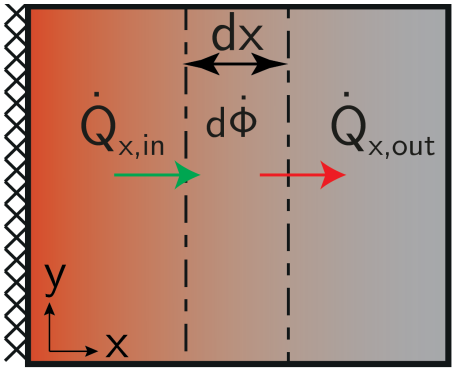
Boundary Conditions - Cond. - IE 15

A wall, which is adiabatic on the left-hand side with a cross-sectional area A has a source $\dot{\Phi}'''$ in inside. Give the appropriate boundary conditions to solve the governing energy balance for one-dimensional steady-state heat transfer through the wall.



Given the differential equation:

$$0 = \lambda \frac{\partial^2 T}{\partial x^2} + \dot{\Phi}'''$$

In order to solve the differential equation, two boundary conditions are required. This can be seen from the fact that the variable T has been differentiated twice with respect to x.

Boundary conditions:

$$\frac{\partial T(x=0)}{\partial x} = 0$$

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

The first boundary condition describes that the temperature gradient on the left should be zero. This is due to the fact that heat transfer to the environment on the left side is zero, because of the insulation, in equation form: $\dot{Q} = -\lambda A \frac{dT}{dx}|_{x=0} = 0$.

The second describes that the temperature of the wall equals T_1 on the right side.