1D-Compressible Navier-Stokes equations: Stabilization to the rest state and Lyapunov analysis

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Abstract

The purpose of this study (see [1] for full version) is a *construction of a Lyapunov functional* for 1D Navier-Stokes equations of a viscous compressible barotropic fluid under the influence of a large mass force in the case when the *rest state density admits vacua.* We assume the standard initial-boundary value problem with zero velocity boundary conditions. An immediate product of our construction is a result on a decay rate of evolutionary solution to the rest state.

The present research is a continuation of the investigation summarized in [2], where a Lyapunov functional has been constructed for the case of *strictly positive* rest state density.

The argument is given by a careful use of a *comparison quasistationary density* approximating the original evolutionary density. Two crucial appriori estimates play a decisive role in the construction. An apriori form of the energy equality and an estimate utilizing the monotonicity of the state function, and the analysis of approximative relation between the quasistationary density and the original density ρ. Despite of the singularity of the problem, a large class of mass forces and state functions is admitted.

Keywords: compressible flow, decay rate of solutions, non-negative rest state density.

References

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[1] Research supported by the University of Toulon-Var, the Grant Agency of the Czech Rep. (grant 201/05/0005) and the research plan of the Acad. of Sciences of the Czech Republic AVOZ1090503

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