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Magneto-Convective Instability in a Horizontal Power-Law Nanofluid Saturated Porous Layer

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Abstract : The onset of the convective instability in the horizontal through flow of a power-law nanofluid saturated by porous layer heated from below under the influences of magnetic field are investigated in this study. The linear stability theory is used for the transformation of the partial differential equations to system of ordinary differential equations through infinitesimal perturbations, scaling, linearization and method of normal modes with two-dimensional periodic waves. The system is solved analytically for the closed form solution of the Rayleigh number by using the Galerkin-type weighted residuals method to investigate the onset of both traveling wave and oscillatory convection. The effects of the power-law index, Lewis number and Peclet number on the stability of the system were investigated. The Lewis number stabilizes while the power-law index and Peclet number destabilize the nanofluid system. The system in the presence of magnetic field is more stable than the system in the absence of magnetic field.

Keywords : convection, instability, magnetic field, nanofluid, power-law
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