

Abstract:

We investigate recently developed implicit constitutive theory and its implication into the modelling of fluids. We base the work on the literature search that is focused on the S-shaped shear stress-shear rate experimental data. The materials that exhibit such a behavior are found to be colloidal suspensions and surfactant solutions. The work summarizes microscopical theories explaining the shear-thickening, the shear-thinning and the shear-banding phenomena that arise in these materials. The theories reveal that the unusual behavior is due to the separation of the fluid into various bands in shear stress-controlled measurements. The extracted experimental data from the literature are fitted with several one-dimensional implicit type relations. Finally, we propose an example of a fully three-dimensional implicit constitutive relation with focus on the normal stress differences effect. The work demonstrates benefits of the implicit constitutive theory for modelling of complex fluids.