Week5_KKAZAN

5 Kasım 2019 Salı
23:55

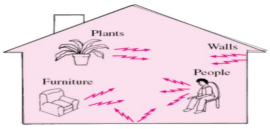
TASK 1:

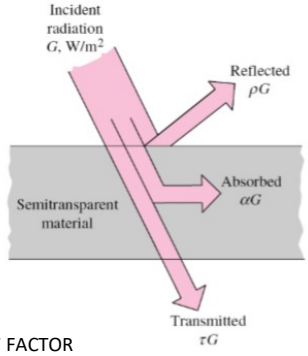
In you own words (which means in your own words) write a summary of the topics about radiative heat transfer we went through including definitions of emissivity, absorptivity and reflectivity, the view factor, the heat exchange betweeen two black surfaces,the heat exchange between the two gray surface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

RADIATIVE HEAT TRANSFER

- *What is the thermal radiation?*

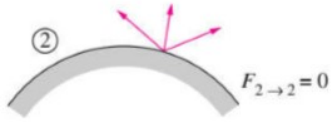
Thermal radiation is the energy emitted in the form of electromagnetic waves by an object having temperature.At temperatures above zero (0 K =- 273 °C) all substances emit thermal radiotıon.Atmosfer is not required for heat transfer by radiation.All materials emit different levels of radiation, emissivatıon, absorption, or reflectivatıon.Everything you see emits thermal radiation.



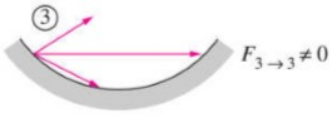


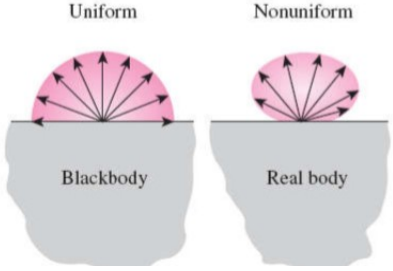
VİEW FACTOR

(a) Plane surface

- 

(b) Convex surface



- 

Emissivity

Emission is the radiation of the surface of a material by radiation.In the words ; the emissivity of the surface of a material refer the impact of the surface in emitting energy as thermal radiation . Emissivity can have a value from 0 (shiny mirror) to 1.0 (blackbody).A true black body would have an ε = 1 while any real object would have ε < 1. when the ratio is close one, emissivity is perfect. when ıt is close zero ,emissivity of object is decrease .

Absorptivity

Absorption is the taking of the heat of another object and keep the heat within itself.A material that absorbs heat can use this energy for their the same time it can emit this heat, at a value between one and 0.

Reflectivity

Reflectivity is an optical property of material. ıt is which describes how heat is reflected from the material in relation to an amount of heat incident on the material. Reflection is the opposite of absorption. Instead of being absorbed, some of the heat energy is bounced, or reflected off in the opposite direction.

View factor

We can explain that view factor is the fraction of the radiation output surface i that intercepted by the surface j. Also ,view factor doesn't based on the surface features.Shape factor, configuration factor, and angle factor are view factor's other names.

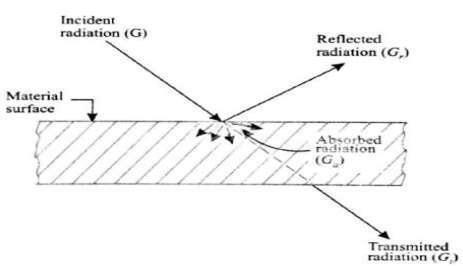
The heat exchange between two black surfaces

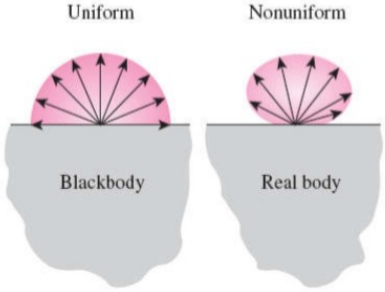
Black surface is an idealized physical body that absorbs all incident electromagnetic radiation. we can say that ıts absorbency value is 1. İt is extraordinary emitter of radiation.It emits the maximum amount of radiation.All objects above absolute zero absorb. If there are two black surface in same place ,occur absolute heat flow in there.

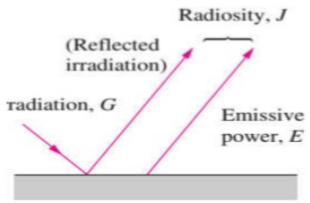
The heat exchange between two grey surfaces

Grey surface emits heat, absorbs, reflects. And we can calculeted with this formula :

$J=\varepsilon Eb+(1-\varepsilon)GJ=\varepsilon Eb+(1-\varepsilon)G$
ε = the emissivity of the object
Eb = the energy emitted from a black body

- 

- 

  - *Real surface*:
    $\varepsilon_\theta \neq$ constant
    $\varepsilon_\lambda \neq$ constant
    Diffuse surface:
    $\varepsilon_\theta =$ constant
    Gray surface:
    $\varepsilon_\lambda =$ constant
    Diffuse, gray surface:
    $\varepsilon = \varepsilon_\lambda = \varepsilon_\theta =$ constant
- 

- *Absorptivity*: $\alpha = \dfrac{\text{Absorbed radiation}}{\text{Incident radiation}} = \dfrac{G_{abs}}{G}, \quad 0 \le \alpha \le 1$
  Reflectivity: $\rho = \dfrac{\text{Reflected radiation}}{\text{Incident radiation}} = \dfrac{G_{ref}}{G}, \quad 0 \le \rho \le 1$
  Transmissivity: $\tau = \dfrac{\text{Transmitted radiation}}{\text{Incident radiation}} = \dfrac{G_{tr}}{G}, \quad 0 \le \tau \le 1$

QUESTION 1:

Find the net heat transfer between two surface ; $A_1 = 1.5\ m^2$, $\varepsilon_1 = 0.2$ $\varepsilon_2 = 0.7$ $T_1 = 298$ K $T_2 = 308$ K and after that , compare
The result when $\varepsilon_1 = \varepsilon_2 = 0.1$?

$\sigma = 5.67 * 10^{-8}$ W/M2k^4

SOLUTION :

For $\varepsilon_1 = 0.2$ $\varepsilon_2 = 0.7$;

$Q_{NET\,1,2} = (A \sigma * (T_1^4 - T_2^4)) / (1/\varepsilon_1 + 1/\varepsilon_2 - 1)$

$= (1.5 * 5.67 * 10^{-8} (298^4 - 308^4)) / (5 + 1{,}4285 - 1)$

$= - 17{,}4379$ W

For $\varepsilon_1 = \varepsilon_2 = 0.1$;

$Q_{NET\,1,2} = (A \sigma * (T_1^4 - T_2^4)) / (1/\varepsilon_1 + 1/\varepsilon_2 - 1)$

$= (1.5 * 5.67 * 10^{-8} (298^4 - 308^4)) / (10 + 10 - 1)$

$= - 4{,}5898$ W