

A Survey of Finite Difference Methods for Fractional Diffusion Equation

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This presentation will review the proposed numerical finite difference approximation methods for solving fractional diffusion (superdiffusion) equations in one or two spatial dimensions.

The consistency and stability, and therefore convergence of the explicit and implicit methods will be discussed.

The analysis of the finite difference treatment for the fractional PDEs does not always parallel those for the classical PDEs in many aspects. For example, the complexity introduced by the fractional derivative renders some analytic methods, such as von Neumann Fourier eigenfunctions stability analysis methods, elusive.

Methods to improve the low order convergence rate of the numerical solutions obtained from the finite difference Grunwald estimates, the computational complexity, treatment of boundary conditions and some implementation details will be presented.