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+ Electric Aircraft Technologies Symposium

JUNE 18–20
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Keynotes

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June 17 - 20 Anaheim, CA

KEYNOTE SPEAKER

Hengchun Mao

President at Quanten Technologies

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ITEC is aimed at helping the industry in the transition from conventional vehicles to advanced electrified vehicles. The conference is focused on components, systems, standards, and grid interface technologies, related to efficient power conversion for all types of electrified transportation, including electric vehicles, hybrid electric vehicles, and plug-in hybrid electric vehicles (EVs, HEVs, and PHEVs) as well as heavy-duty, rail, and off-road vehicles and airplanes and ships.

SPEAKER BIO

Dr. Hengchun Mao is the founder and CEO of Quantentech, a startup of high-performance motor and drive systems for EVs, eVTOLs and Robots. He received his Ph. D. degree from Virginia Tech in 1996, and has been working in power electronics and motor drive industries for over 30 years. He was a staff researcher of power systems in Bell Labs, the principal architect of Huawei's Digital Power department, and a business unit general manager at Diodes Semiconductor. He founded Quanten Technologies, NuVolta Technologies, and NetPower Technologies, respectively in the business of advanced EV drives, wireless charging technologies, and high efficiency power modules. In recent years, Dr. Mao has been focusing on advanced high performance multi-phase motor drive system with dynamically adjustable magnetic structure, with the aid of power electronics and advanced drive algorithm to adapt the magnetic configurations of the motor in real-time according to its load condition, achieving 50% power density improvement for hybrid and electric vehicle applications. He has authored over 100 US patent applications in these fields.

In recent years, multi-phase drive systems are attracting more attention due to their ability to achieve higher power and better reliability than three-phase drives. However, almost all of the multi-phase motors are designed and controlled as multi three-phase systems in parallel, practically limiting the performance improvement and thus application appeal of multi-phase technology. To fully release the potential of such technology, innovative "true" multi-phase design approach and control algorithm have to be developed. Dr. Mao will mainly present advancement of multi-phase motor and drive system development, and discuss how to significantly improve power and torque density of motors and create more reliable and cost-effective drive solutions than conventional three-phase technology. Target applications include electric and hybrid vehicles and eVTOLs.

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KEYNOTE SPEAKER

Zubair A. Baig

Senior Technical Fellow Electrical Systems
Electric Propulsion Expert
Pratt & Whitney

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SPEAKER BIO

Zubair Baig is the Senior Fellow for Electric Systems and Electrification at Pratt and Whitney managing the electrification portfolio for P&W. With over a decade of experience in electric propulsion, he has deep technical knowledge and expertise with development of integrated high power electrical powertrains. Zubair has led the strategic and technical development of Pratt & Whitney's hybrid electric development programs and has established P&W's electrical systems engineering group. He holds over 25 patents and has published various technical papers. Zubair leads the long-term strategic roadmap planning for electrification technologies at the Raytheon Technologies Corporate level is also a member of SAE E-40 and AE-7D helping to develop aerospace certification standard for electrical and hybrid propulsion and is very active within the electric propulsion technology development community.

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KEYNOTE SPEAKER

Xin Wu

Technology-to-Market Advisor
ARPA-E

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SPEAKER BIO

Dr. Xin Wu is a Technology-to-Market Advisor at the Advanced Research Projects Agency – Energy (ARPA-E). With over 16 years of experience in power electronics, system integration, advanced sensors, real-time modeling, and health monitoring, Dr. Wu has a proven track record in cutting-edge technology development.

Before ARPA-E, Dr. Wu served as Discipline Chief for Integrated Electrical Systems at Pratt & Whitney, where she led technology strategies, collaborated with partners and government labs, and advanced system development for military and commercial programs. Previously, at Raytheon Technologies Research Center, she drove innovations in semiconductor applications, wireless power transfer, and embedded sensing systems. She began her career at Ansys Corporation in electromechanical system modeling.

Dr. Wu holds a Bachelor's in Electrical Engineering from Huazhong University of Science and Technology, China, and a Ph.D. in Electrical Engineering from the University of South Carolina.

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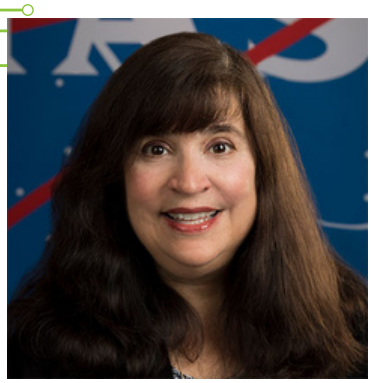

KEYNOTE SPEAKER

GAUDY BEZOS O'CONNOR

EPFD PROJECT MANAGER
NASA

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SPEAKER BIO

Ms. Bezos-O'Connor has over 4 decades of project management and R&D experience delivering high-risk, high-pay-off aerospace solutions for NASA in partnership with the FAA, the aerospace industry and academia. A highly collaborative leader, she brings a solid history of success in public-private partnerships and innovative project management strategies. For the past decade and a half, Ms. Bezos-O'Connor has been at the forefront of enabling sustainable aviation through NASA's Environmentally Responsible Aviation Project, and Advanced Air Transport Technology Project and the FAA CLEEN Program. Currently she is the Project Manager of NASA's aviation industry-led MW-class electrified powertrain flight demonstration (EPFD) project whose goal is to reduce EIS technology barriers and accelerate adoption of hybrid electric propulsion systems that enable a sustainable aviation future.

- Ms. Bezos-O'Connor, is an AIAA Associate Fellow and earned a B.S. in Aeronautical Engineering from Rensselaer Polytechnic Institute and a M.E. in Engineering Management from Old Dominion University.

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KEYNOTE SPEAKER

Sanjeev Naik

Director of Energy & Propulsion System Research Laboratory
GM

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SPEAKER BIO

"Dr. Sanjeev Naik is Director of Energy & Propulsion System Research at GM. He has held multiple
management and technical leadership positions in vehicle electrification, propulsion systems, controls,
and active safety. Dr. Naik is a recipient of GM's Boss Kettering Award, the Charles McCuen R&D Award,
and the Chairman's Honors Award. His technical interests are in developing innovative electric mobility
solutions.
He is an IEEE Senior Member, an SAE Member, and has several publications and over fifty patents.
Sanjeev received his Bachelor's degree from IIT Bombay, India, M.S.E.E. from the University of Michigan,
Ann Arbor, and Ph.D. from the University of Illinois, Urbana–Champaign, all in electrical engineering, and
M.B.A. in corporate strategy from the University of Michigan, Ann Arbor.

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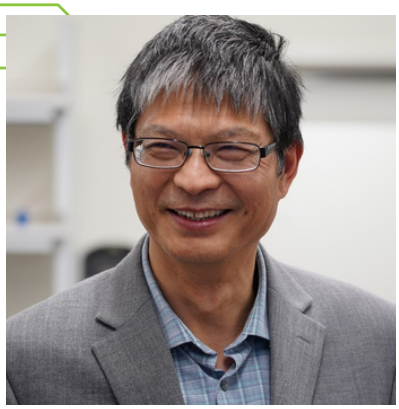

KEYNOTE SPEAKER

Chris Mi

Fellow IEEE & SAE
Distinguished Professor
Electrical and Computer Engineering
San Diego State University

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SPEAKER BIO

Dr. Mi is the Distinguished Professor of Electrical and Computer Engineering at San Diego State University. He is a Fellow of IEEE (Institute of Electrical and Electronics Engineers) and SAE (Society of Automotive Engineers). He is also the Director of the US Department of Energy-funded Graduate Automotive Technology Education (GATE) Center for Electric Drive Transportation at SDSU. He was previously a faculty member at the University of Michigan-Dearborn from 2001 to 2015, and an Electrical Engineer with General Electric from 2000 to 2001. He also served as the CTO of 1Power Solutions from 2008 to 2011, and CTO of EV Safe Charger, Inc. from 2021. Dr. Mi received his Ph. D from the University of Toronto, Canada, in 2001.

Dr. Mi has published five books, 200+ journal papers, 130 conference papers, and 20+ issued and pending patents. He served as Editor-in-Chief, Area Editor, Guest Editor, and Associate Editor of multiple IEEE Transactions and international journals, as well as the General Chair of over ten IEEE international conferences. Dr. Mi has won numerous awards, including the “Distinguished Teaching Award” and “Distinguished Research Award” from the University of Michigan-Dearborn, IEEE Region 4 “Outstanding Engineer Award,” IEEE Southeastern Michigan Section “Outstanding Professional Award,” and SAE “Environmental Excellence in Transportation (E2T) Award.” He is the recipient of three Best Paper Awards from IEEE Transactions on Power Electronics and the 2017 ECCE Student Demonstration Award. In 2019, he received the Inaugural IEEE Power Electronics Emerging Technology Award. In 2022, he received the Albert W. Johnson Research Lectureship and was named the Distinguished Professor, the highest honor given to an SDSU faculty member, and only one award is given each year. He received the 2023 IEEE PELS Vehicle and Transportation Systems Achievement Award, the IEEE Transactions on Industry Applications Best Paper Award, and the SDSU Innovator of the Year Award. In 2024, he received the prestigious Alumni Distinguished Faculty Award from SDSU.

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KEYNOTE SPEAKER

Charlie Roberts

Executive Director
Southwest Research Institute

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SPEAKER BIO

Dr. Charles E. Roberts, Jr., holds the position of Executive Director, Commercial Vehicle Systems, at Southwest Research Institute (SwRI) and is a Fellow of SAE. Dr. Roberts has over 35 technical publications and holds 35 U.S and International patents. Dr. Roberts' formal training is in the general area of Mechanical Engineering, with specialization in Engine Research, Combustion Systems and Combustion Chemistry.

Dr. Roberts manages the SwRI Commercial Vehicle emissions laboratories, which provide engine and emissions development and certification activities to heavy-duty and non-road vehicle companies worldwide. Dr. Roberts also oversees all heavy-duty and non-road powertrain systems advanced R&D activities, including internal research programs and advanced R&D for external clients.

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KEYNOTE SPEAKER

Venkat Vishwanathan

Associate Professor , Co-Founder
University of Michigan, Battery Aero

SPEAKER BIO

Venkat Viswanathan is an Associate Professor in the Aerospace Department at the University of Michigan and co-founder of And Battery Aero and Aionics. He is a prominent researcher in electric aviation, renowned for defining the unique battery performance metrics essential for electrifying flight. His work determined a performance needs chart for eVTOLs, widely known as the “AND chart,” which highlights the dual challenges of achieving both high specific power and specific energy and has attracted significant attention from the media and industry. He is the recipient of numerous prestigious awards including MIT Technology Review Innovators Under 35 and Alfred P. Sloan Fellowship.

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KEYNOTE SPEAKER

Scott Hotz

Founder & CEO
Simplify Tech LLC

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SPEAKER BIO

Scott Hotz is a systems-level multidisciplinary engineering expert, entrepreneur and leader delivering energy optimization, efficiency improvements and emissions reductions. Mr. Hotz founded Simplify Tech LLC in Ann Arbor, Michigan to provide world-class multidisciplinary engineering services in support of research and development programs, and most importantly to commercialize technologies that change the world. Prior to forming Simplify Tech, Mr. Hotz spent 25 years at Southwest Research Institute where he was Director of the Control Systems Department supporting five (5) of SwRI's 11 technical divisions. He founded SwRI's Ann Arbor Technical Center in 2002, to support work at the EPA's National Vehicle & Fuel Emissions Laboratory, US Army GVSC and SwRI's many commercial clients in the Michigan region.
From 2016 to 2025 Mr. Hotz served as Principal Investigator for a $9MM ARPA-E (DOE) research grant. The NEXT-Generation Energy Technologies for Connected and Automated On-Road Vehicles "NEXTCAR" program leveraged connected-vehicle enabled "preview" of the route ahead to operate vehicles more efficiently, saving over 30% energy with no changes to the vehicle powertrain. Mr. Hotz earned his B.S. Electrical Engineering from the University of Toledo in 1999 and his MBA from the University of Michigan's Ross School of Business in 2012. Mr. Hotz is a Professional Engineer in the State of Michigan.

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KEYNOTE SPEAKER

Erika Holtz

Engineering & Quality Manager
Harbour Air Group

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SPEAKER BIO

Erika has been involved in aviation all her life, particularly in the Part 23 aircraft aftermarket repairs and modifications sector, as well as developing aviation quality management systems. Achieving her delegation status in 2010 as a Structural Delegate under the Design Approval Representative Program with Transport Canada, Erika became one of only ten structural DARs in the Pacific Region and started her own engineering company.

Erika has over 25 years of experience with modifications to general aircraft and 20 years spent managing quality systems. Currently, Erika is the Project Manager and Lead Engineer for the Harbour Air electrification of the DHC-2 Beaver project, and was chosen in 2023 as one of 8 “Women of Inspire” by Elevate Aviation. Last year Erika was added to the National Research Council of Canada Advisory Board for their Aero Research group, as well as named the Vice-Chair of the Initiative for Sustainable Aviation Technology™ (INSAT) Board of Directors. INSAT is a joint industry-government initiative to support the growth of one of Canada's most innovative and export-driven sectors – Aerospace.

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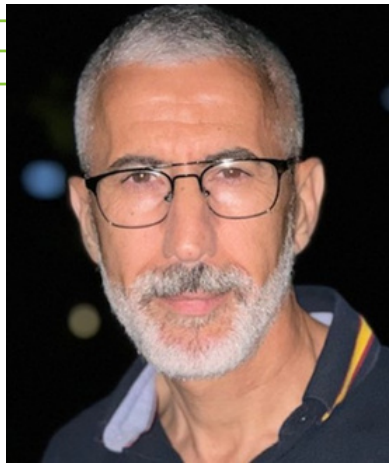

KEYNOTE SPEAKER

Momo Kechmir

Vice President

Electronics & Systems Engineering

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SPEAKER BIO

Momo Kechmir has over two decades of extensive experience in the field of power electronics. Initially, he specialized in developing innovative switch-mode power technology during the early 1990s before pioneering advancements in wireless power technology. His current expertise encompasses the integration of battery energy storage systems combined with advanced power electronics, delivering state-of-the-art DC fast charging (DCFC) solutions.

His solutions effectively mitigate peak demand charges and grid upgrade costs, simultaneously providing valuable grid services such as demand response and power factor correction, ultimately enhancing grid resilience. Additionally, Momo actively contributes to the development and deployment of AI/ML algorithms aimed at optimizing energy management and significantly improving system efficiency and reliability

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Short Courses

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Aerospace and Automotive Electrified Designs, Progression and Mutual Benefits

SPEAKERS

Arif Salam
Chief Engineer
Honeywell Aerospace Technologies

Evgeni Ganev
CEO
EMPS Consulting LLC

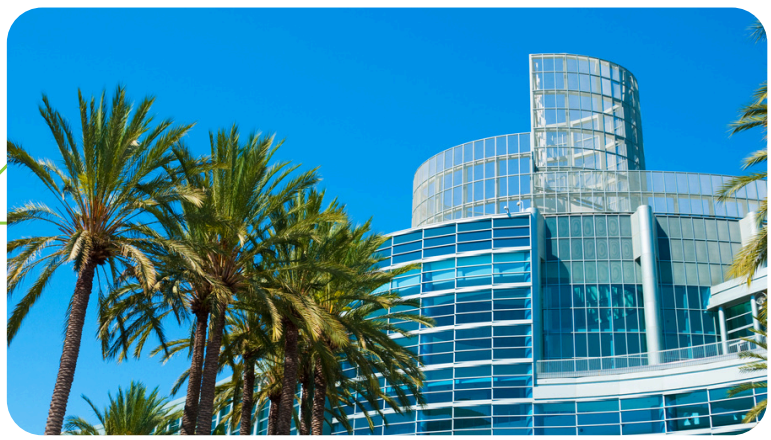
About The Speakers:

Arif Salam:
Arif Salam is Chief Engineer for Electric Power Systems and Electromechanical Actuation Controllers at Honeywell Aerospace. He leads projects on electric propulsion systems and actuation controllers for UAM applications and is the Principal Investigator for an ARPA-E ASCEND project. With 20 years at Honeywell, his expertise spans electric propulsion, actuation controls, electric drives, and power generation systems. He has led key projects, including the NG Jammer power system and high-speed electric drives for ECS applications. Arif holds a BSEE and a master's in electrical and systems engineering and previously worked in industrial automation.

Evgeni Ganev:
Dr. Evgeni Ganev is the CEO of EMPS Consulting LLC, specializing in electrification of aerospace and automotive industries with a focus on electric and hybrid propulsion powertrains. With 40 years of engineering experience, including 30 years as Chief Engineer at Honeywell, he has contributed to platforms such as the F-22, F-35, Space Shuttle, B787, A350, and NASA's eTaxi. Dr. Ganev holds over 50 U.S. patents, has published extensively, and is an active member of AIAA, IEEE, SAE, and ASTM. He has received numerous awards, including the SAE Charles Manly Memorial Award.

ABSTRACT

The steady introduction of electric vehicles for ground applications has recently reached an inflection point for the market. It is projected that in some regions like China and Europe EVs will dominate in the next few years. These developments are putting pressure on aerospace and at the same time paving the way for key technology improvements of batteries, electric machines, and high-power electronics.
As nascent aerospace electric vehicles begin to emerge in the form of trainer aircraft and eVTOLs, there are many challenges to overcome for wide adoption and initial entry into service. These challenges stem from two elements inherent in aerospace, namely, safety and weight. Safety concerns drive many stringent regulations and standards while weight concerns drive development of lightweight technologies that normally would be adequate for ground applications.
In this short course, the power train systems and components common to automotive and aerospace applications will be discussed in-depth. The main vehicle and power train architectures will be reviewed, and the major requirements for systems and components will be analyzed. Similarities and differences between the two segments will be highlighted, and some of the unique challenges will be discussed.
To overcome these challenges and obstacles, new methodologies are required for faster development and rapid entry into service. The major obstacles impeding fast entry into service will be identified and solutions will be proposed. Tools and topics such as Artificial Intelligence (AI), Autonomous Flights, Accelerated Testing using hardware in the loop, Design for Certification, and Design for Manufacturability that will greatly contribute to accelerated introduction will be discussed. Other topics to be covered include performance priorities, results of comparative analysis, and benefits of electrification for automotive and aerospace industries.
This is a highly interactive short course that will benefit anyone interested in the electrification developments for aerospace and automotive industries.



Main considerations for inverter design with SiC MOSFET

SPEAKER

Simon Kim

Principal Engineer Infineon

ABSTRACT

The proposed session will be composed of three topics as the following.
As a start, there is the introduction for both SiC MOSFET and gate driver. SiC MOSFET's characteristics and trends are reviewed. Application review with SiC MOSFET. Selection of discrete or module (two more SiC MOSFET switch is inside) with power dimensioning. Gate driver type and selection guide.
As a main topic, there is the design guide between SiC MOSFET and gate driver IC. Key design consideration with gate driver IC as the followed topics: Low loss, gate clamping, Better EMI with slew rate gate driver IC, current protection by over current protection with shunt, DESAT protection and 2 level DESAT Protection. Used application is reviewed. Signal pattern consideration with related with gate-ringing. Power pattern consideration with stray inductance. Tunning by Gate resistor and snubber.
As a last topic, there is a short introduction of micro controller Selection of Micro controller for inverter. Without program coding. motor driving. Industrial and automotive micro controller. Simple introduction.
And then, there is "Q&A session" and listen & discussion of voices from industrial and academic field.

About The Speakers:

Simon Kim:
At Infineon Technology Korea, he is a Principal Engineer in the System Application Engineering team with 20 years of experience in power electronics and six years in robotics and automation. His expertise includes inverter design using SiC MOSFETs and gate drivers, focusing on UAM, HVAC, rail applications, MV drives, ESS, and electric ships.

Efficient Electrified Transportation: Harnessing Reduced Order Modelling

SPEAKER

Joel Van Sickel

Principal Application Engineer

MathWorks

About The Speaker:

Joel Van Sickel:

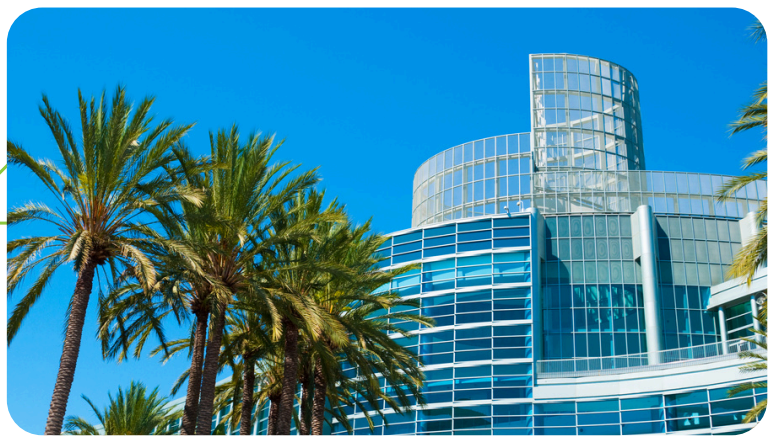
Joel Van Sickel, Principal Application Engineer at MathWorks, specializes in Simscape Electrical, focusing on power electronics and real-time testing. He earned a Ph.D. in Electrical Engineering from Penn State in 2010 and previously worked as a hardware design engineer at Raytheon.

ABSTRACT

In the rapidly evolving field of electrified transportation, efficient and accurate modeling of system components is crucial for optimizing performance and integration. This tutorial explores reduced order modeling techniques for key components of electrified transportation systems, focusing on power converters, motors, and batteries. Participants will gain a comprehensive overview of how to employ system identification, artificial intelligence, and analytical/physics-based approaches to create effective and performant reduced order models.

The session begins with an overview of the various techniques available, discussing their strengths and weaknesses. Following this, three detailed examples will be presented, each highlighting a common use case. First, a classical system identification approach will be applied to a power converter to extract a time-varying state-space representation of the system. Next, an industry-standard approach to 2D motor modelling will be compared to a high-fidelity finite element motor model, capturing essential details such as saturation and spatial harmonics without the computational cost. Finally, the process of designing, training, and using a neural network for modeling a lithium-ion battery will be reviewed.

Participants will leave with a solid understanding of the existing modeling approaches available for electrified transportation systems. They will learn how to effectively apply these techniques to meet specific design and analysis needs, equipping them with the skills necessary to optimize system performance and integration.



Vector Magnetic Circuit Theory and Its Applications

SPEAKER

Peng Han

Application Engineering Manager

Ansys, Inc.

Ming Cheng

Endowed Chair Professor

Southeast University

About The Speaker:

Peng Han:

Peng Han (Senior Member, IEEE) is an Application Engineering Manager at Ansys, specializing in low-frequency electromagnetic products. With a Ph.D. from Southeast University, his expertise includes electric machines, power electronics, and renewable energy. He has held research roles, received IEEE awards, and delivered tutorials at major conferences.

Ming Cheng:

Ming Cheng (Fellow, IEEE, IET) is an Endowed Chair Professor at Southeast University, China, and Director of the Research Center for Wind Power Generation. His research focuses on electrical machines, EV motor drives, and renewable energy. He has authored over 500 papers, 7 books, and holds 150+ patents. A former IEEE IAS Distinguished Lecturer, he has received numerous awards, including the IET Achievement Award and SAE Environmental Excellence in Transportation Award.

ABSTRACT

Magnetic equivalent circuits, or magnetic circuits for simplicity, have long been widely used to understand and analyze electromagnetic devices, such as electric machines, inductors, transformers, etc. The traditional magnetic circuit theory from textbooks relying on the only magnetic circuit element -- magnetic reluctance, has been found facing significant challenges in modeling coupled electromagnetic phenomena at high frequencies (several kHz to hundreds of MHz) with high fidelity, such as the phase difference between magnetomotive force (MMF) and magnetic flux, eddy current reaction and eddy current losses, as well as the magnetic hysteresis, in ac magnetic circuits. By introducing two more magnetic circuit elements, one for the eddy effect and the other for magnetic hysteresis, the magnetic circuit becomes closer to the electric circuit counterpart, and the same electromagnetic power can be calculated from the perspective of magnetic circuit, which has never been successful before.

The extended magnetic circuit theory, termed as “vector magnetic circuit theory” in the literature, makes it possible to understand electromagnetic phenomena from the magnetic circuit perspective and improve electromagnetic component designs by optimizing the placement and size of the two new magnetic circuit elements. Several examples will be provided to show the additional insights obtained from the vector magnetic circuit theory.

The short course will cover:

1. Historical overview of magnetic circuits
2. Introducing two more magnetic circuit elements

2.1 “Magductance” – a new magnetic circuit element characterizing eddy current

2.2 “Hysteretance” – a new magnetic circuit element characterizing magnetic hysteresis

2.2 Consistency with Maxwell’s equations

2.3 Electromagnetic power calculation from the perspective of magnetic circuit

3. Applications and FEA validations

3.1 Analyzing induction machines

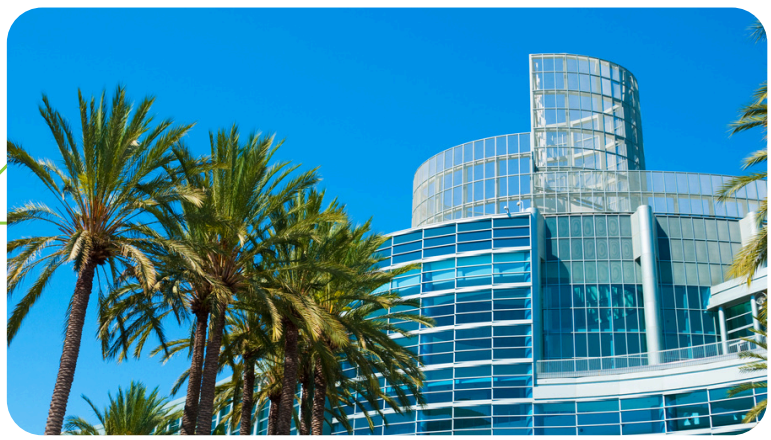
3.2 Solving magnetic equivalent circuit/network taking into account eddy effect

3.3 Optimizing magnetic cores for inductors/transformers

3.4 Interpreting Meissner effect in superconductors

3.5 Designing motor control considering eddy-current reaction

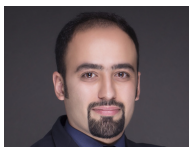
4. Conclusions and outlook



Advanced Battery Management for Transportation Electrification: Challenges and Approaches

SPEAKER

Huazhen Fang
Associate Professor
University of Kansas



Amir Farakhor
Associate Professor
University of Kansas

About The Speaker:

Huazhen Fang:
Huazhen Fang is an Associate Professor of Mechanical Engineering at the University of Kansas. He received his Ph.D. from the University of California, San Diego in 2014, M.Sc. from the University of Saskatchewan, Canada in 2009, and B.Eng from Northwestern Polytechnic University, China in 2006. His research interests lie in advanced battery management. Additionally, he studies autonomy and control of complex spatio-temporal systems for aerospace applications. His work has been sponsored by NSF, DOE, ARL, among others. He received the NSF Faculty Early Career Award in 2019 and the University Scholarly Achievement Award at the University of Kansas in 2024. He currently serves as an Associate Editor for IEEE Transactions on Industrial Electronics and IEEE Control Systems Letters, among others.

ABSTRACT

Lithium-ion batteries (LiBs) serve as a cornerstone technology for advancing transportation electrification, powering electric vehicles, eVTOLs, and other mobility solutions. They offer exceptional energy density, efficiency, and lifespan, making them indispensable in meeting sustainability goals. However, their widespread adoption faces critical challenges, including performance degradation, thermal management, and safety risks. These pressing issues have spurred intense research and development efforts to harness the full potential of LiBs through advanced battery management.

This short course provides a comprehensive exploration of cutting-edge developments in battery management systems (BMS), equipping participants with both foundational knowledge and insights into emerging innovations. The curriculum encompasses three core areas: 1. Battery Modeling: Explore the convergence of electrochemical principles, equivalent circuit models, and machine learning techniques to create accurate and efficient models for diverse applications. 2. State Estimation, Fault Detection, and Control: Learn about model-based methods to monitor critical battery states (e.g., state of charge and state of health), detect faults, and optimize performance through advanced control strategies. 3. Large-Scale Battery System Design and Power Management: Delve into the challenges and solutions for designing safe, robust, and efficient systems that integrate battery packs with power electronics for large-scale applications.

Participants will gain an in-depth understanding of the latest methodologies and tools to enhance battery performance, improve safety, and enable seamless integration into advanced transportation systems. Whether you are an academic researcher, industry professional, or student, this course offers valuable perspectives on the future of battery management. By the end, attendees will be well-prepared to contribute to advancing electrification technologies and shaping the future of sustainable transportation.

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GaN Power Switching Devices for Energy-Efficient Applications

SPEAKER

ZHIKAI TANG
GAN TECHNOLOGY LEAD
TEXAS INSTRUMENTS

ABSTRACT

Lithium-ion batteries (LiBs) serve as a cornerstone technology for advancing transportation electrification, powering electric vehicles, eVTOLs, and other mobility solutions. They offer exceptional energy density, efficiency, and lifespan, making them indispensable in meeting sustainability goals. However, their widespread adoption faces critical challenges, including performance degradation, thermal management, and safety risks. These pressing issues have spurred intense research and development efforts to harness the full potential of LiBs through advanced battery management.

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About The Speaker:

Zhikai Tang received the B.S. degree from the University of Electronic Science and Technology of China, Chengdu, China, and the Ph.D. degree from the Hong Kong University of Science and Technology, Hong Kong. He is currently with Efficient Power Conversion Corporation, El Segundo, CA, USA.

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Tutorials

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Multiphysics analysis and design of rotating machines- PMSM- considering different aspects: electromagnetic, thermal, control and mechanical constraints

SPEAKERS

Abdessamed Soualmi
lead technical specialist

Philippe Wendling
Vice President Business Development LFEM
Simulation & Design Support_GTT

About The Speakers:

Abdessamed Soualmi:
Abdessamed Soualmi earned an M.S. in Electrical Engineering from the University of Havre in 2009 and a Ph.D. in 2013 from SPIM Graduate School in collaboration with Alstom Transport. His research focused on designing and optimizing permanent magnet (PM) machines for railway applications. His expertise includes PM machines, electric motor design, and propulsion systems. Since 2013, he has worked with CEDRAT's application team and is currently a Technical Specialist at Altair.

Philippe Wendling:
Philippe Wendling, a Senior Lifetime IEEE Member, earned his master's degree from École Centrale de Lille in 1979. As Vice President of GTT Electromagnetics Applications at Altair Engineering Inc., he focuses on modeling power systems and electromechanical conversion in Multiphysics environments. With expertise in finite element modeling of electromagnetic fields since the 1980s, he leads technical support and training. Philippe is an active participant and author at IEEE conferences, including CEFC, IAS, IEMDC, ECCE, and ITEC.

ABSTRACT

Manufacturers and designers of rotating machines are increasingly confronted with constraints (technical and environmental) in the design of electrical machines imposed by new standards, particularly environmental ones. Among the technical constraints: mass reduction, acoustic noise, quality and properties of the materials…etc. To meet these constraints, engineers are led to consider the environmental and technical aspects (electromagnetic, thermal, control and mechanical). Hence the need to consider multiphysics aspect (electromagnetic, thermal, control and mechanical) in the design of rotating machines. Multiphysics analysis and study is driving a multi-physics study of a motor concept: electromagnetic, thermal, control, structural constraints have to be considered and coupled defining an analysis scenario. The multiphysics workflow analysis helps engineers to do an accurate analysis and design of rotating machines considering electromagnetic, thermal, control, structural aspects with different constraints.

High Power Density Electric Machine Design for Aerospace Propulsion

SPEAKERS

Sara Roggia

Head of Protection and Control

MagniX

Bulent Sarlioglu

Professor

University of Wisconsin-Madison

About The Speakers:

Bulent Sarlioglu:
Bulent Sarlioglu is a Professor at the University of Wisconsin-Madison and Director of Technology at the Wisconsin Electric Machines and Power Electronics Consortium. Previously with Honeywell Aerospace, he contributed to electric motor drives for aircraft like the Airbus A380 and A350. An expert in electrical machines, drives, and power electronics, he holds 24 U.S. patents and has published over 280 technical papers. Dr. Sarlioglu is a recipient of the IEEE PES Cyril Veniott Award, NSF CAREER Award, and Grand Nagamori Award. He is a Fellow of the National Academy of Inventors (2021) and IEEE (2022).

Sara Roggia:
Sara Roggia (IEEE SM'20, M'16) earned her B.Sc. and M.Sc. in Electrical Engineering from Politecnico di Bari, Italy, and a Ph.D. in electrical machine design from the University of Nottingham, UK, as a Marie Curie Fellow in 2017. She has contributed to novel electrical machine technologies for more electric aircraft and has held roles at Motor Design Limited, SAFRAN, and magniX. Currently Head of Protection and Controls at magniX, her work focuses on protection and control algorithms for inverters. Sara holds five patents and has authored over 18 scientific publications.

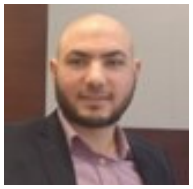
ABSTRACT

The electrification of aircraft is rapidly advancing, driven by significant efforts to develop electric propulsion systems. This burgeoning field is underpinned by innovations and technological advancements aimed at achieving fully electric architectures utilizing energy sources like batteries and fuel cells for aircraft propulsion. Electric machines and power electronics play a pivotal role in delivering the high performance and fault-tolerant capabilities essential for aviation applications. Achieving high power density and fault redundancy is critical in aerospace systems, necessitating advancements in materials such as high-density permanent magnets, improved steel alloys for electric machines, and wide-bandgap devices for power electronics. Additive manufacturing further supports these goals by enabling designs with greater specific power and higher efficiency, which are crucial for aerospace electrification and the potential realization of net-zero carbon emissions in air transportation.

This tutorial will begin with an overview of the current state-of-the-art in commercial and electric aircraft, followed by a discussion of future trends in electric propulsion, including All-Electric Propulsion (AEP), Hybrid Electric Propulsion (HEP), and Turboelectric Propulsion (TEP). Prof. Sarlioglu will highlight the latest advancements in electrical systems for flying vehicles and airplanes, exploring various propulsion architectures such as series and hybrid systems while addressing the challenges and opportunities in the application of electric machines and power electronics. The tutorial will delve into enabling technologies and key machine design considerations specific to aerospace applications. Different electric machine topologies will be examined, including Permanent Magnet Synchronous Machines (PMSM), Induction Machines (IndM), Switched Reluctance Machines (SRM), Synchronous Reluctance Machines (SynRM), and Axial Flux Machines (AFM). Their respective advantages and disadvantages will be analyzed in terms of efficiency, speed range, reliability, compactness, cost, and manufacturability. Additionally, topics on integrated motor drives and fault-tolerant drive systems will be explored in depth.

Grid Integration of EV Charging Infrastructure: Smart Charge Management (SCM) and Vehicle to Everything (V2X)

SPEAKERS



Ahmed Mohamed
Technology Manager for EV Charging Infrastructure at Eaton Research Labs

Azrin Zulkefli
Engineering Specialist
Eaton Research Labs

About The Speakers:

Ahmed Mohamed:
Dr. Mohamed is a Technology Manager at Eaton Corporation, leading R&D for EV Charging Infrastructure. Previously, he was a Senior Researcher at the National Renewable Energy Laboratory (NREL) and an Adjunct Professor at the Colorado School of Mines.
He holds a Ph.D. in Electrical Engineering from Florida International University (FIU) and has nearly 15 years of experience in power electronics, EV charging, and DC distribution systems.
Dr. Mohamed has six U.S. patents/applications, five book chapters, and over 70 publications. A senior IEEE member, he serves as an associate editor for IEEE Transactions on Transportation Electrification and IET Power Electronics Journal. He was also Technical Chair and Publication Chair for the IEEE Greentech conferences in 2023 and 2021.
He received the Outstanding PhD Graduate Award from FIU in 2017.

Azrin Zulkefli:
Dr. Zulkefli, a Specialist Engineer at Eaton Corp., specializes in controls and optimization of dynamical systems. He earned his Ph.D. in Mechanical Engineering from the University of Minnesota in 2017. His work, funded by the U.S. Federal Highway Administration and Minnesota DOT, focused on optimal powertrain controllers for hybrid electric vehicles and hardware-in-the-loop testing for fuel and emissions evaluation. He later served as a Postdoctoral Associate before joining Eaton in 2018.
At Eaton, he develops controllers for power grid systems, distributed energy resources (DERs), and EV charging infrastructure to improve energy efficiency and resiliency. He has authored publications and holds patents in vehicular and grid control technologies.

ABSTRACT

The rapid adoption of electric vehicles (EVs) presents both opportunities and challenges for the power grid. This tutorial, "Grid Integration of EV Charging Infrastructure: Smart Charge Management (SCM) and Vehicle to Everything (V2X)," explores integrating EV charging with the grid, focusing on SCM and V2X technologies.
Smart Charge Management (SCM) optimizes EV charging to reduce peak demand and enhance grid stability. This tutorial covers SCM strategies like time-of-use pricing and demand response programs, helping utilities manage increased EV load and improve energy efficiency.
Vehicle to Everything (V2X) technology allows EVs to act as mobile energy storage units, including Vehicle-to-Grid (V2G), Vehicle-to-Home (V2H), and Vehicle-to-Building (V2B) interactions. The tutorial addresses the technical and regulatory frameworks for V2X, benefits like grid resilience, and challenges such as bi-directional power flow and cybersecurity.
Lessons from two projects provide practical insights: an AC V2G/V2H demonstration for residential applications with vehicle OEMs, utilities, and aggregators, and a DC-coupled fast charging site for medium and heavy-duty commercial EV fleets. These projects highlight stakeholder coordination, technical feasibility, and operational benefits.
Participants will gain a comprehensive understanding of EV grid integration, equipped with knowledge and tools to implement SCM and V2X solutions, fostering a resilient and sustainable energy ecosystem.

ELECTRIFIED AIRCRAFT PROPULSION APPROACHES FOR MODELING AND ELECTRICAL HARDWARE-IN-THE-LOOP TESTING

SPEAKERS

Joseph Connolly

Deputy Project Manager of Technology
Electrified Powertrain Flight Demonstration Project - NASA Glenn Research Center

Joseph Haglage

Hybrid Thermally Efficient Core Project Chief Engineer
NASA Glenn Research Center

About The Speaker:

Joseph Connolly:

Joseph Connolly is the Deputy for Electrified Aircraft Propulsion (EAP) Integration at the NASA Glenn Research Center. In this position Joseph works to support EAP technology development across aeronautics projects. Joseph also serves as the Deputy Project Manager of Technology for the Electrified Powertrain Flight Demonstration Project and a technical lead for the Hybrid Electric Thermally Efficient Core Project. Joseph earned his B.S. in Aerospace Engineering from the Ohio State University, his M.S. in Control Systems from Case Western Reserve University, and his PhD in Aerospace Engineering from the Ohio State University.

Joe Haglage:

ABSTRACT

This tutorial session outlines capabilities made available by the National Aeronautics and Space Administration for testing electrified aircraft propulsion (EAP) hardware and software prior to using turbomachinery. Removing these components from the experimentation process until necessary significantly reduces the development and testing costs and safety risks. Three facilities, the NASA Electric Aircraft Testbed (NEAT) and the Hybrid Propulsion Emulation Rig (HyPER) are unique facilities that provide the following capabilities: (i) the verification of megawatt scale electrical and electromechanical system components at altitude, (ii) the verification of EAP control systems on sub-scale representative electromechanical architectures. The importance, operation, and specifications of each facility is described with detail. Provided examples of past testing showcase the abilities of each facility. Simple and complex methods for replicating the steady state and dynamical mechanical loading on the electrical power system are discussed.

Medium Voltage Converters in Transportation Electrification

SPEAKER

Pourya Shamsi

CTO, Infinity Miles Inc

About The Speaker:

Pourya Shamsi:

Pourya Shamsi is the CTO of Infinity Miles Inc and Route 66 Controls LLC and is also an associate professor of electrical engineering at Missouri University of Science and Technology. His expertise includes power electronics, medium voltage converters, drives, and control. He is a member of IEEE as well as several UL committees.

ABSTRACT

This tutorial will cover an introduction to medium voltage converters, power switches used in these converters, reliability considerations, utilization of these converters in marine, railway, evtol, and EV applications, and challenges and future trends associated with medium voltage converters in transportation electrification.

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Panels

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PANEL 1: ENHANCING EFFICIENCY: THE ROLE OF CONTROLS AND OPTIMIZATION IN ELECTRIC VEHICLE PERFORMANCE

June 18: 2:00pm - 3:30pm

Moderator: Shobhit Gupta - General Motors

Panelists:

- Chunhao Lee - Tech Fellow for General Motors
- Scott Hotz - Director at Southwest Research Institute
- Hareesh Parepalli - Technical Lead at Lucid Motors
- Dr. Caleb Secrest - Global Lead

Abstract:

The electrification of powertrains represents a pivotal step toward sustainable mobility, yet achieving their full potential demands the integration of advanced controls, optimization techniques, and cutting-edge artificial intelligence (AI) and machine learning (ML). This panel convenes leading experts to explore how AI/ML-driven strategies are transforming the design, operation, and performance of next-generation electrified powertrains. Key topics include intelligent energy management systems, real-time adaptive control algorithms, predictive thermal optimization, and data-driven approaches to enhance efficiency, extend range, and improve reliability. Panelists will also tackle critical challenges such as battery degradation, thermal management, and seamless system integration under dynamic driving conditions. Join us to uncover how the synergy of AI/ML, controls, and optimization is shaping the future of electrified transportation, delivering smarter, cleaner, and more efficient mobility solutions.

PANEL 2: ADVANCING AVIATION ELECTRIFICATION: PATHWAYS TO A SUSTAINABLE FUTURE

June 18 4:00pm - 5:30pm

Moderator: Fengyu Wang - Endowed Chair Professor for Utilities Management

Panelists:

- Dr. Liang Sun - *Associate Professor at Baylor University*
- Dr. Nick Gunady - CEO at Aerovy
- Dr. Di Shi - Associate Professor at New Mexico State University
- Dr. Jeffery Saunders - Technical Fellow at Aurora Flight Sciences Corporation

Abstract:

This panel will bring together industry leaders, policymakers, and researchers to provide a holistic overview of the opportunities and challenges associated with aviation electrification. The discussions aim to 1) drive collaboration among stakeholders to address key barriers to electrified aviation. 2) showcase cutting-edge research and technologies shaping the future of eVTOL. 3) offer actionable insights into creating sustainable and equitable electrification pathways.

PANEL 3: ADVANCED BATTERY TECHNOLOGY FOR TRANSPORTATION ELECTRIFICATION

June 18: 2:00pm - 3:30pm

Moderator: Weihan Li

Panelists:

- Dr. Xin Wu, Technology-to-Market Advisor, ARPA-E
- Prof. Yuzhang Li, Assistant Professor, UCLA
- Dr. Valentin Sulzer, Co-founder & CEO, ionworks
- Prof. Weihan Li, RWTH Aachen University

Abstract:

As battery technology plays a key role in the global shift toward sustainable energy, staying up-to-date on these advancements is crucial for improving the efficiency, reliability, and lifespan of energy storage systems. This session will dive into the technical aspects of battery modeling, diagnostics, and aging prediction, with a focus on both automotive and stationary applications. Our expert speakers will explore new methods for simulating battery behavior, introduce cutting-edge diagnostic tools for real-time issue detection, and highlight advanced techniques for predicting battery lifespan. By combining physics-based and data-driven approaches, we'll demonstrate how these innovations are transforming battery development, management, and optimization to allow for more accurate predictions, adaptive diagnostics, and smarter optimizations.

PANEL 4: SAFE AND ADVANCED LOW-CARBON RAIL TRANSPORTATION ELECTRIFICATION TECHNOLOGIES

June 19 2:00pm - 3:30pm

Moderator: Xiaofeng Yang

Panelists:

- Dr. Tiefu Zhao - UNC
- Dr. Tiefu Zhao - University of Birmingham, UK
- Dr. Xiaofeng Yang - Beijing Jiaotong University, China
- Dr. Zhongping Yang - Beijing Jiaotong University, China
- Mohammad Saif - Senior Traction Power Engineer | Team Leader, Mott MacDonald

Abstract:

With the rapid development of global rail transportation, the world is actively promoting rail energy transformation. The demand of Safe and advanced low-carbon rail transportation electrification technologies is essential to guarantee the operation of rail transit. In recent years, emerging technologies such as high-efficiency power supply, energy conversion, safe challenges, condition monitoring, lifecycle health management, renewable energy integration and AI technologies have emerged continuously. The deep integration of these technologies will support safer and low-carbon rail transportation electrification system. Therefore, this panel invited relevant experts to discuss safe and advanced low -carbon rail transit electrification technologies. All scholars from industry and academia who are interested in this field are welcome to join this panel. Let's explore related technologies in depth and promote technological progress.

PANEL 5: HEAVY-DUTY TRUCK ELECTRIFICATION

June 19: 4:00pm- 5:30pm

Moderator: Zuzhao Ye

Panelists:

- Aaron Katzenstein, South Coast Air Quality Management District
- Brent Buffington, Southern California Edison
- Nanpeng Yu, University of California, Riverside
- Jacob Richard, CALSTART
- Chaitanya Inamdar, Kenworth Truck Company , Paccar, Inc,

Abstract:

With the rapid development of global rail transportation, the world is actively promoting rail energy transformation. The demand of Safe and advanced low-carbon rail transportation electrification technologies is essential to guarantee the operation of rail transit. In recent years, emerging technologies such as high-efficiency power supply, energy conversion, safe challenges, condition monitoring, lifecycle health management, renewable energy integration and AI technologies have emerged continuously. The deep integration of these technologies will support safer and low-carbon rail transportation electrification system. Therefore, this panel invited relevant experts to discuss safe and advanced low -carbon rail transit electrification technologies. All scholars from industry and academia who are interested in this field are welcome to join this panel. Let's explore related technologies in depth and promote technological progress.

PANEL 6: SO, YOU THINK YOU CAN FLY: WHAT IT TAKES TO CERTIFY ELECTRIC AIRCRAFT

June 19: 4:00pm- 5:30pm

Moderator: Herb Schlickenmaier

Panelists:

- Vince Schultz, NASA EPFD Regulations & Standards Lead
- Herb Schlickenmaier, Regulations & Standards SME
- Christoph Gentser, Chair, ATSM F44, Diamond Aircraft
- Ed Lovelace, Chair, SAE E-40, Ampaire
- Kevin Bruce, Chair, ASTM F39.05 Working Group on Battery ESS for Propulsion
- Michael Walz, FAA Certification Policy for Electric Engines
- Regis Ressotto, EASA Certification Specialist for Electric Engines

Abstract:

PANEL 7: NASA AND AIRCRAFT ELECTRIFICATION: PROGRESS AND CHALLENGES

June 19: 4:00pm- 5:30pm

Moderator: Gaudy Bezos-O'Connor, NASA EPFD

Panelists:

- Zubair Baig, P&W
- Ben Loxton, MagniX
- Christine Andrews, GE
- Ed Lovelace, Ampaire
- Jeff Engler, Wright Electric

Abstract:

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Industry Sessions

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SELECTING THE RIGHT TEST SOLUTION FOR AEROSPACE COMPLIANCE STANDARDS

SPEAKERS

George Liu
Applications Engineering Manager
Pacific Power Source

About The Speakers:

George Liu:
George Liu has over 15 years of electrical engineering experience, with a strong foundation in test equipment across AC and DC systems. His expertise stems from hands-on experience testing a wide range of power applications including power conversion, grid, renewable energy, batteries, and energy storage systems. In his role, George manages a team of applications engineers and works closely across product line management, engineering, customer support, and manufacturing to drive high-quality, innovative products, and value to our customers. Previously, George held senior field application positions at NI, NH Research, and Bureau Veritas.

ABSTRACT

As aircraft systems become increasingly electrified, simulating real-world power conditions with precision is critical for effective testing and certification. Both commercial and military platforms require advanced AC and DC power sources and electronic loads to meet evolving power architectures and stringent aerospace standards. This presentation explores the latest trends in onboard power systems— such as variable-frequency (wild frequency) AC and high-voltage DC —and how they impact test strategy. Attendees will gain insights into the latest trends, challenges, and best practices in AC/DC power testing for aerospace applications. We'll also share key considerations for selecting power sources and loads that can reliably simulate and absorb power under dynamic conditions, while ensuring compliance with standards like MIL-STD-704, DO-160, and aircraft-specific test requirements.

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Poster Sessions

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Exhibit

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