Asymptotic behavior of a viscoelastic fluid in a closed loop thermosyphon: physical derivation, asymptotic analysis, and numerical experiments

J. Yasappan; A. Jiménez Casas; M. Castro Ponce

Abstract-

Fluids subject to thermal gradients produce complex behaviors that arise from the competition with gravitational effects. Although such sort of systems have been widely studied in the literature for simple (Newtonian) fluids, the behavior of viscoelastic fluids has not been explored thus far. We present a theoretical study of the dynamics of a Maxwell viscoelastic fluid in a closed-loop thermosyphon. This sort of fluid presents elastic-like behavior and memory effects. We study the asymptotic properties of the fluid inside the thermosyphon and the exact equations of motion in the inertial manifold that characterizes the asymptotic behavior. We derive, for the first time, the mathematical derivations of the motion of a viscoelastic fluid in the interior of a closed-loop thermosyphon under the effects of natural convection and a given external temperature gradient.

Index Terms-

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