Week 5

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Task 1: Summary of the topics about radiative heat transfer 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

About Emissivity:

Emissivity is the ability to measure the relative strength of an object's surface in the form of radiation. The radiance of an object is equal to the ratio of the energy radiated by the object at a certain temperature to the radiant energy of the black body at the same temperature. The emissivity of the black body is equal to 1, and the emissivity of other objects is between 0 and 1.

About Absorptivity and Reflectivity:

The absorptivity of the surface of the material is its radiant energy in absorption. It is the ratio of absorbed power to incident radiation power.The reflectivity of the surface of a material is the effectiveness of its reflected radiant energy. Reflected on the interface is a portion of the incident electromagnetic power. The reflectance spectrum or spectral reflectance curve is a plot of reflectance versus wavelength.

About the View Factor:

The view factor represents the amount of radiation emitted from one surface and received by another. It's a geometric quantity, independent of the surface properties of the object, and only related to the distance between the two surfaces and the area of the surface.

About the Heat Exchange between Two Black Surfaces:

Each of the black surface could absorb and reflect all the radiation. It is known that the heat emitted from the surface of the first object surface and reaching the surface of the second object is exchanged with the heat known to be emitted from the surface of the second object and reaching the surface of the first object.

About the Heat Exchange between Two Gray Surfaces:

After receiving radiation, the gray body not only absorbs but also reflects. Therefore, the radiation departing from the surface of the gray body is defined as Radiosity J, and it is the sum of the radiation emitted from the surface of the gray body and the reflected radiation. Therefore, the heat transfer Q is the amount of radiation from the surface of the gray body minus the amount of radiation absorbed by the surface of the gray body, namely formula A1(J1-G1). After the transformation, we can get

About the Definition of Radiative Resistances:

It is the thermal resistance of two objects with different temperatures radiating heat to each other.

Task 2 Solve the last example (radiative heat exchange between two parallel plates) awhile considering the two emissivity to be 0.1, what can you conclude from the result?

We already known: A1=1.5m2, 1= 2 =0.1, T1=298K, T2=308K, =5.67\*10-8

Q2-1 =

4.9823W

F2-1 = 0.0526

When F1-2 = 0.01

Q1-2 =

= -0.9466W

Because A1 = A2

So = -

So Q2-1 = -Q1-2 = 0.9466W

We can see from those two situation that emissivity value can greatly affect the radiative heat exchange between two surfaces.