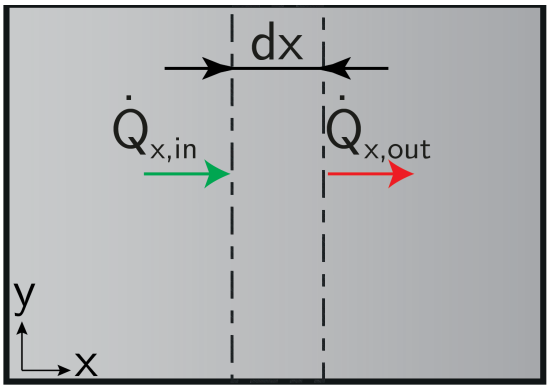
EB - Cond. - IE 3

Develop an energy balance to calculate the temperature profile inside the wall and give the boundary conditions. Assume one-dimensional steady-state heat transfer in x-direction.



Energy Balance:

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

The sum of the in- and outgoing fluxes 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 ingoing flux can be described by use of Fourier's law. The outgoing flux can be approximated by use of the Taylor series expansion.

Boundary conditions:

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

$$T(x = L) = T_2$$

The boundary conditions above describe that the temperature of the wall equals T_1 on the left side and T_2 on the right side, as can be seen in the sketched situation.