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Heat transfer enhancement of uniformly/linearly heated side wall in a square enclosure utilizing alumina–water nanofluid
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Abstract
A numerical study is carried out on natural convection flow of Al 2 O 3 -water nanofluid in a square cavity when the left wall is uniformly (or) linearly heated and the right wall is cooled whereas the top and bottom walls are well insulated. A computational code is developed based on the SIMPLE algorithm, and the finite volume method is used to solve the discretized equations. The Maxwell-Garnett and the Brinkman models are used to evaluate the nanofluid thermal conductivity and dynamic viscosity, respectively. Numerical results are presented in terms of the velocity profiles, stream functions, and isotherm contours, and the local and average Nusselt numbers for a wide range of the Rayleigh number Ra = 10 4 –10 6 and the solid volume fraction (0 ≤ φ ≤ 0.2) at the Prandtl number Pr = 6.2. It is found that, for both cases of boundary conditions, the average Nusselt number increases as the volume fraction increases at a given Rayleigh number. That is, the heat transfer rate performance is improved by the addition of alumina nanoparticles in water. However, the overall heat transfer rate at the left wall for the linearly heated case is less than that for the uniformly heated case with the corresponding values of Ra andφ. © 2017 by Begell House, Inc.

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