Hydromagnetic Convection in the Rotating Cylindrical Annulus with Azimuthal Magnetic Field

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ABSTRACT

The problem of convection induced by radial buoyancy in an electrically conducting fluid contained by a rotating cylindrical annulus in the presence of a homogeneous magnetic field is considered. The small gap approximation is used together with rigid cylindrical boundaries. The onset of convection occurs in the form of axial, axisymmetric or oblique rolls. The angle χ between the roll axis and the axis of rotation depends of the ratio between the Chandrasekhar number, Q and the Coriolis number, τ. At finite amplitudes, transitions to zig - zag patterns, travelling wave patterns and to spatio - temporal chaos are found. Fully three - dimensional numerical simulations as well as Galerkin representations for oblique rolls and a subsequent stability analysis are used in the theoretical investigation. Overlapping regions of pattern stability exist such that the asymtotically realized state may depend on the initial conditions.