Week5_TES ASSIGNMENT

TASK 1

Emissivity- The emissivity of an object or a surface is a measure for how strongly it interacts with thermal radiation in terms of emission and absorption. It can have a value between 0 and 1, and it can be dependent on the optical frequency or wavelength, also on the direction of incidence and the polarization of light.

Absorptivity, α- Absorptivity is the fraction of the radiation energy incident on a surface that is absorbed by the surface. Like emissivity, value of absorptivity is in the range $0 < \alpha < 1$.

Reflectivity, r- is an energy from a remote thermal source, reflected from the surface of the object.

View factor, F- It Describes the effects of orientation on radiation between surfaces. The medium between the two surfaces does not absorb, emit or scatter radiation. The view factor ranges between $0 - 1$.

Heat exchange between two black surfaces- The highest absorbency value is 1, which is achieved when an object absorbs all incoming radiation. This kind of object is called as "black body". All bodies above the absolute zero temperature emit some heat. Two black surfaces that radiate through each other, have absolute heat flow.

Heat exchange between two grey surfaces- In reality, most of the surfaces have grey bodies. The grey bodies absorb a certain amount of radiation while reflecting some of the radiation back from the surface into space. G irradiation is the total radiation that comes in contact with a surface per unit time and unit area. While J represents the radiosity which is the total amount of radiation that is reflected off a surface per unit time and unit area.

Radiative resistances- With radiation resistance, some energy is lost, this transport is provided by electromagnetic waves and convert to heat radiation.

Task 2: solving the example from the class (radiative heat exchange between two parallel plates), considering the two emissivities = 0.1; conclusions from the result. Find the net heat exchange between the surface 1 and 2 where:

$A_1 = 1.5\ m^2$
$F_{12} = 0.01$
$T_1 = 800\ K$
$T_2 = 500\ K$

$\epsilon_1 = 0.1$
$\epsilon_2 = 0.1$

$$\sigma = 5.67 * 10^{-8} \frac{W}{m^2 K^4}$$

Introducing the equation for calculating heat transfer between two parallel plates:

$$Q_{net2-1} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon_2} + \frac{1}{\epsilon_1} - 1}$$

$$Q_{net2-1} = \frac{1.5 * \left(5.67 * 10^{-8}\right) * (800^4 - 500^4)}{\frac{1}{0.1} + \frac{1}{0.1} - 1} \approx 1035.82\ W$$

The above exercise shows that the greatest impact on the net heat exchange between two surfaces will be produced by the emissivity value (in comparison with the results obtained in class with emissivity1 = 0.2, and emissivity2 = 0.7).