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Editorial
The dynamics of thin fluid films

S. K. WILSON

Department of Mathematics, University of Strathclyde, Livingstone Tower, 26 Richmond Street, Glasgow G1 1XH, UK
(*e-mail*: *s.k.wilson@strath.ac.uk*)

Not only are thin fluid films of enormous importance in numerous practical applications, including painting, the manufacture of foodstuffs, and coating processes for products ranging from semi-conductors and magnetic tape to television screens, but they are also of great fundamental interest to mathematicians, physicists and engineers. Thin fluid films can exhibit a wealth of fascinating behaviour, including wave propagation, rupture, and transition to quasi-periodic or chaotic structures. More details of various aspects of thin-film flow can be found in the recent review articles by Oron, Davis & Bankoff (1997) and Myers (1998), and in the volumes edited by Kistler & Schweizer (1997) and Batchelor, Moffatt & Worster (2000).

This special issue of the *European Journal of Applied Mathematics* on 'The Dynamics of Thin Fluid Films' was inspired by a scientific meeting with the same title organised by Drs S. K. Wilson (Chairman), B. R. Duffy and M. Grinfeld from the Department of Mathematics at the University of Strathclyde in Glasgow. The meeting, which took place on 11–14 July 1999, was hosted by the International Centre for Mathematical Sciences (ICMS) in the historic birthplace of James Clerk Maxwell at 14 India Street in Edinburgh. The purpose of the meeting was to provide a forum for over 50 leading international researchers in pure and applied mathematics, as well as in physics and engineering actively working on different aspects of thin-film flow, to discuss the latest developments in the field. This aim was amply achieved during three days of intensive discussion and lively debate, inspired by a diverse programme which covered a range of subjects including the stability of driven contact lines, the rupture of thin films, models for thin fluid sheets and foams, and models for wetting. The organisers gratefully acknowledge the financial support provided by the ICMS, the London Mathematical Society and the Edinburgh Mathematical Society.

This special issue was never intended to be simply the proceedings of the meeting (indeed, not all of the talks are represented here, and not all the work reported here was presented at the meeting). Instead, it aims to bring together into one volume a topical selection of research on thin-film flows that reflects the wide variety of approaches represented in Edinburgh.

In the first paper, Hocking provides a comprehensive theoretical analysis of the draw-up that occurs when a solid plate is withdrawn from a pool of fluid, and then uses the same approach to treat the related draining problem of a receding meniscus in a channel. The next two papers concern two quite different kinds of similarity solution that arise in thin-film flow. In the first, Vaynblat, Lister and Witelski investigate the transition from

symmetric to asymmetric unsteady similarity solutions in a class of pinch-off problems, while in the second Wilson, Duffy and Davis describe two steady similarity solutions for a slender dry patch in a thin fluid film draining under gravity down an inclined plane. Bertozzi, Münch, Shearer and Zumbrun investigate the stability of compressive and undercompressive travelling waves on a thin fluid film. Typically, the unsteady evolution of a thin film in which surface-tension effects are significant is described by a degenerate parabolic fourth-order non-linear diffusion equation. Grün and Rumpf present a finite-element scheme for the numerical solution of such equations whose results for a number of different models are in good agreement with physical experiments. King and Bowen perform a comprehensive asymptotic analysis which elucidates the full range of possible mass-preserving non-negative solutions of an equation of this type describing the spreading of a droplet over a thin precursor layer; other possible regularisations are also discussed. Vanden-Broeck investigates the waves generated by a pressure distribution moving over an inviscid fluid overlying a thin layer of viscous fluid. In particular, it is shown that (depending on the values of the parameters) short waves may appear on either side of the pressure distribution. Minkov and Novick-Cohen study the effect of van der Waals forces on globally energy-minimising profiles of two-dimensional droplets in a vapour atmosphere. In particular, they prove that there is a unique minimising profile both for repulsive forces and for certain forces that are repulsive at short range and attractive at long range. Finally, two closely related papers undertake a detailed analysis of a problem directly relevant to industrial coating processes, namely the flow in a double-film-fed 'bead' between two contra-rotating rollers. In the first, Wilson, Gaskell and Savage analyse the equilibrium flow structure, while in the second, Gostling, Savage and Wilson study the stability of these flows to determine the practically important critical conditions for the fluid bead to break or flood.

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