

The Innovation Iterative Method and its Stability in Time-Fractional Diffusion Equations

ABSTRACT

In this research, we deal with the innovation or application iterative methods of an unconditionally implicit finite difference approximation equation and the one-dimensional, linear time fractional diffusion equations (TFDEs) via Caputo's time fractional derivative. Based on this implicit approximation equation, the corresponding linear system can be generated, in which its coefficient matrix is large scale and sparse. To speed up the convergence rate in solving the linear system iteratively, we construct the corresponding preconditioned linear system. Then we formulate and implement the Preconditioned Gauss-Seidel (PGS) iterative method for solving the generated linear system. Two examples of the problem are presented to illustrate the effectiveness of the PGS method. The two numerical results of this study show that the proposed iterative method is superior to the basic GS iterative method.