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 (ICHMТ)
and
ITALIAN UNION OF THERMAL-FLUID-DYNAMICS (UIT)

FINAL PROGRAM
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 Triumphant 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. Demetrios, 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 time their presentation in 13-15 minutes maximum highlighting the main features of their work, leaving 5-7 minutes for discussion. Session chairs will be very strict on time to ensure an appropriate running of the parallel session and the flow of attendees from one session to another. Overhead transparencies projector and projector for Power Point presentations will be available. 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.

SOCIAL DINNER

The social dinner will be held at the Yachting Club, Themistoki Sofouli Street, on Wednesday 26 at 20:30.

REGISTRATION

Fees

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Full registration</td>
<td>600 Euro</td>
</tr>
<tr>
<td>Student (certification required)</td>
<td>550 Euro</td>
</tr>
<tr>
<td>Accompanying persons</td>
<td>60 Euro</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>start</th>
<th>end</th>
<th>Room 1</th>
<th>Room 2</th>
<th>Room 3</th>
<th>Room 4</th>
<th>Room 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:30</td>
<td>10:00</td>
<td>Welcome Address &amp; Nu-Re Prize</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10:00</td>
<td>10:40</td>
<td>Nusselt-Reynolds Lecture 1 (Bergles)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10:40</td>
<td>11:20</td>
<td>Nusselt-Reynolds Lecture 2 (Adrian)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:20</td>
<td>11:40</td>
<td>Coffee-Break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:40</td>
<td>12:20</td>
<td>Keynote Lecture 1 (Azopardi)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12:20</td>
<td>13:00</td>
<td>Keynote Lecture 2 (Grass)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13:00</td>
<td>14:00</td>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:00</td>
<td>14:40</td>
<td>Keynote Lecture 3 (Hrouwer)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:40</td>
<td>15:40</td>
<td>Sessions (24/1) JE-AR</td>
<td>MT-IMT 1</td>
<td>TH-FPB 1</td>
<td>HTE 1</td>
<td>TH-PD 1</td>
</tr>
<tr>
<td>15:40</td>
<td>16:20</td>
<td>Coffee-Break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16:20</td>
<td>18:20</td>
<td>Sessions (24/2) JE-IHT</td>
<td>MT-IMT 2</td>
<td>TH-FPB 2</td>
<td>HTE 2</td>
<td>TH-PD 2</td>
</tr>
<tr>
<td>18:20</td>
<td>19:00</td>
<td>End of Sessions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuesday 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:20</td>
<td>9:00</td>
<td>Keynote Lecture 4 (Zan)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9:00</td>
<td>10:40</td>
<td>Sessions (25/1) JE-GE 1</td>
<td>MT-IMT 3</td>
<td>MM-BF</td>
<td>HTE 3</td>
<td>TH-TBL 1</td>
</tr>
<tr>
<td>10:40</td>
<td>11:00</td>
<td>Coffee-Break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:00</td>
<td>12:40</td>
<td>Sessions (25/2) JE-GE 2</td>
<td>MT-IMT 4</td>
<td>PEA-HEX 1</td>
<td>TT-RC 1</td>
<td>TH-TBL 2</td>
</tr>
<tr>
<td>12:40</td>
<td>13:00</td>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13:00</td>
<td>14:20</td>
<td>Keynote Lecture 5 (Karabelas)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:20</td>
<td>16:00</td>
<td>Sessions (25/3) JE-GE 3</td>
<td>MT-IMT 5</td>
<td>PEA-HEX 2</td>
<td>TT-RC 2</td>
<td>MM-DD</td>
</tr>
<tr>
<td>16:00</td>
<td>16:20</td>
<td>Coffee-Break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16:20</td>
<td>18:20</td>
<td>Sessions (25/4) MM-TJ</td>
<td>TH-SWP 1</td>
<td>TT-MT 1</td>
<td>PEA-HEX 3</td>
<td>BO-FB</td>
</tr>
<tr>
<td>18:20</td>
<td>19:00</td>
<td>End of Sessions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday 26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:20</td>
<td>9:00</td>
<td>Keynote Lecture 6 (Azevedo)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9:00</td>
<td>11:00</td>
<td>Sessions (26/1) TH-SWP 2</td>
<td>TT-MT 2</td>
<td>FD-RP</td>
<td>NR 1</td>
<td>PEA-IA</td>
</tr>
<tr>
<td>11:00</td>
<td>11:20</td>
<td>Coffee-Break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:20</td>
<td>13:00</td>
<td>Sessions (26/2) TT-HR</td>
<td>BO-CHR</td>
<td>NR 2</td>
<td>CF-NC 1</td>
<td>CO-GE 1</td>
</tr>
<tr>
<td>13:00</td>
<td>14:00</td>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:00</td>
<td>15:00</td>
<td>Open Forum Session</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20:30</td>
<td>24:00</td>
<td>Social Dinner</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Monday 24, 9:30-10:00 - Plenary Room - Welcome Addresses, Nusselt-Reynolds Prize

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

ExHFT for Fourth-Generation Heat Transfer Technology
A.E. Bergles
Rensselaer Polytechnic Institute, New York and University of Maryland, Maryland, USA

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

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

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

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

Similarities and Differences between Gas/Liquid and Liquid/Liquid Flows
B.J. Azzopardi
School of Chemical, University of Nottingham, Nottingham, U.K.

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

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

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

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

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

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

Heat Transfer of Phase-Locked Modulated Impinging-Jet Arrays
Department of Applied Physics, Delft University of Technology, Delft, The Netherlands

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

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

Session Keyword

BO - Boiling Heat Transfer
BO - PB Pool Boiling
BO - BHT Boiling Heat Transfer
BO - FB Flow Boiling
BO - CHR Critical Heat Flux and Rewetting

CN - Condensation
CN - UF Thermalhydraulics
CN - FT Fluid-Dynamics

CO - Combustion
CO - ER Emission Reduction
CO - EM Experimental Methods
CO - GE General Studies

CF - Convective Flow
CF - NMC Natural and Mixed Convection
CF - NC Natural Convection
CF - CHT Convective Heat Transfer
CF - FE Fluid-Entropy

PEA - Process Equipment and Application
PEA - IA Industrial Applications

PEA - HT Heat Transfer Enhancement

FT - Fluid-Dynamics
FT - RF Rotating Flows
FT - VF Vortex Flows
FT - GE General

TH - Heat Exchangers
TH - UF Unstable and Unsteady Flows

HEX - Heat Exchangers
HEX - SWP Shock Waves and Wave Propagation
HEX - TBL Turbulence and Boundary Layers

JE - Jets
JE - AR Jet Arrays
JE - IHT Jet Impingement Heat Transfer
JE - GE General Studies

MT - Measurement Techniques
MT - IMT Instrumentation
MT - TP Thermophysical Properties
Impingement of Inline and Staggered Arrays of Jets with and without Initial Crossflow-Local and Average Heat Transfer Measurements
P. Brevet, E. Dorigue, M. Jolly and J.J. Vollierme
Laboratoire d’études thermiques, ENSMA, Futuroscope Chasseneuil Cedex, France

Flows Generated by the Impingement of Inline and Staggered Arrays of Jets
L.E. Brizi, P. Brevet and C. Dejeu
Laboratoire d’études aérodynamiques, Futuroscope Chasseneuil Cedex, France

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

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. Prinos
Hydraulic Laboratory, Aristotle University of Thessaloniki, Thessaloniki, Greece

An Experimental Technique for Near-Wall Turbulent Measurement
D. Poggi, A. Porporato and L. Ridolfi
Dipartimento di Idraulica, Trasporti e Infrastrutture Civili, Politecnico di Torino, Torino, Italy

Experimental Investigation of the Convective Heat Transfer Using Gradient Heat Flux Sensors
V.Y. Mitiakov*, S.Z. Sapszonikov*, Yu.S. Chumatov** and A.F. Mitakov***
*Department of Thermodynamics and Heat Transfer
**Department of Hydroaerodynamics
***Department of Internal Combustion Engines, State Technical University of St.-Petersburg, Russia

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

Flow Characteristics in Channel with Local Blockage Packed with Spheres
*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 $50 < S < 750$ and $103 < P_{em} < 105$
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

Monday 24, 14:40-16:20 - Room 4 - Session Heat Transfer Enhancement 1
Chairman: A.E. Bergles

The Effect of Liquid Side Heat Transfer Improvement on a Compact Heat Exchanger
J. Saikhonen*, R. Lankinen*, P. Sarkonau* and R. Castrén**
*Department of Energy Technology, Lappeenranta University of Technology, Lappeenranta
**Retemiria Ltd., Finland

Experimental Study on a Bank of Finned Pipes with Inclined Fins
I. Carvaljal-Mariscal*, F. Sanchez-Silva*, P. Quinto-Diez* and V.A. Prontin**
**Laboratorio de Fisica PNM-CONACYT, Mexico
**Moscow Power Engineering Institute, Institute 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. Vasilyevski*, L.F. Yakovleva*, A.V. Chirkhin* and A.N. Osipov**
*Central Aerohydrodynamic 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**
*Chemical Engineering Department University of Milan, Milano
**Moscow Power Engineering Institute, Faculty of Heat Engineering, Moscow, Russia

Monday 24, 14:40-16:20 - Room 5 - Session Thermalhydraulics: Pressure Drops 1
Chairman: G. Yadigaroglu

Experimental Results on Pressure Drop Reductions and Flow Regime Transitions in Oil-Water Mixtures
G. Sotgia*, G. Sparță, E. Vendola* and P. Tartarini**
*Department of Energy Technology, Politecnico of Torino, Torino, Italy
**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**
*Department of Thermodynamics and Heat Transfer
**Institute Superior de Engenharia do Porto

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, 16:40-18:20 - Room 1 - Jets: Jet Impingement Heat Transfer
Chairman: P. Tartarini

Heat Transfer during Transient Cooling of High Temperature Surface with an Impinging Jet in an Evacuated Enclosure
Y. Mitsuike, M. Monde and J. Hammad
Department of Mechanical Engineering, Saga University, Saga, Japan

Annular Impingement Heat Transfer on an Oscillated Heated Surface
K. Ichimiyaa and Y. Matsushima**
*Department of Mechanical Systems Engineering, Yamanshi University, Yamanshi
**Daihatsu Diesel Ltd., Osaka, Japan

Controlled Cooling of a Hot Plate with a Water Jet
H. Rohidoua**, H. Aascher* and P. Girkind** and M. Lébouché***
*TU Berlin, Institut für Energiefechnik, Berlin, Germany
**IRSID, Mazieres-les Metz Cedex, France
***LEMTA, Vandoeuvre Cedex, France

Heat Transfer Measurements of Impinging Two-Dimensional Slot Jets
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

Surface Thermometry by Laser-Induced Fluorescence of Dy3+:YAG
K. Kotsis*, Y. Syovenji** and N. Yoshikawa**
*Aerospace Engineering, 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. Angs, 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. Ghian*, 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

Monday 24, 16:40-18:20 - Room 2 - Session Measurement Techniques: Instrumentation 2
Chairman: I. Zun

Heat Sink
H. Groenewold and E. Tzotzas
Institute for Process Engineering, Otto-von-Guericke-University, Magdeburg, Germany

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

Heat Transfer to Highly Viscous Fluids in a Vessel Agitated by a Non Standard Helical Ribbon Impeller
G. Delplace, J.C. Leuliet, L. Fillandeau 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. Fillandeau*, G. Delplace*, 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

Monday 24, 16:40-18:20 - Room 3 - Session Thermal Hydraulics: Fluidized and Packed Beds 2
Chairman: M. Kiya

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

The Phenomenon of “Thermal Trap Effect” in Packed Bed of Glass Spheres
S. Polezek-Karczewska
Institute of Fluid Flow Machinery of Polish Academy of Sciences, Gdansk, Poland

Monday 24, 16:40-18:20 - Room 4 - Session Heat Transfer Enhancement 2
Chairman: E.G. Keshock

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 Measurements of Impinging Two-Dimensional Slot Jets
A.A. Galabov, B.P. Zhilkin and Yu. M. Brodov
Ural State Technical University, Ekaterinsburg, Russia

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

Heat Sink
H. Groenewold and E. Tzotzas
Institute for Process Engineering, Otto-von-Guericke-University, Magdeburg, Germany

Hydromechanics and Heat Exchange in Gaseous Impinging Jets
A.A. Galabov, B.P. Zhilkin and Yu. M. Brodov
Ural State Technical University, Ekaterinsburg, Russia

Heat Transfer to Highly Viscous Fluids in a Vessel Agitated by a Non Standard Helical Ribbon Impeller
G. Delplace, J.C. Leuliet, L. Fillandeau 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. Fillandeau*, G. Delplace*, 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

Heat Transfer Measurements of Impinging Two-Dimensional Slot Jets
A.A. Galabov, B.P. Zhilkin and Yu. M. Brodov
Ural State Technical University, Ekaterinsburg, Russia
Tuesday 25, 8:20-9:00 - Plenary Room - Keynote Lecture 4
Chairman: P. Di Marco

Phase Discrimination vs. Multiscale Characteristics in Bubbly Flow
I. Zan
Faculty of Mechanical Engineering, University of Ljubljana, Ljubljana, Slovenia

Tuesday 25, 9:00-10:40 - Room 1 - Jets: General Studies 1
Chairman: W. Grassi

The Effects of Hole Arrangements on Heat/Mass Transfer of Impingement/Effusion Cooling System
Department of Mechanical Engineering, Yonsei University, Seoul, Korea

Heat Transfer Experiments in a Submerged Impinging Round Jet Using Liquid Crystal Thermometry
J. Vejrakova**, 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. Galitskiy
Department of Aviation-Space Thermal Technics, Moscow Aviation Institute, Moscow, Russia

Heat Transfer at Interaction of Liquid Nitrogen Jet with Surfaces
G.A. Dreiter, V.P. Firsov, I.V. Antyukhov and A.S. Prokopenko
Department of Aviation-Space Thermal Technics, Moscow Aviation Institute, Moscow, Russia

Tuesday 25, 9:00-10:40 - Room 2 - Measurement Techniques: Instrumentation 3
Chairman: P. Carreira

Flow-Field Measurements near Two Helicoid Fans by Cross-Correlation Particle Image Velocimetry
F. Peyrin and P.S. Miranda
Departement Transformation dea Produits Animaux, Institut National de la Recherche Agronomique, St Genes Chaponnay, France

A Thermal Imaging Procedure for Landmine Detection
J. Deans*, B. Dempster**, G. Schmittal* 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. Kosten*, 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. Hisida* and M. Maeda*
*Department of System Design Engineering, Keio University, Yokohama, Japan
**Paul Scherrer Institut, Villigen PSI, Switzerland
Tuesday 25, 9:00-10:40 - Room 3 - Multi-Component and Multi-Phase Flow: Bubbly Flow
Chairman: A. Tomiyama

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. Salese, A. Larse de Touroutine 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

Tuesday 25, 9:00-10:40 - Room 4 - Heat Transfer Enhancement 3
Chairman: M. Groll

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, Tongyong, Kyongnam, Korea

Influence of Macro-Roughened Surfaces on Convective Film Boiling Heat Transfer
A. Omrani* and E.G. Keshock**
*Department of Mechanical Science and Engineering, University of Michigan, Ann Arbor, USA
**Mechanical Engineering Department, Wayne State University, Detroit, 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

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

Improvement of a Stalled-Diffuser Performance by a Turbulent Wake
O. Mochizuki, H. Ishikawa and M. Koga
Division of Mechanical Science, Hokkaido University, Sapporo, Japan

Flow around a Circular Cylinder with Non-Isothermal Blowing
L. Mastelino, F. Badve 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. Paranthoen
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.P.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. Dao, 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

Tuesday 25, 11:00-12:40 - Room 1 - Jets: General Studies 2
Chairman: G.C.J. Bart

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. Morezumi, A. Kisowata, F. Fukui 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

Tuesday 25, 11:00-12:40 - Room 2 - Measurement Techniques: Instrumentation 4
Chairman: H.M. Prasser

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

LDA and PIV Measurements Applied to Single and Multiple Impinging Jets
Department of Applied Physics, Delft University of Technology, Delft, The Netherlands

Development of a Novel Artificial Heart Muscle Using Thermoelectric Actuators
*Institute of Fluid Science, Tohoku University, Sendai, Japan
**Tohoku Electric Industrial Co. Ltd., Sendai, Japan
***Tongmyong College, Pusan, Korea
****School of Mech. & Manuf. Engr., The University of New South Wales. Sydney, Australia
*****School of Mech. & Manuf. Engr., The University of New South Wales. Sydney, Australia

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

Chairman: C.W.M. van der Geld

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. Fillandeanu*, 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
*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

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

Chairman: J.M. Corberan

Performance Evaluation of a Cascade System Using R-22/R-23
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. Bellette** and A. Lallemant*
*Centre de Thermique de Lyon, INSA de Lyon, Villeurbanne Cedex
**Département 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. Lee and K.N. Cho
School of Mechanical Engineering, Sungkyunkwan University, Suwon, Korea

Multiple Expansion Vapour Compression Refrigeration Cycle
J. Gryzegrodzki and J.A. Brown
Department of Mechanical Engineering, University of Cape Town, South Africa

Heat and Mass Transfer Characteristics of a Helical Absorber Using LiBr+LiI+LiNO3+LiCl Solutions
*Pukyong National University, Pusan
**Tongmyong College, Pusan, Korea
***Kyushu University, Fukuoka, Japan

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

Chairman: P. Paranthoen

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

Tuesday 25, 12:40-13:40 - Lunch
Tuesday 25, 13:40-14:20 - Plenary Room - Keynote Lecture 5
Chairman: A. Goulas

Scale Formation in Tubular Heat Exchangers - Research Priorities
A.J. Karabelas
Department of Chemical Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece

Tuesday 25, 14:20-16:00 - Room 1 - Jets: General Studies 3
Chairman: F. Daumas Bataille

A ‘Thin Layer’ Model of Heat Transfer in a Laminar Liquid Film Formed by Impinging Jet J. Mikeslewyic* and D. Mikeslewyic**
*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 Crisial Technique in Three-Temperature Convective Heat Transfer Measurements G. Engel*, Y. Kim** and R.E. Peck***
**Honeywell, Phoenix
***Arizona State University, Tempe, USA

Instantaneous Behavior of Pulsating Submerged Planar Jets E.C. Mladin* and D.A. Zumbrunnen**
*Department of Mechanical Engineering, University Politecnica 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. Stuba
Ural State Technical University, Ekaterinburg, Russia

Tuesday 25, 14:20-16:00 - Room 2 - Measurement Techniques: Instrumentation 5
Chairman: K. Hishida

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/Trasmitters 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**
*Techische Universitat Hamburg-Harburg, Hamburg
**Technical University of Gdansk, Chair of Heat Technology, Gdansk
*Bialystok Technical University, Institute of Informatics, Bialystok, Poland

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

Tuesday 25, 14:20-16:00 - Room 3 - Process Equipment and Applications: Heat Exchangers 2
Chairman: B. Sunden

*Membrana Research & development, Oberruburg
**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. Skiepko
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. Corberan and J. Gonzalez
Applied Thermodynamics Department, Universidad Politecnica de Valencia, Valencia, Spain

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

Tuesday 25, 14:20-16:00 - Room 4 - Thermodynamics & Heat and Mass Transfer: Refrigeration and Cooling 2
Chairman: F. Oriolo

Characterization of Semi-Crystalline Polymers during Cooling Processes G.C. Alfons*, M. Cartesegna** and L. Tagliafico**
*DCCI, Genova
**DITEC University of Genova, Genova, Italy

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

Coupied Heat Transfer through Building Components with Air Cavities P. Stefanizzi
Dipartimento di Fisica Tecnica, Politecnico di Bari, Bari, Italy

Near Critical Heat Transfer in CO2 Process Cycle R. Eggers* and U. Siwers**
*Technische Universitat Hamburg-Harburg, Hamburg
**Fachhochschule Hamburg, Hamburg, Germany
Tuesday 25, 14:20-16:00 - Room 5 - Multi-Component and Multi-Phase Flow: Particle and Droplet Dynamics
Chairman: I. Kataoka

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
*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. Zhiltov, S. Braun 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, Neyagawa,
**Sharp Corporation, Osaka Japan

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

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

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. Cho, 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. Okayama*, S. Todai* and T. Muramatsu**
*Department of Quantum Energy, Tohoku University, Sendai
**O-ara 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.

Tuesday 25, 17:40-18:20 - Room 1 - Thermalhydraulics: Shock Waves and Wave Propagation
Chairman: M. Giot

Flat Plate Impingement of the Shock Wave Discharged from an Open End of a Shock Tube
*Saga University, Japan
**Andong National University, Korea
***Kyushu University, Fukuoka, Japan

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

Tuesday 25, 16:20-18:20 - Room 2 - Thermodynamics & Heat and Mass Transfer: Mass Transfer 1
Chairman: J.S. Lee

Experiment Investigation of the Humidifying and Desulfuration of Flue Gas in a Boiler of Power Plant
*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. Jakimova and A.V. Brattseva
St. Petersburg State Technological University of Plant Polymers, St.-Petersburg, Russia
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., Himeji, 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. Bernárdez 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

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. Ziołkowski
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. Coffie and A. Ekhlassi
Thermal Science Research Center, Prairie View A&M University, Prairie View, USA

A.V. Klimenko, A.M. Sudarchikov and V.V. Klimenko
Moscow Power Engineering Institute, Moscow, Russia
Wednesday 26, 11:00-11:20 - Coffee Break

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

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

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

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

Chairman: R.D. Boyd

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

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

Critical Power in a Hemispherical Narrow Gap
*Korea Atomic Energy Research Institute, Yusong-Ku, Taejon
**Chosun University, Chon-an, Korea

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

Wednesday 26, 11:20-13:00 - Room 3 - Nuclear Reactor Safety 2
Chairman: R.T. Lahey

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, L. Nagy, L. Marótí, L. Matus, M. Horváth, A. Pintér and M. Balaskó
KFKI Atomic Energy Research Institute, Budapest, Hungary

RELAPS/MOD3.2 Post Test Simulation and Accuracy Quantification of LOBI Test BT-02
R.C. Borges*, F. D’Auria** and A.C.M. Alvim**
*Comisión Nacional de Energía Nuclear, Coordenación de Reactores, Rio de Janeiro, Brazil
**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

Study of Natural Convection from a Line Heat Source of a High Prandtl Number Fluids with Variable Viscosity in a Tank
N. Katsovas, I.G. Pappa, I.E. Sarria, I. Lekakis and N.S. Vlachos
Laboratory of Fluid Mechanics & Turbomachinery, University of Thessaly, Volos, Greece

Wednesday 26, 11:20-13:00 - Room 4 - Convective Flows: Natural Convection 1
Chairman: O. Manca

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

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

Wednesday 26, 14:00-15:00 - Open Forum Session
Poster presentations
Thursday 27, 8:20-9:00 - Plenary Room - Keynote Lecture 7
Chairman: U. Renz
Experimental Study of High-Pressure Turbulent Premixed Flames
H. Kobayashi
Institute of Fluid Science, Tohoku University, Sendai, Japan

Thursday 27, 9:00-9:40 - Plenary Room - Keynote Lecture 8
Chairman: H. Auracher
Wave Flow Liquid Film under Complicated Conditions
S.V. Alekseenko
Institute of Thermophysics SB RAS, Novosibirsk, Russia

Thursday 27, 9:40-10:20 - Plenary Room - Keynote Lecture 9
Chairman: I. Zun
Development of Inverse Natural Convective Fluid and its Thermo-hydrodynamic Characteristic
I. Kataoka and K. Yoshida
Department of Mechatronics Engineering, Osaka University, Osaka, Japan

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

Thursday 27, 10:40-12:20 - Room 1 - Condensation 1
Chairman: J.P. Meyer
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. Otsuho**
*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. Belgazi*, A. Bon temps** 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

Thursday 27, 10:40-12:20 - Room 2 - Thermalhydraulics: Liquid Films 1
Chairman: S. Alekseenko
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 Salvo
Dipartimento di Energetica, Politecnico di Torino, Torino, Italy

Thursday 27, 10:40-12:20 - Room 3 - Thermodynamics & Heat and Mass Transfer: Freezing, Melting and Solidification
Chairman: F. Arinc
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, Yuseong, Taegon
**Dongshin University, Naju, Chonnam, Korea
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-UFRJ-CNRS, Orsay, France

Thursday 27, 10:40-12:20 - Room 4 - Convective Flows: Natural Convection 2
Chairman: W. Lewandowski
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
Thursday 27, 14:00-15:40 - Room 4 - Convective Flows: Natural Convection 3
Chairman: J.Y. Yoo

Some Experiments on Natural-Convective Heat Transfer from Slender Vertical Cylinder
C.O. Pupiel, 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. Razela* and R.N. Kukkia**
*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

Thursday 27, 14:00-15:40 - Room 5 - Combustion: Experimental Methods
Chairman: J.F. Sacadura

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., Malawi
**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 C2H2 Flame Temperature Field
S. Huang and J. Peng
Department of Power Engineering, Huazong University of Science and Technology, Wuhan, China

Thursday 27, 16:40-17:40 - Room 2 - Thermalhydraulics: Liquid Films 3
Chairman: O. Kashinsky

Falling Liquid Film of the Surface Active Agents Solutions
L. Broniarz-Press and D. Dulka
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. Smits**
*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. Tsvetoladse*** and A.A. Bocharov*
*Institute of Thermophysics Siberian Branch of the Russian Academy of Sciences, Novosibirsk
**Novosibirsk State University, Novosibirsk, Russia

Thursday 27, 17:40-18:20 - Room 2 - Measurement Techniques: Thermophysical Properties 1
Chairman: O. Kashinsky
**Thursday 27, 16:40-18:20 - Room 3 - Boiling: Pool Boiling 2**

**Chairman: M. Misale**

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors and Affiliations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-Phase Structure Measurements for Bubbles Departing from a Heated Surface by Means of One- and Two-Probe Hot-Wire Anemometry</td>
<td>J. Bonjour*, N. Ginet** and M. Lallemand**&lt;br&gt;*Laboratoire du Froid- CNam, Paris&lt;br&gt;**CETHIL - INSA, Villeurbanne Cedex, France</td>
</tr>
<tr>
<td>An Experimental Investigation on the Boiling Heat Transfer on the Vertical Square Surface</td>
<td>J.H. Song, J.G. Kim, S.B. Kim and H.D. Kim&lt;br&gt;Korea Atomic Energy Research Institute, Yusong, Taejon, Korea</td>
</tr>
<tr>
<td>Experimental Investigation in Pool Boiling Heat Transfer of Ternary Mixture and Heat Transfer Correlation</td>
<td>Y. Fujita and M. Tsutsui&lt;br&gt;Department of Mechanical Engineering Science, Kyushu University, Fukuoka, Japan</td>
</tr>
<tr>
<td>Boiling Incipience of Ethanol on Platinum Surface: Influence of Pressure</td>
<td>K. Mizukami, X.C. Zhuo and S. Mukasa&lt;br&gt;Department of Mechanical Engineering, Ehime University, Matsuyama, Japan</td>
</tr>
<tr>
<td>Heat Transfer from Horizontal Tubes During Pool Boiling of Water and R141b</td>
<td>J.T. Cieslinski and P.R. Dominiczak&lt;br&gt;Technical University of Gdansk, Gdansk, Poland</td>
</tr>
</tbody>
</table>

**Thursday 27, 16:40-18:20 - Room 4 - Convective Flows: Natural and Mixed Convection**

**Chairman: S.M. Zubair**

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors and Affiliations</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Review of Particular Experimental Methods of Free Convective Heat Transfer</td>
<td>W.M. Lewandowski&lt;br&gt;Department of Apparatus and Chemical Machinery, Technical University of Gdansk, Gdansk, Poland</td>
</tr>
<tr>
<td>Turbulent Mixed Convection Heat Transfer in a Vertical Flat Channel with Opposing Flows</td>
<td>P. Poskas and R. Poskas&lt;br&gt;Lithuanian Energy Institute, Kaunas, Lithuania</td>
</tr>
<tr>
<td>Free Convection of the Near Critical Fluid in Ground-Based and Microgravity Environment</td>
<td>V.I. Polezhaev, V.M. Emelianov, A.A. Gorbunov and E.V. Soboleva&lt;br&gt;Institute for Problems in Mechanics, Russian Academy of Sciences, Moscow, Russia</td>
</tr>
<tr>
<td>An Experimental Study of the Frost Formation on a Cold Surface in Free Convective Flow</td>
<td>G. Tanda and M. Fossa&lt;br&gt;DITEC, University of Genova, Genova, Italy</td>
</tr>
<tr>
<td>Secondary Flow Characteristics and Convective Heat Transfer in a Curved Rectangular Duct with External Heating</td>
<td>T.T. Chandratilleke&lt;br&gt;Department of Mechanical Engineering, Curtin University of Technology, Perth, Australia</td>
</tr>
</tbody>
</table>
Friday 28, 8:20-9:00 - Plenary Room - Keynote Lecture 12  
Chairman: A.M. Taylor  
Recent Progress in Visual Fluid Dynamics  
J.Y. Yoo  
School of Mechanical and Aerospace Engineering, Seoul National University, Seoul, Korea

Friday 28, 9:00-10:40 - Room 1 - Thermalhydraulics: Unstable and Unsteady Flows 2  
Chairman: Z. Bilicki

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  
*High Informatics College of Novosibirsk State University, Novosibirsk, Russia  
**EniTecnologie, San Donato Milanese, Italy

Friday 28, 9:00-10:40 - Room 2 - Measurement Techniques: Thermophysical Properties 2  
Chairman: O. Kashinsky

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  
Amsaldo Energia, Divisisone Nucleare, Genova, Italy

Experimental Determination of the Functional Relationship Among Concentration, Temperature and Refractive Index for Ammonium Chloride Solutions  
C.S. Stampf* and S.L. Brugy**  
*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. Vorobyev*, G.E. Ostrovskiy**, E.N. Nikiporets*, O.V. Tatarinov** 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  
*State Academy of Cooling Technology, St. Petersburg  
**Moscow Power Engineering Institute, Moscow, Russia

Friday 28, 9:00-10:40 - Room 3 - Boiling: Boiling Heat Transfer 1  
Chairman: V. Wadekar

Nucleate Boiling in Climbing Films: a Flow Visualisation Study  
J.R. Barbero 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  
F. Saito*, T. Tanaka** and K. Miskima*  
*Research Reactor Institute, Kyoto University, Osaka  
**Graduate School of Energy and Science, Kyoto University, Kyoto, Japan

Experimental Study on Boiling in Micro-Chambers  
B. Seyedi, A.M.C. Chan and M. Shoakri  
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. Malysheenko  
Institute of High Temperatures, Russian Academy of Sciences, Moscow, Russia

Friday 28, 9:00-10:40 - Room 4 - Multi-Component and Multi-Phase Flow: Atomization and Sprays  
Chairman: I. Ishihara

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, Moskow, 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. Balie  
Department of Mechanical Engineering, Universitě 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
Friday 28, 9:00-10:40 - Room 5 - Multi-Component and Multi-Phase Flow: Particle and Droplet Dynamics

Chairman: A.M. Taylor

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

Friday 28, 11:00-11:40 - Plenary Room - Keynote Lecture 13

Chairman: N. Selcuk

Experimental Characterization of Thermal Radiation Properties of Dispersed Media
J.F. Sacadura and D. Baillis
INSA Lyon - CETHIL, Lyon, France

Friday 28, 11:40-13:20 - Room 1 - Fluid-Dynamics: Vortex Flows 1

Chairman: T. Skiepko

Effect of Embedded Vortices on Film Cooling Performance on a Flat Plate
J.S. Lee, H.G. Jung and S.R. 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

Friday 28, 11:40-13:20 - Room 2 - Thermodynamics & Heat and Mass Transfer: General Studies 1

Chairman: A. Prata

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, McMater 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


Chairman: K. Mishima

The Steam Boat and the Elasticity and Capability of a Bubble in Subcooled Boiling
J.J. Schröder, St. Abran, A. Bode and M. Krüger
Institute for Thermodynamics, University of Hannover, Hannover, Germany

Boiling and Evaporation Heat Transfer from a TiO2-Coated Surface
*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
Biaystok University of Technology, Biaystok, 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
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, UK.

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. Sawat*, K. Mori** and M. Igachi***
*Department of Mechanical Engineering, Kinki University, Osaka
**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. Tsuhara**, A. Kawahara* and Y. Sato***
*Department of Chemical Engineering and Mat. Sci., Kumamoto University, Kumamoto
**Department of Mechanical Engineering, Arike National College of Technology, Omura
***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**
*Russian Scientific Centre of Kurchatov Institute, Moscow, Russia

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, UK.

Interferometric Study of Convective Heat Transfer Structures above the Horizontal Isotermal Rectangular Plates

E. Radsiewska 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

Francisco 28, 11:40-13:20 - Room 4 - Multi-Component and Multi-Phase Flow: General Studies
Chairman: G. Guglielmini

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, UK.

Interferometric Study of Convective Heat Transfer Structures above the Horizontal Isotermal Rectangular Plates

E. Radsiewska 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

Friday 28, 14:20-15:00 - Plenary Room - Keynote Lecture 14
Chairman: to be assigned

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

Friday 28, 15:00-16:40 - Room 1 - Fluid-Dynamics: Vortex Flows 2
Chairman: T. Skiepko
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

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

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, 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