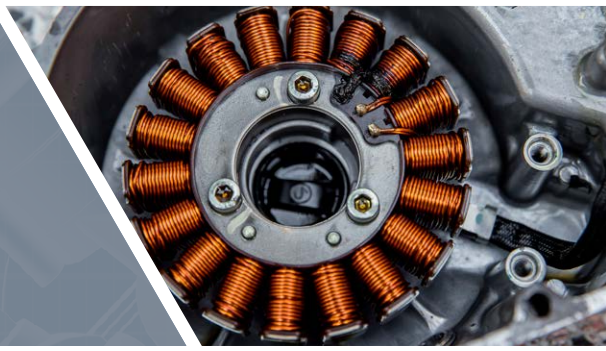
International Electric Machines & Drives Conference

IEMDC 2025

MAY 18-21, 2025 | Houston, TEXAS



IEMDC 2025 Sponsors

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IAS IEEE INDUSTRY APPLICATIONS SOCIETY Linking Research to Practice

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Ansys Motor-CAD and Ansys Maxwell: The Ideal Product Combo

Ansys Motor-CAD and Ansys Maxwell simulation solutions can be used separately or together in the design development of electric machines. When you combine these two solutions, they add even greater value to your motor design.

Motor-CAD users can add Maxwell to expand on their electric machine topologies and advanced magnetics capabilities. The efficiency map workflow in Motor-CAD is expanded with connections to Maxwell, which allows for 2D and 3D geometries. Moreover, Maxwell is ISO 26262 certified which would make your electromagnetic (EM) motor design qualified for passenger vehicles.

Maxwell users can add Motor-CAD to simulate the magnetic and thermal performance in the motor design phase. In addition, Motor-CAD is easy to use and can perform preliminary noise and vibration (NVH) analysis and drive cycle efficiency maps.

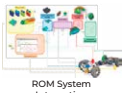
Current and Potential Users of Motor-CAD:	Add Maxwell	To Obtain the Following Benefits:
Ansys MOTOR-CAD Advanced Multiphysics Design Tool for Electric Machines (EM, Thermal, Mechanical, Lab) Optimized Design for Size, Performance & Efficiency Fast & Accurate Design Analysis	+ Ansys MAXWELL	Elevate the Performance Mapping with an Advanced EM Field Solution. Calculate Circuit Coupling, 3D Field Effects, Losses, Detailed Fault Analysis, and more. Make Your EM Design ISO 26262 Compliant.


End-Effects

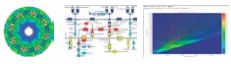

Permanent Magnet Axial Segmentation

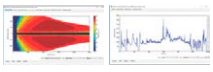

Circuit Coupling Effects


Open & Short-Circuit Tests


ROM System Integration

Current and Potential Users of Maxwell:	Add Motor-CAD	To Obtain the Following Benefits:
Ansys MAXWELL Advanced EM Field Solver (3D Effects, PM Demagnetization, Core Loss Customization, Circuit Coupling, Detailed Fault Analysis, Circuit Current, Arbitrary Winding Excitation, etc.) Comprehensive Coupling Workflow Using Physics-Based Solvers ISO 26262 Compliant Design	+ Ansys MOTOR-CAD	Extend Your Multiphysics Certainty to Your Advanced EM Design. Add Coupled Magnetic and Thermal Analysis to Your ISO 26262 Compliant EM Design. Harness the Power of the Built-in Multi-Workflows to the Comprehensive Multiphysics Solution.


Embedded 2D FE + Analytic Solution Thermal Mechanical NVH


Efficiency Maps and Duty Cycle Analysis

System Integration

Use both Motor-CAD and Maxwell simulation tools in your next motor design project and bring your design to the best conceivable level.

Please scan the QR code to request a free trial for Ansys Motor-CAD

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Welcome

On behalf of the Organizing Committee, welcome to Houston, TX, for the 2025 IEEE International Electric Machines and Drives Conference (IEMDC 2025)!

IEMDC has been running as a biannual conference since 1997 and is sponsored by four IEEE societies: the Industry Applications Society (IAS), the Industrial Electronics Society (IES), the Power Electronics Society (PELS), and the Power and Energy Society (PES). The conference serves as a premier international platform for exchanging expertise and innovative ideas in the design, operation, analysis, optimization, and practical applications of electric machines, drive systems and their associated power electronics and controls.

The conference program offers a truly enriching experience, featuring eight exceptional tutorials led by industry experts, twenty thought-provoking technical sessions, and three special sessions spotlighting some of the most in-demand topics. Additionally, attendees can engage in two interactive poster sessions designed to foster deeper discussions and networking, while the captivating exhibition presents the latest advancements and groundbreaking technologies shaping the future. Renowned experts from Ansys, Weatherford, Oak Ridge National Lab, and General Motors will deliver insightful keynote talks, offering valuable perspectives on the latest industry advancements and innovations. With a dynamic lineup of knowledge-sharing opportunities, this event is set to inspire, educate, and connect professionals from across the industry.

We are thankful to the committee members, technical track chairs, special session organizers, and reviewers for their dedication and hard work. We also extend our gratitude to the IEMDC Steering Committee for their invaluable guidance. We are thankful to all attendees—including speakers, authors, presenters, session chairs, exhibitors, sponsors, and volunteers—whose contributions and participation have been instrumental in making this event both enriching and impactful.

As a global hub for energy, innovation, and cutting-edge technologies, Houston provides the perfect setting for thought leaders, researchers, and industry professionals to come together and explore the future of electric machines and drives. We look forward to an inspiring event filled with knowledge-sharing, collaboration, and new discoveries in the heart of Space City!

Yao Duan
IEMDC 2025 General Chair

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TT-1 – Rotating Electric Machines

- **Glynn Atkinson**
  Newcastle University, UK
- **Xiao Chen**
  The University of Sheffield, UK
- **Yu Wang**
  Fudan University, China
- **Panos Panagiotou**
  The University of Sheffield, UK

TT-2 – Electric Drives

- **Appa Rao Dekka**
  Lakehead University, Canada
- **Hao Chen**
  Zhejiang University, China
- **Su-Dan Huang**
  Shenzhen University, China

TT-3 – Special Machines, Electromagnetic Actuators and Sensors

- **Nick Baker**
  Newcastle University, UK
- **Xin Zhao**
  York University, UK
- **Dawei Liang**
  The University of Sheffield, UK

TT-4 – Thermal, Materials and Efficiency Challenges

- **Pedram Asef**
  University College London, UK
- **Lavanya Vadamola**
  Altair, USA
- **Mohanraj Muthusamy**
  POWERSYS, Canada
- **Nishanth Gadiyar**
  Oak Ridge National Lab, USA

TT-5 – Design Optimization, Modeling and Simulation

- **Feng Niu**
  University of Technology, China
- **Dayong Zheng**
  Beijing Jiaotong University, China
- **Reza Ilka**
  University of Tennessee, USA

TT-6 – Condition Monitoring, Fault Diagnosis and Prognosis

- **Shaopeng Wu**
  Harbin Institute of Technology, China
- **Ahmed Hembel**
  General Motors, USA
- **Dawei Li**
  Huazhong University of Science and Technology, China
- **Mojtaba Afshar**
  University of Texas at Dallas, USA

TT-7 – Transportation Applications

- **Athar Hanif**
  The Ohio State University, USA
- **Feng Guo**
  University of Wisconsin, USA
- **Zheng Wang**
  Southeast University, China

TT-8 – Energy and Grid-Connected Applications

- **Siddavatam R. P. Reddy**
  IIT Bombay, India
- **Qiang Wei**
  Lakehead University, Canada

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2025 General Information

Registration Hours

Magnolia Foyer

Sunday, May 18 . . . . . 7:00 AM – 6:00 PM
Monday, May 19 . . . . . 7:30 AM – 3:30 PM
Tuesday, May 20 . . . . . 7:30 AM – 3:30 PM
Wednesday, May 21 . . . . . 7:30 AM – 11:00 AM

Exhibit Hall Hours – Azalea Ballroom

Monday, May 19 . . . . . 4:00 PM – 7:30 PM
Tuesday, May 20 . . . . . 12:00 PM – 5:00 PM

Attendees have full access to Wi-Fi in the meeting space, foyers, and exhibit hall.

Network: SSID:
Westin_CONFERENCE

Wi-Fi code:
IEMDC2025

Rules and Regulations

Consent to Use of Photographic Images

Registration and attendance at, or participation in, IEMDC constitutes an agreement by the registrant to IEMDC's use and distribution (both now and in the future) of the registrant or attendee's image or voice in photographs, videotapes, electronic reproductions and audiotapes of such events and activities.

Cameras and Recording Devices

The use of cameras and/or recorders is strictly prohibited during the oral and poster sessions. Limited use is allowed for exhibitors in their own booth area. Personal photography is allowed at social functions.

Distributing Commercial Material at IEMDC

Exhibitors: Exhibitors may only distribute commercial materials in their tabletop. IEMDC reserves the right to remove without notice any materials not in compliance with this policy.

Non-Exhibitors: Distribution of commercial material in the IEMDC 2025 hotel space (including directly to the hotel rooms of IEMDC participants), meeting space and Exhibit Hall by people or organizations not participating in the exposition is prohibited. IEMDC reserves the right to remove without notice any materials not in compliance with this policy.

Event Conduct and Safety Statement:

IEEE believes that science, technology, and engineering are fundamental human activities, for which openness, international collaboration, and the free flow of talent and ideas are essential. Its meetings, conferences, and other events seek to enable engaging, thought provoking conversations that support IEEE's core mission of advancing technology for humanity. Accordingly, IEEE is committed to providing a safe, productive, and welcoming environment to all participants, including staff and vendors, at IEEE-related events. IEEE has no tolerance for discrimination, harassment, or bullying in any form at IEEE-related events. All participants have the right to pursue shared interests without harassment or discrimination in an environment that supports diversity and inclusion. Participants are expected to adhere to these principles and respect the rights of others. IEEE seeks to provide a secure environment at its events. Participants should report any behavior inconsistent with the principles outlined here, to on site staff, security or venue personnel, or to **eventconduct@ieee.org**.

Agenda
PROGRAM AT A GLANCE

Sunday | May 18, 2025

7:00 AM – 6:00 PM	**Registration** MAGNOLIA FOYER		
12:00 PM – 4:00 PM	**Speaker Ready Room** SUNFLOWER		
8:00 AM – 11:30 AM	**Tutorials** *(Note there will be a Coffee Break from 9:30 AM – 10:00 AM in the Magnolia Foyer)*		
	ROOM: MAGNOLIA 2	ROOM: MAGNOLIA 1	ROOM: MAGNOLIA 3
	Tutorial 1: Multiphysics Equivalent Circuit Modeling for Electric Machinery – From Macro-scale to Micro-scale	**Tutorial 2: Magnetic and Thermal Self-Commissioning Techniques for AC Motor Drives and Inverters**	**Tutorial 3: 3D Printing for Next-Gen Electrical Machines: Magnetic Materials, Windings, Thermal management, and Electrical Insulation**
11:30 AM – 1:00 PM	**Lunch On Your Own**		
1:00 PM – 3:00 PM	**Tutorials** *(Note there will be a Coffee Break from 3:00 PM – 3:30 PM in the Magnolia Foyer)*		
	ROOM: MAGNOLIA 1	ROOM: MAGNOLIA 2	ROOM: MAGNOLIA 3
	Tutorial 4: Regenerative Motor Drive Systems for Industrial Applications	**Tutorial 5: High Power Density Motor Equipped with Additively Manufactured Windings Integrated with Advanced Cooling and Modular Integrated Power Electronics**	**Tutorial 6: Innovative Approaches to Electric Motor Design: AI-Driven Reduced-Order Modeling and Geometry Optimization**
3:00 PM – 3:30 PM	**Coffee Break**		
3:30 PM – 5:30 PM	**Tutorials** *(Note there will be a Coffee Break from 3:00 PM – 3:30 PM in the Magnolia Foyer)*		
	ROOM: MAGNOLIA 2	ROOM: MAGNOLIA 3	
	Tutorial 7: Current Source Inverters using SiC and GaN Wide Bandgap Devices and Comparison with Voltage Source Inverters	**Tutorial 8: Design, Modelling and Mathematical Formulations of PM-Free Special Machines: from Theory to Practice**	
5:30 PM – 6:30 PM	**Light Cocktail Welcome Reception** WISTERIA BALLROOM		
6:00 PM – 7:00 PM	**High School Engineering Poster EXPO** WISTERIA BALLROOM		

Monday | May 19, 2025 *Expo Open 4:00 PM – 7:30 PM*

7:30 AM – 3:30 PM	**Registration** MAGNOLIA FOYER				
7:00 AM – 8:00 AM	**Speaker's Breakfast** HIBISCUS BALLROOM				
7:30 AM – 4:00 PM	**Speaker Ready Room** SUNFLOWER				
8:00 AM – 9:40 AM	**Conference Opening + Plenary Session 1** WISTERIA BALLROOM				
9:40 AM – 10:00 AM	**AM Coffee Break** MAGNOLIA FOYER				
10:00 AM – 12:00 PM	**Oral/Special Sessions**				
	ROOM: MAGNOLIA 1	ROOM: MAGNOLIA 2	ROOM: MAGNOLIA 3	ROOM: MAGNOLIA 4	ROOM: CYPRESS
	Oral Session 1: Rotating Electric Machines 1	**Oral Session 2: Electric Drives 1**	**Oral Session 3: Special Machines, Electromagnetic Actuators and Sensors 1**	**Oral Session 4: Thermal, Materials and Efficiency Challenges 1**	**Special Session 1: Advancing Rare-Earth-Free and Sustainable Electric Machine Design: Innovations and Applications**

Monday | May 19, 2025 (Continued) *Expo Open 4:00 PM – 7:30 PM*

12:00 PM – 1:30 PM	**Lunch On Own**				
1:30 PM – 3:30 PM	**Oral/Special Sessions**				
	ROOM: MAGNOLIA 1	ROOM: MAGNOLIA 2	ROOM: MAGNOLIA 3	ROOM: MAGNOLIA 4	ROOM: CYPRESS
	Oral Session 5: Design Optimization, Modeling and Simulation 1	**Oral Session 6: Condition Monitoring, Fault Diagnosis and Prognosis**	**Oral Session 7: Transportation Applications 1**	**Oral Session 8: Energy and Grid-Connected Applications 1**	**Special Session 2: Novel Materials and Additive Manufacturing Techniques to Improve the Performance Limits of Electric Machines**
3:30 PM – 4:00 PM	**PM Coffee Break** MAGNOLIA FOYER				
4:00 PM – 7:30 PM	**EXPO Open** AZALEA BALLROOM				
5:00 PM – 7:30 PM	**EXPO Reception** AZALEA BALLROOM				
5:00 PM – 7:30 PM	**Student Demos** AZALEA BALLROOM				
5:30 PM – 7:00 PM	**Poster Session I** AZALEA BALLROOM				

Tuesday | May 20, 2025 *Expo Open 12:00 PM – 5:00 PM*

7:30 AM – 3:30 PM	**Registration** MAGNOLIA FOYER				
7:00 AM – 8:00 AM	**Speaker's Breakfast** HIBISCUS BALLROOM				
7:30 AM – 2:00 PM	**Speaker Ready Room** SUNFLOWER				
8:00 AM – 9:30 AM	**Plenary Session II** WISTERIA BALLROOM				
9:30 AM – 10:00 AM	**AM Coffee Break** MAGNOLIA FOYER				
10:00 AM – 12:00 PM	**Oral/Special Sessions**				
	ROOM: MAGNOLIA 1	ROOM: MAGNOLIA 2	ROOM: MAGNOLIA 3	ROOM: MAGNOLIA 4	ROOM: CYPRESS
	Oral Session 9: Rotating Electric Machines 2	**Oral Session 10: Electric Drives 2**	**Oral Session 11: Special Machines, Electromagnetic Actuators and Sensors 2**	**Oral Session 12: Thermal, Materials and Efficiency Challenges 2**	**Special Session 3: Development of Advanced Permanent Magnet Machines and Drives for E-Mobility**
12:00 PM – 5:00 PM	**EXPO Open** AZALEA BALLROOM				
12:00 PM – 1:30 PM	**EXPO Lunch** AZALEA BALLROOM				
1:30 PM – 3:00 PM	**Poster Session II** AZALEA BALLROOM				
1:30 PM – 5:00 PM	**Student Demos** AZALEA BALLROOM				
3:00 PM – 3:30 PM	**PM Coffee Break** AZALEA BALLROOM				
3:30 PM – 5:00 PM	**Poster Session III** AZALEA BALLROOM				
5:00 PM	**EXPO Closes** AZALEA BALLROOM				
6:00 PM – 8:00 PM	**Banquet** WISTERIA BALLROOM				

Wednesday | May 21, 2025

7:30 AM – 11:00 AM	**Registration** MAGNOLIA FOYER			
7:00 AM – 8:00 AM	**Speaker's Breakfast** HIBISCUS BALLROOM			
7:30 AM – 8:30 AM	**Speaker Ready Room** SUNFLOWER			
8:00 AM – 10:00 AM	**Oral Sessions**			
	ROOM: MAGNOLIA 1	ROOM: MAGNOLIA 2	ROOM: MAGNOLIA 3	ROOM: MAGNOLIA 4
	Oral Session 13: Design Optimization, Modeling and Simulation 2	**Oral Session 14: Condition Monitoring, Fault Diagnosis and Prognosis 2**	**Oral Session 15: Transportation Applications 2**	**Oral Session 16: Special Machines, Electromagnetic Actuators and Sensors 3**
10:00 AM – 10:30 AM	**AM Coffee Break** MAGNOLIA FOYER			
10:30 AM – 12:10 PM	**Oral Sessions**			
	ROOM: MAGNOLIA 1	ROOM: MAGNOLIA 2	ROOM: MAGNOLIA 3	ROOM: MAGNOLIA 4
	Oral Session 17: Rotating Electric Machines 3	**Oral Session 18: Electric Drives 3**	**Oral Session 19: Design Optimization, Modeling and Simulation 3**	**Oral Session 20: Transportation Applications 3**
12:30 PM – 2:00 PM	**Awards Lunch** WISTERIA BALLROOM			

Notes

Special Events

IEMDC Light Cocktail Welcome Reception

Sunday, May 18 | 5:30 PM – 6:30 PM

LOCATION: WISTERIA BALLROOM

The conference will host a Sunday Cocktail Welcome Reception welcoming colleagues. This is a great opportunity to kick off the conference and catch up and network with colleagues you may have not seen in a while.

High School Engineering Poster Expo

Sunday, May 18 | 6:00 PM – 7:00 PM

LOCATION: WISTERIA BALLROOM

The IEEE IEMDC is pleased to announce its inaugural high school outreach event! The High School Engineering Poster Expo showcases the exciting work carried out by Houston local high school students in the field of electrical and electronics engineering, as well as AI. This event provides a great opportunity for local high school students to receive feedback, network with university professors and industry professionals, as well as attracting more potential students into electrical and electronics engineering.

Exhibit Hall Opening Reception

Monday, May 19 | 5:00 PM – 7:30 PM

LOCATION: AZALEA BALLROOM

Join us for the opening of the IEMDC 2025 Exhibit Hall! Enjoy a drink and tastes of hors d'oeuvres from around the world as you mingle with industry partners and friends and explore the latest advances in products and services to meet the needs of current and future challenges facing the energy conversion industry.

Banquet Dinner

Tuesday, May 20 | 6:00 PM – 8:00 PM

LOCATION: WISTERIA BALLROOM

Join us as we celebrate our biannual conference with a plated three course meal. The atmosphere will ensure easy conversation and meaningful connections, providing a pleasant conclusion to the day's technical sessions and discussions.

IEMDC Awards Lunch/Conference Closing

Wednesday, May 21 | 12:30 PM – 2:00 PM

LOCATION: WISTERIA BALLROOM

We will gather to celebrate the great achievement of some of our colleagues and recognize our winning papers for Best Student Presentation, Best student poster, and Student Demo Awards.

Things To Do In Houston

Houston Space Center

Space Center Houston offers a variety of tours that provide unique insights into NASA's Johnson Space Center.The complimentary NASA Tram Tour, included with general admission, takes visitors through astronaut training facilities, historic spacecraft, and cutting-edge research labs. Highlights include the option to disembark at George W.S. Abbey Rocket Park to view one of the remaining Saturn V rockets.

Please note this is not an organized tour by IEMDC, but an option to book on your own should you wish to see Houston sights outside of the conference venue.

Please visit their website at: **https://spacecenter.org/** for more information and to book your tickets.

**The Houston Space Center is approximately an hour drive from IEMDC 2025's host venue.*

Check out the QR code below for more ideas and places to visit while in Houston!

Presenter Information

Speaker Ready Room Hours

Sunday, May 18 . . . . . 12:00 PM – 4:00 PM
Monday, May 19 . . . . . 7:30 AM – 4:00 PM
Tuesday, May 20. . . . . 7:30 AM – 2:00 PM
Wednesday, May 21 . . . . . 7:30 AM – 8:30 AM

Oral Presenters' Orientation

A Speakers' Breakfast will be held for oral presenters and session chairs from 7:00 AM – 8:00 AM Monday, Tuesday and Wednesday in the Hibiscus Ballroom.

Oral presenters should meet with their respective session chairs to review the format and timing of their session and alert conference management of any changes.Presenters should print a short introduction (3-4 lines) that can be used by the session chair to introduce the presenter and bring it to speaker's breakfast. Oral Presenters should attend the orientation each day that they are scheduled to provide an oral presentation (or chair a session); you may only attend on days on which you are scheduled to speak.

Poster Presenters

Poster Presentation Schedule

Monday, May 19 and Tuesday, May 20

LOCATION: AZALEA BALLROOM

POSTER SESSION I
Monday, May 19 . . . . . 5:30 PM – 7:00 PM

POSTER SESSION II
Tuesday, May 20. . . . . 1:30 PM – 3:00 PM

POSTER SESSION III
Tuesday, May 20. . . . . 3:30 PM – 5:00 PM

Poster presenters should be available for questions at their display boards during their scheduled poster presentation time. Your poster will be assigned a specific poster board number and section referenced in the Poster Session section of the program. If you are unsure which session your poster should be presented, please review the complete Technical Session schedule.

**For a complete list of details regarding oral and poster presentations please visit our website at:*
https://www.iemdc.org/authors/presenting-at-the-conference/

Monday, 19 May | 8:10 AM – 8:55 AM

WISTERIA BALLROOM

Simulation Advancements for Electric Machine Technology and Applications

Mark Solveson

Product Manager
Ansys

BIO: Mark has many years of industry experience and numerous patents with the Research and Development Center at Eaton Corporation, where he specialized in the design and analysis of electromechanical devices. Today, he continues with simulation specialization using Ansys electromagnetic FEA and system simulation software for power distribution, automotive, off-road vehicle, healthcare, aerospace, and renewable energy industries. At Ansys, he worked as an Application Engineer, a Manager for the North America Application Engineering team, and now as Product Manager in the Electronics Business Unit responsible for Ansys Motor-CAD, Maxwell, and ConceptEV.

ABSTRACT: Simulation tools are prevalent in all aspects of engineering and enable engineers to design better products. They can help reduce cost, make insightful decisions about material changes, predict outcomes for untestable scenarios, and cut engineering costs by reducing the build-and-test cycle. A market leader in simulation, Ansys software sets a high standard in mechanical and computational fluid dynamics, as well as electrical and electromagnetics. This talk will focus on new and exciting simulation capabilities that advance electric machine technology and show how simulation can solve many of today's toughest challenges.

Monday, 19 May | 8:55 AM – 9:40 AM

WISTERIA BALLROOM

The Role of Variable Speed Drives (VSD) in Artificial Lift Applications Within O&G Industry

Mohammed Arefeen

Global Product Manager
Automation, Weatherford International

BIO: Dr. Mohammed Arefeen has over 30 years of experience in variable speed drives (VSD) , automation and power electronics applications. Dr. Arefeen is currently working as the Global Product Manager - Automation at Weatherford International, leveraging his experience and expertise to develop and commercialize automation solutions for the O&G industry. Dr. Arefeen completed his Ph.D at Texas A&M University, College Station, TX. in 1994.

ABSTRACT: This presentation is on the role of variable speed drives (VSD) in artificial lift applications within the O&G industry. The goal is not to discuss any specific brand or the benefits of any specific algorithm. Instead, I will share my experiences in general terms and will discuss the solutions various VSDs offer for this challenging application. The session will end with the discussion of future trends making VSDs even more crucial.

Tuesday, 20 May | 8:00 AM – 8:45 AM

WISTERIA BALLROOM

Next Generation Electric Traction Drives for Medium and Heavy Duty Vehicles

Burak Ozpineci

Section Head and Corporate Fellow
ORNL Oak Ridge National Lab

BIO: Burak Ozpineci earned his B.S. degree in electrical engineering from Orta Dogu Technical University, Ankara, Turkey, in 1994. He then completed his M.S. and Ph.D. degrees in electrical engineering at the University of Tennessee, Knoxville, in 1998 and 2002, respectively. Since 2001, he has been with Oak Ridge National Laboratory, where he began as a student and has held positions as a researcher, founding group leader of the Power and Energy Systems Group, group leader of the Power Electronics and Electric Machinery Group. He currently serves as a Corporate Fellow and the Section Head of the Vehicle and Mobility Systems Research Section. Additionally, he has a joint faculty appointment with The University of Tennessee. Dr. Ozpineci is a Fellow of IEEE.

ABSTRACT: The transition to electrified transportation presents unique challenges for medium- and heavy-duty vehicles (MHDVs), requiring innovations in cost, reliability, and performance. The NEXT-DRIVE project is helping this transformation by reimagining the design and development of electric traction drive systems. NEXT-DRIVE aims to cut costs by 20%, increase volumetric power density by 20%, and achieve an operational lifetime of 1 million miles or 25,000 hours for Class 8 trucks by 2030.

Through the integration of high-fidelity multiphysics modeling with artificial intelligence and machine learning, NEXT-DRIVE is delivering high-voltage, high-torque electric drive systems that optimize efficiency, reliability, and cost-effectiveness. These projects are not only targeting longer lifetimes and higher asset utilization but also accelerating the widespread adoption of electric drive-based MHDVs.

The presentation will focus on the innovative approaches driving the success of NEXT-DRIVE, explore the project's ambitious goals, and discuss its future impact on the future of sustainable transportation for MHDVs.

Tuesday, 20 May | 8:45 AM – 9:30 AM

WISTERIA BALLROOM

Powering Forward Automotive Electrification

Dr. Sanjeev Naik

Director, Energy & Propulsion Systems Research
GM

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.

ABSTRACT: Vehicle electrification is now mainstream and expected to show continued growth. This talk will offer perspectives on automotive industry challenges, opportunities, and trends in the electrification context.

Tutorials

Sunday, May 18 | 8:00 AM – 5:30 PM

More information may be found at **IEMDC.org**

Sunday, May 18 | 8:00AM – 11:30 AM

Tutorial 1: Multiphysics Equivalent Circuit Modeling for Electric Machinery – From Macro-scale to Micro-scale

MAGNOLIA 2

Instructors:
Matthew Gardner, *University of Texas at Dallas*
Baoyun Ge, *Georgia Institute of Technology*
Peng Han, *Ansys*

Equivalent circuits have long been used to understand and analyze electric machines. Traditionally, these equivalent circuits, based on lumped elements capturing the main physical characteristics, have provided an intuitive way to explain electric, magnetic, and thermal phenomena. However, high-resolution analysis is necessary in high-fidelity virtual prototyping. To this end, finite element analysis (FEA) is usually the ultimate tool. In this tutorial, we illustrate a continuous spectrum from traditional macro-scale equivalent circuit modeling to micro-scale FEA using equivalent circuits. First, a unified circuit view of multiphysics FEA for electric machines is presented. Specifically, FEA of electromagnetic, thermal, and elastic fields are viewed as constructing and solving equivalent circuits at the micro-scale (mesh) level. The RL and RC circuits familiar to electrical engineers are now transferred to physical processes beyond electrical circuits. Secondly, we introduce recent advancements in magnetic equivalent circuit theory. A new element, magductance, can be used to account for eddy currents. The existence of magductance is indicated in the unified circuit view presented first. the electric power can then be calculated from the magnetic equivalent circuit. Examples using vector magnetic circuit theory, which employs reluctance and magductance, to design, analyze, and control various electromagnetic devices are presented. Lastly, we discuss how to solve these equivalent circuits rapidly, which is necessary for micro-scale evaluation. We discuss using circuit-solving techniques to systematically and efficiently set up a matrix equation taking advantage of symmetric boundary conditions, how to efficiently solve the matrix equation, and how to solve nonlinear equivalent circuits.

Tutorial 2: Magnetic and Thermal Self-commissioning Techniques for AC Motor Drives and Inverters

MAGNOLIA 1

Instructors:
Paolo Pescetto, *Politecnico di Torino*
Shafiq Odhano, *Newcastle University*
Marko Hinkkanen, *Aalto University*
Luca Peretti, *KTH*

Accurate identification of motor drive parameters, including machine and converter characteristics, is essential in various applications. Precise measurement of these parameters is critical for validating machine design procedures and implementing model-based control schemes. Among these parameters, measuring flux saturation curves is especially crucial, as it significantly impacts drive performance. Additionally, understanding the operating limits of the drive necessitates thermal characterization, which plays a key role in optimizing efficiency and performance. Moreover, voltage source inverters introduce non-linear distortion of the phase voltage, which can impair control accuracy and limit performance, particularly in low-speed or sensorless applications. While precise drive characterization can be achieved in a controlled laboratory environment, it is often impractical in industrial settings. This is due to the lack of dedicated testing facilities, the high variability caused by manufacturing tolerances, and time constraints on production lines. In such cases, a self-commissioning approach is commonly employed, where motor drive parameters are determined through fast, automatic tests. These tests are conducted with the drive directly mounted in it target application, without requiring additional measurement hardware beyond the drive itself. While self-commissioning tests provide lower accuracy compared to laboratory characterizations, they offer sufficient precision for calibrating motor control algorithms, even in sensorless applications.

This tutorial explores the state of the art in self-commissioning procedures for both synchronous and asynchronous motor drives, addressing both motor and converter characteristics. Special attention will be given to evaluating saturation characteristics and thermal parameters, as well as methods for compensating for non-linear voltage drops in the converter.

Tutorial 3: 3D Printing for Next-Gen Electrical Machines: Magnetic Materials, Windings, Thermal management, and Electrical Insulation

MAGNOLIA 3

Instructors:
Dr. Ahmed Selema, *USP3D – Ghent University*
Prof. Dr. Peter Sergeant, *Ghent University*

This tutorial aims to explore the advancements and challenges in the manufacturability of electrical machines through the integration of 3D printing technology. The utilization of additive manufacturing (AM) technology in electrical machines has revolutionized the traditional manufacturing process, offering new design freedoms, enhanced material options, and the potential for complex geometries. This session seeks to bring together researchers and practitioners to share their latest findings, theoretical advancements, and practical insights in the realm of 3D printing technology applied to electrical machine design and manufacturing.

Sunday, May 18 | 1:00 PM – 3:00 PM

Tutorial 4: Regenerative Motor Drive Systems for Industrial Applications

MAGNOLIA 1

Instructors:
Ahmed Sayed Ahmed, *Rockwell Automation*
Yogesh Patel, *Rockwell Automation*

Over the last few decades, and especially with recent green energy initiatives, regenerative motor-drive systems have become more widely used in numerous industrial applications. The utilization of Active Front End (AFE) power converters coupled with inverters is one of the most accepted power electronic configurations for these drives. Although much attention is given to the design and control of AFE power converters in grid-tie applications, the same cannot be said for regenerative motor-drive applications. The main advantages of adopting AFE-based power converters in regenerative motor-drive systems include the capability to supply energy back to the grid instead of dissipating excess energy in a resistor. This often requires additional cooling and space. They also offer unity power factor and low total harmonic distortion, which often results in reduced sizing of the main feeder, decreased system losses, and improved system efficiency. AFE-based power converters can also be properly controlled to inject reactive power compensation to the line, thereby enhancing the power factor of the entire utility. This tutorial focuses on the design and analysis of industrial AFE-based power converters in regenerative motor-drive systems. It is divided into four main parts: the first part discusses type of adjustable drives, drives applications. The second part discusses power electronics and filter design, highlighting the main trade-offs in the design process along with thermal considerations; the third part centers on different modes of operation and control design; and the fourth part discusses technical application challenges associated with the deployment and operation of AFE-based power converters.

Tutorial 5: High Power Density Motor Equipped with Additively Manufactured Windings Integrated with Advanced Cooling and Modular Integrated Power Electronics

MAGNOLIA 2

Instructors:
Ayman EL-Refaie, *Marquette University*
Nathan Weise, *Marquette University*
Ali Al-Qarni, *Marquette University*
Armin Ebrahimian, *Marquette University*
Salar Koushan, *Marquette University*
Seyed Iman Hosseini Sabzevari, *Marquette University*

There has been a special focus on aerospace electrification over the past few years. Electric machines and their drive systems have been at the center of these research efforts. Considering the power density and efficiency requirements for aerospace electrification, conventional machine/drive systems might not be feasible for such an application. To that end, the concept of integration of the machine, drive system, and cooling system known as Integrated Modular Motor Drive (IMMD) has been introduced. On the power electronics side, the possibility of achieving high power density and efficiency is increased by the emergence of the wide band gap devices (WBGDs). Their intrinsic benefits such as low on-state resistance and fast turn on/off speed contribute to lower conduction and switching losses which in turn lead to higher efficiency. However, designing a proper thermal management system, optimized component placement, and optimal PCB layout is challenging due to processing high power at small footprints. On the machine side, the focus is typically on increasing the machine electric and magnetic loading as well as the mechanical tip speed. This can be achieved via novel machine topologies, advanced materials, advanced manufacturing as well as integrated systems with shared advanced cooling. In this tutorial, the step-by-step design of a motor and its integrated drive system is presented. The advanced cooling system design for both motor and drive system is described. Finally, the overall integrated system is demonstrated, and test results are presented.

Tutorial 6: Innovative Approaches to Electric Motor Design: AI-Driven Reduced-Order Modeling and Geometry Optimization

MAGNOLIA 3

Instructors:
Philippe Wendling, *Altair Co.*
Farid Zidat, *Altair Co.*
Lavanya Vadamodala, *Altair Co.*

This tutorial presents two innovative approaches to enhancing electric motor design and performance.

1. Leveraging AI for Reduced-Order Modeling (RomAI): We explore a hybrid methodology that combines finite element analysis (FEA) data with artificial intelligence (AI) to create reduced-order models. This approach aims to balance accuracy and computational efficiency, using an induction motor (IM) model as a case study. Participants will learn to integrate these techniques to improve efficiency calculations across various operating conditions.

2. Optimizing E-Motor Geometry with Physics AI: The second focus is on Physics AI, which identifies the relationship between shape and performance in physics applications. Users will be guided through optimizing the geometry of electric motors, specifically the Interior Permanent Magnet Synchronous Motor (IPMSM). The tutorial covers setting up a motor simulation dataset, developing an AI model, and refining the optimization process to achieve enhanced performance predictions.

By the end of this tutorial, participants will gain valuable insights into AI-driven modeling and geometric optimization techniques for electric motors.

Sunday, May 18 | 3:30 PM – 5:30 PM

Tutorial 7: Current Source Inverters using SiC and GaN Wide Bandgap Devices and Comparison with Voltage Source Inverters

MAGNOLIA 2

Instructors:
Bulent Sarlioglu, *University of Wisconsin-Madison, USA*

Most recently, with the advance of state-of-the-art wide bandgap devices, the efficiency of the motor drives can be increased significantly compared to using Si devices such as IGBTs. The 2-level voltage source inverter (VSI) is the dominant choice for motor drive applications that are currently in production. However, there are some serious limitations experienced by VSIs when Si-based switches are directly replaced by WBG switches that are attributable to the extremely high dv/dt at the switch output terminals. These challenges include elevated electromagnetic interference (EMI) amplitudes, motor terminal over voltages, and bearing damage risks due to discharge currents. The emergence of WBG power devices opens opportunities for current source inverters (CSIs) to provide a promising alternative drive configuration for motor drive applications. In this tutorial, the CSI will be introduced as a promising alternative approach for applying WBG switches in future motor drives that overcomes several of the key obstacles that hinder their use in conventional VSIs as well as offering some intriguing application advantages made possible by the special features of the CSI topology. The advantages and challenges of CSIs using WBG devices will be discussed. Special attention will be focused on the game-changing potential of M-BD switches in future CSI-based integrated motor drives. Finally, a comprehensive comparison between VSI can CSI with DC-voltage power source and sine voltage output will be introduced including passive components, output performance, efficiency, and volume. Two projects that applied the combination of wide-bandgap power switches and a CSI into an integrated motor drive using a high-performance PM synchronous motor will be presented as examples.

Tutorial 8: Design, Modelling and Mathematical Formulations of PM-Free Special Machines: from Theory to Practice

MAGNOLIA 3

Instructors:
Doga Ceylan, *Eindhoven Univ. of Tech.*
Joost van Zwieten, *Eindhoven Univ. of Tech.*
Mitrofan Curti, *Eindhoven Univ. of Tech.*

This tutorial provides a comprehensive introduction to modeling and designing special permanent magnet-free (PM-free) electric machines using open-source numerical tools, taking the participants from the mathematical concepts up to computation of performance indicators of these machines. We begin by exploring the motivations behind these machines, outlining their advantages and trade-offs compared to traditional permanent magnet designs. The fundamentals of magnetic field theory are introduced, covering Maxwell's equations, magnetostatics, material models, losses, and performance computation methods. The tutorial then delves into the capabilities of Python-based numerical library Nutils, outlining its application in solving complex electromagnetic problems. Participants will learn how to formulate and solve magnetostatic problems, including simple airgap model to familiarize them with the library, and finally, a reluctance machine example will be used to demonstrate how the losses, and torque production, among other features, are computed. Hands-on exercises guide participants through implementing these concepts using example scripts, enabling them to visualize magnetic field distributions, calculate inductances, and compute torque profiles. This tutorial equips attendees with the knowledge and practical skills necessary to design and analyze rare earth PM-free electric machines effectively, leveraging the power of open-source tools, giving insights on the backbones functionality of numerical tools.

Monday, May 19 | 10:00 AM – 12:00 PM

Special Session 1: Advancing Rare-Earth-Free and Sustainable Electric Machine Design: Innovations and Applications

CYPRESS

Organizers:

Dr. Bulent Sarlioglu, *Professor, University of Wisconsin-Madison*
Dr. Woongkul Lee, *Assistant Professor, Purdue University*

Speakers:

Babak Fahimi, *Professor and Distinguished Chair of Engineering, University of Texas at Dallas, USA*
Peter Sergeant, *Professor, Ghent University, Belgium*
Seungdeog Choi, *Professor, Mississippi State University, USA*
Prof. Simone Ferrari, *Assistant Professor, Politecnico di Torino, Italy*
Barrie Mecrow, *Professor, Newcastle University, UK*
Akira Chiba, *Professor, Institute of Science Tokyo, Japan*

This special session will delve into pioneering advancements in the design, development, and application of rare-earth-free and sustainable electric machines. In response to the urgent demand for environmentally friendly and resource-efficient technologies, the session will focus on innovative materials, advanced topologies, recyclability, and methodologies that mitigate or eliminate the reliance on rare-earth elements while optimizing efficiency and performance. By bringing together leading researchers and industry experts, the session aims to highlight cutting-edge strategies and sustainable practices in electric machine design, fostering technological progress aligned with the global transition toward a sustainable and low-carbon future.

Monday, May 19 | 1:30 PM – 3:30 PM

Special Session 2: Novel Materials and Additive Manufacturing Techniques to Improve the Performance Limits of Electric Machines

CYPRESS

Organizers:

Dr. Nishanth Gadiyar, *Oak Ridge National Laboratory*
Dr. Vandana Rallabandi, *Oak Ridge National Laboratory*
Dr. Chins Chinnasamy, *Oak Ridge National Laboratory*

Speakers:

Eric Severson, *Associate Professor, University of Minnesota*
Todd Monson, *Principal Member of the Technical Staff, Sandia National Lab*
Nick Simpson, *Associate Professor. University of Bristol, U.K.*
Gaoyuan Ouyang, *Professor, Iowa State University and AMES National Lab*
Prof. Ayman EL-Refaie, *Marquette University, USA*

The rapidly growing demand for more efficient, compact, and powerful electric machines is driving innovation in both materials science and manufacturing techniques. Electric machines are central to various applications, including electric vehicles (EVs), renewable energy systems, and industrial automation. However, the achievable power density, efficiency, and other performance metrics are limited by today's materials and manufacturing methods. This special session explores the potential of novel materials and advanced additive manufacturing (AM) techniques to push the boundaries of electric machine performance, addressing the challenges of energy efficiency, weight reduction, and cost-effectiveness.

New materials with enhanced electrical, magnetic, and thermal properties are at the fore front of electric machine innovation. For instance, advanced soft magnetic materials, ultra-conductors, and nanostructured materials are poised to dramatically improve the performance of components such as stators, rotors, and windings. These materials offer superior magnetic permeability, lower eddy current losses, and improved conductivity, leading to more efficient and power-dense machines.

Additive manufacturing (AM) presents a revolutionary approach for producing complex geometries and highly customized components, which were previously impossible or prohibitively expensive using traditional manufacturing methods. AM is a key enabler for the creation of electric machine components with optimized topologies, reduced material waste, and enhanced thermal and magnetic properties. These techniques also facilitate rapid prototyping and short production cycles, allowing for more flexible and cost-effective design iterations. The ability to produce complex multi-material structures using AM further enables the integration of novel materials within electric machines, offering customized solutions to specific performance needs.

Advanced materials and additive manufacturing techniques together present a paradigm shift in the design and production of electric machines. By enabling the development of components with enhanced performance characteristics, these innovations will help address the growing demands for higher power densities, energy efficiency, and reliability in a wide range of applications. This session will provide a platform for researchers, engineers, and industry professionals to explore the latest advancements, share insights, and discuss the challenges and future opportunities in utilizing novel materials and additive manufacturing for electric machine performance improvement.

Special Sessions

Tuesday, May 20 | 10:00 AM – 12:00 PM

Special Session 3: Development of Advanced Permanent Magnet Machines and Drives for E-Mobility

CYPRESS

Organizers:

Feng Chai, *Full Professor, Harbin Institute of Technology*
Yanlei Yu, *Research Fellow, Nanyang Technological University*

Speakers:

Josep Pou, *Professor, City University of Hong Kong*
Feng Chai, *Professor, Harbin Institute of Technology*
Yulong Pei, *Professor, Harbin Institute of Technology*
Xin Yuan, *Assistant Professor, University of Aberdeen*
Qingxiang Liu, *Research Fellow, Nanyang Technological University*
Jingwei Zhu, *Research Fellow, Nanyang Technological University*

This special section highlights advancements in permanent magnet machines and drives for E-mobility. As modern transportation evolves, innovative solutions like electric vehicles (EVs), electric aircraft, and eVTOL aircraft are gaining global traction. Permanent magnet machines, as the cornerstone of propulsion systems, play a pivotal role in achieving the high efficiency and reliability demanded by these emerging technologies.

Meeting the stringent requirements of E-mobility, especially in aviation where weight isa critical constraint, necessitates propulsion systems with high torque density, robust fault tolerance, high efficiency, and precise control accuracy. These attributes are essential for delivering reliable power and consistent performance under diverse and demanding conditions. Fault-tolerant electric motors are particularly vital, as they mitigate risks during potential failures, enhancing safety and operational dependability. Thermal modeling and cooling system optimization are key to maximizing output performance. Advancements in theoretical modeling and simulation methods are crucial to improve motor pre-design accuracy, ensuring alignment between design parameters and practical requirements. Additionally, some emerging technologies, such as artificial intelligence (AI), are further enhancing computational efficiency in design and optimization processes. By integrating AI, designers can achieve more accurate predictions and faster iterations, accelerating the development of next-generation electric motors tailored to E-mobility needs.

The future of electric propulsion depends on systems that balance high torque density with exceptional fault tolerance. To drive progress in this field, we invited submissions to the special session, “Development of Advanced Permanent Magnet Machines and Drives for E-Mobility.” This session aims to provide a platform for researchers and practitioners to share cutting-edge advancements, address critical challenges, and explore new directions for E-mobility.

Monday, May 19 | 10:00 AM – 12:00 PM

Oral Session 1: Rotating Electric Machines 1

MAGNOLIA 1

Session Chairs:
Ayman EL-Refaie, *Marquette University*
Ronghai Qu, *Huazhong University of Science and Technology*

10:00 AM | Design and Fabrication of a Ferrofluid-Gap Test Rig for Radial Flux Electrical Machines [#7031]
Fergus Hall[2], Alasdair McDonald[2], Markus Mueller[2], Mike Galbraith[1]
[1]Fountain Design Ltd, United Kingdom; [2]University of Edinburgh, United Kingdom

10:20 AM | Torque Enhancement of Electrically Excited Synchronous Machines by Cross Coupling Braking Torque Mitigation [#7083]
Tianzheng Xiao, Zi Qiang Zhu
University of Sheffield, United Kingdom

10:40 AM | Investigation of a Variable Flux PMSM with Mechanical Modulators Between the Rotor Poles [#7107]
Gabriel Weissitsch, Thomas Krainer, Edmund Marth, Gerd Bramerdorfer, Markus Peer
Johannes Kepler University Linz, Austria

11:00 AM | Characterization of a Variable Flux Machine with Mechanical Flux Modulators Above the Rotor Poles [#7110]
Sarah Schinwald, Gabriel Weissitsch, Edmund Marth, Gerd Bramerdorfer, Thomas Krainer
Johannes Kepler University Linz, Austria

11:20 AM | Speed Range Extension for E-Core Outer-Rotor Flux-Switching Permanent Magnet Machines Through Winding Reconfiguration [#7121]
Zhiyuan Xu[2], Ming Cheng[2], Hang Yin[2], Honghui Wen[1], Ying Fan[2]
[1]Hunan University, China; [2]Southeast University, China

11:40 AM | Influence of Stator Core on the Vibration Behavior of Permanent Magnet Machines with Hairpin Winding [#7138]
Zhongze Wu, Erfang Fu, Jinwen Du, Wentao Zhang, Wei Hua
Southeast University, China

Oral Session 2: Electric Drives 1

MAGNOLIA 2

Session Chairs:
Nick Baker, *Newcastle University*
Xu Deng, *Newcastle University*

10:00 AM | Quantitative Analysis of the Torque-Speed Curve for a Flat Wire Permanent Magnet Machine Drive System [#7108]
Zhongze Wu, Xueyi Yan, Zhimian Wang, Wentao Zhang, Wei Hua
Southeast University, China

10:20 AM | Extended SVM for Dual Inverter Fed Adjustable Field Permanent Magnet Synchronous Motor Using Zero-Sequence Current [#7139]
Kiyohiro Iwama, Yutaro Hiyoshi, Toshihiko Noguchi
Shizuoka University, Japan

10:40 AM | Elimination of Current and Position Sensors in Adjustable Speed SRM Drives [#7061]
Vahid Rafiei, Babak Fahimi
University of Texas at Dallas, United States

11:00 AM | Reinforcement Learning Control of Three-Level Converter Permanent Magnet Synchronous Machine Drives [#7100]
Mario Peña[1], Maximilian Schenke[1], Darius Jakobeit[1], Barnabas Haucke-Korber[1], Oliver Wallscheid[2]
[1]Universität Paderborn, Germany; [2]Universität Siegen, Germany

11:20 AM | Modeling of High-Frequency Common-Mode Impedances for Hairpin Winding Machines [#7111]
Hans-Georg Kneidinger, Annette Muetze
Graz University of Technology, Austria

11:40 AM | Reinforcement Learning-Based Current Controller for Switched Reluctance Motor Drives [#7113]
Gustavo Xavier Prestes[1], William K. Moreira[1], Filipe P. Scalcon[2], Cassiano Rech[1], Andrew M. Knight[2], Rodrigo P. Vieira[1]
[1]Universidade Federal de Santa Maria, Brazil; [2]University of Calgary, Canada

Oral Session 3: Special Machines, Electromagnetic Actuators & Sensors 1

MAGNOLIA 3

Session Chairs:
Le Chang, *General Motors*
Alireza Fatemi, *General Motors*

10:00 AM | A Negative Stiffness Double-Helical Torsional Magnetic Spring for a Wave Energy Converter [#7273]
Payam Emami[2], Jonathan Bird[2], Dawei Che[2], Bertrand Dechant[1]
[1]FluxMagic, Inc., United States; [2]Portland State University, United States

10:20 AM | Investigation of High-Performance Direct-Drive Vernier Motors with Various Permanent Magnet Configurations [#7032]
Jingwei Zhu[1], Huanzhi Wang[1], Yiming Shen[1], Kailiang Yu[1], Hiroshi Yamamoto[2], Ryo Kajitani[2], Christopher Ho Tin Lee[1]
[1]Nanyang Technological University, Singapore; [2]Panasonic Industry Co., Ltd., Japan

10:40 AM | Concept for the Production of Perforated and Endless Paper-Based Slot Insulation for Use in Rail-Bound Traction [#7033]
Alexander Vogel, Felix Wirthmann, Steffen Fritsch, Marcel Baader, Jörg Franke, Florian Risch
Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

11:00 AM | A Novel High-Torque-Density Permanent Magnets Vernier Machine with Enhanced Flux Modulation Effect and Armature MMF [#7098]
Yuwei Zhang, Li Fang, Dawei Li, Yu Zhao, Ronghai Qu, Wenwen Guo
Huazhong University of Science and Technology, China

11:20 AM | Rotor Winding Analysis for Superconducting Electrically Excited Synchronous Machines [#7283]
Lorenzo Perilli[1], Ines Santos Perdigao Peixoto[1], Federica Graffeo[1], Joao Felipe Pereira Fernandes[2], Alberto Tenconi[1], Silvio Vaschetto[1]
[1]Politecnico di Torino, Italy; [2]University of Lisbon, Portugal

11:40 AM | Asymmetric PM Loss Suppression of Consequent Pole PM Vernier Machine by Iron Pole Shaping Methods [#7117]
Yinzhao Zheng, Dawei Liang, Zi Qiang Zhu
University of Sheffield, United Kingdom

Oral Session 4: Thermal, Materials & Efficiency Challenges 1

MAGNOLIA 4

Session Chairs:
Matthew Gardner, *University of Texas at Dallas*
Mona Ghassemi, *University of Texas at Dallas*

10:00 AM | The Tensile Strength of Neodymium Iron Boron Magnets: Weibull Analysis and the Implications for PM Motor Design [#7050]
David Giles, Xu Deng, Barrie Mecrow
Newcastle University, United Kingdom

10:20 AM | Compatibility Study of Water-Based Lubricants and Insulation Systems in Low-Voltage Electrical Machines for Automotive Applications [#7088]
Hujun Peng[2], Jingning Wu[2], Hakim El Bahi[1], Catherine Charrin[1], Andreas Thul[2], Kay Hameyer[2], Simon Steentjes[2]
[1]Centre de Recherche Solaize, TotalEnergies, France; [2]RWTH Aachen University, Germany

10:40 AM | Reducing Calorimetric Loss Measurement Time for Electric Machines Through Optimized Operating Point Sequencing [#7137]
Jasper Nonneman[1], Ilya T'Jollyn[2], Jeroen De Kooning[1], Michel De Paepe[1]
[1]Ghent University, Belgium; [2]University of Antwerp, Belgium

11:00 AM | Development and Analysis of a Novel Electric Motor Rotor Shaft Cooling System [#7160]
Steven Vanhee[2], Jaywant Pawar[1], Frederik Desmet[1], Jasper Nonneman[2], Michel De Paepe[2]
[1]Dana Incorporated, Belgium; [1]Dana Incorporated, India; [2]Ghent University, Belgium

11:20 AM | Comprehensive Overview of Using Additive Manufacturing for Multiphysics Performance Improvement of Electric Machines [#7183]
Ali Zarghani, Peter Sergeant, Mohamed N. Ibrahim
Ghent University, Belgium

11:40 AM | Impact of Lamination Punching on Electromagnetic Performances & NVH Behavior of PMSM: A Comprehensive Study [#7189]
Farid Zidat, Lavanya Vadamodala, Philippe Wendling
Altair Engineering, United States

Monday, May 19 | 1:30 PM – 3:30 PM

Oral Session 5: Design Optimization, Modeling & Simulation 1

MAGNOLIA 1

Session Chairs:
Hailing Huang, *University of Nottingham*
Mehmet Kulan, *Newcastle University*

1:30 PM | A Comparative Study of Meta-Modeling Approaches for IPMSM Performance Prediction with Neural Networks [#7043]
Mitja Garmut[3], Simon Steentjes[2], Martin Petrun[1]
[1]FERI UM, Slovenia; [2]RWTH Aachen University, Germany; [3]University of Maribor, Slovenia

1:50 PM | Universal Modeling Methods of Induction Machines to Study the Influence of Rotor Existence on Terminal Overvoltages During Inverter-Fed Operation [#7096]
Hujun Peng, Yue Yu, Simon Steentjes
RWTH Aachen University, Germany

2:10 PM | Modeling and Optimization of Self-Pumping Air-Cooled Thermal Management System for a High Specific Power Outer Runner Electric Motor [#7134]
Jianqiao Xiao[1], Kevin Uvodich[1], Chengzhang Fu[2], Eungi Youn[3], Finnley Ryan[3], Anjana Jayasanka Samarakoon[3], Kiruba Haran[3]
[1]Hinetics Inc., United States; [2]Indiana University Bloomington, United States; [3]University of Illinois Urbana Champaign, United States

2:30 PM | Simple Design Optimization and Rated Slip Identification of Radial-Flux and Axial-Flux Induction Motors Based on Finite Element Analysis [#7158]
Gustavo Pérez-Guirriman[1], Carlos Madariaga-Cifuentes[1], Cesar Gallardo[2], Felipe Santacruz[1], Juan A. Tapia Ladino[1]
[1]Universidad de Concepción, Chile; [2]University of Nottingham, United Kingdom

2:50 PM | Design and Construction of a Fault-Tolerant Yokeless and Segmented Armature Axial Flux Motor for Aerospace Actuator Applications [#7164]
Mehmet Kulan, Nick Baker
Newcastle University, United Kingdom

3:10 PM | Design of Electric Machines Operating in Heavy Saturation Using a Hybrid Magnetostatic Method of Moments [#7194]
Carlos Castillo[2], Steven Pekarek[2], Daniel Horvath[1]
[1]P. C. Krause and Associates, United States; [2]Purdue University, United States

Oral Session 6: Condition Monitoring, Fault Diagnosis & Prognosis 1

MAGNOLIA 2

Session Chairs:
Ahmed Syed Ahmed, *Rockwell Automation*
Yogesh Patel, *Rockwell Automation*

1:30 PM | Nonlinear Control of Buck-Type Converters for Micro-Wind Generators [#7163]
Noah Wilding, Shuzan Kumar Sarkar, Shruti Pandey, Michael L. McIntyre
University of Louisville, United States

1:50 PM | Modular and Compact Neural Network Framework for Internal Fault Detection in Generators Using Current Signature Data [#7011]
Sergio Avila[1], Rafael Noboro Tominaga[3], Rodolfo Rocha[2], Maurício B. C. Salles[3], Bruno Carmo[3], Renato Monaro[3]
[1]Federal Institute of Santa Catarina, Brazil; [2]Federal University of Mato Grosso, Brazil; [3]Universidade de São Paulo, Brazil

2:10 PM | Experimental Analysis of Negative-Sequence Currents Due to InterTurn Faults in the Stator of a DFIG for Protection and Diagnostic Purposes [#7012]
Sergio Avila[1], Rafael Noboro Tominaga[3], Rodolfo Rocha[2], Renato Monaro[3], Maurício B. C. Salles[3], Bruno Carmo[3]
[1]Federal Institute of Santa Catarina, Brazil; [2]Federal University of Mato Grosso, Brazil; [3]Universidade de São Paulo, Brazil

2:30 PM | Unsupervised Anomaly Detection for Industrial Data Using Generative Adversarial Networks [#7014]
Michel Lehmann, Andreas Möckel
Technische Universität Ilmenau, Germany

2:50 PM | Map-Based Behavior of a Dual Three Phase Machine Under Inter-Turn Short Circuit Faults [#7020]
Daniel Walch[1], Yves Burkhardt[2], Maximilian Hofmann[1]
[1]Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany; [2]Technische Universität Darmstadt, Germany

3:10 PM | Electric Motor Drive Anomaly Detection Using AutoGluon [#7023]
Xiaoqi Wang, Lizon Maharjan, Tausif Husain
Amazon PrimeAir, United States

Oral Session 7: Transportation Applications 1

MAGNOLIA 3

Session Chairs:
Baoyun Ge, *Georgia Institute of Technology*
Yaser Chulaee, *Lennox International Inc.*

1:30 PM | High-Frequency Modeling of Surge Voltage Mitigation in Long-Cable-Fed PMSM-Drive System with Adaptive Impedance Coils [#7323]
Mohamed Metwly[1], Jiangbiao He[1], Majid T. Fard[2]
[1]University of Tennessee, Knoxville, United States; [2]GE Aerospace, United States;

1:50 PM | Implementing Electrical Steel Properties in Excess Loss Modelling of Reduced Critical Rare Earth Electric Traction Machines [#7035]
Jan Rens[2], Sigrid Jacobs[1]
[1]ArcelorMittal Global R&D, Belgium; [2]ArcelorMittal Global R&D Gent, Belgium

2:10 PM | Analysis of Startup Characteristics of Single-Phase Wound-Brushless Exciters Using Analytical Modeling for Aircraft Integrated Starter Generator [#7029]
Thanh-Tuan Nguyen, Sarbajit Paul, Hyeongjin Kim, Jaebeom Kang, Jiheon Lee, Jiyoung Lee
Korea Electrotechnology Research Institute, Korea

2:30 PM | Model Compensation-Based Active Disturbance Rejection Control of Brushless Dual-Electrical-Port Dual-Mechanical-Port Machine [#7042]
Hui Wu, Shuangxia Niu, Mingyuan Jiang, Wei Liu, Kwok-Tong Chau
Hong Kong Polytechnic University, Hong Kong

2:50 PM | Inset Permanent Magnet Machine for Direct Wheel Drive Applications [#7067]
Sreeju Sreedharan Nair, Piyush Chauhan
TVS Motor Company, India

3:10 PM | Optimal System Excitation of a Permanent Magnet Synchronous Motor Using Differentiable Model Predictive Excitation [#7037]
Hendrik Vater[1], Mario Peña[1], Oliver Wallscheid[2]
[1]Universität Paderborn, Germany; [2]Universität Siegen, Germany

Oral Session 8: Energy & Grid-Connected Applications 1

MAGNOLIA 4

Session Chairs:
Paolo Pescetto, *Politecnico di Torino*
Eric Severson, *University of Minnesota*

1:30 PM | Manufacturing of Flux Modulators for Mass-Optimized Concentric Magnetic Gearing [#7038]
Justin J. Scheidler[3], Thomas F. Tallerico[3], Kyle R. Whitling[1], Aaron D. Anderson[3], Jonathan J. Veneziano[3], Zachary A. Cameron[2]
[1]HX5, LLC, United States; [2]NASA Goddard Space Flight Center, United States; [3]NASA John H. Glenn Research Center at Lewis Field, United States

1:50 PM | Optimized Control Approach for PMSM-Driven Solar Water Pumping with Improved Stability and Dynamic Response [#7146]
Jieun Jung, Goeun Jeon, Kahyun Lee
Ewha Womans University, Korea

2:10 PM | Evaluation of Root Cause of Hot-Spot Temperatures Using Full-Size Series-Connection Mock-Up Models of Turbine Generators [#7182]
Kenichi Hattori[1], Kazuhiko Takahashi[1], Kenji Nakamura[2]
[1]Mitsubishi Generator CO, LTD., Japan; [2]Tohoku University, Japan

2:30 PM | Systematic Design Approach for Dual-Pole Line Start Permanent Magnet Synchronous Motors [#7211]
Farhad Mahdavi[2], Aliakbar Damaki Aliabad[2], Ebrahim Amiri[1]
[1]California State University, Long Beach, United States; [2]Yazd University, Iran

2:50 PM | Effect of the Main-to-Auxiliary Winding Turn Ratio in Single-Phase Dual-Pole Line Start Permanent Magnet Synchronous Motor [#7212]
Fakhrossadat Ghoroghchian[2], Yi Du[2], Ebrahim Amiri[1]
[1]California State University, Long Beach, United States; [2]Jiangsu University, China

3:10 PM | Design and Optimization of a Novel 15-Phase Redundant Flux-Switching Permanent Magnet Machine for Wind Power Generation [#7274]
Pirat Khunkitti[1], Pattasad Seangwong[1], Chainattapol Nissayan[1], Nuwantha Fernando[2], Apirat Siritaratiwat[1]
[1]Khon Kaen University, Thailand; [2]Royal Melbourne Institute of Technology, Australia

Tuesday, May 20 | 10:00 AM – 12:00 PM

Oral Session 9: Rotating Electric Machines 2

MAGNOLIA 1

Session Chairs:
Peter Sergeant, *Ghent University*
Peng Han, *Ansys Inc.*

10:00 AM | Bridgeless Rotor Synchronous Reluctance Machine Design Evaluation [#7149]
Miika Parviainen, Charles Nutakor, Arash Allahyari, Iikka Martikainen, Ilkka Poutiainen, Jussi Sopanen, Ilya Petrov, Juha Pyrhönen
LUT University, Finland

10:20 AM | Design of a Magnetically-Geared Actuator for Extremely Cold and Dusty Space Environments [#7039]
Justin J. Scheidler[2], Aaron D. Anderson[2], Thomas F. Tallerico[2], Peter Hoge[1], George Harpster[1], Kyle R. Whitling[1], Jesse Hawk[1], Malcolm Robbie[1]
[1]HX5, LLC, United States; [2]NASA John H. Glenn Research Center at Lewis Field, United States

10:40 AM | Improving Torque Density Through Leakage Reduction in IPM Machines for High Performance Applications [#7200]
Md Sariful Islam, Mohammad Islam
HL Mechatronics, United States

11:00 AM | Torque Ripple Reduction of an Axial-Flux Permanent Magnet Motor with Distributed Winding [#7201]
Junichi Asama[2], Tomoki Sugita[2], Wataru Kitagawa[1]
[1]Nagoya Institute of Technology, Japan; [2]Shizuoka University, Japan

11:20 AM | Reduction of Torque Ripples in Double Stator Wound Field Flux Switching Motor by Rotor Shaping and Tilting of Stator Magnetic Axis [#7226]
Hillary Idoko, Udochukwu Akuru, Olawale Popoola
Tshwane University of Technology, South Africa

11:40 AM | A Novel Variable-Flux Permanent Magnet Machine with Multiple Winding Switching Modules [#7309]
Hui Yang[2], Zhengnan Xie[2], Cheng Qian[2], Yiming Shen[1], Shuhua Fang[2], Heyun Lin[2]
[1]Nanyang Technological University, Singapore; [2]Southeast University, China

Oral Session 10: Electric Drives 2

MAGNOLIA 2

Session Chairs:
Yaser Chulaee, *Lennox International Inc.*
Jingwei Zhu, *Nanyang Technological University*

10:00 AM | Multi-Frequency Current Harmonics Suppression of Dual Three-Phase PMSM Drives Considering Non-Ideal Factors [#7120]
Kailiang Yu, Chenhao Zhao, Huanzhi Wang, Yiming Shen, Jingwei Zhu, Christopher Ho Tin Lee
Nanyang Technological University, Singapore

10:20 AM | Differentiable Predictive Control of Permanent Magnet Synchronous Motors [#7126]
Ali Abdelwanis[2], Felix Berkel[1], Jan Achterhold[1], Mohammad Abu-Ali[1], Joshua Adamek[2], Sergio Lucia[2]
[1]Corporate Research of Robert Bosch GmbH, Germany; [2]Technische Universität Dortmund, Germany

10:40 AM | A Deep Reinforcement Learning-Based Direct Switching Controller Design for Permanent Magnet Synchronous Motors [#7128]
Mohammad Abu-Ali[1], Felix Berkel[1], Maximilian Manderla[1], Daniel Görges[2]
[1]Corporate Research of Robert Bosch GmbH, Germany; [2]Rheinland-Pfälzische Technische Universität Kaiserslautern-Landau, Germany

11:00 AM | Rotor Speed Determination of Induction Machines Using End Ring Leakage Flux Measurement [#7143]
Nico Remus[2], Oliver Meixner[2], Thomas Schuhmann[1], Uwe Schuffenhauer[1], Arne Brix[2]
[1]Dresden University of Applied Sciences, Germany; [2]IAV GmbH, Germany

11:20 AM | Data-Driven Multi-Objective Optimization-Based Excitation Selection Method for an Enhanced Control of a Variable Flux Reluctance Machine [#7188]
Göksenin Hande Bayazıt, Doğa Ceylan, Esin Ilhan Caarls, Elena Lomonova
Eindhoven University of Technology, Netherlands

11:40 AM | Investigation on Noise and Vibration of Rare-Earth Free High-Speed Carbon Composite Wrapped IPM [#7223]
Md Rashedur Rahman, Seungdeog Choi
Mississippi State University, United States

Oral Session 11: Special Machines, Electromagnetic Actuators & Sensors 2

MAGNOLIA 3

Session Chairs:
Yilmaz Sozer, *University of Akron*
Bilal Akin, *University of Texas at Dallas*

10:00 AM | An Inverse Modeling Approach for Thermal Properties Estimation in Multi-Layer PMLSMs [#7115]
Gan Fu, Mitrofan Curti, Calina Ciuhu, Elena Lomonova
Eindhoven University of Technology, Netherlands

10:20 AM | Torque Density Enhancement of Magnetic Worm-Geared Motor with Half Skew Structure by Introducing Curved Tooth Shape [#7044]
Haruki Yamanaka, Yukio Tsutsui, Akira Chiba, Kyohei Kiyota, Yusuke Fujii, Mitsuru Endo
Institute of Science Tokyo, Japan

10:40 AM | Anodised Aluminium Foil Windings for Sustainable YASA Axial Flux Machines [#7021]
Ludovic De Decker, Peter Sergeant, Hendrik Vansompel
Ghent University, Belgium

11:00 AM | A Novel Axial-Flux Permanent Magent Vernier Machine with H-Core Stators and Heat Pipes for Electric Aircraft Propulsion System [#7239]
Yanlei Yu[2], Feng Chai[1], Yulong Pei[1], Yiming Shen[2], Jingwei Zhu[2], Christopher Ho Tin Lee[2]
[1]Harbin Institute of Technology, China; [2]Nanyang Technological University, Singapore

11:20 AM | Hybrid Time-Invariant and Time-Variant Linear Motion Control of a Levitating Platform [#7286]
Andrei Zhuravlev[1], Viktor Dodonov[1], Sadjad Madanzadeh[1], Atte Putkonen[1], Leonid Chechurin[1], Rafal Jastrzebski[2]
[1]LUT University, Finland; [2]University of Turku, Finland

11:40 AM | Characterization-Based Modelling and Control of a Two-Degrees-of-Freedom Axial Flux Machine [#7075]
Matthew Bagnara[1], David Klink[1], Greg Heins[2], Behrooz Bahrani[1]
[1]Monash University, Australia; [2]Regal Rexnord, Australia

Oral Session 12: Thermal, Materials & Efficiency Challenges 2

MAGNOLIA 4

Session Chairs:
Vandana Rallabandi, *Oak Ridge National Lab*
Alireza Fatemi, *General Motors*

10:00 AM | Thermal Modeling of a High-Speed Solid Rotor Induction Machine with Forced Air-Cooling System [#7213]
Tokzhan Toleukaiyr[1], Felipe Ortiz-Bustos[1], Aki Grönman[1], Pia Lindh[1], Teemu Turunen-Saaresti[1], Janne Nerg[1], Michele Degano[2]
[1]LUT University, Finland; [2]University of Nottingham, United Kingdom

10:20 AM | Impact of Multilevel Inverter Supply on Losses in Permanent Magnet Synchronous Machines Considering High-Frequency Current Components [#7231]
Mostafa Fereydoonian, Ali Halawa, Avinash Dornala, Woongkul Lee
Purdue University, United States

10:40 AM | Design and Quantitative Analysis of Dual Permanent Magnet Linear Machine with Reduced Rare-Earth PM Usage [#7277]
Yiming Shen[1], Jingwei Zhu[1], Yanlei Yu[1], Kailiang Yu[1], Qinfen Lu[2], Christopher Ho Tin Lee[1]
[1]Nanyang Technological University, Singapore; [2]Zhejiang University, China

11:00 AM | An Analytical Model for the AC Copper Losses in the Flat-Wire Motors [#7278]
Lutong Hou[3], Qirong Jiang[3], Chengcheng Liu[1], Jing Pang[2]
[1]Hebei University of Technology, China; [2]Qingdao Yunlu Advanced Materials Technology Co., Ltd., China; [3]Tsinghua University, China

11:20 AM | Segmented Stators Offering Improved Thermal Performance and the Potential for Greater Power Density [#7281]
Luke Saunders, Glynn Atkinson, Yusuf Ugurluoglu
Newcastle University, United Kingdom

11:40 AM | Topology Optimization of Carbon-Taped Internal Permanent Magnet Machine with Non-Linear Mechanics Consideration [#7045]
Nicolas Abdelnour[1], Olivier Brun[1], Thomas Lehmann[1], Helmut Schmid[2], Lavanya Vadamodala[1]
[1]Altair Engineering, France; [1]Altair Engineering, Germany; [1]Altair Engineering, United States; [2]ZF Motor, Germany

Wednesday, May 21 | 8:00 AM – 10:00 AM

Oral Session 13: Design Optimization, Modeling & Simulation 2

MAGNOLIA 1

Session Chairs:
Farid Zidat, *Altair Engineering*
Caleb Li, *Toshiba International R&D*

8:00 AM | Performance Evaluation of Aluminum and Copper Windings in Electrically Excited Synchronous Machines Considering Drive Cycle Efficiency and Maximum Continuous Power [#7233]
Andreas Gneiting, Felix Burkard, Nejila Parspour
Universität Stuttgart, Germany

8:20 AM | Hybrid FEA and Meta-Modeling for DE Optimization of a Highly Saturated Spoke IPM [#7260]
Oluwaseun A. Badewa[2], Marcelo D. Silva[3], Rosemary E. Alden[2], Pedram Asef[1], Dan M. Ionel[2]
[1]e-Motion Laboratory, Advanced Propulsion Laboratory, University College London, United Kingdom; [2]SPARK Lab, University of Kentucky, United States; [3]Uppsala University, Sweden

8:40 AM | Optimization of the Tooth Geometry for Axial Flux Machine with Non-Grain Oriented and Grain Oriented Electrical Steel [#7264]
Cristian Demian[2], Abdenour Abdelli[1], Jean-Philippe Lecointe[2], Gianluca Zito[1]
[1]IFP Energies Nouvelles, France; [2]Laboratoire Systèmes Électrotechniques et Environnement, Université d'Artois, France

9:00 AM | Non-Circulating Bearing Currents in Drum-Winding Machine: Threat Level and Role of End Windings [#7270]
Konstantin Vostrov, Ilya Petrov, Shruti Singh, Juha Pyrhönen
LUT University, Finland

9:20 AM | Assessment and Mitigation of Non-Circulating Bearing Currents in Bridgeless Rotor Synchronous Reluctance Machine [#7279]
Konstantin Vostrov, Charles Nutakor, Miika Parviainen, Pia Lindh, Juha Pyrhönen, Jussi Sopanen
LUT University, Finland

9:40 AM | Lateral Rotor Vibrations in Six-Phase Induction Machine Drives [#7292]
Nirangkush Das[1], Muhammad Numan[3], Firdausa Ahmed[1], Bilal Mustafa[1], Ahmed Hemeida[1], Niko Nevaranta[3], Marko Hinkkanen[1], Timo Holopainen[2]
[1]Aalto University, Finland; [2]ABB Oy, Finland; [3]LUT University, Finland

Oral Session 14: Condition Monitoring, Fault Diagnosis & Prognosis 2

MAGNOLIA 2

Session Chairs:
Seungdeog Choi, *Mississippi State University*
Ahmed Syed Ahmed, *Rockwell Automation*

8:00 AM | An End-User Perspective on AC Induction Motor Testing Before, During, and After Repair [#7070]
Henk de Swardt
Timken Power Systems, United States

8:20 AM | Synchronous Generator Sub-Transient Reactance Estimation Through Harmonic Measurements [#7124]
Lukas Malfait, Colin Debruyne, Jos Knockaert, Jan Desmet
Ghent University, Belgium

8:40 AM | Analysis of High-Frequency Current for Comprehensive Winding Insulation Degradation Detection of Railway Propulsion Motors [#7144]
Eduardo Rodriguez Montero[2], Markus Vogelsberger[1], Thomas Wolbank[2]
[1]ALSTOM Transport Austria GmbH, Austria; [2]Technische Universität Wien, Austria

9:00 AM | Sensitivity Analysis of Multiphase Induction Machine Parameter Identification Methods [#7173]
Omer Ikram Ul Haq[1], Rahul Kanchan[1], Sjoerd Bosga[1], Luca Peretti[2]
[1]ABB Ab. Corporate Research Center, Sweden; [2]KTH Royal Institute of Technology, Sweden

9:20 AM | Motor Fault Detection with a Hybrid Physics-Based and Data-Driven Method [#7284]
Dai-Yan Ji[3], Bingnan Wang[2], Hiroshi Inoue[1], Makoto Kanemaru[1]
[1]Mitsubishi Electric Corporation, Japan; [2]Mitsubishi Electric Research Laboratories, United States; [3]University of Maryland, United States

9:40 AM | PMSM Modelling Considering Magnetic Saturation, Spatial Harmonics, and Interturn Short-Circuit Faults [#7290]
Geoffrey Postal[2], Frederik De Belie[1], Johan Gyselinck[2]
[1]Ghent University – Flanders Make, Belgium; [2]Université Libre de Bruxelles, Belgium

Oral Session 15: Transportation Applications 2

MAGNOLIA 3

Session Chairs:
Andy Knight, *University of Calgary*
Lei Zhou, *University of Wisconsin-Madison*

8:00 AM | Retrofitting of a Chevy-Bolt IPM Motor with a PM-Assisted Synchronous Reluctance Rotor Enabled with a Blend of Heavy-Rare-Earth-Free Neodymium and Ferrite Magnets [#7142]
Praveen Kumar, Ali Al-Qarni, Robin Wilson, Ayman EL-Refaie
Marquette University, United States

8:20 AM | Quality Monitoring in Laser Welding of Rectangular Copper Wires for Traction Drives Using a Broadband Process Light Sensor [#7150]
Marcel Baader, Tim Raffin, Florian Risch, Jörg Franke
Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

8:40 AM | A Family of Phase-Unit Axial-Modular Permanent Magnet Vernier Machines for Electric Aircraft Hovering Propulsion System [#7151]
Yanlei Yu[3], Feng Chai[2], Xin Yuan[4], Qingxiang Liu[3], Josep Pou[1], Christopher Ho Tin Lee[3]
[1]City University of Hong Kong, Hong Kong; [2]Harbin Institute of Technology, China; [3]Nanyang Technological University, Singapore; [4]University of Aberdeen, United Kingdom

9:00 AM | Battery Temperature-Aware EV Drivetrain Energy Management System [#7015]
Faris AtaAllah[1], Shayok Mukhopadhyay[2], Habibur Rehman[1]
[1]American University of Sharjah, U.A.E.; [2]University of New Haven, United States

9:20 AM | Analysis of the Impact of Multi-Sector Unbalanced Torque Distribution on Electromagnetic Vibration and Noise in In-Wheel Motors [#7172]
Hang Yin[1], Shuangxia Niu[1], Wei Hua[2], Hengliang Zhang[2], Kaining Qu[2], Min Li[3]
[1]Hong Kong Polytechnic University, Hong Kong; [2]Southeast University, China; [3]Zhejiang Founder Motor Company Limited, China

Oral Session 16: Special Machines, Electromagnetic Actuators & Sensors 3

MAGNOLIA 4

Session Chairs:
Michael Mcintyre, *University of Louisville*
Baoyun Ge, *Georgia Institute of Technology*

8:00 AM | 10 MW Direct-Drive Superconducting Vernier Machines for Offshore Wind Power Application [#7090]
Jian Ye, Guang-Jin Li
University of Sheffield, United Kingdom

8:20 AM | Suspension Force Ripple Reduction Control of a Magnetically Levitated Axial Gap Bearingless Motor [#7119]
Nobuyuki Kurita[1], Junichi Asama[2], Victor Tedesco[4], Ethan Maddin[4], Yaxin Wang[4], Iki Adachi[3]
[1]Baylor College of Medicine, United States; [2]Shizuoka University, Japan; [3]Texas Children's Hospital, United States; [4]Texas Heart Institute, United States

8:40 AM | Modeling of Moving Rotor Elements for Machines with Speed-Dependent Flux Linkage [#7127]
Markus Peer, Gabriel Weissitsch, Edmund Marth, Gerd Bramerdorfer, Thomas Krainer, Martin Koll
Johannes Kepler University Linz, Austria

9:00 AM | Sensorless Position Estimator for Active Magnetic Bearings Based on Non-Linear Voltage Equation and Square-Wave Voltage Injection [#7170]
Minyoung Choi, Daeyong Kim, Minkyun Noh
Korea Advanced Institute of Science and Technology, Korea

9:20 AM | Design and Development of a Large Magnetic Gap Linear Generator for Wave Energy [#7208]
Nick Baker, Ehsan Farmahani, Farshid Mahmouditabar
Newcastle University, United Kingdom

Wednesday, May 21 | 10:30 AM – 12:10 PM

Oral Session 17: Rotating Electric Machines 3

MAGNOLIA 1

Session Chairs:
Mohammad S. Toulab, *Oakland University*
Bojian Cao, *Dana Incorporated*

10:30 AM | Influence of Magnet Layout on Excitation Requirements for Post Assembly Rotor Magnetization in PM Motors [#7310]
Alireza Fatemi, Peng Peng
General Motors, United States

10:50 AM | Filter Based Motor Control for Robotic Applications [#7154]
Shuzan Kumar Sarkar, Noah Wilding, Shruti Pandey, Nicholas Hawkins, Michael L. McIntyre
University of Louisville, United States

11:10 AM | Optimal Design of Coreless Axial Flux PM Machines Using a Hybrid Machine Learning and Differential Evolution Method [#7326]
Matin Vatani[3], David R. Stewart[3], Pedram Asef[1], Dan M. Ionel[2]
[1]e-Motion Laboratory, Advanced Propulsion Laboratory, University College London, United States; [2]SPARK Lab, University of Kentucky, United States; [3]University of Kentucky, United States

11:30 AM | Hardware Design Considerations for 30 kW, SiC Based High-Fundamental Frequency (2 kHz) Inverter for High-Speed Drives [#7155]
Deepak Upadhyay, Aleksi Mattsson, Pasi Peltoniemi
LUT University, Finland

11:50 AM | Multiphase FSCWs with Flux Barrier Stator – A Novel Solution for High Torque Density Applications [#7010]
Gurakuq Dajaku
FEAAM GmbH, Germany

Oral Session 18: Electric Drives 3

MAGNOLIA 2

Session Chairs:
Doga Ceylan, *Eindhoven University of Technology*
Shi-Uk Chung, *ANSYS Inc.*

10:30 AM | Precision Position Control of a Permanent Magnet Linear Synchronous Motor Using Advanced PID Control [#7002]
Yong-Lin Kuo, Pin-Lin Cheng
National Taiwan University of Science and Technology, Taiwan

10:50 AM | Optimal Interleaved Phase-Disposition PWM for Paralleled Cascaded H-Bridge Inverters [#7253]
Hamid Hamza[2], Idéal Oscar Libouga[1], Fils Pascal Lingom[2], Joseph Song-Manguelle[2], Mamadou Lamine Doumbia[2]
[1]Université de Douala, Canada; [2]Université du Québec à Trois-rivières, Canada

11:10 AM | A Unified Observer for Smooth Speed-Sensorless Drive Control of Induction Machines at Full Speed Range [#7304]
Jingjie Wu[2], Abraham Goldsmith[1], Lei Zhou[2], Dehong Liu[1], Bingnan Wang[1], Yebin Wang[1]
[1]Mitsubishi Electric Research Laboratories, United States; [2]University of Wisconsin–Madison, United States

11:30 AM | Modular Design for Sensorless Control of Synchronous Machine Drives with an LC Filter [#7306]
Hannu Hartikainen, Marko Hinkkanen
Aalto University, Finland

11:50 AM | Forced Alignment-Based Motor Position Sensor Error Identification and Compensation Technique to Reduce Second Order Torque Ripple [#7140]
Yunjai Oh, Jaesang Park, Changwoo Shin, Jihyun Jung, Jinhwan Lee
HL Mando Corp., Korea

Oral Session 19: Design Optimization, Modeling & Simulation 3

MAGNOLIA 3

Session Chairs:
Andrea Cavagnino, *Politecnico di Torino*
Dan M. Ionel, *University of Kentucky*

10:30 AM | A Physics-Informed Gaussian Process Regression-Based Meta Model for Rapid Characterization of Permanent Magnet Synchronous Machines [#7185]
Marcelo D. Silva[3], Oluwaseun A. Badewa[2], Rosemary E. Alden[2], Pedram Asef[1], Dan M. Ionel[2], Sandra Eriksson[3]
[1]e-Motion Laboratory, Advanced Propulsion Laboratory, University College London, United Kingdom; [2]SPARK Lab, University of Kentucky, United States; [3]Uppsala University, Sweden

10:50 AM | Design Optimization of Nine-Phase Induction Motor for EV Traction Applications [#7322]
Mohamed Metwly[1], Reza Ilka[1], Hengchun Mao[2], Ron Ye[2], Jiangbiao He[1]
[1]University of Tennessee, Knoxville, United States; [2]Quanten Technologies, Inc, United States

11:10 AM | Meta-Heuristic Based Design and Optimization of Double Stator-Single Rotor Axial-Flux Induction Generator [#7025]
Bati Eren Ergun[1], Tugberk Ozmen[2], Arda Akyildiz[1], Bahaddin Goksun[1], Mehmet Onur Gulbahce[1]
[1]Istanbul Technical University, Turkey; [2]Manisa Celal Bayar University, Turkey

11:30 AM | Electromagnetic Modeling of Lattice Structures in Additively Manufactured Electric Machines [#7178]
Shi-Uk Chung[1], Peng Han[1], Nishanth Gadiyar[2], Eric Severson[3], Alexander Goodall[4], Pavani Gottipati[1], Mark Solveson[1]
[1]Ansys, Inc., United States; [2]Oak Ridge National Laboratory, United States; [3]University of Minnesota, United States; [4]University of Sheffield, United Kingdom

11:50 AM | Influence of PMSM Parameters on the Active Open- vs Short-Circuit Fault-Reaction Strategy [#7203]
Simone Ferrari, Paolo Pescetto, Gianmario Pellegrino
Politecnico di Torino, Italy

Oral Session 20: Transportation Applications 3

MAGNOLIA 4

Session Chairs:
Ebrahim Amiri, *California State University*
Matthew Gardner, *University of Texas at Dallas*

10:30 AM | Experimental Parameter Analysis for the Induction Based Thermal Demagnetization of PM Rotors from Electric Traction Drives [#7234]
Roman Hahn, Thorsten Ihne, Marcel Baader, Jörg Franke, Alexander Kühl, Florian Risch
Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

10:50 AM | Neural Network Meta-Model Method for Performance Prediction of Axial Flux Machines [#7285]
Hailin Huang[2], Tianjie Zou[2], Adam Walker[2], Xiang Ren[2], George Batho[2], Peter H. Connor[2], Liam Portanier Mifsud[2], Oliver Tweedy[2], Christopher Gerada[2], Alin Stirban[1]
[1]Robert Bosch GmbH, United Kingdom; [2]University of Nottingham, United Kingdom

11:10 AM | High Performance Rare-Earth Free Interior Permanent Magnet Motor Enabled by Carbon Fiber Sleeve and Iron Nitride Magnets [#7325]
Ali Al-Qarni[1], James Alexander[2], Ayman EL-Refaie[1]
[1]Marquette University, United States; [2]Spartan Design LLC, United States

11:30 AM | A Dual Three-Plus-Two Phases Synchronous Reluctance Motor for Electric Traction Applications [#7287]
Roberto Moncada, Alvaro Hoffer, Felipe Alarcón, Camilo Maury
Universidad de La Frontera, Chile

POSTER SESSION 1

Monday, May 19 | 5:30 PM – 7:00 PM

AZALEA BALLROOM

Session Chairs:
Hailing Huang, *University of Nottingham*
Yaser Chulaee, *Lennox International Inc.*

Rotating Electric Machines 4

#7018 | Motor Length Reduction of Outer Rotor Type SPM Motor by Magnet Overhang Structure with Three-Dimensional Flux Recovery
Fumiya Yoshimura[1], Yuki Hidaka[2]
[1]Nagaoka University of Technology, Japan; [2]Ritsumeikan University, Japan

#7030 | Torque Improvement with Trapezoidal Magnet Rotor for V-Shaped Interior Permanent Magnet Motors
Taketo Minami[1], Yuki Hidaka[2]
[1]Nagaoka University of Technology, Japan; [2]Ritsumeikan University, Japan

#7041 | Study on Higher Output Power Spoke-Type IPM Motor with Flask-Shaped Magnet
Ryonosuke Otsuka[1], Yuki Hidaka[2]
[1]Nagaoka University of Technology, Japan; [2]Ritsumeikan University, Japan

#7053 | Field-Oriented Design of Notching and Mechanical Stress Relieving Grooves for Rotors in Flat Wire Permanent Magnet Machines
Wentao Zhang, Zhongze Wu, Wei Hua
Southeast University, China

#7232 | Axial Active Magnetic Bearing with Laminated Stators and Slit Rotor Disc Used in On-Board Machinery
Sadjad Madanzadeh, Kristóf Márton Szombati, Juuso Narsakka, Tuhin Choudhury, Jussi Sopanen, Tuomo Lindh, Juha Pyrhönen, Niko Nevaranta
LUT University, Finland

Electric Drives 4

#7003 | Flux-Weakening Control of Dual Three-Phase PMSM Considering the Interaction Between the αβ and xy Planes Within the VSD Frame
Guangxu Lu, Jianyong Su, Fengyang Liu, Guijie Yang
Harbin Institute of Technology, China

#7004 | Discrete-Time PMSM Current Control Based on Current Measurement Error
Xin Yuan[4], Junkai Wen[2], Jingwei Zhu[3], Shuangchun Xie[3], Xueping Li[1]
[1]Beijing Institute of Technology, China; [2]Hong Kong Polytechnic University, Hong Kong; [3]Nanyang Technological University, Singapore; [4]University of Aberdeen, United Kingdom

#7007 | Offline Self-Commissioning Method to Estimate Direct & Quadrature Axes Inductance for IPM/SPM in Industrial Motor Drive Applications
Tensing Duraisingam, Bing Li, Ahmed Sayed-Ahmed
Rockwell Automation, Inc., United States

#7026 | Development of an Active Front End Highly Efficient and Large Capacity Medium Voltage Inverter Drive
Mamun Mostafa, Vivek Gopinathan, Tetsuya Okamoto
TMEIC Corporation, Japan

#7036 | Angle Dependent Current Control Algorithm for Electrical Motors
Stefan Haehnlein[2], Jan Philipp Degel[2], Christian Kloeffer[2], Martin Doppelbauer[1]
[1]Karlsruhe Institute of Technology, Germany; [2]University of Applied Sciences Offenburg, Germany

Special Machines, Electromagnetic Actuators & Sensors 4

#7048 | Magnetic Field Optimization of an Axial Flux Permanent Magnet Energy Harvester
Felix Möller[1], Lutz Göhler[1], Romano Härtel[1], Wilfried Hofmann[2]
[1]Hochschule für Technik und Wirtschaft Dresden, Germany; [2]Technische Universität Dresden, Germany

#7049 | A New Winding Design Method for High Pole Number, Bearingless Machines
Sumaira Ahmed, Dave Winterborne, Xu Deng, Barrie Mecrow
Newcastle University, United Kingdom

#7054 | Analysis and Solution of Residual Force in Electromagnetic Actuators
Iago José Ferreira, Ian Gabriel Silveira, Maurício B. C. Salles, Paulo Alberto Moraes
Universidade de São Paulo, Brazil

#7058 | Partially Superconducting Induction Machine
Nicholas Storti, Emmanuel Agamloh
Baylor University, United States

#7102 | Machine Learning Based ID Identification for Linear Synchronous Motor Driven Cart with Magnetic Field Signal
Brady Chyla, John Oh, Justin Huang, Ridha Chowdhury, Joe Bastulli, Daniel Hudetz, Yuija Cui, Yuhong Huang, Francisco Maturana, Meiling He
Rockwell Automation, Inc., United States

#7184 | Influence of Magnetic Unbalance Pull Force on Rotor Trajectory Control in Oscillatory Motion Mechanism Using a Bearingless Motor
Yuya Shichi, Toshie Kikuchi, Masahide Ooshima
Suwa University of Science, Japan

Thermal, Materials & Efficiency Challenges 3

#7084 | Hybrid Method of AC Copper Loss Calculation with Magnetic Equivalent Circuit and Analytical Method Considering Iron Core Saturation
Tianzheng Xiao, Zi Qiang Zhu
University of Sheffield, United Kingdom

#7135 | Enhanced Design and Electromagnetic Analysis of Synchronous Reluctance Machines Using Multi-Material Additive Manufacturing
Siddique Akbar[2], Yitbarek Bekele[2], Aamir Ebrahimi[3], Bernd Ponick[1]
[1]Leibniz University Hannover, Germany; [2]Profluxx GmbH, Germany; [3]Universität Bremen, Germany

#7147 | High-Frequency Harmonic Loss Location Verification Using Temperature Rise
Miroslav Lípa, Matias Tiihonen, Hannu Kärkkäinen, Janne Nerg, Lassi Aarniovuori
LUT University, Finland

Design Optimization, Modeling & Simulation 4

#7027 | Multiobjective Optimization of Electrical Machines Using Probabilistic Surrogate Modeling with Limited Data
Nuo Chen[1], Christian Digel[1], Yiwei Wang[2], Martin Doppelbauer[1]
[1]Karlsruhe Institute of Technology, Germany; [2]University of Nottingham, United Kingdom

#7051 | Modelling and Measurement of Voltage Stress in Inverter-Fed Stator Phase Windings
Loic Cabrel Kaptoum Kuate[2], Abdenour Abdelli[1], François Balavoine[2], Stéphane Duchesne[2]
[1]IFP Energies Nouvelles, France; [2]Laboratoire Systèmes Électrotechniques et Environnement, Université d'Artois, France

#7069 | Extended State Space Model of a Permanent Magnet Synchronous Machine as Part of a Stator Sided Resonant Inverter
Jan Loos[1], Kerstin Siebert[1], Holger Hirsch[2]
[1]Hochschule Ruhr West, Germany; [2]Universität Duisburg-Essen, Germany

#7092 | Effect of Parasitic Capacitances in Drum-Winding Machine
Konstantin Vostrov, Shruti Singh, Ilya Petrov, Juha Pyrhönen
LUT University, Finland

#7099 | Torque Density Improvement in an Axial Flux Permanent Magnet Machine with Trapezoidal Cross-Section Rotor and Dual Three-Phase Windings
Felipe Ortiz-Bustos[1], Cesar Gallardo[3], Carlos Madariaga-Cifuentes[2], Juan A. Tapia Ladino[2], Pia Lindh[1], Michele Degano[3]
[1]LUT University, Finland; [2]Universidad de Concepción, Chile; [3]University of Nottingham, United Kingdom

#7106 | Motor Noise and Vibration Simulation Accuracy Improvement via Modal Parameter Tuning
Shi-Uk Chung, James Packer, Peng Han, Pavani Gottipati
Ansys, Inc., United States; Ansys, Inc., United Kingdom

Condition Monitoring, Fault Diagnosis & Prognosis 3

#7013 | Improvements in Stacking Deep Learning Models for Current and Vibration Signature Analysis in Rotating Machines
Sergio Avila[1], Rafael Noboro Tominaga[2], Gabriel Ferri[1], Bruno Carmo[2], Renato Monaro[2], Maurício B. C. Salles[2]
[1]Federal Institute of Santa Catarina, Brazil; [2]Universidade de São Paulo, Brazil

#7022 | Adaptive Piecewise Linear Function and Deep Learning for Remaining Useful Life Estimation
Erin Lee, Tanya Chaudhary, Trupti Chavan, Akshay Kakkar, Viraj E, Deepak Mittal, Don Williams, Derek Snaidauf, Edward Bowen, Sunil Reddy Tiyyagura
Deloitte, United States; Deloitte, India

#7059 | Implementation and Experimental Evaluation of Stator Coil Insulation State of Health Measurement Techniques Under SiC Switching Operation
Benjamin Sirizzotti, Emmanuel Agamloh, Annette von Jouanne, Alex Yokochi
Baylor University, United States

#7062 | Comparative Analysis of Modeling Methods for High-Frequency Phenomena and Simulations of Bearing Currents in Induction Motors
Vinícius Carmo[1], Marco Túlio Alves Êvo[1], Diogo Souza[1], José Carlos Leão Veloso Silva[2], Hélder de Paula[1]
[1]Federal University of Uberlândia, Brazil; [2]Petrobrás Petróleo Brasileiro S.A., Brazil

#7081 | Inverter-Induced Bearing Currents: Analysis for Journal Bearings
André M. Alzamora[1], Celso Azevedo Júnior[1], José Carlos Leão Veloso Silva[2], Jurandir Antônio Gomes Da Silva[2], Hélder de Paula[1]
[1]Federal University of Uberlândia, Brazil; [2]Petrobrás Petróleo Brasileiro S.A., Brazil

Transportation Applications 4

#7060 | Loss Analysis of Space-Vector and Discontinuous Pulse Width Modulation for an EESM with Dynamic Motor Drive
Benjamin Wolk, Li-Chun Chien
Tula Technology, Inc, United States

#7066 | Comparative Analysis of Hairpin and Litz Wire Windings in High-Efficiency Electric Vehicle Motors
Richard Hohlfeld[1], Berthold Schlecht[2]
[1]Mercedes-Benz AG, Germany; [2]Technische Universität Dresden, Germany

#7077 | Consideration of a Conductor Configuration of a High-Speed SRM for Automobile Tractions to Reduce its AC Copper Loss
Wenyi Xu[1], Kyohei Kiyota[1], Akira Chiba[1], Jun-Ichi Deguchi[2]
[1]Institute of Science Tokyo, Japan; [2]Toyota Motor Corporation, Japan

#7219 | Optimized Recycling Strategy for Permanent Magnet Drives of Electric Vehicles with Focus on Rare Earth Magnet Extraction
Thorsten Ihne, Roman Hahn, Fabian Giesbert, Marcel Baader, Jörg Franke, Florian Risch
Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

#7221 | Connected C-Core Hybrid SRMs for EV Applications
Gholamreza Davarpanah[1], Sajjad Mohammadiyangijeh[2]
[1]Amirkabir University of Technology, Iran;
[2]Massachusetts Institute of Technology, United States

Energy & Grid-Connected Applications 2

#7034 | Coordinated Control of a Cluster of Advanced Microgrids and Fast Charging Stations in Islanded Mode
Dener Brandao, Joao Callegari, Gabriel Ramos, Danilo Brandao, Igor Pires
Universidade Federal de Minas Gerais, Brazil

#7095 | Controllability-Oriented Design Method of DFIGs in Wind Turbine Systems
Seyedali Seyed-Bouzari[1], Annette Muetze[1], Johann Peter Bacher[1], Boštjan Polajžer[2]
[1]Graz University of Technology, Austria;
[2]University of Maribor, Slovenia

#7125 | Investigation of Startup Characteristics of LSMs Considering Changing Grid Conditions Using a FE-Aided Simulation Strategy
Thomas Krainer, Gabriel Weissitsch, Edmund Marth, Gerd Bramerdorfer, Markus Peer
Johannes Kepler University Linz, Austria

#7162 | Comparison of Inner and Outer Rotor Flux Reversal Machines Using an Efficiency-Based Metric for Wave Energy Converters
Farrel Asker, Nick Baker
Newcastle University, United Kingdom

POSTER SESSION 2

Tuesday, May 20 | 1:30 PM – 3:30 PM

AZALEA BALLROOM

Session Chairs:
Caleb Li, *Toshiba International R&D*
Peng Han, *Ansys Inc.*

Rotating Electric Machines 5

#7132 | Simple Pseudo-IPM Rotor Design of Axial Flux Machine for Wide Speed Range
Junichi Asama[2], Ryuki Yamaoka[2], Seiji Saiga[1]
[1]F.C.C. Co., Ltd., Japan; [2]Shizuoka University, Japan

#7199 | The Yokeless Dual Rotor Electrically Excited Synchronous Machine
Tobias Zürrlein[2], Xinjun Liu[1], Marcel Baader[2], Florian Risch[2]
[1]Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany; [2]Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

#7204 | Emerging Trends in High-Speed Induction Machines and Converter Technologies for Industrial Applications
Shoaib Ahmed[2], Lassi Aarniovuori[2], Janne Nerg[2], Jan Barta[1], Ondrej Vítek[1]
[1]Brno University of Technology, Czech Rep.;
[2]LUT University, Finland

#7251 | Optimization of a Synchronous Reluctance Motor Design Using Genetic Algorithm and On-Off Method
Behnam Mosammam, Babak Fahimi, Poras Balsara
University of Texas at Dallas, United States

#7271 | Structural Optimization of Meta-Reinforcement Learning-Based Finite-Control-Set Direct Torque Control of Permanent Magnet Synchronous Motors
Darius Jakobeit[1], Mario Peña[1], Maximilian Schenke[1], Barnabas Haucke-Korber[1], Oliver Wallscheid[2]
[1]Universität Paderborn, Germany; [2]Universität Siegen, Germany

Electric Drives 5

#7068 | Differentiable Predictive Current Control of Permanent Magnet Synchronous Motors
Marvin Meyer[1], Oliver Schweins[1], Oliver Wallscheid[2]
[1]Universität Paderborn, Germany; [2]Universität Siegen, Germany

#7071 | SiC Four-Leg Inverter Implementing Novel CMV Elimination for Advanced Motor Drive Applications
Annette von Jouanne[1], Francisca Oseghale[1], Pascal Lingom[1], Caleb Li[2], Emmanuel Agamloh[1], Alex Yokochi[1]
[1]Baylor University, United States; [2]Toshiba International Corporation, United States

#7129 | PWM Loss Analysis in Electrically Excited Synchronous Machines: Implications for Loss-Optimal Operation
Felix Burkard, Andreas Gneiting, Nejila Parspour
Universität Stuttgart, Germany

#7136 | Pulsating Torque Harmonics in Electric Motors Driven by Carrier-Based PWM Multilevel Cascaded H-Bridge Inverter
Fils Pascal Lingom[4], Idéal Oscar Libouga[3], Roland Unruh[2], Joseph Song-Manguelle[4], Mamadou Lamine Doumbia[4], Emmanuel Agamloh[1]
[1]Baylor University, United States; [2]Universität Paderborn, Germany; [3]Université de Douala, Canada; [4]Université du Québec à Trois-rivières, Canada

#7017 | A Deep Reinforcement Learning Paradigm for DC Motor Speed Control
Shoaib Ahmed, Usman Tariq, Ammar Hasan, Habibur Rehman
American University of Sharjah, U.A.E.

Special Machines, Electromagnetic Actuators & Sensors 5

#7112 | Modeling and Testing of an Improved HEMM Linear Motor
Aaron D. Anderson[2], William Sixel[2], Kirsten Duffy[3], Paul Passe[1]
[1]HX5, LLC, United States; [2]NASA John H. Glenn Research Center at Lewis Field, United States; [3]University of Toledo, United States

#7130 | Speed Control of a Sensorless Seven-Phase Surface-Mounted PM Machines
Franck Scuiller, Florent Becker
Ecole Navale, France

#7148 | Modeling and Control of Electrical Machine with In-Built Force Actuator and Radial Active Magnetic Bearings for Rotor Suspension
Muhammad Numan, Ibrahim Abubakar, Sadjad Madanzadeh, Tuomo Lindh, Niko Nevaranta
LUT University, Finland

#7156 | Optimization of H∞-Control for Active Magnetic Bearing Suspended Rotor System
Ibrahim Abubakar, Muhammad Numan, Atte Putkonen, Tuomo Lindh, Niko Nevaranta
LUT University, Finland

#7159 | The Limits of Pole Changing Operation of a Nine-Phase Induction Motor
Pedro Montoaneli Bichara, Braz J. Cardoso Filho, Rodrigo R. Bastos
Universidade Federal de Minas Gerais, Brazil

#7181 | Design of a 27 kW 100 kRPM Permanent Magnet Rotor and Bearing System
Miika Parviainen, Charles Nutakor, Jussi Sopanen
LUT University, Finland

Thermal, Materials & Efficiency Challenges 4

#7207 | A Practical Implementation for Field-Based Computation of Core Loss in Permanent Magnet Synchronous Machines
Andrés Beltrán-Pulido[2], Dionysios Aliprantis[2], Ilias Bilionis[2], Nicholas Chase[1], Alfredo Munoz[1]
[1]Ford Motor Company, United States; [2]Purdue University, United States

#7227 | Power Factor Enhancement with Variable Flux Memory Motor for Heating, Ventilation, and Air Conditioning Applications
Erkin Atay Toka[2], Baris Kuseyri[1], Firuzi Keyvan[1]
[1]Middle East Technical University, Turkey; [2]RWTH Aachen University, Germany

#7247 | Effects of Potting and Slot Liner Material Characteristics on Thermal Behavior of a Traction Motor
Sun Lee[2], Arthur Zajac[2], Jigar Mistry[1], Reza Nasirizarandi[1], Ofelia Jianu[2], Narayan Kar[2]
[1]Schaeffler Americas, Canada; [2]University of Windsor, Canada

#7259 | Comparative Evaluation of Cooling Methods and Their Combinations in Electric Motors
Hasnain Nisar, Ali Bazzi
University of Connecticut, United States

#7266 | Experimentally Calibrated FEA Models for Losses Analysis of High-Speed Induction Motors Equipped with Cage Solid Rotors
Yulong Cui[1], Mostafa Ahmadi Darmani[2], Christopher Gerada[2], Andrea Cavagnino[1]
[1]Politecnico di Torino, Italy; [2]University of Nottingham, United Kingdom

Design Optimization, Modeling & Simulation 5

#7114 | Electric Motor Cogging Torque Prediction with Vision Transformer Models
Siyuan Sun[1], Ye Wang[3], Toshiaki Koike-Akino[3], Tatsuya Yamamoto[2], Yusuke Sakamoto[2], Bingnan Wang[3]
[1]Iowa State University, United States; [2]Mitsubishi Electric Corporation, Japan; [3]Mitsubishi Electric Research Laboratories, United States

#7145 | Optimal Current Trajectory Evaluation for Sensorless Controlled Synchronous Machines Based on Finite Element Analysis
Matthias Hofer, Richard Spiessberger
Technische Universität Wien, Austria

#7180 | Effect of Rotor Type on Open-Set Derating Operations of Multi-Three-Phase Synchronous Machines
Simone Ferrari, Sandro Rubino, Gianmario Pellegrino
Politecnico di Torino, Italy

#7191 | Influence of Hyperparameters in Neural State-Space Models for Data-Driven Black-Box Modelling of Synchronous Motors: A Case Study
Philipp Mueller, Stefan Haehnlein, Jan Philipp Degel, Christian Kloeffer
University of Applied Sciences Offenburg, Germany

#7237 | Assessment of AC Losses and Torque Density Enhancement in Hairpin Windings for Axial Flux Induction Motors
Carlos Gálvez-Araya[1], Carlos Madariaga-Cifuentes[1], Cesar Gallardo[2], Felipe Santacruz[1], Juan A. Tapia Ladino[1]
[1]Universidad de Concepción, Chile; [2]University of Nottingham, United Kingdom

#7238 | **Modeling and Analysis of PWM-Induced Current Ripple in Wound-Field Synchronous Machine**
Le Chang, Peng Peng
General Motors, United States

Condition Monitoring, Fault Diagnosis & Prognosis 4

#7101 | **A Motor Vibration Analysis Platform Using Typhoon-HIL Simulator**
Obinna Onodugo, Emmanuel Agamloh, Pascal Lingom
Baylor University, United States

#7141 | **Generalized ML Approach for Fault Diagnosis of Rotating Machinery Using Domain-Based Features**
Akshay Kakkar, Viraj E, Tanya Chaudhary, Erin Lee, Trupti Chavan, Deepak Mittal, Don Williams, Derek Snaidauf, Edward Bowen, Sunil Reddy Tiyyagura
Deloitte, United States; Deloitte, India

#7206 | **Breakdown Performance of Motor Winding Insulation Under Low Pressure Conditions**
Easir Arafat, Farzana Islam, Md Asifur Rahman, Saikat Chowdhury, Mona Ghassemi
University of Texas at Dallas, United States

#7222 | **Partial Discharge Localization Along Medium Voltage Cables**
Bhuban Dhamala, Mona Ghassemi
University of Texas at Dallas, United States

#7246 | **Impact of Load Sharing Among Induction Motor Drives on Reliability and Life Expectancy**
Hanady Krieshan, Ali Bazzi
University of Connecticut, United States

Transportation Applications 5

#7085 | **Optimisation of Additively Manufactured Hairpin Windings for High Power Density Traction Motors**
Hadish Tesfamikael, Riccardo Notari, Mukhammed Murataliyev, Meiqi Wang, Christopher Gerada, Michele Degano
University of Nottingham, United Kingdom

#7089 | **Minimizing Losses in Electric Drivetrains: A Comparative Analysis of Inverter Topologies, Switching Frequencies, and Modulation Techniques**
Lukas Böcker, Enes Ayaz, Luca Peretti
KTH Royal Institute of Technology, Sweden

#7109 | **Hybrid Excitation Variable Flux Memory Motor for Enhancing Output Power and Efficiency During WLTC Driving Cycle in Traction Applications**
Riku Shinohara, Ren Tsunata, Masatsugu Takemoto, Jun Imai
Okayama University, Japan

#7133 | **Design of Reduced and Rare-Earth-Free PM-Assisted SynRMs for Electric Vehicles to Overcome Electromagnetic-Structural Challenges**
Hossain Mohammadi[2], Reza Nasirizarandi[2], Jigar Mistry[2], Aiswarya Balamurali[1]
[1]Schaeffler, Canada; [2]Schaeffler Americas, Canada

#7152 | **Application of the Transmotor-Flywheel Technology to Mild Hybrid Powertrain for Fuel Economy Improvement**
Zhemin Hu[1], Mehrdad Ehsani[2]
[1]Shanghai Electric Fuji Electric Power Technology Co., Ltd., China; [2]Texas A&M University, United States

#7167 | **Electromagnetic Design and Analysis of an Asymmetric Dual Three Phase Slotless 3D Airgap Electric Machine for High Power Density Applications**
Md Junaed Al Hossain, Junyeong Jung, Md Sariful Islam, Iqbal Husain
North Carolina State University, United States

POSTER SESSION 3

Tuesday, May 20 | 3:30 PM – 5:00 PM

AZALEA BALLROOM

Session Chairs:
Sajjad Mohammadi, *Massachusetts Institute of Technology*
Yiming Shen, *Nanyang Technological University*

Rotating Electric Machines 6

#7275 | **A Novel Topology of PM-Assisted Synchronous Reluctance Motor with Fluid Flux Barriers and Rectangular Magnets**
Vishal M. J., Baylon Godfrey Fernandes
Indian Institute of Technology Bombay, India

#7295 | **Effects of Eccentricity on Dual Rotor Single Stator Axial Flux PM Machines**
Sina Khalesidoost[2], S. Mehdi Seyedi[1], Dorsa Talebi[1], Sri Vignesh Sankarraman[2], Nick A. Martin[1], Matthew C. Gardner[2]
[1]Texas A&M University, United States; [2]University of Texas at Dallas, United States

#7311 | **Sensitivity to Demagnetization in Interior and Surface PM Electric Machines for Line-Start Applications**
Aquib Ahmed[2], Md Khalid Mahmud Bin Azam[2], Rajib Mikail[1], Yilmaz Sozer[2]
[1]ABB Corporation, United States; [2]University of Akron, United States

#7319 | **Advanced Magnetic Equivalent Circuit Modeling for Electrically Excited Synchronous Machines with Rotor Rotation**
Federica Graffeo[2], Silvio Vaschetto[2], Alberto Tenconi[2], Gerd Bramerdorfer[1], Andrea Cavagnino[2]
[1]Johannes Kepler University Linz, Austria; [2]Politecnico di Torino, Italy

Electric Drives 6

#7195 | Disturbance Rejection Optimization for Permanent Magnet Synchronous Motor Systems Based on Modified Linear Active Disturbance Rejection Control
Chenggang Wang[3], Hui Yang[3], Jianhu Yan[1], Shuhua Fang[3], Heyun Lin[3], Yiming Shen[2]
[1]Nanjing University of Science and Technology, China; [2]Nanyang Technological University, China; [3]Southeast University, China

#7217 | Reinforcement Learning-Based Direct Torque Control of Externally Excited Synchronous Motors: A Proof of Concept
Barnabas Haucke-Korber[2], Nyi Nyi Aung[1], Maximilian Schenke[2], Mario Peña[2], Darius Jakobeit[2], Oliver Wallscheid[3]
[1]Louisiana State University, United States; [2]Universität Paderborn, Germany; [3]Universität Siegen, Germany

#7220 | Calculation of Optimized Pulse Patterns for Electric Drives with an End-to-End Differentiable Simulation Framework
Lukas Hölsch[2], Daniel Wiechmann[2], Oliver Schweins[1], Oliver Wallscheid[2]
[1]Universität Paderborn, Germany; [2]Universität Siegen, Germany

#7224 | Active Flying Capacitor Voltage Balancing in Single-Phase 5L-ANPC Inverter
Pengwei Li[2], Ali Bazzi[2], Zhe Zhang[1]
[1]Eaton, United States; [2]University of Connecticut, United States

#7245 | Active Torque Capability Determination Under Unity Power Factor Operation of Biaxial Excitation Synchronous Machines
Krishna Mpk Namburi[2], Prerit Pramod[1], Ion Boldea[4], Iqbal Husain[3]
[1]MicroVision Inc, United States; [2]Nexteer Automotive, United States; [3]North Carolina State University, United States; [4]Politehnica University Timisoara, Romania

#7250 | Quantitative Analysis of Filter Parameters in an Electric Motor Drive
Pradeepsundar Simini[1], David Klink[1], Behrooz Bahrani[1], Firuz Zare[2]
[1]Monash University, Australia; [2]Queensland University of Technology, Australia

#7305 | A Novel High-Frequency Injection Method Towards Speed-Sensorless Drive Control of Induction Machines Over Full Speed Range
Jingjie Wu[2], Abraham Goldsmith[1], Lei Zhou[2], Dehong Liu[1], Bingnan Wang[1], Yebin Wang[1]
[1]Mitsubishi Electric Research Laboratories, United States; [2]University of Wisconsin–Madison, United States

Special Machines, Electromagnetic Actuators & Sensors 6

#7236 | Experimental Evaluation of Force-Current Characteristics of a Radial Electromagnetic Bearing
Kamisetti N V Prasad, Aditya Raj, Gopalaratnam Narayanan
Indian Institute of Science, India

#7241 | Performance Evaluation of Single-Pulse-Operated High-Speed Switched Reluctance Machine Towards Multi-Objective Optimization
Samrat Das[1], Krity Rao[2], Gopalaratnam Narayanan[1]
[1]Indian Institute of Science, India; [2]National Institute of Technology Goa, India

#7255 | A Low-Cost Ferrite Brushless DC Motor for Cordless Power Tool Applications
Md Tawhid Bin Tarek, Jarrett Dunston, Dale London, Thomas McNeil, Praveen Gambhir, Teja Kalavala, Dillon Brown
Techtronic Industries Company Limited, United States

#7268 | Comparison Between Pole-Phase Modulation (PPM) Technique and Modulated Rotational Harmonic (MRH) Excitation in Nine-Phase Brushless Wound-Field Synchronous Machine
S. Mehdi Seyedi, Dorsa Talebi, Hamid A. Toliyat
Texas A&M University, United States

#7276 | Finite-Control-Set Current Predictive Control of Linear Switched Reluctance Motors Using Multi-Parameter Dynamic Linearization Model
Su-Dan Huang[1], Rongsheng Lin[1], Guang-Zhong Cao[1], Junqi Xu[2]
[1]Shenzhen University, China; [2]Tongji University, China

#7288 | Design Aspects of a Compact Variable Reluctance Resolver
Valerii Abramenko, Ilya Petrov, Juha Pyrhönen
LUT University, Finland

#7289 | Linear Variable Reluctance Resolver with a Modular Design
Valerii Abramenko, Ilya Petrov, Juha Pyrhönen
LUT University, Finland

#7294 | Analysis of Bridge Placement and Ferromagnetic Piece Curvature on Performance of Coaxial and Flux Angle Mapping Magnetic Gears
Salek Khan, Parisa Afsari, Matthew C. Gardner
University of Texas at Dallas, United States

#7302 | Double Rotor Capacitor-Resonated Electromagnetic Torque Converter
Nuwantha Fernando[2], Pirat Khunkitti[1], Minh Bui[3], Inam Nutkani[2]
[1]Khon Kaen University, Thailand; [2]Royal Melbourne Institute of Technology, Australia; [3]Royal Melbourne Institute of Technology Vietnam, Vietnam

#7308 | Effect of Permanent Magnet Shape in High-Speed Rotor on the Performance of a Magnetic Gear
Saptarshi Dey, Baylon Godfrey Fernandes, Kishore Chatterjee
Indian Institute of Technology Bombay, India

Poster Sessions

#7312 | Full Bridge Converter Based SRM Drive with Extended Conduction Strategy
Fuat Kucuk
Kyoto University of Advanced Science, Japan

#7313 | 3D Topology and Parametric Optimization of a Axial-Radial Flux PMSM with SMC Stator Core for Park Lock Actuators
Mohanraj Muthusamy[1], Yulanda King[3], Sainan Xue[2]
[1]AESIM.Tech, Canada; [2]Powersys, Inc, United States; [3]Stoneridge, United States

#7315 | A Unified Model for Radial Flux Bearingless Motors with Short-Circuited Suspension Windings
Niloofar Ramroodi, Eric Severson
University of Minnesota, United States

#7318 | Winding Factors and Harmonics of Coreless Axial Flux PM Machines
Matin Vatani[3], John F. Eastham[2], Xiaoze Pei[2], Dan M. Ionel[1]
[1]SPARK Lab, University of Kentucky, United States; [2]University of Bath, United Kingdom; [3]University of Kentucky, United States

Design Optimization, Modeling & Simulation 6

#7272 | A Parameterized Nonlinear Magnetic Equivalent Circuit Model for Fast Design and Comparison of Surface Permanent Magnet Synchronous Machines
Manuel De Jesus Contreras, Danial Kazemikia, Salek Khan, Matthew C. Gardner
University of Texas at Dallas, United States

#7291 | Analytical Method for Node-Precise Airgap Reluctance Calculation in Magnetic Equivalent Circuits and Alternative Winding Distribution Approach for Concentrated Windings
Martin Bremer, Raphael Keller, Matthias Brodatzki, Martin Doppelbauer
Karlsruhe Institute of Technology, Germany

#7299 | Multi-Stage Design and Analysis of a Permanent Magnet Synchronous Machine with Parallel Comparison Tracks
Qixuan Wang[1], Torbjörn Thiringer[1], Joachim Härsjö[2]
[1]Chalmers University of Technology, Sweden; [2]Volvo Cars, Sweden

#7303 | Multidisciplinary Design Approach for On-Board High-Speed Energy Conversion Machinery
Tuhin Choudhury, Juuso Narsakka, Kristóf Márton Szombati, Sadjad Madanzadeh, Valerii Abramenko, Niko Nevaranta, Henrik Ebel, Teemu-Turunen Saaresti, Juha Pyrhönen, Jussi Sopanen
LUT University, Finland

Condition Monitoring, Fault Diagnosis & Prognosis 5

#7249 | Impact of Thermal Cycling on Partial Discharge Inception Voltage in Random-Wound Electric Aircraft Motors
Anjana Jayasanka Samarakoon[2], Thomas F. Tallerico[1], Cameron Little[2], Anubhav Bose[2], Aaron D. Anderson[1], Geoffrey Swisher[2], Kiruba Haran[2]
[1]NASA John H. Glenn Research Center at Lewis Field, United States; [2]University of Illinois Urbana Champaign, United States

#7257 | Analytical Modeling and Analysis of Current Sensor Faults in PMSM Drives
Shaya Abou Jawdeh, Ali Bazzi
University of Connecticut, United States

#7298 | Estimation of Induction Motor Power Factor Using Machine Learning
Obinna Onodugo, Emmanuel Agamloh, Daniel Addae, Gordon Asante
Baylor University, United States

#7301 | Physics Informed Neural Network Induction Motor Equivalent Circuit Parameter Estimation with Only Electrical Measurements
Stephen Hurt, Hamid A. Toliyat
Texas A&M University, United States

Transportation Applications 6

#7230 | Enhancing Electromagnetic Performance of Traction PMaSynRMs with Asymmetrical Rotor Configurations
Buddhika De Silva[2], Hossain Mohammadi[1], Reza Nasirizarandi[1], Jigar Mistry[1], Narayan Kar[2]
[1]Schaeffler Americas, Canada; [2]University of Windsor, Canada

#7243 | Comparison Between SPM and IPM Motor for Battery-Powered Electric Ferry Application
Vu-Khanh Tran[2], Sarbajit Paul[1], Jae-Gil Lee[1], Jae-Hak Choi[1], Pil-Wan Han[1], Yon-Do Chun[1]
[1]Korea Electrotechnology Research Institute, Korea; [2]University of Science and Technology, Korea

#7248 | Electromagnetic – Mechanical Comparative Analysis of Rare-Earth Free Traction PMASynRM with Different Barrier Shapes
Andrew Botham[2], Arthur Zajac[2], Narayan Kar[2], Reza Nasirizarandi[1], Hossain Mohammadi[1], Jigar Mistry[1]
[1]Schaeffler Americas, Canada; [2]University of Windsor, Canada

#7262 | Analysis of Reduced Rare Earth PM-Assisted Synchronous Reluctance Motor Enabled with Iron Nitride for High-Speed Traction Application
Robin Wilson, Praveen Kumar, Ayman EL-Refaie
Marquette University, United States

#7016 | Comparative Performance Analysis of PI, Fuzzy Logic, and Sliding Mode Controllers for the Battery Energy Consumption of EV Traction System
Ahmad Rizwan, Shoaib Ahmed, Rached Dhaouadi, Habibur Rehman
American University of Sharjah, U.A.E.

Student Demonstrations

Demo Schedule

Student Demonstrations – Azalea Ballroom

OPEN – Monday, May 19 . . . . . 5:00 PM – 7:30 PM

JUDGING – Tuesday, May 20 . . . . . 1:30 PM – 5:00 PM

NEW FOR 2025! Student Demonstrations provide an opportunity for students from various universities and countries to showcase their emerging technology research outcomes and interact with academia and industry.

Table 1: Real-Time Control and Comparative Analysis of a Lab-Prototyped Ultra-High-Speed (UHS) PMSM Using MATLAB for Embedded and dSPACE Systems

Md Moniruzzaman, Md Rashedur Rahman
Mississippi State University, USA

Table 2: Stator-Excited Synchronous Motors

Oluwaseun Badewa, Ali Mohammadi, Donovin Lewis
University of Kentucky, USA

Table 3: Dual-Stage, Multi-Module Electric Machine for Electric Aircraft Propulsion

Matin Vatani, Diego A. Lopez Guerrero, Oluwaseun A. Badewa
University of Kentucky, USA

Table 4: Reflected Voltage Free AC Motors with Adaptative Impedance Coils

Mohamed Metwly
University of Tennessee, Knoxville, USA

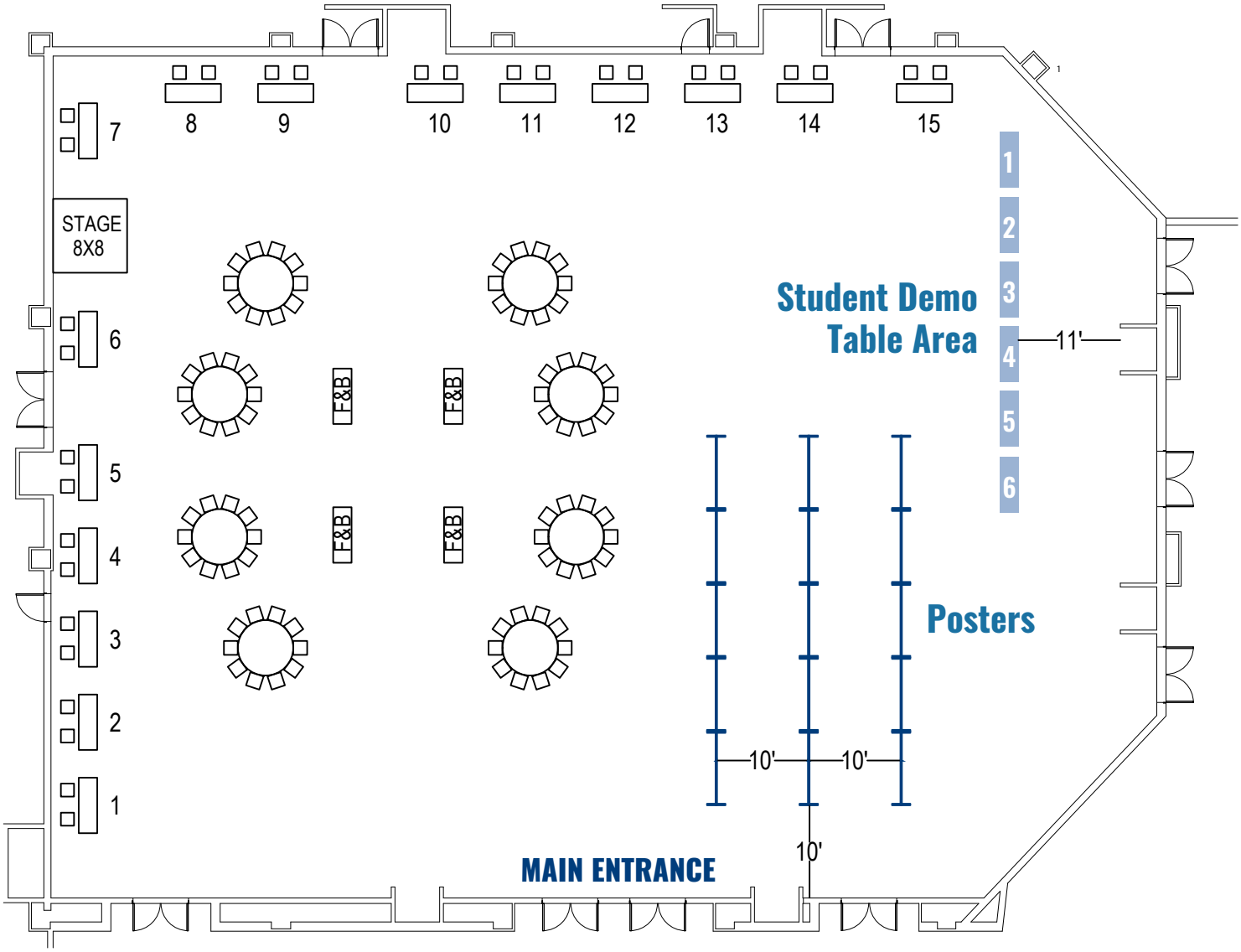
Table 5: Advanced High Power Density n-Layer Hairpin Winding Permanent Magnet Machine for EVs

Wentao Zhang
Southeast University, People's Republic of China

Table 6: High Performance Rare-Earth Free Interior Permanent Magnet Motor Enabled by Carbon Fiber Sleeve and Iron Nitride Magnets

Ali Al-Qarni, James Alexander
Marquette University, USA

The Westin Houston Memorial City
Exhibit Hall



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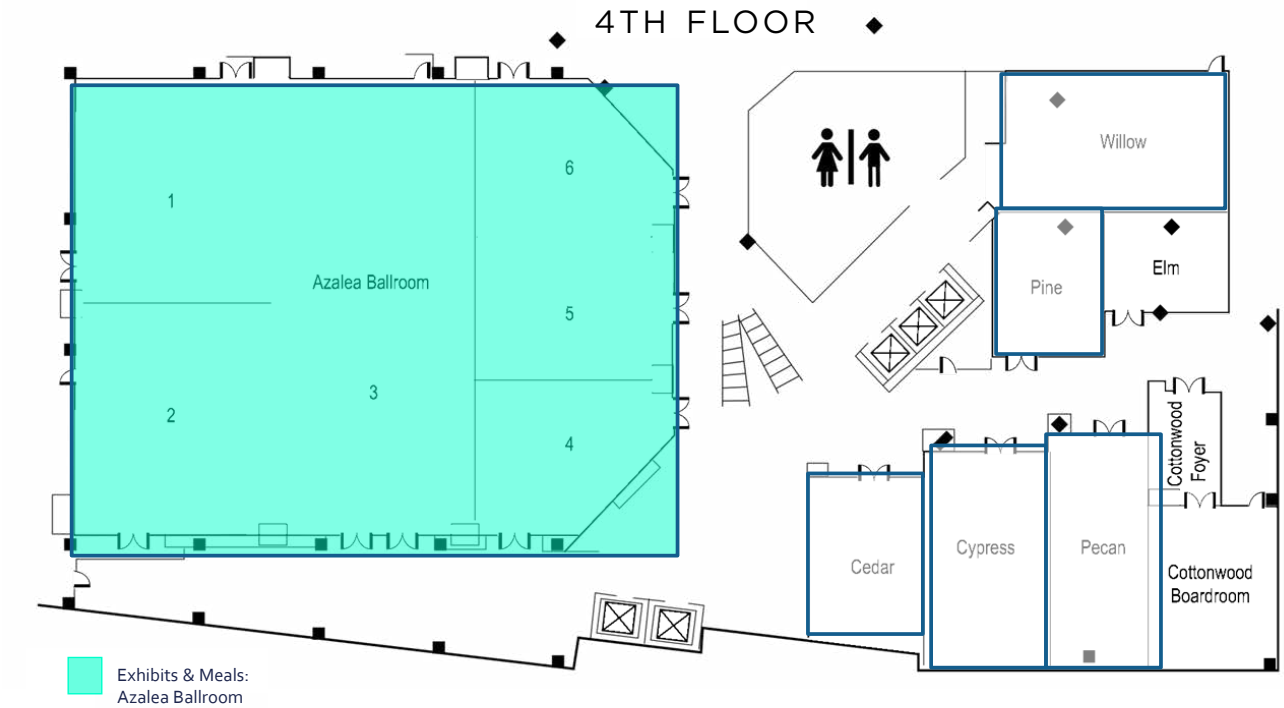

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LCD LaserCut AG/SWD AG Stator und Rotortechnik

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www.lcd-lasercut.ch

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Kaisermatt 3 | CH-5026 Densbüren

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www.magneforcess.com

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Milwaukee, Wisconsin USA

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If you have interest in serving as a volunteer (reviewer, session chair, track chair, organizing committee, or industry exhibitor), please scan the QR code below and fill out your contact information. If you have any questions, please feel free to contact the IEMDC-2027 General Chair, Dr. JiangBiao He, whose email is provided as follows:

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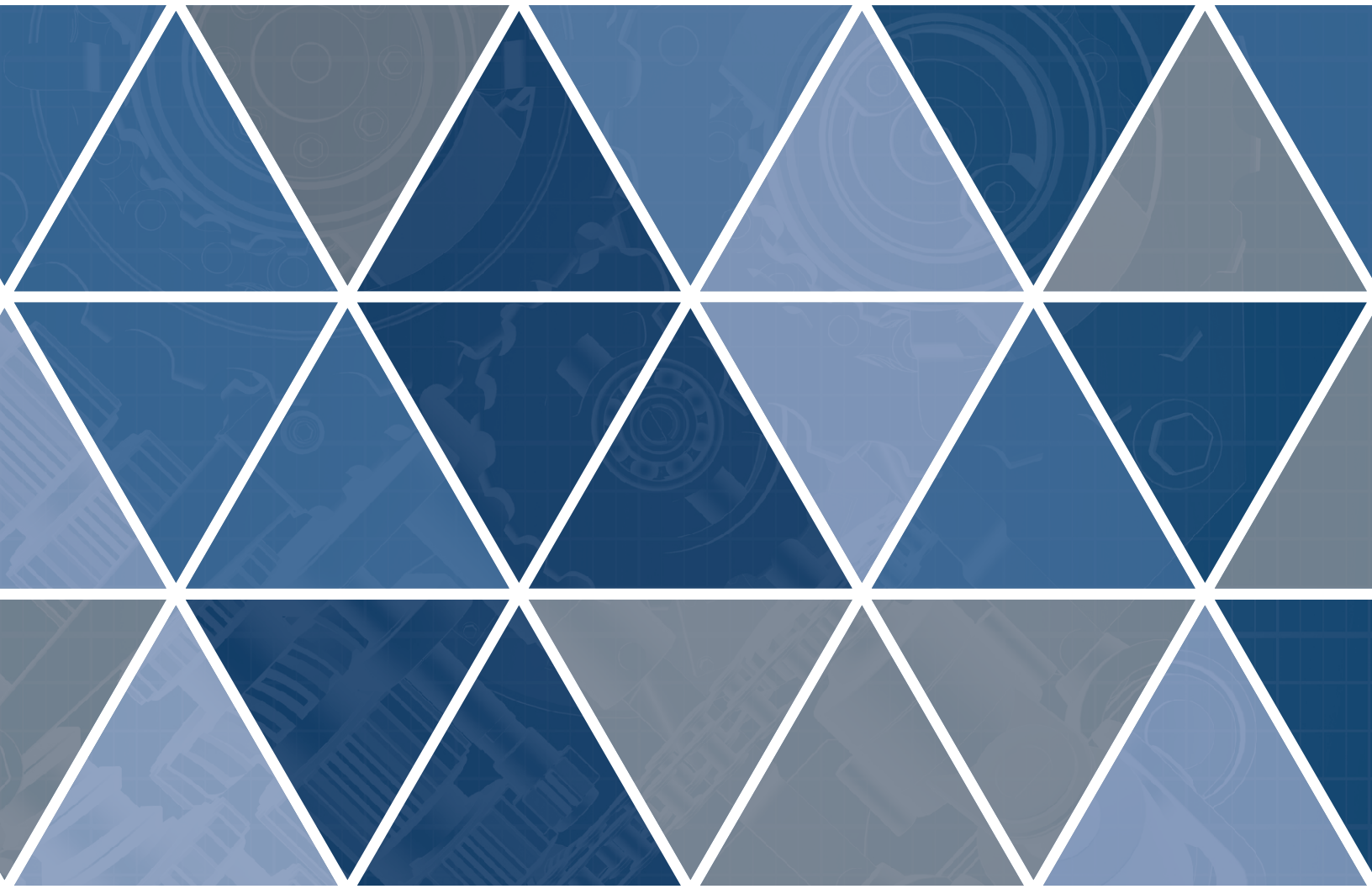
General Chair, IEMDC-2027
University of Tennessee, USA
EMAIL: **jiangbiao.he@utk.edu**



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