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18/ENG08/012
BIOMEDICAL ENGINEERING
ENG282 ASSIGNMENT

NUMBER 1

a) Using Balance law, The accel rate at salt within a system is equal to the input rate of salt into the system minus the output rate of salt from the system.

Accel = Input rate − Output rate.

Say, the quantity of salt in the tank at any time 't' is 'y'.

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

Since 50 gal of brine enters the tank per minute and one gallon = (1 + sin t) lb of salt.

So, at $t = 1$,

$(1 + \sin t) = (1 + \sin(1)) = 1.02$ lb of salt.

$y_{in} = 50 \text{ gal/min} \times 1.02 \text{ lb/gal} = 51 \text{ lb/min}$

$\frac{30 \text{ gal}}{1280 \text{ gal}} = 0.025$

i.e 2.5% of the content of the tank, will therefore leave the tank every minute.

$\therefore y_{out} = 2.5\% \text{ of } y.$

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

c) $dy/dt = 51 - 0.025y$; $dy/dt = -0.025y + 51$;

$dy/dt = -0.025 \begin{bmatrix} -0.025y + 51 \\ -0.025y - 0.025 \end{bmatrix}$; $\frac{dy}{dt} = \frac{-0.025}{(y - 2040)}$.

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

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

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

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

$$y = y_0 e^{-0.025t} + 2040; \quad \text{when } t = 1 \text{ (initially)}$$

$$y = 150 \text{ Lb}$$

$$150 = y_0 e^{-0.025t} + 2040$$

$$150 - 2040 = y_0 \times 1$$

$$-1890 = y_0$$

$$\Rightarrow y_0 = -1890$$

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

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

18/ENG08/012
NWIMO CHARLES .C.

```
commandwindow
clear
clc
close all
t=1:2:500;
y=((50/0.05) + ((50/1.0025)*sin(t)) + (((50*0.05)/1.0025)*cos(t)) - (802.49*exp(-0.05*t)))
tm=0:2:500;
ym=((1000)-(800*exp(-0.05*tm)))
T=[t,tm]
Y=[y,ym]
plot(T,Y,'green')
grid on
grid minor
xlabel('T(min)')
ylabel('V(litre)')
col_header={'t(min)','V(Litre'};
xlswrite('odevbesdata.xlsx',[T(:),Y(:)],'veriler','A2');
xlswrite('odevbesdata.xlsx',col_header,'veriler','A1');
```

Command Window

```
Columns 481 through 492

  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000

Columns 493 through 501

  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000

fx >>
```

xlswrite

Figure 1

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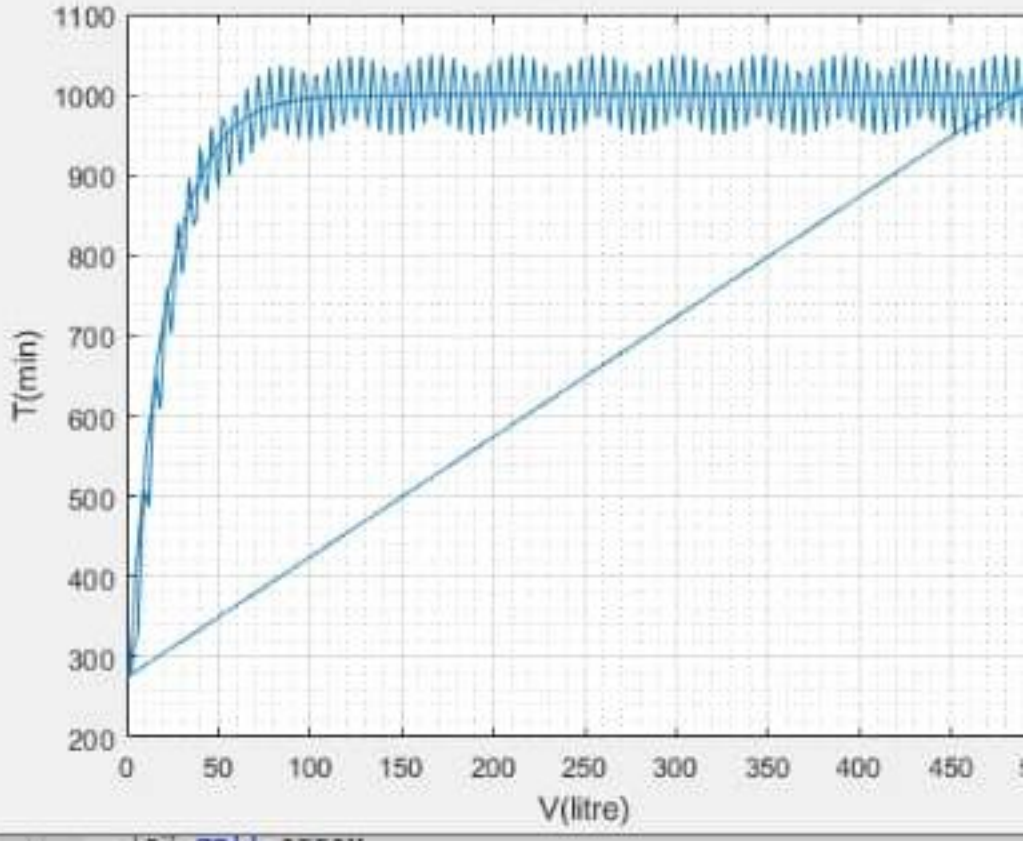

1*2 cell array

{'t(min)'} {'v(litre)'}

fx >>

MATLAB R2018a

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- Njk12.m
- nwimoassignment5a.m
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- onlinequizdata.xlsx
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- pri_ance.m
- roadtostuff.m

nwimoassignment5a.m (Script)

Workspace

Name	Value
Ans	1x1 sym
Ansn	1x901 sym
condition	1x1 sym
equation	1x1 symfun
m	1x1 symfun
t	1x901 double

Editor - C:\Users\HP PC\Documents\MATLAB\nwimoassignment5a.m

nwimoassignment5a.m

```
1 -    commandwindow
2 -    clc
3 -    clear
4 -    syms m(t) t equation Ans(t)
5 -    equation = diff(m,t) == 50*(1 + sin(t)) - 0.025*m;
6 -    condition = m(0)==150;
7 -    Ans = dsolve(equation,condition)
8 -    t = [0:0.5:450]
9 -    Ansn=subs(Ans,t)
10 -   plot(t,Ansn,'red')
11 -   ylabel('Amount of salt in the tank(lb)')
12 -   xlabel('Time(mins)')
13 -   grid on
14 -   grid minor
```

Command Window

```
   450.0000


Ansn =

[ 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

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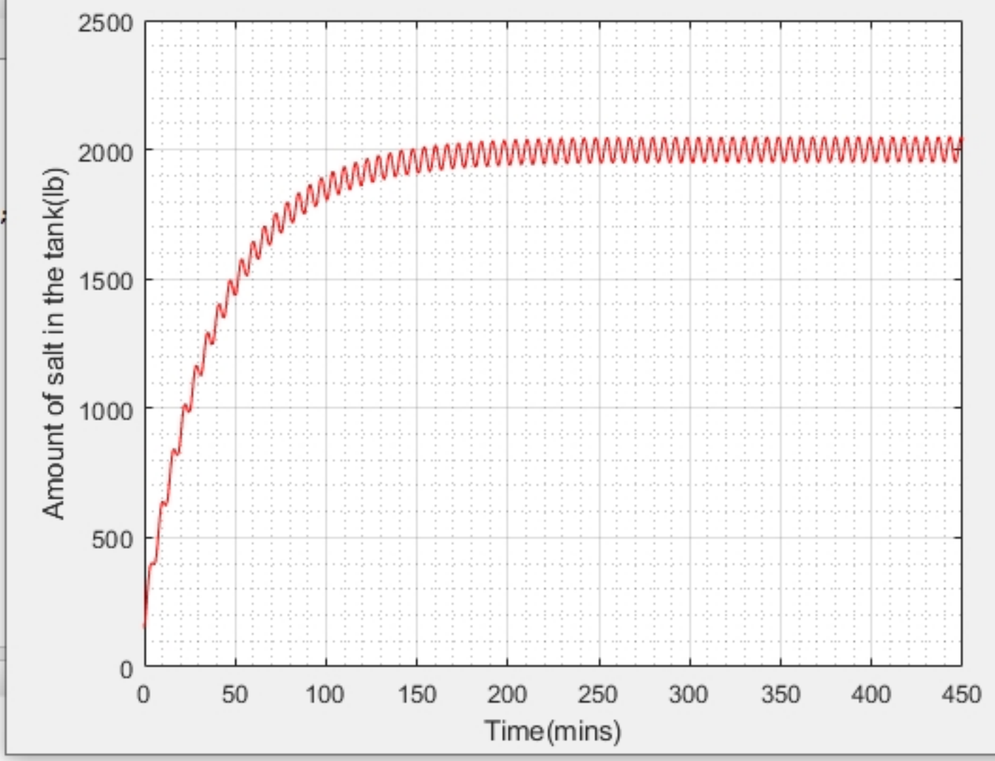

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