Abstract

The problems of free convective heat and mass transfer flow of viscous fluids are portant because of their applications in several fields, such as, aeronautics, fluid l nuclear reactors, industrial chemical processes and other engineering areas.

Exact formulation of a convective heat and mass transfer problem requires using the boundary conditions on the solid wall. Most of the papers published in the erature refer to the velocity on the solid boundary. Because of the mathematical llenge, and of the correspondence with practical engineering, problems with given ndary shear stress, are more interesting.

Two such new problems have been solved in this thesis.

First, it was solved the problem of the free convection flow with heat transfer der influence of the magnetic field, heat source and heat radiation. The influence the thermal diffusivity and radiation effects into Rosseland approximation was died by means of a unique parameter, defined as a combination between Prandtl mber and the radiation parameter. By considering the boundary shear stress and e wall temperature as arbitrary functions of the time variable t, a set of problems th theoretical and practical significance can be studied.

The second problem is referring at the magneto-hydrodynamic natural convec- n flows with heat source and chemical reaction. The shear stress on the wall is nsidered as an arbitrary function of the time t, the plate temperature is a ramped ne function, and the solute concentration is constant on the plate. The fluid flows a porous half-space. It is found that in such type of problems, the magnetic d porous effects can be analyzed by means of a unique parameter defined as a mbination between the Hartmann magnetic number and the porosity parameter.

One year ago, it was elaborated a consistent theory of size-dependent couple-stress uids. Theoretical and experimental results based on the new model have shown that e behavior of some fluids with complex rheology, such as blood, lubricating greases, olymeric solutions is described much better by the couple-stress fluids. Given the portance of practical domains in which the couple-stress fluids can be used, the udy of these models becomes imperative. The complexity of the mathematical odel of the couple-stress fluids makes the problems based on this model to be eresting and attractive.