

CAV2009

7th International Symposium on Cavitation

Conference Proceedings

August 16th -20th, 2009

*Rackham Building,
915, E. Washington St
University of Michigan, Ann Arbor, USA*

cavitation.engin.umich.edu



Welcome!

On behalf of the local organizing committee and the conference co-chairs, I would like to welcome you to Ann Arbor and the 7th International Symposium on Cavitation: CAV2009.

The aim of the symposia series is to promote the worldwide exchange of cavitation knowledge. The inaugural meeting of the series was held in Sendai, Japan, in 1986. Over time, the scope and participation in this meeting has grown to encompass almost every aspect of cavitation. We have accepted 116 papers for the symposium covering a wide range of topics, including fundamental cavitation flow physics, cavitation issues associated with turbomachinery and naval systems, and new applications of cavitation in industrial and biomedical systems. We all will learn about the most recent advancements (experimental, numerical, and theoretical) in the understanding, prediction, and management of cavitating flows. Our six plenary speakers will share their insights on a range of interesting and important subjects.

I would like to thank the Scientific Committee for their help in the paper review process. Their efforts are vital to maintaining the quality of the symposium. Moreover, the technical papers judged by the Scientific Committee to be of the highest quality and interest will be selected for publication in a special issue of the *ASME Journal of Fluids Engineering*.

Finally, I would like to thank the Local Organizing Committee for all of their effort in bringing this meeting about. I would particularly like to thank the Ms. Jane Ritter, Mr. Harish Ganesh, Dr. Natasha Chang (the Chair of the Local Organizing Committee), and the UM Conference Services for their tremendous contribution to the success of the symposium.

On behalf of my conference Co-Chairs, Prof. Joseph Katz and Dr. Georges Chahine, I extend to you a warm welcome to Michigan.

*Prof. Steven L. Ceccio
University of Michigan, Ann Arbor*

People

Program Chairs

Steven Ceccio
Joseph Katz
Georges Chahine

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Tom van Terwisga, *Maritime Research Institute Netherlands & Delft Technical University*
Yulin Wu, *Tsinghua University*

Plenary Talks

Cavitation erosion: towards a new approach – Prof. Jean-Pierre Franc, University of Grenoble, France

Monday, August 17 2009, 9.15-10.05 AM

About the speaker

Prof. Franc is the Research Director (CNRS), Turbomachinery and Cavitation Research Group, Laboratory of Geophysical and Industrial Fluid Flows (LEGI) of the Grenoble University Institut National Polytechnique de Grenoble (INPG) and Université Joseph Fourier, France. He has published extensively in the area of cavitation, and is the author of 'La cavitation: mécanismes physiques et aspects industriels', and the co-author of 'Fundamentals of Cavitation'.

Physical and mathematical problems of hydrodynamics for high speed underwater motion with supercavitation – Dr. Vladimir V. Serebryakov, Institute of Hydromechanics - Kiev, Ukraine

Monday, August 17 2009, 1.00-1.50 PM

About the speaker

Dr. Vladimir Serebryakov, Ph.D., leading scientist of Institute of Hydromechanics of National Academy of Sciences of Ukraine, project manager is known expert in the field of High Speed Hydrodynamics including supercavitation, drag reduction and propulsive systems, dynamics and hydro elastic problems, sub-, supersonic flows in water. Double high education: shipbuilding engineering and physics-mathematics sciences. Post graduate 1969-1972 at the Institute of Hydromechanics of NASU. After that he for over 25 years has been closely collaborating with Prof. Georgy Logvinovich - father founder of the famous Russian torpedo Shkval. Dr. Serebryakov is author of asymptotic theory for axisymmetric supercavitating flows in incompressible fluid, for subsonic and supersonic speeds. He developed equations which expressed known principle of "Independence of the cavity expansion" introduced by G. Logvinovich. At present these equations are seen as one of the most effective way for practical estimation of supercavitation flows. Over 100 papers, National Award of 2002 on science and engineering, DAAD stipendium - Germany 2002, Brain Power stipendium - South Korea 2006-2007, member of sci. com. of CAV2001- USA, 2003-Japan, 2006-Netherlands, High Speed Hydrodynamics scientific school "HSH": HSH2002, 2004, 2006, 2008, SuperFAST2008 – Russia.

Numerical aspects of the collapse of non-spherical bubbles- Prof. Hiroyuki Takahira, Osaka Prefectural University, Japan

Tuesday, August 18 2009, 8.30-9.20 AM

About the speaker

Hiroyuki Takahira is currently a Professor of the Department of Mechanical Engineering at the Osaka Prefecture University. His current research interests are bubble dynamics, cavitation, gas-liquid two phase flows, and computational fluid dynamics. Hiroyuki Takahira received his B.S. and M.S. degrees in Mechanical Engineering from Kyoto University in 1985 and 1987, respectively. He received his Doctor of Engineering degree from Kyoto University in 1992. He joined Kyoto University in 1988 and subsequently worked about 8 years as an instructor and lecturer of the Department of Mechanical Engineering. In 1995, he joined Osaka Prefecture University as an associate professor of the Department of Energy Systems Engineering. He was promoted to a full professor of the Department of Mechanical Engineering at the Osaka Prefecture University in 2004. He was awarded the JSME Young Engineers Award in 1993, the JSME Medal for Outstanding Paper in 1999, and the Frontier Award of JSME Fluids Engineering Division in 2008.

Naval Propeller Cavitation: Historical Development of Design, Evaluation and Prediction- Dr. Stuart Jessup, Naval Surface Warfare Center Carderock Division, USA

Tuesday, August 18 2009, 1.25-2.15 PM

About the speaker

Dr. Jessup attended MIT from 1970-1976 receiving his BS and MS in Ocean Engineering. He then began his career at the Naval Surface Warfare Center Carderock Division as a member of the Propulsor Branch within the Hydromechanics Department. In 1989 he received his PhD from The Catholic University of America.

Dr. Jessup developed as a propeller designer and an experimental scientist conducting research related to improving the design process and the overall quality of naval propulsors. In 1982 Dr. Jessup developed Laser Doppler Velocimetry (LDV) for use in measuring detailed propeller blade flows, including blade boundary layers. In 1988, he began the development of arbitrary propeller blade section technology for the improvement of propeller cavitation performance. This led to installation of an advanced blade section propeller on the DDG-79 Flight IIa class. In 2002 Dr. Jessup was promoted to the position of Senior Scientist for Hydrodynamics for the U.S. Navy. In recent years he has investigated unsteady flows related to the ASDS, UUV docking, and propellers operating in crashback. Presently he is working on the DDG-1000 SOE development and investigating propeller operation in heavy seas.

Dr. Jessup received The Washington Academy of Science Engineering Science Award in 1986, the NSWCCD David W. Taylor Award for Scientific Achievement in 1996, the Navy Meritorious Civilian Service Award in 2000, the ASNE American society of Naval Engineers Gold medal award in 2004 and the SNAME Davidson Medal in 2008. Dr. Jessup was also inducted into the NAE, National Academy of Engineers in 2007.

Nozzle-geometry-dependent breakup of diesel jets by ultrafast x-ray imaging: implication of in-nozzle cavitation- Dr. Jin Wang Argonne National Lab, USA

Thursday, August 20 2009, 8.30-9.20 AM

About the speaker

Dr. Jin Wang, Physicist and Group Leader for Time-Resolved Research at the Advanced Photon Source (APS) of Argonne National Laboratory (ANL), earned his doctoral degree in physical chemistry from The Ohio State University in 1994. After so, he was appointed a post-doctoral fellow at Exxon Research and Engineering Company. He continued his research at ANL in 1995 as a post-doctoral fellow, and was promoted to assistant physicist in 1997, physicist in 2001, group leader in 2003. His research interest includes emerging science and engineering on advanced combustion of conventional and alternative fossil and bio-fuels, structure-function relationships in dynamical systems. His is currently working on dynamics and structure of high-pressure, high-speed fuel sprays for energy applications, kinetics and dynamics of metal/polymer nanocomposites and interaction between high-power and short-pulse laser and solid state surfaces. Wang has co-authored or authored more than 100 journal article publications including those in Nature, Science, Nature Physics, Advanced Materials, and Physics Review Letters. Wang received numerous awards, including the Best Paper Presentation Award of the ASME Internal Combustion Engine Division in 2006, the University of Chicago Distinguished Performance Award in 2005, the US Department of Energy National Laboratory R&D Award in May 2002, the Finalist, Discover Magazine Technology Innovation Awards in 2001.

Cavitation Modeling: bridging the gap between micro- and macro-scales.- Dr. Georges Chahine, Dynaflow, USA

Thursday, August 20 2009, 1.25-2.15 PM

About the speaker

Dr. Georges Chahine, President and founder of Dynaflow has acquired a very broad academic background - civil engineering in 1970 from University St Joseph, Beirut Lebanon (ESIB), naval architecture, 1972, and Engineering Doctorate in Fluid Mechanics, 1974 (from ENSTA, Paris) and Doctorat d'Etat és-Sciences in Applied Mathematics, 1979 (U. Pierre and Marie Curie, Paris). He spent eight years in academia and led a research group on the study of interface phenomena (ENSTA, Paris), then another eight years with the engineering firm, Tracor Hydronautics Inc., directing the Fluid Mechanics and Materials Science Department before founding Dynaflow in 1988. He has published more than 300 technical papers and reports and has three patents – two on decontamination of liquids with the DynaJets® cavitating jets and one on a cross flow filtration system. Dr. Chahine has very actively contributed to the field of cavitation and bubble dynamics and has directed numerous investigations on cavitating and vortical flows, on water jet technology, and in various acoustic and hydrodynamics fields.

Using the Proceedings Flash drive

The proceedings of the conference are made available to the participants in an electronic form rather than a hard bound book. In order to use the electronic version, make sure that the computer used for viewing the proceedings has Adobe Acrobat Reader. The document is in a pdf form.

Once the flash drive is loaded, a text document titled '*Instructions*' and two folders **CAV2009-papers** and **Proceedings** would be visible in the explorer window of the removable flash drive. There are three ways to access any paper. The papers can be directly accessed (by paper number) by getting in to the **CAV2009-papers** folder.

Another way of accessing the paper is through the day wise schedule located in the **Proceedings** folder. There are four pdf files one for each day of the conference. In these files the paper number in bold font has the link to the paper. This link will open up the corresponding paper in the **CAV2009-papers** folder.

Yet another way of accessing is through the book of abstracts. The book of abstracts can be found in the **Proceedings** folder. The author index can be found from the book of abstracts. After noting the paper number of the author, the paper wise index in the book of abstracts can also be used to get the appropriate paper. In the paper index, the bold faced number is a link to that corresponding paper.

Symposium Tour and Banquet

CAVS 2009 attendees will spend an evening touring the Ford Rouge plant, followed by a banquet reception at the Henry Ford Museum. The tour and banquet will be held on Wednesday, August 19th.

Transportation has been arranged to take conference participants and guests to and from the venues. Buses will leave from Rackham Auditorium at 1:40 pm (after lunch). The tour of the Ford Rouge Complex will take place from approximately 3:00 pm to 5:00 pm. Then, we will return to the buses for transportation to the Henry Ford Museum. Dinner will take place from 6:00 pm to 8:00 pm, and then participants will be brought back to Rackham Auditorium.