Ain Shams University

Faculty of Education

Department of mathematics

Pulsatile motion of non-Newtonian fluid with heat and mass transfer through different geometric shapes and its applications

A Thesis

Submitted as a Partial Fulfillment for the Requirement of the Master Degree in Teacher Preparation in Science

(Applied Mathematics)

To

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Summary

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Applied mathematics to biological systems gives the ability to construct mathematical models. Such models are mathematical systems that attempt to represent the complex interactions of biological systems in a way simple enough for their consequences to be understood and explored. Traditionally models that allowed biologists to see a problem in a simplified way have been complicated structure, while mathematical models that constructed to exhibit simple biological properties that could be analyzed. This kind of model, however, is restricted by technology as well as technological ingenuity. Mathematical models have no such restriction and can be used to construct any sort of biological system; respiratory flows, pulsating blood flow, micro-and macro-circulation systems bio heat and mass transfer models are some examples of these mathematical models these flows may be studied under a well-known branch of science it is named by bio fluid mechanics. By bio fluid mechanics we can understand the physiological processes that occur in the human circulation and analyze the physical mechanisms that under line them. Understanding the basic processes occurring in the human body will facilitate the engineering design and construction of new medical devices and machinery. Our thesis concerns with A computational Study of the external forces effects on the motion of fluids through biological tissues such as blood flow through tissues.

The present thesis consists of four chapters with two summaries one of them with Arabic language and the other with English language and list of references for books and papers related to the subjects of the thesis.

Chapter 1

This chapter includes the introduction which is closely related to the subjected of the thesis.

Such asMechanics, Newtonian fluid and Non-Newtonian fluid, magneto-hydrodynamics, and basic equations, porous medium, porosity, Darcy law and non- Darcian equations.

We summarized the basic equations of Newtonian and non- Newtonian fluids(continuity equation, momentum equation, Energy equation, and Concentration equation), models of heat transfer (radiation, convection, conduction, evaporation), bio heat and mass transfer.

Chapter 2

The second chapter investigatesthe influence of the electric field with heat and mass transfer on the pulsatile flow of viscoelastic fluid in a channel bounded by a porous layer of smart material. The problem is modulated mathematically by a set of partial differential equations, which represent the continuity, momentum, energy and concentration equations, besides the Maxwell equations with appropriate boundary conditions. The system of equations which describes the motion of fluid phase and layer porous phase are solved analytically by using perturbation technique for steady and unsteady cases. The effects of various emerging parameters on the flow characteristics, heat and mass processes are shown and discussed with the help of graphs.

Chapter 3

In this chapter, The flow due to the pulsatile pressure gradient of non-Newtonian fluid with heat and mass transfer along a porous oscillating channel is considered. The system is stressed by transvers magnetic field. The non-Newtonian fluid under consideration is obeying the viscoelastic model. The governed system of partial differential equations which describe the motion of this fluid is written, in non-dimensional form. This system of equations with an appropriate boundary conditions is solved analytically by using perturbation technique for small

material parameter α_2. The velocity, temperature and concentration distributions of the fluid are obtained as functions of the physical parameters of the problem. The effects of these physical parameters of the problem on these solutions are discussed and illustrated graphically through a set of figures.

Chapter 4

In this chapter, We have analyzed the MHD flow of a conducting couple stress fluid in oscillating channel with heat and mass transfer. The non-Newtonian fluid under consideration is obeying the Bi-viscosity model. In this analysis we are taking into account the induced magnetic fieldand porous medium . The analytic solution for the problem has been obtained by using homotopy perturbation method for steady and unsteady cases.The distributions ofthevelocity,temperature and concentration functionsare discussed and illustrated graphically for different values of the physical parameters of the problem for various parameters such assuch as the couple stress parameter, the Hartmann number M^2, the Reynolds number R_e andthermal parameters.

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