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18/ENG02/072

Engineering maths

Online assignment V

1 $dm = m_{in} - m_{out}$

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

$$dy/dt = 50(1 + \sin t) - 2.5\% \text{ of } y$$

$$y_{out} = \frac{30}{1200} = 0.025\%$$

$$2.5\% \text{ of } y = \frac{1}{40}y$$

$$dy/dt = 50(1 + \sin t) - 0.025y$$

Separating the variables;

$$dy/dt + 0.025y = 50(1 + \sin t)$$

$$\int (1 + 0.025y) dy = \int 50(1 + \sin t) dt$$

b $dy/dt = 50(1 + \sin t) - 0.025y$

$$dy/dt + 0.025y = 50(1 + \sin t)$$

With linear equation,

$$dy/dx + Py = Q$$

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

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

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

$$I \cdot F = e^{0.025t}$$

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

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

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

Part integration (integration by part method)

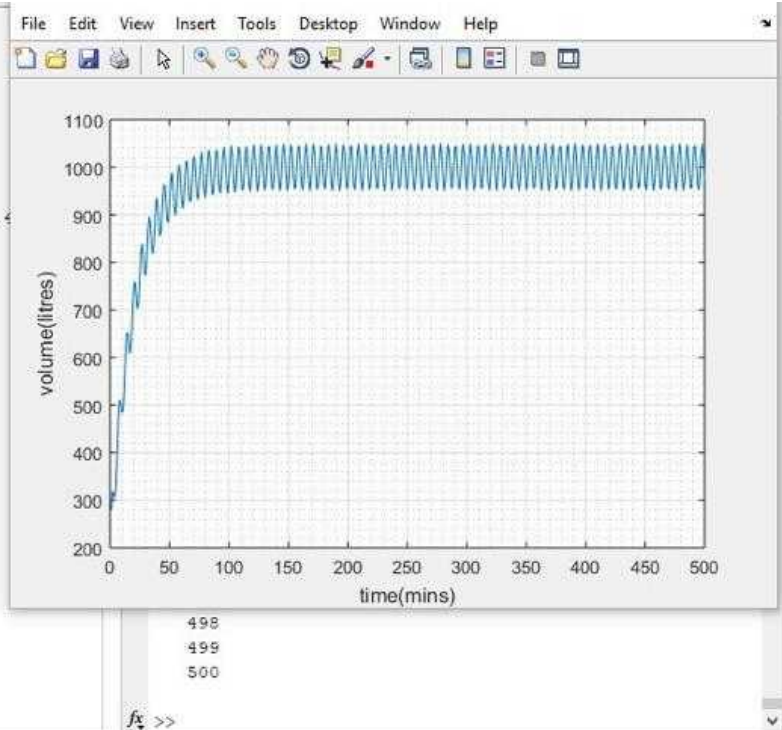
$$\int e^{0.025t} \sin t dt$$

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


```

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')
27

```



$$u = e^{0.025t} \quad dv = \sin t, \quad du = 0.025e^{0.025t}, \quad v = \cos t$$

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

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

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

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

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

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

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

$$Q = \int e^{0.025t} \sin t$$

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

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

$$Q + 0.00625Q = -e^{0.025t} \cos t + 0.025e^{0.025t} \sin t$$

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

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

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

$$y = 150, \quad t = 0$$

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

$$\frac{50C}{50} = \frac{-1800 \cdot 0.32}{50}$$

$$C = -36.00064$$

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

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

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

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