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 IS/CNS05/061  
 MECHATRONICS

$$\frac{30 \text{ gal}}{1200 \text{ gal/min}} = \frac{2.5}{100} \times 100\% = 2.5\% \text{ per m}$$

$$2.5\% = \frac{2.5}{100} = 0.025 \text{ of mlb/min}$$

$$\text{Output rate} = \frac{0.025 \text{ lb}}{\text{min}}$$

~~0.02~~

$$\left(\frac{dm}{dt}\right) = \frac{50(1+\sin t) \text{ lb}}{\text{min}} - \frac{0.025m \text{ lb}}{\text{min}}$$

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

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

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

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

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

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

∴ By Integrating

$$\text{IF } e^{\int P dx} = e^{\int 0.025 dx} = e^{0.025t}$$

$$y \cdot \text{IF} = \int Q \cdot \text{IF} dx$$

$$m \cdot \text{IF} = \int Q \cdot \text{IF} dt$$

$$m \cdot e^{0.025t} = \int Q \cdot e^{0.025t} dt$$

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

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

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

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

$$\frac{e^{0.025t}}{0.025} (1+\sin t) = \frac{1}{0.025} \int e^{0.025t} \cos t$$

$$\text{Integrate } e^{0.025t} \cos t$$



$$\int e^{0.025t} \cos t = \frac{1}{1601} \times \frac{e^{0.025t}}{0.025} \left( \cos t + \frac{\sin t}{0.25} \right)$$

$$\int e^{0.025t} \cos t = \frac{e^{0.025t}}{40 \cdot 0.025} \left( \cos t + \frac{\sin t}{0.025} \right)$$

$$\therefore \int (1 + \sin t) e^{0.025t}$$

$$\frac{e^{0.025t}}{0.025} (1 + \sin t) - \frac{1}{0.025} \left( \frac{e^{0.025t}}{40 \cdot 0.025} \left( \cos t + \frac{\sin t}{0.025} \right) \right)$$

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

$$\frac{50}{0.025} \left( e^{0.025t} (1 + \sin t) - \frac{e^{0.025t}}{40 \cdot 0.025} \left( \cos t + \frac{\sin t}{0.25} \right) \right)$$

$$2000 e^{0.025t} \left( 1 + \sin t \right) - \frac{1}{40 \cdot 0.025} \left( \cos t + \frac{\sin t}{0.25} \right)$$

$$N/B \quad \cos t + \frac{\sin t}{0.025} = \frac{0.025 \cos t + \sin t}{0.025}$$

$$\Rightarrow 2000 e^{0.025t} \left( (1 + \sin t) - \frac{1}{40 \cdot 0.025} \left( \frac{0.025 \cos t + \sin t}{0.025} \right) \right)$$

$$2000 e^{0.025t} (1 + \sin t) - \frac{1}{1.000625} (0.025 \cos t + \sin t)$$

$$M = e^{0.025t} = 2000 e^{0.025t} (1 + \sin t) - \frac{1}{1.000625} (0.025 \cos t + \sin t)$$

$$M = 2000 \left( (1 + \sin t) - \frac{1}{1.000625} (0.025 \cos t + \sin t) \right) + \frac{C}{e^{0.025t}}$$

$$150 = 2000 \left( (1 + \sin 0) - \frac{1}{1.000625} (0.025 \cos(0) + \sin(0)) \right) + \frac{C}{e^{0.025 \cdot 0}}$$

$$150 = 2000 (1 + 0) - \frac{1}{1.000625} (0.025(1) + 0) + \frac{C}{1}$$

$$150 = 2000 \left( 1 - \frac{1}{1.000625} (0.025) \right) + \frac{C}{1}$$

$$150 = 2000 \left( 1 - \frac{0.025}{1.000625} \right) + C$$

$$C = 150 - 2000 \left( 1 - \frac{0.025}{1.000625} \right)$$

$$C = -1800.0312304$$

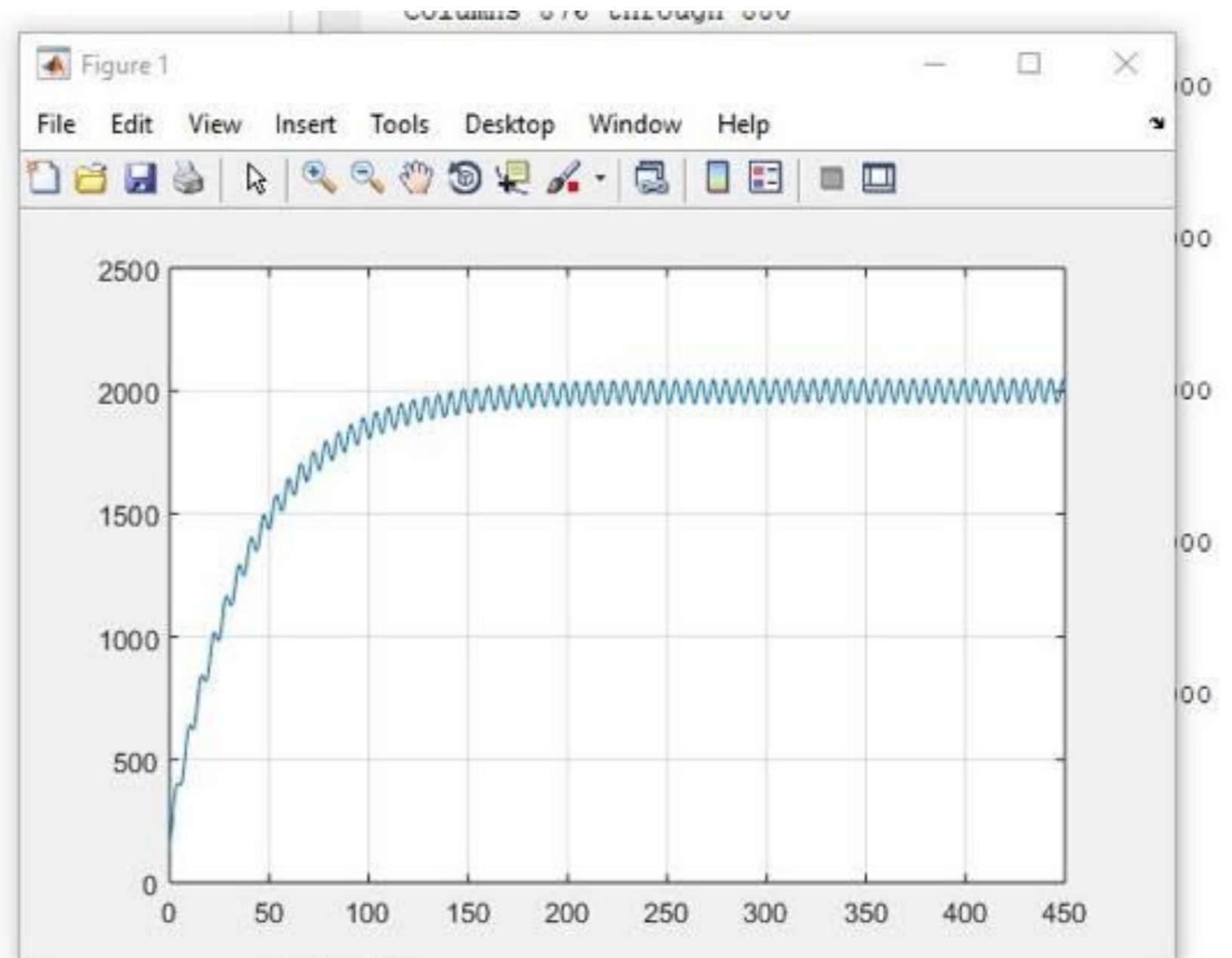
$$M = \left( (1 + \sin t) - \frac{(0.025 \cos t + \sin t)}{1.000625} \right) 2000 - \frac{1800.03}{e^{0.025t}}$$



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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

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[ 150, 2000 - (2000*1601^(1/2))*cos(atan(1/40) + 1/2)]/1
fx >>
<

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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+(80/1.0025)*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')
27

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