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Simulating compressible-incompressible two-phase flows[1] FABIAN DENNER, BEREND VAN WACHEM, Imperial College London — Simulating compressible gas-liquid flows, e.g. air-water flows, presents considerable numerical issues and requires substantial computational resources, particularly because of the stiff equation of state for the liquid and the different Mach number regimes. Treating the liquid phase (low Mach number) as incompressible, yet concurrently considering the gas phase (high Mach number) as compressible, can improve the computational performance of such simulations significantly without sacrificing important physical mechanisms. A pressure-based algorithm for the simulation of two-phase flows is presented, in which a compressible and an incompressible fluid are separated by a sharp interface. The algorithm is based on a coupled finite-volume framework, discretised in conservative form, with a compressive VOF method to represent the interface. The bulk phases are coupled via a novel acoustically-conservative interface discretisation method that retains the acoustic properties of the compressible phase and does not require a Riemann solver. Representative test cases are presented to scrutinize the proposed algorithm, including the reflection of acoustic waves at the compressible-incompressible interface, shock-drop interaction and gas-liquid flows with surface tension.

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