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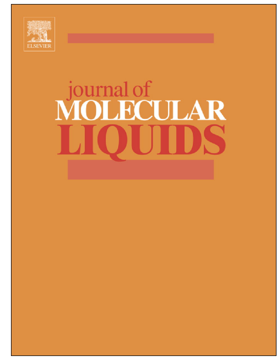

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Energy transfer through mixed convection within square enclosure containing micropolar fluid with non-uniformly heated bottom wall under the MHD impact

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Abstract: Present investigation conveys computations for mixed convective energy flow through a square container carrying micropolar fluid under the influence of constant horizontal magnetic field. Bottom wall of an enclosure is subject to non-uniform heating profile while remaining walls of an enclosure are maintained at low temperature. Numerical simulations are computed incorporating Galerkin method of Finite element scheme against various values of involved parameters like Grashof number, Reynolds number, Hartmann number and micropolar parameter. It has been observed that strength of stream line circulations escalates with augmentation in Grashof (*Gr*) number where it attenuates with augmentation in Hartmann (*Ha*) and Reynolds (*Re*) numbers. Convection regime dominates in cavity for large Grashof number and small Hartmann number. Heat transfer coefficient *Nu* rises with surge in Reynolds number, Hartmann number and micropolar parameter and it reduces with rise in Grashof number along upper boundary where overall heat flow rate is increasing function of Grashof number and decreasing function of Reynolds and Hartmann number along bottom wall.

Keywords: Mixed convection; Cavity flow; Micropolar fluid; Finite element method; MHD

Introduction: Heat transfer through natural and forced convection within micropolar fluids contained in containers of different geometries have been subject to extensive investigation for past few decades due to numerous applications in industry and engineering, e.g. reactor designs, room ventilation, crystal growth, heat exchange devices and various other systems of fluid transportation. Microstructure effects are generally not taken into account in classical Navier Stokes model. Applying shear stress on particles, they may contract, expand, change their shapes or may rotate about their own axis. These fluids have application in animal blood, liquid colloidal solutions, crystals, suspensions and polymer fluids.

Using boundary element method Zadravec et al. [1] conveyed numerical simulations against natural convective flow within a square container carrying micropolar fluid and shown results against various values of Rayleigh number and microrotation. Wang and Hsu [2] studied natural convection in buoyancy driven flow of micropolar fluid inside an inclined enclosure of rectangular shape when heated and cooled from side walls considering insulated top and bottom wall. They presented numerical results for various Rayleigh numbers and aspect ratios of the cavity. T. Hsu et al. [3] numerically studied energy transmission in micropolar