International J. of Math. Sci. & Engg. Appls. (IJMSEA)
ISSN 0973-9424,Vol. 2 No. II (2008), pp. 141-153

EXISTENCE, UNIQUENESS AND ASYMPTOTIC BEHAVIOURS OF MHD BOUNDARY LAYER FLOWS OF AN INCOMPRESSIBLE FLUID PAST A FLAT PLATE

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Abstract

This paper deals with the existence, uniqueness and asymptotic behaviours of the solutions of the magneto-hydrodynamic boundary layer equation $f''' + ff'' + \beta[1 - f'] = 0$ (1) for $\beta \geq 0$, under the boundary conditions $\eta = 0 : f = f' = 0$; $\eta = \infty : f' \to 1$ (2) and the side condition $0 < f' < 1$ on $[0,\infty)$ (3) as the similarity variable $\eta \to \infty$. The discussion is based on some topological arguments and integration of second order linear differential equation. The results pertaining to the existence, uniqueness and asymptotic behaviours are in the form of theorems. It has been proved that the equation (1)-(3) will have a unique solution $f(\eta)$ for $\beta \geq 0$ such that $f''(\eta) > 0$ on $[0,\infty)$ and $f''(\eta) \to 0$ as $n \to \infty$. Also, the behaviours of the velocity profiles in the principal solutions are asymptotic in nature as $\eta \to \infty$, whereas they fail in showing the asymptotic behaviours in the linearly independent solutions.

AMS Subject Classification: 34B40, 34E99.