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Abstract

Hall effects on the MHD Couette flow between two infinite horizontal parallel porous plates in a rotating system under the boundary layer approximations have been studied. One of the plate is

held at rest and the other one moves with uniform velocity. An exact solution of governing equation has obtained in closed form. Asymptotic behavior of the solution has analyzed for large values of magnetic parameter, rotation parameter and Reynolds number. It is observed that a thin boundary layer is formed near the stationary plate for large values of the rotation parameter, magnetic parameter and Reynolds number. The thickness of these boundary layers increases with increase in Hall parameter. The heat transfer characteristic has also discussed on taking viscous and Joule dissipations into account. It is found that an increase in Hall parameter, the temperature in flow field increases.

References

- Gupta, A. S.(1972). Heat transfer in hydromagnetic couette flow with Hall effects. The Mathematics Student. XL: 103-106.
- Jana, R. N., Datta, N. and Mazumder, B. S.(1977). Magnetohydrodynamic Couette flow and heat transfer in a rotating system. J. Phys. Soc. Japn. 42:1034 -1039.
- Soundalgekar, V. M., Dessai, G. A. and Gupta, A. S.(1974). Hall effects on generalized MHD Couete flow with heat transfer. Bulletin De La Classe Des Sciences, Lx: 332-345.
- Ghosh, S. K. and Pop, I. (2004). Hall effects on MHD plasma Couette flow in a rotating environment. Int. J. Applied Mech. Eng. 9(2): 293-305.
- Ghosh, S. K. (2002). Effects of Hall current on MHD Couette flow in a rotating system with arbitrary magnetic field. Czech. J. Phys. 52(1): 51-63.
- Jana, R. N. and Datta, N.(1977). Hall effects on unsteady Couette flow, Int. J. Engng. Sci.15:35-43.
- Kanch, A. K. and Jana, R. N.(2001). Hall effect on unsteady Couette flow under boundary layer approximations. J. Physical Sciences. 7: 74-86.
- Cowling T. G. (1957). Magnetohydrodynamics, New york, Intersscience, pp.101.
- Batchelor, G. K. (1967). An Introduction to Fluid Dynamics, Ist ed., Cambridge Press, Cambridge, U. K., pp.200.
- Jana, R. N. and Datta, N.(1977). Couette flow and heat transfer in a rotating system, Acta Meccanica. 26: 301-306.
- Pop, I. and Soundalgekar, V. M.(1974). Effects of Hall currents on hyromagnetic flow near a porous plate. Acta Meccanica. 20:315-318.
- Gupta, A. S.(1975). Hydromagnetic flow past a porous plate with Hall currents, Acta Meccanica. 22: 281-287.
- Gupta, A. S.(1972). Ekman layer on a porous plate, Physics of fluids, 15: 930-931.
- Majumder, B. S., Gupta, A. S. and Datta, N.(1976). Flow and heat transfer in the hydromagnetic Ekman layer on a porous plate with Hall effects, Int. J. Heat and Mass transfer. 19: 523-527.

Index Terms

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Keywords

Hall effects   MHD Couette   Magnetic parameter

Hall parameter

Rotation parameter

Reynolds number

Joule dissipations

Heat transfer

Boundary layer