Fluid and rigid body interaction in an incompressible electrically conducting fluid

Jan Scherz

Julius-Maximilians-Universität Würzburg, Germany
jan.scherz@stud-mail.uni-wuerzburg.de

We study a problem which stems from both the fields of magnetohydrodynamics and fluid-structure interaction: We consider a system of partial differential equations, which describes the motion of an insulating rigid body through an electrically conducting incompressible fluid. In this system, the fluid interacts on the one hand with the solid body and on the other hand with the electromagnetic fields trespassing both of the materials. Our main result proves the existence of weak solutions to the system.

Our proof is based on an approximation method which involves a time discretization via the Rothe method as well as a penalization via the Brinkman method. The time discretization is used to decouple the system, which enables us to deal with the solution-dependent test functions appearing in the electromagnetic part of the problem. The Brinkman penalization, which describes an approximation of the rigid body by rigidly moving but permeable objects with vanishing permeability, in turn allows us to handle the solution-dependent test functions in the mechanical part of the problem.