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REVIEWER'S REPORT

Manuscript No.: **IJAR-53404** Date: 20-08-2025

Title: Numerical study of the effect of the magnetic field on magnetoconvective flow of a Newtonian fluid confined between two vertically offset hemispheres.

Recommendation:
Accept as it is .....YES.....
Accept after minor revision.....
Accept after major revision .....
Do not accept (*Reasons below*) .....

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity			✓	
Significance		✓		

Reviewer Name: Mir Tanveer

Reviewer's Comment for Publication.

Review Report

The manuscript entitled **"Numerical study of the effect of the magnetic field on magnetoconvective flow of a Newtonian fluid confined between two vertically offset hemispheres"** presents a numerical investigation into the behavior of electrically conductive Newtonian fluids under the influence of magnetoconvection in a complex hemispherical geometry.

The **abstract** is clear and concise, outlining the purpose, methodology, and principal findings of the study. The problem is well defined as the influence of a uniform oblique magnetic field on magnetoconvection within a vertically eccentric hemispherical cavity. The methodology is explicitly described, involving projection of the governing equations into a bispherical coordinate system, discretization using the finite difference method, and computational implementation in FORTRAN. The focus on critical values of physical parameters such as the Hartmann number, Rayleigh number, eccentricity, and magnetic field inclination angle establishes a solid theoretical basis. The abstract further highlights the dual effect of the magnetic field: at low

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Hartmann numbers, convection dominates, increasing the Nusselt number, while at high Hartmann numbers, the magnetic field suppresses convection, reducing heat transfer. The results are reported as consistent with existing literature, underscoring their reliability.

The keywords provided — Magnetoconvection, Hemispherical cavity, Eccentricity, Rayleigh number, Hartmann number, and Nusselt number — are appropriate and capture the core aspects of the study.

The introduction effectively situates the study within the broader research context. Magnetoconvection is presented as a phenomenon of multidisciplinary importance, with applications across geophysics, astrophysics, plasma physics, missile technology, medicine, and biology. The reference to existing studies in different enclosure geometries, including parallelepiped, cylindrical, and spherical domains, establishes a research lineage and justifies the focus on hemispherical cavities. Citations indicate awareness of prior experimental and numerical works, which further supports the study's relevance and originality.

Overall, the manuscript is coherently structured, scientifically rigorous, and contextually relevant, providing a strong foundation for numerical analysis of magnetoconvection in complex geometries.