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DNS study of speed of sound in two-phase flows with phase change. KAI FU, XIAOLONG DENG, Beijing Computational Science Research Center — Heat transfer through pipe flow is important for the safety of thermal power plants. Normally it is considered incompressible. However, in some conditions compressibility effects could deteriorate the heat transfer efficiency and even result in pipe rupture, especially when there is obvious phase change, due to the much lower sound speed in liquid-gas mixture flows. Based on the stratified multiphase flow model (Chang and Liou, JCP 2007), we present a new approach to simulate the sound speed in 3-D compressible two-phase dispersed flows, in which each face is divided into gas-gas, gas-liquid, and liquid-liquid parts via reconstruction by volume fraction, and fluxes are calculated correspondingly. Applying it to well-distributed air-water bubbly flows, comparing with the experiment measurements in air water mixture (Karplus, JASA 1957), the effects of adiabaticity, viscosity, and isothermality are examined. Under viscous and isothermal condition, the simulation results match the experimental ones very well, showing the DNS study with current method is an effective way for the sound speed of complex two-phase dispersed flows. Including the two-phase Riemann solver with phase change (Fechter et al., JCP 2017), more complex problems can be numerically studied.

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