Abstract Submitted
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On the stability of surfactant-laden interfaces in thin-film shear flows[1] ANNA KALOGIROU, MARK BLYTH, University of East Anglia — In this study, we investigate the stability of a two-fluid shear flow with a surfactant-populated interface. The two fluids have in general different densities, viscosities and depths, but here we consider the case with one of the layers being very thin compared to the other. We therefore derive an asymptotic model in the thin-layer approximation, consisting of a set of nonlinear PDEs to describe the evolution of the film and interfacial surfactant disturbances. A novel feature is the presence of a nonlocal term due to multiphase coupling. Interfacial instabilities are induced due to the acting forces of gravity and inertia, as well as the action of Marangoni forces generated as a result of the dependence of surface tension on the local surfactant concentration. We find that in the inertialess limit, a stably stratified flow can become unstable if an insoluble surfactant is present at the interface. Inertial flows are known to be unstable in the absence of surfactant (due to density and viscosity stratification); yet, we identify regions in parameter space where stability is supported due to the existence of the surfactant monolayer at the interface. The destabilising mechanism related to the Marangoni forces will also be discussed.

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