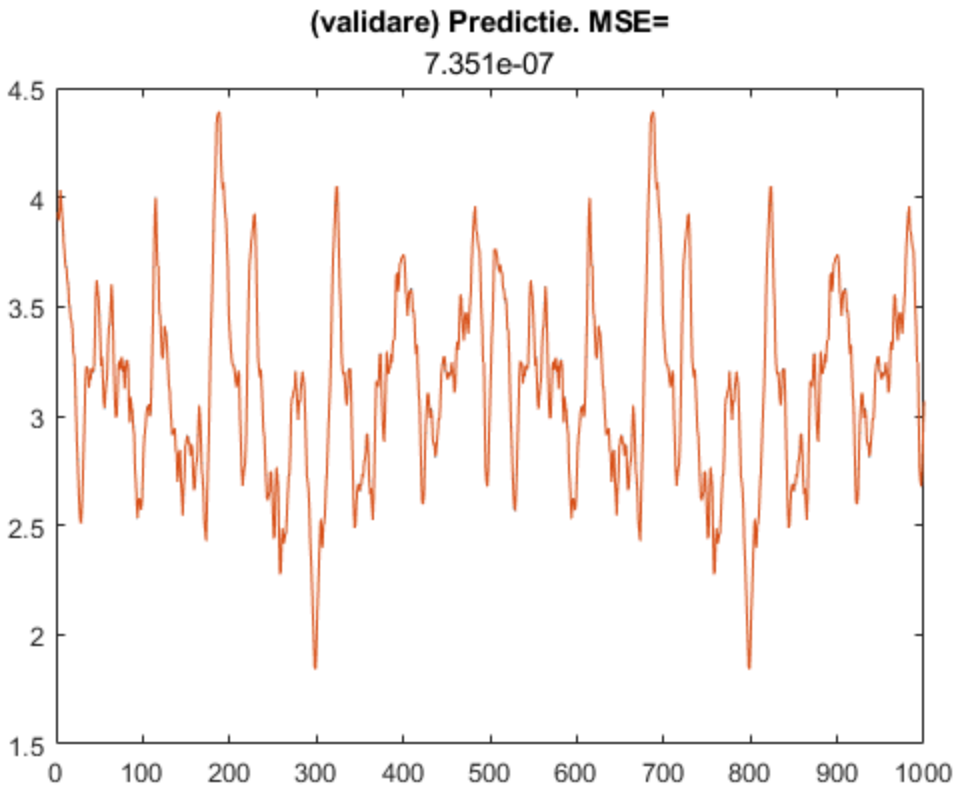
```
clearvars -except teta
load('iddata-18.mat')
u=val.u;
y=val.y;

Nmax=3; Mmax=5;
na=Nmax; nb=Nmax; n=na+nb; b=1;
erori1=ones(Nmax,Mmax);
erori2=ones(Nmax,Mmax);


for na = 1:Nmax
    nb = na;
    n = na+nb;
    for m = 1:Mmax
        clear P;
        x=zeros(length(y),na+nb);
        [Y{1:1:n}] = ndgrid(0:m);
        Pi = reshape(cat(n+1,Y{:}),[],n);
        sumPi = sum(Pi,2);
        l = 1;
        for i = 1:length(sumPi)
            if(sumPi(i) <= m)
                P(:,l) = Pi(i,:);
                l = l + 1;
            end
        end
        P=P';
for k=1:length(y)
    x1=zeros(1,na);
    x2=zeros(1,nb);
    for i=1:na
        if(k>i)
            x1(i)=y(k-i);
            x2(i)=u(k-i);
        end
    end
    x(k,:)=[x1 x2];
end

phi=zeros(length(y),length(P));


% generare phi, yhat
for k=1:length(y)
    for i=1:length(P)
        phi(k,i)=prod(x(k,:).^P(i,:),"all");
    end
end
```

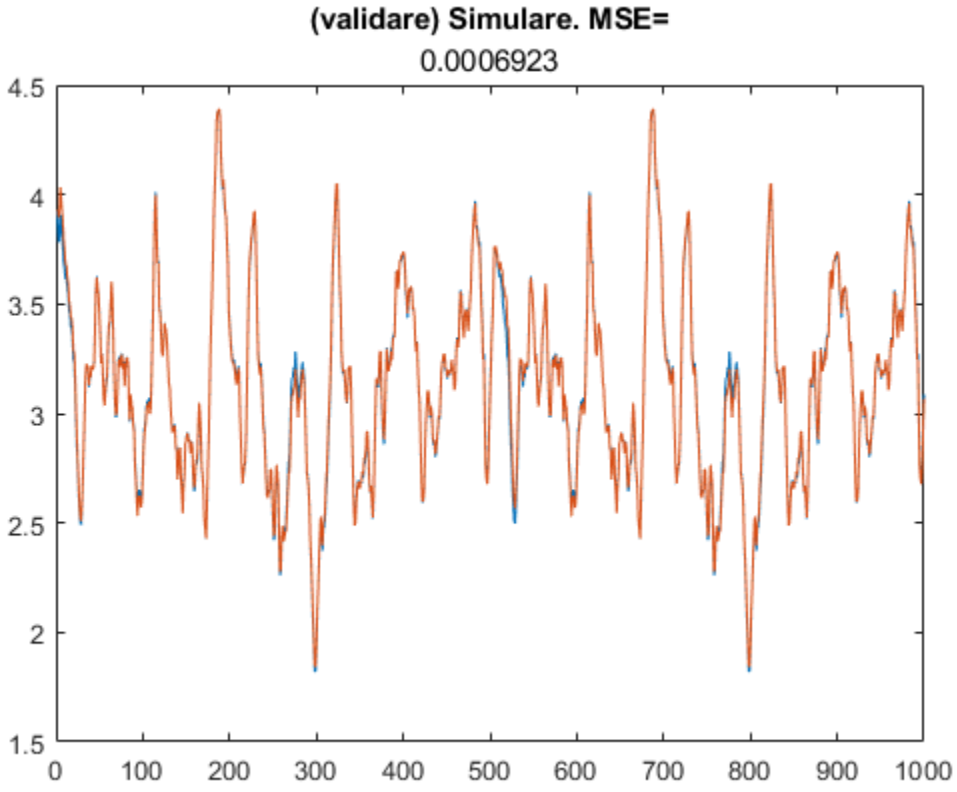
```
teta=phi\y;
yhat=phi*teta;


MSE=0;
for i=1:length(yhat)
MSE=MSE+(y(i)-yhat(i))^2;
end
MEP2=MSE/length(yhat);
%title(MEP2);
erori1(na,m)=MEP2;

%simulare

yhatnou=zeros(1,length(y));
xsim=zeros(length(y),na+nb);

for k=1:length(y)
    x1sim=zeros(1,na);
    x2sim=zeros(1,nb);
    for i=1:na
        if(k-i>0)
            x1sim(i)=yhatnou(k-i);
            x2sim(i)=u(k-i);
        end
    end
    xsim(k,:)=[x1sim x2sim];
    linie=xsim(k,:);
    w=[];

        for i=1:length(P)
            p=1;
            for j=1:na+nb
                p=p*linie(j).^P(i,j);
            end
            w(i)=p;
        end
        yhatnou(k)=w*teta;
end
yhatvector(b,:)=yhatnou;
b=b+1;
MSE=0;
for i=1:length(yhatnou)
MSE=MSE+(y(i)-yhatnou(i))^2;
end
MEP3=MSE/length(yhatnou);

erori2(na,m)=MEP3;

    end
end

min1 = Mmax;
```

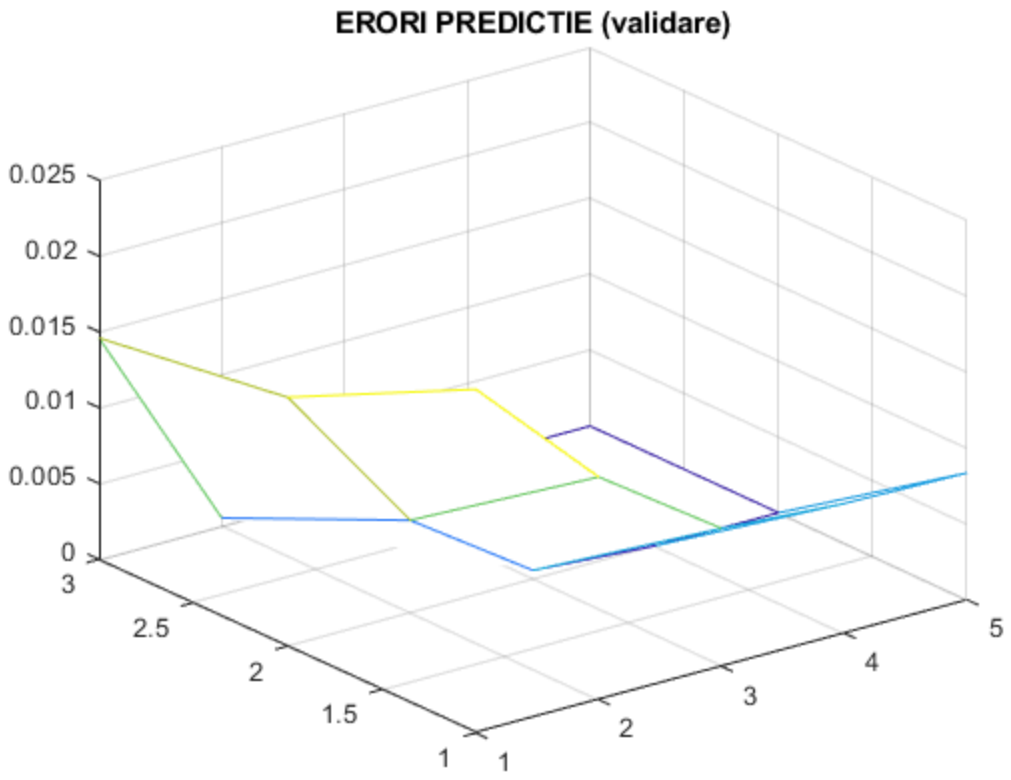
```
for i = 1:Nmax
    for j = 1:Mmax
        if (erori1(i,j)<min1)
            min1 = erori1(i,j);
            nap=i;
            nbp=j;
        end
    end
end

min2 = Mmax;
for i = 1:Nmax
    for j = 1:Mmax
        if (erori2(i,j)<min2)
            min2 = erori2(i,j);
            nas=i;
            nbs=j;
        end
    end
end


na=nap;
nb=na;
n=na+nb;
m=nbp;
clear P;
        x=zeros(length(y),na+nb);
        [Y{1:1:n}] = ndgrid(0:m);
        Pi = reshape(cat(n+1,Y{:}),[],n);
        sumPi = sum(Pi,2);
        l = 1;
        for i = 1:length(sumPi)
            if(sumPi(i) <= m)
                P(:,l) = Pi(i,:);
                l = l + 1;
            end
        end
        P=P';
for k=1:length(y)
    x1=zeros(1,na);
    x2=zeros(1,nb);
    for i=1:na
        if(k-i>0)
        x1(i)=y(k-i);
        x2(i)=u(k-i);
        end
    end
    x(k,:)=[x1 x2];
end

phi=zeros(length(y),length(P));
```

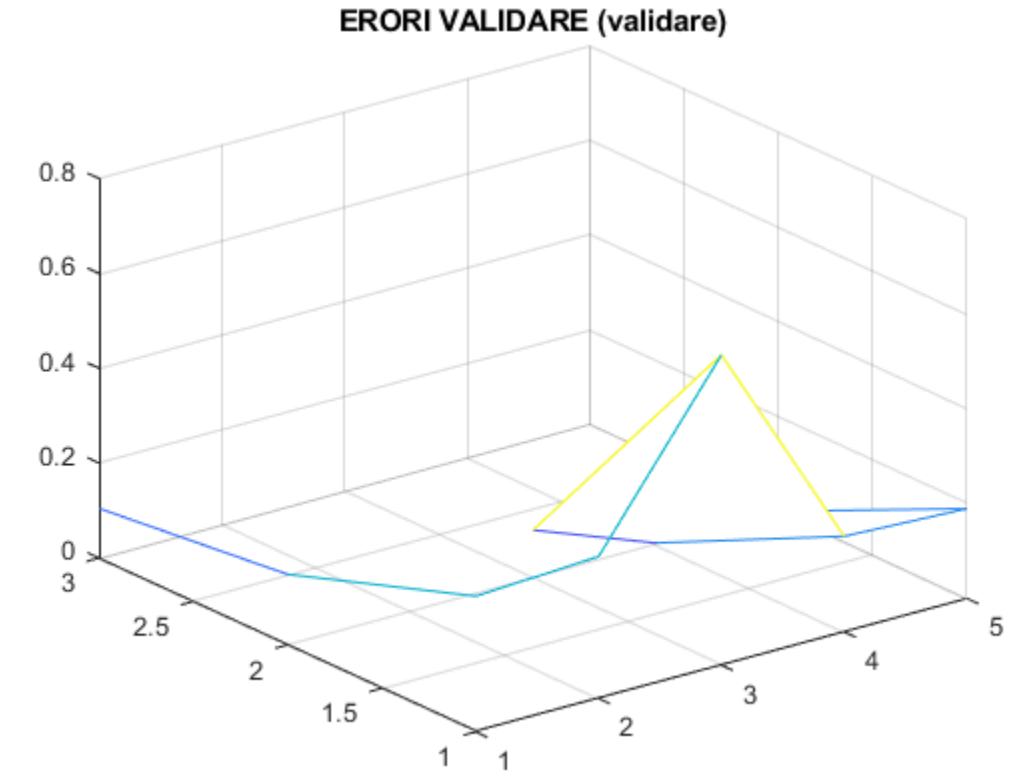
```
% generare phi, yhat
for k=1:length(y)
    for i=1:length(P)
        phi(k,i)=prod(x(k,:).^P(i,:),"all");
    end
end

%teta=phi\y;
yhat=phi*teta;

figure,
plot(yhat)
hold on;
plot(y);
title('(validare) Predictie. MSE=',min1)

na=nas;
nb=na;
n=na+nb;
m=nbs;

figure,
plot(yhatvector(na*m,:))
hold on;
plot(y);
title('(validare) Simulare. MSE=',min2);


figure,
mesh(erori1);
title('ERORI PREDICTIE (validare)');

figure,
mesh(erori2);
title('ERORI VALIDARE (validare)')
```

```
Warning: Updating objects saved with previous MATLAB version...
Resave your MAT files to improve loading speed.
Warning: Rank deficient, rank = 452, tol =  3.177432e-09.
```


(validare) Predictie. MSE=
7.351e-07
4.5
4
3.5
3
2.5
2
1.5
0
100
200
300
400
500
600
700
800
900
1000


(validare) Simulare. MSE=
0.0006923
4.5
4
3.5
3
2.5
2
1.5
0
100
200
300
400
500
600
700
800
900
1000


EROARI PREDICTIE (validare)
0.025
0.02
0.015
0.01
0.005
0
3
2.5
2
1.5
1
1
2
3
4
5


EROARI VALIDARE (validare)
0.8
0.6
0.4
0.2
0
3
2.5
2
1.5
1
1
2
3
4
5

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