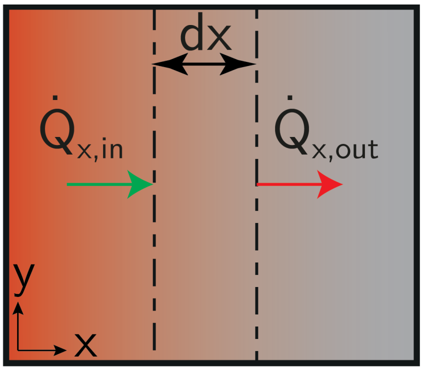
# EB - Cond. - IE 8

**Set up the energy balance for a one-dimensional steady-state heat transfer through the wall subjected to convection $\alpha$ on the right-hand side with the cross-sectional area $A$ and give the corresponding boundary conditions. There is no heat sink or source in the wall.**




**Energy balance:**

$$\dot{Q}_{x,in} - \dot{Q}_{x,out} = 0$$

The sum of the in- and outgoing heat fluxes of the control volume should equal zero, because of steady-state conditions.

**Heat fluxes:**

$$\dot{Q}_{x,in} = -\lambda A \frac{\partial T}{\partial x}$$

$$\dot{Q}_{x,out} = -\lambda A \frac{\partial T}{\partial x} + \frac{\partial \dot{Q}_{x,in}}{\partial x} dx$$

The heat flux entering the control volume can be described by use of Fourier's law. The outgoing heat flux can be approximated by use of the Taylor series expansion.

**Boundary conditions:**

$$T(x=0) = T_1$$

$$\frac{\partial T(x=L)}{\partial x} = -\frac{\alpha}{\lambda}\left(T(x=L) - T_\infty\right)$$

The first boundary condition describes that the temperature on the left side equals $T_1$. The second boundary conditions results from the fact that $\dot{Q}_{x=L} = -\lambda A \frac{\partial T(x=L)}{\partial x} = \alpha A \left(T(x=L) - T_\infty\right)$.