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The Effects of Variable Fluid Properties on MHD Maxwell Fluids Over a Stretching Surface in the Presence of Heat Generation/Absorption

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An analysis is performed to investigate the effects of variable viscosity and thermal conductivity on the two-dimensional steady flow of an electrically conducting, incompressible, upper-convected Maxwell fluid in the presence of a transverse magnetic field and heat generation or absorption. The governing system of partial differential equations is transformed into a system of coupled nonlinear ordinary differential equations, and is solved numerically. Velocity and temperature fields have been computed and shown graphically for various values of the physical parameters. The local skin-friction coefficient and the local Nusselt number have been tabulated. It is found that fluid velocity decreases with an increase in the viscosity parameter and the Deborah number. It is also observed that increasing the magnetic parameter leads to a fall in the velocity and a rise in the temperature. Furthermore, it is shown that the temperature increases due to increasing the values of the thermal conductivity parameter and the heat generation parameter, while it decreases with an increase of both the absolute value of the heat absorption parameter and the Prandtl number.

Keywords MHD; Non-Newtonian fluids; Stretching surface; Variable thermal conductivity; Variable viscosity

Introduction

In recent years, the studies of boundary layer flow and heat transfer of Newtonian and non-Newtonian fluids over a stretching surface have received considerable attention by many authors (Crane, 1970; Gupta and Gupta, 1977; Grubka and Bobba, 1985; Vajravelu and Rollins, 1992; Cortell, 2008a; Ishak et al., 2009; Chakrabarti and Gupta, 1979; Cortell, 2008b; Abel and Mahesha, 2008; Cortell, 2007; Siddheshwar and Mahabaleswar, 2005; Ray et al., 2007; Liu, 2004; Abel and Begum, 2008; Makinde and Ogulu, 2008; Datti et al., 2004; Eldabe and Mohamed, 2002; Krishnambal and Anuradha, 2006) because of its engineering applications and industrial manufacturing processes. The effects of magnetic fields on non-Newtonian fluids have increasing applications in many areas such as MHD generators, nuclear reactors, polymer technology, chemical engineering, plasma studies, petroleum industry, accelerators, geothermal energy; etc. The above

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