2D Heat Conduction Equation solution using PINNs

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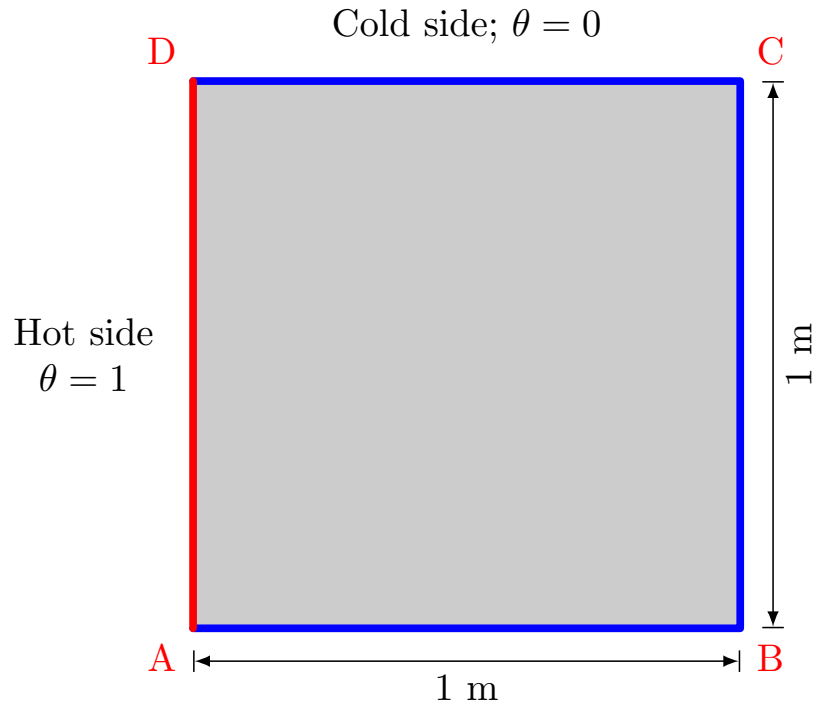
Problem Definition

2D square plate of side 1 m with one hot side and other 3 cold sides



Present work is to compute the temperature field within plate domain using PINNs with different variations in methodology.

Governing equation and Analytical solution

the governing two-dimensional temperature distribution becomes

$$\frac{\partial^2 \theta}{\partial x^2} + \frac{\partial^2 \theta}{\partial y^2} = 0$$

with the boundary conditions

$$\theta(0, y) = 1$$
$$\theta(x, 0) = 0$$
$$\theta(L, y) = 0$$
$$\theta(x, H) = 0$$

Use of the separation of variables method gives the solution for θ as

$$\theta = \frac{4}{\pi} \sum_{n=0}^{\infty} \frac{\sinh\left[(2n+1)\pi(L-x)/H\right]}{\sinh\left[(2n+1)\pi L/H\right]} \frac{\sin\left[(2n+1)\pi y/H\right]}{2n+1}$$

Network Schematic