

Nonlinear convection in a porous medium in the presence of vertical magnetic field

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Abstract: Magnetoconvection in an electrically conducting fluid in a sparsely packed porous medium is investigated using the Darcy-Lapwood-Brinkman model with the Boussinesq approximation. Linear stability analysis is studied by plotting graphs for different values of parameters relevant to a sparsely packed porous medium. We have derived a nonlinear two-dimensional Landau-Ginzburg equation with real coefficients near the onset of stationary convection at the supercritical pitchfork bifurcation and shown the effect of parameters on heat transfer rate. We have also derived a nonlinear two-dimensional cubic-quintic Landau-Ginzburg equation with real coefficients at the onset of stationary convection and discussed about the behavior of the convective system.

Keywords: Magnetoconvection, Landau-Ginzburg equation, Nusselt number, cubic-quintic Landau-Ginzburg equation.

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