UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

ANALYTICAL SOLUTION FOR MHD SECOND GRADE FLUID IN POROUS MEDIUM BY USING LAPLACE TRANSFORMATION

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ABSTRACT

This study concentrates on the analytic solution for MHD Second Grade Fluid by using Laplace Transformation in porous medium. This project investigate problems that illustrate the fluid-induced fluid magnetohydrodynamic flow (MHD) that can not be compressed in half-porous space. The analytical solution for sine and cosine shifting is developed using the Laplace transform method. The amount of settlement obtained is the number of steady and temporary solutions. Particular attention is given to the effects of simple magnetic and porous parameters on velocity. Based on the result, an increase in the permeability of the porous medium reduces the drag force and hence the magnitude of velocity increases for sine oscillations.

1 INTRODUCTION

In this research, it will investigate about problem for incompressible fluid of second grade in the presence of magnetohydrodynamics (MHD) in porous medium. The problem is about the flow of the fluid which can be related to Navier-Stoke equation. The fluid can be classified into two categories, Newtonian fluid and Non-Newtonian fluid but this research will be focus more on Non-Newtonian fluid. The method that been used is Laplace transformation method. The oscillations flow for the fluid which in sine and cosine oscillation can be made by using Laplace transformation method. The oscillations for will be express in term of analytical solution.

1.1 Research Background

The purpose of this project is to develop the analytical solutions for MHD Second Grade Fluid in a Porous Medium using Laplace Transformation and investigate a problem describing the oscillating flow of an incompressible magnetohydrodynamics.

Now days industry, most of the process used a non-Newtonian fluid. The non-Newtonian fluid behavior frequently involved in the chemical and allied processing industries. To understand this behavior it required a lot of knowledge from variance background such as from physicists, chemists and applied mathematics. Only some of the non-Newtonian can be solve due to it non linear dependence of stresses for non-Newtonian fluids compare to Newtonian fluids.

A non-Newtonian fluid is a liquid that is not in accord with Newton's Law of Viscosity. Newton's law of viscosity is the relationship between shear stress and shear rate of the fluid subjected to mechanical stress. The viscosity coefficient or viscosity is the definition for the ratio off shear stress to share rate which is constant at a given pressure and temperature. The Newtonian fluid viscosity which is independent of shear stress obey the laws of Newton shear rate. The viscosity for Non-Newtonian fluids do not obey the Newton's law and their viscosity is inconstant and depends on the shear rate. Given from Chhabra (2010), study the non-Newtonian