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Healing Capillary Films ZHONG ZHENG, Department of Mechanical and Aerospace Engineering, Princeton University, MARCO FONTELOS, Departamento de Matemticas, Universidad Autnoma de Madrid , SANGWOO SHIN, HOWARD STONE, Department of Mechanical and Aerospace Engineering, Princeton University — We study the dynamics of a healing viscous thin film driven by surface tension, i.e., the inward spreading of a film to fill a hole in a thin film. A fourth-order nonlinear partial differential equation is obtained to characterize the time evolution of the film thickness and the novel part of study is then to seek self-similar solutions of the second kind. In this way, we are able to obtain a self-similar solution that describes the interface shape, with the scaling exponent determined by solving a nonlinear eigenvalue problem. The self-similar solution is then compared with the full numerical solution of the partial differential equation, and we observe good agreement. Laboratory experiments have also been conducted using various silicone oils, and the time evolution of the front location and the interface shape can be obtained. A comparison between the theoretical predictions and the experimental observations produces good agreement in both the front location and the interface shape.

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