The 17th International Symposium on Flow Visualization

Gatlinburg Convention Center

Gatlinburg, Tennessee, U.S.A.

June 19 - 22, 2016

Welcome

June 20, 2016

Dear ISFV-17 attendees,

As Chair of the 17th International Symposium on Flow Visualization Symposium (ISFV-17), I would like to warmly welcome you all to this beautiful Convention Center situated just beside the Great Smoky Mountains National Park. In this beautiful venue and location, I am confident that this conference will grant each of you three full days of exciting and productive events.

Our ISFV-17 boasts a total of 115 technical presentations that were submitted from 20 different countries spanning all four major continents: the Americas, Africa, Asia, and Europe. We have attendees from academia, national laboratories, industry, and graduate students.

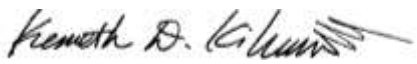
One of the highest merits of ISFV-17 is its world-class keynote lecturers, who each accepted my invitations and volunteered to present their lectures to the society at their own expenses. Undoubtedly I and all of the ISFV attendees will be academically proud of your presentations of valuable lectures throughout the conference period.

This conference has a layout of three parallel sessions. Each session will begin with a keynote lecture of 30 minutes, followed by four stand-up presentations of 15 minutes each. Again, please do your best in attending the precious keynote lectures that have the potential to stir up your mettle for future research motivations. Also, while we offer so many outdoor attractions and entertainment, I sincerely ask for your prompt return after the allotted lunch breaks.

In addition, I am so pleased to accommodate valuable exhibitions from seven of the world's leading and pioneering companies in flow imaging and diagnostics instrumentations. The exhibition booths are located just outside the session rooms along the Upper Gallery area.

Last but not least, I would like to extend my special recognition to Prof. CK Choi of Michigan Tech who created and managed the conference website, handled all regular submission entries, drafted the conference proceedings, and reciprocated thousands of emails and hundreds of phone calls very patiently with me throughout the past two years. Without CK's dedication as Executive Secretary of ISFV-17, I would not have been able to come this far in planning ISFV-17.

With my utmost pleasure, I now officially open the 17th International Symposium on Flow Visualization. Many thanks, and please enjoy your ISFV here in this beautiful park in Tennessee.



Kenneth D. Kihm, Chair of ISFV-17
Professor of MABE Department
University of Tennessee, Knoxville, TN 37996
U. S. A.

Organizers

Symposium Chair

- Dr. Kenneth David Kihm, The University of Tennessee-Knoxville, Knoxville, Tennessee, U.S.A.

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- Dr. Daniel W. Banks, NASA, U.S.A.
- Dr. Steve Wereley, Purdue University, West Lafayette, Indiana, U.S.A.

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Conference Schedule at a Glance

Conference Registration Booth Open at Mills Registration #3: 3:00 pm on Sunday (June 19, 2016) – Noon on Wednesday (June 22, 2016)			
Exhibition Booths Open at Upper Gallery 8:00 am on Monday (June 20, 2016) – Noon on Wednesday (June 22, 2016)			
Sunday (June 19, 2016)			
7:00 ~ 9:00 pm	**Welcome Reception at Mills Gallery**		
Monday (June 20, 2016)			
9:00 – 10:30	**Plenary Session at Mills Auditorium** Chair's Welcome and Opening Remarks Leonardo da Vinci Award Lecture: Prof. Koji Okamoto Asanuma Award Lecture: Prof. Oleg Penyazkov		
	Meeting Rooms 1-3	**Meeting rooms 4-5**	**Meeting Rooms 6-7**
10:45 – 12:15 (1 + 4)	**GFV-01** Chair: Y. Liu Co-Chair: S. Chung KL05, 56, 91, 52, 136	**MNB-01** Chair: S.J. Lee Co-Chair: H.J. Sung KL22, 72,131,133,151	**TPF-01** Chair: N. Ninomiya Co-Chair: J.S. Allen KL01, 44, 45, 157
2:00 – 3:30 (1 + 4)	**GFV-02** Chair: S. Chung Co-Chair: H.-S. Chuang KL03, 15, 49, 78, 111	**GFV-10** Chair: H.J. Sung Co-Chair: J. Sakakibara KL15, 71, 90, 103, 28	**SIA-01** Chair: J.S. Allen Co-Chair: J.T. Heineck KL02, 35, 158, 83, 152
4:00 – 5:30 (1 + 4)	**GFV-03** Chair: H.-S. Chunag Co-Chair: Y. Liu KL09, 46, 13, 110, 117	**MNB-02** Chair: J. Sakakibara Co-Chair: S.J. Lee KL07, 74, 77, 108, 125	**IMP-01** Chair: J.T. Heineck Co-Chair: N. Ninomiya KL12, 58, 79, 109
Conference Banquet at Mills Auditorium **6:00 pm – 7:00 pm: Social and Drinks** **7:00 pm – 9:00 pm: Dinner, Entertainment, and Banquet Lectures**			
Tuesday (June 21, 2016)			
9:00 – 10:30 (1 + 4)	**GFV-04** Chair: F. Scarano Co-Chair: A. Schroder KL18, 9, 128, 137, 153	**MNB-03** Chair: N. Miljkovic Co-Chair: A. Sarles KL16, 34, 63 132, 147	**HTA-01** Chair: A. Ianiro Co-Chair: K. Nishino KL13, 3, 82, 98
10:45 – 12:15 (1 + 4)	**GFV-05** Chair: A. Schroder Co-Chair: V.E. Mosharov KL11, 21, 50, 112, 129	**MNB-04** Chair: A. Sarles Co-Chair: T.A. Kowalewski KL06, 47, 92, 84, 150	**HTA-01** Chair: K. Nishino Co-Chair: C. Wilson KL25, 19, 57, 96, 120
2:00 – 3:30 (1 + 4)	**GFV-06** Chair: V.E. Mosharov Co-Chair: M.G. Olsen KL14, 43, 65, 76, 143	**MNB-05** Chair: T.A. Kowalewski Co-Chair: S. Wereley KL24, 4, 66, 94, 87	**SIA-02** Chair: C. Wilson Co-Chair: F. Leopold KL08, 26, 69, 95

4:00 – 5:30 (1 + 4)	**GFV-07** Chair: M.G. Olsen Co-Chair: F. Scarano KL17, 24, 70, 130, 159	**IMP-02** Chair: S. Wereley Co-Chair: N. Miljkovic KL10, 39, 67, 149, 154	**HTA-01** Chair: F. Leopold Co-Chair: A. Ianiro KL04, 53, 60, 80
ISFV Board Meeting **6:30 pm on Tuesday of June 21 at Wrights Roost Room of Park Grill Restaurants** **(Honorary Board Members/Int. Organizing Board Members/Keynote Lecturers/ISFV-17 Organizers)**			
Wednesday (June 22, 2016)			
9:00 – 10:15 (1 + 3)	**GFV-08** Chair: J. Wang Co-Chair: B. Skews KL21, 17, 97, 138	**SF-01** Chair: F. Seiler Co-Chair: G. Settles KL19, 75, 81, 139	
10:45 – 12:00 (1 + 3)	**GFV-09** Chair: B. Skews Co-Chair: J. Wang KL23, 102, 114, 156	**SF-02** Chair: G. Settles Co-Chair: F. Seiler KL20, 10, 37123	

MNB: Mirofluidics/Nanofluidics/Bio-related Fluidics
HTA: Heat Transfer Applications
TPF: Two-phase Flows
IMP: Impingement
SIA: Schlieren/Interferometry Applications
SF: Supersonic Flows
GFV: General Flow Visualizations

Conference Opening Remarks and Plenary Award Lectures
9:00 am – 10:30 am on June 20 (Monday), 2016
GBCC Mills Auditorium

Leonardo da Vinci Award

Prof. Koji Okamoto
Nuclear Professional School,
The University of Tokyo, Japan

"Dynamic Quantitative Visualization"
..... In Memoriam to Prof. Yasuki Nakayama

In 2002, CMOS high-speed camera with 2kfps, 1Mpixel, opened the Dynamic Quantitative Visualization era. Now, we can measure the fields' information under high-temporal and high-spatial resolution. With reviewing the past 15 years development, the next 10 years revolution on flow visualization will be discussed.

Asanuma Award

Prof. Oleg Penyazkov
Physics and Chemistry of Nonequilibrium Media, A.V. Luikov Heat and Mass Transfer Institute, Minsk, Belarus

Flow Visualization in Experimental High-Temperature Gas Dynamics

Qualitative and quantitative visualization techniques aimed to understanding experimental flow conditions in different high-temperature gasdynamic facilities are considered for reacting and non-reacting flow measurements. The collection of shadow, schlieren, interferometric, and self-luminous observations are presented for shock and detonation tubes, as well as for jets, combustion bombs, rapid compressed machines, low-and high-temperature plasma devices. Advantages and limitations on each of the methods are discussed, considering their efficiency, limitations, and ability to be combined with local flow measurements.

ISFV-17 Conference Banquet
Monday (June 20, 2016) at GBCC Mills Auditorium

6:00 pm – 7:00 pm Social and Drinks
7:00 pm – 9:00 pm Dinner and Banquet Lectures

"ISFV-2018 in Zurich and a Swiss Perspective of Fluid Dynamics"

Prof. Thomas Roesgen
Institute of Fluid Dynamics
Swiss Federal Institute of Technology (ETH)
Zurich, Switzerland

"ISFV-2020 in Shanghai!" (Proposal)

Prof. Yingzheng Liu
School of Mechanical Engineering
Shanghai Jiao Tong University
Shanghai, China

Three Parallel Sessions on Monday Morning

Monday (June 20, 2016) 10:45 – 12:15

Meeting Rooms 1-3 (GFV-01, Chair: Y. Liu, Co-Chair: S. Chung)

Sukho Chung
King Abdullah University of Science and Technology (KAUST), Saudi Arabia

Keynote KL05 (10:45~11:15): Fuel Density and Electric Field Effects on Small Coflow Flames

- Entry 56 (11:15~11:30): Visualization of a Buoyant Round Jet in Coflow (Chuangxin He and Yingzheng Liu, School of Mechanical engineering, Shanghai Jiao Tong University, Shanghai 200240, China)
- Entry 91 (11:30~11:45): An Improved Sunlight Shadowgraph Technique (Gary S. Settles, FloViz Inc., Port Matilda, PA 16870 (www.flovizinc.com))
- Entry 52 (11:45~12:00): Visualization of a Flat-plate Boundary Layer Transition at Mach 3 (He Lin, College of Aerospace Science and Engineering, National University of Defense Technology, Changsha, China)
- Entry 136 (11:30~11:45): Dynamic Sedimentation Behavior of Volcanic Ash (Yasuo Hattori, Hitoshi Suto, Keisuke Nakao, Shingo Takeuchi, Yuzuru Eguchi, and Takahiro Murakami, Central Research Institute of Electric Power Industry, Japan)

Meeting Rooms 4-5 (MNB-01, Chair: S.J. Lee, Co-Chair: H.J. Sung)

Hyung Jin Sung
KAIST, Deajeon, Korea

Keynote KL22 (10:45~11:15): Acousto-Thermo-Microfluidics

- Entry 72 (11:15~11:30): Temperature-Sensitive Luminescent Coating for Surface Temperature Visualization in Microchannels (Yoshitaka Sakamura, Yoshiharu Arai, Shigeki Kawabata, Motohiro Oshima, Toyama Prefectural University, Imizu, Toyama 939-0398, Japan)
- Entry 131 (11:30~11:45): Visualization and Heat Transfer Analysis of Water Flow in Graphene Nano-channel via Molecular Dynamics (Drew C. Marable and Seungha Shin, Mechanical, Aerospace, and Biomedical Engineering, the University of Tennessee, Knoxville, Tennessee 37996, USA)
- Entry 133 (11:45~12:00): Visualization of Trapping and Membrane Integrity of Swimming Bacteria in an Optoelectric Trap (Avanish Mishra[1], Thora Maltais[2], Thomas M. Walter[3], Alexander Wei[2], Stuart J. Williams[4], and Steven T. Wereley[1], [1]Department of Mechanical Engineering and Birck Nanotechnology Center, Purdue University, West Lafayette, 47906, USA; [2]Department of Chemistry and Birck Nanotechnology Center, Purdue University, West Lafayette, 47906, USA; [3]Department of Biological Sciences, Purdue University, West Lafayette, 47906, USA; [4]Department of Mechanical Engineering, University of Louisville, Louisville, 40292, USA)
- Entry 151 (12:00~12:15): Visualization of Frost Propagation Using SPR Imaging Microscopy (Chan Ho Jeong, Seong Hyuk Lee, School of Mechanical Engineering, Chung-Ang University, Seoul 156-756, Korea; Dong Hwan Shin, Center for Urban Energy System Research, Korea Institute of Science and Technology, Seoul 136-791, Korea; Vinaykumar Konduru, Jeffrey S. Allen, & Chang Kyoung Choi, Michigan Technological University, Houghton, MI 49931)

Meeting Rooms 6-7 (TPF-01, Chair: N. Ninomiya, Co-Chair: J.S. Allen)

Jeffrey S. Allen
Department of Mechanical Engineering-Engineering Mechanics, Michigan Technological University, MI, USA

Keynote KL01 (10:45~11:15): Using High Speed, Reflective-Mode Confocal Microscopy to Observe and Measure Liquid Film Dynamics in Microchannel Two-Phase Flow

- Entry 44 (11:15~11:30): Flow Boiling Visualization in Metal-foam-filled Mini Tubes (Gholamreza Bamorovat Abadi and Kyung Chun Kim, School of Mechanical Engineering, Pusan National University, Busan, 609-735, Republic of Korea)
- Entry 45 (11:30~11:45): Visualization of Necklace Vortex Around Blunt Bow Ship by Q-Criterion (Kazuo Suzuki, Teppei Ueura, and Takanori Hino, Yokohama National University, Japan)
- Entry 157 (11:45~12:00): Study of Bubble Deformation in Turbulent Jets (Amir Hessam Aminfar, Campbell Dinsmore, and Marko Princevac, Department of Mechanical Engineering, University of California, Riverside, USA)

Three Parallel Sessions on Monday Early Afternoon

Monday (June 20, 2016) 2:00 – 3:30

Meeting Rooms 1-3 (GFV-02, Chair: S. Chung, Co-Chair: H.S. Chuang)

Han-Sheung Chuang
Department of Biomedical Engineering, National Cheng Kung University, Tainan, Taiwan

Keynote KL03 (2:00~2:30): Turning Brownian Motion from Noise to Signal: An Example of Rapid Anti-Microbial Susceptibility Testing by Diffusometric Immunosensing

- Entry 15 (2:30~2:45): Rotating Egg for Crack Detection Using Image Processing Program (Jetsadaporn Priyadumkol and Chawalit Kittichaikarn, Department of Mechanical Engineering, Faculty of Engineering, Kasetsart University, Bangkok, Thailand)
- Entry 49 (2:45~3:00): Flow Structures of a Cylindrical Pendulum in Flow-Induced Vibration (Junyoung Kim, Minho Song, and Daegyoum Kim, KAIST, Korea)
- Entry 78 (3:00~3:15): Flow Visualization Generated by Piston Motion in the Rapid Compression Machine (Sergey Shimchenko, Vladimir Leschevich, and Oleg Penyazkov, Heat and Mass Transfer Institute of the National Academy of Sciences of Belarus, Belarus)
- Entry 111 (3:15~3:30): CIE-LUV Color Space Clustering Analysis of Western Art Paintings (Kazuo Ohmi, Sudat Tuladhar, and Mizuki Itajima, Osaka Sangyo University, Japan)

Meeting Rooms 4-5 (GFV-010, Chair: H.J. Sung, Co-Chair: J. Sakakibara)

Jun Sakakibara
Department of Mechanical Engineering, Meiji University, Japan

Keynote KL15 (2:00~2:30): Visualization of Flow in Eye

- Entry 71 (2:30~2:45): Prediction of Snowdrift on an Uneven Road Surface by Using Water Flume (A. Ito[1], T. Kojima[2], Y. Yamagishi[1], H. Morikawa[2], H. Endo[2], S. Kimura[1], and Y. Tateiwa[3], [1]Department of Mechanical Engineering, Kanagawa Institute of Technology, 1030 Shimoogino, Atsugi, Kanagawa 243-0292, Japan; [2]Meterological Research Institute for Technology co., Ltd., MR_Building, 1-30-17, Hongo, Bunkyo-ku, Tokyo 113-0033, Japan; [3]Yokohama Sharyo Kogyo Co., Ltd., 427 Higashikatacho, Yokohama, Tsuzuki-ku, Kanagawa 224-0045, Japan)
- Entry 90 (2:45~3:00): Real-Time 3D Flow Visualization with Large Scale Capability (A. Müller, T. Rösgen, Institute of Fluid Dynamics, ETH Zürich, Switzerland; A. Landolt, streamwise gmbh, Männedorf, Switzerland)
- Entry 103 (3:00~3:15): 3-D Velocity Measurement of Small Particles by Doppler Phase-Shifting Holography (Nao Ninomiya, T. Kindaichi, T. Ouchi, and D. Barada, Department of Optical Engineering, Utsunomiya University, Japan)
- Entry 28 (3:15~3:30): Research and Application of Global Skin Friction Measurement Techniques Based on Fluorescent Oil Film (Zhan Huang, China Academy of Aerospace Aerodynamics, China)

Meeting Rooms 6-7 (SIA-01, Chair: J.S. Allen, Co-Chair: J.T. Heineck)

J. T. Heineck
NASA Ames Research Center, Moffet Field, California, USA

D. W. Banks
NASA Armstrong Flight Research Center, Edwards, California, USA

Keynote KL02 (2:00~2:30): Air-to-Air Background Oriented Schlieren

- Entry 35 (2:30~2:45): Ground to Air Flow Visualization using Solar Calcium-K line Background Oriented Schlieren (Michael A. Hill and Edward A. Haering Jr., NASA Armstrong Flight Research Center, Edwards, CA, USA)
- Entry 158 (2:45~3:00): Comparison of Cross Correlation and Optical Flow Methods for Processing Natural Background and Retroreflective BOS data (Nathanial Smith and Michael Hill, NASA Armstrong Flight Research Center, ACI, USA; James Heineck and Ed Schairer, NASA Ames Research Center, USA)
- Entry 83 (3:00~3:15): Experimental Investigation on Aero-optical Aberration of Interactions between Laminar/Turbulent Boundary Layer and Shock Wave (Haolin Ding[1], Shihe Yi[1], Dundian Gang[1], Yu Wu[2], and Lin He[1], [1]College of Aerospace Science and Engineering, National University of Defense Technology, 410073, Changsha , China; [2]Department of Aircraft and Power, Aviation University Air Force, 130022, Changchun, China)
- Entry 152 (3:15~3:30): Background-Oriented Schlieren used in a Hypersonic Inlet Test at NASA GRC (Michelle Clem, Mark Woike, and John Saunders, NASA Glenn Research Center, Cleaveland, OH, USA)

Three Parallel Sessions on Monday Late Afternoon

Monday (June 20, 2016) 4:00 – 5:30

Meeting Rooms 1-3 (GFV-03, Chair: H.S. Chuang, Co-Chair: Y. Liu)

Keynote KL09 (4:00~4:30): Wake Dynamics Behind Bio-Inspired Cylindrical Structures: POD and DMD Analysis

- Entry 46 (4:30~4:45): Unsteady Flow through a Gyromill Wind Turbine (Eiji Ejiri and Tomoya Iwadate, Chiba Institute of Techonology, Narashino, Chiba 275-0016, Japan)
- Entry 13 (4:45~5:00): Flow over a Square Cylinder Controlled by Synthetic Jet Positioned at the Rear Surface (Yuan Qu and Jinjun Wang, Fluid Mechanics Key Laboratory of Education Ministry, Beijing University of Aeronautics and Astronautics, Beijing 100191, China)
- Entry 110 (5:00~5:15): The Wake of a Jumping Archer Fish: 3D Visualization using Synthetic Aperture Particle Image Velocimetry (Leah Mendelson and Alexandra H. Techet, Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139, USA)
- Entry 117 (5:15~5:30): NPLS Technique and Its Applications in Supersonic/Hypersonic Flow Visualization (Shihe Yi, Lin He, Yuxin Zhao, Haolin Ding, Jia Fu, and Dundian Gang, College of Aerospace Science and Engineering, National University of Defense Technology, 410073, Changsha , China)

Yingzheng Liu
School of Mechanical Engineering, Shanghai Jiao Tong University, China

Meeting Rooms 4-5 (MNB-02, Chair: J. Sakakibara, Co-Chair: S.J. Lee)

Keynote KL07 (4:00~4:30): Quantitative Visualization of Various Biofluid Flow Phenomena in Nature

- Entry 74 (4:30~4:45): Numerical Visualization of Cloud Particles with Different Diameters in Lid-Driven Cavity Flow (Arman Safdari and Kyung Chun Kim, School of Mechanical Engineering, Pusan National University, Busan, 609-735, Republic of Korea)
- Entry 77 (4:45~5:00): Time Resolved PIV Measurement of Pulsating Flows in 3D Stenosis Blood Vessels (Hyeonji Hong, Hyun Dong Kim, Ho Seong Ji, and Kyung Chun Kim, School of Mechanical Engineering, Pusan National University, Busan, 609-735, Korea)
- Entry 108 (5:00~5:15): The Visualization of Flow Pattern in Various Intracranial Aneurysm Morphologies (Ming-Wen Wang, Department of Mechanical Engineering, Oriental Institute of Technology, Taiwan and Yen-Jun Lai, Department of Radiological, Far-Estern Memorial Hospital, Taiwan)
- Entry 125 (5:15~5:30): PIV Measurements of the Flow in a Human Upper Airway Phantom (Liran Oren, Department of Otolaryngology, University of Cincinnati, OH, USA; Alexandra Maddox and Ephraim Gutmark, Department of Aerospace Engineering, University of Cincinnati, Cincinnati, OH, USA)

Sang Joon Lee
Department of Mechanical Engineering, POSTECH, Pohang, Korea

Meeting Rooms 6-7 (IMP-01, Chair: J.T. Heineck, Co-Chair: N. Ninomiya)

Keynote KL12 (4:00~4:30): Three-Dimensional Velocity Measurement by a Single Camera Observation using Digital Holography

- Entry 58 (4:30~4:45): Development of Three-dimensional Optical Correction Method for Flow Analysis in Droplet (Yeonghyeon Gim and Han Seo Ko, School of Mechanical Engineering, Sungkyunkwan University, Korea)
- Entry 79 (4:45~5:00): Quantitative Visualization of Temperature Field on Curved Surface Cooled by Impinging Jet Using Thermographic Phosphor (Mirae Kim, Dong Kim, Hyun Dong Kim and Kyung Chun Kim, School of Mechanical Engineering, Pusan National University, Busan, 609-735, Republic of Korea)
- Entry 109 (5:00~5:15): Study of Steam Flow Velocity Measurement using Focused Air-Coupled Ultrasonic Velocity Profiler (Keisuke Tsukada, Graduate School of Science and Engineering, Tokyo Institute of Technology, Japan, and Hiroshige Kikura, Research laboratory for Nuclear Reactors, Tokyo Institute of Technology, Tokyo, Japan)

Nao Ninomiya
Department of Optical Engineering, Utsunomiya University, Japan

Three Parallel Sessions on Tuesday Early Morning

Tuesday (June 21, 2016) 9:00 – 10:30

Meeting Rooms 1-3 (GFV-04, Chair: F. Scarano, Co-Chair: A. Schroeder)

Andreas Schroeder
German Aerospace Center, Institute of Aerodynamics and Flow Technology, Göttingen, Germany

Keynote KL18 (9:00~9:30): Shake-The-Box: 3D Lagrangian Tracking for Turbulence characterization at high particle image densities

- Entry 9 (9:30~9:45): Time-resolved Measurements of Wakes behind a Harbor-vibrissa-shaped Cylinder at Different attack Angles (Shaofei Wang and Yingzheng Liu, School of Mechanical Engineering, Shanghai Jiao Tong University, China)
- Entry 128 (9:45~10:00): Tomographic Stereo PIV Measurements of Turbulent Kinetic Energy Budget in a stirred mixer (Noboru Yamamoto, Kazunao Takahashi, and Koichi Nishino, Department of Mechanical Engineering, Yokohama National University, Yokohama, 240-8501, Japan)
- Entry 137 (10:00~10:15): Time-resolved 3D Imaging of a Round Gas Jet with Side-jets Formation (Akinori Muramatsu and Kenta Kawabe, Department of Aerospace Engineering, College of Science and Technology, Nihon University, Japan)
- Entry 153 (10:15~10:30): Two-Ratio of Three-Wavelength Method for CT-TDLAS(Computed Tomography-Tunable Diode Laser Absorption Spectroscopy) (Deog Hee Doh, Doowon Choi, Gyeongrae Cho, Division of Mechanical Engineering, Korea Maritime and Ocean University, Korea, and Yoshihiro Deguchi, Tokushima University, Japan)

Meeting Rooms 4-5 (MNB-03, Chair: N. Miljkovic, Co-Chair: A. Sarles)

Andy Sarles
Mechanical Engineering, University of Tennessee, USA

Keynote KL16 (9:00~9:30): Biomimetic Membranes at Liquid Interfaces: a Path toward Cell-inspired Materials

- Entry 34 (9:30~9:45): Effect on Junction Geometry on Mono Dispersed Micro Droplet Generation in Microfluidic Aqueous Two-phase Systems (ATPS) (Young Gyu Nam[1] and Woo-Jin Chang[2,3], [1]Department of Mechanical Engineering at Texas A&M University, USA; [2]School of Freshwater Sciences, University of Wisconsin-Milwaukee, WI 53204, USA; [3]Department of mechanical Engineering, University of Wisconsin-Milwaukee, WI 53204, USA)
- Entry 63 (9:45~10:00): In-situ Photopolymerization of Monodisperse and Discoid Oxidized Methacrylated Alginate Microgels in a Microfluidic Device (Shuo Wang, Bruce P. Lee, and Chang Kyoung Choi, Michigan Technological University, Hoghton, MI 49931,USA; Oju Jeon and Eben Alsberg, Case Western Reserve University, Cleveland, OH 44106, USA; Scott T. Retterer, Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA)
- Entry 132 (10:00~10:15): Multiple Sequential Marangoni Instabilities and Surface-adsorbable Macromolecules for Uniform Deposits Inspired by Whisky (Hyoungsoo Kim[1], Francois Boulogne[1], Eujin Um[1], Ian Jacobi[1], Ernie Button[2], and Howard A. Stone[1], [1]Princeton University, USA; [2]E. Pedro Road, Phoenix, AZ 85042, USA)
- Entry 147(10:15~10:30): Biomolecule Rheology with Particle Scattering Diffusometry (Katherine N. Clayton[1] , Tamara L. Kinzer-Ursem[2] , and Steven T. Wereley[1], [1]School of Mechanical Engineering, Purdue University, West Lafayette, IN 47907, USA; [2]Weldon School of Biomedical Engineering, Purdue University, West Lafayette, IN 47907, USA)

Meeting Rooms 6-7 (HTA-01, Chair: A. Ianiro, Co-Chair: K. Nishino)

Koichi Nishino
Department of Mechanical Engineering, Yokohama National University, Japan

Keynote KL13 (9:00~9:30): Whole Flow Field Measurement for the Study of Instability Mechanisms of Thermocapillary Convection in Microgravity Experiments

- Entry 3 (9:30~9:45): Enhanced Heat Transport in Partitioned Thermal Convection (Quan Zhou, Shanghai Institute of Applied Mathematics and Mechanics, Shanghai University, Shanghai 200072, China)
- Entry 82 (9:45~10:00): Using CIP Method to Visualize Oscillatory Flows in Rayleigh-Bénard Convection (Hossein Dabir and Kyung Chun Kim, School of Mechanical Engineering, Pusan National University, Busan, 609-735, Republic of Korea)
- Entry 98 (10:00~10:15): Simultaneous Measurement of Pressure and Temperature using Dual-layer PSP/TSP by Lifetime-based Method (Kil-Ju Moon and Hideo Mori, Department of Mechanical Engineering, Kyushu University, 744 Motooka, Nishi-ku, Fukuoka, Japan)

Three Parallel Sessions on Tuesday Late Morning

Tuesday (June 21, 2016) 10:45 – 12:15

Meeting Rooms 1-3 (GFV-05, Chair: A. Schroder, Co-Chair: V.E. Mosharov)

Keynote KL11 (10:45~11:15): Surface Flow Visualization in Large Wind TUNNELs

V. E. Mosharov
Central Aero-Hydrodynamic Institute (TsAGI), Zhukovsky, Moscow reg., Russia

- Entry 21 (11:15~11:30): Fast PSP Measurements in Low Speed Flows: Improvements Using Proper Orthogonal Decomposition (Di Peng, Shaofei Wang, and Yingzheng Liu, School of Mechanical Engineering, Shanghai Jiao Tong University, China)
- Entry 50 (11:30~11:45): Development of PSP for Measurement of Internal Flows (Hideo Mori[1], Yuki Uchida[1], Keishiro Takeda[1], Masashi Yoshikawa[2], Kazuya Handa[1], and Kil-Ju Moon[1], [1]Department of Mechanical Engineering, Kyushu University,744 Motooka, Nishi-ku, Fukuoka, Japan; [2]Hitachi, Ltd., Research & Development Group, 832-2, Horiguchi, Hitachinaka, Ibaraki, Japan)
- Entry 112 (11:45~12:00): 3D Unsteady Flows by Two Trains Crossing in Straight and Curved Tunnels (Jung Min Cho, Graduate School of Mechanical Engineering, Seoul National University of Science and Technology, Seoul, 139-743, Korea; Jaeyong Sung and Dong Hoon Lee, Department of Mechanical & Automotive Engineering, Seoul National University of Science and Technology, Seoul, 139-743, Korea)
- Entry 129 (12:00~12;15): Realistic Representation of Atmospheric Clouds Depends on a Combination of Computed Physical Quantities (Shintaro Kawahara, Ryo Onishi, Keigo Matsuda, Fumiaki Araki, and Keiko Takahashi, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Kanagawa, 236-0001, Japan, Koji Goto, NEC Corporation, Tokyo, 108-8001, Japan)

Meeting Rooms 4-5 (MNB-04, Chair: A. Sarles, Co-Chair: T.A. Kowalewski)

Keynote KL06 (10:45~11:15): Experimental Challenges of Nano and Microfluidics

Tomasz A. Kowalewski
Institute of Fundamental Technological Research, Polish Academy of Sciences, Warsaw, Poland

- Entry 47 (11:15~11:30): Experimental Study on the Bubble Propulsion of Janus Microparticles (Xu Zheng[1], Jing Zheng[2], Leilei Wang[2], Haihang Cui[2], and Zhanhua Silber-Li[1], [1]LNM, Institute of Mechanics, Chinese Academy of Science, Beijing 100190, China; [2]Xi'an University of Architecture and Technology, Xi'an 710055, China)
- Entry 92 (11:30~11:45): Measurement of Velocity Profile of Horizontal Flow Induced by Steam Condensation in a Torus Pool (Daisuke Yamauchi, Department of Nuclear Engineering and Management School of Engineering The University of Tokyo, Japan; Byeongnam Jo, Nejdet Erkan, Wataru Sagawa, and Koji Okamoto, Nuclear Professional School, The University of Tokyo, 2-22 Shirakata, Tokai-mura, Ibaraki 319-1188, Japan)
- Entry 84 (11:45~12:00): Visualization of Micro-Scale Reactions and Microfluidics in PEMECs for High-efficiency Energy Storage (Jingke Mo, Zhenye Kang, Bo Han, Gaoqiang Yang, William Barnhill, and Feng-Yuan Zhang, Nanodynamics and High Efficiency Lab for Propulsion & Power (NanoHELP), Department of Mechanical, Aerospace and Biomedical Engineering, UT Space Institute, University of Tennessee, Knoxville, Tullahoma, TN 37388, USA)
- Entry 150 (12:00~12:15): Visualization of Respiratory Flows Using Non-Contact Methods (Znamenskaya I.A., Koroteeva E.Y., Chernorisov A.M., and Isaychev S.A., Lomonosov Moscow State University, Russia)

Meeting Rooms 6-7 (HTA-02, Chair: K. Nishino, Co-Chair: C. Wilson)

Keynote KL25 (10:45~11:15): Neutron Radiography for Observation of Oscillating Heat Pipes

Corey Wilson
College of Marine Engineering, Dalian Maritime University, Dalian, China

Hongbin Ma
Department of Mechanical & Aerospace Engineering, University of Missouri, MO, USA

- Entry 19 (11:15~11:30): Ablative Properties of Polymer Composites Used in Aviation (Robert Szczepaniak, Pawel Przybylek, and Andrzej Komorek, Air Force Academy, Dywizjonu 303 35, 08-521 Dębilin, Poland, Wojciech Kucharczyk, University of Technology and Humanities, Krasickiego 54B, 26-600 Radom, Poland, Wit Stryczniewicz, Institute of Aviation, Krakowska 110/114, 02-256 Warsaw, Poland)
- Entry 57 (11:30~11:45): TDLAS-based Investigation on Steam Unsteady Condensation Process with Different Time Scales (Yi Jin, Xindong Fan, Dong Peng, and Jiming Yang, University of Science and Technology of China, Hefei, 230027, China)
- Entry 96 (11:45~12:00): Focal Plane Shift Imaging for the Analysis of Jumping Droplet Condensation (Hyeongyun Cha, Jae Min Chun, Jesus Sotelo, and Nenad Miljkovic, Department of Mechanical Science and Engineering, University of Illinois, Urbana, IL 61801, USA)
- Entry 120 (12:00~12:15): Optical Property Detection of Thermochromics Molecules Dependig Temperature Change (Iltai Isaac Kim, Department of Engineering, Texas A&M University-Corpus Christi, TX, USA; Mark Olson, School of Pharmaceutical Science and Technology, Tianjin University, China, and Lei Fang, Department of Chemistry, TAMU. College Station, 77843 TX USA)

Three Parallel Sessions on Tuesday Early Afternoon

Tuesday (June 21, 2016) 2:00 – 3:30

Meeting Rooms 1-3 (GFV-06, Chair: V.E. Mosharov, Co-Chair: M.G. Olsen)

Keynote KL14 (2:00~2:30): Flow Visualization and Measurement in Microscale and Macroscale Vortex Nanoprecipitation Reactors

- Entry 43 (2:30~2:45): Surface Flow Topology Visualizations of Wings with Leading-edge Tubercles under Pitch, Yaw and Roll Conditions (Zhaoyu Wei, T.H. New, School of Mechanical and Aerospace Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798 and Y.D. Cui, Temasek Laboratories, National University of Singapore, Engineering Drive 1, Singapore 117411)
- Entry 65 (2:45~3:00): Vortex Structure and Instability of Flow Over Heaving and Pitching Foils (Hamidreza Karbasian and Kyung Chun Kim, School of Mechanical Engineering, Pusan National University, Busan 609-735, Republic of Korea)
- Entry 76 (3:00~3:15): Vortex Shedding from Rapidly Accelerated Flat Plates (Randall Tyrone Paton, Beric William Skews, and Morapeli Michael Matjoi, Flow Research Unit; University of the Witwatersrand, Johannesburg, South Africa)
- Entry 143 (3:15~3:30): Lighter than Air Tracers for Vortex Core Velocimetry (Giuseppe Carlo Alp Caridi, Rakesh Yuvaray, Andrea Sciacchitano, and Fulvio Scarano, Department of Aerospace Engineering, TU Delft, The Netherlands)

Michael G. Olsen
Department of Mechanical Engineering, Iowa State University, USA

Meeting Rooms 4-5 (MNB-05, Chair: T.A. Kowalewski, Co-Chair: S. Wereley)

Keynote KL24 (2:00~2:30): Visualizing Microscale Electrothermal Vortices

- Entry 4 (2:30~2:45): Quantitative Study of Single Particles Interaction Force by Combined Atomic Force Microscopy / Optical Tweezers (AFM/OT) (Filippo Pierini, Krzysztof Zembrzycki, Pawel Nakielski, Sylwia Pawlowska, and Tomasz Aleksander Kowalewski, IPPT PAN, Institute of Fundamental Technological Research, Polish Academy of Sciences, Poland)
- Entry 66 (2:45~3:00): Dynamic Behavior of Heterogeneous Impinging Droplets onto High Temperature Plate (Choong Hyun Lee, R&D Center, SEMES CO., LTD., Korea and Kyung Chun Kim, Pusan National University, Korea)
- Entry 94 (3:00~3:15): Frost Wave Propagation on Hydrophobic and Superhydrophobic Surfaces (Shreyas Chavan, Hanmesh Gunnam, Nitish Singla, Patrick Birbarah, and Nenad Miljkovic, Mechanical Science and Engineering Department, University of Illinois at Urbana Champaign, USA)
- Entry 87 (3:15~3:30): Visualization of Particle Motions in Micro Toroidal Vortex Generated by Rapid Electrokinetic Patterning Process (Yining Ma, Dong Kim, and Kyung Chun Kim, School of Mechanical Engineering, Pusan National University, Busan, 609-735, Republic of Korea)

Steve Wereley
Mechanical Engineering, Purdue University, USA

Meeting Rooms 6-7 (SIA-02, Chair: C. Wilson, Co-Chair: F. Leopold)

Keynote KL08 (2:00~2:30): Reconstruction of Unsteady Flows using the Colored Background Oriented Schlieren Technique

- Entry 26 (2:30~2:45): Three-dimensional Shock Wave and Fragment Tracking for Warhead Characterization (Kyle Winter and Michael John Hargather, New Mexico Tech, USA and Sivaram Gogineni, Spectral Energies, LLC, USA)
- Entry 69 (2:45~3:00): Time-Resolved Visualization of Blast Waves Around Various Obstacles Using Colored Background Oriented Schlieren Technique (CBOS) compared with Interferometry and CFD Simulations (D. Klatt and F. Leopold, French-German Research Institute of Saint-Louis (ISL), France)
- Entry 95 (3:00~3:15): Slit-Scan Schlieren Imaging with the iPhone (Gary S. Settles, FloViz Inc., USA)

Friedrich Leopold

Masanori Ota
French-German Research Institute of Saint-Louis (ISL), Saint-Louis, France

Three Parallel Sessions on Tuesday Late Afternoon

Tuesday (June 21, 2016) 4:00 – 5:30

Meeting Rooms 1-3 (GFV-07, Chair: M.G. Olsen, Co-Chair: F. Scarano)

Keynote KL17 (4:00~4:30): The Expanding Dimensions of Particle Image Velocimetry

- Entry 24 (4:30~4:45): Active Control of Turbulent Boundary Layer for Drag Reduction with a Piezoelectric Oscillator (Xiaobo Zheng and Nan Jiang, School of Mechanical Engineering, Tianjin University, Tianjin, 300072, China)
- Entry 70 (4:45~5:00): PIV Visualization of Blast Waves from Pulse Sliding Discharge (Irina Znamenskaya, Ekaterina Koroteeva, Fyodor Glazyrin, and Tahir Kuli-Zade, Lomonosov Moscow State University, 119991, Leninskie Gory, 1, Moscow, Russia)
- Entry 130 (5:00~5:15): Error Propagation Dynamics of PIIV-based Pressure Calculation (Zhao Pan, Jared Whitehead, Department of Mechnical Engineering, Brigham Young University, USA and Tadd Truscott, Department of Mechanical and Aerospace Engineering, Utah State University, USA)
- Entry 159 (5:15~5:30): Flow Visualization in a Carpet under Vacuum Cleaner Nozzle Using Magnetic Resonance Velocimeter (Jeesoo Lee and Simon Song, Department of Mechanical Convergence Engineering, Hanyang University, Korea)

Fulvio Scarano
Aerospace Engineering Department, TU Delft, Delft, The Netherlands

Meeting Rooms 4-5 (IMP-02, Chair: S. Wereley, Co-Chair: N. Miljkovic)

Keynote KL10 (4:00~4:30): Droplet Visualizations on Nanoengineered Surfaces for Enhanced Energy Transfer

- Entry 39 (4:30~4:45): Dynamic Behavior of Droplets Impinging onto a Slender Circular Cylinder (DongHa Kim and Kyung Chun Kim, School of Mechanical Engineering, Pusan National University, Busan, 609-735, Republic of Korea)
- Entry 67 (4:45~5:00): Comparison of the FTIR method and SPR method for visualization of physical processes in liquid droplets (Pavlov I.N., Rinkevichyus B.S., Tolkachev A.V., and Vedyashkina A.V., National Research University "Moscow Power Engineering Institute" (NRU "MPEI"), Russia)
- Entry 149 (5:00~5:15): Simultaneous Velocity and Temperature Measurements inside Droplet in Hot Air Flow using TSPs & PIV (Qian Zhou, Nejdet Erkan, and Koji Okamoto, Department of Nuclear Engineering and Management, The University of Tokyo, Tokyo, 113-8654, Japan)
- Entry 154 (5:15~5:30): Visualization of Droplet Entrainment Generated from Interaction with Falling Film Flow and Lateral Air Flow (Han Sol Kim, Jae Young Lee, Handong Global University, 558 Handong-ro Buk-gu, Pohang Gyeongbuk 37554, Republic of Korea; Jong Rok Kim, Dong Jin Euh, Korea Atomic Energy Research Institute, 111 Daedeok-daero 989Beon-gil Yuseong-gu Daejeon, Republic of Korea)

N. Miljkovic
Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, IL, USA

E. N. Wang
Department of Mechanical Engineering, MIT, MA, USA

Meeting Rooms 6-7 (HTA-03, Chair: F. Leopold, Co-Chair: A. Ianiro)

Keynote KL04 (4:00~4:30): Advanced Techniques for the Investigation of Flow Field and Heat Transfer in impinging Jets

- Entry 53 (4:30~4:45): Numerical Visualization of Flow and Heat Transfer on 3-D μ-CT Scanned Open Cell Metal Foam (Chanhee Moon and Kyung Chun Kim, School of Mechanical Engineering, Pusan National University, Busan, Korea)
- Entry 60 (4:45~5:00): Study on Control of Boundary Layer by Ionic Wind for Heat Transfer (Dong Ho Shin and Han Seo Ko, School of Mechanical Engineering, Sungkyunkwan University, Suwon, Korea)
- Entry 80 (5:00~5:15): Simultaneous Measurement of Temperature and Velocity Field in a Hot-Oil Jet Using Temperature Sensitive Phosphor Particles (Dong Kim, Hyun Dong Kim, Kyung Chun Kim, School of Mechanical Engineering, Pusan National University, Busan, 609-735, Republic of Korea)

Andrea Ianiro
Bioingeniería e Ingeniería Aeroespacial, Universidad Carlos III de Madrid, Spain

Two Parallel Sessions on Wednesday Early Morning

Wednesday (June 22, 2016) 9:00 – 10:15

Meeting Rooms 1-3 (GFV-08, Chair: J. Wang, Co-Chair: B. Skews)

Keynote KL21 (9:00~9:30): Shock wave flows using symmetry

Beric W. Skews
University of the Witwatersrand, Johannesburg, South Africa

- Entry 17 (9:30~9:45): New Reconstruction Algorithm for Light Field PIV and its Application to Jet Flow Measurement (Shengxian Shi, Junfei Ding, and Yingzheng Liu, Gas Turbine Research Institute, School of Mechanical Engineering, Shanghai Jiao Tong University, Shanghai, China)
- Entry 97 (9:45~10:00): 3D Pressure Visualization from 3D PIV/PTV: Comparative Assessment (Dirk Michaelis[1], Paul Blinde[2], Douglas R. Neal[1], Roeland de Kat[3], Angeliki Laskari[3], Young Jin Jeon[4], Laurent David[4], Daniel Schanz[5], Florian Huhn[5], Cameron McPhaden[6], David Rival[6], Pierre-Elie Weiss[7], Jan FG Schneiders[2], Bas van Oudheusden[2], Ferry Schrijer[2], [1]LaVision GmbH, Göttingen, Germany+LaVision Inc, Ypsilanti, Michigan, USA; [2]Delft University of Technology, Faculty of Aerospace Engineering, The Netherlands; [3]Aerodynamics and Flight Mechanics Research Group, University of Southampton, Southamton, UK; [4]Institut PPRIME, UPR3346, CNRS – Université de Poitiers – ISAE-ENSMA, France; [5]German Aerospace Center (DLR), Institute of Aerodynamics and Flow Technology, Department of Experimental Methods, Göttingen, Germany; [6]Department of Mechanical and Materials Engineering, Queen's University, Kingston, Canada; [7]Department of Applied Aerodynamics, ONERA, Meudon Fr-92190, France)
- Entry 138 (10:00~10:15): PIV Measurements of Sloshing Flow in a Rectangular Tank induced by a Sinusoidal Inflow (Mattia Contino, Carlo Salvatore Greco, and Gennaro Cardone, Department of Industrial Engineering, University of Naples, Italy)

Meeting Rooms 4-5 (SF-01, Chair: F. Seiler, Co-Chair: G. Settles)

Keynote KL19 (9:00~9:30): Recent Development in Schlieren and Shadowgraph Techniques

Gary Settles
Mechanical and Nuclear Engineering, Pennsylvania State Univesity, USA

- Entry 75 (9:30-9:45): Density Measurements of Cross Flow/Side-Jet Interaction Field by Computed Tomography (CT) Reconstruction using Colored-Grid Background Oriented Schlieren (CGBOS) Technique (Ken Kurihara, Kiichi Shida, Arimoto Hiromichi, Graduate School of Chiba University, Chiba, Japan, Tatsuro Inage, Department of Mechanical and Electronic Engineering, Salesian Polytechnic, Kanagawa, Japan; Masanori Ota, Graduate School and Faculty of Engineering, Chiba University, Chiba, Japan; Kazuo Maeno, Kisarazu National College of Technology (KNCT), Chiba, Japan)
- Entry 81 (9:45~10:00): 3D Reconstruction of Helium Jet by Multidirectional Polarized White Light Differential Interferometry (François Olchewsky, Jean-Michel Desse, ONERA The French Aerospace Lab, 5, Boulevard Paul Painlevé, F-59045 LILLE Cedex, France, Frédéric Champagnat, Aurélien Plyer, ONERA, The French Aerospace Lab, Chemin de la Hunière, 91761, PALAISEAU Cedex, France)
- Entry 139 (10:00~10:15): Simultaneous Multi Angle Measurement of Unsteady Flow by Colored-Grid Background Oriented Schlieren (CGBOS) Technique (Masanori Ota, Ken Kurihara, Hiromichi Arimoto, and Kiichi Shida, Graduate School of Engineering, Chiba University, Japan; Tatsuro Inage, Salesian Polytechinic, Japan; Friedrich Leopold, Daniel Klatt, and Bastien Martinez, French-German Research Institute of Saint-Louis, ISL, France)

Two Parallel Sessions on Wednesday Late Morning

Wednesday (June 22, 2016) 10:30 – 11:45

Meeting Rooms 1-3 (GFV-09, Chair: B. Skews, Co-Chair: J. Wang)

Keynote KL23 (10:30~11:00): Vortex Induced Laminar Boundary Layer Transition on a Flat Plate with Zero-Pressure Gradient

Jinjun Wang
Key Laboratory of Fluid Mechanics, Beijing University of Aeronautics and Astronautics, China

- Entry 102 (11:00~11:15): Low Order Modeling of Forces and Flow Features in Flapping Wings (Marco Raiola, Stefano Discetti, and Andrea Ianiro, Aerospace Engineering Group, Universidad Carlos III de Madrid, 28911, Leganés, Madrid, Spain)
- Entry 114 (11:15~11:30): Flow Visualization of Single-sided Ventilation Building with Overhang (Jinsoo Park[1], Jung-Il Choi[2], and Gwang Hoon Rhee[1], [1]Department of Mechanical and Information Engineering, University of Seoul, Seoul, Korea; [2]Department of computational Science and Engineering, Yonsei University, Seoul, Korea)
- Entry 156 (11:30~11:45): Visualization of Film Reynolds Number generated from Interaction with Falling Film Flow and Lateral Air Flow (Han Sol Kim, Jae Young Lee, Handong Global University, 558 Handong-ro Buk-gu, Pohang Gyeongbuk 37554, Republic of Korea; Jong Rok Kim, Dong Jin Euh, Korea Atomic Energy Research Institute, 111 Daedeok-daero 989 Beon-gil Yuseong-gu Daejeon, Republic of Korea)

Meeting Rooms 4-5 (SF-02, Chair: G. Settles, Co-Chair: F. Seiler)

Keynote KL20 (10:30~11:00): Mach Waves occurring over a Backward Facing Edge in Supersonic Flow

Friedrich Seiler
Institute for Fluid Mechanics, University of Karlsruhe, Germany

- Entry 10 (11:00~11:15): Imaging Shockwaves and Vortices on Full-Scale Aircraft using Schlieren Photography with the Sun's Limb from the Ground and from an Aircraft (Edward A. Haering, Jr.[1], Paul S. Bean[1], Thomas P. Jones[1], Benjamin D. Buckner[2], and Drew L'Esperance[2], [1]NASA Armstrong Flight Research Center, Edwards, CA, 93523-0273, USA; [2]Spectabit Optics, LLC, Laguna Hills, CA, 92653, USA)
- Entry 37 (11:15~11:30): Pulsed Digital Holographic Interferometry for Analyzing Unsteady Wake Flows (Jean-Michel Desse and François Olchewsky, ONERA, The French Aerospace Lab, 5, Boulevard Paul Painlevé, F-59045 LILLE Cedex, France)

Exhibitors

By Russ Lessmeier and Chris Kerr

Vision Research designs and manufactures a broad range of high-speed digital imaging systems that are used in all military, industry, academic and entertainment sectors. Marketing under the Phantom® brand, our cameras allow you to analyze physical phenomena *when it's too fast to see, and too important not to*™.

By Douglas Neal

LaVision, founded in 1989, specializes in imaging-based measurement systems for users engaged in fluids, sprays, combustion and materials throughout the world. This year we are releasing our "Shake the Box" 3D Lagrangian particle tracking software, allowing fluid dynamics researchers access to volumetric fluid velocity data that had previously been unattainable.

By Kent Peterson

nac Image Technology is the leading global supplier of high-speed camera systems. Since 1958 nac has pioneered new uses for image technology gaining a reputation for quality, experience and reliability. All products are lab/range tested and meet specific requirements for flow visualization and a wide variety of other applications.

By Dan Troolin, Wing Lai, Matt Stegmeir, and Aaron Boomsma

For over 50 years, TSI has been providing a complete line of diagnostics systems for fluid flow research. TSI's new V3V-Flex Volumetric PIV system has a flexible camera configuration for optimized volume size and spatial resolution for 3D3C flow measurements, designed to meet your most challenging research requirements.

By Junichi Goto and Keiichi Omori

We, Flowtech Research (FTR), will display our dual shutter PIV camera "FtrDSC" and PIV software "FtrPIV". This camera is equipped with dual electronic shutters and capable of PIV imaging even in combustion fields. Its capability is exploited by our FtrPIV software that is designed for a variety of PIV measurements.

By Samuel Hellman

A high-speed P-LIF/PIV imaging system is shown with a simulated flame along with our compact and pre-aligned FlowExplorer LDV solution.

By Andrew Bridges and Rick Burmeister

Photron engineers high-speed cameras for slow motion analysis of events and phenomena occurring too fast for the unaided eye to see or the brain to comprehend. Cameras operate between 60 and 2.1 million frames per second (fps), with short interframe times for laser synchronization and particle image velocimetry (PIV) applications.

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