Assignment 5. FTorresPerez

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I- Definitions

1) **Radiative heat transfer:**

Radiatiave heat transfer refers to the transfer of thermal energy between two objects, without the need of direct contact between them. Since there aren´t any objects whose temperature is absolute zero (-273.15 degrees celsius) radiative heat transfer happens between all kind of objects, regardless of their material. The rate of emission of an object increases with it´s temperature.

2) **Emissivity:**

We can define the Emissivity of an object as the effectiveness of emitting energy as thermal radiation. Its value varies from 0 to 1, the latest being closer to the value of a black body (a "perfect objetc" which emmits radiative in heat transfer in an uniform way in all directions, and which emissivity value is 1). The emissivity of a real surface varies according to its temperature, the wavelenght and the direction of the emitted radiation.

3) **Absorptivity:**

The absorsivity of an object´s surface is the ability of a material to absorbe radiant energy. Its value varies from 0 to 1.

4) **Reflectivity:**

Contrary to absorsivity, the reflectance of an object is the effectiveness of an object´s surface to reflect radiant energy. Its value also varies from 1 to 0 and depends on the object´s material.

5) **View factor:**

The view factor is a geometrical quantity, which defines a fraction of the energy that leaves a surface and is intercepted by any other surfaces.

6) **Heat exchange between two black surfaces:**

The heat exchange between two black surfaces refers to the transfer of thermal radiation between two surfaces simultaneously, in which a black surface emits an ammount of radiation per unit area per time and is absorved by the second surface, meanwhile the latter black surface will emit an ammount of radiation per unit per time and will be absorved by the first surface. The ammount of neat heat ransfer will be the same for both surfaces.

7) **Heat exchange between two gray surfaces:**

The difference with the heat exchange between two black surfaces is that a gray surface

will reflect and, or absorb a fraction of the thermal radiation a black body would absorb. In this case the graybody or blackbody fraction is independent of radiation wavelenght.

In this case we need to calculate it , by a formula that dictates that the heat exchange is equal to the emitted radiation, plus the radiation reflected by the other surface and minus the radiation abosrved by the surface.

II - Exercice:

$\epsilon 1 = \ 0.2$
$\epsilon 2 = \ 0.7$

Rtotal = (1/0.2) + (1/0.7) - 1 = 5.4286

$$\dot{Q}_{\square}12 \ = \left(\frac{A_{\square}\sigma\ (T_1^4 - T_2^4)}{\left(\left(\frac{1}{\epsilon 1}\right) + \left(\frac{1}{\epsilon 2}\right) - 1\right)}\right) =$$

$A * (5.67*10^-8)* ((800^4 - 500^4)/((1/0.2) + (1/0.7) - 1)$

= 3 625.37 W

For: $\epsilon 1 = \epsilon 2 = 0.1$

Rtotal = (1/0.1) + (1/0.1) - 1 =19

$$\dot{Q}_{\square}12 \ = \left(\frac{A_{\square}\sigma\ (T_1^4 - T_2^4)}{\left(\left(\frac{1}{\epsilon 1}\right) + \left(\frac{1}{\epsilon 2}\right) - 1\right)}\right) =$$

$A * (5.67*10^-8)* ((800^4 - 500^4)/((1/0.1) + (1/0.1) - 1)$

= 1 035.82 W

By comparing the two results we can conclude that when the emissivity value decreases the heat transfer decreases, so with a higher Emissivity value a higher radiative heat transfer will be attended.