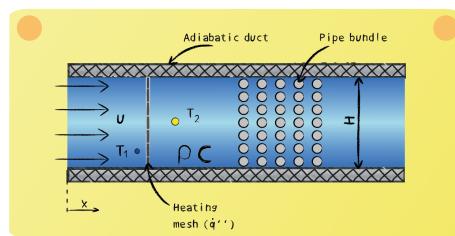


Energy Balance - Convection - Body 3

Water flows through a rectangular duct (height H , width W) with a velocity u and inlet temperature T_1 . The water is heated with a wire mesh (heating power per surface \dot{q}''), located at the beginning of the duct. Behind the mesh a heat exchanger in a pipe bundle configuration is mounted perpendicularly to the flow. Provide the energy balance to determine the water temperature T_2 directly after the wire mesh.



Energy balance:

$$\dot{H}_1 - \dot{H}_2 + \dot{Q}_{\text{mesh}} = 0$$

Energy fluxes:

$$\dot{H}_1 = \dot{m} \cdot c \cdot T_1$$

$$\dot{H}_2 = \dot{m} \cdot c \cdot T_2$$

$$\dot{Q}_{\text{mesh}} = H \cdot W \cdot \dot{q}''$$

Mass flow rate:

$$\dot{m} = u \cdot H \cdot W \cdot \rho$$