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Gravitational stabilization of the interfacial surfactant-induced instability of shear flows ADAM J. SCHWEIGER, ALEXANDER L. FRENKEL, DAVID HALPERN, University of Alabama — The linear stability of a two-layer plane Couette-Poiseuille flow with an insoluble surfactant on the interface in the presence of gravity is considered. Previous work has shown that when gravity is absent, the interfacial surfactant in the incompressible inertialess shear flow implies its instability. Considering now the case when gravity is included and the denser fluid is at the bottom, only the normal modes whose wavenumbers α are smaller than some marginal value α_0 are expected to be unstable. Also, α_0 should decrease as the Bond number Bo (proportional to the acceleration of gravity) increases. A natural question is, as Bo increases, does $\alpha_0 \to 0$ as $Bo \to Bo_0$, some finite threshold value? The answer is "no" for both the infinite and finite thickness ratios, but in differing ways. By the standard normal mode approach, the dispersion equations found to be quadratic in γ, the complex "growth rate." It yields the dispersion relation $\mathrm{Re}\gamma = \mathrm{Re}\gamma(\alpha; Bo, M, s, m)$, where M is the Marangoni number, m is the viscosity ratio, and s is the bottom-side interfacial shear rate. The theory goes without the lubrication approximation: it accounts for the normal modes of all wavelengths.

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