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~~18/ENG06/073~~ 18/ENG06/073

Mechatronics

a. Mathematical Modelling is a mathetical representation of a system and Simultaneous 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 change from one values to another.

b. Methods of Obtaining a Model
- Differentiating
- Use of Balance Law.

c. $T(0) = 10^{\circ}C$

$T(t) = 20^{\circ}C$

Actual temp $= 25^{\circ}C = T_A$

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

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

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

Integrating both sides

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

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

Let e^C be A

$T - T_A = Ae^{kt}$

$T = Ae^{kt} + T_A$

When $T = 10$, $t = 0$

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

$10 = A + 25$

$A = 10 - 25$

$= -15$

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

At $t(5) = 20$

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

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

$15e^{5k} = 5$

$e^{5k} = 0.3333$

$5k = \ln 0.3333$

$5k = -1.0980$

$k = -0.22$

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

ii. Using Microsoft Excel

- Pick a box insert (t)
- Pick another box insert (-t)
- Under the already labelled box 1 (t)
- Insert a value of 0 in an empty box
- Go to Fill
- adjust to Click on Series
- Insert a Step value of 1
- Change the Series to Columns
- Insert a Stop value of 60
- Under the already labelled box 2 (-t)
- Pick a box
- Insert "$=25-(15*EXP(-022*A_2)$"
- Auto Fill
- Go to Insert
- Pick a graph of choice
- Label the graph