Journal of Engineering Mathematics **45:** 195, 2003.

Introduction

The current issue on *Practical Asymptotics* is the second such Special Issue of the *Journal of Engineering Mathematics*, its predecessor comprising Volume 39. We hope that the papers contained herein again provide powerful evidence of the efficacy of asymptotic approaches in yielding precise quantitative information about, as well as qualitative insight into, the solutions to mathematical models of physical (and other) systems, including nonlinear formulations of the level of complexity that frequently arises in the description of phenomena of engineering or industrial interest. Of course, such models are also usually amenable to direct numerical treatments, and these are becoming increasingly prevalent and effective; nevertheless, we contend that asymptotic approaches will continue to provide important complements to numerical simulation, not only in (for example) furnishing parameter dependencies and substantial simplications in the governing systems (making them much more amenable to straightforward numerical treatment) but also in identifying regions of rapid variation and cases in which even very refined numerical procedures may lead to erroneous results (due, for example, to beyond-all-orders effects involving terms which may be smaller than the rounding error but which may nevertheless qualitively change the form of the solution, or even determine whether or not one exists).

Given that the Navier-Stokes equations have provided a crucial testing ground in the development of asymptotic techniques, it is fitting that the current issue contains a number of applications drawn from fluid mechanics, including both high- and low-Reynolds-number flows, the former involving spike development and flow under a moving car and the latter thin-film limits for flow over curved moving substrates. Other fluid applications represented here include Taylor dispersion in viscoelastic materials and nonlinear convection-diffusion (moving-boundary) descriptions of the infiltration of soil by water. Thin-film flows and moving-boundary problems also provide rich sources of formulations which require the development of new asymptotic techniques, notably those able to capture terms which are exponentially small in the relevant parameter. Industrial mathematics and heat- and mass-transfer processes provide other (overlapping) themes, areas of application including the prediction of cement thickening times, condensation within a porous medium (with application to fuel-cell electrodes) and hot-spot development within a reactive fluid.

It is our hope that the current issue attests to the continued vitality of asymptotic techniques, in terms both of the steadily expanding range of applications to which they are being usefully applied and of the further refinements of the methods which are being demanded by some of these new applications. We hope in addition that the valuable systematic role which can be played by asymptotics in potentially every stage of model development and analysis, from the initial neglect of small effects, through iterative model refinement and simplification to the identification of scaling laws and the construction of explicit approximate solutions, is convincingly demonstrated.

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