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Impact of Copper Nanoparticles on Natural Convection and Heat Transfer in Blood Flow over a Stretching Sheet: A Casson Fluid Analysis

BoddulaPrasad[1,2,*], and P. Hama Bindu[3]

[1]*Department of Mathematics, Bharatiya Engineering Science & Technology Innovation University, Gownavaripalli, Sri Sathya Sai, Andhra Pradesh-515231, India*

[2]*Department of Mathematics, Govt Degree college (A),Bodhan, Nizamabad, Telangana, India*

[3]*Department of Mathematics, Shadan Women's College of Engineering and Technology, Khairatabad, Hyderabad, Telangana, India*

Abstract: This study aims to examine the behavior of Casson fluid explicitly focusing on blood infused with (Cu) copper nanoparticles, with the aim of enhancing its physiological and industrial applications over a stretching sheet with natural convection. The basic equations undergo appropriate similarity transformations to convert them from nonlinear higher-order partial differential equations to nonlinear ordinary differential equations. The bvp4c method, an inherent function in MATLAB, is employed to solve nonlinear ordinary differential equations (ODEs). The influence of multiple relevant factors, such as Casson parameter, volume fraction parameter, buoyancy parameter on Nusselt number and skin friction as well as velocity and thermal profiles is being exemplified through the graphs. Results indicate that increasing the Casson and nanoparticle volume fraction parameters elevates the fluid temperature and decrease the velocity of nanofluid. Also, an increase in nanoparticle volume fraction leads to decreased skin friction, suggesting smoother blood flow and elevates heat transfer rate. This effect may aid in designing therapies for conditions like atherosclerosis, where blood flow is impeded due to arterial plaque. The thermal properties of copper nanoparticles can be applied in wound healing technologies, where maintaining optimal temperatures accelerates tissue repair and regeneration.

Keywords: Casson fluid; Stretching Sheet; Natural convection; BVP4C Shooting method.

***Corresponding Author:** boddulaprasad1980@gmail.com **(Boddula Prasad)**