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The Dynamics of Coupled Droplets Under Gravity Condition
HAIDER HEKIRI, TAKUMI HAWA, School of Aerospace and Mechanical Engineering, The University of Oklahoma — The dynamics of a two-dimensional, incompressible, and two coupled spherical-cap water droplets pinned in a straight channel is investigated under gravity condition through the use of CFD. Since the capillary length is three times as large as the channel width, the effect of gravity is small but not negligible. In this simulations FLUENT with a 2-D pressure based solver is utilized. The suspended droplet states are measured by the location of the center of mass of the droplet. Under no gravity condition we find that there is a critical volume, Vc, where a bifurcation of asymmetric states occurs. However, gravity changes the pitchfork bifurcation diagram of coupled droplets systems into two separate branches of equilibrium states. The primary branch describes a gradual and stable change of the droplet states from symmetric to non-symmetric as V is increased across Vc. The secondary branch appears at a certain modified critical volume, Vmc, and describes two additional non-symmetric states for V>Vmc. CFD demonstrated that the large-amplitude state along the secondary branch is stable whereas the small-amplitude states are unstable.

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