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Preface to the inaugural "Perspectives" article entitled "The importance of being thin" by Stephen H. Davis

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In this issue of the *Journal of Engineering Mathematics*, we are proud to launch a new series of occasional "Perspectives" articles surveying topics in Applied and Engineering Mathematics which fall within the *Journal's* scope written by world-leading experts in their fields. These articles are by personal invitation from the Editors-in-Chief only, and aim to be authoritative and valuable to experts working in the field, sufficiently accessible so as to provide an entry point into the subject matter of the article to non-specialists, and give an overview of the open problems in the area which will help to shape the direction of future research.

We are very fortunate that the first of our Perspectives articles is by Professor Stephen H. Davis, the McCormick School (Institute) Professor and Walter P. Murphy Professor of Applied Mathematics at the Northwestern University, USA. Professor Davis has authored over two hundred refereed technical papers in the fields of Fluid Mechanics and Materials Science, including many seminal papers and a highly cited review article on thin-film flow [1] and a textbook on the theory of solidification [2]. He has twice been the Chairman of the Division of Fluid Dynamics of the American Physical Society, is a Fellow of the American Physical Society, member of the National Academy of Sciences, the National Academy of Engineering, and the American Academy of Arts and Sciences, is the 1994 recipient of the Fluid Dynamics Prize of the American Physical Society, and the 2001 G. I. Taylor Medal of the Society of Engineering Science. Professor Davis was the Editor-in-Chief of the world-famous *Journal of Fluid Mechanics*, and is currently a Co-Editor of the highly respected *Annual Review of Fluid Mechanics*.

In his Perspectives article, "The Importance of Being Thin" [3], Professor Davis provides an exposition of a methodology for the derivation of approximate solutions to the incompressible Navier–Stokes equations, one of the cornerstones of Fluid Mechanics. These approximations exploit physical situations characterised by a disparity of length-scales, where, typically, one of the spatial dimensions is small. Starting with a "toy problem" to illustrate his adopted approach, Professor Davis employs a range of techniques of which boundary-layer, lubrication and slender-body theories are but a few examples. He covers a wide range of flows that include buoyancy- and thermocapillary-driven convection in a slot, Hele-Shaw flows, shallow-water-type flows, the dynamics of thin films, and moving contact lines. The topics considered also range from steady to unsteady flows, which may be

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two- or three-dimensional, viscous or inviscid, open or confined. The commonalities between the various problems considered are clearly highlighted, and expertly illustrated by Professor Davis.

The Perspectives article by Professor Davis represents an excellent example of how an analytical approach, often followed by the application of numerical methods, can be used to "dissect" a practically relevant problem, reducing its complexity, and elucidating the driving mechanisms involved. The article is also an outstanding example of the approach to the solution of problems in Applied and Engineering Mathematics the *Journal of Engineering Mathematics* has always sought to champion and, as such, there can be no better way to begin what we intend will be a long series of distinguished articles than with this masterful contribution by Professor Davis.

Professors Omar K. Matar and Stephen K. Wilson
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