Question:

L=0.4m A=20m² $\boldsymbol{\Delta}$T=25K and k=$0.78\frac{W}{mK}$
Find the rate of heat transfer through the wall.

Solution:

By using The Simple Method,

$$\dot{Q}=kA\frac{\boldsymbol{\Delta}\mathrm{T}}{L}=\frac{0.78W}{mK}\times 20\mathrm{m}^2\times\frac{25K}{0.4m}=975w$$

By using The Resistance Concept,

$$R_{wall}=\frac{\boldsymbol{\Delta T}}{\boldsymbol{L}}=\mathbf{0}.\frac{\boldsymbol{4m}}{\mathbf{0.78}\frac{\boldsymbol{W}}{\boldsymbol{mK}}\times\boldsymbol{20m}^2}\approx\mathbf{0.02564}\frac{\boldsymbol{K}}{\boldsymbol{W}}$$

$$\dot{Q}=\frac{\Delta T}{R_{wall}}=\frac{25K}{0.0256K/W}\approx 975.04W$$

Summary:
The rate of heat conduction through a plane wall is proportional to the average thermal conductivity, the wall area, and the temperature difference. But is inversely proportional to wall thickness.

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