



FLUIDS ENGINEERING

OUTGOING CHAIR'S MESSAGE Upendra S. (Kumar) Rohatgi., Chair

Last year FED had two successful meetings, developed new partners for future joint meetings, enlarged our interaction with the industry, expanded our student program, and increased the number of pages for the Journal of Fluids Engineering. Our long term goal is to develop joint meetings and activities with societies outside of ASME with interest in Fluids Engineering.

We held our annual divisional conference, the FEDSM, in Montreal, Canada, July 14-18, 2002. This was a joint conference with Association Francaise de Mecanique (AFM), Society of German Engineers (VDI-GVC), and UK Institute of Mechanical Engineers (I Mech E).

This conference had five plenary talks, twelve symposiums, twenty forums, three general papers sessions. Furthermore, it also sponsored two tutorials, a clinic session, two workshops, two continuing education short courses, and one industry exchange program. The plenary sessions provide the attendees an opportunity to hear an overview from experts in fluids engineering. Symposiums provide the researchers an opportunity to present complete work of current or archival value. The forums are a place to present ongoing work. The workshops are given by industries to educate and train engineers who are interested in their products such as computational tools or instrumentation. The ASME Continuing Education Institute has co-located their regular short courses related to fluids engineering to provide opportunities to short course participants to attend many of the sessions. FED also provides two other services to the attendees: tutorials and clinics. The tutorials are presentations by experts to provide

basic information on a topic of current interest. The clinics are another avenue where experts in the field volunteer to provide free consultancy to engineers at the conference who bring technical issues from their work. Finally, the industry exchange program provides opportunities to industries to discuss fluids engineering related activities in their companies.



This meeting had large emphasis in the development and application of modeling and computational fluid dynamics (CFD). About 400 contributed papers and keynote papers were presented. There are five symposiums and forums that address application of CFD for automotive and large facilities, and numerical methods in CFD, both single and multiphase flows. The four plenary talks addressed different aspects of computation and modeling.

FEDSM is also a place to recognize our colleagues through various awards. The award recipients were as follows; Paul Cooper-Fluids Engineering Award, Jean Bataille- Calvin W. Rice Award, Ganesh Raman, Andrew Mills, Shadi Othman, Valdis Kibens- Lewis F. Moody Award, and William K. George, Xia Wang, Luciano Castillo- Robert T. Knapp Award. Many of our colleagues in FED have made notable contribution to the profession and should be recognized with suitable awards and membership rank of fellow. We should all make an effort to sponsor deserving members.

FED also participated in IMECE in November 17-22, 2002 in New Orleans. The emphasis in this meeting was on joint sessions with other Basic Engineering

James C. Meng, Editor

SUMMER 2003

Fluid Applications and Systems Technical Committee Report: May 2003	2
Technical Committee Report: Fluid Measurement and Instrumentation Technical Committee	2
2004 ASME Heat Transfer/Fluids Engineering Summer Conference	3
Editorial	4
Fluid Mechanics Technical Committee (FMTC)	5
Benchmarking Industrial Flows for CFD Code Validation	6
Professional Development	7
Dancing Bubbles in Turbulent Flows: PIV Measurements and Analysis	8
2003 ASME International Mechanical Engineering Congress and RD&D Expo	9
Fluids Engineering Award	10
Robert T. Knapp Award	10
Lewis F. Moody Award	10
A Message from the 2003 Summer Conference Chairs	11
Committee Rosters 2003-04	12

divisions. FED sponsored about 30 sessions. This year FED sponsored two student competitions; Young Engineer Paper Contest and Senior Design Project Report Contest. The winners for Young Engineer Paper contest were Jared E. Campbell and Richard W. Coppom, and the winners for Senior Design Project Contest were Brent S. Mitchell, Michael Duffy, Bill Engisch, David Heritage, and Rabon Jones. In addition, Prof. Stathis Michaelides delivered his Freeman lecture in this meeting.

FED future plans include joint meeting with JSME Heat Transfer Division in Charlotte in July 11-15, 2004, summer-2005 meeting in Houston in June with emphasis on process industry, Joint European-American Fluids Engineering meeting in summer of 2006 in Miami and Joint ASME/JSME meeting in summer of 2007 in west coast.

The Journal of Fluids Engineering (JFE) continues to grow in number of submis-

continued on page twelve

The Fluid Applications and Systems Technical Committee (FASTC) is the committee of the Fluids Engineering Division (FED), which addresses ASME activities involving fluid mechanics systems and applications of fluid mechanics technology. These activities include fluid machinery and components, industrial and environmental applications of fluid mechanics, and fluid transients and structural interaction. FASTC facilitates the organization of forums and symposia that focus on these specific activities.

FASTC continues the tradition with the seventh International Symposium on the Advances in Numerical Modeling of Aerodynamics and Hydrodynamics in Turbomachinery that was held in Honolulu, Hawaii July 2003. The thrust of the symposium is to provide a platform for presenting results and exposing recent developments in computational aerodynamics and hydrodynamics in the area of turbomachinery.

The seventh symposium consists of 25 contributed papers in several different technical areas including Axial and Centrifugal Turbomachinery; Hydrodynamics in Turbomachinery; Cavitation and Hydroacoustics; Turbine Technology and Methodology Development. From the contributed papers, we see that turbomachinery CFD has emerged from the steady single-blade-row calculations to those challenge calculations such as computations for 3-D multi-blade-row/multi-component unsteady flows, LES for tip clearance flows, multi-phase flows and cavitation breakdown. The structured gridding scheme dominates the past two decades. The unstructured scheme, on the other hand, is gaining popularity due to its flexibility in dealing with ever-increasing complex geometries. There are papers introducing new way of predicting skin friction with roughness, revisiting fan scaling law, and developing blade shape optimization method. The contributed papers have clearly suggested that the industry is heading to more usage of CFD in turbomachinery designs and willing to expand CFD efforts in investigating more difficult problems such as cavitation and turbomachinery noise.

The Fluid Machinery Forum is scheduled every FED Summer Meeting to provide an opportunity for presentation of current work in the area of fluid machinery. The informal nature of the forum allows the presentation of the results of ongoing work, which are not yet completed for ASME formal presentation. The forum also provides an avenue of discussion and an exchange of information. The tenth Fluid Machinery Forum was held in Honolulu, Hawaii July 2003.

The 2003 Forum includes short papers dealing with different areas of fluid-handling machinery such as design methods, theoretical analysis including CFD, experiments, performance charac-

teristics, off-design performance, scaling, NPSH, etc. The types of machinery presented this year are various types of fans, compressors, inducer, screw and centrifugal pumps, wind and hydraulic turbines, control valve for cryogenic flow, Gas Turbine internal cooling flow, servo valve, S-duct diffuser, inlet guide vanes for vertical turbine pumps, nozzles for ship propulsion, artificial heart valves, etc. The tenth Fluid Machinery Forum has 29 papers. The papers have been contributed from industry, academia, and government, and reflect some of the ongoing research in the fluid machinery area in many countries, including Canada, France, Germany, India, Japan, Saudi Arabia, South Korea, and USA. ●

TECHNICAL COMMITTEE REPORT: Fluid Measurement and Instrumentation Technical Committee

(formally Coordinating Group on Fluid Measurements) April, 2003

The Fluid Measurement and Instrumentation Technical Committee (FMITC) is the ASME Fluids Engineering Division committee that deals with experimental measurements, from both a theoretical and applications perspective. This committee was previously named the Coordinating Group on Fluid Measurements (CGFM). This name change better reflects the primary activities of the membership which are to identify, coordinate and oversee the technical sessions, workshops, and tutorials dealing with instrumentation methods and measurement techniques relative to fluid mechanics. Currently, enrollment in the Committee is over 75 members. Because measurement requirements and applications are strongly linked with other fundamental issues in fluid mechanics applications, this technical committee must interact strongly with other technical committees within FED. The Committee deals with all aspects of the measurements associated in a variety of fluid flows, including single and multiphase flows, subsonic and supersonic flows, industrial applications, environmental

flows, and many others. It also deals with experimental uncertainties and the development and applications of new measurement methods. Since measurement techniques and their applications often require the integration of several technologies and disciplines this technical committee interacts strongly with other divisions and areas of interest within ASME such as heat transfer, turbomachinery, multiphase flow, bioengineering and others.

The FMITC meets regularly at the IMECE and the FED Summer Meeting. The last meeting was in New Orleans at the 2003 IMECE. Future technical sessions and their corresponding lead and assistant organizers were established for IMECE 2004 and FEDSM 2004. The business of the meeting also included discussions concerning the liaisons with other technical committees within and outside of FED, identification of possible future associate editors for the Journal of Fluids Engineering, and Honors and Awards Committee. The Committee is open to new membership and welcomes those

continued on page 5



2004 ASME Heat Transfer/Fluids Engineering Summer Conference

(Sponsored by the Fluids Engineering and Heat Transfer Divisions of ASME International and
co-Sponsored by the Transport and Energy Processes Division of AICHE)

**Westin Charlotte & Convention Center, Charlotte, NC,
July 25 – 29, 2004**

FIRST CALL FOR PAPERS

The technical program committee is soliciting papers for the 2004 ASME Heat Transfer/Fluids Engineering Summer Conference, which is a joint conference sponsored by the **Fluids Engineering Division** and **Heat Transfer Division**, to be held in Charlotte, North Carolina.

Papers on all aspects of fluids engineering, and heat and mass transfer are sought, including, but not limited to the following:

- Forum on Multiphase Flows and their Applications
- Symposium on Boiling Heat Transfer and Multiphase Flows in Microsystems
- Benchmarking CFD & Verification Problems for Computational Heat Transfer
- Symposium on Applications of CFD and Computational Heat Transfer
- Advancements and Applications of DNS/LES in Fluid Flow and Heat Transfer
- Transport Phenomena in Manufacturing & Material Processing
- Forum on Free Surface Flows and Interfacial Fluid Dynamics
- Energy Transfer in Environmental Systems
- Forum on Thermal-Fluid Measurements and Instrumentation
- Heat Transfer in Electronic Cooling Equipment
- Transport Phenomena in Heat Transfer Equipment
- Forum on Cavitation and Fluids Machinery
- Computational Heat Transfer for Hazardous Waste
- Transport Phenomena in Gas-Solid-Liquid Three-Phase Flows
- Visualization of Micro/Nano Fluid Dynamics and Heat Transfer
- Predictions of Aero-Acoustic Noise Generated by Turbo-machines
- Numerical Modeling of Aerodynamics and Hydrodynamics in Turbomachinery
- Computational Heat Transfer in Porous/Composite Media
- Computational Heat Transfer for Biological Applications
- Radiative Heat Transfer in Participating Media
- Algorithmic Developments in CFD
- Thermal-Hydraulics of Advanced Reactors
- Fundamentals and Applications of Boiling and Condensation
- Stochastic Heat Transfer
- Computational Heat Transfer with Electric and Magnetic Fields
- Mesh Generation, Mesh Quality, and Meshless Computations
- Numerical Methods in Multiphase Flows
- Non-Invasive Measurements: Symposium on Vehicular Flows
- Convection in Separated/Reattached Flow
- Multi-Scale Methods for Fluid Flow and Heat Transfer
- Turbulent Heat Transfer
- Fundamental Problems in Mass, Momentum & Heat Transfer
- General Papers in Fluids Engineering and Heat Transfer
- 4th International Symposium on Fluid Power
- 5th International Symposium on Fluid-Structure Interactions and Flow Induced Noise in Industrial Applications

A standup presentation of the paper at the conference session by one of the authors is required for each paper. The format of the paper may be a full paper (6-8 pages), or short papers (2-3 pages). The details of specific sessions, their topical scope and chairs/co-chairs, and step-by-step guidelines for abstract and paper submissions and their formats will be available at the conference website www.asme.org

Time-line for Technical Program (Web-based submission/notification):

Abstracts for Symposium/Full-Length Papers	October 1, 2003
Notification of Abstract Acceptance	October 15, 2003
Full-Length Draft Manuscripts	December 15, 2003
Forum Abstracts	February 2, 2004
Notification of Forum Abstract Acceptance	February 16, 2004
Short Papers	February 23, 2004
Notification of Draft Manuscript Acceptance	March 1, 2004
Notification of Short Paper Acceptance	March 23, 2004
Camera Ready Final Paper / Short Paper & Copyright	May 17, 2004

Direct questions to the respective division **Co-Chairs of the Conference Technical Program Committee:**

Dr. S. Gopalakrishnan

(Fluids Engineering Division of ASME)
Pump Division, Technology Department
Flowserve Corporation
Phone: (323) 587-6171
Fax: (323) 586-4192
E-mail: SGopalakrishnan@Flowserve.com

Prof. Raj M. Manglik

(Heat Transfer Division of ASME)
Department of Mechanical, Industrial &
Nuclear Engineering, University of Cincinnati
Phone: (513) 556-5704
Fax: (513) 556-3390
E-mail: Raj.Manglik@uc.edu

Prof. Joel Plawsky

(Transport and Energy Processes Division
of AICHE)
Rensselaer Polytechnic Institute
Phone: (518) 276-6048
Fax: (518) 276-4030
E-mail: plawsky@rpi.edu

The end of 2002 brings about several changes to the Journal of Fluids Engineering. First, several Associate Editors have completed their terms and new ones have joined us. I would like to express my gratitude to the departing Associate Editors, whose valuable and thankless service is critical for the success of the Journal. Bruno Schiavello has served for two consecutive terms, and Dr. James Bridges, Prof. George Karniadakis, Prof. Yoichiro Matsumoto and Lisa Mondy have each completed a three-year term. Professor Yoshinobu Tsujimoto also completed a three-year term, but graciously accepted my request to stay on the Editorial board for another term. He will continue providing his unique expertise, which combines applications and theoretical modeling of complex (single phase and cavitating) turbomachinery flows.

Four new Associate Editors have joined us, and I would like to introduce and welcome them. Dr. Fernando Grinstein from the Naval Research Laboratory is an expert in computational fluid mechanics, and has done substantial research in computations of turbulent shear flows. Dr. Grinstein was also a primary driving force behind the special issue on applications of Large Eddy Simulations (LES). Prof. Sivaramakrishnan Balachandar from the University of Illinois at Urbana-Champaign is an accomplished expert in applications of Direct Numerical Simulations to modeling of heat transfer, structure and stability of wakes and boundary layers, and flows around bluff bodies. He will join the multiphase flow group and will provide essential support for the growing number of papers involving computational aspects in this area. Professor Kyle Squires from Arizona State University has substantial experience in applications, Large Eddy Simulations, and evaluation of associated subgrid stress models. He has also been involved in the modeling of solid-particle flows, and in applications of CFD in separated flows. His wide range of experience will support both the extensive activity involving turbulence modeling and the multiphase group. We are also happy to have Professor Dennis Siginer, the Dean of Engineering at Wichita

State University, on board. He has made substantial contributions to the areas of rheology of non-linear materials, flow and heat transfer in non-Newtonian flows and flows in porous media. I am happy that this distinguished group has agreed to join us, and am looking forward to working with them, taking advantage of their expertise and willingness to contribute.

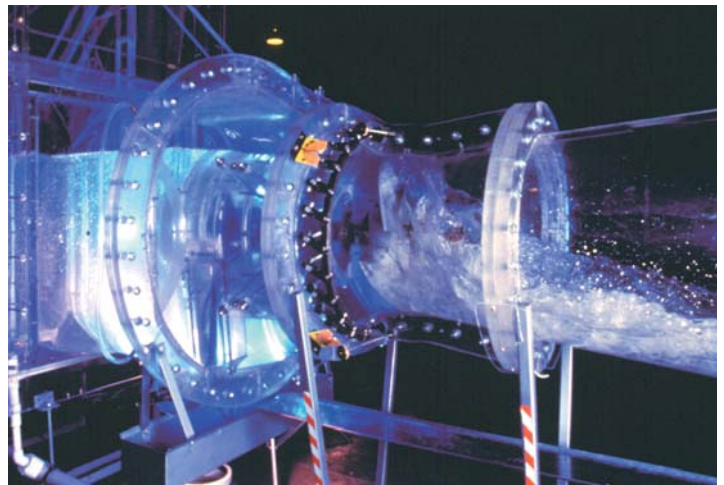
Second, during 2002 JFE had parts of three issues dedicated to specific topics. Initiated and organized by Prof. Karniadakis, the March issue contained eight solicited papers dedicated to uncertainty in numerical analysis. In the June issue, we presented a series of eleven papers dealing with pump flows. These papers were selected and recommended by Dr. Adiel Guinsberg and Dr. Paul Cooper from papers presented at a symposium on pump flows that they had organized. They also assisted us in the expedited review process. The December issue contained a collection of papers on applications of Large Eddy Simulations. These papers were selected by Dr. Grinstein and Prof. Karniadakis, who also oversaw the review process. It is evident that such special issues greatly enhance the quality of the Journal, and improve the service that we provide to the community. We would like to thank our colleagues who initiated and contributed to these efforts, and hope to continue to offer these special sections on other topics.

Third, starting from January 2003, JFE is being transitioned from a quarterly (four issues per year) to a bi-monthly, i.e. to six volumes per year. The number of pages allocated to the Journal has also been increased by about 15%, enabling us to increase the number of published papers and accommodate the increased number of submitted manuscripts.

Fourth, a primary concern is to support the authors

with reliable, efficient and expedited service. In order to reduce the review time and provide closer monitoring of the review process, ASME has developed an online manuscript submission and review system. This new system has in development and testing for several months, and has been made available for trial to several journals, including JFE. Authors are welcomed to submit papers at <http://journal-tool.asme.org> effective immediately. We hope that the new journal tools will improve the service that we provide to the authors, and that adapting to it will cause few problems. For the time being, authors are also welcomed to submit their papers as before, either by email or as hard copies. Once we get accustomed to this system, we believe that the review process will be significantly improved and expedited.

Last but not least, I would like to express my gratitude to Mrs. Laurel Murphy, the Editorial Assistant of JFE. As all of you who have communicated with our office over the past few years already know, Laurel is the primary driving force that actually makes the Journal function. In addition to managing the office, she supports several of the Associate Editors with communications/administration, helps me in finding referees for papers with uncommon topics, reviews and helps many authors to improve the style of papers, and nags me (as well as other people involved with the Journal) when certain tasks need to be performed. We are lucky to have her. ●



2003 IMECE, Nov 16–21, 2003 WASHINGTON, D.C.

Conference Chair: S. Gopalakrishnan

Tracking No.	Program Titles	Organizers	Lead TC	Num of Ses
F-332	Forum on Fluid transients	Arastu, Moody	FMTC	1
F-333	Forum on bifurcation instability and hysteresis in fluid flow	Battaglia, Papadopoulos, Drikakis, Mullin	FMTC	2
F-334	Multiphase CFD modeling in heat exchanges	Farrell, Swanson	MFTC	1
F-335	Global flow measurements: techniques and industrial applications	Papadopoulos, Fiechtner, Hammad, Wang	FMITC	1
F-335A	Fluid Measurement Uncertainty Applications	Sherif, Liburdy, Coleman	FMITC	1
G-25	General Papers	White	FMTC	7
S-368	Rheology and Fluid Mechanics of Non Linear Materials	Siginer, Bakhtiyarov	FMTC	6
S-369	Advances in Materials Processing Science	Siginer, Bakhtiyarov	FMTC	3
P-3	Panel of Emerging areas on the Frontiers of Fluids Engineering	Siginer	FMTC	2
P-4	Fluid Dynamics and Pump Reliability	Sperry, Gopalakrishnan		1
S-371	Fluids 2003: Applications of fluid mechanics to Microsystems technology	Wong, Beskok, Forster, Breuer, Santiago	MNFDTC	8
YEP-	Young Engineers Papers	Beck, EC	I	
		TOTALS		33

TECHNICAL COMMITTEE REPORT

continued from page two

from a diverse background of technical interests. We plan to expand the technical sessions offerings to encompass a wide variety of application areas. To this end we encourage those interested to attend the scheduled meetings, or to contact the current Chair.

For more information see the web page <http://www.asme.org/divisions/fed> or contact Dr. Jim Liburdy of Oregon State University, the current Chair at liburdy@enr.orst.edu or Ms. Judith Bamberger of Pacific Northwest National Laboratory, the current Vice-Chair, at judith.bamberger@pnl.gov.

THE FLUID MECHANICS TECHNICAL COMMITTEE (FMTC)

George Papadopoulos, Ph.D., FMTC Chair

The Fluid Mechanics Technical Committee (FMTC) serves as the focal point within the ASME for technical activities in fundamental fluid mechanics. The main activity of FMTC is to organize symposia and forums related to all aspects of basic fluid mechanics. The committee strives to provide timely technical information to the ASME membership through well organized technical sessions. In addition to conducting successful conferences, the past Chair (Ganesh Raman) helped streamline the technical operation of the TC, as well as, encouraging new and younger members to actively participate in the TC activities. There are four subcommittees within the FMTC, covering the areas of external, internal and unsteady flows, as well as, unconventional/emerging topics in fluid mechanics. Members are welcomed to participate

and to help organize the technical sessions and other activities of the FMTC. The FMTC meets twice per year, at the FEDSM in the summer and at the IMECE in the fall. General information about FMTC including planned symposia/forums as well as past minutes of business meetings can be found on our web page (<http://www.asme.org/divisions/fed/fmfc>).

For further information you may contact either the FMTC Chair:
Dr. George Papadopoulos of Dantec Dynamics (201-512-0037 x121) George.Papadopoulos@dantecdynamics.com
or the Vice Chair:
Professor Brian E. Thompson of the University of Western Ontario (519-850-2530).

CFD derived a need and impetus from the aerospace industry and is rapidly gaining ground and seeking universal application even in non-industrial sectors including agriculture, medicine, sports, etc. This phenomenal growth since the 90's can be attributed to developments in computational speed and memory, information and image processing, interactive graphical applications (ex: GUI), etc. Further, the enormous inflation in the cost of experimentation and the concurrent decline in computational cost have tilted the balance in favor of CFD. These developments have some positive as well as negative aspects. CFD technology is becoming market driven rather than knowledge driven. It appears Bradley [1988] remarked at an AGARD meeting on the validation of Computational Fluid Dynamics, that "No body believes the result of a CFD calculation except the one who has generated it". Perhaps today an appropriate statement would be that - Most of the people believe the result except the originator.

CFD code validation (includes verification also) has been put on a back burner. There is very little validation done for non-aeronautical, complex industrial flow fields. The basic question is, who should do it and how? Is it the responsibility of the user, who is not familiar with the internal details of the code, or the developer, who is rarely and vaguely familiar with the details of the application, or the turbulence modeler, who is neither concerned with the code nor the application. In some cases, the CFD vendors either form industrial consortiums which enable them to acquire some experimental data to validate their code, or join hands with individual customers to get their code validated. In both cases, there would be very restricted dissemination of results and also a comparison between the capabilities of the popular codes would not exist. Some developers claim validation of their codes based on integral flow features relating to the overall performance of the system and its components, gross features of the flow like static pressures and occasionally mean velocities. This likely instills a sense of false confidence in

some users and coupled with the enormous time and resources required might lead to complacency regarding validation.

In fact, it is also not easy to validate the codes, since the type of careful and detailed experiments required for validating them are in most industrial situations expensive, time consuming and lack immediate return for the industry. Bradley [1988] and Marvin [1995] have emphasized the importance of experiments in the CFD code development process by rightly classifying them based on the development phase and the purpose, as building block, benchmark, validation, calibration and design experiments. Also, development of sensors, instrumentation and experimental techniques which were all geared towards simple laboratory type flows have not kept pace with the challenge and need for application to complex industrial configurations and flow fields.

The AFOSR-Stanford turbulence model validation effort as well as the CFD Triathlon and Biathlon organized by ASME were good beginnings made in this direction. But the geometries used were far too simple for present day needs of CFD users who are trying to solve problems in complete turbomachinery, automotive under hood carriages, electronic packaging and even to simulate the flow through a human heart and arteries in real time with intent to use it as an aid during surgery.

The casual, CFD user in an industry would not be aware of the approximations and empiricism involved as well as its limitations. Hence he is likely to be carried away by the power of graphical presentation unless he has the ability to understand the physics of the problem and the audacity to question the realistic images. It is not a coincidence that CFD has earned the nickname of "Colorful Fluid Dynamics". One could argue that engineering design does not require knowledge of the details of the turbulence structure. But they need to understand that at least some aspects of its structure like the dominant flow scales and location of such flow features are required.

If these issues are not addressed, it may lead to improper applications with

catastrophic consequences. Although CFD plays an important role in defining the design and performance of components and systems, it does not leave any signature during system failure, particularly when it is catastrophic. Has CFD been blamed for any accident (aerospace or otherwise)?

Normally the most popular culprit in any accident is the material or the design of the structure, since it is the structure that is visibly damaged, irrespective of the cause.

The main aim of this article is not to suggest a mechanism for regulating the distribution and application of the software but to initiate discussion concerning definition of some standards for development, distribution and use of the software, similar to those for experimental measurements. Existing industrial standards like the ISO standards, emphasize establishing and documenting the process of development or manufacture of a product and hence would not suffice for ascertaining whether the process and its results are correct. Several papers have been written raising some of these important issues of accuracy, uncertainty, credibility, validation, and even certification. The question of establishing standards for journal publication was debated and implemented as early as 1986 by the Fluids Engineering Division of ASME and followed by AIAA and others.

The other important objective of this article is to emphasize the need for benchmarking industrial flows for CFD code validation, discuss the criteria for selecting benchmark configurations and suggest possible ways of dealing with CFD code validation issue by the CFD community.

Industrial flows are dominated by multiple force and strain fields and interactions between them. Most turbulence models which cater only to an isolated or limited number of such fields and rarely to their interactions can not meet the challenge of industrial flows. Dependence on development of inexpensive, brute force calculations like DNS solvers, or splitting the flow in to two widely differing scales as in LES modeling is not likely to solve the problem. Analogously, has the

continued on page 7

BENCHMARKING INDUSTRIAL FLOWS

continued from page 6

splitting of flow by boundary layer theory into two regions based on viscosity solved the problem? The author proposes a cocktail approach, such as used in medicine for handling new and unknown diseases like AIDS be tried for complex industrial flows. The cocktail approach is an extension/combination of zonal modeling, adaptive gridding already being attempted in CFD and the sub-grid modeling used in solid mechanics. One could dynamically adapt the grid, turbulence model and even the zones based on flow field development and the final expected solution as well as available experimental evidence. This cocktail approach could even use empirical, integral models of the flow field in certain zones, where evidence of good information exists, and/or the flow field is complex for resolution. All these are expensive and time consuming ventures and can only be handled by a concerted effort between researchers in universities and laboratories, commercial code developers and industrial users, and applied to limited benchmark cases. It also requires research funding and liaison which could be provided by government and private sponsoring agencies in addition to CFD well wishers like the CFDTC and FMITC of ASME, AIAA, ERCOFTAC, etc.

Rizzi and Vos [1998] have suggested the use of the high speed and large storage capability of the Internet to organize such concerted and systematic efforts by creating a dynamic information and knowledge exchange system for the benefit of everyone. Marvin and Huang [1998] have rightly expressed frustration at the lack of progress in turbulence modeling applicable to practical flow fields and proposed a similar concerted effort using a dynamic, knowledge base, Internet system for accelerating the progress.

For benchmarking, one has to not only identify some criteria for selecting benchmark cases but also the codes, which can handle those cases. Fluid dynamic criteria do not occur in isolation. Hence a judicious choice of the applications have to be made to cover all the criteria. This requires knowledge of the physics of the problem and the dominant mechanisms

involved. The criteria can be classified under the broad categories based on: (1) application - covering industry, importance to system based on performance and reliability, flow field and relevant engineering parameters and (2) flow physics - covering flow class and type, forces acting, nondimensional parameters, dominant mechanisms, and spectral bandwidth.

Even arriving at a meaningful list of criteria, capable of aiding in benchmarking, requires a concerted team effort. The team must identify representative cases covering combinations of such criteria as benchmarks for code validation. Experiments must be conducted in universities in collaboration with industries. The data must be disseminated through the dynamic data/knowledge-base system to code developers for validation. The validation results must be made available through the data/knowledge-base system to industrial users and turbulence modelers. All the knowledge gained during this process must be stored and made available to all the participants for continued improvement of the process. Such a system will help turbulence modelers including experimentalists to focus their attention on practical flows, numerical algorithm and code developers to obtain the well needed feed back concerning speed, stability, and accuracy of their algorithms and codes, and industrial users to gain confidence in selection and application of codes. Such a process will help drive modeling/solution development to industrial needs and perhaps even further accelerate the growth of the CFD industry as well as the knowledge base, further hastening the process of making CFD a design tool. ●

The author would like to thank the past and present chairs of the CFD Technical committee, Prof. Urmila Ghia and Prof. Peter Raad for their continued encouragement to this activity. He would also like to thank all the panelists during the past 3 FEDSM's for the success of those sessions.



PROFESSIONAL DEVELOPMENT

Plans are progressing for workshops, tutorials and short courses for the FEDSM 03 in Honolulu. A workshop is planned for future session organizers. The workshop, led by Dr. Sankaraiyer Gopalakrishnan, FED conference chair for FEDSM04, will provide discussion and guidance to organizers of sessions at both the IMECE03 and FEDSM04. A tutorial is planned as part of the 9th International Symposium on Gas-Particle Flows. John Eaton and Kyle Squires will present their tutorial "Langrangian Direct Numerical Simulation Techniques for Particle-Laden Flows." Three short courses are planned. Dantec Dynamics will offer their short course, "Advanced Measurement Techniques", on July 3-6 immediately preceding the FEDSM 03. Dantec will handle their own registrations and attendance at their course will include access to conference technical sessions and ticketed meal events. The ASME Continuing Education Institute (CEI) will offer two short courses: "Water-hammer" and "Turbulence Modeling." As in the case of the Dantec course, registration at a CEI short course will also include access to all conference sessions and events. ●

Visit the FED Professional Development website at <http://www.asme.org/divisions/fed/conedu/index.html>
Philip A. Pfund, Ph.D., Chair
FED Professional Development
Committee Fermi National
Accelerator Laboratory
630-840-4784
pfund@cannet.com

DANCING BUBBLES IN TURBULENT FLOWS: PIV MEASUREMENTS AND ANALYSIS

Yassin A. Hassan, Texas A&M University

Two-phase bubbly flows are widely applied in engineering and environmental processes. The interaction of the dispersed phase with the continuous phase has a great effect on transfer processes between the phases. The interstitial relative velocities between the phases and the interfacial area and the shape of the dispersed phase are the key dependent parameters in the drag, heat and mass transfer between the phases. Although the physical understanding of bubbles rise in a liquid is a significant practical importance in many areas of engineering, neither the interactions between bubbles in clusters nor the bubble-induced pseudo-turbulence (i.e., the generation of velocity fluctuations by bubbles and their wakes in a laminar flow) are fully understood. The modeling of bubbly flows with the Computational Fluid Dynamics (CFD) codes requires detailed information about the full field velocity close to the bubble and its wake. Such information is not widely available. Experimental data exist mainly from point measurement techniques, which offer the advantage of having high time resolution, but their spatial resolution is poor, and information about the vorticity field is lacking. Many investigations have been carried out over the past three decades using hot-film and hot-wire anemometry. However, the use of hot film anemometry in two-phase flows, raise many questions that remain unanswered. In particular, the interactions between the sensors as X-probe, liquid and bubbles are not well known and can lead to errors in the determination of correct turbulence parameters. The deformation of the bubble surface is caused by sensor penetration through the bubble. Recently, interesting number of direct numerical simulation studies of bubbly flows have cast considerable light on the evolution of bubbly flow (Esamaeeli & Tryggvason, 1998, 1999; Burner & Tryggvason, 2002).

This communication is to present results of an optical technique known as particle image velocimetry (PIV) utilized in multiphase flow investigations. PIV pro-

vides instantaneous velocity fields in a 2-D plane and it can be extended to 3-D situations. Recently, increasing numbers of successful investigations are reported. In this brief PIV is applied to study bubbly flows and the component phases are separated during analysis. With the improvement of digital imaging technology in recent years, PIV measurement techniques are now capable of capturing high-resolution digital images of gas/liquid two-phase flows, in which the continuous liquid phase and the

dispersed gas phase are unsteady and multi-dimensional.

Unfortunately, due to space limitations, we cannot place this entire article in the newsletter.

To view this article in it's entirety, we ask that you please visit the FED website <http://www.asme.org/divisions/fed/newsletter/index.html>

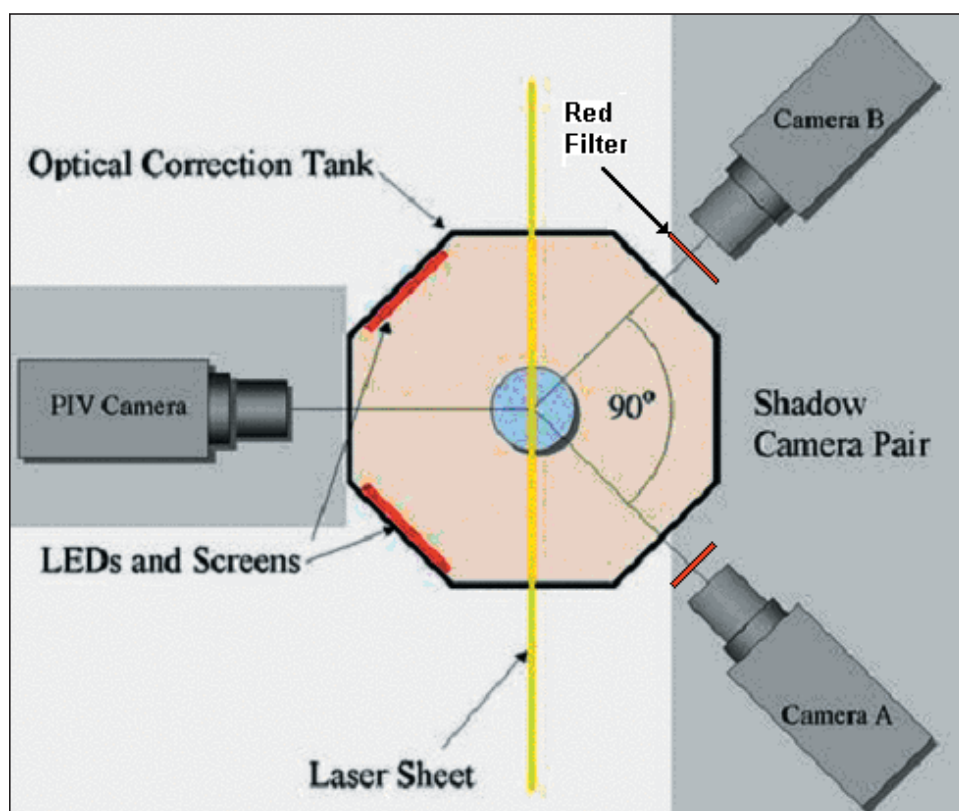


Fig. 1
Measurement
System Layout

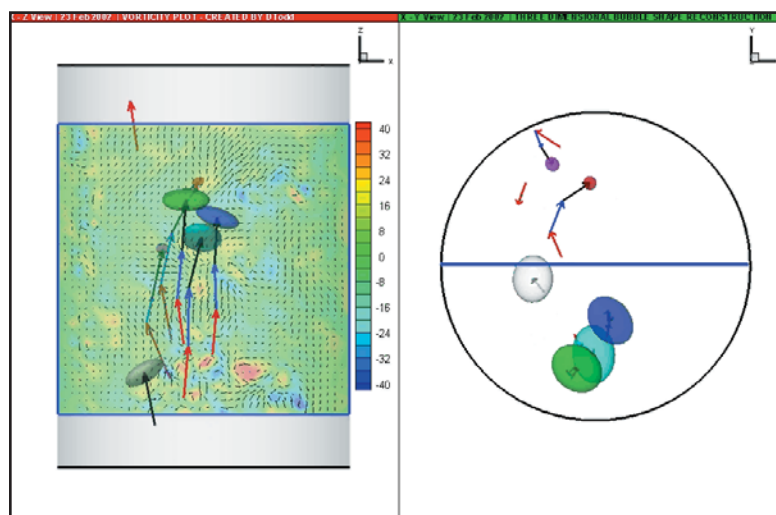
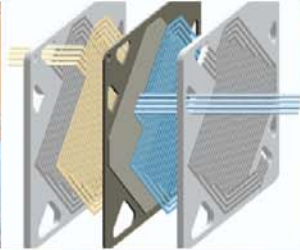
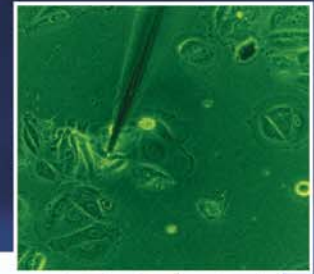


Fig. 2 Selected
snapshots of
interactions of
the bubbles
with the flow.

2003 ASME INTERNATIONAL MECHANICAL ENGINEERING CONGRESS AND RD&D EXPO

■ November 16–21, 2003 ■ Washington, DC



Fluids Engineering

Join us and participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of fluids engineering. Dissemination of knowledge by research results, new developments, and novel concepts in Fluids Engineering will serve as the foundation upon which the conference program of this area will be developed.

A variety of sessions will allow flexibility to the authors and audience. Although the majority are paper sessions, there will also be panel discussions, open forums, and posters. All sessions are quality driven. Some of the areas that will be covered are:

- Advances in Computational and Experimental Plasma Dynamics and Electromagnetics
- Advances in Materials Processing Science
- Global Flow Measurement: Techniques and Industrial Applications
- Rheology and Fluid Mechanics of Nonlinear Materials
- Fluid Measurement Uncertainty Applications
- Electric and Magnetic Phenomena in Micro and Nano Scale Systems
- Fluid Transients
- Bifurcation Instability and Hysteresis in Fluid Flow
- Multiphase CFD Modeling in Heat Exchangers
- Bench Marking CFD
- Microfluids 2003: Applications of Fluid Mechanics to Microsystems Technology
- General
- Young Engineers Paper Contest



Get technical program details now: www.asme.org/congress

FLUIDS ENGINEERING AWARD

The Fluids Engineering Award is conferred upon an individual for outstanding contributions to over a period of years to the engineering profession and in particular to the field of fluids engineering through research, practice or teaching. The winner of the 2002 Fluids Engineering Award is Dr. Paul Cooper of Fluid Machinery Research, Inc. Dr. Cooper was selected for his outstanding contribution to the field of pumps and other turbomachinery, for his development of guidelines for their optimum hydraulic design and for his contribution to the understanding of cavitation and its attendant effect on pump performance. Dr. Cooper spent his first eighteen years of his career, starting in 1959, as a specialist in the fluid dynamic design of aircraft fuel pumps and downhole centrifugal pumps for the oil field. From 1977 to 1985, Dr. Cooper was a staff researcher on flow and cavitation in commercial pumps at Ingersoll-Rand Corporation's research center in Princeton, NJ. In 1986, he expanded Ingersoll-Rand's research facility and its activities as its pump Research and Development Director. When Ingersoll-Rand joined its pump operations with Dresser into IDP joint venture in 1992, he became the Director for Advanced Technology. He retired from IDP in 1999 and formed his own consulting

company, Fluid Machinery Research, Inc. Dr. Cooper, who is a Fellow of ASME, holds ten patents in the field of turbomachinery.

Dr. Cooper served on the Board of Directors of the Research and Development Council of New Jersey between 1987 and 1993. He is the past chairman of the Executive Committee of the Fluids Engineering Division of ASME. He received ASME's George Stephenson Prize in 1984, the Fluid Machinery Design Award in 1991, and the Henry R. Worthington Medal in 1993.

The award was presented to Dr. Cooper at the Joint ASME European Fluids Engineering Division Summer Meeting that was held in Montreal, Canada, July 14-18, 2002. ●

ROBERT T. KNAPP AWARD

This award is given to the authors of the best paper presented to the Fluids Engineering Division dealing with analytical, numerical and laboratory research. The year 2002 award is received by Dr. Luciano Castillo, Dr. William George and Ms. Xia Wang for their paper entitled "Characterizing Turbulent Boundary Layers Subject to Strong Adverse Pressure Gradient with Eventual Separation" (FEDSM 2001-18112). The paper was presented at the ASME Fluids Engineering Division Summer Conference in New Orleans, LA, May 29-June 1, 2001.

Dr. Castillo is an Assistant Professor

of Mechanical Engineering at Rensselaer Polytechnic Institute. He received his Ph.D. degree in 1997 from the State University of New York at Buffalo. Ms. Wang is a Ph.D. Student in the same department. She received her BS and MS degrees from the University of Science & Technology Beijing, China, in 1997 and 2000, respectively. Dr. William George is Professor of Turbulence at Chalmers University of Technology in Gothenburg, Sweden. He received his Ph.D. degree in Mechanics from the Johns Hopkins University in 1971. He has also held positions at the Pennsylvania State University and the State University of New York at Buffalo before joining Chalmers University. ●

LEWIS F. MOODY AWARD

The Lewis F. Moody Award is given to the authors of the best paper presented to the Fluids Engineering Division dealing with a topic useful to mechanical engineering practice. The year 2002 award is received by Dr. Ganesh Raman, Mr. Andrew Mills, Mr. Shadi Othman and Dr. Valdis Kibens for their paper entitled "Development of Powered Resonance Tube Actuators for Active Control" (FEDSM 2001-18273). The paper was presented at the ASME Fluids Engineering Division Summer Conference in New Orleans, LA, May 29-June 1, 2001.

Dr. Raman is an Associate Professor and the Associate Chairman of Aerospace Engineering in the Mechanical, Materials and Aerospace Engineering Department of the Illinois Institute of Technology, Chicago. He received his Ph.D. degree in Mechanical Engineering from Case Western Reserve University in 1991. Dr. Raman, together with Dr. Kibens was cited in Boeing special invention awards in 2001 for the invention of an active flow control device that led to a US Patent. Mr. Mills and Mr. Othman are also with the Mechanical, Materials and Aerospace Engineering Department at Illinois Institute of Technology, the former as an undergraduate student while the latter as a graduate student. Dr. Kibens is with Boeing Company at St. Louis, MO. He holds a Ph.D. degree from the Johns Hopkins University. ●

COORDINATING GROUP ON INDUSTRY TECHNOLOGY

The Industry Relations Committee is the committee of the ASME Fluids Engineering Division (FED), which addresses industry technology issues in Fluids Engineering. The focus is on industry applications of fluids engineering technology which may encompass all areas of fluids engineering, such as, theoretical, numerical, and experimental fluid mechanics. Industry Exchange Program is an activity coordinated by the Industry Relations Committee. It includes presentations by select industries on their fluids engineering programs and is designed to attract more industry participation at FED meetings. Dr. Manoranjan N. Dhaubhadel is the Chairman of the Industry Relations Committee.

Dr. Manoranjan N. Dhaubhadel, Principal Engineer

CNH Global

7 S 600 County Line Road

Burr Ridge, IL 60564

Phone: (630) 887-2009 Fax: (630) 887-2354

e-mail: mano.dhaubhadel@cnh.com

...A MESSAGE FROM THE 2003 SUMMER CONFERENCE CHAIRS...

The 4th ASME & JSME Joint Fluids Engineering Conference was held in Honolulu, Hawaii, July 6–10, 2003. This conference was sponsored by Fluids Engineering Division (FED) of the American Society of Mechanical Engineers (ASME), and the Japanese Society of Mechanical Engineers (JSME).

The objective of this conference was to provide a forum for exchange of information related to fluids engineering for mechanical engineers from around the world representing academia, industry and government laboratories. The meeting addressed a wide range of topics in analysis, numerical methods, experiments in single-phase and multiphase flows and applications. The submittal of a paper, although optional, is strongly encouraged.

The conference had six plenary talks, 17 symposia, 22 forums, one-open forum, two panels, two industry exchange programs, two general papers, and for the first time a poster session. There was a special symposium, Modeling and Simulation of Turbulent Flows, in memory of Prof. Charles G. Speziale, past Professor of Aerospace and Mechanical Engineering at Boston University. There was one tutorial, and one workshop.

The meeting has a large emphasis in the development and applications of multiphase flows, modeling and computational fluid dynamics (CFD). Over 700 contributed papers and keynote papers were presented.

These papers are grouped in symposia and forums. There are over 37 symposium and forum sessions on multiphase flows, including gas-particle, gas-liquid, and liquid-solid. There are over 18 symposium and forum sessions that address the applications of CFD and numerical methods in CFD, both single and multiphase flows. There are other symposia and forums for the application of fluids engineering: advances in fluid engineering education, manufacturing processes, mixing phenomena, fluid power generation, fluid machinery, vehicular flows, fluidics, micro systems, building and bridge aerodynamics, wind turbine and renewable energy systems, water hammer, and environmental flows. The remaining symposia and forums include papers in the fundamental areas: cavitation, optical methods and image processing, virtual reality for visualization of fluid dynamics, measurements and instrumentation, microbubble and polymer friction drag reduction, fluid dynamics of free surface and interface, turbulent flows, unsteady flows, three-dimensional flows, supersonic flows, swirling flows, functional flows, separated and complex flows, high speed jet flows, fluid-structure interaction and flow-induced noise, and wavelet applications. The papers were published in CD-ROM. The conference went very well with a combination of well-attended sessions, good social outings and very happy exhibitors. ●

The following are some statistics from the meeting:

Program

714 papers were presented
179 technical sessions scheduled
6 plenary sessions
2 industry exchange program sessions (IEP)
28 posters
4 exhibitors

Attendance

Total attendance 779
Paid attendance 587
Non paid 58
Students 134 (84 paid)

Prof. Ali Ogut

*Rochester Institute of Technology,
Conference Chair, U.S.A., adoeme@rit.edu*

Prof. Yutaka Tsuji

*Osaka University,
Conference Co-Chair, Japan,
tsuji@mech.eng.osaka-u.ac.jp*

Prof. Masaaki Kawahashi

*Saitama University,
Conference Co-Chair, Japan,
mkawa@mech.saitama-u.ac.jp*



**ASME/JSME Honors luncheon,
over 700 people attended.**

2004 ASME/JSME Delegation



CHAIR'S MESSAGE

continued from page 1

sions and general stature. The JFE provides a unique forum for the FED community to communicate new findings, techniques, and applications. Authors of papers presented at FED conferences are encouraged to submit their papers to JFE. The FED web site www.asme.org/divisions/fed is another means of communication among our members. The web site has been revised, and is continually upgraded with new information on recent and upcoming meetings, calls for papers, publications, committee activities, student programs, continuing educations, etc.

You are invited and encouraged to become involved in activities and program planning of the FED. There are a number of opportunities for you. To find out how to get involved, contact one of the TC/CG officers, or any member of the Executive Committee, all listed in this Newsletter. The TC/CG meetings at our conferences are open to all attendees. ●

COMMITTEE ROSTERS 2003–2004:

EXECUTIVE COMMITTEE

Chair

Ali Ogut
Rochester Inst of Tech
Mech Engrg Dept
PO Box 9887, Rochester, NY 14623
Tel: 716-475-2542 Fax: 716-475-7710
Email: adoeme@ritvax.isc.rit.edu

Conference Chair

Sankaraiy Gopalakrishnan
Flowsolve
2300 E. Vernon Ave
Los Angeles, CA 90058-1609
Tel: 323-584-1815 Fax: 323-586-4192
Email: sgopalakrishnan@flowsolve.com

International Congress Program Committee Chair

Stathis Michaelides
Tulane Univeristy
School of Engineering
New Orleans, LA 70118
Tel: 504-865-5764 Fax: 504-862-8747
Email: emichael@mailhost.tcs.tulane.edu

Secretary

Urmila Ghia
University of Cincinnati
Dept. of Mech Engrg
M L 72, Cincinnati, OH 45221-0001
Tel: 513-556-4612 Fax: 513-556-3390
Email: urmila.ghia@uc.edu

Past Chair

Upendra S. Rohatgi
Brookhaven National Lab
Dept of Nuc Energy Bldg 475B
PO Box 5000
Upton, NY 11973-5000

Tel: 631-344-2475 Fax: 631-344-7650
Email: rohatgi@bnl.gov

ASME Staff Support Edison Aulestia

Senior Program Manager
ASME International
Three Park Avenue, M/S 22W3
New York, NY 10016
Tel: 212-591-7159 Fax: 212-591-7671
Email: aulestia@asme.org

Carol Griffin

Administrative Asst.
ASME International
Three Park Avenue, M/S 22W3
New York, NY 10016
Tel: 212-591-7387 Fax: 212-591-7671
Email: griffinc@asme.org

TECHNICAL COMMITTEES

Fluid Mechanics

Dr. George Papadopoulos
Dantec Measurement Technology
777 Corporate Drive, Mahwah, NJ 07439
Tel: (201) 512-0037 Ext.121
Fax: (201) 512-0120
Email: george.papadopoulos@dantecdynamics.com

Multiphase Flow

Prof. Gretar Tryggvason
Dept. of Mechanical Engineering and Applied Mechanics
The University of Michigan
Ann Arbor, MI 48109-2121
Tel: 734.763.1049 Fax: 734.764.4256
Email: gretar@engin.umich.edu

Fluid Applications & Systems

Prof. Awatef Hamed
University of Cincinnati
798 Rhodes Hall
Cincinnati, OH 45221-0070
Tel: (513) 556-3553 Fax: (513) 556-5038
Email: ahamed@uceng.uc.edu

Micro and Nano Fluid Dynamics

Prof. Fred K. Forster,
University of Washington
Mechanical Engineering Dept
Seattle, WA 98195-2600
Tel: 206-543-4910 Fax: 206-685-8047
Email: forster@u.washington.edu

Computational Fluid Dynamics

Prof. Peter E. Raad
Southern Methodist University
Mechanical Engg Dept
3160 SMU Blvd., Dallas, TX 75205
Tel: 214-768-3043 Fax: 214-768-1473
Email: peter@seas.smu.edu

Fluid Measurements and Instrumentation

Prof. James Liburdy
Oregon State University
Department of Mechanical Engineering
Corvallis, OR 97331-6001
Tel: 541.737.7017 Fax: 541.737.2600
Email: liburdy@enr.orst.edu

ADMINISTRATIVE COMMITTEES

Honors & Awards

Volkan Otugen, Ph.D.
Polytechnic University
Mech Aero & Mfg Eng Dept
6 Metrotech Center, Brooklyn, NY 11201

Tel: 631-755-4385 Fax: 631-755-4526
Email: votugen@poly.edu

Membership

Richard R. Schultz
Idaho National Engrg Lab
MS 3895 PO Box 1625
Idaho Falls, ID 83415-0001
Tel: 208-526-9508 Fax: 208-526-6971
Email: srr@inel.gov

Newsletter Editor

James C. Meng, Ph.D.
Tel: 360-396-2489 Fax: 396-2149
Email: mengjc@kpt.nuwc.navy.mil

Professional Development

Philip A. Pfund, Ph.D.
Fermilab
PO Box 500 MS 343
Batavia, IL 60510-0500
Tel: 630-840-4784 Fax: 630-840-8032
Email: pfund@cannet.com

Technical Editor of the Journal of Fluids Engineering

Joseph Katz, Ph.D.
Johns Hopkins Univ
122 Latrobe Hall, 3400 N Charles St
Baltimore, MD 21218-2680
Tel: 410-516-5470 Fax: 410-516-7254
Email: katz@titan.me.jhu.edu

Webmaster

Ayodeji O. Demuren, Ph.D.
Old Dominion University
Dept. of Mechanical Engineering
Norfolk, VA 23529
Tel: 757-683-6363 Fax: 757-683-5344
Email: demuren@mem.odu.edu

www.asme.org/divisions/fed/

Three Park Avenue, New York, NY 10016-5990

ASME International



FLUIDS ENGINEERING