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Comparative Efficiency of Implicit, Explicit and Implicit-Explicit Strong Stability Preserving Methods GABRIEL MORAES, RENAN TEIXEIRA, Instituto Militar de Engenharia, LEONARDO ALVES, Universidade Federal Fluminense — Several unsteady problems in transport phenomena require highly accurate solutions. Attempts to increase accuracy order of most numerical schemes, however, often weaken their linear and/or nonlinear stability. On the other hand, Strong Stability Preserving (SSP) methods are able to increase their accuracy order in time while still maintaining the overall stability properties of the original forward Euler method from which they were generated. This is achieved by, among other things, restricting the maximum allowed time step of these schemes. Hence, most recent studies have focused on developing optimal SSP schemes, i.e., minimally restrictive. Under this context, a significant variety of explicit and implicit formulations for multi-step and multi-stage marching schemes of different accuracy orders has been created. Despite their popularity, some open issues still remain. Linear stability of implicit schemes usually allows very large time steps, making them cost effective for many applications when compared to their explicit counterparts. Hence, the SSP time step restriction might render these schemes comparatively inefficient. The present study evaluates different explicit, implicit and implicit–explicit SSP time integration schemes for a series of test cases in an attempt to distinguish the most efficient scheme according to an error / computer time analysis. All three schemes employed a second order TVD flux limiter discretization for the spatial derivatives.

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