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Research Article

A Note on Variable Viscosity and Chemical Reaction Effects on Mixed Convection Heat and Mass Transfer Along a Semi-Infinite Vertical Plate

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In the present study, an analysis is carried out to study the variable viscosity and chemical reaction effects on the flow, heat, and mass transfer characteristics in a viscous fluid over a semi-infinite vertical porous plate. The governing boundary layer equations are written into a dimensionless form by similarity transformations. The transformed coupled nonlinear ordinary differential equations are solved numerically by using the shooting method. The effects of different parameters on the dimensionless velocity, temperature, and concentration profiles are shown graphically. In addition, tabulated results for the local skin-friction coefficient, the local Nusselt number, and the local Sherwood number are presented and discussed.

1. Introduction

In many transport processes existing in nature and in industrial applications in which heat and mass transfer is a consequence of buoyancy effects caused by diffusion of heat and chemical species. The study of such processes is useful for improving a number of chemical technologies, such as polymer production and food processing. In nature, the presence of pure air or water is impossible. Some foreign mass may be present either naturally or mixed with the air or water. The effect of the presence of foreign mass on the free convection flow past a semi-infinite vertical plate was studied by Gebhart and Pera [1]. The presence of a foreign mass in air or water causes some kind of chemical reaction. During a chemical reaction between two species, heat is also generated [2]. In most cases of chemical reaction, the reaction rate depends on the concentration of the species itself. A reaction is said to be first order if the rate of reaction is directly proportional