

PREFACE

This volume contains selected presentations from the program of Moving Interface Problems and Applications held at the Institute for Mathematical Sciences (IMS), National University of Singapore, from January to March, 2007. In particular, the four chapters of this volume encompass the tutorials conducted by Robert Dillon (WSU) and Zhilin Li (NCSU), John Lowengrub (UCI), Frank Lu (UT-Arlington), and Gretar Tryggvason (WPI), who are all experts in their specific areas related to moving interface problems and applications.

This volume introduces some fundamental materials related to the modeling, applications, experiments, and computational methods for moving interface problems and summarizes some recent progress in different areas and future works, with applications to biological and physical flows. The chapter by Robert Dillon and Zhilin Li introduces the very popular immersed boundary (IB) method and the immersed interface methods (IIM) for solving free boundary and moving interface problems, and problems defined on irregular domains. The chapter by John Lowengrub focuses on the mathematical modeling aspects of interfacial flow in cell biology (tumor growth) and numerical methods, particularly, the boundary integral method. The chapter by Frank Lu discusses the numerical and experimental aspects in the related area of the physical flow of detonation physics where the dynamics of interfacial phenomena between detonation product and combustible fuel in the midst of chemical reaction (gas) is a challenging problem. The chapter by Gretar Tryggvason provides a discourse on the simulation of multiphase flow and, in particular, the problem on bubbly flow. Overall, each chapter has a concluding note on the (likely) future direction in the respective areas. We believe that the volume would be of interest to researchers and (graduate) students working on moving interface problems. Readers may also find the chapters useful as a guide to the literature of the research area and as a place to pursue their future research ideas.

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Boo Cheong Khoo
National University of Singapore

Zhilin Li
North Carolina State University, USA

Ping Lin
National University of Singapore and
University of Dundee (UK)

Editors