Demre Ertem Weekly Submission 5

6 Kasım 2019 Çarşamba 00:59

Task 1 In you 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 betweeen two black surfaces,the heat exchange between the two gray surface and finally the definition of radiative resistances.

## Radiative Heat Transfer

Heat transfer from high temperature to something with a lower temperature, but sometimes elements cannot physical contact with each other directly. In this circumstances, Hot object cool with their surroundings and reach thermal equilibrium. This is heat thermal mechanism of the radiation.

## Emissivity

Emissivity is defined as the ratio of the energy radiated from a material's surface to that radiated from a a perfect emitter, known as a blackbody, at the same temperature and wavelength and under the same viewing conditions.

## Absorptivity

Absorptivity is an optical property of a material, which describes how much light was absorbed in material in relation to an amount of light incident on the material. The light absorption occurs for optically opaque materials on their surface and for semi-transparent materials on the surface and in the bulk of the material.

## Reflectivity

Reflectivity is an optical property of material, which describes how much light is reflected from the material in relation to an amount.of light incident on the material.
The reflection occurs always on the surface of the material, for the light-diffusing translucent materials also in the volume of the material.

## The view factor

The view factor is thedegree to which heat carried by radiation can bepassed between two surfaces. The view factor is the fraction of radiation leaving one surface which is intercepted by a second surface. The intensity of the emitted radiation depends on the view factor of the surface relative to the sky.

The heat exchange betweeen two black surfaces

Black surfaces has hisghest absorbency. Two black surfaces radiate to eachother to reach net heat. The net radiant exchange between two isothermal black surfaces is given by

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

The heat exchange between the two gray surface

Grey surfaces has a refletivity, so consider two small gray bodies having emissivities e1 and e2, and absorptivities α1 and α2 respectively. The small size of the bodies does signify that their size is very small compared to the distance between them. The radiant energy emitted by surface 1 would be partly absorbed by surface 2, and the unabsorbed reflected portion would be lost in space. It will not be reflected back to surface 2 because of its small size and large distance between the two surfaces.

The definition of the radiative resistance

Radiative resistance is resistance component which takes into account the radiated power that transfers to the differen waves.

Task 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?

Find the net heat exchange between the surface 1 and 2

where A1 = 1.5 $m^2$, $\epsilon_1 = \epsilon_2 = 0.1$ , $T_1 = 298$ K, $T_2 = 308$ K

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

$\dot{Q}_{net1-2} = A_i\sigma\left(\frac{T_1^4 - T_2^4}{\left(1/\epsilon_1 + \frac{1}{\epsilon_2} - 1\right)}\right) = 1.5 * 5(67 * 10^{-8} * (298^4 - 308^4)/\left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right) = 4.9822W$

*Previous Solution*

$\dot{Q}_1 \to 2 = A_1 \times E_{12} \times \sigma(T_1^4 - T_2^4) = 1.5*0.1*5.67*10^{-8}*(298^4 - 308^4) = -0.9466\ W$

*At the end,*

*We can see the differences heat transfer value that can differentiate according to the increase of the emissisitivity. While increasing in the emission values,the radiative heat transfer also will rise.*