Phase Transitions in the zero Mach number limit of compressible multiphase flow equations

Hyeonseong Jin
1) Department of Mathematics, Jeju National University, Jeju, 63243, KOREA

Corresponding Author: Hyeonseong JIN, hjin@jejunu.ac.kr

ABSTRACT

We are concerned on the phase transition of mixing zone in the zero Mach number limit of compressible multiphase flow. In the transition regions, formal asymptotic expansions are derived for the solutions of compressible equations. Specifically, under the singular limit process, the slow and fast transitional variables are found away from the initial time and near the initial time, respectively [9]. The zero Mach number limit of compressible flow models [2-5, 8] is studied describing the asymptotic behavior of the flow motion. The singular limit process of compressible multiphase flow possesses phase transitions as the Mach number goes to zero since the compressible mixing zone edge moves faster than the incompressible mixing zone edge [6]. The zero Mach number limit of the compressible multiphase flow equations is a layer-type problem as well as a time-singular problem, which needs advanced asymptotic methods. The incompressible limit of the single phase compressible Euler or Navier-Stokes equations has been studied in higher space dimensions [1,6,10,11]. Describing a singular limit process, a uniformly valid asymptotic expansion exists uniquely. Each order of an asymptotic expansion for the solution of the compressible flow has an independent existence, defined as proportional to a derivative of the compressible solution with respect to $\lambda$, the reciprocal of the Mach number, evaluated at the value $\lambda$ of the expansion parameter.

References


