Effects of Viscous Dissipation and Joule Heating on Natural Convection Flow of a Viscous Fluid from Heated Vertical Wavy Surface

Nasser S. Elgazery[a] and Nader Y. Abd Elazem[b]

Department of Mathematics, Faculty of Education, Ain Shams University, Roxy, Heliopolis, Cairo, Egypt

[a] Present Address: Department of Mathematics, Deanship of Educational Services, Al-Qassim University, P.O. Box 6595, Al-Qassim, Buraidah, 51452 Saudi Arabia

[b] Present Address: Department of Mathematics, Faculty of Science, Tabuk University, P.O. Box 741, Tabuk 71491, Saudi Arabia

Reprint requests to N.Y. A.E.; E-mail: naderelnafrawy@yahoo.com

Z. Naturforsch. **66a,** 427 – 440 (2011); received July 3, 2010 / revised November 30, 2010

A mathematical model will be analyzed in order to study the effects of viscous dissipation and Ohmic heating (Joule heating) on magnetohydrodynamic (MHD) natural convection flow of a temperature dependent viscosity from heated vertical wavy surface. The present physical problem is studied numerically by using the appropriate variables, which reduce the complex wavy surface into a flat one. An implicit marching Chebyshev collocation scheme is employed for the analysis. Numerical solutions are obtained for velocity, temperature, local skin friction, and Nusselt number for a selection of parameter sets consisting of Eckert number, Prandtl number, MHD variation, and amplitude-wavelength ratio parameter. Numerical results show that these parameters have significant influences on the velocity and the temperature profiles as well as for the local skin friction and Nusselt number.

Key words: Wavy Surface; Magnetohydrodynamic; Viscous Dissipation; Chebyshev Collocation Method.

PACS numbers: 47.11.-j; 47.11.kb