Summary:

Conductive heat transfer is the process of transferring thermal energy from high temperature to low temperature, and is the result of the transmission of vibrational energy from one molecule to another.

To examine conduction heat transfer, it is necessary to relate the heat transfer to mechanical, thermal, or geometrical properties. Consider k A L ΔT
k is the thermal conductivity of the material ,
A is the cross-sectional area perpendicular to the heat transfer direction,
L is the thickness of the plate or wall,
ΔT is higher temperature compared with the outside wall

Question:

L= $0.4m$, A= $20m^2$, ΔT= $25K$, and k=$0.78\frac{W}{mK}$, find the rate of heat transfer through the wall.

Solution:

By using simple method,

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

By using the resistance concept,

$$R_{Wall} = \frac{L}{\mathrm{kA}} = 0.4/(0.78 * 20) \approx 0.02564\ ^{\circ}\mathrm{C}/W$$

$$\dot{Q} = \frac{\Delta T}{R_{Wall}} = \frac{25}{0.02564} \approx 975W;$$