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18/ENG05/024

MECHATRONICS

ENGINEERING MATHEMATICS II ASSIGNMENT V

QUESTION ONE

Let;

Let $m(t)$ denote amount of salt at time t

$r_{in}(t)$ = rate of flow of brine into the tank at time t

$r_{out}(t)$ = rate of flow of brine out of the tank at time t

$C_{in}(t)$ = salt concentration in flowing mixture at time t

$C_{out}(t)$ = salt concentration in out flowing mixture at time t

$V(t)$ = volume of tank at that time

$r_{in}(t) = 50$ $\quad C_{in}(t) = (1+\sin t)$

$r_{out}(t) = 30$ $\quad C_{out}(t) = \frac{m(t)}{V(t)}$

Volume of Tank = 1200 gal

Salt dissolved = 150 lb

Net gal added per minute

$= r_{in}(t) - r_{out}(t)$

$= 50 - 30 = 20$ gal

$V(t) = 1200 + 20t \quad ---(a)$

$\Rightarrow$ Applying the balance law

Δm = input rate of salt into the system − output rate of salt from sys

$\Delta m = (C_{in} \cdot r_{in} - C_{out} \cdot r_{out})\,\Delta t$

$\Delta m = (50 + 50\sin t - C_{out} \times 30)\,\Delta t$

$$\frac{\Delta m}{\Delta t} = 50 + 50\sin t - 30\,C_{out}$$

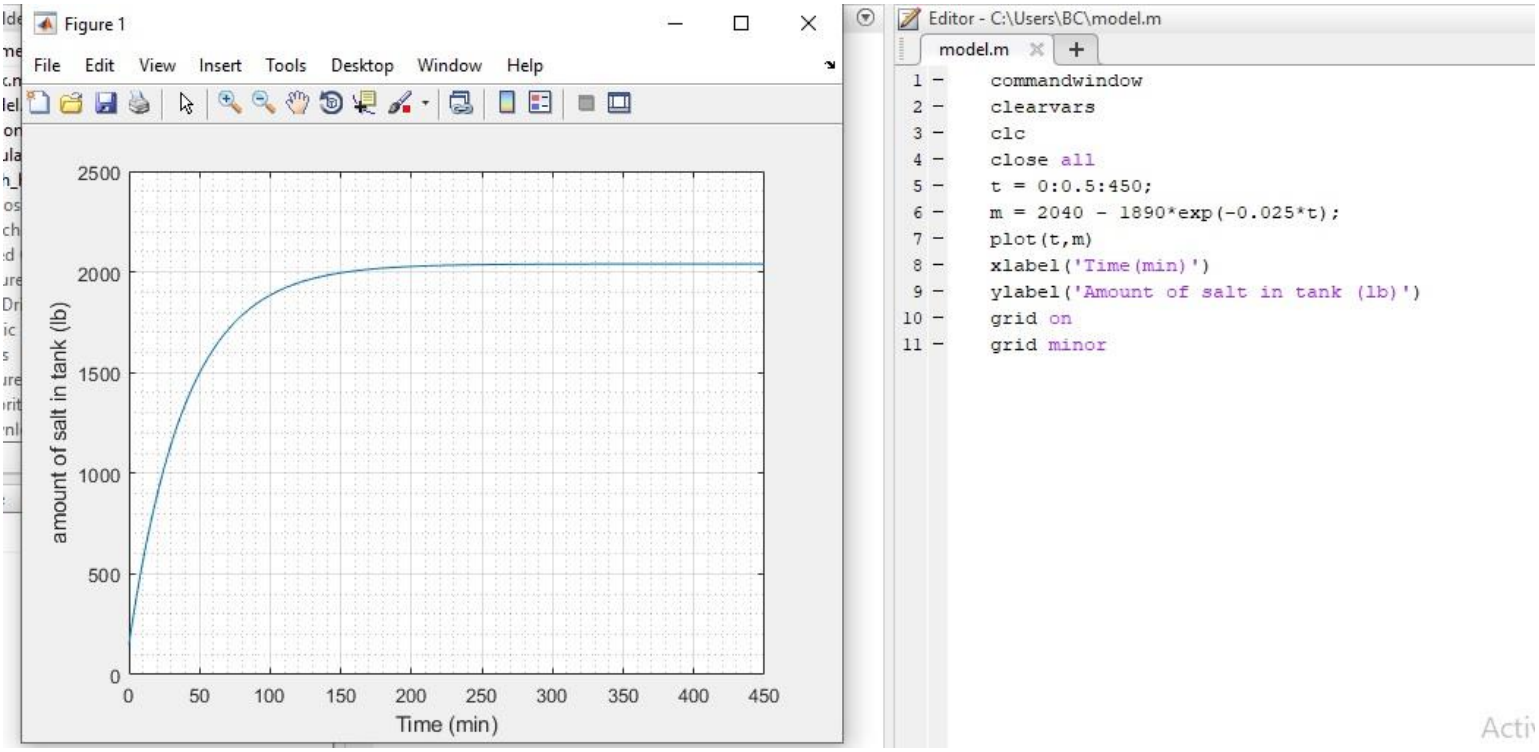
$$C_{out}(t) = \frac{m(t)}{V(t)} \quad \text{and} \quad V(t) = 1200 + 20t \text{ from eq (a)}$$

$$C_{out} = \frac{m}{1200+20t}$$

$$\frac{\Delta m}{\Delta t} = \frac{dm}{dt} = 50 + 50\sin t - \frac{30m}{1200+20}$$

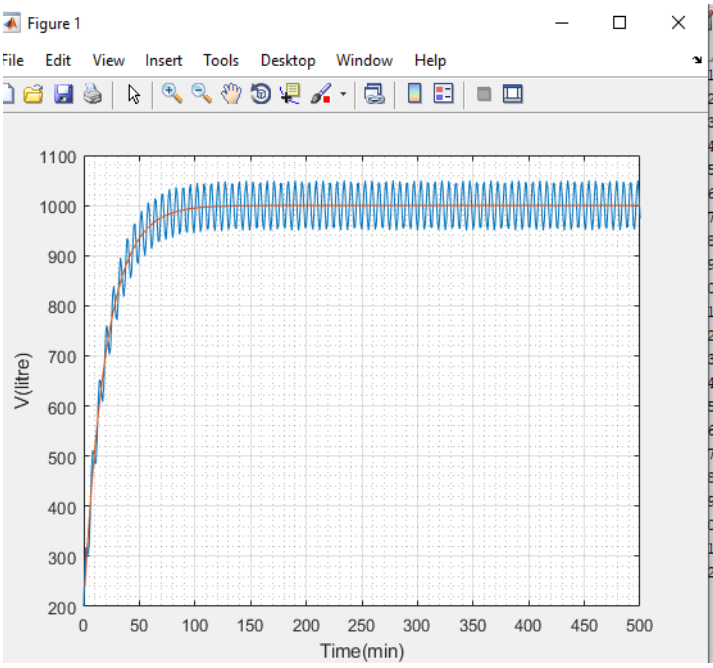
$$\frac{dm}{dt} = 50 + 50\sin t - 0.025$$

MATLAB SCREENSHOT



QUESTION TWO

MATLAB SCREENSHOT

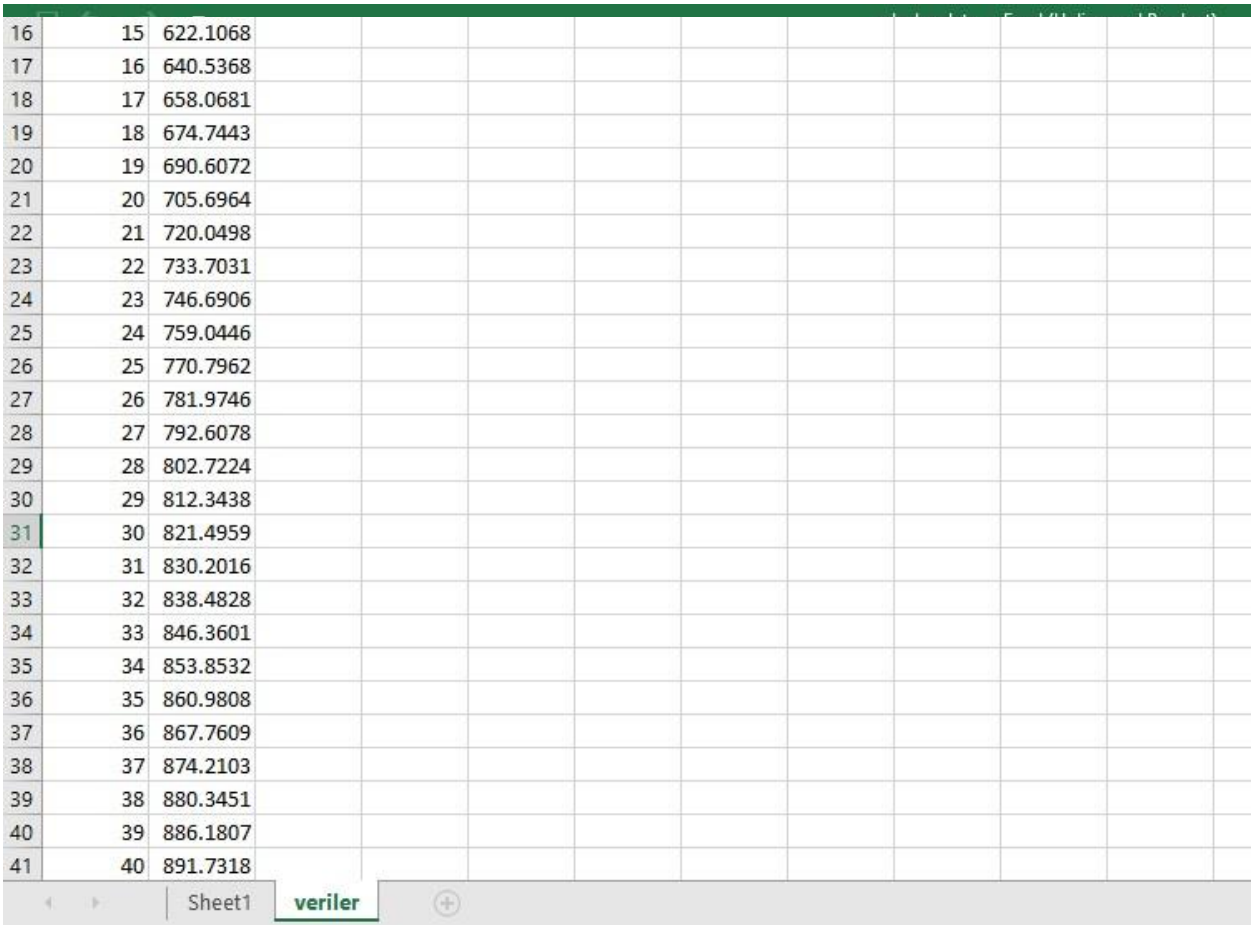


Editor - C:\Users\BC\model2.m

model.m | model2.m | Untitled3*

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

EXCEL SCREENSHOT



16	15	622.1068
17	16	640.5368
18	17	658.0681
19	18	674.7443
20	19	690.6072
21	20	705.6964
22	21	720.0498
23	22	733.7031
24	23	746.6906
25	24	759.0446
26	25	770.7962
27	26	781.9746
28	27	792.6078
29	28	802.7224
30	29	812.3438
31	30	821.4959
32	31	830.2016
33	32	838.4828
34	33	846.3601
35	34	853.8532
36	35	860.9808
37	36	867.7609
38	37	874.2103
39	38	880.3451
40	39	886.1807
41	40	891.7318

Sheet1 veriler