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Long-Wave Marangoni Instability in Binary-Liquid Films with Soret Effect

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We study the Marangoni instability in binary-liquid films in the presence of Soret effect. Linear stability analysis shows that both monotonic and oscillatory long-wave instabilities are possible depending on the value of the Soret number. Sets of long-wave nonlinear evolution equations are derived for both types of instability. In the case of poorly conducting boundaries both monotonic and oscillatory instability modes exist. Bifurcation analysis in the monotonic case for large Prandtl number yields amplitude equations for roll-, square- and hexagon patterns. Squares are stable in the physically relevant limit of large inverse Lewis number. Hexagons bifurcate transcritically and steady stable hexagonal patterns are possible. In the case of oscillatory instability travelling waves are stable. If finite deformations of the interface are allowed binary-liquid films rupture in both settings of prescribed temperature distribution and temperature gradient at substrate. The behavior of the film near rupture is investigated.

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