1968 50 YEARS 2018

FARGO NODAK

NAPS

NORTH AMERICAN POWER SYMPOSIUM

NDSU

BRINGING TOGETHER STUDENTS, FACULTY AND RESEARCHERS IN THE POWER AND ENERGY SYSTEMS FIELD SINCE 1969

50TH NORTH AMERICAN POWER SYMPOSIUM

NORTH DAKOTA STATE UNIVERSITY

50 YEARS

MESSAGE FROM THE CHAIRS:

Welcome to Fargo and North Dakota State University (NDSU) as we host the 50th North American Power Symposium. NDSU is distinctive as a student-focused, land-grant, research university providing affordable education to shape future leaders who will create solutions to national and global challenges. Engineering next-generation power and energy systems is one of those challenges, and we are glad this symposium provides a much-needed influx of fresh ideas in these emerging areas.

Established in 1926, the NDSU Department of Electrical and Computer Engineering is the 39th largest Bachelor of Science program offered in electrical engineering in the country. The department has around 18 full-time faculty members, four support staff, approximately 480 undergraduate students and about 50 graduate students. Among the approximately 90 students who graduate each semester, about 35 specialize in the power and energy systems area, finding employment with local utilities and industries.

NAPS has brought together students, faculty and researchers in the power and energy systems field since its inception in 1969 as the Midwest Power Symposium. Organized at a different university every year in North America, NAPS provide an excellent forum for participants, especially students, to present and receive feedback on their research. NAPS maintains its long-standing tradition to strongly encourage, support and recognize students for their participation. The conference here will continue this long-standing tradition, including a social tour on Sunday, followed by the IEEE-PEEC and NAPS steering committee meetings on campus in the evening. On Monday, the conference will feature a stimulating joint keynote address examining research and education challenges, followed by six parallel technical sessions and concluded with an evening banquet in a picturesque setting. The conference will feature a keynote curated by industry experts and conclude on Tuesday with an award ceremony recognizing the best papers. We hope you will enjoy the variety of activities in our distinctive university and community.

We are grateful for the support from the National Science Foundation, the IEEE Power and Energy Society, the NDSU College of Engineering, the Department of Electrical and Computer Engineering, Otter Tail Power Corp., Ulteig Engineers, Great River Energy, PSCAD, Nayak Corp., Manitoba Hydro International and the University of North Dakota. A special thank you to Nancy Rossland who has tirelessly organized the smallest of details for the conference; Dr. Di Wu for managing the EasyChair system; Dr. Dong Cao for managing the paper production process; Anne Campbell for the support and logistics; Laura Dallmann for coordinating financial matters; department chair Dr. Braaten; Dean Dr. Kessler; and his office staff, especially Alissa Kuntz.

We hope you enjoy the conference and return home revitalized.

Best Regards,

Rajesh Kavasseri, Di Wu and Dong Cao

MAP

SCHEDULE
SEPT. 9-11, 2018

1968 50 YEARS 2018
FARGO NAPS NODAK
NORTH AMERICAN POWER SYMPOSIUM
NDSU

SATURDAY, SEPT. 8

Noon to 6 p.m.	**Conference check-in and information** Holiday Inn - Lobby

SUNDAY, SEPT. 9

7 a.m. to 6 p.m.	**Conference check-in and information**
7 to 8 a.m.	**Continental breakfast** Holiday Inn - Atrium
8 a.m. to 5 p.m.	**Tour to Itasca State Park** Board a bus and experience the beauty of Minnesota. Established in 1891, Itasca is Minnesota's oldest state park. Today, the park totals more than 32,000 acres and includes more than 100 lakes. Walk across the headwaters of the Mississippi as it starts its winding journey to the Gulf of Mexico. Stand under towering pine trees and visit the park's landmarks of centuries gone by. Transportation and lunch are provided.
6 to 7 p.m.	**Welcome reception and pizza party** NDSU Campus – A.G. Hill Center - Atrium
7 to 8 p.m.	**IEEE PEEC Committee meeting** NDSU Campus – A.G. Hill Center
8 to 9 p.m.	**NAPS Steering Committee meeting** NDSU Campus – A.G. Hill Center

MONDAY, SEPT. 10

7:30 a.m. to 6 p.m.	**Conference check-in and information** Holiday Inn – Lobby
7:30 to 8:15 a.m.	**Breakfast buffet** Holiday Inn – Royale, Embassy
8:15 to 8:30 a.m.	**Welcome and introductions** Holiday Inn – Sterling, Crowne
8:30 to 9:30 a.m.	**Plenary session** Speaker: Dr. Ned Mohan and Dr. Marija Ilic Holiday Inn – Sterling, Crowne
9:30 to 10 a.m.	**Networking break**
10 a.m. to noon	**Break-out paper session #1** Holiday Inn – Conference, Director's, Board, Executive, Frontier, Prairie
Noon to 1 p.m.	**Lunch** Holiday Inn – Royale, Embassy
1 to 3 p.m.	**Break-out paper session #2** Holiday Inn – Conference, Director's, Board, Executive, Frontier, Prairie
3 to 3:30 p.m.	**Networking break**
3:30 to 5:30 p.m.	**Break-out paper session #3** Holiday Inn – Conference, Director's, Board, Executive, Frontier, Prairie
6 to 10 p.m.	**Reception and banquet** Join us for a casual night of fun, socializing and great food at the Romantic Moon Event Center located on five beautiful acres along the Buffalo River in Glyndon, Minnesota. Transportation will be provided.

TUESDAY, SEPT. 11

7:30 a.m. to 1 p.m.	**Conference check-in and information** Holiday Inn – Lobby
7:30 to 8:15 a.m.	**Breakfast buffet** Holiday Inn – Royale, Embassy
8:15 to 9:15 a.m.	**Plenary session** Speaker: John D. McDonald, P.E. Holiday Inn – Sterling, Crowne
9:15 to 9:45 a.m.	**Networking break**
9:45 to 11:45 a.m.	**Break-out paper session #1** Holiday Inn – Conference, Director's, Board, Executive, Frontier, Prairie
11:45 a.m. to 1 p.m.	**Awards luncheon and conference closing** Holiday Inn – Royale, Embassy

PLENARY SESSION

“Teaching and Research in Changing Electric Energy Systems: Back to Principles and Why Would it Help?”

Marija Ilic
ilic@mit.edu

Abstract: After many years of wondering why our field is not fully valued by other colleagues at our universities, and why is it so hard to communicate to industry and government innovations we would like to see, I arrived at a relatively simple answer: We are so used to our own focused sub-problem formulations and solutions, and do not have good ways of introducing energy system concepts underlying major open questions in the language understandable by other folks. Implications are multi-fold. This talk is an effort to take a step back and ask the question if or how one might do this.

The talk examines a recently-introduced multi-layered modeling framework for posing the problem of safe, robust and efficient design and control for rapidly changing electric energy systems. The proposed framework establishes dynamic relations between physical concepts such as stored energy, useful work and wasted energy, on one hand; and modeling, simulation and control of interactive modular complex dynamical systems, on the other. In particular, our recently introduced energy state-space modeling approach for electric energy systems is further interpreted using fundamental laws of physics in multi-physical systems, which are modeled as dynamically interacting modules.

This approach is shown to be particularly well-suited for scalable optimization of large-scale complex systems. Instead of using simpler models, the proposed multi-layered modeling of system dynamics in energy space offers a promising basic method for modeling and controlling inter-dependencies across multi-physics subsystems for both ensuring feasible and near-optimal operation. It is illustrated how this approach can be used for understanding fundamental physical causes of inefficiencies created either at the component level or resulting from poor matching of their interactions.

The talk closes with the claim that many open modeling, estimation and optimization challenges and opportunities that exist in the changing electric energy industry can be formulated using this modeling and control approach.

Acknowledgments: This talk is based on the recent paper by M. D. IliĐ and R. Jaddivada, titled ``Multi-layered interactive energy space modeling for near-optimal electrification of terrestrial, shipboard and aircraft systems,” Annual Reviews in Control, available online May 2018. The paper provides theoretical foundations for Dynamic Monitoring and Decision Systems (DyMonDS) framework envisioned as the next-generation SCADA. The control design based on joint work with Xia Miao and R. Jaddivada for microgrids and integration of renewable resources and demand response is used as an example to illustrate potential benefits of this approach. The concepts presented are basis for a Cambridge University Press textbook under preparation that builds on these concepts.

Marija Ilic has retired as a professor emerita at Carnegie Mellon University. She currently is a senior staff in the Energy Systems Group 73 at the MIT Lincoln Laboratory, and a senior research scientist at MIT Institute for Data, Systems and Society (IDSS)/LIDS. She is an IEEE Life Fellow. She was the first recipient of the NSF Presidential Young Investigator Award for Power Systems signed by President Ronald Regan. In addition to her academic work, she is the founder of New Electricity Transmission Software Solutions Inc. (NETSS Inc.). She has co-written several books on the subject of large-scale electric power systems, and has co-organized an annual multidisciplinary electricity industry conference series at Carnegie Mellon (http://www.ece.cmu.edu/-electriconf) with participants from academia, government and industry. She was the founder and co-director of the Electric Energy Systems Group at Carnegie Mellon University (http://www.eesg.ece.cmu.edu) and is continuing its growth at MIT (https://lids.mit.edu/labs-and-groups/electric-energy-systems-group-eesgmit).

PLENARY SESSION

“Teaching and Research in Electric Power Systems: Back to Principles and Why it Would Help”

Ned Mohan

Abstract: This presentation will discuss the educational needs in electric power systems today. With climate change upon us, how we produce, transmit and consume electricity must undergo a radical change. This presentation will contend that this climate-crisis is a great opportunity for us, leading to the renaissance of power engineering.

In doing so, we need to take a holistic connotation of “power systems” that recognizes that power electronics, electric drives, economics, public policy, etc. will all play crucial roles in the next-generation power systems. Therefore, a large number of courses are needed that are synergistic.

This presentation will argue:

- We should teach a university-wide climate-change related course on power/energy to freshman that could also be taught in high schools
- To juniors and seniors, we should offer only a very few carefully-designed courses to train them broadly
- At the graduate level, we should be open to allow our graduates to take a few online courses for credits from outside of their home institutions, because no university has neither the required faculty nor the critical mass of students to teach certain courses.

Ned Mohan (LF-IEEE) joined the University of Minnesota in 1975, where he is the Oscar A. Schott Professor of Power Electronic Systems and Morse-Alumni Distinguished Professor. He earned his bachelor’s degree from the Indian Institute of Technology-Kharagpur in 1967, and his doctorate in electrical engineering and master’s degree in nuclear engineering are from the University of Wisconsin-Madison. He has written five textbooks; all together, they have been translated into eight languages. He has graduated 46 doctoral students. His area of research is in power electronics applied to power systems and he holds several patents.

Mohan received the H.T. Morse Distinguished Teaching Award for undergraduate education from the University of Minnesota in 2007. He has received 2008 IEEE-PES Outstanding Educator Award, 2010 IEEE Undergraduate Teaching Award, and 2010 UWIG Achievement Award from Utility Wind Integration Group, 2011 Distinguished Alumnus Award from IIT-Kharagpur (India), and 2012 IEEE Power and Energy Society Ramakumar Family Renewable Energy Excellence Award. In 2013, he received the Innovative Program Award from the ECE Department Heads Association made up of more than 250 U.S. universities. In 2014, he received the Distinguished Graduate Teaching Award from the University of Minnesota and the IEEE Nari Hingorani FACTS Award from the IEEE Power and Energy Society.

He is a fellow of the IEEE and a member of the National Academy of Engineering.

PLENARY SESSION
“Key Insights to Career Management”

John D. McDonald, P.E.

Abstract: This talk discusses 12 important things to keep in mind when managing your career to achieve your goals. They will be explained and explored with examples and photographs, based on McDonald’s 44 years as an engineer, manager and executive managing people’s careers, and 47 years of IEEE membership. Understanding your priorities, which can change, and your company’s objectives can help you have a rewarding and fulfilling career.

John D. McDonald, P.E., is Smart Grid Business Development Leader for GE Power’s Grid Solutions business. He has 44 years of experience in the electric utility industry. John joined GE on Dec. 3, 2007, as General Manager, Marketing for GE Energy’s transmission and distribution business. In 2010, McDonald accepted the new role of Director, Technical Strategy and Policy Development for GE Digital Energy. In January 2016, he assumed his present role with the integration of Alstom Grid and GE Digital Energy to form GE Grid Solutions.

McDonald was elected to the board of governors of the IEEE-SA (Standards Association), focusing on long term IEEE Smart Grid standards strategy. He was the chair of the Smart Grid Interoperability Panel (SGIP) Governing Board for 2010-2015 (end of 1Q) coordinating Smart Grid standards development in the United States and global harmonization of the standards. McDonald is a member of the NIST Smart Grid Advisory Committee and chair its Technical Subcommittee. McDonald is past president of the IEEE Power and Energy Society (PES), past chair of the Smart Energy Consumer Collaborative (SECC) board, and the vice president for technical activities for the U.S. National Committee (USNC) of CIGRE, and the past chair of the IEEE PES Substations Committee. He was on the IEEE board of directors as the IEEE Division VII Director. He is a member of the Advisory Committee for the annual DistribuTECH Conference, on the board of directors of the GridWise Alliance and chair of its Technical Committee, vice chair of the Texas A&M University Smart Grid Center Advisory Board and a member of the Purdue University Strategic Research Advisory Council. He received the 2009 Outstanding Electrical and Computer Engineer Award from Purdue University.

McDonald teaches a Smart Grid course at the Georgia Institute of Technology, a Smart Grid course for GE and substation automation, distribution SCADA and communications courses for various IEEE PES local chapters as an IEEE PES distinguished lecturer. He has published 80 papers and articles in the areas of SCADA, SCADA/EMS, SCADA/DMS and communications, and is a registered Professional Engineer (Electrical) in California, Pennsylvania and Georgia.

He earned his B.S.E.E. and M.S.E.E. (Power Engineering) degrees from Purdue University, and an M.B.A. (Finance) from the University of California-Berkeley. McDonald is a member of Eta Kappa Nu (Electrical Engineering Honorary) and Tau Beta Pi (Engineering Honorary), a Life Fellow of IEEE (member for 47 years) and was awarded the IEEE Millennium Medal in 2000, the IEEE PES Excellence in Power Distribution Engineering Award in 2002, the IEEE PES Substations Committee Distinguished Service Award in 2003, the IEEE PES Meritorious Service Award in 2015, the 2015 CIGRE Distinguished Member Award and the 2015 CIGRE USNC Attwood Associate Award.

McDonald has co-written five books – “Automating a Distribution Cooperative from A to Z: A Primer on Employing Technology” (National Rural Electric Cooperative Association – 1999), “Electric Power Substations Engineering-Third Edition” (CRC Press – 2012); “Power System SCADA and Smart Grids” (CRC Press – 2015); “Big Data Application in Power Systems” (Elsevier - 2017); and “Smart Grids: Advanced Technologies and Solutions-Second Edition” (CRC Press – 2018).

He has one U.S. Patent (9,853,448) on Systems and Methods for Coordinating Electrical Network Optimization (Dec. 26, 2017).

NAPS 2018 TECHNICAL PRESENTATIONS

MONDAY, SEPT. 10

9:30 – 10 a.m.	**Networking Break**
10 a.m. – noon	**Power Systems Dynamics, Stability and Control (paper session)** Location: CONFERENCE Track Chairs: T. Overbye and Ben Idris
	2018NAPS #24-Sub-Synchronous Resonance Damping using Battery Energy Storage System Javad Khazaei, Arash Asrari and Peter Idowu
	2018NAPS #50-Dynamic Phasor-based Stability Analysis of Multi-Terminal VSC-HVDC Links with Offshore AC Networks Asad Raza, Javad Khazaei, Arash Asrari and Peter Idowu
	2018NAPS #55-Detection of Sub-Synchronous Control Interaction (SSCI) Using Modal Identification Analysis and FFT Farshid Salehi, Igor Brandão Machado Matsuo and Wei-Jen Lee
	2018NAPS #57-Online Detection and Quantification of Transient Instability using Lyapunov Exponents from PMU Data Timothy Gubitz, Kat Sico and Aranya Chakrabortty
	2018NAPS #89-Stability Criteria for Power Systems with Damping Control and Asymmetric Feedback Delays Felipe Wilches-Bernal, David Copp, David Schoenwald and Ian Gravagne
	2018NAPS #99-CXSparse-Based Differential Algebraic Equation Framework for Power System Simulation Alec Yen, Hantao Cui and Kevin Tomsovic
	2018NAPS #119-Lyapunov Function Controlled Parallel Resonance Fault Current Limiter for Transient Stability Enhancement of Power System Dr. Mohammad Sadi and Dr. Mohd. Hasan Ali
10 a.m. – noon	**Power Systems Operations, Planning, and Economics (paper session)** Location: DIRECTOR’S Track Chairs: T. Hansen and B. Chowdhury
	2018NAPS #2-Short-Term Forecast for Locational Marginal Pricing (LMP) Data Sets Logan Peterson and Prakash Ranganathan
	2018NAPS #6-Transmission Constraint Relaxation and Pricing in the New York Electricity Market Guangyuan Zhang, Xian Guo, Mike Swider and Muhammad Marwali
	2018NAPS #18-SDP Based Unit Commitment Via Moment Relaxation Yikui Liu, Lei Wu and Jie Li

2018NAPS #22-Remedial Action Scheme Utilization Practices for Operational Studies in West Interconnection
Xiaping Zhang and Jason Ausmus

2018NAPS #28-Application of Optimization for Daily Scheduling of Renewable Distributed Generations Considering Market Profits in Distribution Networks
Paul Okunade, Meisam Ansari, Arash Asrari and Javad Khazaei

2018NAPS #36-Sparse Tableau Analysis for Power System Analysis and Design
Byungkwon Park, Jayanth Netha, Michael Ferris and Christopher Demarco

2018NAPS #38-Improving Resiliency of Power Grids during Extreme Events
Ali Abur and Ahmet Oner

10 a.m. – noon

Power Systems Communications and Cyber-security (paper session)
Location: BOARD
Track Chairs: A. Srivastava and R. Tonkoski

2018NAPS #11-Configuration of WAMS and Pilot Bus Selection for Secondary Voltage Control in the Egyptian Grid
Hady Fayek, Katherine Davis, A.M. Abdel Ghany and Omar Abdalla

2018NAPS #12-A Novel Integer Linear Programming Based Optimal PMU Placement Model
Yikui Liu, Jie Li and Lei Wu

2018NAPS #17-Least-Cost Joint Placement of PMUs and Flow Measurements for Ensuring Topological Observability under N-2 Contingencies While Improving State Estimation Accuracy
Songming Zhu, Lei Wu, Seyedamirabbas Mousavian and Yikui Liu

2018NAPS #21-On-Line Current Instrumentation Channel Error Correction Within Merging Units Using Constraint WLS Dynamic State Estimation Method
Yuan Kong, Sakis Meliopoulos and George Cokkinides

2018NAPS #29-Synchrophasor Applications as a Service for Power System Operation
Simon Mo, Heng Chen, Uday Kothapa and Lin Zhang

2018NAPS #30-An Equivalent Circuit Formulation for Power System State Estimation including PMUs
Aleksandar Jovicic, Marko Jereminov, Larry Pileggi and Gabriela Hug

2018NAPS #42-DC State Estimation Model-Based Mixed Integer Semidefinite Programming for Optimal PMU Placemen
Anas Almunif and Lingling Fan

10 a.m. – noon

Distribution Systems: Analysis, Operation and Control (paper session)
Location: EXECUTIVE
Track Chairs: J. Solanki and S. Kamalasadan

2018NAPS #10-Resilient Restoration for Distribution System Operators when Facing Extreme Events
Zheming Liang, Abdollah Kavousifard and Wencong Su

2018NAPS #44-A Solid State Transformer Model for Proper Integration to Distribution Networks
Darshit Shah, Bhanu Baddipadiga, Mariesa Crow and Mehdi Ferdowsi

2018NAPS #51-Electric Vehicles Contributions to Voltage Improvement and Loss Reduction in Microgrids
Mohammad Saeed Misaghian, Mohammadali Saffari, Mohsen Kia, Alireza Heidari, Payman Dehghanian and Bo Wang

2018NAPS #54-A Bilateral Transactive Energy Framework for Electric Power Distribution Systems
Juan Bedoya, Chen-Ching Liu and Anamika Dubey

2018NAPS #62-Multi-Microgrid Architecture: Optimal Operation and Control
Styliani Ioanna Kampezidou, Orestis Vasios and Sakis Meliopoulos

2018NAPS #168-A Cost Effective Energy Exchange Strategy to Improve Reliability of Microgrids
Md Kamruzzaman, Mohammed Ben-Idris and Hanif Livani

2018NAPS #63-Renewable Energy Planning for a Microgrid in a Pacific Northwest City
Husam Samkari, Herbert Hess and Brian Johnson

10 a.m. – noon

Emerging Topics in Modern Power Systems (paper session)
Location: FRONTIER
Track Chairs: V. Aravinthan and H. Salehfar

2018NAPS #1-Large Scale Desalination as a Cost Effective, Controlled Electric Load Resource
Gerald Thomas Heydt, Mohammad Al-Muhaini and Elias Kyriakides

2018NAPS #9-Optimal Operation of Smart Home Appliances using Deep Learning
Tareq Hossen, Arun Sukumaran Nair, Sima Noghanian and Prakash Ranganathan

2018NAPS #25-Robustness of Electric Power Engineering Education: Enrollments and University Research Funding Levels 1969Ð2018
Gerald Heydt, Vijay Vittal and Siddharth Suryanarayanan

2018NAPS #27-Reactive Power Control for Multiple Batteries Connected in Parallel Using Modified Power Factor Method
Oluwatosin Adeyemo, Peter Idowu, Arash Asrari and Javad Khazaei

2018NAPS #32-Evaluation of High Temperature Operation of Natural Ester Filled Distribution Transformers
Chinmay Vaidya, George Karady, Jeff Valmus, Alan Sbravati and Michael Dyer

10 a.m. – noon

2018NAPS #67-Electronic Power Waves in Networks of Inverters
Slobodan Vukosavic and Alex Stankovic

2018NAPS #83-Optimal Operation and Forecasts of Residential Electric Vehicles using DNN and Clustering
Arun Sukumaran Nair, Tareq Hossen, Mitch Campion and Prakash Ranganathan

Challenges and solutions to operation of transmission and distribution systems with utility-scale deployment of renewable generation (paper session)
Location: PRAIRIE
Track Chairs: K. Hatipoglu and M. Ilic

2018NAPS #8-Optimal Allocation of Long-Time-Scale Ramp Requirement with High Wind Penetration
Wenlong Liu, Guangchao Geng, Siyuan Wang, Haifeng Fan, Jing Yu and Quanyuan Jiang

2018NAPS #20-Effect of Solar PV Penetration on Residential Energy Consumption Pattern
Malhar Padhee and Anamitra Pal

2018NAPS #37-Instability of PLL-Synchronized Converter-Based Generators in Low Short-Circuit Systems and the Limitations of Positive Sequence Modeling
Wenzong Wang, Garng Huang, Prashant Kansal, Larry Anderson, Robert O'Keefe, Deepak Ramasubramanian, Evangelos Farantatos and Parag Mitra

2018NAPS #49-Two Lossy Multi-period Optimal Power Flow Formulations with Renewable Energy and Storage
Stephany Farfan-Ramirez, Guillermo Gutierrez Alcaraz and Gustavo Perez-Hernandez

2018NAPS #66-Energy Storage for Frequency Control in High Photovoltaic Power Grids
Shutang You, Yong Liu, Yilu Liu, Abigail Till, Jin Tan, Yingchen Zhang and Maozhong Gong

2018NAPS #70-A Stochastic Siting/Sizing Optimization Framework for Intermittent Renewable Energy DG Units
Mahmoud Ghofrani, Amirsaman Arabali, Anthony Suherli and Andrew Steeble

2018NAPS #156-Analysis of the operation and power quality of a microgrid with photovoltaic sources
Juan Lazarte, Orestis Vasios and Ap Meliopoulos

Break-out Paper Session #2

1 – 3 p.m.

Power Systems Dynamics, Stability and Control (paper session)
Location: CONFERENCE
Track Chairs: GT Heydt and S. Suryanarayanan

2018NAPS #127-Power Grid Partitioning: Static and Dynamic Approaches
Miao Zhang, Zhixin Miao and Lingling Fan

2018NAPS #135-Locational Dependence of Inertia's Impacts on Critical Clearing Time
Yijing Liu, Ti Xu and Thomas Overbye

2018NAPS #137-Visualization of Large-Scale Electric Grid Oscillation Modes
Ikponmwosa Idehen, Bin Wang, Komal Shetye, Thomas Overbye and James Weber

2018NAPS #140-Dynamic Simulation of the Arizona-Southern California Blackout to Develop a Wide Area Testbed
Munim Bin Gani and Sukumar Brahma

2018NAPS #181-Assessment and Design of Frequency Containment Reserves with HVDC Interconnections
Danilo Obradovic, Mehrdad Ghandhari and Robert Eriksson

2018NAPS #184-Impact of Geomagnetic Disturbances on Power System Transient Stability
Yiqiu Zhang, Komal Shetye, Raymund Lee and Thomas Overbye

2018NAPS #187-A Network-cognizant Aggregate-frequency Reduced-order Power System Dynamical Model
Bo Chen, Abdullah Al-Digs and Christine Chen

1 – 3 p.m.

Power Systems Operations, Planning and Economics (paper session)
Location: DIRECTOR'S
Track Chairs: T. Hansen and J. Khazaei

2018NAPS #43-A Search Space Reduction Strategy within the MILP Branch Flow Model for Concurrent AC Multistage Transmission Expansion and Reactive Power Planning
Miguel Alberto Torres Rodriguez, Carlos Castro and Marcos Rider

2018NAPS #46-A Data-Driven Model for Simulating the Evolution of Transmission Line Failure in Power Grids
Pankaz Das, Rezoan Ahmed Shuvro, Zhuoyao Wang, Majeed M. Hayat and Francesco Sorrentino

2018NAPS #47-Appropriate Tolerance Value Selection of Least Measurement Rejected Algorithm for Robust Power System State Estimation
Mohammad Shoaib Shahriar, Ibrahim Omar Habiballah and Farhan Ammar Ahmad

2018NAPS #48-A comparative analysis of two lossy DC Optimal Power Flow
J. Mariano Paniagua-Contreras, Guillermo Gutierrez Alcaraz and Victor Hinojosa

2018NAPS #52-Distributed Quasi-Dynamic State Estimation Incorporating Distributed Energy Resources
Boqi Xie, A. P. Sakis Meliopoulos, Chiyang Zhong, Yu Liu, Liangyi Sun and Jiahao Xie

2018NAPS #56-Distribution Locational Marginal Pricing (DLMP) for Multiphase Systems
Ibrahim Alsaleh and Lingling Fan

2018NAPS #58-Graphical Determination of Transient Cable Fault Location with Captured Time-Domain Data
Derrick Anang and Charles Kim

1 – 3 p.m.

Power Systems Communications and Cyber-security (paper session)
Location: BOARD
Track Chairs: B Johnson and K. Hatipoglu

2018NAPS #59-Optimal PMU Allocation for Enhanced Gross Error Detection
Cody Ruben, Surya Chandan Dhulipala, Arturo Suman Bretas and Newton Bretas

2018NAPS #79-MIP-Based Fault Location Identification Using MicroPMUs
Mohammed Alqahtani, Zhixin Miao and Lingling Fan

2018NAPS #103-ANDES: A Python-Based Cyber-Physical Power System Simulation Tool
Hantao Cui and Fangxing Li

2018NAPS #108-Synchrophasor-Based State Estimation for Voltage Stability Monitoring in Power Systems
Xinyun Lu, Xiaozhe Wang, Dmitry Rimorov, Hao Sheng and Geza Joos

2018NAPS #109-Impact of Real-Time Pricing Attack on Demand Dynamics in Smart Distribution Systems
Hazhar Sufi Karimi, Kumarsinh Jhala and Balasubramaniam Natarajan

2018NAPS #113-Synchrophasor Estimation Through An Eigensystem Realization Approach
Francisco Alexander Zelaya Arrazabal, Alejandro Zamora Mendez, Mario Arrieta Paternina and Saul Sarabia

2018NAPS #116-Exploiting Network-induced Correlation for Efficient Compression of PMU Data
Sowmya Acharya and Christopher L. Demarco

1 – 3 p.m.

Distribution Systems: Analysis, Operation and Control (paper session)
Location: EXECUTIVE
Track Chairs: S. Solanki and S. Kamalasadan

2018NAPS #71-A Distributed Strategy for Volt/VAR Control in Distribution Networks: A Smart Buildings Approach
Surya Chandan Dhulipala, Raul V. A. Monteiro, Cody Ruben, Arturo Bretas and Geraldo C. Guimaraes

2018NAPS #74-Community Microgrid Controller Evaluation using Hardware-in-the-Loop Testbed
Qian Long, Yuhua Du, Jian Lu, David Lubkeman, Srdjan Lukic, Ning Lu and John Camilleri

2018NAPS #78-Performance of Branch-Current Based Distribution System State Estimation
Sulaiman Almutairi, Zhixin Miao and Lingling Fan

2018NAPS #80-A Convex Optimization Approach for Distributed Energy Trading of Interconnected Microgrids
Tamal Roy, Zhen Ni and Marco Ciarcia

2018NAPS #90-Probabilistic Evaluation of Line Loading and Line Active Power in an Active Distribution Network Using Numerical and Analytical Approaches
Umair Shahzad and Sohrab Asgarpoor

2018NAPS #98-Stochastic Distribution System Market Clearing and Settlement via Sample Average Approximation
Josue Campos Do Prado, Hamid Vakilzadian, Wei Qiao and Dietmar Möller

2018NAPS #104-A Systematic Method for Reliability Index Evaluation of Distribution Networks in the Presence of Distributed Generators
Maziar Isapour Chehardeh and Constantine Hatziadoniu

1 – 3 p.m.

Emerging Topics in Modern Power Systems (paper session)
Location: FRONTIER
Track Chairs: P. Ranganathan and R. Tonkoski

2018NAPS #87-Impact of Time-Coupled Generator Formulation on Energy Storage Sizing Problem
Siyuan Wang, Guangchao Geng, Wenlong Liu and Quanyuan Jiang

2018NAPS #102-To Overconsume or Underconsume: Baseline Manipulation in Demand Response Programs
Xiaochu Wang and Wenyuan Tang

2018NAPS #111-Labs for EGN 3375 Electromechanical Energy Systems at University of South Florida
Zhixin Miao, Lingling Fan, Minyue Ma, Yin Li and Zhengyu Wang

2018NAPS #115-Optimal Positioning of Mobile Emergency Resources for Resilient Restoration
Shiva Poudel, Monish Mukherjee and Anamika Dubey

2018NAPS #117-A New Traveling Wave Representation for Propagation of Energy Transients in Power Lines from a Quantum Perspective
Wanghao Fei, Guomin Ji, Dhruv Sharma and John Jiang

2018NAPS #167-Advanced Rail Energy and Storage - Analysis of Potential Implementations for the State of West Virginia
Gregory Bottenfield, Kenan Hatipoglu and Yogendra Panta

2018NAPS #172-Establishing the Stacked Value of Battery Energy Storage in Electric Power Systems
Sujit Kumar Tripathy, Qian Deng, Daniel Tylavsky, Travis Stowers, Robert Hess and Jeff Loehr

1 – 3 p.m.

Challenges and solutions to operation of transmission and distribution systems with utility-scale deployment of renewable generation (paper session)
Location: PRAIRIE
Track Chairs: B. Bhattarai and A. Pal

2018NAPS #92-Volt/Var Optimization with Minimum Equipment Operation under High PV Penetration
Ibrahim Alsaleh, Lingling Fan and Hossein Ghassempour Aghamolki

2018NAPS #95-Impact Analysis of Power Network Structure on Grid Strength
Almir Ekic, Andrew Fischer, Ashley Eisenbeisz, Grant Lind, Al Motasem Aldaoudeyeh and Di Wu

2018NAPS #100-Sliding Mode Control for a Distributed Generation Unit Based on Photovoltaic Sources
Carlos Andres Ruiz Zea, Esteban Jimenez Rodriguez, Jose Manuel Cañedo and Alexander Loukianov

2018NAPS #101-Hedging Wind Risk through a Power-to-Gas Enabled Integrated Energy System
Junkai Liang and Wenyuan Tang

2018NAPS #112-Wireless and Real-Time Photovoltaic Power Monitoring System
Saul Sarabia, Carlos Figueroa, Francisco Alexander Zelaya Arrazabal, Alejandro Zamora Mendez and Mario Arrieta Paternina

2018NAPS #118-Application of Machine Learning Algorithm to Forecast Load and Development of a Battery Control Algorithm to Optimize PV System Performance in Phoenix, Arizona
Aashiek Hariharan, Dr George Karady and Joel Dickinson

2018NAPS #120-Battery Swapping Station as an Energy Storage for Capturing Distribution-Integrated Solar Variability
Zohreh S. Hosseini, Mohsen Mahoor and Amin Khodaei

Break-out Paper Session #3

3:30 – 5:30 p.m.

Power Systems Dynamics, Stability and Control (paper session)
Location: CONFERENCE
Track Chairs: F. Bernal and H. Salehfar

2018NAPS #188-Fault Mapping in Multi-machine Power Systems by Principal Component Sensitivity- An Energy Function Perspective
Abhishek Banerjee, Manisha Maharjan and Rajesh G. Kavasseri

2018NAPS #197-Anomaly Detection for Power System Generation Control based on Hierarchical DBSCAN
Pengyuan Wang and Manimaran Govindarasu

2018NAPS #203-Hexverter–Based Optimal Low Frequency AC Transmission System
Carlos Soriano Rangel and Fernando Mancilla-David

2018NAPS #213-Using Large Scale Synthetic Systems for Undergraduate Research in Electric Grid Islanding
D Bodenmiller, A Birchfield and T Overbye

2018NAPS #214-Prediction and Enhancement of Power System Transient Stability Using Taylor Series
A Sahami and S Kamalasadan

2018NAPS #215-Investigation On Evaluating The Unmodeled Dynamics of Power System And Its Effects on Characterizing Power System Oscillations
S Hossain and S Kamalasadan

2018NAPS #208-Fast Generator Placement Algorithm using High Performance Computing
Pavan Sajja and Dagmar Niebur

3:30 – 5:30 p.m.

Power Systems Operations, Planning and Economics (paper session)
Location: DIRECTOR'S
Track Chairs: T. Hansen and V. Aravinthan

2018NAPS #64-Bilevel Programming-Based Unit Commitment for Locational Marginal Price Computation
Abdullah Alassaf and Lingling Fan

2018NAPS #65-Transmission Line Fault Classification Based on Dynamic State Estimation and Support Vector Machine
Jiahao Xie, A. P. Sakis Meliopoulos and Boqi Xie

2018NAPS #76-Unscented Transformations for Probabilistic Load Flow
Juan Franco and Saeed Jafarzadeh

2018NAPS #86-Analysis of Automatic Defence Options for Nigeria: June 27th 2017 Blackout
Mohamed Osman, Barry Rawn and Tochi Nwachukwu

2018NAPS #88-Risk Management for Optimal Wind Power Bidding in an Electricity Market: A Comparative Study
Mohamed Alashery and Wei Qiao

2018NAPS #94-A Fundamental Economic Model of Interacting Electricity Prosumers
Evgeniya Tsybina, Santiago Grijalva and Juan Moreno-Cruz

2018NAPS #96-Geometrically Motivated Reparameterization for Identifiability Analysis in Power Systems Models
Mark Transtrum, Benjamin Francis, Clifford Youn, Andrija Saric and Aleksandar Stankovic

3:30 – 5:30 p.m.

Power Systems Communications and Cyber-security (paper session)
Location: BOARD
Track Chairs: S. Solanki and B. Johnson

2018NAPS #128-Estimation of Transmission Line Sequence Impedances using Real PMU Data
Prashanth Kumar Mansani, Anamitra Pal, Matthew Rhodes and Brian Keel

2018NAPS #134-Cyber Attack-Defense Analysis for Automatic Generation Control with Renewable Energy Sources
Srikrishna Sarangan, Vivek Kumar Singh and Manimaran Govindarasu

2018NAPS #160-A Survey of Voltage Stability Indicators Based on Local Synchronized Phasor Measurements
Hannes Hagmar, Tuan Le Anh, Robert Eriksson and Ola Carlson

2018NAPS #178-Demand Modeling of a dc Fast Charging Station
TQian Deng, Sujit Tripathy, Daniel Tylavsky, Travis Stowers and Jeff Loehr

2018NAPS #166-IEEE C37.118.1a-2014 Compliance Testing of EPLL and DFAC-PLL for Synchrophasors
Puneet Kumar and Gurunath Gurrala

2018NAPS #182-Multi-stage Optimal PMU Placement to Benefit System Voltage Stability
Saleh Almasabi, Nga Nguyen, Fares T. Alharbi and Joydeep Mitra

2018NAPS #194-Cyber Physical Security Analytics For Transactive Energy Systems Using Ensemble Machine Learning
Arman Ahmed, Vignesh V G Krishnan, Anurag K Srivastava, Yinghui Wu and Sindhu Suresh

3:30 – 5:30 p.m.

Distribution Systems: Analysis, Operation and Control (paper session)
Location: EXECUTIVE
Track Chairs: T. Hansen and V. Aravinthan

2018NAPS #114-Distribution Test System for Nontechnical Loss Detection
Rodrigo Trevizan, Aquiles Rossoni and Arturo Bretas

2018NAPS #124-Increasing Distribution Grid Hosting Capacity through Optimal Network Reconfiguration
Mansoor Alturki and Amin Khodaei

2018NAPS #125-Energy Management System for Interconnected Microgrids using Alternating Direction Method of Multipliers (ADMM)
Shravan Akula and Hossein Salehfar

2018NAPS #133-Stability-oriented Optimization and Consensus Control for Inverter-based Microgrid
Weihang Yan, Wei Gao, David Gao and James Momoh

2018NAPS #136-Optimal Scheduling of Integrated Microgrids in Holonic Distribution Grids
Abdullah Albaker and Amin Khodaei

2018NAPS #142-Optimal Energy Storage Sizing and Siting in Hybrid AC/DC Microgrids
Abdulaziz Alanazi, Hossein Lotfi and Amin Khodaei

2018NAPS #145-Centralized Microgrid Energy Management System Based on Successive Linearization
Maad Alowaifeer and A.P. Sakis Meliopoulos

3:30 – 5:30 p.m.

Emerging Topics in Modern Power Systems (paper session)
Location: EXECUTIVE
Track Chairs: A. Pahwa and D. Tylavsky

2018NAPS #121-Residential Load Forecasting Using Deep Neural Networks (DNN)
Tareq Hossen, Arun Sukumaran Nair, Radha Krishnan Angamuthu Chinnathambi and Prakash Ranganathan

2018NAPS #123-A Switched Reluctance Motor Drive System for Future Applications in the Emerged IMPS
Salem Elsaiah and Christian Alvarez

2018NAPS #129-Investigating Switching Surges on EHV Lines and Substations: A Practical Utility Case
Mohammed Mubashir Shaikh, George Karady and Snehal Dalal

2018NAPS #158-Real-Time Simulation of Electric Vehicle Battery Charging Systems
Li Bao, Lingling Fan and Zhixin Miao

2018NAPS #162-The Potential for a GIC-inclusive State Estimator
Cecilia Klauber, Gandhali Juvekar, Katherine Davis, Thomas Overbye and Komal Shetye

2018NAPS #164-A Robust Energy Storage System Siting Strategy Considering Physical Attacks to Transmission Lines
Kexing Lai, Di Shi, Hui Li, Mahesh Illindala, Dong Peng, Lixia Liu and Zhiwei Wang

2018NAPS #174-Making smart thermostats cost-effective by predicting the future
Orestis Vasios, Juan Lazarte, Mohit Srinivasan and Ap Meliopoulos

3:30 – 5:30 p.m.

Challenges and solutions to operation of transmission and distribution systems with utility-scale deployment of renewable generation (paper session)
Location: FRONTIER
Track Chairs: P. Mandal and R. Tonkoski

2018NAPS #130-Solar Photovoltaic output prediction using Jackknife Regression
Bilal Ahmad Bhatti and Robert Broadwater

2018NAPS #132-A Novel Double-Loop Control Structure Based on Fuzzy-PI and Fuzzy-PR Strategies for Single-Phase Inverter in Photovoltaic Application
Parham Mohammadi, Behrouz Azimian and Amir Shahirinia

2018NAPS #138-Optimal Smart Inverters Volt-VAR Curve Selection with a Multi-Objective Volt-VAR Optimization using Evolutionary Algorithm Approach
Mohammadsaleh Jafaritalarposhti, Temitayo Olowu and Arif Sarwat

2018NAPS #139-A Multi-Objective Optimization Technique for Volt-Var Control with High PV Penetration using Genetic Algorithm
Temitayo Olowu, Mohammadsaleh Jafaritalarposhti and Arif Sarwat

2018NAPS #141-Small Signal Analysis of a VSC-Based Battery Energy Storage System with V/f Control
Susham Doddabasappa, Oluwatosin Adeyemo, Javad Khazaei, Peter Idowu and Arash Asrari

2018NAPS #170-Transmission-Distribution Co-Simulation: Model Validation with Standalone Simulation
Yaswanth Nag Velaga, Gayathri Krishnamoorthy, Anamika Dubey, Aoxia Chen and Pankaj Kumar Sen

2018NAPS #191-Parallel Power Flow based on OpenMP
Afshin Ahmadi, Shaungshuang Jin, Melissa Smith and Randolph Collins

TUESDAY, SEPT. 11

8:15 – 9:15 a.m.

Plenary Session
Speaker: John D. McDonald, P.E.
Holiday Inn – Sterling, Crowne

Break-out Session #4

9:45 – 11:45 a.m.

Power Systems Operations, Planning and Economics #1 (paper session)
Location: CONFERENCE
Track Chairs: T. Hansen and S. Kamalasadan

2018NAPS #106-Robust Padé Approximation Applied to the Holomorphic Embedded Power Flow Algorithm
Songyan Li, Qirui Li, Daniel Tylavsky and Di Shi

2018NAPS #107-The Holmorphic Embedding Applied to a Newton Raphson Power Flow Formulation
Shruti Rao, Songyan Li, Daniel Tylavsky and Di Shi

2018NAPS #131-Minimization of Ohmic Losses in Power Networks by Utilization of Interphase Power Controllers
Behrouz Azimian, Amin Helmzadeh and Amir Shahirinia

2018NAPS #151-Enhanced Assessment of Power System Behavior during Multiple Contingencies
Paroma Chatterjee, Mojdeh Khorsand and Kory Hedman

2018NAPS #176-Impact of Initial Stressor(s) on Cascading Failures in Power Grid
Rezoan Ahmed Shuvro, Pankaz Das, Zhuoyao Wang, Mahshid Rahnamay-Naeini and Majeed M. Hayat

9:45 – 11:45 a.m.

Power Systems Operations, Planning and Economics #2 (paper session)
Location: DIRECTOR'S
Track Chairs: Nga Nguyen and S. Suryanarayanan

2018NAPS #175-Real-Time Phasor Estimation via the Taylor-Fourier's Subspace
Gerardo Avalos Almazan, Gabriela Castillo Garcia, Mario Arrieta Paternina, Alejandro Zamora Mendez, Jose Guadalupe Fuentes Velazquez, Juan Ramon Rodriguez Rodriguez and Daniel Guillen

2018NAPS #190-D-FACTS for Improved Reliability of the Transmission System During Contingencies
Alex Corredor, Hussain Beleed, Brian Johnson and Herbert Hess

2018NAPS #146-MILP Model for Reliability Optimization In Active Distribution Networks
Nader Aljohani, Cody Ruben, Surya Chandan Dhulipala, Arturo Bretas and Rochele Silva

2018NAPS #210-Practical Implementation of Synchrophasor Based Real-Time Contingency Analysis
Neeraj Nayak, Lin Zhang, Kenneth Martin, Ian Dobson, Anjan Bose and Dejan Sobajic

2018NAPS #219-A Probabilistic Perspective for Power Flow and Its Implication to Power Network Analysis
Alexander M. Malyscheff, Di Wu, Feng K. Ma and John N. Jiang

9:45 – 11:45 a.m.

Distribution Systems: Analysis, Operation and Control #1 (paper session)
Location: BOARD
Track Chairs: S. Kucuksari and P. Mandal

2018NAPS #183-An Investigation into the Role of Gas Turbines in Supporting Renewable Energy Integration
Nga Nguyen and Joydeep Mitra

2018NAPS #149-Overhead Power Line Sag Monitoring through Augmented Reality
M. Yusuf Sermet, Ibrahim Demir and Sadik Kucuksari

2018NAPS #152-Mathematical Morphological Filter Based Protection Scheme for DC Ring Microgrid System
H M Mesbah Maruf, Faria Kamal and Badrul Chowdhury

9:45 – 11:45 a.m.

2018NAPS #153-Game Theoretic Contribution of Demand Response in Real Time Power Procurement of Distribution System Operator
Ehsan Reihani, Alireza Eshraghi and Mahdi Motalleb

2018NAPS #180-An Artificial Neural Network based Approach to Electric Demand Response Implementation
Md Kamruzzaman, Mohammed Ben-Idris and Sesh Commuri

Distribution Systems: Analysis, Operation and Control #2 (paper session)
Location: EXECUTIVE
Track Chairs: S. Elsaiah and B. Johnson

2018NAPS #189-A dynamic state estimation based centralized scheme for microgrid protection
Orestis Vasios, Styliani Ioanna Kampezidou and Ap Meliopoulos

2018NAPS #198-Efficient Transactive Control for Energy Storage Management System in Prosumer-Centric Networked Microgrids
Eric Galvan, Paras Mandal, Shantanu Chakraborty and Ahmed Y. Saber

2018NAPS #202-Security Evaluation of Two Intrusion Detection Systems in Smart Grid SCADA Environment
Vivek Kumar Singh, Haythem Ebrahem and Manimaran Govindarasu

2018NAPS #209-An Improved DBSCAN Method for Self-sufficient Microgrid Design
Hongda Ren and Noel Schulz

2018NAPS #218-Forecasting Data Center Load Using Hidden Markov Model
Abhilasha Bajracharya, Md Riaz Ahmed Khan, Semhar Michael and Reinaldo Tonkoski

9:45 – 11:45 a.m.

Emerging Topics in Modern Power Systems (paper session)
Location: FRONTIER
Track Chairs: J. Solanki and D. Tylavsky

2018NAPS #185-Probabilistic Impact Analysis of Residential Electric Vehicle Charging on Distribution Transformers
Alejandro Palomino and Masood Parvania

2018NAPS #186-Application of a Simplified model of Solid State Transformer in Hybrid Residential Energy System - A Benchmark model
Manisha Maharjan, Abhishek Banerjee and Rajesh G. Kavasseri

2018NAPS #193-Optimal Trading Strategies for Energy Hubs Equipped with Power-to-Gas Technology
Junkai Liang and Wenyuan Tang

2018NAPS #195-Electric Circuit Theory Based Minimal Cut-Set Realization for Reliability Evaluation of Non-Directional Networks
Shayan Behzadirafi, Arun-Kaarthick Manoharan, Sandhya Rani Nadipalli, Hossein Salehfar and Visvakumar Aravinthan

9:45 – 11:45 a.m.

2018NAPS #199-Comparing the Impact of HEMP Electric Field Waveforms on a Synthetic Grid
Raymund Lee and Thomas Overbye

Challenges and solutions to operation of transmission and distribution systems with utility-scale deployment of renewable generation (paper session)
Location: PRAIRIE
Track Chairs: V. Aravinthan and P. Rangathan

2018NAPS #177-Small-Signal Stability of Islanded-Microgrids With DC side Dynamics of Inverters
Victor Paduani, Mahmoud Kabalan and Pritpal Singh

2018NAPS #196-Haiti RELAY: A Cost-Effective and Portable Solar Home System for Rural Haitian Regions
Jake Smith, Adam Kinsel, Bria Matthews, Jingfan Sun, Maryam Saeedifard and Frank Lambert

2018NAPS #205-Power Consumption Cost Optimization Using Solar Photovoltaic Systems for Data Centers
Alireza Eshraghi, Ashkan Sadeghi-Mobarakeh, Ehsan Reihani, Mahdi Motalleb and S.M.Ali Mousavi

2018NAPS #207-Distributed Generator Sizing for Joint Optimization of Resilience and Voltage Regulation
Monish Mukherjee, Shiva Poudel, Anamika Dubey and Anjan Bose

2018NAPS #216-Frequency Response in Grids with High Penetration of Renewable Energy Sources
Andre Luna, Ujjwol Tamrakar, Timothy M. Hansen and Reinaldo Tonkoski

11:45 a.m. – 1 p.m.

Awards Luncheon and Conference Closing
Holiday Inn – Royale, Embassy

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