

Advances in Fluid Mechanics V

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*

Making the latest research accessible, the WIT electronic-library features papers presented at Wessex Institute of Technology's prestigious international conferences. To access the library and view abstracts free of charge please visit www.witpress.com

International Series on Advances in Fluid Mechanics

Objectives

The field of fluid mechanics is rich in exceptional researchers worldwide who have advanced the science and brought a greater technical understanding of the subject to their institutions, colleagues and students.

This book series has been established to bring such advances to the attention of the broad international community. Its aims are achieved by contributions to volumes from leading researchers by invitation only. This is backed by an illustrious Editorial Board who represent much of the active research in fluid mechanics worldwide.

Volumes in the series cover areas of current interest or active research and will include contributions by leaders in the field.

Topics for the series include: Bio-Fluid Mechanics, Biophysics and Chemical Physics, Computational Methods for Fluids, Experimental & Theoretical Fluid Mechanics, Fluids with Solids in Suspension, Fluid-Structure Interaction, Geophysics, Groundwater Flow, Heat and Mass Transfer, Hydrodynamics, Hydronautics, Magnetohydrodynamics, Marine Engineering, Material Sciences, Meteorology, Ocean Engineering, Physical Oceanography, Potential Flow of Fluids, River and Lakes Hydrodynamics, Slow Viscous Fluids, Stratified Fluids, High Performance Computing in Fluid Mechanics, Tidal Dynamics, Viscous Fluids, and Wave Propagation and Scattering.

Series Editor

M. Rahman

DalTech, Dalhousie University, Halifax,
Nova Scotia, Canada

Assistant Series Editor

M.G. Satish

DalTech, Dalhousie University, Halifax,
Nova Scotia, Canada

Honorary Editors

C.A. Brebbia

Wessex Institute of Technology
UK

L.G. Jaeger

DalTech, Dalhousie University
Canada

L. Debnath

University of Texas-Pan American
USA

A. Jeffrey

University of Newcastle upon Tyne,
UK

Associate Editors

E. Baddour

National Research Council of Canada
Canada

T.B. Gatski

NASA Langley Research Center
USA

S.K. Bhattacharyya

Indian Institute of Technology
Kharagpur, India

R. Grimshaw

Monash University
Australia

A. Chakrabarti

Indian Institute of Science
India

R. Grundmann

Technische Universität Dresden,
Germany

S.K. Chakrabarti

Offshore Structure Analysis, Inc
USA

R.C. Gupta

National University of Singapore
Singapore

M.W. Collins

South Bank University
UK

D. Hally

Defence Research Establishment
Canada

G. Comini

Universita di Udine
Italy

M.Y. Hussaini

Florida State University
USA

J.P. du Plessis

University of Stellenbosch
South Africa

D.B. Ingham

University of Leeds
UK

H.J.S. Fernando

Arizona State University
USA

S. Kim

University of Wisconsin-Madison
USA

B.N.Mandal

Indian Statistical Institute
India

T.Matsui

Nagoya University
Japan

A.C.Mendes

Universidade de Beira Interior
Portugal

T.B.Moodie

University of Alberta
Canada

A.J.Nowak

Technical University of Silesia
Poland

M.Ohkusu

Kyushu University
Japan

E.Outa

Waseda University
Japan

W. Perrie

Bedford Institute of Oceanography
Canada

H.Pina

Instituto Superior Tecnico
Portugal

H.Power

University of Nottingham
UK

D.Prandle

Proudman Oceanographic Laboratory
UK

K.R.Rajagopal

Texas A & M University
USA

D.N.Riahi

University of Illinois
USA

H.Schmitt

Bovenden
Germany

M.P.Singh

Indian Institute of Technology
New Delhi, India

P. Škerget

University of Maribor
Slovenia

P.A.Tyvand

Agricultural University of Norway
Norway

R.Verhoeven

Ghent University
Belgium

L.C.Wrobel

Brunel University
UK

M.Zamir

The University of Western Ontario
Canada

FIFTH INTERNATIONAL CONFERENCE ON
ADVANCES IN FLUID MECHANICS

AFM V

CONFERENCE CHAIRMEN

A. C. Mendes

University of Beira Interior, Portugal

M. Rahman

Dalhousie University, Canada

C.A. Brebbia

Wessex Institute of Technology, UK

INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE

C. Afonso	G Lorenzini
A. Chakrabarti	A.C. Mendes
G Comini	T.B. Moodie
L. Debnath	W. Perrie
J.P. du Plessis	H. Pina
L. Gato	M. Rahman
R.H.J. Grimshaw	D.N. Riahi
R.C. Gupta	L. Skerget
M.Y. Hussaini	R. Verhoeven
D.B. Ingham	M. Zamir
J. Kolodziej	F. Zayas Hinojosa

Organised by

Wessex Institute of Technology, UK

Contents

Section 1: Advanced computational methods

An inverse method for turbomachinery cascades of blades – investigation of the existence and uniqueness of solution <i>J. C. Páscoa, A. C. Mendes & L. M. C. Gato</i>	3
Solution of inverse problem for reservoir permeability <i>S. P. Panawalage, M. Rahman, J. Biazar & M. R. Islam</i>	13
Computation of the NTUA/LTT compressor annular-cascade flow using the multi-dimensional upwind residual distribution method <i>J. C. C. Henriques & L. M. C. Gato</i>	23
A Mach-uniform pressure correction algorithm using AUSM flux definitions <i>K. Nerinckx, J. Vierendeels & E. Dick</i>	33
3D rigid body impact burial prediction model (IMPACT35) <i>P. C. Chu & C. Fan</i>	43
Stability analysis of a liquid bridge for micromanipulation <i>K. J. Obata, S. Saito & K. Takahashi</i>	53
Solving fluid flow problems using a real-coded genetic algorithm with uniform refinement <i>R. Bourisli & D. A. Kaminski</i>	63
Iterative methods for equilibrium problems <i>M. Aslam Noor & K. Inayat Noor</i>	73

Section 2: Hydrodynamics

On closure modelling of volume averaged equations for flow through two-dimensional arrays of squares <i>C. A. Lloyd, J. P. Du Plessis & B. M. Halvorsen</i>	85
Numerical modelling of river flow—data collection and problem solving <i>R. Verhoeven, R. Banasiak, T. Okruszko, D. Swiatek, J. Chormanski & P. Nowakowsky</i>	95
Nonhydrostatic effects in gravity currents <i>T. B. Moodie & N. Antar</i>	107
On the meridional flow of source-driven abyssal currents along a continental slope <i>G. E. Swaters</i>	119
Study of turbulent flow upstream of a bottom outlet gate <i>M. Bélorgey, M. H. Seyed Seraji & A. Asnaashari</i>	129
Secondary instabilities in shock-induced transition to turbulence <i>P. Vorobieff, C. Tomkins, S. Kumar, C. Goodenough, N-G. Mohamed & R. F. Benjamin</i>	139
Structure and energy of turbulence of jet currents in the river mouths <i>R. Khanbilvardi, B. Shteinman, V. Khazin & O. Ozkurt</i>	149
Transcritical transitions in swirling quasi-columnar flows <i>A. Ni</i>	159
Bingham fluid flow in spatially variable fractures <i>V. Di Federico & G. Bizzarri</i>	169

Section 3: Wave studies

Motions of floating bodies in time harmonic waves <i>S. H. Mousavizadegan, M. Rahman & M. G. Satish</i>	181
The linear and nonlinear properties of the high-order Boussinesq equations for wave propagation <i>C.-H. Kong & C.-M. Liu</i>	191

Application of LDA to measurements of 2D regular waves over submerged breakwaters <i>F. T. Pinto</i>	201
Internal solitary waves <i>R. Grimshaw</i>	209
Numerical calculation of steady gravity-capillary waves forced by a surface pressure distribution <i>M. Maleewong, J. Asavanant & R. Grimshaw</i>	219
 Section 4: Multiphase flow	
The collision rate of monodispersed particles in turbulent flows with gravity <i>R. Onishi & S. Komori</i>	229
Viscometric studies of oil-in-water mixtures at low shear rates <i>M. B. Nabhan</i>	237
Investigation of the motion of a fixed rotating solid body over ice with a thin fluid interface <i>A. E. Summers & P. J. Montgomery</i>	247
Heat transfer and absorption of SO ₂ of wet flue gas in a tube cooled <i>L. Jia</i>	257
An experimental analysis of two phase flow for air lift pump design <i>G. K. Awari, P. M. Ardhapurkar & D. G. Wakde</i>	267
Modeling stratified immiscible fluid flows by the recovery of free-phase NAPL for aquifer remediation <i>I. David</i>	277
Flow induced orientation of fibers in Couette flow between eccentric cylinders <i>D. Mandal, A. Bénard & C. Petty</i>	289
Simulation of flow in a pulsed-jet mixer using a volume of fluid model <i>D. Eldin, S. Parks, C. Petty & A. Bénard</i>	297
Deposition of small particles from turbulent flows <i>Z. Wu & J. B. Young</i>	307

Section 5: Biofluids

Blood flow induced wall stress in the left ventricle of the heart <i>A. K. Macpherson, S. Neti, J. A. Mannisi & P. A. Macpherson</i>	321
A “Tochnog” application for blood flow simulation in human vessels <i>G. Lorenzini</i>	331
Simulation of complex biological flows and flow control problems on Cartesian grids <i>R. Mittal, F.M. Najjar, R. Byrganhalli, V. Seshadri & H. Singh</i>	343
The concept of a functional unit of the gut <i>R. N. Miftahof & E. M. Fedotov</i>	353
Chaos in the onset of sickle cell crises <i>A. Apori, R. Coral-Pinto & W. Harris</i>	363
Numerical study of a transient gas and particle flow within a needle-free powdered vaccines delivery system <i>Y. Liu, M. A. F. Kendall & B. J. Bellhouse</i>	377
An exact solution of Navier-Stokes equations for the flow through a diverging artery <i>N. Vlachakis, D. Pavlou, V. Vlachakis, M. Pavlou & M. Kouskouti</i>	389

Section 6: Industrial applications

Design of a new wind tunnel facility at Industrial Engineering School in Badajoz (Spain) <i>F. Zayas Hinojosa</i>	397
Wind tunnel analysis on the influence of cantilever parapets on the wind loads on curved roofs <i>S. Pindado, J. Meseguer, A. Martínez & S. Franchini</i>	405
Clustering process and interfacial area analysis in a large-size dropshaft <i>C. Gualtieri & H. Chanson</i>	415
Effect of rotor shape on the transient performance of viscous micropump – numerical study <i>P. Phutthavong & I. Hassan</i>	425
Investigations concerning the effectiveness of pump hydrocyclone operation <i>A. Wilk</i>	435

Insights to flow induced vibrations in computer hard disks <i>T. H. Yip, M. A. Suriadi, S. C. M. Yu & E. H. Ong</i>	445
Author Index	453