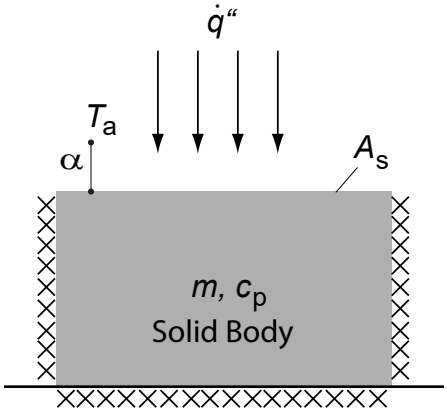
Transient body

A solid body is exposed to a perpendicular flux $\dot{q}''$. The side walls and bottom are adiabatic. The convective heat transfer to the surroundings is described by the heat transfer coefficient α. Compile a differential equation for the temporal variation of the body temperature T_{sb}.



- Heat transfer surface A_{s}
- Absolute heat capacity, $c_{\mathrm{p}} \cdot m$
- Ambient temperature, T_{a}

Hints

- The temperature inside the body is homogeneous at all times.
- Radiation can be neglected.

Cooling of a copper rod

A long copper rod is initially at a uniform temperature T_0. It is now exposed to an air stream at T_∞ with a heat transfer coefficient α. How long will it take for the copper rod to cool to an average temperature of 25 °C?

Hints

- Heat radiation can be neglected.

Given parameter

- Diameter of the copper rod: $d = 2$ cm
- Initial temperature: $T_0 = 100$ °C
- Air stream temperature: $T_\infty = 20$ °C
- Heat transfer coefficient: $\alpha = 200$ W/m^{2}K