

Advances in Fluid Mechanics VIII

WIT*PRESS*

WIT Press publishes leading books in Science and Technology.

Visit our website for the current list of titles.

www.witpress.com

WIT*eLibrary*

Home of the Transactions of the Wessex Institute.

Papers presented at Advances in Fluid Mechanics VIII are archived

in the WIT eLibrary in volume 69 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>.

EIGHTH INTERNATIONAL CONFERENCE ON
ADVANCES IN FLUID MECHANICS

Advances in Fluid Mechanics VIII

CONFERENCE CHAIRMEN

M. Rahman

Dalhousie University, Canada

C.A. Brebbia

Wessex Institute of Technology, UK

INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE

F. Barrera
R. Bourisli
P.C. Chu
S. D'Alessio
J. De Wilde
G. Micale
F. Morency
S. Sinkunas
L. Skerget
G. Swaters
R. Verhoeven

ORGANISED BY

The Wessex Institute of Technology, UK

SPONSORED BY

*WIT Transactions on Engineering Sciences
Fluid Mechanics Book Series*

WIT Transactions

Transactions Editor

Carlos Brebbia

Wessex Institute of Technology
Ashurst Lodge, Ashurst
Southampton SO40 7AA, UK
Email: carlos@wessex.ac.uk

Editorial Board

B Abersek University of Maribor, Slovenia

Y N Abousleiman University of Oklahoma,
USA

P L Aguilar University of Extremadura, Spain

K S Al Jabri Sultan Qaboos University, Oman

E Alarcon Universidad Politecnica de Madrid,
Spain

A Aldama IMTA, Mexico

C Alessandri Universita di Ferrara, Italy

D Almorza Gomar University of Cadiz,
Spain

B Alzahabi Kettering University, USA

J A C Ambrosio IDMEC, Portugal

A M Amer Cairo University, Egypt

S A Anagnostopoulos University of Patras,
Greece

M Andretta Montecatini, Italy

E Angelino A.R.P.A. Lombardia, Italy

H Antes Technische Universitat Braunschweig,
Germany

M A Atherton South Bank University, UK

A G Atkins University of Reading, UK

D Aubry Ecole Centrale de Paris, France

H Azegami Toyohashi University of
Technology, Japan

A F M Azevedo University of Porto, Portugal

J Baish Bucknell University, USA

J M Baldasano Universitat Politecnica de
Catalunya, Spain

J G Bartzis Institute of Nuclear Technology,
Greece

A Bejan Duke University, USA

M P Bekakos Democritus University of
Thrace, Greece

G Belingardi Politecnico di Torino, Italy

R Belmans Katholieke Universiteit Leuven,
Belgium

C D Bertram The University of New South
Wales, Australia

D E Beskos University of Patras, Greece

S K Bhattacharyya Indian Institute of
Technology, India

E Blums Latvian Academy of Sciences, Latvia

J Boarder Cartref Consulting Systems, UK

B Bobee Institut National de la Recherche
Scientifique, Canada

H Boileau ESIGEC, France

J J Bommer Imperial College London, UK

M Bonnet Ecole Polytechnique, France

C A Borrego University of Aveiro, Portugal

A R Bretones University of Granada, Spain

J A Bryant University of Exeter, UK

F-G Buchholz Universitat Gesanthochschule
Paderborn, Germany

M B Bush The University of Western
Australia, Australia

F Butera Politecnico di Milano, Italy

J Byrne University of Portsmouth, UK

W Cantwell Liverpool University, UK

D J Cartwright Bucknell University, USA

P G Carydis National Technical University of
Athens, Greece

J J Casares Long Universidad de Santiago de
Compostela, Spain

M A Celia Princeton University, USA

A Chakrabarti Indian Institute of Science,
India

A H-D Cheng University of Mississippi, USA

J Chilton University of Lincoln, UK
C-L Chiu University of Pittsburgh, USA
H Choi Kangnung National University, Korea
A Cieslak Technical University of Lodz, Poland
S Clement Transport System Centre, Australia
M W Collins Brunel University, UK
J J Connor Massachusetts Institute of Technology, USA
M C Constantinou State University of New York at Buffalo, USA
D E Cormack University of Toronto, Canada
M Costantino Royal Bank of Scotland, UK
D F Cutler Royal Botanic Gardens, UK
W Czyczula Krakow University of Technology, Poland
M da Conceicao Cunha University of Coimbra, Portugal
L Dávid Károly Róbert College, Hungary
A Davies University of Hertfordshire, UK
M Davis Temple University, USA
A B de Almeida Instituto Superior Tecnico, Portugal
E R de Arantes e Oliveira Instituto Superior Tecnico, Portugal
L De Biase University of Milan, Italy
R de Borst Delft University of Technology, Netherlands
G De Mey University of Ghent, Belgium
A De Montis Università di Cagliari, Italy
A De Naeyer Universiteit Ghent, Belgium
W P De Wilde Vrije Universiteit Brussel, Belgium
L Debnath University of Texas-Pan American, USA
N J Dedios Mimbela Universidad de Cordoba, Spain
G Degrande Katholieke Universiteit Leuven, Belgium
S del Giudice University of Udine, Italy
G Deplano Università di Cagliari, Italy
I Doltsinis University of Stuttgart, Germany
M Domaszewski Université de Technologie de Belfort-Montbéliard, France
J Dominguez University of Seville, Spain
K Dorow Pacific Northwest National Laboratory, USA
W Dover University College London, UK
C Dowlen South Bank University, UK
J P du Plessis University of Stellenbosch, South Africa
R Duffell University of Hertfordshire, UK
A Ebel University of Cologne, Germany
E E Edoutos Democritus University of Thrace, Greece
G K Egan Monash University, Australia
K M Elawadly Alexandria University, Egypt
K-H Elmer Universität Hannover, Germany
D Elms University of Canterbury, New Zealand
M E M El-Sayed Kettering University, USA
D M Elsom Oxford Brookes University, UK
A El-Zafrany Cranfield University, UK
F Erdogan Lehigh University, USA
F P Escrig University of Seville, Spain
D J Evans Nottingham Trent University, UK
J W Everett Rowan University, USA
M Faghri University of Rhode Island, USA
R A Falconer Cardiff University, UK
M N Fardis University of Patras, Greece
P Fedelinski Silesian Technical University, Poland
H J S Fernando Arizona State University, USA
S Finger Carnegie Mellon University, USA
J I Frankel University of Tennessee, USA
D M Fraser University of Cape Town, South Africa
M J Fritzler University of Calgary, Canada
U Gabbert Otto-von-Guericke Universität Magdeburg, Germany
G Gambolati Università di Padova, Italy
C J Gantes National Technical University of Athens, Greece
L Gaul Universität Stuttgart, Germany
A Genco University of Palermo, Italy
N Georgantzis Universität Jaume I, Spain
P Giudici Università di Pavia, Italy
F Gomez Universidad Politecnica de Valencia, Spain
R Gomez Martin University of Granada, Spain
D Goulias University of Maryland, USA
K G Goulias Pennsylvania State University, USA
F Grandori Politecnico di Milano, Italy
W E Grant Texas A & M University, USA
S Grilli University of Rhode Island, USA

R H J Grimshaw Loughborough University, UK
D Gross Technische Hochschule Darmstadt, Germany
R Grundmann Technische Universitat Dresden, Germany
A Gualtierotti IDHEAP, Switzerland
R C Gupta National University of Singapore, Singapore
J M Hale University of Newcastle, UK
K Hameyer Katholieke Universiteit Leuven, Belgium
C Hanke Danish Technical University, Denmark
K Hayami National Institute of Informatics, Japan
Y Hayashi Nagoya University, Japan
L Haydock Newage International Limited, UK
A H Hendrickx Free University of Brussels, Belgium
C Herman John Hopkins University, USA
S Heslop University of Bristol, UK
I Hideaki Nagoya University, Japan
D A Hills University of Oxford, UK
W F Huebner Southwest Research Institute, USA
J A C Humphrey Bucknell University, USA
M Y Hussaini Florida State University, USA
W Hutchinson Edith Cowan University, Australia
T H Hyde University of Nottingham, UK
M Iguchi Science University of Tokyo, Japan
D B Ingham University of Leeds, UK
L Int Panis VITO Expertisecentrum IMS, Belgium
N Ishikawa National Defence Academy, Japan
J Jaafar UiTm, Malaysia
W Jager Technical University of Dresden, Germany
Y Jaluria Rutgers University, USA
C M Jefferson University of the West of England, UK
P R Johnston Griffith University, Australia
D R H Jones University of Cambridge, UK
N Jones University of Liverpool, UK
D Kaliampakos National Technical University of Athens, Greece
N Kamiya Nagoya University, Japan
D L Karabalis University of Patras, Greece
M Karlsson Linkoping University, Sweden
T Katayama Doshisha University, Japan
K L Katsifarakis Aristotle University of Thessaloniki, Greece
J T Katsikadelis National Technical University of Athens, Greece
E Kausel Massachusetts Institute of Technology, USA
H Kawashima The University of Tokyo, Japan
B A Kazimee Washington State University, USA
S Kim University of Wisconsin-Madison, USA
D Kirkland Nicholas Grimshaw & Partners Ltd, UK
E Kita Nagoya University, Japan
A S Kobayashi University of Washington, USA
T Kobayashi University of Tokyo, Japan
D Koga Saga University, Japan
S Kotake University of Tokyo, Japan
A N Kounadis National Technical University of Athens, Greece
W B Kratzig Ruhr Universitat Bochum, Germany
T Krauthammer Penn State University, USA
C-H Lai University of Greenwich, UK
M Langseth Norwegian University of Science and Technology, Norway
B S Larsen Technical University of Denmark, Denmark
F Lattarulo Politecnico di Bari, Italy
A Lebedev Moscow State University, Russia
L J Leon University of Montreal, Canada
D Lewis Mississippi State University, USA
S Ighobashi University of California Irvine, USA
K-C Lin University of New Brunswick, Canada
A A Liolios Democritus University of Thrace, Greece
S Lomov Katholieke Universiteit Leuven, Belgium
J W S Longhurst University of the West of England, UK
G Loo The University of Auckland, New Zealand
J Lourenco Universidade do Minho, Portugal
J E Luco University of California at San Diego, USA

H Lui State Seismological Bureau Harbin, China

C J Lumsden University of Toronto, Canada

L Lundqvist Division of Transport and Location Analysis, Sweden

T Lyons Murdoch University, Australia

Y-W Mai University of Sydney, Australia

M Majowiecki University of Bologna, Italy

D Malerba Università degli Studi di Bari, Italy

G Manara University of Pisa, Italy

B N Mandal Indian Statistical Institute, India

Ü Mander University of Tartu, Estonia

H A Mang Technische Universität Wien, Austria

G D Manolis Aristotle University of Thessaloniki, Greece

W J Mansur COPPE/UF RJ, Brazil

N Marchettini University of Siena, Italy

J D M Marsh Griffith University, Australia

J F Martin-Duque Universidad Complutense, Spain

T Matsui Nagoya University, Japan

G Mattrisch DaimlerChrysler AG, Germany

F M Mazzolani University of Naples "Federico II", Italy

K McManis University of New Orleans, USA

A C Mendes Universidade de Beira Interior, Portugal

R A Meric Research Institute for Basic Sciences, Turkey

J Mikielawicz Polish Academy of Sciences, Poland

N Milic-Frayling Microsoft Research Ltd, UK

R A W Mines University of Liverpool, UK

C A Mitchell University of Sydney, Australia

K Miura Kajima Corporation, Japan

A Miyamoto Yamaguchi University, Japan

T Miyoshi Kobe University, Japan

G Molinari University of Genoa, Italy

T B Moodie University of Alberta, Canada

D B Murray Trinity College Dublin, Ireland

G Nakhaeizadeh DaimlerChrysler AG, Germany

M B Neace Mercer University, USA

D Neculescu University of Ottawa, Canada

F Neumann University of Vienna, Austria

S-I Nishida Saga University, Japan

H Nisitani Kyushu Sangyo University, Japan

B Notaros University of Massachusetts, USA

P O'Donoghue University College Dublin, Ireland

R O O'Neill Oak Ridge National Laboratory, USA

M Ohkusu Kyushu University, Japan

G Oliveto Università di Catania, Italy

R Olsen Camp Dresser & McKee Inc., USA

E Oñate Universitat Politècnica de Catalunya, Spain

K Onishi Ibaraki University, Japan

P H Oosthuizen Queens University, Canada

E L Ortiz Imperial College London, UK

E Outa Waseda University, Japan

A S Papageorgiou Rensselaer Polytechnic Institute, USA

J Park Seoul National University, Korea

G Passerini Università delle Marche, Italy

B C Patten University of Georgia, USA

G Pelosi University of Florence, Italy

G G Penelis Aristotle University of Thessaloniki, Greece

W Perrie Bedford Institute of Oceanography, Canada

R Pietrabissa Politecnico di Milano, Italy

H Pina Instituto Superior Tecnico, Portugal

M F Platzer Naval Postgraduate School, USA

D Poljak University of Split, Croatia

V Popov Wessex Institute of Technology, UK

H Power University of Nottingham, UK

D Prandle Proudman Oceanographic Laboratory, UK

M Predeleanu University Paris VI, France

M R I Purvis University of Portsmouth, UK

I S Putra Institute of Technology Bandung, Indonesia

Y A Pykh Russian Academy of Sciences, Russia

F Rachidi EMC Group, Switzerland

M Rahman Dalhousie University, Canada

K R Rajagopal Texas A & M University, USA

T Rang Tallinn Technical University, Estonia

J Rao Case Western Reserve University, USA

A M Reinhorn State University of New York at Buffalo, USA

A D Rey McGill University, Canada

D N Riahi University of Illinois at Urbana-Champaign, USA

B Ribas Spanish National Centre for Environmental Health, Spain

K Richter Graz University of Technology, Austria

S Rinaldi Politecnico di Milano, Italy

F Robuste Universitat Politecnica de Catalunya, Spain

J Roddick Flinders University, Australia

A C Rodrigues Universidade Nova de Lisboa, Portugal

F Rodrigues Poly Institute of Porto, Portugal

C W Roeder University of Washington, USA

J M Roesset Texas A & M University, USA

W Roetzel Universitaet der Bundeswehr Hamburg, Germany

V Roje University of Split, Croatia

R Rosset Laboratoire d'Aerologie, France

J L Rubio Centro de Investigaciones sobre Desertificacion, Spain

T J Rudolphi Iowa State University, USA

S Russenchuck Magnet Group, Switzerland

H Ryssel Fraunhofer Institut Integrierte Schaltungen, Germany

S G Saad American University in Cairo, Egypt

M Saiidi University of Nevada-Reno, USA

R San Jose Technical University of Madrid, Spain

F J Sanchez-Sesma Instituto Mexicano del Petroleo, Mexico

B Sarler Nova Gorica Polytechnic, Slovenia

S A Savidis Technische Universitat Berlin, Germany

A Savini Universita de Pavia, Italy

G Schmid Ruhr-Universitat Bochum, Germany

R Schmidt RWTH Aachen, Germany

B Scholtes Universitaet of Kassel, Germany

W Schreiber University of Alabama, USA

A P S Selvadurai McGill University, Canada

J J Sendra University of Seville, Spain

J J Sharp Memorial University of Newfoundland, Canada

Q Shen Massachusetts Institute of Technology, USA

X Shixiong Fudan University, China

G C Sih Lehigh University, USA

L C Simoes University of Coimbra, Portugal

A C Singhal Arizona State University, USA

P Skerget University of Maribor, Slovenia

J Sladek Slovak Academy of Sciences, Slovakia

V Sladek Slovak Academy of Sciences, Slovakia

A C M Sousa University of New Brunswick, Canada

H Sozer Illinois Institute of Technology, USA

D B Spalding CHAM, UK

P D Spanos Rice University, USA

T Speck Albert-Ludwigs-Universitaet Freiburg, Germany

C C Spyarakos National Technical University of Athens, Greece

I V Stangeeva St Petersburg University, Russia

J Stasiak Technical University of Gdansk, Poland

G E Swaters University of Alberta, Canada

S Syngellakis University of Southampton, UK

J Szmyd University of Mining and Metallurgy, Poland

S T Tadano Hokkaido University, Japan

H Takemiya Okayama University, Japan

I Takewaki Kyoto University, Japan

C-L Tan Carleton University, Canada

M Tanaka Shinshu University, Japan

E Taniguchi Kyoto University, Japan

S Tanimura Aichi University of Technology, Japan

J L Tassoulas University of Texas at Austin, USA

M A P Taylor University of South Australia, Australia

A Terranova Politecnico di Milano, Italy

A G Tjihuis Technische Universiteit Eindhoven, Netherlands

T Tirabassi Institute FISBAT-CNR, Italy

S Tkachenko Otto-von-Guericke-University, Germany

N Tosaka Nihon University, Japan

T Tran-Cong University of Southern Queensland, Australia

R Tremblay Ecole Polytechnique, Canada

I Tsukrov University of New Hampshire, USA

R Turra CINECA Interuniversity Computing Centre, Italy

S G Tushinski Moscow State University,
Russia

J-L Uso Universitat Jaume I, Spain

E Van den Bulck Katholieke Universiteit
Leuven, Belgium

D Van den Poel Ghent University, Belgium

R van der Heijden Radboud University,
Netherlands

R van Duin Delft University of Technology,
Netherlands

P Vas University of Aberdeen, UK

R Verhoeven Ghent University, Belgium

A Viguri Universitat Jaume I, Spain

Y Villacampa Esteve Universidad de
Alicante, Spain

F F V Vincent University of Bath, UK

S Walker Imperial College, UK

G Walters University of Exeter, UK

B Weiss University of Vienna, Austria

H Westphal University of Magdeburg,
Germany

J R Whiteman Brunel University, UK

Z-Y Yan Peking University, China

S Yanniotis Agricultural University of Athens,
Greece

A Yeh University of Hong Kong, China

J Yoon Old Dominion University, USA

K Yoshizato Hiroshima University, Japan

T X Yu Hong Kong University of Science &
Technology, Hong Kong

M Zador Technical University of Budapest,
Hungary

K Zakrzewski Politechnika Lodzka, Poland

M Zamir University of Western Ontario,
Canada

R Zarnic University of Ljubljana, Slovenia

G Zharkova Institute of Theoretical and
Applied Mechanics, Russia

N Zhong Maebashi Institute of Technology,
Japan

H G Zimmermann Siemens AG, Germany

Advances in Fluid Mechanics VIII

Editors

M. Rahman

Dalhousie University, Canada

C.A. Brebbia

Wessex Institute of Technology, UK

WITPRESS Southampton, Boston



Editors:

M. Rahman

Dalhousie University, Canada

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

WIT Press

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: 978-1-84564-476-5

ISSN: (print) 1746-4471

ISSN: (on-line) 1743-3533

*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.*

No responsibility is assumed by the Publisher, the Editors and Authors for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein. The Publisher does not necessarily endorse the ideas held, or views expressed by the Editors or Authors of the material contained in its publications.

© WIT Press 2010

Printed in Great Britain by MPG Books Group, Bodmin and King's Lynn.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the Publisher.

Preface

The field of fluid mechanics is vast and has numerous and diverse applications in everyday life. The papers in this book cover a wide range of topics in the area of advances in fluid mechanics. The papers were presented at the eighth International Conference on Advances in Fluid Mechanics held in Portugal in 2010. The meeting was organised by the Wessex Institute of Technology, UK.

The conference has reconvened every two years since 1996, and originated a very successful book series on the same topics which has resulted in over 60 volumes since then.

The first conference was held in New Orleans, USA (1996), and then followed by Udine, Italy (1998), Montreal, Canada (2000), Ghent, Belgium (2002), Lisbon, Portugal (2004), Skiathos, Greece (2006), and The New Forest, UK (2008).

The papers in the book are arranged in the following sections: Computational Methods in Fluid Mechanics; Environmental Fluid Mechanics; Experimental versus Simulation Methods; Multiphase Flow; Hydraulics and Hydrodynamics; Heat Transfer; Industrial Applications; Wave Studies; Bio-fluids; and Fluid Structure Interaction.

This volume is part of the Transactions of Wessex Institute series, published in paper and digital format and distributed throughout the world. In addition, all papers are archived within Wessex Institute electronic library (<http://library.witpress.com>) where they are permanently and easily available to the scientific community.

The Editors are indebted to all authors as well as the members of International Scientific Advisory Committee who helped review the papers.

The Editors,
The Algarve, Portugal, 2010

Contents

Section 1: Computational methods

Turbulence modeling with the boundary element method <i>J. Lupše, L. Škerget & J. Ravnik</i>	3
On properties of turbulence models <i>T. H. Moulden</i>	15
Turbulence combustion closure model based on the Eddy dissipation concept for large eddy simulation <i>B. Panjwani, I. S. Ertesvåg, A. Gruber & K. E. Rian</i>	27
Computational study on non-asymptotic behavior of developing turbulent pipe flow <i>W. A. S. Kumara, B. M. Halvorsen & M. C. Melaaen</i>	39
Vorticity Confinement method applied to flow around an Ahmed body and comparison with experiments <i>M. Forman, H. Jasak, J. Volavy, M. Jicha, C. Othmer & H. P. Bensler</i>	55
A new class of exact solutions of the Navier–Stokes equations for swirling flows in porous and rotating pipes <i>A. Fatsis, J. Statharas, A. Panoutsopoulou & N. Vlachakis</i>	67
Implementation of an LES mixed subgrid model for the numerical investigation of flow around a circular cylinder at $Re = 3,900$ and $140,000$ <i>J. Wong & E. Png</i>	79
Adaptive meshfree method for thermo-fluid problems with phase change <i>G. Kosec & B. Šarler</i>	91
Particle level set implementation on the finite volume method <i>M. Elmi & M. Kolahdouzan</i>	103

Bidimensional modeling for incompressible viscous flow using the Circumcenter Based Approach in an unstructured grid <i>A. L. Fazenda & J. S. Travelho</i>	115
Pressure-enthalpy coupling for subsonic flows with density variation <i>M. Emans, S. Frolov, B. Lidskii, V. Posvyanskii, Z. Žunič & B. Basara</i>	127
Study of ventilation reversion of airflow in mining roadways and tunnels by CFD and experimental methods <i>S. Torno, J. Toraño & J. Velasco</i>	137
Dam break Smoothed Particle Hydrodynamic modeling based on Riemann solvers <i>L. Minatti & A. Pasculli</i>	145
Numerical modelling of the filling of formworks with self-compacting concrete <i>S. Tichko, J. Van De Maele, N. Vanmassenhove, G. De Schutter, J. Vierendeels, R. Verhoeven & P. Troch</i>	157
Analysis of tunnel compression wave generation and distortion by the lattice Boltzmann method <i>K. Akamatsu & M. Tsutahara</i>	169
A universal multi-dimensional charge and mass transfer model <i>G. Kennell & R. W. Evitts</i>	181
Numerical investigation of the jet formation through the oscillation of a bubble between a couple of parallel walls <i>R. M. B. Teymouri & G. Ahmadi</i>	193
The VOF method applied to the numerical simulation of a 2D liquid jet under gravity <i>G. Rocco, G. Coppola & L. de Luca</i>	207
Large eddy simulation of particle laden jet flow with aerodynamic three-way coupling <i>A. Jadoon & J. Revstedt</i>	219
High quality triangular grid generation for the risk analysis of a special lagoon <i>B. Tansel</i>	231

Section 2: Experimental measurements

Validation of airflow measurement in ducts using Laser Doppler Anemometry and Computational Fluid Dynamics modelling <i>A. Mayes, S. Mitchell, J. Missenden & A. Gilbert</i>	243
Flow field assessment in a vertical axis wind turbine <i>R. Ricci, S. Montelpare, A. Secchiaroli & V. D'Alessandro</i>	255
Characteristics of boundary layer flow induced by a solitary wave <i>C. Lin, S. C. Hsieh, S. M. Yu & R. V. Raikar</i>	267

Section 3: Hydrodynamics

Peculiarities of hydrodynamics in the evaporation of hydrocarbon droplets <i>G. Miliauskas, S. Sinkunas, J. Talubinskas & K. Sinkunas</i>	283
Exact solutions of the two-dimensional Boussinesq and Dispersive water waves equations <i>F. P. Barrera, T. Brugarino & F. Montano</i>	293
Modelling gravity-driven flow over uneven surfaces <i>K. A. Ogden, S. J. D. D'Alessio & J. P. Pascal</i>	299
Sizing of a plastic chamber with air-filled balls for water hammer control <i>A. Al-Khomairi & S. Ead</i>	311
Capture flows of funnel-and-gate reactive barriers without gravel packs <i>H. Klammler, K. Hatfield & A. Kacimov</i>	319
Airfoil cascades with bistable separation control <i>V. Tesař</i>	331
Surface forces and wetting features in drops and capillaries <i>M. G. Velarde & V. M. Starov</i>	345
Power optimization of the complex pumping system <i>A. Alexandrescu</i>	357

Section 4: Fluid structure interaction

Hydrodynamic loading on elliptic cylinders in regular waves <i>M. Rahman & S. H. Mousavizadegan</i>	371
--	-----

Wave effect on the trajectory of a high-speed rigid body in a water column <i>P. C. Chu & C. Fan</i>	383
Dispersion relation of flow-induced wave of a flexible web subjected to fluid flow in a narrow gap <i>M. Watanabe, G. Kudou & K. Hara</i>	395
Fluid/structure interaction analysis using the Smoothed Particle Hydrodynamic method <i>D. Delsart, N. Toso-Pentecôte, A. Vagnot, L. Castelletti, U. Mercurio & S. Alguadich</i>	405
Environmental impacts on coastal structures with a case evaluation of armor stone protection at Keweenaw Waterway, USA <i>M. Zakikhani, D. W. Harrelson, J. G. Tom, J. A. Kissane, M. K. Allis & J. E. Kolber</i>	417
Numerical simulation of reservoir fluctuation effects on the nonlinear dynamic response of concrete arch dams <i>M. A. Hariri Ardebili & H. Mirzabozorg</i>	427
Fluid–structure simulation of a viscoelastic hydrofoil subjected to quasi-steady flow <i>R. L. Campbell, E. G. Paterson, M. C. Reese & S. A. Hambric</i>	439
 Section 5: Multiphase flow	
Visualization of ultrasonic cavitation in visible and IR spectra <i>A. Osterman, O. Coutier-Delgosha, M. Hocevar & B. Sirok</i>	451
Question for Euler–Lagrange type simulator from a view point of macroscopic properties of gas–liquid multiphase flow <i>K. Ueyama</i>	463
Control of a magnetic fluid drop moving in a viscous fluid inside a cylinder <i>M. Shinohara</i>	475
The development and water-air two-phase test results of an electrical submersible pump visualization prototype <i>F. E. Trevisan & M. G. Prado</i>	485
Simulation of multiphase flows with variable surface tension using the Lattice Boltzmann method <i>S. Stensholt</i>	497

Tetra-marching procedure for high order Level Contour Reconstruction Method <i>I. Yoon & S. Shin</i>	507
--	-----

A qualitative model of flashing across an aperture with a pressure differential <i>G. C. Polanco, A. E. Holdo & G. Munday</i>	519
--	-----

Section 6: Applications in biology

Modelling nanoparticle transport in an animal exposure chamber: a comparison between numerical and experimental measurements <i>F. Morency & S. Hallé</i>	533
---	-----

The influence on Dobutamine docking of blood flow around the sinoatrial node <i>A. K. Macpherson, S. Neti, M. Averbach, P. A. Macpherson, C. Chu Takositkanon & M. Chaney</i>	545
---	-----

Section 7: Electronic components cooling

Enhancement of conjugate heat transfer from electronic chips with a rotating tri-vane assembly <i>R. I. Bourisli</i>	557
--	-----

Experimental study of the turbulent flow around a single wall-mounted prism obstacle placed in a cross-flow and an impinging jet <i>Y. Masip, A. Rivas, A. Bengoechea, R. Antón, G. S. Larraona & J. C. Ramos</i>	569
---	-----

Author Index	585
---------------------------	-----