

# Irrotational motions of viscous and viscoelastic liquids

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## **Abstract**

The potential flows being considered are solutions of Laplace's equation. They are also solutions of the Navier-Stokes equations and of some models of viscoelastic fluids with the property that the irrotational viscous stresses are self-equilibrated and they do not move the fluid. The rate of work of these stresses does not vanish and gives rise to a viscous dissipation. We discuss the exact theory in which the irrotational and rotational motions are coupled in a Helmholtz decomposition and purely irrotational theories of fluid motion which are always approximate and always better than theories of potential flows of an inviscid fluid. We also discuss the problem of turning couples on long bodies and the chaining of spherical bodies viscoelastic fluids in Stokes flow and potential flow.