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Validated Numerical Analysis of the Hele-Shaw free boundary problem.

We consider the classical Hele-Shaw free boundary problem of tracking the shape of a two-dimensional region of viscous fluid driven by a source or sink. When surface tension is neglected, the problem reduces, as a consequence of Richardson's Theorem, to solving an inverse moment problem. The problem is further simplified if the conformal map from the unit disk to the initial domain is assumed to take a simplified form, say, a polynomial. The explicit solution to certain low-degree instances are well-known. For more complicated initial domains, we propose an approach using validated numerical analysis, and we discuss how the integrable structure of the problem makes this possible. (Received September 26, 2017)