A Numerical Study of Axi-symmetric Droplet Formation Using A Moving Mesh Approach

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Abstract

Interface tracking techniques, used in conjunction with finite volume methods to study droplet formation, have gained recent popularity, particularly at low and moderate Weber numbers. Simulations of interface behavior using moving and deforming meshes are particularly difficult, since the quality of the underlying mesh must be maintained to obtain high solution accuracy. This paper addresses a few of the common challenges associated with such methods, using simulations involving liquid break-up in axi-symmetric cases. Situations involving the manipulation of mesh connectivity and vertex positions are discussed in detail, including an efficient algorithm for the calculation of length scales at any location in the mesh. Additionally, thermally induced variations of fluid properties like viscosity, surface-tension (Marangoni surface stress) and non-Newtonian effects are incorporated to study droplet formation and behavior. Results of these simulations are useful in the study of Drop-on-Demand ink-Jet printing applications.

Key words: Interface tracking, moving mesh, inkjet, non-Newtonian, adaptive mesh, droplet formation.

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