International J. of Math. Sci. & Engg. Appls. (IJMSEA)
ISSN 0973-9424, Vol. 5 No. I (January, 2011), pp. 189-207

THE ONSET OF BENARD-MARANGONI CONVECTION IN A FERROFLUID LAYER WITH CONSTANT HEAT FLUX AT THE LOWER BOUNDARY

C. E. NANJUNDAPPA AND K. SRIKUMAR

Abstract

The onset of Benard-Marangoni convection in an initially quiescent ferromagnetic fluid layer in the presence of a uniform vertical magnetic field is investigated. The lower boundary is taken to be rigid with constant heat ux, while the upper free boundary at which temperature dependent surface tension effect is considered non-deformable and subject to a general thermal condition. The resulting eigen value problem is solved using the Galerkin technique and also by regular perturbation technique when both boundaries are insulated to temperature perturbations. It is found that increase in the Biot number, decrease in the magnetic number and non-linearity of the magnetization is to delay the onset of ferromagnetic fluid. Further, the nonlinearity of the magnetization is found to have no effect on the onset of ferroconvection in the absence of Biot number.

Key Words and Phrases: Surface-tension, Fixed heat ux, Regular perturbation technique, Galerkin technique, Magnetic nanoparticles.

Ascent Publication House: http:// www.ascent-journals.com