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Two-Fluid Equilibrium for Transonic Poloidal Flows[1] LUCA GUAZZOTTO, RICCARDO BETTI, University of Rochester — Much analytical and numerical work has been done in the past on ideal MHD equilibrium in the presence of macroscopic flow. In recent years, several authors have worked on equilibrium formulations for a two-fluid system, in which inertial ions and massless electrons are treated as distinct fluids. In this work, we present our approach to the formulation of the two-fluid equilibrium problem. Particular attention is given to the relation between the two-fluid equations and the equilibrium equations for the single-fluid ideal MHD system. Our purpose is to reconsider the results of one-fluid calculation with the more accurate two-fluid model, referring in particular to the so-called transonic discontinuities, which occur when the poloidal velocity spans a range crossing the poloidal sound speed (i.e., the sound speed reduced by a factor B_p/B). It is expected that the one-fluid discontinuity will be resolved into a sharp gradient region by the two-fluid model. Also, contrary to the ideal MHD case, in the two-fluid model the equations governing the equilibrium are elliptic in the whole range of interest for transonic equilibria. The numerical solution of the two-fluid system of equations is going to be based on a code built on the structure of the existing ideal-MHD code FLOW.

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