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18/ENG06/015
Mechanical Engineering
ENG 282 (Engineering Math II)

1.) Applying the balance law
Accumulation rate = Input rate of salt - outp
of salt

Salt within a system, denoting the amount of sa
present in the tank at any time (t) as y, its tim
rate of change is given as,

$$dy/dt = y_{in} - y_{out}$$

Since, 50gal of brine water the tank permi
and one gallon contains (1+sint) lb of salt;

$$At\ t = 1, C(1+\sin t) = (1+\sin(1)) = 1.026$$

Hence, the amount of salt entering into the tanks

$$80\ gal/min \times 1.026\ lb/gal$$

$$= 81\ lb/min$$

The tanks contains 1200gal of water with dissolved salt and 30gal of the solution exit the tanks per min $\frac{30gal}{1200gal}$

$$= -0.025\%$$

$$= 2.5\% \text{ of the content}$$

Therefore, 2.5% of the salt present in the soll will leave the tanks per minute;

$y_{out} = 2\text{-}8\%$ of y

a) dy/dt lb/min = 81 lb/min - 2-8% of y lb/min

b) $dy/dt = 81 - 0.028y$, $dy/dt = -0.028y + 81$

$$dy/dt = -0.028\left(\frac{-0.028y + 81}{-0.028y - 0.028}\right)$$

$$dy/dt = -0.028(y - 2040)$$

$$dy/(y-2040) = -0.028\,dt, \quad \int_{y-2040}^{dy} = \int -0.028\,dt$$

$$\int \frac{dy}{(y-2040)} = -0.028\int dt; \ \ln(y-2040) = -0.028t + c$$

$$y - 2040 = e^{-0.028t + c}; \ y - 2040 = e^{-0.028t}\, e^{c}$$

$$y - 2040 = e^{-0.028t}\, y_0; \ y - 2040 = y_0 e^{-0.028t}$$

$$y = y_0 e^{-0.028t} + 2040;$$ Initially, when $t = 1$,

$y = 150$ lb

$$150 = y_0 e^{-0.028t} + 2040; \ 150 - 2040 = y_0 x$$

$$y_0 = -1890$$

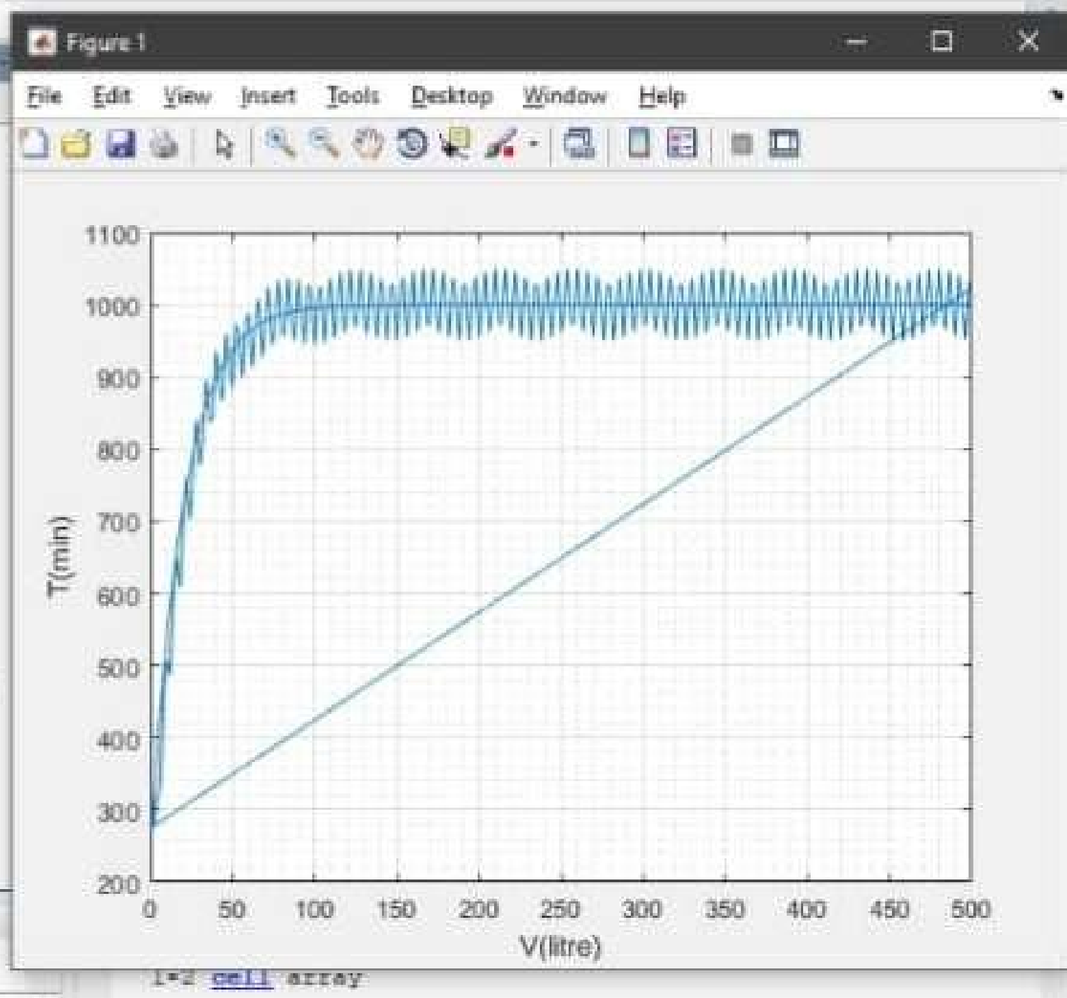
So,

$$y = -1890 e^{-0.028t} + 2040$$

$$y = 2040 - 1890 e^{-0.028t}$$

//

```
commandwindow
clear
clc
close all
ta=2:2:500
tb=1:2:500
y=(50/0.05)+((50/1.0025)*sin(tb))+(((50*0.05)/(1.0025))*cos(tb))-802.49*exp(-0.05*tb)
ym=1000-(800*exp(-0.05*ta))
yg=[y ym]
tg=[ta tb]
plot (tg,yg)
grid on
grid minor
xlabel ('V(litre)')
ylabel ('T(min)')
col_header={'t(min)','v(litre)'}
xlswrite('C:\Users\Seyitan\Documents\MATLAB\odevbeadata.xlsx',[tg(:),yg(:)],'veriler','A2')
xlswrite('C:\Users\Seyitan\Documents\MATLAB\odevbeadata.xlsx',col_header,'veriler','A1')
```




```
1×2 cell array

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

>>
```

```
1 -  commandwindow
2 -  clear
3 -  clc
4 -  close all
5 -  syms m t
6 -  ans=dsolve('Dm=0.025*m-50+50*sin(t)','m(0)=150')
7 -  t=0:0.5:450
8 -  tn=subs(ans,t)
9 -  plot(t,tn)
10 -  grid on
```

Command Window

```
tn =

  [ 150, 2000 - (2000*1601^(1/2)*cos(atan(1/40) + 1/2))/1601 - (2881850*exp(-1/80))/1601, 200
fx >>
```

Figure 1

File Edit View Insert Tools Desktop Window Help