

# 3rd International Symposium on Two-Phase Flow Modelling and Experimentation

Pisa, 22-24 September 2004

## DETAILED PROGRAM

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### Wednesday 22, 9:45-10:00 - Plenary Room - Welcome Addresses

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### Wednesday 22, 10:00-10:40 - Plenary Room - Keynote Lecture 1

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Drag and lift coefficients of single bubbles

*A. Tomiyama*

University of Kobe, Japan

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### Wednesday 22, 10:40-11:10 - Coffee Break

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### Wednesday 22, 11:10-12:50 - Room 1 – Session: Bubbly Flow

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Numerical evaluation of two-fluid model solutions for turbulent fully-developed bubbly two-phase flows

*O.E. Azpitarte and G.C. Buscaglia*

Centro Atomico Bariloche and Instituto Balseiro, Bariloche, Argentina

Data analysis for hot-film anemometry in turbulent bubbly flow

*S. Luther\*, J. Rensen\*, J.M. Burgers\*\* and D. Lohse\**

\*Department of Applied Physics, \*\*Center for Fluid Dynamics, University of Twente, Enschede, The Netherlands

Models for the forces acting on bubbles in comparison with experimental data for vertical pipe flow

*D. Lucas, E. Krepper, H.-M. Prasser and J.M. Shi*

Forschungszentrum Rossendorf e.V., P.O.Box 510 119, Dresden, Germany

Numerical simulations of a bubbly flow in a sudden-expansion with the Neptune code

*C. Morel\*, J. Pouvreau\*, J. Laviéville\*\* and M. Boucker\*\**

\*CEA Grenoble, DEN/DTP/SMTH/LMDS, Grenoble, France, \*\*EDF - R&D, Chatou, France

Flow characteristics around and drag of obstacle in vertical upward gas-liquid bubbly pipe flow

*T. Shakouchi, T. Nakamura, A. Voutinas, J. Kawaguchi and K. Tsujimoto*

Mie University, Mie, Japan

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### Wednesday 22, 11:10-12:50 - Room 2 – Session: Micro- And Minichannels

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Non-stationary analysis of flow boiling in minichannel

*D. Brutin and L. Tadrist*

Ecole Polytechnique Universitaire de Marseille - Laboratoire I.U.S.T.I., Technopôle de Château-Gombert, 5, rue Enrico Fermi, Marseille, France

Numerical calculation of critical mass flow rate in adiabatic capillary tubes

*D. Fuentes\*, \*\*, J.M. Corberán\* and A. Pérez-Navarro\**

\*Applied Thermodynamics Department, Universidad Politécnica de Valencia; Valencia, Spain,

\*\*Mechanical Engineering School, Universidad Industrial de Santander; Bucaramanga, Colombia

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*

Dept. of Mechanical Engineering, Faculty of Engineering Kagoshima University, Kagoshima, Japan

Flow boiling incipience in minichannels

*M. Piasecka and M.E. Poniewski*

Kielce University of Technology, Kielce, Poland

Flow boiling heat transfer in a vertical narrow channel

*J. Shuai, R. Kulenovic, E. Sobierska, R. Mertz and M. Groll*

IKE, Stuttgart, Germany

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### Wednesday 22, 11:10-12:50 - Room 3 – Session: Two-Phase Flow Modeling

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A conservative scheme for the study of multi-dimensional two-fluid flow

*J.R. García-Cascales\* and H. Paillère\*\**

\*Universidad Politécnica de Cartagena, Spain, \*\*CEA Saclay, Nuclear Energy Division, Fluid Modelling and Simulation, Gif-sur-Yvette, France

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. Pérez-Segarra and A. Oliva*

Centre Tecnològic de Transferència de Calor CTTC, Universitat Politècnica de Catalunya, Spain

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

*A. Kumbaro*

CEA Saclay, Gif-sur-Yvette, France

Two-dimensional two-fluid simulation of LBE-Argon two-phase flows for ADS target systems

*R. Chaudhary\*, A. Khanna\*\*, P. Satyamurthy\* and P. Munshi\*\**

\*Laser and Plasma Technology Division, Bhabha Atomic Research Centre, Mumbai, India,

\*\*Indian Institute of Technology Kanpur, India

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

*P.K. Sarma\*, V. Srinivas\*\*, V. Dharmarao\*\*\*, T. Subrahmanyam\*\*\*, P. Sivannarayana\* and H. Liu\*\*\*\**

\*Regency Institute of Technology, Yanam, India, \*\*College of Engineering, GITAM,

Visakhapatnam, India, \*\*\*College of Engineering, Andhra University, Visakhapatnam, India,

\*\*\*\*Department of mechanical Engineering, University of Miami, Miami, USA

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**Wednesday 22, 11:10-12:50 - Room 4 – Session: Fluid Particle Flow**

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Bases for dust mobilisation modelling in the light of stardust experiments

*S. Paci\**, *N. Forgiione\**, *F. Parozzi\*\** and *M.T. Porfiri\*\*\**

\*Dip. di Ingegneria Meccanica, Nucleare e della Produzione, Pisa, Italy, \*\*CESI, Milano, Italy, \*\*\*ENEA FUS, Frascati, Italy

Numerical simulation of suspension flow in the entrance part of a tube

*R. Shtinkova*, *E. Toshev* and *B. Hristov*

Institute of Mechanics, Dept. of Complex and Multiphase Flows, Sofia, Bulgaria

Experimental and numerical studies of pressure drop in particle-laden horizontal channel flow

*S. Lain\**, *M. Sommerfeld\*\** and *J. Kussin\*\**

\*Universidad Autónoma de Occidente (UAO), Colombia, \*\*Institute für Verfahrenstechnik, FB IW, Martin Luther University, Germany

Riser fluid dynamics simulation in a spherizone reactor

*G. Amati\**, *E. Balestra\*\**, *A. Bianchini\**, *G. Penzo\*\**, *R. Rinaldi\*\**, and *C. Sacconi\**

\*Università degli Studi di Bologna, Italy, \*\*Basell Polyolefins, Centro Ricerche Giulio Natta, Ferrara, Italy

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*

Estonian Energy Research Institute at Tallinn Technical University, Tallin, Estonia

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**Wednesday 22, 11:10-12:50 - Room 5 – Session: Measurement Techniques**

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Liquid re-circulation beneath a ventilated cavity in a vertical pipe

*A.A. Sotiriadis*, *R.B. Thorpe*, *N.F. Kirkby* and *N. Rockliff*

University of Surrey, Fluids Research Centre, School of Engineering, Surrey, UK

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. Dijkhuizen*, *G.A. Bokkers*, *M. van Sint Annaland* and *J.A.M. Kuipers*

Univ. of Twente, Twente, The Netherlands

Leak detection in pipelines operating with gas-liquid mixtures

*I.B. Macias*, *C.F. Braga*, *S.L. Cruz* and *J.F.R. Pereira*

Department of Chemical Systems Engineering, FEQ / UNICAMP, Campinas, Brazil

The lift force on bubbles in a swarm: Experimental analysis using LDA

*A.A. Kulkarni\*\**, and *J.B. Joshi\**

\*Institute of Chemical Technology, University of Mumbai, Mumbai, India, \*\*Max-Planck-Institute for Dynamics of Complex Technical Systems, Magdeburg, Germany

Estimation of fiber orientation distribution in accelerating channel flow

*H. Eloranta*, *P. Saarenrinne* and *T. Pärssinen*

Tampere University of Technology, Energy and Process Engineering, P.O.Box 589, Tampere, Finland

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**Wednesday 22, 11:10-12:50 - Room 6 – Session: Bubbles**

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Behavior of bubble departure in the direct-contact boiling field with a continuous liquid-liquid interface

*K. Kadoguchi*

Institute for Energy Utilization, Tsukuba, Japan

Transient effect of bubble contamination on the drag coefficient and on the gas-liquid mass transfer: An experimental study

*S.P. Orvalho*, *J.M.T. Vasconcelos* and *S. Alves*

Centro de Eng. Biológica e Química, Dept. of Chemical Engineering, Lisbon, Portugal

Bubble formation: High speed images and acoustic signals

*R. Bunganic*, *M.C. Ruzicka* and *J. Drahos*

Inst. Chem. Proc. Fundam AS CR, Prague, Czech Republic

Characteristics of microbubble drag reduction on a 50 m-long flat plate

*Y. Kodama*, *T. Takahashi*, *T. Hori*, *M. Makino*, and *T. Ueda*

Center for Smart Control of Turbulence, National Maritime Research Institute, Tokyo, Japan

Optical measurements of velocity gradient in the near-wall region of microbubble-laden turbulent channel flow

*Y. Saitoh* and *K. Hishida*

Department of System Design Engineering, Keio University, Yokohama, Japan

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**Wednesday 22, 11:10-12:50 - Room 7 – Session: Phase Distribution And Separation**

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Dispersion in bubble columns with and without mass transfer

*D. Wiemann* and *D. Mewes*

Institut of Process Engineering, Hannover, Germany

Two-phase flow behavior inside a header connected to multiple parallel channels

*J.K. Lee* and *S.Y. Lee*

Department of Mechanical Engineering, Korea Advanced Institute of Science and Technology, Science Town, Daejeon, Korea

The approach to stratification of a dispersed liquid-liquid flow at a sudden expansion

*L. Yang*, *B.J. Azzopardi*, *G. Baker*, *A. Belghazi* and *D. Giddings*

Multiphase Flow Research Group, School of Chemical, Environmental and Mining Engineering, University of Nottingham, University Park, Nottingham NG7 2RD, U.K.

Uniform distribution conditions of two-phase flow in horizontal header to vertical branch pipes with horizontal entrance connections

*S. Horiki* and *M. Osakabe*

Tokyo University of Marine Science & Technology, Tokyo, Japan

The research on the steam-water separator with corrugated plates

*X.M. Wang*, *S.Y. Huang* and *J. Li*

College of Power Engineering, HuaZhong University of Science and Technology, Wuhan, China

**Wednesday 22, 12:50-14:00 - Lunch**

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**Wednesday 22, 14:00-14:40 - Plenary Room - Keynote Lecture 2**

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Drag reduction with microbubble injection

*Y. Hassan*

Texas A&M University, USA

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**Wednesday 22, 14:45-16:05 - Room 1 – Session: Bubbly Flow**

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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*

Department of System Design Engineering, Keio University, Yokohama, Japan

The clustering phenomena near the wall in a turbulent bubbly channel flow

*T. Ogasawara\*, Y. Tagawa\*, A. Fujiwara\*\*, S. Takagi\* and Y. Matsumoto\**

\*Dept. of Mechanical Engineering, The University of Tokyo, Tokyo, Japan, \*\*Intelligent Moderating Laboratory, The University of Tokyo, Tokyo, Japan

Bubble breakup by pressure wave in bubbly flow

*A. Fujiwara, K. Watanabe, S. Takagi and Y. Matsumoto*

Dept. of Mechanical Engineering, The University of Tokyo, Tokyo, Japan

Numerical analysis for bubbly flows through a convergent-divergent nozzle

*K. Okita, S. Takagi and Y. Matsumoto*

Intelligent Modeling Laboratory, The University of Tokyo, Tokyo, Japan

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**Wednesday 22, 14:45-16:05 - Room 2 – Session: Micro- And Minichannels**

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High heat flux cooling by forced convective boiling in narrow channels

*Y. Shinmoto\*, T. Ohno\*, H. Ohta\*, O. Ogawa\*\* and H. Shida\*\**

\*Department of Aeronautics and Astronautics, Kyushu University, Fukuoka, Japan, \*\*Energy Conservation Technology Development Department, NEDO, Kanagawa, Japan

Experimental study of convective patterns for volatile wetting films

*C. Buffone and K. Sefiane*

School of Engineering and Electronics, University of Edinburgh, UK

Numerical study of heating effect on thermocapillary convection for an evaporating meniscus

*C. Buffone\*, K. Sefiane\*, R. Bannace\*\* and M. El Ganaoui\*\*\**

\*School of Engineering and Electronics, University of Edinburgh, UK, \*\*LEEVAM-LMSC, Université de Gergy Pontoise, France, \*\*\*SPCTS, UMR CNRS, Université de Limoges, Limoges, France

The effect of operating temperature and working fluid on the heat transport capacity of an inclined triangular micro heat pipe

*D. Sugumar\*, T.K. Kiong\*\* and E.K. Chong\**

\*National Technical University College of Malaysia, Malacca, Malaysia, \*\*Multimedia University, Malacca, Malaysia

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**Wednesday 22, 14:45-16:05 - Room 3 – Session: Two-Phase Flow Modeling**

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Simplified transient multiphase model for oil field development analysis

*V. Faluomi\*, M. Bonuccelli\* and A. Bousbia\*\**

\*TEA Group, Pisa, Italy, \*\*University of Pisa, Pisa, Italy

Modelling annular flow at high gas velocities for well blowout analyses

*M. Bonuccelli\*, V. Faluomi\*, A. Ansiati\*, A. Bousbia Salah and P. Blotto*

\*TEA Group, Pisa, Italy, \*\*DIMNP, University of Pisa, Pisa, Italy, \*\*\*ENI-E&P, HSE Department, san Donato Milanese, Italy

Assessment and uncertainty evaluation for the CATHARE 3-dimensional module

*J. Dufrêche and I. Dor*

CEA-Grenoble, DEN/DER/SSTH, GRENOBLE, France

Two-phase flow modeling in a solar concentrator with ammonia evaporation

*N. Ortega, O. García-Valladares and R. Best*

Centro de Investigación en Energía de la UNAM, Temixco, Morelos, México

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**Wednesday 22, 14:45-16:05 - Room 4 – Session: Fluid Particle Flow**

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Experimental measurements of solid concentration distribution in mechanically stirred solid-liquid systems

*E. Brunazzi, A. Paglianti and S. Pintus*

Laboratory of Process Equipment, Department of Chemical Engineering, Industrial Chemistry and Materials Science, University of Pisa, Pisa, Italy

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*

Dipartimento di Ingegneria Chimica, Mineraria e delle Tecnologie Ambientali, Università di Bologna, Bologna, Italy

Characterization of solid-liquid suspensions (real, large and non-spherical particles in non-Newtonian carrier fluids) flowing in horizontal and vertical pipes

*A. Legend\*, M. Renuy\*, E. Goudaliez\*, L. Fillaudeau\*, S. Bournaud\*\*, M. Berthou\*\* and J.C. Leuliet\**

\*INRA, Villeneuve D'Ascq, France, \*\*LGPTA, Villeneuve D'Ascq, France

Numerical simulation for microconvection around brownian motion moving nano-particles

*B.X. Wang\*, H. Li\*, X.F. Peng\* and G.P. Peterson\*\**

\*Department of Thermal Engineering, Tsinghua University, Beijing, China, \*\*Rensselaer Polytechnic Institute, Department of Mechanical Engineering, Troy, U.S.A.

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**Wednesday 22, 14:45-16:05 - Room 5 – Session: Measurement Techniques**

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Bubble shape and orientation determination with a four-point optical fibre probe  
*S. Guet\**, *S. Luther\*\** and *G. Ooms\**

\*Laboratory for Aero and Hydrodynamics and Center for Fluid Dynamics, Delft University of Technology, Delft, The Netherlands, \*\*Department of Applied Physics and Center for Fluid Dynamics, Delft University of Technology, Delft, The Netherlands

On the accuracy of wire mesh tomography for gas-liquid flow measurement  
*W. Wangjiraniran\**, *M. Justus\**, *H. Kikura\**, *M. Aritomi\** and *T. Yamauchi\*\**

\*Research Laboratory for Nuclear Reactor, Tokyo Institute of Technology, Tokyo, Japan, \*\*The Japan Atomic Power Company, Tokyo, Japan

The effect of the structural evolution of snow on heat transfer  
*Th. U. Kaempfer*, *S.A. Sokratov* and *M. Scheebeli*  
WSL, Davos, Switzerland

Online measurements of droplet characteristics in a flowing crude oil/water system using an endoscope and a CCD-NIR camera  
*H. Aakre*, *T. Solbakken* and *R.B. Schüller*

\*R&D Centre, Norsk Hydro ASA, Porsgrunn, Norway, \*\*Advisor Multiphase Flow, Norsk Hydro ASA, Bergen, Norway, \*\*\*Agricultural University Norway

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**Wednesday 22, 14:45-16:05 - Room 6 – Session: Bubbles**

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Bubble behavior and coalescence condition of two bubbles rising side by side  
*T. Sanada*, *M. Watanabe*, *H. Noda* and *T. Fukano*

Department of Mechanical Engineering Science, Graduate School of Engineering, Kyushu University, Fukuoka, Japan

Bouncing and coalescence of a single bubble approaching to free surface  
*T. Sanada*, *M. Watanabe* and *T. Fukano*

Department of Mechanical Engineering Science, Graduate School of Engineering, Kyushu University, Fukuoka, Japan

Experimental study of the onset of the 3D oscillatory thermocapillary convection around a single air or vapor bubble. Influence on heat transfer

*C. Reynard*, *M. Barthès*, *R. Santini* and *L. Tadrist*

Ecole Polytechnique Universitaire de Marseille - Laboratoire IUSTI - CNRS, Université de Provence, Marseille, France

Effect of bubble size on a bubble plume and bubbly flow in a bubble column

*M. Maekawa\**, *A. Tomiyama\*\**, *M. Kageyama\*\*\**, *S. Yoshida\*\**, *A. Sou\*\** and *I. Zun\*\*\*\**

\*Chiyoda Advanced Solutions Corporation, Yokohama, Japan, \*\*Faculty of Engineering, Kobe University, Kobe, Japan, \*\*\*Advanced Technology Research Lab, Nippon Steel Co., Chiba, Japan, \*\*\*\*Faculty of Mechanical Engineering, University of Ljubljana, Ljubljana, Slovenia

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**Wednesday 22, 14:45-16:05 - Room 7 – Session: Phase Distribution And Separation**

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Improvement of the formulation of the dispersed phase boundary conditions for a rough wall needed in two-fluid models

*M. Khalij\**, *B. Arcen\** and *A. Tanière\*\**

\*ESSTIN, Nancy, France, \*\*LEMETA, Nancy, France

Rotating filtration with Taylor-Couette vortex flow for particle-liquid separation

*H. Kawai\**, *H. Takahashi\** and *A. Suzuki\*\**

\*Muroran Institute of Technology, Muroran, Japan, \*\* Faculty of Fisheries, Hokkaido University, Hakodate, Japan

Natural and charged clusters in external and internal gasdynamic flows of flying vehicles

*A.S. Artyukhin\**, *B.V. Egorov\*\**, *Yu.E. Markachev\*\**, *E.A. Plekhanov\*\*\**, *I.S. Ufimtsev\** and *A.Yu. Khlopkov\**

\*Moscow Physical and Engineering Institute MIPT), Zhukovsky, Russia, \*\*Central Aerohydrodynamic Institute (TsAGI), Zhukovsky, Russia, \*\*\*University of Salerno, Baronissi, Italy

Numerical simulation of the liquid-sand separation with downhole hydrocyclone

*Z.M. Li\**, *B.F. Li\**, *Z.H. Zhang\*\** and *L.C. Fu\*\**

\*College of Petroleum Engineering, University of Petroleum, Dongying, China, \*\*Shengli Oil Field, Dongying, China)

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**Wednesday 22, 16:05-16:35 - Coffee Break**

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**Wednesday 22, 16:35-18:35- Room 1 – Session: Bubbly Flow**

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Using geometrical automata to develop constitutive laws in bubbly flows

*V. Herrero\**, *G. Venerè\*\** and *A. Clausse\*\**

\*Ejército argentino - CNEA, Buenos Aires, Argentina, \*\*CNEA-CONICET, Universidad Nacional del Centro, Tandil, Argentina

Modeling and simulation of full-scale bubbly flows around surface ships

*F.J. Moraga*, *D.A. Drew* and *R.T. Lahey*

Center for Multiphase Research. Rensselaer Polytechnic Institute. Troy, New York 12180-3590. USA.

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\*\**

\*Marine Technical College, Hyogo, Japan, \*\*Osaka University, Osaka, Japan,

Numerical simulation of turbulent bubbly flows

*D. Kuzmin* and *S. Turek*

University of Dortmund, LS III, Institute of Applied Mathematics, Dortmund, Germany

Turbulent bubbly flow in pipes  
*A.V. Gorin, A. Vakhguel't and S. Al-Zubaidy*  
School of Engineering and Science, Curtin University of Technology, Curtin Sarawak, CDT 250,  
Miri, Sarawak, Malaysia

Hydrodynamic structure of two-phase bubbly flow in a horizontal channel  
*O.N. Kashinsky, E.V. Kaipova and A.V. Chinak*  
Institute of Thermophysics SB RAS, Novosibirsk, Russia

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**Wednesday 22, 16:35-18:35- Room 2 – Session: Micro- And Minichannels**

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Experimental research on flow patterns in two-phase flow in microchannels  
*J.K. Keska*  
Fluid Power and Mechanical Systems, University of Louisiana, Lafayette, USA

Liquid velocity field measurements in two-phase microchannel convection  
*E.N. Wang, S. Devasenathipathy, C.H. Hidrovo, D.W. Fogg, J.M. Koo, J.G. Santiago, K.E. Goodson and T.W. Kenny*  
Mechanical Engineering, Stanford University, USA

Fluorescent imaging of void fraction in two-phase microchannels  
*D. Fogg, R. Flynn, C. Hidrovo, L. Zhang and K. Goodson*  
Department of Mechanical Engineering, Stanford University, Stanford, USA

Experimental analysis of the flow through a micro-orifice  
*J.J. Shin, C.H. Lee, S.G. Kim and S.K. Oh*  
DA R&D Center, Samsung Electronics, Suwon, Korea

Flow boiling heat transfer and regimes of upward flow in minichannels  
*V.V. Kuznetsov, A.S. Shamirzaev and I.N. Ershov*  
Institute of Thermophysics SB RAS, Novosibirsk, Russia

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**Wednesday 22, 16:35-18:35- Room 3 – Session: Particle Motion And Dynamics**

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On the interactions between coherent structures and particles in turbulent boundary layer  
*M. Picciotto\*, C. Marchioli\*, M.W. Reeks\*\* and A. Soldati\**  
\*Centro Interdipartimentale di Fluidodinamica e Idraulica and Dipartimento di Energetica e Macchine, Università di Udine, Udine, Italy, \*\*School of Mechanical and System Engineering, University of Newcastle upon Tyne, Newcastle upon Tyne, UK

Particle dynamics simulation - Modeling and application to multiphase flow in a cavity  
*K. Nagayama and K. Tanaka*  
Dept. of Mech. Systems Eng., Kyushu Institute of Technology, Iizuka, Japan

Forces between two spheres at low Reynolds numbers  
*S. Vargas and W.J. Easson*  
School of Engineering and Electronics, The University of Edinburgh, The King's Buildings, Edinburgh, Scotland, UK

Measurement of particle velocity in a free stream by means of a modulated laser beam  
*P. Mirek, J. Pisarek and W. Nowak*  
Czestochowa Technical University, Czestochowa, Poland

Separation of particles by chaotic advection  
*R. Chevray\* and A. Omurtag\*\**  
\*Department of Mechanical Engineering, Columbia University, New York, USA, \*\*Bloomberg L.P., New York, USA

Calculation of inclusion concentration in a spherical rotating volume of self-gravitating fluid  
*A.N. Osipov\*, A.B. Belonoshko\*\*, R. Ahuja\*\*\* and B. Johansson\*\**  
\*Lomonosov Moscow State University, Moscow, Russia, \*\*Royal Institute of Technology, Stockholm, Sweden, \*\*\*Uppsala University, Uppsala, Sweden

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**Wednesday 22, 16:35-18:35- Room 4 – Session: Fluid Particle Flow**

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Eulerian-Lagrangian modeling of solid-liquid flow in turbulently stirred tanks  
*J. Derksen*  
Kramers Laboratorium, Delft University of technology, Delft, The Netherlands

TpSimWin: An advanced simulation algorithm for gas-solid and gas-liquid conveying plants analysis  
*C. Sacconi*  
Università degli Studi di Bologna, Bologna, Italy

Interaction of particles with secondary flow in high Reynolds number horizontal pipe flow  
*J.M.C. Van 't Westende, R.J. Belt, L.M. Portela, R.F. Mudde and R.V.A. Oliemans*  
Delft Univ. of Technology, Delft, The Netherlands

Interaction between transitional structures and particles in the near-field of a round, confined jet  
*F. Sbrizzai\*, R. Verzicco\*\*, M.F. Pidria\*\*\*, P. Faraldi\*\*\* and A. Soldati\**  
\*Centro interdipartimentale di Fluidodinamica e idraulica, and Dipartimento di Energetica e Macchine, Università di Udine, Udine, Italy, \*\*Dipartimento di Ingegneria Meccanica e Gestionale, Politecnico di Bari, Bari, Italy, \*\*\*Centro Ricerche FIAT, Torino, Italy

Two-phase gas-particle flow structure and heat transfer in high speed flow over a blunt body  
*A. Volkov\*, Yu. Tsirkunov\* and B. Oesterle\*\**  
\*Baltic State University, St. Petersburg, Russia, \*\*ESSTIN, Henri Poincaré University, Nancy, France

3-D simulation of gas-solid two-phase flow in an operating pre-calciner  
*J.D. Lu, L. Huang, S.J. Wang H.B. Ren and Z.H. Li*  
State Key Laboratory of Coal Combustion, Huazhong University of Science and Technology, Wuhan, China

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**Wednesday 22, 16:35-18:35- Room 5 – Session: Measurement Techniques**

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Analyzing the surface velocity field of multiphase film flow  
*I. Ausner, A. Hoffmann, J.U. Repke and G. Wozny*  
TU Berlin, Institute for Process and Plant Technology, Berlin, Germany

Void fraction measurement for gas-liquid two phase flow of magnetic fluid  
*T. Kuwahara and H. Yamaguchi*  
Department of Mechanical Engineering, Doshisha University, Kyoto, Japan

Study of hydrodynamics and mixing in an airlift reactor with an enlarged separator using magnetic tracer method  
*J. Klein, A.A. Vicente and J.A. Teixeira*  
Univ. Minho, Braga, Portugal

Estimation of two-phase flow quality with pressure difference oscillation  
*M. Osakabe and S. Horiki*  
Tokyo University of Marine Science & Technology, Tokyo, Japan

Use of fibre optical probes for on-line monitoring of multi-phase flow in a novel oscillatory meso-reactor  
*N. Reis, A.A. Vicente, J.A. Teixeira and M.R. Mackley*  
Univ. Minho, Braga, Portugal

On-line measurement of dust concentration in the exhaust dust by laser scattering integration method  
*S.M. Wang, Y.Z. Wu, M. Ye and Y.J. Zhao*  
The Key Laboratory of Clean Coal Power Generation and Combustion Technology Ministry of Education, Southeast University, Nanjing, China

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### Wednesday 22, 16:35-18:35- Room 6 – Session: Bubbles

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Considering bubble size distributions in CFD simulations using a moment method  
*R. Jeschke, O. Gnotke and R. Loth*  
EuR, TU-Darmstadt, Germany

Simultaneous convective heat and mass transfer during gas bubble dissolution in an alternating electric field  
*T. Elperin\*, A. Fominykh\* and Z. Orenbakh\*\**  
\*Dept of Mechanical Engineering, Ben-Gurion University of the Negev, Israel, \*\*Negev Academic College of Engineering, Beer Sheva 84100, Israel

Effects of an applied magnetic field on the bubble growth and departure in a magnetic liquid  
*F.D. Stoian\*\*\*, G. Pop\*\*\*, D. Bica\*\*\*\*, V. StoicaIa\*\*\*, O. Marinic\*\*,\*\*, and L. Vekás\*\*\*\**  
\*Department of Thermal Machines & Transport, \*\*Institute for Complex Fluids and \*\*\*National Center for Engineering of Systems with Complex Fluids, Politehnica University of Timisoara, Timisoara, Romania, \*\*\*\*Laboratory of Magnetic Liquids, Center of Fundamental and Advanced Technical Researches, Romanian Academy - Timisoara Branch, Timisoara, Romania

Bubble nucleation in ducts (numerical simulation)  
*E.Yu. Kumzerova and A.A. Schmidt*  
Computational Physics Laboratory, Ioffe Institute of RAS, St. Petersburg, Russia

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### Wednesday 22, 16:35-18:35- Room 7 – Session: Phase Distribution And Separation

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Two-phase phase distribution effect on drift-flux parameters in a vertical large diameter pipe  
*X. Shen\*, K. Mishima\* and H. Nakamura\*\**  
\*Research Reactor Institute, Kyoto University, Osaka, Japan, \*\*Tokai Establishment, Japan Atomic Energy Research Institute, Ibaraki, Japan

Gas-liquid phase distribution and void fraction measurements using the MRI  
*N. Daidzic*  
NCMR, NASA-GRC, 21000 Brookpark Road, MS 110-3, Cleveland, USA

An application of hele-shaw kind flow in the devices for separation of multiphase mixtures  
*S.M. Drozdov*  
Central Aerohydrodynamic Institute (TsAGI), Zhukovsky

Prediction of phase distribution in laminar bubbly flow by eulerian/lagrangian method  
*T. Wen, D. Che and G. Xi*  
School of Energy Power Engineering, Xi'an Jiaotong University, Xi'an, China

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### Tuesday 23, 8:30-9:10 - Plenary Room - Keynote Lecture 3

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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\*\**  
\*University of Milan, \*\*University of Modena, Italy

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### Tuesday 23, 9:15-10:55 - Room 1 – Session: Boiling Heat Transfer

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A 2D ill-posed problem in predicting boiling heat transfer coefficient  
*T. Orzechowski*  
Kielce University of Technology, Kielce, Poland

Characterization of nucleate pool boiling in aqueous surfactant solutions on a cylindrical heater  
*J.T. Zhang and R.M. Manglik*  
Thermal-Fluids & Thermal Processing Laboratory, Department of Mechanical, Industrial and Nuclear Engineering, University of Cincinnati, Cincinnati, Ohio, USA

Heater size and heater aspect ratio effects on subcooled pool boiling heat transfer in low-g  
*C.D. Henry\*, J. Kim\*, B. Chamberlain\* and T.G. Hartman\*\**  
\*University of Maryland, Department of Mechanical Engineering, College Park, USA, \*\*Rutgers University, Food Science Department, New Brunswick, USA

Simulation of subcooled nucleate boiling in a vertical annulus with coupling of bubble-tracking and two-fluid models  
*I. Kljenak, B. Koncar and B. Mavko*  
Reactor Engineering Division, Joze Stefan Institute, Ljubljana, Slovenia

Boiling of hydrocarbons on a PTFE coated surface  
*S. Bhaumik, L. Prasad, V.K. Agarwal and S.C. Gupta*  
Department of Chemical Engineering, Indian Institute of Technology Roorkee, Roorkee, India

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**Tuesday 23, 9:15-10:55 - Room 2 – Session: Liquid-Liquid Systems**

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Two-phase liquid-liquid flows in pipes of small diameters  
*A. Wegmann and P. von Rohr*  
ETH, Zürich, Switzerland

The CFD modelling of the turbulent liquid-liquid flow in a Kenics mixer  
*Z. Jaworski and P. Pianko-Oprych*  
Szczecin Technical University, Szczecin, Poland

Theoretical prediction with PBE of phase inversion in dispersed two-phase liquid systems  
*B. Hu\*, K.K. Ioannou\*, O.K. Matar\*\*, G.F. Hewitt\*\* and P. Angeli\**  
\*Department of Chemical Engineering, University College London, UK, \*\*Department of Chemical Engineering, Chemical Technology, Imperial College London, UK

Investigation of phase inversion in concentrated emulsions using laser-induced fluorescence  
*L. Liu, O.K. Matar, E.S. Perez de Ortiz and G.F. Hewitt*  
Department of Chemical Engineering, Chemical Technology, Imperial College London, UK

Distribution and properties of liquid drops in viscous liquid-liquid contacting processes  
*C.G. Lee\*, S.M. Son\*, H.T. Kim\*, Y. Kang\* and S.D. Kim\*\**  
\*Chungnam National University, Daejeon, Korea, \*\*KAIST, Daejeon, Korea

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**Tuesday 23, 9:15-10:55 – Room 3 – Session: Condensation**

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Numerical solution of transonic flow of condensing steam  
*J. Fort and J. Halama*  
CTU Prague, Prague, Czech Republic

Modeling of condensation-induced water hammer  
*J. Gale, I. Tiselj and I. Parzer*  
Reactor Engineering Division, Joze Stefan Institute, Jamova 39, Ljubljana, Slovenia

Steam condensation on finned tubes, in presence of non-condensable gases and aerosols: Influence of impaction, diffusiophoresis and settling on aerosol deposition  
*J.L. Muñoz-Cobo\*\*\*\*, J. Peña\*\*, L.E. Herranz\*\*\* and A. Pérez-Navarro\*\*\*\**  
\*Polytechnic University of Valencia, Department of Chemical and Nuclear Engineering, \*\*Department of applied Mathematics, Universidad Politécnica, \*\*\*CIEMAT, Department of Nuclear Fission, Madrid. \*\*\*\*Instituto de Ingeniería Energética, Universidad Politécnica, Spain

The effect of turbulence on spontaneously condensing wet-steam flow  
*A.R. Avetissian\*, G.A. Philippov\* and L.I. Zaichik\*\**  
\*Nuclear Power Engineering Reserch & Development Institute, \*\*Institute for High Temperatures of Russian Academy of Sciences, Russia

Numerical modeling of supersaturated vapor condensation: On the possibility of the experimental determination of the nucleation rate  
*N.M. Kortsenshteyn and E.V. Samuilov*  
Krzhozhanovsky Power Engineering Institute, Moscow, Russia

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**Tuesday 23, 9:15-10:55 - Room 4 – Session: Fluid Particle Flow**

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Particle-driven secondary flow in turbulent horizontal pipe flows  
*R.J. Belt, J.M.C. Van 't Westende, L.M. Portela, R.F. Mudde and R.V.A. Oliemans*  
Delft Univ. of Technology, Kramers Lab. voor Fysische Technology

Non maxwellian behavior in sedimentation  
*C. Bounhoure, Y. Brunet and A. Merlen*  
Bat M3, Mécanique, Université de Lille1, Villeneuve d'ascq, France

Direct simulation of rigid fibers in viscous fluid  
*A. Megally\*, P. Laure\*\* and T. Coupez\**  
\*Centre de Mise Forme des Matériaux, Ecole Nationale Supérieure des Mines de Paris-UMR, Sophia Antipolis, France, \*\*Institut Non-Linéaire de Nice, UMR 6618 CNRS-Université de Nice Sophia Antipolis, France

Modeling and simulation of three-dimensional two-phase flows using finite elements and global Lagrange multipliers  
*C. Diaz-Goano\*, P. Minev\*\* and K. Nandakumar\**  
\*Dept. of Chemical and Materials Engineering, \*\*Dept. of Mathematical and Statistical Sciences, University of Alberta, Edmonton, Alberta, Canada

Large eddy simulation of dense gas-particle flow in a riser  
*P. Xiang and Y.C. Guo*  
Department of Engineering Mechanics, Tsinghua University, Beijing, China

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**Tuesday 23, 9:15-10:55 - Room 5– Session: Measurement Techniques**

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Simultaneous measurements of the local solid phase velocity and the local solid hold-up in a three-phase flow by an X-ray based method  
*U. Kertzscher\*, A. Seeger\*, K. Affeld\* and E. Wellnhofer\*\**  
\*Biofluidmechanics Laboratory, Charité, Berlin, Germany, \*\*German Heart Institute Berlin, Berlin, Germany

Application of ultrasonic Doppler method for bubbly flow measurement using two ultrasonic frequencies  
*H. Murakawa, H. Kikura and M. Aritomi*  
Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology, Tokyo, Japan

Local two-phase flow measurements with advanced data processing methods in bubbly plumes  
*R. Zboray, M. Simiano and F. de Cachard*  
Paul Scherrer Institute, Villigen, Switzerland

Measurement of bubble velocity profiles and turbulent diffusion coefficients of the gaseous phase in rectangular bubble column using image processing  
*A. Zaruba, E. Krepper, H.M. Prasser and E. Schleicher*  
Forschungszentrum Rossendorf e.V., Institut für Sicherheitsforschung, Dresden, Germany

Measurements of velocity, turbulence and phase fractions in horizontal oil-water pipe flow  
*G. Elseth\*, H. Kvandal\* and M.C. Melaaen\*\**  
\*Norsk Hydro Oil & Energy, \*\*Telemark University College, Norway

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**Tuesday 23, 9:15-10:55 - Room 6 – Session: Drop Motion And Dynamic**

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Transient heating of droplets  
*S.S. Sazhin\*, P.A. Krutitskii\*\*, W.A. Abdelghaffar\*, E.M. Sazhina\* and M.R. Heikal\**  
\*School of Engineering, Faculty of Science and Engineering, University of Brighton, Cockcroft Building, Brighton, UK, \*\*Faculty of Physics, Moscow State University, Vorobyovy gory, Moscow, Russia

The effects of plate thickness, surface tension and fluid flow on detachment of drops from a plate end  
*A.S. Lexmond and C.W.M. van der Geld*  
Technische Universiteit Eindhoven, Eindhoven, The Netherlands

An experimental investigation on the relative roles of energy input, surface tension and viscosity on the break-up of a liquid drop  
*J.P. Monteiro\*, M.G. Rasteiro\*\* and J. M. Barata\*\*\**  
\*Dep. Engenharia Electromecânica, Universidade da Beira Interior, Covilhã, Portugal, \*\*Univ. de Coimbra, Coimbra, Portugal, \*\*\*Univ. da Beira Interior, Covilhã, Portugal

Controlling drop impact on cold and hot surfaces by polymer additives  
*V. Bertola*  
Ecole Normale Supérieure, Paris, France

The study of structure, heat and mass transfer in the gas-droplet near-wall jet in a tube  
*V. Terekhov and M. Pakhomov*  
Institute of Thermophysics SB RAS, Novosibirsk, Russia

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**Tuesday 23, 9:15-10:55 - Room 7 – Session: Numerical Modelling**

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Two-and three-phase flow computation for the optimization of oil skimming systems  
*G. Clauss and M.A. Amro*  
Division of Ocean Engineering, Technical University of Berlin, Berlin, Germany

A priori testing of large-eddy simulation of particle-laden channel flow  
*J.G.M. Kuerten*  
Eindhoven Univ. of Technology, Eindhoven, The Netherlands

Numerical simulation of bubble-laden plane mixing layer by vortex in cell method  
*T. Uchiyama\* and T. Degawa\*\**  
\*ECOTOPIA Science Research Institute, Nagoya University, Nagoya, Japan, \*\*Graduate School of Information Science, Nagoya University, Nagoya, Japan

Numerical simulation of two-phase flows using a volume-of-fluid model with various interface reconstruction schemes  
*L. Wang and B. Sundén*  
Division of Heat Transfer, Lund Institute of Technology, Lund, Sweden

Hydraulic parameter estimation and uncertainty in using them to calculate the rate of air flow in compressed air tunnelling  
*A. Chinkulkijniwat, S. Semprich and G. Steger*  
Institute for Soil Mechanics and Foundation Engineering, Graz University of Technology, Graz, Austria

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**Tuesday 23, 10:55-11:25 - Coffee Break**

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**Tuesday 23, 11:25-13:05 - Room 1 – Session: Boiling Heat Transfer**

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Variation of the local wall superheat along the circumference of a horizontal tube on pool boiling heat transfer  
*G. Ribatski\*, J.M. Saiz Jabardo\*\*, E. Fockink da Silva\*\* and E. Bugança Stelute\*\**  
\*Department of Mechanical and Industrial Engineering, University of Illinois at Urbana-Champaign, 1206 W. Green Street, Urbana, USA, \*\*Departamento de Engenharia Mecânica, Escola de Engenharia de São Carlos, Universidade de São Paulo, Av. Trabalhador SãoCarlense, 400, São Carlos, SP, Brazil

Heat transfer regimes at subcooled water swirl flow  
*A.T. Komov, A.N. Varana, A.V. Dedov and V.V. Yagov*  
Moscow Power Engineering Institute, Russia

Heat transfer at subcooled flow boiling  
*M.A. Gotovsky\*, N.D. Agafonova\*\* and I.L. Paramonova\*\**  
\*Polzunov Institute, St. Petersburg State Polytechnical University, St. Petersburg, Russia, \*\*St. Petersburg State Polytechnical University, St. Petersburg, Russia

Certain features of film boiling on a solid hemispherical surface  
*V.S. Grigoriev\*, Yu. P. Ivochkin\*, A.P. Kryukov\*\*, Yu.A. Zeigarnik\* and V.G. Zhilin\**  
\*Institute for High Temperatures of Russian Academy of Sciences, \*\*Moscow Power Engineering Institute, Russia

Explosive vaporization dynamics on a flat microheater  
*V.V. Kuznetsov and E.S. Vasserman*  
Institute of Thermophysics SB RAS, Novosibirsk, Russia

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**Tuesday 23, 11:25-13:05 - Room 2 – Session: Pressure Drop**

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A new model for the pressure recovery of air-oil two-phase flow across sudden expansion  
*W.H. Ahmed, C.Y. Ching and M. Shoukri*  
Dept. of Mechanical Engineering, McMaster University, Hamilton, Canada

Pressure drop for gas-liquid two-phase flow in microchannels - Effects of channel size and liquid properties  
*A. Kawahara, M. Sadatomi, K. Okayama and K. Kano*  
Dept. of Mechanical Engineering and Materials Science, Kumamoto University, Kumamoto City, Japan

Single-phase and two-phase frictional characteristics of R-410A flow in small U-type return bends  
*I.Y. Chen\*, C.C. Wang\*\* and S.Y. Lin\**  
\*National Yunlin University of Science and Technology, Yunlin, Taiwan, \*\*ITRI, Hsinchu, Taiwan

A study on the two-phase flow in single- and multi-channel  
*M.Y. Ha\*, C.H. Kim\*\*, Y.W. Jung\*, G.H. Jeong\* and S.G. Heo\*\**  
\*Pusan National University, Pusan, Korea, \*\*LG Electronics, Changwon, Gyeongnam, Korea

Measurement of pressure gradient during two-phase flow inside multi-port mini-channels  
*A. Cavallini, D. Del Col, L. Doretto, M. Matkovic, L. Rossetto and C. Zilio*  
Dipartimento di Fisica Tecnica, Università di Padova, Padova, Italy

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#### **Tuesday 23, 11:25-13:05 – Room 3 – Session: Condensation**

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Thermal design of a condenser operating under mixed regime on the two-phase flow side  
*T. Skiepko*  
Bialystok Technical University, Bialystok, Poland

Condensation heat transfer and pressure drop of refrigerant R-410A flow in a vertical plate heat exchanger  
*Y.Y. Hsieh\*, Y.M. Lie\*\* and T.F. Lin\*\**  
\*Nan Kai College, Taiwan, \*\*National Chaio Tung University, Hsinchu, Taiwan

Analysis of condensation flow instabilities in a narrow channel  
*B. Mederic, M. Miscevic, P. Lavieille, V. Platel Vincent and J.L. Joly*  
Laboratoire d'Energétique, 118, route de Narbonne, Toulouse, France

An assessment of theoretical modeling for in-tube condensation in the presence of air  
*F. Aglar\* and O. Yesin\*\**  
\*Turkish Atomic Energy Authority, Lodumlu-Ankara, Turkey, \*\*Middle East Technical University, Ankara, Turkey

Analysis of laminar film condensation from vapor-gas mixtures in vertical tubes  
*M.K. Groff, S.J. Ormiston, and H.M. Soliman*  
Department of Mechanical and Industrial Engineering, University of Manitoba, Winnipeg, Manitoba, Canada

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#### **Tuesday 23, 11:25-13:05 - Room 4 – Session: Fluid Particle Flow**

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Statistical models of particle dispersion and preferential concentration in turbulent flows  
*L.I. Zaichik and V.M. Alipchenkov*  
Institute for High Temperatures of the RAS, Moscow, Russia

On numerical simulation of dilute particulate-gas flow over a backward facing step: Lagrangian versus Eulerian approach  
*Z.F. Tian\*, J.Y. Tu\* and G.H. Yeoh\*\**  
\*RMIT University, School of Aerospace, Mechanical & Manufacturing Engineering, Bundoora, Australia, \*\*ANSTO, Menai, Australia

An experimental study of air-solid flow characteristics near blunted body  
*A.Yu. Varaksin and T.F. Ivanov*  
Institute for High Temperatures of Russian Academy of Sciences, Moscow, Russia

Nonlinear oscillations of aerosol in a resonance tube  
*D.A. Gubaidullin\*, R.G. Zaripov\*, R.G. Galiullin\*\*, E.R. Galiullina\*\* and L.A. Tkachenko\**  
\*Institute of Mechanics and Engineering, RAS, \*\*Kazan State University, Kazan, Russia

Experimental study on sand incipience process in wind-blown-sand flow by PTV  
*H.Y. Qi, B. Xi and C.F. You*  
Institute of Thermal Engineering, Beijing 100084, P.R. China

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#### **Tuesday 23, 11:25-13:05 - Room 5 – Session: Measurement Techniques**

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Characterization of turbulent flow and floc morphology in a flocculation process: PIV/digital imaging experiments  
*M. Honkanen\*, P. Saarenrinne\* and J. Reunanen\*\**  
\*Tampere University of Technology, Tampere, Finland, \*\*Kemira Ltd. Typpitie, Oulu, Finland

Improving multiphase flow metering performance using artificial intelligence algorithms  
*C. Alimonti\* and G. Falcone\*\**  
\*ICMPPM, University of Rome "La Sapienza", \*\*TOTAL E&P UK PLC, London, UK

Isokinetic sampling in large scale high-pressure two-phase flow  
*P. Hedne and P. Fuchs*  
Statoil Research Centre, Trodheim, Norway

Minor geometrical change from erosion affects the three-phase mass flow rate through chokes  
*S. Munaweera\*, T. Solbakken\*\* and R.B. Schuller\*\*\**  
\*Norsk Hydro Oil and Energy Research Centre, Porsgrunn, Norway, \*\*Norsk Hydro Exploration and Operation, Bergen, Norway, \*\*\*Agricultural University of Norway, As, Norway

Benchmarking of five-sensor probe method for interfacial area concentration measurement  
*D.J. Euth\*, B.J. Yun\*, W.M. Park\*, Y.J. Youn\*, C.H. Song\* and K.B. Baek\*\**  
\*Korea Atomic Energy Research Institute, Daejeon, Korea, \*\*Chungbuk National University, Cheongju, Korea

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#### **Tuesday 23, 11:25-12:05 - Room 6 – Session: Drop Motion And Dynamic**

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Computation of asymmetrical drops at rest on surfaces with regular roughness according to the Wenzel equation  
*M. Mantegna*  
Dipartimento di Energetica del Politecnico di Milano, piazzale Leonardo da Vinci, 32, Milano, Italy

Theoretical analysis on the effect of liquid droplet geometry on contact angle

*S. Vafaei\* and M.Z. Podowski\*\*,\*\**

\*Dept. of Mechanical, Aerospace and Nuclear Engineering, \*\*Center for Multiphase Research, Rensselaer Polytechnic Institute, Troy, USA

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**Tuesday 23, 12:05-13:05 - Room 6 – Session: Jets**

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Liquid jets expanding into a low-pressure environment - Experimental results

*M.M. Vieira and J. R. Simões-Moreira*

Escola Politécnica da Universidade de São Paulo, Mechanical Engineering Department, São Paulo, Brazil

Liquid jets expanding into a low-pressure environment - Numerical solution

*E. Angelo and J.R. Simões-Moreira*

Escola Politécnica da Universidade de São Paulo, Mechanical Engineering Department, Av. Prof. Mello Moraes, 2231, São Paulo, Brazil

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**Tuesday 23, 11:25-13:05 - Room 7 – Session: Numerical Modelling**

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A kinetic energy correction factor for the laminar pipe flow of viscoplastic fluids

*M.M. Baudouin, V.G. Pienaar and P.T. Slatter*

Flow Process Research Centre, Cape Technikon, South Africa

Verification and validation of volume of fluid methods

*L. Leal, J. Castro, P. Pozo and A. Oliva*

Centre Tecnològic de Transferència de Calor CTTC, Universitat Politècnica de Catalunya, Spain

Modelling of liquid heating under inverted annular film boiling conditions

*A.V. Palagin*

Nuclear Safety Institute of Russian Academy of Sciences (IBRAE), Moscow, Russia

**Tuesday 23, 13:05-14:15 - Lunch**

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**Tuesday 23, 14:15-14:55 - Plenary Room - Keynote Lecture 4**

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Heat transfer and crisis in swirl flow boiling

*V.V. Yagov*

Moscow Power Institute, Russia

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**Tuesday 23, 14:55-15:35 - Plenary Room - Keynote Lecture 5**

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Enhancement of condensation heat transfer by using passive and active drainage techniques

*D. Butrymowicz*

Institute of Fluid-Flow Machinery, Gdansk, Poland

**Tuesday 23, 15:35-16:05 - Coffee Break**

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**Tuesday 23, 16:05-18:05 - Room 1 – Session: Oscillation, Instability And Unsteady Flow**

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Fluctuation phenomenon of two-phase flow through a vertical pipe with contraction

*Y. Morimoto, H. Madarame and K. Okamoto*

The University of Tokyo Nuclear Engineering Research Laboratory, Ibaraki, Japan

Analysis of two-phase flow distribution in Couette-Taylor reactor

*E. Dluska, R. Hubacz, J. Zolinski and S. Wronski*

Faculty of Chemical and Process Engineering, Warsaw University of Technology, Warszawa, Poland

Modelling of instability of water and steam water flow in evaporator

*K. Wojs and P. Szulc*

Institute of Heat Engineering and Fluid Mechanics, Wrocław University of Technology, Poland

Stability of gas-liquid flow in vertical helical coils and inclined tubes

*V.Yu. Liapidevskii\* and A. Boudlal\*\**

\*Lavrentyev Institute of Hydrodynamics, Novosibirsk, Russia, \*\*Laboratoire de Mécanique de Lille, Villeneuve d'Ascq, France

Numerical modeling of self-oscillations in a two-layer viscous fluid with bottom mass supply

*A.A. Osipov*

Lomonosov Moscow State University, Moscow, Russia

A study on the two-phase Strouhal number of cylindrical structures

*Z.H. Lin, R.R. Huang, Y.G. Li and J.C. Lu*

State Key Laboratory of Multiphase Flow in Power Engineering, Xi'an Jiaotong University, Xi'an, China

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**Tuesday 23, 16:05-18:05 - Room 2 – Session: Combustion**

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Burning processes of polyethylene terephthalate resin powder in a high temperature oxidizing atmosphere

*R. Yamakita, K. Miura, Y. Ishino and N. Ohiwa*

Graduate School of Engineering, Nagoya Institute of Technology, Nagoya, Japan

Reactivity and attrition characteristics of oxygen carrier particles for chemical-looping combustion

*S.R. Son and S.D. Kim*

KAIST, Daejeon, Korea

Modelling of multiphase unconfined high speed jet flames

*P. Blotto\*, M. Bonuccelli\*\*, M. Falcitelli\*\*\*, N. Mancini\*\*\*\* and F. Podenzani\*\*\*\**

\*Eni/Division Exploration and Production, San Donato Milanese, Italy, \*\*TEA Sistemi SpA, Pisa, \*\*\*TEA Ambiente srl, Pisa, \*\*\*\*EniTecnologie, San Donato Milanese, Italy

Combustion of isolated single droplets of vacuum residue-water emulsions

*R. Ocampo-Barrera, M. Ramirez de Santiago, A. Chavez-Argüelles and J.P. Martinez-Ramon*

Instituto Mexicano del Petróleo, Veracruz, México

Numerical investigation of cellular heterogeneous detonation in aluminum particle gas suspension  
*T.A. Khmel, A.V. Fedorov and V.M. Fomin*  
Institute of Theoretical and Applied Mechanics SB RAS, Novosibirsk, Russia

An experimental study on removal of NOx in flue gas at the nonequilibrium plasma  
*Q. Zhang\*, S.S. Xu\*, F. Gu\*\* and T. Zhou\*\*\**  
\*Thermal Power Research Institute, State Power of China, Xi'an, China, \*\*Southeast University, Nanjing, China. \*\*\*Tsinghua University, Beijing, China

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**Tuesday 23, 16.05-16:45 – Room 3 – Session: Condensation Slug Flow**

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Electrohydrodynamic organisation of condensate drainage for integral-fin tube by means of double electrode  
*D. Butrymowicz, J. Karwacki and M. Trela*  
Institute of Fluid-Flow Machinery, Polish Academy of Sciences, Gdańsk, Poland

Generalization of experimental data on heat transfer for condensing vapor flowing inside vertical tubes  
*I.I. Gogonin*  
Institute of Thermophysics SB RAS, Novosibirsk, Russia

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**Tuesday 23, 16.45-18:05 – Room 3 – Session: Condensation Slug Flow**

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Flow in the annular film around a Taylor bubble rising through vertical columns of liquid  
*S. Nogueira\*\*, M.L. Riethmuller\*, J.B.L.M. Campos\*\* and A.M.F.R. Pinto\*\**  
\*von Karman Institute for Fluid Dynamics, Rhode Saint Genèse, Belgium, \*\*Centro de Estudos de Fenomenos de Transporte, Departamento de Eng. Qulmica, Faculdade de Engenharia da Universidade do Porto, Porto, Portugal.

A simple model for slug flow of gas and non-newtonian liquid mixtures in a vertical pipe  
*M. Dziubinski and H. Fidos*  
Faculty of Process and Environmental Engineering, Lodz Technical University, Łódź, Poland

Evolution of local characteristics of upward slug flow in a vertical pipe  
*O.N. Kashinsky, V.V. Randin and A.S. Kurdyumov*  
Institute of Thermophysics SB RAS, Novosibirsk, Russia

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**Tuesday 23, 16.05-18:05 - Room 4 – Session: Fluid Particle Flow**

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Particle dynamics in the vortex pair  
*F. Kaplanski\*, S. Sazhin\*\* and Y. Rudi\**  
\*Estonian Energy Research Institute at Tallinn Technical University, Tallin, Estonia, \*\*School of Engineering, Faculty of Science and Engineering, The University of Brighton, Brighton, UK

Interaction between boundary layer flow and moving particle  
*A. Mori\*, Y. Kobayashi\*\*, K. Hirose\* and M. Fujie\**  
\*Department of Civil Engineering, Hokkaido University, Sapporo, Japan, \*\*NIKKEN Consultants Inc., Tokyo, Japan

Precipitation of very fine particles due to thermophoresis and electrophoresis in laminar tube flow  
*L. Reime and D. Mewes*  
University of Hannover, Institute of Process Engineering, Hannover, Germany

Experimental investigations of particle distributions in stirred solid/liquid systems  
*R. Angst and M. Kraume*  
University of Technology Berlin, Department of Chemical Engineering, Berlin, Germany

The structure-phenomenological study of two-phase liquid systems  
*E.Yu. Taran, Yu.V. Pridatchenko and V.A. Gryaznova*  
Kyiv Taras Shevchenko National University, Ukraine

Application of ECT for measuring gas-solid flow regime in circulating suspension bed  
*C.P. Wang\*, \*\*, D.K. Li\* and Z.A. Lu\**  
\*The State Key Laboratory of Clean Combustion of Coal, Tsinghua University, Beijing, \*\*China Depart. Metal. Eng., Hebei University of Technology, Tangshan, China

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**Tuesday 23, 16.05-18:05 - Room 5– Session: Measurement Techniques**

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Velocity bias and concentration fluctuations in two-phase flow applications of phase Doppler particle analysis: A post-processing algorithm  
*T. Bergenblock and B. Leckner*  
Chalmers University of Technology, Dept. of Energy Conversion, Göteborg, Sweden

Foam drainage characterization by using impedance methods  
*B. Fournel\*, H. Lemonnier\*\* and J. Pouvreau\*\**  
\*DEN/DTCD/SPDE, CEA/Perrelatte, France, \*\*DEN/DER/SSSTH, CEA/Grenoble, France

A rotating electric field multiple-electrode impedance sensor for void fraction measurement  
*M.S. Rocha and J.R. Simões-Moreira*  
Escola Politécnica da Universidade de São Paulo, Mechanical Engineering Department, São Paulo, Brazil

Application of electrical resistance imaging to two-phase flows  
*S. Kim\*, K.J. Lee\*, Y.J. Ko\*, K.Y. Kim\*, B.S. Kim\*, M.C. Kim\*, H.S. Cho\*\* and B.S. Lee\*\*\**  
\*Cheju National University, Cheju, Korea, \*\*Yonsei University, Wonju, Korea, \*\*\*Konkuk University, Chungju, Korea

Measurement of the two-phase mass flow rate using an average bidirectional flow tube  
*B.J. Yun, D.J. Euh, K.H. Kang, C.H. Song and W.P. Baek*  
Korea Atomic Energy Research Institute, Daejeon, Korea

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**Tuesday 23, 16.05-18:05 - Room 6 – Session: Jets**

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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. Lebouché\**  
\*Universite Henri Poincare - Nancy 1, Vandoeuvre, France, \*\*ARCELOR/IRSID - Process Engineering, Mazières-les-Metz, France

Numerical simulation of particle-laden compound jet by vortex method

*T. Uchiyama\**, *A. Fukase\*\** and *K. Minemura\*\*\**

\*GECOTOPIA Science Research Institute, Nagoya University, Nagoya, Japan, \*\*Ebara Corporation, Tokyo, Japan, \*\*\*Graduate School of Information Science, Nagoya University, Nagoya, Japan

Numerical simulation of unsteady cavitating vortex flow in submerged water jet

*G. Peng\**, *S. Fujikawa\*\** and *M. Hayakawa\*\**

\*Department of Mechanical Systems Engineering, Faculty of Engineering, Toyama Prefecture University, Toyama, Japan, \*\*Division of Mechanical Science, Graduate School of Engineering, Hokkaido University, Sapporo, Japan

Studies of flow characteristics affected by two-phase jet flow in aeration tank

*K. Ode\**, *K. Yoshida\*\** and *I. Kataoka\*\**

Department of Mechanophysics Eng., Graduate School of Eng. Osaka University, Osaka, Japan, Dept. of Mechanophysics Engineering, Osaka University, Japan

Modeling and computation of heat exchanges in the configuration of an impinging jet on a hot plate

*N. Seiler*

IMFT, Allée du Professeur Camille Soula, Toulouse, France

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#### **Tuesday 23, 16.05-18:05 - Room 7 – Session: Mixtures**

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Numerical simulation of capillary-tube working with pure and mixed refrigerants under adiabatic and non-adiabatic conditions

*O. García-Valladares\** and *A. Oliva\*\**

\*Centro de Investigación en Energía - UNAM, Temixco, Morelos, México, \*\*Centro Tecnológico de Transferencia de Calor - UPC, Terrassa, Spain

Mixing of viscous binary mixtures

*N. Vladimirova\** and *R. Mauri\*\**

\*Dept. of Astronomy and Astrophysics, University of Chicago, Chicago, USA, \*\*Dip. di Ingegneria Chimica, Pisa, Italy

Studies on the drag reduction by the mixtures of polymer/surfactants solutions

*L. Broniarz-Press* and *I. Poltorak*

Poznan University of Technology, Poznan, Poland

Flow and heat transfer properties of ice slurries in a vertical rectangular channel

*E. Stamatiou* and *M. Kawaji*

Department of Chemical Engineering and Applied Chemistry, University of Toronto, 200 College St. Toronto, Ontario, Canada

Simulation of laser-induced detonation in multi-phase mixtures

*V. Emelyanov\** and *K. Volkov\*\**

\*Department of Gas and Plasma Dynamics, Baltic State Technical University, Saint Petersburg, Russia, \*\*Centre for Research in Fire and Explosion Studies, University of Central Lancashire, UK

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#### **Friday 24, 8:30-9:10 - Plenary Room - Keynote Lecture 6**

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DNS and LES of turbulent multifluid flows

*D. Lakehal*

ETH, Zurich, Switzerland

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#### **Friday 24, 9:15-10:55 - Room 1 – Session: Critical Heat Flux**

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Effect of the porous coating on the critical heat flux temperature

*S. Yildiz\** and *G. Bartsch\*\**

\*Yildiz Teknik Universitesi, Makine Fakultesi, Istanbul, Turkey, \*\*Institut für Energietechnik, TU-Berlin, Berlin, Germany

Critical heat flux phenomena in one-dimensional narrow gap

*Y.H. Kim\**, *S.J. Kim\**, *J.J. Kim\**, *S.W. Noh\**, *K.Y. Suh\**, *J.L. Rempel\*\**, *F.B. Cheung\*\*\** and *S.B. Kim\*\*\*\**

\*Seoul National University, Seoul, Korea, \*\*Idaho National Engineering & Environmental Laboratory, Idaho Falls, USA, \*\*\*The Pennsylvania State University, University Park, USA, \*\*\*\*Korea Atomic Energy Research Institute, Taejeon, Korea

Experimental study of third heat transfer crisis at stepwise power generation

*B.P. Avksentiuk\**, *V.M. Kravchenko\** and *V.V. Ovchinnikov\*\**

\*Kiev National Commercial and Economic University, Ukraine, \*\*Institute of Thermophysics SB RAS, Novosibirsk, Russia

Study of CHF on graphite rod in annular channel at low velocity of subcooled flow boiling

*J. Avaliani*, *M. Chkheidze*, *G. Goderdzishvili* and *I. Kordzakhia*

Research Institute "Optica", Tbilisi, Georgia

Critical heat flux in thin rectangular channels for low flow rate

*D.H. Lu*, *Y.P. Huang*, *X.S. Bai* and *Y. Liu*

The National Laboratory of Bubble Physics and Natural Circulation Nuclear Power Institute of China, Chengdu, China

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#### **Friday 24, 9:15-10:55 - Room 2 – Session: Turbulence**

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An anisotropic dispersion model based on a G.L.M.-like approach for turbulent shear flows

*O. Caballina\**, *A. Kheiri\*\** and *B. Oesterle\*\**

\*ENSEM, Institut National Polytechnique de Lorraine, Nancy, France, \*\*ESSTIN, Henri Poincaré University, Nancy, France

Modeling of anisotropic particle motion in turbulent channel flow and comparison with experiments

*J.Ph. Carlier*, *M. Khalij* and *B. Oesterle*

LEMETA, Henri Poincaré University, Nancy, France

Influence of lift force on microbubble behaviour in the wall region of upward/downward turbulent channel flow

*F. Lucci, A. Giusti and A. Soldati*

Università di Udine, Centro Interdipartimentale di Fluidodinamica e Idraulica and Dipartimento di Energetica e Macchine, Udine, Italy

Turbulent structure in a turbulent boundary layer with microbubbles

*M. Hamada\*, H. Kato\*\*, S. Shishukura\* and T. Usui\**

\*Department of Mechanical Engineering, Graduate School of Engineering, Toyo University, Kawagoe, Japan. \*\*Dept. of Comp. Sci. & Eng., Toyo Univ., Kawagoe, Japan

Liquid turbulence measurements in gas-liquid bubbly flow in a large diameter vertical pipe

*M.E. Shawkat, C.Y. Ching and M. Shoukri*

Dept. of Mechanical Engineering, McMaster University, Hamilton, Canada

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**Friday 24, 9:15-10:55 – Room 3 – Session: Slug Flow**

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Dynamic slug tracking model for horizontal gas-liquid flow

*E. de Moraes Franklin and E. Spanó Rosa*

Universidade Estadual de Campinas, Faculdade de engenharia Mecânica, Departamento de Energia, Barão Geraldo, Campinas, Brazil

Improving the sour wet gas transport "Sunuapa - Girdaldas - CPG Cactus" using a multiphase transient simulator

*A. Suárez Chávez, C. Cabrales Cruz and E. A. Bustos*

Instituto Mexicano del Petróleo, Ceiba No.6 Fracc. Framboyanes, México

On the influence of the inlet slug length distribution - A slug flow simulator

*T. Sotto Mayor, A.M.F.R. Pinto and J.B.L.M. Campos*

Centro de Estudos de Fenómenos de Transporte, Departamento de Engenharia Química, Faculdade de Engenharia da Universidade do Porto, Porto, Portugal

Flow around individual Taylor bubbles rising in stagnant CMC solutions: PIV measurements

*R.G. Sousa\*, A.M.F.R. Pinto\*, M.L. Riethmuller\*\* and J.B.L.M. Campos\**

\*Departamento de Engenharia Química, Centro de Estudos de Fenómenos de Transporte, Faculdade de Engenharia da Universidade do Porto, Porto, Portugal, \*\*von Karman Institute For Fluid Dynamics, Rhode-Saint-Genèse, Belgium

Predicting the rise velocity of single gas slugs in stagnant liquid: Influence of liquid viscosity and tube diameter

*M.A.R. Talaia*

Physics Department, University of Aveiro, Aveiro, Portugal

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**Friday 24, 9:15-10:55 - Room 4 – Session Interfacial Phenomena**

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Study of countercurrent flow limitation in a horizontal pipe connected to an inclined one

*M.A. Navarro*

Comissão Nacional da Energia Nuclear, Centro de Desenvolvimento da Tecnologia Nuclear, Pampulha, Belo Horizonte, Brazil

Study of flow reversal phenomenon in crank-type vertical tubes

*C.B. Lee, S.Y. Lee, D.W. Jeong and M.H. Kim*

Department of Mechanical Engineering, Korea Advanced Institute of Science and Technology, Science Town, Daejeon, Korea

Radiation-induced and photo-induced hydrophilicity

*M. Furuya\*, T. Matsumura\*, Y. Honjo\*\*, T. Takamasa\*\*\*, K. Okamoto\*\*\*\* and Y. Imai\*\*\*\**

\*Central Research Institute of Electric Power Industry, Tokyo, Japan, \*\*Electric Power Engineering Systems Co. Ltd., Tokyo, Japan, \*\*\*Tokyo University of Marine Science and Technology, Tokyo, Japan, \*\*\*\*University of Tokyo, Ibaraki, Japan

Heat and mass transfer of an evaporating sessile drop: An experimental and numerical investigation

*L. Grandas, D. Veyret, R. Santini and L. Tadrist*

Ecole Polytechnique Universitaire de Marseille - Laboratoire IUSTI - CNRS, Université de Provence, Marseille, France

Absorption with high heat release in the presence of n-octanol

*V.E. Nakoryakov, N.S. Bufetov and R.A. Dykhtyar*

Institute of Thermophysics SB RAS, Novosibirsk, Russia

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**Friday 24, 9:15-10:55 - Room 5– Session: Two-Phase Flow Equipment And Industrial Applications**

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Rotating sorbent reactor

*E. Mondt, H.P. van Kemenade, J.J.H. Brouwers and E.A. Bramer*

Eindhoven Univ. of Technology, Eindhoven, The Netherlands

Modeling of the packed thread dyeing process and numerical results for effective diffusivity

*D. Souza, A.A. Ulson de Souza and S.M.A. Guelli U. Souza*

Universidade Federal de Santa Catarina, Departamento de Engenharia Química e Engenharia de Alimentos, LABSIN, Laboratório de Simulação Numérica de Sistemas Químicos, Florianópolis, Brazil

Thermodynamic effects on hydrofoil and inducer cavitation

*A. Cervone\*, E. Rapposelli\*\*, C. Bramanti\* and L. D'Agostino\**

\*Dip. Di Ingegneria Aerospaziale, Università degli Studi di Pisa, Pisa, Italy.

\*\*Centrosazio/ALTA, Ospedaletto (Pisa), Italy

Investigation of siphon action in a discharge duct

*J.T. Kshirsagar, S. Gunaseelan, S.G. Joshi and R.K. Srivatsava*

Corporate Research and Engineering Division, Kirloskar Brothers Limited, Udyog Bhavan, Tilak Road, Pune, India

Two-phase heat pipes in heating systems for housings and civil structures

*R.M. Bayasan\*, A.G. Korotchenko\*, G.P. Pustovoi\*\* and N.G. Volkov\*\**

\*Inter Heat Pipe Corp., \*\*Lomonosov Moscow State University, Moscow, Russia

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**Friday 24, 9:15-10:55 - Room 6 – Session: Mass Transfer And Non-Boiling Heat Transfer**

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Mass transport enhancement in turbulent dispersed media

*L. Broniarz-Press and V. Press*

Poznan University of Technology, Poznan, Poland

A numerical study on mass transfer efficiency in bubbly plumes for water purification with ozone

*X. Gong, S. Takagi and Y. Matsumoto*

Dept. of Mechanical Engineering, The University of Tokyo, Tokyo, Japan

Enhancement of absorption performance due to the film wave formation on the vertical absorber

*J. Kim and K. Cho*

Sungkyunkwan University, Suwon, Korea

Non-boiling heat transfer characteristics of annular two-phase flow of nitrogen gas and water in a small vertical tube

*J. Yi\*, Z.H. Liu\* and Z.F. Ma\*\**

\*School of Mechanical Engineering, Shanghai Jiaotong University, Shanghai, China, \*\*School of Chemical Engineering, Shanghai Jiaotong University, Shanghai, China

Mixed convective flow and heat transfer of water in a horizontal pipe under supercritical pressure

*F. Xu, L.J. Guo, B.F. Bai and X.J. Chen*

State Key Laboratory of Multiphase Flow in Power Engineering, Xi'an Jiaotong University, Xi'an, China

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**Friday 24, 9:15-10:55 - Room 7 – Session: Packed Beds, Porous Media**

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Numerical simulation of segregation in fluidized bed using discrete element method and the experimental verification

*Z. Liu\*, T. Hirata\*, T. Kawaguchi\*\*, T. Tanaka\*\* and Y. Tsuji\*\**

\*Thermal & Fluid Technology Dept. Technical Research Laboratory, Ishikawajima-Harima Heavy Industries Co., Ltd. Yokohama, Japan, \*\*Department of Mechanophysics Engineering, Graduate School of Engineering, Osaka University, Osaka, Japan

Liquid phase mixing in the loop-type column reactor

*B. Kawalec-Pietrenko*

Gdansk University of Technology, Gdansk, Poland

Comparative analysis of CFD models for fluidized beds; particle models, solver and experimental validation.

*K. Johansson, B.G.M. van Wachem, and A.E. Almstedt*

Thermo and Fluid Dynamics, Chalmers University of Technology, Gothenburg, Sweden

Shear-thinning fluids flow in fixed and fluidised beds

*L. Broniarz-Press, P. Agacinski and J. Rózsanski*

Poznan University of Technology, Poland

Application of time-frequency analysis to fluidization regimes recognition in circulating fluidized beds

*Y.G. Chen, Z.P. Tian and Z.Q. Miao*

School of Mechanical and Power Engineering, Shanghai Jiaotong University, Shanghai, China

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**Friday 24, 10:55-11:25 - Coffee Break**

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**Friday 24, 11:25-13:05 - Room 1 – Session: Bubble Motion And Dynamic**

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Experimental study of the luminescence during the cavitation of a single bubble

*M. Barbaglia and F. Bonetto*

Comision Nacional de Energia Atomica and CONICET, PLADEMA - UNICEN, Tandí, Argentina

Free turbulence effects on bubble terminal velocity

*F. Scargiali, R. Di Maggio and A. Brucato*

Dip. di Ingegneria Chimica dei Processi e dei Materiali, Università di Palermo, Palermo, Italy

Numerical prediction of bubble coalescence and breakage by the novel parallel parent and daughter classes technique (PPDC)

*S. Bove, T. Solberg and B.H. Hjertager*

Aalborg University Esbjerg, Chemical Engineering Laboratory, Group of Chemical Fluid Flow Processes, Esbjerg, Denmark

The boiling bubble dynamics on the oxide metal accompanying radiation induced boiling enhancement phenomenon

*Y. Imai\*, K. Okamoto\*, H. Madarame\*, T. Takamasa\*\* and M. Furuya*

\*University of Tokyo, Tokyo, Japan, \*\*Tokyo University of Marine Science and Technology, Tokyo, Japan, \*\*\*Central Research Institute of Electric Power Industry, Tokyo, Japan

Modification of shear stress in Taylor-Couette flow containing bubbles

*Y. Murai\*, H. Oiwa\*\*, Y. Takeda\* and F. Yamamoto\*\**

\*Div. Mech. Sci., Graduate Sch. Eng., Hokkaido University, Sapporo, Japan, \*\*Fiber Amenity Eng. Course, Sch. of Eng., University of Fukui, Fukui, Japan

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**Friday 24, 11:25-13:05 - Room 2 – Session: Turbulence**

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Prediction performance of a thermodynamically consistent turbulence modulation for multiphase flows

*M. Chrigui and A. Sadiki*

Technical University of Darmstadt, Institute for Energy- and Powerplant, Darmstadt, Germany

Large eddy simulation of particle-laden vertical channel flow under consideration of a consistent modeling of turbulence modulation

*B. Groh, A. Sadiki and J. Janicka*

Technical University of Darmstadt, Institute for Energy- and Powerplant, Darmstadt, Germany

Study of turbulent particle-laden flow by nonlinear eddy-viscosity model with direct simulation Monte Carlo method

*C.H. Hsu and K.C. Chang*

Dept. of Aeronautics and Astronautics, National ChengKung University, Tainan, Taiwan

Dynamics of a bubbly turbulent boundary layer along a surface-piercing flat plate

*A. Aliseda and J. Lasheras*

Mechanical and Aerospace Engineering Department, University of California, San Diego, La Jolla, California, USA

Numerical study of turbulent heat transfer in an inclined pipe under supercritical pressure

*F. Xu, L.J. Guo and B.F. Bai*

State Key Laboratory of Multiphase Flow in Power Engineering\_Xi'an Jiaotong University\_Xi'an, China

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**Friday 24, 11:25-13:05 – Room 3 – Session: Waves**

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Periodic travelling waves of finite amplitude in two-layer flow

*A. Boudlal*

LML-URA CNRS 8107, Villeneuve d'Ascq, France

Studies on dynamic interaction between gas and liquid flows through interfacial waves in vertical upward annular flow

*K. Yoshida, T. Matsumoto and I. Kataoka*

Department of Mechanophysics Engineering, Graduate School of Engineering, Osaka University, Osaka, Japan

The analysis of interfacial waves

*A.Yu. Galimov, D.A. Drew, F.J. Moraga and R.T. Lahey, Jr.*

Center for Multiphase Research, Rensselaer Polytechnic Institute, Troy, New York, USA

Numerical dissipation and simulation of Faraday waves with WCOBRA/TRAC thermal-hydraulic codes

*C. Frepoli and K. Ohkawa*

Westinghouse Electric Co. Nuclear Services Division PO Box-355, Pittsburg, USA

Pressure waves of moderate amplitude in gas-liquid medium of cluster structures

*V.E. Dontsov and V.E. Nakoryakov*

Institute of Thermophysics SB RAS, Novosibirsk, Russia

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**Friday 24, 11:25-13:05 - Room 4 – Session: Interfacial Phenomena**

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Analytical prediction of single and dual two-phase discharges from stratified regions

*J.T. Bartley, H.M. Soliman, and G.E. Sims*

Department of Mechanical and Industrial Engineering, University of Manitoba, Winnipeg, Manitoba, Canada

Onset of wetting failure in liquid-liquid systems

*D. Jacqmin*

NASA Glenn Research Center

Influence of liquid content in foam flow on heat transfer intensity

*J. Gyls, S. Sinkunas and T. Zdankus*

Department of Thermal and Nuclear Energy, Kaunas University of Technology, Kaunas, Lithuania

Influence of environment parameters on the surface wetting by droplets

*Z. Zapalowicz\* and M. Trela\*\**

\*Szczecin Technical University, Szczecin, Poland, \*\*Institute of Fluid Flow Machinery, Gdansk, Poland

Dynamic wetting angle of a spreading droplet

*S. Sikalo\*, C. Tropea\*\* and E. N. Ganić\**

\*Faculty of Mechanical Engineering, University of Sarajevo, Sarajevo, Bosnia/Herzegovina, \*\*SLA, Technische Universität Darmstadt, Darmstadt, Germany

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**Friday 24, 11:25-13:05 - Room 5 – Session: Two-Phase Flow Equipment And Industrial Applications**

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Two-phase flow characteristics in gas-liquid microreactors

*S. Waelchli and P. von Rohr*

ETH, Zürich, Switzerland

Gas hold-up and power input in agitated gas-liquid system in a tank

*L. Broniarz-Press, W. Szaferski and M. Sypula*

Poznan University of Technology, Poznan, Poland

A novel two-phase flow system for fabrication of a ceramic/polymer composite

*C. Dry*

Natural Process Design 1605 Park Haven Drive Champaign, Illinois, USA

Analysis and experimental investigation of a bubble pump for absorption refrigeration

*A. Franco*

Dipartimento di Energetica "L. Poggi", Università di Pisa, Pisa, Italy

Modeling of two-phase convective-radiative heat exchange in the cooling basin

*V. Katinas, P. Vaitiekunas and A. Markevicius*

Lithuanian Energy Institute, Kaunas, Lithuania

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**Friday 24, 11:25-13:05 - Room 6 – Session: Falling Films**

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Study of free falling liquid layer in inclined pipes: Effect of diameter and inclination angle

*J. Lioumbas\*, O.J. Nydal\*\* and S.V. Paras\**

\*Department of Chemical Engineering, Aristotle University of Thessaloniki University, Thessaloniki, Greece, \*\*Department of Energy and Process Technology, NTNU, Trondheim, Norway

Effect of the microscale wall topography on the thermocapillary convection within a heated liquid film

*T. Gambaryan-Roisman, A. Alexeev and P. Stephan*

Darmstadt University of Technology, Chair of Technical Thermodynamics, Darmstadt, Germany

Performance of an air-cooled, falling film absorber of an ammonia-water absorption cooling machine

*J. Castro, L. Leal, P. Pozo and A. Oliva*

Centre Tecnològic de Transferència de Calor CTTC, Universitat Politècnica de Catalunya, Spain

The study of flow dynamics and heat transfer in falling intensively evaporating wave films of liquid

*A.N. Pavlenko, A.M. Matsekh, I.P. Starodubtseva, A.V. Morozov*  
Institute of Thermophysics SB RAS, Novosibirsk, Russia

Gas-driven disturbance waves on vertical liquid film

*S.V. Alekseenko, V.A. Antipin, A.V. Cherdantsev, S.M. Kharlamov and D.M. Markovich*  
Institute of Thermophysics SB RAS, Novosibirsk, Russia

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**Friday 24, 11:25-13:05 - Room 7 – Session: Packed Beds, Porous Media**

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Analysis of the behaviour of the simulated moving bed reactor in the sucrose inversion process

*E.A. Borges da Silva, D.P. Souza, A.A. Ulson de Souza and S.M.A. Guelli U. Souza*  
Universidade Federal de Santa Catarina, Departamento de Engenharia Química e Engenharia de Alimentos, LABSIN, Laboratório de Simulação Numérica de Sistemas Químicos, Florianópolis, Brazil

A study of two-body forces in fluidization

*B.A. Kashiwa and R.M. Rauenzahn*  
Los Alamos National Laboratory, Los Alamos, NM, USA

**Friday 24, 13:05-14:15 - Lunch**

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**Friday 24, 14:15-14:55 - Plenary Room - Keynote Lecture 7**

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Small-scale and coarse-grained dynamics of interfaces: The modeling of volumetric interfacial area in two-phase flow

*D. Lhuillier*  
Université Pierre et Marie Curie, Paris, France

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**Friday 24, 15:00-17:00- Room 1 – Session: Bubble Motion And Dynamic**

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A simple method for evaluating fluctuating bubble velocity and its application to a hybrid bubble tracking method

*A. Tomiyama\*, K. Sakoda\*, G.P. Celata\*\* and I. Zun\*\*\**  
\*Faculty of Engineering, Kobe University, Kobe, Japan, \*\*ENEA, Institute of Thermal-Fluid Dynamics, Rome, Italy, \*\*\*Faculty of Mechanical Engineering, University of Ljubljana, Ljubljana, Slovenia

Bubble rise characteristics after the departure from a nucleation site in water saturated flow boiling

*T. Okawa\*, T. Ishida\*, I. Kataoka\* and M. Mori\*\**  
\*Department of Mechanophysics Engineering, Osaka University, Osaka, Japan, \*\*Nuclear Power R&D Center, Tokyo Electric Power Company, Kanagawa, Japan

A unified model considering force balances for departing vapour bubbles and population balance in subcooled boiling flow

*G.H. Yeoh\* and J.Y. Tu\*\**  
\*Australian Nuclear Science and Technology Organisation (ANSTO), Menai, Australia, \*\*RMIT University, School of Aerospace, Mechanical & Manufacturing Engineering, Bundoora, Australia

Dynamics of bubbles and bubble clouds: Structure formation in acoustic cavitation

*S. Konovalova\*, K. Zakirov\* and I. Akhatov\*\**  
\*Dept. Of Mech. Eng. And Applied Mechanics, North Dakota State University, Fargo, USA, \*\*Institute of Mechanics, Russian Academy of Sciences, Ufa, Russia

Effect of different breakup and coalescence closures on bubble column CFD simulation

*P. Chen\*, J. Sanyal\*\* and M.P. Dudukovic\**  
\*Chemical Reaction Engineering Laboratory, Washington University, St. Louis, MO, USA, \*\*Fluent Inc., Lebanon, NH, USA

A model of bubble departure from copper-graphite composite surfaces

*N. Zhang\*, D.F. Chao\*\* and W.J. Yang\*\*\**  
\*Ohio Aerospace Institute at NASA Glenn Research Center, Cleveland, OH, \*\*NASA Glenn Research Center, Cleveland, OH, \*\*\*ME Department, The University of Michigan, Ann Arbor, MI, USA

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**Friday 24, 15:00-17:00- Room 2 – Session: Flow Structure**

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Influence of the model bubble diameter on three-dimensional numerical simulations of thermal cavitation in pipe elbows

*E. Laurien*  
University of Stuttgart, Institute for Nuclear Technology and Energy Systems (IKE), Stuttgart, Germany

Modeling of vertical annular and wispy-annular flow

*A. Laforgia, L.Y. Lao, C.J. Lawrence and G.F. Hewitt*  
Department of Chemical Engineering and Chemical Technology, Imperial College London, Prince Consort Road, London, UK

Study on bubbles size distributions and three-dimensional flow pattern visualization in upward flashing flow by means of wire-mesh sensors

*A. Manera\*\*\*, H.M. Prasser\*\*, D. Lucas\*\* and T.H.J.J. van der Hagen\**  
\*Delft University of Technology, Delft, The Netherlands, \*\*Forschungszentrum Rossendorf e.V., P.O.Box 119, 01314 Dresden, Germany

Air-water flow in a vertical pipe with sudden changes of the superficial water velocity

*H.M. Prasser and E. Krepper*  
Forschungszentrum Rossendorf e.V., Institut für Sicherheitsforschung, Dresden, Germany

Two-phase flow regime identification in a horizontal flow using dynamical clustering method

*Z.H. Jia, G. Niu and J. Wang*  
School of Mechanical and Power Engineering, Shanghai Jiao Tong University, Shanghai, China

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**Friday 24, 15:00-17:00– Room 3 – Session: Nuclear Reactor Safety**

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Influence of subcooled boiling on out-of-phase oscillations in boiling water reactors

*L. Muñoz-Cobo\*, S. Chiva\*\* and A. Escrivá\**  
\*Departament of Chemical and Nuclear Engineering, Universidad Politècnica, Valencia, \*\*Departamento de Tecnología, Universidad Jaime I, Castellon, Spain

Gas driven circulation enhancement in an adiabatic air-water loop  
*M. De Salve, M. Malandrone and B. Panella*

Validation of Eulerian multiphase flow models for nuclear safety applications  
*Th. Frank\*, J.M. Shi\*\* and A.D. Burns\*\*\**  
\*ANSYS Germany, Otterfing, Germany, \*\*FZR, Institute of Safety Research, Dresden, Germany, \*\*\*ANSYS CFX, Didcot, UK

Nodalisation qualification in preparation of counterpart test analysis  
*M. Cherubini, F. D'Auria and G. Galassi*  
DIMNP Università di Pisa, Via Diotisalvi, 2, Pisa, Italy

Experimental study on combined natural and gas-injection enhanced circulation  
*W. Ambrosini, G. Forasassi, N. Forgiome, F. Oriolo and M. Tarantino*  
Università di Pisa, Dipartimento di Ingegneria Meccanica, Nucleare e della Produzione  
Via Diotisalvi, Pisa, Italy

Demonstration of the heat removing capabilities of the EPR core catcher  
*M. Fischer, O. Herbst and H. Schmidt*  
Framatome, Erlangen, Germany

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#### Friday 24, 15:00-17:00- Room 4 – Session Evaporation

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Study about the flashing process through a metering expansion valve  
*M.A. Bahajji, J.M. Corberà, J. Urchueguia and J. Gonzalez*  
Instituto de Ingeniería Energética, Universidad Politécnica de Valencia. Camino de Vera 14,  
Valencia, Spain

Transient and steady-state computations of the direct-contact evaporation of a two-phase drop  
*F. Dammel and P. Stephan*  
Darmstadt University of Technology, Chair of Technical Thermodynamics, Darmstadt, Germany

Evaporation modelling in fields with strong pressure gradient-critical flashing flows in nozzles  
*T. Skorek and P. Papadimitriou*  
Thermal Hydraulics Division, Gesellschaft für Anlagen und Reaktorsicherheit (GRS) mbH,  
Garching, Germany

A model for two phase flow with evaporation  
*R. Krahl\*, M. Adamov\*\*, M. Lozano Avilés\*\* and E. Bänisch\**  
\*Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany, \*\*Technische  
Universität Berlin, Berlin, Germany

Evaporation of falling water sheet on a horizontal cylinder: Modelling and experimentation  
*H. Louahlia-Gualous, L. El Omari, E. Artioukhine and P.K. Panday*  
Centre de Recherche sur les Ecoulements, Surface et Transfert, Laboratoire mixte UTBM-UFC,  
UMR CNRS, Belfort, France

Transient natural convection with surface evaporation in a partially filled tanks  
*S. Prasanth Kumar\*, B.V.S.S. Prasad\*, G. Venkatarathnam\*, S. Srinivasamurthy\* and K. Ramamurthi\*\**  
\*Department of Mechanical Engineering, IIT Madras, Chennai-600036, India, \*\*LPSC, ISRO,  
Valiamala, Kerala, India

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#### Friday 24, 15:00-17:00- Room 5– Session: Enhancement Of Heat Transfer

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Enhancement of single drop mass transfer due to Marangoni convection  
*K. Schulze, A. Paschedag and M. Kraume*  
Department of Chemical Engineering, Technical University Berlin, Berlin, Germany

Enhancement of heat transfer in subcooled flow boiling with microbubble emission  
*K. Suzuki, T. Kokubu, M. Nakano, H. Kawamura, and O. Ogawa*  
Department of Mechanical Engineering, Tokyo University of Science, Japan

Boiling heat transfer on enhanced carbon fibre reinforced microcoatings  
*T. Orzechowski*  
Kielce University of Technology, Poland

A dynamic model for pool boiling heat transfer on enhanced surfaces with sub-surfaces channels  
*Y.M. Chen, M. Groll and R. Mertz*  
IKE, Stuttgart, Germany

Narmax identification for the prediction of the dynamics of the vapotron effect  
*C. Biserni\*, A. Fichera\*\*, I.D. Guglielmino\*\*, E. Lorenzini\* and A. Pagano\*\**  
\*Dipartimento di Ingegneria Energetica, Nucleare e del Controllo Ambientale, Università di  
Bologna, Bologna, Italy, \*\*Dipartimento di Ingegneria Industriale e Meccanica, Università di  
Catania, Catania, Italy

An experimental study of heat transfer between horizontal immersed tubes without and with  
annular fins of constant thickness in bubbling fluidized bed  
*S. Rasouli\*, M. Reza Golriz\*\*, A. Asghar Hamidi\*\*\**  
\*Engineering Faculty, Azad University, Tehran, Iran, \*\*Department of Applied Physics and  
Electronics, Umea University, Sweden, \*\*\*Department of Chemical Engineering, Tehran  
University, Tehran, Iran

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#### Friday 24, 15:00-17:00- Room 6 – Session: Atomization And Sprays

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Coupling between instantaneous liquid flow rate and transient air entrainment for GDI sprays  
*G. Delay\*, R. Bazile\*, G. Charnay\* and H.J. Nuglisch\*\**  
\*IMFT, Toulouse, France, \*\*SIEMENS VDO Automotive, Toulouse, France

Dispersed phase measurements in sprays using optical probes  
*A. Cartellier and F. Ben Rayana*  
LEGI, INPG-CNRS-UJF, Grenoble, France

Flashing liquid fragmentation: Is there a hindered mass?  
*J.P. Bigot\*, A. Touil\*, P. Bonnet\*\* and J.M. Lacombe\*\**  
\*ENSMSE, St. Etienne, France, \*\*INERIS, Verneuil en Halatte, France

Characteristics of a two-phase flow inside mixing chamber of an effervescent atomizer  
*J. Jedelsky and M. Jicha*  
Brno Univ. Technol., Brno, Czech Republic

Analysis of single point particle time series for detection of droplet clustering in sprays  
*U. Fritsching and J. Heinlein*  
Universität Bremen, Bremen, Germany

A numerical study on the curvature effect on the behaviors of fuel sprays impinging on the concave surface  
*G.H. Ko and H.S. Ryou*  
Chung-Ang University, Seoul, Korea

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**Friday 24, 15:00-17:00- Room 7 – Session: T-Junction**

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Features of two-phase gas/liquid flow at a combining T-junction - Hold up profiles around the junction  
*B.J. Azzopardi\*, A. Belghazi\*, M. Fossa\*\* and P. Guglielmini\*\**  
\*Multiphase Flow Research Group, Nottingham Fuel and Energy Centre, School of Chemical, Environmental and Mining Engineering, University of Nottingham, University Park, Nottingham NG7 2RD, U.K. \*\*DITEC, University of Genova, Italy

Further investigations into the phase split at a larger diameter vertical T-junction  
*E. Wren, R. Kaji, R. Geary, H. Robinson, E. Cheney, N.K. Omebere-Iyari and B.J. Azzopardi*  
Multiphase Flow Group, Nottingham Fuel and Technology Centre, The University of Nottingham, University Park, Nottingham, England.

Compact gas-liquid phase separators for the use in solar-thermal power plants  
*T. Hirsch*  
German Aerospace Center, Institute of Technical Thermodynamics, Stuttgart, Germany

Effect of tube orientation on two-phase flow distribution of R-22 in T-junction  
*S.J. Tae and K. Cho*  
Sungkyunkwan University, Suwon, Korea

Dividing two-phase flow in branching conduits with large diameter horizontal main pipes and lateral branches  
*M. Casamirra, F. Castiglia, M. Giardina, C. Lombardo and S. Molica Nardo*  
Department of Nuclear Engineering, Palermo University, Palermo, Italy

**Friday 24, 17:00-17:30 - Coffee Break**

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**Friday 24, 17:30-19:10- Room 1 – Session: Bubble Motion And Dynamic**

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Break-up of bubbles and droplets in stagnant media  
*P. Budzinski and M. Dziubinski*  
Faculty of Process and Environmental Engineering, Łódź Technical University, Łódź, Poland

Approximation to the drag coefficient on a bubble moving through power-law or Carreau fluid  
*M. Dziubinski, M. Orczykowska and P. Budzinski*  
Faculty of Process and Environmental Engineering, Lodz Technical University, Poland

Analysis of air bubbles probability distribution functions in a large-size dropshaft  
*C. Gualtieri\* and H. Chanson\*\**  
\*Hydraulic and Environmental Engineering Department "Giralamo Ippolito", University of Napoli "Federico II", Napoli, Italy, \*\*Department of Civil Engineering, The University of Queensland, Brisbane QLD 4072, Australia

A single bubble impact on the wall in upward laminar bubbly flow  
*O.N. Kashinsky, L.C. Timkin, R.S. Gorelik and P.D. Lobanov*  
Institute of Thermophysics SB RAS, Novosibirsk, Russia

Dynamics of bubble media under vibration  
*V.S. Fedotovskiy, T.N. Vereshchagina and L.V. Terenik*  
Leipunsky Institute of Physics and Power Engineering, Obninsk, Russia

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**Friday 24, 17:30-19:10- Room 2 – Session: Flow Structure**

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Experimental and numerical studies of void fraction distribution in rectangular bubble columns  
*E. Krepper\*, B.N.R. Vanga\*\*, H.M. Prasser\* and M.A. Lopez de Bertodano\*\**  
\*Forschungszentrum Rossendorf e.V., Institut für Sicherheitsforschung, Dresden, Germany, \*\*Purdue University, School of Nuclear Engineering, West Lafayette, USA

The levitation force on the core in a stationary core annular flow through a horizontal pipe  
*P. Poesio and G. Ooms*  
Delft Univ. of Technology, Delft, The Netherlands

R134A flow patterns in small diameter tubes  
*L. Chen\*, Y. S. Tian\*\* and T.G. Karayiannis\**  
\*Division of Environmental, Energy and Building Services, Engineering, Faculty of Engineering, Science and the Build Environment, London South Bank University, London, UK, \*\*Aspentech Inc., The Gemini Building, Fermi Avenue, Harwell International Business Centre, Didcot, Oxfordshire, UK

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**Friday 24, 17:30-19:10- Room 3 – Session: Nuclear Reactor Safety**

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Design, experiments and RELAP5 code calculations for the PERSEO facility  
*R. Ferri\*, A. Achilli\*, G. Cattadori\*, F. Bianchi\*\* and P. Meloni\*\**  
\*SIET S.p.A., Piacenza, Italy; \*\*ENEA, Bologna, Italy

Rewetting of a hot vertical surface by liquid sprays  
*M. Casamirra\*, F. Castiglia\*, M. Giardina\*, C. Lombardo\*, G.P. Celata\*\*, A. Mariani\*\* and L. Saraceno\*\**  
\*University of Palermo, Nuclear Engineering Department, Palermo; \*\*ENEA, Institute of Thermal-Fluid Dynamics, Rome, Italy

Direct vessel vertical injection for advanced emergency core cooling system  
*S.H. Yoon\*, Y.H. Yu\*\* and K.Y. Suh\**  
\*Seoul National University, Seoul, Korea, \*\*PHILOSOPHIA, Inc., Seoul, Korea

Analysis of the peach bottom BWR turbine trip pressure wave propagation and its effect on the kinetic core dynamic

*A. Bousbia-Salah and F. D'Auria*

Dipartimento di Ingegneria Meccanica, Nucleare e della Produzione, Università di Pisa, Pisa, Italy

Analysis of effect of noncondensable gases in horizontal steam generator with Relap5/Mod3.2

*O.I. Melikhov\*, V.I. Melikhov\*, G.V. Bychkova\* and A.A. Belsky\*\**

\*Electrogorsk Research & Engineering Centre of Nuclear Plants Safety, Electrogorsk, Russia,

\*\*Atomenergoproekt, Moscow, Russia

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#### **Friday 24, 17:30-19:10- Room 4 – Session: Evaporation**

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Experimental analysis of two-phase flow in evaporators with special emphasis on single phase - two-phase transitions zones

*G. Rausch, J. Rigola, S. Morales, C.D. Pérez-Segarra and A. Oliva*

Centre Tecnològic de Transferència de Calor CTTC, Universitat Politècnica de Catalunya, Spain

Experimental study of flash evaporation on enclosed water pool: Influence of characteristic parameters

*D. Saury, S. Harmand and J. Ermel*

Laboratoire de Mécanique et Energetique, Universite de Valenciennes, France

On the possibility of the evaporator drastic scale reduction in a periodically operating two-phase thermosyphon

*S. Filippeschi, E. Latrofa and G. Salvadori*

Dipartimento di Energetica "L. Poggi", Università di Pisa, via Diotisalvi 2, Pisa , Italy

Simulation of evaporative cooling of droplets in a mechanical draft cooling tower

*S.P. Fisenko, A.A. Brin and A.I. Petruchik*

A.V. Luikov Heat & Mass Transfer Institute, National Academy of Sciences of Belarus, 15, P.

Brovka St., Minsk, Belarus

Improvement of an evaporation drag model

*X.Y. Li, Y.H. Yang and J.J. Xu*

Department of Nuclear Science & System Engineering, School of Mechanics and Power, Shanghai

Jiaotong University, Shanghai, China

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#### **Friday 24, 17:30-19:10- Room 5– Session: Enhancement Of Heat Transfer**

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Heat transfer enhancement in refrigerant R141b pool boiling with wire nets structures

*A. Franco\*, E. Latrofa\* and V.V. Yagov\*\**

\*Dipartimento di Energetica "L. Poggi", Università di Pisa, Pisa , Italy, \*\*Moscow Power Engineering Institute (Technical University), Moscow, Russia

Vibration-induced two-phase cooling technologies for high power thermal management

*S. Heffington, S. Tillery, M. Smith, and A. Glezzer*

George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, USA

Enhanced heat transfer using radial fins

*R.N. Krikkis and P. Razelos*

Institute of Thermal Sciences, 2 Kanigos St., Suite 4-17, Athens, Greece

Boiling heat transfer enhancement on fin arrays with extended micro surfaces

*R. Pastuszko, M.E. Poniewski and P.J. Mroczek*

Kielce University of Technology, Kielce, Poland

Effect of electric field on bubbles in two-phase system

*W. Dong, R.Y. Li and H.L. Yu*

College of Power Engineering, University of Shanghai for Science and Technology, Shanghai, China

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#### **Friday 24, 17:30-19:10- Room 6 – Session: Oil-Water Flow**

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Experimental analysis of water fluid dynamics in oil-water wavy-stratified regime

*B. Pulvirenti\* and G. Sotgia\*\**

\*Università di Bologna, Bologna, \*\*Politecnico di Milano, Milano, Italy

Flow patterns and pressure gradient in horizontal, upward inclined and vertical heavy oil-water-gas flows: Experimental investigation and full-scale experiments

*A.C. Bamwart\*, O.M.H. Rodriguez\*\*, F.E. Trevisan\*, F.F. Vieira\* and C.H.M. de Carvalho\*\*\**

\*Faculty of Mechanical Engineering, Dept. of Petroleum Engineering, UNICAMP, Brazil,

\*\*Faculty of Mechanical Engineering, Dept. of Energy, UNICAMP, Brazil, \*\*\*PETROBRAS,

CENPES/PDP/TE, Brazil

Measurement uncertainty applied to the main parameters in oil-water flows and the related critical transitions

*R. Marchesi\*, M.S. Mello\* and S. Menegozzi\*\**

\*Department of Energetics, Polytechnic University of Milan, \*\*Center for Quality of Athenaeum, Polytechnic University of Milan, Italy

Nonlinear feature analysis and automatic pattern recognition of oil-gas-water multiphase flow

*B.F. Bai and L.J. Guo*

State Key Laboratory of Multiphase Flow in Power Engineering, Xi'an Jiaotong University, Xi'an, China