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Application of a Modified Pseudopotential Lattice Boltzmann Model for Simulation of Splashing Phenomenon

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Abstract

In this study, a two dimensional modified pseudopotential single-component multiphase lattice Boltzmann model is utilized to simulate impingement of single and double droplets on both stationary and moving liquid films. The model is confirmed to be accurate according to the power law in terms of crown spreading. In addition, coexistence densities at both liquid and gas phases are compared with densities, obtained by Maxwell analytical solution. The effects of the Reynolds number, Weber number, Bond number, liquid film thickness, and wall interactions with liquid film for the case of single droplet are individually investigated. The results prove that the enhancement of liquid film thickness postpones the droplet break-up on the crown's free edge. It is also found that, the hydrophobic surface abates the splashing mechanism due to the existing repulsive force between wall and liquid film. Simulation of splashing phenomenon inside a slit indicates that the crown formation follows the rectangular and curvature shape of the slit. The simulation is also carried out for two droplets with horizontal and vertical arrangements. For the horizontal arrangement, the crown is divided into central and lateral regions. In comparison with lateral jets, crown's central jet is higher. Furthermore, droplets' vertical arrangement elevated the cross section of the crown's free edge, therefore the secondary droplets do not form in this condition. Up to the end of this study, the effect of the bottom moving wall on the binary droplet impact is examined,