Week five Submission

Tuesday, November 5, 2019 7:47 PM

Task 1

Radiative heat transfer :(the transfer of heat via photons/electomagnetic waves).

Emissivity(ε):the ratio of the radiation emitted by the surface to the radiation emitted by a blackbody at the same temperature. Thus, $0 \leq \varepsilon \leq 1$ because the radiation emitted from a blackbody is 1, $\varepsilon_{blackbody} = 1$.

Absorptivity:
Is the fraction of The radiation energy incident on a surface per unit area per unit time absorbed by the surface.
α= Absorbed radiation/incident radiation

Reflectivity:
Is the fraction of The radiation energy incident on a surface per unit area per unit time reflected by the surface.
ρ= Reflected radiation/incident radiation

The view factor:(the orientation between the two surfaces according to each other)
is a purely geometrical parameter that accounts for the effects of orientation on radiation between surfaces. In view factor calculations, we assume uniform radiation in all directions throughout the surface, i.e., surfaces are isothermal and diffuse. Also the medium between two surfaces does not absorb, emit, or scatter radiation. $F_{i \to j}$ or F_{ij} = the fraction of the radiation leaving surface i that strikes surface j directly.

The heat exchange between two Black surfaces:A blackbody is considered as a perfect emitter and absorber of radiation
A black body is body that completely absorbs all wavelengths of thermal radiation incident on it. Such bodies do not reflect light.

The radiation energy per unit time from a black body is proportional to the fourth power of the absolute temperature and can be expressed with Stefan-Boltzmann Law as

$$q = \sigma T^4 A$$

where
q = heat transfer per unit time (W)

*σ = 5.6703 10^{-8} (W/m^2K^4) - **The Stefan-Boltzmann Constant***
T = absolute temperature in kelvins (K)
A = area of the emitting body (m^2)

The heat exchange between two Gray surfaces:

is a surface which its properties are independent from wavelength. Therefore, the emissivity of a gray, diffuse surface is the total hemispherical (or simply the total) emissivity of that surface. A gray surface should emit as much as radiation as the real surface it represents at the same temperature

All the surfaces of the enclosure are opaque (τ = 0), diffuse and gray
- Radiative properties such as ρ, ε and α are uniform and independent of direction and frequency
- Irradiation and heat flux leaving each surface are uniform over the surface
- Each surface of the enclosure is isothermal
- The enclosure is filled with a non-participating medium (such as vacuum or air)

Radiative resistances:

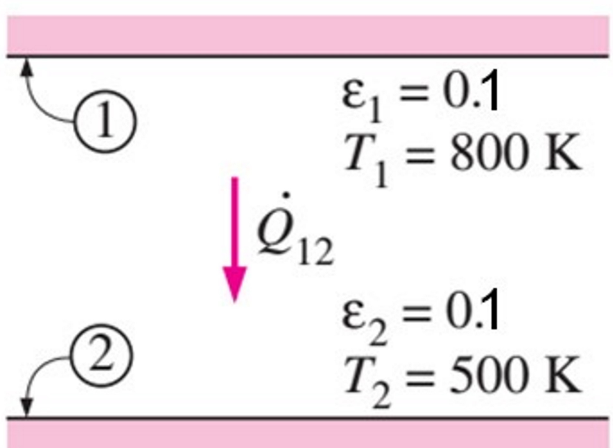
It is the resistance produced by the media to transfer radiation. It is found between the emissive power of the surface i and the radiosity produced by the same surface.used to measure the energy produced by the loss of resistance

Task 2:

Radiative heat exchange between two parallel plates

$A_1 = 1.5\ \mathrm{m}_2$, $F_{12} = 0.01$, $T_1 = 298$ K, $T_2 = 308$ K,
σ = 5,67*10-8 W/m2K 4

$A_1=A_2$ (Two parallel equal sheets)



$$\dot{Q}_{1\,2} = \frac{A \cdot \sigma\,(T_1^4 - T_2^4\,)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1}$$

$$\dot{Q}_{1\,2} = \frac{1 \cdot 5{,}67 \cdot 10^{-8}\,(800^4 K - 500^4 K\,)}{\frac{1}{0{,}1} + \frac{1}{0{,}1} - 1} = 1035{,}81\,W$$

From the previous problem with higher emissivity the radiative heat transfer was higher.

-It is noticed that as the emissivity decreases the radiative heat exchange between the two plates decrease so the emissivity is directly proportional the radiation of heat transfer.