Table of Contents

Keynote-Paper: The digital transformation of power systems with its pros and cons
(Keynote speaker: Prof. Peter Palensky)

1.1 From Opportunities to Obstacles: Advantages and Threats of Power System Digitalization 17
Ali Mollaiee, Sayed Mehran Hashemian, Mohsen Jorjani, Alexandru Ştefanov, Peter Palensky
Delft University of Technology, Delft, The Netherlands

Plenary Session 1: Power system measurement and identification / Power system operation and control
(Session Chair: Prof. Volker Staudt)

1.1 Towards a Set of Bus-Splitting Topologies for Congestion Management 27
Mariano Dominguez Librandi[1], Daniel Stenzel[1], Rolf Witzmann[1], Helmuth Hitzeroth[2], Nicolas Käs[2] and Siew Bopp[2]
[1]Professorship Power Transmission Systems, Technical University of Munich, Munich, Germany
[2]Asset Management-Grid Planning, TenneT TSO GmbH, Bayreuth, Germany

1.2 Frequency-Dependent Grid Impedance Measurement on Low-, Medium- and High-Voltage Level 33
Sebastian Kaiser[1], Florian Heupel[2], Johannes Gilsdorf[1], Steffen Eyhorn[1], and Soenke Rogalla[1]
[1]Fraunhofer Institute for Solar Energy Systems ISE, Heidenhofstraße 2, 79110 Freiburg, Germany
[2]badenovaNETZE GmbH, Tullastraße 61, 79108 Freiburg, Germany

1.3 Application-Oriented Comparison of Quade, FBD and an extension of the CPC Power Theory 39
Daniel Vahle[1], and Volker Staudt[1]
[1]Institute for Power Systems Technology and Power Mechatronics
[1]Ruhr-Universität Bochum, Germany

1.4 Possibilities and Limitations of Frequency-Domain Power Definitions 47
Daniel Vahle[1], and Volker Staudt[1]
[1]Institute for Power Systems Technology and Power Mechatronics
[1]Ruhr-Universität Bochum, Germany

1.5 Advanced Testing Strategy for Impedance Based Stability Investigation Using Novel Impedance Replication Method 53
Christoph Klie[1], Thanh Trung Do[2], and Christian Becker[1]
[1]Institute of Electrical Power and Energy Technology, Hamburg University of Technology, Hamburg, Germany
[2]morEnergy GmbH, Hamburg, Germany

Parallel Session 1: Power system measurement and identification / Energy storage applications

P 1.1 Identification of the frequency behaviour of a power plant during a load step in a microgrid 61
Maximilian Mütherig[1], Giuseppe Puleo[1], Markus Zdrallek[1] and Andrea Schönbauer[2]
[1]University of Wuppertal, Wuppertal, Germany
[2]RheinEnergie AG, Cologne, Germany

P 1.2 Bibliographic Review on Power Oscillation Detection Methods 66
Marta Bernal-Sancho[1], Maria Paz Comech[2] and Noemí Galán-Hernández[1]
[1]Electrical Systems Department, CIRCE Technology Centre, Zaragoza, Spain,
[2]CIRCE Mixed Research Institute (CIRCE Technology Centre and University of Zaragoza), Zaragoza, Spain

P 1.3 Methodology for identification of controller parameters of a diesel generator in islanded grid operation..... 72
Claudia Bernecker-Castro[1], Johanna Timmermann[1], Drinor Mecinaj[1], Rolf Witzmann[1], Tobias Lechner[2], Sebastian Seifried[2], Michael Finkel[2], Kathrin Schaarschmidt[3] and Steffen Herrmann[4]
[1]Technical University of Munich, Munich, Germany, 2Augsburg University of Applied Sciences, Augsburg, Germany
[3]LEW Distribution network operator, Augsburg, Germany
[4]AVS Aggregate Construction, Ehingen, Germany

P 1.4 Optimal Design of Energy Storage System for Peak-Shaving in Industrial Production..... 79
Lixin Li[1], Anna Sina Starosta[1], Bernhard Schwarz[1], Nina Munzke[1], Hanns-Martin Strehle[2], Mark Richter[2] and Marc Hiller[1]
[1]Electrotechnical Institute, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany
[2]Fraunhofer Institute for Machine Tools and Forming Technology (IWU), Chemnitz, Germany

P 1.5 Facing the energy crisis: implementing short-term measures to reduce costs and emissions at industrial manufacturing sites 86
Jonas van Ouwerkerk[1,2,3], Jonas Brucksch[1,2,3], Christian Bußar[1,2,3], Dirk Uwe Sauer[1,2,3,4]
[1]Institute for Power Electronics and Electrical Drives (ISEA), RWTH Aachen University, Aachen, Germany
[2]Institute for Power Generation and Storage Systems (PGS), RWTH Aachen University, Aachen, Germany
[3]Juelich Aachen Research Alliance, JARA-Energy, Germany,
[4]Forschungszentrum Jülich GmbH, Institute of Energy and Climate Research Helmholtz-Institute Münster: Ionics in Energy Storage (IEK-12)), Jülich, Germany

P 1.6 Hybrid Uninterruptible Power Supply in Industrial Microgrids..... 92
Johanna Klocke[1], Thorsten Vogt[1] and Timo Rüwald[2]
[1]AEG Power Solutions, Warstein, Emil-Siepmann-Straße 32, Germany,
[2]BatterieIngenieure GmbH, Germany, Aachen, Germany

Plenary Session 2: Energy storage applications / Grid integration of e-Mobility

(Session Chair: Dr. Thanh Trung Do)

2.1 Modelling the Required State of Charge of a Battery Emergency Power Supply for Temporary Islanded Grid Sections with Decentralized Generation 101
Imke Hebbeln[1,2], Maximilian Rose[1], Michael Hübner[1] and Lutz Hofmann[2,3]
[1]Schleswig-Holstein Netz AG, Quickborn, Germany
[2]Institute of Electric Power Systems (IfES), Leibniz University Hanover (LUH), Hanover, Germany
[3]Fraunhofer Institute for Energy Economics and Energy System Technology (IEE), Kassel, Germany

2.2 Decarbonizing Heavy Industry by Using Green Electricity and Hydrogen - A Case Study of a Glass Production Site 108
Jonas Brucksch[1,2,3], Jonas van Ouwerkerk[1,2,3], Christian Bußar[1,2,3], Dirk Uwe Sauer[1,2,3,4]
[1]Institute for Power Electronics and Electrical Drives (ISEA), RWTH Aachen University, Aachen, Germany
[2]Institute for Power Generation and Storage Systems (PGS), RWTH Aachen University, Aachen, Germany
[3]Juelich Aachen Research Alliance, JARA-Energy, Germany
[4]Forschungszentrum Jülich GmbH, Institute of Energy and Climate Research Helmholtz-Institute Münster: Ionics in Energy Storage (IEK-12)), 52425 Jülich, Germany

2.3 Simulation-aided evaluation of regulatory requirements for control in the low-voltage grid 114
Nils Alexander Müller[1], Nils Reinköster[1], Merten Schuster[1], Bernd Engel[1]
[1]Technische Universität Braunschweig, elenia Institute for High Voltage Technology and Power Systems, Braunschweig, Germany

2.4 Charging Load and Flexibility Assessment of Electric Last-Mile Delivery Van Fleets based on Semi-Synthetic Mobility Profiles 122
Andres F. Londono M.[1,2], Krzysztof Rudion[1]
[1]University of Stuttgart, Institute of Power Transmission and High Voltage Technology (IEH), Stuttgart, Germany
[2]Mercedes-Benz AG, Stuttgart, Germany

Parallel Session 2: Grid Integration of E-Mobility / Load management in smart grids / innovative monitoring and protection methods / Operation of DC grids and future grids

P 2.1 Geo-referenced Synthetic Medium-voltage Distribution Networks: A Data-Driven Approach 131
Abhilash Bandam[1,2], Theresa Gross[1], Jochen Linssen[1] and Detlef Stolten[1,2]
[1]Forschungszentrum Jülich GmbH, Institute of Energy and Climate Research - Techno-economic Systems Analysis (IEK-3), Jülich, Germany
[2]RWTH Aachen University, Chair for Fuel Cells, Faculty of Mechanical Engineering, Aachen, Germany

P 2.2 Bidirectional Electric Vehicles Field Trial Data Set 139
Adrian Ostermann[1,2], Theodor Haug[1], Helena Hahne[1,3] and Michael Hinterstocker[1]
[1]FfE, Munich, Germany
[2]School of Engineering and Design, Technical University of Munich (TUM), München, Germany
[3]School of Computation, Information, and Technology, TUM, München, Germany

P 2.3 Methodology for Impact Analysis of Electric Vehicles on Distribution Networks 145
Pedro Henrique Eisenkraemer[1], Mauro dos Santos Ortiz[1], Daniel Pinheiro Bernardon[1] and Martin Wolter[2]
[1]Universidade Federal de Santa Maria, Santa Maria, Brazil
[2]Otto-von-Guericke-Universität Magdeburg, Magdeburg, Germany

P 2.4 Cross-Market Optimal Flexibility Scheduling for Local Energy and Flexibility Aggregators in the Residential Sector 151
Tariq Almomani, Julian Achatz and Rolf Witzmann
Technical University of Munich, Associate Professorship Power Transmission Systems, Munich, Germany

P 2.5 Concept for a cloud-based holistic energy management of domestic appliances to stabilize the energy supply and the power grid 157
Stephan Stieren[1], Moritz Wichtrup[1], Christian Henke[1] and Ansgar Trächtler[2]
[1]Fraunhofer-Institute for Mechatronic Systems Design, Paderborn, Germany
[2]Heinz-Nixdorf-Institute, University of Paderborn, Paderborn, Germany

P 2.6 Honey Badger Algorithm for Estimating the Parameters of Li-ion Battery 3rd Order ECM 163
Walid Merrouche [1], Badis Lekouaghet [2], and Elouahab Bouguenna[1]
[1]Center for Renewable Energies Development, Bouzareah, Algeria
[2]Research Center in Industrial Technologies, Cheraga, Algeria, Germany

P 2.7 Real-Time Simulation of Hybrid AC/DC Grids 170
Marija Stevic, Sebastian Hubschneider, and Ravinder Venugopal
Opal-RT Germany GmbH, Germany

P 2.8 Investigation of DC circuit breaker with extinguishing chamber at reduced ambient pressure for an application in avionics 175
Fanke Zeng[1], Tobias Kopp[1], Dirk Bösche[1], Lars Claaßen[1], Patrick Vieth[1], Michael Terörde[2], and Michael Kurrat[1]
[1]elenia Institute for High Voltage Technology and Power Systems, TU Braunschweig, Germany
[2]Institute for Electromagnetic Compatibility, TU Braunschweig, Germany

P 2.9 Adaptive Distance Protection Scheme for HV Grids with High Share of Distributed Energy Resources 179
Gourab Banerjee[1,2], Pawel Lytaev[2], and Martin Braun[1,2]
[1]Fraunhofer IEE, Institute for Energy Economics and Energy System Technology, Kassel, Germany
[2]University of Kassel, Energy Management and Power System Operation, Kassel, Germany

P 2.10 Development of an Adaptive MAV Platform for Autonomous Inspection of High Voltage Power Lines 186
Batbayar Battseren[1], Uranchimeg Tudevdagva[1], Wolfram Hardt[1], and Dashdavaa Bilegt[2]
[1]Chemnitz University of Technology, Chemnitz, Germany
[2]National Power Transmission Grid State Owned Joint Stock Company, Ulaanbaatar, Mongolia

P 2.11 A computer-assisted Faulted Phase Selection Algorithm for dealing with the effects of Renewable Resources in Smart grids 192
Maria Teresa Villen[1], Maria Paz Comech[2], Eduardo Martinez[1], Roberto Matute[1], M.A. Oliván[1], Anibal Prada[1], and Jose Saldana[1]
[1]Infrastructure of Electric Grids Group, CIRCE Research Centre, Zaragoza, Spain,
[2]Instituto Universitario de Investigación CIRCE, Fundación CIRCE - Universidad de Zaragoza, Zaragoza, Spain

Plenary Session 3: Operation of DC grids and future grids

(Session Chair: Dr. Markus Dietmannsberger)

3.1 Analysis of Weight Advantages in Superconducting DC Power Distribution Systems for All Electric Aircraft 201
Philip Senkpiel, and Michael Terörde
Technische Universität Braunschweig, Braunschweig, Germany

3.2 Role of stationary energy storage systems in large-scale bus depots in the case of atypical grid usage 207
Mina Eskander[1], Amra Jahic[1], Edvard Avdevicius[1], Ramy Soliman[2], and Detlef Schulz[1]
[1]Electrical Power Systems, Helmut Schmidt University Hamburg / University of Bundeswehr, Hamburg, Germany
[2]Hamburger Hochbahn AG, Hamburg, Germany

3.3 Optimal Power Flow for Multi-Use Case Operation of Integrated DC Sections in Distribution Systems 213
Merlin Engel[1], Hannes Newe[1], Sebastian Deters[1], and Christian Becker[2]
[1]Stromnetz Hamburg GmbH, Hamburg, Germany
[2]Hamburg University of Technology, Hamburg, Germany

Parallel Session 3: Power system operation and control / Fuel Cell in electrical power systems / Energy storage applications

P 3.1 Optimal Reactive Power Planning by covering deficient voltage demands with additional reactive power sources using a sensitivity approach 223
Johannes Rauch[1], Oliver Brückl[1] and Bernd Engel[2]
[1]Ostbayerische Technische Hochschule Regensburg, Regensburg, Germany
[2]Technische Universität Braunschweig, Braunschweig, Germany

P 3.2 Reactive Power Planning in Transmission Grid considering Short Term Voltage Stability - STATCOM or SYNCON? 231
Soupayan Bose[1], Mariano Dominguez Librandi[1], Rolf Witzmann[1], Spyridon Iason Dizes[2], Jörg Michael Schmidt[2], and Mojtaba Momeni[2]
[1]Professorship Power Transmission Systems – Technical University of Munich, Munich, Germany
[2]Energy System Planning - Grid Analysis – TenneT SO GmbH, Bayreuth, Germany

P 3.3 Baseload Concepts for Increasing Fuel Cell Durability in Aircraft Multi-Powertrain Operation 239
Ben Bahe, Lukas Baum, Florian Grumm, and Detlef Schulz
Chair of Electrical Power Systems, Helmut Schmidt University/University of the Bundeswehr Hamburg, Hamburg, Germany

P 3.4 A Multi-Energy Fuel Cell Model in the Extended Node Method 245
Daniela Vorwerk, Marc Schumann, and Detlef Schulz; Helmut Schmidt University / University of the Bundeswehr, Hamburg, Germany Bangkok, Thailand

P 3.5 Analysis and Characterization of the Energy Consumption in an Electric Bus Fleet 255
Sammy Jablonski, Benedikt Tepe, Yuqing Zhao, Andreas Jossen
Chair of Electrical Energy Storage Technology, Department of Energy and Process Engineering, School of Engineering and Design, Technical University of Munich (TUM), Munich, Germany

P 3.6 State of health estimation of Lithium-ion batteries using operational data based on approximate weighted total least squares method 262
Aditya Madhav Vaidya[1,2], Firas Alhaider[1,3]
[1]Vattenfall Solar GmbH, Hamburg, Germany
[2]HAW Hamburg Fakultät Life Sciences, 21033 Hamburg, Germany
[3]Helmut-Schmidt-Universität, Fakultät für Elektrotechnik, 22043 Hamburg, Germany

Plenary Session 4: Grid Integration of E-Mobility

(Session Chair: Dr. Marc Schumann)

4.1 Smart e-mobility: user potential in Germany today and in the future..... 273
Patrick Vollmuth [1,2], Kirstin Ganz[1,2], Timo Kern[1]
[1]FfE (Forschungsgesellschaft für Energiewirtschaft mbH), Munich, Germany,
[2]Technical University of Munich (TUM), School of Engineering and Design, Munich, Germany

4.2 Prioritized EV Charging - Enhanced Smart Meter Gateway infrastructure enabling an event driven flexibility tariff..... 281
Matthias Grandel[1], Claudius Kübler[1], Eike Niehs[2], Volker Wachenfeld[1], Bernd Engel[2]
[1]University of Applied Science Biberach, Biberach/Riss, Germany
[2]Technical University Braunschweig, Braunschweig, Germany

4.3 Amplification and Compensation Effects with regard to Harmonics due to Integration of Electric Vehicles into an Existing Industrial Grid 287
Julia Gartner[1], Sebastian Lindemann[2], Nils Alexander Müller[2], Bernd Engel[2]
[1]Volkswagen AG, Wolfsburg, Germany
[2]Technische Universität Braunschweig, elenia Institute for High Voltage Technology and Power Systems, Braunschweig, Germany

4.4 Improving Distribution System Operation and Planning Using Data from a Charge Point Management System 295
Hannes Newe[1], Merlin Engel[1], Jan Voelkel[1]
Stromnetz Hamburg GmbH, Hamburg, Germany