شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار

في درجة حرارة من ١٥-٢٥ مئوية ورطوبة نسبية من ٢٠-٤٠%

To be Kept away from Dust in Dry Cool place of 15-25- c and relative humidity 20-40%

بعض الوثائـــــــق الاصليـــــة تالفـــة

بالرسالة صفحات لم ترد بالاصل

٤٠١٢

Ain Shams University

Faculty of Education

Department of Mathematics

Some Problems of Newtonian and non-Newtonian Fluid Mechanics in The Presence of External Forces

THESIS

Submitted in partial fulfillment for the requirement of the Master Degree in Teacher Preparation in Science (Applied Mathematics)

To

Department of Mathematics

Faculty of Education – Ain Shams University

By

Mohamed Ahmed Hassan Gaber

B. Science &Education (Mathematics)

Ain Shams University 1996

Supervised by

Prof. Dr. Nabil T. M. El-Dabe

Head of Mathematics Department

Faculty of Education

Ain Shams University

Dr. Gamal Saddeek Ibrahim

Mathematics Department

Faculty of Education

Ain Shams University

2002

ACKNOWLEDGMENTS

I which to express my deep gratitude and sincere appreciation to my supervisor. **Prof. Dr. Nabil. T. M. El-Dabe** Head of Mathematics Department, Faculty of Education, Ain Shams University, for his continuous guidance and his suggestion this investigation to me, without his guidance and help, the complication of this work would have been impossible.

I am very grateful to **Dr. Gamal Saddeek** Department of Mathematics, Faculty of Education, Ain Shams University, for his kind supervision, for his encouragement, keep interest kind cooperation and helpful suggestion during the preparation of this thesis.

I am also thankful to **Dr. A. Y. Ghaly** Associated Professor of Applied Mathematics, Faculty of Education, Ain Shams University, for helping me during the preparation of this thesis.

Many thanks are also due to the chairman and staff of the Department of Mathematics, Faculty of Education, Ain Shams University, for their kind facilities offered through this investigation.

At last, I am deeply indebted to my parents and my wife for their car, kindness and encouragement.

CONTENTS

SUMMARY

The main aim of this thesis is to investigate some problems of Newtonian and non-Newtonian fluid Mechanics in the presence of external forces.

This thesis consists of five chapters:-

Chapter 1: Includes general introduction and consists of the following items

1- The definition of fluids, including the definition of shear stress, and the differences between solids and fluids.

2- Definitions of some properties, which include coefficient of viscosity, kinematic viscosity, thermal conductivity, coefficient of skin friction, rate of heat transfer, porosity and permeability.

3- Classification of non-Newtonian fluids.

4- Constitutive equation, which takes different forms as power law, modified power law, Walter's model, Power series model, Ree-Eyring model and other formulae.

5- The equations of flow for incompressible Newtonian and non-Newtonian fluids, which are the equation of continuity, equations of motion and the energy equation.

6- Mass transfer, which consists of the definition of mass concentration, the equation of mass transfer and mass transfer coefficient.

7- Flow in porous media, we introduced in this part an introduction about porous medium and Darcy momentum equation.

8- Magnetohydrodynamic (MHD), including an introduction about MHD, the basic equations of MHD and the hall effect.

9- The last part of this chapter includes abstracts of some previous studied.

Chapter 2: In this chapter, we had studied the hall effect on MHD viscoelastic free convection flow with mass transfer through a porous

medium near an infinite vertical porous plate, The numerical solution of the problem was obtained using the electronic computer. It was found that

1- The velocity components, longitudinal and transverse, are increase or decrease with increasing the elasticity parameter λ.

2- The velocity components, increase with increasing Grashof number G_r, while they are increasing or decreasing with increasing modified Grashof number G_c.

3- The longitudinal component of the velocity decreases with the magnetic parameter M and increases with the hall parameter m. While the transverse component increases with M, and increases or decreases with m.

4- The velocity components are increase with increasing the permeability parameter K.

5- The longitudinal velocity increases or decreases with increasing Dufour number D_f, also the transverse velocity decreases with increasing D_f.

6- The temperature increases with increasing of Prandtl number P_r.

7- The concentration of the fluid increases with increasing Soret number S_r, while decreases with increasing of Schmidt number S_c.

8- Finally, the rate of heat transfer and the rate of mass transfer decrease or increase with increasing both Prandtl P_r and Soret S_r numbers.

Chapter 3: This chapter includes two problems.

(I) The first problem: We studied free-convection MHD flow for non-Newtonian fluid past a vertical porous flat plate, we considered the effect of gravitational force on the flow and the energy equation is solved analytically for small, negligible values, of Eckart number E_c. Analytical solution of the problem has been obtained, and we have found that

1- The velocity profile increases with increasing the elasticity parameter λ, Grashof number G_r, Prandtl number P_r and reciprocal of magnetic Reynolds number R_e, while the velocity decreases as the magnetic parameter M increases.

2- The magnetic induction increases with decreasing of P_r, R_e and M, and increases with increasing λ and G_r.

3- The temperature profiles decreases with increasing Prandtl number P_r.

4- Finally, we found that the coefficient of skin friction increases when λ decreases and both P_r and M increase.

(II) The second problem: We studied the problem of MHD flow and heat transfer of non-Newtonian viscoelastic fluid past a horizontal infinite porous flat plate. The force due to gravity can be neglect in this case, and we solved the equation of energy in general form for all values of Eckart number E_c. The problem has been solved analytically and it was found that

1- The velocity profiles increases with increasing of the magnetic parameter M, while the magnetic induction increases when the magnetic parameter M decreases.

2- The temperature profiles increases as Prandtl number P_r increases, while the temperature decreases as both elasticity parameter λ and magnetic parameter M increase.

3- The coefficient of skin friction and rate of heat transfer increase or decrease with the magnetic parameter M for different values of λ.

Chapter 4: In this chapter, we studied analytically the problem of viscoelastic fluid flow and forced convection in a permeable channel with a Brinkman-Darcy porous medium. The velocity and temperature profiles are obtained and we found that

1- the velocity profile increases with increasing of elasticity parameter λ, while the velocity increases or decreases with increasing of permeability parameter K.

2- The temperature profile increases with increasing both Prandtl P_r and Eckart E_c numbers.

3- The coefficient of skin friction and rate of heat transfer increases with permeability parameter K and Prandtl number P_r, respectively.

Chapter 5: In this chapter, we studied numerically the problem of unsteady MHD flow through porous medium between two parallel plates with temperature dependent viscosity, under consideration of oscillation the lower plate periodically in time. And we have found that

1- The velocity profile exhibits an oscillatory behavior with time, and the velocity decreases as the position from the lower plate increases.

2- The temperature profile increases time increases, while decreases with increasing position.

3- The velocity of the fluid increases with decreases of both the magnetic parameter M and Brinkman number B_r, while the velocity increases with both permeability parameter K and Reynolds number R_e.

4- The temperature distribution and rate of heat transfer decreases with increasing of Prandtl number P_r, while the coefficient of skin friction increases as Reynolds number R_e increases.