



A Review on Magneto Hydrodynamic Fluid Flows



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Submission: July 16, 2018; Published: July 20, 2018

Abstract

In this review article a detailed study is presented on magneto hydrodynamic flows and their importance. Basic concept of MHD is discussed in detail. The results of various researchers are presented and addressed properly.

Keywords: MHD; Basic equations of MHD; Convective flows

Introduction

The interaction of electromagnetic fields and fluids may be described from a scientific point of view, by the proper application of the principles of the special theory of relativity. The practical application of these principles, to actual physical phenomena of engineering, Astrophysics, Geo-physics, etc., is important in recent years. The study of this application to continuum has become known as magneto hydrodynamics or magneto fluid mechanics. The studies of magneto hydrodynamics of viscous conducting fluids play a significant role during the recent times, owing to its practical interest and abundant applications in astro-physical and geo-physical phenomenon. Astrophysicists and geo-phycists realized soon after the advent of special relativity theory that electromagnetic fluid interactions were of great importance in stellar and planetary processes. The main impetus to the Engineering approach to electromagnetic fluid interaction studies has come from the concept of the MHD direct conversion generation, propulsion studies of radio propagation in the ionosphere, and controlled nuclear fusion. The study of flow problems of electrically conducting fluid particularly of ionized gases is currently receiving considerable interest.

Such studies have made for many years in connection with astro-physical and geo-physical such as sun spot theory, motion of the interstellar gas etc. In recent years some Engineering problems need the studies of the flow of an electrically conducting fluid. Devika et al. [1] introduced the problem an analysis of first order homogeneous chemical reaction and heat source on MHD oscillatory flow of a visco-elastic fluid through a channel filled with

saturated porous medium are reported. The present visco-elastic fluid model is working to suggest rheological liquids encountered in biotechnology (medical creams) and chemical engineering. This rheological model introduces additional terms into the momentum equation. It is assumed that the fluid has small electric conductivity and the electromagnetic force produced is very small. The dimensionless governing equations are solved analytically using regular perturbation method. The effects of various parameters on velocity, temperature and concentration fields are presented graphically and discussed. Raju et al. [2] discussed the problem of MHD free convective, dissipative boundary layer flow past vertical porous surface in the presence of thermal radiation, chemical reaction and constant section, under the influence of uniform magnetic field which is applied normal to the surface is studied. The governing equations are solved analytically using a regular perturbation technique. The expressions for velocity, temperature and concentration fields are obtained.

With the aid of these, the expressions for the coefficient of skin friction, the rate of heat transfer in the form of Nusselt number and the rate of mass transfer in the form of Sherwood number are derived. Finally, the effects of various physical parameters of the flow quantities are studied with the help of graphs and tables. It is observed that the velocity and concentration increase during a generative reaction and decrease in a destructive reaction. The same observed to be true for the behavior of the fluid temperature. The presence of magnetic field and radiation diminishes the velocity and also the temperature. Ravikumar et al. [3] studied the

Magneto Fluid Dynamics

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Magneto Fluid Dynamics:

Magneto-Fluid Dynamics Paul Lorrain, Francois Lorrain, Stephane Houle, 2007-10-31 Magnetohydrodynamics MHD concerns the interaction between magnetic fields and conducting fluids We are concerned here with macroscopic interactions and when the conducting fluid is a plasma time scales are very much longer than the plasma period Plasma periods vary widely but are short say 10 second We prefer the term Magneto F i Z i Dynamics MFD because the discipline concerns mostly plasmas various liquid conductors and the liquid part of the Earth's core It seems that the only applications of MFD to water are the induction of electric currents in the oceans by the Earth's magnetic field and ship propulsion But even MFD is not quite appropriate because that term also includes solid conductors that move in magnetic fields This book is meant for graduate and upper division undergraduate students in Physics Geophysics and Astrophysics as well as for practicing scientists in these fields This book is no more than a brief introduction to MFD because this vast subject is closely related to many others namely Astrophysics Electrodynamics Fluid Dynamics Geophysics Oceanography Plasma Physics Thermonuclear Fusion etc We sketch the fundamentals and provide many Examples as well as Case Studies related to natural phenomena MFD sorely needs a rethink it must of course be totally compatible with Physics On the contrary it is the custom to discuss the shapes of imaginary magnetic field lines without ever referring to the required electric currents

Magneto-fluid dynamics : proceedings of a symposium sponsored by the International Union of Theoretical and Applied Mechanics in coop. with the National Academy of Sciences - National Research Council ; held in Williamsburg, Va. and Washington, D.C., January, 1960 International Union of Theoretical and Applied Mechanics, Williamsburg International Symposium on Magneto-Fluid Dynamics 1960, 1960 **An Introduction to Magneto-fluid Mechanics** Vincenzo Consolato Antonio Ferraro, Charles Plumpton, 1966 *An Introduction to Magneto-fluid Dynamics* Vincenzo Consolato Antonio Ferraro, Charles Plumpton, 1966 **Magnetofluid Dynamics for Engineers and Applied Physicists** Kenneth R. Cramer, Shiyi Bai, 1973 **Magneto-fluid-dynamics** Luigi G. Napolitano, Giorgio Contursi, 1962 **Magneto Fluid Dynamics** William R. Sears, 1971 Magneto-fluid-dynamics North-Atlantic Treaty Organization. Advisory Group for Aeronautical Research and Development, 1959 *Magneto Fluid Dynamics* William Rees Sears, 1970 **Magneto Fluid Dynamics. Editor** William Rees Sears,

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