CASTS TALKS

Special Program in Applied Mathematics and Applied Mechanics

Simulations of the Shock Waves and Cavitation Bubbles during a Three-dimensional High-Speed Droplet Impingement based on a Two-Fluid Model

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2016 - 04 - 13 (Wed.)
15:00 - 18:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

We investigate the aerodynamic characteristics inside a droplet impingement using a compressible two-fluid model. A hybrid type Riemann solver is proposed to compute numerical fluxes across the interfaces of gas-gas, liquid-liquid and gas-liquid flows in the considered flowfields. Here, the compressible liquid flows with high Reynolds number value allow us to use an inviscid approach and neglect the surface tension effect under the assumption of high Weber number. Numerical results demonstrate the evolution of shock-front, rarefaction, cavitation inside the droplet and the contact periphery expands very quickly and liquid compressibility plays an important role in the initial formation of flow physics inside the liquid droplet. Grid independence study is performed. A secondary cavitation zone is simulated to appear near the wall due to the expansion wave propagating downward caused by the eruption of the main cavitation bubble near the top of the liquid droplet. We also found that the growth rate of the cavitation zone is independent of the impact flow velocity. The estimated maximum wall pressure against the incoming Mach number is shown to be closer to the theoretical data than any other previous analysis.