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**Assessment of a high-resolution central scheme for the solution of the relativistic hydrodynamics equations.** (English) Zbl 1065.85009

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Summary: We assess the suitability of a recent high-resolution central scheme developed by Kurganov and Tadmor (2000) for the solution of the relativistic hydrodynamic equations. The novelty of this approach relies on the absence of Riemann solvers in the solution procedure. The computations we present are performed in one and two spatial dimensions in Minkowski spacetime. Standard numerical experiments such as shock tubes and the relativistic flat-faced step test are performed. As an astrophysical application the article includes two-dimensional simulations of the propagation of relativistic jets using both Cartesian and cylindrical coordinates. The simulations reported clearly show the capabilities of the numerical scheme of yielding satisfactory results, with an accuracy comparable to that obtained by the so-called high-resolution shock-capturing schemes based upon Riemann solvers (Godunov-type schemes), even well inside the ultrarelativistic regime. Such a central scheme can be straight-forwardly applied to hyperbolic systems of conservation laws for which the characteristic structure is not explicitly known, or in cases where a numerical computation of the exact solution of the Riemann problem is prohibitively expensive. Finally, we present comparisons with results obtained using various Godunov-type schemes as well as with those obtained using other high-resolution central schemes which have recently been reported in the literature.

**MSC:**

85A30 Hydrodynamic and hydromagnetic problems in astronomy and astrophysics

76Y05 Quantum hydrodynamics and relativistic hydrodynamics



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