Two-level compact implicit schemes for three-dimensional parabolic problems.

ABSTRACT

We derive a class of two-level high-order implicit finite difference schemes for solving three-dimensional parabolic problems with mixed derivatives. The schemes are fourth-order accurate in space and second- or lower-order accurate in time depending on the choice of a weighted average parameter μ. Numerical results with μ=0.5 are presented to confirm the high accuracy of the derived scheme and to compare it with the standard second-order central difference scheme. It is shown that the improvement in accuracy does not come at a higher cost of computation and storage since it is possible to choose the grid parameters so that the present scheme requires less work and memory and gives more accuracy than the standard central difference scheme.

Keyword: Parabolic partial differential equation; Mixed derivative; High-order compact scheme; Crank–Nicolson integrator; Stability.