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Numerical modelling of the impact of a liquid drop on the surface of a two-phase fluid system

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The aim of the study was validation of a numerical model of the impact of a liquid drop on the surface of a two-phase system of immiscible fluids.
The drop impact phenomenon was recorded using a high-speed camera (Vision Research MIRO M310) and the data were recorded at 2000 frames per second. The numerical calculations were performed with the Finite Volume Method (FVM) solving the three-dimensional Navier-Stokes equations for three phases: air and two selected immiscible fluids. The Volume of Fluid (VOF) technique was employed for modelling of the boundaries between the phases. Numerical modelling was done with the Finite Volume Method using an available OpenFOAM software.
The experiment was based on three variables:
• the height from which the drop of the selected fluids fell (the speed of the drop),
• the thickness of the layers of the two selected immiscible fluids (a thin layer of the fluid with a lower density was spread over the higher-density fluid),
• the size of the fluid droplet.
The velocity and radius of the falling drop was calculated based on the recorded images. The used parameters allowed adequate projection of the impact of fluid droplets on a system of two immiscible liquids.
Development of the numerical model of splash may further have practical applications in environmental protection (spraying of hazardous fluids, spread of fuels and other hazardous substances as a result of disasters, spraying (water cooling) of hot surfaces), and in agriculture (prevention of soil erosion).
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