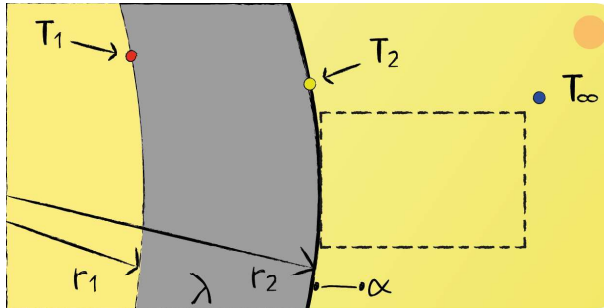# Lecture 8 - Question 5

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

Energy balance:

$$\dot{Q}_{cond} - \dot{Q}_{conv} = 0$$

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

Heat fluxes:

$$\dot{Q}_{cond} = -\lambda 2\pi r L \frac{dT(r)}{dr} = -\lambda 2\pi L \left(T_2 - T_1\right) \frac{1}{ln\frac{r_2}{r_1}}$$

$$\dot{Q}_{conv} = \alpha A \left(T_2 - T_\infty\right)$$

The heat flux entering the control volume has first been conducted through the plate and will then be transferred by convection. For that reason the ingoing heat flux can be described as $\dot{Q}_{in} = \dot{Q}_{cond}$. One should note that for describing conductive heat transfer, the cylindrical coordinate system has to be chosen. The outgoing heat flux can be described as: $\dot{Q}_{out} = \dot{Q}_{conv}$