Numerical Simulation of Multi-Scale Two-Phase Flows Using a Hybrid Interface-Resolving Two-Fluid Model (HIRES-TFM)

Abstract:
This contribution outlines the coherent and mathematical rigorous derivation of a generalized multi-scale model framework that is based on the Eulerian-Eulerian two-fluid methodology. By conditional volume-averaging (based on the immersed interface concept) and subsequent closure modeling, the two-phase flow features are first divided into an unresolved portion (on average or sub-grid scale) and a resolved portion, and then interpreted on a physical basis leading to constitutive relations for closure. The resulting two-fluid model framework HIRES-TFM (Hybrid Interface-Resolving Two-Fluid Model) exhibits the same basic structure as found for single-phase flow, which results in an inherently stable method and enables us to reuse numerical techniques that have been developed for single-phase problems. Moreover, the conceptual approach is both compatible to the Large Eddy Simulation (LES) framework for turbulence modeling, and is expandable to multi-scale flow scenarios, i.e. dispersed and segregated two-phase flows.

Kongresstitel:
ISI Document Delivery No.: 207RW Times Cited: 0 Cited Reference Count: 38 Marschall, Holger Hinrichsen, Olaf Center of Smart Interfaces, TU Darmstadt, Germany The first author (HM) gratefully acknowledges research and financial support from the Mathematical Modeling and Analysis group (Prof. M. Kuczynski).