ASME 2018 Turbo Expo

ADVANCE PROGRAM

June 11 - 15, 2018 | Lillestrøm (Oslo), Norway

American Society of Mechanical Engineers (ASME)

ASME SETTING THE STANDARD

ASME INTERNATIONAL GAS TURBINE INSTITUTE

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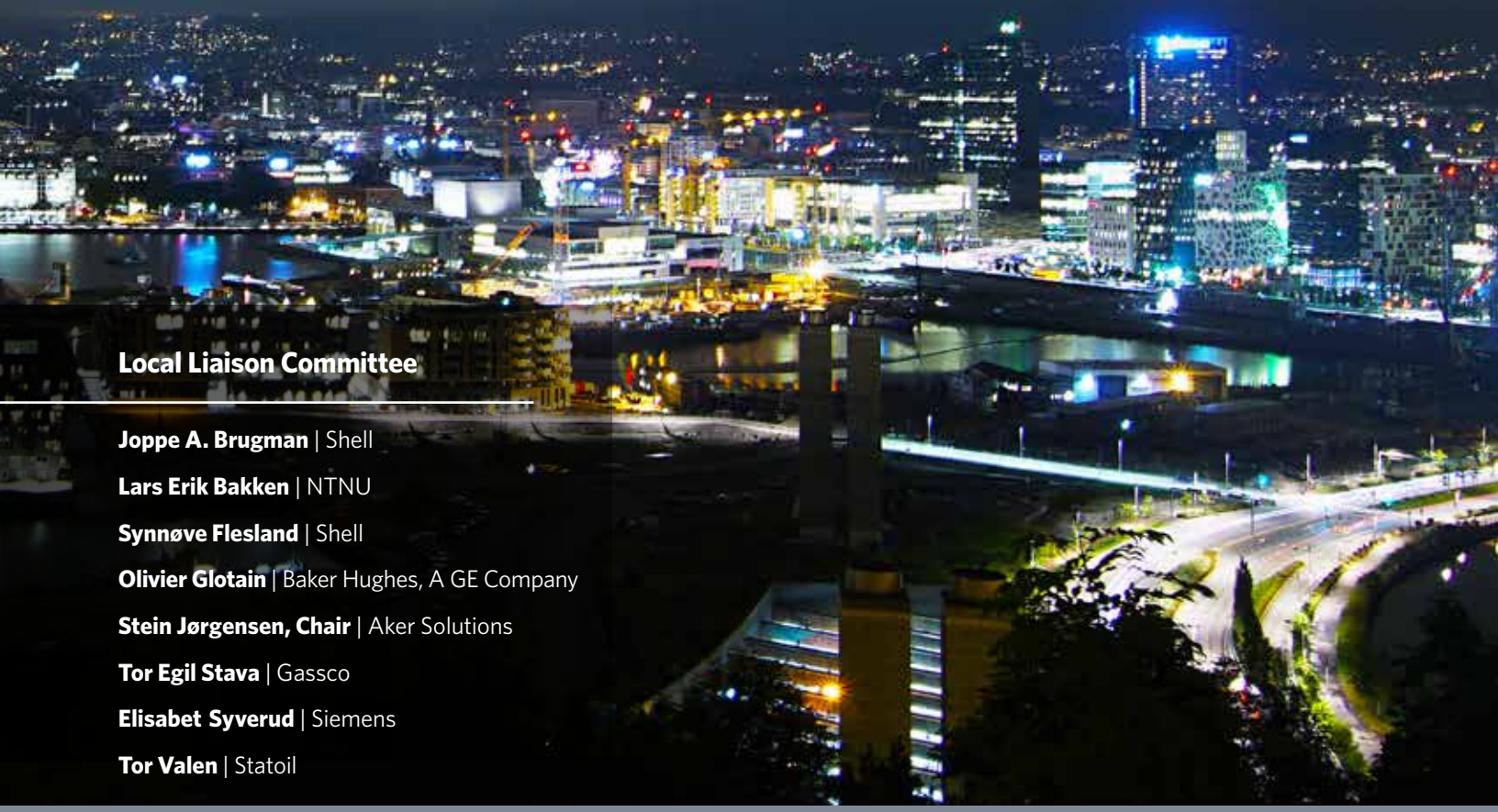
Lillestrøm (Oslo), Norway

Lillestrøm is a town located east-northeast of Oslo, the capital city of Norway. Oslo is the most popular city in Norway and is the economic and governmental centre of Norway. It was ranked number one among European large cities in terms of quality of life.

Norwegian Culture

Norway is arguably one of the most beautiful countries on earth. It's famous for its natural attractions like Fjords, mountains and midnight sun, but it's also well known for a vibrant cultural life. The culture of Norway is closely linked to the country's history and geography. The city of Oslo has a wide variety of cultural institutions and a nice selection of restaurants, some world class. Many of the best things are free of charge, notably Oslo's proximity to wild nature and variety of outdoor activities.



Local Liaison Committee

Joppe A. Brugman | Shell

Lars Erik Bakken | NTNU

Synnøve Flesland | Shell

Olivier Glotain | Baker Hughes, A GE Company

Stein Jørgensen, Chair | Aker Solutions

Tor Egil Stava | Gassco

Elisabet Syverud | Siemens

Tor Valen | Statoil

Norwegian Folk Museum in Oslo

Vigeland Sculpture Park in Oslo

Getting around Lillestrøm and Oslo

Lillestrøm to Oslo

Traveling between Lillestrøm and Oslo is very easy! There are 5 ways to travel between the cities. The quickest and most economical method is by train, which takes 10 mins. The train stop is within walking distance to the Norway Convention Center where ASME Turbo Expo will be held.

Public transportation is free when you purchase the Oslo Pass **https://www.visitoslo.com/en/activities-and-attractions/oslo-pass/prices/**

Find out how to get to Oslo and how to get around the city **https://www.visitoslo.com/en/transport/**

Other Helpful Information

Currency

The Norwegian currency is Norwegian Kroner (NOK). 1 NOK is divided into 100 øre (cents). Coins are circulated in the following denominations: 1 krone, 5 kroner, 10 kroner and 20 kroner.

Tipping

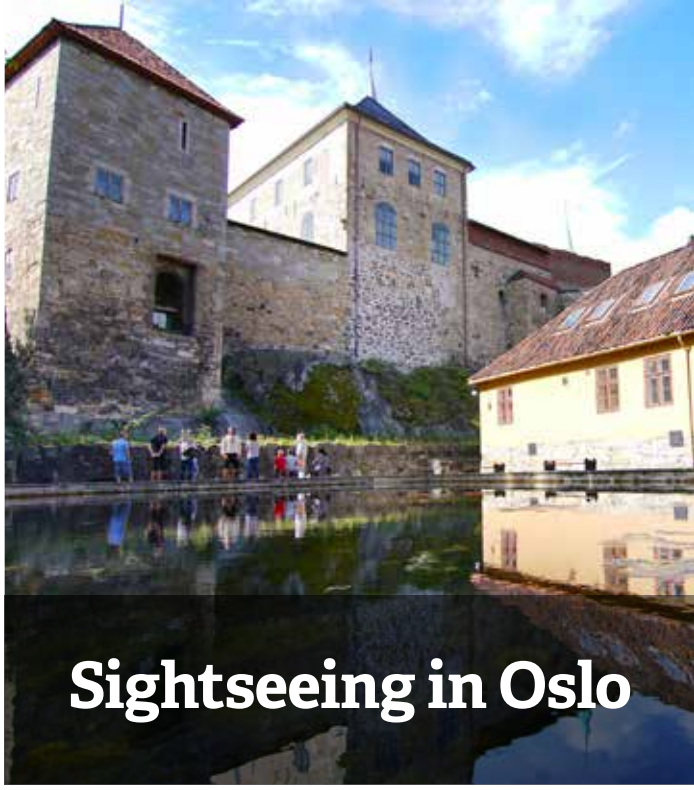
In Norway, tipping is not required. It is, however, usual for Norwegians to leave a tip in restaurants and bars if they are happy about the service. A 10-20% tip is expected if the customer is satisfied. For Norwegians it's uncommon to tip taxi-drivers or cleaning staff at hotels.

Visa Requirements

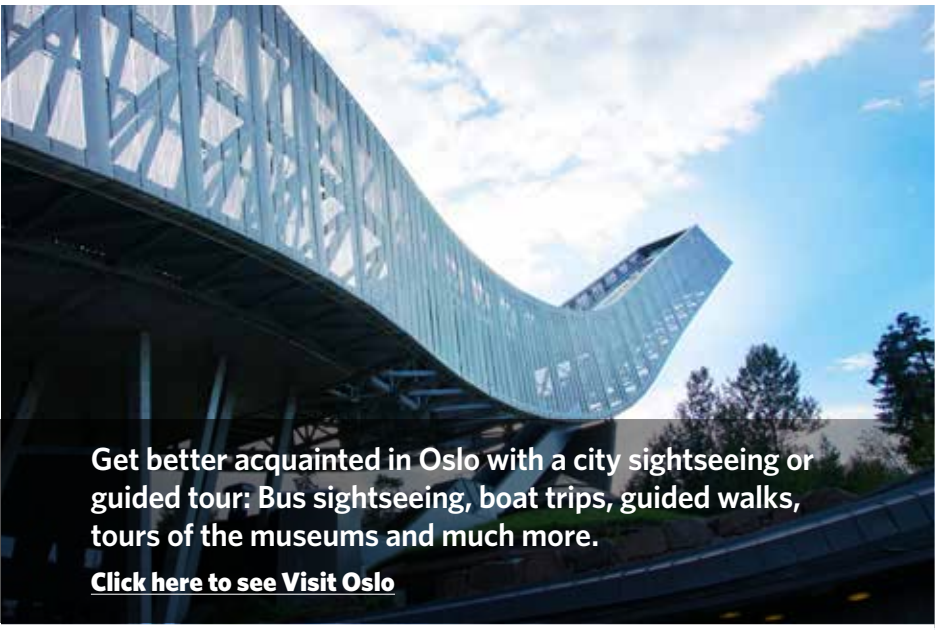
All foreign nationals must have a valid passport to enter Norway. Norway is a part of the Schengen area. The Schengen area includes the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain and Sweden. A visa for any one of the Schengen countries is valid for a stay in all the other Schengen countries during the period for which the visa is valid.

Electrical Outlet

For Norway there are two associated plug types, types C and F. Plug type C is the plug which has two round pins and plug type F is the plug which has two round pins with two earth clips on the side. Norway operates on a 230V supply voltage and 50Hz.



Sightseeing in Oslo



Get better acquainted in Oslo with a city sightseeing or guided tour: Bus sightseeing, boat trips, guided walks, tours of the museums and much more.

Click here to see Visit Oslo

Norway Exhibition and Convention Centre

Messeveien 8, 2004 Lillestrøm, Norway | (10 minutes by train from Oslo, Norway)

Grand Opening & Awards Information

The 2018 keynote theme is Maintenance, Repair and Overhaul in the Light of Digitalization.

Keynote and Awards Program

Maintenance, Repair and Overhaul in the Light of Digitalization

Turbo Expo Keynote & ASME IGTI Annual Awards

Monday June 11, 2018, 10:15 a.m. – 12:15 p.m.
Hall B4, Norway Exhibition and Convention Centre, Lillestrøm (Oslo), Norway

Join the best and brightest experts from around the world at the 2018 must-attend event bringing together business leaders, technology experts and authorities in the field of turbomachinery. It is an ideal opportunity to network, learn about the latest trends and open new chapters in turbomachinery.

Targeted Maintenance, Repair and Overhaul (MRO) at the right time is key to ensuring efficient, reliable and affordable operation of turbomachines throughout their lifetime.

Digitalization thereby provides unprecedented opportunities to define targeted MRO measures, learn valuable lessons from digital twins and optimize processes. In other words, digitalization is about to revolutionize the way of designing, manufacturing, operating and servicing turbomachines. But which are the challenges and opportunities that OEMs are facing in this respect? And how do operators deal with these new trends? What are the views of insurers and certification institutes on this? To learn about these aspects, join your peers and attend the ASME Turbo Expo 2018 Keynote Session on Maintenance, Repair and Overhaul in the Light of Digitalization. Two prominent experts from OEMs, Mr. Paul Stein (RTO Rolls-Royce) and Dr. Zuo Zhi Zhao (CTO Power & Gas Siemens), will share their views on this thrilling subject and discuss it with a panel of specialists from the airline industry, oil & gas industry and insurance/certification 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 SPEAKERS

Mr. Paul Stein is currently Research & Technology Director at Rolls-Royce. He joined the company in 2010 as Chief Scientific Officer. Previously he was Director General, Science and Technology at the UK Ministry of Defence, responsible for national investment in defence science and technology. Prior to that role, Paul was Managing Director of Roke Manor Research, at that time owned by Siemens and was a member of the Siemens UK executive management board, leading on technology and contributing to business strategy.

Dr. Zuo Zhi Zhao is currently Chief Technology Officer in the Power & Gas division at Siemens. He joined the company in 2009 at its Chinese hub in Shanghai as Program Manager of Gas Turbine Technology Development and held the positions of Engineering Manager of Gas Turbine Shanghai Engineering Hub, General Manager of Gas Turbine Business Operation and General Manager of Gas Turbine Business Unit. Previously he was a Project Leader on aircraft engine research and development at GE Global Research in Niskayuna, NY, USA.

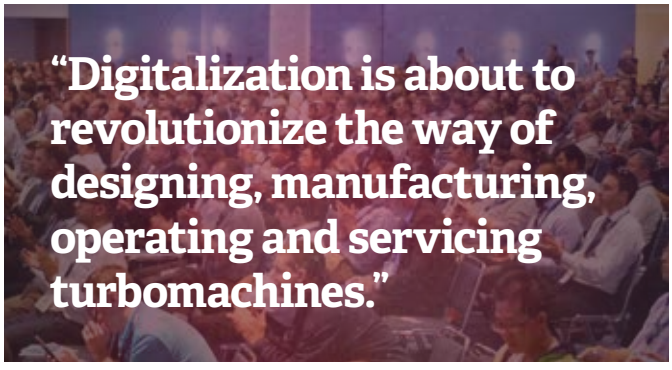
PLENARIES

Additive Manufacturing in MRO

Tuesday, June 12, 2018 | 10:15 – 11:10 a.m.
Hall B4, Norway Exhibition and Convention Centre, Lillestrom (Oslo), Norway

Big Data in MRO

Wednesday, June 13, 2018 | 10:15 – 11:10 a.m.
Hall B4, Norway Exhibition and Convention Centre, Lillestrom (Oslo), Norway



Awards & Scholarships

Young Engineer Turbo Expo Participation Award

The ASME Gas Turbine Segment Young Engineer Turbo Expo Participation Award (YETEP) is intended for young engineers at companies, in government service, or engineering undergraduate or graduate students in the gas turbine or related fields to obtain travel funding to attend ASME Turbo Expo to present a paper which they have authored or co-authored. The purpose is to provide a way for students and young professionals to participate in the annual Turbo Expo.

The nominee must have obtained an academic degree (Bachelor, Master, PhD, or equivalent degrees) in an engineering discipline related to turbomachinery within five years from the year of the Turbo Expo that the applicant wishes to attend. The research results the applicant wishes to present at the conference can have been obtained either while pursuing an academic degree, or afterwards (students, professionals or young academics are eligible).

Congratulations to the 2017 Award Winners:

- Alessio Abrassi, University of Genoa
- Valeria Andreoli, Purdue University
- Myeonggeun Choi, University of Oxford
- Arifur Chowdhury, University of Texas El Paso
- Ward De Paepe, Universite Libre de Bruxelles
- Adam Feneley, Brunel University London
- Seyed M. Ghoreyshi, Texas A&M University
- David Holst, Technical University Berlin
- Seongpil Joo, Seoul National University
- Julia Ling, Citrine Informatics
- Anandkumar Makwana, Penn State University
- Georg Atta Mensah, Technical University Berlin
- Aravin Daas Naidu, Technical University of Munich
- Stefano Puggelli, University of Rouen
- Janith Samarasinghe, GE Global Research
- Prashant Singh, Virginia Tech
- Natalie R. Smith, Southwest Research Institute
- Alom Mohammed Nur, National Institute of Technology Meghalaya
- Adam Gabor Vermes, TU Delft
- Sheng Wei, Georgia Institute of Technology

Nomination deadline for ASME Turbo Expo 2018 was February 1. Be sure to send in an application for ASME Turbo Expo in 2019.

https://www.asme.org/events/turbo-expo/program/students.

ASME IGTI Student Scholarship Program

ASME International Gas Turbine Institute has a long and proud history of providing scholarships to students who show promise for their future profession in the turbomachinery field. The aim is to attract young talent to the profession and reward their commitment, favoring their upcoming enrollment and active participation. ASME IGTI has supplied more than one million dollars to fund these scholarships over the years. The scholarship is to be used for tuition, books and other University expenses. The check will be made out to the University on the student's behalf.

Student application deadline is June 15, 2018 for the 2018-2019 School Year. Scholarship winners will be notified by the end of October 2018. Scholarships will be disbursed in November.

Eligibility of the Applicants

The nominee must be pursuing an academic degree (Bachelor, Master, PhD, or equivalent degrees) in an engineering discipline related to turbomachinery. Students

Awards & Scholarships

must be currently registered at an accredited university (either U.S. or international). The university must have a gas turbine program of some type and only requires that a gas turbine or power course that has significant gas turbine content be offered.

Application Requirements

The application package must contain:

1. A succinct motivational letter (max 1 page) illustrating reasons that should lead to a positive decision by the selection committee;
2. The application form listing the data allowing to assess the eligibility of the applicant, duly signed; and the IRS Foreign W8BEN Form (if a non-US citizen)
3. A nomination form and recommendation letter by the applicant's academic supervisor, or by an industry professional involved in his/her studies. Student should follow up with nominator to confirm the packet has been sent to ASME.
4. Any other document the applicant wishes to attach in order to support the application. (Proof of awards and honors, memberships in honorary or professional societies showing offices held, extra-curricular activities, etc.)

Congratulations to the 2016-2017 Student Scholarship Winners:

- Samuel Barak - University of Central Florida
- Bogdan Cezar Cernat - Von Kaman Institute/Universite Catholique de Louvain
- Zeyuan Cheng - Beihang University
- Ssu-Ying Chien - Virginia Polytechnic Institute & SU
- Arifur Chowdhury - University of Texas at El Paso
- Gen Fu - Virginia Polytechnic Institute & SU
- Florian W. Jacob - Cranfield University
- Zhiping Mao - Duke University
- Farzam Mortazavi - Texas A&M University
- Ali Nikparto - Texas A&M University
- Benjamin Oluwadare - University of Sheffield
- Utkudeniz Ozturk - Polytechnic University of Catalonia
- Manikandan Rajasekaran - Indian Institute of Technology, Madras
- Aravinth Sadagopan - The Penn State University
- Avijit Saha - Indian Institute of Technology, Kharagpur
- Joshua Sebastiampillai - Cranfield University
- Li Weihong - Tsinghua University
- Hua Xiao - Cardiff University
- Kai Zhang - Shanghai Jiao Tong University
- Meiyin Zhu - Beihang University

Application is available at: https://community.asme.org/international_gas_turbine_institute_igti/w/wiki/4029.honors-and-awards.aspx.

Student Advisory Committee Travel Award

The Student Advisory Committee (SAC) represents the interest of the students who attend Turbo Expo and serves as a student-specific liaison to the Gas Turbine Segment Leadership Team. The Committee will engage students by creating student-oriented programs at ASME Turbo Expo, such as poster presentation, tutorial sessions and activities that facilitate student interaction and networking with turbomachinery professionals. This year the SAC is sponsoring up to 20 travel awards for students who actively contribute to the growth of the committee. The awards are reimbursement awards that cover up to $2,000 of travel expenses for the recipients.

Awards & Scholarships

Congratulations to the 2017 Award Winners:

- Thomas Jackowski, Karlsruhe Instititute of Tech
- Deepanshu Singh, Indian Institute of Technology
- David Gonzalez Cuadrado, Purdue University
- Shane Haydt, Penn State
- Nguyen LaTray, UT Arlington
- Chiara Gastaldi, Politecnico di Torino
- Bogdan Cezar Cernat, von Karmen Institute/UCL
- Lisa Zander, Technical University Berlin
- Theofilos Efstathiadis, Aristotle University of Thessaloniki
- Suo Yang, Georgia Institute of Technology
- Alexander Heinrich, Technical University Berlin
- Masha Folk, University of Cambridge
- Simone Giorgetti, Universite Libre de Bruxelles
- Cori Watson, University of Virginia
- Lv Ye, Xi'an Jiaotong University
- James Braun, Purdue University
- Michael Branagan, University of Virginia
- Maria Rinaldi, KTH Royal Institute of Technology
- Salman Javed, Delhi Technological University
- Niclas Hanraths, Technical University Berlin

The deadline for application was February 1. Be sure to check the Website for an application for the 2019 Conference.

The ASME R. Tom Sawyer Award

The R. Tom Sawyer Award is bestowed on an individual who has made important contributions to advance the purpose of the Gas Turbine Industry and to 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. The award was established in 1972 to honor R. Tom Sawyer who, for over four decades, toiled zealously to advance gas turbine technology in all of its aspects and includes a US $1000 honorarium and a plaque presented during ASME Turbo Expo.

The nomination must be complete and accompanied by three to five Letters of Recommendation from individuals who are well acquainted with the nominees' qualifications. Candidate nominations remain in effect for three years and are automatically carried over. The completed reference form from a minimum of 3 people will need to be sent in with the nomination package. It is up to the "Nominator" to submit all required information.

Your nomination package should be received at the ASME Office no later than August 15, 2018 to be considered.

ASME IGTI Awards

11757 Katy Freeway, Ste 380

Houston, TX 77079, USA

Email: igtiawards@asme.org

Congratulations to the 2017 ASME R. Tom Sawyer Award winner Dr. Alan H. Epstein, Vice President Technology and Environment, Pratt & Whitney

The ASME Gas Turbine Award

The Gas Turbine Award is given in recognition of an outstanding individual (or multiple) author contribution to the literature of combustion gas turbines or gas turbines thermally combined with nuclear or steam power plants. The paper may be devoted to design aspects or overall gas turbines or individual components and/or systems such as compressors, combustion systems, turbines, controls and

Awards & Scholarships

accessories, bearings, regenerators, inlet air filters, silencers, etc. It may cover topics specifically related to gas turbines such as high temperature materials or fuel considerations, including erosion and corrosion complications. It can also be devoted to application or operational aspects of gas turbines for aircraft propulsion and ground power units, or automotive, electric utility, gas pipeline pumping, locomotive, marine, oil field pumping, petrochemical, space power, steel, and similar uses. This award was established in 1963 and includes a US $1000 honorarium and a plaque presented during ASME Turbo Expo.

Congratulations to the 2015 ASME Gas Turbine Award winners Dr. Robert Miller, Professor of Aerothermal Technology at the University of Cambridge and Director of the Rolls-Royce Whittle Laboratory University Technology Centre, and Dr. Ho-On To, Whittle Laboratory and Rolls-Royce Derby within the Fan & Compressor Aerodynamics.

ASME IGTI John P. Davis Award

Awarded annually by ASME IGTI in recognition of the technical paper that most significantly describes new or continuing gas turbine applications; identifies planning, installation, operating and/or maintenance problems and their solutions; and exemplifies candid exposure of real-world problems and solutions and is judged, therefore, to be of exceptional value to others supplying or using gas turbines and their support systems. The Award was established in 1985 and includes a US $1,000 honorarium (divided equally among recipients if awarded to a multiple-author paper) and is presented at ASME Turbo Expo.

Congratulations to the 2015 John P. Davis Award winners Dr. Rakesh K. Bhargava, Founder and President of Innovative Turbomachinery Technologies Corp; Lisa Branchini, Post Doctoral Researcher at the University of Bologna; Michele Bianchi, Professor of Fluid Machines, University of Bologna; Andrea De Pascale, University Researcher and Assistant Professor in Energy Systems, University of Bologna; and Valentina Orlandini, Postdoctoral Research Engineer, University of Bologna.

The ASME IGTI Aircraft Engine Technology Award

The Aircraft Engine Award recognizes sustained personal creative contributions to aircraft gas turbine engine technology. Eligible areas of accomplishment are aircraft engine design, and/or research and development performed in an industrial, academic or research laboratory environment in one or more of the following fields:

- Aircraft Engine Propulsion
- Airframe-Propulsion Integration
- Combustion & Fuels
- Controls
- Diagnostics
- Heat Transfer
- Manufacturing Materials & Metallurgy
- Operability
- Structures & Dynamics
- Turbomachinery

The Aircraft Engine Technology Award will include an optional opportunity to deliver a lecture or present an invited technical paper on the work for which the award is being

Awards & Scholarships

bestowed, at ASME Turbo Expo. The recipient of the award will very desirably, but not necessarily, be a member of The American Society of Mechanical Engineers. The award will be made to a single individual.

Nominating and supporting letters for the Aircraft Engine Technology Award should be sent by October 15, 2018 to:

ASME
11757 Katy Freeway, Ste. 380
Houston, TX
77079 USA
igtiawards@asme.org

Nominating letters should contain all information on the nominee's relevant qualifications. The Award Committee will not solicit or consider materials other than those described below. The selection committee will hold nominations active for a period of three years.

A minimum of two supporting letters from individuals, other than the nominator, must accompany the nominating letter. Supporting letters should reflect peer recognition of the nominee's breadth of experience with various aspects of industrial gas turbine technology.

Congratulations to the 2017 Aircraft Engine Technology Award winner Professor Michael G. Dunn, Director of the OSU Gas Turbine Laboratory - Department of Mechanical Engineering at The Ohio State University.

The ASME IGTI Industrial Gas Turbine Technology Award

The Industrial Gas Turbine Technology Award recognizes sustained personal creative scientific or technological contributions unique to electric power or mechanical drive industrial gas turbine technology. Eligible areas of accomplishment are gas turbine design, application, operations/maintenance, and research/development/deployment, performed in an industrial, academic or research laboratory environment in one or more of the following fields:

- Combustion, Fuels, & Emissions Abatement
- Controls
- Diagnostics
- Electric Power Plant Integration
- Fluid Dynamics & Thermal Sciences
- Operation, Maintenance, & Life Cycle Cost
- Manufacturing, Materials, & Metallurgy
- Structures & Dynamics
- Thermodynamic Cycles
- Turbomachinery

The Industrial Gas Turbine Technology Award will include an optional opportunity to deliver a lecture or present an invited technical paper on the work for which the award is being bestowed, at ASME Turbo Expo. The recipient of the award will very desirably, but not necessarily, be a member of The American Society of Mechanical Engineers. The award will be made to a single individual.

Nominating and supporting letters for the Industrial Gas Turbine Technology Award should be sent by October 15, 2018 to:

ASME
11757 Katy Frwy, Ste 380
Houston, TX
77079 USA
igtiawards@asme.org

Nominating letters should contain all information on the nominee's relevant qualifications. The Award Committee will not solicit or consider materials other than those described

Awards & Scholarships

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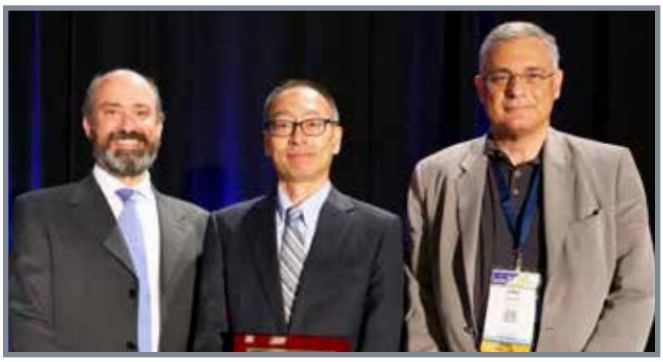
A minimum of two supporting letters from individuals, other than the nominator, must accompany the nominating letter. Supporting letters should reflect peer recognition of the nominee's breadth of experience with various aspects of industrial gas turbine technology.



Congratulations to the 2017 Industrial Gas Turbine Technology Award winner Dr. Eisaku Ito, senior general manager in marketing and innovation at the headquarters of MHI.

ASME IGTI Dilip R. Ballal Early Career Award

Early Career Awards are intended to honor individuals who have outstanding accomplishments during the beginning of their careers. Historically, there has been no such award to recognize early career engineers working in the area of turbomachinery.

An early career award is intended for those starting a professional career, which is typically after a relevant terminal degree: BS, MS, or PhD. A criterion of seven-years-from-degree will be used to define the nominee's eligibility. The nominee must receive the award prior to the completion of the seventh year beyond the terminal degree.

The recipient of the Dilip R. Ballal Early Career Award will be presented with the award at Turbo Expo. The award consists of a plaque, funds to support the travel and registration costs to Turbo Expo, free ASME membership registration for five years, and a US $2000 honorarium.

Nomination Requirements

The nomination package should include the following:

1. A paragraph (less than 50 words) from the nominator highlighting nominee's contributions
2. Nomination letter
3. Two supporting letters
4. Current resume of the nominee

Nomination packets are due to ASME on or before August 1, 2018. Send complete nomination to: igtiawards@asme.org.

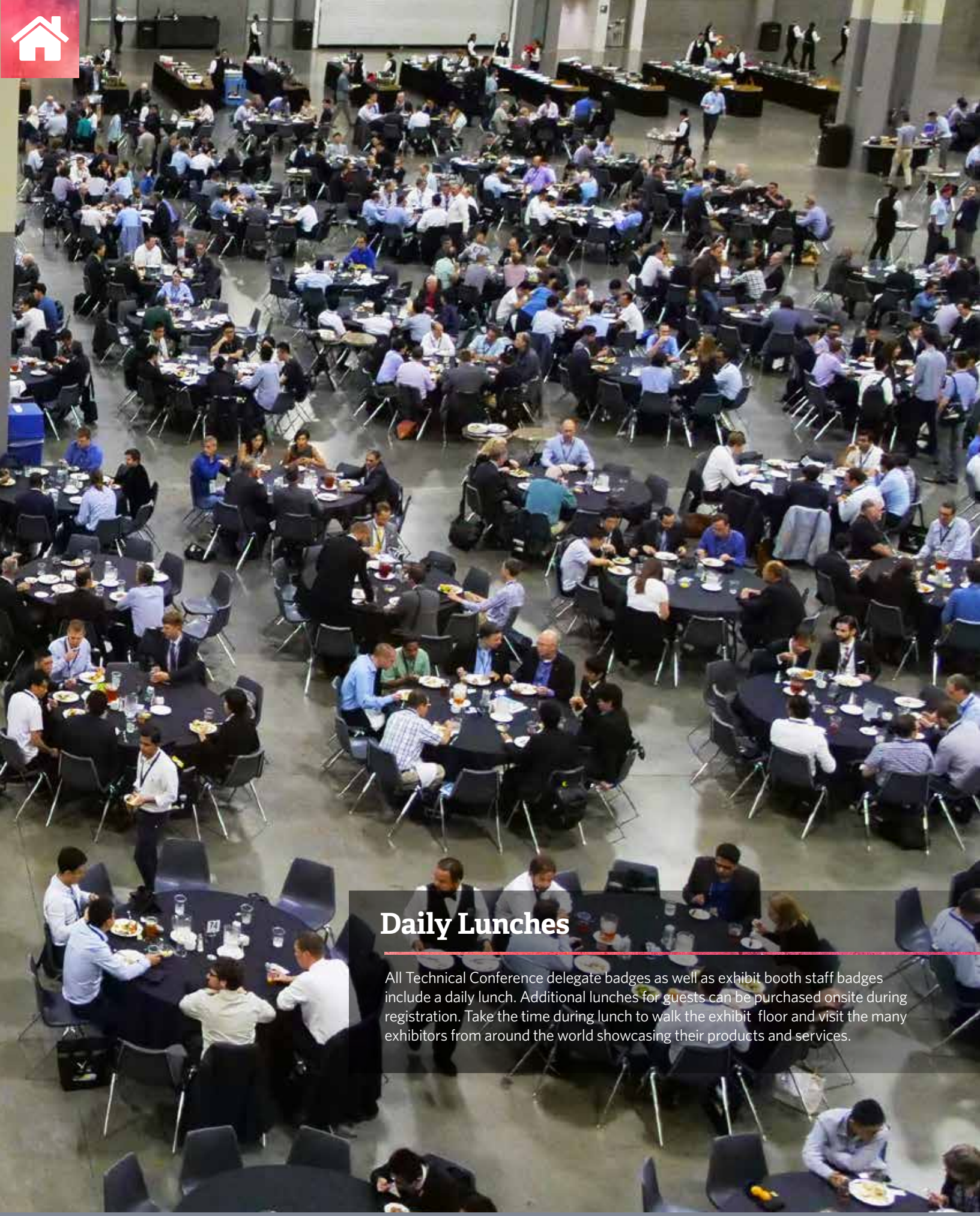
Congratulations to the 2017 Dilip R. Ballal Early Career Award winner Dr. Subith Vasu, assistant professor at the Center for Advanced Turbomachinery and Energy Research (CATER), Mechanical and Aerospace Engineering at the University of Central Florida.

Networking Events

Networking during the conference is an effective method of marketing that is used to build new business contacts through connecting with other like-minded individuals. Make sure you attend all of the networking opportunities during the event. Bring your business cards!

Welcome Reception

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.



Daily Lunches

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 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 12 & 13 | 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.

Student Mixer

Wednesday, 6:45 – 8:00 p.m.

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.

Women in Engineering Networking Event

Tuesday, June 12 | 7:45 p.m. – 10:30 p.m. | Sponsored by GE and Pratt & Whitney

Pratt & Whitney
A United Technologies Company

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.

Women in Engineering Event

Katherine A. Knapp Carney
Exec. Director – Mechanical Systems, Externals & Nacelles Engineering

Pratt & Whitney

Katherine Knapp Carney is originally from Rhode Island. She attended George Washington University in Washington, DC and graduated with a Bachelor of Science in Mechanical Engineering. After graduation Katherine joined Pratt & Whitney in East Hartford Connecticut, a division of the United Technologies Corporation. After joining Pratt & Whitney she took advantage of the United Technologies Corporation Employee Scholar Program completing a Masters in Mechanical Engineering from Rensselaer Polytechnic Institute and an MBA from Carnegie Mellon University.

Katherine started her career in 2005 working on military nozzle design. She worked on the F135 program through the validation phase of the program supporting engine test. As Pratt & Whitney launched the Geared Turbo Fan product family Katherine transitioned to engine inlet design and aerodynamics. During this time she joined the Pratt & Whitney Women's Council whose mission is to support the recruitment, development and retention of female talent by raising the awareness of career opportunities, coaching, guiding, mentoring and providing an inclusive networking environment. She progressed to President of the Council working with the team to increase the Council participation and executing events such as the Leadership Forum to celebrate female accomplishments and champion the change needed for an inclusive workplace.

Katherine moved to the Mechanical Systems engineering organization responsible for the bearing compartments and lubrication system of the engine as well as the Fan Drive Gear system, the game changing technology behind the Geared Turbo Fan. Katherine continued to lead Mechanical Systems teams supporting the different Geared Turbo Fan platforms through engine certification and entry into service. In 2015 Katherine was named an ASME Distinguished Engineer of the Year for her work on resolving a cabin odor issue on the PW1500G powered Bombardier C-Series aircraft. In 2016 Katherine was named Senior Director of the Mechanical Systems organization responsible for the fan drive gear system, bearing compartment and lubrication system designs for all current and future engine programs. In 2017 she was named Executive Director as her role was expanded to include the External engine architecture and Nacelles along with Mechanical Systems. Additionally, she continues to provide leadership to Pratt & Whitney's engineering organization at large with commitment to its incredibly talented employees who believe flight unleashes the world to go beyond.

Katherine lives in Tolland Connecticut with her husband Kevin. Together they enjoy running and traveling. They are welcoming their first child in December 2017.

Silvia Sabbadini
Material Development and Application Consulting Engineer

Avio Aero | Rivalta di Torino, Italy

Silvia was born in Torino and raised in a small town near Torino. She attended Technical University of Torino and graduated in Chemical Engineering in 1997 after spending one year in Montpellier, France to complete her thesis at the Chemical Engineering School.

After graduating Silvia changed several roles until she joined Avio in 2001 as material application engineer. She later held a management position in the area of Research & Development of new materials. She worked for several years in the field of additive manufacturing technologies, contributing to the creation of a center of excellence for additive processes near Milano.

In 2014 Silvia took the responsibility of the newly born Engineering Material Systems team within Engineering: her role was to set-up the foundation of this team, spread in several sites in Italy and in Poland.

In February 2016 she was appointed Consulting Engineer for Material Development and Application, coordinating the technical effort of all the Engineering Material Systems teams in Europe.

She travels a lot and likes visiting new countries. She has two children; her hobbies are playing volleyball, playing tennis and skiing.

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www.rolls-royce.com/futuretechnology

We're working on technology today that will fly his kids around the world.

For 100 years we have inspired generations to take the best that exists and make it better.

Today, as the No.1 engine company for new widebody aircraft, our customers have come to expect the world-leading technology, performance and support that our global teams provide around the clock. But intelligent innovators never stand still - at the forefront of the aerospace industry, we have a responsibility to anticipate the solutions that our customers will need many decades from now.

In just a few years, he will see that this future started life long before he did with our Advance and UltraFan® engine families - demonstrating our long-term commitment to keep our customers at the top of their game and to continue inspiring for many generations to come.

We deliver the best jet engines in the world

The story continues...

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Technical Sessions

The Technical Conference has a well-earned reputation as the premier forum on all aspects of gas turbine and related turbine technology. The 2018 program features technical sessions, panel discussion, tutorials, user-focused sessions and more.

Technical Sessions

Aircraft Engine

Sessions within this track address issues of interest across a broad spectrum of aircraft engine technology subjects. Presenters will cover a range of topics including:

- Conceptual Design and Optimization
- Modeling, Simulation and Validation
- Whole Engine Performance and Novel Concepts
- Operability (inlet distortion, fan-inlet interaction)
- Engine Maintenance and On-wing Monitoring of Deterioration (prognostics and health monitoring)
- Thermal Management Systems
- Inlets, Nozzles, Mixers and Nacelles
- Propellers and Open Rotors
- Combustion and Emissions

Additionally, the following tutorial and panel sessions will be presented:

- APU Tutorial
- Basics of Gas Turbine Engines
- Radical Concepts to Improve Fuel Efficiency
- USAF Case Study of Utilizing Digital Twin in Propeller Upgrade
- NASA Icing Panel Session
- Boundary Layer Ingesting Propulsion and Aircraft

Ceramics

Ceramics are important materials for consideration in the extreme environments found in the gas turbine engine hot sections due to their higher temperature mechanical as well as lower density than metals. The advantages of utilizing ceramic hot section components include weight reduction, improved thermal efficiency as well as enhanced power output and lower emissions. In order to realize the potential of rotating and static ceramic components, some unique technical challenges are being overcome by the engineering community. Specific areas of research and development include:

- Design, development and processing of monolithic ceramic and ceramic matrix composite (CMC) materials;
- Development, processing and characterization of Thermal and Environmental Barrier Coatings (TBCs/EBCs);
- Modeling and validation of material performance;
- Life Prediction;
- NDE;
- Test methods and standards;
- Design and fabrication of components;
- Engine & laboratory testing of components.

The technical and panel sessions sponsored by the ceramics committee cover breakthrough developments and demonstrations critical for the incorporation of ceramic hot section components for gas turbine engines. Two topical sessions are organized for the 2018 ASME IGTI:

- Ceramic Matrix Composites: Properties and Performance
- Ceramic Matrix Composites: Modeling and Life Prediction

Coal, Biomass & Alternative Fuels

Sessions focus on high-interest topics in the area of alternative fuel systems for gas turbines, including steam turbine and other turbomachinery technologies. Alternative and renewable fuels include gaseous hydrocarbon fuels and alternative liquid hydrocarbon fuels derived from coal or biomass feedstocks. Technical, tutorial, and panel sessions will cover the fundamental physical and chemical properties of renewable fuels, important to their use in gas-turbine engines and other power systems, as well as their application in different power systems. Sessions will be of interest to researchers/technologists involved in the generation and utilization of non-conventional fuels in gas-turbine-based energy systems and for those wishing to start a new activity in this field.

- Alternative Fuel Chemistry and Fundamentals
- Alternative Fuel Use in Gas-Turbine Engines
- Basics of Alternative Fuels

Technical Sessions

- Liquid Fuel Atomization and Combustion
- Basics of Computational Fluid Dynamics

Combustion, Fuels & Emissions

Aero and Industrial Gas Turbines with low specific fuel consumption and reduced CO2 emissions require high combustor outlet temperatures with a continued emphasis on reducing emissions, without sacrificing operability or durability. In addition, Combustion systems are increasingly expected to operate with synthetic gaseous fuels or alternative liquid fuels. The Combustion, Fuels & Emissions sessions will highlight new technology and design approaches, using both experimental and computational techniques, employed to achieve improved combustor performance including ultra-low pollutant emissions and enhanced operability such as turndown and transient response. Broad trends for the 2018 conference include a continued focus on combustion dynamics for lean-staged combustion systems, significant innovation in the development of combustion system such Dry Low NOx or novel rotary detonation, maturation of large eddy simulation analyses, as well as continued research of fundamental and applied topics in atomization, mixing, ignition, auto ignition, blowout and chemical kinetics. Technical sessions include:

- Ignition & Auto Ignition
- Atomization & Sprays
- Fundamental Combustion
- Novel Combustion Concepts
- Flashback & Blowout
- Pollutant Emissions Formation & Control: Combustor Performance
- Combustor Design & Development
- Chemical Kinetics
- Combustion Noise
- Pollutant Emissions: Modeling, Soot and Particulates
- Combustion Dynamics: Basic Mechanisms, Flame Response to Perturbations, Instability, Analysis, Model Development and Damping & Control
- Combustion Modeling: Combustor Simulations and Large Eddy Simulations
- High Hydrogen Combustion
- Dry Low-NOx Combustor Development
- Micro Devices
- Jet-in-crossflow & Swirling Flows
- Combustor Diagnostics

Controls, Diagnostics & Instrumentation

The Controls, Diagnostics & Instrumentation Committee will host technical, panel and tutorial sessions that will closely examine the global challenges associated with Gas Turbine Engine Technology. These will include the latest developments in gas turbine engine control, prognostics, diagnostics and health management, artificial intelligence, and instrumentation technology, and the impact these technologies have in enabling more efficient and reliable engines, lowering engine emissions, and reducing engine operating costs. More precisely, the exchange of information between experts from Government, Academia and Industry is promoted on the following topics:

- Control System Technology
- Optimal and Intelligent Controls
- Active Component Control
- Distributed Engine Control
- Engine Health Management
- Gas Path Performance Diagnostics
- Structural and Mechanical Component Health Management
- On-Board Engine Monitoring and Diagnostics
- Prognostics for Gas Turbine Engines
- Novel Sensors and Sensor Technologies
- Development of Standard and High Temperature Test Rigs

Technical Sessions

and Probes

- Optical and Non-intrusive Measurement Techniques
- Flow, Temperature, Pressure and Acoustic Instrumentation
- Advanced Data Reduction Methods
- Integrated Controls and Diagnostics
- Modeling for Controls and Diagnostic Applications
- Life Usage Monitoring and Life Extending Control Algorithms and Sensors

Cycle Innovations

The Cycle Innovations Committee is dedicated to the advancement of technology and innovation, with a particular focus on the thermodynamic cycle of gas turbine–based plants for power generation and propulsion. The Committee traditionally attracts paper submissions from a wide range of disciplines and scientific areas. Some of the thematic areas the Committee currently encompasses are listed below:

- Low or No Emissions Thermal Cycles and Advanced CO_2 Handling
- Supercritical CO_2 Cycles
- H2 Production and Utilization
- Polygeneration Cycles and Process Integration (Power, Heat, Cooling, Fuels, Chemicals)
- Advanced Steam and Humid Air Cycles
- Steam and Water Injection Gas Turbine Cycles
- Closed Cycle Gas Turbine Technology
- Novel Aero Propulsion Systems for Aircraft and Rotorcraft
- Novel Marine Propulsion Systems
- Innovative Heat Recovery Steam Generators & Once Through Steam Generators
- Renewable and Bio-Energy Concepts and Innovative Cycles
- Concentrated Solar Power Systems Incorporating Gas Turbine Technology
- Fuel Cell Driven Cycles and Hybrid Systems
- Externally Fired Gas Turbines and High Temperature Heat Exchangers
- New Cycles for Distributed Power Generation
- Thermo-Economic and Environmental Impact Analysis
- Cycle Simulation and Analysis for Performance and Health Assessment
- Low Temperature Heat Recovery Cycles
- Geothermal Cycles
- Compressed Air Energy Storage
- Innovative Control Systems For Power Plants
- Optimization of Traditional and Innovative Energy and Propulsion Systems

Education

Sessions encompass gas turbine/turbomachinery education both in the university and in industry. Specific teaching tools and techniques will be discussed, including web-based and large-scale remote education, along with industry opportunities for gas turbine engineers. Anyone interested in gas turbine/turbomachinery engineering education is welcome, from students to PhDs. Academics will be exposed to ideas and best practices being used at other institutions as well as innovative approaches for gas turbine/turbomachinery education. Industry will have an opportunity to interact with educators to discuss relevant topic areas and to express the expectations with regard to changing needs. Discussions here have the potential to influence engineering education for a positive impact on future engineers. The sessions provide an active and constructive dialogue about gas turbine/turbomachinery education among practitioners from the industry, students, educators and researchers.

- Education Issues

Electric Power

The Electric Power Committee (EPC) promotes the exchange of significant technical information about the application and operation of gas turbine power plant systems. The EPC organizes technical and tutorial sessions that deal with the current topics in the electric power industry related to the gas turbine as a major power plant component, its integration

Technical Sessions

into the power plant, as well as the optimization of the overall plant. Presenters include owner/operators, original equipment manufacturers and industry independent service providers.

The EPC also coordinates a panel session of the Original Equipment Manufacturers (Pathway Forward) and another of the Equipment Owner/Operators (Voice of the Customer), each intended to provide information and perspective on the current energy market. Furthermore, with respect to the economic and regulatory boundary conditions that provide commercial direction to gas turbine technology developers and their equipment's application, the EPC offers a panel session on these topics to provide a perspective on the challenges affecting our industry.

- Combined Cycle Advancements
- Gas Turbine Analysis & Optimization
- Turbine Development
- Path Forward: Gas Turbine Technology
- Voice of the Customer – User Experience with Gas Turbine Technology
- Turbine Industry Update
- Gas Turbine Operational Risk Management

Fans & Blowers

Improvements in fans and blowers are means to address the global energy challenge, with manufacturers increasingly focusing on improvement in fan efficiency under legislative pressure and as a part of their response to global climate change.

The academia-industry collaboration and the up-front use of Computational Fluid Dynamics (CFD) and Experimental Fluid Dynamics (EFD) are the key ingredients to facilitate the advancement from traditional empirical design methodologies. In response to these challenges, the ASME-IGTI Fans and Blowers Technical Committee consider all technical aspects associated with fans and blowers, with a special emphasis on:

- Fans and Blowers: Computational Fluid Dynamics
- Fans and Blowers: Experimental Methods
- Fans and Blowers: Optimization
- Fans and Blowers: Noise Analysis and Experiments
- Fans and Blowers: System Component Design and Analysis

Heat Transfer

Heat transfer is a pacing technology in the development of advanced high-performance gas turbines for aircraft propulsion and power generation in both simple and combined cycle operations. The heat transfer sessions offered at Turbo Expo 2018 relate to every aspect of the state-of-the-art heat transfer, internal air system and seals design of turbomachinery and will include 225 technical papers and presentations in 50 sessions. Heat transfer topics are subdivided into 13 tracks, one of which is sponsored jointly with Turbomachinery committee and the second with Combustion, Fuels & Emissions committee. The Conjugate Heat Transfer track with 2 sessions presents the latest methodology of performing conjugate heat transfer computations for the design of several critical gas turbine components, including validation with measurements. While the Numerical Internal Cooling track (6 sessions) primarily focuses on both CFD- and non-CFD-based computations, the Experimental Internal Cooling track (5 sessions) focuses on the advanced experimental methods and benchmark-quality measurements and empirical correlations. Both these tracks present all aspects of internal cooling technology for the design of turbine blades and vanes and adjacent hot components. Similarly, the Numerical Film Cooling (6 sessions) and Experimental Film Cooling (7 sessions) tracks offer a wide range of information related to the development and recent research activities on film cooling that contribute significantly to heat transfer advancement in cooled turbomachinery components. Both these tracks include sessions detailing novel film cooling holes geometries, film cooling optimization, and recent advances in numerical and computational methods suitable for advanced film cooling design and performance. General Computation Heat Transfer (2 sessions) and General Experimental Heat (5 sessions) cover a broad range of topics from fundamental heat transfer research to the development of advanced CFD and heat transfer methods and tools. Internal Air Systems & Seals track (9 sessions), offered jointly with the Turbomachinery Committee, represents the key area of gas turbine internal cooling and sealing technologies. Sessions in this track include papers on hot mainstream gas ingestion, pressure loss, free and forced convection heat transfer on rotating

Technical Sessions

surfaces and in closed cavities, including innovative sealing systems and cooling air delivery concepts. The Combustors track (3 sessions) is held jointly with the Combustion, Fuels and Emissions Committee. This track presents numerical and experimental studies on optimal cooling of combustor liners and all aspects of combustor heat transfer. In Turbo Expo 2017, Heat Transfer Committee offers three new tracks, each with one session. Additional tracks include Additive Manufacturing (2 sessions), Multiphysics Modeling & Optimization (1 session), and Special Sessions (1 session), which features a session on miscellaneous heat transfer investigations that do not fit in other tracks. The Tutorials track presents two basic heat transfer tutorial sessions for all interested conference attendees.

Conjugate Heat Transfer

- Conjugate Heat Transfer I
- Conjugate Heat Transfer II

Numerical Internal Cooling

- Passages with Turbulators and Bends I
- Passages with Turbulators and Bends II
- Leading Edge and Tip Cooling
- Rotating Flows
- Innovative Models & New Concepts

Experimental Internal Cooling

- Impingement Cooling
- Special Topics
- Passages with Enhancement Features
- Cooling System Designs
- Cooling with Rotation

Numerical Film Cooling

- Numerical Simulation of Vane & Blades Film Cooling Design
- General Numerical Simulation of Film Cooling
- Numerical Simulation of Vanes End-wall & Blades Tip Film Cooling Design
- Numerical Simulation of Novel Film Cooling Design
- Unsteady Film Cooling Simulation
- Modelling Techniques for Film Cooling Numerical Simulation

Experimental Film Cooling

- NGV/Blade Film Cooling
- Endwall Film Cooling
- Hole Geometry Effects I
- Hole Geometry Effects II
- Film Cooling - Internal Geometry Effects
- Tip and Trailing Edge Cooling
- Methods and Analysis for Film Cooling

General Computational Heat Transfer

- Computational Heat Transfer I
- Computational Heat Transfer II

General Experimental Heat Transfer

- Thermal Systems Design and Research
- Blade Tip, Shroud and Casing Heat Transfer
- Experimental Investigation of Impingement Heat Transfer
- Experimental Heat Transfer Methods and Heat Exchangers

Internal Air Systems & Seals (with Turbomachinery)

- Air System Pre-Swirl and Analysis
- Air System Components
- Labyrinth Seals
- Brush, Leaf, and Labyrinth Seals
- Rim Seals 1
- Rim Seals 2
- Rim Seals 3

Technical Sessions

- Rotor Cavities
- Shaft Seals and Lube Oil Systems

Combustors (with Combustion, Fuels & Emissions)

- Combustor Liner Heat Transfer
- Combustor-Turbine Interaction
- Combustor Heat Transfer

Additive Manufacturing

- Additive Manufacturing I
- Additive Manufacturing II

Multiphysics Modeling & Optimization

- Multiphysics Modeling & Optimization

Special Sessions

- Miscellaneous Heat Transfer Investigations

Tutorials

- Heat Transfer Tutorial I: Physics-Based Introduction to Vortex, Windage, Rothalpy, Mach Number, Choking, Normal Shock, and Entropy Map
- Heat Transfer Tutorial II: Turbine Cooling Fundamentals

Industrial & Cogeneration

Representing gas turbine applications within the cogeneration and process industries, technical sessions in this track cover a wide range of topics on cogeneration/CHP (Combined Heat & power) systems, including but not limited to the following: thermoeconomic analysis, optimization and simulation methods, design, operation & maintenance aspects of Heat Recovery Steam Generators, operation & maintenance issues of cogeneration plants, gas turbine power augmentation technologies (inlet chilling, high pressure fogging, and wet compression or overspray, dry/humid air inject, steam injection, etc.), compressor fouling, inlet air filtration systems, compressor washing, gas turbine upgrades and modifications, environmental and regulatory issues, and lessons learned from field experiences.

Other applications such as non-gas turbine based cogeneration/CHP systems (steam turbine and reciprocating engine based systems, solar energy based systems, etc.), cogeneration and cold energy recovery in LNG plants, hybrid cogeneration systems (combined with fuel cells), and organic Rankine cycle based systems are also included.

Panel/Tutorial sessions cover topics on cogeneration technologies, compressor washing technologies, inlet air filtration systems, gas turbine power augmentation technologies, dynamic modeling of cogeneration/CHP systems, gas turbine combustion processes and emissions issues, fuel related issues, and Impact of Shale energy market.

- Gas Turbine Augmentation Technologies - Inlet Fogging, Wet Compression and Water Injections
- Waste Heat Recovery and Energy Storage Technologies
- Co-Generation Power Plant Performance, Operation and Maintenance
- Design and Evaluation of Co-Generation Power Systems
- Special Topics for Industrial and Co-Generation Systems
- Combustion & Emissions

Marine

Gas turbines are increasingly being used in both naval and commercial marine applications. Marine sessions showcase the latest developments and best practices for gas turbines and associated equipment in marine electrical power and propulsion systems. Paper subjects cover a variety of gas turbine related topics ranging among hot corrosion of advanced material, inlet filtration and protection, development and testing of hybrid electric propulsion, different innovative marine propulsion systems, and papers on clutch designs and comparisons for these marine propulsion systems.

Technical Paper Session Topics include:

- Design and Development
- Applications
- Auxiliaries and Support Systems
- Numerical Analysis and Performance Simulation

Technical Sessions

Microturbines, Turbochargers & Small Turbomachines

- Oil-Free Bearing Systems
- Turbochargers - Turbines 1
- Turbochargers - Turbines 2
- Turbochargers - Compressors 1
- Turbochargers - Compressors 2
- Turbochargers - Performance & Systems
- Turbochargers - Bearings & Seals
- Microturbine Combustion and Fuels
- Microturbine Design, Development and Performance
- Microturbine and small compressor Performance and Design in Refrigeration Cycles
- Small Turbomachines Performance and Design

Manufacturing Materials & Metallurgy

The field of materials and metallurgy associated with gas turbine manufacturing has traditionally been the source of numerous disruptive technologies such as the development of superalloys, precision single-crystal investment casting and ceramic coatings. These in turn have allowed an incredibly accelerated pace of innovation. Next generation materials and processes will allow even higher efficiency and reliability as well as greater flexibility operational mode. A major goal is to balance these with lower emissions and lower life-cycle cost of turbomachinery. Materials with higher strength, lighter weight and improved durability are required for these applications. The continuing development in metallurgy and materials science has resulted in newer materials, better surface protecting methods, and more reliable component life. Development in manufacturing technologies, including better process planning/optimization, advance machining operations, additive manufacturing, newer coating and repair methods, helps to reduce the manufacturing cost and decrease overall operating cost of gas turbines. Condition assessment of parts after service and advanced repairs are required to further reduce life cycle cost and impact to the environment.

The MMM committee is organized to disseminate the latest developments and research results in the areas of manufacturing, materials and metallurgy to gas and steam turbine designers, manufacturers, users, repair and service vendors, researchers and consultants. In addition to technical paper sessions, panel sessions are planned where highly experienced panel members will discuss their latest experiences and knowledge in manufacturing methods, repair/coating processes and component inspections.

Tutorials and lectures will be given on gas turbine materials.

- Coatings for Gas Turbine Engines
- Additive Manufacturing Properties, Products, Processes
- Component Degradation, Life Prediction, Prognostics
- Advances in Superalloys
- Manufacturing and Repairs

Oil & Gas Applications

The Oil & Gas industry is a large user of turbomachinery. The demand for oil and gas is consistently growing, and changing market conditions require innovative solutions. Operation and optimization of turbomachinery in a variety of Oil & Gas applications is therefore of great interest. Moreover, potentially extreme operation environments require the consideration of innovative design and operational attributes. Sessions in the Oil & Gas Applications Committee address both theoretical and practical Oil & Gas industry perspectives. The technical sessions provide the latest information on gas turbines and compressors in pipeline and compression stations. Particular emphasis is given to design, operation and maintenance, management, dynamic behavior, diagnostics and vibration and noise, as well as to all engineering issues in Oil & Gas applications.

Wet gas compression and multi-phase pumping are also addressed, due to the increasing interest in many installations. The Oil & Gas Applications Committee brings industry experts together in panel and tutorial sessions jointly held by both academic educators and industry

Technical Sessions

professionals. Both basics of Oil & Gas installations and off-design operation issues will be covered, aimed to ensure improved efficiency and safe and reliable operation. The latest information about environmental impact, product upgrade, risk assessment, standards and legislation of gas turbines and compressors in Oil & Gas applications is also provided.

- Diagnostic, Prognostic and Control
- Wet Gas Compression
- Two- and Multi-Phase Applications
- Surge and Stall
- Fouling and Degradation
- MRO/Digital
- LNG and Off-Shore Applications
- Performance and Design
- Miscellaneous

Organic Rankine Cycle Power Systems

The use of an organic fluid in place of water (steam) in Rankine cycles is in general advantageous if the thermal energy source is at low/medium temperature, and/or the thermal power availability is small (few kW to few MW). In these cases the proper selection of the working fluid allows to obtain comparatively higher cycle efficiency, to solve several technological problems to obtain a more compact design of the expander and to limit the air leakage in the condenser. In the rather new framework of decentralized conversion of low temperature heat into electricity, the Organic Rankine Cycle (ORC) technology offers an interesting alternative, which is partly explained by its modular feature: a similar ORC system can be used, with little modifications, in conjunction with various heat sources such as waste heat, geothermal, biomass combustion or solar power. The technical sessions cover the latest research and operational experience in this field, with a special focus on working fluid, expansion machines, modeling and optimization issues.

- Cycle and Component Analysis
- Design and Testing

Steam Turbines

ASME Turbo Expo 2018 includes a track dedicated to Steam Turbines. While many of the analyses, computational methods, and experimental techniques are common for steam turbines and gas turbines, there are some unique features on steam turbines that warrant special consideration. Separate, co-located, steam turbine sessions at Turbo Expo provide a natural way of sharing many of the cutting edge technologies while giving the steam turbine community a dedicated forum for the unique technical challenges associated with wet steam, long last stage blades, industrial and cogeneration steam turbines, erosion, stresscorrosion-cracking (SCC) and more.

- Steam Turbines Panel
- Steam Turbines Tutorial
- Steam Turbines Special Interest Session
- Heat Transfer & Thermal Aspects
- Blade Vibrational Aspects
- General Design Aspects
- LSB and Exhaust Design Aspects
- Mechanical Aspects
- Valves & Seals
- Design Optimization and Probabilistic Modelling
- HP/IP Aerodynamics and Design
- Wet Steam I
- Wet Steam II

Structures & Dynamics

The expanded use of gas turbines in extreme environments introduces new demands on the structural integrity of aero and industrial gas turbine development and operation. The program of seven Structures & Dynamics tracks, including (1) Emerging Methods in Design & Engineering, (2) Fatigue, Fracture & Life Prediction, (3) Probabilistic Methods, (4) Rotordynamics, (5) Bearing & Seal Dynamics, (6) Structural Mechanics, Vibration & Damping and (7)

Technical Sessions

Aerodynamic Excitation & Damping, covers highly relevant issues concerning the mechanical integrity of gas turbine engines, compressors, steam and wind turbines as well as turbochargers.

Papers in the Structures and Dynamics Committee deal with best-in-class structural mechanics solutions by contributing fluid, acoustic, thermodynamic, and cooling interactions, which have an impact on the reliability and lifetime prediction or failure-free operation of mechanical components. Modeling and design methodologies based on analytical, numerical, probabilistic and experimental approaches are presented in more than 40 technical sessions organized by internationally recognized industry leaders and academic researchers. International networking is arranged among all attended engineers, designers and researchers representing industry, academia and government from different countries.

All participants benefit from scientific discussions and identification of cutting edge technological news and trends in mechanical integrity for meeting today's and tomorrow's challenges in gas, steam and wind turbine industry for the best cross-product methodology synergy. The diversity of subjects covered will boost attendees' knowledge and contribute to their professional career development. The S&D panel and tutorial sessions, organized in collaboration with other Congress Committees, leverage engineer's knowledge for topics of the highest interest to the international mechanical engineering society.

Emerging Methods in Design & Engineering

- Developments in Optimization Methods and Parameter Studies
- Emerging Methods in Structural System Design
- Emerging Methods Application

Fatigue, Fracture & Life Prediction

- Crack Growth Modelling
- Creep and Themomechanical Fatigue Modelling
- Fatigue Life Modelling
- Integrity of Engine Components (1)
- Integrity of Engine Components (2)
- Material and Structural Integrity

Probabilistic Methods

- Probabilistic Applications
- Probabilistic Method Developments
- Probabilistic Application – Airfoils

Rotordynamics

- Rotordynamics I - Analyses
- Rotordynamics II - Model Improvements
- Rotordynamics III - Experiments and Special Investigations
- Rotordynamics IV - Application
- Rotordynamics V - Bearings and Seal Flows

Bearing & Seal Dynamics

- Seals 1
- Tilting Pad Bearings
- Seals 4
- Gas Bearings 3
- Gas Bearings 4
- Seals 5
- Seals 6
- Magnetic Bearings 2
- Seals 2
- Bearings 1
- Bearings 2
- Gas Bearings 1
- Gas Bearings 2
- Seals 3
- Magnetic Bearings 1
- Squeeze Film Dampers

Structural Mechanics, Vibration & Damping

- Mistuning I: General Aspects
- Experimental Vibration Analysis

Technical Sessions

- Tip Timing Measurements
- Introduction to Harmonic Balance and Application to Nonlinear Vibration Analysis
- Mistuning II: Aerodynamic and Contact Interaction
- Mistuning III: Intentional Mistuning
- Mistuning IV: Geometric and Material Imperfections
- Frictional Joints I: Underplatform Dampers
- Frictional Joints II: Shrouds, Flanges, Bolts, and Root Joints
- Dynamics of Bladed Disks with Nonlinearities
- Vibration and Damping of Bladed Disks
- Rotor-Stator Interaction

Aerodynamic Excitation & Damping

- Aeroelastic Design and Flutter Mitigation Mechanisms
- Numerical and Experimental Methods for Flutter Evaluation
- Flutter Sensitivity to Specific Parameters
- Forced Response I
- Forced Response II

Supercritical CO_2 Power Cycles

Supercritical CO_2 based power cycles provide significant efficiency and cost of electricity benefits to applications in waste heat, thermal solar, nuclear, and fossil fuel power generation. They also provide for separation, compression, transportation, and storage (geologic) of CO_2 from fossil fuel power plants. The approach to supercritical geologic storage of CO_2 benefits greatly from the existing technology and knowledge amassed around CO_2 utilization and management in the oil & gas industry. While the end goals of the CO_2 based power cycles and the CO_2 storage applications in the oil & gas industry are different, the properties of the working fluid, thermodynamics, technology and machinery used for these applications are very similar. The confluence of interests related to the use and management of supercritical CO_2 has created an imperative to further the understanding of these applications. The Supercritical CO_2 Power Cycle committee organizes sessions that focus on the dissemination of machinery and cycle related technologies of sCO_2 power plant applications.

- Supercritical CO_2 Turbomachinery
- Supercritical CO_2 Compressors
- Supercritical CO_2 Heat Exchangers
- Supercritical CO_2 Testing
- Supercritical CO_2 Properties and Design Considerations
- Supercritical CO_2 Cycle Optimization
- Supercritical CO_2 Oxy-Combustion
- Supercritical CO_2 Cycle Concepts and Modeling

Turbomachinery

The Turbomachinery Committee of ASME IGTI at Turbo Expo is the premier forum for the world's experts from academia, industry, and government to share advances in the state of the art in turbomachinery aero/thermodynamics technology. Technical paper sessions address aerodynamics topics on fans, compressors, turbines, and ducts in axial, radial and mixed flow configurations. The technical content covers not just a wide range of gas turbine applications for air and marine propulsion and power generation, but also other important sectors such as oil and gas, industrial gas compression, and expanders for waste heat recovery. Design concepts and processes, experimental results, and analytical approaches for modeling with CFD and simpler models are addressed. Design topics include such areas as optimization strategies, endwall profiling, leakage effects, tip clearance effects, quality effects, flow control, casing treatments, unsteady flows, and stall inception and control. Modeling topics include turbulence and transition modeling, LES and DNS, accelerated steady and unsteady formulations, and multi-stage steady CFD, as well as lower-order (non-CFD) models. The increasing emphasis on interaction effects between adjacent components and between multiple disciplines is reflected in specific sessions on these subjects. In addition, several sessions sponsored jointly with other committees focus on important areas of crossdisciplinary interest: with Heat Transfer, sessions on turbine cooling and secondary flow circuits; with Structures, on aeromechanics;

Technical Sessions

and with Aircraft, on noise and acoustics. A new track was added this year to address all facets of deposition, erosion, fouling, and icing; sessions in this track are jointly sponsored by several other committees.

Turbomachinery: Axial Flow Fan & Compressor Aerodynamics

- Water Ingestion, Fogging, Pre-Cooling
- Transition & Roughness Effects
- Compressor Experiments
- Manufacturing & Deterioration Effects
- Transonic Compressor Design
- Tandem Aerofoils
- Tip-Clearance Flows
- Design Concepts
- End-Wall Flows & Passage Contouring
- Seal & Leakage Flows
- Flow Control - 1
- Flow Control - 2
- Flow Control - 3
- Casing Treatment - 1
- Casing Treatment - 2
- Stall
- Fan Design - 1
- Fan Design - 2
- Test Rig & Facility Design
- Compressor Design - 1
- Compressor Design – 2

Turbomachinery: Axial Flow Turbine Aerodynamics

- Endwall Profiling
- Tip leakage flows I
- Low Pressure Turbine Aerodynamics I
- Low Pressure Turbine Aerodynamics II
- Low Pressure Turbine Aerodynamics III
- Unsteady flows and transition
- Aerodynamic Studies I
- Aerodynamic Performances and Design
- Aerodynamic Losses
- Aerodynamic Studies II
- Aerodynamic Studies III

Turbomachinery: Design Methods & CFD Modeling for Turbomachinery

- LES and DNS Methods and Applications (1)
- LES and DNS Methods and Applications (2)
- Compressor Design Methods and Applications (1)
- Compressor Design Methods and Applications (2)
- Turbine Design Methods and Applications (1)
- Turbine Design Methods and Applications (2)
- Optimization Methods and Applications (1)
- Optimization Methods and Applications (2)
- Preliminary Design Methods (1)
- Preliminary Design Methods (2)
- Preliminary Design Methods (3)
- Radial Turbomachinery Design Methods and Applications (1)
- Cavity, Bearings and Seal Design Methods and Applications (1)
- Fan Design Methods and Applications
- Component Interaction and Multi-Physics Coupling (1)
- Novel Solver and Simulation Frameworks (1)
- LES and DNS Methods and Applications (3)
- Novel Solver and Simulation Frameworks (2)

Technical Sessions

- Cavity, Bearings and Seal Design Methods and Applications (2)
- Methods and Application for Hydrodynamics
- Application and Methods for Unsteady Flow (1)
- Component Interaction and Multi-Physics Coupling (2)
- Geometry Design and Meshing (1)
- Flow Separation, Loss and Boundary Layer Interaction Methods
- Novel Solver and Simulation Frameworks (3)
- Geometry Design and Meshing (2)
- Preliminary Design Methods (4)
- Radial Turbomachinery Design Methods and Applications (2)
- Novel Methods for CFD (1)
- Novel Methods for CFD (2)

Turbomachinery: Noise, Ducts and Interactions

- Compressor and Combustion Noise
- Fan and Engine Noise
- Gas Turbine Engine Intakes, Exhaust Diffusers, and Ejectors
- Gas Turbine Engine Transition Ducts and Flow Interactions

Turbomachinery: Radial Turbomachinery Aerodynamics

- Radial and Mixed Flow Turbines I
- Radial and Mixed Flow Turbines II
- Centrifugal Compressors 1
- Centrifugal Compressors 2
- Centrifugal Compressors 3
- Centrifugal Compressors 4
- Centrifugal Compressors 5
- Centrifugal Compressors 6
- Centrifugal Compressors 7

Turbomachinery: Unsteady Flows in Turbomachinery

- Unsteady Flows in Compressors I
- Unsteady Flows in Turbines I
- Unsteady Flows in Turbines II
- Unsteady Flows in Turbines III
- Unsteady Flows in Turbines IV
- Stall and Surge I
- Stall and Surge II
- Stall and Surge in Centrifugal Compressors
- Unsteady Flows in Centrifugal Compressors
- Analysis and Processing Techniques for Unsteady Flows
- Unsteady Flows in Compressors II

Turbomachinery: Multidisciplinary Design Approaches, Optimization & Uncertainty Quantification

- Parameterization Approaches
- Manufacturing Tolerances and Uncertainties
- Surrogate-Assisted Approaches, including Sampling and Data Mining
- Axial Compressors, Propellers and Fans
- Turbine Design and Cooling
- Preliminary Design Systems and Approaches
- Adjoint Methods
- Multidisciplinary Optimization and Sensitivity Analysis (fluid, structure)
- Sensitivity Analysis and Design for AM

Turbomachinery: Deposition, Erosion, Fouling, and Icing

- Multi-phase (Water/Ice) Deposition in Gas Turbines
- Modeling Deposition in Turbine Cooling Passages

Technical Sessions

- Erosion in Turbines
- Deposition Modeling - I
- Deposition Modeling - II

Wind Energy

The rapid expansion of wind power and the steady decrease in the cost of wind-generated electricity has consolidated the position of wind power as an indispensable part of the global energy mix. Thus, the Wind Energy Technical Program will focus on innovations that are driving technological advances in the wind industry. The technical presentations cover aerodynamics, aeroelasticity, structures and condition monitoring aspects of wind turbines, as well as the interaction of wind turbines with other energy systems. These topics are addressed for small and large wind turbines, as well as vertical and horizontal axis wind turbines. Special panel sessions highlight the challenges that the industry is facing, as well as research being undertaken in universities and research laboratories. For experts and beginners, tutorial sessions and workshops will be presented to detail developments and tools that are employed in the rapidly growing wind industry.

The main topics addressed during the Turbo Expo 2018 conference are:

- Blade and Airfoil Aerodynamics: Experiments
- Blade and Airfoil Aerodynamics: Numerical Simulations
- Vertical Axis Wind Turbines
- Structural Loads, Aeroelasticity and Noise
- Condition Monitoring and Reliability
- Wind Turbine Simulation Methods and Applications
- Introduction to Wind Energy
- Latest Developments on Wind Turbine Design
- Flow Control and Smart Wind Turbines
- Tutorial: Machine Learning-based Power Curve Methods
- Academic Research Panel Session
- Industry Panel Session


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Workshops

The following pre-conference workshops will be held on Sunday, June 10. Consider attending one of the workshops and take advantage of the LOW registration fee. Registration is available online.

Workshops

Physics-Based Modeling of Gas Turbine Secondary Air Systems

8:00 am – 5:00 pm

In gas turbines used for power generation and aircraft propulsion, the main flow paths of compressors and turbines are responsible for the direct energy conversion. To ensure acceptable life (durability) under creep, LCF, and HCF from operational transients causing high temperatures and their gradients in critical engine components, around 20% of the compressor air flow is used for cooling and sealing. This is analogous to blood, water, and air flow within a human body for its proper functioning. The main thrust of this workshop is to develop a clear understanding of the underlying flow and heat transfer physics and the mathematical modeling of various components of gas turbine secondary air systems (SAS). Besides some key concepts of thermofluids, the workshop will discuss vortex, windage and disk pumping in rotor/stator cavities, centrifugally-driven buoyant convection in compressor rotor cavities, pre-swirler systems, multiple reference frames, hot gas ingestion and rim sealing, and whole engine modeling (WEM) using multisurface forced vortex convection links with windage in a layered approach. Additionally, the workshop will provide a design-friendly overview of rotating compressible flow network methodology along with robust solution techniques, physics-based post-processing of 3-D CFD results, and the generation of entropy map for design optimization. A number of design-relevant examples will also be solved in the workshop.

Note: Prior to the workshop, participants are encouraged to review Chapter 2 (Key Concepts of Thermofluids) and Chapter 5 (Compressible Flow) from the book Fluid Mechanics: An Intermediate Approach (Author: Bijay K. Sultanian) published by Taylor & Francis on July 28, 2015.

Earn 7 Professional Development Hours (PDH's) and receive a certificate of completion!

Key Benefits to Participants

- Will develop a strong foundation in flow and heat transfer physics of various components of gas turbine secondary air systems
- Will be more knowledgeable in developing accurate physics-based and solution-robust secondary air flow network models
- Will be more knowledgeable in detecting input and modeling errors in their flow network models
- Will correctly interpret results from their models for design applications.
- Will develop skills to hand-calculate results to perform s anity-checks of predictions by design tools as well as to validate these tools during their development and continuous improvement
- Will improve participant's engineering productivity with reduced design cycle time

Who Should Attend

Design and research engineers involved in secondary air systems design, airfoil cooling, rotor heat transfer, whole engine modeling, and active and passive turbine tip clearance control of advanced gas turbines for aircraft propulsion and simple- and combined-cycle power generation, including Oil & Gas and Land & Marine applications.

Workshop Schedule

8:00 – 10:00 am | Module 1: An Overview of Secondary Air Systems

- Role of Secondary Air Systems (SAS) modeling in gas turbine design engineering
- The concept of physic-based modeling
- Key components of SAS
- Flow network modeling and robust solution techniques
- Role of 3-D CFD in SAS modeling
- Physics-based post-processing of CFD results
- Entropy map generation and application

10:00 – 10:15 am | Break

10:15 am – 12:00 pm | Module 2: Special Concepts of Secondary Air Systems – Part I

- Free vortex
- Forced vortex

Workshops

- Rankine vortex
- Windage
- Compressible flow functions
- Loss coefficient and discharge coefficient for an incompressible flow
- Loss coefficient and discharge coefficient for a compressible flow

12:00 – 1:00 pm | Lunch

1:00 – 2:00 pm | Module 3: Special Concepts of Secondary Air Systems – Part II

- Euler's turbomachinery equation
- Rothalpy
- Multiple reference frames
- Pre-Swirler system
- Rotor disk pumping

2:00 – 3:00 pm | Module 4: Physics-Based Modeling – Part I

- Stationary and rotating orifices and channels
- Rotor-stator and rotor-rotor cavities
- Windage and swirl distribution
- Centrifugally-driven buoyant convection in compressor rotor cavity with and without bore flow

3:00 – 3:15 pm | Break

3:15 – 4:00 pm | Module 5: Physics-Based Modeling – Part II

- Hot gas ingestion
- Turbine rim sealing
- Coupling with rotor-stator cavity purge flow and windage

4:00 – 5:00 pm | Module 6: Physics-Based Modeling – Part III

- Whole engine modeling (WEM)
- Multisurface forced vortex convection link with windage
- Junction treatment in the network of convection links
- Layered flow network modeling methodology
- Key recommendations on SAS modeling
- Gas Turbines: Internal Flow Systems Modeling

(Author: Bijay K. Sultanian) to be published by Cambridge University Press in 2018 under Cambridge Aerospace Series)

Instructor

Dr. Bijay (BJ) K. Sultanian, *PhD, PE, MBA, ASME Fellow*

Dr. Bijay Sultanian is an international authority in gas turbine heat transfer, secondary air systems, and Computational Fluid Dynamics (CFD). Dr. Sultanian is Founder & Managing Member of Takaniki Communications, LLC, a provider of high-impact, web-based, and live technical training programs for corporate engineering teams. Dr. Sultanian is also an Adjunct Professor at the University of Central Florida, where he has been teaching graduate-level courses in Turbomachinery and Fluid Mechanics since 2006. During his 30+ years in the gas turbine industry, Dr. Sultanian has worked in and led technical teams at a number of organizations, including Allison Gas Turbines (now Rolls-Royce), GE Aircraft Engines (now GE Aviation), GE Power Generation (now GE Power & Water), and Siemens Energy (now Siemens Power & Gas). He has developed several physics-based improvements to legacy heat transfer and fluid systems design methods, including new tools to analyze critical high-temperature components with and without rotation.

During 1971-81, Dr. Sultanian made landmark contributions toward the design and development of India's first liquid rocket engine for a surface-to-air missile (Prithvi) and the first numerical heat transfer model of steel ingots for optimal operations of soaking pits in India's steel plants.

Dr. Sultanian is a Fellow of the American Society of Mechanical Engineers, a registered Professional Engineer in the State of Ohio (1995), a GE-certified Six Sigma Green Belt (1998), and an Emeritus Member of Sigma Xi, The Scientific Research Society (1984). His graduate textbook Fluid Mechanics: An Intermediate Approach has been published by Taylor & Francis on July 28, 2015. For the ASME Turbo Expo 2018, he is the Heat Transfer Committee Point Contact, a role he also had for Turbo Expos 2013, 2016, and 2017.

Dr. Sultanian received his B. Tech. and MS in Mechanical Engineering from Indian Institute of Technology, Kanpur (1971) and Indian Institute of Technology, Madras (1978), respectively. He received his PhD in Mechanical Engineering from Arizona State University, Tempe (1984) and MBA from the Lally School of Management and Technology at Rensselaer Polytechnic Institute (1999).

Workshops

Design, Operation and Maintenance Considerations for Cogeneration and Combined Cycle Systems

8:00 am – 5:00 pm

This course is designed to provide a comprehensive understanding of design, operational and maintenance issues experienced by owners/operators/consultants of cogeneration, district heat and cooling and combined cycle systems. In addition to refreshing the basics of these systems and related recent developments, attendees will become familiar with various practical considerations and rules of thumb relating to the key topics listed below on technologies currently used and under development for enhanced performance. Topics also include:

- Importance of design, performance, operational, and maintenance issues of HRSG systems
- Emissions related issues, best available emissions control technologies and environmental regulations
- Operational and maintenance considerations with emphasis on performance enhancement technologies
- Case studies of actual systems and lessons learned

Who Should Attend

Owners, operators, consultants, designers, engineering, procurement & construction companies, government policy and regulatory staff, young engineers and project developers involved with; gas turbine cogeneration, district heating & cooling and combined cycle systems, and waste heat recovery applications.

Earn 7 Professional Development Hours (PDH's) and receive a certificate of completion!

Instructor Bios

Rakesh Bhargava, Ph. D.

Dr. Bhargava is President and Founder of Innovative Turbomachinery Technologies Corp. His expertise includes applications of gas turbines and other rotating and reciprocating machines and packaged process equipment used in the off-shore, refinery, power generation, chemical, and pipeline industries. His more than 30 years of experience encompasses inspection and design reviews of process machinery and packaged equipment, field problems resolution, on-site plant equipment performance testing, failure analysis, technical evaluation of used gas turbines, technical expertise in commercial disputes involving rotating machines and the global energy market analysis. He has given numerous invited lectures on gas turbine technologies and energy market around the world and provides customized training courses on rotating machinery and related topics. He is an active member of API Committee on Standards on Mechanical Equipment and has participated in upgrades of number of API specifications. He is a Fellow and Associate Fellow of ASME and AIAA, respectively and is past Chair of the ASME/IGTI Industrial & Cogeneration Committee. Dr. Bhargava received his Ph.D. in Mechanical Engineering from the City University of New York.

Cyrus Meher-Homji, P.E.

Cyrus Meher-Homji is an Engineering Fellow and Technology Manager at Bechtel Corporation. He works as a turbomachinery advisor for the LNG Technology Group on ongoing LNG projects and studies. His thirty four years of industrial experience covers gas turbine and compressor engineering, design and troubleshooting. His areas of interest include condition monitoring, aerothermal analysis and gas turbine and compressor applications in LNG liquefaction. Cyrus is a registered Professional Engineer in the State of Texas, a Fellow of ASME and is active on several committees of ASME's International Gas Turbine Institute. He serves on the Texas A&M University Turbomachinery Symposium Advisory Committee. Cyrus has a Master's Degree in Engineering from Texas A&M University and an MBA from the University of Houston.

Manfred Klein

Manfred Klein is principal consultant with MA Klein & Assoc. He is recently retired with 33 years in the Canadian government, most recently as Coordinator, Energy and Environment at the Gas Turbine Labs of the National Research Council. Prior to this, he spent eleven years at the National Energy Board and 16 years with Environment Canada, involved in gas pipelines and industrial energy-related solutions to air pollution and greenhouse gases. There Manfred developed the National Emission Guidelines for Gas Turbines with energy-output based environmental standards, emission measurement practices and taxation incentives for industrial cogen and district energy. He has been

Workshops

involved extensively in training functions with governments, universities and with various industry organizations: Canadian Industrial Gas Turbine Applications Committee, Canadian Gas Association and the Int'l Gas Turbine Institute (former Chair, Environment & Regulatory Affairs). Manfred has Bachelor degree in Mechanical Engineering in 1980 from Carleton University in Ottawa.

Steve Ingistov, P.E.

Steve Ingistov is Principal Engineer in a 420 MW Watson Cogeneration Facility situated inside Los Angeles Refinery in Carson, CA. His main responsibilities include maintaining reliability and availability of the main gas and steam turbines, other plant auxiliary equipment and striving continuously to improve their efficiencies. Steve's innovative engineering contributions have resulted in 12 US Patents geared to minimize parasitic losses associated with gas turbines. Steve is a registered Professional Engineer in the State of California, ASME Fellow, and past Chair of the IGTI Industrial & Cogeneration Committee. For his outstanding contributions to the Watson Cogeneration Facility, he has been recognized with 2000 Refinery Manager Award for Innovation and 2002 Helios Innovation Award. Steve received Master Degree in Mechanical engineering with specialization in the area of Turbomachinery from Marymount University in Los Angeles, CA. Steve has written numerous technical papers in the areas of operations, maintenance and power enhancement of cogeneration system.

Supercritical CO2 Cycle and Turbomachinery Design and Analysis

8:00 am – 12:00 pm

Interest in supercritical carbon dioxide (sCO_2) in closed loop power cycles has significantly increased in recent years. These cycles benefit from the unique properties of CO_2 near the critical point but these properties also pose unique challenges for turbomachinery design. Two of the most important issues in sCO_2 turbomachinery are the rapid variation of the thermodynamic properties and the potential for two-phase flow phenomena. While none these issues precludes the development of effective turbomachinery designs for sCO_2, they greatly complicate the modeling and prediction process, since many modeling assumptions that may be perfectly reasonable for conventional designs no longer apply.

This course seeks to educate the engineer on the basics of sCO_2 design. We will identify the basic issues, tradeoffs, and limitations involved in laying out cycles; including the benefits of starting with higher power prototype sCO_2 systems rather than developing prototype systems below 500kWe. The most suitable applications of sCO_2 cycles will be discussed; from nuclear energy source to exhaust gas, waste heat recovery. Basic aerodynamic and structural design issues unique to sCO_2 will be covered along with special concerns for design and analysis of turbomachinery components.

Key Benefits to Participants

- An understanding of the benefits and challenges of sCO_2 power cycles
- Introduction to the modeling and numerical methods required for sCO_2 design
- Awareness of the special design consideration for sCO_2 compressors and turbines
- Overview of advanced topics that bring special risks to sCO_2 design

Note: Participants are expected to have basic understanding of thermodynamics and fluid dynamic principles. Some prior knowledge of turbomachinery design principles is helpful but not essential.

Who Should Attend

Engineers involved in the design of compressors and turbines for application in supercritical CO_2 cycles

Workshop Schedule and Content

Section 1 | Supercritical CO_2 Cycles

- Brayton cycle
- Recompression cycle
- Allam cycle
- Applications

Section 2 | Thermodynamic and Fluid Modeling Concerns

- Thermodynamic modeling options
- Accuracy and computational efficiency
- Component tradeoffs
- Basic sizing

Workshops

Section 3 | Compressor and Turbine Design for sCO_2

- Overview of basic design theory for compressors and turbines
- Special treatment for sCO_2 in the design process
- Materials
- Mechanical design and seals required for sCO_2

Section 4 | Advanced Topics

- Nucleation and cavitation in sCO_2 machines
- Turbulence modeling considerations
- Impacts of non-linear fluid dynamic thermodynamic effects in the design
- General discussion

Earn 4 Professional Development Hours (PDH's) and receive a certificate of completion.

Instructors

Mark Anderson, M.S.

Mark Anderson has a B.S. in Mechanical Engineering from Northeastern University and a M.A. from the Massachusetts Institute of Technology. His experience includes research in the area of hypersonic propulsion for X-30 and NASA's Atmospheric Effect of Aviation Programs. He was Vice President of Concepts NREC Software Development for 7 years leading a group developing advanced engineering software for turbomachinery design and analysis. Currently, he is Chief Technology Officer at Concepts NREC. He has authored or co-authored over 25 papers on turbomachinery, CFD, and environmental modeling. Mr. Anderson graduated from Northeastern University ME Class of 1985 with BS in ME. Graduated from MIT in 1987 with Masters in Mech. Engineering.

Francis Di Bella, P.E., M.S.

Worked at Thermo Electron Corp.s' subsidiary: Tecogen, Inc. on a variety of energy related projects for both private companies and D.O.E. projects. Such projects ranged from the development of steam atmosphere, industrial dryers to Mechanical Vapor Recompression systems to Organic Rankine Cycle waste heat recovery systems. In general, the engineering team at Tecogen, Inc. was focused on innovative ways of improving the energy efficiency of mechanical systems. In 2000 Frank left Industry to teach full time at NU's Engineering Technology Dept. receiving the University-wide Teaching Award in 2002 and becoming the Director of ET in 2005. Joined current employer Concepts NREC in 2008 where he continues the development of energy related systems; ranging from water wave energy systems to supercritical CO_2 power generation and CO_2 sequestration to a variety of waste heat recovery systems and continues to teach a variety of engineering courses. Mr. Di Bella graduated from Northeastern University ME Class of 1974 with BS in ME. Graduated from RPI in 1975 with Masters in Mechanical Engineering.

Gas Turbine Aerothermodynamics and Performance Calculations

8:00 am – 6:30 pm

This interactive workshop provides review and reinforcement of relevant thermodynamic and aerodynamic concepts as applied to gas turbine engines, and introduces performance calculation methods of both aircraft engine and power generation gas turbines. The workshop emphasizes fundamentals which will be helpful for the practicing engineer but is not designed to review industrial practices which are usually proprietary. The acquired knowledge, including the review of illustrative examples, will enhance the participants' ability to excel in various assignments in gas turbine design, development, education, and application. The workshop material has been evaluated by the Department of Mechanical and Aerospace Engineering of North Carolina State University.

The workshop includes: a review of the relevant thermodynamics and compressible flow; introduction to cycle analysis; propulsive, thermal, and overall efficiencies; elements of turbomachinery aero design; familiarization with combustor characteristics; integration of component performances to obtain overall engine performance with illustrative examples of design point and off-design calculations; multivariable solver; and various cycles used for power generation.

After completing the course the participants should be able to apply aerothermodynamic concepts to the analysis of gas turbine engines; analyze turbomachinery velocity

Workshops

diagrams and relate those to thermodynamic parameters; appreciate the usefulness of the degree of reaction and the radial equilibrium equation; comprehend the discipline of operability and combustor characteristics; analyze cycle analysis problems on integrating the component performances to get the overall engine performance. The illustrative examples on the integration of the component performances to obtain the overall performance will facilitate comprehension of compressor/turbine matching; accounting for turbine cooling flows; the method of sizing critical flow path areas at the design point; method of satisfying conservation laws to achieve cycle balance at off-design; technique of the multivariable solver used in cycle models; making models match test data; and the analysis of various engine cycles in the power generation field including hybrid cycles.

Who Should Attend

Early Career or Experienced Engineers in Turbomachinery and Gas Turbine Engine Design, Development, Application, and Education.

Special Notation: A laptop is recommended for individual reviewing of the materials, on a flash drive, in class.

Earn 8 Professional Development Hours (PDH's) and receive a certificate of completion!

Instructor

Syed Khalid, President, *Gas Turbine Systems Solutions, LLC*

Syed J. Khalid has an MSME (Purdue) and an ME (Aerospace, North Carolina State University). He has extensive experience in performance, controls, operability, and installation aerodynamics at Pratt & Whitney, GE, Roll-Royce, Lockheed Martin, and Boeing. He is inventor/co-inventor of 20 issued patents and 3 pending patents. He has received numerous industry and professional society awards. He is author of 14 technical papers. He is an elected member of Phi Kappa Phi.

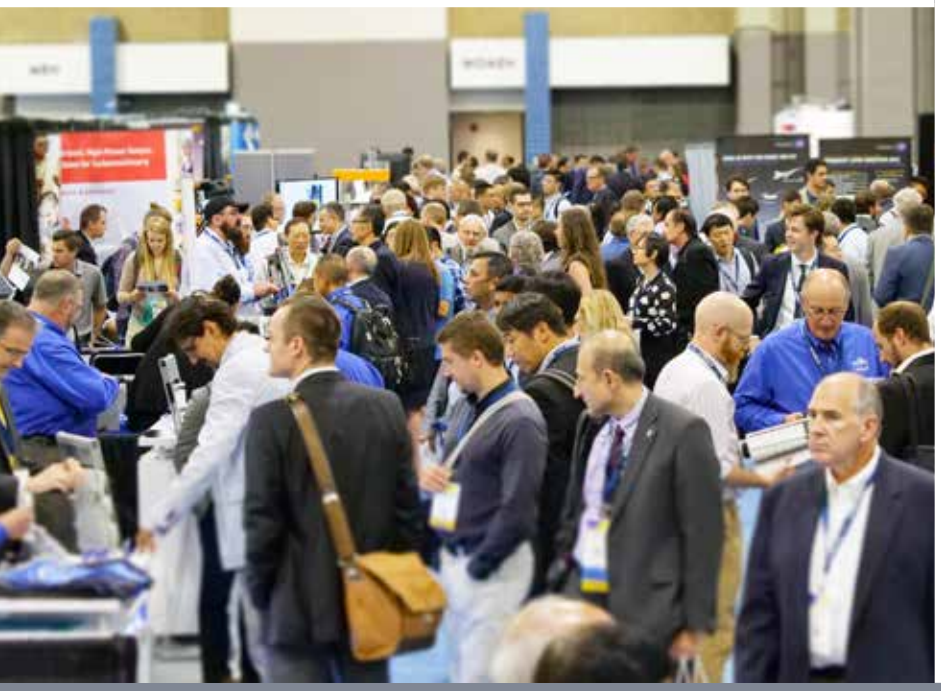
Why Exhibit

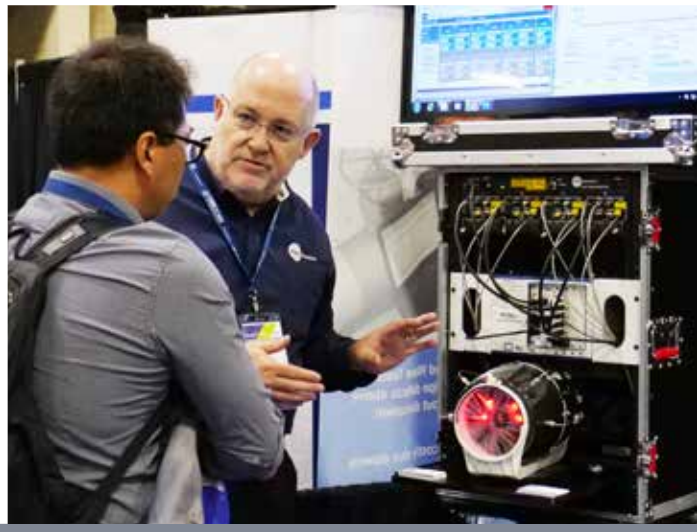
We understand that you need return on investment for your sponsorship, exhibiting, and advertising dollars. Partnering with ASME Turbo Expo gives you strategically focused access to an influential audience of commercial, governmental and academic engineers in the field of turbomachinery. This alliance offers many key opportunities, including high visibility, hospitality, and networking.

Why Exhibit?

Gain access to professionals in the power generation and turbomachinery fields from industry, R&D, academia and government over three days while showcasing your products and services and building your customer base.

Raise Your Company Profile and Awareness





Why Exhibit?

The 3-day exposition will be held June 12-14 in Lillestrøm, Norway with some value added activities to promote traffic! Daily lunches in the exhibit hall are included in the registration package for exhibit booth staff.

The event is known for its high-quality exhibition of leading companies in the turbomachinery industry. This is your chance to attract new clients, visit with current ones, learn more about the changing needs of the international turbomachinery industry - and ultimately, increase your sales.

ASME Turbo Expo brings together from around the world the top players in the turbomachinery industry and academia - attracting a key audience from aerospace, power generation and other prime mover-related industries interested in sharing the latest in turbine technology, research, development, and application.

ASME Turbo Expo attract over 2,800 turbomachinery professionals from over 50 countries.

Exhibition Information

Secure your booth now for prime space availability and see how this event can generate bottom-line results for your marketing dollars. Visit the online **floor plan** and reserve your booth today. Click on the desired booth space and select RESERVE BOOTH. You will then be prompted to complete an application. Contact igtiexpo@asme.org if you have any questions or issues with space selection.

Booth Space Pricing:

Booth Space: 3x3 Booth Space: $3500 USD plus VAT

All exhibitors receive:

- Each exhibit space will be constructed from the modular system, using aluminum profiles with white infill panels to rear 2.5m walls and 1m high dividing walls, 300mm deep fascia to all open sides with a standard name board per side detailing company name and stand number.
- 1 technical conference badge per 9 square meters of exhibit space
- 3 booth personnel badges per 9 square meters of exhibit space
- Monday Welcome Reception, Monday Keynote and Opening Luncheon
- Tuesday, Wednesday and Thursday exhibit hall lunch
- Complimentary entrance to the exhibit hall passes to share with customers and prospects
- 1 complimentary Lead Retrieval unit
- Significantly discounted Technical Conference registration for company employees
- 15-word company listing in the printed Conference Program
- Discounted advertising opportunities
- Product category and company description in the online exhibitor directory

Stay ahead of the competition and meet your customers face to face.

SPONSORSHIP INFORMATION

Take control of your company's exposure before, during and after the event. Featuring a variety of sponsorship opportunities designed to maximize your company's visibility, the ASME Turbo Expo sponsorship program provides even more ways to stand out from the crowd and make the most of your budget. Additional opportunities and descriptions can be found at https://www.asme.org/events/turbo-expo/sponsor-exhibit.

PLATINUM CLUB: $20,000

GOLD CLUB: $15,000

SILVER CLUB: $10,000

BRONZE CLUB: $5,000

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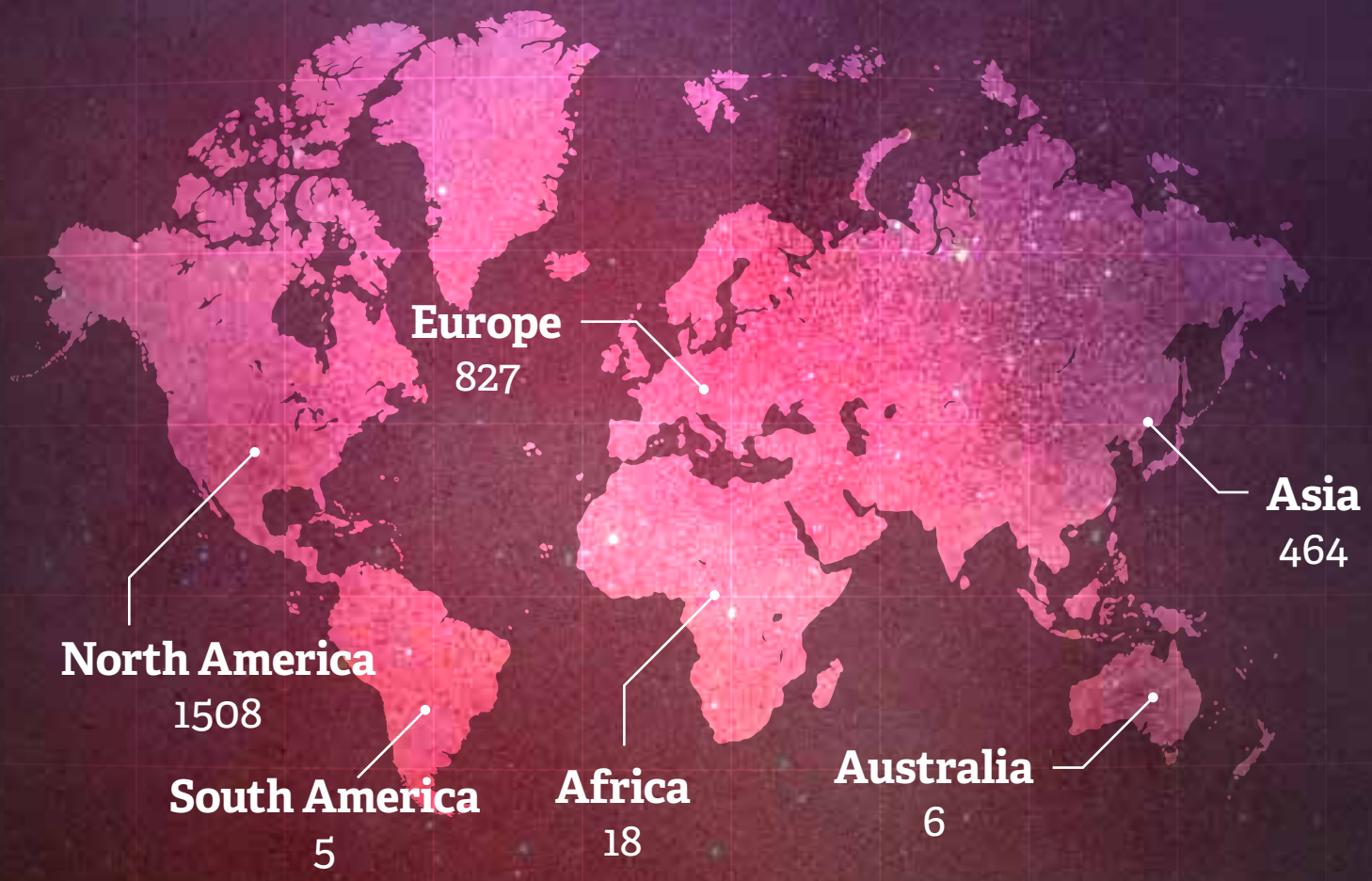
Click here to view the current floor plan

Current as of 1-11-18.



Industry Participants

ASME Turbo Expo is proud to have over 2800 Industry participants from all over the world. These Individuals are active with the technical conference details such as authors, panelists, reviewers, session organizers, session chairs, etc.

Registration Information

Be sure to register for ASME Turbo Expo as soon as possible as rates will increase as the conference approaches. Continue reading to see full details on rates and benefits.

Registration

Registration Fees

All fees are in Norwegian Kroner (NOK). Photo identification will be required for all badge pick-ups.

All fees include 25%* Norwegian Value-Added Tax (VAT). *The standard rate of VAT in effect at the time of the event. Please note that Norwegian VAT may be refundable under certain conditions (not guaranteed). **FAQ** on the Norwegian VAT. If you have any questions you may contact **n.petit@bc-a.com**

The invoice for your participation shall be issued by:

VMC
1 Rond-Point de l'Europe
92250 La Garenne Colombes (France)
French VAT Number: FR75523098614
Norwegian VAT Number: NO998162726MVA

Technical Conference Registration

- Access to every session in the Technical Conference
- Final Papers DVD comprised of all papers published for TURBO EXPO 2018
- Professional Development Hours (PDHs) Certificate
- Admission to the following networking events:
  - Grand Opening: Turbo Expo Keynote Panel & Awards Program (June 11,. 2018)
  - Welcome Reception (June 11, 2018)
  - Tuesday Plenary Panel: Additive Manufacturing in MRO (June 12, 2018)
  - Wednesday Plenary Panel: Big Data in MRO (June 13, 2018)
- Daily Lunch (June 11 – 15, 2018)
- Exhibition (June 12 – 14, 2018)
  - Exhibit Hall Reception (June 12 – 13, 2018)
- Opportunity to attend Facility Tours

REGISTRATION TYPE	Register On or Before April 16, 2018	Register After April 16, 2018
ASME Member 5-Day	10875	11675
ASME Member 3-Day	8900	9700
The following may register at the discounted Member rate(s): • ASME Members • Point Contacts, Vanguard Chairs • Session Chairs, Session Co-Chairs • Authors, Presenters, Speakers • ASME IGTI Committee Members • Active Military • Members of Reciprocating or Participating Organizations		
ASME Life Member 5-Day	4450	5250
Platinum Sponsor Employee 5-Day	8350	9150
Exhibiting Company Employee 5-Day	8840	9640
Non-Member 5-Day	12840	13640
Non-Member 3-Day	10875	11675
Student Member 5-Day	4450	5250
Student Non-Member 5-Day	4700	5500

Registration

Exhibition Personnel

Admission to the following networking events:

- Opening Session: Turbo Expo Keynote & Awards Program (June 11, 2018)
- Welcome Reception (June 11, 2018)
- Daily Lunch (June 11 – 14, 2018)
- Exhibition (June 12 – 14, 2018)
- Exhibit Hall Reception (June 12 – 13, 2018)
- Opportunity to attend Facility Tours

REGISTRATION TYPE	Register On or Before April 16, 2018	Register After April 16, 2018
Booth Personnel	FREE	FREE
Three (3) free badges per 100 sf of booth space.		
Additional Booth Personnel	1980	1980
Booth purchase includes one technical conference badge per 9 sqm of booth space. Contact igtiexpo@asme.org for more information.		

Visitor/Guest

Admission to the following networking events:

- Welcome Reception (June 11, 2018)
- Exhibition and Exhibition Receptions (June 12 – 13, 2018)

REGISTRATION TYPE	Register On or Before April 16, 2018	Register After April 16, 2018
Visitor/Guest 3-Day	1490	1490

Pre-Conference Workshops

Sunday, June 10, 2018 at the Norway Convention Center
Workshop registration includes Presentation CD and Lunch

REGISTRATION TYPE	Register on or Before April 16, 2018	Register After April 16, 2018
• Physics-Based Modeling of Gas Turbine Secondary Air Systems (8:00 am – 5:00 pm) • Design, Operation and Maintenance Considerations for Cogeneration and Combined Cycle Systems (8:00 am – 5:00 pm) • Supercritical CO2 Cycle and Turbomachinery Design and Analysis (8:00 am – 12:00 pm) • Gas Turbine Aerothermodynamics and Performance Calculations (8:00 am – 6:30 pm)		
Member	2450	3250
Non-Member	3250	4050
1/2 Day Workshop Supercritical CO2 Cycle and Turbomachinery Design and Analysis		
Member	1225	1625
Non-Member	1625	2025

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- We are pleased to be able to offer a product of that research: BOXERMesh v3.8.3

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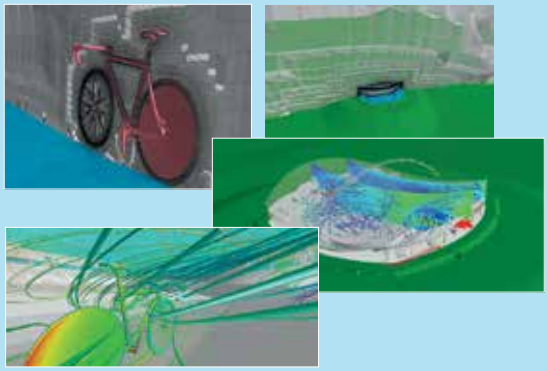
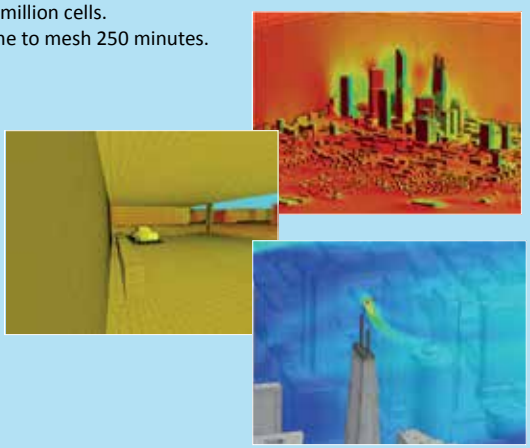
Bicycle in velodrome in landscape example

Mesh cell sizes range from 1mm to 100 metres.
100 million cells. Time to mesh 300 minutes.



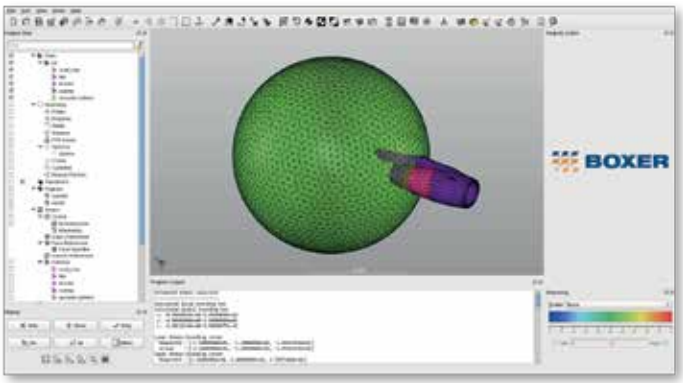
Helicopter and car in cityscape example

84 million cells.
Time to mesh 250 minutes.



NEW in v3.8.3 Geometry Primitives

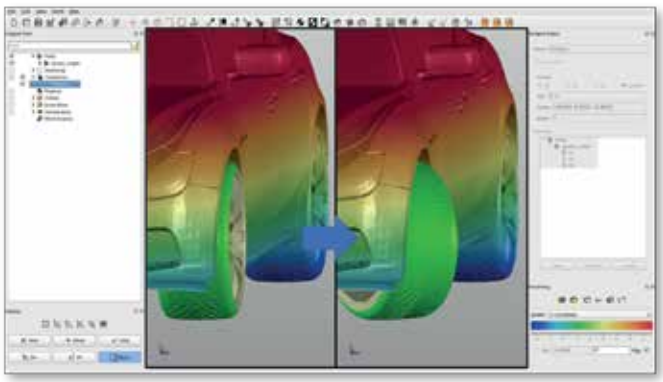
Create cubes, spheres, cones and cylinders to augment imported CAD or build simple models from scratch



Create a sphere to act as an acoustic propagation surface for jet exhaust noise prediction

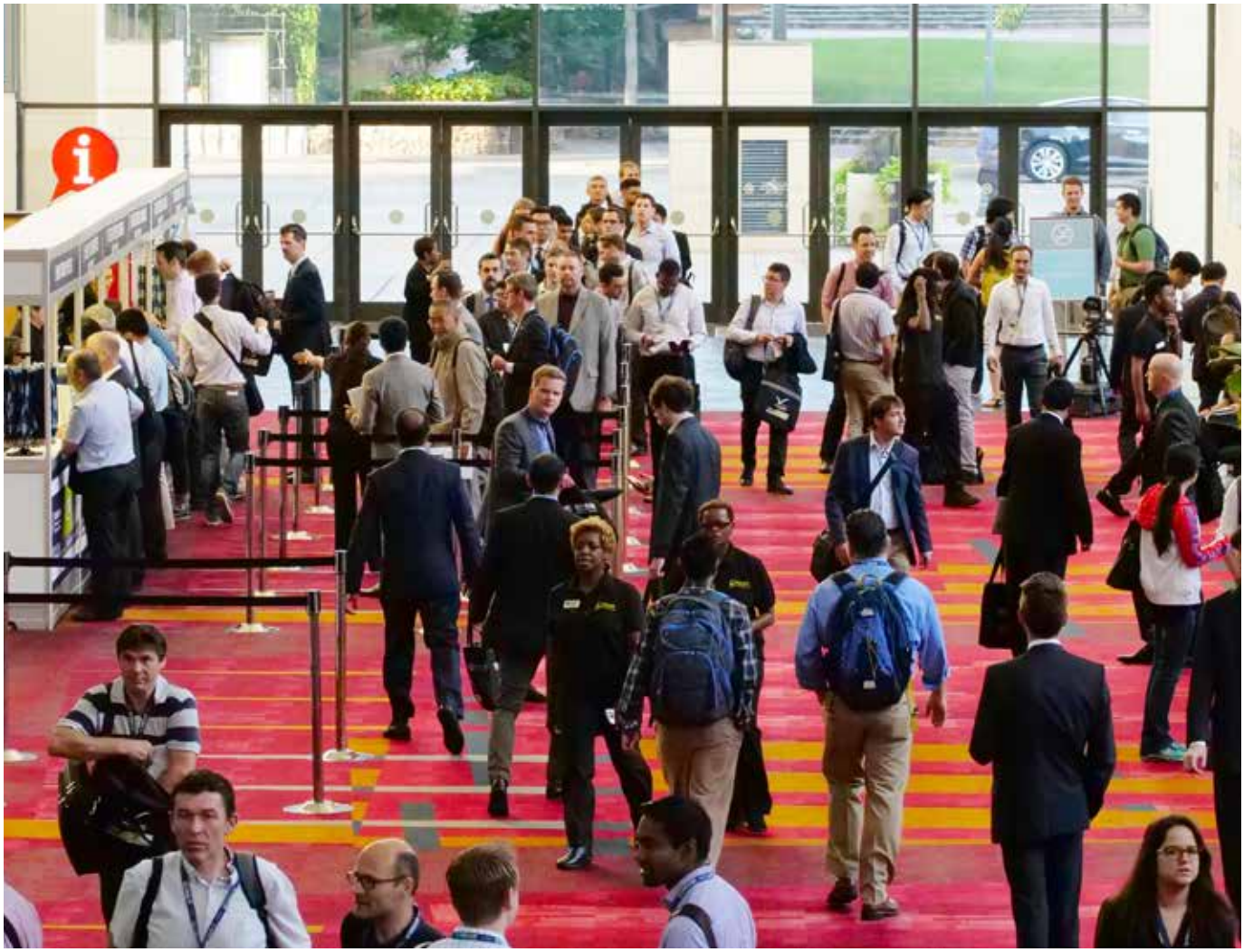
NEW in v3.8.3 In-built geometry transform tools

Transform any collection of patches, parts or facets to model mechanism motion, deformation under load etc



Change car steering angle and ride height for cornering analysis

Free ASME Membership



The following paid registrants will receive a free one-year ASME membership:

- Non-Member 5-Day/Non-Member 3-Day
- Student Non-Member 5-Day

ASME will contact eligible registrants and invite them to join within 90 days after the conference. For more information, visit ASME Membership.

Cancellation/Refund Policy:

Cancellations received on or before May 7, 2018 will receive a full refund, less a NOK 1490 administrative fee.

No refunds will be granted after May 7, 2018. **NO EXCEPTIONS**. No-shows will not be eligible for refunds. All changes, except full cancellations, that result in a refund will incur a NOK 500 administrative fee.

Visas and Letters of Invitation

You will be able to request your Conference Letter of Invitation during the Registration process.

Registration Inquiries:

Contact us at igtiprogram@asme.org

Hotel Information

Conference Headquarters Hotel
Thon Hotel Arena, Lillestrøm
Connected to the Convention Center

Thon Hotel Arena, Lillestrøm

Nesgaten 1, 2004 Lillestrøm, Norway.
Phone +47 66 93 63 30
Rate: NOK 1,600 single
Additional persons: plus NOK 200 per person/per night
The rate includes breakfast, guestroom wifi, and taxes.

Convert NOK to different currency

This hotel is connected to the Norway Trade Fairs Convention Center.

Thon Hotel Opera, Oslo

Queen Eufemias gate 4, 0191 Oslo
Tel: +47 24 10 30 00
Rate: NOK 1,850 single
Additional persons: plus NOK 200 per person/per night
The rate includes breakfast, guestroom wifi, and taxes.

Convert NOK to different currency

Make your hotel reservation NOW!

Student News

NUMECA INTERNATIONAL

The Nr 1 in Turbomachinery Simulation

Boost your performance in Design - Analysis - Optimization

OMNIS™ Platform - Integrated environment for multidisciplinary simulation and optimization

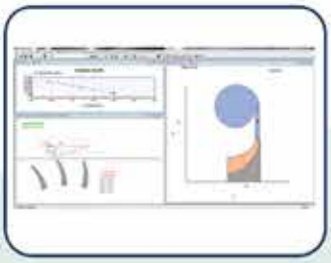
NEW: Lattice Boltzmann ánd **Navier Stokes** in one environment

Turbo-machinery

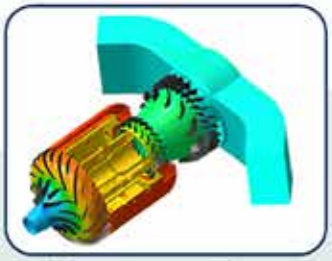
Multiphysics & External Aero

Meshing

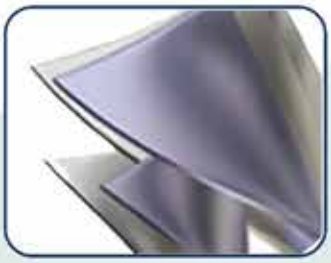
Marine



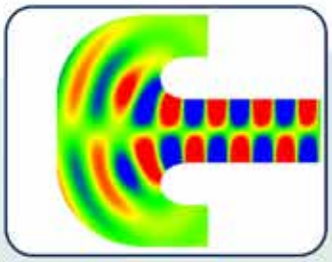
From preliminary, meanline design to detailed 3D steady & unsteady CFD



Full engine simulation with NLH



Robust Design Optimization with Uncertainty Quantification



Fully coupled aero-vibro-acoustics suite with wizard-based automation

Visit us at **stand #300-302**

FREE Lunch & Learn session Tuesday June 12th

FREE Workshops Wednesday June 13th (*)

(*) Check your conference program for exact location and timing

NUMECA

Advanced developments for better products

Student News

The 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.

SAC Committee Members

Chair
Zhiping Mao, *Duke University*

Vice Chair
Wisher Paudel, *University of Virginia*

Secretary
Samuel Barak, *University of Central Florida*

Past-Chair
Jacob Snyder, *Penn State University*

SAC Sessions at Turbo Expo

The sessions organized by the SAC during the technical conference are focused on professional development and are open to all conference attendees. In previous years, the SAC has curated panel sessions led by community leaders on Turbomachinery Careers and Networking, as well as tutorial sessions titled "Effective Technical Presentations", and "The Art of the Peer Review Process".

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 12th from 12:30 – 2:30 p.m. Be sure to stop by the poster session to see the results of their work and encourage them to become active in the ASME IGTI community.

Cash Prizes for Poster Session Winners

1st Place - $500

2nd Place – $250

People's Choice - $100

Technical Committee Student Liaison Application

Applications are now being accepted to join the student liaison subcommittee designed to encourage interaction between the Student Advisory Committee (SAC) and the ASME IGTI technical committees. The student will be expected to serve as a link between the SAC and the leadership of the technical committee to which they are assigned. The potential outcomes of this relationship include, but are not limited to, collaboration for future tutorial sessions at IGTI Turbo Expo, communication of ideas and announcements between the SAC and the technical committee, and opportunities for professional development.

Applicants for these positions must be students who are or plan to be members of the SAC. The liaison will be expected to communicate directly with the leadership of the technical committee to which they are assigned. Further, the liaison should be in attendance at the ASME Turbo Expo 2018 Conference in Lillestrom (Oslo), Norway. Because attendance at Turbo Expo may not be guaranteed, applicants should apply with the intention to attend Turbo Expo 2018. Communication with the SAC leadership team may be requested prior to, during, and following Turbo Expo. The service period will extend from April 1, 2018 to March 31, 2019. Additional expectations may be outlined by the SAC leadership team, but not without input from the liaison.

To apply for a position as a liaison to the IGTI technical committees on behalf of SAC, please submit a resume or CV with the application to the SAC via email at sac.igti@gmail.com by March 1, 2018.

If several applicants desire to represent the same technical committee, the SAC leadership team will choose representatives based on the contents of this application. You will be notified of the status of your application by March 30, 2018.

Download the Application

Student/Early Career Mixer

Wednesday, 6:45 – 8:00 p.m.

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.

ASME Gas Turbine Segment 2018

Jaroslaw Szwedowicz
Segment Leader
Siemens Power and Gas

Richard Dennis
Segment Vice-Leader
National Energy Technology Laboratory

Ruben Del Rosario
Advisor
NASA

Paul Garbett
Member
Siemens Power & Gas

Eisaku Ito
Member
MHI

Anestis Kalfas
Member
Aristotle University of Thessaloniki

Tim Lieuwen
Advisor
Georgia Institute of Technology

Nicole Key
TEC Representative
Purdue University

James Maughan
Member
GE Power

Hany Moustapha
Member
École de Technologie Supérieure

Mark Turner
Member
University of Cincinnati

Turbo Expo Organizing Commmittee

Prof. Damian Vogt
Conference Chair
University Of Stuttgart

Dr. Elisabet Syverud
Executive Conference Chair
Dresser-Rand A Siemens Busines

Dr. Jeff Green
Technical Program Chair
Rolls-Royce

Patricia Cargill
Review Chair
GE Aviation

Dr. Dilip Prasad
Vice Review Chair
Pratt & Whitney

Dr. Graham Pullan
Review Vice Chair
University Of Cambridge

Zolti Spakovszky
Review Chair
Massachusetts Institute Of Technology

Prof. Mark Turner
Gas Turbine Segment Liaison
University Of Cincinnati

Gaylord Klammt
Exhibitor Representative
Präwest

Stein Jørgensen
Local Liaison Chair
Aker Solution

Digital Technologies and MRO are Coming to ASME Turbo Expo!

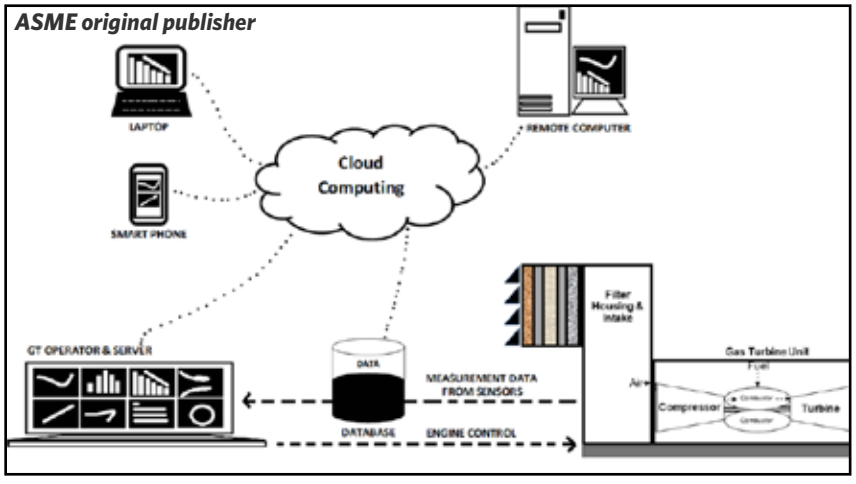
Photo courtesy of GE Power

ASME Turbo Expo 2018 will explore the application and impact of Digital technologies across the turbomachinery industry with a special focus on MRO (Maintenance, Repair and Overhaul).

It is an exciting time as technologies historically focused on turbomachinery design and analysis as well as other industries are brought to bear in the operational and MRO environments. Listen, interact, and learn how academia and industry are researching, developing, and maturing the systems and methods today that will fully leverage Digital technologies across the turbomachinery lifecycle to optimize performance and minimize cost.

What you can learn:

- How digital data can yield intelligence to reduce costs and increase performance in every phase of a product's lifecycle
- How sensor technology is expanding data capture opportunities
- How to capitalize on digital technologies to optimize engine performance and component lifecycle costs
- Insight into forecasting restoration costs through condition-based modeling
- Why a designer or researcher should also be interested in MRO



Topics of interest include:

- Data analytics
- Digital thread
- Digital twin
- Sensors and actuators
- Robotics and Autonomous Engine Inspection

Who should attend?

- OEMs
- Operators
- MRO providers
- Service Engineers
- Insurers and financiers
- Researchers and Students interested in Digital Solutions for MRO of Turbomachinery

Schedule at a Glance

Sunday June 10	Monday June 11	Tuesday June 12	Wednesday June 13	Thursday June 14	Friday June 15
	Registration 7:00 a.m. – 5:30 p.m.	**Registration** 7:00 a.m. – 6:30 p.m.	**Registration** 7:00 a.m. – 6:30 p.m.	**Registration** 7:00 a.m. – 5:30 p.m.	**Registration** 7:00 a.m. – 3:00 p.m.
	Speaker Ready Room 7:00 a.m. – 5:30 p.m.	**Speaker Ready Room** 7:00 a.m. – 5:30 p.m.	**Speaker Ready Room** 7:00 a.m. – 5:30 p.m.	**Speaker Ready Room** 7:00 a.m. – 5:30 p.m.	**Speaker Ready Room** 7:00 a.m. – 3:30 p.m.
	Session Participant Networking Coffee 7:00 – 7:45 a.m.	**Session Participant Networking Coffee** 7:00 – 7:45 a.m.	**Session Participant Networking Coffee** 7:00 – 7:45 a.m.	**Session Participant Networking Coffee** 7:00 – 7:45 a.m.	**Session Participant Networking Coffee** 7:00 – 7:45 a.m.
GT Workshops 8:00 a.m. – 5:00 p.m.	**Conference Sessions** 8:00 – 10:00 a.m.	**Conference Sessions** 8:00 – 10:00 a.m.	**Conference Sessions** 8:00 – 10:00 a.m.	**Conference Sessions** 8:00 – 10:00 a.m.	**Conference Sessions** 8:00 – 10:00 a.m.
	Coffee Break 10:00 – 10:15 a.m.	**Coffee Break** 10:00 – 10:15 a.m.	**Coffee Break** 10:00 – 10:15 a.m.	**Coffee Break** 10:00 – 10:15 a.m.	**Coffee Break** 10:00 – 10:15 a.m.
	Opening Session Turbo Expo Keynote Panel: MRO in the Light of Digitalization & Awards Program 10:15 a.m.– 12:15 p.m.	**Plenary: Additive Manufacturing in MRO** 10:15 a.m. – 11:10 a.m. **Conference Sessions** 11:15 - 12:45 p.m.	**Plenary: Big Data in MRO** 10:15 a.m. – 11:10 a.m. **Conference Sessions** 11:15 - 12:45 p.m.	**Conference Sessions** 10:15 a.m.– 12:15 p.m.	**Conference Sessions** 10:15 a.m.– 12:15 p.m.
Registration 12:00 – 6:00 p.m.		**Expo Open** 12:30 – 6:30 p.m.	**Expo Open** 12:30 – 6:30 p.m.	**Expo Open** 12:30 – 2:30 p.m.	
Speaker Ready Room 12:00 – 6:00 p.m.	**Opening Lunch** 12:30 – 2:00 p.m.	**Expo Lunch** 12:30 – 2:00 p.m. **Poster Session** 12:15 – 2:00 p.m.	**Expo Lunch** 12:30 – 2:00 p.m.	**Expo Lunch** 12:30 – 2:00 p.m. **Closing Ceremony** 1:30 p.m.	**Closing Lunch** 12:30 – 2:00 p.m.
Gas Turbine Segment Meeting 1:00 – 5:00 p.m.	**Conference Sessions** 2:00 - 3:30 p.m.	**Conference Sessions** 2:00 - 3:30 p.m.	**Conference Sessions** 2:00 - 3:30 p.m.	**Conference Sessions** 2:00 - 3:30 p.m.	**Conference Sessions** 2:00 - 3:30 p.m.
	Coffee Break 3:30 – 4:00 p.m.	**Coffee Break** 3:30 – 4:00 p.m.	**Coffee Break** 3:30 – 4:00 p.m.	**Coffee Break** 3:30 – 4:00 p.m.	**Coffee Break** 3:30 – 4:00 p.m.
	Conference Sessions 4:00 – 5:30 p.m.	**Conference Sessions** 4:00 – 5:30 p.m.	**Conference Sessions** 4:00 – 5:30 p.m.	**Conference Sessions** 4:00 – 5:30 p.m.	**Conference Sessions** 4:00 – 5:30 p.m.
	Welcome Reception 6:00 – 7:30 p.m.	**Expo Hall Reception** 5:00 – 6:30 p.m.	**Expo Hall Reception** 5:00 – 6:30 p.m.		
Council of Chairs Meeting 6:00 – 7:30 p.m.		**Committee Meetings** 6:00 – 7:30 p.m.	**Committee Meetings** 6:00 – 7:30 p.m.	**Committee Meetings** 6:00 – 7:30 p.m.	
		Women in Engineering Event/ Dinner 7:45 – 10:30 p.m.	**ECE/Student Mixer** 6:45 – 8:00 p.m.		

SCHEDULE SUBJECT TO CHANGE