Heat Transfer in Magnetohydrodynamic Flow of a Casson Fluid with Porous Medium and Newtonian Heating

Abid Hussanan[1], Mohd Zuki Salleh[1], Ilyas Khan[2,*], and Razman Mat Tahar[3]

[1]*Futures and Trends Research Group, Faculty of Industrial Science and Technology, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 UMP Kuantan, Pahang, Malaysia*
[2]*College of Engineering, Majmaah University, P.O. Box 66, Majmaah 11952, Saudi Arabia*
[3]*Faculty of Industrial Management, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 UMP Kuantan, Pahang, Malaysia*

This paper deals with exact solutions for unsteady magnetohydrodynamic (MHD) flow of a Casson fluid over an infinite vertical oscillating plate embedded in a porous medium. The analysis of heat transfer in the presence of Newtonian heating is also considered. Some suitable non-dimensional variables are introduced. The governing equations together with imposed conditions are transformed into dimensionless forms. Expressions for the velocity and temperature fields are obtained using the Laplace transform. Skin-friction and Nusselt number are also evaluated. Solution for Newtonian fluid is also reduced as a special case. The graphical results show that velocity decreases significantly with increases of magnetic effects, but it increases when either conjugate parameter or porosity parameter increases. The main outcomes of the present work is that fluid flow can be controlled by the increasing the values of Prandtl number as well as by the increasing of Casson parameter.

KEYWORDS: Casson Fluid, MHD Flow, Porous Medium, Newtonian Heating, Exact Solutions.