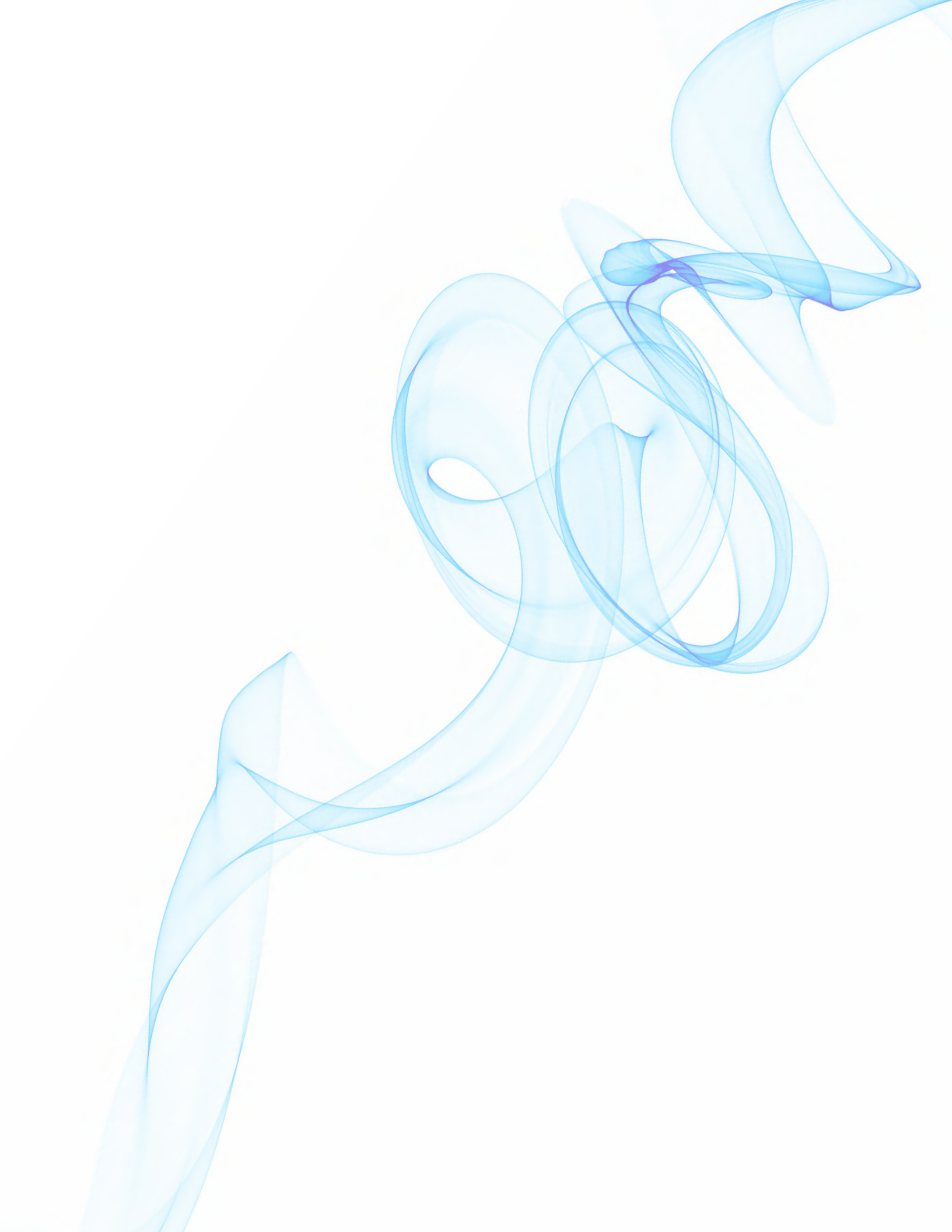
# ASME 2017
# Fluids Engineering Division Summer Meeting

Hilton Wailoloa Village, Waikoloa, Hawaii

July 30 - August 3, 2017

## Conference Program

ASME
SETTING THE STANDARD



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# Welcome from the Chair

It is with absolute pleasure that I welcome you to the ASME 2017 Fluids Engineering Division Summer Meeting (FEDSM 2017) at Waikoloa Beach, Hawaii, from July 30 to August 3, 2017. In close collaboration with the officers of the six Technical Committees (TC), their symposium organizers and session chairs, the FED Executive Committee (EC) has created an exciting technical program for this year's Conference.

We start the professional training part of our program on Sunday, July 30th, with two stimulating workshops on "An Introduction to the NASA FUN3D Computational Fluid Dynamics Software," a fully unstructured Navier-Stokes code. This workshop will be led by Dr. Eric Nielsen from the Computational AeroSciences Branch at NASA Langley Research Center. The second workshop for the day will be directed by Professor Pratap Vanka from University of Illinois Urbana-Champaign, on "Computational Fluid Dynamics on Graphical Processing Units: Architecture, Algorithms and Implementation."

Our technical sessions commence on Monday, July 31st, with a plenary talk presented by Dr. Eric Nielsen on "Adjoint-Based Aerodynamic Design of Complex Aerospace Configurations," a series of algorithms developed in the past two decades to assess the sensitivity of complex large-scale Computational Fluid Dynamics (CFD) simulations.

One of the EC initiatives during FEDSM 2017 is the institution of luncheon keynote sessions. During these catered lunch-time presentations, the attendees will have the opportunity to listen to two back-to-back talks on new understanding of the fundamentals or contemporary applications of fluid mechanics. Our first keynote session will include discussions on "The Onset of Turbulence: Insights into the Navier-Stokes Equations" and "Dynamic Stability of Flapping-Wing Micro Air Vehicles with Unsteady Aerodynamic Model," presented by Professors Carl Rathmann from California State Polytechnic University, Pomona, and Jae-Hung Han from the Korea Advanced Institute of Science and Technology, respectively.

The Freeman Award Lecture will be presented by Professor Sivaramakrishnan-Balachandar, the 2017 Freeman Scholar, from University of Florida during the Tuesday, August 1st, plenary session. He will discuss his latest results on "An Improved Point-Particle Approach that Captures Fully Resolved Physics Euler-Lagrange Point-Particle." The luncheon keynote sessions of the day include "The Role and Future of Turbomachinery Design" presented by Professor Mark Turner from the University of Cincinnati, and "Fluid Mechanics of Balls" by Sports Aerodynamicist, Dr. Rabindra Mehta.

The technical program on Wednesday, August 2nd, starts with the general talk titled "An Overview of Aerospace Propulsion Research at NASA Glenn Research Center." Our plenary presenter will be Dr. Dhanireddy Reddy from the Propulsion Division of NASA Glenn Research Center. Siemens PLM's Aaron Godfrey and Eric Volpenhein, and Oak Ridge National Laboratory's Adrian Sabau and Yarum Polsky, as well as Jentung Ku of NASA Goddard Space Flight Center and Triem Hoang of TTH Research, Inc. will deliver our luncheon keynotes sessions on "Efficient Heat Exchanger Designs Using Additive Manufacturing and Siemens Automated Design Exploration Technology" and "An Advanced Loop Heat Pipe for Cryogenic Applications," respectively.

On our final day, Thursday, August 3rd, our plenary session is dedicated to the Fluids Engineering Lecture. Professor Michael Plesniak from George Washington University is our ASME 2017 Fluids Engineering Award recipient and will deliver the Award's plenary talk on "Studies of Unsteady Flows Inspired by Biomedical Applications." The final lunchtime keynote is on "Visions of Exascale CFD" offered by Dr. Steve Legensky from Intelligent Light. This talk will bring our 2017 Summer Meeting to a close. A workshop run by Professor Kozo Fujii of Tokyo University of Science and Japan Space Exploration Agency (JAXA), and Steve Legensky and Yves-Marie Lefebvre of Intelligent Light, will follow after the close of the Conference on Thursday afternoon. During this workshop, the presenters will discuss "Extract-based and In-situ Methods for HPC Enabled CFD." All are invited to attend.

In 2016, our Fluids Engineering community lost a dear friend and colleague, Dr. Jonathan Hugh Watmuff. Jon's dedication to furthering the field, his expertise, his grasp of foreign and advanced concepts and, more importantly, his passion for fluid mechanics and education of the next generation, was second to none. The FED is honored to have Jon's friends, past students and colleagues join us during the Conference to commemorate Jon and honor his legacy. All FEDSM delegates are cordially invited to join us during the "Symposium in Memory of Dr. Jonathan Watmuff" to celebrate his life. The presenters will share their memories of Jon from different stages of his stellar career as a fluid mechanics researcher at Princeton University, experimental fluid dynamist at NASA Ames Research Center, and subsonic and supersonic aerodynamics and fluid mechanics advisor and professor at the Royal Melbourne Institute of Technology.

Jon's recent research interests included laminar-turbulence transition, turbulence and coherent structures, flow control and buffet loading of airframes. During Jon's memorial session, we will hear from Rabindra Mehta on "Jon Watmuff's Legacy at NASA Ames Research Center;" Michael Plesniak on "Surface-Mounted Obstacles Immersed in Extremely Pulsatile Flows;" and Brandon Horton, Yangkun Song and Javid Bayandor on "Full-Scale Aircraft Water Ditching Investigation using Lagrangian Based Compressible Fluid Solid Interaction." David Pook, Robert Carrese and Pier Marzocca will complement the tributes by presenting "In Memory of Dr. Jonathan Hugh Watmuff: Experiments with Passion and Purpose."

The Division is further saddened by the recent passing of Professor Karman Ghia in June 2017. Karman was a familiar and friendly face at all our FED meetings going back several decades. His absence among us will be felt dearly. A deserving commemoration is currently being planned and will be held during the next summer meeting.

This year, in addition to the special talks and sessions, approximately 80 technical sessions will highlight the research and educational advances in the field of Fluids Engineering in the broad areas of Fluids Measurements and Instrumentation, Computational Fluid Dynamics, Multiphase Flow, Fluid Applications and Systems and Fluid Mechanics, represented by the six TCs of the Division. The list of sessions further includes an open panel discussion on "Toward Exascale: Challenges and Opportunities for Fluid Flow Simulation," moderated by Professors Ning Zhang and Jingsen Ma, the past and current officers of CFDTC from McNeese University and Dynaflow, respectively. The international panel comprises of Dr. Michael Sprague, NREL USA; Professor Philipp Schlatter, KTH Sweden; Professor Makoto Tsubokura, RIKEN Japan; and Professor Wei Ge, Institute of Process Engineering China.

The Division's Graduate Students Steering Committee (GSSC) has reviewed and ranked tens of submissions by students who contributed to the FEDSM graduate scholarship track. GSSC is delighted to see an exceptionally sharp rise in the number of submissions this year, and encourages graduate students to continue to apply for consideration for the FED Scholar of the Year Award in 2018 and beyond. As part of this award, students will be assigned to one of the six FED TCs to serve for one year and benefit from the graduate mentoring program that the Division has developed for our scholarship recipients.

Finally, on behalf of the Executive Committee, I would like to thank all the authors, contributors and participants, TC chairs and vice chairs, symposium organizers, reviewers, judges, session chairs, and the ASME staff. The organization of this event has required your hard work and dedication for which we are grateful.

Set in scenic Waikoloa and enriched with many informative and inspiring technical presentations, panels, and workshops, this year's Conference provides an incredible opportunity for all of us to actively participate in technical discussions and network with Fluids Engineering experts and professionals. I invite you to be a part of the stimulating presentations and enticing conversations — and to thoroughly enjoy the Conference.

**Javid Bayandor, PhD, FASME**
*Conference Chair*

# General Information

### 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 2017 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)

One 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 Honors & Awards Banquet. Wednesday, August 2, 8:00 – 10:00 PM

### CONFERENCE LUNCHES

Conference lunches will be held from 11:45 – 1:00 PM on Monday, Tuesday, and Wednesday and 11:45 – 12:30 PM on Thursday of the conference. Please join your fellow attendees for three fantastic lectures all delivered over a warm sit down meal.

### CONFERENCE EVENT CONNECT APP

Download the new ASME Event Connect App and hold the entire program in the palm at your hand! The new ASME Event Connect 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 Event Connect App is available at the App Store, Google Play and Windows Market.

### CONFERENCE PROCEEDINGS

Each attendee receives a conference DVD that includes all of the papers accepted for presentation at the conference. The official conference archival proceedings will be published after the conference and will not include accepted papers that were not presented at the conference. The official conference proceedings is registered with the Library of Congress and are submitted for abstracting and indexing. The proceedings are published on the AMSE Digital Library

### CONFERENCE REFRESHMENT BREAKS

Three morning breaks and three afternoon breaks will be provided in the exhibition area (Grand Promenade). 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 31, 10:00 AM and 4:00-4:15 PM
Tuesday, August 1, 10:00 AM
Wednesday, August 2, 10:00 AM and 4:00-4:15 PM
Thursday, August 3, 10:00 AM

### EMERGENCY INFORMATION

In the event of an emergency, please dial 55 on any hotel phone to connect with the hotel emergency hotline. The hotel will communicate with the local authorities. The hotel also has 24-hour security, and officers trained in first aid, CPR & AED service.

## EXHIBITS INFORMATION

Location: Grand Promenade (Conference Center)

Hours:

Monday, July 31, 10:00 AM – 5:20 PM
Tuesday, August 1, 10:00 AM – 5:20 PM
Wednesday, August 2, 10:00 AM – 4:00 PM

## INTERNET ACCESS

Internet is provided in the conference center for FEDSM 2017.

## 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 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.

## REGISTRATION INFORMATION

Location: Grand Promenade (Conference Center)

Hours:

Sunday, July 10, 10:00 AM – 5:00 PM
Monday, July 11, 7:30 AM – 5:30 PM
Tuesday, July 12, 7:30 AM – 5:30 PM
Wednesday, July 13, 7:30 AM – 5:30 PM
Thursday, July 14, 7:30 AM – Noon

# Program At-A-Glance

| Sunday, July 30, 2017 | | |
|---|---|---|
| **Time** | **Location** | **Session #** |
| 7:30am-6:00pm | Grand Promenade | **Registration** |
| 8:00am-12:00pm | King's 1 | **Workshop 1 / An Introduction to the NASA FUN3D Computational Fluid Dynamics Software** |
| 11:45am-1:15pm | Kona 3 | **FED Petroleum Division Lunch** (Sponsored by Petroleum Division) **(closed to general attendance)** |
| 1:00-5:00pm | King's 1 | **Workshop 2 / Computational Fluid Dynamics on GPUs: Architecture, Algorithms and Implementation** |
| 1:30-4:30pm | Kona 3 | **FED Executive Committee Meeting (closed to general attendance)** |
| 4:30-5:30pm | Kona 3 | **FED Advisory Board and Executive Committee Meeting (closed to general attendance)** |
| 5:30-6:30pm | Kona 3 | **FED Executive Committee with TC Chairs/Vice Chairs Meeting (closed to general attendance)** |
| 6:30-7:00pm | Kona 3 | **FED Graduate Student Steering Committee Meeting (closed to general attendance)** |
| 7:00-8:30pm | Water's Edge Boardroom | **FED AE Dinner Meeting (closed to general attendance)** |

## Monday, July 31, 2017

| Time | Location | Session # |
|---|---|---|
| **MORNING SESSIONS** | | |
| 8:45-10:00am | Monarchy Ballroom | **1-2-1**<br>**Morning Plenary 1 "Adjoint-Based Aerodynamic Design of Complex Aerospace Configurations"**<br>FEDSM2017-69357 |
| 10:00-10:15am | Grand Promenade | **COFFEE BREAK** |
| 10:15-11:45am | King's 2 | **2-2-5**<br>**29th Symposium on Fluid Machinery: Gas Turbines**<br>Keynote Presentation: FEDSM2017-69597<br>Technical Paper Publication: FEDSM2017-69195 / FEDSM2017-9254 / FEDSM2017-695245 |
| 10:15-11:45am | King's 3 | **2-3-1**<br>**24th Symposium on Industrial and Environmental Applications of Fluid Mechanics: Industrial 1**<br>Keynote Presentation: FEDSM2017-69309<br>Technical Paper Publication: FEDSM2017-69072 / FEDSM2017-69541 / FEDSM2017-69101 |
| 10:15-11:45am | King's 1 | **2-4-1**<br>**9th International Symposium on Pumping Machinery: Pump Design**<br>Keynote Presentation: FEDSM2017-65698<br>Technical Paper Publication: FEDSM2017-69532 / FEDSM2017-69308 |
| 10:15-11:45am | Kona 5 | **3-4-1**<br>**Symposium on Renewable and Sustainable Energy Conversion**<br>Technical Paper Publication: FEDSM2017-69424 / FEDSM2017-69411 / FEDSM2017-69087 / FEDSM2017-69458 / FEDSM2017-69224 |
| 10:15-11:45am | Queen's 4 | **5-1-2**<br>**Symposium on Development and Applications in Computational Fluid Dynamics: CFD 1 Fundamental Studies**<br>Keynote Presentation: FEDSM2017-69603<br>Technical Paper Publication: FEDSM2017-69442 / FEDSM2017-69495 / FEDSM2017-69540 |
| 10:15-11:45am | Queen's 5 | **5-2-2**<br>**12th Synposium on DNS/LES and Hybrid RANS/LES Methods: RANS and Hybrid RANS/LES Methods**<br>Technical Paper Publication: FEDSM2017-69120 / FEDSM2017-69352 / FEDSM2017-69241 / FEDSM2017-69341 |
| 10:15-11:45am | Kona 4 | **6-4-1**<br>**15th International Symposium on Gas & Liquid-Solid Two-phase Flows: Session 1 Erosion**<br>Technical Paper Publication: FEDSM2017-69350 / FEDSM2017-69240 / FEDSM2017-69355 / FEDSM2017-69444 / FEDSM2017-69374 |

# Program At-A-Glance

| Monday, July 31, 2017 (Continued) | | |
|---|---|---|
| **Time** | **Location** | **Session #** |
| 10:15-11:45am | Kona 2 | **7-2-1**<br>**8th International Symposium on Turbulent Flows: Issues and Perspectives**<br>Technical Paper Publication: FEDSM2017-69558 / FEDSM2017-69316 / FEDSM2017-69521 / FEDSM2017-69066 / FEDSM2017-69533 |
| 10:15-11:45am | Queen's 6 | **7-5-2**<br>**8th Symposium on Bio-Inspired Fluid Mechanics: Locomotion and Fluid Mechanics in Nature**<br>Technical Paper Publication: FEDSM2017-69221 / FEDSM2017-69559 / FEDSM2017-69460 / FEDSM2017-69566 / FEDSM2017-69241 |
| 10:15-11:45am | Kona 1 | **7-7-1**<br>**21st Symposium on Fundamental Issues and Perspectives in Fluid Mechanics: High Speed and Vehicle Flows**<br>Technical Paper Publication: FEDSM2017-69314 / FEDSM2017-69420 / FEDSM2017-69502 / FEDSM2017-69299 / FEDSM2017-69372 |
| 11:45am- 1:00pm | | **LUNCH** |

## AFTERNOON SESSIONS

| | | |
|---|---|---|
| 1:00-2:15pm | Monarchy Ballroom | **1-3-1**<br>**Keynote Session 1**<br>**Keynote I: "The Onset of Turbulence: Insights into the Navier-Stokes Equations"**<br>FEDSM2017-69491<br>**Keynote II: "Dynamic Stability of Flapping-Wing Micro Air Vehicles with Unsteady Aerodynamic Model"**<br>FEDSM2017-69568 |
| 2:15-2:30pm | | **BREAK** |
| 2:30-4:00pm | King's 2 | **2-2-6**<br>**29th Symposium on Fluid Machinery: Compressors**<br>Technical Paper Publication: FEDSM2017-69024 / FEDSM2017-69255 / FEDSM2017-69271 / FEDSM2017-69130 |
| 2:30-4:00pm | King's 3 | **2-3-2**<br>**29th Symposium on Industrial and Environmental Applications of Fluid Mechanics: Industrial 2**<br>Technical Paper Publication: FEDSM2017-69097 / FEDSM2017-69582 / FEDSM2017-69602 / FEDSM2017-69577 / FEDSM2017-69356 / FEDSM2017-69394 |
| 2:30-4:00pm | King's 1 | **2-4-2**<br>**9th International Symposium on Pumping Machinery: Multi-Stage Pumps**<br>Technical Paper Publication: FEDSM2017-69013 / FEDSM2017-69251 / FEDSM2017-69283 / FEDSM2017-69587 |
| 2:30-4:00pm | Kona 5 | **3-4-2**<br>**Symposium on Renewable and Sustainable Energy Conversion: Food-Water-Energy Nexus**<br>Technical Paper Presentations: FEDSM2017-69395 / FEDSM2017-69547 / FEDSM2017-69384 / FEDSM2017-69508 / FEDSM2017-69134 |

| Monday, July 31, 2017 (Continued) | | |
|---|---|---|
| **Time** | **Location** | **Session #** |
| 2:30-4:00pm | Kona 2 | **4-1-1**<br>**Microfluidics and Nanofluidics Symposium in FEDSM 2017: Novel Applications of Micro/Nanofluidics**<br>Technical Paper Publication: FEDSM2017-69084 / FEDSM2017-69006 / FEDSM2017-69358 / FEDSM2017-69519 / FEDSM2017-69025 |
| 2:30-4:00pm | Queen's 4 | **5-1-4**<br>**Symposium on Development and Applications in Computational Fluid Dynamics: CFD III Applications I**<br>Technical Paper Publication: FEDSM2017-69453 / FEDSM2017-69367 / FEDSM2017-69192 / FEDSM2017-60137 / FEDSM2017-69615 |
| 2:30-4:00pm | Queen's 5 | **5-2-1**<br>**12th Symposium on DNS/LES and Hybrid RANS/LES Methods: Investigations using DNS/LES Methods**<br>Keynote Presentation: FEDSM2017-69214<br>Technical Paper Publication: FEDSM2017-69041 / FEDSM2017-69340 / FEDSM2017-69326 |
| 2:30-4:00pm | Kona 4 | **6-1-1**<br>**52nd Forum on Cavitation and Multiphase Flow: Session 1**<br>Technical Paper Publication: FEDSM2017-69189 / FEDSM2017-69296 / FEDSM2017-69468 / FEDSM2017-69131 / FEDSM2017-69536 |
| 2:30-4:00pm | Queen's 6 | **7-3-1**<br>**11th International Symposium on Flow Applications in Aerospace: Shock and Vortical Flows**<br>Technical Paper Publication: FEDSM2017-69117 / FEDSM2017-69238 / FEDSM2017-69614 / FEDSM2017-69248 / FEDSM2017-69501 |
| 2:30-4:00pm | Kona 1 | **7-7-2**<br>**21st Symposium on Fundamental Issues and Perspectives in Fluid Mechanics: Explosions**<br>Technical Paper Presentations: FEDSM2017-69408 / FEDSM2017-69448 / FEDSM2017-69417 / FEDSM2017-69398 / FEDSM2017-69343 |
| 4:00-4:20pm | Grand Promenade | **COFFEE BREAK** |
| 4:20-5:50pm | King's 2 | **2-2-7**<br>**29th Symposium on Fluid Machinery: Fans**<br>Technical Paper Publication: FEDSM2017-69182 / FEDSM2017-69261 / FEDSM2017-69287 / FEDSM2017-69292 |
| 4:20-5:50pm | King's 3 | **2-3-3**<br>**24th Symposium on Industrial and Environmental Applications of Fluid Mechanics: Industrial 3**<br>Keynote Presentation: FEDSM2017-69590<br>Technical Paper Publication: FEDSM2017-69147 / FEDSM2017-69229 / FEDSM2017-69010 |

# Program At-A-Glance

| Monday, July 31, 2017 (Continued) | | |
|---|---|---|
| **Time** | **Location** | **Session #** |
| 4:20-5:50pm | King's 1 | **2-4-3**<br>**9th International Symposium on Pumping Machinery: Multi-Stage Pumps, etc.**<br>Technical Paper Publication: FEDSM2017-69121 / FEDSM2017-69191 / FEDSM2017-69386 / FEDSM2017-69094 |
| 4:20-5:50pm | Kona 5 | **3-3-1**<br>**Symposium on the Fluid Dynamics of Wind Energy**<br>Technical Paper Publication: FEDSM2017-69534 / FEDSM2017-69342 / FEDSM2017-69560 / FEDSM2017-69346 / FEDSM2017-69402 |
| 4:20-5:50pm | Kona 2 | **4-1-2**<br>**Microfluidics and Nanofluidics Symposium in FEDSM 2017: Emerging Topics on Microfluidics/Nanofluidics**<br>Keynote Presentation: FEDSM2017-69594<br>Technical Paper Publication: FEDSM2017-69112 |
| 4:20-5:50pm | Queen's 4 | **5-1-11**<br>**Symposium on Development and Applications in Computational Fluid Dynamics: CFD VIII Applications II**<br>Technical Presentation: FEDSM2017-69099<br>Technical Paper Publication: FEDSM2017-69171 / FEDSM2017-69208 / FEDSM2017-69050 |
| 4:20-5:50pm | Kona 4 | **6-1-2**<br>**52nd Forum on Cavitation and Multiphase Flow: Session 2**<br>Technical Paper Publication: FEDSM2017-69544 / FEDSM2017-69212 / FEDSM2017-69499 |
| 4:20-5:50pm | Queen's 5 | **6-5-1**<br>**17th International Symposium on Numerical Methods for Multiphase Flow: Interfacial Flow**<br>Technical Paper Publication: FEDSM2017-69435 / FEDSM2017-69139 / FEDSM2017-69190 / FEDSM2017-69098 / FEDSM2017-69335 |
| 4:20-5:50pm | Queen's 6 | **7-3-2**<br>**11th International Symposium on Flow Applications in Aerospace: Aerodynamics, FSI and Ice Accretion Methods**<br>Technical Paper Publication: FEDSM2017-69583 / FEDSM2017-69361 / FEDSM2017-69616 / FEDSM2017-69365 |
| 4:20-5:50pm | Kona 1 | **7-7-3**<br>**21st Symposium on Fundamental Issues and Perspectives in Fluid Mechanics: Non-Newtonian Flows**<br>Technical Paper Publication: FEDSM2017-69280 / FEDSM2017-69469 / FEDSM2017-69549 / FEDSM2017-69091 / FEDSM2017-69237 |
| **EVENING** | | |
| 6:00-7:00pm | Queen's 5 | **TOWN HALL ASSEMBLY** |
| 7:00-8:30pm | Lagoon Lanai | **CONFERENCE WELCOME RECEPTION** |

## Tuesday, August 1, 2017

| Time | Location | Session # |
|---|---|---|
| **MORNING SESSIONS** | | |
| 8:45-10:00am | Monarchy Ballroom | **1-2-2**<br>**Morning Plenary 2 "An Improved Point-Particle Approach That Captures Fully Resolved Physics Euler-Lagrange Point-Particle"**<br>Technical Paper Publication: FEDSM2017-69606 |
| 10:00-10:15am | Grand Promenade | **COFFEE BREAK** |
| 10:15-11:45am | King's 2 | **2-2-4**<br>**29th Symposium on Fluid Machinery: Hydraulic Turbines**<br>Technical Paper Publication: FEDSM2017-69527 / FEDSM2017-69514 / FEDSM2017-69218 / FEDSM2017-69405 / FEDSM2017-69164 |
| 10:15-11:45am | King's 3 | **2-3-4**<br>**24th Symposium on Industrial and Environmental Applications of Fluid Dynamics: Industrial 4**<br>Keynote Presentation: FEDSM2017-69591<br>Technical Presentation: FEDSM2017-69407<br>Technical Paper Publication: FEDSM2017-69181 / FEDSM2017-69167 |
| 10:15-11:45am | King's 1 | **2-4-4**<br>**9th International Symposium on Pumping Machinery: Cavitation Erosion**<br>Keynote Presentation: FEDSM2017-69604<br>Technical Paper Publication: FEDSM2017-69085 / FEDSM2017-69187 / FEDSM2017-69011 |
| 10:15-11:45am | Kona 5 | **3-2-1**<br>**Symposium on Fluid Measurement and Instrumentation: Fluid Measurement and Instrumentation I-PIV**<br>Technical Paper Publication: FEDSM2017-69090 / FEDSM2017-69546 / FEDSM2017-69005 / FEDSM2017-69204 / FEDSM2017-69589 |
| 10:15-11:45am | Queen's 4 | **5-1-5**<br>**Symposium on Development and Applications in Computational Fluid Dynamics: CFD IV Development and Applications in Fluid-Structure Interaction**<br>Technical Paper Publication: FEDSM2017-69061 / FEDSM2017-69078 / FEDSM2017-69217 / FEDSM2017-69360 / FEDSM2017-69585 |
| 10:15-11:45am | Kona 4 | **6-4-2**<br>**15th International Symposium on Gas and Liquid-Solid Two-Phase Flows: Session 2**<br>Keynote Presentation: FEDSM2017-69612<br>Technical Paper Publication: FEDSM2017-69188 / FEDSM2017-69126 / FEDSM2017-69234 / FEDSM2017-69243 |
| 10:15-11:45am | Queen's 5 | **6-5-2**<br>**17th International Symposium on Numerical Methods for Multiphase Flow: Liquid-Gas**<br>Technical Paper Publication: FEDSM2017-69113 / FEDSM2017-69258 / FEDSM2017-69206 / FEDSM2017-69096 / FEDSM2017-69128 / FEDSM2017-69242 |

# Program At-A-Glance

| Tuesday, August 1, 2017 (Continued) | | |
|---|---|---|
| **Time** | **Location** | **Session #** |
| 10:15-11:45am | Queen's 6 | **7-5-1**<br>**8th Symposium on Bio-Inspired Fluid Mechanics: Fluid-Structure Acoustics and Flight Kinematics**<br>Keynote Presentation: FEDSM2017-69607<br>Technical Presentation: FEDSM2017-69349<br>Technical Paper Publication: FEDSM2017-69573 / FEDSM2017-69344 |
| 10:15-11:45am | Kona 1 | **7-7-4**<br>**21st Symposium on Fundamental Issues and Perspectives in Fluid Mechanics: Jet and Wake Flows**<br>Technical Paper Publication: FEDSM2017-69418 / FEDSM2017-69419 / FEDSM2017-69554 / FEDSM2017-69389 |
| 10:15-11:45am | Kona 2 | **7-9-1**<br>**16th Symposium on Transport Phenomena in Materials Processing and Manufacturing Processes**<br>Technical Paper Publication: FEDSM2017-69249 / FEDSM2017-69270 |
| 11:45am-1:00pm | | **LUNCH** |
| 1:00-3:00pm | Monarchy Ballroom | **1-3-2**<br>**Keynotes Session 2:**<br>**I. "The Role and Future of Turbomachinery Design"** / FEDSM2017-69609<br>**II. "Fluid Mechanics of Balls"** / FEDSM2017-69608 |

**AFTERNOON FREE**

| | | |
|---|---|---|
| 3:00-4:30pm | Kona 3 | **FED Executive Committee with ASME Staff (closed to general attendance)** |
| 3:00-4:00pm | Waikoloa 1 | **FED Micro & Nano Fluid Dynamics Technical Committee** |
| 4:00-5:00pm | Waikoloa 1 | **FED Fluid Measurement & Instrumentation Technical Committee** |
| 5:00-6:00pm | Kona 3 | **FED Fluid Mechanics Technical Committee** |
| 6:00-7:00pm | Kona 3 | **FED Computational Fluid Dynamics Technical Committee** |
| 7:00-8:00pm | Kona 3 | **FED Multiphase Flow Technical Committee** |
| 8:00-9:00pm | Kona 3 | **FED Fluid Applications & Systems Technical Committee** |

## Wednesday, August 2, 2017

| Time | Location | Session # |
|---|---|---|
| **MORNING SESSIONS** | | |
| 8:45-10:00am Ballroom | Monarchy | **1-2-3**<br>**Morning Plenary 3 "An Overview of Aerospace Propulsion Research at NASA Glenn Research Center"**<br>FEDSM2017-69576 |
| 10:00-10:15am | Grand Promendate | **COFFEE BREAK** |
| 10:15-11:45am | King's 3 | **2-1-1**<br>**18th International Symposium on Advances in Numerical Modeling for Turbomachinery Flow Optimization: Turbo 1**<br>Technical Paper Publication: FEDSM2017-69108 / FEDSM2017-69186 / FEDSM2017-69284 / FEDSM2017-69393 / FEDSM2017-69581 |
| 10:15-11:45am | King's 2 | **2-2-1**<br>**29th Symposium on Fluid Machinery: Pumps 1**<br>Technical Paper Publication: FEDSM2017-69018 / FEDSM2017-69044 / FEDSM2017-69048 / FEDSM2017-69119 |
| 10:15-11:45am | King's 1 | **2-4-5**<br>**9th International Symposium on Pumping Machinery: Cavitation**<br>Keynote Presentation: FEDSM2017-69388<br>Technical Paper Publication: FEDSM2017-69178 / FEDSM2017-69256 / FEDSM2017-69159 |
| 10:15-11:45am | Kona 5 | **3-2-2**<br>**Symposium on Fluid Measurement and Instrumentation II: PIV, LDA, HW**<br>Technical Paper Publication: FEDSM2017-69278 / FEDSM2017-69252 / FEDSM2017-69321 / FEDSM2017-69017 / FEDSM2017-69588 |
| 10:15-11:45am | Kona 2 | **4-1-3**<br>**Microfluidics and Nanofluidics Symposium in FEDSM 2017: Flows in Microfluidic Systems**<br>Technical Paper Publication: FEDSM2017-69065 / FEDSM2017-69466 / FEDSM2017-69525 / FEDSM2017-69399 / FEDSM2017-69550 |
| 10:15-11:45am | Queen's 4 | **5-1-6**<br>**Symposium on Development and Applications in Computational Fluid Dynamics: CFD V – Novel Development for Compressible and Multiphase Flows**<br>Technical Paper Publication: FEDSM2017-69057 / FEDSM2017-69100 / FEDSM2017-69312 / FEDSM2017-69315 |
| 10:15-11:45am | Kona 4 | **6-4-3**<br>**15th International Symposium on Gas and Liquid-Solid Two-Phase Flows: Session 3**<br>Technical Paper Publication: FEDSM2017-69409 / FEDSM2017-69317 / FEDSM2017-69412 / FEDSM2017-69462 |
| 10:15-11:45am | Queen's 5 | **7-1-1**<br>**Forum on Advances in Fluids Engineering Education**<br>Technical Paper Publication: FEDSM2017-69031 / FEDSM2017-69196 / FEDSM2017-69211 |

# Program At-A-Glance

| Wednesday, August 2, 2017 (Continued) | | |
|---|---|---|
| **Time** | **Location** | **Session #** |
| 10:15-11:45am | Queen's 6 | **7-4-1**<br>**17th International Symposium on Fluid Power: Transient Lift and Jet and Hydrogen Fuels**<br>Keynote Presentation: FEDSM2017-69618<br>Technical Paper Publication: FEDSM2017-69014 / FEDSM2017-69158 / FEDSM2017-69617 |
| 10:15-11:45am | Kona 1 | **7-7-5**<br>**21st Symposium on Fundamental Issues and Perspectives in Fluid Mechanics**<br>Technical Paper Publication: FEDSM2017-69127 / FEDSM2017-69136 / FEDSM2017-69345 / FEDSM2017-69503 / FEDSM2017-69198 |
| 11:45am-1:00pm | | **LUNCH** |
| 12:00-1:00pm | Kona 3 | **FED Executive Committee with TC Chairs/Vice Chairs (closed to general attendance)** |



## AFTERNOON SESSIONS

| | | |
|---|---|---|
| 1:00-2:15pm | Monarchy Ballroom | **1-3-3**<br>**Keynote Sessions 3:**<br>**I. Efficient Heat Exchanger Designs Using Additive Manufacturing and Siemens Automated Design Exploration Technology /** FEDSM2017-69482<br>**II. Visions of Exascale CFD** / FEDSM2017-69620 |
| 2:30-4:00pm | King's 3 | **1-1-1**<br>**Symposium in Memory of Dr. Jonathan Watmuff**<br>Technical Presentation: FEDSM2017-69600 / FEDSM2017-69563 / FEDSM2017-69601 / FEDSM2017-69599 |
| 2:30-4:00pm | King's 2 | **2-2-2**<br>**29th Symposium on Fluid Machinery: Pumps 2**<br>Technical Paper Publication: FEDSM2017-69142 / FEDSM2017-69163 / FEDSM2017-69239 / FEDSM2017-69124 |
| 2:30-4:00pm | King's 1 | **2-4-6**<br>**9th International Symposium on Pumping Machinery: Cavitation and Unsteady Flows**<br>Technical Paper Publication: FEDSM2017-69427 / FEDSM2017-69416 / FEDSM2017-69133 / FEDSM2017-69077 / FEDSM2017-69028 |
| 2:30-4:00pm | Kona 5 | **3-2-3**<br>**Symposium on Fluid Measurement and Instrumentation III**<br>Technical Paper Publication: FEDSM2017-69003 / FEDSM2017-69088 / FEDSM2017-69382 / FEDSM2017-69415 / FEDSM2017-69425 |
| 2:30-4:00pm | Kona 2 | **4-1-4**<br>**Microfluidics and Nanofluidics Symposium in FEDSM 2017: Microfluidic Devices for Biomedical Applications**<br>Technical Paper Publication: FEDSM2017-69146 / FEDSM2017-69595 / FEDSM2017-69596 / FEDSM2017-69465 / FEDSM2017-69148 |

| Wednesday, August 2, 2017 (Continued) | | |
|---|---|---|
| **Time** | **Location** | **Session #** |
| 2:30-4:00pm | Queen's 4 | **5-1-7**<br>**Symposium on Development and Applications in Computational Fluid Dynamics: CFD VI – RANS and URANS Applications**<br>Technical Paper Publication: FEDSM2017-69203 / FEDSM2017-69311 / FEDSM2017-69586 / FEDSM2017-69033 |
| 2:30-4:00pm | Kona 4 | **6-3-1**<br>**15th International Symposium on Gas-Liquid Two-Phase Flows: Session 1**<br>Keynote Presentation: FEDSM2017-69613<br>Technical Paper Publication: FEDSM2017-69022 / FEDSM2017-69023 / FEDSM2017-69483 |
| 2:30-4:00pm | Queen's 5 | **6-5-3**<br>**17th International Symposium on Numerical Methods for Multiphase Flow: Gas-Solid**<br>Technical Presentation: FEDSM2017-69205<br>Technical Paper Publication: FEDSM2017-69555 / FEDSM2017-69051 / FEDSM2017-69370 / FEDSM2017-69562 / FEDSM2017-69102 |
| 2:30-4:00pm | Queen's 6 | **7-6-1**<br>**12th Symposium on Flow Manipulation and Active Control: Flow Control with Dielectric Barrier Discharge**<br>Technical Paper Publication: FEDSM2017-69060 / FEDSM2017-69226 / FEDSM2017-69246 |
| 4:00-4:20pm | Grand Promenade | **COFFEE BREAK** |
| 4:20-5:50pm | King's 3 | **2-1-2**<br>**18th International Symposium on Advanced in Numerical Modeling for Turbomachinery Flow Optimization: Turbo II**<br>Technical Paper Publication: FEDSM2017-69116 / FEDSM2017-69180 / FEDSM2017-69220 / FEDSM2017-69263 |
| 4:20-5:50pm | King's 2 | **2-2-3**<br>**29th Symposium on Fluid Machinery: Pumps 3**<br>Technical Paper Publication: FEDSM2017-69165 / FEDSM2017-69275 / FEDSM2017-69426 / FEDSM2017-69481 / FEDSM2017-69034 |
| 4:20-5:50pm | King's 1 | **2-4-7**<br>**9th International Symposium on Pumping Machinery: Wastewater Pumps**<br>Technical Paper Publication: FEDSM2017-69020 / FEDSM2017-69021 / FEDSM2017-69298 / FEDSM2017-69123 |
| 4:20-5:50pm | Kona 5 | **3-2-4**<br>**Symposium on Fluid Measurement and Instrumentation IV**<br>Technical Paper Publication: FEDSM2017-69075 / FEDSM2017-69076 / FEDSM2017-69391 / FEDSM2017-69439 / FEDSM2017-69565 |
| 4:20-5:50pm | Kona 2 | **4-1-5**<br>**Microfluidics and Nanofluidics Symposium in FEDSM 2017: Microscale Multiphase Flow and Surface Interactions**<br>Technical Paper Publication: FEDSM2017-69194 / FEDSM2017-69380 / FEDSM2017-69472 / FEDSM2017-69524 / FEDSM2017-69411 |

# Program At-A-Glance

| Wednesday, August 2, 2017 (Continued) | | |
|---|---|---|
| **Time** | **Location** | **Session #** |
| 4:20-5:50pm | Queen's 4 | **5-1-9**<br>**Symposium on Development and Applications in Computational Fluid Dynamics: CFD VII Development and Applications in Particle Transfer**<br>Technical Paper Publication: FEDSM2017-69111 / FEDSM2017-69219 / FEDSM2017-69222 / FEDSM2017-69366 / FEDSM2017-69449 |
| 4:20-5:50pm | Queen's 5 | **5-3-1**<br>**Symposium on Algorithms and Applications for High Performance CFD Computation: Toward Exascale – Challenges and Opportunities for Fluid Flow Simulation (Panel Discussion)**<br>Keynote Presentation: FEDSM2017-69610 / FEDSM2017-69611 |
| 4:20-5:50pm | Kona 4 | **6-3-2**<br>**15th International Symposium on Gas-Liquid Two-Phase Flows: Session 2**<br>Technical Paper Publication: FEDSM2017-69413 / FEDSM2017-69557 / FEDSM2017-69447 / FEDSM2017-69451 / FEDSM2017-69276 |
| 4:20-5:50pm | Queen's 6 | **7-6-2**<br>**12th Symposium on Flow Manipulation and Active Control: Active Flow Control**<br>Technical Paper Publication: FEDSM2017-69046 / FEDSM2017-69272 / FEDSM2017-69461 / FEDSM2017-69569 |
| **EVENING** | | |
| 6:30-10:00pm | Monarchy Ballroom | **2017 ASME Fluids Engineering Division Honors and Awards Banquet** |

| Thursday, August 3, 2017 | | |
|---|---|---|
| **Time** | **Location** | **Session #** |
| **MORNING SESSION** | | |
| 8:45-10:00am | Monarchy Ballroom | **1-2-4**<br>**Morning Plenary 4: "Studies of Unsteady Flows Inspired by Biomedical Applications"**<br>FEDSM2017-69605 |
| 10:00-10:15am | Grand Promenade | **COFFEE BREAK** |
| 10:15-11:45am | King's 3 | **2-1-3**<br>**18th International Symposium on Advanced in Numerical Modeling for Turbomachinery Flow Optimization: Turbo III**<br>Technical Paper Publication: FEDSM2017-69103 / FEDSM2017-69115 / FEDSM2017-69135 / FEDSM2017-69152 |
| 10:15-11:45am | King's 2 | **2-2-8**<br>**29th Symposium on Fluid Machinery: Extra Fluid Machinery**<br>Technical Paper Publication: FEDSM2017-69210 / FEDSM2017-69306 / FEDSM2017-69307 / FEDSM2017-69129 |
| 10:15-11:45am | King's 1 | **2-4-8**<br>**9th International Symposium on Pumping Machinery: Pump Efficiency Aspects**<br>Technical Paper Publications: FEDSM2017-69093 / FEDSM2017-69157 / FEDSM2017-69036 / FEDSM2017-69322 / FEDSM2017-69537 |
| 10:15-11:45am | Kona 5 | **3-2-5**<br>**Symposium on Fluid Measurement and Instrumentation V: Heat Transfer**<br>Technical Paper Publication: FEDSM2017-69347 / FEDSM2017-69570 / FEDSM2017-69517 / FEDSM2017-69513 / FEDSM2017-69523 |
| 10:15-11:45am | Kona 2 | **3-5-1**<br>**Symposium on Energy and Process Engineering: Energy and Process Engineering I**<br>Technical Paper Publication: FEDSM2017-69310 / FEDSM2017-69512 / FEDSM2017-69479 / FEDSM2017-69513 / FEDSM2017-69464 |
| 10:15-11:45am | Queen's 4 | **5-1-3**<br>**Symposium on Development and Applications in Computational Fluid Dynamics: CFD III – Novel Development Efforts**<br>Technical Paper Publication: FEDSM2017-69174 / FEDSM2017-69175 / FEDSM2017-69378 / FEDSM2017-69045 |
| 10:15-11:45am | Queen's 5 | **5-2-3**<br>**12th Symposium on DNS/LES and Hybrid RANS/LES Methods: Applications Employing RANS/LES/DNS**<br>Technical Paper Publication: FEDSM2017-69230 / FEDSM2017-69305 / FEDSM2017-69138 / FEDSM2017-69341 |

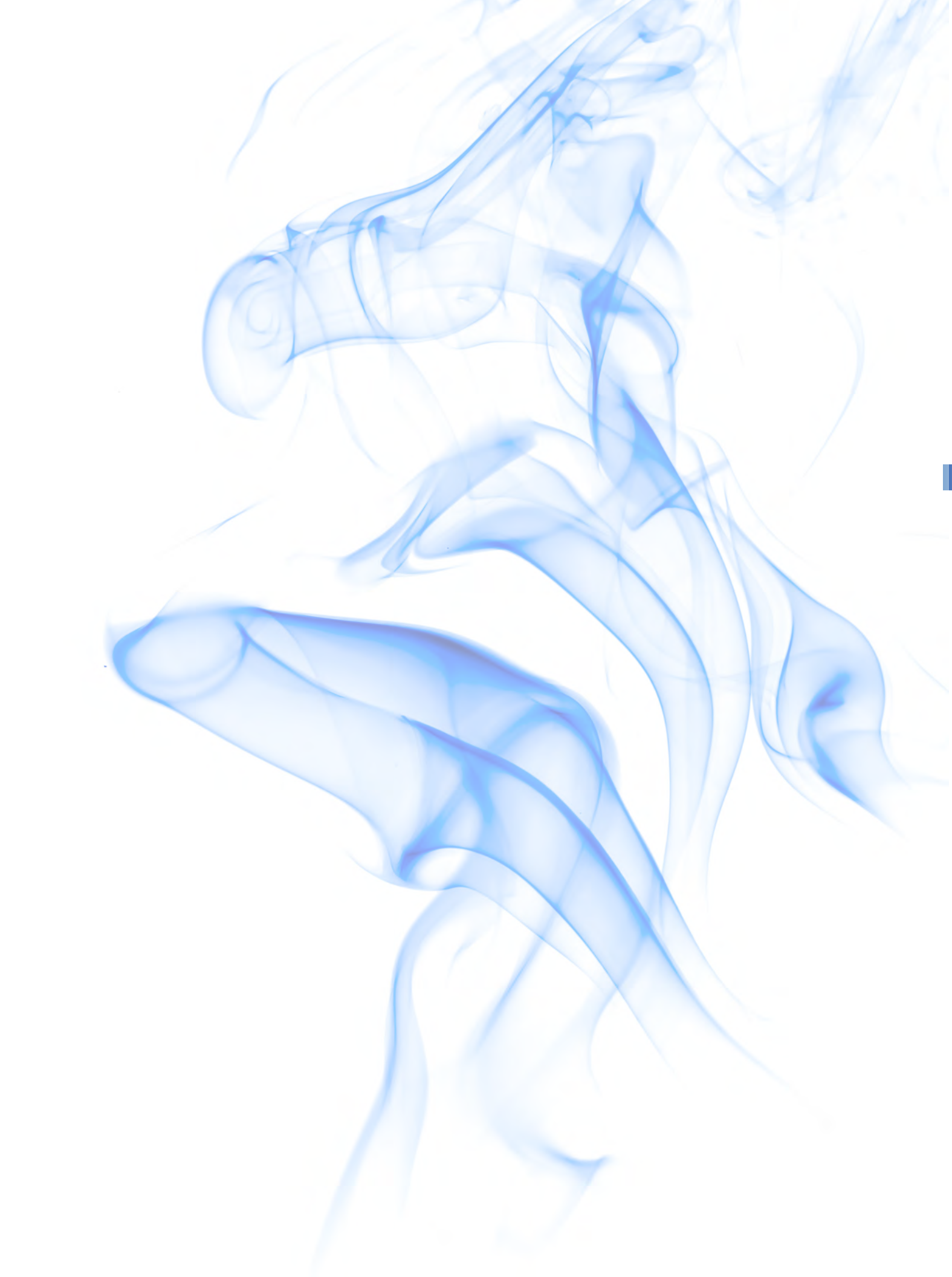
# Program At-A-Glance

| Thursday, August 3, 2017 (Continued) | | |
|---|---|---|
| **Time** | **Location** | **Session #** |
| 10:15-11:45am | Kona 4 | **6-3-3**<br>**15th International Symposium on Gas-Liquid Two-Phase Flows: Session 3**<br>Technical Paper Publication: FEDSM2017-69047 / FEDSM2017-69086 / FEDSM2017-69145 / FEDSM2017-69184 |
| 10:15-11:45am | Queen's 6 | **7-5-3**<br>**8th Symposium on Bio-Inspired Fluid Mechanics: Unsteady Flight and Biomedical Studies**<br>Technical Paper Publication: FEDSM2017-69285 / FEDSM2017-69264 / FEDSM2017-69579 / FEDSM2017-69470 / FEDSM2017-69471 |
| 10:15-11:45am | Kona 1 | **7-8-1**<br>**10th Symposium on Transport Phenomena in Energy Conversion from Clean and Sustainable Resources**<br>Technical Paper Publication: FEDSM2017-69009 / FEDSM2017-69485 / FEDSM2017-69511 / FEDSM2017-69575 |
| 11:45am-12:30pm | | **LUNCH** |



## AFTERNOON SESSIONS

| | | |
|---|---|---|
| 1:00-2:15pm | Monarchy Ballroom | **1-3-4**<br>**Keynote Session 4: "An Advanced Loop Heat Pipe for Cryogenic Applications"**<br>FEDSM2017-69437 |
| 2:30-4:30pm | King's 1 | **Workshop 3 / Workshop on Extract-Based and In Situ Methods for HPC Enabled CFD** |



# Fluids Engineering Plenaries

**Session 1-2-1:**

Date: Monday July 31, 2017
Time: 8:30am - 10:00am
Location: Monarchy Ballroom
Plenary: "Adjoint-Based Aerodynamic Design of Complex Aerospace Configurations"
Presenter: Eric Nielsen, NASA Langley Research Center
Langley, VA, United States

Summary: An overview of 20 years of adjoint-based aerodynamic design research at NASA Langley Research Center is presented. Adjoint-based algorithms provide a powerful tool for efficient sensitivity analysis of complex large-scale computational fluid dynamics (CFD) simulations. Unlike alternative approaches for which computational expense generally scales with the number of design parameters, adjoint techniques yield sensitivity derivatives of a simulation output with respect to all input parameters at the cost of a single additional simulation. With modern large-scale CFD applications often requiring millions of compute hours for a single analysis, the efficiency afforded by adjoint methods is critical in realizing a computationally tractable design optimization capability for such applications

**Session 1-2-2:**

Date: Tuesday August 1, 2017
Time: 8:30am - 10:00am
Location: Monarchy Ballroom
Plenary: "An Improved Point-Particle Approach That Captures Fully-Resolved Physics Euler-Lagrange point-particle"
Presenter: S. Balachandar, University of Florida
Gainesville, FL, United States

Summary: S. "Bala" Balachandar got his undergraduate degree in Mechanical Engineering at the Indian Institute of Technology, Madras in 1983, and his MS and PhD in Applied Mathematics and Engineering at Brown University in 1985 and 1989. From 1990 to 2005 he was at the University of Illinois, Urbana-Champaign, in the Department of Theoretical and Applied Mechanics. From 2005 to 2011 he served as the Chairman of the Department of Mechanical and Aerospace Engineering at the University of Florida. Currently he is a distinguished professor at the University of Florida. He is the William F. Powers Professor of Mechanical & Aerospace Engineering and the Director of College of Engineering Institute for Computational Engineering. Bala received the Francois Naftali Frenkiel Award from American Physical Society (APS) Division of Fluid Dynamics (DFD) in 1996 and the Arnold O. Beckman Award and the University Scholar Award from University of Illinois. He is Fellow of ASME and the American Physical Society Division of Fluid Dynamics. He is currently an editor of the International Journal of Multiphase Flow and the Theoretical and Computational Fluid Dynamics.

**1-2-3 Plenary:**

Date: Wednesday August 2, 2017
Time: 8:30am - 10:00am
Location: Monarchy Ballroom
Plenary: "An Overview of Aerospace Propulsion Research at NASA Glenn Research Center"
Presenter: Dhanireddy Reddy, NASA Glenn Research Center
Cleveland, OH, United States

Summary: NASA Glenn Research center is the recognized leader in aerospace propulsion research, advanced technology development and revolutionary system concepts committed to meeting the increasing demand for high-performance, and light-weight propulsion systems for affordable and safe aviation with environmental compatibility and space transportation needs to reduce travel times as well as increase payload capability for deep space missions. The technologies span a broad range of areas, including air-breathing propulsion, combined-cycle propulsion, chemical rocket components and engines, electric and plasma-based propulsion systems, and advanced propulsion concepts for commercial and military aviation, as well as in-space propulsion applications. The scope of work includes fundamentals, components, processes and system interactions. Technologies developed use both experimental and analytical approaches.

Recent technology advancement efforts in gas turbine engines used for aviation propulsion have been focused on achieving significant improvement in performance at the system level with the overall goals of reducing engine weight, fuel burn, emissions, and noise to meet the national challenges in the areas of energy efficiency and environmental compatibility. These goals translate to aggressive designs of all

the engine components well beyond the state of the art. Compressors and turbines would need highly loaded turbomachinery resulting in dramatic increase of work absorption and output with high efficiencies, as well as adequate stable operability margins. Inlets and nozzles should be able to diffuse and expand the flow in much smaller regions maintaining minimum total pressure losses and satisfying operability, cost, weight, signature, life and acoustic requirements, simultaneously. Combustor designs need to deliver targeted emission reductions through efficient combustion at lower peak temperatures in order to eliminate or significantly reduce NOX, $CO_2$, and unburnt hydrocarbons.

In the area of in-space propulsion, the areas of focus for research and technology development have included advanced chemical propulsion technology aimed at innovative low-cost component design and manufacturing; nontoxic and advanced propellants; nuclear thermal propulsion (NTP) research, technology and system analysis; electric and plasma-based propulsion systems technology aimed at very high specific impulse devices such as ion and hall-effect thrusters, magneto plasmadynamic and pulsed inductive thrusters utilizing electrostatic and electromagnetic acceleration mechanisms; and advanced propulsion concepts to meet the performance and life requirements for deep-space missions.

The presentation provides an overview of the current research and technology development activities at NASA Glenn Research Center in the areas mentioned above to enable the future aerospace propulsion system designs to meet aggressive mission goals.

**1-2-4 Plenary:**

Date: Thursday August 3, 2017
Time: 8:30am - 10:00am
Location: Monarchy Ballroom
Plenary: "Studies of Unsteady Flows Inspired by Biomedical Applications"
Presenter: Michael Plesniak, George Washington University Washington, DC, United States

Summary: Pulsatile flows, unsteady phenomena, coherent vortical structures, and transitional or turbulent flows at low Reynolds numbers occur in the human body. Examples of pathological blood flow in which unsteadiness, separation and turbulence are important include regurgitant heart valves, stenoses or blockages, stents, and arterial branches and bifurcations. Speech production involves unsteady pulsatile flow and turbulent structures that affect the aeroacoustics and fluid-tissue interaction. The overall goal of our cardiovascular-inspired research program is to understand secondary flow structures in arteries and to assess their potential impact on vascular health and disease progression. The richness of morphologies and physics of secondary flow vortical structures and their formation and subsequent loss of coherence during deceleration phases suggests implications related to the blood flow in diseased, stented and stent-fractured conditions.

The goal of our human phonation research program is to investigate the dynamics of flow past the vocal folds (VF) and the aerodynamic interaction with the VF. Studies are performed under both normal and pathological conditions of speech. In particular, recent attention has been focused on understanding the role of polyps (growths on the VF) in altering voice quality. This has led to very fundamental studies of 3D flow separation in pulsatile flows. Our overarching motivation for studying flows relevant to biomedical applications is to facilitate evaluation and design of treatment interventions and for surgical planning, i.e. to enable physicians to assess the outcomes of surgical procedures by using faithful computer simulations. Such simulations are on the horizon with the advent of increasingly more powerful high performance computing and cyberinfrastructure, but they still lack many of the necessary physical models.

# Fluids Engineering Luncheon Keynotes

## Monday, July 31, 2017

1:00pm – 2:15pm
Monarchy Ballroom

### Session 1-3-1

**Keynote I:** "The Onset of Turbulence: Insights into the Navier-Stokes Equations"

Presenter: Carl Rathmann, California State Polytechnic University, Pomona, CA, United States

Summary: For well over 150 years now, theoreticians and practitioners have been developing and teaching our students easily visualized models of fluid behavior that distinguish between the laminar and turbulent fluid regimes. Because of our emphasis on applications, perhaps insufficient attention has been paid to actually understanding the mechanisms by which fluids transition between these regimes. Summarized in this paper is the product of four decades of research into the sources of these mechanisms, at least one of which is a direct consequence of the non-linear terms of the Navier-Stokes equation. A scheme utilizing chaotic dynamic effects that become dominant only for sufficiently high Reynolds numbers is explored. This paper is designed to be of interest to faculty in the engineering, chemistry, physics, biology and mathematics disciplines, as well as to practitioners in these and related applications.

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**Keynote II:** "Dynamic Stability of Flapping-Wing Micro Air Vehicles with Unsteady Aerodynamic Model

Presenter: Jae-Hung Han, Anh Tuan Nguyen, Korea Advanced Institute of Science and Technology (KAIST)

Summary: In this paper, we introduce a numerical approach based on an unsteady aerodynamic model to study the dynamic stability of insect-like flapping-wing micro air vehicles (FWMAVs). Trimmed free flight of FWMAVs is simulated by a framework that couples the unsteady potential-based aerodynamic model and a multibody dynamics code. Flight dynamic modal structures are obtained by a linearization method. This paper also briefly presents the applications of the abovementioned approach to study several problems associated with the flight dynamic stability of FWMAVs, such as the effects of body aerodynamics and wing flexibility, as well as ground effect.

## Tuesday, August 1, 2017

1:00pm – 2:15pm
Monarchy Ballroom

### Session 1-3-2

(Sponsored by George Washington University)

**Keynote I:** "The Role and Future of Turbomachinery Design"

Presenter: Mark Turner, University of Cincinnati, Cincinnati, OH, United States

Summary: Turbomachinery is used in gas turbines, jet engines, turbochargers, pumps, wind turbines, water turbines, fans and more. The role of turbomachinery design will be presented along with a demonstration of design software that is freely available and helps to explain the design process. Future capability in optimization and simulation will be described in addition to the potential for improving efficiency and sustainability of systems due to improved turbomachinery. The increased design space prompted by additive manufacturing as well as other improvements in materials will also be described.

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**Keynote II:** "Fluid Mechanics of Balls"

Presenter: Rabindra Mehta, Sports Aerodynamics Consulting, Mountain View, CA, United States

Summary: Fluid Mechanics plays a prominent role in defining the flight of a ball that is struck or thrown through the air in almost all ball sports. The main interest is in the fact that the ball can often deviate from its initial straight path, resulting in a curved, or sometimes an unpredictable, flight path. It is particularly fascinating that that not all the parameters that affect the flight of a ball are always under human influence. Lateral deflection in flight, commonly known as swing, swerve or curve, is well recognized in cricket, tennis, golf, soccer, volleyball, football and baseball. In most of these sports, the lateral deflection is produced by spinning the ball about an axis perpendicular to the line of flight, which gives rise to what is commonly known as the Magnus effect. It is now well recognized that the fluid mechanics of sports balls are strongly dependent on the detailed development and behavior of the boundary layer on the ball's surface. A side force, which makes a ball curve through the air, can also be generated in the absence of the Magnus effect. In one of the cricket deliveries, the ball is released with the seam angled, which creates the flow asymmetry necessary to produce swing. In baseball, volleyball and soccer there is an interesting variation whereby the ball is released with very little spin imparted to it. In this case, depending on the seam or stitch orientation, an asymmetric, and sometimes time-varying flow field can be generated, thus resulting in an unpredictable flight path (the "knuckling" effect). The fluid mechanics of several different balls, including cricket balls, tennis balls, golf balls, soccer balls, volleyballs, footballs and baseballs will be discussed with the help of test measurements and theoretical analyses, and amply supported by video footage.

## Wednesday, August 2, 2017

1:00pm – 2:15pm
Monarchy Ballroom

### Session 1-3-3

**Keynote I:** "Efficient Heat Exchanger Designs Using Additive Manufacturing and Siemens Automated Design Exploration Technology"

Presenter: Aaron Godfrey and Eric Volpenhein, Siemens PLM; Adrian Sabau, and Yarum Polsky, Oak Ridge National Laboratory, Oak Ridge, TN, United States

Summary: With the rise of global enterprise, digital data and connectivity, the ceaseless challenge of product obsolescence is becoming more acute. Fortunately, so is the opportunity to innovate through advancements in enabling technologies. A partnership between two such technologies, Automated Design Exploration and Additive Manufacturing, to accelerate development of a more efficient and economical heat exchanger for geothermal applications is presented. The partnership more generally pioneers an innovative engineering process through which a broad range of complex variants of scale-down mockups are explored using high-fidelity simulation, with additive manufacturing effectively employed for validation.

Design exploration aspects feature the Siemens Simcenter portfolio of modeling software to assess thermal performance, most prominently including STAR-CCM+ for CFD analysis. These are coordinated with cost-assessment models from Oak Ridge National Laboratory (ORNL). The fully automated process is driven through the HEEDS orchestrator, a central element of the Simcenter portfolio offering a versatile and robust process management environment with intelligent multi-objective search technology. Highlights of the automated design exploration process with representative industrial accomplishments are showcased. Application of the Siemens automated design exploration methodology to heat exchangers in geothermal energy systems is then presented. The opportunity to reduce the total cost of energy derived from such systems hinges on novel design concepts to reduce the size of heat exchangers. These novel design concepts are often beyond the experience of conventional engineering practices, and sole experimental evaluation of all designs is costly. An innovative engineering approach by ORNL that involves additive manufacturing of scale-down mock-ups and design exploration via simulation to address this technology gap in a timely and cost-effective manner is described. Behaviors of advantaged designs at application-scale are subsequently analyzed to confirm the favored design and to estimate overall performance.

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**Keynote II:** "Visions of Exascale CFD"

Presenter: Steve Legensky, Intelligent Light, Rutherford, NJ, United States

Summary: Over the past 30 years, computational simulation of fluid dynamics has made huge strides in meshing of complex geometries, computational efficiency and most importantly, greater fidelity in physics models. Current trends include greater adoption of unsteady methods via LES, higher order methods and alternatives to classical CFD such as Lattice Boltzmann methods. However, the majority of engineering applications remain constrained by computational and storage resources as well as schedule and time pressure. The Department of Energy's Exascale Computing Project (ECP) offers the capacity for scale, fidelity and perhaps most interesting, non-deterministic engineering (NDE) in which variations in boundary conditions, discretization and models can more realistically predict the behavior of complex aerodynamic, propulsion or power generation systems. Intelligent Light is participating in research activities aimed at managing the massive data flows resulting from ensembles of unsteady CFD calculations and implementing tools to support engineering use of uncertainty quantification techniques. Through the perspective of post-processing and data analysis, we have gained a unique perspective of research and engineering use of CFD from the late 1980's through today. The talk will touch on this history but have a primary focus on state-of-the-art, peta-scale CFD in aerospace, combustion and wind energy and survey the challenges that ECP is intended to address.

## Thursday, August 3, 2017

12:30pm – 1:30pm
Monarchy Ballroom

### Session 1-3-4

(Sponsored by Intelligent Light)
**Keynote:** "An Advanced Loop Heat Pipe for Cryogenic Applications"

Presenter: Jentung Ku, NASA Goddard Space Flight Center, Greenbelt, MD, United States, TTH Research, Clifton, VA, United States

Summary: A loop heat pipe (LHP) is a very versatile heat transfer device, which can transport a large heat load over a long distance with a small temperature difference. All LHPs currently servicing orbiting spacecraft are designed to operate in the room temperature range. Future space telescopes and space-based Earth resource imaging satellites require passive cryogenic heat transport devices that can thermally couple remote cryocoolers to sensor or instrument of interest, while providing the capability of payload vibration/jitter isolation, implementation of redundant coolers, and coupling of multiple sensors to a common heat sink. All of these requirements can be satisfied by using a cryogenic LHP (CLHP). Although the development of CLHPs faces several technical challenges, NASA Goddard Space Flight Center has devoted extensive efforts in developing CLHP technology over the past decade and has made significant progress. In particular, the combination of the innovative ideas of using a secondary capillary pump to manage the parasitic heat gain and using a hot reservoir to reduce the system pressure under the ambient condition has led to the successful development of the CLHP. Several CLHPs charged with nitrogen and hydrogen were built and tested in thermal vacuum chambers. These CLHPs demonstrated reliable start-up and robust operation during power cycle and sink temperature cycle tests.

# Fluids Engineering Division Summer Meeting Awards

A variety of awards will be given at the 2017 Fluids Engineering Division Honors and Awards Banquet.

The awards of distinction are as follows:

## 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.

## Sankaraiyer Gopalakrishnan – Flowserve Pump Technology Award

The Flowserve Pump Technology Award recognizes an individual with the potential of becoming the next generation's expert pump engineer.

## 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.

## Robert T. Knapp Award

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

## 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.

# Technical Sessions

## Monday, July, 31

### 1-2
### Fluids Engineering Plenaries
Monarchy Ballroom 8:30am - 10:00am

**1-2-1**
**Morning Plenary 1**

Adjoint-Based Aerodynamic Design of Complex Aerospace Configurations
Plenary Presentation. FEDSM2017-69357

**Eric Nielsen,** *NASA Langley Research Center, Hampton, VA, United States*

### 2-2
### 29th Symposium on Fluid Machinery
King's 2 10:15am - 11:45am

**2-2-5**
**Gas Turbines**

Shortcomings of the URANS Approach in the Simulation of Multi-Stage Compressor Flow Physics
Keynote Presentation. FEDSM2017-69597

**Chunill Hah,** *NASA Glenn Research Center, Cleveland, OH, United States*

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A Detailed Experimental and Numerical Investigation of Flow Structures in a Turbine Tip Gap With Passive Injection
Technical Paper Publication. FEDSM2017-69195

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

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Reduction Method for the Secondary Flow Loss in Turbine Cascade
Technical Paper Publication. FEDSM2017-69254

**Shouhei Mizuguchi, Kakeru Kusano,** *Osaka Institute of Technology, Osaka, Japan*, **Hiroharu Oyama,** *Mitsubisi Hitachi Power Systems, Takasago City, Hyogo, Japan*, **Yutaka Kawata,** *Osaka Institute of Technology, Osaka, Japan*

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Reseach on Heat-Transfer and Cooling Performance of Gas Turbine End Wall
Technical Paper Publication. FEDSM2017-69245

**Kazuto Kakio, Yutaka Kawata,** *Osaka Institute of Technology, Osaka, Japan*

### 2-3
### 24th Symposium on Industrial and Environmental Applications of Fluid Mechanics
King's 3 10:15am - 11:45am

**2-3-1**
**Industrial 1**

Modeling Sealing in Transient Injector Simulations
Keynote Paper Publication. FEDSM2017-69309

**Chinmoy Mohapatra, Gabriel Jacobsohn, Eli Baldwin, David Schmidt,** *University of Massachusetts, Amherst, MA, United States*

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Fuel-Spray Simulation with Valve Motion Perpendicular to Closing Direction
Technical Paper Publication. FEDSM2017-69072

**Eiji Ishii, Yoshihito Yasukawa, Kazuki Yoshimura,** *Hitachi, Ltd., Hitachinaka, Japan,* **Kiyotaka Ogura,** *Hitachi Automotive Systems, Ltd., Hitachinaka, Ibaraki, Japan*

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Turbulent flow behavior in a pipe fully submerged in a hot fluid
Technical Paper Publication. FEDSM2017-69541

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

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Study On the Methods For Adjusting the Vacuum Degree of Jet Vacuum Device
Technical Paper Publication. FEDSM2017-69101

**Xusong Feng,** *Jiangsu Water Source Company Ltd. of the Eastern Route of the South-to-North Water Diversion Project, Nanjing City, China,* **Qingjiang Xiang, Zhengdian Xu,** *Jiangsu University, Zhenjiang, China,* **tao Sun,** *Jiangsu Water Source Company Ltd. of the Eastern Route of the South-to-North Water Diversion Project, Nanjing city, China*

# Technical Sessions

**2-4**
**9th International Symposium on Pumping Machinery**
King's 1 10:15am - 11:45am

**2-4-1**
**Pump Design**

Three-dimensional Flow Control in Pumps: Review of Technological Challenges over the Last 35 Years Based on Personal Experience
Keynote Presentation. FEDSM2017-69598

**Akira GOTO,** *Ebara Corporation, Fujisawa-shi, Japan*

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CFD Analysis and Experimental Comparison of a Large Size Centrifugal Pump
Technical Paper Publication. FEDSM2017-69532

**Giuseppe Rocco, Davide Pirola, Giancarlo Cicatelli,** *Flowserve Corporation, Desio, Monza Brianza, Italy,* B**runo Schiavello,** *Flowserve, Millburn, NJ, United States*

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Experimental and numerical investigations of a low cost axial pump design for the drainage of flooded areas
Technical Paper Publication. FEDSM2017-69308

**Sebastian Wulff, Evgenii Palamarchuk, Raja Abou Ackl, Stephan Häusler, Paul Uwe Thamsen,** *Technische Universität Berlin, Berlin, Germany,*

**3-4**
**Symposium on Renewable and Sustainable Energy Conversion**
Kona 5 10:15am - 11:45am

**3-4-1**
**Renewable and Sustainable Energy Conversion – I**

Computational Assessment of Double-Inlet Collector in Solar Chimney Power Plant Systems
Technical Paper Publication. FEDSM2017-69424

**Nima Fathi,** *University of New Mexico, Albuquerque, NM, United States,* **Seyed Sobhan Aleyasin,** *University of Manitoba, Winnipeg, MB, Canada,* **Patrick Wayne,** *University of New Mexico, Peralta, NM, United States,* **Peter Vorobieff,** *University of New Mexico, Albuquerque, NM, United States*

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Cryo-Adsorbent Hydrogen Storage Systems for Fuel Cell Vehicles
Technical Paper Publication. FEDSM2017-69411

**David Tamburello, Bruce Hardy,** *Savannah River National Laboratory, Aiken, SC, United States,* **Claudio Corgnale, Martin Sulic,** *Savannah River Consulting, Aiken, SC, United States,* **Donald Anton,** *Savannah River National Laboratory, Aiken, SC, United States*

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Research on Flow Field of a Fixed Duct in a Rotary Energy Recovery Device
Technical Paper Publication. FEDSM2017-69087

**Kai Liu, Jianqiang Deng, Bing Yang,** *Xi'an Jiaotong University, Xi'an, China*

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A Vertical Axis Rotor for Wave Energy Conversion
Technical Paper Publication. FEDSM2017-69458

**Yingchen Yang, Joab Soto, Francisco Salazar,** *University of Texas Rio Grande Valley, Brownsville, TX, United States*

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3D Computational Simulations of Bottom-hinged Pitching Ocean Wave Energy Converters
Technical Presentation. FEDSM2017-69224

**Ashish Pathak, Cole R. Freniere, Mehdi Raessi,** *University of Massachusetts-Dartmouth, North Dartmouth, MA, United States*

**5-1**
**Symposium on Development and Applications in Computational Fluid Dynamics**
Queen's 4 10:15am - 11:45am

**5-1-2**
**CFD I: Fundamental Studies**

Transitional and Turbulent Bent Pipes
Keynote Presentation. FEDSM2017-69603

**Philipp Schlatter,** *KTH, Stockholm, Sweden*

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Simulations of Three Dimensional Convective Heat Transfer with Spectral Element Method
Technical Paper Publication. FEDSM2017-69442

**Don Liu,** *Louisiana Tech University, Ruston, LA, United States,* **Yonglai Zheng,** *Department of Hydraulic Engineering, School of Civil Engineering, Tongji University, Shanghai, China,* **Arden Moore,** *Louisiana Tech University, Ruston, LA, United States*

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Modeling Interfacial Instabilities with a Modal Model
Technical Paper Publication. FEDSM2017-69495

**Jesse Canfield, Nick Denissen, Jon Reisner,** *Los Alamos National Laboratory, Los Alamos, NM, United States*

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Geometry Effects on Thermal Striping in Nuclear Reactors: POD Analysis of Large-Eddy Simulations and Experiments
Technical Paper Publication. FEDSM2017-69540

**Oana Marin, Elia Merzari, Aleksandr Obabko,** *Argonne National Laboratory, Lemont, IL, United States,* **Andres Alvarez,** *MIT, Cambridge, MA, United States,* **Stephen Lomperski,** *Argonne National Laboratory, Lemont, IL, United States,* **Paul Fischer,** *University of Illinois at Urbana-Champaign, Urbana, IL, United States*

## 5-2
## 12th Symposium on DNS/ LES and Hybrid RANS/LES Methods
Queen's 5 10:15am - 11:45am

### 5-2-2
### RANS and Hybrid RANS/LES Methods

Lattice Boltzmann Method Simulation of Turbulent Indoor Airflow Using Hybrid LES/RANS Model
Technical Paper Publication. FEDSM2017-69120

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

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LES and PANS of Turbulent Flow Through a Staggered Tube Bundle
Technical Paper Publication. FEDSM2017-69352

**Sinisa Krajnovic, Guglielmo Minelli,** *Chalmers University of Technology, Gothenburg, Sweden,* **Branislav Basara,** *AVL LIST GMBH, Graz, Austria*

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STRUCT: a Second Generation Urans Approach for Effective Design of Advanced Systems
Technical Paper Publication. FEDSM2017-69241

**Emilio Baglietto,** *Massachusetts Institute of Technology, Cambridge, MA, United States,* **Giancarlo Lenci,** *Dominion Engineering, inc.,, Reston, VA, United States,* **Davide Concu,** *Advanced Design Technology, Ltd., London, United Kingdom*

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PANS Study of the Flow Around an Oscillating Truck Cabin with Flow Control
Technical Paper Publication. FEDSM2017-69341

**Sinisa Krajnovic, Guglielmo Minelli,** *Chalmers University of Technology, Gothenburg, Sweden,* **Branislav Basara,** *AVL LIST GMBH, Graz, Austria*



## 6-4
## 15th International Symposium on Gas & Liquid-Solid Two-Phase Flows
Kona 4 10:15am - 11:45am

### 6-4-1
### Gas- & Liquid-Solid Flows - Session 1: Erosion

Experimental Investigation on the Influence of Particle Size in a Submerged Slurry Jet on Erosion Rates and Patterns
Technical Paper Publication. FEDSM2017-69350

**Soroor Karimi,** *The University of Tulsa, Tulsa, OK, United States,* **Amir Mansouri,** *Dynaflow, Inc., Jessup, OK, United States,* **Siamack Shirazi, Brenton S. McLaury,** *The University of Tulsa, Tulsa, OK, United States*

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Effective Particle Size Representation For Erosion Wear In Centrifugal Pump Casings
Technical Paper Publication. FEDSM2017-69240

**Krisnhnan Pagalthivarthi, John Furlan, Robert Visintainer,** *GIW Industries Inc, Grovetown, GA, United States*

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Erosion Modeling in High Concentration Slurry Flow
Technical Paper Publication. FEDSM2017-69355

**Hadi Arabnejad Khanouki, Peyman Zahedi, Siamack Shirazi, Brenton S. McLaury,** *The University of Tulsa, Tulsa, OK, United States*

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Modeling Jet Erosion of Particle Beds
Technical Paper Publication. FEDSM2017-69444

**Leonard Pease, Judith A. Bamberger, Michael Minette,** *Pacific Northwest National Laboratory, Richland, WA, United States*

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Effect of Near Wall Modeling Approaches on Solid Particle Erosion Prediction
Technical Paper Publication. FEDSM2017-69374

**Jun Zhang, Brenton S. McLaury, Siamack Shirazi,** *The University of Tulsa, Tulsa, OK, United States*



## 7-2
## 8th International Symposium on Turbulent Flows: Issues and Perspectives
Kona 2 10:15am - 11:45am

### 7-2-1
### Turbulent Flows

Large Eddy Structure Appearing in Meandering Motion of High Reynolds Number Viscoelastic Flow Past a Backward-Facing Step
Technical Paper Publication. FEDSM2017-69558

**Shohei Onishi, Ryusuke Ii, Shumpei Hara,** *Tokyo University of Science, Noda, Japan,* **Takahiro Tsukahara,** *Tokyo University of Science, Chiba, Japan,* **Yasuo Kawaguchi,** *Tokyo University of Science, Yamazaki, Japan*

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The Destruction-of-Dissipation Tensor in Wall Turbulence
Technical Paper Publication. FEDSM2017-69316

**Georges Gerolymos,** *Université Pierre-et-Marie-Curie, Paris, France,* **Isabelle Vallet,** *Sorbonne University, Université Pierre-et-Marie-Curie, Paris, France*

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Modification of Near-Wall Turbulent Structure in Channel Flow by Dosing a Small Amount of Polymer Solution
Technical Paper Publication. FEDSM2017-69521

**Yushi Okamura, Tomohiro Kurose,** Tokyo University of Science, Noda City, Japan, **Yasuo Kawaguchi,** *Tokyo University of Science, Yamazaki, Japan*

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A Numerical Investigation to Study Roughness Effects in Oscillatory Flows
Technical Paper Publication. FEDSM2017-69066

**Chaitanya Ghodke,** *Convergent Science Inc., Madison, WI, United States,* **Sourabh Apte,** *Oregon State University, Corvallis, OR, United States*

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Instantaneous Turbulent Eddy Structure Relating to Momentum and Scalar Transport in a Drag Reducing Channel Flow with Surfactant Additives
Technical Paper Publication. FEDSM2017-69533

**Takuya Matsumoto,** *Tokyo University of Science, Chiba, Japan,* **Shumpei Hara,** *Tokyo University of Science, Noda, Japan,* **Takahiro Tsukahara,** *Tokyo University of Science, Chiba, Japan,* **Yasuo Kawaguchi,** *Tokyo University of Science, Yamazaki, Japan*

## 7-5
## 8th Symposium on Bio-Inspired Fluid Mechanics
Queen's 6 10:15am - 11:45am

### 7-5-2
### Locomotion and Fluid Mechanics in Nature

Sharks, Dolphins and Butterflies: Micro-Sized Surfaces Have Macro Effects
Technical Paper Publication. FEDSM2017-69221

**Amy Lang,** *University of Alabama, Tuscaloosa, AL, United States,* **Farhana Afroz,** *Virginia Polytechnic Institute and State University, Blacksburg, VA, United States,* **Philip Motta,** *University of South Florida, Tampa, FL, United States,* **Jacob Wilroy,** *University of Alabama, Tuscaloosa, AL, United States,* **Redha Wahidi,** *Univeristy of Texas of the Permian Basin, Odessa, TX, United States,* **Cassidy Elliott,** *The University of Alabama, Tuscaloosa, AL, United States,* **Maria Habegger,** *Florida Southern College, Lakeland, FL, United States*

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Power Regeneration of a Bioinspired Electromechanical Propulsive Fin
Technical Paper Publication. FEDSM2017-69559

**Brittany Gater, Javid Bayandor,** *Virginia Tech, Blacksburg, VA, United States*

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A Preliminary Investigation of Caudal Fin Shape Effects on Thrust and Power of a Newly Designed Robotic Tuna
Technical Paper Publication. FEDSM2017-69460

**Alexander Matta, Javid Bayandor, Hodjat Pendar,** *Virginia Tech, Blacksburg, VA, United States*

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Towing Tank Experiments for Flapping-Wing Aerodynamics
Technical Paper Publication. FEDSM2017-69566

**Jong-Seob Han, Jong-Wan Lee, Jae-Hung Han,** *KAIST, Daejeon, Republic of Korea*

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Beyond Tubercles: Exploring Passive Flow Control on Humpback Whale Flippers
Technical Presentation. FEDSM2017-69619

**David Shormann,** *DIVE, LLC, Haleiwa, HI, United States*

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**7-7**
**21st Symposium on Fundamental Issues and Perspectives in Fluid Mechanics**
Kona 1 10:15am - 11:45am

**7-7-1**
**High Speed and Vehicle Flows**

Simplified Transient Numerical Model of a Supersonic Jet Impacting a Substrate
Technical Paper Publication. FEDSM2017-69314

**Sichang Xu, Patrick Pomerleau-Perron, Gary Rankin,** *University of Windsor, Windsor, ON, Canada*

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Understanding the Mechanics of Blast Pressure Waves Inside a Shock-Tube: Effects of Geometry Optimization on the Blast Profile
Technical Paper Publication. FEDSM2017-69420

**Ashkan Eslaminejad,** *North Dakota State University, Fargo, ND, United States,* **Hesam Sarvghad-Moghaddam,** *Harvey Mudd College, Claremont, CA, United States,* **Mariusz Ziejewski, Ghodrat Karami,** *North Dakota State University, Fargo, ND, United States*

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Oblique Shock Reflection over a Soft Reflecting Surface
Technical Paper Publication. FEDSM2017-69502

**Hiroki Henmi,** *Saitama Institute of Technology, Fukaya, Saitama, Japan,* **Susumu Kobayashi,** *Saitama Institute of Technology, Fukaya-shi, Saitama, Japan*

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Low Memory Reduced Order Modelling with Dynamic Mode Decomposition Applied on Unsteady Wheel Aerodynamics
Technical Paper Publication. FEDSM2017-69299

**Marco Kiewat,** *Technical University of Munich, Garching, Germany,* **Lukas Haag,** *Technical University of Munich, Garching bei München, Bavaria, Germany,* **Vincent Zander,** *AUDI AG, Ingolstadt, Germany,* **Thomas Indinger,** *Technical University of Munich, Garching, Germany*

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Computational Analysis of Benzing Airfoils for Optimization in a Wing Configuration for a Formula SAE Car
Technical Paper Publication. FEDSM2017-69372

**Yuling Su, Akshay Basavaraj,** *University of Kansas, Lawrence, KS, United States*



**1-3**
**Fluids Engineering Luncheon Keynotes**
Monarchy Ballroom 1:00pm - 2:15pm

**1-3-1**
**Conference Keynotes 1**

The Onset of Turbulence: Insights into the Navier-Stokes Equations
Keynote Paper Publication. FEDSM2017-69491

**Carl Rathmann,** *California State Polytechnic University, Pomona, CA, United States*

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Dynamic Stability of Flapping-Wing Micro Air Vehicles with Unsteady Aerodynamic Model
Keynote Paper Publication. FEDSM2017-69568

**Jae-Hung Han, Anh Tuan Nguyen,** *KAIST, Daejeon, Republic of Korea*

# Technical Sessions

## 2-2
## 29th Symposium on Fluid Machinery
King's 2 2:30pm - 4:00pm

### 2-2-6
### Compressors

The Optimum Meridian Profile of Various Annular Surface Roughness And Impeller Blade Number
Technical Paper Publication. FEDSM2017-69024

**Takuji Tsugawa,** *Independent Consultant, Kobe, Hyogo, Japan*

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Feasibility Study of Centrifugal Compressor Performance under Wet Gas Conditions
Technical Paper Publication. FEDSM2017-69255

**Daisuke Kawaguchi, Kiyohide Sakamoto,** *Hitachi,Ltd., Hitachinaka, Ibaraki, Japan,* **Katsutoshi Kobayashi,** *Hitachi Ltd, Hitachinaka-shi, Japan*

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A Critical Comparison of Numerical and Experimental Results for the Examination of a Cascade Consisting of NACA 65-010 1% Profiles
Technical Paper Publication. FEDSM2017-69271

**Andreas Baum, Constantin Berger, Christian Landfester, Martin Böhle,** *TU Kaiserslautern, Kaiserslautern, Germany*

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Analysis and Design of a Methyl Linoleate Biofuel High Temperature, High Pressure Refrigeration Compressor
Technical Presentation. FEDSM2017-69130

**Kevin Anderson,** *California State Polytechnic University, Pomona, CA, United States,* **Christopher McNamara,** *Ingenium Technical Services, Inc., Cupertino, CA, United States,* **Chris Aquino,** *California State Polytechnic University, Pomona, CA, United States,* **Ariel Gatti,** *Ingenuim Technical Services, Inc., Cupertino, CA, United States*

## 2-3
## 24th Symposium on Industrial and Environmental Applications of Fluid Mechanics
King's 3 2:30pm - 4:00pm

### 2-3-2
### Industrial 2

Investigation of Dust Separator Design and Risk Mitigation
Technical Paper Publication. FEDSM2017-69097

**Wayne Strasser,** *Eastman Chemical Co., Kingsport, TN, United States,* **Alex Strasser,** *Oak Ridge National Laboratory, Oak Ridge, TN, United States*

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Study of Forced Convection Heat Transfer from a Porous Wrapped Cylinder
Technical Paper Publication. FEDSM2017-69582

**Nahid Rahmati, Zohreh Mansoori, Majid Saffar Avval,** *Amirkabir University of Technology, Tehran, Iran,* **Goodarz Ahmadi,** *Clarkson University, Potsdam, NY, United States*

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A Multiscale Strategy for Atomization Simulation: Combining Volume-of-Fluid Method and Lagrangian Point-Particle Model
Technical Presentation. FEDSM2017-69602

**Yue Ling,** *Baylor University, Waco, TX, United States*

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Computational Study of High Temperature Liquid Metal Infusion
Technical Paper Publication. FEDSM2017-69577

**Arturo Schiaffino, Vinod Kumar, Arturo Bronson, V M Krushnarao Kotteda, Ashesh Chattopadhyay, Shaikh Tanveer Hossain,** *University of Texas at El Paso, El Paso, TX, United States*

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The Influence of Surface Patterning on the Thermal Properties of Textured Thrust Bearings
Technical Paper Publication. FEDSM2017-69356

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

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Research on Application of 500MPa Water Cutting Composite Material
Technical Paper Publication. FEDSM2017-69394

**Shengxiong Xue, Zhengwen Chen, Qile Ren, Caihong Han,** *Hefei General Machinery Research Institute, Hefei, Anhui, China,* **Bo Chen,** *Nanjing Dadi Water Limited by Share Ltd., Nanjing, China,* **Ziquan Wu,** *All-Powerful Inc, Shenyang, Liaoning, China,* Yuefeng Li, *Guangzhou Hua Zhen Mechanical Equipment Co. Ltd., Guangzhou, Guangdong, China*

**2-4**
**9th International Symposium on Pumping Machinery**
King's 1 2:30pm - 4:00pm

**2-4-2**
**Multi-Stage Pumps**

Improvement of a Bowl Pump Diffuser Through the Aid of CFD
Technical Presentation. FEDSM2017-69013

**Paul Cooper,** *Research, Education & Consulting in Fluid Machinery, Titusville, NJ, United States,* **Ashvin Hosangadi, Zisen Liu,** *Craft Tech, Pipersville, PA, United States,* **Michael C. Mancini,** *Mancini Consulting, Boca Raton, FL, United States*

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Exit Loss Model for Plain Axial Seals in Multi-Stage Centrifugal Pumps
Technical Paper Publication. FEDSM2017-69251

**Kevin Bruurs,** *Flowserve, Etten-Leur, Noord-Brabant, Netherlands,* **B.P.M. Van Esch,** *Eindhoven University of Technology, Eindhoven, Noord-Brabant, Netherlands,* **Martijn Van Der Schoot,** *Flowserve, Etten-Leur, Noord-Brabant, Netherlands*

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Axial Thrust Prediction for a Multi-Stage Centrifugal Pump
Technical Paper Publication. FEDSM2017-69283

**Kevin Bruurs,** *Flowserve, Etten-Leur, Noord-Brabant, Netherlands,* **B.P.M. Van Esch,** *Eindhoven University of Technology, Eindhoven, Noord-Brabant, Netherlands,* **Martijn Van Der Schoot, Eric Van der Zijden,** *Flowserve, Etten-Leur, Noord-Brabant, Netherlands*

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CFD Simulation of a Multi-Stage Centrifugal Pump
Technical Paper Publication. FEDSM2017-69587

**Hui Ding,** *Simerics, Bellevue, WA, United States,* **William Gao,** *CPC Pumps International, Burlington, ON, Canada,* **Haiyang Gao,** *Simerics Inc., Bellevue, WA, United States*

**3-4**
**Symposium on Renewable and Sustainable Energy Conversion**
Kona 5 2:30pm - 4:00pm

**3-4-2**
**Food-Water-Energy Nexus**

Numerical and Experimental Investigation of Flow in Fish Tanks for Small-Scale Aquaponic Systems
Technical Paper Publication. FEDSM2017-69395

**Ivaylo Nedyalkov, Todd Guerdat, Drue Seksinsky, Sylvia Romero, Justin Stickney, Ethan Pirie,** *University of New Hampshire, Durham, NH, United States*

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Effect of Drip Line Hydrocyclone Design on Head Loss for Agricultural Irrigation
Technical Paper Publication. FEDSM2017-69547

**Christian Ramirez, Deify Law,** *California State University Fresno, Fresno, CA, United States*

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Mixing Control in an Isobaric Energy Recovery Device of Seawater Reverse Osmosis Desalination System
Technical Paper Publication. FEDSM2017-69384

**Akira Goto,** *Ebara Corporation, Fujisawa-shi, Japan,* **Masao Shinoda,** *Ebara Corporation, Fujisawa, Japan,* **Takashi Takemura,** *Ebara Corporation, Futtsu, Japan*

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A Theoretical Study of Saline Droplet Evaporation in Solar-thermal Driven Full Separation Multi Effect Distillation (FS-MED) System
Technical Paper Publication. FEDSM2017-69508

**Yan Wei,** *Eastern Washington University, Cheney, WA, United States,* **Penghua Guo,** *Xi'An Jiaotong University, Xi'An, Shaanxi, China,* **Ben Xu, Thomas Rodriguez, Luis Escobar, Hermes Chirino,** *University of Texas Rio Grande Valley, Edinburg, TX, United States*

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Distribution of Air Flow through a Green Wall Module
Technical Paper Publication. FEDSM2017-69134

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

# Technical Sessions

## 4-1
## Microfluidics and Nanofluidics Symposium in FEDSM 2017

Kona 2 2:30pm - 4:00pm

### 4-1-1
### Novel Applications of Micro/Nanofluidics

New Method of Flow Maldistribution Mitigation in Parallel Microchannel Heat Sink
Technical Paper Publication. FEDSM2017-69084

**Vikas Yadav, Ritunesh Kumar,** *Indian Institute of Technology, Indore, Indore, India*

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Study on the Characteristics of Flow and Heat Transfer of Polymeric-Fluid-Based Cu Nanofluids
Technical Paper Publication. FEDSM2017-69006

**Weihua Cai, Yongyao Li, Yue Wang, Xing Zheng, Mengsheng Zhu,** *Harbin Institute of Technology, Harbin, China*

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Metal Foam Microchannel Heat Exchangers for Cooling of Fuel Cells & Flow Batteries
Technical Paper Publication. FEDSM2017-69358

**Anthony Santamaria, Jingru Zhang,** *Western New England University, Springfield, MA, United States*

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Evaluation of an Integrated Micro-Cooling Chip Architecture for Managing Thermal Concerns of a Power Electronics Module
Technical Paper Publication. FEDSM2017-69519

**George Papadopoulos,** *Innoveering, LLC, Ronkonkoma, NY, United States,* **Daniel Kearney, Daniele Torresin**, ABB Schweiz AG, Baden-Daettwil, Switzerland

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Synthesis and Experimental Performance Evaluation of a Hyper-Branched Polymer Electrolyte for a Rechargeable Lithium-Air Battery
Technical Presentation. FEDSM2017-69025

**Susanta Kumar Das,** *Kettering University, Grand Blanc, MI, United States,* **Abhijit Sarkar,** *Michigan Molecular Institute, Midland, MI, United States*

## 5-1
## Symposium on Development and Applications in Computational Fluid Dynamics

Queen's 4 2:30pm - 4:00pm

### 5-1-4
### CFD III: Applications I - including Heat Transfer

Single-Phase Heat Transfer Enhancement in Partially Blocked Rod Bundles
Technical Paper Publication. FEDSM2017-69453

**Ngoc Hung Nguyen, Jong Rok Kim, Seung Hyun Hong, Sang-Ki Moon,** *Korea Atomic Energy Research Institute, Daejeon, Yuseong-gu, Republic of Korea,* **Chul-Hwa Song,** *Korea Atomic Energy Research Institute (KAERI), Daejeon, Republic of Korea*

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Developed Insight on the Internal Pressure of a Ventilated Supercavity
Technical Paper Publication. FEDSM2017-69367

**Melissa Fronzeo,** *Pennsylvania State University Applied Research Lab, State College, PA, United States,* **Michael Kinzel,** *Pennsylvania State University, State College, PA, United States,* **Jules Lindau,** *Pennsylvania State Applied Research Lab, State College, PA, United States*

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Effect of Combining Buoyancy-Driven and Wind-Driven Ventilation in a Windcatcher
Technical Presentation. FEDSM2017-69192

**Peter Abdo, B. P. Huynh,** *University of Technology Sydney UTS, Sydney, Australia*

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Numerical Study on Pressure Difference of Valve Core in Vertical Pilot-Control Globe Valve
Technical Paper Publication. FEDSM2017-69137

**Zhi-xin Gao, Fu-qiang Chen, Jin-Yuan Qian, Zhi-jiang Jin,** *Zhejiang University, Hangzhou, Zhejiang, China*

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The Prediction of Pipeline Expansion-joint Liner using Fluid-Structure Interactions in CFD
Technical Presentation. FEDSM2017-69615

**Kevin Yugulis,** *Battelle Memorial Institute, Columbus, OH, United States*

## 5-2
## 12th Symposium on DNS/ LES and Hybrid RANS/LES Methods
Queen's 5 2:30pm - 4:00pm

### 5-2-1
### Investigations Using DNS/LES Methods

Improved Understanding, Prediction and Control of Dynamic Stall Using Large-Eddy Simulation
Keynote Presentation. FEDSM2017-69214

**Miguel Visbal,** *Air Force Research Laboratory, Wright-Patterson AFB, OH, United States*

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Using Direct Numerical Simulations for Investigating Physics of Turbulence in Porous Media
Technical Paper Publication. FEDSM2017-69041

**Yan Jin,** *University of Bremen, Bremen, Germany,* **Andrey Kuznetsov,** *North Carolina State University, Raleigh, NC, United States*

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An Investigation of the Dynamics of Incompressible Flow in Domains of Multiple Close Packed Spheres
Technical Paper Publication. FEDSM2017-69340

**Lambert Fick,** *Texas A&M University, College Station, TX, United States,* **Elia Merzari, Oana Marin,** *Argonne National Laboratory, Lemont, IL, United States,* **Yassin Hassan,** *Texas A&M University, College Station, TX, United States*

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LES of Flow Past A Circular Cylinder With Roughened Surface
Technical Paper Publication. FEDSM2017-69326

**Li Jiang,** *N***Hua Shan, Kurt Junghans, John Mansfield,** *Naval Surface Warfare Center Carderock Division, West Bethesda, MD, United States,* **Emily Harrison,** *NAVSEA Carderock, West Bethesda, MD, United States*

## 6-1
## 52nd Forum on Cavitation and Multiphase Flow
Kona 4 2:30pm - 4:00pm

### 6-1-1
### 52nd Forum on Cavitation and Multiphase Flow- Session 1

Numerical Study on the Characteristics of Natural Supercavitation by Planar Symmetric Cavitators with Streamlined Headforms
Technical Paper Publication. FEDSM2017-69189

**Zhi-Ying Zheng,** *Harbin Institute of Technology, Harbin, China,* **Lu Wang,** *Harbin Engineering University, Harbin, China,* **Qian Li, Yue Wang, Weihua Cai, Fengchen Li,** *Harbin Institute of Technology, Harbin, China*

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Experimental and Numerical Study of the Cloud Cavitating Flow around a Slender Cylinder with a Petals-Shaped Section
Technical Paper Publication. FEDSM2017-69296

**Yiwei Wang, Jian Huang, Chang Xu, Chao Yu,** *Institute of Mechanics, Chinese Academy of Sciences, Beijing, China,* **Chenguang Huang, Insititute of Mechanics, Chinese Academy of Sciences, Beijing, China,** *Xiaocui Wu, IMCAS, Beijing, China*

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Investigation of Internal Flow Velocity Distribution and Gas Loss of High-Speed Supercavitating Flows
Technical Paper Publication. FEDSM2017-69468

**Wang Zou, Lei-Ping Xue, Wei-Wei Jin, Xin-Tao Xiang,** *Shanghai Jiao Tong University, Shanghai, China*

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Numerical Study on Ventilated Cavitation Influenced by Injection of Drag-Reducing Solution
Technical Paper Publication. FEDSM2017-69131

**Lu Wang, Ping-An Liu,** *Harbin Engineering University, Harbin, China,* **Zhi-Ying Zheng, Yue Wang, Weihua Cai, Fengchen Li,** *Harbin Institute of Technology, Harbin, China*

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Investigation of Cavitation Phenomena on Noise of Underwater Propeller
Technical Paper Publication. FEDSM2017-69536

**Amir Karimi Noughabi,** *AmirKabir University of Technology, Tehran, Iran,* **Morteza Bayati,** *Azad University East Tehran Branch, Tehran, Iran,* **Mehran Tadjfar,** *Amirkabir University of Technology, Tehran, Iran*

# Technical Sessions

## 7-3
## 11th International Symposium on Flow Applications in Aerospace

Queen's 6 2:30pm - 4:00pm

### 7-3-1
### Shock and Vortical Flows

Investigating The Effects of Using Synthetic Jet on Wing Tip Vortex at Low Reynolds Number
Technical Paper Publication. FEDSM2017-69117

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

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Flow Energy Harvesting of an Oscillating Foil with Passive Surface Flexibility
Technical Paper Publication. FEDSM2017-69238

**Alexander D. Totpal, Firas F. Siala, James A. Liburdy,** *Oregon State University, Corvallis, OR, United States*

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Numerical Investigations of Flow Characteristics and Aerodynamic Parameters of an Airfoil with a Trailing Edge Rotating Cylinder
Technical Presentation. FEDSM2017-69614

**Hamid Rahai**, **Preston Chan, Komal Gada,** *California State University Long Beach, Long Beach, CA, United States*

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Experimental Investigation of the Vortical Flow Structure over a Slender Delta Wing at High Angles of Attack
Technical Presentation. FEDSM2017-69248

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

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Dispersion of Shock Wave Transmitted into Non-Uniform Materials
Technical Paper Publication. FEDSM2017-69501

**Susumu Kobayashi, Hiroki Henmi,** *Saitama Institute of Technology, Fukaya-shi, Saitama, Japan*

## 7-7
## 21st Symposium on Fundamental Issues and Perspectives in Fluid Mechanics

Kona 1 2:30pm - 4:00pm

### 7-7-2
### Explosions

Comparative Calculations of TROI TS-2 and TS-3 Steam Explosion Experiments with TEXAS-V
Technical Paper Publication. FEDSM2017-69408

**Kim Taehoon, Pak Sukyoung, Yongjin Cho,** *Korea Institute of Nuclear Safety, Daejeon, Republic of Korea*

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Computational Fluid Dynamics Analysis of Blast Wave Interaction with Head and Helmet
Technical Paper Publication. FEDSM2017-69448

**Hesam Sarvghad-Moghaddam,** *Harvey Mudd College, Claremont, CA, United States,* **Ashkan Eslaminejad,** *North Dakota State University, Fargo, ND, United States,* **Nassibeh Hosseini,** *Harvey Mudd College, Claremont, CA, United States,* **Mariusz Ziejewski, Ghodrat Karami,** *North Dakota State University, Fargo, ND, United States*

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Numerical Modeling of Spores Dispersal of Sphagnum Moss Using ANSYS FLUENT
Technical Paper Publication. FEDSM2017-69417

**Dwight L. Whitaker, Robert Simsiman,** *Pomona College, Claremont, CA, United States,* **Emily S. Chang,** *Google, Mountain View, CA, United States,* **Samuel Whitehead,** *Cornell University, Ithaca, NY, United States,* **Hesam Sarvghad-Moghaddam,** *Harvey Mudd College, Claremont, CA, United States*

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Experimental Investigation of a Drafting Cyclist in Cross-Wind
Technical Paper Publication. FEDSM2017-69398

**Ivaylo Nedyalkov, Adam Lovell, Alec Cunningham,** *University of New Hampshire, Durham, NH, United States*

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Optimal Leading Edge Vortex Formation of a Flapping Foil in Energy Harvesting Regime
Technical Paper Publication. FEDSM2017-69343

**Firas F. Siala, Alexander D. Totpal, James A. Liburdy,** *Oregon State University, Corvallis, OR, United States*

## 2-2
## 29th Symposium on Fluid Machinery
King's 2 4:20pm - 5:50pm

### 2-2-7
### Fans

Flow Characteristics of Axial-flow Fans with an Upstream/ Downstream Blockage Disk
Technical Paper Publication. FEDSM2017-69182

**Keiichi Ochiai,** *Kogakuin University, Tokyo, Japan,* **Shinsaku Nakamura,** *Kogakuin University, Shinjuku-Ku, Japan,* **Kotaro Sato,** *Kogakuin University, Tokyo, Japan,* **Donghyuk Kang,** *Aoyama Gakuin Univ, Sagamihara-shi, Kanagawa, Japan,* **Kazuhiko Yokota,** *Aoyama Gakuin University, Sagamihara, Japan*

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Visualization of Internal Flow Field of Propeller Fan
Technical Paper Publication. FEDSM2017-69261

**Takaya Onishi, Hiroki Sato,** *Osaka Institute of Technology, Osaka, Japan,* **Michihiro Hayakawa,** *Teral Inc., Fukuyama City, Japan,* **Yutaka Kawata,** *Osaka Institute of Technology, Osaka, Japan*

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Noise Reduction Measures for an Axial Fan
Technical Paper Publication. FEDSM2017-69287

**Andreas Swienty, Evgenii Palamarchuk, Raja Abou Ackl, Paul Uwe Thamsen,** *Technical University Berlin, Berlin, Berlin, Germany*

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Experimental and Numerical Analysis of Failure for 4-Fan Wall with Different Number of Fans Units
Technical Paper Publication. FEDSM2017-69292

**Hua-Shu Dou,** *Zhejiang Sci-Tech University, Hangzhou, Zhejiang, Zhejiang, China,* **Shaoqing Chi,** *Zejiang Sci-Tech University, Hangzhou, Zhejiang, China*

## 2-3
## 24th Symposium on Industrial and Environmental Applications of Fluid Mechanics
King's 3 4:20pm - 5:50pm

### 2-3-3
### Industrial 3

Liquid Atomization and Spray: A Multi-Scale Description
Keynote Paper Publication. FEDSM2017-69590

**Christophe Dumouchel,** *Normandie Université - CNRS CORIA, Saint-Étienne-du-Rouvray, France*

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Improving LPG Pump Efficiency by Considering Variant Physical-Properties of Liquefied Petroleum Gas
Technical Paper Publication. FEDSM2017-69147

**Gerardo Lara-Rodriguez, Ofelia Begovich, José Luis Naredo,** *Center for Research and Advanced Studies of the National Polytechnic Institute, Guadalajara, Mexico, Zapopan, Mexico*

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Study on Small Fluctuation Stability in Air Cushion Surge Chamber Based on State Space Method
Technical Paper Publication. FEDSM2017-69229

**Jiachun Liu, Jian Zhang, Xiaodong Yu, Hui Xie,** *Hohai University, Nanjing, China*

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Entropy Generation for Oscillatory Flow inside Thermal-Lag Type Stirling Engine / Numerical Analysis
Technical Paper Publication. FEDSM2017-69010

**Houda Hachem, Ramla Gheith, Sassi Ben Nasrallah, Enim,** *University of Monastir, Monastir, Tunisia,* **Fethi Aloui,** *University of Valenciennes (UVHC), LAMIH UMR CNRS 8201, Valenciennes, France*

## 2-4
## 9th International Symposium on Pumping Machinery
King's 1 4:20pm - 5:50pm

### 2-4-3
### Multi-Stage Pumps etc.

Effect of Baffles between Stages on Performance and Flow Characteristics of a Two-Stage Split Case Centrifugal Pump
Technical Paper Publication. FEDSM2017-69121

**Yiyun Wang, Ji Pei, Shouqi Yuan, Wenjie Wang,** *Jiangsu University, Zhen Jiang, Jiangsu, China*

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# Technical Sessions

Rotor Stability Evaluation for High Pressure, Multi-Stage Pump by Excitation Diagnosis Method
Technical Paper Publication. FEDSM2017-69191

**Shichao Peng, Akira Arai, Takaki Fukuchi, Taiju Katayama,** *Hitachi, Ltd., Tsuchiura-shi, Ibaraki-ken, Japan,* **Osami Matsushita,** *National Defense Academy, Yokosuka-shi, Kanagawa-ken, Japan*

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Experimental Investigation on Diffuser Rotating Stall in a Three-Stage Centrifugal Pump
Technical Paper Publication. FEDSM2017-69386

**Taiki Takamine, Satoshi Watanabe, Daichi Furukawa,** *Kyushu University, Fukuoka, Japan,* **Hiroyoshi Watanabe,** *Ebara Corporation, Futtsu-Shi Chiba, Japan,* **Kazuyoshi Miyagawa,** *Waseda University, Tokyo, Japan*

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Influence of Gas-Liquid Multiphase-Flow on Acoustic Behavior and Performance of Side Channel Pumps
Technical Paper Publication. FEDSM2017-69094

**Sebastian Fleder,** *Technical University Kaiserslautern, Kaiserslautern, Germany,* **Frank Hassert,** *SERO PumpSystems GmbH, Meckesheim, Germany,* **Martin Böhle,** *Technical University Kaiserslautern, Kaiserslautern, Germany,* **Beate Zientek-Strietz,** *SERO PumpSystems GmbH, Meckesheim, Germany*

Uncertainty Analysis in a Scale Model Wind Turbine Array Boundary Layer
Technical Paper Publication. FEDSM2017-69342

**John J. Turner V,** *University of New Hampshire, Dover, NH, United States,* **Martin Wosnik,** *University of New Hampshire, Durham, NH, United States*

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Design of a Controllable One-Meter Scale Research Wind Turbine
Technical Paper Publication. FEDSM2017-69560

**Martin Wosnik, Samuel Cole, Gavin Hess,** U*niversity of New Hampshire, Durham, NH, United States*

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Experimental Analysis of a Cyclic Pitch Turbine
Technical Paper Publication. FEDSM2017-69346

**Jubilee Prasad Rao, Francisco Diez,** *Rutgers University, Piscataway, NJ, United States*

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A Hydrofoil Configuration for Wind Powered Energy Ship Applications
Technical Paper Publication. FEDSM2017-69402

**Jacob Woeste, Mark Turner, Nicolas Saxer,** *University of Cincinnati, Cincinnati, OH, United States*



## 3-3
## Symposium on the Fluid Dynamics of Wind Energy
Kona 5 4:20pm - 5:50pm

### 3-3-1
### Fluid Dynamics of Wind Energy I

Experimental Investigation of the Influence of Inflow Conditions on the Flow over an Extended-Edge Escarpment
Technical Paper Publication. FEDSM2017-69534

**Julien LoTufo, Kamran Siddiqui, Horia Hangan,** *University of Western Ontario, London, ON, Canada*

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## 4-1
## Microfluidics and Nanofluidics Symposium in FEDSM 2017
Kona 2 4:20pm - 5:50pm

### 4-1-2
### Emerging Topics on Microfluidics/Nanofluidics

Droplet Manipulation using the Constrained Drop Surfactometer
Keynote Presentation. FEDSM2017-69594

**Yi Zuo,** *University of Hawaii at Manoa, Honolulu, HI, United States*

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Separation Kinetics Of Oil/Water Emulsions Stabilized By Nanoparticles
Technical Paper Publication. FEDSM2017-69112

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

**5-1**
**Symposium on Development and Applications in Computational Fluid Dynamics**
Queen's 4 4:20pm - 5:50pm

**5-1-11**
**CFD VIII: Applications II**

Forecasting Optimal Time-of-Arrival For Carrier Landings Using Prior Ship Motion
Technical Presentation. FEDSM2017-69099

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

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The Aerodynamic Characteristics of the Pantograph when the Train Passes through the Tunnel
Technical Paper Publication. FEDSM2017-69171

**Guo Dilong, Liu Wen, Song Junhao, Ye Zhang, Guowei Yang,** *Institute of Mechanics, Chinese Academy of Sciences, Beijing, China*

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Investigation of Water pH in Calcasieu Lake Area Using Regional Scale Hydrodynamic Models
Technical Paper Publication. FEDSM2017-69208

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

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Three-Dimensional Computational Hydrodynamics Modeling for Algae Transport
Technical Paper Publication. FEDSM2017-69050

**Haidong Liu, Zhongquan Charlie Zheng, Bryan Young,** *University of Kansas, Lawrence, KS, United States*

**6-1**
**52nd Forum on Cavitation and Multiphase Flow**
Kona 4 4:20pm - 5:50pm

**6-1-2**
**52nd Forum on Cavitation and Multiphase Flow- Session 2**

The Effect of Temperature on Water Cavitation Phenomena in Converging-Diverging Nozzle Flow
Technical Paper Publication. FEDSM2017-69544

**Zayed Ahmed, B. Terry Beck, Mohammad Hosni,** *Kansas State University, Manhattan, KS, United States*

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Stochastic Sensitivity Analysis Of Numerical Simulations Of High-Pressure Injectors To Cavitation Modeling Parameters
Technical Paper Publication. FEDSM2017-69212

**Alessandro Anderlini, Maria Vittoria Salvetti,** *University of Pisa, Pisa, Italy,* **Antonio Agresta, Luca Matteucci,** *Continental Automotive Italy S.p.a., San Piero a Grado, Pisa, Italy*

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Modeling of Cavitation Induced Fuel Atomization and Breakup Processes
Technical Paper Publication. FEDSM2017-69499

**Bolin Zhao,** *University of Michigan-Shanghai Jiao Tong University Joint Institute, Shanghai, China,* **Chien Pin Chen,** *University of Alabama, Huntsville, AL, United States*



**6-5**
**17th International Symposium on Numerical Methods for Multiphase Flow**
Queen's 5 4:20pm - 5:50pm

**6-5-1**
**Interfacial Flow**

Multiscale Simulation of Convective Boiling
Technical Paper Publication. FEDSM2017-69435

**Miad Yazdani, Hailing Wu, Abbas Alahyari, Thomas Radcliff,** *United Technologies Corporation, East Hartford, CT, United States*

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Computations of Buoyancy Driven Motion of a Single Droplet in Another Immiscible Liquid
Technical Paper Publication. FEDSM2017-69139

**Shunji Homma, Tamaki Yoshikawa,** *Saitama University, Saitama, Saitama, Japan*

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A VoF-based Consistent Mass-Momentum Transport for Two-Fluid Flow Simulations
Technical Paper Publication. FEDSM2017-69190

**Annagrazia Orazzo, Isabelle Lagrange, Jean-Luc Estivalèzes, Davide Zuzio,** *ONERA, Toulouse, France*

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# Technical Sessions

High-Speed Microdroplet Impact on a Textured Rough Surface: A Numerical Investigation
Technical Paper Publication. FEDSM2017-69098

**Hua Tan,** *Washington State University-Vancouver, Vancouver, WA, United States*

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Numerical Simulation of Two-Phase Slug Flow from Horizontal to Downward Inclined Pipe using a Hybrid Code Based on Slug Tracking and Slug Capturing Methodologies
Technical Paper Publication. FEDSM2017-69335

**Vinicius R. Almeida, Marco G. COnte, Fausto A.A. Barbuto, Cristiane COzin,** *NUEM - PPGEM - UTFPR, Curitiba, Parana, Brazil,* **RIGOBERTO E. M. MORALES,** *Federal University of Technology - Parana, Curitiba, OO, Brazil*



**7-3**
**11th International Symposium on Flow Applications in Aerospace**
Queen's 6 4:20pm - 5:50pm

**7-3-2**
**Aerodynamics, FSI and Ice Accretion Methods**

Characterization of Distorted Fluid Flow Along Advanced High-Bypass Jet Engines Subject to Foreign Object Ingestion
Technical Paper Publication. FEDSM2017-69583

**Yangkun Song, Javid Bayandor,** *Virginia Tech, Blacksburg, VA, United States*

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Sequential Design of UAV Fuselage Pods using Bounding Aerodynamic Models
Technical Paper Publication. FEDSM2017-69361

**Justin Valenti, Michael Kinzel,** *Pennsylvania State University, State College, PA, United States,* **Simon Miller,** *Penn State Applied Research Laboratory, State College, PA, United States*

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Assessment and Design of Aircraft Deicing System Using CFD
Technical Presentation. FEDSM2017-69616

**Kevin Yugulis,** *Battelle Memorial Institute, Columbus, OH, United States*

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An Improved CFD Approach for Ice-Accretion Prediction using the Discrete Element Roughness Method
Technical Paper Publication. FEDSM2017-69365

**David Hanson, Michael Kinzel,** *Pennsylvania State University, University Park, PA, United States*

**7-7**
**21st Symposium on Fundamental Issues and Perspectives in Fluid Mechanics**
Kona 1 4:20pm - 5:50pm

**7-7-3**
**Non-Newtonian Flows**

Inflow Conditions and Suddenly Expanding Annular Shear-Thinning Flows
Technical Paper Publication. FEDSM2017-69280

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

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Flow Inertia and Heat Transfer in Suddenly Expanding Annular Shear-Thinning Flows
Technical Paper Publication. FEDSM2017-69469

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

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Nested First-Passages of Tracer Particles in Flows of Blood and Control Suspensions: Symmetry and Lorentzian Transformations
Technical Paper Publication. FEDSM2017-69549

**Eugene Eckstein,** *University of Memphis, Memphis, TN, United States,* **Vinay Bhal,** *Zimmer Biomet, Warsaw, IN, United States,* **Mark Leggas,** *University of Kentucky, Lexington, KY, United States,* **Baoshun Ma,** *University of Memphis, Memphis, TN, United States,* **JoDe Lavine,** *Bunker Hill Community College, Boston, MA, United States,* **Jerome A. Goldstein,** *University of Memphis, Memphis, TN, United States*

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A Generlaized Model for Dynamic Contact Angle
Technical Paper Publication. FEDSM2017-69091

**Joseph Thalakkottor, Kamran Mohseni,** *University of Florida, Gainesville, FL, United States*

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Confinement Effects on Effective Slip of Patterned Surfaces
Technical Paper Publication. FEDSM2017-69237

**Avinash Kumar, Subhra Datta, Dinesh Kalyanasundaram,** *Indian Institute of Technology Delhi, New Delhi, India*

## Tuesday, August 1

**1-2**
**Fluids Engineering Plenaries**
Monarchy Ballroom 8:30am - 10:00am

**1-2-2**
**Morning Plenary 2**

An Improved Point-Particle Approach That Captures Fully-Resolved Physics Euler-Lagrange Point-Particle
Plenary Presentation. FEDSM2017-69606

**S. Balachandar,** *University of Florida, Gainesville, FL, United States*

**2-2**
**29th Symposium on Fluid Machinery**
King's 2 10:15am - 11:45am

**2-2-4**
**Hydraulic Turbines**

Effect of Silt on Performance on Turgo Impulse Hydro Turbine
Technical Paper Publication. FEDSM2017-69527

**Sourabh Khurana,** *OM Institute of Technology and Management Hisar, Hisar, India,* **Varun Goel,** *NIT Hamirpur, Hamirpur, India,* **Gurmeet Singh,** *Thapar University Patiala, Punjab, India*

Numerical Analysis on the Impact of Inter-Stage Flow Addition in a High-Pressure Steam Turbine
Technical Paper Publication. FEDSM2017-69514

**Soo Young Kang, Jeong Jin Lee, Tong Seop Kim,** *INHA University, Incheon, Republic of Korea,* **Seong Jin Park,** *Doosan Heavy Industries & Construction, Changwon, Republic of Korea,* **Giwon Hong,** *Doosan, Chanwon Gyeongnam, Republic of Korea*

Pressure Oscillations in Piva Hydro Power Plant Draft Tube Case Studies
Technical Paper Publication. FEDSM2017-69218

**Zdravko Giljen,** *Montenegrin Electric-Montenegro/Faculty of Mechanical Engineering, University of Belgrade-Serbi, Nikic, Montenegro*

Study on Vortex Generators for Control of Attached Cavitation
Technical Paper Publication. FEDSM2017-69405

**Bangxiang Che,** *Zhejiang University, Hangzhou, Zhejiang, China,* **Dazhuan Wu,** *Zhejiang University, Zhejiang, China*

Load Rejection Test and Numerical Prediction of Critical Load Case Scenarios for Pumped Storage Plant
Technical Paper Publication. FEDSM2017-69164

**Chen Sheng, Jian Zhang,** *Hohai University, Nanjing, OO, China,* **Gaohui Li,** *PowerChina Huadong Engineering Corporation Limited, Hangzhou, China,* **Xiaodong Yu,** *Hohai University, Nanjing, China*

**2-3**
**24th Symposium on Industrial and Environmental Applications of Fluid Mechanics**
King's 3 10:15am - 11:45am

**2-3-4**
**Industrial 4**

On the Modeling of Combustion Systems for Reliable and Efficient Predictions of Detailed Reactions
Keynote Presentation. FEDSM2017-69591

**Francine Battaglia,** *Virginia Tech, Blacksburg, VA, United States*

Influence of Rotation on Convective Dynamics Induced by Simultaneous Imposition of Radial and Vertical Temperature Gradients
Technical Presentation. FEDSM2017-69407

**Ayan Kumar Banerjee, Amitabh Bhattacharya, Sridhar Balasubramanian,** *Indian Institute of Technology, Mumbai, India*

# Technical Sessions

Effect Analysis of Rolling Motion on the Labyrinth Seals Characteristic Based on CFD
Technical Paper Publication. FEDSM2017-69181

**Ning Huang, Zhenlin Li, Shiyao Li, Ning Zhang, Zhihui Dong,** *China University of Petroleum(Beijing), Beijing, China*

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Parametrization of High-Speed Train Streamline Shape
Technical Paper Publication. FEDSM2017-69167

**Zhenxu Sun, Ye Zhang, Guowei Yang,** *Institute of Mechanics, Chinese Academy of Sciences, Beijing, China*

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## 2-4
## 9th International Symposium on Pumping Machinery
King's 1 10:15am - 11:45am

### 2-4-4
### Cavitation Erosion

From Computational Fluid Dynamics (CFD) to Mass Loss Prediction in Cavitation Erosion
Keynote Presentation. FEDSM2017-69604

**Regiane Fortes-Patella,** *LEGI, Université. Grenoble Alpes, Grenoble, France*

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First Attempt on Numerical Prediction of Cavitation Damage on a Centrifugal Pump
Technical Paper Publication. FEDSM2017-69085

**Leclercq Christophe,** *EDF R&D, Chatou, France,* **Fortes-Patella Regiane,** *Université. Grenoble Alpes, Grenoble, France,* **Archer Antoine,** *EDF R&D, Chatou, France,* **Cerru Fabien,** *Cetim, Nantes, France*

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Assessment of Cavitating Flow Aggressiveness on a Hydrofoil: Experimental and Numerical Approaches
Technical Paper Publication. FEDSM2017-69187

**Jean-Bastien Carrat, Regiane Fortes-Patella, Jean-Pierre Franc,** *LEGI, Univ. Grenoble Alpes,, Grenoble, France*

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Pump Cavitation Practical Highlights: NPSHR Criteria – Impeller Life Expectancy
Technical Presentation. FEDSM2017-69011

**Bruno Schiavello,** *Flowserve, Millburn, NJ, United States*

## 3-2
## Symposium on Fluid Measurement and Instrumentation
Kona 5 10:15am - 11:45am

### 3-2-1
### Fluid Measurement and Instrumentation I – PIV

Experimental and Computational Characterization of a Large-Scale, Underwater Towed SPIV System
Technical Paper Publication. FEDSM2017-69090

**Emily Harrison, Joseph Ramsey,** *NAVSEA Carderock, West Bethesda, MD, United States,* **Li Jiang,** *Naval Surface Warefare Center Carderock Division, West Bethesda, MD, United States*

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A Multicolor Grid Technique for Volumetric Velocity Measurements
Technical Paper Publication. FEDSM2017-69546

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

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Study on Vortex Structures and Intermittency in Two-Oscillating Grid Turbulence with Viscoelastic Fluids Based on Wavelet Analysis
Technical Paper Publication. FEDSM2017-69005

**Yue Wang, Yongyao Li, Weihua Cai, Lu Wang, Fengchen Li,** *Harbin Institute of Technology, Harbin, China,* **Liming Yao,** *Institute of Advanced Technology of Heilongjiang Academy of Sciences, Harbin, China*

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POD Analysis of the Wake Development of a Pivoted Circular Cylinder undergoing Vortex Induced Vibrations
Technical Paper Publication. FEDSM2017-69204

**Erik Marble,** *University of Waterloo, Waterloo, ON, Canada,* **Chris Morton,** *University of Calgary, Calgary, AB, Canada,* **Serhiy Yarusevych,** *University of Waterloo, Waterloo, ON, Canada*

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Experimental Evaluation of PIV Uncertainty Prediction Methods
Technical Presentation. FEDSM2017-69589

**Stamatios Pothos,** *TSI Incorp, Shoreview, MN, United States,* **Sayantan Bhattacharya, Pavlos Vlachos,** *Purdue Univeristy, West Lafayette, IN, United States*

**5-1**
**Symposium on Development and Applications in Computational Fluid Dynamics**
Queen's 4 10:15am - 11:45am

**5-1-5**
**CFD IV: Development and Applications in Fluid-Structure Interaction**

Numerical Modeling and Simulations of Coupling Fluid-Structure Interaction (FSI) with an Ultrasonic Wave Propagation
Technical Paper Publication. FEDSM2017-69061

**Bhuiyan Shameem Mahmood Ebna Hai, Markus Bause,** *Helmut Schmidt Universität - Universität der Bundeswehr Hamburg, Hamburg, HAM, Germany*

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Fluid-Structure Interaction with a Fully Integrated Multiphysics Environment
Technical Paper Publication. FEDSM2017-69078

**David Grasselt, Chetan Kumar Sain, Klaus Höschler,** *Brandenburg University of Technology, Cottbus, Brandenburg, Germany*

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Implementation of Immersed Boundary Method in WENO Scheme to Simulate Shock-Structure Interaction
Technical Paper Publication. FEDSM2017-69217

**Min Xu, Tao Yang,** *New Mexico State University, Las Cruces, NM, United States,* **Mingjun Wei,** *Kansas State University, Manhattan, KS, United States*

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Simulation of Fluid Structure Interaction of Crossflow Through Tube Bundle and Experimental Validation
Technical Paper Publication. FEDSM2017-69360

**Landon Brockmeyer,** *Texas A&M University Department of Nuclear Engineering, College Station, TX, United States,* **Elia Merzari,** *Argonne National Laboratory, Lemont, IL, United States,* **Jerome Solberg,** *Lawrence Livermore National Laboratory, Livermore, CA, United States,* **Yassin Hassan,** *Texas A&M University, College Station, TX, United States*

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Aeromechanical Analysis of Two-Bladed Downwind Turbine Using a Nacelle Tilt Control
Technical Paper Publication. FEDSM2017-69585

**Qiuying Zhao, Chunhua Sheng, Yousuf Al-Khalifin, Abdollah Afjeh,** *The University of Toledo, Toledo, OH, United States*

**6-4**
**15th International Symposium on Gas & Liquid-Solid Two-Phase Flows**
Kona 4 10:15am - 11:45am

**6-4-2**
**Gas- & Liquid-Solid Flows - Session 2**

Measurements of Slurry Flows in Pipes, Slurry Pumps and Mining Equipment
Keynote Presentation. FEDSM2017-69612

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

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Optical Diagnostics for Multiphase Flows Characterization
Technical Paper Publication. FEDSM2017-69188

**Fabrice Lamadie, Sophie Charton, Mathieu de Langlard, Mariam Ouattara, Matthias P.L. Sentis,** *French Alternative Energies and Atomic Energy Commission (CEA), Bagnols-sur-Cèze, France,* **Johan Debayle,** *École des Mines de Saint-Étienne (EMSE), Saint-Etienne, France,* **Fabrice R.A. Onofri,** *CNRS/Aix-Marseille University, Marseille, France*

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Particles Transport In Railway Braking Systems: An Experimental And Numerical Investigation
Technical Paper Publication. FEDSM2017-69126

**Charlene Octau, Marc Lippert, Anthony Graziani,** *LAMIH CNRS UMR 8201, University of Valenciennes and Hainaut-Cambresis, Valenciennes, France,* **Talib Dbouk,** *IMT Lille Douai, Industrial Engineering Department, Douai, France,* **Michel Watremez, Laurent Keirsbulck, Laurent Dubar,** *LAMIH CNRS UMR 8201, University of Valenciennes and Hainaut-Cambresis, Valenciennes, France*

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Experimental and Computational Investigation of an Air Core Inside a Milling Circuit Hydroclone
Technical Paper Publication. FEDSM2017-69234

**Jaikrishnan Kadambi, Chinmay Shingote, Zhiyuan Tian, Renjie Ke,** *Case Western Reserve University, Cleveland, OH, United States,* **John Furlan, Robert Visintainer,** *GIW Industries Inc, Grovetown, GA, United States*

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Consistent Evaluation of Wear Coefficients from the Experiments for use in CFD Simulations
Technical Paper Publication. FEDSM2017-69243

**Krisnhnan Pagalthivarthi, John Furlan, Robert Visintainer,** *GIW Industries Inc, Grovetown, GA, United States*

## 6-5
## 17th International Symposium on Numerical Methods for Multiphase Flow
Queen's 5 10:15am - 11:45am

### 6-5-2
### Liquid-Gas



Experimental and Numerical Study of Bubble Drag Reduction on a Flat Plate
Technical Paper Publication. FEDSM2017-69113

**Shijie Qin, Dazhuan Wu,** *Zhejiang University, Hangzhou, Zhejiang Province, China*

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CFD Prediction of Gas-Liquid Separation Efficiency of Geothermal Steam-Water Cyclone Separator Using a Verified Turbulence Model
Technical Paper Publication. FEDSM2017-69258

**Xidong Hu, Shaoxiang Qian, Kaori Yamauchi, Haruo Okochi,** *JGC Corporation, Yokohama, Kanagawa-Ken, Japan*

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Numerical Study on Two-Phase Flow Patterns in Vortex Dropshaft
Technical Paper Publication. FEDSM2017-69206

**Xichen Wang, Jian Zhang, Xiaodong Yu, Chen Sheng,** *Hohai University, Nanjing, Jiangsu, China*

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A Priori Filtering and LES Modeling of a Phase Separation Turbulent Two-Phase Flow
Technical Presentation. FEDSM2017-69096

**Stephane Vincent, Mathilde Tavares, Solène Fleau,** *UPEM / MSME, Marne-La-Vallée, France,* **Stéphane Mimouni,** *EDF, Chatou, France,* **Meryem Ould-Rouiss,** *UPEM / MSME, Marne-La-Vallée, France,* **Jean-Luc Estivalèzes,** *ONERA, Toulouse, France*

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DNS of Turbulent Bubbly Flows in Plane Channels using the Front-Tracking algorithm of TrioCFD
Technical Paper Publication. FEDSM2017-69128

**Guillaume BOIS, Antoine du Cluzeau,** *CEA (French Alternative Energies and Atomic Energy Commission), Gif-Sur-Yvette, France*

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Predicting Critical Heat Flux with Multiphase CFD: 4 Years in the Making
Technical Paper Publication. FEDSM2017-69242

**Emilio Baglietto, Etienne Demarly, Ravikishore Kommajosyula,** *Massachusetts Institute of Technology, Cambridge, MA, United States*

## 7-5
## 8th Symposium on Bio-Inspired Fluid Mechanics
Queen's 6 10:15am - 11:45am

### 7-5-1
### Fluid-Structure Acoustics and Flight Kinematics

What Bat Flight Has to Offer
Keynote Presentation. FEDSM2017-69607

**Rolf Mueller,** *Virginia Tech Institute for Advanced Learning & Research, Danville, VA, United States,* **Matthew Bender, Yousi Lin,** *Virginia Tech, Blacksburg, VA, United States,* **Xu Yang, Hui Chen,** *Shandong University, Jinan, Shandong, China,* **Lynn Abbott, Danesh Tafti, Andrew J. Kurdila,** *Virginia Tech, Blacksburg, VA, United States*

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New Insights into Myoelastic-Aerodynamic Mechanism of Vocalization in Birds — Fluid-Structure-Acoustics Interaction Simulation in Syrinx
Technical Presentation. FEDSM2017-69349

**Weili Jiang, Qian Xue, Xudong Zheng,** *University of Maine, Orono, ME, United States,* **Jeppe H. Rasmussen, Coen P.H. Elemans,** *University of Southern Denmark, Odense, Denmark*

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The Two-Dimensional Aerodynamic Analysis of Various Cross-Sections of a Morphologically Accurate Bee Wing in Forward Flight
Technical Paper Publication. FEDSM2017-69573

**Jeffrey Feaster, Francine Battaglia, Javid Bayandor,** *Virginia Tech, Blacksburg, VA, United States*

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Sound Generation of Flapping Wing and the Effects of Wing Flexibility
Technical Presentation. FEDSM2017-69344

**Biao Geng, Qian Xue, Xudong Zheng,** *University of Maine, Orono, ME, United States,* **Junshi Wang, Geng Liu, Yan Ren, Haibo Dong,** *University of Virginia, Charlottesville, VA, United States*

**7-7**
## 21st Symposium on Fundamental Issues and Perspectives in Fluid Mechanics
Kona 1 10:15am - 11:45am

**7-7-4**
**Jet and Wake Flows**

Experimental-Numerical Analysis of Turbulent Incompressible Isothermal Jets
Technical Paper Publication. FEDSM2017-69418

**Seyed Sobhan Aleyasin,** *University of Manitoba, Winnipeg, MB, Canada,* N**ima Fathi,** *University of New Mexico, Albuquerque, NM, United States,* **Mark Tachie,** *University Of Manitoba, Winnipeg, MB, Canada,* **Peter Vorobieff,** *University of New Mexico, Albuquerque, NM, United States,* **Mikhail Koupriyanov,** *Price Industries Limited, Winnipeg, MB, Canada*

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Comparison of Turbulent Jets Issuing from Various Sharp Contoured Nozzles
Technical Paper Publication. FEDSM2017-69419

**Seyed Sobhan Aleyasin,** *University of Manitoba, Winnipeg, MB, Canada,* **Nima Fathi,** *University of New Mexico, Albuquerque, NM, United States,* **Mark Tachie,** *University Of Manitoba, Winnipeg, MB, Canada,* **Mikhail Koupriianov,** *Price Industries Limited, Winnipeg, MB, Canada*

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Application of Plasma Discharges to the Ignition of a Jet Diffusion Flame
Technical Paper Publication. FEDSM2017-69554

**Ying-Hao Liao, Ming-Chien Sun, Ru-Yi Lai,** *National Chiao Tung University, Hsinchu, Taiwan*

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Liquid Film Thickness Prediction in Elbows for Annular Flows
Technical Paper Publication. FEDSM2017-69389

**Peyman Zahedi, Hadi Arabnejad Khanouki, Brenton S. McLaury, Siamack Shirazi,** *University of Tulsa, Tulsa, OK, United States*

**7-9**
## 16th Symposium on Transport Phenomena in Materials Processing and Manufacturing Processes
Kona 2 10:15am - 11:45am

**7-9-1**
**Transport Phenomena in Materials Processing and Manufacturing Processes**

Characteristics of Pneumatic Non-Contact Holder with Two Swirling Flows
Technical Paper Publication. FEDSM2017-69249

**Takuya Morisawa, Tetsuhiro Tsukiji,** *Sophia University, Chiyoda-ku, Tokyo, Japan,* **Ryoichi Suzuki,** *SMC Corporation, Chiyoda-ku, Tokyo, Japan*

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Development of Impulse Pressure System for A Large Size Butterfly Valve
Technical Paper Publication. FEDSM2017-69270

**Gi-Chun Lee, Byung-Oh Choi, Young-Bum Lee, Jong-Won Park, Jae-Ho Lee,** *Korea Institute of Machinery & Materials, Daejeon, Republic of Korea,* **Jae-Hoon Kim,** *Chungnam National University, Daejeon, Republic of Korea*



**1-3**
## Fluids Engineering Luncheon Keynotes
Monarchy Ballroom 1:00pm - 2:15pm

**1-3-2**
**Conference Keynotes 2, Sponsored by The George Washington University**

The Role and Future of Turbomachinery Design
Keynote Presentation. FEDSM2017-69609

**Mark Turner,** *University of Cincinnati, Cincinnati, OH, United States*

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Fluid Mechanics of Balls
Keynote Presentation. FEDSM2017-69608

**Rabindra Mehta,** *Self Employed, Mountain View, CA, United States*

## Wednesday, August 02

**1-2**
**Fluids Engineering Plenaries**
Monarchy Ballroom 8:30am - 10:00am

**1-2-3**
**Morning Plenary**

An Overview of Aerospace Propulsion Research at NASA Glenn Research Center
Plenary Presentation. FEDSM2017-69576

**Dhanireddy Reddy,** *NASA Glenn Research Center, Cleveland, OH, United States*



**2-1**
**18th International Symposium on Advances in Numerical Modeling for Turbomachinery Flow Optimization**
King's 3 10:15am - 11:45am

**2-1-1**
**Turbo I**

Design Study of a Pyrolysis Plant Compressor with Heavy Wall Erosion from Metal Particle Impact
Technical Paper Publication. FEDSM2017-69108

**Riadh Omri, Matthias Semel, Antonio Delgado,** *Institute of Fluid Dynamics, Friedrich-Alexander-Universität, Erlangen, Bavaria, Germany,* **Hans.J Russwurm,** *Russwurm Ventilatoren GmbH, Meitingen-Ostendorf, Bavaria, Germany*

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Investigation on Pulsating Flow Effect of a Turbocharger Turbine
Technical Paper Publication. FEDSM2017-69186

**Zhanming Ding, Weilin Zhuge, Yangjun Zhang,** *Tsinghua University, Beijing, China,* **Hua Chen,** *National Laboratory of Turbocharging Technology North China Engineering Research Institute, Tianjin, China,* **Ricardo Martinez-Botas,** *Imperial College London, Middlesex, United Kingdom*

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Numerical Investigations and Performance Experiments of a Deep-Well Centrifugal Pump under Different Rotating Speed.doc
Technical Paper Publication. FEDSM2017-69284

**Yang Yang, Zhou Ling, Weidong Shi,** *Jiangsu University, Zhenjiang, Jiangsu Province, China*

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Experimental and Numerical Study on Hydraulic Performances of a Turbopump with and without an Inducer
Technical Presentation. FEDSM2017-69393

**Yanxia Fu,** *Jiangsu University, Zhenjiang, China,* **Aixiang Ge,** *Wei Hai CreditFan Ventilator Co., Ltd., Weihai, Shandong, China,* **Wei Sun,** *Patent Examination Cooperation, Jiangsu Center of the Patent Office, SIPO., Suzhou, China,* **Jianping Yuan,** *Jiangsu University, Zhenjiang, China,* **Giovanni Pace, Dario Valentini, Angelo Pasini,** *Alta S.p.A., Pisa, Italy,* **Luca d'Agostino,** *University of Pisa, Pisa, Italy*

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Experimental and Numerical Investigations on the Positive Slopes on the Pump Performance Curve of a Low Specific Speed Model Pump-Turbine
Technical Paper Publication. FEDSM2017-69581

**Guocheng Lu, Zhigang Zuo, Yuekun Sun,** *Tsinghua University, Beijing, Beijing, China,* **Shuhong Liu,** *Dept. of Thermal Engineering, Tsinghua University, Beijing, China*

**2-2**
**29th Symposium on Fluid Machinery**
King's 2 10:15am - 11:45am

**2-2-1**
**Pumps 1**

Investigation on the Influence of Surface Roughness on the Moment Coefficient in a Rotor-Stator Cavity with Centripetal Through-Flow
Technical Paper Publication. FEDSM2017-69018

**Bo Hu, Dieter Brillert, Hans Josef Dohmen, Friedrich K. Benra,** *University Duisburg-Essen, Duisburg, Germany*

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Experimental Investigation of the Wake Decay Process in an Axial Pump with Varied Rotor-Stator Axial Spacings
Technical Paper Publication. FEDSM2017-69044

**Han Xu, Mengyu Wang, Donghai Jin, Dakun Sun, Xingmin Gui,** *Beihang University, Beijing, China,* **Xiaofeng Sun,** *Beijing University of Aeronautics and Astronautics, Beijing, China*

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Effects of Loop Heat Pipe Capillary Pump Design on Fluid Dynamics and Heat Transfer in Wick Structure
Technical Presentation. FEDSM2017-69048

**Triem T. Hoang,** *TTH Research, Inc., Clifton, VA, United States*

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Oil Aeration and Degassing Measurements for the Study of Aero-Engine Oil Pump Performance in Cavitation
Technical Paper Publication. FEDSM2017-69119

**Laurent Ippoliti, Joëlle Vincké, Patrick Hendrick,** *Université Libre De Bruxelles, Brussels, Belgium*

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**2-4**
**9th International Symposium on Pumping Machinery**
King's 1 10:15am - 11:45am

**2-4-5**
**Cavitation**

Stereoscopic PIV Measurements of the Flow along the Blade Pressure Side of an Axial Waterjet Pump during Cavitation Breakdown
Keynote Presentation. FEDSM2017-69388

**Huang Chen, Nick Doeller, Yuanchao Li, Joseph Katz,** *Johns Hopkins University, Baltimore, MD, United States*

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Experimental Investigation of Tip Cavitating Vortices in Axial-Flow Pump
Technical Paper Publication. FEDSM2017-69178

**Desheng Zhang,** *Jiangsu University, Zhenjiang, Select State/Province, China*

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Improvement of Suction Performance Using Splitter Impeller and Inducer
Technical Paper Publication. FEDSM2017-69256

**Kentaro Hayashi, Shinichi Konno,** *Osaka Institute of Technology, Osaka, Osaka, Japan,* **Michihiro Hayakawa,** *Teral Inc., Fukuyama City, Japan,* **Yutaka Kawata,** *Osaka Institute of Technology, Osaka, Osaka, Japan*

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Part-Load Cavitation Instability Investigation of A High Specific Speed Pump
Technical Paper Publication. FEDSM2017-69159

**Zhenhua Shen,** *Grundfos China Holding Co., Ltd./Jiangsu University, Suzhou, Jiangsu, China,* **Nicholas Pedersen,** *Grundfos Holding A/S, Bjerringbro, Denmark,* **Hong Li,** *Jiangsu University, Zhenjiang, China,* **Christian Brix Jacobsen,** *Grundfos Holding A/S, Bjerringbro, Denmark,* **Xiaofen Ma,** *Grundfos China Holding Co., Ltd., Suzhou, China*

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**3-2**
**Symposium on Fluid Measurement and Instrumentation**
Kona 5 10:15am - 11:45am

**3-2-2**
**Fluid Measurement and Instrumentation II - PIV, LDA, HW**



Traceable Flow Rate Measurements with a Very Low Uncertainty Using Laser Doppler Anemometry
Technical Paper Publication. FEDSM2017-69278

**Markus Juling, Jonas Steinbock, Andreas Weissenbrunner,** *Physikalisch-Technische Bundesanstalt (PTB), Berlin, Berlin, Germany*

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Experimental Study on the Effects of Surface Roughness on the Hydrodynamic instabilities? Behaviors of Couette-Taylor Flow
Technical Paper Publication. FEDSM2017-69252

**Mostafa Monfared,** *Isfahan University of Technology, Isfahan, Iran,* **Lamia Gaied,** *Unversity of Valenciennes, LAMIH UMR CNRS 8201, Valenciennes, France,* **Emna Berrich,** *University of Nantes, GEPEA UMR CNRS 6144, Nantes, France,* **Ebrahim SHIRANI,** *Foolad Institute of Technology, Fooladshahr, Iran,* **Maxence Bigerelle, Fethi ALOUI,** *University of Valenciennes, LAMIH UMR CNRS 8201, Valenciennes, France*

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Investigation of the Effect of Inlet Turbulence on Transitional Wall-Bounded Flows
Technical Paper Publication. FEDSM2017-69321

**Burak A. Tuna, Xianguo Li,** *University of Waterloo, Waterloo, ON, Canada,* **Serhiy Yarusevych,** *University of Waterloo, Waterloo, ON, Canada*

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# Technical Sessions

Boundary Layer Formation on Axially Aligned Cylinders
Technical Paper Publication. FEDSM2017-69399

**Nicholas Jones, David M. Rooney,** *Hofstra University, Hempstead, NY, United States,* **John Vaccaro,** *Hofstra University, Levittown, NY, United States*

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Practical Considerations for Performing Simultaneous PIV and LDV Measurements in Experimental Facilities
Technical Presentation. FEDSM2017-69588

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

## 4-1
## Microfluidics and Nanofluidics Symposium in FEDSM 2017

Kona 2 10:15am - 11:45am

### 4-1-3
### Flows in Microfluidic Systems

Computational Model Development and Failure Mode Investigation for a Magnetically-Driven Bearingless Micro-Pump
Technical Paper Publication. FEDSM2017-69065

**Gabriel B. Goodwin, Jesse Maxwell,** *U.S. Naval Research Laboratory, Washington, DC, United States,* **Triem T. Hoang,** *TTH Research, Inc., Washington, DC, United States*

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Flow and Mixing in Rotating Zigzag Microchannel
Technical Paper Publication. FEDSM2017-69466

**Wallace Leung, Yong Ren,** *The Hong Kong Polytechnic University, Hong Kong*

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Mixed Electroosmotic Pressure Driven Flow And Heat Transfer Of Power Law Fluid In A Hydrophobic Microchannel
Technical Paper Publication. FEDSM2017-69525

**Ainul Haque, Ameeya Nayak,** *IIT Roorkee, Roorkee, India*

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Multi-Scale Transport Modeling - Asbestos and Nano Fibers in Inhalation Risk Assessments
Technical Paper Publication. FEDSM2017-69083

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

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Study of Frequency Response of Quartz Crystal Microbalance to Different Wetting States of Micropillar Surfaces
Technical Paper Publication. FEDSM2017-69550

**Junwei Su, Hamed Esmaeilzadeh, Hongwei Sun,** *University of Massachusettes Lowell, Lowell, MA, United States*

## 5-1
## Symposium on Development and Applications in Computational Fluid Dynamics

Queen's 4 10:15am - 11:45am

### 5-1-6
### CFD V: Novel Developments for Compressible and Multi-Phase Flows

Coarse-Grained Simulation of Shock-Driven Turbulent Mixing
Technical Paper Publication. FEDSM2017-69057

**Fernando Grinstein, Rick Rauenzahn, Juan Saenz, Marianne Francois,** *Los Alamos National Laboratory, Los Alamos, NM, United States*

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Preconditioning for the All-Speed Compressible Navier-Stokes Equations with Laser-Induced Phase Change
Technical Paper Publication. FEDSM2017-69100

**Brian Weston,** *University of California Davis, Davis, CA, United States,* **Robert Nourgaliev,** *Lawrence Livermore National Laboratory, Livermore, CA, United States,* **Jean-pierre Delplanque,** *University Of California Davis, Davis, CA, United States*

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Physics-Based Reconstruction of Interfacial Jump Conditions in All-Speed Multi-Fluid Dynamics
Technical Paper Publication. FEDSM2017-69312

**Robert Nourgaliev, Patrick Greene, Samuel Schofield,** *Lawrence Livermore National Laboratory, Livermore, CA, United States*

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Marker Re-Distancing (MRD) Algorithm for High-Fidelity Interface Tracking on Arbitrary Meshes
Technical Paper Publication. FEDSM2017-69315

**Patrick Greene, Robert Nourgaliev, Samuel Schofield,** *Lawrence Livermore National Laboratory, Livermore, CA, United States*

**6-4**
**15th International Symposium on Gas & Liquid-Solid Two-Phase Flows**
Kona 4 10:15am - 11:45am

**6-4-3**
**Gas- & Liquid-Solid Flows - Session 3**

Experimental Investigation of Sand Bed Height and Wave Height in Gas-Slurry Stratified Flow
Technical Paper Publication. FEDSM2017-69409

**Ashwin Padsalgikar, Ramin Dabirian, Ram Mohan, Ovadia Shoham,** *University of Tulsa, Tulsa, OK, United States*

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Particle-Cluster Formation and Vorticity in Gas-Solid Flows
Technical Paper Publication. FEDSM2017-69317

**Venkata Subba Sai Satish Guda, Ismail Celik,** *West Virginia University, Morgantown, WV, United States*

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Fluid-Structure Interaction Study Of GLCC© Inlet Modifications
Technical Paper Publication. FEDSM2017-69412

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

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Performance of Supercritical Slurry Jet Drilling System
Technical Paper Publication. FEDSM2017-69462

**Ashwin Padsalgikar, Ramin Dabirian,** *University of Tulsa, Tulsa, OK, United States,* **Ken Oglesby,** *Impact Technologies LLC, Tulsa, OK, United States,* **Ram Mohan, Ovadia Shoham,** *The University of Tulsa, Tulsa, OK, United States*

**7-1**
**Forum on Advances in Fluids Engineering Education**
Queen's 5 10:15am - 11:45am

**7-1-1**
**Forum on Advances in Fluids Engineering Education**

Educational Results Obtained using an Improved Two-Dimensional Panel Method Code in Undergraduate Fluid Dynamics and Aerodynamics Courses
Technical Paper Publication. FEDSM2017-69031

**Robert Spall, Joshua Hodson,** *Utah State University, Logan, UT, United States*

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Development and Commissioning of a Supersonic Blow Down Wind Tunnel for Educational Purposes
Technical Paper Publication. FEDSM2017-69196

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

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Open-ended Curiosity Driven Fluids Lab Project
Technical Paper Publication. FEDSM2017-69211

**Thomas Shepard,** *University of St. Thomas, St. Paul, MN, United States,* **Christopher Haas,** *3M, St. Paul, MN, United States,* **Rajagopala Menon,** *University of St. Thomas, St.Paul, MN, United States*



**7-4**
**17th International Symposium on Fluid Power**
Queen's 6 10:15am - 11:45am

**7-4-1**
**Transient Lift and Jet and Hydrogen Fuels**

Sulfur Deposit Formation in Jet Fuel at High Thermal Stressing Temperatures
Keynote Presentation. FEDSM2017-69618

**Sylvester Abanteriba,** *RMIT University, Melbourne, Victoria, Australia,* **Paul Rawson,** *DST, Fishermans Bend, Victoria, Australia*

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Comparison Between NACA 65 Profile and Circular Arc Blade Based on Numerical Investigation
Technical Paper Publication. FEDSM2017-69014

**Tao Bian, Qianpeng Han,** *JiangHan University, Wuhan, Hubei, China,* **Martin Böhle,** *TU Kaiserslautern, Kaiserslautern, Germany*

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Transient Lift on a Blade during Orthogonal Vortex Cutting
Technical Paper Publication. FEDSM2017-69158

**D. Curtis Saunders,** *University of Vermont, Burlington, VT, United States,* **Jeffrey Marshall,** *University of Vermont, Jericho, VT, United States*

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# Technical Sessions

An Overview on Dry Low Nox Micromix Combustor Development for Hydrogen-Rich Gas Turbine Applications
Technical Presentation. FEDSM2017-69617

**Nils Beckmann,** *Aachen University of Applied Sciences, Goch, NRW, Germany,* **Sylvester Abanteriba,** *RMIT University, Melbourne, Victoria, Australia,* **Harald Funke,** *Aachen University of Applied Sciences, Aachen, Germany*

## 7-7
## 21st Symposium on Fundamental Issues and Perspectives in Fluid Mechanics
Kona 1 10:15am - 11:45am

### 7-7-5
### Fundamental Issues in Fluid Mechanics

Vortex-Induced Vibration of a Circular Cylinder with Low Mass Ratio Near a Plane Wall
Technical Paper Publication. FEDSM2017-69127

**Sina Daneshvar, Chris Morton,** *University of Calgary, Calgary, AB, Canada*

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A Molecular Dynamics-Based Model for Knudsen Number and Slip Velocity
Technical Paper Publication. FEDSM2017-69136

**Mohamad Cheikh, Emma Schinstock, Grant Ferland, James Chen,** *Kansas State University, Manhattan, KS, United States*

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Prediction of Local Losses of Low Re Flows in Elastic Porous Media
Technical Paper Publication. FEDSM2017-69345

**Sid Becker,** *University of Canterbury, Christchurch, New Zealand,* **Stefan Gasow,** *Technical University of Hamburg, Hamburg, Germany*

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Numerical and Experimental Study of the Rotational Behaviour of Flat Plates Falling Freely with Periodic Oscillating Motion
Technical Paper Publication. FEDSM2017-69503

**Jakob Hærvig,** *Aalborg Univesity, Aalborg, Denmark,* **Anna Lyhne Jensen,** *Aalborg University, Aalborg Øst, Denmark,* **Marie Cecilie Pedersen, Henrik Sørensen,** *Aalborg University, Aalborg, Denmark*

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Experimental and Numerical Study of the Prandtl Number Effect on Natural Convection of an Overhanging Disk in an Enclosure
Technical Presentation. FEDSM2017-69198

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

## 1-3
## Fluids Engineering Luncheon Keynotes
Monarchy Ballroom 1:00pm - 2:15pm

### 1-3-3
### Conference Keynotes 3

Efficient Heat Exchanger Designs Using Additive Manufacturing and Siemens Automated Design Exploration Technology
Keynote Presentation. FEDSM2017-69482

**Aaron Godfrey,** *Siemens PLM, Bellevue, WA, United States,* **Eric Volpenhein,** *Siemens PLM Software, Cincinnati, OH, United States,* **Adrian / A. S. Sabau,** *Oak Ridge National Laboratory, Oak Ridge, TN, United States,* **Prasanna Venuvanalingam,** *Siemens PLM, Orlando, FL, United States*

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Visions of Exascale CFD
Keynote Presentation. FEDSM2017-69620

**Steve Legensky,** *Intelligent Light, Rutherford, NJ, United States*

## 1-1
## Symposium in Memory of Dr. Jonathan Watmuff
King's 3 2:30pm - 4:00pm

### 1-1-1
### Symposium in Memory of Dr. Jonathan Watmuff

Jon Watmuff's Legacy at NASA Ames Research Center
Technical Presentation. FEDSM2017-69600

**Rabindra Mehta,** *Self Employed, Mountain View, CA, United States*

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Full-Scale Aircraft Water Ditching Investigation using Lagrangian Based Compressible Fluid Solid Interaction
Technical Presentation. FEDSM2017-69563

**Brandon Horton, Yangkun Song, Javid Bayandor,** *Virginia Tech, Blacksburg, VA, United States*

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Surface-Mounted Obstacles Immersed in Extremely Pulsatile Flows
Technical Presentation. FEDSM2017-69601

**Michael Plesniak,** *George Washington University, Washington, DC, United States*

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In Memory of Dr Jonathan Hugh Watmuff: Experiments with Passion and Purpose
Technical Presentation. FEDSM2017-69599

**David Pook, Robert Carrese, Pier Marzocca,** *RMIT University, Melbourne, Victoria, Australia*

## 2-2
## 29th Symposium on Fluid Machinery
King's 2 2:30pm - 4:00pm

### 2-2-2
### Pumps 2

Comparative Study on Hydraulic Performance of Single-suction Centrifugal Pump and Double-suction Centrifugal Pump
Technical Paper Publication. FEDSM2017-69142

**Chaoyue Wang, Fujun Wang, ZHICHAO ZOU,** *China Agricultural University, Beijing, China*

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Numerical Simulation of Unsteady Cavitation Flow in a Centrifugal Pump
Technical Paper Publication. FEDSM2017-69163

**Weiguo Zhao, Rennian Li, Guoshou Zhao,** *Lanzhou University of Technology, Lanzhou, China*

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Multiphase Flow Analysis for Air-Water Bubbly Flow in a Multiphase Pump
Technical Paper Publication. FEDSM2017-69239

**Jun-Won Suh, Young-Seok Choi, Jin-Hyuk Kim, Kyoung-Yong Lee,** *Korea Institute of Industrial Technology (KITECH), Cheonan, Republic of Korea,* **Won-Gu Joo,** *Yonsei Univ., Seoul, Republic of Korea*

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Lumped Parameter and Three-Dimensional CFD Simulation of a Variable Displacement Vane Pump for Engine Lubrication
Technical Paper Publication. FEDSM2017-69124

**Massimo Rundo, Giorgio Altare,** *Politecnico Di Torino, Torino, Italy*

## 2-4
## 9th International Symposium on Pumping Machinery
King's 1 2:30pm - 4:00pm

### 2-4-6
### Cavitation & Unsteady Flows

Numerical Study of One-Dimensional Pipe Flow under Pump Cavitation Surge
Technical Paper Publication. FEDSM2017-69427

**Motohiko Nohmi,** *EBARA Corporation, Fujisawa-shi, Kanagawa, Japan,* **Satoshi Yamazaki,** *Aoyama Gakuin University, Sagamihara-shi, Japan,* **Shusaku Kagawa,** *EBARA Corporation, Futtu, Chiba, Japan,* **Byungjin An,** *EBARA Corporation, Fujisawa-shi, Japan,* **Donghyuk Kang,** *Aoyama Gakuin Univ, Sagamihara-shi, Kanagawa, Japan,* **Kazuhiko Yokota,** *Aoyama Gakuin University, Sagamihara, Japan*

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Improvement of Cavitation Surge in a Double Suction Centrifugal Pump by Use of CFD
Technical Paper Publication. FEDSM2017-69416

**Shusaku Kagawa, Naoki Matsushita,** *EBARA Corporation, Futtsu-shi, Chiba, Japan*

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Transient Pressure Pulsations of a Model Pump-Turbine during Power Failure
Technical Paper Publication. FEDSM2017-69133

**Jinhong Hu, Jiandong Yang, Wei Zeng, Renbo Tang,** *Wuhan University, Wuhan, Non US State, China*

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Influence of Impeller Vane Arrangement on Efficiency Performance and Pressure Fluctuations of a Double-Suction Centrifugal Pump
Technical Paper Publication. FEDSM2017-69077

**Yu Song, Lei Tan, Yun Xu, Yabin Liu, Yue Hao,** *Tsinghua University, Beijing, China*

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Influence of an Adaptive Blade System on Unsteady Flow Conditions in a 2D Compressor Cascade
Technical Paper Publication. FEDSM2017-69028

**Julija Peter, David Konstantin Tilcher,** *Technische Universitaet Berlin, Berlin, Germany,* **Robert Meyer,** *German Aerospace Center (DLR), Berlin, Germany,* **Paul Uwe Thamsen,** *Technical University Berlin, Berlin, Germany*

# Technical Sessions

## 3-2
## Symposium on Fluid Measurement and Instrumentation
Kona 5 2:30pm - 4:00pm

### 3-2-3
### Fluid Measurement and Instrumentation III

Phase Doppler Measurements in Spray generated by Twin-Jet-Nozzles
Technical Paper Publication. FEDSM2017-69003

**Inez von Deschwanden, Friedrich K. Benra, Hans Josef Dohmen, Dieter Brillert,** *University of Duisburg-Essen, Duisburg, Nordrhein-Westfalen, Germany*

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Visualizing Near-Field Spray Characteristics with Broadband X-rays
Technical Paper Publication. FEDSM2017-69088

**Danyu Li, Timothy Morgan, Luke D. Pulfer, Theodore Heindel,** *Iowa State University, Ames, IA, United States*

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Solids Erosion Patterns Developed by Pulse Jet Mixers
Technical Paper Publication. FEDSM2017-69382

**Judith A. Bamberger, Leonard Pease, Michael Minette,** *Pacific Northwest National Laboratory, Richland, WA, United States*

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Experimental and Numerical Studies of Solid Particle Erosion in Elbows Installed in Series
Technical Paper Publication. FEDSM2017-69415

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

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Experimental Investigation on the Rapid Evaporation of Droplet during Sudden Depressurization
Technical Presentation. FEDSM2017-69425

**Jiangbo Wu,** *Gansu Key Lab of Fluid Machinery and System, Lanzhou University of Technology, Lanzhou, Gansu, China,* **Qincheng Bi,** *State Key Laboratory of Multiphase Flow in Power Engineering, Xi'an Jiaotong University, Xi'an, Shaanxi, China,* **Senchun Miao,** *Key Laboratory of Fluid Machinery and System,LanZhou University Of Technology, Lanzhou, Gansu, China,* **Yanning Han,** *Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou, Gansu, China,* **Yajun Guo,** *Xi`an University of Architecture and Technology, Xi?an, shaanxi, China*

## 4-1
## Microfluidics and Nanofluidics Symposium in FEDSM 2017
Kona 2 2:30pm - 4:00pm

### 4-1-4
### Microfluidic Devices for Biomedical Applications

Development of a Bead-Based Optoelectrokinetic Immunosensing Technique for Detection of Low-Abundance Analytes
Technical Paper Publication. FEDSM2017-69146

**Han-Sheng Chuang, Hsiao-Neng Lin, Hu-Yao Ku,** *National Cheng Kung University, Tainan City, Taiwan*

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A Label-Free Microfludic Sensor for High Sensitivity Biomarker Sensing
Technical Presentation. FEDSM2017-69595

**Jiang Zhe,** *University of Akron, Akron, OH, United States*

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Dissolvable Tattoo Electronics for Biomedicine
Technical Presentation. FEDSM2017-69596

**Huanyu Cheng,** *Pennsylvania State University, University Park, PA, United States*

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Evaporation Dynamics and Deposition Patterns of Protein Laden Droplets Under AC and DC Fields
Technical Paper Publication. FEDSM2017-69465

**Xi Li, Kara L. Maki, Michael Schertzer,** *Rochester Institute of Technology, Rochester, NY, United States*

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Compact and Thermosensitive Micropump inspired by plant leaf.
Technical Paper Publication. FEDSM2017-69148

**Hyejeong Kim, Kiwoong Kim, Sang Joon Lee,** *Pohang University of Science and Technology, Pohang, Republic of Korea,*

**5-1**
## Symposium on Development and Applications in Computational Fluid Dynamics
Queen's 4 2:30pm - 4:00pm

**5-1-7**
**CFD VI: RANS and URANS Applications**

Capability Assessment of Five Different RANS-Based Turbulence Models to Simulate the Various Regions of Slot Turbulent Impingement Jet Flow
Technical Paper Publication. FEDSM2017-69203

**Mahmoud CHARMIYAN,** *Isfahan University of Technology, Isfahan, Iran,* **Ahmed-Riza AZIMIAN,** *Islamic Azad University, Isfahan, Iran,* **Ebrahim SHIRANI,** *Foolad Institute of Technology, Fooladshahr, Iran,* **Fethi ALOUI,** *University of Valenciennes (UVHC), LAMIH UMR CNRS 8201, Valenciennes, France*

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Numerical Study of Transient Flow and the Influence of Height and Viscosity in a Cyclonic Chamber in a Distribution System
Technical Paper Publication. FEDSM2017-69311

**Carolina C. Rodrigues, Paualo H. D. Santos, Henrique K. Eidt, Rafael Dunaiski, Cesar Ofuchi, Flávio Neves Jr., Rigoberto E. M. Morales,** *Federal University of Technology - Parana, Curitiba, Brazil*

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Computational Aerodynamic Analysis of Downwind Turbine Using a New Tilt Control Concept
Technical Paper Publication. FEDSM2017-69586

**Qiuying Zhao, Chunhua Sheng,** *The University of Toledo, Toledo, OH, United States*

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A Numerical Study on Flow Characteristics through Orifice Flowmeter and Measurement Accuracy Depending on Upstream Straight Length
Technical Paper Publication. FEDSM2017-69033

**Jang Il Lee, Ae Ju Cheong, Bok Ki Min,** *Korea Institute of Nuclear Safety, Daejeon, Republic of Korea*

**6-3**
## 15th International Symposium on Gas-Liquid Two-Phase Flows
Kona 4 2:30pm - 4:00pm

**6-3-1**
**Gas-Liquid Flows - Session 1**

Bubbles Behaving Badly: Bubble Motion due to Vibration and through Complex Geometries
Keynote Presentation. FEDSM2017-69613

**Timothy J. O'Hern,** *Sandia National Laboratories, Albuquerque, NM, United States*

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Gas-Induced Motion of an Object in a Liquid-Filled Housing during Vibration: I. Analysis
Technical Paper Publication. FEDSM2017-69022

**John R. Torczynski, Timothy J. O'Hern, Jonathan R. Clausen, Timothy P. Koehler,** *Sandia National Laboratories, Albuquerque, NM, United States*

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Gas-Induced Motion of an Object in a Liquid-Filled Housing during Vibration: II. Experiments
Technical Paper Publication. FEDSM2017-69023

**Timothy J. O'Hern, John R. Torczynski, Jonathan R. Clausen, Timothy P. Koehler,** *Sandia National Laboratories, Albuquerque, NM, United States*

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A Flow Regime Map for Gas Jets in a Bubbly Flow
Technical Paper Publication. FEDSM2017-69483

**Melissa Fronzeo, Michael Kinzel, Jules Lindau,** *Pennsylvania State University, State College, PA, United States*

**6-5**
## 17th International Symposium on Numerical Methods for Multiphase Flow
Queen's 5 2:30pm - 4:00pm

**6-5-3**
**Gas-Solid**

Large-Scale Direct Numerical Simulation of Gas-solid Flows
Technical Presentation. FEDSM2017-69205

**Wei Ge,** *Institute of Process Engineering, Chinese Academy of Sciences, Beijing, China*

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# Technical Sessions

Next-Generation Multiphase Flow Solver for Fluidized Bed Applications
Technical Paper Publication. FEDSM2017-69555

**V M Krushnarao Kotteda, Ashesh Chattopadhyay, Vinod Kumar,** *University of Texas at El Paso, El Paso, TX, United States,* **William Spotz,** *Sandia National Laboratories, Albuquerque, NM, United States*

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CFD Simulation of Three Phase Gas-Liquid-Solid Flow in Horizontal Pipes
Technical Paper Publication. FEDSM2017-69051

**Rasel Sultan, Mohammad Aziz Rahman, Sohrab Zendehboudi,** *Memorial University of Newfoundland, St. John's, NL, Canada,* **Vassilios Kelessidis,** *Petroleum Institute, Abu Dhabi, United Arab Emirates*

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An Immersed Boundary Method in OpenFOAM for Arbitrarily Shaped Particles in the Shear Flow Field of Centrifugal Separators
Technical Paper Publication. FEDSM2017-69370

**Markus Buerger,** *University of Wuppertal, Wuppertal, Germany,* **Chethan M. Kumar,** *DHBW Mosbach, Mosbach, Germany,* **Uwe Janoske,** *University of Wuppertal, Wuppertal, Germany*

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Interaction of a Shock Wave with a Dense Corrugated Particle Curtain
Technical Paper Publication. FEDSM2017-69562

**Bertrand Rollin,** *Embry-Riddle Aeronautical University, Daytona Beach, FL, United States,* **Marie Desenlis,** *École Nationale Superieure de Mecanique et Aerotechnique, Futuroscope Chasseneuil, France*

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Computational Modeling of Particulate Pollutant Transport in a Ventilated Room in the Presence of Two Heated Breathing and Rotating Manikin
Technical Paper Publication. FEDSM2017-69102

**Ali Keshavarz, Mazyar Salmanzadeh,** *Shahid Bahonar University of Kerman, Kerman, Iran,* **Goodarz Ahmadi,** *Clarkson University, Potsdam, NY, United States*

## 7-6
## 12th Symposium on Flow Manipulation and Active Control

Queen's 6 2:30pm - 4:00pm

### 7-6-1
### Flow Control with Dielectric Barrier Discharge

Data Mining of Experimental Data on Separation Control of the Flows over NACA0015 and Ishii Airfoils Using Dielectric Barrier Discharge Plasma Actuator
Technical Paper Publication. FEDSM2017-69060

**Kengo Asada, Satoshi Sekimoto, Tomoaki Tatsukawa, Tomoyasu Shimizu, Masaya Yabu, Kozo Fujii,** *Tokyo University of Science, Katsushika-ku, Tokyo, Japan*

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Experimental Study of Separation Control over a Wide Range of Reynolds Numbers Using Dielectric Barrier Discharge Plasma Actuator on Airfoil
Technical Paper Publication. FEDSM2017-69226

**Satoshi Sekimoto,** *Tokyo University of Science, Katsushika-ku, Tokyo, Japan,* **Masayuki Anyoji,** *Kyushu University, Kasuga, Fukuoka, Japan,* **Yuma Miyakawa,** *Kogakuin University, Sagamihara, Kanagawa, Japan,* **Satoshi Shimomura,** *Tokyo University of Agriculture and Technology, Koganei, Tokyo, Japan,* **Taku Nonomura,** *Institute of Space and Astronautical Science, JAXA (currently Tohoku University), Sagamihara, Kanagawa, Japan,* **Takashi Matsuno,** *Tottori University, Tottori, Tottori, Japan,* **Kozo Fujii,** *Tokyo University of Science, Katsushika-ku, Tokyo, Japan,* **Shinichiro Ito,** *Kogakuin University, Hachioji, Tokyo, Japan,* **Hiroyuki Nishida,** *Tokyo University of Agriculture and Technology, Koganei, Tokyo, Japan*

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Experimental Analysis of Closed-Loop Control of Flow around Airfoil Using DBD Plasma Actuator
Technical Paper Publication. FEDSM2017-69246

**Satoshi Shimomura,** *Tokyo University of Agriculture and Technology, Koganei, Tokyo, Japan,* **Takuto Ogawa, Satoshi Sekimoto,** *Science University of Tokyo, Katsushika, Tokyo, Japan,* **Taku Nonomura,** *Institute of Space and Astronautical Science, JAXA (currently Tohoku University), Sagamihara, Kanagawa, Japan,* **Akira Oyama,** *Institute of Space and Astronautical Science, JAXA, Sagamihara, Kanagawa, Japan,* **Kozo Fujii,** *Tokyo University of Science, Katsushika-ku, Tokyo, Japan,* **Hiroyuki Nishida,** *Tokyo University of Agriculture and Technology, Koganei, Tokyo, Japan*

**2-1**
**18th International Symposium on Advances in Numerical Modeling for Turbomachinery Flow Optimization**
King's 3 4:20pm - 5:50pm

**2-1-2**
**Turbo-II**

Vortical Flow Structure of Hub-Corner Separation in a Stator Cascade of a Multi-Stage Transonic Axial Compressor
Technical Paper Publication. FEDSM2017-69116

**Seishiro Saito, Masato Furukawa, Kazutoyo Yamada, Yuki Tamura,** *Kyushu University, Fukuoka, Japan,* **Akinori Matsuoka, Naoyuki Niwa,** *Kawasaki Heavy Industries,Ltd., Akashi city, Japan*

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Calculation Model Based Design-Point Gas Generator Performance Adaptation Method
Technical Paper Publication. FEDSM2017-69180

**Shiyao Li, Zhenlin Li, Ning Huang,** *China University of Petroleum (Beijing), Beijing, China*

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A Numerical Study on the Performance Improvement for a Vertical-Axis Wind Turbine at Low Tip Speed Ratios
Technical Paper Publication. FEDSM2017-69220

**Zhenyu Wang, Mei Zhuang,** *Ohio State University, Columbus, OH, United States*

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Effects of a Groove Patterned Cooling Tube on the Film Cooling Performance of a Gas Turbine Blade
Technical Paper Publication. FEDSM2017-69263

**Yeon-Ho Lee, Youn J. Kim,** *Sungkyunkwan University, Suwon, Republic of Korea*

**2-2**
**29th Symposium on Fluid Machinery**
King's 2 4:20pm - 5:50pm

**2-2-3**
**Pumps 3**

Research on Slip Phenomenon of Pump Running in Turbine Mode
Technical Paper Publication. FEDSM2017-69165

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

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Unstable Flow Characteristics in S-Shaped Region of Pump-Turbine Runners with Large Blade Lean
Technical Paper Publication. FEDSM2017-69275

**Zhe Ma, Bao shan Zhu, Cong Rao, Lei Tan,** *Tsinghua University, Beijing, China*

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Study on the Transient Characteristics of Pump during the Starting Process with Assisted Valve
Technical Paper Publication. FEDSM2017-69426

**Qiao Li, Peng Wu,** *Zhejiang University, HangZhou, China,* **Dazhuan Wu,** *Zhejiang University, Zhejiang, China*

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Effects of Medium Containing Free Gas on Hydraulic Performance of Single Stage Centrifugal Pump
Technical Paper Publication. FEDSM2017-69481

**Tiejian ZHANG,** *China Nuclear Power Engineering Co.,Ltd./ Guangdong University of Technology, Shenzhen, China,* **Guohui Cong,** *China Nuclear Power Design Co., Ltd (Shenzhen), Shenzhen China,* **Yan YAN,** *Dalian Deepblue Pump CO.,LTD, Dalian, China,* **Wei ZHANG, Xueling WANG,** *China Nuclear Power Engineering Co., Ltd, Shenzhen, China*

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Inner Flow Field PIV Measurement and Study on Turbulence Generator of Medium Consistency Pump
Technical Paper Publication. FEDSM2017-69034

**Daoxing Ye, xide lai,** *Xihua University, Chengdu City, China*

**2-4**
**9th International Symposium on Pumping Machinery**
King's 1 4:20pm - 5:50pm

**2-4-7**
**Waste Water Pumps**

Cleaning Sequence Counters Clogging: A Quantitative Assessment Under Real Operation Conditions Of A Wastewater Pump
Technical Paper Publication. FEDSM2017-69020

**Stefan Gerlach, Paul Uwe Thamsen,** *Technische Universität Berlin, Berlin, Germany*

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# Technical Sessions

The Clogging Behaviour of a Vortex Pump - An Experimental Study on the Influence of Impeller Designs
Technical Paper Publication. FEDSM2017-69021

**Angela Gerlach, Dorian Perlitz,** *Technische Universität Berlin, Berlin, Germany,* **Flemming Lykholt-Ustrup, Christian Brix Jacobsen,** *Grundfos Holding A/S, Bjerringbro, Denmark,* **Paul Uwe Thamsen,** *Technical University Berlin, Berlin, Germany*

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Numerical and Experimental Investigation of Trailing Edge Modifications of Centrifugal Wastewater Pump Impellers
Technical Paper Publication. FEDSM2017-69123

**Oliver Litfin,** *Institute of Fluid Mechanics, Friedrich-Alexander-University Erlangen-Nuremberg, Erlangen, Bavaria, Germany,* **Kais Haddad, Horst Klein,** *Sulzer Pump Solutions Germany GmbH, Lohmar, Germany,* **Antonio Delgado**, *Institute of Fluid Dynamics, Friedrich-Alexander-Universität, Erlangen, Bavaria, Germany*

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Investigation of the Influence of Operating Point on the Shape and Position of Textile Material in the Inlet Pipe to a Dry-installed Wastewater Pump
Technical Paper Publication. FEDSM2017-69298

**Anna Lyhne Jensen,** *Aalborg University, Aalborg Øst, Denmark,* **Stefan Gerlach,** *Technische Universität Berlin, Berlin, Germany,* **Flemming Lykholt-Ustrup,** *Grundfos Holding A/S, Bjerringbro, Denmark,* **Henrik Sørensen, Lasse Rosendahl,** *Aalborg University, Aalborg, Denmark,* **Paul Uwe Thamsen,** *Technical University Berlin, Berlin, Germany*

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## 3-2
## Symposium on Fluid Measurement and Instrumentation
Kona 5 4:20pm - 5:50pm

### 3-2-4
### Fluid Measurement and Instrumentation IV

Leak Rate Uncertainty Parametric Study
Technical Paper Publication. FEDSM2017-69075

**John W. Magradey,** *Clemson University, Clemson, SC, United States,* **Christopher C. Daniels, Heather A. Oravec,** *University of Akron, Akron, OH, United States*

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Validation of Test Methods for Air Leak Rate Verification of Spaceflight Hardware
Technical Paper Publication. FEDSM2017-69076

**Heather A. Oravec, Christopher Daniels, Janice Mather,** *University of Akron, Akron, OH, United States*

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Studies of Flow Induced on a Water Surface Due to the Impingement of a Drop or a Water Source
Technical Paper Publication. FEDSM2017-69391

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

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Design and Performance of a Hypersonic Wind Tunnel
Technical Paper Publication. FEDSM2017-69439

**Jesse Maxwell,** *U.S. Naval Research Laboratory, Washington, DC, United States*

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Improved Mixing with the Kar Dynamic Mixer Impeller in Batch Laboratory-Scale Systems
Technical Presentation. FEDSM2017-69565

**Shankhadeep Das, Irfan Khan, Smita Agrawal, Mike Cloeter,** *Dow Chemical Company, Freeport, TX, United States*

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## 4-1
## Microfluidics and Nanofluidics Symposium in FEDSM 2017
Kona 2 4:20pm - 5:50pm

### 4-1-5
### Microscale Multiphase Flow and Surface Interactions

Effect of Charge Density on Electrokinetic Ions and Fluid Flow Through Polyelectrolyte Coated Nanopore
Technical Paper Publication. FEDSM2017-69194

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

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Numerical Simulations of Electric Field Driven Self-Assembly of Monolayers of Mixtures of Nanoparticles
Technical Paper Publication. FEDSM2017-69380

**Edison Amah, Naga Aditya Musunuri, Ian Fischer, Pushpendra Singh,** *New Jersey Institute of Technology, Newark, NJ, United States*

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Use Multiphysics Simulations and Resistive Pulse Sensing to Study the Effect of Metal and Non-Metal Nanoparticles in Different Salt Concentration
Technical Paper Publication. FEDSM2017-69472

**Chun-Lin Chiang, Che-Yen Lee, Yu-shan Yeh,** *Industrial Technology Research Institute, Hsinchu, Taiwan*

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Assessment and Prediction of EOF Mixing in Binary Electrolytes
Technical Paper Publication. FEDSM2017-69524

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

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Thermal and Fluid Dynamic Model for Capillary-Driven Heat Pipe with Closed-Form Solution
Technical Paper Publication. FEDSM2017-69441

**Jesse Maxwell,** *U.S. Naval Research Laboratory, Washington, DC, United States*

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**5-1**
**Symposium on Development and Applications in Computational Fluid Dynamics**
Queen's 4 4:20pm - 5:50pm

**5-1-9**
**CFD VII: Development and Applications in Particle Transfer**

Simulations of Particle Detachment from a Flat Surface
Technical Paper Publication. FEDSM2017-69111

**Nithin Kumar Palakurthi, Urmila Ghia,** *University of Cincinnati, Cincinnati, OH, United States,* **Leonid Turkevich,** *CDC/NIOSH/DART, Cincinnati, OH, United States*

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Evaluation of the Effectiveness of a Coastal Wave Reduction and Sediment Retention Structure Using CFD Simulations
Technical Paper Publication. FEDSM2017-69219

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

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How Computational Grid Refinement Affects CFD-DEM Results for Psuedo-2D Fluidized Gas-Solid Beds
Technical Paper Publication. FEDSM2017-69222

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

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A Simplified Model for the Normal Collision of Arbitrary Shape Particles in a Viscous Flow
Technical Paper Publication. FEDSM2017-69366

**Fazlolah Mohaghegh, HS Udaykumar,** *University of Iowa, Iowa City, IA, United States*

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On the Predictive Capability of DNS-DEM Applied to Suspended Sediment-Turbulence Interactions
Technical Paper Publication. FEDSM2017-69449

**Pedram Pakseresht, Sourabh Apte,** *Oregon State University, Corvallis, OR, United States,* **Justin R. Finn,** *National Energy Technology Labratory, Albany, OR, United States*

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**5-3**
**SYMPOSIUM ON ALGORITHMS AND APPLICATIONS FOR HIGH PERFORMANCE CFD COMPUTATION**
Queen's 5 4:20pm - 5:50pm

**5-3-1**
**Toward Exascale: Challenges and Opportunities for Fluid Flow Simulation**

Toward Exascale: Challenges and Opportunities for Fluid Flow Simulation
Keynote Presentation. FEDSM2017-69610

**Michael Sprague,** *National Renewable Energy Laboratory, Golden, CO, United States*

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Toward Exascale: Challenges and Opportunities for Fluid Flow Simulation
Keynote Presentation. FEDSM2017-69611

**Makoto Tsubokura,** *Koben University, Japan*

# Technical Sessions

## 6-3
## 15th International Symposium on Gas-Liquid Two-Phase Flows

Kona 4 4:20pm - 5:50pm

### 6-3-2
### Gas-Liquid Flows - Session 2

Computational Fluid Dynamics Study on the Effect of Inlet Modifications of GLCC© Compact Separators
Technical Paper Publication. FEDSM2017-69413

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

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Numerical Study of Hydrodynamic Instabilities in Converging Geometry
Technical Paper Publication. FEDSM2017-69557

**Erik S. Proano,** *Embry-Riddle Aeronautical University, Port Orange, FL, United States,* **Bertrand Rollin,** *Embry-Riddle Aeronautical University, Daytona Beach, FL, United States*

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Numerical Simulations of Hydrodynamic Instabilities with Surface Tension
Technical Presentation. FEDSM2017-69447

**Jan Velechovsky, Marianne Francois, Zechariah Jibben, Thomas Masser,** *Los Alamos National Laboratory, Los Alamos, NM, United States*

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Surface Tension Capability within an Adaptively Refined Compressible Flow Code
Technical Paper Publication. FEDSM2017-69451

**Zach Jibben, Jan Velechovsky, Thomas Masser, Marianne Francois,** *Los Alamos National Laboratory, Los Alamos, NM, United States*

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Numerical and Experimental Analysis of Vertical Ascendant Liquid and Gas Flow Under Action of Centrifugal And Gravitational Fields
Technical Paper Publication. FEDSM2017-69276

**Henrique K. Eidt, Paulo H. D. Santos, Carolina C. Rodrigues, Rafael Dunaiski, Cesar Ofuchi, Flávio Neves Jr., Rigoberto E. M. Morales,** *Federal University of Technology - Parana, Curitiba, Brazil*

## 7-6
## 12th Symposium on Flow Manipulation and Active Control

Queen's 6 4:20pm - 5:50pm

### 7-6-2
### Active Flow Control

Numerical Analysis of Internal and External Flow Fields of a Fluidic Actuator for Active Flow Control Applications
Technical Paper Publication. FEDSM2017-69046

**Shawn Aram,** *Naval Surface Warfare Center, Carderock Division, West Bethesda, MD, United States,* **Yu-Tai Lee,** *Emeritus of Naval Surface Warfare Center, West Bethesda, MD, United States,* **Hua Shan, Abel Vargas,** *Naval Surface Warfare Center - Carderock Division, Bethesda, MD, United States*

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Machine Learning Control for Experimental Turbulent Flow Targeting the Reduction of a Recirculation Bubble
Technical Paper Publication. FEDSM2017-69272

**Camila Chovet, Laurent Keirsbulck,** *Université de Valenciennes et du Hainaut-Cambrésis, Valenciennes, Hauts-de-France, France,* **Bernd Noack,** *University of Orsay, Orsay, France,* **Marc Lippert,** *LAMIH CNRS UMR 8201, University of Valenciennes and Hainaut-Cambresis, Valenciennes, France,* **Jean-Marc Foucaut,** *Ecole Centrale de Lille, Lille, France*

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Study on the Effects of Active Flow Control on Aerodynamic Performance of Two Airfoils in Tandem Configurations
Technical Paper Publication. FEDSM2017-69461

**Ehsan Asgari, Armin Sheidani, Mehran Tadjfar,** *Amirkabir University of Technology, Tehran, Iran*

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Wind-Turbine Vibration Reduction Using Flow Control Devices
Technical Paper Publication. FEDSM2017-69569

**Ho-Young Kim, Jae-Hung Han,** *KAIST, Daejeon, Republic of Korea*

## Thursday, August, 03

**1-2**
**Fluids Engineering Plenaries**
Monarchy Ballroom 8:30am - 10:00am

**1-2-4**
**Morning Plenary 4**

Studies of Unsteady Flows Inspired by Biomedical Applications
Plenary Presentation. FEDSM2017-69605

**Michael Plesniak,** *George Washington University, Washington, DC, United States*

**2-1**
**18th International Symposium on Advances in Numerical Modeling for Turbomachinery Flow Optimization**
King's 3 10:15am - 11:45am

**2-1-3**
**Turbo-III**

Numerical Analysis of a Centrifugal Fan for a Road Sweeper
Technical Paper Publication. FEDSM2017-69103

**Xiaoxuan Chen, Mingyang Yang, Kangyao Deng,** *Shanghai Jiao Tong University, Shanghai, China,* **Yunlong Bai,** *Fujian Longma Environmental Sanitation Equipment Co. Ltd, Longyan, China*

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Study on Appropriate Diameter of Centrifugal Fan Surrounded by Heat Exchanger in Air Conditioner
Technical Paper Publication. FEDSM2017-69115

**Daiwa Sato,** *Hitachi, Ltd., Hitachinaka-City Ibaraki, Japan,* **Taku Iwase,** *Hitachi, Ltd., Hitachi Research Laboratory, Hitachinaka, Ibaraki, Japan,* **Jun Xue,** *Hitachi, Ltd., Hitachinaka, Ibaraki, Japan,* **Kazuhiro Tsuchihashi, Hideshi Obara, Naoyuki Fushimi,** *Hitachi-Johnson Controls Air Conditioning, Inc., Sizuoka, Japan, Japan*

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Research on the Geometry Parameters of Diffuser Vane Influence on the Performance of Bulb Tubular Pumping System
Technical Paper Publication. FEDSM2017-69135

**Yan Jin, Junxin Wu, Hongcheng Chen, Chao Liu,** *Yangzhou University, Yangzhou, China*

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Aerodynamic Design and Optimization of the Pipe Diffuser for a High-Loading Centrifugal Compressor
Technical Paper Publication. FEDSM2017-69152

**Xi Yang, Donghai Jin, Xingmin Gui,** *Beihang University, Beijing, Beijing, China*

**2-2**
**29th Symposium on Fluid Machinery**
King's 2 10:15am - 11:45am

**2-2-8**
**Extra Fluid Machinery**

Lubricant Inertia in Water Lubricated Bearings
Technical Paper Publication. FEDSM2017-69110

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

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Numerical Study on Flow Characteristics in Multi-Stage High Pressure Reducing Valve
Technical Paper Publication. FEDSM2017-69210

**Fu-qiang Chen, Zhi-xin Gao, Jin-Yuan Qian, Zhi-jiang Jin,** *Zhejiang University, Hangzhou, Select State/Province, China*

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Modeling the Viscoelastic Effects in the Hydrodynamic Lubrication of Journal Bearing in a High-Torque Low Speed Diesel Engine
Technical Paper Publication. FEDSM2017-69306

**Talha Zia,** *NUST College of Electrical and Mechanical Engineering, Lahore, Punjab, Pakistan,* **Syed Adnan Qasim,** *Engine Research Center, Taxila, Punjab, Pakistan,* **Raja Amer Azim,** *NUST College of Electrical and Mechanical Engineering, Rawalpindi, Punjab, Pakistan*

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Modeling Shear Heating in the Hydrodynamic Lubrication of Crankshaft Journal Bearing of a High-Torque Diesel Engine Operating at a Low Speed
Technical Paper Publication. FEDSM2017-69307

**Saqib Naseer,** *NUST college of Electrical and Mechanical engineering, Gojra, Punjab, Pakistan,* **Syed Adnan Qasim,** *Engine Research Center, Taxila, Punjab, Pakistan,* **Raja Amer Azim,** *NUST College of Electrical and Mechanical Engineering, Rawalpindi, Punjab, Pakistan*

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# Technical Sessions

Numerical Modeling and Experimental Measurements of Poiseuille Taylor Couette Flow Induced Windage Losses in a High Speed Electric Motor
Technical Presentation. FEDSM2017-69129

**Kevin Anderson, Jun Lin, Alexander Wong,** *California State Polytechnic University, Pomona, CA, United States,*

Sensitivity Analysis of Fluid Pre-Swirl and Swirl Brakes Design on the Performance of Labyrinth Seals
Technical Paper Publication. FEDSM2017-69537

**Hanxiang Jin, Alexandrina Untaroiu, Gen Fu,** *Virginia Tech, Blacksburg, VA, United States,* **Vahe Hayrapetian, Kariem Elebiary,** *Flowserve Corporation, Vernon, CA, United States*

## 2-4
## 9th International Symposium on Pumping Machinery
King's 1 10:15am - 11:45am

### 2-4-8
### Pump Efficiency Aspects

CFD Results vs. ANSI Formulas for the Pump Performance with Different Liquid Viscosity
Technical Paper Publication. FEDSM2017-69093

**Mikhail Strongin,** *WILO-USA LLC, Rosemont, IL, United States*

Evaluation of Effect of Viscosity on an Electrical Submersible Pump
Technical Paper Publication. FEDSM2017-69157

**Gerald Morrison, Wenjie Yin, Rahul Agarwal, Abhay Patil,** *Texas A&M University, College Station, TX, United States*

Measured Static and Rotordynamic Characteristics of a Smooth-Stator/Grooved-Rotor Liquid Annular Seal
Technical Paper Publication. FEDSM2017-69036

**J. Alex Moreland, Dara W. Childs,** *Texas A&M University, College Station, TX, United States,* **Josh T. Bullock,** *Valero Energy Corp., Houston, TX, United States*

Developing an Optimal Helix Angle as a Function of Pressure for Helical Groove Seals
Technical Paper Publication. FEDSM2017-69322

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

## 3-2
## Symposium on Fluid Measurement and Instrumentation
Kona 5 10:15am - 11:45am

### 3-2-5
### Fluid Measurement and Instrumentation V - Heat Transfer

Direct Measurement of Heat Flux Partitioning in Boiling Heat Transfer
Technical Paper Publication. FEDSM2017-69347

**Andrew Richenderfer, Artyom Kossolapov, Jee Hyun Seong,** *Massachusetts Institute of Technology, Cambridge, MA, United States,* **Giacomo Saccone,** *Universitá di Pisa, Pisa, Italy,* **Matteo Bucci, Jacopo Buongiorno,** *Massachusetts Institute of Technology, Cambridge, MA, United States,*

Heat Transfer of Pico Projector Using a Piezoelectric Fan with an Aluminum Blade
Technical Paper Publication. FEDSM2017-69570

**Jin-Cherng Shyu, Shu-Kai Jheng,** *National Kaohsiung University of Applied Sciences, Kaohsiung, Taiwan*

On the Test Setting at Condenser in Thermal Performance Tests of Heat Pipes
Technical Paper Publication. FEDSM2017-69517

**Shwin-Chung Wong, Zong-Jyun Hsu, Li-Cheng Hsu,** *National Tsing Hua University, Hsin-Chu, Taiwan*

Energy Saving Analysis and Improvement of Cooling Circulating Water System in M199 Technological Process
Technical Paper Publication. FEDSM2017-69513

**Zhixiang Xiong, Yin Luo,** *Jiangsu University, Zhenjiang, Jiangsu Province, China*

A General Frictional Pressure Drop Correlation for Condensation in Microfin Tubes
Technical Paper Publication. FEDSM2017-69523

Zhichuan Sun, Wei Li, Zhejiang University, HangZhou, Zhejiang Province, China, China

Investigation of EGR with EGB (Exhaust Gas Bypass) on Low Speed Marine Diesel Engine Performance and Emission Characteristics
Technical Paper Publication. FEDSM2017-69464

**Zhanguang Wang, Song Zhou, Yongming Feng, Yuanqing Zhu,** *Harbin Engineering University, Harbin, China*

## 3-5
## Symposium on Energy and Process Engineering
Kona 2 10:15am - 11:45am

### 3-5-1
### Energy and Process Engineering I

A Compressible Thermohydrodynamic Analysis of Journal Bearings Lubricated with Supercritical CO2
Technical Paper Publication. FEDSM2017-69310

**Ssu-Ying Chien, Mark S. Cramer, Alexandrina Untaroiu,** *Virginia Tech, Blacksburg, VA, United States*

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Effect of Surfactant (Foamer) Delivery Location on Horizontal Wells Deliquification
Technical Paper Publication. FEDSM2017-69512

**Carolina Vasconcelos Barreto,** *University of Tulsa, Rio de Janeiro, Brazil,* **Hamidreza Karami, Eduardo Pereyra, Cem Sarica,** *The University of Tulsa, Tulsa, OK, United States*

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The Performance Analysis of a Reactor Coolant Pump Hydrostatic Seal in Different Operating Conditions by Reynolds Equations
Technical Paper Publication. FEDSM2017-69479

**Guohui Cong,** *China Nuclear Power Design Co., Ltd, Shenzhen, China,* **Zhang YiXun,** *China Nuclear Power Engineering CO.,Ltd, Shenzhen, China,* **Tiejian ZHANG,** *China Nuclear Power Engineering Co.,Ltd.,/Guangdong University of Technology, Shenzhen, China,* **Kan Chen,** *Sichuan Sunny Seal Co., Ltd., Chengdu, China*

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Pool Scrubbing Efficiency of Hypothesized Filtered Containment Venting System for APR1400 Nuclear Power Plants
Technical Paper Publication. FEDSM2017-69387

**Seungwon Seo, Jungjae Lee, Yongjin Cho,** *Korea Institute of Nuclear Safety, Daejeon, Daejeon, Republic of Korea*

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## 5-1
## Symposium on Development and Applications in Computational Fluid Dynamics
Queen's 4 10:15am - 11:45am

### 5-1-3
### CFD II: Novel Development Efforts

Verification and Validation of the Caelus Library - Incompressible Flow Solvers
Technical Paper Publication. FEDSM2017-69174

**Aleksandar Jemcov,** *University of Notre Dame, Notre Dame, IN, United States,* **Darrin W. Stephens,** *Applied CCM, Melbourne, Victoria, Australia,* **Chris Sideroff,** *Applied CCM Inc, Gloucester, ON, Canada*

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Verification and Validation of the Caelus Library - Incompressible Turbulence Models
Technical Paper Publication. FEDSM2017-69175

**Darrin W. Stephens,** *Applied CCM, Melbourne, Victoria, Australia,* **Aleksandar Jemcov,** *University of Notre Dame, Notre Dame, IN, United States,* **Chris Sideroff,** *Applied CCM Inc, Gloucester, ON, Canada*

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A Conformal Decomposition Finite Element Method for Dynamic Wetting Applications
Technical Paper Publication. FEDSM2017-69378

**David Noble, Alec Kucala, Mario Martinez,** *Sandia National Labs, Albuquerque, NM, United States*

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A Unified CFD Model for Cavitation
Technical Paper Publication. FEDSM2017-69363

**Michael Kinzel,** *Pennsylvania State University, University Park, PA, United States,* **Jules Lindau,** *Pennsylvania State Applied Research Lab, State College, PA, United States,* **Robert Kunz,** *Pennsylvania State University, University Park, PA, United States*

# Technical Sessions

## 5-2
## 12th Symposium on DNS/LES and Hybrid RANS/LES Methods

Queen's 5 10:15am - 11:45am

### 5-2-3
### Applications employing RANS/LES/DNS

Large Eddy Simulation of a Helical Coil Steam Generator Test Section
Technical Paper Publication. FEDSM2017-69230

**Jonathan K. Lai,** *Texas A&M University, College Station, TX, United States,* **Elia Merzari,** *Argonne National Laboratory, Lemont, IL, United States,* **Marilyn Delgado, Samuel J. Lee, Saya Lee, Yassin Hassan,** *Texas A&M University, College Station, TX, United States*

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Numerical and Experimental Investigations of Rotating Wheel Aerodynamics on the DrivAer Model with Engine Bay Flow
Technical Paper Publication. FEDSM2017-69305

**Lukas Haag,** *Technical University of Munich, Garching bei München, Bavaria, Germany,* **Marco Kiewat,** *Technical University of Munich, Garching, Germany,* **Thomas Blacha,** *AUDI AG, Ingolstadt, Bavaria, Germany,* **Thomas Indinger,** *Technical University of Munich, Garching, Germany*

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An Immersed Boundary Direct Numerical Simulation Study of the Wall Effect on the Dynamics of a Rigid Sphere
Technical Paper Publication. FEDSM2017-69381

**Jason Gatewood,** *Nextera Energy - Florida Power and Light, Jupiter, FL, United States,* **Zhigang Feng,** *University of Texas San Antonio, San Antonio, TX, United States*

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Direct Numerical Simulation of a Variable Viscosity Turbulence Study in a Channel and Pipe Flow
Technical Presentation. FEDSM2017-69138

**Fatih S. Sarikurt,** *Texas A&M University, Nuclear Engineering, College Station, TX, United States,* **Elia Merzari,** *Argonne National Laboratory, Lemont, IL, United States,* **Yassin Hassan,** *Texas A&M University, College Station, TX, United States*

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Turbulent-Turbulent Spot Detected beneath the Buffer Layer of the Turbulent Flat-Plate Boundary Layer using Direct Numerical Simulation
Technical Presentation. FEDSM2017-69045

**Xiaohua Wu,** *Royal Military College of Canada, Kingston, ON, Canada*

## 6-3
## 15th International Symposium on Gas-Liquid Two-Phase Flows

Kona 4 10:15am - 11:45am

### 6-3-3
### Gas-Liquid Flows - Session 3

Modeling Fluid Flow and Phase-Change Heat Transfer Processes in Loop Heat Pipe System
Technical Presentation. FEDSM2017-69047

**Triem T. Hoang,** *TTH Research, Inc., Clifton, VA, United States*

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Fuel Production from Thermoplastic Wastes Pyrolysis
Technical Paper Publication. FEDSM2017-69086

**Emna Berrich-Betouche,** *University of Nantes, GEPEA UMR CNRS 6144, Nantes, France,* **Asma Dhahak, Abdelaziz Touati,** *University of Gabes, National High Engineering School of Gabes, Chemical Engineering Department, Gabes, Tunisia,* **Fethi Aloui,** *University of Valenciennes, LAMIH UMR CNRS 8201, Valenciennes, France*

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Pipe Inclination Effects on Slug Flow Characteristics of High Viscosity Oil-Gas Two-Phase Flow for Near Horizontal Pipes
Technical Paper Publication. FEDSM2017-69145

**Samet Ekinci, Tayfun Aydin, Cem Sarica, Eduardo Pereyra, Teawoo Kim,** *University of Tulsa, Tulsa, OK, United States*

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Numerical Simulation on the Organic Fluid Two-Phase Flow and Heat Transfer in the PEMFC Cooling Plate for Waste Heat Recovery
Technical Paper Publication. FEDSM2017-69184

**Lili Yu, Weilin Zhuge, Yangjun Zhang, Jie Peng,** *Tsinghua University, Beijing, China*

## 7-5
## 8th Symposium on Bio-Inspired Fluid Mechanics
Queen's 6 10:15am - 11:45am

### 7-5-3
### Unsteady Flight and Biomedical Studies

Characteristics of Dynamic Forces Generated by a Flapping Butterfly and Its Wake Structure
Technical Paper Publication. FEDSM2017-69285

**Masaki Fuchiwaki, Kazuhiro Tanaka,** *Kyushu Institute of Technology, Iizuka, Japan*

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Investigation of Obstacle Effects on the Aerodynamic Performance of Flapping Wings
Technical Paper Publication. FEDSM2017-69264

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

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Unsteady Vortex Interactions for Performance Enhancement in a Free Flying Dragonfly
Technical Paper Publication. FEDSM2017-69579

**Csaba Hefler, Ryusuke Noda, Wei Shyy, Huihe Qiu,** *The Hong Kong University of Science & Technology, Kowloon, Hong Kong*

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Assessment Of Hemodynamic Characteristics In A Four-Way Right-Atrium Bypass Connector
Technical Paper Publication. FEDSM2017-69470

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

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Design of a Dual Propeller Micro-Pump in Conjunction with Flared TCPC for Cavopulmonary Assist in Fontan Patients
Technical Paper Publication. FEDSM2017-69471

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

## 7-8
## 10th Symposium on Transport Phenomena in Energy Conversion from Clean and Sustainable Resources
Kona 1 10:15am - 11:45am

### 7-8-1
### Transport Phenomena in Energy Conversion

Resistant Energy Analysis of Dropwise Condensation on Superhydrophobic Surfaces with Hierarchical Roughness
Technical Paper Publication. FEDSM2017-69009

**Jiangtao Cheng,** *Virginia Tech, Blacksburg, VA, United States*

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Fluid Flow, Heat and Contaminant Transport Iin a Ventilated Enclosure Due to the Presence of Thermosolutal Body
Technical Paper Publication. FEDSM2017-69485

**Neha Gupta, Ameeya Nayak,** *IIT Roorkee, Roorkee, India*

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Flow and Mixing in a Chamber Using Inertia Generated Spiral Toroidal Vortex
Technical Presentation. FEDSM2017-69511

**Wallace Leung,** *Hong Kong Polytechnic University, Kowloon, Hong Kong,* **Yong Ren,** *The Hong Kong Polytechnic University, Hong Kong, Hong Kong*

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Effect of Fouling on the Heat Transfer Coefficient and Pressure Drop in Tubes with Twisted-Tape Inserts under Laminar Flow Conditions
Technical Presentation. FEDSM2017-69575

**Irfan Khan, Shankhadeep Das, Sean Ewart, Shrikant Dhodapkar, Maria Pollard, Pradeep Jain, Michael Turner,** *The Dow Chemical Company, Freeport, TX, United States*

## 1-3
## Fluids Engineering Luncheon Keynotes
Monarchy Ballroom 1:00pm - 2:15pm

### 1-3-4
### Conference Keynotes 4, Sponsored by Intelligent Light

An Advanced Loop Heat Pipe for Cryogenic Applications
Keynote Presentation. FEDSM2017-69437

**Jentung Ku,** *NASA Goddard Space flight Center, Greenbelt, MD, United States,* **Triem T. Hoang**, *TTH Research, Inc., Washington, DC, United States*

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Track Co-Organizer: Chih-Yung Wen, The Hong Kong Polytechnic University

## Symposium/Forum Organizers

### 2-1 18th International Symposium on Advances in Numerical Modeling for Turbomachinery Flow Optimization
Symposium Organizer: Yu-Tai Lee,Emeritus of Naval Surface Warfare Center

### 2-2 29th Symposium on Fluid Machinery
Symposium Organizer: Kwang-yong Kim, Inha University
Symposium Co-Organizer: Upendra Rohatgi,Brookhaven National Laboratory
Symposium Co-Organizer: Jinkook Lee, Eaton Aerospace
Symposium Co-Organizer: Hans Josef Dohmen,university Duisburg Essen
Symposium Co-Organizer: Yoshinobu Tsujimoto, Osaka University
Symposium Co-Organizer: Shouqi Yuan, Jiangsu University
Symposium Co-Organizer: Yangjun Zhang, Tsinghua University
Symposium Co-Organizer: Young-Seok Choi,KITECH(Korea Institute of Industrial Technology)

### 2-3 24th Symposium on Industrial and Environmental Applications of Fluid Mechanics
Symposium Organizer: Alexandrina Untaroiu, Virginia Tech
Symposium Co-Organizer: Wayne Strasser, Eastman Chemical Co
Symposium Co-Organizer: Ivaylo Nedyalkov,University of New Hampshire

### 2-4 9th International Symposium on Pumping Machinery
Symposium Organizer: Bruno Schiavello, Flowserve
Symposium Co-Organizer: Satoshi Watanabe, Kyushu University
Symposium Co-Organizer: Shouqi Yuan, Jiangsu University
Symposium Co-Organizer: Yoshinobu Tsujimoto, Osaka University
Symposium Co-Organizer: Frank Visser, Flowserve
Symposium Co-Organizer: Akira GOTO, Ebara Corporation
Symposium Co-Organizer: Paul Cooper, Paul Cooper: Research, Education & Consulting in Fluid Machinery
Symposium Co-Organizer: Chisachi KATO,Institute of Industrial Science, The University of Tokyo
Symposium Co-Organizer: Kazuyoshi Miyagawa, Waseda University
Symposium Co-Organizer: Joseph Katz, Johns Hopkins University
Symposium Co-Organizer: Jinkook Lee, Eaton Aerospace
Symposium Co-Organizer: Donald Sloteman,Curtiss-Wright Corporation
Symposium Co-Organizer: Mikhail Strongin, WILO-USA LLC
Symposium Co-Organizer: Alexandrina Untaroiu, Virginia Tech
Symposium Co-Organizer: Giancarlo Cicatelli, Flowserve
Symposium Co-Organizer: Stefan Berten, Sulzer Management Ltd.
Symposium Co-Organizer: Hans Josef Dohmen,University Duisburg Essen

# Acknowledgments

Symposium Co-Organizer: B.p.m. Van Esch,Eindhoven University of Technology
Symposium Co-Organizer: Christian Brix Jacobsen,Grundfos Holding A/S
Symposium Co-Organizer: Regiane Fortes-Patella,LEGI, Université Grenoble Alpes,
Symposium Co-Organizer: Paul Uwe Thamsen,Technical University Berlin
Symposium Co-Organizer: Ashvin Hosangadi, Craft Tech
Symposium Co-Organizer: Takahide Nagahara, Hitachi, Ltd.

### 3-2 Symposium on Fluid Measurement and Instrumentation

Symposium Organizer: Judith A. Bamberger, Pacific Northwest National Laboratory
Symposium Co-Organizer: Francisco Diez, Rutgers University
Symposium Co-Organizer: Joel Park, Naval Surface Warfare Center Carderock Division
Symposium Co-Organizer: Jun Chen, Purdue University
Symposium Co-Organizer: Martin Wosnik, University of New Hampshire
Symposium Co-Organizer: Stamatios Pothos, TSI Incorp

### 3-3 Symposium on the Fluid Dynamics of Wind Energy

Symposium Organizer: Martin Wosnik, University of New Hampshire
Symposium Co-Organizer: Francisco Diez, Rutgers University
Symposium Co-Organizer: Zhongquan Charlie Zheng,University of Kansas Location: Lawrence, KS, United States
Symposium Co-Organizer: Hui Hu, Iowa State University

### 3-4 Symposium on Renewable and Sustainable Energy Conversion

Symposium Organizer: Khaled J. Hammad,Central Connecticut State University
Symposium Co-Organizer: Chih Jen Sung, University of Connecticut
Symposium Co-Organizer: Martin Wosnik, University of New Hampshire

### 3-5 Symposium on Energy and Process Engineering

Symposium Organizer: Martin Wosnik, University of New Hampshire
Symposium Co-Organizer: Stamatios Pothos, TSI Incorp

### 4-1 Microfluidics and Nanofluidics Symposium in FEDSM 2017

Symposium Organizer: Hongwei Sun, University of Massachusetts Lowell
Symposium Co-Organizer: Michael Schertzer,Rochester Institute of Technology
Symposium Co-Organizer: Prodip K. Das, Newcastle University
5-1 Symposium on Development and Applications in Computational Fluid Dynamics
Symposium Organizer: Zhongquan Charlie Zheng, University of Kansas
Symposium Co-Organizer: Elia Merzari, Argonne National Laboratory
Symposium Co-Organizer: Yassin Hassan, Texas A&M University
Symposium Co-Organizer: Ning Zhang, McNeese State University
Symposium Co-Organizer: Caleb Barnes,Air Force Research Laboratory

### 5-2 12th Symposium on DNS/ LES and Hybrid RANS/LES Methods

Symposium Organizer: Daniel Garmann, Air Force Research Laboratory
Symposium Co-Organizer: Chaitanya Ghodke, Convergent Science Inc.

### 5-3 Symposium on Algorithms and Applications for High Performance CFD Computation

Symposium Organizer: Ning Zhang, McNeese State University
Symposium Co-Organizer: Jingsen Ma, Dynaflow, Inc

### 6-1 52nd Forum on Cavitation and Multiphase Flow (Forum)

Symposium Organizer: William Straka, Pennsylvania State University
Symposium Co-Organizer: Ki Han Kim, Office of Naval research
Symposium Co-Organizer: Ivaylo Nedyalkov, University of New Hampshire

### 6-3 15th International Symposium on Gas-Liquid Two-Phase Flows

Symposium Organizer: Mark Duignan, Savannah River National Laboratory
Symposium Co-Organizer: Timothy J. O'Hern, Sandia National Laboratories
Symposium Co-Organizer: Jules (Jay) Lindau, Applied Research Lab/Penn State University
Symposium Co-Organizer: Robert Kunz, Pennsylvania State University
Symposium Co-Organizer: Michael Kinzel, Pennsylvania State University

### 6-4 15th International Symposium on Gas & Liquid-Solid Two-Phase Flows

Symposium Organizer: Mark Duignan, Savannah River National Laboratory
Symposium Co-Organizer: Timothy J. O'Hern, Sandia National Laboratories

### 6-5 17th International Symposium on Numerical Methods for Multiphase Flow

Symposium Organizer: Marianne Francois, Los Alamos National Laboratory
Symposium Co-Organizer: Francine Battaglia, Virginia Tech

### 7-1 Forum on Advances in Fluids Engineering Education (Forum)

Symposium Organizer: Ray Taghavi, University of Kansas

### 7-2 8th International Symposium on Turbulent Flows: Issues and Perspectives

Symposium Organizer: Kamran Siddiqui, University of Western Ontario

**7-3 11th International Symposium on Flow Applications in Aerospace**
Symposium Organizer: Javid Bayandor, Virginia Tech

**7-4 17th International Symposium on Fluid Power**
Symposium Organizer: Javid Bayandor, Virginia Tech

**7-5 8th Symposium on Bio-Inspired Fluid Mechanics**
Symposium Organizer: Javid Bayandor, Virginia Tech

**7-6 12th Symposium on Flow Manipulation and Active Control**
Symposium Organizer: Hassan Peerhossaini, Université Paris Diderot
Symposium Co-Organizer: Mihir Sen, University of Notre Dame

**7-7 21st Symposium on Fundamental Issues and Perspectives in Fluid Mechanics**
Symposium Organizer: Khaled J. Hammad, Central Connecticut State University
Symposium Co-Organizer: Francine Battaglia, Virginia Tech
Symposium Co-Organizer: Ivana Milanovic, University of Hartford
Symposium Co-Organizer: David Davis, NASA Glenn Research Center
Symposium Co-Organizer: Stefan aus der Wiesche, University of Applied Sciences Muenster

**7-8 10th Symposium on Transport Phenomena in Energy Conversion from Clean and Sustainable Resources**
Symposium Organizer: Khaled J. Hammad, Central Connecticut State University
Symposium Co-Organizer: Fethi Aloui, University of Valenciennes

**7-9 16th Symposium on Transport Phenomena in Materials Processing and Manufacturing Processes**
Symposium Organizer: Dennis Siginer, Botswana International University

## Session Organizers:

**1-2-1 Morning Plenary 1**
Session Organizer: Yu-Tai Lee, Emeritus of Naval Surface Warfare Center

**1-2-2 Morning Plenary 2**
Session Organizer: Goodarz Ahmadi, Clarkson Univ

**1-2-3 Morning Plenary 3**
Session Organizer: Javid Bayandor, Virginia Tech

**1-2-4 Morning Plenary 4**
Session Organizer: Francine Battaglia, Virginia Tech

**1-3-1 Conference Keynotes 1**
Session Organizer: D. Keith Walters, University of Oklahoma

**1-3-2 Conference Keynotes 2, Sponsored by The George Washington University**
Session Organizer: Khaled J. Hammad, Central Connecticut State University

**1-3-3 Conference Keynotes 3**
Session Organizer: Mark Duignan, Savannah River National Laboratory

**1-3-4 Conference Keynotes 4, Sponsored by Intelligent Light**
Session Organizer: Javid Bayandor, Virginia Tech

**2-1-1 Turbo I (Technical)**
Session Organizer: Hiroyoshi Watanabe, Ebara Corporation
Session Co-Organizer: Yu-Tai Lee, Emeritus of Naval Surface Warfare Center

**2-1-2 Turbo-II (Technical)**
Session Organizer: Chunill Hah, NASA Glenn Research Center
Session Co-Organizer: Yu-Tai Lee, Emeritus of Naval Surface Warfare Center

**2-1-3 Turbo-III (Technical)**
Session Organizer: Yu-Tai Lee, Emeritus of Naval Surface Warfare Center
Session Co-Organizer: Chunill Hah, NASA Glenn Research Center

**2-2-1 Pumps 1 (Technical)**
Session Organizer: Hans Josef Dohmen, university Duisburg Essen

**2-2-2 Pumps 2 (Technical)**
Session Organizer: Jinkook Lee, Eaton Aerospace

**2-2-3 Pumps 3 (Technical)**
Session Organizer: Shouqi Yuan, Jiangsu University

**2-2-4 Hydraulic Turbines (Technical)**
Session Organizer: Yoshinobu Tsujimoto, Osaka University
Session Co-Organizer: Jin-Hyuk Kim, KITECH

**2-2-5 Gas Turbines (Technical)**
Session Organizer: Tong Seop Kim, Inha University

**2-2-6 Compressors (Technical)**
Session Organizer: Yangjun Zhang, Tsinghua University

**2-2-7 Fans (Technical)**
Session Organizer: Kwang-Yong Kim, Inha Univ

# Acknowledgments

**2-2-8 Extra Fluid Machinery (Technical)**
Session Organizer: Young-Seok Choi, KITECH(Korea Institute of Industrial Technology)

**2-3-1 Industrial 1 (Technical)**
Session Organizer: Wayne Strasser, Eastman Chemical Co
Session Co-Organizer: Alexandrina Untaroiu, Virginia Tech

**2-3-2 Industrial 2 (Technical)**
Session Organizer: Alexandrina Untaroiu, Virginia Tech
Session Co-Organizer: Ivaylo Nedyalkov, University of New Hampshire

**2-3-3 Industrial 3 (Technical)**
Session Organizer: George Chamoun, Eastman Chemical Company
Session Co-Organizer: Ivaylo Nedyalkov, University of New Hampshire



**2-3-4 Industrial 4 (Technical)**
Session Organizer: Ivaylo Nedyalkov, University of New Hampshire
Session Co-Organizer: Alexandrina Untaroiu, Virginia Tech

**2-4-1 Pump Design (Keynote)**
Session Organizer: Bruno Schiavello, Flowserve
Session Co-Organizer: Giancarlo Cicatelli, Flowserve

**2-4-2 Multi-Stage Pumps (Technical)**
Session Organizer: Akira Goto, Ebara Corporation
Session Co-Organizer: Mikhail Strongin, WILO USA LLC

**2-4-3 Multi-Stage Pumps etc. (Technical)**
Session Organizer: Takahide Nagahara, Hitachi, Ltd.
Session Co-Organizer: Hans Josef Dohmen, University Duisburg Essen

**2-4-4 Cavitation Erosion (Keynote)**
Session Organizer: Frank Visser, Flowserve
Session Co-Organizer: Motohiko Nohmi, EBARA Corporation

**2-4-5 Cavitation (Keynote)**
Session Organizer: Regiane Fortes-Patella, LEGI, Université. Grenoble Alpes
Session Co-Organizer: Kazuyoshi Miyagawa, Waseda University

**2-4-6 Cavitation & Unsteady Flows (Technical)**
Session Organizer: Satoshi Watanabe, Kyushu University
Session Co-Organizer: Shouqi Yuan, Jiangsu University

**2-4-7 Wastewater Pumps (Technical)**
Session Organizer: Paul Uwe Thamsen, Technical University Berlin
Session Co-Organizer: Christian Brix Jacobsen, Grundfos Holding A/S

**2-4-8 Pump Efficiency Aspects (Technical)**
Session Organizer: B.p.m. Van Esch, Eindhoven University of Technology
Session Co-Organizer: Alexandrina Untaroiu, Virginia Tech

**3-2-1 Fluid Measurement and Instrumentation I - PIV (Technical)**
Session Organizer: Kamran Siddiqui, University of Western Ontario
Session Co-Organizer: Matt Stegmeir, TSI Incorporated

**3-2-2 Fluid Measurement and Instrumentation II - PIV, LDA, HW (Technical)**
Session Organizer: Matt Stegmeir, TSI Incorporated
Session Co-Organizer: John Vaccaro, Hofstra University

**3-2-3 Fluid Measurement and Instrumentation III (Technical)**
Session Organizer: Theodore Heindel, Iowa State Univ

**3-2-4 Fluid Measurement and Instrumentation IV (Technical)**
Session Organizer: Christopher C. Daniels, The University of Akron
Session Co-Organizer: Judith A. Bamberger, Pacific Northwest National Laboratory

**3-2-5 Fluid Measurement and Instrumentation V - Heat Transfer (Technical)**
Session Organizer: Matteo Bucci, Massachusetts Institute of Technology

**3-3-1 Fluid Dynamics of Wind Energy I (Technical)**
Session Organizer: Martin Wosnik, University of New Hampshire
Session Co-Organizer: Francisco Diez, Rutgers University

**3-4-1 Renewable and Sustainable Energy Conversion - I (Technical)**
Session Organizer: Khaled J. Hammad, Central Connecticut State University
Session Co-Organizer: Fethi Aloui, University of Valenciennes

**3-4-2 Food-Water-Energy Nexus (Technical)**
Session Organizer: Ivaylo Nedyalkov, University of New Hampshire

**3-5-1 Energy and Process Engineering I (Technical)**
Session Organizer: Martin Wosnik, University of New Hampshire

**4-1-1 Novel Applications of Micro/Nanofluidics (Technical)**
Session Organizer: Jiang Zhe, University of Akron

**4-1-2 Emerging Topics on Microfluidics/Nanofluidics (Technical)**
Session Organizer: Jiang Zhe, University of Akron

**4-1-3 Flows in Microfluidic Systems (Technical)**
Session Organizer: Michael Schertzer, Rochester Institute of Technology

**4-1-4 Microfluidic Devices for Biomedical Applications (Technical)**
Session Organizer: Michael Schertzer, Rochester Institute of Technology

**4-1-5 Microscale Multiphase Flow and Surface Interactions (Technical)**
Session Organizer: Jiang Zhe, University of Akron

**5-1-2 CFD I: Fundamental Studies (Technical)**
Session Organizer: Zhongquan Charlie Zheng, University of Kansas
Session Co-Organizer: Don Liu, Louisiana Tech University

**5-1-3 CFD II: Novel Development Efforts (Technical)**
Session Organizer: Caleb Barnes, Air Force Research Laboratory
Session Co-Organizer: Zhongquan Charlie Zheng, University of Kansas

**5-1-4 CFD III: Applications I - including Heat Transfer (Technical)**
Session Organizer: Yassin Hassan, Texas A&M University
Session Co-Organizer: Elia Merzari, Argonne National Laboratory
Session Co-Organizer: Michael Kinzel, Pennsylvania State University

**5-1-5 CFD IV: Development and Applications in Fluid-Structure Interaction (Technical)**
Session Organizer: Caleb Barnes, Air Force Research Laboratory
Session Co-Organizer: Zhongquan Charlie Zheng, University of Kansas

**5-1-6 CFD V: Novel Developments for Compressible and Multi-phase flows (Technical)**
Session Organizer: Surya Vanka, UIUC
Session Co-Organizer: Yiwei Wang, Institute of Mechanics, Chinese Academy of Sciences
Session Co-Organizer: Fernando Grinstein, Los Alamos National Laboratory

**5-1-7 CFD VI: RANS and URANS applications (Technical)**
Session Organizer: Ning Zhang, McNeese State University
Session Co-Organizer: Yiwei Wang, Institute of Mechanics, Chinese Academy of Sciences

**5-1-9 CFD VII: Development and Applications in Particle Transfer (Technical)**
Session Organizer: Elia Merzari, Argonne National Laboratory
Session Co-Organizer: Wei Ge, Institute of Process Engineering, Chinese Academy of Sciences

**5-1-11 CFD VIII: Applications II (Technical)**
Session Organizer: Elia Merzari, Argonne National Laboratory
Session Co-Organizer: Don Liu, Louisiana Tech University

**5-2-1 Investigations Using DNS/LES Methods (Technical)**
Session Organizer: Daniel Garmann, Air Force Research Laboratory
Session Co-Organizer: Chaitanya Ghodke, Convergent Science Inc.

**5-2-2 RANS and Hybrid RANS/LES methods (Technical)**
Session Organizer: Daniel Garmann, Air Force Research Laboratory
Session Co-Organizer: Prashant Khare, University of Cincinnati

**5-2-3 Applications Employing RANS/LES/DNS (Technical)**
Session Organizer: Chaitanya Ghodke, Convergent Science Inc.
Session Co-Organizer: Prashant Khare, University of Cincinnati

**6-1-1 52nd Forum on Cavitation and Multiphase Flow- Session 1 (Technical)**
Session Organizer: William Straka, Pennsylvania State University
Session Co-Organizer: Ivaylo Nedyalkov, University of New Hampshire
Session Co-Organizer: Ki Han Kim, Office of Naval research

**6-1-2 52nd Forum on Cavitation and Multiphase Flow- Session 2 (Technical)**
Session Organizer: William Straka, Pennsylvania State University
Session Co-Organizer: Ki Han Kim, Office of Naval Research
Session Co-Organizer: Ivaylo Nedyalkov, University of New Hampshire

**6-3-1 Gas-Liquid Flows - Session 1 (Technical)**
Session Organizer: Mark Duignan, Savannah River National Laboratory
Session Co-Organizer: Timothy J. O'Hern, Sandia National Laboratories

**6-3-2 Gas-Liquid Flows - Session 2 (Technical)**
Session Organizer: Timothy J. O'Hern, Sandia National Laboratories
Session Co-Organizer: Mark Duignan, Savannah River National Laboratory

**6-3-3 Gas-Liquid Flows - Session 3 (Technical)**
Session Organizer: Joseph Katz, Johns Hopkins University
Session Co-Organizer: Mark Duignan, Savannah River National Laboratory

**6-4-1 Gas- & Liquid-Solid Flows - Session 1: Erosion (Technical)**
Session Organizer: Jaikrishnan Kadambi, Case Western Reserve University
Session Co-Organizer: Mark Duignan, Savannah River National Laboratory

# Acknowledgments

**6-4-2 Gas- & Liquid-Solid Flows - Session 2 (Technical)**
Session Organizer: Judith A. Bamberger, Pacific Northwest National Laboratory
Session Co-Organizer: Mark Duignan, Savannah River National Laboratory

**6-4-3 Gas- & Liquid-Solid Flows - Session 3 (Technical)**
Session Organizer: John Furlan, Giw Industries
Session Co-Organizer: Mark Duignan, Savannah River National Laboratory

**6-5-1 Interfacial Flow (Technical)**
Session Organizer: Marianne Francois, Los Alamos National Laboratory
Session Co-Organizer: Francine Battaglia, Virginia Tech

**6-5-2 Liquid-Gas (Technical)**
Session Organizer: Francine Battaglia, Virginia Tech
Session Co-Organizer: Marianne Francois, Los Alamos National Laboratory

**6-5-3 Gas-Solid (Technical)**
Session Organizer: Marianne Francois, Los Alamos National Laboratory
Session Co-Organizer: Francine Battaglia, Virginia Tech

**7-1-1 Forum on Advances in Fluids Engineering Education (Technical)**
Session Organizer: Ray Taghavi, University of Kansas
Session Co-Organizer: Ganesh Raman, California State University

**7-2-1 Turbulent Flows (Technical)**
Session Organizer: Yasuo Kawaguchi, Tokyo University of Science

**7-3-1 Shock and Vortical Flows (Technical)**
Session Organizer: Javid Bayandor, Virginia Tech
Session Co-Organizer: Eric Nielsen, NASA Langley Research Center

**7-3-2 Aerodynamics, FSI and Ice Accretion Methods (Technical)**
Session Organizer: Kevin Anderson, California State Polytech Univ
Session Co-Organizer: Jae-Hung Han, KAIST

**7-4-1 Transient Lift and Jet and Hydrogen Fuels (Technical)**
Session Organizer: Kevin Anderson, California State Polytechnic University
Session Co-Organizer: Irfan Khan, The Dow Chemical Company

**7-5-1 Fluid-Structure Acoustics and Flight Kinematics (Technical)**
Session Organizer: S. Balachandar, University of Florida
Session Co-Organizer: D. Keith Walters, University of Oklahoma

**7-5-2 Locomotion and Fluid Mechanics in Nature (Technical)**
Session Organizer: Javid Bayandor, Virginia Tech
Session Co-Organizer: Kevin Anderson, California State Polytechnic University

**7-5-3 Unsteady Flight and Biomedical Studies (Technical)**
Session Organizer: Michael Plesniak, George Washington University
Session Co-Organizer: Yiwei Wang, Institute of Mechanics, Chinese Academy of Sciences

**7-6-1 Flow control with dielectric barrier discharge (Technical)**
Session Organizer: Hassan Peerhossaini, Université Paris Diderot
Session Co-Organizer: Mihir Sen, University of Notre Dame

**7-6-2 Active flow control (Technical)**
Session Organizer: Mihir Sen, University of Notre Dame

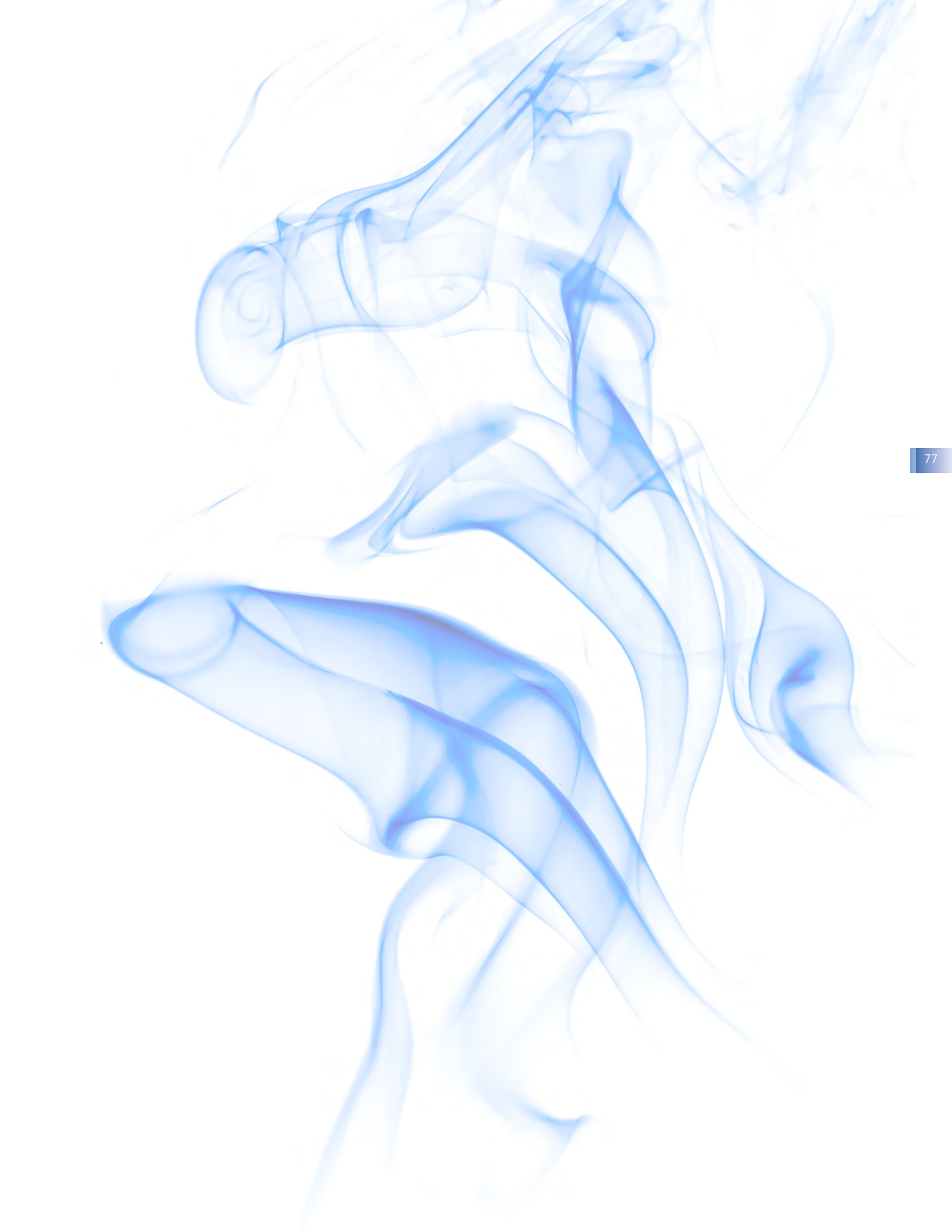
**7-7-1 High Speed and Vehicle Flows (Technical)**
Session Organizer: Stefan aus der Wiesche, University of Applied Sciences Muenster
Session Co-Organizer: Maximilian Passmann, University of Applied Sciences Muenster

**7-7-2 Explosions (Technical)**
Session Organizer: Javid Bayandor, Virginia Tech
Session Co-Organizer: Stefan aus der Wiesche, University of Applied Sciences Muenster

**7-7-3 Non-Newtonian Flows (Technical)**
Session Organizer: Francine Battaglia, Virginia Tech
Session Co-Organizer: Khaled J. Hammad, Central Connecticut State University

**7-7-4 Jet and Wake Flows (Technical)**
Session Organizer: Ivana Milanovic, University of Hartford
Session Co-Organizer: Khaled J. Hammad, Central Connecticut State University

**7-7-5 Fundamental Issues in Fluid Mechanics (Technical)**
Session Organizer: Chih-Yung Wen, The Hong Kong Polytechnic University
Session Co-Organizer: Javid Bayandor, Virginia Tech



# Resort Map




Hilton Grand Vacations

TOURS & ACTIVITIES BY HILTON GRAND VACATIONS

ISLAND ORIENTATION
HGVC Welcome Center in Makai/Lagoon Tower

- Beach Shuttle departs from the MAIN Lobby
- Please see your Concierge or call extension 33 for accessibility assistance and stroller access around the resort


## OCEAN TOWER

RESTAURANTS
- O1 Kohala Pool Bar
- O2 Boat Landing Cantina
- O3 Waikoloa Coffee

ACTIVITIES
- O5 Kohala Pool
- O6 Kohala Pool Slide
- O7 Adult Pool

VENUES
- O9 Buddha Point
- O10 Ocean View Terrace
- O11 Palm Terrace

SHOPPING
- O12 Dancing Dolphins Sundry Shop

- O13 AMENITIES
  Launderette (1st floor)

## PALACE TOWER

RESTAURANTS
- P1 Dona & Tony's Pizza (1st Floor)

ACTIVITIES
- P3 Wedding Chapel
- P4 Wedding Gazebo

OUTDOOR VENUES
- P5 Palace Garden
- P6 Palace Lawn

## Welcome to Hilton Waikoloa Village

If we can assist with anything, anytime, simply text us.
808-369-9870.

Please provide your name and room number when using this service.
Standard messaging/data fees may apply.

Concierge (Dining & Activities)
808-886-1234 Ext. 54

Hilton Waikoloa Village
69-425 Waikoloa Beach Drive
Waikoloa, Hawaii 96738-5710

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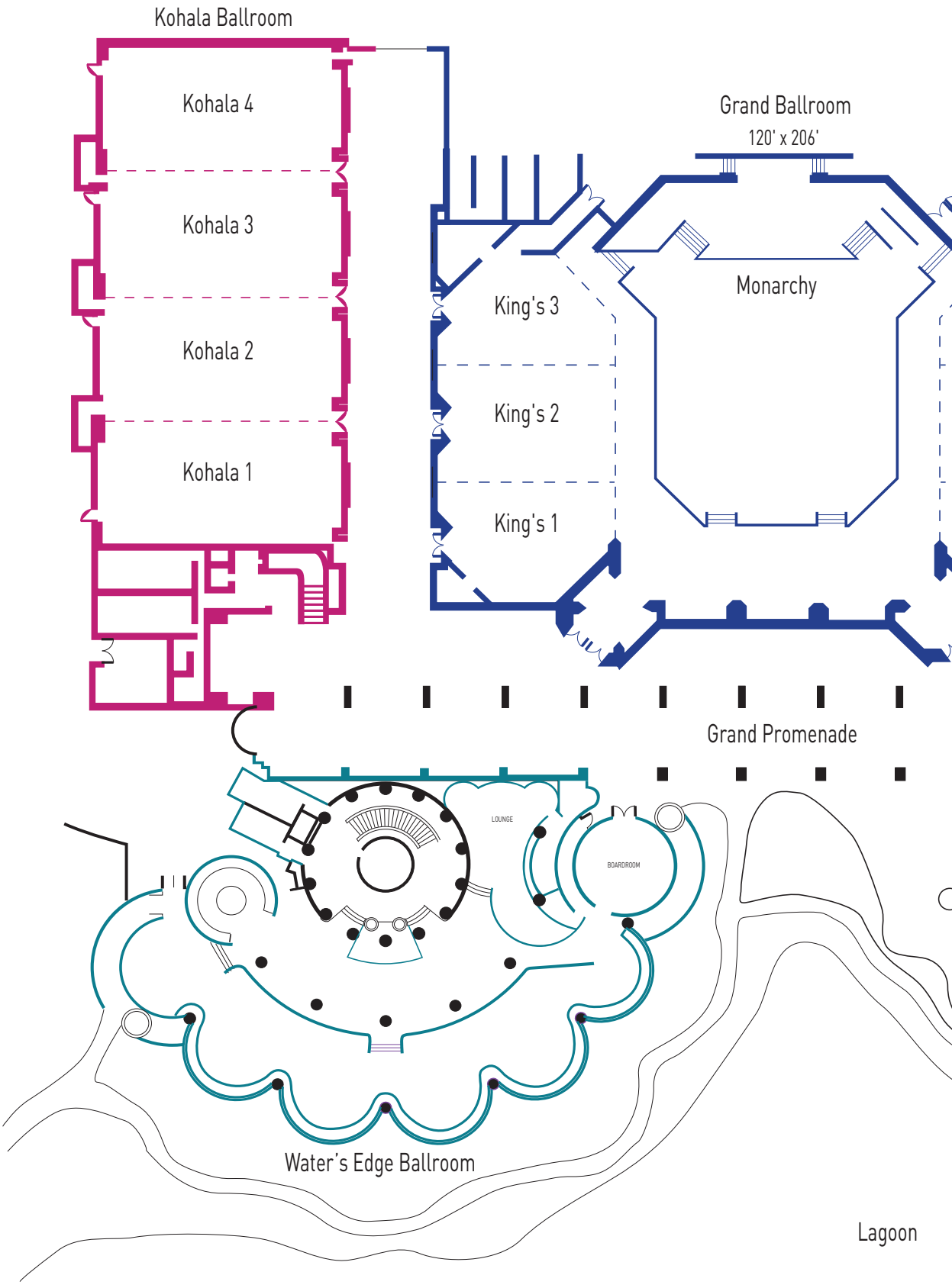
INSTAGRAM @HiltonWaikoloaVillage
TWITTER @HiltonWaikoloa

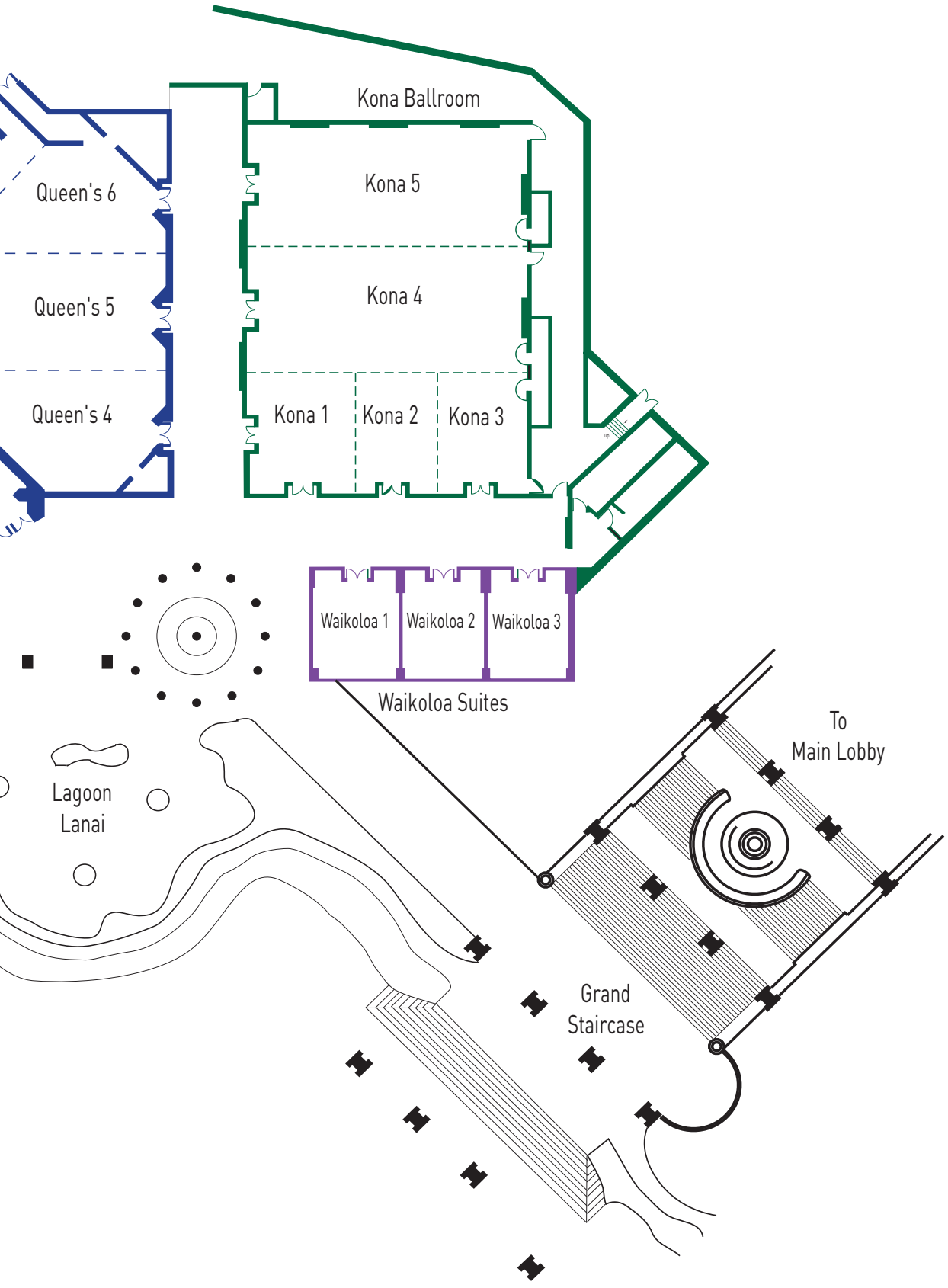
2017-04-06

CONCIERGE
RESTROOMS
STAIRWAYS
ELEVATORS
BOATWAY
TRAM
WALKWAY
BICYCLE RENTALS
HANDICAPPED ACCESSIBILITY
Wi-Fi AREA

BOAT STOP
TRAM STOPS
1 MAKAI at Lagoon Tower
2 Main Lobby
3 Convention Center/Big Island Breakfast
4 Palace Tower
5 Ocean Tower
RECREATION DESK
CABANA RENTALS
Only at Kona Pool Desk
ATM
WAIKOLOA SUNSET
SMOKING AREA

# Meeting Space




Kona Ballroom
Kona 5
Kona 4
Kona 1
Kona 2
Kona 3
Queen's 6
Queen's 5
Queen's 4
Waikoloa 1
Waikoloa 2
Waikoloa 3
Waikoloa Suites
To
Main Lobby
Lagoon
Lanai
Grand
Staircase


ASME
SETTING THE STANDARD