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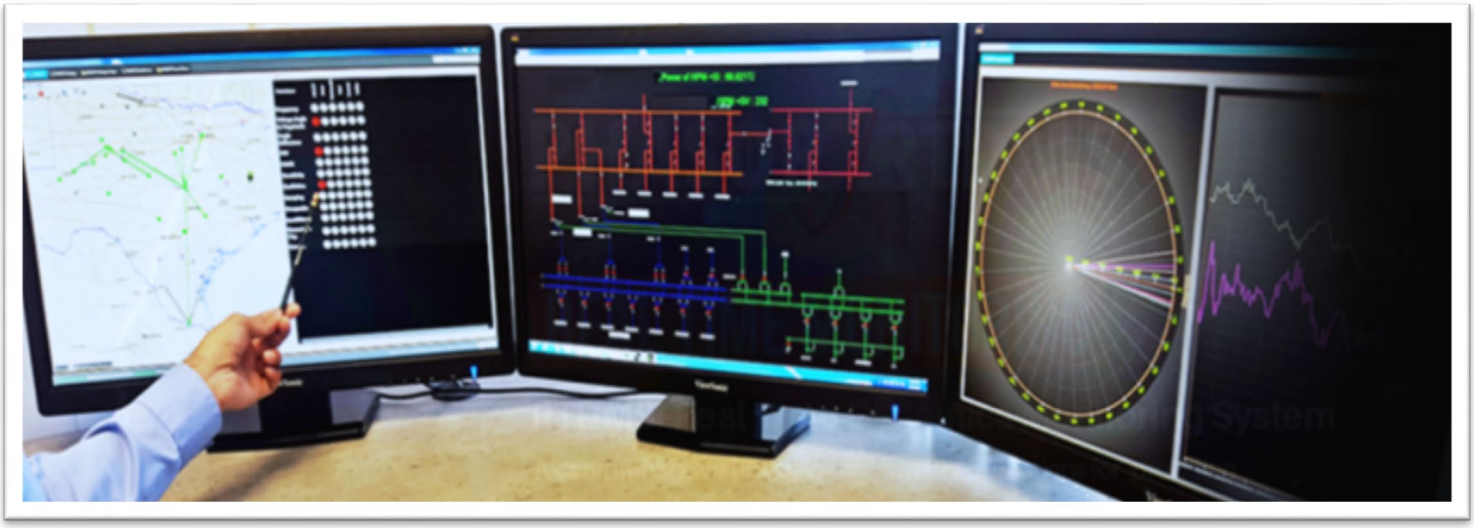

Phasor Simulator Training Course

Date: June 24 - 26, 2019

Time: 8:30 AM – 4:30 PM

Purpose

Since the August 2003 Blackout that affected 50 million people in Canada and Northeast U.S.A, Synchrophasor Technology has been widely deployed and used by utilities and ISOs.

Synchrophasors provide high resolution time synchronized data that enables monitoring of power system dynamic metrics such as oscillations, damping, phase angles, frequency instability, and voltage sensitivities that are not observable with EMS/SCADA.

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Synchrophasors are the next generation technology being used for:

- Wide Area Situational Awareness
- Oscillation Monitoring
- Event Root Cause Diagnostics and Analytics
- Model Validation
- Improved State Estimation
- Compliance with NERC Guidelines and Standards

Course Description

The focus of the Phasor Simulator Training Course is on the use of synchrophasor technology to improve the operation and design of electric power grids. The training course will encompass the basic concepts, the mainstream tools to visualize grid conditions, use of simulations to visualize extreme events, and introduction to advanced tools such as oscillations, event detection, root cause analysis and validation of power system models.

Field matured Synchrophasor based analytic applications and visualization tools from EPG and PSCAD simulation tool from MHI will be used throughout the training course to reflect the in-depth understanding of the benefits of synchrophasor technology under various system contingencies.

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The Training will equip students to:

1. Fully understand the capabilities of synchrophasors to provide wide-area visibility of power grid conditions and stresses

2. Use synchrophasor applications to gain wide-area detailed assessments

3. Know when, and under what conditions, to use the general purpose wide-area visibility tools, as well as advanced tools to perform oscillation monitoring and diagnosis, root-cause identification, mathematical model validation, disturbance recording, major event simulation and others

When the students return to their home offices, they will have a working knowledge of the synchrophasor tools and copies of reference materials to equip them to begin applying their knowledge.

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Agenda:

Day 1 - Getting started

- Introduction to Synchrophasor Technology
- Synchrophasor Industry Standards and Testing Procedures
- Synchrophasor Infrastructure
  - Time Synchronization
  - PMU and PDC
  - Synchrophasor Data Quality Issues
- Differences between SCADA and Synchrophasors
- Synchrophasor Metrics
- Phase Angles and their importance in Grid Operations
  - Detecting Grid Vulnerability to Outage
  - Taking Preventative Remedial Action
  - Line closing
  - Detecting System Separation and Islanding
- Types of Grid Event Signatures
  - Generation Trip, Line Fault, Line Trip, Load Trip, Islanding, Oscillations
- Using Grid Event Signatures
  - Identify Event Type
  - Event Diagnosis - Using Synchrophasor Metrics
  - Corrective Action – Using Phase Angle Differences
- Introduction to Power System Oscillations
  - Importance of Oscillations
  - Characteristics of Oscillations
  - Types of Oscillations
- Identify and analyze Oscillations
  - Oscillation Monitoring
  - Oscillation Detection








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Day 2 - Real Time Operations Synchrophasor Cases

- Basic Examples
  - Fault and line trip
  - Voltage or power flow out of bounds
  - Generation drop
  - System load frequency response
- Intermediate Examples
  - Grid Stability Monitoring
  - Line Reclosing using voltage phase angles
  - Using Phasor Alarms to Prevent Cascading Outages
  - Marking System Events for Replay and Training
  - Oscillation Detection and Remediation

Day 3 - Real Time Operations Synchrophasor Cases

- Islanding Detection and Grid Restoration
- Automatic Event Analysis:
  - Root-Cause Diagnostics & Operator Action
- Identifying Voltage Stability Issues
- Detecting System Vulnerability using Composite Alarms
- Hands-on Guided Event Exercises

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Advanced Courses (available upon request):

1. Oscillations – Oscillations arise from wind/solar resources, or defective control systems at generating stations.
2. Supplemental fault analysis – Often synchrophasors can be useful in analyzing faults and transients, especially when the sampling rates are high and individual A, B and C phases are monitored. Symmetrical components techniques may be used.
3. Unbalanced conditions – In special circumstances, phase imbalances in currents and voltages can cause undesirable effects, equipment damage and outages. Synchrophasors can be useful in understanding unbalance when individual A, B and C phases are monitored. Symmetrical components techniques may be used.
4. Verification of mathematical models for excitation systems – Invalid models can lead to power systems being operated outside their actual capabilities (e.g. In North America as per NERC Mod 26 standard).
5. Verification of mathematical models for governor systems (e.g. In North America as per NERC Mod 27 standard).
6. Verification of system dynamics mathematical models (In North America as per NERC Mod 33 standard).

Training Venue:

211 Commerce Drive

Winnipeg, Manitoba, Canada

Price:

$2,000 CAD - Per Participant

For group pricing and other inquiries, please contact:

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