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On thermodynamically consistent schemes for two-phase flow with mass density contrast and species transport

Recently, Abels, Garcke, and Grün proposed a class of diffuse interface models for two-phase flow with different mass densities which allow both for energy estimates and for solenoidal velocity fields. It differs from earlier approaches – apparently not consistent with thermodynamics or not frame-indifferent – by a convective coupling of velocity field and Cahn-Hilliard flux. We present a subtle discretization of these terms which entails energy estimates and existence results in the discrete setting. Special attention is put on the implementation of some projection terms occurring. Finally, we present numerical simulations in various settings – Rayleigh-Taylor instability, rising droplets, species transport and Henry’s law – and compare them with those obtained by other models. (joint work with Fabian Klingbeil) Comments: This is an invited talk of the focus session organized by Marco Fontelos.