Week 1

A short summary about the conductive heat transfer and solving the same exercise with L= 0.4 m, A= 20 m2, DeltaT= 25, and k=0.78 W/m K using both simple method and using the resistance concept

1.A short summary about conductive

Heat transfer through the wall of a house can be modeled as steady and one-dimensional. The temperature of the wall in this case depends on one direction only (say the x-direction) and can be expressed as T(x).
In steady operation, the rate of heat transfer through the wall is constant.

Simple Method:

$$\dot{Q}_{cond,wall} = KA\frac{T_1 - T_2}{L}$$

Thermal Resistance Concept:

$$\dot{Q}_{cond,wall} = KA\frac{T_1 - T_2}{L}$$

$$\dot{Q}_{cond,wall} = \frac{T_1 - T_2}{R_{wall}}$$

$$R_{wall} = \frac{L}{KA}$$

2. Calculation

1) Simple Method:

$$\dot{Q}_{cond,wall} = KA\frac{T_1 - T_2}{L} = 0.78\mathrm{W/mK} * 20\mathrm{m}^2 * \frac{25\mathrm{K}}{0.4\mathrm{m}} = 975\mathrm{W}$$

2) Thermal Resistance Concept:

$$R_{wall} = \frac{L}{KA} = \frac{0.4\mathrm{m}}{0.78\mathrm{W/mK} * 20\ \mathrm{m}^2} = \frac{1}{39}\mathrm{K/W}$$

$$\dot{Q}_{cond,wall} = \frac{T_1 - T_2}{R_{wall}} = \frac{25\mathrm{K}}{\frac{1}{39}\mathrm{K/W}} = 975W$$