Final Exercise

1.

a)input: current i

output: distance :x

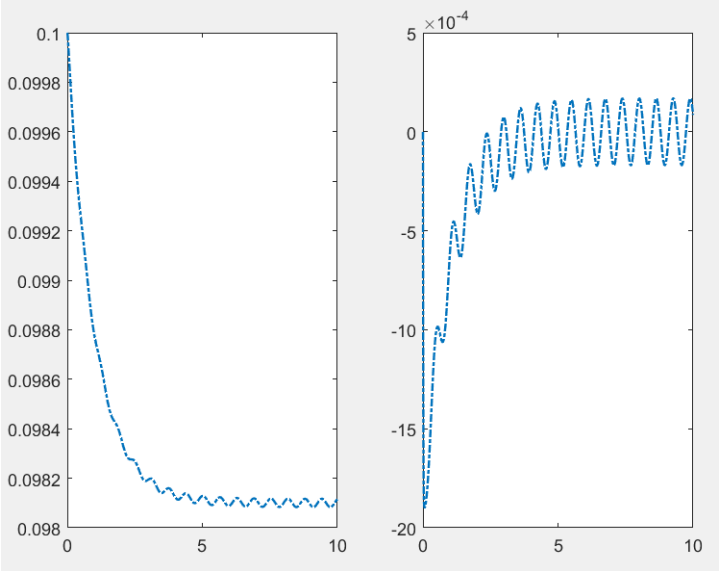
constants:k,b,p,e_0,m,g

time-varying variables: x1:velocity, x2:accelerate;

b) $m\ddot{z} = mg - \left(\frac{1}{e_0+z}\right)^2 - \dot{z}b - zk$

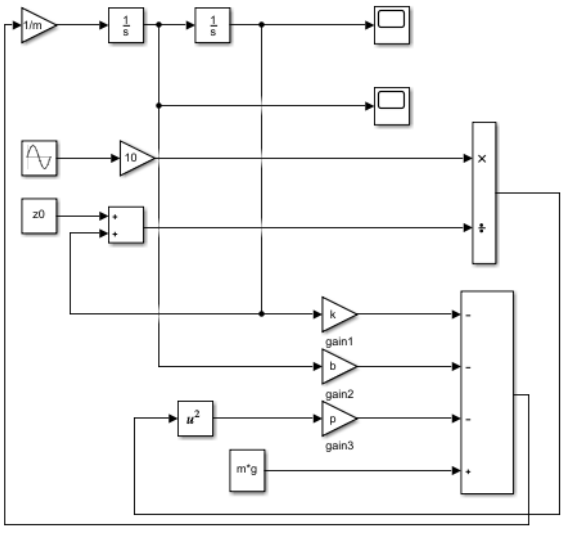
$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}x_2\\ g - \frac{F(x_1,i)}{m} - \frac{k}{m}x_1 - \frac{b}{m}x_2\end{bmatrix}$$

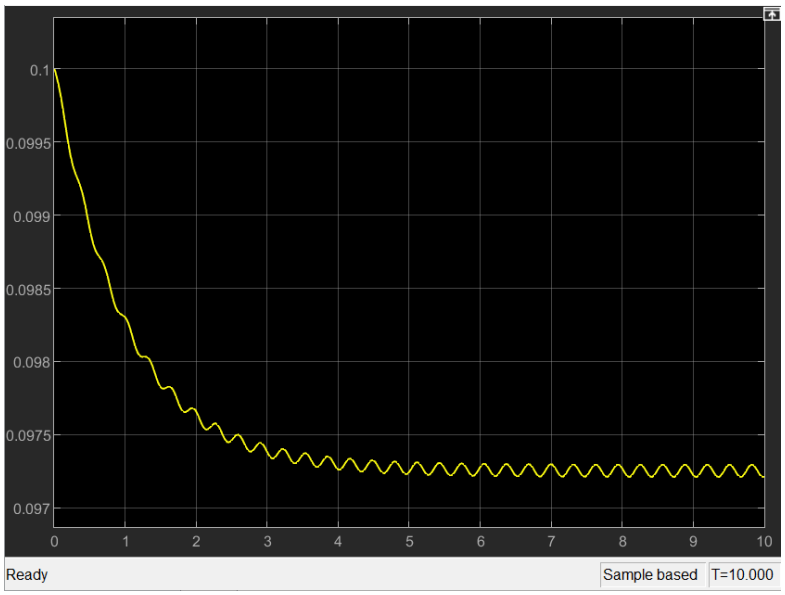
c)

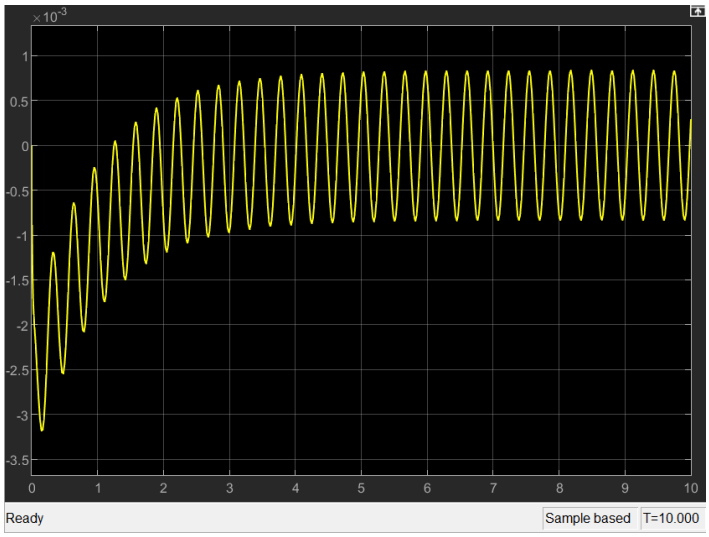


At t=10s, z=0.9811m

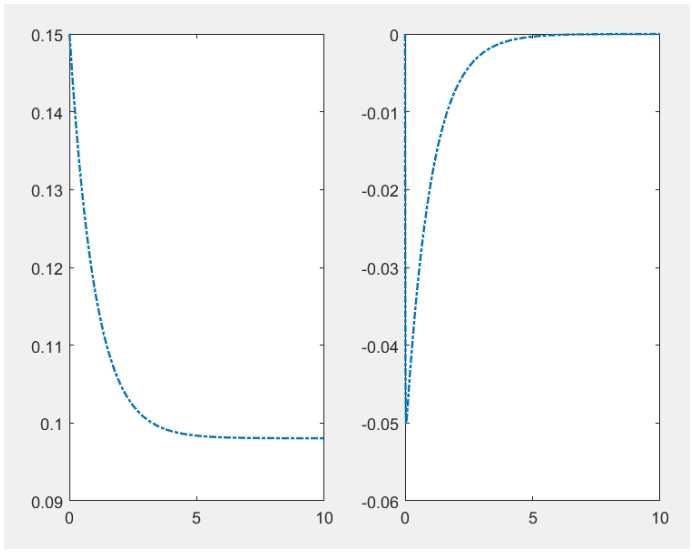
d)





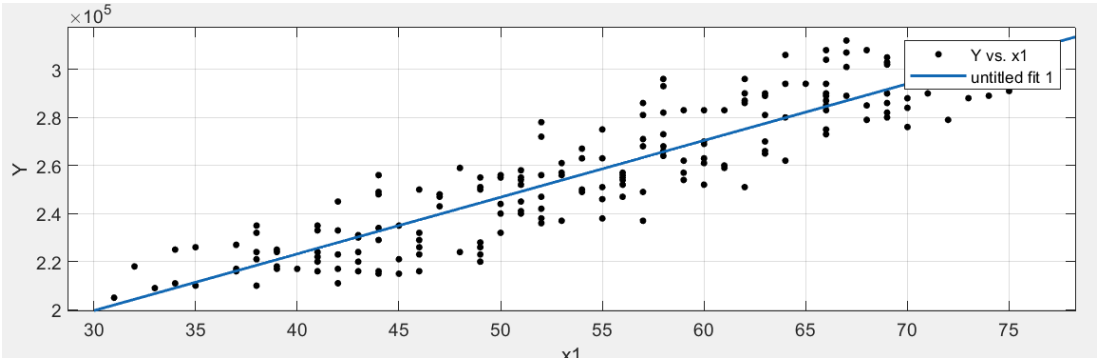


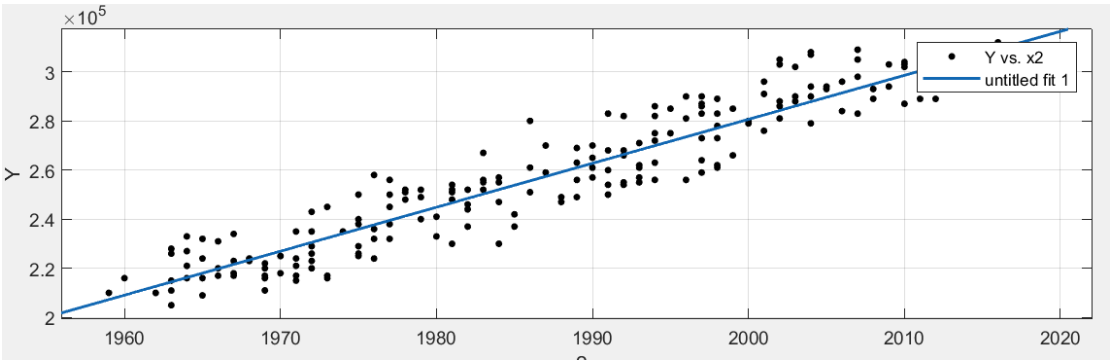
e)

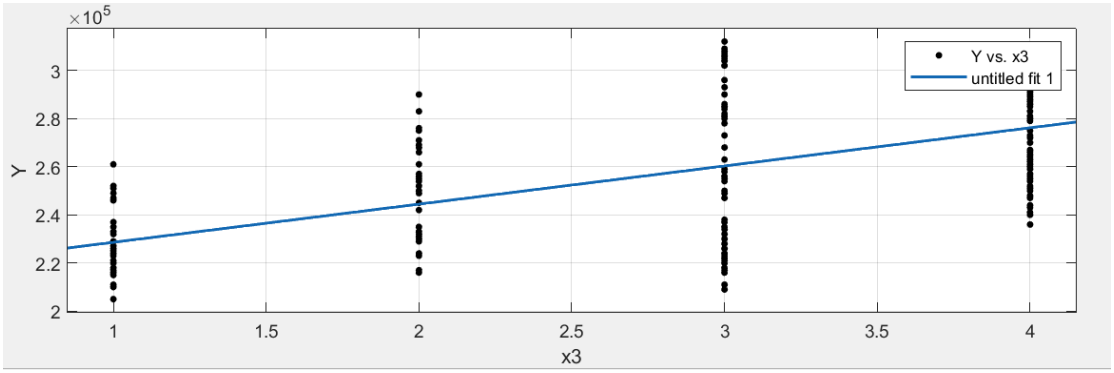


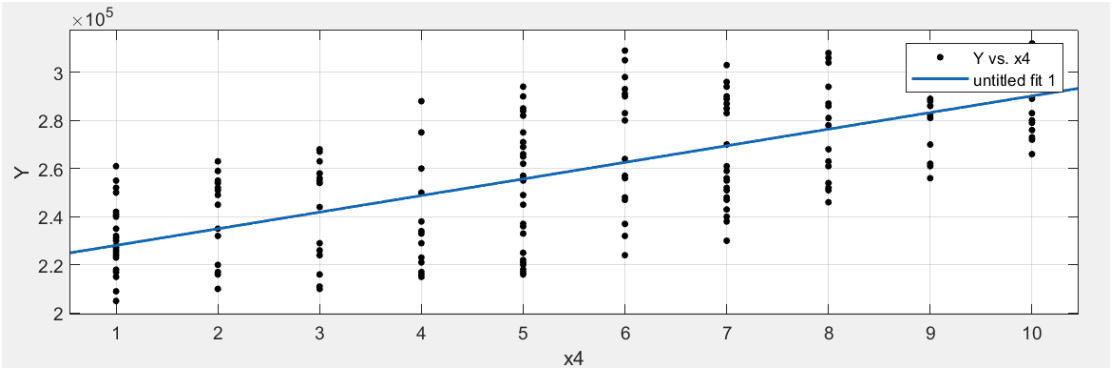
The current I = 3.5

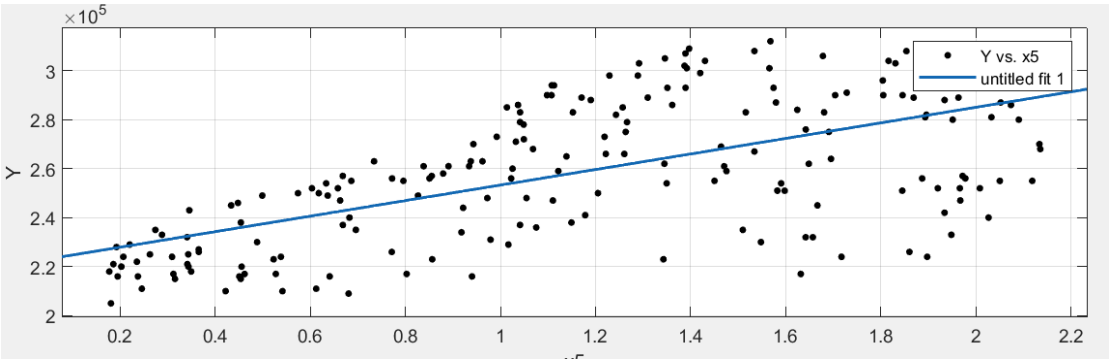
2. By analyzing the data with Curve Fitting Tool, linear regression can be utilized to fit the model.

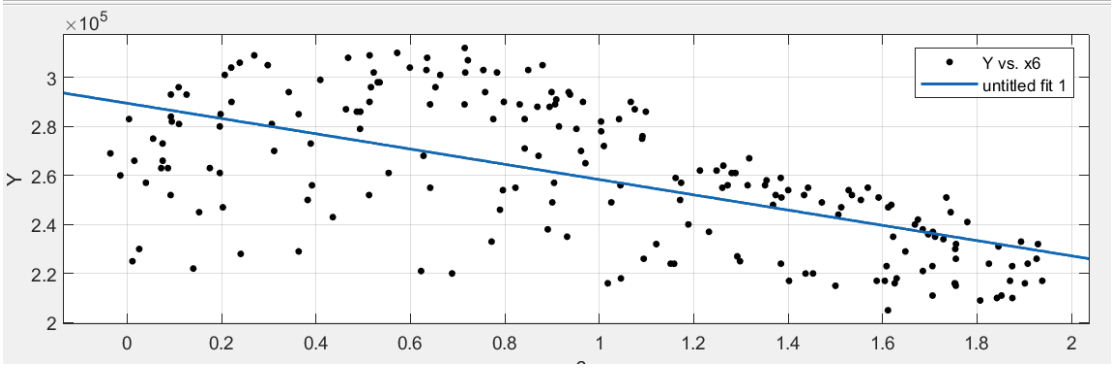






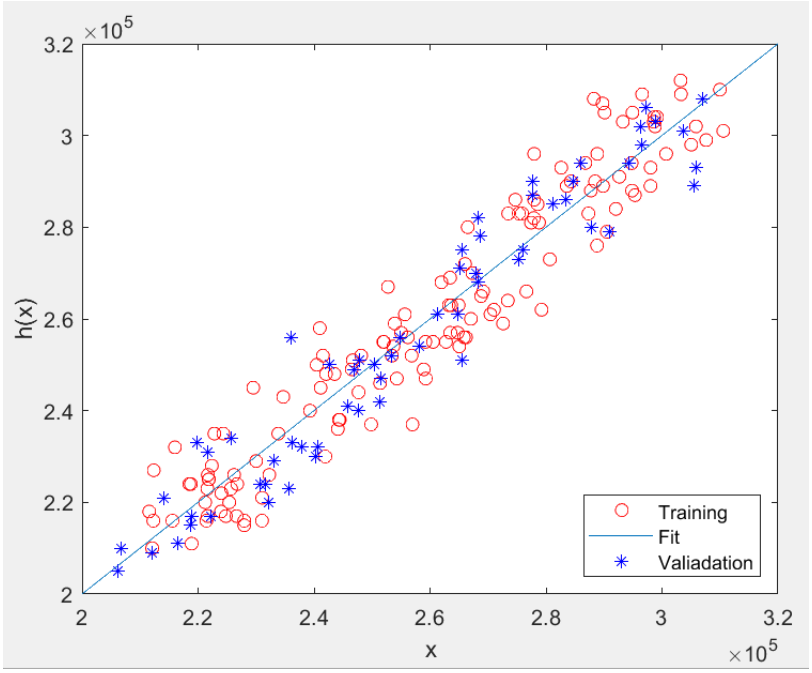






The predictions the housing prices are:
House No.1: 233347
House No.2: 269535
House No.3: 303944

70% of the data is used for training, and 30% of the data is used for validation.
SSE for training data = $1.3348*10^{10}$
$R^2 = 0.9209$



My code here:

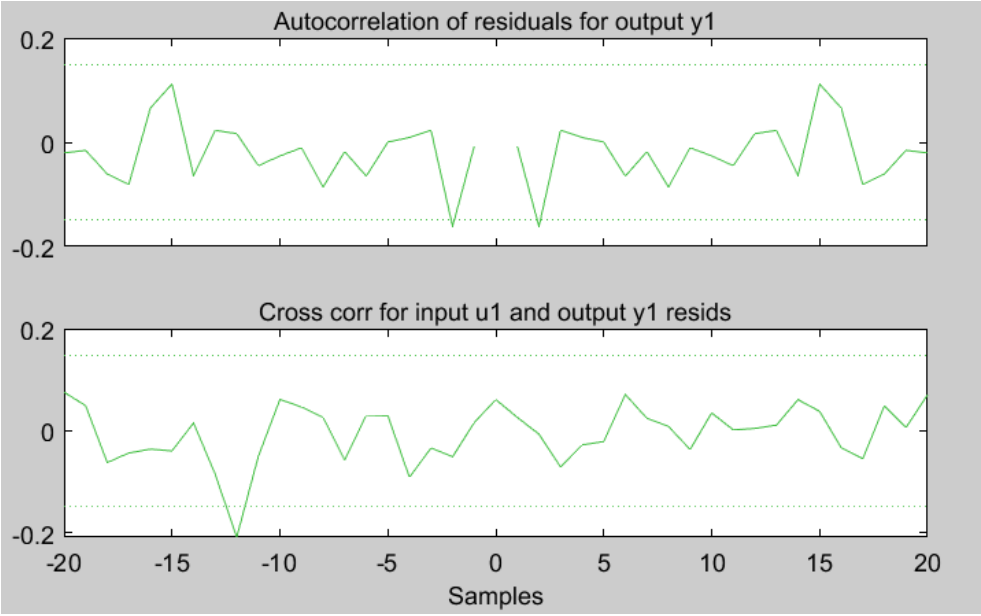
```
clear all
close all
clc
load data2.mat

R=randperm(height(data2));
R=randperm(200);
data2=data2(R(1:200),:);
R=randperm(height(data2));
array2=table2array(data2);

x=array2(:,6);
y=array2(:,7);
x_init=zeros(200,1);
y_init=zeros(200,1);
x_init(:)=1.43;
y_init(:)=0.63;
x1=x+x_init;
y1=y+y_init;
dis=sqrt(x1.^2+y1.^2);
title=ones(200,1);
tuple=zeros(200,6);
tuple(:,1)=title;
tuple(:,2:5)=array2(:,2:5);
tuple(:,6)=dis;
list=[1:140];
train=tuple(list,:);
val=tuple(141:200,:);

predict=array2(:,1);
T=predict(list);
N = inv(train'*train)*train'*T;

y_train=train*N;
P=predict(141:200,:);
y_val=val*N;

plot(y_train,T,'ro')
hold on

plot(200000:100:320000,200000:100:320000)
hold on
plot(y_val,P,'b*')
```

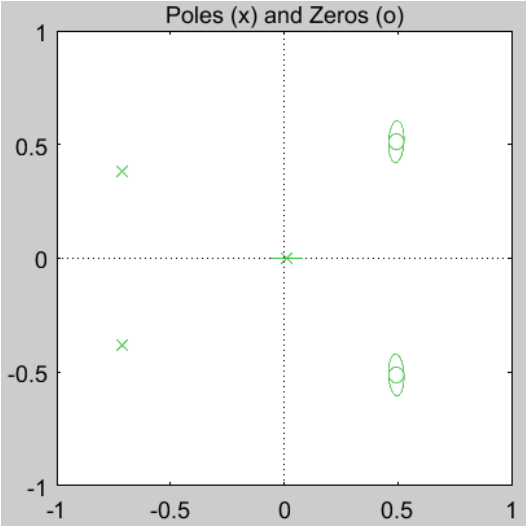
```
legend({'Training','Fit','Valiadation'},'Location','southeast')
xlabel('x')
ylabel('h(x)')

yy=tuple*N;
SSE = sum((yy-predict).^2)
SST=sum((predict.^2))-200*(mean(predict).^2);
R_square=1-SSE/SST

feature=[45,1978,1,1,0.2,0.3;
    56,2000,2,2,0.6,1.6;
    72,2016,3,6,1.4,0.65];
area=feature(:,1);
year=feature(:,2);
room=feature(:,3);
floor=feature(:,4);
distance_x=feature(:,5);
distance_y=feature(:,6);
x_t= zeros(3,1)+1;
distance=((distance_x-1.43).^2+(distance_y-0.63).^2).^0.5;
house_data=[x_t,area,year,room,floor,distance];
price=house_data*N;
```

3.

(u1,y1)

I use bj32331





B(z) = -1.72 (+/- 0.01477) z^-1 + 1.698 (+/- 0.03865) z^-2 - 0.8713 (+/- 0.07221) z^-3

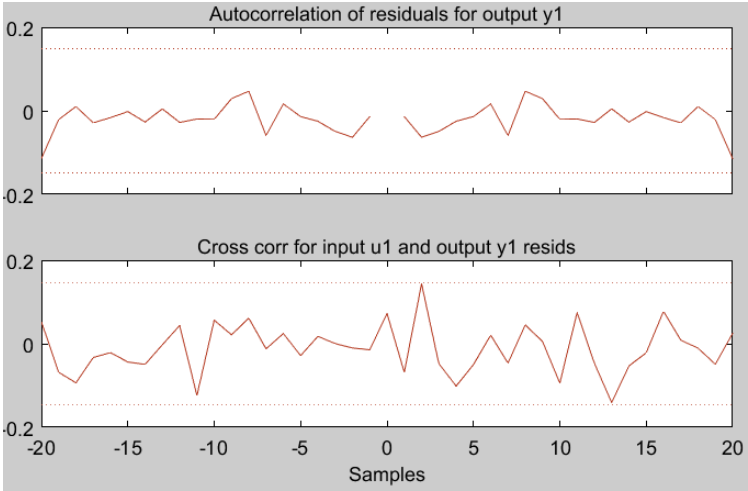
C(z) = 1 - 0.5717 (+/- 0.08641) z^-1 + 0.6801 (+/- 0.08454) z^-2

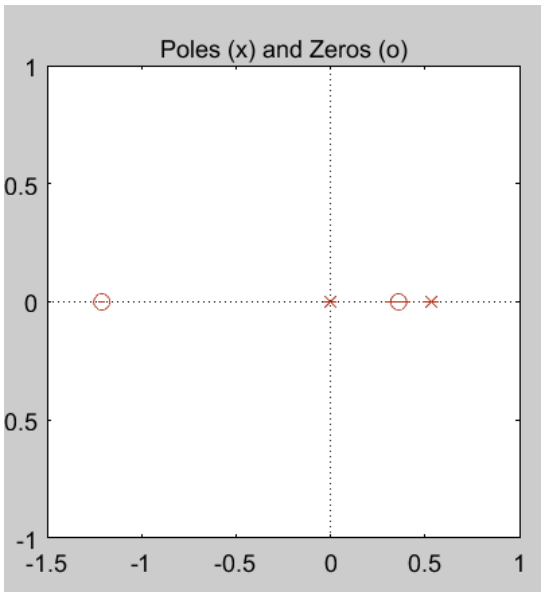
D(z) = 1 - 1.402 (+/- 0.1037) z^-1 + 0.8859 (+/- 0.1582) z^-2 - 0.4217 (+/- 0.09938) z^-3

F(z) = 1 + 1.414 (+/- 0.02645) z^-1 + 0.6368 (+/- 0.03848) z^-2 - 0.008929 (+/- 0.01773) z^-3

(u2,y2)

I use ARX231



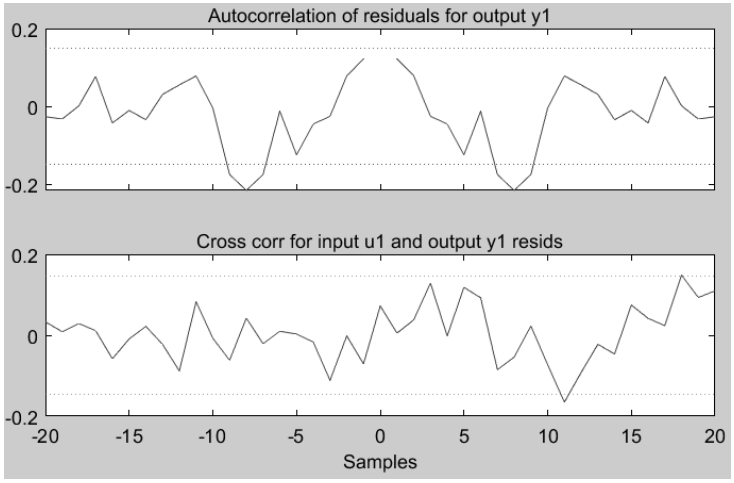


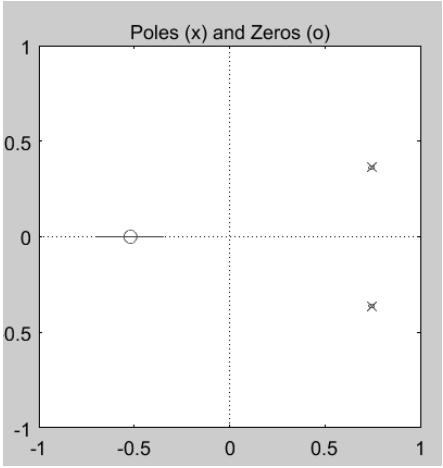
A(z) = 1 - 0.5364 (+/- 0.02761) z^-1 + 0.0009702 (+/- 0.007346) z^-2

B(z) = -1.683 (+/- 0.00778) z^-1 - 1.43 (+/- 0.04698) z^-2 + 0.7347 (+/- 0.05404) z^-3

(u3,y3)

I use bj23222





B(z) = 0.9846 (+/- 0.03865) z^-2 + 0.5115 (+/- 0.05274) z^-3

C(z) = 1 - 0.6864 (+/- 0.03736) z^-1 + 0.5052 (+/- 0.04096) z^-2 + 0.2997 (+/- 0.03722) z^-3

D(z) = 1 - 1.238 (+/- 0.005365) z^-1 + 0.9927 (+/- 0.00533) z^-2

F(z) = 1 - 1.488 (+/- 0.01127) z^-1 + 0.6854 (+/- 0.009449) z^-2