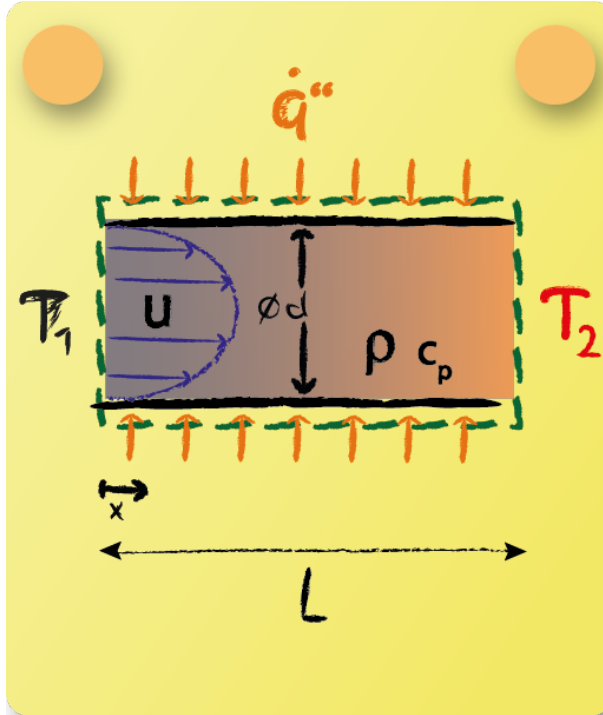


Energy Balance: Task 12



Choose a differential equation for temperature profile in x -direction.

1



A differential equation for the axial temperature profile is obtained by setting up an energy balance for an infinitesimal slice of pipe in x -direction. Ingoing energy fluxes are water $\dot{m}c_p T$ and heating at the pipes surface $\dot{q}'' 2\pi r dx$. Outgoing flux is represented by water leaving the control volume with increased temperature: $\dot{m}c_p(T + \frac{\partial T}{\partial x})$. Expressing the mass flows as velocity, cross section area and density as well as canceling out recurring terms one is left with an equation for the axial temperature gradient:

$$0 = \frac{\partial T}{\partial x} - \frac{4\dot{q}''}{du \rho c_p}$$