CHEBYSHEV COLLOCATION COMPUTATION OF MAGNETO-BIOCONVECTION NANOFLUID FLOW OVER A WEDGE WITH MULTIPLE SLIPS AND MAGNETIC INDUCTION

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ABSTRACT:
In this paper the steady two dimensional stagnation point flow of a viscous incompressible electrically conducting bio-nanofluid over a stretching/shrinking wedge in the presence of passively control boundary condition, Stefan blowing and multiple slips is numerically investigated. Magnetic induction is also taken into account. The governing conservation equations are rendered into a system of ordinary differential equations via appropriate similarity transformations. The reduced system is solved using a fast, convergent Chebyshev collocation method. The influence of selected parameters on the dimensionless velocity, induced magnetic field, temperature, nanoparticle volume fraction and density of motile microorganisms as well as on the local skin friction, local Nusselt number, local Sherwood number and density of motile microorganism numbers are discussed and presented graphically. Validation with previously published results is performed and an excellent agreement is found. The study is relevant to electromagnetic manufacturing processes involving bio-nano-fluids.

KEYWORDS; *Electromagnetic materials processing; nano-biofluid, slip; magnetic induction; Chebyshev collocation method; Stefan blowing*

1. INTRODUCTION

The external boundary layer flow over a two dimensional wedge is a classical problem in viscous fluid dynamics which has considerable relevance to many areas of technology including materials processing operations. Early studies of this so-called "Falkner-Skan flows" have been summarized succinctly in the monograph of Rosenhead[1]. These flows consider a wedge with included apex angle of $\pi\beta$ with an external pressure gradient associated with the inviscid external flow solution. Such flows introduce a "wedge parameter" which enables a number of physically viable special cases to be extracted including forward stagnation point flow, rear stagnation point flow, Blasius boundary layer flow etc. The fluids considered in Rosenhead's book were Newtonian. Numerous investigations of momentum, heat and mass transfer from wedge geometries have been communicated subsequently for non-Newtonian fluids since these abound in chemical and biotechnology operations. In many applications multi-physical effects also arise simultaneously and these may include electrical fields, magnetic fields, multi-mode heat transfer (conduction, convection and radiation), non-isothermal behavior, entropy generation, thermal stratification etc. Atalik and Sönmezler[2]