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Impact and Spreading of a Compound Droplet on a Solid Wall
METIN MURADOGLU, SAVAS TASOGLU, Koc University — Impact and spreading of a compound viscous droplet are studied computationally using a finite-difference/front-tracking method. The problem is motivated by single cell epitaxy developed for printing biological cells on a solid substrate using ink-jet printer technology. In this study, the biological cell is modeled as a highly viscous Newtonian liquid encapsulated by a less viscous droplet. The substrate is partially wettable for the encapsulating droplet and non- wettable for the inner droplet. The contact angle is specified dynamically for the encapsulating droplet using the empirical correlation given by Kistler (1993). In addition, a precursive film model is also used especially for the highly wettable cases, i.e., the static contact angle is smaller than 30° due to numerical difficulty of resolving thin liquid later penetrating into surrounding gas near the solid surface. The numerical method is first applied to simple droplet spreading and the results are compared with experimental data of Sikalo et al. (2005). Then the impact and spreading dynamic of a compound droplet is studied in details. The effects of governing non-dimensional numbers on the spreading rate and apparent contact angle of the outer droplet as well as on the pressure force and deformation of the inner droplet (cell) are investigated.

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