NAME:- AGWU UCHE.A
MATRIC NO:- 18/ENG05/008
DEPARTMENT:- MECHATRONICS

ASSINGMENT V

1. $\left\{\begin{matrix}\text{Accumulation}\\ \text{Rate}\end{matrix}\right\} = \left\{\begin{matrix}\text{Input}\\ \text{Rate}\end{matrix}\right\} - \left\{\begin{matrix}\text{Out put}\\ \text{Rate}\end{matrix}\right\}$

$\frac{dm}{dt} = M_{in} - M_{out}$

Since 50 gal of brine enters per min & 1 gal contains (1+sint) lb of salt.

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

$M_{in} = 50(1+\sin t)\frac{gal}{min}$

~~Min =~~

The tank ~~tank~~ contains 1200 gal of water and salt And 30 gal leaves per min

$M_{out} = \frac{30}{1200} = 0.025 = 2.5\%$

∴ 25% of the salt solution will also leave per min

$M_{out} = 2.5\%$ of $m\frac{gal}{min}$

2.5% of m
= 0.025 m

Therefore ~~Min = M~~ $\frac{dm}{dt} = M_{in} - M_{out}$

$\frac{dm}{dt}\frac{gal}{min} = \{50(1+\sin t)\frac{gal}{min} - 2.5\% \text{ of } m\frac{gal}{min}\} \left(\times \frac{min}{gal}\right)$

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

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

$\cancel{\frac{dm}{dt} = (50(\sin t) + 1)}$ $\frac{dm}{dt} = (50(\sin t + 1) - \frac{m}{40})$

$= \int (50(\sin t + 1) - \frac{m}{40})\, dt$

Apply linearity

$= 50\int \sin(t)\, dx + (50 - m/40) \int 1\, dt$

$= 50 \int \sin t \, dt + (50 - m/40) \int 1\, dt$

$\cancel{= (50 - m/40)\, x - 50}$

$= (50 - m/40)\, t - 50\cos t$

$= 50(t - \cos t) - \frac{mt}{40} + C$

$\cancel{= -2000\cos(x)}$

$= \frac{-2000\cos t + (m - 2000)t}{40} + C$

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commandwindow
clear
close all

syms m(t)

min = 50*(1 + sin(t))
mout = 0.025*m
m = dsolve(diff(m, t) == min - mout, m(0) == 150)

time = 0:0.5:450
values = subs(m, t)

plot(t, values)
grid on
grid minor
xlabel('time (minutes)')
ylabel('Amount of Salt')
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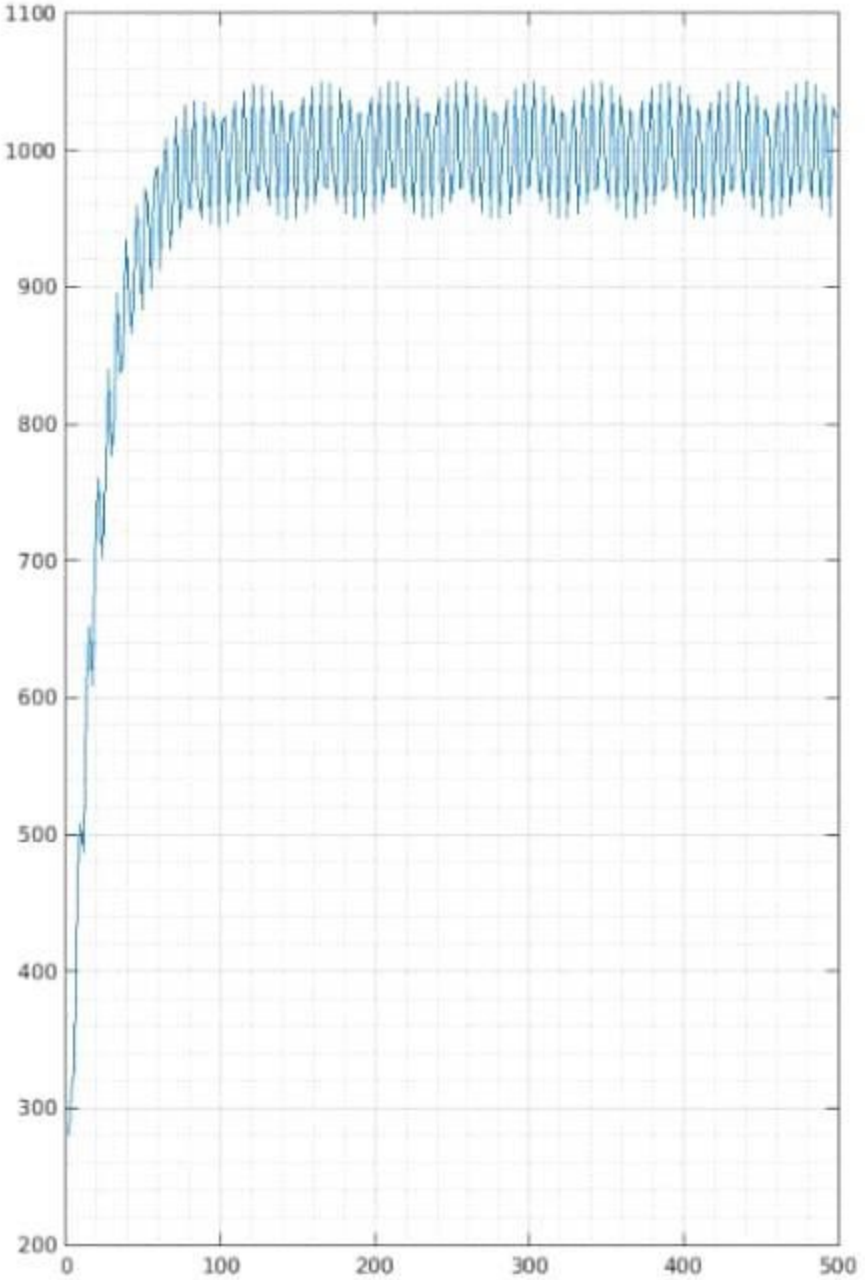
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