

# MHD Flow and Heat Transfer in a Casson Fluid Over A Nonlinearly Stretching Sheet With Newtonian Heating

Abid Hussanan,<sup>1</sup> Mohd Zuki Salleh,<sup>1,\*</sup> Hamzeh Taha Alkawasbeh,<sup>1</sup> & Ilyas Khan<sup>2</sup>

<sup>1</sup>Applied and Industrial Mathematics Research Group, Faculty of Industrial Science and Technology, Universiti Malaysia Pahang, Pahang, Malaysia

<sup>2</sup>College of Engineering, Majmaah University, P.O. Box 66, Majmaah 11952, Saudi Arabia

## ABSTRACT

The magnetohydrodynamic (MHD) flow of a Casson fluid and heat transfer to a nonlinearly stretching sheet with Newtonian heating are studied. With the help of similarity transformations, the governing equations are converted into non-linear ordinary differential equations. The Runge–Kutta 4–Fehlberg fourth-fifth order (RK45) method is employed to obtain numerical solutions for the velocity and temperature distributions. Closed form analytical solutions are also obtained. The resulting velocity and temperature are shown graphically and discussed for the case of a uniform moving surface, a linearly or nonlinearly stretching sheet. The present results are also compared with the previous results for a Newtonian fluid. The results show that the velocity field is much more pronounced in the case of a uniformly moving surface as compared to a linearly stretching sheet or a nonlinearly stretching sheet. It is also found that the Casson fluid have higher velocity than the Newtonian fluid.

**KEY WORDS:** Casson fluid, MHD flow, nonlinearly stretching sheet, Newtonian heating