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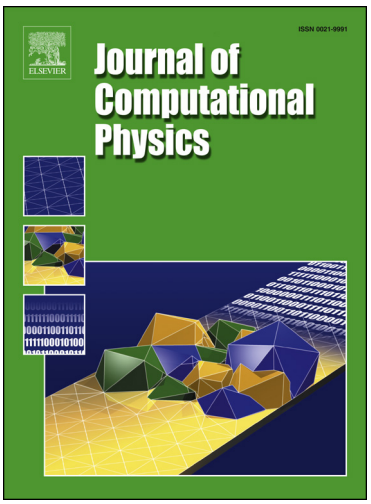

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High-Order Localized Dissipation Weighted Compact Nonlinear Scheme for Shock- and Interface-Capturing in Compressible Flows

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Abstract

Simulations of single- and multi-species compressible flows with shock waves and discontinuities are conducted using a weighted compact nonlinear scheme (WCNS) with a newly developed sixth order localized dissipative interpolation. In smooth regions, the scheme applies the central nonlinear interpolation with minimum dissipation to resolve fluctuating flow features while in regions containing discontinuities and high wavenumber features, the scheme suppresses spurious numerical oscillations by hybridizing the central interpolation with the more dissipative upwind-biased nonlinear interpolation. In capturing material interfaces between species of different densities, a quasi-conservative five equation model that can conserve mass of each species is used to prevent pressure oscillations across the interfaces. Compared to upwind-biased interpolations with classical nonlinear weights [1, 2] and improved weights [3], and the interpolation with adaptive central-upwind weights for scale-separation [4], it is shown that WCNS with the proposed localized dissipative interpolation has better performance to simultaneously capture discontinuities and resolve smooth features.

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