Assignment :- 2

- 1- Dimension Un-steady State conduction

$$\frac{\partial T}{\partial t} = \frac{\partial}{\partial x}\left(\Gamma \cdot \frac{dT}{dx}\right)$$

Assuming $\Gamma = \frac{k}{\rho C_p}$ as constant,

$$\frac{\partial T}{\partial t} = \Gamma \cdot \frac{\partial^2 T}{\partial x^2} = \frac{k}{\rho C_p} \frac{\partial^2 T}{\partial x^2}$$

$$\frac{\Delta T}{\Delta t} = \frac{k}{\rho C_p}\left[\frac{T(x+h) - 2T(x) + T(x-h)}{h^2}\right] \quad \text{-- } \boxed{1}$$

In $\boxed{1}$, we have descritize the $\frac{dT}{dt}$ used Taylor's expansion for second order.

$$T(x+h) = T(x) + h\frac{\partial T}{\partial x} + \frac{h^2}{2!} \cdot \frac{\partial^2 T}{\partial x^2} + \dots$$

$$T(x-h) = T(x) - h\frac{\partial T}{\partial x} + \frac{h^2}{2!} \cdot \frac{\partial^2 T}{\partial x^2} - \dots$$

$$T(x+h) + T(x-h) = 2T(x) + h^2 \frac{\partial^2 T}{\partial x^2}$$

$$\therefore \frac{T'(x) - T(x)}{\Delta t} = \frac{k}{\rho C_p}\left[\frac{T(x+h) - 2T(x) + T(x-h)}{h^2}\right]$$

$$\therefore T'(x) = \Delta t \frac{K}{\rho C_p} \left[\frac{T(x+h) - 2T(x) + T(x-h)}{h^2} \right] + T(x)$$

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