A hierarchy of mathematical models for compressible two-phase flows

Hervé Guillard, INRIA Sophia-Antipolis

The computations of two phase flows by homegenized macroscopic models is a difficult task. Instead of a unique well-established mathematical model, there exits a huge collection of models designed to deals with specific situations. It is therefore not easy to choose the right level of modeling between the many possible ones.
This talk will show that this set of models can be organized according to the various assumptions that are made concerning the equilibria attained in the flow. It will be shown that using Chapman-Enskog expansions in the limit of zero relaxation time toward the various equilibria that exist in these flows, a full set of models of decreasing complexity can be constructed. At the top of this hierarchy, we have a complete seven equation model with two pressures, two velocities and two temperatures while the simplest model is given in the inviscid case by the Euler equations of compressible flows. We also show how some non-equilibrium effects can be retained in these models under the form of second-order dissipative terms.