

Assignment 14. Shooting method and PDE

Marks 10

Posted on 29.10.2025 @ 2:30 pm and due on 29.10.2025 @ 6:00 pm

1. Equation for heat conduction in a thin, un-insulated rod of length $L = 10$ m is

$$\frac{d^2T}{dx^2} + \alpha(T_a - T) = 0$$

where the heat transfer coefficient $\alpha = 0.01 \text{ m}^{-2}$ parameterizes heat dissipated to the surrounding air and $T_a = 20^\circ\text{C}$ is the ambient temperature. If $T(x = 0) = 40^\circ\text{C}$ and $T(x = L) = 200^\circ\text{C}$, solve the boundary value problem using *Shooting Method* with *RK4* integrator and determine at what x the temperature is $T = 100^\circ\text{C}$.

2. Solve the 1-dimensional heat equation $u_{xx} = u_t$ over a conducting bar, of length 2 units, kept at 0°C but is heated to 300°C at its center at time $t = 0$. Choose your Δx and Δt with care such that $\Delta t/(\Delta x)^2 \ll 0.5$.