Effects of Reversible Chemical Reaction on Boundary Layer Flow

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ABSTRACT

The aforementioned work delves into the non-Newtonian hydromagnetic flow of a Casson fluid. The phenomenon of flow is observed on a vertical plate, whereby the medium through which the flow occurs is characterised by its porous nature. Furthermore, it is widely acknowledged that the chemical reaction under consideration exhibits reversibility and necessitates the presence of activation energy. The contemplation of the reversible esterification process is of utmost importance. The transformation of a higher order nonlinear partial differential equation (PDE) system into a system of ordinary differential equations (ODEs) can be achieved through the judicious selection of appropriate variables. To ascertain the solutions to equations of this nature, a numerical methodology is employed. The R-K based shooting method is employed for the purpose of calculating the undetermined boundary conditions. Following the utilisation of the fourth-order Runge-Kutta (R-K) approach to obtain the solution to the prevailing equations, the bvp4c method was subsequently employed to ascertain the dependability of the outcomes and ascertain the accuracy of the R-K methodology. This study aims to investigate the influence of different numerical values on the velocity field, temperature field and volumetric concentration within the context of the esterification process. The paramount considerations pertaining to the parameters concerning the profiles of velocity, temperature and concentration are assessed through a meticulous graphical analysis that duly acknowledges the pertinent physical ramifications. The graphical representation of the local Sherwood number, skin friction and local Nusselt number is accompanied by their corresponding explanations. When considering the inertial parameter, temperature difference parameter and activation energy, a notable differentiation arises between reversible and irreversible flows in the assessment of the local Sherwood number, rate of shear stress and local Nusselt number. The outcomes derived from the theoretical simulations possess noteworthy ramifications for an array of disciplines pertaining to thermal engineering.

Keywords: Casson Fluid, Reversible Chemical Reaction, MHD

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