Abstract

In the present thesis, we have presented the analytical studies of some fluid flow models. We wish to investigate three main problems. In this regard, we study the Stocks' second problem taking to account porous and magnetic effects. General expressions for the velocity and shear stress fields and the skin friction coefficient corresponding to the motion due to a moving plate is used to provide new interesting solutions for the second problem of Stokes. As an application, exact solutions are developed for motions induced by an arbitrary time dependent shear stress on the boundary. Next, we have investigated the problem of hydromagnetic free convection flow over a moving infinite vertical plate with Newtonian heating, mass diffusion and chemical reaction in the presence of a heat source. Radiative and porous effects are not taken into consideration but they can be immediately included by a simple rescaling of Prandtl number and magnetic parameter. Exact general solutions for the velocity and concentration fields, the corresponding Sherwood number and skin friction coefficient are determined under integral form in terms of error function or complementary error function of Gauss. Moreover, for illustration, three special cases are considered and the influence of physical parameters on some fundamental motions are graphically underlined and discussed. The required time to reach the steady-state for cosine or sine oscillating concentrations on the boundary is graphically determined. The presence of destructive chemical reaction is improved this time for increasing values of chemical reaction parameter. Finally, we have investigated the hydromagnetic natural convection flow of an electrically conducting, incompressible viscous fluid over a moving infinite, vertical plate with exponential heating, chemical

reaction and constant concentration. Radiative effects are also taken into consideration in the presence of transverse magnetic field that is either fixed to the fluid or to the plate. The dimensionless velocity, as well as the corresponding skin friction, are presented as sum of mechanical, thermal or concentration components whose contribution to the fluid motion are graphically brought to light for motions due to slowly accelerating translations of the plate. Moreover, steady-state solutions corresponding to motions due to cosine or sine oscillations of the plate are presented in simple and elegant forms and the required time to reach the steady-state is graphically determined and discussed.