Stability of discontinuous solutions for inviscid compressible flows

Alexis Vasseur

University of Texas at Austin, USA

Abstract : We will discuss some recent developments of the theory of a contraction with shifts to study the stability of discontinuous solutions of systems of equations modeling inviscid compressible flows.

In a first result, in collaboration with Geng Chen and Sam Krupa, we provide some extensions of the Bressan theory for uniqueness of BV solutions in 1D [1]. We show that for 2×2 systems, the technical condition, known as bounded variations on space-like curve, is not needed for the uniqueness result. Moreover, we extend the result to a weak/BV stability result (in the spirit of the weak/strong principle of Dafermos) allowing wild perturbations fulfilling only the so-called strong trace property.

In a second work in collaboration with Moon-Jin Kang, we consider the stability of 1D viscous shocks for the compressible Navier-Stokes equation, uniformly with respect to the viscosity [3]. Thanks to the uniformity with respect to the viscosity, the result can be extended to the Euler equation (the associated inviscid model).This provides a stability result which holds in the class of wild perturbations of inviscid limits of solutions to Navier-Stokes, without any regularity restriction, not even the strong trace property [2]. This shows that the class of inviscid limits of Navier-Stokes equations is better behaved that the class of weak solutions to the inviscid limit problem.

Finally, we will present a first multi-D result obtained with Moon-Jin Kang and Yi Wang [4]. We show the stability of contact discontinuities without shear, in the class of inviscid limits of compressible Fourier-Navier-Stokes equation. Note that it is still unknown whether non-uniqueness results can be obtained via convex integration for this special kind of singularity.

Références

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