ImEx second order central scheme for hyperbolic systems with stiff source terms

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Abstract: Quasi-linear hyperbolic systems with source terms introduce significant computational challenges due to the presence of a stiff source term. To address this, a numerical scheme is explored and applied to benchmark models to assess their effectiveness. The proposed framework extends the Nessyahu-Tadmor scheme [1] to non-homogeneous systems through a non-splitting strategy [2], ensuring a more coherent treatment of the source term. A discrete cell-averaging approach is employed for source term approximation, leading to the construction of an implicit-explicit scheme [3] with proven second-order accuracy. Theoretical analysis and numerical validation confirm the stability and accuracy of the method, highlighting its potential for efficiently solving the stiff hyperbolic systems of balance laws.

Keywords: Hyperbolic systems of balance laws, implicit-explicit scheme, stability and accuracy.

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