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Tracking droplet breakup in homogenous isotropic turbulence

ALEXANDER BUSSMANN[1], Technical University Munich , JONAS BUCHMEIER, University of Southern California, MICHAEL DODD, CTR, Stanford University, IVAN BERMEJO-MORENO, University of Southern California — A methodology is introduced to study the dynamics of fluid interfaces in multiphase flows, emphasizing their breakup and coalescence. The algorithm tracks surfaces, here obtained by isocontouring an interface-describing scalar field (e.g., VOF) from a time series of volumetric snapshots. Physical and geometric information of the surfaces is used to find correspondences in a higher-dimensional space, from which events are derived to describe the interactions among surfaces at consecutive time instances. Correspondences and events are filtered based on physical realizability, accounting for geometric constraints between consecutive time instances, as well as temporal constraints on the relations between surfaces in previous tracking steps. Resulting events are used to map the time evolution of all surfaces and their interactions into a graph, which is then queried to retrieve information on the dynamics of the fluid interfaces. The methodology is applied to a DNS dataset of droplet breakup in homogeneous isotropic turbulence. Emphasis is placed on the statistics of split and merge events, the lifetime of surfaces, and their geometric evolution in relation to the background flow fields.

[1]Visiting scholar at University of Southern California. Supported by the Prof. Dr. Erich-Mller Foundation, the Walther Blohm Foundation and the German Academic Exchange Service.

Alexander Bussmann
Technical University Munich

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