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Flow and convective heat transfer of a ferro-nanofluid in a double-sided lid-driven cavity with a wavy wall in the presence of a variable magnetic field
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Abstract
In this work, the effect of a variable spatial magnetic field on ferro-nanofluid flow and heat transfer in a double-sided lid-driven enclosure with a sinusoidal hot wall is investigated. The working fluid is a mixture of iron oxide (Fe3O4) nanoparticles and water and is referred to as a ferro-nanofluid. The control volume-based finite element method (CVFEM) is used to solve the governing equations in the stream function-vorticity formulation. In deriving the governing equations for this investigation, the effect of both ferro-hydrodynamics and magneto-hydrodynamics is taken into account. The numerical calculations are performed for different governing parameters namely; the Reynolds number, nanoparticle volume fraction, magnetic number (arising from Ferrohydrodynamics (FHD) consideration), and the Hartmann number (arising from Magnetohydrodynamics (MHD) consideration). The results show that an enhancement in heat transfer has a direct relationship with the Reynolds number and the Hartmann number, but it has an inverse relationship with the magnetic number. Also, it can be concluded that the Nusselt number increases with the increase of the nanoparticle volume fraction, magnetic number, and the Reynolds number while the opposite trend is observed for the Hartmann number. © 2016 Taylor & Francis Group, LLC.

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