NAME: JUI HALVADIA 05-11-2019

# EXAMPLE AND SUMMARY

**Example 1**

Solve the last example you solved in the class (radiative heat exchange between two parallel plates) awhile considering the two emissivities to be 0.1, what can you conclude from the result?

When the $\epsilon_1 = \epsilon_1 = 0.1$,

R total $= \frac{1}{0.1} + \frac{1}{0.1} - 1 = 19 \ \frac{℃}{W}$

$Q_{12} = \frac{A1\ \sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon\ 1} + \frac{1}{\epsilon\ 2} - 1} = \frac{1.5 \text{ x } 5.67 \text{ x } 10^{-8} \text{ x } (298^4 - 308^4)}{\frac{1}{0.1} + \frac{1}{0.1} - 1}$ = - 4.9823 W

And from the equation solved in the class,

$Q_{12} = A_1 F_{12}\ \sigma\ (T_1^4 - T_2^4)$

$= 1.5 \text{ x } 0.01 \text{ x } 5.67 \text{ x } 10^{-8} \text{ x } (298^4 - 308^4)$ = -0.9466 w

From the above example, we can derive that emissivity is directly affects the net heat exchange irrespective of the same temperature difference for both the situations.

## write a summary of the topics about radiative heat transfer we went through including the definitions of emissivity, absorptivity and reflectivity, the view factor, the heat exchange betweeen two black surfaces, the heat exchange between the two gray surface and finally the definition of radiative resistances:

Emissivity:

Emissivity of a material surface is used to measure the amount of thermal radiation the surface is emitting. The ratio of the radiation emitted by a surface at a particular time divided by the radiation emitted by a black body at same temperature is used to calculate emissivity of that surface. The value of emissivity is between 0(lowest) and 1(highest). The more the value is, the closer itis to the blackbody.

Absorptivity:

The radiation coming from a surface to another surface, fraction of it is absorbed by the second surface. The ability of the second surface to absorb part of radiation is called absorptivity. It is calculated by the amount of absorbed radiation divided by the overall incident radiation of the surface. The calculated ratio is called absorptivity($\alpha$) of the surface.

The view factor:

A fraction of radiation going from surface 1 towards surface 2 gets obstructed by surface 2. This fraction number is called the view factor. The view factor works differently for plane, convex and concave surfaces. In case of concave surface, it hits another part of the same surface when in plane and convex surfaces, it hits other surfaces. It this way, heat passes through radiation.

Reflectivity:

The incident radiation coming from a surface to another surface, fraction of it is reflected by the second surface. The ability of the second surface to reflect part of radiation is called reflectivity. It is calculated by the amount of reflected radiation divided by the overall incident radiation of the surface. The calculated ratio is called reflectivity($\rho$) of the surface.

Radiative heat transfer:

When any object gains heat through convection and conduction, its temperature increases to a significant rate and its molecules and atoms releases energy which we call thermal radiation. So, radiative heat transfer is when an object or surface transfers the heat through radiation to another object or surface. This generally happens when a body contains more heat than the other body. Unlike convection and conduction, radiative heat transfer does not need a medium or to be in contact. Radiative heat transfers in form of wavelength. Almost all objects (solid, liquid or gas) do radiative heat transfer from all surfaces.

Radiative resistance:

During the radiation process, energy loss happens while creating electromagnetic waves and converted to heat radiation. This phenomenon is called radiative resistance, to measure the incident.

Heat exchange between two black surfaces:

If we consider radiative heat exchange between two black surface B1 and B2, the heat exchange will be the subtraction between radiation leaving from B1 hitting B2 and radiation leaving B2 hitting B1. Black bodies absorb the radiation so both the radiations will be absorbed by both surfaces.

Heat exchange between two grey surfaces:

Unlike black bodies, when a grey surface receives radiation, it absorbs and reflects a portion of the incident radiation. The emissivity of a grey surface depends on the direction and the wavelength is constant in this case. So, if we consider a grey surface g1, the net heat transfer rate is the subtraction between the incident radiation and the radiation leaving the surface through absorption and reflection.