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Impact of magnetohydrodynamics in bidirectional flow of nanofluid subject to second order slip velocity and homogeneous-heterogeneous reactions

Tasawar Hayat[a,b], Maria Imtiaz[a,1] and Ahmed Alsaedi[b]

[a]Department of Mathematics, Quaid-I-Azam University 45320, Islamabad 44000, Pakistan

[b]Nonlinear Analysis and Applied Mathematics (NAAM) Research Group, Department of Mathematics, Faculty of Science, King Abdulaziz University, Jeddah 21589, Saudi Arabia

Abstract: This article addresses the steady three-dimensional boundary layer flow of viscous nanofluid. The flow is caused by a permeable stretching surface with second order velocity slip and homogeneous-heterogeneous reactions. Water is treated as base fluid and copper as nanoparticle. An incompressible fluid fills the porous space. The fluid is electrically conducting in the presence of an applied magnetic field. A system of ordinary differential equations is obtained by using suitable transformations. Convergent series solutions are derived. Impact of various pertinent parameters on the velocity, concentration and skin friction coefficient is discussed. Analysis of the obtained results shows that the flow field is influenced appreciably by the presence of velocity slip parameters. Also concentration distribution decreases for larger values of strength of homogeneous reaction parameter while it increases for strength of heterogeneous reaction parameter.

Keywords: MHD nanofluid; Three-dimensonal flow; Homogeneous-heterogeneous reactions; Second order velocity slip.

1 Introduction

Engineered suspension of nanoparticles in liquids (such as water, oil and ethylene glycol) known as "nanofluids" have gained substantial interest due to their enhanced thermal conductivity. The nanomaterials are more effective in micro/nano electromechanical devices, advanced cooling systems, large scale thermal management systems via evaporators, heat exchangers and industrial cooling applications. Nanofluids are very stable and free from extra issues of sedimentation, erosion, additional pressure drops and rheological characteristics. This is due to the tiny size and the low volume fraction of nanoelements. Nanofluids in presence of magnetic field are particularly important in applications like optical modulators,

[1]Corresponding author Tel.: +92 51 90642172.

Email address: mi_qau@yahoo.com