Abstract Submitted
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An efficient pressure-correction method for incompressible multifluid flows[1] M. DODD, A. FERRANTE, University of Washington, Seattle — We present a new pressure-correction (PC) method for solving incompressible multifluid flows with large density ratios. The novelty of the method is that the variable coefficient Poisson equation that arises in solving the variable-density Navier-Stokes equations has been reduced to a constant coefficient equation, which can then be solved directly using a fast Poisson solver. The new method is coupled to our mass-conserving volume-of-fluid (VoF) method to capture the interface between the moving fluids. First, we verified the new PC/VoF solver using the capillary wave test-case up to density and viscosity ratios of 10,000. Then, we validated the new flow solver by simulating the motion of a falling water droplet in air by comparing the droplet terminal velocity with the experimental value (Beard, 1976) for $95.6 \leq \mathrm{Re} \leq 473$, $0.06 \leq \mathrm{We} \leq 0.61$, and $0.05 \leq \mathrm{Bo} \leq 0.26$. We also verified the solver for a rising air bubble in water. The algorithm is shown to be second-order accurate, and stable for density and viscosity ratios up to 10,000. Also, we show that our fast Poisson solver is more than ten times faster than the Hypre multigrid solver up to a 1024^3 grid and 1024 cores.

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Antonino Ferrante
University of Washington, Seattle

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