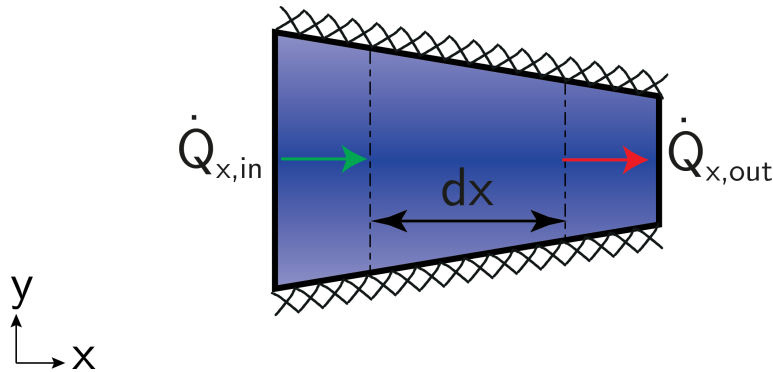# EB - Cond. - IE 4

Specify the energy balance and the appropriate boundary conditions to obtain the temperature profile in the cone shown below.

Energy Balance:

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

Heat Fluxes:

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

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

The in and outgoing flux should equal each other and are characterized by conductive heat transfer. The outgoing flux can be approximated by use of the Taylor series expansion. It should be noted that the cross sectional area is not constant along axial direction.

Boundary conditions:

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

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

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