Global solutions for a hyperbolic model of multi-phase flow

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We consider a one-dimensional model for the flow of an inviscid fluid admitting liquid and vapor phases as well as a mixture of them. It consists of three equations, the state variables being the specific volume, the velocity and the mass density fraction of vapor in the fluid. The model is then completed by a reaction term for the equation of the mass density fraction, that vanishes for certain regimes, leading to stable and metastable configurations.

This model presents some remarkable analytic features. As a first step toward the study of the complete system, one can consider the system without source term. It is strictly hyperbolic and admits non-trivial stationary waves, that are used to connect interfaces between different phases. This homogeneous system admits solutions, for data with large total variation, which are global in time. On the other hand, despite its simple form, the system with source term does not fit into the framework of the known theories. We will analyze some aspects concerning the existence of solutions for both models.