WEEK 5 – ASSIGNMENT
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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 betweeen two black surfaces,the heat exchange between the two gray surface and finally the definition of radiative resistances

Emissivity

The emissivity of the surface of a material refers to the effectiveness of the surface in emitting energy as thermal radiation (electromagnetic radiation with wavelength depending on the temperature).Emissivity is mathematically defined as the ratio of the thermal radiation from the surface to the radiation from an ideal black surface at the same temperature; the value varies from 0 to 1.

Absorptivity

Absorptivity, α, which 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 $0 < \alpha < 1$.

From its definition, a blackbody, which is an idealized physical body, absorbs all incident electromagnetic radiation, regardless of frequency or angle of incidence. That is, a blackbody is a perfect absorber. Since for real objects the absorptivity is less than unity, a real object can not absorb all incident light. The incomplete absorption can be due to some of the incident light being transmitted through the body or to some of it being reflected at the surface of the body.

Reflectivity

The fraction of radiation reflected by the surface is called the reflectivity (ρ). It is the ratio of reflected radiation (G_{ref}) to incident radiation (G).
Its value: $0 \le \rho \le 1$

P – reflected radiation/ incident radiation

View factor

View factor is the proportion of the radiation which leaves surface that strikes surface. View factor (or shape factor) is a purely geometrical parameter that accounts for the effects of orientation on radiation between surfaces.

$F_{i \to j}$ or F_{ij} = the fraction of the radiation leaving surface i that strikes surface j directly.

The heat exchange between two black surfaces

Radiation heat exchange between two black surfaces depends on the shape and size of the bodies, relative position, and distance between them while the radiation exchange between gray bodies also depends on their emissivity.

For calculation of the radiation exchange between two black surfaces, basic integral equation of the shape factor has been derived which represents the fraction of the total radiation emitted by a surface intercepted by other surface.

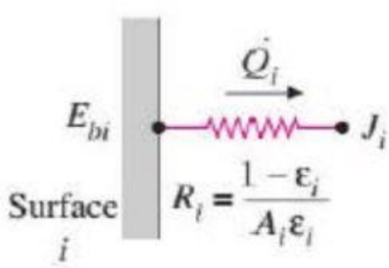
The heat exchange between the two gray surface

Grey body is an imperfect black body; i.e., a physical object that partially absorbs incident electromagnetic radiation.

The grey bodies absorb a certain amount of radiation while reflecting a portion of the radiation off of the surface back into space.

Radiative resistances

Radiative resistance is defined as a measure of energy produced during the transfer of radiation. It is calculated by the following equation:



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?

Given

σ = 5.67 x 10-8

T1=800k   T2= 500k

$$\dot{Q}_{12} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1}$$

$$Q_{12} = A\,\frac{5.670\times10^{-8}\times(800^4 - 500^4)}{\frac{1}{0.2}+\frac{1}{.7}-1} = A \times \frac{19680}{5.42} = \mathbf{3630.99w}$$

When ε = 0.1

$$Q_{12} = A\,\frac{5.670\times10^{-8}\times(800^4 - 500^4)}{\frac{1}{0.1}+\frac{1}{0.1}-1} = \mathbf{1035.8w}$$