Numerical methods for weakly compressible two-phase flow

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Abstract

We are interested in solving unsteady weakly compressible two-phase flow problems where the flow speed is assumed to be much less than the sound speed of the fluid component and the wavelengths of the acoustic waves are assumed to be large. Representative applications of this kind of problems are such as the rising of gas bubbles in liquids, the falling of liquid drops in the air under gravitational force field, bubbly flow in liquids, and breaking of waves.

It is without question that one possible approach to simulate the aforementioned low speed (single- or two-phase) flow problem is to consider it as a fully compressible flow and use a standard upwind finite volume method for numerical approximation When this is done with the use of an explicit method, it is known in the literature that we would have a severe time step restriction due to the CFL (Courant-Friedrichs-Lewy) condition for stability, yielding difficulties as the lack of robustness of the method and also the loss of accuracy of the computed solutions. The aim of this talk is to describe state-of-the-art numerical methods to overcome these difficulties in that not only the pressure-based, but also the density-based of approaches will be discussed.

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