Week_5

Task 1 In your own words (which means in your own words) 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

Radiation heat transfer rate, q [W/m2], from a body (e.g. a black body) to its surroundings is proportional to the fourth power of the absolute temperature and can be expressed by the following equation's = εσT4 - this is Stefan–Boltzmann Law. σ is a fundamental physical constant called the Stefan–Boltzmann constant, which is equal to 5.6697×10-8 W/m2K4.

Emissivity is how much energy is emitted by a surface comparing to the black body. It depends on temperature and direction. In black body emissivity is $\varepsilon = 1$

Absorptivity is an ability of a body or a surface to absorb energy. To calculate it, it is needed to divide an amount of absorbed radiation with overall incident radiation of the surfaces. The calculated ratio is called absorptivity (α) of the surface $\boldsymbol{\alpha = \frac{G_{abs}}{G}}$

Reflectivity - when a energy travels from one surface to another, the ability of a second surface to reflect the energy is called reflectivity.
Reflectivity (ρ) $is\ equal\ to\ the\ ratio\ between\ reflected\ radiation\ and\ incident\ radiation.$

$$\boldsymbol{\rho = \frac{G_{ref}}{G}}$$

The view factor represent the emissive power transfer from one surface to another one, and it doesn't depends on a properties of a surface. The view factor and surface are related to each other in respect of the area.

Heat exchange between two black surfaces- If we have two black bodies, all the energy will be absorbed. So it means that energy that goes from surface 1 to surface 2 will be rejected by the energy traveling from surface 2 to surface 1

Gray bodies- some of the energy will be absorbed and some will be reflected

Radiative resistances - is possibility of a surface to resist against the heat exchange.

Task 2 Solve the last example you solved in the class (radiative heat exchange between two parallel plates) awhile considering the two emissivity to be 0.1, what can you conclude from the result?

$\varepsilon_1 = 0.1$
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$A_1 = 1.5$m
$F_{12} = 0.01$
T_1 = 800 K
T_2 = 500K

$$\dot{Q} = \frac{A\sigma\left(T_1^4 - T_2^4\right)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1}$$

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

If we change the emissivity, the heat transfer would change also, no matter that the other factors are the same. In this case, lower the emissivity is, the lower the heat transfer will be.