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Effect of rotating solid cylinder on entropy generation and convective heat transfer in a wavy porous cavity heated from below
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Abstract
The aim of the present study is to analyze the entropy generation and convective heat transfer in a bottom-heated wavy porous cavity containing a solid rotating cylinder. An isothermal heater of length h is placed on the bottom wall of the cavity, while both the left and right vertical wavy walls are maintained at a constant cold temperature Tc. The remainder parts of the bottom wall and the top wall are kept adiabatic. The Forchheimer-Brinkman-extended Darcy model is assumed to hold. The dimensionless governing equations subject to the selective boundary conditions are solved numerically using the Galerkin weighted residual finite element method. The governing parameters of this study are the Rayleigh number (Ra = 105 and 106), angular rotational velocity (− 1000 ≤Ω≤ 1000), Darcy number (10−6 ≤ Da ≤ 10−2), number of oscillations (1 ≤ N ≤ 4) and porosity of the medium (0.2 ≤ ε ≤ 0.8). The developed computational code is validated comprehensively using the grid independence test and numerical data of other authors. The obtained results reveal that the flow control can be accomplished by the angular rotational velocity or direction of the cylinder rotation, which have important design implications in practical applications. In addition, an augmenting in the porosity of the medium causes an increase in heat transfer from the wall to the fluid and therefore an increase in the convective flow and consequently a decrease in the Bejan number. © 2018 Elsevier Ltd

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