P.21 Analysis of an axisymmetric two-phase flow model for particle transport at fluid interfaces

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The derivation of averaged equations describing bulk suspensions of particles has been the subject of a large number of studies (see e.g. [1]). In contrast, similar studies focusing on particles trapped at fluid interfaces, and whose trajectories are therefore constrained to lie on curved surfaces, are relatively scarce. The bulk of the literature indeed focuses primarily on interfacial transport of surfactants [see e.g.[2],[3]), which have specific features not found in colloidal systems and suspension of inertial particles, such as the importance of the particle size, the influence of gravity, and hysteretic effects in the surface pressure owing to deformation of kinetically trapped configurations. This talk examines similarities and difference between two-phase flow equations for bulk suspensions and interfacial suspensions. The analysis reveals that, apart from terms related to the curvature of the control volume, the governing equations for interfacial suspensions have the same structure as those for bulk suspensions. The essential difference is in the way the coupling terms are parameterized. In this talk, the issue of closing the particle-pressure term and the slip velocity for colloidal suspensions subject to lateral capillary and electrostatic forces [4,5] is explored using literature data. Simple closure models are proposed, and the resulting closed equations specialized to the case of a slender axisymmetric particle-laden interface. This case is amenable to mathematical analysis and is relevant to studies on the dynamics of axisymmetric liquid jets and bridges.

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