Kolade Ayomide Olanrewaju
17/ENG 05 /018
Mechatronic Engineering
ENG 282
Assignment 5

a Define Mathematical modelling

Mathematical modelling is a mathematical representation of a system a simulation of a system which involves solving the model and obtaining its output variable for different values of its input variable or as input variable is changed from one value to another.

b methods of obtaining a model:

Differentiating
Use of balance law

c. Solution

$T(0) = 10°C$

$T(5) = 20°C$

Actual temp $= 25°C = T_A$

$$\frac{dT}{dt} = k(T - T_A)$$

$$dT = k(T - T_A)dt$$

$$\frac{dT}{(d - T_A)} = kdt$$

Integration both sides

$$\ln(T - T_A) = kt + C$$

$$T - T_A = e^{kt} + e^{c}$$

let e^{c} be A

$$T - T_A = e^{kt} \cdot A$$

$$T - T_A = Ae^{kt}$$

$$T = Ae^{kt} + T_A$$

When $T = 10$

$$10 = Ae^{k(0)} + 25$$

$10 = A + 25$

$A = 10 - 25$

$A = -15$

$T\ 25 - 15e^{kt}$

At $t(5) = 20$

$20 = 25 - 15e^{k(5)}$

$20 = 25 - 15e^{5k}$

$15e^{5k} = 25 - 20$

$15e^{5k} = 5$

$e^{5k} = 0.3333$

$5k = \ln 0.3333$

$5k = -1.0986$

$k = -0.22$

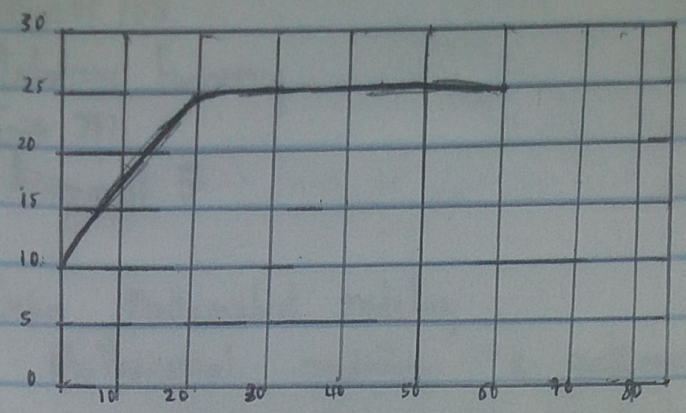
$T(t) = 25 - 15e^{-0.22t}$

:: Using Microsoft Excel

- Pick a box insert 't'
- Pick another box insert 'T'
- Under the already labelled box 1 't'
- Insert a value at 0 in an empty box
- Go to Sum Fill
- Click on series
- Insert a step value of 1
- Change the Serision to columns
- Insert a stop value of 60
- Under the already labelled box 2 'T'
- Pick a box
- Insert "=25 - (15* Exp(-0.22 * A2)]

- Autofill
- Go to insert
- Pick a graph of choice
- Label the graph

Output



Using Matlab

```
Command window
clear
clc
close all
t=0:1:60
T=25-15*exp(-0.022*t)
plot(t,T)
grid on
grid minor
xlabel('Time (secs)')
ylabel('Temperature')
grid on
grid minor
```

iv) Using excel's dynamic response; the temperature of the system wo at 20 minutes

v) Using the developed model equation, rature of the thermometer at t be at 25°C

Output