UNSTEADY FLOW OF AN OLDROYD-B FLUID GENERATED BY A CONSTANTLY ACCELERATING PLATE BETWEEN TWO SIDE WALLS PERPENDICULAR TO THE PLATE

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Abstract

The velocity field and the adequate tangential stresses corresponding to the unsteady flow of an Oldroyd-B fluid generated by a constantly accelerating plate between two side walls perpendicular to the plate, are established by means of Fourier sine transforms. The solutions corresponding to Maxwell, second grade and Newtonian fluids, performing the same motion, appear as limiting cases of the solutions obtained here. In the absence of the side walls, namely when the distance between walls tends to infinity, all solutions that have been determined reduce to those corresponding to the flow over an infinite plate. Finally, for comparison, the velocity fields at the middle of the channel as well as the shear stresses on the bottom wall are plotted as functions of y or z for several values of t and of the material constants.

Key words: Oldroyd-B fluid, constantly accelerating plate, side walls, velocity field.