TEEBA Engineering Inc.

Reaping Excellence in Training and Consultancy

www.teebaengineering.com / Phone: 905-301-1177

Electrical / Civil / Construction / Mechanical / Project Management

TEEBA

Power Quality, Harmonics Analysis and EMF

March 28-29, 2016. Hampton Inn, Mississauga West, Ontario
April 18-19, 2016. Hampton Inn, Calgary Airport, Alberta

Course Description

Power must be supplied that allows loads to operate effectively, regardless the size of the electrical system. Power disturbances often cross the meter boundary between electrical utility and user causing motor overheating, transformer failure, nuisance tripping, data corruption, light flickering and voltage sags and swells. More equipment is in use today than ever before that is sensitive to power quality problems: VFDs, PLCs, computers, electronic ballasts, data processing and medical equipment. These same loads are often the source of power quality problems. The ability to quickly identify, analyze and remedy power quality problems will help ensure metering accuracy, lengthen the life of electrical equipment and improve power system availability.

The Power Quality, Harmonic Analysis and EMF Seminar combines extensive field measurement and study experience to familiarize attendees with the terminology and concepts to evaluate power quality and EMF effects. The effects of harmonics on various power system components and methods of reducing excessive harmonics will also be addressed.

Who Should Attend

Electric power utility engineers, power quality engineers, power system engineers, construction and project managers, consulting engineers, electrical technicians, contractors and professionals concerned with power quality problems arising from grounding practices and EMI phenomena

Learning Objectives

- Identify power quality indices
- Recognize symptoms of power quality problems including sags, swells, under or overvoltage, harmonics, transients, electrical noise (EMI/RFI/EMF), interruptions, wiring and grounding issues
- Classify power quality events according to IEEE, ITIC (CEBNA) and public utility standards
- Explain proper application and interpret results of power quality monitoring equipment
- Recommend viable solutions including UPS, line voltage regulators, transient (surge) suppressors, harmonic filters, k-rated, isolation and zig-zag transformers, proper wiring and grounding, etc.
- Recognize EMF and EMC issues and mitigations

Course Outline

Day I | March 28, 2016

1. **Introduction to Power Quality Analysis**
   a. Review of Industrial Power Systems Concepts
   b. Power Quality Definitions and Indices
   c. Equipment Ratings
   d. Effects of Disturbances on Equipment and Processes

2. **Industry Commitment to Power Quality**
   a. IEEE Standards and Recommendations
   b. EPRI Survey Results
   c. Challenges Facing Utilities for a Power Quality Program

3. **Harmonics**
   a. Sources of Harmonics
   b. Symptoms and Effect on Equipment
   c. Power Factor Capacitors and Resonance
   d. Harmonic Limitations (IEEE Standard 519)
   e. Series Resonance and Filter Design
   f. Third Harmonic Neutral Current

4. **Calculation of Harmonic Voltages and Currents**
   a. System Harmonic Models
   b. The Current Injection Method
   c. Frequency Response Modeling

5. **Grounding**
   a. Types of Grounding
   b. Arcing Ground Faults
   c. Symptoms of Ineffective Grounding
   d. Electronics and Computer Grounding
   e. IEEE Std. 1100 applications

6. **Voltage Disturbances**
   a. Lightning (transients)
   b. System Switching
   c. System Faults
   d. Sags
   e. Swells
   f. Unbalance

Day II | March 29, 2016

7. **PQ Measurement Techniques**
   a. IEEE Emerald Book -Conducting Site Surveys
   b. Manufacturers' Terminology
   c. Grounding Measurements
   d. Disturbance Measurements
   e. Waveform Signatures
   f. Harmonics analysis study and data collection

8. **Surge Protective Devices**
   a. Definitions by standards
   b. Transient voltage surge suppressors
   c. Technology used
   d. UL standard 1449
   e. Implementing surge protection
   f. Surge location categories

9. **Utility PQ impacts on industrial customers**
   a. Capacitor switching issues
   b. Breaker switching issues
   c. Transient voltage recovery (TRV)
   d. VFDs sag impacts and mitigations

10. **Case Studies and Mitigation Techniques**
    a. K-Factor Transformers
    b. Power Line Conditioners

c. Lightning/Surge Protection Device

11. **Electromagnetic Field (EMF)**

a. What is an electric field
b. What is a magnetic field
c. Factors contributing to exposure to EMFs
d. EMFs in our homes
e. EMFs in data centres and communication circuits
f. EMFs in our distribution system
g. EMFs near high voltage lines
h. EMFs near substations
i. Induced Current
j. Corona Effect
k. Effects of EMFs on health

12. **EMF Applications and Audits**

a. Standards used for EMF exposures, measurements and calculations
b. Measuring, Modeling and Analysis of EMFs
c. Case Study – EMF and induction current analysis under 500 kV Transmission lines

13. **Electromagnetic Compatibility (EMC)**

a. Definition
b. Electromagnetic interference
c. Electromagnetic mitigations
d. Transformer noise and shielding

Program Schedule
(Day 1 - Day 2)

08:30	Registration
09:00	Morning Session Begins
10:30-10:45	Refreshments & Networking Break
12:00	Lunch break
13:00	Afternoon Session begins
14:30-14:45	Refreshments & Networking Break
16:30	Day Ends

Fees*

Registration Type	Single	Group(3+)**
Register for the 2 Days Course	$999	$899

* Early birds (registration before February 14, 2016) will get $100 off per registration
Fees include hard copy course material, hot breakfast and lunch and course certificate

** Group means three (3) or more registrants from the same company

Registration:

- ✓ Register by email to: Khaled.akida@teebaengineering.com
- ✓ Registration fee of $150 (part of the course fee but non-refundable) will guarantee your spot, and is part of the course fee by Credit Card or by bank transfer
- ✓ The balance can be paid by at the door by a bank certified check to TEEBA Engineering Inc. Or by Credit Card payment online on the course page.
- ✓ TEEBA Engineering Inc. reserves the right to cancel the course maximum 7 days before it starts

In-House Training

In-House Training Cost effective In-house courses, tailored specifically to your organization's needs, can be arranged at your preferred location and time. If you would like to discuss further, please contact our inhouse division at Khaled.akida@teebaengineering.com

About your Course Facilitator

Khaled Akida, MBA, P.Eng., M.Sc.

Khaled is a registered professional engineer in Canada (provinces of Ontario and Alberta) with 15+ years of experience in power system studies, substation design, field-testing and commissioning, grounding and power quality audits, electromagnetic field and interference (EMF/EMI) audits, Electrical Health and Safety (EHS) programs settings for Oil and Gas, Mining, Electrical Utilities and Industrial Plants.

He is the General Manager of TEEBA Engineering Inc. (www.teebaengineering.com), an engineering consulting firm based in Mississauga, ON, Canada.

Formerly, he was Engineering Manager at GE Canada and Schneider Electric Canada in Ontario, where he managed medium to large engineering projects across North America.

He received his B.Sc. from Ain Shams University, hisM.Sc. in electrical engineering from the University of New Brunswick (UNB), Canada, and his MBA from Laurier School of Business (WLU) in Waterloo, Canada.

Khaled has managed and executed 100+ engineering projects on substation design, field testing, power quality audits and power system studies (short circuit, coordination study, arc flash, load flow, power factor correction, harmonics, dynamic stability, transient motor starting, ground grid testing and design, etc.), EMF/EMI audits and grounding audits, for major electrical utilities, mines, oil and gas, data centers, industrial and commercial facilities in Canada and the USA.

Mr. Akida has various IEEE publications, has served as a technical reviewer in many IEEE journals in power systems and control systems, and was the ex-chair of the Industry Application Chapter (IAS) for IEEE Toronto Section. He remains an active member for the IEEE substation committee of IEEE Std. 81 ground testing (WGE6) and IEEE Std. 80 ground design (WGD7). A certified electrical safety trainer by GE Corporate, Khaled also taught more than 60 technical courses across Canada, USA, Asia and the Middle East from COO level up to electrical technicians in all power systems engineering areas.

Partial List of Customers Includes:

- ✓ Hydro One
- ✓ Hydro Ottawa
- ✓ Oakville Hydro
- ✓ North Bay Hydro
- ✓ GreatLakes Power Transmission
- ✓ Canadian Nuclear Laboratories
- ✓ ATCO Electric
- ✓ EPCOR
- ✓ Vale
- ✓ BC Hydro
- ✓ Dofasco
- ✓ Millar Western
- ✓ Puerto Rico Electrical Power Utilities
- ✓ Telus
- ✓ Rogers Communications
- ✓ Lafarge
- ✓ Meralco Power Generation (Philippines)
- ✓ SNC Lavalin
- ✓ ABB Canada
- ✓ GE Energy (USA, Canada)
- ✓ GE Power & Water
- ✓ GE Hitachi Canada
- ✓ Schneider Electric Canada
- ✓ Siemens Canada
- ✓ Nova Chemicals
- ✓ Plan Group
- ✓ Weston Consulting
- ✓ Vodafone (Egypt)
- ✓ Puerto Rico Electrical Utility (PREPA)