→ Role of boundary condition in solving partial differential equations : →

Boundary conditions : → Partial differential equations are those who contain one or more partial derivatives and are connected with at least two independent variables. The order of a partial differential equation is the order of its highest derivatives appearing in the equation. A partial differential equation involves two or more independent variables say x and y such as

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

Then conditions which enable us to find the values of n arbitrary constants in a n-parameter family of solutions if given in terms of one value of the independent variable are called Initial or Boundary conditions.

Thus, we see that the boundary conditions enable us in solving a particular partial differential equation by imposing some limits to it. For example, let us consider a thin plate bounded by the lines $x = 0$, $x = l$, $y = 0$ and $y = \infty$.

The two-dimensional Lapace's differential equation in this case is $\nabla^2 \psi = \frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} = 0$

For its solution, the boundary conditions imposed are $\psi = 0$ for $x = 0$, $\psi = 0$ for $x = l$, $\psi = 0$ for $y = \infty$ and $\psi = f(x)$ for $y = 0$.

Different boundary conditions are imposed in solving different types of partial differential equations.

→ Solution of one-dimensional wave equation : →

The study of vibration of stretched string is the problem of one-dimensional wave equation given by