Nwanze Chigozie Harry
18/eng06/046
Mechanical Eng
ENG 282 (Eng maths II)

Using Balance law, the acceleration rate of salt within a is equal to the input rate of salt ~~from~~ into the system minus output rate of salt from the system

Acceleration rate of salt within a system = input rate of salt system
= output rate of salt from system

let the amount of salt present in the tank at any time by (y).

Time rate of change of $y = \frac{dy}{dt} = y_{in} - y_{out}$

If 50 gal of brine enters the tank per minute and one gallon contains (1 sin) lb of salt then

at $t = 1$, $(1 + \sin t) = (1 + \sin 1) = 162$ lb

Hence, the amount of salt entering into the tank is 50 gals/min

$\times 1.02$ lb/gal = 51 lb/min

The tank contains 1200 gal of water with dissolved salt and 30 gal of the solution exists the tank per min that is $\frac{30 \text{ gal}}{1200 \text{ gal}} = 0.025$ 5%

of the content of the tank. 102.5 % of the salt present inside the tank will also have the tank per minute that is

$y_{out} = 2.5\%$ of y

$\frac{dy}{dt}$ lb/min $= 51$ lb/min $- 2.5\%$ of y lb/min

$\frac{dy}{dt} = 51 - 0.025y$, $\frac{dy}{dt} = -0.025y + 51$

$\frac{dy}{dt} - 0.025\left(\frac{-0.025y + 51}{(-0.025) - 0.025}\right)$

$$\frac{dy}{dt} = -0.02(y-2040)$$

$$\frac{dy}{(y-2040)} = -0.025\,dt \quad \int \frac{dy}{(y-2040} = \int -0.025\,dt$$

$$\int \frac{dy}{(y-2040)} = -0.025 \int dt \quad \ln(y-2040) = -0.025t + c$$

$$y-2040 = e^{-0.025t+c} \quad y-2040 = e^{-0.024}e^{c}$$

$$y-2040 = e^{-0.025t}\,y_0 \quad y-2040 = y_0 e^{-0.025t}$$

$$150 = y_0 e^{-0.025t} + 2040 \quad 150 - 2040 = y_0 \times 1$$

$$y_0 = -1890$$

50

$$y = -1890e^{-0.025t} + 2040$$

$$y = 2040 - 1890e^{-0.025t}$$

Untitled3.m

```
commandwindow
clear
clc
close all
syms mt
ans=dsolve('Dm+0.025*m=50+50*sin(t)','m(0)=150')
t=0:0.5:450
tn=subs(ans,t)
plot(t,tn)
grid on
```

Command Window

```
  450.0000


tn =

[ 150, 2000 - (2000*1601^(1/2)*cos(atan(1/40) + 1/2))/1601 - (2881850*exp(-1/80))/1601, 2000 - (2000*1601^(1/2)*cos(atan(1
>>
```

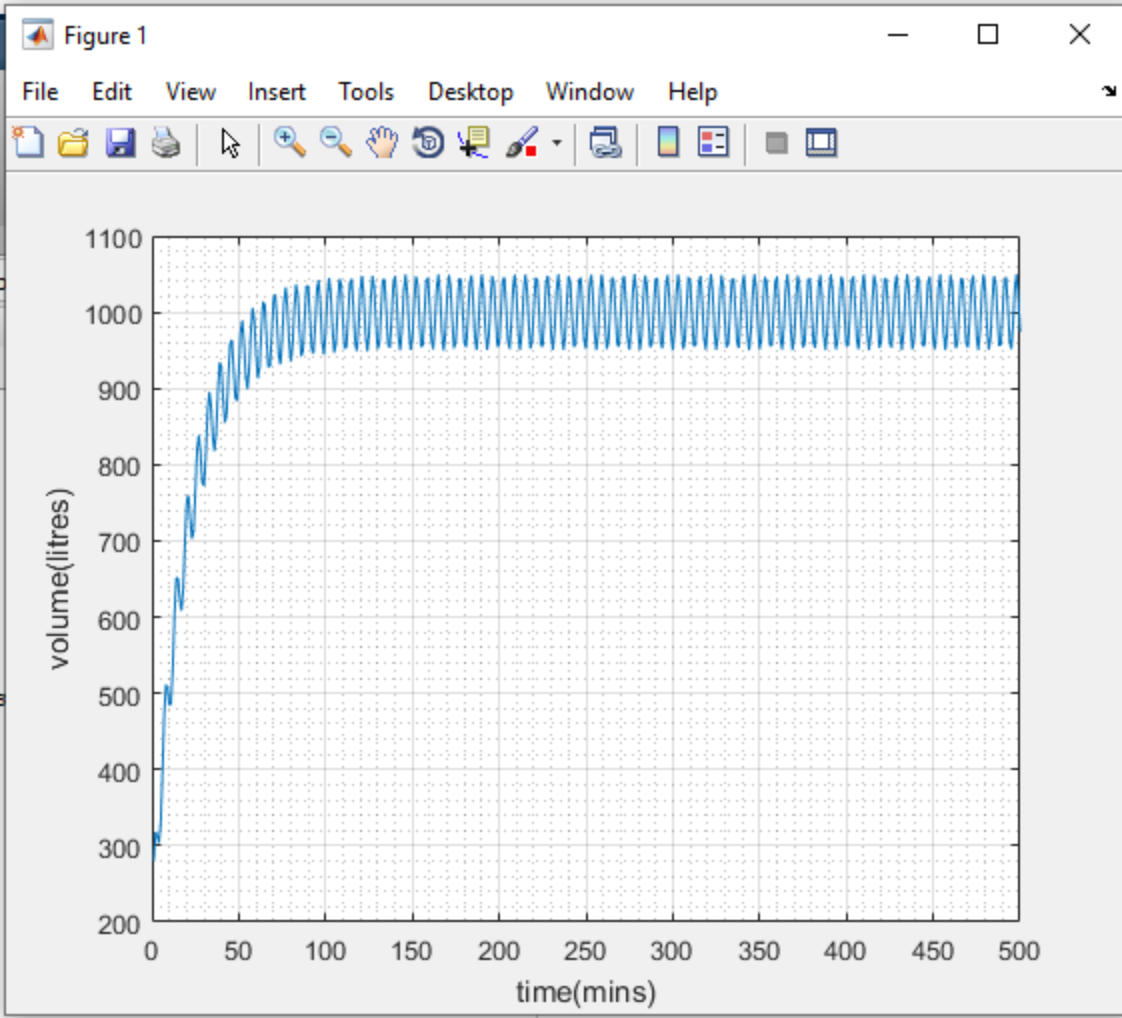
Figure 1
File
Edit
View
Insert
Tools
Desktop
Window
Help
1100
1000
900
800
700
600
500
400
300
200
volume(litres)
0
50
100
150
200
250
300
350
400
450
500
time(mins)

Untitled3.m | Untitled.m

```
commandwindow
clear
clc
close all
syms t
values=[]
t=1:1:500
mean=1000-((exp(-0.05*t))*800)
y=1000+(50/1.0025)*sin(t)+(2.5/1.0025)*cos(t)-((exp(-0.05*t)))*802.49

if rem(t,2) ==0
     values=[values,mean]
else
    values=[values,y]
end
excelvalues=transpose(values)
mins=transpose(t)
plot(t,values)
grid on
grid minor
xlabel ('time(mins)')
ylabel ('volume(litres)')
xlswrite('odevbesdata.xlsx',{'t(min)'},'veriler','A1')
xlswrite('odevbesdata.xlsx',mins,'veriler','A2')
xlswrite('odevbesdata.xlsx',{'V(Litre)'},'veriler','B1')
xlswrite('odevbesdata.xlsx',excelvalues,'veriler','B2')
```

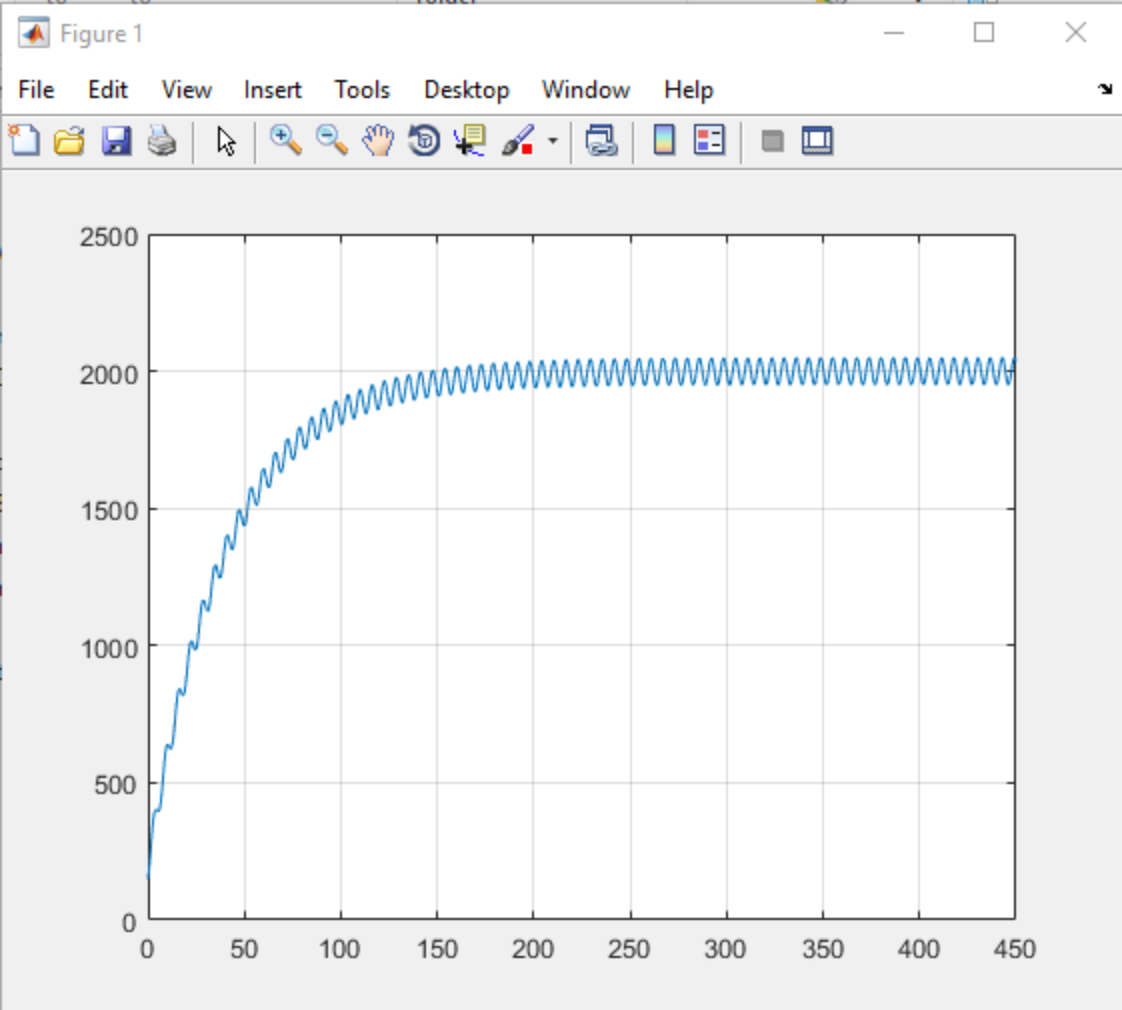
Figure 1
File
Edit
View
Insert
Tools
Desktop
Window
Help
2500
2000
1500
1000
500
0
0
50
100
150
200
250
300
350
400
450