

A Semi-Implicit Phase Field Model for Droplet Evolution

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Abstract : A semi-implicit phase field method for droplet evolution is proposed. Using the phase field Cahn-Hilliard equation, we are able to track the interface in multiphase flow. The idea of a semi-implicit finite difference scheme is reviewed and employed to solve two nonlinear equations, including the Navier-Stokes and the Cahn-Hilliard equations. The use of a semi-implicit method allows us to have larger time steps compared to explicit schemes. The governing equations are coupled and then solved by a GMRES solver (generalized minimal residual method) using modified Gram-Schmidt orthogonalization. To show the validity of the method, we apply the method to the simulation of a rising droplet, a leaky dielectric drop and the coalescence of drops. The numerical solutions to the phase field model match well with existing solutions over a defined range of variables.

Keywords : coalescence, leaky dielectric, numerical method, phase field, rising droplet, semi-implicit method

Conference Title : ICFMT 2016 : International Conference on Fluid Mechanics and Thermodynamics

Conference Location : New York, United States

Conference Dates : June 06-07, 2016