COMPUTATIONAL METHODS IN MULTIPHASE FLOW III

WITPRESS

WIT Press publishes leading books in Science and Technology.
Visit our website for new and current list of titles.
www.witpress.com

WITeLibrary

Home of the Transactions of the Wessex Institute.
Papers presented at Computational Methods in Multiphase Flow III are archived in the WIT eLibrary in volume 50 of WIT Transactions on Engineering Sciences (ISSN 1743-3533).

The WIT eLibrary provides the international scientific community with immediate and permanent access to individual papers presented at WIT conferences.
http://library.witpress.com

THIRD INTERNATIONAL CONFERENCE ON COMPUTATIONAL METHODS IN MULTIPHASE FLOW

MULTIPHASE FLOW III

CONFERENCE CHAIRMEN

C. A. Brebbia
Wessex Institute of Technology, UK

A.A. Mammoli
University of New Mexico, USA

Organised by:
Wessex Institute of Technology, UK
and
University of New Mexico, USA

Sponsored by:
WIT Transactions on Engineering Sciences

Computational Methods in Multiphase Flow III

Editors

A.A. Mammoli
University of New Mexico, USA

C. A. Brebbia
Wessex Institute of Technology, UK

WIT*PRESS* Southampton, Boston

A.A. Mammoli
University of New Mexico, USA

C. A. Brebbia
Wessex Institute of Technology, UK

Published by

WIT Press
Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK
Tel: 44 (0) 238 029 3223; Fax: 44 (0) 238 029 2853
E-Mail: witpress@witpress.com
http://www.witpress.com

For USA, Canada and Mexico

Computational Mechanics Inc
25 Bridge Street, Billerica, MA 01821, USA
Tel: 978 667 5841; Fax: 978 667 7582
E-Mail: infousa@witpress.com
http://www.witpress.com

British Library Cataloguing-in-Publication Data

A Catalogue record for this book is available
from the British Library

ISBN: 1-84564-030-6
ISSN: 1746-4471 (print)
ISSN: 1743-3533 (on-line)

The texts of the papers in this volume were set individually by the authors or under their supervision. Only minor corrections to the text may have been carried out by the publisher.

Printed in Great Britain by Cambridge Printing.

Preface

The topic of multiphase flow is broad, encompassing a variety of fluids, transported solids and flow regimes. A common feature is that there is generally a dispersed, or discontinuous phase, carried by a continuous phase. The interactions between particles or deforming drops in the disperse phase dominate the overall behavior of the flow. Much of the research has focused on understanding these complex interphase interactions, through a wide array of theoretical, computational and experimental techniques. Research in multiphase flows is driven by the challenge of understanding such complex phenomena, as well as by practical considerations dictated by technological needs.

Despite recent advances in experimental and computational capabilities, multiphase flows still present many open questions. While for individual, rather restricted classes of flows (such as, for example, rigid spheres in a Newtonian fluid) there exist several models which provide good simulation under a certain set of conditions, these are not robust. Difficulties arise especially when the scale of the disperse phase is comparable to the scale of the characteristic dimension of the flow itself. In this case, boundary conditions are particularly difficult to impose. Modeling has been approached from all length scales, from the particle level, with direct numerical simulation, to the continuum level via constitutive equations of varying complexity, while some recent work was aimed at combining various length scales within the same model.

Similarly, experimental work can focus of many aspects of the flow process, from phase distributions, to small-scale interactions between two particles, to macroscopic fluid and flow properties. The presence of multiple phases renders optical observation difficult for moderate and high concentrations of the disperse phase, so non-invasive techniques have been adapted and devised to achieve the capability of seeing inside the flow, sometime in real-time. For low concentrations, optical observation and PIV are still the preferred choice.

A recent area of research is multiphase flow in porous media, in which the carrier phase and the dispersed phases (drops, bubbles, particles) interact with each other and with the porous phase, thereby adding another level of complexity. These flows are increasingly important, particularly in the energy sector (geological sequestration of greenhouse gases, enhanced oil recovery, fuel cells).This research area is becoming treatable due to constantly increasing computing capacity, as well as improved experimental diagnostics This book covers a broad spectrum of the most recent research in multiphase flow, ranging from basic research, to industrial applications, to the development of new numerical simulation techniques.

Hoping that the readers finds this collection of papers useful in pursuing their activity, the authors wish to acknowledge the invaluable help of the Scientific Advisory Committee in selecting the papers and ensuring their quality.

The Editors
Portland, Maine, 2005

Contents

Section 3: Flow in porous media

Section 4: Interfaces

Section 5: Turbulent flow

Section 6: Injectors and nozzles

Section 10: Finite volumes

Section 11: Interface tracking methods