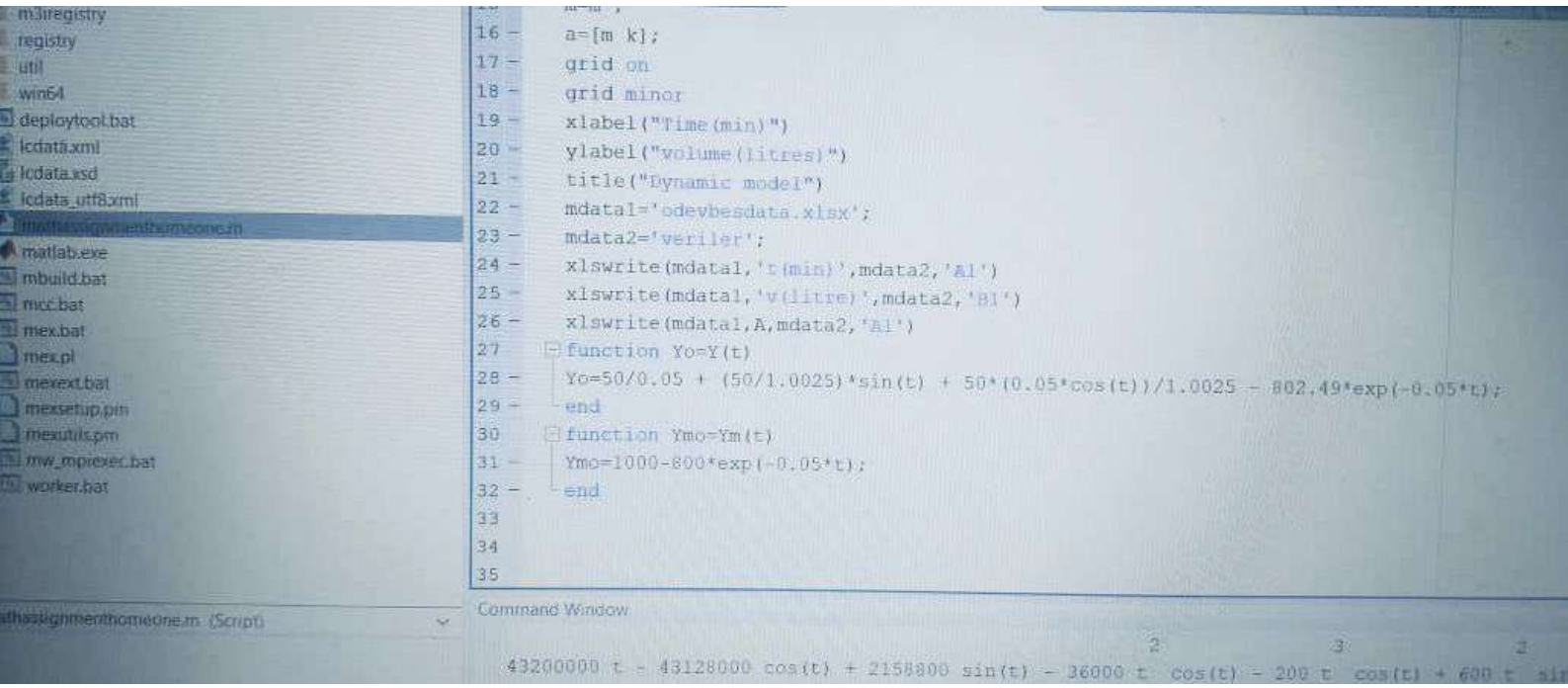
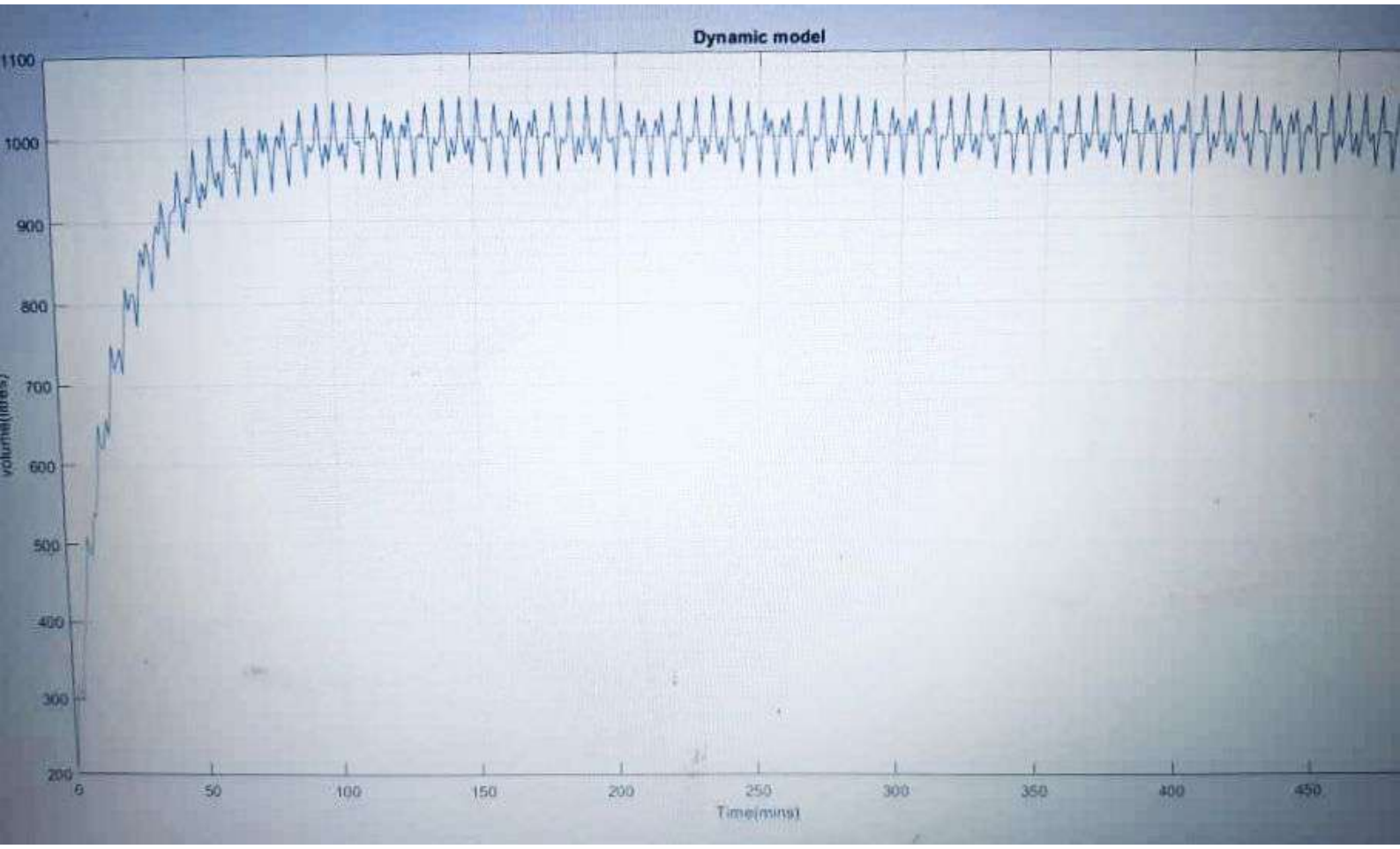
```
commandwindow
clear
clc
m=[0:1:500];
k=[];
for i=m
    if(mod(i,2)==0)
        k=[k Y(i)];
    else
        k=[k Ym(i)];
    end
end
plot(m,k)
k=k';
m=m';
a=[m k];
grid on
grid minor
xlabel("Time(min)")
ylabel("Volume(Litres)")
```

Command Window

$$43200000\,t = 43128000\cos(t) + 2156000\sin(t)$$

$$\cos(t) + 72000\,t\sin(t) + 1080000\,t^2 + 13000$$


m3iregistry
registry
util
win64
deploytool.bat
lcdata.xml
lcdata.xsd
lcdata_utf8.xml
matlab.exe
mbuild.bat
mcc.bat
mex.bat
mex.pl
mexext.bat
mexsetup.pm
mexutils.pm
mw_mpiexec.bat
worker.bat
a=[m k];
grid on
grid minor
xlabel("Time(min)")
ylabel("volume(litres)")
title("Dynamic model")
mdata1='odevbesdata.xlsx';
mdata2='veriler';
xlswrite(mdata1,'t(min)',mdata2,'A1')
xlswrite(mdata1,'v(litre)',mdata2,'B1')
xlswrite(mdata1,A,mdata2,'A1')
function Yo=Y(t)
Yo=50/0.05 + (50/1.0025)*sin(t) + 50*(0.05*cos(t))/1.0025 - 802.49*exp(-0.05*t);
end
function Ymo=Ym(t)
Ymo=1000-800*exp(-0.05*t);
end
Command Window
43200000 t - 43128000 cos(t) + 2158800 sin(t) - 36000 t^2 cos(t) - 200 t^3 cos(t) + 600 t^2 sin


Dynamic model
1100
1000
900
800
700
600
500
400
300
200
volume(litres)
0
50
100
150
200
250
300
350
400
450
Time(mins)

from $y \cdot If = \int Q \cdot If\, dx$

$m \cdot e^{0.025t} \cdot If = \int 0 \cdot If\, dt$

$= \int 50(\sin t + 1) \cdot e^{0.025t}\, dt$

$= 50 \int e^{t/40}(\sin t + 1)\, dt$

let $u = \frac{t}{40} \rightarrow \frac{dv}{dt} = \frac{1}{40}$, $dt = 40\,dv$

$= 40 \int e^v (\sin 40u + 1)\, dv$

$\int e^v (\sin 40v + 1)\, dv$

Let $q = \sin 40v + 1$, $dp = e^v dv$

$\frac{dq}{dv} = 40\cos 40v$ $\int dp = \int e^v dv$

$dq = 40(\cos 40v)dv$ $p = e$

from $\int q\,dp = qp - \int p\,dq$

$\int 40e^v(\cos 40v)\,dv = 40\int e^v(\cos 40v)\,dv$

$\int e^t \cos 40v\,dv =$ Let $q = \cos 40v$ $dp = e^v dv$

Integrating, we have

$\int e^t \cos 40v\,dv = e^v \cos 40v - \int -40e^v(\sin 40v)\,dv$ --- (ii)

Integrating by part,

$q = -40\sin 40v$ $dp = e^v$

$dq = -1600\cos 40v\,dv$ $p = e^v$

$\int e^v \cos 40v\,dv = e^t \cos 40v - \int -40e^v \sin 40v - \int -1600 e^v \cos 40v\,dv$

$1601 \int e^v \cos 40v\,dv = e^v \cos 40v + 40e^v \sin 40v$

$\int e^v \cos 40v\,dv = \frac{e^v \cos 40v + 40e^v \sin 40v}{1601}$

$40\int e^v \cos 40v\,dv = 40(40e^v \sin 40v + e^v \cos 40v)$ --- (iv)

from (iii),

$\Rightarrow \int e^v(\sin 40v + 1)\,dv = e^v \sin 40v + 1 - \int 40e^v \cos 40v\,dv$

$\int e^v(\sin 40v + 1) \Rightarrow e^v \sin 40 + 1 - \frac{40(40e^v \sin 40v + e v \cos(40)}{1601}$

UGWUOKE CHUKWUDUMEBI DAVID
ELECT/ELEC
18/ENG04/074

1) Input rate = 50gal at brine/min (1gal = (1+sint)lb of salt)
Output rate = 30gal of brine/min
m = amount of salt at anytime t
using the balance law
$\frac{dm}{dt} = m_{in} - m_{out}$

50gal of water enters per minute and 1gal = (1+sint)lb of salt
$\therefore min = 50gal/min \times (1+\sin t) = 50(1+\sin t)lb/min$
If the tank contains 1200gal of water and 30gal of water leaves per minute $\therefore \frac{30}{1200} = \frac{1}{40} = 0.025$
2.5% of water in the tank leaves per minute. Also, 2.5% of salt will also leave the tank per minute.

$M_{out} = 2.5\%$ of m
$\frac{dm}{dt} = 50(1+\sin t) - 0.025m \quad \cdots (6)$

(6) differentiating using integration factor method,

$\frac{dm}{dt} + 0.025m = 50(\sin t + 1)$

$\frac{dy}{dx} + Py = Q \left(\frac{dm}{dt} + Pm = Q\right)$

$P = 0.025, \; Q = 50(\sin t + 1)$

$e^{\int P dt}$ = Integrating factor

$\int P\,dt = \int 0.025\,dt = 0.025t$

$If \Rightarrow e^{0.025t}$

$$40\int e^v \sin 40v + 1\,dv = 40e^v(\sin 40v + 1) - \frac{1608(40e^v \sin 40v + e^v \cos 40v)}{1601}$$

putting $v = t/40$,

$$40e^{t/40}(\sin t + 1) - \frac{1608(40e^{t/40} + e^{t/40}\cos(t))}{1601}$$

$$50\int e^{t/40}(\sin t + 1)\,dt$$

$$50\int e^{t/40}(\sin t + 1)\,dt \rightarrow \frac{2000e^{t/40}(\sin t - 40\cos t + 1601)}{1601} + C \quad \text{---(V)}$$

Recalling the original integration factor,

$$m \cdot If = \int q \cdot If\,dt$$

$$m \cdot e^{0.025} = \int 150(\sin t + 1) \cdot e^{0.025t}\,dt$$

putting eqn (v),

$$m \cdot e^{0.025t} = \frac{2000e^{0.025t}(\sin t - 40\cos t + 1601)}{1601} + m_0 \cdot e^{-0.025t} \quad \text{---(VI)}$$

at $t = 0$ min and $m = 150$ lb of salt,

$$150 = \frac{2000(\sin 0 - 40\cos(0) + 1601)}{1601} + m_1 \cdot 1$$

$$150 = 1950.03 + m_0$$

$$m_0 = -1800.03$$

putting m_0 in eqn (VI),

$$m = \frac{200(\sin t - 40\cos t + 1601)}{1601} - \frac{1800.03}{e^{0.025t}}$$