

Chaotic convection in a ferrofluid with internal heat generation

ABSTRACT

The nonlinear stability analysis of a ferrofluid layer system is formulated mathematically. This system considered the upper and lower free isothermal boundary with the system heated from below. A mathematical formulation is produced to study the behaviour of the chaotic convection in a ferrofluid layer system using Galerkin truncated expansion. The Boussinesq approximation is opted with the existence of internal heating and the magnetic number. It is found that the transition to chaos in this present study is identical to the Lorenz attractor and thus validate the method and analysis of this study. The impact of elevating the internal heat generation is found to hasten the instability of the system and as for the magnetic number, at $M_1 = 2.5$ the homoclinic bifurcation occurs and thus accelerates the convection process.

Keyword: Chaotic convection; Ferrofluid; Internal heating