ASME
SETTING THE STANDARD

Fluids Engineering

The Fluids Engineering Division is involved in all areas of fluid mechanics, encompassing both fundamental as well as applications

Spring 2008 Newsletter
James C. Meng, *Editor*

Chair's Message

by George Papadopoulos

Dear FED Members,

It is my great pleasure to report to you another exciting year for the Fluids Engineering Division. Our Summer Conference, FEDSM2007, was held in San Diego, California, July 30-August 2, 2007, jointly with JSME's Fluids Engineering Division. This was the 5th time we have held our summer conference jointly with our Japanese colleagues, and it proved to be another stimulating and successful event. We had over 550 participants, with over 35 counties being represented, making the meeting a truly international event in the field of Fluids Engineering. The conference had three plenary talks, the Fluids Engineering Award Lecture, 15 symposia, 13 fora, one-open forum, two general paper sessions, and a poster session. There were three insightful panel discussion sessions held, focusing on micro-scale transport in lab-on-a-chip applications, the role of Fluids Engineering in industry, and government funding trends in Japan and the USA for Fluids Engineering research. There was also one workshop on the fundamentals and developments in CFD that took place in advance of the start of the technical program. A more detailed brief on FEDSM2007 follows further inside the newsletter.

Since our first joint meeting with JSME in 1991, the JSME FED membership has shown us great support by traveling to North America and participating in large numbers. Our next joint meeting is scheduled for the summer of 2011, and in discussions at San Diego we all agreed that it was time for ASME FED to show its support to JSME FED. Hence, we are currently planning to hold our joint summer meeting of 2011 in Japan, to be hosted by our Japanese colleagues. Furthermore, KSME (Korean Society of Mechanical Engineers) FED may also join us. The site for this meeting is tentative, and further discussions are planned to reach full consensus among all the parties involved. An additional possibility exists that the meeting may grow even bigger if the Heat Transfer Divisions of all the associated societies join in. We are in the very early stages of planning for this meeting, so everything is still tentative and may change in the near future. Stay tuned for further information as it becomes available.

The division had a good presence at IMECE 2007 in Seattle, WA, contributing again with over 30 sessions and over 100 papers to the conference. IMECE 2007 marked a transition state for ASME, as the Congress is being reshaped to focus more on technical events, with ASME lowering the meeting's overall footprint by not hosting most of the business activities at the same venue. At the same time, a more interdisciplinary structure is being introduced in the track system of IMECE, meant to bring together the various divisions and institutes that participate. Our division is well poised to accommodate this new interdisciplinary track structure, as most of our topical areas being offered at IMECE are already multidiscipline in nature, leveraging the broad application aspect of Fluids Engineering. We look forward to remaining active participants at the newly shaped Congress, and welcome suggestions for new topical areas that may be introduced in future events. With the new format in place, IMECE2008 is promising to be a technically stimulating event. Dr. Joel Park is the Division's Representative , and Dr. Urmila Ghia, past FED EC Chair, is the IMECE2008 Conference Chair. See the section on upcoming conferences for more information on this, and future events.

(continued on page 2)

Chair's Message (continued from page 1)

Our next big event will be held in Jacksonville, Florida, on August 10-14, 2008. Dr. James Liburdy is the FEDSM2008 Conference Chair, and we are holding our summer meeting in co-location with the Heat Transfer Division, Advanced Energy Systems Division, Solar Energy Division and the Nano Institute. Participants will have the unique opportunity to listen to and network with researchers from a wide spectrum of backgrounds, covering interesting developments and concepts at the macro, micro and nano scales. I look forward to seeing many of you at this exciting event, and invite you to actively participate in one of division's six technical committees.

The Journal of Fluid Engineering (JFE) continues to grow in the number of submissions, number of pages and impact factor, under the leadership of our Editor, Dr. Joe Katz. Authors of papers presented at FED meetings are strongly encouraged to submit their contributions to this Journal. The success of JFE is now bringing some long waited financial reward to the division. Until recently ASME collected all revenue associated with the journals, and did not share with the divisions. The decision has now been made to share a part of the revenue that each journal brings with the respective society that supports that journal. This means that a recurring revenue stream now exists for the division, which enhances our division's financial well being. We take considerable financial risk when planning our conferences, but recent successes along with this new recurring revenue stream has put the custodial funds of the division in good standing allowing us to look for opportunities by which we can enhance our various programs and also create new ones.

In a recent action, the members of the Executive Committee decided to increase the financial support for the Young Engineers Paper (YEP) contest. Prof. Terry Beck has done a great job at running the YEP contest every year at IMECE, and the increased funding should enhance the program's appeal.

In closing, I would like to invite you to participate in the activities of the Division. The Technical Committees are open to all members of the Division, and I urge you to take an active role by helping organize future Symposia and Fora. Seek out the Technical Committee Chairs and Vice-Chairs to find out how you can participate. The FED is the Division that is closest to your professional interests. Participating offers a unique opportunity to meet others who share the same professional interests as you. I look forward to seeing you in Jacksonville on August 10th. ■

With best wishes,
George Papadopoulos
Fluids Engineering Division Chair

Upcoming Conferences:

FEDSM2008 Jacksonville, Florida

The ASME Fluids Engineering Division Summer Conference will be in Jacksonville, Florida, August 10–14, 2008, at the Hyatt Regency Riverfront. This conference is co-located with the Heat Transfer Division, Energy Sustainability, and Energy-Nano Conferences. Approximately, 1,000 attendees are anticipated. FED has received 310 abstracts for this conference. To take advantage of advance registration, you should register before July 15. All authors are required to register no later than June 27 for their papers to be published in the conference proceedings on CD. Prof. Jim Liburdy of Oregon State University is the Conference Chair. Additional information on the conference may be found on the conference web page at:
www.asmeconferences.org/fedsm08/

IMECE 2008 Boston, Massachusetts

The ASME International Mechanical Engineering Congress and Exposition will be in Boston on October 31–November 6, 2008, at the Sheraton Boston Hotel. Yes, ASME scheduled the meeting on election day, again. If you attend the conference, you must vote by absentee ballot or by early voting if your state has early voting. The anticipated attendance is approximately 3,000. To take advantage of advance registration, you must register by August 28, 2008. Authors are required to register by this date. Prof. Urmila Ghia of the University of Cincinnati and FED is the Conference Chair. Additional information may be found on the conference web page at:
www.asmeconferences.org/Congress08/

The papers for FED are located in Track 10 with the Heat Transfer Division. Prof. Van Carey of the University of California at Berkeley and HTD is the Track Chair and Dr. Joel Park of the Naval Surface Warfare Center and FED is the Track Co-chair. Track 10 has a total of 33 topics with 13 from FED. Abstract deadline was March 10. A total of 458 abstracts have been submitted to Track 10.

FEDSM 2009 Vail, Colorado

Tentatively, FEDSM2009 has been scheduled for Vail, Colorado, on August 2–5, 2009. Completion of final negotiations for the site and date is expected by April 18. A conference attendance of 250–300 is planned. Dr. Joel Park of the Naval Surface Warfare Center is the Conference Chair. Until a formal announcement is provided, Joel may be contacted for additional information at joel.park@navy.mil .

FED Committee Reports

Government Relations Committee

Richard S. Meyer, Chair

A fundamental mission of ASME is to provide government policy-makers with technical information needed to make the most informed decisions on technical and related issues. Under the direction of the Board on Government Relations, ASME conducts programs to facilitate participation in the public policy process through presentation of non-partisan analysis, study, or research; informal briefings for government personnel; formal comment on proposed legislation and regulations; and testimony before legislative and regulatory bodies.

As part of its ongoing mission, ASME conducts regular surveys on the public policy issues most important to its membership. The 2009-2010 Public Policy Agenda Survey is now available online, giving all Society members the opportunity to participate in formulating the Public Policy Agenda. The Public Policy Agenda is a compendium of federal issues of concern to the Society put together from the results of a survey done every two years by the ASME's Government Relations department.

All members are encouraged to visit the ASME website on Government Relations and to participate in the ASME International 2009-2010 Public Policy Agenda Survey. All surveys are completed online and then are tabulated electronically as they are submitted. The Agenda Survey results will be published at the International Mechanical Engineering Congress and Exposition (IMECE), November 2-6, 2008, in Boston, Massachusetts.

An online link is now provided to enable members to view weekly summaries of public policy issues relevant to ASME at www.asme.org/NewsPublicPolicy/GovRelations/ ■

Multiphase Flow Technical Committee (MFTC)

Professor Dimitris E. Nikitopoulos, Chair

The Multiphase Flow Technical Committee (MFTC) focuses initiatives and activities towards the exploration, understanding and exploitation of multiphase or multi-component flows in which at least one of the phases or components is a fluid. The committee conceives and organizes symposia and fora covering a broad range of fundamental and application-relevant multi-phase flow subjects. Multi-phase flow and transport is a multi-disciplinary subject of broad practical interest, so these activities are often co-sponsored/organized by technical committees from other ASME divisions including Heat Transfer, Manufacturing, Acoustics, Fuels and Combustion Technology, and Microelectromechanical Systems. The Fluids Engineering Division (FED) Summer Meeting is currently the principal venue of the committee's activities. This last year during the San Diego (CA) FED meeting the MFTC successfully organized five (5) fora and six (6) symposia in collaboration with colleagues from the Japan Society of Mechanical Engineers (JSME).The topics of these events covered the traditional gas-solid, gas-liquid and liquid-solid broad subject areas, cavitation, biological flows, interfacial and micro-scale phenomena as well as nuclear applications. The membership of the committee expressed through a unanimous vote their gratitude to the Japanese colleagues who contributed to the success of this venture. During the International Mechanical Engineering Congress and Exposition (IMECE) in Seattle, the committee organized a general forum on multi-phase flows and collaborated with the HTD by co-sponsoring a forum on flows with phase-change at macro and micro-scales. The MFTC is also a standing co-sponsor of the International Conference on Multiphase Flow (ICMF), which was successfully held last year in Leipzig (GE) under the chairmanship of Professors Martin Sommerfeld of the Martin-Luther-Universität (Halle-Wittenberg) and Cameron Tropea of the Technische Universität Darmstadt. The membership of the committee congratulated the chairs and organizers of the ICMF 2007 for a job well done through a unanimous vote during the last FED meeting.

The MFTC currently has about 40 active members and meets twice a year during the FED Summer Meeting and at the IMECE. New members are always welcomed when attending the committee meetings and volunteering for committee activities. New officers are elected during the FED Summer Meeting every even year. For additional information or to volunteer for an activity please contact the Chair: Professor Dimitris E. Nikitopoulos of the Louisiana State University (menikki@me.lsu.edu). ■

Fluid Mechanics Technical Committee (FMTC)

Khaled J. Hammad FMTC Chair, and Francine Battaglia FMTC Vice-Chair

The Fluid Mechanics Technical Committee (FMTC) is the main platform within ASME dedicated to organizing technical activities in the area of fundamental fluid mechanics. FMTC members organize, promote, and present symposia, fora, and panel discussions on topics of importance to the fluid mechanics technical community. There are more than 60 active members. The business meetings of FMTC are held twice a year, at the International Mechanical Engineering Congress and Exposition (IMECE) and the Fluids Engineering Division (FED) Summer Meeting. Elections of FMTC officers were held during the 2006 2nd U.S.-European FED summer meeting, Miami, FL. The two-year term (2006-2008) of the current officers began at the conclusion of the Miami meeting. The FMTC is also working on attracting a new generation of volunteers and establishing a close working relationship with other technical committees through jointly sponsored multidisciplinary activities.

FMTC members are currently engaged in organizing the following symposia/fora, for the ASME Fluids Engineering Summer Conference, to be held in Jacksonville, FL, USA, August 10-14, 2008.

- Symposium on Fundamental Issues and Perspectives in Fluid Mechanics
- Symposium on Flows in Manufacturing Processes
- International Symposium on Flow Applications in Aerospace
- Symposium on Flow Manipulation and Active Control
- Symposium on the Transport Phenomena in Mixing
- International Symposium on Fluid Power
- Symposium on Transport Phenomena in Energy Conversion from Clean and Sustainable Resources

(continued on page 4)

FED Committee Reports: (continued from page 3)

- Forum on Advances in Fluids Engineering Education

FMTC is also sponsoring the following symposia/fora scheduled during the IMECE to be held in Boston, MA, October 31 - November 6, 2008.

- Symposium on Advances In Materials Processing Science
- Symposium on the Fluid Mechanics and Rheology of Complex Fluids
- Forum on Fundamental Issues and Perspectives in Fluid Mechanics

We cordially invite you to assist in organizing, and/or contributing to the technical sessions and other activities of FMTC. As a volunteer organization, we depend on the dedicated efforts of those interested in fundamental fluid mechanics issues and their communication to other researchers and practitioners. FMTC is always seeking ideas and new members with the capacity and interest in fulfilling our future plans.

Information about FMTC can be found on our website (http://divisions.asme.org/fed/committees/fmtc.html). Further information can be obtained by contacting either the FMTC chair: Dr. Khaled J. Hammad of Dantec Dynamics (khaled.hammad@dantecdynamics.com) or the Vice-Chair: Dr. Francine Battaglia of Virginia Tech (fbattaglia@vt.edu). ■

Chair: Khaled J. Hammad, Ph.D.
Dantec Dynamics, Inc.
200 Williams Drive
Ramsey, NJ 07446-2902 USA
Tel.: 201-236-2446 x 114
Fax: 201-236-2469
khaled.hammad@dantecdynamics.com

Vice Chair: Francine Battaglia, Ph.D
Department of Mechanical Engineering
107 Randolph Hall
Virginia Polytechnic Institute & State University
Blacksburg, VA 24061 USA
Tel.: 540-231-0077
Fax: 540-231-9100
fbattaglia@vt.edu

Micro and Nano Fluid Dynamics Technical Committee (MNFDTC)

by Steve Wereley and Kendra Sharp

We will again be offering the Microfluidics Forum (Microfluidics 2008) at ASME's IMECE conference in November 2008. David Erickson (Cornell) and Minjun Kim (Drexel) are organizing the sessions this year.

Some news from the 2007 IMECE follows: David Sinton (University of Victoria), Dan Maynes (Brigham Young U) and Derek Tretheway (Portland State) served as an Honors Committee. For the first time, this committee awarded Best Paper and Best Presentation citations. The winning papers are: 1) Best Presentation: Krishnan M., Tolley M. T., Lipson H., Erickson D., (2007) "Directed Hierarchical Self Assembly - Active Fluid Mechanics at the Micro and Nanoscales", Proceedings of ASME International Mechanical Engineering Congress and Exposition (IMECE), Seattle WA, Nov. 2007, IMECE2007-41784, and 2) Best Paper: Soni, G., Squires, T.M. and Meinhart, C.D., "Nonlinear Phenomena in Induced Charge Electroosmosis," IMECE2007-41468. In addition, Soni et al's paper was nominated for the FE Division Robert T. Knapp Award.

Congratulations to the winners and a word of thanks to the awards committee!

Given the changing format of IMECE and the proximity in time to the annual APS DFD meeting, the MNFDTC has considered migrating our emphasis on sessions to the FED Summer meeting. Steve Wereley, MNFDTC Chair, is organizing a microfluidics forum at the 2008 FED Summer Meeting. In 2009, the FED Summer Meeting is rumored to be happening in a yet secret but exciting location, and we expect to be encouraging more submissions to the microfluidics sessions. Stay tuned, and if you have an opinion on the matter, please be sure to either voice it to the MNFDTC Chair (wereley@purdue.edu) or Vice-Chair (ksharp@mne.psu.edu) or bring your voice to the MNFDTC committee meeting at IMECE2008 in Boston. ■

Fluid Applications and Systems Technical Committee (FASTC)

Yu-Tai Lee, Chair, and S. A. Sherif, Vice Chair, FASTC

The Fluid Applications and Systems Technical Committee (FASTC) is responsible for promoting advancement of fluids engineering technologies related to various single- or multidisciplinary applications including fluid machinery, fluid transients, and industrial and environmental fluid systems and controls. The function of the committee is to organize symposia/fora for FED-sponsored technical meetings. The committee also provides interface such as tutorials and panel discussions between designers and technology developers. Recurring summer programs include symposia on turbomachinery CFD for design and development and on industrial applications of swirling flows, and fora on fluid machinery, automotive flows, and industrial and environmental applications of fluid mechanics. During IMECE meetings, FASTC usually collaborates with other divisions in organizing multidisciplinary sessions for a much wider audience.

For the upcoming 2008 FEDSM in Jacksonville, FL, August 10-14, there will be two major fora and one symposium in the areas of automotive flows, fluid machinery and computational methods for turbomachinery. For the 2008 IMECE in Boston, the committee is co-sponsoring activities related to the automotive, aerospace, biomedical and manufacturing industries.

Working towards the traditional joint ASME/JSME meeting in 2011, the committee is also promoting collaboration between ASME FED with the Mechanical Engineering Societies in Asian countries by expanding the scope to cover Korea, Taiwan, China and other Asian countries. Professor Shin-Hyoung Kang of the Seoul National University and Chairman of the KSME has initiated an effort by proposing joint meetings with extended scope between the United States and South Korea. The committee encourages members' suggestions and participation to make this effort successful.

The committee cordially invites your participation in all committee activities during our annual summer and winter meetings. If you are interested in volunteering, or have any questions or suggestions, please contact the Chair, Yu-Tai Lee at the Naval Surface Warfare Center, Carderock Division (yu.lee@navy.mil) or the Vice Chair, S. A. Sherif at the University of Florida (sasherif@ufl.edu). ■

FED Awards

Adiel Guinzburg, Chair

Fluids Engineering Award

The Fluids Engineering Award is conferred upon an individual for outstanding contributions over a period of years to the engineering profession and in particular to the field of fluids engineering through research, practice or teaching. The recipient of the 2007 Fluids Engineering Award is Alexander J. Smits, Professor at Princeton University. Dr. Smits received his Ph.D. from the University of Melbourne, Australia, in 1975. After serving two years as a Research Assistant to Professor P. Bradshaw at Imperial College, London, he returned to the University of Melbourne as a Research Fellow, working with Professor P. N. Joubert. He was appointed Assistant Professor in the Department of Mechanical and Aerospace Engineering at Princeton University in 1981, promoted to Associate Professor in 1985, and Full Professor in 1991. Professor Smits served as Chairman of his department from 1998 to 2004. He has served as the Director of the Princeton University Gasdynamics Laboratory since 1989. He is currently an Associate Editor of the Journal of Fluid Mechanics and an Associate Editor of the Journal of Turbulence. From 1990 to 1995, he served as an Associate Editor for the Journal of Experimental and Thermal Fluid Science published by Elsevier, and he was the Editor-in-Chief from 1995 to 1999. He was an Associate Editor of Physics of Fluids from 2000 to 2003. He is Chief Editor, www.efluids.com, a specialty web portal for students and researchers in fluid dynamics, and a Founding Partner, iCentral LLC, a publisher of specialty web portals, 1999.

Robert T. Knapp Award

This award is given for the best paper presented at the Fluids Engineering Division sponsored sessions dealing with analytical, numerical and laboratory research. The 2007 Knapp Award was awarded to Marina Campolo, Andrea Cremese, and Alfredo Soldati for their paper entitled "Strategies for dispersion control by pulsed injection: particle dispersion by jet in crossflow." This paper is published in the Proceedings of the 2006 ASME Fluids Engineering Summer Conference (FEDSM2006-98245). **Marina Campolo** graduated in Industrial Engineering (B.Sc and M.Sc.) and obtained a PhD (1999) in Chemical Engineering all at the University of Udine. She was Post Doc at the University of Udine in the group of Professor Soldati and she was also Post-Doc at Universidad Complutense de Madrid in the group of Professor Manuel Velarde before joining again the research staff at the University of Udine. She leads the computational lab of the Center for Fluid Mechanics and Hydraulics and she is interested in mixing and reacting flows with applications to chemical reactors and combustion modelling. **Andrea Cremese** obtained his B.Sc. in Mechanical Engineering and an M.Sc. also in Mechanical Engineering in 2006 both at the University of Udine. His M. Sc. Thesis was "Optimal particle dispersion control in a transverse jet via synchronized pulsed injection", under the supervision of prof. Alfredo Soldati and dr. Marina Campolo. He was also an exchange student at the University of Leeds in 2005 and since 2007 he has joined Arup (global design, engineering and business consultancy) in the London Facade Engineering Group. His activities now involve structural, thermal and detailed design of external envelopes of world class buildings. **Alfredo Soldati** has been working in the area of turbulent dispersed flows for several years. He is associated with the Department of Energy Technology at the University of Udine, Italy and he is the head of the center for Fluid Mechanics and Hydraulics. Alfredo graduated at the University of Pisa in Nuclear Engineering (B.Sc and M.Sc.) and earned his PhD in Chemical Engineering also at the University of Pisa. He worked with Professor Sanjoy Banerjee at the University of California at Santa Barbara before moving back to Udine, Italy, as Assistant, Associate and then full Professor of Chemical Engineering.

Lewis F. Moody Award

The Lewis F. Moody Award is given for the best paper presented at the Fluids Engineering Division sponsored sessions dealing with a topic useful in mechanical engineering practice. The 2007 Moody Award was presented to Alicia M. Williams, Pavlos P. Vlachos, and Barbar Akle, Virginia Tech for their paper entitled "Active Laminar Mixing Induced by Surface Disturbance." This paper is published in the Proceedings of the 2006 ASME Fluids Engineering Summer Conference (FEDSM2006-98123). **Alicia Williams** is a graduate student in the Mechanical Engineering Department at Virginia Tech, where she also received her B.S. in 2005. She completed a M.S. in laminar flow mixing using actuated ionic polymers in spring 2007. Alicia will continue research at Virginia Tech for a PhD. Her doctoral research focuses on developing a new drug targeting system with capitalizes on self-assembly of ferrofluid under external magnetic fields in biologically-relevant flows. **Dr. Vlachos** is assistant professor in the Mechanical Engineering Dept at Virginia Tech. He received his BS in Mechanical Engineering from the National Technical University of Athens (1995) and his PhD (2000) in Engineering Mechanics from Virginia Tech. Pavlos Vlachos' research focuses on experimental fluid mechanics with primary focus on biofluids, aero-thermodynamics and multi-phase flows. **Dr. Akle** received his bachelor's from American University of Beirut, Master's and Ph.D. from Virginia Tech. His areas of interest are characterization and modeling of smart materials with special interest in ion conducting transducers. Developing applications using smart materials as sensors, actuators and self healing structures. Developing biologically inspired and nano-structured smart materials. .

S. Gopalakrishnan—Flowserve Pump Technology Award

The Award was established in July 2006, with funding generously provided by the Flowserve Corporation, in honor of the late Dr. Sankaraiyer Gopalakrishnan, "Gopal". The first recipient of the award, Dr. John Tuzson, was a close friend and associate of Dr. Gopalakrishnan. Future awards are presented biennially in recognition of outstanding achievement in pump technology, documented through publications and testimonials of peers and co-work-

(continued on page 6)

FED Awards: (continued from page 5)

ers and in keeping with Gopal's dedication to the education of the next generation of expert pump engineers. The recipient of the 2007 S. Gopalakrishnan-Flowserve Pump Technology Award is Robert Kiesow. Dr. Kiesow is a principal hydraulic design engineer at Curtiss-Wright Electro-Mechanical Corporation in Cheswick, PA, where he has been since 1999. He received his B.S. in mechanical engineering from Virginia Tech (1991) and his M.S. (1994) and Ph.D. (2000) from Purdue University. While at Purdue, Dr. Kiesow performed experimental research in the field of fluid mechanics and gained experience in the design of water loop test facilities and advanced flow measurement techniques while completing research investigating turbulence generation and near-wall flow physics in complex three-dimensional flows. In his current position at Curtiss-Wright EMD, Dr. Kiesow's responsibilities include the hydraulic design, analysis and qualification of critical function canned motor pumps for both Navy nuclear and commercial applications. In his capacity as lead hydraulic designer, he has integrated new design procedures with legacy pump hydraulic design techniques to improve EMD's design process and drastically reduce cycle time. These new techniques are also being utilized to address pump performance development initiatives. Among his accomplishments at EMD are the designs of single and multi-stage reactor coolant pumps that include the next generation nuclear reactor coolant pump for the AP1000 plant, hazardous waste process pumps, and canned motor spool pumps for the petrochemical industry.

Freeman Scholar Award

The Freeman Scholar Award is given every two years to an eminent contributor to Fluids Engineering, who is expected to deliver the Freeman Scholar Lecture and write an extensive review paper that is published in the Journal of Fluids Engineering. The 2008 members of the Freeman Scholar Award committee are Tim O'Hern (chair) of Sandia National Laboratories, Dave Stock of Washington State University and Stathis Michaelides of the University of Texas at San Antonio. This year the committee received a large number of nominations and applications from prominent researchers and was quickly faced with the unpleasant task of having to eliminate several otherwise meritorious applications. At the end of the selection process two outstanding applications remained and the committee decided to give two awards in 2008. The two recipients are Dr. William K George of the Chalmers University of Technology in Gothenburg in Sweden and Joseph Klewicki of the University of New Hampshire.

William K. George joined the faculty of the Pennsylvania State University in 1968, holding positions in both Aerospace Engineering and the Applied Research Laboratory. In 1974 he moved to the State University of New York at Buffalo Department of Mechanical and Aerospace Engineering, where he was promoted to full professor in 1980. He joined the Department of Applied Mechanics of the Chalmers University of Technology in Gothenburg, Sweden in September 2000 as Professor of Turbulence.

He has authored several hundred papers, mostly on turbulence and its many applications. In addition to his work on both theoretical and experimental turbulence, his contributions range from measurements in gas turbines and automotive components to the development of optical flow diagnostic techniques. One of his most important contributions was as the editor and translator of *Wind Atlas for Denmark*, which became the model for predicting wind generator performance around the world. He has supervised 25 Ph.D. students, all of whom hold responsible positions as professors, researchers, or engineers in leading establishments throughout the world. Professor George will make his Freeman lecture at the 2008 FEDSM, August 10-14, Jacksonville, FL.

Joseph Klewicki's areas of expertise are in vorticity dynamics, complex, unsteady and turbulent flow dynamics, mixing processes, atmospheric surface layer phenomena and the experimental and analytical methods associated with the effective study of these flows. A primary focus is in the study of the physical mechanisms of wall-bounded turbulent flows, the vorticity dynamics of these flows, and the Reynolds number scaling of these flows. Over the course of his career Professor Klewicki has graduated 10 PhDs and 26 MS students, and with these students has published over 55 peer-reviewed journal articles. Professor Klewicki is currently the Dean of the College of Engineering and Physical Sciences at the University of New Hampshire. He has been in this position since August 2005. Prior to this, Professor Klewicki was in the Mechanical Engineering Department at the University of Utah for fifteen years. During the last four years at Utah he was the Department Chair. While at Utah he received a number of awards for teaching excellence. Dean Joseph Klewicki is currently the Chair of the Board of Trustees of the New Hampshire Academy for Science and Design, New Hampshire's first high-tech charter middle/high school. Professor Klewicki's Freeman lecture will be held at the 2009 FEDSM. ■

Visualizing Fluidized Bed Hydrodynamics with X-rays

Theodore (Ted) J. Heindel
Department of Mechanical Engineering, Iowa State University, theindel@iastate.edu

Background

When a fluid passes through a bed of solid particles with sufficient velocity to suspend the particles, the bed is said to be fluidized and the hydrodynamics are similar to a fluid. Fluidized beds are used in many industrial processes because they exhibit low pressure drop, uniform temperature distribution, and high heat and mass transfer rates. Additionally, many different types of particles of varying sizes can be fluidized. As a result, fluidized beds are often central components in thermochemical conversion processes, such as biomass gasification where biomass is injected into a heated bed of inert material like sand, and it undergoes a thermochemical reaction to create a flammable gas. Studying gasifi-

(continued on page 7)

Visualizing Fluidized Bed Hydrodynamics with X-rays: (continued from page 6)

cation processes is extremely difficult because of the harsh environment and the opaque nature of the flow. For example, Fig. 1 shows a cold-flow (operates at room temperature) fluidized bed composed of 500-600 μm glass beads fluidized with air. A few bubbles are observed near the wall, but visualizing the internal flow structure by optical methods is not possible.

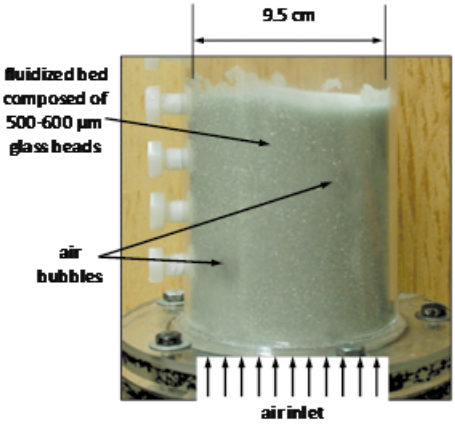


Figure 1: Operating 9.5 cm ID cold-flow fluidized bed filled with 500-600 μm glass beads.

X-ray Flow Visualization

We have been using X-rays in our laboratory to visualize and characterized multiphase fluid flows using a one-of-a-kind X-ray flow visualization system. With this system, we can complete flow visualization studies in vertical opaque fluid systems that are up to 32 cm in diameter at various axial locations spanning nearly 4 m. Our X-ray imaging capabilities include digital X-ray radiography, digital X-ray stereography, and digital X-ray computed tomography. Details of our X-ray flow visualization facility can be found in [1]. We have begun to use this system to visualize the hydrodynamics in cold-flow fluidized beds [2, 3].

In X-ray radiography, an X-ray imaging device records a 2D projection of a 3D object when it is placed between a cone beam X-ray source and a 2D detector. Using two identical sources and detectors, two projections of the same process can be recorded simultaneously for stereographic imaging. Figure 2 shows selected still frames from two perpendicular projections of a 10.2 cm diameter cold-flow fluidized bed with 500-600 μm glass beads. The superficial gas velocity (U_g), defined as the volumetric gas flow rate divided by the bed cross-sectional area, was U_g = 65.1 cm/s. This value corresponds to 3 times the minimum fluidization velocity of 21.7 cm/s, where the minimum fluidization velocity is the superficial gas velocity at which the bed begins to fluidize. These images were captured at a frame rate of 20 frames per second; hence, the time difference between each frame is 0.05 sec. The darker regions correspond to regions of higher glass bead content while the lighter regions correspond to regions of higher gas content. The x-projection also shows a 12.7 μm OD polypropylene tube that is used for experiments with side air injection. These images can be assembled to provide a movie of the fluidization process and large internal bubbles are easily observed. The turbulent nature of the fluid flow is also captured in the X-ray videos.

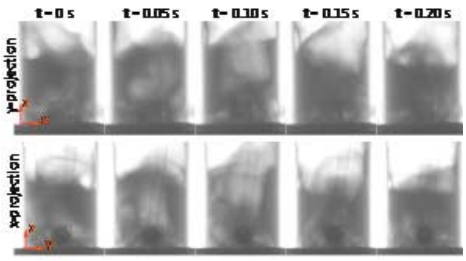


Figure 2: Radiographic projections from two perpendicular directions of a 10.2 cm ID cold-fluid fluidized bed filled with 500-600 μm glass beads and Ug = 65.1 cm/s.

X-ray computed tomography (CT) imaging generates a 2D cross-sectional image of an object showing internal details. Radiographic projections from several hundred orientations are collection and reconstructed to generate an image of the object cross-section. Since it takes time to acquire several hundred projections, X-ray CTs produce time-averaged details of the object's internal features.

Using a cone beam X-ray source and a 2D detector, we can reconstruct several slices at a time to generate time-averaged phase distribution in a 3D volume. Figure 3 (top) schematically represents a cylindrical fluidized bed showing a reference coordinate system. The CT image produces time-averaged gas holdup information at any location within this 3D volume. To visualize internal features, we can identify imaging planes at any location. For simplicity, the x-slice and y-slice CT images correspond to y-z and x-z imaging planes, respectively, that pass through the bed centerline. The z-slice CT image corresponds to the x-y imaging plane and can be viewed at any axial location within the imaging volume.

Figure 3 shows CT images of a 10.5 cm ID 500-600 μm glass bead fluidized bed operating at U_g = 65.1 cm/s. The x-, y-, and z-slice CT images reveal the local time-average gas holdup distribution and the colors correspond to the given scale. The blue regions at the base of the bed shows small regions of locally low gas holdup (i.e., high solid fraction). These regions are between the aeration holes and uniform aeration is not observed until 1-2 cm above the aeration plate. The z-slices reveal that the gas fraction in the bottom portion of the bed is higher near the walls (i.e., the yellow ring at z = 3.4 cm), while it is higher near the bed center in the upper portion. This trend is also shown in the x- and y-slice CT images and is caused by large bubbles coalescing near the bed mid-height and then rising. As these large bubbles break the surface, solid particles are thrown out and fall back against the bed walls. This causes the higher solid content near the bed walls in the upper region of the bed. These observations are confirmed with our X-ray radiographic movies.

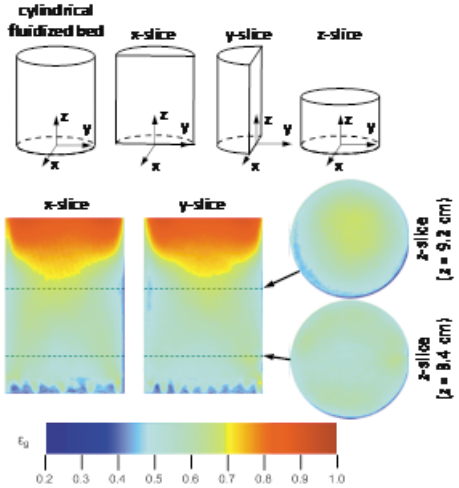


Figure 3: CT images of a 10.2 cm ID cold-fluid fluidized bed filled with 500-600 μm glass beads and U_g = 65.1 cm/s.

Summary

X-ray radiography, stereography, and computed tomography can be used to visualize opaque fluid flows. This brief shows the type of information that can

(continued on page 8)

Visualizing Fluidized Bed Hydrodynamics with X-rays: (continued from page 7)

be obtained in fluidized beds. We have also used this facility to visualize gas-liquid flows in bubble columns [4] and stirred-tank reactors [5]. X-ray video clips of these and other systems can be viewed at http://www3.me.iastate.edu/heindel/researchXFV.html. For more information, contact the author at theindel@iastate.edu.

References

1. Heindel, T.J., Gray, J.N., and Jensen, T.C., "An X-Ray System for Visualizing Fluid Flows," *Flow Measurement and Instrumentation,* 19(2): 67-78 (2008).
2. Franka, N.P., Heindel, T.J., and Battaglia, F., "Visualizing Cold-Flow Fluidized Beds with X-Rays," in *Proceedings of IMECE2007: 2007 ASME International Mechanical Engineering Congress and Exposition,* Seattle, WA: ASME Press, Paper IMECE2007-43073 (2007).
3. Franka, N.P., Drake, J.B., and Heindel, T.J., "Minimum Fluidization Velocity and Gas Holdup in Fluidized Beds with Side Port Air Injection," in *Proceedings of FEDSM2008: 2008 ASME Fluids Engineering Division Summer Meeting,* Jacksonville, FL: ASME Press, Paper FEDSM2008-55100 (2008).
4. Hubers, J.L., Striegel, A.C., Heindel, T.J., Gray, J.N., and Jensen, T.C., "X-Ray Computed Tomography in Large Bubble Columns," *Chemical Engineering Science,* 60(22): 6124-6133 (2005).
5. Ford, J.J., Heindel, T.J., Jensen, T.C., and Drake, J.B., "X-Ray Computed Tomography of a Gas-Sparged Stirred-Tank Reactor," *Chemical Engineering Science,* 63: 2075-2085 (2008).

FED Technical Committee Chairs and Vice Chairs
November 08, 2007

Fluid Mechanics Technical Committee (FMTC)

Chair:
Khaled J. Hammad, Ph.D.
Dantec Dynamics, Inc.
200 Williams Drive
Ramsey, NJ 07446-2902 USA
Tel.: 201-236-2446 x 114
Fax: 201-236-2469
khaled.hammad@dantecdynamics.com

Vice Chair:
Francine Battaglia, Ph.D
Associate Professor
Department of Mechanical Engineering
107 Randolph Hall
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061 USA
Tel.: 540-231-0077
Fax: 540-231-9100
fbattaglia@vt.edu

Fluid Applications and Systems Technical Committee (FASTC)

Chair:
Yu-Tai Lee, Ph.D.
David Taylor Model Basin
9500 Macarthur Blvd, Code 5400
West Bethesda, MD 20817-5700 USA
Tel.: 301-227-1328
Fax: 301-227-3585
yu.lee@navy.mil

Vice Chair:
S. A. Sherif, Ph. D.
Professor of Mechanical and Aerospace Eng.
Assistant Director, Industrial Assessment Center
Founding Director, Wayne K. and Lyla L. Masur HVAC Laboratory
Dept. of Mechanical and Aerospace Eng.
University of Florida
232 MAE Bldg. B, P. O. Box 116300
Gainesville, FL 32611-6300 USA
Tel: 352-392-7821
Fax: 352-392-1071
sasherif@ufl.edu

Fluid Measurements and Instrumentation Technical Committee (FMITC)

Chair:
Theodore (Ted) J. Heindel, Ph.D.
Professor
Department of Mechanical Engineering
2026 H.M. Black Engineering Building
Iowa State University
Ames, IA 50011-2161 USA
Tel.: 515-294-0057
Fax: 515-294-3261
theindel@iastate.edu

Vice Chair:
Paisan Atsavapranee, Ph. D.
Naval Surface Warfare Center
Carderock Division
9500 MacArthur Boulevard, Code 5600
Bethesda, MD 20817-5700 USA
Tel.: 301-227-5948
paisan.atsavapranee@navy.mil

Computational Fluid Dynamics Technical Committee (CFDTC)

Chair:
David W. Halt, D. Sc.
Senior Technical Fellow/Senior Manager
North America CAD/CAE
Visteon Climate Systems
One Village Center Drive
Van Buren Township, MI 48111-5711 USA
Tel.: 734-710-2072
dhalt@visteon.com

Vice Chair:
Richard W. Johnson, Ph.D.
Idaho National Laboratory
M.S. 3855
P.O. Box 1625
Idaho Falls, ID 83415-3855 USA
Tel.: 208-526-0955
Rich.Johnson@inl.gov

Multiphase Flow Technical Committee (MFTC)

Chair:
Dimitris E. Nikitopoulos, Ph.D.
Louisiana State University
Department of Mechanical Engineering
2508 CEBA BLDG
Baton Rouge, LA 70803-0001 USA
Tel.: 225-578-5903
Fax: 225-578-5924
meniki@me.lsu.edu

Vice Chair:
Malcolm J. Andrews, Ph. D.
National Security Fellow
P.O. Box 1663
Mail Stop D413
Los Alamos National Laboratory
Los Alamos, NM 87545 USA
Tel: 505-606-1430
mandrews@lanl.gov

Micro and Nano Fluid Dynamics Technical Committee (MNFDTC)

Chair:
Steven T. Wereley, Ph. D.
Associate Professor
School of Mechanical Engineering and Birck Nanotechnology Center
Purdue University
West Lafayette, IN 47907-1288 USA
Tel.: 765-494-5624
Fax: 765- 494-0539; Fax:765-496-6443
Lab: Room 338, Potter
Lab: Room 1217, Birck
wereley@purdue.edu

Vice Chair:
Kendra V. Sharp, Ph. D.
Assistant Professor of Mechanical Engineering
Pennsylvania State University
157D Hammond Building
University Park, PA 16802 USA
Tel.: 814-865-4292
Fax: 814-863-7222
ksharp@mne.psu.edu

FEDSM2007 Post Conference Report

by George Papadopoulos

The 5th Joint ASME / JSME Fluids Engineering Conference was sponsored by the Fluids Engineering Divisions (FED) of the American Society of Mechanical Engineers (ASME) and the Japanese Society of Mechanical Engineers (JSME). Dr. George Papadopoulos of ATK GASL was the ASME Conference Chair, while Professors Kozo Fujii of the Japanese Aerospace Exploration Agency and Hiroshi Tsukamoto of the Kyushu Institute of Technology were the JSME Conference Co-Chairs.

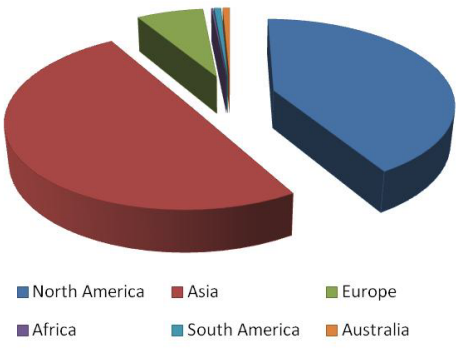
The meeting addressed a wide range of topics in analysis, numerical methods, experiments in single-phase and multiphase flows and applications. Full length papers accompanied most presentations, with a digital copy of these provided to participants.

The statistics for the conference are summarized in the table below:

Number of participants:	552
Number of countries represented	36
Total presentations	460
Plenary	3
Keynote	15
Panel	3
Workshop	1
Exhibitors	11

The meeting was truly an international event, with many countries being represented. The demographics of the participants are shown in the adjacent chart.

The conference started on Sunday afternoon with a well attended workshop on "Fundamentals and Developments in CFD," instructed by Dr. Nip Shah of Hamilton Sundstrand. A reception followed later in the evening, held outside by the hotel's pool area facing the marina. The weather was fantastic and everyone that came had a joyous time in a casual and friendly atmosphere.



The start of the technical program featured the plenary talk entitled "Japan's 10PetaFLOPS Supercomputer Development Project and Grand Challenges in CFD" by Dr. Ryutaro Himeno of Next Generation Sumpercomputer R&D Center, Riken, Japan. The two other plenary talks were given on Wednesday, with Mr. Mark Page of Swift Engineering, San Clemente, CA, presenting "From Blended-Wings to Racecars and Back Again" and with Dr. Koichi Hishida of Keio University, Yokohama, Japan, presenting "Phase Separation Control and Combined Laser Sensing in a Microchannel." All the plenaries were stimulating in their own way, and addressed well current trends in Fluids Engineering research and development.

The same was true for this year's panel discussions, which focused on micro-scale transport in lab-on-a-chip applications, the role of Fluids Engineering in industry, and government funding trends in Japan and the USA for Fluids Engineering research.

As is customary, the Honors and Awards Luncheon was held on Tuesday. Several awards were presented during the function:

° **Fluids Engineering Award**
This is the highest award presented by the FED, given for contributions to engineering that have been outstanding over a number of years. The award winner was Dr. Alexander J. Smits of Princeton University, with his accompanied lecture entitled "Turbulence in Pipes: the Moody Diagram and Moore's Law" presented on Tuesday following the afternoon's parallel technical sessions.

° **Robert T. Knapp Award**
The Robert T. Knapp Award is presented for the most outstanding original paper dealing with analytical or laboratory research. The award winners were: Marina Campolo, Ph.D, Andrea Cremese and Alfredo Soldati, Ph.D.

° **Lewis F. Moody Award**
The Lewis F. Moody Award is presented for the most outstanding original paper dealing with the practice of fluids engineering. The award winners were: Alicia M. Williams, Pavlos Vlachos, Ph.D and Barbar Akle, Ph.D

° **Sankaraiyer Gopalakrishnan-Flowserve Pump Technology Award**
The Sankaraiyer Gopalakrishnan-Flowserve Pump Technology Award is given biannually in recognition of outstanding achievement in pump technology, documented through publications and testimonials of peers and co-workers. The award winner for 2007 was Robert O. Kiesow, Ph.D.

Dr. Walter Munk of the Scripps Institution of Oceanography was scheduled to give a talk during the Luncheon, but at the last minute he was unable to come due to an injury that hospitalized him. We were fortunate to be able to arrange, with the help of Dr. Nip Shah and Mr. Phillip Young of the ASME San Diego Section, for Mr. Steve Drogin to present on a very short notice his exciting perspective of the undersea world, in high definition, taken from his remarkable private submarine called DeepSee. It was a delight and an honor to have Mr. Drogin come and present to us a small sample of his undersea adventures.

Barring some other oddities that for the most part went unnoticed, the conference was a huge success. We now look forward to our next summer meeting in Jacksonville, Florida.

Once again, I want to personally thank all the ASME and JSME symposium, forum and panel organizers for putting together an outstanding technical program, the reviewers for assuring the high quality of the technical papers, and all the session chairs, authors, plenary and keynote speakers, and workshop participants who are the major contributors to the success of the conference. I would also like to acknowledge the FED technical committee chairs and vice-chairs, members of the FED executive committee, and especially the ASME staff for their critical support in the planning and the execution of the FEDSM2007 conference.

A collage of photos taken during the conference is presented in the next page. Enjoy!

(continued on page 10)

FEDSM2007 Post Conference Report: (continued from page 9)