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Numerical Study of Magneto- Convection in a Partitioned Enclosure

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In the majority of magneto-hydrodynamics (MHD) natural-convection simulations, the Lorentz force due to the magnetic field is suppressed into a damping term resisting the fluid motion. Employment of an external magnetic field has increasing applications in material manufacturing industry as a control mechanism since the Lorentz force suppresses the convection currents by reducing the velocities. It is well known that natural convection heat transfer can be damped with the help of a magnetic field [1-3]

Steady, laminar, natural-convection flow in the presence of a magnetic field in a differentially heated square cavity which one insulated horizontal baffle attached to the hot walls is considered. The vertical walls are at different temperatures while the horizontal walls are adiabatic. In our formulation of governing equations, mass, momentum, energy and induction equations are applied to the cavity. To solve the governing differential equations a finite volume code based on PATANKAR's SIMPLER method is utilized. Numerical predictions are obtained for various Rayleigh number (Ra), Hartmann number (Ha) and baffles position at the Prandtl number Pr = 0.02. It is observed that when the magnetic field is weak and the Rayleigh number is high, the convection is dominant and vertical temperature stratification is predominant in the core region. Also in the case with $D_b = 0.4$ heat transfer is blocked more effectively than the other case. For sufficiently large Ha, the convection is suppressed and the temperature stratification in the core region diminishes.

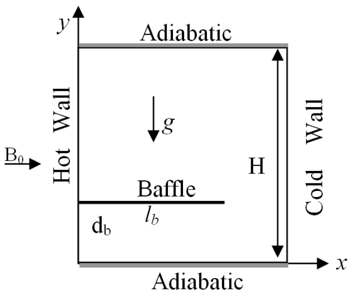

Fig. 1. Geometry and coordinates of enclosure configuration with magnetic effect.

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