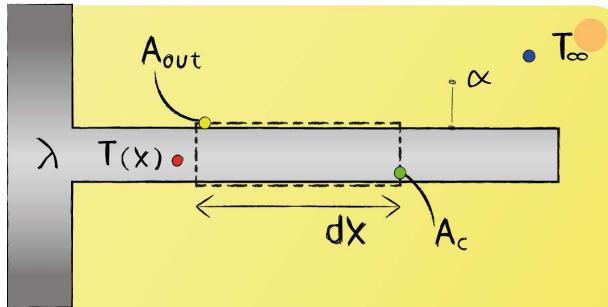


Lecture 9 - Question 7



Give the energy balance and describe the heat fluxes. Assume one-dimensional steady-state heat transfer.

Energy balance:

$$\dot{Q}_{cond}(x) - \dot{Q}_{cond}(x + dx) - \dot{Q}_{conv}(x) = 0$$

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

Heat fluxes:

$$\dot{Q}_{cond}(x) = -\lambda \cdot A_c \cdot \frac{\partial T}{\partial x}$$

$$\dot{Q}_{cond}(x + dx) = -\lambda \cdot A_c \cdot \frac{\partial T}{\partial x} + \frac{\partial \dot{Q}}{\partial x} \cdot dx$$

$$\dot{Q}_{conv}(x) = \alpha \cdot A_{out} (T(x) - T_\infty)$$



The heat entering the system is transferred from the base by conductive heat transfer. This heat flux is distributed over a convective and conductive heat flux. $\dot{Q}_{cond}(x + dx)$ can be approximated by use of the Taylor series expansion.

