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Effects of non-homogeneous nanofluid model on natural convection in a square cavity in the presence of conducting solid block and corner heater
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Abstract
This study investigates numerically the effect of the two-phase nanofluid model due to natural convection within a square cavity along with the existence of a conducting solid block, and a corner heater using the finite difference method (FDM). The top horizontal wall is retained at a cold temperature that is fixed as constant, while the isothermal heater is positioned at the bottom left corner within the square cavity. The remaining fractions of the right vertical wall and the heated wall are set to be adiabatic. The water-based nanofluid, together with Al2O3 nanoparticles, have been evaluated by determining the following parameters: the volume fraction of nanoparticles, thickness of solid block, Rayleigh number, and the solid block thermal conductivity. As a result, the comparative evaluation with outputs reported in publications and prior experimental works has pointed out exceptional agreement with the findings retrieved in this study. The experimental outcomes are graphically illustrated in terms of the average and local Nusselt numbers, isotherms, distribution of nanoparticles, and the streamlines. The findings indicate that an elevation of the thermal conductivity in blocks with a similar size successfully increases the transfer rate of heat, wherein the dominance of conduction has been observed. © 2018 Energies. All rights reserved.

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