

## Report

# The 13<sup>th</sup> International Symposium on Flow Visualization

Prenel, J. P.\*

\* FEMTO-ST Institute, University of Franche Comté / CNRS 6174, Department “Energy and Multi-physical systems”. 2 avenue Jean Moulin, Parc Technologique, 90000 Belfort, France.  
E-mail: jean-pierre.prenel@univ-fcomte.fr ; URL: www.femto-st.fr

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**Abstract** : The 13<sup>th</sup> international Symposium on Flow Visualization (ISFV 13) was held in Nice, Acropolis Convention Center, France, July 1-4, 2008. In order to avoid duplication, the 12<sup>th</sup> French Congress on Visualization in Fluid Mechanics (Fluvisu 12) took place simultaneously. The symposium attracted 298 participants from 27 countries and was organized in 40 ORAL sessions, four invited lectures and a poster exhibition. The Asanuma and Leonardo da Vinci Awards were attributed to scientists for their outstanding contributions to the field of flow visualization. A technical exhibition was organized in order to present recent optical systems and components. A video / photo contest allowed to reward the most aesthetic pictures presented during the symposium.

**Keywords** : Flow Visualization, Imagery, Optical measurements, Velocimetry, Image Processing.

## 1. Introduction

The International Symposium on Flow Visualization was back in France after 22 years around the world. Its 13<sup>th</sup> edition was held in Nice- Acropolis Convention Center on July 1<sup>st</sup>- 4<sup>th</sup>, 2008, under the scientific patronage of the French Optical Society – SFO. In order to avoid duplication, the 12<sup>th</sup> French Congress on Visualization in Fluid Mechanics-FLUVISU 12 took place simultaneously.

Initiated in 1977 by the Visualization Society of Japan, ISFV was held successively in Tokyo, Bochum and Ann Arbor. It made a first stop in Paris in 1986, on the occasion of its 4<sup>th</sup> edition, organized by ONERA and chaired by Dr. Claude Veret. The principle of a co-organization ISFV – FLUVISU had already been adopted. Since then, it has taken place in major scientific sites and convention centers, trying to respect a geographical balance between Asia, Europe and America: Yokohama, Praha, Seattle, Napoli / Sorrento, Edimburgh, Kyoto, Notre Dame (Mueller, T. J., 2005) and Göttingen (Kompenhans, J., 2007).

Every two years, the ISFV series gathers the international communities of Fluid Mechanics, Thermal Engineering and Optics around the common theme of imagery and optical measurements in fluids: visualization of phenomena (wakes, vortices, shock waves...), characterization of fields of velocity, temperature and pressure and of course validation of theoretical models are present in this interdisciplinary symposium.

The participants come from various backgrounds: searchers from university laboratories, from major national research organizations, but also from research-development services of aircraft, spacecraft or car manufacturers meet in a common will to present the evolutions of optical investigation methods and the innovations in all the fields of applications concerned by fluid movements, heat transfers or phase changes.

## 2. Organization

### 2.1 Main Organizer

The symposium was organized by the Institute “FEMTO – ST”, Mixed Research Unit attached to 4 institutions: University of Franche Comté (UFC), National Center for Scientific Research (CNRS), Mechanics and Microtechnics engineering college (ENSM) and Belfort-Montbéliard University of Technology (UTBM), in association with the French Committee “Fluvisu- Visualization in Fluid Mechanics”.

FEMTO-ST is established in 3 different cities in Franche Comté: Besançon (main establishment), Belfort and Montbéliard and carries out multidisciplinary research in the scientific and technological fields of Engineering and Information (Fig. 1). With 500 employees and nearly 250 annual research contracts, FEMTO is one of the major player in the French Applied Sciences.

The Institute is structured in 6 research departments:

- Applied Mechanical Engineering
- Automatic control and micro-mechatronic systems
- Energy and multiphysical systems
- Micro and Nano Sciences
- Optics
- Time and Frequency

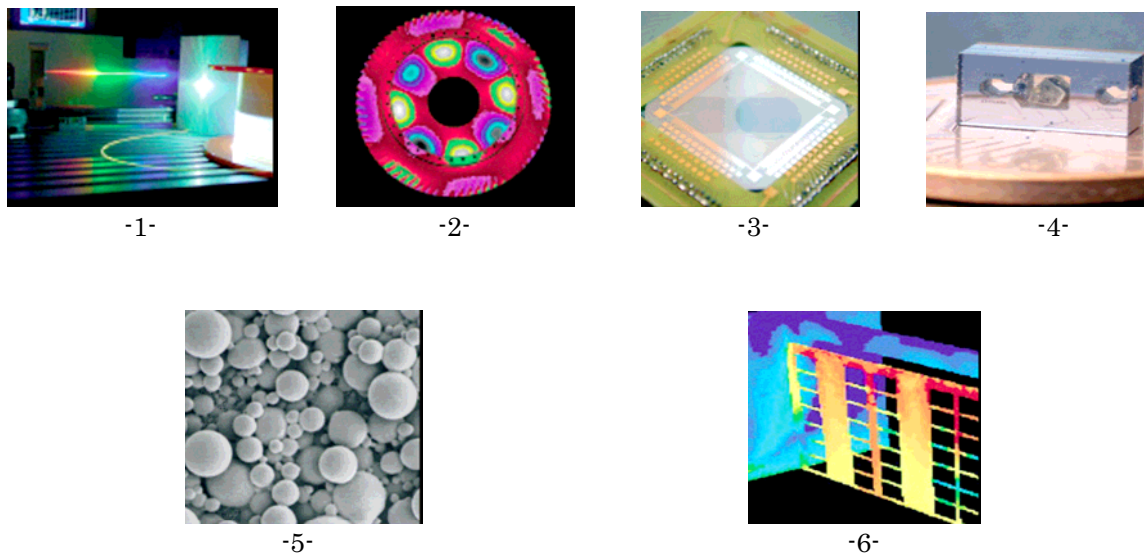


Fig. 1. 1- White laser, 2- Holographical analysis of a turbo jet wheel, 3- Chip for droplet displacements, 4- Atomic Caesium microclock, 5- Micro-encapsulation, 6- Thermal modeling.

### 2.2 Sessions

The symposium was organized in 32 standard sessions: Acoustics, Specific PIV / PTV, Periodic phenomena, Aeronautics and Space 1-2, High speed 1-2, Multiphase 1-2-3, Turbulence / Vortices 1-2, Computer Visualization 1-2, Industrial Application 1-2, DGV / DPV, Cavities, Refractometry, Stereo and 3D 1-2, Heat and Mass Transfer, BOS / Stereo Schlieren, Walls / Boundaries, Microflows, Combustion, Hybrid / Specific methods, Coating sensors, Interferometry, Terrestrial vehicles, Rotating / Oscillating / Swirling flows, Advanced image processing.

In order to point out original and unusual applications, 7 special sessions have been added: optical and electrical manipulations, Natural life, Human life 1-2, Earth and Environment 1-2, Art and Learning. Besides, a set of 40 posters was displayed during 3 days.

Four international experts have been invited to present the “state-of-the-art” in various fields of activities, from “scale 1” wind tunnel experiments to micro and even nano-scale flows:

- Dr. Antonello Cogotti, Pininfarina Aerodynamics and Aeroacoustics research center, Torino, Italy: *Wind tunnel techniques in cars full scale tests.*
- Prof. Kenneth. D. Kihm, University of Tennessee, Knoxville, USA: *Near-field and Label-free imaging by surface plasmon resonance (SPR).*
- Dr. Friedrich Leopold, French-German Research Institute, St Louis, Germany: *Flow visualization by using the Coloured Background Oriented Schlieren (CBOS) technique: wind tunnel, free-flight and in-flight applications.*
- Prof. Jean Marc Fournier, EPF Lausanne, Switzerland: *Optical Micromanipulation of Mesoscopic Objects in Microfluidics Devices.*

### 2.3 Technical Exhibition

A technical exhibition, located in the poster area, allowed to present recent optical components, specific lasers, imagery and velocimetry systems. Seven companies were present during 3 days: Dantec, Excel Technology, LaVision, Melles Griot / CVI, Quantel, Shimadzu and TSI.

### 2.4 CD ROM Proceedings

After the first selection process, 287 abstracts were accepted. Finally, 240 paper presentations have been scheduled: 200 oral communications and 40 posters. Most of them are included in the CD Proceedings (Copyright UFC / FEMTO 2008). Only 5 final papers, received after the deadline, are only displayed on the symposium website: <http://isfv13.univ-fcomte.fr> - program heading.

## 3. Symposium Summary

### 3.1 Attendance

Finally, 298 participants from 27 countries attended ISFV 13. As for ISFV 12, the majority came from Japan (85 attendants), the second national group being the French community (75 attendants). For an evident geographical reason, the European Area represented the first international group (44 % -131): Germany (25), Italy (13), Czech Republic (5), UK (4), Turkey (3), Austria (2), Denmark (2), Finland (2), Belgium (1), Greece (1), Serbia (1) and Switzerland (1). Almost equivalent, about 42% -125) of participants came from Asia: South Korea (24), ROC Taiwan (11), Singapore (2), India (1), Malaysia (1) and Thailand (1). American people, north and south were 21: USA (16), Canada (4) and Brazil (1). Scientists from CEI were 12: Russia (10) and Belarus (2), and after a very long trip: Australia (3) and new Zealand (2).

### 3.2 About Scientific Aspects

During the Eighties, the supporters of the “all numerical calculation”, relying on the fast improvements of computers and softwares, had foreseen that “wind tunnel type experiments” would assuredly disappear before the mythic year 2000. Optical methods, considered by the most radical as ancestors would be washed away! It is true that a few “classical” methods, a non pejorative term in this context, do not hide their age: the idea of making use of refractive index variations in order to characterize a fluid dates from before the 20th century and the principle of flow seeding in order to visualize trajectories is attributed to Leonardo da Vinci. As a matter of fact, a main international scientific award in this field of activities wears his name. Today, the year 2000 and its accompanying predictions have been forgotten and the “numerical wind tunnel” has not killed the experimental methods, far from it, as demonstrated by the invited lecture of Dr. Antonello Cogotti. The new Airbus or Boeing aircrafts, the recent high speed trains have known countless hours of wind tunnels.

The most recent Formula 1 and even the “man in the street’s cars” do not escape it either.

“Extremes are always bad” as the phrase goes! So, the scientific evolution has conserved the precious balance ‘theory – experimentation’ which is most often a source of progress. Even better, the increasing quantity of information issued from theoretical models and computer processes has generated an important need for validation means, stimulating the improvement of existing methods: Shadowgraphy, Schlieren, Interferometry and its sister Holography are still topical under entirely renewed aspects (Invited lecture 3 Dr. F. Leopold). It also induced the appearance of new methods, more rapid, with a best resolution (Invited lectures 2 and 4: Prof. K. D. Kihm, Prof. J. M. Fournier) and well adapted to the needs of the specialists who focus their efforts on either 3D, micro, unstationary, multiphase flows, sometimes all simultaneously.

In another positive way, today’s extraordinary awareness of energetic and environmental problems reveals to be a driving force behind the development of the characterization of fluidic and thermal phenomena. All the scientific approaches obviously show a common point which is that the circulation of fluids, thermal exchanges and phase changes will be at the heart of the problem. No recession in sight then for this abundant field of activities, in which optical investigations hold an important place, thanks to their little intrusive aspect and their faculty to analyse a global field by imagery.

### 3.3 International Awards

Two traditional International Awards in the ISFV series were presented during a specific session in order to reward two international experts for their outstanding contributions to the field of Flow Visualization:

- The Asanuma Award, issued from a vote of the Japanese team of the Visualization Society of Japan.
- The Leonardo da Vinci Award, issued from a vote of the International Scientific Committee.

The laureates were:

- Dr. Juergen Kompenhans, DLR, Germany, Asanuma Award 2008 (Fig. 2).
- Prof. Kenneth. D. Kihm, University of Tennessee, Knoxville, USA, Leonardo da Vinci Award 2008 (Fig. 3).



Fig. 2. Dr. Juergen Kompenhans awarded by Prof. Yasuki Nakayama.



Fig. 3. Prof. Kenneth. D. Kihm awarded by Prof. J. P. Prenel, ISFV 13 Chairman.

## 4. Social Program

### 4.1 Welcome Events

Two welcome concerts took place in the social program: during the opening ceremony the participants warmly applauded the French mezzo-soprano “prima donna” Christèle Frisch, harp accompanied by Graziella Vo-Perrier (Fig. 4).

It was difficult to open the first scientific session just in time, because she came back on stage

for an encore... During the evening welcome party a modern jazz band was also present. The mayor of Nice gave a specific souvenir to the ISFV Honorary Board members, a friendly attention that is to be noted (Fig. 5).



Fig. 4. Welcome Concert.



Fig. 5. Gifts for Prof. Y. Nakayama and Dr. C. Veret.

#### 4.2 Symposium Dinner

The Symposium Dinner took place on the famous beach “Promenade des Anglais”, the climate of the beginning of July on the French Riviera being perfectly adapted for such an event. The welcome of the participants was accompanied by a local country music group. In agreement with the local tradition, every woman received a carnation, symbolical flower of the city of Nice.

#### 4.3 Social Excursions

An optional day tour to Monaco was planned on Monday June 30<sup>th</sup>, for the participants arriving during the week-end before the symposium. Besides, a half-day break was scheduled on Wednesday afternoon: a short walk in the old city (2h) and a longer one including the old city and the castle hill climbing above the harbor (4h). Most of the participants were courageous and chose the longer walk.

#### 4.4 Photo / Video Contest

This contest being a tradition in the French “Fluvisu” series, the organizing committee decided to include this friendly competition in the ISFV program. Twenty nine pictures or video clips had been registered before the deadline. After 3 days, the polling box, located in the poster and exhibition area, was full and the counting of votes was carried out on Friday morning. The laureates were: Guillaume Polidori, France (Colored visualization of bubbles in a champagne glass), Pery Burge, artist from the UK (Chain of paint radial spreads) and Irina Znamenskaya, Russia (Schlieren shock picture)

## 5. Future Symposia

The International Committee gathered in Göttingen for ISFV 12 – 2006 confirmed that the 14<sup>th</sup> symposium would be held in Daegu Korea, June 21-24, 2010, organized and chaired by Prof. K. C. Kim. During the ISFV 13 Committee meeting and dinner in Nice, the location of ISFV 15 – 2012 was also confirmed: Minsk, Belarus, organized and chaired by Prof. Nikita Fomin. On the occasion of the ISFV 13 closing ceremony, the ISFV 14 and ISFV 15 Chairmen presented attractive descriptions of their countries and of the Convention Centers where the symposia will be located. The team of the Visualization Society of Japan indicated that they would probably apply for the 16<sup>th</sup> edition. As for the Olympic Games, the ISFV schedule is full for many years: a proof of very good health!

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helped efficiently to the diffusion of information in the world of Flow Visualization and to the difficult choice of awarded scientists. A special thanks to the French organizing team, particularly to the very efficient and devoted co-chairs, alternately webmaster, secretary and even travel agent. The financial supports from French public authorities and French establishments have been greatly appreciated as well as the personal support of our Institute manager and the practical help of the Research Promotion Service of our University. We do not forget the American Editor of Experiments in Fluids who organized the specific selection of the best papers to be published as full articles.

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### ***Author Profile***



Jean Pierre Prenel: He received his PhD in Optics in 1970 and Doctorate “es Sciences” in Physics in 1973 from the University of Franche Comté, France. He worked in the field of Flow Visualization since 1974 and was research manager of different laboratories (CNRS and University of Franche Comté). Recently he was head of department of the FEMTO Institute. Now he is retired as Emeritus Professor and fulfils various activities as Chairman of the French Committee “Fluvisu - Visualization in Fluid Mechanics”, Vice President of the PCTFE, Pacific Center of Thermal - Fluids Engineering, Hawaii, USA and European editor of “Journal of Flow Visualization and Image Processing”.