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Fluid flow simulations meet high-speed video: Computer vision comparison of droplet dynamics

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Abstract

Hypothesis

While multiphase flows, particularly droplet dynamics, are ordinary in nature as well as in industrial processes, their mathematical and computational modelling continue to pose challenging research tasks - patent approaches for tackling them are yet to be found. The lack of analytical flow field solutions for non-trivial droplet dynamics hinders validation of computer simulations and, hence, their application in research problems. High-speed videos and computer vision algorithms can provide a viable approach to validate simulations directly against experiments.

Experiments

Droplets of water (or glycerol-water mixtures) impacting on both hydrophobic and superhydrophobic surfaces were imaged with a high-speed camera. The corresponding configurations were simulated using a lattice-Boltzmann multiphase scheme. Video frames from experiments and simulations were compared, by means of computer vision, over entire droplet impact events.

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