One-Dimensional Wave Patterns in Phase Transition Problems

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Abstract

Many successfully used numerical schemes for the simulation of the dynamics of homogeneous media rely on the careful analysis of one-dimensional initial value problems. The most prominent examples are Riemann solvers based on finite volume methods. It is a-priori not clear whether these approaches can be transferred to describe problems with phase transitions: How do we characterize a phase transition within a 1D-Riemann pattern? How can be taken into account the effect of curvature, respectively, surface tension?

In the talk we will first present the analysis of the Riemann problem for the isothermal Euler equations with Van-der-Waals pressure isotherm. Furthermore, we discuss the influence of surface tension in the case of curved fronts.

In the second part of the talk we will address the question of stability of fronts where the phase changes. We present a new result concerning the global stability of fronts and certain multi-phase solutions in the framework of a non-local diffuse interface approach.

The talk relies on joint work with Chr. Chalons, A. Dressel, and Chr. Merkle.