ISBN: 978-81-948993-1-0

Basic Concepts and Recent Advancements on Magnetohydrodynamic Flow

Goutam Kumar Mahato and Sasi Bhusan Padhi*

Department of Mathematics,
Centurion University of Technology and Management,
Bhubaneswar, Odisha, India
*Email: sasi@cutm.ac.in

Abstract: A brief study on "Magnetohydrodynamic Flow" has been done. The study is divided into 6 sections, namely, (1) Concept of Magnetohydrodynamics and its Applications, (2) Hall Current, (3) Basic Equations of Magnetohydrodynamics in a Rotating Frame, (4) Literature Review, and (5) Conclusion and Future Scope of Research. First sections provide the basic concepts of Magnetohydrodynamics along with its development and possible applications. Second section illustrates the origin and idea of Hall current and the mathematical expressions used for it in different situations of MHD flow to model the problem. Section 3 is purely devoted to the basic equations of Magnetohydrodynamics in a rotating frame of reference. Section 4 is dedicated to a brief literature review of the relevant studies (recent studies) carried out by different investigators. Conclusion and future scope of research has been discussed in section 5. At the end of the study references have been provided. Such a compact study may help readers to understand the basics of "Magnetohydrodynamics" and develop interest in this area of research.

Keywords: Magnetohydrodynamics (MHD), Hall Current, Navier-Stokes equation, Ohm's law

1. Concept of Magnetohydrodynamics and its Applications

Magnetohydrodynamics is the union of three widely separated disciplines, namely, electrodynamics, fluid dynamics and thermodynamics. It deals with the flow of electrically conducting fluids, namely, plasmas, liquid metals, salt water or electrolytes etc., in the presence of electric and magnetic fields. Magnetohydrodynamic phenomena are outcome of mutual interaction between magnetic field and electrically conducting fluid flowing across it i.e. electric current is generated when an electrically conducting fluid flows in the presence of a magnetic field and the resulting current and magnetic field together produce a force, called Lorentz force, which resists fluid motion. The electric current also generates its own magnetic field, called induced magnetic field,