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A novel methodology for simulating low Mach number combustion AMMAR ABDILGHANIE, JAMES RILEY, University of Washington, OSCAR FLORES, Universidad Carlos III de Madrid, ROBERT MOSER, University of Texas at Austin — The velocity-vorticity formulation for the solution of unsteady three-dimensional incompressible flows (Kim, Moin and Moser JFM 1987) is extended for compressible flows under the low Mach number approximation for combustion applications. A key advantage of the methodology is the elimination of the pressure from the momentum equations and, as a result, the errors and complications of pressure boundary conditions associated with pressure-splitting algorithms. The added efficiency of the method for horizontally homogeneous flows makes it computationally very attractive. The hydrodynamic part of the algorithm comprises two evolution equations for two dependent variables and two Poisson-type equations that, by construction, ensure mass conservation. Sixth-order accurate compact scheme is used for spatial discretization in the vertical and third order implicit-explicit Runge-Kutta is used for time advancement. Open boundary conditions are used at the top boundary and free-slip no-flux conditions are employed at the bottom. Simulations of compressible Taylor Green vortex flow are briefly discussed and future research directions are summarized.

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