

2024

IEEE Sixth

International Conference on
Direct Current Microgrids



August 5-8, 2024

Columbia, SC



Sponsored By



Welcome to ICDCM 2024

Enrico Santi, General Chair



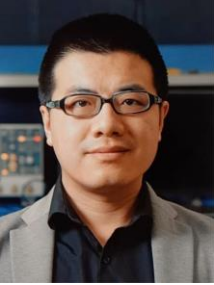
I am honored to welcome you to the Sixth International Conference on DC Microgrids here in Columbia, SC. This conference has traveled all over the world, from Atlanta, GA in 2015 to Nuremberg, Germany in 2024, to Matsue, Japan in 2019, to being virtual due to the pandemic in 2021, to Auckland, New Zealand in 2023 and finally to Columbia, SC this year. In the past the conference has been held every other year, but, given the strong interest in DC microgrids, it is transitioning to being held annually. I am sure that our conferees have made great technical progress recently and I look forward to learning the many exciting details. This new technology is evolving rapidly and it is an exciting time to be involved in it. We've seen dc microgrid applications in homes, commercial and industrial buildings, manufacturing, renewable energy systems, marine systems and elsewhere. The pace of adoption is increasing and the next few years will be exciting times indeed.

Our conference was assembled by a team of talented and dedicated people. I thank my co-Chair Roger Dougal for providing his invaluable expertise for the conference organization. I thank Dong Dong for his outstanding leadership of the Technical Program Committee. Dong and his committee worked tirelessly to solicit, review, and arrange over 60 papers and presentations into topical sessions and to invite technical stars to open our sessions. Harshita Singh put together an exciting tutorial program. Aaron Cramer held a hard line on the budget to bring you great value for your conference dollars. Wayne Weaver and Tommaso Caldognetto authored many publicity releases and ensured their delivery to our target audience. Adel Nasiri was instrumental in soliciting industrial support, gleaned Patronage that was vital in meeting the conference budget. Jared Cronin expertly and responsively managed the web site, while Jen Charnecky provided professional support through IEEE's Office of Conferences, Events & Experiences.

I especially want to thank the IEEE Power Electronics Society for sponsoring the conference. PELS TC1 provided strong support for the conference organization. Thanks go especially to Luca Corradini, the PELS TC1 Chair.

Welcome to Columbia, SC. Let the conference begin!

Welcome Message from Technical Chair



Dong Dong, Technical Program Chair

On behalf of the technical committee, I would like to thank our researchers, authors, Technical Program Committee for their hard work and diligence. ICDCM 2024's Technical Program features 61 peer-reviewed technical papers in 9 oral and 1 poster sessions, 7 invited keynote talks. The technical sessions cover a wide range of topics, particularly focusing on industry and application-oriented topics, showcasing the most recent progress on DC Microgrids technologies.

Committee Members

Organizing Committee

| NAME | ORGANIZATION | Role |
|---------------------|--------------------------------|----------------------------|
| Enrico Santi | Univ. South Carolina | General Chair |
| Roger Dougal | Univ. South Carolina | General Co-Chair |
| Dong Dong | Virginia Polytechnic Institute | Technical Program Chair |
| Lisa Qi | ABB | Technical Program co-Chair |
| Aaron Cramer | Univ. Kentucky | Treasurer |
| Jun Wang | Univ. Nebraska | Co-Treasurer |
| Tony T Vu | Clarkson University | Publications Chair |
| Adel Nasiri | Univ. South Carolina | Patronage Chair |
| Roger McGinnis | Florida State Univ | Patronage Co-Chair |
| Wayne Weaver | Michigan Technological Univ. | Publicity Chair |
| Tommaso Caldognetto | University of Padova | Publicity Chair, Europe |
| Harshita Singh | Brookhaven National Laboratory | Tutorials Chair |
| Warren Gillens | Power Engineering | Local Arrangements |
| Jen Charnecky | IEEE MCE | MCE Coordinator |
| Jared Cronin | Univ. South Carolina | Website |

Technical Program Committee

| NAME | ORGANIZATION |
|---------------------|---|
| Rudy Wang | Delta Electronics |
| River T. H. Li; | Hong Kong Applied Science and Technology Research Institute |
| Jiangbiao He | University of Kentucky |
| Di Zhang | Naval Postgraduate School |
| Dong Dong | Virginia Tech |
| Chunmeng Xu | ABB |
| Lisa Qi | Xi'an Jiaotong University |
| Hanchao Liu | GE Research |
| Xiaoqing Song | University of Arkansas |
| Giel VAN DEN BROECK | Direct Energy Partners |
| Aditya Shekhar | TU Delft |

| | |
|------------------|---------------------------------------|
| Shuo Wang | University of Florida |
| Bernd Wunder | Braunhofer IISB |
| Xianyong Feng | Meta Platforms |
| Dmitry Ishchenko | Eaton Corporation |
| Fang Luo | University of Stony Brook |
| Ke Jia | North China Electric Power University |

Student Volunteer Assistants

| | |
|----------------------|------------------------------|
| Cameron Ball | University of South Carolina |
| Matthew Belanger | University of South Carolina |
| Ali Haji Ali Biglo | University of South Carolina |
| Navid Hadifar | University of South Carolina |
| Emerson Miller | University of South Carolina |
| Quang-Ha Ngo | Clarkson University |
| Muhammad Tukhtasunov | University of South Carolina |
| Andy Wong | University of South Carolina |

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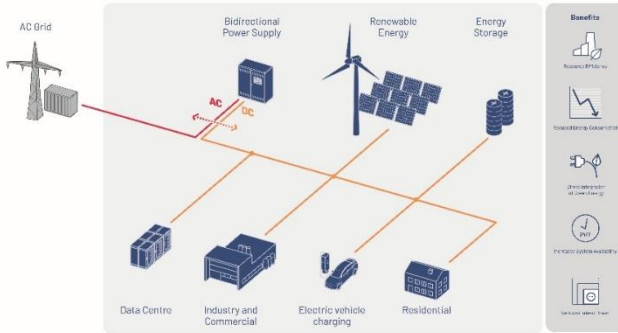
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ODCA
direct current by zvei



The Open Direct Current Alliance (ODCA) is a collaborative initiative aimed at promoting the adoption and development of DC technology. Bringing together industry leaders, companies, academic institutions, and policymakers, the alliance seeks to advance the use of direct current in various applications, including industrial, residential, commercial, and electric vehicle (EV) infrastructure.

The alliance focuses on the inherent efficiency of DC, particularly beneficial in systems involving renewable energy and energy storage. By minimizing power conversions between AC and DC, energy losses are reduced, leading to greater efficiency. Key activities of the ODCA include developing standards and best practices for DC technologies, ensuring product interoperability, and facilitating wider adoption of DC systems. The alliance also engages in educational and outreach activities to raise awareness about the benefits of DC and to push the growth of a skilled workforce capable of implementing and maintaining these systems and supports regulatory and policy changes to enable DC infrastructure deployment.

Overall, the ODCA fosters innovation, drives efficiency, and supports the transition to a sustainable energy future by leveraging the advantages of DC technology. Further information: <https://odca.zvei.org>

Silver Patrons



Integer Technologies was founded to support U.S. national security customers by equipping them with world-class technology. We do this by teaming up with top research universities to accelerate the development of scientific research into fielded systems that keep our country safe.

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imperix

Imperix develops high-end control equipment and prototyping hardware for power electronics, drives, smart grids, and related topics. Its products are designed to enable cutting-edge innovation in corporate and academic environments. They are especially valued for their ability to accelerate the implementation of laboratory-scale power converters and facilitate the derivation of high-quality experimental results.

The company also offers various levels of integration services, intended to assist its customers in their prototyping activities. As such, its offering ranges from the delivery of plug-and-play hardware and software, to that of fully customized systems involving specialized control software algorithms.



Experience the future of power electronics with EGSTON Power Electronics, a pioneering Austrian company revolutionizing the industry with cutting-edge real-time emulation and test systems. Their advanced programmable amplifiers and Power Hardware-in-the-Loop (P-HIL) systems offer seamless operation with current-control, voltage-control, and mixed-mode capabilities in one unit. With a bandwidth of up to 15kHz, these systems ensure precise and reliable performance. Scalable solutions range from 100kVA to megawatt levels, tailored to meet power requirements.

The technology excels in a wide array of applications, including Power Hardware-in-the-Loop (P-HIL), grid emulation, motor emulation, AC/DC source/sink, certification and testing, impedance spectroscopy, and RLC load emulation. Developed and produced in Austria, these products embody the precision and innovation that define a global leader. Visit egstonpower.com to learn how these systems can transform testing and emulation capabilities.



Eaton is an intelligent power management company dedicated to improving the quality of life and protecting the environment for people everywhere. We are guided by our commitment to do business right, to operate sustainably and to help our customers manage power – today and well into the future. By capitalizing on the global growth trends of electrification and digitalization, we're accelerating the planet's transition to renewable energy and helping to solve the world's most urgent power management challenges.

Eaton Research Labs is Eaton's global corporate research team, which is located throughout the world and works to accelerate innovation across Eaton's entire portfolio of products. The core research platforms that Eaton Research Labs focuses on Energy Systems, Power Electronics, Advanced Materials & Process, Additive Manufacturing, and Digital Design.

Keynote Speakers

Mario Schweizer, ABB, Switzerland



Presentation Title: Stability in DC microgrids: what can we learn from AC world?

Biography: Mario Schweizer received the M.Sc. and Ph.D. degrees in electrical engineering from ETH Zurich, Switzerland, in 2008 and 2012. Since 2013, he has been with ABB Corporate Research in Switzerland, where he is currently working as a

Senior Principal Scientist.

From 2024-2023, he was in addition a lecturer of power electronics and drives with the University of Applied Sciences and Arts Northwestern Switzerland. His research interests include advanced converter topologies, converter control, converter interactions in the future power grid and AC/DC microgrids.

Rajib Datta, GE Vernova



Presentation Title: Evolution of the DC Grid: Challenges and Opportunities

Biography: Dr. Rajib Datta is the Chief Engineer at GE Vernova's Advanced Research Center in Niskayuna, NY. He has over 24 years of experience in power electronics and electrical systems in a broad range of industrial applications and is currently leading R&D projects for GE's energy related businesses. His specific interests are in the integration of renewables, energy

storage, flexible AC transmission systems (FACTS), high voltage DC transmission (HVDC), and application of new power electronic devices. After finishing his PhD from Indian Institute of Science, Bangalore, he started his career at ABB Corporate Research, Germany in 2000. Since joining the GE Research Center in 2002, he has held various positions, including manager of the power electronics lab and technology leader for silicon carbide power device applications. Dr. Datta has over 50 US patents in power conversion and has authored more than 35 publications in international conferences and journals.

Keynote Speakers

Giorgio Sulligoi, University of Trieste, Italy



Presentation Title: DC grids and ships: technological trends, proof of concepts, integrated ship design

Biography: Giorgio Sulligoi (Senior Member IEEE) earned the Ph.D. (University of Padua, 2005) and the M.Sc. (University of Trieste, 2001), both in Electrical Engineering. He is the founder and Director of the Digital Energy Transformation & Electrification Facility (D-ETEF) at the

Department of Engineering and Architecture of the University of

Trieste. He joined the University of Trieste as an Assistant Professor of Electric Power Generation and Control in 2007, tenured since 2010, appointed Associate Professor of Shipboard Electrical Power Systems since 2016 and elevated to Full Professor in 2019. Dr. Sulligoi has been Deputy Rector for Community Affairs and Business Relations of the University of Trieste, Italy in 2013-2019.

He is the author of about 200 scientific papers and 4 book chapters in the fields of shipboard power systems, all-electric ships, generators modeling and voltage control, where he also has earned some scientific awards. He is one of the technical program chairmen of IEEE ESARS (the International Conference on Electrical Systems for Aircraft, Railway and Ship Propulsion), recently also named as ITEC-EUROPE. He is a member of the technical committee of IEEE ESTS (Electric Ship Technologies Symposium). He is the General Coordinator of the V-ACCESS (Vessel Advanced Clustered and Coordinated

Energy Storage Systems), a Horizon Europe Research & Innovation Action, and of the ETEF (Electric TEst Facility) research program (coordinator: University of Trieste; partners: Wartsila Italy, Fincantieri Group) He has been the Scientific Manager of MVDC Large Ship research program (funder: Regional Government of Trieste, lead partner: Fincantieri; research partners: University of Trieste, Polytechnic of Milan) and of the Naval Smart Grid research programs (funder: Italian Navy; research coordinator: University of Trieste; research partners: University of Trieste, Polytechnic of Milan, University of Rome “Sapienza”), in the field of the next generation integrated power systems for all electric ships.

Keynote Speakers

John Shen, Simon Fraser University, BC, Canada



Presentation Title: Towards Ideal DC Circuit Breakers: The Evolution of Series-Type Hybrid Circuit Breaker (SHCB) Concepts

Biography: Dr. John Shen is a professor and director of the School of Mechatronics at Simon Fraser University, BC, Canada. He was Grainger Chair Professor of Electrical and Power

Engineering at Illinois Institute of Technology between 2013 and 2021. He has more than 35 years of industrial, academic, and entrepreneurial experience in power electronics and power semiconductor devices with over 350 publications and 20 issued U.S. patents in these areas. He has been involved in circuit breaker research since 2013, and is an inventor of several patents and an author of over 40 publications on the subject. He served as PI or co-PI on several ARPA-E projects related to DC circuit breakers and co-edited a book on Directot Current Fault Protection (Springer 2023). He is a recipient of the 2023 IEEE PELS Technical Achievement Award for Integration and Miniaturization of Switching Power Converters and the 2012 IEEE Region 3 Outstanding Engineer Award. He has served the IEEE Power Electronics Society (PELS) in various capacities including Vice President of Products, AdCom member, Chair of Distinguished Lecturers Program, Deputy Editor-in-Chief of IEEE Power Electronics Magazine, Guest Editor-in-Chief of the IEEE Transaction on Power Electronics and the IEEE Journal of Emerging and Selected Topics in Power Electronics. He has been on the organizing or technical program committee of over 30 international conferences in the field, and served as the General Chair of the 2016 Energy Conversion Congress and Exposition (ECCE2016) and the 2018 International Symposium on Power Semiconductor Devices & IC's (ISPSD2018). He is a Fellow of IEEE and the U.S. National Academy of Inventors.

Keynote Speakers

Don Tan, Fortune 500 Company



Presentation Title: Resilient hybrid microgrids for mission-critical systems

Biography: Dr. Tan has served as Distinguished Engineer, Fellow, Chief Engineer-Power Conversion, Program Manager, Department Manager, and Center Director in a US Fortune 500 corporation. Don earned his PhD from Caltech and is an IEEE fellow. Unusually prolific as a visionary technical leader in ultra-efficient power conversion and electronic energy systems, he has pioneered breakthrough innovations with numerous high-impact industry firsts and record performances that received commendations from the highest level of US Government. He has developed hundreds of designs and thousands of hardware units deployed for space applications without a single on-orbit failure. His suite of world-class electronics performed flawlessly on the James Webb Space Telescope (JWST), located one million miles away, achieving world-record-breaking performances.

Bernd Wunder, Fraunhofer Institute, Germany



Presentation Title: DC-Microgrid Application, Use Cases and Standardization in Europe

Biography: Bernd Wunder completed his studies in Electrical Engineering at the Friedrich-Alexander University Erlangen-Nuremberg in 2010, graduating as a Diplom-Ingenieur. From 2010 to 2013, he worked as a research assistant at the Chair of Electronic Devices, developing power electronic systems. In 2013, he founded the research group for DC networks at the Institute for Integrated Systems and Device Technology (IISB) to develop new descriptive infrastructures for renewable and sustainable energy. His research areas are the design and architecture of DC microgrids; development of power electronics; analysis of electronic devices and systems; control and stabilization of microgrids.

As the elected chairman of VDE UK221.6 "DC Installations", he is involved in numerous standardization projects related to electromobility and direct current. He is also currently the head of the IEC project PT 63317 "LVDC industry applications".

Luncheon Keynote Speaker

George Stefopoulos, DOE Solar Energy Technologies Office



Presentation Title: Photovoltaic Systems and Microgrids: A perspective from the U.S. Department of Energy's Solar Energy Technologies Office

Biography: George Stefopoulos is a Solar Innovation Technical Advisor for the U.S. Department of Energy, Solar Energy Technologies Office (SETO). He joined SETO as a support service contractor in September 2021 and currently works with

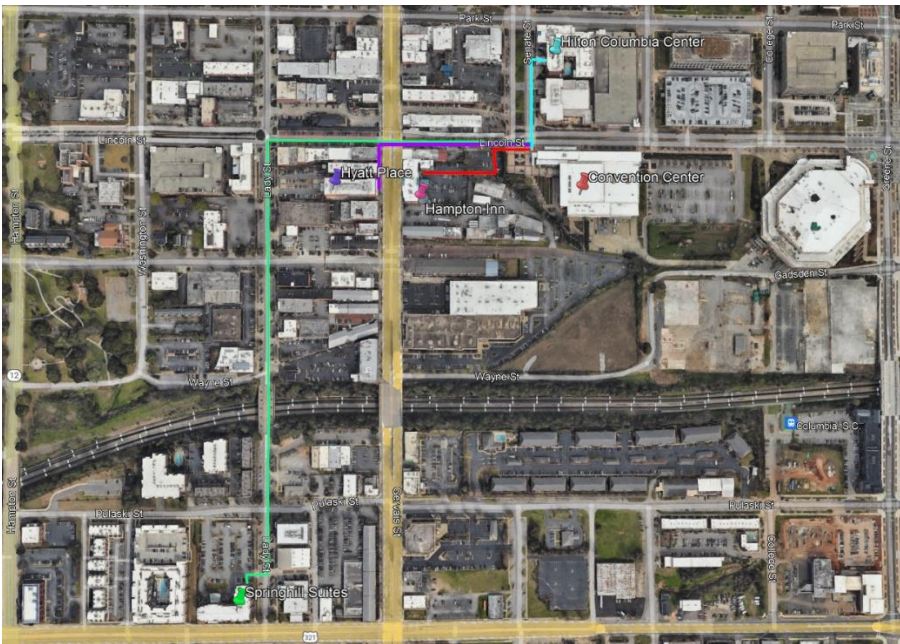
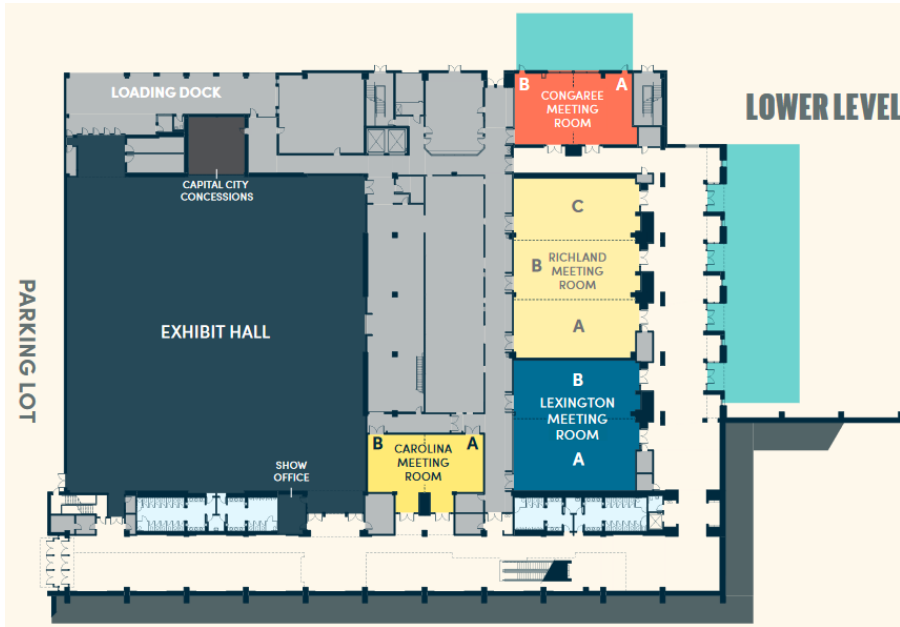
the SETO's Manufacturing and Competitiveness team focusing, among other areas, on power electronics for solar applications, grid operations and integration of renewable energy resources, as well as building- and vehicle-integrated photovoltaics.

Prior to joining SETO, George was with the New York Power Authority (NYPA) for over 12 years where he held multiple positions of increasing responsibility engaging in the deployment of new technologies to modernize NYPA's transmission grid and generating facilities. His last role at NYPA was Director of NYPA's Advanced Grid Innovation Laboratory for Energy (AGILE), a newly created research, development, and testing facility focusing on grid modeling and real-time digital simulation, software/hardware-in-the-loop testing, grid automation, protection and control applications, renewable energy integration, power system communications, and cyber security.

George received his Ph.D. in Electrical and Computer Engineering from the Georgia Institute of Technology in 2009. He also received his M.S. in Electrical and Computer Engineering in 2002 from Georgia Tech and his Diploma in the same field from the National Technical University of Athens, Greece, in 2001. George also holds an MBA degree in Executive Management from Pace University of New York. He has authored or co-authored over 60 scientific papers and articles and has presented his work at many international scientific conferences. He has also delivered several invited talks at a variety of meetings and other events. He is a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and a member of the Institute of Engineering Technology (IET).

Venue and Directions

Technical sessions in Lexington meeting rooms A and B, meals in Richland meeting room and registration in Carolina meeting room.



Registration Desk Hours

Registration in Carolina Meeting Room.

| Registration Desk Hours | |
|--------------------------------|--------------|
| Monday | 7:30 – 19:30 |
| Tuesday | 7:30 – 16:30 |
| Wednesday | 7:30 – 17:30 |
| Thursday | 7:30 – 12:00 |

Program At-a-Glance

| Monday | | |
|--|---|--|
| Time | Lexington A Room | Lexington B Room |
| Monday Aug 5th, 2024 08:30-11:30 | Tutorial I: System level modelling and simulation of MVDC distribution grids featuring solid-state transformers | Tutorial II: Hybrid modular multilevel converters: a compact, efficient and cost-effective solution for medium-voltage applications |
| Monday Aug 5th, 2024 11:30-13:00 | Lunch on Own | |
| Monday Aug 5th, 2024 13:00-15:00 | Tutorial IV: A comprehensive guide to digital twin design, integration, and applications in DC microgrids | Tutorial III: Partial power energy processing – a new toolbox for efficient DC microgrids |
| Monday Aug 5th, 2024 15:00-15:30 | Coffee Break | |
| Monday Aug 6th, 2024 15:30-17:30 | Tutorial V: Supercapacitor assisted converters and protection techniques for DC microgrids and DC homes | |
| Monday Aug 5th, 2024 17:30-19:30 | Welcome Reception Foyer and Patio Area | |
| <h2 style="margin: 0;">Tuesday</h2> | | |
| Time | Lexington A Room | Lexington B Room |
| Tuesday Aug 6th, 2024 08:00-09:40 | A1L-A Keynotes: Mario Schweizer & Don Tan (2 presentations) Chr: Roger Dougal | |
| Tuesday Aug 6th, 2024 09:40-10:05 | Coffee Break | |
| Tuesday Aug 6th, 2024 10:05-11:45 | A2L-A Circuit Breaker and Protections (5 papers) Chr: John Shen, Daniel Siemaszko Track: 12 | |
| Tuesday Aug 6th, 2024 11:45-13:00 | Lunch in Richland Room | |
| Tuesday Aug 6th, 2024 13:00-14:40 | A4L-A MVDC System, Architecture, and Test Solutions (5 papers) Chr: Daniele Bosich, Namwon Kim Track: 1 | A4L-B LVDC for Commercial, Residential, Utility (5 papers) Chr: Nihal Kularatna, Daniel Gerber Track: 1 |
| Tuesday Aug 6th, 2024 14:40-15:05 | Coffee Break | |
| Tuesday Aug 6th, 2024 15:05-16:45 | A5L-A Modeling and Control in Microgrids 1 (5 papers) Chr: Dino Ablakovic, Valentin Bolborici Track: 8 | A5L-B Energy Storage and Charging (5 papers) Chr: Wayne Weaver, Saban Ozdemir Track: 7 |

| Wednesday | | |
|--|---|--|
| Time | Lexington A Room | Lexington B Room |
| Wednesday Aug 7th, 2024 08:00-09:40 | B1L-A Keynotes: Rajib Datta & Bernd Wunder (2 presentations) Chr: Adel Nasiri | |
| Wednesday Aug 7th, 2024 09:40-10:05 | Coffee Break | |
| Wednesday Aug 7th, 2024 10:05-11:45 | B2L-A DC-DC Converters (5 papers) Chr: Zeljko Pantic, Pablo Paz | |
| Wednesday Aug 7th, 2024 11:45-13:00 | Lunch in Richland Room | |
| | A3L-A (occurring during lunch) KEYNOTE: George Stefopoulos Chr: Enrico Santi | |
| Wednesday Aug 7th, 2024 13:00-15:00 | B3L-A Stability, Reliability, and Reconfigurability of DC Systems (6 papers) Chr: Andrii Chub, Kristen Booth Track: 9 | B3L-B Modeling and Control in Microgrids 2 (6 papers) Chr: Xiaotian Yang, Kathleen Lentijo Track: 8 |
| Wednesday Aug 7th, 2024 15:00-15:15 | Coffee Break | |
| Wednesday Aug 7th, 2024 15:15-16:15 | B4P-C Poster Session (14 posters) Chr: Necmi Altin | |
| Wednesday Aug 7th, 2024 18:00-20:00 | Banquet in Richland Room | |
| Thursday | | |
| Time | Lexington A-B Room | |
| Thursday Aug 8th, 2024 08:00-09:40 | C1L-A Keynotes: John Shen & Giorgio Sulligoi (2 presentations) Chr: Enrico Santi | |
| Thursday Aug 8th, 2024 09:40-10:05 | Coffee Break | |
| Thursday Aug 8th, 2024 10:05-11:45 | C2L-A Component-level Technologies for DC Microgrids Chr: Kristen Booth, Goran Mandic Track: 15 | |

Registration Desk Hours

Registration in Carolina meeting room.

| Registration Hours | |
|---------------------------|--------------|
| Monday | 7:30 – 19:30 |
| Tuesday | 7:30 – 16:30 |
| Wednesday | 7:30 – 17:30 |
| Thursday | 7:30 – 12:00 |

MONDAY

7:30 – 19:30 Registration Desk Hours

Tutorials

8:30 - 11:30 | Lexington A Room

Tutorial 1: System level modelling and simulation of MVDC distribution grids featuring solid-state transformers

Instructors: Daniel Siemaszko

8:30 - 11:30 | Lexington A Room

Tutorial 2: Hybrid modular multilevel converters: a compact, efficient and cost-effective solution for medium-voltage applications

Instructors: Jayesh K. Motwani, Dong Dong, Di Zhang

11:30 – 13:00

Lunch - on your own

13:00 – 15:00 | Lexington B Room

Tutorial 3: Partial power energy processing – a new toolbox for efficient DC microgrids

Instructors: Andrii Chub

13:00 – 15:00 | Lexington A Room

Tutorial 4: A comprehensive guide to digital twin design, integration, and applications in DC microgrids

Instructors: Dr. Kristen Booth, Dr. Kerry Sado, Jarrett Peskar

15:00 – 15:30

Coffee Break

15:30 – 17:30 | Lexington A Room

Tutorial 5: Supercapacitor assisted converters and protection techniques for DC microgrids and DC homes

Instructors: Nihal Kularatna

MONDAY

17:30 – 19:30 (Foyer and Patio Area)

Welcome Reception

Welcome by Enrico Santi

7:30 – 16:30 Registration Desk Hours

8:00 - 9:40 - Session A1L-A | Lexington A-B Room

Daily Keynotes

Chair: Roger Dougal

Stability in DC Microgrids: What Can We Learn from AC World?

Mario Schweizer

Resilient Hybrid Microgrids for Mission-Critical Systems

Don Tan

09:40 – 10:05

Coffee Break

10:05 - 11:45 - Session A2L-A | Lexington A-B Room

Circuit Breakers and Protection

Session Chairs: John Shen, Daniel Siemaszko

Short-Circuit Faults in DC Microgrids

John Shea, Tony Landry, Mike Liptak

A Solid-State Circuit Breaker Configuration with Reduced Energy Dissipation

Ana Rafaela Figueiredo Bento, Fernando Bento, Antonio J. Marques Cardoso

On the Effectiveness of Faulty DC Circuit Breakers

Ana Rafaela Figueiredo Bento, Fernando Bento, Antonio J. Marques Cardoso

Experimental Performance Validation of Z-Source DC Circuit Breaker for High Impedance Faults

Aditya Pogulaguntla, Satish Naik Banavath, Andrii Chub, Dmitri Vinnikov, Rajendra Singh

Hybrid and Solid State Circuit Breakers

Marcel Gaudreau, David Cope, Joe Harbour, Shannon Hunter, Susie Eustis, Robert Phillips, Michael Kempkes, Rebecca Simpson

TUESDAY

11:45 - 13:00 Richland Room

LUNCH

13:00 – 14:40 – Session A4L-A | Lexington B Room

MVDC System, Architecture, and Test Solutions Session

Chair: Daniele Bosich, | Co-Chair: Namwon Kim

A Review of Medium-Voltage Direct Current Distribution Technologies at ARPA-E

Kathleen Lentijo, Isik Kizilyalli

Direct Coupling of Solar Plants and Electrolyzers with Voltage-Source Converters

Martin Geske, Dino Ablakovic, Kamran Jalili, Christian Keller

Study on Conversion from an Existing Alternating Current Medium-Voltage Line to a Direct Current Line: A Case of Load or Source Expansion

Sreenivasa S Jaldanki, Rajendra Prasad Kandula, Madhu Sudhan Chintavali

Enabling MVDC PV Collection Grids with Modular Solid State Transformers

Daniel Siemaszko, Marko Mogorovic

Design of a Modular Marine DC Microgrid Testbed with Controller-Hardware-in-the-Loop (CHIL) for Real-Time Evaluation

Syed Muhammad Hassan Gillani, Hatif Bin Abdul Majeed, Al Raji Billah, Amiya Haque, Zeljko Pantic, Iqbal Husain

13:00 – 14:40 – Session A4L-B | Lexington B Room

LVDC for Commercial, Residential, Utility Session

Chair: Nihal Kularatna | Co-Chair: Daniel Gerber

A Power-Centric Digitally-Managed 48V Distribution Technology

Bruce Nordman, Richard Brown, Daniel L. Gerber, Jim Baldwin, Lauren Parker, Aditya Kanteti, Jason Poon

Economical Pathway of Adopting Single-Phase Induction Motors in Emerging DC Microgrids

Amirhussein Zia, Soroush Naeiji, Z. John Shen

Investigation of a Decentralized Energy Management System for Undersupplied EV Charging Parks

Raffael Schwanninger, Juliane Friedrich, Melanie Lavery, Martin März

USB-C Outlets for Plug Loads in 350V DC Buildings

Daniel L. Gerber, Jordan Shackelford, Howdy Goudey, Alan Meier, David Chen, Donnie Saturno, Marvin Espino, Mark Manan...

Output Impedance Measurement of Digitally Controlled Power Converters in LVDC-Grids

Raffael Schwanninger, Daniel Schmitt, Melanie Lavery, Bernd Wunder, Martin März

14:40 – 15:05

Coffee Break

15:05 – 16:45 – Session A5L-A | Lexington A Room

Modeling and Control in Microgrids 1 Session

Chair: Dino Ablakovic | Co-Chair: Valentin Bolborici

A Novel Cost-Effective Controller Hardware-in-the-Loop (CHIL) Test for SSCB Coordination in DC Microgrid Systems

Shervin SalehiRad, Elias Nadi, Javad Chevinly, Shuyan Zhao, Zilong Zheng, Fei Lu, Hua Zhang

DC Microgrid Control Using a Multi-Function Multi-Domain Image-Based Hierarchical Digital Twin

Kerry Sado, Jarrett Peskar, Austin Downey, Kristen Booth

Frequency Domain Modeling of Droop-Controlled Systems for Bus Stability

Andy Wong, Cameron Ball, Enrico Santi

Exploration of Use-Case-Dependent Modeling Approach for Distributed DC-Grids

Melanie Lavery, Raffael Schwanninger, Martin März

TUESDAY

Reliability Assessment of DC Space Microgrids Using a Markov Modeling Approach

Leila Chebbo, Ali Bazzi

15:05 – 16:45 – Session A5L-B | Lexington B Room

Energy Storage and Charging Session

Chair: Wayne Weaver | Co-Chair: Saban Ozdemir

Degradation and State of Health Prediction of a Battery Used in a Microgrid in Real-Time

Laxman Timilsina, Ali Moghassemi, Elutunji Buraimoh, S M Imrat Rahman, Asif Ahmed Khan, Grace Muriithi, Gokhan Ozkan,...

Enhanced Performance DC Microgrid Control Scheme with Li-Ion Battery System for Electric Vehicle Applications

Christos Mademlis, Nikolaos Jabbour, Evangelos Tsioumas, Dimitrios Papagiannis

Modeling and Energy Management Optimization of a Hybrid Electric Ferry with DC Power Distribution

Shokoufeh Valadkhani, Matt Burchett, Zhansen Akhmetov, Othman Alkandri, Zeljko Pantic

Evaluation of Semiconductor-Based Isolation for Electric Vehicle Chargers in DC Microgrids

Kilian Drexler, Yan Zhou, Johannes Gehring, Bernd Wunder, Vincent Lorentz, Martin März

Supercapacitors for Enabling Mechanical Circuit Breakers in Shipboard Zonal Secondary DC-Grids

Jacques Julien Deroualle, Stefan Vinks

7:30 – 17:30 Registration Desk Hours

8:00 – 9:40 – Session B1L-A | Lexington A-B Room

Daily Keynotes

Session Chair: Adel Nasiri

Evolution of the DC Grid: Challenges and Opportunities

Rajib Datta

DC-Microgrid Application, Use Cases and Standardization in Europe

Bernd Wunder

09:40 – 10:05

Coffee Break

10:05 - 11:45 – Session B2L-A | Lexington A-B Room

DC-DC Converters Session

Chair: Zeljko Pantic | Co-Chair: Pablo Paz

Non-Linear Active Disturbance Rejection Control for Three-Phase Dual-Active-Bridge DC/DC Converter

Asimena Korompili, Marija Stevic, Antonello Monti

Modeling and Analysis of Voltage Overshoot in Bidirectional Phase-Shift Full Bridge Converters

Tien-Sheng Li, Minh Ngo, Rolando Burgos, Dong Dong

Hybrid Modulation Scheme for CLLC Resonant Converter with Ultra-Wide Voltage Range for V2G Applications

Xiaotian Yang, Shi Yin, Raffael Schwanninger, Bernd Wunder, Vincent Lorentz, Martin März

A Study on Efficiency Improvement of Power Flow Control Using Four-Switch Buck-Boost Converter Focusing on Phase Shift

Kenta Kitazoe, Kenji Natori, Yukihiko Sato

WEDNESDAY

Design of a Cell String Level Maximum Power Point Tracking Converter Connected to a DC Grid

Lukas Irazusta Gorostidi, Jesse Echeverry, Hidde Moens, Bob Van Someren, Laurens Mackay

12:00 - 13:00 – LUNCH Richland Room

Luncheon Keynote

Chair: Enrico Santi

Photovoltaic Systems and Microgrids: A perspective from the U.S. Department of Energy's Solar Energy Technologies Office

George Stefopoulos

13:00 - 15:00 – Session B3L-A | Lexington A Room

Stability, Reliability, and Reconfigurability of DC Systems

Chair: Andrii Chub | Co-Chair: Kristen Booth

Effects of Switching Overvoltages in LVDC Microgrids

Bertrand Du Peloux, David Corbet, Julien Renoux, Tony Landry, Marco Carminati

Reliability Assessment of Meshed DC Shipboard Power Systems Using Stochastic Simulation

Robin van der Sande, Aditya Shekhar, Pavol Bauer

Solid State Power Substation DC Node Optimization and Controller Hardware-in-the-Loop Demonstration

Namwon Kim, Michael Starke, Steven Campbell, Benjamin Dean, Madhu Chinthavali

Stability Analysis of a Droop-Controlled DC Microgrid

Hatif Bin Abdul Majeed, Zeljko Pantic

Distributed Deep Deterministic Policy Gradient Agents for Real-Time Energy Management of DC Microgrid

Elutunji Buraimoh, Gokhan Ozkan, Laxman Timilsina, Grace Muriithi, Ali Arsalan, Behnaz Papari, Ali Moghassemi, Christ...

Design Considerations of Modular Multilevel Converters in Bidirectional Energy-Storage Systems

Vilma Ritamäki, Tomi Roinila

13:00 - 15:00 – Session B3L-B | Lexington B Room

Modeling and Control in Microgrids 2 Session

Chair: Xiaotian Yang | Co-Chair: Kathleen Lentijo

Integral Sliding Mode Controlled 3L-ANPC Based Bidirectional AFE Converter for DC Microgrids

Cagdas Hisar, Guven Balta, Ibrahim Sefa, Necmi Altin, Saban Ozdemir, Adel Nasiri

Operating Range Analysis of Dual Active Bridge Converters in FRT-Buck Modulation Mode

Wei Liu, Zhiguo Hao, Ting Wang, Yuning Zhang, Dongmeng Ye, Jingxin Hu, Li Qi

Grid Supporting Nonlinear Control for AC-Coupled DC Microgrids

Ömer Ekin, Filipe Perez, Friedrich Wiegel, Veit Hagenmeyer, Gilney Damm

Heuristic Evolutionary Optimization for Control and Management of Renewable-Based Hybrid Microgrids

Ali Moghassemi, Laxman Timilsina, Douglas Scruggs, Ali Arsalan, S M Imrat Rahman, Asif Ahmed Khan, Okan Ciftci, Behnaz Papari, Gokhan Ozkan, Christopher S. Edrington

Unified Machine Learning Based Fault Detection Strategy Through Voltage-Sensing for Both AC and DC Side Faults in Photovoltaic Farms

Soroush Naeiji, Hamid Jafarabadi Ashtiani, Amir Shabani, Z. John Shen

Hamiltonian Surface Shaping Power Flow Modeling and Control Design of DC Microgrids

Wayne Weaver, Rush Robinett III, David Wilson

15:00 – 16:15

Coffee Break

WEDNESDAY

15:15 - 16:15 – Session B4P-C | Escalator Area

Poster Session

Chair: Necmi Altin

Issues in Practical Impedance Measurement of Li-Ion Batteries

Minh Tran, Leevi Lignell, Tomi Roinila

Self-Powered and Self-Controlled Hybrid DC Circuit Breaker for Low Voltage Applications

Chamara Dassanayake, Nihal Kularatna, Alistair Steyn-Ross, Nicoloy Gurusinghe

A Techno-Economic Study of DC Microgrids for Electric School Bus Charging Depots

Gustave Roverato, Daniel L. Gerber, Laura Wong, Morgan Faulkner, Vagelis Vossos

Remaining Useful Life Digital Shadow for an eVTOL Powertrain

Jack Hannum, Kerry Sado, Aqarib Hussain, George Anthony, Jason Bakos, Austin Downey, Kristen Booth

SiC MOSFET with Embedded Current Sensor for SSCB Application - Enabling Real Time Dynamic SOA

Dominique Tournier, Jean François De Palma, Roy Ball, Thomas Vadebout, Thibaut Chailloux

Dynamical Characterization of STATCOM Application: Applying Computer-Optimized Orthogonal Perturbations

Hikmat Basnet, Minh Tran, Enrico Santi, Tomi Roinila

An Open-Source Programmable DC/DC Converter for DC Nanogrids

Daniel Gerber, Bryan Carrillo, Tom Elkayam, Joshua Hutchinson, Elijah Gordon, Brandon Ng, Bo Chang, Thomas Bozada, Mahmoud Kabalan, Jason Poon

Fault Analysis and Simulation Study on Modular Resonant-Type Solid State Transformers in DC Distribution Systems

Jaswanth Daniel Sathri, Marie Lawson, Dong Dong, Sungmin Kim

A 380VDC/20A Bidirectional Solid State Circuit Breaker Using a Single GaN Four Quadrant Switch

Triston Cooper, Anas Ghammaz, Ian Brown, Zheng Shen

Filtered Feedback Control on DC Microgrid to Power a High-Performance Battery-Based Cutter Dredger

Andrea Alessia Tavagnutti, Jacques Julien Deroualle, Andrea Colavitto, Daniele Bosich, Giorgio Sulligoi

Leakage Inductance and Turns-Ratio Optimization for Fixed Input Variable Output Dual Active Bridge Converter

Daniel Perez, Aqarib Hussain, Kristen Booth

Energy Source Integration with Storage Systems via a Multiport Converter

Francisco J. Arizaga, Juan M. Ramirez, Janeth A. Alcala, A. G. Rojas-Hernandez

Selection of Supercapacitor Banks for Renewable Energy-Based DC-Operable Refrigerators

Nirashi Polwaththa Gallage, Nihal Kularatna, Alistair Steyn-Ross, Dulsha Kularatna-Abeywardana

Business Case of Green Energy Based End to End DC Power Networks: Extremely Fast DC Charging of Electrical Vehicles Near Highways

Vishwas Power, Chinmay Morankar, Rajendra Singh, Satish Naik Banavath, Ashok Chakravarthi, Shafia Sultana

THURSDAY

7:30 – 12:00 Registration Desk Hours

8:00 – 9:40 – Session C1L-A | Lexington A-B Room

Daily Keynotes

Chair: Enrico Santi

Innovation in DC Fault Protection

John Shen

DC Grids and Ships: Technological Trends, Proof of Concepts Integrated Ship Design

Giorgio Sulligoi

09:40 – 10:05

Coffee Break

10:05 - 11:45 – Session C2L-A | Lexington A-B Room

Component-level Technologies for DC Microgrids

Chair: Kristen Booth | Co-Chair: Goran Mandic

FEA-Driven Solutions to Minimize Driving Loop Inductance and EMI in MHz PCB Designs

Aqarib Hussain, Kerry Sado, Daniel Perez, Kristen Booth

Mitigation of Series Arc Faults in DC Microgrids Using Inverters

Pablo Daniel Paz Salazar, Robert Hebner, Shannon Strank, Xianyong Feng

Novel Device for Fast Detection and Limitation of Short-Circuit Currents in LVDC Grids

Johannes Gehring, Raffael Schwanninger, Bernd Wunder, Martin März, Vincent Lorentz

Compact GaN-Based 25kW, 480V Three-Level Active Front End Rectifier

Mohammad Hassan Adeli, Erkan Deniz, Necmi Altin, Saban Ozdemir, Adel Nasiri

Two-Phase Cooling Solution for SiC/GaN Power Modules

Ali Haji Ali Biglo, Fahim Foysal, Navid Hadifar, Kai Luo, Chen Li, Enrico Santi

Closing Session

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Sixth International Conference
on DC Microgrids

August 5-8, 2024

Columbia, SC

