Uddin, M. J.; Alginahi, Yasser; Bég, O. Anwar; Kabir, M. N.
Numerical solutions for gyrotactic bioconvection in nanofluid-saturated porous media with Stefan blowing and multiple slip effects. (English) 

Summary: A mathematical model is developed to examine the effects of the Stefan blowing, second order velocity slip, thermal slip and microorganism species slip on nonlinear bioconvection boundary layer flow of a nanofluid over a horizontal plate embedded in a porous medium with the presence of passively controlled boundary condition. Scaling group transformations are used to find similarity equations of such nanoconvection flows. The similarity equations are numerically solved with a Chebyshev collocation method. Validation of solutions is conducted with a Nakamura tri-diagonal finite difference algorithm. The effects of nanofluid characteristics and boundary properties such as the slips, Stefan blowing, Brownian motion and Grashof number on the dimensionless fluid velocity, temperature, nanoparticle volume fraction, motile microorganism, skin friction, the rate of heat transfer and the rate of motile microorganism transfer are investigated. This work is relevant to bio-inspired nanofluid-enhanced fuel cells and nano-materials fabrication processes.

MSC:
76Z10 Biopropulsion in water and in air
76M20 Finite difference methods applied to problems in fluid mechanics
76S05 Flows in porous media; filtration; seepage

Keywords:
second order slip; porous media; Stefan blowing; Chebyshev collocation method; Nakamura second order difference scheme; gyrotactic micro-organisms

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