Capillary Surfaces at Re-Entrant Corners

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Abstract

Concus and Finn have characterized remarkable and strikingly varying modes of behavior for capillary surfaces $u(x, y)$ at protruding corner points of the domain of definition, depending on boundary contact angle and on gravity. In later work, Korevaar showed that quite different behavior can occur at a re-entrant corner; Lancaster and Siegel then clarified and gave precise formulations to the ways in which that can happen. In the present work, I will use a conjecture of Concus and Finn for a protruding corner to relate these possible modes to ranges for the boundary data as determined according to a diagram introduced by those authors. Eleven qualitatively distinct cases can be distinguished; each such mode actually occurs within the indicated ranges, as I show by explicit examples. In the interim, Lancaster has announced a proof of the conjecture, in an as yet unpublished work available as a preprint.