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ELECTRICAL ENGINEERING

18/ENG04/048

$Q = -e^{0.025}$ cost ×

0.05 sint

$5x \quad \cancel{\frac{5x^2}{2}} \quad 5x \quad 10x$

$\cancel{4x = 2y + 8z}$

$\cancel{x = \frac{1}{2}y + \frac{1}{4}}$

$\cancel{1x \frac{1}{2}y} + 2z$

<u>Engineering math</u>

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

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

using the linear equation method,

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

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

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

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

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

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

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

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

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

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

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

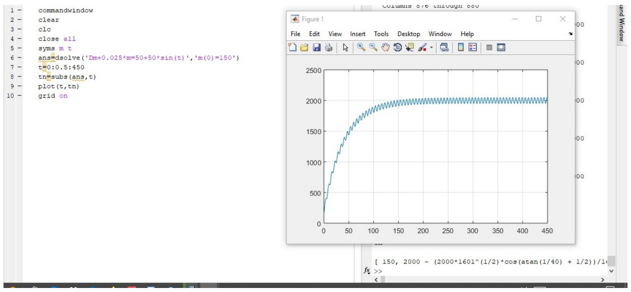
using integration by part, $\int u\,dv = uv - \int v\,du$

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

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

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

$\therefore \int e^{0.025t}\sin t = e^{0.025t} \cdot -\cos t - \int -\cos t \cdot 0.025e^{0.0…}$



commandwindow
clear
clc
close all
syms m t
ans=dsolve('Dm+0.025*m=50+50*sin(t)','m(0)=150')
t=0:0.5:450
tn=subs(ans,t)
plot(t,tn)
grid on
Figure 1
File Edit View Insert Tools Desktop Window Help
2500
2000
1500
1000
500
0
0 50 100 150 200 250 300 350 400 450
[ 150, 2000 - (2000*1601^(1/2)*cos(atan(1/40) + 1/2))/1
>>

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

when $y = 150$

$t = 0$.

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

$$150 = 2000 - 49.968(1) + 50c.$$

$$150 = 1950.032 + 50c.$$

$$-1800.032 = 50c.$$

$$c = -36.00064.$$

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

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

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

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

$$\cancel{ye^{0.025t} = 2000e^{0.025t} + 50 \times \frac{e^{0.025t}}{1.000625}(\cos t - 0.025) + C}$$

~~divide through by~~ $\cancel{e^{0.025t}}$

$$\cancel{y = 2000}$$

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

divide through by $e^{0.025t}$

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

$= -e^{0.025}$

$\cos t + 0.025 e^{0}$

$\frac{50c}{0.025t}$

$e^{..} = e^{..}$ $\quad 50c = 5$

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

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

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

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

using integration by part,

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

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

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

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

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

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

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

$Q = -e^{0.025t} \cos t + 0.025 e^{0.025t} - 6.25^{-4} Q.$

$Q + 6.25^{-4} Q = -e^{0.025t} \cos t + 0.025 e^{0.025t}.$

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

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

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

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

$\therefore$ From

$$\frac{dy}{dt} = y_{in} - y_{out}$$

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

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

$\therefore$ By seperating the variables,

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

multiply both sides by $dt$.

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