THE CAUCHY PROBLEM FOR 3D POISSON EQUATION USING FINITE DIFFERENCE METHOD

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In this paper, the Finite difference method (FDM) is proposed to solve the ill-posed Cauchy problem for the three dimensional Poisson's equation with the data given on a part of the boundary (continuation problem) with Dirichlet and Neumann boundary conditions in a cube. Numerical analysis of partial differential equations is necessary to understand in order to model these complex problems. The idea of Finite difference method is to discretize the PDE by replacing the partial derivatives with their approximations, that is finite differences [2]. Poisson's equation can be approximated with a finite difference approximation. This approximation will be used to establish a system of linear algebraic equations that gives solutions at the internal points of the domain.

A computer program was developed to solve this system by utilising the Matlab software and using the inputs such as boundary conditions and a non-homogenous source function. In order to get the approximations closer to the actual solution, the program was checked with an increasing number of subintervals. The effectiveness of this method is tested for some Poisson's equation with known analytical solutions and the derived numerical results show that the method produces accurate results. In the real-world systems, the numerical methods can be used to provide precise results.

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