Global Well-posedness and Asymptotics of Full Compressible Non-resistive MHD System with Large External Potential Forces

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Abstract

We consider the global well-posedness and asymptotic behavior of compressible viscous, heat-conductive, and non-resistive magnetohydrodynamics (MHD) fluid in a field of external forces over three-dimensional periodic thin domain $\Omega=\mathbb{T}^2\times(0,\delta)$ The unique existence of the stationary solution is shown under the adhesion and the adiabatic boundary conditions. Then, it is shown that a solution to the initial boundary value problem with the same boundary and periodic conditions uniquely exists globally in time and converges to the stationary solution as time tends to infinity. Moreover, if the external forces are small or disappeared in an appropriate Sobolev space, then δ can be a general constant. Our proof relies on the two-tier energy method for the reformulated system in Lagrangian coordinates and the background magnetic field which is perpendicular to the flat layer. Compared to the work of Tan and Wang (SIAM J. Math. Anal. 50:1432–1470, 2018), we not only overcome the difficulties caused by temperature, but also consider the big external forces.

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