

I.F. = $e^{0.025t}$
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 181ENG051005
 MECHATRONICS
 ENG 282
 ASSIGNMENT

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

$\frac{dy}{dt} + 0.025y = 50(1 + \sin t)$

$\frac{dy}{dx} + Py = Q$ (Linear equation method)

$P = 0.025, Q = 50(1 + \sin t)$

$\int P \cdot dt = 0.025t$

I.F. = $e^{\int P dt}$

I.F. = $e^{0.025t}$

$y \cdot I.F. = \int Q \cdot I.F. \cdot dt$

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

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

$y e^{0.025t} = 50 \int e^{0.025t} + e^{0.025t} \sin t \cdot dt$

$y e^{0.025t} = 50 \int e^{0.025t} dt + \int e^{0.025t} \sin t \cdot dt$

0.025

Integration by Part

$\int e^{0.025t} \sin t \cdot dt$

$u = e^{0.025t} \quad du = 0.025 e^{0.025t}$

$du = 0.025 e^{0.025t}$

$v = -\cos t$

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

$\int e^{0.025t} \sin t = -e^{0.025t} \cos t + 0.025 \int e^{0.025t} \cos t dt + C$

$\int u \cdot dv = uv - \int v \cdot du$

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

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

$= -e^{0.025t} \cos t + 0.025 \left[e^{0.025t} \sin t - \int \sin t \cdot 0.025 e^{0.025t} dt \right]$

$= -e^{0.025t} \cos t + 0.025 \left[e^{0.025t} \sin t - 0.025 \int \sin t e^{0.025t} dt \right]$

Let $a = \int e^{0.025t} \sin t$

$0.025 a = \dots$

$$Q = -e^{0.025t} \cos t + 0.025 [e^{0.025t} \sin t - 0.025Q]$$

$$Q = -e^{0.025t} \cos t + 0.025 e^{0.025t} - 6.25Q$$

$$Q + 6.25Q = -e^{0.025t} \cos t + 0.025 e^{0.025t}$$

$$Q + 0.000625Q = -e^{0.025t} \cos t + 0.025 e^{0.025t}$$

$$1.000625Q = -e^{0.025t} \cos t + 0.025 e^{0.025t}$$

$$1.000625Q = -e^{0.025t} (\cos t - 0.025)$$

$$Q = \frac{-e^{0.025t} (\cos t - 0.025)}{1.000625}$$

$$\int e^{0.025t} \sin t = \frac{1.000625}{1.000625} (\cos t - 0.025) + C$$

$$y e^{0.025t} = 50 \left[\frac{e^{0.025t}}{0.025} - \frac{e^{0.025t}}{1.000625} (\cos t - 0.025) + C \right]$$

$$y e^{0.025t} = 2000 e^{0.025t} - 50 \cdot \frac{e^{0.025t}}{1.000625} (\cos t - 0.025) + 50C$$

Divide through by $e^{0.025t}$

$$\therefore y = 2000 - \frac{50}{1.000625} (\cos t - 0.025) + \frac{50C}{e^{0.025t}}$$

$$y = 2000 - \frac{50}{1.000625} (\cos t - 0.025 \sin t) + \frac{50C}{e^{0.025t}}$$

when $y = 150$
 $t = 0$

Substitute the values

$$150 = 2000 - \frac{50}{1.000625} (1 - 0) + \frac{50C}{1}$$

$$150 = 2000 - 49.97(1) + 50C$$

$$150 = 1950.032 + 50C$$

$$-1800.032 = 50C$$

$$C = -36.00064$$

$$\frac{dy}{dt} = y \ln - y \cos t$$

$$\frac{dy}{dt} = 50(1 + \sin t) - 25\% \cos t$$

$$\frac{dy}{dt} = 50(1 + \sin t) - 0.625y$$

$$\frac{dy}{dt} + 0.625y = 50(1 + \sin t)$$

$$0.625y dy = 50(1 + \sin t) dt$$

$$0.025y^2 = [50 + 50 \sin t] dt$$

$$0.025y^2 + 50C = 50t - 50 \cos t + C$$

$$0.0125y^2 = 50t - 50 \cos t + C$$

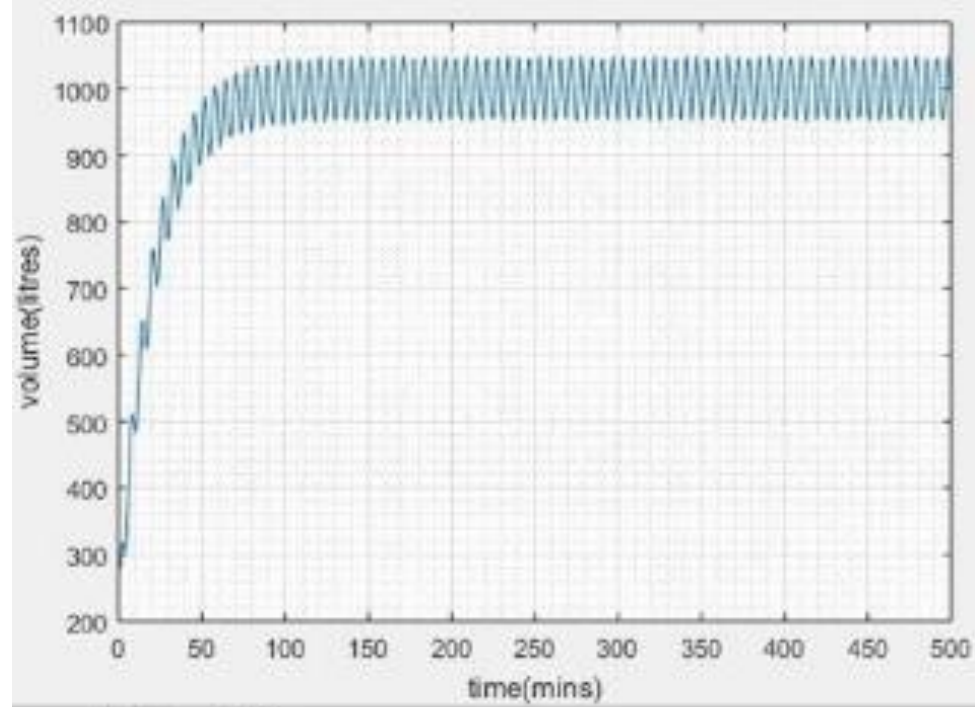
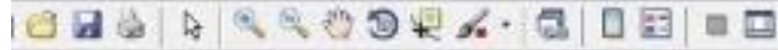
divide through by 0.0125

$$y^2 = 4000t - 4000 \cos t + 80C$$

$$y^2 = 4000(t - \cos t) + 80C$$

$$y = \sqrt{4000(t - \cos t) + 80C}$$

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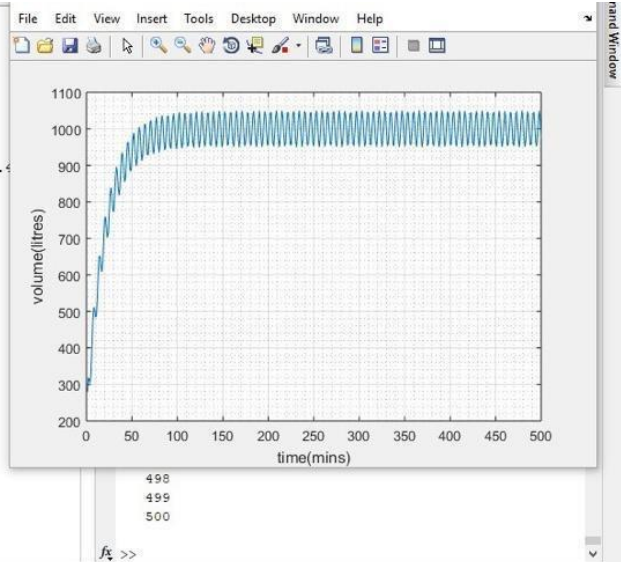
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1 - commandwindow
2 - clear
3 - clc
4 - close all
5 - syms t
6 - values=[]
7 - t=1:1:500
8 - mean=1000-((exp(-0.05*t))*800)
9 - y=1000+(50/1.0025)*sin(t)+(2.5/1.0025)*cos(t)-((exp(-0.05*t))*802.4
10
11 - if rem(t,2) ==0
12 -     values=[values,mean]
13 - else
14 -     values=[values,y]
15 - end
16 - excelvalues=transpose(values)
17 - mins=transpose(t)
18 - plot(t,values)
19 - grid on
20 - grid minor
21 - xlabel('time(mins)')
22 - ylabel('volume(litres)')
23 - xlswrite('odevbesdata.xlsx',{'t(min)'],'veriler','A1')
24 - xlswrite('odevbesdata.xlsx',mins,'veriler','A2')
25 - xlswrite('odevbesdata.xlsx',{'V(Litre)'},'veriler','B1')
26 - xlswrite('odevbesdata.xlsx',excelvalues,'veriler','B2')
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fx >>