2015 IEEE Electrical Power and Energy Conference (EPEC 2015)

London, Ontario, Canada
26-28 October 2015

IEEE Catalog Number: CFP15EPE-POD
ISBN: 978-1-4799-7665-2

IEEE Catalog Number: CFP15EPE-POD
ISBN (Print-On-Demand): 978-1-4799-7665-2

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

Monday, October 26, 08:00 - 17:00

Tut-1: Practical Power Flow Controller Brings Benefits of Power Electronics to the Grid

Kalyan K. Sen, Chief Technology Office, Sen Engineering Solutions Inc.

Room: Executive Boardroom

Power flow control techniques have been practiced, from using inductors, capacitors, and breakers in earlier days of Electrical Engineering to power electronics-based solutions in recent years. Since the commissioning of the first commercial power electronics-based Flexible Alternating Current Transmission Systems (FACTS) controller two decades ago, a great deal has been learnt about the true needs of a utility for its everyday use and they are low installation and operating costs, component non-obsolescence, and easy relocation to adapt to changing power system's needs. This was the motivation to develop a SMART Power Flow Controller (SPFC) whose objectives are specific (design a power flow controller that meets utilities' needs), measurable (high reliability, high efficiency, cost-effective, component non-obsolescence, and portability), attainable (demonstrated theory by Westinghouse), relevant (efficient power grid), and timely (contemporary).Utilities that are looking for ways to enhance the controllability in an electric power transmission system by voltage regulation, phase angle regulation, line impedance regulation, fault-current limitation, and much more should consider using a SPFC that uses functional requirements and cost-effective solutions. Even though the costs of the available solutions range from $20/kVA to $200/kVA, the basic underlying theory of power flow control and power quality is still the same as it always has been. The question is which solution one should buy. The answer depends on knowing what the true need is. The presentation is designed to provide the basic principles of power flow control theory, an overview of the most commonly used power flow controllers, and future trends. The tutorial is organized in the following way.• Part 1: A high-level overview of various power flow controllers and their features.• Part 2: Traditional power flow controllers - voltage regulating transformer, phase angle regulator, shunt inductor/capacitor, and series inductor/capacitor; Voltage-Sourced Converter (VSC).• Part 3: VSC - 6-pulse, 12-pulse, 24-pulse, 48-pulse harmonic neutralized and PWM VSCs.• Part 4: Modeling and implementation of the VSC-based technology, comparison of theory, simulation, and field results; special applications of VSC-based technology; Sen Transformer.

Tut-2: New Developments in HVDC and FACTS for Power Transmission Grids

Ervin Spahic, Dr.-Ing., Head of Future Technologies, Siemens, Transmission Solutions' Jörg Dorn, Head of R&D, Technology and Innovation, Siemens, Transmission

Room: Salon D

Outline: Introduction Trends in Europe, focus on Germany (Energiewende - nuclear phase out). Integration of renewables, examples for offshore wind farm connections. Transmission technology overview HVDC classic Technology, Applications, trends and new developments (e.g. UHVDC). Actual projects in Canada and USA HVDC PLUS Introduction, Technology and Performance, Layout (Half Bridge, Full Bridge, Monopole, Bipole). New developments and trends: valve, voltage… Principle operation, Grid stability, Black start capability, compatibility, protection, standardization, Overhead, underground and offshore application FACTS, Storage and Synchronous condenser Introduction, Overview, Applications STATCOM - Multilevel technology, Performance, Applications STATCOM + Storage - new development, description, layout, application: grid support, frequency support Synchronous Condenser - old solution for solving new problems HVDC Grids, GIL, Grid Access HVDC grids - needs, developments, protection, DC circuit breakers Gas Insulated Lines (GIL) - DC and AC, Technology, Performance, Applications. New developments. Connection of offshore wind farms - new solutions and trends

Monday, October 26, 08:00 - 12:00

Tut-3: Microgrids Operation and Control - Theory and Practice

Amir Hajimiragha, PhD, SMIEEE, Director of Technical Projects & Smart Grid Integration, BBS Access

Room: Salon C

Abstract: Microgrids are commonly referred to as self-sustained small distribution systems composed of loads and multiple generation and/or storage assets. Microgrids can offer greater availability, flexibility and reliability through multiple sources of power generation and/or storage and immunization from the fault conditions or power disturbances in the upstream grid. Building a business case for developing the microgrids has always been a concern especially in the well-developed North American or European context, since it

is argued that the large cost for developing the grid infrastructure has already been made. In this regard, the economic justification of microgrids can be well manifested in the remote communities where there is no access to the transmission and distribution grid. For example, there are more than 175 remote communities in Canada and hundreds more across the world with no access to the grid.These locations represent a profound opportunity for developing microgrid installations. In this context and according to Navigant, the market for remote community microgrids is projected at $10.2 billion by 2017. Moreover, lack of economic justification for the microgrid developments in the areas with well-established infrastructure loses its credibility after having experienced recent natural disasters that resulted in loss of power delivery for an extended period of time. Buying, storing, and selling energy in different time frames as well as providing ancillary services for the grid are some of the opportunities that provide more economic justification for the microgrids. These economic opportunities together with their role in future smart grids as well as presenting higher levels of reliability demonstrate the unique value and importance of microgrids. The aforementioned reliability is of crucial importance for critical loads such as hospitals, military bases and data centers in view of the existing threats imposed by natural disasters. Motivated by the existing and growing interest in microgrids and inspired by real-world microgrid projects and the operational limitations experienced in practice, this course aims to discuss different aspects of microgrid control. The main objectives are to provide a theoretical background, to share some technical perspectives and to present the existing challenges and some practical approaches in this area.Outline:• Microgrid Definition• Microgrid Challenges and Potentials (old perception, new influential factors, changing standards, role of smart grid and energy storage systems)• History of Microgrids• DC vs. AC• CERTS Microgrid Concept• Concepts and Interactions among Distribution Management System (DMS), Energy Management System (EMS), Microgrid Controller (MGC) and Microgrid Control System (MCS)• Standards• Central Control vs. Distributed Control• Software vs. Hardware-based Control• Expectations from an MCS• Different Layers of an MCS• Microgrid Operation Modes• Microgrids Voltage and Frequency Control Mechanisms• Smart Inverters• Seamless Transition between Grid-connected and Islanded Modes (challenges & solutions)• Generation and Storage Devices' Operational Considerations in an MCS/EMS• Controlling Aspects of the Two Typical Microsources (Wind & Hydro) based on the Experiences from Two Remote-community Microgrids• Three-step Framework for Developing an MCS/EMS• Microgrids Optimization-based Control (theory, applications and computational challenges)• Microgrids Communications• MCS/EMS Validation• A Real-world Microgrid Example: Conventional System Configuration, Challenges, Control and Monitoring Solutions, Achievements and Lessons Learned

Tut-7: Introduction to Smart Grid and Distributed Energy Resources Standards by IEEE SCC21

T. Basso (TB), IEEE SCC21 and IEEE P1547 Committee Chair; M. Siira (MS), IEEE 2030.2 Working Group Chair and IEEE P1547 Committee Vice Chair; C. Vartanian (CV), IEEE 2030.2 Working Group Secretary and IEEE P1547 Committee Secretary and Treasurer

Room: Salon E

Co-sponsored by the IEEE Canada Industry Relations and the IEEE Standards Association SCC21 CommitteesSyllabus (Qualifies for Professional Development Hours):Module 1) Introduction — IEEE standards development, 20 min, TBIEEE Standards Coordinating Committee 21: SCC21 - "Fuel Cells, Photovoltaics, Dispersed Generation, and Energy Storage"SCC21 scope, purpose, and officersOverview of standards development by SCC21DER and Smart Grid interconnection and interoperabilityModule 2) Listing of IEEE 1547™ Distributed energy resources (DER) interconnection series, 25 min, CV, (TB) Background; 1547 standards use in U.S.A. IEEE Std 1547 and Amendment 1: DER interconnection and interconnection tests IEEE Std 1547.1 and Amendment 1: Interconnection equipment test procedures IEEE Std 1547.2: Guide to 1547 IEEE Std 1547.3: Monitoring, information exchange and control (MIC) for DER IEEE Std 1547.4: Planned DER islands/microgrids IEEE Std 1547.6: DER on distribution secondary networks IEEE Std 1547.7: DER impact studies IEEE P1547.8: Expanded use of IEEE 1547 Full revision of 1547 and 1547.1 (interconnection, interoperability and interfacesModule 3) Listing of IEEE SCC21 2030™ Smart Grid series, 20 min, MS Background IEEE Std 2030™ Smart Grid Interoperability IEEE Std 2030.2™ Energy Storage Systems Interoperability IEEE P2030.2.1™ Design, and O & M of Battery Energy Storage Systems IEEE P2030.1™ Electric-Sourced Transportation Infrastructure IEEE P2030.3™ Test Procedures for Electric Energy Storage Equipment and Systems IEEE P2030.9™ Planning and Design of the MicrogridModule 4) Using of the published IEEE SCC21 2030 standards (2030 and 2030.2), 30 min, MS Selected topicsModule 5a) Using of the published IEEE 1547 Stds (1547 and 1547.1), 15 min, CV Selected topicsBreak, 20 minModule 5b) Using of the published IEEE 1547 Stds (1547.2, 1547.3, 1547.4, 1547.6, and 1547.7), 45 min, CV Selected topicsModule 6) Status of ongoing full revision of IEEE 1547 and 1547.1: DER interconnection, interoperability, and interfaces, 35 min, CV, MS Scope, purpose, and selected topics Next actionsModule 7) Closing remarks; getting involved; and discussion, 30 min, CV, MS

Monday, October 26, 13:00 - 17:00

Tut-5: Smart Fault Monitoring and Protection

Amir Mojtahed, Managing Director, Bender Canada Ltd.

Room: Salon C

Target Audience, Pre-requisites, and Benefits: This workshop and presentation is tailored to benefit everyone with different background or qualifications.At the end of the presentation, people will have better understanding of ground faults in AC/DC systems and how to deal with this issue perfectly.

Tut-6: Smart Grid Lab

Pratap Revuru, MEng PEng, Smart Grid Solution Architect, Schneider Electric Canada; Bala Venkatesh, PhD, Peng, Professor and Director, Centre for Urban Energy, Ryerson University

Room: Salon E

Abstract: New technologies such as smart meters, Electric Vehicles, Conservation and Demand Management at Residential Level, Energy Storage (numerous small and aggregated), etc are available as products.Communication technologies are becoming inexpensive, efficient and reliable for their pervasive use.Further computing technologies including hardware and software with phenomenal artificial intelligence capabilities are becoming a commonplace.This confluence of technologies and opportunities is making smart grid technologies available at costs that are palatable to energy consumers and holds the potential of bring unprecedented benefits. To benefit from these developments, distribution systems are now being revisited to make them smart. Smart grid technologies hold the potential of enabling utilities to deliver energy at the least cost in the most environmentally friendly manner while providing the highest reliability. It also holds the potential of enabling customers manage their usage of energy and source in the manner that best suits their desires.This tutorial examines aspects of the smart distribution network and focuses on illustrating benefits of advanced distribution management system (ADMS) that provides intelligence, a layer above the conventional SCADA (supervisory control and data acquisition). The tutorial also illustrates a smart grid laboratory facility built at Ryerson as a path for process that enables smart grid technologies and its use in distribution systems.1. Elements of a smart distribution system - 30 mins2. Elements of SCADA - 30 mins3. Elements of ADMS - 30 mins4. Break in between for 30 mins.5. Smart Grid Laboratory Development - test case - 30 mins6. Discussion - 30 mins

Tuesday, October 27

Tuesday, October 27, 10:20 - 12:00

TM01: Panel Energy Storage

Room: Salon A/B

Tuesday, October 27, 10:20 - 11:40

TM02: Wind Energy Systems

Room: Salon C

Chair: Allan Van Damme (London Hydro, Canada)

10:20 ***Wind Farm Integration in a Harmonic Environment*** *1*

Michael Dang (McMaster University / Mohawk College, Canada); Nafia Al-Mutawaly (Mohawk College of Applied Arts and Technology, Canada); Peter Sztur (Mohawk College/McMaster University, Canada); Mark Coenen (Mohawk College & McMaster University, Canada)

10:40 ***Fault Ride-Through Capability of Doubly-Fed Induction Generators Based Wind Turbines*** *8*

Abobkr Abobkr and Mohamed E. El-Hawary (Dalhousie University, Canada)

11:00 ***A New Reactive Power Management Strategy to Enhance the Behavior of the Wind Turbine Generator Driven a DFIG Under Grid Faults*** *16*

Hussein Ibrahim and Karim Belmokhtar (Wind Energy TechnoCentre, Canada)

11:20 ***Design Concepts for a Direct Drive Wind Generator Using New Superconductors*** *22*

Haran Karmaker (TECO- Westinghouse Motor Company, USA); Edward Chen (TECO-Westinghouse Motor Company, USA)

Tuesday, October 27, 10:20 - 12:00

TM03: Electrification of Transportation and its Impact

Room: Salon D

Chair: Shokry Rashwan (Red River College (RRC), Canada)

10:20 ***On the Impact of Transportation Electrification on Distribution Systems in the Presence of Rooftop Solar Photovoltaic 26***
Sherif Abdelsamad (UOIT, Canada); Walid Morsi and Tarlochan Sidhu (University of Ontario Institute of Technology, Canada)

10:40 ***Mitigating the Impact of Charging Second Generation Plug-in Battery Electric Vehicles on Distribution Transformer's Insulation Life Using TOU Prices 32***
Yasser Assolami (UOIT, Canada); Walid Morsi (University of Ontario Institute of Technology, Canada)

11:00 ***A Bi-Directional Single-Stage Isolated AC-DC Converter for EV Charging and V2G 36***
Behnam Koushki (Queen's University, Canada); Alireza Safaee (Bombardier Transportation, Canada); Praveen Jain and Alireza Bakhshai (Queen's University, Canada)

11:20 ***Optimal Scheduling Algorithm for Charging Electric Vehicle in a Residential Sector Under Demand Response 45***
Zhanle Wang and Raman Paranjape (University of Regina, Canada)

11:40 ***Study on Train Operation Energy Between Commuter Train and Traction Substations in a Japanese Urban Railway 50***
Kosuke Kumagai, Tetsuo Fujita, Masashi Nakahira, Yoshiki Mizuguchi and Hideki Sonoda (East Japan Railway Company, Japan)

Tuesday, October 27, 10:20 - 11:40

TM04: Facts and HVDC

Room: Salon E
Chair: Kings Wong (Hydro One Networks Inc., Canada)

10:20 ***Coordinated Control of STATCOM and PSS for Damping Generator Electromechanical Oscillations 56***
Syed Ahmed Raza Naqvi and Rajiv Varma (University of Western Ontario, Canada)

10:40 ***A Generic Algorithm for Peak Fault Current Calculation in HVDC Links 62***
Mohmmed Nassar, Ramadan A. El Shatshat and Magdy Salama (University of Waterloo, Canada)

11:00 ***Adaptive Droop Based Power Sharing Control Algorithm for Offshore Multi-terminal VSC-HVDC Transmission 67***
Mohamed Abdelwahed (University of Waterloo, Canada); Ehab El-Saadany (Waterloo University, Canada)

11:20 ***Multilevel STATCOM with Power Intensive Energy Storage for Dynamic Grid Stability - Frequency and Voltage Support 73***
Ervin Spahic, Charlie Paul Susai Sakkanna Reddy, Martin Pieschel and Rodrigo Alvarez (Siemens AG, Germany)

Tuesday, October 27, 13:30 - 15:10

TA01: Panel - Automation and Simulation

Room: Salon C

Tuesday, October 27, 13:30 - 14:50

TA02: Future Urban Energy Systems

Room: Salon C

Chair: John Harris (IEEE EPEC 2015, USA)

13:30 ***Development of Autonomous Schedules of Controllable Loads for Cost Reduction and PV Accommodation in Residential Distribution Networks 81***
Saeed Alyami, Caisheng Wang and Chang Fu (Wayne State University, USA)

13:50 ***Benchmarking Energy Performance for LEED Residential Homes in Manitoba 87***
Shokry Rashwan (Red River College (RRC), Canada); Marten Duhoux (Principal, ft3 Architecture Landscape Interior Design, Canada)

14:10 ***A Proof-of-Concept Approach to Unit Commitment Using the Theory of Complementarity 93***
Bala Venkatesh, Steven Craig and Peng Yu (Ryerson University, Canada)

14:30 ***Coordinated Volt-VAR Control in Active Distribution Systems for Renewable Energy Integration 99***
Xiangsheng Lai (State Grid Beijing Electric Power Company, P.R. China); Zhanyong Yang and Guangyi Liu (China Electrical Power Research Institute, P.R. China); Shuang Gao, Dan Wang, Jia Tang, Zhaoyu Chen and Jia Hongjie (Tianjin University, P.R. China)

Tuesday, October 27, 13:30 - 15:10

TA03: Energy Storage and Transformers

Room: Salon D
Chair: Walid Morsi (University of Ontario Institute of Technology, Canada)

13:30 ***A Survey on Energy Storage Technologies in Power System 105***
Reza Ghaffari (Ryerson, Canada); Bala Venkatesh (Ryerson University, Canada); Apparao Dekka (Ryerson, Canada); Bin Wu (ELCERU, Canada)

13:50 ***SOC Model of High Power Lithium-ion Battery 112***
Bala Venkatesh and Nastaran Hajia (Ryerson University, Canada)

14:10 ***Transformer Health Index Estimation Using Orthogonal Wavelet Network 120***
Mohamed Ahmed (University of Waterloo & IBM Canada, Canada); Mohamed Elkhatib and Magdy Salama (University of Waterloo, Canada); Khaled Bashir Shaban (Qatar University & College of Engineering, Qatar)

14:30 ***Comparison Between Numerical and Analytical Methods of AC Resistance Evaluation for Medium Frequency Transformers: Validation on a Prototype 125***
Albert Pereira (Ampere Laboratory & SuperGrid Institute, France); Fabien Sixdenier, Marie-Ange Raulet and Noël Burais (Ampere Laboratory, France); Bruno Lefebvre (SuperGrid Institute, France)

14:50 ***Modular Multilevel Converter with Short-Time Power Intensive Electrical Energy Storage Capability 131***
Rodrigo Alvarez, Martin Pieschel, Ervin Spahic and Herbert Gambach (Siemens AG, Germany)

TA04: Smart Grids and Metering

Room: Salon E
Chair: Ken Walsh (London Hydro Inc., Canada)

13:30 ***Smart Metering and Functionalities of Smart Meters in Smart Grid - A Review 138***
Bala Venkatesh, Gouri Barai and Sridhar Krishnan (Ryerson University, Canada)

13:50 ***Adverse Harmonic Impact of Network Resonances on Smart Meters 146***
Rajiv Varma, Anas Abdul Hameed, Shams Hmaidi, Syed Mir and Sibin Mohan (University of Western Ontario, Canada)

14:10 ***Model Predictive Control Based Home Energy Management System in Smart Grid 152***
Omar Alrumayh and Kankar Bhattacharya (University of Waterloo, Canada)

14:30 ***Stochastic Energy Coordination in Hybrid AC/DC Smart Grids 158***
Abdelsalam Eajal and Mostafa Shaaban (University of Waterloo, Canada); Ehab El-Saadany (Waterloo University, Canada); Kumaraswamy Ponnambalam (University of Waterloo, Canada)

14:50 ***Influence of Power Quality on FortisAlberta's PLC Based Automatic Meter Reading System 164***
Xun Long, Wayne Parent and Eric Staff (FortisAlberta, Canada)

Tuesday, October 27, 15:40 - 17:00

TE01: Panel - Electrification of Transportation

Room: Salon C

Tuesday, October 27, 15:40 - 17:20

TE02: Microgrids

Room: Executive Boardroom
Chair: Magdy Salama (University of Waterloo, Canada)

15:40 ***Optimal Energy Management and Smart Charging of PEVs in Isolated Microgrids 169***
Talal Alharbi and Kankar Bhattacharya (University of Waterloo, Canada)

16:00 ***Performance Assessment Tool for Remote Electrical Microgrids (PATREM) 177***
Tarek EL-Fouly (Natural Resources Canada, Canada); Ayman B. Eltantawy and Magdy Salama (University of Waterloo, Canada)

16:20 ***A SoC Based Voltage Control Strategy for DC Microgrid 185***
Nirod Chandra Sahoo (IIT Bhubaneswar, India); Sankarsan Mohapatro (Indian Institute of Technology Bhubaneswar, India); Manoj Senapati (National Institute of Technology, India)

16:40 ***Operation Challenges of Feeder Shunt Capacitors in Islanded Microgrids 191***
Nader El-Taweel (York University, Canada)

TE03: Power System Economics

Room: Salon D
Chair: Mohamed E. El-Hawary (Dalhousie University, Canada)

15:40 ***An Evolutionary Game Approach to Predict Demand Response From Real-Time Pricing 197***
Dongchan Lee and Deepa Kundur (University of Toronto, Canada)

16:00 ***A Distributed Game Theoretic Approach to Energy Trading in the Smart Grid 203***
Naouar Yaagoubi and Hussein T Mouftah (University of Ottawa, Canada)

16:20 ***A Discussion of the Financial Valuation of Transmission Line Assets and Asset Renewal Projects 209***
Kings Wong (Hydro One Networks Inc., Canada)

16:40 ***Influence of Demand Response Tariffs on the Electrical Load of Households 215***
Krischan Keitsch and Thomas Bruckner (Fraunhofer MOEZ, Germany)

17:00 ***Energy Cost Forecasting for Event Venues 220***
Andrea Zagar (Western University, Canada); Katarina Grolinger and Miriam A M Capretz (University of Western Ontario, Canada); Luke Seewald (London Hydro, Canada)

TE04: International Papers

Room: Salon E
Chair: Sean Dunne (IEEE Peterborough, Canada)

15:40 ***Adaptive Kalman Filter for Harmonic Detection in Active Power Filter Application 227***
Hengyi Wang (University of Kaiserslautern, Germany)

16:00 ***Small-Signal Modelling for In-Depth Modal Analysis of an MTDC System 233***
Samy Akkari (Group of Electrical Engineering Paris (GeePs), CentraleSupélec, France); Jing Dai (Supelec, France); Marc Petit (Supélec, France); Pierre Rault (Réseau de Transport d'Electricité (RTE), France); Xavier Guillaud (L2EP, France)

16:20 ***A Hybrid Islanding Detection Technique for Inverter Based Distributed Generations 239***
Riyasat Azim (The University of Tennessee, USA); Fangxing Li (University of Tennessee, USA); Xiayang Zhao (State Grid International Development Cooperation, P.R. China)

16:40 ***PMU Optimal Placement Using Sensitivity Analysis for Power Systems Fault Location 244***
Pooria Mohammadi (4066 Burbank Dr apt 7 & LSU, USA); Shahab Mehraeen (Louisiana State University, USA)

17:00 ***Towards a Rigorous Approach for Verifying Cyber-physical Systems Against Requirements 250***
Daniel Bouskela, Thuy Nguyen and Audrey Jardin (EDF, France)

Wednesday, October 28

Wednesday, October 28, 10:20 - 12:00

WM01: Panel - Integrated Grid and Microgrids

Room: Salon A/B

WM02: Solar Energy Systems

Room: Salon C
Chair: Vijay K Sood (University of Ontario Institute of Technology, Canada)

10:20 ***A Comparative Study of a PV-MPPT Grid-Integrated System Under Different Control Techniques 256***
Marwan Abouzeid and Vijay K Sood (University of Ontario Institute of Technology, Canada); Mohamed Youssef (UOIT, Canada)

10:40 ***Nonlinear Maximum Power Point Tracking Controller for Photovoltaic System 262***
Shamsodin Taheri (Université du Québec en Outaouais, Canada); Hamed Taheri (École de Technologie Stupérieure (ÉTS), Canada)

11:00 ***Reducing Distribution Transformer's Loss of Life Through Determining the Maximum Permissible Penetration of Rooftop Solar Photovoltaic 267***
Shady El-Battawy and Walid Morsi (University of Ontario Institute of Technology, Canada)

11:20 ***Increasing the Integration Capabilities of Photovoltaic Generation in a Small and Isolated Power System 272***
Carmen Cardozo (CentraleSupelec & EDF R&D, France); Laurent Capely (EDF R&D, France); Philippe Dessante (GeePs, CNRS, CentraleSupelec, UPSud and UPMC, France)

11:40 ***Gauss-Seidel Iteration Based Parameter Estimation for a Single Diode Model of a PV Module 278***
Samkeliso Shongwe (University of Cape Town & Swaziland Electricity Company, South Africa); Moin Hanif (University of Cape Town, South Africa)

WM03: Resiliency of Electrical power Systems

Room: Salon D
Chair: Hany Farag (University of Waterloo, Canada)

10:20 ***A Computer Tool to Calculate Zone of Protection Against Direct Lightning Strokes for Substations 285***
Vinit Marathe and George Karady (Arizona State University, USA); Snehal Dalal and Thomas W LaRose (Salt River Project, USA)

10:40 ***Enhancing Stability Simulation for NERC Reliability Standard TPL-001-4 Compliance 290***
Yaming Zhu and Douglas Brown (Siemens PTI, USA)

11:00 ***Transient Stability Improvement Using Series Reactors: A Case Study 296***
Glenn Jennings (Digsilent Buyisa, South Africa); Franco de Villiers (Eskom, South Africa)

11:20 ***A Unique Current Differential Based Algorithm for Protection of Multi-Terminal Lines, Three Winding Transformers, and Bus Bars., N/A***
Basil Al-Fakhri (Freelancer, New Zealand)

11:40 ***Directional Relaying Scheme for TCSC Compensated Line 303***
Om Hari Gupta and Manoj Tripathy (Indian Institute of Technology Roorkee, India)

WM04: Energy Conversion - Electric Machines and Power Electronics

Room: Salon E
Chair: John Makaran (Fanshawe College, Canada)

10:20 ***A Review of Short-Circuit Models of Wind Generators 308***
Chandrabhanu Opathella, Bob Singh and Bala Venkatesh (Ryerson University, Canada)

10:40 ***Modeling and Control of Induction Generator Applied to Variable Speed Wind Energy Systems Conversion 314***
Paul Makanga Koumba (Université du Québec à Trois-Rivières, Canada); Mamadou Lamine Doumbia (Universite de Quebec à Trois-Rivieres, Canada); Ahmed Cheriti (Université du Québec a Trois Rivières, Canada)

11:00 ***Direct Torque Control of Induction Motor Based on Artificial Neural Networks Speed Control Using MRAS and Neural PID Controller 320***
Bekhada Hamane (University of Québec, Canada); Mamadou Lamine Doumbia (Universite de Quebec à Trois-Rivieres, Canada); Paul Makanga Koumba (Université du Québec à Trois-Rivières, Canada); Mohamed amine Zegai, Mokhtar Bendjebbar and Kheira Belhadri (University of Science and Technology of Oran, Algeria)

11:20 ***Improved Control Strategy of Full-Bridge Modular Multilevel Converter 326***
Grain Philip Adam (University of Strathclyde, United Kingdom)

11:40 ***Losses Estimation Method by Simulation for the Modular Multilevel Converter 332***
Julian Freytes (Ecole Centrale de Lille & L2EP, France); François Gruson (L2EP - Ecole National d'Arts et Metiers, France); Philippe Delarue (Laboratory L2EP, University of Lille France, France); Frederic Colas and Xavier Guillaud (L2EP, France)

Wednesday, October 28, 13:30 - 15:10

WA01: Panel - Integrated Energy Planning

Room: Salon A/B

WA02: Power Management Schemes

Room: Salon C

Chair: Dennis Michaelson (The University of Western Ontario, Canada)

13:30 ***A Basic Load Following Control Strategy in a Direct Load Control Program 339***
Mostafa Shaad Zolpirani, Chris Diduch, Mary E. Kaye and Liuchen Chang (University of New Brunswick, Canada)

13:50 ***Multilayer Artificial Neural Networks for Real Time Power System State Estimation 344***
Hossam Mosbah and Mohamed E. El-Hawary (Dalhousie University, Canada)

14:10 ***Comparison Study of Different Load Management Methods for Cost and Emission Reduction 352***
Zhongyang Zhao, Caisheng Wang, Yang Wang and Carol Miller (Wayne State University, USA)

14:30 ***Assessment of PTDF Based Power System Aggregation Schemes 358***
Yonas Gebrekiros, Ir. and Gerard Doorman (Norwegian University of Science and Technology, Norway); Arild Helseth (Sintef Energy Research, Norway); Traian Preda (Norwegian University of Science and Technology, Norway)

14:50 ***Observability Analysis of Power Systems in the Presence of Hybrid Measurements 364***
Neerak Sharma (Indian Institute of Technology, India); Saikat Chakrabarti (Indian Institute of Technology Kanpur, India); Benjamin Jeyasurya (Memorial University, Canada)

WA03: Power Electronics

Room: Salon D
Chair: Hisham Mahmood (The University of Western Ontario, Canada)

13:30 ***Effects of Parallel Load-Side Compensation in Wireless Power Transfer 369***
Konrad Woronowicz and Alireza Safaee (Bombardier Transportation, Canada); Tim Dickson (Bombardier Transportation Inc., Canada); Behnam Koushki (Queen's University, Canada)

13:50 ***Reactive Power Compensation in Three Phase High Output Inductive Power Transfer 375***
Alireza Safaee and Konrad Woronowicz (Bombardier Transportation, Canada); Tim Dickson (Bombardier Transportation Inc., Canada)

14:10 ***Development of a Programmable DC-DC Converter Module for Driving a Scalable LED Array 381***
Yoon G Kim (Calvin College, USA); Nathan Terschak (Koops, Inc., USA)

14:30 ***Analysis of Switching Converters with Type 3 Compensator Using Ripple-based Control 385***
Hikaru Kujirada, Kenta Nakamoto and Terukazu Sato (Oita University, Japan)

14:50 ***A New Extended Topology for Dual Active Bridge DC-DC Converter 391***
Seyed Hossein Hosseini and Mehran Sabahi (University of Tabriz, Iran); Farzad Sedaghati (University of Mohaghegh Ardebili, Iran); G H Gharehpetian (Amirkabir University of Technology, Iran)

WA04: Computatonal Methods

Room: Salon E

13:30 ***Application of Wavelet-based Ensemble Tree Classifier for Non-intrusive Load Monitoring 397***
Walid Morsi (University of Ontario Institute of Technology, Canada); Sami Alshareef (UOIT, Canada)

13:50 ***Application of Directed Bacterial Foraging Optimization for Voltage Collapse Detection 402***
Walid Morsi and Matt Gray (University of Ontario Institute of Technology, Canada); Saurabh Talwar (UOIT, Canada)

14:10 ***Distributed Computing Approach to Solve Unbalanced Three-Phase DOPFs 408***
Abolfazl Mosaddegh, Claudio Canizares and Kankar Bhattacharya (University of Waterloo, Canada)

14:30 ***Reduced Model State Estimation for Wide-Area Monitoring Systems 414***
Amamihe Onwuachumba and Mohamad Musavi (University of Maine, USA)

14:50 ***Principal Components Null Space Analysis Based Non-intrusive Load Monitoring 420***
Tayyar Güzel (Mimosa Networks, Turkey); Eser Ustunel (Procitec GmbH, Germany)

Wednesday, October 28, 15:40 - 17:00

WE01: Panel - Students

Room: Salon A/B

WE02: Communication Aspects of Smart Grid

Room: Salon C
Chair: Luke Seewald (London Hydro, Canada)

15:40 ***OFDM Systems with CPM Mappers for Smart Grid Applications 424***
Emammer Shafter (University of Western Ontario, Canada); Abdulfattah Noorwali and Raveendra Kolarramakrishna Rao (The University of Western Ontario, Canada)

16:00 ***Performance Evaluation of Channel-Aware MAC Protocol in Smart Grid 429***
Abdulfattah Noorwali, Raveendra Kolarramakrishna Rao and Abdallah Shami (The University of Western Ontario, Canada)

16:20 ***RF Planning of Multi-Cell, Metropolitan-Area Networks 436***
Mihail Georgiev, Nafia Al-Mutawaly and Mohamed Bakr (McMaster University, Canada); Shirook Ali, Dr. (Research In Motion Ltd., Canada)

16:40 ***A Markov-Middleton Model for Corona Noise in WSN Transmission Line Monitoring 440***
Faranak Dowlatdad (Ryerson University, Canada); Reza Saddat (Yazd University, Iran); Jamshid Abouei (University of Waterloo, Canada); Alagan Anpalagan (Ryerson University, Canada)

WE03: Renewable Energy

Room: Salon D
Chair: Shamsodin Taheri (Université du Québec en Outaouais, Canada)

15:40 ***Strategic Analysis of Potential Conflicts in the Smart Grid Paradigm and Their Effects on the Planning Procedures of Smart Distribution Systems 446***
Hatem Sindi (University of Waterloo & King Abdulaziz University, Canada); Mostafa Shaaban and Ehab El-Saadany (University of Waterloo, Canada)

16:00 ***Impacts of Binding Constraints on the Planning Process of Renewable DG in Distribution Systems 451***
Sarah Kandil and Hany Farag (YorkU, Canada)

16:20 ***Appliance Scheduling Optimization in Smart Home Networks Comprising of Smart Appliances and a Photovoltaic Panel 457***
Fatima Qayyum, Muhammad Naeem, Ahmed Shaharyar Khwaja and Alagan Anpalagan (Ryerson University, Canada)

16:40 ***Regulatory Scenarios for Microgeneration in Brazil and Its Impacts in the Next Decade 463***
Marco Castro (Brazilian Electricity Regulatory Agency - ANEEL, Brazil)

WE04: Late Breaking Papers

Room: Salon E

15:40 ***BioGenerator - Effect of Physicochemical Parameters on Performance 468***
Victor Pupkevich (University of Western Ontario, Canada); Dimitre Karamanev (Western University, Canada)

16:00 ***Operational Modes of Hydrogen Energy Storage in a Micro Grid System 473***
Khaled Nigim (Lambton Collge & Instrumentation and Control Coordinator, Canada); Matt Persohn-Costa (School of Technology, Energy and Apprenticeship & Lambton College, Canada); Joshua McQueen (School of Technology, Energy and Apprenticiship & Lambton College, Canada)

16:20 ***MOSFET Gate Charge Control Through Observation of Diode Forward and Reverse Recovery Behaviour 478***
John Makaran (Fanshawe College, Canada)

16:40 ***Dynamic Reactive Power Compensation for Voltage Support Using Static Var Compensator (SVC) in Saudi Arabia 484***
Ahmed H. Al-Muabark, Muhammad Haris Khan and Moayed Z. Al-Kadhem (Saudi Electricity Company, Saudi Arabia)