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Titel des Beitrags: Numerical investigation of 3D drop-breakup mechanisms using a sharp interface level-set method

Abstract: We present two- and three-dimensional numerical simulation results of a shock-induced droplet breakup. We study the breakup mechanism for two different Weber numbers. Reynolds and Ohnesorge numbers are kept constant. We apply a conservative interface-interaction model to compute the exchange of momentum and energy between the two immiscible fluids water and air. The fluids are separated by a sharp interface (level set). A block-structured multiresolution scheme is used to adapt the mesh to the evolving flow field. We verify our simulation setup using a two-dimensional shock-induced breakup with a high Weber number, which is compared to experimental and numerical data. Simulation results show that the flattening of the droplet, which is the first stage of the droplet breakup, is independent of the Weber number. Once interfacial instabilities appear at the water-air interface, surface-tension effects play a dominant role in determining the second stage of the breakup. For small surface-tension forces, the droplet breakup occurs in the shear-induced entrainment (SIE).
regime. Shear instabilities grow near the droplet equator, and form the sheet which is
classical for this regime. For large surface-tension forces, the droplet breakup occurs in the
Rayleigh-Taylor piercing (RTP) regime. Surface tension forces suppress the growth of the sheet,
and lead instead to a smooth water-air interface. At later stages, the onset of the characteristic
bag shape is observed. © 2019 International Symposium on Turbulence and Shear Flow
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