Week 5

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

Emissivity: emissivity is a measure of the efficiency in which a surface emits thermal energy. It is defined as the fraction of energy being emitted relative to that emitted by a thermally black surface (a black body)

Absorptivity: absorptivity is defined as the ratio of the radiation energy absorbed by any substance to that absorbed under the same conditions by a blackbody.

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 F12 is the fraction of energy exiting an isothermal, opaque, and diffuse from surface 1 (by emission or reflection), that directly to the surface 2.

The heat exchange between two black surfaces: The two black surfaces will constantly absorb and emission all the radiation. Suppose there are two black surfaces with given area, A1 for the first object and A2 for the second object. So the energy leaving the first object and the second object are Eb1A1 and Eb2A1. The energy leaving object 1 that arrive the object 2 is Eb1A1F1-2 and the for the object 2 in this situation is Eb2A2F2-1. The net energy interchange from body 1 to body 2 is Eb1A1F1-2 - Eb2A2F2-1 = Q1-2

The heat exchange between two gray surfaces: The two gray surfaces will absorb and reflect a certain fraction of radiation. The reflect part will also constantly absorb by the other side for a certain fraction and reflect the other radiation, and the same thing happens in the other surface. The radiation will generally lose its power during the process.

Radiative resistance: It is the resistance of a particular medium or system to the flow of heat through its boundaries and is dependent upon geometry and thermal properties of the
medium such as thermal conductivity.

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?

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

$T1 = 37°C = 310K$

$T2 = 17°C = 290K$

$\dot{Q}_{net_{2-1}} = A\sigma(T2^4 - T1^4)/1/\varepsilon_1+1/\varepsilon_2-1 = 1.5*5.67*10^{-8} (310^4-290^4) /1/0.2+1/0.7-1 = 33.8763W$

$\dot{Q}_{net_{1-2}} = A\sigma(T1^4 - T1^4)/1/\varepsilon_1+1/\varepsilon_2-1 = 1.5*5.67*10^{-8} (310^4-290^4) /1/0.1+1/0.1-1 = 9.6789W$

it shows the value of emissivity notably changes the radiative between two gray surface