Fayoum University

Faculty of Science

Mathematics Department

STUDY OF ANALYTICAL AND NUMERICAL SOLUTIONS OF SOME PROBLEMS OF NEWTONIAN AND NON-NEWTONIAN FLUIDS

A Thesis

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Requirements for the Degree of Doctor of Philosophy

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In

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Presented By

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SUMMARY

Chapter (I):

In this section some important definitions are discussed, which are

1) Newtonian and non-Newtonian fluids
2) Classification of non-Newtonian fluids.
3) Nano fluids.
4) Atherosclerosis (medically stenosis).
5) Cilia.
6) Catheters.
7) Peristaltic motions.
8) The Governing Equations.

Chapter (II):

This chapter discusses the peristaltic of non-Newtonian incompressible blood flow with heat transfer through ciliated arteries because the flow of blood through arteries is an important physiological problem. The nonlinear partial differential equations of the problem are simplified by using an approximation of long wavelength and low Reynolds number. The differential equations are solved analytically by using the perturbation method. We find that Sisko fluid parameter and the power index effect the behavior of the velocity where the velocity increase in the arteries then decreases near the wall, but the Sisko parameter give opposite behavior where the velocity decrease then increases near the wall of arteries. The velocity increase in arteries with the increase of cilia length and elliptic path. The temperature profile increases then decreases near the wall of arteries with the increase of power index, Sisko fluid parameter and Grashof number, while the temperature decrease then increase near the wall with increase of Sisko parameter. The effect of increase in the cilia length give an

increase of the temperature. The pressure gradient increases with the increase of power index and elliptic path, while the pressure gradient decrease with an increase of elliptic path, Sisko parameter. The pressure gradient increases and decreases in a different interval with the increase the cilia length. Our results are illustrated through a set of Figures.

Chapter (III):

This chapter shows the mathematical investigation of the binary Powell- Eyring Nano fluid of peristaltic flow with heat transfer in a ciliated tube. The approximation of long wavelength and low Reynolds number is taken into consideration. We obtain a system of partial differential equations which solved by using the perturbation method. The velocity and the temperature are computed for various values of the physical parameters. The results are illustrated graphically through a set of Figures. We found that the increase of Grashof number causes an increase in the velocity, then the velocity decrease near the wall of the tube. When the volume fraction of the Nanoparticles increase the velocity increase and decrease near the wall of the tube. The increase in the cilia length leads to an increase in the velocity, then a decrease near the wall of the tube. The increase of the first Eyring-Powell parameter gives an increase in the velocity and decrease near the wall of the tube. The increase of the second Eyring-Powell parameter cause decrease in the velocity. The temperature parameter increase then decreases with the increase of the Sink parameter. The increase of the volume fraction of the Nanoparticles leads to decreases then increase in the temperature parameter. The increase of the cilia length parameter causes an Increase in the temperature.

Chapter (IV):

The main purpose of this paper is to study the mathematical investigation of the effect of the metachronal wave of power-low fluid flow inside ciliated walls symmetrical channel. The momentum equation of power-low fluid flow is analyzed by using the low Reynolds number and long-wavelength approximation. The governing partial differential equations are solved by using the Homotopy perturbation method (HPM). A discussion is provided to explain the effect of power low index, length of cilia, Weisenberg number, and the eccentricity of the elliptic path on the velocity and pressure gradient for pseudo-plastic fluid, Newtonian fluid, and dilatant fluid. The results are illustrated graphically through a set of figures.

Chapter (V):

This chapter is devoted to study the effect of slip velocity on Sutterby blood flow with technique of balloon catheter through stenotic arteries. The non-linear partial differential equations governing the problem accompanied by the appropriate choice of prescribed boundary conditions are solved by using the perturbation method. Expression for axial velocity, wall shear stress and volumetric flow rate are obtained analytically and displayed through graphical illustration for different values of flow parameters.