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Simulations of Coalescence and Breakup of Interfaces Using a 3D Front-tracking Method[1] JIACAI LU, GRETAR TRYGGVASON, University of Notre Dame — Direct Numerical Simulations (DNS) of complex multiphase flows with coalescing and breaking-up of interfaces are conducted using a 3D front-tracking method. Front-tracking method has been successfully used in DNS of turbulent channel bubbly flows and many other multiphase flows, but as the void fraction increases changes in the interface topology, though coalescence and breakup, become more common and have to be accounted for. Topology changes have often been identified as a challenge for front tracking, where the interface is represented using a triangular mesh, but here we present an efficient algorithm to change the topology of triangular elements of interfaces. In the current implementation we have not included any small-scale attractive forces so thin films coalesce either at prescribed times or when their thickness reaches a given value. Simulations of the collisions of two drops and comparisons with experimental results have been used to validate the algorithm but the main applications have been to flow regime transitions in gas-liquid flows in pressure driven channel flows. The evolution of flow, including flow rate, wall shear, projected interface areas, pseudo-turbulence, and the average size of the various flow structures, is examined as the topology of the interface changes through coalescence and breakup.

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