Dynamical phase transitions and interface conditions for two phase flows

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Abstract

Liquid vapour phase transitions can be modeled by the Navier-Stokes- Korteweg model, a modification of the compressible Navier Stokes equations. In this case the equation of state is given by the van-der-Waals one. We will discuss the mathematical problems which arise from this system, some theoretical results and numerical simulations (obtained by my PhD student Dennis Diehl). Furthermore we will discuss the behaviour of static solutions of this model. One obtains that the pressure is continuous across the phase boundary whereas for the incompressible two phase flow the pressure is discontinuous and the jump is proportional to the mean curvature. But this is not a real contradiction since the pressure in the compressible and the incompressible Navier Stokes equations are not the same. The relation can be obtained by the low Mach number limit. For a suitable scaling of the capillarity coefficient in the Navier- Stokes- Korteweg model, we obtain for the second order term in the asymptotic expansion for the pressure the expected result.