Abstract Submitted
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Numerical modeling of encapsulated microbubbles with a coupled level set and volume-of-fluid method[1] BASHIR M. ALNAJAR, University of Colorado, Colorado Springs, INDRAJIT CHAKRABORTY, University of Warwick, MICHAEL L. CALVISI, University of Colorado, Colorado Springs — The coupled level set and volume-of-fluid (CLSVOF) method is an efficient approach used to simulate multiphase flows in which fluids of different phases are separated by a complex, evolving interface. This method leverages the advantages of both the level set (LS) and volume-of-fluid (VOF) approaches by combining the strong mass conservation properties of the VOF method, while retaining the accurate interface representation of the LS method. In this work, the flow field is discretized by a single-field, finite difference formulation of the weakly compressible Navier-Stokes equations on a stationary grid. A coupled second-order operator split algorithm is used to advect the volume fraction and level set function, and the interface is reconstructed using the least-squares volume-of-fluid interface reconstruction algorithm (LVIRA). A numerical code has been developed for 2D and axisymmetric cases, and its performance has been validated through a series of test cases, such as the oscillation of a spherical bubble in response to changes in ambient pressure. An elastic layer is incorporated at the gas-liquid interface to simulate the nonspherical dynamics of ultrasonically-forced encapsulated microbubbles, which are used for ultrasound imaging and intravenous drug delivery.

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