

A Computational Study for Momentum Transmission of the Blood in the Presence of Transverse Magnetic Field

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ABSTRACT

The present paper deals with a computational study for momentum transport in the presence of transverse magnetic field, the analysis show an open form. In the present paper we have studied, velocity and pressure conditions for blood flow conditions. In the present paper we have done a comprehensive analysis of momentum and pressure for blood taking in account low shear stress show blood is considered a non-Newtonian liquid and flow is considered laminar and incompressible. The differential equation occurring during the study are solved by Finite Element and Finite Volume Methods. We hope our study will be helpful for medical scientists to diagnosis various diseases occurring in the human body.

Keywords- Transverse magnetic Field, Momentum, Incompressible.

I. INTRODUCTION

Large number of researcher have already done on similar topics. Here we will like to explore their valuable contribution. **Dabri at el (2013)** did work on measuring ostracard, swimming behaviour and back group flow. **Khatija.K (2014)** studied quantatively measuring in situ flows using as elf contained under water velocimeter. **Ruila (2015)** studied vortex motion enhanced population. **Collin at el (2016)** did work on stealth prediction the bases for vertical axis wind turbine farm design. **Breathburg at el (2020)** studied a ecosystems engineers in the pelagic realm. **Kartika and Dabri (2026)** studied a viscosity enhanced mechanism for biometric ocean mixing. Basically fluid dynamics to accurately calculated the velocity and unidirectional its complex motion. The complexities of governing equations is removed by non dimensionlizing them. Hence there are two cases to consider them. First case involves disregarding the long wavelengths approach. We have proceed the second the partial differential equation taking into account magneto hydrodynamics.

Momentum profile in the radial direction

$$\delta \left(\frac{u}{r} + \frac{du}{dr} \right) + \frac{d\omega}{dz} = 0 \dots \dots \dots (1)$$

$$\frac{\delta}{R(z)} \left(\frac{u}{x} + \frac{du}{dx} \right) + \frac{d\omega}{dz} = \frac{x}{R(z)} \frac{d\omega}{dx} \cdot \frac{d(R(z))}{dz} \dots \dots \dots (2)$$

$$\frac{du}{dt} + \delta c \frac{u}{R(z)} \frac{du}{dx} + c \omega \frac{du}{dz} - \frac{\epsilon x}{R(z)} \omega \frac{du}{dx} \cdot \frac{dR}{dz} = \frac{ef}{ebc^2 Re} \left[\frac{-dp}{dr} + \frac{\delta c^2 Re}{Pf} \right] \dots \dots \dots (3)$$

$$\frac{d\theta}{dt} = - \left(\frac{\delta \in u}{R(z)} \frac{d\theta}{dx} + c \omega \frac{d\theta}{dz} \right) + \frac{x}{R(z)} \frac{dR}{dz} \cdot \frac{du}{dx} \cdot \frac{d\omega}{dz} \dots \dots \dots (4)$$

$$\frac{d^2 u}{dz^2} - \frac{u}{r^2} \dots \dots \dots (5)$$

$$\frac{d\bar{u}}{dt} + \frac{d\bar{u}}{dr} + \bar{\omega} \frac{d\bar{u}}{dz} = - \frac{d\bar{P}}{dr} + \mu \left(1 + \frac{1}{\beta} \right) \left[\frac{d^2 \bar{u}}{dr^2} + \frac{1}{r} \frac{d\bar{u}}{dr} + \frac{d^2 \bar{u}}{dz^2} - \frac{\bar{u}}{r^2} \right] \dots \dots \dots (6)$$

$$\epsilon \left(\frac{d\bar{\omega}}{dt} + \bar{u} \frac{d\bar{\omega}}{dr} + \bar{\omega} \frac{d\bar{\omega}}{dz} \right) = - \frac{d\bar{P}}{dz} + \mu \left(1 + \frac{1}{\beta} \right) \left[\frac{d^2 \bar{\omega}}{dr^2} + \frac{1}{r} \frac{d\bar{\omega}}{dr} + \frac{d^2 \bar{\omega}}{dz^2} \right] \dots \dots \dots (7)$$

initial condition $\bar{\omega} = 0, \bar{T} = 0$ at $\bar{t} = 0$

wall conditions $\frac{d\bar{\omega}}{d\bar{s}} = 0, \frac{d\bar{T}}{d\bar{r}} = 0$ at $\bar{r} = 0$
 $\bar{\omega} = 0, \bar{T} = \bar{T}_w$ at $t = \bar{R}$

Numerical Techniques

II. FINITE ELEMENT METHOD

The Solution is approximated by

$$u(x) = \sum_{i=1}^n N_i(x) u_i$$

When $N_i(x)$ are the Shape function on

U_i are the nodal unknowns

Element stiffness matrix

$$K^{(e)} = \int B^T D B dr$$

Where B =Strain –displacement method

D = Material property method

Element Load Vector

$$F^{(e)} = \int_r N^T f dr + \int_{T_e} N^T q dT$$

GLOBAL System of Equation

After assembling all elements

$KU=F$

III. FINITE VOLUME METHOD

$$\frac{d}{dt}(\rho \phi) + \Delta \cdot (\rho u \phi) = \Delta \cdot (T \Delta \phi) + S \phi$$

Where

ϕ – depends on variable

ρ -density

u - velocity vector

T =diffusion coefficient

$S\phi$ = Source Term

IV. DISCRETE FINITE VOLUME METHOD

For a typically control P

$$\phi_P = \sum_{nb} a_p \phi_{nb} + b$$

where a_p =central coefficient

and neighbouring coefficient

matrix $\Delta \phi = B$

V. NUMERICAL RESULTS AND DISCUSSIONS

Magnetic field in combination offers a way to deliver drugs in human artery where blood is restricted due to buildup. This condition can increase the risk of cardiovascular risk. The use of nanoparticle allows us targeted drug delivery to special locations within the human blood. Magnetic field can be used to precisely control the localization of drug loaded magnetic nanoparticles. Magnetic field help them to overcome obstacles such as turbulent blood flow and endothelial barriers making it easier for therapeutic agents to penetrate deeper into arterial wall. It was observed that

due to magnetic effect blood particle began to discrete so that velocity trajectory takes a remarkable degradation therefore momentum profile also go to a degradation. Due to coronary attack same situation arise. By giving appropriate magnetic field intensity such type of critical situation can be avoided.

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