Abstract:
A survey of secondary flows of viscoelastic liquids in straight tubes is given including recent work pointing at striking analogies with transversal deformations associated with the simple shearing of solid materials. The importance and implications of secondary flows of viscoelastic fluids in heat transfer enhancement are explored together with the difficulties in detecting weak secondary flows (dilute, weakly viscoelastic solutions) in a laboratory setting. Recent new work by the author and colleagues which explores for the first time the structure of the secondary flow field in the pulsating as well as steady flows of constitutively nonlinear simple fluids in straight tubes of arbitrary cross-sections is summarized. Arbitrary conduit contours are obtained through a novel approach to the concept of domain perturbation. Secondary flow streamline contours for steady flows and time averaged, mean contours for pulsating flows are presented for the first time for triangular, square and hexagonal pipes.