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Global solution to the n-dimensional viscous non-resistive MHD system with damping in magnetic field

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Abstract

The global existence is obtained for the solution to the viscous non-resistive MHD system with magnetic damping in $\mathbb{R}^n (n \geq 2)$. This study is inspired by the recent examinations obtained by Fefferman et al. J. Funct. Anal. (2014) and Chemin et al. Adv. Math. (2016) on the local well-posedness of the viscous non-resistive MHD system.

Key Words: Global solution; MHD system; Besov space

Mathematics Subject Classification (2010) 35Q30; 35A05; 76D03

1. Introduction

Consider the viscous non-resistive MHD system with magnetic damping:

$$\begin{cases} \partial_t B + \eta B + u \cdot \nabla B - B \cdot \nabla u = 0, \\ \partial_t u + u \cdot \nabla u - \nu \Delta u + \nabla \Pi - B \cdot \nabla B = 0, \\ \operatorname{div} u = \operatorname{div} B = 0, \\ (u, B)|_{t=0} = (u_0, B_0). \end{cases} \tag{1.1}$$

Here u is the velocity field, B is the magnetic field, Π is the scalar pressure, $\nu > 0$ is the kinematic viscosity coefficient and $\eta > 0$ is the damping parameter. Equation (1.1) is a well-known system modelling the dynamics of the velocity and magnetic fields in electrically conducting fluids such as plasmas, liquid metals, and salt water, etc. There has been an extensive literature [2, 3, 4, 5, 6] on existence of the strong solution to the

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