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Non-Darcy Effects in Magnetohydrodynamic Natural Convection in a Cavity Filled with a Porous Medium AMAR K C, ABHILASH J. CHANDY, Department of Mechanical Engineering, University of Akron, Akron, OH - 44325-3903 — Magnetohydrodynamic (MHD) natural convection in a porous medium has received considerable attention recently, on account of its applicability in many fields of science and engineering like geophysics, chemical processes and material processing. Low-magnetic Reynolds number (Re_m) MHD natural convection is investigated in a rectangular cavity with isothermal walls on the left and right and adiabatic walls on the top and bottom. The validity of Darcy's law is addressed for high-Rayleigh number (Ra) flows with high permeability, where the velocity-pressure gradient relationship transitions from linear (that is the Darcy law) to nonlinear, due to the fact that the form drag due to solid obstacles is now comparable with the surface drag due to friction, which in turn results in the Darcy-Forchheimer law. In addition, the effect of different magnetic field strengths in terms of Hartmann numbers (Ha) is also investigated to analyze how the flow and thermal characteristics in a porous medium are influenced by the applied magnetic field.

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