

High Order Semi-Implicit IMEX WENO Scheme for the Euler System with All-Mach Number

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We propose a high order asymptotic preserving method for all-Mach number simulations. In particular, we focus on finite difference schemes with weighted essentially non-oscillatory (WENO) reconstructions coupled with proper implicit-explicit (IMEX) Runge-Kutta (RK) treatments for the system. The proposed method enjoys the following properties:

1. the schemes can robustly capture shock fronts in the compressible regime when the Mach number is of order 1;
2. the schemes automatically become high order, stable and consistent solvers for the incompressible Euler system when the Mach number approaches 0;
3. the schemes are high order accurate in both space and in time both when the acoustic waves are well-resolved and are under-resolved. 1D and 2D numerical results will be presented to showcase the method.