Two-Phase Flow Modelling and Experimentation
2004

Proceedings of the Second International Symposium on Two-Phase Flow Modelling and Experimentation
Pisa, ITALY, 22-25 September, 2004

Editors

G.P. Celata
ENEA
CR Casaccia, Rome, ITALY

P. Di Marco
Department of Energetics
University of Pisa,
ITALY

A. Mariani
ENEA
CR Casaccia, Rome,
ITALY

R.K. Shah
R.I.T.
Rochester, NY
USA

Volume 1

2004
Edizioni ETS
PISA
TABLE OF CONTENTS

Preface v
Conference Scientific Committee vi

Invited Lectures

Drag, lift and virtual mass forces acting on a single bubble
A. Tomiyama I-3

Drag reduction with microbubble injection
Y. Hassan I-13

Heat transfer and crisis in swirl flow boiling
V.V. Yagov I-19

The flow of oil-water mixtures in horizontal pipes. State of the art and recent developments on pressure drop reductions and flow regime transitions
G. Sotgia and P. Tartarini I-31

Enhancement of condensation heat transfer by using passive and active drainage techniques
D. Butrymowicz I-51

DNS and LES of turbulent multifluid flows
D. Lakehal I-67

Small-scale and coarse-grained dynamics of interfaces: The modeling of volumetric interfacial area in two-phase flows
D. Lhuillier I-79

CONTRIBUTED PAPERS

Bubbly Flow

Numerical evaluation of two-fluid model solutions for turbulent fully-developed bubbly two-phase flows
O.E. Azpitarte and G.C. Buscaglia I-87

Data analysis for hot-film anemometry in turbulent bubbly flow
S. Luther, J. Rensen, T.H. van den Berg and D. Lohse I-95

Models for the forces acting on bubbles in comparison with experimental data for vertical pipe flow
D. Lucas, J.M. Shi, E. Krepper and H.-M. Prasser I-103

Numerical simulations of a bubbly flow in a sudden-expansion with the NEPTUNE code
C. Morel, J. Pouvreau, J. Lavièville and M. Boucker I-111

Flow characteristics around and drag of obstacle in vertical upward gas-liquid bubbly pipe flow
T. Shakouchi, T. Nakamura, A. Voutsinas, J. Kawaguchi and K. Tsujimoto I-121
Turbulence modification in bubbly upward pipe flow (Extraction of microscopic turbulent structure by high speed time-resolved PIV)
K. Yoshimura, D. Minato, T. Tanaka, Y. Sato and K. Hishida 1-129

The clustering phenomena near the wall in a turbulent bubbly channel flow
T. Ogasawara, Y. Tagawa, A. Fujiwara, S. Takagi and Y. Matsumoto 1-135

Bubble breakup by pressure wave in bubbly flow
A. Fujiwara, K. Watanabe, S. Takagi and Y. Matsumoto 1-143

Numerical analysis for bubbly flows through a convergent-divergent nozzle
K. Okita, S. Takagi and Y. Matsumoto 1-149

Using geometrical automata to develop constitutive laws in bubbly flows
V. Herrero, G. Venere and A. Clausse 1-157

Modeling and simulation of full-scale bubbly flows around surface ships
F.J. Moraga, D.A. Drew and R.T. Lahey 1-163

Prediction of void fraction distribution for turbulent bubble flow in a vertical pipe with sudden expansion
K. Kondo, K. Yoshida, T. Okawa and I. Kataoka 1-171

Numerical simulation of turbulent bubbly flows
D. Kuzmin and S. Turek 1-179

Axial development of bubbly flow under microgravity environment
T. Takamasa, T. Hazuku, N. Tamura, T. Hibiki and M. Ishii 1-189

Hydrodynamic structure of two-phase bubbly flow in a horizontal channel
O.N. Kashinsky, E.V. Kaipova and A.V. Chinak 1-197

Micro and Minichannels

Non-stationary analysis of flow boiling in a minichannel
D. Brutin and L. Tadrist 1-205

Numerical calculation of critical mass flow rate in adiabatic capillary tubes
D. Fuentes,, J.M. Corberan and A. Perez-Navarro 1-213

Experimental research on the correlations of hold up and frictional pressure drop in air-water two-phase flow in a capillary rectangular channels
H. Ide and T. Fukano 1-221

Flow boiling incipience in minichannels
M. Piasecka and M.E. Poniewski 1-229

Flow boiling heat transfer in a vertical narrow channel
J. Shuai, R. Kulenovic, E. Sobierska, R. Mertz and M. Groll 1-237

High heat flux cooling by forced convective boiling in narrow channels
Y. Shinmoto, T. Ohno, H. Ohta, O. Ogawa and H. Shida 1-245
Experimental study of convective patterns for volatile wetting films  
C. Buffone and K. Sefiane  

Numerical study of heating effect on thermocapillary convection for an evaporating meniscus  
C. Buffone, K. Sefiane, R. Bennacer and M. El Ganaoui  

The effect of operating temperature and working fluid on the heat transport capacity of an inclined triangular micro heat pipe  
D. Sugumar, K.K. Tio and K.E. Chong  

Experimental research on flow patterns in two-phase flow in microchannels  
J.K. Keska  

Liquid velocity field measurements in two-phase microchannel convection  

Fluorescent imaging of void fraction in two-phase microchannels  
D. Fogg, R. Flynn, C. Hidrovo, L. Zhang and K. Goodson  

Experimental analysis of the flow through a micro-orifice  

Flow boiling heat transfer and regimes of upward flow in minichannels  
V.V. Kuznetsov, A.S. Shamirzaev and I.N. Ershov  

Two-Phase Flow Modeling  

A conservative scheme for the study of multi-dimensional two-phase flow  
J.R. Garcia-Cascales and H. Paillre  

Numerical analysis of two-phase flow in condensers and evaporators with special emphasis on single phase - two-phase transitions zones  
S. Morales, J. Rigola, C.D. Perez-Segarra and A. Oliva  

Simulation of two-phase flows using a multiple-size group model  
A. Kumbaro  

Two-dimensional two-fluid simulation of LBE-Argon two-phase flows for ADS target systems  
R. Chaudhary, A. Khanna, P. Satyamurthy and P. Munshi  

A method to fix the velocity and temperature fields in two-phase flow - A homogeneous model  

Simplified transient multiphase model for oil field development analysis  
V. Faluomi, M. Bonuccelli and A. Bousbia Salah  

Modelling annular flow at high gas velocities for well blowout analyses  
M. Bonuccelli, V. Faluomi, A. Ansiati, A. Bousbia Salah and P. Blotto
Assessment and uncertainty evaluation for the CATHARE 3-dimensional module
J. Dufreche and I. Dor I-367

Two-phase flow modeling in a solar concentrator with ammonia evaporation
N. Ortega, O. Garcia-Valladares and R. Best I-375

Fluid Particle Flow

Bases for dust mobilisation modelling in the light of STARDUST experiments
S. Paci, N. Forgione, F. Parozzi and M.T. Porfiri I-385

Numerical simulation of suspension flow in the entrance part of a tube
R. Shtinkova, E. Toshev and B. Hristov I-393

Experimental and numerical studies of pressure drop in particle-laden horizontal channel flow
S. Lan, M. Sommerfeld and J. Kussin I-401

Riser fluid dynamics simulation in a Spherizone reactor

An experimental investigation of effect of the velocity slip on modification of the grid-generated turbulence in a gas-solid particles flow
M. Hussainov, A. Kartushinsky, U. Rudi, I. Shcheglov and S. Tisler I-417

Experimental measurements of solid concentration distribution in mechanically stirred solid-liquid systems
E. Brunazzi, A. Paglianti and S. Pintus I-421

Role of CFD techniques in discriminating experimental solids concentration data in stirred suspensions and modelling of the solids concentration profiles in a pilot reactor
G. Montante, D. Fajner, F. Orlandini and F. Magelli I-427

Characterization of solid-liquid suspensions (real, large and non-spherical particles in non-Newtonian carrier fluid) flowing in horizontal and vertical pipes
A. Legrand, M. Renuy, E. Goudaliez, L. Fillaudeau, S. Bournaud, M. Berthou and J.C. Leuliet I-433

Numerical simulation for microconvection around brownian motion moving nano-particles

Eulerian-Lagrangian modeling of solid-liquid flow in turbulently stirred tanks
J. Derksen I-451

TpSimWin: An advanced simulation algorithm for gas-solid and gas-liquid conveying plants analysis
C. Saccani I-459
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction of particles with secondary flow in high Reynolds number horizontal pipe flow</td>
<td>1-465</td>
</tr>
<tr>
<td>J.M.C. Van 't Westende, R.J. Belt, L.M. Portela, R.F. Mudde and R.V.A. Oliemans</td>
<td></td>
</tr>
<tr>
<td>Interaction between transitional structures and particles in the near-field of a round, confined jet</td>
<td>1-473</td>
</tr>
<tr>
<td>F. Sbrizzai, R. Verzicco, M.F. Pidria, P. Faraldi and A. Soldati</td>
<td></td>
</tr>
<tr>
<td>Two-phase gas-particle flow structure and heat transfer in high speed flow over a blunt body</td>
<td>1-481</td>
</tr>
<tr>
<td>A. Volkov, Yu. Tsirkunov and B. Oesterle</td>
<td></td>
</tr>
<tr>
<td>3-D simulation of gas-solid two-phase flow in an operating pre-calciner</td>
<td>1-489</td>
</tr>
<tr>
<td>J.D. Lu, L. Huang, S.J. Wang, H.B. Ren and Z.H. Li</td>
<td></td>
</tr>
<tr>
<td>Particle-driven secondary flow in turbulent horizontal pipe flows</td>
<td>1-497</td>
</tr>
<tr>
<td>R.J. Belt, J.M.C. Van 't Westende, L.M. Portela, R.F. Mudde and R.V.A. Oliemans</td>
<td></td>
</tr>
<tr>
<td>Non maxwellian behavior in sedimentation</td>
<td>1-507</td>
</tr>
<tr>
<td>C. Bounhoure, Y. Brunet and A. Merlen</td>
<td></td>
</tr>
<tr>
<td>Direct simulation of rigid fibers in viscous fluid</td>
<td>1-511</td>
</tr>
<tr>
<td>A. Megally, P. Laure and T. Coupez</td>
<td></td>
</tr>
<tr>
<td>Modeling and simulation of three-dimensional two-phase flows using finite elements and global Lagrange multipliers</td>
<td>1-515</td>
</tr>
<tr>
<td>C. Diaz-Goano, P. Minev and K. Nandakumar</td>
<td></td>
</tr>
<tr>
<td>Large eddy simulation of dense gas-particle flow in a riser</td>
<td>1-523</td>
</tr>
<tr>
<td>P. Xiang and Y.C. Guo</td>
<td></td>
</tr>
<tr>
<td>Statistical models of particle dispersion and preferential concentration in turbulent flows</td>
<td>1-527</td>
</tr>
<tr>
<td>L.I. Zaichik and V.M. Alipchenkov</td>
<td></td>
</tr>
<tr>
<td>On numerical simulation of dilute particulate-gas flow over a backward facing step: Lagrangian versus Eulerian approach</td>
<td>1-535</td>
</tr>
<tr>
<td>Z.F. Tian, J.Y. Tu and G.H. Yeoh</td>
<td></td>
</tr>
<tr>
<td>An experimental study of air-solid flow characteristics near blunted body</td>
<td>1-543</td>
</tr>
<tr>
<td>A.Yu. Varaksin and T.F. Ivanov</td>
<td></td>
</tr>
<tr>
<td>Nonlinear oscillations of aerosol in a resonance tube</td>
<td>1-551</td>
</tr>
<tr>
<td>Experimental study on sand incipience process in wind-blown-sand flow by PTV</td>
<td>1-557</td>
</tr>
<tr>
<td>H.Y. Qi, B. Xi and C.F. You</td>
<td></td>
</tr>
<tr>
<td>Particle dynamics in a vortex pair</td>
<td>1-565</td>
</tr>
<tr>
<td>F. Kaplanski, S. Sazhin and Y. Rudi</td>
<td></td>
</tr>
<tr>
<td>Interaction between boundary layer flow and moving particle</td>
<td>1-571</td>
</tr>
<tr>
<td>A. Mori, Y. Kobayashi, K. Hirose and M. Fujie</td>
<td></td>
</tr>
</tbody>
</table>
Precipitation of very fine particles due to thermophoresis and electrophoresis in laminar tube flow
L. Reime and D. Mewes I-577

Experimental investigations of particle distributions in stirred solid/liquid systems
R. Angst and M. Kraume I-585

The structure-phenomenological study of two-phase liquid systems
E.Yu. Taran, Yu.V. Pridatchenko and V.A. Gryaznova I-591

Application of ECT for measuring gas-solid flow regime in circulating suspension bed
C.P. Wang, D.K. Li and Z.A. Lu I-599

Jets

Liquid jets expanding into a low-pressure environment - Experimental results
M.M. Vieira and J. R. Simões-Moreira I-607

Liquid jets expanding into a low-pressure environment - Numerical solution
E. Angelo and J.R. Simões-Moreira I-615

Numerical simulation of water-jet-cooling process by using VOF model including phase change and conjugated heat transfer
S.I. Shimasaki, P. Gardin, J.L. Borean and M. Lebouch I-621

Numerical simulation of particle-laden compound jet by vortex method
T. Uchiyama, A. Fukase and K. Minemura I-629

Numerical simulation of unsteady cavitating vortex flow in submerged water jet
G. Peng, S. Fujikawa and M. Hayakawa I-637

Studies of flow characteristics affected by two-phase jet flow in aeration tank
K. Ode, K. Yoshida and I. Kataoka I-645

Modelling and computation of heat exchanges in the configuration of an impinging jet on a hot plate
N. Seiler, P. Gardin, O. Simonin and S. Mimouni I-653

Measurement Techniques

Liquid re-circulation beneath a ventilated cavity in a vertical pipe
A.A. Sotiriadis, R.B. Thorpe, N.F. Kirkby and N. Rockliff II-661

Validation of the granular temperature prediction of the kinetic theory of granular flow by particle image velocimetry and a discrete particle model
N.G. Deen, W. Dijkstraizen, G.A. Bokkers, M. van Sint Annaland and J.A.M. Kuipers II-669