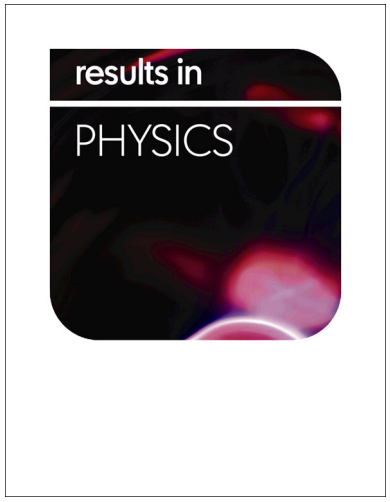

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Shah Jahan, Hamzah Sakidin, Roslinda Nazar, Ioan Pop

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Analysis of heat transfer in nanofluid past a convectively heated permeable stretching/shrinking sheet with regression and stability analyses

Shah Jahan[1], Hamzah Sakidin[1], Roslinda Nazar[2,a], Ioan Pop[3]

[1] *Fundamental and Applied Sciences Department, Universiti Teknologi PETRONAS, 32610 Bandar Seri Iskandar, Perak, Malaysia*

[2] *School of Mathematical Sciences, Faculty of Science & Technology, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia*

[3] *Department of Mathematics, Babes-Bolyai University, R-400084 Cluj-Napoca, Romania*

Abstract

In this article, we study the revised model of boundary-layer flow past a permeable stretching/shrinking sheet over the heated surface in a nanofluid with stability and regression analyses. The revised model refers to a physically more realistic approach, where the nanoparticle fraction can be controlled on the boundary in a similar way as for temperature on the boundary. The system of nonlinear similarity ordinary differential equations is solved numerically and dual solutions are found for both stretching and shrinking sheets up to a certain range of the stretching/shrinking parameter. Effect of pertinent parameters on the skin friction coefficient, the local Nusselt number, the velocity, temperature and concentration profiles are deliberated. Stability analysis is executed to know about the stability of dual solutions when sheet is being stretched or shrunk under the suction effect. The local Nusselt number is estimated through regressions for both stretching and shrinking sheets. It is observed through regressions and graphical results that the Brownian motion has no more effect on the heat transfer rate. The Schmidt number gives a very minimal effect on the heat transfer rate, while with an increase in Biot number, the heat transfer rate increases but at a higher value of Biot number accomplishes a constant wall temperature condition. The Brownian and thermophoresis parameters should be kept small as mainly the transfer of heat is due to fluid motion. From the stability analysis, it is found through numeric values and graphical results that the first solution is stable and thus physically realizable. Finally, the flow pattern is analyzed, and it is observed that streamline contracts with the increase of the suction parameter.

Keywords: Convectively heated stretching/shrinking sheet; passive control of nanoparticles; numerical approach; regression and stability analyses.

Introduction

[a] e-mail: rmn@ukm.edu.my (corresponding author)