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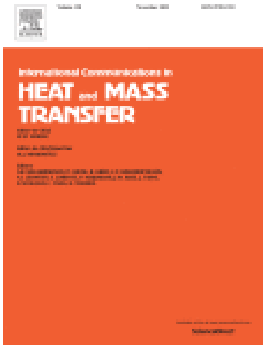

Thermohydraulic and second law analyses during the cooling of an electronic device mounted in an open cavity equipped with magnetic nanofluid, magnetic field inducer, and porous media: A two-phase numerical investigation

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Abstract

Electronic component cooling is one of the most critical barriers to system development in terms of being faster, smaller, and more reliable. Therefore, thermal management is necessary to control the large amount of heat that is produced. In the present study, a highly effective hybrid method is recommended to improve the thermal performance of an electronic device's cooling. A two-phase model is used in a three-dimensional numerical study to accurately examine the heat transfer characteristics, pumping power, and entropy production of Fe3O4/water nanofluid flow affected by a magnetic field inducer and a porous medium. Validation with the available data and mesh independence are performed to shed light on the accuracy of the presented model. The outcomes reveal that the combined technique improves both convection and conduction phenomena and decreases the irreversibility in the system. In addition, the data indicates that there is an optimum velocity for each magnetic field strength in order to maximize the cooling performance. In comparison with the circumstance of pure water and no magnetic field and porous medium, the heat transfer enhancement can be improved by 2.3 times when employing these conditions simultaneously: a magnetic field of 500G, Reynolds number of 500, a porosity of 0.85, and a volume fraction of 2%. Finally, the proposed method shows only a slight increase in pressure drop since no additional obstacles were used.

Keywords

Electronic chip Ferrofluid Magnetic field Porous media Thermodynamics
Two-phase model