Numerical Solutions for Intermediate Angles of the Laplace-Young Capillary Equations

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Abstract

Capillarity is the phenomena of fluid rise against a solid vertical wall. In this paper, we consider bounded cases of intermediate corner angles ($\pi/2 < \alpha + \gamma < \pi/2 + 2\gamma$) , where γ is the angle of contact and 2α is the wedge angle. The Laplace-Young Capillary equations are used to determine the rise of the fluid, especially at corners. While there exist asymptotic expansions for the height rise occurring at the corner of an intermediate angle, not all coefficients are known analytically. Therefore, numerical solutions are necessary, even though only a few numerical methods have been published. We explain our least-squares finite element method used in determining solutions to the Laplace-Young Capillary equations, and then give our numerical results.