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Conjugate heat transfer and entropy generation in a cavity filled with a nanofluid-saturated porous media and heated by a triangular solid
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Abstract
Entropy generation due to conjugate natural convection-conduction heat transfer in a square domain is numerically investigated under steady-state condition. The domain composed of porous cavity heated by a triangular solid wall and saturated with a CuO-water nanofluid. Equations governing the heat transfer in the triangular solid together with the heat and nanofluid flow in the nanofluid-saturated porous medium are solved numerically using the over-successive relaxation finite-difference method. A temperature dependent thermal conductivity and modified expression for the thermal expansion of nanofluid are adopted. A new criterion for assessment of the thermal performance is proposed. The investigated parameters are the nanoparticles volume fraction φ (0-0.05), modified Rayleigh number Ra (10-1000), solid wall to base-fluid saturated porous medium thermal conductivity ratio Kro (0.44, 1, 23.8), and the triangular solid thickness D (0.1-1). The results show that both the average Nusselt number and the entropy generation are increasing functions of Kro, while they are maxima at some critical values of D. It is also found that the addition of nanoparticles increases the entropy generation. According to the new proposed criterion, the results show that the largest solid thickness (D = 1.0) and the lower wall thermal conductivity ratio manifest better thermal performance. © 2015 Taiwan Institute of Chemical Engineers.

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