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Topological Transitions in Direct Numerical Simulations of Multiphase Flows[1] GRETAR TRYGGVASON, JIACAI LU, SIJU THOMAS, Worcester Polytechnic Institute — Topological transitions are ubiquitous in multiphase flows and can change the nature of such flows dramatically. Here we first briefly describe a new algorithm to accomplish topology changes in front tracking simulations of multiphase flows. The algorithm, allows detailed control of when topology changes take place. The method is then used to examine regime transitions in vertical gas-liquid channel flow, when bubbly flows transition to slug or annular flows. Nearly buoyant spherical bubbles, rising in an upflow in a vertical channel, will form a bubble rich layer near the walls. The high bubble concentration increases the probability of bubble coalescence. As bubbles coalesce, they deform and move away from the walls. For the relatively narrow channels studied here, the final flow configuration consists of either slugs in the middle of the channel or annular core, depending on the void fraction. The overall evolution for this particular problem is relatively insensitive to the exact film thickness used to initiate coalescence. The present algorithm is only concerned with achieving the topology change. Capturing exactly when a thin film ruptures requires the inclusion of models for the physical processes responsible for the rupture. We end by briefly discussing how to incorporate such models.

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