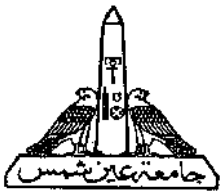

Newtonian and Non-Newtonian Fluids Flow through Porous Medium with Heat and Mass Transfer

A Thesis
submitted for the award of the Ph.D. degree
in Applied Mathematics

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SUMMARY

SUMMARY

The aim of this thesis is to investigate some problems of Newtonian and Non-Newtonian fluids flow through porous medium with Heat and Mass Transfer. These problems are of great importance because of their multiple applications in various scientific fields, including biological, chemical, physical, medical and industrial such as materials manufactured by polymer extrusion, glass fiber and paper production, crystal growing, hot rolling and wire drawing annealing and tinning of copper wires, stretching of plastic film, cooling of metallic sheets or electronic chips, artificial fibers. The thesis consists of six chapters, with an Arabic and English summaries with a list of references

In chapter one**,** Introduction, we presented an introduction to the following topics:

1- Newtonian and non-Newtonian fluids.
2- The equations of flow for incompressible fluids.
3- Heat transfer and Mass transfer.
4- Dimensionless numbers in convective heat and mass transfer.
5- Flow in a porous medium.
6- Stretching surfaces.
7- Boundary layer theory.
8- Magnetohydrodynamics (MHD).
9- Micropolar fluid theory. 10- Nano fluids.

In chapter two**,** we investigated two problems elaborated in parts one and two as follows:

Part 1

We studied the unsteady flow of MHD viscous fluid with heat and mass transfer through porous medium bounded by an infinite vertical plate. The governing partial differential equations, which describe the motion of the fluid, are converted dimensionless formulas by using similarity transformation method and solved analytically by using Laplace transform.

We obtained the formulas of velocity, temperature and concentration of the fluid as well as the skin friction and the rate of heat transfer. The effects of the physical parameters (chemical reaction, magnetic field, heat source, permeability, thermal Grashof number, mass Grashof number, Prandtl number, Schmidt number) of the problem on the velocity, temperature and concentration distributions are discussed numerically and illustrated graphically through a set of figures.

The results of this problem have been published in the ***International journal of energy and technology, vol. 3, pp. 1-11, 2011.***

Part 2

We studied the unsteady motion of MHD incompressible non-Newtonian fluid, which obeys the Powell-Eyring model with heat and mass transfer through porous medium near a moving vertical plate. The governing partial differential equations, which describe the motion of the fluid, are converted into dimensionless formulas by using similarity transformation method and solved analytically by using Laplace transform.

We obtained the distributions of the velocity, temperature and concentration of the fluid as well as the skin friction and the rate of heat transfer. The effects of the physical parameters (non-Newtonian material constant, chemical reaction, magnetic field, heat source, permeability, thermal Grashof number, mass Grashof number, Prandtl number, Schmidt number and Reynolds number) of the problem on these analytical solutions are discussed numerically and illustrated graphically through a set of figures.

The results of this problem have been published in the ***International Journal of Applied Mathematics and Physics, vol. 3, pp. 259-273, 2011.***

In chapter three**,** we studied effect of the thermal radiation on flow and heat transfer over an unsteady stretching surface in a micropolar fluid with variable heat flux. The governing partial differential boundary layer equations are transformed into a system of ordinary differential equations. These equations are

solved numerically by mathematica program (Like shooting method). Comparison of the special cases of the numerical results is made with previous published results and we found that the results are good agreement. The effects of the unsteadiness parameter *A*, material parameter K, radiation parameter R and Prandtl number Pr on the flow and heat transfers are studied and shown graphically.

The results of this problem have been published in the ***International journal of heat and technology, vol. 30, pp. 93-98, 2012.***

In chapter four, we studied the effects of thermal radiation and magnetic field on heat transfer in a micropolar fluid with variable viscosity along a vertical porous stretching surface in the presence of internal heat generation. The governing equations are transformed into a system of ordinary differential equations and solved numerically using Mathematical program. The special cases of the obtained results are checked against previous published work in order to access the accuracy of the numerical method and we found that the excellent agreement between them Effects of the various parameters of the problem on the velocity, temperature and rate of the heat transfer are also displayed graphically and in a tabulated form.

The results of this problem have been published in the ***International Research Journal of Engineering Science, Technology and Innovation (IRJESTI), vol. 2, pp. 8-16, 2013***

In chapter five, we studied the steady flow over a nonlinearly stretching surface in a water-based Nano fluid containing different types of nanoparticles: Cu, Ag and Al_2O_3. The governing equations are transformed into a system of ordinary differential equations and solved numerically by using Mathematica program. The special cases of the obtained results are checked against previous published work in order to access the accuracy of the numerical method and we found that the in excellent agreement between them. Effects of the various parameters on the nanofluid velocity profiles, temperature profiles, skin friction and rate of heat transfer are also displayed graphically and in a tabulated form.

The results of this problem have been published in the ***International Journal of Applied Mathematics, vol. 28, pp. 1130-1139, 2013.***

In chapter six, The effect of the magnetic field on the flow and heat transfer over an unsteady stretching surface embedded in a porous medium filled with nanofluid is studied. The governing equations are transformed into a system of ordinary differential equations and solved them numerically using Mathematica

program. The special cases of the obtained results are checked against previous published work in order to access the accuracy of the numerical method and we found the excellent agreement between them. Effects of the various parameters on the nanofluid velocity profiles, temperature profiles, skin friction and rate of heat transfer are also displayed graphically and in a tabulated form.

The results of this problem have been published in the ***International journal of energy and technology, vol. 5, pp. 1-8, 2013.***

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