

Poisson's Equation

Poisson's equation is a second order partial differential equation¹ of potential theory. It is most often written as

$$\nabla^2 \varphi = f,$$

where ∇^2 is the Laplace operator². Poisson's equation is a generalisation of Laplace's equation and when $f = 0$ Poisson's equation is the same as Laplace's equation. Although the Poisson equation can be theoretically of any number of dimensions, in applied mathematics, it is of interest mainly in three dimensions or two dimensions.

In two dimensions the Laplace equation has the we have:

$$\frac{\partial^2 \varphi}{\partial x^2} + \frac{\partial^2 \varphi}{\partial y^2} = f,$$

and in three dimension,

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

Laplace's equation on its own has many solutions

¹ [Partial Differential Equations](#)

² [Laplace Operator or Laplacian](#)