Modelling liquid-vapor phase change with metastable states.

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We propose a model of liquid-vapor phase transition including metastable states of the van der Waals Equation of State. The first part of the talk concerns the thermodynamics model. Following the second principle, the problem boils down to a minimization problem with constraints of the mixture energy. This "static" description allows to recover the classical equilibria: pure liquid/vapor states and a coexistence state (given by the Maxwell equal area rule). Then, when assuming a dependency with respect to time, we define a dynamical system with long time equilibria which are either the classical equilibria or the metastable states. In a second part of the talk, we use the dynamical system as a source term of a two-phase isothermal model. The homogeneous model is hyperbolic under condition. However for smooth solutions, we manage to prove that the regions of hyperbolically are invariant domains. We finish with some numerical experiments, obtained by a finite volume scheme and a splitting technique to handle the source term.