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Numerical simulations of vortex breakdown in low-Reynolds-number swirling flow JOSEPH CHUNG, XIAO ZHANG, RYAN HOUIM, ELAINE ORAN, Department of Aerospace Engineering, University of Maryland, College Park, MD — Numerical simulations of low-Reynolds-number vortex breakdown were carried out by solving the unsteady, three-dimensional, compressible, Navier-Stokes (NS) equations on a Cartesian mesh. The flux-corrected transport algorithm was used to solve for the inviscid fluxes and high-order central differencing for the viscous terms. BoxLib, an adaptive mesh-refinement library, was used for spatial refinement near the core of the vortex. The molecular weight and temperature were scaled to relax the time-step constraints imposed by the sound speed. The results confirm three-dimensional vortex breakdown in qualitative and quantitative agreement with previous incompressible simulations. Application of the barely implicit correction (BIC) algorithm further relaxed the time-step constraint by solving for a pressure correction to the energy and momentum equations.

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