Week6-Zhou Yuhan

1 Considering the same example you solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with epsilon = 0.1 should you add in order to have the new heat transfer rate to be 1% of the case without shields ?

$$q_{net_{1-2}} = \frac{\dot{Q}net_{1-2}}{A} = \frac{A\sigma(T_2^4 - T_1^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} / A = \frac{\sigma(T_2^4 - T_1^4)}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1}$$

$$= \frac{(5.67 * 10^{-8}) * (800^4 - 500^4)}{\frac{1}{0.1} + \frac{1}{0.1} - 1} \approx 1036 \frac{W}{m^2}$$

$$q_{net_{1-2,\ shields}} = \frac{\dot{Q}net_{1-2}}{A} = \frac{A\sigma(T_2^4 - T_1^4)}{(n+1)\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} / A = \frac{\sigma(T_2^4 - T_1^4)}{(n+1)\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1}$$

$$if \frac{\sigma(T_2^4 - T_1^4)}{(n+1)\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1} = \frac{\sigma(T_2^4 - T_1^4)}{(100)\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1}$$

$$n = 99$$

So 99 shields with epsilon = 0.1 should we add in order to have the new heat transfer rate to be 1% of the case without shields