Technical Session

Thursday August 22, 2013

TM1	Power Quality I
TM2	Computational Methods in Power Systems I
TM3	Energy Conservation and Efficiency I
TM4	Energy Storage I
TP1	Power Quality II
TP2	Computational Methods in Power Systems II
TP3	Energy Conservation and Efficiency II
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TE1	Distribution Systems
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TE3	Energy Conservation and Efficiency III
TE4	Transmission Systems

TM1:Power Quality I

Session Chair: Petr Musilek and Walid Morsi

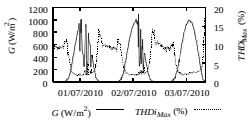
Sable A 10:20-12:00 Thursday, August 22

Sable A(1) 10:20-10:40

Prediction of PV Power Quality: Total Harmonic Distortion of Current

James Rodway, Petr Musilek, Stanislav Misak and Lukas Prokop
Electrical and Computer Engineering, University of Alberta, Edmonton, Canada &
Electrical Engineering and Computer Science, VSB-TU Ostrava, Czech Republic

- Relationships between environmental conditions and photovoltaic power quality have been explored.
- Methods of predicting total harmonic distortion of current $THDi_{Max}$ from solar irradiance G were devised.
- Performance for discrete and continuous $THDi_{Max}$ predictions are compared.



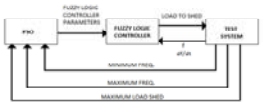
Comparison of solar irradiance and total harmonic distortion of current.

Sable A(2) 10:40-11:00

Application of PSO and Fuzzy Logic for Underferequency Load Shedding

M.K. Gray and W.G. Morsi
Power and Energy Research Group, UOIT
Oshawa, Ontario, Canada

- Fuzzy system is used in underfrequency load shedding in distribution systems.
- The parameters of the fuzzy system are optimally chosen using Particle Swarm Optimizer (PSO).
- The proposed approach determines the minimum amount of load to be shed while maintaining the system frequency.



The proposed PSO-fuzzy under-frequency load shedding

Sable A(3) 11:00-11:20

Time-varying Power Quality in Unbalanced Three-phase Systems

T. Zafar, S. Talwar, M.K. Gray and W.G. Morsi
Power and Energy Research Group, UOIT
Oshawa, Ontario, Canada

- Un-decimated wavelet transform (UWT) is used to compute the reactive power in three-phase system subject to time-varying disturbance.
- Quadrature and non-quadrature reactive power metering approaches are investigated.
- The UWT was able to explain the discrepancies associated with both approaches when other signal processing tools are used to compute the reactive power in distorted environment

Sable A(4) 11:20-11:40

Investigation on the System Grounding Types for Low Voltage Direct Current Systems

Lulu Li, Jing Yong, Liqiang Zeng and Xiaoyu Wang
State Key Laboratory of Power Transmission Equipment & System Security and New Technology, Chongqing University, Chongqing, China

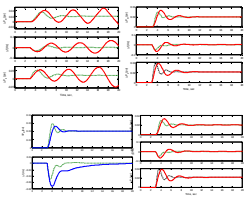
- The touch voltage limits of LVDC systems were compared with those of low voltage AC (LVAC) systems.
- The safety of LVDC systems with various grounding types when a grounding fault occurs were analyzed. The simulation results for the LVDC systems with different AC/DC interfaces were also presented and compared.
- From the safety perspective, the DC voltage used in LVDC distribution systems can be higher than that in LVAC systems for the same expected touch voltage. The negative-pole grounding LVDC systems are of excellent safe nature.

Sable A(5) 11:40-12:00

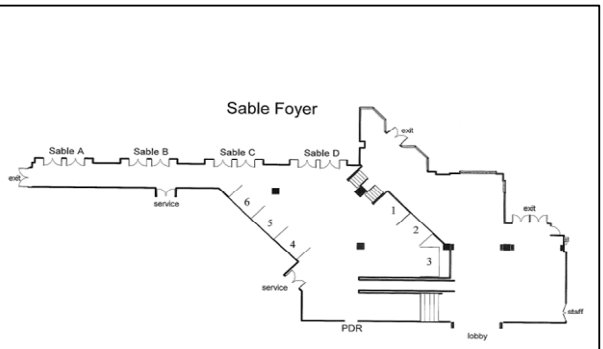
CDM Application on Power System as a Load Frequency Controller

**Michael Z. Bernard, *T. H. Mohamed, **Yasunori Mitani, and **Yaser Soliman Qudaih,
**Department of Electrical and Electronics Engineering, Kyushu Institute of Technology, Japan .
*Faculty of Energy Engineering, Aswan University, Egypt

- Robust load frequency control of a single area power system based on the Coefficient Diagram Method (CDM) was investigated with simulations carried out in Matlab/Simulink to validate the effectiveness of the proposed scheme.
- Fast response, robustness against parameter uncertainties and load changes were observed as advantages of the proposed CDM control technique.
- Performance comparison between the proposed CDM, the MPC and a conventional integrator control scheme carried shows that the proposed CDM response is much more desirable as compared to the other two controllers and its advantage over MPC has to do with easy to design making it favorable for power system Load frequency Control.



Power System respond to small and different changes in the presence of integral control, MPC and CDM



TM2:Computational Methods in Power Systems I

Session Chair: U. D. Annakkage and Hung Huynh

Sable B 10:20-12:00 Thursday, August 22

Sable B(1) 10:20-10:40

Investigation of the Applicability of Lyapunov Exponents for Transient Stability Assessment

D. Prasad Wadduwage, Janath Geeganage, U. D. Annakkage and Christine Q. Wu
Power Systems Research Group, University of Manitoba
Winnipeg, Manitoba, Canada

- Application of the concept of Lyapunov Exponents (LEs) for power system transient stability assessment was investigated.
- The Lyapunov spectrums of the post-fault system equilibrium points were calculated using the mathematical models.
- It was found that the computational burden associated with the convergence of the LEs was significant.
- The negative sign of the largest LE indicated the exponential stability of the post-fault system equilibrium point.
- The concept of LEs was proposed as a theoretically sound approach for the determination of power system stability regions.

Sable B(2) 10:40-11:00

AMPds: A Public Dataset for Load Disaggregation and Eco-Feedback Research

Stephen Makonin, Fred Popowich, Lyn Bartram, Bob Gill and Ivan V. Bajic
Simon Fraser University and British Columbia Institute of Technology
Burnaby, British Columbia, Canada

- A publicly available dataset containing electricity, water, and natural gas consumption for 1 year at 1 minute intervals (25 meters).
- A new load disaggregation method that uses single-measurement and probability mass functions (PMF).
- A demonstration of highly accurate results shown for complex load types--not just simple on/off appliances.

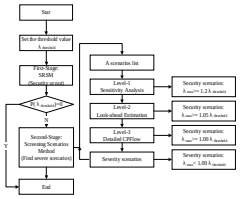
Collecting data from multiple breakers

Sable B(3) 11:00-11:20

A Two-Stage Method for Assessment of Voltage Stability in Power System with Renewable Energy

Yang Wang, Hsiao-Dong Chiang, Fellow, IEEE and Tao Wang
School of Electrical Engineering and Automation Tianjin University Tianjin, China
School of Electrical and Computer Engineering Cornell University Ithaca, NY, USA

- A two-stage method for evaluating the impact of uncertain power injections on voltage stability was proposed.
- SRSM(stochastic response surface method) was applied in the first stage for giving preliminary information whether uncertainty of power injections causes voltage collapse.
- The proposed 'scenarios screening method' was applied in the second stage for screening out severe scenarios.



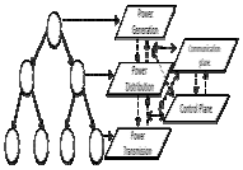
The procedure of the two stage method

Sable B(4) 11:20-11:40

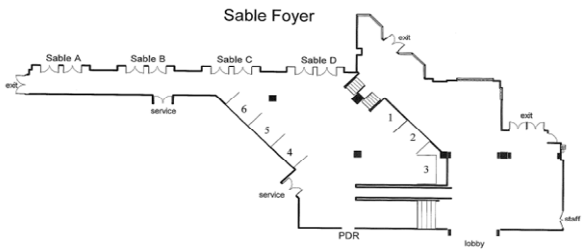
Vulnerability Analysis of Power Grid Network against Failures by State Classification

Akansha Singh, Jyotsna Bapat and Debabrata Das
CEEMS Lab, IIIT-Bangalore, India

- A health monitoring system is proposed using the **demand** prediction.
- Grid health is assessed at various points by using a hybrid system that couples electrical and non-electrical parameters.
- Goal is early detection of localized failures such that larger area blackouts due to cascade can be prevented.



Five Plane Grid Architecture and Tree Structure



TM3:Energy Conservation and Efficiency I

Session Chair: Geza Joos and Phil Zinck

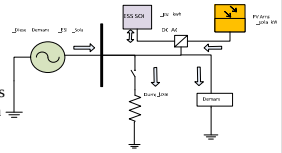
Sable C 10:20-12:00 Thursday, August 22

Sable C(1) 10:20-10:40

Dispatch Techniques for Canadian Remote Communities with Renewable Sources

Juan Clavier, Michael Ross and Geza Joos
ECE Department McGill University
Montreal, Quebec, Canada

- The dispatch of Load Shifting Devices (LSD) and Renewable Energy Sources (RES) is still a challenging issue for the Remote Community (RC)
- Three dispatch techniques are analyzed as to see the strengths and weakness of each method.
- A load shifting capability of approximately 25% is translated in a reduction of the total diesel consumed by the system by approx. 3%.



Schematic of the full Study Case

Sable C(2) 10:40-11:00

Voltage Stability and Power Quality Issues of Wind Farm with Series Compensation

T. F. Orchi[1], M. J. Hossain[2], H. R. Pota[3] and M. S. Rahman[4]
School of EIT, UNSW Canberra, ACT 2600, Australia[1,3,4]
Griffith University, Gold Coast, QLD 4215, Australia[2]

- A series capacitor (SC) is used to enhance the voltage stability issues caused by the high penetration of wind energy in transmission side.
- If the series capacitance is high, the frequency of occurrence of voltage sag is low at a low fault voltage.
- Using a SC with Type A and C wind farms can enhance the system's voltage level, fault ride through (FRT) capability and reduce the harmonic current and flicker.

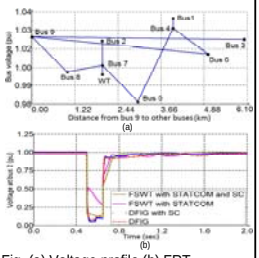


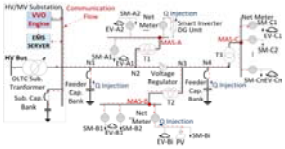
Fig. (a) Voltage profile (b) FRT capability of wind farm using SC

Sable C(3) 11:00-11:20

Impact of V2G on Real-Time Adaptive Volt/VAR Optimization of Distribution Networks

Moein Manbachi*, Hassan Farhangi**, Ali Palizban**, Siamak Arzanpour*
*Mechatronic Systems Engineering, Simon Fraser University (SFU), Surrey, BC, Canada
**British Columbia Institute of Technology (BCIT), Burnaby, BC, Canada

- A new real-time Smart Grid adaptive Volt/VAR optimization (VVO) approach was primarily introduced.
- The impact of EV on distribution network VVO was studied in different EV charging and penetration levels.
- The validity of the proposed engine was tested by employing revised IEEE 37-Node test feeder.



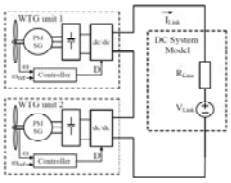
Topology of proposed VVO in a feeder

Sable C(4) 11:20-11:40

Reduced Model and Control of Diode-Interfaced Offshore Wind Farms with DC Power Systems

Shadi Chuangpishit and Ahmadreza Tabesh
Power Systems Group, Isfahan University of Technology
Isfahan, Iran

- Based on perturbation theory, a model was proposed for a diode-interfaced wind turbine generator unit integrated to pure dc power system.
- A control design procedure for wind farm maximum power point tracking was presented using the reduced model.
- The performance of the controller was investigated based on sensitivity analysis and time-domain simulation of a study system.



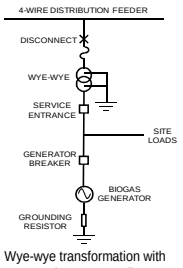
Diode-interfaced OWF Study System

Sable C(5) 11:40-12:00

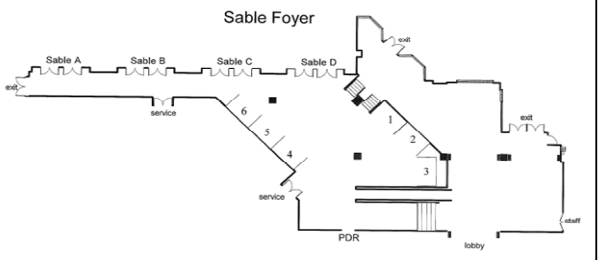
Distributed Generation Grid Connection Experiences Minimizing High Voltage Equipments

Aidan Foss and Kalle Leppik
ANF Energy Solutions Inc.
Ottawa, Ontario, Canada

- Initial attempts at biogas grid connection in Ontario revealed several costly barriers.
- Many barriers reduced through
  - Socializing of infrastructure costs
  - Alternative to transfer-trip
  - Alternative to HV PTs
  - Relaxation of effective grounding for 8.3kV & 12.5kV feeder connections
  - Use of LV grounding transformers for 27.6kV feeder connections



Wye-wye transformation with Impedance Grounding



TM4:Energy Storage I

Session Chair: Petr Musilek and Perry Mason

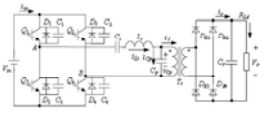
Sable D 10:20-12:00 Thursday, August 22

Sable D(1) 10:20-10:40

The Influence of Parallel Capacitor to Output Voltage in High-Frequency ESP Power

C.H.Zhang K.X.Zhang D.S.Zhou
Harbin Institute of Technology University

- **Operating modes of the LCC resonant converter are presented in this article**
- **The calculation of the series inductance, series capacitors, shunt capacitance value are presented in this article.**
- **The influence of parallel capacitance to output voltage is analyzed and verified by experiment as well.**



High-frequency ESP power structure

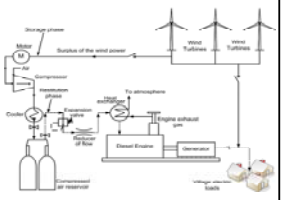
Sable D(2) 10:40-11:00

Optimization of Compressed Air Storage's Volume for a Stand-Alone Wind-Diesel Hybrid System

Hussein Ibrahim[1], Ali Bourji[2], Mazen Ghandour[2], Adel Merabet[3]

[1]TechnoCentre éolien, Gaspé, Canada; [2]Engineering Faculty, Lebanese University, Beirut, Lebanon; [3]Division of Engineering, Saint Mary's University, Halifax, NS, Canada

- Hybrid wind-diesel-compressed air generator with pneumatic hybridization of diesel generator (DG) represents an innovative concept to overcome most of the technical, economic and social barriers that faces the deployment of wind energy in isolated sites.
- This study consist to find the optimum tank volume, associated with the minimum mass of the tank and the maximum time of feeding DG with CAES.
- The optimization algorithm can be resumed in three main steps:
  - The first one is to calculate the optimum wind farm size.
  - The second step consists of optimizing the storage tank volume. The empty tank frequency and the mass of tank factors are the two influencing factors in this step.
  - The final step is to apply practical limitations; by limiting the high pressure to applicable ranges, the full tank frequency factor and the energy dissipation shall be minimized as much as possible.



Sable D(3) 11:00-11:20

Batteries-Supercapacitors Storage System for a Mobile Hybrid Renewable Energy System

*J.M. Sandoval[1], M. J. Espinoza Trujillo[1], M I. Flota Buñuelos[2], J.L. Duran Gómez[3], J.Y. Verde Gómez[4] and D. E. Pacheco-Catalán[1]**

[1]Renewable Energy Unit, Yucatán Center for Scientific Research (CICY) Mérida, Yucatán.[2] Autonomous University of Yucatán (UADY), [3]Technological Institute of Chihuahua (IT Chihuahua), [4]Technological Institute of Cancun (IT Cancun)

*emal: dpacheco@cicy.mx

- The characterization of a SC module was proposed, for its operation in a Mobile Hybrid Renewable Energy System (HRES), and will be able to operate in natural disaster situations.
- Experimental charge-discharge tests and simulations of the SC module were made.
- Based in results obtained, a Battery-Supercapacitor connection will be proposed.

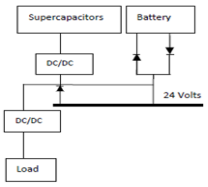


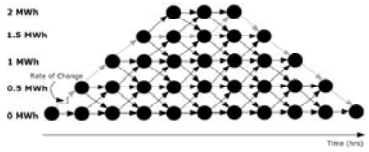
Figure 1: Supercapacitor module interconnection diagram

Sable D(4) 11:20-11:40

An Optimal Battery Energy Storage Charge/Discharge Method

Stephen Cialdea MIEEE, John A. Orr, LFIEEE , Alexander E. Emanuel, LFIEEE, and Tan Zhang
Worcester Polytechnic Institute Electrical & Computer Engineering Department
Worcester, MA, USA

Given predicted load and Locational Marginal Price (LMP) curves, the optimum battery energy storage system (BESS) operation over the predicted timeframe can be determined using the discrete mathematic method of dynamic programming. In this method the optimum path through a discrete graph is found where points represent distinct BESS charge (kWh) at distinct times throughout the prediction timeframe and the connecting paths represent the rate of charging or discharging of the BESS in a particular time step. The rate at which the BESS is charged or discharged (kW) can be multiplied with the LMP curve ($/kWh) and the time step to determine the value of the energy supplied or consumed. The path from the beginning of the predicted time frame to the end that yields the highest economic gain represents the optimum BESS operation schedule.

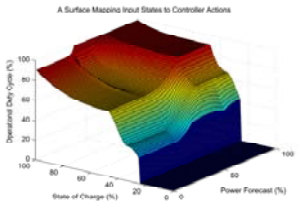


Sable D(5) 11:40-12:00

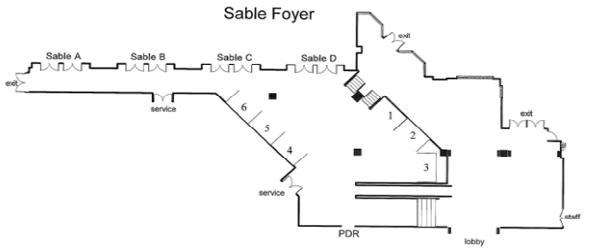
Managing the Energy-for-Data Exchange in Remote Monitoring Systems

A. G. Watts, P. Musilek, and L. Wyard-Scott
Electrical and Computer Engineering, University of Alberta, Edmonton, Alberta, Canada

- A simulator was used to explore the energy-for-data exchange in remote monitors.
- Management strategies were developed using a fuzzy controller optimized by a genetic algorithm.
- Data collection was improved by energy management in power constrained scenarios.



Fuzzy Control Surface for Energy Management of Remote Monitor



TP1:Power Quality II

Session Chair: Xiaoyu Wang and Walid Morsi

Sable A 14:00-15:40 Thursday, August 22

Sable A(1) 14:00-14:20

Harmonic Analysis of Power System with Wind Generations and Plug-in Electric Vehicles

Ze Zhang
School of Electrical Engineering and Automation, Tianjin University
Tianjin, China
Hsiao-Dong Chiang and Tao Wang
School of Electrical and Computer Engineering, Cornell University
Ithaca, New York, USA

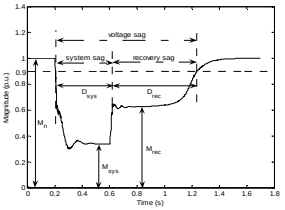
- A decoupled-harmonic power flow based program was developed using a robust homotopy-enhanced power flow method.
- The good convergence property of homotopy-enhanced power flow method was taken advantage of for handling divergence problem when dispersed generations are modeled as P-V nodes.
- A sensitivity analysis method for the network due to installations of harmonic sources is proposed.

Sable A(2) 14:20-14:40

Induction Motor Interactions after Voltage Sags

Zhijun Wang[1] and Xiaoyu Wang[2]
[1]School of Electrical Engineering, Shandong University, China
[2]Department of Electronics, Carleton University, Ottawa, Ontario, Canada

- Investigated the interactions among induction motors after voltage sags in power systems.
- Analyzed recovery voltage sag of multi-motor reacceleration after system voltage sag.
- Verified the analytical results through simulations.



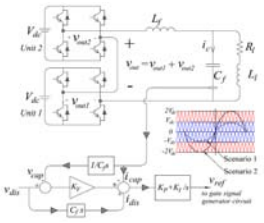
voltage sag contour occurred in industrial power systems

Sable A(3) 14:40-15:00

Performance of a Cascaded Multilevel H-bridge Series Voltage Compensation System under Multiple Loop Control Strategy

Amir Tahavorgar, *Student Member, IEEE,* and John E. Quaicoe *Senior Member, IEEE*
Faculty of Engineering and Applied Science, Memorial University of Newfoundland
St. John's, Newfoundland, Canada

- The implementation of multiple loop control strategy (MLCS) for a cascaded five-level, full-bridge converter was investigated.
- An optimization approach based on response surface methodology was employed to find the optimum values of MLCS controllers gains in order to minimize the THD of the load voltage.



The cascaded five-level full-bridge converter under MLCS

Sable A(4) 15:00-15:20

Advanced Power Quality Laboratory

Thomas Marshall, Nafia Al-Mutawaly
B.Tech. Energy, McMaster University
Hamilton, Ontario, Canada

- A teaching, training and research lab facility to study power quality issues with a distribution system
- Utilizes typical distribution transformer, CTs/PTs, protection/control systems, grid-tie inverters, EV chargers and home appliances
- Used to evaluate harmonic profiles and perform harmonic testing of various modern loads and utility devices

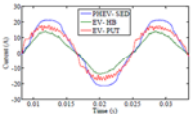
Laboratory PV Installations at Mohawk College

Sable A(5) 15:20-15:40

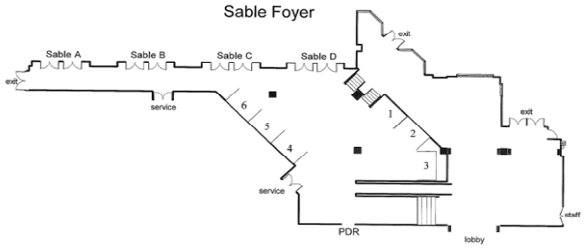
Low and High Order Harmonic Emission Quantification of Plug-in Hybrid and Battery Electric Vehicles

K. Jamal, M.K. Gray and W.G. Morsi
Power and Energy Research Group, UOIT
Oshawa, Ontario, Canada

- Harmonic and inter-harmonic emission from electric vehicles are quantified considering indoor level 1 and outdoor level 2 chargers.
- Three representative electric vehicles are studied; plug-in hybrid sedan, battery electric hatchback and electric pick-up truck.
- The emission level varies depending on the charging level and the vehicle type.



Current waveforms of three types of vehicles considered



TP2:Computational Methods in Power Systems II

Session Chair: Benjamin Jeyasurya and Jaclyn Monaghan

Sable B 14:00-15:40 Thursday, August 22

Sable B(1) 14:00-14:20

COMPARISON OF BIOGEOGRAPHY BASED OPTIMIZATION AND GENETIC ALGORITHM FOR POWER SYSTEM DAMPING-BASED CONTROLLERS DESIGN

Amr I. said, Ehab F. El-Saadany, and Magdy M. A. Salama
Smart Distribution Systems Research Group, University of Waterloo
Waterloo, Ontario, Canada

- Soft computing techniques were shown to add significant value in solving complicated optimization problems and controllers designing in nonlinear systems.
- Comparing Biogeography Base Optimization (BBO) and Genetic Algorithm (GA) in designing real power systems controller is proposed to highlight the strength and weakness of each technique.

Emigration vs immigration in biogeographical system

Sable B(2) 14:20-14:40

Determination of Power Transfer Capability by Incremental Changes

Mutlu Yilmaz and Bulent Bilir
Department of Electrical and Computer Engineering
Dalhousie University, Halifax, NS, Canada and Northeastern University, Boston, MA, USA

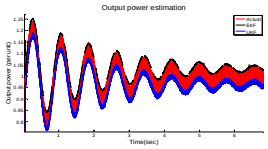
- The objective of this paper is to present how to determine power transfer capability of transmission lines by practical method.
- The proposed method is based on computer simulations of various scenarios of operation under incremental power changes at a chosen load bus and a corresponding generator bus.
- The method we have proposed is computationally efficient and easy to implement. Also, we have developed the power-flow program in a modular way so that it can be expandable with new applications when needed.

Sable B(3) 14:40-15:00

Dynamic State Estimation in Power Systems Using Kalman Filters

Hamed Tebianian and Benjamin Jeyasurya
Faculty of Engineering and Applied Science, Memorial University of Newfoundland
St. John's, Newfoundland, Canada

- Extended Kalman Filter and Unscented Kalman Filter as nonlinear estimation methods are presented in details.
- These approaches are used for dynamic state estimation in a simple power system.
- The estimation results are compared with real states.



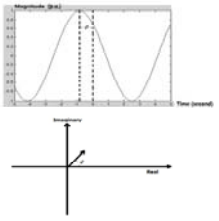
Real and estimated power with EKF and UKF

Sable B(4) 15:00-15:20

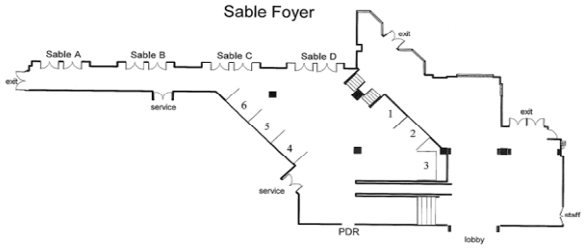
Measurement-Based Analysis of Power System Small Signal Stability

Dan Lin and Benjamin Jeyasurya
Faculty of Engineering & Applied Science, Memorial University of Newfoundland
St.John's, Newfoundland, Canada

- The measurement-based analysis for power system small signal stability is proposed using the combination of synchrophasor measurement and prony method.
- Synchrophasor measurment expresses the power system signal using real-time phasor expression with time stamps.
- Prony method calculates the damping ratio, frequency and mode shape of oscillation of power system.



Phasor expression for power system signal



TP3:Energy Conservation and Efficiency II

Session Chair: Adel Merabet and Bill Kennedy

Sable C 14:00-15:40 Thursday, August 22

Sable C(1) 14:00-14:20

Open-Loop Maximum Power Point Tracking Strategy for Marine Current Turbines Based on Resource Prediction

Francisco Paz and Martin Ordonez
University of British Columbia

Sable C(2) 14:20-14:40

DSP-Based SVM Generation Algorithm For DFIM

wamkeue René (UQAT)
Jean-Jacques Beaudoin (Université du Québec en Abitibi-Témiscamingue)
Djilali kairous (uhbc)

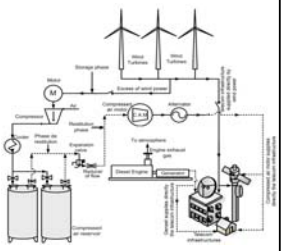
Sable C(3) 14:40-15:00

Modeling and Simulation of a Novel Small-Scale Compressed Air Hybrid System for Stand-Alone Off-Grid Applications

Hussein Ibrahim[1], Adrian Ilinca[1], Jean Perron[2], Adel Merabet[3]

[1]TechnoCentre éolien, Gaspé, Canada; [2]Université du Québec à Rimouski, Canada; [3]Université du Québec à Chicoutimi, Canada; [4]Division of Engineering, Saint Mary's University, Halifax, NS, Canada

- Small scale compressed air hybrid system is proposed as novel solution to electrify electrical and electronic devices as telecom infrastructures located at remote areas (hard to access, and are not linked to the electric grid.)
- Thermodynamic modeling and simulation of compression and expansion energy conversion cycles has been investigated in this paper to obtain the characteristic and performance of a remote hybrid power system. Energy conversion model is also developed for the wind turbine.
- A case study was conducted on a telecom station of Bell Canada situated in Kuujjuarapik (North of Quebec, at 1130 kilometers from Montreal).
- This study has demonstrated that the fuel economy and the saved GHG obtained with the proposed solution is about 98% for the month of April 2005



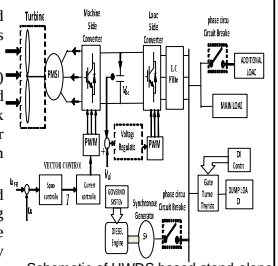
Sable C(4) 15:00-15:20

Control System Simulation for Stand-Alone Hybrid Wind Diesel System

Vigneshwaran Rajasekaran[1], Adel Merabet[1], Hussein Ibrahim[2], Rachid Beguenane[3], Jogendra S. Thongam[3]

[1]Division of Engineering, Saint Mary's University, Halifax, NS, Canada, [2]Wind Energy Techno-Centre, Gaspé, QC, Canada, [3]Department of Electrical Engineering, Royal Military College, Kingston, ON, Canada

- Control system developed for hybrid wind diesel system (HWDS) operating as standalone power system is presented.
- A maximum power point tracking (MPPT) control system is developed and simulated for machine side power converter to track the optimum rotor shaft speed for achieving maximum power extraction through wind turbine.
- Developed control system has been tested on dynamic model of HWDS operating under standalone condition, where the transition from wind-diesel to wind-only mode of operation is simulated.



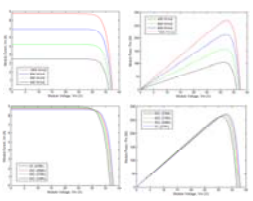
Schematic of HWDS based stand-alone power system

Sable C(5) 15:20-15:40

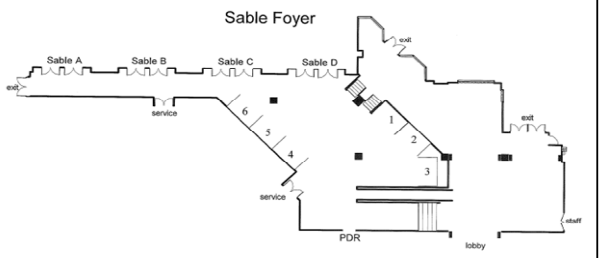
Modeling Solar Photovoltaic Cell and Simulated Performance Analysis of a 250W PV Module

Md. Aminul Islam, Adel Merabet, Rachid Beguenane and Hussein Ibrahim
Division of Engineering, Saint Mary's University, Halifax, Nova Scotia, Canada
Royal Military College, Kingston, ON and Wind Energy Techno-Centre, Gaspe, QC, Canada

- A simulation model of solar photovoltaic cell was developed using the Matlab®/Simulink®.
- The study is focused to simulate the behavior of solar PV generation based on possible environmental effects like varying temperature and solar irradiation level.
- The performance analysis of 250W PV module was compared and validated from the datasheet of CS6P-250M PV module.



I-V and P-V Characteristic Curves for varying temperature and irradiation



TP4:Energy Storage II

Session Chair: Alexander Emmanuel and Baron Young

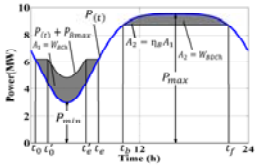
Sable D 14:00-15:40 Thursday, August 22

Sable D(1) 14:00-14:20

Electric Energy Cost Reduction by Shifting Energy Purchases from On-Peak Times

Tan Zhang, Stephen Cialdea, Alexander E. Emanuel, LFIEEE and John A. Orr, LFIEEE
Electrical & Computer Engineering, Worcester Polytechnic Institute
Worcester, MA, US

- Simulation results that detail the effects of the parameters that control the charge/ discharge operation of a Battery Energy Storage System (BESS) are reported.
- BESS performance is quantified as a function of the differential cost of energy (DCE) representing the difference between the cost of energy purchased to charge the BESS and the cost of energy delivered (sold).
- The results demonstrate that the use of a BESS can be beneficial, yielding significant savings, under appropriate conditions of battery size and efficiency.



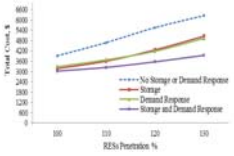
The Optimal/Charge Discharge Method

Sable D(2) 14:20-14:40

Energy Storage and Demand Response in MV Islanded Microgrids for High Penetration of Renewables

Walied Alharbi and Kankar Bhattacharya
Department of Electrical & Computer Engineering, University of Waterloo, Waterloo, Canada

- A mixed integer linear programming (MILP) model for day-ahead energy scheduling in MV islanded microgrid is proposed.
- The operation of energy storage and demand response are included in the MILP model to enhance microgrid flexibility, and high penetration of renewables can be accommodated.



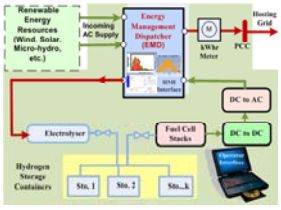
Comparison of total cost for different renewable penetration levels

Sable D(3) 14:40-15:00

Grid Connected Dispatch-able Operating Modes for Hydrogen Production from Renewable Energy Sources

Khaled Nigim and Joshua McQueen
School of Applied Technology, Energy and Apprenticeship, Lambton College, Sarnia, Ontario, Canada

- EMD Control modes allows for a fully automated system using hydrogen storage produced from renewable sources to maintain long and short term energy production with minimal downtime.
- EMD multiple modes make the renewable generating units more versatile and easier to integrate with a hosting grid and support the grid during peak demands with minimal influence of intermittency issues.



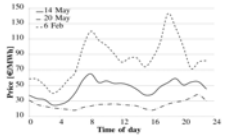
Hydrogen production, storage and electric power dispatching system

Sable D(4) 15:00-15:20

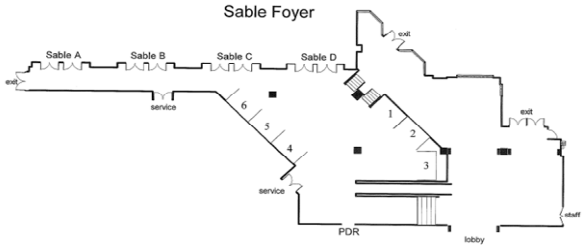
Use of Energy Storage for Belgian Power Network

Mohammad Moradzadeh, Brecht Zwaenepoel, René Boel and Lieven Vandevelde
Electrical Energy Laboratory, Ghent University
Ghent, Belgium

- Technical applicability and economical viability of different storage devices to the Belgian power network is assessed.
- The structure of the Belgian electricity market is taken into account.
- A high-level overview of widely-used storage technologies, their benefits and shortcomings are provided.



Evolution of electricity price on three different days in 2012 (Belpex)



TE1:Distribution Systems

Session Chair: D. Bouchard and Jaclyn Monaghan

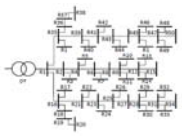
Sable A 16:00-17:40 Thursday, August 22

Sable A(1) 16:00-16:20

Management of a Smart Grid with Controlled-Delivery of Discrete Levels of Energy

Roberto Rojas-Cessa, Yifei Xu, and Haim Grebel
Department of Electrical and Computer Engineering
New Jersey Institute of Technology, Newark, NJ 07102 USA

- A new paradigm of energy deliverance by discrete amounts.
- A request-supply approach where the amount of power delivered is requested beforehand.
- Model applicable for energy starving grids: more than 98% of random requests were satisfied when the available power was limited by the average yearly demand (AYD).



The distribution network

Sable A(2) 16:20-16:40

Trends in Naval Ship Propulsion Drive Motor Technology

J.S. Thongam, M. Tarbouchi, A. F. Oukou, D. Bouchard, and R. Beguenane
Department of Electrical and Computer Engineering, Royal Military College of Canada
Kingston, Ontario, Canada

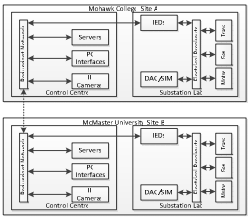
- Electric drive propulsion system for naval ships is a very active and fast-growing research area driven by the rapid growth in power electronics and advancement in machine design
- This paper presents the technology trends in propulsion drive motors for all-electric ship propulsion systems
- Induction motor, permanent magnet synchronous motor, high temperature superconducting synchronous motor and superconducting homopolar DC motor are examined. They have high power densities and efficiencies, allowing a more compact and efficient propulsion system design
- Superconducting motors may be considered to be the propulsion motors of the future as they offer significant weight and volume reductions and improved acoustic performance as compared to conventional motors

Sable A(3) 16:40-17:00

Advanced Power System Laboratory

Jasmeet Bhattal, Gobi Jakakumar, Muhammad D. Sarwar, Dr. Nafia Al-Mutawaly
B.Tech. Energy, McMaster University
Hamilton, Ontario, Canada

- A teaching, training and research lab facility to study power protection and control within two substations
- Dual-site configuration with multi-media links allows for comprehensive scheme testing and inter-site communications
- The lab facility covers: IED function verification, combined multi-vendor IED platforms, media type performance and communication protocols



APSL Conceptual Layout

Sable A(4) 17:00-17:20

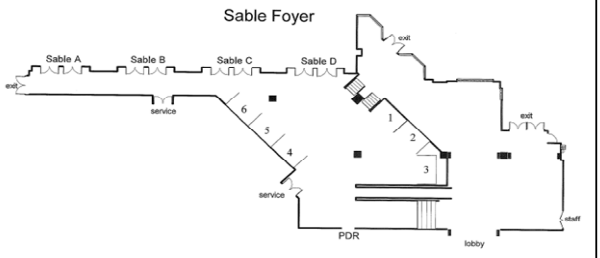
A New Selection Criteria for Combined Optimal Allocation of RESs based DGs in Restructured Electricity Market

Amit Kumar Singh (IIT Patna; India)

Sable A(5) 17:20-17:40

Future Distribution Feeder Protection using Directional Overcurrent Elements

John Kumm and Doug Jones



TE2:Building Energy Systems

Session Chair: Adel Merabet and Qinmin Yang

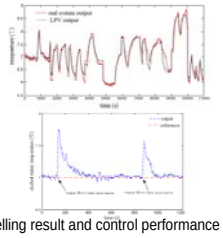
Sable B 16:00-17:40 Thursday, August 22

Sable B(1) 16:00-16:20

Model Predictive Control of Chilled Water Temperature for Centralized HVAC Systems

Jianhua Zhu, Qinmin Yang, Jiangang Lu
State Key Laboratory of Industrial Control Technology, Zhejiang University
Hangzhou, Zhejiang, China

- LPV model was proposed to model the nonlinear heat transfer dynamics undergoing in evaporators.
- A LPV-based model predictive control was designed to maintain the chilled water temperature under varying operating conditions.
- The scheme was implemented on a pilot HVAC system in our lab.



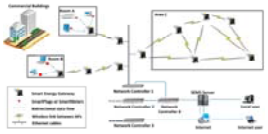
Modelling result and control performance

Sable B(2) 16:20-16:40

Design and Implementation of a Web-based Energy Management Application for Smart Buildings

Yunfei Qu, Hongjie Wang
School of Electrical Engineering and Automation, Tianjin University, Tianjin, China
Shau-Ming Lun
Intelicis US Headquarter, Intelicis Corporation, Cupertino, CA 95014, USA.
Hsiao-Dong Chiang, Tao Wang
School of Electrical and Computer Engineering, Cornell University, Ithaca, NY14853, USA

- A Web-based Energy Management Application (WEMA) is designed and implemented.
- This application makes possible the energy management of buildings in device-level and high time resolution.



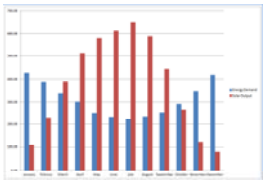
Communication network structure

Sable B(3) 16:40-17:00

System Architecture of the Sustainable Energy System for Performance Buildings

Vladimir Grebenyuk
Ascent Systems Technologies
Sun Peaks, British Columbia, Canada

- A System Architecture approach to design sustainable energy system for performance building was proposed.
- The knowledge-based Predictive Algorithm (ASPA) for optimal system configuration was developed.
- ASPA has been implemented in the software program and tested through simulation and against selected stand-alone components.
- The network-based advanced control system (ASCENT) is proposed.



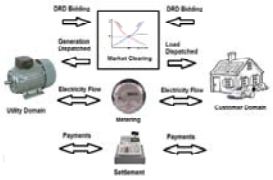
ASPA-generated energy balance

Sable B(4) 17:00-17:20

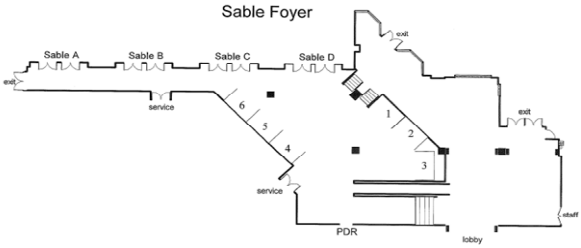
Demand Request Dispatch Approach for Electric Distribution Systems

Luke Seewald and Vinay Sharma
London Hydro
London, Ontario, Canada

- Practical Demand Request Dispatch approach to utility market definition and communication interoperability.
- Intelligent devices within a Smart Home request electricity from the utility prior to consuming it .
- Electricity Utility is provided with the flexibility to grant, deny or schedule requested load profiles.



Proposed DRD Settlement Process



TE3:Energy Conservation and Efficiency III

Session Chair: Reza Iravani and Phil Zinck

Sable C 16:00-17:40 Thursday, August 22

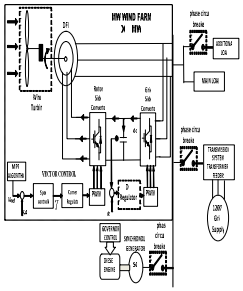
Sable C(1) 16:00-16:20

Control System for Hybrid Wind Diesel Based Microgrid

Vigneshwaran Rajasekaran[1], Adel Merabet[1], Hussein Ibrahim[2], Rachid Beguenane[3], Jogendra S. Thongam[3]

[1]Division of Engineering, Saint Mary's University, Halifax, NS, Canada, [2]Wind Energy Techno-Centre, Gaspé, QC, Canada, [3]Department of Electrical Engineering, Royal Military College, Kingston, ON, Canada

- Control system developed for hybrid wind diesel system (HWDS) based microgrid is presented.
- A maximum power point tracking (MPPT) control system is developed and simulated for rotor side power converter and a vector control based voltage regulation system is developed and simulated for grid side power converter.
- Developed control system has been tested on a dynamic model of HWDS operating under isolated and grid connected mode. Simulation results to validate the performance of the developed control system are presented.



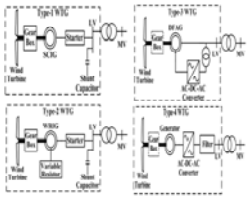
Schematics of HWDS based microgrid

Sable C(2) 16:20-16:40

A Review of the Impacts of Multiple Wind Power Plants on Large Power Systems Dynamics

Ahmed El-Klhy and Reza Iravani
Department of Electrical and Computer Engineering, University of Toronto
Toronto, Ontario, Canada

- A review of the impacts of large-scale wind power integration through multiple WPPs on transient stability and inter-area power oscillations was presented.
- Different modeling approaches of the WTGs, especially the aggregated generic models were reviewed.
- Discussing the different proposed counter measures, implemented through the WPPs controllers, to mitigate these impacts.



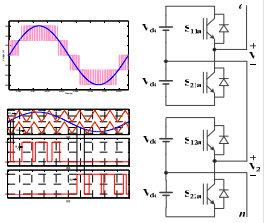
Grid interface-based classification of WTGs

Sable C(3) 16:40-17:00

Half-Bridge Based Multilevel Inverter Generating Higher Voltage and Power

Hani Vahedi and Kamal Al-Haddad
Power Electronics Research Group, GREPCI, Ecole de Technologie Superieure
Montreal, Quebec, Canada

- A multilevel inverter topology has been proposed using half-bridge inverters.
- This topology can be used effectively in case of having low DC sources due to generating higher voltage and delivering higher power.
- The proposed topology is kind of an alternative for cascaded H-bridge (CHB) multilevel inverter in energy conversion and machine drive applications.



Cascaded Half-Bridge Multilevel Inverter (CHalfB)

Sable C(4) 17:00-17:20

Flexible Programming in Connections Between Supercapacitors in a Module to Maximizing the Energy Discharge Time

M. G. Reveles-Miranda[1], M. Flota-Bañuelos[2], F. Chan-Puc[3] and D. Pacheco-Catalán[1]
[1] *Centro de Investigación Científica de Yucatán A.C., Mérida Yucatán, México*
[2] *Facultad de Ingeniería, Universidad Autónoma de Yucatán., Mérida, Yucatán, México*
[3] *Universidad de Quintana Roo,* Chetumal, *Quintana Roo., México.*
*e-mail: dpacheco@cicy.mx

- An increasing in the energy discharge time was proposed using the flexible reconfiguration.
- The reconfiguration increase the discharging time, obtaining so a greater performance in each supercapacitor, by presenting deep cycles of charge/discharge.
- The flexible configuration in connections between supercapacitors is controlled by means of a platform based in a microcontroller.
- The results showed at 27% increase in the discharging time with deep cycle of charge/discharge in each supercapacitor.

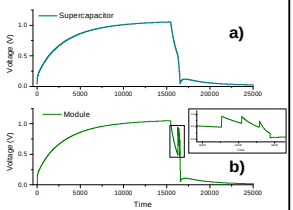


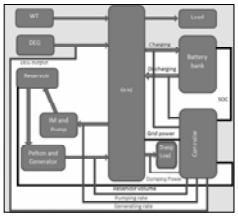
Figure 1: a) Deep cycle of charge/discharge in each supercapacitor. b) increment in the time of discharge at a constant output voltage range in the module.

Sable C(5) 17:20-17:40

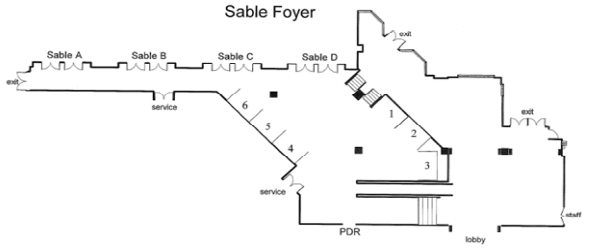
Diesel Consumption in a High Penetration Remote Hybrid Power System with a Pumped Hydro and Battery Storage

M. R. H. Asif, Student member, IEEE and M. T. Iqbal
Memorial University of Newfoundland, St. John's, NL, Canada

- Study of different operational modes of diesel engine generator to estimate the fuel consumption, number of switching and resulting system frequency deviation.
- Integration of a pumped hydro storage system, battery bank and controllable dump load to increase the wind penetration



Ramea Wind-Diesel hybrid power system



TE4:Transmission Systems

Session Chair: Roger Wiget and Baron Young

Sable D 16:00-17:40 Thursday, August 22

Sable D(1) 16:00-16:20

Power Grid Protection against Geomagnetic Disturbances (GMD)

F. R. Faxvog, W. Jensen. G. Fuchs, G. Nordling; D. B. Jackson; B. Groh; N. Ruehl, A.P. Vitols, T. L. Volkmann, M.R. Rooney, and Russell Neal
Emprimus LLC, ABB North Am., US Dept of Homeland Security (DTRA), & So. Cal Edison

- A transformer neutral blocking system, SolidGround™ ,was designed, constructed and tested in a live power grid
- System electronics sense either neutral DC GIC or phase harmonics to automatically activating the DC GIC protection mode of operation
- Potential power system impacts and protection against ground faults will be discussed

Emprimus Transformer Neutral Blocking System

Sable D(2) 16:20-16:40

Wide-area Control for Damping Inter-area Oscillations: A Comprehensive Review

Mohamed Ramadan Younis and Reza Iravani
Energy Systems Group, ECE Department, University of Toronto
Toronto, Ontario, Canada

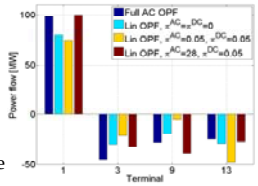
- A survey of recent research and developments in the field of wide-area control for inter-area oscillation damping was provided.
- Main designing procedures of wide-area damping controller were discussed with a summary of existing techniques for each step and their advantages and disadvantages.
- Challenges face wide-area control systems were presented and present solutions were indicated
- New researchers can follow recent and future trends in the field of wide-area damping control systems.

Sable D(3) 16:40-17:00

DC Optimal Power Flow Including HVDC Grids

Roger Wiget and Göran Andersson
Power Systems Laboratory, ETH Zürich
Zürich, Switzerland

- A linearized optimal power flow algorithm for combined AC and multi-terminal HVDC grid was proposed.
- The method approximates the active power flows in the HVDC grid and neglects the losses.
- Different flow penalty factors for the AC and HVDC grid were investigated and compared to the full nonlinear OPF formulation.



Power exchange through VSC terminals

Sable D(4) 17:00-17:20

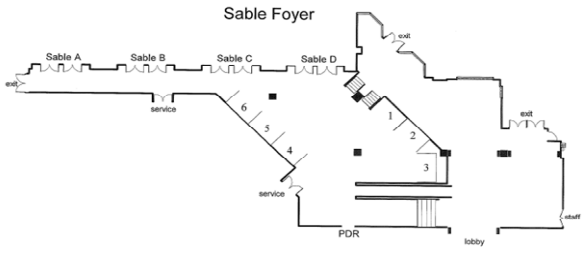
COMPARISON OF BIO-FUELS USED IN CO-GENERATION BASED SUGAR INDUSTRY OF PUNJAB: A CASE STUDY

Rubalpreet Saini
Guru Nanak Dev Engineering College

Sable D(5) 17:20-17:40

Optimal Partitioning of Power Networks and Locating Pilot Buses proposed for Voltage Regulation

Hasan Mehrjerdi (IREQ)



Friday August 23, 2013

FP1	Smart Grid including HVDC and FACTS I
FP2	Integrated Energy System Planning I
FP3	Energy Conservation and Efficiency IV
FE1	Smart Grid including HVDC and FACTS II
FE2	Integrated Energy System Planning II
FE3	Computational Methods

FP1:Smart Grid including HVDC and FACTS I

Session Chair: Wahab Almuhtadi and Hung Huynh

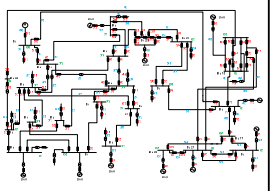
Sable A 14:00-15:40 Friday, August 23rd

Sable A(1) 14:00-14:20

Phasor-Assisted Automated Topology Processing for State Estimators

Mostafa Farrokhabadi and Luigi Vanfretti
Electric Power Systems Department, KTH Royal Institute of Technology
Stockholm, Sweden

- An openly and fully documented TP that has the ability to work with variety of substation configurations.
- The only TP which is capable of working with traditional data, or in PMU-assisted mode, or PMU-only.
- A TP that is fast enough to work with PMU-only state estimators.
- The only openly available TP that considers the presence of disconnectors in the system..



IEEE Reliability Test System 1996

Sable A(2) 14:20-14:40

An Intelligent Multi-Agent Approach to Enhance the Transient Stability of a Smart Power Grid

M. S. Rahman, H. R. Pota and T. F. Orchi
SEIT, University of New South Wales
Canberra, ACT 2600, Australia

- A decentralized multi-agent system (MAS) framework is proposed for smart grid protection to enhance its transient stability.
- MAS is suitable for large-scale power systems due to its distributed nature, dynamic adaptability and flexibility.
- Performance of the proposed approach is evaluated for different conditions and also validated by a comparison with a conventional centralized approach.

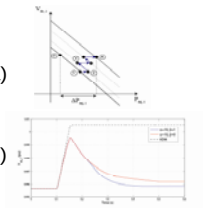
Fig. Flow-chart of the proposed approach

Sable A(3) 14:40-15:00

Application of Multi-Agent Control to Multi-Terminal HVDC Systems

Mohammad Nazari and Mehrdad Ghandhari
Electric Power Systems Department, KTH Royal Institute of Technology
Stockholm , Sweden

- A distributed DC voltage control method was proposed based on multi-agent system(MAS), which can work either with or without communication between terminals.
- MAS is used to shift the droop characteristic of each terminal in order to control the dc voltage in multi-terminal HVDC system, after a disturbance, with a very small steady state error.



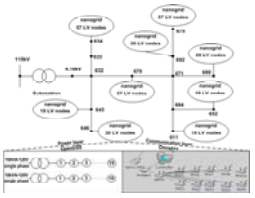
(a)The droop characteristic of a terminal, which is updated using MAS
(b) dc voltage after a disturbance

Sable A(4) 15:00-15:20

Co-Simulation of Real-Time Decentralized Vehicle/Grid (RT-DVG) Coordination Scheme for E-mobility within Nanogrids

Samah Mansour , Géza Joós, Intissar Harrabi, and Martin Maier
ECE Department McGill University and INRS
Montreal, Quebec, Canada

- Nanogrids benefits, operations and challenges were discussed.
- A real time decentralized V2G/G2V charging coordination algorithm RT-DVG was proposed and co-simulated from both perspectives power and communication.
- For a network of 335 residential customers, power system results proved efficiency providing 14% peak shaving.
- Communication results measured an upstream traffic of 0.65 Mbps with a maximum delay of 0.8 ms at the controller end.



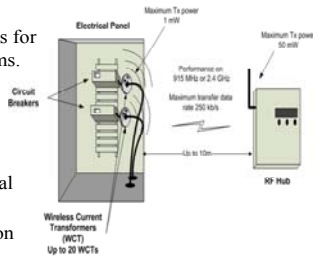
Single-line diagram of power distribution network topology

Sable A(5) 15:20-15:40

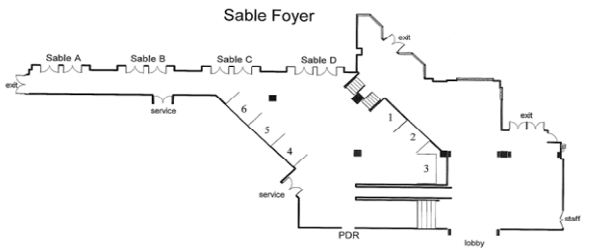
Optimizing Wireless Performance of Current Metering and Consumption Control in Commercial Buildings

Kelvert Ballantyne[1], Shilian Zhao[1], Natalia Gorbenko[1], Dr. Wahab Almuhtadi[1], & Denis Gallant[2]
[1] Faculty of Technology and Trades, Algonquin College, Ottawa, ON. Canada
[2] Triacta Power Technologies, Inc., Ottawa, ON. Canada

- Research into wireless protocols for Wireless Smart metering systems.
- Investigation of propagation issues and limitations through an Electrical Panel.
- Impact of antenna design and orientation on propagating signal strength.
- Minimizing WiFi interference on Zigbee.



Commercial Wireless Smart metering



FP2:Integrated Energy System Planning I

Session Chair: Ahmed Cheriti and Phil Zinck

Sable B 14:00-15:40 Friday, August 23rd

Sable B(1) 14:00-14:20

A Game Theoretic Framework for DG Optimal Contract Pricing

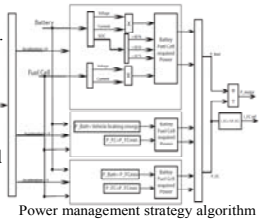
Ashkan Sadeghi Mobarakeh and Abbas Rajabi Ghahnavieh

Sable B(2) 14:00-14:20

A real time energy management for electrical vehicle using combination of rule-based and ECMS

Hanane HEMI, Jamel GHOUILI and Ahmed CHERITI
University of Moncton, Moncton, NB, Canada
University of Quebec in Trois-Rivieres, Trois-Rivieres, QC, Canada

- The approach proposed use the rule-based and ECMS algorithm strategy.
- The objectives of the strategy are reduce a hydrogen consumption and maintain battery state of charge fixed to the desired value.
- The approach has been implemented in a fuel cell vehicle (FCV) power train which was developed in Matlab/Simulink software



Power management strategy algorithm subsystem

Sable B(3) 14:20-14:40

Hybrid SVM & ARMAX Based Mid-term Electricity Market Clearing Price Forecasting

Xing Yan and Nurul A. Chowdhury
Department of Electrical and Computer Engineering, University of Saskatchewan
Saskatoon, Saskatchewan, Canada

- A hybrid mid-term electricity market clearing price forecasting model was proposed.
- Mid-term electricity MCP forecasting is different from short-term electricity MCP forecasting in data selection and the use of underlying assumptions.
- SVM intends to lose the top and bottom peak values during training process because those values are considered as non-support vectors.

Hybrid Forecasting Model Architecture

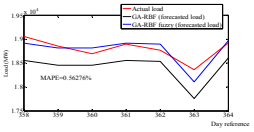
Sable B(4) 14:40-15:00

A hybrid Genetic Radial Basis Function Network with Fuzzy Corrector for Short Term Load Forecasting

W. T. Ghareeb, Student Member, IEEE and E. F. El Saadany, Senior Member, IEEE
Department of Electrical and Computer Engineering, University of Waterloo, Waterloo, Canada

- This paper proposes a Genetic Algorithm optimized Radial Basis Function network (GA-RBF) with a fuzzy corrector for the problem of short term load forecasting.
- The system has been compared with the multi-layer feed forward neural network, the RBF network, the adaptive neuro-fuzzy inference System and the genetic programming

Proposed system	Average MAPE (%)
GA-RBF with fuzzy corrector	0.56276
ANFIS	1.7801
GA-RBF network	2.0121
Feedforward neural network	2.1884
RBF network	2.3366
Standard GP	2.5462



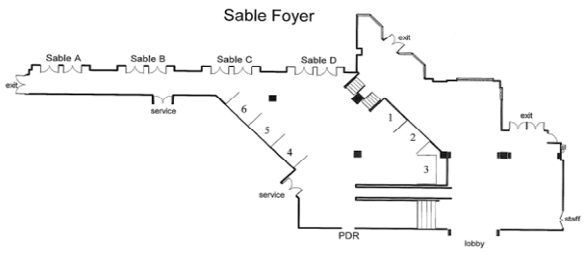
The forecasted load

Sable B(5) 15:00-15:20

Competitive Market Mechanism at Microgrid Level

Swapan Sikdar and Karen Rudie
Department of Electrical and Computer Engineering, Queen's University
Kingston, Ontario, Canada

- A new electricity trading mechanism using dynamic matching of bids from generators and loads is proposed.
- A game theoretic formulation of the mechanism is outlined where generators and loads pursue bid strategies to maximize respective benefits.
- It is shown that
  - low participation costs make it rational for generators and loads to participate in the mechanism,
  - the mechanism can be tuned to improve volume of localized trade.
- The mechanism is suitable for microgrids and is a possible approach for decentralized markets.



FP3:Energy Conservation and Efficiency IV

Session Chair: Adel Merabet and Perry Mason

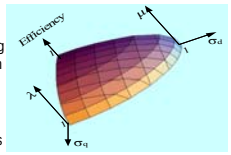
Sable C 14:00-15:40 Friday, August 23rd

Sable C(1) 14:00-14:20

Novel Method of Pre-determining Induction Machine Parameters and Energetic Efficiency

V. Groza, C D. Pitis, A. Merabet and V D. Giurgiu
University of Ottawa, BC Hydro, Saint Mary's University, Eaton Corporation

- The novel idea of this paper resides is the introduction of a new concept of «coupling coefficients». Physical interpretation of the coupling coefficients is explained by the physical connection between mutual and direct inductances. It is well-known the values of these inductances influence the level of the losses in IM.
- Proposed method of IM parameters identification is based on data obtained from routine no-load tests and nameplate.
- Proposed method could also be used to pre-determine new parameters values of the rewound IM.



Energy efficiency as function of total dispersion coefficient

Sable C(2) 14:20-14:40

Comparison of Bio-fuels Used In Co-Generation Based Sugar Industry of Punjab: A Case Study

Rubalpreet Kaur Saini, Charan Preet Singh Gill and Harmeet Singh Gill
Department of Electrical Engineering, Guru Nanak Dev Engineering College, Ludhiana, Punjab, India

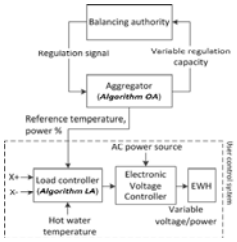
- Compared various bio-fuels used in co-generation based sugar industry of Punjab state in India. A. B. Sugars Limited, located in Hoshiarpur district of Punjab state has been selected for the case study.
- Various bio-fuels have been compared and investigated experimentally for different parameters namely, moisture content, volatile matter, ash content and calorific value.
- Results reveal that co-generation using bio-fuels can prove to be a promising alternative to the practice of conventional coal based electricity generation in agrarian state of Punjab as ample quantities of bio-fuels are available.

Sable C(3) 14:40-15:00

Electric Water Heaters Control Strategy for Providing Regulation Services

Simon Ayoub
Halifax, Nova Scotia, Canada

- To manage stochasticity of loads and renewable sources, a distributed control technique of residential loads was proposed, using reference temperature as control signal.
- An algorithm was developed for determining the variable regulation capacity of residential thermal loads.
- High variation of the reference temperature allows, simultaneously, regulations and load leveling.

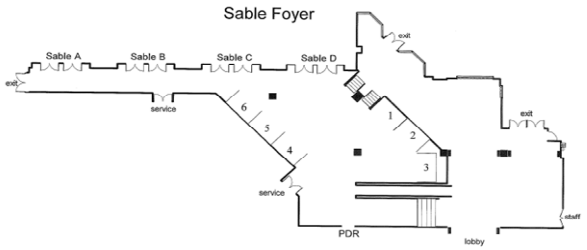


Bloc diagram of the control system

Sable C(4) 15:00-15:20

A Revised Incremental Conductance MPPT Algorithm for Solar PV Generation Systems

Xiaoyu Wang and Meng Yue
Brookhaven National Laboratory



FE1:Smart Grid including HVDC and FACTS II

Session Chair: Hussein Mouftah and Hung Huynh

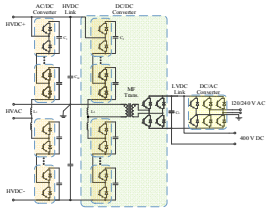
Sable A 16:00-17:40 Friday, August 23rd

Sable A(1) 16:00-16:20

A Modular Solid State Transformer with a Single-Phase Medium-Frequency Transformer

Ali Shojaei and Geza Joos
Department of Electrical and Computer Engineering, McGill University
Montreal, Quebec, Canada

- A three-stage solid state transformer configuration is proposed which employs modular multilevel converters in both the first and second stages.
- The proposed topology: is easily scalable to higher voltage levels; requires only one medium-frequency transformer, simplifying the implementation and control; and provides high-voltage DC in addition to common terminals.



Detailed model of the proposed three-stage solid state transformer

Sable A(2) 16:20-16:40

E-Mobility in Smart Microgrids: A New Research Area for Communications Networks

Intissar Harrabi and Martin Maier
Optical Zeitgeist Laboratory, INRS
Montreal, Quebec, Canada

- The suitability of intermittent wind and solar renewable energy sources was investigated to locally charge electric vehicles within smart microgrids.
- The most important random variables of electric-mobility were surveyed, while discussing the pros and cons of different electric vehicle charging scenarios.
- The extent to which electric-mobility can be sustained from these renewable energy source was quantified by investigating their cross-correlations and outlining possible solutions and open challenges for future smart microgrid communications networks.

Sable A(3) 16:40-17:00

A Game Theoretic Approach for PHEV Load Management in the Smart Grid

Naouar Yaagoubi and Hussein T. Mouftah
School of
Electrical Engineering and Computer Science, University of Ottawa
Ottawa, Ontario, Canada

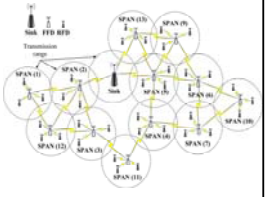
- Smart PHEV charging algorithm that significantly balances the load and reduce total energy cost.
- A game theoretic approach is used to formulate the PHEV charging problem.
- The algorithm preserves the user's privacy and incurs very limited overhead on the network

Sable A(4) 17:00-17:20

Time Slot Allocation in WSNs for Differentiated Smart Grid Traffic

Irfan Al-Anbagi, Melike Erol-Kantarci, Hussein T. Mouftah
School of Electrical Engineering and Computer Science, University of Ottawa, Ottawa, ON, Canada

- A scheme based on an optimization model to provide QoS differentiation and significantly reduce the end-to-end delay of high priority data in mesh based WSNs is presented.
- The presented scheme could adaptively change the MAC parameters to achieve the delay reduction and can invert back to normal IEEE 802.15.4 MAC setting when there is no high priority data.

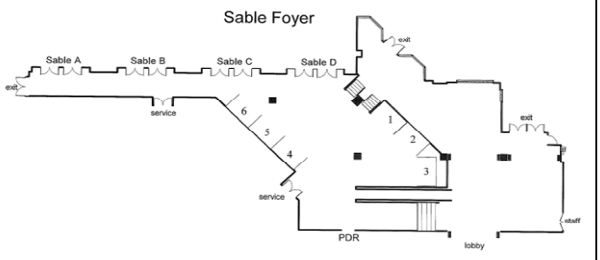


The proposed topology.

Sable A(5) 17:20-17:40

A Risk Assessment Framework for the Smart Grid

Voicu Groza (University of Ottawa)
Dan Krewski (University of Ottawa)
Greg Paoli (Risk Science International; Ottawa)



FE2:Integrated Energy System Planning II

Session Chair: Ehab El-Saadany and Phil Zinck

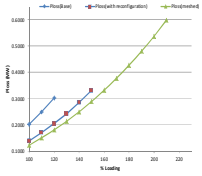
Sable B 16:00-17:40 Friday, August 23rd

Sable B(1) 16:00-16:20

The Effect of Network Configuration on Maximum Loadability and Maximum Allowable DG Penetration in Distribution Systems

Aboelsood Zidan and Ehab El-Saadany
Smart Distribution Systems Research Group, University of Waterloo
Waterloo, Ontario, Canada

- Three possible arrangements for distribution networks (base radial configuration, radial configuration obtained from a reconfiguration problem, and meshed network) have been investigated and compared with each other.
- The comparison includes losses, maximum loadability, voltage profile and maximum DG penetration level.



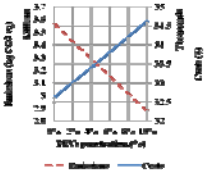
Maximum loadability at different system configurations

Sable B(2) 16:20-16:40

Accommodating high penetration of PEV in distribution networks

M. F. Shaaban and E. F. El-Saadany
Electrical and Computer Engineering Department, University of Waterloo
Waterloo, Ontario, Canada

- A multi-objective planning algorithm to accommodate high penetration of electric vehicles in distribution systems is proposed in this paper.
- The proposed algorithm is based on allocating different DG units to minimize system costs and emissions.
- The proposed methodology can help the LDC to better assess the PEV impacts on their systems and mitigate them.



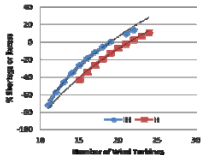
System costs and emissions without DG units

Sable B(3) 16:40-17:00

In Search of An Optimization Tool for Renewable Energy Resources: Homer vs. In-House Model

AmarKumar[1], Marzia Zaman[2], Nita Goel[1], Nishith Goel[2], Ron Church[2]
[1]Tecsis Corporation, 210 Colonnade Road, Ottawa,[2]Cistel Technology Inc., 30 Concourse Gate, Ottawa,ON

- A generic iteration based algorithm is presented as an alternative optimization model for designing hybrid renewable energy resources
- Simulation results between the Homer and the in-house model is compared and the observed differences are addressed
- Optimized unit number and cost of energy obtained by in-house model differ from Homer by around 10 percent in general
- Overall, the in-house model appears to be simple and flexible in use and performance



Simulation results for the Primary Load II

Sable B(4) 17:00-17:20

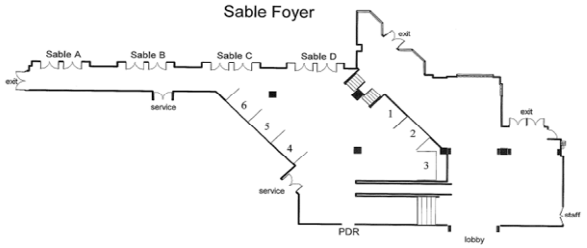
Oil Barrel Price Forecasting: A Case Study of Saudi Arabia

M.E. El-Hawary and Bandar Mutwali
Dalhousie University

Sable B(5) 17:20-17:40

An Overview of Inverter Topologies for Photovoltaic Electrical Energy

M.E. El-Hawary, Hamed Aly and Shadi Shehadeh
Dalhousie University



FE3:Computational Methods

Session Chair: Benjamin Jeyasurya and Perry Mason

Sable C 16:00-17:40 Friday, August 23rd

Sable C(1) 16:00-16:20

Dynamic State Estimation in Power Systems Using Kalman Filters

Benjamin Jeyasurya and Hamed Tebianian
Memorial University of Newfoundland

Sable C(2) 16:20-16:40

Differential Protection of Transformer Based on Artificial Neural Network and Programmable Logic

Ricardo Caneloi Santos

Sable C(3) 16:40-17:00

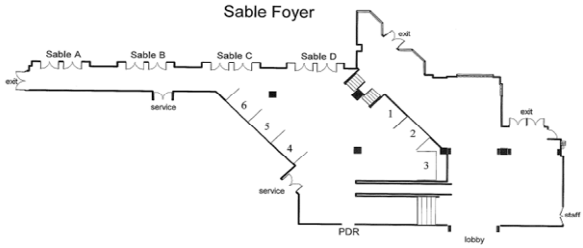
Measurement-Based Analysis of Power System Small Signal Stability

Dan Lin and Benjamin Jeyasurya
Memorial University of Newfoundland

Sable C(4) 17:00-17:20

The Influence of Parallel Capacitor to Output Voltage in High-Frequency ESP Power

Kexin Zhang
Harbin Institute of Technology, China



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