

# Applied Power Quality: Harmonics, Unbalance & Voltage Sags

Continuing Professional Development Course  
3-4 November 2016, University of Wollongong Innovation Campus

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 an advanced course which builds 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 harmonics, voltage unbalance, voltage sags and interruptions, power electronic mitigation techniques, power quality monitoring and reporting

## Course Benefits

Following the course, participants will be able to:

- Calculate distortion levels, evaluate resonance problems, apply the AS/NZS 61000.3.6 Technical Report methodologies and assess the effectiveness of mitigation methods.
- Apply symmetrical component theory to the calculation of unbalance factors, understand the effects of unbalance on various loads and appreciate the essentials of voltage unbalance standards.
- Determine sag depth at a site depending on fault location or motor start characteristics.
- Assess candidates for sag mitigation and determine whether they should be applied within the plant or network.
- Understand how power electronic devices can be used to mitigate power quality problems.
- Better understand PQ monitoring methodology including disturbances to be measured, how they should be characterised and reported, and their acceptable levels.

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

**Emeritus Professor Vic Gosbell** is a Technical Advisor to Australian Power Quality and Reliability Centre and Emeritus Professor for the School of Electrical, Computer and Telecommunications Engineering. His current research interest is power quality with an emphasis on harmonics, PQ survey measurements and standards.

**Mr. Sean Elphick** is a Research Coordinator with the School of Electrical, Computer and Telecommunications Engineering. He is active in the areas of power quality monitoring and data analysis.

**Professor Robert Barr** is principal of Electric Power Consulting Pty Ltd and has dealt with a wide range of power quality and general electricity industry problems.

**Professor Peeter Muttik** is Chief Engineer with Alstom Grid and has many years experience in a wide variety of electric power projects.

**Associate Professor Phil Ciuffo** is an Associate Professor with the School of Electrical, Computer and Telecommunications Engineering. His research interests include power quality (PQ) including system harmonics, harmonic management, voltage fluctuations and unbalance.

**Professor David Sweeting** is principal of Sweeting Consulting specialising in HV electrical distribution and power quality reviews for distributors and customers.

## Course Outline

---

The course is conducted over two days commencing at 8:25 am on Thursday 3 November, 2016 and comprises lectures and computer laboratories:

### Day 1

- **Harmonics:** Overview of harmonics and Fourier analysis, definitions, estimation of harmonic currents due to load types, effect of system impedance, modelling harmonic loads, resonance effects, standards including AS/NZS 61000.3.6, practical mitigation techniques.
- **Voltage unbalance:** Sequence components, IEEE & IEC standard definitions of unbalance factor, load behaviour, IEC 61000-3-13 Technical Report.
- **Power electronic mitigation techniques:** Application of power electronic systems to the mitigation of voltage problems in distribution systems.

### Day 2

- **Voltage sags:** Application of symmetrical components to fault calculations, sag characterisation, sag aggregation, equipment susceptibility, assessing sag distribution, influence of network design, practical mitigation techniques.
- **Power quality monitoring and reporting:** Monitoring imperatives, characterising events, instrumentation, benchmarking practices, site indices.

## Enquiries

---

### Registration enquiries:

Ms Raina Lewis  
School of Electrical, Computer and Telecommunications  
Engineering  
University of Wollongong  
Ph: 02 4221 3335  
Email: Raina\_Lewis@uow.edu.au

### Course enquiries:

Mr Sean Elphick  
Australian Power Quality and Reliability Centre  
University of Wollongong  
Ph: 02 4221 4737  
Email: elpho@uow.edu.au

## Registration Form

Please enrol me in the two-day course “Applied Power Quality: Harmonics, Unbalance and Voltage Sags” to be held at the University of Wollongong, Innovation Campus, Building 233 Room 116, Squires Way, North Wollongong NSW on 3-4 November 2016

**Cost per person:** AUD\$1,500 inclusive of GST (Course fee includes course notes, lunches, morning and afternoon tea). Lectures commence 8:30 am.

Please register before 21 October 2016 (please see Note below).

Surname..... Given Name.....  
Organisation..... Job title/position.....  
Postal Address.....  
State..... Postcode..... Country.....  
Telephone..... Fax.....  
Mobile..... Email.....  
Special dietary requirements.....

### Methods of Payment

If you wish to pay by **credit card**, please fill out the details below and email to [Raina\\_Lewis@uow.edu.au](mailto:Raina_Lewis@uow.edu.au).

Please debit (circle):    Bankcard        Visa        Mastercard

Card number:

□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Expires:    □□/□□        for the amount of

AUD\$.....

Name on card: .....

Signature: .....

Email for receipt: .....

Cheque payable to “The University of Wollongong”

**Mail to:**        Applied PQ Course Registration  
                  School of Electrical, Computer and Telecommunications Engineering  
                  University of Wollongong    NSW    2522  
                  Australia

**Note:** There is no guarantee that economic participation levels for this course can be achieved. Registrants will be notified on the 24 October 2016 if the course cannot proceed due to insufficient numbers. The program may be changed at any time due to unforeseen circumstances. If the course cannot proceed for any reason, UOW will not accept liability of whatsoever kind for expenses incurred by any person or corporation with the sole exception of the course investment, which will be refunded in full.

### Customised In-House Courses Available

We can come to you to provide customised courses on a range of topics at your location. For more information contact Raina Lewis ([Raina\\_Lewis@uow.edu.au](mailto:Raina_Lewis@uow.edu.au))