

# ASME<sup>®</sup> 2018 FEDSM

5th Joint US-European Fluids Engineering  
Summer Conference

# Program

## CONFERENCE

July 15 – July 19

## EXHIBITION

July 16 – July 18

Le Centre Sheraton  
Montreal, Quebec, Canada

[www.asme.org/events/fedsm](http://www.asme.org/events/fedsm)

# Welcome

## FROM THE CONFERENCE CHAIR

I would like to welcome you to the American Society of Mechanical Engineers 5th Joint US-European Fluids Engineering Summer Conference (FEDSM2018). The conference will be held at the Le Centre Sheraton Hotel, Montreal, Canada, during July 15-19, 2018. FEDSM2018 program includes technical paper sessions, plenary lectures, committee meetings, and social events. FEDSM2018 is involved in all areas of fluid mechanics, encompassing both fundamental as well as applications, to all types of devices, processes and machines involving fluid flows.

The FEDSM2018 program is the outcome of collaboration between the ASME Fluids Engineering Division (FED) and our colleagues from Europe. The technical sessions will focus on advances in the field of Fluids Engineering in the areas represented by the FED technical committees. It consists of six technical tracks, each corresponding to one of the FED technical committees. The Computational Fluid Dynamics, Fluid Mechanics, Multiphase Flow, Fluid Applications & Systems, Fluid Measurements & Instrumentation, and Micro & Nano Fluid Dynamics tracks cover a wide range of topics that are compatible with the scope, mission, and expertise of the corresponding FED technical committee.

The program will start on Sunday, July 15 with a workshop on "Axial and Radial Fan Design" by Prof. Dr.-Ing. Philipp Epple of the Coburg University of Applied Sciences in Germany. The technical program part of FEDSM2018 includes five plenary lectures. The ASME Freeman Scholar Lecture, "Fluid Mechanics of Geological Sequestration of Carbon Dioxide," will be given by Professor Ramesh K. Agarwal of Washington University in St. Louis. The ASME Fluids Engineering Award Lecture, "Scaling Analyses for Complex Systems," will be given by Dr. Upendra Singh Rohatgi of the Brookhaven National Laboratory. A plenary lecture on "Liquid/liquid slug flow and mass transport in a micro-capillary reactor - simulation and experiment," will be given by Prof. Dr.-Ing. habil. Peter Ehrhard of Dortmund University of Technology. Professor Stavros Tavoularis of the University of Ottawa will give a plenary lecture on the "Flow Instability and Coherent Structures in Complex Channels." Professor Martin Brouillette of Université de Sherbrooke will give a plenary lecture on "Using guidewire-mediated shock waves to revascularize chronic total occlusions."

The FEDSM2018 will include an awards dinner banquet to recognize winners of the Freeman Scholar, Fluids Engineering, Fluids Machinery Design, Lewis F. Moody, Robert T. Knapp, Flow Visualization Competition, and Graduate Student awards.

On a sad note, Professor Hugh Coleman passed away May 15, 2018 in Huntsville, Alabama. He and Dr. W. Glenn Steel co-authored Experimentation, Validation, and Uncertainty Analysis for Engineers (4th Edition 2018). His absence will be felt dearly. A deserving commemoration will be held during the next summer meeting.

I strongly urge you to get involved in the ongoing and future activities of FED by identifying and attending the technical committee meetings of interest.

Finally, I would like to thank the FED executive committee members, our European track co-organizers, TC chairs and vice chairs, topic and symposium organizers, session chairs, reviewers, judges, and the ASME staff. The organization of this event has required your hard work and dedication for which we are grateful.

I am looking forward to seeing you all in Montreal for what will surely be an exciting conference!

Khaled J. Hammad, PhD

Conference Chair



**KHALED J. HAMMAD,**  
PhD  
*Conference Chair*

*Our program provides  
a unique opportunity  
for our colleagues to focus on  
advances in the field of  
Fluids Engineering in the  
areas represented by the  
FED technical committees.*

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# General Information



## REGISTRATION HOURS AND LOCATION

**Ballroom Foyer, Level 4 – Le Centre Sheraton Hotel**

### Sunday

July 15, 2018 8:30 AM – 5:30 PM

### Monday

July 16, 2018 7:30 AM – 5:30 PM

### Tuesday

July 17, 2018 7:30 AM – 5:30 PM

### Wednesday

July 18, 2018 7:30 AM – 4:30 PM

### Thursday

July 19, 2018 7:30 AM – 10:00 AM

## AUDIOVISUAL EQUIPMENT IN SESSION ROOMS

All technical sessions are equipped with one LCD projector and one screen. Laptops will NOT be provided in the sessions. Presenters MUST bring their own or arrange in advance to share.

## BADGE REQUIRED FOR ADMISSION

All conference attendees must wear the official ASME 2018 FEDSM badge at all times in order to gain admission to technical sessions, exhibits and other conference events. Without a badge, you will NOT be allowed to attend any conference activities.

## CONFERENCE AWARD BANQUETS (TICKET REQUIRED)

Our Awards Banquet will take place during the conference to recognize and celebrate a select group of individuals for their contributions and achievements in fluids engineering. The schedule is as follows:

Fluids Engineering Division Summer Meeting.

### Tuesday

July 17, 2018 6:30 PM – 9:00 PM

## CONFERENCE CROWDCOMPASS APP

Download the new ASME CrowdCompass App and hold the entire program in the palm at your hand! The new ASME CrowdCompass App allows you to easily look up sessions, search for papers or people, message with other attendees, post to various social media platforms, and create your own schedule.

The ASME CrowdCompass App is available at the App Store on iOS devices and Play store on Android.

## CONFERENCE REFRESHMENT BREAKS

A 15 minute morning and an afternoon break will be provided in the exhibition area (Level 3 Foyer). Come and meet the exhibitors, and join your fellow attendees for a few minutes of networking and discussion. The schedule is as follows:

### Monday

July 16, 2018 10:00 AM and 2:30 PM

### Tuesday

July 17, 2018 10:00 AM and 2:30 PM

### Wednesday

July 18, 2018 10:00 AM and 3:00 PM

### Thursday

July 19, 2018 10:00 AM

## EMERGENCY INFORMATION

In the event of an emergency, please dial 0 (zero) on any hotel phone to connect with the hotel emergency hotline. The hotel will communicate with the local authorities.

## EXHIBITS INFORMATION

**Location:** Level 3 Foyer – Le Centre Sheraton Hotel

### Monday

July 16, 2018 8:00 AM – 5:00 PM

### Tuesday

July 17, 2018 8:00 AM – 5:00 PM

### Wednesday

July 18, 2018 8:00 AM – 5:00 PM

## MEMBERSHIP TO ASME (ONE-YEAR FREE)

Registrants who paid the non-member conference registration fees will receive a complimentary one-year ASME Membership. ASME will automatically activate this complimentary membership for qualified attendees. Please allow approximately four weeks after the conclusion of the conference for your membership to become active. Visit [www.asme.org/membership](http://www.asme.org/membership) for more information about the benefits of ASME Membership.

## PRESENTER ATTENDANCE POLICY

According to ASME's Presenter Attendance Policy, if a paper is not presented at the conference, the paper will not be published in the official Archival Proceedings, which are registered with the Library of Congress and are abstracted and indexed. The paper also will not be published in the ASME Digital Collection and may not be cited as a published paper.

# Schedule at a Glance

## SUNDAY, JULY 15

TIME	SESSION #	EVENT	LOCATION
8:30AM - 5:30PM		Registration	Ballroom Foyer, Level 4
8:00AM - 8:00PM		Committee Meetings	Suite 701 & 716, Level 7
1:00PM - 5:00PM		<b>Workshop on Radial and Axial Fan Design</b> by Philipp Epple	Hemon, Level A
6:00PM - 8:00PM		Welcome Reception	Ballroom East and Ballroom Foyer, Level 4

## MONDAY, JULY 16

TIME	SESSION #	EVENT	LOCATION
7:30AM - 5:30PM		Registration	Ballroom Foyer, Level 4
8:00AM - 5:00PM		Exhibits	Foyer, Level 3
8:00AM - 8:30AM		Breakfast	Ballroom Centre, Level 4
8:00AM - 10:00PM		Committee Meetings	Salon 4 and 6, Level 2 and Level 3
<b>8:30AM - 10:00AM</b>		<b>Plenary Sessions</b>	<b>Ballroom West, Level 4</b>
		<b>Fluid Mechanics of Geological Sequestration of Carbon Dioxide</b> by Ramesh K. Agarwal, <i>Washington University in St. Louis, United States</i>	
10:00AM - 10:15AM		Coffee Break	Foyer, Level 3
<b>10:15AM - 12:00PM</b>		<b>Technical Sessions</b>	
	1-2-1	Boundary Layer Flows	Salon Drummond West, Level 3
	1-4-1	Turbulent Flows -I	Salon Drummond Centre, Level 3
	1-5-1	Bio-Inspired Fluid Mechanics I	Salon Drummond East, Level 3
	2-1-1	Single Phase Applications	Salon 1, Level 2
	2-3-1	Fluid-Structure Interaction I	Salon 3, Level 2
	3-1-1	Pumps 1	Salon 7, Level 3
	5-1-1	Experimental and Multiscale Methods for Multiphase Flows	Salon 5, Level 4
	6-1-1	Micro/nano-fluidics I	Ballroom East, Level 4
12:00PM - 1:15PM		FED Towne Hall Assembly	Salon 6, Level 3
<b>1:15PM - 2:30PM</b>		<b>Plenary Session</b>	<b>Ballroom West, Level 4</b>
		<b>Liquid/Liquid Slug Flow and Mass Transport in a Micro-Capillary Reactor - Simulation and Experiment</b> by Peter Ehrhard, <i>Dortmund University of Technology, Germany</i>	
2:30PM - 2:45PM		Coffee Break	Foyer, Level 3
<b>2:45PM - 4:30PM</b>		<b>Technical Sessions</b>	
	1-2-2	High-Speed Flows	Salon Drummond West, Level 3
	1-4-2	Turbulent Flows II	Salon Drummond Centre, Level 3
	1-5-2	Bio-Inspired Fluid Mechanics II	Salon Drummond East, Level 3
	2-1-2	Heat and Mass Transfer	Salon 1, Level 2
	2-3-2	Fluid-Structure Interaction II	Salon 3, Level 2
	3-1-2	Pumps 2	Salon 7, Level 3
	5-1-2	Numerical Methods for Multiphase Flows	Salon 5, Level 4
	6-1-2	Micro/nano-fluidics II	Ballroom East, Level 4

## TUESDAY, JULY 17

TIME	SESSION #	EVENT	LOCATION
7:30AM - 5:30PM		Registration	Ballroom Foyer, Level 4
8:00AM - 5:00PM		Exhibits	Foyer, Level 3
8:00AM - 8:30AM		Breakfast	Ballroom Centre, Level 4
<b>8:30AM - 10:00AM</b>		<b>Plenary Session</b>	<b>Ballroom West, Level 4</b>
		<b>Scaling Analyses for Complex Systems</b> by Upendra Singh Rohatgi, <i>Brookhaven National Laboratory, United States</i>	
10:00AM - 10:15AM		Coffee Break	Foyer, Level 3
<b>10:15AM - 12:00PM</b>		<b>Technical Sessions</b>	
	1-3-1	Vortex Dynamics I	Salon Drummond West, Level 3
	1-4-3	Turbulent Flows III	Salon Drummond Centre, Level 3
	1-6-1	Active Flow Control I	Salon Drummond East, Level 3
	2-1-3	Applications	Salon 1, Level 2
	3-2-1	Fundamental Investigations of Industrial Flows	Salon 3, Level 2
	3-1-3	Pumps 3	Salon 7, Level 3
	5-2-1	Cavitation	Salon 5, Level 4
	6-1-3	Micro/nano-fluidics III	Ballroom East, Level 4
<b>1:15PM - 2:30PM</b>		<b>Plenary Session</b>	<b>Ballroom West, Level 4</b>
		<b>Flow Instability and Coherent Structures in Complex Channels</b> by Stavros Tavoularis, <i>University of Ottawa, Canada</i>	
2:30PM - 2:45PM		Coffee Break	Foyer, Level 3
<b>2:45PM - 4:30PM</b>		<b>Technical Sessions</b>	
	1-3-2	Vortex Dynamics II	Salon Drummond West, Level 3
	1-4-4	Turbulent Flows IV	Salon Drummond Centre, Level 3
	1-6-2	Active Flow Control II	Salon Drummond East, Level 3
	2-1-4	Novel Developments and High Performance Computing	Salon 1, Level 2
	3-2-2	Sprays, Propulsion, and Thrust	Salon 3, Level 2
	3-1-4	Pumps 4	Salon 7, Level 2
	5-2-2	Phase Change	Salon 5, Level 2
	6-1-4	Micro/nano-fluidics IV	Ballroom East, Level 4
6:30PM - 9:00PM		Award Dinner - Ticketed Event	Ballroom Centre, Level 4

# Schedule at a Glance

## WEDNESDAY, JULY 18

TIME	SESSION #	EVENT	LOCATION
7:30AM - 4:30PM		Registration	Ballroom Foyer, Level 4
8:00AM - 5:00PM		Exhibits	Foyer, Level 3
8:00AM - 8:30AM		Breakfast	Ballroom Centre, Level 4
<b>8:30AM - 10:00AM</b>		<b>Plenary Session</b>	<b>Ballroom West, Level 4</b>
		<b>Using Guidewire-Mediated Shock Waves to Revascularize Chronic Total Occlusions</b> by Martin Brouillette, <i>Université de Sherbrooke, Canada</i>	
10:00AM - 10:15AM		Coffee Break	Foyer, Level 3
<b>10:15AM - 12:00PM</b>		<b>Technical Sessions</b>	
	1-1-1	Fluids Engineering Education	Salon Drummond West, Level 3
	1-4-5	Turbulent Flows V	Salon Drummond Centre, Level 3
	2-2-1	LES/DNS I	Salon Drummond East, Level 3
	2-1-5	Multiphase Applications	Salon 1, Level 2
	3-2-3	Interaction of Flows with Structures	Salon 3, Level 2
	3-1-5	Hydraulic Turbines	Salon 7, Level 3
	5-3-1	Gas-Liquid Flows	Salon 5, Level 4
	5-5-1	Bubble, Droplet, and Aerosol Dynamics I	Ballroom East, Level 4
<b>1:15PM - 3:00PM</b>		<b>Technical Sessions</b>	
	1-7-1	Transport Phenomena in Energy Conversion and Mixing	Salon Drummond West, Level 3
	4-1-1	Fluid Measurement and Instrumentation I	Salon Drummond Centre, Level 3
	2-2-2	LES/DNS II	Salon Drummond East, Level 3
	2-1-6	Automated Design Optimization and Machine Learning	Salon 1, Level 2
	3-2-4	Particles and Solids Transport	Salon 3, Level 2
	3-1-6	Gas Turbines and Compressors	Salon 7, Level 3
	5-3-2	Gas-Solid Flows	Salon 5, Level 4
	5-5-2	Bubble, Droplet, and Aerosol Dynamics II	Ballroom East, Level 4
3:00PM - 3:15PM		Coffee Break	Foyer, Level 3
<b>3:15PM - 5:00PM</b>		<b>Technical Sessions</b>	
	4-2-1	Fluid Dynamics of Wind Energy	Salon Drummond West, Level 3
	4-1-2	Fluid Measurement and Instrumentation II	Salon Drummond Centre, Level 3
	2-2-3	Hybrid LES/RANS Methods and Applications	Salon Drummond East, Level 3
	2-1-7	Computational Marine Hydrodynamics	Salon 1, Level 2
	3-2-5	Industrial and Atmospheric Flows	Salon 3, Level 2
	3-1-7	Extra Fluid Machinery 1	Salon 7, Level 3
	5-3-3	Liquid-Solid Flows	Salon 5, Level 4
	5-6-1	Erosion, Slurry, and Sedimentation I	Ballroom East, Level 4

## THURSDAY, JULY 19

TIME	SESSION #	EVENT	LOCATION
7:30AM - 10:00AM		Registration	Ballroom Foyer, Level 4
8:00AM - 8:15AM		Refreshments	Foyer, Level 3
<b>8:15AM - 10:00AM</b>		<b>Technical Sessions</b>	
	4-1-3	Fluid Measurement and Instrumentation III	Salon Drummond West, Level 3
	2-1-8	Computational Turbulent Combustion	Salon Drummond Centre, Level 3
	3-2-6	Flow around Bluff Bodies	Salon Drummond East, Level 3
	3-1-8	Extra Fluid Machinery II	Salon 1, Level 2
	5-4-1	Performance of Multiphase Flow Systems	Salon 3, Level 2
	5-6-2	Erosion, Slurry, and Sedimentation II	Salon 7, Level 3
10:00AM - 10:15AM		Coffee Break	Foyer, Level 3
<b>10:15AM - 12:00PM</b>		<b>Technical Sessions</b>	
	4-1-4	Fluid Measurement and Instrumentation IV	Salon Drummond West, Level 3
	3-1-9	Turbomachinery Optimization	Salon Drummond Centre, Level 3

## SESSION P-1

MONDAY JULY 16, 2018 • 8:30AM - 10:00AM  
BALLROOM WEST, LEVEL 4



**Professor Ramesh K. Agarwal**

Department of Mechanical Engineering and Materials Science, Washington University in St. Louis, United States

### Fluid Mechanics of Geological Sequestration of Carbon Dioxide

**Summary:** The lecture will begin by describing the need for Geological Carbon Sequestration (GCS) and current GCS practice in US and Worldwide. It will then describe the basic mechanisms for trapping CO<sub>2</sub> in Saline aquifers and their spatial and temporal scales of sequestration. It will be followed by the presentation of analytical and numerical modeling of underground multiphase flow including the models of relative permeability and capillary pressure for the geological formation. Various CO<sub>2</sub> injection strategies will be discussed including their optimization for maximum CO<sub>2</sub> storage and minimum plume migration. Finally, the simulations will be presented for model benchmark problems followed by the simulations of pilot and industrial scale GCS projects. The talk will be concluded by offering perspective on opportunities, challenges and future directions.

**Biography:** Ramesh Agarwal received B.S. in Mechanical Engineering from Indian Institute of Technology, Kharagpur, India in 1968, M.S. in Aeronautical Engineering from the University of Minnesota in 1969, and PhD in Aeronautical Sciences from Stanford University in 1975. Prior to joining the faculty at Washington University in 2001 as William Palm Professor of Engineering, he was the Chair of the Aerospace Engineering Department at Wichita State University from 1994 to 1996 and the Executive Director of National Institute for Aviation Research from 1996 to 2001. From 1994 to 2001, he was also the Bloomfield Distinguished Professor at Wichita State University. From 1978 to 1994, Professor Agarwal worked in various scientific and managerial positions at McDonnell Douglas Research Laboratories in St. Louis. He became the Program Director and McDonnell Douglas Fellow in 1990. From 1976 to 1978, Professor Agarwal was a researcher for the National Research Council at NASA Ames Research Center. Professor Agarwal has received many honors and awards for his research and educational contributions. In 2017, American Society of Mechanical Engineers awarded him the Honorary Membership. In 2015, the American Society for Engineering Education (ASEE) awarded him the Isadore T. Davis Award and the Archie Higdon Distinguished Mechanics Educator Award. In 2015, Professor Agarwal received an Honorary Fellowship from the Royal Aeronautical Society, the Reed Aeronautics Award from the American Institute of Aeronautics and Astronautics (AIAA) and the International Medal of Honor from the Society of Automotive Engineers (SAE). He is a Fellow of ASME, AIAA, SAE, ASEE, IEEE, American Physical Society and American Association for Advancement of Science.

## SESSION P-2

MONDAY JULY 16, 2018 • 1:15 PM – 2:30 PM  
BALLROOM WEST, LEVEL 4



**Peter Ehrhard**

Fluid Mechanics. Biochemical & Chemical Engineering, Dortmund University of Technology, Germany

### Liquid/Liquid Slug Flow and Mass Transport in a Micro-Capillary Reactor - Simulation and Experiment

**Summary:** The mass transport in multiphase systems has wide applications in Chemical Engineering, e.g. in reactors or extraction operations. Particularly with regard to the mass transport, liquid-liquid systems have a specific significance, since the mass transport across the interface is often governed by the properties of both liquid phases – this may be termed a conjugate problem. Here, numerical simulations allow for a detailed investigation of the mass transport, while experimental approaches remain usually restricted to integral information. In the present investigations, an extraction process is numerically simulated and the results are compared to integral data from experiments. The process is performed in a micro-capillary reactor, consisting of a slug generator, a straight circular pipe to achieve sufficient residence time, and a phase separator. The numerical model captures all fields of a single (periodic) element of the slug flow. For this, a stationary interface is imported from two-phase level-set computations of the flow and used to generate numerical grids fitted to the interface from both sides. An explicit coupling of the computational domains of both phases at the interface, finally, allows for the simulation of both the hydrodynamic and the concentration fields. This numerical treatment has been validated against analytical reference cases, it is valid for small concentrations of the dissolved species. For the experimental validation, a standard extraction system is utilized. The rate of extraction is measured for varied volumetric flow rate for eight different lengths of the circular pipe, i.e. for eight different mean residence times. Hereby, the effect of the slug generator and the phase separator are both inherently present in the experimental data. Through the comparison of simulation and experiment, e.g. the progress of the extraction along the pipe and the effect of the slug generator can be extracted and validated.

#### Biography (short):

- Diploma in Mechanical Engineering, University of Karlsruhe, 1984;
- Ph.D., Fluid Mechanics, Mechanical Engineering, University of Karlsruhe, 1988;
- Postdoc, Engineering Sciences & Applied Mathematics, Northwestern University, Evanston, 1988-1989;
- Habilitation, Fluid Mechanics, Mechanical Engineering, University of Karlsruhe, 1995;
- Professor for Fluid Mechanics, Mechanical Engineering, University of Karlsruhe, 2002;
- Full Professor for Fluid Mechanics, Dortmund University of Technology, 2006;
- Mary Shepard B. Upson Visiting Professor, Chemical & Biomolecular Engineering, Cornell University, Ithaca, SS 2012

## SESSION P-3

TUESDAY JULY 17, 2018 • 8:30 AM – 10:00 AM  
BALLROOM WEST, LEVEL 4



**Upendra Singh Rohatgi**  
Brookhaven National Laboratory, United States

### Scaling Analyses for Complex Systems

**Summary:** Scaling analyses has been used in many fields such as finance, psychology, engineering, biology, data mining etc. Basic idea is to develop relationship between various variables, extrapolate to larger set to make predictions and validate extrapolation. Scaling analyses for thermal hydraulics systems is different due to complexity and is a process to identify non-dimensional groups representing relevant phenomena governing the flows. This is a necessary first step in identifying and ranking important phenomena needed to assess similitude and distortions. Scaling analyses provides a systematic method of prioritizing analytical model development and supporting relevant experimental program for specific applications. Scaling considerations are easier for simple systems with few phenomena. However, the complex systems need a systematic approach such as hierarchical two step (H2S) method or fractional scaling analyses (FSA). Complexity of a system comes from geometry, transient behavior and type of fluid that is a single phase or two phases, steady state or transient. There are examples from aerodynamics, turbomachinery, and nuclear reactors where scaling analyses has been extensively used. Examples of applications for simple and complex systems will be provided to illustrate the methods.

**Biography:** Dr. Upendra Rohatgi is on scientific staff of Brookhaven National Laboratory since 1975 and is currently a senior scientist. He received his bachelor of technology degree from Indian Institute of Technology, Kanpur in 1970 and his Ph.D. from Case Western Reserve University, Cleveland, both in Mechanical Engineering. He has contributed to Fluids Engineering in the areas of pumps for aircraft fuel system and nuclear reactors, nuclear reactor system, enhanced heat transfer for li-ion batteries for automobile application, and development of fluidized bed furnaces. He served as chair of Fluids Engineering Division and has also served as technical associate editor for the Journal of Fluids Engineering for three years. He taught graduate level courses in Fluid Mechanics and Heat transfer at State University of New York in Stony Brook. He has been contributing to US Nuclear Regulatory Commission programs for thermal-hydraulic code development, validation, scaling methods and uncertainty analyses for different scenarios for PWR and BWR since 1975. He has consulted with AECL and OPG Canada for uncertainty methods for CANDU transient analyses. In addition, he is leading a task force for developing guidelines for multi-physics code validation and uncertainty methods for NEA-OECD expert group. He is currently a thermal-hydraulic consultant to Advisory Committee for Reactor Safeguards of USNRC. He has authored over 100 papers. He has chaired two NASA Scientific Review Panels for Microgravity Experiments in shuttle, 1997 and in Space Station-Mir 2013.

## SESSION P-4

TUESDAY JULY 17, 2018 • 1:15 PM – 2:30 PM  
BALLROOM WEST, LEVEL 4



**Stavros Tavoularis**  
Department of Mechanical Engineering, University of  
Ottawa, Canada

### Flow Instability and Coherent Structures in Complex Channels

**Summary:** Flows in channels with complex cross sections occur in many important technological and biological systems. Examples include oil-drilling wells, nuclear reactor fuel channels, inundated rivers, trains passing through tunnels, fuel cells and catheterized arteries. Such flows are susceptible to complexity that is absent from flows in tubes or other simple channels. Spanwise velocity profiles that contain inflection points are vulnerable to inviscid instability, which may generate vortex streets and result in early transition to turbulence. A recent global stability analysis has demonstrated that this type of instability, referred to as gap instability, is present in annular channels with very small eccentricity at Reynolds numbers that are much smaller than critical values in concentric channels. Early experimental observations of such phenomena could not be reproduced with the use of conventional steady-state turbulence models, but time-dependent turbulence modelling (URANS and LES) has produced fairly realistic simulations of both the instability process and the vortex street formation. In many applications, these phenomena have beneficial consequences, including drag reduction, intense mixing and improved heat and mass transfer.

**Biography:** Following doctoral studies and a research appointment at The Johns Hopkins University, Professor Stavros Tavoularis has, since 1980, been a member of the Department of Mechanical Engineering at the University of Ottawa, where he served terms as Department Chair, Director of the Ottawa-Carleton Institute for Mechanical and Aerospace Engineering and Interim Vice Dean, Research. He is Director of the uOttawa Fluid Mechanics Laboratory, supervising a large team of researchers on turbulence, turbulent mixing, vortex dynamics, aerodynamics, nuclear reactor thermalhydraulics, cardiovascular mechanics and design of flow apparatus and instrumentation. He has initiated fundamental and applied research projects supported by grants and contracts from NSERC, MRC, NRC, DND, EMR, AECL (CNL), NRCAN, UNENE, CNSC, Pratt and Whitney Canada and others and has served as a consultant to government and industry. Professor Tavoularis has been elected as a Fellow of the Canadian Academy of Engineering, a Fellow of the Engineering Institute of Canada, a Fellow of the Canadian Society for Mechanical Engineering and a Fellow of the American Physical Society and is a recipient of the George S. Glinski Award for Excellence in Research and the 2017 Medal of the Canadian Congress for Applied Mechanics. He is the author of the graduate textbook Measurement in Fluid Mechanics, published by Cambridge University Press, and numerous research articles and reports.

## SESSION P-5

WEDNESDAY JULY 18, 2018 • 8:30 AM – 10:00 AM

BALLROOM WEST, LEVEL 4

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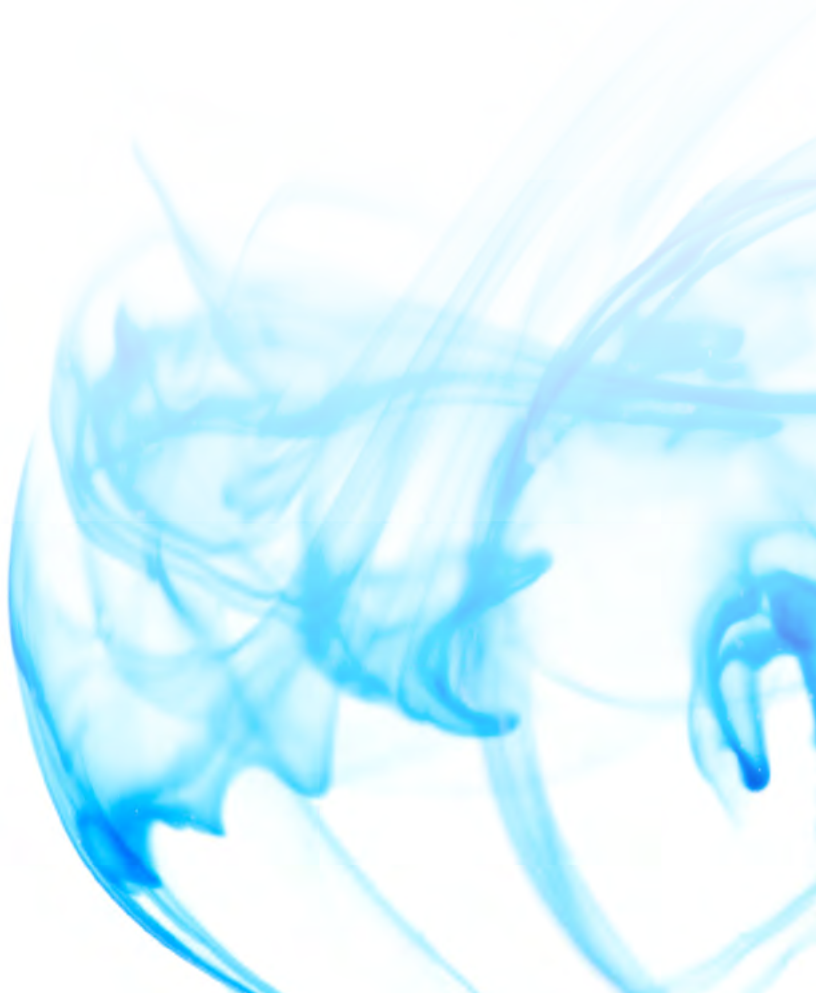
**Martin Brouillette**

Department of Mechanical Engineering, Université de Sherbrooke, Canada

### **Using Guidewire-Mediated Shock Waves to Revascularize Chronic Total Occlusions**

**Summary:** Cardiovascular disease is the leading cause of death worldwide. This disease includes chronic total occlusions (CTOs), which are complete blockages of an artery. Unlike partial occlusions, CTOs are difficult to cross percutaneously using conventional guidewires (thin and flexible wires) because of the fibrotic and calcified nature of the blockage. We report on the design and testing of a new minimally-invasive device used to cross CTOs in the coronary and peripheral vasculature. The device is based on a novel shock wave generator which exploits inverse dispersion in solid waveguides to amplify the signal of broadband piezoelectric ultrasound transducers to produce high-amplitude (~500 Bars) and short duration (~1 microsecond) pressure pulses. These pulses are then propagated into small (~0.35 mm) non-dispersive waveguides, which have the same dimensions and properties as conventional cardiology guidewires, for percutaneous introduction into the vascular system. The distal tip of the non-dispersive waveguide is then placed in contact with the occlusion where the arrival of the shock waves locally erodes the hard calcified components of the CTO, enabling the waveguide to progress across the lesion. The presentation will describe in detail the novel shock wave generator and mechanism of action and present some of the pre-clinical and clinical results with the device on surrogates, ex-vivo arteries, live animals and humans.

**Biography:** Martin Brouillette holds a B. Eng. from McGill University and a Ph.D. in Aeronautics from Caltech. Currently, he is Professor of Mechanical Engineering at the Université de Sherbrooke and the Head of the Shock Wave Research Laboratory. Professor Brouillette is the originator of several technology development projects in bio-engineering and micro-engineering, based on gas dynamics and shock wave physics. He is the holder of numerous patents for biomedical devices and sensor systems for biological and engineering applications, and has been one of the creators of three start-ups exploiting these technologies. In particular, he is the Founder and Chief Technical Officer of SoundBite Medical Solutions Inc.



## THE FLUIDS ENGINEERING AWARD

The Fluids Engineering Award is the most prestigious award conferred by ASME upon an individual in the field. It recognizes an individual for his or her outstanding contributions to the engineering profession over a period of years and, in particular, to the field of Fluids Engineering through research, practice or teaching.

**Winner:** Upendra Singh Rohatgi (Brookhaven National Laboratory)

## FREEMAN SCHOLAR AWARD

The Freeman Scholar Award is offered to a person of outstanding ability who is selected to review a major technical area of Fluids Engineering and author a review article in the Journal of Fluids Engineering.

**Winner:** Ramesh K. Agarwal (Washington University in St. Louis)

## LEWIS F. MOODY BEST PAPER AWARD

The Lewis F. Moody Award is presented for the most outstanding original paper dealing with the practice of Fluids Engineering.

**Paper:** "Modeling Sealing in Transient Injector Simulations"

**Authors:** Chinmoy Mohapatra, Gabriel Jacobsohn, Eli Baldwin, and David Schmidt (University of Massachusetts, Amherst)

## ROBERT T. KNAPP AWARD

The Robert T. Knapp Award is presented for the outstanding original paper resulting directly from analytical or laboratory research.

**Paper:** "Hybrid Eulerian Eulerian Discrete Phase Model of Turbulent Bubbly Flow"

**Authors:** Hyunjin Yang, Surya. P. Vanka (University of Illinois at Urbana-Champaign), and Brian G. Thomas (Colorado School of Mines)

# Technical Sessions

MONDAY, JULY 16

## 1 FLUID MECHANICS (FMTC)

### 1-2 BOUNDARY LAYER AND HIGH-SPEED FLOWS

#### 1-2-1 BOUNDARY LAYER FLOWS

##### SALON DRUMMOND WEST/OUEST

**Stefan aus der Wiesche**, *University of Applied Sciences Muenster, Steinfurt, Germany*

#### Optimization of Piece-Wise Conical Nozzles: Theory and Application

Technical Paper Publication. FEDSM2018-83055

**Karsten Hasselmann, Muhammad Aiman Bin Khamalrudin, Stefan aus der Wiesche**, *University of Applied Sciences Muenster, Steinfurt, Germany*, **Eugeniy Y. Kenig**, *University of Paderborn, Paderborn, Germany*

#### Experimental study of flow around a rotating sphere at a moderate Reynolds number

Technical Paper Publication. FEDSM2018-83325

**Zhuoyue Li, Nan Gao**, *Dalian University of Technology, Dalia, China*

#### Channel Flow of Herschel-Bulkley Fluid past a Vertical Wall

Technical Paper Publication. FEDSM2018-83329

**Nariman Ashrafi**, *UWO*, **Ali Sadeghi, Mehdi Shafahi**, *Srb-lau, Tehran, Iran*

#### Exact Solution of Unsteady Two-Dimensional Couette Flow with Time-Dependent Movement of Upper Plate

Technical Paper Publication. FEDSM2018-83394

**Asghar Rahimi**, *Ferdowsi University of Mashhad, Mashhad, Iran*

#### Wind Flow Characteristics of a Model Downburst

Technical Paper Publication. FEDSM2018-83443

**Junayed Chowdhury, Jubayer Chowdhury, Dan Parvu, Mohammad Karami, Horia Hangan**, *Western University - Windeee Research Institute, London, ON, Canada*

### 1-4 TURBULENT FLOWS

#### 1-4-1 TURBULENT FLOWS I

##### SALON DRUMMOND CENTRE

**Kamran Siddiqui**, *University of Western Ontario, London, ON, Canada*

#### Perforated-Plate Turbulence: Orifice versus Converging Nozzle

Technical Paper Publication. FEDSM2018-83038

**Yang Yang, David Ting**, *University of Windsor, Windsor, ON, Canada*, **Steve Ray**, *Essex Energy, Oldcastle, ON, Canada*

#### Vortex Identification Study of a Turbulent Cavity Flow

Technical Paper Publication. FEDSM2018-83048

**Khaled J. Hammad**, *Central Connecticut State University, Simsbury, CT, United States*

#### Multi-objective Optimization on Inlet Pipe of a Vertical Inline Pump Based on Genetic Algorithm and Artificial Neural Network

Technical Paper Publication. FEDSM2018-83053

**Xingcheng Gan, Ji Pei, Shouqi Yuan, Wenjie Wang, Yajing Tang**, *Jiangsu University, Zhenjiang, Jiangsu, China*

#### Governing Parameters of Adverse Pressure Gradient Turbulent Boundary Layers

Technical Paper Publication. FEDSM2018-83110

**Yvan Maciel**, *Laval University Quebec City, QC, Canada*, **Tie Wei**, *New Mexico Institute of Mining and Technology, Socorro, NM, United States*, **Ayse G. Gungor**, *Istanbul Technical University, Istanbul, Turkey*, **Mark P. Simens**, *Universidad Politecnica de Madrid, Madrid, Spain*

#### Turbulent Flow Characteristics over Offset Wall Confined Columns in a Channel at Low Reynolds Numbers

Technical Paper Publication. FEDSM2018-83519

**Kira Toxopeus, Kamran Siddiqui**, *University of Western Ontario, London, ON, Canada*

10:15AM - 12:00PM

MONDAY, JULY 16

## 1 FLUID MECHANICS (FMTC)

### 1-5 BIO-INSPIRED FLUID MECHANICS

#### 1-5-1 BIO-INSPIRED FLUID MECHANICS I

##### SALON DRUMMOND EAST

Javid Bayandor, *The State University of New York, Buffalo, NY, United States*

#### The Effects of Wakes on Aerodynamic Characteristics of Flapping Wings in Clap-And-Fling Motion At $Re$ of $\sim 10^4$

Technical Paper Publication. FEDSM2018-83112

Jong-Seob Han, Jae-Hung Han, *KAIST, Daejeon, Korea (Republic)*

#### Computational Analysis on Aerodynamics and Vortex Formation of Sleep Apnea

Technical Paper Publication. FEDSM2018-83257

Junshi Wang, Pan Han, Yaselly V. Sanchez, Haibo Dong, *University of Virginia, Charlottesville, VA, United States*, Jinxiang Xi, *California Baptist University, Riverside, CA, United States*

#### Kinematics and Hydrodynamics of Invertebrate Undulatory Swimming

Technical Paper Publication. FEDSM2018-83259

Jianghong Tian, *Eastern Mennonite University, Harrisonburg, VA, United States*, Pan Han, Xiaolong Deng, Royce E. Lin-dengren, Geng Liu, Yan Ren, Haibo Dong, *University of Virginia, Charlottesville, VA, United States*

#### Physics-Based Analysis of Pulse Synchronous Tinnitus

Technical Paper Publication. FEDSM2018-83275

Justin M. Hyde, Xuanming Zhao, Junshi Wang, Pan Han, Haibo Dong, Bradley W. Kesser, *University of Virginia Health System, Charlottesville, VA, United States*

#### Numerical Simulation of Airflow and ellipsoidal Particle Deposition in Human Upper Respiratory Tract

Technical Paper Publication. FEDSM2018-83380

Morteza Kiasadegh, Omid Abouali, Homayoun Emdad, *Shiraz University, Shiraz, Fars, Iran*, Goodarz Ahmadi, *Clarkson University, Potsdam, NY, United States*

## 2 COMPUTATIONAL FLUID DYNAMICS (CFDTC)

### 2-1 SYMPOSIUM ON DEVELOPMENT AND APPLICATIONS IN COMPUTATIONAL FLUID DYNAMICS

#### 2-1-1 SINGLE PHASE APPLICATIONS

##### SALON 1

Ning Zhang, *McNeese State University, Lake Charles, LA, United States*

#### Numerical Investigations of Flow past a Rotating Stepped Cylinder

Technical Paper Publication. FEDSM2018-83018

Jamei Shin, Ryan Ferris, *CEERS/CSULB, Long Beach, CA, United States*, Hamid Rahai, *California St. University Long Beach, CA, United States*, Shahab Taherian, *CSULB, Los Angeles, CA, United States*

#### RANS Modelling of a Swirling Flow Interacting With a Conical Bluff Body

Technical Paper Publication. FEDSM2018-83065

Jinli Song, Nabil Kharoua, Lyes Khezzer, Mohamed Alshehhi, *Khalifa University of Science and Technology, Abu Dhabi, United Arab Emirates*

#### Numerical Study on the Performance of a Centrifugal Impeller with Self-Adaptive Casing Treatment

Technical Paper Publication. FEDSM2018-83132

Mingqiang Gong, Jianqiang Deng, *Xi'an Jiaotong University, Xi'an, Shaanxi, China*, Haisheng Chen, Yujie Xu, *Institute of Engineering Thermophysics, Chinese Academy of Sciences, Beijing, China*

#### Numerical Analysis of the Turbulent Flow Characteristics around Submerged Permeable Breakwaters

Technical Paper Publication. FEDSM2018-83155

William Foltz, Ning Zhang, *McNeese State University, Lake Charles, LA, United States*

#### Numerical Analysis of Lateral Skirts Performance on Drag Force of A Semi-Trailer Truck

Technical Paper Publication. FEDSM2018-83457

Mohamed Lateb, Hachimi Fellouah, *Université de Sherbrooke, Sherbrooke, QC, Canada*

10:15AM - 12:00PM

# Technical Sessions

MONDAY, JULY 16

## 2 COMPUTATIONAL FLUID DYNAMICS (CFDTC)

### 2-3 SYMPOSIUM ON FLUID STRUCTURE INTERACTION

#### 2-3-1 FLUID-STRUCTURE INTERACTION I

#### SALON 3

Cristoph Brandstetter, *EC-lyon, Lyon, France*

#### A New Immersed Boundary Method with Level Set Based Geometry Representation and Volume Fraction Based Body Force Calculation

Technical Paper Publication. FEDSM2018-83011

*Guangfa Yao, Numersolution, LLC, Mason, OH, United States*

#### A Method for Tracking a Solid Body in a Fluid Field in Immersed Boundary Methods

Technical Paper Publication. FEDSM2018-83012

*Guangfa Yao, Numersolution, LLC, Mason, OH, United States*

#### Fluid-structure CFD simulation of Lactating Breast

Technical Paper Publication. FEDSM2018-83305

*Jamasp Azarnoosh, Fatemeh Hassanipour, University of Texas at Dallas, Richardson, TX, United States*

#### A Comprehensive Analysis of Compound Impactor Based on Mixed Flow Impeller Drive

Technical Presentation. FEDSM2018-83536

*Xiaosong Wen, Jun Li, Xueli Guo, China University of Petroleum Beijing, Beijing, China, Gonghui Liu, Chunqing Zha, Beijing University of Technology, Beijing, China*

#### Fluidization of Hailstone Due to High-Speed Impact onto Aircraft

Technical Presentation. FEDSM2018-83510

*Yangkun Song, Brandon Horton, Javid Bayandor, The State University of New York, Buffalo, NY, United States*

## 3 FLUID APPLICATIONS & SYSTEMS (FASTC)

### 3-1 30TH SYMPOSIUM ON FLUID MACHINERY

#### 3-1-1 PUMPS I

#### SALON 7

Hans Josef Dohmen, *University Duisburg Essen, Duisburg, Germany*

#### Experimental Study of Gas-Liquid Flow through a Multistage, Mixed-Flow Electric Submersible Pump

Technical Paper Publication. FEDSM2018-83032

*Marine Dupoiron, Schlumberger, Cambridge, United Kingdom*

#### Investigations on Flow Characteristics in Discharge Channel of Centrifugal Pump with Asymmetric Volute

Technical Paper Publication. FEDSM2018-83051

*Yandong Gu, Ji Pei, Shouqi Yuan, Jinfeng Zhang, Xingcheng Gan Jiangsu University, Zhenjiang, China, Ernst Nikolajew, Technical University of Kaiserslautern, Kaiserslautern, Germany*

#### Investigation of Unsteady Flow in a Submersible Tubular Pumping System

Technical Paper Publication. FEDSM2018-83062

*Yan Jin, Hongcheng Chen, Junxin Wu, Chao Liu, Yangzhou University, Yangzhou, China, David Ting, Jacqueline Stag-ner, University Of Windsor, Windsor, ON, Canada*

#### The Effects of the Inlet Guide Vanes on an Axial Pump under Off Design Points

Technical Paper Publication. FEDSM2018-83071

*Zhiwei Guo, Jingye Pan, Zhongdong Qian, Wuhan University, Wuhan, China*

#### Experimental and Numerical Study on Hydraulic Performances of a Turbopump with and without an Inducer

Technical Paper Publication. FEDSM2018-83506

*Yanxia Fu, Meng Fan, Jiangsu University, Zhenjiang, China, Giovanni Pace, Dario Valentini, Sitael S.P.A., Pisa, Italy, Angelo Pasini, Luca D'agostino, University of Pisa, Pisa, Italy*

10:15AM - 12:00PM

MONDAY, JULY 16

## 5 MULTIPHASE FLOW (MFTC)

### 5-1 EXPERIMENTAL, MULTISCALE, AND NUMERICAL METHODS FOR MULTIPHASE FLOWS

#### 5-1-1 EXPERIMENTAL AND MULTISCALE METHODS FOR MULTIPHASE FLOWS

##### SALON 5

*Joseph Katz, Johns Hopkins University, Baltimore, MD, United States, Yassin Hassan, Texas A&M University, College Station, TX, United States, Jules (Jay) Lindau, Applied Research Lab/ Penn State University, State College, PA, United States, Bertrand Rollin, Embry-Riddle Aeronautical University, Daytona Beach, FL, United States*

#### Simulating the Emptying of a Water Bottle with a Multi-scale Two-fluid Approach

Technical Paper Publication. FEDSM2018-83196

*Samuel Mer, Olivier Praud, Jacques Magnaudet, Veronique Roig, IMFT, Toulouse, France*

#### Measurement of Water Volume Fraction in Oil-Water Upward Flow by Using Microwave Cylindrical Resonant Cavity

Technical Paper Publication. FEDSM2018-83513

*Chao Yuan, Ying Xu, Tao Zhang, Tianjin University, Tianjin, China, Georgios Dimitrakis, Buddhika Hewakandamby, Ebiundu Komonibo, The University of Nottingham, Nottinghamshire, United Kingdom*

#### Flow Characteristics of Water Jets Discharging from Rectangular and Elliptical Injectors

Technical Paper Publication. FEDSM2018-83022

*Amin Jaber, Mehran Tadjfar, Amirkabir University of Technology, Tehran, Iran*

#### Experiments on the Injection of Elliptical Liquid Jets into a Low Speed Airflow

Technical Paper Publication. FEDSM2018-83157

*Yosef Rezaei, Mehran Tadjfar, Amirkabir University of Technology, Tehran, Iran*

#### Dispersion of Immiscible Liquids with a High Density Ratio in a Stirred Tank Reactor

Technical Presentation. FEDSM2018-83427

*Sarat Chandra Kuchibhatla, De-Wei Yin, James Pressler, Dow Chemical Company, Midland, MI, United States*

## 6 MICRO & NANO FLUID DYNAMICS (MNFDTC)

### 6-1 MICRO/NANO-FLUIDICS

#### 6-1-1 MICRO/NANO-FLUIDICS I

##### BALLROOM EAST

*Jeff Darabi, Southern Illinois University Edwardsville, Edwardsville, IL, United States, Shriram Jagannathan, ANSYS, Inc., Lebanon, NH, United States*

#### Numerical Study on Electrokinetic Flow through Periodically Modulated Polyelectrolyte Layer Coated Nanopore

Technical Paper Publication. FEDSM2018-83211

*Subrata Bera, National Institute of Technology Silchar, Silchar, Assam, India, Somnath Bhattacharyya, Indian Institute of Technology Kharagpur, Kharagpur, India*

#### Numerical Simulation of Dielectrophoretic Particle Separation

Technical Paper Publication. FEDSM2018-83413

*Bahareh Kazemi, Jeff Darabi, Southern Illinois University Edwardsville, Edwardsville, IL, United States*

#### Blood Flow and Mixing Analysis in Split-And-Recombine Micromixer with Offset Fluid Inlets

Technical Paper Publication. FEDSM2018-83468

*Afzal Husain, Farhan A. Khan, Nabeel Z. Al-Rawahi, Sultan Qaboos University, Muscat, Oman, Abdus Samad, IITM India, Chennai, India*

#### Computational Analysis of a Microfluidic Magnetophoretic Device for DNA Isolation

Technical Paper Publication. FEDSM2018-83482

*Colin Hale, Jeff Darabi, Southern Illinois University Edwardsville, Edwardsville, IL, United States*

#### Analysis of a Combined Electroosmotic-Pressure Driven Flow of Multi-Layer Immiscible Fluids in a Narrow Capillary

Technical Paper Publication. FEDSM2018-83117

*David A. Torres, Juan P. Escandon, SEPI-ESIME Azcapotzalco del Instituto Politécnico Nacional, Mexico, Mexico*

10:15AM - 12:00PM

# Technical Sessions

MONDAY, JULY 16

## 1 FLUID MECHANICS (FMTC)

### 1-2 BOUNDARY LAYER AND HIGH-SPEED FLOWS

#### 1-2-2 HIGH-SPEED FLOWS

#### SALON DRUMMOND WEST/OUEST

George Papadopoulos, *Innoveering, LLC, Ronkonkoma, NY, United States*

#### Mass Flow Performance for Large Aspect Ratio Supersonic Boundary Layer Bleed Holes

Technical Paper Publication. FEDSM2018-83052

George Papadopoulos, Gary Go, Frank Celentano, Robert Bakos, *Innoveering, LLC, Ronkonkoma, NY, United States*

#### The Mechanism of Three-Dimensional Steady Shock Wave Interactions

Technical Paper Publication. FEDSM2018-83023

Chun Wang, Ruixin Yang, Zonglin Jiang, *Institute of Mechanics, Chinese Academy of Sciences, Beijing, Beijing, China*

#### Numerical Investigation on Gas Radiation Heating of FIRE re-entry at Hyper-Velocity

Technical Paper Publication. FEDSM2018-83532

JunMing Lyu, WenBo Miao, XiaoLi Cheng, JiJun Yu, *China Academy of Aerospace Aerodynamics, Beijing, China*

#### Multi-Plane Characterization of the Turbulent Boundary Layer

Technical Paper Publication. FEDSM2018-83507

Kadeem Dennis, Kamran Siddiqui, *University of Western Ontario, London, ON, Canada*

### 1-4 TURBULENT FLOWS

#### 1-4-2 TURBULENT FLOWS II

#### SALON DRUMMOND CENTRE

David Ting, *University of Windsor, Windsor, ON, Canada*

#### Heat Transfer Enhancement with Delta Winglets Vortex Generator for Different Arrangement in a Circular Tube

Technical Paper Publication. FEDSM2018-83244

Md. Islam, Arif Nurizki, Abdul Kareem, Abdul Baba, *Petroleum Institute, Khalifa University of Science & Technology, Abu Dhabi, United Arab Emirates*

#### Effects of Offset Height on the Turbulent Characteristics of Rectangular Twin-Jets

Technical Paper Publication. FEDSM2018-83264

Chidiebere Nwaiwu, Mark F. Tachie, *University of Manitoba, Winnipeg, MB, Canada*, Martin Agelin-Chaab, *University of Ontario Institute of Technology, Oshawa, ON, Canada*

#### Nozzle Orientation Effects on the Turbulent Structure of Submerged Twin-Jets

Technical Paper Publication. FEDSM2018-83269

Chidiebere Nwaiwu, Mark F. Tachie, *University of Manitoba, Winnipeg, MB, Canada*, Martin Agelin-Chaab, *University of Ontario Inst of Technology, Oshawa, ON, Canada*

#### Coherent Structures and Correlation Fields in the Mixing Transition of a Turbulent Round Free Jet

Technical Paper Publication. FEDSM2018-83280

Benedikt Krohn, Sunming Qin, Victor Petrov, Annalisa Manera, *University of Michigan Ann Arbor, Ann Arbor, MI, United States*

#### Dynamic Zero-Net Liquid Holdup (ZNLH) in Gas-Liquid Cylindrical Cyclones

Technical Presentation. FEDSM2018-83309

Megharaj Praneeth Karpurapu, Srinivas Swaroop Kolla, Ram Mohan, Ovadia Shoham, *The University of Tulsa, Tulsa, OK, United States*

2:45PM - 4:30PM

MONDAY, JULY 16

## 1 FLUID MECHANICS (FMTC)

### 1-5 BIO-INSPIRED FLUID MECHANICS

#### 1-5-2 BIO-INSPIRED FLUID MECHANICS II

##### SALON DRUMMOND EAST

Javid Bayandor, *The State University of New York, Buffalo, NY, United States*

#### Effects of Non-Newtonian Blood Flow on Coronary Artery Hemodynamics in a Cohort of Patients with Stenosed Artery

Technical Paper Publication. FEDSM2018-83381

*Mehrzad Shams, Majid Abbasian, Ziba Valizadeh, K.N.Toosi University of Technology, Tehran, Iran, Abouzar Moshfegh, Ashkan Javadzadegan, University of Sydney, Sydney, Australia*

#### Experimental Study on Modeled Caudal Fins Propelling by Elastic Deformation

Technical Paper Publication. FEDSM2018-83386

*Naomichi Baba, Shinnosuke Obi, Keio University, Yokohama, Japan*

#### Investigation on Loading-Induced Fluid Flow in Osteogenesis Imperfecta Bone

Technical Paper Publication. FEDSM2018-83496

*Nikhil V. Shrivastava, Abhishek K. Tiwari, Rakesh Kumar, Dharmendra Tripathi, Manipal University Jaipur, India, Vasu Raman Sharma, S.R.M. University Chennai, Chennai, NA, India*

#### Hemodynamics Characteristics of A Four-Way Right-Atrium Bypass Connector With An Optimized Central Diverter

Technical Paper Publication. FEDSM2018-83167

*Elizabeth Mack, Jakin Jagani, Alexandrina Untaroiu, Virginia Tech, Blacksburg, VA, United States*

#### Experimental Study of Large Scale Flow Structures in an Aneurysm

Technical Paper Publication. FEDSM2018-83531

*Paulo Yu, Vibhav Durgesh, California State University, Northridge, CA, United States*

#### Effect of Changes in Caudal Fin Geometry on Thrust Production during Thunniform Locomotion

Technical Presentation. FEDSM2018-83479

*Alexander Matta, UB, Buffalo, NY, United States, Javid Bayandor, The State University of New York, Buffalo, NY, United States*

## 2 COMPUTATIONAL FLUID DYNAMICS (CFDTC)

### 2-1 SYMPOSIUM ON DEVELOPMENT AND APPLICATIONS IN COMPUTATIONAL FLUID DYNAMICS

#### 2-1-2 HEAT AND MASS TRANSFER

##### SALON 1

Yassin Hassan, *Texas A&M University, College Station, TX, United States*

#### Effect of Cavitation Flow on Energy Conversion Characteristics of Nuclear Main Pump

Technical Paper Publication. FEDSM2018-83090

*Xiaorui Cheng, Lanzhou University of Technology, Lanzhou City, China*

#### Numerical and Experimental Analyses of Heat Transfer

Technical Paper Publication. FEDSM2018-83149

*Ning Zhang, Pankaj Chandra, Ryan Robledo, Sree Balijepalli, McNeese State University, Lake Charles, LA, United States*

#### Numerical Investigation of Impinging-film Heat Transfer and Flow Characteristics of Turbine Inner Casing

Technical Paper Publication. FEDSM2018-83206

*Fujuan Tong, Wenxuan Gou, Wenjing Gao, Lei Li, Zhufeng Yue, Northwestern Polytechnical University (Chang'an Cam-pus), Xi'an, China*

#### Calculation of Friction Factors and Nusselt Numbers for Twisted Elliptical Tube Heat Exchangers using Nek5000

Technical Paper Publication. FEDSM2018-83477

*Dillon Shaver, Elia Merzari, Argonne National Laboratory, Argonne, IL, United States, Lane B. Carasik, Nate Salpeter, Edward Blandford, Kairos Power LLC, Oakland, CA, United States*

#### Numerical Analysis of Thermal Effects Induced In the Hydrodynamics of the Heavy Oil Transport

Technical Paper Publication. FEDSM2018-83061

*Salvador Sanchez, Gabriel Ascanio. J. Pablo Aguayo, National Autonomous University of Mexico, Ciudad de México, Mexico, Felipe Sanchez-Minero, ESIQIE, National Polytechnic Institute of Mexico, Ciudad de Mexico, Mexico*

2:45PM - 4:30PM

# Technical Sessions

MONDAY, JULY 16

## 2 COMPUTATIONAL FLUID DYNAMICS (CFDTC)

### 2-3 SYMPOSIUM ON FLUID STRUCTURE INTERACTION

#### 2-3-2 FLUID-STRUCTURE INTERACTION II

#### SALON 3

*Joris Degroote, Ghent University, Ghent, Belgium*

#### Analysis of Transient Two-Phase Flow in Pressure Safety Valve Outlet Headers

Technical Paper Publication. FEDSM2018-83142

*Maral Taghva, AAU, Esbjerg, Denmark, Lars Damkilde, AAU, Aalborg, Denmark*

#### Fluid-Structure Interaction Simulations of Flexible Cylinders in Confined Axial Flow

Technical Paper Publication. FEDSM2018-83193

*Joris Degroote, Lucas Delcour, Laurent De Moerloose, Henri Dolfen, Jan Vierendeels, Ghent University, Ghent, Belgium*

#### A Comparison of Strong and Weak Coupling Schemes for Computational Aeroelasticity in OpenFOAM

Technical Paper Publication. FEDSM2018-83292

*Sabet Seraj, Amin Fereidooni, Anant Grewal, National Research Council Canada, Ottawa, ON, Canada*

#### Full-Scale Aircraft Ditching Prediction using a Fluid-structure Interactive Strategy

Technical Presentation. FEDSM2018-83527

*Brandon Horton, Yangkun Song, Javid Bayandor, The State University of New York, Buffalo, NY, United States*

## 3 FLUID APPLICATIONS & SYSTEMS (FASTC)

### 3-1 30TH SYMPOSIUM ON FLUID MACHINERY

#### 3-1-2 PUMPS II

#### SALON 7

*Shouqi Yuan, Jiangsu University, Zhenjiang, China*

#### Numerical Study on Transient Dynamics in a Centrifugal Pump Considering Clearance Flow

Technical Paper Publication. FEDSM2018-83525

*Chen-Xing Jiang, Xi Wang, Na-Xin Kang, Xiang-yuan Zhang, Zhi-Jun Shuai, Wan-You Li, Harbin Engineering University, Harbin, Heilongjiang, China*

#### Status Review for the Prediction Methods of the Radial Force Caused by a Centrifugal Pump or Volute during Off-Design-Point Operation

Technical Paper Publication. FEDSM2018-83017

*Mekuannint Messele, Abraham Engeda, Michigan State University, East Lansing, MI, United States*

#### Numerical Analysis of Tip Clearance Effects in an Unshrouded Impeller for Liquid Rocket Engines

Technical Paper Publication. FEDSM2018-83024

*Lucrezia Veggi, Mattia Reganaz, Julian D. Pauw, Oskar J. Haidn, Technical University of Munich, Garching bei München, Germany, Bernd Wagner, German Aerospace Center (DLR), Institute of Space Propulsion, Hardthausen, Germany*

#### CFD Simulations for Temperature Dependence Water Pump NPSH

Technical Paper Publication. FEDSM2018-83425

*Mikhail Strongin, Wilo-usa LLC, Rosemont, IL, United States*

#### Investigation of Interaction between Tip Leakage Flow Generated By Unshrouded Impeller and Diffuser Internal Flow

Technical Paper Publication. FEDSM2018-83502

*Asuma Ichinose, Norio Kimura, Mamiko Yoshimura, Tomoyuki Hayashi, Kazuyoshi Miyagawa, Waseda University, Tokyo, Japan*

2:45PM - 4:30PM

MONDAY, JULY 16

## 5 MULTIPHASE FLOW (MFTC)

### 5-1 EXPERIMENTAL, MULTISCALE, AND NUMERICAL METHODS FOR MULTIPHASE FLOWS

#### 5-1-2 NUMERICAL METHODS FOR MULTIPHASE FLOWS

#### SALON 5

**Marianne Francois**, *Los Alamos National Lab, Los Alamos, NM, United States*, **Francine Battaglia**, *University at Buffalo, Buffalo, NY, United States*

#### On Molecular Scale Boundary Conditions in Dynamic Wetting of an Ideal Surface

Technical Paper Publication. FEDSM2018-83074

**Hacene Si Hadj Mohand**, **Hai Hoang**, **Guillaume Galliero**, *Université de Pau et des Pays de l'Adour, Pau, France*, **Dominique Legendre**, *institut national polytechnique de Toulouse, Toulouse, France*

#### A Wall Film Model for Membrane Fouling

Technical Paper Publication. FEDSM2018-83298

**Sina Jahangiri Mamouri**, **Volodymyr V. Tarabara**, **Andre Benard**, *Michigan State University East Lansing, MI, United States*

#### Wetness Effect on Transonic Moist-Air Flow through A Compressor Rotor

Technical Paper Publication. FEDSM2018-83422

**Shota Moriguchi**, **Hironori Miyazawa**, **Takashi Furusawa**, **Satoru Yamamoto**, *Tohoku University, Sendai 980-8579, Japan*

#### Validation of a CFD Model Predicting the Effect of High Level Lateral Acceleration Sloshing on the Heat Transfer and Pressure Drop in a Small-Scale Tank in Normal Gravity

Technical Paper Publication. FEDSM2018-83113

**Olga Kartuzova**, *Case Western Reserve University, Cleveland, OH, United States*, **Mohammad Kassemi**, *NASA GRC/Case Western Reserve University, Solon, OH, United States*

#### Theoretical Analysis of CFD-DEM Mathematical Model Solution Change with Varying Computational Cell Size

Technical Paper Publication. FEDSM2018-83263

**Annette Volk**, **Urmila Ghia**, *University of Cincinnati, Cincinnati, OH, United States*

## 6 MICRO & NANO FLUID DYNAMICS (MNFDTC)

### 6-1 MICRO/NANO-FLUIDICS

#### 6-1-2 MICRO/NANO-FLUIDICS II

#### BALLROOM EAST

**Sang-Joon J. Lee**, *San Jose State University, San Jose, CA, United States*, **Asghar Rahimi**, *Ferdowsi University of Mashhad, Mashhad, Iran*

#### Utilization of Machine Learning To Predict the Surface Tension of Metals and Alloys

Technical Paper Publication. FEDSM2018-83248

**Zackery Nieto**, **V M Krushnarao Kotteda**, **Arturo Rodriguez**, **Sanjay Shantha-Kumar**, **Vinod Kumar**, **Arturo Bronson**, *University of Texas at El Paso, El Paso, TX, United States*

#### In-Plane Hydraulic Resistance through Paper-Thin Porous Media

Technical Paper Publication. FEDSM2018-83262

**Stefan Doser**, **Sang-Joon J. Lee**, *San Jose State University, San Jose, CA, United States*

#### Experimental Investigation of Liquid Cooling Through Shallow Copperclad Cavities with Etched Pin-Fin Arrays

Technical Paper Publication. FEDSM2018-83265

**Yin Lam**, **Nicole Okamoto**, **Younes Shabany**, **Sang-Joon J. Lee**, *San Jose State University, San Jose, CA, United States*

#### Computer-Aided Design of Valves-Integrated Microfluidic Layouts Using Parameter-Guided Electrical Models

Technical Paper Publication. FEDSM2018-83362

**Oron Feinerman**, **Mor Sofer**, **Elishai Ezra Tsur**, *Jerusalem College of Technology, Jerusalem, Israel*

#### Effects of Radiation on Mixed Convection Stagnation- Point Flow of MHD Third Grade Nanofluid over a Vertical Stretching Sheet

Technical Paper Publication. FEDSM2018-83395

**Asghar Rahimi**, **Bijan Golafshan**, *Ferdowsi University of Mashhad, Mashhad, Iran*

2:45PM - 4:30PM

# Technical Sessions

TUESDAY, JULY 17

## 1 FLUID MECHANICS (FMTC)

### 1-3 VORTEX DYNAMICS

#### 1-3-1 VORTEX DYNAMICS I

##### SALON DRUMMOND WEST/OUEST

Francine Battaglia, University at Buffalo, Buffalo, NY, United States

#### Flow Structure formed by a Sweeping Jet Ejected into a Main Flow

Technical Paper Publication. FEDSM2018-83045

Masaki Fuchiwaki, Kyushu Institute of Technology, Itzuka 820-8502, Japan, Surya Raghu, Advanced Fluidics LLC, Ellicott City, MD, United States

#### Experimental Investigation of the Contributions of Flow Structures on the Lift Force Production of a Heaving and Pitching Foil

Technical Paper Publication. FEDSM2018-83111

Firas Siala, Michael Prier, James Liburdy, Oregon State University Corvallis, OR, United States

#### Flow Structures and Vortex Dynamics in the Wake Three Tandem Prisms

Technical Paper Publication. FEDSM2018-83127

Qinmin Zheng, Md Mahub Alam, Harbin Institute of Technology, Shenzhen, China

#### Coherent Structures of Tornado-Like Vortices

Technical Paper Publication. FEDSM2018-83152

Mohammad Karami, Western University, London, ON, Canada, Luigi Carassale, University of Genova, Genova, Italy, Horia Hangan, Western University - Windsee research Institute, London, ON, Canada, Maryam Refan, Florida International University, Miami, FL, United States

#### Effect of Liquid Level on Gas Carry-Under in GLCC Compact Separators

Technical Paper Publication. FEDSM2018-83301

Srinivas Swaroop Kolla, Ram Mohan, Ovidia Shoham, The University of Tulsa, Tulsa, OK, United States

### 1-4 TURBULENT FLOWS

#### 1-4-3 TURBULENT FLOWS III

##### SALON DRUMMOND CENTRE

Stefan aus der Wiesche, University of Applied Sciences Muenster, Steinfurt, Germany

#### Simulation of Coalescence and Breakup of Dispersed Water Droplets in Continuous Oil Phase

Technical Paper Publication. FEDSM2018-83314

Shuxia Yuan, Ramin Dabirian, Ram Mohan, Ovidia Shoham, The University of Tulsa, Tulsa, OK, United States

#### Foam Breakup in CFC/GLCC® System

Technical Paper Publication. FEDSM2018-83315

Ramin Dabirian, Ardianty Nababan, Ilias Gavrielatos, Ram Mohan, Ovidia Shoham, The University of Tulsa, Tulsa, OK, United States

#### Effect of Fluid Properties and Inlet Slug Length on Slug Dissipation in Enlarged Impacting Tee-Junction

Technical Paper Publication. FEDSM2018-83313

Mobina Mohammadikharkeshi, Ramin Dabirian, Ovidia Shoham, Ram Mohan, The University of Tulsa, Tulsa, OK, United States

#### Characteristics of Large Vortical Structures in the Shallow Wake Flow with a Gap near the Bed

Technical Paper Publication. FEDSM2018-83501

Monsif Shinneeb, Higher Colleges of Technology, Abu Dhabi, United Arab Emirates, Ram Balachandar, University of Windsor, Windsor, ON, Canada

#### Fluid Flow and Heat Transfer Behavior for Turbulent Flows in a Tube with Vortex Generator Pairs for an Efficient Heat Exchanger

Technical Paper Publication. FEDSM2018-83240

Md. Islam, Zhai Chong, Petroleum Institute, A part of Khalifa University of Science & Technology, Abu Dhabi, United Arab Emir., Shrinivas Bojanampati, Khalifa University of Science and Technology, Abu Dhabi, AD, United Arab Emir.

10:15AM - 12:00PM

TUESDAY, JULY 17

## 1 FLUID MECHANICS (FMTC)

### 1-6 ACTIVE FLOW CONTROL

#### 1-6-1 ACTIVE FLOW CONTROL I

#### SALON DRUMMOND EAST

Ivana Milanovic, University of Hartford, Simsbury, CT, United States

#### Numerical Comparison between Steady and Sweeping Jets for Active Flow Control Applications

Technical Paper Publication. FEDSM2018-83083

Shawn Aram, Andrew DeJong, Naval Surface Warfare Center-Carderock Div, Bethesda, MD, United States

#### Synthetic Jet Flow Control Optimization on SD7003 Airfoil at low Reynolds Number

Technical Paper Publication. FEDSM2018-83195

Djavad Kamari, Mehran Tadjfar, Amirkabir University of Technology, Tehran, Iran

#### Route to Chaos in the Fluidic Pinball

Technical Paper Publication. FEDSM2018-83359

Luc Pastur, IMSIA, Palaiseau, France, Bernd R. Noack, LIMSI, Orsay, France, Marek Morzynski, Institute of Combustion Engines and Basics of Machine Design, Poznan, Poland, Nan Deng, University Paris Sud, Orsay, France

#### Comparison of Two Active Flow Control Mechanisms of Pure Blowing and Pure Suction on a Pitching NACA0012 Airfoil at Reynolds Number of $1 \times 10^6$

Technical Paper Publication. FEDSM2018-83463

Ehsan Asgari, Mehran Tadjfar, Amirkabir University of Technology, Tehran, Iran

#### Synthetic Jet Actuator Cavity Shape Influence Modeled with a 3D Lattice Boltzmann Approach

Technical Paper Publication. FEDSM2018-83430

Hongbin Mu, Pierre Sullivan, University of Toronto, Toronto, ON, Canada, Wei Wei, Qingdong Yan, Beijing Institute of Technology, Beijing, China

## 2 COMPUTATIONAL FLUID DYNAMICS (CFDTC)

### 2-1 SYMPOSIUM ON DEVELOPMENT AND APPLICATIONS IN COMPUTATIONAL FLUID DYNAMICS

#### 2-1-3 APPLICATIONS

#### SALON 1

Zhongquan Zheng, University of Kansas, Lawrence, KS, United States

#### Effect of Windcatcher's Inlet Shape on Ventilation Flow through a Two Dimensional Room

Technical Paper Publication. FEDSM2018-83141

Peter Abdo, Rahil Taghipour, B. Phuoc Huynh, University of Technology Sydney UTS, Sydney, Australia

#### Numerical Analysis of Alternating Strand Diameter in Spiral Wound Membrane to Maximize Permeate Flux

Technical Paper Publication. FEDSM2018-83368

Gohar Shoukat, Weatherford, Islamabad, Pakistan, Muhammad Sajid, Zaib Ali, Emad Uddin, National University of Sciences and Technology (NUST), Islamabad, Pakistan

#### Effects of Local Thermal Non-Equilibrium and Periodicity of Sinusoidal Condition on Conjugate Natural Convection in Porous Square Cavity

Technical Paper Publication. FEDSM2018-83082

Ammar Alsabery, Ishak Hashim, National University of Malaysia, Selangor, Malaysia, Dr. Ali J. Chamkha, Prince Mohammad Bin Fahd University, Al-Khobar 31952, Saudi Arabia

#### A Computational Modelling for Hemodynamic Conditions Following Flow-Diverting Treatment in Cerebral Aneurysms

Technical Paper Publication. FEDSM2018-83408

Gen Fu, Alexandrina Untaroiu, Virginia Tech, Blacksburg, VA, United States

10:15AM - 12:00PM

# Technical Sessions

TUESDAY, JULY 17

## 3 FLUID APPLICATIONS & SYSTEMS (FASTC)

### 3-1 30TH SYMPOSIUM ON FLUID MACHINERY

#### 3-1-3 PUMPS 3

#### SALON 7

Jinkook Lee, Eaton, Concord, OH, United States

#### Clogging Mechanism of Vortex Pumps: Fibrous Material Motion Capture and Simulation with CFD and DEM Coupling Method

Technical Paper Publication. FEDSM2018-83503

*Yamato Imasaka, Hitoshi Kanno, Sumio Saito, Kazuyoshi Miyagawa, Waseda University, Tokyo, Japan, Motohiko Nohmi, Miho Isono, Masahito Kawai, EBARA Corporation, Fujisawa-Shi, Japan*

#### Study on the Reduction of Pressure Fluctuation for a Double-Suction Centrifugal Pump with Staggered Blades

Technical Paper Publication. FEDSM2018-83118

*Qianqian Li, Dazhuan Wu, Zhejiang University, Hangzhou, China*

#### Numerical Investigation of Air-Water Two-Phase Flow Pattern Inside A Centrifugal Pump at Different Air Void Fractions

Technical Paper Publication. FEDSM2018-83075

*Qiaorui Si, Jiangsu University, Zhen Jiang, China*

#### Numerical and Experimental Study of Inner Flow and Hydraulic Performance of the Mixed-Flow Pump with Low Specific Speed

Technical Paper Publication. FEDSM2018-83094

*Jianping Yuan, Meng Fan, Vanxia Fu, Rong Lu, Vanjun Li, Jiangsu University, Zhenjiang, China*

#### Interactional Effects of Inlet Guide Vane and Blade Angle On Hydraulic Performance Characteristics of a Submersible Axial-Flow Pump

Technical Paper Publication. FEDSM2018-83126

*Youn-Sung Kim, Hyeon-Seok Shim, Kwang-Yong Kim, Inha University Incheon, Korea (Republic)*

### 3-2 25TH SYMPOSIUM ON INDUSTRIAL AND ENVIRONMENTAL APPLICATIONS OF FLUID MECHANICS

#### 3-2-1 FUNDAMENTAL INVESTIGATIONS OF INDUSTRIAL FLOWS

#### SALON 3

Wayne Strasser, Eastman Chemical Co, Kingsport, TN, United States, George Chamoun, Eastman Chemical Company, Gray, TN, United States

#### Applied Computational Fluid Dynamics Simulations of Engineered Systems in Transitional and Turbulent Flow Re-gimes

Keynote Presentation. FEDSM2018-83353

*Dibbon K. Walters, Keaton Mullenix, University of Oklahoma, Norman, OK, United States*

#### Theoretical and Numerical Analysis of the Pressure Distribution and Discharge Velocity in Flows under Sluice Gates

Technical Paper Publication. FEDSM2018-83277

*Philipp Epple, Michael Steppert, Michael Steber, Coburg University of Applied Sciences, Coburg, Bavaria, Germany, Andreas Malcherek, Universität der Bundeswehr München, München, Bavaria, Germany*

#### Modified Rankine Hugoniot Theory to account for Considerations of Turbulence and Mass Divergence

Technical Presentation. FEDSM2018-83080

*Henry Foust, Nick Vaughan, Adrianus Tjandra, Travis Fisk, University of St. Thomas, Houston, TX, United States*

#### Experiments and Large Eddy Simulation of Swirling Flow in a Pipe

Technical Paper Publication. FEDSM2018-83067

*Zhang Tianxing, Nabil Kharoua, Mohamed Alshehhi, Shrinivas Bojanampati, Khalifa University of Science and Technology, Abu Dhabi, AD, United Arab Emir., Lyes Khezzer, Khalifa University of Science and Technology, Petroleum Institute, Abu Dhabi, United Arab Emirates*

10:15AM - 12:00PM

TUESDAY, JULY 17

## 5 MULTIPHASE FLOW (MFTC)

### 5-2 CAVITATION AND PHASE CHANGE

#### 5-2-1 CAVITATION

#### SALON 5

**William Straka**, Pennsylvania State University, State College, PA, United States, **Michael Kinzel**, The Pennsylvania State University, State College, PA, United States, **Ki Han Kim**, Office of Naval research, Potomac, MD, United States

#### Experimental Study on Pressure Transients with Cavitation in Low Pressure Water-hydraulic Pipeline

Technical Paper Publication. FEDSM2018-83019

**Dan Jiang, Cong Ren**, School of Mechanical and Electrical Engineering UESTC, Chengdu, China, **Qing Guo**, School of Aero-nautics and Astronautics, UESTC, Chengdu, China

#### Combined Numerical and Experimental Analysis of Cloud Cavitation for Burst Wave Lithotripsy

Technical Paper Publication. FEDSM2018-83034

**Kazuki Maeda**, California Institute of Technology, Pasadena, CA, United States, **Wayne Kreider, Adam D Maxwell**, University of Washington, Seattle, WA, United States, **Tim Colonius**, Cal Tech, Pasadena, CA, United States, **Michael Bailey**, University of Washington, Seattle, WA, United States

#### Re-Entry Jet and Shock Induced Cavity Shedding in Cloud Cavitating Flow around an Axisymmetric Projectile

Technical Paper Publication. FEDSM2018-83200

**Yiwei Wang, Bingsheng Ye, Jingzhu WANG, Chenguang Huang**, Institute of Mechanics, Chinese Academy of Sciences, Beijing, China

#### Assessment of Cavitation Models in the Prediction of Cavitation in Nozzle Flow

Technical Paper Publication. FEDSM2018-83223

**Dorien Villafranco, Huy Do, Sheryl Grace, Emily Ryan, R. Glynn Holt**, Boston University, Boston, MA, United States

## 6 MICRO & NANO FLUID DYNAMICS (MNFDTC)

### 6-1 MICRO/NANO-FLUIDICS

#### 6-1-3 MICRO/NANO-FLUIDICS III

#### BALLROOM EAST

**Maria Vittoria Salvetti**, DICl - University of Pisa, Pisa, Italy, **Kiarash Keshmiri**, University of Alberta, Edmonton, AB, Canada

#### Extending a Hybrid Continuum-Molecular Simulation Method to Solve the Micro/Nanoscale Gas Mixing Problems

Technical Paper Publication. FEDSM2018-83454

**Moslem Sabouri, Masoud Darbandi**, Sharif University of Technology, Tehran, Iran, **Gerry Schneider**, University of Waterloo, Waterloo, ON, Canada

#### Experimental and Numerical Analyses of Unsteady Flow Regimes and Mixing in a Micro T-Mixer

Technical Paper Publication. FEDSM2018-83459

**Maria Vittoria Salvetti, DICl, Alessandro Mariotti, Chiara Galletti, Elisabetta Brunazzi**, University of Pisa, Pisa, Italy

#### Effects of Wettability on Capillary Flow of Non-Newtonian Fluid in Microchannels

Technical Paper Publication. FEDSM2018-83533

**Kiarash Keshmiri, Neda Nazemifard**, University of Alberta, Edmonton, AB, Canada, **Haibo Huang**, InnoTech Alberta, Ed-monton, AB, Canada

#### Electroosmotic Flow Separation in a Corrugated Microchannel: A Numerical Study

Technical Paper Publication. FEDSM2018-83026

**Abhishek Banerjee, Ameeya Nayak**, Indian Institute of Technology (IIT) Roorkee, India

#### Water-Oil Flow in Square Microchannels with a Crossed Junction

Technical Paper Publication. FEDSM2018-83056

**Zhen Cao, Zan Wu, Bengt Sundén**, Lund University, Lund, Sweden, **Jin-Yuan Qian**, Zhejiang University, Hangzhou, China

10:15AM - 12:00PM

# Technical Sessions

TUESDAY, JULY 17

## 1 FLUID MECHANICS (FMTC)

### 1-3 VORTEX DYNAMICS

#### 1-3-2 VORTEX DYNAMICS II

##### SALON DRUMMOND WEST/OUEST

Francine Battaglia, *University at Buffalo, Buffalo, NY, United States*

#### Effects of Forcing Frequency on Pulsating Impinging Jet Behavior and Boundary Layer on Target Curved Wall

Technical Paper Publication. FEDSM2018-83334

*Nabil Kharoua, Khalifa University of Science and Technology, Abu Dhabi, OO, UAE, Lyes Khezzar, Khalifa University of Science and Technology, Petroleum Institute, Abu Dhabi, UAE, Zoubir Nemouchi, Universite Constantine 1, Constantine, Algeria*

#### Effect of Corner-Arc on the Flow Structures around a Square Cylinder

Technical Paper Publication. FEDSM2018-83367

*Hariprasad Chakkalparambil Many, Ajith Kumar Raghavan, Amrita Vishwa Vidyapeetham, Kollam, Kerala, India, Vishnu Chandar Srinivasan, Saveetha School of Engineering, Chennai, Tamil Nadu, India*

#### Wingtip Vortex Interaction with a Grid Generated Turbulent Flow

Technical Paper Publication. FEDSM2018-83478

*Kamal Ben Miloud, Marouen Dghim, Hachimi Fellouah, Université de Sherbrooke, Sherbrooke, QC, Canada, Mohsen Fer-chichi, Royal Military College of Canada, Kingston, ON, Canada*

#### Influence of Corner Radius on Aerodynamic Characteristics of Square Cylinder with Tandem Arrangements

Technical Presentation. FEDSM2018-83535

*Sajjad Miran, University of Gujrat, Gujrat, Pakistan*

### 1-4 TURBULENT FLOWS

#### 1-4-4 TURBULENT FLOWS IV

##### SALON DRUMMOND CENTRE

Ali Ogut, *Rochester Institute of Technology, Rochester, NY, United States*

#### Mechanistic Modeling of Liquid Carry-Over for 3-Phase Flow in GLCC® Compact Separators

Technical Paper Publication. FEDSM2018-83407

*Srinivas Swaroop Kolla, Ram Mohan, Ovadia Shoham, The University of Tulsa, Tulsa, OK, United States*

#### Comparative Evaluation of Single/Twin Round and Elliptic Jets Using Particle Image Velocimetry

Technical Paper Publication. FEDSM2018-83495

*Seyed Sobhan Aleyasin, Mark F. Tachie, University of Manitoba, Winnipeg, MB, Canada*

#### The Study of Surface-Mounted Bluff Bodies Immersed in Deep Turbulent Boundary Layers

Technical Paper Publication. FEDSM2018-83498

*Helen Amorin, Xingjun Fang, Mark F. Tachie, University of Manitoba, Winnipeg, MB, Canada*

#### Utilization of Churn Flow Coalescer (CFC) for Improving Foam Breakup in GLCC®

Technical Paper Publication. FEDSM2018-83317

*Ramin Dabirian, Ilias Gavrielatos, Ram Mohan, Ovadia Shoham, The University of Tulsa, Tulsa, OK, United States*

#### Evaluation of Models for Droplet Shear Effect of Centrifugal Pump

Technical Paper Publication. FEDSM2018-83318

*Ramin Dabirian, Shihao Cui, Ilias Gavrielatos, Ram Mohan, Ovadia Shoham, The University of Tulsa, Tulsa, OK, United States*

2:45PM - 4:30PM

TUESDAY, JULY 17

## 1 FLUID MECHANICS (FMTC)

### 1-6 ACTIVE FLOW CONTROL

#### 1-6-2 ACTIVE FLOW CONTROL II

#### SALON DRUMMOND EAST

Chih-Yung Wen, *The Hong Kong Polytechnic University, Kowloon, Hong Kong*

#### Application of Periodic Dielectric Barrier Discharge Plasma Actuators on a Highly Swept Delta Wing

Technical Presentation. FEDSM2018-83391

Chih-Yung Wen, Lu SHEN, *The Hong Kong Polytechnic University, Hong Kong, Hong Kong*

#### Modeling of Decelerated Descent of an Elongated Body with Vectored Thrust

Technical Paper Publication. FEDSM2018-83171

Konstantin Matveev, John Swensen, Matthew Taylor, *Washington State University, Pullman, WA, United States*

#### Detailed Pressure Measurements during the Transition to Rotating Stall in an Axial Compressor: Influence of the Throttling Process

Technical Paper Publication. FEDSM2018-83057

Gabriel Margalida, Antoine Dazin, Olivier Roussette, Pierrick Joseph, *École Nationale Supérieure d'Arts et Métiers, Lille, France*

## 2 COMPUTATIONAL FLUID DYNAMICS (CFDTC)

### 2-1 SYMPOSIUM ON DEVELOPMENT AND APPLICATIONS IN COMPUTATIONAL FLUID DYNAMICS

#### 2-1-4 NOVEL DEVELOPMENTS AND HIGH PERFORMANCE COMPUTING

#### SALON 1

Jingsen Ma, *Dynaflow, Inc., Laurel, MD, United States*

#### Simulation of Incompressible Multiphase Flows Using the Artificial Compressibility Method

Technical Paper Publication. FEDSM2018-83013

Mohammad Mortezaazadeh, *Concordia University, Montreal, QC, Canada*, Kazem Hejranfar, *Sharif University of Technology, Tehran, Iran*

#### Effect of Multiple Reference Frame (MRF) Interface Location on Flow Field Predictions in Baffled Stirred Tanks

Technical Paper Publication. FEDSM2018-83046

Devarajan Krishna Iyer, Ajey Kumar Patel, *National Institute of Technology Warangal, Warangal, India*

#### Data Compression Algorithms for Adjoint Based Sensitivity Studies Of Unsteady Flows

Technical Paper Publication. FEDSM2018-83060

Liu Yang, Siva K. Nadarajah, *McGill University, Montreal, QC, Canada*

#### A Performance Analysis of Nek5000 for Single Assembly Calculations

Technical Paper Publication. FEDSM2018-83517

Elia Merzari, Ronald Rahaman, Paul Fischer, Mi-Sun Min, *Argonne National Laboratory, Lemont, IL, United States*

2:45PM - 4:30PM

# Technical Sessions

TUESDAY, JULY 17

## 3 FLUID APPLICATIONS & SYSTEMS (FASTC)

### 3-1 30TH SYMPOSIUM ON FLUID MACHINERY

#### 3-1-4 PUMPS 4

#### SALON 7

Jin-Hyuk Kim, KITECH, ChunAn, Korea (Republic), Yoshinobu Tsujimoto, Osaka University, Osaka, Japan

#### Effects of Blade Configuration on the Performance of a Feed Pump

Technical Paper Publication. FEDSM2018-83182

Can Kang, Yiping Gu, Jiangsu University, Zhenjiang, China, Kejin Ding, Wenbin Zhang, Shanghai Marine Equipment Re-search Institute, Shanghai, China

#### Study on Unsteady Characteristics of Secondary Flow in Volute of a High Specific Speed Centrifugal Pump

Technical Paper Publication. FEDSM2018-83333

Tao Liu, Peijian Zhou, Jiegang Mou, Jiacheng Dai, Zhejiang University Of Technology, Hangzhou, China

#### The Relationship of the Performances and the Design Parameters for Non-overload Centrifugal Pumps

Technical Paper Publication. FEDSM2018-83342

Yang Junhu, School of Energy and Power Engineering, Lanzhou University of Technology, Lanzhou, China

#### The Computation of Service Life of Three Screw Spindle Pump Based on Design and Operating Parameters

Technical Paper Publication. FEDSM2018-83418

Zhiqiang GAN, Shiguang MA, Jianning LIU, Tianjin Pumps & Machinery Group Co. Ltd, Tianjin, China

#### Internal Flow Analysis in a Two-Channel Pump Used for Salt Transportation

Technical Paper Publication. FEDSM2018-83428

Jiaqi Wang, Tsinghua University, Beijing, China, Xianwu Luo, Dept. of Energy and Power Engineering, Beijing, OO, China, Wanming Li, Zhanhua Haite Machinery Co., Ltd., Zhanhua, China, Bin Ji, Wuhan University, Wuhan, China

### 3-2 25TH SYMPOSIUM ON INDUSTRIAL AND ENVIRONMENTAL APPLICATIONS OF FLUID MECHANICS

#### 3-2-2 SPRAYS, PROPULSION, AND THRUST

#### SALON 3

Ivaylo Nedyalkov, University of New Hampshire, Durham, NH, United States, Alexandrina Untaroiu, Virginia Tech, Blacksburg, VA, United States

#### A Critical View of the Simulation of Spray Formation

Keynote Presentation. FEDSM2018-83364

Mario F. Trujillo, University of Wisconsin, Madison, WI, United States

#### Numerical Computation of the Thrust, Drag and the Maximal Flight Altitude of the Historical HW2 Rocket Using CFD

Technical Paper Publication. FEDSM2018-83379

Michael Steppert, Philipp Epple, Michael Steber, Coburg University of Applied Sciences, Coburg, Bavaria, Germany

#### Geometrical Optimizations of a Steam Jet-Ejector Using the Computational Fluid Dynamics Tool

Technical Paper Publication. FEDSM2018-83203

Masoud Darbandi, Seyedali Sabzpoushan, Sharif University of Technology, Tehran, OO, Iran, Gerry Schneider, University of Waterloo, Waterloo, ON, Canada

#### Design of Turbo-Compression System for Hale UAV Propulsion System

Technical Paper Publication. FEDSM2018-83354

Young Seok Kang, Byeung Jun Lim, Dong-Ho Rhee, Tae Choon Park, Yongmin Jun, Yang Ji Lee, Sangook Jun, Korea Aerospace Research Institute, Daejeon, Korea (Republic)

2:45PM - 4:30PM

TUESDAY, JULY 17

## 5 MULTIPHASE FLOW (MFTC)

### 5-2 CAVITATION AND PHASE CHANGE

#### 5-2-2 PHASE CHANGE

#### SALON 5

**Timothy J. O'Hern**, Retired from Sandia National Laboratories, Albuquerque, NM, United States, **Ivaylo Nedyalkov**, University of New Hampshire, Durham, NH, United States

#### Approximate Method for Phase change in Self-Healing Materials

Technical Paper Publication. FEDSM2018-83175

**Rahul Basu**, Adarsha Institute of Technology, Bangalore, Ka, India

#### Three-Dimensional Jet Impingement Boiling

Technical Paper Publication. FEDSM2018-83393

**Asghar Rahimi**, Ferdowsi University of Mashhad, Mashhad, Iran

#### A Numerical Study of Flow Boiling Heat Transfer of Nanoemulsion in Mini-Channel Heat Exchanger

Technical Paper Publication. FEDSM2018-83396

**Jiajun Xu**, **Musa Acar**, **Naresh Poudel**, **Jaime Rios**, University of the District of Columbia, Washington, DC, United States, **Thanh Tran**, Naval Surface Warfare Center, Bethesda, MD, United States

#### Development and Validation of Enthalpy-Porosity Method for Artificial Ground Freezing under Seepage Conditions

Technical Paper Publication. FEDSM2018-83473

**Mahmoud Alzoubi**, **Agus Sasmito**, McGill University, Montreal, QC, Canada

#### The Influence of Heat Source Orientation on the PCM Flow Behavior during Phase Transition

Technical Paper Publication. FEDSM2018-83509

**Steven Jevnikar**, **Kamran Siddiqui**, University of Western Ontario, London, ON, Canada

## 6 MICRO & NANO FLUID DYNAMICS (MNFDTC)

### 6-1 MICRO/NANO-FLUIDICS

#### 6-1-4 MICRO/NANO-FLUIDICS IV

#### BALLROOM EAST

**Liangliang Fan**, Xi'an Jiaotong University, Xi'an, OO, China, **Afzal Husain**, Sultan Qaboos University, Muscat, OO, Oman

#### A Passive Micromixer for Rapid and High-Throughput Fluid Mixing

Technical Presentation. FEDSM2018-83099

**Liang-Liang Fan**, **Qing Yan**, **Liang Zhao**, Xi'an Jiaotong University, Xi'an, Shaanxi, China, **Jiang Zhe**, University of Akron, Akron, OH, United States

#### The Influence of PEO Concentration on Particle Focusing In Viscoelastic Fluid

Technical Presentation. FEDSM2018-83120

**Qing Yan**, **Liang-Liang Fan**, **Liang Zhao**, Xi'an Jiaotong University, Xi'an, Shaanxi, China, **Jiang Zhe**, University of Akron, Akron, OH, United States

#### Pressure Drop Characteristics of Generalized Diverging-Converging Microchannel for Heat Sink Applications

Technical Presentation. FEDSM2018-83469

**Rohit Singhal**, **Mohd. Z. Ansari**, PDPM-Indian Institute of Information Technology, Jabalpur, OO, India, **Afzal Husain**, Sultan Qaboos University, Muscat, OO, Oman

2:45PM - 4:30PM

# Technical Sessions

WEDNESDAY, JULY 18

## 1 FLUID MECHANICS (FMTC)

### 1-1 FLUIDS ENGINEERING EDUCATION

#### 1-1-1 FLUIDS ENGINEERING EDUCATION

#### SALON DRUMMOND WEST/OUEST

Ray Taghavi, *University of Kansas, Lawrence, KS, United States*, Ivana Milanovic, *University of Hartford, Simsbury, CT, United States*

#### Hydrodynamic Design and Verification of Water-Jet Mixed-Flow Pump Based on Controllable Velocity Moment Theory

Technical Paper Publication. FEDSM2018-83066

Gang Chen, Bin Yu, Ning Li, Youlin Cai, *Marine Design and Research Institute of China, Shanghai, China*

#### The Influence of Wrap Angle of Blade on the Internal Flow Field of Double Suction Centrifugal Pump

Technical Paper Publication. FEDSM2018-83190

Hao Chang, Wei Li, Jianrui Liu, Chuan Wang, Wei Fu, Xiaowei Li, *Jiangsu University, Zhenjiang, China*, Weidong Shi, *Nantong University, Nantong, China*, Ling Zhou, *National Research Center of Pumps, Jiangsu University, Zhenjiang, China*

#### Assessing the Value and Balance of In-Class Demos and Videos in Fluid Mechanics Lecture

Technical Paper Publication. FEDSM2018-83276

Thomas Shepard, *University of St. Thomas, Minneapolis, MN, United States*

#### Influence of Mechanical Relaxation Coefficient on Water Hammer Calculation by using Two - Fluid Model

Technical Paper Publication. FEDSM2018-83302

Jiang Jin, You Fu, *Wuhan University, Wuhan, OO, China*

#### An Integrated Approach for the Teaching of Pipe Network Analysis Using Project Based Learning

Technical Paper Publication. FEDSM2018-83382

Ishaq Ibrahim, Waleed Bin Khalid, Muhammad Sajid, *National University of Sciences and Technology (NUST), Islamabad, Pakistan*, Gohar Shoukat, *Weatherford, Islamabad, Pakistan*

### 1-4 TURBULENT FLOWS

#### 1-4-5 TURBULENT FLOWS V

#### SALON DRUMMOND CENTRE

Pierre Sullivan, *University of Toronto, Toronto, ON, Canada*

#### Experimental Investigation of a Flapping Motion Downstream Of a Backward Facing Step

Technical Paper Publication. FEDSM2018-83327

Zhuoyue Li, Nan Gao, *Dalian University of Technology, Dalia, China*

#### Wake Flow Patterns behind Smooth Spheres and Baseballs

Technical Paper Publication. FEDSM2018-83357

Patrick Mortimer, John Vaccaro, David Rooney, *Hofstra University, Hempstead, NY, United States*

#### Numerical Investigation of Stall Control of a NACA 0024 Airfoil

Technical Paper Publication. FEDSM2018-83277

Saad Ahmed, Argin Nazari, *AUS, Sharjah, United Arab Emir.*

#### Experimental Investigation of Oscillating Heat Pipe Efficiency by Changing the Geometry of the Condenser in the Form of Vertical Corrugated, Horizontal Corrugated and Straight

Technical Paper Publication. FEDSM2018-83339

Hamid Reza Goshayeshi, *Azad University, Mashad, Iran*

10:15AM - 12:00PM

WEDNESDAY, JULY 18

## 2 COMPUTATIONAL FLUID DYNAMICS (CFDTC)

### 2-1 SYMPOSIUM ON DEVELOPMENT AND APPLICATIONS IN COMPUTATIONAL FLUID DYNAMICS

#### 2-1-5 MULTIPHASE APPLICATIONS

#### SALON 1

Ivar Lund, *University of Southern Denmark, Odense, Denmark*

#### Hybrid Eulerian Multiphase-Dense Discrete Phase Model Approach for Numerical Simulation of Dense Particle-Laden Turbulent Flows within Vertical Multi-Stage Cyclone Heat Exchanger

Technical Paper Publication. FEDSM2018-83058

*Eugen-Dan Cristea, Independent Author, Bergamo, BG, Italy, Pierangelo Conti, Università degli Studi di Bergamo, Dalmine, BG, Italy*

#### A Drying Model for a Polar Biomass Particle Gasification Using Finite Volume Method

Technical Paper Publication. FEDSM2018-83247

*Xiyang Li, Chungeng Yin, Aalborg University, Aalborg, ND - North Jutland, Denmark*

#### Analysis of Agricultural Spray by Phase-Doppler Anemometry and Numerical Methods

Technical Presentation. FEDSM2018-83294

*Ivar Lund, University of Southern Denmark, Odense, Denmark*

#### CFD Analysis of Natural Gas Cooling System through a Conventional Air cooler Improved by a Fogging System

Technical Paper Publication. FEDSM2018-83441

*Jhon Pérez, Miguel Asuaje Tovar, Universidad Simón Bolívar, Caracas, Venezuela*

#### Improvements in the Dehydration Process of Heavy Crude Oil, Using CFD. Case Study Campo Quífa. Colombia

Technical Paper Publication. FEDSM2018-83442

*Miguel Asuaje Tovar, Carlos Chacón, Simon Bolivar University, Caracas, Miranda, Venezuela, Nelson Benítez, Myriam Rocío Gaviria, Eduardo Díaz, Dario Quintero, Frontera Energy, Bogotá, Colombia*

### 2-2 12TH SYMPOSIUM ON DNS/LES AND HYBRID RANS/LES METHODS

#### 2-2-1 LES/DNS I

#### SALON DRUMMOND EAST

Daniel Garmann, *U.S. Air Force Research Laboratory, Wright-Patterson AFB, OH, United States*

#### Large-Eddy Simulation to Enhance the Understanding and Control of High Reynolds Number Dynamic Stall

Keynote Presentation. FEDSM2018-83231

*Stuart Benton, U.S. Air Force Research Laboratory, WPAFB, OH, United States*

#### Numerical Analysis of a Low-Noise Blade Design Inspired by the Down Coat of the Owl

Technical Paper Publication. FEDSM2018-83385

*Andrew Bodling, Anupam Sharma, Iowa State University, Ames, IA, United States*

#### Flow separation control and drag reduction for a two-dimensional boat-tailed bluff body through transverse grooves

Technical Paper Publication. FEDSM2018-83458

*Alessandro Mariotti, Guido Buresti, Maria Vittoria Salvetti, DICI - University of Pisa, Pisa, Italy*

#### Analysis of the Effect of Separation Distance in Z-Configuration Close-Coupled Elbows Using Large Eddy Simulation

Technical Paper Publication. FEDSM2018-83097

*Mohammed Karbon, KAHRAMAA, Doha, Qatar, Ahmad Sleiti, Qatar University, Doha, Qatar*

10:15AM - 12:00PM

# Technical Sessions

WEDNESDAY, JULY 18

## 3 FLUID APPLICATIONS & SYSTEMS (FASTC)

### 3-1 30TH SYMPOSIUM ON FLUID MACHINERY

#### 3-1-5 HYDRAULIC TURBINES

#### SALON 7

Kwang-Yong Kim, *Inha University Incheon, Korea (Republic)*

#### Comparative Analysis of the 800MW Hydraulic Turbine Prototype and Model Test Results

Technical Paper Publication. FEDSM2018-83003

*Ma Yukui, China Three Gorges Corporation, Chengdu, Sichuan, China*

#### Design and Development of a ULTRA Low Head Axial Hydro Turbine for Electricity Supply Part I

Technical Paper Publication. FEDSM2018-83015

*Jinbo Chen, Abraham Engeda, Michigan State University, East Lansing, MI, United States*

#### Design and Development of a ULTRA Low Head Axial Hydro Turbine for Electricity Supply Part II

Technical Paper Publication. FEDSM2018-83016

*Jinbo Chen, Abraham Engeda, Michigan State University, East Lansing, MI, United States*

#### Vibration Characteristics of a 50MW Francis type Hydro Power Plant

Technical Paper Publication. FEDSM2018-83453

*Yong Cho, Yun-Ryeong OH, Jong-Woong Choi, Young-Joon Kim, K-Water, Daejeon, OO, Korea (Republic), Jiri Novotny, Radim Loub, CKD Blansko Engineering, Blansko, Czech Republic*

#### The Effect of Runner Blade Loading on the Performance of a Francis Hydro Turbine Model

Technical Presentation. FEDSM2018-83420

*Young-Do Choi, Zhenmu Chen, Hyunkyoo Cho, Mokpo National University, Muan, Jeonnam, Korea (Republic)*

#### Unsteady Swirl Flow Suppression in the Draft Tube of a Francis Hydro Turbine Model

Technical Presentation. FEDSM2018-83421

*Hyunkyoo Cho, Zhenmu Chen, Young-Do Choi, Mokpo National University, Muan, Korea (Republic)*

### 3-2 SYMPOSIUM ON INDUSTRIAL AND ENVIRONMENTAL APPLICATIONS OF FLUID MECHANICS

#### 3-2-3 INTERACTION OF FLOWS WITH STRUCTURES

#### SALON 3

Alexandrina Untaroiu, *Virginia Tech, Blacksburg, VA, United States*, Philipp Epple, *DDD, Antigua and Barbuda*

#### Effect of Stent design parameters on Hemodynamics and Blood Damage in a Percutaneous Cavopulmonary assist device

Technical Paper Publication. FEDSM2018-83210

*Jakin Jagani, Elizabeth Mack, Jihyeon Gong, Alexandrina Untaroiu, Virginia Tech, Blacksburg, VA, United States*

#### Research on the Solid-Liquid Two-Phase Flow in a Helical Groove Seal

Technical Paper Publication. FEDSM2018-83105

*Kai Zhang, Dazhuan Wu, Zhejiang University, Hangzhou, Zhejiang, China*

#### Study of Transmissivity of a Fracture under Shearing

Technical Paper Publication. FEDSM2018-83348

*Amir Abdollahi Mofakham, Goodarz Ahmadi, Clarkson University Potsdam, NY, United States, Matt Stadelman, NETL, DOE, Morgantown, WV, United States, Kevin Shanley, SUNY - New Paltz, New Paltz, NY, United States, Dustin Crandall, Department of Energy, Morgantown, WV, United States*

#### Flow-Field in a Linear Vane Cascade with Endwall Fillet and Film-Cooling

Technical Paper Publication. FEDSM2018-83140

*Gazi Mahmood, Keenesh Arnachellan, University of Pretoria, Pretoria, OO, South Africa*

#### Estimating Fatigue Life of Thermowells in Supercritical Operation

Technical Paper Publication. FEDSM2018-83426

*Philip Diwakar, Yuqing Liu, Matt Jaouhari, Bechtel Corporation, Sugar Land, TX, United States*

10:15AM - 12:00PM

WEDNESDAY, JULY 18

## 5 MULTIPHASE FLOW (MFTC)

### 5-3 GAS-LIQUID, GAS-SOLID, AND LIQUID-SOLID FLOWS

#### 5-3-1 GAS-LIQUID FLOWS

#### SALON 5

Robert Kunz, *The Pennsylvania State University, University Park, PA, United States*, Ivaylo Nedyalkov, *University of New Hampshire, Durham, NH, United States*

#### Flow Pattern Prediction in an Electrical Submersible Pump (ESP) under Gassy Flow Conditions using Transient Multiphase CFD Method with Visualization Experiment Validation

Technical Paper Publication. FEDSM2018-83081

Jianjun Zhu, Haiwen Zhu, Jiecheng Zhang, Hong-Quan Zhang, *The University of Tulsa, Tulsa, OK, United States*, Ruben Cuamatzi-Melendez, Jose Alberto Martinez Farfan, *Instituto Mexicano del Petróleo, Mexico City, Mexico*

#### Two-Phase Flow Visualization for a Hybrid Heat Sink

Technical Paper Publication. FEDSM2018-83363

Ibrahim Hassan, Danish Rahman, Ahmad AlMomani, Aziz Rahman, Yasser Al Hamidi, *Texas A&M University At Qatar, Dohar, Qatar*

#### Particle Image Velocimetry Measurements of Flow inside a Hydrocyclone with an Air Core

Technical Paper Publication. FEDSM2018-83375

Chinmay Shingote, Jaikrishnan Kadambi, Renjie Ke, *Case Western Reserve University, Cleveland, OH, United States*, John Furlan, Robert Visintainer, Mohamed Garman, *GIW Minerals, Grovetown, GA, United States*

#### Influence of Viscosity on Gas-Liquid Two Phase Flows in Vertical and Inclined Pipes

Technical Paper Publication. FEDSM2018-83460

Buddhika Hewakandamby, Josep Escrig-Escrig, *University of Nottingham, Nottingham, OO, United Kingdom*

#### Effect of Liquid Viscosity on Two-Phase Flow Development in a Vertical Large Diameter Pipe

Technical Paper Publication. FEDSM2018-83466

Abubakr Ibrahim, Buddhika Hewakandamby, Barry Azzopardi, *The University of Nottingham, Nottingham, Nottingham-shire, United Kingdom*, Zhilin Yang, *Statoil ASA, Trondheim, Norway*

### 5-5 BUBBLE, DROPLET, AND AEROSOL DYNAMICS

#### 5-5-1 BUBBLE, DROPLET, AND AEROSOL DYNAMICS I

#### BALLROOM EAST

Thomas Shepard, *University of St. Thomas, Saint Paul, MN, United States*

#### Oxidation-Assisted Pulsatile Three-Stream Non-Newtonian Slurry Atomization

Technical Paper Publication. FEDSM2018-83025

Wayne Strasser, *Eastman Chemical Co, Kingsport, TN, United States*

#### Three-Dimensional Volume of Fluid Simulations of Air Bubble Dynamics in a Converging Nozzle

Technical Paper Publication. FEDSM2018-83180

Deify Law, *California State University Fresno, CA, United States*, Thomas Shepard, *University of St. Thomas, Minneapolis, MN, United States*

#### Experimental Observation of Bubbles Released in Horizontal Water Flow

Technical Paper Publication. FEDSM2018-83185

Can Kang, Yanguang Ji, Lili Zhang, Wei Zhang, *Jiangsu University, Zhenjiang, China*

#### Bubble Formation from Porous Plates in Liquid Cross-Flow

Technical Paper Publication. FEDSM2018-83221

Thomas Shepard, Eric Ruud, Henry Kinane, Kohl Ordahl, *University of St. Thomas, St. Paul, MN, United States*, Deify Law, *California State University, Fresno, CA, United States*

10:15AM - 12:00PM

# Technical Sessions

WEDNESDAY, JULY 18

## 1 FLUID MECHANICS (FMTC)

### 1-7 TRANSPORT PHENOMENA IN ENERGY CONVERSION AND MIXING

#### 1-7-1 TRANSPORT PHENOMENA IN ENERGY CONVERSION AND MIXING

##### SALON DRUMMOND WEST/OUEST

Fethi Aloui, LAMIH UMR CNRS 8201, University of Valenciennes (UVHC), Valenciennes, France, George Papadopoulos, Innoveering, LLC, Ronkonkoma, NY, United States

#### CFD and Experiment Investigation of the Mixing Characteristics of Non-Newtonian Biopolymer Solutions in a Stirred Vessel Equipped With a Side-Entry Propeller

Technical Paper Publication. FEDSM2018-83107

Peng Wang, Thomas Reviol, Haikun Ren, Martin Boehle, T.U. Kaiserslautern, Kaiserslautern, Germany

#### Internal Groove Influenced Thermohydraulic Performance of an Air-Channel

Technical Paper Publication. FEDSM2018-83236

Gazi Mahmood, Aasa Samson, University of Pretoria, Pretoria, OO, South Africa

#### Refractive Index Matching for Optical Flow Investigations with High Density Stratification

Technical Paper Publication. FEDSM2018-83245

Benedikt Krohn, Sunming Qin, Annalisa Manera, Victor Petrov, University of Michigan Ann Arbor, Ann Arbor, MI, United States

#### Lattice Boltzmann Model for Incompressible Axisymmetric Thermal Flows with Swirl

Technical Paper Publication. FEDSM2018-83337

Insaf Mehrez, Ramla Gheith, University of Monastir, Monastir, Tunisia, Fethi Aloui, University of Valenciennes (UVHC), Valenciennes, France, Samia Ben Nasrallah, University of Sousse, Monastir, Tunisia

#### The Transport Phenomena in Capacitive Deionization Systems: A Parametric Numerical and Experimental Study

Technical Presentation. FEDSM2018-83429

Yasamin Salamat, Carlos H. Hidrovo, Northeastern University, Boston, MA, United States

## 2 COMPUTATIONAL FLUID DYNAMICS (CFDTC)

### 2-1 SYMPOSIUM ON DEVELOPMENT AND APPLICATIONS IN COMPUTATIONAL FLUID DYNAMICS

#### 2-1-6 AUTOMATED DESIGN OPTIMIZATION AND MACHINE LEARNING

##### SALON 1

Elia Merzari, Argonne National Laboratory, Lemont, IL, United States

#### Machine Learning Approach to Predict the Flow Rate for an Immiscible Two-Phase Flow at Pore Scale for Enhanced Oil Recovery Application

Technical Paper Publication. FEDSM2018-83050

Arturo Rodriguez, Vinod Kumar, Arturo Schiaffino, V M KRUSHNARAO Kotteda, Zackery Nieto, Luis F. Rodriguez, University of Texas at El Paso, TX, United States

#### Predicting the Depth of Penetration of Molten Metal into a Pore Network Using Tensorflow

Technical Paper Publication. FEDSM2018-83258

Arturo Schiaffino, V M KRUSHNARAO Kotteda, Arturo Bronson, Sanjay Shantha-Kumar, Vinod Kumar, The University of Texas at El Paso, TX, United States

#### Numerical Simulation of Formation of Melt Jets in Melt-Coolant Interactions

Technical Paper Publication. FEDSM2018-83273

Jorge Contreras-Serna, Tecnológico de Monterrey, Monterrey, Nuevo León, Mexico, Arturo Schiaffino, Vinod Kumar, V M Krushnarao Kotteda, The University of Texas at El Paso, El Paso, TX, United States Alejandro J. Garcia-Cuellar, ITESM Campus Monterrey, Monterrey, N L, Mexico

#### Numerical Simulation and Optimization of Electric Field-Based Sorting in Particle Laden Flows in Microchannels

Technical Paper Publication. FEDSM2018-83281

Ashkan Davanlou, Siemens PLM, Orlando, FL, United States, Venkateswara Reddy, Siemens PLM, Bangalore, Karnataka, India

#### Design and Multiparameter Optimization of Jet-Pumps in a Pipeline Loops Using DFC Tools

Technical Paper Publication. FEDSM2018-83440

Jens Toteff, Miguel Asuaje Tovar, Universidad Simón Bolívar / Frontera Energy, Caracas, Venezuela

1:15PM - 3:00PM

WEDNESDAY, JULY 18

## 2 COMPUTATIONAL FLUID DYNAMICS (CFDTC)

### 2-2 12TH SYMPOSIUM ON DNS/LES AND HYBRID RANS/LES METHODS

#### 2-2-2 LES/DNS II

#### SALON DRUMMOND EAST

Daniel Garmann, U.S. Air Force Research Laboratory, Wright-Patterson AFB, OH, United States

#### Advanced Techniques to Analyze Large Datasets arising from Large-Eddy Simulations

Keynote Presentation. FEDSM2018-83303

Datta Gaitonde, S Unnikrishnan, The Ohio State University, Columbus, OH, United States

#### Application of a Modal Filter for Large Eddy Simulation of Turbulence using Discontinuous Spectral Element Method

Technical Presentation. FEDSM2018-83446

Zia Ghiasi, Jonathan Komperda, Dongru Li, Farzad Mashayek, University of Illinois at Chicago, Chicago, IL, United States

#### Simulations of Hairpin Vortices In the Presence of a Passive Scalar

Technical Paper Publication. FEDSM2018-83158

Robert A. Handler, George Mason University, Fairfax, VA, United States, David B. Goldstein, Saikishan Suryanarayanan, University of Texas, Austin, TX, United States

#### Analysis of Pressure Field on Wire-Wrapped Pin Surface for Concerns of FSI

Technical Paper Publication. FEDSM2018-83521

Landon Brockmeyer, Yassin Hassan, Texas A&M University Department of Nuclear Engineering, College Station, TX, United States, Aleksandr Obabko, Elia Merzari, Argonne National Laboratory, Lemont, IL, United States

## 3 FLUID APPLICATIONS & SYSTEMS (FASTC)

### 3-1 30TH SYMPOSIUM ON FLUID MACHINERY

#### 3-1-6 GAS TURBINES AND COMPRESSORS

#### SALON 7

Young-Seok Choi, KITECH(Korea Institute of Industrial Technology), Cheonan, Korea (Republic)

#### Interaction between Surge Behavior and Internal Flow Field in an Axial-Flow Compressor

Technical Paper Publication. FEDSM2018-83172

Yuu Sakata, Nobumichi Fujisawa, Yutaka Ohta, Waseda University, Tokyo, Japan

#### Study of the Similarity Laws for Supercritical CO2 Turbine Performance Testing Using High Pressurized Air

Technical Paper Publication. FEDSM2018-83181

Qiyu YING, Weilin Zhuge, Yangjun Zhang, Panpan Song, Lei Zhang, Tsinghua University, Beijing, China

#### Performance Comparison of Gas Turbine Cycle Combined with Supercritical CO2 Recompression and Regenerative Cycle

Technical Paper Publication. FEDSM2018-83187

Yuqi Han, Weilin Zhuge, Yangjun Zhang, Haoxiang Chen, Tsinghua University, Beijing, China

#### The Role of Meridional Geometry in Aerodynamic Design of Centrifugal Compressor

Technical Paper Publication. FEDSM2018-83398

Sasuga ITO, Kazutoyo Yamada, Masato Furukawa, Kaito Manabe, Kyushu University, Fukuoka, Japan, Nobuhito Oka, Mitsubishi Heavy Industries Engine & Turbocharger, Ltd., Sagami-hara, Japan, Isao Tomita, Yoshihiro Hayashi, Mitsubishi Heavy Industries, Ltd, Nagasaki, Japan

#### Influence of Pulsating Flow on Turbine Performance Investigated by DES and PIV

Technical Paper Publication. FEDSM2018-83504

Yohei Nakamura, Manato Chinen, Masamichi Sakakibara, Kazuyoshi Miyagawa, Waseda University, Tokyo, Japan

1:15PM - 3:00PM

# Technical Sessions

WEDNESDAY, JULY 18

## 3 FLUID APPLICATIONS & SYSTEMS (FASTC)

### 3-2 25TH SYMPOSIUM ON INDUSTRIAL AND ENVIRONMENTAL APPLICATIONS OF FLUID MECHANICS

#### 3-2-4 PARTICLES AND SOLIDS TRANSPORT

##### SALON 3

**George Chamoun**, *Eastman Chemical Company, Gray, TN, United States*, **Ivaylo Nedyalkov**, *University of New Hampshire, Durham, NH, United States*

##### **Predicting Particle Segregation in Industrial Granular Flows**

Keynote Presentation. FEDSM2018-83279

**Richard Lueptow**, *Northwestern University, Evanston, IL, United States*

##### **Numerical Investigation of the Efficiency of the Treatment Shaft for Separation of Suspended Solids in Wastewater Treatment**

Technical Paper Publication. FEDSM2018-83347

**Sina Jahangiri Mamouri**, **Andre Benard**, *Michigan State University, East Lansing, MI, United States*, **Saad A. Ghalib**, *Water Engineering Technologies, Ann Arbor, MI, United States*

##### **Fouling Analysis on Energy Dissipation Orifice Plates with Sediment Contained Water Flow**

Technical Paper Publication. FEDSM2018-83159

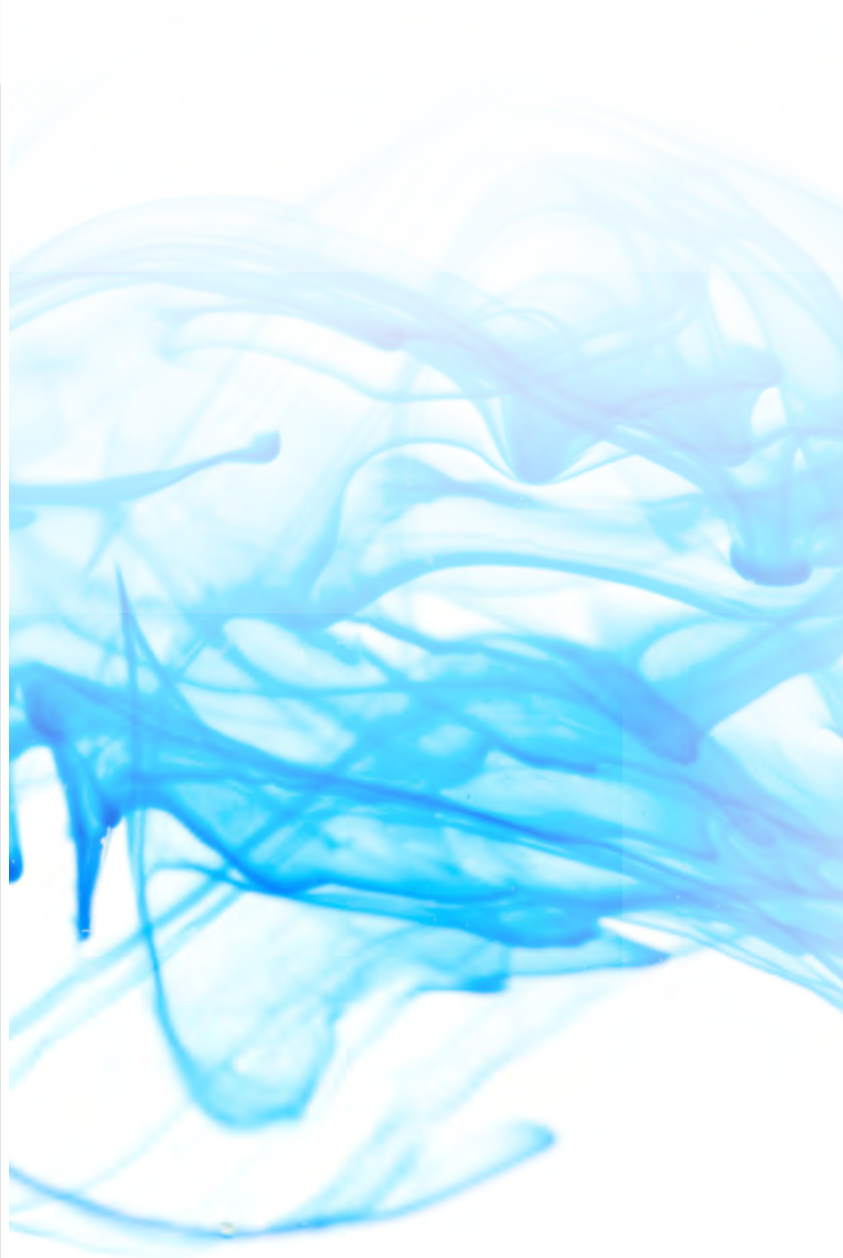
**Jin-Yuan Qian**, **Min-rui Chen**, **Zhi-xin Gao**, **Zhi-Jiang Jin**, *Zhejiang University, Hangzhou, China*

##### **A Numerical Study of Sand Particle Erosion in Elbow and a Series of Plugged Tees in Gas-Particle Two-Phase Flow**

Technical Paper Publication. FEDSM2018-83122

**Goodarz Ahmadi**, *Clarkson University Potsdam, NY, United States*, **Zohreh Mansoori**, **Amirkabir**, *Univ. Of Tech, Tehran, Iran*, **Ali Farokhipour**, **Majid Saffar Avval**, **M.A. Rasoulian**, **Amin Rasteh**, *Amirkabir University of Technology, Tehran, Iran*, **Si-amack Shirazi**, *University of Tulsa, Tulsa, OK, United States*

1:15PM - 3:00PM



## WEDNESDAY, JULY 18

### 4 FLUID MEASUREMENT & INSTRUMENTATION (FMITC)

#### 4-1 FLUID MEASUREMENT AND INSTRUMENTATION

##### 4-1-1 FLUID MEASUREMENT AND INSTRUMENTATION I

#### SALON DRUMMOND CENTRE

**Martin Wosnik**, *University of New Hampshire, Durham, NH, United States*

#### Aerodynamic Drag Measurement in a High-Enthalpy Shock Tunnel

Technical Paper Publication. FEDSM2018-83021

**Yunpeng Wang, Zonglin Jiang**, *Institute of Mechanics, Chinese Academy of Sciences, Beijing, China*, **Honghui Teng**, *Beijing Institute of Technology, Beijing, China*

#### Effect of 30% Closed Valve Disturber on the Discharge Coefficient with Flow Conditioners Online

Technical Paper Publication. FEDSM2018-83031

**Boualem Laribi**, *University Djillali Bounaama of Khemis Miliana, Ain defla, Ain defla, Algeria*, **Abdellah Hadj Abdellah**, *University Feres Yahia de Medea, Medea, Medea, Algeria*

#### CLOWT: A Multifunctional Test Facility for the Investigation of Organic Vapor Flows

Technical Paper Publication. FEDSM2018-83076

**Felix Reinker**, *Muenster University of Applied Sciences, Steinfurt, Germany*, **Eugen Y. Kenig**, *University of Paderborn, Pa-derborn, Germany*, **Stefan aus der Wiesche**, *University of Applied Sciences Muenster, Steinfurt, Germany*

#### Experiments of tip leakage vortex cavitation cloud and suction-side-perpendicular cavitating vortices in an axial flow pump

Technical Paper Publication. FEDSM2018-83134

**Xi Shen, Desheng Zhang**, *Jiangsu University, Zhenjiang, Jiangsu Province, China*

#### Effect of Green Wall Modules on Air Temperature and Humidity

Technical Paper Publication. FEDSM2018-83139

**Peter Abdo, B. Phuoc Huynh, Vahik Avakian**, *University of Technology Sydney, Sydney, Australia*

### 5 MULTIPHASE FLOW (MFTC)

#### 5-3 GAS-LIQUID, GAS-SOLID, AND LIQUID-SOLID FLOWS

##### 5-3-2 GAS-SOLID FLOWS

#### SALON 5

**Michael Kinzel**, *The Pennsylvania State University, State College, PA, United States*, **Hadi Arabnejad Khanouki**, *The University of Tulsa, Tulsa, OK, United States*

#### Modelling of Two-Phase Dense Gas-Solid Flow in Pneumatic Conveying of an Operational Bulk Handling System

Technical Paper Publication. FEDSM2018-83220

**Mahmoud Afshar**, *Petroleum University of Technology, Abadan, Khuzestan, Iran*, **Mojgan Abbasi**, *Tehran University, Tehran, Iran*

#### Interactions of Flow Structure with Nano- and Micro-Particles in Turbulent Channel Flows

Technical Paper Publication. FEDSM2018-83349

**Amir Abdollahi Mofakham, Goodarz Ahmadi, John McLaughlin**, *Clarkson University, Potsdam, NY, United States*

#### On Non-Spherical Nanoparticle Dynamics in Turbulent Flows

Technical Paper Publication. FEDSM2018-83356

**Lin Tian**, *RMIT University, Bundoora, VIC, Australia*, **Goodarz Ahmadi**, *Clarkson University Potsdam, NY, United States*

#### Lattice Boltzmann Method - Hybrid LES/RANS Model for Simulation of Particle Dispersion and Deposition

Technical Paper Publication. FEDSM2018-83383

**Hasan Sajjadi**, *University of Bojnord, Bojnord, Iran*, **Mazyar Salmanzadeh, Saeed Jafari**, *Shahid Bahonar University of Kerman, Kerman, Iran*, **Goodarz Ahmadi**, *Clarkson University Potsdam, NY, United States*

#### On DRW and CRW Models for Prediction of Deposition Velocity and Concentration Distribution of Nano- and Mi-cro-Particles in Turbulent Duct Flows

Technical Presentation. FEDSM2018-83355

**Amir Abdollahi Mofakham, Goodarz Ahmadi**, *Clarkson University Potsdam, NY, United States*

# Technical Sessions

WEDNESDAY, JULY 18

## 5 FLUID MEASUREMENT & INSTRUMENTATION (FMITC)

### 5-5 BUBBLE, DROPLET, AND AEROSOL DYNAMICS

#### 5-5-2 BUBBLE, DROPLET, AND AEROSOL DYNAMICS II

##### BALLROOM EAST

Leitao Chen, *Rice University, Houston, TX, United States*

##### Numerical Analysis of Droplet Impact on a Smooth Slippery Surface

Technical Paper Publication. FEDSM2018-83282

*Firoozeh Yeganehdoust, Ida Karimfazli, Ali Dolatabadi, Concordia University, Montreal, QC, Canada*

##### Effects of Ambient Air Relative Humidity and Surface Temperature on Water Droplet Spreading Dynamics

Technical Paper Publication. FEDSM2018-83287

*Mehdi Jadidi, Mohammad Ali Farzad, Ali Dolatabadi, Concordia University, Montreal, QC, Canada, Jean-yves Trepanier, Ecole Polytech Montreal, Montreal, QC, Canada*

##### Nucleate Boiling Heat Transfer and Bubble Dynamics of Water-In-Polyalphaolefin Nanoemulsion

Technical Paper Publication. FEDSM2018-83397

*Jiajun Xu, James Mclaurin, Cyree Beckett, The University of the District of Columbia, Washington, DC, United States*

##### Quantifying the Spatial-Temporal Evolution of Rim/Ligament in Drop Breakup via Digital In-Line Holography

Technical Paper Publication. FEDSM2018-83470

*Longchao Yao, Jun Chen, Paul Sojka, School of Mechanical Engineering, Purdue University, West Lafayette, IN, United States, Xuecheng Wu, Zhejiang University, Hangzhou, Zhejiang, China*

1:15PM - 3:00PM



WEDNESDAY, JULY 18

## 2 COMPUTATIONAL FLUID DYNAMICS (CFDTC)

### 2-1 SYMPOSIUM ON DEVELOPMENT AND APPLICATIONS IN COMPUTATIONAL FLUID DYNAMICS

#### 2-1-7 COMPUTATIONAL MARINE HYDRODYNAMICS

##### SALON 1

**Shawn Aram**, *Naval Surface Warfare Center, Carderock Division, West Bethesda, MD, United States*, **Hua Shan**, *Naval Surface Warfare Center-Carderock Div, Bethesda, MD, United States*

#### Validation Study of Compact Planing Hulls at Pre-planing Speeds

Technical Paper Publication. FEDSM2018-83091

**Miles Wheeler**, *Konstantin Matveev*, *Washington State University, Pullman, WA, United States*, **Tao Xing**, *University of Idaho, Moscow, ID, United States*

#### Forecasting Optimal Time-Of-Arrival for Carrier Landings Using Prior Ship Motion

Technical Paper Publication. FEDSM2018-83218

**John Vorwald**, **Phong Nguyen**, **Alan Schwartz**, **Christopher Kent**, *Naval Surface Warfare Center Carderock Division, Bethesda, MD, United States*

#### Strength Analysis of Oil Tanker under Numerical Wave

Technical Paper Publication. FEDSM2018-83436

**Shu Cheng**, **Hong Li**, **Dongxu Zhang**, *Harbin Engineering University, Harbin, China*

### 2-2 12TH SYMPOSIUM ON DNS/LES AND HYBRID RANS/LES METHODS

#### 2-2-3 HYBRID LES/RANS METHODS AND APPLICATIONS

##### SALON DRUMMOND EAST

**Yiwei Wang**, *Institute of Mechanics, Chinese Academy of Sciences, Beijing, China*

#### Evaluation of Performance and Code-to-Code Variation of a Dynamic Hybrid RANS/LES Model for Simulation of Backward-Facing Step Flow

Technical Paper Publication. FEDSM2018-83160

**Olalekan O.**, **Shobayo**, **Dibbon K. Walters**, *University of Oklahoma, Norman, OK, United States*

#### Effects of an Underbody Device on the Characteristics of a Trailer Truck Wake Region

Technical Paper Publication. FEDSM2018-83176

**Mohamed Ibrahim**, **Martin Agelin-Chaab**, *University of Ontario Institute of Technology, Oshawa, ON, Canada*

#### Influence of Numerical Dissipation on Draft Tube Flows

Technical Paper Publication. FEDSM2018-83225

**Yao Jiang**, **Liu Yang**, **Siva K. Nadarajah**, *McGill University, Montreal, QC, Canada*

#### Performance of an Algebraic Non-Equilibrium Wall Model in Mildly Separated Compressible Flows

Technical Presentation. FEDSM2018-83295

**David Gonzalez**, *NSWC Indian Head EOD Tech Division, Indian Head, MD, United States*, **Michael Adler**, **Datta Gaitonde**, *The Ohio State University, Hilliard, OH, United States*

#### Assessment of URANS, Hybrid RANS/LES and LES Models for the Prediction of Low-Pr Turbulent Flows

Technical Paper Publication. FEDSM2018-83307

**Shanti Bhushan**, **Oumnia ElFajri**, *Mississippi State University, Starkville, MS, United States*, **William Daniel Jock**, **Dibbon K. Walters**, *University of Oklahoma, Norman, OK, United States*, **Jonathan Lai**, **Yassin Hassan**, *Texas A&M University, College Station, TX, United States*, **R. Brian Jackson**, *Terrapower, Bellevue, WA, United States*, **Aleksandr Obabko**, **Elia Merzari**, *Argonne National Laboratory, Lemont, IL, United States*

3:15PM - 5:00PM

# Technical Sessions

WEDNESDAY, JULY 18

## 3 FLUID APPLICATIONS & SYSTEMS (FASTC)

### 3-1 30TH SYMPOSIUM ON FLUID MACHINERY

#### 3-1-7 EXTRA FLUID MACHINERY 1

#### SALON 7

Yangjun Zhang, *Tsinghua University, Beijing, China*

#### Technical Countermeasures Research on Deep Sea Shipwreck Water Cutting Engineering

Technical Paper Publication. FEDSM2018-83070

*Shengxiang Xue, Zhengwen Chen, Hefei General Machinery Research Institute, Anhui, China, Qile Ren, Di Zhang, Anhui Province Key Laboratory of General Machine Composite Material Technology, Hefei, China, Yongqiang Wang, Songlin Cao, Caihong Han, Hefei General Machinery Research Institute, Hefei, Anhui, China*

#### Research on Optimized Parameters of Air Vessel for Pump Stopping Water Hammer Protection in Practical Water Supply Engineering

Technical Paper Publication. FEDSM2018-83119

*Lyu Jiawen, Zhang Jian, Ho Hai University, Nanjing, China*

#### Analysis on Energy-saving Reconstruction of Jinshan Water pumping Station in Zhenjiang

Technical Paper Publication. FEDSM2018-83129

*Yin Luo, Bo Gong, Shouqi Yuan, Hui Sun, Zhixiang Xiong, Jiangsu University, Zhenjiang, China*

#### Study on Flow Mechanism of Solid-Liquid Two-phase Flow in Vortex Pump

Technical Paper Publication. FEDSM2018-83073

*Hui Quan, Yi Chai, Rennian Li, Shifang Yuan, Jianhui Guo, Pengye Wang, Lanzhou University of Technology, Lanzhou, China*

#### A New Method on Performance Prediction for the Turbine Operation of Centrifugal Pump

Technical Presentation. FEDSM2018-83146

*Xiaohui Wang, Fengxia Shi, Lanzhou University of Technology, Lanzhou, China, Yang Junhu, School of Energy and Power Engineering, Lanzhou University of Technology, Lanzhou, China*

### 3-2 25TH SYMPOSIUM ON INDUSTRIAL AND ENVIRONMENTAL APPLICATIONS OF FLUID MECHANICS

#### 3-2-5 INDUSTRIAL AND ATMOSPHERIC FLOWS

#### SALON 3

Philipp Epple, *DDD, Antigua and Barbuda, Wayne Strasser, Eastman Chemical Co, Kingsport, TN, United States*

#### A 3D Computational Study of Plug Splitting Dynamics and Film Deposition in a Bifurcating Airway Model

Technical Presentation. FEDSM2018-83350

*Cory Hoi, Mehdi Raessi, University of Massachusetts-Dartmouth, North Dartmouth, MA, United States*

#### Study of Flow Field of a Residential Gas Furnace with Particle Image Velocimetry

Technical Paper Publication. FEDSM2018-83471

*Puyuan Wu, Weixiao Shang, Jun Chen, School of Mechanical Engineering, Purdue University, West Lafayette, IN, United States*

#### Implementing Artificial Intelligence in Predicting Metrics for Characterizing Laser Propagation in Atmospheric Turbulence

Technical Paper Publication. FEDSM2018-83209

*Diego Lozano, Vinod Kumar, V M Krishnarao Kottedda, The University of Texas at El Paso, El Paso, TX, United States, V.S. Rao Gudimetla, AFRL/RDSM, MSSS, Kihei, HI, United States*

#### Analysis of Unsteady Flow Characteristics in Spool Valves for Mobile Hydraulics Machine Control

Technical Paper Publication. FEDSM2018-83515

*Sea-June OO, Goeun Kim, Jinyoung Do, Seungbae Lee, Inha University, Incheon, Incheon Metro, Korea (Republic)*

#### Using CFD Simulations to Improve the Air-Cooled Condenser Performance in Severe Windy Condition via Proper Tuning of Pitch Angles for the Blades of Related Fans

Technical Paper Publication. FEDSM2018-83260

*Masoud Darbandi, Hamidreza Khorshidi-Behzadi, Sharif University of Technology, Tehran, Iran, Vahid Farhangmehr, University of Bonab, Bonab, Iran, Gerry Schneider, University of Waterloo, Waterloo, ON, Canada*

3:15PM - 5:00PM

WEDNESDAY, JULY 18

## 4 FLUID MEASUREMENT & INSTRUMENTATION (FMITC)

### 4-1 FLUID MEASUREMENT AND INSTRUMENTATION

#### 4-1-2 FLUID MEASUREMENT AND INSTRUMENTATION II

##### SALON DRUMMOND CENTRE

Stamatios Pothos, *TSI Incorp, Shoreview, MN, United States*

#### Characterization of Cavitation during Pump Operation Based on Hilbert-Huang Transform

Technical Paper Publication. FEDSM2018-83163

*Hui Sun, Shouqi Yuan, Yin Luo, Bo gong, Jiangsu University, Zhenjiang, China*

#### Design of a Thermal Mass Flow Meter for Measurements within the Rotor Rim Ducts of a Hydroelectric Generator

Technical Paper Publication. FEDSM2018-83178

*Kevin Venne, Federico Torriano, Jean-Philippe Charest-Fournier, Claude Hudon, Institut de recherche d'Hydro-Québec (IREQ), Varennes, QC, Canada, Laurent Mydlarski, McGill University, Montreal, QC, Canada, Mathieu Kirouac, Université de Sherbrooke, Sherbrooke, QC, Canada*

#### Effect of Fan Speed on Air Flow through a Green Wall Module

Technical Paper Publication. FEDSM2018-83199

*Peter Abdo, B. Phuoc Huynh, Vahik Avakian, University of Technology Sydney, Sydney, NSW, Australia*

#### Computational Modeling of Flow Rate Measurements using Orifice Flow Meters

Technical Paper Publication. FEDSM2018-83296

*YiQin Xu, Daniel Coxe, Yulia Peet, Taewoo Lee, Arizona State University Tempe, AZ, United States*

#### Void Fraction Measurements of Air-Water Pipe Flows Using Quick-Closing Valves and Wire-Mesh Sensors

Technical Paper Publication. FEDSM2018-83405

*Etienne Lessard, Jun Yang, Canadian Nuclear Laboratories, Chalk River, ON, Canada*

### 4-2 FLUID DYNAMICS OF WIND ENERGY

#### 4-2-1 FLUID DYNAMICS OF WIND ENERGY

##### SALON DRUMMOND WEST/OUEST

Martin Wosnik, *University of New Hampshire, Durham, NH, United States*

#### Stall Flutter Measurements on a Rectangular Wing

Technical Paper Publication. FEDSM2018-83162

*Dimitrios Gkiolas, Demetri Mathioulakis, National Technical University of Athens, Zografos, Greece, Fragiskos Mouzakis, Center for Renewable Energy Sources and Saving, Greece, Pikermi, Greece*

#### Development of an Advanced Wind Turbine Actuator Line Model

Technical Paper Publication. FEDSM2018-83173

*Murphy O'Dea, Laila Guessous, Oakland University, Rochester, MI, United States*

#### Lift and Drag Forces with respect to Azimuth Position of a Darrieus Wind Turbine

Technical Paper Publication. FEDSM2018-83192

*Sajid Ali, University of Science & Technology, Daejeon, Yuseong-gu, Korea (Republic), Sang-Moon Lee, Choon-Man Jang, Korea Institute of Civil Engineering and Building Technology, Gyeonggi-Do, Korea (Republic)*

#### Evolution of a High Reynolds Number Axisymmetric Wake in a Rectangular Cross-Section Wind Tunnel

Technical Presentation. FEDSM2018-83484

*Martin Wosnik, Gregory Taylor-Power, University of New Hampshire, Durham, NH, United States*

#### Wake Effect of a Wind Turbine Model in Different Driving Modes

Technical Presentation. FEDSM2018-83530

*Bingzheng Dou, Liping Lei, Pan Zeng, Tsinghua University, Beijing, Beijing, China*

3:15PM - 5:00PM

# Technical Sessions

WEDNESDAY, JULY 18

## 5 MULTIPHASE FLOW (MFTC)

### 5-3 GAS-LIQUID, GAS-SOLID, AND LIQUID-SOLID FLOWS

#### 5-3-3 LIQUID-SOLID FLOWS

#### SALON 5

Mark Duignan, Savannah River National Laboratory, Aiken, SC, United States, Jaikrishnan Kadambi, Chirag Kharangate, Case Western Reserve University, Cleveland, OH, United States, John Furlan, GIW Minerals, Grovetown, GA, United States

#### Thermophoresis of Nanoparticles in Dilute Gases

Technical Paper Publication. FEDSM2018-83005

Jun Wang, Guodong Xia, Beijing University of Technology, Beijing, China

#### Effect of Pipe Inclination on Settling Slurry Flow near Deposition Velocity

Technical Paper Publication. FEDSM2018-83423

Vaclav Matousek, Mikolas Kesely, Jiri Konfrst, Pavel Vlasak, Institute of Hydrodynamics, Prague, Czech Republic, Vaclav Matousek, Czech Technical University in Prague, Czech Republic

#### Strength Analysis of PV Components on Solar Tanker based on Fluid-Structure Interaction

Technical Paper Publication. FEDSM2018-83433

Dongxu Zhang, Hong Li, Fangfang Xu, Harbin Engineering University, Harbin, China

#### Threshold Criteria for Components of Predictive Model for Pipe Flow of Broadly Graded Slurry

Technical Paper Publication. FEDSM2018-83455

Vaclav Matousek, Czech Technical University in Prague, Prague 6, Not Applicable, Czech Republic, Robert Visintainer, John Furlan, GIW Minerals, Grovetown, GA, United States, Anders Sellgren, Lulea University of Technology, Lulea, Sweden

#### Numerical and Experimental Study of Electrorheological Fluids

Technical Presentation. FEDSM2018-83283

Suchandra Das, Naga Aditya Musunuri, Islam Benouaguef, Edison Amah, Ian Fischer, Pushpendra Singh, New Jersey Institute of Technology, Newark, NJ, United States

### 5-6 EROSION, SLURRY, SEDIMENTATION

#### 5-6-1 EROSION, SLURRY, AND SEDIMENTATION I

#### BALLROOM EAST

John Furlan, GIW Minerals, Grovetown, GA, United States

#### CFD Predictions and Experiments of Erosion of Elbows in Series in Liquid Dominated Flows

Technical Paper Publication. FEDSM2018-83116

Thiana A. Sedrez, Yeshwanth R. Rajkumar, Siamack Shirazi, Hadi Arabnejad Khanouki, Brenton McLaury, The University of Tulsa, Tulsa, OK, United States

#### Sand Erosion Model Prediction, Selection and Comparison for Electrical Submersible Pump (ESP) using CFD Method

Technical Paper Publication. FEDSM2018-83179

Haiwen Zhu, Jianjun Zhu, Jiecheng Zhang, Hong-Quan Zhang, The University of Tulsa, Tulsa, OK, United States, Risa Rutter, Baker Hughes, a GE company, Claremore, OK, United States

#### Experimental Investigation of Flow Behavior in a Bend and Sand Erosion Pattern under Single-Phase and Multiphase Flow Conditions

Technical Paper Publication. FEDSM2018-83238

Peyman Zahedi, Alireza Asgharpour, Hadi Arabnejad Khanouki, Brenton McLaury, Siamack Shirazi, University Of Tulsa, Tulsa, OK, United States

#### Experimental Investigation of Solid Particle Erosion in Successive Elbows in Gas Dominated Flows

Technical Paper Publication. FEDSM2018-83299

Alireza Asgharpour, Peyman Zahedi, Hadi Arabnejad Khanouki, Siamack Shirazi, Brenton McLaury, The University of Tulsa, Jenks, OK, United States

#### A Test of Steady State Erosion Models

Technical Paper Publication. FEDSM2018-83392

Leonard Pease, Arich Fuher, Judith Bamberger, Michael Minette, Pacific Northwest National Laboratory, Richland, WA, United States

3:15PM - 5:00PM

THURSDAY, JULY 19

## 2 COMPUTATIONAL FLUID DYNAMICS (CFDTC)

### 2-1 SYMPOSIUM ON DEVELOPMENT AND APPLICATIONS IN COMPUTATIONAL FLUID DYNAMICS

#### 2-1-8 COMPUTATIONAL TURBULENT COMBUSTION

#### SALON DRUMMOND CENTRE

Chaitanya Ghodke, *Convergent Science Inc., Madison, WI, United States*

#### Systematic Development and Mesh Sensitivity Analysis of a Mathematical Model for an Anode Baking Furnace

Technical Paper Publication. FEDSM2018-83131

*Prajakta Nakate, Domenico Lahaye, Cornelis Vuik, Delft University of Technology, Delft, South Holland, Netherlands, Marco Talice, PM2 Engineering, Cagliari, Italy*

#### Careful Parameter Study to Enhance the Effect of Injecting Heavy Fuel Oil into a Swirling Crossflow Using Numerical Approaches

Technical Paper Publication. FEDSM2018-83207

*Masoud Darbandi, Ali Fatin, Sharif University of Technology, Tehran, Iran, Gerry Schneider, University of Waterloo, Waterloo, ON, Canada*

#### Exploring the Application of Spectral Line-Based Weighted Sum of Grey Gases (Slw) Model in Numerical Simulation of Radiative Turbulent Reacting Flow in an Industrial Furnace

Technical Paper Publication. FEDSM2018-83431

*Masoud Darbandi, Mohammad Bagher Barezban, Sharif University of Technology, Tehran, Iran, Gerry Schneider, University of Waterloo, Waterloo, ON, Canada*

#### Flame Speed and Deflagration-Detonation Analysis in Flare Stack and Header

Technical Paper Publication. FEDSM2018-83445

*Philip Diwakar, Jaleel Valappil, Bechtel Corp, Houston, TX, United States*

## 3 FLUID APPLICATIONS & SYSTEMS (FASTC)

### 3-1 30TH SYMPOSIUM ON FLUID MACHINERY

#### 3-1-8 EXTRA FLUID MACHINERY 2

#### SALON 1

Yutaka Ohta, *Waseda University, Tokyo, Japan*

#### Transient Simulation on Dynamic Motion of Mobile Perforated Plate in Two-Stage Spring Linked Perforated Plates

Technical Paper Publication. FEDSM2018-83156

*Jin-Yuan Qian, Cong-Wei Hou, Zhi-xin Gao, Zhi-Jiang Jin, Zhejiang University, Hangzhou, China*

#### Comparison of Experimental, Thermoelastohydrodynamic (Tehd) and Isothermal, Non-Deforming Computational Fluid Dynamics (Cfd) Results for Thrust Bearings

Technical Paper Publication. FEDSM2018-83177

*Xin Deng, Cori Watson, Minhui He, Houston G. Wood, Roger Fittro, University of Virginia, Charlottesville, VA, United States*

#### Investigation of the Causes of Static Instability in Externally Pressurized Gas Journal Bearings

Technical Paper Publication. FEDSM2018-83403

*Tom Lawrence, IUPUC, Columbus, IN, United States, Marvin D. Kemple, Indiana University Purdue University Indianapolis, Indianapolis, IN, United States*

#### Numerical Investigation of the Flow in Hydrostatic Journal Bearings with Porous Material

Technical Paper Publication. FEDSM2018-83437

*Martin Boehle, T.U. Kaiserslautern, Kaiserslautern, Germany*

#### The Numerical and Experimental Investigation into Hydraulic Characteristics of a No-Load Running Check Valve Due To FSI

Technical Paper Publication. FEDSM2018-83524

*Xiang-yuan Zhang, Zhi-Jun Shuai, Chen-Xing Jiang, Wan-You Li, Jie Jian, Harbin Engineering University, Harbin, China*

8:15AM - 10:00AM

# Technical Sessions

THURSDAY, JULY 19

## 3 FLUID APPLICATIONS & SYSTEMS (FASTC)

### 3-2 25TH SYMPOSIUM ON INDUSTRIAL AND ENVIRONMENTAL APPLICATIONS OF FLUID MECHANICS

#### 3-2-6 FLOW AROUND BLUFF BODIES

#### SALON DRUMMOND EAST

Kevin Anderson, *California State Polytech University Pomona, CA, United States*, George Chamoun, *Eastman Chemical Company, Gray, TN, United States*

#### Influence of Typical Subgrade Structures on Aerodynamic Characteristics of High Speed Trains in Cross wind Conditions

Technical Paper Publication. FEDSM2018-83300

Zhenxu SUN, GuoWei Yang, *Institute of Mechanics, Chinese Academy of Sciences, Beijing, China*

#### Flow Control around a SUV Simplified Vehicle

Technical Paper Publication. FEDSM2018-83444

Stephie Edwige, Iraj Mortazavi, *CNAM, Paris, France*, Philippe Gilotte, Yoann Eulalie, *Plastic Omnium Auto Exterior Division, STE JULIE, France*, David Holst, Christian Navid Nayeri, *TU Berlin, Berlin, Germany*, Jean-Luc Aider, Elliott Varon, *PMMH-ESPCI-UPMC, Paris, France*

#### Numerical Analysis on Drag Reduction of High-Speed Train Using Rough Surface

Technical Paper Publication. FEDSM2018-83374

Bo Yin, GuoWei Yang, *Institute of Mechanics, Chinese Academy of Sciences, Beijing, China*

#### Flame Speed and Deflagration-Detonation Analysis in Flare Stack and Header

Technical Paper Publication. FEDSM2018-83445

Philip Diwakar, Jaleel Valappil, *Bechtel Corp, Houston, TX, United States*

## 4 FLUID MEASUREMENT & INSTRUMENTATION (FMITC)

### 4-1 FLUID MEASUREMENT AND INSTRUMENTATION

#### 4-1-3 FLUID MEASUREMENT AND INSTRUMENTATION III

#### SALON DRUMMOND WEST/OUEST

Fethi Aloui, *University of Valenciennes (UVHC), Valenciennes, France*

#### Dynamic Measurement of Liquid Sheet Formed by Impinging Jets via Partial Coherent Interferometry

Technical Paper Publication. FEDSM2018-83465

Weixiao Shang, Jun Chen, *School of Mechanical Engineering, Purdue University, West Lafayette, IN, United States*

#### Testing of a Cooling Fan for Wing-bay Electro-Mechanical Actuators

Technical Paper Publication. FEDSM2018-83480

Jose Corona, Augustine Akuoko Kwarteng, Gene Warwick, Kamal Kaddoura, John Kizito, *North Carolina A&T Student University, Greensboro, NC, United States*, Osama Mesalhy, Louis Chow, *University of Central Florida, Orlando, FL, United States*, Quinn Leland, *Air Force Research Lab, Kettering, OH, United States*

#### Key Aspects in the Implementation of Digital Processors' Algorithms Used in Laser Doppler Velocity and Phase Dop-pler Anemometry

Technical Presentation. FEDSM2018-83481

Stamatios Pothos, *TSI Incorp, Shoreview, MN, United States*

#### Characterization of Radial Injection of Suspension from an Effervescent Atomizer

Technical Presentation. FEDSM2018-83499

Ali Akbarnozari, Shahin Amiri, Christian Moreau, Ali Dolatabadi, *Concordia University, Montreal, QC, Canada*

#### Large-Scale Experimentation Using the Wall of Wind Experimental Facility to Assess Wind and Rain Impacts on Buildings and Infrastructure Systems

Technical Presentation. FEDSM2018-83534

Amal Elawady, *Florida International University, Miami, FL, United States*

8:15AM - 10:00AM

THURSDAY, JULY 19

## 5 MULTIPHASE FLOW (MFTC)

### 5-4 PERFORMANCE OF MULTIPHASE FLOW SYSTEMS

#### 5-4-1 PERFORMANCE OF MULTIPHASE FLOW SYSTEMS

##### SALON 3

Ram Mohan, *The University of Tulsa, Tulsa, OK, United States*,  
Ramin Dabirian, *The University of Tulsa, Tulsa, OK, United States*

#### Small bubble Generation with Swirl Bubblers for SNS target

Technical Paper Publication. FEDSM2018-83077

Charlotte Barbier, *Elvis Dominguez-Ontiveros, Robert Sangrey, UT Batelle, Oak Ridge, TN, United States*

#### Simulations of an Air-Ventilated Vertical Strut Crossing Water Surface at Variable Yaw Angles

Technical Paper Publication. FEDSM2018-83092

Konstantin Matveev, *Miles Wheeler, Washington State University, Pullman, WA, United States*, *Tao Xing, University of Idaho, Moscow, ID, United States*

#### Phase Separation in Vertical Header of Microchannel Condensers - A Mechanistic Model

Technical Paper Publication. FEDSM2018-83311

Jun Li, *Pega Hrnjak, University of Illinois at Urbana-Champaign, Urbana, IL, United States*

#### CFD Characterization of a Wet Foam Flow Rheological Behavior

Technical Paper Publication. FEDSM2018-83338

Heni Dallagi, *Ahmad Al Saabi, Christine Faille, Thierry Benezech, INRA of Lille, Villeneuve d'Ascq, France*, *Ramla Gheith, University of Monastir, Monastir, Tunisia*, *Wolfgang Augustin, Technische Universität Braunschweig, Braunschweig, Germany*, *Fethi Aloui, University of Valenciennes (UVHC), Valenciennes, France*

#### Gas Carry-Under In GLCC® For Separated and Recombined Outlet Configurations

Technical Paper Publication. FEDSM2018-83406

Srinivas Swaroop Kolla, *Ram Mohan, Ovadia Shoham, The University of Tulsa, Tulsa, OK, United States*

#### Numerical Analysis of Effects of Surface tension and Viscosity on 3 Dimensional Pulsating Heat Pipe

Technical Paper Publication. FEDSM2018-83417

Durga Bastakoti, *Hongna Zhang, Weihua Cai, Harbin Institute of Technology, Harbin, China*, *Fengchen Li, Sun Yat-Sen University, Zhuhai, China*

### 5-6 EROSION, SLURRY, SEDIMENTATION

#### 5-6-2 EROSION, SLURRY, AND SEDIMENTATION II

##### SALON 7

Jaikrishnan Kadambi, *Case Western Reserve University, Cleveland, OH, United States*

#### Construction of a Rain Erosion Test Rig for Wind Energy Blade Coatings

Technical Paper Publication. FEDSM2018-83505

Moritz Mühlbauer, *Paul Uwe Thamsen, Technical University Berlin, Berlin, Germany*, *Maik Wagner, Seilpartner GmbH, Berlin, Germany*, *Jan Liersch, Julian Michael, Key Wind Energy GmbH, Berlin, Germany*

#### Fluid Properties of Microencapsulated Phase Change Material Slurries

Technical Paper Publication. FEDSM2018-83170

Jonathan Young, *Jingru Benner, Anthony Santamaria, Western New England University, Springfield, MA, United States*

#### Single Particle Behavior in Low Reynolds Linear Shear Flow

Technical Presentation. FEDSM2018-83526

Nima Fathi, *Peter Vorobieff, University of New Mexico, Albuquerque, NM, United States*, *Seyed Sobhan Aleyasin, University of Manitoba, Winnipeg, MB, Canada*, *Goodarz Ahmadi, Clarkson University, Potsdam, NY, United States*

#### Experimental and Numerical Investigation of Sediment Transport in Sewers

Technical Paper Publication. FEDSM2018-83274

Maryam Alihosseini, *Paul Uwe Thamsen, Berlin University of Technology Berlin, Germany*

8:15AM - 10:00AM

# Technical Sessions

THURSDAY, JULY 19

## 3 FLUID APPLICATIONS & SYSTEMS (FASTC)

### 3-1 30TH SYMPOSIUM ON FLUID MACHINERY

#### 3-1-9 TURBOMACHINERY OPTIMIZATION

##### SALON DRUMMOND CENTRE

*Hiroyoshi Watanabe, Ebara Corporation, Futtsu-Shi Chiba, Japan, Yu-Tai Lee, Naval Surface Warfare Center, West Bethesda, MD, United States*

#### Development of a Measurement Method for the Classification and Performance Evaluation of Positive Pressure Ventilation (PPV) Fans

Technical Paper Publication. FEDSM2018-83278

*Manuel Fritsche, Philipp Epple, Coburg University of Applied Sciences, Nurnberg, Bavaria, Germany, Antonio Delgado, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany*

#### Numerical Study of Improving Savonius Turbine Power Coefficient by Various Blade Shapes

Technical Paper Publication. FEDSM2018-83284

*Hassan A. Hassan Saeed, Ahmed M. Nagib Elmekawy, Sadek Z. Kassab, Alexandria University, Alexandria, Egypt*

#### Second Stage Optimization of Helical Groove Seals Using Computational Fluid Dynamics to Evaluate the Dependency of Optimized Design on Preswirl

Technical Paper Publication. FEDSM2018-83492

*Cori Watson, Houston G. Wood, University of Virginia, Charlottesville, VA, United States*

#### Optimization and Investigation on the Impact of Centrifugal Impeller Blade Thickness Distribution on Hydro-induced Vibration

Technical Paper Publication. FEDSM2018-83104

*Bo Qian, Dazhuan Wu, Zhejiang University, Hangzhou, Zhejiang, China*

#### Remarks on the Recirculation at the Outlet of a Radial Impeller Near Shut-Off

Technical Paper Publication. FEDSM2018-83462

*Evgenii Palamarchuk, Paul Uwe Thamsen, Technical University Berlin, Berlin, Germany, Tino Mengdehl, Ernst Augustin, Berlin, Germany*

## 4 FLUID MEASUREMENT & INSTRUMENTATION (FMITC)

### 4-1 FLUID MEASUREMENT AND INSTRUMENTATION

#### 4-1-4 FLUID MEASUREMENT AND INSTRUMENTATION IV

##### SALON DRUMMOND WEST/OUEST

*Judith Bamberger, Pacific Northwest National Laboratory, Richland, WA, United States*

#### Turbulent Structure with Microbubbles Generated by Electrolysis in a Horizontal Channel Flow

Technical Paper Publication. FEDSM2018-83027

*Takamichi Hiroi, Tatsuya Hamada, Masahiko Makino, Chiharu Kawakita, National Maritime Research Institute, Tokyo-to, Japan*

#### Characterization of the Bag Breakup of Liquid Drop Using High-Speed Digital in-line Holography

Technical Paper Publication. FEDSM2018-83467

*Longchao Yao, Jun Chen, Paul Sojka, School of Mechanical Engineering, Purdue University, West Lafayette, IN, United States, Xuecheng Wu, Zhejiang University, Hangzhou, Zhejiang, China*

#### Experimental and Computational Fluid Dynamic Analysis of Laboratory-Scaled Counter-Rotating Cross-Flow Turbines in Marine Environment

Technical Paper Publication. FEDSM2018-83030

*Minh Doan, Ivan H Alayeto, Shinnosuke Obi, Keio University, Yokohama, Japan, Claudio Padricelli, Keio University, Milan, Italy, Yoshitaka Totsuka, Wind Energy Institute of Tokyo Inc., Tokyo, Kanagawa, Japan*

#### Effects of Fluid Viscosity and Impingement Angle on Submerged Jet Flow fields

Technical Paper Publication. FEDSM2018-83251

*Soroor Karimi, Matthew R. Fulton, Siamack Shirazi, Brenton McLaury, The University of Tulsa, Jenks, OK, United States*

#### Particle-Imaging Velocimetry and Pressure Measurements of the Turbulent Flows inside the Intake Duct

Technical Paper Publication. FEDSM2018-83378

*Ruizhi Zhang, Renfang Huang, Tsinghua University, Beijing, China, Lei Zhu, China Institute of Water Resources and Hydro-power Research, Beijing, China, Yuanxing Dai, Jiajian Zhou, Science and Technology on Water Jet Propulsion Laboratory, Shanghai, China, Xianwu Luo, Department of Energy and Power Engineering, Beijing, China*

8:15AM - 10:00AM

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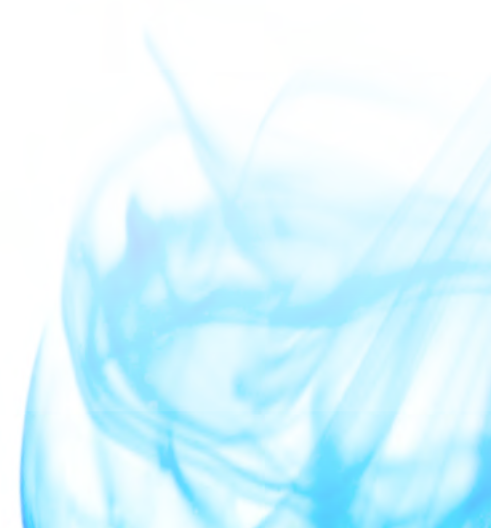
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Session Organizer: Thomas Shepard, University of St. Thomas

## **5-5-2 Bubble, Droplet, and Aerosol Dynamics II (Technical)**

Session Organizer: Leitao Chen, Rice University

## **5-6-1 Erosion, Slurry, and Sedimentation I (Technical)**

Session Organizer: John Furlan, GIW Minerals

## **5-6-2 Erosion, Slurry, and Sedimentation II (Technical)**

Session Organizer: Jaikrishnan Kadambi, Case Western Reserve University

## **6-1-1 Micro/nano-fluidics I (Technical)**

Session Organizer: Jeff Darabi, Southern Illinois University Edwardsville  
Session Co-Organizer: Shriram Jagannathan, ANSYS, inc.

## **6-1-2 Micro/nano-fluidics II (Technical)**

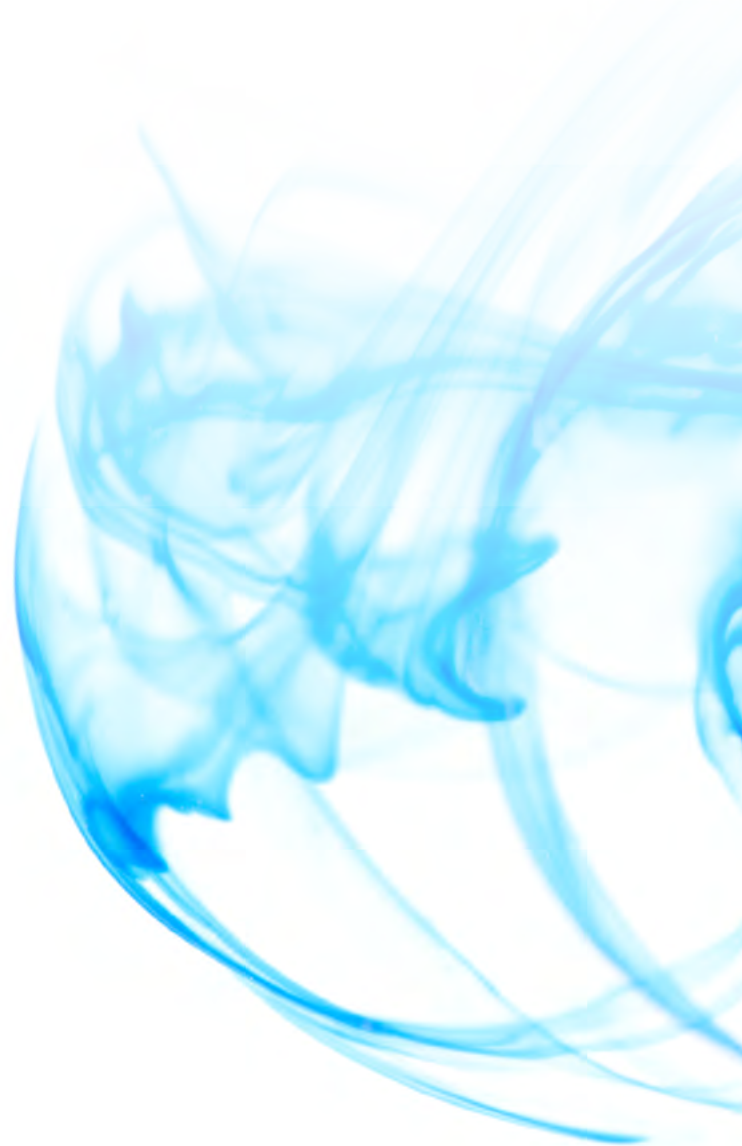
Session Organizer: Sang-Joon J. Lee, San Jose State University  
Session Co-Organizer: Asghar Rahimi, Ferdowsi University of Mashhad

## **6-1-3 Micro/nano-fluidics III (Technical)**

Session Organizer: Maria Vittoria Salvetti, DICI - University of Pisa  
Session Co-Organizer: Kiarash Keshmiri, University of Alberta

## **6-1-4 Micro/nano-fluidics IV (Technical)**

Session Organizer: Liangliang Fan, Xi'an Jiaotong University  
Session Co-Organizer: Afzal Husain, Sultan Qaboos University



# Acknowledgments

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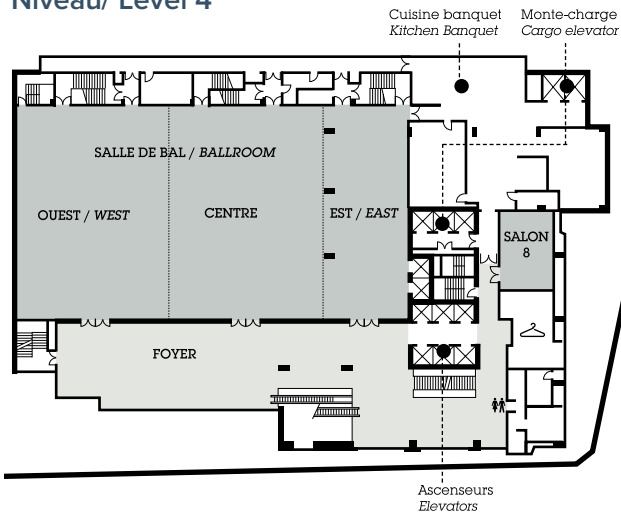
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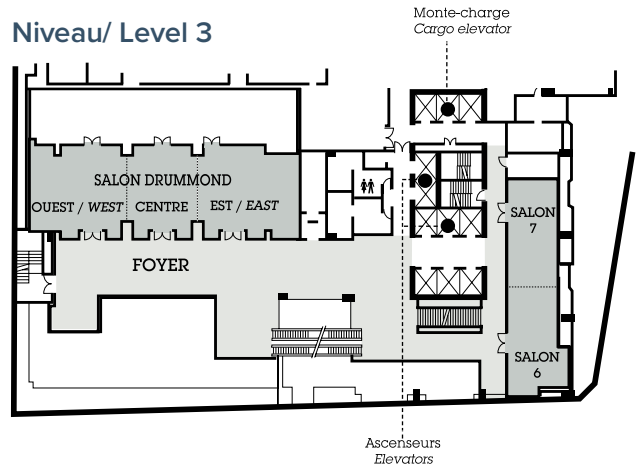
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# Hotel Floor Plan

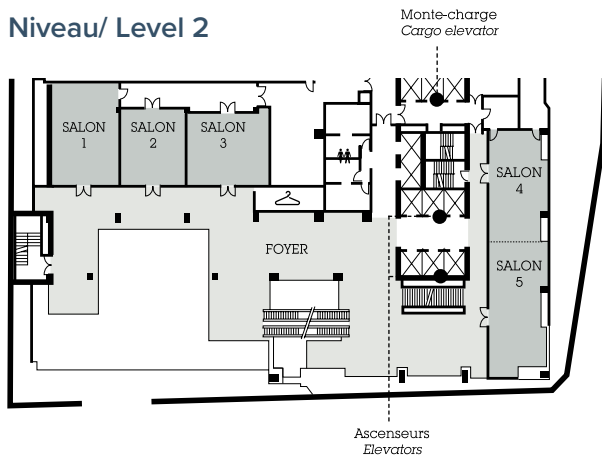
Niveau/ Level 4



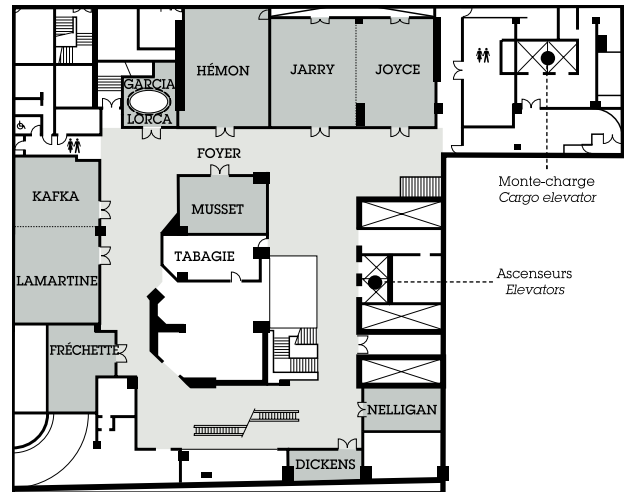
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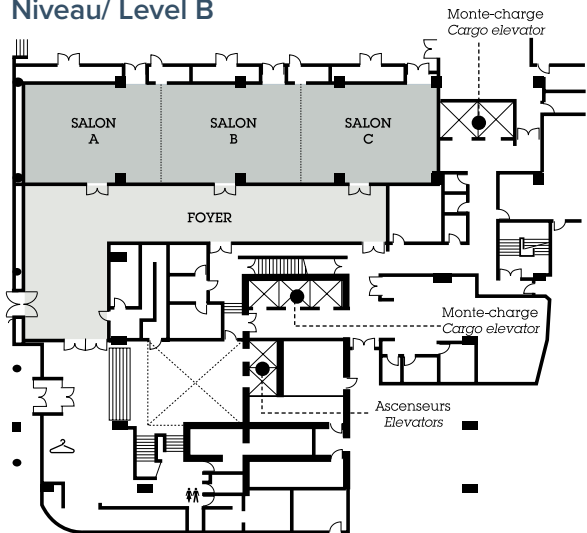
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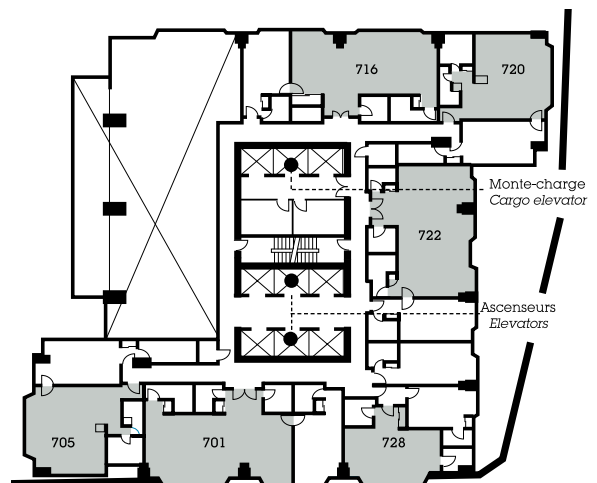
Niveau/ Level A



Niveau/ Level B



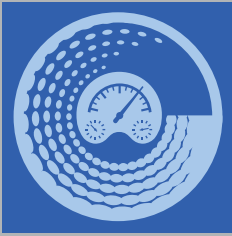
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