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Boiling Dynamics with Diffuse Interface Methods TEEMU LAURILA, MIKA SAUKKONEN, TAPIO ALA-NISSILA, Laboratory of Physics, Helsinki University of Technology, JUHA RUOKOLAINEN, CSC - Finnish IT Center for Science — We study the dynamics of fluid systems composed of two phases of a sigle component, such as a mixture of water and water vapour. Diffuse interface methods (Anderson et al., Ann. Rev. Fluid Mech., 98) can be used to desribe the system without explicitly keeping track of interfaces. An implementation of standard fluid dynamics on a FEM platform (ELMER) is converted to the diffuse interface method. Using the Van der Waals equation of state and proper boundary conditions, we obtain a consistent description of a liquid/gas system in coexistence (closed system) or undergoing a transition (open system). However, we find that this description requires the use of interface widths in the range of those of real systems. This leads to a dead-end with numerics, since it is numerically unfeasible to solve a system large enough to contain a supercritical domain. Our proposed solution inlvolves fitting the two-phase bulk free energy to obtain the stable state densities and the surface tension according to experimental or approximated values. Furthermore, an addition to the boundary condition is needed to account for three-phase contact line motion. We aim to apply the resulting model to two-phase phenomena in microfluidics (Zwaan et al. , PRL 07), and boiling in particular (Nikolayev, PRL, 06).

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