

1 Write a short summary about the conductive heat transfer.

Conductive heat transfer takes place when there is a temperature gradient in a solid or stationary fluid medium. Heat flows from more energetic to less energetic molecules until a thermal equilibrium is reached.

Conductive heat transfer can be expressed with **Fourier's Law**:

$$\dot{Q} = -kA \frac{dT}{dx} \quad (W)$$

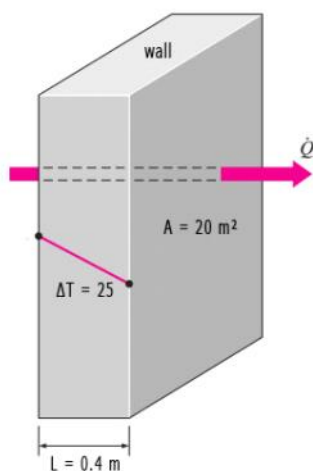
The Fourier's Law can be applied to calculate the rate of heat conduction transfer through the wall of a house.

$$\dot{Q}_{cond, wall} = kA \frac{T_1 - T_2}{L} \quad (W)$$

Conclusions:

- ▶ It is proportional to the average thermal conductivity, the wall area, and the temperature difference;
- ▶ It is inversely proportional to the wall thickness;
- ▶ Once the rate of heat conduction is available, the temperature $T(x)$ at any location x can be determined;
- ▶ Under steady conditions, the temperature distribution in a plane wall is a straight line: $dT/dx = \text{constant}$.

2 Find the rate of heat transfer through the wall if $k=0.78 \text{ W/m K}$ (using both simple method and using the resistance concept)



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

$$R_{wall} = \frac{L}{kA} = \frac{0.4}{0.78 * 20} = 0.0256 \text{ K/W}$$

$$\dot{Q} = \frac{\Delta T}{R_{wall}} = \frac{25}{0.0256} = 976.56 \text{ W}$$