

The shifted box scheme for scalar transport problems

by

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Abstract

We consider scalar transportation problems governed by the equation $\phi_t + (u\phi)_x + (v\phi)_y = 0$, where u and v are velocity components for incompressible flow, i.e., $u_x + v_y = 0$. For certain applications it is important to use fast methods that do not produce any parasitic oscillating solutions, but still has good energy conservation properties. The well known box scheme, originally introduced by B. Wendroff, has these properties. If u and v do not change sign within the computational domain, it is unconditionally stable, and for the initial-boundary value problem, it requires no more work per time-step than an explicit scheme. However, the restriction on the velocity is too severe for realistic problems. Therefore we suggest a modified method called *the shifted box scheme*, which uses a simple trick to overcome this difficulty. It has the same stability properties as the original scheme, and the extra work is negligible.