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NUMERICAL SOLUTIONS OF THIRD-ORDER TIME-FRACTIONAL DIFFERENTIAL EQUATIONS USING CUBIC B-SPLINE FUNCTIONS

ASSOCIATE PROFESSOR DR. MUHAMMAD ABBAS

UNIVERSITY OF SARGODHA, PAKISTAN

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Abstract. Numerous fields, including the physical sciences, social sciences, and earth sciences, benefit greatly from the application of fractional calculus (FC). The fractional-order derivative is developed from the integer-order derivative, and in recent years, real-world modelling has performed better using the fractional-order derivative. Due to the flexibility of B-spline functions and their capability for very accurate estimation of fractional equations, they have been employed as a solution interpolating polynomials for the solution of fractional partial differential equations (FPDEs). In this study, cubic B-spline (CBS) basis functions with new approximation are utilized for numerical solution of third-order fractional differential equation. Initially, the CBS functions and finite difference scheme are applied to discretize the spatial and Caputo time fractional derivative, respectively. The scheme is convergent numerically and theoretically as well as unconditionally stable. On a variety of problems, the validity of the proposed technique is assessed, and the numerical results are contrasted with those reported in the literature.

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Website: https://math.usm.my
Email: dean_mat@usm.my
Tel: +604 653 3284