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18/ENG02/031
COMPUTER ENGINEERING
ENG 282 ASSIGNMENT

1. Applying the balance law and using the equation below

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

For Y_{in} 50 gal. enters the tank per minute with each having (1+sint) lb of salt in it

$$\therefore Y_{in} = 50\frac{gal}{min} \times (1+\sin t)\frac{lb}{gal} = 50(1+\sin t)\frac{lb}{min}$$

Noting the fact that the rate at which the mixture leaves IS NOT the same as the rate enters meaning that

If 30 gallons leave, we need to account for the remaining 20 gallons

$$\therefore Y_{out} = \frac{30}{1200+20t} \cdot y$$

$$\therefore \frac{dy}{dt}\frac{lb}{min} = 50(1+\sin t) - \frac{30y}{1200+20t}$$

To solve this, we put in the form of

$$\frac{dy}{dx} + P_{y(x)} = f(x)$$

$$dy/dx + \left(\frac{30}{1200+20t}\right)y = 50(1+\sin t)$$

Integrating factor $\mu(t) = e^{\int P dx}$

$$= e^{\int \frac{30}{1200+20t} dt}$$

let $u = 1200+20t$

$du = 20 dt$

$dt = \frac{du}{20}$

$$\therefore e^{\int \frac{30}{1200+20t} dt} = e^{\frac{30}{20}\int \frac{1}{u} du} = e^{\frac{3}{2}\int \frac{1}{u} du}$$

$$= e^{\frac{3}{2}\ln u}$$

$$= e^{3/2 \ln(1200+20t)}$$

$$= (1200+20t)^{3/2}$$

Multiplying through by $\mu(t)$

$$(20t+1200)^{3/2}\frac{dy}{dt} + (20t+1200)^{3/2}\left(\frac{30}{1200+20t}\right)y$$

$$= 50(1+\sin t)(20t+1200)$$

$$= \frac{d}{dt}\left[(20t+1200)^{3/2}y\right] = 50(1+\sin t)\cdot(20t+1200)^{3/2}$$

Integrating both sides,

$$\int \frac{d}{dt}\left((20t+1200)^{3/2}\cdot y\right) dt = \int 50(1+\sin t)\cdot(20t+1200)^{3/2} dt$$

$$(20t+1200)^{3/2} \cdot y = \int 50(1+\sin t) \cdot (20t+1200)^{3/2}\,dt$$

Using ~~Parts~~ integration by part on the RHS

$$\int U\,dv = UV - \int V\,du$$

$\cancel{= 50(1+\sin t)}$

$U = 50(1+\sin t) \qquad du = 50\cos t$

$dv = (20t+1200)^{3/2} \qquad V = \dfrac{(20x+1200)^{5/2}}{50}$

~~UV~~

$$\therefore \int U\,dv = \frac{\cancel{50}(1+\sin t)\cdot(20\cancel{t}+1200)^{5/2}}{\cancel{50}} - \int \frac{(20t+1200)^{5/2}\cdot \cancel{50}\cos t}{\cancel{50}}$$

$$= (1+\sin t)\cdot(20x+1200)^{5/2} - \int (20t+1200)^{5/2} \cdot \cos t$$

~~=~~ integrating $V\,du$ again with integration by parts

$u = (20t+1200)^{5/2}$

$dv = \cos t$

$du = 50(20t+1200)^{3/2}$

$v = \sin t$

$$U\,dv = (20t+1200)^{5/2}\cdot \sin t - \int \sin t \cdot (1000t+6000)^{3/2}$$

$$= (20t+1200)^{5/2}\cdot \sin t - \int \sin t \sqrt{(1000t+6000)^{\cancel{3}}}$$

$$= (20t+1200)^{5/2}\cdot \sin t - \int \sin t \cdot (1000t+6000)$$

$$= (20t+1200)^{3/2}\cdot \sin t - \int 1000t\sin t^{\cancel{2}} + 6000\sin t$$

$$= (20t+1200)^{5/2}\cdot \sin t + \cancel{1000t\sin t + 600}$$

$$1000(\sin \cancel{t} - \cos \cancel{t}) + 6000x$$

$\therefore \int u\,dv = (1+\sin t)(20t+1200)^{5/2} - \Big[(20t+1200)^{5/2}\cdot \sin t + 1000(\sin t - \cos t) - 6000t\Big] + C$

$\therefore (20t+1200)^{3/2}\cdot y = (1+\sin t)(20t+1200)^{5/2} - \Big[(20t+1200)^{5/2}\cdot \sin t + 1000(\sin t - \cos t) - 6000t\Big] + C$

When for $y = 150$ when $t = 0$

$\therefore 41569.2\,y = 0 - [0 - 1000 - 0] + C$

$41569.2 \times 150 = 1000 + C$

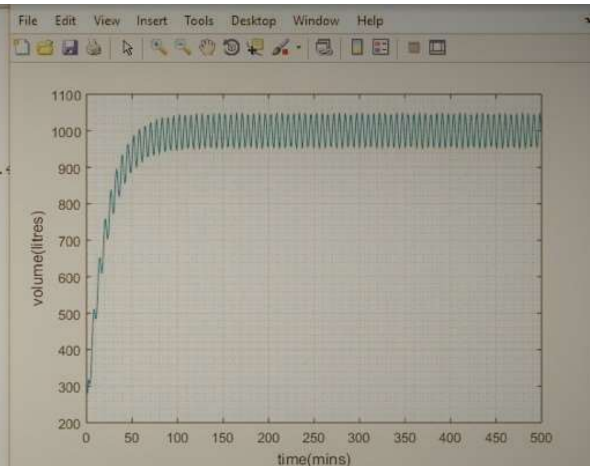
$C = 6.238 \times 10^6$

$$\therefore Y = \frac{(1+\sin t)(20t+1200)^{5/2}}{(20t+1200)^{3/2}} - \frac{\Big[(20t+1200)^{5/2}\cdot \sin t + 1000(\sin t - \cos t) - 6000t\Big]}{(20t+1200)^{3/2}} + \frac{C}{(20t+1200)^{3/2}}$$

I am really not sure about this sir that is why I won't have the matlab solution for this question I would like to request assistance on the after

```
commandwindow
clear
clc
close all
syms t
values=[]
t=1:1:500
mean=1000-((exp(-0.05*t))*800)
y=1000+(50/1.0025)*sin(t)+(2.5/1.0025)*cos(t)-((exp(-0.05*t))*802.

if rem(t,2) ==0
    values=[values,mean]
else
    values=[values,y]
end
excelvalues=transpose(values)
mins=transpose(t)
plot(t,values)
grid on
grid minor
xlabel ('time(mins)')
ylabel('volume(litres)')
xlswrite('odevbesdata.xlsx',{'t(min)'},'veriler','A1')
xlswrite('odevbesdata.xlsx',mins,'veriler','A2')
xlswrite('odevbesdata.xlsx',{'V(Litre)'},'veriler','B1')
xlswrite('odevbesdata.xlsx',excelvalues,'veriler','B2')
```

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498
499
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