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عنوان مقاله:

Radial and Axial Magnetic Fields Effects on Natural Convection in a Nanofluid-filled Vertical Cylinder

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نویسندگان:

M. Battira - *Department of Physics,Moulay Tahar University, Saida, ۲۰۰۰۰, Algeria*

R. Bessaïh - *Department of Mechanical Engineering, LEAP Laboratory, Constantine, ۲۵۰۰۰۰, Algeria*

خلاصه مقاله:

This work aims to study numerically the steady natural convection in a vertical cylinder filled with an Al۲O۳ nanofluid under two different external magnetic fields (Br, Bz) either in the radial or axial directions. The cylinder having an aspect ratio H/R۰=۱ is bounded by the top and the bottom disks at temperatures Tc and Th, and by an adiabatic side wall. The equations of continuity, Navier-Stokes and energy are non-dimensionalized and then discretized by the finite volume method. A computer program based on the SIMPLER algorithm is developed and compared with the numerical results found in the literature. The effects of nano-size solid volume fraction ranging from ۰ to ۰.۱ and application of the magnetic field in either directions axial and radial for various values of Hartmann numbers on flow and thermal fields, and on local and average Nusselt numbers are presented and discussed for two values of Rayleigh numbers (Ra=۱۰۳ and ۱۰۴). The behaviors of average Nusselt number, streamlines, temperature contours, and the both components of velocity are illustrated. The results indicate that for small values of the Hartmann number, where the flow remains due to the convection, the average Nusselt number decreases when increasing the solid volume fraction and this decrease is more important if the magnetic field is applied in the axial direction and by increasing the Hartmann numbers. The increasing in the solid volume fraction increases the performance of heat transfer in the nanofluid.

کلمات کلیدی:

Natural convection, Nanofluid, Magnetic field

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