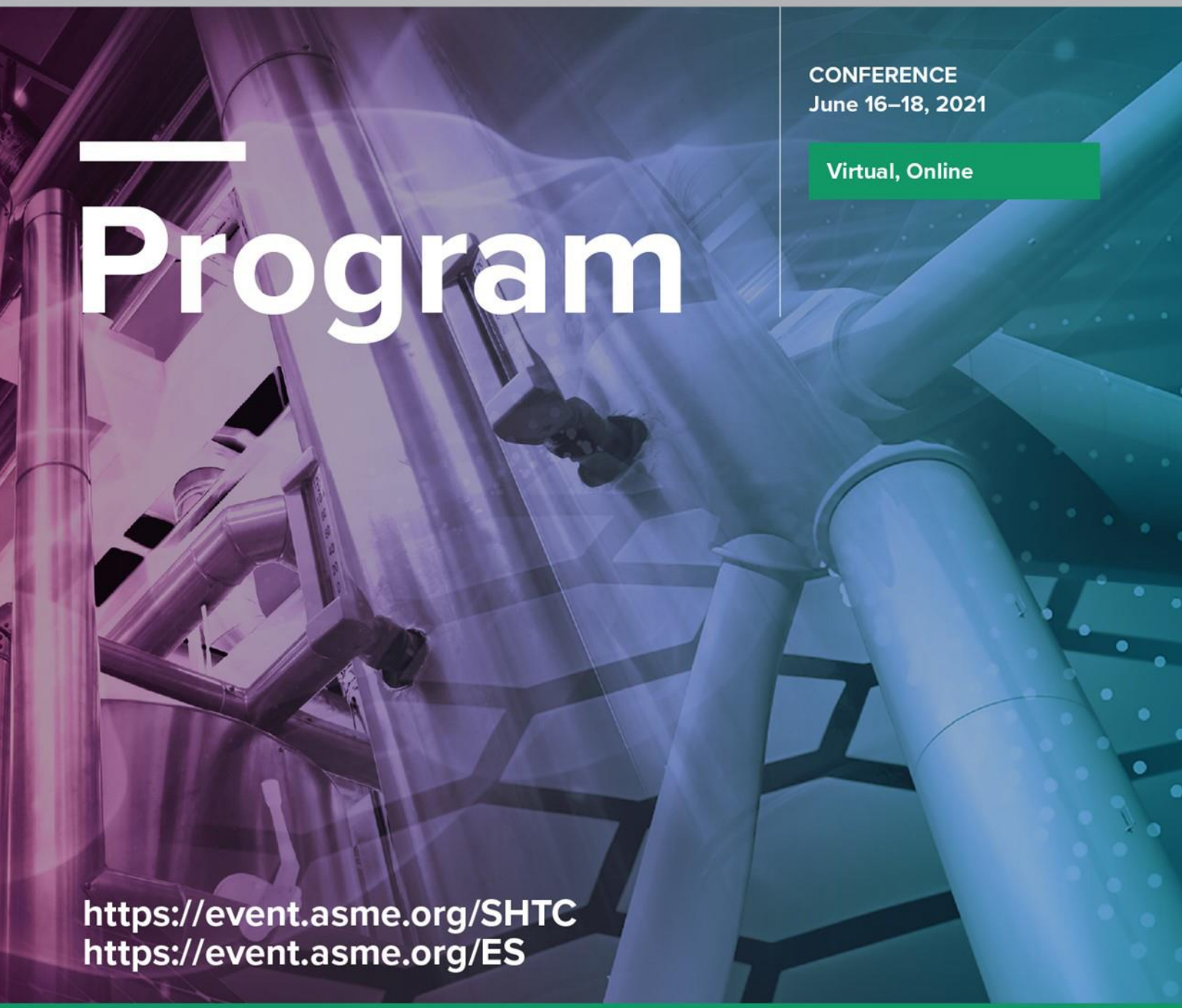
SHTC 2021
Summer Heat Transfer Conference

ES 2021
15th International Conference on Energy Sustainability



CONFERENCE
June 16–18, 2021

Virtual, Online

Program

https://event.asme.org/SHTC
https://event.asme.org/ES

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WELCOME LETTERS
FROM THE CONFERENCE CHAIRS

Dear Colleagues,

On behalf of the ASME Heat Transfer Division, it is our pleasure to welcome you to participate in the virtual ASME 2021 Summer Heat Transfer Conference held June 16–18, 2021. The conference is a premier event that offers excellent opportunities to disseminate your research and network with the international heat transfer community. The technical content of the conference is broad in scope and will provide a forum for presentation of state-of-the-art research and opportunities. It is co-located with the ASME 15th International Conference on Energy Sustainability.

The conference offers a vibrant program with several technical sessions, panels, and special workshops. The plenary sessions include presentations from Raj M. Manglik, Donald Q. Kern award winner, Arun Majumdar, Max Jakob award winner, and Yasuyuki Takata, Japanese Society of Mechanical Engineers. One hundred and seventy papers, presentations, and posters are scheduled OnDemand and available up to three months after the conference. Several panels on timely topics are planned, such as Machine Learning and Heat Transfer, Frontiers in Heat/Mass Transport Intensification, Heat Transfer and ASME Standards, and Standards for Thermal Energy Storage Using Phase Change Materials

A special panel is planned on the Impacts of COVID-19 on Careers, sponsored by K23 Diversity, Equity, and Inclusion, the newest K-Committee under the Heat Transfer Division. A special forum to discuss funding opportunities has been organized with representatives from the National Science Foundation, ARPA-E, and the Department of Energy.

A highlight of the conference is the virtual Festschrift to celebrate the 85th birthday of John R. Howell. Following the gathering, several special workshops on Conjugate Heat Transfer Problems with Emphasis in Radiation Transfer Solvers will take place.

The contributions of all the track, topic, and session chairs; authors; reviewers; and ASME staff have been invaluable in organizing this conference. We would like to specifically acknowledge ASME staff Mary Jakubowski, Laraine Lee, and April Tone. We also thank track and session organizers for supporting the conference technical program, overseeing the reviews of the technical papers, and helping maintain high standards. Most importantly, we thank you the participants for giving strength to the conference with your presence and by engaging in the important task of the review process and the ongoing technical engagement.

Due to the 17th International Heat Transfer Conference, which will take place August 8–12, 2022 in Cape Town, South Africa, ASME will join AIAA for the 8th AIAA/ASME Joint Thermophysics and Heat Transfer Conference.

We hope you enjoy the virtual meeting, and we look forward to seeing everyone in person soon.

Sandra Boetcher, Conference Chair
Embry-Riddle Aeronautical University

Milind Jog, Conference Co-Chair
University of Cincinnati

Kashif Nawaz, Technical Program Chair
Oak Ridge National Laboratory

Dear Colleagues,

On behalf of ASME Advanced Energy System Division and Solar Energy Division, we cordially welcome you to the ASME 2021 Energy Sustainability Conference!

This year, the theme of our conference is “For a Sustainable Planet!” We all believe that sustainability is an inherent part of the future in all aspects, including sustainable energy generation and its environmental impacts. As we are facing more drastic climate change which affects the whole planet and human living conditions, we hope this conference can provide an avenue for researchers to share their issues and ideas to plan “For a Sustainable Planet!”

Although we cannot gather physically due to the COVID pandemic, we are excited about the opportunity of holding an innovative virtual conference this year. In 2021, the Energy Sustainability Conference is co-located with the Summer Heat Transfer Conference to provide a unique opportunity for the attendees to expand their network and combine theory with application. We are proud to announce that we have a packed schedule and much for you to engage in and share newly added knowledge to each other virtually from expert technical presentations to keynote and plenary speakers, poster session, and quality virtual networking events.

A special thank you to our volunteer session chairs, reviewers, track organizers, and Executive Advisory Committee who have spent countless hours putting together a top-notch technical program. We would also like to thank ASME staff members for their support of the program and express our gratitude to our attendees for sharing their latest research results with us.

We look forward to virtually meeting many of you. Please stay connected!

Have a great conference and thank you again for attending.

2021 Energy Sustainability Conference Organizing Committee

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Conference General Chair, AESD
Mississippi State University

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Florida Institute of Technology

CONFERENCE INFORMATION

REGISTRATION FEES

Full Conference Rates

ASME Member/Author: $299
ASME Non-Member: $349
Life Member: $225
ASME Student Member: $225Student Non-Member: $260

Registration Includes: OnDemand access to the virtual platform for 90 days after the conference, online access to all technical presentations, pre-recorded technical presentations, and live presentations (recorded and posted after the conference), and digital access to all online papers as well as the official conference proceedings.

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Registration Fees: All conference participants must register and pay the advertised fee, including authors, presenters, chairs, co-chairs, topic and session organizers, sponsors, exhibitors, and general attendees.

Payment Method: Individuals with incomplete registrations will not be able to attend the conference until payment has been made and registration is completed. ASME accepts VISA, MasterCard, American Express, and Discover as well as wire transfers. Non-member fees include a one-year complimentary membership to ASME.

Presenter Substitution: Each abstract/paper has a primary author identified who is responsible to present the abstract/paper at the conference. Should the primary author not be available to present the paper, a co-author may be nominated to present the paper as a substitution. Any proposed substitution must be approved one week in advance by ASME Publications, and the Event Management staff must be notified one week in advance of the presentation.

Refunds/Cancellation Fee: There will be no refunds for ASME Virtual Conference Registration.

Registration Substitutions: Registrations may not be transferred or substituted at any time.

CONFERENCE PROCEEDINGS

Each attendee receives an email with a unique code to access the papers online. Check your spam folder if you have not received an email shortly before the conference. The official conference archival proceedings will be published after the conference and will not include accepted papers that were not presented at the conference. The official conference proceedings are registered with the Library of Congress and are submitted for abstracting and indexing. The proceedings are published on the ASME Digital Library. You will be provided with an individual link to the online papers via email. In the event you do not receive the email, send a request to toolboxhelp@asme.org.

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

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It is easy to apply, and the benefits include the fellowship and recognition from being associated with one of the largest engineering societies in the world. ASME members and student members, and members from select countries can receive a discount on their conference registration. You can apply for ASME membership by registering online. Alternatively, you can call 1-800-THE-ASME (800-843-2763) or outside North America 973-882-1170 and ASME will mail you an application, or you can follow this link: https://www.asme.org/membership/membership-benefits to obtain an application.

For questions about the conference and registration, please contact, **Mary Jakubowski, CMP** Manager, Conferences & Events, Tel.: 212-591-7637, Email: jakubowskim@asme.org.

"No shows" are not refundable and are liable for the full registration fee.

TAX DEDUCTIBILITY

Expenses of attending professional meetings have been held to be tax deductible as ordinary business expenses for U.S. citizens. Because of changes in the tax code, the current level of deduction is subject to change.

PUBLICATION SALES

All HTD, AESD AND SED Technical Papers are available electronically to registered attendees only. Attendees will receive electronic access via their email on record. Additional copies of the proceedings can be ordered from: **ASME Order Department, 150 Clove Road, 6th Fl, Little Falls, NJ 07424-2139**

PROGRAM AT-A-GLANCE

Please Note: The Program-at-a-Glance can be found on both websites under the Program page. For SHTC, there is a separate document on the program page called SHTC 2021 Technical Presentations in addition to what is included in this program starting on page 50. For ES, the video presentations that will be shown during the conference by session can be found starting on page 78.

Links to each conference are as follows:

For SHTC2021: https://event.asme.org/SHTC

For ES2021: https://event.asme.org/ES

SHTC WORKSHOP – All Times are in Eastern Daylight Savings Time

WORKSHOP FOR COMPLEX CONJUGATE PROBLEMS & FESTSCHRIFT FOR JACK HOWELL: 85 YEARS OF RADIATION TRANSFER

Date: Thursday, June 17
Time: 10:00AM–4:30PM
Location: Room 5

M. Pinar Mengüç[1] and John R. Howell[2]

[1]Center for Energy, Environment and Economy (CEEE), Ozyegin University, Istanbul, 34794, Turkey
[2]2308 Indian Trl., Austin, Texas, 78703, USA

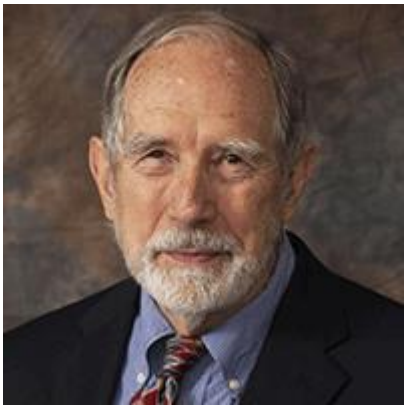
Abstract: Accurate and efficient solutions of multi-dimensional thermal problems need to be considered not only to reduce energy consumption in industry, but also for their potential long-term impacts on climate change. In this Workshop, we will discuss the challenges related to complex conjugate heat transfer problems, with particular emphasis on radiative transfer. The know-how accumulated at universities should be transferred to industry in a rapid and timely manner to impact the bottom-line operations of the industry both on cost of operations and to minimize the carbon dioxide and particulate matter emissions. To this end, developments in computational and experimental techniques will be discussed. The requirements for deeper analysis of the complex problems that industry faces will be outlined.

As we have done in two previous Workshops, we will consider a number of pre-defined conjugate heat transfer problems. These problems are presented with the hope of attracting researchers to solve them and provide information on the methods used and difficulties encountered. The details of these problems are outlined by Howell and Mengüç (see *JQSRT*, Vol. 221, December 2018, Pages 253–259.

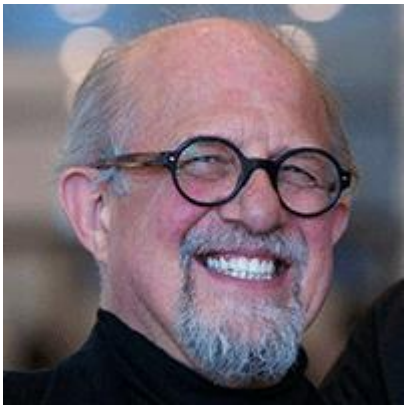
The future studies and announcements will be posted online.
The Workshop will consist of two 3-hour-long panel presentations. The first panel will also allow us to celebrate Jack Howell's 85th birthday.

KEYWORDS: Conjugate heat transfer, thermal radiation, combined-mode heat transfer, RTE solvers, challenge problem sets

WORKSHOP SPEAKERS:



John (Jack) Howell is retired from the Walker Department of Mechanical Engineering at The University of Texas at Austin. He spent over 50 years in research during seven years at NASA Lewis (now Glenn) Research Center, the University of Houston, and UT-Austin. His research centered on radiation transfer and inverse methods in conjugate heat transfer. He was a pioneer in bringing Monte Carlo methods into the treatment of thermal radiation. He is a member of the U.S. National Academy of Engineering and the Russian Academy of Science and is an Honorary Life Fellow of ASME and a Fellow of AIAA. He received various honors and awards, including the NASA Special Service Award, The ASME Heat Transfer Memorial Award, the AIAA Thermophysics Medal, the ASME/AIChE Max Jakob Award, and the ICHMT Liukov Medal. He is presently retired after completing (with Profs. Pinar Mengüç and Kyle Daun) the Seventh Edition of *Thermal Radiation Heat Transfer* and pursuing his hobby of researching and writing on the history of technology.



Professor M. Pinar Mengüç received his BS and MS from ODTU/METU in Ankara, Turkey, and his PhD from Purdue University, USA in 1985, all in Mechanical Engineering. He was a visiting professor at Università degli Studi di Napoli Federico II, Italy during 1991 and at Harvard University, Cambridge, Massachusetts, during 1998–99 academic year. He was awarded an Honorary Professorship at ESPOL, Ecuador in 2006. At the end of 2008, he was promoted to Engineering Alumni Association Chair Professor at the University of Kentucky, which he still holds. In 2009, he joined the newly established Özyeğin University, in Istanbul as the founding Head of Mechanical Engineering. The same year, he founded the Centre for Energy, Environment and Economy (CEEE), which he is still directing. His research areas include radiative transfer, nano-scale transport phenomena, applied optics, and sustainable energy applications. He has worked with more than 70 MS, PhD, and Post-Doc researchers in the U.S. and in Turkey. He is also co-author of Thermal Radiation Heat Transfer book, with Jack Howell and Bob Siegel. He is an elected member of Science Academy, Turkey, a fellow of both ASME (American Society of Mechanical Engineering) and ICHMT (International Center for Heat and Mass Transfer), and a Senior Member of OSA (Optical Society of America). He is the recipient of several awards, including the ASME Heat Transfer Memorial Award (2018) and the Purdue University Outstanding Mechanical Engineer Award (2020). He is in the executive committees of several NGO, including the Science Academy, Turkey and ICHMT. He is one of the three Editors-in-Chief of the *Journal of Quantitative Spectroscopy and Radiative Transfer* (JQSRT) and a Handling Editor of *Physics Open*.

SHTC PLENARY SPEAKERS

MAX JACOB AWARD PLENARY LECTURE

Date: Wednesday, June 16
Time: 10:15AM–11:15PM
Location: Room 5

Title: Energy, Mass and Charge Transfer at the Extremes

Dr. Arun Majumdar is the Jay Precourt Provostial Chair Professor at Stanford University, a faculty member of the Department of Mechanical Engineering.

From 2009 to 2012 Dr. Majumdar served as the Founding Director of ARPA-E and from March 2011 to June 2012 as the Acting Under Secretary of Energy. After leaving Washington, Dr. Majumdar was the VP for Energy at Google.

Dr. Majumdar is a member of the National Academy of Sciences, National Academy of Engineering and the American Academy of Arts and Sciences. He also served as the Vice Chairman of the Advisory Board to the US Secretary of Energy, Dr. Ernest Moniz, was a Science Envoy for the US Department of State and serves on the advisory board of numerous energy businesses and non-profits.

Dr. Majumdar received his BS in Mechanical Engineering in 1985 from the Indian Institute of Technology, Bombay, and his Ph.D. from the University of California, Berkeley in 1989.

2020 AICHE-ASME DONALD Q. KERN AWARD LECTURE

Date: Wednesday, June 16
Time: 11:35AM–12:35PM
Location: Room 5

Title: The Legacy of Donald Q. Kern Redux: Imperative of Energy Conservation and Enhancement of Process Heat and Mass Transfer

Raj M. Manglik, PhD, ASME Fellow
Professor of Mechanical and Materials Engineering
Thermal-Fluids & Thermal Processing Laboratory, University of Cincinnati, Cincinnati, OH

Dr. Raj M. Manglik, Professor of Mechanical Engineering and Director, Thermal-Fluids & Thermal Processing Laboratory at the University of Cincinnati, is a Fellow of ASME and ASHRAE, Senior Member of AIChE, and member of Sigma Xi and Tau Beta Pi. He received his Ph.D. from Rensselaer Polytechnic Institute, M.S. from Iowa State University, and B.Tech. from the Indian Institute of Technology – Madras, all in Mechanical Engineering. He has served as a two-term Associate Editor as well as Guest Editor of ASME *Journal of Heat Transfer*, and Editor-in-Chief of the *Journal of Enhanced Heat Transfer*. He has published more than 260 archival papers and technical reports and has given numerous keynote and plenary lectures at a variety of national and international forums. He has also published 15 highly acclaimed books, monographs, and book chapters, including the classical textbook, *Principles of Heat Transfer* (7th and 8th Eds., Cengage) and the monograph, *Plate Heat Exchangers: Design, Applications and Performance*. His research expertise spans a broad spectrum of thermal science and engineering, and he is a leading international expert on interfacial phenomena, boiling heat transfer, bubble dynamics and droplet-spray transport processes, thermal processing of polymeric materials and non-Newtonian flows, enhancement of heat transfer, compact and high-performance heat exchangers, and waste-heat recovery and energy systems. He has been the recipient of the very first CAREER Award (1995) from the National Science Foundation, ASME Melville Medal (2006) for the best original scientific contribution, the ASME HTD 75th Anniversary Medal (2013), Heat Transfer Memorial Award (2016), and the Potter Gold Medal (2018), among many other research and teaching awards.

Abstract: The imperatives of sustainability warrant the mitigation of both energy consumption and environmental degradation. The efforts to achieve these goals are perhaps most acutely underscored by the need for not only conserving primary energy resources, but also their conversion, utilization, and recovery in every industrial, commercial, and domestic application. This energy crisis has become a subject of considerable present-day debate with enormous economic and political implications. However, the primary problems in conversion and conservation, which inherently involve a heat and/or mass transport process, have several viable engineering solutions, particularly with the use of enhancement techniques. Heat and mass transfer in the process industry and the pioneering work of Donald Q. Kern has become acutely important, and its reiteration provides unique antecedent insights. This presentation delineates the development and applications of enhancement devices and methods, which have driven significant technological changes in the past and continue to do so in contemporary times. Some specific examples of innovative and transformational engineering science in, single-phase flow convection, phase-change processes with boiling, and spray-droplet engendered mass transfer are highlighted. Their implementation directly contributes to increased heat/mass exchanger performance, thereby effecting energy, material, and cost savings, as well as a consequential mitigation of environmental degradation – or a pathway toward sustainability of both our energy-driven economy and our environment. Moreover, general current trends in the field as well as reflections on significant contributions from the past and their impact on future thermal processing excursions are delineated.

SHTC PANELS

2021 SHTC PLENARY LECTURE

Date: Friday, June 17
Time: 10:00AM–11:00AM
Location: Room 5

Title: On the Quench of Spray Cooling: When Does it Occur?

Yasuyuki Takata, DEng
Professor, Department of Mechanical Engineering
International Institute for Carbon-Neutral Energy Research (WPI-I2CNER), Kyushu University

Yasuyuki (Yas) Takata is Professor of Thermofluid Physics in the Department of Mechanical Engineering and a Principal Investigator of the International Institute for Carbon-Neutral Energy Research (WPI-I2CNER), Kyushu University, Japan. His research area covers liquid-vapor phase change heat transfer, especially the effect of surface wettability and nano-microstructure on pool boiling and spray cooling, heat transfer devices, and thermophysical properties of hydrogen, as well as a database of thermophysical properties of fluids. He received a number of awards such as The JSTP Best Paper Award in 2010, Heat Transfer Society Award for Scientific Contribution in 2002, and JSME Thermal Engineering Achievement Award in 2010, JSME Thermal Engineering Award for International Activity in 2018, ASME ICNMM2018 Outstanding Leadership Award in 2018 and ATPC Significant Contribution Award in 2019. He served as a head of Thermal Engineering Division and executive board director of the Japan Society of Mechanical Engineers (JSME), the President of the Heat Transfer Society of Japan (HTSJ) and the President of the Japan Society of Thermophysical Properties (JSTP). He is currently the President of Asian Union of Thermal Science and Engineering (AUTSE) since November 2020. He is a Council Member of the Science Council of Japan since October 2020.

Abstract: It is of great importance for water spray cooling of hot steel to predict “quench point” where rapid cooling occurs by the direct contact between liquid and hot surface. Despite a number of previous studies, the mechanism of onset of quench has not yet been clearly understood. One of the reasons is due to the oxide layers formed on the hot surface. These oxide layers have non-uniform porous structure and low thermal conductivity and hence increase the quenching temperature. In the present study, we try to explain the quenching temperature based on the assumption of the transient heat conduction for a contact between two semi-finite bodies. We used several different artificial oxide layers and made a series of experiments on spray cooling and observation of single individual droplet impinging onto the hot oxide surfaces. As a result, the onset of quench always seems to happen at the contact surface temperature of around 250°C regardless of the composition and thickness of the oxide layer.

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RESEARCH FUNDING OPPORTUNITIES PANEL

Day: Wednesday, June 16
Time: 1:00 PM–2:30 PM
Location: Room 5

Program Directors from various federal agencies will discuss research programs and funding opportunities in areas of interest to participants in the Summer Heat Transfer Conference including Thermal Transport, Thermal Management, Energy Efficiency, and Renewable Energy.

Moderator:

Dr. Sandra Boetcher is a Professor of Mechanical Engineering at Embry-Riddle Aeronautical University and a Fellow of ASME. She obtained her B.M.E., M.S., and Ph.D. in Mechanical Engineering from the University of Minnesota in 2001, 2003, and 2006, respectively. Prior to her appointment at Embry-Riddle, Professor Boetcher was a founding faculty member in the newly formed Department of Mechanical and Energy Engineering at the University of North Texas.

Panelists:

Dr. Peter de Bock currently serves as Program Director at the Advanced Research Projects Agency-Energy (ARPA-E). His focus at ARPA-E includes electronics thermal management and electrified aviation propulsion systems. Prior to joining ARPA-E, Dr. de Bock spent nearly 18 years with GE Research, holding various research and development positions. At GE Research, Dr. de Bock served as a Principal Engineer and Platform Leader for Power and Thermal Management Systems, and principal investigator on advanced programs in the areas of additive heat exchangers and advanced propulsions systems. Dr. de Bock also serves as the chair of the ASME K-16 committee on Heat Transfer in Electronics equipment and holds over 50 patents and publications.

Raised in the Netherlands, Dr. de Bock received his Ph.D. in Mechanical Engineering from the University of Cincinnati and holds MSc degrees from University of Twente in the Netherlands, and University of Warwick in the UK.

Dr. Ying Sun is the Program Director of the Thermal Transport Processes program at NSF and Professor of Mechanical Engineering and Mechanics at Drexel University. Dr. Sun received her Bachelor's degree at Tsinghua University in Beijing. She completed her Master's and PhD at the University of Iowa. She joined Drexel's College of Engineering faculty in 2009. She has authored over 65 refereed publications, supervised six PhD dissertations, 12 Master's theses, over 25 undergraduate researchers, and eight post-docs. Her research interests include multiphase flows and heat/mass transport, multiscale modeling of transport phenomena, wetting and interfacial phenomena, and scalable nanomanufacturing. Dr. Sun's lab is funded by the NSF, DOE, ARPA-E, AFOSR, EPRI, ACS PRF, Ben Franklin Technology Partners, and industry. She is a Fellow of the ASME.

Antonio M. Bouza is a Technology Manager with the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE), Advanced Manufacturing Office (AMO). He has been with DOE for over twenty years as a technology and project manager including several rulemakings with respect to energy efficiency standards. Before joining DOE, he was senior engineer with EG&G Technical Services and worked for Environmental Research and Development Corp performing emissions testing on alternative fuel vehicles. He holds a Bachelor's Degree in Mechanical Engineering from the University of Maryland at College Park, a Master's Degree in Mechanical Engineering from The Johns Hopkins University. He is a member of the American Society of Mechanical Engineers (ASME), Society for Industrial and Applied Mathematics (SIAM), and The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

MACHINE LEARNING IN APPLIED HEAT TRANSFER PANEL

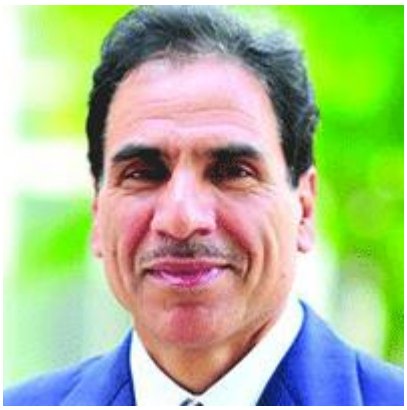
Date: Thursday, June 17
Time: 10:00AM–11:30AM
Location: Room 6

Organizers: Metodi Zlatinov, Michael Ohadi, Marcus Richardson

Topic Scope: This panel brings together experts at the intersection of artificial intelligence (A.I.) and heat transfer to discuss the opportunities and challenges of applying machine learning (ML) tools to solve thermal problems. Machine learning (ML) is a branch of the artificial intelligence (A.I.) that deals with algorithms capable of making predictions and decisions based on prior data, without relying on explicit instructions from a human. The field is quickly gaining traction in many industrial applications. Some examples relevant to heat transfer include metamodel-assisted shape/topology optimization and generative design. The goal of this panel discussion will be to review current applications of ML in the heat transfer community and to examine future opportunities, challenges, and risks.

Moderators:

Metodi Zlatinov is a Senior Engineer at ERG Aerospace, responsible for leading R&D efforts on open celled metal foam for application in high performance heat exchangers, flow control components and energy absorbers. Prior to joining ERG, Zlatinov advanced the state of the art in CFD-based optimization while developing cooling technologies for gas turbines at GE Aviation, and later led the fluid design and hydraulic testing efforts for novel hydroelectric turbines at Natel Energy. Zlatinov earned his S.M. in Aeronautics and Astronautics from M.I.T., and a B.S.E. in Mechanical and Aerospace Engineering from Princeton University.



Michael Ohadi is a Minta Martin Professor of Mechanical Engineering at the University of Maryland, College Park. From 2016 to 2020, Ohadi served as Program Director (PD) at the U.S. Department of Energy, Advanced Research Project Agency-energy (ARPAE). As PD, Ohadi led the development of programs in high-temperature heat exchangers and energy conversion systems, and lightweight and ultra-efficient electric motors, drives, and associated thermal management systems for de-carbonization/electrification of aviation. Ohadi received his Ph.D. in mechanical engineering from the University of Minnesota and joined the University of Maryland in 1990. He is a fellow member with both ASME and ASHRAE and has published close to 300 peer reviewed technical publications in his fields of expertise.

Marcus Richardson is a senior engineer in the Boeing Commercial Airplanes Product Development group. He develops pneumatic systems for aircraft pressurization, cabin air conditioning and protective systems and thermal management solutions and the analysis tools that support that development. He is named on 14 patents with The Boeing Company. He received his BS in mechanical engineering from California State University, Long Beach in 2005. He is member of ASME.

Panelists:

Vikrant C. Aute, University of Maryland College Park

Vikrant Aute is a Research Scientist and Director of the industry and government-supported Modeling & Optimization Consortium at the University of Maryland. He has more than 20 years of experience in developing algorithms and numerical methods for modeling and design optimization of heat exchangers and heat pumps. His research focuses on modeling and optimization of HVAC&R systems and components, innovation in next-generation heat exchangers, approximation assisted and multi-objective robust optimization, data visualization, and applications of machine learning to HVAC&R. He is an ASME Fellow and Associate Editor for the ASME *J. of Thermal Science and Engineering Applications*. He has published over 180 papers, has five commercialized inventions and one issued patent. He holds a BE in Mechanical Engineering from the University of Pune (India), MS and PhD in Mechanical Engineering from the University of Maryland, and an MS in Data Analytics from the University of Maryland University College.

David Tew, ARPA-E

Dr. David Tew is currently a Program Director at the Advanced Research Projects Agency - Energy (ARPA-E), which is part of the U.S. Department of Energy. At ARPA-E, he is leading the INTEGRATE, DIFFERENTIATE, and REEACH Programs. INTEGRATE and REEACH are focused on the development of ultra-efficient (>70%) fuel (fossil or renewable) to electric power conversion systems for both stationery and transportation applications. DIFFERENTIATE seeks to develop machine-learning-enhanced engineering design tools to enhance the productivity of energy engineers as they develop technology solutions to our current climate crisis. Prior to ARPA-E, Dr. Tew worked for United Technologies Corporation for nearly 20 years—at the Research Center, Pratt & Whitney and UTC Power. He has a B.S. in Aerospace Engineering summa cum laude from the University of Michigan, an S.M. and Ph.D. in Aeronautics and Astronautics from MIT, and an M.B.A. from Columbia Business School.

Matteo Bucci, Massachusetts Institute of Technology

Matteo Bucci is Assistant Professor of Nuclear Science and Engineering at MIT, where he teaches undergraduate and graduate courses in nuclear reactor engineering and design, and two-phase heat transfer. His research focuses on the understanding of two-phase heat transfer mechanisms and the development of non-intrusive optical diagnostics and data analysis techniques. For his research work and his teaching, he has won several awards, among which are the MIT Ruth and Joel Spira Award for Excellence in Teaching (2020), the European Nuclear Education Network Award (2010), and the 2012 American Nuclear Society Thermal-Hydraulics Division Best Paper Award (2012). Matteo is Associate Editor of *Applied Thermal Engineering* and a consultant for the nuclear industry.

Ryan P. O'Hara, nTopology

Dr. Ryan P. O'Hara is currently serving as the Technical Director for Aerospace and Defense at nTopology. Ryan joined nTopology in April 2019 after 20 years of military service, where he worked on cutting-edge technologies for the United States Air Force as a Developmental Engineer. Ryan is passionate about demonstrating the power of implicit geometry to enable optimized designs through the use of meta-materials, hierarchical structures, and advanced manufacturing. He is currently working at the intersection of design and automation to enable the next generation of compact heat exchangers for the aerospace industry.

HEAT TRANSFER AND ASME STANDARDS PANEL

Date: Thursday, June 17
Time: 1:00PM–2:30PM
Location: Room 6

Panel Description: This panel will highlight ASME Standards and Certification activities related to heat transfer and the role of ASME standards in heat transfer industry practice. ASME standards committees related to heat transfer include but are not limited to: Verification & Validation, Thermal Medicine, Pressure and Temperature Instruments, Additive Manufacturing, Overpressure Protection, and Welding, Brazing and Fusing

Moderator:

Dr. Amy Mensch, National Institute of Standards and Technology

Dr. Amy Mensch is a mechanical engineer in the Fire Research Division of the Engineering Laboratory (EL) at the National Institute of Standards and Technology (NIST), where she has conducted research on the thermal performance of fire fighter respirators, smoke deposition and detection, and ember heat transfer in the context of wildland-urban interface fires. Dr. Mensch received her B.S. in mechanical engineering from the University of Maryland Baltimore County and her M.S. and Ph.D. degrees in mechanical engineering from Penn State University. She served as a technical advisor for the 2013 revision of NFPA 1981 - Standard for Open Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services. She has been an active member of ASME for nine years and is currently the 2020–2021 ASME ECLIPSE Intern with the Standards and Certification (S&C) sector, working to improve communication and collaboration between ASME's technical divisions and S&C.

Panelists:

Jack Burns, Burns Engineering Services, Inc.

Jack Burns is an engineer at Burns Engineering Services Inc., a company that independently specializes in the technology of power plant steam condensers and cooling towers. He previously worked as Engineering Manager of development in the Condenser Division of Ingersoll-Rand and as the cooling system Specialist for the Stone & Webster Engineering Corporation. He is honored to currently be the Chair of the separate, national ASME Test Code Committees on Condensers, Cooling Towers, and Air-Cooled Steam Condensers and is a Member of the Supervisory ASME Committee. Jack is a licensed PE in several states, has written and presented over three dozen papers in the field, and holds four patents. He has a Batchelor's Degree in Marine Engineering from the New York State Maritime College and a MS in Mechanical Engineering from Lehigh University.

Katie Kirsch, Raytheon Technologies

Katie Kirsch is a Senior Research Engineer at Raytheon Technologies Research Center. Since joining the Research Center in 2019, she has been involved in experimental and modeling activities across multiple fluid- and thermal-related applications. Her technical interests lie at the intersection of heat transfer, additive manufacturing, and design, with an emphasis on topology and shape optimization. As part her work supporting the research needs of Raytheon Technologies' business units, Katie is involved in the full additive manufacturing workflow: designing, building, testing, and qualifying additive components. Katie received her Ph.D. in Mechanical Engineering from The Pennsylvania State University focusing on shape optimization of wavy micro-cooling channels for applications in gas turbine engines or electronics cooling.

Thomas G. Lestina, AIChE

Thomas G. Lestina is a Senior Vice President, Engineering, at AIChE and has more than 30 years of engineering project management experience. He directs HTRI's contract and consulting services, as well as oversees research and technical support. Lestina also assists in developing and customizing training and teaches courses. He earned a BS in Mechanical Engineering from Union College, Schenectady, New York, USA, and an MS in Mechanical Engineering from Rensselaer Polytechnic Institute, Troy, NY. Prior to joining HTRI, he worked as a Lead Engineer for MPR Associates, Inc., Alexandria, Virginia, USA. Besides being a member of ASME, he serves on the technical committee for the ASME Performance Test Code 12.5, Single Phase Heat Exchangers. He is a licensed Professional Engineer (PE) in Texas.

William F. Newell, Jr., PE, PEng, IWE

William F. Newell, Jr., is involved in welding engineering applications and consulting in the nuclear & fossil electric power and heavy industrial arenas for nearly 50 years, both domestic and internationally. Bill is a member on national and international code bodies, a Life Member and Counselor in the American Welding Society, and a member of AWS A5N, Chair of AWS D10 Piping and Tubing, a Member of ISAC and ISO/TC 44, International Committee on Welding and Allied Processes, plus a member of ASME Standards Committee IX – Welding and Brazing Qualifications, ASME Post Construction Issues – Subcommittee on Materials and Repair, former Chair of ASME SCII/IX Subgroup on Strength of Weldments, and a member on the ASME SCII Working Group on Creep Strength-Enhanced Ferritic Steels. He is the President of W. F. Newell & Associates, Inc., and Co-Founder/Vice President – Engineering of Euroweld, Ltd.

STANDARDS FOR THERMAL ENERGY IN PHASE CHANGE MATERIALS PANEL

Date: Thursday, June 17
Time: 3:30PM–5:00PM
Location: Room 6

Moderator:

Dr. D. Yogi Goswami is a Distinguished University Professor and Director of the Clean Energy Research Center at the University of South Florida. He is also a Co-Founder and Chief Science and Technology Advisor of Molekule, Inc.

He has published as an author or editor 22 books and more than 400 scientific papers. He is the emeritus editor-in-chief of preeminent scientific journal *Solar Energy*. He also holds 31 patents and has been inducted in the Florida Inventors Hall of Fame.

Dr. Goswami is a recipient of the highest energy related awards of ASME, ASES, ISES and AAES and more than 50 other awards and certificates from major engineering and scientific societies. Prof. Goswami has served as President of the International Solar Energy Society (ISES), a Governor and Senior Vice President of ASME-International, and President of the International Association for Solar Energy Education (IASEE).

Panelists:

Dr. Craig Turchi is the group manager for the Thermal Energy Science and Technologies Research Group at the National Renewable Energy Laboratory and acting manager for the NREL Geothermal Program. His research focus includes thermal energy storage technologies and techno-economic assessment. Craig has a PhD in chemical engineering from North Carolina State University.

Dr. Jason Woods is a senior research engineer in NREL's Building Technologies and Science Center where he specializes in heat and mass transfer, including the design, analysis, and testing of heat and mass transfer devices and processes. Jason's recent focus has been on modeling and valuing how phase change materials can improve the efficiency of energy systems by time shifting or reducing peak thermal loads. This research sets a clear framework for comparing thermal storage materials and devices and can be used by researchers and designers to increase clean energy use with storage. Jason has a Ph.D. Mechanical Engineering from the University of Colorado.

Dr. Yi Jin, is R&D director of Jiangsu Jinhe Technology Company. He graduated from University of Science and Technology Beijing in 2010 with doctor degree. Then he joined the Institute of Process Engineering, Chinese Academic Sciences and Global Energy Interconnection Research Institute, State Grid of China. In the past decades, he developed composite phase change materials with micro encapsulation technology and its scale up technologies. These materials have been used for the waste heat recovery, renewable energy consumption and cold chain, etc. In the thermal energy storage area, he has published over 50 journal papers and applied for 30 patents. He participated in three Chinese standards in thermal energy storage area.

IMPACT OF COVID-19 ON CAREERS

Friday, June 18
11:30 AM–1:00PM
Location: Room 5

Moderator:

Dr. Leslie M. Phinney, Sandia National Laboratories

Dr. Leslie M. Phinney is Manager of the Thermal Sciences and Engineering Department at Sandia National Laboratories in Albuquerque, New Mexico. She earned Mechanical Engineering M.S. and Ph.D. degrees from UC Berkeley and an Aerospace Engineering B.S. from UT Austin. She is a Fellow of ASME and a 2017 Society of Women Engineers Prism Award recipient. She is currently chairing the K23 Committee on Diversity, Equity, and Inclusion.

Panelists:

Maria Lund Dahlberg, National Academies of Sciences, Engineering, and Medicine

Dr. Maria Lund Dahberg is a Senior Program Officer and Study Director with the Board on Higher Education and Workforce and the Committee on Women in Science, Engineering, and Medicine of the National Academies of Sciences, Engineering, and Medicine. Her current work focuses on the Impact of COVID-19 on the Research Careers of Women in Academic Science, Engineering, and Medicine; the Response and Adaptation of Higher Education to the COVID-19 Pandemic; the Science on Effective Mentoring in STEMM (Science, Technology, Engineering, Mathematics, and Medicine); and Equity, Diversity, and Inclusion in Postsecondary Education. Her work with the National Academies spans topics ranging from equity and identity in science, through science communications, to postdoctoral research experiences, health care, and innovation ecosystems. She came to the National Academies by way of a Christine Mirzayan Science and Technology Policy Fellowship, which she received after completing all requirements short of finalizing the dissertation for her doctorate in physics at the Pennsylvania State University. Ms. Lund Dahlberg holds a BA with high honors in physics from Vassar College and an MS in physics from the Pennsylvania State University.

Ms. Dahlberg will review the findings and the range of disruptions experienced by women in academic STEMM careers during 2020 as laid out in the March 2021 NASEM report, "Impact of COVID-19 on the Careers of Women in Academic Sciences, Engineering, and Medicine," and discuss how the COVID-19 pandemic amplified structural inequities for women in academic STEMM.

Roberta Rincon, PhD, Society of Women Engineers (SWE)

Dr. Roberta Rincon is the Associate Director of Research for the Society of Women Engineers (SWE). She oversees the organization's research activities on gender equity issues affecting women in engineering and technology, through education and career. In this role, she applies her expertise to influence cultural and policy changes in academic, industry, and public policy spheres.

Before joining SWE, Roberta was a Senior Research and Policy Analyst at The University of Texas System in the Office of Academic Affairs. Roberta received her B.S. in Civil Engineering from The University of Texas at Austin, an MBA and an M.S. in Information Management from Arizona State University, and a Ph.D. in Educational Policy and Planning from UT Austin.

Dr. Amy Mensch , National Institute of Standards and Technology (NIST)

Dr. Amy Mensh is a mechanical engineer in the Fire Research Division of the Engineering Laboratory (EL) at the National Institute of Standards and Technology (NIST), where she has conducted research on the thermal performance of fire fighter respirators, smoke deposition and detection, and ember heat transfer in the context of wildland-urban interface fires. Dr. Mensch received her Ph.D. in mechanical engineering from Penn State University in 2015, where she researched heat transfer in gas turbine applications. She has been an active member of ASME for nine years and is currently the 2020–2021 ASME ECLIPSE Intern with the Standards and Certification sector.

Rahima Mohammed, Intel Corporation

Rahima Mohammed is an Intel Senior Principal Engineer in Intel Architecture Graphics Software (IAGS) team and leads the Automation Infrastructure and Workload Sensing office of IP Competitive Analytics (IPCA). Prior to this, she served as a customer delight office lead for strategic customers in the Performance, power and competitive analysis (P2CA) team in IAGS and Data Center Customer Solutions Technologist in Manufacturing Validation Engineering (MVE). Rahima led the data mining efforts on customer returned parts. She has been with Intel over 22 years after graduate schooling from Yale. Before joining MVE, she served as the advanced test module technologist in Manufacturing Development Organization (MDO). Prior to that, she served as the path finding czar for strategic emerging technologies across market segments and also setup the innovation programs for the division. Rahima led the team to deliver 15 advanced validation platform designs and pioneered innovative temperature margining thermal tools for over thirty-five silicon products.

She also chairs various technical steering committees and serves on Industry advisory boards. She demonstrates consistent leadership in IP creation, and has published 140+ papers in Intel internal and external conferences and filed 8 patents. She serves as a reviewer for various conferences like Itherm, Interpack, and a program committee member of IEEE Semi-therm conference and Burn-in-test strategies/TestConX workshop.

Dr. Yoonjin Won, University of California, Irvine

Dr. Yoonjin Won's overarching research goal is to gain fundamental insights into nanoscale phase change and interfacial principles, centering on keywords—machine vision, machine learning models, data-driven analysis, and materials design approach. The research efforts aim to bring transformational efficiency enhancements in energy, water, manufacturing processes, and electronics cooling by fundamentally manipulating liquid-solid-vapor interactions and transport phenomena across multiple length and time scales. Dr. Won is recognized with an NSF CAREER in 2018 and has also received several awards including the ASME EPPD Early Career Award 2018, The Emerging Innovation/Early Career Innovator of the Year 2020 from UCI Beall Innovation Center, ASME EPPD Women Engineer Award 2020, ASME ICNMM Outstanding Leadership Award 2019, UCI Samueli Career Development Fellowship, and numerous best paper and poster awards. The key papers are published in high impact journals including *Small*, *Proceedings of National Academy of Science* (PNAS), *Advanced Functional Materials*, and American Chemical Society (ACS). Additional details for Dr. Won's qualifications and research group are available online.

FRONTIERS IN HEAT/MASS TRANSPORT INTENSIFICATION PANEL

Date: Friday, June 18
Time: 1:30PM–3:00PM
Location: Room 5

Organizers:
Michael Ohadi, Marcus Richardson, Metodi Zlatinov

Panelists:

Dr. Philseok Kim is a program director at ARPA-E with a focus on innovative materials and engineered interfaces for energy storage systems and electrification and deep decarbonization of the building sector. Prior to joining ARPA-E, Dr. Kim co-founded Adaptive Surface Technologies, Inc. leveraging ARPA-E-funded SLIPS projects and launching commercial products such as fouling-resistant and fuel-saving ship hull coatings. He also co-led SLIPS project at Harvard University to improve the energy efficiency of refrigerators by reducing frost formation and defrost time. Dr. Kim has 12 years of experience in the petrochemicals, polymers, and coatings industry. Raised in South Korea, Dr. Kim received his B.S. and M.S. from Seoul National University then Ph.D. in chemistry at Georgia Institute of Technology. Dr. Kim has published over 40 papers in high-impact, peer-reviewed journals and holds about 40 issued patents in surface functionalization, materials for organic field-effect transistors, adaptive optical materials, and slippery surfaces.

Dr. Stephen Lynch is an associate professor of Mechanical Engineering at Penn State, and is the director of the Experimental and Computational Convection Laboratory. He received his BSME from the University of Wyoming in 2003, and his MS and PhD from Virginia Tech in 2007 and 2011, respectively. He joined Penn State in 2013, after working as a senior research engineer for two years with United Technologies Research Center (now Raytheon Technologies Research Center). He received a 2015 Office of Naval Research Young Investigator award and has been responsible for more than $2.5M of research funding to date.

Dr. Addison K. Stark is a mission-driven leader focused on commercializing advanced technologies in the energy and industrial sectors. He has broad experience across Government, Start-ups, Policy, and Academia. Dr. Stark is the Director for Energy and Environment at Clark Street Associates, a boutique consulting firm focused on helping hard-tech start-ups develop first markets and demonstration projects. In addition to his work at Clark Street, Dr. Stark serves on the faculty at Georgetown University in the Science Technology and International Affairs program in the Walsh School of Foreign Service. Prior to joining Clark Street, he led the Energy Innovation program at the Bipartisan Policy Center, and served as a Fellow and Acting Program Director at ARPA-E. While at ARPA-E, he led ARPA-E's $33 million Energy-Water Nexus portfolio, the Advanced Research In Dry-cooling (ARID) program. Stark is the author of multiple peer reviewed journal articles and popular press pieces on diverse topics in energy technology innovation including industrial decarbonization, hybrid PV/thermal solar energy, energy-water nexus, leveraging additive manufacturing for chemical reactor design, and innovation in energy technology and finance. Dr. Stark received his PhD in Mechanical Engineering at MIT and holds Master's degrees in Technology and Public Policy and Mechanical Engineering from MIT and Bachelor's degrees in Mathematics and Chemistry from the University of Iowa.

Dr. Peter de Bock currently serves as Program Director at the Advanced Research Projects Agency-Energy (ARPA-E). His focus at ARPA-E includes electronics thermal management and electrified aviation propulsion systems.

Prior to joining ARPA-E, Dr. de Bock spent nearly 18 years with GE Research, holding various research and development positions. At GE Research, Dr. de Bock served as a Principal Engineer and Platform Leader for Power and Thermal Management Systems, and principal investigator on advanced programs in the areas of additive heat exchangers and advanced propulsions systems. Dr. de Bock also serves as the chair of the ASME K-16 committee on Heat Transfer in Electronics equipment and holds over 50 patents and publications.

Raised in the Netherlands, Dr. de Bock received his Ph.D. in Mechanical Engineering from the University of Cincinnati and holds MSc degrees from University of Twente in the Netherlands, and University of Warwick in the UK.

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ES KEYNOTE SPEAKER

Date: Thursday, June 17
Time: 12:00PM–1:00PM
Location: Room 1

Title: Energy Transition Towards Carbon Neutrality: Challenge and Opportunities

Professor Jerry Yan, Mälardalen University & Royal Institute of Technology, Sweden

Professor Jerry Yan, PhD, is chair professor of Energy Engineering at Mälardalen University, Sweden. Prof. Yan's research interests include advanced energy systems, renewable energy, advanced power generation, climate change mitigation technologies and related environment and policy, etc. Prof. Yan published about 400 papers including papers in *Science*, *Nature Energy*, *Nature Climate*, & *Nature Communications* and hold 10+ patents with about 15,000+ citations and H-index 63. Prof. Yan is the editor-in-chief of *Applied Energy* journal (Impact factor 8.848), *Advances in Applied Energy*, and editor-in-chief of *Handbook of Clean Energy Systems*. He is the Chair of International Conferences on Applied Energy. He is an academician of European Academy of Sciences and Arts, and serves as the advisory expert to the UN, EU, ADB, etc. Founder of ICAE, AEii, UNiLAB, iCET, Energy Proceedings, EnerarXiv and OC:E, etc. He has led research platform (Future Energy Profile) with funding of over 80 MEuro by Swedish Knowledge Foundation and industrial partners, and participated in several EU Projects (FP5, FP6, FP7, and Horizon) and other international and national projects. He was granted with several awards, such as Global Human Settlements Award of Green Technology, 2014 with supported by UNDP, etc. Finalist of SWFF (Securing Water for Food: A Grand Challenge for Development) award by USAID, Government of Sweden and the Netherlands, 2015; William Mong Distinguished Lecture, Hong Kong, 2017. Energy Islands' Award conferred by the European Union with the project TILOS (2017), Highly Cited Researcher 2019 (one of the two selected in engineering in Sweden) by Web of Sciences (2020), IVA's Research2Business Top100 (IVA=Swedish Royal Academy of Engineering Sciences).

Abstract: To achieving the future carbon neutrality, energy systems are under the transition with high renewable energy penetration. The flexibility of the energy systems becomes more important for dynamic balancing of supplies and demands. This lecture focuses on the challenges and opportunities associated with energy transitions, for example, spatial and temporal characterization of energy demand and renewable resources for urban district, smart intervention with the new technologies for consumers into prosumers, and integration of renewable energy with energy storage. We argue that the renewable industry has reached the tipping point of competitive costs. We call for accelerating and promoting market-based distributed energy technologies, energy storage, and smart integration of prosumers to respond energy transition.

ES PLENARY SPEAKERS

PLENARY 1

Title: High Temperature Thermochemical Processes for Energy Storage

Date: Wednesday, June 16
Time: 12:20 PM–1:10 PM
Location: Room 1

Dr. James Klausner, UAE University

Dr. James Klausner is a Professor and Dean of Engineering at the UAE University and is formerly an MSU Foundation Professor and Mechanical Engineering Department Chair at Michigan State University (2016–2021). He is the co-founder of a grid scale energy storage company, RedoxBlox. He formerly served as Chair of the ASME Heat Transfer Division (2011–2012). He serves on the board of directors for the American Society of Thermal Fluid Engineers and the International Titanium Association Foundation. For three and a half years he served as a Program Director at the U.S. Department of Energy Advanced Research Projects Agency-Energy (ARPA-E). Prior to that he held the Newton C. Ebaugh Professorship in Mechanical and Aerospace Engineering at the University of Florida (1989–2015). He received his Ph.D. degree in 1989 from the University of Illinois, Urbana-Champaign. He has made substantial fundamental contributions to understanding the dynamics of boiling heat transfer systems. He has made many fundamental and applied research contributions in high temperature thermochemistry, waste heat and solar driven desalination, and high heat flux phase-change heat transfer. Dr. Klausner has authored more than 150 refereed publications, and his theoretical work on boiling dynamics is included in the *Handbook of Heat Transfer*. He is the author of ten patents and four provisional patents. He is a Fellow of the American Society of Mechanical Engineering and the American Society of Thermal Fluid Engineers. He is a recipient of the ASME Heat Transfer Division Memorial Award and the 75th Anniversary Award.

PLENARY 2

Date: Friday, June 18
Time: 11:20AM–12:10PM
Location: Room 1

Title: Building a Just Transition to a Sustainable Energy Future

Dr. Roderick Jackson, National Renewable Energy Laboratory

Dr. Roderick Jackson is a distinguished Member of Research Staff, Lab Program Manager – Building Technologies Research. He is the laboratory program manager for buildings research at the National Renewable Energy Laboratory (NREL). He sets the strategic agenda for NREL's buildings portfolio, while working closely with senior laboratory management. The portfolio includes all research, development, and market implementation activities, which aim to improve the energy efficiency of building materials and practices. He also guides discussions with the U.S. Department of Energy (DOE) Building Technologies Office to expand research ranging from grid-interactive efficient buildings to mechanical and thermal properties of building materials.

At NREL, Dr. Jackson was recognized as a Distinguished Member of Research Staff. He is serving a three-year appointment to the American Council for an Energy-Efficient Economy (ACEEE) Research Advisory Board, which began in 2021. He has been a member of the American Society of Heating, Refrigerating and Air-Conditioning Engineers and has received several awards in his career, including the National GEM Consortium Alumni of the Year and *Greater Knoxville Business Journal*'s 40 under 40. https://www.nrel.gov/research/staff/roderick-jackson.html

ES PANELS

Date: Wednesday, June 16
Time: 10:15AM–12:00PM
Location: Room 1

WOMEN IN ENGINEERING PANEL

The history of women's contribution in science, technology, engineering, and mathematics dates back to several centuries B.C. with their discoveries in astronomy and influence in philosophy. By the 19th century, women's influence in engineering emerged with their admission to get academic training in mathematics and science although they were still not allowed to receive graduate level education in engineering. Admission of women to engineering programs started in the beginning of the 20th century. It wasn't until 1918, when Kate Gleason was unanimously elected to ASME as its first woman member. In 1986, Dr. Nancy Fitzroy became the 105th and first female president of the ASME. She graduated from the Kate Gleason College of Engineering at the Rochester Institute of Technology, which is the first engineering school in the U.S. to be named for a woman. Since these pioneering women engineers, many female students decided to pursue engineering as their career and many inspiring women have made their contribution into industry and academia with their outstanding inventions, research, and leadership. However, according to the data by the Society of Women Engineers (SWE), female students' interest in majoring in engineering has increased, but it still lags behind male students' number of enrollments. Similarly, SWE data show that only 13% of the engineers in workforce are women, and only 17% of tenure/tenure-track faculty in engineering are women. As for the pay scale, SWE data indicate that female engineers earn 90¢ for every $1 male engineers earn. The ASME Energy Sustainability 2021 Women in Engineering panel showcases outstanding women engineers that have made numerous contributions to engineering through their research and leadership. The panel will showcase highlights of their career and accomplishments along with vibrant discussions on exciting aspects of engineering, a wide spectrum of technical topics and opportunities in engineering, and ideas to enhance the number of female engineers and influential contributions of female engineers. Last but not the least, the panel will provide a forum to discuss the conference theme, "For a Sustainable Planet," and women's potential roles as creative engineers toward that goal.

Moderator:

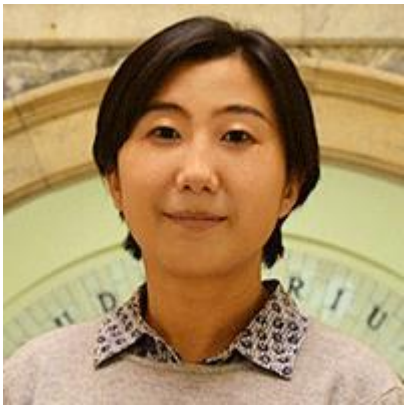
Nesrin Ozalp, Purdue University

Nesrin Ozalp is a Professor and Chair of Mechanical and Civil Engineering Department, Purdue University Northwest, and Editor-in-Chief of *Thermopedia* by Begell House

Panelists:

Dr. Margot Gerritsen, Stanford University

Dr. Margot Gerritsen received her MS degree at University of Delft, and her Ph.D. from Stanford University. She is Professor of Energy Resources Engineering, Stanford University and has been a faculty member at Stanford since 2001. From 2010 to 2018, she directed the Stanford Institute for Computational and Mathematical Engineering. Since 2015, she is the Senior Associate Dean for Educational Affairs in the School of Earth, Energy and Environmental Sciences, as well as the co-director of Women in Data Science (WiDS) and the host of the WiDS podcasts. Dr. Gerritsen's research area of interest is on computer simulation and mathematical analysis of engineering and natural processes.



Dr. Ying Sun, Drexel University

Dr. Ying Sun is the Program Director of the Thermal Transport Processes program at NSF, Professor of Mechanical Engineering and Mechanics at Drexel University. She received her bachelor's degree at Tsinghua University in Beijing. She completed her Master's and PhD at the University of Iowa. She joined Drexel's College of Engineering faculty in 2009. She has authored over 65 refereed publications, supervised six PhD dissertations, 12 Master's theses, over 25 undergraduate researchers, and eight post-docs. Her research interests include multiphase flows and heat/mass transport, multiscale modeling of transport phenomena, wetting and interfacial phenomena, and scalable nanomanufacturing. Dr. Sun's lab is funded by the NSF, DOE, ARPA-E, AFOSR, EPRI, ACS PRF, Ben Franklin Technology Partners, and industry. She is a Fellow of the ASME.

Erin Slayton, PE, DBIA, ENV., HDR

Erin Slayton is a SP, Principal Project Manager/Vice President at HDR. Ms. Slayton received her BSc from Stanford University and her MS from University of Washington. With nearly 20 years of experience in the planning, design and delivery of major transportation infrastructure programs, Erin Slayton leads delivery of program management in all transportation markets. She served as an HDR department manager for the $4.56 billion Washington State DOT SR 520 Floating Bridge Replacement and HOV Program from 2012 to 2014. Erin helped develop and manage the procurement and delivery of the $1.7 billion Arizona DOT South Mountain Freeway Project, before moving to Columbia, South Carolina, in 2018 to focus on the management of the South Carolina DOT's $1.6 billion Carolina Crossroads Project.

Dr. Evelyn Wang, Massachusetts Institute of Technology

Dr. Evelyn Wang is a Gail E. Kendall Professor and Department Head, at Massachusetts Institute of Technology Dr. Wang received her bachelor's degree in mechanical engineering from MIT in 2000, and MS and PhD degrees from Stanford University in 2001 and 2006, respectively. An internationally recognized leader in phase change heat transfer on nanostructure surfaces, Wang's research focuses on high-efficiency energy and water systems. Her work on solar cells that convert heat into focused beams of light was named as one of MIT Technology Review's 10 breakthrough technologies of 2017. Her work on the development of a device that can extract fresh water from the air in arid environments was selected by Scientific American and the World Economic Forum as one of 2017's 10 promising emerging technologies.

Dr. Sophia Haussener, Ecole Polytechnique Federale de Lausanne

Dr. Sophia Haussener is an Associate Professor, Ecole Polytechnique Federale de Lausanne (EPFL). Dr. Haussener received her MSc and PhD (2010) in Mechanical Engineering from ETH Zurich. Her current research is focused on providing design guidelines for thermal, thermochemical, and photo-electrochemical energy conversion reactors through multi-physics modeling. She has published over 70 articles in peer-reviewed journals and conference proceedings. She has been awarded the ETH medal (2011), the Dimitris N. Chorafas Foundation award (2011), the ABB Forschungspreis (2012), the Prix Zonta (2015), the Global Change Award (2017), and the Raymond Viskanta Award (2019), and is a recipient of a Starting Grant of the Swiss National Science Foundation (2014). She is a deputy leader in the Swiss Competence Center for Energy Research (SCCER) on energy storage and acts as a Member of the Scientific Advisory Council of the Helmholtz Zentrum.

NATIONAL LABORATORY PANEL

Date: Thursday, June 17
Time: 10:10 AM–11:50 PM
Location: Room 1

Moderator:

Dr. Michael Wagner, Assistant Professor, University of Wisconsin-Madison, and Senior Researcher, National Renewable Energy Laboratory

The United States Department of Energy's national laboratory system is home to 17 institutions that produce world leading research in energy efficiency, nuclear and renewable energy, advanced power generation, materials, fundamental physics, and a broad array of related topics. Often referred to as the "crown jewels" of the national research ecosystem, the labs are home to thousands of engineers and scientists who transfer cutting edge science from concept to technology. These researchers come from myriad backgrounds and are trained in a variety of fields but share a common goal of advancing the state of knowledge for energy-related applications to benefit U.S. interests. We welcome a panel of researchers from four national laboratories who will offer perspective on selected areas of active research at their respective institutions, provide insight into work and life at a national lab, and offer guidance on skills that may be helpful in pursuing a career as a lab researcher.

Panelists:

Dr. Mark Messner, Argonne National Laboratory

Dr. Mark Messner is a Principal Mechanical Engineer at Argonne National Laboratory. Dr. Messner conducts research on modeling, simulation, and design of high temperature materials and structures. His research areas include meso-structural modeling, structural and material design and optimization, machine learning for design problems, the development of simulation methods, and engineering design method development. Dr. Messner is a member and chair of several of the ASME Section III Boiler and Pressure Vessel Code working groups responsible for high temperature design. He received his BS, MS, and PhD in Civil Engineering from the University of Illinois – Urbana-Champaign.

Dr. Judith Vidal, National Renewable Energy Laboratory

Dr. Judith Vidal is a Group Manager at the National Renewable Energy Laboratory. Since joining NREL in 2010, Dr. Vidal has established an international reputation for her cutting-edge work on thermal systems. Her work has produced first-class capabilities such as the Thermal Storage Materials Laboratory and the Thermal Systems Process and Components Laboratory at NREL. Dr. Vidal is a joint faculty member at the Colorado School of Mines. She earned her BS and MS in Materials Engineering from Simon Bolivar University (Venezuela) and her PhD in Metallurgical and Materials Engineering from Colorado School of Mines.

Dr. Paul Talbot, Idaho National Laboratory

Dr. Paul Talbot is a Computational Postdoctoral Research Associate at Idaho National Laboratory. He is a post-doctoral computational scientist with experience in industry, academics, and government laboratories. He has made research contributions in the areas of optimization, uncertainty quantification, simulation and surrogate modeling, software development, reactor physics and neutron transport. Dr. Talbot earned a PhD in Nuclear Engineering at the University of New Mexico, an MS at Oregon State University, and a BS in Physics BYU-Idaho.

Dr. Kenneth Armijo, Sandia National Laboratory

Dr. Kenneth Armijo is a Senior Member of the Engineering Staff at Sandia National Laboratory. He leads molten salt and molten alkali metals R&D at the National Solar Thermal Test Facility (NSTTF). His research interests are in alternative energy technologies and sustainability, as they pertain to scientific and technological innovation, business, and policy. He is recognized for work in the development of U.S. and international arc-fault detection and mitigation codes and standards. Dr. Armijo holds a BS, MS, and PhD in Mechanical Engineering from the University of California, Berkeley with minors in Energy and Resources, and business credentials in Management of Technology.

SHTC AWARDS

The Heat Transfer Division is pleased to present the following 5 awards during the 2021 Summer Heat Transfer Conference:

- **2020 Donald Q. Kern Award**
  Raj M. Manglik

- **2019 Max Jakob Award**
  Arun Majumdar

- **2020 Max Jakob Award**
  Peter C. Wayner

- **2019 Rohsenow Award**
  Ramy Anwar Ibrahim Abdelmaksoud

- **2020 Rohsenow Award**
  Daniel Castillo Gutierrez

ES AWARDS

The ASME Advanced Energy Systems Division and Solar Energy Division are pleased to present nine awards in three different categories to the participants of the ES2021:

- **Best Technical Paper Publication Award:**
  The purpose of these awards is to promote high quality research contributions in the field of Energy Sustainability through the recognition of outstanding papers. The selection will be based on the inputs from the reviewers and the organizing committee. 1st place: $1000; 2nd place: $500; 3rd place: $300

- **Best Student Paper Award:**
  These awards will be presented to the lead author students whose works best exemplify the research and advance in Energy Sustainability. 1st place: $500; 2nd place: $300; 3rd place: $200

- **Best Technical Presentation Only Award:**
  The best presenters will be recognized for their excellent contribution to the field of Energy Sustainability and the ES2021 conference. 1st place: $500; 2nd place: $300; 3rd place: $200

SHTC TECHNICAL SESSIONS

Please note, all Heat Transfer technical publications and presentations will not be shown during the virtual conference due to time constraints but will be available OnDemand during the conference and for 3 months after the conference. The list on the following pages shows you what sessions the technical presentations have been assigned to and where you can find them in the virtual platform.

Session: 06-01 - Thermal Storage in Energy Systems Session

Chair: ***Alexander Rattner - Penn State University***
Co-Chair: ***Leitao Chen - Tennessee State University***
Co-Chair: ***Hohyun Lee - Santa Clara University***

Onset of Benard Convection in an Electromagnetic Heat Exchanger Under Laminar Flow Conditions
Technical Paper Publication: SHTC2021-60452
Ajit Mohekar - Worcester Polytechnic Institute
Burt Tilley - Worcester Polytechnic Institute
Vadim Yakovlev - Worcester Polytechnic Institute

Effect of Altitude on the In-Cylinder Heat Transfer of a Compression Ignition Engine
Technical Paper Publication: SHTC2021-62351
Zhentao Liu - Zhejiang University
Jinlong Liu - Zhejiang University

Numerical Investigation of an Induced Draft Air-Cooled Condenser Under Crosswind Conditions
Technical Paper Publication: SHTC2021-62355
Daniel Louis Louw - Stellenbosch University
Sybrand Johannes Van Der Spuy - Stellenbosch University
Christiaan Johannes Meyer - Stellenbosch University

Numerical Simulation and Flame Characteristics Analysis of Non-Premixed Swirling Combustion

Technical Paper Publication: SHTC2021-62482

Su Yi - Qingdao University of Science and Technology
Zhang Bin - Qingdao University of Science and Technology
Wei Li - Zhejiang University
Hou Junqing - Qingdao University of Science and Technology
Chen Yifeng - Qingdao University of Science and Technology
Jiang Jieyu - Qingdao University of Science and Technology

Analysis of Convection-Radiation Heat Transfer in Molten Salts for Thermal Energy Applications Using Particle Image Velocimetry

Technical Presentation Only: SHTC2021-62540

Valerie Lamenta - McGill University
Noah Le François - McGill University
Melanie Tetreault-Friend - McGill University

Numerical Analysis of a PV/T System Integrated With PCM and Highly Conductive Porous Material

Technical Paper Publication: SHTC2021-62974

Vivek R. Pawar - University of Missouri-Kansas City
Mahbube K. Siddiki - University of Missouri-Kansas City
Sarvenaz Sobhansarbandi - University of Missouri-Kansas City

Effect of Geometry Configurations on the Thermal Performance of Encapsulated PCMS

Technical Paper Publication: SHTC2021-63181

Mohammad Reza Mohaghegh - University of Guelph
Shohel Mahmud - University of Guelph
Syeda Tasnim - University of Guelph

The Effect of Condenser Temperature on the Performance of the Evaporator in a Wickless Heat Pipe Performance

Technical Presentation Only: SHTC2021-63137

Jiaheng Yu - Rensselaer Polytechnic Institute
Thao Nguyen - Rensselaer Polytechnic Institute
Anisha Pawar - Rensselaer Polytechnic Institute
Peter Wayner - Rensselaer Polytechnic Institute
Joel Plawsky - Rensselaer Polytechnic Institute
David Chao - NASA Glenn Research Center
Ronald Sicker - NASA Glenn Research Center

Toward Extreme High-Temperature/High-Pressure Energy Systems: Leakage Characterization of Ceramic 3D-Printed Structures
Technical Presentation Only: SHTC2021-64034
Rasoul Bayaniahangar - Michigan Technological University
Joseph Cesarano - Robocasting Enterprises
Kashif Nawaz - Oak Ridge National Laboratory
Sajjad Bigham - Michigan Tech University

Experimental Evaluation of Ceramic 3D-Printed Heat Exchangers at High-Temperatures
Technical Presentation Only: SHTC2021-64028
Behzad Ahmadi - Michigan Technological University
Joseph Cesarano - Robocasting Enterprises
Kashif Nawaz - Oak Ridge National Laboratory
Sajjad Bigham - Michigan Tech University

A Proposed Procedure for Identifying the Predominant Heat Transfer Modes Along the Length of Large Nickel Laterite Ore Rotary Kiln: Experimental Validation in an Industrial Process
Technical Paper Publication: SHTC2021-64016
Janneth Ruiz - Cerro Matoso S.A. (South 32)
Antonio Ardila - Cerro Matoso S.A. (South 32)
Bernardo Rueda - Cerro Matoso S.A. (South 32)
Jorge Echeverri - Universidad del Norte
Daniel Quintero - Universidad del Norte
Wilson Guillin - Universidad del Norte
Lesme Corredor - Universidad del Norte
Arturo González - Universidad del Norte

Experimental Evaluation of a Membrane-Based Liquid-Desiccant Regenerator
Technical Presentation Only: SHTC2021-64006
Behnam Ahmadi - Michigan Technological University
Masoud Ahmadi - Michigan Technological University
Sajjad Bigham - Michigan Tech University

Data Analytics Approach for Understanding the Relationship Between the Thermal and Energy Performance in Ferronickel Large Industrial Rotary Kilns

Technical Paper Publication: SHTC2021-63999

Antonio Ardila - Cerro Matoso S.A
Bernardo Rueda - Cerro Matoso S.A
Iván Sánchez - Cerro Matoso S.A
Maricel Parra - Universidad del Norte
Lesme Corredor - Universidad del Norte
Arturo González - Universidad del Norte
Johanna Romero - Universidad del Norte

A Simplified Numerical Approach to Characterize the Thermal Response of a Moving Bed Solar Reactor

Technical Paper Publication: SHTC2021-63924

Assaad Alsahlani - Purdue University Northwest
Nesrin Ozalp - Purdue University Northwest
Kelvin Randhir - Michigan State University
James Klausner - Michigan State University

Empirical Determination of the Design Influence of Large Industrial Rotary Kilns for Ferronickel Production on Heat Transfer and Energy Performance

Technical Paper Publication: SHTC2021-63970

Janneth Ruiz - Cerro Matoso S.A. (South 32)
Antonio Ardila - Cerro Matoso S.A. (South 32)
Bernardo Rueda - Cerro Matoso S.A. (South 32)
Andy Castillo - Universidad del Norte
Yuleisy Pardo - Universidad del Norte
Lesme Corredor - Universidad del Norte
Heriberto Maury - Universidad del Norte

Indirection Freeze Desalination Experimental Observation and 1st Principal Modeling

Technical Paper Publication: SHTC2021-63842

Hongtao Zhang - Khalifa University of Science & Technology
Khawlah Alabdouli - Khalifa University of Science & Technology
Isam Janajreh - Khalifa University of Science & Technology
Md. Islam - Khalifa University of Science & Technology

Numerical Investigation of Photovoltaics Cooling Using Wicking Channels
Technical Paper Publication: SHTC2021-63657
Sajag Poudel - Syracuse University
Durgesh Ranjan - Syracuse University
An Zou - Syracuse University
Shalabh Maroo - Syracuse University

Study of Reduction of Energy Use by Varying Mass Flow Rate of AC System Using a Sensor Network on Large Buildings
Technical Paper Publication: SHTC2021-63464
Daniel Medina Portilla - CSU Northridge
Abhijit Mukherjee - CSU Northridge

Optical Characterisation of Alumina–Mullite Materials for Solar Particle Receiver Applications
Technical Presentation Only: SHTC2021-74001
Jingjing Chen - The Australian National University
Vincent Wheeler - University of Wisconsin-Stout
Boqing Liu - The Australian National University
Apurv Kumar - Federation University
Joe Coventry - The Australian National University
Wojciech Lipinski - The Australian National University

Session: 07-01 - Measurements of Thermophysical Properties, Including Development of Measurement Systems Session

Chair: ***Nicholas Roberts - Utah State University***
Co-Chair: ***Troy Munro - Brigham Young University***

A Novel Fast Predicting Technique for the Absorptivity of Surface Coating
Technical Paper Publication: SHTC2021-61956
Emir Özkökdemir - Roketsan
Berkay Filiz - Roketsan
Yener Usul - Roketsan

Sun Drying and Far-Infrared Drying Characteristics of Lily

Technical Paper Publication: SHTC2021-63541

Pei Yang - Central South University of Forestry and Technology,
Dan Huang - Central South University of Forestry and Technology
Sisi Lv - Central South University of Forestry and Technology
Ruiqi Wang - Central South University of Forestry and Technology,
S.A. Sherif - University of Florida
Wei Li - Zhejiang University

Drying Characteristics and Quality of Fresh White Waxy Corn Under Different Drying Methods

Technical Paper Publication: SHTC2021-63543

Yanling He - Central South University of Forestry and Technology
Dan Huang - Central South University of Forestry and Technology
Yongjia Chen - Central South University of Forestry and Technology
Kaiyang Men - Central South University of Forestry and Technology
s.a. Sherif - University of Florida
Wei Li - Zhejiang University

Viscosity and Natural Evaporation Studies: Aqueous Solutions of Surfactants and Hydrotopes

Technical Paper Publication: SHTC2021-63951

Birce Dikici - Embry-Riddle Aeronautical University
Angelos Kaminis - Embry-Riddle Aeronautical University
Dakotah Stirnweis - Embry-Riddle Aeronautical University
Lauren Stollenwerk - Embry-Riddle Aeronautical University
Qi Jiang - Embry-Riddle Aeronautical University

Session: 08-01 - Fundamentals of Boiling, Condensation, and Evaporation

Chair: ***Diana Borca-Tasciuc - Rensselaer Polytechnic Institute***
Co-Chair: ***Amitabh Narain - Michigan Tech University***
Co-Chair: ***Xiulin Ruan - Purdue University***
Co-Chair: ***Vaibhav Bahadur - University of Texas at Austin***
Co-Chair: ***Ming-Chang Lu - National Chiao Tung University***
Co-Chair: ***Navdeep Dhillon - CSU Long Beach***
Co-Chair: ***Van Carey - UC Berkeley***

A Comparative Study on Effectiveness of Evaporative Cooling and Phase Change Material Vests of People With Paraplegia
Technical Paper Publication: SHTC2021-60491
Farah Mneimneh - American University of Beirut
Nesreen Ghaddar - American University of Beirut
Kamel Ghali - American University of Beirut
Charbel Moussalem - American University of Beirut Medical Center
Ibrahim Omeis - American University of Beirut Medical Center

Flow Boiling on Homogenous and Gradient Wick Surfaces
Technical Presentation Only: SHTC2021-63370
Sajjad Bigham - Michigan Technological University
Masoud Ahmadi - Michigan Technological University

Determining Parametric Effects for Droplet Evaporation on Nanoporous Superhydrophillic Surfaces Using Machine Learning Techniques
Technical Paper Publication: SHTC2021-63618
Emma R. McClure - University of California
Van P. Carey - University of California, Berkeley

Use of Machine Learning Tools to Assess Surface Dryout During Nucleate and Transition Boiling on Surfaces With Different Wetting and Substrate Properties
Technical Paper Publication: SHTC2021-64012
Ursan Tchouteng Njike - University of California, Berkeley
Samuel Cabrera - University of California
Emma McClure - University of California, Berkeley
Van Carey - University of California

Understanding Condensation-Mediated Degradation of Low Surface Energy Monolayer Coatings on Silicon Surfaces
Technical Presentation Only: SHTC2021-68343
Ruisong Wang - Texas A&M University
Karan Jakhar - Texas A&M University
Shoaib Ahmed - Texas A&M University
Dion Antao - Texas A&M University

Session: 08-02 - Fundamentals of Single-Phase Flow

Chair: ***Diana Borca-Tasciuc - Rensselaer Polytechnic Institute***

Investigation of Buoyancy Effects in Asymmetrically Heated Near-Critical Flows of Carbon Dioxide in Horizontal Microchannels Using Infrared Thermography
Technical Paper Publication: SHTC2021-63004
Lindsey Randle - Oregon State University
Brian Fronk - Oregon State University

Numerical Investigation of Porosity Effect on Confined Round Impinging Jets of Nanofluids in Aluminum Foams
Technical Paper Publication: SHTC2021-63390
Bernardo Buonomo - Università degli Studi della Campania "Luigi Vanvitelli"
Anna Di Pasqua - Università degli Studi della Campania "Luigi Vanvitelli"
Oronzio Manca - Università degli Studi della Campania "Luigi Vanvitelli"
Sergio Nappo - Università degli Studi della Campania "Luigi Vanvitelli"

The Simulation of Water Transport in Proton Exchange Membrane Fuel Cell Based on Lattice Boltzmann Method
Technical Paper Publication: SHTC2021-63572
Zhou Shikun - Northwestern Polytechnical University
Zhang Yingchun - Northwestern Polytechnical University
Xie Gongnan - Northwestern Polytechnical University

Effect of Protuberances in the Heat Transfer Enhancement in Mini-Channels
Technical Paper Publication: SHTC2021-64045
Gerardo Carbajal - Florida Polytechnic University
Ariel Cruz-Diaz - Ana G Mendez University System

Session: 09-02 - Thermal Transport in 2D and Anistroptic Materials Session

Chair: ***Dong Liu - University of Houston***
Co-Chair: ***Liping Wang - Arizona State University***

Enhanced Mechanism of Water Evaporation Through Nanoporous Membrane
Technical Paper Publication: SHTC2021-61719
Runkeng Liu - Shanghai Jiao Tong University
Zhenyu Liu - Shanghai Jiao Tong University

Photon Tunneling via Coupling Graphene Plasmons With Phonon Polaritons of Hexagonal Boron Nitride in Reststrahlen Bands
Technical Paper Publication: SHTC2021-62180
Ruiyi Liu - Shandong Universtity
Xiaohu Wu - Shandong Institute of Advanced Technology
Zheng Cui - Shandong Institute of Advanced Technology

Diffusion-Mediated Anharmonic Phonon Transport and Thermal Conductivity Reduction in Defective Hybrid Perovskites
Technical Paper Publication: SHTC2021-62601
Zhuangli Cai - Shanghai Jiao Tong University
Shangchao Lin - Shanghai Jiao Tong University
Zuolin Liu - Shanghai Jiao Tong University
Min Yang - Shanghai Jiao Tong University
Bin Yang - Shanghai Jiao Tong University

High-Throughput Screening of Aperiodic Superlattice for Minimum Thermal Conductivity Based on Atomistic Simulation-Informed Effective Medium Theory and Genetic Algorithm
Technical Paper Publication: SHTC2021-62825
Shangchao Lin - Shanghai Jiao Tong University
Yixuan Liu - Shanghai Jiao Tong University
Zhuangli Cai - Shanghai Jiao Tong University

Efficient Frost Removal on the Surface With Molecular-Level Slippery Coating
Technical Presentation Only: SHTC2021-60909
Siyan Yang - Dalian University of Technology
Yajie Song - Dalian University of Technology
Bingang Du - Dalian University of Technology
Rongfu Wen - Dalian University of Technology
Tingting Hao - Dalian University of Technology
Xuehu Ma - Dalian University of Technology

Accurate Modeling of Charge and Photon Transport for Near-Field Thermophotovoltaic Systems
Technical Presentation Only: SHTC2021-62142
Dudong Feng - Georgia Institute of Technology
Eric Tervo - National Renewable Energy Laboratory
Dragica Vasileska - Arizona State University
Shannon Yee - Georgia Institute of Technology
Ajeet Rohatgi - Georgia Institute of Technology
Zhuomin Zhang - Georgia Institute of Technology

Effects of Metal-Metal Interfaces on Non-Equilibrium Heat Transfer in Nanoscale Metal Bilayers
Technical Presentation Only: SHTC2021-61491
Gen Li - Dalian University of Technology
Jie Zhu - Dalian University of Technology
Zhongying Zhang - Dalian University of Technology
Jing Zhou - Dalian University of Technology
Xuanhui Fan - Dalian University of Technology
Dawei Tang - Dalian University of Technology

Generalized "Slope Method" of 3ω Analysis to Measure the Thermal Conductivity and Heat Capacity of Solids: Frequency- vs. Current-Sweep
Technical Presentation Only: SHTC2021-61896
Nan Chen - Jiangsu Key Laboratory for Design & Manufacture or Micro/Nano Biomedical Instruments, School of Mechanical Engineering, Southeast University
Tao Li - Jiangsu Key Laboratory for Design & Manufacture or Micro/Nano Biomedical Instruments, School of Mechanical Engineering, Southeast University
Yin Wang - State Key Laboratory of ASIC and System, School of Microelectronics, Fudan University
Li Pan - Jiangsu Key Laboratory for Design & Manufacture or Micro/Nano Biomedical Instruments, School of Mechanical Engineering, Southeast University
Wenzhong Bao - State Key Laboratory of ASIC and System, School of Microelectronics, Fudan University
Zhen Chen - Jiangsu Key Laboratory for Design & Manufacture or Micro/Nano Biomedical Instruments, School of Mechanical Engineering, Southeast University

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Session: 10-01 - Single-Phase Enhanced Heat Transfer Equipment Session

Chair: ***Maulik Shelat - Air Products***

Influence of Flue Gas Turbulence Intensity on the Heat and Mass Transfer and Pressure Drop Inside a TMC Based Heat Exchanger
Technical Paper Publication: SHTC2021-62552
Saja Al-Rifai - Florida International University
Cheng-xian Lin - Florida International University

Computational Fluid Dynamics Based Investigation of the Performance of Hybrid Heat Sinks
Technical Paper Publication: SHTC2021-63099
Anas Alkhazaleh - United Arab Emirates University
Mohamed Younes El-Saghir Selim - United Arab Emirates University
Fadi Alnaimat - United Arab Emirates University
Bobby Mathew - United Arab Emirates University

Slip Gas Flow and Heat Transfer in Confined Porous Media With Different Shape Cylinders
Technical Paper Publication: SHTC2021-63408
Ammar Tariq - Shanghai Jiao Tong University
Zhenyu Liu - Shanghai Jiao Tong University

A Numerical Study on the Thermal Control of Lithium Batteries by Composite Phase Change Materials and Metal Foams
Technical Paper Publication: SHTC2021-63893
Bernardo Buonomo - Università degli Studi della Campania "Luigi Vanvitelli"
Oronzio Manca - Università degli Studi della Campania "Luigi Vanvitelli"
Simone Mancin - Università degli Studi di Padova
Ferdinando Menale - Università degli Studi della Campania "Luigi Vanvitelli"
Francesco Moriello - Università degli Studi della Campania "Luigi Vanvitelli"

High Temperature Heat Exchangers- Opportunities and Challenges for Design and Manufacturing
Technical Presentation Only: SHTC2021-64049
Kashif Nawaz - Oak Ridge National Laboratory

The Effect of Fillet Profile on Heat Transfer Characteristics of Heat Sink
Technical Paper Publication: SHTC2021-61091
Karim Egab - Southern Technical University
Saad Oudah - University of South Carolina
Azzam Salman - University of South Carolina

CFD Study of the Thermal Performance Improvement of a Counter-Flow Heat Exchanger Using Enhanced Surface Tubes
Technical Paper Publication: SHTC2021-63577
Humberto Santos - Professor Agamemnon Magalhaes Technical School
Wei Li - Zhejiang University
David Kukulka - State University of New York at Buffalo

Session: 13-01 - Boiling and Evaporation

Chair: ***Scott Thompson - Kansas State University***

The Effects of Bending on Heat Pipes
Technical Paper Publication: SHTC2021-61823
Mahboobe Mahdavi - Gannon University
Amir Faghri - University of Connecticut

Flow Boiling of Deionized Water in Ultrahigh-Aspect-Ratio Copper Microchannel Heat Sink
Technical Paper Publication: SHTC2021-62094
Peilin Cui - Shanghai Jiao Tong University
Zhenyu Liu - Shanghai Jiao Tong University

Machine Learning Based Estimation of Fuel Quality for Leidenfrost Droplets
Technical Paper Publication: SHTC2021-62231
Awan Bhati - University of Texas at Austin
Palash V. Acharya - University of Texas at Austin
Ofodike A. Ezekoye - University of Texas at Austin
Vaibhav Bahadur - University of Texas at Austin

Numerical Simulation and Analysis of Effect of Injection Volume on Biomass Particle Cyclone Venturi Dryer
Technical Paper Publication: SHTC2021-63513
Guohai Jia - Central South University of Forestry and Technology
Guoshuai Tian - Central South University of Forestry and Technology
Zicheng Gao - Central South University of Forestry and Technology
Dan Huang - Central South University of Forestry and Technology
Wei Li - Zhejiang University
Li Dai - Central South University of Forestry and Technology
Qiuyao Zhang - Central South University of Forestry and Technology

Study of Boiling Heat Transfer on Heterogeneous Wetting Surface With MD Simulation
Technical Paper Publication: SHTC2021-63363
Zeyu Liu - Shanghai Jiao Tong University
Runkeng Liu - Shanghai Jiao Tong University
Peng Li - Shanghai Institute of Aerospace System Engineering
Anyi Xu - Shanghai Institute of Aerospace System Engineering
Zhenyu Liu - Shanghai Jiao Tong University

A Numerical Investigation Into the Heat Transfer Performance and Particle Dynamics of a Compressible, Highly Mass Loaded, High Reynolds Number, Particle-Laden Flow
Technical Paper Publication: SHTC2021-63262
Kyle Hassan - Penn State University
Robert Kunz - Penn State University
David Hanson - Penn State University
Michael Manahan - Penn State University

Effect of Build Angle on Additively Manufactured Aluminum Alloy Surface Roughness and Water Wetting Ability
Technical Paper Publication: SHTC2021-63599
Christopher Bailey - Kansas State University
Cameron Weeks - Kansas State University
Jordan Morrow - Kansas State University
Melanie Derby - Kansas State University
Scott Thompson - Kansas State University

Experimental Investigation on the Effects of Inclination Angle on Heat Transfer Performance of a Liquid Metal High-Temperature Oscillating Heat Pipe
Technical Paper Publication: SHTC2021-63718
Mengke Wu - Dalian Maritime University
Yulong Ji - Dalian Maritime University
Yanmin Feng - Dalian Maritime University
Xin Yang - Dalian Maritime University
Yadong Li - Dalian Maritime University
Qinan Liu - Dalian Maritime University

An Experimental Investigation of an Additively Manufactured Polymer Vapor Chamber
Technical Presentation Only: SHTC2021-63987
Cameron Weeks - Kansas State University
Christopher Bailey - Kansas State University
John Matulis - Kansas State University
Scott Thompson - Kansas State University

Flow Boiling on ZNO Micro-Rod Surface in a Vertical Narrow Microchannel
Technical Presentation Only: SHTC2021-65133
Yuhao Lin - Zhejiang University
Junye Li - Zhejiang University
Kan Zhou - Zhejiang University
Jia Sun - Zhejiang University
Wei Li - Zhejiang University
Zhichuan Sun - AVIC Nanjing Engineering Institute of Aircraft Systems

Volume of Fluid Computational Fluid Dynamics Approach for Modeling and Analysis of Cryogenic Thermal Transitions in a Horizontal Feed Line
Technical Presentation Only: SHTC2021-66066
Abraham Adu-Mills - Southern University and A&M College
Patrick Mensah - Southern University and A&M College
Samuel Ibekwe - Southern University and A&M College
Stephen Akwaboa - Southern University and A&M College
John Van Pelt - United Launch Alliance

Role of Surface Structures in Liquid-Desiccant-Based Air Dehumidifiers
Technical Presentation Only: SHTC2021-63988
Masoud Ahmadi - Michigan Technological University
Behnam Ahmadi - Michigan Technological University
Sajjad Bigham - Michigan Technological University

Condensation Heat Transfer Model: A Comparison Study of Condensation Rate Between a Single Bubble and Multiple Rising Bubbles
Technical Paper Publication: SHTC2021-63593
Fadi Alnaimat - United Arab Emirates University
Omar Alhammadi - United Arab Emirates University
Bobby Mathew - United Arab Emirates University

Observations of Multifractality in Temperature Fluctuations of a Wire in Pool Boiling
Technical Presentation Only: SHTC2021-63801
Ankit Saini - University of Minnesota Twin Cities
Preston Holt - University of Minnesota Twin Cities
Vinod Srinivasan - University of Minnesota Twin Cities

Flow Boiling on Superhydrophobic Porous Copper Surface in a Vertical Narrow Microchannel
Technical Presentation Only: SHTC2021-65123
Yuhao Lin - Zhejiang University
Junye Li - Zhejiang University
Kan Zhou - Zhejiang University
Wei Li - Zhejiang University
Zhichuan Sun - AVIC Nanjing Engineering Institute of Aircraft Systems

Thermal Circuit Analysis of Droplet Evaporation on Hot Microstructured Superhydrophobic Surfaces
Technical Presentation Only: SHTC2021-69038
Jiangtao Cheng - Virginia Tech
Wenge Huang - Virginia Tech
Xukun He - Virginia Tech

Numerical Thermal Performance Investigation of an Electric Motor Passive Cooling System Employing Phase Change Materials
Technical Paper Publication: SHTC2021-63506
Ali Deriszadeh - University of L'Aquila
Filippo De Monte - University of L'Aquila
Marco Villani - University of L'Aquila

Session: 14-01 - Gas Turbine Heat Transfer

Chair: ***Marc D. Polanka - AFIT/ENY***
Co-Chair: ***Lesley M. Wright - Texas A&M University***

Effects of Vortex Generators on the Impingement Jet Arrays Heat Transfer
Technical Paper Publication: SHTC2021-60461
Yue Yang - Nanjing University of Aeronautics and Astronautics
Juikui Mao - Jiangsu Province Key Laboratory of Aerospace Power System, Nanjing University of Aeronautics and Astronautics
Feilong Wang - Jiangsu Province Key Laboratory of Aerospace Power System, Nanjing University of Aeronautics and Astronautics

Optimal Design of Novel Laminated Cooling System Considering Cooling Effectiveness and Thermomechanical Performance
Technical Paper Publication: SHTC2021-62602
Honglin Li - Northwestern Polytechnical University
Lei Li - Northwestern Polytechnical University
Wenjing Gao - Northwestern Polytechnical University
Zhonghao Tang - Northwestern Polytechnical University
Chunlong Tan - Northwestern Polytechnical University
Shuoshuo Ren - Northwestern Polytechnical University

Numerical Analysis on the Leading-Edge Film Cooling of Bifurcation Holes for Gas Turbine Blade
Technical Paper Publication: SHTC2021-62615
Zhonghao Tang - Northwestern Polytechnical University
Gongnan Xie - Northwestern Polytechnical University
Honglin Li - Northwestern Polytechnical University
Wenjing Gao - Northwestern Polytechnical University
Chunlong Tan - Northwestern Polytechnical University
Lei Li - Northwestern Polytechnical University

Validation of Multiphase Computational Model Using Experimental Study of Air/Mist Film Cooling
Technical Paper Publication: SHTC2021-63467
Ramy Abdelmaksoud - University of New Orleans
Ting Wang - University of New Orleans

The Influence of Deterministic Surface Roughness and Free-Stream Turbulence on Transitional Boundary Layers: Heat Transfer Distributions and a New Transition Onset Correlation
Technical Paper Publication: SHTC2021-63504
Christoph Gramespacher - Karlsruhe University of Applied Sciences
Matthias Stripf - Karlsruhe University of Applied Sciences
Hans-Jörg Bauer - Karlsruhe Institute of Technology

Effect of Variation of Pin-Fin Height on Jet Impingement Heat Transfer on a Rotating Surface
Technical Paper Publication: SHTC2021-63946
Pratik Bhansali - North Carolina State University
Srinath Ekkad - North Carolina State University

Session: 15-01 - Additive Manufacturing Processes

Chair: ***Ying Sun - Drexel University***
Co-Chair: ***Stephen Akwaboa - Southern University and A&M College***

Lightweight Pem Fuel Cell Stack for Unmanned Aerial Vehicle
Technical Paper Publication: SHTC2021-62626
Jinmyun Jo - Virginia State University
Xiayu Zhang - Old Dominion University
Ali Ansari - Virginia State University

Femtosecond Two-Photon 3D Light Field Photolithography
Technical Paper Publication: SHTC2021-62290
Sy-Bor Wen - Texas A&M University
Balaji Baskar - Texas A&M University
Aravind Jakkinapalli - Texas A&M University

Session: 16-01 - Heat Transfer in Electronic Equipment

Chair: ***Milind Jog – University of Cincinnati***
Co-Chair: ***Peter De Bock - Advanced Research Projects Agency - Energy***
Co-Chair: ***Ankur Jain - The University of Texas at Arlington***

A Comparative Study of Simulation Methodologies to Predict Thermal Performance of Power Electronics Hardware
Technical Paper Publication: SHTC2021-62306
Ankit Tiwari - Gentherm Inc.
Craig Whitaker - Gentherm Inc.
Brian Kendall - Gentherm Inc.

Thermo-Hydraulic Performance of Heat Sinks With Microchannel Embedded With Pin-Fins
Technical Paper Publication: SHTC2021-62804
Anas Alkhazaleh - United Arab Emirates University
Mohamed Younes El-Saghir Selim - United Arab Emirates University
Fadi Alnaimat - United Arab Emirates University
Bobby Mathew - United Arab Emirates University

Characterizing Heat Transfer Enhancement in Ferrofluid 2-D Channel Flows Using Mixing Numbers
Technical Paper Publication: SHTC2021-63795
Nadish Anand - North Carolina State University
Richard Gould - North Carolina State University

Session: 19-01 - Heat and Mass Transfer for Natural and Built Environments

Chair: ***Gongnan Xie - Northwestern Polytechnical University***
Chair: ***Sandra K. S. Boetcher - Embry Riddle Aeronautical University***
Chair: ***Kashif Nawaz - Oak Ridge National Laboratory***
Chair: ***Qingang Xiong - Corning Incorporated***

Numerical Research on Heat Transfer Characteristics Analysis of Two Particles in Supercritical Water
Technical Paper Publication: SHTC2021-61486
Hui Jin - Xian Jiaotong University
Zhenqun Wu - Xian Jiaotong University
Xiaoyu Li - Xian Jiaotong University
Huibo Wang - Xian Jiaotong University

Session: 20-01 - Applications of Computational Heat Transfer in Convection

Chair: ***Mohamed Abdelhady - University of Calgary***
Chair: ***Sandip Mazumder - Ohio State Univ***
Chair: ***Aaron Wemhoff - Villanova University***
Chair: ***Sandra K. S. Boetcher - Embry Riddle Aeronautical Univ***
Chair: ***Hamidreza Najafi - Florida Institute of Technology***
Chair: ***Kashif Nawaz - Oak Ridge National Laboratory | ORNL***

Dynamic Behavior of a Streamwise Oscillating Heated Cylinder
Technical Paper Publication: SHTC2021-63856
Ussama Ali - Khalifa University of Science & Technology
Md. Islam - Khalifa University of Science & Technology
Isam Janajreh - Khalifa University of Science & Technology

CFD Analysis of Transient Heat Conduction With Temperature-Dependent Heat Source in a Steering Wheel Column Adjustment Motor
Technical Paper Publication: SHTC2021-63973
Ankit Tiwari - Gentherm Inc.
Trevor Davey - Gentherm Inc.
Matthew Willis - Gentherm Inc.

Computational Study of Oscillating 3-Phase Contact Line on Flat Surfaces
Technical Presentation Only: SHTC2021-63268
Anisha Pawar - Rensselaer Polytechnic Institute
Joel Plawsky - Rensselaer Polytechnic Institute

First-Principles Calculations of Acoustic Phonon Tunneling
Technical Presentation Only: SHTC2021-69161
Takuro Tokunaga - University of Utah
Takuma Shiga - The University of Tokyo
Masao Arai - National Institute for Materials Science
Kazuaki Kobayashi - National Institute for Materials Science
Wataru Hayami - National Institute for Materials Science
Shigeru Suehara - National Institute for Materials Science
Keunhan Park - University of Utah
Mathieu Francoeur - University of Utah

Reduction of Fuel Utilization Through Oxygen-Enriched Combustion in a Reheat Furnace Pusher-Type
Technical Paper Publication: SHTC2021-63931
Francisco Martinez - Purdue University Northwest
Armin Silaen - Purdue University Northwest
Kelly Tian - Linde
Joe Maiolo - Linde
Chenn Zhou - Purdue University Northwest

Session: 20-02 - Application of Computational Heat Transfer for Indoor Environmental Quality

Chair: ***Mohamed Abdelhady - University of Calgary***
Chair: ***Sandip Mazumder - Ohio State University***
Chair: ***Aaron Wemhoff - Villanova University***
Chair: ***Hamidreza Najafi - Florida Institute of Technology***
Chair: ***Shima Hajimirza - Stevens Institute of Technology***
Chair: ***Ashley F. Emery - University of Washington***

Effect of Intermittent Personalized Ventilation on Coughed Particles Dispersion in an Office Space and Resulting Cross Contamination
Technical Paper Publication: SHTC2021-60817
Elvire Katramiz - American University of Beirut
Nesreen Ghaddar - American University of Beirut
Kamel Ghali - American University of Beirut

Sustainable Poultry House Ventilation Using Dew Point Indirect Evaporative Cooler Aided With Radiative Cooling
Technical Paper Publication: SHTC2021-62381
Douaa Al-Assaad - American University of Beirut
Kamel Ghali - American University of Beirut
Nesreene Ghaddar - American University of Beirut
Djamel Ouahrani - Qatar University

A Novel Integrated Passive Ventilation and Air Conditioning System for an Office Space in Hot Climate
Technical Paper Publication: SHTC2021-62520
Jean Paul Harrouz - American Universtiy of Beirut
Kamel Ghali - American University of Beirut
Nesreen Ghaddar - American University of Beirut

Numerical Simulation of Human Coughing Subjected to Different Flow Scenarios and Environmental Conditions
Technical Paper Publication: SHTC2021-64043
Isam Janajreh - Khalifa University of Science and Technology
Muhammad Sajjad - Khalifa University of Science and Technology
Md. Islam - Khalifa University of Science and Technology
Lina Janajreh - Gyms American Academy, Abu Dhabi

Development of a Fast Fluid Dynamics Model Based on PISO Algorithm for Simulating Indoor Airflow
Technical Paper Publication: SHTC2021-63909
Hongtao Qiao - Mitsubishi Electric Research Labs
Sibo Li - University of Illinois at Chicago

Session: 20-03 - Thermal Transport in Nano/Microscale Amorphous Materials

Chair: ***Mohamed Abdelhady - University of Calgary***
Chair: ***Sandip Mazumder - Ohio State University***
Chair: ***Aaron Wemhoff - Villanova University***
Chair: ***Hamidreza Najafi - Florida Institute of Technology***
Chair: ***Som Shrestha - Oak Ridge National Laboratory***

Numerical Simulation of Flow Reversal During Flow Boiling in Microchannel
Technical Presentation Only: SHTC2021-65137
Yuhao Lin - Zhejiang University
Wei Li - Zhejiang University
Yang Luo - Zhejiang University

Zhichuan Sun - AVIC Nanjing Engineering Institute of Aircraft Systems

Numerical Simulation of Flow Boiling on Micro-Fin Surface in Microchannel
Technical Presentation Only: SHTC2021-65138
Yuhao Lin - Zhejiang University
Yang Luo - Zhejiang University
Wei Li - Zhejiang University
Zhichuan Sun - AVIC Nanjing Engineering Institute of Aircraft Systems

A Study of Wall Temperature Jump in UGKS Simulation With Maxwell Type Boundary
Technical Paper Publication: SHTC2021-63683
Lianfu Dai - Institute of Engineering Thermophysics
Huiying Wu - Institute of Engineering Thermophysics

Numerical Simulation of Bubble Growth During Microchannel Flow Boiling Process With Self-Rewetting Fluid
Technical Presentation Only: SHTC2021-65134
Yuhao Lin - Zhejiang University
Wei Li - Zhejiang University
Yang Luo - Zhejiang University
Zhichuan Sun - AVIC Nanjing Engineering Institute of Aircraft Systems

Machine Learning for Chaotic Rayleigh Transitions
Technical Paper Publication: SHTC2021-61158
Ben Tribelhorn - University of Portland
Heather Dillon - University of Washington Tacoma

Session: 20-04 - Methods for Using Machine Learning/Artificial Intelligence in HT Computations

Chair: ***Mohamed Abdelhady - University of Calgary***
Co-Chair: ***Sandip Mazumder - Ohio State University***
Co-Chair: ***Aaron Wemhoff - Villanova University***
Co-Chair: ***Jorge Alvarado - Texas A&M University***
Co-Chair: ***Shima Hajimirza - Stevens Institute of Technology***
Co-Chair: ***John Tencer - Sandia National Laboratories***

Enabling Nonlinear Manifold Projection Reduced-Order Models by Extending Convolutional Neural Networks to Unstructured Data
Technical Presentation Only: SHTC2021-62470
John Tencer - Sandia National Laboratories
Kevin Potter - Sandia National Laboratories

A Novel Computational Forced Convection Model Using Deep Learning
Technical Presentation Only: SHTC2021-68068
Munku Kang - Arizona State University
Beomjin Kwon - Arizona State University

Using Monte Carlo Ray Tracing and Data-Driven Techniques to Model Radiative Transport in Particulate Media
Technical Presentation Only: SHTC2021-68372
Zijie Chen - University of Michigan-Ann Arbor
Rohini Bala Chandran - University of Michigan-Ann Arbor

Session: 20-05 - Applications and Inverse Problems in Computational Heat Transfer

Chair: ***Mohamed Abdelhady - University of Calgary***
Co-Chair: ***Sandip Mazumder - Ohio State University***
Co-Chair: ***Aaron Wemhoff - Villanova University***
Co-Chair: ***Hamidreza Najafi - Florida Institute of Technology***
Co-Chair: ***Shima Hajimirza - Stevens Institute of Technology***

The Effect of Biot Number on a Three-Dimensional General Conduction Solution
Technical Paper Publication: SHTC2021-61670
Robert McMasters - Virginia Military Institute
Filippo De Monte - University of L'Aquila
James Beck - Michigan State University

Using Variational Bayes for Inverse Thermal Problems
Technical Paper Publication: SHTC2021-62998
Ashley F. Emery - University of Washington

Flow Dynamics Over Two Cylinders in Tandem Subjected to Different Heating Cases
Technical Paper Publication: SHTC2021-63848
Rami Homsi - Khalifa University of Science and Technology
Md. Islam - Khalifa University of Science and Technology
Yap Fatt - Khalifa University of Science and Technology
Isam Janajreh - Khalifa University of Science and Technology

Two-Phase Multispecies CFD Modeling of a Liquid Desiccant Dehumidifier
Technical Presentation Only: SHTC2021-63994
Behnam Ahmadi - Michigan Technological University
Masoud Ahmadi - Michigan Technological University
Sajjad Bigham - Michigan Technological University

Visualization of Heat Transfer Characteristics of 1EHT and Smooth Surface Tubes
Technical Paper Publication: SHTC2021-63564
Humberto Santos - Technical School Professor Agamemnon Magalhaes
Ailson Alves - Federal University of Sao Francisco Valley
David Kukulka - State University of New York at Buffalo
Rick Smith - Vipertex Division, Rigidized Metals Corporation
Wei Li - Zhejiang University

Session: SHTC2021 Presentations

Chair: ***Sandra K. S. Boetcher - Embry Riddle Aeronautical University***

Concentrated Radiative Cooling and Its Constraint From Reciprocity
Technical Presentation Only: SHTC2021-62486
Minghao Dong - Jiangsu Key Laboratory for Design & Manufacture or Micro/Nano Biomedical Instruments, School of Mechanical Engineering, Southeast University
Linxiao Zhu - Pennsylvania State University
Shanhui Fan - Ginzton Laboratory, Stanford University
Zhen Chen - Jiangsu Key Laboratory for Design & Manufacture or Micro/Nano Biomedical Instruments, School of Mechanical Engineering, Southeast University

Velocity and Heat Transfer Studies of an Impinging Jet Using MRV and IR Thermometry
Student Poster Presentation: SHTC2021-74197
Jack Galante - United States Military Academy
Nathan Humbert - United States Military Academy
F. Todd Davidson - United States Military Academy
Michael Benson - United States Military Academy
Steven Chetcuti - United States Military Academy
David Helmer - United States Military Academy
Gunnar O. Tamm - United States Military Academy
Christopher James Elkins - Stanford University

Optimization of Radiative Fin Planar Shape and Thickness Profile for Maximum Heat Loss While Minimizing Mass
Technical Presentation Only: SHTC2021-70315
Nicholas Debortoli - University of Dayton
Natalie Douglass - University of Dayton
Abinesh Selvacanabady - University of Dayton
Rydge Mulford - University of Dayton

Molecular Dynamics Simulation of Equilibrium Pressure and Temperature of Water Under Electric Field
Technical Presentation Only: SHTC2021-74286
Malcolm Porterfield - Rensselaer Polytechnic Institute
Diana Borca-Tasciuc - Rensselaer Polytechnic Institute

Interfacial Vapor Generation Using Buried Nanochannels Wicks
Technical Presentation Only: SHTC2021-70078
Durgesh Ranjan - Syracuse University
An Zou - Syracuse University
Shalabh Maroo - Syracuse University

Energy Transport With Phonon Polaritons Inside Hexagonal Boron Nitride
Technical Presentation Only: SHTC2021-69523
Hakan Salihoglu - Purdue University
Xianfan Xu - Purdue University

Separation of Liquid and Vapor Paths During Pool Boiling on Hemi-Wicking Surfaces
Student Poster Presentation: SHTC2021-69232
Youngsup Song - Massachusetts Institute of Technology
Shuai Gong - Shanghai Jiao Tong University
Geoffrey Vaartstra - Massachusetts Institute of Technology
Hyeongyun Cha - Massachusetts Institute of Technology
Evelyn Wang - Massachusetts Institute of Technology

Development of a Multivariate Spectral Emissivity Model for an Advanced High Strength Steel Alloy Through Factorial Design-of-Experiments
Technical Presentation Only: SHTC2021-66960
Fatima Suleiman - University of Waterloo
Kaihsiang Lin - University of Waterloo
Kyle Daun - University of Waterloo

Experimentally Characterizing Average Disjoining Pressure of Water in SiO_2 Nanochannels
Technical Presentation Only: SHTC2021-70440
An Zou - Syracuse University
Sajag Poudel - Syracuse University
Shalabh Maroo - Syracuse University

Single Phase and Condensation Heat Transfer in Plastic Heat Exchangers
Technical Presentation Only: SHTC2021-63641
Zaki Mohsin - Texas A&M University
Jorge Alvarado - Texas A&M University

Asymmetric Evaporation and Transport of Liquid Droplets in V-Shaped Grooves
Technical Presentation Only: SHTC2021-67725
Xukun He - Virginia Tech
Jiangtao Cheng - Virginia Tech

Design of a Novel Heat Exchanger for Rolling Road Devices in Automotive Wind Tunnels
Technical Presentation Only: SHTC2021-69205
Ramitha Edirisinghe - California State University, Fullerton
Salvador Mayoral - California State University, Fullerton

Multiscale Porous High-Temperature Heat Exchanger Design Using Ceramic Co-Extrusion
Technical Presentation Only: SHTC2021-74301
Xiangyu Li - MIT
Chad Wilson - MIT
Lenan Zhang - MIT
Jeffrey Youngblood - Purdue University
Rodney Trice - Purdue University
Evelyn Wang - MIT

Radiative Cooling Paints With High Figure of Merit
Technical Presentation Only: SHTC2021-74304
Xiangyu Li - Purdue University
Joseph Peoples - Purdue University
Peiyan Yao - Purdue University
Xiulin Ruan - Purdue University

Performance of a Hybrid HVAC-Integrated Thermal Storage Device
Technical Presentation Only: SHTC2021-66746
Allison Mahvi - National Renewable Energy Laboratory
Eric Kozubal - National Renewable Energy Laboratory
Jason Woods - National Renewable Energy Laboratory

Numerical Simulation of Bubble Nucleation in Nanochannel
Technical Presentation Only: SHTC2021-69682
Sajag Poudel - Syracuse University
An Zou - Syracuse University
Manish Gupta - Syracuse University
Shalabh Maroo - Syracuse University

CFD Simulation of Wicking in Nanochannels
Technical Presentation Only: SHTC2021-70362
Sajag Poudel - Syracuse University
An Zou - Syracuse University
Shalabh Maroo - Syracuse University

Simple QED Nanoscale Heat Transfer
Technical Presentation Only: SHTC2021-71059
Thomas Prevenslik - QED Radiations

Assessment of Material Bond Integrity via Inversion for Thermophysical Properties
Technical Presentation Only: SHTC2021-69302
Benjamin Treweek - Sandia National Laboratories
Wyatt Hodges - Sandia National Laboratories
Elbara Ziade - Sandia National Laboratories
Timothy Walsh - Sandia National Laboratories

Numerical Study of Bio-Ink Transfer in Laser-Induced-Forward-Transfer Bioprinting Using Initial Bubble Model
Technical Presentation Only: SHTC2021-70829
Jie Qu - China University of Mining Technology
Shuqi Zhou - Mississippi State University
Ben Xu - Mississippi State University
Jianzhi Li - University of Texas Rio Grande Valley
Zhonghao Rao - China University of Mining and Technology

Thermal Conductivities of WSe_2 With Layer and Strain Dependence
Technical Presentation Only: SHTC2021-74253
Elham Easy - Stevens Institute of Technology
Xian Zhang - Stevens Institute of Technology

Air Side Heat Transfer for Metal Foam Heat Exchanger Under Dehumidifying Operating Conditions- Impact of Surface Morphology and Metal Foam Characteristics
Technical Presentation Only: SHTC2021-64055
Kashif Nawaz - Oak Ridge National Laboratory

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ES TECHNICAL SESSIONS

WEDNESDAY, JUNE 16

1:30PM–2:20PM - Technical Sessions Room #1

Session: 1-1 - Energy Nexus – Fuel Efficiency

Chair: ***Pei Dong - George Mason University***
Co-Chair: ***Jian Zhang – University of Wisconsin-Green Bay50***
Co-Chair: ***Yang Chen - Oak Ridge National Laboratory***

Fuel Economy Results From Diesel Engine Tuning for Steady Speed and Drive Cycle Operation
Technical Paper Publication: ES2021-62572
James Carl M. Satorre - UP Diliman
Edwin N. Quiros - University of the Philippines
Jose Gabriel E. Mercado - UP Diliman
Paul L. Rodgers - UP Diliman

An Investigation of the Fuel Economy of a Drive Cycle Developed Using the Road Load Energy Criterion
Technical Paper Publication: ES2021-62790
Peter Vasquez - Colegio De Muntinlupa
Edwin Quiros - University of the Philippines - Diliman
Gerald Jo Denoga - University of the Philippines - Diliman
Robert Michael Corpus - Polytechnic University of the Philippines - Manila
Robert James Lomotan - Colegio De Muntinlupa

Effect of Train Energy Consumption on the Wear of Railroad Catenary Contact Conductor
Technical Paper Publication: ES2021-62881
Egide Niringiyimana - Addis Ababa University
Celestin Nkundineza - Addis Ababa University

Wednesday, June 16
1:30PM–2:20PM - Technical Session Room #2

Session: 2-1 - Green Building/Net-Zero Energy Building Performance

Chair: ***Yeobeom Yoon - North Carolina State University***
Co-Chair: ***Dongsu Kim - Hanbat National University***

Energy Storage Versus Demand Side Management for Peak-Demand Reduction at the Hawaii Ocean Science and Technology Park
Technical Paper Publication: ES2021-63799
Alexander Headley - University of Memphis
Yogesh Manoharan - University of Memphis
Laurence Sombardier - Natural Energy Laboratory of Hawaii Authority
Keith Olson - Natural Energy Laboratory of Hawaii Authority
Benjamin Schenkman - Sandia National Laboratories

Bayesian Inference for Incidence Factor of the Thermal Bridge Using In-Situ Measurement Infrared Thermography
Technical Paper Publication: ES2021-63750
Eunho Kang - Hanbat National University
Hyomun Lee - Hanbat National University
Jongho Yoon - Hanbat National University
Dongsu Kim - Hanbat National University

Sustainability Indicators for Selected Greenhouse Production Facilities in North America
Technical Presentation Only: ES2021-60524
Jaime Thissen - University of Illinois Urbana Champaign
Paul Davidson - University of Illinois Urbana Champaign

Design of Net-Zero Energy Attached Housing
Poster Presentation: ES2021-70087
Liam Nelson - Mississippi State University
Jacob Lindley - Mississippi State University
Luke Murray - Mississippi State University
Colby Freeman - Mississippi State University
Jonathan Cimino - Mississippi State University

Wednesday, June 16
1:30PM–2:20PM - Technical Session Room #3

Session: 6-1 - Solar Fuel Production I

Chair: ***Brendan Bulfin - ETH Zurich***

Coupled Heat and Mass Transfer in Anisotropic Heterogeneous Porous Media Applied in Solar Thermochemically Processed Hydrogen and Syngas
Technical Presentation Only: ES2021-62597
Xiaoyu Dai - Ecole Polytechnique Federale De Lausanne
Sophia Haussener - Ecole Polytechnique Federale de Lausanne

Thermodynamic Guiding Principles for Designing Efficient High-Temperature Redox Materials for Solar Thermochemical Fuel Production
Technical Presentation Only: ES2021-63975
Sha Li - The Australian National University
Vincent Wheeler - University of Wisconsin-Stout
Apurv Kumar - Federation University
Mahesh Venkataraman - 1414 Degrees
Christopher Muhich - Arizona State University
Yong Hao - Chinese Academy of Sciences
Wojciech Lipinski - The Australian National University

High-Temperature Heat Recovery System Coupled to a Solar Redox Reactor for Splitting Water and Carbon Dioxide
Technical Presentation Only: ES2021-66538
Alon Lidor - ETH Zürich
Yves Aschwanden - ETH Zürich
Jamina Häseli - ETH Zürich
Philipp Haueter - ETH Zürich
Aldo Steinfeld - ETH Zürich

Electrochemical Oxygen Pump Assisted Thermochemical Reactor for Highly Efficient Solar Fuel Production
Technical Presentation Only: ES2021-70079
Meng Lin - Southern University of Science and Technology
Song Yang - Southern University of Science and Technology
Wandong Bai - Sichuan University

Solar Fuel Production From Ambient Air in a Modular Solar Concentrator-Reactor System
Technical Presentation Only: ES2021-74422
Remo Schäppi - ETH Zurich
Philipp Haueter - ETH Zurich
Philipp Furler - Synhelion SA
Aldo Steinfeld - ETH Zürich

Wednesday, June 16
1:30PM–2:20PM - Technical Session Room #4

Session: 5-1 - CSP Materials Advancements

Chair*: **Peter Loutzenhiser - Georgia Institute of Technology***

Electrochemical Mitigation of Corrosion in Molten Chloride Salts During CSP Plant Operation
Technical Presentation Only: ES2021-69151
Kerry Rippy - National Renewable Energy Laboratory (NREL)
Liam Witteman – National Renewable Energy Laboratory (NREL)
Judith Vidal - National Renewable Energy Laboratory (NREL)
Abigale Monasterial - National Renewable Energy Laboratory (NREL)

Development of In-Situ Corrosion Kinetics and Salt Property Measurements
Technical Presentation Only: ES2021-69338
Emily Liu - Rensselaer Polytechnic Institute
Robert Hull - Rensselaer Polytechnic Institute
Jinsuo Zhang - Virginia Tech

High-Temperature Stabilization of Silica Aerogel Monoliths Using Model-Enabled Conformal Atomic Layer Deposition
Technical Presentation Only: ES2021-69518
Andrew J. Gayle - University of Michigan
Zachary J. Berquist - University of Michigan
Yuxin Chen - University of Michigan
Alexander J. Hill - University of Michigan
Jacob Y. Hoffman - University of Michigan
Ashley R. Bielinski - University of Michigan
Andrej Lenert - University of Michigan
Neil P. Dasgupta - University of Michigan

Finite Element Modeling of Carbon-Carbon Composites for Renewable Energy Applications
Technical Presentation Only: ES2021-70893
Vahid Daghigh - University of Tulsa
Taylor Brown - Boise State University
Todd Otanicar - Boise State University
Michael Keller - University of Tulsa

Wednesday, June 16
2:40PM–3:30PM - Technical Sessions Room #1

Session: 3-1 - Energy Storage Media

Chair*: **Kelvin Randhir - Michigan State University***

Using Molding to Fabricate Stable Salt Structures for Thermochemical Energy Storage
Technical Paper Publication: ES2021-63188
Adam Gladen - North Dakota State University
Fardad Azarmi - North Dakota State University

A Novel Composite Material of Hygroscopic Salt Stabilized by Nanocellulose for Thermochemical Energy Storage
Technical Paper Publication: ES2021-63814
Adam Gladen - North Dakota State University
Dilpreet Bajwa - Montana State University

Compressed Expanded Natural Graphite (CENG) Processing for Phase Change Material (PCM) Composites
Technical Presentation Only: ES2021-63978
Jason Woods - National Renewable Energy Laboratory
Wale Odukomaiya - National Renewable Energy Laboratory
Alex Bulk - National Renewable Energy Laboratory

Preparation of a Sustainable Shape-Stabilized Phase Change Material for Thermal Energy Storage Based on Mg^{2+}-Doped $CaCO_3$/PEG Composites
Technical Presentation Only: ES2021-69388
Md. Hasan Zahir - King Fahd University of Petroleum & Minerals
Kashif Irshad - King Fahd University of Petroleum & Minerals
Amjad Ali - King Fahd University of Petroleum & Minerals
Khaled Own Mohaisen - King Fahd University of Petroleum & Minerals

Wednesday, June 16
2:40PM–3:30PM - Technical Session Room #2

Session: 2-2 - Optimization and Control

Chair: ***Dongsu Kim - Hanbat National University***

Artificial Neural Network Based Optimized Control of Condenser Water Temperature Set-Point
Technical Paper Publication: ES2021-63735
Tae Young Kim - Korea University
Jong Man Lee - Korea University
Sung Hyup Hong - Korea University
Jong Min Choi - Hanbat National University
Kwang Ho Lee - Korea University

Upper and Lower Threshold Limit of Chilled and Condenser Water Temperature Set-Points During Ann Based Optimized Control
Technical Paper Publication: ES2021-63997
Sang Hun Yeon - Korea University
Won Hee Kang - Korea University
Je Hyeon Lee - Samsung Electronics
Kwan Woo Song - Samsung Electronics
Young Tae Chae - Cheong Ju University
Kwang Ho Lee - Korea University

Evaluation of Simplified Physics-Based Building Energy Model for the Purpose of Automatic Fault Detection
Technical Paper Publication: ES2021-63925
Christopher Fernandez - Georgia Institute of Technology
Sheldon Jeter - Georgia Institute of Technology

Optimal Design and Operation Strategies of Variable Refrigerant Flow Heat Recovery System With a Domestic Hot Water System
Technical Presentation Only: ES2021-63853
Dongsu Kim - Hanbat National University
Byeongho Yu - Mississippi State University
Heejin Cho - Mississippi State University
Hyunjin Nam - LG Electronics
Jaeyoon Koh - LG Electronics

Wednesday, June 16
2:40PM–3:30PM - Technical Session Room #3

Session: 7-1 - Photovoltaics

Chair: ***Justin Lapp - University of Maine***

Simulations of Solar Power Systems to Provide Electricity to a Water Desalination Plant (Model) in Floreana Island, Ecuador
Technical Paper Publication: ES2021-62841
Fernando Amoroso - Centro de Energias Renovables y Alternativas CERA-ESPOL
Ruben Hidalgo-Leon - Centro de Energias Renovables y Alternativas CERA-ESPOL
Jaqueline Litardo - Politecnico di Milano, Alejandro Granja - Facultad de Ingenieria en Mecanica y Ciencias de la Produccion FIMCP-ESPOL
Jackeline Calderon - Facultad de Ingenieria en Mecanica y Ciencias de la Produccion FIMCP-ESPOL
Diego Siguenza-Alvarado - Purdue University
Guillermo Soriano - Centro de Energias Renovables y Alternativas CERA-ESPOL

Short Term Photovoltaic Power Forecasting
Technical Paper Publication: ES2021-63850
Lamiaa Elsherbiny - Khalifa University
Ali Al-Alili - Khalifa University
Saeed Alhassan - Khalifa University

Simulating Steady-State Characteristics of Solar Cells Using wxAMPS and AMPS-1D
Technical Presentation Only: ES2021-63461
Jiawei Gong - Penn State Behrend

Wednesday, June 16
2:40PM–3:30PM - Technical Session Room #4

Session: 5-2 - CSP Particle Systems

Chair: ***Alexander Zolan - National Renewable Energy Laboratory***

Preliminary Design, Analysis, and Cost Modeling of the Particle Handling System for a Pre-Commercial 26.5 MW-E Solid Particle Concentrated Solar Power Plant
Technical Paper Publication: ES2021-61841
Kenzo Repole - Georgia Institute of Technology
Shaker Alaqel - King Saud University
Sheldon Jeter - Georgia Institute of Technology
Hany Al-Ansary - King Saud University
Ryan Yeung - Georgia Institute of Technology
Muhammad Sarfraz - Georgia Institute of Technology

Proposed Design and Integration of 1.3 MWE Pre-Commercial Demonstration Particle Heating Receiver Based Concentrating Solar Power Plant
Technical Paper Publication: ES2021-62529
Muhammad Sarfraz - Georgia Institute of Technology
Sheldon Jeter - Georgia Institute of Technology
Ryan Yeung - Georgia Institute of Technology
Hany Al-Ansary - King Saud University
Kenzo K. D. Repole - Georgia Institute of Technology
Shaker Alaqel - King Saud University
Abdelrahman El-Leathy - King Saud University
Nader Saleh - King Saud University
Rageh Saeed - King Saud University
Matthew Golob - Georgia Institute of Technology
Abdulelah Alswaiyd - King Saud University

Sensitivity Analysis of the Levelized Cost of Electricity for a Particle-Based CSP System
Technical Paper Publication: ES2021-63223
Luis F. González-Portillo - Universidad Politécnica de Madrid
Kevin Albrecht - Sandia National Laboratories
Jeremy Sment - Sandia National Laboratories
Brantley Mills - Sandia National Laboratories
Clifford K. Ho - Sandia National Laboratories

Preliminary Techno-Economic Optimization of 1.3 MWE Particle Heating Receiver Based CSP Power Tower Plant for the Mena Region
Technical Paper Publication: ES2021-63926
Shakir Shakoor Khatti - Georgia Institute of Technology
Hany Al-Ansary - King Saud University
Sheldon Jeter - Georgia Institute of Technology

A Conceptual Design Tool for the Power Tower With Integrated Thermal Energy Storage and Heat Exchanger for PHR-Based CSP
Technical Presentation Only: ES2021-63921
Sheldon Jeter - Georgia Institute of Technology
Hany Al-Ansary - King Saud University

Wednesday, June 16
3:50PM–4:40PM - Technical Sessions Room #1

Session: 11-1 - Evaluation and Assessment of Fuels and Alternative Fuels

Chair: ***Joonsik Hwang - Mississippi State University***

Sustainability Assessment of Aviation Fuel Blends
Technical Paper Publication: ES2021-60617
Cherie Gambino - Arizona State University
Agami Reddy - Arizona State University

Feasibility Analysis of Refueling Infrastructure for Compressed Renewable Natural Gas Long-Haul, Heavy-Duty Trucks in Canada
Technical Paper Publication: ES2021-62478
Wahiba Yaici - Natural Resources Canada/CanmetENERGY
Michela Longo - Politecnico di Milano/Department of Energy

Feasibility Study of Refuelling Infrastructure for Hydrogen Gas Long-Haul, Heavy-Duty Trucks in Canada
Technical Paper Publication: ES2021-62480
Wahiba Yaici - Natural Resources Canada/CanmetENERGY
Michela Longo - Politecnico di Milano/Department of Energy

Invited Talk (Live Talk) Title: ***Steam Reforming of Liquid Fuels to Produce Hydrogen-Rich Syngas for High Temperature Fuel Cell Cogeneration Applications***
Speaker: Xinhai Xu - Harbin Institute of Technology

Wednesday, June 16
3:50PM–4:40PM - Technical Session Room #2

Session: 4-1 - Grid-Interactive Efficient Buildings

Chair: ***Xin Jin - National Renewable Energy Laboratory***
Co-Chair: ***Liang Zhang - National Renewable Energy Laboratory***

A Study of Cost-Savings Potential of Load Flexibility Measures in Grid Interactive Multi-Family Buildings
Technical Paper Publication: ES2021-62981
Chris CaraDonna - National Renewable Energy Laboratory
Korbaga Woldekidan - National Renewable Energy Laboratory
Jie Xiong - National Renewable Energy Laboratory

Investigation on Optimal EES Capacity to Maximize Self-Consumption of PV System With Existing Energy-Efficient Houses in Korea
Technical Paper Publication: ES2021-63283
Ruda Lee - Hanbat National University
Jongho Yoon - Hanbat National University
Dongsu Kim - Hanbat National University
Hyomun Lee - Hanbat National University

Sensitivity Analysis of Occupant Preferences on Energy Usage in Residential Buildings
Technical Paper Publication: ES2021-64053
Kaleb Pattawi - Santa Clara University
Prateek Munankarmi - National Renewable Energy Laboratory
Michael Blonsky - National Renewable Energy Laboratory
Jeff Maguire - National Renewable Energy Laboratory
Sivasathya Pradha Balamurugan - National Renewable Energy Laboratory
Xin Jin - National Renewable Energy Laboratory
Hohyun Lee - Santa Clara University

Rubik's Cube Topology Based Particle Swarm Algorithm for Bilevel Building Energy Transaction
Technical Paper Publication: ES2021-62982
Xiaochun Feng - Northwest A&F University
Yang Chen - Oak Ridge National Laboratory
Jian Zhang - University of Wisconsin-Green Bay
Heejin Cho - Mississippi State University
Xin Shi - Lehigh University

Evaluate the Impact of Building Faults on Demand Response in Small Commercial Buildings
Technical Presentation Only: ES2021-70661
Liang Zhang - National Renewable Energy Laboratory
Matt Leach - National Renewable Energy Laboratory
Xin Jin - National Renewable Energy Laboratory

Wednesday, June 16
3:50PM–4:40PM - Technical Session Room #3

Session: 8-1 - Wind Energy

Chair: ***Julia Nicodemus - Lafayette College***

Maximizing Wind Turbine Efficiency by Using Soft Switching Multiple Model Predictive Control
Technical Paper Publication: ES2021-61857
Babak Mehdizadeh Gavgani - Ghent University
Arash Farnam - Ghent University
Jeroen De Kooning - Ghent University
Guillaume Crevecoeur - Ghent University

Fluttering Amplitude Amplification by Utilizing Flapping Moment in Flutter-Driven Triboelectric Nanogenerator
Technical Paper Publication: ES2021-62501
Yi Zhang - The University of Hong Kong
Ka Chung Chan - The University of Hong Kong
Sau Chung Fu - The University of Hong Kong
Christopher Yu Hang Chao - The University of Hong Kong

A Comparative Study of the Influence of Different Wake Models on Wind Farm Layout Optimization
Technical Paper Publication: ES2021-63911
Hamidreza Najafi - Florida Institute of Technology
Puyi Yang - Florida Institute of Technology

Experimental and Numerical Investigation of Channeling Effects on Aerodynamics Performance of NACA 0012 Airfoil
Technical Presentation Only: ES2021-60498
Hussein Mohammad - Western Michigan University
Saad Jalil - University of Anbar
Arz Qwam Alden - University of Anbar
Bade Shrestha – Western Michigan University

Wednesday, June 16
3:50PM–4:40PM - Technical Session Room #4

Session: 5-3 - CSP Material Lifetime Evaluations

Chair: ***Andrey Gunawan - Georgia Institute of Technology***

Assessment of Particle Candidates for Falling Particle Receiver Applications Through Irradiance and Thermal Cycling
Technical Paper Publication: ES2021-62305
Nathan Schroeder - Sandia National Laboratories
Kevin Albrecht - Sandia National Laboratories

Abrasion Wear at High Temperature in Particle Receiver Type Concentrating Solar Power Systems
Technical Presentation Only: ES2021-66895
Nipun Goel - Boise State University
Tessa Mei-Lin Fong - Boise State University
John Shingledecker - Electric Power Research Institute
Michael Keller - The University of Tulsa
Siamack Shirazi - The University of Tulsa
Todd Otanicar - Boise State University

Metallurgical Observations in Metallic Materials Subjected to High-Temperature Abrasion Experiments to Simulate Concentrating Solar Power Particle Systems
Technical Presentation Only: ES2021-69123
John Shingledecker - Electric Power Research Institute
Stephen Tate - Electric Power Research Institute
Nipun Goel - Boise State University
Tessa Mei-Lin Fong - Boise State University
Todd Otanicar - Boise State University
Michael Keller - The University of Tulsa

Impact Erosion Testing at Low Particle Velocities for Falling Particle CSP Systems
Technical Presentation Only: ES2021-69656
Evan Gietzen - The University of Tulsa
Nipun Goel - Boise State University
Soroor Karimi - The University of Tulsa
Siamack Shirazi - The University of Tulsa
Michael Keller - The University of Tulsa
Todd Otanicar - Boise State University

Corrosion Mitigation of Stainless-Steel Alloys in Molten Chloride Salt Blend for Concentrated Solar Power Applications
Technical Presentation Only: ES2021-71309
Animesh Kundu - Lehigh University
Sreya Dutta - Dynalene, Inc.

THURSDAY, JUNE 17

1:30PM–2:20PM - Technical Sessions Room #1

Session: 1-2 - Nexus: Energy, Water and Climate I

Chair: ***Jian Zhang - University of Wisconsin-Green Bay***
Co-Chair: ***Pei Dong - George Mason University***
Co-Chair: ***Yang Chen - Oak Ridge National Laboratory***

Model Predictive Control Design for Wastewater Purification System
Technical Presentation Only: ES2021-69237
Kyle Anderson - Water and Energy Technology Lab
Chris Hagen - Oregon State University
Bahman Abbasi - Oregon State University

Thermodynamic and Economic Analysis of a Hybrid Desalination System With Low Brine Rejection
Technical Presentation Only: ES2021-69423
Rodrigo Caceres Gonzalez - Georgia Institute of Technology
Marta C. Hatzell - Georgia Institute of Technology

Data Analytics: A Geospatial Mapping and Phenomenological Relationship for Predicting Total Dissolved Solids in Produced Water
Technical Presentation Only: ES2021-71576
A. G. Agwu Nnanna - The University of Texas Permian Basin
Bibian Ogbuji - The University of Texas Permian Basin

Thursday, June 17
1:30PM–2:20PM - Technical Session Room #2

Session: 2-3 - Large-Scale Building Performance Assessment

Chair: ***Dongsu Kim - Hanbat National University***

Resiliency Evaluation of Net-Zero Residential Communities
Technical Paper Publication: ES2021-63651
Jordan Thompson - University of Colorado Boulder
Moncef Krarti - University of Colorado Boulder

The Impact of Covid 19 on Energy Consumption in the United States: An Overview
Technical Paper Publication: ES2021-63903
Hamidreza Najafi - Florida Institute of Technology
Lindsey Kahn - Florida Institute of Technology

Space Conditioning Entirely by Ambient Sources Across US Climates
Technical Presentation Only: ES2021-69154
M. Keith Sharp - University of Louisville

On the Role of Energy Mitigation Measures to Reduce Energy Demands in the Context of Changing Climate for a Tropical Coastal City
Technical Presentation Only: ES2021-62618
Jorge Gonzalez - City College of New York
Rabindra Pokhrel - City College of New York

Thursday, June 17
1:30PM–2:20PM - Technical Session Room #3

Session: 6-2 - Solar Fuel Production II

Chair: ***Alon Lidor, ERH-Zurich***

A Forward Feedback Control Scheme for a Solar Thermochemical Moving Bed Countercurrent Flow Reactor
Technical Paper Publication: ES2021-63912
Assaad Alsahlani - Purdue University Northwest
Kelvin Randhir - Michigan State University
Nesrin Ozalp - Purdue University Northwest
James Klausner - Michigan State University

Investigation of Zr-Doped Ceria and Sr-Doped La-Mn Perovskites as Redox Intermediates for Solar Chemical-Looping Reforming of Methane
Technical Presentation Only: ES2021-69548
Caroline Hill - University of Florida
Enrique Hernaiz - University of Florida
Philipp Furler - Synhelion SA
Simon Ackermann - Synhelion SA
Jonathan Scheffe - University of Florida

Photo-Thermo-Electrochemical Cells for Efficient Solar Fuel and Power Production
Technical Presentation Only: ES2021-69884
Yuzhu Chen - Southern University of Science and Technology
Meng Lin - Southern University of Science and Technology

Experimental Validation of Hybrid Wood Gasification in a High-Temperature Solar Spouted Bed Reactor
Technical Presentation Only: ES2021-70356
Axel Curcio - CNRS - PROMES
Sylvain Rodat - CNRS - PROMES
Stéphane Abanades - CNRS - PROMES
Pascal Aubouin - CEA - INES
Valéry Vuillerme - CEA - INES

Hydrogen Production From Alternative Feedstocks via Solar Chemical Looping Reforming
Technical Presentation Only: ES2021-70630
Nate Degoede - Valparaiso University
Peter Krenzke - Valparaiso University

Thursday, June 17
1:30PM–2:20PM - Technical Session Room #4

Session: 5-4 - Novel CSP Component Integration

Chair: ***John Shingledecker - Electric Power Research Institute***

Application Methods for Refractory Insulation in Hot Particle Storage Bins
Technical Paper Publication: ES2021-63923
Jeremy Sment - Sandia National Laboratories
Kevin Albrecht - Sandia National Laboratories
Matthew Lambert - Allied Mineral Products LLC
Clifford K. Ho - Sandia National Laboratories
Murphy Davidson - Allied Mineral Products

Detailed Engineering of a High-Performance Molten Salt Tower Receiver System
Technical Presentation Only: ES2021-62754

Miriam Ebert - German Aerospace Center
Cathy Frantz - German Aerospace Center
Matthias Binder - MAN Energy Solutions SE
Martin Muhr - MAN Energy Solutions SE
Andreas Heinrich - MAN Energy Solutions SE
Christian Schuhbauer - MAN Energy Solutions SE
Markus Stetka - MAN Energy Solutions SE
Nadine Kaczmarkiewicz - MAN Energy Solutions SE
Tobias Kunze - Solar-Institute Jülich of FH Aachen, University of Applied Sciences
Bärbel Schlögl-Knothe - German Aerospace Center
Christian Schwager - Solar-Institute Jülich of FH Aachen, University of Applied Sciences
Cristiano Teixeira Boura - Solar-Institute Jülich of FH Aachen, University of Applied Sciences
Jana Stengler - German Aerospace Center
Stefan Eisen - FLEXIM Flexible Industriemesstechnik GmbH
Bernhard Funck - FLEXIM Flexible Industriemesstechnik GmbH
Stefan Schmitz - German Aerospace Center

Progress Towards a Gen3 Concentrating Solar-Thermal Power Test Facility
Technical Presentation Only: ES2021-65167

Mark Lausten – U.S. Department of Energy (Contractor)
Matthew Bauer – U.S. Department of Energy
Levi Irwin – U.S. Department of Energy (Contractor)
Shane Powers – U.S. Department of Energy (Contractor)
Rajgopal Vijaykumar – U.S. Department of Energy
Andru Prescod – U.S. Department of Energy (Contractor)
Avi Shultz – U.S. Department of Energy

Detailed Engineering of a High Storage Density Solar Power Plant for Flexible Energy Systems
Technical Presentation Only: ES2021-62834
Miriam Ebert - German Aerospace Center
Matti Lubkoll - German Aerospace Center
Gabriele Bertoni - Kinetics Technology S.p.A.
Annarita Salladini - NEXTCHEM
Lars Amsbeck - HelioHeat
Lucia Alfieri - Barilla
Antoine Guillick - John Cockerill
Manuel Smolders - John Cockerill
Kevin Misse - John Cockerill
Julian Hertel - German Aerospace Center
Deniz Ackura - Tekfen
Thorsten Duermeier - Durmeier
Wladislaw Schewtschenko - Durmeier
Wei Wu - HelioHeat
Sara Costa - Sugimat
Tereza Levova - Quantis
Martina Neises-Von Puttkamer - German Aerospace Center
Reiner Buck - German Aerospace Center
Luca Ruini – Barilla

Thursday, June 17
2:40PM–3:30PM - Technical Sessions Room #1

Session: 3-2 - Energy Storage for Grid Application

Chair: ***Xingchao Wang - Colorado School of Mines***

Economic Analysis of a Novel Thermal Energy Storage System Using Solid Particles for Grid Electricity Storage
Technical Paper Publication: ES2021-61729
Zhiwen Ma - National Renewable Energy Laboratory
Xingchao Wang - National Renewable Energy Laboratory
Patrick Davenport - National Renewable Energy Laboratory
Janna Martinek - National Renewable Energy Laboratory
Jeffrey Gifford - National Renewable Energy Laboratory

Terrestrial Heat Repository for Months of Storage (Therms): A Novel Radial Thermocline System

Technical Paper Publication: ES2021-63066

Clifford Ho - Sandia National Laboratories
Walter Gerstle - CSolPower
Athena Christodoulou - CSolPower

Simulation of an ROC-Based Thermal Energy Storage System in Charge and Discharge Cycles

Technical Paper Publication: ES2021-63930

Reza Baghaei Lakeh - University of California Los Angeles
Rozina Nalbandian - California State Polytechnic University
Justin Lee - California State Polytechnic University
Ulyses Aguirre - California State Polytechnic University
Karen Girgis - California State Polytechnic University
Benjamin Kong - California State Polytechnic University
Adrian Victorio - California State Polytechnic University

Effect of Phase Change and Buoyancy-Driven Flows n Charge and Discharge of an ROC-Based Thermal Energy Storage System

Technical Paper Publication: ES2021-63938

Reza Baghaei Lakeh - California State Polytechnic University
Justin Andrew Lee - California State Polytechnic University
Christopher Salerno - California State Polytechnic University
Karen Girgis - California State Polytechnic University
Ulyses Aguirre - California State Polytechnic University

Dispatch Optimization of a Grid-Scale, Stand-Alone Electric Thermal Energy Storage System

Technical Presentation Only: ES2021-70351

William Hamilton - National Renewable Energy Laboratory
Ty Neises - National Renewable Energy Laboratory
Joshua Mctigue - National Renewable Energy Laboratory

Thursday, June 17
2:40PM–3:30PM - Technical Session Room #2

Session: 12-1 - Distributed Energy Systems

Chair: ***Wahiba Yaici - Natural Resources Canada***
Co-Chair: ***Ali Al-Alili – Khalifa University***

Optimal Design of Integrated Distributed Energy Systems for Off-Grid Buildings in Different Regions in the United States
Technical Paper Publication: ES2021-60503
Jian Zhang - University of Wisconsin Green Bay
Heejin Cho - Mississippi State University
Pedro Mago - West Virginia University

Design and Feasibility Study of Biomass-Driven Combined Heat and Power Systems for Rural Communities
Technical Paper Publication: ES2021-62057
Philippe Schicker - Mississippi State University
Dustin Spayde - Mississippi State University
Heejin Cho - Mississippi State University

Dynamic Simulation of Organic Rankine Cycle-Assisted Ground-Source Heat Pump Based Micro-Cogeneration System in Cold Climates: A Case Study in Canada
Technical Paper Publication: ES2021-62464
Wahiba Yaici - Natural Resources Canada/CanmetENERGY
Evgueniy Entchev - Natural Resources Canada/CanmetENERGY
Michela Longo - Politecnico di Milano/Department of Energy

Least Cost Microgrid Resource Planning for the Natural Energy Laboratory of Hawaii Authority Research Park
Technical Paper Publication: ES2021-63257
Alexander Headley - University of Memphis
Benjamin Schenkman - Sandia National Laboratories
Laurence Sombardier - Natural Energy Laboratory of the Hawaii Authority
Keith Olson - Natural Energy Laboratory of the Hawaii Authority

Study on Operation Scheduling Optimization of Integrated-Energy System in an Industrial Park With Consideration of Heat Storage
Technical Paper Publication: ES2021-63553
Shuting Zhang - Institution of Thermal Science, Zhejiang University
Xiaojie Lin - Institution of Thermal Science, Zhejiang University
Wei Zhong - Institution of Thermal Science, Zhejiang University
Sibin Liu - Institution of Thermal Science, Zhejiang University

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Thursday, June 17
2:40PM–3:30PM - Technical Session Room #3

Session: 6-3 – Thermochemical Energy Storage and Separation Processes

Chair: ***Peter Krenzke, Valparaiso University***

Tubular Falling Bed Reactor for Synthesizing a Solid-State Solar Fuel
Technical Presentation Only: ES2021-66363
Kelvin Randhir - Michigan State University
Michael Hayes - Michigan State University
Phillip Schimmels - Michigan State University
Joerg Petrasch - Michigan State University
James Klausner - Michigan State University

Redox Chemical Looping of Strontium Iron Perovskite Oxide for Oxygen Separation and Nitrogen Production
Technical Presentation Only: ES2021-67333
Brendan Bulfin - ETH Zurich
Louisa Buttsworth - ETH Zurich
Alon Lidor - ETH Zurich
Aldo Steinfeld - ETH Zurich

Design, Modeling, and Operation of Reactors for Solar Thermochemical Air Separation and Ammonia Production
Technical Presentation Only: ES2021-69301
H. Evan Bush - Sandia National Laboratories
Matthew Kury - Sandia National Laboratories
Kevin Albrecht - Sandia National Laboratories
Andrea Ambrosini - Sandia National Laboratories

Experimental Evaluation of a Solar Carbonation–Calcination Reactor Under Simulated High-Flux Solar Irradiation
Technical Presentation Only: ES2021-69348
Lifeng Li - The Australian National University
Bo Wang - The Australian National University
Roelof Pottas - The Australian National University
Mahdiar Taheri - The Australian National University
Mustafa Habib - The Australian National University
Wojciech Lipinski - The Australian National University

Thursday, June 17
2:40PM–3:30PM - Technical Session Room #4

Session: 5-5 – CSP Optical Characterization and Control

Chair: ***Hany Al-Ansary, King Saud University***

Demonstrating SolarPILOT's Python API Through Heliostat Optimal Aimpoint Strategy Use Case
Technical Paper Publication: ES2021-60502
William Hamilton - National Renewable Energy Laboratory
Michael Wagner - University of Wisconsin-Madison
Alexander J. Zolan - National Renewable Energy Laboratory

Camera Position Measurement Sensitivity for CSP Optical Characterization Software
Technical Presentation Only: ES2021-70512
Devon Kesseli - National Renewable Energy Laboratory
Guangdong Zhu - National Renewable Energy Laboratory

A Non-Intrusive Optical (NIO) Approach to Characterize In-Situ Optical Performance of Heliostats: Progress on UAS Flight Path Generation
Technical Presentation Only: ES2021-70730
Tucker Farrell - National Renewable Energy Laboratory
Rebecca Mitchell - National Renewable Energy Laboratory
Guangdong Zhu - National Renewable Energy Laboratory

A Non-Intrusive Optical (NIO) Approach to Characterize In-Situ Optical Performance of Heliostats: Progress on 2D Slope Error Calculations With Synthetic Image Data
Technical Presentation Only: ES2021-70801
Rebecca Mitchell - National Renewable Energy Laboratory
Guangdong Zhu - National Renewable Energy Laboratory

Thursday, June 17
3:50PM–4:40PM - Technical Sessions Room #1

Session: 16-1 – Emerging and Hybrid Technologies I

Chair: ***Jennifer King - National Renewable Energy Laboratory***

Performance of Bio-Inspired Oscillating Hydrofoil Turbine; a Computational Fluid Dynamics Study
Technical Paper Publication: ES2021-63383
Sameer Osman - Egypt-Japan University of Science and Technology
Esraa Mansour - Egypt-Japan University of Science and Technology

A Dispatch Optimization Model for Hybrid Renewable and Battery Systems Incorporating a Battery Degradation Model
Technical Paper Publication: ES2021-63425
Sahana Updahya - University of Wisconsin-Madison
Michael Wagner - University of Wisconsin-Madison

Performance Study of Thermoelectric Power Generators at Different Geometrical Configurations
Technical Paper Publication: ES2021-63914
Mohamed Elsabahy - Egypt-Japan University for Science and Technology
Ramy Rabie - Egypt-Japan University for Science and Technology
Mahmoud Ahmed - Assiut University

Solar Irradiance Measurement at High Altitudes Using Pyranometers and Weather Balloons
Technical Presentation Only: ES2021-74438
Yun Liu - Purdue University Northwest
Michael Jerde - Purdue University Northwest

Thursday, June 17
3:50PM–4:40PM - Technical Session Room #2

Session: 11-2 – Assessment and Treatment of Biofuel, Biomass and Wastes

Chair: ***Han Hu - University of Arkansas***

Evaluation of the Influence of 1,4-Dioxane and Exhaust Gas Recirculation on the Performance and Emission Values of a Diesel Engine Fuelled With Low Viscous Biofuel Blend
Technical Paper Publication: ES2021-60484
Mebin Samuel Panithasan - Indian Institute of Technology Kanpur
Gnanamoothi Venkadesan - University College of Engineering Villupuram

Waste-to-Energy Technology Suitability Assessment for the Treatment and Disposal of Medical, Industrial, and Electronic Residual Wastes in Metropolitan Manila, Philippines
Technical Paper Publication: ES2021-63768
Reynald Ferdinand Manegdeg - University of the Philippines Diliman
Analiza Rollon - University of the Philippines Diliman
Florencio Jr. Ballesteros - University of the Philippines Diliman
Eduardo Jr. Magdaluyo - University of the Philippines Diliman
Louernie De Sales-Papa - University of the Philippines Diliman
Emma Macapinlac - University of the Philippines Diliman
Roderaid Ibañez - University of the Philippines Diliman
Rinlee Butch Cervera - University of the Philippines Diliman
Eligia Clemente - University of the Philippines Diliman

Environmental Impacts of Power Generation From Biomass Residue in a Rural Community
Technical Presentation Only: ES2021-67494
Veera Gnaneswar Gude - Mississippi State University
Hariteja Nandimandalam - Mississippi State University
Mohammad Marufuzzaman - Mississippi State University

Thursday, June 17
3:50PM–4:40PM - Technical Session Room #3

Session: 10-1 – Electrochemical Energy Conversion and Storage

Chair: ***Jun Xu - University of North Carolina At Charlotte***

Performance of Two-Dimensional Functionally Graded Anode Supported Solid-Oxide Fuel Cells
Technical Paper Publication: ES2021-63582
Mahmoud Ahmed - Assiut University
Sameer Osman - Egypt-Japan University of Science and Technology
Khaled Ahmed - King Abdulaziz University

Coupled Mechanical-Electrochemical Phase-Field Model for Crack Propagation and Li Dendrite Growth in Solid State Battery
Technical Presentation Only: ES2021-65055
Chunhao Yuan - University of North Carolina at Charlotte
Jun Xu - University of North Carolina at Charlotte

Detecting "Real" End-of-Life of Spent EV Lithium-Ion Battery for Second-Life Applications
Technical Presentation Only: ES2021-69255
Zoran Milojevic - Newcastle University
Pierrot Attidekou - Newcastle University
Simon Lambert - Newcastle University
Prodip Das - Newcastle University

Thursday, June 17
3:50PM–4:40PM - Technical Session Room #4

Session: 5-6 – Particulate Media Characterization

Chair: ***Cathy Frantz - German Aerospace Center (DLR)***

Experimental Determination of Radiative Properties of Ceramic Particles
Technical Presentation Only: ES2021-68379
James Abraham - University of Michigan
Mike Mayer - University of Michigan
Rohini Bala Chandran - University of Michigan

High Temperature Diffuse Reflectance Measurements for Particulate Media
Technical Presentation Only: ES2021-68703
Mike Mayer - University of Michigan
James Abraham - University of Michigan
Rohini Bala Chandran - University of Michigan

Radiative Transfer Modeling in a High Temperature Packed Bed With Experimentally Determined Single-Particle Scattering Phase Function
Technical Presentation Only: ES2021-69342
Shin Young Jeong - Georgia Institute of Technology
Chuyang Chen - Georgia Institute of Technology
Malavika Bagepalli - Georgia Institute of Technology
Joshua Brooks - Georgia Institute of Technology
Devesh Ranjan - Georgia Institute of Technology
Peter Loutzenhiser - Georgia Institute of Technology
Zhuomin Zhang - Georgia Institute of Technology

Granular Flow Experiments and Modeling at Elevated Temperatures Coupled With Measured Properties for Solar Thermal Energy Storage
Technical Presentation Only: ES2021-72498
Malavika Bagepalli - Georgia Institute of Technology
Shin Young Jeong - Georgia Institute of Technology
Justin Yarrington - Idaho National Laboratory
Joshua Brooks - Georgia Institute of Technology
Zhuomin Zhang - Georgia Institute of Technology
Devesh Ranjan - Georgia Institute of Technology
Peter Loutzenhiser - Georgia Institute of Technology

The Effect of Particle Mixture and Multiple Scattering on the Radiative Properties of Particle Beds
Technical Presentation Only: ES2021-72506
Chuyang Chen - Georgia Institute of Technology
Joshua Brooks - Georgia Institute of Technology
Peter Loutzenhiser - Georgia Institute of Technology
Devesh Ranjan - Georgia Institute of Technology
Zhuomin Zhang - Georgia Institute of Technology

FRIDAY, JUNE 18

10:15AM–11:05AM - Technical Session Room #1

Session: 1-3 - Nexus: Energy, Water and Climate II

Chair: ***Pei Dong - George Mason University***
Co-Chair: ***Jian Zhang - Mississippi State University***
Co-Chair: ***Yang Chen - Oak Ridge National Laboratory***

A Semi-Empirical Water and Energy Analysis of Industrial Production of Nickel From Mineral Ores: Comparative Analysis Between Two Different Technologies of Calcination
Technical Paper Publication: ES2021-63958
Janneth Ruiz - Cerromatoso S.A. (South 32)
Antonio Ardila - Cerromatoso S.A. (South 32)
Bernardo Rueda - Cerromatoso S.A. (South 32)
Jorge Echeverry - Universidad del Norte
Daniel Quintero - Universidad del Norte
Arturo Gonzalez - Universidad del Norte
Lesme Corredor - Universidad del Norte

Power Outages Prediction Using Weather and Night-Light Satellite Data
Technical Presentation Only: ES2021-64971
Jorge Gonzalez - City College of New York
Juan Pablo Montoya-Rincon - City College of New York

Thermo-Economic Analyses of Net Water-Producing Solid Oxide Fuel Cell-Gas Turbine Hybrid Systems
Technical Presentation Only: ES2021-62358
Fabian Rosner - University of California, Irvine
Scott Samuelsen - University of California, Irvine

Friday, June 18
10:15AM–11:05AM - Technical Session Room #2

Session: 2-4 – Advanced HVAC Equipment & Systems

Chair: ***Weimin Wang – University of North Carolina at Charlotte***

Design and Development of an Experimental Apparatus for Hardware-in-Loop Testing of Solar Assisted Heat Pump Systems
Technical Paper Publication: ES2021-63776
George Benzion van Arnold - University of North Carolina at Charlotte
Weimin Wang - University of North Carolina at Charlotte

A Numerical Investigation of Thermal Comfort for Thermoelectric-Based Cooling Systems
Technical Paper Publication: ES2021-63980
Hamidreza Najafi - Florida Institute of Technology
Mohadeseh Seyednezhad - Florida Institute of Technology

A Novel Tankless Adsorption Heat Pump Water Heater
Technical Presentation Only: ES2021-68893
Darshan Pahinkar - Florida Institute of Technology
Nitish Chauhan - Florida Institute of Technology
Anurag Goyal - National Renewable Energy Laboratory

Friday, June 18
10:15AM–11:05AM - Technical Session Room #3

Session: 9-1 – Solar Desalination and Industrial Process Heat

Chair: ***Parthiv Kurup - National Renewable Energy Laboratory***

Comparison of the Performance of a Solar Thermal Absorption Chiller and a Novel Sub Wet-Bulb Evaporative Chiller for Cooling Processes in Food Manufacturing
Technical Paper Publication: ES2021-62308
Emily Fricke - University of California, Davis
Vinod Narayanan - University of California, Davis

Experimental Study on a Passive Solar Desalination Unit Associated With Fresnel Lens and Thermal Storage

Technical Paper Publication: ES2021-63359

Jun Yan Tan - Universiti Tunku Abdul Rahman, Sungai Long Campus
Jun Wei Ding - Universiti Tunku Abdul Rahmn, Sungai Long Campus
Zhi Yong Ho - Universiti Tunku Abdul Rahman, Sungai Long Campus
Rubina Bahar - University Tunku Abdul Rahman, Sungai Long

Enhancement the Solar Still Performance Using Chimney Exhaust Gasses

Technical Paper Publication: ES2021-63858

Hamdy Hassan - Egypt-Japan University of Science and Technology

Concentrating Solar Thermal Desalination: An Approach of Utilizing High-Exergy Solar Radiation for Water Production

Technical Presentation Only: ES2021-69173

Yanjie Zheng - Vanderbilt University
Rodrigo Caceres Gonzalez - Georgia Institute of Technology
Marta Hatzell - Georgia Institute of Technology
Kelsey Hatzell - Vanderbilt University

Methods of Recycling Produced Water Using Enhanced Evaporation

Technical Presentation Only: ES2021-70780

Gabriel Leal - University of Texas Permian Basin
Christian Castillo - University of Texas Permian Basin
Bibian Ogbuji - University of Texas Permian Basin
George Nnanna - University of Texas Permian Basin

Friday, June 18
10:15AM–11:05AM - Technical Session Room #4

Session: 5-7 – Receiver and Reactor Development

Chair: ***Rohini Bala Chandran, University of Michigan***

Design Development, Testing, and Optimization of a 6.5 MW-Thermal All-Refractory Particle Heating Receiver
Technical Paper Publication: ES2021-62902
Ryan Yeung - Georgia Institute of Technology
Sheldon Jeter - Georgia Institute of Technology
Muhammad Sarfraz - Georgia Institute of Technology
Kenzo Repole - Georgia Institute of Technology
Hany Al-Ansary - King Saud University
Shaker Alaqel - King Saud University
Abdelrahman El-Leathy - King Saud University
Abdulelah Alswaiyd - King Saud University

Image Analysis of Particle Flow in Centrifugal Solar Particle Receiver
Technical Paper Publication: ES2021-63763
Serdar Hicdurmaz - Institute of Solar Research German Aerospace Center (DLR)
Reiner Buck - Institute of Solar Research German Aerospace Center (DLR)
Bernhard Hoffschmidt - Institute of Solar Research German Aerospace Center (DLR)

Predicting the Annual Thermal Performance of Next-Generation Falling Particle Receivers Subject to Wind
Technical Presentation Only: ES2021-62212
Brantley Mills - Sandia National Laboratories
Reid Shaeffer - Sandia National Laboratories
Clifford Ho - Sandia National Laboratories

Test Setup for the Experimental Evaluation of the Convective Heat Transfer for Nitrate Salt in Tubular Solar Receivers
Technical Presentation Only: ES2021-63552
Cathy Frantz - German Aerospace Center (DLR)
Reiner Buck - German Aerospace Center (DLR)
Marc Röger - German Aerospace Center (DLR)
Jana Stengler - German Aerospace Center (DLR)

Impact of Spatial and Temporal Non-Uniformity in Heat Flux on the Performance of a Micro-Pin-Array Solar Receiver
Technical Presentation Only: ES2021-63668
Raymond Odele - University of California, Davis
Vinod Narayanan - University of California, Davis

Friday, June 18
12:35PM–1:25PM - Technical Sessions Room #1

Session: 3-3 – Energy Storage Media

Chair: ***Wale Odukomaiya - National Renewable Energy Laboratory***

Heat Based Power Augmentation for Modular Pumped Hydro Storage in Smart Buildings Operation
Technical Paper Publication: ES2021-60517
Yang Chen - Oak Ridge National Laboratory
Ahmad Abu-Heiba - Oak Ridge National Laboratory
Saiid Kassaee - University of Tennessee, Knoxville
Chenang Liu - Oklahoma State University
Guodong Liu - Oak Ridge National Laboratory
Michael Starke - Oak Ridge National Laboratory
Brennan Smith - Oak Ridge National Laboratory
Ayyoub Momen - Oak Ridge National Laboratory

Physical Model of Underground Thermal Energy Storage Efficiency
Technical Presentation Only: ES2021-63449
Anders Carlsson - Washington University

Development of a Shape-Stabilized Phase Change Material Utilizing Natural Materials and Industrial Byproducts for Thermal Energy Storage in Buildings
Technical Presentation Only: ES2021-69387
Md. Hasan Zahir - King Fahd University of Petroleum and Minerals
Khaled Own Mohaisen - King Fahd University of Petroleum and Minerals

Friday, June 18
12:35PM–1:25PM - Technical Session Room #2

Session: 15-1 – Geothermal Energy

Chair: ***Amanda Kolker - National Renewable Energy Laboratory***

A 3-Dimensional Numerical Thermal Analysis for the Configuration Effect of a Single and Double U-Tube on the Borehole Performance
Technical Paper Publication: ES2021-60659
A. H. Tarrad - University of Lorraine

Performance Considerations for Ground Source Heat Pumps in Cold Climates
Technical Paper Publication: ES2021-64051
Robbin Garber-Slaght - National Renewable Energy Laboratory

Cost and Technical Profiling of Geothermal District Heating Using Geophires and Comsof Heat Simulation Software
Technical Paper Publication: ES2021-65121
Nicholas Fry - Reykjavik University; Iceland School of Energy

Geothermal Operational Optimization With Machine Learning (GOOML)
Technical Presentation Only: ES2021-63432
Grant Buster - National Renewable Energy Laboratory
Nicole Taverna - National Renewable Energy Laboratory
Michael Rossol - National Renewable Energy Laboratory
Jay Huggins - National Renewable Energy Laboratory
Jon Weers - National Renewable Energy Laboratory
Paul Siratovich - Upflow
Andrea Blair - Upflow

Optimization of a Sparger Head for Airlift Pumping of Downhole Geothermal Fluids
Technical Presentation Only: ES2021-69200
Terence Musho - West Virginia University
Daniel Hand - Sustainable Engineering LLC
Roy Mink - Mink GeoHydro Inc,
Nigel Clark - West Virginia University

Friday, June 18
12:35PM–1:25PM - Technical Session Room #3

Session: 16-2 – Emerging and Hybrid Technologies II

Chair: ***Jennifer King - National Renewable Energy Laboratory***

Simulation of a Wet-Surface Bare Rod Heat Exchanger
Technical Paper Publication: ES2021-63836
Abdul Raheem Shaik - Khalifa University
Ali Al-Alili - Khalifa University
Saeed Alhassan - Khalifa University

Investigations of Lab-Scale, Heat Exchanger Prototypes Designed to Provide Refugia for Trout
Technical Paper Publication: ES2021-63934
Rajib Uddin Rony - North Dakota State University
Adam Gladen - North Dakota State University
Sarah Lavallie - North Dakota State University
Jeremy Kientz - South Dakota Game, Fish, and Parks

Friday, June 18
12:35PM–1:25PM - Technical Session Room #4

Session: 5-8 – Receiver Characterization and Control

Chair: ***Jeremy Sment, Sandia National Laboratories***

Receiver Outlet Temperature Controller for Falling Particle Receiver Applications
Technical Paper Publication: ES2021-62319
Nathan Schroeder - Sandia National Laboratories
Hendrik Laubscher - Sandia National Laboratories
Clifford Ho - Sandia National Laboratories
Brantley Mills - Sandia National Laboratories

Particle Plume Velocities Extracted From High-Speed Thermograms Through Particle Image Velocimetry
Technical Paper Publication: ES2021-63336
Jesus Ortega - University of New Mexico
Guillermo Anaya - University of New Mexico
Peter Vorobieff - University of New Mexico
Clifford Ho - Sandia National Laboratories
Gowtham Mohan - University of New Mexico

Near-Field and Far-Field Sampling of Aerosol Plumes to Evaluate Particulate Emission Rates From a Falling Particle Receiver During On-Sun Testing
Technical Paper Publication: ES2021-63466
Andrew Glen - Sandia National Laboratories
Andres Sanchez - Sandia National Laboratories
Darielle Dexheimer - Sandia National Laboratories
Clifford Ho - Sandia National Laboratories
Swarup China - Pacific Northwest National Laboratories
Fan Mei - Pacific Northwest National Laboratories
Nurun Nahar Lata - Michigan Technological University

A Non-Intrusive Particle Temperature Measurement Methodology Using Thermogram and Visible-Light Image Sets
Technical Paper Publication: ES2021-63791
Jesus Ortega - University of New Mexico
Clifford Ho - Sandia National Laboratories
Guillermo Anaya - University of New Mexico
Peter Vorobieff - University of New Mexico
Gowtham Mohan - University of New Mexico

A Flexible Thermal Model for Solar Cavity Receivers Using Analytical View Factors
Technical Paper Publication: ES2021-63810
Michael Wagner - University of Wisconsin-Madison
Jacob Kerkhoff - University of Wisconsin-Madison

Friday, June 18
1:45PM–2:35PM - Technical Sessions Room #1

Session: 3-4 – General Energy Storage

Chair: ***Abhishek Singh - University of Twente***

Heat Transfer Modeling in a Counter-Current Moving-Bed Tubular Reactor for High-Temperature Thermochemical Energy Storage
Technical Paper Publication: ES2021-63490
Wei Huang - Mississippi State University
Eric Million - Mississippi State University
Kelvin Randhir - Michigan State University
Joerg Petrasch - Michigan State University
James Klausner - Michigan State University
Nick Auyeung - Oregon State University
Like Li - Mississippi State University

Experimental Investigation of Latent Heat Thermal Energy Storage System Enhanced by Annular and Radial Fins
Technical Paper Publication: ES2021-63832
Addison Hockins - Gannon University
Samantha Moretti - Gannon University
Saeed Tiari - Gannon University

Design and Development of a Prototype Fluid Bed Heat Exchanger for Discharging Power Generation
Technical Presentation Only: ES2021-63258
Xingchao Wang - Colorado School of Mines and NREL
Patrick Davenport - NREL
Jeffrey Gifford - Colorado School of Mines and NREL
Jacob Wrubel - NREL
Ruichong Zhang - Colorado School of Mines
Zhiwen Ma - NREL

Friday, June 18
1:45PM–2:35PM - Technical Session Room #2

Session: 5-9 – CSP Energy Storage and Heat Exchange

Chair: ***Todd Otanicar, Boise State University***

Assessment of Packing Structures for Gas-Particle Trickle Flow Heat Exchanger for High Temperature Application in CSP Plants
Technical Paper Publication: ES2021-62746
Markus Reichart - German Aerospace Center - Institute of Solar Research
Martina Neises-Von Puttkamer - German Aerospace Center - Institute of Solar Research
Reiner Buck - German Aerospace Center - Institute of Solar Research
Robert Pitz-Paal - German Aerospace Center - Institute of Solar Research

Thermal-Economic Optimization of Moving Packed Bed Particle-to-SCO_2 Heat Exchanger Using Particle Swarm Optimization
Technical Paper Publication: ES2021-63435
Yanjie Zheng - Vanderbilt University
Kelsey B. Hatzell - Vanderbilt University

Development and Testing of a 20 kWth Moving Packed-Bed Particle-to-SCO_2 Heat Exchanger and Test Facility
Technical Paper Publication: ES2021-64050
Kevin Albrecht - Sandia National Laboratories
Hendrik Laubscher - Sandia National Laboratories
Matthew Carlson - Sandia National Laboratories
Clifford Ho - Sandia National Laboratories

Development of a Prototype 40 kWth Counterflow Particle-Supercritical Carbon Dioxide Fluidized Bed Heat Exchanger for Concentrating Solar Energy Driven Brayton Power Cycles With Particle-Based Thermal Energy Storage
Technical Presentation Only: ES2021-70411
Jesse Fosheim - Colorado School of Mines
Winfred Arthur-Arhin - Colorado School of Mines
Azariah Thompson - Colorado School of Mines
Gregory Jackson - Colorado School of Mines

SHTC TRACK CHAIRS - TECHNICAL SESSIONS

06-01 Thermal Storage in Energy Systems
Track Chair: Alex Rattner, Penn State
Track Co-Chairs: Hohyun Lee, Santa Clara University; Leitao Chen, Tennessee State University

07-01 Measurements of Thermophysical Properties, Including Development of Measurement Systems
Track Chair: Nicholas Roberts, Utah State University
Track Co-Chair: Troy Munro, Brigham Young University

08-01 Fundamentals of Boiling, Condensation, and Evaporation
Track Chair: Diana Andra Borca Tascuic, Rensselaer Polytechnic Institute
Track Co-Chair: Amitabh Narain, Michigan Tech; Ming-Chang Liu, National Chiao Tung University; Navdeep Dhillon, CSU Long Beach; Vaibhav Bahadur, UT Austin; Van Carey, UC Berkeley

08-02 Fundamentals of Single-Phase Flow
Track Chair: Diana Andra Borca Tascuic, Rensselaer Polytechnic Institute
Track Co-Chairs: Amitabh Narain, Michigan Tech; An Zou, Syracuse University; Chris Kobus, Oakland University; Oronzio Manca, Università degli Studi della Campania "Luigi Vanvitelli"; Xiulin Ruan, Purdue University

09-02 Thermal Transport in 2D and Anisotropic Materials
Track Chair: Dong Liu, University of Houston
Track Co-Chair: Liping Wang, Arizona State University

10-01 Single Phase Enhanced Heat Transfer Equipment
Track Chair: Maulik Shelat, Air Products

13-01 Boiling and Evaporation
Track Chair: Scott Thompson, Kansas State
Track Co-Chair: Vinod Srinivasan, University of Minnesota

14-01 Gas Turbine Heat Transfer
Track Chair: Marc Polanka, AFIT/ENY
Track Co-Chair: Lesley M. Wright, Texas A&M

15-01 Additive Manufacturing Processes
Track Chair: Ying Sun, Drexel University
Track Co-Chair: Stephen Akwaboa, Southern University and A&M College

16-01 Heat Transfer in Electronic Equipment
Track Chair: Milind Jog, University of Cincinnati
Track Co-Chairs: Peter de Bock, ARPA-E; Ankur Jain, University of Texas at Arlington

19-01 Heat and Mass Transfer for Natural and Built Environment
Track Chair: Gongnan Xie, Northwestern Polytechnical University
Track Co-Chair: Qingang Xiong, Corning Incorporated

20-01 Applications of Computational Heat Transfer in Convection
Track Chair: Mohamed Abdelhady, University of Calgary
Track Co-Chairs: Aaron Wemhoff, Villanova; Hamidreza Najafi, FIT; Sandip Mazumder, The Ohio State University

20-02 Applications of Computational Heat Transfer for Indoor Environmental Quality
Track Chair: Mohamed Abdelhady, University of Calgary
Track Co-Chairs: Shima Hajimirza, Stevens Tech; Aaron Wemhoff, Villanova; Hamidreza Najafi, FIT; Sandip Mazumder, The Ohio State University

20-03 Thermal Transport in Nano/Micro-scale Amorphous Materials
Track Chair: Mohamed Abdelhady, University of Calgary
Track Co-Chair: Som Shrestha, Oak Ridge National Lab; Aaron Wemhoff, Villanova; Hamidreza Najafi, FIT; Sandip Mazumder, The Ohio State University

20-04 Methods for using Machine Learning/Artificial Intelligence in HT Computations
Track Chair: Mohamed Abdelhady, University of Calgary
Track Co-Chairs: John Tencer, Sandia National Lab; Jorge Alvarado, Texas A&M; Aaron Wemhoff, Villanova; Hamidreza Najafi, FIT; Sandip Mazumder, The Ohio State University

20-05 Applications and Inverse Problems in Computational Heat Transfer
Track Chair: Mohamed Abdelhady, University of Calgary
Track Co-Chairs: Shima Hajimirza, Stevens Tech; Aaron Wemhoff, Villanova; Hamidreza Najafi, FIT; Sandip Mazumder, The Ohio State University

22-01 Heat Transfer Visualization
Track Chair: Nenad Miljkovic, University of Illinois
Track Co-Chair: Konrad Rykaczewski, Arizona State University

SHTC WORKSHOP

Festschrift for Jack Howell: 85 years of Radiation Transfer
Workshop on Complex Conjugate Systems: 1
Workshop on Complex Conjugate Systems: 2

Organizers: M. Pinar Mengüç, Ozyegin University; John Howell, University of Texas; Raj Manglik, University of Cincinnati

SHTC PANELS

Research Funding Opportunities
Organizers: Sandra Boetcher, Milind Jog, Kashif Nawaz

Heat Transfer and ASME Standards
Organizer: Amy Mensch

Machine Learning in Applied Heat Transfer
Organizers: Metodi Zlatinov, Michael Ohadi, Marcus Richardson

Impacts of COVID-19 on Careers
Organizer: Leslie Phinney

Frontiers in Heat/Mass Transport Intensification
Organizers: Michael Ohadi, Marcus Richardson, Metodi Zlatinov

Standards for Thermal Energy Storage using Phase Change Materials
Organizer: Yogi Goswami

ES TRACK CHAIRS

Track 1: Nexus: Energy, Water and Climate – Pei Dong (George Mason University), Jian Zhang (University of Wisconsin-Green Bay), Yang Chen (Oak Ridge National Laboratory)

Track 2: Sustainable Buildings and Cities – Dongsu Kim (Hanbat National University), Weimin Wang (University of North Carolina at Charlotte)

Track 3: Energy Storage – Zhiwen Ma (National Renewable Energy Laboratory), Like Li (Mississippi State University)

Track 4: Grid-interactive Efficient Buildings – Xin Jin (National Renewable Energy Laboratory)

Track 5: Concentrating Solar Power – Matthew Bauer (U.S. Department of Energy), Andrew Schrader (University of Dayton), Kevin Albrecht (Sandia National Laboratories)

Track 6: Solar Chemistry – Brendan Bulfin (ETH Zurich)

Track 7: Photovoltaics – Justin Lapp (University of Maine)

Track 8: Wind Energy – Justin Lapp (University of Maine)

Track 9: Solar Desalination and Industrial Process Heat – Parthiv Kurup (National Renewable Energy Laboratory)

Track 10: Electrochemical Energy Conversion Systems – Jun Xu (University of North Carolina at Charlotte)

Track 11: Biofuel and Alternative Fuel – Ben Xu (Mississippi State University)

Track 12: Distributed Energy Systems – Wahiba Yaici (Natural Resources Canada), Ali Alili (Khalifa University)

Track 15: Geothermal Energy – Amanda Kolker (National Renewable Energy Laboratory)

Track 16: Emerging and Hybrid Technologies – Jen King (National Renewable Energy Laboratory)

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Kashif Nawaz, Ph. D.
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Oak Ridge National Laboratory
Oak Ridge, TN

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TVA Endowed Associate Professor in Mechanical Engineering
Mississippi State University

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Professor by Courtesy at School of Mechanical Engineering, Purdue University West Lafayette

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University of Wisconsin-Madison

Prof. Justin Lapp, Ph.D.
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Director of Solar Thermal Energy Laboratory
University of Maine

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Department of Mechanical and Civil Engineering
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