The relative entropy method in diffusive and dispersive systems

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Abstract.

The relative entropy method is a calculation originally developed for hyperbolic conservation laws by Dafermos and DiPerna, which exploits the thermodynamical entropy structure of hyperbolic systems in order to compare two appropriate solutions of the same or related thermomechanical systems. In this talk I will survey extensions of such calculations in two directions:

(a) for entropy dissipating hyperbolic-parabolic systems where the hyperbolic part is symmetrizable. This indicates the role of the second law of thermodynamics and as an application provides convergence from the system of thermoviscoelasticity to the system of adiabatic elasticity in the limit as the viscosity and heat conduction tend to zero for smooth solutions.

(b) A class of dispersive systems can be written as Euler flows generated by a variational structure induced by an energy functional. This class admits as examples the Euler-Korteweg system, the quantum hydrodynamics system, and the Euler-Poisson system. For these problems we develop a relative energy identity which in turn yields various asymptotic convergence results again for smooth solutions.

The talk is based on joint works with C. Christoforou (Univ. of Cyprus), J. Giesselmann (Univ. of Stuttgart) and C. Lattanzio (Univ. dell’Aquila).