Olasinde Olaitan Oghenerauma
18/ENG05/047 Mechatronics Engineering
ENG 282 Assignment

Accumulator rate = Input rate − Output rate

$$\frac{dm}{dt} = m_{in} - m_{out}$$

$$m_{in} = \frac{(1+\sin t)\,lb}{gallons} \times \frac{50\,gallons}{min} = 50(1+\sin t)\frac{lb}{min}$$

$$m_{out} = \frac{30\,gallons}{1200\,gallons} = 0.025$$ water runs out hence 0.025 salt runs out

$= 0.025m$.

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

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

Comparing to $\frac{dy}{dx} + Py = Q$

$dy = m$, $dt = dx$, $Py = 0.025m$, $P = 50(1+\sin t)$

Hence

$m \cdot If = \int Q \cdot If\, dt$ where $If = e^{\int f dx}$

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

$If = e^{0.025t}$

Integrating

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

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

$$m \cdot e^{0.025t} = 50 \left[\left[\frac{e^{0.025t}}{0.025} \right] + \int e^{0.025} \sin dt \right] \rightarrow (1)$$

$$\int e^{0.025t} \sin t\, dt = uv - \int v\, du$$

$u = e^{0.025t}$ $\quad dv = \sin t$

$u = 0.025 e^{0.025t}$

$v = -\cos t$

$$\int e^{0.025t} \sin t\, dt = e^{0.025t} - \cos t - \int -\cos t \cdot 0.025$$

$$\int \sin t\, dt = e^{0.025t} - \cos t - \int -\cos t \cdot 0.025 e^{0.025t}$$

$$\int \sin t\, dt = -e^{0.025t} \cos t + 0.025 \int e^{0.025t} \cos t \quad -(1)$$

Integrating a second time

$$\int e^{0.025t} \cdot \cos t = uv - \int v\, du$$

$u = e^{0.025t}$ $\quad dv = \cos t$

$u = 0.025 e^{0.025t}$ $\quad v = \sin t$

$$\cdot \cos t = e^{0.025t} \cdot \sin t - \int \sin t \cdot 0.025 e^{0.025t}$$

$$\cos t = e^{0.025t} \cdot \sin t - 0.025 \int e^{0.025} \cdot \sin t\, dt \rightarrow (2)$$

Substituting equ (2) into equ (1)

$$\int e^{0.025t} \sin t\, dt = -e^{0.025t} \cos t + 0.025 \left(e \right.$$

$$\left. 0.25 \int e^{0.025t} \sin t\, dt \right)$$

$$\int e^{0.025t} \cdot \sin t\, dt = -e^{0.025t} \cos t + 0.025 e^{0.025t} \sin t - 6.25$$

(4)

Grouping like terms (3) & (4)

$$1.000625 \int e^{0.025t} \cdot \sin t\, dt = -e^{0.025t} \cos t + 0$$

$$1.000625 \int e^{0.025t} \cdot \sin t\, dt = e^{0.025t} (-\cos t + 0.025$$

$$\int e^{0.025t} \cdot \sin dt = \frac{e^{0.025t}}{1.000625} [0.025 \sin t - \cos$$

Substitution equ (3) into equ

$$m \cdot e^{0.025t} = 50 \left[\frac{e^{0.025t}}{0.025} + \frac{e^{0.025t}}{1.000625} (0.025 \sin \right.$$

$$m \cdot e^{0.025t} = \frac{50 e^{0.025t}}{0.025} + \frac{50 e^{0.025t}}{1.000625} [0.025 \sin$$

$$m = 2000 + 49.689 [0.025 \sin t - \cos t$$

~~When $y = 150$~~

~~$t = 0$~~

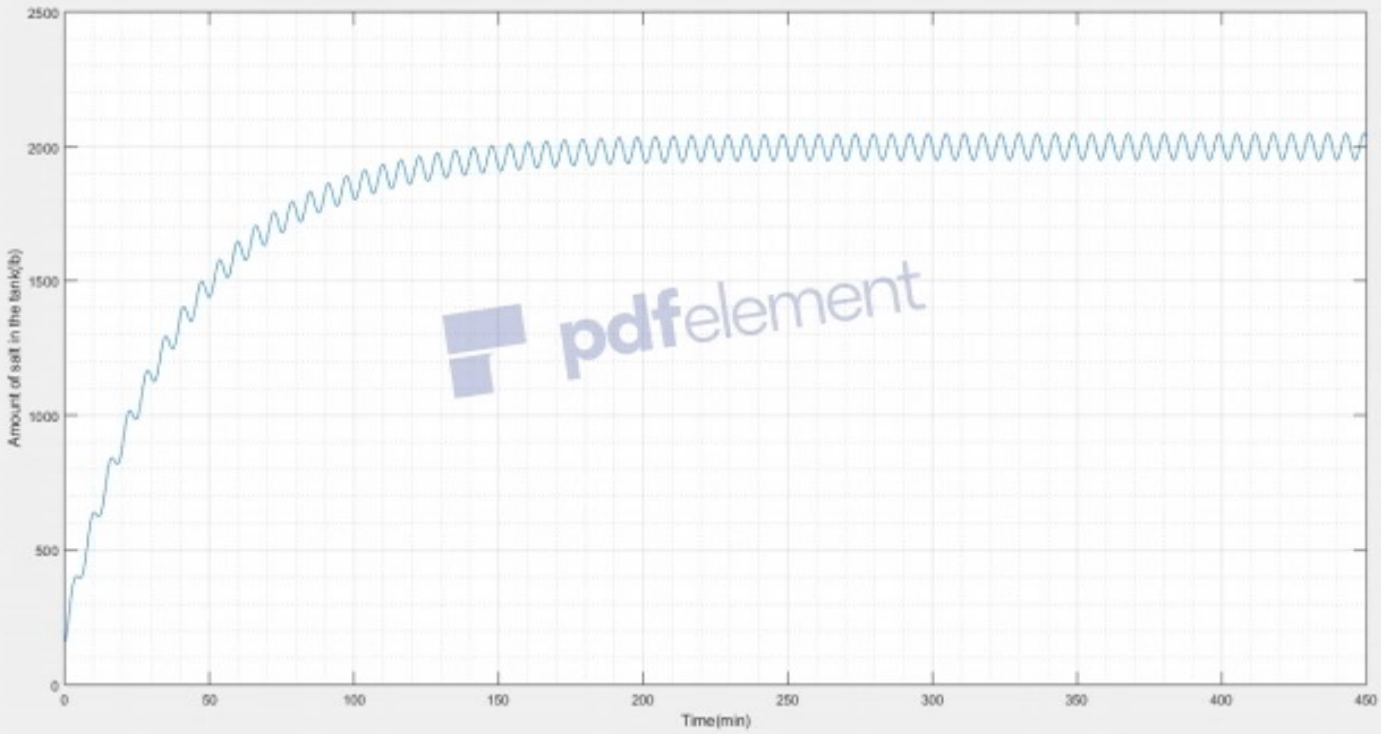
~~$150 = 2000 - 50$~~

Command Window

```
M =

2000 - (2000*1601^(1/2)*cos(t + atan(1/40)))/1601 - (2881850*exp(-t/40))/1601


M1 =

2000 - (2000*1601^(1/2)*cos(t + atan(1/40)))/1601 - (2881850*exp(-t/40))/1601

>>
```

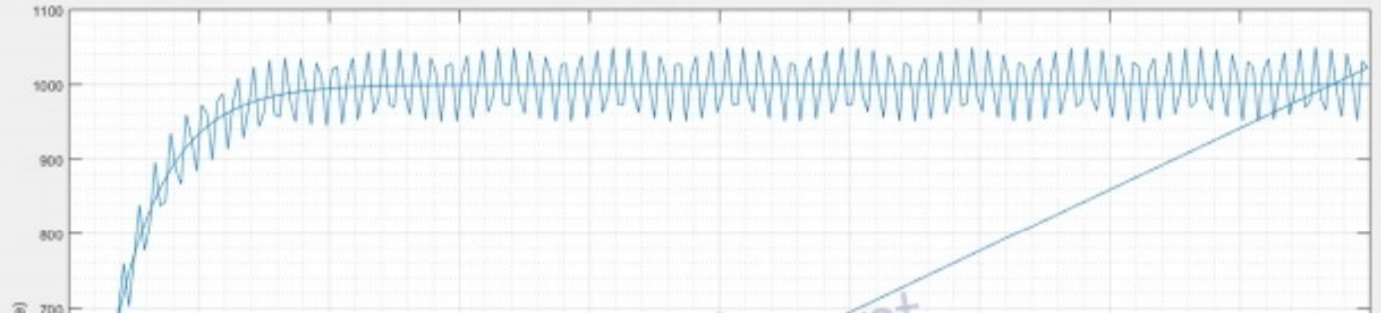
Figure 1

File Edit View Insert Tools Desktop Window Help



Editor - C:\Users\Boma Longjohn\Documents\MATLAB\ENG 282 Mine\lmsassignmayreal.m

lmsassignmentmay.m | lmsassignmay2.m | lmsassignmayreal.m | assignment5_2_1.m | onlinequiz.m

```
commandwindow
clear
clc
close all
t1=1:2:500;
t2=0:2:500;
y1=(50/0.05)+((50*sin(t1))/1.0025)+((50*0.05*cos(t1))/1.0025)-(802.49*exp(-0.05*t1));
y1=1000-(800*exp(-0.05*t2));
xcom=[t1,t2];
ycom=[y1,y1];
plot(xcom,ycom)
grid on
grid minor
xlabel('time(min)')
ylabel('Volume(litre)')
heading1=('t(mins)')
heading2=('V(litres)')
xlswrite('odevbesdata.xlsx',[xcom(:),ycom(:)],'veriler','A2')
xlswrite('odevbesdata.xlsx',heading1,'veriler','A1')
xlswrite('odevbesdata.xlsx',heading2,'veriler','B1')
```

Command Window