Assignment 5

Question 1

In general, *radiation* is energy that moves from one place to another. Thermal radiation is the electromagnetic radiation that bodies emit at a certain temperature. Conduction and convection require material medium to transfer heat. Radiation is a method of heat transfer that does not depend on any contact between the heat source and the heated object. All objects absorb and emit radiation. When the absorption of energy balances the emission of energy, the temperature of an object stays constant. If the absorption of energy is greater than the emission of energy, the temperature of an object rises. If the absorption of energy is less than the emission of energy, the temperature of an object decreases.

A medium that emits radiation that can be visible is called a light source. The biggest and most important natural light source is the Sun and it represents the primary light source. Electromagnetic radiation that Sun produces is also known as solar radiation. The majority of the solar radiation is light (visible) and other parts include utraviolet and infrared light.

Different bodies produce different amount of radiation. Bodies that emit heat well absorb it as well. One of the best examples is black body -it completely absorbs all the radiation that falls on it. Moreover, it is an ideal body that emits and absorbes radiation.

Emissivity in general is how much radiation is emitted by a certain surface at given temperature in respect with the blackbody at the same temperature.

Emissivity of blackbody is blackbody is $\varepsilon = 1$.

The surface can be diffused and gray. Surface is said to be diffuse when it has the sam directional emissive intesivity at every direction. Gray surface depends on the wavelenght.

Absorptivity is ability of surface to absorb the raditation and *reflectivity* is ability of surface to reflect radiant energy. From Kirchhoff's Law we know that the emissivity of a surface is always equal to its absorptivity.

The view factor represents the amount of emissive power leaving the surface 1 that is recieved by surface 2, and it does not depend on the surface properties. Surfaces and view factor are related to each other in repect of the area.

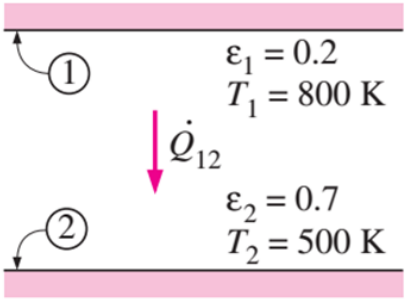
Exchange between to black surfaces is radiation leaving the surface 1 to 2 is deducted by radiation leavong surface 2 to 1.

Exchange between gray surfaces

Radiocity$_i$ (everything leaving the surface i) is equal to radiation emitted by the surface i + radiation reflected by surface i. Net radiation of heat trasfer of gray surfaces is all radiation leaving surface i substracted by incident radiation on surface i.

Question 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?



ε_1=0.1

ε_2=0.1

σ=5.670*10^{-8}W/m^{2}K^4

From first example when the ϵ_1=0.2 and ϵ_2=0.7;

$$\dot{Q}_{12} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} = A * 5.67 * 10^{-8} * \frac{800^4 - 500^4}{\frac{1}{0.2} + \frac{1}{0.7} - 1} = A * 3624.68\ W$$

When the ε_1=ε_2=0.1;

$$\dot{Q}_{12} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} = A * 5.67 * 10^{-8} * \frac{800^4 - 500^4}{\frac{1}{0.1} + \frac{1}{0.1} - 1} = A * 1035.72\ W$$