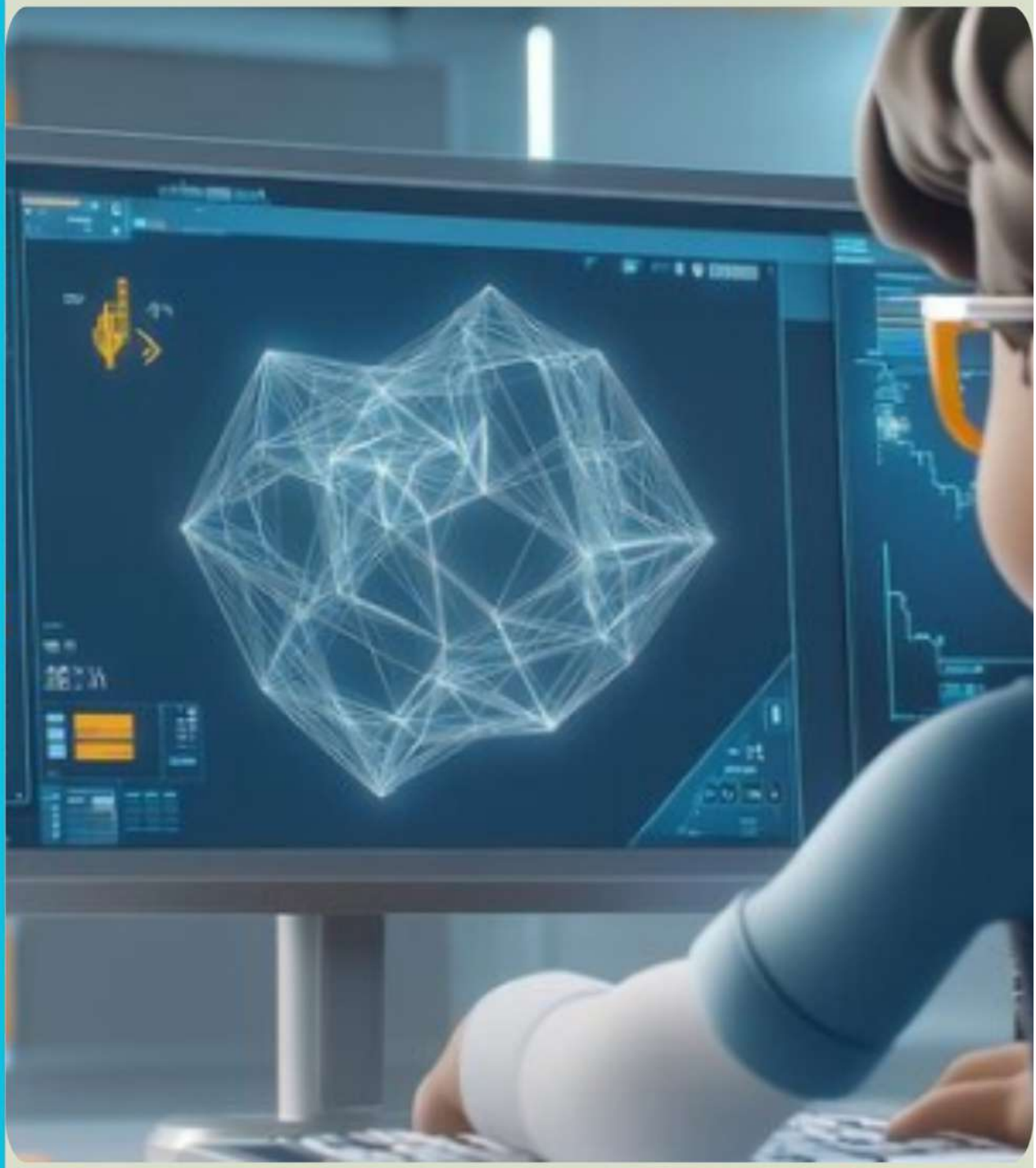
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MAGNETOHYDRODYNAMIC NATURAL CONVECTION OF COPPER–ENGINE OIL NANOFLUID IN A PARTIALLY HEATED SQUARE ENCLOSURE

Abstract

The magnetohydrodynamic natural convection of copper-engine oil nanofluid within a partially heated square enclosure subject to a uniform horizontal magnetic field has been examined numerically. The present problem is governed by vorticity-stream function formulations that are solved by employing finite-difference method (FDM). $Ra = 10^5$, $Pr = 10^4$, nanoparticle volume fraction $\varphi = 0.05$, cylindrical particle shape factor n = 6, and Hartmann numbers varied from 0 to 100 have been used in the simulations. The obtained outcomes are compared with benchmark solutions and a deviation as small as 2.07% is found. The Hartmann number shows a tendency to hinder buoyancy-driven circulations with increasing value of it due to the Lorentz force, and the streamlines become weaker while isotherms become more straightened, which reduces heat transfer. As Hartmann number enhances from 0 to 100, the average Nusselt number reduces by approximately 68.1%. Therefore, the influence of magnetic field may be effectively utilized to regulate natural convection and heat transfer, which should be significant in the area of thermal management and other MHD applications.

Keywords: Porous medium; Magnetic field; Nanofluid; Thermal radiation; Natural convection; Chemical reaction.

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