

# **3rd INTERNATIONAL SYMPOSIUM ON TWO-PHASE FLOW MODELLING AND EXPERIMENTATION**

*Pisa, Italy – September 22-25, 2004*

---

---

*Organized by*  
THE ASSEMBLY OF WORLD CONFERENCES  
ON EXPERIMENTAL HEAT TRANSFER, FLUID MECHANICS AND THERMODYNAMICS  
*and*  
ENEA INSTITUTE OF THERMAL-FLUID DYNAMICS  
DEPARTMENT OF ENERGETICS, UNIVERSITY OF PISA

*with the contribution of the*  
BEGELL HOUSE

---

---

## **FINAL PROGRAM**



We are happy to welcome you to the 3rd International Symposium on Two-Phase Flow Modelling and Experimentation. Authors from over 40 countries have contributed to this Symposium.

The objective of the Symposium is to bring together the international two-phase flow community. The researchers, designers, experimentalists, modellers and numerical analysts in the area of two-phase flow have the opportunity to meet themselves in a forum for high-level scientific and technical interchange of ideas, to stimulate discussion and liaison between specialists' groups and to exchange their expertise and experiences to further incite their research activities. Interchange of ideas between experimentalists and people involved in mathematical modelling is of utmost importance for synergism between the two disciplines. All participants will have an opportunity to become informed on:

- Experimental, computational and theoretical work on two-phase flow, including heat and mass transfer, fluid mechanics and thermodynamics aspects.
- Latest developments in optical methods and instrumentation for two-phase flow measurements.
- State-of-the-art of two-phase flow modelling.
- Advances in basic phenomena of two-phase flow through conventional and sophisticated experiments.
- Innovative applications of research results through cross-fertilization of ideas from symposium participants of various disciplines.

## **VENUE**

### *Location*

The Symposium will be held in Pisa, Italy. Pisa is a lovely city located not far from Florence (1 hour by train) in the north of Tuscany, one of the most wonderful regions in Italy. The Miracles' Square with the Dome, the Baptistery and the world-wide well known Leaning Tower represent the most unique and original complex of the Tuscan Romanesque architecture. But many other attractions deserve some attention from the tourists such as the sculptures and the paintings of the local Thirteenth and Fourteenth century stored in the St. Matthew National Museum, the ancient city and many wonderful churches. Pisa is also a convenient location for exploring Tuscany hills, vineyards and its beautiful cities, such as Florence, Siena, S. Gimignano, Lucca, Volterra, etc. The climate in late September is normally very pleasant in Pisa. It is perhaps the best period for a visit.

### *Meeting Place*

The meeting will take place in the Conference Hall ("Palazzo dei Congressi") of Pisa, via Matteotti 1, Pisa. The Conference Hall is easily reachable from any point of the city by walking, by bus or by taxi. The meeting location can also be reached directly from the railway station (5 min taxi) or from the airport (10-15 min taxi).

### *Liability and Insurance*

It is regretted that the organizers cannot accept any responsibility for injury or damage to persons or property during the Symposium. Participants are, therefore, kindly requested to arrange their own insurance.

## **PRESENTATION OF PAPERS**

Presentation of papers will be in the oral format. As the time allocated for each paper is 20 minutes, speakers are requested to time their presentation in 13-15 minutes maximum highlighting the main features of their work, leaving 5-7 minutes for discussion. Session chairs will be very strict on time to ensure an appropriate running of the parallel session and the flow of attendees from one session to another. Overhead transparencies projector and projector for Power Point presentations will be available. Slide projector is available upon request.

## **OPEN FORUM SESSION**

Due to the interest in the Symposium and the tight deadlines necessary for the preparation of a reviewed papers meeting, it has not been possible for the Organisers to include all of the potential presentations whose abstracts were submitted after the deadlines. Having had a number of enquiries about the availability of making presentations on material which is precluded because of the above reasons, the Organisers have decided to include an Open Forum Session in the Conference. These papers ARE NOT included in the Symposium Proceedings. Presentations in this session ONLY will be given in the poster format. Details on the poster presentation have been given to authors before the Symposium.



## SYNOPSIS

start	end	<b>Wednesday 22</b>	Auditorium	Room Pacinotti	Room Fermi	Room Galilei	Room 1	Room 2	Room 3
9:45	10:00	Welcome Address							
10:00	10:40	KL 1 (Tomiyama)							
10:40	11:10	<i>Coffee-Break</i>							
11:10	12:50	<b>Sessions (24/1)</b>	<b>BF1</b>	<b>MIC1</b>	<b>TPM1</b>	<b>FP1</b>	<b>MT1</b>	<b>BB1</b>	<b>PDS1</b>
12:50	14:00	<i>Lunch</i>							
14:00	14:40	KL 2 (Hassan)							
14:45	16:05	<b>Sessions (24/2)</b>	<b>BF2</b>	<b>MIC2</b>	<b>TPM2</b>	<b>FP2</b>	<b>MT2</b>	<b>BB2</b>	<b>PDS2</b>
16:05	16:35	<i>Coffee-Break</i>							
16:35	18:35	<b>Sessions (24/1)</b>	<b>BF3</b>	<b>MIC3</b>	<b>PMD</b>	<b>FP3</b>	<b>MT3</b>	<b>BB3</b>	<b>PDS3</b>
18:35		End of Sessions							
		<b>Thursday 23</b>							
8:30	9:10	KL 3 (Yagov)							
9:15	10:55	<b>Sessions (23/1)</b>	<b>BO1</b>	<b>LL</b>	<b>CN1</b>	<b>FP4</b>	<b>MT4</b>	<b>DMD1</b>	<b>NM1</b>
10:55	11:25	<i>Coffee-Break</i>							
11:25	13:05	<b>Sessions (23/2)</b>	<b>BO2</b>	<b>PRD</b>	<b>CN2</b>	<b>FP5</b>	<b>MT5</b>	<b>DMD2-JE1</b>	<b>NM2</b>
13:05	14:15	<i>Lunch</i>							
14:15	14:55	KL 4 (Sotgia)							
14:55	15:35	KL 5 (Butrymowicz)							
15:35	16:05	<i>Coffee-Break</i>							
16:05	18:05	<b>Sessions (23/3)</b>	<b>OUF</b>	<b>CO</b>	<b>CN3-SF1</b>	<b>FP6</b>	<b>MT6</b>	<b>JE2</b>	<b>MX</b>
18:05		End of Sessions							
		<b>Friday 24</b>							
8:30	9:10	KL 6 (Lakehal)							
9:15	10:55	<b>Sessions (24/1)</b>	<b>CHF</b>	<b>TUR1</b>	<b>SF2</b>	<b>IP1</b>	<b>IA1</b>	<b>MNB</b>	<b>PBPM1</b>
10:55	11:25	<i>Coffee-Break</i>							
11:25	13:05	<b>Sessions (24/2)</b>	<b>BMD1</b>	<b>TUR2</b>	<b>FS1</b>	<b>IP2</b>	<b>IA2</b>	<b>FF</b>	<b>PBPM2</b>
13:05	14:15	<i>Lunch</i>							
14:15	14:55	KL 7 (Lhuillier)							
15:00	17:00	<b>Sessions (24/3)</b>	<b>BMD2</b>	<b>WA</b>	<b>NR1</b>	<b>EV1</b>	<b>EH1</b>	<b>AS</b>	<b>TJ</b>
17:00	17:30	<i>Coffee-Break</i>							
17:30	19:10	<b>Sessions (24/4)</b>	<b>BMD3</b>	<b>FS2</b>	<b>NR2</b>	<b>EV2</b>	<b>EH2</b>	<b>OW</b>	
19:10		Closure							
		<b>Saturday 25</b>							
8:30	13:10	Lahey's Symposium							

### SESSION KEYWORDS

AS	Atomization & Sprays	LL	Liquid-Liquid Systems
BB	Bubbles	MIC	Micro- & Minichannels
BF	Bubbly Flow	MNB	Mass Transfer & Non-Boiling Heat Transfer
BMD	Bubble Motion & Dynamics	MT	Measurement Techniques
BO	Boiling Heat Transfer	MX	Mixtures
CHF	Critical Heat Flux	NC	Natural Convection
CN	Condensation	NM	Numerical Modelling
CO	Combustion	NR	Nuclear Reactor Safety
DMD	Drop Motion & Dynamics	OUF	Oscillation, Instability & Unsteady Flow
EV	Evaporation	OW	Oil-Water Flow
EH	Enhancement of Heat Transfer	PB	Pool Boiling
FB	Flow Boiling	PBPM	Packed Beds & Porous Media
FF	Falling Films	PRD	Pressure Drop
FP	Fluid Particle Flow	PDS	Phase Distribution & Separation
FS	Flow Structure	PMD	Particle Motion & Dynamics
IA	Two-Phase Flow Equipment & Industrial Applications	SF	Slug Flow
IP	Interfacial Phenomena	TJ	T-Junctions
JE	Jets	TPM	Two-Phase Flow Modeling
KL	Keynote Lecture	TUR	Turbulence
		WA	Waves

**Welcome address, keynote lectures and Lahey's Symposium will be given in the 'Auditorium'**



### Meeting Rooms

- 1 Auditorium
- 2 Room Pacinotti
- 3 Room Fermi
- 4 Room Galilei
- 5 Room 1
- 6 Room 2
- 7 Room 3

## **DETAILED PROGRAM**

**Wednesday 22, 9:45-10:00 – Auditorium – WELCOME ADDRESS**

---

**Wednesday 22, 10:00-10:40 – Auditorium – KEYNOTE LECTURE 1**  
**Chairman: G.P. Celata**

---

**Drag, lift and virtual mass forces acting on a single bubble**  
*A. Tomiyama*  
Faculty of Engineering, Kobe University, Rokkodai Nada, Japan

**Wednesday 22, 10:40-11:10 – Coffee Break**

---

**Wednesday 22, 11:10-12:50 – Auditorium – SESSION BF1: Bubbly Flow 1**  
**Chairman: A. Clausse**

---

**Data analysis for hot-film anemometry in turbulent bubbly flow**  
*S. Luther, J. Rensen, T.H. van den Berg and D. Lohse*  
Department of Applied Physics and J.M. Burgers 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, J.M. Shi, E. Krepper and H.-M. Prasser*  
Forschungszentrum Rossendorf e.V., 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. Voutsinas, J. Kawaguchi and K. Tsujimoto*  
Mie University, Mie, Japan

**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

---

**Wednesday 22, 11:10-12:50 – Room Pacinotti – Session MIC1: Micro- & Minichannels 1**  
**Chairman: M. Kawaji**

---

**Non-stationary analysis of flow boiling in a minichannel**  
*D. Brutin and L. Tadrist*  
Ecole Polytechnique Universitaire de Marseille - Laboratoire I.U.S.T.I., Technopôle de Château-Gombert, 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\*\**

\*Department of Mechanical Engineering, Faculty of Engineering Kagoshima University,

Kagoshima, Japan, \*\*Department of Mech. Eng. Sci., Kyushu University, Fukuoka, 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

---

## **Wednesday 22, 11:10-12:50 – Room Fermi – Session TPM1: Two-Phase Flow Modeling 1**

**Chairman: R.T. Lahey**

---

### **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

### **A conservative scheme for the study of multi-dimensional two-phase 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

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

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

\*Regency Institute of Technology, Yanam, India, \*\*College of Engineering, GITAM, Visakhapatnam, India, \*\*\*College of Engineeringandhra University, Visakhapatnam, India, \*\*\*\*Department of Mechanical Engineering, University of Miami, Miami, USA

### **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

---

**Wednesday 22, 11:10-12:50 – Room Galilei – Session FP1: Fluid Particle Flow 1**  
**Chairman: A. Soldati**

---

**Bases for dust mobilisation modelling in the light of STARDUST experiments**

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

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

**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. Saccani\**

\*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

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

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

Institute of Mechanics, Department of Complex and Multiphase Flows, Sofia, Bulgaria

---

**Wednesday 22, 11:10-12:50 – Room 1 – Session MT1: Measurement Techniques 1**  
**Chairman: N. Daidzic**

---

**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*

University 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 in pulp-suspension flow**

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

Tampere University of Technology, Energy and Process Engineering, Tampere, Finland

---

**Wednesday 22, 11:10-12:50 – Room 2 – Session BB1: Bubbles 1**  
**Chairman: P. Stephan**

---

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

*K. Kadoguchi*

National Institute of Advanced Industrial Science and Technology, 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.S. Alves*

Centro de Eng. Biologica e Quimica, Department 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

---

**Wednesday 22, 11:10-12:50 – Room 3 – Session PDS1: Phase Distribution & Separation 1**

**Chairman: K. Mishima**

---

**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, 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, Nottingham, 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**

---

**Wednesday 22, 14:00-14:40 – Auditorium – KEYNOTE LECTURE 2**

**Chairman: P. Di Marco**

---

**Drag reduction with microbubble injection**

*Y. Hassan*

Texas A&M University, USA

---

**Wednesday 22, 14:45-16:05 – Auditorium – Session BF2: Bubbly Flow 2**

**Chairman: P. Di Marco**

---

**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, \*\*Department of Mechanical Engineering, Stanford University, Stanford, USA

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

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

\*Department of Mechanical Engineering, The University of Tokyo, Tokyo, Japan, \*\*Intelligent Modeling Laboratory, The University of Tokyo, Tokyo, Japan

**Bubble breakup by pressure wave in bubbly flow**

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

Department 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

---

**Wednesday 22, 14:45-16:05 – Room Pacinotti – Session MIC2: Micro- & Minichannels 2**

**Chairman: J.R. Thome**

---

**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. Bennacer\*\* 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\**, *K.K. Tio\*\** and *K.E. Chong\**

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

---

**Wednesday 22, 14:45-16:05 – Room Fermi – Session TPM2: Two-Phase Flow Modeling 2**

**Chairman: D. Lakehal**

---

**Simplified transient multiphase model for oil field development analysis**

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

\*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

---

**Wednesday 22, 14:45-16:05 – Room Galilei – Session FP2: Fluid Particle Flow 2**

**Chairman: M. Reeks**

---

**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 fluid) flowing in horizontal and vertical pipes**

*A. Legrand\**, *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.

---

**Wednesday 22, 14:45-16:05 – Room 1 – Session MT2: Measurement Techniques 2**  
**Chairman: M.H. Prasser**

---

**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 J.M. Burgers Center for Fluid Dynamics, Delft University of Technology, Delft, The Netherlands, \*\*Department of Applied Physics and J.M. Burgers Center for Fluid Dynamics, University of Twente, Enschede, 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. Schneebeli*

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, Ås, Norway

---

**Wednesday 22, 14:45-16:05 – Room 2 – Session BB2: Bubbles 2**  
**Chairman: J. Drahos**

---

**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

---

**Wednesday 22, 14:45-16:05 – Room 3 – Session PDS2: Phase Distribution & Separation 2**

**Chairman: S.Y. Lee**

---

**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, Vandoeuvre-lès-Nancy, France, \*\*LEMETA, Université Henri Poincaré, 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

**Neutral 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

---

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

---

**Wednesday 22, 16:35-18:35 – Auditorium – Session BF3: Bubbly Flow 3**

**Chairman: A. Tomiyama**

---

**Using geometrical automata to develop constitutive laws in bubbly flows**

*V. Herrero\**, *G. Venere\*\** 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, 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, Institute of Applied Mathematics, Dortmund, Germany

**Axial development of bubbly flow under microgravity environment**

*T. Takamasa\**, *T. Hazuku\**, *N. Tamura\**, *T. Hibiki\*\** and *M. Ishii\*\*\**

\*Faculty of Marine Technology, Tokyo University of Marine Science and Technology, Koto, Tokyo Japan, \*\*Research Reactor Institute, Kyoto University, Kumatori, Osaka, Japan, \*\*\*School of Nuclear Engineering, Purdue University, West Lafayette, USA

---

**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

---

**Wednesday 22, 16:35-18:35 – Room Pacinotti – Session MIC3: Micro- & Minichannels 3**

**Chairman: L. Tadrif**

---

**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

**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

**Experimental research on flow patterns in two-phase flow in microchannels**

*J.K. Keska*

Fluid Power and Mechanical Systems, University of Louisiana, Lafayette, USA

---

**Wednesday 22, 16:35-18:35 – Room Fermi – Session PMD: Particle Motion & Dynamics**

**Chairman: A. Paglianti**

---

**On the preferential concentration of inertial particles dispersed in a 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*

Department 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, Edinburgh, Scotland, UK

**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

**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

---

**Wednesday 22, 16:35-18:35 – Room Galilei – Session FP3: Fluid Particle Flow 3**  
**Chairman: M: Sommerfeld**

---

**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. Saccani*

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 University 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 Technical 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

---

**Wednesday 22, 16:35-18:35 – Room 1 – Session MT3: Measurement Techniques 3**  
**Chairman: G. Sotgia**

---

**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*

University of Minho, Braga, Portugal

**On-line measurement of dust concentration in the exhaust duct 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

**The use of fibre optic probes for flow monitoring within a small-scale tube**

*N. Reis\*, A.A. Vicente\*, J.A. Teixeira\* and M.R. Mackley\*\**

\*University of Minho, Braga, Portugal, \*\*Department of Chemical Engineering, University of Cambridge, UK

**Estimation of two-phase flow quality with pressure difference oscillation**

*M. Osakabe and S. Horiki*

Tokyo University of Marine Science & Technology, Tokyo, Japan

---

**Wednesday 22, 16:35-18:35 – Room 2 – Session BB3: Bubbles 3**  
**Chairman: Y. Hassan**

---

**Considering bubble size distributions in CFD simulations using a moment method**

*R. Jeschke, O. Gnotke and R. Loth*

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, 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. Stoica\*, O. Marinica\* and L. Vékás\*\**

\*National Research Center for Engineering of Systems with Complex Fluids, POLITEHNICA University of Timisoara, Romania, \*\*Laboratory of Magnetic Liquids, Romanian Academy - Timisoara Branch, Romania

**Electric field effects on bubbles of nitrogen in FC-72 originating from a flat plate**

*P. Di Marco, W. Grassi, A. Faini and G. Memoli*

LOTHAR, Dipartimento di Energetica “L. Poggi”, Università di Pisa, Pisa, Italy

**Turbulent bubbly flow in pipes**

*A.V. Gorin, A. Vakhguelt and S. Al-Zubaidy*

School of Engineering and Science, Curtin University of Technology, Curtin Sarawak, Miri, Sarawak, Malaysia

**Bubble nucleation in ducts (numerical simulation)**

*E.Yu. Kumzerova and A.A. Schmidt*

Computational Physics Laboratory, Ioffe Institute of RAS, St. Petersburg, Russia

---

**Wednesday 22, 16:35-18:35 – Room 3 – Session PDS3: Phase Distribution & Separation 3**

**Chairman: D. Mewes**

---

**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

**An application of Hele-Shaw kind flow in the devices for separation of multiphase mixtures**

*S.M. Drozdov*

Central Aerohydrodynamic Institute (TsAGI), Zhukovsky, Russia,

**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

---

**Thursday 23, 8:30-9:10 – Auditorium – KEYNOTE LECTURE 3**  
**Chairman: J.R. Thome**

---

**Heat transfer and crisis in swirl flow boiling**

*V.V. Yagov*

Moscow Power Engineering Institute (Technical University), Russia

---

**Thursday 23, 9:15-10:55 – Auditorium – Session BO1: Boiling Heat Transfer 1**  
**Chairman: W. Grassi**

---

**A 2D ill-posed problem in predicting boiling heat transfer coefficient**

*T. Orzechowski*

Kielce University of Technology, Kielce, Poland

**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, Jozef Stefan Institute, Ljubljana, Slovenia

**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

**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

---

**Thursday 23, 9:15-10:55 – Room Pacinotti – Session LL: Liquid-Liquid Systems**  
**Chairman: B.J. Azzopardi**

---

**Two-phase liquid-liquid flows in pipes of small diameters**

*A. Wegmann and P.R. 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 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

---

**Thursday 23, 9:15-10:55 – Room Fermi – Session CN1: Condensation 1**

**Chairman: R.J. Shyu**

---

**Numerical solution of transonic flow of condensing steam**

*J. Fort and J. Halama*

CTU Prague, Prague, Czech Republic

**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, Moscow, Russia, \*\*Institute for High Temperatures of Russian Academy of Sciences, Moscow, Russia

**Modeling of condensation-induced water hammer**

*J. Gale, I. Tiselj and I. Parzer*

Reactor Engineering Division, Jozef Stefan Institute, 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 de Valencia, \*\*\*CIEMAT, Department of Nuclear Fission, Madrid, \*\*\*\*Institute for Energy Engineering, Polytechnic University of Valencia Spain

**Numerical modeling of supersaturated vapor condensation: On the possibility of the experimental determination of the nucleation rate**

*N.M. Kortsenshteyn and E.V. Samuilov*

Krzhizhanovsky Power Engineering Institute, Moscow, Russia

---

**Thursday 23, 9:15-10:55 – Room Galilei – Session FP4: Fluid Particle Flow 4**

**Chairman: M. Sommerfeld**

---

**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 University of Technology, Kramers Lab. voor Fysische Technology, The Netherlands

**Non maxwellian behavior in sedimentation**

*C. Bounhoure, Y. Brunet and A. Merlen*

Laboratoire de Mecanique de Lille, Université de Lille, 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, Sophia Antipolis, France, \*\*Institut Non-Linéaire de Nice, Université de Nice Sophia Antipolis, Valbonne, France

**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

**Modeling and simulation of three-dimensional two-phase flows using finite elements and global Lagrange multipliers**

*C. Diaz-Goano\*, P. Minev\*\* and K. Nandakumar\**

\*Department of Chemical and Materials Engineering, \*\*Department of Mathematical and Statistical Sciences, University of Alberta, Edmonton, Alberta, Canada

---

**Thursday 23, 9:15-10:55 – Room 1– Session MT4: Measurement Techniques 4**  
**Chairman: A. Cartellier**

---

**Simultaneous measurement of the local solid phase velocity and the local solid hold-up in a three-phase flow using an X-ray based method**

*U. Kertzscher\*, A. Seeger\*, K. Affeld\* and E. Wellenhofer\*\**

\*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 fraction in horizontal oil-water pipe flow**

*G. Elseth\*, H. Kvandal\* and M.C. Melaaen\*\**

\*Norsk Hydro Oil & Energy, Porsgrunn, Norway, \*\*Telemark University College, Norway

---

**Thursday 23, 9:15-10:55 – Room 2 – Session DMD1: Drop Motion & Dynamics 1**  
**Chairman: M. Trela**

---

**The effects of plate thickness, surface tension and fluid flow on detachment of drops from a plate**

*A.S. Lexmond and C.W.M. van der Geld*

Technische Universiteit Eindhoven, Eindhoven, The Netherlands

**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, Brighton, UK, \*\*Faculty of Physics, Moscow State University, Moscow, Russia

**Controlling drop impact on cold and hot surfaces by polymer additives**

*V. Bertola*

Ecole Normale Supérieure, Paris, France

**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\*\*\**

\*Departamento de Engenharia Electromecânica, Universidade da Beira Interior, Covilhã, Portugal,

\*\*Departamento de Eng. Química, University de Coimbra, Coimbra, Portugal, \*\*\*Departamento de Ciências Aeroespaciais, University da Beira Interior, Covilhã, Portugal

**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

---

**Thursday 23, 9:15-10:55 – Room 3 – Session NM1: Numerical Modelling 1**  
**Chairman: R. Issa**

---

**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

**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. Sunden*

Division of Heat Transfer, Lund Institute of Technology, Lund, Sweden

**A priori testing of large-eddy simulation of particle-laden channel flow**

*J.G.M. Kuerten*

Eindhoven University of Technology, Eindhoven, The Netherlands

**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

**Thursday 23, 10:55-11:25 – Coffee Break**

---

**Thursday 23, 11:25-13:05 – Auditorium – Session BO2: Boiling Heat Transfer 2**  
**Chairman: J.H. Kim**

---

**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. Bagança Stelute\*\*\**

\*Laboratory of Heat and Mass Transfer (LTCM), École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, \*\*Escuela Politécnica Superior, Universidad de la Coruña, Ferrol, Coruña, Spain, \*\*\*Escola de Engenharia de São Carlos, Universidade de São Paulo, São Carlos, SP, Brazil

**Heat transfer regimes at subcooled water swirl flow**

*A.T. Komov, A.N. Varava, A.V. Dedov and V.V. Yagov*

Moscow Power Engineering Institute (Technical University), Russia

**Explosive vaporization dynamics on a flat microheater**

*V.V. Kuznetsov and E.S. Vasserman*

Institute of Thermophysics SB RAS, Novosibirsk, 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

**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

---

**Thursday 23, 11:25-13:05 – Room Pacinotti – Session PRD: Pressure Drop  
Chairman: T. Fukano**

---

**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*

Department 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*

Department 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

---

**Thursday 23, 11:25-13:05 – Room Fermi – Session CN2: Condensation 2  
Chairman: J.M. Corberan**

---

**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* and *J.L. Joly*

Laboratoire d'Energétique, Toulouse, France

**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

**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

---

**Thursday 23, 11:25-13:05 – Room Galilei – Session FP5: Fluid Particle Flow 5**

**Chairman: C. Saccani**

---

**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

**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, P.R. China

**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, Russia, \*\*Kazan State University, Kazan, Russia

---

**Thursday 23, 11:25-13:05 – Room 1 – Session MT5: Measurement Techniques 5**

**Chairman: H. Lemonnier**

---

**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\*\**

\*ICMMPM, University of Rome "La Sapienza", \*\*TOTAL E&P UK PLC, London, UK

**Isokinetic sampling in large scale high-pressure two-phase pipe flow**

*P. Hedne and P. Fuchs*

Statoil Research Centre, Trodheim, Norway

**Benchmarking of five-sensor probe method for interfacial area concentration measurement**

*D.J. Euh\*, 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

**Minor geometrical change from erosion affects the three-phase mass flow rate through chokes**

*S. Munaweera\*, T. Solbakken\*\* and R.B. Schüller\*\*\**

\*Norsk Hydro Oil and Energy Research Centre, Porsgrunn, Norway, \*\*Norsk Hydro Exploration and Operation, Bergen, Norway, \*\*\*Agricultural University of Norway, As, Norway

---

**Thursday 23, 11:25-12:25 – Room 2 – Session DMD2: Drop Motion & Dynamics 2**

**Chairman: M. Trela**

---

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

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

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

**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

**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, Milano, Italy

---

**Thursday 23, 12:25-13:05 – Room 2 – Session JE1: Jets 1**

**Chairman: B. Sunden**

---

**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, São Paulo, Brazil

---

**Thursday 23, 11:25-13:05 – Room 3 – Session NM2: Numerical Modelling 2**  
**Chairman: M. Giot**

---

**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, Universidad 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

**Thursday 23, 13:05-14:15 – Lunch**

---

**Thursday 23, 14:15-14.55 – Auditorium – KEYNOTE LECTURE 4**

**Chairman: M. Giot**

---

**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\*\**

\*Polytechnic of Milan, Milan, Italy, \*\*University of Modena and Reggio Emilia, Modena, Italy

---

**Thursday 23, 14:55-15:35 – Auditorium – KEYNOTE LECTURE 5**

**Chairman: J.M. Corberan**

---

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

*D. Butrymowicz*

Institute of Fluid-Flow Machinery, Gdansk, Poland

**Thursday 23, 15:35-16:05 – Coffee Break**

---

**Thursday 23, 16:05-18:05 – Auditorium – Session OUF: Oscillation, Instability & Unsteady Flow**

**Chairman: M. Podowski**

---

**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

**Modelling of instability of water and steam water flow in evaporator**

*K. Wojs and P. Szulc*

Institute of Heat Engineering and Fluid Mechanics, Wroclaw 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 Mecanique 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

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

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

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

---

**Thursday 23, 16:05-18:05 – Room Pacinotti – Session CO: Combustion**

**Chairman: L. d'Agostino**

---

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

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

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

**An experimental study on removal of NO<sub>x</sub> 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

**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

---

**Thursday 23, 16:05-16:45 – Room Fermi – Session CN3: Condensation 3**

**Chairman: J.M. Corberan**

---

**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

---

**Thursday 23, 16:45-18:05 – Room Fermi – Session SF1: Slug Flow 1**

**Chairman: C. Alimonti**

---

**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. Química, 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

---

**Thursday 23, 16:05-18:05 – Room Galilei – Session FP6: Fluid Particle Flow 6**

**Chairman: T. Skiepko**

---

**Particle dynamics in a vortex pair**

*F. Kaplanski\*, S. Sazhin\*\* and Y. Rudi\**

\*Tallinn University of Technology, Laboratory of Multiphase Media Physics, 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

**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 Department of Metal. Eng., Hebei University of Technology, Tangshan, China

**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

---

**Thursday 23, 16:05-18:05 – Room 1 – Session MT6: Measurement Techniques 6**  
**Chairman: T. Takamasa**

---

**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, Department 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/SSTH, 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

**Gas-liquid phase distribution and void fraction measurements using the MRI**

*N.E. Daidzic\*, E. Schmidt\*, M.M. Hasan\* and S. Altobelli\*\**

\*NCMR, NASA-GRC, Cleveland, USA, \*\*New Mexico Resonance, Albuquerque, NM, USA

---

**Thursday 23, 16:05-18:05 – Room 2 – Session JE2: Jets 2**  
**Chairman: B. Sunden**

---

**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

**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, \*\*Department of Mechanophysics Engineering, Osaka University, Japan

**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\**

\*Université Henri Poincaré - Nancy 1, Vandoeuvre, France, \*\*ARCELOR/IRSID - Process Engineering, Mazières-les-Metz, France

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

*N. Seiler\*, P. Gardin\*\*, O. Simonin\*\*\* and S. Mimouni\**

\*EDF R&D MFTT I81, Chatou, France, \*\*IRSID/PE, Maizières-lès-Metz, France, \*\*\*IMFT Toulouse, France

**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

---

**Thursday 23, 16:05-18:05 – Room 3 – Session MX: Mixtures**

**Chairman: G.F. Hewitt**

---

**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

**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, Toronto, Ontario, Canada

**Mixing of viscous binary mixtures**

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

\*Department of Astronomy and Astrophysics, University of Chicago, Chicago, USA, \*\*Dipartimento di Ingegneria Chimica, Pisa, Italy

**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

---

**Friday 24, 8:30-9:10 – Auditorium – KEYNOTE LECTURE 6**  
**Chairman: R.T. Lahey**

---

**DNS and LES of turbulent multifluid flows**

*D. Lakehal*

ETH, Zurich, Switzerland

---

**Friday 24, 9:15-10:55 – Auditorium – Session CHF: Critical Heat Flux**  
**Chairman: G.P. Celata**

---

**The effect of porous coating on 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. Rempe\*\*, 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, Taejon, Korea

**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 Key Laboratory of Bubble Physics and Natural Circulation, Nuclear Power Institute of China, Chengdu, China

**An experimental study of third heat transfer crisis at stepwise power generation**

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

\*Vinnitsa Institute of Trade and Economics of Kiev National University of Trade and Economics, Ukraine, \*\*Institute of Thermophysics SB RAS, Novosibirsk, Russia

---

**Friday 24, 9:15-10:55 – Room Pacinotti – Session TUR1: Turbulence 1**  
**Chairman: K. Hishida**

---

**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, Vandoeuvre-lès-Nancy, France

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

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

ESSTIN, Henri Poincaré University, Vandoeuvre-lès-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. Shishikura\* and T. Usui\**

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

Department of Mechanical Engineering, McMaster University, Hamilton, Canada

---

**Friday 24, 9:15-10:55 – Room Fermi – Session SF2: Slug Flow 2**

**Chairman: C: Alimonti**

---

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

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

Instituto Mexicano del Petróleo, 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 a single gas slug in stagnant liquid: Influence of liquid viscosity and tube diameter**

*M.A.R. Talaia*

Physics Department, University of Aveiro, Aveiro, Portugal

**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

---

**Friday 24, 9:15-10:55 – Room Galilei – Session IP1: Interfacial Phenomena 1**

**Chairman: I. Zun**

---

**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. Tadrif*

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. Dekhtyar*

Institute of Thermophysics SB RAS, Novosibirsk, Russia

### **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

---

## **Friday 24, 9:15-10:55 – Room 1 – Session IA1: Two-Phase Flow Equipment & Industrial Applications 1**

**Chairman: A.G. Chavez**

---

### **Rotating sorbent reactor**

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

Eindhoven University of Technology, Eindhoven, The Netherlands

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

*D.P. Souza*, *E.A. Borges da Silva*, *S.M.A. Guelli U. de Souza* and *A.A. Ulson de Souza*

Federal University of Santa Catarina, Department of Chemical and Food Engineering, Florianópolis, Brazil

### **Thermodynamic effects on hydrofoil and inducer cavitation**

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

\*Dipartimento 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. Srivastava*

Corporate Research and Engineering Division, Kirloskar Brothers Limited, 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., Russia, \*\*Lomonosov Moscow State University, Moscow, Russia

---

## **Friday 24, 9:15-10:55 – Room 2 – Session MNB: Mass Transfer & Non-Boiling Heat Transfer**

**Chairman: B. Panella**

---

### **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*

Department 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

**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

**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

---

**Friday 24, 9:15-10:55 – Room 3 – Session PBPM1: Packed Beds & Porous Media 1**  
**Chairman: R.K. Shah**

---

**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 Department 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

**Comparison 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. Różanski*

Poznan University of Technology, Poland

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

---

**Friday 24, 11:25-13:05 – Auditorium – Session BMD1: Bubble Motion & Dynamics 1**  
**Chairman: M. Ruzicka**

---

**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

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

*M. Barbaglia and F. Bonetto*

CONICET, Instituto Balseiro, S.C. de Bariloche, 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

---

**Friday 24, 11:25-13:05 – Room Pacinotti – Session TUR2: Turbulence 2**  
**Chairman: B. Oesterle**

---

**Prediction performance of a thermodynamically consistent turbulence modulation for multiphase flows**

*M. Chrigui and A. Sadiki*

Institute for Energy and Power Plant Technology, Technical University of 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*

Institute for Energy and Power Plant Technology, Technical University of Darmstadt, Germany

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

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

Department of Aeronautics and Astronautics, National Cheng Kung University, Tainan, Taiwan

**Numerical study of turbulent heat transfer in an inclined 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

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

*A. Aliseda and J.C. Lasheras*

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

---

**Friday 24, 11:25-13:05 – Room Fermi – Session FS1: Flow Structure 1**  
**Chairman: J.B.L.M. Campos**

---

**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, UK

**Bubble size distributions and three-dimensional flow pattern visualization in stationary and transient upward flashing flow**

*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., 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 Engineering, Shanghai Jiao Tong University, Shanghai, China

---

**Friday 24, 11:25-13:05 – Room Galilei – Session IP2: Interfacial Phenomena 2**  
**Chairman: A. Mariani**

---

**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 Manufacturing Engineering, University of Manitoba, Winnipeg, Manitoba, Canada

**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

**Influence of liquid content in foam flow on heat transfer intensity**

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

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

**Dynamic wetting angle of a spreading droplet**

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

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

---

**Friday 24, 11:25-13:05 – Room 1 – Session IA2: Two-Phase Flow Equipment & Industrial Applications 2**

**Chairman: T. Skiepko**

---

**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

**Analysis and experimental investigation of a bubble pump for absorption diffusion refrigeration systems**

*A. Franco*

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

**Heat exchangers and thermal systems for fuel cell systems**

*R.K. Shah*

Rochester Institute of Technology, Rochester, NY, USA

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

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

Lithuanian Energy Institute, Kaunas, Lithuania

---

**Friday 24, 11:25-13:05 – Room 2 – Session FF: Falling Films**

**Chairman: W. Ambrosini**

---

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

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

\*Department of Chemical Engineering, Aristotle University of Thessaloniki, 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 and 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

---

**Friday 24, 11:25-13:05 – Room 3 – Session PBPM2: Packed Beds & Porous Media 2**  
**Chairman: R.K. Shah**

---

**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, Florianópolis, Brazil

**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

**Friday 24, 13:05-14:15 – Lunch**

---

**Friday 24, 14:15-14:55 – Auditorium – KEYNOTE LECTURE 7**

**Chairman: A. Soldati**

---

**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

---

**Friday 24, 15:00-17:00 – Auditorium – Session BMD2: Bubble Motion & Dynamics 2**

**Chairman: S. Takagi**

---

**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 and subcooled 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\*\**

\*Institute of Mechanics, Russian Academy of Sciences, Ufa, Russia, \*\*Department Of Mech. Eng. And Applied Mechanics, North Dakota State University, Fargo, USA

**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, USA, \*\*NASA

Glenn Research Center, Cleveland, OH, USA, \*\*\*ME Department, The University of Michigan, Ann Arbor, MI, USA

---

**Friday 24, 15:00-17:00 – Room Pacinotti – Session WA: Waves**

**Chairman: D. Markovich**

---

**Periodic travelling waves of finite amplitude in two-layer flow**

*A. Boudlal*

Laboratoire de Mecanique de Lille -UMR 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*, *R.T. Lahey, Jr.* and *F.J. Moraga*

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

**A study of two-body forces in fluidization**

*B.A. Kashiwa* and *R.M. Rauenzahn*

Los Alamos National Laboratory, Los Alamos, NM, USA

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

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

Institute of Thermophysics SB RAS, Novosibirsk, Russia

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

*C. Frepoli* and *K. Ohkawa*

Westinghouse Electric Co. Nuclear Services Division, Pittsburg, USA

---

**Friday 24, 15:00-17:00– Room Fermi – Session NR1: Nuclear Reactor Safety 1**

**Chairman: Z.H. Lin**

---

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

*L. Muñoz-Cobo\**, *S. Chiva\*\** and *A. Escrivá\**

\*Department of Chemical and Nuclear Engineering, Polytechnic University of Valencia,

\*\*Department of Technology, Jaume I University, Castellon, Spain

**Gas driven circulation enhancement in an adiabatic air-water loop**

*M. De Salve*, *M. Malandrone* and *B. Panella*

Politecnico di Torino, Italy

### **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, Pisa, Italy

### **Experimental study on combined natural and gas-injection enhanced circulation**

*W. Ambrosini, G. Forasassi, N. Forgone, F. Oriolo and M. Tarantino*

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

### **Demonstration of the heat removing capabilities of the EPR core catcher**

*M. Fischer, O. Herbst and H. Schmidt*

Framatome, Erlangen, Germany

---

## **Friday 24, 15:00-17:00- Room Galilei – Session EV1: Evaporation 1**

**Chairman: E. Latrofa**

---

### **Study about the flashing process through a metering expansion valve**

*M.A. Bahajji, J.M. Corberàn, J. Urchueguà, J. Gonzalez and J. Santiago*

Instituto de Ingeniería Energética, Universidad Politécnica de Valencia, Valencia, Spain

### **Transient and steady-state computations of the direct-contact evaporation of a two-phase drop**

*F. Dammal 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. Bänsch\**

\*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. Louahli-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 partially filled tanks**

*S. Prasanth Kumar\**, *B.V.S.S.S. Prasad\**, *G. Venkatarathnam\**, *S. Srinivasamurthy\** and *K. Ramamurthi\*\**

\*Department of Mechanical Engineering, IIT Madras, Chennai, India, \*\*LPSC, ISRO, Valiamala, Kerala, India

---

**Friday 24, 15:00-17:00 – Room 1 – Session EH1: Enhancement of Heat Transfer 1**  
**Chairman: P. Tartarini**

---

**Enhancement of heat transfer in subcooled flow boiling with microbubble emission**

*K. Suzuki, T. Kokubu, M. Nakano, H. Kawamura and I. Ueno*

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

**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\*\* and 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

**A dynamic model for pool boiling heat transfer on enhanced surfaces with sub-surface channels**

*Y.M. Chen, M. Groll and R. Mertz*

IKE, Stuttgart, Germany

---

**Friday 24, 15:00-17:00 – Room 2 – Session AS: Atomization & Sprays**  
**Chairman: V. Bertola**

---

**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 the mixing chamber of an effervescent atomizer**

*J. Jedelsky and M. Jícha*

Brno University 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

---

**Friday 24, 15:00-17:00 – Room 3 – Session TJ: T-Junctions**

**Chairman: S.Y. Lee**

---

**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, Nottingham, 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, 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 flow direction on flow distribution characteristics of two-phase refrigerant 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**

---

**Friday 24, 17:30-19:10 – Auditorium – Session BMD3: Bubble Motion & Dynamics 3**

**Chairman: C.W.M. van der Geld**

---

**Break-up of bubbles and droplets in stagnant media**

*P. Budzynski and M. Dziubinski*

Faculty of Process and Environmental Engineering, Łódź Technical University, Łódź, Poland

**Approximations to the drag coefficient on a bubble moving through power-law or carreau fluid**

*M. Dziubinski, M. Orczykowska and P. Budzynski*

Faculty of Process and Environmental Engineering, Lodz Technical University, Poland

**A single bubble impact on the wall in upward laminar bubbly flow**

*O.N. Kashinsky, L.S. 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

### **Analysis of air bubbles probability distribution functions in a large-size dropshaft**

*C. Gualtieri\* and H. Chanson\*\**

\*Hydraulic and Environmental Engineering Department "Girolamo Ippolito", University of Napoli "Federico II", Napoli, Italy, \*\*Department of Civil Engineering, The University of Queensland, Brisbane, Australia

---

## **Friday 24, 17:30-19:10 – Room Pacinotti – Session FS2: Flow Structure 2**

**Chairman: A. Sou**

---

### **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 University of Technology, Delft, The Netherlands

### **R134A flow patterns in small diameter tubes**

*L. Chen\*, Y.S. Tian\*\* and T.G. Karayiannis\**

\*Department of Engineering Systems, London South Bank University, London, UK, \*\*Aspentech Inc., Didcot, UK

---

## **Friday 24, 17:30-19:10 – Room Fermi – Session NR2: Nuclear Reactor Safety 2**

**Chairman: F. Oriolo**

---

### **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

---

**Friday 24, 17:30-19:10 – Room Galilei – Session EV2: Evaporation 2**  
**Chairman: B.V.S.S.S. Prasad**

---

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

*G. Raush, 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, Université 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, Pisa, Italy

**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

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

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

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

---

**Friday 24, 17:30-19:10 – Room 1 – Session EH2: Enhancement of Heat Transfer 2**  
**Chairman: D. Butrymowicz**

---

**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, A. Glezer, S. Tillery and M. Smith*

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

**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

**Enhanced heat transfer using radial fins**

*R.N. Krikkis and P. Razelos*

Institute of Thermal Sciences, Athens, Greece

**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

---

**Friday 24, 17:30-19:10 – Room 2 – Session OW: Oil-Water Flow**

**Chairman: P. Tartarini**

---

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

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

\*Università di Bologna, Bologna, Italy, \*\*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. Bannwart\*, O.M.H. Rodriguez\*, F.E. Trevisan\*, F.F. Vieira\* and C.H.M. de Carvalho\*\**

\*Faculty of Mechanical Engineering, Department of Petroleum Engineering, UNICAMP, Brazil, \*\*PETROBRAS, CENPES/PDP/TE, Brazil

**Measurement uncertainty applied to the main parameters in oil-water flows and 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**

*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



# **SPECIAL MINI-SYMPOSIUM FOR THE 65TH BIRTHDAY OF PROF. RICHARD LAHEY**

**Saturday 25, 8:30-8:50 – Auditorium – Introductions: P. Di Marco / R. P. Taleyarkhan**

---

**Saturday 25, 8:50-10:50 – Auditorium –  
Chairman: P. Di Marco**

---

**The simulation of multidimensional multiphase flows**

*R.T. Lahey, Jr.*

Rensselaer Polytechnic Institute, Troy, NY, USA

**Vapor explosion studies for nuclear and non-nuclear industries**

*R.P. Taleyarkhan*

Purdue University, W. Lafayette, IN, USA

**The theory of supercompression of vapor bubbles and nano-scale thermonuclear fusion**

*R.I. Nigmatulin*

Russian Academy of Sciences, Ufa, Russia

**Saturday 25, 10:50-11:10 – Coffee break**

---

**Saturday 25, 11:10-13:10 – Auditorium –  
Chairman: R. Taleyarkhan**

---

**Three-phase gas-liquid-liquid-liquid flows in the steady and transient states**

*G.F. Hewitt*

Imperial College of London, UK

**Boiling water reactor stability revisited**

*G. Yadigaroglu*

Swiss Federal Institute of Technology, Zurich, Switzerland

**Nanostructure computation with coupled momentum phase-ordering kinetics models**

*S. Banerjee*

University of California at Santa Barbara, CA, USA

**Saturday 25, 13:10 – Lunch**



1. **Accademia Palace Hotel**, Viale Gronchi (out of the map)
  2. **Ariston**, via Cardinale Maffi 42
  3. **Bologna**, via Mazzini 57
  4. **California**, via Aurelia km.338, Madonna dell'Acquai (out of the map)
  5. **Euro Hotel**, via Nazario Sauro, Cascina (out of the map)
  6. **Granduca**, via Statale Brennero 13, S. Giuliano Terme (out of the map)
  7. **La Pace**, V.le Gramsci, Galleria B
  8. **Repubblica Marinara**, via Matteucci 81
  9. **Royal Victoria Hotel**, Lungarno Room Pacinotti 12
  10. **Touring**, via Puccini 24
  11. **Verdi**, Piazza della Repubblica 5
- Congress Palace**, Via Matteotti, 1 (Symposium place)
- B. La stazione Leopolda**, Piazza Guerrazzi (Banquet)