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Towards unravelling surfactant transport MATHIEU SELLIER, University of Canterbury, SATYANANDA PANDA, NIT Calicut — Surfactant transport arises in many natural or industrial settings. Examples include lipid tear layers in the eye, pulmonary surfactant replacement therapy, or industrial coating flows. Flows driven by the surface tension gradient which arises as a consequence of surfactant concentration inhomogeneity, also known as Marangoni-driven flows, have attracted the attention of fluid dynamists for several decades and has led to the development of sophisticated models and the undeniable advancement of the understanding of such flows. Yet, experimental confirmation of these models has been hampered by the difficulty in reliably and accurately measuring the surfactant concentration and its temporal evolution. In this contribution, we propose a methodology which may help shed some light on surfactant transport at the surface of thin liquid films. The surface stress induced by surfactant concentration induces a flow at the free surface which is visible and measurable. In the context of thin film flows for which the lubrication approximation hold, we demonstrate how the knowledge of this free surface flow field provides sufficient information to reconstruct the surfactant tension field. From the surface tension and an assumed equation of state, the local surfactant concentration can also be calculated and other transport parameters such as the surfactant surface diffusivity indirectly inferred. In this contribution, the proposed methodology is tested with synthetic data generated by the forward solution of the governing partial differential equations in order to illustrate the feasibility of the algorithm and highlight numerical challenges.

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