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Simulations of bubble coalescence and breaking-up using connectivity-free point-set front tracking method with finite element CHU WANG, LUCY ZHANG — The capability of handling constant and multi-scale bubble topological changes is essential in modeling and simulating bubble coalescence and breaking up. The traditional front tracking method relies on the connectivity of the interfacial points to calculate the normal and curvature in order to evaluate surface tension. In bubble coalescence and breaking up, such connectivity reconstruction can be quite expensive. In this work, we adopt the point-set method [1] to construct each individual interfacial point without any connectivity. This approach combined with the original front tracking concept allow us to model bubble topological changes automatically. By letting the interface to be at a constant level, the indicator field is smeared out using the quintic B-Spline function. A regeneration method adopting one-dimensional Newton iteration can update the interfacial points in order to cope with the topology change. The interface points are then coupled with a finite element fluid solver to study bubble rising in a channel testing case. The coalescence and breaking up are also simulated to show the advantage of using the point-set method.

[1] D. J. Torres, J. U. Brackbill, The Point-Set Method: Front-Tracking without Connectivity, J. Comupt. Phys, 2000,165(2):620-644

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