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7th IEEE International Conference on DC Microgrids

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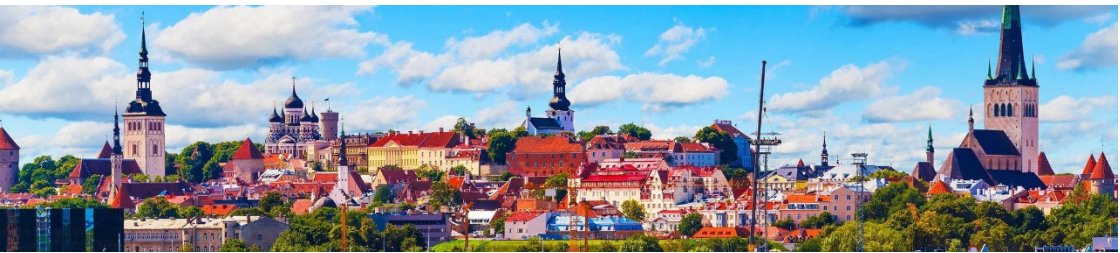
4-6 JUNE 2025

TALLINN, ESTONIA



CONFERENCE GUIDE

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ORGANIZERS

MESSAGE FROM CONFERENCE CHAIRS

On behalf of the Organizing Committee and the Technical Board, it is our great pleasure to welcome you to the 7th IEEE International Conference on DC Microgrids (ICDCM 2025), taking place in the beautiful city of Tallinn, Estonia.

This year's conference once again reflects the truly international scope of our community, with participants joining us from 28 countries. We're especially pleased to note that Germany leads in the number of attendees, a testament to its continued efforts in DC microgrid research and application. We also warmly acknowledge the participation of colleagues from far-reaching regions such as New Zealand, underscoring the global commitment to this field.

We are particularly encouraged by the strong presence of industry, which highlights the growing real-world relevance of DC microgrids and reinforces the value of academic-industry collaboration. Together, we are not just discussing technical challenges; we are shaping the future of energy systems.

We would like to express our sincere gratitude to the track chairs, who coordinated a rigorous and thoughtful review process; to the reviewers, whose efforts ensured the high technical quality of the program; and to the authors, whose innovative work lies at the heart of this conference.

Our most profound appreciation also goes to our sponsors, whose support has been instrumental in making ICDCM 2025 a success. We gratefully acknowledge our Platinum Sponsors – Current/OS Foundation and ABB; our Gold Sponsors – Open DC Alliance, Maschinenfabrik Reinhausen GmbH, Eaton Corporation, and DC Opportunities; and our Silver Sponsors – Imperix and Astrolkwx. Your contributions not only advance this event but also the field as a whole.

As we gather to exchange ideas and explore new technologies, we are reminded of the larger mission that connects us all: building more resilient, efficient, and sustainable energy systems. DC microgrids are a key enabler in this transition, and your participation here plays a vital role in shaping that future.

We encourage all attendees to take full advantage of the many opportunities for networking and collaboration throughout the week, whether during technical

sessions, coffee breaks, or social events. Conferences like ICDCM thrive not only on the strength of the presentations but also on the spontaneous conversations and lasting partnerships that emerge between sessions. We are also grateful to our oral and poster session chairs, whose dedication and attention to detail will ensure that the technical program runs smoothly and stays on schedule. Their efforts are essential to maintaining the momentum and professionalism of the conference.

We look forward to an inspiring, productive, and memorable week together in Tallinn.

Dmitri Vinnikov
General Chair

Andrii Chub
Co-Chair

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Yuchen Zhang, Zhejiang University, China

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Power Electronic Converters for DC Microgrids

Óscar Lucía, University of Zaragoza, Spain

Modeling, Stability & Control of DC Microgrids

Subham Sahoo, Aalborg University, Denmark

MV/HV DC Power Distribution and Technologies

Drazen Dujic, EPFL, Switzerland

DC-Based Energy Generation & Storage Systems

Hadi Kanaan, Saint-Joseph University of Beirut, Lebanon

DC Buildings & Smart Homes

Joao Martins, NOVA University of Lisbon, Portugal

Transportation Electrification & DC Charging

Sheldon Williamson, Ontario Tech University, Canada

DC Industry & Data Centers

Marco Stieneker, Maschinenfabrik Reinhausen, Germany

SUCCESSFUL SPECIAL SESSIONS

SS1. Design, Control and Fault Detection of Power Converters for Energy Storage and EV Charging in DC Microgrids

Hadi Kanaan, Saint-Joseph University of Beirut, Lebanon
Jean Sawma, Saint-Joseph University of Beirut, Lebanon
Kamal Al-Haddad, Ecole de Technologie Supérieure, Montreal, Canada
Sheldon Williamson, Ontario Tech University, Canada

SS2. Fault Currents for Active LVDC Grids: Evaluation Methods and Protection Strategies

Roberto Sebastiano Faranda, Politecnico di Milano, Italy
Dejan Pejovski, ABB, Italy
Simone Negri, Politecnico di Milano, Italy
Luigi Martirano, Sapienza Università di Roma, Italy

SS6. Empowering Sustainable Living: DC Systems for Residential Applications and Energy-Efficient Homes

Neelesh Yadav, Tallinn University of Technology, Estonia
Edivan Laercio Carvalho da Silva, Tallinn University of Technology, Estonia
Enrique Romero-Cadaval, University of Extremadura, Spain
Hugo Morais, IST/INESC-ID, Portugal

REVIEWERS

We are grateful to the reviewers listed below for their contributions!

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FUN FACTS ABOUT ESTONIA

Untouched, Accessible, and Wild Nature

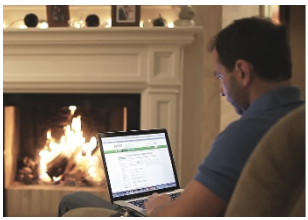
One might think that a country as modernized and digitally advanced as Estonia wouldn't be very green or nature-rich, but believe it or not, Estonia is actually ranked as one of the greenest countries in the world. With about half of the country covered in forests, nature lovers can explore and enjoy Estonia's untouched natural beauty.

Historical Country

Estonia's occupation by the Swedes, Russians, and Germans, as well as its previous affiliation with the Soviet Union, has left the country with a distinct history, rich culture, and beautiful architecture. No matter where you go, you will find remnants of historical sights and old traditions and customs, especially in Tallinn.

Internet Everywhere

Estonia ensures that all its visitors can tweet and steam about how awesome Estonia is by having free Wi-Fi hotspots everywhere. It's a digital nomads' and travel bloggers' haven! Estonia is also the birthplace of ten unicorn companies, like Skype, BOLT, Wise, Playtech, and others.



Digital Society

Estonia takes a modern, hassle-free approach to digital life – from voting and signing documents to filing taxes online. Residents can handle nearly all tasks digitally, including medical prescriptions and business registration. As the world's first e-government, Estonia also offers global e-residency.

For more information, visit:
https://www.visitestonia.com/en/why-estonia/estonia-facts
https://www.workinestonia.com/living-in-estonia/fun-facts/
https://www.roadaffair.com/visit-estonia/

THINGS TO SEE AND DO IN TALLINN

St Olaf's Church is Tallinn's biggest medieval structure. It was first mentioned in 1267. According to some sources, it may have been the tallest building in the world from 1549 to 1625. Its observation platform is open for visits.

Passages were constructed alongside the **bastions** in the 17th and 18th centuries to conceal the movement of soldiers and ammunition. After removing fortifications in 1857, parks were established on the Ingrian and Swedish bastions.

Kadriorg Park is a palatial urban park covering around 70 hectares. Its construction began in 1718 on the orders of Russian tsar Peter I. Elements of park design from the 18th, 19th, and 20th centuries can be seen here.

Kumu Art Museum features a permanent exhibition that showcases Estonian art from the 18th century to 1991, as well as temporary exhibitions of international and contemporary art.

Telliskivi Creative City is home to galleries, small shops, various creative companies, start-ups, and restaurants within the former industrial complex of Tallinn. More than twenty different works of street art can be found in the creative city.

Tallinn TV Tower, built in 1980, offers a picturesque view of Tallinn. Today, it serves three functions: to facilitate nationwide communication, to offer traditional Estonian flavors in a modern café-restaurant setting, and to provide unique experiences.

Estonian Open Air Museum showcases the Estonian rural architecture and way of life. The 14 farms in the museum offer an overview of how families from different social strata lived in the 18th–20th centuries.

Rotermann Quarter was founded in the 19th century. This industrial site has evolved into an oasis of modern architecture, skillfully blending the old with the new. It offers a variety of shops, cafes, restaurants, and the Estonian Museum of Architecture.

Seaplane Harbour displays about 200 genuine items: a real submarine called Lembit, a century-old icebreaker called Suur Tõll, a Short 184 seaplane, the remains of the oldest ship found in Estonia, etc. in the historical seaplane hangars.

For more information, visit:
https://www.visitestonia.com/en/why-estonia/estonia-facts
https://www.workinestonia.com/living-in-estonia/fun-facts/
https://www.roadaffair.com/visit-estonia/

VENUE – ORIGINAL SOKOS HOTEL VIRU

Original Sokos Hotel Viru is a landmark in Tallinn and a welcoming base for conference attendees. Ideally located next to the city's medieval Old Town and within walking distance of key attractions, shopping areas, and dining spots, the hotel offers the perfect combination of convenience, comfort, and culture.

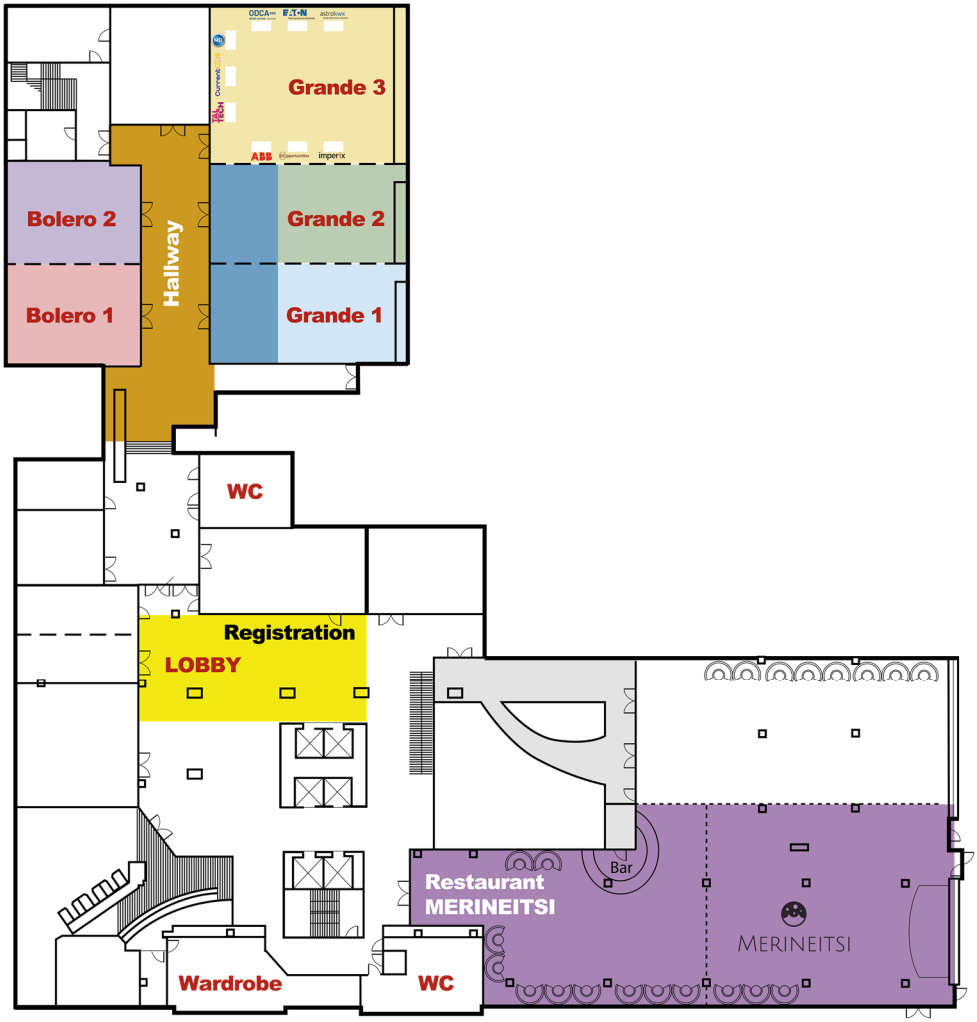
The hotel features over 500 modern rooms. Guests can enjoy several on-site restaurants, including local and international cuisine, as well as a stylish bar and panoramic views from the upper floors. The hotel also offers a relaxing sauna area, fitness facilities, and workspace options, making it easy to strike a balance between productivity and rest.

Notably, the hotel is renowned for its historical significance during the Soviet era and features the **KGB Museum**, offering visitors a unique glimpse into Estonia's past.

VENUE MAP

The event takes place on the **2nd floor** of the venue hotel.

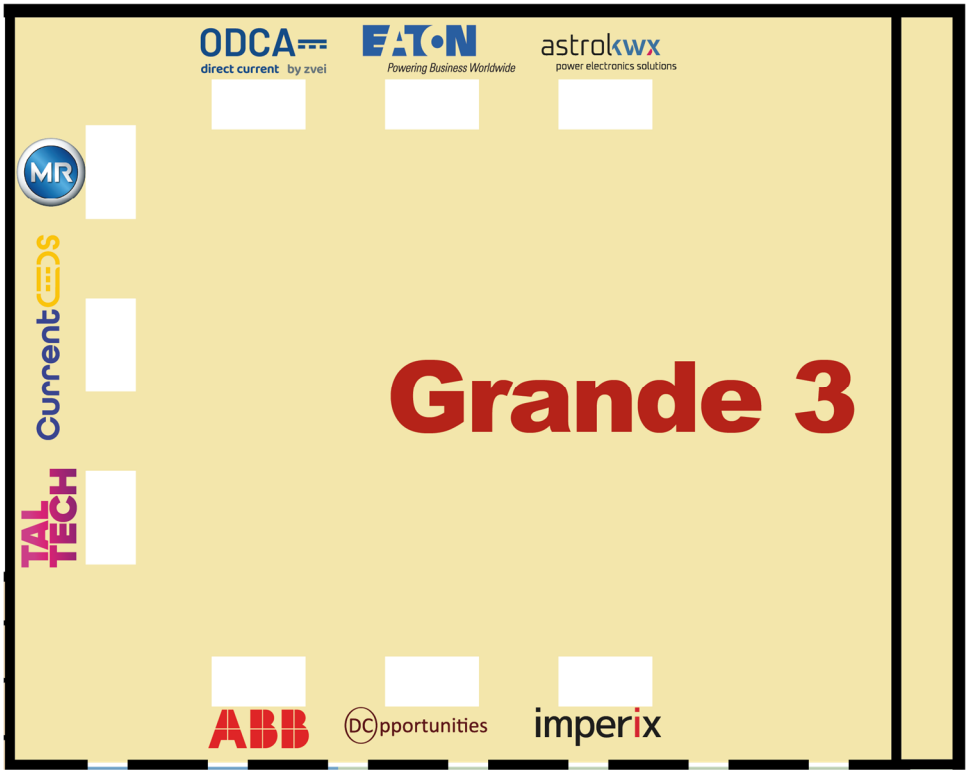
Keynotes, oral sessions, and tutorials will be held in rooms **Grande 1 & 2** and **Bolero 1 & 2**. Luncheons will take place in the **Merineitsi restaurant**, and poster sessions will be in the **Hallway** between conference rooms. Coffee breaks, vendor presentations, and industrial seminars will be hosted in **Grande 3**.



EXPO

We invite all attendees to visit the exhibition area in room **Grande 3** – a central hub for exploring the latest technologies, meeting industry leaders, and discovering real-world applications of **DC microgrids**. Whether during coffee breaks or other time, it's the perfect place to connect, learn, and get inspired.

Exhibitors include **Platinum Sponsors**: Current/OS Foundation and ABB; **Gold Sponsors**: Open DC Alliance, Maschinenfabrik Reinhausen, Eaton, and DC Opportunities; **Silver Sponsors**: Imperix and Astrolkwx; and **Local Host**: TalTech.



PROGRAM AT A GLANCE

The IEEE ICDCM 2025 conference spans three days, beginning with registration on Wednesday, June 4, and a Welcome Reception that evening at the PROTO Invention Factory.

For those arriving late, registration is available on-site at the venue of the Welcome Reception.

The main technical program runs on Thursday and Friday, featuring **16 oral sessions, 2 poster sessions, 2 keynote sessions, and 7 tutorials**. Oral sessions are scheduled in up to four parallel tracks. Poster sessions on both afternoons provide an opportunity to highlight research in power electronics, control, and secure microgrid design.

Each oral presentation is allocated 15 minutes, with a maximum of 12 minutes for presenting and the remaining time for discussion. Session chairs are asked to **keep sessions on schedule**.

Each morning opens at 8:30 a.m. with a **keynote session** featuring leading experts who will present their perspectives on the future of DC technologies. **Tutorials** follow in the afternoons, offering focused technical training across various topics, including modeling, components, fault management, and control of DC systems.

Two networking **luncheons** are part of the program. Thursday's IEEE PELS S&YP and WiE Luncheon focuses on early-career engagement and inclusion in power electronics. Friday's DC Pilots Luncheon highlights real-world experiences from industry professionals involved in the deployment and operation of DC microgrids.

Coffee breaks are paired with **vendor presentations and industrial seminars**, offering valuable interactions with technology providers and developers.

Social events complement the technical program: the Welcome Reception on Wednesday evening offers an informal opportunity to meet fellow attendees. At the same time, the Gala Dinner on Thursday at the Seaplane Harbour provides a scenic and relaxed setting for continued networking.

The program, at a glance, is presented below with color-coded conference rooms. It is worth noting that the registration will be open every day, including Wednesday.

June 4 – Wednesday				
10:00 – 17:00	**Registration**			
19:30 – 22:00	**Opening and Welcome Reception** *(PROTO Invention Factory)*			
June 5 – Thursday				
8:00 – 17:00	**Registration**			
8:30 – 10:00	**Keynote session: R. De Doncker** (RWTH Aachen) & **S. Norrga** (Scibreak)			
10:00 – 10:30	**Coffee break & vendor presentations:** Current/OS, ABB, DC Opportunities			
10:30 – 11:30 Sessions	DC Grid Stability	Converters for EV Charging	MVDC – Part I	SS on Residential DC Systems
11:30 – 12:30 Sessions	Design, Simul., and Valid. Tools	Energy Management	MVDC – Part II	DC Protection and Safety
12:30 – 13:30	**PELS S&YP and WiE Luncheon:** M. Josevski and K. Hetzenecker			
13:30 – 15:30 Tutorials	Short-Circuit Analysis of DC Sys.	Resilient & Secure DC Microgrids	µGrids: Modeling, Stability & Control	Supercap. Techniques for DC
15:30 – 16:00	**Coffee break with industrial seminar of ABB**			
15:30 – 17:00	**Poster Session** on Advanced Power Converters, Control & High-Power Appl.			
19:30 – 23:30	**Gala Dinner** ("Seaplane Harbour")			
June 6 – Friday				
8:00 – 15:00	**Registration**			
8:30 – 10:00	**Keynote session: H. Stammberger** (ODCA/Eaton) & **R. Singh** (Clemson U.)			
10:00 – 10:30	**Coffee break & vendor presentations:** ODCA, MR, Eaton			
10:30 – 11:30 Sessions	DC Installations and Testbeds	Residential and Urban DC Use	SS on Fault Currents – Part I	Power Converters for DC Systems
11:30 – 12:30 Sessions	DC Industry	Bipolar DC Microgrids	SS on Fault Currents – Part II	SS on Energy Stor. & EV Charg.
12:30 – 13:30	**DC Pilots Luncheon:** A. Makkieh, M. Stieneker, S. Lidstrom, L. Mackay			
13:30 – 15:00 Tutorials	Emerg. Convert. for DC Buildings	Components for DC Lighting	Solid-State Circuit Breakers	-
15:00 – 15:30	**Coffee break with industrial seminar of Current/OS**			
15:00 – 16:30	**Poster Session** on Intelligent and Secure DC Microgrids & Emerging Topics			
16:30 – 17:00	**Awards and Closing Ceremony**			

Color-Coding of Locations					
Original Sokos Hotel Viru					**Outside hotel**
Room Grande 1	**Room Grande 2**	**Room Bolero 1**	**Room Bolero 2**	**Room Grande 3**	
Rooms Grande 1 and Grande 2	**Lobby 2nd floor**	**Hallway**	**Restaurant Merineitsi**		

PRESENTATION FORMATS

Oral Presentation

The total time allocated to each oral presentation is 15 minutes, including 10-12 minutes for the presentation and 3-5 minutes for Q&A. Please use the widescreen format (i.e., an aspect ratio of 16:9) for your slides to best utilize the projection screen. PowerPoint slides are highly recommended, while slides in PDF format are acceptable.

All presenters will be using a conference laptop, which is a Windows PC. ***Individual laptops will not be accommodated.*** Presenters should have a copy of their presentation on a flash drive that is compatible with PCs. Please be sure to **upload your presentation** onto the PC **during the morning coffee break**, before the first presentations begin. Technical support will be available to help you with this.

Poster Presentation

The total time allocated to each poster session is 1.5 hours to enable thoughtful discussions.

You MUST use the portrait poster format. The poster boards can accommodate posters up to 970 mm wide and 2400 mm high. Posters should not exceed this size. **The recommended format is A0 (portrait).**

Only one poster will be hung on each side of the poster board. The posters should be hung during lunch so they are ready for viewing during the appropriate session.

SOCIAL EVENTS

Welcome Reception

Address:
Peetri tn 10
10415 Tallinn

The welcome reception will be organized in PROTO Invention Factory at **19:30 on June 4**. Current/OS Foundation supports this event as a Platinum sponsor.

PROTO Invention Factory uniquely combines the thrills of virtual reality with the historical charm of the former Noblessner Foundry building, a remarkable industrial landmark in Tallinn. Experience exciting virtual adventures, pilot historic vehicles, and engage with various hands-on installations designed to captivate curious minds of all ages.

Gala Dinner & Awards Ceremony

Address:
Vesilennuki 6,
10145 Tallinn

Gala Dinner will be organized in "Seaplane Harbour" – Estonian Maritime Museum – at **19:30 on June 5**. ABB supports this event as a Platinum sponsor.

Located in the unique and historic seaplane hangar, the interactive exhibition features many authentic items on display, including a submarine from the mid-1930s called Lembit, a century-old icebreaker named Suur Tõll, a seaplane called Short 184, and the remains of the oldest ship found in Estonia, among other artifacts.

Gala Dinner attendees can visit inside the 89-year-old mine-laying diesel submarine Lembit from 19:30 to 20:30.

You MUST present the corresponding ticket from your conference package to gain entry to a social event.

DAY II – JUNE 5 – THURSDAY

June 5 8:30 – 10:00 Grande 1+2	**KEYNOTE SESSION I** Moderator: *Dmitri Vinnikov, TalTech, Estonia* **DC Technologies for Flexible Distribution Grids** ***Rik W. De Doncker,*** *RWTH Aachen University, Germany* **Protection of DC Grids – Challenges and Solutions** ***Staffan Norrga,*** *Scibreak AB / KTH, Sweden*
June 5 10:00 – 10:30 Grande 3	**COFFEE BREAK & VENDOR PRESENTATIONS:** Current/OS, ABB, DC Opportunities
June 5 10:30 – 11:30 Grande 1	**DC GRID STABILITY** Chairs: ***Qobad Shafiee, Ilya Galkin*** **97. Ensuring Stability in DC Microgrids Through Application of the Passivity Principle** *Vladan Lazarević, Mario Schweizer, Dejan Pejovski and Antonello Antoniazzi* **119. Enhancing Stability and Control of HESS in DC Microgrid Feeding CPLs: An Optimized Terminal Sliding Mode Approach** *Aqeel Ur Rahman, Filippo Pellitteri, Nicola Campagna, Antonino Oscar Di Tommaso and Rosario Miceli*

	92. Data-driven Control of DC-DC Boost Converters Interfaced with Constant Power Loads *Behdad Moradi, Kamran Moradi, Pavol Bauer and Qobad Shafiee* **32. Impedance Measurement in DC-Grids using Central Excitation and Distributed Measurement** *Raffael Schwanninger, Moritz Bosch, Bernd Wunder and Martin Maerz*
June 5 **10:30 – 11:30** **Grande 2**	**CONVERTERS FOR EV CHARGING** **Chairs:** ***Alireza Khaligh, Vitor Monteiro*** **50. Fault Detection and Mitigation of DC/DC Converters with Semiconductor-Based Isolation for DC-EVSEs** *Kilian Drexler, Yan Zhou, Bernd Wunder, Vincent Lorentz and Martin März* **98. A Topology Morphing Partial Power Converter with Variable Turns Ratio for Integration of On-Board Battery Chargers with DC Buildings** *Niwton Feliciani, Mário Martins and Andrii Chub* **70. Novel Concept of Universal AC/DC-DC Onboard Battery Charger for Electric Vehicles** *Parham Mohseni, Oleksandr Husev, Dmitri Vinnikov, Matthias Kasper and Gerald Deboy* **40. Impact of Fixed vs. Variable DC-Link Voltages on Maximizing Efficiency of EVs Fast-Charging Systems** *Saghir Amin, Muhammad Awais, Joao Rocha, Joao L. Afonso, Nuno Costa and Vitor Monteiro*

June 5 **10:30 – 11:30** **Bolero 1**	**MVDC – Part I** **Chairs:** ***Sven Marquardt, Rosa Anna Mastromauro*** **16. Feasibility Analysis of Protection Diodes for Breakerless DC Grids** *Jan Mathé, Raphael Mencher and Rik W. de Doncker* **47. DC-Side Interaction Studies for Control and Protection in an MVDC System** *Jaqueline Cabañas Ramos, Ilka Jahn, Ferdinanda Ponci and Antonello Monti* **63. Transient Behavior of Power-Flow Control in Meshed MVDC Cable Grids** *Sven Marquardt and Thomas Brückner* **79. Impact of System Parameters on Selectivity Requirements for MVDC Grids** *Amila Kaharević, Ferdinanda Ponci and Antonello Monti*
June 5 **10:30 – 11:30** **Bolero 2**	**SS6 – Empowering Sustainable Living: DC Systems for Residential Applications and Energy-Efficient Homes** **Chairs:** ***Edivan Laercio Carvalho, Neelesh Yadav*** **107. Performance Analysis of Partial Power Converter in DC Microgrid with Active Front-End Converter** *Neelesh Yadav, Sayeed Hasan, Ilya A. Galkin and Andrii Chub* **111. Application and Control of Bidirectional T-Type Converter in Hybrid Bipolar AC/DC Microgrid** *Moria Sassonker Elkayam and Dmitri Vinnikov*

	135. Universal Interlinking Converter for Prosumer DC Buildings: Operation Under Normal and Abnormal AC Grid Conditions *Edivan Laercio Carvalho, Riccardo Mandrioli, Lohith Kumar Pittala, Isabella Bianchini, Andrei Blinov, Andrii Chub and Dmitri Vinnikov* **136. Universal Interlinking Converter for Prosumer DC Buildings: Operation With Different DC Grid Types** *Edivan Laercio Carvalho, Riccardo Mandriolli, Lohith Kumar Pittala, Andrei Blinov, Andrii Chub and Dmitri Vinnikov*
June 5 **11:30 – 12:30** **Grande 1**	**DESIGN, SIMULATION, AND VALIDATION TOOLS** **Chairs:** ***Fabio D'Agostino, Tanel Jalakas*** **144. HIL Replication of DC-Based Hybrid Microgrids** *Dominique Roggo, Evan Schucan, Hugo Huerta and Georgy Tsvetkov* **86. Software Tool to Support the Planning and Design of Industrial Direct Current Microgrids: A Review** *Janosch Hecker, Ismail Mesutoğlu and Alexander Sauer* **133. Modeling a Hybrid Hydrogen Microgrid in a Novel Multiphysical Energy System Simulator – MEgy** *Michael Bareev-Rudy, Malte Pfennig, Barbara Schiffer, Steffen Schedler, Gerd Steinebach and Tanja Clees* **35. Development of the Functional Mock-up Unit of a Solid-State Circuit Breaker for Digital Twin Applications** *Fabio D'Agostino, Federico Silvestro, Fabrizio Sivori, Pavel Purgat, Andres Enrique Villamil Prieto and Enrico Ragaini*

June 5 **11:30 – 12:30** **Grande 2**	**ENERGY MANAGEMENT IN DC MICROGRIDS** **Chairs:** ***Qianwen Xu, Prashant Singh*** **113. Energy Management Implementation Approach for Droop-Controlled Residential DC Nanogrids** *Sayeed Hasan, Andrii Chub, Neelesh Yadav, Andrei Blinov, Jarek Kurnitski and Dmitri Vinnikov* **91. MPC Based Power Management for Off-Grid Photovoltaic Hybrid Inverters Using Li-Ion Batteries and Supercapacitors** *Ezequiel Gonschorowski, Rafael Cardoso, Edivan Laercio Carvalho, Carlos Marcelo de Oliveira Stein, Emerson Giovani Carati, Gustavo Weber Denardin and Jean Patric da Costa* **23. Cloud-Based Energy Distribution Algorithm for DC-Microgrids Incorporating Renewable Sources and Electric Vehicle Support** *Martin Stoiber, Manuel Freiberger and Lucas Winder* **67. Control and Power Management of a Battery-Supercapacitor-PV-Wind based Grid-Independent DC-Microgrid** *Prashant Singh, Pankaj Saha and Ari Hentunen*
June 5 **11:30 – 12:30** **Bolero 1**	**MVDC – PART II** **Chairs:** ***Aditya Shekhar, Davide De Simone*** **77. HVDC-MVDC Converter with Three-Phase Semi-Coaxial Medium-Frequency Transformer** *Amandus Bach and Rik W. De Doncker*

	52. Fault Ride-Through Modulation for Forced Soft-Switched Three-Phase Dual-Active Bridge Converter *Raphael Mencher, Jan Mathé and Rik W. de Doncker* **53. Multilevel Multiport Converter for Grid-Tied DC Microgrids with Integrated PV and Storage** *Marzio Barresi, Davide De Simone, Edoardo Ferri and Luigi Piegari* **60. Experimental Demonstrator of Full Bridge Modular Multilevel Converter For DC Grid Applications** *Miad Ahmadi, Hitesh Dialani, Mladen Gagic, Pavol Bauer and Aditya Shekhar*
June 5 **11:30 – 12:30** **Bolero 2**	**DC Protection and Safety** **Chairs:** ***Satish Naik, Bertrand du Peloux*** **12. Semiconductor-based Fault Current Interruption Technology in DC Distribution Systems** *Dong-Jin Yun, Seong-Eon Kim, Cheol-Jun Shin, Hee-Su Kang, Jae-Seop Ryu and Chae-Yoon Bae* **29. Fuse Arcing Model for Low Voltage Direct Current Distribution Grid** *Frédéric Reymond-Laruina, Alexis Arellano and Djamel Hadbi* **65 Impact of DC Stray Currents - Induced Corrosion on Reinforced Concrete Structures and Mitigation Strategies** *Bertrand du Peloux, Isabelle Gal, Elie Sassine, Stephane Laurens, Jiri Stepanek and Vincent Guenego* **120. Zone Protection in Closed DC Bus and Ring Systems** *Peter van den Berg, Anju Upadhyay and Andreas Stöckli*

June 5 **12:30 – 13:30** **Restaurant Merineitsi**	**PELS S&YP AND WIE LUNCHEON** Moderator: ***Edivan Laercio Carvalho,*** *TalTech, Estonia* **Career Paths in Corporate Research: How does it compare to academia?** ***Martina Josevski,*** *Eaton Research Labs, Germany* **Choosing a PhD in Power Electronics** ***Katharina Hetzenecker,*** *RWTH Aachen University, Germany*
June 5 **13:30 – 15:30** **Grande 1**	**TUTORIAL** **Contemporary Short-Circuit Analysis of DC Systems: Components and System Models** Instructors: ***Fabio D'Agostino*** *(University of Genova),* ***Pavel Purgat*** *(ABB),* ***Dimitrije Jelić*** *(Typhoon HIL)*
June 5 **13:30 – 15:30** **Grande 2**	**TUTORIAL** **Resilient and Secure DC Microgrids: Decentralized Control, Stability, and AI-Driven Cybersecurity** Instructors: ***Qianwen Xu*** *(KTH),* ***Yihao Wan*** *(KTH),* ***Jiawei Chen*** *(Chongqing University),* ***Mengfan Zhang*** *(KTH)*
June 5 **13:30 – 15:30** **Bolero 1**	**TUTORIAL** **Microgrids: Modeling, Stability and Control** Instructors: ***Pavol Bauer*** *(TU Delft),* ***Qobad Shafiee*** *(TU Delft)*

June 5 **13:30 – 15:30** **Bolero 2**	**TUTORIAL** **Supercapacitor Techniques for Protecting Future DC Systems, DC Appliances and DC Microgrids: New Zealand Experiences with FAN Project Outcomes** Instructors: ***Nihal Kularatna*** *(University of Waikato),* ***Chamara Dassanayake*** *(University of Waikato)*
June 5 **15:30 – 16:00** **Grande 3**	**COFFEE BREAK WITH INDUSTRIAL SEMINAR** **Navigating the Future of Energy: Faults in LV DC Microgrids and Protection Technologies** ***Dejan Pejovski,*** *ABB Electrification – Smart Power, Italy*
June 5 **15:30 – 17:00** **Hallway**	**POSTER SESSION** **Section A: Advances in Power Converters** Chairs: ***Riccardo Mandrioli*** **Posterboard A1** **10. Current Shift Effect of Dead-time Switching Dynamics for Three-Phase Dual Active Bridge Converter** *Ryo Wakabayashi and Tohru Kohno* **Posterboard A2** **43. Active Redundancy in Fault Tolerance: A Modular Switch Level Solution with Synchronous Switching** *Aditya Shirodkar, Satish Naik, Andrii Chub, Riccardo Mandrioli and Mattia Ricco*

Posterboard A3

34. A Simplified Modular Multilevel Step-Down DC/DC Converter for Medium to High-Voltage Applications

Georgios Orfanoudakis, Georgios Kotoulas, Evangelos Pompodakis and Alon Kuperman

Posterboard A4

27. Variable DC-Link Voltage for an LLC Converter with Wide Input and Output Voltage Range

Joao Rocha, Saghir Amin, Muhammad Awais, Goncalo Rego, Joao Luiz Afonso and Vítor Monteiro

Posterboard A5

90. Novel Dual-Purpose Cost-effective Forward-Based Micro-Converter

Hossein Afshari, Oleksandr Husev, Oleksandr Matiushkin and Dmitri Vinnikov

Posterboard A6

137. Performance Analysis of SI-SIDO Boost-Buck-Boost Converter under Unbalanced Output Scenarios Using a Continuous Switching Method

Babak Rooholahi and Hans-Günter Eckel

Posterboard A7

140. Bidirectional Cuk DC-DC Voltage-Doubler Converter in Discontinuous Conduction Mode

Mateus Nava Mezaroba, Eduardo Valmir de Souza, Marcelo Lobo Heldwein and Telles Brunelli Lazzarin

Posterboard A8

78. Modified Boost Converter Topology for Enhanced Converter-Based DC Protection

Moein Ghadrdan, Honeymol Mathew, Ömer Ekin and Giovanni De Carne

	Posterboard A9 **118. Active Power Sharing Control in Asymmetrical Bidirectional DC/DC for Smart Transformers** *Lohith Kumar Pittala, Mattia Ricco, Andrii Chub, Moshe Sitbon, Alon Kuperman and Riccardo Mandrioli* **Posterboard A10** **37. Enhanced Thermal Management Strategies for SiC MOSFETs in EV Fast Charging Systems Using Cold Plate and Copper Inlay Solution** *Muhammad Awais, Saghir Amin, Francisco P. Brito, João Luiz Afonso, Nuno Costa and Vítor Monteiro*
June 5 **15:30 – 17:00** **Hallway**	**POSTER SESSION** **Section B: Advanced Control and High-Power Applications** **Chairs:** ***Alon Kuperman*** **Posterboard B1** **62. Nonlinear Control of the Four-Wire Y-Converter for Grid Integration of 400 V DC Microgrids** *Mohammed B. Debbat, Ahmed Yahia Farag Abdelfattah, Paolo Mattavelli and Jose Luis Dominguez-García* **Posterboard B2** **108. Control of Multiport Partial Power Converters for PV-Battery Systems Integration in DC Microgrids** *Neelesh Yadav, Tuhin Mitra, Ahmad Makkieh and Andrii Chub* **Posterboard B3** **21. Design of a Model Predictive Controller for the Dual-active Bridge Converter** *Marco Guerreiro, Wesley Becker, Pedro dos Santos and Steven Liu*

Posterboard B4

84. Controller for Grid-Current Regulation and RMS Current Reduction of a Matrix-Type Converter

Matteo Vazzoler, Davide Biadene, Paolo Mattavelli and Tommaso Caldognetto

Posterboard B5

56. Performance Evaluation of Multiport Y-Converters using Renewable Source Mission Profile

Khaled Awadallah Ahmed Mohammed, Ahmed Yahia Farag Abdelfattah, Davide Biadene, Tommaso Caldognetto and Paolo Mattavelli

Posterboard B6

5. Distributed MPC for Cost-Optimal Control of FC-Battery Shipboard Microgrids

Timon Kopka, Andrea Coraddu and Henk Polinder

Posterboard B7

125. Dynamic Droop Voltage Control in Zonal DC Microgrids Supplying High-power Pulsed Loads

Andrea Alessia Tavagnutti, Andrea Vicenzutti, Daniele Bosich, Robert M. Cuzner and Giorgio Sulligoi

Posterboard B8

13. Analysis of Fault Simulation in LVDC Distribution System and Application Effects of Semiconductor Circuit Breaker Using PSCAD/EMTDC

Hee-Su Kang, Dong-Jin Yun, Seong-Eon Kim, Chul-Jun Shin, Da-Eun Kim, Jae-Seop Ryu and Chae-Yoon Bae

Posterboard B9

39. Multi-DC-Bus Power Conversion Stage for Integration of PV Systems in the MV Network

Javed Jamshed and Rosa Anna Mastromauro

DAY III – JUNE 6 – FRIDAY

June 6 **8:30 – 10:00** **Grande 1+2**	**KEYNOTE SESSION II** Moderator: *Dmitri Vinnikov, TalTech, Estonia* **How DC Contributes to the Energy Transition** ***Hartwig Stammberger,*** *ODCA / Eaton, Germany* **Why and How Direct Current Power Networks Will Dominate Global Green Electricity Infrastructure** ***Rajendra Singh,*** *Clemson University, USA*
June 6 **10:00 – 10:30** **Grande 3**	**COFFEE BREAK & VENDOR PRESENTATIONS:** **Open DC Alliance, Maschinenfabrik Reinhausen, Eaton**
June 6 **10:30 – 11:30** **Grande 1**	**DC INSTALLATIONS AND TESTBEDS** Chairs: ***Hartwig Stammberger, Holger Borcherding*** **110. The Smart2DC Microgrid Laboratory at Karlsruhe Institute of Technology** *Ömer Ekin, Friedrich Wiegel, Luigi Spatafora, Richard Jumar, Moein Ghadrdan, Simon Waczowicz, Giovanni De Carne and Veit Hagenmeyer*

	6. Demonstration of a 700 V – 18 kW Low Voltage Direct Current Microgrid *Kenan Askan, Michael Bartonek, Ronald Niehoff and Hartwig Stammberger* **88. Building-Level DC-Aware Energy Management System: Experimental Realization and Outcomes** *Hossein Nourollahi Hokmabad, Oleksandr Husev, Pedro P. Vergara, Jarek Kurnitski, Dmitri Vinnikov and Juri Belikov* **24. A DC Microgrid Testbed: Concept to Real World Applications** *Indra Bhogaraju, Muhammad Anees, Mehnaz Khan, James Stoupis and Srdjan Lukic*
June 6 **10:30 – 11:30** **Grande 2**	**DC SYSTEMS FOR RESIDENTIAL AND URBAN USE** **Chairs:** ***Pedro Pereira, Niwton Feliciani*** **85. Bipolar 350/700V DC Grid for Public Lighting – A Case Study** *Lukas Irazusta, Khawaja Samad Shah, Hidde L. Moens, Peter Broekhuijsen and Laurens Mackay* **76. A Conceptual Design of Multibus Architectures for Smart Homes in Residential DC Microgrids Powered by Solid-State Transformers** *Sergio Coelho, Joao Rocha, Manuel Sepulveda, Vitor Monteiro and Joao L. Afonso* **124. Feasibility Study of Snow Removal from PV Module Using Universal Power Electronic Interface** *Sachin Chauhan, Andrii Chub, Sayeed Hasan, Artur Lavrov, Jarek Kurnitski and Dmitri Vinnikov*

	EV Charging in DC Public Lighting Grids enabled by Enhanced Power Capacity *Laurens Mackay and Pedro Parreira /invited presentation/*
June 6 **10:30 – 11:30** **Bolero 1**	**SS2 - FAULT CURRENTS FOR ACTIVE LVDC GRIDS: EVALUATION METHODS AND PROTECTION STRATEGIES – PART I** Chairs: ***Roberto Faranda, Simone Negri*** **102. Equivalent Circuit for LVDC Grid Fault Analysis: Numerical Parameters Evaluation** *Julian David Valbuena Godoy, Simone Negri, Francesca Oliva, Dejan Pejovski, Antonello Antoniazzi and Roberto Faranda* **103. Equivalent Circuit for LVDC Grid Fault Analysis: Physical Parameters Evaluation** *Julián Valbuena, Simone Negri, Francesca Oliva, Dejan Pejovski, Antonello Antoniazzi and Roberto Faranda* **61. In-depth Analysis on Protection and Selectivity for LVDC Building** *David Corbet and Thi-Thu-Ha Pham* **75. Simplified Short Circuit Current Simulation in LVDC Microgrids** *Laura Bayerdörffer, Timo Heurich, Stephan Rupp, Sebastian Brüske and Marius Langwasser*

June 6 **10:30 – 11:30** **Bolero 2**	**POWER CONVERTERS FOR DC SYSTEMS** **Chairs:** ***Drazen Dujic, Pedro Pereira*** **18. Exploring the Features of Power Electronic Converters for Hybrid AC-DC Microgrids** *Jules Mace and Drazen Dujic* **96. Wide Voltage Gain Current-Fed Isolated Buck-Boost Series-Resonant DC-DC Converter with Active Clamp for DC Microgrid Applications** *Salman Khan, Andrii Chub, Dmitri Vinnikov, Matthias Kasper, Gerald Deboy and Sachin Chauhan* **100. DC-DC Converter with Buck-Boost Characteristics and High Voltage Gain Based on the Differential Concept** *Vitor Pires, Daniel Foito, Armando Cordeiro, Joaquim Monteiro, Sonia Pinto and Jose Fernando Silva* **139. Cycle-Skipping Technique based on Sigma-Delta Modulation in Series Resonant DC Transformer** *Lohith Kumar Pittala, Andrii Chub, Vadim Sidorov, Salman Khan, Mattia Ricco and Riccardo Mandrioli*
June 6 **11:30 – 12:30** **Grande 1**	**DC INDUSTRY** **Chairs:** ***Marco Stieneker, Daniele Bosich*** **82. Availability of Multi-infeed Industrial LVDC Grids with Multiple Zones Considering Timely Protection** *Glenn Emmers, Tom Van Acker and Johan Driesen*

	64. Technical-Economic Assessment of a DC Microgrid for Electroplating Industry *Stefano Lilla, Andrea Alessia Tavagnutti, Daniele Bosich, Fabio Napolitano, Andrea Prevedi, Fabio Tossani, Giorgio Sulligoi and Carlo Alberto Nucci* **17. Methodical Identification and Evaluation of Critical Failures in DC Hybrid Switchgear** *Matthias Streck, Johannes Gehring, Arno Bernhardt, Bernhard Fauth, Sebastian Gerke, Christian Hoyer, Julian Kaiser, Ann-Catrin Uhr-Müller, Christoph Oehler, Frank Berger, Vincent Lorentz and Martin März* **80. Consequences of Transformer DC Bias in AC Earthed Low Voltage DC Grids** *Simon Ravyts, Lucas Van Der Veken, Timon De Wispelaere, Luc Lasne and Michael Kleemann*
June 6 **11:30 – 12:30** **Grande 2**	**BIPOLAR DC MICROGRIDS** **Chairs:** ***Vitor Monteiro, Neelesh Yadav*** **83. GaN-based Neutral-point-clamped Multi-port DC-DC Converter** *Ke Xu, Jesse Echeverry, Laurens Mackay and Hani Vahedi* **71. Capacitively Isolated Triple-Active-Bridge (CITAB) DC-DC Converter for Bipolar DC Nanogrid** *Emmanuel Oluwasogo, Jens Konrath, Sandhya Burri and Ignatius Okakwu* **101. A Single-Switch DC-DC NonIsolated Buck-Boost Converter with Wide Voltage Gain for Bipolar DC Microgrids** *Victor Pires, Daniel Foito, Armando Cordeiro, Pedro Pereira and Joao Martins*

	31. An Active Balancer of Currents for Bipolar DC Power Grids *Vitor Monteiro, Sergio Coelho, Saghir Amin, Muhammad Awais, Pedro Brito and Joao Afonso*
June 6 **11:30 – 12:30** **Bolero 1**	**SS2 - FAULT CURRENTS FOR ACTIVE LVDC GRIDS: EVALUATION METHODS AND PROTECTION STRATEGIES – PART II** **Chairs:** ***Roberto Faranda, Simone Negri*** **99. Current-Derivative-Based Fault Detection in Converter-Interfaced LVDC Grids: A Different Approach** *George Govaerts, Johan Driesen and Wilmar Martinez* **141. Supercapacitor-based Arc Reduction Technique for DC Circuit Breakers** *Chamara Dassanayake, Nihal Kularatna, Alistair Steyn-Ross, Nicoloy Gurusinghe, Tarek Lamara and Claudio Tricarico* **45. Three-level Gate Driver for Latching Current Limiter in DC Microgrid Protection** *Alejandro Latorre, Thiago Batista Soeiro, Rinze Geertsma and Henk Polinder* **58. Selectivity in DC-Microgrids: The Reaction Time Gap** *Johannes Gehring, Raffael Schwanninger, Kilian Drexler, Bernd Wunder, Vincent Lorentz and Martin März*

June 6 **11:30 – 12:30** **Bolero 2**	**SS1 – Design, Control and Fault Detection of Power Converters for Energy Storage and EV Charging in DC Microgrids** Chairs: ***Hadi Kanaan, Maurice Fadel*** **8. Multi-objective Online Optimization technique of a DC Microgrid** *Elie Hleihel, Maurice Fadel and Hadi Kanaan* **11. Enhancing Dynamic Performance of Asymmetrical CLLC Resonant Converters by Optimal Trajectory Control and First Harmonic Approximation** *Xiaotian Yang, Zhuoyun Liu, Bernd Wunder, Vincent Lorentz and Martin Maerz* **51. Adaptive Grid Forming Control of STATCOM To Improve DC Dynamics In Hybrid AC-DC Microgrid** *Hikmat Basnet, Henrik Alenius and Tomi Roinila* **106. Three-Phase Three-Level Dual Active Bridge for EV Charging: Wide Output Voltage Range with Light-Load Soft-Switching Morphing** *Riccardo Mandrioli, Francesca Grazian, Lohith Kumar Pittala, Mattia Ricco and George Papafotiou*
June 6 **12:30 – 13:30** **Restaurant Merineitsi**	**DC Pilots Luncheon** Moderator: ***Dmitri Vinnikov,*** *TalTech, Estonia* **DC Microgrids Power the Way – Scaling Up Renewables Without Shaking the Grid Down** ***Ahmad Makkieh,*** *Schneider Electric, UK*

	DC Microgrids for Charging Infrastructure – PV2V ***Marco Stieneker**, Maschinenfabrik Reinhausen, Germany* **Direct Current Microgrids Installed in Scandinavia** ***Stefan Lidstrom**, Comsys, Sweden* **Bipolar 350/700V DC Microgrids** ***Laurens Mackay**, DC Opportunities, Netherlands*
June 6 **13:30 – 15:00** **Grande 1**	**TUTORIAL** **Emerging Power Converters Topologies for DC Buildings Applications** Instructors: ***Edivan Laercio Carvalho** (TalTech), **Neelesh Yadav** (TalTech), **Sachin Chauhan** (TalTech), **Niwton Gabriel Feliciani dos Santos** (TalTech)*
June 6 **13:30 – 15:00** **Grande 2**	**TUTORIAL** **Components for Lighting in Local DC Microgrids** Instructors: ***Zafer Cankurtaran** (RITTAL), **Dietmar Klien** (Tridonic), **Birthe Bittner** (ZUMTOBEL)*

June 6 **13:30 – 15:00** **Bolero 1**	**TUTORIAL** **Solid-State Circuit Breakers – Emerging Topologies, Challenges, and Applications** Instructors: ***Satish Naik Banavath*** *(IIT Dharwad)*, ***Martina Joševski*** *(Eaton)*
June 6 **15:00 – 15:30** **Grande 3**	**COFFEE BREAK WITH INDUSTRIAL SEMINAR** **Unlock the Secrets of DC Microgrids** ***Harry Stokman,*** *Current/OS | DC Expert, Netherlands*
June 6 **15:00 – 16:30** **Hallway**	**POSTER SESSION** **Section A: Emerging Research Topics** Chairs: ***Tanja Clees*** **Posterboard A1** **42. Low Cost Arc Preventer for Converting AC Devices for DC Supply** Raffael Schwanninger, Kilian Drexler, Raphaël Rohmer, Justus Renner, Vincent Lorentz and Martin März **Posterboard A2** **114. Configurable Solid State Protection Devices for Residential DC Microgrids** *Tanel Jalakas and Siim Erik Viiding* **Posterboard A3** **20. Active Clamping Modeling for Electronic Fuses in the Vehicular Low-Voltage Power Supply** *Bastian Eisenmann, Martin Baumann, Christoph Mayer and Marcelo Lobo Heldwein*

Posterboard A4

121. Identifying the Potential of the Heat Generation of the Power Supply for a PEM Electrolyzer Plant in the Megawatt Range

Malte Pfennig, Barbara Schiffer and Tanja Clees

Posterboard A5

131. Analysis of a Reconfigurable Non-Isolated DC-DC Converter for DC Microgrid Applications

Vinod Kumar Yadav and Andrii Chub

Posterboard A6

89. Conducted EMI Emission Evaluation Considerations for Lab Test Site and In-situ Measurements of DC Microgrid Supplied Power Converters

Lauri Kütt, Kamran Daniel, Hetal Sharma, Martin Parker and Andrii Chub

Posterboard A7

48. Practical Implementation of a Public LVDC Microgrid: Challenges and Experiences

Ward Ysebie, Hakim Azaioud, Brecht Caers and Jan Desmet

Posterboard A8

36. A Modified DC-link Structure for PWM Motor Drives to Eliminate Common-mode Leakage and Bearing Currents

Georgios Orfanoudakis, Evangelos Pompodakis and Alon Kuperman

Posterboard A9

130. Active Front-End DC Grid-Forming Converter Design with Power Balancing Capability

Ievgen Verbytskyi, Andrei Blinov, Andrii Chub and Dmitri Vinnikov

	Posterboard A10 **105. Battery-Integrated Dual-Winding Magnetic Energy Harvester Supplying a Constant Power DC Load** *Asaf Levhar, Alex Belenky, Georgios Orfanoudakis, Moshe Sitbon, Riccardo Mandrioli and Alon Kuperman*
June 6 **15:00 – 16:30** **Hallway**	**POSTER SESSION** **Section B: Intelligent and Secure DC Microgrids** **Chairs:** ***Niwton Feliciani*** **Posterboard B1** **66. Open-loop Control Stability of Buck Converters with Constant Power Loads Considering Parasitic Parameters Effects** *Yeji Jiang, Li Qi, Jinzhuo Bai, Xuemeng Zhang and Zhiguo Hao* **Posterboard B2** **2. Resilient Control Strategy for DC Microgrid Clusters with Bidirectional Power Flow under Cyber Attacks** *Dat Thanh Tran, Hieu Xuan Nguyen, Min Kang, Kyeong-Hwa Kim, Myungbok Kim and Bongwoo Kwak* **Posterboard B3** **123. Adversarial Learning-Based Cybersecurity Framework for DC Microgrids** *Yihao Wan, Qianwen Xu and Tomislav Dragicevic* **Posterboard B4** **127. Multi-Step Ahead Short-Term Residential DC Load Forecasting: A Comparative Study of NGBoost-Based Algorithms** *Noman Shabbir, Oleksandr Husev, Hossein Noroillahi Hokmabad, Kamran Daniel, M. Jawad and Joao Martins*

	Posterboard B5 **109. Online Embedded Analytics for Energy Time Series Pre-Processing in LVDC Microgrids** *Grigore Stamatescu, Radu Plamanescu and Mihaela Albu* **Posterboard B6** **14. SAC-Based Distributed Optimal Control of Generation Cost in DC Microgrids** *Mohsen Salimi Khanghah, Fariba Moghaddam, Amirabolfazl Suratgar and Mohammad Bagher Menhaj* **Posterboard B7** **3. Rapid State-of-Power Estimation of Lithium-Ion Batteries in DC Microgrids** *Leevi Lignell, Minh Tran and Tomi Roinila* **Posterboard B8** **19. Optimal Distributed SoH Balancing of Second-Life Battery Energy Storage Systems in a dc Microgrid** *Enrique Nunes, Gaowen Liang, Ezequiel Rodriguez, Hein Wai Yan, Glen G. Farivar, Petr Vorobev and Josep Pou* **Posterboard B9** **28. Real-time Power Management of Lithium-Ion Batteries in DC Microgrids** *Minh Tran, Leevi Lignell and Tomi Roinila* **Posterboard B10** **143. Remote Data Transfer and Comparative Performance Through PyBaMM and Mathematical Techniques in Battery Applications** *Rolando Antonio Gilbert Zequera, Diana Belolipetskaja and Anton Rassõlkin*
June 6 **16:30 – 17:00** **Grande 1+2**	**AWARDS AND CLOSING CEREMONY**

KEYNOTE I

DC Technologies for Flexible Distribution Grids

RIK W. DE DONCKER

RWTH Aachen University
Germany

Rik W. De Doncker (M'87 SM'99 F'01) received his Ph.D. degree in electromechanical engineering from the KU Leuven, Belgium.

In 1987, he was appointed Visiting Associate Professor at the University of Wisconsin, Madison, where he developed the DAB converter. In 1988, he joined the GE Corporate Research and Development Center, Schenectady, NY. In November 1994, he joined Silicon Power Corporation (formerly GE-SPCO) as Vice President Technology, developing the world's first medium-voltage static transfer switch.

Since Oct. 1996, he is professor at RWTH Aachen University, Germany, where he leads the Institute for Power Electronics and Electrical Drives (ISEA). Oct. 2006 he was appointed director of the E.ON Energy Research Center at RWTH Aachen University, where he leads the Institute of Power Generation and Storage Systems.

Since 2014, he has been director of the German Federal Government BMBF Flexible Electrical Networks (FEN) Research CAMPUS. He has a doctor honoris causa degree from TU Riga, Latvia. He has published over 800 technical papers and is a holder of more than 60 patents.

Dr. De Doncker is a recipient of the IAS Outstanding Achievements Award, the 2013 Newell Power Electronics IEEE Technical Field Award, and the 2014 IEEE PELS Harry A. Owen Outstanding Service Award. In 2015, he was awarded Fellow status

at RWTH University. In 2016, he became member of the German Academy of Science and Technology (ACATECH). 2020 he received the IEEE Medal in Power Engineering.

Abstract:

The liberalization of the energy market has significantly impacted the entire structure of the energy supply system. In addition, partially due to a strong commitment of governments to reduce CO2 emissions, vast amounts of renewable, dispersed, but volatile power generator systems (mostly wind and PV) are being installed. To cope with this new landscape of dispersed, volatile generation, several measures must be taken to provide a robust and secure energy supply of electrical energy. In particular, next to fully automated demand side management systems, all sorts of energy storages (in form of heat, cold, gas and batteries) and more flexible grid structures are needed. This presentation explores the potential of DC technologies in distribution systems. The role and prospects of state-of-the-art power electronics and protection gear, a key enabling technology to realize a modern energy supply system, is discussed.

KEYNOTE II

Protection of DC Grids – Challenges and Solutions

STAFFAN NORRGA

Scibreak / KTH
Sweden

Staffan Norrga was born in Lidingö, Sweden, in 1968. He received the M.Sc. degree in applied physics from Linköping Institute of Technology, Linköping, Sweden, in 1993 and the Ph.D. degree in electrical engineering from the Royal Institute of Technology (KTH), Stockholm, Sweden, in 2005.

Between 1994 and 2011, he worked as a Development Engineer at ABB in Västerås, Sweden, in various power-electronics-related areas such as railway traction systems and converters for HVDC power transmission systems. He currently holds a position as associate professor in power electronics at KTH.

In 2014 he co-founded Scibreak AB to develop new technology for current interruption. The company is now part of Mitsubishi Electric.

His research interests include power electronics and its applications in power grids, renewables, and electric vehicles. He is the inventor or co-inventor of more than 15 granted patents and has authored or co-authored more than 100 scientific papers published at international conferences or in journals.

Abstract:

Just like any other power grids DC microgrids need protection from short-circuit faults. Both fault detection and fault clearing differ greatly from AC grids. Generally, DC protection need to be faster as there is no reactance to limit the fault current. Furthermore, DC current interruption is challenging since there are no natural zero-crossings in the current. The approach to protection in DC grids will likely be different at different voltage levels and the types of protection equipment used will differ. DC circuit breaker technologies suitable for DC microgrids will be reviewed, and their design and properties described. Also, protection interoperability in a multivendor context is crucial for the deployment of DC microgrids. Methodologies for achieving interoperability will be discussed and explained.

KEYNOTE III

How DC Contributes to the Energy Transition

HARTWIG STAMMBERGER

ODCA / Eaton
Germany

Hartwig Stammberger received a Ph.D. in Electrical Engineering from the Technical University of Braunschweig, Germany, in 1995.

After joining Moeller (named Klöckner-Moeller at the time) in Bonn, Germany, in 1995, he was first a senior engineer, promoted to group manager in 1997, and deputy department leader of the Technology development department in 2003. After Eaton Corporation acquired Moeller in 2008 he took over the management position of the technology department of the Power Distribution Components Division of Eaton in Europe, Middle East & Africa (EMEA). Currently, he is Manager Strategic Associations Direct Current at Eaton EMEA.

He was in charge of coordinating the German government-funded project DC-INDUSTRIE between 2016 and 2019, as well as DC-INDUSTRIE2 from 2019 to 2023. Since 2022, he has been Chair of the Board of the Open DC Alliance (ODCA).

Abstract:

The international commitment to keep global temperature rise to around 1.5°C requires every sector to contribute. This talk focuses on the use of electrical energy and, specifically, how low-voltage DC reduces power loss, needs less equipment to achieve the same tasks, and relieves the supply grid. Collaboration in alliances such as the Open DC Alliance (ODCA) brings stakeholders together. Application examples and the achieved benefits round up the talk.

KEYNOTE IV

Why and How Direct Current Power Networks Will Dominate Global Green Electricity Infrastructure

RAJENDRA SINGH

Clemson University

USA

Rajendra Singh is Houser Banks Distinguish professor in the Holcombe Department of Electrical and Computer Engineering and Automotive Engineering at Clemson University (CU). Motivated by the statement of Thomas Edison about solar Energy, during the energy crisis of 1973, he decided to do Ph.D. dissertation in the area of Silicon Solar Cells. In the last 50 years, he has contributed and witnessed the growth of photovoltaic and semiconductor industries.

With proven success in operations, project/program leadership, R&D, product/process commercialization, and start-ups, Dr. Singh is a leading technologist with the focused goal of mitigation of climate related challenges by providing sustainable green electric power.

He is author or co-author of over 500 publications in various journals and conference proceedings. He is editor or coeditor of more than fifteen conference proceedings. He has presented over 60 keynote addresses and invited talks in various national and international conferences. He is founding technical chair of IEEE DC Microgrid Conference.

Dr. Singh holds six patents. Technology developed in his lab has been licensed to industry for commercialization. Currently he is serving as Chair of IEEE Power and

Energy Society Committee on End-to-End DC power. He is Fellow of IEEE, SPIE, ASM and AAAS.

Dr. Singh has received a number of national and international awards. In 2010, Photovoltaics World selected him as one of the ten Global Champions of photovoltaics. In 2014, he was honored by US President Barack Obama as a White House “Champion of Change for Solar Deployment” for his leadership in advancing solar energy with photovoltaics technology. In 2019, he received Hind Rattan (Jewel of India) Award presented by Bibek Debroy, chairman of the Economic Advisory Council to Prime Minister Narendra Modi of India.

Abstract:

It is a common practice to read almost every day the news about flooding, extreme heat related deaths, hurricanes and high food prices, etc. all over the world. Globally, dirty energy of fossil fuel represents 81% of all energies used by mankind. Getting rid of fossil fuel as early as possible and electrifying everything by green sustainable electric power is the only answer to tackle climate emergency. Solar electricity generated by photovoltaics (PV) has reached to the point that PV is now the cheapest source of electric power generation. On-shore wind, electricity is as cheap as solar electricity and off-shore wind electricity has issues of higher cost than on shore wind electricity. The cost of batteries is coming down every day and the combination of PV and batteries at utility scale can provide lower cost than electrical power generated by fossil fuel in many parts of the world. It remains to be seen if the cost of green hydrogen can be brought down significantly or it will remain a future source of energy. Thus, today, we have nearly a solution of sustainable green electrical power generation and storage. Globally AC electric power infrastructure has been adopted over DC power due to invention of transformer. However, due to power electronics the situation is totally different today. Except for induction motors running at 100 % speed, all loads using variable frequency device (VFD) are DC loads. Both PV and batteries are based on DC power and virtually all loads are DC loads. Considering power generation, transmission, distribution and utilization, as a single entity, we are wasting a large amount of power using our AC power electricity infrastructure. By using end-to-end DC (EEDC) power networks, we will save energy and capital investment of electricity infrastructure as well as DC loads as compared to the existing AC power infrastructure. The bottleneck challenge in achieving the goal of end-to-end DC (EEDC) power networks is the lack of bi-directional solid state based LVDC to MVDC and MVDC to HVDC converters with protection circuits. The purpose of this talk is to provide pathway that includes technical and policy details to expedite green energy transition by using EEDC electricity infrastructure.

TUTORIAL

Contemporary Short-Circuit Analysis of DC Systems: Components and System Models

Duration: 120 minutes

Abstract. The efficient and reliable design of DC systems is one of the main roadblocks to large-scale deployment of these emerging systems. Despite the fact that the DC systems were used in special applications for over a decade, the knowledge and lessons learned remained often in the application silos. This tutorial aims to bring the latest knowledge from academia on DC systems and their protection and fuse it with industrial experience. The tutorial will first give an overview of the protection components needed in the DC systems and the emerging design methods and criteria. It will also provide important information from the IEC standards that should be considered. Approximately half of the tutorial will be dedicated to using numerical simulations to analyze the severity of various short-circuits and the performance of the system during the fault. The state-of-the-art simulation approach will be applied to shipboard power systems. The use case will be used to demonstrate the lessons learned in designing and operating DC systems in the marine industry.

INSTRUCTORS

Fabio D'Agostino (Senior Member, IEEE) is currently Tenure Track Professor at the Department of Electrical, Electronic, Telecommunication Engineering and Naval Architecture (DITEN) of the University of Genova, where he received the master's degree (2013) and the Ph.D. degree (2016) in Electrical Engineering. From 2021, he is one of the representatives of the IEEE Marine Systems Coordinating Committee, liaison with the IEEE Electric Ship Technology Symposium. He is the Secretary of the CIGRE Working Group C1.45, and from 2023 he is Associate Editor of IEEE Electrification Magazine. His research activity includes control and the protection of electrical power systems and microgrids, with special focus on shipboard power systems, and active distribution networks automation.

Pavel Purgat received the M.Sc. and Ph.D. degrees in electrical sustainable engineering from the Delft University of Technology, Delft, the Netherlands, in 2016 and 2020, respectively.
He was a visiting researcher at Fraunhofer IISB in 2017. He was with Eaton Industries as a senior innovation engineer between 2020 and 2022 and with Egston Power Electronics in various roles between 2022 and 2024. He is currently at ABB with the global applications team responsible for developing the emerging direct current applications, and applications in battery and hydrogen energy storage area. His research interests include isolated dc-dc converters, battery energy storage systems, marine systems and power distribution related applications of power electronics.

Dimitrije Jelić (Applications Engineer, Typhoon HIL) started working in Typhoon HIL in 2019 and has been involved in projects regarding power electronics, drives and DC microgrids applications. He received the B.Sc degree in Power Engineering - Power Electronics and Electric Machines from the Faculty of Technical Sciences University of Novi Sad, Serbia in 2021.

TUTORIAL

Resilient and Secure DC Microgrids: Decentralized Control, Stability, and AI-Driven Cybersecurity

Duration: 120 minutes

Abstract. In recent years, DC microgrids have gained increasing attention due to the widespread utilization of DC power sources, such as photovoltaics (PV), fuel cells (FC), and various energy storage systems (ESSs), and the increasing penetration of DC loads, such as computing devices, data centers, motor drive systems. Unlike their AC counterparts, DC microgrids avoid issues related to synchronization, reactive power flow, and harmonics. As a result, DC microgrids have been extensively deployed in renewable energy systems, high-efficiency households, and electrified transportation systems, including naval ships, spacecraft, aircraft, submarines, and electric vehicles. However, DC microgrids face challenges, including the critical demand-supply power balance under intermittent renewable generations, the stability issue emerged from the high penetration of power electronic converters, and vulnerabilities to cyberattacks due to the employment of communication systems. Moreover, the rapid advancement of artificial intelligence (AI) introduces both new challenges and opportunities for its application in DC microgrids. This tutorial will explore decentralized power management strategies, stability analysis and stabilization strategies, and AI-enabled cybersecurity framework to address the stability and cybersecurity issues in DC microgrids. The tutorial will begin with an overview of control strategies for DC microgrids. Next, decentralized power management strategy is developed for hybrid energy storage systems to compensate for power fluctuations. In addition, stability analysis and stabilization methods are introduced. Finally, machine learning-based cyber-attack identification and detection framework is developed to enhance the cybersecurity of DC microgrids.

INSTRUCTORS

Qianwen Xu (Senior Member, IEEE) received the B.Sc. degree from Tianjin University, Tianjin, China, in 2014, and the Ph.D. degree from Nanyang Technological University, Singapore, in 2018, both in electrical engineering. From 2018 to 2020, she was a Postdoc Research Fellow with Aalborg University, Aalborg, Denmark, a Visiting Researcher with Imperial College London, London, U.K., and a Wallenberg-NTU Presidential Postdoc Fellow with Nanyang Technological University, Singapore.

She is currently an Associate Professor with the Department of Electric Power and Energy Systems, KTH Royal Institute of Technology, Stockholm, Sweden. Her research interests include advanced control, optimization, and AI applications for microgrids and smart grids. Dr. Xu is the Vice Chair for the IEEE Power and Energy Society and Power Electronics Society, Sweden Chapter, and an Associate Editor for the IEEE Transactions on Smart Grid, IEEE Transactions on Sustainable Energy, IEEE Transactions on Transportation Electrification, and IEEE Journal of Emerging and Selected Topics in Power Electronics. She was a recipient of the Humboldt Research Fellowship, Excellent Doctorate Research Work, Best Paper Award in IEEE PEDG 2020, Nordic Energy Award 2022, etc.

Yihao Wan (Member, IEEE) received his B.S. degree in Electrical Engineering from Wuhan University of Technology, Wuhan, China, in 2017, an M.S. degree in Electrical Engineering from Chongqing University, Chongqing, China, in 2020, and a Ph.D. in Electrical Engineering from the Technical University of Denmark, Copenhagen, Denmark, in 2024. He is currently a Postdoctoral Researcher at KTH Royal Institute of Technology, Sweden. His research focuses on advanced control, optimization, and AI techniques for the design, control, and cybersecurity of power electronics-dominated energy systems.

Jiawei Chen (Senior Member, IEEE) received the B.S. and Ph.D. degrees in electrical engineering from Nanjing University of Aeronautics and Astronautics, Nanjing, China, in 2008 and 2013 respectively. From 2013 to 2015, he was a Research Fellow with Rolls Royce, NTU Co-lab, Singapore, doing research on the intelligent energy management system for future more electric aircraft. After that, he joined Chongqing University, Chongqing, China, where he is currently a Full Professor. His research interests are renewable energy generation systems, power control, and energy management strategies for distributed energy generation systems and microgrids, and the power electronics circuits in these systems. Dr. Chen is an Associate Editor for IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, and CONTROL AND DECISION.

Mengfan Zhang (Member, IEEE) received the B.S. and M.S. degrees in electrical engineering from the Nanjing University of Aeronautics and Astronautics, Nanjing, China, in 2015 and 2018, respectively, and the Ph.D. degree in power electronic engineering from Aalborg University, Aalborg, Denmark, in 2022. From 2020 to 2021, he was a guest researcher with KTH Royal Institute of Technology, Stockholm, Sweden, where he is currently a postdoctoral researcher. His research interests include Artificial Intelligence based modeling, control and optimization for power electronics dominated power systems.

TUTORIAL

Microgrids: Modeling, Stability and Control

Duration: 120 minutes

Abstract. The microgrid concept provides an effective solution for integrating renewable energy sources and distributed energy resources (DERs) into power grids. Microgrids are small-scale systems that interconnect customers, DERs, and storage, serving as key components of modern power grids. Their ability to operate in grid-connected and islanded modes enhances resilience and energy efficiency. This tutorial covers the modeling, stability, and control of microgrids, focusing on off-grid applications. It begins with a comparative analysis of DC vs. AC microgrids, discussing their advantages, challenges, and suitability for various applications. The tutorial then explores microgrid dynamic modeling, including small-signal and nonlinear modeling techniques and methods for interconnecting sub-models for efficient simulation. Microgrid stability is addressed, covering stability classification methods and small-signal stability analysis techniques such as eigenvalue analysis and sensitivity analysis. Key parameters affecting stability are examined. The session also addresses transient stability and power-sharing challenges in AC MGs and stability enhancement techniques for DC microgrids. The control of microgrids is explored, with a focus on hierarchical control structures and strategies for stable and cost-effective operation in both modes. Linear and practical control solutions are highlighted. This tutorial offers a comprehensive understanding of microgrid structures, dynamics, stability, and control, supported by theoretical analysis, simulations, and practical examples, making it valuable for researchers, engineers, and practitioners in smart grids and power electronics.

INSTRUCTORS

Pavol Bauer (Senior Member, IEEE) received a master's degree in electrical engineering from the Technical University of Kosice in 1985 and a PhD degree from the Delft University of Technology in 1995. He received the title prof. from the President of Czech Republic with the Brno University of Technology in 2008, and with the Delft University of Technology in 2016. He is currently a Full Professor with the Department of Electrical Sustainable Energy, Delft University of Technology, where he is the Head of the DCE&S group. He is also an Honorary Professor with Politehnica University Timis,oara, Romania, where he obtained an honorary doctorate too. From 2002 to 2003, he was with KEMA (DNV GL), Arnhem, on different projects related to power electronics applications in power systems. He published over 180 journals and 450 conference papers in his field. He is an author or a coauthor of eight books, holds ten international patents, and has organized several tutorials at international conferences. He has worked on many projects for the industry concerning wind and wave energy, power electronic applications for power systems such as Smarttrafo, as well as HVDC systems, and projects for smart cities such as photovoltaic (PV) charging of electric vehicles, PV and storage integration, and contactless charging. He participated in several Leonardo da Vinci, H2020, and Electric Mobility Europe EU Projects as Project Partner (ELINA, INETELE, E-Pragmatic, Micact, Trolly 2.0, OSCD, P2P, Progressus, Tulip, and Flow) and a coordinator (PEMCWebLab.com-Edipe, SustEner, Eranet, and DCMICRO). He is the former chairman of Benelux IEEE Joint Industry Applications Society, Power Electronics Society, and Power Engineering Society Chapter, the chairman of the Power Electronics and Motion Control Council, a member of the Executive Committee of the European Power Electronics Association, and a member of the international steering committee at numerous conferences.

Qobad Shafiee (Senior Member, IEEE) received PhD degree in Electrical Engineering from the Department of Energy Technology, Aalborg University (Denmark) in 2014. He is currently a visiting professor and researcher with the DCE&S group in the Department of Electrical Sustainable Energy at Delft University of Technology, Netherlands. Additionally, he is an Associate Professor and Program Co-Leader of the Smart/Micro Grids Research Center at the University of Kurdistan, Sanandaj, Iran, where he previously served as a lecturer from 2007 to 2011. In 2014, he was a visiting scholar with the Electrical Engineering Department, the University of Texas at Arlington, Arlington, TX, USA. He was a Post-Doctoral Fellow and visiting professor with the Department of Energy Technology, Aalborg University in 2015 and 2017, respectively. He has co-authored over 100 articles, one book and several book chapters in his field of research. He is a Senior Member of IEEE, Associate Editor of IEEE Transactions on Power Electronics, Associate Editor of IEEE Transactions on Energy Conversion, and Associate Editor of e-Prime - Advances in Electrical Engineering, Electronics and Energy. His current research interests include dynamic modelling, stability, security, and control of power electronics-based systems and microgrids.

TUTORIAL

Supercapacitor Techniques for Protecting Future DC Systems, DC Appliances and DC Microgrids: New Zealand Experiences with FAN Project Outcomes

Duration: 120 minutes

Abstract. DC systems are proliferating as the renewable energy systems are propagating rapidly. Reliability of these systems are dependent on two main factors (a) energy storge to buffer fluctuations of renewable energy (b) protection against transient over-voltages and over-current situations. Traditional and common energy storge systems are based on rechargeable battery systems. However, the battery systems come with short life cycles and environmental issues. Within the last two decades supercapacitors (SC) have emerged as an alternative to batteries for limited applications where lower energy density of SCs are acceptable. Within the last two decades University of Waikato power electronics research team has come up with a unique set of power converters and protection systems based on supercapacitors which are now known as Supercapacitor Assisted (SCA) techniques. SCA surge absorbers are one of the successful techniques to protect systems against lightning and transient inductive voltage surges. Within the last 5 years they have joined the Future Architecture Network project funded by the NZ govt and expanded their work to develop SCA protection techniques such as SCA-DC circuit breaker. This tutorial will present the unique properties of commercial supercapacitor families and how these new device families could be used beyond simple energy storage and design transient over-voltage protection systems and transient over current protection systems.

INSTRUCTORS

Nihal Kularatna graduated with an electrical engineering degree in 1976 from University of Ceylon, Peradeniya, Sri Lanka. He was a practicing engineer for 25 years working in the areas of aviation ground electronics, digital telephony, industrial systems and power electronics. From 1985 to 2001 he was employed by the Arthur C Clarke Institute for Modern Technologies and in 1999 he was promoted to the CEO of the institute. In 2002 he moved to New Zealand and joined University of Auckland as a senior lecturer. He moved to University of Waikato in 2006, and currently he is Professor in Electronics. He was conferred with DSc degree in 2015 by the University of Waikato. Nihal has authored 7 reference books and 3 research monographs with a cumulative printed page count of over 4000 pages published by leading int'l publishers such as IET-London, Elsevier and CRC Press. He won the New Zealand Engineering Innovator of the Year (2013) award for developing supercapacitor assisted (SCA) techniques. He has published more than 190 scholarly papers and supervised over a dozen PhD students and a dozen of Masters students at UoW, wining the Postgraduate Research Supervision Staff Excellence Award in 2021. He has several US, PCT and other granted patents for his SCA and other power electronic techniques. He frequently delivers invited tutorials and workshops at IEEE and industry conferences. His latest book published in 2021 by Elsevier is titled Energy Storage Systems for Renewable Energy Based Systems: Rechargeable Batteries and Supercapacitors.

Chamara Dassanayake is a senior PhD student at the University of Waikato who developed the first working prototype of a supercapacitor assisted DC circuit breaker technique. He has published over ten IEEE papers on his work and he is currently writing his PhD thesis. He graduated with an electrical engineering honors degree from University of Moratuwa Sri Lanka in 2017. His research interests are in circuit breaker techniques and power electronics for renewable energy systems.

TUTORIAL

Emerging Power Converters Topologies for DC Buildings Applications

Duration: 90 minutes

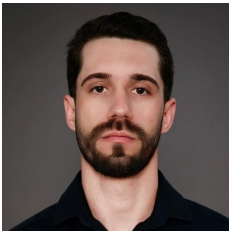
Abstract. DC power distribution is gaining increasing attention in residential and commercial buildings due to its potential for significant energy savings — up to 30% by eliminating losses associated with reactive power and rectification needed in traditional AC systems. This shift towards DC grids for buildings not only enhances energy efficiency but also aligns with the growing adoption of renewable energy systems, increasing the self-consumption of buildings as energy can be generated and used on-site. The emergence of DC-powered buildings drives the need for new power conversion technologies, including DC-DC converters for photovoltaic (PV) systems, DC electric vehicle (EV) chargers, and grid-interface converters to integrate AC grid with DC electrical installations inside homes, offices, and other buildings. This tutorial will delve into emerging power converter topologies, offering detailed insights into their design, operation, and requirements for DC building applications.

INSTRUCTORS

Edivan Laercio Carvalho (Senior Member, IEEE), received the B.Sc. and M.Sc. degrees in electrical engineering from the Federal University of Technology – Paraná (UTFPR), Brazil, in 2015, and 2018, respectively, and the Ph.D. degree in electrical engineering from Federal University of Santa Maria (UFSM), Brazil. He is currently a Researcher with the Power Electronics Group, Tallinn University of Technology. His research interests include high-frequency DC-DC power converter topologies, net-zero energy buildings, grid-connected converters, and power management systems.

Neelesh Yadav (Member, IEEE) received the B. Tech.-M.Tech. dual degree from Lovely Professional University, Punjab, India, in 2016, and the Ph.D. degree in electrical engineering from the Indian Institute of Technology Mandi, Mandi, India, in 2022. He is currently a Postdoctoral Researcher with the Power Electronics Group, Tallinn University of Technology, Tallinn, Estonia. His research interests include control and power management in DC microgrids, fault detection, and AC-DC/DC-DC converters.

Sachin Chauhan (Member, IEEE) received the B.Tech. degree in electrical and electronics engineering from Dr. A. P. J. Abdul Kalam Technical University, Lucknow, India, in 2014, the M.Tech. degree in power electronics and drives from Madan Mohan Malaviya University Of Technology, Gorakhpur, India, in 2017, and and the Ph.D. degree in electrical engineering from the Indian Institute of Technology Mandi, Mandi, India, in 2023. He is currently a Postdoctoral Researcher with the Power Electronics Group, Tallinn University of Technology, Tallinn, Estonia. His research interests include the new topologies, control, and modulation of DC–DC power converters for electric vehicle, wireless power transfer, and renewable energy integration applications.



Niwton Gabriel Feliciani dos Santos (Member, IEEE) was born in Rosário do Sul, Brazil, in 1995. He received the B.S. degree (Hons.) in electrical engineering from the Federal University of Pampa, Alegrete, Brazil, in 2018, and both the M.S. and Ph.D. degrees in electrical engineering from the Federal University of Santa Maria, Santa Maria, Brazil, in 2020 and 2024, respectively. He is currently a Postdoctoral Researcher with the Power Electronics Group, Tallinn University of Technology, Tallinn, Estonia. His current research interests include active and nonactive power processing, dc–dc conversion systems, partial power converters, battery chargers for electric vehicles (EVs), and photovoltaic (PV) systems.

TUTORIAL

Components for Lighting in Local DC Microgrids

Duration: 90 minutes

Abstract. LEDification leads to significantly lower energy demand for lighting, which could be verified during the last 15 years, but power grids and power distribution is still designed to be compatible with traditional light source types and power demands. Considerations in other power-hungry building infrastructure and industrial applications led to the design of the DC-Supply Grid for these more demanding sectors. Lighting can benefit in two ways from following the DC considerations laid down by industry. First, seamless integration into existing DC grids allows savings in installation effort, transformation cost and planning volume. Next, DC integration of lighting allows a small saving in energy consumption (when done right) and component count. Thus, in terms of energy efficiency, but more in therms of resource efficacy and effort reduction, going for DC lighting is the obvious path.

INSTRUCTORS

Zafer Cankurtaran is the Product Manager for Direct Current (DC) technology at RITTAL GmbH & Co. KG. He is an industrial engineer and has been involved with DC power supply and distribution in industrial environments ever since. This includes both the decentralised supply of systems and automation technology as well as the infrastructure in switchgear. As a member of the Open Direct Current Alliance (ODCA), he also promotes DC technology in the low-voltage sector and focuses his activities on developing solutions for applications.

Dietmar Klien got his Engineer graduate in Electronics and Communication Technologies in 1983 at HTL in Austria.
From 1984 to 1991 he worked in R&D for high-voltage cable-testing and cable fault detection at the company Baur GmbH in Austria. He joined R&D of Tridonic, part of Zumtobel Group, in 1991 with focus on developing of electronic drivers for HID-lamps. After working in various projects in the field of dimmable drivers for fluorescent lamps he took over the lead of the product-development for dimming converters from 2005 to 2015. From 2015 till now he is responsible for identification, evaluation and proof of concept of new solutions in the field of Power Conversion within the department “Global Technology and Innovation”.
He holds several patents in the field of lighting and is IEEE-member since 23 years as well as member of ODCA and currentOS. Some special interests are power semiconductors, converter topologies for LED-drivers, magnetics and EMI.

Birthe Bittner has studied media technology with focus on lighting at the Technical University of Ilmenau. After the Diploma in 2007 she immediately started at ZUMTOBEL Lighting GmbH, in the headquarter in Austria. Currently she is the Head of Application-Managment for Industry, Retail and Art&Culture, taking care of the strategical development of the Application segement and detecting new business fields. Email: birthe.bittner@zumtobelgroup.com Since November 2022 Zumtobel Lighting has become a member in the ODCA and is promoting DC technologies. Birthe Bittner has took over the chair of the working group 5 (communication) at the ODCA. Next to the ODCA, Dipl. Ing. Birthe Bittner is active in the German Lighting Association (LitG – Expert forum Interior lighting), some technical commitees of the CIE and DIN standardization.

TUTORIAL

Solid-State Circuit Breakers – Emerging Topologies, Challenges, and Applications

Duration: 90 minutes

Abstract. The solid-state circuit breaker (SSCB) is renowned for its ultra-fast fault tripping speed and arc-free current interruption, which are highly desirable for applications including battery energy storage systems, renewable energy systems, and DC microgrids. WBG power semiconductor devices (SiC or GaN power devices) further facilitate the popularity of SSCBs due to their superior performances, like low conduction resistance and high blocking voltage capability. In this tutorial, the speakers will discuss the potentials and opportunities of DC systems, SSCB technology, and the possible applications where SSCBs could find their living space. The emerging standards governing SSCBs will also be briefly outlined. In addition, barriers that limit the wide application of SSCBs will also be discussed. Although SSCB topologies seem simple and easy to design, some technological challenges still exist, which will be highlighted.

INSTRUCTORS

Satish Naik Banavath (Senior Member, IEEE), holds a B.Tech. degree in electrical and electronics engineering from Acharya Nagarjuna University, Guntur, India (2010). He further pursued his M.E. and Ph.D. degrees in electrical engineering at the Indian Institute of Science, Bengaluru, India, completing them in 2012 and 2018, respectively. From 2012 to 2014, he worked with the Defence Research and Development Organization (DRDO), Ministry of Defence, Government of India, in Bengaluru. Subsequently, he served as a Postdoctoral Fellow at the University of Houston, Houston, TX, USA, from Sept. 2017 to May 2018. Later, he joined Mahindra Electric Mobility in Bengaluru, where he was a Research and Development Manager from July 2018 to January 2019. Since February 2019, Dr. Banavath has served as an Assistant Professor in the Department of Electrical Engineering at the Indian Institute of Technology, Dharwad, India. He received prestigious awards, incl. the IEEE PES Bangalore Chapter Outstanding Engineer Award 2021, IEEE IES S&YP Fellowship, and IGSTC's PECFAR Award 2024.

Martina Joševski is a Regional Leader of Eaton Research Labs based in Aachen, Germany. She is also an External Lecturer at the RWTH Aachen University, Faculty of Electrical Engineering, where she teaches the Modeling and Control of Low-Inertia Power Systems courses. She received B.Sc. and M.Sc. degree in Electrical Engineering from the University of Novi Sad and Ph.D. degree from RWTH Aachen University, Germany. Before joining Eaton, she was a Research Associate and Teaching Assistant at the Institute of Control Engineering at RWTH Aachen University, as a Postdoctoral Researcher at the Institute for Automation of Complex Power Systems at RWTH Aachen University, and as a Team Leader of the Research Group for Advanced Control Methods in Power System Applications & HIL at the E. ON Energy Research Center. Her research interests include control and optimization of converter-based systems, focusing on optimal and passivity-based control methods.

INDUSTRIAL SEMINARS

Do not miss the industry seminars by our **Platinum Sponsors**, held during the afternoon coffee breaks – an ideal chance to grab a coffee, hear cutting-edge insights, and connect with leading voices shaping the future of DC microgrids!

June 5, 15:30 – 16:00

Navigating the Future of Energy: Faults in LV DC Microgrids and Protection Technologies

Dejan Pejovski, ***ABB Electrification – Smart Power, Italy***

Abstract: In the evolving landscape of electrical grids, the transition from traditional AC systems to innovative DC microgrids is transforming energy distribution. This presentation will address the complexities and challenges associated with faults in DC grids, dominated by power electronic converters. Participants will gain insights into the relevant parameters and criteria for selecting appropriate protection devices including electromechanical and solid-state breakers. A key highlight will be ABB's SACE Infinitus, a cutting-edge solid-state circuit breaker that exemplifies efficiency and rapid fault interruption.

June 6, 15:00 – 15:30

Unlock the Secrets of DC Microgrids!

Harry Stokman, ***Current/OS | DC Expert, Netherlands***

Abstract: DC microgrids are not just about converter efficiency, cable sizing, or the speed of switching devices. To ensure a practical and safe design and implementation, several other system aspects must be considered.

Join us for an engaging seminar where Harry Stokman, a globally recognized DC expert representing the Current/OS Foundation, will highlight the most critical aspects to consider. With extensive hands-on experience in real-world DC applications, Harry will share insights into system-level design, protection strategies, grounding, and interoperability – key elements crucial for the successful deployment of DC microgrids.

Do not miss this opportunity to deepen your knowledge and discover best practices for successfully implementing DC microgrids!

PELS S&YP AND WIE LUNCHEON

Instead of a simple lunch, ALL attendees can enjoy an inspiring luncheon hosted by the IEEE Power Electronics Society's Student & Young Professionals (S&YP) and Women in Engineering (WiE) Committees at 12:30 on June 5.

This event brings together the S&YP and WiE communities for a vibrant exchange of ideas, mentorship, and networking. It is a platform to connect with peers, gain career insights, and celebrate the vital role of diversity and inclusion in advancing power electronics.

We are proud to feature two outstanding speakers who exemplify leadership and innovation.

Career Paths in Corporate Research: How does it compare to academia?

MARTINA JOŠEVSKI

Regional Leader, Eaton Research Labs Germany

Abstract. You are a PhD student in power electronics or energy systems, you enjoy research and wonder how research looks like in a corporate environment? This talk will provide useful insights into potential research career paths in a global power management company like Eaton – highlighting the similarities and differences in daily work. Hiring PhD graduates is key to drive forward innovation and develop emerging technologies in corporate research, such as DC conversion and distribution. This is one of the reasons why companies establish their R&D teams in the vicinity of research/university campuses. This aspect will be further elaborated on the example of the research campus Flexible Elektrische Netze (FEN) at the RWTH Aachen University campus, where Eaton has established its German R&D team. Besides hiring exceptional talent, it will be explained why close collaboration with academia is of key importance. Finally, the speaker will provide a personal view on the role and relevance of diversity in research teams in both, academia and corporate research. She will highlight the clear benefits and discuss some of the challenges, and eventually explain how Eaton supports diversity.

Choosing a PhD in Power Electronics

KATHARINA HETZENECKER
Group Leader, RWTH Aachen University
Germany

Abstract. This presentation discusses the journey of pursuing a PhD in Power Electronics, contrasting initial expectations with actual experiences. It explores the benefits of engaging in scientific research and highlights the opportunities for development and collaboration. The talk also reflects on my experiences as a group leader, offering perspectives on leadership and teamwork in a research setting.

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DC PILOTS LUNCHEON

The DC Pilots Luncheon held at 12:30 on June 6, offers a focused forum for technically minded attendees to engage with industry experts presenting real-world DC microgrid projects. Concise, practice-driven talks will highlight system architectures, integration challenges, and performance insights, providing a clear view of how DC technologies are evolving from concept to deployment.

DC Microgrids Power the Way – Scaling Up Renewables Without Shaking the Grid Down

AHMAD MAKKIEH

Schneider Electric, UK

DC Microgrids for Charging Infrastructure – PV2V

MARCO STIENEKER

Maschinenfabrik Reinhausen, Germany

Direct Current Microgrids Installed in Scandinavia

STEFAN LIDSTROM

Comsys, Sweden

Bipolar 350/700V DC Microgrids

LAURENS MACKAY

DC Opportunities, Netherlands

IMPORTANT INFORMATION

Registration

The registration desk will be open from 10:00 to 17:00 on June 4 and from 08:30 on the other two days of the conference. ***If you arrive late on June 4, you can register at the Welcome Reception.***

Conference Badges

Please always wear your participant badge for access to lunches and sessions.

Emergency contacts

For conference-related emergencies:
Andre Blinov: +372 5566 7657
Dmitri Vinnikov: +372 51907446 **Andrii Chub:** +372 54592062
Estonian Emergency Response Centre: +372 6000 112 (for calls in roaming).

Social Events

You **MUST** present the corresponding ticket from your conference package to gain entry to the social event.

Public Transportation and Taxi

Tallinn offers an extensive public transportation network. You can plan your journey by visiting **transport.tallinn.ee** and buy a ticket at **tallinn.pilet.ee**.

We recommend **BOLT** app for getting a taxi at a reasonable fare. Official taxis display their rates on a yellow sticker on the right rear window. Be sure to **check it** before you take a ride.

Weather

Early June Baltic weather can be unpredictable, with some rain in the forecast, but ***brighter skies and pleasant moments*** are still on the horizon! Here is a forecast:

	Night	Morning	Afternoon	Evening	Temperature high/low	Precip.	Wind
Today 3 June					18° / 13°		7 m/s
Wednesday 4 June					23° / 10°		4 m/s
Thursday 5 June					20° / 13°	1.9 mm	5 m/s
Friday 6 June					19° / 13°	3 mm	4 m/s