Abstract Submitted
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Numerical investigation of the turbulent MHD flow in a circular pipe with transverse magnetic field[1] XAVIER DECHAMPS, Department of Aero-Thermo-Mechanics, Université Libre de Bruxelles, MICHEL RASQUIN, Argonne National Laboratory and University of Colorado Boulder, GÉRARD DEGREZ, Department of Aero-Thermo-Mechanics, Université Libre de Bruxelles — In modern industrial metallurgical processes, external magnetic fields are often applied to control the motion of liquid metals by a non-intrusive means. The desired results are for example the damping of unwanted motions or the homogenization of a liquid zone in a partially solidified ingot. Because of the commonly appearing parameters in these processes, one can assume the quasi-static assumption for the magnetohydrodynamic equations. Here we are interested in the numerical study of the turbulent flow of a liquid metal inside an electrically insulated pipe with a transverse uniform magnetic field. For this purpose, we will use a hybrid spectral/finite element solver, which allows to study complex flows in Cartesian and axisymmetric geometries. For the case of interest, we consider a bulk Reynolds number of 8200 and a Hartmann number ranging between 5 and 30. Here, the main points of interest are the evolution of the skin friction coefficient as a function of the ratio of the Hartmann number Ha over the Reynolds number Re (with $0 < \mathrm{Ha/Re} < 75\mathrm{x}10^{-4}$) as well as the energy budget (viscous, Joule and numerical dissipations, kinetic energy production) in a cross-section. These results will determine the transition point between laminar and turbulent flows.

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