**WEEK 5 SUBMISSION** **PAOLA GOBBI - 926210**

1. **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 between two black surfaces, the heat exchange between the two gray surface and finally the definition of radiative resistances.**

**Emissivity:**

the ratio of the radiant energy emitted by a surface to that emitted by a blackbody at the same temperature. $0 \leq \varepsilon \leq$

It change with the temperature of the surface, the wavelength and the direction of the emitted radiation.

**Absorptivity:**

the property of a body that determines the fraction of incident radiation absorbed by the body.

$$\alpha = \frac{Absorbed\ radiation}{Incident\ radiation} = \frac{G_{abs}}{G}$$

**Reflectivity:**

The ratio of the energy of a wave reflected from a surface to the energy possessed by the wave hits the surface.

$$\rho = \frac{Reflected\ radiation}{Incident\ radiation} = \frac{G_{ref}}{G}$$

**View factor:**

is the proportion of the radiation which leaves surface $i$ that strikes surface $j$.

$$F_{i \to j}$$

## Radiation Heat Transfer: Black Surfaces

A black or ideal surface, will have not surface resistance, so radiosity and emissive power will be equal.

$$\dot{Q}_{1\to 2} = \begin{pmatrix}\text{Radiation leaving} \\ \text{the entire surface 1} \\ \text{that strikes surface 2}\end{pmatrix} - \begin{pmatrix}\text{Radiation leaving} \\ \text{the entire surface 2} \\ \text{that strikes surface 1}\end{pmatrix}$$
$$= A_1 E_{b1} F_{1\to 2} - A_2 E_{b2} F_{2\to 1} \qquad \text{(W)}$$

$$\dot{Q}_{1\to 2} = A_1 F_{1\to 2}\sigma(T_1^4 - T_2^4)$$

## Radiation Heat Transfer: Gray Surfaces

The gray surface is a medium whose emissivity does not change with wavelength and the two surfaces forming an enclosure.

$$J_i = \begin{pmatrix}\text{Radiation emitted} \\ \text{by surface } i\end{pmatrix} + \begin{pmatrix}\text{Radiation reflected} \\ \text{by surface } i\end{pmatrix}$$
$$= \varepsilon_i E_{bi} + \rho_i G_i$$
$$= \varepsilon_i E_{bi} + (1 - \varepsilon_i) G_i \qquad (\text{W/m}^2)$$

$$\dot{Q} = \frac{\sigma(T_1^4 - T_2^4)}{\dfrac{1-\varepsilon_1}{A_1} + \dfrac{1}{A_1 F_{1\to 2}} + \dfrac{1-\varepsilon_2}{A_2 \varepsilon_2}}$$

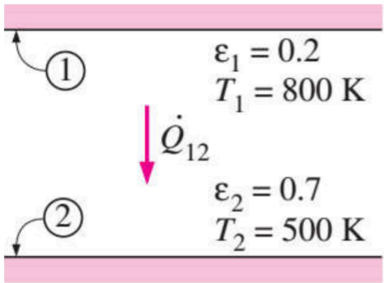
## Radiative resistance:

The net radiative heat transfer from one surface to another is the radiation leaving the first surface for the other minus that arriving from the second surface.

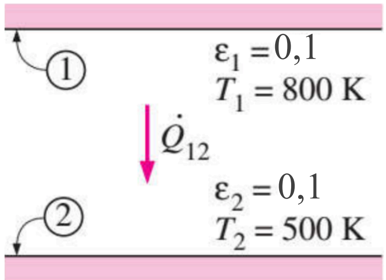
$$\dot{Q}_{\mathrm{i}\to\mathrm{j}} = A_i J_i F_{i\to j} - A_j J_j F_{j\to i}$$

2. **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?**

$$\dot{Q}_{1\,2} = \frac{A \cdot \sigma\,(T_1^4 - T_2^4\,)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1}$$




$$\dot{Q}_{1\,2} = \frac{1 \cdot 5{,}67 \cdot 10^{-8}\,(800^4 K - 500^4 K\,)}{\frac{1}{0{,}2} + \frac{1}{0{,}7} - 1} = 3625{,}41\,W$$




$$\dot{Q}_{1\,2} = \frac{1 \cdot 5{,}67 \cdot 10^{-8}\,(800^4 K - 500^4 K\,)}{\frac{1}{0{,}1} + \frac{1}{0{,}1} - 1} = 1035{,}81\,W$$

It can be noticed that if the two surfaces have lower emissivity value, the radiation heat transfer between the surfaces decreases considerably.