Master 2 Internship

Inviscid limit of compressible flows on thin domains

Recent developments in Mathematical Analysis shed a new light on the mathematical modelling of compressible multiphase flows. Until recently, the models of the literature were obtained using formal expansions or averaging tools, and closed by empirical relations, see [3] for instance. It is a key issue to provide a mathematical theory of derivation of inviscid compressible multiphase models. Starting from multiphase Navier–Stokes models, new methodologies may enable to derive original average multiphase models — or validate existing models.

The goal of this internship is to study asymptotic limits of the compressible model of Navier–Stokes equations, in the monofluid case. This model may serve as the starting point for deriving simpler models by means of asymptotic analysis. A major example is the inviscid limit which enables to recover the compressible Euler equations, see for instance [1]. Another example of nontrivial limit is the transition from a 3D to a 2D model, by considering quasi-2D domains in 3D, as studied in [2]. In both cases, the relative energy is used to compare the solution of the 3D Navier–Stokes equations with the solution of the limit model, and rigorously prove the convergence. Our aim is to study the limit from the 3D Navier–Stokes equations on a thin domain towards the 2D Euler equations, by including a viscosity which depends on the thickness of the domain.

The intership will be held at Institut Camille Jordan, Lyon 1. According to the success of the internship, it may be followed by a PhD Thesis.

Key-words. Fluid Mechanics, Systems of Partial Differential equations, Multiphase Flows, Asymptotic Analysis.

References.

[1] Bardos, Claude, and Nguyen, Toan T. **Remarks in the inviscid limit for the compressible flows**. *Recent advances in partial differential equations and applications*, 55–67, Contemp. Math., 666, Amer. Math. Soc., 2016.
[2] Maltese, David, and Novotný, Antonín. **Compressible Navier-Stokes equations on thin domains**. *J. Math. Fluid Mech.* 16 (2014), no. 3, 571–594.
[3] Drew, Donald A., and Passman, Stephen L. **Theory of multicomponent fluids**. *Applied Mathematical Sciences*, vol. 135, Springer-Verlag, New York, 1999.

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