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Numerical investigation of mixed convection and entropy generation in a wavy-walled cavity filled with nanofluid and involving a rotating cylinder
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Abstract

This numerical study considers the mixed convection and the inherent entropy generated in Al₂O₃-water nanofluid filling a cavity containing a rotating conductive cylinder. The vertical walls of the cavity are wavy and are cooled isothermally. The horizontal walls are thermally insulated, except for a heat source segment located at the bottom wall. The dimensionless governing equations subject to the selected boundary conditions are solved numerically using the Galerkin finite-element method. The study is accomplished by inspecting different ranges of the physical and geometrical parameters, namely, the Rayleigh number ($103 \leq Ra \leq 106$), angular rotational velocity ($0 \leq \Omega \leq 750$), number of undulations ($0 \leq N \leq 4$), volume fraction of Al₂O₃ nanoparticles ($0 \leq \phi \leq 0.04$), and the length of the heat source ($0.2 \leq H \leq 0.8$). The results show that the rotation of the cylinder boosts the rate of heat exchange when the Rayleigh number is less than 5×10^5 . The number of undulations affects the average Nusselt number for a still cylinder. The rate of heat exchange increases with the volume fraction of the Al₂O₃ nanoparticles and the length of the heater segment. © 2018 by the authors.

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