

# ExHFT-5

## 5th World Conference on Experimental Heat Transfer, Fluid Mechanics, and Thermodynamics

*Thessaloniki, 24-28 September 2001*



*Organized by*

THE ASSEMBLY OF WORLD CONFERENCES  
ON EXPERIMENTAL HEAT TRANSFER, FLUID MECHANICS AND THERMODYNAMICS

*and*

ENEA INSTITUTE OF THERMAL-FLUID DYNAMICS  
DEPARTMENT OF MECHANICAL ENGINEERING, ARISTOTLE UNIVERSITY OF THESSALONIKI  
DEPARTMENT OF ENERGETICS, UNIVERSITY OF PISA

*with participation of the*

INTERNATIONAL CENTRE FOR HEAT AND MASS TRANSFER (ICHMT)

*and*

ITALIAN UNION OF THERMAL-FLUID-DYNAMICS (UIT)

# FINAL PROGRAM

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ENEA, ITFD, Institute of Thermal-Fluid Dynamics, CR Casaccia, Rome, ITALY

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A.S. Mujumdar, National University of Singapore, Singapore  
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G. Yadigaroglu, Institut für Energietechnik ETH, Zurich, Switzerland  
J.Y. Yoo, Seoul National University, Seoul, Korea  
S.M. Zubair, King Fahd Univeristy of Petroleum & Minerals, Dhahran, Saudi Arabia  
I. Zun, University of Ljubljana, Ljubljana, Slovenia

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We are happy to welcome you to ExHFT-5, the 5th World Conference on Experimental Heat Transfer, Fluid Mechanics, and Thermodynamics. Authors from over 40 countries have contributed to this Conference.

The objectives of ExHFT-5 are to bring together again experimental researchers and those in industry who are active in the areas of thermal and fluid science and engineering, to exchange their expertise, experiences and insights in many research areas in a spirit of cooperation and friendship, and to further stimulate their research activities. All participants will have an opportunity to become informed on:

- advances in the understanding of basic phenomena of heat transfer and fluid flow through conventional and sophisticated experiments
- the state-of-the-art in experimental techniques and instrumentation
- innovative applications of research results in an interdisciplinary environment
- validity of experimental results in many fields
- definition and needs for further measurements
- experience gained and lessons learned from new measuring techniques and design of research facilities

## **VENUE**

### **Location**

The Conference will be held in Thessaloniki, Greece. Thessaloniki, the second largest city in Greece with a population of 1.000.000, is one of the oldest cities in Europe. It stretches over twelve kilometres in a bowl formed by low hills facing a bay that opens into the Gulf of Thermaikos. Founded about 315 B.C., on a site of old prehistoric settlements going back to 2300 B.C., by Cassander, king of Macedonia, it was named after his wife, Thessaloniki, the sister of Alexander the Great. Since then, Thessaloniki has become the main city of Macedonia and its most important commercial port.

Among the numerous monuments from Roman and Byzantine times are those from the Roman period, the Triumphal Arch of Galerius and the Rotonda. Many churches whose fine mosaics and wall-paintings are representative of various periods of Byzantine art have survived to enhance the image of the city. They include St. Demetrius, Panagia (Virgin) Acheiropoietus (i.e. not made by human hand), the Holy Apostles, St. Sophia, St. Catherine, Panagia Chalkeon (i.e. of the coppersmiths), St. Nicholas the Orphan, the Prophet Elijah, and the Monastery of Vlatadon. Large sections of the city-walls are still standing, including the landmark of the city, the White Tower. Also, noteworthy from a national, spiritual and cultural viewpoint are the continuing strong bonds between the city of Thessaloniki and Mt. Athos.

The modern era of material and cultural development in Thessaloniki dates from its liberation from the Turkish occupation in 1912. Thessaloniki then became the major city of Northern Greece. The Ministry of Macedonia and Thrace, the Cathedral, and a Court of Justice, in addition to other major Government institutions, are situated in the city. The town has two quite distinct sectors: The "old town", which is continuously undergoing reconstruction, and the modern sector, with many examples of advanced architecture.

In addition to the University of Thessaloniki, there are numerous institutions that contribute to the academic and cultural life of the city. Among them are the University of Macedonia, the Thessaloniki Polytechnic (TEI), the Archaeological and Byzantine Museums, the Folklore Museum, the State Conservatory, Theatre and Orchestra, the Society of Macedonian Studies and the Institute of Balkan Studies.

Thessaloniki is a flourishing city which thrives on financial activities and is one of the most significant trade and communication centres in the Mediterranean. It has an international airport, a port providing facilities to other Balkan countries, an internationally important industrial complex and an annual International Trade Fair. During 1997 Thessaloniki was the Cultural Capital of Europe.

### **Meeting Place**

The Conference will take place from 24 to 28 September 2001, at the HELEXPO Conference Center J. Germanos, 154 Egnatia Street, 546 36 Thessaloniki, Greece.

## **Liability and Insurance**

It is regretted that neither the organizers nor Eurostar-Travel Plan can accept any responsibility for injury or damage to persons or property during the Conference. 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 timing 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. Speakers are requested to bring their own notebook. Slide projector is available upon request.

## **OPEN FORUM SESSION**

Due to the interest in the Conference 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 Conference 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 Conference.

Although the posters can be displayed the whole week, authors are requested to stay in front of their poster for discussion with participants on WEDNESDAY 26 SEPTEMBER from 14:00 to 15:00.

## **REGISTRATION**

### **Fees**

Full registration	600 Euro
Student (certification required)	550 Euro
Accompanying persons	60 Euro

Full and student registrations include participation to all technical sessions, a copy of bound Conference proceedings, lunches and coffee-breaks during the days of the Conference, and a banquet on September 26 evening (details at the registration).

Accompanying persons fee includes participation to the banquet on September 26.

The Grecian currency is the Greek Drachma (GRD). Drachma is part of the Euro currency system and the fixed exchange rate is 1 EUR = 340.75 GRD

### **Registration Hours**

Sunday 23	15:00 - 19:00
Monday 24 through Thursday 27	08:30 - 12:30 & 14:30 - 17:30
Friday 28	08:30 - 12:30

### **METHODS OF PAYMENT**

**By credit card** (Visa, MasterCard, Eurocard, American Express)

**Cash**, Major currencies may be accepted at the exchange rate of the day.

## SYNOPSIS

start	end	<b>Monday 24</b>	Room 1	Room 2	Room 3	Room 4	Room 5
9:30	10:00	Welcome Address & Nu-Re Prize					
10:00	10:40	Nusselt-Reynolds Lecture 1 (Bergles)					
10:40	11:20	Nusselt-Reynolds Lecture 2 (Adrian)					
11:20	11:40	<i>Coffee-Break</i>					
11:40	12:20	Keynote Lecture 1 (Azzopardi)					
12:20	13:00	Keynote Lecture 2 (Grassi)					
13:00	14:00	<i>Lunch</i>					
14:00	14:40	Keynote Lecture 3 (Brouwers)					
14:40	16:20	<b>Sessions (24/1)</b>	<b>JE-AR</b>	<b>MT-IMT 1</b>	<b>TH-FPB 1</b>	<b>HTE 1</b>	<b>TH-PD 1</b>
16:20	16:40	<i>Coffee-Break</i>					
16:40	18:20	<b>Sessions (24/2)</b>	<b>JE-IHT</b>	<b>MT-IMT 2</b>	<b>TH-FPB 2</b>	<b>HTE 2</b>	<b>TH-PD 2</b>
18:20		End of Sessions					
		<b>Tuesday 25</b>					
8:20	9:00	Keynote Lecture 4 (Zun)					
9:00	10:40	<b>Sessions (25/1)</b>	<b>JE-GE 1</b>	<b>MT-IMT 3</b>	<b>MM-BF</b>	<b>HTE 3</b>	<b>TH-TBL 1</b>
10:40	11:00	<i>Coffee-Break</i>					
11:00	12:40	<b>Sessions (25/2)</b>	<b>JE-GE 2</b>	<b>MT-IMT 4</b>	<b>PEA-HEX 1</b>	<b>TT-RC 1</b>	<b>TH-TBL 2</b>
12:40	13:40	<i>Lunch</i>					
13:40	14:20	Keynote Lecture 5 (Karabelas)					
14:20	16:00	<b>Sessions (25/3)</b>	<b>JE-GE 3</b>	<b>MT-IMT 5</b>	<b>PEA-HEX 2</b>	<b>TT-RC 2</b>	<b>MM-DD</b>
16:00	16:20	<i>Coffee-Break</i>					
16:20	18:20	<b>Sessions (25/4)</b>	<b>MM-TJ</b> <b>TH-SWP 1</b>	<b>TT-MT 1</b>	<b>PEA-HEX 3</b>	<b>BO-FB</b>	<b>MM-FS</b>
18:20		End of Sessions					
		<b>Wednesday 26</b>					
8:20	9:00	Keynote Lecture 6 (Azevedo)					
9:00	11:00	<b>Sessions (26/1)</b>	<b>TH-SWP 2</b>	<b>TT-MT 2</b> <b>FD-RF</b>	<b>NR 1</b>	<b>PEA-IA</b>	<b>MM-BD</b>
11:00	11:20	<i>Coffee-Break</i>					
11:20	13:00	<b>Sessions (26/2)</b>	<b>TT-HR</b>	<b>BO-CHR</b>	<b>NR 2</b>	<b>CF-NC 1</b>	<b>CO-GE 1</b>
13:00	14:00	<i>Lunch</i>					
14:00	15:00	<b>Open Forum Session</b>					

start	end	Thursday 27	Room 1	Room 2	Room 3	Room 4	Room 5
8:20	9:00	Keynote Lecture 7 (Kobayashi)					
9:00	9:40	Keynote Lecture 8 (Alekseenko)					
9:40	10:20	Keynote Lecture 9 (Kataoka)					
10:20	10:40	<i>Coffee-Break</i>					
10:40	12:20	<b>Sessions (27/1)</b>	<b>CN 1</b>	<b>TH-TLF 1</b>	<b>TT-FMS</b>	<b>CF-NC 2</b>	<b>CO-GE 2</b>
12:20	13:20	<i>Lunch</i>					
13:20	14:00	Keynote Lecture 10 (Auracher)					
14:00	15:40	<b>Sessions (27/2)</b>	<b>CN 2</b>	<b>TH-TLF 2</b>	<b>BO-PB 1</b>	<b>CF-NC 3</b>	<b>CO-EM</b>
15:40	16:00	<i>Coffee-Break</i>					
16:00	16:40	Keynote Lecture 11 (Kandlikar)					
16:40	18:20	<b>Sessions (27/3)</b>	<b>TH-UF 1</b>	<b>TH-TLF 3 MT-TP 1</b>	<b>BO-PB 2</b>	<b>CF-NMC</b>	<b>CO-ER</b>
18:20		End of Sessions					
		<b>Friday 28</b>					
8:20	9:00	Keynote Lecture 12 (Yoo)					
9:00	10:40	<b>Sessions (28/1)</b>	<b>TH-UF 2</b>	<b>MT-TP 2</b>	<b>BO-BHT 1</b>	<b>MM-AS</b>	<b>MM-PDD</b>
10:40	11:00	<i>Coffee-Break</i>					
11:00	11:40	Keynote Lecture 13 (Sacadura)					
11:40	13:20	<b>Sessions (28/2)</b>	<b>FD-VF 1</b>	<b>TNB-GE 1</b>	<b>BO-BHT 2</b>	<b>MM-GE</b>	<b>CF-CHT</b>
13:20	14:20	<i>Lunch</i>					
14:20	15:00	Keynote Lecture 14 (Nishioka)					
15:00	16:40	<b>Sessions (28/3)</b>	<b>FD-VF 2</b>	<b>TNB-GE 2</b>	<b>FD-GE</b>	<b>MM-FL</b>	<b>TH-NC</b>
16:40		<b>Closure</b>					

### Session Keyword

<b>BO - Boiling Heat Transfer</b>	<b>MM - Multi-Component and Multi-Phase Flows</b>
BO - PB Pool Boiling	MM - BF Bubbly Flow
BO - BHT Boiling Heat Transfer	MM - FS Flow Structure and Flow Transition
BO - FB Flow Boiling	MM - BD Bubble Dynamics
BO - CHR Critical Heat Flux and Rewetting	MM - DD Droplet Dynamics
	MM - PDD Particle and Droplet Dynamics
<b>CN - Condensation</b>	MM - TJ T-Junctions
	MM - FL Flooding
<b>CO - Combustion</b>	MM - GE General Studies
CO - ER Emission Reduction	MM - AS Atomization and Sprays
CO - EM Experimental Methods	
CO - GE General Studies	<b>NR - Nuclear Reactor Safety</b>
	<b>PEA - Process Equipment and Application</b>
<b>CF - Convective Flow</b>	PEA - IA Industrial Applications
CF - NMC Natural and Mixed Convection	PEA - HTE Heat Transfer Enhancement
CF - NC Natural Convection	
CF - CHT Convective Heat Transfer	<b>TH - Thermalhydraulics</b>
	TH - FPB Fluidized and Packed Beds
<b>FD - Fluid-Dynamics</b>	TH - NC Natural Circulation
FD - RF Rotating Flows	TH - PD Pressure Drops
FD - VF Vortex Flows	TH - TLF Liquid Films
FD - GE General	TH - SWP Shock Waves and Wave Propagation
	TH - TBL Turbulence and Boundary Layers
<b>HEX - Heat Exchangers</b>	TH - UF Unstable and Unsteady Flows
	<b>TT - Thermodynamics &amp; Heat and Mass Transfer</b>
<b>JE - Jets</b>	TT - RC Refrigeration and Cooling
JE - AR Jet Arrays	TT - FMS Freezing, Melting and Solidification
JE - IHT Jet Impingement Heat Transfer	TT - HR Heat Recovery
JE - GE General Studies	TT - GE General
<b>MT - Measurement Techniques</b>	TT - MT Mass Transfer
MT - IMT Instrumentation	
MT - TP Thermophysical Properties	

**Monday 24, 9:30-10:00 - Plenary Room - Welcome Addresses, Nusselt-Reynolds Prize**

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**Monday 24, 10:00-10:40 - Plenary Room - Nusselt-Reynolds Prize Lecture 1**  
**Chairman: N. Kasagi**

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**ExHFT for Fourth-Generation Heat Transfer Technology**

*A.E. Bergles*

Rensselaer Polytechnic Institute, New York and University of Maryland, Maryland, USA

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**Monday 24, 10:40-11:20 - Plenary Room - Nusselt-Reynolds Prize Lecture 2**  
**Chairman: R.K. Shah**

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**Scaling of Velocity and Temperature Fluctuations in Turbulent Thermal Convection**

*R.L.J. Fernandes and R.J. Adrian*

Department of Theoretical and Applied Mechanics, University of Illinois, Urbana, USA

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**Monday 24, 11:20-11:40 - Coffee Break**

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**Monday 24, 11:40-12:20 - Plenary Room - Keynote Lecture 1**  
**Chairman: C.W.M. van der Geld**

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**Similarities and Differences between Gas/Liquid and Liquid/Liquid Flows**

*B.J. Azzopardi*

School of Chemical, University of Nottingham, Nottingham, U.K.

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**Monday 24, 12:20-13:00 - Plenary Room - Keynote Lecture 2**  
**Chairman: P. Stephan**

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**Motivation and Results of a Long-Term Research on Pool Boiling Heat Transfer in Low Gravity**

*W. Grassi*

University of Pisa, Department of Energetics, Pisa, Italy

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**Monday 24, 13:00-14:00 - Lunch**

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**Monday 24, 14:00-14:40 - Plenary Room - Keynote Lecture 3**  
**Chairman: T. Skiepko**

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**Phase Separation in Centrifugal Fields with Emphasis on the Rotational Particle Separator**

*J.J.H. Brouwers*

Department of Mechanical Engineering, Technische Universiteit Eindhoven, Eindhoven, The Netherlands

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**Monday 24, 14:40-16:20 - Room 1 - Session Jets: Jet Arrays**  
**Chairman: D. Mikielewicz**

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**Heat Transfer of Phase-Locked Modulated Impinging-Jet Arrays**

*G.C.J. Bart, A.J. van Ijzerloo, L.F.G. Geers, L. Hoek and K. Hanjalic*

Department of Applied Physics, Delft University of Technology, Delft, The Netherlands

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**Local Heat-Transfer Characteristics of Impinging Jets in In-Line and Staggered Arrays**

*R. Matsumoto\*, I. Ishihara\* and Y. Nakatsuka\*\**

\*Department of Mechanical Systems Engineering, Kansai University, Osaka, \*\*Kansai Chemical Engineering Co., Hyogo, Japan

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**Heat/Mass Transfer Characteristics of Arrays of Impingement Jets with Effusion Holes**

*H.H. Cho, P.H. Yoon, D.H. Rhee*

Department of Mechanical Engineering, Yonsei University, Seoul, Korea

**Impingement of Inline and Staggered Arrays of Jets with and without Initial Crossflow-Local and Average Heat Transfer Measurements**

*P. Brevet, E. Dorignac, M. Jolly and J.J. Vullierme*

Laboratoire d'études thermiques, ENSMA, Futuroscope Chasseneuil Cedex, France

**Flows Generated by the Impingement of Inline and Staggered Arrays of Jets**

*L.E. Brizzi, P. Brevet and C. Dejeu*

Laboratoire d'études aérodynamiques, Futuroscope Chasseneuil Cedex, France

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**Monday 24, 14:40-16:20 - Room 2 - Session Measurement Techniques: Instrumentation 1**  
**Chairman: M. Behnia**

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**Quantitative Temperature Imaging in a Gas-Phase Turbulent Thermal Convection by Laser-Induced Fluorescence of Acetone**

*S.P. Kearney and F.V. Reyes*

Engineering Science Centre, Sandia National Laboratory, Albuquerque, USA

**Measurements of Bed Suction Effects on an Open Channel Flow with Laser-Doppler/Hot-Film Anemometry**

*A. Zeris and P. Prinós*

Hydraulic Laboratory, Aristotle University of Thessaloniki, Thessaloniki, Greece

**Data Filtering Applied to Infrared Thermographic Measurement intended for the Estimation of Local Heat Transfer Coefficient**

*S. Rainieri and G. Pagliarini*

Industrial Engineering Department, University of Parma, Parma, Italy

**An Experimental Technique for Near-Wall Turbulent Measurement**

*D. Poggi, A. Porporato and L. Ridolfi*

Dipartimento di Idraulica, Trasporti e Infrastrutture Civili, Politecnico of Torino, Torino, Italy

**Experimental Investigation of the Convective Heat Transfer Using Gradient Heat Flux Sensors**

*V.Y. Mitiakov\*, S.Z. Sapozhnikov\*, Yu.S. Chumakov\*\* and A.V. Mitiakov\*\*\**

\*Department of Thermodynamics and Heat Transfer, \*\*Department of Hydroaerodynamics, \*\*\*Department of Internal Combustion Engines, State Technical University of St.-Petersburg, Russia

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**Monday 24, 14:40-16:20 - Room 3 - Session Thermalhydraulics: Fluidized and Packed Beds 1**  
**Chairman: A. Kolar**

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**Flow Characteristics in Channel with Local Blockage Packed with Spheres**

*G. Matsui\*, K. Mishiro\*, H. Monji\*, M. Tanaka\*\* and H. Kamide\*\**

\*Institute of Engineering Mechanics and Systems, University of Tsukuba, Tsukuba, \*\*O-arai Engineering Center, JNC, Ibaraki, Japan

**Radial Dispersion in Liquid Flow through Packed Beds for  $50 < Sc < 750$  and  $103 < Pem < 105$**

*J.R.F. Guedes de Carvalho and J.M.P.Q. Delgado*

Departamento de Engenharia Química, Universidade do Porto, Porto, Portugal

**Instability of a Gas-Solid Fluidized Bed at High Particle Reynolds Numbers**

*P. Vainshtein\*, M. Shapiro\*\* and C. Gutfinger\**

\*Faculty of Mechanical Engineering, \*\*Laboratory of Transport Processes in Porous Materials, Technion-Israel Institute of Technology, Haifa, Israel

**Direct Contact Air-Water Heat Transfer in a Column with Structured Packing**

*S. Kypritzis and A. J. Karabelas*

Department of Chemical Engineering, Aristotle University of Thessaloniki, and Chemical Process Engineering Research Institute, P.O. Box 1517, GR 540 06 Thessaloniki, Greece

**Determination of Molecular Diffusion Coefficient through Measurement of Mass Transfer around a Cylinder Exposed to Liquid Flow in a Packed Bed**

*J.R.F. Guedes de Carvalho, M.A. Alves and J.M.P.Q. Delgado*

Departamento de Engenharia Química, Universidade do Porto, Porto, Portugal

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**Monday 24, 14:40-16:20 - Room 4 - Session Heat Transfer Enhancement 1**

**Chairman: A.E. Bergles**

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**The Effect of Liquid Side Heat Transfer Improvement on a Compact Heat Exchanger**

*J. Suihkonen\*, R. Lankinen\*, P. Sarkomaa\* and R. Castrén\*\**

\*Department of Energy Technology, Lappeenranta University of Technology, Lappeenranta, \*\*ReTermia Ltd., Finland

**Experimental Study on a Bank of Finned Pipes with Inclined Fins**

*I. Carvajal-Mariscal\*, F. Sánchez-Silva\*, P. Quinto-Diez\* and V.A. Pronin\*\**

\*LABINTHAP-SEPI-ESIME-IPN-CONACyT, México, \*\*Moscow Power Engineering Institute, Faculty of Heat Engineering, Moscow, Russia

**Two-Phase Flow Stabilization and Heat Transfer Enhancement at Vapour-Liquid Flow in Horizontal Tube under Subatmospheric Pressures**

*O.N. Kaban'kov, L.A. Sukomel and V.V. Yagov*

Moscow Power Engineering Institute, Moscow, Russia

**Heat Transfer Intensification by Small Particles in a Supersonic Flow**

*E.B. Vasilevskii\*, L.V. Yakovleva\*, A.V. Chirikhin\* and A.N. Osipov\*\**

\*Central Aerohydrodynamical Institute (TsAGI), \*\*Institute of Mechanics, Lomonosov Moscow State University, Russia

**Heat Transfer Enhancement in Tubes of Ceramic Heat Exchangers**

*A.V. Soudarev\*, B.V. Soudarev\*, V.V. Grishaev\* and A.S. Leznov\*\**

\*NPP "TARC", JSC "K.T.S", St.Petersburg, \*\*JSC "GAZPROM", Moscow, Russia

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**Monday 24, 14:40-16:20 - Room 5 - Session Thermalhydraulics: Pressure Drops 1**

**Chairman: G. Yadigaroglu**

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**Experimental Results on Pressure Drop Reductions and Flow Regime Transitions in Oil-Water Mixtures**

*G. Sotgia\*, G. Spartà\*, E. Vendola\* and P. Tartarini\*\**

\*Department of Energetics, Polytechnic University of Milan, Milano, \*\*Department of Engineering Sciences, University of Modena and Reggio Emilia, Modena, Italy

**A New Pressure Drop Correlation for Air-Water Flow in a Horizontal Tube**

*A.M. Ribeiro\*, T. Pimenta\*, J.M.M.C. Lopes\* and L.F. Melo\*\**

\*Instituto Superior de Engenharia do Porto, \*\*Chemical Engineering Department University of Porto, Porto, Portugal.

**Heat Transfer and Pressure Loss in a 180°-Turn of a Rectangular, Rib-Roughened Two Passage Channel**

*M. Schnieder, R. Höcker and J. von Wolfersdorf*

ALSTOM Power, Baden/Dättwil, Switzerland

**Two Phase Flow Patterns and Pressure Drop in the Heated Horizontal Tube at High Vapour Specific Volumes**

*O.N. Kaban'kov, L.A. Sukomel and V.V. Yagov*

Moscow Power Engineering Institute, Moscow, Russia

**Flow Structure and Pressure Gradient in Churn Flow**

*T. Sawai and M. Kaji*

Department of Mechanical Engineering, Kinki University, Wakayama, Japan

**Monday 24, 16:20-16:40 - Coffee Break**

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**Monday 24, 16:40-18:20 - Room 1 - Jets: Jet Impingement Heat Transfer**

**Chairman: P. Tartarini**

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**Heat Transfer during Transient Cooling of High Temperature Surface with an Impinging Jet in an Evacuated Enclosure**

*Y. Mitsutake, M. Monde and J. Hammad*

Department of Mechanical Engineering, Saga University, Saga, Japan

### **Annular Impingement Heat Transfer on an Oscillated Heated Surface**

*K. Ichimiya\* and Y. Matsushima\*\**

\*Department of Mechanical Systems Engineering, Yamanashi University, Yamanashi, \*\*Daihatsu Diesel Ltd., Osaka, Japan

### **Controlled Cooling of a Hot Plate with a Water Jet**

*H. Robidou\*, \*\*, H. Auracher\*, P. Gardin\*\* and M. Lebouché\*\*\**

\*TU Berlin, Institut für Energietechnik, Berlin, Germany, \*\*IRSID, Maizieres-les-Metz Cedex, France, \*\*\*LEMETA, Vandoeuvre Cedex, France

### **Heat Transfer Measurements of Impinging Two-Dimensional Slot Jets**

*X. Gao and B. Sunden*

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

### **Hydromechanics and Heat Exchange in Gaseous Impinging Jets**

*A.A. Gulakov, B.P. Zhilkin and Yu.M. Brodov*

Ural State Technical University, Ekaterinsburg, Russia

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## **Monday 24, 16:40-18:20 - Room 2 - Session Measurement Techniques: Instrumentation 2**

**Chairman: I. Zun**

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### **Surface Thermometry by Laser-Induced Fluorescence of Dy<sup>3+</sup>:YAG**

*K. Kontis\*, Y. Syogenji\*\* and N. Yoshikawa\*\**

\*Department of Aerodynamics, Hellenic Air Force Academy, Athens, Greece, \*\*Department of Aerospace Engineering, Nagoya University, Japan

### **Application of LDA and PIV to Solid/Liquid Flow in Jet Loop Reactors with High Dispersed Phase Volume Fractions**

*R. Angst, P. Mier and M. Kraume*

Department of Chemical Engineering, Technical University of Berlin, Berlin, Germany

### **Fast Wire-Mesh Sensors for Gas-Liquid Flows and Decomposition of Gas Fraction Profiles according to Bubble Size Classes**

*H.M. Prasser, E. Krepper and D. Lucas*

Forschungszentrum Rossendorf E.V., Dresden, Germany

### **Microscale Temperature Measurement at an Evaporating Liquid Meniscus**

*C. Höhmann and P. Stephan*

Fachgebiet für Technische Thermodynamik, Technische Universität Darmstadt, Darmstadt, Germany

### **Measurements of Gas Flow Parameters Inside Complex Geometry Industrial Units**

*A.G. Ghiaus\*, \*\*, D.P. Margaritis\* and D.G. Papanikas\**

\*Fluid Mechanics Laboratory, University of Patras, Rio-Patras, Greece, \*\*Thermal Engineering Department, Technical University of Civil Engineering of Bucharest, Bucharest, Romania

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## **Monday 24, 16:40-18:20 - Room 3 - Session Thermalhydraulics: Fluidized and Packed Beds 2**

**Chairman: M. Kiya**

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### **Fluid Mechanics and Heat Transfer in Bubbling Fluidized Beds**

*O. Molerus*

Lehrstuhl für Mechanische Verfahrenstechnik, Univ. Erlangen-Nürnberg, Erlangen, Germany

### **Transmittance of Packed Bed as Effective Radiative Property**

*B.J. Grochal*

Institute of Fluid Flow Machinery of Polish Academy of Sciences, Gdansk, Poland

### **Experimental Investigation of Heat Transfer from a Cylinder to Fluidized Particles with a Latent Heat Sink**

*H. Groenewold and E. Tsotsas*

Institute for Process Engineering, Otto-von-Guericke-University, Magdeburg, Germany

### **The Phenomenon of "Thermal Trap Effect" in Packed Bed of Glass Spheres**

*S. Polesek-Karczewska*

Institute of Fluid Flow Machinery of Polish Academy of Sciences, Gdansk, Poland

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**Effect of Axial Tube Location on Heat Transfer in the Core of a Circulating Fluidized Bed**

*A.K. Kolar\* and R. Sundaresan\*\**

\*Department of Mechanical Engineering, Indian Institute of Technology, Madras, \*\*Department of Mechanical Engineering, Vellore Engineering College, Vellore, India

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**Monday 24, 16:40-18:20 - Room 4 - Session Heat Transfer Enhancement 2**

**Chairman: E.G. Keshock**

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**Enhanced Boiling Tubes with Subsurface Structures: Investigation, Visualization and Industrial Application**

*R. Mertz, R. Kulenovic and M. Groll*

Institute for Nuclear Technology and Energy Systems (IKE), University of Stuttgart, Stuttgart, Germany

**Heat Transfer to Highly Viscous Fluids in a Vessel Agitated by a Non Standard Helical Ribbon Impeller**

*G. Delaplace, J.C. Leuliet, L. Fillaudeau and N. Belaubre*

Institut National de la Recherche Agronomique, Villeneuve d'Ascq, France

**Improvement of Heat Transfer in Joule Effect Tubular Heat Exchanger by Geometrical Modifications - Applications to Model (Milky Dessert) and Real (Whole Egg) Fluids -**

*L. Fillaudeau\*, G. Delaplace\*, S. Lefebvre\*, J.C. Leuliet\* and F. Quenard\*\**

\*INRIA/LGPTA, Villeneuve d'Ascq, \*\*ACTINI SA, Evian, France

**Turbulent Swirling Flow Structure in Complex Shape Channels and its Effect on Enhancement of Heat Transfer Processes**

*B.V. Dzyubenko and G.A. Dreitser*

Moscow Aviation Institute, Moscow, Russia

**Heat Transfer Enhancement due to Swirl Created by Tangential Injection of Flow at the Inlet of an Artificially Roughened Annulus**

*S.A. Abdel-Moneim, A.R. El-Shamy and N.S. Berbish*

Mechanical Engineering Department, Faculty of Engineering, Cairo, Egypt

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**Monday 24, 16:40-18:20 - Room 5 - Session Thermalhydraulics: Pressure Drops 2**

**Chairman: J. Deans**

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**Drag Reduction in Polymers and Surfactants Solutions**

*L. Broniarz-Press, J. Rozanski and I. Poltorak*

Department of Chemical Engineering and Apparatus, Poznan University of Technology, Poznan, Poland

**Experimental Set-Up to Measure Tube-Side Heat Transfer and Pressure Drop in Laminar and Turbulent One-Phase Flow**

*P.G. Vicente, A. García and A. Viedma*

Department of Thermal and Fluids Engineering, Technical University of Cartagena. Cartagena, Spain

**Entrance Length and Pressure Drop in an Entry Gap Flow**

*J. Wojtkowiak and C.O. Popiel*

Poznan University of Technology, Poznan, Poland

**Characteristics of Single-Phase Heat Transfer and Pressure Drop in Plate Heat Exchangers with and without PTFE Coatings**

*L. Cheng\* and G. Xia\*\**

\*Department of Mechanical Engineering, Eindhoven University of Technology, Eindhoven, The Netherlands, \*\*College of Environmental & Energy Engineering, Beijing Polytechnic University, Beijing, P.R. China

**Turbulent Air Flow Friction and Heat Transfer of Finned Circular Tube Heat Exchanger with Rectangular Fins**

*D. Yang, T. Chen, C. Wan and M. Tang*

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

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**Tuesday 25, 8:20-9:00 - Plenary Room - Keynote Lecture 4**

**Chairman: P. Di Marco**

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**Phase Discrimination vs. Multiscale Characteristics in Bubbly Flow**

*I. Zun*

Faculty of Mechanical Engineering, University of Ljubljana, Ljubljana, Slovenia

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**Tuesday 25, 9:00-10:40 - Room 1 - Jets: General Studies 1**

**Chairman: W. Grassi**

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**The Effects of Hole Arrangements on Heat/Mass Transfer of Impingement/Effusion Cooling System**

*H.H. Cho, J.H. Choi and D.H. Rhee*

Department of Mechanical Engineering, Yonsei University, Seoul, Korea

**Heat Transfer Experiments in a Submerged Impinging Round Jet Using Liquid Crystal Thermometry**

*J. Vejrazka\*, \*\*, P. Marty\* and V. Sobolik\*\**

\*Equipe LEGI-GRETh, CEA/Grenoble, Grenoble, France, \*\*Institute of Chemical Process Fundamentals, Praha, Czech Republic

**Near Wall Flow Characteristics Beneath a Turbulent Impinging Jet**

*S. Ashforth-Frost, B.C.Y. Cheong and P.T. Ireland*

Department of Mechanical and Manufacturing Engineering, The Nottingham Trent University, Nottingham, U.K.

**Jet Cooling System of Gas Turbine Blades**

*B.M. Galitseyskiy*

Department of Aviation-Space Thermal Technics, Moscow Aviation Institute, Moscow, Russia

**Heat Transfer at Interaction of Liquid Nitrogen Jet with Surfaces**

*G.A. Dreitser, V.P. Firsov, I.V. Antyukhov and A.S. Prokopenko*

Department of Aviation-Space Thermal Technics, Moscow Aviation Institute, Moscow, Russia

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**Tuesday 25, 9:00-10:40 - Room 2 - Measurement Techniques: Instrumentation 3**

**Chairman: P. Carrica**

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**Flow-Field Measurements near Two Helicoid Fans by Cross-Correlation Particle Image Velocimetry**

*F. Peyrin and P.S. Mirade*

Departement Transformation de Produits Animaux, Institut National de la Recherche Agronomique, St Genès Champanelle, France

**A Thermal Imaging Procedure for Landmine Detection**

*J. Deans\*, B. Dempster\*\*, G. Schmithals\* and L.J. Carter\**

\*University of Auckland, Auckland, New Zealand, \*\*University of Strathclyde, Scotland, U.K.

**An Image Recording Method Utilising Two Cameras with Application to PIV**

*A. Fouras and J. Soria*

Laboratory for Turbulence Research in Aerospace & Combustion, Department of Mechanical Engineering, Monash University, Melbourne, Australia

**Proper Orthogonal Decomposition of Vorticity PIV Data on a Backward Facing Step Flow**

*J. Kostas\*, J. Soria\* and M.S. Chong\*\**

\*Mechanical Engineering Department, Monash University, Melbourne, \*\*Mechanical and Manufacturing Engineering Department, Melbourne University, Melbourne, Australia

**High Time Resolution Ultrasonic Velocity Profiler**

*Y. Ozaki\*, T. Kawaguchi\*, Y. Takeda\*\*, K. Hishida\* and M. Maeda\**

\*Department of System Design Engineering, Keio University, Yokohama, Japan, \*\*Paul Scherrer Institut, Villigen PSI, Switzerland

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**Tuesday 25, 9:00-10:40 - Room 3 - Multi-Component and Multi-Phase Flow: Bubbly Flow**

**Chairman: A. Tomiyama**

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**Downward Laminar Gas-Liquid Flow in a Vertical Pipe**

*O.N. Kashinsky and V.V. Randin*

Institute of Thermophysics Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

**Development of Bubble Cluster Detection and Identification Method**

*A. Salesse, A. Larue de Tournemine and V. Roig*

Institut de Mécanique des Fluides de Toulouse, Toulouse, France

**Microstructure of the Flow Field Around a Bubble in Counter-Current Bubbly Flow**

*Y. Suzuki\*, M. Nakagawa\*\*, M. Aritomi\*, H. Murakawa\*, H. Kikura\* and M. Mori\*\*\**

\*Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology, Tokyo, \*\*Department of Mechanical Science and Engineering, Tokyo Institute of Technology, Tokyo, \*\*\*Tokyo Electric Power Company, Yokohama, Japan

**Co-Current Bubbly Flow in a Vertical Square Channel: Comparison Between Experimental and Modelling Results for Various Turbulence Models**

*A.D. Matos, E.S. Rosa and F.A. Franca*

Department of Energy, State University of Campinas, Campinas, Brazil

**A Comparative Analysis of Bubbly Flow Void Fraction Based on Different Approaches for Interfacial Drag Force**

*Z.V. Stosic and V.D. Stevanovic*

Framatome ANP GmbH-NBTT, Erlangen, Germany

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**Tuesday 25, 9:00-10:40 - Room 4 - Heat Transfer Enhancement 3**

**Chairman: M. Groll**

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**Experimental Analysis of the Performances of Finned Elliptical-Section Tube Air-Cooled Compact Heat Exchangers**

*G. Fabbri and S. Lazzari*

Department of Energy, Nuclear and Environmental Control Engineering, University of Bologna, Bologna, Italy

**Friction Factor and Heat Transfer in Triangular Ducts with Ridge Type Two Dimensional Roughness**

*S.W. Ahn and B.C. Lee*

Gyeongsang National University, Institute of Marine Industry, Tongyeong, Kyongnam, Korea

**Influence of Macro-Roughened Surfaces on Convective Film Boiling Heat Transfer**

*A. Omrani\* and E.G. Keshock\*\**

\*University of Tennessee Space Institute, Tullahoma, \*\*Mechanical Engineering Department, Cleveland State University, Cleveland, USA

**Investigations In Heat Transfer Enhancement In Natural Convection In a Rectangular Enclosure With Suspensions of Microencapsulated Phase Change Materials - A Parametric Study**

*P. Datta\*, S. Sengupta\*\* and T. Singh\*\*\**

\*Daimler Chrysler Corporation, Detroit, \*\*University of Michigan-Dearborn, Dearborn, \*\*\*Wayne State University, Department of Mechanical, Detroit, USA

**An Experimental Investigation on Heat Transfer of Internally Ribbed Tube in The Near Critical Pressure Region**

*D. Sun, T. Chen, Y. Luo, Z. Hu and H. Luan*

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

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**Tuesday 25, 9:00-10:40 - Room 5 - Thermalhydraulics: Turbulence and Boundary Layers 1**  
**Chairman: D. Papailiou**

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**Improvement of a Stalled-Diffuser Performance by a Turbulent Wake**

*O. Mochizuki, H. Ishikawa and M. Kiya*

Division of Mechanical Science, Hokkaido University, Sapporo, Japan

**Flow around a Circular Cylinder with Non-Isothermal Blowing**

*L. Mathelin, F. Bataille and A. Lallemand*

Centre de Thermique de Lyon, INSA de Lyon, Villeurbanne, France

**Heat Transfer from a Line Source Located in the Periodic Laminar Near Wake of a Circular Cylinder**

*G. Godard and P. Paranthoën*

LTH U.M.R. 6614 CNRS Université de Rouen, Mont Saint-Aignan Cedex, France

**On the Transition from Laminar to Turbulent Regime in Vertical Upward Two-Phase Slug Flow**

*A.M.F.R. Pinto\*, M.N. Coelho Pinheiro\*\*, S. Nogueira\*\*\* and J.B.L.M. Campos\**

\*Departamento de Engenharia Química, Universidade do Porto, Porto, Portugal , \*\*Departamento de Engenharia Química, Instituto Politecnico de Coimbra, Coimbra, Portugal , \*\*\*Von Karman Institut for Fluid Dynamics, Rhode Saint Genese, Belgium

**Scintillometric Measurements of Atmospheric Turbulent Heat and Momentum Fluxes and Their Application to Atmospheric Stability Evaluation**

*V.J. Daoo, N.S. Panchal, F. Sunny and V. Venkat Raj*

Health, Safety and Environmental Group, Bhaba Atomic Research Centre, Trombay, India

**Tuesday 25, 10:40-11:00 - Coffee Break**

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**Tuesday 25, 11:00-12:40 - Room 1 - Jets: General Studies 2**

**Chairman: G.C.J. Bart**

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**Diffusion of Two-Dimensional Jets into Counterflowing Flow**

*N. Ogawa and A. Miura*

Science University of Tokyo, Chiba, Japan

**Phase-Averaged PIV Measurements of Turbulent ZNMF Jets**

*J. Cater, K. von Ellenrieder and J. Soria*

Mechanical Engineering Department, Monash University, Melbourne, Australia

**Mixing and Diffusion Processes of Twin Circular Free Jets with Various Nozzle Spacing**

*T. Harima\*, S. Fujita\* and H. Osaka\*\**

\*Tokuyama College of Technology, Tokuyama, \*\*Yamaguchi University, Ube, Japan

**Spectral Analysis on the Disturbance of a Round Water Jet with an Annular Airflow**

*Y. Morozumi, A. Kuwata, J. Fukai and O. Miyatake*

Department of Chemical Engineering, Kyushu University, Fukuoka, Japan

**Quantitative Visualization of Turbulent Mixing in Parallel Triple Plane Jets**

*K. Yamamoto and K. Hishida*

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

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**Tuesday 25, 11:00-12:40 - Room 2 - Measurement Techniques: Instrumentation 4**

**Chairman: H.M. Prasser**

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**PTV Measurement on Interaction between Two Immiscible Droplets and Turbulent Uniform Shear Flow of Carrier Fluid**

*Y. Hagiwara, S. Sakamoto, M. Tanaka and K. Yoshimura*

Department of Mechanical and System Engineering, Kyoto Institute of Technology, Kyoto, Japan

**Velocity Profile Measurement by Ultrasound Time-Domain Correlation Method**

*G. Yamanaka, H. Kikura and M. Aritomi*

Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology, Tokyo, Japan

## **Acoustic Excitation and the Stability of Single Bubble Sonoluminescence for Various Noble Gases**

*G.A. Delgadino, F. Bonetto, R.T. Lahey, Jr.*

Center for Multi-Phase Research, Rensselaer Polytechnic Institute, Troy, USA

## **LDA and PIV Measurements Applied to Single and Multiple Impinging Jets**

*L.F.G. Geers, M.J. Tummers, G.C.J. Bart and K. Hanjalic*

Department of Applied Physics, Delft University of Technology, Delft, The Netherlands

## **Development of a Novel Artificial Heart Muscle Using Thermoelectric Actuators**

*S. Maruyama\*, R. Ibuki\*, S. Sakai\*, M. Yamada\*\*, M. Sato\*\*\*, T. Yanbe\*\*\*\*, T. Takagi\*, Y. Luo\* and M. Behnia\*\*\*\*\**

\*Institute of Fluid Science, Tohoku University, Sendai, Japan, \*\*Tohoku Electric Industrial Co. Ltd., Sendai, Japan, \*\*\*Influence Planning Corp., Takamori, Japan, \*\*\*\*Institute of Development, Aging and Cancer, Tohoku University, Sendai, Japan, \*\*\*\*\*School of Mech. & Manuf. Engr., The University of New South Wales, Sydney, Australia

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## **Tuesday 25, 11:00-12:40 - Room 3 - Process Equipment and Applications: Heat Exchangers 1**

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

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### **A Study on Mixing Between Gas Turbine Exhaust Gas and Fresh Air in a Supplemental-Fired Heat Recovery Steam Generator**

*C.S. Lee\*, B.E. Lee\*, J.W. Ryu\*\* and S.J. Park\**

\*R&D Center, Doosan Heavy Industries, Changwon, \*\*Seoul National University, Korea

### **Distillation of Mixtures of Free Fatty Acids and Condensation in a Shell-and-Tube Heat Exchanger**

*M.M. Prieto\* and J.C. Bada\*\**

\*Energy Department, Oviedo University, Gijón, \*\*Consejo Superior de Investigaciones Científicas, Villaviciosa, Spain

### **Ohmic Heating to Achieve UHT Sterilisation of Milk - Comparison with Plate Heat Exchanger and Definition of a Heat Dissipation Coefficient -**

*L. Fillaudeau\*, G. Delaplace\*, J. C. Leuliet\*, J.P. Tissier\*, M. Berthou\*\* and F. Chopard\*\*\**

\*INRIA/LGPTA, Villeneuve d'Ascq, \*\*EDF-DER, Moret Sur Loing, \*\*\*Alfa Laval Vicarb, Fontanil Cornillon, France

### **Experimental Study on the Heat Transfer Performance of Thermosyphons Using Plain and Micro Grooved Tube**

*K.I. Han\*, S.S. Yee\*, S.H. Park\*, S.H. Lee\* and D.H. Cho\*\**

\*Pukyong National University, Pusan, \*\*Daejin University, Kyonggi-do, Korea

### **Designing Shell-and-Coil Natural Convection Heat Exchangers**

*H. Taherian\* and P.L. Allen\*\**

\*Mechanical Engineering Department, Mazandaran University, Babol, Iran, \*\*Mechanical Engineering Department, Dalhousie University (DalTech), Halifax, Canada

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## **Tuesday 25, 11:00-12:40 - Room 4 - Thermodynamics and Heat and Mass Transfer: Refrigeration and Cooling 1**

**Chairman: J.M. Corberan**

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### **Performance Evaluation of a Cascade System Using R-22/R-23**

*H.G. Cho, J.H. Park and K.N. Cho*

School of Mechanical Engineering, Sungkyunkwan University, Suwon, Korea

### **Experimental Investigation of the Mixing between Hot and Cold Gas in Two Cooling Processes**

*F. Bataille\*, J. Bellettre\*\* and A. Lallemand\**

\*Centre de Thermique de Lyon, INSA de Lyon, Villeurbanne Cedex, \*\*Departement Systemes Energetiques et Environnement, Ecole des Mines de Nantes, Nantes Cedex, France

## **The Effect of Diameter on the Heat and Mass Transfer Characteristics in a Vertical Absorber**

*J.K. Kim, J.H. Seo and K.N. Cho*

School of Mechanical Engineering, Sungkyunkwan University, Suwon, Korea

## **Multiple Expansion Vapour Compression Refrigeration Cycle**

*J. Gryzgoridis and J.A. Browne*

Department of Mechanical Engineering, University of Cape Town, South Africa

## **Heat and Mass Transfer Characteristics of a Helical Absorber Using LiBr+LiI+LiNO<sub>3</sub>+LiCl Solutions**

*J.I. Yoon\*, H.S. Lee\*, C.G. Moon\*, E.P. Kim\*, J.D. Kim\*\* and B.B. Saha\*\**

\*Pukyong National University, Pusan, \*\*Tongmyong College, Pusan, Korea, \*\*\*Kyushu University, Fukuoka, Japan

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## **Tuesday 25, 11:00-12:40 - Room 5 - Thermalhydraulics: Turbulence and Boundary Layers 2**

**Chairman: P. Paranthoen**

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## **Eduction of Multi-Scale Turbulent Structures in the Near-Wake of a Cylinder Using Wavelet Multi-Resolution Technique**

*H. Li\* and Y. Zhou\*\**

\*Department of Mechanical Engineering, Kagoshima University, Kagoshima, Japan, \*\*Department of Mechanical Engineering, The Hong Kong Polytechnic University, Hong Kong, China

## **Comparison of Local Heat Transfer by Ammonia Absorption Measurements and Different Turbulence Models in a Square Duct with Longitudinal Vortex Generator Roughness**

*S. Wang, J. Bergmann and M. Fiebig*

Institut für Thermo-und Fluidodynamik, Ruhr-Universität, Bochum, Germany

## **Turbulent Heat Transfer in a Separated and Reattached Flow on a Blunt Flat Plate**

*T. Ota\* and T. Kon\*\**

\*Department of Machine Intelligence and System Engineering, Tohoku University, Sendai, \*\*Honda Motor Co., Ltd., Tokyo, Japan

## **Study on Relationship between Shear Stress Distribution and Bursting Motion in a Turbulent Boundary Layer by Using Micro Shear Stress Imager**

*Y. Iwadare, N. Miyagi, M. Kimura and H. Shoji*

Department of Mechanical Engineering, Nihon University, Tokyo, Japan

## **An Experimental Study of Turbulent Backward-Facing Step Flow under Two-Frequency Forcing**

*S. Jin\*, H. Choi\*, S. Kim\*, J.Y. Yoo\* and S. Kim\*\**

\*School of Mechanical and Aerospace Engineering, Seoul National University, Seoul, \*\*Department of Precision Mech. Eng., Kangnung National University, Kangnung, Korea

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## **Tuesday 25, 12:40-13:40 - Lunch**

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## **Tuesday 25, 13:40-14:20 - Plenary Room - Keynote Lecture 5**

**Chairman: A. Goulas**

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## **Scale Formation in Tubular Heat Exchangers - Research Priorities**

*A.J. Karabelas*

Department of Chemical Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece

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## **Tuesday 25, 14:20-16:00 - Room 1 - Jets: General Studies 3**

**Chairman: F. Daumas Bataille**

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## **A 'Thin Layer' Model of Heat Transfer in a Laminar Liquid Film Formed by Impinging Jet**

*J. Mikielewicz\* and D. Mikielewicz\*\**

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

### **Helical Vortices in the Axisymmetric Jets with Peripheral Suction**

*X.L. Xie\**, *H.L. Zhou\** and *W.W. Mar\*\**

\*Department of Mechanics & Engineering Science, Fudan University, Shanghai, \*\*College of Basic Science, Donghua University, Shanghai, China

### **Application of the Quasi-Steady Liquid Cristal Technique in Three-Temperature Convective Heat Transfer Measurements**

*G. Engels\**, *Y. Kim\*\** and *R.E. Peck\*\*\**

\*MPC Products Corp. Skokie, \*\*Honeywell, Phoenix, \*\*\*Arizona State University, Tempe, USA

### **Instantaneous Behavior of Pulsating Submerged Planar Jets**

*E.C. Mladin\** and *D.A. Zumbrennen\*\**

\*Department of Mechanical Engineering, University Politehnica of Bucharest, Bucharest, Romania, \*\*Department of Mechanical Engineering, Clemson University, USA

### **Experimental Investigation on Heat Transfer Characteristics of Heated Jet in Crossflow**

*H. Wang*, *Y. Luo*, *D. Lu* and *T. Chen*

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

### **Hydrodynamics and Heat Exchange of Free Swirl Gas Jet**

*B.V. Berg*, *B.P. Zhilkin* and *A.N. Shuba*

Ural State Technical University, Ekaterinsburg, Russia

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## **Tuesday 25, 14:20-16:00 - Room 2 - Measurement Techniques: Instrumentation 5**

**Chairman: K. Hishida**

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### **LDV Measurements of the Flow of Water in the Volute of a Centrifugal Pump**

*W.G. Li*

Hydraulic Machinery Division, Gansu University of Technology, Lanzhou, China

### **Liquid Crystal Technique Application for Heat Transfer Investigation in a Fin-Tube Heat Exchanger Element**

*M. Wierzbowski* and *J. Stasiek*

Technical University of Gdansk, Gdansk, Poland

### **Sensors/Transmitters Data Acquisition System to Value Temperature Distribution in a Natural Ventilation Building**

*P. Principi*, *C. Di Perna* and *E. Ruffini*

Dipartimento di Energetica, Università degli Studi di Ancona, Ancona, Italy

### **Identification of Chaotic Attractors in Gas Bubbling**

*J.T. Cieslinski\** and *R. Mosdorf\*\**

\*Technical University of Gdansk, Chair of Heat Technology, Gdansk, \*\*Bialystok Technical University, Institute of Informatics, Bialystok, Poland

### **Leak Detection in Pipelines. Pressure Transients Analysis Through On-line Computer Techniques**

*C.F. Braga*, *S.L. Cruz*, *A. Cariati* and *J.A.F.R. Pereira*

Department of Chemical Systems Engineering, Universidade Estadual de Campinas, Campinas, Brazil

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## **Tuesday 25, 14:20-16:00 - Room 3 - Process Equipment and Applications: Heat Exchangers 2**

**Chairman: B. Sunden**

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### **Comparison of Heat and Mass Transfer in Different Heat Exchanger Geometries with Corrugated Walls**

*C. Zimmerer\**, *P. Gschwind\*\**, *G. Gaiser\*\*\** and *V. Kottke\*\**

\*Membrana Research & development, Obernburg, \*\*Chair of Food Process Engineering, University of Hohenheim, Stuttgart, \*\*\*Institute of Chemical Process Engineering, University of Stuttgart, Stuttgart

### **Experimental Results Concerning Gas-Leakage Flow Patterns in a Rotary Heat Exchanger**

*T. Skiepmo*

Department of Thermodynamics and Fluid Mechanics, Bialystok Technical University, Bialystok, Poland

## **Precipitation Fouling in Plate Heat Exchangers – The Role of Suspended Matter**

*N. Andritsos and A.J. Karabelas*

Chemical Process Engineering Research Institute and Department of Chemical Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece

## **Two-Phase Heat Transfer Analysis of Evaporators**

*J.M. Corberán and J. González*

Applied Thermodynamics Department, Universidad Politécnica de Valencia, Valencia, Spain

## **Experimental Studies to Select a Mixer Device Design for Use in PFBR Intermediate Heat Exchanger**

*G. Padmakumar\*, T.R. Sundaramoorthy\*, G. Vaidyanathan\*, R. Prabhakar\*, R.D. Kale\*, R. Mascomani\*\*, M. Suresh\*\*, C.B. Suresh\*\*, T.V. Ashraf\*\* and V. Jayaraman\*\**

\*Indira Gandhi Centre for Atomic Research, Kalpakkam, \*\*Fluid Control Research Institute, Palghat, India

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## **Tuesday 25, 14:20-16:00 - Room 4 - Thermodynamics & Heat and Mass Transfer: Refrigeration and Cooling 2**

**Chairman: F. Oriolo**

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## **Characterization of Semi-Crystalline Polymers during Cooling Processes**

*G.C. Alfonso\*, M. Cartesegna\*\* and L. Tagliafico\*\**

\*DCCI, Genova, \*\*DITEC University of Genova, Genova, Italy

## **The Applicability of the EHD Technique for Dehumidification**

*W.Y. Cheng, S.P. Lin, R.J. Shyu, L.J. Fang and C.C. Wang*

Energy & Resources Laboratories, Industrial Technology Research Institute, Hsinchu, Taiwan

## **Experimental Results and Evaluation of Linear Compressor**

*S. Kawahara, T. Akazawa, S. Kawano, H. Hasegawa, M. Ueda and Y. Asaida*

Matsushita Electric Industrial Co. Ltd., Osaka, Japan

## **Coupled Heat Transfer through Building Components with Air Cavities**

*P. Stefanizzi*

Dipartimento di Fisica Tecnica, Politecnico di Bari, Bari, Italy

## **Near Critical Heat Transfer in CO<sub>2</sub> Process Cycle**

*R. Eggers\* and U. Sievers\*\**

\*Technische Universität Hamburg-Harburg, Hamburg, \*\*Fachhochschule Hamburg, Hamburg, Germany

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## **Tuesday 25, 14:20-16:00 - Room 5 - Multi-Component and Multi-Phase Flow: Particle and Droplet Dynamics**

**Chairman: I. Kataoka**

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## **Experimental Measurements of Spreading of Volatile Liquid Droplets**

*N. Zhang\* and D.F. Chao\*\**

\*Ohio Aerospace Institute at NASA Glenn Research Center, Cleveland, \*\*NASA Glenn Research Center, Cleveland, USA

## **Experimental Study of the Interaction of a Droplet Cloud with a Turbulent Stratified Free Convection Environment as Related to Heat and Mass Transport**

*A. Vouros\*, Th. Panidis\*, D.D. Papailiou\*, X.J. Chen\*\*, L.J. Guo\*\* and B. Chen\*\**

\*Department of Mechanical and Aeronautical Engineering, University of Patras, Rio, Greece, \*\*State Key Laboratory of Multiphase Flow in Power Engineering, Xi'an Jiaotong University, Xi'an, P.R.China

## **Injection of Water Droplets in an Axial Compressor**

*S. Zhluktov, S. Bram and J. de Ruyck*

Vrije Universiteit Brussel, Brussels, Belgium

## **Effect of Liquid Viscosity on Inception of Disturbance Waves and Droplets in Gas-Liquid Two-Phase Flow**

*K. Mori\* and K. Nakano\*\**

\*Department of Intelligent Machine Engineering, Osaka Electro-Communication University, Neyegawa, \*\*Sharp Corporation, Osaka Japan

**Tuesday 25, 16:00-16:20 - Coffee Break**

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**Tuesday 25, 16:20-17:40 - Room 1 - Multi-Component and Multi-Phase Flow: T-Junctions**  
**Chairman: M. Shoukri**

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**The Split of Slug Flow at a Small Diameter Horizontal T-Junction**

*R. Jones, E. Wren, G. Baker and B.J. Azzopardi*

School of Chemical, Environmental and Mining Engineering, University of Nottingham, Nottingham, U.K.

**The Phase Separation and Pressure Drop for R-22 Refrigerant in a Horizontal T-Junction**

*S.J. Tae, Y.H. Choi, K.N. Cho*

School of Mechanical Engineering, Sungkyunkwan University, Suwon, Korea

**Fundamental Study on Fluid Mixing Mechanism in a Tee Junction Area**

*K. Yuki\*, K. Okuyama\*, S. Toda\* and T. Muramatsu\*\**

\*Department of Quantum Energy, Tohoku University, Sendai, \*\*O-arai Engineering Center, JNC, Ibaraki, Japan

**Application of a T-Junction as a Partial Separator for Liquid/Liquid Flows**

*L. Yang, B.J. Azzopardi and A. Belghazi*

Environmental and Mining Engineering, University of Nottingham, Nottingham, U.K.

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**Tuesday 25, 17:40-18:20 - Room 1 - Thermalhydraulics: Shock Waves and Wave Propagation 1**

**Chairman: M. Giot**

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**Flat Plate Impingement of the Shock Wave Discharged from an Open End of a Shock Tube**

*T. Setoguchi\*, K. Yamashita\*, H.D. Kim\*\*, H.S. Kim\*\* and K. Matsuo\*\*\**

\*Saga University, Japan, \*\*Andong National University, Korea, \*\*\*Kyushu University, Fukuoka, Japan

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**Tuesday 25, 16:20-18:20 - Room 2 - Thermodynamics & Heat and Mass Transfer: Mass Transfer 1**

**Chairman: J.S. Lee**

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**Experiment Investigation of the Humidifying and Desulfuration of Flue Gas in a Boiler of Power Plant**

*L.J. Guo\*, B. Chen\*, X.J. Chen\*, D.D. Papailiou\*\* and Th. Panidis\*\**

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

\*\*Department of Mechanical Engineering and Aeronautics, University of Patras, Patras-Rion, Greece

**Application of a Simplified Heat and Mass Transfer Model to the Measurement of the Transfer Factor of Moist Insulating Materials**

*P. Baggio\*, C. Bonacina\*\*, M. Campanale\*\*, L. Moro\*\* and S. Zorzi\*\**

\*Dipartimento di Ingegneria Civile ed Ambientale, Università di Trento, Trento, \*\*Dipartimento di Fisica Tecnica, Università di Padova, Padova, Italy

**Experimental Determination of Adsorption Capacity and Optimisation of Performance of a Rotary Desiccant Dehumidifier for Hot Humid Climates**

*F. Toribio, P.H. Nguyen and M. Dupont*

Groupe de Recherche sur les Energies Renouvelables, Université des Antilles et de la Guyane, Pointe-à-Pitre Cedex, France

**Experimental Investigation and Theoretical Modeling of Heat and Mass Transfer in Absorbers for Cleaning Exhaust Flue Gases from Sulfur Dioxide**

*I.V. Derevich*

Moscow State University of Environmental Engineering, Moscow, Russia

**Energy and Mass Transfer Phenomena in Natural Draft Cooling Towers**

*B. Sirok\*, B. Blagojevic\*, M. Novak\*\*, M. Hocevar\*\* and F. Jere\*\**

\*Faculty of Mechanical Engineering, University of Ljubljana, Ljubljana, \*\*Turboinstitut, Ljubljana, Slovenia

## **Dust Trapping and Absorption of Sulphur-Containing Components on the Film During a Steam-Gas Mixture Condensation**

*L.V. Romanova, I.V. Iakimova and A.V. Brattseva*

St. Petersburg State Technological University of Plant Polymers, St.-Petersburg, Russia

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### **Tuesday 25, 16:20-18:20 - Room 3 - Process Equipment and Applications: Heat Exchangers 3**

**Chairman: L. Melo**

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#### **Investigation of Heat Loss from Advanced Solar Water Heaters**

*N. Groenhout, M. Behnia and G.L. Morrison*

School of Mechanical and Manufacturing Engineering, University of New South Wales, Sydney, AUSTRALIA

#### **Fouling Effects of Geothermal Water Scale on Heat Transfer Around In-Line Two Circular Cylinders**

*T. Ota\*, T. Uryu\*\* and H. Yoshikawa\**

\*Department of Machine Intelligence and Systems and Engineering, Tohoku University, Sendai,

\*\*Mitsubishi Electric Corp., Himegi, Japan

#### **Formation of Fouling Layers on a Heat Exchanger Element Exposed to Warm, Humid and Solid Loaded Air Streams**

*S. Kaiser, D. Antonijevic and E. Tsotsas*

Chair for Thermal Process Engineering, Otto-von-Guericke-University, Magdeburg, Germany

#### **Measurement of Diffusion-Reaction Characteristics of Pseudomonas Fluorescens Biofilms**

*R.J. Taylor\* and T.R. Bott\*\**

\*School of Chemical Engineering, The University of Birmingham, Birmingham, \*\*Imerys, Par Moor Laboratories, Cornwall, U.K.

#### **Shallow Fluidized Bed Heat Exchanger - An Experimental Study**

*A.A.Bbernárdez Pécora and M.R. Parise*

College of Mechanical Engineering, State University of Campinas, Campinas, Brazil

#### **Thermal and Friction Characterization of Compact Heat Exchanger with One and Two Rows of Finned Elliptical Tubes**

*R.B. Perez and J.I. Yanagihara*

Department of Mechanical Engineering, Polytechnic School of University of São Paulo, São Paulo, Brazil

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### **Tuesday 25, 16:20-18:20 - Room 4 - Boiling: Flow Boiling**

**Chairman: H. Auracher**

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#### **On Thermo-Hydraulic Instabilities in Small Channels During Flow Boiling**

*D.D. Brutin, F. Topin and L. Tadrist*

Laboratoire de l'Institut Universitaire de Systemes Thermiques Industriels, Technopôle de Château-Gombert, Marseille, France

#### **Experimental Study on the Onset of Nucleate Boiling in Vertical Concentric Annular Tubes**

*I.S. Kim and S.H. Lee*

School of Mechanical Engineering, Pusan National University, Pusan, Korea

#### **Heat Transfer to Evaporating Binary Liquid Films Inside a Vertical Tube**

*R. Krupiczka, A. Rotkegel and Z. Ziobrowski*

Institute of Chemical Engineering, Polish Academy of Sciences, Gliwice, Poland

#### **3-D Conjugate Heat Transfer Measurements in a Non-Uniformly Heated Circular Flow Channel Under Flow Boiling Conditions**

*R.D. Boyd Sr., P. Cofie and A. Ekhlassi*

Thermal Science Research Center, Prairie View A&M University, Prairie View, USA

#### **Investigation of a Heat Transfer for Forced Flow Boiling of Nitrogen in Channel at High Pressures**

*A.V. Klimenko, A.M. Sudarchikov and V.V. Klimenko*

Moscow Power Engineering Institute, Moscow, Russia

## **Flow Boiling Heat Transfer in Tube Bundles**

*A. Gupta*

Mechanical and Industrial Engineering Department, University of Roorkee, Roorkee, India

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**Tuesday 25, 16:20-18:20 - Room 5 - Multi-Component and Multi-Phase Flow: Flow Structure and Flow Transition**

**Chairman: G. Matsui**

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### **Measurements in High Pressure Wall Heated Annular Two-Phase Flow**

*R. Kumar and T.A. Trabold*

Lockheed Martin Corporation, New York, USA

### **Prediction Methods for Interfacial Drag in Transitional Two-Phase Flow Regimes**

*Z.V. Stosic and V.D. Stevanovic*

Framatome ANP GmbH-NBTT, Erlangen, Germany

### **Evolution of Two-Phase Slug Flow in Vertical and Inclined Pipes**

*R. van Hout, D. Barnea and L. Shemer*

Department of Fluid Mechanics and Heat Transfer, Faculty of Engineering, Tel-Aviv University, Ramat-Aviv, Israel

### **Structure of Upward Slug Flow in a Vertical Pipe**

*O.N. Kashinsky, R.S. Gorelik and V.V. Randin*

Institute of Thermophysics, Novosibirsk, Russia

### **A Transition Criterion for the Onset of Slugging or Mixing in Horizontal Conduits**

*J.N. Reyes, Jr*

Department of Nuclear Engineering, Oregon State University, Corvallis, USA

### **Anomalous Taylor Vortex Flows in a Short Annulus**

*H. Kawai and H. Takahashi*

Muroran Institute of Technology, Muroran, Japan

### **An Experimental Investigation on the Formation of Oil-Gas Two Phase Annular Flow in Horizontal Pipes**

*Z. Hu, H. Qian and F. Zhou*

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

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**Wednesday 26, 8:20-9:00 - Plenary Room - Keynote Lecture 6**

**Chairman: B. Azzopardi**

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**Wax Deposition in Subsea Pipelines: A Review of Modelling Attempts**

*L.F.A. Azevedo*

Department of Mechanical Engineering, PUC-RIO, Rio de Janeiro, Brazil

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**Wednesday 26, 9:00-11:00 - Room 1 - Thermalhydraulics: Shock Waves and Wave Propagation 2**

**Chairman: M. Giot**

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**Control of Shock Wave Using Nonequilibrium Condensation of Moist Air**

*S. Matsuo\**, *T. Setoguchi\**, *H. Yamashita\**, *K. Kaneko\**, *H.D. Kim\*\** and *K. Matsuo\*\*\**

\*Department of Mechanical Engineering, Saga University, Japan, \*\*School of Mechanical Engineering, Andong National University, Andong, Korea, \*\*\*Graduate School of Engineering Sciences, Kyushu University, Fukuoka, Japan

**Thermodynamic Aspects in Modelling the Wave Phenomena in a Liquid-Vapour System**

*Z. Bilicki*

Institute of Fluid Flow Machinery, Polish Academy of Sciences, Gdansk, Poland

**Enhancement of Shock Wave and Mass Transfer behind a Wave in Saturated Porous Medium**

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

Institute of Thermophysics, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

**Structure of Shock-Trains in Constant Area Ducts**

*K. Matsuo, Y. Miyazato, J.K. Kwon and M. Masuda*

Graduate School of Engineering Sciences, Kyushu University, Fukuoka, Japan

**The Pressure Wave with Complete Vapor Condensation in Flow Boiling**

*V.V. Kuznetsov and O.V. Vitovsky*

Institute of Thermophysics, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

**Experimental Study of Thermo-Fluid Dynamic Phenomena in Superfluid Helium by using Superfluid Shock Tube Facility**

*H. Nagai\**, *Y. Ueta\*\**, *H.S. Yang\*\**, *M. Murakami\*\** and *K. Yanaka\*\**

\*Office of Research and Development, National Space Development Agency of Japan, Tsukuba, \*\*Institute of Engineering Mechanics and Systems, University of Tsukuba, Tsukuba, Japan

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**Wednesday 26, 9:00-10:00 - Room 2 - Thermodynamics & Heat and Mass Transfer: Mass Transfer 2**

**Chairman: J.S. Lee**

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**Heat and Mass Transfer in Rotating Air-Water Flow**

*I. Borisov\**, *A. Khalatov\** and *N. Syred\*\**

\*Department of Thermogasdynamics, National Academy of Sciences, Kiev, Ukraine, \*\*School of Engineering, Cardiff University, Cardiff, U.K.

**Heat and Mass Transfer During the Degassing of Polymers**

*I. Gestring and D. Mewes*

Institute for Process Engineering, University of Hannover, Hannover, Germany

**Modeling and Experiments of the NH<sub>3</sub>/H<sub>2</sub>O Bubble Absorption Using a Non- Equilibrium Phenomenological Theory of the Mass and Heat Transfer**

*M.D. Staicovici*

Thermopower Equipment Research and Design Institute, SC ICPET-CERCETARE SA, Bucharest, Romania

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**Wednesday 26, 10:00-11:00 - Room 2 - Fluid-Dynamics: Rotating Flows**

**Chairman: F. Arinc**

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**The Effect of Diffuser Inlet Flow Angle on Diffuser Rotating Stall**

*J.H. Kim\* and K.R. Cho\*\**

\*Siemens Building Technology Ltd., Seoul, \*\*Department of Mechanical Engineering, Yonsei University, Seoul, Korea

**Flow between Two Coaxial Rotating Cylinders with a Highly Water-Repellent Wall**

*K. Watanabe\*, S. Ogata\*, S. Isozaki\*\* and T. Takayama\**

\*Graduate School of Engineering, Tokyo Metropolitan University, Tokyo, \*\*Ebara Co., Tokyo, Japan

**Thermal Modelling of a Rotating Cavity Rig to Simulate the Internal Air System of a Gas Turbine H.P. Compressor**

*A. Alexiou\*, C.A. Long\*, A.B. Turner\* and C. J. Barnes\*\**

\*Thermo-Fluid Mechanics Research Centre, University of Sussex, Brighton, \*\*Rolls-Royce Plc, Derby, U.K.

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**Wednesday 26, 9:00-11:00 - Room 3 - Nuclear Reactor Safety 1**

**Chairman: L. Maròti**

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**Flow and Solidification of Corium in the Vulcano Facility**

*C. Journeau, E. Boccaccio, C. Jegou, P. Piluso and G. Cognet*

Department of Thermalhydraulics and Physics, CEA/Cadarache, St Paul lez Durance, France

**Water/Air Tests to Investigate the RPV Exterior Two-Phase Flow Behavior in the Event of a Core Melt**

*H. Schmidt\*, W. Brettschuh\*, E. Friesen\*, O. Herbst\*, W. Kastner\*, W. Köhler\*, J. Meseth\* and J. Miettinen\*\**

\*Framatome ANP, Erlangen, Germany, \*\*Technical Research Centre of Finland, Espoo, Finland

**Modelling the Influence of Aerosol Deposition onto Horizontal Finned Tubes on Heat Transfer under Cross-Flow Condensing Conditions**

*L.E. Herranz\*, J.L. Muñoz-Cobo\*\* and M.J. Palomo\*\**

\*Department of Nuclear Fission, CIEMAT, Madrid, \*\*Department of Nuclear Engineering, UPV, Valencia, Spain

**An Experimental Investigation on a Steam Explosion with a Small Scale Tin-Water System**

*J.H. Kim, Y.S. Shin, I.K. Park, S.W. Hong, J.H. Song and H.D. Kim*

Thermal Hydraulics and Safety Research Team, Korea Atomic Energy Research Institute, Yusong, Taejon, Korea

**Hot-Leg Injection: 3D Versus 1D Three Velocity Fields Modeling and Comparison with UPTF Experiment**

*N.I. Kolev, H. Seitz and I. Roloff-Bock*

Framatome ANP, NDS1, Erlangen, Germany

**Experimental Investigation on Heat Transfer in Surge Line Nozzle of Pressurizer in PWR**

*D. Lu, T. Chen, H. Wang and Y. Luo*

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

**3-D Flow Field Studied in Rod Bundles with Spacer Grids**

*W.Y. Xiong, B.D. Chen, Z.J. Xiao and X.J. Ma*

National Key Laboratory of Bubble Physics and Nature Circulation, Chengdu, China

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**Wednesday 26, 9:00-11:00 - Room 4 - Process Equipment and Applications: Industrial Applications**

**Chairman: R.J. Shyu**

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**Transient Behavior of a Compact Heat Transfer Surface During Brazing**

*D.P. Sekulic\**, *A.J. Salazar\**, *F. Gao\**, *\*\**, *J.S. Rosen\*\*\** and *H.F. Hutchins\*\*\**

\*CRMS, University of Kentucky, Lexington, USA, \*\*National Key Laboratory of Advanced Welding Production Technology, Harbin Institute of Technology, Harbin, P.R. China, \*\*\*Delphi Harrison Thermal System, Lockport, USA

**Numerical Simulation of the Side-Flow and Main-Flow Interactions in the Turbine Impulse Stage**

*R. Chodkiewicz\**, *B. Donevski\*\**, *W. Gundlach\**, *P. Hanausek\** and *K. Sobczak\**

\*Technical University of Lodz, Institute of Turbomachinery, Lodz, Poland, \*\*University St. Clement Ohridski, Faculty of Technical Sciences, Bitola, Macedonia

**Effects of Lobe Shapes on the Performance of Roots-Type Vacuum Pump**

*H.J. Kim*, *D.W. Kim* and *Y.J. Kim*

School of Mechanical Engineering, Sungkyunkwan University, Jangan-gu, Suwon, Korea

**Performance of the Impinging Stream Emulsifiers**

*Z. Kemblowski*, *J. Sêk*, *A. Bobiński* and *M. Pingot*

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

**Texture Simulation of High Temperature Phase Transformation in Steels**

*H.H.A. El-Sharawy*

Department of Mechanical and Materials Engineering, Military Institute of Engineering, Rio de Janeiro, Brazil

**Highly Ionized Aluminum Flux Produced by Electron Cyclotron Resonance Plasma Sputtering**

*V.N. Kharchenko*, *N.P. Poluektov*, *Yu.P. Tsar'gorodsev* and *I.G. Usatov*

Department of Physics, Moscow State University of Forestry, Moscow, Russia

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**Wednesday 26, 9:00-11:00 - Room 5 - Multi-Component and Multi-Phase Flow: Bubble Dynamics**

**Chairman: F.A. Franca**

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**Bubble Rising Velocity in Saturated Liquid up to the Critical Pressure**

*G.P. Celata\**, *M. Cumo\*\**, *F. D'Annibale\** and *A. Tomiyama\*\*\**

\*ENEA, ITFD, Rome, Italy, \*\*University of Rome, DINCE, Rome, Italy, \*\*\*University of Kobe, Graduate School of Science & Technology, Kobe, Japan

**Study of the Bubble Characteristic and the Local Void Fraction in Subcooled Flow Boiling using Digital Imaging- and Analysing Techniques**

*R. Maurus*, *V. Ilchenko* and *T. Sattelmayer*

Lehrstuhl A für Thermodynamik, Technische Universität München, Garching, Germany

**A Photographic Study on the Near-Wall Bubble Behavior in Subcooled Flow Boiling**

*I.C. Bang\**, *W.P. Baek\*\** and *S.H. Chang\**

\*Korea Advanced Institute of Science and Technology, Taejon, \*\*Korea Atomic Energy Research Institute, Taejon, Korea

**Bubble Dynamics in Nucleate Boiling around a Cylinder**

*M.A. Atmane* and *D.B. Murray*

Mechanical Engineering Department, Trinity College Dublin, Dublin Ireland

**Experimental Study on Terminal Velocity of Nitrogen Bubbles in FC-72**

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

University of Pisa, Department of Energetics, Pisa, Italy

**Calculation of Rise Velocity and Mass Transfer for Ellipsoidal Bubbles**

*P.I. Geshev* and *N.S. Safarova*

Institute of Thermophysics Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

**Wednesday 26, 11:00-11:20 - Coffee Break**

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**Wednesday 26, 11:20-13:00 - Room 1 - Thermodynamics & Heat and Mass Transfer: Heat Recovery**

**Chairman: S.P. Venkateshan**

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**Characteristics of a Thermal Storage Tank on an Under-Water Ice-Harvesting System**

*E.P. Kim\**, *J.I. Yoon\**, *I.S. Choi\**, *J.D. Kim\*\** and *B.B. Saha\*\**

\*Pukyong National University, Pusan, \*\*Tongmyong College, Pusan, Korea, \*\*\*Kyushu University, Fukuoka, Japan

**Experimental and Numerical Analysis of a Thermal Storage Tanks**

*R. De Césaró Oliveski*, *A. Krenzinger*, *H.A. Vielmo* and *C.W.M. Prieb*

Departamento de Engenharia Mecânica, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

**A New Technique for Enhancing Thermal Conductivity of Thermal Energy Storage Materials**

*J. Fukai*, *Y. Morozumi*, *Y. Hamada*, *W. Otsu* and *O. Miyatake*

Department of Chemical Engineering, Kyushu University, Japan

**Experimental Study on the Self-Operative Heat Transportation by Utilizing the Accumulated High-Pressure Vapor**

*K. Kadoguchi\**, *M. Yamazaki\** and *M. Watanabe\*\**

\*National Institute of Advanced Industrial Science, Tsukuba, \*\*Tokyo University of Fisheries, Tokyo, Japan

**Solar Desalination with Recovery of Heat of Condensation**

*B. Bouchekima\**, *B. Gros\*\**, *R. Ouahes\*\*\** and *M. Diboun\*\*\*\**

\*Département Génie Chimique C.U. Ouargla, Ouargla, Algeria, \*\*Département Génie Chimique I.U.T Paul Sabatier, Toulouse, France, \*\*\*Laboratoire de Chimie Solaire U.S.T.H.B., El Alia, Algeria, \*\*\*\*Institut de Chimie Industrielle U.S.T.H.B., El Alia, Algeria

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**Wednesday 26, 11:20-13:00 - Room 2 - Boiling: Critical Heat Flux and Rewetting**

**Chairman: R.D. Boyd**

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**Experimental Investigation of Boiling Curve in Vicinity of CHF and Rewetting Conditions. Part 1: Boiling Curve, Experiments and Post-CHF Test Results**

*T. Iguchi\**, *Z.V. Stosic\*\** and *C. Iwaki\*\*\**

\*JAERI - Japan Atomic Energy Research Institute, Tokai, Japan, \*\*Framatome ANP GmbH-NBTT, Erlangen, Germany, \*\*\*Toshiba, Kawasaki, Japan

**Critical Power in a Hemispherical Narrow Gap**

*R.J. Park\**, *K.S. Ha\**, *S.B. Kim\**, *H.D. Kim\** and *J.H. Jeong\*\**

\*Korea Atomic Energy Research Institute, Yusong-Ku, Taejon, \*\*Chinan College of Foreign Studies, Chun-an, Korea

**An Experimental and Analytical Study of the Effect of Flow Obstacles on the Critical Heat Flux**

*D.C. Groeneveld\*,\*\**, *I.L. Pioro\**, *Y. Guo\**, *S.C. Cheng\**, *Y.V. Antoshko\**, *S.S. Doerffer\*\** and *A. Vasic\**

\*Fuel Channel Thermalhydraulics Branch, Chalk River Laboratories, AECL, Chalk River, \*\*Department of Mechanical Engineering, University of Ottawa, Ottawa, Canada

**New CHF Enhancement Techniques: Passive Impeller Micropump and Gravity Driven Fluid Flow**

*K.S. Yigit*, *M. Arik* and *A. Bar-Cohen*

Laboratory for Thermal Management of Electronics, University of Minnesota, Minneapolis, USA

**Experimental Investigation of Boiling Curve in Vicinity of CHF and Rewetting Conditions. Part 2: Reflood Test Results and Comparison to Post-CHF Test Results**

*T. Iguchi\**, *Z.V. Stosic\*\** and *C. Iwaki\*\*\**

\*JAERI - Japan Atomic Energy Research Institute, Tokai, Japan, \*\*Framatome ANP GmbH-NBTT, Erlangen, Germany, \*\*\*Toshiba, Kawasaki, Japan

## **Fluid to Fluid Modeling of Critical Heat Flux**

*J. Chen, H. Zhao and J. Liao*

National Key Laboratory of Bubble Physics and Nature Circulation, Chengdu, China

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### **Wednesday 26, 11:20-13:00 - Room 3 - Nuclear Reactor Safety 2**

**Chairman: R.T. Lahey**

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#### **Local Void Measurements in Integral-Type Experiments Simulating Nuclear Power Plant Transients**

*Gy. Ézsöl\*, L. Szabados\* and H.M. Prasser\*\**

\*KFKI Atomic Energy Research Institute, Budapest, Hungary, \*\*Research Center Rossendorf Inc., Germany

#### **Experiments on the GEST-SIP1 Facility for Testing an Innovative Passive Injection System for LWRs**

*A. Achilli, G. Cattadori, R. Ferri and S. Gandolfi*

SIET S.p.A., Piacenza, Italy

#### **Simulation Method Research on Nuclear-Heat-Release Transient Characteristics**

*X. Wu, H. Zhao, X. Jiang, J. Liu and K. Wang*

National Key Laboratory of Bubble Physics and Nature Circulation, Chengdu, China

#### **High Temperature Behaviour of Reactor Core Materials under Air Oxidation Conditions**

*Z. Hózer, P. Windberg, I. Nagy, L. Maróti, L. Matus, M. Horváth, A. Pintér and M. Balaskó*

KFKI Atomic Energy Research Institute, Budapest, Hungary

#### **RELAP5/MOD3.2 Post Test Simulation and Accuracy Quantification of LOBI Test BT-02**

*R.C. Borges\*, F. D'Auria\*\* and A.C.M. Alvim\*\**

\*Comissão Nacional de Energia Nuclear, Coordenação de Reatores, Rio de Janeiro, Brazil, \*\*Dipartimento di Ingegneria Meccanica, Nucleare e della Produzione, Università di Pisa, Pisa, Italy, \*\*\*Programa de Engenharia Nuclear, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil

#### **Experimental Research on the Double Tube Gravity Driven Boron Injection System**

*S.Y. Jiang, Y.J. Zhang, L.L. Gao and C.W. Ma*

Institute of Nuclear Energy Technology, Tsinghua University, Beijing, China

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### **Wednesday 26, 11:20-13:00 - Room 4 - Convective Flows: Natural Convection 1**

**Chairman: O. Manca**

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#### **Study of Natural Convection from a Line Heat Source of a High Prandtl Number Fluids with Variable Viscosity in a Tank**

*N. Katsavos, I.G. Pappa, I.E. Sarris, I. Lekakis and N.S. Vlachos*

Laboratory of Fluid Mechanics & Turbomachinery, University of Thessaly, Volos, Greece

#### **Corona Wind Augmented Natural Convection: An Experimental Investigation**

*S. Bhattacharyya\* and A. Peterson\*\**

\*Department of Mechanical Engineering, IIT, Kharagpur, \*\*Department of Mechanical Engineering, University of Canterbury, Christchurch, New Zealand

#### **Effect of Natural Convection on Heat Transfer to a Horizontal Flow of Supercritical Water in a Round Tube**

*M. Bazargan and D. Fraser*

Department of Mechanical Engineering, University of British Columbia, Vancouver, Canada

#### **An Experimental Study of Unsteady Natural Convection**

*D. Rousse\*, P. Jacquet\*\* and A. Sawadogo\**

\*Département de Génie Mécanique, Université Laval, Quebec, Canada, \*\*LABOMAP, Ecole Nationale Supérieure d'Arts et Métiers, Cluny, France

#### **Natural Convective Heat Transfer in a Vertical Channel with Flow Resistance at the Lower End**

*I. Ishihara\*, T. Honiden\*\* and R. Matsumoto\**

\*Department of Mechanical Engineering, Kansai University, Osaka, \*\*Mitsubishi Cable Industries Ltd., Tokyo, Japan

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**Wednesday 26, 11:20-13:00 - Room 5 - Combustion: General Studies 1**

**Chairman: T. Niioka**

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**Burner Design Retrofit for Heavy Fuel Oil in Mexican Power Stations**

*R. Escalera, A. Chavez and R. Bolado*

Instituto Mexicano del Petróleo, Centro IMP-Veracruz, Veracruz, Mexico

**Pulse Detonation Engines. Experimental Investigation**

*D.I. Baklanov, L.G. Gvozdeva and N.B. Scherbak*

Institute for Energy Density, Russian Academy of Sciences, Moscow, Russia

**Active Control of Coaxial Jet Mixing and Combustion with Arrayed Micro Actuators**

*N. Kurimoto, Y. Suzuki and N. Kasagi*

Department of Mechanical Engineering, The University of Tokyo, Tokyo, Japan

**A Comparison of Experimental Indices to Determine Knock Limit in CHP SI Engines**

*G. Brecq, M. Tazerout and O. Le Corre*

Departement Systemes Energetiques et Environnement, Ecole des Mines de Nantes, Nantes, France

**Thermal Flux Characterization of Multiholed Plates Using Neural Networks : Application to Combustion Chamber Walls**

*J.B. Lopez Velasco\*, B. Leger\*\*, J.M. Emidio\**

\*Turbomeca, Sce Aérodynamique, \*\*Laboratoire Aquitain de Recherche en Aérodynamique, Université de Pau, Bordes Cedex, France

**Wednesday 26, 13:00-14:00 - Lunch**

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**Wednesday 26, 14:00-15:00 - Open Forum Session**

**Poster presentations**

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**Thursday 27, 8:20-9:00 - Plenary Room - Keynote Lecture 7**

**Chairman: U. Renz**

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**Experimental Study of High-Pressure Turbulent Premixed Flames**

*H. Kobayashi*

Institute of Fluid Science, Tohoku University, Sendai, Japan

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**Thursday 27, 9:00-9:40 - Plenary Room - Keynote Lecture 8**

**Chairman: H. Auracher**

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**Wave Flow Liquid Film under Complicated Conditions**

*S.V. Alekseenko*

Institute of Thermophysics SB RAS, Novosibirsk, Russia

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**Thursday 27, 9:40-10:20 - Plenary Room - Keynote Lecture 9**

**Chairman: I. Zun**

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**Development of Inverse Natural Convective Fluid and its Thermo-hydrodynamic Characteristic**

*I. Kataoka and K. Yoshida*

Department of Mechanophysics Engineering, Osaka University, Osaka, Japan

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**Monday 24, 10:20-10:40 - Coffee Break**

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**Thursday 27, 10:40-12:20 - Room 1 - Condensation 1**

**Chairman: J.P. Meyer**

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**On the Prediction of Condenser Plate Temperatures in a Cross-Flow Condenser**

*F.L.A. Ganzevles and C.W.M. van der Geld*

Faculty of Mechanical Engineering, Eindhoven University of Technology, Eindhoven, The Netherlands

**Condensation Heat Transfer of Herringbone Micro Fin Tubes**

*A. Miyara\* and Y. Otsubo\*\**

\*Department of Mechanical Engineering, Saga University, Saga-shi, \*\*Graduate School of Science and Engineering, Saga University, Saga-shi, Japan

**Design Considerations for Dropwise Condensation on Tube Bundles**

*D.A. McNeil, B.M. Burnside and G. Cuthbertson*

Department of Mechanical and Chemical Engineering, Heriot-Watt University, Edinburgh, U.K.

**Study of Condensation Heat Transfer of a Pure Fluid and Binary Mixture in a Bundle of Enhanced Surface Tubes**

*M. Belghazi\*, A. Bontemps\*\* and C. Marvillet\**

\*GRETh,DTA/DTEN-CEA/Grenoble, Grenoble, \*\*Laboratoire des Ecoulements Geophysiques et Industriels, Université Joseph Fourier, Grenoble, France

**In-Tube Condensation of Steam-Air Mixtures**

*F. Aglar\*, S. Saric\*\*, A. Tanrikut\* and O. Yesin\*\**

\*Technology Department, Turkish Atomic Energy Authority, Ankara, \*\*Mechanical Engineering Department, Middle East Technical University, Ankara, Turkey

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**Thursday 27, 10:40-12:20 - Room 2 - Thermalhydraulics: Liquid Films 1**

**Chairman: S. Alekseenko**

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**Experiments in Laminar Film Flow Along a Corrugated Wall**

*M. Vlachogiannis and V. Bontozoglou*

Department of Mechanical & Industrial Engineering, University of Thessaly, Volos, Greece

**On Freely-Falling Liquid Film Along a Vertical Flat Plate**

*C. Bertani and M. De Salve*

Dipartimento di Energetica, Politecnico di Torino, Torino, Italy

### **Thermal Performances of a Falling Film Graphite Evaporator**

*S. Bessenet\**, \*\*, *V. Renaudin\**, \*\*, *M. Daroux\**, *J.M. Hornut\**, \*\* and *P. LeGoff\**

\*LSGC, CNRS, ENSIC, INPL, Nancy, \*\*UHP-Nancy 1, Villers-les-Nancy, France

### **Local and Instantaneous Distribution of Heat Transfer Rates through Wavy Films**

*F. Al-Sibai*, *A. Leefken* and *U. Renz*

Lehrstuhl für Wärmeübertragung und Klimatechnik, RWTH Aachen, Aachen, Germany

### **Measurement of Falling Films Thickness by Capacitive Sensors**

*W. Ambrosini\**, *N. Forgione\**, *F. Oriolo\** and *A. Kammerer\*\**

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

\*\*Technische Universität München, Lehrstuhl A für Thermodynamik, Garching, Germany

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## **Thursday 27, 10:40-12:20 - Room 3 - Thermodynamics & Heat and Mass Transfer: Freezing, Melting and Solidification**

**Chairman: C. Pisoni**

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### **Heat Transfer and Phase Transformations in Laser Annealing of Thin Si Films**

*C.P. Grigoropoulos*, *S. Moon* and *M. Lee*

Department of Mechanical Engineering, University of California, Berkeley, USA

### **Evaluation of Analytical Model on Power Balance of Skull Melting Set-up**

*S.W. Hong\**, *B.T. Min\**, *H.D. Kim\** and *J.K. Choi\*\**

\*Korea Atomic Energy Research Institute, Yusong, Taejon, \*\*Dongshin University, Naju, Chonnam, Korea

### **An Investigation of the Phase Change Process with Natural Convection in the New PCMS Encapsulated in a Rectangular Cavity**

*R. Domanski\**, *K. Nagano\*\**, *M. Rebow\** and *T. Mochida\*\**

\*Institute of Heat Engineering, Warsaw University of Technology, Warszawa, Poland, \*\*Environmental Engineering, Hokkaido University, Sapporo, Japan

### **Experimental Study on the Thermal Performance with Frosting to Predict Frost Growth on a Flat Plate**

*N. Shimomura\**, *M. Kumada\*\**, *R. Chu\*\** and *T. Mizuno\*\**

\*Matsushita Refrigeration Company, Kusatsu City, \*\*Department of Mechanical Engineering, Gifu University, Gifu City, Japan

### **Convective Melting of Ice near 4°C**

*G.R. Vieira\**, *S.L. Braga\*\** and *D. Gobin\*\**

\*Department of Mechanical Engineering, Universidade Católica de Petrópolis, Petrópolis, Brazil,

\*\*Department of Mechanical Engineering, Catholic University of Rio de Janeiro, Rio de Janeiro, Brazil,

\*\*\*FAST-UMR-CNRS, Orsay, France

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## **Thursday 27, 10:40-12:20 - Room 4 - Convective Flows: Natural Convection 2**

**Chairman: to be assigned**

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### **Air Natural Convection in a Convergent Channel with Uniformly Heated Plates**

*N. Bianco\**, *O. Manca\*\**, *S. Nardini\** and *V. Naso\**

\*DETEC, Università degli Studi di Napoli Federico II, Napoli, \*\*DIA, Seconda università degli Studi di Napoli, Aversa, Italy

### **Experimental Data and Evaluation of Numerical Methods for Natural Convection in a Rectangular Enclosure with a Uniformly Heated Bottom Surface**

*J. Onishi\**, *H. Ikegami\*\**, *N. Otsuka\*\*\**, *S. Ito\*\** and *M. Mizuno\*\*\*\**

\*Department of Intelligent Machine Engineering, Osaka Electro-Communication University, Osaka, \*\*Osaka Gas Co., \*\*\*Mitsubishi Electric Corp., \*\*\*\*Department of Environmental Engineering, Osaka University, Osaka, Japan

### **Radiative Effects on Natural Convection in a Vertical Channel with an Auxiliary Parallel Plate**

*A. Andreozzi*, *O. Manca* and *B. Morrone*

Dipartimento di Ingegneria Aerospaziale, Seconda Università di Napoli, Aversa, Italy

**Natural Convection of Suspension with Water and Fine Particles in a Rectangular Vessel Heated and Cooled from Opposing Vertical Walls: Effects of Initial Particle Concentration Gradient**

*C. Kang\**, *M. Okada\*\** and *A. Hattori\*\**

\*School of Mechanical & Aerospace Engineering, Seoul National University, Seoul, Korea, \*\*Department of Mechanical Engineering, Aoyama Gakuin University, Tokyo, Japan

**Experimental Analysis of Chimney Effect in a Vertical Isoflux Channel**

*O. Manca\**, *M. Musto\** and *V. Naso\*\**

\*DIA, Seconda università degli Studi di Napoli Real Casa dell'Annunziata, Aversa, \*\*DETEC, Università degli Studi di Napoli Federico II, Napoli, Italy

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**Thursday 27, 10:40-12:20 - Room 5 - Combustion: General Studies 2**

**Chairman: A. Chavez**

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**Observation of Soot Agglomeration Process with Aid of Thermophoretic Force in a Microgravity Jet Diffusion Flame**

*O. Fujita* and *K. Ito*

Department of Mechanical Science, Hokkaido University, Sapporo, Japan

**Experimental Study on Pressure Effect and Diffusion Effect of Oxygen Gas by Magnetic Field**

*H. Tanaka\**, *M. Uehara\**, *K. Yoshida\*\**, *M. Kimura\*\**, *H. Shoji\*\** and *A. Saima\*\**

\*Department of Applied Physics, National Defense Academy, Hashirimizu Yokosuka, \*\*Department of Mechanical Engineering, Nihon University, Tokyo, Japan

**Premixed Flame Kernel Growth in the Presence of a Vortex Ring**

*Y. Xiong\**, *W.L. Roberts\**, *M.C. Drake\*\** and *T.D. Fansler\*\**

\*Department of Mechanical and Aerospace Engineering, North Carolina State University, Raleigh, \*\*General Motors Research, Development and Planning, Warren, USA

**Experimental Study of Flow and Combustion Processes based on Physical and Numerical Modelling Techniques**

*J. Baranski\**, *W. Blasiak\*\** and *J. Stasiak\**

\*Technical University of Gdansk, Gdansk, Poland, \*\*Royal Institute of Technology, Stockholm, Sweden

**The Clinker Burning Process Simulated with Different Thermochemical Databases**

*M. Modigell\**, *D. Liebig\** and *K. Hack\*\**

\*Institute for Chemical Engineering, RWTH Aachen, Aachen, \*\*GTT-Technologies, Herzogenrath, Germany

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**Thursday 27, 12:20-13:20 - Lunch**

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**Thursday 27, 13:20-14:00 - Plenary Room - Keynote Lecture 10**

**Chairman: K. Mishima**

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**New Experimental Results in Boiling Heat Transfer**

*H. Auracher\**, *W. Marquardt\*\**

\*TU Berlin, Institut für Energietechnik, Berlin, \*\*RWTH Aachen, Lehrstuhl für Prozesstechnik, Aachen, Germany

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**Thursday 27, 14:00-15:40 - Room 1 - Condensation 2**

**Chairman: A.J. Karabelas**

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**Condensation Heat Transfer Coefficients of the Zeotropic Refrigerant Mixture R-22/R-142b in Smooth Horizontal Tubes**

*F.J. Smit* and *J.P. Meyer*

Department of Mechanical and Manufacturing Engineering, Rand Afrikaans University, Johannesburg, South Africa

**Local Heat Transfer During Dropwise Condensation of Steam on a Single Horizontal Tube**

*M. Izumi\**, *S. Kumagai\*\**, *R. Shimada\*\*\** and *N. Yamakawa\*\*\**

\*Department of Mechanical Engineering, Miyagi National College of Technology, Natori, \*\*Department of Machine Intelligence and System Engineering, Tohoku University, Sendai, \*\*\*Department of Mechanical Engineering, Ishinomaki Senshu University, Ishinomaki, Japan

**Experimental Investigation of EHD Condensate Drainage from Horizontal Finned Tube**

*D. Butrymowicz*, *M. Trela* and *J. Karwacki*

Institute of Fluid Flow Machinery of Polish Academy of Sciences, Gdansk, Poland

**The Comparison of Steam Condensation Rates when there are Low Concentrations of Ammonia, Methylamine and Trimethylamine in the Vapour**

*J. Deans*, *C. Korte* and *M. Dunstall*

Department of Mechanical Engineering, University of Auckland, New Zealand

**Film Condensation on Eccentrically Cut Horizontal Integral-Fin Tubes**

*L.K. Sreepathi*

Department of Mechanical Engineering, JNN College of Engineering, Shimoga, India

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**Thursday 27, 14:00-15:40 - Room 2 - Thermalhydraulics: Liquid Films 2**

**Chairman: U. Renz**

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**Flow Dynamics and Heat Transfer in Intensively Evaporating Wavy Liquid Film**

*A.N. Pavlenko*, *V.V. Lel*, *A.F. Serov* and *A.D. Nazarov*

Institute of Thermophysics, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

**Conditions for the Change of the Droplet Structure into the Water Film on a Heated Wall Surface Overflowed by a Stream of Air**

*Z. Zapalowicz*

Department of Mechanical Engineering, Technical University of Szczecin, Szczecin, Poland

**Heat Transfer and Breakdown of Subcooled Falling Liquid Film on a Middle Size Heater**

*E.A. Chinnov*, *D.V. Zaitsev*, *I.A. Sharina*, *I.V. Marchuk* and *O.A. Kabov*

Institute of Thermophysics Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

**Characteristics of Liquid Film in a Vertical Pipe with the Presence of Gas Flow**

*S. Alekseenko*, *A. Cherdantsev*, *S. Kharlamov* and *D. Markovich*

Institute of Thermophysics Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

**Methodic of Measurements and Experimental Results of Local Heat Transfer at Liquid Film Flow on the Horizontal Finned Tubes**

*V. Rifert*, *V. Sidorenko*, *V. Usenko* and *I. Zolotukhin*

National Technical University of Ukraine, Kiev, Ukraine

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**Thursday 27, 14:00-15:40 - Room 3 - Boiling: Pool Boiling 1**

**Chairman: S. Kandlikar**

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**Boiling of Saturated FC-72 on Square Pin Fin Arrays**

*G. Guglielmini*, *M. Misale* and *C. Schenone*

DITEC, Università di Genova, Genova, Italy

**Passive Enhancement in Two Phase Heat Transfer: Analysis of Pool Boiling and CHF with Fins and Metallic Wire Nets**

*A. Franco* and *E. Latrofa*

Dipartimento di Energetica, University of Pisa, Pisa, Italy

**Adverse Electric Field Effects on Heat Transfer in Transition and Film Boiling**

*V. Masson\** and *P.M. Carrica\*\**

\*Centro Atómico Bariloche, Bariloche, \*\*Universidad Argentina de la Empresa, Buenos Aires, Argentina

**Bubble Growth Rate at Pool Boiling in Wide Range of Reduced Pressures**

*V.V. Yagov*

Moscow Power Engineering Institute, Moscow, Russia

## **Study of Transition from Film to Nucleate Boiling on a Solid Hemispheric Surface**

*V.V. Glazkov\**, *V.G. Zhilin\*\**, *Yu.A. Zeigarnik\*\**, *Yu.P. Ivochkin\*\**, *O.A. Sinkevich\** and *V.R. Tsoi\*\*\**

\*Moscow Power Engineering Institute, Moscow, \*\*Joint Institute for High Temperature of the Russian Academy of Sciences, Moscow, \*\*\*Scientific Research Center, Electrogorsk, Russia

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### **Thursday 27, 14:00-15:40 - Room 4 - Convective Flows: Natural Convection 3**

**Chairman: J.Y. Yoo**

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#### **Some Experiments on Natural-Convective Heat Transfer from Slender Vertical Cylinder**

*C.O. Popiel, J. Wojtkowiak and K. Bober*

Poznan University of Technology, Poznan, Poland

#### **An Interferometric Investigation of the Effect of Separation Distance and Temperature Imbalance on Natural Convection for Two Horizontal Cylinders at Moderate Rayleigh Numbers**

*P. Razelos\* and R.N. Krikis\*\**

\*College of Staten Island, CUNY New York, Athens, \*\*Institute of Chemical Engineering and High Temperature Processes, Patras, Greece

#### **Scale Model: An Effective Tool in Validation of CFD Simulation Results in Natural Convection**

*R. Kulkarni*

Faculty of Engineering & Technology, Multimedia University Melaka, Malaysia

#### **An Experimental Study of Natural Convection and Surface Radiation in an Open Cavity**

*N. Ramesh\*, C. Balaji\*\* and S.P. Venkateshan\*\**

\*National Aerospace Laboratories, Bangalore, \*\*Heat Transfer and Thermal Power Laboratory, Indian Institute of Technology, Madras, India

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### **Thursday 27, 14:00-15:40 - Room 5 - Combustion: Experimental Methods**

**Chairman: J.F. Sacadura**

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#### **Surface Heat-Transfer Measurements Inside a Supersonic Combustor by LIF**

*K. Kontis\* and N. Yoshikawa\*\**

\*Department of Aerodynamics, Hellenic Air Force Academy, Athens, Greece, \*\*Department of Aerospace Engineering, Nagoya University, Japan

#### **Temperature Measurements and Heat-Transfer Modelling Using Plate Thermometers in a Plasterboard Wall System Subjected to a Standard Furnace Test**

*G.E. Collins, C Brescianini and C. Wojcik*

Fire Science and Technology Laboratory, CSIRO, Sydney, Australia

#### **Flow Characterization of Flickering Methane/Air Diffusion Flames using PIV**

*G. Papadopoulos\*, R.A. Bryant\*\* and W. Pitts\*\**

\*Dantec Dynamics Inc., Mahwah, \*\*National Institute of Standards Technology, Building and Fire Laboratory, Gaithersburg, USA

#### **Application of Quotient Pyrometry to Industrial Pulverised Coal Combustion**

*T. Sabel, S. Unterberger and K.R.G. Hein*

Institute of Process Engineering and Power Plant Technology (IVD), University of Stuttgart, Stuttgart, Germany

#### **Real-Time Exposure Holographic Interferometric Measurement and Tomography of C<sub>2</sub>H<sub>2</sub> Flame Temperature Field**

*S. Huang and J. Peng*

Department of Power Engineering, Huazong University of Science and Technology, Wuhan, China

**Thursday 27, 15:40-16:00 - Coffee Break**

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**Thursday 27, 16:00-16:40 - Plenary Room - Keynote Lecture 11**

**Chairman: G.P. Celata**

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**Fundamental Issues Related to Flow Boiling in Minichannels and Microchannels**

*S.G. Kandlikar*

Mechanical Engineering Department, Rochester Institute of Technology, Rochester, U.S.A

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**Thursday 27, 16:40-18:20 - Room 1 - Thermalhydraulics: Unstable and Unsteady Flows 1**

**Chairman: to be assigned**

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**Experimental Investigation of Annular Diffuser in Consideration of Efficiency and Unsteady Flow**

*P. Kraus, J. Messner and H. Stetter*

Institut für Thermische Strömungsmaschinen und Maschinenlaboratorium, University of Stuttgart, Stuttgart, Germany

**Effects of Pulsation on External Flow Heat Transfer around a Rod**

*Y. Ishino\*, T. Abe\*\*, S. Yamaguchi\*\*\* and N. Ohiwa\**

\*Department of Mechanical Engineering, Nagoya Institute of Technology, Nagoya, \*\*Toyota Motor Co., Toyota, \*\*\*Department of Transportation Machine Engineering, Meijo University, Nagoya, Japan

**Dynamics and Quasi-Periodicity in Axially Forced Taylor-Couette Flow**

*M. Sinha\*, I.G. Kevrekidis\*\* and A.J. Smits\**

\*Gas Dynamics Laboratory, Princeton University, Princeton, \*\*Chemical Engineering & PACM, Princeton University, Princeton, USA

**Experimental Investigation of Propagating Flow Instabilities Generated by Super Vibratory Agitation**

*A. Jianu\*, M. Brede\*, P. Claude\*\*, A. Leder\* and H.J. Speck\*\*\**

\*Institute of Fluidmechanics, University of Rostock, Rostock, \*\*Chemetall GmbH, Frankfurt/Main, \*\*\*Daimler Chrysler AG, Sindelfingen, Germany

**Self-Oscillation of Cavitating Flow Around an Elliptic Cylinder**

*T. Mori\*, T. Takahashi\*\*, T. Kaga\*\*\* and T. Ota\*\*\*\**

\*Japan Defence Agency, Tokyo, \*\*Central Research Institute of Electric Power Industry, Yokosuka, \*\*\*Department of Mechanical Engineering, Hachinohe Institute of Technology, Hachinohe, \*\*\*\*Department of Machine Intelligence and Systems Engineering, Tohoku University, Sendai, Japan

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**Thursday 27, 16:40-17:40 - Room 2 - Thermalhydraulics: Liquid Films 3**

**Chairman: U. Renz**

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**Falling Liquid Film of the Surface Active Agents Solutions**

*L. Broniarz-Press and D. Dulcka*

Department of Chemical Engineering and Apparatus, Poznan University of Technology, Poznan, Poland

**Thermocapillary Convection in a Falling Thin Liquid Film Locally Heated**

*O.A. Kabov\*, B. Scheid\*\*, L.A. Sharina\* and J.C. Legros\*\**

\*Institute of Thermophysics Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia, \*\*Microgravity Research Center, Universite Libre de Bruxelles, Brussels, Belgium

**The Long Waves on a Liquid Film Falling over a Vertical Cylinder**

*O.Y. Tsvlodub\*, \*\* and A.A. Bocharov\**

\*Institute of Thermophysics Siberian Branch of the Russian Academy of Sciences, Novosibirsk, \*\*Novosibirsk State University, Novosibirsk, Russia

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**Thursday 27, 17:40-18:20 - Room 2 - Measurement Techniques: Thermophysical Properties 1**

**Chairman: O. Kashinsky**

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**Experimental Investigation of Dynamic and Equilibrium Surface Tension Characteristics of Aqueous Surfactant Solutions**

*V.M. Wasekar, J. Zhang and R.M. Manglik*

Thermal-Fluids and Thermal Processing Laboratory, University of Cincinnati, Cincinnati, USA

**Effective Thermal Properties of Mexican Geothermal Cementing Systems from 25 to 220 °C**

*A. García\*, \*\*, J.M. Morales\*\*, E. Contreras\*, E. Santoyo\*\*\* and G. Espinosa\*\*\*\**

\*Instituto de Investigaciones Eléctricas, Temixco, \*\*Centro Nacional de Investigación y Desarrollo

Tecnológico, Cuernavaca, \*\*\*UNAM, Centro de Investigación en Energía, Temixco, \*\*\*\*UAM-iztapalapa, Depto. de IPH, México

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**Thursday 27, 16:40-18:20 - Room 3 - Boiling: Pool Boiling 2**

**Chairman: M. Misale**

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**Two-Phase Structure Measurements for Bubbles Departing from a Heated Surface by Means of One- and Two-Probe Hot-Wire Anemometry**

*J. Bonjour\*, N. Ginet\*\* and M. Lallemand\*\**

\*Laboratory du Froid- Cnam, Paris, \*\*CETHIL - INSA, Villeurbanne Cedex, France

**An Experimental Investigation on the Boiling Heat Transfer on the Vertical Square Surface**

*J.H. Song, J.G. Kim, S.B. Kim and H.D. Kim*

Korea Atomic Energy Research Institute, Yusong, Taejeon, Korea

**Experimental Investigation in Pool Boiling Heat Transfer of Ternary Mixture and Heat Transfer Correlation**

*Y. Fujita and M. Tsutsui*

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

**Boiling Incipience of Ethanol on Platinum Surface: Influence of Pressure**

*K. Mizukami, X.C. Zhuo and S. Mukasa*

Department of Mechanical Engineering, Ehime University, Matsuyama, Japan

**Heat Transfer from Horizontal Tubes During Pool Boiling of Water and R141b**

*J.T. Cieslinski and P.R. Dominiczak*

Technical University of Gdansk, Gdansk, Poland

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**Thursday 27, 16:40-18:20 - Room 4 - Convective Flows: Natural and Mixed Convection**

**Chairman: S.M. Zubair**

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**The Review of Particular Experimental Methods of Free Convective Heat Transfer**

*W.M. Lewandowski*

Department of Apparatus and Chemical Machinery, Technical University of Gdansk, Gdansk, Poland

**Turbulent Mixed Convection Heat Transfer in a Vertical Flat Channel with Opposing Flows**

*P. Poskas and R. Poskas*

Lithuanian Energy Institute, Kaunas, Lithuania

**Free Convection of the Near Critical Fluid in Ground-Based and Microgravity Environment**

*V.I. Polezhaev, V.M. Emelianov, A.A. Gorbunov and E.V. Soboleva*

Institute for Problems in Mechanics, Russian Academy of Sciences, Moscow, Russia

**An Experimental Study of the Frost Formation on a Cold Surface in Free Convective Flow**

*G. Tanda and M. Fossa*

DITEC, University of Genova, Genova, Italy

## **Secondary Flow Characteristics and Convective Heat Transfer in a Curved Rectangular Duct with External Heating**

*T.T. Chandratilleke*

Department of Mechanical Engineering, Curtin University of Technology, Perth, Australia

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**Thursday 27, 16:40-18:20 - Room 5 - Combustion: Emission Reduction**

**Chairman: N. Selcuk**

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### **NO<sub>x</sub> Emission from High-Temperature Air/Methane Counterflow Diffusion Flame**

*R. Fuse\**, *H. Kobayashi\*\**, *Y. Ju\*\*\**, *K. Maruta\*\*\*\** and *T. Niioka\*\**

\*National Space Development Agency, Kagoshima, \*\*Institute of Fluid Science, Tohoku University, Sendai, \*\*\*Department of Aerospace Engineering, Tohoku University, Sendai, \*\*\*\*Department of Science and Technology System, Akita Prefectural University, Honjo, Japan

### **Filtration Combustion of Hydrogen Sulfide, Comparison of Theory and Experiment**

*J.P. Bingue*, *A.V. Saveliev*, *A.A. Fridman* and *L.A. Kennedy*

Department of Mechanical Engineering, University of Illinois at Chicago, Chicago, USA

### **FTIR Low Resolution Emission Spectrometry of a Laboratory-Scale Diffusion Flame: Experimental Set-Up**

*R. Bourayou*, *R. Vaillon* and *J.F. Sacadura*

Centre de Thermique de Lyon, INSA de Lyon, Villeurbanne Cedex, France

### **Improving Combustion of High Asphaltene Heavy Fuel Oil by Water Emulsification**

*R. Ocampo-Barrera\**, *A. Diego-Marín\*\**, *M. Martínez-Flores\*\**, *A. Tamayo-Flores\*\** and *E. Alarcón-Quiroz\*\**

\*Instituto Mexicano del Petróleo, Centro IMP-Veracruz, Veracruz, \*\*Instituto de Investigaciones Electricas, Procesos Termicos, Temixco, Mexico

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**Friday 28, 8:20-9:00 - Plenary Room - Keynote Lecture 12**

**Chairman: A.M. Taylor**

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**Recent Progress in Visual Fluid Dynamics**

*J.Y. Yoo*

School of Mechanical and Aerospace Engineering, Seoul National University, Seoul, Korea

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**Friday 28, 9:00-10:40 - Room 1 - Thermalhydraulics: Unstable and Unsteady Flows 2**

**Chairman: Z. Bilicki**

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**The Spatial Amplification of Disturbances in the Kármán Boundary-Layer**

*Y.K. Hwang and Y.Y. Lee*

School of Mechanical Engineering, Sungkyunkwan University, Suwon, Korea

**The Spatial Amplification of Disturbances in Vertical Natural Convection Flows of Water Near Density Extremum**

*Y.K. Hwang*

School of Mechanical Engineering, Sungkyunkwan University, Jangan-gu, Suwon, Korea

**Transition in a Laminar Spot**

*A. Matsumoto*

College of Science and Technology, Nihon University, Tokyo, Japan

**Experimental Study of Transient Evaporation of Superfluid Helium Induced by Incidence of Second Sound Thermal Pulse onto Free Surface**

*M. Murakami, T. Furukawa, M. Maki and J. Fujiyama*

Institute of Engineering Mechanics and Systems, University of Tsukuba, Tsukuba, Japan

**Pressure Transient in Compressible Bubbly Flows in the Petroleum Industry**

*D. Kim\*, S. Correr\*\*, A. Di Lullo\*\*, N. Mancini\*\* and F. Podenzani\*\**

\*High Informatics College of Novosibirsk State University, Novosibirsk, Russia, \*\*EniTecnologie, San Donato Milanese, Italy

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**Friday 28, 9:00-10:40 - Room 2 - Measurement Techniques: Thermophysical Properties 2**

**Chairman: O. Kashinsky**

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**On the Effective Thermal Conductivity of Dry Olivine**

*F. Gori and S. Corasaniti*

Department of Mechanical Engineering, University of Rome "Tor Vergata", Rome, Italy

**Application of a Cubic Equation of State to a Self-Consistent Thermodynamic Model to Obtain Thermodynamic Surfaces for Various Organic Heat Transfer Fluids**

*E. Silvestri*

Ansaldo Energia, Divisione Nucleare, Genova, Italy

**Experimental Determination of the Functional Relationship Among Concentration, Temperature and Refractive Index for Ammonium Chloride Solutions**

*C.S. Stampa\* and S.L. Braga\*\**

\*Department of Mechanical Engineering, Universidade Católica de Petrópolis, Petrópolis, \*\*Department of Mechanical Engineering, Pontifical Catholic University of Rio de Janeiro, Rio de Janeiro, Brazil

**Method of Thermal Conductivity Determination of Conductive Composites at a High Temperature**

*V.V. Vorobey\*, G.E. Ostrovskiy\*\*, E.N. Nikiporets\*, O.V. Tatarnikov\*\* and S.V. Tashchilov\*\**

\*Moscow Aviation Institute, Moscow, \*\*Open Joint-Stock Company Research, Development and Production Corporation "KOMPOZIT", Korolev, Russia

**Thermodynamics Properties of HFC 134a in Wide Intervals of Pressure and Temperature Including the Critical Region**

*V.A. Rykov\*, I.V. Rykova\*, E.E. Ustjuzhanin\*\*, B.F. Reutov\*\* and A.B. Lobanov\*\**

\*State Academia of Cooling Technology, St. Petersburg, \*\*Moscow Power Engineering Institute, Moscow, Russia

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**Friday 28, 9:00-10:40 - Room 3 - Boiling: Boiling Heat Transfer 1**

**Chairman: V. Wadekar**

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**Nucleate Boiling in Climbing Films: a Flow Visualisation Study**

*J.R. Barbosa Jr., G.F. Hewitt and S.M. Richardson*

Department of Chemical Engineering, Imperial College of Science, London, U.K.

**Boiling Heat Transfer at Liquid-Liquid Interface between Water and Molten Metal**

*Y. Saito\*, T. Tanaka\*\* and K. Mishima\**

\*Research Reactor Institute, Kyoto University, Osaka, \*\*Graduate School of Energy and Science, Kyoto University, Kyoto, Japan

**Experimental Study on Boiling in Micro-Chambers**

*B. Seyedan, A.M.C. Chan and M. Shoukri*

Department of Mechanical Engineering, McMaster University, Hamilton, Canada

**Experimental Investigations of Bubble Entrainment Peculiarities at Steam Generation in Horizontal Channel with Porous Coating**

*V.I. Borzenko and S.P. Malyshenko*

Institute of High Temperatures, Russian Academy of Sciences, Moscow, Russia

**An Experimental Investigation of the Influence of System Pressure on the Boiling Heat Transfer Coefficient in a Closed Two-Phase Thermosyphon Loop**

*R. Khodabandeh and B. Palm*

Department of Energy Technology, Royal Institute of Technology, Stockholm, Sweden

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**Friday 28, 9:00-10:40 - Room 4 - Multi-Component and Multi-Phase Flow: Atomization and Sprays**

**Chairman: I. Ishihara**

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**Determination of Bulk Temperature of Semitransparent Oxide Particles in Thermal Spraying from the Experimental Data on their Color Temperature**

*L.A. Dombrovsky\* and M.B. Ignatiev\*\**

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

**Index of Performance of Effervescent Atomisers**

*O. Schmidt\*, J.S. Lewis\* and J. Kubie\*\**

\*School of Engineering Systems, Middlesex University, London, \*\*School of Engineering, Napier University, Edinburgh, U.K.

**Practical Design of Ultrasonic Spray Devices: Experimental Testing of Several Atomizer Geometries**

*M. Dobre and L. Bolle*

Department of Mechanical Engineering, Université Catholique de Louvain, Louvain-la-Neuve, Belgium

**Properties of Sandblasting Nozzle for Micro Processing**

*N. Ogawa and K. Matsuyama*

Science University of Tokyo, Chiba, Japan

**Measurement of Spray Cooling Heat Transfer Using an Infrared-Technique**

*F. Puschmann, E. Specht and J. Schmidt*

Institute of Fluid Dynamics and Thermodynamics, Otto-von-Guericke-Universität, Magdeburg, Germany

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**Friday 28, 9:00-10:40 - Room 5 - Multi-Component and Multi-Phase Flow: Particle and Droplet Dynamics**

**Chairman: A.M. Taylor**

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**Contact Angle Behavior during Impingement of Molten Solder Droplets on Metal Plates**

*C. Richard, I.S. Bayer and C.M. Megaridis*

Department of Mechanical Engineering, University of Illinois, Chicago, USA

## **Motion of Two Settling Particles in a Stagnant Viscous Fluid inside a Vertical Cylinder**

*M. Shinohara*

Department of Mechanical Engineering, Gifu National College of Technology, Gifu, Japan

## **Particle Deposition in Low-Speed, High-Turbulence Flows**

*M. Reck, P.S. Larsen and U. Ullum*

Department of Mechanical Engineering, Technical University of Denmark, Copenhagen, Denmark

## **Evaporation of the Array of Hydrocarbon Droplets in an Air Stream**

*T. Kadota, Y. Ohta, H. Enomoto and D. Segawa*

Department of Mechanical Engineering, Osaka Prefecture University, Japan

## **Oblique Impact of Droplets on Walls and Films**

*S. Sikalo\*, C. Tropea\*\*, M. Marengo\*\*\* and E.N. Ganic\**

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

**Friday 28, 10:40-11:00 - Coffee Break**

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**Friday 28, 11:00-11:40 - Plenary Room - Keynote Lecture 13**

**Chairman: C. Pisoni**

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## **Experimental Characterization of Thermal Radiation Properties of Dispersed Media**

*J.F. Sacadura and D. Baillis*

INSA Lyon - CETHIL, Lyon, France

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**Friday 28, 11:40-13:20 - Room 1 - Fluid-Dynamics: Vortex Flows 1**

**Chairman: T. Skiepko**

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## **Effect of Embedded Vortices on Film Cooling Performance on a Flat Plate**

*J.S. Lee, H.G. Jung and S.B. Kang*

School of Mechanical & Aerospace Engineering, Seoul National University, Seoul, Korea

## **Flow Structures of Swirling Wakes behind Circular Discs**

*R.F. Huang and F.C. Tsai*

Department of Mechanical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan

## **Experimental Investigation of the Confined Vortex Flow in a One Channel Vortex Enhanced Heat Exchanger**

*F. Dupont, N. Daviot, C. Gabillet and P. Bot*

Institut de Recherche de l'Ecole Navale, Brest-Naval, France

## **Vortical Structures behind Three Side-by-Side Cylinders**

*X.W. Wang\*, Y. Zhou\* and H. Li\*\**

\*Department of Mechanical Engineering, The Hong Kong Polytechnic University, Hong Kong, China,

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

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**Friday 28, 11:40-13:20 - Room 2 - Thermodynamics & Heat and Mass Transfer: General Studies 1**

**Chairman: A. Prata**

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## **Rayleigh-Bénard Phenomena, Bifurcations, Exergy Degradation and System Evolution**

*G. Bisio and C. Pisoni*

Energy and Conditioning Department, University of Genoa, Genova, Italy

## **Experimental Measurements of Radiative Heat Flux in Complex Geometries and Comparison with Numerical Modelling**

*J.S. Almeida\*, W. Malalasekera\*\* and E.H. James\*\**

\*Laboratorio de Integracao e Testes-LIT, Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil, \*\*Department of Mechanical Engineering, Loughborough University, Loughborough, U.K.

## **Prediction of Stagnation Region Heat Transfer Using a Neural Network**

*B. Seyedan\**, *A.N. Oo\**, *C.Y. Ching\** and *M. Shoukri\**

\*Department of Mechanical Engineering, McMaster University, Hamilton, \*\*Faculty of Engineering & Applied Science, Memorial University of Newfoundland, St. John's, Canada

## **Non-Newtonian Laminar Heat Transfer in Stirred Tank Bioreactors**

*Y. Kawase*, *M. Hoshino* and *T. Takahashi*

Department of Applied Chemistry, Toyo University, Saitama, Japan

## **Non-Linearity: Fundamentals and Applications in Different Processes**

*G. Bisio\**, *L. Tagliafico\** and *A. Bisio\*\**

\*Energy and Conditioning Department, University of Genoa, Genova, \*\*Botanical Institute, University of Genoa, Genova, Italy

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## **Friday 28, 11:40-13:20 - Room 3 - Boiling: Boiling Heat Transfer 2**

**Chairman: K. Mishima**

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### **The Steam Boat and the Elasticity and Capability of a Bubble in Subcooled Boiling**

*J.J. Schröder*, *St. Alraun*, *A. Bode* and *M. Krüger*

Institute for Thermodynamics, University of Hannover, Hannover, Germany

### **Boiling and Evaporation Heat Transfer from a TiO<sub>2</sub>-Coated Surface**

*Y. Takata\**, *S. Hidaka\**, *J.M. Cao\**, *T. Nakamura\**, *H. Yamamoto*, *M. Masuda\**, *T. Ito\** and *T. Watanabe\*\**

\*Department of Mechanical Science and Engineering, Kyushu University, Fukuoka, \*\*Research Center for Advanced Science and Technology, The University of Tokyo, Tokyo, Japan

### **Explosive Vaporization on a Microheater: Effect of Dissolved Gas**

*E.S. Vasserman*

Institute of Thermophysics, Siberian Division of the Russian Academy of Sciences, Novosibirsk, Russia

### **Some Aspects of Reconstruction of Attractors from the Heating Surface Temperature Fluctuations in Boiling**

*R. Mosdorf*

Biasystok University of Technology, Biasystok, Poland

### **Development of Nucleate Boiling in an Annular Clearance**

*T. Bohdal*, *Z. Bilicki* and *M. Czapp*

Technical University of Koszalin, Department of Thermomechanics and Refrigerating Engineering, Koszalin, Poland

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## **Friday 28, 11:40-13:20 - Room 4 - Multi-Component and Multi-Phase Flow: General Studies**

**Chairman: B. Azzopardi**

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### **Impedance Probe for Phase Distribution Measurements and Flow Pattern Identification in Oil-Water Flows**

*J. Lovick* and *P. Angeli*

Department of Chemical Engineering, University College London, London U.K.

### **Effects of Polymer, Surfactant, and Salt Additives to a Coolant on the Mitigation and the Severity of Vapor Explosions**

*M. Furuya* and *I. Kinoshita*

Central Research Institute of Electric Power Industry, Tokyo, Japan

### **Behaviors of Bubble Formation from a Bottom Porous Nozzle in a Bath**

*M. Kaji\**, *T. Sawai\**, *K. Mori\*\** and *M. Iguchi\*\*\**

\*Department of Mechanical Engineering, Kinki University, Wakayama, \*\*Department of Intelligent Machine Engineering, Osaka Electro-Communication University, Osaka, \*\*\*Division of Materials Science and Engineering, Hokkaido University, Sapporo, Japan

**A New Magnetic Fluid Circulator Utilizing Waste Gas and /or Heat - First Report, Feasibility Test**

*M. Sadatomi\**, *H. Tsubone\*\**, *A. Kawahara\** and *Y. Sato\*\*\**

\*Department of Mechanical Engineering and Mat. Sci., Kumamoto University, Kumamoto, \*\*Department of Mechanical Engineering, Ariake National College of Technology, Omuta, \*\*\*Yatsushiro National College of Technology, Yatsushiro, Japan

**Experimental Research of Magnetohydrodynamic Resistance to a Flow of Lead, Gallium, Lead-Bismuth, and Lead-Lithium Eutectics in a Transverse Magnetic Field**

*A.V. Besnosov\**, *S.S. Pinaev\**, *V.N. Zakhvatov\**, *A.V. Semyonov\**, *T.A. Bokova\** and *P.V. Romanov\*\**

\*Nizhny Novgorod State Technical University, Nizhny Novgorod, \*\*Russian Scientific Centre of Kurchatov Institute, Moscow, Russia

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**Friday 28, 11:40-13:20 - Room 5 - Convective Flows: Convective Heat Transfer**  
**Chairman: G. Guglielmini**

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**The Effect of Swirl on Convective Heat Transfer Downstream of Sudden Axisymmetric Expansions in a Circular Duct**

*J. Ward*, *A. Bertelmann* and *D.R. Garwood*

School of Technology, University of Glamorgan, Pontypridd, U.K.

**Interferometric Study of Convective Heat Transfer Structures above the Horizontal Isothermal Rectangular Plates**

*E. Radziemska* and *W.M. Lewandowski*

Department of Apparatus and Chemical Machinery, Technical University of Gdansk, Gdansk, Poland

**An Experimental Investigation of Forced Convection Heat Transfer in Channels with Rib Turbulators by means of Liquid Crystal Thermography**

*D. Cavallero* and *G. Tanda*

DITEC University of Genova, Genova, Italy

**Friday 28, 13:20-14:20 - Lunch**

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**Friday 28, 14:20-15:00 - Plenary Room - Keynote Lecture 14**  
**Chairman: to be assigned**

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**On the Mechanism of Supersonic Cavity Flow Oscillations**

*M. Nishioka*, *T. Asai*, *S. Sakaue* and *K. Shirai*

Department of Aerospace Engineering, Osaka Prefecture University, Osaka, Japan

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**Friday 28, 15:00-16:40 - Room 1 - Fluid-Dynamics: Vortex Flows 2**  
**Chairman: to be assigned**

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**Criterion for the Necklace Vortex Excitation in Criss-Cross Circular Cylinder System**

*I. Kumagai\**, *T. Matsumoto\*\**, *T. Takahashi\** and *M. Shirakashi\**

\*Department of Mechanical Engineering, Nagaoka University of Technology, Nagaoka, \*\*Mitsubishi Heavy Industries Co., Ltd., Japan

**Experimental Study of Interference Drag For Multi-Element Objects**

*A. Sakellariadis* and *A. Lazaridis*

Department of Mechanical Engineering, Wiedener University, One University Place, Chester, PA 19013, USA

**Comparison of Rotating Flows with Vortex Breakdown in Cylindrical and Quadratic Containers**

*J.N. Sorensen\**, *V. Okulov\**, \*\**I. Naumov\*\** and *E. Varlamova\**, \*\*

\*Department of Mechanical Engineering, Technical University of Denmark, Kongens Lyngby, Denmark, \*\*Institute of Thermophysics Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

## **Influence of the Dissymmetry in Rotating Fluids on the Vortex Core Precession and Spectral Characteristics of the Flows**

*I. Naumov\**, *\*\**, *V. Meledin\**, *\*\** and *V. Okulov\**

\*Institute of Thermophysics Siberian Branch of the Russian Academy of Sciences, Novosibirsk,

\*\*Technological Design Institute of Scientific Instrument Engineering, Novosibirsk, Russia

## **Studies on Junction Flow in Swirling Flow Exhaust Pipe System**

*L. Cao*, *Y. Liu*, *H. Liu* and *S. Shuai*

Power Engineering Department, Huazhong University of Science & Technology, Wuhan, China

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### **Friday 28, 15:00-16:40 - Room 2 - Thermodynamics & Heat and Mass Transfer: General Studies 2**

**Chairman: G. Zummo**

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#### **Heat Transfer in a Spherical Cavity during Variation of Dynamics Conditions**

*V.I. Terekhov*, *S.V. Kalinina* and *Yu.M. Mshvidobadze*

Institute of Thermophysics, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

#### **Heat Transfer During Foam Flow Across Bank of Tubes**

*J. Gyllys*, *M. Jakubcionis* and *S. Sinkunas*

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

#### **Experimental Research on Heat Transfer Phenomena through Fuel Oil in Railway Wagon Tanks**

*I. Ionel*, *C. Ungureanu*, *D. Lelea*, *P.D. Oprisa-Stanescu*

Department of Thermal Machines and Transport, Plitehnica University of Timisoara, Timisoara, Romania

#### **Novel Method Thermodynamic Analysis of Energy Intensive Systems**

*V. Nikulshin\**, *C. Wu\*\** and *V. Nikulshina\*\*\**

\*Odessa State Polytechnic University, Odessa, Ukraine, \*\*U.S. Naval Academy, Annapolis, USA,

\*\*\*Odessa State Academy of Refrigeration, Odessa, Ukraine

#### **Heat Transfer to Kerosene at Supercritical Pressure in a Round Tube with a Large Heat Flux at the Wall**

*Z. Hu*, *T. Chen* and *Y. Luo*

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

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### **Friday 28, 15:00-16:40 - Room 3 - Fluid-Dynamics: General Studies**

**Chairman: A. Goulas**

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#### **Visualisation of Three-Dimensional, Transonic Cavity Flows**

*N. Taborda*, *D. Bray* and *K. Knowles*

Department of Aerospace, Power and Sensor, Cranfield University, Swindon, U.K.

#### **Investigation of Airfoil Ground Effects Using a Moving Belt System**

*Y.J. Kim* and *J.H. Cho*

School of Mechanical Engineering, Sungkyunkwan University, Jangan-gu, Suwon, Korea

#### **Hydrodynamics of Aeration and Suspending in a Mixer**

*P. Wesolowski*

Department of Chemical Engineering and Apparatus, Poznan University of Technology, Poznan, Poland

#### **Some Functions of Wing Apparatus in Insects**

*S. Sudo\**, *K. Tsuyuki\** and *T. Ikohagi\*\**

\*Department of Mechanical Engineering, Iwaki Meisei University, Iwaki, \*\*Institute of Fluid Science, Tohoku University, Sendai, Japan

#### **Pump Design CAD Based on the PDE Numerical Grid Generation Techniques**

*C. Li*, *J. Su* and *X. Cheng*

Power Engineering Department, University of Shanghai for Sci & Tech, Shanghai, China

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**Friday 28, 15:00-16:40 - Room 4 - Multi-Component and Multi-Phase Flow: Flooding**  
**Chairman: M. Furrer**

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**Visualization of Flooding Instability in Counter-Current Gas-Liquid Flow Along Vertical Flat Walls**

*J.R.F. Guedes de Carvalho and M.J.F. Ferreira*

Departamento de Engenharia Química, Universidade do Porto, Porto, Portugal

**Counter-Current Gas/Liquid Flow through Channels with Corrugated Walls. Visual Observations of Liquid Distribution and Flooding**

*S.V. Paras\*, E.I.P. Drosos\*, A.J. Karabelas\* and F. Chopard\*\**

\*Department of Chemical Engineering & Chemical Process Engineering Research Institute, Aristotle University of Thessaloniki, Thessaloniki, Greece, \*\*ALFA LAVAL – VICARB, Le Fontanil Carnillon, France

**Experimental Study on CCFL in Narrow Annular Gaps with Large Diameter**

*J.H. Jeong, S.J. Lee, R.J. Park and S.B. Kim*

Korea Atomic Energy Research Institute, Yusong-ku, Taejon, Korea

**Flooding Phenomenon and Determination of Interfacial and Wall Shear in One Dimensional Two-Fluid Model**

*T. Skorek*

Thermal Hydraulics Division, Gesellschaft für anlagen- und Reaktorsicherheit (GSR) mbH, Garching, Germany

**An Investigation on the Flow Characteristics of Oil-Water Emulsions Flow in the Annulus with the Inner Rotating Cylinder**

*J. Zhang, T. Chen, Y. Luo and H. Wang*

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

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**Friday 28, 15:00-16:40 - Room 5 - Thermalhydraulics: Natural Circulation**

**Chairman: G. Tanda**

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**Experimental Dynamics of a Natural Circulation Loop**

*G. Cammarata, A. Fichera, I.D. Guglielmino and A. Pagano*

Dipartimento di Ingegneria Industriale e Meccanica, Università degli Studi di Catania, Catania, Italy

**Heat Island Effect in Urban Areas: Airborne Measurements to Determine the Radiation Intensity**

*A.M. Papadopoulos and E.A. Kalognomou*

Laboratory of Heat Transfer and Environmental Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece

**Influence of Power Steps on the Thermohydraulic behavior of a Natural Circulation Loop**

*M. Misale, D. Cavallero and M. Frogheri*

DITEC, University of Genoa, Genova, Italy

**Natural Circulation in a Adiabatic Air-Water Loop**

*A. Kulkarni and K. Iyer*

Department of Mechanical Engineering, Indian Institute of Technology, Bombay, India