A Novel Higher Order Numerical Scheme for Generalized Time-Fractional Burgers' Equation

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ABSTRACT

A fast higher-order scheme is established for solving inhomogeneous generalized time-fractional Burgers' equation. The time-fractional operator is taken as the modified operator with the Mittag-Leffler kernel. Through stability analysis, it has been demonstrated that the proposed numerical approach is unconditionally stable. The convergence of the numerical method is analyzed theoretically using Von Neumann's method. It has been proved that the proposed numerical method is fourth-order convergent in space and second-order convergent in time in the L_2-norm. The scheme's proficiency and effectiveness are examined through two numerical experiments to validate the theoretical estimates. The tabular and graphical representations of numerical results confirm the high accuracy and versatility of the scheme.

Keywords: Mittag-Leffler kernel; Compact finite difference method; Generalized time-fractional Burgers' equation; Von-Neumann's method.

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