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Asymptotic analysis, low Mach number limit: from compressible to incompressible system

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We will show asymptotic analysis for hydrodynamic system, as Navier-Stokes-Fourier system, as a useful tool in in the situation when certain parameters in the system – called characteristic numbers – vanish or become infinite. The choice of proper scaling, namely proper system of reference units, the parameters determining the behaviour of the system under consideration allow to eliminate unwanted or unimportant for particular phenomena modes of motion. The main goal of many studies devoted to asymptotic analysis of various physical systems is to derive a simplified set of equations - simpler for mathematical or numerical analysis. Such systems may be derived in a very formal way, however we will concentrate on rigorous mathematical analysis. I will concentrate on low Mach number limits with so called ill-prepared data and I will present some results wich concerns passage from compressible to incompressible models of fluid flow emphasising difficulties characteristic for particular problems. In particular we will discuss Navier-Stokes-Fourier system on varying domains, a multi-scale problem for viscous heat-conducting fluids in fast rotation and the incompressible limit of compressible finitely extensible nonlinear bead-spring chain models for dilute polymeric fluids.

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