INTERNAL HEAT GENERATION EFFECT ON MIXED CONVECTION HEAT AND MASS TRANSFER OVER A VERTICAL HEATED PLATE WITH SORET AND DUFOUR EFFECTS

Dinesh P.A., Department of Mathematics, M. S. Ramaiah Institute of Technology, India
dineshdpa@msrit.edu
Nalinakshi N, Department of Mathematics, Atria Institute of Technology,India
Chandrashekhar D. V. , epartment of Mathematics, Vivekananda Institute of Technology, India

Key Words: Mixed convection, porous medium, boundary layer, internal heat generation, Soret and Dufour parameters

Study and analysis of internal heat generation effect of two-dimensional, steady, laminar, heat and mass transfer mixed convection flow of a viscous incompressible fluid from a vertical heated plate embedded in a sparsely packed porous medium with variable fluid properties such as permeability, porosity, thermal conductivity and solutal diffusivity with the Soret and Dufour effects are considered and studied numerically. The boundary layer flow in the porous medium is governed by Lapwood-Forcheimer-Brinkman extended Darcy model. In this analysis, the governing non-linear coupled partial differential equations are transformed into a system of ordinary differential equations with the help of similarity transformations and solved them numerically by using the shooting technique with Runge-Kutta-Fehlberg scheme and Newton-Raphson method to obtain velocity, temperature and concentration distributions in terms of non-dimensional parameters involved in the physical configuration. The features of fluid flow, heat and mass transfer characteristics are analyzed by in detail to interpret the effects of various significant parameters of the problem. It is observed that the exponential form of internal heat generation enhances melting and impedes freezing. The effect of the Dufour parameter on the local surface temperature becomes more significant and the effect of Soret parameter leads to an increase in the local surface concentration. The effects of the pertinent parameters on the local skin friction coefficient (viscous drag), Nusselt number (rate of heat transfer) and Sherwood number (rate of mass transfer) are also discussed. The obtained results are compared with previously published work of the problem and they are found to be in very good agreement.