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Abstract

New Explicit Asymmetric Hopscotch Methods for the Heat Conduction Equation †

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Abstract: This study aims at constructing new and effective fully explicit numerical schemes for solving the heat conduction equation. We use fractional time steps for the odd cells in the well-known odd–even hopscotch structure and fill it with several different formulas to obtain a large number of algorithm combinations. We generate random parameters in a highly inhomogeneous spatial distribution to set up discretized systems with various stiffness ratios, and systematically test these new methods by solving these systems. The best combinations are verified by comparing them to analytical solutions. We also show analytically that their rate of convergence is two and that they are unconditionally stable.

Keywords: odd–even hopscotch methods; diffusion equation; heat equation; parabolic PDEs; explicit time-integration; stiff equations; unconditional stability

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