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Nonreflecting Boundary Conditions Based on Nonlinear Multidimensional Characteristics[1] Q. LIU, O.V. VASILYEV, Univ. of Colorado at Boulder — The nonlinear multidimensional characteristics-based nonreflecting boundary conditions are proposed for compressible Navier-Stokes equations with/without scalar transport equations. This model is consistent with the physics of flows and transport properties. Based on the theory of characteristics, the multidimensional flows can be decomposed into acoustic, entropy, and vorticity waves. In order to obtain appropriate nonreflecting boundary conditions, the corresponding characteristic variables of incoming waves are set to zeros, and the source terms of the incoming acoustic wave are partially damped. The plane waves are analyzed to obtain the optimal damping coefficient. This novel approach substantially minimizes the spurious wave reflections of pressure, density, temperature, velocity, and vorticity from the artificial boundaries, where strong multidimensional flow effects exist. The proposed method has advantages of simplicity, robustness, and numerical accuracy, due to the fact that it conforms to the flow physics. The methodology is tested on two benchmark problems: cylindrical acoustic waves propagation and the wake flow after cylinder with periodic strong vortex convected out of the computational domain. These numerical simulations yield accurate results and verify that the method substantially improves the 1-D characteristics-based nonreflecting boundary conditions for the complex multidimensional flows.

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