Week5_assignment

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#Week 5

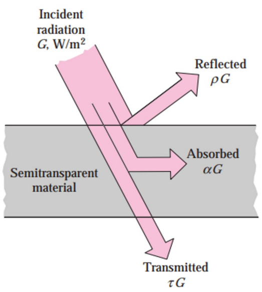
Task 1 In you own words (which means in your own words) write a summary of the topics about radiative heat transfer we went through including the definitions of emissivity, absorptivity and reflectivity, the view factor, the heat exchange between two black surfaces,the heat exchange between the two gray surface and finally the definition of radiative resistances

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?

RADIATIVE HEAT TRANSFER :

Radiation means that the spread of energy from matter as electromagnetic waves as a result of changes in atomic and molecular components. Radiation is a volumetric happening; All solids, liquids and gases, radiation
they emit, absorb, and transmit at varying levels. Radiation for such solids is often considered a surface occurance.

Radiative heat transfer is a non-contact heat transfer method between the heat source and the heated object. So no-need mediative tool/ambient to create radiative heat transfer by means of electromagnetic waves.
The part of the radiation reflected by a substance is defined by "reflectivit", the absorbed part is "absorbivity" and the passing part is "transmissivity". The sum all is equal to 1



EMISSIVITY: (ε) is the ability of the surface of a material to emit energy relative to radiation. Emission is a dimensionless quantity. Each material has a separate emissivity value. This value is evaluated between 0.00 (no transmission) and 1.00 (full transmission). The emission is also expressed as the ratio of the energy emitted by a given material to the energy emitted by a black body at the same temperature. When value is $\varepsilon < 1$ for a real object, $\varepsilon = 1$ for a real black body.

ABSORPTIVITY : (α) is a ratio that how much of the radiation is absorbed by the object.

REFLECTIVITY : (r) is a energy from a remote thermal source, reflected from the surface of the object.

VIEW FACTOR : (F) 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 eachother, 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. Can be calculated with this formula:

J=εEb+(1−ε)GJ=εEb+(1−ε)G
ε = the emissivity of the object
Eb = the energy emitted from a black body

RADIATIVE RESISTANCES: With radiation resistance, some energy is lost, this transport is provided by electromagnetic waves and convert to heat radiation.

PROBLEM : Find the net heat transfer between two surface $A_1 = 1.5\ m^2$,
$\varepsilon_1 = \varepsilon_2 =$ **0.1** , $T_1 = 298$ K, $T_2 = 308$ K $\sigma = 5.67 * 10^{-8} \frac{W}{m^2\ K^4}$

SOLUTION:

$$\dot{Q}_{net\ 12} = A\sigma \frac{(T_1^4 - T_2^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_1} - 1}$$

$$=1.5 \times (5.67 \times 10^{-8}) \times (308^4 - 298^4) / \frac{1}{0.1} + \frac{1}{0.1} - 1$$

$$= 4.98225\ W$$

Previous solution due to $\varepsilon_1 = \varepsilon_2 =$ **0.01** value

$$\dot{Q}_{net12} = A_1 \times \varepsilon_{1-2} \times \sigma(T_1^4 - T_2^4)\ (1.5*5.67*10^{-8}*(298^4-308^4)) / ((1/0.001)*2 -1$$

$$= - 0.9466\ W$$

To sum up : *Due to these two different value that defines two different condition; diversity of emissivity value is affect over the radiative heat transfer between surfaces and can not be ignored. So the increasing of the emissivity value also increase radiative heat transfer altough it it a dimensionless quantity.*