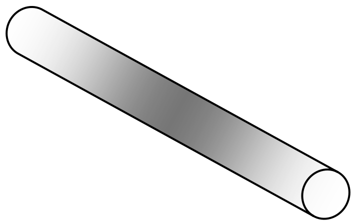
Example

A long cylinder of cross section A is insulated along its outer diameter and is subject to a uniform internal heat generation per unit volume of $\dot{e}_{gen}$. Assuming constant conductivity k and specific heat c, find a differential equation describing the temperature distribution as a function of length and time.



Example

The temperature distribution in a wall 1m thick at a certain instant of time is given as

$$T(x) = a + bx + cx^2$$

where T is in °C and x is in m. The constants are a = 900°C, b = -300°C/m and c = - 50°C/m^2. A uniform heat generation $\dot{e}_{gen}$ = 1000 W/m^3 exists in the wall. The wall area is 10 m^2 and has the following properties: ρ = 1600 kg/m^3, k = 40 W/m-K and c_p = 4 kJ/kg-K. Determine:

1. the rate of heat transfer entering the wall and leaving the wall. (x=0 and 1 m, respectively),

2. the rate of change of energy storage in the wall, and

3. the time rate of temperature change at x = 0 and 0.25 m.