Applied Power Quality: Fluctuations/Flicker, Harmonics & Unbalance

A professional development course in power engineering presented by the Australian Power Quality and Reliability Centre, School of Electrical, Computer and Telecommunications Engineering, University of Wollongong.

Course Objectives

The rapidly increasing installation of electronic equipment such as digital controls, computers and sensitive process control equipment has increased the susceptibility of utility customers to supply disturbances. In addition, the application of power electronic equipment with its higher energy efficiency and more effective control features has in turn often increased the level of disturbances that might affect customer equipment. Electricity supply businesses need to have an ongoing awareness of problems and solutions in the power quality area.

This course is one of two advanced courses which build on the introductory course, Quality of Electrical Supply, and is designed to expand the coverage of selected power quality topics in order to give participants practical skills in the analysis and mitigation of specific problems. The selected topics for this course are:

- Voltage fluctuations and flicker
- Harmonics
- Voltage unbalance
- Power electronic mitigation techniques

Following the course, participants will be able to:

- Understand how short-term and long-term flicker severity indices are calculated, assess limits for rapid voltage changes, apply the standard AS/NZS 61000.3.7 and evaluate the effectiveness of different mitigation techniques.
- Calculate distortion levels, evaluate resonance problems, apply the standard AS/NZS 61000.3.6 and determine the effectiveness of mitigation methods.
- Apply symmetrical component theory to the calculation of unbalance factors and understand the effects of unbalance on various loads.
- Understand how power electronic devices can be used to mitigate power quality problems.

Participants will learn advanced analysis techniques and methods of improving power quality by both network and plant modifications. Course participants will have the opportunity to develop their knowledge and skills through discussion and laboratory sessions.

Who Should Attend?

Utility specialists, consultants, engineers and senior technical staff who wish to advise customers on power quality concerns, or who service large customers or who wish to understand aspects of network design, construction and maintenance techniques for maximising quality of supply.

The course assumes the participants will have an understanding of phasor calculations, simultaneous equations and Fourier analysis.

About the Speakers

Professor Vic Gosbell is Technical Advisor to the Australian Power Quality and Reliability Centre and has been actively engaged in teaching, research and consulting in various aspects of power quality for over thirty years.

Professor Danny Sutanto is Professor of Power Engineering in the School of Electrical, Computer and Telecommunications Engineering. His research interests include power electronic applications in industry and electrical transmission and distribution networks.

Professor Sarath Perera is Technical Director of the Australian Power Quality and Reliability Centre and teaches in the School of Electrical, Computer and Telecommunications Engineering. His research interests include power quality, EMC and power system simulation techniques.

Course Outline

The course is conducted over two days and comprises lectures and computer laboratories:

Day 1

- *Voltage fluctuations & flicker:* Causes, standards, effects on loads, limits, mitigation, case studies, flicker severity indices, tutorial on standard AS/NZS 61000.3.7.
- *Power electronic mitigation techniques I:* Application of power electronic devices to the mitigation of voltage fluctuations, harmonics and unbalance.
- *Harmonics I:* Overview of harmonics and Fourier analysis, definitions, estimation of harmonic currents due to load types, effect of system impedance, modelling harmonic loads, resonance effects, effect of mitigation techniques, standards including AS/NZS 61000.3.6.

Day 2

- *Harmonics II:* Overview of harmonics and Fourier analysis, definitions, estimation of harmonic currents due to load types, effect of system impedance, modelling harmonic loads, resonance effects, effect of mitigation techniques, standards including AS/NZS 61000.3.6.
- *Power electronic mitigation techniques II:* Application of power electronic devices to the mitigation of voltage fluctuations, harmonics and unbalance.
- *Voltage unbalance:* Sequence components, IEEE & IEC standard definitions of unbalance factor, load behaviour.

Enquiries

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