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Vorticity generation and Kármán street in the flow past a magnetic obstacle[1] SERGIO CUEVAS, Center for Energy Research, UNAM, SERGEY SMOLENTSEV, MOHAMED ABDOU, University of California, Los Angeles — A numerical investigation of a 2D flow of an incompressible electrically conducting viscous fluid past a localized zone of applied magnetic field, denominated a magnetic obstacle, is carried out. The applied field is produced by the superposition of two small parallel magnetized square surfaces uniformly polarized in the normal direction. Using the low magnetic Reynolds number approximation, it is shown that the flow past a magnetic obstacle may develop vortical structures and eventually instabilities similar to those observed in flows interacting with bluff bodies. In the small zone where the oncoming uniform flow encounters the non- negligible magnetic field, the induced electric currents interact with the field, creating a non-uniform Lorentz force that opposes the flow and creates vorticity. Numerical computations have been conducted for Reynolds numbers $Re = 100$ and 200, and Hartmann numbers in the range $1 \leq Ha \leq 100$. Under these conditions, a wake is formed behind the obstacle. It may display two elongated streamwise vortices that remain steady as long as the Hartmann number does not exceed a critical value. Once this value is reached, the wake becomes unstable and a vortex shedding process similar to the one observed in the flow past bluff bodies is established.

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