FINAL REPORT FOR ICMS ON
"Recent Developments and New Directions in Thin-Film Flow"
6th to 9th July 2009

Thin films of fluid are of central importance in numerous industrial, biomedical, geophysical and domestic applications and display a rich and varied range of behaviours, including pattern formation, dewetting, rupture and finite-time blow up. As well as being of great interest in their own right, thin-film flows provide a "test bed" for research into a huge range of challenging nonlinear problems in physics, chemistry and mathematics. As a consequence research by a wide range of scientists, including physicists, engineers, chemists and mathematicians, using a wide variety of analytical, numerical and experimental techniques on many different aspects of thin-film flow, has grown dramatically in recent years as novel applications have continued to appear and increasingly sophisticated theoretical and experimental techniques have been developed.

The aim of the workshop was to bring together the leading international experts in thin-film flow from across several different traditional academic disciplines, including mathematics, engineering, physics and chemistry, to report on their latest discoveries and to foster new inter-disciplinary collaborations. The workshop was a natural continuation of an unofficial series of meetings on thin-film flow that has taken place in recent years, including the famous ICMS workshop on "The Dynamics of Thin Films" held in Edinburgh in 1999 and the more recent (and also highly successful) EUROMECH 490 meeting on "Dynamics and Stability of Thin Liquid Films and Slender Jets" held in London in 2007.

The workshop was organised by Professor Stephen Wilson and Dr Brian Duffy from the Department of Mathematics at the University of Strathclyde in Glasgow together with Professor George "Bud" Homsy from the University of California, Santa Barbara, USA.

Following a competitive bidding process, the workshop secured the valuable support of the European Mechanics Society (EUROMECH). This support brought with it a modest grant of 2,000 Euros and the (arguably more valuable) scientific prestige associated with the EUROMECH "brand". Thanks to ICMS's support, specifically £20,100 from the Engineering and Physical Sciences Research Council and £1,000 from the London Mathematical Society, we were able to provide all participants with accommodation for four nights in single en-suite rooms in local guest houses, a cheese and wine reception on Sunday evening, an informal evening meal at Nargile Turkish restaurant on Tuesday evening, a workshop dinner at The Magnum Restaurant on Wednesday evening, plus substantial morning and afternoon refreshments on all four days of the workshop.

All of the scientific session took place in the historic Royal Society of Edinburgh building in George Street, with the cheese and wine reception in the old ICMS building in India Street.

The mix of participants was impressively international, with 7 from France, 6 from Germany, 4 from the USA, 2 from the Netherlands and 1 from each of Belgium, Ireland, Israel and India, in addition to the 26 from the United Kingdom. A full list of participants and talks together with some photographs taken during the workshop can be found on the workshop webpages at `http://www.icms.org.uk/workshops/thinfilms`.

Scientifically the workshop was very successful, with 49 of the 50 of the expected participants present for the duration of the workshop (one participant had to withdraw at the last minute due to a family illness) and a full programme of 40 scientific presentations. Perhaps the best way to reflect the friendly and lively but scientifically challenging nature of the workshop is to quote from some of the (anonymous) responses to the feedback questionare sent to all participants immediately after the workshop.

In response to the question "What, for you, was the highlight of the workshop?" participants said things like *"All the talks were interesting, and many were excellent, but also I felt that I got a lot from the informal chats, especially at the evening meals that ICMS set up (and the "socialising" afterwards!).", "Just about everything really; in particular the chance to meet other experts in the*

field in an informal atmosphere. An excellent networking opportunity.", and *"There were several. I found the organisation outstandingly efficient thanks to the enthusiasm, professionalism and helpfulness of the ICMS staff. This left a great impression with participants. Academically, the talks were of consistently high quality, and the friendly and convivial atmosphere (augmented by generously subsidised social activities) made it one of the most enjoyable meetings of my career."* Similarly, in response to the question "What was your impression of the overall academic value of the workshop?" participants said things like *"Excellent: a very high scientific standard. Speakers who included reviews of their specialist topics were particularly good. The younger generation were impressive, with some really good work being done, in many countries."*, *"The academic value of the workshop is extremely high. I think that the nearly all most important new developments in the field [were] covered."*, *"Great academic value, contributions were at the forefront of the area internationally."* and simply *"Remarkable!"*. Areas identified by the participants as key future research areas and/or directions in the field included research on thin films in the boundaries of biology, chemistry and physics, the dynamics of contact lines, microfluidic applications, thin-films in the presence of complexities (e.g. complex fluids, stochastic effects and particle rheology), and flow over textured surfaces/in complex geometries. All the participants who responded agreed that the workshop helped then to develop/sustain contacts likely to result in new research, one participant saying *"As a consequence [of the workshop] I shall be visiting a number of colleagues in Europe in the coming months to foster research collaborations and to give invited talks - hopefully the same will lead to funding applications."*, and that the workshop had resulted in new ideas or the acquisition of new techniques or methods.

There were a huge number of positive comments both during the workshop and afterwards about the quality and efficiency of the practical arrangements provided by ICMS. Typical comments included *"Administrative arrangements were excellent. For a workshop of this size the venue was ideal. The accommodation was excellent."*, *"Excellent on all counts. One can instinctively tell when everything is running smoothly. Everything was located close by which was a real plus. The hotel accommodation that was provided was excellent."* and *"Everything was great. Congratulations for a job very well done."*, with Johanna Kytöharju being picked out for special praise by several of the participants (including *"Excellent organisation - Johanna deserves a medal!"* and *"Ms Johanna Kytöharju did a wonderful job of making all the arrangements."*). As organisers, we were delighted with ICMS's running of the workshop and it was a joy to work with Johanna Kytöharju, Irene Moore and Helen Bridle, who were immensely efficient (and patient!) throughout.

In conclusion, one participant said *"It was the best and the most interesting scientific meeting I have ever seen! The organizers of the colloquium did an excellent job!"* which we hope reflects the general view of the workshop by the participants.

Around ten research papers written by participants in the workshop will be published in a special themed issue of the *Journal of Engineering Mathematics* on "thin-film flow" guest edited by Wilson and Duffy and scheduled to appear in late 2010 or early 2011. Although not intended to be simply a "proceedings" volume for the workshop (in our experience, standard conference proceedings volumes or books are often of distinctly mixed scientific quality), it will begin with an introduction describing the workshop and how all of the papers in the volume were either presented at or are closely related to work presented at the workshop.

We are very grateful to the support given by ICMS to our workshop, without which it could not have taken place.

Professor Stephen K. Wilson and Dr Brian Duffy (Co-organisers)
March 2010