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Numerical study of three-dimensional liquid jet breakup with adaptive unstructured meshes ZHIHUA XIE, DIMITRIOS PAVLIDIS, PABLO SALINAS, CHRISTOPHER PAIN, OMAR MATAR, Imperial College London —
Liquid jet breakup is an important fundamental multiphase flow, often found in many industrial engineering applications. The breakup process is very complex, involving jets, liquid films, ligaments, and small droplets, featuring tremendous complexity in interfacial topology and a large range of spatial scales. The objective of this study is to investigate the fluid dynamics of three-dimensional liquid jet breakup problems, such as liquid jet primary breakup and gas-sheared liquid jet breakup. An adaptive unstructured mesh modelling framework is employed here, which can modify and adapt unstructured meshes to optimally represent the underlying physics of multiphase problems and reduce computational effort without sacrificing accuracy. The numerical framework consists of a mixed control volume and finite element formulation, a volume of fluid type method for the interface capturing based on a compressive control volume advection method and second-order finite element methods, and a force-balanced algorithm for the surface tension implementation. Numerical examples of some benchmark tests and the dynamics of liquid jet breakup with and without ambient gas are presented to demonstrate the capability of this method.

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