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The effect of a magnetic field on vortex breakdown in an enclosed swirling flow[1] YANG YU, Institute of Thermodynamics and Fluid Mechanics, Ilmenau University of Technology, Ilmenau, Germany, BENWEN LI, Northeastern University, China, ANDRE THESS, Ilmenau University of Technology, Germany — An axisymmetric swirling flow, which is driven by rotation of top lid of an enclosed cylinder and subjected to of an axial uniform magnetic field, is studied numerically. As Reynolds numbers increasing, the phenomenon of vortex breakdown, a vortex appears and disappear on the axis of the cylinder, is a significantly process in the transition from the laminar flow to turbulent flow. The collocation spectral solver is developed to simulate the MHD flow. While, different conductivities of the walls, insulating and perfectly conducting cases, are considered to analyze the magnetic effect on the vortex breakdown. In order to validate the collocation spectral solver, the dynamic and MHD problems are referred, respectively. In the presence of an axial uniform magnetic field, the effects on the non-dimensional lengths of vortex along the z-axis and the central positions of vortex on the z-axis are presented, and the influence of the conductivities of the top lid, bottom base and side wall are discussed. The results show that, for different electrical boundary conditions, the behaviors of vortex are significantly different and even converse. In particular, when the top rotating lid is the only perfectly conducting, the magnetic effects are the strongest.

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