**Week 2**

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1. Convection Heat Transfer Summary:

Convection is the movement of a fluid such as air or a liquid which has been heated. The fluid above a hot surface expands, becomes less dense and rises. Convection heat transfer is usually between a surface and a moving fluid with different temperatures. Convection could happen between moving fluids or a solid and a moving fluid.

There are two types of convection, the first type is Natural and the second type is Forced. Natural Convection is caused by temperature variations in the fluid where the hot air usually rises and the cooler air drops.

Whereas the Forced convection occurs when a fluid flow is induced by an external force such as a pump, fan or heater.

Increasing the thickness of a single glass panel does not increase the total resistance since the thickness of glass does not make any effect and is a very small value which doesn’t affect the total thermal resistance. The resistance through glass is low and the does not resist heat transfer throughout the glass therefore it does not increase the total resistance.

1. Review of the mistakes:

-A simple mistake: Forgot to change thickness of glass from mm to m

-Was confused whether the R calculated for air between two glass panels was convection or conduction since I didn’t know if the air inside was moving or not but I understood later in the lecture that air will not be able to move in a small space so it was considered conduction.

1. Problem:

Given:

Air gap thickness: 13mm , Glass thickness: 6mm, 0.8m high, 1.5m wide, Glass (k=0.78 W/m C), Air (0.026 W/m. C)

h1= 10 W/m2 · °C and h2=40 W/m2 · °C, which includes the effects of radiation.

Solution:

A= 1.5x0.8 =1.2

R(glass1)=R (glass2) = Lg/(Kg x A) = 0.006/0.78 x1.2 =0.0064 C/W

R(airgap) = L airgap/(K airgap x A) =0.013/0.026x1.2=0.0416 C/W

R (conv. 1) = 1/h1 x A = 1/10 x 1.2 = 0.0833 C/W

R (conv. 2) = 1/h2 x A = 1/40 x 1.2 = 0.0208 C/W

R total = R (glass1)+R(glass2)+R(conv.1)+R(conv.2)

=0.0064+0.416+0.08337+0.0208+0.0064

=0.5333 C/W

Q.=T(infinity1)-T(infinity2)/R(total) = 20-(-10)/0.5333 =56.2535 W

Temperate of inner surface Q.= T(infinity1) – T1/R(conv.1)

T1= T(infinity1) – Q. \* (Rconv.1) = 20C – (56.2535 W \*0.0833 C/W) =15.314 C

The resistance through air gap increases as the thickness of air gap increases.

We have an optimal range of air gap thickness because the larger the air gap thickness is the more the air inside will start to move and create a natural convection motion between the glass panels. Therefore we have a range in order to consider the air in a conduction steady state.