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Summary: We improve the algebraic formulation of the fractional partial differential equations (FPDEs) by using the matrix-vector multiplication representation of the problem. This representation allows us to investigate an operational approach of the Tau method for the numerical solution of FPDEs. We introduce a converter matrix for the construction of converted Chebyshev and Legendre polynomials which is applied in the operational approach of the Tau method. We present the advantages of using the method and compare it with several other methods. Some experiments are applied to solve FPDEs including linear and nonlinear terms. By comparing the numerical results obtained from the other methods, we demonstrate the high accuracy and efficiency of the proposed method.

MSC:
65M99 Numerical methods for partial differential equations, initial value and time-dependent initial-boundary value problems
35R11 Fractional partial differential equations
26A33 Fractional derivatives and integrals
45K05 Integro-partial differential equations

Keywords:
spectral methods; operational approach of the tau method; improved algebraic formulation; fractional partial differential equations

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References: