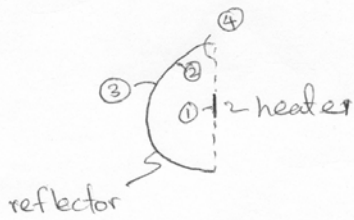


Recitation Problem

10/19/04



$$d) \quad F_{21} + F_{22} + \cancel{F_{23}} + F_{24} = 1$$

$$\cancel{F_{11}} + F_{12} + \cancel{F_{13}} + \cancel{F_{14}} = 1$$

$$F_{12} = 1$$

$$A_1 F_{12} = A_2 F_{21}$$

$$F_{21} = \frac{A_1}{A_2} = \frac{0.02}{\pi(0.15)/2} = 0.085$$

$$\cancel{F_{41}} + F_{42} + \cancel{F_{43}} + \cancel{F_{44}} = 1$$

$$F_{42} = 1$$

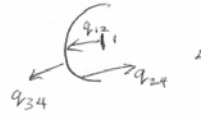
$$A_4 F_{42} = A_2 F_{24}$$

$$F_{24} = \frac{A_4}{A_2} = \frac{(0.15 - 0.02)}{\pi(0.15)/2} = \boxed{0.552 = F_{24}}$$

$$0.085 + F_{22} + 0.552 = 1$$

$$\boxed{F_{22} = 0.363}$$

b) EB on reflector:



$$E_{in} - E_{out} = 0$$

$$\sigma A_1 F_{12} (T_1^4 - T_2^4) - \sigma A_2 F_{24} (T_2^4 - T_4^4) - \sigma A_3 F_{34} (T_3^4 - T_4^4) = 0$$

$$= A_2 F_{21}$$

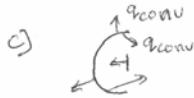
$$A_2 = A_3$$

$$T_2 = T_3$$

$$F_{21} (T_1^4 - T_2^4) - F_{24} (T_2^4 - T_4^4) - F_{34} (T_2^4 - T_4^4) = 0$$

$$0.085 (1373^4 - T_2^4) - 0.552 (T_2^4 - 293^4) - 1 (T_2^4 - 293^4) = 0$$

$$T_2 = 661 \text{ K}$$



$$\sigma A_2 F_{21} (T_1^4 - T_2^4) - \sigma A_2 F_{24} (T_2^4 - T_4^4) - \sigma A_3 F_{34} (T_3^4 - T_4^4) - 2 h A_2 (T_2 - T_A) = 0$$

$$\sigma = 5.67 \times 10^{-8}$$

$$A_2 = \pi (0.075)^2 = A_3$$

$$h = 15 \text{ W/m}^2\text{K}$$

$$F_{21} = 0.085$$

$$F_{24} = 0.552$$

$$F_{34} = 1$$

$$T_A = 293 \text{ K}$$

$$T_1 = 1373 \text{ K}$$

solve for $T_2 (= T_3)$

$$T_2 = 566 \text{ K}$$