SUMMARY

- Conduction : heat transfer through solids

Heat transfer through the wall $\dot{Q}$ of a building is considered steady and temperature T of the wall depends by then on one direction.

$Q \;\; Energy\,(J)$

$$\dot{Q} = \frac{dQ}{dt}\frac{Energy}{time}\left(\frac{J}{s}\right) \rightarrow W\ Power$$

$$\dot{Q} = kA \times \frac{\Delta T}{L}$$

(Simplified conclusions of Fourier's law of heat conduction)

Heat transfer through a wall is proportional to its Area
It is proportional to the difference of temperature and the conductivity
Conductivity: willingness of material to transfer heat

$$\frac{dT}{dx} \rightarrow homo.Assumption \rightarrow \frac{\Delta T}{\Delta x}$$

It is inversely proportional to the thickness

By making an analogy between the thermal and electrical resistance concepts, we can define the conduction resistance of the wall as follow :

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

$$\dot{Q} = \frac{\Delta T}{R_{Wall}}$$

EXERCICE

Example: 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

Simple method $\dot{Q} = kA\frac{\Delta T}{L} = 0.78 * 20 * \frac{25}{0.4} = 975\ W$

Resistance concept

$$R_{wall} = \frac{L}{kA} = \frac{0.4}{0.78 * 20} = 0.02564\ °C/W$$

$$\dot{Q} = \frac{\Delta T}{R_{Wall}} = \frac{25}{0.02564}$$

$$= 975{,}04\ W$$