THE CONDUCTIVE HEAT TRANSFER

The heat transfer can take place in only 3 ways:

- Conduction $\dot{Q}$
- Convection
- Radiation

Conductiond and *convection* need a trasmission medium, while radiation does not.

The **Thermal Conduction** is the transmission of the heat that takes place in a solid, liquid or aeriform medium (inside a only body or two bodies in contact with each other) from the zones with higher temperature towards those with lower temperature.

$$\dot{Q}_{int} - \dot{Q}_{out} = \frac{dEwall}{dt} \qquad [\frac{J}{s} = W]$$

$$\dot{Q}_{cond,wall} = -kA\frac{dT}{dx} \quad [W] \qquad \textbf{FOURIER'S LAW OF HEAT CONDUCTION}$$

$\dot{Q}$ is proportional to the Conductivity (K), that is the willingness of a material to transfer heat

$$[\frac{W}{m°C}] \text{ or } [\frac{W}{mK}]$$

$\dot{Q}$ is proportional to the Area of the wall [m^2]

$\dot{Q}$ is proportional to the Difference of Temperature [°C] or [K]

$\dot{Q}$ is inversely proportional to the Thickness [m]

The "-" is a convention that allowed to consider positive the power transmitted in the positive direction of x.

Exercise 1

Find the resistence using the thermal and electrical method.

Data:

L = 0,4m

A = 20 m^2

ΔT = 25 k

K = 0.78 $[\frac{W}{mk}]$

Thermal method:

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

Electrical method

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

$\dot{Q} = \frac{\Delta T}{Rwall} = \frac{25}{0.0256} = 976{,}5625\ W$

The difference of $\dot{Q}$ is due to rounding.