Abstract
New Explicit Asymmetric Hopscotch Methods for the Heat Conduction Equation †

Mahmoud Saleh * and Endre Kovács

Institute of Physics and Electrical Engineering, University of Miskolc, 3515 Miskolc, Hungary; kendre01@gmail.com
* Correspondence: mhmodsalh84@gmail.com
† Presented at the 1st International Electronic Conference on Algorithms, 27 September–10 October 2021; Available online: https://ioca2021.sciforum.net/

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

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/IOCA2021-10902/s1.

Funding: The research was funded by the ÚNKP-21-3 new national excellence program of the ministry for innovation and technology from the source of the national research, development and innovation fund.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: No data is available.

Conflicts of Interest: The authors declare no conflict of interest.