Impact, buckling, and breakup of dense suspension droplets, jets and filaments

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Résumé

Viscous jet columns can bend, twist, stretch and be compressed when hitting a surface or a substrate, following to the balance between capillary, viscous, gravitational, and inertial forces. In addition, stretching of fluid filaments to form either drops or broken threads as well as compression to induce bending and/or coiling instabilities are sensitive to filaments geometry and rheology. These instabilities become richer when the fluids exhibit non-Newtonian characters, such as dense suspensions. These fluids can exhibit for instance a yield stress from which non-linear dynamics and supplemental regimes emerge. In this study, we explore, both experimentally and numerically, these various instabilities by analysing four different problems: (1) container filling with dense suspensions; (2) buckling of dense suspension filaments under compression stresses; (3) breakup of dense suspension filaments under tensile stresses; (4) impact of dense suspension droplets on a liquid substrate. Theoretical analyses of the onset and development of the problems mentioned above are presented, which provide a deeper understanding on the non-linear dynamics of these phenomena.

Mots-Clés: dense suspension, rheology, viscous jet, capillary, viscous, gravitational and inertial forces, geometry, droplet impact, buckling instability, stretching breakup, container filling

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