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Week 2 submission

Summary about the convective heat transfer:

The convection is a type of heat transfer where the thermal energy leaves the solid where the hot air moves up in a cycle leaving the cold air going down.

The rate of convective heat transfer depends on the temperature difference, speed and king of liquid or gas.

There are two types of convection, natural convection with convective heat transfer coefficient of 5 to 20 W/m2 · °C and force convection with heat transfer coefficient of 20 to 200 W/m2 · °C.

We calculate the heat transfer through a window to decide on the heating syste going to be used and estimate the costs of the bills to be charged.

We should try to decrease the heating system when calculating the power. By increasing the air gap in a wall or a double plane glass, the rate of heat flow is decreased. As the distance increases the density of the air inside the wall decreases which leaves a space for the air to move increasing the thermal resistance of the wall.

By increasing the thickness of a single plane glass does not increase the total resistance because the resistance is independent on the depth of the surface but it depends only on the length and height (Area) of the surface and the heat transfer coefficient of the surface.

Mistakes made in class:

I had a problem in calculating the temperature of the inner surface of the glass as I thought that the inner surface is the surface shared with the air gap which is T_2 as T_1 is considered the outer surface so I calculated the difference between the T s1 and the $T_{\text{air gap}}$ to get the rate of heat transfer.

Example:

Answer:

A= 0.8 * 1.5 = 1.2m

K_{glass} = 0.78 W/m.°C

K_{air} = 0.026 W/m.°C

H_1 = 10 W/m2 · °C

H_2 = 40 W/m2 · °C

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

$R_{total} = \frac{1}{h1*A} + \frac{L}{K\,glass*A} + \frac{L}{K\,air*A} + \frac{L}{K\,glass*A} + \frac{1}{h2*A}$

$R_{total} = \frac{1}{10*1.2} + \frac{0.006}{0.78*1.2} + \frac{0.013}{0.026*1.2} + \frac{0.006}{0.78*1.2} + \frac{1}{40*1.2} = 0.53\ °C/W$

$\dot{Q} = \frac{\Delta T}{R_{Total}} = \frac{30}{0.53} = 69.25$ W

$\dot{Q} = \frac{T\,inf - T\,s1}{R\,conv.1} = \frac{20 - T\,s1}{0.0833}$

T s1 = 15.28 W

The resistance increased as the air gap increased.

we have an optimal range for the air gap's distance because as the distance increases the density of the air inside the wall decreases which leaves a space for the air to move increasing the thermal resistance of the wall.

Concluding that the resistance is proportional to the thickness of the wall.