Attractors for the magnetic Bénard problem

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The influence of the magnetic field on the heat convection in a viscous and resistive fluid is an important topic for researches in various industrial situations, which include steel processing, the production of semi-conductors, and so on. A mathematical formulation of the heat convection phenomena under the presence of the magnetic field is provided by the magnetic Bénard equations, which is a coupled system of the magnetohydrodynamic equations and the thermohydraulics equations. We refer to [1]–[3] for more details.

We deal here with the asymptotic behavior of solutions to the magnetic Bénard system. In particular, we are concerned with the attractors, which characterize the long-time dynamics of the original system and possess the finite dimensional structure. Indeed, the theory of infinite dimensional dissipative dynamical systems developed so far and the analysis of the asymptotic behavior of solutions to the nonlinear evolution equations of these types generally show the finite dimensional features of the problems.

Our intension is then to estimate the fractal dimension of the attractors in terms of the various physical constants; that is, the (magnetic) Prandtl number, Rayleigh number to name a few. We believe that such characteristics may reveal the degree and the extent of the influence of magnetic factors and may be used as controlling parameters.

References

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[3] *M. A. Nakamura*: Regularity and analyticity of the solution of the magnetic Bénard problem. Adv. Math. Sci. Appl. *2* (1993), 117–137.