

High fidelity anisotropic adaptive FEM towards physical couplings occurring in turbulent boiling

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We propose in this work an adaptive variational multiscale method for complex multiphase flows with surface tension: applications to 3D bubble dynamics, turbulent boiling and solid quenching with experimental comparisons will be presented. A new conservative level-set method is used to provide a precise position of the interfaces. An implicit implementation of the surface tension in the context of the Continuum Surface Force is proposed to circumvent the capillary time step restriction. The obtained system is then solved using a unified compressible-incompressible variational multiscale stabilized finite element method designed to handle the abrupt changes at the interface and large density and viscosity ratios. Combined with an a posteriori error estimator, we show that anisotropic mesh adaptation yields an accurate 3D modeling framework for turbulent multiphase flows with phase change.