New Problems Chapter 17

17.1-6. ***Increase in amount of heat transfer from a radiative body.*** How much more heat is transfer from a $1 m^2$ blackbody at 2000 K verses one that is at 1600 K.

17.1-7. ***Radiation and Convection:*** A horizontal cast iron, 6m long, 1in schedule 80 pipe has a surface temperature of 500K, calculate the heat loss (W and BTU/S) due to radiation to the atmosphere which is at 273K? Assume $\varepsilon = 0.65$ for cast iron.

17.2-13. ***Radiation and Heating of Planes:*** Two plane black rectangular surfaces (both 10m x 10m), are parallel to each other with a spacing of 3m. The two surfaces are maintained at T_1 =1200K and T_2 = 600K respectively.

a) Determine the net radiation between the two surfaces if they are infinite black planes and separated by a vacuum/empty space.

b) Determine the net radiation between the two surfaces if they are infinite grey planes where $\varepsilon_1 = 0.7$ & $\varepsilon_2 = 0.6$.

c) Determine the net radiation between the two surfaces if they are black planes (not infinite) using the following equations to calculate the view factor:

$$\bar{X} = X / L; \ \bar{Y} = Y / L$$

$$a = \sqrt{\frac{\left(1+\bar{X}^2\right)\left(1+\bar{Y}^2\right)}{1+\bar{X}^2+\bar{Y}^2}}$$

$$b = \bar{X}\sqrt{\left(1+\bar{Y}^2\right)} \cdot \arctan\left(\frac{\bar{X}}{\sqrt{\left(1+\bar{Y}^2\right)}}\right)$$

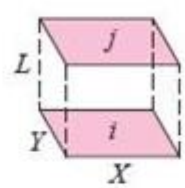
$$c = \bar{Y}\sqrt{\left(1+\bar{X}^2\right)} \cdot \arctan\left(\frac{\bar{Y}}{\sqrt{\left(1+\bar{X}^2\right)}}\right)$$

$$d = \bar{X} \arctan\left(\bar{X}\right)$$

$$e = \bar{Y} \arctan\left(\bar{Y}\right)$$

$$F_{i,j} = \frac{2}{\pi \bar{X}\bar{Y}}\left(\ln\left(a\right) + b + c - d - e\right)$$

Aligned parallel rectangles



17.2-14. ***Radiation between a double pipe heat exchanger:*** A fluid flows in a 30mm diameter, 1 m long tube with an outer surface temperature of 265K and an emissivity of 0.4. A larger tube having a diameter of 50mm, surrounds the smaller tube and has a emissivity of 0.6, with a surface temperature of 500K. The annulus of the pipe is held at a vacuum to prevent convection from occurring. What is the heat gain by the inside pipe? Assume $\bar{F}_{12} \approx 1$ and use equation 17.2-45.