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The Chebyshev collocation method for a class of time fractional convection-diffusion equation with variable coefficients. (English) Zbl 07382906

Summary: In this paper, an efficient and accurate computational scheme based on the Chebyshev collocation method and finite difference approximation is proposed to solve the time-fractional convection-diffusion equation (TFCDE) on a finite domain. The time fractional-order derivative $\mu \in (0,1]$ is considered in the Caputo sense. The finite-difference approximation is used in time direction while the Chebyshev collocation method is used in space direction to reduce the TFCDE into a system of algebraic equations. We also illustrate the error and convergence analysis of the proposed scheme. The proposed method is very convenient for solving such problems since the initial and boundary conditions are automatically taken into account. The efficiency and accuracy of the proposed algorithm are examined through some examples and comparisons with existing methods.

MSC:
65-XX Numerical analysis
35R11 Fractional partial differential equations
65M06 Finite difference methods for initial value and initial-boundary value problems involving PDEs
65M70 Spectral, collocation and related methods for initial value and initial-boundary value problems involving PDEs

Keywords:
collocation method; finite difference methods; fractional partial differential equations

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