A phasefield model for flows with phasetransition, FEF 2017

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ABSTRACT

There are different mathematical models for describing two phase flows with phasetransition. In [1] we have considered the Navier-Stokes-Korteweg model and in this contribution we concentrate on a phasefield model which is based on [2], [3], [4]. The compressible Navier-Stokes-Allen-Cahn Model (NSAC) is able to model compressible two phase flows including surface tension effects and phasetransitions. In this talk we will present a discontinuous Galerkin scheme for the NSAC-Model. The scheme is designed to fulfill a discrete version of the free energy inequality, which is the Second Law of Thermodynamics in the isothermal case. For situations near the thermodynamic equilibrium this property suppresses so called 'parasitic currents', which are unphysical velocity fields near the phase boundary. Furthermore we investigate the scaling of the reaction rate in the Allen-Cahn part of the model, with respect to phase transitions and the relationship of the surface tension and the pressure laws of pure phases. As the width of the interface is only several nanometers, an artificial enlargement of the layer is mandatory to perform simulations on meaningful length scales. Therefore we are in particular interested in decoupling the width of the interfacial layer from the value of the surface tension. We will present numerical results demonstrating the influence of different model parameters (interface width, reaction rate, surface tension) on the behaviour of the two phase system.

REFERENCES

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