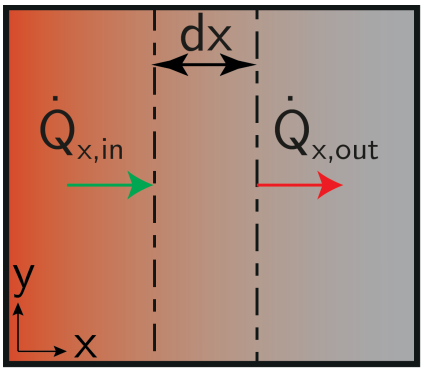
EB - Cond. - IE 6

Set up the energy balance for a one-dimensional steady-state heat transfer through the wall under constant heat flux $\dot{q}''$ on the left-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:

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

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 in- and outgoing flux should equal each other. The ingoing flux can be described by use of Fourier's law and the outgoing flux can be described by use of the Taylor series expansion.

Boundary conditions:

$$\frac{\partial T(x=0)}{\partial x} = -\frac{\dot{q}''}{\lambda}$$

$$T(x = L) = T_1$$

The first boundary condition results from the fact that $\dot{Q}_{x=0} = -\lambda A \frac{\partial T(x=0)}{\partial x} = \dot{q}'' A$, the second boundary condition results from the fact that the temperature equals T_1 on the right side of the wall.