Stress Tensor Effects for Compressible Flows

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Lecture 1:

Pressure dependent viscosities and Navier-Stokes equations

We introduce the compressible Navier-Stokes equations with pressure dependent viscosity as a model for a fluid flow. We discuss mathematical challenges of this system and explain several recent mathematical results related to such systems.

Lecture 2:

Some mathematical results linked to Lecture 1

In this lecture, we discuss several mathematical results obtained for well-known physical systems assuming density dependent viscosities: multifluid system, granular system, pressure dependent incompressible system, ….

Lecture 3:

A new compactness criterium for compressible advection models

We present in this lecture a new compactness criterium for compressible advection models and how it is possible to obtain precise quantitative regularity estimates using a precise analysis of the structure of the equations combined to a novel approach to the compactness of the continuity equation. We will also present various compactness criteria which are usually used in fluid mechanics.

Lecture 4:

Compressible Stokes system with pressure states which are not thermodynamically stable

We focus on a Stokes-like system which can for instance model flows in a compressible tissue in biology or in a compressible porous media in petroleum engineering. We show existence of global weak solutions with non-monotone pressure laws. At the end we discuss extensions to compressible Navier-Stokes equations with pressures which are not thermodynamically stable and also with a possible anisotropy in the viscous stress tensor.