

Thin Film Lubrication Dynamics of a Binary Mixture: Example of an Oscillatory Instability

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ABSTRACT

We study thin film instabilities in liquid films with deformable surface using lubrication theory. An externally applied vertical temperature gradient may give cause to an instability (Marangoni instability) of the flat motionless film. Contrary to earlier work where mostly pure fluids were discussed, the focus of the present paper lays on instabilities in mixtures of two completely miscible liquids [1]. We show that the normally found monotonic long wave instability may turn into an oscillatory one if the two components have a different surface tension and if the Soret coefficient establishes a stabilizing vertical concentration gradient. A systematic derivation of the basic equations in long wave approximation is given. The character of instabilities is studied using linear stability analysis. Finally, a real system consisting of a water-isopropanol mixture is discussed in some detail.

REFERENCES

- [1] Michael Bestehorn, Ion Dan Borcia *Thin film lubrication dynamics of a binary mixture: Example of an oscillatory instability*, Phys. Fluids **22**, 104102, 2010.