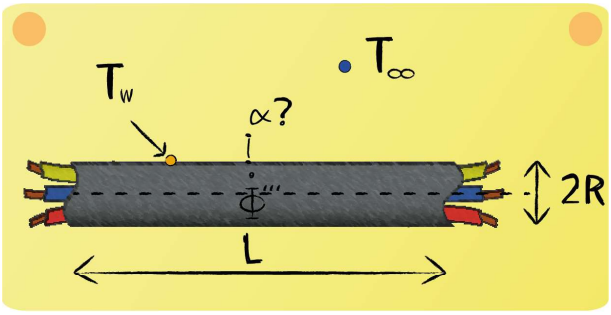
Lecture 8 - Question 7



A constant energy flux is passing a wire with an homogeneous surface temperature. Due to the voltage drop, heat is being generated at a constant rate $\dot{\Phi}'''$. Provide the governing energy balance to determine the heat transfer coefficient.

Energy balance:

$$\dot{\Phi} - \sum \dot{Q}_{out} = 0$$

Since the type of heat transfer is steady-state, the sum of the in- and outgoing heat fluxes of the control volume should equal zero.

Heat fluxes:

$$\dot{\Phi} = \dot{\Phi}''' \cdot \pi \cdot R^2 \cdot L$$

$$\sum \dot{Q}_{out} = \alpha \cdot 2\,\pi \cdot R \cdot L\,(T_w - T_\infty)$$