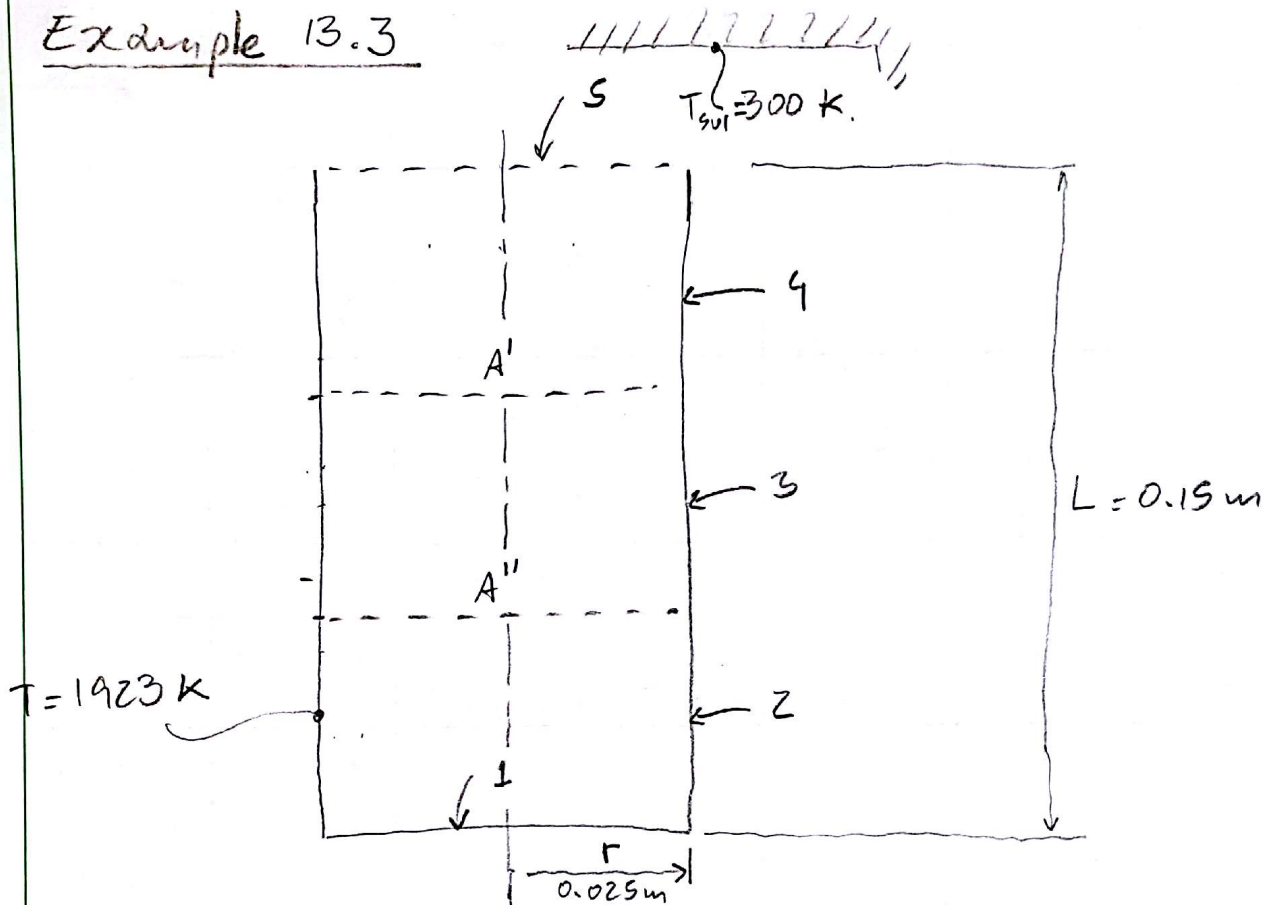


Example 13.3



FIND: q for each section

- heat is exchanged only w/ places of $\neq T$.

$$q_1 = A_1 F_{1S} \sigma (T_1^4 - T_{sur}^4)$$

$$q_2 = A_2 F_{2S} \sigma (T_1^4 - T_{sur}^4) = A_5 F_{S2} \sigma (T_1^4 - T_{sur}^4)$$

surface 1

$$A_1 = \pi r^2 = \pi \times 0.025^2 = 1.96 \times 10^{-3} \text{ m}^2$$

F_{1S} : - Table 13.2 for disks

$$F_{1S} = \frac{1}{2} \left\{ S - [S^2 - 4]^{1/2} \right\} = 0.0263$$

$$S = 1 + \frac{1 + R_j^2}{R_i^2} = 3.8$$

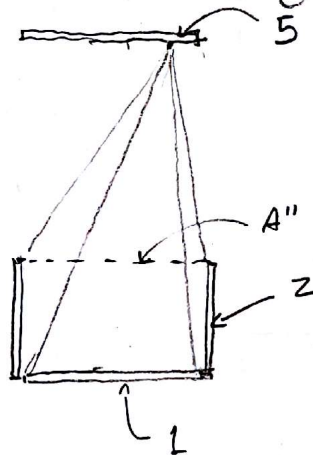
$$R_i = R_j = r/L = \frac{0.025}{0.15} = 0.167$$

$$q_1 = 1.96 \times 10^{-3} \text{ W/m}^2 \times 0.0263 \times 5.67 \times 10^{-8} \frac{\text{W}}{\text{m}^2 \text{K}^4} (1923^4 - 300^4)$$

$$q_1 = 39.9 \text{ W}$$

Surface 2

Instead of considering $2 \rightarrow S$, let's consider $S \rightarrow 2$



$$F_{SA''} = F_{S2} + F_{S1} \quad (\text{VIRTUAL SURFACE})$$

$$F_{S2} = F_{SA''} - F_{S1}$$

$$F_{SA''} : \text{Table 13.2.}$$

$$F_{S2} = \frac{1}{2} \left\{ S - [S^2 - 4]^{1/2} \right\} = 0.0557$$

$$S = 1 + \frac{1 + R^2}{R^2} = 18$$

$$R = \frac{1/2 L}{3L} = \frac{0.025}{0.10} = 0.25$$

$$F_{S1} = \frac{A_1 F_{1S}}{A_S} = F_{1S} = 0.0263$$

$$F_{S2} = 0.0294$$

$$q_2 = A_S F_{S2} (T_s^4 - T_{sw}^4)$$

$$= 1.96 \times 10^{-3} \text{ W/m}^2 \times 0.0294 \times 5.67 \times 10^{-8} \frac{\text{W}}{\text{m}^2 \text{K}^4} (1923^4 - 300^4)$$

$$q_2 = 44.7 \text{ W}$$