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DNS using CLSVOF method of single micro-bubblebreakup and dynamics in ?ow focusing

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Abstract: Numerical simulations are performed to investigate the breakup of air bubble in ?ow focusingcon?guration; the CLSVOF (coupled level set with volume of ?uid) method is employed to track theinterface, which allows a better identi?cation of the liquid–gas interface via a function called level set. TheCFD simulations showed that the velocity ratio, the interfacial tension, the outer channel diameter, thecontinuous phase viscosity, the ori?ce width and length play an important role in the determination of the airbubble's size and shape. However, at low capillary number, increasing the ?ow velocity ratio gives a smallerbubble size in shorter time, while the increase in interfacial tension leads to a bigger bubble. Moreover, thecarrier ?uid is found to slightly affect the bubbling mechanism, while the smallest bubbles were obtainedwith the smallest ori?ce size. In addition, three breakup regimes are observed in this device: disc-bubble(DB), elongated bubble (EB) and the slug bubble (SB) regime ?ows. This work also demonstrates that theCLSVOF is an effective method to simulate the bubbles breakup in ?ow focusing geometry. In addition, acomparison of our computational simulations with available experimental results reveals reasonably goodagreement.

Keywords : Bubbling, Multiphase ?ow, CLSVOF, CFD and ?ow focusing