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Hydrodynamics of a hollow water droplet falling in air MOUNIKA BALLA, Indian Institute of Technology Hyderabad, India, MANOJ TRIPATHI, Indian Institute of Science Education and Research Bhopal, KIRTI SAHU, Indian Institute of Technology Hyderabad, India — We study the hydrodynamics of a compound/hollow water droplet falling in air by conducting three-dimensional numerical simulations of the Navier-Stokes and the continuity equations using a finite volume based volume-of-fluid method. The various physical parameters influencing the dynamics are the thickness of the hollow droplet, inertia and surface tension at the air-water interface. It is found that the droplet exhibits shape oscillations. The oscillations of the inner interface (inner air bubble) of the hollow droplet is periodic with a time period about half of that of a normal droplet. The deformation of the outer interface of the hollow droplet is aperiodic and breaks up when the deformation is more. Increasing the thickness of the hollow droplet decreases the amplitude of oscillations of both the inner and outer interfaces. As expected, the oscillations decay with time at low inertia. As the thickness of the hollow droplet decreases a spike like structure appears at the bottom of the hollow droplet. This instability is enhanced as the surface tension and the ratio of the viscous force to the gravitational force are decreased. The velocity contours are used to explain the behaviour observed in the present study.

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