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18/ENG05/063 Mechatronics (1)

r = Rate of inflow, rout = rate of out flow, ~~Cm = concentration of salt~~

$r_{in} = 50\ gal/min$, $r_{out} = 30\ gal/min$, $c_{in} = (1+\sin t)\ lb$

$$\Delta m = \{50 \times (1+\sin t) - (30 \times C_{out})\}$$

$$\Delta m = \{50 + 50\sin t - 30\, C_{out}\}\Delta t$$

Divide through by Δt

$$\frac{\Delta m}{\Delta t} = 50 + 50\sin t - 30\, C_{out}$$

taking the limit

$$\frac{dm}{dt} = 50 + 50\sin t - 30\, C_{out}$$

$$C_{out}(t) = \frac{m(t)}{V(t)}$$

where C_{out} = Concentration of salt in out flow mixture

$V(t)$ = Volume of fluid in the tank at time t.

$m(t)$ = amount of salt in the tank at time t

$$C_{out} = \frac{m}{1200 + 20t}$$

$$\frac{dm}{dt} = 50 + 50\sin t - \left(30 \times \frac{m}{1200 + 20t}\right)$$

$$\left\{\frac{dm}{dt} = 50 + 50\sin t - \frac{30m}{1200 + 20t}\right\}$$ differential eqn

MATLAB Online R2020a

matlab.mathworks.com

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CURRENT FOLDER

WORKSPACE

assignment06.m *

```
1 - syms m t;
2 - dsolve('Dm = (50+(50(sin(t))))-((30*m)/(1200+(20*t)))')
```

COMMAND WINDOW

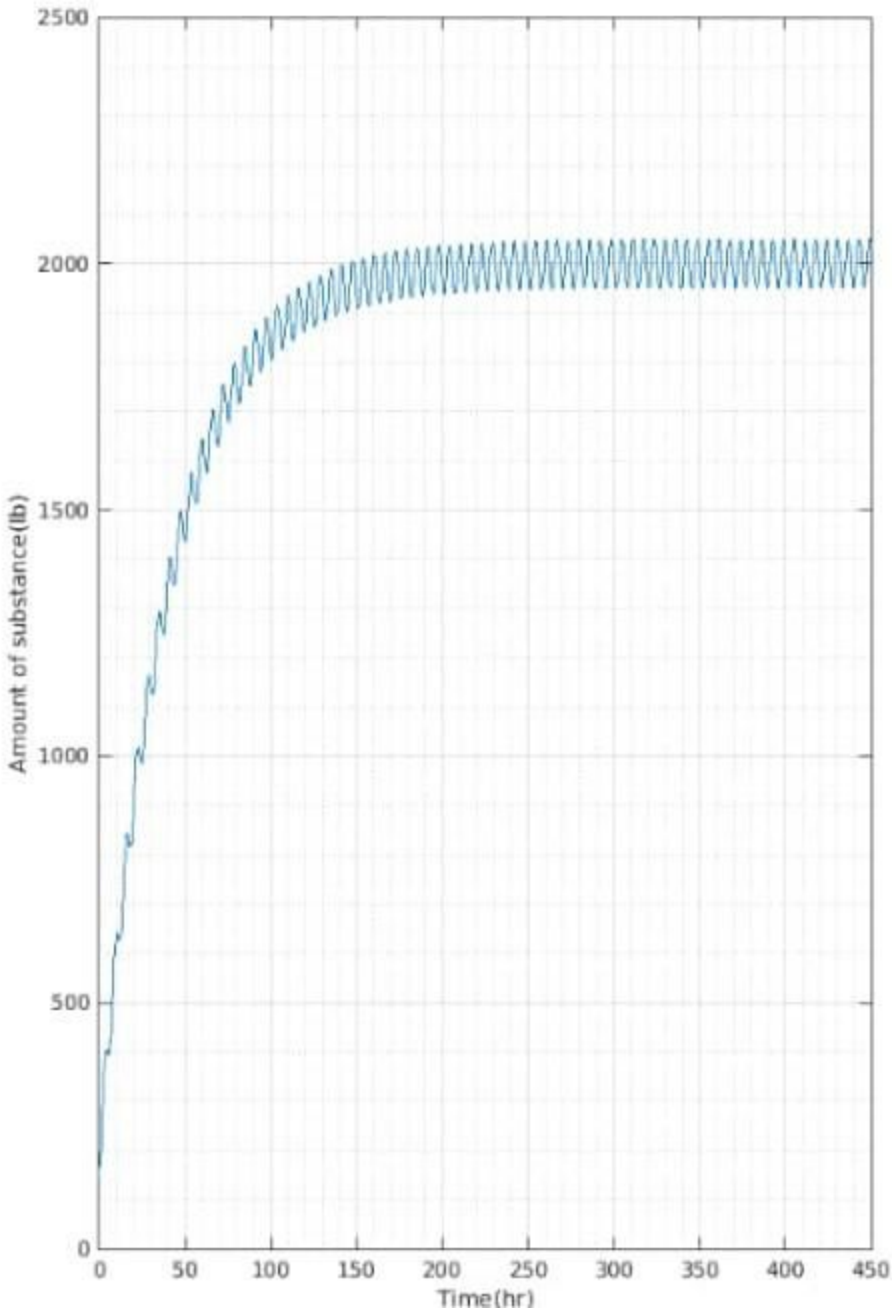
New to MATLAB? See resources for Getting Started.

```
40*t + C1/(t + 60)^(3/2) + 2400
```

Stop

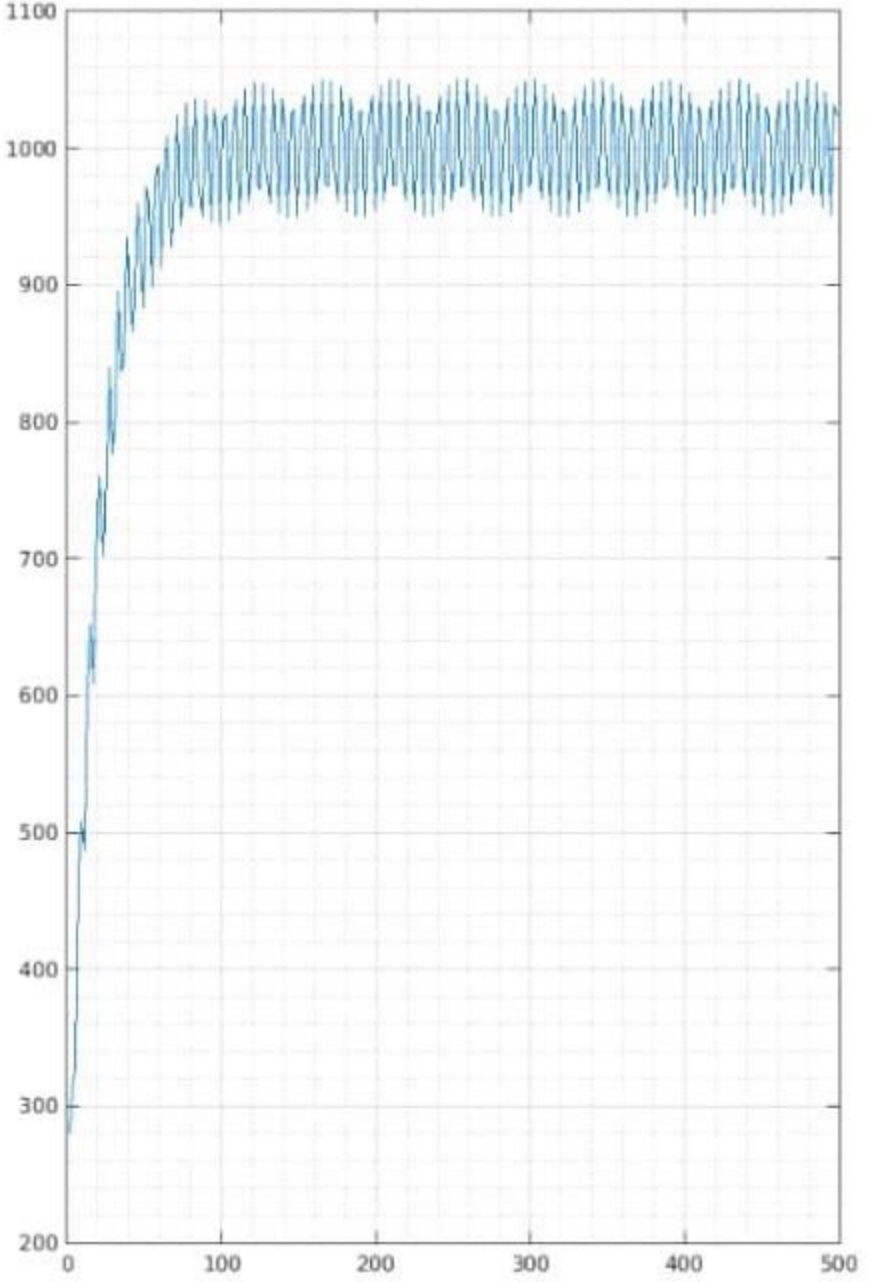
5:58 PM
5/6/2020

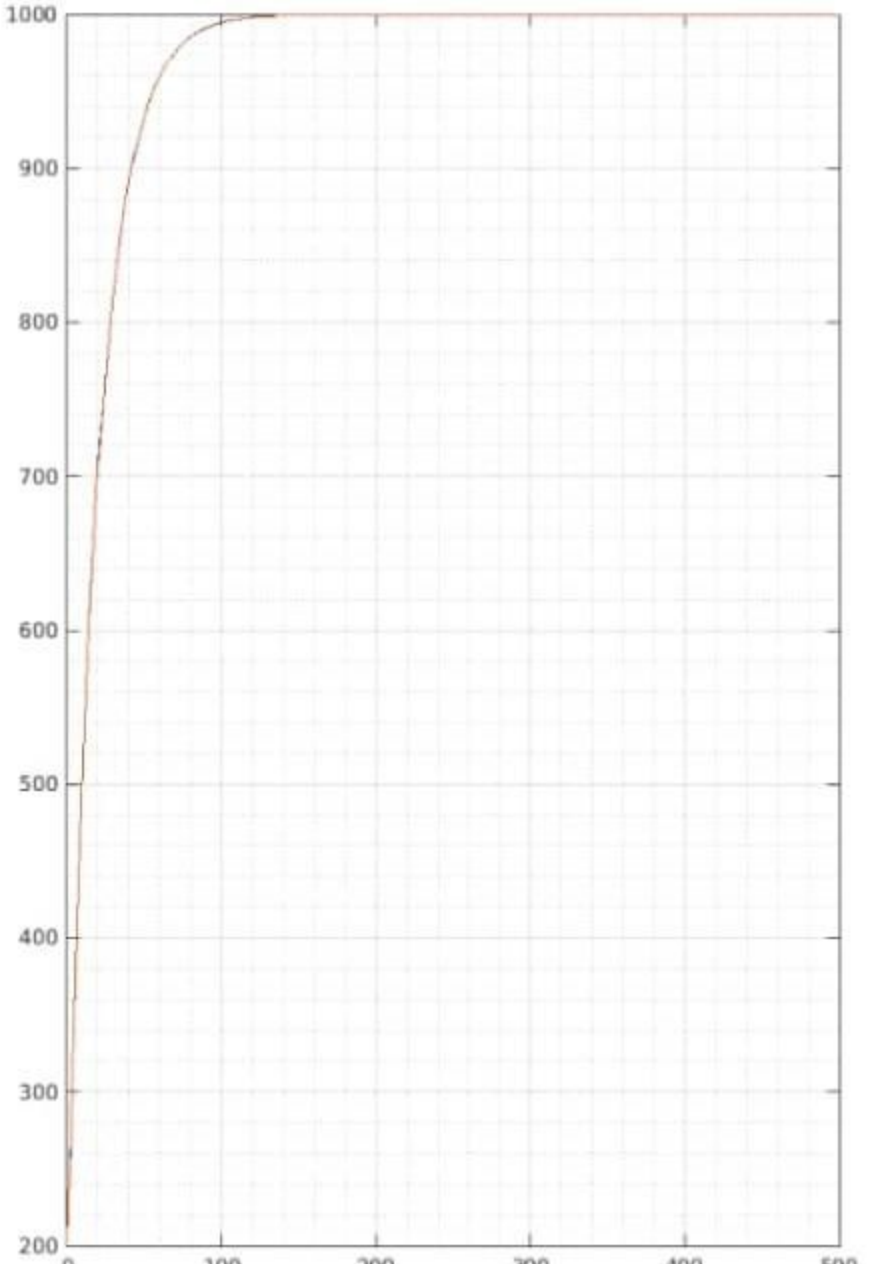
```
commandwindow
clearvars
clc
close all

syms m(t) t
eqn = diff(m,t) == (50+50*sin(t))-0.025*
cond = m(0)==150;
mSol(t) = dsolve(eqn,m(0)==150)
t = 0:0.5:450;
plot(t,mSol(t))
xlabel('Time(hr)')
ylabel('Amount of substance(lb)')
grid on
grid minor
```


2500
2000
1500
1000
500
0
Amount of substance(lb)
0
50
100
150
200
250
300
350
400
450
Time(hr)

```
commandwindow
clearvars
clc
close all

syms y1 y2 t1 t2
y(t1)=(1000)+(50/1.0025)*sin(t1)+((50*0.05)/1.0025)*cos(t1)-802.49*exp(-0.05*t1)
y(t2) = 1000-800*exp(-0.05*t2)
t1 = 1:2:499
t2 = 0:2:500
xlabel('Time values(min)')
ylabel('Litre')
plot(t1,y(t1))
hold on
plot(t2,y(t2))
```

```
16 hold off
17 grid on
18 grid minor
```


1100
1000
900
800
700
600
500
400
300
200
0
100
200
300
400
500


1000
900
800
700
600
500
400
300
200
0
100
200
300
400
500