ASME 2019 TURBO EXPO

FINAL PROGRAM

JUNE 17-21 IN PHOENIX, ARIZONA

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

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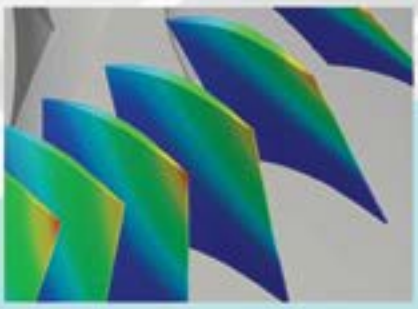
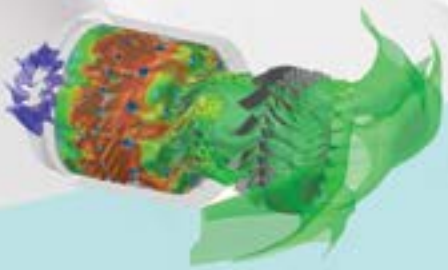
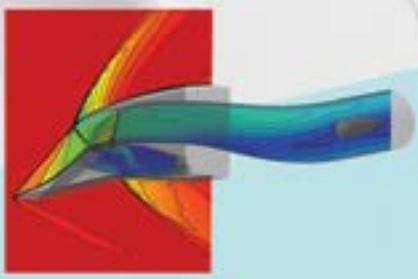


Fluid Structure Interaction - Compressor vibration modes



Full engine simulation with combustor



Intake of supersonic aircraft

Join us for a **Lunch & Learn** on
Tuesday, June 18 | Room 101B
West Bldg, Convention Center

Booth #519

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Welcome to Turbo Expo

WE HOPE YOU WILL ENJOY YOUR VISIT TO THE VALLEY OF THE SUN, PHOENIX!

Please join us Monday morning for the Grand Opening Session including the Turbo Expo keynote panel and ASME IGTI Awards Ceremony. This year's keynote panel, "Turbomachines for Clean Power and Propulsion Systems" will be moderated by the Executive Conference Chair Ruben Del Rosario and myself. Offering their expert perspectives will be keynote panelists Janet Kavandi, Director, NASA Glenn Research Center; John Lammas, VP Technology, GE Gas Power; and Thomas Alley, Vice President – Generation, EPRI. Two plenary sessions will explore the conference theme in more detail and follow a similar format on Tuesday and Wednesday morning (see page 10 for more information).

The awards ceremony will honor the winners of the ASME R. Tom Sawyer Award, ASME Gas Turbine Award, ASME IGTI Industrial Gas Turbine Technology and Aircraft Engine Technology Awards, ASME IGTI Scholar Award, John P. Davis Award, and the Early Career Engineer Award in memory of the late Dilip R. Ballal.

As one of an estimated 3,000 participants, you will have a choice of over 1,000 technical papers to be presented in over 400 technical sessions. The exposition will showcase the latest products from almost 100 companies, offering opportunities for practitioners and researchers to come together. The conference schedule has been put together for seamless attendance in sessions related to specific tracks along with your networking experience in mind; there is no other event that brings together as many experienced and new experts from the various turbomachinery fields from around the world as Turbo Expo does and we truly hope that you will be able to interact with existing contacts while making new ones.

At Turbo Expo 2019, three focus tracks will center on high-potential areas within the framework of the existing technical committees: Turbomachines for Clean Power and Propulsion Systems – Aviation Focus, Turbomachines for Clean Power and Propulsion Systems – Power Focus and Maintenance, Repair and Overhaul in the light of Digitalization (MRO/Digital). These focus tracks feature plenary sessions (Aviation and Power focus only), technical papers, as well as panel and tutorial sessions that are highlighted and grouped together for the benefit of attendees (see page 20 for more information). In the spirit of continuous improvement, tutorials have undergone a selection and review process with the aim to ensure high quality and in addition, handout documents will be published for optimum learning outcome. All Turbo Expo attendees are kindly invited to the Welcome Reception on Monday evening. The Women in Engineering Networking Event is on Tuesday evening and finally, students and young engineers should not miss the mixer on Wednesday evening where they can network with established engineers.

On behalf of ASME IGTI, I wish to thank our sponsors who have ensured the success of Turbo Expo 2019 through their generous support. I also wish to thank our Executive Conference Chair, Ruben Del Rosario, our Local Liaison Committee Chair, Bob Rasmussen; Technical Program Chair, Harald Schoenenborn; this year's Review Chair, Dilip Prasad and the Vice Review Chairs, Ardeshir Riahi, Wing Ng, Graham Pullan; Review team advisor Pat Cargill; Tutorial Chair, David Bogard and Gas Turbine Segment Liaison, Damian Vogt. Special thanks to the keynote and plenary panelists and all the volunteers who make Turbo Expo the premier conference for turbomachinery technology. Turbo Expo would not be possible without the tireless efforts of the authors, reviewers, session organizers, point contacts, vanguard chairs, committee leaders, and the excellent support team at ASME. Thank you for attending Turbo Expo. I hope that you find your time in Phoenix to be an enriching and memorable experience.

Atul Kohli
Conference Chair
Pratt & Whitney

2018 Grand Opening & Keynote

A View from Above — Welcome to Phoenix

IT TOOK A BIRD'S-EYE VIEW TO USHER IN A NEW ERA OF AVIATION IN ARIZONA.

In 1927, having just started with the Ford Motor Company's airline division, J. Parker Van Zandt was flying from Michigan to California to deliver a new Ford Tri-Motor. The flight came on the heels of Lindbergh's famous cross-Atlantic flight, so Van Zandt turned his flight into a show, flying over cities and landmarks along the way. But it was the pristine aerial view of one of the Seven Natural Wonders of the World – the Grand Canyon – that would set him on a path far from the bustle of the Motor City, one that would change the future of Arizona.

After securing partners in his new venture, Van Zandt left Ford and returned to Arizona to launch Scenic Airways, a small two-aircraft operation dedicated to providing tourists with the same awe-inspiring view that forever changed his life.

His endeavor was so successful, he ended up purchasing additional aircraft and farmland on the outskirts of Phoenix to build an airfield, which he called Sky Harbor. This is where he based his scenic operation and set up a flight training school.

Van Zandt's pioneering legacy lives on in world-renowned aerospace programs at Arizona State University and Embry-Riddle University in Prescott, and the cutting-edge aerospace research and development happening at Boeing, Honeywell, Northrup Grumman and hundreds of other aerospace companies that call Arizona home.

Scenic Airways is still around some 90 years later, today flying tours of the Grand Canyon under the Grand Canyon Airlines brand. While Sky Harbor, which most of us arrived through, has grown from a humble airfield outside of town into one of the busiest airports in America.

Arizona is an aviation success story, and it has set the bar for those of us working in aerospace and defense across the United States. Our industry in the U.S. is thriving, offering a diverse, highly-skilled workforce, extensive research and development opportunities, with strong political support. The investments we're making in aerospace are central to the well-being of our national and global economies, including the growth of scientific and technical jobs, sustaining and improving national security, and fostering emerging technologies now and for the future.

But this growth and innovation is not limited to the aerospace sector. The future technologies and trends we will discuss this week have far-reaching applications beyond our respective fields and lifetimes, including those needed to evolve turbomachinery to meet the needs of greener, future architectures. Therefore, we should take this opportunity as a mandate to ensure the research we are conducting and the technologies we're developing are working toward reducing our carbon footprint in the near term, while improving the human experience in the long-term.

Welcome to Phoenix and Turbo Expo 2019. I wish you all an enjoyable and productive conference, and I hope you can experience the magnificent weather and the local attractions that have made the Valley of the Sun one of the United States' most exceptional aerospace communities for nearly a century.

Ruben Del Rosario
Executive Conference Chair
NASA's Glenn Research Center

Grand Canyon

Desert Botanical Garden

Phoenix, Arizona

Established as Arizona's capital in 1912 the sprawling metropolis city of Phoenix is locally known as the "The Valley of the Sun." With warm temperatures and bright sunny skies year-round this city boasts many featured attractions both outside and indoors. From picturesque mountain trails to some of the nation's most luxurious spas, Phoenix has something for everyone.

LOCAL LIAISON COMMITTEE

Greg Bullock, *Grand Canyon University*
Rudy Dudebout, *Honeywell Aerospace*
John Gunaraj, *Honeywell Aerospace*
Marcus Herrmann, *Arizona State University*
Peiwen Li, *University of Arizona*
Eric Miller, *PADT, Inc.*
Nick Nolcheff, *Honeywell Aerospace*
Kathryn Pesta, *PADT, Inc.*
Ward Rand, *PADT, Inc.*
Bob Rasmussen, *Chair,* *Honeywell Aerospace*
Ardeshir Riahi, *Honeywell Aerospace*

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POWER

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GAS COMPRESSION magazine

MPS
modern power systems

Conference Wi-Fi

NETWORK
ASME IGTI

PASSWORD
Turbo Expo 2019

Keynote & Awards Program

TURBOMACHINES FOR CLEAN POWER AND PROPULSION SYSTEMS

TURBO EXPO KEYNOTE & ASME IGTI ANNUAL AWARDS

Monday June 17, 2019, 10:15 a.m. – 12:15 p.m.
Ballroom 120, Lower Level, Phoenix Convention Center

Advances in technology, regulatory changes, and market forces require future power and propulsion systems to undergo a major transformation. Emphasis on clean energy is leading toward increased use of renewables for power generation. Operational flexibility is critical for energy utilities that incorporate wind turbines or solar panels with traditional gas turbines for efficient peak and level load power management. This has driven innovative ideas for power plant integration, new cycles, and energy storage concepts that are in many ways reliant on turbomachinery.

For aviation, marine, and other applications, there is a push to reduce the carbon footprint by moving to alternative or bio-fuels. Recently, the aviation industry is considering turbo-electric and hybrid-electric propulsion concepts in future aircraft for reduced emissions. These new propulsion systems require changes to the traditional turbomachinery architecture for seamless integration with the electrical components. Turbo Expo will bring together experts from power and propulsion areas to highlight the emerging trends and challenges associated with bringing clean energy technologies to fruition and new applications that will shape the turbomachines of the future.

It is the unique experience of the ASME Turbomachinery community combined with the conference theme Turbomachines for Clean Power and Propulsion Systems and the focus tracks Turbomachines for Clean Power and Propulsion; Maintenance, Repair and Overhaul (MRO) for Turbomachinery, that makes the 2019 ASME Turbo Expo a must-attend event. Use this opportunity to network with the best and brightest experts from around the world in Phoenix, Arizona, USA, to open new chapters in turbomachinery.

Kicking off the Conference on Monday is the Keynote, a Panel focusing on Turbomachines for Clean Power and Propulsion Systems. On Tuesday and Wednesday, Plenary sessions will explore the keynote theme further by dedicated discussion on the aviation and power industry. The Keynote is held in conjunction with the annual ASME IGTI Honors & Awards program honoring individuals who have made significant contributions to the advancement of the turbomachinery technology.

KEYNOTE MODERATORS

Atul Kohli, *Pratt & Whitney*
Ruben Del Rosario, *NASA*

KEYNOTE PANELISTS

Andrew "John" Lammas
Vice President & CTO
Gas Power Systems, *GE*

Janet L. Kavandi
Center Director
NASA Glenn Research Center

Thomas Alley
Vice President of Generation
Electric Power Research Institute (EPRI)

PLENARIES

Turbomachines for Clean Power and Propulsion Systems — Aviation Focus

Tuesday, June 18 from 9:40 a.m. – 11:10 a.m.
Phoenix Convention Center

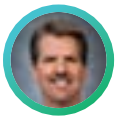
Panelists

Alexander Simpson
Executive Leader, Electric & Hybrid Electric Propulsion
GE Aviation

Francis R. Preli, Jr.
VP Propulsion and Materials Technologies
Pratt & Whitney

Eric Blumer
Director, Engines & Air Management
Honeywell

Moderators



James Heidmann
Acting Deputy Director, Advanced Air Vehicles Program
NASA Glenn Research Center

Tim Lieuwen
Executive Director
Strategic Energy Institute
Regents' Professor, School of Aerospace Engineering
Georgia Institute of Technology

Turbomachinery and Clean Energy — Future Trends and Opportunities

Wednesday, June 19 from 9:40 a.m. – 11:10 a.m.
Phoenix Convention Center

Panelists

Kunal Chandra
Global Head for New Energy Business
Siemens Power & Gas

Guy DeLeonardo
Executive Product Manager
GE Gas Power

Yasushi Fukuizumi
Vice President, Power Systems
MHI

Moderators

Richard Dennis
Technology Manager
Department of Energy
NETL

Karen A. Thole
Department Head and Distinguished Professor, Department of Mechanical Engineering
Pennsylvania State University

2019 Leadership

GAS TURBINE SEGMENT LEADERSHIP TEAM

Richard Dennis
Leader
DOE, National Energy Technology Laboratory

Nicole Key
Vice Leader, TEC Sector Council Representative
Purdue University

Paul Garbett
Member
Siemens

Eisaku Ito
Member
MHI

Anestis Kalfas
Member
Aristotle University of Thessaloniki

James Maughan
Member, Treasurer
GE

Jaroslaw Swedowicz
Member
Siemens

Mark Zelesky
Member
Pratt & Whitney

Damian Vogt
Member, IGTI EC Chair, TEOC Liason
University of Stuttgart

Ruben Del Rosario
Special Advisor
NASA

Tim Lieuwen
Special Advisor
Georgia Institute of Technology

IGTI EXECUTIVE COMMITTEE MEMBERS ANNOUNCED SOON!

TURBO EXPO ORGANIZING COMMITTEE

Atul Kohli
Conference Chair
Pratt & Whitney

Ruben Del Rosario
Executive Conference Chair
NASA

Harald Schoenenborn
Technical Program Chair
MTU Aero Engines AG

Patricia Cargill
Review Team Advisor
GE Aviation

Dilip Prasad
Review Chair
Pratt & Whitney

Wing Ng
Vice Review Chair
Virginia Tech

Graham Pullan
Vice Review Chair
University of Cambridge

Ardeshir Riahi
Vice Review Chair
Honeywell Aerospace

Bob Rasmussen
Local Liaison Chair
Honeywell Aerospace

David G. Bogard
Tutorial Chair
The University of Texas

Damian Vogt
Gas Turbine Segment Liaison
University of Stuttgart

Award Recipients

Congratulations to all award recipients and thank you to all ASME IGTI committee award representatives whose work assists the awards and honors chair and the awards committee in the recognition of important gas turbine technological achievements. Thank you to John Blanton for serving as the IGTI Honors and Awards Committee Chair, John Gülen as Industrial Gas Turbine Technology Award Committee Chair, and Andrew Nix as the Aircraft Engine Technology Award Committee Chair.

2019 ASME R. TOM SAWYER AWARD

Awarded to an individual who has made important contributions to advance the purpose of the gas turbine industry and the International Gas Turbine Institute over a substantial period of time. The contribution may be in any area of Institute activity, but must be marked by sustained forthright efforts.

**** Dr. Om Sharma, United Technologies Research Center**

2017 ASME GAS TURBINE AWARD

The Gas Turbine Award was established in 1963 to be given in recognition of an outstanding contribution to the literature of combustion gas turbines or gas turbines thermally combined with nuclear or steam power plants.

**** Dr. Heinz-Peter Schiffer, TU Darmstadt**

**** Maxmilian Jüngst, Technische Universität Darmstadt**

**** Dr. Christoph Brandstetter, Ecole Centrale de Lyon**

2019 ASME IGTI SCHOLAR AWARD

Bestowed upon an individual who submits a learned and comprehensive paper that makes a significant and timely contribution to the science and practice of gas turbine engineering. The Scholar presents the award-winning paper as a lecture to an audience of his peers.

**** Dr. Kenneth Suder, NASA Glenn**

2019 AIRCRAFT ENGINE TECHNOLOGY AWARD

For Outstanding Contribution to Air Breathing Propulsion Through Inspiring Leadership, Education, and Research Having Major Impacts on Aircraft Engine Operational Capability, Performance, and Design

**** Thomas Prete, Pratt & Whitney**

2019 INDUSTRIAL GAS TURBINE TECHNOLOGY AWARD

For outstanding contributions and leadership in gas turbine maintenance, repair and overhaul in electric power generation and pipeline industries..

**** Ron Natole, Natole Turbine Enterprises**

2019 DILIP R. BALLAL EARLY CAREER AWARD

Awarded to an individual who has made significant contributions in the gas turbine industry within the first five years of their career.

**** Dr. Lisa Branchini, University of Bologna**

ASME DEDICATED SERVICE AWARD

The ASME Dedicated Service Award honors unusual dedicated voluntary service to the Society marked by outstanding performance, demonstrated effective leadership, prolonged and committed service, devotion, enthusiasm and faithfulness.

**** Patricia Cargill, GE and Adnan Eroglu, Siemens Gas and Power**

For more details on the award winners, please refer to the 2019 Awards Program. Programs will be available during the Grand Opening: Keynote and Awards Program on Monday.

Upcoming Award Opportunities

2020 ASME R. TOM SAWYER AWARD

Nominations due to **igtiawards@asme.org** by **August 15, 2019**.

2020 DILIP R. BALLAL EARLY CAREER AWARD

Nominations due to **igtiawards@asme.org** by **August 1, 2019**.

2021 ASME IGTI SCHOLAR AWARD

Nominations due to **igtiawards@asme.org** by **September 1, 2019**.

2020 ASME IGTI AIRCRAFT ENGINE TECHNOLOGY AND INDUSTRIAL GAS TURBINE TECHNOLOGY AWARDS

Nominations due to **igtiawards@asme.org** by **October 15, 2019**.

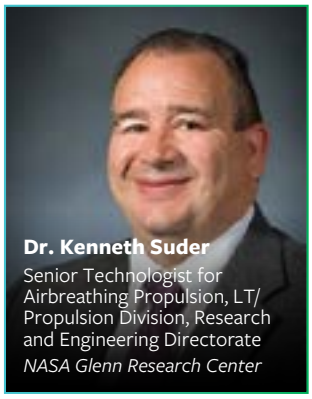
For more information on how to submit a nomination for an award, visit https://community.asme.org/international_gas_turbine_institute_igti/w/wiki/4029.honors-and-awards.aspx.

Want a new headshot for work, social media or for your future ASME award recognition?

Plan some time to visit the ASME Headshot Booth, 239.

There is no cost to you.

Featured Lectures



Dr. Kenneth Suder
Senior Technologist for Airbreathing Propulsion, LT/ Propulsion Division, Research and Engineering Directorate
NASA Glenn Research Center

SCHOLAR LECTURE:

NASA'S ROLE IN GAS TURBINE TECHNOLOGY DEVELOPMENT: ACCELERATING TECHNICAL PROGRESS VIA COLLABORATION BETWEEN ACADEMIA, INDUSTRY, AND GOVERNMENT AGENCIES

Monday June 17, 2019, 5:45 p.m. – 7:00 p.m.
Phoenix Convention Center, North Ballroom, Street Level, North Building

Given the maturity of the gas turbine engine since its invention and considering the limited and flattened level of resources expected to be allocated for NASA aeronautics research and development, we ask the question are NASA technology investments still needed to enable future turbine engine-based propulsion systems? If so, what is NASA's unique role to justify NASA's investment? To address this topic, we will first review the accomplishments and the impact that NASA Glenn Research Center has made on turbine engine technologies over the last 78 years. Specifically, this paper discusses NASA's role and contributions to turbine engine development, specific to both 1) NASA's role in conducting experiments to understand flow physics and provide relevant benchmark validation experiments for Computational Fluid Dynamics (CFD) code development, validation, and assessment; and 2) the impact of technologies resulting from NASA collaborations with industry, academia, and other government agencies.

Note that the scope of the discussion is limited to the NASA technology contributions with which the author was intimately associated and does not represent the entirety of the NASA contributions to turbine engine technology. The specific research, development, and demonstrations discussed herein were selected to both 1) provide a comprehensive review and reference list of the technology and its impact, and 2) identify NASA's unique role and highlight how NASA's involvement resulted in an additional benefit to the gas turbine engine community. Secondly, we will discuss current NASA collaborations that are in progress and provide a status of the results.

Finally, we discuss the challenges anticipated for future turbine engine-based propulsion systems for civil aviation and identify potential opportunities for collaboration where NASA involvement would be beneficial. Ultimately, the gas turbine engine community will decide if NASA involvement is needed to contribute to the development of the design and analysis tools, databases, and technology demonstration programs to meet these challenges for future turbine engine-based propulsion systems.

Thomas Prete
Engineering Vice President
Pratt & Whitney Military Engines

AIRCRAFT ENGINE TECHNOLOGY AWARD LECTURE:

EVOLUTION AND REVOLUTION IN FIGHTER JET PROPULSION - PAST, PRESENT, AND FUTURE

Tuesday June 18, 2019, 8:30 – 9:30 a.m.
Phoenix Convention Center, Room 124-B

Thomas Prete is the Engineering Vice President for Military Engines for Pratt & Whitney. He has leadership responsibility for all technical activities related to military engine programs including working to create future product strategies, technologies and innovation, and advanced military propulsion systems for the Warfighter and their allies.

Thomas started at Pratt & Whitney in 1989, holding leadership roles in engineering, operations, aftermarket, and customer support. Prior to his current position, he was the Engineering Vice President for Pratt & Whitney. Under his leadership, the F135 propulsion system achieved USAF and USM IOC.

At Pratt & Whitney, Tom has been engaged in various leadership positions helping the community and the engineering profession through the United Way, Engineers Without Borders, ASME, and Engineering Ambassadors.

Tom holds a bachelor's degree in mechanical engineering from UConn, a master's degree in mechanical engineering from Rensselaer, and an MBA from UConn.

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Turbo Expo 2019

Networking Events

WELCOME RECEPTION

Monday June 17, 7:00 – 8:30 p.m.

North Ballroom Foyer, Street Level, North Building, Phoenix Convention Center

All Conference registrants are invited to join their colleagues for complimentary light refreshments during the Monday evening event. In a casual atmosphere, greet friends, and meet the thinkers from around the world who are shaping the future of turbomachinery.

COFFEE BREAKS

DAY	TIME	LOCATION
Monday - Friday	10:00 – 10:15 am	Near the technical session rooms.
Monday, Thursday, and Friday	3:30 – 4:00 pm	Near the technical session rooms.
Tuesday – Wednesday	3:30 – 4:00 pm	Expo Hall

DAILY LUNCHES

June 17 – 21

All Technical Conference delegate badges as well as exhibit booth staff badges include a daily lunch. Additional lunches for guests can be purchased onsite during registration. Take the time during lunch, Tuesday – Thursday, to walk the exhibit floor and visit the many exhibitors from around the world showcasing their products and services.

EXPO HALL RECEPTIONS

Tuesday & Wednesday, June 18 & 19, 5:00 – 6:30 p.m.

All registered delegates are invited to the Expo Hall for complimentary drinks and networking with industry colleagues, while viewing the exhibits of the industry's leading companies.

Networking Events

EARLY CAREER ENGINEER & STUDENT MIXER

Wednesday, June 19, 6:45 – 8:00 p.m.
Second Level Foyer, North Building, Phoenix Convention Center

Unwind after a full day of technical sessions and exhibits with fellow engineering students and early career engineers. This popular event allows students to make new friends and build their professional network in a casual evening atmosphere. Complimentary refreshments will be provided.

EXPOSITION CLOSING CEREMONY

Thursday, June 20, 1:30 – 2:15 p.m.
Exhibit Hall, Lower Level, North Building, Phoenix Convention Center

Please join us as we announce the "People's Choice" booth display winners, the Student Poster winners, recognize outgoing committee chairs, the Young Engineer and Student Advisory Committee Travel Award recipients, and announce plans for Turbo Expo 2020 in London, United Kingdom!

WOMEN IN ENGINEERING NETWORKING EVENT

Tuesday, June 18, 7:45 p.m. – 9:00 p.m.

Female registrants are invited to join their colleagues for a networking event that will feature motivating talks by GE and Pratt & Whitney representatives. Attendees will have the opportunity to network with women in the industry and learn about the career paths of some successful women in the industry. Dinner will follow the talks and is included with your registration.

Mary Anne Cannon
Vice President, West Palm Beach Site and Development Operations, Engineering
Pratt & Whitney

Mary F. Wadel
Acting Project Manager, Advanced Air Transport Technology
NASA

The American Society of Mechanical Engineers (ASME)

ASME 2020 Turbo Expo

June 22 - 26, 2020 | London, United Kingdom

Join us for ASME 2020 Turbo Expo in London, United Kingdom!

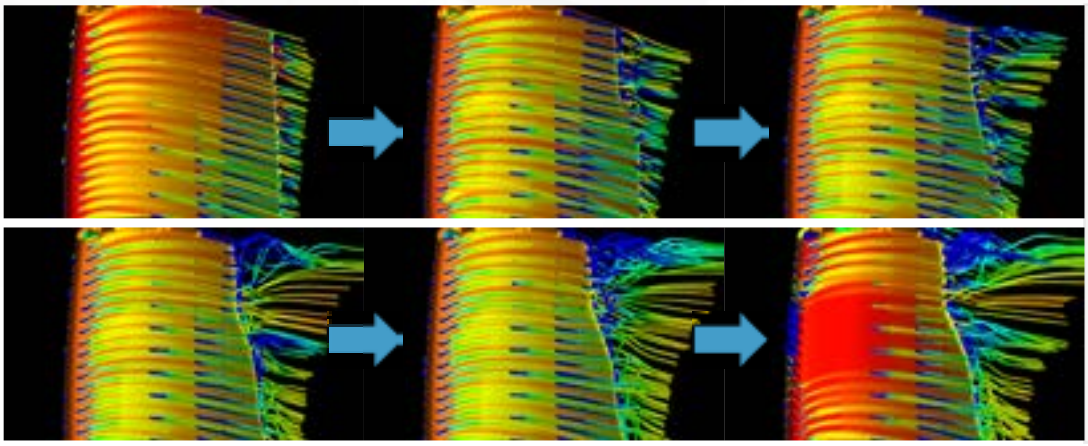
ExCeL London Convention Center

Abstract Submission Deadline: October 4, 2019

LAUNCHING a demo version during 2019

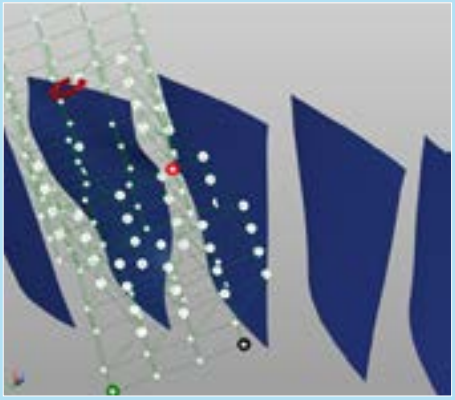
BOXERgeom

Interactively morph, deform, erode, transform and manipulate geometry



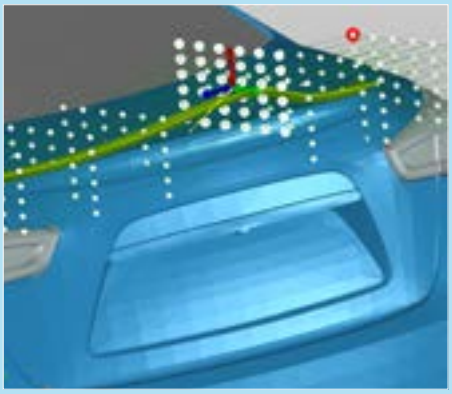
Geometry morphing technology models blade erosion based on simulated thermal loads.

Model and represent system performance degradation as seen in real in-services machines



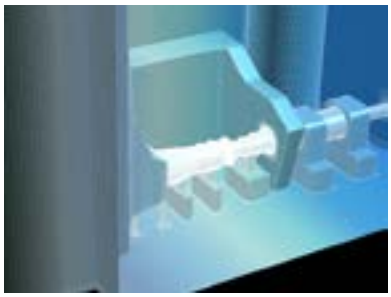
Interactively apply Free-Form twist to the mid span of an IP compressor blade

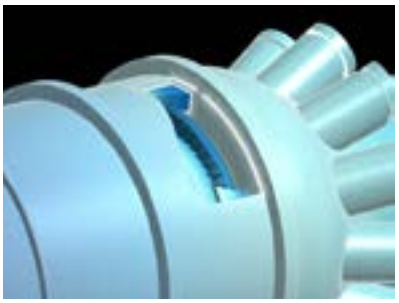
Interactively change the profile of a car rear spoiler

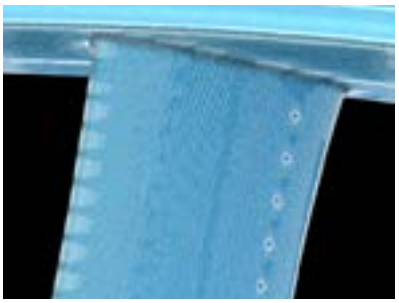


BOXERmesh

Scalable parallel mesh generation for large scale simulation







System Level Gas Turbine Power-Gen installation including turbomachinery assembles and blade cooling components

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Proprietary and customised CFD

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Schedule at a Glance

FOCUS TRACK TURBOMACHINES FOR CLEAN POWER AND PROPULSION SYSTEMS

SUN JUNE 16	**MON** JUNE 17	**TUE** JUNE 18	**WED** JUNE 19	**THU** JUNE 20	**FRI** JUNE 21
	Registration 7:00 am - 5:30 pm	**Registration** 7:00 am - 6:30 pm	**Registration** 7:00 am - 6:30 pm	**Registration** 7:00 am - 5:30 pm	**Registration** 7:00 am - 3:00 pm
	Speaker Ready Room 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 3:30 pm
	Session Participant Networking Coffee 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am
GT Workshops 8:00 am - 5:00 pm	**Tutorial (23-11): Design and Evaluation Considerations of Waste Heat Recovery Technologies** 8:00 - 10:00 am	**Papers (1-6): Whole Engine Performance and Novel Concepts; Papers (4-3): Combustor Design and Development - Design for Emissions Reduction; Papers (23-5): Hybrid Industrial Co-Generation Systems** 8:00 - 9:30 am **Aircraft Engine Technology Award Lecture** 8:30 - 9:30 am	**Conference Sessions** 8:00 - 9:30 am	**Panel (4-41): Opportunities for Fuel Variability in Aircraft Gas Turbine Engines; Tutorial (23-10): Combustion and Emissions** 8:00 - 10:00 am	**Conference Sessions** 8:00 - 10:00 am
	Coffee Break 10:00 - 10:15 am	**Coffee Break** 9:30 - 9:40 am	**Coffee Break** 9:30 - 9:40 am	**Coffee Break** 10:00 - 10:15 am	**Coffee Break** 10:00 - 10:15 am
	Opening Session Turbo Expo Keynote Panel: Turbomachines for Clean Power and Propulsion Systems 10:15 am - 12:15 pm	**Plenary: Turbomachines for Clean Power and Propulsion Systems — Aviation Focus** 9:40 am - 11:10 am **Tutorial (23-12): Cogeneration from Solar and Biomass Energy Sources Including Thermal Storage** 11:15 am - 12:45 pm	**Plenary: Turbomachinery and Clean Energy – Future Trends and Opportunities** 9:40 am - 11:10 am **Conference Sessions** 11:15 am - 12:45 pm	**Panel (3-11): Environmental impact assessment on the Life Cycle for industrial gas turbines - Is it still an option?; Tutorial (6-14): Overview of Grid-Scale Energy Storage Systems and Technologies** 10:15 am - 12:15 pm	**Panel (8-5A): Path Forward: Gas Turbine Technology; Tutorial (6-12A): Introduction to Dynamic Analysis and Hybridisation of Plant Systems** 10:15 am - 12:45 pm **Special Session: Planning for your Next Big Life Transition** 10:15 am - 12:45 pm
Registration 12:00 - 6:00 pm		**Expo Open** 12:30 – 6:30 pm	**Expo Open** 12:30 – 6:30 pm	**Expo Open** 11:30 am – 2:30 pm	
Speaker Ready Room 12:00 - 6:00 pm	**Opening Lunch** 12:30 – 2:00 pm	**Expo Lunch** 12:30 - 2:00 pm **Poster Session** 12:15 - 2:00 pm	**Expo Lunch** 12:30 - 2:00 pm	**Expo Lunch** 12:15 - 2:00 pm **Closing Ceremony** 1:30 pm	**Closing Lunch** 12:30 - 2:00 pm
Gas Turbine Segment Meeting 8:30 am - 5:00 pm *Paradise Valley Sheraton Grand Phoenix Hotel*	**Conference Sessions** 2:00 - 3:30 pm	**Papers (4-18): Chemical Kinetics - 1; Papers (26-2): Micro Gas Turbine: Combustion and Fuels; Papers (27-7A): Diagnostics, Maintenance, Operation - 1; Panel (1-13): Developments in Hybrid-electric Propulsion and Enabling Technologies; Tutorial (48-5A): R&D Trends in Wind Energy** 2:00 - 3:30 pm	**Papers (1-5): Whole Engine Performance and Novel Concepts II; Papers (41-21): Novel Solver and Simulation Framework (2); Panel (29-1A): Steam Turbines Panel** 2:00 - 3:30 pm	**Panel (8-5A): Path Forward: Gas Turbine Technology; Tutorial (6-12A): Introduction to Dynamic Analysis and Hybridisation of Plant Systems** 2:00 - 3:30 pm	**IGTI Executive Committee** 1:00 - 5:00 pm *Paradise Valley Sheraton Grand Phoenix Hotel*
	Coffee Break 3:30 - 4:00 pm	**Coffee Break** 3:30 - 4:00 pm	**Coffee Break** 3:30 - 4:00 pm	**Coffee Break** 3:30 - 4:00 pm	
	Panel (23-13): Cogeneration and the Future of Gas Turbine Systems 4:00 - 5:30 pm	**Panel (1-18): Developments in Hybrid-electric Propulsion and Enabling Technologies; Panel (6-16): Future of Power Systems; Tutorial (48-5B): R&D Trends in Wind Energy** 4:00 - 5:30 pm	**Panel (29-1B): Steam Turbines Panel** 4:00 - 5:30 pm	**Panel (8-5B): Path Forward: Gas Turbine Technology** 4:00 - 5:30 pm	
	Scholar Lecture 5:45 - 7:00 pm	**Expo Hall Reception** 5:00 - 6:30 pm	**Expo Hall Reception** 5:00 - 6:30 pm		
Council of Chairs Meeting 6:00 - 7:30 pm	**Welcome Reception** 7:00 - 8:30 pm	**Committee Meetings** 6:00 - 7:30 pm	**Committee Meetings** 6:00 - 7:30 pm	**Committee Meetings** 6:00 - 7:30 pm	
		Women in Engineering Event/Dinner 7:45 - 10:30 pm	**ECE/Student Mixer** 6:45 - 8:00 pm		

Schedule at a Glance

FOCUS TRACK MAINTENANCE, REPAIR AND OVERHAUL (MRO)

SUN JUNE 16	**MON** JUNE 17	**TUE** JUNE 18	**WED** JUNE 19	**THU** JUNE 20	**FRI** JUNE 21
	Registration 7:00 am - 5:30 pm	**Registration** 7:00 am - 6:30 pm	**Registration** 7:00 am - 6:30 pm	**Registration** 7:00 am - 5:30 pm	**Registration** 7:00 am - 3:00 pm
	Speaker Ready Room 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 3:30 pm
	Session Participant Networking Coffee 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am
GT Workshops 8:00 am - 5:00 pm	**Papers (39-1): Compressor Design - 1** 8:00 - 10:00 am	**Conference Sessions** 8:00 - 9:30 am **Aircraft Engine Technology Award Lecture** 8:30 - 9:30 am	**Conference Sessions** 8:00 - 9:30 am	**Papers (5-9): Data Analytics & Parameter Estimation; Tutorial (8-1): History, Challenges and Opportunities for Gas Turbines** 8:00 - 10:00 am	**Conference Sessions** 8:00 - 10:00 am
	Coffee Break 10:00 - 10:15 am	**Coffee Break** 9:30 - 9:40 am	**Coffee Break** 9:30 - 9:40 am	**Coffee Break** 10:00 - 10:15 am	**Coffee Break** 10:00 - 10:15 am
	Opening Session Turbo Expo Keynote Panel: Turbomachines for Clean Power and Propulsion Systems 10:15 am - 12:15 pm	**Plenary: Turbomachines for Clean Power and Propulsion Systems — Aviation Focus** 9:40 am - 11:10 am **Conference Sessions** 11:15 am - 12:45 pm	**Plenary: Turbomachinery and Clean Energy – Future Trends and Opportunities** 9:40 am - 11:10 am **Conference Sessions** 11:15 am - 12:45 pm	**Papers (24-7): Prognosis and Prediction; Papers (48- 1): Condition Monitoring and Reliability; Papers (23-3): Co-Generation Power Plant Performance, Operation and Condition- Based Maintenance** 10:15 am - 12:15 pm	**Conference Sessions** 10:15 am - 12:45 pm **Special Session: Planning for your Next Big Life Transition** 10:15 am - 12:45 pm
Registration 12:00 - 6:00 pm		**Expo Open** 12:30 – 6:30 pm	**Expo Open** 12:30 – 6:30 pm	**Expo Open** 11:30 am – 2:30 pm	
Speaker Ready Room 12:00 - 6:00 pm	**Opening Lunch** 12:30 – 2:00 pm	**Expo Lunch** 12:30 - 2:00 pm **Poster Session** 12:15 - 2:00 pm	**Expo Lunch** 12:30 - 2:00 pm	**Expo Lunch** 12:15 - 2:00 pm **Closing Ceremony** 1:30 pm	**Closing Lunch** 12:30 - 2:00 pm
Gas Turbine Segment Meeting 8:30 am - 5:00 pm *Paradise Valley Sheraton Grand Phoenix Hotel*	**Panel Session (32-5): Part A: Moving Additive Manufacturing beyond Trial and Error with Probabilistics and Machine Learning** 2:00 - 3:30 pm	**Conference Sessions** 2:00 - 3:30 pm	**Conference Sessions** 2:00 - 3:30 pm	**Papers (46-2A): UQ, Manufacturing Uncertainties & FOD** 2:00 - 3:30 pm	
	Coffee Break 3:30 - 4:00 pm	**Coffee Break** 3:30 - 4:00 pm	**Coffee Break** 3:30 - 4:00 pm	**Coffee Break** 3:30 - 4:00 pm	
	Panel Session (32-5) Part B: Moving Additive Manufacturing Beyond Trial and Error with Probabilistics and Machine Learning; Tutorial (24-11): Turbomachinery Manufacturing in a Digital Environment 4:00 - 5:30 pm	**Conference Sessions** 4:00 - 5:30 pm	**Conference Sessions** 4:00 - 5:30 pm	**Conference Sessions** 4:00 - 5:30 pm	**IGTI Executive Committee** 1:00 - 5:00 pm *Paradise Valley Sheraton Grand Phoenix Hotel*
	Scholar Lecture 5:45 - 7:00 pm	**Expo Hall Reception** 5:00 - 6:30 pm	**Expo Hall Reception** 5:00 - 6:30 pm		
Council of Chairs Meeting 6:00 - 7:30 pm	**Welcome Reception** 7:00 - 8:30 pm	**Committee Meetings** 6:00 - 7:30 pm **Women in Engineering Event/ Dinner** 7:45 - 10:30 pm	**Committee Meetings** 6:00 - 7:30 pm **ECE/Student Mixer** 6:45 - 8:00 pm	**Committee Meetings** 6:00 - 7:30 pm	

Student News

The ASME IGTI Student Advisory Committee (SAC) is a group of students who work to foster student engagement in the IGTI community and improve the Turbo Expo conference every year. Towards this goal, the SAC organizes various sessions and events during the conference, provides opportunities for students to work behind the scenes with leaders in their technical area, and awards travel funds to eligible degree seeking individuals.

STUDENT ADVISORY COMMITTEE MEMBERS

Chair
Wisher Paudel, *University of Virginia*

Vice Chair
Shawn Siroka, *Penn State University*

Secretary
Samuel Barak, *University of Central Florida*

Past-Chair
Zhiping Mao, *Duke University*

STUDENT/EARLY CAREER MIXER

Wednesday, 6:45 – 8:00 p.m.
Second Level Foyer, North Building, Phoenix Convention Center

Unwind after a full day of technical sessions and exhibits with fellow engineering students and early career engineers. This popular event allows students to make new friends and build their professional network in a casual evening atmosphere. Complimentary refreshments will be provided.

SAC TUTORIAL SESSION

Advice for Developing Effective Technical Presentations

Thursday, June 20 | 4:00 – 5:30 p.m. | 221-C
North Building, Phoenix Convention Center

Michael Alley, Associate Teaching Professor
Pennsylvania State University

This tutorial, which targets graduate students, presents a non-traditional method of crafting scientific presentations using what is known as an assertion-evidence approach. This approach allows speakers to build their talks on primary messages accompanied by visual evidence. More details on this approach can be found at (**http://vimeo.com/88991194**).

POSTER SESSION

The Student Advisory Committee is once again sponsoring a student poster session at ASME Turbo Expo. Student posters will be on display on the main exposition floor on **Tuesday, June 18 from 12:30 – 2:00 p.m.** Be sure to stop by the poster session to see the results of their wvork and encourage them to become active in the ASME IGTI community.

Cast your vote for the People's Choice Best Student Poster – enter your selection at the computer station at the entrance to the exhibit hall.

1st Place - $500

2nd Place – $250

People's Choice - $100

2018 Student Poster Session

Student News

2019 STUDENT ADVISORY COMMITTEE TRAVEL AWARD WINNERS

Jeffrey A. Bennett
University of Virginia

Lakshya Bhatnagar
Purdue University

James Braun
Purdue University

Bogdan Cernat
von Karman Institute / UCL Louvain

Louis E. Christensen
The Ohio State University

Andres Curbelo
University of Central Florida

Penghao Duan
Oxford University

Simone Giorgetti
Université Libre de Bruxelles

William, J. Gooding
Purdue University

Xiao He
Imperial College London

Shreyas Hegde
Duke University

Lachlan J. Jardine
University of Cambridge

Mavroudis D. Kavvalos
Mälardalen University (MDH)

Akshay Khadse
University of Central Florida

Sneha Neupane
University of Central Florida

Marcel Otto
University of Central Florida

Marek Pátý
Czech Technical University in Prague

Hien Minh Phan
University of Oxford

Smruti Sahoo
Mälardalens University

Jonathan R. Tobias
University of Alabama

2018 Early Career Engineer & Student Mixer

2019 YOUNG ENGINEER TURBO EXPO PARTICIPATION AWARD WINNERS

Parash Agarwal
Cranfield University

Nikhil Baraiya
Indian Institute of Technology Madras

Tania Sofia Cacao Ferreira
Von Karman Insitute/Universite catholique de Louvain

Xin Deng
University of Virginia

Antoine Durocher
McGill University

Theofilos Efstathiadis
University of Thessaloniki

Chiara Gastaldi
Politecnico Di Torino

Shuai Guo
Technical University of Munich, Thermo-Fluid Dynamics group

Jee Hee
University of Nottingham

Yousef Kanani
Illinois Institute of Technology

Bonjin Koo
Daikin Applied

Eric Kurstak
Ohio State University

Madasseri Payyappalli Manas
Indian Institute of Technology Bombay (IITB)

Pedro Milani
Stanford University

Avinash Renuke
University of Genoa, Italy

Jon Runyon
Cardiff University

Jacob Snyder
Penn State University

Tingcheng Wu
Texas A&M University

Jing Yang
Texas A&M University

Wenqiang Zhang
Imperial College London

Nathan Balke
Formosa Plastics Corp USA

Cis Guy M De Maesschalck
Rolls-Royce PLC

THE **STUDENT ADVISORY COMMITTEE** AND **YOUNG ENGINEER TURBO EXPO PARTICIPATION** AWARDS HELP TO COVER TRAVEL COSTS FOR THE YOUNG ENGINEERS TO ATTEND ASME TURBO EXPO.

Student Poster Presenters

Burcu Ataseven, *Technische Universität Berlin*
GT2019-92266: Influence Of System Resonance on A Dynamically Forced Impinging Jet

J.H. Bae, *Gyeongsang National University*
GT2019-92180: Phase Stability and Properties of Ti-Nb-Zr Thin Films and Their Dependence on Zr Addition

Jeffrey Bennett, *University of Virginia*
GT2019-92280: Adiabatic Compressed Air Energy Storage Sizing and Optimization for the University of Virginia

Tania Sofia Cacao Ferreira, *Von Karman Inst*
GT2019-92282: Investigation of Thermal Effects on Boundary Layer Transition Under High Levels of Turbulence Intensity

Richard Celestina, *The Ohio State University*
GT2019-92279: Development of Next Generation High Frequency Double-Sided Heat Flux Gauges

Deok Yeong Cheong, *Gyeongsang National University*
GT2019-92168: A Study on the Feature-Based Performance Implementation for the Classification of Rotary Defects

Yun O Choi, *Gyeong Sang National University*
GT2019-92170: A Study on Characteristic Parameter Development for Rotor Diagnosis

Louis Christensen, *The Ohio State University*
GT2019-92256: Processing Infrared Images of Rotating Gas Turbine Blades

Elise Delhez, *University of Liège*
GT2019-92234: Comparative Study of Reduced Order Modeling Techniques Applied to Geometrically Nonlinear Structures

Khaoula Derbel, *Budapest University of Technology and Economics*
GT2019-92267: Sliding Mode Control for Micro Turbojet Engine Using Turbofan Power Ratio as Control Law

Antoine Durocher, *McGill University*
GT2019-92284: Bayesian Calibration of Kinetic Parameters in the CH Chemistry Towards Robust Emissions Modelling

Berk C. Duva, *Michigan State University*
GT2019-92218: Experimental and Numerical Investigation of the CO_2 Dilution Effect on the Laminar Burning Velocities of Methane/Air Mixtures at High Temperature

Wafaa El Masnaoui, *Safran Aircraft Engines/ ICA Toulouse*
GT2019-92237: Bolted Metal-3D Woven Composite joints: Experimental Study and Innovative Semi-Analytical Model Development

Matthew Fuehne, *Purdue University*
GT2019-92239: Tip Clearance Effects on the Performance of a High-Speed Centrifugal Compressor

Harrison Gates, *University of Virginia*
GT2019-92247: Thermal Mixing Models

Andrew Goldin, *Air Force Research Laboratory*
GT2019-92172: Determining Geometric Integrity of Additively Manufactured Repaired Blades Using MORPH and Modal Assurance Criteria

Herbert Harrison, *Purdue University*
GT2019-92240: An Investigation of Inlet Distortion Effects on Centrifugal Compressor Performance

Xiao He, *Imperial College London*
GT2019-92244: Towards Improved Prediction of Compressor Flow by Uncertainty Quantification of Spalart-Allmaras Turbulence Model

Shreyas Hegde, *Duke University*
GT2019-92211: Multi-Row Compressor Model Selection Method Based on Mode of Vibration and Loading Conditions

Karl Hohenberg, *Imperial College London*
GT2019-92273: 3-D Numerical Study for Validation of Meanline Modelling Prediction for Turbine Design Optimisation

Anthony Hresko, *Texas A&M University*
GT2019-92281: Experimental Investigation of Morton Effect (Thermally Induced Rotor Instability)

Sedong Kim, *Gyeongsang National University*
GT2019-92171: Experiment on Dispersion and Thermal Conductivity for Surface Treated MWCNTs in Aqueous Solution

Tae Ho Kim, *Kookmin University*
GT2019-92276: Comparison of Structural Performance for Gas Foil Journal Bearings with Single Bump Layer and Double Bump Layers

Young Won Kim, *Korea Institute of Industrial Technology*
GT2019-92198: Development of 1-kW Single Axial Turbine Embedded in Generator for Application of Organic Rankine Cycle

Student Poster Presenters

Nikita Kozak, *Iowa State University*
GT2019-92181: Computational Finite Element Analysis of Adaptive Gas Turbine Stator-Rotor Flow Interactions for Future Vertical Lift Propulsion

Devesh Kulkarni, *University of Toronto*
GT2019-92212: Zirconium Oxide Ceramics for High Temperature Abradable Coating Applications

Eric Kurstak, *The Ohio State University*
GT2019-92248: Experimental Investigation of a Rotating Bladed Disk System with Under-Platform Dampers using Air Jet Excitation

Chitrarth Lav, *The University of Melbourne*
GT2019-92261: A Machine-Learning Framework for Improving Prediction of Unsteady Turbomachinery Flows

Mingyang Lou, *Xi'an Jiaotong University*
GT2019-92155: Static Performance of Fluid Pivot Journal Bearing

K. R. V. Manikantachari, *University of Central Florida*
GT2019-92230: A Supercritical CO2 Opposite Flow Diffusion Flame Study

Filippo Merli, *Graz University of Technology*
GT2019-92254: New Experimental Setup for Assessing Turbine Vane Frame Aerodynamic Performance

Sneha Neupane, *University of Central Florida*
GT2019-92255: Combustion of Organo-Phosphorous Compounds Based on Experimental (shock tube) and Computational Studies

Michael Palman, *Technion-Israel Institute of Technology*
GT2019-92252: Development of Adaptive Cycle Micro-Turbofan Engine for UAS Applications

Heesung Park, *Changwon National University*
GT2019-92245: The Numerical Assessment of Degraded Cooling Performance of Gas Turbine Vane with Damaged Thermal Barrier Coating

Seonghun Park, *Gyeongsang National University*
GT2019-92169: A Study on the Classification of Rotary Defects Using Difference Signal

Avinash Renuke, *University of Genova*
GT2019-92269: Bladeless: Micro Expanders for Energy Harvesting, the Tesla Renaissance

THANK YOU ASME TURBO EXPO STUDENT POSTER JUDGES!

The ASME IGTI Student Advisory Committee would like to take this opportunity to thank the Turbo Expo Student Poster Judges for their diligent and meticulous judging efforts.

Tim Allison
Southwest Research Institute

Klaus Brun
Elliott Group

Sergio Camporeale
Polit

Ward De Paepe
University of Mons

Kiran D'Souza
Ohio State University

Lorenzo Ferrari
University of Pisa

Mario Luigi Ferrari
University of Genoa

Clement Joly
SoftInWay, Inc

Anestis Kalfas
Aristotle University of Thessaloniki

Scott Keller
PSM

Atul Kohli
Pratt & Whitney

Jing Li
GE Global Research Center

Paul Lowden
Liburdi Turbine Services

Matt Montgomery
Doosan Heavy Industries

Grant Musgrove
Southwest Research Institute

Guillermo Paniagua
Purdue University

Marc Polanka
US Air Force

Luca Porreca
MAN Energy Solutions Schweiz AG

Arnd Reichert
Siemens

Jorge Saavedra
Purdue University

Onome Scott-Emuakpor
U.S. Air Force Research Laboratory

Alessandro Sorce
University of Genoa

Alex Tsai
United States Coast Guard Academy

Mauro Venturini
Università degli Studi di Ferrara

Toshinori Watanabe
The University of Tokyo

Jing Yang
Texas A&M University

Min Zhang
Praxair, Inc.

Student Poster Presenters

Lukas Schuchard, *Technische Universität Dresden*
GT2019-92251: 3D Thermo-Mechanical Model for Probabilistic Analysis of Steam Turbine Rotor Fatigue Life

Richard Selo, *University of Nottingham*
GT2019-92278: Convective Heat Transfer Performance of Lattice Structures

Shreyas P Shetty, *Manipal Institute of Technology*
GT2019-92257: Augmenting Performance Of Savonius Vertical Axis Wind Turbines By combination of Upstream Deflector And Trapped Cylindrical Flow

Ajey Singh, *Indian Institute of Technology Kharagpur*
GT2019-92271: Effect Of Axial Overlap On Tip Leakage Flow Structure In Tandem Bladed Axial Flow Compressor

Zachary Stiegler, *Loyola Marymount University*
GT2019-92259: Novel Hole Shapes for Optimizing Film Cooling in Turbine Blades

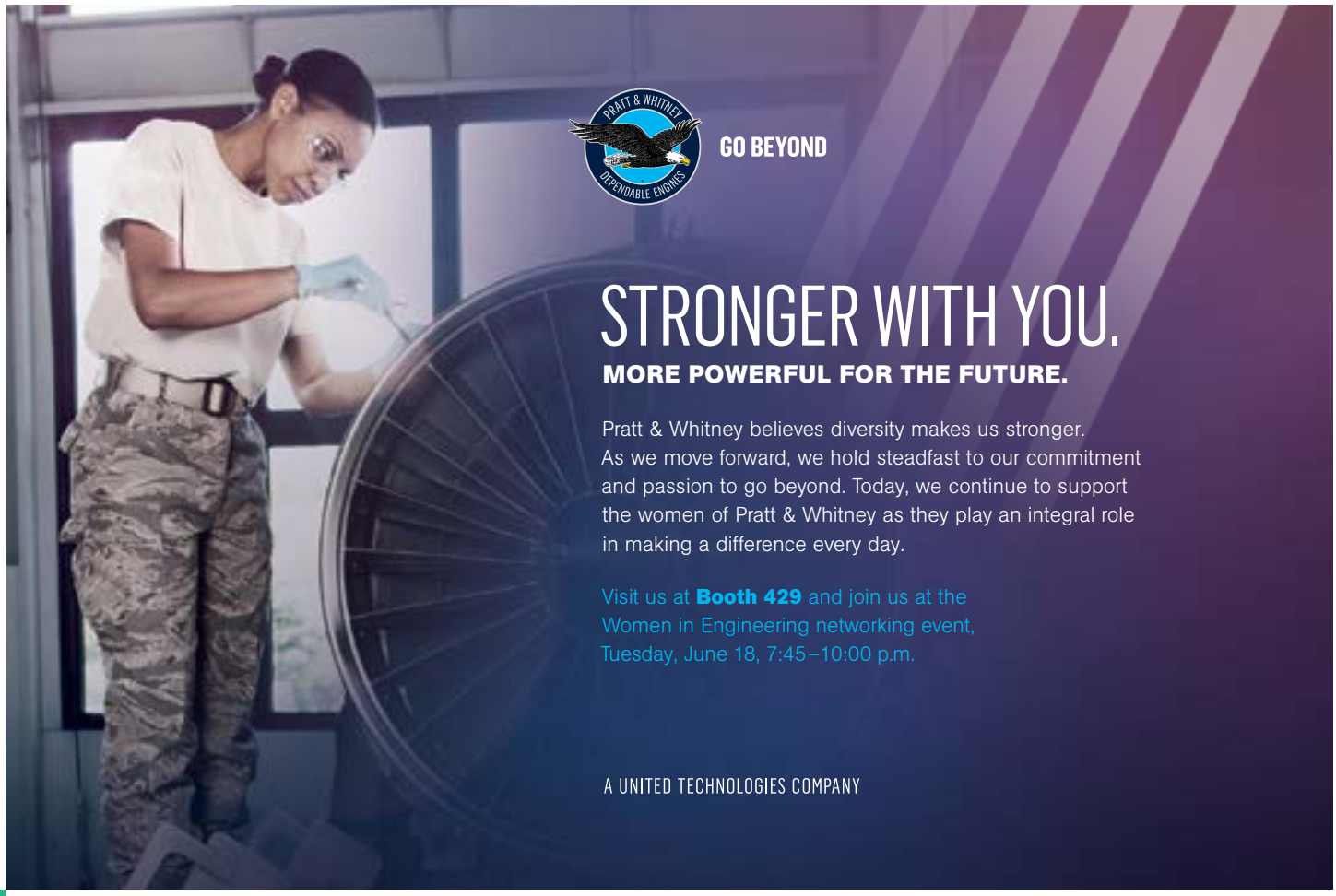
Javier Viana, *University of Cincinnati*
GT2019-92173: Vertical Axis Wind Turbine with Dynamic Blades

Michael M. Wojewodka, *University of Glasgow*
GT2019-92199: Complex Flow Physics In Convoluted Ducts

Jinghao Xu, *Linköping University*
GT2019-92202: Short-Term Creep Behavior of a Gamma Prime Containing Nickel-Base Superalloy by Laser Powder Bed Fusion

Sung Jin You, *Korea University*
GT2019-92258: Numerical Investigation of Effects of Angle of the Rib Inside the Multi-Cavity Blade Tip on Aerodynamic Performance and Heat Transfer Characteristics in a Transonic Turbine

Pablo Ale Martos, *Imperial College London*
GT2019-92253: Flow Field Analysis and Optimization of a Centrifugal Compressor Volute



Student Poster Presenters

POWERING THE FUTURE

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ASME 2019 Gas Turbine India Conference

December 5 - 6, 2019 • Indian Institute of Technology Madras, Chennai, India

The Most Advanced Turbomachinery Conference in India

ASME Gas Turbine India Conference is the must-attend event for turbomachinery professionals. Over 300 leading experts will gather to present their peer-reviewed research and the latest technology advancements in the industry. If warranted by review, papers may also be recommended for publication in ASME's Journal of Turbomachinery or Journal of Engineering for Gas Turbines and Power.

Technical Content

- 2-day conference packed with technical education and knowledge exchange
- Panel sessions featuring industry professionals

Networking Opportunities

- Meet and connect with colleagues from Global power exhibition
- Coffee breaks, lunches, and a dinner

ASME
INTERNATIONAL GAS TURBINE INSTITUTE

Session Participant Information

SESSION PARTICIPANT NETWORKING COFFEE

Monday, June 17 to Friday, June 21, 7:00 – 7:45 am
Room 120-D, Street Level, North Building

On the day of your scheduled presentation, a table will be reserved for your session. Meet with the other session participants and discuss session logistics. All session organizer materials will be distributed at this meeting. Complimentary coffee and pastry provided.

PRESENTATION UPLOADS

Presenters (authors, panelists, tutorial instructors, lecturers) should plan to upload their presentations only on the computer in their session room. Please arrive 15 to 30 minutes prior to your session to upload your presentation. Presentations may be uploaded from a USB flash drive. There will not be a central network server for the sessions. **It is recommended that presentations be removed from the computer as soon as the presentation has ended.**

Audiovisual Equipment Provided

Standard AV equipment provided in meeting rooms: LCD Projector, Laptop Computer, Projection Screen, Microphone(s), Wireless Remote/Pointer

Aspect Ratio is 16:9

SPEAKER READY ROOM

Room 132-C, Street Level, North Building
Sunday, June 16 12:00 pm – 6:00 pm
Monday, June 17 7:00 am – 5:30 pm
Tuesday, June 18 7:00 am – 5:30 pm
Wednesday, June 19 7:00 am – 5:30 pm
Thursday, June 20 7:00 am – 5:30 pm
Friday, June 21 7:00 am – 12:45 pm

REGISTRATION

As a non-profit organization, ASME requires all presenters to register for the conference and pay an appropriate fee. We are pleased to offer all presenters the discounted ASME Member registration rate. Onsite registration is located in the Lower Level, North Building of the Phoenix Convention Center (Hall 5&6 Foyer).

BADGE RIBBONS

Role and attendance ribbons are available at the Information Desk in Registration. See the display for available options.

FINAL PAPERS DVD/PAPER PRINTING STATIONS

All Technical Conference registrants are eligible to receive a DVD containing the collection of the technical papers accepted for presentation and publication plus online access. Presentations, such as panels or posters, that do not have an accompanying paper are considered to be "Oral Presentation Only" and do not appear in the system. Please note that this is NOT the official proceedings of the Conference, which is published after the Conference and is also made available online on the ASME Digital Collection at http://asmedigitalcollection.asme.org. As such, papers that appear in the system may not be cited until after the official Proceedings have been published. Registered ASME Turbo Expo 2019 technical conference attendees may view and print accepted conference papers at the 2019 Paper Printing Station in the Registration area.

Need Assistance?

ASME staff (red badges) and Hall Monitors are circulating the session room hallways to provide assistance as needed.

Altair

Join Our Lunch and Learn Sessions

Designing Gas Turbine Thermo Fluid Systems Using GE's Flow Simulator
Wednesday, June 19, 2019 12:30-2:30 in West 101 A

Altair SimSolid: Simulating Large, Complex Assemblies in Minutes
Thursday, June 20, 2019 12:30-1:30 in West 101 A

Register now at altair.com/turboexpo Booth 549

The Exposition

2019 EXHIBIT DIRECTORY

Round out your conference experience by spending time Tuesday through Thursday in the exhibit hall featuring the latest technology offered by leading companies in the industry and an exhibitor presentation stage. Lunches and receptions in the exhibit hall each day will provide relaxed, yet focused networking opportunities.

EXPOSITION OPEN:

Tuesday.....12:30 p.m. - 6:30 p.m.

Wednesday.....12:30 p.m. - 6:30 p.m.

Thursday.....11:30 a.m. - 2:30 p.m.

Don't miss the Turbo Expo Exhibit Closing Ceremony at 1:30 p.m.

Thank you to our Exhibit Advisory Committee. Please stop by and visit with our EAC members and give them your suggestions and feedback for making the Turbo Expo Exposition an even better event. A complete listing can be found on page 32. If you are interested in joining this committee, contact the ASME IGTI Expositions Department at igtiexpo@asme.org.

TURBO EXPO 2020 EXHIBITS AVAILABLE

If you are interested in exhibiting at the 65h ASME Turbo Expo in London, England in June 2020, contact **igtiexpo@asme.org** or stop by the ASME IGTI Exhibit Sales Office in the exhibit hall to secure your booth or one of the sponsorship opportunities.

REMINDERS:

No photographs can be taken in the exhibit hall without permission of Show Management and/or the exhibiting company.

Place your votes for the People's Choice Best Booth Award and the People's Choice Best Student Poster at the entrance of the exhibit hall. Cash Prize opportunity!

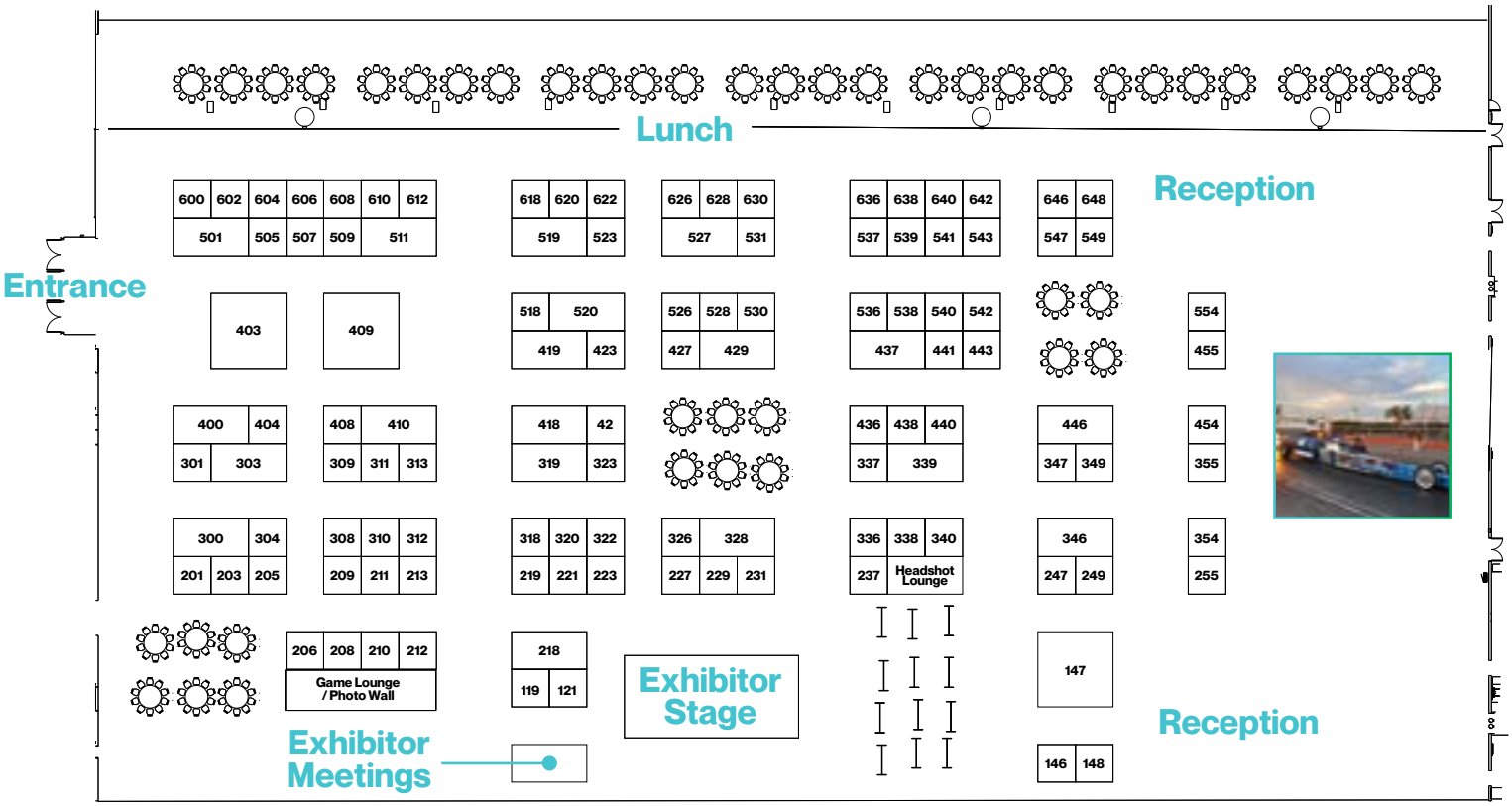
See security personnel for emergencies and first aid assistance.

PRESENTATION SCHEDULE

Every visitor, delegate and exhibitor at the EXPO can attend any of the following presentations, FREE OF CHARGE. Each is delivered by one of the Exhibitors at the EXPO - all of them leading experts in their field.

TUESDAY	
1:00 – 1:30 pm	Automated Inspection and Defect Detection in Aerospace Components Using Laser Scanning presented by Eric Grald, Creare LLC
1:45 – 2:15 pm	*Advanced Monitoring of Dynamics in Gas Turbines presented by Robert Widhopf-Fenk from Ifta GmbH*
2:30 – 3:00 pm	Metal Additive Manufacturing Applications in the Field of Turbine Industries presented by Dr. Stephane Abed of Poly-Shape
3:15 - 3:45 pm	Efficient Gas Turbine Combustor Meshing using ANSYS Fluent Mosaic presented by Mike Tooley from ANSYS, Inc.
4:00 – 4:30 pm	Altair HyperWorks- a Platform for Innovation presented by Matt King from Altair Engineering, Inc.
4:45 – 5:15 pm	Anti-Icing System Modeling and Simulation for Gas Turbines using AxSTREAM® presented by Clement Joly from SoftinWay
WEDNESDAY	
1:00 – 1:30 pm	Using Simulation to Enhance Turbomachinery Additive Manufacturing presented by Jeff Bronson from ANSYS, Inc.
1:45 – 2:15 pm	Advanced Monitoring of Dynamics in Gas Turbines presented by Robert Widhopf-Fenk from Ifta GmbH
2:30 – 3:00 pm	Advances in Turbomachinery Test Instrumentation using Additive Manufactured Parts and Probes presented by Thomas Decker from Vectoflow GmbH
3:15 - 3:45 pm	Introducing a Pragmatic Approach to Modeling Blade Film Cooling presented by Robin Steed from ANSYS, Inc.
4:00 – 4:30 pm	Safely Secure Fasteners in Critical Applications presented by Rodney Sandoval from Nord-Lock, Inc.
4:45 – 5:15 pm	AxSTREAM® Integrated Design and Analysis Platform for Fans in Turbofan Engines presented by Abdul Nassar from SoftinWay
THURSDAY	
12:45 - 1:15 pm	Overview of the US DOE's Advanced Turbines Program presented by Richard Dennis from National Energy Technology Laboratory
1:30 - 2:15 p.m.	ASME Turbo Expo Closing Ceremony and Kick-Off for London, England

The Exposition Floor Plan



The Exposition

EXHIBIT ADVISORY COMMITTEE

Mission: To assist in the growth and expansion of the Turbo Expo exhibit with continued support to exhibiting companies and ASME IGTI expositions staff. Representatives serve as experts for fielding questions and providing resources and initiatives for continued success of the exposition.

Dr. Jakob Hermann
IfTA Ingenieurbuero fuer Thermoakustik GmbHIndustriestr.
33 D-82194
Groebenzell Germany
Term: 2018-2021

Dr. Leonid Moroz
SoftInWay Inc.
15 New England Executive Park
Burlington, MA 01803 USA
Term: 2017-2020

Gaylord Klammt
Praewest Präzisionswerkstätten
Dr.-Ing.Heinz-RudolfJung GmbH & Co.
Martinsheide 7
Bremen, 28757 Germany
Term: 2017-2020

Barbara Shea
Concepts NREC
285 Billerica Road – Suite 102
Chelmsford, MA 01824
Term: 2018-2021

Kristin Barranger
ASME International Gas Turbine Institute
barrangerk@asme.org
Term: Staff Liaison

If you are interested in joining this committee, contact Kristin Barranger igtiexpo@asme.org.

EXHIBIT HALL: BEST EXHIBIT DISPLAY AND STUDENT POSTER AWARDS

People's Choice for Best Booth Display

Enter for a chance to win 1 of 3 USD cash prizes by Casting Your Ballot for the People's Choice Best Booth Award Winners.

100 USD **250 USD** **500 USD**

Three cash prize winners will be announced during the Closing Ceremony in the Exhibit Hall on Thursday, 1:30 pm.

CAST YOUR BALLOT FOR:

- Most creative display design
- Best display of technology
- Best overall exhibit
- Best method of crowd attraction

One vote per attendee. Entrant must be present to win at the Closing Ceremony. To qualify for the prize drawings, votes must be cast by 6:30pm on Wednesday.

PLACE YOUR VOTE FOR BOTH CATEGORIES:

Large Display AND **Small Display**

CONGRATULATIONS TO THE 2018 PEOPLE'S CHOICE AWARD WINNERS

Large Display: ANSYS

Small Display: NASA

Please take a moment to also vote for the Best Student Poster.

Voting kiosk can be found at the entrance of the exhibit hall! Stop by and vote Tuesday and Wednesday.

Exhibitor Social Media

AERODYN
@AerodynLtd
@aerodyneng
aerodyn-engineering-ltd

ALTA SOLUTIONS, INC.
@altasolutions

ANSYS
@ANSYSInc
@ANSYS
ANSYS, Inc.

ASME TURBO EXPO 2020
@ASMEIGTI
@igti
asme-international-gas-turbine-institute

CALSPAN SYSTEMS CORPORATION
@Calspan-Corporation
@Calspan_Corp
Calspan Corporation

COMPRESSORTECH2
@COMPRESSORtech2
@COMPRESSORtech2
compressortech2

CONCEPTS NREC
@conceptsnrec
@ConceptsNREC
Concepts NREC

CREARE LLC
Creare

DIESEL & GAS TURBINE WORLDWIDE
@COMPRESSORtech2
@COMPRESSORtech2
compressortech2

FUSION INC
Fusion, Inc

GADCAP TECHNICAL SOLUTIONS LTD.
GadCap Technical Solutions ltd

GAS COMPRESSION MAGAZINE
@GasCompressionMagazine
@GasCompressionM
gas-compression-magazine-official

GAS TURBINE SOCIETY OF JAPAN
@gtsj.org

GTI
@gastechnology
gas-technology-institute

KULITE SEMICONDUCTOR PRODUCTS, INC.
@kulitesemiconductor
kulite-semiconductor-products-inc

MEE INDUSTRIES INC.
Mee Industries Inc.

MMP TECHNOLOGY
@MicroTek-Finishing
MicroTek Finishing

NORD-LOCK GROUP
@nordlockgroup
@NordLockGroup
nordlockgroup

NOTRE DAME TURBOMACHINERY LABORATORY
@ND_Turbo
Notre Dame Turbomachinery Laboratory

NTOPOLOGY
@ntopologyinc
ntopology

OROS
@OROS_NV
oros

OXFORD FLOW
Oxford Flow

PCA ENGINEERS LIMITED
pca-engineers-limited

PCB PIEZOTRONICS, INC.
@pcbsensors
@PCBSensors
PCB Piezotronics, Inc.

POLY-SHAPE
@AddiCtiveManufacturing
@PolyShape
poly-shape

RENISHAW INC
@Renishawusa
@renishawusa
Renishaw USA

SCANIVALVE
@scanivalve

SENSOR COATING SYSTEMS LIMITED
Sensor Coating Systems (SCS)

SOFTINWAY INC.
@SoftInWay
@softinway
softinway

SOUTHWEST RESEARCH INSTITUTE
@southwestresearch
Southwest Research Institute

SVI DYNAMICS
SVI DYNAMICS

TEES - TURBOMACHINERY LABORATORY
@TAMUTurboLab
@TurboLabTEES
Turbomachinery Laboratory at Texas A&M

TORQUEMETERS LTD.
Torquemeters Limited

TURBOCAM INTERNATIONAL
@Turbocam
@TurbocamIntl
turbocam-inc

TUTCO SUREHEAT
@tutcosureheat
@TutcoS
tutcosureheat

VECTOFLOW GMBH
@vectoflow
@vectoflow
vectoflow

WAUKESHA BEARINGS CORPORATION
Waukesha Bearings Corporation

PLEASE REFER TO ONLINE EXHIBITOR DIRECTORY FOR EXHIBITING COMPANY LISTINGS.

Exhibit Product Categories

3D INSPECTION AND MEASUREMENTS

Aerodyn
Apogee Scientific
Renishaw Inc

ADDITIVE MANUFACTURING

Präwest Präzisionswerkstätten GmbH & Co. KG.
ANSYS
MMP Technology
nTopology
Concepts NREC
Southwest Research Institute
Renishaw Inc
Notre Dame Turbomachinery Laboratory
Poly-Shape
CEROBEAR GmbH
Aerodyn
Aeroprobe Corporation

AERODERIVATIVE GAS TURBINE REPAIR & OVERHAUL

Jasc-Controls
Southwest Research Institute

AIR SYSTEMS

ANSYS
Institut Pprime
NRG Energy Services

ANALYTICAL

ANSYS
Creare LLC
Turbines & Diesels Magazine
University of Stuttgart, ITSM
Aerodyn
AneCom AeroTest GmbH
Alta Solutions, Inc.
Aeroprobe Corporation

ANCILLARY EQUIPMENT

e+a
NRG Energy Services
Alta Solutions, Inc.

AUTOMATED 3D INSPECTION AND MEASUREMENTS

Apogee Scientific
Renishaw Inc
Creare LLC

AXIAL & CENTRIFUGAL COMPRESSORS

ANSYS
Calspan Systems Corporation
PCA Engineers Limited
Concepts NREC
Southwest Research Institute
SoftInWay Inc.
Creare LLC
Turbostream Ltd
University of Stuttgart, ITSM
Aerodyn
AneCom AeroTest GmbH

BEARINGS, SEALS & LUBRICANTS

ANSYS
Cross Manufacturing
Waukesha Bearings Corporation
Institut Pprime
Southwest Research Institute
SoftInWay Inc.
CEROBEAR GmbH
NRG Energy Services
Alta Solutions, Inc.

COMPONENTS

Nord-Lock Group
Turbocam International
Fusion Inc
Institut Pprime
Jasc-Controls
Concepts NREC
Southwest Research Institute
Notre Dame Turbomachinery Laboratory
Dou Yee Technologies Pte Ltd
Aerodyn
AneCom AeroTest GmbH

CONSULTING & ENGINEERING SERVICES

ANSYS
MMP Technology
Cross Manufacturing
Calspan Systems Corporation
Waukesha Bearings Corporation
Maul-Theet GmbH
PCA Engineers Limited
Apogee Scientific
Jasc-Controls
Concepts NREC
Southwest Research Institute
Notre Dame Turbomachinery Laboratory
SoftInWay Inc.
Creare LLC
Turbines & Diesels Magazine
OROS
Fracture Analysis Consultants Inc
IfTA GmbH
University of Stuttgart, ITSM
Aerodyn
AneCom AeroTest GmbH
Flow Systems, Inc.

CONTINUING EDUCATION COURSES

TEES - Turbomachinery Laboratory
University of Stuttgart, ITSM

CONTROLS/ INSTRUMENTATION

ANSYS
Calspan Systems Corporation
Institut Pprime
Southwest Research Institute
Notre Dame Turbomachinery Laboratory
GadCap Technical Solutions Ltd.
Creare LLC
IfTA GmbH
University of Stuttgart, ITSM
Aerodyn
AneCom AeroTest GmbH
Alta Solutions, Inc.
Scanivalve
Aeroprobe Corporation
datatel Telemetry

DESIGN PROCESS & METHODOLIGIES

ANSYS
Cambridge Flow Solutions Ltd
Haynes International, Inc.
Jasc-Controls
Concepts NREC
Southwest Research Institute
Dou Yee Technologies Pte Ltd
SoftInWay Inc.

Exhibit Product Categories

Turbostream Ltd
Aerodyn
AneCom AeroTest GmbH

DRIVE TRAIN EQUIPMENT

ANSYS
Calspan Systems Corporation
Southwest Research Institute

EDUCATION

ASME Turbo Expo 2020
Institut Pprime
PCB Piezotronics, Inc.
Concepts NREC
American Society of Mechanical Engineers (ASME)
Notre Dame Turbomachinery Laboratory
SoftInWay Inc.
TEES - Turbomachinery Laboratory
Penn State University
University of Stuttgart, ITSM
Scanivalve

EXPANDERS

Präwest Präzisionswerkstätten GmbH & Co. KG.
ANSYS
SoftInWay Inc.
Creare LLC
University of Stuttgart, ITSM

FANS & BLOWERS

Präwest Präzisionswerkstätten GmbH & Co. KG.
ANSYS
PCA Engineers Limited
Concepts NREC
Southwest Research Institute
SoftInWay Inc.
Creare LLC
NRG Energy Services
University of Stuttgart, ITSM
AneCom AeroTest GmbH
Alta Solutions, Inc.

FILTERS

ANSYS
Cross Manufacturing
Southwest Research Institute

FIRE PROTECTION SYSTEMS

ANSYS

FUEL SYSTEMS

ANSYS
Jasc-Controls
Southwest Research Institute

GAS TURBINES

Präwest Präzisionswerkstätten GmbH & Co. KG.
ANSYS
MMP Technology
Mee Industries Inc.
Cross Manufacturing
Calspan Systems Corporation
Turbocam International
Fusion Inc
Haynes International, Inc.
PCA Engineers Limited
Jasc-Controls
PCB Piezotronics, Inc.
Concepts NREC
Southwest Research Institute
American Society of Mechanical Engineers (ASME)
Notre Dame Turbomachinery Laboratory
SoftInWay Inc.
Turbostream Ltd
NRG Energy Services
University of Stuttgart, ITSM
Aerodyn
AneCom AeroTest GmbH
Alta Solutions, Inc.
Scanivalve

GEAR TYPE COMPRESSORS

ANSYS
MMP Technology
Southwest Research Institute
University of Stuttgart, ITSM
Aerodyn

GOVERNMENT ORGANIZATION

Institut Pprime

ISOTHERM COMPRESSORS

Präwest Präzisionswerkstätten GmbH & Co. KG.
ANSYS
University of Stuttgart, ITSM

LASER AND OPTICAL 3D SCANNING

Maul-Theet GmbH
Apogee Scientific
Creare LLC
Aerodyn

LASER MACHINING

Haynes International, Inc.

LASER WELDING

GadCap Technical Solutions Ltd.
Creare LLC

MAINTENANCE AND OPERATION

Nord-Lock Group
Southwest Research Institute
SVI DYNAMICS
Aerodyn
Alta Solutions, Inc.

MANAGEMENT & MAINTENANCE OF ROTATING EQUIPMENT

Southwest Research Institute
Notre Dame Turbomachinery Laboratory
IfTA GmbH
Aerodyn

MANUFACTURING PROCESSES

Präwest Präzisionswerkstätten GmbH & Co. KG.
Cross Manufacturing
Calspan Systems Corporation
PCB Piezotronics, Inc.
Concepts NREC
Renishaw Inc
Dou Yee Technologies Pte Ltd
Aerodyn
Aeroprobe Corporation

MICROSCOPE SYSTEMS AND DIGITAL IMAGING

Institut Pprime
Renishaw Inc

Exhibit Product Categories

MONITORING SOFTWARE

GadCap Technical Solutions Ltd.
OROS
IfTA GmbH
Aerodyn
Alta Solutions, Inc.
datatel Telemetry

NOISE CONTROL

SVI DYNAMICS
OROS
AneCom AeroTest GmbH

OEM GAS TURBINE/ POWER TURBINE

Mee Industries Inc.
Cross Manufacturing
Turbocam International
PCB Piezotronics, Inc.
Southwest Research Institute
Notre Dame Turbomachinery Laboratory
SoftInWay Inc.
University of Stuttgart, ITSM
Aerodyn

OIL SYSTEMS

ANSYS
Jasc-Controls
PCB Piezotronics, Inc.
Southwest Research Institute
Scanivalve

PACKAGE/ TURNKEY APPLICATIONS

Mee Industries Inc.
Jasc-Controls

PROCESS CONTROL SYSTEMS

ANSYS
Jasc-Controls
PCB Piezotronics, Inc.
Southwest Research Institute
Scanivalve
Aeroprobe Corporation

PROCESS GAS SCREW COMPRESSORS

ANSYS
PCB Piezotronics, Inc.
Southwest Research Institute

PUBLICATION

Diesel & Gas Turbine Worldwide
COMPRESSORtech2
Institut Pprime
Turbomachinery International
American Society of Mechanical Engineers (ASME)
Power Magazine
Gas Compression Magazine
Turbines & Diesels Magazine

PUBLISHING COMPANY

Diesel & Gas Turbine Worldwide
Turbomachinery International
American Society of Mechanical Engineers (ASME)
Power Magazine
Gas Compression Magazine
Turbines & Diesels Magazine

RESEARCH

TEES - Turbomachinery Laboratory
Penn State University
Turbostream Ltd
Aerodyn
Scanivalve
Aeroprobe Corporation

SERVICE FOR TURBINES & COMPRESSORS

MMP Technology
Cross Manufacturing
Southwest Research Institute
NRG Energy Services
Aerodyn
AneCom AeroTest GmbH
Aeroprobe Corporation

SOFTWARE & COMPUTER HARDWARE

ANSYS
Maul-Theet GmbH
Cambridge Flow Solutions Ltd
PCA Engineers Limited
nTopology
Concepts NREC
SoftInWay Inc.
TEES - Turbomachinery Laboratory
Fracture Analysis Consultants Inc
Siemens PLM Software USA
IfTA GmbH
Alta Solutions, Inc.
Aeroprobe Corporation

SOLAR

Southwest Research Institute
Scanivalve

SPECIAL MATERIALS

Präwest Präzisionswerkstätten GmbH & Co. KG.
Cross Manufacturing
Institut Pprime
Haynes International, Inc.
Aeroprobe Corporation

STEAM TURBINES

Präwest Präzisionswerkstätten GmbH & Co. KG.
ANSYS
Cross Manufacturing
Calspan Systems Corporation
Turbocam International
Fusion Inc
PCA Engineers Limited
Concepts NREC
Southwest Research Institute
SoftInWay Inc.
Turbostream Ltd
NRG Energy Services
University of Stuttgart, ITSM
Aerodyn
Alta Solutions, Inc.
Scanivalve

TEMPERATURE MEASUREMENT

Sensor Coating Systems Limited
University of Stuttgart, ITSM
Aerodyn
AneCom AeroTest GmbH
Scanivalve
Aeroprobe Corporation
datatel Telemetry

TESTING

Exhibit Product Categories

Cross Manufacturing
Calspan Systems Corporation
Maul-Theet GmbH
Institut Pprime
Concepts NREC
Oxford Flow
Southwest Research Institute
Notre Dame Turbomachinery Laboratory
OROS
IfTA GmbH
Aerodyn
AneCom AeroTest GmbH
Alta Solutions, Inc.
Flow Systems, Inc.
Scanivalve
Aeroprobe Corporation

VACUUM HEAT TREATING AND BRAZING SERVICES

Präwest Präzisionswerkstätten GmbH & Co. KG.

WATERJET CUTTING/DRILLING

Haynes International, Inc.
NRG Energy Services

WIND TURBINES

Präwest Präzisionswerkstätten GmbH & Co. KG.
ANSYS
Fusion Inc
PCB Piezotronics, Inc.
Southwest Research Institute
Turbostream Ltd
Aerodyn
Alta Solutions, Inc.
Scanivalve

Last October driver Dave Spangler managed to pierce the 500 mph barrier with an astounding speed of 503.332 mph on the Bonneville Salt Flats in Utah, making him the fastest person in the world to drive a wheel driven car!

Come by the exhibit to see the **TURBINATOR II**.

ASME IGTI Committee Leaders

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Current Chair: Wilfried Visser
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CERAMICS

Current Chair: Jun Shi
Current Vice Chair: Rajesh S. Kumar

COAL, BIOMASS & ALTERNATIVE FUELS

Current Chair: Pierre Q. Gauthier
Current Vice Chair: Dr. Marina Braun-Unkhoff

COMBUSTION, FUELS & EMISSIONS

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Incoming Chair: Christian Oliver Paschereit
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Incoming Vice Chair: Panos Laskaridis

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Incoming Chair: Markus Schatz
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Incoming Chair: Grant Musgrove
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Current Chair: George Pechlivanoglou
Current Vice Chair: Alessandro Bianchini
Incoming Chair: Alessandro Bianchini
Incoming Vice Chair: Alexandrina Untaroiu

Committee Meeting Schedule

GROUP	DATE	TIME	LOCATION
Aircraft Engine	Thursday, June 20	6:00 - 7:30 p.m.	**124-A**
Ceramics joint with Microturbines, Turbochargers & Small Turbomachines	Wednesday, June 19	6:00 - 7:30 p.m.	**125-AB**
Coal, Biomass & Alternative Fuels	Wednesday, June 19	6:00 - 7:30 p.m.	**131-B**
Combustion, Fuels & Emissions	Tuesday, June 18	6:00 - 7:30 p.m.	**122-A**
Controls, Diagnostics & Instrumentation	Wednesday, June 19	6:00 - 7:30 p.m.	**222-B**
Cycle Innovations	Tuesday, June 18	6:00 - 7:00 p.m.	**221-B**
Education	Thursday, June 20	1:00 - 2:00 p.m.	**131-A**
Electric Power	Wednesday, June 19	1:00 - 2:00 p.m.	**131-A**
Exhibit Advisory Committee	Wednesday, June 19	10:30 am - 12:00 p.m.	**Exhibit Hall Stage**
Fans & Blowers	Thursday, June 20	6:00 - 7:30 p.m.	**131-C**
Gas Turbine India Chapter Meeting	Wednesday, June 19	1:30 - 2:00 p.m.	**122-A**
Gas Turbine Segment Leadership Team	Sunday, June 16	8:30 a.m. - 5:00 p.m.	**Paradise Valley, Sheraton Grand Phoenix Hotel**
Heat Transfer	Wednesday, June 19	6:00 - 7:30 p.m.	**124-B**
IGTI Executive Committee	Friday, June 21	1:00 - 5:00 p.m.	**Paradise Valley, Sheraton Grand Phoenix Hotel**
Industrial & Cogeneration	Tuesday, June 18	6:00 - 7:30 p.m.	**221-C**
Manufacturing Materials & Metallurgy	Wednesday, June 19	6:00 - 7:30 p.m.	**121-C**
Marine	Tuesday, June 18	6:30 p.m.	**Off Site**
Microturbines, Turbochargers & Small Turbomachines joint with Ceramics	Wednesday, June 19	6:00 - 7:30 p.m.	**124-A**
Oil & Gas Applications	Wednesday, June 19	6:00 - 7:30 p.m.	**121-AB**
ORC Power Systems	Thursday, June 20	6:00 - 7:30 p.m.	**131-B**
Steam Turbine	Wednesday, June 19	6:00 - 7:30 p.m.	**129-AB**
Structures & Dynamics	Tuesday, June 18	6:00 - 7:30 p.m.	**127-C**
Student Advisory	Thursday, June 20	5:30 - 7:00 p.m.	**129-AB**
Supercritical CO_2	Wednesday, June 19	6:00 - 7:30 p.m.	**123**
Turbomachinery	Tuesday, June 18	6:00 - 7:30 p.m.	**129-AB**
Wind Energy	Thursday, June 20	6:00 - 7:30 p.m.	**131-A**

Turbo Expo Committee Point Contacts

Aircraft Engine
Harald Funke, *Aachen University of Applied Sciences*
Kurt Rouser, *Oklahoma State University*
Konstantinos Kyprianidis, *Malardalen University*
Wilfried Visser, *Delft University*

Ceramics
Jun Shi, *Rolls-Royce Corporation*
Rajesh Kumar, *United Technologies Research Ctr.*

Coal, Biomass, Hydrogen & Alternative Fuels
Pierre Gauthier, *Siemens Energy Canada*
Bhupendra Khandelwal, *University of Sheffield*
Jeff Bergthorson, *McGill University*
Marina Braun-Unkhoff, *DLR, Institute of Combustion Technology*
Francesco Fantozzi, *University of Perugia, Dip. Ingegneria Industriale*
Ajay Agrawal, *University of Alabama*

Combustion, Fuels & Emissions
Sebastien Ducruix, *Laboratoire EM2C - CNRS*
Oliver Paschereit, *Technische Universität Berlin*
Mirko Bothien, *Ansaldo Energia Switzerland*
Jacqueline O'Connor, *Pennsylvania State University*
Mike Klassen, *Combustion Science & Engineering, Inc.*

Controls, Diagnostics & Instrumentation
Liang Tang, *Pratt & Whitney*
Peter Loftus, *Rolls-Royce Plc*
Igor Loboda, *Instituto Politécnico Nacional*
Lorenzo Ferrari, *University of Pisa - DESTEC*

Cycle Innovations
Konstantinos Kyprianidis, *Malardalen University*
David Sanchez, *University of Seville*
Mario Luigi Ferrari, *University of Genoa*

Education
Ioanna Aslanidou, *Mälardalen University*
Subith Vasu, *University of Central Florida*

Electric Power
Bin Zhou, *FM Global*
Rick Tomlinson, *Chevron*
Seyfettin Can Gulen, *Bechtel Infrastructure & Power Inc.*
Thomas Christiansen, *Strategic Power Systems Inc.*

Fans & Blowers
Johan Van der Spuy, *Stellenbosch University*
Giovanni Delibra, *Sapienza University of Rome*
Alessandro Corsini, *'sapienza' University Of Rome*
Zhiping Wang, *Morrison Products Inc.*
Chunill Hah, *NASAGlenn*

Heat Transfer: Conjugate Heat Transfer
Bijay Sultanian, *Takaniki Communications, LLC*
Li He, *University of Oxford*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Heat Transfer: Numerical Internal Cooling
Bijay Sultanian, *Takaniki Communications, LLC*
Domenico Borello, *Sapienza University of Rome*
Ali Ameri, *The Ohio State University*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Heat Transfer: Numerical Film Cooling
Bijay Sultanian, *Takaniki Communications, LLC*
Ardeshir Riahi, *Honeywell Aerospace*
Robert Krewinkel, *MAN Energy Solutions SE*
Antonio Andreini, *University of Florence*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Heat Transfer: General Experimental Heat Transfer
Bijay Sultanian, *Takaniki Communications, LLC*
James Downs, *Florida Turbine Technologies Inc.*
Lesley Wright, *Texas A&M University*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Heat Transfer: Tutorials
Bijay Sultanian, *Takaniki Communications, LLC*
Andrew Nix, *West Virginia University*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Heat Transfer: Internal Air Systems & Seals (with Turbomachinery)
Bijay Sultanian, *Takaniki Communications, LLC*
Riccardo Da Soghe, *Ergon Research*
Carl Sangan, *University of Bath*
Raymond Chupp, *REC consulting*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Heat Transfer: Experimental Internal Cooling
Bijay Sultanian, *Takaniki Communications, LLC*
Eric Ruggiero, *GE Aviation*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Heat Transfer: Combustors (with Combustion, Fuels & Emissions)
Bijay Sultanian, *Takaniki Communications, LLC*
Hee-Koo Moon, *Yonsei University*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Turbo Expo Committee Point Contacts

Heat Transfer: Special Sessions
Bijay Sultanian, *Takaniki Communications, LLC*
Guillermo Paniagua, *Purdue University*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Heat Transfer: Experimental Film Cooling
Bijay Sultanian, *Takaniki Communications, LLC*
Lamyaa El-Gabry, *Princeton University*
Kenneth Van Treuren, *Baylor University*
Kenichiro Takeishi, *Tokushima Bunri University*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Heat Transfer: Multiphysics Modeling & Optimization
Bijay Sultanian, *Takaniki Communications, LLC*
Shailendra Naik, *Ansaldo Energia*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Heat Transfer: Additive Manufacturing
Bijay Sultanian, *Takaniki Communications, LLC*
Harika S. Kahveci, *Middle East Technical University (METU)*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Heat Transfer: General Computational Heat Transfer
Bijay Sultanian, *Takaniki Communications, LLC*
Gregory Laskowski, *GE Global Research*
Marc D. Polanka, *Air Force Institute of Technology*
John Blanton, *Classic Engineering, LLC*

Industrial & Cogeneration
Yiguang Li, *Cranfield University*
Francesco Melino, *University of Bologna*

Manufacturing Materials & Metallurgy
Douglas Nagy, *Liburdi Turbine Services*
David Day, *Doosan*
Ashok Koul, *Life Prediction Technologies Inc.*

Marine
Morgan Hendry, *SSS Clutch Company, Inc.*
Jeffrey Patterson, *Naval Surface Warfare Center*

Microturbines, Turbochargers & Small Turbomachines
Keun Ryu, *Hanyang University*
Fabrizio Reale, *Istituto Motori, CNR, Italy*

Oil & Gas Applications
Michele Pinelli, *University of Ferrara Endif*
Klaus Brun, *Malta Inc.*

Organic Rankine Cycle Power Systems
Teemu Turunen-Saaresti, *Lappeenranta University of Technology*
Marco Astolfi, *Politecnico di Milano*

Steam Turbines
Ivan Mcbean, *GE*
Markus Schatz, *ITSM University of Stuttgart*
Henning Almstedt, *Siemens AG*
Grant Ingram, *Durham University*

Structures & Dynamics: Emerging Methods in Design & Engineering
Thomas Weiss, *Rolls Royce Deutschland Ltd & Co. KG*
Jerzy Sawicki, *Cleveland State University*
Michael Gorelik, *FAA FSDO*
Jose Maria Rey Villazon, *GE Aviation*

Structures & Dynamics: Fatigue, Fracture & Life Prediction
Thomas Weiss, *Rolls Royce Deutschland Ltd & Co. KG*
Jerzy Sawicki, *Cleveland State University*
Michael Gorelik, *FAA FSDO*
Alessandro Ramaglia, *Ansaldo Energia*

Structures & Dynamics: Probabilistic Methods
Thomas Weiss, *Rolls Royce Deutschland Ltd & Co. KG*
Jerzy Sawicki, *Cleveland State University*
Michael Gorelik, *FAA FSDO*
Andrew Milliken, *Pratt & Whitney*

Structures & Dynamics: Rotordynamics
Thomas Weiss, *Rolls Royce Deutschland Ltd & Co. KG*
Jerzy Sawicki, *Cleveland State University*
Michael Gorelik, *FAA FSDO*
Mateusz Golebiowski, *General Electric (Switzerland) GmbH*

Structures & Dynamics: Bearing & Seal Dynamics
Thomas Weiss, *Rolls Royce Deutschland Ltd & Co. KG*
Jerzy Sawicki, *Cleveland State University*
Michael Gorelik, *FAA FSDO*
Keun Ryu, *Hanyang University*

Structures & Dynamics: Structural Mechanics, Vibration & Damping
Thomas Weiss, *Rolls Royce Deutschland Ltd & Co. KG*
Jerzy Sawicki, *Cleveland State University*
Michael Gorelik, *FAA FSDO*
Lars Panning-von Scheidt, *Leibniz Universität Hannover*

Structures & Dynamics: Aerodynamic Excitation & Damping
Thomas Weiss, *Rolls Royce Deutschland Ltd & Co. KG*
Jerzy Sawicki, *Cleveland State University*
Michael Gorelik, *FAA FSDO*
Maria Angelica Mayorca, *Siemens Industrial Turbomachinery*

Student Advisory
Wisher Paudel, *University of Virginia*
Samuel Barak, *University of Central Florida*
Shawn Siroka, *Penn State University*

Turbo Expo Committee Point Contacts

Supercritical CO2 Power Cycles
Eric Clementoni, *Naval Nuclear Laboratory*
Grant Musgrove, *Southwest Research Institute*

Turbomachinery: Axial Flow Fan & Compressor Aerodynamics
Ricardo Martinez-Botas, *Imperial College London*
Dale Van Zante, *NASA Glenn Research Center*
Bronwyn Power, *Rolls-Royce Corporation*

Turbomachinery: Axial Flow Turbine Aerodynamics
Ricardo Martinez-Botas, *Imperial College London*
Dale Van Zante, *NASA Glenn Research Center*
Luca Porreca, *MAN Energy Solutions Schweiz AG*

Turbomachinery: Design Methods & CFD Modeling for Turbomachinery
Ricardo Martinez-Botas, *Imperial College London*
Dale Van Zante, *NASA Glenn Research Center*
Akin Keskin, *Rolls-Royce plc*

Turbomachinery: Ducts & Component Interactions
Ricardo Martinez-Botas, *Imperial College London*
Dale Van Zante, *NASA Glenn Research Center*
Jeff Defoe, *University of Windsor*

Turbomachinery: Noise & Innovative Noise Reduction (with Aircraft Engine)
Ricardo Martinez-Botas, *Imperial College London*
Dale Van Zante, *NASA Glenn Research Center*
Jeff Defoe, *University of Windsor*

Turbomachinery: Radial Turbomachinery Aerodynamics
Ricardo Martinez-Botas, *Imperial College London*
Dale Van Zante, *NASA Glenn Research Center*
Jan Ehrhard, *Continental Automotive GmbH*

Turbomachinery: Unsteady Flows in Turbomachinery
Ricardo Martinez-Botas, *Imperial College London*
Dale Van Zante, *NASA Glenn Research Center*
Natalie Smith, *Southwest Research Institute*

Turbomachinery: Multidisciplinary Design Approaches, Optimization & Uncertainty Quantification
Ricardo Martinez-Botas, *Imperial College London*
Dale Van Zante, *NASA Glenn Research Center*
Ingrid Lepot, *Cenaero*

Turbomachinery: Deposition, Erosion, Fouling, and Icing
Ricardo Martinez-Botas, *Imperial College London*
Dale Van Zante, *NASA Glenn Research Center*
Jeffrey Bons, *Ohio State University*

Turbomachinery: Tutorials
Andreas Peters, *GE Aviation*
Ricardo Martinez-Botas, *Imperial College London*

Wind Energy
Georgios Pechlivanoglou, *Eunice Wind*
Alessandro Bianchini, *University of Florence*

Honors and Awards
John Blanton, *Classic Engineering, LLC*

2018 General Session

Registration

REGISTRATION LOCATION/HOURS

Phoenix Convention Center, North Building, Lower Level, Halls 5&6 Foyer

Sunday, June 16 - 12:00 pm – 6:00 pm
Monday, June 17 - 7:00 am – 5:30 pm
Tuesday, June 18 - 7:00 am – 6:30 pm
Wednesday, June 19 - 7:00 am – 6:30 pm
Thursday, June 20 - 7:00 am – 5:30 pm
Friday, June 21 - 7:00 am – 2:00 pm

TECHNICAL CONFERENCE REGISTRATION

- Access to every session in the Technical Conference
- Final Papers DVD comprised of all papers published for TURBO EXPO 2019
- Professional Development Hours (PDHs) Certificate
- Admission to the following networking events:
- Grand Opening: Turbomachines for Clean Power and Propulsion Systems (June 17)
- Welcome Reception (June 17)
- Tuesday Plenary Panel: Turbomachines for Clean Power and Propulsion Systems – Aviation Focus (June 18)
- Wednesday Plenary Panel: Turbomachinery and Clean Energy – Future Trends and Opportunities (June 19)
- Daily Lunch (June 17 – 21)
- Exhibition (June 18 – 20)
- Exhibit Hall Reception (June 18 – 19)
- Opportunity to attend Facility Tours

FREE ASME MEMBERSHIP

Non-member 5-day and 3-day registrants, plus students are eligible to receive a complimentary one-year ASME membership. Registrants in this category will receive an email invitation within 90 days after the conference from ASME Membership with the invitation to join.

BADGE/TICKETS

Your badge is encoded with all payments made through conference registration. It is your only ticket and must be presented for admission to ticketed functions.

SECURITY

For security reasons, your badge must be worn at all official functions including Technical Conference, the Welcome Reception, the Keynote Sessions, luncheons and in the Exposition.

PDH CERTIFICATES

Technical Conference delegates will receive their PDH (Professional Development Hours) certificate for attendance by email within 3-weeks following the conference. (5-day = 32.5 PDHs, 3-day = 19.5 PDHs).

CONFERENCE PROCEEDINGS

Printed volumes of the official Conference Proceedings may be ordered after the Conference by emailing customercare@asme.org or by calling 1-800-THE-ASME. All ASME Conference Proceedings are submitted for indexing to the Engineering index, which publishes COMPENDEX, SCOPUS, and a host of other indexing databases. Proceedings are also submitted to ISI for indexing in the Thomson Reuters Conference Proceedings Citation Index. Only presented papers are submitted.

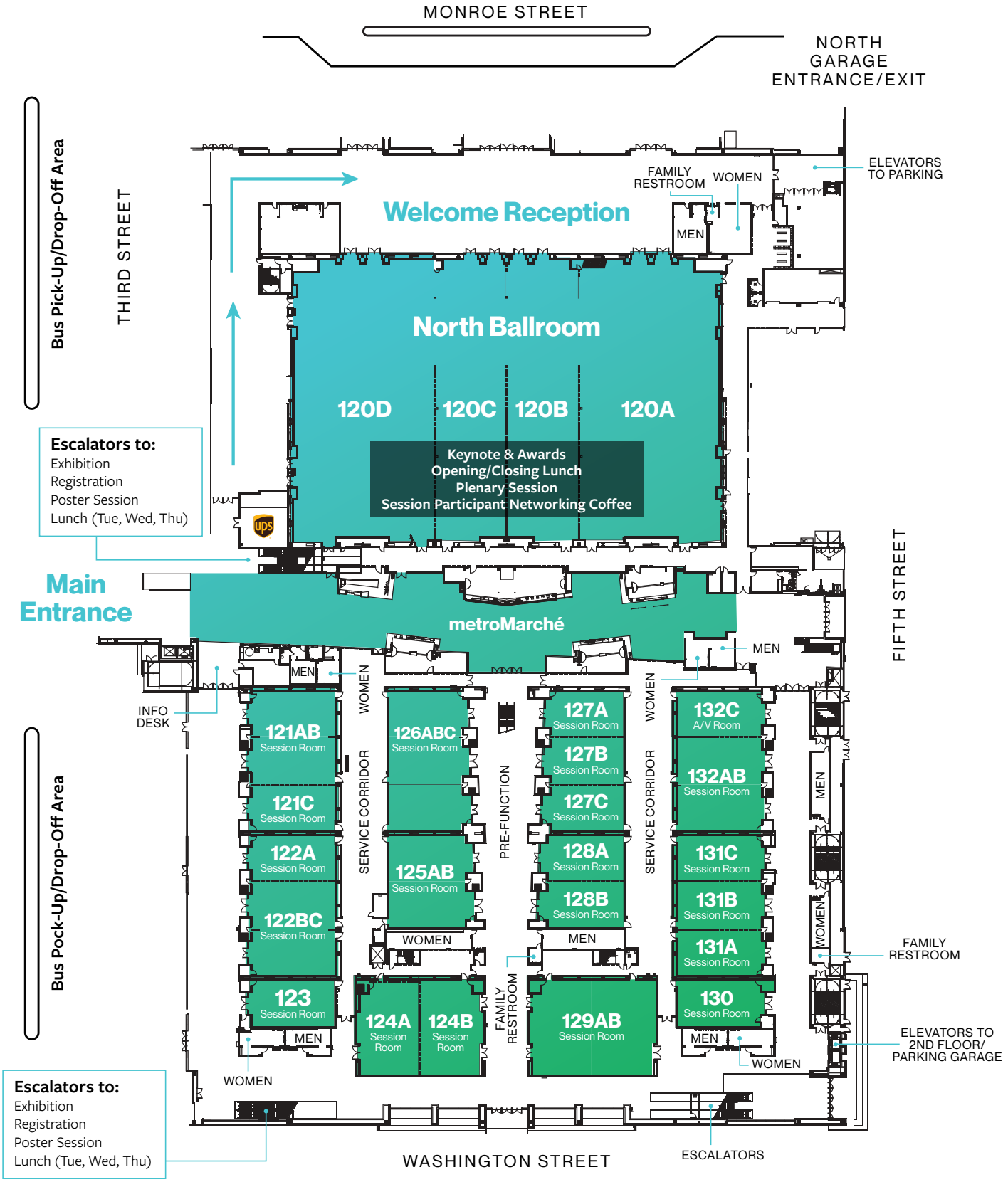
TECHNICAL PAPERS

The collection of the technical papers accepted for presentation and publication are posted online. Presentations, such as panels, posters or tutorials, that do not have an accompanying paper are considered to be "Oral Presentation Only" and do not appear in the system. Please note that this is NOT the official proceedings of the Conference, which is published after the Conference and is also made available online on the ASME Digital Collection at http://asmedigitalcollection.asme.org. As such, papers that appear in the system may not be cited until after the official Proceedings have been published. Technical conference attendees may view accepted conference papers at the 2019 Paper Printing Station in Registration.

2018 General Session

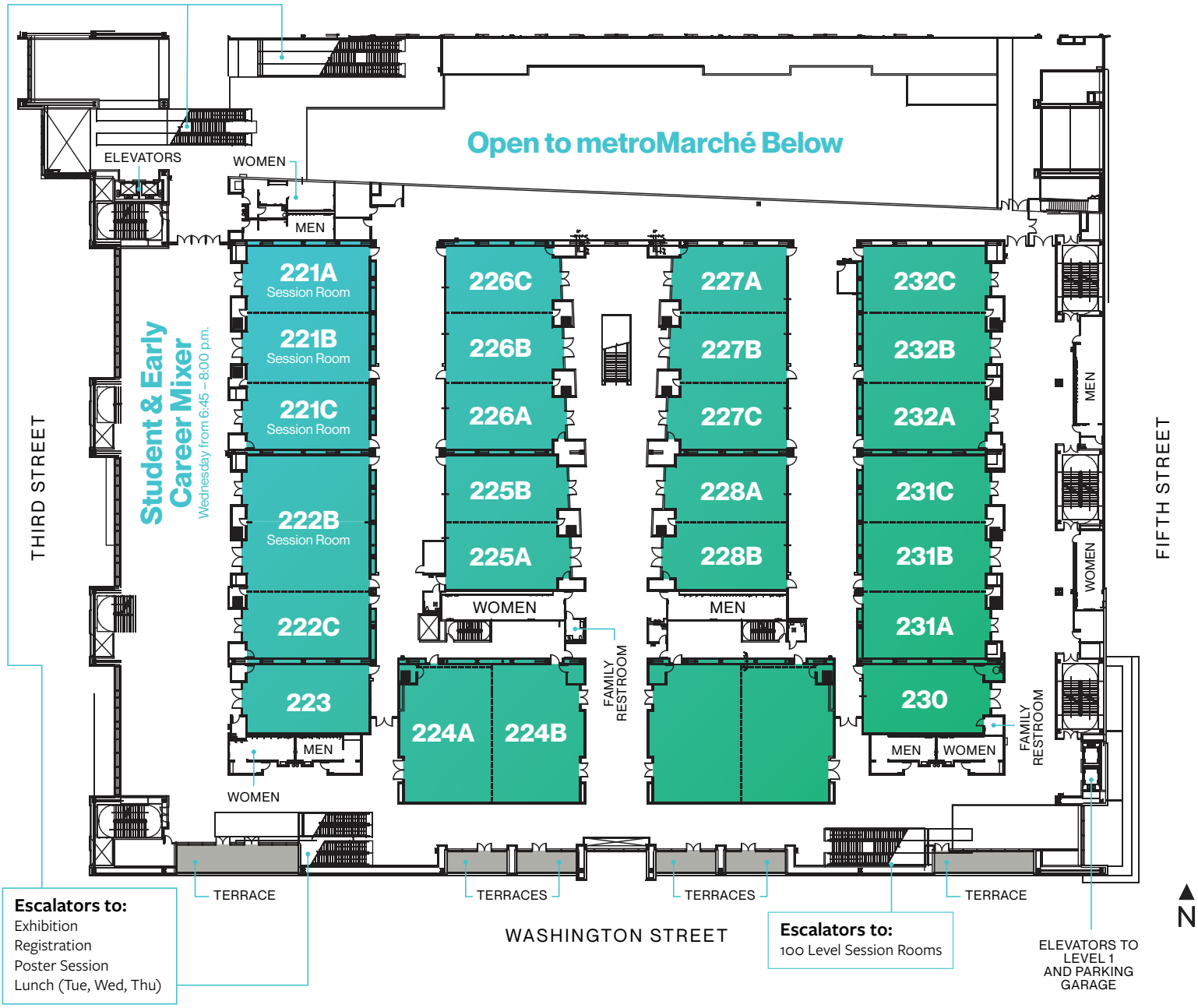
North Building | 100 Level (Street Level)

NORTH BALLROOM & MEETING ROOMS
PHOENIX CONVENTION CENTER



North Building | 200 Level

MEETING ROOMS
PHOENIX CONVENTION CENTER

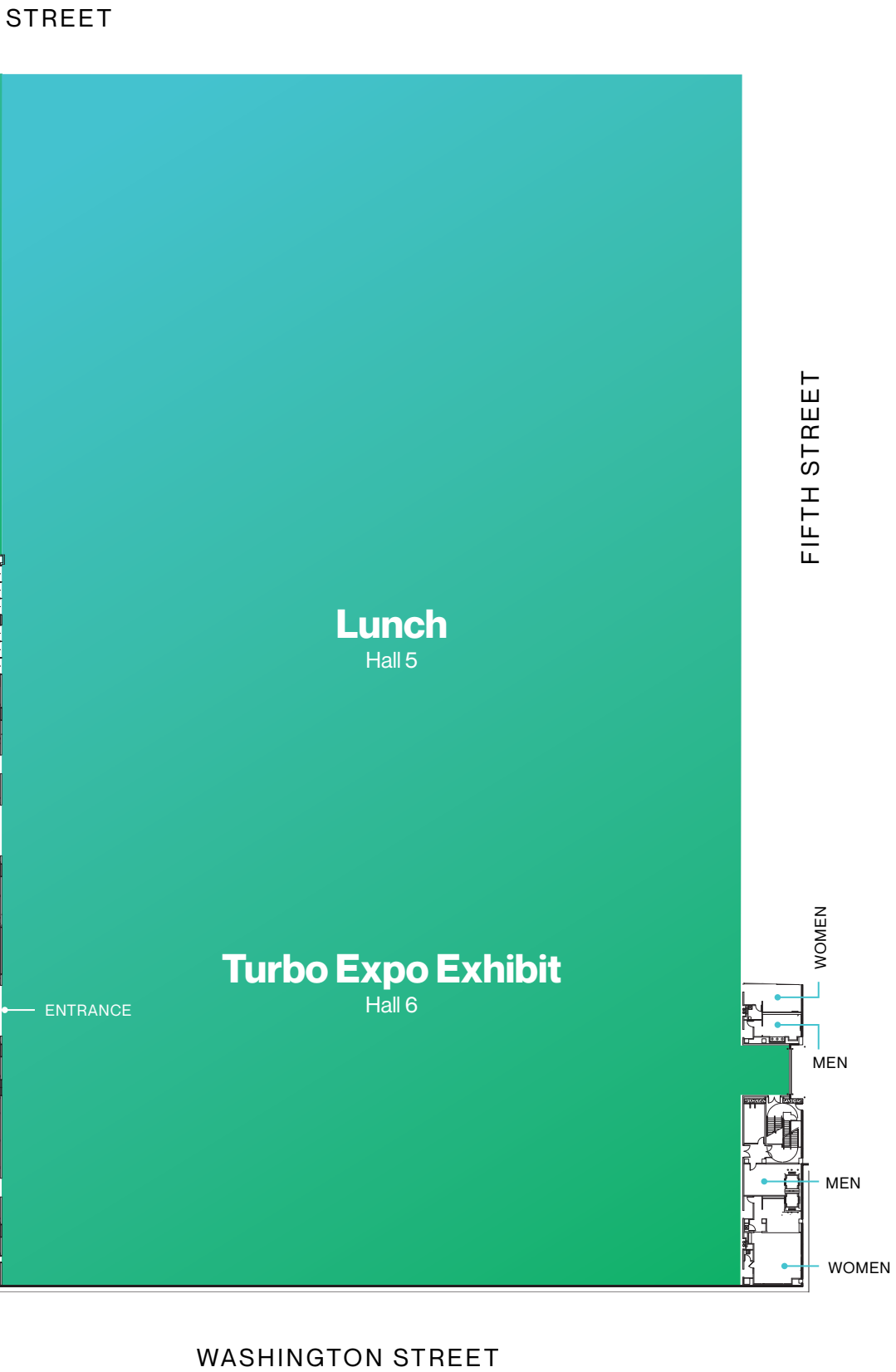


North Building | Exhibition Hall

LOWER LEVEL
PHOENIX CONVENTION CENTER

North Building | Exhibition Hall

LOWER LEVEL
PHOENIX CONVENTION CENTER



Ancillary Events

Altair's Lunch and Learn Session

Wednesday, June 19 from 12:30 - 2:30 pm
Thursday, June 20 from 12:30 - 1:30 pm
Room 101A, West Building, Phoenix Convention Center
Exit the North Building 3rd St. Main Entrance then cross 3rd St. to enter West Building.

Join our Lunch and Learn Sessions to discover Altair's Latest Innovation in Simulation Software.

Visit Booth 549 for more information

NUMECA's Lunch and Learn Session

Tuesday, June 18, 2019 at 12:45 pm
Room 101B, West Building, Phoenix Convention Center
Exit the North Building 3rd St. Main Entrance then cross 3rd St. to enter West Building.

You are invited to attend NUMECA's Lunch & Learn Session. During this free lunch, our technical experts will provide you with a detailed overview of our brand new solutions for turbomachinery design and analysis.

Visit Booth 519 for more information

SoftInWay's Lunch and Learn Session

Wednesday, June 19 from 12:30 - 2:30 pm
Room 101B, West Building, Phoenix Convention Center
Exit the North Building 3rd St. Main Entrance then cross 3rd St. to enter West Building.

During this seminar, one of SoftInWay's expert engineers will lead attendees through best practices for integrating and automating thermodynamic cycles, aerodynamic design, rotor dynamics, secondary system modeling, CAD and more using AxSTREAM®.

Visit Booth 526 for more information

Technical Tours

THIS TOUR IS FULL

Honeywell

THE POWER OF CONNECTED

Honeywell Aerospace, Phoenix Engines Facility

Wednesday, June 19, 2019
8:00 - 11:00 am (includes travel time)

Honeywell's Engines assembly & test facility is located on an approximately 60-acre campus adjacent to Phoenix's Sky Harbor International Airport. At this location, Honeywell designs and manufactures propulsion engines and auxiliary power units for a variety of commercial and military applications.

These include:

- Turbofan engines for business aviation and regional airline aircraft.
- Turboshaft engines for helicopter applications, with power ranging from 650 to 4500 shaft horsepower.
- Auxiliary Power Units (APUs) which supply from 40 up to 1400 equivalent shaft horsepower for all types of ground and airborne products.

Throughout its history, Honeywell's Power System's business has shipped over 125,000 propulsion systems and auxiliary power units to the market from this facility. The tour will include visits to an engine assembly area, a turbofan engine test cell, an additive manufacturing facility, and the Honeywell flight line.

Visit us in Booth 355

SRP

SALT RIVER PROJECT

Salt River Project (SRP), Santan Power Generating Facility

Tuesday, June 18, 2019 and Wednesday, June 19th, 2019
1:00 - 4:30 pm (includes travel time)

The Santan Generating Station was first constructed during the 1973-74 time frame to provide backup generating for the Salt River Project's portion of a large coat fired station being constructed in northern Arizona. It provided 288 MW of fast start generation using fuel oil since natural gas fuel was not available at that time.

The plant consisted for 4 each GE Frame 7B gas turbines, 4 each generators, 4 each steam turbines and 4 each waste heat steam generators (HRSGs). Each of the 4 units was on a single shaft, with a gas turbine and a steam turbine attached to either end of each generator. These were the first Frame 7B turbines built using this single shaft configuration by the General Electric Company.

The gas turbines have since been through several upgrades to the combustion systems, hot gas paths and compressors. Units 5 and 6 were constructed during the 2005-2006 time frame and added an additional 850 MW output to the plant. These units consisted of 3 each GE Frame 7FA gas turbines, 3 each Alstom HRSGs and GE D-11 steam turbines. These units were added to provided additional generation for peak summer loads. This plant tour will provide a good cross section of the combined cycle equipment that the General Electric Company has provided in the past.

Tutorials of Basics & Joint Sessions

Tutorials of Basics

CYCLE INNOVATIONS

TC-6-15, Simulation of Gas Turbine Dynamic Behavior at Design, Off-Design and Adverse Dynamic Operation Conditions (*Room 221-B*)
ThC-6-12 Part A, Introduction to Dynamic Analysis and Hybridisation of Plant Systems (*Room 221-B*)
ThD-6-12 Part B, Introduction to Dynamic Analysis and Hybridisation of Plant Systems, (*Room 221-B*)
ThB-6-14, Overview of Grid-Scale Energy Storage Systems and Technologies (*Room 221-B*)

ELECTRIC POWER

ThA-8-1, History, Challenges and Opportunities for Gas Turbines (*Room 131-A*)

HEAT TRANSFER

MA-14-2, Tutorial of Basics II: Conjugate Heat Transfer methodologies for GT Combustor Aerothermal Investigation (*Room 132-AB*)
MB-14-1, Tutorial of Basics I: Turbine Cooling Fundamentals (*Room 132-AB*)

OIL & GAS APPLICATIONS

MA-27-13, Oil and Gas Applications (*Room 130*)
WA-27-12, Industrial Gas Turbines - An Introduction, (*Room 130*)
WC-27-14, Thrust Management 101: Analysis, Balance and Monitoring (*Room 130*)
WD-27-15, Basics of Rotordynamics Instrumentation and Data Acquisition (*Room 130*)
ThA-27-16, Dry Gas Seals and Panels: Design, Operation, and Maintenance Techniques for Improved Reliability (*Room 130*)
FB-27-17, Compressor Dynamics, (*Room 130*)

STEAM TURBINES

ThA-29-2, Steam Turbines Tutorial (*Room 127-A*)

MANUFACTURING MATERIALS & METALLURGY

TA-24-10, Narrow and Wide Gap Diffusion Braze Repair Technology including Applications (*Room 121-C*)
MC-24-11, Turbomachinery Manufacturing in a Digital Environment (*Room 121-C*)

MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES

WC-26-12, Introduction to Gas Bearings for Oil-Free Turbomachinery Part A (*Room 221-A*)
WD-26-12, Introduction to Gas Bearings for Oil-Free Turbomachinery Part B (*Room 221-A*)

Joint Sessions

CYCLE INNOVATIONS WITH ELECTRIC POWER

ThB-6-14, Overview of Grid-Scale Energy Storage Systems and Technologies (*Room 221-B*)
TD-6-16, Future of Power Systems (*Room 221-B*)

HEAT TRANSFER AND TURBOMACHINERY

TB-15-1, Hot Gas Ingestion: Ingress/Egress I (*Room 131-B*)
TC-15-2, Hot Gas Ingestion: Ingress/Egress II (*Room 131-B*)
WA-15-6, Miscellaneous (*Room 131-B*)
WB-15-3, Rotor Disk and Cavity (*Room 131-B*)
FB-15-5, Seals and Rigs (*Room 131-B*)

HEAT TRANSFER AND COMBUSTION, FUELS & EMISSIONS

ThC-17-2, Combustor Liner Cooling I (*Room 131-C*)
ThD-17-3, Combustor Cooling (*Room 131-C*)

MANUFACTURING MATERIALS & METALLURGY WITH CERAMICS

WC-24-8, Thermal Barrier Coatings I (*Room 121-C*)
ThA-24-9, Thermal Barrier Coatings II (*Room 121-C*)

ELECTRIC POWER WITH OIL & GAS

WD-8-6, Voice of the Customer, Part B (*Room 131-A*)

ASME 2018 Turbo Expo Best Papers Available Open Access

A new initiative launching this year is to Open the Access to the awarded 2018 Turbo Expo papers. Each paper granted the Best Paper Award by the Technical Committees from last year's Turbo Expo will be made freely available during the 2019 conference. The papers will be accessible via the ASME Digital Collection (**asmedigitalcollection.asme.org**), and more detailed information will be communicated during the 2019 conference. Additionally, the manuscripts will be bundled in a single entity as well, entitled 'ASME Turbo Expo 2018 Best Paper Awards Compendium', also available via the same platform.

Open access publishing has been rapidly evolving over the past years, offering the global community increased accessibility to published technical resources. With this effort, the ASME Gas Turbine Segment and IGTI envision to enable wider dissemination of the top Turbo Expo papers, broaden the target audience, further reward the researchers for their exceptional contribution, and encourage future authors to select their high-quality work for the Turbo Expo conference.

Enjoy the read!

Turbo Expo Pre-Conference Workshop Instructor

Thanks for sharing your knowledge, skills and time with all the engineers attending this year's ASME Turbo Expo Pre-Conference workshop.

Physics-Based Modeling of Gas Turbine Secondary Air Systems

Dr. Bijay (BJ) K. Sultanian
Ph.D., PE, MBA, ASME Fellow
Founder & Managing Member,
Takaniki Communications, LLC
Oviedo, Florida, USA;
Adjunct Professor,
University of Central Florida

Advanced Manufacturing & Repair for Gas Turbines (AMRGT)

ASME INTERNATIONAL GAS TURBINE INSTITUTE

"IMPROVING GAS TURBINE DESIGN AND REPAIR THROUGH ADVANCED MANUFACTURING"

EPRI Conference Center
Charlotte, North Carolina
March 3-4, 2020

Turbo Expo Session Schedule

SESSION ID KEY

The Session ID is comprised of the day code and the original session number from the conference web tool.

- Consult pages 66-208 for the detailed Technical Conference session schedule.
- All Tutorials of Basics sessions are listed on page 62.
- All sessions are conducted in English.
- Sessions are held at the Phoenix Convention Center.

MA - Monday, June 17	**8:00 – 10:00 a.m.**
MB - Monday, June 17	**2:00 – 3:30 p.m.**
MC - Monday, June 17	**4:00 – 5:30 p.m.**
TA - Tuesday, June 18	**8:00 – 9:30 a.m.**
TB - Tuesday, June 18	**11: 15 a.m. – 12:45 p.m.**
TC - Tuesday, June 18	**2:00 – 3:30 p.m.**
TD - Tuesday, June 18	**4:00 – 5:30 p.m.**
WA - Wednesday, June 19	**8:00 – 9:30 a.m.**
WB - Wednesday, June 19	**11: 15 a.m. – 12:45 p.m.**
WC - Wednesday, June 19	**2:00 – 3:30 p.m.**
WD - Wednesday, June 19	**4:00 – 5:30 p.m.**
ThA - Thursday, June 20	**8:00 – 10:00 a.m.**
ThB - Thursday, June 20	**10:15 a.m. – 12:15 p.m.**
ThC - Thursday, June 20	**2:00 – 3:30 p.m.**
ThD - Thursday, June 20	**4:00 – 5:30 p.m.**
FA - Friday, June 21	**8:00 – 10:00 a.m.**
FB - Friday, June 21	**10:15 a.m. – 12:45 p.m.**

Sessions are detailed vertically. The top rows contain general information, and the bottom rows list the organizer and paper details. The name of the presenting author is underlined. Presentation start times are noted to the left.

Column Detail

COMMITTEE NAME

Session Title

Session Type • Room • Session ID

Session Chair, Affiliation
Session Co-Chair, Affiliation

Presentation Time

ASME Paper Number
Paper Title
FirstAuthor Name[1] SecondAuthor Name[2] ThirdAuthor Name[1]
1. First Affiliation; 2. Second Affiliation

Example

CYCLE INNOVATIONS

Innovative Power Cycles

Technical Session • 221-B • MA-6-6

Session Organizer: **Majed Sammak**, GE Power
Session Co-Organizer: **Nana Zhou**, U.S. Department of Energy, National Energy Technology Laboratory

8:00

GT2019:90767
Investigation of a Combined Inverted Brayton and Rankine Cycle
Ian J. Kennedy[1] Tomasz Duda[1] Zheng Liu[1] Bob Ceen[2] Andy Jones[3] Colin D. Copeland[1]
1. University of Bath, United Kingdom;
2. Axes Design Ltd, United Kingdom; 3. HiETA Technologies Ltd, United Kingdom

8:30

GT2019:91036
Techno-Economic Comparative Analysis of Innovative Combined Cycle Power Plant Layouts Integrated With Heat Pumps and Thermal Energy Storage
Rafael Guédez[1] Jose Garcia[1] Antti Nuutinen[1] Giovanni Graziano[1] Justin Chiu[1] Alessandro Sorce[2] Luca Piantelli[3] Alberto Traverso[2] Björn Laumert[1]
1. KTH Royal Institute of Technology, Sweden;
2. University of Genoa, Italy; 3. IREN s.p.a, Italy

MONDAY JUNE 17 — 08:00 AM - 10:00 AM

	AIRCRAFT ENGINE	COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS	COMBUSTION, FUELS & EMISSIONS
	Thermal Management Systems and Aero-engine Oil Systems	**Biomass and Coal I**	**Combustion Dynamics: Flame-to-Flame Interaction**
	Technical Session • 124-A • MA-1-4	**Technical Session • 131-A • MA-3-5**	**Technical Session • 121-AB • MA-4-21**
	Session Organizer: **Brian Nicholson**, Air Force Research Laboratory Session Co-Organizer: **Guillermo Paniagua**, Purdue University	Session Organizer: **Marina Braun-Unkhoff**, DLR, Institute of Combustion Technology Session Co-Organizer: **Jeff Bergthorson**, McGill University	Session Organizer: **Janith Samarasinghe**, GE Global Research Session Co-Organizer: **Kyu Tae Kim**, Korea Advanced Institute of Science and Technology
8:00	**GT2019-90320** **Flow Characteristics in Aeroengine Bearing Chambers With Shallow Sump** Budi W. Chandra[1] Kathy Simmons[2] *1. University of the West of England, United Kingdom; 2. University of Nottingham, United Kingdom*	**GT2019-90196** **Solid Biomass to Medium CV Gas Conversion With Rich Combustion** Gordon E. Andrews[1] Aysha Irshad[2] Herodotos Phylaktou[1] Bernard Gibbs[1] *1. University of Leeds, United Kingdom; 2. University of Engineering and Technology, Pakistan*	**GT2019-90339** **Numerical Investigation of Ignition Sequence in a Multi-Burner Methane-Air Swirl Combustor Using Flamelet Generated Manifold Combustion Model** Pravin Nakod[1] Sourabh Shrivastava[1] Saurabh Patwardhan[1] Stefano Orsino[2] Rakesh Yadav[2] *1. ANSYS Inc., India; 2. ANSYS Inc., USA*
8:30	**GT2019-90347** **Numerical Investigation of Two Phase Flow in a Dual Drive Booster (DDB)** Arun Prabhakar, Stephen Ambrose, Hervé Morvan *University of Nottingham, United Kingdom*	**GT2019-90576** **Development of a High-Pressure Hot-Corrosion Burner Rig for Testing Structural Materials Following Long Exposures to Arabian Extra Light Crude Oil Combustion Products** Saumitra Saxena[1] Krishna Shesha Giri[2] John McIntosh[1] Ziad Dawood[1] Andrew Maloney[1] Ronan Carolan[1] Hatsari Mitsudharmadi[1] Aiping Chen[1] William L. Roberts[1] Bassam Mohammad[3] Paul Glaser[4] Jeffrey Goldmeer[5] *1. King Abdullah University of Science and Technology, Saudi Arabia; 2. Indian Institute of Technology, India; 3. GE Global Research, USA; 4. GE Power, USA; 5. GE Energy, USA*	**GT2019-90679** **On the Interaction of Swirling Flames in a Lean Premixed Combustor** R. Gopakumar, Dutta Ankit, D Harish, Swetaprovo Chaudhuri *Indian Institute of Science, India*
9:00	**GT2019-90764** **Modelling of Spur Gear Friction and Gear Teeth Thermal Scenario in Mixed-Lubrication** Pietro Molesini, Miriam Manzoni, Saypen Baraggia Au Yeung, Fabio De Bellis *GE Avio, Italy*	**GT2019-90663** **Spray Flame Characteristics of Bio-Derived Fuels in a Simulated Gas Turbine Burner** Heena Panchasara[1] Pankaj Kolhe[2] Ajay Agrawal[3] *1. Central Queensland University, Australia; 2. IIT Hyderabad, India; 3. University of Alabama, USA*	**GT2019-91152** **Effects of Fuel Staging on the Hydrodynamic Stability of Multi Nozzle Swirl Flows** Saarthak Gupta, Kiran Manoharan, Santosh Hemchandra *Indian Institute of Science, India*
9:30	**GT2019-91309** **Load Independent Losses of an Aeroengine Epicyclic Power Gear Train: Numerical Investigation** Cosimo Bianchini[1] Riccardo Da Soghe[1] Lorenzo Giannini[1] Tommaso Fondelli[2] Daniele Massini[2] Bruno Facchini[2] Jacopo D'Errico[1] *1. Ergon Research, Italy; 2. University of Florence, Italy*		**GT2019-91656** **Flame Edge Dynamics and Interaction in a Multi-Nozzle Can Combustor With Fuel Staging** Daniel Doleiden[1] Wyatt Culler[2] Ankit Tyagi[1] Stephen Peluso[1] Jacqueline O'Connor[1] *1. Pennsylvania State University, USA; 2. Honeywell Thermal Solution, USA*

MONDAY JUNE 17 — 08:00 AM - 10:00 AM

	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS	CONTROLS, DIAGNOSTICS & INSTRUMENTATION
	Combustion Dynamics: Annular & Can-Annular Systems	**Combustion Fundamentals Tutorial**	**Topics in Controls**
	Technical Session • 122-A • MA-4-28	**Tutorial Session • 122-BC • MA-4-38**	**Technical Session • 222-B • MA-5-1**
	Session Organizer: **Jonas Moeck**, Norwegian University of Science and Technology Session Co-Organizer: **Owen Graham**, GE Global Research	Session Organizer: **Timothy C. Lieuwen**, Georgia Institute of Technology Session Co-Organizer: **Mike Klassen**, Combustion Science & Engineering, Inc.	Session Organizer: **Syed Khalid**, Gas Turbine Systems Solutions LLC Session Co-Organizer: **Jeffrey Simmons**, Pratt & Whitney
8:00	**GT2019-90327** **Heavy Duty Gas Turbine Combustion Dynamics Study Using a Two-Can Combustion System** Krishna Venkatesan[1] Arin Cross[2] Changjin Yoon[1] Fei Han[1] Sven Bethke[3] *1. GE Global Research Center, USA; 2. General Electric, USA; 3. GE Power, USA*	**GT2019-92068** **Combustion Fundamentals** Timothy C. Lieuwen[1] Mike Klassen[2] *1. Georgia Institute of Technology, USA;* *2. Combustion Science & Engineering, Inc., USA* **GT2019-92068** **Combustion Fundamentals** Timothy C. Lieuwen *1Georgia Institute of Technology, USA;*	**GT2019-90116** **Two Degree-of-Freedom – Synthesis Control With Kalman Filter for Flight Environment Simulation Volume With Sensors Uncertainty** Meiyin Zhu, Xi Wang, Shubo Yang, Huairong Chen, Keqiang Miao, Nannan Gu *Beihang University, China*
8:30	**GT2019-90546** **Effect of Noise and Nonlinearities on Thermoacoustics of Can-Annular Combustors** Giulio Ghirardo[1] Jonas Moeck[2] Mirko Bothien[1] *1. Ansaldo Energia Switzerland, Switzerland;* *2. Norwegian University of Science and Technology, Norway*	**T U T O R I A L**	**GT2019-90429** **Design of Control Laws Based on Inverted Decoupling and LMI for a Turboprop Engine** Huairong Chen, Xi Wang, Meiyin Zhu, Nannan Gu, Shubo Yang *Beihang University, China*
9:00	**GT2019-90793** **Analysis of the Self-Excited Dynamics of a Heavy-Duty Annular Combustion Chamber by Large-Eddy Simulation** Vittorio Michelassi[1] Roberto Meloni[2] Giovanni Riccio[2] Gianni Ceccherini[2] *1. General Electric, Italy; 2. Baker Hughes, a GE Company, Italy*		**GT2019-90118** **The Design of Predictive Controller for Aero-Engine Based on Self-Tuning Model** Zhimin Wang, Xian Du, Yanhua Ma, Ximing Sun *Dalian University of Technology, China*
9:30	**GT2019-91604** **Time Domain Bloch Boundary Conditions for Efficient Simulation of Thermoacoustic Limit-Cycles in (Can-) Annular Combustors** Matthias Haeringer, Wolfgang Polifke *Technical University of Munich, Germany*		**GT2019-90558** **Novel Method to Predict Non-Measured Parameters of Industrial Gas Turbines Using Kalman Filter Technique** Jae Hong Lee[1] Tong Seop Kim[1] Do Won Kang[2] Jeong Lak Sohn[2] Jungho Lee[2] *1. Inha University, Korea; 2. Korea Institute of Machinery and Materials, Korea*

MONDAY JUNE 17 — 08:00 AM - 10:00 AM

	CYCLE INNOVATIONS	HEAT TRANSFER: CONJUGATE HEAT TRANSFER	HEAT TRANSFER: NUMERICAL INTERNAL COOLING
	Innovative Power Cycles	**Conjugate Heat Transfer I**	**Numerical Internal Cooling I**
	Technical Session • 221-B • MA-6-6	**Technical Session • 131-C • MA-10-1**	**Technical Session • 131-B • MA-11-1**
	Session Organizer: **Majed Sammak**, GE Power Session Co-Organizer: **Nana Zhou**, U.S. Department of Energy, National Energy Technology Laboratory	Session Organizer: **Gregory Laskowski**, GE Global Research Session Co-Organizer: **James Kopriva**, Dassault Systemes	Session Organizer: **Sung in Kim**, Queen's University Belfast
8:00	**GT2019-90767** **Investigation of a Combined Inverted Brayton and Rankine Cycle** Ian J. Kennedy[1] Tomasz Duda[1] Zheng Liu[1] Bob Ceen[2] Andy Jones[3] Colin D. Copeland[1] *1. University of Bath, United Kingdom;* *2. Axes Design Ltd, United Kingdom;* *3. HiETA Technologies Ltd, United Kingdom*	**GT2019-90397** **LES-Conjugate Heat Transfer Analysis of a Ribbed Cooling Passage Using the Immersed Boundary Method** Tae Kyung Oh[1] Danesh Tafti[1] Krishnamurthy Nagendra[2] *1. Virginia Tech, USA; 2. Exa Corporation, USA*	**GT2019-90069** **Investigation on the Internal Cooling of Two-Passage Channels With Parallel Ribs and Guide Vanes** Ryo Amano, Mandana S. Saravani, Nicholas DiPasquale *University of Wisconsin-Milwaukee, USA*
8:30	**GT2019-91036** **Techno-Economic Comparative Analysis of Innovative Combined Cycle Power Plant Layouts Integrated With Heat Pumps and Thermal Energy Storage** Rafael Guédez[1] Jose Garcia[1] Antti Nuutinen[1] Giovanni Graziano[1] Justin Chiu[1] Alessandro Sorce[2] Luca Piantelli[3] Alberto Traverso[2] Björn Laumert[1] *1. KTH Royal Institute of Technology, Sweden;* *2. University of Genoa, Italy; 3. IREN s.p.a, Italy*	**GT2019-90999** **A Computational Technique to Evaluate the Relative Influence of Internal and External Cooling on Overall Effectiveness** Carol Bryant[1] James L. Rutledge[2] *1. Air Force Research Laboratory, USA;* *2. Air Force Institute of Technology, USA*	**GT2019-90143** **Numerical Study on Heat Transfer and Flow Characteristics in Double Turning Areas Ribbed Serpentine Channel With Lateral Outflow** Bo-lun Zhang, Hui-ren Zhu, Tao Guo, Chun-Yi Yao, Zhong-Yi Fu *Northwestern Polytechnical University, China*
9:00	**GT2019-91534** **Second Law Analysis of an Energy Storage System Consisting of an Electrolysis Plant and the Graz Cycle With Internal H2/O2 Combustion** Simeon Dybe, Tom Tanneberger, Panagiotis Stathopoulos *Technical University of Berlin, Germany*	**GT2019-90705** **Experimental Study on Analogy Principle of Overall Cooling Effectiveness for Composite Cooling Structures With Both Internal Cooling and Film Cooling** Gang Xie[1] Cunliang Liu[2] Rui Wang[2] Lin Ye[2] Jiajia Niu[2] *1. Beihang University, China; 2. Northwestern Polytechnical University, China*	**GT2019-90211** **Heat Transfer Enhancement for Gas Turbine Blade Leading Edge Cooling Using Curved Double-Wall/Vortex Cooling With Various Disturbing Objects** Xiaojun Fan, Liang Li, Jiefeng Wang, Fan Wu *Xi'an Jiaotong University, China*
9:30	**GT2019-91789** **Multi Objective Optimization of Flexible Supercritical CO2 Coal-Fired Power Plants** Dario Alfani, Marco Astolfi, Marco Binotti, Stefano Campanari, Francesco Casella, Paolo Silva *Politecnico di Milano, Italy*	**GT2019-90730** **Predictions of Impingement Heat Transfer With Dimples, Pin-Fins and Zig-Zag Rib Obstacles: Conjugate Heat Transfer Computational Fluid Dynamics Predictions** Abubakar M. El-Jummah[1] Gordon E. Andrews[2] John E. J. Staggs[2] *1. University of Maiduguri, Nigeria; 2. University of Leeds, United Kingdom*	**GT2019-90830** **Research on the Effects of Dimples and Protrusions on Flow and Heat Transfer in Matrix Cooling Channels in Turbine Blades** Yigang Luan[1] Lianfeng Yang[1] Yue Yin[1] Pietro Zunino[2] *1. Harbin Engineering University, China;* *2. University of Genoa, Italy*

MONDAY JUNE 17 — 08:00 AM - 10:00 AM

	HEAT TRANSFER: TUTORIALS	INDUSTRIAL & COGENERATION	MANUFACTURING MATERIALS & METALLURGY
	Conjugate Heat Transfer methodologies for GT Combustor Aerothermal Investigation	**Design and Evaluation Considerations of Waste Heat Recovery Technologies**	**Subtractive Manufacturing**
	Tutorial Session • 132-AB • MA-14-2	**Tutorial Session • 221-C • MA-23-11**	**Panel Session • 121-C • MA-24-6**
	Session Organizer: **Andrew Nix**, West Virginia University	Session Organizer: **Clement Joly**, Softinway, Inc Session Co-Organizer: **Abdul Nassar**, Softinway Turbomachinery Solutions Pvt Ltd	Session Organizer: **Joseph Janssen**, Metem Corp Session Co-Organizer: **Sascha Gierlings**, Fraunhofer IPT
8:00	**GT2019-92139** **Conjugate Heat Transfer Modelling: Review and Applications** Antonio Andreini[1] Florent Duchaine[2] Catalin Fotache[3] *1. University of Florence, Italy; 2. CERFACS, France; 3. United Technologies Research Center, USA*	**GT2019-92141** **Design and Evaluation Considerations of Waste Heat Recovery Systems** Clement Joly[1] Abdul Nassar[2] *1. Softinway, Inc, USA; 2. Softinway Turbomachinery Solutions Pvt Ltd, India*	**GT2019-92331** **Final Machining of Complex Geometries Using Best Fits of Actual Parts** Kenneth Morgan *Integrated Inspection Systems, USA* **GT2019-92332** **Traditional Hot Gas Path Manufacturing in the Additive Age** Blake Fulton *GE - Advanced Manufacturing Works, USA*
8:30	T U T O R I A L	T U T O R I A L	**GT2019-92333** **Cooling Hole Machining in an Additive Manufacturing World** Lucas Guarino *Metem - A GE Power Business, USA* **GT2019-92336** **Innovative Techniques for Investment Casting IGT Components** Steve Rauch *FLC Flowcasting GmbH, Germany*
9:00			P A N E L
9:30			

MONDAY JUNE 17 — 08:00 AM - 10:00 AM

	MARINE	OIL & GAS APPLICATIONS	STEAM TURBINES
	Design, Development & Applications	**Oil and Gas Applications**	**Last Stage Blades II**
	Technical Session • 221-A • MA-25-1	**Tutorial Session • Room 130 • MA-27-13**	**Technical Session • 127-A • MA-29-4**
	Session Organizer: **Morgan Hendry**, SSS Clutch Company, Inc Session Co-Organizer: **Jeffrey Patterson**, Naval Surface Warfare Center - Philadelphia Division	Session Organizer: **Rainer Kurz**, Solar Turbines Session Co-Organizer: **Klaus Brun**, Elliott Group	Session Organizer: **Shigeki Senoo**, Mitsubishi Heavy Industries, Ltd. Session Co-Organizer: **Fabian F. Müller**, ITSM University of Stuttgart
8:00	**GT2019-91738** **Aerodynamic and Structural Design of a Centrifugal Fan for an Air Cushion Vehicle** Benjamin Cameron[1] Eric Grald[1] Thomas Conboy[1] Christian Passow[1] Nicholas Kattamis[1] Daniel George[2] Joseph Bray[3] Robert Cole[3] *1. Creare LLC, USA; 2. Concurrent Technologies Corporation, USA; 3. Naval Surface Warfare Center, USA*	**GT2019-90022** **Oil and Gas Applications** Rainer Kurz[1] Klaus Brun[2] Bernhard Winkelmann[1] *1. Solar Turbines Inc., USA; 2. Elliott Group, USA*	**GT2019-91815** **Experimental and Numerical Assessment of the Impact of Part-Span Connectors on Turbine Efficiency and Flow Field** Christoph Brüggemann[1] Markus Schatz[1] Damian Vogt[2] Frederik Popig[3] *1. ITSM, University of Stuttgart, Germany; 2. University of Stuttgart, Germany; 3. Siemens AG Power and Gas Division, Germany*
8:30	**GT2019-91992** **Design and Maintenance Issues of Being Able to Repair Marine Gas Turbines Without Removal From the Ship** Bruce Thompson[1] John Hartranft[2] Dan Groghan[3] *1. U. S. Navy, USA; 2. Naval Sea Systems Command, USA; 3. BAI, USA*	**T U T O R I A L**	**GT2019-91128** **Improvement of Steam Turbine Blade Foil With Biomimetic Design and its Influence on Aerodynamic Performance** Fan Wu[1] Danmei Xie[2] Jing Zhang[2] Hengliang Zhang[1] Wang Chun[2] *1. Key Laboratory of Hydraulic Machinery Transients (MOE), Wuhan University, China; 2. Wuhan University, China*
9:00	**GT2019-91873** **Advantages and Experience of Using SSS (Synchro-Self-Shifting) Clutches in Hybrid Propulsion Such As CODELOG or CODELAG Naval Marine Systems** Morgan Hendry[1] Nicholas Bellamy[2] *1. SSS Clutch Company, Inc, USA; 2. SSS Gears Limited, United Kingdom*		**GT2019-90391** **Numerical Investigation of the Influence of Flow Deflection at the Upper Hood on Performance of Low Pressure Steam Turbine Exhaust Hoods** Dickson Munyoki[1] Markus Schatz[2] Damian Vogt[1] *1. University of Stuttgart, Germany; 2. ITSM, University of Stuttgart, Germany*
9:30	**GT2019-90111** **The Increasing Complexity of Corrosion in Gas Turbines** David Shifler *Office of Naval Research, USA*		**GT2019-90640** **Experimental and Numerical Investigations of Steam Turbine Exhaust Hood Flow Field With Two Types of Diffusers** Soichiro Tabata[1] Hisataka Fukushima[1] Kiyoshi Segawa[1] Koji Ishibashi[1] Yoshihiro Kuwamura[2] Hideaki Sugishita[2] *1. Mitsubishi Hitachi Power Systems, Ltd., Japan; 2. Mitsubishi Heavy Industries Ltd., Japan*

MONDAY JUNE 17 — 08:00 AM - 10:00 AM

	STRUCTURES & DYNAMICS: FATIGUE, FRACTURE & LIFE PREDICTION	STRUCTURES & DYNAMICS: PROBABILISTIC METHODS	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS
	Lifetime Prediction Methods	**Application Challenges in Probabilistic Methods**	**Seals 1**
	Technical Session • 128-A • MA-31-1	**Technical Session • 128-B • MA-32-2**	**Technical Session • 129-AB • MA-34-16**
	Session Organizer: **Scott Keller**, Power Systems Mfg., LLC. Session Co-Organizer: **Casey Holycross**, Air Force Research Laboratory	Session Organizer: **Kai Kadau**, Siemens Session Co-Organizer: **Mark Andrews**, SmartUQ	Session Organizer: **Min Zhang**, Praxair Inc.
8:00	**GT2019-90717** **Experimental Investigation on the Creep and Low Cycle Fatigue Behaviors of a Serviced Turbine Blade** Zhenlei Li[1] Duoqi Shi[1] Xiaoguang Yang[1] Nina Li[2] *1. Beihang University, China; 2. AECC Guiyang Engine Design Institute, China*	**GT2019-91652** **Point Cloud to Parameter: An Inverse Geometric Approach to Probabilistic Design** Christopher Meckstroth[1] Jeff Brown[2] *1. University of Dayton Research Institute, USA; 2. US Air Force Research Laboratory, USA*	**GT2019-90059** **A Novel Bulk-Flow Model for Pocket Damper Seals** Filippo Cangioli[1] Giuseppe Vannini[2] Thomas Chirathadam[3] *1. Waukesha Bearing Corporation, United Kingdom; 2. Baker Hughes, a GE company, Italy; 3. Bearings Plus, Waukesha Bearings, USA*
8:30	**GT2019-91804** **An Approach to Identify Bounding Damage Locations for Condition Based Structural Integrity Assessments of Gas Turbine Components** Richard Green[1] Jonathan Douglas[2] Andrew Moffat[2] Brent Scaletta[3] *1. Solar Turbines, USA; 2. Frazer-Nash Consultancy Ltd, United Kingdom; 3. Solar Turbines Inc., USA*	**GT2019-90624** **Stochastic Fatigue Life Prediction Based on a Reduced Data Set** Dino Celli[1] Mo-How Shen[1] Onome Scott-Emuakpor[2] Casey Holycross[2] Tommy George[3] *1. The Ohio State University, USA; 2. Air Force Research Laboratory, USA; 3. US Air Force, USA*	**GT2019-90331** **Leakage and Dynamic Force Coefficients of a Pocket Damper Seal Operating Under a Wet Gas Condition: Tests vs. Predictions** Jing Yang, Luis San Andres, Xueliang Lu *Texas A&M University, USA*
9:00	**GT2019-90625** **Application of the Wilshire Stress-Rupture and Minimum-Creep-Strain-Rate Prediction Models for Alloy P91 in Tube, Plate and Pipe Form** Jaime Cano, Calvin Stewart *University of Texas at El Paso, USA*	**GT2019-91230** **Bayesian Analysis of In-Situ High-Resolution X-Ray Diffraction Synchrotron Experiments of Ti-6Al-4V Specimens Undergoing Tensile Loading** Nicholas Armstrong[1] Peter A. Lynch[2] Sitarama R. Kada[2] Pavel Cizek[2] Justin A. Kimpton[3] Ross A. Antoniou[1] *1. Defence Science and Technology, Australia; 2. Institute for Frontier Materials, Deakin University, Australia; 3. Australian Synchrotron (ANSTO), Australia*	**GT2019-90459** **Influence of Lubrication Oil on the Performance of Carbon Fibre Brush Seals for Aero-Engines Bearing Chambers** Bilal Outirba[1] Patrick Hendrick[2] *1. Université Libre de Bruxelles, Belgium; 2. Université Libre de Bruxelles - Dpt. of Aero-Thermo Mechanics, Belgium*
9:30	**GT2019-91137** **Assessment of Long Term Creep Using Strain Rate Matching From the Stepped Isostress Method** Robert Mach, Amanda Haynes, Calvin Stewart, Jacob Pellicotte *University of Texas at El Paso, USA*		

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	SUPERCRITICAL CO2 POWER CYCLES	TURBOMACHINERY: AXIAL FLOW FAN & COMPRESSOR AERODYNAMICS	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY
	Fundamentals of Supercritical CO2 Power Cycles	**Compressor Design - 1**	**Fan / Compressor Design Methods and Applications**
	Tutorial Session • 123 • MA-38-13	**Technical Session • 126-ABC • MA-39-1**	**Technical Session • 124-B • MA-41-3**
	Session Organizer: **Jason Wilkes**, Southwest Research Institute	Session Organizer: **Anthony Dickens**, Whittle Laboratory Session Co-Organizer: **Sameer Kulkarni**, NASA Glenn Research Center	Session Organizer: **Jaeho Choi**, Hanwha Aerospace Session Co-Organizer: **Peter Flassig**, Rolls-Royce Deutschland
8:00	**GT2019-92113** **Fundamentals of Supercritical CO2 Power Cycles** Jason Wilkes, Aaron Rimpel *Southwest Research Institute, USA*	**GT2019-90150** **Loss in Axial Compressor Bleed Systems** Sam Grimshaw[1] James Brind[1] Ryosuke Seki[2] Graham Pullan[3] *1. University of Cambridge, Whittle Laboratory, United Kingdom; 2. Mitsubishi Heavy Industries, Japan; 3. University of Cambridge, United Kingdom*	**GT2019-90257** **Conceptual Fan Design for Boundary Layer Ingestion** Maximilian Mennicken, Dirk Schönweitz, Markus Schnoes, Rainer Schnell *German Aerospace Center (DLR), Germany*
8:30	**TUTORIAL**	**GT2019-90465** **Study of High Pressure Compressor Performances in Windmilling Conditions by Three Complementary Approaches: Experiment, LBM and 1D Modeling** Michel Nocture[1] Yoann Méry[1] Javier Ruiz Domingo[1] Nicolas Rochuon[1] Benoît Bonnal[2] Emmanuel Vanoli[2] Pradeep Gopalakrishnan[3] Avinash Jammalamadaka[3] *1. Safran Aircraft Engines, France; 2. Dassault Systèmes, France; 3. Dassault Systèmes, USA*	**GT2019-90323** **Reduced-Order Model of Unsteady Flows in a Turbomachinery Fan Modeled Using a Novel Proper Orthogonal Decomposition** Elizabeth H. Krath[1] Forrest L. Carpenter[1] Paul Cizmas[1] David Johnston[2] *1. Texas A&M University, USA; 2. Air Force Research Laboratory, USA*
9:00		**GT2019-91181** **Design and Test of a Novel Highly-Loaded Compressor** Chengwu Yang[1] Ge Han[2] Shengfeng Zhao[1] Xingen Lu[2] Yanfeng Zhang[2] Ziliang Li[1] *1. Institute of Engineering Thermophysics, Chinese Academy of Sciences, China; 2. Key Laboratory of Light-duty Gas-turbine, Institute of Engineering Thermophysics, CAS, China*	**GT2019-90908** **High Pressure Compressor Aerodynamic Performance at Uncertain Boundary Conditions** Philip Magin[1] Florian Danner[1] Matthias Voigt[2] Ronald Mailach[2] *1. MTU Aero Engines, Germany; 2. Technische Universität Dresden, Germany*
9:30		**GT2019-91310** **Accuracy Assessment of Steady and Unsteady Multistage High Pressure Compressor Simulations** Sebastian Lück[1] Stefan Kuntzagk[2] Guido Doebbener[3] Andreas Kellersmann[1] Christoph Bode[1] Jens Friedrichs[4] *1. Technical University of Braunschweig, Germany; 2. Lufthansa Technik AG, Germany; 3. ANSYS Germany GmbH, Germany; 4. Technical University of Braunschweig Inst of Aircraft Propulsion & Turbomachinery, Germany*	**GT2019-91378** **New Methods for Secondary Flow Phenomena Visualization and Analysis** Mattia Straccia, Rodolfo Hofmann, Volker Guemmer *Technische Universität München, Germany*

MONDAY JUNE 17 — 08:00 AM - 10:00 AM

	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY	TURBOMACHINERY: RADIAL TURBOMACHINERY AERODYNAMICS	TURBOMACHINERY: RADIAL TURBOMACHINERY AERODYNAMICS
	Novel Solver and Simulation Framework (3)	**Radial and Mixed Flow Turbine Design**	**Centrifugal Compressors 4**
	Technical Session • 127-C • MA-41-22	**Technical Session • 125-AB • MA-44-1**	**Technical Session • 127-B • MA-44-5**
	Session Organizer: **Mahmoud Mansour**, Honeywell International Session Co-Organizer: **Raul Vazquez Diaz**, Rolls-Royce plc	Session Organizer: **Jason Walkingshaw**, BorgWarner Turbo Systems Engineering GmbH Session Co-Organizer: **Mingyang Yang**, Shanghai Jiao Tong University	Session Organizer: **Michele Marconcini**, University of Florence Session Co-Organizer: **Philipp Jenny**, MAN Diesel & Turbo Schweiz AG
8:00	**GT2019-91622** **On the Effect of Inflow Disturbances on the Flow Past a Linear LPT Vane Using Spectral/hp Element Methods** Andrea Cassinelli[1] Hui Xu[1] Francesco Montomoli[1] Paolo Adami[2] Raul Vazquez Diaz[3] Spencer Sherwin[1] *1. Imperial College London, United Kingdom; 2. Rolls-Royce Deutschland, United Kingdom; 3. Rolls-Royce plc, United Kingdom*	**GT2019-90070** **Turbocharger Turbine Rotor Design for Low U/C Values** Hua Chen[1] Y. C. Song[2] A. G. Gu[3] Y. F. Zhang[3] H. W. Li[3] *1. Marine Eng. College, Dalian Maritime University, China; 2. Dalian Maritime University, China; 3. Wuxi Cumminus Turbo Technologies, China*	**GT2019-90455** **Experimental and Numerical Investigation on the Flow in a Return Channel of Multistage Centrifugal Compressors** Bastian Dolle, Dieter Brillert, Hans Josef Dohmen, Friedrich-Karl Benra *University of Duisburg-Essen, Germany*
8:30	**GT2019-91637** **A Step Towards an Intelligent Aerodynamic Design Process** Christopher Clark *University of Cambridge, Whittle Laboratory, United Kingdom*	**GT2019-90285** **Investigation on the Degree of Reaction in Twin Scroll Radial Turbines at Different Operating Conditions for Turbocharging Applications** Carlo Cravero[1] Davide De Domenico[2] Andrea Ottonello[2] *1. Universita' Degli Studi Di Genova, Italy; 2. DIME - Universita di Genova, Italy*	**GT2019-90559** **Experimental and Numerical Investigations on Flow Losses of a U-Bend and Return Channel System for Centrifugal Compressor** Guang Xi, Yubao Tian, Yunpeng Guo, Yonghong Tang, Zhiheng Wang *Xi'an Jiaotong University, China*
9:00	**GT2019-91661** **Efficient Passage-Spectral Method for Unsteady Flows Under Stall Conditions** David Romera[1] Roque Corral[2] *1. Universidad Politécnica de Madrid, Spain; 2. ITP Aero, Spain*	**GT2019-90389** **Design and Performance Analysis of Mixed Flow Turbine Rotors With Extended Blade Chord** Thomas Leonard[1] Stephen Spence[2] Dietmar Filsinger[3] Andre Starke[3] *1. IHI Charging Systems International, Germany; 2. Queen's University Belfast, United Kingdom; 3. IHI Charging Systems Intl., Germany*	**GT2019-90614** **Design of Cryogenic Centrifugal Compressor Stages With Heat Transfer Considerations** Jin Xiong, Yingkun Zhang, Penghua Guo, Jingyin Li *Xi'an Jiaotong University, China*
9:30		**GT2019-90398** **Evaluating the Use of Leaned Stator Vanes to Produce a Non-Uniform Flow Distribution Across the Inlet Span of a Mixed Flow Turbine Rotor** Richard Morrison[1] Stephen Spence[1] Sung in Kim[1] Thomas Leonard[2] Andre Starke[2] *1. Queen's University Belfast, United Kingdom; 2. IHI Charging Systems International, Germany*	**GT2019-91195** **Secondary Flows in the Return System of a Centrifugal Compressor Stage** Tim Rossbach[1] Jan Bisping[1] Daniel Grates[2] Peter Jeschke[1] Andre Hildebrandt[3] Holger Franz[3] *1. RWTH Aachen University, Germany; 2. Aachen University of Applied Sciences, Germany; 3. MAN Energy Solutions SE, Germany*

KEYNOTE & PLENARIES

Turbomachines for Clean Power and Propulsion Systems

Panel Session • North Ballroom • MA-51-1

Session Organizer: **Atul Kohli**, Pratt & Whitney
Session Co-Organizer: **Ruben Del Rosario**, NASA Glenn Research Center

10:15

GT2019-92360
Turbomachines for Clean Power and Propulsion Systems: Janet Kavandi
Janet L. Kavandi
NASA Glenn Research Center, USA

GT2019-92361
Turbomachines for Clean Power and Propulsion Systems: Thomas Alley
Thomas Alley
Electric Power Research Institute (EPRI), USA

GT2019-92369
Turbomachines for Clean Power and Propulsion Systems: Andrew "John" Lammas
Andrew "John" Lammas
GE Power, USA

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MONDAY JUNE 17 — 02:00 PM - 03:30 PM

	AIRCRAFT ENGINE	COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS	COMBUSTION, FUELS & EMISSIONS
	Thermal Management Systems and Aero-engine Oil Systems II	**Alternative Gaseous Fuels II**	**Combustor Design and Development - Design Methods**
	Technical Session • 124-A • MB-1-17	**Technical Session • 131-A • MB-3-4**	**Technical Session • 122-BC • MB-4-2**
	Session Organizer: **Brian Nicholson**, Air Force Research Laboratory Session Co-Organizer: **Guillermo Paniagua**, Purdue University	Session Organizer: **Pierre Gauthier**, Siemens	Session Organizer: **Jeffery Lovett**, Pratt and Whitney Session Co-Organizer: **Khawar Syed**, InfoSys
2:00	**GT2019-90701** **Transient Regime Simulation From Idle to Maximum Take-Off Flight Conditions of Cooled Cooling Air Heat Exchanger for an Aero Gas Turbine Heat Management** Alberto Mucci[1] Foster Kwame Kholi[1] Man Ha[1] June Kee Min[1] Peter Beecroft[2] Sang Youl Yoon[1] Won Geun Yun[3] Thierry Sibilli[4] *1. Pusan National University, Korea; 2. Rolls-Royce plc, United Kingdom; 3. Center for Next-Generation Heat Exchanger, Korea; 4. Rolls-Royce and Pusan National University Technology Center, Korea*	**GT2019-90570** **Effect of Steam Dilution on Laminar Flame Speeds of Syngas Fuel Blends at Elevated Pressures and Temperatures** Michael C. Krejci, Charles Keesee, Andrew J. Vissotski, Sankaranarayanan Ravi, Eric Petersen *Texas A&M University, USA*	**GT2019-90720** **Progress in Burner Design Using Additive Manufacturing With a Monolithic Approach and Added Features** Vanessa Moosbrugger[1] Fabrice Giuliani[1] Nina Paulitsch[1] Lukas Andracher[2] *1. Combustion Bay One e.U., Austria; 2. FH Joanneum Gmbh, Austria*
2:30	**GT2019-91076** **Numerical Study on Flow Characteristics of Liquid Jet in Airflows** Jiang Le, Zhenxia Liu, Yaguo Lyu, Zhu Pengfei *Northwestern Polytechnical University, China*	**GT2019-90911** **An Investigation of Combustion Properties of a Gasoline Primary Reference Fuel Surrogate Blended With Butanol** Marina Braun-Unkhoff[1] Jürgen Herzler[2] Torsten Methling[3] Clemens Naumann[4] Sandra Richter[4] Uwe Riedel[4] *1. DLR, Institute of Combustion Technology, Germany; 2. Institute for Combustion and Gas Dynamics, Germany; 3. Lund University, Sweden; 4. German Aerospace Center (DLR), Germany*	**GT2019-91388** **Effect of Deterministic and Continuous Design Space Resolution on Multiple-Objective Combustor Optimization** Alejandro M Briones[1] Markus P Rumpfkeil[2] Nathan Thomas[2] Brent Rankin[3] *1. University of Dayton Research Institute, USA; 2. University of Dayton, USA; 3. Air Force Research Laboratory, USA*
3:00	**GT2019-91508** **Critical Speeds Analysis for Dual Rotor Turbofan Engine Using Finite Element Method** Kai Sun, Zhao Wan, Huiying Song, Shaohui Wang *AECC Commercial Aircraft Engine CO., LTD, China*	**GT2019-91379** **Dynamic Response of Acoustically Forced Turbulent Premixed Biogas Flames** Oluwaseun Ajetunmobi, Midhat Talibi, Ramanarayanan Balachandran *University College London, United Kingdom*	**GT2019-91528** **A Re-Design Study Based on a High Pressure Cyclonic Combustor Operated With Liquid Fuel** Felix Grimm, Benedict Enderle, Oliver Kislat, Saeed Izadi, Jan Zanger, Peter Kutne, Manfred Aigner *German Aerospace Center (DLR), Germany*

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	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS	CONTROLS, DIAGNOSTICS & INSTRUMENTATION
	Novel Combustor Concepts - Micromixing and Axial Staging	**Combustion Dynamics: High Frequency Instabilities**	**Topics in Diagnostics**
	Technical Session • 122-A • MB-4-17	**Technical Session • 121-AB • MB-4-22**	**Technical Session • 222-B • MB-5-2**
	Session Organizer: **Geoff Myers**, Mitsubishi Heavy Industries America, Inc. Session Co-Organizer: **Adel Ben Mansour**, Parker Hannifin Corp	Session Organizer: **Vishal Acharya**, Georgia Institute of Technology Session Co-Organizer: **Nicholas Magina**, GE Global Research	Session Organizer: **David Doel**, formerly of GE Aviation Session Co-Organizer: **Craig Davison**, National Research Council Canada
2:00	**GT2019-90286** **Combustion Characteristics of Natural Gas Fueled, Premixed Turbulent Jet Flame Arrays Confined in a Hexagonal Combustor** Robbin Bhagwan[1] Alexander Schwagerus[1] Christof Weis[1] Peter Habisreuther[1] Nikolaos Zarzalis[2] Michael Huth[3] Berthold Koestlin[3] Stefan Dederichs[3] *1. Karlsruhe Institute of Technology, Germany; 2. Karlsruhe Institute of Technology, Division of Comb. Tech., Germany; 3. Siemens AG, Germany*	**GT2019-90240** **Quantification of Energy Transformation Processes Between Acoustic and Hydrodynamic Modes in Non-Compact Thermoacoustic Systems via a Helmholtz-Hodge Decomposition Approach** Thomas Hofmeister[1] Tobias Hummel[1] Bruno Schuermans[2] Thomas Sattelmayer[1] *1. Technical University of Munich, Germany; 2. General Electric, Switzerland*	**GT2019-90998** **Dynamic Characterization and Identification of Flow in a Blade Passage in Near-Stall Conditions of Axial Compressor Systems** Eighdi Aung[1] Marco Schoen[1] Jichao Li[2] *1. Idaho State University, USA; 2. Institute of Engineering Thermalphysics, Chinese Academy of Sciences, China*
2:30	**GT2019-90895** **An Experimental and Numerical Investigation of the Aerodynamic Characteristics of a Flameless Combustor** Melchior Huijts, André Augusto Viviani Perpignan, Arvind Gangoli Rao *Delft University of Technology, Netherlands*	**GT2019-90241** **Modeling and Quantification of Acoustic Damping Induced by Vortex Shedding in Non-Compact Thermoacoustic Systems** Thomas Hofmeister[1] Tobias Hummel[1] Bruno Schuermans[2] Thomas Sattelmayer[1] *1. Technical University of Munich, Germany; 2. General Electric, Switzerland*	**GT2019-91111** **A Novel Structural Health Monitoring System Using Surface Acoustic Sensor Network and Guided Lamb Waves** Prabhav Borate, Azam Thatte *Energy Recovery, USA*
3:00	**GT2019-91796** **Combustion and Emission Characteristics of a Lean Axial-Stage Combustor** Bernhard Stiehl[1] Tyler Worbington[1] Alexander Miegel[2] Scott Martin[3] Carlos Velez[4] Kareem Ahmed[1] *1. University of Central Florida, USA; 2. Ostbayerische Technische Hochschule, Germany; 3. Embry-Riddle Aeronautical University, USA; 4. General Electric Company, USA*	**GT2019-91029** **High-Frequency Acoustic Mode Identification of Unstable Combustors** Jeongwon Kim[1] Timothy C. Lieuwen[1] Benjamin L. Emerson[1] Vishal Acharya[1] David Wu[1] Randal G Mckinney[1] Xingjian Wang[1] Mitsunori Isono[2] *1. Georgia Institute of Technology, USA; 2. Mitsubishi Heavy Industries Ltd., Japan*	**GT2019-91644** **Comparative Analysis of Two Gas Turbine Diagnosis Approaches** Igor Loboda[1] Juan L. Pérez Ruiz[1] Sergiy Yepifanov[2] Roman Zelenskyi[3] *1. Instituto Politécnico Nacional, Mexico; 2. National Aerospace University, Ukraine; 3. National Aerospace University "Kharkiv Aviation Institute", Ukraine*

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	CYCLE INNOVATIONS	HEAT TRANSFER: NUMERICAL FILM COOLING	HEAT TRANSFER: TUTORIALS
	Fuel Cell Driven Cycles I	**Miscellaneous I**	**Tutorial of Basics I: Turbine Cooling Fundamentals**
	Technical Session • 221-B • MB-6-1	**Technical Session • 131-C • MB-12-1**	**Tutorial Session • 132-AB • MB-14-1**
	Session Organizer: **Tong Seop Kim**, Inha University Session Co-Organizer: **Jeong Lak Sohn**, Korea Institute of Machinery & Materials	Session Organizer: **Kapil Panchal**, Elliott Group Session Co-Organizer: **Arnab Roy**, NETL-West Virginia University Research Corporation	Session Organizer: **Andrew Nix**, West Virginia University
2:00	**GT2019-90379** **Advanced Control System for Grid-Connected SOFC Hybrid Plants: Experimental Verification in Cyber-Physical Mode** Mario Luigi Ferrari, Iacopo Rossi, Alessandro Sorce, Aristide F. Massardo *University of Genoa, Italy*	**GT2019-90130** **Effect of Turbine Blade Tip Cooling Configuration on Tip Leakage Flow and Heat Transfer** Sergen Sakaoglu, Harika S. Kahveci *Middle East Technical University (METU), Turkey*	**GT2019-92119** **Turbine Cooling Fundamentals** Kenichiro Takeishi *Tokushima Bunri University, Japan* **T U T O R I A L**
2:30	**GT2019-91351** **Uncertainty Quantification Analysis of a Pressurised Fuel Cell Hybrid System** Alessandra Cuneo, Andrea Giugno, Luca Mantelli, Alberto Traverso *University of Genoa, Italy*	**GT2019-91104** **Numerical Investigation of the Effect of Inlet Flow Angle on Film Cooling Performance for the Blade Tip With Suction Surface Squealer Rim** Zhiqiang Yu, Jianjun Liu, Chen Li, Baitao An *Institute of Engineering Thermophysics, Chinese Academy of Sciences, China*	
3:00	**GT2019-91585** **Impact of Different Volume Sizes on Dynamic Stability of a Gas Turbine Fuel Cell Hybrid System** Alessio Abrassi[1] Alberto Traverso[1] David Tucker[2] Eric Liese[2] *1. University of Genoa, Italy; 2. National Energy Technology Laboratory, USA*	**GT2019-90490** **A Numerical Study on the Effect of Hole Inclination Angle With Imperfection on Film Cooling Effectiveness** Taha Rezzag, Bassam A. Jubran *Ryerson University, Canada*	

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	HEAT TRANSFER: EXPERIMENTAL FILM COOLING	INDUSTRIAL & COGENERATION	MANUFACTURING MATERIALS & METALLURGY
	Experimental Film Cooling I	**Waste Heat Recovery and Energy Storage Technologies**	**Material and Manufacturing Considerations in Life Prediction**
	Technical Session • 131-B • MB-19-1	**Technical Session • 221-C • MB-23-2**	**Panel Session • 121-C • MB-24-12**
	Session Organizer: **Anil Tolpadi**, GE Aviation Session Co-Organizer: **Paul Giel**, ASRC Aerospace	Session Organizer: **Mauro Venturini**, Università degli Studi di Ferrara Session Co-Organizer: **Lucrezia Manservigi**, Università degli Studi di Ferrara	Session Organizer: **David Day**, Doosan
2:00	**GT2019-90018** **Inlet Flow Incidence Effects on the Thermal Performance of Showerhead Cooling in a Nozzle Vane Cascade** Hamed Abdeh[1] Giovanna Barigozzi[1] Antonio Perdichizzi[1] Marc Henze[2] Joerg Krueckels[3] *1. Università di Bergamo, Italy; 2. Alstom Switzerland Ltd., Switzerland; 3. Ansaldo Energia Switzerland, Switzerland*	**GT2019-90324** **Gas Path Diagnostics for a Once-Through Steam Generator** Yiguang Li[1] Yuzhi Chen[1] Mike Newby[2] *1. Cranfield University, United Kingdom; 2. Manx Utilities, Isle of Man*	**GT2019-92323** **Gas Turbine Component Life Extension via Advanced Coatings Technologies** Dheepa Srinivasan *Adjunct Faculty, IIT, Ropar, India* **GT2019-92324** **Digital Twins for the Life Cycle Management of Gas Turbine Engines** Ashok Koul *Life Prediction Technologies Inc., Canada* **GT2019-92330** **Manufacturing Considerations that Impact Lifing** David Day *Doosan, USA* **GT2019-92334** **On Mechanical Integrity of Additively Manufactured Gas Turbine Components** Jaroslaw Szwedowicz *Siemens Schweiz AG, Switzerland* **P A N E L**
2:30	**GT2019-90019** **A Parametric Investigation of Vane Showerhead Film Cooling by PSP Technique** Hamed Abdeh[1] Giovanna Barigozzi[1] Silvia Ravelli[2] Samaneh Rouina[1] *1. Università di Bergamo, Italy; 2. Università di Bergamo - Faculty of Engineering, Italy*	**GT2019-90946** **Evaluation of the Optimum Hybrid Power to Heat Configuration for a Gas Turbine Based Industrial Combined Heat and Power Plant** Sikke Klein, Femke van Deursen *Delft University of Technology, Netherlands*	
3:00	**GT2019-90108** **Experimental Film Cooling Effectiveness of Multi-Row Patterns on Flat and Step-Down Surfaces** Filippo Baldino[1] Mohammad Taslim[2] *1. Politecnico di Milano, Italy; 2. Northeastern University, USA*	**GT2019-91122** **Working Fluid Selection for a Waste Heat Recovery Organic Rankine Cycle (ORC) Applied to a Petroleum Distillation Process** Sergio Peralta, Cesar Celis *Pontificia Universidad Católica del Perú, Peru*	

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	MARINE	OIL & GAS APPLICATIONS	STEAM TURBINES
	Auxiliary and Support Systems	**Systems, Components and Auxiliary Devices Analysis - 1**	**Last Stage Blades I**
	Technical Session • 221-A • MB-25-3	**Technical Session • 130 • MB-27-5Part A**	**Technical Session • 127-A • MB-29-3**
	Session Organizer: **Andy Cullis**, Woodward, Inc.	Session Organizer: **Meera Day Towler**, Southwest Research Institute Session Co-Organizer: **Mirko Morini**, University of Parma	Session Organizer: **Tadashi Tanuma**, Teikyo University Session Co-Organizer: **Christian Siewert**, Siemens AG - Power and Gas Division
2:00	**GT2019-90246** **Concept Verification and Preliminary Design of Reversible Turbine for High Power Marine Gas Turbine Engine** Wen Xue-You[1] Xiying Niu[1] Yonglai Li[2] ShunWang Yu[1] Feng Lin[1] Dongming Li[1] Bing Ge[3] *1. Harbin Marine Boiler and Turbine Research Institute, China; 2. State Grid Heilongjiang Electric Power Company Limited, China; 3. Shanghai Jiao Tong University, China*	**GT2019-90854** **Compression Technology Selection for Downhole Application in Gas Wells** Ameen Malkawi[1] Ahmed Aladawy[1] Rajesh Kumar V Gadamsetty[2] Rafael Lastra Melo[3] *1. Baker Hughes, a GE company, Saudi Arabia; 2. General Electric Company, India; 3. Saudi Aramco, Saudi Arabia*	**GT2019-90003** **Development and Verification Tests of Titanium 50-Inch and 60-Inch Last Stage Blades for Steam Turbines** Shigeki Senoo[1] Takeshi Kudo[2] Hisataka Fukushima[2] Kiyoshi Segawa[2] Kazuya Sakakibara[2] *1. Mitsubishi Heavy Industries Ltd., Japan; 2. Mitsubishi Hitachi Power Systems, Ltd., Japan*
2:30	**GT2019-92053** **2-Stage Air Filtration for Gas Turbine Naval Applications** Gianluca de Arcangelis *TTT Navy, Italy*	**GT2019-91798** **Measurements of End Cap Temperatures in a Multistage Barrel-Style Centrifugal Compressor** Natalie Smith[1] Jason Wilkes[1] Jonathan Wade[1] Tim Allison[1] Meera Day Towler[1] J. Jeffrey Moore[1] Ian Weinberg[2] Michael McCune[2] *1. Southwest Research Institute, USA; 2. Solar Turbines Inc., USA*	**GT2019-90089** **Aerodynamic Numerical Investigation of Low-Pressure Steam Turbine Last Stage Under Low Load Conditions With Mode Decomposition Methods** Ping Hu[1] Tong Lin[2] Rui Yang[2] Xiaocheng Zhu[1] Zhaohui Du[1] *1. Shanghai Jiao Tong University, China; 2. Shanghai Turbine Works Company Limited, China*
3:00		**GT2019-91865** **Pipeline Compressors Dry Gas Seal Retrofits** Inderpal Sihra[1] Ian Goldswain[1] Christina Twist[2] Jorge Pacheco[2] *1. John Crane, United Kingdom; 2. John Crane, USA*	**GT2019-90350** **Development of Highly Efficient and Robust Ultra-Long Last Stage Blade for High Backpressure** Ondrej Novak[1] Marek Bobcik[1] Vaclav Slama[1] Bartolomej Rudas[1] Josef Kellner[1] Petr Mestanek[1] Jan Hlous[1] Zdenek Simka[1] Martin Luxa[2] David Simurda[2] Antonín Živný[3] Ales Macalka[3] Jiri Ira[3] *1. Doosan Skoda Power, Czech Republic; 2. Institute of Thermomechanics, CAS, Czech Republic; 3. NUM Solution s.r.o., Czech Republic*

MONDAY JUNE 17 — 02:00 PM - 03:30 PM

	STRUCTURES & DYNAMICS: PROBABILISTIC METHODS	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS	STRUCTURES & DYNAMICS: STRUCTURAL MECHANICS, VIBRATION & DAMPING
	Moving Additive Manufacturing beyond Trial and Error with Probabilistics and Machine Learning	**Gas Bearings 1**	**Mistuning I**
	Panel Session • 129-AB • MB-32-5	**Technical Session • 128-A • MB-34-1**	**Technical Session • 128-B • MB-35-1**
	Session Organizer: **Liping Wang**, GE Corporate Res & Develop Session Co-Organizer: **Kenneth Knopp**, FAA	Session Organizer: **Daejong Kim**, University of Texas at Arlington	Session Organizer: **Evgeny Petrov**, The University of Sussex Session Co-Organizer: **Florence Nyssen**, Polytechnique Montreal
2:00	**GT2019-92392** **FAA Perspective** Michael Gorelik *FAA FSDO, USA* **GT2019-92393** **Pratt & Whitney Perspective** Jesse Boyer *Pratt & Whitney, USA* **GT2019-92394** **Rollie Dutton** Rollie Dutton *Universal Technology Corporation, USA*	**GT2019-90494** **A New Structural Bump Foil Model With Application From Start-Up to Full Operating Conditions** Mihai Arghir, Omar Benchekroun *Universite De Poitiers - Instit Pprime, D3, France*	**GT2019-91174** **Probabilistic Response of a Bladed Disk With Uncertain Geometry** Luigi Carassale[1] Andrea Cavicchi[2] Silvia Bruzzone[2] Michela Marrè Brunenghi[2] *1. University of Genova, Italy; 2. Ansaldo Energia, Italy*
2:30	**P A N E L**	**GT2019-90741** **Dynamic Characteristic Analysis of Compressible Turbulent Lubrication Bearing Considering Disturbance of Complete Variables** ChunXiao Bi, Dongjiang Han, Jinfu Yang *Institute of Engineering ThermoPhysics, Chinese Academy of Sciences, China*	**GT2019-91094** **A Statistical Characterization of the Effects and Interactions of Small and Large Mistuning on Multistage Bladed Disks** Eric Kurstak, Kiran D'Souza *The Ohio State University, USA*
3:00		**GT2019-90865** **Compliant Hybrid Gas Bearing Using Integral Hermetically-Sealed Squeeze Film Dampers** Bugra Ertas *GE Global Research Center, USA*	**GT2019-90510** **Study on Vibration Response Characteristics of Mistuned Bladed Disk Expressed by Vibratory Stress** Yasutomu Kaneko[1] Toshio Watanabe[2] Tatsuya Furukawa[3] Saiji Washio[4] *1. Ryukoku University, Japan; 2. Mitsubishi Heavy Industries Ltd., Japan; 3. Mitsubishi Hitachi Power Systems, Ltd., Japan; 4. Cybernet Systems Co.,Ltd., Japan*

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	SUPERCRITICAL CO2 POWER CYCLES	TURBOMACHINERY: AXIAL FLOW FAN & COMPRESSOR AERODYNAMICS	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY
	Fundamentals of Direct-Fired Supercritical CO2 Combustion	**Flow Control**	**Cavity, Bearings and Seal Design Methods and Applications**
	Tutorial Session • 123 • MB-38-18	**Technical Session • 124-B • MB-39-16Part A**	**Technical Session • 127-B • MB-41-13Part A**
	Session Organizer: **Subith Vasu**, University of Central Florida	Session Organizer: **Florian Herbst**, Leibniz University Hannover Session Co-Organizer: **Nick Nolcheff**, Honeywell	Session Organizer: **Dr Adele Nasti**, Rolls-Royce plc Session Co-Organizer: **Michael J Pekris**, University of Surrey
2:00	**GT2019-92109** **Fundamentals of Direct-Fired sCO2 Combustion** Subith Vasu[1] Scott Martin[2] *1. University of Central Florida, USA; 2. Embry-Riddle Aeronautical University, USA*	**GT2019-90609** **Experimental Investigation on the Plasma Flow Control of Axial Compressor Rotating Stall** Haiden Zhang[1] Yun Wu[2] Xianjun Yu[3] Yinghong Li[1] Baojie Liu[3] *1. Airforce Engineering University, China; 2. Xi'an Jiaotong University, China; 3. Beihang University, China*	**GT2019-91323** **Assessment of an Enhanced Thin Film Model to Capture Wetting and Drying Behavior in an Aero-Engine Bearing Chamber** Kuldeep Singh[1] Medhat Sharabi[1] Stephen Ambrose[1] Carol Eastwick[1] Richard J Jefferson-Loveday[1] Jing Cao[2] Adrian Jacobs[3] *1. University of Nottingham, United Kingdom; 2. ANSYS Inc., United Kingdom; 3. Rolls-Royce plc, United Kingdom*
2:30	**T U T O R I A L**	**GT2019-90754** **A Passive Flow Control to Mitigate the Corner Separation in an Axial Compressor by a Slotted Rotor Blade** Sungho Yoon[1] Ajay Rao[2] Venkata Chaluvadi[3] Vittorio Michelassi[4] Ramakrishna Mallina[5] *1. GE Global Research, Germany; 2. General Electric John F Welch Technology Centre, India; 3. GE Power, USA; 4. General Electric, Italy; 5. GE, USA*	**GT2019-91506** **Influence of Charging Oil Condition on Torque Converter Cavitation Characteristics** Cheng Liu, Wei Wei, Qingdong Yan, Changle Xiang *Beijing Institute of Technology, China*
3:00		**GT2019-91467** **Influence Mechanism of End Wall Suction on Leakage Flow and in the Tip Region of a Diffusion Cascade** Hang Zhao, Bo Liu, Zhiyuan Cao *Northwestern Polytechnical University, China*	

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	TURBOMACHINERY: DUCTS & COMPONENT INTERACTIONS	TURBOMACHINERY: RADIAL TURBOMACHINERY AERODYNAMICS	TURBOMACHINERY: UNSTEADY FLOWS IN TURBOMACHINERY
	Inter-Component Ducts in Compressors and Other Rotating Components	**Centrifugal Compressors 1**	**Modeling and Control Methods for Unsteady Flows**
	Technical Session • 127-C • MB-42-1Part A	**Technical Session • 125-AB • MB-44-2**	**Technical Session • 126-ABC • MB-45-13Part A**
	Session Organizer: **David Cerantola**, Pratt and Whitney Canada Session Co-Organizer: **Deepak Thirumurthy**, Siemens Energy, Inc.	Session Organizer: **Hamid Hazby**, PCA Engineers Limited Session Co-Organizer: **Rodrigo R. Erdmenger**, GE Aviation	Session Organizer: **David Halstead**, GE Aviation Session Co-Organizer: **Tianyu Pan**, Beihang University
2:00	**GT2019-90479** **Modelling and Design of LPC Components With Semi-Analytical Models: Part I – Model Formulation and Validation** Luca di Mare[1] Mauro Carnevale[1] Max E. Rife[1] Davendu Kulkarni[2] Richard Northall[2] *1. University of Oxford, United Kingdom; 2. Rolls-Royce plc, United Kingdom*	**GT2019-90038** **3D Computational Loss Analysis of a Compressor for Heavy Duty Truck Engine Turbochargers** Matthias Abel[1] Ricardo Martinez-Botas[2] Michael Woehr[1] Markus Müller[1] Johannes Leweux[1] *1. Daimler AG, Germany; 2. Imperial College London, United Kingdom*	**GT2019-90745** **Control Strategies of an Academic Rotor/Stator Cavity Through Sensitivity Analysis** Matthieu Queguineur[1] Laurent Y.M. Gicquel[2] Gabriel Staffelbach[2] *1. CERFACS/CNES, France; 2. CERFACS, France*
2:30	**GT2019-90481** **Modelling and Design of LPC Components With Semi-Analytical Models: Part II – Design of Optimal OGV Cascades** Luca di Mare[1] Mauro Carnevale[1] Max E. Rife[1] Davendu Kulkarni[2] Richard Northall[2] *1. University of Oxford, United Kingdom; 2. Rolls-Royce plc, United Kingdom*	**GT2019-90308** **A Deep Insight Into the Transonic Flow of an Advanced Centrifugal Compressor Design** David Wittrock, Martin Junker, Manfred Beversdorff, Andreas Peters, Eberhard Nicke *German Aerospace Center (DLR), Germany*	**GT2019-92041** **Active Control of Unsteady Cavitating Flows in Turbomachinery** Maria Grazia De Giorgi, Donato Fontanarosa, Antonio Ficarella *University of Salento, Italy*
3:00	**GT2019-92048** **The Influence of Fan Root Flow on the Aerodynamics of a Low-Pressure Compressor Transition Duct** A Duncan Walker[1] Ian Mariah[1] Dimitra Tsakmakidou[1] Hiren Vadhvana[1] Chris Hall[2] *1. Loughborough University, United Kingdom; 2. Rolls-Royce, United Kingdom*	**GT2019-91153** **Effect of Curvilinear Element Blade for Open-Type Centrifugal Impeller on Stator Performance** Kazuhiro Tsukamoto[1] Kiyohide Sakamoto[1] Kiyotaka Hiradate[2] Yasushi Shinkawa[2] *1. Hitachi, Ltd., Research & Development Group, Japan; 2. Hitachi, Ltd., Industrial Products Business Unit, Japan*	**GT2019-91008** **Modelling the Transient Behaviour of Gas Turbines** Djordje Petkovic[1] Milan Banjac[1] Srdjan Milic[2] Milan Petrovic[1] Alexander Wiedermann[3] *1. University of Belgrade, Serbia; 2. Faculty of Mechanical Engineering, Serbia; 3. Man Energy Solutions SE, Germany*

MONDAY JUNE 17 — 04:00 PM - 05:30 PM

	AIRCRAFT ENGINE	COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS	COMBUSTION, FUELS & EMISSIONS
	Inlets, Nacelles, Nozzles, and Mixers	**Basics of Biomass**	**High Hydrogen Combustion**
	Technical Session • 124-A • MC-1-8	**Tutorial Session • 131-A • MC-3-7**	**Technical Session • 122-BC • MC-4-14**
	Session Organizer: **Aaron Byerley**, USAF Academy Session Co-Organizer: **Kevin Lowe**, Virginia Polytechnic Institute and State University	Session Organizer: **Bhupendra Khandelwal**, University of Sheffield	Session Organizer: **Vincent McDonell**, University of California Session Co-Organizer: **William D. York**, GE Power
4:00	**GT2019-91689** **Validation of CFD Analyses Results With Instrumented Ground and Flight Tests Measurements of an Aerobatic Turboprop Aircraft Inlet** Daniela Pitel Welnitz, Tomas Vlach, Luca Lombardi, Pierre-Jean Faltot, Philippe Vertenoeuil, Michele D'Ercole *GE Aviation, Czech Republic*	**GT2019-91325** **Biomass** Sai Babu Patarlapalli, Kamalesh Nistala *Godavari Institute of Engineering and Technology, India*	**GT2019-90272** **Computational Fluid Dynamics Simulation of Syngas Nozzle of Gas Turbine for Syngas** Bo Zhang, Ye Qin, Shaoping Shi, Shu Yan, Yanfei Mu, Xin Liu, Xinming Chen, Yutong Guo, Chongji Zeng *Huaneng Clean Energy Research Institute, China*
4:30	**GT2019-91780** **Pre-Test Evaluation of Probe Configuration Errors** John Gillespie, Dustin Frohnapfel, Walter Obrien *Virginia Polytechnic Institute and State University, USA*	**T U T O R I A L**	**GT2019-90095** **Development and Testing of a FuelFlex Dry-Low-NOx Micromix Combustor for Industrial Gas Turbine Applications With Variable Hydrogen Methane Mixtures** Harald Funke[1] Nils Beckmann[1] Sylvester Abanteriba[2] *1. Aachen University of Applied Sciences, Germany; 2. RMIT University, Australia*
5:00	**GT2019-92064** **On the Application of Particle Image Velocimetry for Turbofan Engine Flow Quantification** Dillon Sluss, William George, Kevin Lowe *Virginia Polytechnic Institute and State University, USA*		**GT2019-90798** **Sequential Combustion in Gas Turbines: The Key Technology for Burning High Hydrogen Contents With Low Emissions** Mirko Bothien, Andrea Ciani, John Wood, Gerhard Fruechtel *Ansaldo Energia Switzerland, Switzerland*

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	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS	CONTROLS, DIAGNOSTICS & INSTRUMENTATION
	Novel Combustor Concepts	**Combustion Dynamics: POD & DMD Analysis**	**Advances in Pressure Meas.**
	Technical Session • 122-A • MC-4-16	**Technical Session • 121-AB • MC-4-29**	**Technical Session • 222-B • MC-5-5**
	Session Organizer: **Gilles Bourque**, Siemens Canada Session Co-Organizer: **Adnan Eroglu**, Siemens	Session Organizer: **Adam M. Steinberg**, Georgia Institute of Technology Session Co-Organizer: **A.J. Wickersham**, GE Global Research Center	Session Organizer: **Lorenzo Ferrari**, University of Pisa - DESTEC
4:00	**GT2019-90484** **A Third-Generation Swirl-Venturi Lean Direct Injection Combustor With a Prefilming Pilot Injector** Kathleen Tacina[1] Derek P. Podboy[2] Bidhan Dam[3] F. Phil Lee[3] *1. NASA, USA; 2. NASA Glenn Research Center, USA; 3. Woodward, FST, USA*	**GT2019-90814** **Flow Dynamics in a Multi-Swirler Model Combustor Based on LES and POD Analysis** Weijie Liu[1] Huiru Wang[1] Qian Yang[1] Ranran Xue[1] Bing Ge[2] Yongbin Ji[2] *1. Aero-Engine Academy of China, China;* *2. Shanghai Jiao Tong University, China*	**GT2019-90079** **An Innovative Development of a Five-Hole Pressure Probe for Highly Unsteady Flow Phenomena** Florian M. Heckmeier[1] Daniel Iglesias[2] Sascha Kienitz[3] Christian Breitsamter[1] *1. Technical University of Munich, Germany;* *2. Vectoflow GmbH, Germany; 3. fos4X GmbH, Germany*
4:30	**GT2019-90607** **Experimental Analysis of an Ultra Compact Combustor Powered Turbine Engine** Brian T. Bohan, Marc D. Polanka *Air Force Institute of Technology, USA*	**GT2019-90954** **Re-Oriented POD for Feature Extraction From Time Resolved Reacting Flow Datasets** Hanna M. Ek[1] William Proscia[2] Timothy C. Lieuwen[1] Benjamin L. Emerson[1] *1. Georgia Institute of Technology, USA;* *2. Pratt & Whitney, USA*	**GT2019-90470** **Design and Testing of a Miniaturized Five-Hole Fast Response Pressure Probe With Large Frequency Bandwidth and High Angular Sensitivity** Elissavet Boufidi[1, 2] Marco Alati[1] Fabrizio Fontaneto[1] Sergio Lavagnoli[1] *1. von Karman Institute, Belgium; 2. Université Catholique de Louvain, Belgium*
5:00	**GT2019-90608** **Development and Initial Testing of a Radial Wave Engine** Pejman Akbari[1] Christopher J. Tait[1] Marc D. Polanka[2] Brian C. Sell[3] *1. California State Polytechnic University, USA;* *2. Air Force Institute of Technology, USA;* *3. Innovative Scientific Solutions, Inc., USA*	**GT2019-91473** **Study of Dynamical Instabilities in Siemens Liquid Spray Injectors Using Complementary Modal Decomposition Techniques** Adesile Ajisafe[1] Midhat Talibi[1] Andrea Ducci[1] Ramanarayanan Balachandran[1] Nishant Parsania[2] Suresh Sadasivuni[2] Ghenadie Bulat[2] *1. University College London, United Kingdom;* *2. Siemens Industrial Turbomachinery Ltd., United Kingdom*	**GT2019-91681** **Semiconductor Nano and Micro Membrane Based Pressure Sensors for Wide Bandwidth Measurements** Yuhong Kang[1] Ridge Sibold[2] Michelle Homer[1] Liz Gladwin[1] Richard O. Claus[1] Wing Ng[2] Hang Ruan[1] *1. Nanosonic, Inc., USA; 2. Virginia Polytechnic Institute and State University, USA*

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	CYCLE INNOVATIONS	HEAT TRANSFER: EXPERIMENTAL FILM COOLING	HEAT TRANSFER: MULTIPHYSICS MODELING & OPTIMIZATION
	Fuel Cell Driven Cycles II	**Experimental Film Cooling VII**	**Thermofluilds and Thermomechanical Modeling and Optimization**
	Technical Session • 221-B • MC-6-2	**Technical Session • 131-B • MC-19-7**	**Technical Session • 132-AB • MC-20-1**
	Session Organizer: **Mario Luigi Ferrari**, University of Genoa Session Co-Organizer: **Valentina Zaccaria**, Mälardalen University	Session Organizer: **Anil Tolpadi**, GE Aviation Session Co-Organizer: **Paul Giel**, ASRC Aerospace	Session Organizer: **Riccardo Da Soghe**, Ergon Research Session Co-Organizer: **Carlo Carcasci**, University of Florence
4:00	**GT2019-91920** **Performance Comparison of Internal and External Reforming for Hybrid SOFC-GT Applications by Using 1D Real-Time Fuel Cell Mode** Hao Chen[1] Chen Yang[2] Nana Zhou[3] Nor Farida Harun[3] David Tucker[3] *1. Chongqing University, USA; 2. Chongqing University, China; 3. National Energy Technology Laboratory, USA*	**GT2019-90236** **Turbine Vane Endwall Film Cooling Effectiveness of Different Purge Slot Configurations in a Linear Cascade** Gunther Müller[1] Christian Landfester[1] Martin Boehle[1] Robert Krewinkel[2] *1. Technical University of Kaiserslautern, Germany; 2. MAN Energy Solutions SE, Germany*	**GT2019-90897** **Multi-Physics Simulation Based Approach for Life Prediction of a Gas Turbine Combustor Liner** Sourabh Shrivastava[1] Prem Andrade[1] Vinay Carpenter[1] Ravindra Masal[1] Pravin Nakod[1] Stefano Orsino[2] *1. ANSYS Inc., India; 2. ANSYS Inc., USA*
4:30	**GT2019-91929** **Study on the Effect and Fuzzy Compensation of Nonlinear Characteristics on SOFC-GT Fuel Supply System** Jinwei Chen, Shengnan Sun, Jingxuan Li, Huisheng Zhang *Shanghai Jiao Tong University, China*	**GT2019-90295** **The Effect of Density Ratio on Full Coverage Film Cooling for a Turbine Guide Vane** Xingming Wang, Li Zhang, Hui-ren Zhu, Ru Jiang, Lijian Cheng, Tianliang Zhou *Northwestern Polytechnical University, China*	**GT2019-91004** **An Assessment of Machine Learning Techniques for Predicting Turbine Airfoil Component Temperatures, Using FEA Simulations for Training Data** James A. Tallman[1] Michal Osusky[2] Nicholas Magina[2] Evan Sewall[3] *1. General Electric Research, USA; 2. GE Global Research, USA; 3. GE, USA*
5:00	**GT2019-91946** **Use of Ion Transport Membrane for Oxygen Generation to Enhance the Performance of the Integrated Gasification Fuel Cell System** Ji Hun Jeong, Ji Ho Ahn, Tong Seop Kim *Inha University, Korea*	**GT2019-90349** **Unsteady Analysis of Adiabatic Film Cooling Effectiveness Behind a Row of Circular Holes Fed by Internal Crossflow** Mohamed Qenawy, Wenwu Zhou, Han Chen, Hongyi Shao, Di Peng, Yingzheng Liu *Shanghai Jiao Tong University, China*	**GT2019-91278** **Finite Element Transient Modelling for Aero-Thermo-Mechanical Analysis of Whole Gas Turbine Engine** Sabrina Giuntini[1] Antonio Andreini[2] Bruno Facchini[2] *1. Department of Industrial Engineering, University of Florence, Italy; 2. University of Florence, Italy*

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	HEAT TRANSFER: GENERAL COMPUTATIONAL HEAT TRANSFER	INDUSTRIAL & COGENERATION	MANUFACTURING MATERIALS & METALLURGY
	General Computational Heat Transfer I	**Cogeneration and the Future of Gas Turbine Systems**	**Turbomachinery Manufacturing in a Digital Environment**
	Technical Session • 131-C • MC-22-1	**Panel Session • 221-C • MC-23-13**	**Tutorial Session • 121-C • MC-24-11**
	Session Organizer: **Harika S. Kahveci**, Middle East Technical University (METU) Session Co-Organizer: **Sergio Lavagnoli**, von Karman Inst for Fluid Dynamics	Session Organizer: **Manfred Klein**, MA Klein and Associates	Session Organizer: **Sascha Gierlings,** Fraunhofer IPT
4:00	**GT2019-90207** **Unsteady Passing Wake Effects on Turbine Blade Tip Aerodynamic and Aerothermal Performance With Film Cooling** Bo Zhang, Xiao-Qing Qiang, Jinfang Teng, Shaopeng Lu *Shanghai Jiao Tong University, China*	**GT2019-92290** **Future of Gas Turbines** Christer Björkqvist *ETN European Turbine Network, Belgium* **GT2019-92291** **Environmental Aspects of Power and Propulsion** Thomas Sattelmayer *Technical University of Munich, Germany* **GT2019-92292** **Cogeneration Policy** Neeharika Naik-Dhungel *U.S. Environmental Protection Agency, USA* **GT2019-92293** **Cogeneration as an Environmental Solution** Manfred Klein *MA Klein and Associates, Canada* **GT2019-92297** **The Future of Gas Turbines** S.C. John Gulen *Bechtel Infrastructure and Power, USA* **PANEL**	**GT2019-92112** **Turbomachinery Manufacturing in a Digital Environment** Sascha Gierlings[1] Robin Day[2] *1. Fraunhofer IPT, Germany; 2. Chair of Digital Additive Production DAP, Germany* **TUTORIAL**
4:30	**GT2019-90381** **A CFD Assessment of Engine Core Zone Casing Heat Transfer** Zixiang Sun[1] Nick Hills[2] Richard Scott[3] *1. Thermo-Fluid Systems UTC, United Kingdom;* *2. University of Surrey, United Kingdom;* *3. Rolls-Royce plc, United Kingdom*		
5:00	**GT2019-92055** **Influence of Pin Shape on Heat Transfer Characteristics of Laminated Cooling Configuration** Lei Li, Honglin Li, Wenjing Gao, Fujuan Tong, Zhonghao Tang *Northwestern Polytechnical University, China*		

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	MARINE	OIL & GAS APPLICATIONS	STEAM TURBINES
	Gas Turbine Controls	**Systems, Components And Auxiliary Devices Analysis - 2**	**Last Stage Blades III**
	Tutorial Session • 221-A • MC-25-6	**Technical Session • 130 • MC-27-5Part B**	**Technical Session • 127-A • MC-29-5**
	Session Organizer: **Morgan Hendry**, SSS Clutch Company, Inc	Session Organizer: **Meera Day Towler**, Southwest Research Institute Session Co-Organizer: **Mirko Morini**, University of Parma	Session Organizer: **Paul Petrie-Repar**, Department of Energy Technology, KTH Session Co-Organizer: **Michal Hoznedl**, Doosan Skoda Power s.r.o.
4:00	**GT2019-92126** **Considerations for Marine Gas Turbine Controls** Matt Heath, Steve Pacheco, Andy Cullis *Woodward Inc., USA*	**GT2019-90228** **Surrogate Model Based Optimization for Chevron Foil Thrust Bearing** Alexandrina Untaroiu, Gen Fu *Virginia Tech, USA*	**GT2019-90661** **Unsteady Aerodynamics on Multi-Passage LP Last Stage Induced by Flow Separation Under Low Load Flow** Jing Zhang[1] Danmei Xie[1] Fan Wu[2] Haifen Du[2] Wei Chen[2] *1. Wuhan University, China; 2. Key Laboratory of Hydraulic Machinery Transients (MOE), Wuhan University, China*
4:30	**T U T O R I A L**	**GT2019-91199** **Modelling of Sonic Jets for Gas Leak Applications** Stefano Minotti[1] Alessandro Corsini[2] Giovanni Delibra[2] Gabriele Lucherini[1] Stefano Rossin[1] Lorenzo Tieghi[2] Stefania Traldi[3] *1. Baker Hughes, a GE company, Italy; 2. Sapienza University of Rome, Italy; 3. Dept. of Mechanical and Aerospace Engineering, Sapienza University of Rome, Italy*	**GT2019-90860** **Advanced Last Stage Blade for Nuclear Power Plant Upgrades** Christian Siewert[1] James McCracken[2] Thomas Thiemann[3] *1. Siemens AG - Power and Gas Division, Germany; 2. Siemens Westinghouse, USA; 3. Siemens AG, Germany*
5:00			**GT2019-91279** **Numerical and Experimental Aerodynamic Investigation of a Low Pressure Steam Turbine Module** Juri Bellucci[1] Lorenzo Peruzzi[1] Andrea Arnone[2] Lorenzo Arcangeli[3] Nicola Maceli[3] *1. Department of Industrial Engineering, University of Florence, Italy; 2. University of Florence, Italy; 3. Baker Hughes, a GE company, Italy*

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	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS	STRUCTURES & DYNAMICS: STRUCTURAL MECHANICS, VIBRATION & DAMPING	SUPERCRITICAL CO2 POWER CYCLES
	Gas Bearings 2	**Mistuning II**	**Oxy-Combustion**
	Technical Session • 128-A • MC-34-2	**Technical Session • 128-B • MC-35-2**	**Technical Session • 123 • MC-38-11**
	Session Organizer: **Mihai Arghir**, Universite De Poitiers - Instit Pprime, D3	Session Organizer: **Carlos Martel**, Universidad Politecnica de Madrid Session Co-Organizer: **Bogdan Epureanu**, University of Michigan	Session Organizer: **Jacob Delimont**, Southwest Research Institute Session Co-Organizer: **Subith Vasu**, University of Central Florida
4:00	**GT2019-90983** **An Instrumented High-Speed Rotor With Embedded Telemetry for the Continuous Spatial Pressure Profile Measurement in Gas Lubricated Bearings: A Proof of Concept** Karim Shalash, Jürg Schiffmann *Ecole Polytechnique Federale De Lausanne, Switzerland*	**GT2019-90884** **Prediction of Geometrically Induced Localization Effects Using a Subset of Nominal System Modes** Thomas Maywald[1] Christoph R. Heinrich[1] Arnold Kuehhorn[1] Sven Schrape[2] Thomas Backhaus[3] *1. Brandenburg University of Technology, Germany; 2. Rolls-Royce Deutschland, Germany; 3. Technische Universität Dresden, Germany*	**GT2019-90178** **Ignition Delay Times of Syngas and Methane in sCO2 Diluted Mixtures for Direct-Fired Cycles** Samuel Barak[1] Owen Pryor[2] Erik Ninnemann[1] Sneha Neupane[1] Xijia Lu[3] Brock Forrest[3] Subith Vasu[1] *1. University of Central Florida, USA; 2. UCF-CATER, USA; 3. 8 Rivers Capital, LLC, USA*
4:30	**GT2019-90984** **Pressure Profile Measurements Within the Gas Film of Journal Foil Bearings Using an Instrumented Rotor With Telemetry** Karim Shalash, Jürg Schiffmann *Ecole Polytechnique Federale De Lausanne, Switzerland*	**GT2019-90632** **Analysis of Statistical Characteristics and Global Sensitivity for Forced Response of Bladed Disks Mistuned by Material Anisotropy** Rahul Rajasekharan: Evgeny Petrov *Sussex University, United Kingdom;*	**GT2019-90899** **Igniter Testing for sCO2 Oxy-Combustion** Kelsi Katcher[1] Tim Allison[1] Shane Coogan[1] Yuin Jin[2] Chansun Lim[2] Sungho Chang[3] *1. Southwest Research Institute, USA; 2. Hanwha Power Systems, Korea; 3. KEPCO Research Institute, Korea*
5:00		**GT2019-90629** **Sensitivity and Forced Response Analysis of Anisotropy-Mistuned Bladed Disks With Nonlinear Contact Interfaces** Adam Koscso, Evgeny Petrov *University of Sussex, United Kingdom*	**GT2019-91779** **Carbon Monoxide Emission Measurements From a Supercritical CO2 Combustor Rig Using a Mid-Infrared Laser Absorption Diagnostic** James Anderson[1] Alejandro Camou[2] Eric Petersen[1] Mark Harris[3] David Cusano[3] *1. Texas A&M University, USA; 2. Solar Turbines Inc., USA; 3. Parametric Solutions, Inc., USA*

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	TURBOMACHINERY: AXIAL FLOW FAN & COMPRESSOR AERODYNAMICS	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY	TURBOMACHINERY: DUCTS & COMPONENT INTERACTIONS
	Flow Control	**Cavity, Bearings and Seal Design Methods and Applications**	**Inter-Component Ducts in Compressors and Other Rotating Components**
	Technical Session • 124-B • MC-39-16Part B	**Technical Session • 127-B • MC-41-13Part B**	**Technical Session • 127-C • MC-42-1Part B**
	Session Organizer: **Florian Herbst**, Leibniz University Hannover Session Co-Organizer: **Christoph Bode**, TU Braunschweig	Session Organizer: **Dr Adele Nasti**, Rolls-Royce plc Session Co-Organizer: **Michael J Pekris**, University of Surrey	Session Organizer: **David Cerantola**, Pratt and Whitney Canada Session Co-Organizer: **Deepak Thirumurthy**, Siemens Energy, Inc.
4:00	**GT2019-91552** **Improving Aerodynamic Performance of a Highly Loaded Compressor Based on Coanda Jet Flap** Juan Du, Yiwen Li, Zhihui Li, Jichao Li, Zinan Wang, Hongwu Zhang *Institute of Engineering Thermophysics, Chinese Academy of Sciences, China*	**GT2019-90146** **Simulation of an Aero-Engine Bearing Compartment Using Two-Way Transition Between Lagrangian Droplets and a Three-Dimensional Eulerian Liquid Film** Jean-Sebastien Dick[1] Vivek Kumar[2] Pravin Nakod[3] Federico Montanari[4] *1. Pratt & Whitney Canada, Canada; 2. ANSYS Software Pvt. Ltd., India; 3. ANSYS Inc., India; 4. ANSYS Inc., USA*	**GT2019-90213** **Experimental Investigation of the Discharge Behavior of Cavitating and Non-Cavitating Flow Through Rotating Radial Orifices** Laura Cordes, Corina Schwitzke, Hans-Jorg Bauer *Karlsruhe Institute of Technology, Germany*
4:30	**GT2019-91734** **Evaluation of Compressor Blading With Blade End Slots and Full-Span Slots in a Highly Loaded Compressor Cascade** Yumeng Tang, Yangwei Liu, Lipeng Lu *Beihang University, China*	**GT2019-90264** **A New OpenFOAM Solver Capable of Modelling Oil Jet-Breakup and Subsequent Film Formation for Bearing Chamber Applications** Andrew Nicoli, Richard J Jefferson-Loveday, Kathy Simmons *University of Nottingham, United Kingdom*	**GT2019-91866** **Aeromechanic Response of a Coupled Inlet-Fan Boundary Layer Ingesting Distortion-Tolerant Fan** Gregory S. Heinlein[1] Jen-Ping Chen[2] Milind Bakhle[1] *1. National Aeronautics and Space Administration, USA; 2. The Ohio State University, USA*
5:00		**GT2019-91657** **Modelling Droplet Heat and Mass Transfer in Aero-Engine Bearing Chambers** Dafne Gaviria Arcila[1] Hervé Morvan[1] Kathy Simmons[1] Stephen Ambrose[1] Bruce Kakimpa[2] Michael Walsh[1] *1. University of Nottingham, United Kingdom; 2. Norton Straw, United Kingdom*	

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	TURBOMACHINERY: RADIAL TURBOMACHINERY AERODYNAMICS	TURBOMACHINERY: UNSTEADY FLOWS IN TURBOMACHINERY	
	Centrifugal Compressors 2	**Modeling and Control Methods for Unsteady Flows**	
	Technical Session • 125-AB • MC-44-3	**Technical Session • 126-ABC • MC-45-13Part B**	
	Session Organizer: **Hideaki Tamaki**, IHI Corporation Session Co-Organizer: **Lee Galloway**, Queen's University Belfast	Session Organizer: **David Halstead**, GE Aviation Session Co-Organizer: **Tianyu Pan**, Beihang University	
4:00	**GT2019-90914** **Experimental Investigation for Enhanced Control of Rotating Unsteady Flow Instabilities in an Unshrouded Centrifugal Compressor Impeller** Bob Mischo[1] Philipp Jenny[2] Yves Bidaut[1] Nicola Fonzi[1] Daniel Hermann[3] Manfred C. Wirsum[3] *1. MAN Energy Solutions Schweiz AG, Switzerland; 2. MAN Diesel & Turbo Schweiz AG, Switzerland; 3. IKDG, RWTH Aachen University, Germany*	**GT2019-91253** **Loss Analysis of Unsteady Turbomachinery Flows Based on the Mechanical Work Potential** John Leggett[1] Edward Richardson[1] Stephan Priebe[2] Aamir Shabbir[3] Vittorio Michelassi[4] Richard D. Sandberg[5] *1. University of Southampton, United Kingdom; 2. GE Global Research, USA; 3. GE Aviation, USA; 4. General Electric, Italy; 5. The University of Melbourne, Australia*	
4:30	**GT2019-90476** **LDV Characterization of Unsteady Vaned Diffuser Flow in a Centrifugal Compressor** William J. Gooding, John C. Fabian, Nicole Key *Purdue University, USA*	**GT2019-91545** **Time-Space Spectral Method for Rotor-Rotor/Stator-Stator Interactions** Dingxi Wang, Xiuquan Huang, Shenren Xu, Huang Huang *Northwestern Polytechnical University, China*	
5:00			

HONORS AND AWARDS

ASME IGTI Scholar Lecture - Dr. Kenneth Suder

Lecture Session • North Ballroom • MC-50-1

Session Organizer: **John Blanton**, Classic Engineering, LLC

5:45

GT2019-91539

NASA's Role in Gas Turbine Technology Development: Accelerating Technical Progress via Collaboration Between Academia, Industry, and Government Agencies

Kenneth Suder
NASA Glenn Research Center, USA

TUESDAY JUNE 18 — 08:00 AM - 09:30 AM

	AIRCRAFT ENGINE	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS
	Whole Engine Performance and Novel Concepts	**Combustor Design and Development - Design for Emissions Reduction**	**Combustion Dynamics: Liquid Fuels**
	Technical Session • 124-A • TA-1-6	**Technical Session • 122-A • TA-4-3**	**Technical Session • 121-AB • TA-4-31**
	Session Organizer: **Andrew Nix**, West Virginia University Session Co-Organizer: **Eric Shepard**, Honeywell	Session Organizer: **Keith McManus**, GE Global Research Center Session Co-Organizer: **A. Benim**, Duesseldorf University of Applied Sciences	Session Organizer: **Antonio Andreini**, University of Florence Session Co-Organizer: **Stefano Puggelli**, Laboratoire EM2C, CNRS, CentraleSupélec, Université Paris-Saclay
8:00	**GT2019:90788** **Similarity Study of Lightly Loaded Shrouded Rotors for Distributed Propulsion** Massyl Lagha[1] Sébastien Duplaa[1] Nicolas Binder[1] Xavier Carbonneau[1] Benoit Rodriguez[2] *1. Université de Toulouse, ISAE-SUPAERO, France; 2. Safran Tech, France*	**GT2019:91653** **Lean Fully Premixed Injection for Commercial Jet Engines: An Initial Design Study** Paul Palies, Ragini Acharya, Andreas Hoffie, Matthew Thomas *CFD Research Corporation, USA*	**GT2019:91547** **Thermo-Acoustic Analysis of a Realistic Liquid-Fueled GT Combustor** Owen Graham[1] Nicholas Magina[1] A.J. Wickersham[1] Sebastiano Sorato[2] Sven Bethke[3] Fei Han[1] *1. GE Global Research, USA; 2. GE Power, Switzerland; 3. GE Power, USA*
8:30	**GT2019:90175** **Impact of Engine Degradation on Optimum Aircraft Trajectories - Short Range** Rukshan Navaratne[1] Vishal Sethi[2] Craig Lawson[2] *1. University of South Wales, United Kingdom; 2. Cranfield University, United Kingdom*	**GT2019:91937** **Scaling Methodology of the FAA Burner for Pre-Qualification Fire Tests of Aircraft Engine Panels** Mathieu Beland[1] Alain DeChamplain[1] Smail Kalla[1] Etienne Robert[2] *1. University Laval, Canada; 2. Ecole Polytechnique de Montreal, Canada*	**GT2019:91624** **Manufacture, Characterization and Stability Limits of an AM Prefilming Air-Blast Atomizer** Andrew P., Crayford[1] Franck Lacan[2] Jon Runyon[3] Philip J. Bowen[3] Shrinivas Balwadkar[3] Joseph Harper[1] Daniel Pugh[3] *1. Gas Turbine Research Centre, United Kingdom; 2. Mechanics, Materials and Advanced Manufacturing Research Group, United Kingdom; 3. Cardiff University, United Kingdom*
9:00	**GT2019:92011** **Integrated Turbine Design Using Evolutionary Strategies to Minimize Fuel Burn** Roy Hartfield, Noel Cervantes *Auburn University, USA*	**GT2019:91052** **Design Procedure and Performance Analysis of a Microturbine Combustor Working on Biogas for Power Generation** Bahamin Bazooyar, Hamidreza Gohari Darabkhani *Staffordshire University, United Kingdom*	**GT2019:91879** **Turbulent Flame Shape Switching at Conditions Relevant for Gas Turbines** Ivan Langella[1] Johannes Heinze[2] Thomas Behrendt[2] Lena Voigt[2] Nedunchezhian Swaminathan[3] Marco Zedda[4] *1. Loughborough University, United Kingdom; 2. German Aerospace Center (DLR), Germany; 3. University of Cambridge, United Kingdom; 4. Rolls-Royce plc, United Kingdom*

TUESDAY JUNE 18 — 08:00 AM - 09:30 AM

	CONTROLS, DIAGNOSTICS & INSTRUMENTATION	CYCLE INNOVATIONS	HEAT TRANSFER: NUMERICAL INTERNAL COOLING
	Performance Monitoring for GT	**Cycle Innovations in Renewable Power Systems**	**Numerical Internal Cooling II**
	Technical Session • 222-B • TA-5-4	**Technical Session • 221-B • TA-6-4**	**Technical Session • 131-B • TA-11-2**
	Session Organizer: **Donald L. Simon**, NASA Glenn Research Center	Session Organizer: **Jafar Alzaili**, City University of London Session Co-Chairs: **Ward De Paepe**, Université de Mons; **Simone Giorgetti**, Université Libre De Bruxelles	Session Organizer: **Hongzhou Xu**, Solar Turbines Inc Session Co-Organizer: **Lamyaa El-Gabry**, Princeton University
8:00	**GT2019:91018** **Automatic Gas Turbine Matching Scheme Adaptation for Robust GPA Diagnostics** Mikael Stenfelt[1] Valentina Zaccaria[2] Konstantinos Kyprianidis[2] *1. SAAB Aeronautics, Sweden; 2. Mälardalen University, Sweden*	**GT2019:90929** **Solar Desalination Based on Micro Gas Turbines Driven by Parabolic Dish Collectors** David Sánchez, Miguel Rollán, Lourdes García-Rodríguez, Gonzalo S. Martínez *University of Seville, Spain*	**GT2019:90520** **Numerical Study on Flow and Heat Transfer Characteristics of Pin-Fins With Different Shapes** Wei Jin, Ning Jia, Junmei Wu, Jiang Lei, Lin Liu *Xi'an Jiaotong University, China*
8:30	**GT2019:90858** **A Model-Based Solution for Gas Turbine Diagnostics: Simulations and Experimental Verification** Valentina Zaccaria[1] Mikael Stenfelt[1] Anna Sjunnesson[2] Andreas Hansson[2] Konstantinos Kyprianidis[1] *1. Mälardalen University, Sweden; 2. Siemens Turbomachinery AB, Sweden*	**GT2019:91180** **Application of Artificial Neural Networks for Monitoring and Optimum Operation Prediction of Solar Hybrid MGT Systems** Davide Iaria[1] Homam Nikpey Somehsaraei[2] Jafar Alzaili[1] Abdulnaser Sayma[1] Mohsen Assadi[2] Mohsen Ghavami[1] *1. City University of London, United Kingdom; 2. University of Stavanger, Norway*	**GT2019:90421** **Effects of Jetting Orifice Geometry Parameters and Channel Reynolds Number on Bended Channel Cooling for a Novel Internal Cooling Structure** Wei He, Qinghua Deng, Juan He, Tieyu Gao, Zhenping Feng *Xi'an Jiaotong University, China*
9:00	**GT2019:90161** **Extending Engine Gas Path Analysis Using Full Flight Data** Liang Tang, Allan Volponi, Ethan Prihar *Pratt & Whitney, USA*	**GT2019:91048** **Preliminary Design and Performance Assessment of an Underwater CAES System (UW-CAES) for Wind Power Balancing** Marco Astolfi, Giulio Guandalini, Marco Belloli, Adriano Hirn, Paolo Silva, Stefano Campanari *Politecnico di Milano, Italy*	**GT2019:90567** **Effects of High Heating Loads on Unsteady Flow and Heat Transfer in a Cooling Passage With a Staggered Array of Pin Fins** Chien-Shing Lee[1] Tom Shih[1] Kenneth Mark Bryden[2] Richard Dennis[3] *1. Purdue University, USA; 2. U.S. Department of Energy, Ames Laboratory, USA; 3. U.S. Department of Energy, National Energy Technology Laboratory, USA*

TUESDAY JUNE 18 — 08:00 AM - 09:30 AM

	HEAT TRANSFER: NUMERICAL FILM COOLING	HEAT TRANSFER: EXPERIMENTAL FILM COOLING	INDUSTRIAL & COGENERATION
	Hole Shape Studies I	**Experimental Film Cooling IV**	**Hybrid Industrial Co-Generation Systems**
	Technical Session • 131-C • TA-12-6	**Technical Session • 132-AB • TA-19-4**	**Technical Session • 221-C • TA-23-5**
	Session Organizer: **James Heidmann**, NASA Glenn Research Ctr Session Co-Organizer: **Stephen Lynch**, Pennsylvania State University	Session Organizer: **Lesley Wright**, Texas A&M University Session Co-Organizer: **Pepe Palafox**, GE Aviation	Session Organizer: **Yiguang Li**, Cranfield University Session Co-Chairs: **Alozie Ogechukwu**, Cranfield University; **Sergio Camporeale**, Politecnico di Bari - DMMM
8:00	**GT2019:90304** **The Effect of Mainstream Mach Number on Film Cooling Characteristics of a Hole Integrated With Saw-Tooth Slot** Zhiping LI, Wei-Jiang Xu, Zhuang Wu, Tianliang Zhou, Yidian Zhou, Hui-ren Zhu *Northwestern Polytechnical University, China*	**GT2019:91132** **Evaluation of Film Cooling Superposition Predictions Using Shaped Holes on the Suction Side of a Blade Model** Christopher Yoon, Jacob Moore, David Bogard *University of Texas at Austin, USA*	**GT2019:90604** **Performance Analysis of a Hybrid Solar Gas Turbine Plant Combined With Chemical Recuperation** Zhitao Wang, Wanling Qi, Tielei Li, Shuying Li *Harbin Engineering University, China*
8:30	**GT2019:91475** **Enhancement of Film Cooling Effectiveness Using Dean Vortices** Pingting Chen[1] Lang Wang[1] Xueying Li[2] Jing Ren[1] Hongde Jiang[1] Terrence Simon[3] *1. Tsinghua University, China; 2. Tsinghua University, Department of Thermal Engineering, China; 3. Univeristy of Minnesota, USA*	**GT2019:91476** **Surface Curvature Effects on Film Cooling Performance for Shaped Holes on a Model Turbine Blade** Jacob Moore, Christopher Yoon, David Bogard *University of Texas at Austin, USA*	**GT2019:90617** **Capacity Matching of Aeroderivative Gas Generator With Free Power Turbine: Challenges, Uncertainties, and Opportunities** Deepak Thirumurthy[1] Jose C. Casado Coca[2] Kanishka Suraweera[3] *1. Siemens Energy, Inc., USA; 2. China Huaneng Clean Energy Research Institute, Canada; 3. Siemens Canada Limited, Canada*
9:00	**GT2019:90458** **Aerothermal Simulations Comparisons of a Shaped-Hole Film Cooling Flow** Matthieu Simon[1] Gautier Sebastien[2] Emmanuel Vanoli[3] Pierre Auzillon[1] *1. Safran Aircraft Engines, France; 2. Exa Corp, Germany; 3. Dassault Systèmes, France*	**GT2019:91446** **Time-Resolved Flow Field Analysis of Effusion Cooling System With Representative Swirling Main Flow** Tommaso Lenzi[1] Lorenzo Palanti[2] Alessio Picchi[1] Tommaso Bacci[1] Lorenzo Mazzei[1] Antonio Andreini[1] Bruno Facchini[1] Ignazio Vitale[3] *1. University of Florence, Italy; 2. Department of Industrial Engineering, University of Florence, Italy; 3. Avio Aero - a GE Aviation Business, Italy*	**GT2019:90748** **Steam Injected Gas Turbine (STIG) for Load Flexible CHP: Aspects of Dynamic Behaviour, Control and Water Recovery** Thorsten Lutsch, Guntram Buchheim, Uwe Gampe *Technische Universität Dresden, Germany*

TUESDAY JUNE 18 — 08:00 AM - 09:30 AM

	MANUFACTURING MATERIALS & METALLURGY	MARINE	OIL & GAS APPLICATIONS
	Narrow and Wide Gap Diffusion Braze Repair Technology including Applications	**Testing**	**LNG Applications**
	Tutorial Session • 121 C • TA-24-10	**Technical Session • 221-A • TA-25-4**	**Technical Session • 130 • TA-27-1**
	Session Organizer: **David Day**, Doosan Session Co-Organizer: **Robin Day**, Chair of Digital Additive Production DAP	Session Organizer: **Kenneth M. Braccio**, Advanced Turbine Services	Session Organizer: **Tim Allison**, Southwest Research Institute
8:00	**GT2019:92148** **Narrow and Wide Gap Diffusion Braze Repair Technology including Applications** Warren Miglietti *Miglietti and Associates, USA*	**GT2019:90135** **Performance and Voyage Analysis of a Marine Gas Turbine Engine Installed to Power and Propel an Ocean-Going Cargo Ship From Cape Town to Rotterdam** Mathias Bonet[1] Pericles Pilidis[2] Georgios Doulgeris[2] Evangelos Tsoudis[2] *1. Nigerian Defence Academy, Nigeria;* *2. Cranfield University, United Kingdom*	**GT2019:90068** **Property Risk Assessment for Liquefied Natural Gas Liquefaction Plants** George Orme[1] Mauro Venturini[2] *1. Berkshire Hathaway Specialty Insurance, USA;* *2. Università Degli Studi Di Ferrara, Italy*
8:30	**T U T O R I A L**	**GT2019:90784** **The Research on Compressor Performance Degradation Caused by Surface Roughness Enlargement due to Corrosion in Marine Environments** Haiou Sun, Ma Jingyuan, Zhongyi Wang, Cao Lei *Harbin Engineering University, China*	**GT2019:90495** **Off-Design Performance Evaluation of a LNG Production Plant Coupled With Renewables** Maria Alessandra Ancona[1] Michele Bianchi[1] Lisa Branchini[1] Francesco Catena[2] Andrea De Pascale[1] Francesco Melino[1] Antonio Peretto[3] *1. University of Bologna, Italy; 2. Alma Mater Studiorum, Università di Bologna - DIN, Italy;* *3. Diem-facolta Inegneria, Italy*
9:00		**GT2019:91535** **Analysis of U.S. Navy Rolls Royce 501-K34 Turbine Engine Removals 2008 to 2018** Dennis Russom, Jeffrey Patterson, Ivan Pineiro *Naval Surface Warfare Center - Philadelphia Division, USA*	**GT2019:90329** **Design Considerations for High Pressure Boil-Off Gas (BOG) Centrifugal Compressors With Synchronous Motor Drives in LNG Liquefaction Plants** Matt Taher, Cyrus Meher-Homji *Bechtel Corporation, USA*

TUESDAY JUNE 18 — 08:00 AM - 09:30 AM

	STEAM TURBINES	STRUCTURES & DYNAMICS: ROTORDYNAMICS	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS
	Valves and Seals	**Introduction to Torsional Rotordynamics**	**Seals 2**
	Technical Session • 127-A • TA-29-7	**Tutorial Session • 129-AB • TA-33-12Part A**	**Technical Session • 128-A • TA-34-13**
	Session Organizer: **Cosimo Bianchini**, Ergon Research Session Co-Chairs: **Deqi Yu**, Shanghai Electric; **Zhenping Feng**, Xi'an Jiaotong University	Session Organizer: **Mateusz Golebiowski**, General Electric (Switzerland) GmbH	Session Organizer: **Adolfo Delgado**, Texas A&M University Session Co-Organizer: **Bugra Ertas**, GE Global Research Center
8:00	**GT2019:90152** **Effects of Labyrinth Fin Wear on Aerodynamic Performance of Turbine Stages: Part I: Bending Damages** Xin Yan, Xinbo Dai *Xi'an Jiaotong University, China*	**GT2019:92091** **An Introduction to Torsional Rotordynamics** Justin Hollingsworth *Southwest Research Institute, USA*	**GT2019:90004** **Preswirl and Mixed-Flow (Mainly-Liquid) Effects on Rotordynamic Performance of a Long (L/D=0.75) Smooth Seal** Dung L. Tran[1] Dara W. Childs[2] Hari Shrestha[3] Min Zhang[4] *1. Energy Recovery Inc., USA; 2. Turbomachinery Laboratory, Texas A&M University, USA; 3. Atlas Copco Comptec LLC, USA; 4. Praxair Inc., USA*
8:30	**GT2019:90153** **Effects of Labyrinth Fin Wear on Aerodynamic Performance of Turbine Stages: Part II: Mushrooming Damages** Xinbo Dai, Xin Yan *Xi'an Jiaotong University, China*	**T U T O R I A L**	**GT2019:90237** **Non-Axisymmetric Flows and Rotordynamic Forces in an Eccentric Shrouded Centrifugal Compressor: Part – Measurement** Jieun Song[1] Suyong Kim[1] Tae Choon Park[2] Bong-Jun Cha[2] Dong Hun Lim[3] Joo Sung Hong[3] Tae Wook Lee[3] Seung Jin Song[1] *1. Seoul National University, Korea; 2. Korea Aerospace Research Institute (KARI), Korea; 3. Hanwha Power Systems, Korea*
9:00	**GT2019:91605** **Demonstration of a Dynamic Clearance Seal in a Rotating Steam Test Facility** Andrew Messenger[1] Richard Williams[1] Grant Ingram[1] Simon Hogg[2] Philip Reggentin[3] *1. Durham University, United Kingdom; 2. Department of Engineering, United Kingdom; 3. Technical University of Braunschweig, Germany*		**GT2019:90669** **Non-Axisymmetric Flows and Rotordynamic Forces in an Eccentric Shrouded Centrifugal Compressor: Part 2 – Analysis** Jieun Song, Seung Jin Song *Seoul National University, Korea*

TUESDAY JUNE 18 — 08:00 AM - 09:30 AM

	STRUCTURES & DYNAMICS: STRUCTURAL MECHANICS, VIBRATION & DAMPING	SUPERCRITICAL CO2 POWER CYCLES	TURBOMACHINERY: AXIAL FLOW TURBINE AERODYNAMICS
	Mistuning III	**Heat Exchangers for Supercritical CO2 Power Cycle Applications**	**Endwall Profiling**
	Technical Session • 128-B • TA-35-3	**Tutorial Session • 123 • TA-38-14**	**Technical Session • 126-ABC • TA-40-2**
	Session Organizer: **Luigi Carassale**, University of Genova Session Co-Organizer: **Christian M. Firrone**, Politecnico di Torino	Session Organizer: **Grant Musgrove**, Southwest Research Institute	Session Organizer: **Giacomo Persico**, Politecnico Di Milano
8:00	**GT2019:91484** **Strain Gage Ramifications on Mistuning in As-Manufactured Models and Experimental Testing** Daniel Gillaugh[1] Alex Kaszynski[2] Jeff Brown[3] Joseph Beck[4] Joseph Slater[5] *1. AFRL/RQTI, USA; 2. UTC, USA; 3. US Air Force Research Laboratory, USA; 4. Perceptive Engineering Analytics, LLC, USA; 5. Wright State University, USA*	**GT2019:90063** **Heat Exchangers for Supercritical CO2 Power Cycle Applications** Grant Musgrove[1] Marc Portnoff[2] Shaun Sullivan[3] *1. Southwest Research Institute, USA; 2. Thar Energy, LLC, USA; 3. Brayton Energy LLC, USA*	**GT2019:90377** **An Advanced Single-Stage Turbine Facility for Investigating Non-Axisymmetric Contoured Endwalls in the Presence of Purge Flow** Robin Jones, Oliver Pountney, Bjorn Cleton, Liam Wood, Buchan Deneys Schreiner, Artur Carvalho Figueiredo, James Scobie, David Cleaver, G.D. Lock, Carl Sangan *University of Bath, United Kingdom*
8:30	**GT2019:91702** **A New Mistuning Identification Method Based on the Subset of Nominal System Modes Method** Christian Waldherr[1] Patrick Buchwald[2] Damian Vogt[2] *1. ITSM, University of Stuttgart, Germany; 2. University of Stuttgart, Germany*	**T U T O R I A L**	**GT2019:90443** **Design of Contoured Turbine Endwalls in the Presence of Purge Flow: A Feature-Based Approach** Buchan Deneys Schreiner[1] Mike Wilson[1] Y.S. Li[2] Carl Sangan[1] *1. University of Bath, United Kingdom; 2. Siemens Industrial Turbomachinery Ltd, United Kingdom*
9:00	**GT2019:92047** **Vibration Analysis of a Mistuned Axial Turbine Blisk** Bernd Beirow[1] Arnold Kuehhorn[1] Felix Figaschewsky[1] Alfons Bornhorn[2] *1. Brandenburg University of Technology, Germany; 2. MAN Energy Solutions SE, Germany*		**GT2019:90446** **A Geometry Generation Framework for Contoured Endwalls** Liam Wood, Robin Jones, Oliver Pountney, James Scobie, D. Andrew Rees, Carl Sangan *University of Bath, United Kingdom*

TUESDAY JUNE 18 — 08:00 AM - 09:30 AM

	TURBOMACHINERY: RADIAL TURBOMACHINERY AERODYNAMICS	TURBOMACHINERY: DEPOSITION, EROSION, FOULING, AND ICING	WIND ENERGY
	Radial and Mixed Flow Turbine Modelling	**Deposition Modeling**	**Wind Turbine Design and Farm Analysis**
	Technical Session • 125-AB • TA-44-8	**Technical Session • 127-B • TA-47-6Part A**	**Technical Session • 131-A • TA-48-2**
	Session Organizer: **Jason Walkingshaw**, BorgWarner Turbo Systems Engineering GmbH Session Co-Organizer: **Mingyang Yang**, Shanghai Jiao Tong University	Session Organizer: **Ryan Lundgreen**, Pratt & Whitney Session Co-Organizer: **Michele Pinelli**, University of Ferrara Endif	Session Organizer: **Alessandro Bianchini**, University of Florence Session Co-Organizer: **Kenneth Van Treuren**, Baylor University
8:00	**GT2019:91982** **Meanline Modeling of Asymmetrical Twin-Scroll Turbine: Loss Coefficient Transferability Between Turbines of Different Sizes** Meng Soon Chiong[1] Srithar Rajoo[1] Ricardo Martinez-Botas[2] Torsten Palenschat[3] Peter Weitzman[4] Mark Anderson[4] Thiago Ebel[4] *1. Universiti Teknologi Malaysia, Malaysia; 2. Imperial College London, United Kingdom; 3. Daimler AG, Germany; 4. Concepts NREC, USA*	**GT2019:90266** **A Multiphase Computational Framework for Deposit Formation and Growth** Steven Paul[1] Danesh Tafti[1] Kuahai Yu[2] *1. Virginia Tech, USA; 2. Henan University of Science and Technology, China*	**GT2019:91491** **CFD Investigation of the Multiple Rotors Darrieus Type Turbine Performance** Ahmed El Baz, Omar Sherif Mohamed, Ahmed Ibrahim *The British University in Egypt, Egypt*
8:30	**GT2019:91856** **A New Approach to Performance Mapping of Radial Inflow Turbines** Davide Biliotti, Alberto Scotti del Greco, Francesco Cangioli, Giuseppe Iurisci *Baker Hughes, a GE company, Italy*	**GT2019:91087** **Heat Transfer During Impact of Elastoplastic and Cohesive Particles** Kuahai Yu[1] Danesh Tafti[2] Xi Yang[1] Shihong Xin[1] *1. Henan University of Science and Technology, China; 2. Virginia Tech, USA*	**GT2019:91523** **Impact of Forecast Uncertainty on Wind Farm Profitability** Guido Francesco Frate[1] Lorenzo Ferrari[2] Umberto Desideri[1] *1. University of Pisa, Italy; 2. University of Pisa - DESTEC, Italy*
9:00	**GT2019:91299** **TURBODYNA: Centrifugal/Centripetal Turbomachinery Dynamic Simulator and its Application on a Mixed Flow Turbine** Bijie Yang, Ricardo Martinez-Botas *Imperial College London, United Kingdom*	**GT2019:91733** **A Non-Dimensional Approach for Generalizing the Particle Impact Behavior of Gas Turbine Fouling** Alessio Suman[1] Nicola Casari[1] Elettra Fabbri[1] Michele Pinelli[2] Luca di Mare[3] Francesco Montomoli[4] *1. University of Ferrara, Italy; 2. Univeristy of Ferrara Endif, Italy; 3. University of Oxford, United Kingdom; 4. Imperial College London, United Kingdom*	

TUESDAY JUNE 18 — 08:00 AM - 09:30 AM

TURBOMACHINERY: TUTORIALS

Secondary Flow Systems Modeling

Tutorial Session • 127-C • TA-52-1

Session Organizer: **Andreas Peters**, GE Aviation

8:00

GT2019:92137
Modeling of Turbomachinery Secondary Flow Systems
Clement Joly[1] Abdul Nassar[2]
1. Softinway, Inc, USA; 2. Softinway Turbomachinery Solutions Pvt Ltd, India

8:30

9:00

T U T O R I A L

HONORS AND AWARDS

Aircraft Engine Technology Award

Lecture Session • 124-B • TA-50-2

Session Organizer: **Andrew Nix**, West Virginia University

8:30

GT2019:92349
Evolution and Revolution in Fighter Jet Propulsion - Past, Present, and Future
Thomas W. Prete
Pratt & Whitney, USA

9:00

9:30

KEYNOTE & PLENARIES

Plenary: Turbomachines for Clean Power and Propulsion Systems – Aviation Focus

Panel Session • North Ballroom • TA-51-2

Session Organizer: **James Heidmann**, NASA Glenn Research Ctr
Session Co-Organizer: **Timothy C. Lieuwen**, Georgia Institute of Technology

9:40

GT2019:92362
Plenary: Aviation Focus, Eric Blumer
Eric Blumer
Honeywell, INC., USA

GT2019:92370
Plenary: Aviation Focus, Alexander Simpson
Alexander Simpson
GE Aviation, USA

GT2019:92411
Plenary: Aviation Focus, Francis Preli
Francis R. Preli
Pratt & Whitney, USA

10:10

10:40

TUESDAY JUNE 18 — 11:15 AM - 12:45 PM

	AIRCRAFT ENGINE	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS
	Basics of Gas Turbine Cycle Modelling	**Fundamental Combustion - Flame Propagation and Quenching**	**Blow-Off, Flashback & Ignition -1**
	Tutorial Session • 124-A • TB-1-12	**Technical Session • 122-BC • TB-4-6**	**Technical Session • 121-AB • TB-4-36Part A**
	Session Organizer: **Wilfried Visser**, Delft University Session Co-Chairs: **Oscar Kogenhop**, National Aerospace Laboratory NLR; **Konstantinos Kyprianidis**, Mälardalen University	Session Organizer: **Samir Rida**, Honeywell Aerospace Session Co-Organizer: **Scott Drennan**, Convergent Science, Inc.	Session Organizer: **Thomas Sattelmayer**, TU-Muenchen Session Co-Organizer: **Francesca di Mare**, Ruhr-University Bochum
11:15	**GT2019:92110** **Basics of Gas Turbine Cycle Modelling** Wilfried Visser[1] Konstantinos Kyprianidis[2] Oscar Kogenhop[3] *1. Delft University, Netherlands; 2. Malardalen University, Sweden; 3. National Aerospace Laboratory NLR, Netherlands*	**GT2019:90832** **A Semi-Analytical Model for Prediction of Wall Quenching Distances of Premixed Flames** Xia Huang, Huiru Wang *Aero-Engine Academy of China, China*	**GT2019:90507** **Boundary Layer Flashback Prediction for Turbulent Premixed Jet Flames: Comparison of Two Models** Alireza Kalantari[1] Nicolas Auwaijan[1] Vincent McDonell[2] *1. UCI Combustion Laboratory, USA; 2. University of California, USA*
11:45	**T U T O R I A L**	**GT2019:90918** **Effect of CO2 Dilution on the Laminar Burning Velocities of Premixed Methane/Air Flames at Elevated Temperature** Berk C. Duva, Lauren E. Chance, Elisa Toulson *Michigan State University, USA*	**GT2019:91252** **Simultaneous TR-PIV and CH* Chemiluminescence During Combustion-Instability Triggered Flame-Flashback in a Backward Facing Step Combustor** Pankaj Pancharia, Vikram Ramanan, Baladandayuthapani Nagarajan, S.R. Chakravarthy *Indian Institute of Technology Madras, India*
12:15		**GT2019:91392** **An Investigation of Laminar Flame Speed of CH4-O2-CO2 Mixtures** Mattias Turner, Tyler Paschal, Waruna Kulatilaka, Eric Petersen *Texas A&M University, USA*	**GT2019:91235** **Improving Emission and Blow-Out Characteristics of Novel Natural Gas Low NOx Burners for Heavy Duty Gas Turbine** Matteo Cerutti[1] Michele Roma[1] Alessio Picchi[2] Riccardo Becchi[2] Bruno Facchini[2] *1. Baker Hughes, a GE company, Italy;* *2. University of Florence, Italy*

TUESDAY JUNE 18 — 11:15 AM - 12:45 PM

	COMBUSTION, FUELS & EMISSIONS	CONTROLS, DIAGNOSTICS & INSTRUMENTATION	CYCLE INNOVATIONS
	Combustion Dynamics Tutorial	**Surface Diag. Instrumentation Applications**	**Cycle Innovations in Small Scale Applications**
	Tutorial Session • 122-A • TB-4-39	Technical Session • 222-B • TB-5-7	Technical Session • 221-B • TB-6-3
	Session Organizer: **Jacqueline O'Connor**, Pennsylvania State University Session Co-Organizer: **Timothy C. Lieuwen**, Georgia Institute of Technology	Session Organizer: **Richard Bunce PE**, Siemens Energy, Inc. (Retired)	Session Organizer: **Ward De Paepe**, Université de Mons Session Co-Chairs: **Iacopo Rossi**, University of Genoa; **Alessandro Sorce**, University of Genoa
11:15	**GT2019:92096** **Combustion Dynamics Tutorial: Presentation Handout** Timothy C. Lieuwen[1] Jacqueline O'Connor[2] *1. Georgia Institute of Technology, USA; 2. Pennsylvania State University, USA*	**GT2019:91012** **Development of High Speed and High Temperature Atomic Layer Thermopiles** Lakshya Bhatnagar, Guillermo Paniagua *Purdue University, USA*	**GT2019:90894** **Adaptive Control of Micro Gas Turbine for Engine Degradation Compensation** Valentina Zaccaria[1] Mario Luigi Ferrari[2] Konstantinos Kyprianidis[1] *1. Mälardalen University, Sweden; 2. University of Genoa, Italy*
11:45	**T U T O R I A L**	**GT2019:90260** **Investigation of an Advanced Acoustic Based Nondestructive Evaluation Method** Peter Warren[1] Jason Williams[2] Paul Zombo[2] Ranajay Ghosh[1] *1. University of Central Florida, USA; 2. Siemens Power Generation, USA*	**GT2019:91389** **Humidified Micro Gas Turbine for Range Extended Electric Vehicles: Thermodynamic Performance Assessment** Ward De Paepe[1] Marina Montero Carrero[2] Alessio Pappa[1] Laurent Bricteux[1] Francesco Contino[2] *1. Université de Mons, Belgium; 2. Vrije Universiteit Brussel, Belgium*
12:15		**GT2019:91105** **Experimental Demonstration of Inverse Heat Transfer Methodologies for Turbine Applications** David Gonzalez Cuadrado, Francisco Lozano, Guillermo Paniagua *Purdue University, USA*	**GT2019:91400** **Surrogate-Assisted Modeling and Robust Optimization of a Micro Gas Turbine Plant With Carbon Capture** Simone Giorgetti[1] Diederik Coppitters[2] Gianmarco Aversano[1] Alessandro Parente[1] Laurent Bricteux[3] Francesco Contino[2] Ward De Paepe[3] *1. Université Libre De Bruxelles, Belgium; 2. Vrije Universiteit Brussel, Belgium; 3. Université de Mons, Belgium*

TUESDAY JUNE 18 — 11:15 AM - 12:45 PM

	HEAT TRANSFER: NUMERICAL FILM COOLING	HEAT TRANSFER: INTERNAL AIR SYSTEMS & SEALS (WITH TURBOMACHINERY)	HEAT TRANSFER: EXPERIMENTAL INTERNAL COOLING
	Advanced Turbulence Modeling/ Simulation	**Hot Gas Ingestion: Ingress/Egress I**	**Experimental Internal Cooling I**
	Technical Session • 131-C • TB-12-5	**Technical Session • 131-B • TB-15-1**	**Technical Session • 132-AB • TB-16-1**
	Session Organizer: **Antonio Andreini**, University of Florence Session Co-Organizer: **Cosimo Bianchini**, Ergon Research	Session Organizer: **Peter Smout**, Rolls-Royce plc Session Co-Organizer: **John Chew**, University of Surrey	Session Organizer: **Eric Ruggiero**, GE Aviation Session Co-Chairs: **Seth Lawson**, US Department of Energy; **Brian Brzek**, GE Global Research
11:15	**GT2019:90646** **Topology and Physical Interpretation of Turbulence Model Behavior on an Array of Film Cooling Jets** Justin Hodges[1] Jayanta Kapat[2] *1. CATER / University of Central Florida, USA; 2. University of Central Florida, USA*	**GT2019:90987** **The Effect of Vanes and Blades on Ingress in Gas Turbines** Fabian Hualca, Josh Horwood, Carl Sangan, G.D. Lock, James Scobie *University of Bath, United Kingdom*	**GT2019:90097** **Detailed Heat Transfer Coefficient Measurements on a Scaled Realistic Turbine Blade Internal Cooling System** Chao-Cheng Shiau[1] Andrew F Chen[1] Je-Chin Han[1] Robert Krewinkel[2] *1. Texas A&M University, USA; 2. MAN Energy Solutions SE, Germany*
11:45	**GT2019:90943** **Effects of Velocity Ratio on Trends in Film-Cooling Adiabatic Effectiveness and Turbulence** Zachary Stratton, Tom Shih *Purdue University, USA*	**GT2019:90441** **Numerical Investigation on Unsteady Flow in the Upstream and Downstream Sealing System of a 1.5-Stage Gas Turbine** Zhao Lianpeng, Ma Hongwei *Beihang University, China*	**GT2019:90099** **Effect of 45-Deg Rib Orientations on Heat Transfer in a Rotating Two-Pass Channel With Aspect Ratio From 4:1 to 2:1** Izzet Sahin[1] Andrew F Chen[1] Chao-Cheng Shiau[1] Je-Chin Han[1] Robert Krewinkel[2] *1. Texas A&M University, USA; 2. MAN Energy Solutions SE, Germany*
12:15	**GT2019:91375** **Large-Eddy Simulations of Heat Transfer Within a Multi-Perforation Synthetic Jets Configuration** Soizic Esnault, Florent Duchaine, Laurent Gicquel *CERFACS, France*	**GT2019:90982** **Flow Instabilities in Gas Turbine Chute Seals** Josh Horwood[1] Fabian Hualca[1] Mike Wilson[1] James Scobie[1] Carl Sangan[1] G.D. Lock[1] Johan Dahlqvist[2] Jens Fridh[3] *1. University of Bath, United Kingdom; 2. Scania CV AB, Sweden; 3. KTH Royal Institute of Technology, Sweden*	**GT2019:90552** **Vortical Structures in Pin Fin Arrays for Turbine Cooling Applications** Marcel Otto[1] Justin Hodges[2] Gaurav Gupta[1] Jayanta Kapat[1] *1. University of Central Florida, USA; 2. CATER / University of Central Florida, USA*

TUESDAY JUNE 18 — 11:15 AM - 12:45 PM

	INDUSTRIAL & COGENERATION	MANUFACTURING MATERIALS & METALLURGY	MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES
	Cogeneration from Solar and Biomass Energy Sources Including Thermal Storage	**Machining**	**Microturbines: Component Design and Performance Analysis**
	Tutorial Session • 221-C • TB-23-12	**Technical Session • 121-C • TB-24-5Part A**	**Technical Session • 221-A • TB-26-1**
	Session Organizer: **Sergio Camporeale**, Politecnico di Bari - DMMM	Session Organizer: **Joseph Janssen**, Metem Corp Session Co-Organizer: **Sascha Gierlings**, Fraunhofer IPT	Session Organizer: **Raffaele Tuccillo**, University of Naples
11:15	**GT2019:92235** **Cogeneration From Solar and Biomass Energy Sources Including Thermal Storage** Sergio Camporeale *Politecnico di Bari - DMMM, Italy*	**GT2019:90139** **Development of an Alternative Approach for Cutting Force Determination in Broaching** Thomas Bergs, Benjamin Doebbeler, Tobias Seelbach, Martin Seimann, Fritz Klocke *Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University, Germany*	**GT2019:90010** **Experimental and Analytical Analysis of Aero-Derivative Micro Gas Turbine Heat Transfer and Performance** Aki Grönman, Petri Sallinen, Juha Honkatukia, Jari Backman, Antti Uusitalo, Janne Nerg, Ahti Jaatinen-Värri *Lappeenranta University of Technology, Finland*
11:45	**T U T O R I A L**	**GT2019:91505** **Influence of an Additional Indexing Rotary Axis on Wire EDM Performance for the Automated Manufacture of Fir Tree Slots** Thomas Bergs[1] Ugur Tombul[1] Tim Herrig[1] Andreas Klink[1] David Welling[2] *1. Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University, Germany; 2. Makino Europe GmbH, Germany*	**GT2019:90927** **Validation of Lifetime Models for Recuperator Foils Through Long-Term Laboratory and Engine Testing** Sebastien Dryepondt, Bruce A. Pint *Oak Ridge National Laboratory, USA*
12:15		**GT2019:91266** **Mandrel-Free Hot-Spinning of 17-4 PH Truncated Cone** Ken Ikawa, Yoshihide Imamura, Kojiro Motoyama, Hayato Iwasaki, Takeo Hirakawa *Kawasaki heavy industries, Ltd., Japan*	

TUESDAY JUNE 18 — 11:15 AM - 12:45 PM

	OIL & GAS APPLICATIONS	STEAM TURBINES	STRUCTURES & DYNAMICS: ROTORDYNAMICS
	Power Cycles and Thermodynamics	**Operational Aspects**	**Introduction to Torsional Rotordynamics**
	Technical Session • 130 • TB-27-9	**Technical Session • 127-A • TB-29-8**	**Tutorial Session • 129-AB • TB-33-12Part B**
	Session Organizer: **Mirko Morini**, University of Parma	Session Organizer: **Christian Kontermann**, Chair and Institute for Materials Technology, TU Darmstadt Session Co-Organizer: **Jan Vogt**, GE Germany	Session Organizer: **Mateusz Golebiowski**, General Electric (Switzerland) GmbH
11:15	**GT2019:90009** **Optimum Size of ORC Cycles for Waste Heat Recovery in Natural Gas Compressor Stations** Lisa Branchini[1] Maria Alessandra Ancona[1] Michele Bianchi[1] Andrea De Pascale[1] Francesco Melino[1] Antonio Peretto[2] Saverio Ottaviano[1] Noemi Torricelli[1] Daniele Archetti[3] Nicola Rossetti[3] Tommaso Ferrari[3] *1. University of Bologna, Italy; 2. Diem-facolta Inegneria, Italy; 3. Turboden srl, Italy*	**GT2019:90464** **Steam Turbine Hot Standby: Electrical Pre-Heating Solution** Yevgen Kostenko, David Veltmann, Simon Hecker *Siemens AG Power and Gas Division, Germany*	**GT2019:92346** **Introduction to Torsional Rotordynamics** Justin Hollingsworth *Southwest Research Institute, USA* **T U T O R I A L**
11:45	**GT2019:90112** **The Use of Departure Functions to Estimate Deviation of a Real Gas From the Ideal Gas Model** Matt Taher *Bechtel, USA*	**GT2019:90580** **Thermo-Structural Analysis of Steam Turbine in Pre-Warming Operation With Hot Air** Piotr Luczynski[1] Dennis Toebben[2] Lukas Pehle[3] Manfred Wirsum[1] Wolfgang F. D. Mohr[4] Klaus Helbig[5] *1. IKDG, RWTH Aachen University, Germany; 2. RWTH Aachen University, Germany; 3. Institute for Power Plants Technology, Steam and Gas Turbines, Germany; 4. General Electric Power AG, Switzerland; 5. GE Power, Germany*	
12:15	**GT2019:90348** **Impacts of H2 Blending on Capacity and Efficiency on a Gas Transport Network** Francis Bainier[1] Rainer Kurz[2] *1. Grtgaz, France; 2. Solar Turbines, USA*	**GT2019:90761** **Investigation of Steam Turbine Warm-Keeping by Use of Air** Dennis Toebben[1] Piotr Luczynski[2] Manfred Wirsum[2] Wolfgang F. D. Mohr[3] Klaus Helbig[4] *1. RWTH Aachen University, Germany; 2. IKDG, RWTH Aachen University, Germany; 3. General Electric Power AG, Switzerland; 4. GE Power, Germany*	

TUESDAY JUNE 18 — 11:15 AM - 12:45 PM

	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS	STRUCTURES & DYNAMICS: STRUCTURAL MECHANICS, VIBRATION & DAMPING	SUPERCRITICAL CO2 POWER CYCLES
	Seals 3	**Dynamics of Bladed Disks with Nonlinearities**	**sCO2 Power Cycles - I**
	Technical Session • 128-A • TB-34-14	**Technical Session • 128-B • TB-35-4**	**Technical Session • 123 • TB-38-8**
	Session Organizer: **Patrick Keogh**, University of Bath Session Co-Organizer: **Jason Wilkes**, Southwest Research Institute	Session Organizer: **Kiran D'Souza**, The Ohio State University Session Co-Organizer: **Yasutomu Kaneko**, Ryukoku University	Session Organizer: **Anton Moisseytsev**, Argonne National Laboratory Session Co-Organizer: **Robin Ames**, DoE National Energy Technology Lab
11:15	**GT2019:90113** **Comparison of a Liquid Annular Seal for Pump Applications With and Without a Swirl Brake** Nathan Balke[1] Dara W. Childs[2] *1. Formosa Plastics Corporation, USA; 2. Turbomachinery Laboratory, Texas A&M University, USA*	**GT2019:91213** **Nonlinear Harmonic Analysis of a Blade Model Subjected to Large Geometrical Deflection and Internal Resonance** Nicolas Di Palma[1] Adrien Martin[1] Fabrice Thouverez[2] Vivien Courtier[3] *1. Ecole Centrale de Lyon, France; 2. Ecole Centrale de Lyon / LTDS, France; 3. Safran Aircraft Engines, France*	**GT2019:90315** **Simple Recuperated S-CO2 Cycle Revisited: Optimization of Operating Parameters for Maximum Cycle Efficiency** Anchit Dutta[1] Adhip Gupta[2] Sharath Sathish[2] Aman Bandooni[2] Pramod Kumar[2] *1. RVCE, India; 2. Indian Institute of Science, India*
11:45	**GT2019:91824** **A Study on the Leakage and Rotordynamic Coefficients of a Long-Smooth Seal With Laminar-Two-Phase, Mainly-Oil Mixtures** Min Zhang[1] Dara W. Childs[2] Dung L. Tran[3] Hari Shrestha[4] *1. Praxair Inc., USA; 2. Turbomachinery Laboratory, Texas A&M University, USA; 3. Energy Recovery Inc., USA; 4. Atlas Copco Comptec LLC, USA*	**GT2019:90813** **Reduced Order Models for Nonlinear Dynamic Analysis With Application to a Fan Blade** Mikel Balmaseda[1] Georges Jacquet-Richardet[2] Antoine Placzek[3] Duc Minh Tran[1] *1. ONERA, DMAS, Université Paris Saclay, France; 2. Université de Lyon, CNRS INSA Lyon, LaMCoS, France; 3. ONERA, DAAA, Université Paris Saclay, France*	**GT2019:91189** **The Role of Turbomachinery Performance in the Optimization of Supercritical Carbon Dioxide Power Systems** Alessandro Romei, Paolo Gaetani, Andrea Giostri, Giacomo Persico *Politecnico di Milano, Italy*
12:15	**GT2019:91831** **A Study for Rotordynamic and Leakage Characteristics of a Long-Honeycomb Seal With Two-Phase, Mainly Air Mixtures** Min Zhang[1] Dara W. Childs[2] *1. Praxair Inc., USA; 2. Turbomachinery Laboratory, Texas A&M University, USA*	**GT2019:90765** **Asymptotic Description of Forced Response Vibration Saturation by Friction Forces** Carlos Martel, Juan Ángel Martín *Universidad Politecnica de Madrid, Spain*	**GT2019:91509** **Selecting the Optimum Supercritical CO2 Cycle for Indirect-Fired Applications** Brittany Tom, January Smith, Aaron McClung *Southwest Research Institute, USA*

TUESDAY JUNE 18 — 11:15 AM - 12:45 PM

	TURBOMACHINERY: AXIAL FLOW FAN & COMPRESSOR AERODYNAMICS	TURBOMACHINERY: AXIAL FLOW TURBINE AERODYNAMICS	TURBOMACHINERY: DUCTS & COMPONENT INTERACTIONS
	Stability & Stall	**Aerodynamic Performances and Design II**	**Inter-Component Ducts in Turbines**
	Technical Session • 124-B • TB-39-4	**Technical Session • 125-AB • TB-40-6**	**Technical Session • 127-C • TB-42-2**
	Session Organizer: **William Cousins**, United Technologies Research Center Session Co-Organizer: **Sungho Yoon**, GE Aviation	Session Organizer: **Martin Rose**, Sussex University	Session Organizer: **Markus Brettschneider**, MTU Aero Engines AG Session Co-Organizer: **Panagiota Tsifourdaris**, Pratt Whitney Canada
11:15	**GT2019:91227** **Deficiencies in Turbulence Modelling for the Prediction of the Stability Boundary in Highly Loaded Compressors** Jose Moreno[1] John Dodds[2] Sina Stapelfeldt[1] Mehdi Vahdati[1] *1. Imperial College London, United Kingdom; 2. Rolls-Royce plc, United Kingdom*	**GT2019:90636** **An Impact Assessment of Erosion of Nozzle Guide Vanes and Rotor Blades on Aerodynamic Performance of a Gas Turbine by CFD** Koichi Yonezawa[1] Masahiro Takayasu[2] Genki Nakai[2] Kazuyasu Sugiyama[2] Katsuhiko Sugita[3] Shuichi Umezawa[4] Shuichi Ohmori[4] *1. Central Research Institute of Electric Power Industry, Japan; 2. Osaka University, Japan; 3. Tokyo Electlic Power Company, Japan; 4. Tokyo Electric Power Company Holdings Inc., Japan*	**GT2019:90733** **Investigation of Combustor-Turbine-Interaction in a Rotating Cooled Transonic High-Pressure Turbine Test Rig: Part 1 – Experimental Results** Alexander Krumme[1] Clemens Buske[1] Johannes R. Bachner[1] Jerrit Dähnert[2] Marc Tegeler[1] Federica Ferraro[1] Simon Gövert[1] Frank Kocian[1] Francesca di Mare[3] Andreas Pahs[1] *1. German Aerospace Center (DLR), Germany; 2. Rolls-Royce Deutschland, Germany; 3. Ruhr-University Bochum, Germany*
11:45	**GT2019:91340** **Prediction of Rotating Stall During Startup for Axial Compressors** Ryosuke Mito, Satoshi Yamashita *Mitsubishi Heavy Industries Ltd., Japan*	**GT2019:91632** **Non-Dimensional Parameters for Comparing Conventional and Counter-Rotating Turbomachines** Jonathan J. Waldren[1] Christopher Clark[1] Sam Grimshaw[1] Graham Pullan[2] *1. University of Cambridge, Whittle Laboratory, United Kingdom; 2. University of Cambridge, United Kingdom*	**GT2019:90736** **Investigation of Combustor-Turbine-Interaction in a Rotating Cooled Transonic High-Pressure Turbine Test Rig: Part II – Numerical Modelling and Simulation** Simon Gövert[1] Federica Ferraro[1] Alexander Krumme[1] Clemens Buske[1] Marc Tegeler[1] Frank Kocian[1] Francesca di Mare[2] *1. German Aerospace Center (DLR), Germany; 2. Ruhr-University Bochum, Germany*
12:15	**GT2019:91486** **A Time-Space Multigrid Method With Implicit Residual Smoothers Applied to Harmonic Balance Equation System** Hangkong Wu, Dingxi Wang, Xiuquan Huang, Shenren Xu *Northwestern Polytechnical University, China*	**GT2019:90294** **Highly Accurate Delta Efficiency Measurements at the Large Scale Turbine Rig** Johannes Eitenmüller[1] Manuel Wilhelm[2] Leonhard Gresser[2] Tom Ostrowksi[2] Sebastian Leichtfuss[1] Heinz-Peter Schiffer[2] Christoph Lyko[3] Shailendra Naik[4] *1. GLR, Technical University of Darmstadt, Germany; 2. Technical University of Darmstadt, Germany; 3. Rolls-Royce Deutschland Ltd & Co KG, Germany; 4. Ansaldo Energia, Switzerland*	**GT2019:90795** **Impact of Varying High- and Low-Pressure Turbine Purge Flows on a Turbine Center Frame and Low-Pressure Turbine System** Patrick Zeno Sterzinger[1] Stefan Zerobin[2] Filippo Merli[2] Lukas Wiesinger[2] Andreas Peters[3] Gabriele Maini[4] Matteo Dellacasagrande[5] Franz Heitmeir[2] Emil Goettlich[2] *1. Institute of Thermal Turbomachinery and Machine Dynamics, Austria; 2. Graz University of Technology, Austria; 3. GE Aviation, Germany; 4. Avio Aero, Italy; 5. University of Genova, Italy*

TUESDAY JUNE 18 — 11:15 AM - 12:45 PM

	TURBOMACHINERY: DEPOSITION, EROSION, FOULING, AND ICING	WIND ENERGY	TURBOMACHINERY: TUTORIALS
	Deposition Modeling	**Simulation Techniques**	**Introduction to Large Eddy Simulations**
	Technical Session • 127-B • TB-47-6Part B	**Technical Session • 131-A • TB-48-3**	**Tutorial Session • 126-ABC • TB-52-3**
	Session Organizer: **Ryan Lundgreen**, Pratt & Whitney Session Co-Organizer: **Michele Pinelli**, University of Ferrara Endif	Session Organizer: **Giacomo Persico**, Politecnico Di Milano Session Co-Organizer: **Juan Jauregui**, University of Queretaro	Session Organizer: **Andreas Peters**, GE Aviation
11:15	**GT2019:91631** **Porosity Driven Approaches to Model Fouling Effects on Flow Field** Nicola Casari[1] Alessio Suman[1] Michele Pinelli[2] *1. University of Ferrara, Italy; 2. University of Ferrara Endif, Italy*	**GT2019:90889** **Development of a CFD Methodology to Reproduce the Effects of Macro Turbulence on Wind Turbines and its Application to the Particular Case of a VAWT** Francesco Balduzzi, Marco Zini, Giovanni Ferrara, Alessandro Bianchini *Università degli Studi di Firenze, Italy*	**GT2019:92124** **Introduction to Large Eddy Simulations** Joseph Mathew *Indian Institute of Science, India* **T U T O R I A L**
11:45	**GT2019:90739** **Numerical Modeling of Particle Deposition in Turbine Cascade** Xiaojun Yang, Yingqi Hu, Tianhao Yu, Zhigang Liu *Civil Aviation University of China, China*	**GT2019:91218** **Development and Validation of a Hybrid Simulation Model for Darrieus Vertical-Axis Wind Turbines** Alessandro Bianchini[1] Francesco Balduzzi[1] Leopold Haack[2] Simone Bigalli[1] Bernhard Müller[2] Giovanni Ferrara[1] *1. Università degli Studi di Firenze, Italy; 2. Hochschule Kempten, Germany*	
12:15		**GT2019:91499** **Implementation of Adaptive Gaussian Quadrature for Improved Accuracy of Boundary Element Methods Applied to Three Dimensional Geometries** Michael Davies[1] Joseph Saverin[2] *1. University of Calgary, Canada; 2. Technical University of Berlin, Germany*	

TUESDAY JUNE 18 — 01:00 PM - 05:15 PM

EXHIBITOR PRESENTATIONS

Tuesday Exhibit Hall Presentations

Technical Presentations • Exhibit Hall Presentation Stage • 53-1

1:00

GT2019:92207
Automated Inspection and Defect Detection in Aerospace Components Using Laser Scanning
Eric Grald
Creare LLC, USA

1:45

GT2019:92220
Advanced Monitoring of Dynamics in Gas Turbines
Robert Widhopf-Fenk
IfTA Ingenieurbüro für Thermoakustik GmbH, Germany

2:30

GT2019:92238
Metal Additive Manufacturing Applications in the Field of Turbine Industries
Dr. Stephane Abed
Poly-Shape, France

3:15

GT2019:92221
Efficient Gas Turbine Combustor Meshing using ANSYS Fluent Mosaic
Mike Tooley
ANSYS Inc., Canada

4:00

GT2019: *92275*
Itair HyperWorks - a Platform for Innovation
Matt King
Altair Engineering Inc., USA

4:45

GT2019: *92222*
Anti-Icing System Modeling and Simulation for Gas Turbines using AxSTREAM®
Clement Joly
Softinway, Inc, USA

TUESDAY JUNE 18 — 02:00 PM - 03:30 PM

	AIRCRAFT ENGINE	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS
	Developments in Hybrid-electric Propulsion and Enabling Technologies	**Fundamental Combustion - Flame Stabilization - 1**	**Chemical Kinetics - 1**
	Panel Session • 124-A • TC-1-13	**Technical Session • 122-BC • TC-4-5Part A**	**Technical Session • 122-A • TC-4-18Part A**
	Session Organizer: **Konstantinos Kyprianidis**, Malardalen University Session Co-Chairs: **Kurt Rouser**, Oklahoma State University; **Anestis Kalfas**, Aristotle University of Thessaloniki	Session Organizer: **Brent Rankin**, Air Force Research Laboratory Session Co-Organizer: **Benjamin L. Emerson**, Georgia Institute of Technology	Session Organizer: **Subith Vasu**, University of Central Florida Session Co-Organizer: **Owen Pryor**, Southwest Research Institute
2:00	**GT2019:92305** **Developments in Hybrid-electric Propulsion and Enabling Technologies** Manfred Aigner *DLR, Germany* **GT2019:92312** **Developments in Hybrid-electric Propulsion and Enabling Technologies** Ruben Del Rosario *NASA Glenn Research Center, USA* **GT2019:92313** **Developments in Hybrid-electric Propulsion and Enabling Technologies** Charles Lents *United Technologies Research Center, USA*	**GT2019:90127** **Experimental and Numerical Investigation of Different Flame Types Inside a Laboratory Scale RQL Combustion Chamber** Thomas von Langenthal[1] Marco Konle[2] Nikolaos Zarzalis[3] *1. Karlsruhe Institute of Technology, Germany; 2. MTU Aero Engines AG, Germany; 3. Karlsruhe Institute of Technology, Division of Comb. Tech., Germany*	**GT2019:90486** **Quantifying the Effect of Kinetic Uncertainties on NO Predictions at Engine-Relevant Pressures in Premixed Methane-Air Flames** Antoine Durocher[1] Gilles Bourque[2] Jeffrey Bergthorson[1] *1. McGill University, Canada; 2. Siemens Canada, Canada*
2:30	**GT2019:92408** **Developments in Hybrid-electric Propulsion and Enabling Technologies** David Hall *Aurora Flight Sciences, USA* **P A N E L**	**GT2019:90933** **Effects of Axial Velocity of Main Stage on the Performances of a Centrally Staged LPP Combustor** Zhichao Wang, Xin Hui, Jianchen Wang, Yuzhen Lin, Chi Zhang *Beihang University, China*	**GT2019:90569** **CH Kinetics Measurements and Their Importance for Modeling Prompt NOx Formation in Gas Turbines** Sean P. Cooper[1] Clayton R. Mulvihill[1] Olivier Mathieu[1] Eric Petersen[1] Mark W. Crofton[2] King Yiu Lam[2] *1. Texas A&M University, USA; 2. The Aerospace Corporation, USA*
3:00			**GT2019:90826** **Kinetics Modeling on NOx Emissions of a Syngas Turbine Combustor Using RQL Combustion Method** Haoyang Liu, Wenkai Qian, Min Zhu, Suhui Li *Tsinghua University, China*

TUESDAY JUNE 18 — 02:00 PM - 03:30 PM

	COMBUSTION, FUELS & EMISSIONS	CONTROLS, DIAGNOSTICS & INSTRUMENTATION	CYCLE INNOVATIONS
	Blow-Off, Flashback & Ignition -2	**Near Wall Flow Diag. Instrumentation**	**Simulation of Gas Turbine Dynamic Behavior at Design, Off-Design and Adverse Dynamic Operation Conditions**
	Technical Session • 121-AB • TC-4-36Part B	**Technical Session • 222-B • TC-5-6**	**Tutorial Session • 221-B • TC-6-15**
	Session Organizer: **Thomas Sattelmayer**, TU-Muenchen	Session Organizer: **Lubomir Ribarov**, Pratt & Whitney Session Co-Organizer: **Bill Rhoden**, Hamilton Sundstrand	Session Organizer: **Meinhard Schobeiri**, Texas A&M University
2:00	**GT2019:91915** **Behavior of Autoignition in Polydisperse Jet-A Fuel Spray With High Temperature Co-Flow** Aimee Williams, Nishant Jain, Jerry Seitzman, Ben Zinn *Georgia Institute of Technology, USA*	**GT2019:90288** **Pressure-Sensitive Paint Measurements in Narrow Clearances: A Feasibility Study** Anna-Lisa Zimmermann[1] Mattia Graiff[1] Quang Tue Nguyen Tran[2] Volker Guemmer[3] *1. Technical University of Munich, Germany; 2. GE Aviation Munich, Germany; 3. Technische Universität München, Germany*	**GT2019:90590** **Simulation of Gas Turbine Dynamic Behavior at Design, Off-Design and Adverse Dynamic Operation Conditions** Meinhard Schobeiri *Texas A&M University, USA* **T U T O R I A L**
2:30	**GT2019:91396** **Impact of Wall Temperature in Large Eddy Simulation of Light-Round in an Annular Liquid Fueled Combustor and Assessment of Wall Models** Stefano Puggelli[1] Théa Lancien[1] Kevin Prieur[2] Daniel Durox[1] Sebastien Candel[1] Ronan Vicquelin[1] *1. Laboratoire EM2C, CNRS, CentraleSupélec, Université Paris-Saclay, France; 2. SafranTech; Laboratoire EM2C, CNRS, CentraleSupélec, Université Paris-Saclay, France*	**GT2019:91020** **Transient Performance of Separated Flows: Experimental Characterization of Flow Detachment Dynamics** Jorge Saavedra, Guillermo Paniagua *Purdue University, USA*	
3:00	**GT2019:90856** **Large Eddy Simulation of Lean Blow-Off in a Premixed Swirl Stabilized Flame** Pier Carlo Nassini[1] Daniele Pampaloni[1] Antonio Andreini[1] Roberto Meloni[2] *1. University of Florence, Italy; 2. Baker Hughes, a GE Company, Italy*	**GT2019:91077** **Design and Evaluation of a Fiber Optic Sensor for Particle and Concentration Monitoring in a Contaminated Flow Rig** Alice K. Li[1] Vincent McDonell[1] Max Venaas[1] Gregor A. Waldherr[2] Hai Lin[2] *1. University of California, USA; 2. Hal Technology, LLC, USA*	

TUESDAY JUNE 18 — 02:00 PM - 03:30 PM

	HEAT TRANSFER: INTERNAL AIR SYSTEMS & SEALS (WITH TURBOMACHINERY)	HEAT TRANSFER: EXPERIMENTAL FILM COOLING	HEAT TRANSFER: GENERAL COMPUTATIONAL HEAT TRANSFER
	Hot Gas Ingestion: Ingress/Egress II	**Experimental Film Cooling II**	**General Computational Heat Transfer II**
	Technical Session • 131-B • TC-15-2	**Technical Session • 132-AB • TC-19-2**	**Technical Session • 131-C • TC-22-2**
	Session Organizer: **Jens Fridh**, KTH Session Co-Organizer: **Oliver Pountney**, University of Bath	Session Organizer: **Stephen Lynch**, Pennsylvania State University Session Co-Organizer: **James Heidmann**, NASA Glenn Research Ctr	Session Organizer: **Guillermo Paniagua**, Purdue University Session Co-Organizer: **Qiang Zhang**, City University London
2:00	**GT2019:90205** **Numerical Investigations on the Sealing Effectiveness of Turbine Groove Radial Rim Seal** Shuxian Chen[1] Zhigang Li[2] Jun Li[1] Xin Yan[2] Liming Song[2] *1. Institute of Turbomachinery, Xi'an Jiaotong University, China; 2. Xi'an Jiaotong University, China*	**GT2019:90375** **An Experimental Investigation of Film Cooling Effectiveness of Shaped Holes on a Transonic Turbine Vane** Chun-Yi Yao, Hui-ren Zhu, Zhong-Yi Fu, Bo-lun Zhang *Northwestern Polytechnical University, China*	**GT2019:91009** **Application of Multi-Scale Methodology for Transonic Turbine Blade Tip Cooling Design** Penghao Duan, Li He *University of Oxford, United Kingdom*
2:30	**GT2019:90489** **Effect of Annulus Flow Conditions on Turbine Rim Seal Ingestion** Donato Maria Palermo[1] Feng Gao[1] John Chew[1] Paul F. Beard[2] *1. University of Surrey, United Kingdom; 2. University of Oxford, United Kingdom*	**GT2019:90430** **Effect of Unsteady Wake on Turbine Blade Film Cooling Along the Suction Surface Using PSP Technique** Dao'en Zhou, Hui-ren Zhu, Dawei Chen, Huatai Li, Zhiping Li *Northwestern Polytechnical University, China*	**GT2019:90842** **Optimization Design Analysis of Primary Surface Recuperator for Rotorcraft Powerplant Applications** Chengyu Zhang, Volker Guemmer *Technische Universität München, Germany*
3:00	**GT2019:91807** **Analysis of Gas Turbine Rim Cavity Ingestion With Axial Purge Flow Injection** Christopher Robak[1] Amir Faghri[2] Karen Thole[3] *1. United Technologies Pratt & Whitney, USA; 2. University of Connecticut, USA; 3. Pennsylvania State University, USA*	**GT2019:90508** **The Influence of Turbulence and Reynolds Number on Slot Film Cooling Over the Downstream Pressure Surface** Loren Soma[1] Forrest Ames[1] Sumanta Acharya[2] *1. University of North Dakota, USA; 2. Illinois Institute of Technology, USA*	**GT2019:90928** **Research on the Heat Insulation Performance of Advanced Thermal Barrier Coatings Based on Dense Vertical Cracked Structure** Yun Long, Yuzhang Wang, Mengtian Zhao, Yiwu Weng *Shanghai Jiao Tong University, China*

TUESDAY JUNE 18 — 02:00 PM - 03:30 PM

	INDUSTRIAL & COGENERATION	MANUFACTURING MATERIALS & METALLURGY	MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES
	Compressing a Wet Gas: Perspectives and Experience Across a Range of Applications.	**Additive Manufacturing: Materials and Processes**	**Micro Gas Turbine: Combustion and Fuels**
	Panel Session • 221-C • TC-23-7	**Technical Session • 121-C • TC-24-1**	**Technical Session • 221-A • TC-26-2**
	Session Organizer: **Grant Musgrove**, Southwest Research Institute	Session Organizer: **Nejib Chekir**, Liburdi Engineering Session Co-Organizer: **Piero Grasso**, GE Power	Session Organizer: **Jeffrey Armstrong**, Flexenergy Energy Systems Inc.
2:00	**GT2019:91721** **Compressing a Wet Gas: Perspectives and Experience across a Range of Applications** Grant Musgrove *Southwest Research Institute, USA* **GT2019:92337** **SwRI Perspectives on Wet Gas Compression** Griffin Beck *Southwest Research Institute, USA* **GT2019:92338** **UTRC Perspectives on Wet Gas Compression** Chaitanya V. Halbe *United Technologies Research Center, USA*	**GT2019:90947** **Laser Additive Manufacturing of Titanium Aluminides for Turbomachinery Applications** Andreas Vogelpoth[1] Johannes Henrich Schleifenbaum[2] Silja Rittinghaus[1] *1. Fraunhofer Institute for Laser Technology ILT, Germany; 2. RWTH Aachen University, Chair for Digital Additive Production, Germany*	**GT2019:90229** **Methane-Hydrogen Blends in Micro Gas Turbines: Comparison of Different Combustor Concepts** Raffaele Tuccillo[1] Maria Cristina Cameretti[2] Roberta De Robbio[2] Fabrizio Reale[3] Fabio Chiariello[3] *1. Univeristy of Naples, Italy; 2. D.I.i., Università di Napoli "Federico II", Italy; 3. Istituto Motori CNR, Italy*
2:30	**GT2019:92339** **MeeFog Perspectives on Wet Gas Compression** Tae Lee *Mee Fog, USA* **GT2019:92340** **Helmut-Schmidt-University Perspectives on Wet Gas Compression** Franz Joos *Helmut Schmidt University, Germany* **GT2019:92341** **Harbin Engineering University Perspectives on Wet Gas Compression** Qun Zheng *Harbin Engineering University, China*	**GT2019:90971** **Development of Production Eddy Current Inspection Process for Additively Manufactured Industrial Gas Turbine Engine Components** Brandon Kemerling, Daniel Ryan *Solar Turbines Inc., USA*	**GT2019:91342** **The Preliminary CFD Design of a Compressor and Combustor System Towards a 100 kW Hydrogen Fuelled Micro Gas Turbine** Cedric Devriese[1] Willem Pennings[2] Henk de Reuver[2] Rob Bastiaans[2] Ward De Paepe[3] *1. Turbotec, Belgium; 2. Eindhoven University of Technology, Netherlands; 3. Université de Mons, Belgium*
3:00	**GT2019:92377** **BHGE Experience in Wet Gas Compression** Giuseppe Sassanelli *Baker Hughes, a GE Company, Italy* **GT2019:92378** **Hitachi Perspective on Wet Gas Compression** Daisuke Kawaguchi *Hitachi, Ltd., Japan* **PANEL**	**GT2019:91781** **Characterization of an Additively Repaired Ti-6Al-4V Alloy** Andrew Gyekenyesi[1] Sulochana Shrestha[2] Manigandan Kannan[2] Gregory Morscher[2] Onome Scott-Emuakpor[3] *1. Ohio Aerospace Institute, USA; 2. University of Akron, USA; 3. Air Force Research Laboratory, USA*	**GT2019:91483** **A Biogas Fuelled Micro Gas Turbine: Energetic Performance and Environmental Impact Analysis** Fabio Chiariello, Fabrizio Reale, Raffaela Calabria, Patrizio Massoli *Istituto Motori CNR, Italy*

TUESDAY JUNE 18 — 02:00 PM - 03:30 PM

	OIL & GAS APPLICATIONS	STEAM TURBINES	STRUCTURES & DYNAMICS: ROTORDYNAMICS
	Diagnostics, Maintenance, Operation - 1	**Mechanical Aspects of Steam Turbines I**	**Analysis**
	Technical Session • 130 • TC-27-7Part A	**Technical Session • 127-A • TC-29-9**	**Technical Session • 128-B • TC-33-1**
	Session Organizer: **J. Jeffrey Moore**, Southwest Research Institute Session Co-Organizer: **Kevin Hoopes**, Southwest Research Institute	Session Organizer: **Magdalena Speicher**, Materialprüfungsanstalt Universität Stuttgart Session Co-Chairs: **Vamadevan Gowreesan**, Sulzer RES; **Thomas Mayer**, ZHAW Zuercher Hochschule	Session Organizer: **Filippo Cangioli**, Waukesha Bearings Session Co-Organizer: **Feng Kai**, Hunan University
2:00	**GT2019:90055** **A General Diagnostic Methodology for Sensor Fault Detection, Classification and Overall Health State Assessment** Lucrezia Manservigi[1] Mauro Venturini[1] Giuseppe Fabio Ceschini[2] Giovanni Bechini[2] Enzo Losi[1] *1. Università degli Studi di Ferrara, Italy; 2. Siemens SpA, Italy*	**GT2019:90106** **Fretting Induced Fatigue Failure in Steam Turbine Blades** Vamadevan Gowreesan[1] Kyrylo Grebinnyk[2] *1. Sulzer RES, USA; 2. Sulzer Turbo Services Houston Inc., USA*	**GT2019:90256** **Dynamic Analysis and Optimization on Assembly Parameters of Rod Fastening Rotor System With Manufacturing Tolerances** Bingxi Zhao, Qi Yuan, Pu Li *Xi'an Jiaotong University, China*
2:30	**GT2019:90056** **Validation of an Advanced Diagnostic Methodology for the Identification and Classification of Gas Turbine Sensor Faults by Means of Field Data** Lucrezia Manservigi[1] Mauro Venturini[1] Giuseppe Fabio Ceschini[2] Giovanni Bechini[2] Enzo Losi[1] *1. Università degli Studi di Ferrara, Italy; 2. Siemens SpA, Italy*	**GT2019:90437** **High Power Steam Turbine Lifetime Increase by Means of Front End Seal Arrangement and Start-Up Heating Conditions Improvement** Leonid Moroz[1] Roman Kochurov[1] Julija Bakhmutska[2] Vladimir Goloshchapov[2] *1. SoftInWay Inc., USA; 2. A.M.Podgorny Institute For Mechanical Engineering Problems, Ukraine*	**GT2019:90573** **Dynamics of a Rod-Fastened Rotor Considering the Bolt Loosening Effect** Pu Li[1] Qi Yuan[1] Bingxi Zhao[1] Jin Gao[2] *1. Xi'an Jiaotong University, China; 2. Dongfang Steam Turbine, China*
3:00	**GT2019:90610** **Optimized SGT-A35 (GT61) for Improved Emissions and Enhanced Efficiency Across the Load Range** Deepak Thirumurthy[1] Barry Ruggiero[2] Gautam Chhibber[3] Jaskirat Singh[4] *1. Siemens Energy, Inc., USA; 2. TransCanada Pipelines Corporation, Canada; 3. Dresser-Rand - A Siemens Business, USA; 4. Siemens, USA*	**GT2019:91633** **Innovative Mechanical Integrity Approaches for Steam Turbines: Industrial Needs** Henning Almstedt, Zeynep Yigit-Rohde, Juergen Havemann, Thomas Thiemann, Martin Stadler *Siemens AG, Germany*	**GT2019:91096** **Analysis of Instantaneous Vibrational Energy Flow for an Aero-Engine Dual-Rotor-Support-Casing Coupling System** Yingqun Ma, Kai Zhang, Wei Zhao, Meng Xu, Qingjun Zhao *Institute of Engineering Thermophysics, Chinese Academy of Sciences, China*

TUESDAY JUNE 18 — 02:00 PM - 03:30 PM

	STRUCTURES & DYNAMICS: ROTORDYNAMICS	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS	SUPERCRITICAL CO2 POWER CYCLES
	Rotordynamics - Theory, Vibration Monitoring, and Case Studies	**Magnetic Bearings**	**sCO2 Power Cycles II**
	Tutorial Session • 129-AB • TC-33-13Part A	**Technical Session • 128-A • TC-34-9**	**Technical Session • 123 • TC-38-9**
	Session Organizer: **Almudena Vega**, Siemens Gamesa	Session Organizer: **Ilmar Ferreira Santos**, Technical University of Denmark	Session Organizer: **Tim Allison**, Southwest Research Institute Session Co-Organizer: **Ladislav Vesely**, Czech Technical University in Prague
2:00	**GT2019:92114** **Rotordynamics 101 - Theory, Vibration Monitoring, and Case Studies** Jason Wilkes, Aaron Rimpel *Southwest Research Institute, USA*	**GT2019:91172** **Design and Prototype Test Data for a 300 kW AMB-Supported Turbine Generator for Natural Gas Pressure Letdown** Rasish Khatri[1] Larry Hawkins[1] Massimiliano Ortiz Neri[2] Francesco Cangioli[2] Davide Biliotti[2] *1. Calnetix, USA; 2. Baker Hughes, a GE company, Italy*	**GT2019:90493** **sCO2 Power Cycle Component Cost Correlations From DOE Data Spanning Multiple Scales and Applications** Nathan T. Weiland[1] Blake W. Lance[2] Sandeep R. Pidaparti[3] *1. National Energy Technology Laboratory, USA; 2. Sandia National Laboratories, USA; 3. KeyLogic, USA*
2:30	**T U T O R I A L**	**GT2019:90990** **Influence of Blade Flexibility on the Dynamic Response Simulation of a Turbomolecular Pump on Magnetic Bearings** Alysson Bruno Barbosa Moreira[1] Fabrice Thouverez[2] *1. Ecole Centrale de Lyon, France; 2. Ecole Centrale de Lyon / LTDS, France*	**GT2019:90777** **Advanced S-CO2 Brayton Power Cycles in Nuclear and Fusion Energy** Jan Syblik[1] Ladislav Vesely[2] Slavomir Entler[3] Vaclav Dostal[2] Jan Stepanek[1] *1. Czech Technichal University in Prague, Faculty of Mechanical Engineering, Czech Republic; 2. Czech Technical University In Prague, Czech Republic; 3. Institute of Plasma Physics AS CR, Czech Republic*
3:00		**GT2019:91645** **Simulation, Test and Mitigation of 1/2X Forward Whirl Following Rotor Drop Onto Auxiliary Bearings** Xiao Kang, Alan Palazzolo *Texas A&M University, USA*	**GT2019:91917** **The STEP 10 MWe sCO2 Pilot Plant Demonstration** John Marion[1] Michael Kutin[1] Aaron McClung[2] Jason Mortzheim[3] Robin Ames[4] *1. Gas Technology Institute, USA; 2. Southwest Research Institute, USA; 3. GE Energy, USA; 4. DoE National Energy Technology Lab, USA*

TUESDAY JUNE 18 — 02:00 PM - 03:30 PM

	TURBOMACHINERY: AXIAL FLOW TURBINE AERODYNAMICS	TURBOMACHINERY: AXIAL FLOW TURBINE AERODYNAMICS	TURBOMACHINERY: UNSTEADY FLOWS IN TURBOMACHINERY
	Leakage Flows	**Aerodynamic Studies**	**Unsteady Flows in Turbines IV**
	Technical Session • 127-C • TC-40-1Part A	**Technical Session • 125-AB • TC-40-8Part A**	**Technical Session • 124-B • TC-45-11Part A**
	Session Organizer: **Emil Goettlich**, Graz University of Technology Session Co-Organizer: **Marios Patinios**, Graz University of Technology	Session Organizer: **Matthew Montgomery**, Doosan ATSA Session Co-Organizer: **Jong - Shang Liu**, Honeywell Engines Systems & Services	Session Organizer: **Thomas Praisner**, Pratt And Whitney Session Co-Organizer: **Nateri Madavan**, NASA Ames Research Center
2:00	**GT2019:90589** **Effect of the Double-Slot Injection on the Leakage Flow Control in a Honeycomb-Tip Turbine Cascade** Yabo Wang, Yanping Song, Jianyang Yu, Fu Chen *Harbin Institute of Technology, China*	**GT2019:90401** **A Method for Estimating Profile Loss of Low Pressure Turbine Blades From the Low Speed Cascade Test Data** Hidekazu Kodama, Ken-ichi Funazaki, Kodai Ito, Ryo Ikehata, Yamato Koda *Iwate University, Japan*	**GT2019:90276** **Study on Flow Induced Vibration Mechanism of Internal Flow Field in Hydraulic Torque Converter** Zhifang Ke, Cheng Liu, Qingdong Yan, Wei Wei, Zemin Song *Beijing Institute of Technology, China*
2:30	**GT2019:90726** **Experimental and Numerical Evaluation of Losses From Turbine Hub Clearance Flow** Jan Uher[1, 2] Petr Milcak[1] Radek Skach[1, 2] David Fenderl[1] Pavel Zitek[2] Marek Klimko[2] *1. Doosan Skoda Power, Czech Republic; 2. University of West Bohemia, Czech Republic*	**GT2019:91264** **Profile Loss of Ultra-Highly Loaded Turbine Cascade at Transonic Flow Condition** Hoshio Tsujita[1] Masanao Kaneko[2] *1. Hosei University, Japan; 2. Tokyo Denki University, Japan*	**GT2019:91206** **Large Eddy Simulation of Combustor and Complete Single-Stage High-Pressure Turbine of the FACTOR Test Rig** Martin Thomas[1] Jerome Dombard[1] Florent Duchaine[1] Laurent Gicquel[1] Charlie Koupper[2] *1. CERFACS, France; 2. Safran TURBOMECA, France*
3:00	**GT2019:91576** **Evaluating the Effect of Vane Trailing Edge Flow on Turbine Rim Sealing** Iván Monge-Concepción, Reid A. Berdanier, Michael Barringer, Karen Thole *Pennsylvania State University, USA*	**GT2019:90342** **Application of Quantitative Monochrome Calibrated Schlieren Technique in Highly-Loaded Turbine Cascade Test** Zhihong Zhou, Haotian Wang, Huoxing Liu *Beihang University, China*	**GT2019:91276** **Computational and Experimental Study of Hot Streak Transport Within the First Stage of a Gas Turbine** Paolo Gaetani[1] Giacomo Persico[1] Lorenzo Pinelli[2] Michele Marconcini[2] Roberto Pacciani[2] *1. Politecnico di Milano, Italy; 2. University of Florence, Italy*

TUESDAY JUNE 18 — 02:00 PM - 03:30 PM

	TURBOMACHINERY: MULTIDISCIPLINARY DESIGN APPROACHES, OPTIMIZATION & UNCERTAINTY QUANTIFICATION	TURBOMACHINERY: DEPOSITION, EROSION, FOULING, AND ICING	WIND ENERGY
	Machine Learning for Design Optimization, Data Analysis & Control	**Deposition in Internal Turbine Cooling Passages**	**R&D Trends in Wind Energy**
	Technical Session • 126-ABC • TC-46-7Part A	**Technical Session • 127-B • TC-47-3Part A**	**Tutorial Session • 131-A • TC-48-5Part A**
	Session Organizer: **Swati Saxena**, ANSYS Inc. Session Co-Organizer: **Lieven Baert**, Cenaero	Session Organizer: **Steven Whitaker**, Honeywell Aerospace Session Co-Organizer: **Nagaraja Rudrapatna**, Honeywell	Session Organizer: **George Pechlivanoglou**, Eunice Session Co-Organizer: **Alessandro Bianchini**, *University of Florence*
2:00	**GT2019:90811** **Prediction of Flow Properties on Turbine Vane Airfoil Surface From 3D Geometry With Convolutional Neural Network** Yuan Jin, Shan LI, Olivier Jung *BSS-TurboTech.Ltd, China*	**GT2019:90850** **Numerical Investigation on Sand Particles Deposition in a U-Bend Ribbed Internal Cooling Passage of Turbine Blade** Lin Li, Cunliang Liu, Xiao-Yu Shi, Hui-ren Zhu, Bing-ran LI *Northwestern Polytechnical University, China*	**GT2019:92213** **Recent Developments in Wind Turbine Technology and Research** Alessandro Bianchini *University of Florence, Italy* **T U T O R I A L**
2:30	**GT2019:91570** **Aerodynamic Optimisation of the Low Pressure Turbine Module: Exploiting Surrogate Models in a High-Dimensional Design Space** Lieven Baert[1] Emmanuel Chérière[2] Ingrid Lepot[1] Caroline Sainvitu[1] Arnaud Nouvellon[3] Vincent Leonardon[3] *1. Cenaero, Belgium; 2. Cenaero France, France; 3. Safran Aircraft Engines, France*	**GT2019:90981** **Impact of Dust Feed on Capture Efficiency and Deposition Patterns in a Double-Walled Liner** Trevor Cory[1] Karen Thole[1] Kathryn Kirsch[2] Ryan Lundgreen[3] Robin Prenter[3] Stephen Kramer[3] *1. The Pennsylvania State University, USA; 2. KCF Technologies, USA; 3. Pratt & Whitney, USA*	
3:00	**GT2019:90893** **Experimental Comparison of Two Integer Valued Iterative Learning Control Approaches at a Stator Cascade** Florian Arnold, Karl Neuhäuser, Rudibert King *Technische Universität Berlin, Germany*	**GT2019:91032** **Effects of Dust Composition on Particle Deposition in an Effusion Cooling Geometry** Evan Crowe, Jeffrey Bons *The Ohio State University, USA*	

TUESDAY JUNE 18 — 04:00 PM - 05:30 PM

	AIRCRAFT ENGINE	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS
	Developments in Hybrid-electric Propulsion and Enabling Technologies (continued)	**Fundamental Combustion - Flame Stabilization - 2**	**Chemical Kinetics - 2**
	Panel Session • 124-A • TD-1-18	**Technical Session • 122-BC • TD-4-5Part B**	**Technical Session • 122-A • TD-4-18Part B**
	Session Organizer: **Konstantinos Kyprianidis**, Mälardalen University Session Co-Chairs: **Kurt Rouser**, Oklahoma State University; **Anestis Kalfas**, Aristotle University of Thessaloniki	Session Organizer: **Brent Rankin**, Air Force Research Laboratory Session Co-Organizer: **Benjamin L. Emerson**, Georgia Institute of Tech	Session Organizer: **Subith Vasu**, University of Central Florida Session Co-Organizer: **Owen Pryor**, Southwest Research Institute
4:00	**GT2019:92317** **Developments in Hybrid-electric Propulsion and Enabling Technologies (continued)** Manfred Aigner *DLR, Germany* **GT2019:92314** **Developments in Hybrid-electric Propulsion and Enabling Technologies (continued)** Ruben Del Rosario *NASA Glenn Research Center, USA* **GT2019:92315** **Developments in Hybrid-electric Propulsion and Enabling Technologies (continued)** Charles Lents *United Technologies Research Center, USA*	**GT2019:91403** **Efficiency Measurement Approach for a Hydrogen Oxyfuel Combustor** Tom Tanneberger, Sebastian Schimek, Christian Oliver Paschereit, Panagiotis Stathopoulos *Technische Universität Berlin, Germany*	**GT2019:90332** **A General Study of Counterflow Diffusion Flames for Supercritical CO2 Mixtures** K. R. V. Manikantachari[1] Scott Martin[2] Ramees K Rahman[1] Carlos Velez[3] Subith Vasu[1] *1. University of Central Florida, USA; 2. Embry-Riddle Aeronautical University, USA; 3. General Electric Company, USA*
4:30	**GT2019:92409** **Developments in Hybrid-electric Propulsion and Enabling Technologies** David Hall *Aurora Flight Sciences, USA*	**GT2019:91516** **Effects of Swirl on the Stabilization of Non-Premixed Oxygen Enriched Flames Above Coaxial Injectors** Arthur Degenève[1] Clement Mirat[1] Jean Caudal[2] Ronan Vicquelin[1] Thierry Schuller[3] *1. Laboratoire EM2C, CNRS, CentraleSupélec, Université Paris-Saclay, France; 2. Air Liquide, France; 3. Institut De Mécanique Des Fluides De Toulouse, France*	**GT2019:90599** **Kinetics Study of a Staged Combustor Concept for Oxy-Fuel Combustion Gas Turbine Cycles** Wenkai Qian, Haoyang Liu, Min Zhu, Suhui Li *Tsinghua University, China*
5:00	**P A N E L**	**GT2019:90394** **Validation of a New Turbulent Flame Speed Facility for the Study of Gas Turbine Fuel Blends at Elevated Pressure** Anibal Morones, Mattias Turner, Victor Leon, Kyle Ruehle, Eric Petersen *Texas A&M University, USA*	**GT2019:91385** **Comparative Analysis of Detailed and Reduced Chemical Models of N-Dodecane** Chenwei Zheng[1] Mazen Eldeeb[2] Deshawn Coombs[1] Benjamin Akih Kumgeh[1] *1. Syracuse University, USA; 2. California State University, Fresno, USA*

TUESDAY JUNE 18 — 04:00 PM - 05:30 PM

	COMBUSTION, FUELS & EMISSIONS	CONTROLS, DIAGNOSTICS & INSTRUMENTATION	CYCLE INNOVATIONS
	Combustion Dynamics: Numerical Approaches	**Free Stream Flow Diagnostic Instrumentation**	**Future of Power Systems**
	Technical Session • 121-AB • TD-4-32	**Technical Session • 222-B • TD-5-3**	**Panel Session • 221-B • TD-6-16**
	Session Organizer: **Alejandro M Briones**, University of Dayton Research Institute	Session Organizer: **Andrew Consiglio**, United Technologies - Pratt & Whitney Session Co-Organizer: **Min Zhang**, Praxair Inc.	Session Organizer: **David Sánchez**, University of Seville Session Co-Organizer: **S.C. John Gulen**, Bechtel Infrastructure and Power
4:00	**GT2019:90140** **Prediction of Premixed Flame Dynamics Using LES With Tabulated Chemistry and Eulerian Stochastic Fields** Alexander Avdonin, Alireza Javareshkian, Wolfgang Polifke *Technical University of Munich, Germany*	**GT2019:91421** **Investigating Ethanol-Gasoline Spray Characteristics Using an Interferometric Drop Sizing Technique** Hywel Davies[1] Midhat Talibi[1] Martin Hyde[2] Ramanarayanan Balachandran[1] *1. University College London, United Kingdom; 2. TSI Instruments Ltd., United Kingdom*	**GT2019:92335** **Leap Forward Through Redefinition of a "Brayton"-Based Engine: Examination of Supercritical Carbon Dioxide and Other Working Fluids** Douglas Hofer *GE Global Research, USA* **GT2019:92367** **Combined Cycle Power Plants: Past, Present And Future** S.C. John Gulen *Bechtel Infrastructure and Power, USA* **GT2019:92368** **US DOE Advanced Turbines Program and Future Power Systems** Richard Dennis *U.S. Department of Energy, National Energy Technology Laboratory, USA* **GT2019:92371** **Leap Forward Through Introduction of New Generation of Ultra-High Efficiency Gas Turbines Utilizing Distributed Combustion** Meinhard Schobeiri *Texas A&M University, USA* **GT2019:92372** **Is There a Role for Gas Turbines in a Climate-neutral Society?** Christer Björkqvist *ETN European Turbine Network, Belgium* **P A N E L**
4:30	**GT2019:90878** **Numerical Investigation of Combustion Instabilities in a Single Element Lean Direct Inject (LDI) Combustor Using Flamelet Based Approaches** Saurabh Patwardhan[1] Pravin Nakod[1] Stefano Orsino[2] Carlo Arguinzoni[2] *1. ANSYS Inc., India; 2. ANSYS Inc., USA*	**GT2019:91955** **Accurate Field Compressor Inlet Flow Measurement System** Josh McConkey[1] Richard Bunce PE[2] Heiko Claussen[1] *1. Siemens Industry, Inc., USA; 2. Siemens Energy, Inc. (Retired), USA*	
5:00	**GT2019:92037** **The Influence of Geometric and Aerodynamic Boundary Conditions on Fuel Injector Feed and External Aerodynamics for Lean Burn Combustors** Yanling Li, Paul Denman, A Duncan Walker *Loughborough University, United Kingdom*	**GT2019:91428** **A Pneumatic Probe for Measuring Spatial Derivatives of Stagnation Pressure** Christopher Clark, Sam Grimshaw *University of Cambridge, Whittle Laboratory, United Kingdom*	

TUESDAY JUNE 18 — 04:00 PM - 05:30 PM

	HEAT TRANSFER: EXPERIMENTAL INTERNAL COOLING	HEAT TRANSFER: EXPERIMENTAL FILM COOLING	HEAT TRANSFER: GENERAL COMPUTATIONAL HEAT TRANSFER
	Experimental Internal Cooling II	**Experimental Film Cooling VIII**	**General Computational Heat Transfer III**
	Technical Session • 131-B • TD-16-2	**Technical Session • 132-AB • TD-19-8**	**Technical Session • 131-C • TD-22-3**
	Session Organizer: **Nirm Nirmalan**, Consultant Session Co-Organizer: **Randall Mathison**, Ohio State University	Session Organizer: **Stephen Lynch**, Pennsylvania State University Session Co-Organizer: **James Heidmann**, NASA Glenn Research Ctr	Session Organizer: **Lamyaa El-Gabry**, Princeton University Session Co-Organizer: **Jason Dees**, General Electric
4:00	**GT2019:90801** **Developing Secondary Flow and Heat Transfer in the Entrance Region of a Square Channel With 45° Crossed Rib Arrangement** Mark Wieler[1] Beate Woerz[2] Peter Jeschke[2] Michael Rabs[3] *1. Institute of Jet Propulsion and Turbomachinery, RWTH Aachen, Germany; 2. RWTH Aachen University, Germany; 3. MAN Energy Solutions SE, Germany*	**GT2019:90399** **Compound Angle Effects on Shaped Hole Film Cooling** Ian E. Gunady, Daniel D. Borup, Andrew Banko, Christopher J. Elkins, John K. Eaton *Stanford University, USA*	**GT2019:91614** **Analysis of Operational Effects on Cooled H-Class Gas Turbines** Selcuk Can Uysal, Jim Black *National Energy Technology Laboratory, USA*
4:30	**GT2019:90757** **Experimental Investigations of Turbulent Flow in a Rotating Ribbed Channel in Terms of the Effect of Coriolis Force** Haoliang You, Haiwang Li, Ruquan You, Zhi Tao, Jincheng Shi *Beihang University, China*	**GT2019:90545** **Study of Film Cooling Effectiveness on a Double-Walled Effusion-Cooled Turbine Blade in a High-Speed Flow Using Pressure Sensitive Paint** Gladys C. Ngetich[1] Peter Ireland[1] Eduardo Romero[2] *1. University of Oxford, United Kingdom; 2. Rolls-Royce plc, United Kingdom*	**GT2019:91099** **Large Eddy Simulation of Bypass Transition in Vane Passage With Freestream Turbulence** Yousef Kanani[1] Sumanta Acharya[1] Forrest Ames[2] *1. Illinois Institute of Technology, USA; 2. University of North Dakota, USA*
5:00	**GT2019:91251** **Experimental Investigation of Heat Transfer on the Internal Tip Wall in a Rotating Two-Pass Rectangular Channel** Kai-Chieh Chia, Szu-Chi Huang, Yao-Hsien Liu *National Chiao Tung University, Taiwan*	**GT2019:90584** **Superposition Characteristics of Full Coverage Film Cooling With Various Blowing Ratio and Row Number** Lang Wang[1] Xueying Li[2] Weihong Li[3] Jing Ren[1] Hongde Jiang[1] *1. Tsinghua University, China; 2. Tsinghua University, Department of Thermal Engineering, China; 3. University of Glasgow, United Kingdom*	**GT2019:90093** **A Numerical Investigation of Air/Mist Cooling Through a Conjugate, Rotating 3-D Gas Turbine Blade With Internal, External, and Tip Cooling** Ramy Abdelmaksoud, Ting Wang *University of New Orleans, USA*

TUESDAY JUNE 18 — 04:00 PM - 05:30 PM

	MANUFACTURING MATERIALS & METALLURGY	MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES	OIL & GAS APPLICATIONS
	Additive Manufacturing: Structures and Performance	**Microturbines for Distributed Power Generation and Hybrid Energy Grids**	**Diagnostics, Maintenance, Operation - 2**
	Technical Session • 121-C • TD-24-2	**Technical Session • 221-A • TD-26-3**	**Technical Session • 130 • TD-27-7Part B**
	Session Organizer: **Onome Scott-Emuakpor**, Air Force Research Laboratory Session Co-Organizer: **David Day**, Doosan	Session Organizer: **Ward De Paepe**, Université de Mons	Session Organizer: **J. Jeffrey Moore**, Southwest Research Institute Session Co-Organizer: **Kevin Hoopes**, Southwest Research Institute
4:00	**GT2019:90966** **Additive Manufacture of Prototype Turbine Blades for Hot-Fired Engine Performance Validation Trials** David Adair[1] Michael Kirka[2] Daniel Ryan[1] *1. Solar Turbines Inc., USA; 2. Oak Ridge National Laboratory, USA*	**GT2019:90509** **Multi-Disciplinary Design Optimization of a Horizontal Micro Kaplan Hydro Turbine** Ryo Amano, Ahmad Abbas, Mohammad Qandil, Muhannad Al-Haddad *University of Wisconsin-Milwaukee, USA*	**GT2019:90057** **Anomaly Detection in Gas Turbine Time Series by Means of Bayesian Hierarchical Models** Enzo Losi[1] Mauro Venturini[1] Lucrezia Manservigi[1] Giuseppe Fabio Ceschini[2] Giovanni Bechini[2] *1. Università degli Studi di Ferrara, Italy;* *2. Siemens SpA, Italy*
4:30	**GT2019:91056** **Modeling the Torsional Cyclic Response of Direct Metal Laser Sintered Inconel 718** Sanna Siddiqui[1] Firat Irmak[2] Nathan O'Nora[2] Ali Gordon[2] *1. Florida Polytechnic University, USA;* *2. University of Central Florida, USA*	**GT2019:90709** **Detailed Experimental Investigation of the Operational Parameters of a 30 kW Micro Gas Turbine** Oliver Kislat, Jan Zanger, Thomas Krummrein, Peter Kutne, Manfred Aigner *German Aerospace Center (DLR), Germany*	**GT2019:90075** **Wheel Box Test Aeromechanical Verification of New First Stage Bucket With Integrated Cover Plates for MS5002 GT** Marco Mariottini[1] Nicola Pieroni[1] Beniamino Pacifici[1] Pietro Bertini[1] Alessandro Giorgetti[2] *1. Baker Hughes, a GE company, Italy;* *2. Guglielmo Marconi University, Italy*
5:00	**GT2019:91849** **3D Printing in Turbomachinery: Overview of Technologies, Applications and Possibilities for Industry 4.0** Vaclav Novotny[1] Jan Spale[1] Barbora Bryksi Stunova[1] Michal Kolovratnik[1] Monika Vitvarova[1] Petr Zikmund[2] *1. Czech Technical University In Prague, Czech Republic; 2. Metal 3D, s. r. o., Czech Republic*		**GT2019:90158** **A Methodology and Case Study of Outboard Traverse Flame Detection on Aeroderivative Gas Turbines** Jean-Roch Jacques[1] Noor Azman Mohamat Nor[2] *1. Siemens Canada, Canada; 2. Siemens Energy, USA*

TUESDAY JUNE 18 — 04:00 PM - 05:30 PM

	STEAM TURBINES	STRUCTURES & DYNAMICS: ROTORDYNAMICS	STRUCTURES & DYNAMICS: ROTORDYNAMICS
	Mechanical Aspects of Steam Turbines II	**Modeling improvements**	**Rotordynamics - Theory, Vibration Monitoring, and Case Studies**
	Technical Session • 127-A • TD-29-12	**Technical Session • 128-B • TD-33-3**	**Tutorial Session • 129-AB • TD-33-13Part B**
	Session Organizer: **Vamadevan Gowreesan**, Sulzer RES	Session Organizer: **Theodore Brockett**, Honeywell Aerospace Session Co-Chairs: **Larry Hawkins**, Calnetix Technologies; **Patrick Keogh**, University of Bath	Session Organizer: **Almudena Vega**, Siemens Gamesa
4:00	**GT2019:90406** **Verification of Combined Main Steam Valve Pressure Distribution and Vibration Characteristics With Downscale Model Test on Air Condition** Fumiyuki Suzuki[1] Shingo Nishida[2] Shinji Fukao[2] Megumu Tsuruta[2] *1. Mitsubishi Hitachi Power Systems, Ltd., Japan; 2. Mitsubishi Heavy Industries Ltd., Japan*	**GT2019:90396** **Simple Contact Stiffness Model Validation for Tie Bolt Rotor Design With Butt Joints and Pilot Fits** Aaron Rimpel, Matthew Leopard *Southwest Research Institute, USA*	**GT2019:92347** **Rotordynamics 101 - Theory, Vibration Monitoring, and Case Studies** Jason Wilkes, Aaron Rimpel *Southwest Research Institute, USA* T U T O R I A L
4:30	**GT2019:90419** **Numerical Investigation on the Vibration of Steam Turbine Main Inlet Control Valves Considering Fluid Force Effects** Yueyue Li, Sihua Xu, Jin He, Zhiqiang Hu, Lei Xiao *Shanghai Electric Power Generation Equipment Co.,Ltd., China*	**GT2019:90598** **Reduced-Order Modeling for Stability and Steady-State Response Analysis of Asymmetric Rotor Using 3D Finite Element Model** Zhaoli Zheng[1] Yonghui Xie[2] Di Zhang[1] *1. Xi'an Jiaotong University, China; 2. Institute of Turbomachinery, China*	
5:00	**GT2019:92005** **Structural Optimization of Fir-Tree Root and Groove for Turbine Blade With Superellipse and P-Norm Aggregation Function** Deqi Yu[1] Xiaojuan Zhang[2] Jiandao Yang[3] Kai Cheng[3] Ming Li[2] *1. Shanghai Electric, China; 2. Dalian University of Technology, China; 3. Shanghai Electric Shanghai Turbine Works Co. Ltd, China*		

TUESDAY JUNE 18 — 04:00 PM - 05:30 PM

	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS	STUDENT ADVISORY	SUPERCRITICAL CO2 POWER CYCLES
	Squeeze Film Dampers	**Advice for Developing Effective Technical Presentations**	**Technoeconomic Assessments & Plant Concepts for SCO2 Power Cycles**
	Technical Session • 128-A • TD-34-10	**Tutorial Session • 221-C • TD-37-1**	**Panel Session • 123 • TD-38-12**
	Session Organizer: **Sunghwa Jeung**, Ingersoll Rand Session Co-Organizer: **Jianming Cao**, Rotor Bearing Solutions International	Session Organizer: **Shawn Siroka**, Pennsylvania State University	Session Organizer: **Richard Dennis**, U.S. Department of Energy, National Energy Technology Laboratory Session Co-Chairs: **Rajgopal Vijaykumar**, US Department of Energy; **Robin Ames**, NETL
4:00	**GT2019:90330** **Model and Experimental Verification of the Dynamic Forced Performance of a Tightly Sealed Squeeze Film Damper Supplied With a Bubbly Mixture** Luis San Andres[1] Bonjin Koo[2] *1. Texas A&M University, USA; 2. Daikin Applied, USA*	**GT2019:92286** **Rethinking Scientific Presentations: The Assertion-Evidence Structure** Michael Alley *Penn State University, USA*	**GT2019:92304** **Technical and Economic Assessments of SCO2 Power Cycles for Fossil Energy Applications** Nathan T. Weiland *National Energy Technology Laboratory, USA* **GT2019:92350** **Technoeconomic Assessment of SCO2 Power Cycles Integrated with Concentrating Solar Power and Thermal Energy Storage** Ty Neises *NREL, USA* **GT2019:92384** **Meeting DOE Goals and Objectives with a 10 MW SCO2 Recompression Brayton Cycle** Michael Kutin *Gas Technology Institute, USA*
4:30	**GT2019:91285** **CFD Simulation of Air Ingestion in a Squeeze Film Damper** Yan Wang, Xuesong Li, Yuhong Li *Tsinghua University, China*	TUTORIAL	PANEL
5:00			

TUESDAY JUNE 18 — 04:00 PM - 05:30 PM

	TURBOMACHINERY: AXIAL FLOW TURBINE AERODYNAMICS	TURBOMACHINERY: AXIAL FLOW TURBINE AERODYNAMICS	TURBOMACHINERY: UNSTEADY FLOWS IN TURBOMACHINERY
	Leakage Flows	**Aerodynamic Studies**	**Unsteady Flows in Turbines IV**
	Technical Session • 127-C • TD-40-1Part B	**Technical Session • 125-AB • TD-40-8Part B**	**Technical Session • 124-B • TD-45-11Part B**
	Session Organizer: **Emil Goettlich**, Graz University of Technology Session Co-Organizer: **Marios Patinios**, Graz University of Technology	Session Organizer: **Matthew Montgomery**, Doosan ATSA Session Co-Organizer: **Jong - Shang Liu**, Honeywell Engines Systems & Services	Session Organizer: **Thomas Praisner**, Pratt And Whitney Session Co-Organizer: **Nateri Madavan**, NASA Ames Research Center
4:00	**GT2019:91654** **Evaluating the Effects of Transient Purge Flow on Stator-Rotor Seal Performance** Reid A. Berdanier, Eric T. DeShong, Karen Thole *Pennsylvania State University, USA*	**GT2019:90462** **A Novel Vortex Identification Technique Applied to the 3D Flow Field of a High-Pressure Turbine** Marek Pátý[1] Sergio Lavagnoli[2] *1. CTU in Prague, Faculty of Mechanical Engineering, Czech Republic; 2. von Karman Institute for Fluid Dynamics, Belgium*	**GT2019:90179** **A New Data-Driven Turbulence Model Framework for Unsteady Flows Applied to Wall-Jet and Wall-Wake Flows** Chitrarth Lav, Jimmy Philip, Richard D. Sandberg *The University of Melbourne, Australia*
4:30	**GT2019:90827** **An Experimental Study of Ingress and Egress Flow Structures in an Axial Research Turbine Stage** Zhenyang Zhang, Ma Hongwei *Beihang University, China*	**GT2019:90585** **A New Physics Based Unsteady Transition Model Using the Universal Intermittency Function** Meinhard Schobeiri[1] Ali Nikparto[2] *1. Texas A&M University, USA; 2. Carrier Corporation, USA*	**GT2019:91183** **Full-Annulus URANS Study on the Transportation of Combustion Inhomogeneity in a Four-Stage Cooled Turbine** Zhongran Chi[1] Haiqing Liu[1] Shusheng Zang[1] Chengxiong Pan[2] Guangyun Jiao[2] *1. Shanghai Jiao Tong University, China;* *2. Shanghai Electric Gas Turbine Company, China*
5:00		**GT2019:91834** **Influence of the Gas-to-Wall Temperature Ratio on the Boundary Layer Transition: Investigation of the Wake Behind a Turbine Nozzle Guide Vane** Pietro Formisano, Tania Sofia Cacao Ferreira, Tony Arts *von Karman Institute, Belgium*	**GT2019:91249** **Robust Active Flow Control of a Stator Cascade With Integer Control Functions and Sum-Up Rounding** Karl Neuhäuser, Rudibert King *Technische Universität Berlin, Germany*

TUESDAY JUNE 18 — 04:00 PM - 05:30 PM

	TURBOMACHINERY: MULTIDISCIPLINARY DESIGN APPROACHES, OPTIMIZATION & UNCERTAINTY QUANTIFICATION	TURBOMACHINERY: DEPOSITION, EROSION, FOULING, AND ICING	WIND ENERGY
	Machine Learning for Design Optimization, Data Analysis & Control	**Deposition in Internal Turbine Cooling Passages**	**R&D Trends in Wind Energy**
	Technical Session • 126-ABC • TD-46-7Part B	**Technical Session • 127-B • TD-47-3Part B**	**Tutorial Session • 131-A • TD-48-5Part B**
	Session Organizer: **Swati Saxena**, ANSYS Inc. Session Co-Organizer: **Lieven Baert**, Cenaero	Session Organizer: **Steven Whitaker**, Honeywell Aerospace Session Co-Organizer: **Nagaraja Rudrapatna**, Honeywell	Session Organizer: **George Pechlivanoglou**, Eunice Session Co-Organizer: **Alessandro Bianchini**, University of Florence
4:00	**GT2019:90974** **Multidisciplinary Design Optimization of a Bladed Disc for Small-Size Gas-Turbine Engines** Anton Salnikov, Maxim Danilov *Central Institute of Aviation Motors (CIAM) Called P.I. Baranov, Russia*	**GT2019:91740** **Fine Particulate Deposition in an Effusion Plate Geometry** Bruce Varney[1] Brett Barker[1] Jeffrey Bons[2] Trent Wolff[2] Pritheesh Gnanaselvam[2] *1. Rolls-Royce, USA; 2. Ohio State University, USA*	**GT2019:92214** **Wind Turbine Blade Design: An Industrial Perspective** Georgios Pechlivanoglou[1] Alessandro Bianchini[2] *1. Eunice Wind, Greece; 2. University of Florence, Italy*
4:30	**GT2019:91471** **Multipoint Optimization of an Axial Turbine Cascade Using a Hybrid Algorithm** Arnaud Châtel[1] Tom Verstraete[1] Gregory Coussement[2] *1. von Karman Institute for Fluid Dynamics, Belgium; 2. University of Mons - Fluids/Machines Dep, Belgium*	**GT2019:91785** **Modeling Deposit Erosion in Internal Turbine Cooling Geometries** Nathan Libertowski, Gabe Geiger, Jeffrey Bons *Ohio State University, USA*	TUTORIAL
5:00			

WEDNESDAY JUNE 19 — 08:00 AM - 09:30 AM

	AIRCRAFT ENGINE	CERAMICS	COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS
	On-Wing Engine Condition Monitoring, Modelling and Optimization	**CMC Components**	**Life Cycle Assessment**
	Technical Session • 124-A • WA-1-9	**Technical Session • 222-B • WA-2-1**	**Technical Session • 122-A • WA-3-1**
	Session Organizer: **William Gallops**, GallopsAE Session Co-Organizer: **Kevin Schwan**, Lockheed Martin Aeronautics	Session Organizer: **Jun Shi**, Rolls-Royce Corporation Session Co-Organizer: **Sung Choi**, Naval Air Systems Command	Session Organizer: **Marina Braun-Unkhoff**, DLR, Institute of Combustion Technology Session Co-Organizer: **Jeff Bergthorson**, McGill University
8:00	**GT2019-90420** **Jet Propulsion Engine Modelling Using Pseudo Bond Graph Approach** Jan Göing, Andreas Kellersmann, Christoph Bode, Jens Friedrichs *Technical University of Braunschweig, Germany*	**GT2019-90875** **Complex Design Method of Ceramic Blades and Metal Disk Connection** Dmitry Sapronov[1] Michael Mezencev[1] Telman Karimbaev[1] Sergey Reznik[2] Pavel Prosuntsov[2] *1. Central Institute of Aviation Motors, Russia; 2. Bauman Moscow State Technical University, Russia*	**GT2019-90380** **Tailored Fuel Treatment Enables Optimizing the Operation of Heavy-Fueled Gas Turbines** Matthieu Vierling[1] Michel Moliere[2] Maher Aboujaib[3] Dmitry Sokolov[3] Sven Catrin[3] Paul Glaser[4] Richard Denolle[5] Nuhuman Marikkar[6] Tharindu Jayath[6] Kithsiri Egodawatta[6] Pierre Montagne[7] *1. GE Energy Products France SNC, France; 2. UTBM, France; 3. GE, France; 4. GE Power, USA; 5. Katalis, France; 6. LTL Holdings (Pvt) Ltd, Sri Lanka; 7. GE Power, France*
8:30	**GT2019-90882** **Physics-Based Simulation in Support of a Through-Life Gas Turbine Service Business Model** Bill Dawes[1] Matthew Hunt[2] Nabil Meah[2] Andrey Kudryavtsev[2] Rich Evans[2] *1. University of Cambridge, Whittle Laboratory, United Kingdom; 2. Cambridge Flow Solutions Ltd., United Kingdom*	**GT2019-91233** **Validation of Fracture Prediction Model to Design CMC Turbine Vane** Hayao Sato, Yusuke Ueda, Masaharu Andoh, Tatsuhito Honda *IHI Corporation, Japan*	**GT2019-91185** **Application of Design-for-LCA Methodology to Compare Architectural Alternatives for the Compressor Rotor of an Industrial Gas Turbine** Alessandro Musacchio[1] Mattia Vicarelli[2] Simone Colantoni[1] Pietro Bartocci[2] Francesco Fantozzi[2] *1. Baker Hughes, a GE company, Italy; 2. University of Perugia, Italy*
9:00	**GT2019-91190** **The Effect of Rated Climb Performance on Low Cycle Fatigue of a Civil Turbojet Engine** Jonas König[1] Matthias Weissschuh[1] Sven von Ende[1] Stephan Staudacher[2] *1. Rolls-Royce Deutschland Ltd & Co KG, Germany; 2. Institute of Aircraft Propulsion Systems / University of Stuttgart, Germany*	**GT2019-91787** **Design Considerations for Ceramic Matrix Composite High Pressure Turbine Blades** Robert Boyle, Ankur Parikh, Vinod Nagpal *N&R Engineering and Management Services, USA*	**GT2019-91191** **Implementing Environmental Impact Assessment on the Life Cycle for Industrial Gas Turbines Development** Alessandro Musacchio[1] Mattia Vicarelli[2] Simone Colantoni[1] Pietro Bartocci[2] Francesco Fantozzi[2] *1. Baker Hughes, a GE company, Italy; 2. University of Perugia, Italy*

WEDNESDAY JUNE 19 — 08:00 AM - 09:30 AM

	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS	CYCLE INNOVATIONS
	Combustion Modeling - Effect of Chemistry Model	**Combustion Dynamics: Stability Analysis**	**Combined Cycle Performance**
	Technical Session • 122-BC • WA-4-11	**Technical Session • 121-AB • WA-4-33**	**Technical Session • 221-B • WA-6-7**
	Session Organizer: **Ponnuthurai Gokulakrishnan**, Combustion Science & Engineering, Inc.	Session Organizer: **Luca Magri**, University of Cambridge Session Co-Organizer: **Marco Zedda**, Rolls-Royce plc	Session Organizer: **Panagiotis Stathopoulos**, TU Berlin Session Co-Chairs: **Clinton Bedick**, National Energy Technology Laboratory-DOE; **Majed Sammak**, GE Power
8:00	**GT2019-90218** **Validation of Chemistry Acceleration Techniques With an Industrial Gas Turbine** George Mallouppas[1] Graham Goldin[2] Yongzhe Zhang[2] Piyush Thakre[2] Jim Rogerson[3] *1. Siemens PLM, United Kingdom; 2. Siemens PLM, USA; 3. Siemens, United Kingdom*	**GT2019-91784** **Thermoacoustic Spectrum of a Swirled Premixed Combustor With Partially Reflecting Boundaries** Kah Joon Yong, Maximilian Meindl, Wolfgang Polifke, Camilo F. Silva *Technical University of Munich, Germany*	**GT2019-91354** **Gas Turbine Combined Cycle Flexibility: A Dynamic Model for Compressor Intake Conditioning Through a Heat-Pump** Iacopo Rossi[1] Luca Piantelli[2] Alberto Traverso[1] *1. University of Genoa, Italy; 2. IREN s.p.a, Italy*
8:30	**GT2019-90219** **Investigation of Flamelet Generated Manifold Reaction Source Term Closure Models Applied to an Industrial Gas Turbine** George Mallouppas[1] Graham Goldin[2] Yongzhe Zhang[2] Piyush Thakre[2] Jim Rogerson[3] *1. Siemens PLM, United Kingdom; 2. Siemens PLM, USA; 3. Siemens, United Kingdom*	**GT2019-90834** **Solution of Thermoacoustic Eigenvalue Problems With a Non-Iterative Method** Philip E. Buschmann[1] Georg Atta Mensah[2] Franck Nicoud[3] Jonas P. Moeck[1] *1. Norwegian University of Science and Technology, Norway; 2. Technische Universität Berlin, Germany; 3. Université de Montpellier, France*	**GT2019-91541** **Analysis of a Combined Cycle Exploiting Inlet Conditioning Technologies for Power Modulation** Alessandro Sorce[1] Andrea Giugno[1] Daniela Marino[2] Stefano Piola[2] Rafael Guédez[3] *1. University of Genoa, Italy; 2. Ansaldo Energia, Italy; 3. KTH Royal Institute of Technology, Sweden*
9:00	**GT2019-90821** **Modeling of CO Emissions in Multi-Burner Systems With Fuel Staging** Noah Klarmann[1] Benjamin Timo Zoller[2] Thomas Sattelmayer[1] *1. Technical University of Munich, Germany; 2. GE Power, Switzerland*	**GT2019-90732** **Efficient Robust Design for Thermoacoustic Instability Analysis: A Gaussian Process Approach** Shuai Guo, Camilo F. Silva, Wolfgang Polifke *Technical University of Munich, Germany*	**GT2019-91138** **Model-Based Analysis of the Start-Up Improvement of a CCPP due to Steam Turbine Warm-Keeping With Air** Dennis Toebben[1] Tobias Burgard[1] Sebastian Berg[1] Manfred Wirsum[2] Pei Liu[3] Zheng Li[3] Wolfgang F. D. Mohr[4] Klaus Helbig[5] *1. RWTH Aachen University, Germany; 2. IKDG, RWTH Aachen University, Germany; 3. Tsinghua University, China; 4. General Electric Power AG, Switzerland; 5. GE Power, Germany*

WEDNESDAY JUNE 19 — 08:00 AM - 09:30 AM

	FANS & BLOWERS	HEAT TRANSFER: NUMERICAL FILM COOLING	HEAT TRANSFER: INTERNAL AIR SYSTEMS & SEALS (WITH TURBOMACHINERY)
	Experimental Evaluation of Fans and Fan System Performance	**Hole Shape Studies II**	**Miscellaneous**
	Technical Session • 131-A • WA-9-2	**Technical Session • 131-C • WA-12-7**	**Technical Session • 131-B • WA-15-6**
	Session Organizer: **Giovanni Delibra**, Sapienza University of Rome	Session Organizer: **Giovanna Barigozzi**, Universita' Di Bergamo Session Co-Organizer: **Jianhua Wang**, University of Science & Technology	Session Organizer: **Cosimo Bianchini**, Ergon Research Session Co-Organizer: **J. Axel Glahn**, Pratt & Whitney, Aero Thermal Systems
8:00	**GT2019-91532** **A New Practical Approach to the Design of Industrial Axial Fans: Part II ? Forward-Swept Blades With Low Hub-to-Tip Ratio** Massimo Masi[1] Andrea Lazzaretto[2] *1. University of Padova - DTG, Italy; 2. University of Padova, Italy*	**GT2019-90518** **Film Cooling of Compound Angle Upstream Sister Holes** Sana Abd Alsalam, Bassam A. Jubran *Ryerson University, Canada*	**GT2019-92050** **Development of a CFD Based Methodology for Predicting Oil Auto-Ignition in Gas Turbine Bearing Chambers** Ashley Peyton-Bruhl[1] Darcy Belton[1] A Duncan Walker[1] Guy Snowsill[2] Colin Young[2] *1. Loughborough University, United Kingdom; 2. Rolls-Royce plc, United Kingdom*
8:30	**GT2019-90555** **Experimental Study of Flow Inside a Centrifugal Fan Using Magnetic Resonance Velocimetry** Davis W. Hoffman, Laura Villafane, Christopher J. Elkins, John K. Eaton *Stanford University, USA*	**GT2019-91788** **Evaluating the Usefulness of RANS in Film Cooling** Fraser Jones, Dale Fox, David Bogard *University of Texas At Austin, USA*	**GT2019-90700** **Lumped Mass Thermal Model for Steady State and Transient Simulations of Aeronautical Gearbox** Saypen Baraggia Au Yeung, Pietro Molesini, Miriam Manzoni, Fabio De Bellis *GE Avio, Italy*
9:00	**GT2019-91688** **CFD and Experimental Analysis of Centrifugal Fans With Forward Curved Blades Used in Electric Motors** Samuel Borges *WEG, Brazil*	**GT2019-90180** **Large-Eddy Simulation of Shaped Hole Film Cooling With the Influence of Cross Flow** Qingsong Wang[1] Yifei Li[2] Xiutao Bian[1] Xinrong Su[3] Xin Yuan[2] *1. Tsinghua University, China; 2. Department of Thermal Engineering, Tsinghua University, China; 3. Department of Energy and Power Engineering, Tsinghua University, China*	**GT2019-90698** **Liquid Jet Bending in Gaseous Crossflows for Gearbox Applications** Miriam Manzoni, Saypen Baraggia Au Yeung, Pietro Molesini, Fabio De Bellis *GE Avio, Italy*

WEDNESDAY JUNE 19 — 08:00 AM - 09:30 AM

	HEAT TRANSFER: EXPERIMENTAL FILM COOLING	INDUSTRIAL & COGENERATION	MANUFACTURING MATERIALS & METALLURGY
	Experimental Film Cooling III	**GT Power Augmentation Technologies - Inlet Fogging, Wet Compression, water Injections and Compressor Cleaning**	**Role of High-Performance Computing, in-Situ and ex-Situ Characterization in Qualification of AM Components**
	Technical Session • 132-AB • WA-19-3	**Technical Session • 221-C • WA-23-1**	**Discussion Session • 121-C • WA-24-4**
	Session Organizer: **Forrest Ames**, University of North Dakota Session Co-Organizer: **Andrew Nix**, West Virginia University	Session Organizer: **Mustapha Chaker**, McDermott Session Co-Organizer: **Maria Alessandra Ancona**, University of Bologna	Session Organizer: **Dheepa Srinivasan**, Adjunct Faculty, IIT, Ropar Session Co-Organizer: **Pontus Slottner**, Siemens Industrial Turbomachinery AB
8:00	**GT2019-90671** **Experimental Investigation on the Flat-Plate Film Cooling Enhancement Using the Vortex Generator Downstream for the Cylindrical Hole and Fan-Shaped Hole Configurations** Chao Zhang[1] Jie Wang[1] Luo Xin[1] Liming Song[1] Jun Li[2] Zhenping Feng[1] *1. Xi'an Jiaotong University, China; 2. Institute of Turbomachinery, Xi'an Jiaotong University, China*	**GT2019-90136** **Power Augmentation Technologies for Gas Turbines: Alternatives for an Existing Simple Cycle Power Plant in Peru** Cesar Celis[1] Sergio Peralta[1] Walter Galarza[2] *1. Pontificia Universidad Católica del Perú, Peru; 2. Faculty of Mechanical Engineering, Universidad Nacional de Ingeniería, Peru*	**GT2019-92325** **Role of High-Perfomance Computing, In-Situ and Ex-Situ Characterization in Qualification of AM Components** Sudarsanam Babu *University of Tennessee, Knoxville, USA* **D I S C U S S I O N**
8:30	**GT2019-90734** **Experimental and Numerical Investigation on Film Cooling Performance and Flow Structure of Film Holes** 0 Cao, Xue Li, Zeyu Wu, Xiang Luo *Beihang University, China*	**GT2019-90172** **Object-Oriented Approach to Determine Effectiveness of Potential Gas Turbine Power Augmentation Methods** Charles Krouse, Jacob Delimont *Southwest Research Institute, USA*	
9:00	**GT2019-90817** **Experimental and Numerical Study on the Effect of Fan-Shaped Hole Configuration on Film Cooling Effectiveness** Hyun Jae Seo[1] Sang Hyeon Park[1] Young Seok Kang[2] Jae Su Kwak[1] *1. Korea Aerospace University, Korea; 2. Korea Aerospace Research Institute, Korea*	**GT2019-90340** **Laboratory and On-Site Findings Demonstrating the Greater Effectiveness of Biphase Water-Based Compressor Cleaners Over Monophase Cleaners** Simon Kloter[1] Neil F. Ashford[2] Duncan R. Fitchett[3] *1. Turbotect Ltd., Switzerland; 2. Turbotect Ltd., United Kingdom; 3. RWE Generation, United Kingdom*	

WEDNESDAY JUNE 19 — 08:00 AM - 09:30 AM

	MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES	OIL & GAS APPLICATIONS	STEAM TURBINES
	Microturbines: Compressors	**Industrial Gas Turbines - an Introduction**	**Wet Steam**
	Technical Session • 221-A • WA-26-5	**Tutorial Session • Room 130 • WA-27-12**	**Technical Session • 127-A • WA-29-6**
	Session Organizer: **Fangyuan Lou**, Purdue University	Session Organizer: **Rainer Kurz**, Solar Turbines Session Co-Organizer: **Klaus Brun**, Elliott Group	Session Organizer: **Francesca di Mare**, Ruhr-University Bochum Session Co-Organizer: **Tao Guo**, GE Power
8:00	**GT2019-90977** **Investigation of Mixed Micro-Compressor Casing Treatment Using Non-Matching Mesh Interface** Purvic Patel, Gecheng Zha *University of Miami, USA*	**GT2019-90021** **Industrial Gas Turbines – an Introduction** Rainer Kurz, Bernhard Winkelmann *Solar Turbines Inc., USA*	**GT2019-90221** **Separation of Water Film From Last Stage Guide Blades of 1000 MW Steam Turbine** Michal Hoznedl[1] Ladislav Tajc[2] Lukas Bednar[1] Ales Macalka[3] Antonín Živný[3] *1. Doosan Skoda Power s.r.o., Czech Republic;* *2. University of West Bohemia, Czech Republic;* *3. NUM Solution s.r.o., Czech Republic*
8:30	**GT2019-90980** **Design of High Specific Speed Mixed Flow Micro-Compressor for Co-Flow Jet Actuators** Kewei Xu, Gecheng Zha *University of Miami, USA*	**T U T O R I A L**	**GT2019-91269** **Towards Scale Resolving Computations of Condensing Wet Steam Flows** Pascal Post, Marwick Sembritzky, Francesca di Mare *Ruhr-Universität Bochum, Germany*
9:00			**GT2019-91928** **Optical Coarse Droplet Measurement and Wet Loss Analysis on the Wet Air Flow Through the Subsonic Blade Cascade Channel** Yasuhiro Sasao[1] Ryo Takata[2] Satoshi Miyake[1] Soichiro Tabata[1] Satoru Yamamoto[3] *1. Mitsubishi Hitachi Power Systems, Ltd., Japan;* *2. Mitsubishi Heavy Industries Ltd., Japan;* *3. Tohoku University, Japan*

WEDNESDAY JUNE 19 — 08:00 AM - 09:30 AM

	STRUCTURES & DYNAMICS: EMERGING METHODS IN DESIGN & ENGINEERING	STRUCTURES & DYNAMICS: ROTORDYNAMICS	STRUCTURES & DYNAMICS: STRUCTURAL MECHANICS, VIBRATION & DAMPING
	Emerging Methods on Advanced Designs	**How to Apply API Standards to Turbomachinery Rotordynamics - An Introduction**	**Frictional Joints**
	Technical Session • 128-A • WA-30-1	**Tutorial Session • 129-AB • WA-33-14Part A**	**Technical Session • 128-B • WA-35-6**
	Session Organizer: **Roberto Alonso**, Industria de Turbo Propulsores, S.A.u. Session Co-Organizer: **Partha S Das**, Honeywell International, Inc.	Session Organizer: **Mateusz Golebiowski**, General Electric (Switzerland) GmbH	Session Organizer: **Fabrice Thouverez**, Ecole centrale de lyon / LTDS Session Co-Organizer: **Jeffrey Kauffman**, University of Central Florida
8:00	**GT2019-90073** **Studies of Hybrid Titanium Compressor Blisks for Gas Turbine Engines Manufactured Using Additive Technologies** Liubov Magerramova[1] Olga Klimova-Korsmik[2] Gleb Turichin[2] Mikhael Volkov[1] Marina Guschina[2] *1. Central Institute of Aviation Motors, Russia; 2. Saint Petersburg State Marine Technical University, Russia*	**GT2019-92138** **How to Apply API Standards to Turbomachinery Rotordynamics: An Introduction** Roman Kochurov, Clement Joly *SoftInWay Inc., USA*	**GT2019-91764** **A Reliable Pre-Processing for the Simulation of Friction Joints in Turbomachineries and its Validation: A Case Study With Policontact** Christian M. Firrone, Giuseppe Battiato *Politecnico di Torino, Italy*
8:30	**GT2019-90344** **Structural Integrity Assessment and Engine Test of an Additive Manufactured First Stage Ring Segment of a Siemens Large Gas Turbine** Tobias Rühmer[1] Uwe Gampe[2] Kathrin Anita Fischer[1] Thomas Wimmer[1] Christoph Haberland[1] *1. Siemens AG, Germany; 2. Technische Universitaet Dresden, Germany*	**T U T O R I A L**	**GT2019-90416** **Experimental Investigation on Real Under-Platform Dampers: The Impact of Design and Manufacturing** Chiara Gastaldi[1] Teresa Berruti[1] Muzio Gola[1] Andrea Bessone[2] *1. Politecnico di Torino, Italy; 2. Ansaldo Energia, Italy*
9:00	**GT2019-91272** **Structural Analysis of an Auxetic Casing Structure Incorporating Tip Blowing Casing Treatment Modification** Tobias Schmidt[1] Jan Lorenz[1] Volker Guemmer[1] Andreas Hupfer[2] *1. Technical University of Munich, Germany; 2. University of the German Federal Armed Forces Munich, Germany*		**GT2019-91040** **Design Tools to the Best Coupling of Dry-Friction Solid Underplatform Dampers to Turbine Blades** Chiara Gastaldi, Muzio Gola *Politecnico di Torino - DIMEAS, Italy*

WEDNESDAY JUNE 19 — 08:00 AM - 09:30 AM

	SUPERCRITICAL CO2 POWER CYCLES	TURBOMACHINERY: AXIAL FLOW FAN & COMPRESSOR AERODYNAMICS	TURBOMACHINERY: AXIAL FLOW TURBINE AERODYNAMICS
	Turbomachinery Design for Supercritical CO2 Applications	**Tip-clearance Flows**	**Aerodynamic Performances and Design I**
	Tutorial Session • Room 123 • WA-38-15	**Technical Session • 126-ABC • WA-39-5**	**Technical Session • 125-AB • WA-40-5**
	Session Organizer: **Jason Wilkes**, Southwest Research Institute	Session Organizer: **Simon Evans**, UTRC Session Co-Organizer: **Mark H. Ross**, Notre Dame Turbomachinery Laboratory	Session Organizer: **Cis De Maesschalck**, Rolls Royce Plc Session Co-Organizer: **Sergio Lavagnoli**, von Karman Inst for Fluid Dynamics
8:00	**GT2019-92135** **Tutorial: Turbo Machinery Design for Supercritical CO2 Applications** J. Jeffrey Moore[1] Tim Allison[2] *Southwest Research Institute, USA*	**GT2019-90224** **Study of the Tip Leakage Flow in a Compressor Cascade With Incidence Exceeding the Stability Limit** Markus W. Leitner[1] Stephan Staudacher[1] Martin Rose[2] *1. Institute of Aircraft Propulsion Systems, University of Stuttgart, Germany; 2. Sussex University, United Kingdom*	**GT2019-91255** **Design of a Working Fluid Versatile Supersonic Turbine for Micro Launchers** Cleopatra Cuciumita[1] Valeriu Vilag[2] *1. Technical University of Berlin, INCDT Comoti, Germany; 2. COMOTI Romanian R&D Institute for Gas Turbines, Romania*
8:30	**T U T O R I A L**	**GT2019-90844** **Investigation of Turbulence Characteristics in a Tip Leakage Flow Model Using Large-Eddy Simulation** Yanfei Gao, Yangwei Liu, Lipeng Lu *Beihang University, China*	**GT2019-91262** **Design, Testing, and Performance Impact of Exhaust Diffusers in Aero-Derivative Gas Turbines for Mechanical Drive Applications** Alberto Scotti del Greco[1] Tomasz Jurek[2] Daniele Di Benedetto[1] Vittorio Michelassi[3] Giacomo Ragni[1] Enrico Beghini[1] Maria Vittoria Borghesi[1] *1. Baker Hughes, a GE company, Italy; 2. Baker Hughes, a GE company, Poland; 3. General Electric, Italy*
9:00		**GT2019-91366** **Study on Effect of Axial Overlap on Tip Leakage Flow Structure in Tandem Bladed Low Speed Axial Flow Compressor** Ajey Singh, Chetan Mistry *Indian Institute of Technology Kharagpur, India*	**GT2019-91592** **Towards Large Eddy Simulation of Rotating Turbomachinery for Variable Speed Gas Turbine Engine Operation** Nishan Jain[1] Luis G. Bravo[2] Dokyun Kim[3] Muthuvel Murugan[2] Anindya Ghoshal[2] Frank Ham[3] Alison Flatau[1] *1. University of Maryland, USA; 2. U.S. Army Research Laboratory, USA; 3. Cascade Technologies, Inc., USA*

WEDNESDAY JUNE 19 — 08:00 AM - 09:30 AM

	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY	TURBOMACHINERY: UNSTEADY FLOWS IN TURBOMACHINERY	TURBOMACHINERY: DEPOSITION, EROSION, FOULING, AND ICING
	Novel Solver and Simulation Framework (1)	**Unsteady Flows in Turbines III**	**Gas Turbine Deposition - System Level Modeling and Mitigation**
	Technical Session • 127-C • WA-41-15	**Technical Session • 124-B • WA-45-10**	**Technical Session • 127-B • WA-47-2**
	Session Organizer: **Kurt Weber**, Rolls-Royce Corporation Session Co-Organizer: **Raul Vazquez Diaz**, Rolls-Royce plc	Session Organizer: **Dr. Yuan Dong**, Pratt and Whitney Session Co-Organizer: **Reid A. Berdanier**, Pennsylvania State University	Session Organizer: **Paolo Venturini**, Dipartimento di Meccanica e Aeronautica, 'Sapienza University of Rome Session Co-Organizer: **Danesh Tafti**, Virginia Tech
8:00	**GT2019-91300** **Favre-Averaged Fourier-Based Methods for Gas Turbine Flows** Feng Wang[1] Luca di Mare[1] Paolo Adami[2] *1. University of Oxford, United Kingdom;* *2. Rolls-Royce Deutschland, United Kingdom*	**GT2019-91222** **Recognition of Structures Leading to Transition in a Low Pressure Turbine Cascade: Effect of Reduced Frequency** Davide Lengani[1] Daniele Simoni[2] Marina Ubaldi[1] Pietro Zunino[1] Francesco Bertini[3] *1. Università di Genova, Italy; 2. DIMSET Università di Genova, Italy; 3. GE AvioAero Srl, Italy*	**GT2019-90400** **Experimental Analysis of a Particle Separator Design With Full-Field 3D Measurements** Daniel D. Borup, Christopher J. Elkins, John K. Eaton *Stanford University, USA*
8:30	**GT2019-91306** **Numerical Investigations on the Power Generation of Turbo-Expander During the Propane De-Hydrogenation Process** Hwabhin Kwon, Heesung Park *Changwon National University, Korea*	**GT2019-91226** **Turbine Cascade Profile Loss Sensitivity to Incoming Wake Parameters: Effects of Reduced Frequency, Wake Momentum Defect and Axial Gap** Daniele Simoni[1] Vianney Yepmo[2] Pietro Zunino[2] Marina Ubaldi[2] Davide Lengani[2] Francesco Bertini[3] *1. DIMSET Università di Genova, Italy;* *2. Università di Genova, Italy; 3. GE AvioAero, Italy*	**GT2019-91627** **A Design for Fouling Oriented Optimization of an HPT Nozzle** Riccardo Friso[1] Nicola Casari[1] Alessio Suman[1] Michele Pinelli[2] Francesco Montomoli[3] *1. University of Ferrara, Italy; 2. Univeristy of Ferrara Endif, Italy; 3. Imperial College London, United Kingdom*
9:00		**GT2019-91346** **Prediction of Reynolds Number Effects on Low-Pressure Turbines Using a High-Order ILES Method** Marc Bolinches i Gisbert[1] David Cadrecha Robles[2] Roque Corral[2] Fernando Gisbert[2] *1. Universidad Politécnica de Madrid, Spain;* *2. ITP Aero, Spain*	**GT2019-91910** **Challenges Associated With Replicating Rotor Blade Deposition in a Non-Rotating Annular Cascade** Christopher Bowen, Ali Ameri, Jeffrey Bons *The Ohio State University, USA*

KEYNOTE & PLENARIES

Plenary: Turbomachinery and Clean Energy - Future Trends and Opportunities

Panel Session • North Ballroom • WA-51-3

Session Organizer: **Richard Dennis**, U.S. Department of Energy, National Energy Technology Laboratory
Session Co-Organizer: **Karen Thole**, Pennsylvania State University

9:40

GT2019-92364
Plenary: Power Focus, Kunal Chandra
Kunal Chandra
Siemens, Germany

GT2019-92365
Plenary: Power Focus, Guy DeLeonardo
Guy DeLeonardo
GE Power, USA

GT2019-92366
Plenary: Power Focus, Yasushi Fukuizumi
Yasushi Fukuizumi
Mitsubishi Heavy Industries, Japan

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WEDNESDAY JUNE 19 — 11:15 AM - 12:45 PM

	AIRCRAFT ENGINE	CERAMICS	COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS
	Propulsion System Integration – an Airframer View	**Ceramics Tutorials**	**Alternative Gaseous Fuels I (Hydrogen)**
	Tutorial Session • 124-A • WB-1-15	**Technical Session • 222-B • WB-2-5**	**Technical Session • 122-A • WB-3-3**
	Session Organizer: **Harald Funke**, Aachen University of Applied Sciences Session Co-Organizer: **Nils Beckmann**, Aachen University of Applied Sciences	Session Organizer: **Jun Shi**, Rolls-Royce Corporation Session Co-Organizer: **Rajesh Kumar**, United Technologies Research Ctr	Session Organizer: **Bhupendra Khandelwal**, University of Sheffield
11:15	**GT2019-92117** **Commercial Aircraft Propulsion System Integration: An Aircraft Manufacturer View** Philippe Mogilka *Airbus S.A.S., France*	**GT2019-92128** **Ceramic Matrix Composites: Basics, Properties and Design Considerations** Gregory Morscher *University of Akron, USA*	**GT2019-90453** **An Analysis of Civil Aviation Industry Safety Needs for the Introduction of Liquid Hydrogen Propulsion Technology** C.M. Benson[1] J.M. Ingram[1] P. N. Battersby[1] David Mba[2] Vishal Sethi[3] Andrew M Rolt[3] *1. London South Bank University, United Kingdom; 2. Faculty of Technology, De Montfort University, United Kingdom; 3. Cranfield University, United Kingdom*
11:45	**T U T O R I A L**	**GT2019-92130** **Overview of SiCf/SiCm Ceramic Matrix Composite (CMC) Processing Methods; Implications of Operating Temperature on Processing Approaches** Sungbo Shim *Rolls-Royce High Temperature Composite, USA*	**GT2019-90532** **NOX Emissions Predictions for a Hydrogen MicromiX Combustion System** Giulia Babazzi[1] Pierre Gauthier[2] Parash Agarwal[1] Jonathan McClure[1] Vishal Sethi[1] *1. Cranfield University, United Kingdom; 2. Siemens, Canada*
12:15		**GT2019-91750** **Processing Science of Thermal and Environmental Barrier Coatings** Sanjay Sampath, Eugenio Garcia-Granados *State University of New York- Stony Brook, USA*	**GT2019-90833** **Injector Design Space Exploration for an Ultra-Low NOx Hydrogen Micromix Combustion System** Parash Agarwal, Xiaoxiao Sun, Pierre Gauthier, Vishal Sethi *Cranfield University, United Kingdom*
12:45			**GT2019-90538** **Comparison of Hydrogen Micromix Flame Transfer Functions Determined Using RANS and LES** Jonathan McClure[1] David Abbott[1] Pierre Gauthier[2] Parash Agarwal[1] Xiaoxiao Sun[1] Giulia Babazzi[1] Vishal Sethi[1] *1. Cranfield University, United Kingdom; 2. Siemens, Canada*

WEDNESDAY JUNE 19 — 11:15 AM - 12:45 PM

	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS	CYCLE INNOVATIONS
	Pollutant Emissions Formation and Control - 1	**Combustion Dynamics: Hydrodynamic Instabilities -1**	**Hybrid Electric System Design in Cycle Innovations**
	Technical Session • 121-AB • WB-4-8Part A	**Technical Session • 122-BC • WB-4-23Part A**	**Technical Session • 221-B • WB-6-11**
	Session Organizer: **Luke Cowell**, Solar Turbines Incorporated Session Co-Organizer: **Tomohiro Asai**, Mitsubishi Heavy Industries, Ltd.	Session Organizer: **Santosh Hemchandra**, Indian Institute of Science	Session Organizer: **Anestis Kalfas**, Aristotle University of Thessaloniki Session Co-Organizer: **Theofilos Efstathiadis**, Aristotle University of Thessaloniki
11:15	**GT2019-90544** **Experimental Study on the Emissions Characteristics of a Premixed Axial-Fuel-Staged Model Combustor** Xianglong Zheng, Yan Xiong, Fulin Lei, Cong Deng, Zhedian Zhang, Yunhan Xiao *Institute of Engineering Thermalphysics, Chinese Academy of Sciences, China*	**GT2019-90447** **Examining the Effect of Geometry Changes in Industrial Fuel Injection Systems on Hydrodynamic Structures With BiGlobal Linear Stability Analysis** Thomas Ludwig Kaiser[1] Kilian Oberleithner[2] Laurent Selle[3] Thierry Poinsot[4] *1. Institut für Strömungsmechanik und Technische Akustik - TU Berlin, Germany; 2. Flow Instabilities and Dynamics, TU Berlin, Germany; 3. IMFT, France; 4. CERFACS, France*	**GT2019-91335** **A Framework for Optimization of Hybrid Aircraft** Xin Zhao[1] Konstantinos Kyprianidis[1] Smruti Sahoo[1] Sharmila Sumsurooah[2] Mohamed Rashed[2] Gaurang Vakil[2] Christopher Ian Hill[2] Giorgio Valente[2] Jacob, Claire Helene[3] Andreas Gobbin[3] Andreas Bardenhagen[3] Katrin Prölss[4] Michael Sielemann[4] Jonatan Rantzer[5] Edward Ekstedt[5] *1. Mälardalen University, Sweden; 2. University of Nottingham, United Kingdom; 3. Technical University of Berlin, Germany; 4. Modelon Deutschland GmbH, Germany; 5. Modelon, Sweden*
11:45	**GT2019-91365** **Numerical Investigations of Pollutant Emissions From Novel Heavy Duty Gas Turbine Burners Operated With Natural Gas** Daniele Pampaloni[1] Pier Carlo Nassini[1] Antonio Andreini[1] Bruno Facchini[1] Matteo Cerutti[2] *1. University of Florence, Italy; 2. Baker Hughes, a GE company, Italy*	**GT2019-90924** **Phase-Opposition Control of the Precessing Vortex Core in Turbulent Swirl Flames for Investigation of Mixing and Flame Stability** Finn Lückoff[1] Moritz Sieber[1] Christian Oliver Paschereit[2] Kilian Oberleithner[1] *1. Flow Instabilities and Dynamics, Technische Universität Berlin, Germany; 2. Technische Universität Berlin, Germany*	**GT2019-91459** **Performance Assessment of an Integrated Parallel Hybrid-Electric Propulsion System Aircraft** Smruti Sahoo[1] Xin Zhao[1] Konstantinos Kyprianidis[1] Anestis Kalfas[2] *1. Mälardalen University, Sweden; 2. Aristotle University of Thessaloniki, Greece*
12:15		**GT2019-91079** **The Effects of Exit Boundary Condition on Precessing Vortex Core Dynamics** Danielle Mason[1] Sean Clees[1] Mark Frederick[2] Jacqueline O'Connor[1] *1. Pennsylvania State University, USA;* *2. Purdue University, USA*	**GT2019-91481** **Assessment of Thermo-Electric Power Plants for Rotorcraft Application** Ioannis Roumeliotis[1] Vassilios Pachidis[1] Olivier Broca[2] Deniz Unlu[2] Christos Mourouzidis[1] Mirko Zafferetti[1] *1. Cranfield University, United Kingdom;* *2. Siemens Industry Software SAS, France*

WEDNESDAY JUNE 19 — 11:15 AM - 12:45 PM

	EDUCATION	ELECTRIC POWER	HEAT TRANSFER: NUMERICAL FILM COOLING
	Industry, academia, and education	**Digital Solutions**	**Miscellaneous III**
	Panel Session • 221-C • WB-7-4	**Technical Session • 131-A • WB-8-3**	**Technical Session • 131-C • WB-12-9**
	Session Organizer: **Ioanna Aslanidou**, Mälardalen University	Session Organizer: **Bin Zhou**, FM Global Session Co-Organizer: **David Noble**, Electric Power Research Institute	Session Organizer: **Ardeshir Riahi**, Honeywell Aerospace Session Co-Organizer: **John Clark**, Air Force Research Laboratory
11:15	**GT2019-92386** **Industry, Academia, and Education** Ian Halliwell *USA* **GT2019-92387** **Industry, Academia, and Education** David Tucker *National Energy Technology Laboratory, USA* **GT2019-92388** **Industry, Academia, and Education** Tadashi Tanuma *Teikyo University, Japan* **GT2019-92391** **Industry, Academia, and Education** Jan Ehrhard *Continental Automotive GmbH, Germany*	**GT2019-90995** **Use of Vector Autoregressive Model for Anomaly Detection in Utility Gas Turbines** Vipul Goyal[1] Mengyu Xu[2] Jayanta Kapat[2] *1. Department of Mechanical & Aerospace Engineering, University of Central Florida, USA; 2. University of Central Florida, USA*	**GT2019-90961** **Effect of Blade Row Interaction on Rotor Film Cooling** James Brind[1] Graham Pullan[2] *1. Whittle Laboratory, University of Cambridge, United Kingdom; 2. University of Cambridge, United Kingdom*
11:45	**P A N E L**	**GT2019-91587** **Digital Solutions for Power Plant Operators in a Dynamic Market Place: An Advanced Automated Gas Turbine Combustion Tuning for Low Emissions and Operational Flexibility** Nicolas Demougeot[1] Alexander Steinbrenner[2] Wenping Wang[2] Matthew Yaquinto[1] *1. Power Systems Manufacturing - Ansaldo Energia, USA; 2. Power Systems Manufacturing, USA*	**GT2019-90575** **Numerical Study on Flow and Heat Transfer Characteristics of Discrete Film Cooling Holes of the Sinusoidal Longitudinal Corrugated Heat Liner** Zhi-peng Xu[1] Hui-ren Zhu[1] Ya-zhou Wang[1] Xinyu Bian[2] *1. Northwestern Polytechnical University, China; 2. University of Manchester, United Kingdom*
12:15		**GT2019-91973** **Investigation Into Advanced Combustion System Health Monitoring** David Noble[1] Leonard Angello[1] Scott Sheppard[2] Jared Kee[2] Benjamin L. Emerson[3] Tim Lieuwen[3] *1. Electric Power Research Institute, USA; 2. Turbine Logic, USA; 3. Georgia Institute of Technology, USA*	**GT2019-90723** **Numerical Study on Turbine Rotor Blade Unsteady Film Cooling Performance With Consideration of Inlet Non-Uniformities and Upstream Coolant** Zhihao Wang, Zhiduo Wang, Wenhao Zhang, Zhenping Feng *Xi'an Jiaotong University, China*

WEDNESDAY JUNE 19 — 11:15 AM - 12:45 PM

	HEAT TRANSFER: INTERNAL AIR SYSTEMS & SEALS (WITH TURBOMACHINERY)	HEAT TRANSFER: EXPERIMENTAL FILM COOLING	MANUFACTURING MATERIALS & METALLURGY
	Rotor Disk and Cavity	**Experimental Film Cooling IX**	**Surfaces and Coatings**
	Technical Session • 131-B • WB-15-3	**Technical Session • 132-AB • WB-19-9**	**Technical Session • 121-C • WB-24-3**
	Session Organizer: **James Scobie**, University of Bath Session Co-Organizer: **Jose Maria Rey Villazon**, GE Aviation	Session Organizer: **Forrest Ames**, University of North Dakota Session Co-Organizer: **Andrew Nix**, West Virginia University	Session Organizer: **Victor Correia**, General Electric Session Co-Organizer: **Xiao Huang**, Carleton University
11:15	**GT2019-90654** **Numerical Investigation of the Flow Control Methods in the Impeller Rear Cavity** Guang Liu[1] Qiang Du[2] Ruo N. Wang[3] Jun Liu[4] Qingzong Xu[5] Zeng Y. Lian[1] *1. Chinese Academy of Sciences, China; 2. Institute of Engineering Thermalphysics, Chinese Academy of Sciences, China; 3. Chinese Academy of Sciences, University of Chinese Academy of Sciences, China; 4. Institute of Engineering Thermophysics, Chinese Academy of Sciences, China; 5. University of Chinese Academy of Sciences, China*	**GT2019-91030** **Transonic Turbine Vane Endwall Film Cooling Using PSP Measurement Technique** Chao-Cheng Shiau[1] Izzet Sahin[1] Izhar Ullah[1] Je-Chin Han[1] Alexander Mirzamoghadam[2] Ardeshir Riahi[2] Curtis Stimpson[2] *1. Texas A&M University, USA; 2. Honeywell Aerospace, USA*	**GT2019-90505** **High Temperature Oxidation Lifetime Modeling of Thin-Walled Components** Rishi Pillai, Sebastien Dryepondt, Bruce A. Pint *Oak Ridge National Laboratory, USA*
11:45	**GT2019-90450** **Heat Transfer Prediction From Large Eddy Simulation of a Rotating Cavity With Radial Inflow** Michel Onori, Dario Amirante, Nick Hills, John Chew *University of Surrey, United Kingdom*	**GT2019-90667** **Experimental Study on the Effects of Slot Jet on Film Cooling Performance in the Cascade Endwall With Purge Flow** Yunjia Yao[1] Peiyuan Zhu[1] Zhi Tao[1] Liming Song[1] Jun Li[2] *1. Xi'an Jiaotong University, China; 2. Institute of Turbomachinery, Xi'an Jiaotong University, China*	**GT2019-90578** **Experimental Investigation of the Water Erosion Resistance With Different Impact Angle for Thermal Spraying Coatings on Turbine Blade** Zheyuan Zhang[1] Di Zhang[1] Yonghui Xie[2] *1. Xi'an Jiaotong University, China; 2. Institute of Turbomachinery, China*
12:15	**GT2019-91848** **Influence of Temperature Distribution on Radial Growth of Compressor Discs** Dario Luberti, Hui Tang, James Scobie, Oliver Pountney, Mike Owen, G.D. Lock *University of Bath, United Kingdom*		**GT2019-90945** **Assessing Manufacturing Repeatability of Inherently Damped Nickel Alloy Components via Forced-Response Testing** Onome Scott-Emuakpor[1] Tommy George[2] Brian Runyon[1] Luke Sheridan[1] Casey Holycross[1] Ryan O'Hara[3] *1. Air Force Research Laboratory, USA; 2. US Air Force, USA; 3. Air Force Institute of Technology, USA*

WEDNESDAY JUNE 19 — 11:15 AM - 12:45 PM

	MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES	OIL & GAS APPLICATIONS	STEAM TURBINES
	Turbochargers: Performance Evaluation and Prediction	**Wet Gas Compression and Multiphase Flow**	**HP/IP Aerodynamics and General Design Aspects**
	Technical Session • 221-A • WB-26-10	**Technical Session • 130 • WB-27-2**	**Technical Session • 127-A • WB-29-10**
	Session Organizer: **Harold Sun**, GAC R&D Center Session Co-Organizer: **Nguyen Thao LaTray**, University of Texas at Arlington	Session Organizer: **Grant Musgrove**, Southwest Research Institute	Session Organizer: **Alex Stein**, GE Energy Session Co-Organizer: **Christoph Brüggemann**, ITSM University of Stuttgart
11:15	**GT2019-90250** **Improving Accuracy and Comparability of Turbocharger Performance Measurements** Mario Schinnerl, Mathias Bogner, Jan Ehrhard *Continental Automotive GmbH, Germany*	**GT2019-90353** **Wet Gas Compressor Modeling and Performance Scaling** Martin Bakken[1] Tor Bjorge[1] Lars Eirik Bakken[1] Ajay Lakshmanan[2] Suriya Arulselvan[2] *1. Norwegian University of Science and Technology, Norway; 2. Aspentech, USA*	**GT2019-90644** **Effect of Blade Secular Change on Unsteady Flows in Middle Pressure First-Stage Steam Turbines** Akihiro Uemura[1] Hironori Miyazawa[1] Takashi Furusawa[1] Satoru Yamamoto[1] Koichi Yonezawa[2] Shuichi Umezawa[3] *1. Tohoku University, Japan; 2. Central Research Institute of Electric Power Industry, Japan; 3. Tokyo Electric Power Company Holdings Inc., Japan*
11:45	**GT2019-90451** **Study on Analytical Method for Thermal and Flow Field of a Turbocharger With the Catalyst Unit** Tsuyoshi Kitamura[1] Seiichi Ibaraki[1] Yuichi Kihara[1] Toru Hoshi[1] Motoki Ebisu[2] *1. Mitsubishi Heavy Industries Ltd., Japan; 2. Mitsubishi Heavy Industries Engine & Turbocharger, Ltd., Japan*	**GT2019-90354** **Wet Gas Compressor Model Validation** Martin Bakken, Tor Bjorge, Lars Eirik Bakken *Norwegian University of Science and Technology, Norway*	**GT2019-90891** **Application of the Nozzle Analogy to Easily Predict Steam Turbine Performance With Minimal Geometric Input** Wim F. Fuls[1] John S. Clark[2] Alton C. Marx[2] *1. University of Cape Town, South Africa; 2. Eskom Holdings SOC Ltd, South Africa*
12:15	**GT2019-91596** **A Numerical Thermohydrodynamic Study of Fixed Pad Oil Lubricated Thrust Bearings** Saeid Dousti[1] Paul Allaire[1] Jianming Cao[1] Bradley Nichols[2] Timothy Dimond[1] *1. Rotor Bearing Solutions International, USA; 2. University of Virginia, USA*	**GT2019-91143** **Effect of Wet Gas Behavior on Centrifugal Compressor Shaft Power** Daisuke Kawaguchi, Katsutoshi Kobayashi *Hitachi, Ltd., Japan*	**GT2019-90934** **Advanced Steam Turbine Technology for Unique Double Reheat Steam Power Plant Layout** Benjamin Kloss-Grote[1] Michael Wechsung[2] Rainer Quinkertz[2] Henning Almstedt[2] *1. Siemens AG - Power and Gas, Germany; 2. Siemens AG, Germany*

WEDNESDAY JUNE 19 — 11:15 AM - 12:45 PM

	STRUCTURES & DYNAMICS: ROTORDYNAMICS	STRUCTURES & DYNAMICS: STRUCTURAL MECHANICS, VIBRATION & DAMPING	STRUCTURES & DYNAMICS: AERODYNAMIC EXCITATION & DAMPING
	How to Apply API Standards to Turbomachinery Rotordynamics - an Introduction	**Rotor-Stator Interaction**	**Compressor Aerodynamic Forcing**
	Tutorial Session • 129-AB • WB-33-14Part B	**Technical Session • 128-A • WB-35-8**	**Technical Session • 128-B • WB-36-1**
	Session Organizer: **Mateusz Golebiowski**, General Electric (Switzerland) GmbH	Session Organizer: **Bogdan Epureanu**, University of Michigan Session Co-Organizer: **Mainak Mitra**, ANSYS Inc.	Session Organizer: **Sina C Stapelfeldt**, Imperial College London
11:15	**GT2019-92348** **How to Apply API Standards to Turbomachinery Rotordynamics - An Introduction** Roman Kochurov[1] Clement Joly[2] *SoftInWay Inc., USA*	**GT2019-90628** **Analytical Formulation of Friction Contact Elements for Frequency-Domain Analysis of Nonlinear Vibrations of Structures With High-Energy Rubs** Evgeny Petrov *The University of Sussex, United Kingdom*	**GT2019-90939** **Analysis of Vortex Ingestion Impact on the Dynamic Response of the Fan in Resonance Condition** Thomas Berthelon[1] Alain Dugeai[2] Jonathan Langridge[1] Fabrice Thouverez[3] *1. Safran Aircraft Engines, France; 2. ONERA, France; 3. Ecole Centrale de Lyon / LTDS, France*
11:45	**T U T O R I A L**	**GT2019-91447** **Strongly Coupled Thermo-Mechanical Casing/Abradable Model for Rotor/Stator Interactions** Florence Nyssen[1] Thibaut Vadcard[2] Elsa Piollet[1] Alain Batailly[1] *1. Polytechnique Montréal, Canada; 2. Ecole Centrale de Lyon, France*	**GT2019-91514** **Acoustic and Convective Mechanisms Contributing to Non-Synchronous-Vibrations in a Multistage Compressor** Christoph Brandstetter, Benoit Paoletti, Xavier Ottavy *Ecole Centrale De Lyon - Laboratoire De Mecanique Des Fluides Et D'Acoustique, France*
12:15		**GT2019-91333** **Analysis of Composite Blade/Casing Rub Stability Through Delayed Differential Equations** Jiaguangyi Xiao, Yong Chen, Jie Tian, Hua Ouyang, Anjenq Wang *Shanghai Jiao Tong University, China*	

WEDNESDAY JUNE 19 — 11:15 AM - 12:45 PM

	SUPERCRITICAL CO2 POWER CYCLES	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY
	Turbines for sCO2 Power Cycles	**Turbine Design Methods and Applications**	**Numerical Design Methods, Meshing and Blading (1)**
	Technical Session • 123 • WB-38-1	**Technical Session • 124-B • WB-41-6**	**Technical Session • 127-B • WB-41-18**
	Session Organizer: **Jason Mortzheim**, GE Energy Session Co-Organizer: **Jason Preuss**, Barber-Nichols	Session Organizer: **Kai Koerber**, MTU Session Co-Chairs: **Dragan Kožulović**, HAW Hamburg; **Luigi Capone**,	Session Organizer: **Chunill Hah**, NASAGlenn Session Co-Organizer: **Bharat Lad**, Rolls-Royce plc
11:15	**GT2019-90392** **Radial Inlet and Exit Design for a 10 MWe sCO2 Axial Turbine** Stefan Cich[1] J. Jeffrey Moore[1] Michael Marshall[1] Kevin Hoopes[1] Jason Mortzheim[2] Douglas Hofer[3] *1. Southwest Research Institute, USA; 2. GE Energy, USA; 3. GE Global Research, USA*	**GT2019-90362** **Gear Windage Prediction With Reduced Order CFD Models: Spur Gears Application** Francesco Santacroce[1] Pietro Molesini[2] Miriam Manzoni[2] Saypen Baraggia Au Yeung[2] Fabio De Bellis[2] Francesco Larocca[1] *1. Politecnico di Torino, Italy; 2. GE Avio, Italy*	**GT2019-90126** **Using a New Entropy Loss Analysis to Assess the Accuracy of RANS Predictions of an HPT Vane** Yaomin Zhao, Richard D. Sandberg *The University of Melbourne, Australia*
11:45	**GT2019-90606** **Novel Approaches for sCO2 Axial Turbine Design** Sharath Sathish[1] Pramod Kumar[1] Adi Narayana Namburi[2] Lokesh Swami[2] Carsten Fuetterer[3] Pramod Chandra Gopi[2] *1. Indian Institute of Science, India; 2. Triveni Turbines Limited, India; 3. Friendship Systems AG, Germany*	**GT2019-90251** **The Effect of Isentropic Exponent on Transonic Turbine Performance** David Baumgärtner, John J Otter, Andrew P S Wheeler *University of Cambridge, United Kingdom*	**GT2019-90314** **Multi-Scale Parallelised CFD Modelling Towards Resolving Manufacturable Roughness** Marios Kapsis[1] Li He[1] Y.S. Li[2] Roger Wells[2] Omar Valero[2] Senthil Krishnababu[2] Gaurav Gupta[3] Jayanta Kapat[3] Megan Schaenzer[4] *1. University of Oxford, United Kingdom; 2. Siemens Industrial Turbomachinery Ltd, United Kingdom; 3. University of Central Florida, USA; 4. Siemens Canada Ltd, Canada*
12:15	**GT2019-90876** **Design of 20 kW Turbomachinery for Closed Loop Supercritical Carbon Dioxide Brayton Test Loop Facility** Seshadri Lakshminarayanan[1] Sharath Sathish[1] Pramod Kumar[1] Gaurav Giri[2] Abdul Nassar[3] Leonid Moroz[4] Raghavendra Setty[5] Pramod Chandra Gopi[5] Adi Narayana Namburi[5] *1. Indian Institute of Science, India; 2. Softinway, India; 3. Softinway Turbomachinery Solutions Pvt Ltd, India; 4. SoftInWay Inc., USA; 5. Triveni Turbines Limited, India*	**GT2019-91146** **Scale-Resolving Simulations of a Fundamental Trailing-Edge Cooling Slot Using a Discontinuous-Galerkin Spectral-Element Method** Anirban Garai[1] Scott Murman[2] Nateri Madavan[2] *1. Science and Technology Corporation, USA; 2. NASA Ames Research Center, USA*	**GT2019-91569** **Comprehensive Smith Charts for Axial Compressor Design** Mark Anderson *Concepts NREC, USA*

WEDNESDAY JUNE 19 — 11:15 AM - 12:45 PM

	TURBOMACHINERY: RADIAL TURBOMACHINERY AERODYNAMICS	TURBOMACHINERY: UNSTEADY FLOWS IN TURBOMACHINERY	TURBOMACHINERY: TUTORIALS
	Centrifugal Compressors 5	**Stall and Surge III**	**CFD for Turbomachinery**
	Technical Session • 125-AB • WB-44-6	**Technical Session • 126-ABC • WB-45-3**	**Tutorial Session • 127-C • WB-52-2**
	Session Organizer: **Luca Porreca**, MAN Energy Solutions Schweiz AG Session Co-Organizer: **Jan Ehrhard**, Continental Automotive GmbH	Session Organizer: **William Cousins**, United Technologies Research Center Session Co-Chairs: **Vishnu Sishtla**, UTC Climate, Controls & Security; **Roy Fulayter**, Zunum Aero	Session Organizer: **Andreas Peters**, GE Aviation Session Co-Organizer: **Emil Goettlich**, Graz University of Technology
11:15	**GT2019-90735** **Experimental Study on Centrifugal Compressor Performance at Pulsating Backpressure Conditions** Mengying Shu[1] Mingyang Yang[1] Kaiyue Zhang[1] Ricardo Martinez-Botas[2] Kangyao Deng[1] *1. Shanghai Jiao Tong University, China; 2. Imperial College London, United Kingdom*	**GT2019-90713** **Investigation of Stall Process in a Centrifugal Compressor With a Volute Under Transonic Conditions** Ce Yang[1] Wenli Wang[1] Hanzhi Zhang[1] Yanzhao Li[2] Ding Tong[3] Changmao Yang[1] Weilin Yi[1] *1. Beijing Institute of Technology, China; 2. Kangyue Technology Co., Ltd., China; 3. China North Engine Research Institute, China*	**GT2019-92150** **Introduction to CFD for Turbomachinery** Ellen Smith[1] Kevin Hoopes[1] Sewoong Jung[2] *1. Southwest Research Institute, USA; 2. Hanwha Power Systems, USA* **T U T O R I A L**
11:45	**GT2019-90791** **Experimental Investigation of Surge Phenomena in a Transonic Centrifugal Compressor** Sasuga Ito[1] Masato Furukawa[1] Satoshi Gunjishima[1] Hiroki Usuki[1] Takafumi Ota[1] Yamada Kazutoyo[2] *1. Kyushu University, Japan; 2. Iwate University, Japan*	**GT2019-90797** **Transient Analysis of Rotating Stall Development in a Centrifugal Compressor With Vaned Diffuser** Nobumichi Fujisawa, Masaki Takahashi, Yutaka Ohta *Waseda University, Japan*	
12:15	**GT2019-90794** **Effects of Upstream Bend on Aerodynamic Performance of a Transonic Centrifugal Compressor** Yamada Kazutoyo[1] Masato Furukawa[2] Hiromitsu Arai[3] Sasuga Ito[2] *1. Iwate University, Japan; 2. Kyushu University, Japan; 3. Kawasaki Heavy Industries, Ltd., Japan*	**GT2019-91602** **Numerical Simulation of Surge in a Centrifugal Compressor With Different Operating Condition Using the Plenum Model** Cheng Jia, Guoliang Qin, Xuefei Chen, Yi Wang *Xi'an Jiaotong University, China*	

WEDNESDAY JUNE 19 — 01:00 PM - 05:15 PM

EXHIBITOR PRESENTATIONS

Wednesday Exhibit Hall Presentations

Technical Presentations • Exhibit Hall Presentation Stage • 53-2

1:00

GT2019- 92223
Using Simulation to Enhance Turbomachinery Additive Manufacturing
Jeff Bronson
ANSYS, Inc., USA

1:45

GT2019-92224
Advanced Monitoring of Dynamics in Gas Turbines
Robert Widhopf-Fenk
IfTA Ingenieurbüro für Thermoakustik GmbH, Germany

2:30

GT2019- 92225
Advances in Turbomachinery Test Instrumentation using Additive Manufactured Parts and Probes
Thomas Decker
Vectoflow GmbH, Germany

3:15

GT2019- 92226
Introducing a Pragmatic Approach to Modeling Blade Film Cooling
Robin Steed
ANSYS, Inc., USA

4:00

GT2019- 92219
Safely Secure Fasteners in Critical Applications
Nord-Lock Inc.

4:45

GT2019- 92227
AxSTREAM® Integrated Design and Analysis Platform for Fans in Turbofan Engines
Abdul Nassar
Softinway Turbomachinery Solutions Pvt Ltd, India

WEDNESDAY JUNE 19 — 02:00 PM - 03:30 PM

	AIRCRAFT ENGINE	COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS	COMBUSTION, FUELS & EMISSIONS
	Whole Engine Performance and Novel Concepts II	**Alternative Liquid Fuels**	**Pollutant Emissions Formation and Control - 2**
	Technical Session • 124-A • WC-1-5	**Technical Session • 122-A • WC-3-2Part A**	**Technical Session • 121-AB • WC-4-8Part B**
	Session Organizer: **Arvind Gangoli Rao**, Delft University of Technology Session Co-Organizer: **Sikke Klein**, Delft University of Technology	Session Organizer: **Ajay Agrawal**, University of Alabama Session Co-Chairs: **Bhupendra Khandelwal**, University of Sheffield; **Marina Braun-Unkhoff**, DLR, Institute of Combustion Technology	Session Organizer: **Luke Cowell**, Solar Turbines Incorporated Session Co-Organizer: **Tomohiro Asai**, Mitsubishi Heavy Industries, Ltd.
2:00	**GT2019-92065** **Development of a Gas Turbine Concept for Electric Power Generation in a Commercial Hybrid Electric Aircraft** Michael Schneider[1] Jens Dickhoff[1] Karsten Kusterer[2] Wilfried Visser[3] Dieter Bohn[4] Eike Stumpf[5] Jan-Philipp Hofmann[5] *1. B&B-AGEMA Gesellschaft für energietechnische Maschinen und Anlagen GmbH, Germany; 2. B&B-AGEMA, Germany; 3. Delft University, Netherlands; 4. RWTH Aachen, Germany; 5. Institute of Aerospace Systems - RWTH Aachen University, Germany*	**GT2019-90115** **Spray Characteristics of Alternative Jet Fuel at Elevated Ambient Conditions** Kumaran Kannaiyan[1] Reza Sadr[2] *1. Texas A & M University at Qatar, Qatar; 2. Texas A&M University, USA*	**GT2019-90952** **Impact of Flame Lifting on Nitrogen Oxide Emissions From Premixed Reacting Jets in a Vitiated Crossflow** Matthew D. Sirignano, Vedanth Nair, Divya Sunkara, Benjamin L. Emerson, Jerry M. Seitzman, Timothy C. Lieuwen *Georgia Institute of Technology, USA*
2:30	**GT2019-92066** **Potential of Semi-Closed Cycles for UAV Propulsion** Jacopo Tacconi[1] Wilfried Visser[1] Dries Verstraete[2] *1. Delft University, Netherlands; 2. The University of Sydney, Australia*	**GT2019-90270** **Autoignition Study of "Gas-to-Liquid" Fischer-Tropsch Jet Fuels** Sulaiman Alturaifi[1] Tatyana Atherley[1] Olivier Mathieu[1] Bing Guo[2] Eric Petersen[1] *1. Texas A&M University, USA; 2. Texas A&M University At Qatar, Qatar*	**GT2019-91037** **Effect of High Pressures on the Formation of Nitric Oxide in Lean, Premixed Flames** Philippe Versailles[1] Antoine Durocher[2] Gilles Bourque[3] Jeff Bergthorson[2] *1. Siemens Canada Limited, Canada; 2. McGill University, Canada; 3. Siemens Canada, Canada*
3:00		**GT2019-90372** **Air-Assisted Atomization at Constant Mass and Momentum Flow Rate: Investigation of the Ambient Pressure Influence With the SPH Method** Geoffroy Chaussonnet[1] Shreyas Joshi[2] Simon Wachter[3] Rainer Koch[2] Tobias Jakobs[3] Thomas Kolb[4] Hans-Jorg Bauer[5] *1. Institut of Turbomachinery (ITS) - Karlsruhe Institut of Technology (KIT), Germany; 2. Karlsruher Institut für Technologie - Institut für Thermische Strömungsmaschinen, Germany; 3. Karlsruher Institut für Technologie - Institut für Technische Chemie, Germany; 4. Karlsruher Institut für Technologie - Engler-Bunte-Institut, CEB, Germany; 5. Karlsruhe Institute of Technology, Germany*	**GT2019-91558** **Numerical Investigation of NOx Emissions Characteristics of a Natural Gas Premixed Burner Based on Chemical Reactor Network Model** Bin Mu, Fulin Lei, Xunwei Liu, Zhedian Zhang, Yunhan Xiao, Weiwei Shao *Institute of Engineering Thermalphysics, Chinese Academy of Sciences, China*

WEDNESDAY JUNE 19 — 02:00 PM - 03:30 PM

	COMBUSTION, FUELS & EMISSIONS	CONTROLS, DIAGNOSTICS & INSTRUMENTATION	CYCLE INNOVATIONS
	Combustion Dynamics: Hydrodynamic Instabilities -2	**Transient Gas Turbine Engine Simulation and Controls Basics**	**Turbomachinery Design Aspects in Cycle Innovation I**
	Technical Session • 122-BC • WC-4-23Part B	**Tutorial Session • 222-B • WC-5-10**	**Technical Session • 221-B • WC-6-9**
	Session Organizer: **Santosh Hemchandra**, Indian Institute of Science	Session Organizer: **Liang Tang**, Pratt & Whitney	Session Organizer: **Rainer Schnell**, German Aerospace Center (DLR) Session Co-Chairs: **Mavroudis D. Kavvalos**, Mälardalen University; **Xin Zhao**, Mälardalen University
2:00	**GT2019-91095** **Role of Turbulence in Precessing Vortex Core Dynamics** Ashwini Karmarkar[1] Mark Frederick[2] Sean Clees[1] Danielle Mason[1] Jacqueline O'Connor[1] *1. Pennsylvania State University, USA; 2. Purdue University, USA*	**GT2019-90550** **Transient Gas Turbine Engine Simulation and Controls Basics** Syed Khalid *Gas Turbine Systems Solutions LLC, USA*	**GT2019-91047** **Design and Experimental Assessment of Bladeless Turbines for Axial Inlet Supersonic Flows** James Braun[1] Guillermo Paniagua[1] Francois Falempin[2] Bruno Le Naour[2] *1. Purdue University, USA; 2. MBDA, France*
2:30	**GT2019-91619** **Experimental Study of the Precessing Vortex Core Impact on the Liquid Fuel Spray in a Gas Turbine Model Combustor** Antoine Renaud, Sebastien Ducruix, Laurent Zimmer *Laboratoire EM2C - CNRS - CentraleSupélec, France*	**T U T O R I A L**	**GT2019-91756** **Design, Optimization and Analysis of Supersonic Radial Turbines** Lukas Benjamin Inhestern[1] James Braun[2] Guillermo Paniagua[2] Jose-Ramon Serrano-Cruz[3] *1. CMT/ Universitat Politècnica De València, Spain; 2. Purdue University, USA; 3. Universitat Politècnica De València, Spain*
3:00			**GT2019-91460** **Unsteady Heat Transfer Assessment of Supersonic Turbines Downstream of a Rotating Detonation Combustor** Zhe Liu[1] Lukas Benjamin Inhestern[2] James Braun[1] Guillermo Paniagua[1] *1. Purdue University, USA; 2. CMT/ Universitat Politècnica De València, Spain*

WEDNESDAY JUNE 19 — 02:00 PM - 03:30 PM

	ELECTRIC POWER	HEAT TRANSFER: NUMERICAL FILM COOLING	HEAT TRANSFER: GENERAL EXPERIMENTAL HEAT TRANSFER
	Voice of the Customer	**Miscellaneous II**	**General Experimental Heat Transfer III**
	Panel Session • 131-A • WC-8-6	**Technical Session • 131-C • WC-12-8**	**Technical Session • 131-B • WC-13-3**
	Session Organizer: **Robert Steele**, Electric Power Research Institute Session Co-Organizer: **Tim Allison**, Southwest Research Institute	Session Organizer: **Robert Krewinkel**, MAN Energy Solutions SE Session Co-Organizer: **Gordon E. Andrews**, University of Leeds	Session Organizer: **Thomas Dyson**, GE Global Research Session Co-Organizer: **Eric Ruggiero**, GE Aviation
2:00	**GT2019-92396** **Technical Challenges and Opportunities for Tucson Electric Power** John Baum *Tucson Electric Power, USA* **GT2019-92397** **Technical Challenges and Opportunities for Salt River Project** Sheldon Lee *Salt River Project, USA* **GT2019-92398** **Technical Challenges and Opportunities for Korea Electric Power Corporation** Seik Park *Korea Electric Power Corporation, Korea*	**GT2019-90498** **Generalization of Machine-Learned Turbulent Heat Flux Models Applied to Film Cooling Flows** Pedro Montebello Milani[1] Julia Ling[2] John K. Eaton[1] *1. Stanford University, USA; 2. Citrine Informatics, USA*	**GT2019-91463** **Experimental Investigation of Forced Convection Enhancement by Acoustic Resonance Excitations in Turbulated Heat Exchangers** Samuel Gendebien, Alex Kleiman, Boris Leizeronok, Beni Cukurel *Technion - Israel Institute of Technology, Israel*
2:30	**P A N E L**	**GT2019-90156** **Coolant Jets Interaction in Effusion Cooling System: Experimental and Numerical Study** Yuewen Jiang, Alexander Murray, Peter Ireland, Luca di Mare *University of Oxford, United Kingdom*	**GT2019-91493** **Effects of Wakes on Blade Endwall Heat Transfer in High Turbulence Intensity** Sehjin Park[1] Ho-Seong Sohn[1] Hyung Hee Cho[1] Hee-Koo Moon[1] Yang Seok Han[2] Osamu Ueda[3] *1. Yonsei University, Korea; 2. Korea Southern Power Co., Korea; 3. Mitsubishi Hitachi Power Systems, Ltd., Japan*
3:00		**GT2019-90162** **Predicting the Adiabatic Effectiveness of Effusion Cooling by the Convolution Modeling Method** Li Yang[1] Yu Rao[2] *1. Shanghai Jiao Tong University, China; 2. Shanghai Jiao Tong University, Dept. Mechanical Eng, China*	**GT2019-91697** **A Modular Transonic Turbine Cascade for Cooled Rotor Metal Effectiveness Investigations** James Parker[1] Eduardo Romero[2] Thomas Povey[1] *1. University of Oxford, United Kingdom; 2. Rolls-Royce plc, United Kingdom*

WEDNESDAY JUNE 19 — 02:00 PM - 03:30 PM

	HEAT TRANSFER: SPECIAL SESSIONS	INDUSTRIAL & COGENERATION	MANUFACTURING MATERIALS & METALLURGY
	Richard Rivir Memorial Session I	**Gas Turbine Technology Development for Industrial Applications - Special Lecture**	**Thermal Barrier Coatings I**
	Panel Session • 132-AB • WC-18-3	Lecture Session • 221-C • WC-23-8Part A	Technical Session • 121-C • WC-24-8
	Session Organizer: **Marc D. Polanka**, Air Force Institute of Technology Session Co-Organizer: **James L. Rutledge**, Air Force Institute of Technology	Session Organizer: **Yiguang Li**, Cranfield University Session Co-Organizer: **Rakesh Bhargava**, Innovative Turbomachinery Technologies Corp.	Session Organizer: **Tania Bhatia Kashyap**, United Technologies Research Center Session Co-Chairs: **Vaishak Viswanathan**, Praxair Surface Technologies, Inc.; **Jeff Smith**, MPT
2:00	**GT2019-92228** **Introduction to Rivir Memorial Session** Marc D. Polanka *Air Force Institute of Technology, USA* **GT2019-92229** **Tribute to Dr. Richard Rivir** Michael Dunn *The Ohio State University, USA* **GT2019-92232** **Career Retrospective of Dr. Rivir** Rolf Sondergaard *US Air Force, USA* **GT2019-92231** **Influence of Dr. Rivir on Other Researchers and Careers** Jeffrey Bons *Ohio State University, USA*	**GT2019-92075** **Gas Turbine Technology Development for Industrial Applications** Rakesh Bhargava *Innovative Turbomachinery Technologies Corp., USA*	**GT2019-91722** **Modeling Thermally Grown Oxides in Thermal Barrier Coatings Using Koch Fractal** Peter Warren, Sandip Haldar, Seetha Raghavan, Ranajay Ghosh *University of Central Florida, USA*
2:30	**P A N E L**	**L E C T U R E**	**GT2019-91013** **Synchrotron XRD Measurements of Thermal Barrier Coating Configurations With Rare Earth Elements for Phosphor Thermometry** Sandip Haldar[1] Peter Warren[1] Quentin Fouliard[1] David Moreno[2] Mary Helen McCay[2] Jun-Sang Park[3] Peter Kenesei[3] Jonathan Almer[3] Ranajay Ghosh[1] Seetha Raghavan[1] *1. University of Central Florida, USA; 2. Florida Institute of Technology, USA; 3. Argonne National Laboratory, USA*
3:00			**GT2019-90828** **Comparison of Electron-Beam Physical Vapor Deposition and Plasma-Spray Physical Vapor Deposition Thermal Barrier Coating Properties Using Synchrotron X-Ray Diffraction** Matthew Northam[1] Linda Rossmann[1] Brooke Sarley[1] Bryan Harder[2] Jun-Sang Park[3] Peter Kenesei[3] Jonathan Almer[3] Vaishak Viswanathan[4] Seetha Raghavan[1] *1. University of Central Florida, USA; 2. NASA Glenn Research Center, USA; 3. Argonne National Laboratory, USA; 4. Praxair Surface Technologies, Inc., USA*

WEDNESDAY JUNE 19 — 02:00 PM - 03:30 PM

	MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES	STEAM TURBINES	STRUCTURES & DYNAMICS: ROTORDYNAMICS
	Introduction to Gas Bearings for Oil-Free Turbomachinery	**Steam Turbines Panel**	**Gas Turbine Rotordynamics - Practical Aspects**
	Tutorial Session • 221-A • WC-26-12Part A	**Panel Session • 127-A • WC-29-1Part A**	**Tutorial Session • 129-AB • WC-33-11Part A**
	Session Organizer: **Thomas Chirathadam**, Bearings Plus, Waukesha Bearings	Session Organizer: **Markus Schatz**, ITSM University of Stuttgart Session Co-Organizer: **Grant Ingram**, Durham University	Session Organizer: **Mateusz Golebiowski**, General Electric (Switzerland) GmbH
2:00	**GT2019-92203** **General Design Guideline and Limits for Gas Bearings** Keun Ryu *Hanyang University, Korea* **GT2019-92204** **Practical Performance of Gas Bearings** Keun Ryu *Hanyang University, Korea*	**GT2019-92285** **Clean Energy with Steam Turbine Technology** Eiji Saito *Mitsubishi Hitachi Power Systems, Japan* **GT2019-92298** **Clean Energy with Steam Turbine Technology** Adam Bajer *Doosan Skoda Power, Czech Republic* **GT2019-92307** **Clean Energy with Steam Turbine Technology** Ivan Mcbean *GE, Switzerland*	**GT2019-92071** **Gas Turbine Rotordynamics - Practical Aspects** Mark Corbo *No Bull Engineering, PLLC, USA*
2:30	T U T O R I A L	P A N E L	T U T O R I A L
3:00			

WEDNESDAY JUNE 19 — 02:00 PM - 03:30 PM

	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS	STRUCTURES & DYNAMICS: STRUCTURAL MECHANICS, VIBRATION & DAMPING	SUPERCRITICAL CO2 POWER CYCLES
	Seals 4	**Experimental Vibration Analysis**	**Compressors and Seals for sCO2 Power Cycles**
	Technical Session • 128-A • WC-34-11	**Technical Session • 128-B • WC-35-9**	**Technical Session • 123 • WC-38-2**
	Session Organizer: **Bugra Ertas**, GE Global Research Center Session Co-Organizer: **Adolfo Delgado**, Texas A&M University	Session Organizer: **Daniele Botto**, Politecnico Di Torino Session Co-Organizer: **Muzio Gola**, Politecnico di Torino	Session Organizer: **Natalie Smith**, Southwest Research Institute Session Co-Organizer: **Aaron Rimpel**, Southwest Research Institute
2:00	**GT2019-90962** **Flow Induced Dynamics of Plate Seals** Deepak Trivedi[1] Bernardo Kerr[2] *1. General Electric Research, USA;* *2. GE Healthcare, Brazil*	**GT2019-90042** **Determination of Simultaneous Steady-State Movements Using Blade Tip Timing Data** Mohamed Elsayed Elsayed Mohamed[1] Philip Bonello[1] Peter Russhard[2] *1. University of Manchester, United Kingdom;* *2. EMTD Ltd, United Kingdom*	**GT2019-91088** **Transcritical / Supercritical CO2 Recompression Brayton Cycle Using a Novel Rotary Liquid Piston Compressor** Azam Thatte *Energy Recovery, USA*
2:30	**GT2019-90254** **Leakage and Force Coefficients of a Grooved Wet (Bubbly Liquid) Seal for Multiphase Pumps and Comparisons With Prior Test Results for a Three Wave Seal** Xueliang Lu, Luis San Andres, Tingcheng Wu *Texas A&M University, USA*	**GT2019-91374** **Validation of a Turbine Blade Component Test With Frictional Contacts by Phase-Locked-Loop and Force-Controlled Measurements** Stefan Schwarz[1] Lukas Kohlmann[1] Andreas Hartung[1] Johann Gross[2] Maren Scheel[3] Malte Krack[3] *1. MTU Aero Engines AG, Germany;* *2. ILA (Universitaet Stuttgart), Germany;* *3. University of Stuttgart, Germany*	**GT2019-91615** **Impact of Fluid Substitution on the Performance of an Axial Compressor Blade Cascade Working With Supercritical Carbon Dioxide** Alejandro Muñoz[1] David Sánchez[2] Mark Savill[3] Timoleon Kipouros[3] Carlos Tello-Castillo[2] *1. Celeste, France; 2. University of Seville, Spain;* *3. Cranfield University, United Kingdom*
3:00	**GT2019-90776** **Numerical Investigations on the Static and Rotordynamic Characteristics of Hole-Pattern Seals With Annular or Pocket Grooves on Seal Stator** Zhi Fang[1] Zhigang Li[1] Jun Li[2] Zhenping Feng[1] *1. Xi'an Jiaotong University, China; 2. Institute of Turbomachinery, Xi'an Jiaotong University, China*	**GT2019-91573** **New Possibilities for Analyzing Complex Asynchronous Blade Vibrations From Tip-Timing Data Using a Sparse Spectral Analysis Method** Antoine Bouchain[1] José Picheral[1] Elisabeth Lahalle[1] Agathe Vercoutter[2] Bertrand Burgardt[2] Arnaud Talon[2] *1. Laboratoire des Signaux et Systèmes, France;* *2. Safran Helicopter Engines, France*	**GT2019-90975** **Supercritical CO2 Tests for Hydrostatic Film Stiffness in Film-Riding Seals** Deepak Trivedi[1] Rahul Bidkar[1] Chris Wolfe[1] Jason Mortzheim[2] *1. General Electric Research, USA;* *2. GE Energy, USA*

WEDNESDAY JUNE 19 — 02:00 PM - 03:30 PM

	TURBOMACHINERY: AXIAL FLOW TURBINE AERODYNAMICS	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY	TURBOMACHINERY: UNSTEADY FLOWS IN TURBOMACHINERY
	Unsteady Flows and Transition	**Novel Solver and Simulation Framework (2)**	**Unsteady Flows in Compressors**
	Technical Session • 126-ABC • WC-40-3Part A	**Technical Session • 127-C • WC-41-21**	**Technical Session • 124-B • WC-45-4Part A**
	Session Organizer: **Alex Stein**, GE Energy Session Co-Organizer: **Fabrizio Fontaneto**, von Karman Institute	Session Organizer: **Luigi Capone** Session Co-Organizer: **Roque Corral**, ITP Aero	Session Organizer: **Michael Barton**, Honeywell International
2:00	**GT2019-90473** **A Comparison of Turbulence Levels From PIV and CTA Downstream of a Low-Pressure Turbine Cascade at High-Speed Flow Conditions** Silvio Chemnitz[1] Reinhard Niehuis[2] *1. Universität der Bundeswehr München, Germany; 2. Bundeswehr University Munich - Institute of Jet Propulsion, Germany*	**GT2019-91701** **An Analytical Shock-Loss Model Fully Integrated to a Streamline Curvature Method for Axial-Flow Compressors** Hasani Azamar Aguirre[1] Vassilios Pachidis[1] Ioannis Templalexis[2] *1. Cranfield University, United Kingdom; 2. Hellenic Air Force Academy, Greece*	**GT2019-90091** **Modelling Axisymmetric Centrifugal Compressor Characteristics From First Principles** Katherine H. Powers, Chris J. Brace, Chris J. Budd, Colin D. Copeland, Paul A. Milewski *University of Bath, United Kingdom*
2:30	**GT2019-91234** **Inlet Turbulence and Off-Design Incidence Response of High Efficiency, Turbine OGV Profiles** Benigno Lazaro[1] Ezequiel Gonzalez[1] Jorge Parra[2] David Cadrecha Robles[2] *1. Universidad Politecnica de Madrid, Spain; 2. ITP Aero, Spain*	**GT2019-91747** **A Comparison of Tip Gap Loss Sensitivity for Shrouded vs. Unshrouded Turbine Rotors** William Banks[1] Ali Ameri[2] Robert Boyle[3] Jeffrey Bons[1] *1. Ohio State University, USA; 2. The Ohio State University, USA; 3. N&R Engineering and Management Services, USA*	**GT2019-90189** **Effect of Surface Roughness on Laminar Separation Bubble Near the Leading-Edge for Different Angles of Attack** Subrata Sarkar, Pradeep Singh *Indian Institute of Technology Kanpur, India*
3:00	**GT2019-91263** **Numerical Investigation of a Turbine Guide Vane Exposed to Rotating Detonation Exhaust Flow** Majid Asli[1] Cleopatra Cuciumita[2] Panagiotis Stathopoulos[1] Christian Oliver Paschereit[1] *1. Technical University of Berlin, Germany; 2. H.F.I Technical University of Berlin, Germany*	**GT2019-91314** **Prediction of Film Thickness of an Aero-Engine Bearing Chamber Using Coupled VOF and Thin Film Model** Kuldeep Singh, Medhat Sharabi, Stephen Ambrose, Carol Eastwick, Richard J Jefferson-Loveday *University of Nottingham, United Kingdom*	**GT2019-91007** **The Effect of Rotor-Stator Gap on Repeating-Stage Compressor Loss** Pawel Przytarski, Andrew P S Wheeler *University of Cambridge, United Kingdom*

WEDNESDAY JUNE 19 — 02:00 PM - 03:30 PM

	TURBOMACHINERY: MULTIDISCIPLINARY DESIGN APPROACHES, OPTIMIZATION & UNCERTAINTY QUANTIFICATION	TURBOMACHINERY: DEPOSITION, EROSION, FOULING, AND ICING	
	Multi-fidelity Optimization and Reduced Order Models	**Turbomachinery Erosion and Coating Degradation**	
	Technical Session • 125-AB • WC-46-6Part A	**Technical Session • 127-B • WC-47-5Part A**	
	Session Organizer: **Peter Flassig**, Rolls-Royce Deutschland	Session Organizer: **Bruce Varney**, Rolls-Royce Corporation Session Co-Organizer: **Rudy Dudebout**, Honeywell	
2:00	**GT2019-90088** **Multifidelity Based Optimization of Shaped Film Cooling Hole and Experimental Validation** Hao Zhang[1] Yifei Li[2] Ziyu Chen[1] Xinrong Su[3] Xin Yuan[2] *1. Tsinghua University, China; 2. Department of Thermal Engineering, Tsinghua University, China; 3. Department of Energy and Power Engineering, Tsinghua University, China*	**GT2019-90216** **Erosion Testing of Environmental-Barrier-Coated CMC and its Behavior on an Aero-Engine Turbine Vane Under Particle-Laden Hot Gas Stream** Yoji Okita[1] Yousuke Mizokami[2] Jun Hasegawa[2] *1. Japan Aerospace Exploration Agency, Japan; 2. IHI Corporation, Japan*	
2:30	**GT2019-90269** **Further Reduction of the Fundamental Mistuning Model Using Mistuned Aeroelastic Modes** Aaron Quan, Robert Kielb *Duke University, USA*	**GT2019-90880** **Measurement Drift in 3-Hole Yaw Pressure Probes From 5 Micron Sand Fouling at 1050° C** Edward Turner[1] Matthew Bogdan[1] Tyler O'Connell[1] Wing Ng[1] Kevin Lowe[1] Loren Crook[2] Richard Stevenson[3] James Roberts[3] *1. Virginia Polytechnic Institute and State University, USA; 2. Rolls-Royce Corporation, USA; 3. Rolls-Royce plc, United Kingdom*	
3:00	**GT2019-90727** **Identification of Metal Temperature Distribution in Steam Turbine During Start-Up Operation Using Particle Filter and Model Order Reduction** Hiroshi Ito *Mitsubishi Heavy Industries Ltd., Japan*	**GT2019-90886** **Geometric Effects of Thermal Barrier Coating Damage on Turbine Blade Temperatures** Shane Colon[1] Mark Ricklick[1] Douglas Nagy[2] Amy Lafleur[2] *1. Embry Riddle Aeronautical University, USA; 2. Liburdi Turbine Services, Canada*	

WEDNESDAY JUNE 19 — 04:00 PM - 05:30 PM

	AIRCRAFT ENGINE	COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS	COMBUSTION, FUELS & EMISSIONS
	Inlets, Exhausts and Ducts	**Alternative Liquid Fuels**	**Pollutant Emissions Formation and Control - 3**
	Technical Session • 124-A • WD-1-3	**Technical Session • 122-A • WD-3-2Part B**	**Technical Session • 121-AB • WD-4-8Part C**
	Session Organizer: **Parthiv Shah**, ATA Engineering Inc. Session Co-Organizer: **Dylan Dawson**, Honeywell Aerospace	Session Organizer: **Ajay Agrawal**, University of Alabama Session Co-Chairs: **Bhupendra Khandelwal**, University of Sheffield; **Marina Braun-Unkhoff**, DLR, Institute of Combustion Technology	Session Organizer: **Luke Cowell**, Solar Turbines Incorporated Session Co-Organizer: **Tomohiro Asai**, Mitsubishi Heavy Industries, Ltd.
4:00	**GT2019-90992** **Shielded Swirl Versus Piccolo Tube Inlet Thermal Anti-Icing System** Morris Anderson *Honeywell, USA*	**GT2019-90475** **Laminar Flame Speed Experiments of Alternative Liquid Fuels** Charles Keesee[1] Bing Guo[2] Eric Petersen[1] *1. Texas A&M University, USA; 2. Texas A&M University At Qatar, Qatar*	**GT2019-90382** **Efficient Smoke Suppressant Reduces the Particulate Matter Emissions of Crude Oil Fired Gas Turbines** Matthieu Vierling[1] Michel Moliere[2] Paul Glaser[3] Richard Denolle[4] Sathya Nayani[5] Nouri Amadou[5] Amit Dutta[5] Maher Aboujaib[6] Brandon Westrup[7] Dmitry Sokolov[6] Pierre Montagne[8] *1. GE Energy Products France SNC, France; 2. UTBM, France; 3. GE Power, USA; 4. Katalis, France; 5. GE, Chad; 6. GE, France; 7. GE, USA; 8. GE Power, France*
4:30	**GT2019-90336** **Numerical Investigation of Flow Characteristics With Water Injection Cooling in an Aero-Engine High Altitude Simulated Pre-Cooling Section** Aqiang Lin[1] Jie Zhou[2] Qun Zheng[1] Ping Dong[1] Guoqiang Yue[1] Hai Zhang[1] *1. Harbin Engineering University, China; 2. Science and Technology on Altitude Simulation Laboratory, China*	**GT2019-91742** **Evaluation of Spray Performance of Pyrolysis Oil** Sangsig Yun, Minji Choi, Ashwani Kumar *National Research Council of Canada, Canada*	**GT2019-90873** **Impact of the Reaction Mechanism Model on Soot Growth and Oxidation in Laminar and Turbulent Flames** Livia Tardelli, Bendetta Franzelli, Pedro Rodrigues, Nasser Darabiha *Laboratoire EM2C, CNRS, CentraleSupélec, Université Paris-Saclay, France*
5:00	**GT2019-90472** **Effect of Surface Roughness on Aerodynamic Performance of Turbine Rear Structure** Srikanth Deshpande[1] Isak Jonsson[2] Valery Chernoray[2] *1. GKN Aerospace Engine Systems, Sweden; 2. Chalmers University of Technology, Sweden*		

WEDNESDAY JUNE 19 — 04:00 PM - 05:30 PM

	COMBUSTION, FUELS & EMISSIONS	CONTROLS, DIAGNOSTICS & INSTRUMENTATION	CYCLE INNOVATIONS
	Combustion Dynamics: Advanced Optical Investigations	**Advanced Controls for GT**	**Turbomachinery Design Aspects in Cycle Innovation II**
	Technical Session • 122-BC • WD-4-34	**Technical Session • 222-B • WD-5-8**	**Technical Session • 221-B • WD-6-10**
	Session Organizer: **Wajid Chishty**, NRC Aerospace Session Co-Organizer: **William Proscia**, Pratt and Whitney	Session Organizer: **Alex Tsai**, United States Coast Guard Academy	Session Organizer: **Ioannis Roumeliotis**, Cranfield University Session Co-Chairs: **Theoklis Nikolaidis**, Cranfield University; **Xin Zhao**, Mälardalen University
4:00	**GT2019-90215** **Characterization of ALM Swirl Burner Surface Roughness and its Effects on Flame Stability Using High-Speed Diagnostics** Jon Runyon, Anthony Giles, Richard Marsh, Daniel Pugh, Burak Goktepe, Philip J. Bowen, Steven Morris *Cardiff University, United Kingdom*	**GT2019-91413** **Control Technology Needs for Electrified Aircraft Propulsion Systems** Donald L. Simon, Joseph W. Connolly, Dennis E. Culley *NASA Glenn Research Center, USA*	**GT2019-91352** **Experimental and Numerical Investigation of Small Scale Tesla Turbines** Avinash Renuke, Alberto Vannoni, Matteo Pascenti, Alberto Traverso *University of Genova, Italy*
4:30	**GT2019-91752** **High-Speed Spectrally Resolved Imaging Studies of Spherically Expanding Natural Gas Flames Under Gas Turbine Operating Conditions** Pradeep Parajuli, Tyler Paschal, Mattias Turner, Eric Petersen, Waruna Kulatilaka *Texas A&M University, USA*	**GT2019-92017** **Sliding Mode Quantized Feedback Control for Aircraft Engine** Penghui Sun[1] Xi Wang[1] Bei Yang[2] *1. Beihang University, China; 2. Nanchang Hangkong University, China*	**GT2019-91708** **Theoretical and Experimental Investigation on Rotor Dynamic Behavior of Bladeless Turbine for Innovative Cycles** Paolo Silvestri[1] Alberto Traverso[2] Federico Reggio[1] Theofilos Efstathiadis[3] *1. Università di Genova - DIME, Italy; 2. University of Genoa, Italy; 3. Aristotle University of Thessaloniki, Greece*
5:00	**GT2019-92022** **Investigation on Effect of Inlet Flow Turbulence on the Combustion Instability Using Simultaneous PIV and CH* Chemiluminescence in a Backward Facing Step Combustor** Pankaj Pancharia, Vikram Ramanan, Baladandayuthapani Nagarajan, S.R. Chakravarthy *Indian Institute of Technology Madras, India*		

WEDNESDAY JUNE 19 — 04:00 PM - 05:30 PM

	HEAT TRANSFER: SPECIAL SESSIONS	HEAT TRANSFER: ADDITIVE MANUFACTURING	HEAT TRANSFER: GENERAL COMPUTATIONAL HEAT TRANSFER
	Richard Rivir Memorial Session II	**Heat Transfer: Additive Manufacturing I**	**General Computational Heat Transfer IV**
	Panel Session • 132-AB • WD-18-4	**Technical Session • 131-B • WD-21-1**	**Technical Session • 131-C • WD-22-4**
	Session Organizer: **Marc D. Polanka**, Air Force Institute of Technology Session Co-Organizer: **James L. Rutledge**, Air Force Institute of Technology	Session Organizer: **Michael Barringer**, Pennsylvania State University Session Co-Organizer: **Seth Lawson**, US Department of Energy	Session Organizer: **Qiang Zhang**, City University London Session Co-Organizer: **Jason Dees**, General Electric
4:00	**GT2019-92233** **Surface Curvature and Pressure Gradient Effects on the Performance of Turbine Airfoils at Low Reynolds Numbers** Om Sharma *United Technologies Research Center, USA* **GT2019-92300** **Dr. Rivir's Role as a Mentor and Supporter of New Technologies** Misael Malak *Honeywell, USA* **GT2019-92301** **Dr. Rivir's Influence on Turbine Engines** John Clark *Air Force Research Laboratory, USA*	**GT2019-90227** **Experimental and Numerical Investigation on an Additively Manufactured Gas Turbine Ring Segment With an In-Wall Cooling Scheme** Thomas Wimmer[1] Tobias Rühmer[1] York Mick[1] Lieke Wang[2] Bernhard Weigand[3] *1. Siemens AG, Germany; 2. Siemens Energy, Inc., USA; 3. University of Stuttgart, Germany*	**GT2019-91208** **Aerothermal Optimization of Turbine Squealer Tip Geometries With Arbitrary Cooling Injection** Cis De Maesschalck[1] Valeria Andreoli[2] Guillermo Paniagua[2] Tyler Gillen[3] Brett Barker[3] *1. Rolls-Royce plc, United Kingdom; 2. Purdue University, USA; 3. Rolls-Royce, USA*
4:30	**GT2019-92302** **Open Time for Impromptu Speakers** Marc D. Polanka *Air Force Institute of Technology, USA* **GT2019-92303** **The Personal Side of Dr. Rivir** Awatef Hamed *Univeristy of Cincinnati, USA* **P A N E L**	**GT2019-90978** **Effect of Surface Roughness Induced by Laser Powder Bed Fusion Additive Manufacturing in a Mini-Channel Heat Exchanger** Thomas Parent-Simard[1] Alexandre Landry-Blais[1] Patrick Dubois[1] Mathieu Picard[1] Vladimir Brailovski[2] *1. Université de Sherbrooke, Canada; 2. École de Technologie Supérieure, Canada*	**GT2019-91548** **Multi-Fidelity Analysis of Acoustic Streaming in Forced Convection Heat Transfer** Tapish Agarwal[1] Iman Rahbari[2] Jorge Saavedra[2] Guillermo Paniagua[2] Beni Cukurel[1] *1. Technion - Israel Institute of Technology, Israel; 2. Purdue University, USA*
5:00		**GT2019-91583** **Thermal-Fluid and Mechanical Investigations of Additively Manufactured Geometries for Transpiration Cooling** Zheng Min[1] Sarwesh Parbat[1] Li Yang[2] Minking Chyu[1] *1. University of Pittsburgh, USA; 2. Shanghai Jiao Tong University, China*	

WEDNESDAY JUNE 19 — 04:00 PM - 05:30 PM

	INDUSTRIAL & COGENERATION	MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES	OIL & GAS APPLICATIONS
	Gas Turbine Technology Development for Industrial Applications - Special Lecture	**Introduction to Gas Bearings for Oil-Free Turbomachinery**	**Basics of Rotordynamics Instrumentation and Data Acquisition**
	Lecture Session • 221-C • WD-23-8Part B	**Tutorial Session • 221-A • WD-26-12Part B**	**Tutorial Session • 130 • WD-27-15**
	Session Organizer: **Yiguang Li**, Cranfield University Session Co-Organizer: **Rakesh Bhargava**, Innovative Turbomachinery Technologies Corp.	Session Organizer: **Thomas Chirathadam**, Bearings Plus, Waukesha Bearings	Session Organizer: **Meera Day Towler**, Southwest Research Institute
4:00	**GT2019-92311** **Gas Turbine Technology Development for Industrial Applications** Rakesh Bhargava *Innovative Turbomachinery Technologies Corp., USA*	**GT2019-92205** **Introduction to Foil Bearings** Daniel Lubell *Oil-Free Machinery, LLC, USA* **GT2019-92206** **Foil Bearings in Gas Turbines** Daniel Lubell *Oil-Free Machinery, LLC, USA*	**GT2019-92146** **Basics of Rotordynamics Instrumentation and Data Acquisition** Meera Day Towler[1] Tim Allison[1] Robert Mihata[2] *1. Southwest Research Institute, USA;* *2. Alta Solutions, Inc, USA*
4:30	L E C T U R E	T U T O R I A L	T U T O R I A L
5:00			

WEDNESDAY JUNE 19 — 04:00 PM - 05:30 PM

	STEAM TURBINES	STRUCTURES & DYNAMICS: ROTORDYNAMICS	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS
	Steam Turbines Panel	**Gas Turbine Rotordynamics - Practical Aspects**	**Seals 5**
	Panel Session • 127-A • WD-29-1Part B	**Tutorial Session • 129-AB • WD-33-11Part B**	**Technical Session • 128-A • WD-34-12**
	Session Organizer: **Markus Schatz**, ITSM University of Stuttgart Session Co-Organizer: **Grant Ingram**, Durham University	Session Organizer: **Mateusz Golebiowski**, General Electric (Switzerland) GmbH	Session Organizer: **Jason Wilkes**, Southwest Research Institute Session Co-Organizer: **Patrick Keogh**, University of Bath
4:00	**GT2019-92321** **Clean Energy with Steam Turbine Technology** Thomas Thiemann *Siemens AG, Germany* **GT2019-92322** **Clean Energy with Steam Turbine Technology** Xiaolan Liu *Shanghai Electric, China* **GT2019-92328** **Clean Energy with Steam Turbine Technology** Naoki Shibukawa *Toshiba Corporation, Japan*	**GT2019-92345** **Gas Turbine Rotordynamics - Practical Aspects** Mark Corbo *No Bull Engineering, PLLC, USA*	**GT2019-90499** **Pump Grooved Seals: A CFD Approach to Improve Bulk-Flow Model Predictions** Tingcheng Wu, Luis San Andres *Texas A&M University, USA*
4:30	**P A N E L**	**T U T O R I A L**	**GT2019-91507** **Leakage and Cavity Pressures in an Interlocking Labyrinth Gas Seal: Measurements vs. Predictions** Luis San Andres[1] Tingcheng Wu[1] Jose Barajas-Rivera[1] Jiaxin Zhang[1] Rimpei Kawashita[2] *1. Texas A&M University, USA; 2. Mitsubishi Heavy Industries Ltd., Japan*
5:00			**GT2019-91676** **Experimentally Measured Effectiveness of Different Shroud Swirl Brake Profiles in a Centrifugal Compressor** Jason Wilkes[1] Natalie Smith[1] Balaji Venkataraman[2] Marco Vagani[2] Sara Goucher[2] *1. Southwest Research Institute, USA; 2. Solar Turbines, USA*

WEDNESDAY JUNE 19 — 04:00 PM - 05:30 PM

	STRUCTURES & DYNAMICS: STRUCTURAL MECHANICS, VIBRATION & DAMPING	SUPERCRITICAL CO2 POWER CYCLES	TURBOMACHINERY: AXIAL FLOW TURBINE AERODYNAMICS
	Mistuning IV	**Compressors for sCO2 Power Cycles - Near-Critical Point Considerations**	**Unsteady Flows and Transition**
	Technical Session • 128-B • WD-35-11	**Technical Session • 123 • WD-38-3**	**Technical Session • 126-ABC • WD-40-3Part B**
	Session Organizer: **Bernd Beirow**, Brandenburg University of Technology Session Co-Organizer: **Stefano Zucca**, Politecnico Di Torino - DIMEAS	Session Organizer: **Ashvin Hosangadi**, Craft Tech Session Co-Organizer: **Robert Pelton**, Hanwha Power Systems	Session Organizer: **Alex Stein**, GE Energy Session Co-Organizer: **Fabrizio Fontaneto**, von Karman Institute
4:00	**GT2019-90923** **Geometric Mistuning Reduced Order Model Development Utilizing Bayesian Surrogate Models for Component Mode Calculations** Joseph Beck[1] Jeff Brown[2] Alexander A. Kaszynski[3] Emily B. Carper[2] Daniel Gillaugh[4] *1. Perceptive Engineering Analytics, LLC, USA; 2. US Air Force Research Laboratory, USA; 3. Advanced Engineering Solutions, USA; 4. AFRL/RQTI, USA*	**GT2019-90409** **Limiting Inlet Conditions for Phase Change Avoidance in Supercritical CO2 Compressors** Tim Allison, Aaron McClung *Southwest Research Institute, USA*	**GT2019-91485** **Numerical Performance Assessment of a Turbine Blade Row Operating Under Pulsed Detonation Combustion Inlet Conditions** Cleopatra Cuciumita[1] Christian Oliver Paschereit[2] *1. H.F.I Technical University of Berlin, Germany; 2. Technische Universität Berlin, Germany*
4:30	**GT2019-91670** **Emulation of As-Manufactured Transonic Rotor Airfoil Modal Behavior and the Significance of Frequency Veering** Jeff Brown[1] Emily B. Carper[1] Joseph Beck[2] Alexander A. Kaszynski[3] *1. US Air Force Research Laboratory, USA; 2. Perceptive Engineering Analytics, LLC, USA; 3. Advanced Engineering Solutions, USA*	**GT2019-90497** **Numerical Simulation of Non-Equilibrium Condensation in Supercritical CO2 Compressors** Kevin Brinckman[1] Ashvin Hosangadi[2] Zisen Liu[1] Tim Weathers[1] *1. Combustion Research and Flow Technology, USA; 2. Craft Tech, USA*	**GT2019-91629** **An Experimental Study of Passage-to-Passage Flow Interactions in a Single Stage Axial Flow Research Turbine Rotor** Cengiz Camci[1] Veerandra Chakkaravarthy Andichamy[1] Yong Weon Kim[2] *1. Pennsylvania State University, USA; 2. Solar Turbines Inc., USA*
5:00	**GT2019-90820** **Mistuning Analysis of a Detuned Bladed-Disk With Geometrical Nonlinearities** Anthony Picou[1] Evangeline Capiez-Lernout[1] Christian Soize[1] Moustapha Mbaye[2] *1. University Paris-Est Marne-La-Vallée, France; 2. Safran Tech, France*	**GT2019-90647** **Effect of Compressor Inlet Condition on Supercritical Carbon Dioxide Compressor Performance** Haoxiang Chen[1] Weilin Zhuge[1] Yangjun Zhang[1] Hongdan Liu[2] *1. Tsinghua University, China; 2. Chongqing Jiangjin Shipbuilding industry CO.,LTD, China*	**GT2019-90307** **The Impact of Combustor Turbulence on Turbine Loss Mechanisms** Masha Folk[1] Robert Miller[2] John D. Coull[2] *1. Whittle Laboratory, University of Cambridge, United Kingdom; 2. University of Cambridge, United Kingdom*

WEDNESDAY JUNE 19 — 04:00 PM - 05:30 PM

	TURBOMACHINERY: UNSTEADY FLOWS IN TURBOMACHINERY	TURBOMACHINERY: MULTIDISCIPLINARY DESIGN APPROACHES, OPTIMIZATION & UNCERTAINTY QUANTIFICATION	TURBOMACHINERY: DEPOSITION, EROSION, FOULING, AND ICING
	Unsteady Flows in Compressors	**Multi-fidelity Optimization and Reduced Order Models**	**Gas Turbine Engine Icing**
	Technical Session • 124-B • WD-45-4Part B	**Technical Session • 125-AB • WD-46-6Part B**	**Technical Session • 127-C • WD-47-1**
	Session Organizer: **Michael Barton**, Honeywell International	Session Organizer: **Peter Flassig**, Rolls-Royce Deutschland	Session Co-Organizer: **Christian Koch**, University of Stuttgart
4:00	**GT2019-90252** **Understanding Unsteady Flow Behaviour in a Low Aspect Ratio Contra-Rotating Axial Fan Under Radially Distorted Inflow** Manas Madasseri Payyappalli, A. Pradeep *Indian Institute of Technology Bombay, India*	**GT2019-91258** **Surrogate Estimations of Complete Flow Fields of Fan Stage Designs via Deep Neural Networks** Marcel Aulich, Fabian Küppers, Andreas Schmitz, Christian Voss *German Aerospace Center (DLR), Germany*	**GT2019-90528** **Numerical and Experimental Study of Ice Accretion Process and Ice Protection on Turbo-Fan Engine Splitter** Yutao Zheng[1] Fukun Zhang[2] Daijun Wang[1] Si Li[2] *1. AECC Commercial Aircraft Engine CO., LTD, China; 2. AVIC Aerodynamcs Research Institute, China*
4:30	**GT2019-91229** **Evaluation of Turbulent Spot Production Rate in Boundary Layers Under Variable Pressure Gradients for Gas Turbine Applications** Matteo Dellacasagrande[1] Davide Lengani[1] Daniele Simoni[2] Marina Ubaldi[1] Pietro Zunino[1] *1. Università di Genova, Italy; 2. DIMSET Università di Genova, Italy*	**GT2019-91778** **Multi-Fidelity Global-Local Optimization of a Transonic Compressor Rotor** Sudeepta Mondal[1] Michael Joly[2] Soumalya Sarkar[2] *1. Pennsylvania State University, USA; 2. United Technologies Research Center, USA*	**GT2019-90002** **Analysis of the Honeywell Uncertified Research Engine (HURE) With Ice Crystal Cloud Ingestion at Simulated Altitudes** Joseph Veres, Philip Jorgenson, Samaun Nili, Shashwath Bommireddy, Kenneth Suder *NASA Glenn Research Center, USA*
5:00	**GT2019-90410** **Flow Mechanism and Loss Analysis of Tip Leakage Flow With Delayed Detached Eddy Simulation** Hui Li[1] Xiutao Bian[1] Xinrong Su[2] Xin Yuan[2] *1. Tsinghua University, China; 2. Department of Energy and Power Engineering, Tsinghua University, China*		

WEDNESDAY JUNE 19 — 04:00 PM - 05:30 PM

TURBOMACHINERY: DEPOSITION, EROSION, FOULING, AND ICING

Turbomachinery Erosion and Coating Degradation

Technical Session • 127-B • WD-47-5Part B

Session Organizer: **Bruce Varney**, Rolls-Royce Corporation
Session Co-Organizer: **Rudy Dudebout**, Honeywell

4:00

GT2019-91791
Analyzing the Potential for Erosion in a Supercritical CO2 Turbine Nozzle With Large Eddy Simulation
Justin Finn[1] Omer Dogan[2]
1. National Energy Technology Laboratory / AECOM, USA; 2. National Energy Technology Laboratory, USA

4:30

GT2019-91215
Analysis of Solid Particle Ingestion and Dynamics in a Turbomachine Using Large-Eddy Simulation
Benjamin Martin, Martin Thomas, Jerome Dombard, Florent Duchaine, Laurent Y.M. Gicquel
CERFACS, France

5:00

GT2019-92033
New Model to Predict Water Droplets Erosion Based on Erosion Test Curves: Application to On-Line Water Washing of a Compressor
Domenico Borello[1] Paolo Venturini[2] Serena Gabriele[3] Michele Andreoli[1]
1. Sapienza Università di Roma, Italy; 2. Dipartimento di Meccanica e Aeronautica, 'Sapienza Univ. of Rome, Italy; 3. Baker Hughes, a GE company, Italy

THURSDAY JUNE 20 — 08:00 AM - 10:00 AM

	AIRCRAFT ENGINE	COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS	COMBUSTION, FUELS & EMISSIONS
	Propellers and Open Rotors	**Challenges of Combustion Computational Fluid Dynamics for Industrial Gas Turbine Engines**	**Liquid Fuel Atomization and Combustion Tutorial**
	Technical Session • 124-A • ThA-1-7	**Tutorial Session • 122-BC • ThA-3-10**	**Tutorial Session • 122-A • ThA-4-40**
	Session Organizer: **Antonio Ficarella**, University of Salento Session Co-Organizer: **Harald Funke**, Aachen University of Applied Sciences	Session Organizer: **Pierre Gauthier**, Siemens	Session Organizer: **Ajay Agrawal**, University of Alabama
8:00	**GT2019-90290** **Technical and Economic Viability of an EIS 2050 Geared Open Rotor** Joshua Sebastiampillai, Andrew M Rolt, Devaiah Nalianda, Francesco S. Mastropierro, Vishal Sethi *Cranfield University, United Kingdom*	**GT2019-91348** **Challenges of Combustion Computational Fluid Dynamics for Industrial Gas Turbine Engines** Pierre Gauthier [1] Daniel Lorstad [1] *Siemens, Canada*	**GT2019-92115** **Liquid Fuel Atomization and Combustion** Ajay Agrawal[1] Adel Ben Mansour[2] *1. University of Alabama, USA; 2. Parker Hannifin Corp, USA*
8:30	**GT2019-90534** **Testing Propeller Tip Modifications to Reduce Acoustic Noise Generation on a Quadcopter Propeller** Kenneth Van Treuren[1] Charles Wisniewski[2] *1. Baylor University, USA; 2. Wisniewski Enterprises, USA*	TUTORIAL	TUTORIAL
9:00	**GT2019-90800** **Updating the Helicopter Gas Turbine Engine Mass Model for the Defining of the Turboshaft Engine Optimal Operating Cycle Parameters** Dmitry S. Kalabukhov, Vladimir A. Grigoriev, Artem O. Zagrebel'nyi, Dmitry S. Diligenskiy *Samara National Research University, Russia*		
9:30	**GT2019-90775** **Modelling Geared Turbofan and Open Rotor Engine Performance for Year-2050 Long-Range and Short-Range Aircraft** Joshua Sebastiampillai, Florian Jacob, Francesco S. Mastropierro, Andrew M Rolt *Cranfield University, United Kingdom*		

THURSDAY JUNE 20 — 08:00 AM - 10:00 AM

	COMBUSTION, FUELS & EMISSIONS	CONTROLS, DIAGNOSTICS & INSTRUMENTATION	CYCLE INNOVATIONS
	Opportunities for Fuel Variability in Aircraft Gas Turbine Engines	**Data Analytics & Parameter Estimation**	**Operations Simulation and Diagnostics**
	Panel Session • 121-AB • ThA-4-41	**Technical Session • 222-B • ThA-5-9**	**Technical Session • 221-B • ThA-6-8**
	Session Organizer: **Meredith Colket**, Combustion Consulting Services	Session Organizer: **Igor Loboda**, Instituto Politécnico Nacional	Session Organizer: **Valentina Zaccaria**, Mälardalen University
8:00	**GT2019-92356** **The Mission Benefits of Sustainable Drop-in High-Performance Fuels** Joshua Heyne *University of Dayton, USA*	**GT2019-91150** **Vibration Based Condition Monitoring of Helicopter Gearboxes Based on Cyclostationary Analysis** Alexandre Mauricio[1] Linghao Zhou[2] David Mba[3] Konstantinos Gryllias[1] *1. KU Leuven, Belgium; 2. School of Engineering, London South Bank University, United Kingdom; 3. Faculty of Technology, De Montfort University, United Kingdom*	**GT2019-90457** **Compressor Characteristics for Transient and Part-Load Performance Simulation** Mavroudis D. Kavvalos, Konstantinos Kyprianidis *Mälardalen University, Sweden*
8:30	**GT2019-92357** **Aircraft Particulate Matter (PM) Emissions – Fuel Approaches and Challenges** Edwin Corporan *Air Force Research Laboratory, USA*	**GT2019-91259** **Turning Dynamic Sensor Measurements From Gas Turbines Into Insights: A Big Data Approach** Roman Karlstetter[1] Robert Widhopf-Fenk[1] Jakob Hermann[1] Driek Rouwenhorst[1] Amir Raoofy[2] Carsten Trinitis[2] Martin Schulz[2] *1. IfTA Ingenieurbüro für Thermoakustik GmbH, Germany; 2. Technical University of Munich, Germany*	**GT2019-91021** **Surge and Stall Detection Using Acoustic Analysis for Gas Turbine Hybrid Cycles** Keishaly Cabrera Cruz[1] Paolo Pezzini[2] Larry Shadle[3] Kenneth Mark Bryden[2] *1. University of Puerto Rico at Mayaguez, USA; 2. U.S. Department of Energy, Ames Laboratory, USA; 3. U.S. Department of Energy NETL, USA*
9:00	**GT2019-92358** **Fuel Specifications and Annexes for Alternative Fuels** Bradley Culbertson *Honeywell Aerospace, USA*	**GT2019-90273** **Numerical Analysis and Optimization of Syngas Flow Rates for Gas Turbine for Low Heating Value Fuel** Bo Zhang[1] Ye Qin[2] Yanfei Mu[1] Shaoping Shi[1] *1. China Huaneng Clean Energy Research Institute, China; 2. Huaneng Clean Energy Research Institute, China*	**GT2019-91950** **Study on the Smart Diagnosis of Gas Turbine With Distributed Computing Technique** Hang Wu, Jinwei Chen, Huisheng Zhang *Shanghai Jiao Tong University, China*
9:30	**GT2019-92359** **Major Results from the National Jet Fuels and Combustion Program** Meredith Colket[1] Joshua Heyne[2] *1. Combustion Consulting Services, USA; 2. University of Dayton, USA*	**GT2019-90461** **A Probabilistic Uncertainty Estimation Method for Turbulence Parameters Measured by Hot Wire Anemometry in Short Duration Wind Tunnels** Elissavet Boufidi[1, 2] Sergio Lavagnoli[1] Fabrizio Fontaneto[1] *1. von Karman Institute, Belgium; 2. Université Catholique de Louvain, Belgium*	**GT2019-91597** **Modelica and Functional Mock-Up Interface: Open Standards for Gas Turbine Simulation** Michael Sielemann[1] Matthis Thorade[1] Jim Claesson[2] Anh Nguyen[3] Xin Zhao[4] Smruti Sahoo[4] Konstantinos Kyprianidis[4] *1. Modelon, Germany; 2. Modelon, Sweden; 3. Modelon, USA; 4. Mälardalen University, Sweden*

THURSDAY JUNE 20 — 08:00 AM - 10:00 AM

	ELECTRIC POWER	HEAT TRANSFER: CONJUGATE HEAT TRANSFER	HEAT TRANSFER: NUMERICAL INTERNAL COOLING
	History, Challenges and Opportunities for Gas Turbines	**Conjugate Heat Transfer III**	**Numerical Internal Cooling III**
	Technical Session • 131-A • ThA-8-1	**Technical Session • 131-C • ThA-10-3**	**Technical Session • 131-B • ThA-11-3**
	Session Organizer: **Rick Tomlinson**, Chevron Session Co-Chairs: **Jeffrey Benoit**, Ansaldo Energia Group; **Brock Ramey**, Industrial Infor Resources	Session Organizer: **Riccardo Da Soghe**, Ergon Research Session Co-Organizer: **Robert Proctor**, GE Aviation	Session Organizer: **Shailendra Naik**, Ansaldo Energia Session Co-Organizer: **Sumanta Acharya**, Illinois Institute of Technology
8:00	**GT2019-90177** **80 Years Open GT Development in Baden** Hans Wettstein *HEW Consulting, Switzerland*	**GT2019-92025** **Numerical Investigation on Cooling Air Flow and Resistance Characteristics Inner Laminated Cooling Structures** Wei Song, Huazhao Xu, Jianhua Wang, Xiaofang Cheng *University of Science and Technology of China, China*	**GT2019-90370** **Large Eddy Simulation of the Flow Developing in Static and Rotating Ribbed Channels** Florent Duchaine[1] Laurent Y.M. Gicquel[1] Thomas Grosnickel[2] Charlie Koupper[3] *1. CERFACS, France; 2. Safran Helipcopter Engines, France; 3. Safran TURBOMECA, France*
8:30	**GT2019-90883** **Disappearing Thermo-Economic Sanity in Gas Turbine Combined Cycle Ratings: A Critique** S.C. John Gulen *Bechtel Infrastructure and Power, USA*	**GT2019-91080** **Experimental Study on Overall Cooling Effectiveness of Swirl-Stabilized Model Combustor With Effusion Cooling** Yongbin Ji[1] Liang Zhang[1] ming jin[1] Bing Ge[1] Shusheng Zang[1] Jianhua Xin[1] Weiliang Wu[1] Mingjia Li[2] Wenyan Xu[2] *1. Shanghai Jiao Tong University, China; 2. Harbin Marine Boiler and Turbine Research Institute, China*	**GT2019-90770** **Numerical Investigation on the Effect of Rotation and Holes Arrangement in Cold Bridge Type Impingement Cooling Systems** Simone Paccati[1] Lorenzo Cocchi[1] Lorenzo Mazzei[2] Antonio Andreini[2] *1. Department of Industrial Engineering, University of Florence, Italy; 2. University of Florence, Italy*
9:00	**GT2019-91963** **Consideration of Artificial Intelligence Application and Impact for the Electric Power Gas Turbine Industry** David Noble[1] Chris Perullo[2] Steve Seachman[3] Leonard Angello[3] Benjamin L. Emerson[2] Tim Lieuwen[2] Neva Espinoza[3] *1. Electric Power Research Institute, USA; 2. Georgia Institute of Technology, USA; 3. EPRI, USA*	**GT2019-91578** **Steady Conjugate Heat Transfer Method for High Temperature Gradient in Turbomachinery Applications** Rami Salem, Julien Marty, Marc Errera *ONERA, France*	**GT2019-91014** **Effects of Novel Roughened Wall of Swirl Cooling in Gas Turbine on Heat Transfer Characteristics and Pressure Drop** Fifi Elwekeel[1] Qun Zheng[2] Antar Abdala[1] *1. Helwan University, Egypt; 2. Harbin Engineering University, China*
9:30		**GT2019-91556** **The Effect of Heat Transfer on Turbine Performance** Lachlan J. Jardine, Robert Miller *University of Cambridge, United Kingdom*	**GT2019-91197** **Effects of Curved Ribs on Heat Transfer, Friction and Exergy Loss in Rectangular Cooling Channels by CFD** Fifi Elwekeel[1] Antar Abdala[1] Qun Zheng[2] *1. Helwan University, Egypt; 2. Harbin Engineering University, China*

THURSDAY JUNE 20 — 08:00 AM - 10:00 AM

	HEAT TRANSFER: GENERAL EXPERIMENTAL HEAT TRANSFER	INDUSTRIAL & COGENERATION	MANUFACTURING MATERIALS & METALLURGY
	General Experimental Heat Transfer I	**Combustion and Emissions**	**Thermal Barrier Coatings II**
	Technical Session • 132-AB • ThA-13-1	**Tutorial Session • 221-C • ThA-23-10**	**Technical Session • 121-C • ThA-24-9**
	Session Organizer: **James Downs**, Florida Turbine Technologies Inc Session Co-Organizer: **Michael Barringer**, Pennsylvania State University	Session Organizer: **Manfred Klein**, MA Klein and Associates Session Co-Chairs: **Mike Klassen**, Combustion Science & Engineering, Inc.; **Leonard Angello**, EPRI	Session Organizer: **Jeff Smith**, MPT Session Co-Chairs: **Tania Bhatia Kashyap**, United Technologies Research Center; **Vaishak Viswanathan**, Praxair Surface Technologies, Inc.
8:00	**GT2019-90823** **Experimental and Computational Methods for the Evaluation of Double-Wall, Effusion Cooling Systems** Alexander Murray[1] Peter Ireland[1] Eduardo Romero[2] *1. University of Oxford, United Kingdom; 2. Rolls-Royce plc, United Kingdom*	**GT2019-92195** **Combustion Fundamentals** Mike Klassen *Combustion Science & Engineering, Inc., USA* **GT2019-92196** **Emission Prevention and Control** Leonard Angello *EPRI, USA* **GT2019-92174** **Gas Turbine Emission Standards** Manfred Klein *MA Klein and Associates, Canada*	**GT2019-90104** **Hot Gas Corrosion and its Influence on the Thermal Cycling Performance of Suspension Plasma Spray TBCs** Krishna Praveen Jonnalagadda[1] Pimin Zhang[1] Mohit Gupta[2] Xin-Hai Li[3] Ru Lin Peng[1] *1. Linköping University, Sweden; 2. University West, Sweden; 3. Siemens Industrial Turbomachinery AB, Sweden*
8:30	**GT2019-90769** **Investigation and Thermal Modeling of the Thermal Contact Resistance at a Steam Turbine Blade Root** Dennis Toebben[1] Alexander Goerner[1] Piotr Luczynski[2] Manfred Wirsum[2] Wolfgang F. D. Mohr[3] Klaus Helbig[4] *1. RWTH Aachen University, Germany; 2. IKDG, RWTH Aachen University, Germany; 3. General Electric Power AG, Switzerland; 4. GE Power, Germany*	**T U T O R I A L**	**GT2019-90210** **Laser Thermal Gradient Test of a Thermal Barrier Coating and Failure Analysis** Yingsang Wu[1] Yao Wang[1] Pei-Feng Hsu[1] Mary Helen McCay[1] Ed Croy[1] David Moreno[1] Lei He[2] Chao Wang[2] Hongqi Zhang[2] *1. Florida Institute of Technology, USA; 2. Shanghai Electric Gas Turbine Co. Ltd., China*
9:00	**GT2019-90248** **High Resolution Measurements of Heat Transfer, Near-Wall Intermittency, and Reynolds-Stresses Along a Flat Plate Boundary Layer Undergoing Bypass Transition** Holger Albiez[1] Christoph Gramespacher[1] Matthias Stripf[1] Hans-Jorg Bauer[2] *1. University of Applied Sciences, Germany; 2. Karlsruhe Institute of Technology, Germany*		**GT2019-90395** **Rare-Earth Oxides Blended With Yttria-Stabilized Zirconia Thermal Barrier Coatings for Improved Resistance to Sand Adherence and Calcia-Magnesia-Alumino-Silicate (CMAS) Infiltration** Clara Mock[1] Michael Walock[1] Andrew Wright[2] Andy Nieto[1] Anindya Ghoshal[1] Muthuvel Murugan[1] Marc Pepi[1] *1. US Army Research Laboratory, USA; 2. University of California, San Diego, USA*
9:30	**GT2019-90359** **Impact of a Combustor-Turbine Interface on Turbine Vane Aerodynamics and Film Cooling** Andreas Lerch[1] Rainer Bauer[1] Joerg Krueckels[1] Marc Henze[2] *1. Ansaldo Energia Switzerland, Switzerland; 2. Alstom Switzerland Ltd., Switzerland*		**GT2019-90501** **Effect of APS Flash Bond Coatings on Furnace Cycle Lifetime of Disks and Rods** Bruce A. Pint[1] Michael J Lance[1] J. Allen Haynes[1] Edward Gildersleeve[2] Sanjay Sampath[2] *1. Oak Ridge National Laboratory, USA; 2. Stony Brook University, USA*

THURSDAY JUNE 20 — 08:00 AM - 10:00 AM

	MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES	OIL & GAS APPLICATIONS	STEAM TURBINES
	Microturbines and Turbochargers: Emerging System and Application	**Dry Gas Seals and Panels: Design, Operation, and Maintenance Techniques for Improved Reliability**	**Steam Turbines Tutorial**
	Technical Session • 221-A • ThA-26-6	**Tutorial Session • 130 • ThA-27-16**	**Tutorial Session • 127-A • ThA-29-2**
	Session Organizer: **Mingxu Qi**, Beijing Institute of Technology Session Co-Organizer: **Liangjun Hu**, Ford Motor Company	Session Organizer: **Meera Day Towler**, Southwest Research Institute	Session Organizer: **Henning Almstedt**, Siemens AG
8:00	**GT2019-90346** **Design and Flow Analysis of a Radial Outflow Turbo-Expander** Xuesong Wang[1] Jinju Sun[1] Changjiang Huo[1] Guilong Huo[2] Peng Song[1] *1. Xi'an Jiaotong University, China; 2. Taiyuan Heavy Industry Co. Ltd, China*	**GT2019-92147** **Dry Gas Seals and Panels: Design, Operation, and Maintenance Techniques for Improved Reliability** Meera Day Towler[1] Tim Allison[1] Matt Taher[2] Inderpal Sihra[3] *1. Southwest Research Institute, USA; 2. Bechtel, USA; 3. John Crane, United Kingdom*	**GT2019-92133** **Some Fundamentals of Component Assessment Concepts Addressing Crack Initiation and Crack Growth Under a Combined Creep and Fatigue Loading** Christian Kontermann[1] Klaus Helbig[2] Henning Almstedt[3] *1. Chair and Institute for Materials Technology, TU Darmstadt, Germany; 2. GE Power, Germany; 3. Siemens AG, Germany*
8:30	**GT2019-91361** **Theoretical and Experimental Investigation of a Small-Scale, High-Speed, and Oil-Free Radial Anode Off-Gas Recirculation Fan for Solid Oxide Fuel Cell Systems** Patrick Hubert Wagner[1] Jan Van herle[2] Jürg Schiffmann[1] *1. Ecole Polytechnique Federale De Lausanne (EPFL), Switzerland; 2. STI-SCI/JVH Fuelmat Group, Switzerland*	**T U T O R I A L**	**T U T O R I A L**
9:00	**GT2019-91822** **Design and Manufacturing of a Metal 3D Printed kW Scale Axial Turboexpander** Vaclav Novotny[1] Monika Vitvarova[1] Michal Kolovratnik[1] Barbora Bryksi Stunova[1] Vaclav Vodicka[2] Jan Spale[1] Petr Zikmund[3] Martin Drasnar[3] Elizaveta Schastlivtseva[1] *1. Czech Technical University In Prague, Czech Republic; 2. University Centre for Energy Efficient Buildings, Czech Technical University in Prague, Czech Republic; 3. Metal 3D, s. r. o., Czech Republic*		
9:30	**GT2019-91843** **Structural Dynamics and Aeroelasticity of Airborne Diesel Engine Turbochargers** Ryan C. McGowan[1] Muthuvel Murugan[1] Michael T. Szedlmayer[1] Kenneth S. Kim[1] Kurt M. Kruger[1] David J. Gondol[1] Chol-Bum M. Kweon[1] Peter J. Clerkin[2] Rik D. Meininger[3] Joseph A. Gibson[4] Christopher A. Lindsey[4] Bernard N. Acker[4] Marshall R. Musser[5] *1. U.S. Army Research Laboratory, USA; 2. Environmental Research Group, USA; 3. Science Applications International Corporation, USA; 4. U.S. Army Aviation and Missile Research, Development, and Engineering Center, USA; 5. Sigmatech, Inc., USA*		

THURSDAY JUNE 20 — 08:00 AM - 10:00 AM

	STRUCTURES & DYNAMICS: FATIGUE, FRACTURE & LIFE PREDICTION	STRUCTURES & DYNAMICS: PROBABILISTIC METHODS	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS
	Material Constitutive Modelling	**Industry Challenges in Uncertainty Quantification: Narrowing the Simulation – Test Gap with Statistical Calibration**	**Tilting Pad Bearings**
	Technical Session • 128-A • ThA-31-5	**Tutorial Session • 129-AB • ThA-32-3**	**Technical Session • 128-B • ThA-34-6**
	Session Organizer: **Ajay Taneja**, Rolls-Royce Session Co-Organizer: **Pontus Slottner**, Siemens Industrial Turbomachinery AB	Session Organizer: **Andrew Milliken**, Pratt & Whitney Session Co-Organizer: **Michael Enright**, Southwest Research Institute	Session Organizer: **Aaron Rimpel**, Southwest Research Institute
8:00	**GT2019-91521** **A Constitutive Model for Predicting Modified Creep Strain Rates due to Cyclic Loading of Gas Turbine Components** Richard Green[1] Jonathan Douglas[2] Andrew Moffat[2] Brent Scaletta[3] *1. Solar Turbines, USA; 2. Frazer-Nash Consultancy Ltd, United Kingdom; 3. Solar Turbines Inc., USA*	**GT2019-92094** **Industry Challenges in Uncertainty Quantification: Narrowing the Simulation - Test Gap With Statistical Calibration** Mark Andrews, Zachary Graves *SmartUQ, USA*	**GT2019-90195** **On the Frequency Dependency of Tilting-Pad Journal Bearings** Laurence Wagner *Rotor Bearing Solutions International, LLC, USA*
8:30	**GT2019-91695** **Constitutive Modeling of TMF and Creep-Fatigue of a Ni-Base Alloy** Nathan O'Nora, Thomas Bouchenot, Grant Geiger, Ali Gordon *University of Central Florida, USA*	**T U T O R I A L**	**GT2019-90231** **Effect of Pad and Liner Material Properties on the Static Load Performance of a Tilting Pad Thrust Bearing** Rasool Koosha, Luis San Andres *Texas A&M University, USA*
9:00	**GT2019-91903** **A Crystal Visco-Plastic Model for Ni-Base Superalloys Under Low Cycle Fatigue** Navindra Wijeyeratne[1] Firat Irmak[1] Grant Geiger[1] Jun-Young Jeon[2] Ali Gordon[3] *1. University of Central Florida, USA; 2. Doosan Heavy Industries and Construction, Korea; 3. Univeristy of Central Florida, USA*		**GT2019-90278** **Experiments on a Large Flexure Pivot Journal Bearing: Summary of Test Results and Comparison With Predictions** Giuseppe Vannini[1] Filippo Cangioli[2] Enrico Ciulli[3] Matteo Nuti[4] Paola Forte[3] Jongsoo Kim[5] Richard Livermore-Hardy[2] *1. Baker Hughes, a GE company, Italy; 2. Waukesha Bearing Corporation, United Kingdom; 3. University of Pisa, Italy; 4. AM Testing srl, Italy; 5. Waukesha Bearings, USA*
9:30	**GT2019-90174** **Novel and Applicable Method to Determine Equivalent Strain Range and Equivalent Strain Direction Under Multiaxial Non-Proportional Loading** Charles Krouse[1] Grant Musgrove[1] Tae Woan Kim[2] Seungmin Lee[3] Muhyoung Lee[3] *1. Southwest Research Institute, USA; 2. Doosan Heavy Industries and Construction, Korea; 3. Doosan Heavy Industries, Korea*		**GT2019-90626** **Improvement and Analysis for a Gaseous Cavitation Model Applied in a Tilting-Pad Journal Bearing** Aoshuang Ding, Xuesong Li, Yuhong Li *Tsinghua University, China*

THURSDAY JUNE 20 — 08:00 AM - 10:00 AM

	STRUCTURES & DYNAMICS: AERODYNAMIC EXCITATION & DAMPING	SUPERCRITICAL CO2 POWER CYCLES	TURBOMACHINERY: AXIAL FLOW FAN & COMPRESSOR AERODYNAMICS
	Aerodynamic Forcing in Different Turbomachinery Applications	**Materials for Supercritical CO2 Applications**	**Transonic Compressors**
	Technical Session • 127-C • ThA-36-2	**Technical Session • Room 123 • ThA-38-17**	**Technical Session • 124-B • ThA-39-3**
	Session Organizer: **Tobias Mueller**, ITSM University of Stuttgart Session Co-Organizer: **Virginie Chenaux**, German Aerospace Center (DLR)-AE	Session Organizer: **Henry Saari**, Carleton University	Session Organizer: **Aaron J King**, Rolls-Royce Corporation Session Co-Organizer: **Michael Joly**, United Technologies Research Center
8:00	**GT2019-90105** **Aerodynamic Excitation Analysis of a Radial Turbine Featuring a Multi-Channel Casing Design** Ahmed Farid Ayad Hassan[1] Jennifer Blackburne[1] Nikola Kovachev[1] Markus Schatz[1] Damian Vogt[2] *1. ITSM, University of Stuttgart, Germany; 2. University of Stuttgart, Germany*	**GT2019-92142** **Materials for Supercritical CO2 Applications** Henry Saari[1] Ganesan Subbaraman[2] Steven Kung[3] *1. Carleton University, Canada; 2. Gas Technology Institute, USA; 3. Electric Power Research Institute, USA*	**GT2019-90439** **Mechanisms and Quantitative Evaluation of Flow Loss Generation in a Multi-Stage Transonic Axial Compressor** Seishiro Saito[1] Masato Furukawa[1] Yamada Kazutoyo[2] Keisuke Watanabe[1] Akinori Matsuoka[3] Naoyuki Niwa[3] *1. Kyushu University, Japan; 2. Iwate University, Japan; 3. Kawasaki Heavy Industries, Ltd., Japan*
8:30	**GT2019-90456** **Hydro Francis Runner Stability and Forced Response Calculations** Sunil Patil[1] Charles Seeley[2] Andrew Madden[1] Laith Zori[1] Stuart Connell[3] Gwenael Hauet[4] *1. ANSYS Inc., USA; 2. General Electric Research and Development, USA; 3. GE Retired, USA; 4. GE, France*	**T U T O R I A L**	**GT2019-90440** **On the Importance of Transition Control at Transonic Compressor Blades** Alexander Hergt, Joachim Klinner, Sebastian Grund, Christian Willert, Wolfgang Steinert, Manfred Beversdorff *German Aerospace Center (DLR), Germany*
9:00	**GT2019-91492** **Design Considerations for High Pressure Turbo Expanders Supported by Active Magnetic Bearings** Francesco Cangioli, Davide Biliotti, Alice Innocenti, Giuseppe Iurisci *Baker Hughes, a GE company, Italy*		**GT2019-90201** **Transition and Flow Structures on the Suction Surface of a Controlled-Diffusion Compressor Blade Using Large-Eddy Simulation** Subrata Sarkar, Shubham Katiyar *Indian Institute of Technology Kanpur, India*
9:30	**GT2019-91947** **Forced Response Analysis of a Radial Turbine With Different Modelling Methods** Yang Gao[1] Mauricio Gutierrez Salas[1] Paul Petrie-Repar[2] Tobias Gezork[1] *1. KTH Royal Institute of Technology, Sweden; 2. Department of Energy Technology, KTH, Sweden*		**GT2019-91141** **Effect of Turbulence Model on the Prediction of Performance and Span-Wise Mixing in High-Speed Highly-Loaded Multi-Stage Axial-Flow Compressor** Takashi Goto, Tetsuya Oshio, Naoki Tani, Mizuho Aotsuka, Guillaume Pallot, Dai Kato *IHI Corporation, Japan*

THURSDAY JUNE 20 — 08:00 AM - 10:00 AM

	TURBOMACHINERY: AXIAL FLOW FAN & COMPRESSOR AERODYNAMICS	TURBOMACHINERY: UNSTEADY FLOWS IN TURBOMACHINERY	TURBOMACHINERY: MULTIDISCIPLINARY DESIGN APPROACHES, OPTIMIZATION & UNCERTAINTY QUANTIFICATION
	Compressor Design - 2	**Unsteady Flows in Turbines I**	**Radial Compressors and Turbines Design Optimization - Torque Converter Design**
	Technical Session • 126-ABC • ThA-39-9	**Technical Session • 125-AB • ThA-45-8**	**Technical Session • 127-B • ThA-46-1**
	Session Organizer: **William J Solomon**, GE Aviation Session Co-Organizer: **Choon S. Tan**, Massachusetts Institute of Technology	Session Organizer: **John Clark**, Air Force Research Laboratory Session Co-Organizer: **Florian Herbst**, Leibniz University Hannover	Session Organizer: **Koen Hillewaert**, Cenaero Session Co-Organizer: **Edward Childs**, Concepts NREC
8:00	**GT2019-91339** **Predicting the Operability of Damaged Compressors Using Machine Learning** James Taylor[1] Bryce Conduit[2] Anthony Dickens[1] Chris Hall[2] Malcolm Hillel[2] Robert Miller[3] *1. Whittle Laboratory, United Kingdom; 2. Rolls-Royce plc, United Kingdom; 3. University of Cambridge, United Kingdom*	**GT2019-90790** **Unsteady Flow Interactions Between a High- and Low-Pressure Turbine: Part 1 – Time-Resolved Flow** Patrick Zeno Sterzinger[1] Stefan Zerobin[2] Filippo Merli[2] Lukas Wiesinger[2] Matteo Dellacasagrande[3] Andreas Peters[4] Gabriele Maini[5] Franz Heitmeir[2] Emil Goettlich[2] *1. Institute of Thermal Turbomachinery and Machine Dynamics, Austria; 2. Graz University of Technology, Austria; 3. University of Genova, Italy; 4. GE Aviation, Germany; 5. Avio Aero, Italy*	**GT2019-91408** **Automatic Numerical Analyses and Optimization of Operating Maps Applied to a Radial Compressor** Markus Wagner[1] Johannes Einzinger[2] Oliver Velde[3] Ralf Lampert[4] *1. Dynardo GmbH, Germany; 2. ANSYS Germany GmbH, Germany; 3. Cfturbo GmbH, Germany; 4. Dynardo US, Inc., USA*
8:30	**GT2019-90289** **Numerical Study of the Penny Cavity Leakage Effects From Variable Guide Vanes in a High Pressure Compressor: Adjustment of Standard-RANS-CFD-Model to a Hybrid LES Calculation** Hannes Wolf, Alexander Halcoussis *MTU Aero Engines AG, Germany*	**GT2019-90824** **Unsteady Flow Interactions Between a High- and Low-Pressure Turbine: Part 2 – Rotor-Synchronic Averaging and Proper Orthogonal Decomposition of the Unsteady Flow Fields** Matteo Dellacasagrande[1] Patrick Zeno Sterzinger[2] Stefan Zerobin[3] Filippo Merli[3] Lukas Wiesinger[3] Andreas Peters[4] Gabriele Maini[5] Franz Heitmeir[3] Emil Goettlich[3] *1. University of Genova, Italy; 2. Institute of Thermal Turbomachinery and Machine Dynamics, Austria; 3. Graz University of Technology, Austria; 4. GE Aviation, Germany; 5. Avio Aero, Italy*	**GT2019-91452** **Using Optimization in Industrial Multi-Point Radial Compressor Design: Map Correction** Edward Childs, Dimitri Deserranno, Akshay Bagi *Concepts NREC, USA*
9:00	**GT2019-91611** **Reducing Compressor Shroud Leakage Flows by Raising the Stator Hub Line: Low Speed Tests** Henner Schrapp[1] Arne N. Dodegge[2] Volker Guemmer[3] Neil Harvey[4] Jorn Stading[2] Jens Friedrichs[5] *1. Rolls-Royce Deutschland, Germany; 2. MTU Maintenance GmbH, Germany; 3. Technische Universität München, Germany; 4. Rolls-Royce, United Kingdom; 5. Technical University of Braunschweig Inst of Aircraft Propulsion & Turbomachinery, Germany*	**GT2019-90574** **Clocking of Stators and Rotors in a Three-Stage Axial Turbine** Zongqi Lei, Hualing Luo, Lei Zhao, Shiji Wang, Jing Wang *AECC Commercial Aircraft Engine CO., LTD, China*	**GT2019-91497** **Parametric Analysis and Optimization of Leaning Angle in Torque Converters** Cheng Liu, Changle Xiang, Qingdong Yan, Wei Wei *Beijing Institute of Technology, China*
9:30	**GT2019-90553** **A No-Calibration Approach to Modelling Compressor Blade Rows With Body Forces Employing Artificial Neural Networks** Syamak Pazireh, Jeff Defoe *University of Windsor, Canada*	**GT2019-90721** **Impact of Turbine Center Frame Wakes on Downstream Rows in Heavy Duty Low Pressure Turbine** Sara Biagiotti[1] Juri Bellucci[2] Michele Marconcini[1] Andrea Arnone[1] Gino Baldi[3] Mirko Ignesti[3] Vittorio Michelassi[4] Libero Tapinassi[3] *1. University of Florence, Italy; 2. Department of Industrial Engineering, University of Florence, Italy; 3. Baker Hughes, a GE company, Italy; 4. General Electric, Italy*	**GT2019-91823** **Adjoint-Based Multidisciplinary, Multipoint Optimization of a Radial Turbine Considering Aerodynamic and Structural Performances** Lasse Mueller, Tom Verstraete, Marc Schwalbach *von Karman Institute for Fluid Dynamics, Belgium*

THURSDAY JUNE 20 — 10:15 AM - 12:15 PM

	AIRCRAFT ENGINE	COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS	COMBUSTION, FUELS & EMISSIONS
	Modeling, Simulation and Validation	**Environmental Impact Assessment on the Life Cycle for Industrial Gas Turbines - Is it Still an Option?**	**Combustion Dynamics: Nonlinearities**
	Technical Session • 124-A • ThB-1-2	**Panel Session • 122-BC • ThB-3-11**	**Technical Session • 122-A • ThB-4-27**
	Session Organizer: **Stefan Bretschneider**, MTU Aero Engines AG Session Co-Organizer: **Mikael Stenfelt**, SAAB Aeronautics	Session Organizer: **Angela Serra**, Baker Hughes a GE Company Session Co-Chairs: **Francesco Fantozzi**, University of Perugia; **Pierre Gauthier**, Siemens	Session Organizer: **Camilo F. Silva**, Technische Universität München Session Co-Organizer: **Giulio Ghirardo**, Ansaldo Energia Switzerland
10:15	**GT2019-90583** **Dynamic Behavior of the Ultra-High Efficiency Gas Turbine Engine, UHEGT, With Stator Internal Combustion** Meinhard Schobeiri, Seyed Ghoreyshi *Texas A&M University, USA*	**GT2019-92382** **Gas Turbine Environmental Impact Assessment in BHGE** Luca M. Rossi *Baker Hughes, a GE Company, Italy* **GT2019-92383** **Gas Turbine Environmental impact Assessment in GE Power** John Lammas *GE Power, USA*	**GT2019-90738** **High Amplitude Combustion Instabilities in an Annular Combustor Inducing Pressure Field Deformation and Flame Blow-Off** Guillaume Vignat[1] Daniel Durox[1] Antoine Renaud[2] Sebastien Candel[1] *1. Laboratoire EM2C, CNRS, CentraleSupélec, Université Paris-Saclay, France; 2. Laboratoire EM2C - CNRS - CentraleSupélec, France*
10:45	**GT2019-91402** **Multi-Disciplinary Tool Coupling for the Determination of Turbofan Transients During Preliminary Design** Maximilian Vieweg, Florian Wolters, Stanislaus Reitenbach, Carsten Hollmann, Richard Becker *German Aerospace Center (DLR), Germany*	**GT2019-92389** **Gas Turbine Environmental Impact Assessment is it Still an Option?** Francesco Fantozzi *Università degli Studi di Perugia, Italy* **GT2019-92410** **Gas Turbine Environmental Impact Assessment in Siemens** Kunal Chandra *Siemens, Germany*	**GT2019-91319** **Comparison of Machine Learning Algorithms in the Interpolation and Extrapolation of Flame Describing Functions** Michael McCartney[1] Matthias Haeringer[2] Wolfgang Polifke[2] *1. GE Aviation, Germany; 2. Technical University of Munich, Germany*
11:15	**GT2019-91432** **Using Machine Learning to Predict Core Sizes of High-Efficiency Turbofan Engines** Michael T. Tong *NASA John Glenn Research Center, USA*	**P A N E L**	**GT2019-91835** **Synchronization During Multi-Mode Thermoacoustic Oscillations in a Liquid-Fueled Gas Turbine Combustor at Elevated Pressure** Mitchell Passarelli[1] J. D. Maxim Cirtwill[1] Timothy Wabel[2] Adam M. Steinberg[3] A.J. Wickersham[4] *1. University of Toronto Institute for Aerospace Studies, Canada; 2. University of Toronto, Canada; 3. Georgia Institute of Technology, USA; 4. GE Global Research Center, USA*
11:45	**GT2019-91039** **Fan Flow Field in an Installed Variable Pitch Fan Operating in Reverse Thrust for a Range of Aircraft Landing Speeds** David John Rajendran[1,2] Vassilios Pachidis[2] *1. Rolls-Royce UTC, United Kingdom; 2. Cranfield University, United Kingdom*		**GT2019-92052** **Data Assimilation and Optimal Calibration in Nonlinear Models of Flame Dynamics** Hans Yu[1] Thomas Jaravel[2] Matthias Ihme[2] Matthew P. Juniper[1] Luca Magri[1] *1. University of Cambridge, United Kingdom; 2. Stanford University, USA*

THURSDAY JUNE 20 — 10:15 AM - 12:15 PM

	COMBUSTION, FUELS & EMISSIONS	CYCLE INNOVATIONS	FANS & BLOWERS
	Soot Modeling for Gas Turbines Engines: Recent Developments, Remaining Gaps, and Emerging Needs	**Overview of Grid-Scale Energy Storage Systems and Technologies**	**Machine Learning and Design Optimization**
	Panel Session • 121-AB • ThB-4-42	**Tutorial Session • 221-B • ThB-6-14**	**Technical Session • 222-B • ThB-9-5**
	Session Organizer: **Michael Mueller**, Princeton University	Session Organizer: **Tim Allison**, Southwest Research Institute	Session Organizer: **Johan Van der Spuy**, Stellenbosch University Session Co-Organizer: **Massimo Masi**, University of Padova - DTG
10:15	**GT2019-92373** **Soot Modeling for Gas Turbines Engines: Recent Developments, Remaining Gaps, and Emerging Needs** M. S. Anand *Rolls-Royce, USA* **GT2019-92374** **Soot Modeling for Gas Turbines Engines: Recent Developments, Remaining Gaps, and Emerging Needs** Rudy Dudebout *Honeywell, USA*	**GT2019-92145** **Overview of Grid-Scale Energy Storage Systems and Technologies** Tim Allison, J. Jeffrey Moore, Natalie Smith, Brittany Tom, Aaron McClung *Southwest Research Institute, USA*	**GT2019-91527** **A New Practical Approach to the Design of Industrial Axial Fans: Part I – Tube-Axial Fans With Very Low Hub-to-Tip Ratio** Massimo Masi[1] Andrea Lazzaretto[2] *1. University of Padova - DTG, Italy; 2. University of Padova, Italy*
10:45	**GT2019-92375** **Soot Modeling for Gas Turbines Engines: Recent Developments, Remaining Gaps, and Emerging Needs** Stephen Zeppieri *United Technologies Research Center, USA* **GT2019-92376** **Soot Modeling for Gas Turbines Engines: Recent Developments, Remaining Gaps, and Emerging Needs** Emmanuel Laroche *ONERA, France*	T U T O R I A L	**GT2019-91198** **Identification of Poorly Ventilated Zones in Gas-Turbine Enclosures With Machine Learning** Giovanni Delibra[1] Alessandro Corsini[1] Marco Giovannelli[1] Gabriele Lucherini[2] Stefano Minotti[2] Stefano Rossin[2] Lorenzo Tieghi[1] *1. Sapienza University of Rome, Italy; 2. Baker Hughes, a GE Company, Italy*
11:15	P A N E L		**GT2019-91238** **Assessment of a Machine-Learnt Adaptive Wall-Function in a Compressor Cascade With Sinusoidal Leading Edge** Lorenzo Tieghi[1] Alessandro Corsini[1] Giovanni Delibra[1] Gino Angelini[2] *1. Sapienza University of Rome, Italy;* *2. La Sapienza University of Rome, Italy*
11:45			**GT2019-91588** **A Multi-Dimensional Extension of Balje Chart for Axial Flow Turbomachinery Using Artificial Intelligence Based Meta-Models** Gino Angelini, Alessandro Corsini, Giovanni Delibra, Lorenzo Tieghi *Sapienza University of Rome, Italy*

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	HEAT TRANSFER: NUMERICAL FILM COOLING	HEAT TRANSFER: GENERAL EXPERIMENTAL HEAT TRANSFER	HEAT TRANSFER: SPECIAL SESSIONS
	Endwall	**General Experimental Heat Transfer II**	**Tip Clearance Control**
	Technical Session • 131-C • ThB-12-4	**Technical Session • 132-AB • ThB-13-2**	**Technical Session • 131-B • ThB-18-2**
	Session Organizer: **Khosro Mollahosseini**, Honeywell Aerospace Session Co-Organizer: **Hongzhou Xu**, Solar Turbines Inc	Session Organizer: **Michael J. Benson**, Department of Civil & Mechanical Engineering/ United States Military Academy Session Co-Organizer: **James Downs**, Florida Turbine Technologies Inc	Session Organizer: **Robert Proctor**, GE Aviation Session Co-Organizer: **Dave Flodman**, Mitsubishi Heavy Industries America
10:15	**GT2019-91601** **Combined Experimental and Numerical Investigation of the Aero-Thermal Performance of a Rotor Blade Cascade With Platform Cooling** Giovanna Barigozzi[1] Antonio Perdichizzi[1] Luca Pestelli[2] Roberto Abram[2] *1. Universita' Di Bergamo, Italy; 2. Ansaldo Energia, Italy*	**GT2019-90997** **Scaling Flat Plate, Low Temperature Adiabatic Effectiveness Results Using the Advective Capacity Ratio** Jacob Fischer[1] James L. Rutledge[2] Luke McNamara[3] Marc D. Polanka[2] *1. Air Force Research Laboratory, USA; 2. Air Force Institute of Technology, USA; 3. US Air Force, USA*	**GT2019-90232** **Controlling Leakage Flows Over a Rotor Blade Tip Using Air-Curtain Injection: Part I – Aero-Thermal Performance of Rotor Tips** Xing Yang[1] Qiang Zhao[1] Zhao Liu[1] Zhenping Feng[1] Terrence Simon[2] *1. Xi'an Jiaotong University, China; 2. University of Minnesota, USA*
10:45	**GT2019-90154** **Effect of Non-Axisymmetric Endwall Profiling on Heat Transfer and Film Cooling Effectiveness of a Transonic Rotor Blade** Jinjin Li, Xin Yan, Kun He *Xi'an Jiaotong University, China*	**GT2019-90849** **Effect of Squealer Rim Slot Structure on Turbine Blade Aerothermal Performance** Mengcheng Qian, Shaopeng Lu, Bo Zhang, Weijie Wang, Jinfang Teng *Shanghai Jiao Tong University, China*	**GT2019-90234** **Controlling Leakage Flows Over a Rotor Blade Tip Using Air-Curtain Injection: Part II – Rotor Casing Film Cooling** Qiang Zhao[1] Xing Yang[1] Zhao Liu[1] Zhenping Feng[1] Terrence Simon[2] *1. Xi'an Jiaotong University, China; 2. University of Minnesota, USA*
11:15	**GT2019-91069** **Numerical Study on Cooling Characteristics of Double-Row Cylindrical Holes on Upstream Endwall** Ding Luo[1] Ruishan Lu[1] Jiang Lei[1] Lesley Wright[2] *1. Xi'an Jiaotong University, China; 2. Texas A&M University, USA*	**GT2019-91074** **Linear Cascade and Wind Tunnel Development for Turbine Blade Tip Heat Transfer Investigations With and Without Film Cooling** Michael Sampson[1] Avery Fairbanks[1] Jacob Moseley[1] Phillip M. Ligrani[1] Hongzhou Xu[2] Michael Fox[2] *1. University of Alabama in Huntsville, USA; 2. Solar Turbines Inc., USA*	**GT2019-91243** **The Effect of Local Casing Features and External Dummy Flanges on Casing Contraction for Thermal Control of Blade Tip Clearance** Myeonggeun Choi, David Gillespie *University of Oxford, United Kingdom*
11:45	**GT2019-91490** **The Effect of Upstream Backward-Facing Step on the Film Cooling Effectiveness of Turbine Vane Endwall** Qingzong Xu[1] Pei Wang[2] Qiang Du[2] Xiangtao Xiao[2] *1. University of Chinese Academy of Sciences, China; 2. Institute of Engineering Thermalphysics, Chinese Academy of Sciences, China*	**GT2019-91698** **Characterisation of Waves and Ligaments in Films Close to an Aeroengine Ball Bearing** Jee Loong Hee[1] Kathy Simmons[1] David Hann[1] Michael Walsh[2] *1. University of Nottingham, United Kingdom; 2. Nottingham University, United Kingdom*	**GT2019-90007** **Aero-Thermal Investigation of Convective and Radiative Heat Transfer on Active Clearance Control Manifolds** Riccardo Da Soghe, Cosimo Bianchini *Ergon Research, Italy*

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	INDUSTRIAL & COGENERATION	MANUFACTURING MATERIALS & METALLURGY	MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES
	Co-Generation Power Plant Performance, Operation and Condition-Based Maintenance	**Prognosis and Prediction**	**Microturbines and Turbochargers: Turbines**
	Technical Session • 221-C • ThB-23-3	**Technical Session • 121-C • ThB-24-7**	**Technical Session • 221-A • ThB-26-7**
	Session Organizer: **Qun Zheng**, Harbin Engineering University Session Co-Organizer: **Lisa Branchini**, University of Bologna	Session Organizer: **Ranajay Ghosh**, University of Central Florida Session Co-Organizer: **Ashok Koul**, Life Prediction Technologies Inc.	Session Organizer: **Srithar Rajoo**, Universiti Teknologi Malaysia (UTM)
10:15	**GT2019-90274** **Economy and Emission Analysis of the Effects of Different Diluents in Syngas for Gas Turbine Using Low Heating Value Syngas Through Numerical Model** Yanfei Mu, Shaoping Shi, Ye Qin, Bo Zhang, Shu Yan, Xin Liu, Xinming Chen *China Huaneng Clean Energy Research Institute, China*	**GT2019-90132** **Performance Informed Prognostics and its Implications** Pontus Slottner, Per Johansson *Siemens Industrial Turbomachinery AB, Sweden*	**GT2019-90163** **Radial Inflow Turbine Geometry Generation Method Using Third Order Bezier Curves for Blade Design** U. Caldiño-Herrera[1] J. C. García[2] F. Sierra-Espinosa[3] JO Davalos[1] M. A. Lira[1] *1. Universidad Autónoma de Ciudad Juárez, Mexico; 2. Universidad Autónoma del Estado de Morelos, Mexico; 3. Center For Research & Applied Science, Mexico*
10:45	**GT2019-90686** **Application of Adaptive GPA to an Industrial Gas Turbine Using Field Data** Ericcson Ramadhan[1] Yiguang Li[2] Deplian Maherdianta[1] *1. PT Pupuk Kaltim, Indonesia; 2. Cranfield University, United Kingdom*	**GT2019-92087** **Reliable Temperature Measurement With Thermal History Paints: An Uncertainty Estimation Model** David Peral[1] Daniel Castillo[1] Silvia Araguas-Rodriguez[1] Alvaro Yanez-Gonzalez[1] Christopher Pilgrim[1] Solon Karagiannopoulos[1] Jörg Peter Feist[1] Stephen Skinner[2] *1. Sensor Coating Systems Ltd., United Kingdom; 2. Imperial College London, United Kingdom*	**GT2019-90868** **Validation of a Numerical Quasi One-Dimensional Model for Wave Rotor Turbines With Curved Channels** Stefan Tuechler, Colin D. Copeland *University of Bath, United Kingdom*
11:15	**GT2019-91316** **Estimation of the Hydraulic Losses in the Work Shaft of a Gas Turbine Engine of a Gas Compressor Unit Under Various Operating Conditions** Oleg Baturin, Aleksandr Krivtsov, Daria Kolmakova, Grigorii Popov *Samara National Research University, Russia*	**GT2019-90142** **Calibrating Material Models in a Commercial FE Code for Transient TMF Simulations of Single-Crystal and Directionally-Solidified Alloys** Grant Musgrove[1] Tae Woan Kim[2] Seungmin Lee[3] Muhyoung Lee[3] *1. Southwest Research Institute, USA; 2. Doosan Heavy Industries and Construction, Korea; 3. Doosan Heavy Industries, Korea*	**GT2019-91017** **Power Density vs Efficiency Trade-Off for a Recuperated Inside-Out Ceramic Turbine (ICT)** Benoit Picard, Alexandre Landry-Blais, Mathieu Picard, David Rancourt *Université de Sherbrooke, Canada*
11:45		**GT2019-91419** **A Novel Solid-State Additive Manufacturing Technology in Support of Turbomachinery Sustainment** Chase Cox, Nanci Hardwick *MELD Manufacturing, USA*	**GT2019-91155** **Investigation on Unsteady and Steady Swirling Inflow Effect on Turbocharger Turbine Performance** Zhanming Ding[1] Weilin Zhuge[1] Yangjun Zhang[1] Yingjie Chen[1] Chang Liu[2] *1. Tsinghua University, China; 2. Science and Technology on Diesel Engine Turbocharging Laboratory, China*

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	OIL & GAS APPLICATIONS	STRUCTURES & DYNAMICS: FATIGUE, FRACTURE & LIFE PREDICTION	STRUCTURES & DYNAMICS: PROBABILISTIC METHODS
	Performance Degradation and Critical Conditions	**Fatigue Crack Initiation**	**Introduction to Probabilistic Analysis and Uncertainty Quantification**
	Technical Session • 130 • ThB-27-6	**Technical Session • 128-A • ThB-31-4**	**Tutorial Session • 129-AB • ThB-32-4**
	Session Organizer: **Rainer Kurz**, Solar Turbines Session Co-Organizer: **Jason Wilkes**, Southwest Research Institute	Session Organizer: **Onome Scott-Emuakpor**, Air Force Research Laboratory Session Co-Chairs: **Siva Kumar Mamidi**, University of Illinois,Chicago; **Quang Le**, Siemens Energy Inc.	Session Organizer: **Michael Enright**, Southwest Research Institute Session Co-Organizer: **Andrew Milliken**, Pratt & Whitney
10:15	**GT2019-91748** **Gas Turbine Fouling: The Influence of Climate and Part-Load Operating Conditions** Nicola Aldi[1] Nicola Casari[1] Mirko Morini[2] Michele Pinelli[3] Pier Ruggero Spina[1] Alessio Suman[1] Alessandro Vulpio[1] *1. University of Ferrara, Italy; 2. University of Parma, Italy; 3. Univeristy of Ferrara Endif, Italy*	**GT2019-91572** **A Critical Plane Approach for LCF Evaluation of Gas Turbine Disks and Rotors** Andrea Riva[1] Sergei Riazantsev[2] Stefano Foletti[3] Stefano Beretta[3] *1. Ansaldo Energia, Italy; 2. Ansaldo Energia Switzerland, Switzerland; 3. Politecnico di Milano, Italy*	**GT2019-92095** **Introduction to Probabilistic Analysis and Uncertainty Quantification** Mark Andrews, Zachary Graves *SmartUQ, USA*
10:45	**GT2019-90020** **Compressor Speed Decay During Emergency Shutdowns** Rainer Kurz[1] Klaus Brun[2] Sean Garceau[1] Min Ji[1] *1. Solar Turbines, USA; 2. Elliott Group, USA*	**GT2019-91540** **Experimental and Numerical Investigation on the Influence of Thermally Induced Stress Gradients on Fatigue Life of the Nickel-Base Alloy Mar-M247** Marcus Thiele[1] Stefan Eckmann[2] Min Huang[3] Uwe Gampe[1] Kathrin Anita Fischer[4] Michael Schlesinger[2] *1. Technische Universität Dresden, Germany; 2. Fraunhofer Institute for Mechanics of Materials IWM, Germany; 3. Materials Testing Institute University of Stuttgart, Germany; 4. Siemens AG, Germany*	**T U T O R I A L**
11:15	**GT2019-90054** **Gas Turbine Health State Prognostics by Means of Bayesian Hierarchical Models** Enzo Losi, Mauro Venturini, Lucrezia Manservigi *Università degli Studi di Ferrara, Italy*	**GT2019-91958** **A Bayesian Framework for Estimation of Strain Life Lower Bounds and its Application to IN617** Arinan Dourado, Firat Irmak, Felipe Viana, Ali Gordon *University of Central Florida, USA*	
11:45	**GT2019-90098** **A Model for System Instability Analysis in a Multi-Stage Intercooled Industrial Compressor** Jiaye Gan, Ahmed Abdelwahab, Viktor Kilchyk *Praxair, USA*	**GT2019-90351** **Parametric Design of Blisk Repairs by Patching Considering High Cycle Fatigue** Ricarda Berger, Benedikt Hofmeister, Cristian G. Gebhardt, Raimund Rolfes *Leibniz University Hannover, Institute of Structural Analysis, Germany*	

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	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS	STRUCTURES & DYNAMICS: AERODYNAMIC EXCITATION & DAMPING	SUPERCRITICAL CO2 POWER CYCLES
	Fluid Film Bearings	**Aerodynamic Excitation Mechanisms**	**Testing of sCO2 Power Cycles**
	Technical Session • 128-B • ThB-34-7	**Technical Session • 127-C • ThB-36-6**	**Technical Session • 123 • ThB-38-5**
	Session Organizer: **Kostandin Gjika**, Garrett - Advancing Motion Session Co-Organizer: **Pascal Jolly**, Institut Pprime - CNRS - UPR 3346	Session Organizer: **Nikola Kafedzhiyski**, Siemens Industrial Trubomachinery AB Session Co-Organizer: **Christoph Brandstetter**, Ecole Centrale De Lyon - Laboratoire De Mecanique Des Fluides Et D'Acoustique	Session Organizer: **Nathan T. Weiland**, National Energy Technology Laboratory Session Co-Organizer: **Eric Clementoni**, Naval Nuclear Laboratory
10:15	**GT2019-90488** **Static Stiffness Measurements for a Thrust Collar Used in an Integrally Geared Compressor** Thomas Kerr[1] Adolfo Delgado[1] Dara W. Childs[2] *1. Texas A&M University, USA; 2. Turbomachinery Laboratory, Texas A&M University, USA*	**GT2019-90387** **A Method to Evaluate the Sensitivity of Aerodynamic Damping to Mode Shape Perturbations** Jing Li, Suryarghya Chakrabarti, Wei-Min Ren *GE Global Research, USA*	**GT2019-90337** **Development of a 250-kWe Class Supercritical Carbon Dioxide Rankine Cycle Power Generation System and its Core Components** JeongMin Seo, Won Chul Choi, HyungSoo Lim, MooRyong Park, Dong Ho Kim, KongHoon Lee, EuiSoo Yoon *Korea Institute of Machinery and Materials, Korea*
10:45	**GT2019-90504** **Computational Analysis of the Equalization Behavior of Thrust Bearings With Regular and Modified Leveling Plates** Seckin Gokaltun, Ascanio De Camillo *Kingsbury Inc., USA*	**GT2019-90541** **Reducing Blade Force Response in a Radial Turbine by Means of Jet Injection** Stephan Netzhammer[1] Damian Vogt[2] Stephan Kraetschmer[1] Johannes Leweux[1] Jennifer Blackburne[3] *1. Daimler AG, Germany; 2. University of Stuttgart, Germany; 3. ITSM, University of Stuttgart, Germany*	**GT2019-90681** **Development of a Hundreds of kWe-Class Supercritical Carbon Dioxide Power Cycle Test Loop in KIER** Bongsu Choi, Junhyun Cho, Hyungki Shin, Jongjae Cho, Chulwoo Roh, Beomjoon Lee, Gilbong Lee, Ho-Sang Ra, Young-Jin Baik *Korea Institute of Energy Research, Korea*
11:15	**GT2019-90951** **Nonlinear Vibration Prediction of a Highly Flexible Rotor Supported by an Axial Groove Journal Bearing Considering Journal Angular Whirling Motion** Nuntaphong Koondilogpiboon, Tsuyoshi Inoue *Nagoya University, Japan*	**GT2019-91359** **Evaluating Splitter Blade Designs to Avoid Impeller Failure in a High-Speed Unshrouded Centrifugal Compressor** Alex Curtin[1] Reid A. Berdanier[2] Robert F. Kunz[2] Michael L. Jonson[2] *1. FS-Elliott, USA; 2. The Pennsylvania State University, USA*	**GT2019-91391** **An Overview of Initial Operational Experience With the Closed-Loop sCO2 Test Facility at Cranfield University** Eduardo Anselmi[1] Ian Bunce[2] Vassilios Pachidis[1] *1. Cranfield University, United Kingdom; 2. Rolls-Royce, United Kingdom*
11:45	**GT2019-91984** **Response Surface Mapping and Multi-Objective Optimization of Crowning and Tapers in Water-Lubricated Thrust Bearings** Xin Deng, Cori Watson, Minhui He, Roger Fittro, Houston Wood *University of Virginia, USA*	**GT2019-90366** **Prediction of Low-Engine-Order Excitation due to a Non-Symmetrical Nozzle Ring in a Radial Turbine by Means of the Nonlinear Harmonic Approach** Nikola Kovachev[1] Tobias Mueller[1] Christian Waldherr[1] Damian Vogt[2] *1. ITSM, University of Stuttgart, Germany; 2. University of Stuttgart, Germany*	**GT2019-91772** **Compact Heat Exchanger Semi-Circular Header Burst Pressure and Strain Validation** Blake W. Lance, Matthew D. Carlson *Sandia National Laboratories, USA*

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	TURBOMACHINERY: AXIAL FLOW FAN & COMPRESSOR AERODYNAMICS	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY	TURBOMACHINERY: UNSTEADY FLOWS IN TURBOMACHINERY
	Inlet Distortion	**Multi-physics or Multi-component Design Methods and Applications**	**Stall and Surge II**
	Technical Session • 124-B • ThB-39-6	**Technical Session • 126-ABC • ThB-41-8**	**Technical Session • 125-AB • ThB-45-2**
	Session Organizer: **Henner Schrapp**, Rolls-Royce Deutschland Session Co-Organizer: **Alexander Hergt**, German Aerospace Center (DLR)	Session Organizer: **Peter Flassig**, Rolls-Royce Deutschland Session Co-Organizer: **Alexander Krumme**, German Aerospace Center DLR	Session Organizer: **Michael Macrorie**, GE Aviation Session Co-Organizer: **Mark Celestina**, NASA Glenn Research Center
10:15	**GT2019-90425** **Aerodynamic Comparison Between Circumferential and Wing-Embedded Inlet Distortion for an Ultra-High Bypass Ratio Fan Stage** Daniel Giesecke, Jens Friedrichs *Technical University of Braunschweig, Germany*	**GT2019-90110** **A Methodology for Steady and Unsteady Full-Engine Simulations** Luigi Romagnosi, Yingchen Li, Mohamed Mezine, Mateus Teixeira, Stephane Vilmin, Jan Anker, Kilian Claramunt, Yannick Baux, Charles Hirsch *NUMECA Int., Belgium*	**GT2019-91139** **Numerical Investigations on the Key Contributing Factor and Flow Features of Compressor Stall Hysteresis** Zhiping Li, Dong Yang, Peng Zhang, Xinyu Gong *Beihang University, China*
10:45	**GT2019-90471** **Efficient Design Investigation of a Turbofan in Distorted Inlet Conditions** Benjamin Godard[1] Edouard De Jaeghere[2] Nicolas Gourdain[3] *1. ONERA, France; 2. Safran Aircraft Engines, France; 3. ISAE-SUPAERO, France*	**GT2019-90352** **Modelling the Unsteady Dynamics of a Turbine Research Facility** John Longley *Cambridge University, United Kingdom*	**GT2019-91498** **Circumferential Propagation Characteristic of Unsteady Flow in a Subsonic Axial Flow Compressor Rotor at Different Reynolds Numbers** Zhiyang Chen, Yanhui Wu, Yanwen Zhang, Junwen Gan, Jinhuaiyuan An *Northwestern Polytechnical University, China*
11:15	**GT2019-91753** **Radial Variation in Distortion Transfer and Generation in a Highly Loaded Fan Stage From Near-Stall to Choke** Daniel Soderquist[1] Andrew Orme[1] Steven Gorrell[1] Mike List[2] *1. Brigham Young University, USA; 2. Air Force Research Laboratory, USA*	**GT2019-90325** **Modeling of Combustor and Turbine Vane Interaction** Ishan Verma[1] Laith Zori[2] Jaydeep Basani[3] Samir Rida[4] *1. ANSYS Inc., India; 2. ANSYS Inc., USA; 3. Honeywell Technology Solutions, India; 4. Honeywell Aerospace, USA*	**GT2019-92034** **Experimental Study on the Influence of Casing Treatment on Near-Stall Unsteady Behavior of a Mixed-Flow Compressor** Juan Du[1] Felix Kauth[2] Jichao Li[1] Qianfeng Zhang[3] Joerg Seume[4] *1. Institute of Engineering Thermalphysics, Chinese Academy of Sciences, China; 2. Leibniz University of Hannover, Germany; 3. Institute of Engineering Thermophysics, Chinese Academy of Sciences, China; 4. Gottfried Wilhelm Leibniz Universitaet, Germany*
11:45	**GT2019-92073** **Swirl Distortion Using Stream Vanes for Boundary Layer Ingestion Research** Julia Stephens, Mark Celestina, Christopher Hughes *NASA Glenn Research Center, USA*	**GT2019-90483** **Evaluation of the Numerical Modelling of a High Pressure Turbine Test Rig** David Luquet, François Julienne, Aurélien Arntz, Eric Lippinois *Safran Aircraft Engines, France*	**GT2019-90857** **Impact of Exit Duct Dynamic Response on Compressor Stability** Wenqiang Zhang, Mehdi Vahdati, Fanzhou Zhao *Imperial College London, United Kingdom*

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	TURBOMACHINERY: MULTIDISCIPLINARY DESIGN APPROACHES, OPTIMIZATION & UNCERTAINTY QUANTIFICATION	WIND ENERGY	TURBOMACHINERY: TUTORIALS
	Endwall and Leakage Flows, and Associated Control	**Condition Monitoring and Reliability**	**A Pragmatic Approach to CFD - Best Practices for Industrial Flows and Turbomachinery**
	Technical Session • 127-B • ThB-46-5	**Technical Session • 131-A • ThB-48-1**	**Tutorial Session • 127-A • ThB-52-4**
	Session Organizer: **Marcus Meyer**, Rolls-Royce Deutschland Ltd & Co KG	Session Organizer: **Georgios Pechlivanoglou**, Eunice Wind Session Co-Organizer: **Shuangwen Sheng**, National Renewable Energy Laboratory	Session Organizer: **Jeff Defoe**, University of Windsor
10:15	**GT2019-90191** **Thermal End-Wall Contouring** Dajan Mimic[1] Marcel Oettinger[1] Christoph Jaetz[1] Florian Herbst[1] Joerg Seume[2] *1. Leibniz Universitaet Hannover, Germany; 2. Gottfried Wilhelm Leibniz Universitaet, Germany*	**GT2019-90015** **Modelling the Effects of Reliability and Maintenance on Levelised Cost of Wind Energy** Cuong Dao, Behzad Kazemtabrizi, Christopher Crabtree *Durham University, United Kingdom*	**GT2019-92118** **A Pragmatic Approach to CFD - Best Practices for Industrial Flows and Turbomachinery** Robin Steed [1] Paul F. Galpin [2] *1. ANSYS, Inc., Canada; 2. Isimq Ltd., Canada*
10:45	**GT2019-90744** **Aerodynamic Topology Optimization for Tip Configurations of Turbine Blades** Min Zhang, Yan Liu, Jinguang Yang *Dalian University of Technology, China*	**GT2019-91136** **Condition Monitoring of Wind Turbine Planetary Gearboxes Under Different Operating Conditions** Alexandre Mauricio[1] Shuangwen Sheng[2] Konstantinos Gryllias[1] *1. KU Leuven, Belgium; 2. National Renewable Energy Laboratory, USA*	**T U T O R I A L**
11:15	**GT2019-90199** **Study on Leakage Loss Control Method of Circumferential Bending Clearance** Shuai Jiang, Fu Chen, Jianyang Yu, Chen Shaowen, Yanping Song *Harbin Institute of Technology, China*	**GT2019-91533** **A Prognostics and Health Management Framework for Wind** Shuangwen Sheng, Yi Guo *National Renewable Energy Laboratory, USA*	
11:45	**GT2019-90208** **Optimization and Evaluation of Multiple DBD Plasma Actuators Applied in the Tip Leakage Control for Turbine Cascade** Jianyang Yu[1] Wenchun Bao[2] Fu Chen[1] Yanping Song[1] Cong Wang[1] *1. Harbin Institute of Technology, China; 2. Beijing Institute of Space System Engineering, China*	**GT2019-91862** **Dynamic Characterization of a Two Degree of Freedom Planetary Gearbox During Varying Load Conditions** Claudia Gonzalez-Cruz[1] Juan Jauregui[2] Marco Ceccarrelli[1] *1. University of Cassino, Italy; 2. University of Queretaro, Mexico*	

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EXHIBITOR PRESENTATIONS

Thursday Exhibit Hall Presentations

Technical Session • Exhibit Hall Presentation Stage • 53-3

12:45

GT2019-92329
Overview of the US DOE's Advanced Turbines
Richard Dennis
U.S. Department of Energy, National Energy Technology Laboratory, USA

1:30

GT2019-92208
ASME Turbo Expo Closing Ceremony and Kick-Off for London, England

THURSDAY JUNE 20 — 02:00 PM - 03:30 PM

	AIRCRAFT ENGINE	CERAMICS	COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS
	Basics of Gas Turbine Engine (GTE) Core	**CMC Behavior: Fast Fracture-1**	**Alternative Gaseous Fuels III**
	Tutorial Session • 124-A • ThC-1-14	**Technical Session • 221-C • ThC-2-2Part A**	**Technical Session • 122-A • ThC-3-6**
	Session Organizer: **Keith Boyer**, Practical Aeronautics Session Co-Organizer: **Kenneth Van Treuren**, Baylor University	Session Organizer: **Rajesh Kumar**, United Technologies Research Ctr Session Co-Organizer: **Anindya Ghoshal**, U.S. Army Research Laboratory	Session Organizer: **Pierre Gauthier**, Siemens
2:00	**GT2019-92154** **Basics of Gas Turbine Engine (GTE) Core** Keith Boyer[1] Kenneth Van Treuren[2] *1. Practical Aeronautics, USA; 2. Baylor University, USA*	**GT2019-90356** **Characterisation of SiCf/SiC Specimens Using an In-Situ Tensile Stage Within a Scanning Electron Microscope** Stephen P. Jordan[1] Martin R. Bache[2] Christopher Newton[2] Louise Gale[3] *1. Institute of Structural Materials, United Kingdom; 2. Swansea University, United Kingdom; 3. Rolls-Royce plc, United Kingdom*	**GT2019-91404** **Gas Turbine Co-Firing of Steelworks Ammonia With Coke Oven Gas or Methane: a Fundamental and Cycle Analysis** Sally G. Hewlett, Agustin Valera-Medina, Daniel Pugh, Philip J. Bowen *Cardiff University, United Kingdom*
2:30	T U T O R I A L	**GT2019-90357** **Mechanical Damage Accumulation in SiCF/SiC CMCs Characterised via In-Situ Computed X-Ray Tomography** Eleri Weston[1] P. Ian Nicholson[1] Stephen Pattison[2] Martin R. Bache[3] *1. TWI Technology Centre Wales, United Kingdom; 2. Rolls-Royce plc, United Kingdom; 3. Swansea University, United Kingdom*	**GT2019-91978** **Auto Ignition Study of Methane and Bio Alcohol Fuel Blends** Xuan Zheng, Shirin Jouzdani, Benjamin Akih Kumgeh *Syracuse University, USA*
3:00		**GT2019-91908** **Effect of Microporosity on Damage Initiation in Ceramic Matrix Composites** Suhasini Gururaja, Abhilash Nagaraja *Indian Institute of Science, India*	**GT2019-92086** **CO Time-Histories During Oxy-Methane Combustion in a CO2 Environment** Owen Pryor, Erik Ninnemann, Subith Vasu *University of Central Florida, USA*

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	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS	CYCLE INNOVATIONS
	Combustor Flowfields - 1	**Fuel Effects - 1**	**Introduction to Dynamic Analysis and Hybridisation of Plant Systems**
	Technical Session • 121-AB • ThC-4-15Part A	**Technical Session • 121-C • ThC-4-19Part A**	**Tutorial Session • 221-B • ThC-6-12Part A**
	Session Organizer: **Benjamin L. Emerson**, Georgia Institute of Technology Session Co-Organizer: **David Noble**, Electric Power Research Institute	Session Organizer: **Bhupendra Khandelwal**, University of Sheffield Session Co-Organizer: **Mike Klassen**, Combustion Science & Engineering, Inc.	Session Organizer: **Alberto Traverso**, University of Genoa
2:00	**GT2019-90144** **Time-Volume Estimation of Velocity Fields From Non-Synchronous Planar Measurements Using Linear Stochastic Estimation** Daniel Butcher, Adrian Spencer *Loughborough University, United Kingdom*	**GT2019-90672** **Evaluation of Arabian Super Light and Arabian Extra Light Crude Oil for Use in Dry Low NOx (DLN) Combustion Systems** Jeffrey Goldmeer[1] Paul Glaser[2] Bassam Mohammad[3] *1. GE Energy, USA; 2. GE Power, USA; 3. GE Global Research, USA*	**GT2019-92070** **Introduction to Dynamic Analysis and Hybridisation of Plant Systems** Alberto Traverso[1] S.C. John Gulen[2] Kihyung Kim[3] Alessandro Ramaglia[4] *1. University of Genoa, Italy; 2. Bechtel Infrastructure and Power, USA; 3. Praxair, USA; 4. Ansaldo Energia, Italy* **T U T O R I A L**
2:30	**GT2019-90438** **Prediction of the Flow Response of a Turbulent Flame to Acoustic Pertubations Based on Mean Flow Resolvent Analysis** Thomas Ludwig Kaiser[1] Lutz Lesshafft[2] Kilian Oberleithner[3] *1. Institut für Strömungsmechanik und Technische Akustik - TU Berlin, Germany; 2. Laboratoire d'Hydrodynamique, France; 3. Flow Instabilities and Dynamics, TU Berlin, Germany*	**GT2019-90903** **Effect of Natural Gas Composition on Low NOx Burners Operation in Heavy Duty Gas Turbine** Serena Romano[1] Matteo Cerutti[1] Giovanni Riccio[1] Antonio Andreini[2] Christian Romano[1] *1. Baker Hughes, a GE company, Italy; 2. University of Florence, Italy*	
3:00	**GT2019-91713** **Lagrangian Saddle Point Analysis in the Flow-Field of a Bluff-Body Stabilized Combustor** C.P. Premchand[1] Nitin B. George[2] Manikandan Raghunathan[2] Vishnu R. Unni[2] R.I. Sujith[2] Vineeth Nair[1] *1. Indian Institute of Technology Bombay, India; 2. Indian Institute of Technology Madras, India*	**GT2019-91896** **Impact of Fuel Composition on Gas Turbine Engine Performance** Daniel Burnes, Alejandro Camou *Solar Turbines, USA*	

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	ELECTRIC POWER	HEAT TRANSFER: COMBUSTORS (WITH COMBUSTION, FUELS & EMISSIONS)	HEAT TRANSFER: EXPERIMENTAL FILM COOLING
	Path Forward: Gas Turbine Technology	**Combustor Liner Cooling I**	**Experimental Film Cooling V**
	Panel Session • 122-BC • ThC-8-5Part A	**Technical Session • 131-C • ThC-17-2**	**Technical Session • 132-AB • ThC-19-5**
	Session Organizer: **Tom Christiansen**, Strategic Power Systems, Inc.	Session Organizer: **Chiyuki Nakamata**, IHI Corporation Session Co-Organizer: **Riccardo Da Soghe**, Ergon Research	Session Organizer: **John Clark**, Air Force Research Laboratory Session Co-Organizer: **Richard Anthony**, Air Force Research Laboratory
2:00	**GT2019-92299** **Siemens Power Corporation – The Path Forward for Gas Turbine Technology** Pratyush Nag *Siemens Power Gen Inc, USA* **GT2019-92309** **MHPS - The Path Forward for Gas Turbine Technology** Eisaku Ito *Mitsubishi Heavy Industries Ltd., Japan*	**GT2019-90885** **Numerical Simulation of Combustor Effusion Cooling Flow Based on Source Term Method** Jing Wang[1] Ronghai Mao[1] Wenjie Tao[1] Zhichao Wang[2] Chi Zhang[2] Yuzhen Lin[2] *1. AECC Commercial Aircraft Engine CO., LTD, China; 2. Beihang University, China*	**GT2019-91522** **Effects on Heat Transfer Coefficient and Adiabatic Effectiveness in Combined Backside and Film Cooling With Short-Hole Geometry** Renzo Larosa[1] Jaideep Pandit[1] Wing Ng[1] Brett Barker[2] *1. Virginia Polytechnic Institute and State University, USA; 2. Rolls-Royce, USA*
2:30	**P A N E L**	**GT2019-91423** **Modeling Effusion Cooling and Conjugate Heat Transfer Using Local Source Method** Kalyana Gottiparthi[1] Changmin Cao[2] Vaidya Sankaran[3] *1. United Technologies Research Center, USA; 2. United Technologies Research Center (China), China; 3. United Technologies Corp, USA*	**GT2019-91537** **Experimental Evaluation of Heat Transfer in a High Temperature High Pressure Test Facility** Sridharan Ramesh[1] Edward Robey[2] Douglas Straub[3] Jim Black[4] *1. National Energy Technology Laboratory (WVURC), USA; 2. US DOE/National Energy Technology Laboratory -- AECOM, USA; 3. U.S. Dept of Energy, USA; 4. National Energy Technology Laboratory, USA*
3:00		**GT2019-91437** **Multiphysics Numerical Investigation of an Aeronautical Lean Burn Combustor** Davide Bertini, Lorenzo Mazzei, Antonio Andreini, Bruno Facchini *University of Florence, Italy*	**GT2019-92057** **Influence of Hole Inlet Geometry on the Film Cooling Effectiveness From Shaped Film Cooling Holes** Travis Watson[1] Kyle Vinton[1] Lesley Wright[2] Daniel Crites[3] Mark Morris[3] Ardeshir Riahi[3] *1. Baylor University, USA; 2. Texas A&M University, USA; 3. Honeywell Aerospace, USA*

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	HEAT TRANSFER: ADDITIVE MANUFACTURING	OIL & GAS APPLICATIONS	ORGANIC RANKINE CYCLE POWER SYSTEMS
	Heat Transfer: Additive Manufacturing II	**Performance Analysis**	**Organic Rankine Cycle Design and Exploitation**
	Technical Session • 131-B • ThC-21-2Part A	**Technical Session • 130 • ThC-27-8**	**Technical Session • 221-A • ThC-28-1**
	Session Organizer: **Hyung Hee Cho**, Yonsei University Session Co-Organizer: **Dong-Ho Rhee**, Korea Aerospace Research Institute	Session Organizer: **Natalie Smith**, Southwest Research Institute	Session Organizer: **Teemu Turunen-Saaresti**, Lappeenranta University of Technology
2:00	**GT2019-90862** **Effect of Additive Manufacturing Process Parameters on Turbine Cooling** Jacob Snyder[1] Karen Thole[2] *1. Penn State University, USA; 2. Pennsylvania State University, USA*	**GT2019-90871** **The Impact of Model Assumptions on the CFD Assisted Design of Gas Turbine Packages** Gabriele Lucherini[1] Vittorio Michelassi[2] Stefano Minotti[1] *1. Baker Hughes, a GE Company, Italy; 2. General Electric, Italy*	**GT2019-90170** **Assessment of an Innovative Technique for the Robust Optimization of Organic Rankine Cycles** Aldo Serafino[1,2] Benoit Obert[1] Hayato Hagi[1] Paola Cinnella[2] *1. ENERTIME, France; 2. École Nationale Supérieure d'Arts et Métiers, France*
2:30	**GT2019-90877** **Performance of Public Film Cooling Geometries Produced Through Additive Manufacturing** Jacob Snyder, Karen Thole *Pennsylvania State University, USA*	**GT2019-90942** **Transient Loading on Turbomachinery Packages due to Pressure Waves Caused by Accidental Deflagration Events** Hannes Gauch[1] Valentina Bisio[2] Stefano Rossin[2] Francesco Montomoli[1] Vito Tagarielli[1] *1. Imperial College London, United Kingdom; 2. Baker Hughes, a GE Company, Italy*	**GT2019-90758** **Experimental Study on Combined Ocean Thermal Energy Conversion in South Korea** Sanghyup Lee, Hoon Jung *KEPCO/KEPRI, Korea*
3:00	**GT2019-90931** **Flow in a Scaled Turbine Coolant Channel With Roughness due to Additive Manufacturing** David R. Hanson[1] Stephen McClain[2] Jacob Snyder[1] Robert F. Kunz[1] Karen Thole[1] *1. The Pennsylvania State University, USA; 2. Baylor University, USA*	**GT2019-91053** **Field Qualification of an Improved DLE Gas Turbine Control Algorithm to Reduce Part Load Emissions** Luke Cowell, James Roesch, Alejandro Camou, Timothy Caron, Jason Ritchie, Ivan Carlos *Solar Turbines Inc., USA*	**GT2019-91609** **Development and Commissioning of a Blowdown Facility for Dense Gas Vapours** Miles Robertson, Peter Newton, Tao Chen, Ricardo Martinez-Botas *Imperial College London, United Kingdom*

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	STEAM TURBINES	STRUCTURES & DYNAMICS: EMERGING METHODS IN DESIGN & ENGINEERING	STRUCTURES & DYNAMICS: FATIGUE, FRACTURE & LIFE PREDICTION
	High Temperature Research in Mechanical Integrity I	**Emerging Methods on Structural Design System**	**Fatigue Crack Growth Analysis**
	Technical Session • 127-A • ThC-29-11	**Technical Session • 128-B • ThC-30-2**	**Technical Session • 127-C • ThC-31-6**
	Session Organizer: **Andreas Fischersworring-Bunk**, MTU Aero Engines AG Session Co-Organizer: **Klaus Helbig**, GE Power	Session Organizer: **Bernd Beirow**, Brandenburg University of Technology Session Co-Organizer: **Onome Scott-Emuakpor**, Air Force Research Laboratory	Session Organizer: **Youri Lenets**, Honeywell Aerospace Session Co-Organizer: **Wieslaw Beres**, NRC-CNRC
2:00	**GT2019-90909** **Aspects of Creep Fatigue Lifetime Assessment for High Temperature Components With Accumulative Model** Stefan Linn[1] Christian Kontermann[2] Matthias Oechsner[2] *1. Fachgebiet und Institut fuer Werkstoffkunde, TU Darmstadt, Germany; 2. Chair and Institute for Materials Technology, TU Darmstadt, Germany*	**GT2019-90262** **Estimation of Forcing Function, Mistuning and Modal Damping in a Bladed Rotor** Arjun Chauhan, Alok Sinha *Pennsylvania State University, USA*	**GT2019-90373** **Diagnostics of Fatigue Crack in the Shaft Using Spectral Kurtosis** Sagi Rathna Prasad, A S Sekhar *Indian Institute of Technology Madras, India*
2:30	**GT2019-91450** **Application Concepts and Experimental Validation of Constitutive Material Models for Creep-Fatigue Assessment of Components** Christian Kontermann[1] Stefan Linn[2] Matthias Oechsner[1] *1. Chair and Institute for Materials Technology, TU Darmstadt, Germany; 2. Fachgebiet und Institut fuer Werkstoffkunde, TU Darmstadt, Germany*	**GT2019-90972** **High Fidelity Simulation of Fluid-Structure Interaction in a 1½ Stage Axial Turbine** Joshua Zorn[1] Roger Davis[1] John Clark[2] *1. University of California, Davis, USA; 2. Air Force Research Laboratory, USA*	**GT2019-91630** **Life Assessment of Large Gas Turbine Blades** Santosh B Narasimhachary[1] Kyle Smith[2] Sachin Shinde[2] Christian Amann[3] Kai Kadau[4] Saiganesh Iyer[2] *1. Siemens Corporate Technology, USA; 2. Siemens Energy, USA; 3. Siemens, Germany; 4. Siemens, USA*
3:00	**GT2019-92028** **Towards a Better Understanding of Crack Growth in Nickel-Cast Alloys Under Creep-Fatigue and Thermo-Mechanical Fatigue Conditions** Karl Michael Kraemer, Falk Mueller, Christian Kontermann, Matthias Oechsner *Chair and Institute for Materials Technology, TU Darmstadt, Germany*	**GT2019-91112** **Reduced-Scale Model Design for a High-Speed Rotor System Based on Similitude Theory** Biao Zhou[1] Haotian Liang[1] Hui Miao[1] Chaoping Zang[2] *1. Nanjing University of Aeronautics and Astronautics, China; 2. The College of Energy and Power Engineering, China*	**GT2019-91860** **Confidence Bound Estimation for Mechanism-Based Small Crack Growth Probabilistic Design Life Predictions** Patrick Golden[1] Sushant Jha[2] James Larsen[1] *1. Air Force Research Laboratory, USA; 2. University of Dayton Research Institute, USA*

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	STRUCTURES & DYNAMICS: ROTORDYNAMICS	STRUCTURES & DYNAMICS: STRUCTURAL MECHANICS, VIBRATION & DAMPING	SUPERCRITICAL CO2 POWER CYCLES
	Experiments and Special Investigations	**Turbomachinery Aeromechanics**	**Components, Subsystems and Materials for SCO2 Power Cycles**
	Technical Session • 128-A • ThC-33-5	**Tutorial Session • 129-AB • ThC-35-12**	**Panel Session • 123 • ThC-38-19PartA**
	Session Organizer: **Mateusz Golebiowski**, General Electric (Switzerland) GmbH Session Co-Organizer: **Almudena Vega**, Siemens Gamesa	Session Organizer: **Luigi Carassale**, University of Genova	Session Organizer: **Richard Dennis**, U.S. Department of Energy, National Energy Technology Laboratory Session Co-Organizer: **Rajgopal Vijaykumar**, US Department of Energy
2:00	**GT2019-90017** **Determination of the Vibration Within a Squeeze-Film Damper Under Rotational Unbalance Conditions From Externally Mounted Sensors** Ghaith Ghanim Hameed Al-Ghazal[1] Philip Bonello[1] Sergio Guillermo Torres Cedillo[2] *1. University of Manchester, United Kingdom; 2. Centro Tecnológico Aragón, FES Aragón, Universidad Nacional Autonoma de Mexico (UNAM), Mexico*	**GT2019-92069** **Introduction to Turbomachinery Aeromechanics (No Equations) - Just Pictures and Movies** Matthew Montgomery *Doosan ATSA, USA* **T U T O R I A L**	**GT2019-92306** **Material Performance in SCO2 Environments** Bruce A. Pint *Oak Ridge National Laboratory, USA* **GT2019-92351** **Components, Subsystems and Materials for SCO2 Power Cycles** Timothy Held *Echogen, USA* **GT2019-92390** **Component technology roadmaps driving towards commercial application for sCO2 Power cycles** Jason Mortzheim *GE Energy, USA* **P A N E L**
2:30	**GT2019-90417** **Rotordynamic Stability Evaluation With Constructed Forward Whirl Signals Based on Full Spectrum Technique: Numerical and Experimental Investigation** Qihang Li, Chu Fulei *Tsinghua University, China*		
3:00	**GT2019-91926** **Experimental Validation of Friction Models for Rotor-Rubbing** Juan Jauregui[1] Oscar De Santiago Duran[2] *1. University of Queretaro, Mexico; 2. ETU I+D, Mexico*		

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	TURBOMACHINERY: AXIAL FLOW TURBINE AERODYNAMICS	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY	TURBOMACHINERY: RADIAL TURBOMACHINERY AERODYNAMICS
	Low Pressure Turbine Aerodynamics	**Radial Turbomachinery Design Methods and Applications - Part A**	**Centrifugal Compressors 6**
	Technical Session • 125-AB • ThC-40-4PartA	**Technical Session • 124-B • ThC-41-16**	**Technical Session • 127-B • ThC-44-7**
	Session Organizer: **Reid A. Berdanier**, Pennsylvania State University Session Co-Organizer: **Michal Siorek**, Solar Turbine	Session Organizer: **Mark Anderson**, Concepts NREC Session Co-Organizer: **Asad Asghar**, Royal Military College	Session Organizer: **Friedrich Froehlig**, MTU Friedrichshafen Gmbh Session Co-Organizer: **Jan Ehrhard**, Continental Automotive GmbH
2:00	**GT2019-90408** **Parametric Studies on Aerodynamic Performance of Various Types of LP Turbine Airfoils for Aero-Engines Under the Influence Periodic Wakes and Freestream Turbulence** Ken-ichi Funazaki[1] Daichi Murakami[2] Yasuhiro Okamura[2] *1. Iwate University, Japan; 2. IHI Corporation, Japan*	**GT2019-90134** **Effect of Tip Clearance on Rotating Stall in a Mixed-Flow Pump** Wei Li[1] Ramesh Agarwal[2] Ling Zhou[1] Enda Li[3] Leilei Ji[3] *1. Jiangsu University-National Research Center of Pumps, China; 2. Washington University, USA; 3. Jiangsu University, China*	**GT2019-90217** **Tip Leakage Flow Instability in a Centrifugal Compressor** Teng Cao[1] Tadashi Kanzaka[2] Liping Xu[3] Tobias Brandvik[4] *1. University of Cambridge, Whittle Laboratory, United Kingdom; 2. Mitsubishi Heavy Industries Europe, United Kingdom; 3. University of Cambridge, United Kingdom; 4. Turbostream, United Kingdom*
2:30	**GT2019-91280** **Reducing Secondary Flow Losses in Low-Pressure Turbines With Blade Fences: Part I – Design in an Engine-Like Environment** Filippo Rubechini[1] Matteo Giovannini[1] Andrea Arnone[1] Daniele Simoni[2] Francesco Bertini[3] *1. University of Florence, Italy; 2. DIMSET University of Genova, Italy; 3. GE AvioAero Srl, Italy*	**GT2019-90165** **Investigation and Prediction Models of the Axial Thrust in Centrifugal Compressors** Mohand Younsi, Eric Hypolite *Sundyne International SA, France*	**GT2019-91967** **High Pressure Novel Single Hub Multi-Rotor Centrifugal Compressor: Performance Prediction and Loss Analysis** Sai Muppana, Kiran Siddappaji, Shaaban Abdallah *University of Cincinnati, USA*
3:00	**GT2019-91284** **Reducing Secondary Flow Losses in Low-Pressure Turbines With Blade Fences: Part II – Experimental Validation on Linear Cascades** Matteo Giovannini[1] Filippo Rubechini[1] Giorgio Amato[1] Andrea Arnone[1] Daniele Simoni[2] Vianney Yepmo[3] Francesca Satta[3] Francesco Bertini[4] *1. University of Florence, Italy; 2. DIMSET University of Genova, Italy; 3. University of Genova, Italy; 4. GE AvioAero Srl, Italy*	**GT2019-90310** **Influence of Thermodynamic and Regime Parameters on the Efficiency of a System of Series Connected Low-Power Natural Gas Turbogenerators** Dmitry S. Kalabukhov *Samara National Research University, Russia*	**GT2019-92056** **Considerations for Using Additive Manufacturing Technology in Centrifugal Compressor Research** Matthew Meier, William J. Gooding, John C. Fabian, Nicole Key *Purdue University, USA*

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	TURBOMACHINERY: MULTIDISCIPLINARY DESIGN APPROACHES, OPTIMIZATION & UNCERTAINTY QUANTIFICATION	WIND ENERGY	
	UQ, Manufacturing Uncertainties & FOD	**Blade and Airfoil Aerodynamics**	
	Technical Session • 126-ABC • ThC-46-2PartA	**Technical Session • 131-A • ThC-48-6**	
	Session Organizer: **Rémy Nigro**, Safran Aero Boosters	Session Organizer: **Lorenzo Ferrari**, University of Pisa - DESTEC Session Co-Organizer: **Alexandrina Untaroiu**, Virginia Tech	
2:00	**GT2019-90378** **A Novel Methodology for Detecting Foreign Object Damage on Compressor Blading** Paul Voigt[1] Matthias Voigt[1] Ronald Mailach[1] Daniel Münzinger[2] Kimon Abu-Taa[3] Alexander Lange[4] *1. Technische Universität Dresden, Germany; 2. GWT-TUD GmbH, Germany; 3. Rolls-Royce Deutschland Ltd & Co KG, Germany; 4. FTT Deutschland GmbH, Germany*	**GT2019-90956** **Assessing the Sensitivity of Stall-Regulated Wind Turbine Power to Blade Design Using High-Fidelity CFD** Andrea Giuseppe Sanvito[1] Giacomo Persico[1] Michele Sergio Campobasso[2] *1. Politecnico di Milano, Italy; 2. Lancaster University, United Kingdom*	
2:30	**GT2019-91480** **Aerodynamic Impact of Manufacturing Variation on a Nonaxisymmetric Multi-Passage Turbine Stage With Adjoint CFD** Alexander Liefke[1] Vincent Marciniak[1] Jan Backhaus[2] Christian Frey[2] Hanno Gottschalk[3] Uwe Janoske[3] *1. Siemens AG, Germany; 2. German Aerospace Center (DLR), Germany; 3. Universität Wuppertal, Germany*	**GT2019-91044** **Airfoil Optimization for a Wind Turbine Operating in a Particle-Laden Environment** Aya Diab[1] Ahmed Hossam El-Din[2] *1. Faculty of Engineering - Ain Shams University/ KEPCO International Nuclear Graduate School (KINGS), Egypt; 2. Faculty of Engineering - Ain Shams University, Egypt*	
3:00	**GT2019-91591** **Physics-Based Part Orientation and Sentencing: A Solution to Manufacturing Variability** Wen Yao Lee[1] Bill Dawes[1] John D. Coull[2] *1. Whittle Laboratory, University of Cambridge, United Kingdom; 2. University of Cambridge, United Kingdom*	**GT2019-90500** **Static and Dynamic Analysis of a NACA 0021 Airfoil Section at Low Reynolds Numbers: Drag and Moment Coefficients** David Holst[1] Francesco Balduzzi[2] Alessandro Bianchini[2] Giovanni Ferrara[2] Christian Navid Nayeri[1] Christian Oliver Paschereit[3] *1. H.F.I. Technische Universität Berlin, Germany; 2. Università degli Studi di Firenze, Italy; 3. Technische Universität Berlin, Germany*	

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	AIRCRAFT ENGINE	CERAMICS	COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS
	Operability	**CMC Behavior: Fast Fracture-2**	**Biomass and Coal II**
	Technical Session • 124-A • ThD-1-1	**Technical Session • 221-C • ThD-2-2Part B**	**Technical Session • 122-A • ThD-3-8**
	Session Organizer: **Walter Obrien**, Virginia Tech Session Co-Organizer: **Kevin Shepherd**, Honeywell Aerospace	Session Organizer: **Rajesh Kumar**, United Technologies Research Ctr Session Co-Organizer: **Anindya Ghoshal**, U.S. Army Research Laboratory	Session Organizer: **Marina Braun-Unkhoff**, DLR, Institute of Combustion Technology Session Co-Organizer: **Jeff Bergthorson**, McGill University
4:00	**GT2019-90242** **A Novel Stall Warning Indicator: Part I – Applications and Limitations** Roland Rückert, Mario Eck, Dieter Peitsch, Marc Lehmann *Technical University of Berlin, Germany*	**GT2019-90031** **An Investigation of the End-Notched Flexure and End-Loaded Split Tests Applied to the Mode II Interlaminar Fracture of a SiC/SiC Ceramic Matrix Composite** Mike Presby[1] Manigandan Kannan[1] Gregory Morscher[1] Cody Godines[2] Amir Eftekharian[2] Jalees Ahmad[2] Frank Abdi[2] Sung Choi[3] *1. University of Akron, USA; 2. AlphaSTAR Corporation, USA; 3. Naval Air Systems Command, USA*	**GT2019-91707** **Development and Analysis of an Integrated Mild/Partial Gasification Combined (IMPGC) Cycle: Part 1 – Development of a Baseline IMPGC System** Ting Wang, Henry Long *University of New Orleans, USA*
4:30	**GT2019-90243** **A Novel Stall Warning Indicator: Part II – Underlying Flow Mechanism** Mario Eck, Roland Rückert, Marc Lehmann, Dieter Peitsch *Technical University of Berlin, Germany*	**GT2019-90985** **CMC Mode II Crack Growth Resistance Prediction of ASTM Specimen and Test Validation** Frank Abdi[1] Cody Godines[1] Mike Presby[2] Amir Eftekharian[1] Jalees Ahmad[1] Sung Choi[3] Gregory Morscher[2] Stephen Gonczy[4] Jun Shi[5] *1. AlphaSTAR Corporation, USA; 2. University of Akron, USA; 3. Naval Air Systems Command, USA; 4. Gateway Material Technology, USA; 5. Rolls-Royce Corporation, USA*	**GT2019-91711** **Development and Analysis of an Integrated Mild-Partial Gasification Combined (IMPGC) Cycle: Part 2 – Comparison With Other Power Generation Systems** Henry Long, Ting Wang *University of New Orleans, USA*
5:00	**GT2019-90815** **Experimental Research on the Characteristics of Thermal Bow in an Aeroengine HP Spool** Yu Xiangyu, Zhansheng Liu, Guanghui Zhang, Peng He *Harbin Institute of Technology, China*	**GT2019-90838** **Experimental and Modeling Study on Tension Characteristics of a 2.5D Woven Composites** Xuefeng Teng, Duoqi Shi, Xiaoguang Yang *Beihang University, China*	

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	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS	CYCLE INNOVATIONS
	Combustor Flowfields - 2	**Fuel Effects - 2**	**Introduction to Dynamic Analysis and Hybridisation of Plant Systems (continued)**
	Technical Session • 121-AB • ThD-4-15Part B	**Technical Session • 121-C • ThD-4-19Part B**	**Tutorial Session • 221-B • ThD-6-12Part B**
	Session Organizer: **Benjamin L. Emerson**, Georgia Institute of Technology Session Co-Organizer: **David Noble**, Electric Power Research Institute	Session Organizer: **Bhupendra Khandelwal**, University of Sheffield Session Co-Organizer: **Mike Klassen**, Combustion Science & Engineering, Inc.	Session Organizer: **Alberto Traverso**, University of Genoa
4:00	**GT2019-90284** **Air Splits Research of Multi-Sector Combustor With Flow Network Approach and Experiments** Shanping Shen, Guoqian Song *AECC Commercial Aircraft Engine CO., LTD, China*	**GT2019-91360** **Atmospheric Tests of a Full Scale Gas Turbine Burner Fed With Blast Furnace Gas and Coke Oven Gas** Edoardo Bertolotto[1] Alberto Amato[1] Guoqiang Li[2] *1. Ansaldo Energia, Italy; 2. Shanghai Electric, China*	**GT2019-92344** **Introduction to Dynamic Analysis and Hybridisation of Plant Systems** Alberto Traverso *University of Genoa, Italy* **T U T O R I A L**
4:30	**GT2019-91244** **Experimental Investigation of a RQL Burner With Jet in Cross Flow Fuel Injection: Characterization of the Reacting Flow Field at Realistic Operating Conditions** Thomas Soworka[1] Thomas Behrendt[1] Christoph Hassa[1] Johannes Heinze[1] Eggert Magens[1] Michael M. Schroll[1] Francesca di Mare[2] Steven Ballantyne[3] Jon Gregory[3] *1. DLR - German Aerospace Center, Germany; 2. Ruhr-University Bochum, Germany; 3. Rolls-Royce plc, United Kingdom*	**GT2019-91811** **Thermal Degradation of Biofuels in Contact With Hot Metal Surfaces** Katerina Chagoya, Alan Felix, Fernand Torres, Nicholas Ciaffone, Taylor Pitts, Andres Curbelo, Laurene Tetard, Jayanta Kapat, Richard Blair *University of Central Florida, USA*	
5:00	**GT2019-90601** **Generation and Migration of Hot Streaks Within an LPP Combustor** Wenjie Tao[1] Jing Wang[1] Ronghai Mao[1] Xinyao Wang[2] Chi Zhang[2] Yuzhen Lin[2] *1. AECC Commercial Aircraft Engine CO., LTD, China; 2. Beihang University, China*		

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	EDUCATION	ELECTRIC POWER	HEAT TRANSFER: COMBUSTORS (WITH COMBUSTION, FUELS & EMISSIONS)
	Education Issues - I	**Path Forward: Gas Turbine Technology**	**Combustor Cooling**
	Technical Session • 222-B • ThD-7-1	**Panel Session • 122-BC • ThD-8-5Part B**	**Technical Session • 131-C • ThD-17-3**
	Session Organizer: **Sam Grimshaw**, University of Cambridge Whittle Laboratory Session Co-Organizer: **Ioanna Aslanidou**, Mälardalen University	Session Organizer: **Tom Christiansen**, Strategic Power Systems, Inc.	Session Organizer: **Chiyuki Nakamata**, IHI Corporation Session Co-Organizer: **Riccardo Da Soghe**, Ergon Research
4:00	**GT2019-90535** **Involving Students in the Learning Process: Using Team Competition to Teach Gas Turbine Cycle Design** Kenneth Van Treuren *Baylor University, USA*	**GT2019-92308** **GE – The Path Forward for Gas Turbine Technology** Christian Vandervort *GE Power, USA* **GT2019-92310** **Ansaldo – The Path Forward for Gas Turbine Technology** Mauro Moretto *Ansaldo Energia, Italy*	**GT2019-91425** **Experimental Analysis of an Additively Manufactured Cooled Ultra Compact Combustor Vane** Tylor C. Rathsack, Brian T. Bohan, Marc D. Polanka, James L. Rutledge *Air Force Institute of Technology, USA*
4:30	**GT2019-92060** **Offering Engineering Students Global Prospective Through Experiential Learning Project in Wind Energy and Sustainability** Lamyaa El-Gabry[1] Tina Jaskolski[2] *1. Princeton University, USA; 2. The American University in Cairo, Egypt*	**P A N E L**	
5:00	**GT2019-91616** **An Enhanced Gas Turbine Engine Laboratory: A Learning Platform Supporting an Undergraduate Engineering Curriculum** Andrew T. Bellocchio[1] Michael J. Benson[1] Bret P. Van Poppel[1] Seth A. Norberg[2] Ryan Benz[2] *1. Department of Civil & Mechanical Engineering/ United States Military Academy, USA; 2. United States Military Academy, USA*		

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	HEAT TRANSFER: EXPERIMENTAL FILM COOLING	HEAT TRANSFER: ADDITIVE MANUFACTURING	OIL & GAS APPLICATIONS
	Experimental Film Cooling X	**Heat Transfer: Additive Manufacturing II**	**Upgrades and Updates of Gas Compressors and Gas Turbines**
	Technical Session • 132-AB • ThD-19-10	**Technical Session • 131-B • ThD-21-2Part B**	**Panel Session • 130 • ThD-27-11**
	Session Organizer: **John Clark**, Air Force Research Laboratory Session Co-Organizer: **Richard Anthony**, Air Force Research Laboratory	Session Organizer: **Hyung Hee Cho**, Yonsei University Session Co-Organizer: **Dong-Ho Rhee**, Korea Aerospace Research Institute	Session Organizer: **Klaus Brun**, Elliott Group Session Co-Organizer: **Rainer Kurz**, Solar Turbines
4:00	**GT2019-91696** **Sweeping Jet Film Cooling at High Blowing Ratio on a Turbine Vane** Mohammad Arif Hossain, Ali Ameri, James Gregory, Jeffrey Bons *The Ohio State University, USA*	**GT2019-91057** **Topology Optimization of Serpentine Channels for Minimization of Pressure Loss and Maximization of Heat Transfer Performance As Applied for Additive Manufacturing** Shinjan Ghosh, Jayanta Kapat *University of Central Florida, USA*	**GT2019-92399** **Solar Turbines Update** Rainer Kurz *Solar Turbines, USA* **GT2019-92400** **Elliott Update** Klaus Brun *Elliott Group, USA* **GT2019-92401** **MAN Turbo Update** Kevin Kisor *MAN Turbo, USA* **GT2019-92402** **BHGE Update** Leonardo Baldassarre *BHGE, Italy* **P A N E L**
4:30	**GT2019-91765** **Time-Accurate Evaluation of Film Cooling Jet Characteristics for Plenum and Crossflow Coolant Supplies** Spencer Sperling, Randall Mathison *The Ohio State University, USA*	**GT2019-91949** **Experimental and Numerical Analysis of Additively Manufactured Inconel 718 Coupons With Lattice Structure** Sarwesh Parbat[1] Zheng Min[1] Li Yang[2] Minking Chyu[1] *1. University of Pittsburgh, USA; 2. Shanghai Jiao Tong University, China*	
5:00	**GT2019-91783** **Adiabatic Film Cooling Effectiveness Measurement of High Performance Combustion Liner Slot Jets** Wilmer Flores[1] Andres Curbelo[2] Luisana Calderon[1] Jayanta Kapat[2] Kareem Ahmed[2] *1. CATER/ University of Central Florida, USA; 2. University of Central Florida, USA*		

THURSDAY JUNE 20 — 04:00 PM - 05:30 PM

	STEAM TURBINES	STRUCTURES & DYNAMICS: ROTORDYNAMICS	STRUCTURES & DYNAMICS: AERODYNAMIC EXCITATION & DAMPING
	High Temperature Research in Mechanical Integrity II	**Bearings and seals**	**Aeroelastic Stability of Compressors and Seals**
	Technical Session • 127-A • ThD-29-13	**Technical Session • 128-A • ThD-33-10**	**Technical Session • 128-B • ThD-36-5**
	Session Organizer: **Klaus Helbig**, GE Power	Session Organizer: **Adolfo Delgado**, Texas A&M University Session Co-Chairs: **Daniel Lubell**, Oil-Free Machinery, LLC; **Wan Zhong**, Technip FMC	Session Organizer: **Roque Corral**, ITP Aero Session Co-Organizer: **Nikola Kovachev**, ITSM University of Stuttgart
4:00	**GT2019-91479** **Assessment of Power Plant Components With Flaws and Defects Operating in the Long-Term Creep Range** Magdalena Speicher[1] Thorben Bender[1] Andreas Klenk[1] Falk Mueller[2] Christian Kontermann[2] Juergen Ewald[3] *1. Materials Testing Institute University of Stuttgart, Germany; 2. Chair and Institute for Materials Technology, TU Darmstadt, Germany; 3. Independent Author, Germany*	**GT2019-91544** **High Temperature Magnetic Thrust Bearing: Theory and Experiment** Mohammad W. Mohiuddin[1] Alan Palazzolo[1] Randall P. Tucker[1] Desireddy V. Reddy[1] Andrew Provenza[2] Albert F. Kascak[2] *1. Texas A&M University, USA; 2. NASA Glenn Research Center, USA*	**GT2019-90427** **Numerical and Experimental Studies of Labyrinth Seal Aeroelastic Instability** Toshimasa Miura, Naoto Sakai *Kawasaki Heavy Industries, Ltd., Japan*
4:30	**GT2019-91297** **Probabilistic Lifetime Assessment Approach of 2%-Cr Steel Considering Material and Loading Profile Scatter** Klaus Helbig[1] Dennis Jarmowski[1] Felix Kölzow[2] Christian Kontermann[3] *1. GE Power, Germany; 2. Fachgebiet und Institut fuer Werkstoffkunde, TU Darmstadt, Germany; 3. Chair and Institute for Materials Technology, TU Darmstadt, Germany*	**GT2019-91135** **Transfer Function Modeling and Experimental Variation of Rotor System Considering Morton Effect Caused in Journal Bearing** Shota Yabui[1] Jotaro Chiba[1] Takafumi Suzuki[2] Shigeyuki Tomimatsu[2] Tsuyoshi Inoue[1] *1. Nagoya University, Japan; 2. DMW Corporation, Japan*	**GT2019-91337** **An Inverse Approach to Identify Tuned Aerodynamic Damping, System Frequencies and Mistuning: Part 3 – Application to Engine Data** Felix Figaschewsky[1] Arnold Kuehhorn[1] Bernd Beirow[1] Thomas Giersch[2] Sven Schrape[2] Jens Nipkau[2] *1. Brandenburg University of Technology, Germany; 2. Rolls-Royce Deutschland, Germany*
5:00		**GT2019-90390** **Computational Study of the Non-Parametric Squeeze Film Damper Bearing Inverse Model Based on Artificial Neural Networks Applied to a Rotor-Casing System Running on Unsupported SFDs** Sergio Guillermo Torres Cedillo[1] Ghaith Ghanim Hameed Al-Ghazal[2] Philip Bonello[2] Jacinto Cortés Pérez[1] Alberto Reyes Solis[1] *1. Centro Tecnológico Aragón, FES Aragón, Universidad Nacional Autonoma de Mexico (UNAM), Mexico; 2. University of Manchester, United Kingdom*	**GT2019-91286** **Nonsynchronous Vibration Associated With Transonic Fan Blade Untwist** Yaozhi Lu[1] Bharat Lad[2] Mehdi Vahdati[1] Sina C Stapelfeldt[1] *1. Imperial College London, United Kingdom; 2. Rolls-Royce plc, United Kingdom*

THURSDAY JUNE 20 — 04:00 PM - 05:30 PM

	SUPERCRITICAL CO2 POWER CYCLES	TURBOMACHINERY: AXIAL FLOW TURBINE AERODYNAMICS	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY
	Components, Subsystems and Materials for SCO2 Power Cycles	**Low Pressure Turbine Aerodynamics**	**Radial Turbomachinery Design Methods and Applications - Part 2**
	Panel Session • 123 • ThD-38-19Part B	**Technical Session • 125-AB • ThD-40-4Part B**	**Technical Session • 124-B • ThD-41-17**
	Session Organizer: **Richard Dennis**, U.S. Department of Energy, National Energy Technology Laboratory Session Co-Organizer: **Rajgopal Vijaykumar**, US Department of Energy	Session Organizer: **Reid A. Berdanier**, Pennsylvania State University Session Co-Organizer: **Michal Siorek**, Solar Turbine	Session Organizer: **Asad Asghar**, Royal Military College Session Co-Organizer: **Mark Anderson**, Concepts NREC
4:00	**GT2019-92353** **Heatric 15 years of design evolutions for sCO2 diffusion bonded heat exchangers** Renaud Le Pierres *Heatric, United Kingdom* **GT2019-92355** **Components, Subsystems and Materials for SCO2 Power Cycles** Adam Goff *8 Rivers, USA* **GT2019:92385** **Testing of a 1 MWe Supercritical CO2 Test Loop** J. Jeffrey Moore *Southwest Research Institute, USA*	**GT2019-91820** **Detailed Experimental Measurement and RANS Simulation of a Low Pressure Turbine With High Lift Blading** Ethan Perez[1] John T. Schmitz[2] Nicholas A. Jaffa[3] Aleksandar Jemcov[4] Joshua D. Cameron[1] Scott C. Morris[4] *1. Notre Dame Turbomachinery Laboratory, USA; 2. Williams International, USA; 3. Applied Research Laboratory, Penn State, USA; 4. University of Notre Dame, USA*	**GT2019-90643** **Numerical Simulation and Design Optimization of an Electrical Submersible Power Recovery Turbine** Risa Rutter, Tony Hepp, David Mcmanus *Baker Hughes, a GE company, USA*
4:30	**P A N E L**	**GT2019-91699** **A Low Reynolds Number Experimental Evaluation of Tubercles on a Low-Pressure Turbine Cascade** Stephen Pym[1] Asad Asghar[1] William Allan[1] John Clark[2] *1. Royal Military College of Canada, Canada; 2. Air Force Research Laboratory, USA*	**GT2019-91353** **Numerical Investigation of Vaneless Diffuser by Pinching and Rotation** Niveditha Porika, Bhamidi Prasad *Indian Institute of Technology Madras, India*
5:00			**GT2019-92002** **Low Fidelity Design and Analysis Parametric Tool for General Centrifugal Compressors** Sai Muppana, Kiran Siddappaji, Mark Turner, Shaaban Abdallah *University of Cincinnati, USA*

THURSDAY JUNE 20 — 04:00 PM - 05:30 PM

	TURBOMACHINERY: MULTIDISCIPLINARY DESIGN APPROACHES, OPTIMIZATION & UNCERTAINTY QUANTIFICATION	WIND ENERGY	
	UQ, Manufacturing Uncertainties & FOD	**Control and Diagnostic of Wind Turbines**	
	Technical Session • 126-ABC • ThD-46-2Part B	**Technical Session • 131-A • ThD-48-4**	
	Session Organizer: **Rémy Nigro**, Safran Aero Boosters	Session Organizer: **Almudena Vega**, Siemens Gamesa Session Co-Organizer: **Francesco Balduzzi**, Università degli Studi di Firenze	
4:00	**GT2019-91035** **A Statistical Imputation Method for Handling Missing Values in Generalized Polynomial Chaos Expansions** Mark Andrews, Gavin Jones, Brian Leyde, Lie Xiong, Max Xu, Peter Chien *SmartUQ, USA*	**GT2019-91046** **The Effect of Blade Deflections on the Torsional Dynamic of a Wind Turbine** Juan Jauregui[1] Diego Cardenas[2] Luis Morales[1] Miguel Martínez[1] Jovan Basaldua[1] *1. Universidad Autonoma de Queretaro, Mexico; 2. ITESM, Mexico*	
4:30	**GT2019-91205** **Probabilistic FE-Analysis of Cooled High Pressure Turbine Blades: Part A – Holistic Description of Manufacturing Variability** Lars Högner[1] Matthias Voigt[1] Ronald Mailach[1] Marcus Meyer[2] Ulf Gerstberger[3] *1. Technische Universität Dresden, Germany; 2. Rolls-Royce Deutschland Ltd & Co KG, Germany; 3. Rolls-Royce, Germany*	**GT2019-90572** **Incipient Fault Diagnosis of the Planetary Gearbox Based on Improved Variational Mode Decomposition and Frequency-Weighted Energy Operator** Hongkun Li, Chaoge Wang, Jiayu Ou *Dalian University of Technology, China*	
5:00	**GT2019-91214** **Probabilistic FE-Analysis of Cooled High Pressure Turbine Blades: Part B – Probabilistic Analysis** Lars Högner[1] Matthias Voigt[1] Ronald Mailach[1] Marcus Meyer[2] Ulf Gerstberger[3] *1. Technische Universität Dresden, Germany; 2. Rolls-Royce Deutschland Ltd & Co KG, Germany; 3. Rolls-Royce, Germany*		

FRIDAY JUNE 21 — 08:00 AM - 10:00 AM

	CERAMICS	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS
	CMC Material Behavior: FOD, Erosion and CMAS	**Combustor Diagnostics**	**Combustion Modeling - Effect of Turbulent Combustion Model**
	Technical Session • 221-C • FA-2-4	**Technical Session • 122-A • FA-4-7**	**Technical Session • 121-C • FA-4-12**
	Session Organizer: **Martin R. Bache**, Swansea University Session Co-Organizer: **Gregory Morscher**, University of Akron	Session Organizer: **Ajay Agrawal**, University of Alabama	Session Organizer: **Baris Sen**, Pratt & Whitney Session Co-Organizer: **Fei Han**, GE Global Research Center
8:00	**GT2019-90368** **Foreign Object Impact Damage in Ceramic Matrix Composites: Experiments and Computational Predictions** Rajesh Kumar, Matthew Mordasky *United Technologies Research Center, USA*	**GT2019-90622** **X-Ray Phase Contrast Imaging of Liquid Film and Spray Development Inside an Aircraft Engine Swirler** Brandon Sforzo, Alan Kastengren, Katarzyna Matusik, Felipe Gomez del Campo, Christopher Powell *Argonne National Laboratory, USA*	**GT2019-90950** **An Assessment of the Implicit Non-Iterative PISO Solution Procedure for the Prediction of Combustor Performance** Megan Karalus[1] Niveditha Krishnamoorthy[1] Bob Reynolds[2] George Mallouppas[3] *1. Siemens PLM, USA; 2. Honeywell Aerospace, USA; 3. Siemens PLM, United Kingdom*
8:30	**GT2019-90837** **Erosion in an MI SiC/SiC Ceramic Matrix Composite (CMC)** Mike Presby, Cajer Gong, Sean Kane, Nesredin Kedir, Ashlynn Stanley, D. Calvin Faucett, Sung Choi *NAVAIR, USA*	**GT2019-91177** **High Momentum Jet Flames at Elevated Pressure: Part D – Simultaneous Measurements of OH/PAH PLIF and Mie Scattering on Liquid Fuels** Dominik Schäfer, James Dakshina Gounder, Oliver Lammel, Holger Ax, Rainer Lueckerath, Manfred Aigner *German Aerospace Center (DLR), Germany*	**GT2019-91147** **Modeling of Turbulent Swirl Stabilized Flame With Flamelet Generated Manifold and Hybrid LES-RANS Turbulence Model** Ishan Verma[1] Rakesh Yadav[2] Patrick Sharkey[3] Shaoping Li[2] Ellen Meeks[2] *1. ANSYS Inc., India; 2. ANSYS Inc., USA; 3. ANSYS Inc., United Kingdom*
9:00	**GT2019-90841** **Impact of Foreign Object Damage to Leading Edge on Fatigue Capability of CMC Turbine Vanes** Kenro Obuchi[1] Fumiaki Watanabe[1] Hiroshi Kuroki[1] Kazuyoshi ARAI[2] *1. IHI Corporation, Japan; 2. Hosei University, Japan*	**GT2019-91377** **High Momentum Jet Flames at Elevated Pressure: Part C – Statistical Distribution of Thermochemical States Obtained From Laser-Raman-Measurements** Holger Ax, Oliver Lammel, Rainer Lueckerath, Michael Severin *German Aerospace Center (DLR), Germany*	**GT2019-91317** **Comparison of Different CFD Models for Predicting Emissions in an OPRA DLE Combustor** Wilhelmus Ramaekers[1] Ferry Tap[1] Thijs Bouten[2] Lars-Uno Axelsson[2] *1. Avl-Dacolt, Netherlands; 2. OPRA Turbines BV, Netherlands*
9:30	**GT2019-92000** **Governing Parameters Influencing CMAS Adhesion and Infiltration Into Environmental/ Thermal Barrier Coatings in Gas Turbine Engines** Anindya Ghoshal[1] Michael Walock[1] Andy Nieto[2] Muthuvel Murugan[1] Clara Mock[1] Marc Pepi[1] Luis G. Bravo[1] Nishan Jain[3] Andrew Wright[4] Jian Luo[4] Larry Fehrenbacher[5] Alison Flatau[3] *1. US Army Research Laboratory, USA; 2. Naval Postgraduate School, USA; 3. University of Maryland, USA; 4. University of California, USA; 5. Technology Assessment and Transfer Inc, USA*	**GT2019-91971** **Combustion Characterization of a Fuel-Flexible Piloted Liquid-Spray Flame Apparatus Using Advanced Laser Diagnostics** Yejun Wang, Tyler Paschal, Waruna Kulatilaka *Texas A&M University, USA*	**GT2019-90452** **Numerical Investigation of a Swirl Stabilized Methane Fired Burner and Validation With Experimental Data** Federica Farisco, Philipp Notsch, Rene Prieler, Felix Greiffenhagen, Jakob Woisetschlaeger, Franz Heitmeir, Christoph Hochenauer *Graz University of Technology, Austria*

FRIDAY JUNE 21 — 08:00 AM - 10:00 AM

	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS	EDUCATION
	Combustion Dynamics: Damping & Control	**Combustion Dynamics: Flame Transfer Functions**	**Education Issues - II**
	Technical Session • 122-BC • FA-4-20	**Technical Session • 121-AB • FA-4-30**	**Technical Session • 221-B • FA-7-2**
	Session Organizer: **Bruno Schuermans**, General Electric Session Co-Organizer: **Fei Han**, GE Global Research Center	Session Organizer: **Joseph Meadows**, Virginia Tech Session Co-Organizer: **Owen Graham**, GE Global Research	Session Organizer: **Lamyaa El-Gabry**, Princeton University Session Co-Organizer: **Ioanna Aslanidou**, Mälardalen University
8:00	**GT2019-90238** **Impact of Damper Placement on the Stability Margin of an Annular Combustor Test Rig** Michael Betz, Max Zahn, Christoph Hirsch, Thomas Sattelmayer *Technische Universität München, Germany*	**GT2019-90870** **Influence of the Laminar Burning Velocity on the Transfer Functions of Premixed Methane and Propane Swirl Flames** Francesco Di Sabatino[1] Thibault F. Guiberti[1] Jonas P. Moeck[2] William L. Roberts[1] Deanna A. Lacoste[1] *1. King Abdullah University of Science and Technology, Saudi Arabia; 2. Norwegian University of Science and Technology, Norway*	**GT2019-90204** **Offshore Experience With Thermal Turbomachinery in Norwegian Petroleum Industry Through Fifty Years: A Review of Major Milestones, Lessons Learned and Impacts** Arne Lynghjem[1] Lars Eirik Bakken[2] Tore Naess[1] *1. Consultant, Norway; 2. Norwegian University of Science and Technology, Norway*
8:30	**GT2019-90239** **Impact of Combustion Chamber Dynamics on the Temperature Distribution in a Resonator** Michael Betz, Max Zahn, Christoph Hirsch, Thomas Sattelmayer *Technische Universität München, Germany*	**GT2019-91100** **Experimental Analysis of Flame Transfer Function Peaks in a Partially Premixed Gas Turbine Combustor** Seongpil Joo, Sanghyeok Kwak, Seongheon Kim, Youngbin Yoon *Seoul National University, Korea*	**GT2019-91854** **An Evidence Based Process Facilitating Engineering Education and Innovation in the Field of Turbomachinery** Marcel Otto[1] Jayanta Kapat[1] Robin Phelps[1] Thomas O'Neal[1] George Gramatikas[2] *1. University of Central Florida, USA;* *2. TTS Energy Services, USA*
9:00	**GT2019-90600** **Suppression of Combustion Instabilities in a Premixed Swirl Combustor With Acoustic Liner** Liangliang Xu[1] Guoqing Wang[1] Changcai Mo[1] Xunchen Liu[1] Lei Li[1] Fei Qi[1] Xiaofeng Sun[2] *1. Shanghai Jiao Tong University, China; 2. Beijing University of Aeronautics and Astronautics, China*	**GT2019-91577** **Effect of a Premixed Pilot Flame on the Velocity-Forced Flame Response in a Lean-Premixed Swirl-Stabilized Combustor** Jihang Li[1] Stephen Peluso[1] Domenic Santavicca[1] James W. Blust[2] *1. Pennsylvania State University, USA; 2. Solar Turbines Inc., USA*	**GT2019-91961** **AeroEngineS: Multi-Platform Application for Aero Engine Simulation and Compressor Map Operating Point Prediction** Evangelia Pontika[1] Anestis Kalfas[1] Ioanna Aslanidou[2] *1. Aristotle University of Thessaloniki, Greece;* *2. Mälardalen University, Sweden*
9:30	**GT2019-91246** **Combustion Instabilities Damping System Development for Dry Low NOx Emissions Operability Enhancement of a Heavy-Duty Gas Turbine** Matteo Cerutti[1] Nicola Giannini[1] Bruno Schuermans[2] Riccardo Brenci[1] Alessandro Marini[1] Gianni Ceccherini[1] Giovanni Riccio[1] *1. Baker Hughes, a GE company, Italy; 2. General Electric, Switzerland*		

FRIDAY JUNE 21 — 08:00 AM - 10:00 AM

	ELECTRIC POWER	FANS & BLOWERS	HEAT TRANSFER: CONJUGATE HEAT TRANSFER
	Gas Turbine Development	**Fan Performance and Multi-Physics Simulations**	**Conjugate Heat Transfer II**
	Technical Session • 131-A • FA-8-2	**Technical Session • 222-B • FA-9-1**	**Technical Session • 131-C • FA-10-2**
	Session Organizer: **Philip Andrew**, General Electric Session Co-Organizer: **S.C. John Gulen**, Bechtel Infrastructure and Power	Session Organizer: **Zhiping Wang**, Morrison Products Inc. Session Co-Chairs: **Johan Van der Spuy**, Stellenbosch University; **Gregory Wagner**, Morrison Products	Session Organizer: **Li He**, University of Oxford Session Co-Organizer: **Danesh Tafti**, Virginia Tech
8:00	**GT2019-91594** **Commercialization and Fleet Experience of the 7/9HA Gas Turbine Combined Cycle** Christian Vandervort[1] David Leach[1] David Walker[1] Jerry Sasser[2] *1. GE Power, USA; 2. GE Power Services, USA*	**GT2019-90212** **Successive Aeroacoustic Transfer of Leading Edge Serrations From Single Airfoil to Low-Pressure Fan Application** Till M. Biedermann[1] Frank Kameier[1] Christian Oliver Paschereit[2] *1. Institute of Sound and Vibration Enigneering - University of Applied Sciences Duesseldorf, Germany; 2. Technische Universität Berlin, Germany*	**GT2019-91123** **Numerical Study of Heat Transfer in Novel Wavy Trailing Edge Design for Gas Turbine Airfoils** Sarwesh Parbat[1] Li Yang[2] Minking Chyu[1] Sin C. Siw[3] Ching-Pang Lee[3] *1. University of Pittsburgh, USA; 2. Shanghai Jiao Tong University, China; 3. Siemens Energy, Inc., USA*
8:30	**GT2019-90773** **Development of High Efficiency 5MW Class Gas Turbine the Kawasaki M5A** shinya ishihara, Koji Terauchi, Takuya Ikeguchi, Masanori Ryu *Kawasaki Heavy Industries, Ltd., Japan*	**GT2019-91290** **Simulation of the Deposit Evolution on a Fan Blade for Tunnel Ventilation** Alessio Castorrini[1] Paolo Venturini[2] Alessandro Corsini[1] Franco Rispoli[1] *1. Sapienza University of Rome, Italy; 2. Dipartimento di Meccanica e Aeronautica, Sapienza University of Rome, Italy*	**GT2019-91194** **Conjugate Heat Transfer Analysis to Assess Overall Cooling Effectiveness of High Pressure Turbine Nozzle With Optimized Film Cooling Hole Arrangements** Young Seok Kang[1] Dong-Ho Rhee[1] Sanga Lee[2] Bong-Jun Cha[1] *1. Korea Aerospace Research Institute, Korea; 2. Samgsung Electronics, Korea*
9:00	**GT2019-91647** **Retrofittable Solutions to Keep Existing Gas Turbine Power Plants Viable and Profitable in an Increasingly Dynamic Power Generation Market: Validation of Low Pressure Drop FlameSheetTM Combustor** Fred Hernandez, Hany Rizkalla *Power Systems Manufacturing, USA*	**GT2019-91296** **Strongly Coupled Fluid-Structure Interaction Simulation of a 3D Printed Fan Rotor** Alessio Castorrini, Valerio Barnabei, Alessandro Corsini, Franco Rispoli *Sapienza University of Rome, Italy*	**GT2019-91103** **Overall Cooling Effectiveness on a Gas Turbine Vane With Swirl-Film Cooling** Haifen Du[1] Danmei Xie[2] Wei Chen[1] Ziyue Mei[1] Jing Zhang[2] *1. Key Laboratory of Hydraulic Machinery Transients (MOE), Wuhan University, China; 2. Wuhan University, China*
9:30	**GT2019-92407** **Ansaldo GT36 Technology Update** Patrik Meier *Ansaldo Energia Switzerland, Switzerland*	**GT2019-91705** **Numerical Investigation of Circumferential Groove Casing Treatment on a Low Speed Contra-Rotating Fan** Martin Heinrich[1] Hossein Khaleghi[2] Christian Friebe[3] *1. TU Bergakademie Freiberg, Germany; 2. Amirkabir University of Technology, Islamic Republic Of Iran; 3. Institut für Luft- und Kältetechnik Gemeinnützige Gesellschaft mbH, Germany*	**GT2019-91228** **A Steady State Thermal Prediction Method for Ship Board Turbocharger and its Validation With Experiments** Satoshi Ohuchida[1] Satoshi Seo[1] Yoji Okita[2] *1. IHI Corporation, Japan; 2. Japan Aerospace Exploration Agency, Japan*

FRIDAY JUNE 21 — 08:00 AM - 10:00 AM

	HEAT TRANSFER: NUMERICAL INTERNAL COOLING	HEAT TRANSFER: SPECIAL SESSIONS	MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES
	Numerical Internal Cooling IV	**Impingement Heat Transfer**	**Turbochargers: Compressors**
	Technical Session • 132-AB • FA-11-4	**Technical Session • 131-B • FA-18-1**	**Technical Session • 221-A • FA-26-11**
	Session Organizer: **Changmin Son**, Virginia Tech Session Co-Organizer: **Paul Davis**, Rolls-Royce Corp.	Session Organizer: **Sanjay Chopra**, GE Aviation Session Co-Organizer: **Kenneth Suder**, NASA Glenn Research Center	Session Organizer: **Tom Heuer**, BorgWarner Turbo Systems Engineering GmbH
8:00	**GT2019-91718** **Effect of Blade Profile on Four-Passage Serpentine Configuration Designed to Negate Coriolis Effect on Heat and Fluid Flow** Ajay Sarja, Srivatsan Madhavan, Prashant Singh, Srinath Ekkad *North Carolina State University, USA*	**GT2019-91427** **An Experimental Study of Impingement Cooling on Latticework in a Wide Channel** Jin Xu, Ruishan Lu, Ke Zhang, Jiang Lei, Junmei Wu *Xi'an Jiaotong University, China*	**GT2019-90384** **Investigation of Cross-Sectional Velocity Field Near the Inducer Plane of a Turbocharger Compressor Using 2D Particle Image Velocimetry** Deb Banerjee[1] Ricky Dehner[1] Ahmet Selamet[1] Keith Miazgowicz[2] Todd Brewer[2] Philip Keller[3] John Shutty[3] Arno Schwarz[3] *1. The Ohio State University, USA; 2. Ford Motor Company, USA; 3. BorgWarner Inc., USA*
8:30	**GT2019-91084** **Numerical Study on the Flow and Heat Transfer Characteristics With Different Rib Structures Placed on the Impingement Plate** Yongfeng Ding, Hui-ren Zhu, Qiang Gao *Northwestern Polytechnical University, China*	**GT2019-90695** **Influence of Excitation Frequency, Phase-Shift and Duty Cycle on Cooling Ratio in a Dynamically Forced Impingement Jet Array** Arne Berthold, Frank Haucke *Technische Universität Berlin, Germany*	**GT2019-90867** **Flow-Driven Design Optimization of Centrifugal Compressor Volutes for Turbochargers** Andrea Tanganelli, Giulia Andreini, Matteo Rossini, Francesco Balduzzi, Alessandro Bianchini, Giovanni Ferrara *Università degli Studi di Firenze, Italy*
9:00	**GT2019-91989** **Numerical Investigation of Pin-Fin Influences on Cooling Air Flow Characteristics in Blade Trailing Edge Region** Weilong Wu[1] Huazhao Xu[1] Jianhua Wang[1] Xiangyu Wu[2] Lei Wang[2] *1. University of Science and Technology of China, China; 2. Shenyang Research Institute of Aero-engine Corporation of China, China*	**GT2019-91068** **Optimization of Inserts to Minimize Cross-Flow Impact in Impingement Heat Transfer** Andres Curbelo[1] Jayanta Kapat[1] Steven Thorpe[2] Michael Maurer[2] *1. University of Central Florida, USA; 2. Ansaldo Energia Switzerland, Switzerland*	**GT2019-91245** **Parametric Study on Ported Shroud Locations and Geometries for a Turbocharger Compressor** Suheab Thamizullah[1] Abdul Nassar[1] Antonio Davis[2] Gaurav Giri[3] Leonid Moroz[4] *1. SoftInway Turbomachinery Solutions Private Limited, India; 2. Jain Univeristy, India; 3. SoftInWay Inc., India; 4. SoftInWay Inc., USA*
9:30	**GT2019-90789** **Numerical Investigation of Rotation Effects on the Flow and Heat Transfer on the Turbine Blade Tip Underside With Bleed Hole at Different Locations** Zhiqi Zhao, Lei Luo, Xiaoxu Kan, Dandan Qiu, Xun Zhou *Harbin Institute of Technology, China*		**GT2019-91422** **Methodology to Optimize and Predict the Measurement Point Distribution for Compressor Mapping on the Hot-Gas Test Bench** Holger Mai[1] André Kaufmann[2] Mathias Vogt[3] *1. Kratzer Automation AG, Germany; 2. University of Applied Sciences Ravensburg-Weingarten, Germany; 3. IAV GmbH, Germany*

FRIDAY JUNE 21 — 08:00 AM - 10:00 AM

	STRUCTURES & DYNAMICS: PROBABILISTIC METHODS	STRUCTURES & DYNAMICS: ROTORDYNAMICS	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS
	Probabilistic Analysis Methods and Applications For Rotors	**Applications**	**Seals 6**
	Technical Session • 127-C • FA-32-1	**Technical Session • 129-AB • FA-33-7**	**Technical Session • 128-A • FA-34-17**
	Session Organizer: **Jeff Brown**, US Air Force Research Laboratory Session Co-Organizer: **Florian Danner**, MTU Aero Engines AG	Session Organizer: **Ilmar Ferreira Santos**, Technical University of Denmark Session Co-Organizer: **Giuseppe Vannini**, Baker Hughes a GE Company	Session Organizer: **Jing Yang**, Texas A&M University Session Co-Organizer: **Cori Watson**, University of Virginia
8:00	**GT2019-90586** **Robust Optimization of Flexible Rotor Systems With Uncertain Parameters via Interval Analysis Method** Hong Jie[1] ZheFu Yang[2] Yaoyu Ni[2] Yanhong Ma[3] *1. Beihang University -- 405Group, China; 2. Beihang University, China; 3. Beihang University; Collaborative Innovation Center of Advanced Aero-Engine, China*	**GT2019-90367** **Nonlinear Reduced Dynamic Model of Turbofan Engine for Investigation of Engine Structural Frame Vibrations After Fan Blade Out Event** Ilya Ivanov, Boris Blinnik, Vladislav Myasnikov *Central Institute of Aviation Motors, Russia*	**GT2019-90846** **Rotordynamic Characteristics Prediction for Hole-Pattern Seals Using CFD** Manish R. Thorat, James R. Hardin *Elliott Group, USA*
8:30	**GT2019-90418** **Probabilistic Fracture Mechanics Framework Including Crack Nucleation of Rotor Forging Flaws** Francesco Radaelli[1] Kai Kadau[2] Christian Amann[1] Peter Gumbsch[3] *1. Siemens AG, Germany; 2. Siemens, USA; 3. Karlsruhe Institute of Technology, Germany*	**GT2019-91904** **A Method for Rotordynamic Force Prediction of a Centrifugal Compressor Impeller Front Cavity Using a Transient Whirling CFD Technique** Kevin Hoopes[1] J. Jeffrey Moore[1] Aaron Rimpel[1] Chris Kulhanek[1] Balaji Venkataraman[2] *1. Southwest Research Institute, USA; 2. Solar Turbines, USA*	**GT2019-91907** **Experimental Study of the Static and Dynamic Characteristics of a Long (L/D=0.75) Labyrinth Annular Seal Operating Under Two-Phase (Liquid/Gas) Conditions** Hari Shrestha[1] Dara W. Childs[2] Dung L. Tran[3] Min Zhang[4] *1. Atlas Copco Comptec LLC, USA; 2. Turbomachinery Laboratory, Texas A&M University, USA; 3. Energy Recovery Inc., USA; 4. Praxair Inc., USA*
9:00	**GT2019-90513** **Accelerated Multi-Fidelity Emulator Modeling for Probabilistic Rotor Response Study** Harok Bae[1] Ian Boyd[1] Emily B. Carper[2] Jeff Brown[2] *1. Wright State University, USA; 2. US Air Force Research Laboratory, USA*	**GT2019-91995** **Improvement of Rotordynamic Performance of Integrally Geared Centrifugal Compressors Through a Systematic Design Modification Approach** Zhusan Luo, Carl Schwarz *Praxair Inc., USA*	**GT2019-90779** **Numerical Modeling of Static and Rotordynamic Characteristics for Three Types of Helically-Grooved Liquid Annular Seals** Zhigang Li[1] Zhi Fang[1] Jun Li[2] Zhenping Feng[1] *1. Xi'an Jiaotong University, China; 2. Institute of Turbomachinery, Xi'an Jiaotong University, China*
9:30	**GT2019-90316** **Quantification of Performance Uncertainty for a Transonic Compressor Rotor Using an Adaptive NIPC Method** Jiaqi Luo[1] Zhiheng Xia[2] Feng Liu[3] *1. Zhejiang University, China; 2. Peking University, China; 3. University of California Irvine, USA*	**GT2019-91445** **Vibration Characteristics of Rotor System Considering Gear Meshing** Hong Jie[1] Xiru Xu[2] Liming Jiang[2] Yanhong Ma[3] *1. Beihang University -- 405Group, China; 2. Beihang University, China; 3. Beihang University; Collaborative Innovation Center of Advanced Aero-Engine, China*	**GT2019-90781** **Numerical Comparison of Static and Rotordynamic Characteristics for a Grooved-Stator/Smooth-Rotor and a Smooth-Stator/Grooved-Rotor Liquid Annular Seals** Zhigang Li[1] Zhi Fang[1] Jun Li[2] Zhenping Feng[1] *1. Xi'an Jiaotong University, China; 2. Institute of Turbomachinery, Xi'an Jiaotong University, China*

FRIDAY JUNE 21 — 08:00 AM - 10:00 AM

	STRUCTURES & DYNAMICS: STRUCTURAL MECHANICS, VIBRATION & DAMPING	SUPERCRITICAL CO2 POWER CYCLES	SUPERCRITICAL CO2 POWER CYCLES
	Vibration and Damping of Bladed Disks	**Properties and Physical Behavior for sCO2 Power Cycles**	**Supercritical CO2 Power Cycle Modeling and Fluid Properties**
	Technical Session • 128-B • FA-35-7	**Technical Session • 127-B • FA-38-10**	**Tutorial Session • Room 123 • FA-38-16**
	Session Organizer: **Florence Nyssen**, Polytechnique Montreal Session Co-Organizer: **Stefan Schwarz**, MTU Aero Engines AG	Session Organizer: **Jeongik Lee**, Kaist	Session Organizer: **Anton Moisseytsev**, Argonne National Laboratory Session Co-Organizer: **Douglas Hofer**, GE Global Research
8:00	**GT2019-91832** **Effect of Switching Impulse on Piezoelectric-Based Vibration Reduction With Multiple Patches** Christopher Kelley, Jeffrey Kauffman *University of Central Florida, USA*	**GT2019-90704** **Techno-Economic Evaluation of the Effect of Impurities on the Performance of Supercritical CO2 Cycles** Ladislav Vesely[1] Vaclav Dostal[1] Jayanta Kapat[2] Subith Vasu[2] Scott Martin[3] *1. Czech Technical University In Prague, Czech Republic; 2. University of Central Florida, USA; 3. Embry-Riddle Aeronautical University, USA*	**GT2019-92121** **Supercritical CO2 Power Cycle Modeling and Fluid Properties Tutorial** Anton Moisseytsev[1] Douglas Hofer[2] *1. Argonne National Laboratory, USA; 2. GE Global Research, USA*
8:30	**GT2019-91861** **Multi-Objective Optimization for Piezoelectric-Based Approaches With Applications Toward Bladed Disks** Garrett Lopp, Jeffrey Kauffman *University of Central Florida, USA*	**GT2019-91613** **Numerical Study of Radiation Heat Transfer for a Supercritical CO2 Turbine Linear Cascade** Akshay Khadse, Andres Curbelo, Jayanta Kapat *University of Central Florida, USA*	**T U T O R I A L**
9:00	**GT2019-90167** **A Study on the Application of Tuned Vibration Absorbers to Nominally Cyclic Structures** Mainak Mitra[1] Andrea Lupini[2] Bogdan Epureanu[2] *1. ANSYS Inc., USA; 2. University of Michigan, USA*	**GT2019-91691** **Visualization of Supercritical Carbon Dioxide Flow Through a Converging-Diverging Nozzle** Chang Hyeon Lim, Gokul Pathikonda, Sandeep Pidaparti, Devesh Ranjan *Georgia Institute of Technology, USA*	
9:30	**GT2019-90168** **Application of Tuned Vibration Absorber Concept to Blisk Ring Dampers: A Nonlinear Study** Andrea Lupini[1] Mainak Mitra[2] Bogdan Epureanu[1] *1. University of Michigan, USA; 2. ANSYS Inc., USA*	**GT2019-91371** **A Supercritical CO2 Combined Power and Liquefaction Cycle** Griffin Beck, David Ransom, Kevin Hoopes *Southwest Research Institute, USA*	

FRIDAY JUNE 21 — 08:00 AM - 10:00 AM

	TURBOMACHINERY: AXIAL FLOW FAN & COMPRESSOR AERODYNAMICS	TURBOMACHINERY: AXIAL FLOW FAN & COMPRESSOR AERODYNAMICS	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY
	End-wall Flows	**Experiments & Rigs**	**LES, DNS & Optimization Methods and Applications**
	Technical Session • 124-B • FA-39-8	**Technical Session • 126-ABC • FA-39-11**	**Technical Session • 127-A • FA-41-1**
	Session Organizer: **Lisa Brilliant**, UTC/Pratt & Whitney Session Co-Organizer: **Roland Matzgeller**, MTU Aero Engines GmbH	Session Organizer: **Cleopatra Cuciumita**, Technical University of Berlin, INCDT Comoti Session Co-Organizer: **Sam Grimshaw**, University of Cambridge Whittle Laboratory	Session Organizer: **Koen Hillewaert**, Cenaero Session Co-Organizer: **Marcus Meyer**, Rolls-Royce Deutschland Ltd & Co KG
8:00	**GT2019-90123** **Secondary Flow Measurements in a Compressor Cascade Using 3D Lda/Pda: Part A – Flow Topology and Its Numerical Representation** Silvio Geist, Janneck Harbeck, Franz Joos *Helmut Schmidt University, Germany*	**GT2019-90743** **Advances in High-Speed Linear Design Technology: Novel Approach to Sidewall Geometry Design for Erosion Tests** Maksim Sokolov[1] Max Lorenz[1] Christian Koch[1] Stephan Staudacher[2] Mirco Rostamian[3] Matthias Weissschuh[3] *1. University of Stuttgart, Germany; 2. Institute of Aircraft Propulsion Systems / University of Stuttgart, Germany; 3. Rolls-Royce, Germany*	**GT2019-90051** **Aerodynamic Shape Optimization of a Turbine Blade Considering Geometric Uncertainty Using an Adjoint Method** Jiaqi Luo, Yao Zheng *Zhejiang University, China*
8:30	**GT2019-90334** **The Influence of Non-Axisymmetric End Wall in a High-Load Compressor Stage With Tandem Stator** Xiangjun Li[1] Wuli Chu[2] *1. Dalian Maritime University, China;* *2. Northwestern Polytechnical University, China*	**GT2019-90839** **Reducing Instrumentation Errors Caused by Circumferential Flow Field Variations in Multi-Stage Axial Compressors** Martin Chilla[1] Graham Pullan[2] Simon Gallimore[3] *1. Whittle Laboratory, University of Cambridge, United Kingdom; 2. University of Cambridge, United Kingdom; 3. Rolls-Royce plc, United Kingdom*	**GT2019-90214** **Prediction of Separated Flow Transition Using LES and Transitional RANS Model** Ettore Bertolini[1] Paul Pieringer[2] Wolfgang Sanz[2] *1. ITTM, Graz University of Technology, Austria;* *2. Graz University of Technology, Austria*
9:00	**GT2019-90712** **An Improved Prediction Model for the Corner Stall in Axial Compressors With the Dihedral Effect I: Principle and Validation** Jiabin Li, Lucheng Ji *Beijing Institute of Technology, China*	**GT2019-91165** **Introduction and Commissioning of the New Darmstadt Transonic Compressor Test Facility** Christian Kunkel[1] Jan Werner[1] Daniel Franke[1] Heinz-Peter Schiffer[1] Fabian Wartzek[2] Christoph Biela[2] Christoph Starke[2] *1. Technische Universität Darmstadt, FG GLR, Germany; 2. Siemens AG, Power and Gas Division, Germany*	**GT2019-90747** **Inlet and Outlet Characteristics Boundary Conditions for Large Eddy Simulations of Turbomachinery** Nicolas Odier[1] Thierry Poinsot[1] Florent Duchaine[1] Laurent Y.M. Gicquel[1] Stephane Moreau[2] *1. CERFACS, France; 2. University of Sherbrooke, Canada*
9:30	**GT2019-90919** **Corner Stall Prediction in a Compressor Linear Cascade Using Very Large Eddy Simulation (VLES) Lattice-Boltzmann Method** Antoine Maros[1] Benoît Bonnal[2] Ignacio Gonzalez-Martino[2] James Kopriva[3] Francesco Polidoro[3] *1. Ecole Centrale de Lyon, France; 2. Dassault Systèmes, France; 3. Dassault Systemes, USA*	**GT2019-90124** **Secondary Flow Measurements in a Compressor Cascade Using 3D Lda/Pda: Part B – Dispersed Phase Effects on Flow Topology** Janneck Harbeck, Silvio Geist, Franz Joos *Helmut Schmidt University, Germany*	**GT2019-91608** **Adjoint Based Aerodynamic Optimization of a Multi-Splitter Turbine Vane Frame** Vincenzo Russo, Simone Orsenigo, Lasse Mueller, Tom Verstraete, Sergio Lavagnoli *von Karman Institute for Fluid Dynamics, Belgium*

FRIDAY JUNE 21 — 08:00 AM - 10:00 AM

TURBOMACHINERY: NOISE & INNOVATIVE NOISE REDUCTION (WITH AIRCRAFT ENGINE)

Compressor noise and methods

Technical Session • 125-AB • FA-43-1

Session Organizer: **Stephane Moreau**, Universite de Sherbrooke
Session Co-Organizer: **Trevor Wood**, General Electric Global Research

8:00

GT2019-90782
Sound Power Measurements at Radial Compressors Using Compressed Sensing Based Signal Processing Methods
Jakob Hurst[1] Maximilian Behn[2] Ulf Tapken[3] Lars Enghardt[1]
1. Technical University of Berlin, Germany; 2. DLR, Germany; 3. German Aerospace Center, Germany

8:30

GT2019-90283
Aeroacoustical and Aerodynamical Investigations of Riblets Applied on Low Pressure Turbine Exit Guide Vanes for Two Different Operating Points
Manuel Zenz[1] Asim Hafizovic[1] Loris Simonassi[2] Peter Leitl[3] Franz Heitmeir[2] Andreas Marn[2]
1. Institute of Thermal Turbomachinery and Machine Dynamics, Graz University of Technology, Austria; 2. Graz University of Technology, Austria; 3. Bionic Surface Technologies GmbH, Austria

9:00

GT2019-90554
Multi-Objective Design of a Transonic Turbocharger Compressor With Reduced Noise and Increased Efficiency
Peng Wang[1] Mehrdad Zangeneh[2] Francis Heyes[3] Paul Roach[3]
1. Advanced Design Technology, United Kingdom; 2. Univ College London, United Kingdom; 3. Napier Turbochargers, United Kingdom

9:30

GT2019-90804
Rotor-Alone Tones in the Outflow Noise of a Centrifugal Compressor
Armin Fassbender[1] Martin Enneking[2] Peter Jeschke[1]
1. RWTH Aachen University, Germany; 2. Institute of Jet Propulsion and Turbomachinery, RWTH Aachen University, Germany

FRIDAY JUNE 21 — 10:15 AM - 12:45 PM

	AIRCRAFT ENGINE	CERAMICS	COMBUSTION, FUELS & EMISSIONS
	Lifting-line Aerodynamics of Propellers, Propfans, and Windprops With Application to Electric Flight	**CMC Material Behavior: Fatigue**	**Combustor Design and Development - Microturbines**
	Tutorial Session • 124-A • FB-1-16	**Technical Session • 221-C • FB-2-3**	**Technical Session • 121-C • FB-4-1**
	Session Organizer: **Kurt Rouser**, Oklahoma State University	Session Organizer: **Jun Shi**, Rolls-Royce Corporation Session Co-Organizer: **Rajesh Kumar**, United Technologies Research Ctr	Session Organizer: **Sunil James**, Honeywell Session Co-Organizer: **Jeffrey Armstrong**, Flexenergy Energy Systems Inc.
10:15	**GT2019-92089** **Principles of High-Efficiency Electric Flight** J. Philip Barnes *Pelican Aero Group, USA*	**GT2019-90067** **Thermomechanical Fatigue of Ceramic Matrix Composites** Longbiao Li *Nanjing University of Aeronautics and Astronautics, China*	**GT2019-90183** **Experimental Analysis of a Micro Gas Turbine Combustor Optimized for Flexible Operation With Various Gaseous Fuel Compositions** Hannah Bower, Andreas Schwärzle, Felix Grimm, Timo Zornek, Peter Kutne *German Aerospace Center (DLR), Germany*
10:45	**T U T O R I A L**	**GT2019-90355** **High Temperature Fatigue Assessment of a SiCf/SiC Ceramic Matrix Composite Using Advanced Monitoring Techniques** Christopher Newton[1] Stephen P. Jordan[2] Martin R. Bache[1] Louise Gale[3] *1. Swansea University, United Kingdom; 2. Institute of Structural Materials, United Kingdom; 3. Rolls-Royce plc, United Kingdom*	**GT2019-90197** **Influence of Fuel Injection Location in a Small Radial Swirler Low NOx Combustor for Micro Gas Turbine Applications** Gordon E. Andrews, Su Kim *University of Leeds, United Kingdom*
11:15		**GT2019-91330** **Monitoring Fatigue of SiC/SiC Ceramic Matrix Composites With Acoustic Emission and Electrical Resistance** Zipeng Han, Gregory Morscher *University of Akron, USA*	**GT2019-90245** **Experimental and Computational Analysis of an Additive Manufactured Vaporization Injector for a Micro-Gas Turbine** Adamos Adamou[1] Ian J. Kennedy[1] Ben Farmer[2] Ahmed Hussein[2] Colin D. Copeland[1] *1. University of Bath, United Kingdom; 2. HiETA Technologies, United Kingdom*
11:45			**GT2019-90799** **Combustion Analysis of Syngas Fuels Applied in a Micro Gas Turbine Combustor With a Rotating Casing** Maaz Ajvad, Hsin-Yi Shih *Chang Gung University, Taiwan*

FRIDAY JUNE 21 — 10:15 AM - 12:45 PM

	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS	COMBUSTION, FUELS & EMISSIONS
	Atomization and Sprays	**Combustion Dynamics: Rotating Detonation**	**Combustion Dynamics: Instability Mechanisms**
	Technical Session • 121-AB • FB-4-4	**Technical Session • 122-BC • FB-4-25**	**Technical Session • 122-A • FB-4-26**
	Session Organizer: **Brandon Sforzo**, Argonne National Laboratory Session Co-Organizer: **Robert Lucht**, Purdue University	Session Organizer: **Fei Han**, GE Global Research Center Session Co-Organizer: **Joseph Meadows**, Virginia Tech	Session Organizer: **Christoph Hirsch**, Technical University of Munich
10:15	**GT2019-90321** **The Effect of Sauter Mean Diameter Fluctuations on the Heat Release Rate in a Lean-Burn Aero-Engine Combustor** Nicholas Treleaven, Andrew Garmory, Gary J. Page *Loughborough University, United Kingdom*	**GT2019-90082** **Numerical Research on the Toroidal Shock Wave Focusing Detonation Initiation** Xiang Chen[1] Ningbo Zhao[1] Hongtao Zheng[1] Xiongbin Jia[1] Shizheng Liu[1] Qingbo Liu[2] *1. Harbin Engineering University, China; 2. Harbin Institute of Technology, China*	**GT2019-90852** **Combustion Instabilities of Separated Stratified Swirling Flames With Different Degrees of Premixedness** Xinyao Wang[1] Xiao Han[1] Xin Hui[1] Chi Zhang[1] Heng Song[1] Yuzhen Lin[1] Chih-Jen Sung[2] *1. Beihang University, China; 2. University of Connecticut, USA*
10:45	**GT2019-90989** **Effects of Varying Liquid Fuel and Air Co-Flow Rates on Spray Characterisation of an Annular Co-Flow Spray Burner** Radi Alsulami[1] Stuart Nates[2] Weijing Wang[2] Sang Hee Won[2] Bret Windom[1] *1. Colorado State University, USA; 2. University of South Carolina, USA*	**GT2019-90938** **Investigating Instabilities in a Rotating Detonation Combustor Operating With Natural Gas-Hydrogen Fuel Blend: Effect of Air Preheat and Annulus Width** Arnab Roy[1] Clinton Bedick[2] Donald Ferguson[2] Todd Sidwell[2] Peter Strakey[2] *1. NETL-West Virginia University Research Corporation, USA; 2. National Energy Technology Laboratory - DOE, USA*	**GT2019-91182** **Combustion Instability Characteristics Under Various Fuel and Air Flow Rates in a Partially Premixed Model Gas Turbine Combustor** Sanghyeok Kwak, Seongpil Joo, Seongheon Kim, Jaehong Choi, Youngbin Yoon *Seoul National University, Korea*
11:15	**GT2019-91972** **Liquid Jet in Crossflow: Effect of Momentum Flux Ratio on Spray and Vaporization Characteristics** Manu Kamin, Prashant Khare *University of Cincinnati, USA*	**GT2019-91643** **Numerical Investigations of Instabilities in a Natural Gas-Air Fueled Rotating Detonation Engine** Pankaj Saha[1] Peter Strakey[2] Donald Ferguson[2] *1. National Energy Tecnology Laboratory-WVURC, USA; 2. National Energy Technology Laboratory - DOE, USA*	**GT2019-91981** **The Role of Mean Flame Anchoring on the Stability Characteristics of Syngas, Synthesis Natural Gas, and Hydrogen Fuels in a Turbulent Non-Premixed Bluff-Body Combustor** Nikhil Ashokbhai Baraiya, Satyanarayanan R. Chakravarthy *IIT Madras, India*
11:45	**GT2019-92039** **Effects of Emulsified Fuel on the Performance and Emission Characteristics of Aeroengine Combustors** Maria Grazia De Giorgi, Elisa Pescini, Stefano Campilongo, Giuseppe Ciccarella, Donato Fontanarosa, Antonio Ficarella *University of Salento, Italy*	**GT2019-91931** **Multidimensional Numerical Simulations of Reacting Flow in a Non-Premixed Rotating Detonation Engine** Pinaki Pal[1] Gaurav Kumar[2] Scott Drennan[2] Brent Rankin[3] Sibendu Som[1] *1. Argonne National Laboratory, USA; 2. Convergent Science, Inc., USA; 3. Air Force Research Laboratory, USA*	**GT2019-90436** **The Effect of the Corner Recirculation Zone on Separated Stratified Swirling Flames and Combustion Instabilities** Heng Song[1] Xiao Han[1] Yuzhen Lin[1] Chi Zhang[1] Xin Hui[1] Xinyao Wang[1] Chih-Jen Sung[2] *1. Beihang University, China; 2. University of Connecticut, USA*

FRIDAY JUNE 21 — 10:15 AM - 12:45 PM

	CYCLE INNOVATIONS	EDUCATION	ELECTRIC POWER
	Sustainable Business Opportunities in Low-income Countries	**Professional Development Workshop for Mid and Late Career Engineers on Transition Coaching**	**Gas Turbine Industry Update**
	Panel Session • 221-B • FB-6-17	**Tutorial Session • 126-ABC • FB-7-3**	**Panel Session • 131-A • FB-8-7**
	Session Organizer: **Piero Colonna**, Delft University of Technology Session Co-Organizer: **Francesco Roncallo**, University of Genoa	Session Organizer: **Atul Kohli**, Pratt & Whitney	Session Organizer: **S.C. John Gulen**, Bechtel Infrastructure and Power Session Co-Organizer: **Sy Ali**, Clean Energy Consulting
10:15	**GT2019-92403** **Sustainable Development and Growth Opportunities** Francesco Roncallo *University of Genoa, Italy* **GT2019-92404** **Scalable Microgrids for Disaster Response and Energy Access** Nathan Johnson *Arizona State University, USA*	**GT2019-92116** **Planning for Your Next Big Life Transition** Brian Forbes, Mark Turner *1. Executive Coach, USA; 2. University of Cincinnati, USA*	**GT2019-92379** **Legislative and Regulatory Landscape** Andrew Dicke *GE Energy, USA* **GT2019-92380** **Special Cycles** Richard Dennis *U.S. Department of Energy, National Energy Technology Laboratory, USA*
10:45	**GT2019-92405** **Sustainable Energy for All - a Siemens Perspective** Amit Paspulati *Siemens, USA* **GT2019-92406** **Academia Duties for Low-income Countries** David Sánchez *University of Seville, Spain*	T U T O R I A L	**GT2019-92381** **Fuels in Electric Power Generation** Peter Baldwin *Base-E, USA*
11:15	P A N E L		P A N E L
11:45			

FRIDAY JUNE 21 — 10:15 AM - 12:45 PM

	HEAT TRANSFER: GENERAL EXPERIMENTAL HEAT TRANSFER	HEAT TRANSFER: INTERNAL AIR SYSTEMS & SEALS (WITH TURBOMACHINERY)	HEAT TRANSFER: EXPERIMENTAL FILM COOLING
	General Experimental Heat Transfer IV	**Seals and Rigs I**	**Experimental Film Cooling VI**
	Technical Session • 131-C • FB-13-4	**Technical Session • 131-B • FB-15-5**	**Technical Session • 132-AB • FB-19-6**
	Session Organizer: **Gustavo Ledezma**, GE Global Research Session Co-Organizer: **Silvia Ravelli**, University of Bergamo-Faculty of Engrg	Session Organizer: **Neelesh Sarawate**, GE Global Research Session Co-Organizer: **Aaron Bowsher**, Cross Mftg Co (1938) Ltd	Session Organizer: **Ali Ameri**, The Ohio State University Session Co-Organizer: **Lamyaa El-Gabry**, Princeton University
10:15	**GT2019-92058** **Thermal Characterization of a Turbulent Free Jet With Planar Laser Induced Fluorescence (PLIF)** Sara Seitz[1] Lesley Wright[2] *1. Baylor University, USA; 2. Texas A&M University, USA*	**GT2019-90492** **Numerical Analysis of Lift Generation in a Radial Segmented Gas Seal** Mihai Arghir[1] Samia Dahite[2] *1. Universite De Poitiers - Instit Pprime, D3, France; 2. Safran Aircraft Engines, France*	**GT2019-91678** **Experimental Investigation of Sweeping Jet Film Cooling in a Transonic Turbine Cascade** Mohammad Arif Hossain, Munevver Elif Asar, James Gregory, Jeffrey Bons *The Ohio State University, USA*
10:45	**GT2019-92062** **Thermal Development of an Impinging Jet Using Planar Laser Induced Fluorescence (PLIF)** Lesley Wright[1] Sara Seitz[2] *1. Texas A&M University, USA; 2. Baylor University, USA*	**GT2019-90991** **On the Development of a Pressure Actuated Leaf Seal for Turbomachinery Applications** Ernesto Pedraza-Valle[1] Georgios Papageorgiou[2] Aaron Bowsher[2] Peter Crudgington[2] Carl Sangan[1] Patrick Keogh[1] James Scobie[1] *1. University of Bath, United Kingdom; 2. Cross Manufacturing Company (1938) Ltd, United Kingdom*	**GT2019-91919** **3D Heat Transfer Assessment of Full-Scale Inlet Vanes With** **Surface-Optimized Film Cooling: Part 1: Experimental Results** Richard Anthony[1] John Clark[1] John Finnegan[1] Jamie Johnson[2] *1. Air Force Research Laboratory, USA; 2. Deloitte, USA*
11:15	**GT2019-91897** **Impact of Sweeping Jet on Area-Averaged Impingement Heat Transfer** Andrea Osorio[1] Justin Hodges[1] Husam Zawati[2] Erik Fernandez[1] Jayanta Kapat[1] Jose Rodriguez[3] *1. University of Central Florida, USA; 2. CATER / University of Central Florida, USA; 3. Siemens, USA*	**GT2019-90137** **The Effect of Inlet Swirl on Brush Seal Bristle Deflections and Stability** Yuxin Liu[1] John Chew[2] Michael J Pekris[2] Xiaozhi Kong[1] *1. Dalian Maritime University, China; 2. University of Surrey, United Kingdom*	**GT2019-91864** **3D Heat Transfer Assessment of Full-Scale Inlet Vanes with Surface-Optimized Film Cooling: Part 2: Conjugate CFD Simulations** Jamie Johnson[1] John Clark[2] Richard Anthony[2] Michael Ooten[2] Ron Ho Ni[3] William Humber[3] *1. Deloitte, USA; 2. Air Force Research Laboratory, USA; 3. Aerodynamic Solutions, Inc., USA*
11:45	**GT2019-91817** **Comparison of Thin Film Heat Flux Gauge Technologies Emphasizing Continuous-Duration Operation** Shawn Siroka[1] Reid A. Berdanier[1] Karen Thole[1] Charles W Haldeman[2] Kam Chana[3] Richard Anthony[4] *1. Pennsylvania State University, USA; 2. Pratt & Whitney, USA; 3. Oxford Thermofluids Institute, United Kingdom; 4. Air Force Research Laboratory, USA*	**GT2019-91265** **High Speed Single Cavity Rig With Axial Throughflow of Cooling Air: Rig Structure and Periphery** Eric Diemel[1] Stefan Odenbach[1] Wieland Uffrecht[1] Jose Maria Rey Villazon[2] Antonio Guijarro Valencia[2] Mike Reinecke[2] *1. Technische Universität Dresden, Germany; 2. GE Aviation, Germany*	**GT2019-91810** **The Effect of Step Misalignment on Purge Flow Cooling of Nozzle Guide Vane at Transonic Conditions** Luke Luehr[1] Ridge Sibold[1] Shuo Mao[1] Wing Ng[1] Zhigang Li[2] Hongzhou Xu[3] Michael Fox[3] *1. Virginia Polytechnic Institute and State University, USA; 2. Xi'an Jiaotong University, China; 3. Solar Turbines Inc., USA*
12:15	**GT2019-91303** **The Effect of Surface Tension on Bubble Generation in Gas-Sheared Liquid Films** Joao Vasques[1] Abubakr Ibrahim[1] David Hann[1] Kathy Simmons[1] Michael Walsh[2] *1. University of Nottingham, United Kingdom; 2. Nottingham University, United Kingdom*	**GT2019-90965** **Test Rig Commissioning for Advanced Rotor-Stator Seals** Deepak Trivedi[1] Eric Ruggiero[2] Chris Wolfe[3] Joel Kirk[3] John R. Williams[2] James E. Graham[4] *1. General Electric Research, USA; 2. GE Aviation, USA; 3. GE Global Research Center, USA; 4. GE Global Research, USA*	**GT2019-91870** **Heat Transfer Coefficient Augmentation for a Shaped Film Cooling Hole at a Range of Compound Angles** Shane Haydt[1] Stephen Lynch[2] *1. Pratt & Whitney, USA; 2. Penn State University, USA*

FRIDAY JUNE 21 — 10:15 AM - 12:45 PM

	OIL & GAS APPLICATIONS	STRUCTURES & DYNAMICS: FATIGUE, FRACTURE & LIFE PREDICTION	STRUCTURES & DYNAMICS: BEARING & SEAL DYNAMICS
	Compressor Dynamics	**Creep Modelling, Analysis and Testing**	**Gas Bearings 3**
	Tutorial Session • 130 • FB-27-17	**Technical Session • 129-AB • FB-31-2**	**Technical Session • 128-A • FB-34-4**
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10:15	**GT2019-92294** **Impact of Piping Impedance and Acoustic Characteristics on Centrifugal Compressor Surge and Operating Range** Klaus Brun *Elliott Group, USA* **GT2019-92295** **Compressor Dynamics - Surge and Choke** Rainer Kurz *Solar Turbines, USA* **GT2019:92296** **Compressor Dynamics - Transient Surge** J. Jeffrey Moore *Southwest Research Institute, USA*	**GT2019-90267** **Assessment of the Theta Projection Model for Interpolating Creep Deformation** Jimmy Perez, Calvin Stewart *University of Texas at El Paso, USA*	**GT2019-90187** **A Reduced Model for Air Foil Journal Bearings for Time-Efficient Run-Up Simulations** Pascal Zeise, Marcel Mahner, Marcel Bauer, Markus Rieken, Bernhard Schweizer *Technical University Darmstadt, Department of Mechanical Engineering, Germany*
10:45		**GT2019-90616** **Assessment of Calibration Approaches for the Stress Relaxation Test** Jacob Pellicotte, Mario Cotto, Calvin Stewart *University of Texas at El Paso, USA*	**GT2019-91207** **Thermal Optimization of Air Foil Thrust Bearings Using Different Foil Materials** Markus Rieken, Marcel Mahner, Bernhard Schweizer *Technical University Darmstadt, Department of Mechanical Engineering, Germany*
11:15	**T U T O R I A L**	**GT2019-90637** **Development and Application of Minimum Creep Strain Rate Metamodeling** Ricardo Vega, Calvin Stewart *University of Texas at El Paso, USA*	**GT2019-91710** **On the Integration of Hot Foil Bearings Into Gas Turbine Engines: Theoretical Treatment** James F. Walton II, Hooshang Heshmat *Mohawk Innovative Technology, Inc., USA*
11:15		**GT2019-90424** **Comparison of the Predicted Creep Life and Hot Spin Tests for the Turbine Wheel in Automotive Turbocharger** Keigo Sakamoto[1] Makoto Ozaki[2] Yusuke Furuta[2] Toyotaka Yoshida[1] *1. Mitsubishi Heavy Industries Ltd., Japan; 2. Mitsubishi Heavy Industries Engine & Turbocharger, Ltd., Japan*	**GT2019-91109** **Experimental Rotordynamic Force Coefficients for a Diffusion Bonded Compliant Hybrid Journal Gas Bearing Utilizing Fluid-Filled Hermetic Dampers** Keith Gary, Bugra Ertas *GE Global Research Center, USA*
11:45		**GT2019-90979** **Untwist Creep Analysis of Gas Turbine First Stage Blade** Anthony Jarrett, Veda V. Erukulla, Ashok K. Koul *Life Prediction Technologies Inc., Canada*	**GT2019-91735** **The Influence of Ambient Pressure on the Measured Load Capacity of Bump-Foil and Spiral-Groove Gas Thrust Bearings at Ambient Pressures up to 69 Bar on a Novel High-Pressure Gas Bearing Test Rig** Jason Wilkes[1] Ryan Cater[1] Erik Swanson[2] Kevin Passmore[3] Jerry Brady[4] *1. Southwest Research Institute, USA; 2. Xdot Engineering and Analysis, USA; 3. Halliburton, USA; 4. Brady Tech, USA*

FRIDAY JUNE 21 — 10:15 AM - 12:45 PM

	STRUCTURES & DYNAMICS: AERODYNAMIC EXCITATION & DAMPING	STRUCTURES & DYNAMICS: AERODYNAMIC EXCITATION & DAMPING	SUPERCRITICAL CO2 POWER CYCLES
	Compressor Aerodynamic Damping and Flutter	**Turbine Aerodynamic Damping and Flutter**	**Modeling and Control of sCO2 Power Cycles**
	Technical Session • 127-C • FB-36-3	**Technical Session • 128-B • FB-36-4**	**Technical Session • 123 • FB-38-6**
	Session Organizer: **Yoon Choi**, GE Aviation Session Co-Organizer: **Tianyu Pan**, Beihang University	Session Organizer: **Toshinori Watanabe**, The University of Tokyo Session Co-Organizer: **Almudena Vega**, Siemens Gamesa	Session Organizer: **Jayanta Kapat**, University of Central Florida Session Co-Organizer: **Aaron McClung**, Southwest Research Institute
10:15	**GT2019-90651** **Effect of Rotating Instabilities on Aerodynamic Damping of Axial Flow Fan Blades** Weichao Yang[1] Yanrong Wang[1] Le Han[1] Xiaobo Zhang[1] Zichao Li[2] *1. School of Energy and Power Engineering, Beihang University, China; 2. Beihang University, China*	**GT2019-90247** **Multi-Wave Vibration Caused by Flutter Instability and Nonlinear Tip Shroud Friction** Johann Gross[1] Malte Krack[2] *1. ILA (Universitaet Stuttgart), Germany; 2. University of Stuttgart, Germany*	**GT2019-90374** **Analysis of Thermal Transients for sCO2 Brayton Cycle Heat Exchangers** Anton Moisseytsev, James Sienicki *Argonne National Laboratory, USA*
10:45	**GT2019-90941** **Validation Studies of Linear Oscillating Compressor Cascade and Use of Influence Coefficient Method** Hien Phan, Li He *University of Oxford, United Kingdom*	**GT2019-90887** **Aeroelastic and Aerodynamic Investigation of a Low Pressure Turbine Under the Influence of a Circumferential Inlet Distortion** Loris Simonassi[1] Manuel Zenz[2] Philipp Bruckner[1] Franz Heitmeir[1] Andreas Marn[1] *1. Graz University of Technology, Austria; 2. Institute of Thermal Turbomachinery and Machine Dynamics, Graz University of Technology, Austria*	**GT2019-91409** **Transient Thermodynamic Modeling of Air Cooler in Supercritical CO2 Brayton Cycle for Solar Molten Salt Application** Ankur Deshmukh[1] Jayanta Kapat[2] Akshay Khadse[2] *1. Siemens Energy, USA; 2. University of Central Florida, USA*
11:15	**GT2019-91468** **Rig Testing of the Operability of a Transonic Compressor Blade of an Industrial Gas Turbine** Hyunsu Kang[1] Sungjong Ahn[1] Kyusic Hwang[1] Justin N. Bock[2] Jeongseek Kang[3] Matthew Montgomery[4] *1. Doosan Heavy Industries, Korea; 2. Notre Dame Turbomachinery Laboratory, USA; 3. University of Notre Dame, USA; 4. Doosan ATSA, USA*	**GT2019-91204** **Influence of Tip Shroud Modeling on the Flutter Stability of a Low Pressure Turbine Rotor** Lorenzo Pinelli[1] Federico Vanti[1] Andrea Arnone[1] Benjamin Bessling[2] Damian Vogt[2] *1. University of Florence, Italy; 2. University of Stuttgart, Germany*	**GT2019-91443** **Transient Modeling of 10 MW Supercritical CO2 Brayton Power Cycles Using Numerical Propulsion System Simulation (NPSS)** Ching-Jen Tang[1] Aaron McClung[2] Douglas Hofer[1] Megan Huang[3] *1. GE Global Research, USA; 2. Southwest Research Institute, USA; 3. Gas Technology Institute, USA*
11:45	**GT2019-91550** **Nonlinear Aerodynamic Damping in a Highly Loaded Vibrating Compressor Cascade** Matthias Schuff, Virginie Chenaux *German Aerospace Center (DLR), Germany*	**GT2019-91489** **Tip-Shroud Labyrinth Seal Effect on the Flutter Stability of Turbine Rotor Blades** Roque Corral[1] Michele Greco[2] Almudena Vega[3] *1. ITP Aeroas, Spain; 2. Universidad Politécnica de Madrid, Spain; 3. Siemens Gamesa, Spain*	**GT2019-90393** **Loop Filling and Start Up With a Closed Loop sCO2 Brayton Cycle** Stefan Cich[1] J. Jeffrey Moore[1] Meera Day Towler[1] Jason Mortzheim[2] Douglas Hofer[3] *1. Southwest Research Institute, USA; 2. GE Energy, USA; 3. GE Global Research, USA*
12:15		**GT2019-91621** **Conceptual Flutter Analysis of Stepped Labyrinth Seals** Roque Corral[1] Almudena Vega[2] Michele Greco[3] *1. ITP Aero, Spain; 2. Siemens Gamesa, Spain; 3. Universidad Politécnica de Madrid, Spain*	**GT2019-90496** **Modeling and Control of a Supercritical CO2 Water Cooler in an Indirect-Fired 10MWe Recompression Brayton Cycle Near Critical Conditions** Eric Liese[1] Priyadarshi Mahapatra[1] Yuan Jiang[2] *1. National Energy Technology Laboratory, USA; 2. Pacific Northwest National Laboratory, USA*

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	TURBOMACHINERY: AXIAL FLOW FAN & COMPRESSOR AERODYNAMICS	TURBOMACHINERY: DESIGN METHODS & CFD MODELING FOR TURBOMACHINERY	
	Casing Treatments	**Numerical Design Methods, Meshing and Blading (2)**	
	Technical Session • 124-B • FB-39-13	**Technical Session • 125-AB • FB-41-19**	
	Session Organizer: **Nick Nolcheff**, Honeywell Session Co-Organizer: **Kenneth Suder**, NASA Glenn Research Center	Session Organizer: **Bharat Lad**, Rolls-Royce plc Session Co-Organizer: **Jochen Gier**, MTU	
10:15	**GT2019-90543** **Numerical Investigation on the Effect of Bleed Port With Self-Recirculating Casing Treatment on the Stability of a 1.5-Stage Transonic Compressor** Yiming Zhong, Wuli Chu, Haoguang Zhang *Northwestern Polytechnical University, China*	**GT2019-90363** **Improving Steady CFD to Capture the Effects of Radial Mixing in Axial Compressors** Lorenzo Cozzi[1] Filippo Rubechini[1] Andrea Arnone[1] Andrea Schneider[2] Pio Astrua[2] *1. University of Florence, Italy; 2. Ansaldo Energia, Italy*	
10:45	**GT2019-91050** **Systematic Experimental Evaluations Aimed at Optimizing the Geometry of Axial Casing Groove in a Compressor** Huang Chen, Subhra Shankha Koley, Yuanchao Li, Joseph Katz *Johns Hopkins University, USA*	**GT2019-90426** **Transient CFD Co-Simulation of a 3D Compressor Model in its 1D System Environment** Andreas Spille-Kohoff[1] Farai Hetze[1] Bennie du Toit[2] *1. CFX Berlin Software GmbH, Germany;* *2. Flownex, South Africa*	
11:15	**GT2019-91369** **Evaluating the Aerodynamic Impact of Circumferentially Grooved Fan Casing Treatments With Integrated Acoustic Liners on a Turbofan Rotor** Richard Bozak, Gary G. Podboy *NASA Glenn Research Center, USA*	**GT2019-90851** **CFD-Based Throughflow Analysis of Transonic Flows in Steam Turbines** Martina Ricci[1] Roberto Pacciani[1] Michele Marconcini[1] Paolo Macelloni[2] Stefano Cecchi[2] Claudio Bettini[2] *1. University of Florence, Italy; 2. Ansaldo Energia, Italy*	
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	Registration 7:00 am - 5:30 pm *Hall 5 & 6 Foyer*	**Registration** 7:00 am - 6:30 pm *Hall 5 & 6 Foyer*	**Registration** 7:00 am - 6:30 pm *Hall 5 & 6 Foyer*	**Registration** 7:00 am - 5:30 pm *Hall 5 & 6 Foyer*	**Registration** 7:00 am - 2:00 pm *Hall 5 & 6 Foyer*
	Speaker Ready Room 7:00 am - 5:30 pm *Room 132-C*	**Speaker Ready Room** 7:00 am - 5:30 pm *Room 132-C*	**Speaker Ready Room** 7:00 am - 5:30 pm *Room 132-C*	**Speaker Ready Room** 7:00 am - 5:30 pm *Room 132-C*	**Speaker Ready Room** 7:00 am - 12:15 pm *Room 132-C*
	Session Participant Networking Coffee 7:00 - 7:45 am *Room 120-D*	**Session Participant Networking Coffee** 7:00 - 7:45 am *Room 120-D*	**Session Participant Networking Coffee** 7:00 - 7:45 am *Room 120-D*	**Session Participant Networking Coffee** 7:00 - 7:45 am *Room 120-D*	**Session Participant Networking Coffee** 7:00 - 7:45 am *Room 120-D*
GT Workshop 8:00 am - 5:00 pm	**Conference Sessions** 8:00 - 10:00 am	**Conference Sessions** 8:00 - 9:30 am	**Conference Sessions** 8:00 - 9:30 am	**Conference Sessions** 8:00 - 10:00 am	**Conference Sessions** 8:00 - 10:00 am
	Coffee Break 10:00 - 10:15 am	**Coffee Break** 9:30 - 9:40 am	**Coffee Break** 9:30 - 9:40 am	**Coffee Break** 10:00 - 10:15 am	**Coffee Break** 10:00 - 10:15 am
	Opening Session Turbo Expo Keynote Panel: Turbomachines for Clean Power and Propulsion Systems 10:15 am - 12:15 pm *Ballroom 120*	**Turbomachines for Clean Power and Propulsion Systems — Aviation Focus** 9:40 am - 11:10 am *Ballroom 120*	**Turbomachinery and Clean Energy – Future Trends and Opportunities** 9:40 am - 11:10 am *Ballroom 120*	**Conference Sessions** 10:15 am - 12:15 pm	**Conference Sessions** 10:15 am - 12:15 pm
		Conference Sessions 11:15 am - 12:45 pm	**Conference Sessions** 11:15 am - 12:45 pm		**Special Session: Planning for your Next Big Life Transition** 10:15 am - 12:45 pm *Room 126*
Registration 12:00 - 6:00 pm *Hall 5 & 6 Foyer*		**Expo Open** 12:30 – 6:30 pm *North Hall 5 & 6*	**Expo Open** 12:30 – 6:30 pm *North Hall 5 & 6*	**Expo Open** 11:30 am – 2:30 pm *North Hall 5 & 6*	
Speaker Ready Room 12:00 - 6:00 pm *Room 132-C*	**Opening Lunch** 12:30 – 2:00 pm *Ballroom 120*	**Expo Lunch** 12:30 - 2:00 pm **Poster Session** 12:15 - 2:00 pm *North Hall 5 & 6*	**Expo Lunch** 12:30 - 2:00 pm *North Hall 5 & 6*	**Expo Lunch** 12:15 - 2:00 pm **Closing Ceremony** 1:30 pm *North Hall 5 & 6*	**Closing Lunch** 12:30 - 2:00 pm *Ballroom 120*
Gas Turbine Segment Meeting 8:30 am - 5:00 pm *Paradise Valley Sheraton Grand Phoenix Hotel*	**Conference Sessions** 2:00 - 3:30 pm	**Conference Sessions** 2:00 - 3:30 pm	**Conference Sessions** 2:00 - 3:30 pm	**Conference Sessions** 2:00 - 3:30 pm	**IGTI Executive Committee** 1:00 - 5:00 pm *Paradise Valley Sheraton Grand Phoenix Hotel*
	Coffee Break 3:30 - 4:00 pm	**Coffee Break** 3:30 - 4:00 pm *North Hall 5 & 6*	**Coffee Break** 3:30 - 4:00 pm *North Hall 5 & 6*	**Coffee Break** 3:30 - 4:00 pm	
	Conference Sessions 4:00 - 5:30 pm	**Conference Sessions** 4:00 - 5:30 pm	**Conference Sessions** 4:00 - 5:30 pm	**Conference Sessions** 4:00 - 5:30 pm	
	Scholar Lecture 5:45 - 7:00 pm *Ballroom 120*	**Expo Hall Reception** 5:00 - 6:30 pm *North Hall 5 & 6*	**Expo Hall Reception** 5:00 - 6:30 pm		
Council of Chairs Meeting 6:00 - 7:30 pm *Room 121-AB*	**Welcome Reception** 7:00 - 8:30 pm *North Ballroom Foyer*	**Committee Meetings** 6:00 - 7:30 pm	**Committee Meetings** 6:00 - 7:30 pm	**Committee Meetings** 6:00 - 7:30 pm	
		Women in Engineering Event/Dinner 7:45 - 10:00 pm *Off-Site*	**ECE/Student Mixer** 6:45 - 8:00 pm *Second Level Foyer*		

SCHEDULE SUBJECT TO CHANGE

ANSYS

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- **Turbine design and optimization**
- **Digital Twin**
- **Clean power and propulsion systems**
- **Additive manufacturing -** ***Register for the workshop, Design and Simulation for Turbomachinery Additive Manufacturing, Sunday, June 16.***

Booth #403