

Global **COE** Program

Fifth International Conference on Flow Dynamics

November 17-19, 2008

Sendai Excel Hotel Tokyu, Sendai, Japan



Preface

It has grown as a world's leading international academic conference

The 5th International Conference on Flow Dynamics hosted by Tohoku University was held this year. The continuation of this event has a great meaning. This conference has a reputation among many participants to be becoming a very effective conference not only for listening to research presentations, but also for holding practical discussions. It has been also called as a conference leading the world in the field of flow dynamics. We believe it has been matured as an international academic conference. There are 45 universities with which Institute of Fluid Science, Tohoku University has made exchange agreements and which have liaison offices on Institute of Fluid Science campus and whose campuses have Institute of Fluid Science offices. Faculty members and students participated in this conference from 28 universities among them. Our consistent goal is to establish Tohoku University as a center of flow dynamics and we are now confident that we have been certainly getting closer to that goal.

Surprisingly matured presentation and discussion of the students

Another thing that has been surprising for

these 5 years is the students' progress. Students sessions themselves are organized by students and faculty members hardly give any advice from faculties. The students' organizing ability has drastically improved in these 5 years. More surprisingly, their presentation skills have improved. They have reached the level of writing papers in English, giving presentations in English and having discussions with overseas participants in English. They have made the significant progress compared to the first student session. The international communication abilities of the graduate students of Tohoku University have dramatically improved. Many of them can be successful researchers at any universities in any countries. It gives us the sense of bright future.

Entering the era of international collaboration and competition exceeding mere international friendship

The word "international exchange between universities" used to have the meaning of the friendship construction between researchers in the same fields. The current international universities, however, has undoubtedly entered the next stage. In one word, it is the globalization of universities, but it means the

stage where they participate in borderless competitions while they conduct borderless collaboration researches. Not all the university need to aim for globalization, but some Japanese representative university including Tohoku University may not survive as the world class university unless they play internationally. They need to dominate the globalization competition by attracting competent students and creating excellent studies. Holding flow dynamics international conferences and improving the quality of the conferences are important means for that. We think it is our task to mature this conference so that the best scientists and researchers are willing to participate and feel honored to give research presentations in this conference.



Shigenao Maruyama

Global COE Program, Program Leader, Japan
Institute of Fluid Science, Tohoku University, Distinguished Professor

Tohoku University is solidly heading for the world center of flow dynamics





Plenary Lecture

Energy production with less environmental load — methanol production by giant parawings

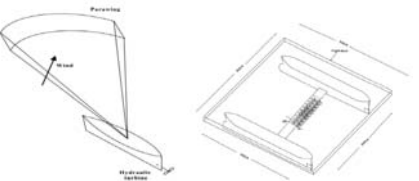
Technology framework overcoming the limit of wind power generation

Wind power generation has been expected to be a production method of clean energy. Yet, the current wind power generation method can create limited amount of usable energy. Wind power is proportional to the cube of wind speed and the main reason of such small amount of usable energy is because it is impossible to install the wind power generation turbine at the altitude high enough to receive that much amount of wind power.

Electricity generation on ships by wind power of parawings

In this proposal first projected by Professor Kim Jung-cheol of Korea Aerospace Research Institute, they fly parawings into the air to capture the wind power and draw the ship in the ocean by that wind power. This ship is installed with water power turbine which turns around the tidal turbine to generate water power. The electric power generated on the ship decomposes water and produces hydrogen or methanol. These fuels are stored in the tank of the ship and periodically discharged on the land by tanker. In order for this wind power generation system to stably function, there needs to be a balance between the power generated by

parawings in the air and the power generated by the ships in the ocean. These powers can be calculated by the well-known theory of fluid science. All the parameters of this system may be determined by solving two nonlinear algebraic equations.



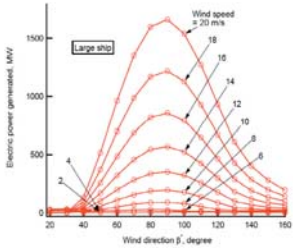
Operating 100 large catamaran ships can provide all energy required by Korea

The word “international communication between the ships which are drawn by the parawings are large catamaran ships of 300mx360m. A bridge will be spanned between fuselages and many tidal turbines will be placed. On the fuselages and bridge, a flight deck such as an airplane carrier will be placed and from there the parawings will be released and developed. The area of the developed parawings will be 400,000 square meters. Parawings fly at the altitude around 1,000m where average wind speed is the fastest. The electricity generating ship is 100,000 tons without load and it can freight up to 100,000

tons of methanol. Although it depends on the wind speed, the electricity generating ship can generate up to 1,500 mega watts of electricity. We are expecting to gather 85,000 tons of methanol by one month's operation. Operating 100 of such electricity generating ships at all time may cover all energy required by Korea.

Let's make Sea of East (Japan Sea) as the electricity generating station by Japan-Korea cooperation

The area with the strongest wind power on the earth is the mid-latitude belt around northern latitude of 35 degrees and Japan and Korea are part of that area. In order to operate 100 large electricity generating ships, by calculation, the ocean area of 500kmX100km is required. The most appropriate area lies near both Japan and Korea. It is the ocean area called as Sea of East by Korea and called as Japan Sea by Japan which has been disputed over by the both countries. I am dreaming of the day when hundreds of large electricity generating ships will provide clean energy with less environmental load to both Japan and Korea. Why don't we Japan and Korea develop together the parawings electricity generating system which has the potential to solve the energy issue?



Chul Park

Korea Advanced Institute of Science and Technology (KAIST), Korea

Energy and Environment: An Aerospace Solution





PIV and Molecular Sensor technology can be applied in both fluid mechanics and solid mechanics

Particle image Velocimetry (PIV) is widely applied for velocity measurement in fluid engineering field and molecular sensors for pressure temperature measurements. The major point of my presentation is that we can detect in real-time the changes of not only velocity but also of pressure and temperature by combining molecular sensors with PIV. In the micro channel, the important part of MEMS devices, the gas flow is known to behave in completely different manners from when it is under the macro environment. Thus, the flow behavior in the micro channel may be easily measured by combining molecular sensors with PIV. These technologies enables us to measure details of the manufacturing processes of precision instruments in real-time. The technologies have a wide range of application fields.

The encounter with Tohoku University started with wind tunnel experiments

In 1994, I presented a paper at an aerospace conference. After the presentation, one per-

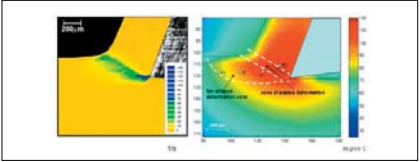
son came up to me and said, “Won’t you validate your logic by experiments?” “Of course I would like to do experiments, but my university doesn’t have a wind tunnel,” I answered and he said, “Then come to NAL, currently JAXA. We have a wind tunnel.” It was Professor Keisuke Asai now at Tohoku University. I gladly accepted his invitation and conducted an experiment using the wind tunnel with excellent research results. This was my first encounter and I have continued to work with Professor Asai at Tohoku University.

Different cultures and thoughts stimulate researches

Then, I began to operate collaborative work with Professor Tsunemoto Kuriyagawa through application studies for manufacture of precision instrument process using PIV technology and the relationship between Tohoku University and me became more and more intimate. The relationships with Professor Asai and Professor Kuriyagawa have given me a lot of stimulation. The people at Tohoku University are not only smart, but they also have different cultural background from mine. Therefore, they sometimes have different ways of thinking that gave me intellectual stimulation to bring out some ideas for my studies.

I pay my respects to the dynamic GCOE educational program

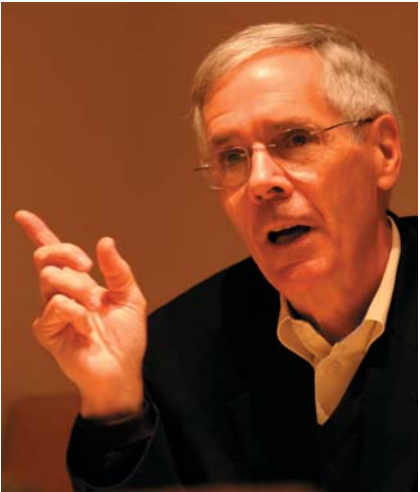
Five years ago, Professor Asai visited my college and proposed students’ interactive communication based on COE (internship). I agreed to his proposal and since then Purdue University and Tohoku University have interactively accepted over twenty students from each other as interns. In the same way as I was stimulated by the different culture, I expect young students to receive stimulation as researchers by facing different cultures through internship. GCOE project which gives opportunities of international experiences to young researchers is a very bold program. I would like to pay my respects to the concerned people at Tohoku University who planned out such a bold educational program and to Japanese government who decided to fund a great amount of money to that program.



John P. Sullivan

Purdue University, USA

Molecular Sensors and Particle Image Velocimetry —Trans-Disciplinary Flow Dynamics Techniques—





Keynote Lectures

Method of Weighted Residuals approach to reducing the workload of aircraft designers

In the analysis of physical systems, there needs to be an appropriate balance between theory, experiments and numerical simulations. The purpose of my study is to develop a tool that can seamlessly combine all available information related to aircraft aerodynamics. Data combination, by the method of weighted residuals approach, is a concept borrowed from my work in artificial neural networks applied to computational fluid dynamics (CFD). The major characteristics of this method when applied to CFD, are that it is mesh-free and requires relatively little user interaction. With existing CFD methods, engineers who are engaged in numerically analyzing the aerodynamics of an aircraft must spend a good deal of time in creating the mesh and its coding. This method can relieve the engineers from mesh coding so they can spend more of their valuable time in analysis.

Encounter with Professor Obayashi at American Institute of Aeronautics and Astronautics Conferences

In the 90's I met Shigeru Obayashi (at that time an employee at NASA Ames Research Center, currently Professor at Institute of Fluid Science Tohoku University) at the Intelligent Systems Technical Committee Meeting of the AIAA (American Institute of Aeronautics and Astronautics). He was involved in aircraft design using CFD and I was developing the tools to streamline CFD. Our professional work complemented each other, but we also became good friends. He then returned to Japan and my relationship with Tohoku University began.

International academic conferences give excellent stimulation to researchers

In daily life, even university professors cannot work exclusively on their research. They must lecture and instruct students and are involved in school management matters. Academic conferences allow us to gather with colleagues and concentrate on advances in research. The ICFD conference in Sendai is a perfect stimulus for me. The presentations covered a number of areas of interest and the quality of the work is high as well. By attending these research presentations and speaking with colleagues

from around the world, we can work to understand the current problems we face in fluid science and their solution. Fluid dynamics is studied at many universities around the world and international conferences on this subject are held many times a year, but this conference hosted by Tohoku University's Institute of Fluid Science is of top quality. I would like to thank all those who helped in preparing this conference.

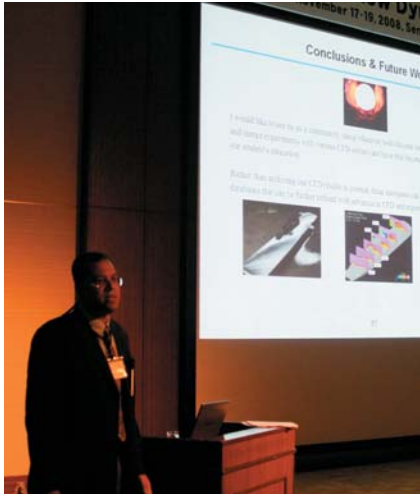
I would like to start an official student exchange study program (internship)

I hosted an excellent doctoral student from Tohoku University two years ago. I am now discussing with Professor Obayashi, with the support of the GCOE program, the possibility of establishing an official exchange program (internship) between Rice University and Tohoku University. I expect our young students will receive as much intellectual stimulation as I did through this international internship.

Andrew J. Meade

Rice University, USA

A Method of Weighted Residuals Approach to Data Fusion with Aerospace Applications



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Chapt.
01 **Trans-disciplinary Flow Division Sessions**
Cutting edge of evolving fluid science — heated discussions



**Fruitful basic studies are the strength to explore the future of human beings.
There are results that we have to present to the world as researchers.
There is no border for studies. The world is the stage.**

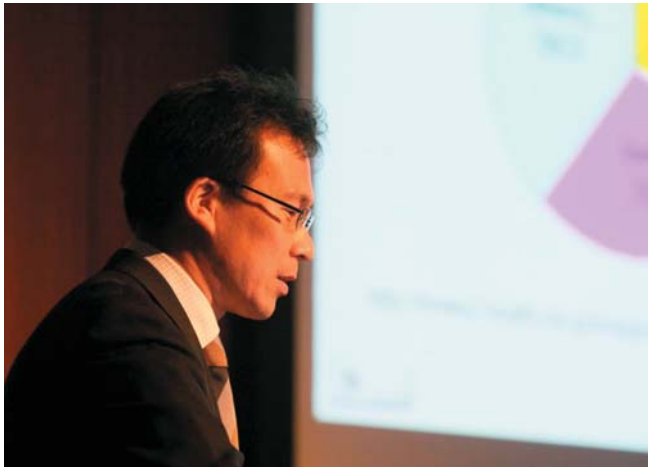
OS 1

Trans-disciplinary Informatics Flow Division Session

We extract information from the flow and add the intelligence on the flow.

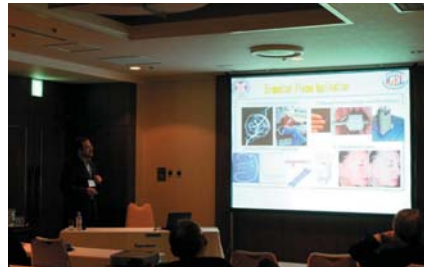


Chair: Jun Ishimoto (Tohoku University, Japan)



Program

- OS1-1 Globalization and engineering research in the 21st century International Conference on Flow Dynamics (Invited)
Eric A. Grulke (University of Kentucky, USA)
- Chair: Jun Ishimoto (Tohoku University, Japan)
- OS1-2 Institute of Research for Technology Development at the University of Kentucky: Its Principles and Methods to seek Interdependent Partnership with Industry (Invited)
Kozo Saito (University of Kentucky, USA)
- Chair: Makoto Ohta (Tohoku University, Japan)
- OS1-3 Recent Advances in Non-Invasive Brain Perfusion Measurement with MRI(Invited)
Ivan Zimine (Philips Electronics Japan, Japan)
- OS1-4 WENO type limiters for discontinuous Galerkin methods (Invited)
Jianxian Qiu (Nanjing University, China)
- OS1-5 A Weakened Weak (W2) Form for a Unified Formulation of Compatible and Incompatible Displacement Methods (Invited)
G. R. Liu (National University of Singapore, Singapore)



OS 2

Trans-disciplinary Reactive Flow Division Session

We investigate reactive flow and control chemical.



Chair: H. Nishiyama (Tohoku University, Japan)

Program

- OS2-1 Biomass Gasification in DC Arc Plasma Flow Generated in Hybrid Gas/Water Torch (Invited)
M.Hrabovsky (Institute of Plasma Physics ASCR, Czech Republic)
- OS2-2 Combustion towards Alternative Fuels for 21st Century Transportation (Invited)
Z. Chen, S. Won, M. Bulke, and Y. Ju (Princeton University, USA)
- OS2-3 In-Situ Plasma Micro-Metallurgy of Mechanically Agglomerated Reacting Powder Particles (Invited)
O. P. Solonenko, V. A. Poluboyarov and A. N. Cherepanov (SB RAS, Russia)
- OS2-4 The Applications of Atmospheric Pressure Cold Plasmas for Skin Cancer and Dental Treatments (Invited)
A.-A. H. Mohamed, H. W. Lee, G. J. Kim (Pohang University of Science and Technology, Korea), G. C. Kim (Pusan National University, Korea), P. K. Tiwari, S. M. Lee, J. Choi and J. K. Lee (Pohang University of Science and Technology, Korea)
- OS2-5 Parametric Study of Hybrid Argon-Water Stabilized Arc for Biomass Gasification (Invited)
J. Jeništa (Institute of Plasma Physics AS CR, Czech Republic), H. Takana, H. Nishiyama (Tohoku University, Japan), M. Bartlová, V.Aubrecht (Brno University of Technology, Czech Republic) and M.Hrabovský (Institute of Plasma Physics AS CR, Czech Republic)
- OS2-6 Pilot-scale Experiments with Diesel Particulate and NOx Aftertreatment Systems Using Nonthermal Plasma Hybrid Processes (Invited)
M. Okubo (Osaka Prefecture University, Japan)
- OS2-7 Modeling of Reactive Modulated Thermal Plasmas and Their Applications (Invited)
Y. Tanaka (Kanazawa University, Japan)
- OS2-8 Optimization of Small Power Reactive Air Jet for Industrial Applications
H. Takana and H. Nishiyama (Tohoku University, Japan)
- OS2-9 Statistical Modeling of Non-Equilibrium Reactive Flows (Invited)
M. S. Ivanov and Y. A. Bondar (Khristianovich Institute of Theoretical and Applied Mechanics, Russia)
- OS2-10 Recent Trend of the Rocket Engines and the Hydrocarbon Propellants for the Space Exploration (Invited)
T. Hiraiwa (JAXA KSC, Japan)
- OS2-11 Plasma Assisted Ignition and Combustion
K. Takita (Tohoku University, Japan)
- OS2-12 One Aspect of Entrained Flow Coal Gasifier Simulation in Japan
Y. Matsushita, H. Aoki and T. Miura (Tohoku University, Japan)
- OS2-13 Combustion Characteristics of Stretched Premixed Methane-Air Flame in Front of an Inert Hot Wall
H. Nakamura, A. W. Fan, H. Minamizono, K. Maruta, H. Kobayashi (Tohoku University, Japan) and T. Nioka (Akita Prefectural University, Japan)



Chair: K. Maruta (Tohoku University, Japan)



We elucidate the mechanism of flow phenomena in the level of molecules and electrons



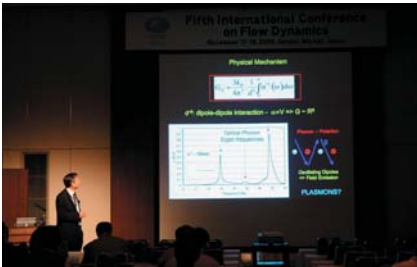
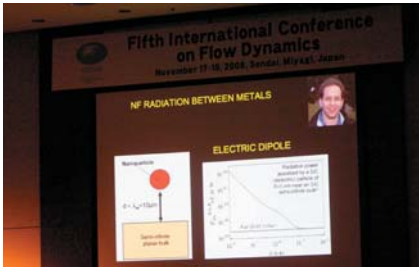
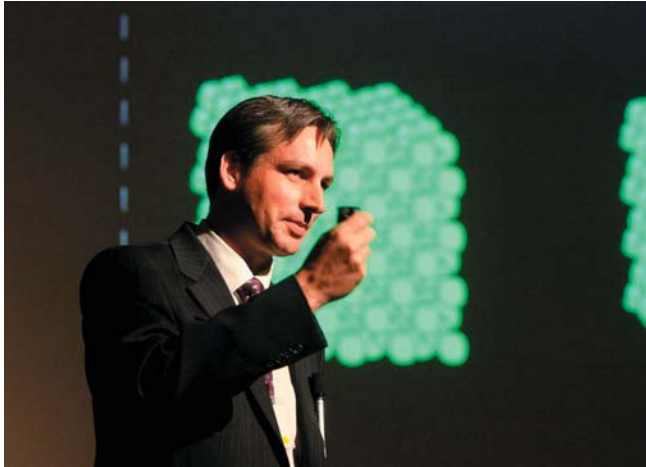
Chair: Taku Ohara (Tohoku University, Japan)



Chair: Takashi Tokumasu (Tohoku University, Japan)

Program

- OS3-1 Thermal phenomena in solid nanostructures (Invited)
Y. Chalopin, P.-O. Chapuis (Ecole Centrale Paris, France), S. Volz (The University of Tokyo, Japan)
- Chair: Takashi Tokumasu (Tohoku University, Japan)
- OS3-2 A study of cation dependent Raman mode in ionic liquid [CnMIM]⁺[TFSI]⁻ (Invited)
Hyun-Joung Kwon, Si-In Kim, Dong-Myoung Shin, Hyung Kook Kim and Yoon-Hwae Hwang (Pusan National University, Korea)
- OS3-3 Kinetic Numerical Methods for Semiclassical Boltzmann Hydrodynamic Transport of Gases of Arbitrary Statistics (Invited)
J. Y. Yang, Yu-Hsin Shi and Tse-Yang Hsieh (National Taiwan University, Taiwan)



We study the flow in the macro field and develop fluid dynamics system.



Chair: Shigeru Obayashi (Tohoku University, Japan)



Chair: Takatoshi Ito (Tohoku University, Japan)

Program

- Chair: Shigeru Obayashi (Tohoku University, Japan)
- OS4-1 Progress and Expectation of CFD for Near-Future Peta-Flops Computers (Invited)
Kazuhiro Nakahashi (Tohoku University, Japan)
- OS4-2 Methane Hydrate Production; as Transport Phenomena (Invited)
Koji Yamamoto (Japan Oil, Gas and Metals National Corporation, Japan)
- OS4-3 Fracturing of Sand and Soft Rock (Invited)
C. J. de Pater (Technical University Delft, The Netherlands)
- OS4-4 Hydraulic Fractures in Cohesionless Particulate Materials (Invited)
L. N. Germanovich (Georgia Tech, USA)
- OS4-5 Various Patterns of Hydraulic Fractures in Unconsolidated Sands Observed in Laboratory Tests
A. Igarashi, T. ITO (Tohoku University, Japan), K. Yamamoto (JOGMEC, Japan), S. Nagakubo (Japan Drilling Co., Ltd., Japan) and K. Suzuki (National Institute of Advanced Industrial Science and Technology, Japan)
- OS4-6 Distinct Element Modeling for Hydraulic Fracturing
H. Shimizu, S. Murata (Kyoto University, Japan), T. Ito (Tohoku University, Japan) and T. Ishida (Kyoto University, Japan)
- Chair: Shigeru Obayashi (Tohoku University, Japan)
- OS4-7 Recent Development in Active Control of Turbulent Boundary Layers (Invited)
Kwing-So Choi (University of Nottingham, UK)
- OS4-8 Fundamental Studies of the Application of the Shock Tunnel Cycle for Coating Techniques (Invited)
H. Olivier, C. Henkes (RWTH Aachen University, Germany) and X. Luo (University of Science and Technology of China, China)
- OS4-9 Challenges and Opportunities in Aerodynamic Shape Optimization (Invited)
David W. Zingg and Jason E. Hicken (University of Toronto Institute for Aerospace Studies, Canada)

- OS4-10 New Trends in Optimization Methodologies for Fluid Dynamics and Multidisciplinary Problems (Invited)
Carlo Poloni, V. Pediroda, L. Parussini and M. Lettich (University of Trieste, Italy)
- OS4-11 Uncertainty Analysis in Fluid Dynamics (Invited)
L. Parussini, V. Pediroda and C. Poloni (University of Trieste, Italy)
- OS4-12 Aerodynamic Shape Optimization using Evolutionary Algorithms, Gradient-based Methods, Computational Intelligence and Multilevel Schemes - Recent Activities (Invited)
K. C. Giannakoglou (National Technical University of Athens, Greece)
- OS4-13 Multi-Objective Optimisation of a Compressor S-Shaped Duct Using RSM (Invited)
E. Naylor, M. Karakasis, R. Miller and H. Hodson (University of Cambridge, UK)
- OS4-14 Optimising the Aerodynamics for Internal Stores Carriage and Release (Invited)
K. Knowles, B. Khanal, S. A. Ritchie, P. Gerald and N. Taborda (Cranfield University, UK)
- OS4-15 Application of Plasma Actuator for Controlling Small UAV
Tomohiro Narumi and Keisuke Asai (Tohoku University, Japan)





Chapt. 02

Frontier Project

The research results of fluid science are applied for the cutting-edge area.



Flow science studies combines with the latest engineering systems. Reduction of shock wave, super visualization, carbon-coating. Discussions heated up for the latest researches.

OS 5

Prediction and Mitigation of Sonic Boom

We reduce the shock wave, the greatest limiting factor for supersonic airplanes.



Chair: Shigeru Obayashi (Tohoku University, Japan)

Program

- Chair:Shigeru Obayashi (Tohoku University, Japan)
- OS5-1 From Sonic Boom to Sonic Puff (Invited)**
Kenneth J. Plotkin (Wyle Laboratories, USA)
- OS5-2 Research at NASA on Human Response to Sonic Booms**
Brenda M. Sullivan (NASA Langley Research Center, USA)
- OS5-3 Sonic Boom Modeling at JAXA**
Y. Naka, Y. Makino and T. Ito (Japan Aerospace Exploration Agency, Japan)
- OS5-4 Sonic Boom Propagation with Atmospheric Fluctuations of Wind and Temperature**
H. Yamashita and S. Obayashi (Tohoku Univeristy, Japan)
- OS5-5 Effects of Turbulent Flow Sheet on Weak Shock Wave (Invited)**
Jae Hyung Kim, Atsushi Matsuda and Akihiro Sasoh (Nagoya University, Japan)
- OS5-6 Effects of Molecular Vibrational Relaxation on Weak Shock Wave Propagation (Invited)**
T. Sakai (Nagoya University, Japan)
- OS5-7 Active Control of Separation Shock Wave on a Compression Ramp Using Plasma Actuators (Invited)**
T. Matsuno, H. Arahori and H. Kawazoe (Tottori University, Japan)



OS 6

Super Visualization: Concepts and Challenges

The leading-edge studies of computer visualization elucidate complex flow structures.



Chair: Issei Fujishiro (Tohoku University, Japan)



Program

- Chair:Issei Fujishiro (Tohoku University, Japan)
- OS6-1 What is Super Visualization? -Definition and Scope- (Invited)**
Kazuki Joe (Nara Women's University, Japan)
- OS6-2 Two Multi-scale Morse Theory and Data Streaming for Science Discovery**
V. Pascucci (University of Utah, USA)
- OS6-3 Manifold Learning Techniques for Visualizing Complexities (Invited)**
Shigeo Takahashi (The University of Tokyo, Japan)
- Chair: Kazuki Joe (Nara Women's University, Japan)
- OS6-4 A System for Visualization of Large Irregular Volume Datasets on a Tiled Display Wall (Invited)**
K. Koyamada (Kyoto University, Japan)
- OS6-5 FRUITS Time: An Interactive Visualization Technique for Time-Varying Data (Invited)**
Takayuki Itoh and Yumiko Uchida (Ochanomizu University, Japan)
- OS6-6 Visualizing Social Community Evolution (Invited)**
Y. Hashimoto, Y. Chen and H. Ohashi (The University of Tokyo, Japan)
- OS6-7 On the Recordability and Traceability of Visualization-Centered Knowledge Discovery Process**
I. Fujishiro and Y. Takeshima (Tohoku University, Japan)

OS 7

Nano-micro Flow Dynamics of Carbon Related Coatings

Carbon related coatings open the flow dynamics of nano-micro scale.



Chair: Toshiyuki Takagi (Tohoku University, Japan)

Program

- Chair: A. Erdemir (Argonne National Laboratory, USA)
- OS7-1 Wetting and Adhesion Force behavior of Undulated a-C:H Film Deposited on Nanoscale Copper Dots (Invited)**
Young-Jun Jang and Noritsugu Umehara (Nagoya University, Japan)
- OS7-2 Development of Tribochemical Reaction Simulator Based on Quantum Chemistry and Its Application (Invited)**
Momoji Kubo, Yusuke Morita, Tasuku Onodera, Ai Suzuki, Hideyuki Tsuboi, Michihisa Koyama, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba and Akira Miyamoto (Tohoku University, Japan)
- Chair: T. Takeno (Tohoku University, Japan)
- OS7-3 What is the meaning of drag reduction? (Invited)**
Y. Kohama and H. Cao (Tohoku University, Japan)
- OS7-4 The Fundamental Mechanisms of Superlubricity and Tribochemistry in DLC Films (Invited)**
Ali Erdemir and Osman Eryilmaz (Argonne National Laboratory, USA)

- OS7-5 Evaluation of Thin Coating Layers using Minimum Reflection Profiles of Rayleigh-Like Waves (Invited)**
Hak-Joon Kim, Sung-Jin Song (Sungkyunkwan University, Korea), Sung D. Kwon (Andong National University, Korea), Dong-Yeol Kim(Sungkyunkwan University, Korea), T. Takagi , T. Uchimoto and T. Abe(Tohoku University, Japan)
- Chair: O. Bourgeois(CNRS-UJF, France)
- OS7-6 New carbon-based coatings deposited by Pulsed Laser Deposition (Invited)**
Anne-Sophie LOIR, Florence GARRELIE, Christophe DONNET (Université Jean Monnet, France)
- OS7-7 Anti-Fretting Coatings Using Segment-Structured DLC Films (Invited)**
Naoto Ohtake, Mai Takashima, Tsuyoshi Kuroda (Nagoya University, Japan), Makoto Matsuo, Yoshinao Iwamoto (iMott Inc., Japan), Masanori Saito (Tokyo Institute of Technology, Japan), Masao Kumagai, Makoto Kano (Kanagawa Industrial Technology Center, Japan), Hiroshi Kimoto (Kobe Material Testing Laboratory, Japan) and Masaru Shinohara (Kurita Seisakusyo Co. Ltd., Japan)
- Chair: A. Loir (Université Jean Monnet, France)
- OS7-8 Non-lubrication Sliding Mechanism and Nano-Micro Ground Effect of the partly polished CVD Diamond Surface**
H. Miki, T. Takeno and T. Takagi (Tohoku University, Japan)
- OS7-9 Running-in for Reducing Friction of CNx-coatings under Nitrogen Gas (Invited)**
Koshi Adachi and M. Sugo (Tohoku University, Japan)
- Chair:H.Miki (Tohoku University,Japan)
- OS7-10 Carbon Nanotube Toughened Diamond-like Carbon Nanocomposite Coatings (Invited)**
Sam Zhang, Huili Wang(Nanyang Technological University, Singapore)
- OS7-11 Surface state and electrical properties of diamond like carbon films deposited by pulsed laser (Invited)**
A.Sikora (Université Jean Monnet, France), O. Bourgeois, H. Ftouni (CNRS-UJF, France), J.-L. Garden, A.-S. Loir, F. Garrelie and C. Donnet (Université Jean Monnet, France)
- OS7-12 Deposition of metal-doped diamond-like carbon coatings by CVD and PVD hybrid technique**
T. Takeno, H. Miki and T. Takagi (Tohoku University, Japan)



International "Takenoko" (bamboo shoot) Student Promotion Program
International Leading Researcher Hatchery Program
Global Exchange Education and Research Program



The International Students/ Young Birds Seminar on Multi-scale Flow Dynamics

Organizer Hidemi Takahashi (Tohoku University, Japan)

During the conference, we held the Students/Young Birds Friendship Night where all the cost was covered by the grant that we had applied for by ourselves. No professors or lecturers were invited, but we were able to have casual yet enthusiastic conversations with overseas students, while busily eating, drinking and making true friendships.

Valuable experience in foreign countries to change philosophy greatly

I was sent to International Space University in 2006 and studied in Strasbourg, France for three months as a part of COE education program. It did not only expand my horizon, but it was also a precious experience which drastically changed my view of life. I truly appreciate Tohoku University's COE program, including the students' international conference and International Space University which gave me precious experiences.

Program

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| <p>OS8-1 The Design Concept for High-Temperature Photo-Electronic Devices using SrTiO₃
Fumimasa Horikiri, Kazuhisa Sato, Keiji Yashiro, Tatsuya Kawada and Junichiro Mizusaki (Tohoku University, Japan)</p> <p>OS8-2 A Study of Cation Dependent Abnormal Properties of Ionic Liquid [CnMIM]⁺[TFSI]⁻ by using Brillouin and Dielectric Loss Spectroscopies (Invited)
Hyun Joung Kwon, Jeong Ah Seo, Tae-Young Kim, Hyung Kook Kim and Yoon Hwa Hwang (Pusan National University, Korea)</p> <p>OS8-3 Flame Synthesis of Eu³⁺ Activated Yttrium Oxysulfate Phosphors
Yasuo Iwako, Isao Kobayashi, Toshihisa Ueda and Takeshi Yokomori (Keio University, Japan)</p> <p>OS8-4 Oxygen Nonstoichiometry of La_{2-x}Sr_xNiO_{4+δ}
Takashi Nakamura, Keiji Yashiro Kazuhisa Sato and Junichiro Mizusaki (Tohoku University, Japan)</p> <p>OS8-5 Simple yet Precise Calibration Method of Thermometers for Measuring the Temperature of Biological Tissue
Naoya Ogasawara, Shigenao Maruyama, Atsuki Komiya, Hiroki Takeda, Takashi Seki and Tomoyuki Yambe (Tohoku University, Japan)</p> <p>OS8-6 Water Transport in Novel Nanostructured Coatings Obtained from Latex Technology (Invited)
J. Faucheu, L. Chazeau, C. Gauthier and J.Y. Cavaille (Institut National des Sciences Appliquées de Lyon, France)</p> <p>OS8-7 Numerical Investigation of Spray Combustion with Considering Secondary Atomization
Hirotatsu Watanabe, Katsuyuki Hoshino, Takuji Harada, Haruyuki Kamata, Yohsuke Matsushita, Hideyuki Aoki and Takatoshi Miura (Tohoku University, Japan)</p> <p>OS8-8 A Quantum Chemistry Study on Flow Dynamics of Excitation Energy in Phosphors
Hiroaki Onuma, Itaru Yamashita, Kazumi Serizawa, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momiji Kubo and Akira Miyamoto (Tohoku University, Japan)</p> <p>OS8-9 Determination Method of Concentration Dependency of Mass Diffusion Coefficient by Phase Shifting Interferometer and Inverse Method
Junnosuke Okajima, Atsuki Komiya and Shigenao Maruyama (Tohoku University, Japan)</p> <p>OS8-10 On the Development of a Starting Vortex by Dielectric Barrier Discharge Plasma (Invited)
Richard D. Whalley, Timothy N. Jukes and Kwing-So Choi (University of Nottingham, United Kingdom)</p> | <p>OS8-11 Character of Plasma Flow at the Exit of DC Arc Gas-water Torch (Invited)
T. Kavka, A. Maslani, O. Chumak and M. Hrabovsky (Institute of Plasma Physics ASCR, Czech Republic)</p> <p>OS8-12 An Experimental Study of Plasma Actuator Performance in Martian Atmosphere
Masahiko Takagaki, Hiroki Nagai and Keisuke Asai (Tohoku University, Japan)</p> <p>OS8-13 Multimodal Vibration Control using a Synchronized Switch Based on a Displacement Switching Threshold (Invited)
Hongli Ji, Jinhao Qiu, Yuansheng Chen and Kongjun Zhu (Nanjing University of Aeronautics and Astronautics, China)</p> <p>OS8-14 Evaluation of the Peltier Cryoprobe Availability through Animal Experiment
Hiroki Takeda, Setsuya Aiba, Junnosuke Okajima, Atsuki Komiya and Shigenao Maruyama (Tohoku University, Japan)</p> <p>OS8-15 An Experimental Study of Micro-Synthetic Jets using MicroPIV (Invited)
A. Sinclair, V. Timchenko, J. Reizes, G. Rosengarten and E. Leonardi (University of New South Wales, Australia)</p> <p>OS8-16 Design of Fluid Mechanics Devices with a Topology Optimization Method (Invited)
Marzio Lettich (University of Trieste, Italy)</p> <p>OS8-17 The Effect of Neck Shape on Flow Pattern in Cerebral Aneurysm using Computational Fluid Simulation with Idealized Models
Kenjiro Okuno, Toshio Nakayama (Tohoku University, Japan), Daniel A. Rufenacht (University Hospital of Geneva, Switzerland) and Makoto Ohta (Tohoku University, Japan)</p> <p>OS8-18 Higher-order Fictitious Domain approach for Navier-Stokes equations (Invited)
Lucia Parussini, Valentino Pediroda and Carlo Poloni (University of Trieste, Italy)</p> <p>OS8-19 Numerical Analysis on the Influence of Solid Particles in a Slush Nitrogen Two-phase Pipe Flow
Yasuaki Mukai, Katsuhide Ohira, Jun Ishimoto and Masakazu Nozawa (Tohoku University, Japan)</p> <p>OS8-20 Runge-Kutta Discontinuous Galerkin Method using WENO Limiters II: Unstructured Meshes (Invited)
Jun Zhu, Jianxian Qiu (Nanjing University, China), Chi-Wang Shu (Brown University, USA) and Michael Dumbser (University of Trento, Italy)</p> |
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The Effect of Neck Shape on Flow Pattern in Cerebral Aneurysm using Computational Fluid Simulation with Idealized Models

Kenjiro Okuno (Tohoku University, Japan)

The basic studies for stent design of aneurysm therapeutic device

Institute of Fluid Science is focusing on medical engineering field and under the instruction of Mr. Makoto Ohta, I have studied stent as an aneurysm therapeutic device. Our study purpose is to analyze the relationship between the form of cervical part of aneurysm and blood flow pattern by using computer simulation. We presented the result of the simulation from numeric calculation by creating the models of nine different forms of aneurismal cervical parts. With such analysis as the basement, the design technique of stent inserted into aneurysm is established.

This was the second presentation at the academic conference. While the first presentation was made at the conference for experts focused on a narrow field such as stent, I was excited since this presentation was for the conference of broad field such as general fluid engineering with a lot of foreign audience.

Program

OS8-21 Application of Gradient Smoothing Method (GSM) for Steady and Unsteady Incompressible Flow Problems using Irregular Triangular Mesh (Invited)

George X. Xu (Institute of High Performance Computing, Singapore) and G.R. Liu (National University of Singapore, Singapore)

OS8-22 Comparison of Solution Algorithms of Pressure-velocity Coupling for Unsteady-state Fluid Flow Calculations

Yasuhiro Saito, Kotaro Yasumura, Yohsuke Matsushita, Hideyuki Aoki, Takatoshi Miura (Tohoku University, Japan), Shin Ogasawara, Masatoshi Daikoku (Hachinohe Institute of Technology, Japan) and Takao Inamura (Hirosaki University, Japan)

OS8-23 Computational Aeroacoustic Study of a Landing Gear (Invited)

Bidur Khanal, Kevin Knowles, Alastair Saddington (Cranfield University, United Kingdom) and Shigeru Obayashi (Tohoku University, Japan)

OS8-24 Spatial Correlations of Concentration Fluctuations in a Supersonic Mixing Flowfield

Hidemi Takahashi and Goro Masuya (Tohoku University, Japan)

OS8-25 Characteristic Length of the Downstream Recirculation Zone of Wall Injection Interacting with Incident Shock Wave

Yoshimune Sakimitsu, Shunsuke Ishida, Hisashi Nakamura, Yasuhiro Ogami and Hideaki Kobayashi (Tohoku University, Japan)

OS8-26 In Search of Optimal Aerodynamic Shapes: Induced Drag Minimization (Invited)

Jason E. Hicken and David W. Zingg (University of Toronto, Canada)

OS8-27 Design and Construction of Mars Wind Tunnel for Simulating Atmospheric Flight on Mars

Masayuki Anyoji, Hiroki Nagai and Keisuke Asai (Tohoku University, Japan)

OS8-28 Multilevel Optimization Techniques in the Design of Aerodynamic Shapes (Invited)

Ioannis C. Karpolis (National Technical University of Athens, Greece)

OS8-29 Automatic Detection Algorithm of Wake Vortices Considering Decay Process

Hiroshi Kato, Takashi Misaka and Shigeru Obayashi (Tohoku University, Japan), I. Yamada (Electric Navigation Research Institute, Japan), Y. Okuno (Japan Aerospace Exploration Agency, Japan)

OS8-30 PSP Measurement of the Leeward-Side Pressure Distribution of a Simplified Car Model in Yaw

Daisuke Yorita, Hiroki Nagai, Keisuke Asai (Tohoku University, Japan), S. Tanaka and K. Ishida (NISSAN Motor Co. Ltd., Japan)

Research presentation as the mop-up of my graduate school days

In fact, I was accepted by a private company. It is not in the medical engineering field which I have been studying in my master course, but it is a plant engineering company. It may seem to be outside of medical engineering field, but I am not concerned since its basement is also fluid engineering.

I spent two meaningful years of my graduate school at Institute of Fluid Science. The training of logical thinking and experience of all the processes related to the research and of speaking decently in front of many people for this presentation have helped me greatly improve since my undergraduate years. My English ability has also improved thanks to this presentation. In many senses, this presentation is the highlight of my master course. I have no problem with the content of the presentation since I am always prepared, but I made preparation in a great deal to give the research presentation in English and create the poster. Now I have a strong feeling of achievement after the presentation.

OS8-31 Relation between the Interface Characteristics and Mixing Effect in a Small-scale Channel Flow

Shuta Noro, Masaya Shigeta, Seiichiro Izawa and Yu Fukunishi (Tohoku University, Japan)

OS8-32 CFD Simulation of ER (electro-rheological) Fluids with Finite Volume/element Model (Invited)

Arpad Forberger, Gabor Stepan and Miklos Zrinyi (Budapest University of Technology, Hungary)

OS8-33 Internal Structure of Triple-Shock-Wave Intersection Zone in Mach Reflection (Invited)

Yevgeniy A. Bondar, Dmitry V. Khotyanovsky, Georgiy V. Shoen, Alexey N. Kudryavtsev and Mikhail S. Ivanov (Khristianovich Institute of Theoretical and Applied Mechanics, Russia)

OS8-34 Aeroacoustic DES Simulation of Double Diaphragm Restricted Pipe Flow (Invited)

S. Höttges, S. Krittian and H. Oertel (University of Karlsruhe, Germany)

OS8-35 Development of a High-order Spectral Volume Method for 3D RANS Computation

Takanori Haga and Keisuke Sawada (Tohoku University, Japan)

OS8-36 Laminar Plane Free-fountains in a Homogeneous Fluid (Invited)

N. Srinarayana (University of Sydney, Australia), A. Komiya (Tohoku University, Japan), S. W. Armfield, M. Behnia (University of Sydney, Australia) and S. Maruyama (Tohoku University, Japan)

OS8-37 Global Linear Stability of a Plane Liquid Jet (Invited)

Outi-Leena O. Tammisola, Fredrik Lundell and L. Daniel Söderberg (Royal Institute of Technology, Sweden)

OS8-38 Experimental and Numerical Investigations of Spray Combustion Characteristic with Biodiesel Fuel

Haruyuki Kamata, Yoshiyuki Suzuki, Katsuyuki Hoshino, Takuji Harada, Hirotatsu Watanabe, Yohsuke Matsushita, Hideyuki Aoki and Takatoshi Miura (Tohoku University, Japan)

An Investigation for Lean-rich Spray Combustion using Twin-fluid

OS8-39 An Investigation for Lean-rich Spray Combustion using Twin-fluid Atomizer

Katsuyuki Hoshino, Yoshiyuki Suzuki, Takuji Harada, Haruyuki Kamata, Hirotatsu Watanabe, Yohsuke Matsushita, Hideyuki Aoki and Takatoshi Miura (Tohoku University, Japan)

OS8-40 A Numerical Investigation of Heat Transfer and Fluid Flow in a Single Droplet of Fuel

Takuji Harada, Haruyuki Kamata, Hirotatsu Watanabe, Yohsuke Matsushita, Hideyuki Aoki and Takatoshi Miura (Tohoku University, Japan)



Design of Fluid Mechanics Devices with a Topology Optimization Method

Marzio Lettich (University of Trieste, Italy)

Efficient calculation method is necessary for efficient engine design

My research presentation is the proposal of a new method in topology optimization. While this method produces rough designs, it enables us to reduce the computation cost compared to the existing methods. Our idea is to search for the design possibility of fluid machines by using this method, select the structure with better possibility and calculate with the existing sophisticated method.

Italy is the country of active automobile industry. These cars are required to run for a long distance with a little fuel. This means they need an engine with good mileage. We must design engines at lower cost. Our research goal is to reduce the computation cost required for the engine design.

Program

OS8-41 A Computational Study of CO Oxidation Reaction on Precious Metal Catalyst Based on Ultra Accelerated Quantum Chemical Molecular Dynamics Method

Sunho Jung, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)

Study on Ignition and Combustion Characteristics of DME-air Mixture in a Heated Channel

Hiroshi Oshibe, Yosuke Tsuboi, Hisashi Nakamura, Susumu Hasegawa and Kaoru Maruta (Tohoku University, Japan)

OS8-43 Ignition Characteristics of N_2/O_2 PJ in High Subsonic Flow

Yoshinori Matsubara and Kenichi Takita (Tohoku University, Japan)

OS8-44 Computational Chemistry Study on Mechanism of Superlubricity of Molybdenum Disulfide by Misfit Angle Formation

Yusuke Morita, Takanori Kuriaki, Tasuku Onodera, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)

OS8-45 Tribological Behaviour of Nanocrystalline Titanium Carbide/Carbon Nanotube: Amorphous (Invited)

Huili Wang, Sam Zhang (Nanyang Technological University, Singapore)

OS8-46 Lubrication Mechanism of the Thin Solid Film on Rubbing Contact Surface: A Computational Chemistry Study

Tasuku Onodera, Takanori Kuriaki, Yusuke Morita, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)

OS8-47 Comparison between Optimized Iron Oxide and Titanium Dioxide Pigmented Coatings both Thermally and Aesthetically

Mehdi Baneshi, Shigenao Maruyama and Atsuki Komiya (Tohoku University, Japan)

OS8-48 Studies on DC Potential Drop Method for Quantitative NDT of Metallic Foam (Invited)

Shejuan Xie, Zhenmao Chen, Minglong Xu and Tian-Jian Lu (Xian Jiaotong University, China)

OS8-49 Development of Analysis Method based on Tight-binding Quantum Chemical Molecular Dynamics for Ferroelectric Ceramics

Hongjun Xiao, Takashi Hirai, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)

OS8-50 Computational Study on Electron Transport in TiO_2 Porous Electrode for Dye-Sensitized Solar Cells

Kei Ogiya, Chen Lv, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)

Joy to listen to the world's most advanced research results

I have heard that the relationship between University of Trieste and Tohoku University has been developed mainly with Professor Shigeru Obayashi. As Tohoku University is the world's leader for the optimization method of aircraft design by CFD, the researchers studying about CFD are always paying attention to their activities. Being able to attend such a large-scale international academic conference is a big chance for researchers. Sendai is a beautiful city, but moreover, listening to the world's leading scientists' lectures and speaking directly with them give me great intellectual stimulation. I appreciate the opportunity to be able to attend such conference and give my presentation.

OS8-51 Theoretical Study on Unzipping Degradation Mechanism of Polymer Electrolyte for Fuel Cell Technology

Boyeong Kim, Donghyun Kim, Hiroaki Onuma, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)

OS8-52 Numerical Investigations of the Mechanism of Aggregation of Carbon Black

Ryo Watanabe, Tomoyuki Shindo, Yohsuke Matsushita, Hideyuki Aoki and Takatoshi Miura (Tohoku University, Japan), Katsuya Nishiwaki (Asahi Carbon Corporation, Japan), Hiroshi Yamada (Bridgestone Corporation, Japan) and Okiteru Fukuda (Asahi Carbon Corporation, Japan)

OS8-53 Molecular Study about Dissociation Phenomena of H_2 on Pt Surface

Daigo Ito and Takashi Tokumasu (Tohoku University, Japan)

OS8-54 Theoretical Investigation on Stereo Selectivity in Homogeneous Gold

Hema Malani, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)

OS8-55 Study of Surface Reduction Mechanisms over CeO_2 (111) using Ultra Accelerated Quantum Chemical Molecular Dynamics

Md. Khorshed Alam, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)

OS8-56 Study of the Mechanism of Hydrogen Spillover at $\text{Pt}/\gamma\text{-Al}_2\text{O}_3$ Catalyst Surface by using Ultra Accelerated Quantum Chemical Molecular Dynamics

Farouq Ahmed, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)

OS8-57 Influence of Deposition Parameters on Tribological Behavior of Nanocomposite Cu-DLC Films (Invited)

Maxime Ruet (Ecole Centrale de Lyon, France), Takanori Takeno (Tohoku University, Japan), Julien Fontaine and Kosuke Ito (Ecole Centrale de Lyon, France), Hiroyuki Miki (Tohoku University, Japan), Michel Belin (Ecole Centrale de Lyon, France) and Toshiyuki Takagi (Tohoku University, Japan)

OS8-58 Tribological Properties of Metal-containing Conductive Amorphous Carbon Films Deposited on Metal Substrate

T. Sugawara (Tohoku University, Japan), M. Ruet (Ecole Centrale de Lyon, France), K. Ito (Ecole Centrale de Lyon, France), H. Miki, T. Takeno (Tohoku University, Japan), J. Fontaine, M. Belin (Ecole Centrale de Lyon, France) and T. Takagi (Tohoku University, Japan)

OS8-59 Ferromagnetic Shape Memory Alloy $\text{Ni}_{54}\text{Fe}_{19}\text{Ga}_{27}$ (Invited)

T. M. Vasilchikova, T. N. Voloshok, K. V. Klimov and A. N. Vasiliev (Moscow State University, Russia), Yu. I. Chumlyakov (Tomsk University, Russia), O. Heczko and S. Fähler (Institute for Metallic Materials, Germany)

OS8-60 Giant Magnetocaloric Effect in NiCoMnIn Heusler Alloy (Invited)

A. N. Vasiliev, T. N. Vasilchikova, O. S. Volkova, T. N. Voloshok, A. A. Shiryayev and K. V. Klimov (Moscow State University, Russia), O. Heczko and S. Fähler (Institute of Metallic Materials), K. Oikawa, K. Ishida, R. Kainuma and W. Ito (Tohoku University, Japan)





Automatic Detection Algorithm of Wake Vortices Considering Decay Process

Hiroshi Kato (Tohoku University, Japan)

Ensure the safe aircrafts landing and takeoff by detecting backward turbulence

When an aircraft takes off and lands, it generates turbulence in its backward. When the following aircraft is caught in the turbulence, sometimes it causes a major accident. In the tragic accident of November 2001 at JFK Airport in New York, Airbus A300 crashed due to wake turbulence generated by a Japan Airlines' Jumbo Jet and all the passengers and crew were killed. In order to avoid such accidents, there are certain minutes of intervals between landings and takeoffs of aircrafts, yet it won't ensure the complete safety and it may also cause inefficiency at the airport. We must then analyze backward turbulence scientifically and increase safety of aircrafts and efficiency of airports based on that analysis.

Detecting backward turbulence by installing the instrument at Senda Airport

Tohoku University, as a collaborative research with Japan Aerospace Exploration Agency(JAXA) and Electronic Navigation Research Institute (ENRI), has been studying the turbulence detecting algorism by installing the backward turbulence detecting instrument (Doppler LIDAR). Today, I was determined to present a part of the research result.

My first thrilling experience of conference presentation

It is usually impossible for the person in the first grade of master course to make a conference presentation at an international conference. I also suppose that the research content of backward turbulence is studied only at Tohoku University within Japan. I could hardly find the reference literature in Japan. In various senses, I feel happy to have studied in the master course at Tohoku University. Yet, I was really nervous since this was my first conference presentation. Now I feel relieved.



Higher-order Fictitious Domain approach for Navier-Stokes equations

Lucia Parussini (University of Trieste, Italy)

An approach to increase the productivity of computation

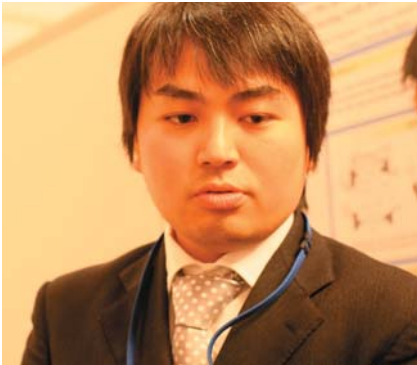
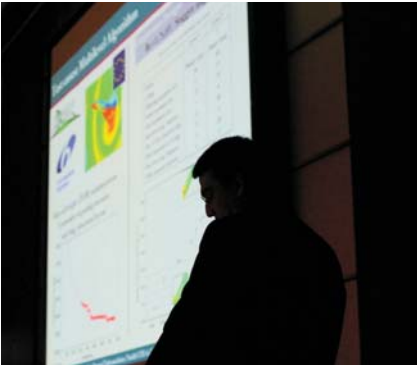
As the presentation title shows, our study is the basic field of fluid science which proposes an approach to the calculation of Navier-Stokes equations, the basic equations for fluid science. It has not been long since computation was introduced to fluid dynamics and CFD was established as one field, but increasing the accuracy and efficiency of its calculation is a big issue. While various methods and approaches are presented, our higher virtual area approach is one of them.

Going back to my hometown in Sendai

I stayed in Sendai for internship for five months four years ago. It was the first year of my doctoral course and I studied optimization by CFD. Since then, I have been engaged in CFD research. I personally enjoy the beautiful city of Sendai in my visit after four years.

People grow by acknowledging other cultures

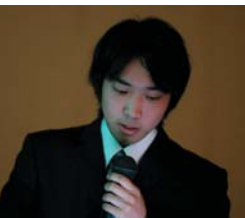
I used to watch a lot of Japanese animations in my childhood. I remember Conan and Candy Candy. After I grew up, I visited that country, had conversations and worked with the people there. Whether we can understand or not, it is good to know about many things, many people and many cultures. I find myself grown or spiritually rich as a person and also a researcher through many of my experiences including my stay in Sendai.



Program

- OS8-61 Huge Magnetostriction of Ferromagnetic Composite**
Gildas Diguët, Eric Beaugnon and Jean Yves Cavaille (Institut National des Sciences Appliquées de Lyon, France)
- OS8-62 Investigating the Hydroxylation of α -naphthoflavone Mediated by CYP1A2 Using Reaction Time Accelerated Molecular Dynamics**
Mohamed Ismael, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)
- OS8-63 Quantum Chemical Molecular Dynamics Study to Investigate Enzyme-substrate Interactions**
Kamlesh Kumar Sahu, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)
- OS8-64 Ultra Accelerated Quantum Chemical Molecular Dynamics to Study the Effect of Carcinogenic Mutations on p53-DNA Interaction**
Shah M. Rauf, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo and Akira Miyamoto (Tohoku University, Japan)

- OS8-65 Multi-physics Electron Emission from MgO Surface Induced by Ion Impact Studied by Ultra Accelerated Quantum Chemical Molecular Dynamics**
Kazumi Serizawa, Hiroaki Onuma (Tohoku University, Japan), Hiromi Kikuchi, Masaki Kitagaki (Hiroshima University, Japan), Itaru Yamashita, Ai Suzuki, Riadh Sahnoun, Michihisa Koyama, Hideyuki Tsuboi, Nozomu Hatakeyama, Akira Endou, Hiromitsu Takaba, Carlos A. Del Carpio, Momoji Kubo (Tohoku University, Japan), H. Kajiyama (Hiroshima University, Japan) and Akira Miyamoto (Tohoku University, Japan)
- OS8-66 Hydrodynamic Peculiarities of Single Hollow Droplet Impact onto a Substrate (Invited)**
Igor P. Gulyaev and Oleg P. Solonenko (Institute of Theoretical and Applied Mechanics, Russia)
- OS8-67 Fluid and Particle Simulations of Atmospheric-pressure Discharges (Invited)**
Seung Min Lee, Yong Jung Hong, Young Sik Seo and Jae Koo Lee (Pohang University of Science and Technology, Korea)
- OS8-68 Flow Control of MR Fluid Channel Flow by Using MRF Plugging Effect**
Kotae Mizuki (Tohoku University, Japan), Hannah Weisbecker, Stefan Odenbach (Technische Universität Dresden, Germany), Hidemasa Takana and Hideya Nishiyama (Tohoku University, Japan)



Yoon-Hwae Hwang
Pusan National University
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Exchange alliance with universities and institutes in worldwide 45 countries.
International joint laboratories established with six liaison offices.
International collaborative researches, international conferences and symposiums.
These abundant accomplishments are the basement of GCOE program.

FLOW
LINNÉ FLOW CENTRE



Joint Laboratory Agreement

Joël Courbon

INSA-Lyon, France



The relationship which started 25 years ago has developed into the double-degree system

The relationship between Tohoku University and INSA-Lyon started 25 years ago when the professors from both schools met each other at an international conference. They became personal friends and exchanged their students based on their relationship for a long time. This relationship drastically changed when the 21st century COE program of Institute of Fluid Science, Tohoku University in 2003 started. Financially supported by Japanese government first, then by French government, an official internship program started between the two schools. Currently four students from Tohoku University are engaged in the researches in Lyon and likewise four students from Lyon are conducting research activities in Sendai. Of course, there is the double-degree system with which they can receive PhD at two schools at the same time. Two researchers from Lyon attended this international academic conference.

Relationship enforcement by joint laboratory installation with the interactive complementary relationship

MATEIS lab at INSA-Lyon has about fifty professors and researchers and about fifty

doctoral students and its special field is material engineering. The specialty of Institute of Fluid Science is, as its name shows, fluid science. The specialty of Institute of Fluid Science is, as its name shows, fluid engineering. These two research institutes partially have different fields, but they can be called as the bordering engineering research institutes. Therefore, the interactive complementary relationship between Lyon and Tohoku can work out. If the research field completely overlapped, it would cause a competition and such successful collaborative relationship would not have been established.

Following the 21st century COE, Institute of Fluid Science was designated as the hub for the global COE, which enhanced their relationship. They have entered into Joint Laboratory Agreement. With this agreement, I expect that the collaborative researches by Tohoku University and INSA-Lyon will be drastically developed and get successful results.

Nuclear plant related project involving private companies is also in process

Currently between the two, many collaborative researches are conducted in various areas such as new materials development, friction engineering, fluid engineering and bioengineering. The broad collaborative relationship is being held from personal-basis collaborative

researches and collaborative researches by research field to collaborative researches by project.

One of the most remarkable researches is monitoring technology of pipe deterioration at nuclear power plants. The electric power companies from both Japan and France have common interest in longer use of nuclear power plants. They already share common research projects on materials aging and they are interested in contracting with the joint laboratory. It is thus hoped that our common academic expertise on pipe deterioration monitoring will contribute to the cheaper yet safe production of electricity in both countries

Learn a lot by meeting a lot of people

When I first visited Japan, I found exotic and beautiful the landscapes, handicraft food and fashion as well as a different climate. The combination was very attractive and still is. While I worked at Tohoku University, I also found a different research organization from home, yet very efficient and world-class. People way of thinking and addressing successfully risky issues also is new to me, which means that great ideas can be produced by confronting Japanese and French way of thinking. I expect this will be an excellent benefit for all people participating in the joint laboratory activities.

An extraordinary educational program at a unique laboratory

Hiroshi Higuchi

Syracuse University, USA



Development from inter-department cooperation into inter-school cooperation

On the morning of November 19, 2008, President Inoue signed the inter-university agreement between Tohoku University and Syracuse University. Director Hayase of Institute of Fluid Science visited Syracuse University to have our president signed that agreement document on November 5, the academic exchange agreement has been now completed. Between Institute of Fluid Science, Tohoku University and L.C.S School of Engineering and Computational Science, Syracuse University, there has already been a division-level cooperation agreement in 2001, and so the cooperative relationship between both schools has been expanded to a broader level.

Unique laboratory

I recognize this very well because I used be a professor at the Institute of Fluid Science, this laboratory has a very unique presence

worldwide. Here as many as thirty professors gather and conduct academic studies focusing on one field, fluid science. In the United States, sometimes many researchers are called on for realization of a project, but no other academic laboratories have such a large group of fluid scientists gather in one place. One of the extraordinary activities this unique laboratory has been developing is the educational program carried over from the 21st century COE to the Global COE. It is quite remarkable that the government supports the students' international collaborations. Typically students themselves have to bare the expenses or apply for scholarship for their international education.

Unique research program

It is also well-timed that this support targets students in doctoral course and also young post-docs. There is a program called “SU Abroad” at Syracuse University in which undergraduate students (junior year students) receive education and credits overseas. It gives an excellent opportunity to

study abroad while they are young, but undergraduate students are a little too young and tend to spend time sightseeing when they are not taking classes, though not a bad idea to travel in their impressionable stage. In this sense, it is very meaningful for the students in doctoral course who have just started their career as researchers to have overseas experience. It may be a time to travel for undergraduate students, but for doctoral course students, it will be the time to “live” on the international level. The difference between taking courses and doing research abroad may be significant. I would like to pay my high respects to the effort by the people who realized such a unique and meaningful educational program to give young researchers overseas experiences in the important period for their growth.

Becoming a self-sustainable educational program

I believe this unique COE program is now working very smoothly and I look forward to watching how it develops into a self-sustainable program with continual funding in future.

Fluid Dynamics and Paper Manufacturing Industry

Fredrik Lundell

KTH Engineering Sciences, Sweden



From the basic study to the application to paper manufacturing industry

I was studying pure fluid dynamics when I was a student. My main academic interest was laminar/ turbulent transition of boundary layers that form near solid surfaces, for example airplane wings. Now I am applying this basic research to the paper manufacturing process. Sweden has abundant forest resources of needle leaf trees and the pulp and paper manufacturing industry is one of the main export industries. Paper is manufactured through many processes and a lot of water is used. Actually, 100kg of water is pumped around in the machine when 1kg of paper is made. Understanding the characteristics of, the flows, the production of paper can be improved and the environment load reduced. I feel I am engaged in an important job for Sweden.

My precious communication experiences with Tohoku University

It was in the last year of my master course and I

was twenty-two years old when I first came to Japan. I spent five months doing my master's studies in Professor Yasuaki Kohama's laboratory. It has been twelve years. The attendance at this conference is my eighth to visit Japan. Every time I have received various kinds of stimulations as a researcher, not to mention personally. I was greatly stimulated as a researcher three years ago when I saw Professor Toshiyuki Hayase's research at Tohoku University. It was the method to get a dramatically more sophisticated result by combining an experiment using the wind channel with calculations by super-computer. I thought we could apply this idea to the paper manufacturing industry. What I am doing now is to use fishing lines with longer diameter instead of pulp fiber which is too small for experiments and measurement. We cut fishing lines and let them model pulp fibers and conduct experiments. While they usually place a scaled down aircraft model in the wind tunnel, we use the enlarged model of pulp fiber made of cut fishing line in my laboratory.

Interactive student exchange program starting next year

My laboratory will now receive a budget of ¥ 30M which will cover three years from Sweden Energy Agency. The details will be determined under consultation with Professor Hayase and Professor Maruyama, but it is going to be an internship where students from both institutions stay at the other's laboratory for a few months and conduct research activities. I expect the students to receive intellectual stimulation by having more intimate relationship, similar to my own experiences at Tohoku University.



OS 9

Multi-Stage Network Session

Program

Session1 Introduction of Universities with Collaborative Agreement
Chair: Atsushi Shirai and Tetsuya Uchimoto (Tohoku University, Japan)

Toshiyuki Takagi (Tohoku University, Japan)
Gary Rozengarden (University of New South Wales, Australia)
Masud Behnia (The University of Sydney, Australia)
Fredrik Lundell (KTH, Royal Institute of Technology, Sweden)
Alexander N. Vasiliev (Moscow Lomonosov State University, Russia)
Joël Courbon (INSA-Lyon, France)
Jae-Hung Han (KAIST, Korea)
Hiroshi Higuchi (Syracuse University, USA)
Oleg P. Solonenko (Russian Academy of Sciences, Russia)
Herbert Olivier (RWTH Aachen University, Germany)
Jianxian Qiu (Nanjing University, China)
Liu Gui-Rong (National University of Singapore, Singapore)
Abdel-Aleam H Mohamed (Pohang University of Science and Technology, Korea)
Jaw-Yen Yang (National Taiwan University, Taiwan)
Kwing-So Choi (University of Nottingham, UK)

Jinhao Qiu (Nanjing University of Aeronautics and Astronautics, China)
Zhenmao Chen (Xi'an Jiaotong University, China)
Yoon-Hwae Hwang (Pusan National University, Korea)
Gabor Vertesy (Hungarian Academy of Sciences, Hungary)
Kevin Knowles (Cranfield University, UK)
David Zingg (University of Toronto, Canada)
Milan Hrabovsky (Academy of Sciences of the Czech Republic, Czech Republic)
Sam Zhang Shanyong (Nanyang Technological University, Singapore)
Guangheng Wu (Chinese Academy of Sciences)
Miklós Zrínyi (Budapest University of Technology and Economics, Hungary)
Carlo Poloni (University of Trieste, Italy)
Kyriakos C. Giannakoglou (National Technical University of Athens, Greece)
Stefan Hoettges (University of Karlsruhe, Germany)
Sun-Jin Song (Sungkyunkwan University, Korea)
Eric Grulke (University of Kentucky, USA)

OS 10 Flow Dynamics Session

Program

OS10-1 Self-powered vibration damping system by a semi-passive technique (Invited)
Hui Shen, Hongli Ji, Jinhao Qiu
(Nanjing University of Aeronautics & Astronautics, China),
Adrien Badel (Savoie University, France),
Yong Ma, Hao Jiang and Yongchun Zhao
(Nanjing University of Aeronautics & Astronautics, China)

OS10-2 The origin of open recoil loops in nanocrystalline permanent magnets (Invited)
Hong-wei Zhang (IOP, CAS, China),
Bo Zheng (IOP, CAS & Beihang Univ., China),
Su-fen Zhao (Beihang Univ., China),
Jing-lan Chen and Guang-heng Wu (IOP, CAS, China)

OS10-3 From ferrofluids to ferrogels (Invited)
Miklós Zrínyi (Semmelweis University, Hungary)

OS10-4 Micro-Gap Flow Dynamics of Nano- / Micro-Particle Electro-Rheological Fluids and Braille Display using ER Micro-Actuators (Invited)
M. Nakano (Tohoku University, Japan)

OS10-5 Field-induced martensitic transformation in magnetic shape memory alloys (Invited)
Guang Heng Wu (Chinese Academy of Sciences, China)

OS10-6 The Ni45.7Co5.2Mn36.5In12.6 Heusler alloy for the use in magnetocaloric devices (Invited)
A. N. Vasiliev, T. M. Vasilchikova, O. S. Volkova, T. N. Voloshok and K. V. Klimov (Moscow State University, Russia),
O. Heczko and S. Faehler (Institute for Metallic Materials, Germany),
K. Oikawa, K. Ishida, R. Kainuma and W. Ito (Tohoku University, Japan)

OS10-7 Inspection of Steel Degradation by Magnetic Adaptive Testing (Invited)
G. Vértesy (Hungarian Academy of Sciences, Hungary),
I. Tomáš (Academy of Sciences of the Czech Republic, Czech Republic),
S. Kobayashi (Iwate University, Japan)



To Be the Only "New International Collaboration Base" in the World

Toshiyuki Takagi Global COE Program, Program Sub Leader
Institute of Fluid Science, Tohoku University, Professor

To Become Global COE from Abundant Experiences

We have settled the exchange agreements with colleges and research institutes in 45 countries in the world since 21st Century COE. Furthermore, we have positively promoted exchanges with the world including the establishment of liaison offices and joint laboratories. These efforts greatly contributed to this time's invitation of researchers from overseas. This Flow Dynamics International Conference shall be considered to be successful for us who aim the “new international collaboration base.”

Why “Multistage Network”?

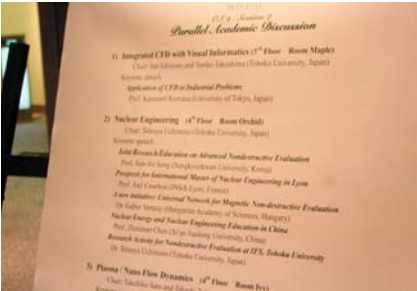
A lot of exchanges with colleges and research institutes from all over the world are our great treasure and asset. Flow Dynamics International Conference is an international conference with a significant meaning where we practically discuss and grow top-class research presentations. What we need is to have researchers come over from all over the world and discuss together, for which our worldwide multistage network we have established in a long time may be applied as the great asset.

“Growth” and “Power”

We asked the students to give a total of 68 presentations. Among them, there were foreign students who used to study at Tohoku University. It was completely controlled by the students, and led by their organizers. Compared to the beginning, their organizing and presentation abilities have been both drastically improved. The attitude to ask “have we done all right?” not “what should we do?” to each other is truly the “future power.”

To Be the Only One in the World.

I believe we are the only research institute in the world to have the consistent research system from the basic to application for flow dynamics. We are establishing the base and various kinds of exchanges with the world, aiming to be called the only one research institute in the world as the “new international collaboration base.”



The door of the new era will open.

The group of 346 creators gathered from 18 countries to Sendai, the city of forest. What we have to deliver as researchers. The idea we have to transmit to the world. There is no border for researches. We have been and will be aiming for contribution to the societies by “intellectual network of flow dynamics.”

