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Combined MHD convection and thermal radiation of nanofluid in a lid-driven porous enclosure with irregular thermal source on vertical sidewalls
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Abstract
Mixed convective heat transfer of Cu–water nanofluid in a porous cavity with non-uniform temperature profiles on vertical sidewalls in the presence of thermal radiation and magnetic field is examined numerically. The vertical sidewalls are heated sinusoidally. Thermally insulated walls are considered at the remaining sides of the cavity. The magnetic field is applied parallel to the horizontal walls uniformly. The SIMPLE algorithm based on finite volume approach is applied to solve the governing equations. The numerical outcomes are discussed in the wide range of the parameters, Richardson number, phase deviation, amplitude ratio, Darcy number, Hartmann number, the thermal radiation, and the solid volume fraction. It is found that the average Nusselt number is decreased in value with the raise in the either Hartmann number or Richardson number in the presence of thermal radiation. The average heat transfer rate is enhanced with an augment in the solid volume fraction, and this enhancement is more effective in the presence of thermal radiation than that of in the absence of thermal radiation. The highest heat transfer rate is obtained for φ= 0 in the forced convection regime, whereas it is maximum at φ= 3 π/ 4 in the mixed and free convection regimes. © 2019, Akadémiai Kiadó, Budapest, Hungary.

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