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Effects of two-phase nanofluid model on MHD mixed convection in a lid-driven cavity in the presence of conductive inner block and corner heater
(2019) *Journal of Thermal Analysis and Calorimetry*, 135 (1), pp. 729-750. Cited 9 times.

Abstract
This paper investigates a steady mixed convection in a lid-driven square cavity subjected to an inclined magnetic field and heated by corner heater with an inserted square solid block. Water–Al 2 O 3 nanofluid fills the cavity based on Buongiorno's two-phase model. A corner heater is configured in the left lower corner of the cavity by maintaining 40% of the bottom and vertical walls at constant hot temperature. The top horizontal wall is moving and maintained at a constant low temperature. The remainder walls are thermally insulated. The governing equations are solved numerically using the finite element method. The governing parameters are the nanoparticles volume fraction (0 ≤ ϕ≤ 0.04), Reynolds number (1 ≤ Re≤ 500), Richardson number (0.01 ≤ Ri≤ 100), Hartmann number (0 ≤ Ha≤ 50) and the size of the inner solid (0.1 ≤ D≤ 0.7). The other parameters: the Prandtl number, Lewis number, Schmidt number, ratio of Brownian to thermophoretic diffusivity and the normalized temperature parameter, are fixed at Pr= 4.623 , Le= 3.5 × 10 5 , Sc= 3.55 × 10 4 , N BT = 1.1 and δ= 155 , respectively. The inclination of the magnetic field is fixed at γ=π4. Results show that at low Reynolds number, the increase in nanoparticles loading more the 2% becomes useless. It is also found that a big size of the solid block can augment heat transfer in the case of high values of both the Reynolds and Richardson numbers. © 2018, Akadémiai Kiadó, Budapest, Hungary.

2-s2.0-85047665722
Document Type: Article
Publication Stage: Final
Source: Scopus

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