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

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In this paper, we will introduce an Explicit Finite difference method to solve the ill-posed Cauchy problem for the three-dimensional Parabolic equation with the data given on a part of the boundary (continuation problem). These problems are defined by the combination of space and time. The Parabolic PDEs are used to describe a wide variety of time-dependent phenomena including heat conduction, particle diffusion etc. Explicit methods can be used to calculate the state of the system at a later time frame from the state of the system at the current time frame. Finite difference method is one of the numerical methods that is used to compute the solutions of Parabolic PDEs by discretizing the given domain into finite number of regions and consequent reduction of a given PDEs into a system of linear algebraic equations.

A MATLAB code is developed to implement the numerical method in a unit cube by considering Jacobi, Gauss-Seidel and SOR(w_{opt}) iterative methods used to solve the linear system. An example is provided to prove the consistency and stability of the proposed method and we compare the analytical solution and numerical solution for different time phenomena. The findings of this study concluded that the SOR(w_{opt}) iterative method is superior in terms of less number of iterations and less execution time when compared with the other two iterative methods.

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