

## 14th IEEE International Conference on Power Electronics and Drive Systems (PEDS 2023)

## Montreal, Canada, 7 – 10 August 2023 Conference Programme



Conference Organizers and Sponsors



## **IEEE PEDS 2023 Conference Programme**

## École de Technologie Supérieure (ÉTS), Montreal, Canada 7 – 10 August 2023

The conference has a four-day technical programme, starting from 7 August on the tutorials. Four excellent tutorials will be conducted. 8 August starts with the opening ceremony and keynotes, followed by the oral presentation sessions in the afternoon. An industrial visit to the OPAL-RT open house is arranged in parallel with the technical sessions. 9 - 10 August have the keynotes and panel sessions in the morning, followed by the oral presentation sessions in the afternoon.

	7 August 2023	8 August 2023	9 August 2023	10 August 2023			
8 am – 9 am	Registration and Breakfast for Participants						
9 am – 1 pm 10:30 am - 10:50 am Coffee break	9 am – 12 pm: Tutorials classrooms pav. E E-2025 and E-2022	<b>9 am– 12 pm</b> Opening Ceremony And Keynotes* A-1600	9 am– 10:30 am Keynote Speeches 11 am – 1 pm WIE Panel Session A-1600	9 am– 10:30 am Keynote Speeches 11 am – 1 pm YPs Panel Session A-1600			
1 pm – 2 pm	Lunch for Participants						
2 pm – 5 pm	2 pm – 5 pm Tutorials	Oral Presentation* Sessions S1 to S4 E-2025, 22, 23, 24	Oral Presentation Sessions S9 to S11 E-2025, 22, 23	Oral Presentation Sessions S15 to S17 E-2025, 22, 23			
3:20 pm-3:40 pm Coffee break	E-2025 and E-2022	Sessions S5 to S8 E-2025, 22, 23, 24	Sessions S12 to S14 E-2022, 23, 24	Sessions S18 to S21 E-2025, 22, 23, 24			
	6 pm – 8 pm Welcome Reception E-2033 and E-2011	<b>4pm – 7pm</b> Open house at OPAL-RT (Industrial visit)	5:30 pm – 6:30 pm Cocktail 6:30 pm – night Conference Banquet Hotel Bonaventure				

\*: To accommodate the **industrial visit to OPAL-RT**, the morning session on **8 August** will end earlier, and the afternoon oral sessions will **start at 1pm and end at 4pm**, with coffee break from 2:20-2:40pm.

8 August 2023		9 August 2023		10 August 2023			
<b>S1</b>	Power Electronics 1 (PE1)	S9	Power Electronics 3 (PE3)	S15	Power Electronics 4 (PE4)		
S2	Motor Drives 1 (MD1)	S10	Motor Drives 2 (MD2)	S16	Motor Drives 3 (MD3)		
S3	Power Semiconductor and Applications (PS)	S11	Renewable Energy Technologies 1 (RE1)	S17	Renewable Energy Technologies 3 (RE3)		
S4	Distributed Generation & Energy Conversion (DGEC)						
Break							
S5	Power Electronics 2 (PE2)			S18	Motor Drives 4 (MD4)		
S6	Power Electronics Control, Applications and Reliability 1 (PC1)	S12	Power Electronics Control, Applications and Reliability 2 (PC2)	S19	Power Electronics Control, Applications and Reliability 3 (PC3)		
S7	Electrical Machines (EM)	S13	Renewable Energy Technologies 2 (RE2)	S20	Renewable Energy Technologies 4 (RE4)		
S8	Distributed Generation & Smart-Grid 2 (DS2)	S14	Traction and Automotive Systems 1 (TA1)	S21	Traction and Automotive Systems 2 (TA2)		

## **Conference Venue**

The IEEE PEDS 2023 will be held at the École de technologie supérieure (ÉTS) which is a public engineering faculty in Montreal, Quebec, Canada. Founded in 1974, the École de technologie supérieure is a constituent of Université du Québec system. All technical presentations will be made on-site in oral or poster sessions.

Address: 1100 Notre-Dame St W, Montreal, Quebec H3C 1K3, Canada

## **Instruction to Presenters**

All presentations are to be made on-site in person in the conference meeting rooms. The presenters are invited to meet the Session Chairs on the day of their presentation. Please meet the Session Chairs in the rooms of your presentation 10 minutes before the session time to do the following:

- To load up your power point presentation file;
- To hand in a copy of your biography (60 words or less) to the Session Chair.

Each paper is given 15 minutes for the entire presentation. This includes:

- 12 minutes oral presentation
- 3 minutes Q & A

A PC with Microsoft Windows operating system and an LCD projector will be provided in each session room. For the presentation, each PC will be installed with Microsoft Power Point and Adobe Acrobat Reader.

A helper will be available to assist with the file uploading. It is the responsibility of the presenters to make sure that their files are presentable using the provided software.

## **IEEE PEDS 2023 - Technical Programme**

## **Tutorial Sessions**

**Four tutorial sessions** will be offered in the conference, two in the morning and two in the afternoon on **7 August 2023**. The number of participants in each tutorial session will be capped based on the room capacity.

## **Tutorial 1: Advances in Nonlinear Control of Robotic Manipulators**

#### Time/Date/Venue: 9 am - 12 pm, 7 August 2023 E-2025

Robotic manipulators are widely used in many applications: industrial, space, medical, rehabilitation, etc. These systems are highly nonlinear, multivariable with coupled dynamics. Controlling robot manipulators is a difficult problem considering model uncertainties, external disturbances and unmodeled dynamics. This tutorial will introduce some of the most important nonlinear control techniques for ensuring stability and good trajectory tracking. Some of the robust techniques will be covered and discussed in this tutorial.



**Maarouf Saad** obtained a bachelor's and a master's degree in electrical engineering from the Ecole Polytechnique of Montreal respectively in 1982 and 1984. In 1988, he obtained a Ph.D. from McGill University in electrical engineering. He joined **Ecole de Technologie Superieure** in 1987 where he is teaching control theory and robotics in the electrical engineering department. His research is mainly in nonlinear control and optimization applied to robotics and autonomous

systems. He is a Senior Member of the IEEE.

## **Tutorial 2: Motor Drive Topologies in Electrified Air Transportation Systems**

#### Time/Date/Venue: 9 am - 12 pm, 7 August 2023 E-2022

For two decades, the air transportation industry is undergoing a deep revolution, in which most actuators are being electrified. This started with the concept of "power by wire" leading to the well-known more electric aircraft (MEA). Then, electrified propellers have been considered for small air vehicles, like electric vertical take-off and landing (eVTOL) vehicles and very small aircraft. The trend is towards larger aircraft to be propelled by electric motors. The aim is to enhance reliability and propulsion efficiency and reduce maintenance costs and environmental impact. As an example, for vital functions like flight control system and landing system, the target mean time between failures (MTBF) for electric actuators is 109 hours. To get there, the aircraft industry must develop new electronic, electrical, and mechanical components, and look at new means to monitor them throughout their operating life. Hence, the reliability and fault-tolerant capability and control of power electronic converters, electric machines and microgrids become increasingly more important in modern aircraft.

In this tutorial, after a quick overview of the concepts and presentation of some existing motor drive topologies in electrified air transportation systems, the speaker focuses on some specific use cases. Different topologies will be studied and compared in terms of reliability, power density, and cost. Then, some topologies will be selected for which adequate control algorithms will be developed under different operating conditions including fault situations. This includes the state of the art of motor control techniques and their design, performance and robustness supported by simulation and

experimental results. Also, some auxiliary functions like active stabilization will be considered. Finally, future challenges and trends in electric motor control for air transportation will be discussed.



**Dr. Babak Nahid-Mobarakeh** (M'05–SM'12–F'22) received the Ph.D. degree in electrical engineering from the Institut National Polytechnique de Lorraine, Nancy, France, in 2001. From 2001 to 2006, he was with the Centre de Robotique, Electrotechnique et Automatique, University of Picardie, Amiens, France. In September 2006, he joined the Ecole Nationale Superieured'Electricite et de Mecanique, University of Lorraine, Nancy, where he was a Professor. Since January 2020, he has been a Professor with **McMaster University**, Hamilton, ON, Canada. Dr.

Nahid-Mobarakeh has authored or co-authored more than 300 international journal and conference papers as well as several book chapters and patents. He is the recipient of several IEEE awards. Between 2012 and 2019, he served as the Secretary, Vice Chair, Chair, and Past Chair of the Industrial Automation and Control Committee (IACC) of the IEEE Industry Applications Society (IAS). Currently, he is the Vice Chair of the IEEE Power Electronics Society Technical Committee on Electrified Transportation Systems, and a member of the Power Electronics and Motion Control (PEMC) Council. His main research interests include motor drives, nonlinear and robust control design for power converters and drives, fault detection and fault-tolerant control of electric systems, and design, control, and stabilization of microgrids.

## **Tutorial 3: Smart Health-conscious Battery Management Systems and Fast Charging Strategies**

#### Time/Date/Venue: 2 pm – 5 pm, 7 August 2023 E-2025

Lithium-ion batteries (LIBs) are frequently used in energy storage systems for electric vehicles (EVs). Adding extra batteries to extend range will increase the cost and weight of EVs. With the development of rapid charging, the problems of range anxiety and long charging periods have been alleviated significantly. Nevertheless, fast, and ultra-quick charging has had a negative impact on battery health, thermal runaway, and other safety issues. Superfast data collecting, processing, control, and accurate state estimate are critical for the effective operations of battery management system (BMS). As a result, smart BMS and sensors are necessary for high-resolution data collection, analysis, and control to capture the dynamics of the operational environment and the nonlinear characteristics of LIB. As a result, there is a lot of wire harnesses within the BMS. As a result, wireless BMS will be critical in reducing wire harness and increasing flexibility. Moreover, smart, and intelligent BMS requires lightning-fast data collection, precise state prediction, and control, where Internet-of-things and machine learning approaches will be important.

As a result, this session will go through some of the existing fast charging algorithms, their health implications, and new fast charging strategies for best performance in terms of battery health, safety, and longer cycle life. In addition, issues connected to inadequate thermal management control will be identified, along with viable remedies. Insights on the utilisation of data-driven techniques and electromagnetic impedance spectroscopy for battery diagnostics, remaining useful life prediction, and remaining useful capacity estimation will be covered in this tutorial. Particular attention will be placed on estimating the status of unknown old batteries and second-life LIBs. Current advances, new trends, and, most crucially, the impediments to commercialization of research ideas in the targeted sector will be discussed. Moreover, an overview of hybrid energy storage systems including different chemistries of LIB, supercapacitors, and solid-state batteries along with the concept of reconfigurable battery pack for EV applications will be discussed.



**Akash Samanta** received B. Tech degree  $(1^{st} class)$  in Electrical Engineering from the West Bengal University of Technology in 2012. He also received M. Tech  $(1^{st} class)$  and MBA  $(1^{st} class)$  degree in Electrical Engineering and Energy Management from the University of Calcutta in 2018 and 2014 respectively. From 2014 to 2018 he was a Project Officer and Solar Energy Master Trainer with the Department of Energy Management, Indian Institute of Social Welfare and

Business Management, Kolkata, India. He is currently a Doctoral Research Scholar with the Department of Electrical, Computer, and Software Engineering at **Ontario Tech University**, Oshawa, ON, Canada. His research interest includes electric energy storage systems, battery management systems, power electronics converters, and the application of machine learning and artificial intelligence in the related field. He conducted tutorials, special sessions, and short courses at several flagship IEEE conferences such as IECON, SPEC, and ITEC.



**Sheldon Williamson** (Fellow, IEEE) received the B.E. degree (Hons.) in electrical engineering from the University of Mumbai, Mumbai, India, in 1999, and the M.S. and Ph.D. degrees (Hons.) in electrical engineering from the Illinois Institute of Technology, Chicago, IL, USA, in 2002 and 2006, respectively. He is currently a Professor with the Department of Electrical, Computer and Software Engineering and the Director of Smart Transportation Electrification and Energy Research

(STEER) Group, Faculty of Engineering and Applied Sciences, **Ontario Tech University**, Oshawa, ON, Canada. His current research interests include advanced power electronics, electric energy storage systems, and motor drives for transportation electrification. He holds the prestigious NSERC Canada Research Chair position in electric energy storage systems for transportation electrification. He conducted tutorials, special sessions, and short courses several flagship IEEE conferences such as APEC, ECCE, IECON, ITEC.

## Tutorial 4: Real time simulation of resonant converter with OPAL-RT simulators

## Time/Date/Venue: 2 pm – 5 pm, 7 August 2023 E-2022

As power density is a priority in recent power electronics designs, resonant converter topologies become a mainstream solution for low and medium power DC-DC conversion applications. Their high switching frequency characteristic, along with their makes it challenging to simulate accurately in Real-time. This tutorial will demonstrate what are the key features to be capable to simulate in real time a LLC resonant converter, and how industrial partners were using the eHS gen5 FPGA-based Power Electronics simulator to leverage Hardware in the loop simulation for the validation of a On Board Charger.



**Sebastien Cense** received his B.S. and M.S. degrees in microelectronics from the ISEN Engineering School in Lille, France in 2010. His final paper on FPGA embedded command of polyphase motor using space vector algorithm was conducted at the L2EP lab in collaboration with OPAL-RT. He joined **OPAL-RT** in October 2010 where he has been engaged in developing FPGA application solutions such as rapid control prototyping and electric motor simulation. Sebastien contributed in a number of projects involving FPGA-based hardware-

in-the-loop and power-hardware-in-the-loop for power-electronics application, as well as the design and development of the eHS solution. Currently, he is the eFPGASIM division lead and offering manager of the power conversion market at OPAL-RT Technology.

## Keynote Speech and Panel Sessions

8 August 2023, 9:15 am - 10:00 am



Challenges and solutions for integrating a vast number of power electronic-based systems in microgrids, distribution, and transmission systems for renewable energy integration Jean Belanger, OPAL-RT

## 8 August 2023, 10:00 am - 10:45 am



Power electronics and water treatment: efficient solutions to modern water treatment Mohamad Mortada, Veolia Water Technologies & Solutions



## 9 August 2023, 9:00 am - 09:45 am

Safeguarding the EV Ecosystem: reliable and secure ecosystem for the charging needs of EVs and achieving a sustainable transportation sector **Chadi Assi, Concordia University** 

## 9 August 2023, 09:45 am - 10:30 am



Challenges in Transportation Electrification, Powertrain Drives & New Power Electronics Architectures Osama Mohammed, Florida International University

## 9 August 2023, 11:00 am - 12:30 pm

Panel session: Women in Engineering



Sadia Khaf



Manar El-Fashny

## **Organizers and Moderators**



Kanika Aggarwal



Neda Zahedi



Wafa Gharsallaoui



Sophie Larivière-Mantha



Chunyan Lai





Marie-José Nollet



Hakimeh Purmehdi



Danielle Sami Nasrallah

## 10 August 2023, 9:00 am - 09:45 am



*The Value of Electrification in Heavy-Duty Vehicles* **Brij Singh, John Deere Inc.** 

## 10 August 2023, 09:45 am – 10:30 am

40-year long journey through power electronics Praveen K. Jain, Queen's University

## 10 August 2023, 11:00 am – 12:30 pm Panel session: Young Professionals Event



Matt Naslcheraghi





Vahid Maleki Raee



Joel Reginald Dodoo



**Matthew Posner** 



Seyed Masoud Mohseni-Bonab



Jasmine Boparai



Carla Mouradian



Qingsong Wang



Ali Moeini



Miloud Rezkallah

## Session SO Poster Session

Date/Time: 08 August 2023 Tuesday / 12:00 PM – 1:00 PM Venue: TBD Session Chair: Parth Patel

## <u>SO - 8055</u>

A Novel Design of High-Temperature Superconducting DC Generator Based on Structural Variation Peng Cheng, Yige Ren and Ruiye Li Harbin Engineering University China

## <u>SO - 8568</u>

## Investigation of Threshold Voltage Mismatch on Junction Temperature Estimation for Multichip SiC MOSFET Power Modules

Ying Wang, Xi Jiang, Shijie Zhang, Daoyong Jia, Runze Ouyang and Xiaowu Gong Xidian University Key Laboratory of Wide Bandgap Semiconductor Materials China

#### <u>SO - 2855</u>

## A Novel DC-DC Converter for Electrolyzer with Low Ripple and High Step-Down Ratio

Xiaoqiang Guo, Shiqi Zhang, Wenhe Wang, Baocheng Wang and Sanjeevikumar Padmanaban Yanshan University Shenyang Vycon New Energy Technology Co.,Ltd China TX IIOT Corporation Limited University of South-Eastern Norway China Norway

## <u>SO - 2702</u>

## An Improved Hybrid Control Method for 400Hz Medium Frequency Inverter

Xiaoqiang Guo, Yupeng Wei, Wenhe Wang, Baocheng Wang and Sanjeevikumar Padmanaban Yanshan University Shenyang Vycon New Energy Technology Co.,Ltd China TX IIOT Corporation Limited University of South-Eastern Norway China Norway

#### <u>SO - 4049</u>

## An improved Enhanced Linear ADRC Speed Control of the Permanent Magnet Linear Synchronous Motor

Xiao Liu, Haoran Xie, Meng Lu and Pingtin Lin College of Electrical and Information Engineering, Hunan University China

## <u> 50 - 8662</u>

## Structural Optimization of High-Voltage Switchgear for Prefabricated Substation of Distributed Generation

Kai Gao, Peng Xu, Pei Cao, Pengqi Zuo, Jiaqi Huang and Lijun Jin State Grid Shanghai Electric Power Research Institute Tongji University China

## <u>SO - 3044</u>

Synchronous Control of Multi-mover PMLSM Using Ring Coupling Control Strategy with Sliding Mode

Jinglong Zhong, Bao Song, Hu Li and Xiangdong Zhou Huazhong University of Science and Technology Guangdong Intelligent Robotics Institute China

## Session S1 Power Electronics 1 (PE1)

Date/Time: 08 August 2023 Tuesday / 01:00 PM – 02:20 PM Venue: E-2025 Session Chair: Rasoul Milasi, Co-Chair: Qingsong Wang

#### <u> 501 - 454</u>

*Comparative Study of Self-Compensated Coil Geometries for Wireless Power Transfer System* Neda Zahedi Saadabad, Qingsong Wang and Ambrish Chandra École de technologie supérieure, Montreal, Canada Canada

## <u> 501 - 740</u>

*A Review of Self-Compensated Wireless Power Transfer System* Neda Zahedi Saadabad, Qingsong Wang and Ambrish Chandra École de technologie supérieure, Montreal, Canada Canada

#### <u>S01 - 3937</u>

*Hardware-in-the-Loop Adaptive Control of an AC-DC Converter Based on Nonlinear Dynamics* Rasoul Milasi Pennsylvania State University United States

#### <u> 501 - 4623</u>

**Recent Advancements in Solid State Transformer-based EV Fast Charging Stations** Ruvini De Seram, Anindita Golder and Sheldon Williamson Ontario Tech University Canada

## Session S2 Motor Drives 1 (MD1)

Date/Time: 08 August 2023 Tuesday / 01:00 PM – 02:20 PM Venue: E-2022 Session Chair: Chunyan Lai; Co-Chair: Hazzab Abdeldjebar

#### <u> 502 - 4296</u>

A Comparative Study of State Observers for Position Sensorless Control of Permanent Magnet Synchronous Machines

Ying Zuo, Chunyan Lai, Anastasiia Galkina, Martin Grossbichler and Lakshmi Varaha Iyer Concordia University Magna International Inc Canada Austria United States

## <u> 502 - 7773</u>

Method of Mitigating Heat Generated by Rotor of a 45kw-Class MG-PMSM

Jae-Hyeon Lim, Hyung-Woo Lee, Jae-Bum Lee, Seong-Yong Hong and Chan-Bae Park Korea National University of Transportation South Korea

#### <u> 502 - 8849</u>

Comparison of Linear and Switched Amplifier Power-Hardware-in-the-Loop-Based Emulators for the Stator Inter-turn fault of an Induction Motor Koteswara Rao Alla and Pillay Pragasen Concordia University Canada

#### <u> 502 - 8234</u>

Single Phase AC Source Motor Drive With Small DC-Link Capacitor Kilho Lee, Beomjin Choi and Byungnam Kang Korea Automotive Technology Institute South Korea

## Session S3 Power Semiconductor and Applications (PS)

Date/Time: 08 August 2023 Tuesday / 01:00 PM – 02:20 PM Venue: E-2023 Session Chair: Ajit Kanale; Co-Chair: Sonam Acharya

#### <u> 503 - 5732</u>

## *Efficiency Improvement of Induction Machine Powertrain by High Switching Frequency and Wide Bandgap Semiconductors*

Julia Maria Tscherniewski, Stefan Butzmann and Wolfgang Meier University of Wuppertal NexGen Power Systems Germany United States

#### <u> 503 - 6781</u>

**Design and Implementation of an Air-Cored Fly-back Converter** Sonam Acharya, Somenath Banerjee and Santanu Mishra Indian Institute of Technology, Delhi Indian Institute of Technology, Kanpur India

#### <u> 503 - 9589</u>

Unclamped Inductive Load Avalanche Capability of the BaSIC(DMM) Topology Ajit Kanale, B. Jayant Baliga and Subhashish Bhattacharya North Carolina State University United States

## Session S4 Distributed Generation & Energy Conversion (DGEC)

Date/Time: 08 August 2023 Tuesday / 01:00 PM – 02:20 PM Venue: E-2024

Session Chair: Shailendra Kumar Sharma; Co-Chair: Takagi Shigeyuki

## <u> 504 - 5724</u>

Modeling and Control of VIENNA Circuit Employed Single-Phase Single-Stage Solar PV System Pemendra Kumar Pardhi, Shailendra Kumar Sharma and Ambrish Chandra Shri G. S. Institute of Technology & Science Indore, M.P., India École de Technologie Supérieure, Montréal, QC H3C1K3, Canada India Canada

## <u> 504 - 1966</u>

Modified Andronov-Hopf Oscillator Voltage Control for Single-Phase Grid Forming Inverters Mohammad Momeni, Liuchen Chang and Chris Diduch University of New Brunswick Canada

## <u> 504 - 2187</u>

**Regulated Power Supply for Energy Harvesting Using Bidirectional Chopper** Takuya Onitsuka and Takagi Shigeyuki Tokyo University of Technology Japan

## Session S5 Power Electronics 2 (PE2)

Date/Time: 08 August 2023 Tuesday / 02:40 PM – 04:00 PM Venue: E-2025 Session Chair: Alireza Bakhshai; Co-Chair: Sanjeev Singh

## <u> 505 - 5580</u>

*Novel Two-Stage AC-DC Power Converter with Partial Single-Stage Power Processing* Mina Fakhri, Adel Abosnina and Gerry Moschopoulos University of Western Ontario Canada

## <u> 505 - 7267</u>

Investigation of a Transformer Connected Power Amplifier for Grid Emulation Seyedeh Nazanin Afrasiabi, Rajendra Thike, K. S. Amitkumar, Chunyan Lai and Pragasen Pillay Concordia University Opal-RT Technologies Inc. Canada

## <u> 505 - 9102</u>

A Novel Multilevel Inverter Structure for Renewable Energy Applications Amirhosein Akbari and Alireza Bakhshai Queen's University Canada

<u>S05 - 9809</u>

## Three-Phase AC/DC Converter fed Two Parallel Interleaved DC-DC Converters for Fast Charging Applications with Improved Power Quality

Sanjeev Singh, Rheesabh Dwivedi, Bhim Singh, Ambrish Chandra and Miloud Rezkallah Maulana Azad National Institute of Technology Bhopal Sant Longowal Institute of Engineering and Technology, Longowal Punjabv Indian Institute of Technology, New Delhi École de technologie supérieure ITMI India Canada

## Session S6 Power Electronics Control, Applications and Reliability 1 (PC1)

Date/Time: 08 August 2023 Tuesday / 02:40 PM – 04:00 PM Venue: E-2022 Session Chair: Raouf Fareh; Co-Chair: Kuljeet Kaur

## <u> 506 - 921</u>

## Towards Smart Distributed Robotics Solution using Digital Twin

Cedric Melancon, Kuljeet Kaur, Julien Gascon-Samson and Maarouf Saad École de technologie supérieure, Montreal, Canada Canada

## <u> 506 - 1933</u>

## *Robust Fast Terminal SMC with Prescribed Performance for a Wearable Exoskeleton Robot* Mahmoud Abdallah, Yassine Kali, Maarouf Saad, Raouf Fareh and Maamar Bettayeb

Ecole de Technologie Superieure University of Sharjah Canada

United Arab Emirates

## <u> 506 - 2047</u>

## Fractional-Order Synergetic Attitude Control Strategy for Quadcopter System Raouf Fareh, Mohammad Alfuqaha and Maamar Bettayeb University of Sharjah United Arab Emirates

## <u> 506 - 2544</u>

## A Fast Active Cell Balancing Strategy for Lithium-ion Battery Packs

Mohammad Abareshi, Erfan Sadeghi, Yousef Naghibzadeh, Mohsen Hamzeh and Mehrdad Saif School of Electrical and Computer Engineering, College of Engineering, University of Tehran, Tehran, Iran

Department of Electrical and Computer Engineering, University of Windsor, Windsor, Canada Iran

Canada

## Session S7 Electrical Machines (EM)

Date/Time: 08 August 2023 Tuesday / 02:40 PM – 04:00 PM

Venue: E-2023 Session Chair: Pillay Pragasen ; Co-Chair: Konstantin Vostrov

## <u> 507 - 1438</u>

*Diagnostic Tool for Printed Circuit Board* Rochdi El Abdi and Hans Essone Obame Université de Rennes1 Ecole Normale Supérieure France

## <u> 507 - 2094</u>

## *Electromagnetic Field and Thermal Analyses of Outer-Rotor Permanent Magnet Synchronous Motor* Shigeyuki Takagi, Tatsuhiro Nakaegawa and Reiji Ishii Tokyo University of Technology

Japan

## <u> 507 - 5202</u>

## Irreversible Demagnetization Risk of Rotor Surface-Mounted Permanent Magnets at Rated and Short-Circuit Modes in Two-Pole Multi-Megawatt Machines

Konstantin Vostrov, Ilya Petrov, Valerii Abramenko, Juha Pyrhönen and Lassi Aarniovuori LUT University

Finland

## Session S8 Distributed Generation & Smart-Grid 2 (DS2)

Date/Time: 08 August 2023 Tuesday / 02:40 PM – 04:00 PM Venue: E-2024 Session Chair: Milutin Jovanovic ; Co-Chair: Toshiyuki Fujii

## <u> 508 - 321</u>

## Study Of An Electrical Lng Plant With Active Front End Drive Systems For Power Unbalance Failure

Toshiyuki Fujii, Hiroyuki Masuda, Yoshihiro Ogashi and Toshiaki Oka Mitsubishi Electric Corporation Toshiba Mitsubishi-Electric Industrial Systems Corporation Japan

## <u> 508 - 752</u>

**Power Quality Improvement Of The Grid System With Advanced Hysteresis Controller Design** Arun Raja Palpandian and Hicham Chaoui Department of Electronics, Carleton University Canada

## <u> 508 - 3070</u>

## **Power Management in Distribution System Employing Solid State Transformer** Ratndeep Sharma, Shailendra Kumar Sharma and Ambrish Chandra Shri. G.S. Inst. of Tech. & Sc., Indore, India Ecole de Technologie Superieure

India Canada

#### <u> 508 - 7689</u>

## A Sensorless Parameter Independent Controller for Brushless Doubly-Fed Reluctance Wind Generators

Mohammad Reza Agha Kashkooli and Milutin Jovanovic Northumbria University Newcastle United Kingdom

## Session S9 Power Electronics 3 (PE3)

Date/Time: 09 August 2023 Wednesday / 02:00 PM – 03:20 PM Venue: E-2025 Session Chair: Juan Paez Alvarez ; Co-Chair: Ashwin Kanavalkadu

#### <u>S09 - 1222</u>

Active Capacitor Voltage Balancing Method for Flying Capacitor Multilevel Converters Based on Overall Priority Index

Javad Ebrahimi, Suzan Eren and Alireza Bakhshai Queen's University Canada

#### <u>S09 - 2577</u>

*Efficient and Accurate Modeling of Resonant Converter for Real-Time Simulation Application* Hossein Chalangar, Juan Paez Alvarez and Wei Li OPAL-RT Canada

#### <u> 509 - 3141</u>

Artificial Intelligence Applications in the Control and Performance Improvement of Modular Multilevel Converters: A Review Niloufar Yousefi, Javad Ebrahimi and Alireza Bakhshai Queen's University

Canada

#### <u> 509 - 3160</u>

A Novel Switched Capacitor DC-AC Converter with Hysteresis Control Ashwin K, Nakul Narayanan K, Umanand L and Subba Reddy B Indian Institute of Science, Bangalore India

#### <u> 509 - 9464</u>

Control Strategies For Optimal Power Flow Management and Enhanced Cycle Life Of Battery-Supercapacitor Hybrid Energy Storage System (HESS) Manraj Singh Ladhar and Sheldon Williamson Ontario Tech University Canada

## Session S10 Motor Drives 2 (MD2)

Date/Time: 09 August 2023 Wednesday / 02:00 PM – 03:20 PM Venue: E-2022 Session Chair: Mohammad H Rahman; Co-Chair: Yen-Fang Li

## <u> 510 - 4194</u>

**On The Design of a Simultaneous Motion Controller for the Four-Axis SCARA System** Yen-Fang Li, Zhong-Wei Xu, Yi-Jun Zhang and Yong-Bin Wu Yong-Bin Wu Ming Hsin University of Science & Technology Taiwan

## <u> S10 - 6125</u>

**Real Time Estimation of Bearing Fault in Inverter-Fed Three-Phase Induction Motor** Priyanka C P and Sanjeevikumar Padmanaban National Institute of Technology Calicut University of South-Eastern Norway India Norway

## **S10 - 6928**

## Compliance Flatness Based Control of a Collaborative Upper-Limb Exoskeleton Robot

Brahim Brahmi, Tanvir Ahmed, Maarouf Saad and Mohammad H Rahman Electrical Engineering Department, Ahuntcis College University of Wisconsin-Milwaukee Electrical Engineering Department, École de Technologie Supérieure Canada United States

## <u> 510 - 7887</u>

## Numerical Inverse Kinematics Solution of 7-DOF Exoskeleton

Javier Dario Sanjuan De Caro, Tanvir Ahmed, Md Mahafuzur Rahaman Khan, Md Ishrak Islam Zarif, Sheikh Iqbal Ahamed, Maarouf Saad and Mohammad H Rahman University of Wisconsin Milwaukee Marquette University Ecole de Technologie Superieure United States Canada

## <u> 510 - 8878</u>

## A Novel Multi-Source Inverter with Optimal Design

Yousefreza Jafarian, Omid Salari, Mohamed Youssef and Alireza Bakhshai Queen's University Canada

## Session S11 Renewable Energy Technologies 1 (RE1)

Date/Time: 09 August 2023 Wednesday / 02:00 PM - 03:20 PM

Venue: E-2023 Session Chair: Vivek Nandan Lal; Co-Chair : Mamadou Lamine Doumbia

## <u> S11 - 129</u>

**Comparison of Two Reward Functions for a Multi-Stack Hybrid Trike Motor** Razieh Ghaderi, Mohsen Kandidayeni, Loïc Boulon and João P. Trovão Department of Electrical and Computer Engineering, UQTR Department of Electrical Engineering and Computer Engineering, Universite de Sherbrooke Canada

## <u>S11 - 1317</u>

## Prediction of Mechanical Stresses on Wind Turbine Drivetrain due to the Power Converters System Simon Pierre Ii Betoka Onyama, Joseph Song-Manguelle, Fils Pascal Lingom and Mamadou Lamine Doumbia University of Quebec à Trois rivières

S11 - 7167

Canada

PV and Wind Utilization Analysis for a Canadian Small Arctic PV-Wind-Diesel Hybrid Microgrid Thomas Paulin-Bessette, Nayeem Ninad and Luiz A.C. Lopes Natural Resources Canada Concordia University Canada

## <u> 511 - 3208</u>

## Bidirectional Asymmetrical Dual Active Bridge Resonant Converter for Renewable to DC Microgrid Interface

Prakash Ji Barnawal, Vivek Nandan Lal and Rajeev Kumar Singh Indian Institute of Technology (BHU) India

## <u>S11 - 7330</u>

## A Five-level Inverter Structure with Reduced Losses

Amirhosein Akbari, Javad Ebrahimi and Alireza Bakhshai Queen's University Canada

## Session S12 Power Electronics Control, Applications and Reliability 2 (PC2)

Date/Time: 09 August 2023 Wednesday / 03:40 PM – 05:00 PM Venue: E-2022 Session Chair: Kilho Lee ; Co-Chair: Brahim Brahmi

## <u> 512 - 2819</u>

## Vision-Based Localization and Tracking of Objects Through Robotic Manipulation Md Tanzil Shahria, Aniketh Arvind, Iysa Iqbal, Maarouf Saad, Jawhar Ghommam and Mohammad H Rahman University of Wisconsin-Milwaukee Hackley School

Nicolet High School École de Technologie Supérieure Sultan Quaboos University United States Canada Oman

## <u> S12 - 3606</u>

Kinematic Optimization and Comparison of Wheelchair-mounted Assistive Robots for Activities of Daily Living

Elias Jose Munoz Montenegro, Md Samiul Haque Sunny, Javier Dario Sanjuan De Caro, Brahim Brahmi, Jawhar Ghommam, Maarouf Saad and Mohammad H Rahman University of Wisconsin-Milwaukee Collège Ahuntsic Sultan Qaboos University École de technologie supérieure United States Canada Oman

## <u>S12 - 8051</u>

Implementation of Real Time Normalized Advantage Function Control for a Buck Converter Ryo Watanabe, Daiki Sugiura, Ryuta Ito, Yuki Sato and Hirokazu Matsumoto Aoyama Gakuin Univesity Japan

#### <u> 512 - 8190</u>

## A Study of High-Efficiency/High-Density Phase Shift Full Bridge Converter with Low Profile Two-Transformer Structure

Sang-Gyun Ryu, Seong-Yong Hong, Jae-Hyeon Lim, Chan-Bae Park, Hyung-Woo Lee and Jae-Bum Lee Korea National University of Transportation (KNUT) South Korea

#### <u>S12 - 4911</u>

*State-of-the-Art Wireless Charging Systems for E-Bikes: Technologies And Applications* Niranjan Shrestha, Akash Samanta, Filipe Fietosa and Sheldon Williamson Ontario Tech University Canada

## Session S13 Renewable Energy Technologies 2 (RE2)

Date/Time: 09 August 2023 Wednesday / 03:40 PM – 05:00 PM Venue: E-2023 Session Chair: Osama A. Mohammed; Co-Chair: Sanjeevikumar Padmanaban

## <u> 513 - 7917</u>

*Inverter Based Resources Control for Islanded Mode Microgrid-based Power System* Ahmed S. Soliman, S M Sajjad Hossain Rafin and Osama A. Mohammed Florida International University **United States** 

## <u> S13 - 942</u>

## A High Gain Expandable DC-DC Converter with PSO-based MPPT Tracking for Partial Shading Conditions

Rajat Kumar Keshari, Prakash Ji Barnawal, Rajeev Kumar Singh and Vivek Nandan Lal Indian Institute Of Technology (BHU), Varanasi India

## <u> S13 - 1999</u>

Thirteen-Level Cascaded H-Bridge Converters and 30-Pulse Converter Transformer Based High-Power Voltage Source Converters for Large-Scale Integration of Battery Energy Storage Subir Karmakar, Bhim Singh, Ambrish Chandra and Kamal Al-Haddad Indian Institute of Technology Delhi Ecole de Technology Superieure India Canada

## <u> 513 - 2982</u>

## *Reinforcement Learning-Based Approaches to Energy Management of Hybrid Energy Storage Systems in Electric Vehicles*

Parisa Ranjbaran, Javad Ebrahimi, Alireza Bakhshai and Praveen Jain Queen's University Canada

## <u> 513 - 9388</u>

## Singapore Local Energy Market Development Using Blockchain-enabled Peer-to-Peer Trading

Liaqat Ali, M. Imran Azim, Jan Peters, Sanjeevikumar Padmanaban, Vivek Bhandari, Anand Menon, Jemma Green and S.M. Muyeen Powerledger University of South-Eastern Norway Qatar University, Doha Australia Norway Qatar

## Session S14 Traction and Automotive Systems 1 (TA1)

Date/Time: 09 August 2023 Wednesday / 03:40 PM – 05:00 PM Venue: E-2024

Session Chair: Sanjeev Singh; Co-Chair: Qingsong Wang

## <u> 514 - 617</u>

## A Bidirectional Onboard Charger with G-V/V-G /V-H Functionality and Seamless Mode Transfer Capability for E-2 and E-3 Wheelers Applications

Jitendra Gupta, Bhim Singh, Ambrish Chandra and Kamal Al-Haddad IIT DELHI Ecole de Technologie Superieure India Canada

## <u> 514 - 836</u>

## *Fast Electromagnetic and Thermal Design Space Analysis for PMSM Propeller Drives* Jonas Franzki and Markus Henke

Institute for Electrical Machines, Traction and Drives - Technische Universität Braunschweig Germany

## <u> 514 - 6692</u>

## A Novel Beluga Whale-Jaya Optimization for Effective EV Charge Scheduling in Power Generation Amritansh Sagar, Sanjeevikumar Padmanaban and Manuele Bertoluzzo University of Padova Padova, Italy University of South-Eastern Norway Italy Norway

## <u> 514 - 9896</u>

A Hybrid Coaxial Magnetic Gear Using Flux-Focusing Halbach Permanent Magnet Arrangement Essossinam Frederic Aloeyi, Aran Shoaei and Qingsong Wang École de technologie supérieure Canada

## Session S15 Power Electronics 4 (PE4)

Date/Time: 10 August 2023 Thursday / 02:00 PM – 03:20 PM Venue: E-2025 Session Chair: Djilali Hamza ; Co-Chair: Mamadou Lamine Doumbia

## <u> S15 - 978</u>

## A Comparative Study of Reinforcement Learning and Classic Nonlinear Methods for Stabilization of DC Microgrids Supplying Constant Power Loads

Shima Shahnooshi, Javad Ebrahimi and Alireza Bakhshai Queen's University Canada

## <u> S15 - 2122</u>

A Pulsewidth Modulation Based Double Integral Sliding Mode Controller for Class-D Amplifier Nueraimaiti Aimaier, Nicolas Constantin and Glenn Cowan Concordia University École de technologie Supérieure Canada

#### <u> 515 - 5590</u>

## *Performance Evaluation of Multi-Modulation Single-Carrier PWM Methods for Motor Drive Applications*

Pascal Lingom, Joseph Song-Manguelle, Roland Unruh, Jean-Maurice Nyobe-Yome and Mamadou Lamine Doumbia University of Quebec at Trois-Rivieres Paderborn University University of Douala Canada

#### <u> S15 - 2684</u>

*EMI investigation of a Bridgeless-PFC LED Driver with Direct Power Transfer Circuit* Djilali Hamza and Madjid Pahlevani University of Ottawa Queen's University Canada

#### <u>S15 - 6971</u>

#### Recent Advancements in Vehicle to Vehicle Charging

Anindita Golder, Kushan Tharuka Lulbadda and Sheldon Williamson Ontario Tech University Canada

## Session S16 Motor Drives 3 (MD3)

Date/Time: 10 August 2023 Thursday / 02:00 PM – 03:20 PM Venue: E-2022 Session Chair: Hiroaki Mukaidani ; Co-Chair: Junho Cho

#### <u> 516 - 3008</u>

*Electro-Mechanical System Design and Implementation for an Automated Radio Telescope* Kala Meah, Donald Hake II, Stephen Wilkerson, Daniel Shook, Jacob Minor, Mikayla Trost, David Babcock and Kerry Smith York College of Pennsylvania York County Astronomical Society United States

#### <u> 516 - 5052</u>

LQ Zero-Sum Differential Games for Stochastic Delay Systems and Application to Stability Control for Permanent Magnet Synchronous Motors Hiroaki Mukaidani, Shunpei Irie, Tian Zihang, Tadashi Shima and Hua Xu Hiroshima University The University of Tsukuba Japan

#### <u> 516 - 2887</u>

## Development of IEMI Generator for High Voltage EV Component EMC Test

Kihun Park, Junho Cho and Hyunji Kim EM Environment R&D Department, KATECH (Korea Automotive Technology Institute) South Korea

#### <u> 516 - 5530</u>

## *Comparative Study on Machine Emulation Systems Based on Switching Converters and Linear Power Amplifier Configurations*

Seyedeh Nazanin Afrasiabi, Rajendra Thike, K. S. Amitkumar, Chunyan Lai and Pragasen Pillay

Concordia University Opal-RT Technologies Inc. Canada

## Session S17 Renewable Energy Technologies 3 (RE3)

Date/Time: 10 August 2023 Thursday / 02:00 PM – 03:20 PM Venue: E-2023 Session Chair: Hua Geng; Co-Chair: Miloud Rezkallah

## <u> S17 - 3140</u>

*Investigation of Power Generation Reduction Patterns due to Wind Speed Fluctuations* Masaya Mitsuhashi, Hidehito Matayoshi, Akihiro Kitamura and Toshimitsu Morizane Osaka Institute of Technology Japan

## <u> S17 - 3175</u>

Analysis Study and Control of High Gain Quasi-Z-Source Step-up DC-DC boost converter for isolated Photovoltaic System Wafa Gharsallaoui, Miloud Rezkallah and Ambrish Chandra École de Technologie Supérieure Energy Intelligence Research and Innovation Center (CR2ie) Canada

## <u>S17 - 7451</u>

A Novel Partial Power Cascaded DC/DC Topology for CPV Application: A Theoretical Study Philippe Camail, Christian Martin, Bruno Allard, Charles Joubert, Maxime Darnon and Joao Trovao Laboratoire Ampère - UMR 5005 CNRS IRL-3463 Institut Interdisciplinaire d'Innovation Technologique (3IT) e-TESC Laboratory, Sherbrooke University France Canada

## <u>S17 - 9060</u>

Solar Power Electronics System Design for the Future Building Laboratory at Concordia University Zahra Asadi, Akrem Mohamed Aljehaimi and Pragasen Pillay Concordia University Canada

## Session S18 Motor Drives 4 (MD4)

Date/Time: 10 August 2023 Thursday / 03:40 PM – 05:00 PM Venue: E-2025 Session Chair: Peng Cheng ; Co-Chair: Sanjeev Singh

## <u> 518 - 5808</u>

**Robust MPC with Integral Super-Twisting for Trajectory Tracking of an Exoskeleton Robot Arm** David Bedolla-Martinez, Yassine Kali, Maarouf Saad, Cristobal Ochoa-Luna and Mohammad H. Rahman École de Technologie Supérieure Tecnologico de Monterrey, School of Engineering and Sciences University of Wisconsin-Milwaukee Canada Mexico United States

## <u> 518 - 7344</u>

A Review of Fault-Tolerant Control Methods for Cascaded H-Bridge Multilevel Inverters Hamid Hamza, Joseph Song-Manguelle, Jean-Maurice Nyobe-Yome, Mamadou Lamine Doumbia and Pascal Lingom University of Quebec Trois-Rivieres ENSPD Canada Cameroon

## <u>S18 - 9769</u>

**Torque control of Quadcopter using Fractional Active Disturbance Rejection Control** Raouf Fareh, Amal Alali and Maamar Bettayeb University of Sharjah United Arab Emirates

## <u> 518 - 2514</u>

*Emulation of a Permanent Magnet Synchronous Machine with Stator Winding Fault* Neetusha Kalarikkal, Mathews Boby and Pragasen Pillay Concordia University Canada

## Session S19 Power Electronics Control, Applications and Reliability 3 (PC3)

Date/Time: 10 August 2023 Thursday / 03:40 PM – 05:00 PM Venue: E-2022 Session Chair: Hua Geng; Co-Chair : Lu Liu

## <u> 519 - 488</u>

Dead-Beat Predictive Control of DFIG-DC Based on Data-Driven Neural Network Predictor Lu Liu, Guangqiang Wang, Dan Wang and Zhouhua Peng Dalian Maritime University China

## <u> S19 - 959</u>

*Fault Diagnosis of Electric Motors by a Convolutional-based Neural Network and STFT* Arta Mohammad-Alikhani, Subarni Pradhan, Sumedh Dhale and Babak Nahid-Mobarakeh McMaster Automotive Resource Centre, McMaster University Canada

## <u> 519 - 3018</u>

Application of Partical Swarm Optimization Algorithm On Nonlinear PI Controllers for Stable Operation of DFIG Based Wind Turbine Hicham Gouabi, Abdeldjebar Hazzab, Mohamed Habbab, Miloud Rezkallah, Ambrish Chandra and Hussein Ibrahim École de Technologie Supérieure Université Tahri Mohamed Energy Intelligence Research and Innovation Center (CR2ie) Canada Algeria

## <u> 519 - 9161</u>

## A Novel Islanding Detection Method Based on a Hybrid Algorithm in DC Microgrids

Elmira Kazeminia, Suzan Eren and Alireza Bakhshai Queen's University Canada

## <u> S19 - 9653</u>

## Optimal Power Flow Control of UPFC for Closed-loop Distribution Network

Junyu Gan, Hua Geng, Xiaoqing Bai, Wenping Cao, Cungang Hu and Wenjie Zhu School of Electrical Engineering and Automation, Anhui University Department of Automation, Tsinghua University Xi'an Actionpower Electric Co., Ltd. China

## Session S20 Renewable Energy Technologies 4 (RE4)

Date/Time: 10 August 2023 Thursday / 03:40 PM – 05:00 PM Venue: E-2023 Session Chair: Miloud Rezkallah ; Co-Chair: Satoshi Majima

## <u>S20 - 2731</u>

## Analysis Study and Control of Quasi-Z-Source Inverter Connected to Grid for Photovoltaic System Application

Seifeddine Dridi, Miloud Rezkallah and Ambrish Chandra School of Higher Technology (ETS) Energy Intelligence Research and Innovation Center (CR2Ie) Canada

## <u>S20 - 6849</u>

## Charging system for electric vehicles in off-grid isolated areas without electrical network using PV with Wifi telemetry

Victor Quintana Rodriguez, Melvin Njamen Tchaptchet and Chan Wang Park UQAR Canada

## <u>S20 - 9745</u>

# Development of a Cooperative Control Method Using Photovoltaic Characteristics within a DC Microgrid

Satoshi Majima, Hidehito Matayoshi and Toshimitsu Morizane Osaka Institute of Technology Japan

#### <u>S20 - 4487</u>

**Energy Management Strategy for Battery Protection in a Standalone PV-Battery DC Microgrid** Felix Dubuisson, Ambrish Chandra, Miloud Rezkallah and Hussein Ibrahim École de Technologie Supérieure Energy Intelligence Research and Innovation Center (CR2ie) Canada

## <u>S20 - 6353</u>

*Optimization of Diesel Generator Usage for Multi-Source Nano-Grid* Mathieu Blanchard, Abid Ali, Christian Dubuc, João Pedro F. Trovão and Maxime Darnon Université de Sherbrooke Saint-Augustin Canada Electric Inc. Canada

## Session S21 Traction and Automotive Systems 2 (TA2)

Date/Time: 10 August 2023 Thursday / 03:40 PM – 05:00 PM Venue: E-2024 Session Chair: Omer Ikram UI Haq; Co-Chair: Abdeldjebar Hazzab

#### <u>S21 - 1197</u>

## Solutions for integrating fuel cell systems into electric on-board grid for sustainable mobility applications

Mohammadreza Bagheribavaryani, Johanna Anspach, Lennart Koesters, Michael Heere, Regine Mallwitz, Markus Henke and Niklas Langmaack

Technische Universität Braunschweig - Institute for Internal Combustion Engines Technische Universität Braunschweig - Institute for Electrical Machines, Traction and Drives Germany

## <u>S21 - 1227</u>

## Online Winding Reconfiguration of a Multiphase Stator

Omer Ikram Ul Haq, Luca Peretti, Sjoerd Bosga and Rahul Kanchan ABB Corporate Research, Sweden KTH Royal Institute of Technology Sweden

#### <u>S21 - 2153</u>

## A 200 hp Dynamometer Test Facility in a University Laboratory Environment Mathews Boby, Pierre Angers and Pragasen Pillay Concordia University Canada

#### <u>S21 - 4895</u>

## Fuzzy Sliding Mode Controller for Direct Torque Control of Four-Wheel Drive Electrical Vehicle

Abdeldjebar Hazzab, Hicham Gouabi, Mohamed Habbab, Miloud Rezkallah, Ambrish Chandra and Hussein Ibrahim

École de Technologie Supérieure, Montréal, Québec.

Laboratoire Commande, Analyse et Optimisation des Systèmes Electro-Energétiques, Université Tahri Mohamed, Béchar.

Energy Intelligence Research and Innovation Center (CR2ie)

Canada Algeria

## <u>S21 - 3835</u>

An Electric Vehicle Circuit for Powering Independent Loads Tolga Osmancik, Akrem Mohamed Aljehaimi and Pragasen Pillay Concordia University

Canada