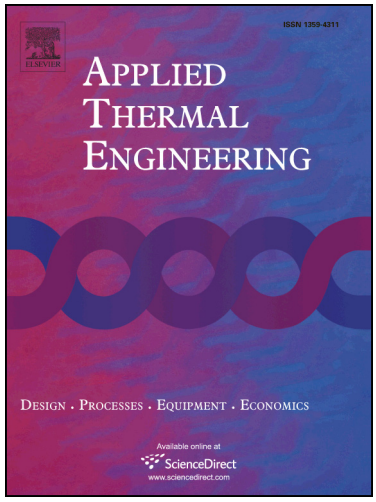

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Boundary layer flow past a continuously moving thin needle in a nanofluid

Siti Khuzaimah Soid[1], Anuar Ishak[2*] & Ioan Pop[3]

[1]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, 40450 UiTM Shah Alam, Selangor, Malaysia

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

[3]Department of Mathematics, Babeș-Bolyai University, 400084 Cluj-Napoca, Romania

*Corresponding author.

E-mail: anuar_mi@ukm.edu.my (A Ishak)

Tel.: +603 8921 5785; Fax: +603 8925 4519

Abstract

A steady two-dimensional laminar forced convection boundary layer flow along a horizontal thin needle immersed in a nanofluid is considered. The governing partial differential equations are first reduced to a system of nonlinear ordinary differential equations, before being solved numerically using the boundary value problem solver (bvp4c) in Matlab, for copper-water nanofluid with Prandtl number Pr = 6.2 (water). The physical quantities of interest such as the skin friction coefficient and the local Nusselt number as well as the velocity and temperature profiles are presented. Dual solutions are found when the needle and the free stream move in the opposite directions. It is seen that the solution domain decreases with increasing values of the solid volume fraction parameter. The influences of the needle size and the solid volume fraction parameter on the flow and heat transfer characteristics as well as on the velocity and temperature profiles are investigated.

Keywords: Nanofluid, heat transfer, forced convection, thin needle, stability analysis