Welcome to ICDCM 2017

I am honored to welcome you to the Second International Conference on DC Microgrids here in Nuremberg Germany, seemingly a very short two years after the First ICDCM was held in Atlanta, Georgia, USA. I am sure that our conferees have made great technical progress in the interim and I look forward to learning the many exciting details. We are just on the cusp of this new technology so we expect that things will evolve very quickly. We’ve seen dc microgrid applications in homes, commercial and industrial buildings, manufacturing, renewable energy systems, marine systems and elsewhere. The next few years will be exciting times indeed.

Our conference was assembled by a global team of talented and dedicated people. I thank Bernd Wunder for his outstanding leadership of the Technical Program Committee which comprised nearly 40 individuals. Bernd and his committee worked tirelessly to solicit, review, and arrange over 100 papers and presentations into topical sessions and to invite technical stars to open our sessions. Andreas Lindemann held a hard line on the budget to bring you great value for your conference Euros (or dollars!). Andreja Rojko authored many publicity releases and ensured their delivery to our target audience. Paul Savage jumped into the mix to solicit industrial support, gleaning Patronage that was vital in meeting the conference budget. Matt Bosworth expertly and responsively managed the web site, while Melynda Johnson provided professional support through IEEE’s office of Meetings, Conferences and Events.

I especially want to thank the IEEE Power Electronics Society for their thoughtful and deliberative sponsorship of the conference, and the IEEE Power and Energy Society for sharing in that sponsorship. PELS TC1 members played important behind-the-scenes roles in conference organization. Thanks go especially to Steering Committee members Rik DeDoncker, Yan-Fei Liu, David Perreault, Krishna Shenai (General Chair of the first conference), and Yunwei (Ryan) Li.

Welcome to Nuremberg. Let the conference begin!

Roger Dougal
Welcome Message from Technical Chair

On behalf of the ICDCM technical committee, I am honored and delighted to welcome you to the 2nd ICDCM in Nuremberg, Germany. We have chosen a venue that promises an insightful technical conference surrounded by the culture and scenery of downtown Nuremberg. We look forward to providing a stimulating technical program and numerous opportunities for informal networking. The ICDCM is the largest technical professional society for the up-and-coming DC microgrid industry. It provides an opportunity for participants to interact within the professional community, experience and learn about many advanced technology applications, and business trends via keynotes, technical sessions, workshops and other events. Active participation in the ICDCM contributes to build a widespread network connecting industry leaders, professionals, universities and students through a variety of interaction opportunities. The technical program of the last ICDCM in 2015 focused mainly on LVDC and there were many examples of moderate-sized DC-microgrids. This year, there was a greater effort to also include medium voltage topics and more industrial-sized DC-microgrid applications. We succeeded and the topics of the first conference day will be on MVDC application, protection and safety; whereas the second day will mainly focus on LVDC industrial applications, which have huge power demands and complex control and stability issues. The final day will present many papers on nanogrids, electrical access and standardization of LVDC and other low power applications. From the beginning, we have strived to create a program that meets the expectations of our industry partners and the scientific requirements. This has proved to be a challenging task and I would like to take the opportunity to thank all the members of the Technical Committee, the Session Chairs, as well as the reviewers and authors. Without their support, this year’s highly sophisticated program would not have been possible. My special thanks go to Prof. März, Prof. Frey, Birgit Kott and Toahna Meier for their outstanding work and support for our much-anticipated event. Finally, I would like to thank the steering committee and particularly Roger Dougal for the excellent cooperation. It is a great honor to be a part of this excellent scientific DC microgrid community from all over the world. It is a great pleasure for me to welcome you to Nuremberg, Germany.

Bernd Wunder
## Committees

### Organizing

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION</th>
<th>POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roger Dougal</td>
<td>University of South Carolina</td>
<td>General Chair</td>
</tr>
<tr>
<td>Bernd Wunder</td>
<td>Fraunhofer Institute, IISB</td>
<td>Technical Program Chair</td>
</tr>
<tr>
<td>Andreas Lindemann</td>
<td>Otto von Guericke Universitat Magdeburg</td>
<td>Treasurer</td>
</tr>
<tr>
<td>Chris S. Edrington</td>
<td>Florida State University</td>
<td>Publications Chair</td>
</tr>
<tr>
<td>Paul Savage</td>
<td>CEO Nextek Power Systems</td>
<td>Patronage Chair</td>
</tr>
<tr>
<td>Andreja Rojko</td>
<td>ECPE European Center for Power Electronics</td>
<td>Publicity Chair</td>
</tr>
<tr>
<td>Melynda Johnson</td>
<td>IEEE MCE</td>
<td>MCE Coordinator</td>
</tr>
<tr>
<td>Matt Bosworth</td>
<td>Florida State University</td>
<td>Website</td>
</tr>
</tbody>
</table>

### Technical

<p>| John Akerlund       | Uwe Liess                            | Kazuto Yukita             |
| Pierre-Jean Alet    | Zhengyu Lin                          | Regan Zane                |
| Mark Kakran         | Georg Luber                          | Fengyan Zhang             |
| Pavol Bauer         | Vimal Mahendru                       | Andreja Rojko             |
| Ulrich Boeke        | Anton Maurer                         |                           |
| Johan Driesen       | Peter Meckler                        |                           |
| Abdullah Emhemed    | John Meinecke                        |                           |
| David Geary         | Brian Patterson                      |                           |
| Josep Guerrero      | Harry Stokman                        |                           |
| Tomas Harder        | Priya Ranjon Pishra                  |                           |</p>
<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sol Haroon</td>
<td>Tilo Püschel</td>
</tr>
<tr>
<td>Terrence Hill</td>
<td>Worajit Setthapun</td>
</tr>
<tr>
<td>Keiichi Hirose</td>
<td>Rajendra Singh</td>
</tr>
<tr>
<td>Ashok Jhunjhunwala</td>
<td>Zareh Soghomonian</td>
</tr>
<tr>
<td>Tero Kaipia</td>
<td>Mischa Steurer</td>
</tr>
<tr>
<td>Nihal Kularatna</td>
<td>Roland Weiss</td>
</tr>
</tbody>
</table>

**Steering**

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rik De Doncker</td>
<td>RWTH-Aachen</td>
</tr>
<tr>
<td>Yan-Fei Liu</td>
<td>Queens University</td>
</tr>
<tr>
<td>David Perreault</td>
<td>EE&amp;CS, MIT</td>
</tr>
<tr>
<td>Krishna Shenai</td>
<td>Nitte University</td>
</tr>
<tr>
<td>Roger Dougal</td>
<td>University of South</td>
</tr>
<tr>
<td></td>
<td>Carolina</td>
</tr>
<tr>
<td>Yunwei (Ryan) Li</td>
<td>University of Alberta</td>
</tr>
</tbody>
</table>
Siemens AG (Berlin and Munich) is a global technology powerhouse that has stood for engineering excellence, innovation, quality, reliability and internationality for more than 165 years. The company is active in more than 200 countries, focusing on the areas of electrification, automation and digitalization. Further information is available on the Internet at www.siemens.com.

Corporate Technology Research in Energy and Electronics (CT REE) covers all research and development activities relating to energy and electrification, electronics, new materials and innovative manufacturing methods. Our goal is to protect traditional fields of business while tapping new markets for Siemens.

The **Forschungscampus Flexible Electrical Networks FEN** is a consortium of institutes of the RWTH Aachen University and of industrial partners from different faculties and industrial sectors. With its four institutes the **E.ON Energy Research Center** is a main research partner in the Forschungscampus FEN. The joint research of the scientific and industrial partners under one roof promotes application-oriented research.

The aim of the Forschungscampus FEN is to investigate and to develop innovative technologies for future electrical grids with a high proportion of fluctuating and decentralized renewable energy sources.

The university and industrial partners in the Forschungscampus FEN conduct joint research on the technological foundations of the future power grids. The experts investigate how direct current technology (DC) can be applied to our future energy supply system. Non-technological topics such as social acceptance, urbanistic and health aspects are also investigated in this context.

www.forschungscampus-FEN.de
Keynote Speaker  
Dr. Rik De Doncker, RTWH Aachen, Germany  
Presentation Title: Direct Current in Medium Voltage Distribution  
Biography: Rik W. De Doncker (M'87-SM'99-F'01) received his Ph.D. degree in electrical engineering from the KU Leuven. Since 1996, he has been a professor at Aachen University of Technology, leading the Institute for Power Electronics and Electrical Drives (ISEA). In 2006 he was appointed director of the E.ON Energy Research Center, where he leads the Institute for Power Generation and Storage Systems. He is director of the RWTH CAMPUS Cluster Sustainable Energy and leads the BMBF Research CAMPUS Project “Flexible Electrical Networks”. He has over 400 technical papers and more than 40 patents, with several pending. He is an IEEE Fellow and is a past president of the IEEE Power Electronics Society (PELS). He is member of the EPE Executive Council. He was founding Chairman of the German IEEE IAS-PELS Joint Chapter. He is recipient of the IAS Outstanding Achievements Award and the IEEE Power Engineering Nari Hingorani Custom Power Award (2008). In 2009, he led a VDE/ETG Task Force on Electric Vehicles. He is the recipient of the 2013 Newell Power Electronics IEEE Technical Field Award, the highest distinction in this field within IEEE, and the 2014 IEEE PELS Outstanding Service Award. 2015 he was awarded Fellow status at RWTH University.

Plenary Speaker  
Mr. Harry Stokman, Direct Current BV  
Presentation Title: DC in the Netherlands  
Biography: Harry Stokman is European leading expert on DC and has been active for 29 years as an entrepreneur, developer and realisator of DC businesses. Because of his dedication, years of experience, knowledge and development, he plays a leading role in many DC innovations. Together with his team of DC engineers, he is currently realizing a smart DC system. These innovations in DC smart grids are being deployed in the Netherlands and abroad and shows that a DC system is more reliable, affordable, and safe.
Plenary Speaker

Dr. Peter Zeller, University of Wels Austria

Presentation Title: Safety/Electrical Arcing Aspects in Micro Grids with DC Systems

Biography: Dr. Zeller graduated from the technical University of Vienna in Electrical Energy Engineering and received his PhD from the Institute of Switching Devices and High Voltage Engineering. He is now head of the international study program “Electrical Engineering” with a strong focus on electrical energy engineering. He teaches more than 30 nations of students and collaborates with institutes globally. His working focus is on electrical arcs and switches and high voltage engineering. He is involved in a collaborative research project COMPSTOR to develop the basics for high voltage and power battery storage systems focusing on design of the battery system with respect to high voltage criteria and protection of such systems, investing 2.2 M€ into a high voltage and current test facility. In a second project, arc detection in PV- and low voltage DC systems based on analyzing harmonics is investigated.

Plenary Speaker

Mr. Stig Olav Settemsdal, Seimens AG

Presentation Title: BlueDrive PlusC, DC Powergrid for Marine and Offshore Vessels

Biography: Stig Olav Settemsdal was born in Trondheim, Norway. After graduating as Master of Science Electrical Engineering at the University of Trondheim in 1995. He has been working with Siemens Power Electronic Centre in Trondheim as engineer, project manager, and became technical manager of drilling systems in 2006. He has been in charge of the development of the BlueDrive drilling system in Siemens and in 2009 was given the position as Product Lifecycle Manager in Siemens Oil & Gas. The first development project he initiated after this appointment was the DP3 closed ring power plant in 2010. He was appointed Global Head of Drilling Solutions in 2012. In 2014 was appointed Global Head of Technology for Drilling & Marine technology. Last year Stig was appointed as Global Head of Portfolio Management & Innovation Offshore for the Offshore Production, Drilling & Oil and Gas vessels in Siemens Process Industries & Drives, Solutions business unit.
Plenary Speaker

Dr. Mischa Steurer, Florida State University

Presentation Title: Evaluating Performances of Emerging MVDC Systems Technologies

Biography: Dr. Michael "Mischa" Steurer received a B.S. and M.S. in Electrical Engineering from the Vienna Technical University in 1994 and PhD in Electrical Engineering from the Swiss Federal Institute of Technology in 2001. Since 2001, Dr. Steurer has been a researcher at Florida State University in the Center for Advanced Power Systems where he leads the Power Systems group which focuses primarily on hardware-in-the-loop real-time simulation and modeling of integrated power systems for all-electric ships and future terrestrial power systems. Dr. Steurer has authored/co-authored more than 150 technical papers in the area of shipboard power systems, hardware-in-the-loop real-time simulation, and superconductivity. Dr. Steurer is a Senior Member IEEE and a member of CIGRE. He currently chairs IEEE WG P2004 which develops a recommended practice for HIL simulations.

Keynote Speaker

Dr. Martin März, Fraunhofer IISB

Presentation Title: The Role of Power Electronics in LVDC Grids

Biography: Prof. Dr.-Ing. Martin März studied electrical engineering at the University of Erlangen-Nuremberg with a focus on high frequency engineering. After his PhD on microwave excitation of CO₂ lasers, he started his career in the semiconductor division of Siemens (later Infineon AG) in Munich. Since 2000 he is head of the power electronics system department at the Fraunhofer Institute of Integrated Systems and Device Technology (IISB) in Erlangen/Germany. Since 2012 he is deputy director of the IISB, and since 2013 Honorary Professor at the University of Erlangen-Nuremberg. In 2016 Prof. März was appointed as full-professor to the newly established chair of energy electronics. His research areas are innovative technologies for very high power density and efficiency in low and medium voltage power electronics, DC-grids and thermal management.
Plenary Speaker

Dr. Frank Berger, TU Ilmenau

Presentation Title: Mechanical Switches in Low Voltage DC Nano and Micro Grids: Imperative and Challenges

Biography: Dr. Berger received the Dipl.-Ing. (1984) and the Dr.-Ing. (1991) degrees in electrical engineering from the Technical University Dresden. From 1991 to 2003 he worked for Moeller GmbH Bonn, responsible for research on switching devices and switchgear as Manager of the Applied Research Group. Since 2003 is a Full Professor for Electrical Apparatus and Switchgear at the TU Ilmenau. Since 2007 he is the chairman of the committee “Contact Behaviour and Switching” of the German Association of Electrical, Electronic and Information Technologies (VDE) and he represents Germany as a vice-chairman of the Advisory Group for International Conference on Electrical Contacts. In 2015 he received the Albert-Keil-Price for outstanding accomplishments in the field of electrical contacts from the Förderverein Kontakte und Schalter e. V. His research areas are: high voltage discharges, contact physics, switching arc phenomena in high and low voltage AC as well as DC components and systems. He is author and co-author of more than 130 publications in scientific journals or books.

Plenary Speaker

Dr. Patrick Kröhner, Daimler AG

Presentation Title: Industrie 4.0 Meets Energiewende: Towards a Smart Automation DC Grid for Automotive Industry

Biography: Patrick Kröhner started his professional career at Daimler AG as qualified technician for electronics and automation. After several years of international experience in the process development and materials department he started his studies in mechatronics with a special focus on automation at Reutlingen University. As a project manager in the European founded research project “AREUS” and the German founded research project “DC-INDUSTRIE” he has been driving the development of DC power architectures at Daimler AG forward.
**Plenary Speaker**

**Dr. Keiichi Hirose, Senior Manager, Data Center Business**
**HQ, NTT Facilities, Inc.**

**Presentation Title:** Expansion of DC Power from ICT to Smart Solutions

**Biography:** Dr. Hirose works for NTT Group, which is one of the largest telecom operators in the world. From the telecom operator’s point of view, he can contribute information and lessons obtained from his years in the telecom industry on topics including state-of-the-art technologies, R&D, DC powering, and natural disaster measurements. He won the 3rd Best paper prize at the IEEE PELS INTELEC 2009, the IEEJ paper award in 2010, the IEIEJ paper award in 2013, the IEIEJ HOSHINO award in 2014, the SHIBUSAW award in 2014, and so on. Over the course of his INTELEC activities, Dr. Hirose has served as the president of the IEEE PELS INTELEC (TC7 Chair). He also works as a chair of the IEEE PELS Japan Chapter, IEC Japanese SC22E, and a member of IEEJ, IEIEJ, IEICE, and IEEE.

**Plenary Speaker**

**Mr. Brian Patterson, Emerge Alliance**

**Presentation Title:** Real-time Transactional Power Management of Direct Current based Microgrid Meshed Networks: The Enternet

**Biography:** Brian T. Patterson is President and a founder of the EMerge Alliance. He is a 30 plus year veteran of the electrical and electronics industry, has an extensive technical and work history in electronics, fiber optics and building electrical systems technologies and holds multiple patents in those fields. He is currently Managing Director of B. L. Coliker Associates, a market and technology consulting firm. Prior positions include General Manager at Armstrong World Industries, Director of AMP Incorporated’s Fiber Optic Business, and President of an Electronic Interconnect Division of Kollmorgen Corporation.
Keynote Speaker

Dr. Pavol Bauer, Delft University of Technology

Presentation Title: How Direct will the Future Electricity Be?

Biography: Pavol Bauer is a full Professor with the Department of Electrical Sustainable Energy of Delft University of Technology and head of DC Systems, Energy Conversion and Storage group. He published over 80 journals and almost 300 conference papers in his field, he is an author or co-author of 8 books, and holds 5 international patents. He has worked on many projects for industry concerning wind, solar and wave energy, power electronic applications for power systems such as Smarttrafo; HVDC systems, DC distribution grids and microgrids, projects for smart cities such as PV charging of electric vehicles, PV and storage integration, contactless charging; and he participated in several Leonardo da Vinci and H2020 EU projects as project partner (ELINA, INETELE, E-Pragmatic) and coordinator (PEMCWebLab.com-Edipe, SustEner, Eranet DCMICRO). He is a Senior Member of IEEE ('97), former chairman of Benelux IEEE Joint IAS, PES, PELS chapter, chairman of the PEMC council, member of the Executive Committee of EPE and also member of international steering committee at numerous conferences.

Plenary Speaker

Dr. Ashok Jhunjhunwalla, IIT Madras

Presentation Title: Scaled Adoption of DC Power Line in India: Homes, Offices and Village Microgrids

Biography: Dr. Jhunjhunwala is an Institute Professor at IIT, Madras at Chennai, India. He is currently Advisor to Minister of Power and MNRE, Government of India. Dr. Jhunjhunwala did B. Tech from IITK, MS and PhD from the University of Maine and was a faculty at Washington State University from 1979 to 1981, before joining IIT Madras in 1981. Dr. Jhunjhunwala is considered the pioneer in nurturing Industry - Academia interaction in India towards R&D, Innovation and Product Development. His group (TENET) at IIT Madras has innovated, designed, developed and commercialized a large number of technologies in the area of Telecom, IT, Banking and Energy sectors, especially in solar rooftop and electric vehicles. He conceived and built the first Research Park (IIT Madras Research Park) in India which houses over 65 R&D companies and 100 incubated companies. He leads IITM Incubator which has incubated 120 companies so far.
Plenary Speaker

Dr. Hannes Kirchhoff, Technische Universität Berlin

Presentation Title: Standardization for LVDC Applications in the Energy Access Context

Biography: Hannes grew up in Germany and the U.S. and has lived in South Africa, Tanzania and Bangladesh. He is an energy and process engineer by background and holds a master’s degree in renewable energy systems engineering. Hannes pursues his PhD on peer to peer DC microgrids framed as “Swarm Electrification”, is part of the MicroEnergy Research Group (MES) and affiliated with the Department for Sustainable Electric Networks and Sources of Energy (SENSE) at the Technische Universität Berlin. Hannes has worked as a technical consultant for MicroEnergy International (Germany) on a number of projects in Asia and Africa undertaking technology, supplier and value chain assessments. Previously, Hannes worked for CAMCO (Tanzania), Schott Solar CSP (Germany) and the Institute for Ecological Economy Research (Germany).

Special Speaker

Lynn Petersen, Captain US-Navy (Ret)

Presentation Title: The Ship as a Microgrid

Biography: Mr. Petersen graduated from the US Naval Academy, Annapolis, MD with a BS in Mathematics in 1986 and was commissioned an Ensign in the US Navy. Selected for lateral transfer to the Engineering Duty Officer program, he received his MS in Mechanical Engineering from the Naval Postgraduate School, Monterey, CA in 1994. Following Active Duty, he was employed by the Naval Surface Warfare Center, Carderock Division, Annapolis, MD as an Electrical Engineer. From 1998-2002, he led several projects supporting Navy Electric Drive and authored several papers and reports on electrical propulsion, conversion, generation and distribution. In October, 2002, he was detailed to the Office of Naval Research (ONR), and in May, 2006 he was hired by ONR and served as the ONR S&T rep to the Electric Ships Office, PMS 320. In November, 2008, he was recalled to Active Duty with assignment as the Deputy Director, Electric Ships Office, PMS 320. While in that assignment, he was promoted to the rank of Captain in 2009. Following return from Active Duty, Mr. Petersen currently serves as a Program Officer at ONR where he leads basic research in power electronics and electromagnetism, basic research into adaptive controls and applied research into machinery controls, and applied research in SiC WBG semiconductors and MVDC electrical systems.
Map of Venue

NH Collection, Nürnberg
<table>
<thead>
<tr>
<th>Time</th>
<th>Monday 26 June</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 – 9:00</td>
<td>Registration - Konferenz Foyer</td>
</tr>
<tr>
<td>9:00 – 12:00</td>
<td>Tutorial I: Flexible Distribution Grids based on DC Technologies (Königsturm I+II)</td>
</tr>
<tr>
<td>12:00 – 13:00</td>
<td>Lunch NH Restaurant</td>
</tr>
<tr>
<td>13:00 – 16:00</td>
<td>Tutorial II: Power Architectures, Applications and Control of DC Distribution Systems and Microgrids (Königsturm I+II)</td>
</tr>
<tr>
<td>16:00 – 16:30</td>
<td>Refreshment Break</td>
</tr>
<tr>
<td>16:30 – 19:30</td>
<td>Tutorial III: Power Electronics and Systems Design for LVDC Microgrids (Königsturm I+II)</td>
</tr>
<tr>
<td>19:30 – 21:30</td>
<td>Welcome Reception – Konferenz Foyer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Tuesday</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 – 11:10</td>
<td>Plenary Session: Medium Voltage DC (Königsturm 1+2+3)</td>
</tr>
<tr>
<td>11:10 – 11:40</td>
<td>Coffee Break – Konferenz Foyer</td>
</tr>
<tr>
<td>11:40 – 13:20</td>
<td>DC Breaker and Arc Detection (Königsturm 1+2)</td>
</tr>
<tr>
<td>13:20 – 14:20</td>
<td>Lunch NH Restaurant</td>
</tr>
<tr>
<td>14:20 – 15:40</td>
<td>MV Systems (Aircraft and Wind Parks) (Königsturm 3)</td>
</tr>
<tr>
<td>15:40 – 16:20</td>
<td>Break – Konferenz Foyer</td>
</tr>
<tr>
<td>16:20 – 17:50</td>
<td>Marine and Railway Applications (Königsturm 1+2)</td>
</tr>
<tr>
<td>18:30 – 20:00</td>
<td>Nuremberg City Tour – Meet tram at Hauptbahnhof</td>
</tr>
<tr>
<td>20:15 – 22:00</td>
<td>Organizing Committee – Dinner/Meeting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Wednesday</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 – 11:10</td>
<td>Plenary Session: Industrial and Commercial Buildings (Königsturm 1+2+3)</td>
</tr>
<tr>
<td>11:10 – 11:40</td>
<td>Coffee Break – Konferenz Foyer</td>
</tr>
<tr>
<td>11:40 – 13:20</td>
<td>DC Microgrids in Buildings (Königsturm 1+2)</td>
</tr>
<tr>
<td>13:20 – 14:20</td>
<td>Lunch NH Restaurant</td>
</tr>
<tr>
<td>14:20 – 15:40</td>
<td>ICT and Real-time Energy Management (Königsturm 3)</td>
</tr>
<tr>
<td>15:40 – 16:20</td>
<td>Break – Konferenz Foyer</td>
</tr>
<tr>
<td>16:20 – 17:50</td>
<td>Stability and Performance Analysis I (Königsturm 1+2)</td>
</tr>
<tr>
<td>19:00 – 20:30</td>
<td>Banquet at Zum Spiegesellen Rathausplatz 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 – 11:10</td>
<td>Plenary Session: Nanogrids (Königsturm 1+2+3)</td>
</tr>
<tr>
<td>11:10 – 11:40</td>
<td>Coffee Break – Konferenz Foyer</td>
</tr>
<tr>
<td>11:40 – 13:20</td>
<td>DC Microgrids in Buildings (Königsturm 1+2)</td>
</tr>
<tr>
<td>13:20 – 14:20</td>
<td>Lunch NH Restaurant</td>
</tr>
<tr>
<td>14:20 – 15:40</td>
<td>Power Electronics for Nanogrids (Königsturm 1+2)</td>
</tr>
<tr>
<td>15:40 – 16:20</td>
<td>Break – Konferenz Foyer</td>
</tr>
<tr>
<td>16:20 – 17:50</td>
<td>Voltage/Droop Control (Königsturm 3)</td>
</tr>
<tr>
<td>18:30 – 20:00</td>
<td>Battery Applications (Königsturm 3)</td>
</tr>
<tr>
<td>19:00 – 20:30</td>
<td>Simulation, Emulation and Analysis of Microgrids (Königsturm 1+2+3)</td>
</tr>
<tr>
<td>19:30 – 21:30</td>
<td>Closing Remarks</td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>8:00 – 9:00</td>
<td>Registration</td>
</tr>
<tr>
<td></td>
<td><strong>Tutorials</strong></td>
</tr>
<tr>
<td>9:00 – 12:00</td>
<td>Königsturm I+II</td>
</tr>
<tr>
<td></td>
<td><strong>Tutorial 1: Flexible Distribution Grids</strong></td>
</tr>
<tr>
<td></td>
<td><strong>based on DC Technologies</strong></td>
</tr>
<tr>
<td></td>
<td><em>Instructors: R. De Doncker, A. Monti, RWTH Aachen</em></td>
</tr>
<tr>
<td>12:00 – 13:00</td>
<td>Hotel Restaurant</td>
</tr>
<tr>
<td></td>
<td><strong>Lunch</strong></td>
</tr>
<tr>
<td>13:00 – 16:00</td>
<td>Königsturm I+II</td>
</tr>
<tr>
<td></td>
<td><strong>Tutorial 2: Power Architectures, Applications and</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Control of DC Distribution Systems and Microgrids</strong></td>
</tr>
<tr>
<td></td>
<td><em>Instructors: Tomislav Dragicevic, Aalborg University and Giampaolo</em>*</td>
</tr>
<tr>
<td></td>
<td>Buticchi, Kiel University</td>
</tr>
<tr>
<td>16:00 – 16:30</td>
<td><strong>Coffee Break</strong></td>
</tr>
<tr>
<td>16:30 – 19:30</td>
<td>Königsturm I+II</td>
</tr>
<tr>
<td></td>
<td><strong>Tutorial 3: Power Electronics and System</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Design for LVDC Microgrids</strong></td>
</tr>
<tr>
<td></td>
<td><em>Instructors: Dr. Martin März, Fraunhofer IISB</em></td>
</tr>
<tr>
<td>19:30 – 21:00</td>
<td><strong>Welcome Reception</strong></td>
</tr>
<tr>
<td></td>
<td>Welcome by Roger Dougal</td>
</tr>
</tbody>
</table>
TUESDAY

8:00 – 9:00 Registration

9:00 - 11:10 | Königsturm 1+2+3

Plenary: Medium Voltage DC
Chair: Pavol Bauer, Bernd Wunder

Direct Current in Medium Voltage Distribution
Dr. Rik W. De Doncker, RWTH Aachen

DC in the Netherlands
Mr. Harry Stokman, Direct Current BV

Safety/Electrical Arcing Aspects in Micro Grids with DC Systems
Dr. Peter Zeller, University of Wels Austria

BlueDrive PlusC, DC Powergrid for Marine and Offshore Vessels
Stig Olav Settemsdal, Siemens AG

Evaluating Performances of Emerging MVDC Systems Technologies
Dr. Mischa Steurer, Florida State University

11:10 - 11:40

Coffee Break
11:40  Resonant Electric Arcs in DC Microgrids with Low System Impedance in the VLF-Band  
Christian Strobl\(^{(1)}\), Leopold Ott\(^{(2)}\), Julian Kaiser\(^{(2)}\), Matthias Streck\(^{(4)}\), Frank Nothnagel\(^{(4)}\), Frank Berger\(^{(4)}\), Maximilian Schäfer\(^{(3)}\), Rudolf Rabenstein\(^{(3)}\) | \(^{(1)}\)E-T-A Elektrotechnische Apparate GmbH, Germany; \(^{(2)}\)Fraunhofer-Institut für Integrierte Systeme und Bauelementetechnologie, Germany; \(^{(3)}\)Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany; \(^{(4)}\)Technische Universität Ilmenau, Germany

12:00  DC Arc Fault Scenarios and Detection Methods in Battery Storage Systems  
Felix Eger, Georg Bopp, Dennis Freiberger, Nikolaus Lang, Hermann Laukamp, Gilles Rouffaud | Fraunhofer-Institut für Solare Energiesysteme, Germany

12:20  Novel Control Methodology for Detecting Series Arc in DC Circuits  
Qumera Sultana, PriyaRanjan Mishra, Sreenivasa Chary | Philips Lighting, India

12:40  Design of a Forward-Flyback Converter based Drive with Gate Voltage Limitation for a DC Circuit Breaker using Normally-On SiC JFET  
Thi Thuong Huyen Ma\(^{(2)}\), Thanh Kha Tran\(^{(2)}\), Hamed Yahoui\(^{(2)}\), Nicolas Siauve\(^{(2)}\), Hoang Giang Vu\(^{(1)}\) | \(^{(1)}\)Electric Power University, Vietnam; \(^{(2)}\)Université Claude-Bernard Lyon 1, France

13:00  DC Ultra-Fast Solid State Circuit Breaker using the Voltage Inductor to Activate Short Circuit Protection  
L.A. Capilla, E.J.J. Rodríguez, F.J. León, C. Gordillo-Tapia, J.J. Martínez | Instituto Tecnologico de Celaya, Mexico
TUESDAY

11:40 - 13:20 - Session A1L-B | Königsturm 3

MV Systems (Aircraft and Wind Parks)
Chair: Fengyan Zhang | Co-Chair: Nihal Kularanta

11:40 Analysis and Control of a Medium Voltage DC Link Interface between DFIG Wind Turbine System and Weak Power Grid
Theodoros I. Mamalis, Antonio T. Alexandridis | University of Patras, Greece

12:00 ANFIS-DBN based Energy Management Architecture of Hybrid Emergency Power System for More-Electric Aircrafts
Mohasinina Binte Kamal, Jin Wei, Gihan J. Mendis | University of Akron, United States

12:20 DC Power Distribution: New Opportunities and Challenges
Li Qi(2), Jiuping Pan(2), Lars Liljestrand(3), Magnus Backman(3), Antonello Antoniazzi(1), Luca Raciti(1), Marco Riva(1) | (1)ABB S.p.A., Italy; (2)ABB Inc., United States; (3)ABB AB, Sweden

12:40 Establishment of Functional Requirements to DC-Connected Wind Turbine and Their use in Concept Selection
Catalin Dincan, Philip Kjaer, Yu-Hsing Chen, Stig-Munk Nielsen, Claus Leth Bak | Aalborg University, Denmark

13:00 Flexible HF Distribution Transformers for Inter-Connection between MVAC and LVDC Connected to DC Microgrids: Main Challenges
M.A. Bahmani(1), K. Vechalapu(2), M. Mobarrez(2), S. Bhattacharya(2) | (1)Chalmers University of Technology, Sweden; (2)North Carolina State University, United States

13:20 - 14:20 – Hotel Restaurant
Lunch
14:20 – 15:40 – Session A2L-A | Königsturm 1+2

**MV Protection and Microgrid Grounding**
*Chair: Harry Stokman | Co-Chair: Abdullah Emhemed*

**14:20** Fault Protection in Medium Voltage DC Microgrids
*Qiu Deng, Roger A. Dougal | University of South Carolina, United States*

**14:40** A Novel Protection Scheme for an LVDC Distribution Network with Reduced Fault Levels
*Dong Wang, Abdullah Emhemed, Graeme Burt | University of Strathclyde, United Kingdom*

**15:00** Capacitive Grounding for DC Distribution Grids with Two Grounding Points
*Laurens Mackay, Kenji F. Yanez Martinez, Elisabeth Vandeventer, Laura Ramirez-Elizondo, Pavol Bauer | Technische Universiteit Delft, Netherlands*

**15:20** Grounding Architectures for Enabling Ground Fault Ride-Through Capability in DC Microgrids
*Maziar Mobarrez(2), D. Fregosi(2), S. Bhattacharya(2), M.A. Bahmani(1) | (1)Chalmers University of Technology, Sweden; (2)North Carolina State University, United States*

---

14:20 – 15:40 – Session A2L-B | Königsturm 3

**PHEV/EV Interconnection with DC Microgrids**
*Chair Regan Zane | Co-Chair David Geary*

**14:20** Co-Location of CHP Units for High Power Charging of Battery Electric Vehicles: A Comparison of the Fuel Efficiency for AC and DC Coupled Systems
*Kyle Smith, Stuart Galloway, Graeme Burt | University of Strathclyde, United Kingdom*
TUESDAY

14:40 Electricity Market Design Requirements for DC Distribution Systems
Longjian Piao, Mathijs de Weerdt, Laurens de Vries | Technische Universiteit Delft, Netherlands

15:00 A New Method to Achieve ZVS for DC-DC Dual Active Bridge (DAB) Converters used between Electric Vehicles and DC Micro-Grids
Iman Askarian, Majid Palevani, Andy Knight | University of Calgary, Canada

15:20 Modular Electric Generator Rapid Deployment DC Microgrid
Ewan Pritchard\(^{1}\), Landon Mackey\(^{1}\), Di Zhu\(^{1}\), Daniel Gregory\(^{2}\), Greg Norris\(^{2}\) | \(^{1}\)North Carolina State University, United States; \(^{2}\)Positive Energies LLC, United States

15:40- 16:20 Coffee Break

16:20 – 18:00 – Session A3L-A | Königsturm 1+2
Marine and Railway Applications
Chair: Michael Steurer | Co-Chair: Zareh Soghomonian

16:20 Special Presentation: DC Ship as a Microgrid
Lynn Petersen | Office of Naval Research, USA

16:40 DC Microgrid Islands on Ships
Aditya Shekhar, Laura Ramírez-Elizondo, Pavol Bauer | Technische Universität Delft, Netherlands

17:00 Graph Traversal-Based Automation of Fault Detection, Location, and Recovery on MVDC Shipboard Power Systems
Christoph Diendorfer\(^{2}\), Jean D. Hallewell Haslwanter\(^{2}\), Mark Stanovitch\(^{1}\), Karl Schoder\(^{1}\), Mike Sloderbeck\(^{1}\), Harsha Ravindra\(^{1}\), Mischa Steurer\(^{1}\) | \(^{1}\)Florida State University, United States; \(^{2}\)University of Applied Sciences Upper Austria, Austria
17:20  Large-Signal Stability Analysis of Two Power Converters Solutions for DC Shipboard Microgrid

Daniele Bosich\(^{(2)}\), Madeleine Gibescu\(^{(1)}\), Giorgio Sulligo\(^{(2)}\)  
\(^{(1)}\)Eindhoven University of Technology, Netherlands;  
\(^{(2)}\)Università degli Studi di Trieste, Italy

17:40  Comparison of Energy Storage Configurations in Railway Microgrids

Yuko Yoshida\(^{(2)}\), Hernan P. Figueroa\(^{(1)}\), Roger A. Dougal\(^{(2)}\)  
\(^{(1)}\)George Washington University, United States;  
\(^{(2)}\)University of South Carolina, United States

16:20 – 18:00 – Session A3L-B | Königsturm 3  
Protection and Safety  
Chair: Abdullah Emhemed | Co-Chair: Tilo Püschel

16:20  Grid Behavior under Fault Situations in ±380 VDC Distribution Systems

Julian Kaiser\(^{(1)}\), Kilian Gosses\(^{(1)}\), Leopold Ott\(^{(1)}\), Yunchao Han\(^{(1)}\),  
Bernd Wunder\(^{(1)}\), Martin März\(^{(1)}\), Roland Weiss\(^{(2)}\)  
\(^{(1)}\)Fraunhofer-Institut für Integrierte Systeme und Bauelementetechnologie,  
Germany;  
\(^{(2)}\)Siemens AG, Germany

16:40  PSCAD/EMTDC-Based Simulations for Fault Analysis and Fault Identification in 380V Ring DC Systems

Julia Niewind\(^{(3)}\), Nasser G.A. Hemdan\(^{(3)}\), Christoph Klosinski\(^{(3)}\),  
Michael Kurrat\(^{(3)}\), Frank Ferdinand\(^{(1)}\), Johann Meisner\(^{(2)}\),  
Stephan Passon\(^{(2)}\)  
\(^{(1)}\)E-T-A Elektrotechnische Apparate GmbH, Germany;  
\(^{(2)}\)Physikalisch-Technische Bundesanstalt, Germany;  
\(^{(3)}\)Technische Universität Braunschweig, Germany

17:00  Practical Computation of di/dt for High-Speed Protection of DC Microgrids

Chunpeng Li\(^{(2)}\), Puran Rakhra\(^{(2)}\), Patrick Norman\(^{(2)}\), Pawel Niewczas\(^{(2)}\),  
Graeme Burt\(^{(2)}\), Paul Clarkson\(^{(1)}\)  
\(^{(1)}\)National Physical Laboratory, United Kingdom;  
\(^{(2)}\)University of Strathclyde, United Kingdom
TUESDAY

17:20 Development of a Test Bench to Investigate the Breakdown Voltage of Insulation Oil in a Frequency Range between 1 kHz and 10 kHz
R. Möller, B. Soppe, A. Schnettler | Rheinisch-Westfälische Technische Hochschule Aachen, Germany

17:40 Current Measurement of Flat Conductors with a Circular Array of Magnetic Sensors
R. Weiss(2), A. Itzke(2), R. Weigel(1) | (1)Friedrich-Alexander-Universität Erlangen-Nürenberg, Germany; (2)Siemens AG, Germany

18:30 – 20:00 –Meet Tram at Hauptbahnhof
City Tour

20:15 – 22:00
Organizing Committee Dinner/Meeting
8:00 – 9:00 Registration

9:00 – 11:10 | Königsturm 1+2+3

Plenary: Industrial and Commercial Buildings
Chair: Bernd Wunder / Co-Chair: Tomislav Dragicevic

The Role of Power Electronics in LVDC Grids
Dr. Martin März, Fraunhofer IISB

Mechanical Switches in Low Voltage DC Nano and Micro Grids: Imperative and Challenges
Dr. Frank Berger, TU Ilmenau

Industrie 4.0 meets Energiewende: Towards a Smart Automation
DC Grid for Automotive Industry
Dr. Patrick Krohner, Daimler AG

Expansion of DC Power from ICT to Smart Solutions
Dr. Keiichi Hirose, NTT Facilities, Inc.

Real-time Transactional Power Management of Direct Current based Microgrid Meshed Networks: The Enternet
Dr. Brian Paterson, EMerge Alliance

11:10 - 11:40

Coffee Break

11:40 - 13:20 – Session B1L-A | Königsturm 1+2

DC Microgrids in Buildings (Industrial/Commercial)
Chair: Tilo Püschel / Co-Chair: Uwe Liess

11:40 DC-Powered Community Center and Amphitheater: A Whole-Systems Approach
Robert F. Lachenmayer, Daniel C. Gregory |
Positive Energies, LLC, United States
WEDNESDAY

12:00 Stability of Meshed DC Microgrids using Probabilistic Analysis
Lia Strenge$^{(2)}$, Hannes Kirchhoff$^{(2)}$, Gabriel L. Ndow$^{(3)}$, Frank Hellmann$^{(1)}$

Potsdam Institute for Climate Impact Research, Germany; Technische Universität Berlin, Germany; Université Cheikh Anta Diop de Dakar, Senegal

12:20 An Optimal Power Management System for Automatic Connection of DC and AC Resources of Hybrid-Microgrid Systems
Reza Rahmani$^{(2)}$, Ahmad Fakharian$^{(2)}$, J.M. Guerrero$^{(1)}$

Aalborg University, Denmark; Qazvin Islamic Azad University, Iran

12:40 Hybrid AC/DC Building Microgrid for Solar PV and Battery Storage Integration
Johannes Hofer, Bratislav Svetozarevic, Arno Schlüeter

Eidgenössische Technische Hochschule Zürich, Switzerland

13:00 Air Conditioning Equipment using DC Power Supply System
Kazuto Yukita$^{(1)}$, Tadashi Hosoe$^{(1)}$, Keiichi Hirose$^{(2)}$, Masatoshi Noritake$^{(2)}$

Aichi Institute of Technology, Japan; NTT Facilities Inc., Japan

Control Strategy of Microgrids
Chair: Zhengyu Lin | Co-Chair: Pierre-Jean Alet

11:40 Distributed Adaptive Control Design for Cluster of Converters in DC Distribution Systems
Tuyen V. Vu, Dallas Perkins, Behnaz Papari, Hesen Vahedi, Chris S. Edrington

Florida State University, United States

12:00 Topology Identification for Multiple-Bus DC MicroGrids via Primary Control Perturbations
Marko Angjelichinoski$^{(1)}$, Čedomir Stefanović$^{(1)}$, Petar Popovski$^{(1)}$, Anna Scaglione$^{(2)}$, Frede Blaabjerg$^{(1)}$

Aalborg University, Denmark; Arizona State University, United States
12:20  A Simulation of Local Power Distribution Control Strategies
Bruce Nordman, Aditya Khandekar, Michael Spears, Mattia Pezzola | Lawrence Berkeley National Laboratory, United States

12:40  Control Strategy of DC Micro Grids based on Power Flow
Zhenghong Chen, Tao Zheng, Zhengyuan Li, Kangda Wang, Wei Ba | Xi'an Jiaotong University, China

13:00  Active DC Bus Signaling Control Method for Coordinating Multiple Energy Storage Devices in DC Microgrid
Fulong Li{1}, Zhengyu Lin{1}, Zhongnan Qian{2}, Jiande Wu{2} | {1}Aston University, United Kingdom; {2}Zhejiang University, China

13:20 - 14:20 – Hotel Restaurant
Lunch

14:20 - 15:40 – Session B2L-A | Königsturm 1+2
DC Microgrids in Buildings (Industrial)
Chair: Ulrich Boeke | Co-Chair: Fengyan Zhang

14:20  Concepts for a DC Network in Industrial Production
Holger Borcherding{2}, Johann Austermann{2}, Timm Kuhlmann{1}, Benno Weis{3}, André Leonide{3} | {1}Fraunhofer-Institut für Produktionstechnik und Automatisierung, Germany; {2}Hochschule Ostwestfalen-Lippe, Germany; {3}Siemens AG, Germany

14:40  Demonstration of a Microgrid based on a DC Bus Backbone at an Industrial Building
Luis E. Zubieta | ARDA Power Inc., Canada

15:00  Comparative Study of Current Redistributor’s Topologies for Mitigating Unbalanced Currents in Bipolar DC Microgrids
Tuan-Dat Mai, Tars Verschelde, Johan Driesen | Katholieke Universiteit Leuven / EnergyVille, Belgium
Analysis of Three-Level Converters with Voltage Balancing Capability in Bipolar DC Distribution Networks

Giel Van Den Broeck{1}, Sven De Bruecker{2}, Jeroen Zwysen{1}, Mauricio Dalla Vecchia{1}, Johan Driesen{1} | {1}Katholieke Universiteit Leuven / EnergyVille, Belgium; {2}VITO EnergyVille, Belgium

14:20 - 15:40 – Session B2L-B | Königsturm 3

ICT and Real-time Energy Management

Chair: Brian Patterson | Co-Chair: Hannes Kirchhoff

Real-Time Energy Management System for a Hybrid AC/DC Residential Microgrid

Enrique Rodriguez-Diaz{1}, Emilio J. Palacios-Garcia{2}, Amjad Anvari-Moghaddam{1}, Juan C. Vasquez{4}, Josep M. Guerrero{1} | {1}Aalborg University, Denmark; {2}Universidad de Córdoba, Spain

14:40 LVDC Network Integrated Functionalities for Demand Response

Andrey Lana{1}, Tero Kaipia{2}, Antti Pinomaa{1}, Pasi Nuutinen{2}, Arun Narayanan{2}, Jarmo Partanen{2} | {1}Lappeenranta University of Technology, Finland; {2}Lappeenranta University of Technology (LUT), Finland

15:00 A Comprehensive Cloud-Based Real-Time Simulation Framework for Oblivious Power Routing in Clusters of DC Microgrids

M. Hadi Amini{2}, Kianoosh G. Boroojeni{3}, Tomislav Dragičević{1}, Arash Nejadpak{4}, S.S. Iyengar{3}, Frede Blaabjerg{1} | {1}Aalborg University, Denmark; {2}Carnegie Mellon University, United States; {3}Florida International University, United States; {4}University of North Dakota, United States

15:20 Modular ICT based Energy Management System for a LVDC-Microgrid with Local PV Production and Integrated Electrochemical Storage

Christoph Ellert, Rodolfo Horta, Thomas Sterren, Dominique Gabioud, Dominique Roggo, Pierre-Olivier Moix | HES-SO Valais-Wallis, Switzerland
WEDNESDAY

16:20 – 17:40 – Session B3L-A | Königsturm 1+2

**Stability and Performance Analysis I**

*Chair: Tero Kaipia / Co-Chair: Harry Stokman*

16:20  **Design Guidelines for Stable DC Distribution Systems**  
Nils van der Blij, Laura Ramírez-Elizondo, Pavol Bauer, Matthijs Spaan  
Technische Universiteit Delft, Netherlands

16:40  **Modeling and Stability of Autonomous DC Microgrids with Converter-Controlled Energy Storage Systems**  
Despoina I. Makrygiorgou, Antonio T. Alexandridis  
University of Patras, Greece

17:00  **Autonomous Decentralized Stabilizing Control of DC Microgrid**  
Yoichiro Hakuto, Takao Tsuji, Jingting Qi  
Yokohama National University, Japan

17:20  **Characterization of Series Arcs in LVdc Microgrids**  
Zhihao Liu, Aditya Shekhar, Laura Ramírez-Elizondo, Pavol Bauer  
Technische Universiteit Delft, Netherlands

16:20 – 17:40 – Session B3L-B | Königsturm 3

**Stability and Performance Analysis II**

*Chair: Josep Guerrero / Co-Chair: Keiichi Hirose*

16:20  **On-Line Stability Monitoring for Power Converters in DC Microgrids**  
Aram Khodamoradi, Guangyuan Liu, Paolo Mattavelli, Tommaso Caldognetto, Paolo Magnone  
Università degli Studi di Padova, Italy
WEDNESDAY

16:40  Closed-Loop Impedance Calculation of Grid-Tied Three-Phase Inverters/Rectifiers in Bus Signaling Strategy-Controlled DC Microgrids
Loïc Eggenschwiler\textsuperscript{(2)}, Patrick Favre-Perrod\textsuperscript{(2)}, Moustafa Adly\textsuperscript{(1)}, Kai Strunz\textsuperscript{(1)} \textsuperscript{1}Technische Universität Berlin, Germany; \textsuperscript{2}University of Applied Sciences and Arts Western Switzerland, Switzerland

17:00  Transient Analysis of DC Distribution Grids
Dimitris Petropoulos, Laurens Mackay, Laura Ramirez-Elizondo, Marjan Popov, Pavol Bauer \textsuperscript{1}Technische Universiteit Delft, Netherlands

17:20  Coordinated Controller Design and Stability Analysis of DC Microgrid with Constant Power Load
Shiv Raman Mudaliyar, Sukumar Mishra, Rishi Kant Sharma \textsuperscript{1}Indian Institute of Technology Delhi, India

19:00 -20:30 - Zum Spiessgesellen Rathausplatz 4
Banquet
THURSDAY

8:00 – 9:00 Registration

9:00 – 10:20 | Königsturm 1+2+3

Plenary: Nanogrids
Chair: Andreja Rojko / Co-Chair: Tero Kaipia

How Direct will the Future Electricity be?
Dr. Pavol Bauer, Delft University of Technology

Scaled Adoption of DC Power Line in India: Homes, Offices and Village Microgrids
Dr. Ashok Jhunjhunwalla, IIT Madras

Standardization for LVDC Applications in the Energy Access Context
Dr. Hannes Kirchhoff, Technische Universität Berlin

10:20 – 11:10 Poster Session I | Weißer Turm 1+2

Chair: Andreja Rojko | Co-Chair: Tero Kaipia

Experimental Performance Analysis of Existing Conventional AC Air Conditioner and Corresponding New Pure DC Air Conditioner
Ahmad Al-Subhi, Ibrahim El-Amin | King Fahd University of Petroleum and Minerals, Saudi Arabia

A Heuristic Method for Optimal Energy Management of DC Microgrid
B. Papari, C.S. Edrington, T.V. Vu, F. Diaz-Franco | Florida State University, United States

Virtualization of Power for Data Center and Telecom Environments
Daniel Rixhon | CE+T Power, United States

Multifunction Controller and DC Revenue Meter for Nanogrid
David Silva, Ricardo Aceves, Ernesto Sánchez | Esolenergy Technologies SAPI de CV, Mexico
A Novel Control Method for Preventing the PV and Load Fluctuations in a DC Microgrid from Transferring to the AC Power Grid

Maziar Mobarrez(2), D. Fregosi(2), Gh. Jalali(2), S. Bhattacharya(2), M.A. Bahmani(1) |
(1) Chalmers University of Technology, Sweden; (2) North Carolina State University, United States

Theoretical Analysis of Supercapacitor-Based DC-DC Converter with DC-UPS Capability for 12 V LED Lighting Applications

Thilini Wickramasinghe(1), Nihal Kularatna(2), D. Alistair Steyn-Ross(2) |
(1) Open University of Sri Lanka, Sri Lanka; (2) University of Waikato, New Zealand

Load Control for Supply-Demand Balancing Under Renewable Energy Forecasting

Daud Mustafa Minhas, Raja Rehan Khalid, Georg Frey |
Universität des Saarländes, Germany

A Simulation Tool for Ad Hoc Low Voltage DC Grids with Decentralized Control

Muhammed Areff, Willie A. Cronje, Jacques A. Naudé, Ivan W. Hofsajer |
University of the Witwatersrand, South Africa

Towards Self-Sustainable Power Systems: DC MicroGrid Optimization via Power Talk

Marko Angjelichinoski, Pietro Danzi, Čedomir Stefanović, Petar Popovski, Frede Blaabjerg |
Aalborg University, Denmark

DC Connected Modular Power Converter System for Microgrids

Norbert Grass(3), Marco Grund(3), Bartos Gogolka(3), Michael Felgenhauer(3), Joachim Kleylein-Feuerstein(4), Christian Bay(4), Martin Schwendner(1), Christian Raum(1), Wolfgang Peter(2) |
(1) Grass Power Electronics GmbH, Germany; (2) Komponenten GmbH & Co. KG, Germany; (3) Technische Hochschule Nürnberg, Germany; (4) Universität Bayreuth, Germany

Voltage Regulation of Electric Power Network Interconnected with Wind Energy Distributed Generations

Abdellah Bouakra(2), Fouad Slaoui-Hasnaoui(2), Michella Rustom(1), Semaan Georges(1) |
(1) Notre Dame University, Lebanon, Lebanon; (2) Université du Québec en Abitibi-Témiscamingue, Québec, Canada
A Study on Optimum Design of Storage Battery Capacity for DC Microgrid
Kazufumi Yuasa, Miki Ueshima, Tadatoshi Babasaki | NTT Facilities Inc., Japan

PV Generator Modelling in EMTP
Andreas Theocharis(2), Marjan Popov(1) | (1)Technische Universiteit Delft, Netherlands; (2)University of Karlstad, Sweden

10:20 – 11:10 Poster Session II | Jakobsturm 1+2
Chair: Andreja Rojko | Co-Chair: Tero Kaipia

Hybrid Electro-Mechanical Photovoltaic Maximum Power Point Tracking Technique for Innovative Solar Trees

Feasibility Studies for Implementation of LVDC Distribution for Software Parks using the Novel Eratosthenes Estimation Technique
Aditya Anilkumar, Phalgun Madhusudan, Shubhankar S. Kulkarni | R.V. College of Engineering, India

A Rapid Prototyping Environment for DC and AC Microgrids: Smart Energy Integration Lab (SEIL)
Milan Prodanovic, Alberto Rodríguez-Cabero, Miguel Jiménez-Carrizosa, Javier Roldán-Pérez | IMDEA Energy Institute, Spain

Off-Grid Diesel Generators Enhanced Performance using Photovoltaic Powered On-Board HHO Generation: Experimental Validation
Rana M. Ahmed, Ahmed K. Abdelsalam, Motaz Amer | Arab Academy for Science, Technology & Maritime Transport, Egypt

DC Microgrids Providing Frequency Regulation in Electrical Power System – Imperfect Communication Issues
Hrvoje Bašić(2), Tomislav Dragičević(1), Hrvoje Pandžić(2), Frede Blaabjerg(1) | (1)Aalborg University, Denmark; (2)University of Zagreb, Croatia
A Nanogrid Concept for Supplying ICT Devices to Improve the Energy Efficiency of Small Offices
András Cserép, Ágnes Halász, Tamás Iváncsy, Zoltán Ádám Tamus | Budapest University of Technology and Economics, Hungary

Power Flow Formulation for LVDC Microgrids with Nonlinear Load Models
Irina Ciornei\textsuperscript{(2)}, Mihaela Albu\textsuperscript{(2)}, Mihai Sanduleac\textsuperscript{(2)}, Andres Felipe Martinez Palomino\textsuperscript{(1)} \& \textsuperscript{(1)}Politecnico di Torino, Italy; \textsuperscript{(2)}University Politehnica of Bucharest, Romania

Z-Source Circuit Breaker Utilizing Ultra-Fast Mechanical Switch for High Efficiency DC Circuit Protection
Landon Mackey, Md Rifat Kaisar Rachi, Chang Peng, Iqbal Husain | North Carolina State University, United States

Optimization of the Light-Load Efficiency Enhancement Technique in a Transformerless Inverter Aimed at DC Microgrid
Carlos Correa-Betanzo\textsuperscript{(1)}, Hugo Calleja\textsuperscript{(1)}, Susana de León-Aldaco\textsuperscript{(1)}, Elias Rodríguez\textsuperscript{(2)} \& \textsuperscript{(1)}Centro Nacional de Investigación y Desarrollo Tecnológico, Mexico; \textsuperscript{(2)}Instituto Tecnologico de Celaya, Mexico

Safe DC Outlet and Arc Suppressor
L.A. Capilla, E.J.J. Rodríguez, F.J. León, C. Gordillo-Tapia, J.H. Rodríguez | Instituto Tecnologico de Celaya, Mexico

Assessment of the Feasibility of Interconnected Smart DC Homes in a DC Microgrid to Reduce Utility Costs of Low Income Households
Karthik Palaniappan\textsuperscript{(2)}, Swachala Veerapeneni\textsuperscript{(2)}, Robert Cuzner\textsuperscript{(2)}, Yue Zhao\textsuperscript{(1)} | \textsuperscript{(1)}University of Arkansas, United States; \textsuperscript{(2)}University of Wisconsin–Milwaukee, United States

How DSO Liander Develops Direct Current in Order to Learn from Direct Current
Paul Juffermans | Alliander, Netherlands

11:10 - 11:40

Coffee Break
11:40 - 13:20 – Session C1L-A | Königsturm 1+2

Power Electronics in Nanogrids I
Chair: Regan Zane | Co-Chair: Kazuto Yukita

11:40 Power Flow Control Converter for Meshed LVDC Distribution Grids
Pavel Purgat, Laurens Mackay, Ryan Adilardi Prakoso, Laura Ramirez-Elizondo, Pavol Bauer | Technische Universiteit Delft, Netherlands

12:00 Fault Tolerant DC-DC Converters in DC Microgrids
Fernando Bento, Antonio J. Marques Cardoso | Universidade da Beira Interior / CISE - Electromechatronic Systems Research Centre, Portugal

12:20 Applications of a Dual Function Multi-Port Converter Topology in DC Microgrid Systems
Kyle Muehlegg, Peter W. Lehn | University of Toronto, Canada

12:40 Construct and Control a PV-Based Independent Public LED Street Lighting System with an Efficient Battery Management System based on the Power Line Communication
Thanh Kha Tran{3}, Hamed Yahoui{3}, Nicolas Siauve{3}, Nam Nguyen-Quang{1}, Denis Genon-Catalot{2} | {1}Ho Chi Minh City University of Technology, Vietnam; {2}Institut polytechnique de Grenoble, France; {3}Université Claude-Bernard Lyon 1, France

13:00 A Buck-Boost Topology based Hybrid Converter for Standalone Nanogrid Applications
Milind D. Bagewadi, Sanjay S. Dambhare | College of Engineering, Pune, India

11:40 - 13:20 – Session C1L-B | Königsturm 3

Voltage/Droop Control
Chair: Tero Kaipia | Co-Chair: Ulrich Boecke
THURSDAY

11:40  Analysis of the Dynamics of DC Voltage Droop Controller of DC-DC Converters in Multi-Terminal DC Grids
Asimenia Korompili, Antonello Monti | Rheinisch-Westfälische Technische Hochschule Aachen, Germany

12:00  Comparative Admittance-Based Analysis for Different Droop Control Approaches in DC Microgrids
Zheming Jin, Lexuan Meng, Josep M. Guerrero | Aalborg University, Denmark

12:20  Power-Based Droop Control in DC Microgrids Enabling Seamless Disconnection from AC Grids
Guangyuan Liu, Tommaso Caldognetto, Paolo Mattavelli | Università degli Studi di Padova, Italy

12:40  Design Methodology of the Primary Droop Voltage Control for DC Microgrids
Eduardo Prieto-Araujo, Doru Bogdan Bolboceanu, Enric Sánchez-Sánchez, Oriol Gomis-Bellmunt | Universitat Politècnica de Catalunya, Spain

13:00  A Modeling and Simulation of Optimized Interconnection between DC Microgrids with Novel Strategies of Voltage, Power and Control
Jorge Mírez | National University of Engineering, Peru

13:20 - 14:20 – Hotel Restaurant
Lunch
14:20 - 15:40 – Session C3L-A | Königsturm 1+2

DC Nanogrids in Buildings (Domestic/Residential)
Chair: Hannes Kirchhoff | Co-Chair: Fengyan Zhang

14:20  A Bidirectional Approach for Segregated DC Microgrids
Fabian Fersterra, Kilian Gosses, Matthias Schulz, Bernd Wunder,
Martin März | Fraunhofer-Institut für Integrierte Systeme und
Bauelementetechnologie, Germany

14:40  Potential Energy Savings by using Direct Current for
Residential Applications: A Danish Household Study Case
Enrique Rodriguez-Díaz, Juan C. Vasquez, Josep M. Guerrero |
Aalborg University, Denmark

15:00  Single-Inductor Multiple-Source Mixer for DC Power
Packet Dispatching System
C.M.F.S. Reza\(^{(2)}\), Dylan Dah-Chuan Lu\(^{(2)}\), Ling Qin\(^{(1)}\) |
\(^{(1)}\)Nantong University, China; \(^{(2)}\)University of Sydney, Australia

15:20  Optimization Scheduling in Intelligent Energy Management
System for the DC Residential Distribution System
Jingpeng Yue\(^{(2)}\), Zhijian Hu\(^{(2)}\), Chendan Li\(^{(1)}\), J.C. Vasquez\(^{(1)}\),
Josep M. Guerrero\(^{(1)}\) | \(^{(1)}\)Aalborg University, Denmark;
\(^{(2)}\)Wuhan University, China

---

14:20 - 15:40 – Session C2L-B | Königsturm 1+2

Battery Applications
Chair: Pavol Bauer | Co-Chair: Harry Stokman

14:20  Improved Ramp-Rate and Self Consumption Ratio in a
Renewable-Energy-Based DC Micro-Grid
Vincenzo Musolino, Christian Rod, Pierre-Jean Alet, Andreas Hutter,
Christophe Ballif | Swiss Center for Electronics and
Microtechnology, Switzerland
THURSDAY

14:40  Power Management of a DC Bus Regulated by Multiple Energy Storage Resources  
Luis E. Zubieta | ARDA Power Inc., Canada

15:00  Energy Management Strategy for Renewable Backup Supply  
Chung-Lun Li, Chih-Han Lin, Le-Ren Chang-Chien | National Cheng Kung University, Taiwan

15:20  Optimal Sizing of a Lithium Battery Energy Storage System for Grid-Connected Photovoltaic Systems  
Jérémy Dulout\textsuperscript{(2)}, Bruno Jammes\textsuperscript{(2)}, Corinne Alonso\textsuperscript{(2)}, Amjad Anvari-Moghaddam\textsuperscript{(1)}, Adriana Luna\textsuperscript{(1)}, Josep M. Guerrero\textsuperscript{(1)} | \textsuperscript{(1)}Aalborg University, Denmark; \textsuperscript{(2)}LAAS-CNRS / Université de Toulouse, France

15:40 - 16:10  Coffee Break

16:10 – 17:30 – Session C3L-A | Königsturm 1+2/3  
Simulation, Emulations and Analysis of Microgrids  
Chair: Johan Driesen | Co-Chair: Ashok Jhunjhunwalla

16:10  A Simulation based Comparison of AC and DC Power Distribution Networks in Buildings  
Daniel L. Gerber, Vagelis Vossos, Wei Feng, Aditya Khandekar, Chris Marnay, Bruce Nordman | Lawrence Berkeley National Laboratory, United States

16:30  Simplified Analytical Modeling and Experimental Validation of Diode Bridge Rectifier Operation during Rail-to-Rail Short-Circuit Faults in Synchronous Generator-Fed DC Distribution Systems  
Andrea Vicenzutti\textsuperscript{(1)}, Giorgio Sulligoi\textsuperscript{(1)}, Robert Cuzner\textsuperscript{(2)}, Vikas Singh\textsuperscript{(2)} | \textsuperscript{(1)}Università degli Studi di Trieste, Italy; \textsuperscript{(2)}University of Wisconsin–Milwaukee, United States
16:50  Low-Cost Modular PV-Battery Microgrid Emulator for Testing of Energy Management Algorithms
Leong Kit Gan\textsuperscript{(1)}, Baljit Riar\textsuperscript{(2)}, Jaehwa Lee\textsuperscript{(1)}, David Howey\textsuperscript{(1)} | \textsuperscript{(1)}University of Oxford, United Kingdom; \textsuperscript{(2)}Utah State University, United States

17:10  How to Model a DC Microgrid: Towards an Automated Solution
A. Francés, R. Asensi, O. García, R. Prieto, J. Uceda | Universidad Politécnica de Madrid, Spain

17:35 - 17:50  
Closing Session
Dr. Roger Dougal