Symmetry Analysis of Boundary Layer Equations of an Upper Convected Maxwell Fluid with Magnetohydrodynamic Flow

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Steady state boundary layer equations of an upper convected Maxwell fluid with magnetohydrodynamic (MHD) flow are considered. The strength of the magnetic field is assumed to be variable with respect to the location. Using Lie group theory, group classification of the equations with respect to the variable magnetic field is performed. General boundary conditions including stretching sheet and injection are taken. Restrictions imposed by the boundary conditions on the symmetries are discussed. Special functional forms of boundary conditions for which similarity solutions may exist are derived. Using the symmetries, similarity solutions are presented for the case of constant strength magnetic field. Stretching sheet solutions with or without injection are presented. Effects of physical parameters on the solutions are depicted.

Key words: Upper Convected Maxwell Fluid; Boundary Layers; Stretching Sheet; Magnetohydrodynamic (MHD) Flow; Lie Group Theory; Group Classification.