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 the 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**

Radiative heat transfer is a way for objects to transfer heat through electromagnetic waves. Unlike convection and conduction, radiation does not need to propagate through the medium. Radiation can spread in vacuum, solids, liquids as well as gases. As long as the temperature is greater than zero, the object will emit heat radiation to the surrounding area continuously. The propagation of a wave in that medium is related to its wavelength (λ) and frequency (υ). The formula is like: $C=\lambda\upsilon$. The energy each photon of frequency is considered to have an energy of $e=h\upsilon=hc/\lambda$.

- **Emissivity**

Emissivity (ε) is a measure of how closely a surface approximates a blackbody. It this the ratio of the radiation emitted by the surface at a given temperature to the radiation emitted by a blackbody at the same temperature and its value varies from 0 to 1. For the blackbody, the emissivity (ε) equals to 1.

The emissivity of a surface at a specified wavelength is called ε_λ. The emissivity of a surface at a specified direction is called ε_θ. A diffuse surface is a reflective surface whose properties are independent of direction. A gray surface is a reflective surface whose properties are independent of wavelength.

- **Absorptivity**

The absorptivity is the ratio of the thermal radiation absorbed by the object to the incident radiation. The value is from 0 to 1. For black body, the $\alpha=1$.

- **Reflectivity**

Reflection is divided into specular and diffuse reflection, related to the roughness of the surface. For gases without particles, the reflectivity is almost zero. It can be seen that the gas with a large absorptivity has a small transmissivity.

- **The view factor**

The view factor,$\mathbf{F_{ij}}$, is the percentage of the radiant energy emitted by surface i falling onto surface j.

- **The heat exchange betweeen two black surfaces**

Radiation energy emitted from surface 1 and projected directly onto surface 2.

$$\dot{Q}_{1\rightarrow 2}=A_1E_{b1}F_1$$

Also radiation energy emitted from surface 2 and projected directly onto surface 1.

$$\dot{Q}_{2\to1} = A_2 E_{b2} F_{2\to1}$$

Because both surfaces are black, the radiation on their surface will be absorbed by each surface. The amount of direct radiation heat exchange between two black surfaces is:

$$\dot{Q}_{1\to2} = A_1 E_{b1} F_{1\to2} - A_2 E_{b2} F_{2\to1}$$

- **The heat exchange between the two gray surface**

The ratio of the radiant intensity of all wavelengths of the gray body to the corresponding wavelength of the black body at any temperature remains unchanged. We use irradiation G and radiosity J to calculate the Q between two gray surfaces.

$$J_i = \varepsilon_i E_{bi} + \rho_i G_i = \varepsilon_i E_{bi} + (1-\varepsilon_i) G_i$$

$$Q_i = A_i(J_i - G_i) \Rightarrow Q_i = A_i\left(J_i - \frac{J_i - \varepsilon_i E_{bi}}{1-\varepsilon_i}\right) = \frac{A_i \varepsilon_i}{1-\varepsilon_i}\left(E_{bi} - J_i\right)$$

- **Radiative resistances**

The radiative resistance is generally to value the energy that release from resistance which converted to heat radiation. The radiative resistance from one surface to another surface is related to the view factor between the two surfaces.

$$R_{i\to j} = \frac{1}{A_i F_{i\to j}}$$

Task 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?

$$\dot{Q}_{12} = \frac{A\sigma\,(T_1^4 - T_2^4)}{\frac{1}{\varepsilon_1}+\frac{1}{\varepsilon_2}-1} = \frac{A\times5.67\times10^{-8}\times(800^4-500^4)}{\frac{1}{0.2}+\frac{1}{0.7}-1} \approx 3625.3491A\ (W)$$

While considering the two emissivities to be 0.1, what can you conclude from the result?

$$\dot{Q}_{12} = \frac{A\sigma\,(T_1^4 - T_2^4)}{\frac{1}{\varepsilon_1}+\frac{1}{\varepsilon_2}-1} = \frac{A\times5.67\times10^{-8}\times(800^4-500^4)}{\frac{1}{0.1}+\frac{1}{0.1}-1} \approx 1035.8195A\ (W)$$

Comparing the two results, it is possible to say that the radiative heat exchange between two surfaces is lower while the emissivities of the two surfaces are lower.