Computational Simulation of Fluid Flow Magnetic in Cavities

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Abstract. In this work we studied flows of magnetic fluids in a lid driven cavity. We proposed a vorticity-streamfunction formulation to solve the flow and an evolution equation for the magnetization. The equations governing the flow are solved using a finite differences scheme. We identified the main dimensionless physical parameters of the problem. The magnetic field is generated by a conductive wire, is locally constant and the fluid is considered weakly magnetizable. With this well-known geometry we study the effects of each of the terms of the magnetization equation in the flow. In order to obtain flows with more intense distributions of velocities and vorticity throughout the cavity, we studied several configurations of moving walls in the cavity. It was observed that for high values of the magnetic pressure coefficient, flows in the absence of the precessional term, the steady state regime of the flow is periodic. In addition, the increase in the magnetic pressure coefficient leads us to aperiodic regimes. Simulations with homogeneous field were performed in an attempt to isolate the effects of the precession term on the magnetization equation and the magnetic torque term in the rotational of the Navier-Stokes equation.
This is an ongoing work jointly with Y. Sobral and F. Cunha.

References

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