WEEK ASSIGNMENT 5

QUESTIONS:

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

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?

ANSWERS:

1. Radiation is emission or transmission of energy in the form of waves or particles through space or a material medium.

Energy transfer by radiation occurs at the speed of light and radiation can occur between two bodies separated by a medium colder than both bodies. Thermal radiation is electromagnetic radiation generated by the thermal motion of particles in matter.

Thermal energy is emitted in all the space where the temperature is above 0.

Emissivity- ratio of the radiation emitted by the surface at the one defined temperature to the radiation which is emitted from the black body at the exact same temperature.

Absorptivity- the ability of the material to absorb thermal radiation.

Reflectivity- the ability of the material to reflect thermal radiation.

View factor- is proportion of radiation which leaves surface A and is received by surface B. It is not dependent on the surface properties.

Heat exchange between the two black surfaces- is radiation leaving from surface A to surface B which is subtracted by radiation leaving from surface B to surface A.

Heat exchange between two grey surfaces- two grey surfaces will absorb and reflect a certain fraction of radiation.

Radiative resistance- energy spent by loss resistance and converted to heat radiation and energy lost by radiation resistance is converted to electromagnetic waves.

2.

When the ϵ_1=0.2 and ϵ_2=0.7;

$$R_{total} = \frac{1}{0.2} + \frac{1}{0.7} - 1 = 5.43$$

$$\dot{Q}_{12} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} = A * 5.67 * 10^{-8} * \frac{800^4 - 500^4}{\frac{1}{0.2} + \frac{1}{0.7} - 1} = A * 3624.68\ W$$

When the ϵ_1=ϵ_2=0.1;

$$R'_{total} = \frac{1}{0.1} + \frac{1}{0.1} - 1 = 19$$

$$\dot{Q}'_{12} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon'_1} + \frac{1}{\epsilon'_2} - 1} = A * 5.67 * 10^{-8} * \frac{800^4 - 500^4}{\frac{1}{0.1} + \frac{1}{0.1} - 1} = A * 1035.72\ W$$

When the emissivity is lower, the heat transfer is lower as well.