Abstract

This work presents new results regarding the behavior of some non-Newtonian fluids into different circumstances. Chapter 1 presents the preliminary concepts regarding Newtonian and non-Newtonian fluids, the constitutive equations and the equations of motion and integral transforms. New exact solutions for the velocity field and the shear stress corresponding to some flows of ordinary and generalized Maxwell fluids, ordinary second grade and Oldroyd-B fluids have been established.

In chapter 2, by means of the Laplace transform, we have established new exact solutions corresponding to Stokes' type flows for ordinary Maxwell fluids with slip boundary conditions. We obtained the velocity field corresponding to both cases with slip and non-slip conditions, for Maxwell and viscous Newtonian fluids . Also, the exact and approximate solutions are compared and a good agreement is found.

In chapter 3, some new exact analytical solutions for Stokes' first problem of Maxwell fluid with fractional derivative approach are established. The obtained solutions for the velocity field and shear stress, written in terms of generalized $G - Lorenzo - Hartley functions$, are presented as a sum of the similar Newtonian solutions and the corresponding non-Newtonian contributions.

Chapter 4 contains exact solutions for the helical flow of a second grade fluid, between two infinite coaxial circular cylinders. Solutions are presented in series form, in terms of Bessel functions and they are written as a sum of large-time and transient solutions.

Lastly, chapter 5 is devoted to the study of unsteady flow of an Oldroyd-B fluid through the infinite circular cylinder on which a sinusoidal azimuthal tension is given.

Solutions, obtained by means of the Hankel and Laplace transforms, are written as a sum of large-time and transient solutions. The corresponding solutions for Maxwell and Newtonian fluids are obtained as limiting cases.