ASYMPTOTIC LIMITS IN FLUID MECHANICS

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Asymptotic (singular) limits provide a bridge between several conceptually different models in fluid mechanics. We discuss the relation between the full Navier–Stokes–Fourier system describing the motion of a compressible, viscous, and heat conductive fluid and its *incompressible* counterparts that can be identified as singular limits when certain dimensionless parameters, notably, the Mach and Froude numbers tend to zero.

Our approach is based on the concept of weak solution regarded as an object in a suitable *Sobolev space*. The asymptotic limits are carried out by means of compactness arguments of Sobolev imbedding theorems and careful analysis of propagation of the acoustic waves.

Several particular systems are obtained as asymptotic limits: the Oberbeck–Boussinesq approximation, the anelastic limit, and the low Peclet number models used in astrophysics.