

WESTERN PROTECTIVE RELAY CONFERENCE 2018

Monday, October 15, 2018

5:00 – 7:00 P.M. Registration – Spokane Convention Center
5:00 – 8:00 P.M. Visit Vendor Suites – Spokane Convention Center

Tuesday, October 16, 2018

All sessions are in the Spokane Convention Center

7:00 A.M. Registration— Spokane Convention Center
7:45 A.M. Dr. Anjan Bose, Program Chair
Washington State University

SESSION I (General Session)

Moderator: Bogdan Kasztenny

8:00–8:35 A.M. ***Five Surprises Discovered With Megahertz Sampling and Traveling-Wave Data Analysis***
Edmund O. Schweitzer, III, Schweitzer Engineering Laboratories, Inc.
Veselin Skendzic, Schweitzer Engineering Laboratories, Inc.
Armando Guzmán, Schweitzer Engineering Laboratories, Inc.
Venkat Mynam, Schweitzer Engineering Laboratories, Inc.
Jean León Eternod, Schweitzer Engineering Laboratories, Inc.

8:40–9:15 A.M. ***BC Hydro Protection Interconnection Practices for Sources with Inverter or Converter Interface***
Mukesh Nagpal, BC Hydro
Charles Henville, Henville Consulting Inc.

9:15 A.M. BREAK

9:35–10:10 A.M. ***Evaluation of 13kV Dry-Type Shunt Reactor Protection following Near-Miss***
Gary Kobet, Tennessee Valley Authority

10:15–10:50 A.M. ***Overcurrent Protection - Old Truths and New Applications***
Charles Henville, Henville Consulting Inc

10:55–11:30 A.M. ***Utility experience with travelling wave fault locating on lower voltage transmission lines.***
Robert James, Pacific Gas & Electric Co.
Scott Hayes, Pacific Gas & Electric Co.

11:30 A.M. LUNCH—Spokane Convention Center

SESSION II – Transmission 1 (Concurrent with Session III)

Moderator: Ian Riensche

- 1:15–1:50 P.M. ***Grounding Considerations for Line Relaying***
Aaron Findley, POWER Engineers, Inc.
Jared Mraz, POWER Engineers, Inc.
David Lewis, POWER Engineers, Inc.
- 1:55–2:30 P.M. ***Protection and Control issues associated with Shunt Compensated Transmission Lines***
Pratap Mysore, Pratap Consulting Services, LLC
Paul Nyombi, Xcel Energy
Derrick Schlangen, Great River Energy
- 2:30 P.M. BREAK
- 2:50–3:25 P.M. ***69kV Line Relay Misoperation Due to Zero Sequence Mutual Coupling on Non-Parallel Lines***
Sergio Flores Castro, San Diego Gas & Electric
Ahsan Mirza, San Diego Gas & Electric
Girolamo Rosselli, Rosselli Utility Services LLC
- 3:30–4:05 P.M. ***New Design of directional Ground Fault Protection 67N***
Joerg Blumschein, Siemens AG
Yilmaz Yelgin, SIEMENS
- 4:10–4:45 P.M. ***CCVT Failures and Their Effects on Distance Relays***
Derrick Haas, Schweitzer Engineering Laboratories, Inc.
Sophie Gray, CenterPoint Energy
Ryan McDaniel, Schweitzer Engineering Laboratories, Inc.
- 4:45 P.M. ADJOURN

SESSION III – 61850 (Concurrent with Session II)

Moderator: Galina Antonova

- 1:15–1:50 P.M. ***Interfacing IEC 61850 Station Bus Protection to Existing Protection in a Brown-field Substation***
Donald Pratt, Consolidated Edison Company of New York, Inc.
Mark Seiter, Consolidated Edison Company of New York, Inc.
- 1:55–2:30 P.M. ***Hydro One experience in digitizing transmission substation and new approach in distribution protection***
David Ma, Hydro One
Anne Deng, Hydro One
Kevin Donahoe, GE Power
Mital Kanabar, GE Power

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| 2:30 P.M. | BREAK |
| 2:50–3:25 P.M. | <p><i>Substation Protection Applications with IEC 61850 Standard</i>
 Ian Higginson, POWER Engineers, Inc.
 Kirsten Petersen, San Diego Gas & Electric
 Prajwal Raval, Samearth Consulting Engineers
 Aaron Findley, POWER Engineers, Inc.
 Jared Eby, POWER Engineers, Inc.
 Jake Groat, POWER Engineers, Inc.</p> |
| 3:30–4:05 P.M. | <p><i>The Development of Self-Monitoring Substation Protection and Control System Using the IEC 61850 standard with VLAN translation as a GOOSE Isolation Tool that expedites the commissioning and routine updating of existing IEDs.</i>
 Aaron Martin, Bonneville Power Administration
 Tracy Yuan, Bonneville Power Administration
 Myla Matson, Bonneville Power Administration
 Jun Zha, Double Tree Systems
 Weiyang Wayne Lu, Double Tree Systems</p> |
| 4:10–4:45 P.M. | <p><i>First Digital Substation in TransGrid – Australia: A journey, Business case, Lessons</i>
 Mike Ramlachan, GE Grid Solutions
 Kevin Hinkley, TransGrid, Australia
 Chirag Mistry, GE Grid Solutions</p> |
| 4:45 P.M. | ADJOURN |
| 4:45 – 8:00 P.M. | Visit Vendor Suites – Spokane Convention Center |

Wednesday, October 17, 2018

SESSION IV – Transformers (Concurrent with Session V)

Moderator: Mukesh Nagpal

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| 8:00–8:35 A.M. | <p><i>Time-Domain Elements Optimize the Security and Performance of Transformer Protection</i>
 Bogdan Kasztenny, Schweitzer Engineering Laboratories, Inc.
 Michael Thompson, Schweitzer Engineering Laboratories, Inc.
 Douglas Taylor, Schweitzer Engineering Laboratories, Inc.</p> |
| 8:40–9:15 A.M. | <p><i>Application Considerations for Protecting Transformers With Dual Breaker Terminals</i>
 Ryan McDaniel, Schweitzer Engineering Laboratories, Inc.
 Shahab Uddin, American Electric Power
 Abu Bapary, American Electric Power</p> |

Michael Thompson, Schweitzer Engineering Laboratories, Inc.
Kunal Salunkhe, Schweitzer Engineering Laboratories, Inc.

9:15 A.M. BREAK

9:35–10:10 A.M. ***Improving Security of Sensitive Protective Elements during CT Saturation***

Fenghai Sui, Hydro One Networks Inc
Abu Zahid, Hydro One Networks Inc.

10:15–10:50 A.M. ***Phase-Shifting Transformer Control and Protection Settings Verification***

Kamal Garg, Schweitzer Engineering Laboratories, Inc.
Bill Cook, San Diego Gas & Electric
Michael Thompson, Schweitzer Engineering Laboratories, Inc.
Milind Malichkar, Schweitzer Engineering Laboratories, Inc.

10:55–11:30 A.M. ***Open-Phase Detection for Station Auxiliary Transformers***

Ahmed Abd Elkader, Schweitzer Engineering Laboratories, Inc.
Kirk Robbins, Exelon Generation Company, LLC
Dwayne Cox, Exelon Generation Company, LLC
Harish Chaluvadi, Schweitzer Engineering Laboratories, Inc.

11:30 A.M. LUNCH—Spokane Convention Center

SESSION V – System Performance/RAS (Concurrent with Session IV)

Moderator: Charlie Henville

8:00–8:35 A.M. ***GSE Experience With a Country-Wide Distributed Remedial Action Scheme for Power System Protection and Control***

Fernando Calero, Schweitzer Engineering Laboratories, Inc.
Alexander Didbaridze, Georgian State Electrosystem
Vladimer Korganashvili, Georgian State Electrosystem
Pedro Loza, Schweitzer Engineering Laboratories, Inc.
Alejandro Carbajal, Schweitzer Engineering Laboratories, Inc.

8:40–9:15 A.M. ***Innovative Approach to Meet NYC System Reliability and Resilience Needs***

Ed Chen, Con Edison
Anastasia O'Malley, Con Edison
Nadia Ali, Con Edison
Leslie Philp, Con Edison
Diego Pichardo, Con Edison
Fabricio Mantilla, Con Edison
Rogerio Scharlach, Schweitzer Engineering Laboratories, Inc.

9:15 A.M. BREAK

- 9:35–10:10 A.M. ***Best Practices for Developing and Implementing a New Protection Design Standard***
Scott Hayes, Pacific Gas and Electric
Aaron Feathers, Pacific Gas and Electric
- 10:15–10:50 A.M. ***Microgrid Control System Protects University Campus From Grid Blackouts***
Krishnanjan Gubba Ravikumar, Schweitzer Engineering Laboratories, Inc.
John Dilliot, University of California, San Diego
Bharath Nayak, Schweitzer Engineering Laboratories, Inc.
Ashish Upreti, Schweitzer Engineering Laboratories, Inc.
- 10:55–11:30 A.M. ***What are the NERC efforts to reduce protection system misoperations related to commissioning testing practices?***
Segundo (Jerry) Timiraos, Pacific Gas and Electric Co.
- 11:30 A.M. LUNCH—Spokane Convention Center

SESSION VI – Substation (Concurrent with Session VII)

Moderator: Jared Mraz

- 1:15–1:50 P.M. ***230 KV SUBSTATION SHUNT CAPACITOR BANK FAILURE AND CASCADING AREA DISTURBANCES***
Aaron Feathers, Pacific Gas and Electric
Leo B. Hisugan, Pacific Gas & Electric Company
Fortino Arroyo Rivera, Pacific Gas & Electric Company
- 1:55–2:30 P.M. ***Protection and Control Dependencies on Time: Applications, Challenges and Solutions***
Galina Antonova, ABB Inc
Marc Weiss, Marc Weiss Consulting
Davis P. Erwin, PG&E
- 2:30 P.M. BREAK
- 2:50–3:25 P.M. ***Circuit Breaker Ratings – A Primer for Protection Engineers***
Bogdan Kasztenny, Schweitzer Engineering Laboratories, Inc.
Joe Rostron, Southern States, LLC
- 3:30–4:05 P.M. ***Enabling Teleprotection via packet switch wide area networks with guaranteed performance***
Ramon Baechli, ABB
Martin Haeusler, ABB
Adolf Frei, ABB
Samuel Alves, ABB

4:10–4:45 P.M. ***Addressing Analog Leased Line Obsolescence by Preserving Protection Channel Performance Over Ethernet***
Paul Robertson, Schweitzer Engineering Laboratories, Inc.
Jonathan Geurink, Consumers Energy
Kevin Crandall, Consumers Energy
Ken Fodero, Schweitzer Engineering Laboratories, Inc.

4:45 P.M. ADJOURN

SESSION VII – Generator Protection (Concurrent with Session VI)

Moderator: Jeanne Harshbarger

1:15–1:50 P.M. ***Generator Third-Harmonic Protection Explained***
Dale Finney, Schweitzer Engineering Laboratories, Inc.
Ritwik Chowdhury, Schweitzer Engineering Laboratories, Inc.
Normann Fischer, Schweitzer Engineering Laboratories, Inc.
Jason Young, Schweitzer Engineering Laboratories, Inc.
Terry Foxcroft, Snowy Hydro

1:55–2:30 P.M. ***Shaft Currents and Rotating Machinery***
Terry Foxcroft, Snowy Hydro

2:30 P.M. BREAK

2:50–3:25 P.M. ***Stator Ground Protection for Multiple High-Impedance Grounded Generators Sharing a Common Bus***
Ritwik Chowdhury, Schweitzer Engineering Laboratories, Inc.
Dale Finney, Schweitzer Engineering Laboratories, Inc.
Normann Fischer, Schweitzer Engineering Laboratories, Inc.
Jason Young, Schweitzer Engineering Laboratories, Inc.
Veselin Skendzic, Schweitzer Engineering Laboratories, Inc.
Subhash Patel, Schweitzer Engineering Laboratories, Inc.

3:30–4:05 P.M. ***An Introduction to Completing a NERC PRC-026 Study for Traditional Generation Applications***
Matt Horvath, POWER Engineers, Inc.
Matt Manley, POWER Engineers Inc.

4:10–4:45 P.M. ***Capability Curve-Based Generator Protection Minimizes Generator Stress and Maintains Power System Stability***
Armando Guzman, Schweitzer Engineering Laboratories, Inc.
Matchyaraju Alla, Schweitzer Engineering Laboratories, Inc.
Dale Finney, Schweitzer Engineering Laboratories, Inc.
Normann Fischer, Schweitzer Engineering Laboratories, Inc.

4:45 P.M. ADJOURN

4:45 – 6:00 P.M. Visit Vendor Suites – Spokane Convention Center

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SESSION VIII – Transmission 2 (Concurrent with Session IX)

Moderator: Pratap Mysore

8:00–8:35 A.M. ***Arc Resistance Coverage and Mho Expansion – The Devil is in the Details***
Craig Holt, Patterson Power Engineers, LLC
Meyer Kao, Patterson Power Engineers, LLC
Akram Saad, Patterson Power Engineers, LLC

8:40–9:15 A.M. ***Field Experience With an Ultra-High-Speed Line Relay and Traveling-Wave Fault Locator***
Venkat Mynam, Schweitzer Engineering Laboratories, Inc.
Akhilesh Chandrakar, Tata Power Company Limited
Sthitaprajnyan Sharma, Schweitzer Engineering Laboratories, Inc.
Sajesh Vadakkethil, Schweitzer Engineering Laboratories, Inc.

9:15 A.M. BREAK

9:35–10:10 A.M. ***Practical Experience With Ultra-High-Speed Line Protective Relays***
Frank Heleniak, Schweitzer Engineering Laboratories, Inc.
Nicholas Metzger, Baltimore Gas and Electric Company
Benjamin Carstens, Baltimore Gas and Electric Company

10:15–10:50 A.M. ***A creative Line Differential Protection scheme for the Hudson River Crossing section of a 345kV Transmission Line***
Mike Kockott, ABB Inc
Bharat Vasudevan, ABB Inc
Alex Echeverria, NYPA
Eric Anderson, NYPA

10:55–11:30 A.M. ***Low-Cost Fast Bus Tripping Scheme Using High-Speed Wireless Fault Sensors***
Jeremy Blair, Schweitzer Engineering Laboratories, Inc.
Eric McCollum, Blue Ridge Electric Cooperative
Kei Hao, Schweitzer Engineering Laboratories, Inc.
Shankar Achanta, Schweitzer Engineering Laboratories, Inc.
David Keckalo, Schweitzer Engineering Laboratories, Inc.

11:30 A.M. LUNCH—Spokane Convention Center
Keynote
Dr. James Merlo, NERC

SESSION IX – New Sources/Renewables (Concurrent with Session VIII)

Moderator: Ron Forster

- 8:00–8:35 A.M. ***Protection & Control strategy for effectively interconnecting and islanding Distributed Energy Resources during grid disturbances***
Joe Xavier, ABB Inc
TBD, ABB
- 8:40–9:15 A.M. ***Talega SynCon - Power Grid Support for Renewable-based Systems***
Cesar Guerriero, Siemens
Christopher J Bolton, San Diego Gas and Electric (SDG&E)
Tariq Rahman, San Diego Gas and Electric (SDG&E)
Ha Thi Nguyen, Technical University of Denmark
Guangya Yang, Technical University of Denmark
Peter Højgaard Jensen, Siemens
- 9:15 A.M. BREAK
- 9:35–10:10 A.M. ***Protective Relaying for Distribution and Microgrids Evolving from Radial to Bi-Directional Power Flow***
Thomas McDermott, Pacific Northwest National Laboratory
Travis Smith, Oak Ridge National Laboratory
Joshua Hambrick, Oak Ridge National Laboratory
Arthur Barnes, Los Alamos National Laboratory
Rui Fan, Pacific Northwest National Laboratory
Bharat GNVS Vyakaranam, Pacific Northwest National Laboratory
Priya Thekkumparambath Mana, Pacific Northwest National Laboratory
Zhi Li, Oak Ridge National Laboratory
- 10:15–10:50 A.M. ***AEP Experience with Sub-Synchronous Oscillation Phenomenon***
Zachary Campbell, American Electric Power
Kiril Andov, American Electric Power
Shawn Coppel, American Electric Power
- 10:55–11:30 A.M. ***Negative sequence current injection by power electronics based generators and its impact on faulted phase selection algorithms of distance protection***
David López, Red Eléctrica de España S.A.U
Ruben Andrino, Red Eléctrica de España S.A.U
Lucía Pindado, Red Eléctrica de España S.A.U
Eduardo Martínez, CIRCE
Mayte Villén, CIRCE
Samuel Borroy, CIRCE
Rahul Dubey, TU DELFT
Marjan Popov, TU DELFT

11:30 A.M. LUNCH—Spokane Convention Center
Keynote
Dr. James Merlo, NERC

SESSION X – Fault Locating/Misc (General Session)

Moderator: Kevin Damron

1:15–1:50 P.M. ***Application and Staged Testing of the Travelling Wave Fault Locator at Extra-Long HVDC Line***

Ilia Voloh, GE Grid Solutions
Diogo Totti Custódio, Interligações Elétricas do Madeira
Alberto Becker Soeth Jr, GE Grid Solutions
Paulo Renato Freire de Souza, GE Grid Solutions

1:55–2:30 P.M. ***Traveling-Wave Fault Locating for Multiterminal and Hybrid Transmission Lines***

Venkat Mynam, Schweitzer Engineering Laboratories, Inc.
Stephen Marx, Bonneville Power Administration
Yajian Tong, Schweitzer Engineering Laboratories, Inc.

2:30 P.M. BREAK

2:50–3:25 P.M. ***Analysis Technique for Ground Faults in Resistively Grounded Systems: Visiting an Old Friend, the BDD Relay***

David Williams, FirstEnergy Corporation
Dr. Allen G. Morinec, FirstEnergy Corporation

3:30–4:05 P.M. ***Computationally Efficient Methods for Improved Double-Ended Transmission Line Fault Locating***

Normann Fischer, Schweitzer Engineering Laboratories, Inc.
Kanchanrao Dase, Schweitzer Engineering Laboratories, Inc.

4:10–4:45 P.M. ***Holistic Security***
Roy Moxley, Siemens

4:45 P.M. ADJOURN

2018 WPRC Fundamentals Session

Tuesday, October 16, 2018

Session I: 1:15 p.m. – 2:30 p.m.

Basics of Protection

Terrence Smith, GE

Moderator: Aaron Feathers

- ☐ Components of protective systems
 - Breakers
 - Relay input sources
 - CTs
 - PTs
 - CCVTs
- ☐ Zones of protection
- ☐ Schematic diagrams
 - AC
 - DC
- ☐ Device numbers
- ☐ Sensitivity, selectivity, reliability, dependability vs. security

Session II: 2:50 p.m. – 4:45 p.m.

Symmetrical Components

Joe Xavier, ABB, Inc.

Moderator: Iliia Voloh

- ☐ Symmetrical components overview
- ☐ Sequence impedances of equipment and what affects them
- ☐ Network connections for fault calculations

Wednesday, October 17, 2018

Session III: 8:00 a.m. – 9:15 a.m.

Line Overcurrent Protection (radial systems)

Kevin Damron, Avista Utilities

Moderator: Roy Moxley

- ☐ Coordination principles for radial systems
 - General coordination principles of overcurrent devices in distribution feeders
 - Principles and methods to coordinate fuses and other distribution protective devices with overcurrent relays

Session IV: 9:35 a.m. – 11:30 a.m.

Non-pilot Line Protection (lines with two sources)

Héctor Altuve, Schweitzer Engineering Laboratories, Inc.

Moderator: Kevin Damron

- ☐ Basic principles
- ☐ Directional overcurrent
- ☐ Distance

- ☐ Coordination considerations

Session V: 1:15 p.m. – 2:30 p.m.

Bus Protection

Matthew Leyba, GE

Moderator: TBD

- ☐ Low-impedance
- ☐ High-impedance
- ☐ Zone interlock
 - Instrument transformer and control circuit considerations of each

Session VI: 2:50 p.m. – 4:45 p.m.

Pilot Protection

Mike Kockott, ABB, Inc.

Moderator: Ahsan Mirza

- ☐ Basic principles
 - Extends instantaneous protection to 100% of line
 - Relies on communications
- ☐ Directional comparison blocking
- ☐ DUTT/PUTT/POTT/DTT
- ☐ Phase comparison
- ☐ Line differential

Thursday, October 18, 2018

Session VII: 8:00 a.m. – 9:15 a.m.

Generator Protection

Roy Moxley, Siemens

Moderator: Charlie Henville

- ☐ Voltage-controlled / voltage-restrained overcurrent
- ☐ Differential
- ☐ 100% stator ground protection
- ☐ Loss of field

Session VIII: 9:35 a.m. – 11:30 a.m.

Transformer Protection

Héctor Altuve, Schweitzer Engineering Laboratories, Inc.

Moderator: TBD

- ☐ Fuse
- ☐ Overcurrent
- ☐ Differential
- ☐ Restricted earth fault
- ☐ Non-electrical (sudden pressure, low oil, etc.)

Session IX: 1:15 p.m. – 2:30 p.m.

Event Discussion

Various utility volunteers

Moderator: TBD

- ☐ A-B-C-Fox-to-Ground
 - Cheryl Nez, Salt River Project
- ☐ Analysis of 138/13.8 kV Transformer Differential Misoperation Points to Faulty CT
 - JC Theron, GE Grid Solutions
- ☐ Out of Zone Bus Trip Depoe Bay
 - Steve Alexanderson, Central Lincoln PUD

Session X: 2:50 p.m. – 4:45 p.m.

Event Discussion

Various utility volunteers

Moderator: Aaron Feathers

& Jeanne Harshbarger

- ☐ 87R Differential Trip During a Through Fault Condition
 - Scott Griffith, Duke Energy Renewable's
- ☐ Destruction in the Desert
 - Jeff Irving, Salt River Project
- ☐ Wind Farm Sensitive Directional Overcurrent Undesired Operation for Remote System Disturbance
 - Ian Higginson, POWER Engineers, Inc.
- ☐ Out of Zone Trip for a Transformer Failure
 - Steve Gooding, Georgia Power Company
- ☐ Lesson Learned from Multiple Simultaneous Cable Faults
 - John Wang, National Grid