



The International Information Center for Multiphase Flow

NEWSLETTER

No.28 May 2007

The Japanese Society for Multiphase Flow



The Workshop on Modeling and Measurements of Two-Phase Flows and Heat Transfer in Nuclear Fuel Assemblies October 10–11, 2006, Stockholm, Sweden

by Henryk Anglart

The Workshop on Modeling and Measurements of Two-Phase Flows and Heat Transfer in Nuclear Fuel Assemblies was organized by the Nuclear Reactor Technology Division at the Royal Institute of Technology (KTH), Stockholm, Sweden. Prof. Henryk Anglart (KTH) served as Workshop Chair with Dr. Thomas Frank (ANSYS Germany) and Prof. H-M. Prasser (ETH) as co-Chairs. The Workshop was sponsored by the Scandinavian Reactor Thermal Hydraulic Network NORTHNET.

The over-all objective of the Workshop has been to provide a platform for experts to exchange information on latest achievements in the field of two-phase flows and heat transfer in nuclear fuel assemblies. Both numerical and experimental contributions have been invited. The primary focus of the Workshop has been on applications of the Computational Fluid Dynamics (CFD) for the numerical predictions as well as detailed local flow and heat transfer measurements that are suitable for the validation of the CFD predictions.

65 participants from 14 countries and three continents (America, Asia and Europe) participated in the Workshop. In total 23 papers were presented in 6 sessions of the Workshop.

The papers were dealing with a wide range of topics as foreseen in the call for papers; however, the majority of them were devoted to the numerical predictions in fuel assemblies. In the first day of the workshop several overview papers were presented dealing with such topics as: (i) thermal-hydraulic challenges in the nuclear industry, (ii) overview of existing thermal-hydraulic methodologies in the nuclear industry, (iii) multiphase flow modeling and simulations in nuclear fuel assemblies: current needs and challenges, (iv) progress in modeling of boiling two-phase flows as viewed by CFD code developers, (v) towards the prediction of local thermal-hydraulics in PWR cores.

One of the frequently addressed topics included the prediction of the sub-cooled nucleate boiling heat transfer in fuel assemblies. Some modeling improvement

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Everybody, who is interested in “multiphase flow”, can be a member of ICeM. You are welcome to join ICeM. Please contact one of the following to register as an ICeM member.

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were addressed in which a three-dimensional bubble tracking model was combined with a two-dimensional two-fluid model to predict void fraction profiles in sub-cooled boiling. Applications were demonstrated where sub-cooled boiling model was applied to predict thermal-hydraulic behavior of a hot sub-channel in a fuel rod assembly. Also, an approach to deal with the prediction of the critical heat flux in the sub-cooled boiling conditions was demonstrated. Finally, additional validation of existing models of sub-cooled boiling against detailed measurements was presented.

Another topic addressed by several papers was the simulation and modeling of the annular dispersed two-phase flows in fuel assemblies with spacers. The drop dynamics and deposition rates were modeled using the Eulerian-Lagrangian approach, in which the influence of flow obstacles was treated in a mechanistic way.

In the second day of the workshop certain aspects of the experimental and advanced CFD approaches were presented. One paper was covering an overview of instrumentation used for two-phase flow measurements.

Another paper presented an experimental research on enhancement of the critical heat flux in water-based nanofluids. The advanced CFD studies were represented by papers dealing with the Large Eddy Simulation (LES) of turbulent flow in PWR fuel assemblies and computation of droplet-laden turbulent channel flow. The last accent of the Workshop was a panel study on "Physical Modeling and CFD as a tool for simulation of two-phase flows and heat transfer in nuclear fuel assemblies: feasibility and needs".

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Report on 5th International Symposium on Measurement Techniques for Multiphase Flow December 10–13, ISMTMF'2006, Macao, China

by Shimin Wang

The 5th International Symposium on Measurement Techniques for Multiphase Flow (ISMTMF'2006) was held on December 10 to 13, 2006, in Macao, China. It was jointly organized by Macau University of Science and Technology, Southeast University, University of Shanghai for Science and Technology, Zhejiang University, University of Leeds, OMEC Technology Co.Ltd and under the joint sponsorship of The Chinese Society for Measurement, The Japanese Society for Multiphase Flow, National Natural Science Foundation of China, The Chinese Academy of Sciences The Chinese Society of Engineering Thermophysics, Virtual Center for Industrial Process Tomography.

In order to exchange academic ideas and to present new research achievements in the measurement techniques for multiphase flows, which is very important for both of basic study of multiphase flows and its application in industry, a series of conferences has been developed by the Chinese Society for Measurement at three-yearly intervals. The previous

conferences were held in: Nanjing, China (1995); Beijing, China (1998); Fukui, Japan (2001); Hangzhou, China (2004). And the 2nd International Workshop on Process Tomography (IWPT-2) was held jointly with ISMTMF'2006 for the first time.

Following 7 invited plenary lectures were contained in the proceedings of this symposium.

- ❖ Prof. Richard A Williams, "Micro X-ray Tomographic Imaging of Porous Media"
- ❖ Prof. Ping Zheng, "Recent Work on Flow Boiling and Condensation in a Single Microchannel"
- ❖ Prof. M. Sommerfeld, "Application of Advanced Imaging Techniques for Analyzing Multiphase Flows"
- ❖ Prof. Yingxian Wu, "Multiphase Flow Measurement by Dual Gamma Ray Tomography"
- ❖ Prof. Yassin A. Hassan, "Novel Measurements in Multiphase Flows Using Dynamic Particle Image Velocimetry"
- ❖ Prof. Shu Takagi, "Surfactant Effect on the Structure



of Bubbly Flow"

- ❖ Prof. Xiaoshu Cai, "Flame Measurement and Combustion Diagnoses with Spectrum Analysis"

Over 190 participants from 16 countries participated in the conference. Seven keynote lectures were presented along with 166 contributed papers covered the following major topics:

- ❖ Fundamentals of Multiphase Flow Measurement
- ❖ New Sensors and Measurement Methods
- ❖ Information Technology and Instrumentation
- ❖ Optical, Non-intrusive Techniques
- ❖ Industrial Application and Others
- ❖ Developments of PT Technology
- ❖ Image Reconstruction and Applications of PT Technology

Some selected papers presented in the 5th ISMTMF will be published in a special issue "The proceedings of 5th ISMTMF" of the journal of Chemical Engineering

Communications in May, 2007. Some selected papers presented in the IWPT-2 will be also published in a special issue of the journal of Flow Measurement and Instrumentations in May, 2007

The success of this conference was supported by voluntary efforts by the members of the organizing committee. We trust that the conference provide a forum for the interchange of new ideas and the presentation of the latest work in the measurement technique for multiphase flow. And we look forward to the continued success of the International Symposium on Measurement Technique for Multiphase Flows next time.

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An Announcement from Editor

The JSMF gives internet-service for ICMF members.

You can read updated ICeM NEWSLETTER by visiting JSMF homepage

<http://www.jsmf.gr.jp/index-en.htm>

Report on "Fundamentals of Microscale Heat Transfer: Boiling, Condensation, Single- and Two-Phase Flows", an International Short Course given in Dallas, Texas on January 24–27, 2007 (and previously in Lausanne, Switzerland on June 12–16, 2006)

by John R. Thome

In response to the growing number of evolving technologies and applications based on microscale flow and heat transfer, the present 4-day course was developed to provide a broad, fundamental state-of-the-art review on this emerging topic. The course provides a comprehensive treatment of both single-phase flow and heat transfer *and* two-phase flow and heat transfer in microchannels. The course is directed to heat transfer specialists in the computer and electronics cooling industries, the automotive and the air-conditioning industries, the aerospace industry, and the micro- and compact heat exchanger industries. Furthermore, the course is addressed to Ph.D. students, post-doctoral researchers and senior scientists involved in this area of research.

The four course lecturers are internationally recognized experts in micro-scale (and macro-scale) research and applications:

John R. Thome (*Course Coordinator*) is Professor of Heat and Mass Transfer at the Swiss Federal Institute of Technology in Lausanne, Switzerland. He lectured primarily on two-phase flow, heat transfer and pressure drops in microchannels (and macrochannels), on thermal modelling of heat sinks and on CO₂ heat transfer.

Iztok Zun is Professor and Head of the Laboratory for Fluid Dynamics and Thermodynamics, Faculty of Mechanical Engineering, University of Ljubljana, Slovenia. He lectured on the numerical simulation of single-phase microchannel cooling elements and the status of numerical techniques for two-phase flows in microchannels of simple and complex geometry.

Gian Piero Celata is Director of the Institute of Thermal-Fluid Dynamics at the Italian national research center ENEA and is honorary chair of the European Two-Phase Flow Group among his many international appointments. He focused his lectures on the state-of-the-art of single-phase heat transfer and fluid flow in simple and complex geometries and on condensation and boiling heat transfer in microchannels.

Anthony M. Jacobi is Kritzer Distinguished Professor of the Department of Mechanical and

Industrial Engineering at the University of Illinois Champaign-Urbana and is Co-director of the Air-Conditioning and Refrigeration Center. He lectured on air-side heat transfer on compact heat exchanger coils (including prediction methods for heat transfer and pressure drop, flow visualization, turbulence promoters, frost formation and condensate retention effects).

Heat Transfer Research Inc. (Host) is a well-known industrial research and development consortium founded in 1962 and located in College Station, Texas with over 600 member companies from around the world and acted as the host for the course.

The *first edition* of this course was held at the EPFL in Lausanne from June 12-16 in 2006 and was attended by 38 participants representing 17 different countries (from Europe, Japan, North America, South America and Turkey).

The *second edition* of this course was held in Dallas, Texas from January 24-27 at the Radisson Hotel in a slightly shorten version and was attended by participants from North America, Europe and South America.

It is planned to make this course an annual event in Lausanne each June. The new *third edition* of the course will be held in Lausanne from June 4-8, 2007 (*see program below*). For information to attend the course, contact the course coordinator (John Thome) or one of the other lecturers. The course lectures are updated for each new edition of the course to account for the rapid advances taking place in this new, dynamic discipline.

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website: <http://ltdcm.epfl.ch>

Microscale Heat Transfer Course: Program for Lausanne, June 4-8, 2007

Monday, June 4

- 12.45 – 13.00 Registration
 13.00 – 13.15 Introduction to Course (Thome)
 13.15 – 13.30 Overview of Microscale Heat Transfer and Its Applications (Thome)
 13.30 – 14.15 Differences in Macro- and Micro-Scale Single-Phase Flows and Heat Transfer (Celata)
 14.15 – 15.00 Single-Phase Microscale Heat Transfer Experimental Techniques and Studies (Celata)
 15.00 – 15.15 *Coffee Break*
 15.15 – 17.00 Principles of Air-Side Heat Transfer in Compact Heat Exchangers (Jacobi)
 17.00 – 18.00 Topic to be announced (Jacobi)

Tuesday, June 5

- 08.30 – 09.15 Prediction Methods for Microscale Single-Phase Flows and Heat Transfer (Celata)
 09.15 – 10.00 Topic to be announced (Jacobi)
 10.00 – 10.15 *Coffee Break*
 10.15 – 11.00 Macroscale Two-Phase Flows and Flow Pattern Maps (Thome)
 11.00 – 11.45 Microscale Two-Phase Flows and Flow Pattern Maps (Thome)
 11.45 – 13.15 Topic to be announced (Jacobi)
 13.15 – 14.30 *Lunch Break*
 14.30 – 17.00 *Tour of Two-Phase Flow and Heat Transfer Lab and Discussions*

Wednesday, June 6

- 08.30 – 10.00 Void Fraction Measurements and Models for Macro- and Microchannels (Thome)
 10.00 – 10.15 *Coffee Break*
 10.15 – 11.15 Review of Experimental Work on Condensation in Microchannels (Celata)
 11.15 – 12.00 Prediction Methods for Condensation in Microchannels (Celata)
 12.00 – 13.15 *Lunch Break*
 13.15 – 14.15 Microchannel Flow Boiling Experimental Studies (Celata)

- 14.15 – 14.45 Microchannel Flow Boiling Heat Transfer Models-I (Thome)
 14.45 – 15.15 *Coffee Break*
 15.15 – 16.00 Microchannel Flow Boiling Heat Transfer Models-II (Thome)
 16.00 – 17.00 CHF in Microchannels (Thome)

Thursday, June 7

- 08.30 – 09.15 Numerical Modeling of Microscale Single-Phase Flows (Zun)
 09.15 – 10.00 Transient Characteristics of Phase Interface in Microchannels (Zun)
 10.00 – 10.15 *Coffee Break*
 10.15 – 12.00 Numerical Modeling of Slug Flows in Microchannels (Zun)
 12.00 – 13.15 *Lunch Break*
 13.15 – 14.00 Phenomenological Modeling of Bubble Dynamics in Microchannels (Thome)
 14.00 – 14.45 Principles of Multiscale Modeling of Two-phase Flows (Zun)
 14.45 – 15.15 *Coffee Break*
 15.15 – 16.00 Two-Phase Pressure Drop Models for Macroscale Channels (Thome)
 16.00 – 17.00 Two-Phase Pressure Drop Models and Data for Microscale Channels (Thome)

Friday, June 8

- 08.30 – 09.15 Hierarchical Decomposition and Boundary Conditions in Two-Phase Flow (Zun)
 09.15 – 10.00 Perspectives in Numerical Modeling of Two-Phase Flow in Microchannels (Zun)
 10.00 – 10.15 *Coffee Break*
 10.15 – 11.00 Numerical Simulations of Transient Conduction in Microchannel Heat Sinks (Thome)
 11.00 – 12.00 Two-Phase Flow and Boiling of CO₂ in Macro- and Microchannels (Thome)
 12.00 – 12.15 Closing Remarks/Distribution of Course Certificates (Thome)

3D S.UN.COP TRAINING COURSES

<http://dimnp.ing.unipi.it/3dsuncop/>
January 22 – February 9, 2007, Texas, USA

by Alessandro Petruzzi

The 3D S.UN.COP (*Scaling, Uncertainty and 3D COuPled code calculations*) training aims to transfer competence, knowledge and experience from recognized international experts in the area of scaling, uncertainty and 3D coupled code calculations in nuclear reactor safety technology to analysts with a suitable nuclear background. Among the main objectives are:

- To diffuse the use of international guidance;
- To homogenize the approach in the use of computer codes (like RELAP, TRACE, CATHARE, ATHLET, IMPACT) for accident analysis;
- To disseminate the use of standard procedures for qualifying thermal-hydraulic system code calculation;
- To promote Best Estimate Plus Uncertainty (BEPU) methodologies in thermal-hydraulic accident analysis through the presentation of the current industrial applications and the description of the theoretical aspects of the deterministic and statistical uncertainty methods as well as the method based upon the propagation of output;
- To spread available-robust approaches based on BEPU methodology in Licensing Process;
- To address and reduce User Effects;
- To realize a meeting point for exchanges of ideas among the worlds of Academy, Research Laboratories, Industry, Regulatory Authorities and International Institutions.

The framework in which the 3D S.UN.COP seminars have been designed may be derived from Figure 1, where the roles of two main international institutions (OECD and IAEA) and of the US NRC (and the regulatory bodies of other countries) in order to address the problem of user effect are outlined.

The training is open to research organizations, companies, vendors, industry, academic institutions, regulatory authorities, national laboratories, etc. The seminar is in general subdivided into three parts and participants may choose to attend a one-, two- or three-week course. The first week is dedicated to the background information including the theoretical bases for the proposed methodologies; the second week is devoted to the practical application of the methodologies and to the hands-on training on numerical codes; the

third week is dedicated to the user qualification problem through the hands-on training for advanced user and include a final exam. From the point of view of the conduct of the training, the weeks are characterized by lectures, code-expert teaching and by hands-on application. More than thirty scientists are in general involved in the organization of the seminars, presenting theoretical aspects of the proposed methodologies and holding the training and the final examination. A certificate of qualified code user is released to participants that successfully solve the assigned problems during the exams (Figure 2).

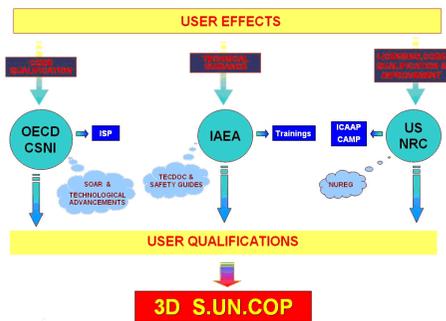


Figure 1: 3D S.UN.COP Framework to address the user effect problem.

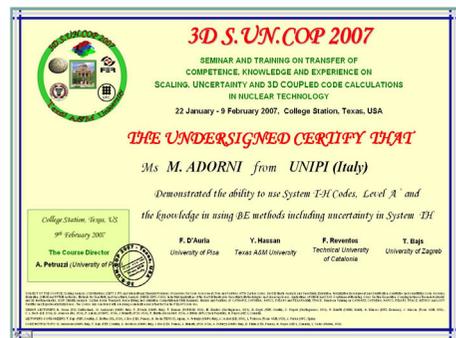


Figure 2: 3D S.UN.COP "LA Code User Grade" Certificate.

Seven Training Courses (Figure 3) have been organized up to now and were successfully held at:

- The University of Pisa (Pisa, Italy), 5 – 9 January 2004 (6 participants) and 14 – 18 June 2004 (11 participants);
- The Pennsylvania State University (University Park, PA, USA), 24 – 28 May 2004 (15 participants);
- The University of Zagreb (Zagreb, Croatia), 20 June – 8 July 2005 (19 participants);
- The Polytechnic University of Catalonia (Barcelona, Spain), 23 January – 10 February 2006 (33 participants)
- The Autoridad Regulatoria Nuclear (ARN), the Comisión Nacional de Energía Atómica (CNEA), the Nucleoelectrica Argentina S.A (NA-SA) and the Universidad Argentina De la Empresa (Buenos Aires, Argentina), 2 October – 14 October 2006 (37 participants) ;
- The Texas A&M University (College Station, Texas, USA), 22 January – 9 February 2007. It was successfully held with the attendance of 26 participants (Figure 4) coming from 12 countries and 17 different institutions (universities, vendors, national laboratories and regulatory bodies). About 30 scientists (from 11 countries and 19 different institutions) were involved in the organization of the seminar, presenting theoretical aspects of the proposed methodologies and holding the training and the final examination.

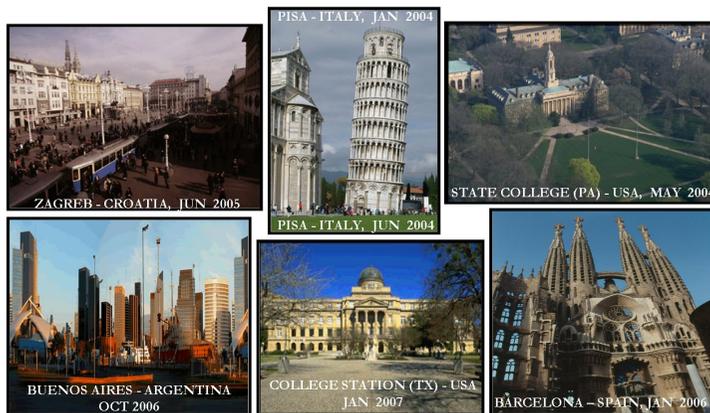


Figure 3: The seven 3D S.UN.COP training courses.



Figure 4: Lecturers and participants at 3D S.UN.COP 2007

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The JSMF Annual Meeting 2007 will be held at Hokkaido, Sapporo Convention Center on 22nd–24th June, 2007. During the Meeting,, **the 26th Multiphase Flow Symposium** will be held 23rd.

24th Zurich Short Courses on Modelling and Computation of Multiphase Flows March 12–16, 2007, Zurich, Switzerland

by George Yadigaroglu

The 24th edition of these courses has been conducted, hosted again by the Swiss Federal Institute of Technology in Zurich. This year there was an increased number of participants from Europe (possibly linked to the renewal of interest in the nuclear technology, but there were also participants from a host of other industries: energy technology, petroleum, chemical, food processing, information technology, metallurgy, etc.). An increasing number of overseas participants are also attending these courses now; there were numerous participants from Japan, Korea, India, USA, Canada, Mexico, South Africa and Australia. By now, some 1500 participants attended the Zurich courses.

The courses are organised in a modular form as intensive introductory courses for persons having basic knowledge of fluid mechanics, heat transfer, and numerical techniques, but also serve as advanced courses for specialists wishing to obtain the latest information. Inter-industry transfer of multiphase flow knowledge is one of the aims of the courses that are attended by scientists and engineers coming from a variety of backgrounds and industries.

As usual, *Part I, Bases* covered the common background material and emphasised the latest mechanistic understanding, modelling and computational aspects of multiphase flows. An introductory "tutorial" chapter was emailed this year to the participants to familiarize them with the basic material and bring them to a common basic level before the beginning of the course. Lectures on advanced two-phase flow instrumentation were added to the course this year.

Part IIA, New Reactor Systems and Methods covered the multiphase phenomena in LWRs as well as advanced computational modelling of these systems. The state-of-the-art and beyond in modelling and simulation methods for core design and accident analysis was presented and then the most recently proposed advanced reactor system designs, including the near-deployment passive LWR systems and those in Generation IV were reviewed, in particular in relation

to multiphase flow phenomena.

Part IIB, the module on *Computational Multi-Fluid Dynamics (CMFD)* reflects the growing interest in the application of CFD techniques to multi-phase flows. This part of the course was again expanded to cover most new computational techniques. It included an introductory lecture and lectures on the Volume of Fluid (VOF) method, the ghost-fluid, level-set and phase-field methods, Lattice Gas Cellular Automata, as well as reviews of applications of all these.

Finally the relatively new module, *CMFD with Commercial Codes* completed the course and was well received again: the participants had the possibility to meet the main commercial code developers who presented the multiphase computational capability of their codes that is constantly improving.

Numerous movies, videos, animations, and computer simulations, some classical, some produced very recently, were offered again to illustrate the physical phenomena and the numerical techniques.

The lecturers in this series of carefully organized courses are experts in their respective fields but are selected also for their pedagogical capabilities. This year they included: S. Banerjee, D. Bestion, M.L. Corradini, G. Hetsroni, G.F. Hewitt, D. Lakehal, S. Lo, J.-M. Prasser, G. Scheuerer, S.A. Vasquez, G. Yadigaroglu and S. Zaleski.

The participants received an extensive set of lecture notes and copies of all the standardised presentations. The course language was English. The exact schedule and contents of the lectures can be found in the Course web site: <http://www.ascomp.ch/ShortCourse>.

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Future Meetings

Following list includes Conference Name, Place, Date and Contact.

International Conference on Computational Methods (ICCM 2007)

Hiroshima, Japan, April 4-6, 2007
Prof. Noguchi, H., Keio University, Japan
Prof. Kitamura, M., Hiroshima University, Japan
E-mail: iccm2007@hiroshima-u.ac.jp
<http://home.hiroshima-u.ac.jp/iccm2007/>

Heat Transfer in Components and Systems for Sustainable Energy Technologies (Heat-SET 2007)

France, April 18-20, 2007
Dr. Bernard Thonon, GRETh, France
E-mail: info@greth.fr
<http://www.greth.fr/heatset/>

15th International Conference on Nuclear Engineering (ICONE15)

Nagoya, Japan, April 22-26, 2007
Dr. Takahiko Ito, Chubu Electric Power Co., Inc., Japan
E-mail: icone15@jsme.or.jp
<http://www.icone15.org/>

2007 International Congress on Advances in Nuclear Power Plants (ICAPP 2007)

Nice Acropolis, France, May 13-18, 2007
E-mail: icapp2007@sfn.fr
<http://www.inspi.ufl.edu/icapp07/index.html>

The 6th Pacific Symposium on Flow Visualization and Image Processing (PSFVIP-6)

Hawaii, USA, May 16-19, 2007
Prof. Manabu Iguchi
Division of Materials Science and Engineering,
Graduate School of Engineering,
Hokkaido University,
Sapporo, 060-8628 Japan
Tel.: +81-11-706-6335
Fax: +81-11-706-7810
E-mail: psfvip-6@eng.hokudai.ac.jp
<http://fox27.hucc.hokudai.ac.jp/indexHAWAII.html>

Fundamentals of Microscale Heat Transfer: Boiling, Condensation, Single- and Two-Phase Flows

Lausanne, Switzerland, June 4-8, 2007
Dr. Gian Piero Celata
E-mail: celata@casaccia.enea.it
Prof. John R. Thome
E-mail: john.thome@epfl.ch
http://termserv.casaccia.enea.it/mht_course/

9th Asian Symposium on Visualization (9ASV)

Hong Kong, June 4-9, 2007
Prof. C. T. Hsu, HKUST
E-mail: 9asv@ust.hk
<http://www.me.ust.hk/~9asv/>

Second International Conference on Porous Media and its Applications in Science, Engineering and Industry

Kauai, Hawaii, June 17-21, 2007
Prof. Kambiz Vafai
Department of Mechanical Engineering
University of California, Riverside
Bourns Hall A363
Riverside, California 92521-0425
Tel: 1-951-827-2135
Fax: 1-951-827-2899
E-mail: vafai@engr.ucr.edu
<http://www.engconfintl.org/7ap.html>

ENERGY 2007, First International Conference on Energy and Sustainability

The New Forest, UK, June 20-22, 2007
Prof. C A Brebbia
Prof. V Popov
Wessex Institute of Technology, UK
E-mail: rgreen@wessex.ac.uk
<http://www.wessex.ac.uk/conferences/2007/energy07/index.html>

5th International Energy Conversion Engineering Conference (IECEC 2007)

St. Louis, Missouri, USA, June 25-27, 2007
Prof. Henry W Brandhorst Jr, Auburn University
<http://www.aiaa.org/content.cfm?pageid=230&lumeetingid=1478&viewcon=overview>

11th European Turbulence Conference (ETC11)

Porto, Portugal, June 25-28, 2007
Prof. Arne V. Johansson, Sweden
E-mail: congresses.porto@viagensabreu.pt
<http://etc11.fe.up.pt/>

5th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics (HEFAT2007)

Sun City, South Africa, July 1-4, 2007
Prof. JP Meyer, University of Pretoria, South Africa
E-mail: jmeyer@up.ac.za
<http://www.africaspecials.com/hefat2007/>

2007 ASME-JSME Thermal Engineering Conference and Summer Heat Transfer Conference

Vancouver, BC, Canada, July 8-12, 2007
ASME Conference Chair
Prof. Rod Douglass, Los Alamos National Laboratory
JSME Chair
Prof. Ken Okazaki, Tokyo Institute of Technology
Contact
Prof. Kelly Sutton, Administrative Chair
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<http://www.ajtec.org/>

International Conference on Multiphase Flow (ICMF Leipzig 2007)

Leipzig, Germany, July 9-13, 2007
Prof. Dr.-Ing. Martin Sommerfeld
Martin-Luther-Universität Halle-Wittenberg
Fachbereich Ingenieurwissenschaften
Institut für Verfahrenstechnik
Lehrstuhl Mechanische Verfahrenstechnik
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E-mail: martin.sommerfeld@iw.uni-halle.de
E-mail: info@icmf2007.org
<http://www.icmf2007.org>

International Colloquium on the Dynamics of the Explosions and Reactive System (ICDERS)

Poitiers, France, July 23-27, 2007
Dr. M. Champion
Laboratoire de Combustion et de Détonique
UPR 9028 CNRS
ENSMA - BP 40109
1, rue Clément Ader
86961 Futuroscope-Chasseneuil, France
Tel.: +33 (0) 5 49 49 81 78
Fax: +33 (0) 5 49 49 81 76
E-mail: icders@lcd.ensma.fr
<http://www.icders2007-poitiers.org/>

8th Asian Thermophysical Properties Conference (ATPC Fukuoka 2007)

Fukuoka, Japan, August 21-24, 2007
Prof. Fujii, Motoo, Kyushu University, Japan
E-mail: fujii@cm.kyushu-u.ac.jp
<http://www.mech.nagasaki-u.ac.jp/atpc2007/>

5th International Symposium on Turbulence and Shear Flow Phenomena (TSFP-5)

TU Munich, Germany, August 27-29, 2007
Prof. R. Friedrich, Techn. Univ. München
Prof. N. Kasagi, University of Tokyo
<http://www.aer.mw.tum.de/TSFP5/>

18th International Symposium on Transport Phenomena (ISTP-18)

Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, August 27-30, 2007
Prof. Sang Yong Lee, Department of Mechanical Engineering, KAIST
Tel.: +82-42-869-3026
Fax: +82-42-869-8207
E-mail: sangyonglee@kaist.ac.kr
<http://www.istp-18.org>

5th World Congress on Industrial Process Tomography (WCIPT5)

Bergen, Norway, September 3-6, 2007
Prof. Hugh McCann, UK
Prof. Geir Anton Johansen, Norway
E-mail: jenefer.cockitt@manchester.ac.uk
<http://www.vcipt.org/wcipt5/>

9th International Symposium on Fluid Control, Measurements, and Visualization (FLUCOME2007)

Tallahassee, FL, USA, September 16-19, 2007
Prof. Ching-Jen Chen
Dean of College of Engineering
Florida A&M University-Florida State University
2525 Pottsdamer Street
Tallahassee, Florida 32310
E-mail: cjchen@eng.fsu.edu
<http://www.eng.fsu.edu/flucome9/>

Sixth International Conference on Enhanced, Compact and Ultra-Compact Heat Exchangers: Science, Engineering and Technology

Potsdam, Germany, September 16-21, 2007
Prof. R.K. Shah, Rochester Institute of Technology, Rochester, NY, USA
E-mail: info@eci.poly.edu
<http://www.engconfintl.org/7aq.html>

The 1st International Colloquium on Dynamics, Physics and Chemistry of Bubbles and Gas-Liquid Boundaries (ICBB2007)

Niseko, Hokkaido, Japan, September 25-28, 2007
Prof. Shigeo Fujikawa, Japan
Division of Mechanical and Space Engineering
Hokkaido University
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Japan
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<http://mech-me.eng.hokudai.ac.jp/~icbb2007/>

flotek.g Global Conference & Exhibition 2007

FCRI, Palakkad, Kerala, India, September 26-28, 2007
Dr. M. Viswanathan
Convener flotek.g
Fluid Control Research Institute
E-mail: flotek.g@fcriindia.com
<http://www.fcriindia.com/flotekg/>

International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-12)

Pittsburgh, Pennsylvania, U.S.A., September 30 - October 4, 2007
Dr. Novak Zuber
Prof. Lawrence E. Hochreiter
Penn State University
304 Reber Building, University Park, PA 16802
Tel.: 814-863-4261
E-mail: fxc4@psu.edu
<http://www.nureth12.org/>

International Conference on Power Engineering-2007 (ICOPE-2007)

Hangzhou, China, October 23-27, 2007
Prof. Kefa Cen, CSPE
Zhejiang University
<http://www.ceu.zju.edu.cn/icope2007.htm>

International Gas Turbine Congress (IGTC '07 Tokyo)

Tokyo, Japan, December 2-7, 2007
Prof. Eisuke Outa, Waseda Univ.
Prof. Shimpei Mizuki, Hosei Univ.
Prof. Toshinori Watanabe, Univ. of Tokyo
E-mail: igtc@rainbow.dti.ne.jp
<http://wwwsoc.nii.ac.jp/gtsj/igtc/>

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10th World Filtration Congress (WFC10)

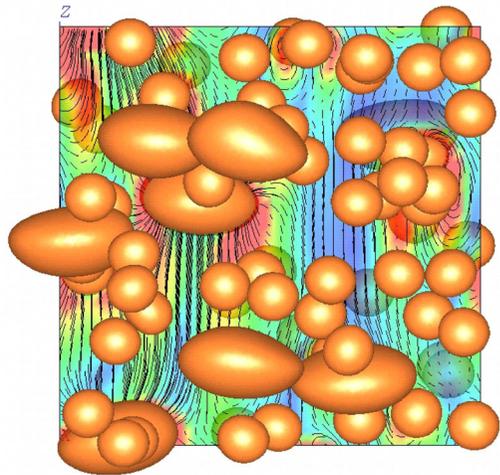
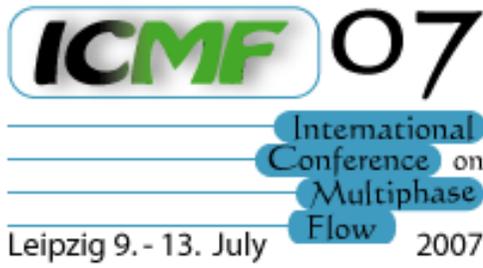
Leipzig, Germany, April 14-18 2008
Dr. Harald Anlauf
E-mail: info@wfc10.com
<http://www.wfc10.com/>

Executive Division of The Japanese Society for Multiphase Flow (2006-2007)

President	Y. Tsuji (Osaka University)
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Chair of International Intercourse Division	T. Tanaka (Osaka University)
Chair of General Affairs Division	T. Okawa (Osaka University)

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E-mail: office@jsmf.gr.jp
WWW : homepage <http://www.jsmf.gr.jp/index.htm>



Conference Centre Leipzig
(CCL)

www.icmf2007.org

Chairman: Prof. Dr.-Ing. Martin Sommerfeld
Martin-Luther-Universität Halle-Wittenberg
e-mail: martin.sommerfeld@iw.uni-halle.de

Co-Chair: Prof. Dr.-Ing. Cameron Tropea
Technische Universität Darmstadt
e-mail: ctropea@sla.tu-darmstadt.de

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Local Organising Committee

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Prof. K.-E. Wirth, Universität Erlangen-Nürnberg

Conference Location

The conference will be held at the Conference Centre (CCL) in Leipzig, Germany which is located within the area of the new trade fair center. The CCL can be easily reached from the central station of Leipzig by S-Bahn or Tram within about 20 min. All the major hotels are within walking distance from the central station.



History of the Conference

The International Conference on Multiphase Flow (ICMF) first was held in TSUKUBA, Japan in 1991 and the second ICMF took place in KYOTO, Japan in 1995. During this conference it was decided to establish an International Governing Board which takes care about the major aspects of the conference and decides about the future locations. Due to the great importance of the field it was furthermore decided to hold the conference every three years successively in Asia including Australia, Europe including Africa, Russia and the Near East and America. Hence, ICMF 98 was held in LYON, France; ICMF 2001 in NEW ORLEANS, USA and ICMF 2004 in YOKOHAMA, Japan. In Yokohama the Governing Board decided to have the ICMF 2007 in LEIPZIG Germany.

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 Prof. Theo Theofanous, University of California, USA
 Prof. Lixing Zhou, Tsinghua University, China

Scope of the Conference

The conference will be devoted to all aspects of Multiphase Flow. Researchers from all over the world should gather in order to introduce their recent advances in the field and thereby promote the exchange of new ideas, results and techniques. The conference should be a key event in Multiphase Flow and support the advancement of science in this very important field. The major research areas relevant for the conference are:

- Elementary processes for particles, droplets, bubbles and nano-particles (dispersed Multiphase Flows)
- Interaction phenomena in dense dispersed multiphase flows (collision, agglomeration, coalescence)
- Discontinuous multiphase flows (annular, slug, wavy and stratified flows, flow pattern regimes and instabilities)
- Multiphase flows with phase change (boiling, evaporation and condensation, reactive flows)
- Numerical methods for multiphase flows (Euler/Euler, Euler/Lagrange, DNS, LES, VOF, interface tracking population balance, molecular modelling)
- Instrumentation for multiphase flow analysis (holography, tomography, LDA, PDA, imaging techniques)
- Applications (chemical engineering, biotechnology, nuclear engineering, combustion, automotive, nano-technology, life science, environment)

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