

Improved meshless finite integration method for solving time fractional diffusion equations

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Abstract

In this paper, a new method named Improved Finite Integration Method (IFIM) is proposed for solving Time Fractional Diffusion Equations (TFDEs). In the IFIM, the Extended Simpson's Rule (ESR) is employed for numerical quadrature in spatial discretization. Besides, the Piecewise Quadratic Interpolation (PQI) in sense of the Hadamard finite-part integral is utilized for time discretization. Compared with the primary Finite Integration Method (FIM) which uses the finite difference scheme to address the time discretization, the combination of ESR and PQI in IFIM will lead to a better performance in solving TFDEs. Numerical examples in 2D/3D are performed and compared to show the superiority of IFIM. It can be found that the IFIM is able to obtain a higher accuracy without losing the stability and efficiency.

Keywords: Time fractional diffusion equation; Finite integration method; Trapezoidal rule; Simpson's rule; Hadamard finite-part integral;