The Newsletter of the Power Engineering Research & Consulting Group at the University of Wollongong

From the TD’s Desk

New Funding Secures Future of Centre

Electrical power engineering activities at the University of Wollongong received yet another boost in late June by the establishment of the agreement to operate the newly named ‘Australian Power Quality and Reliability Centre’ (APQRC). This marks 20 years of continuous industry support.

The main objectives of the Centre are undergraduate training, continuing education, research and development, consulting and contributions to the industry operation in the areas of power quality, reliability, renewable and embedded generation and contributions to the development of relevant industry standards.

The Centre currently consists of 7 academic staff members, four general staff members including two research engineers, two research fellows, one emeritus professor and five visiting professorial fellows in addition to 22 higher degree research students.

Memberships of the Standards Australia Power Quality Committee and several international CIGRE/CIRED working group memberships and Australian CIGRE Panel memberships are held by some of the members of the Centre.

APQRC houses one of the best power quality and renewable energy laboratories in the country and has been serving the industry with power quality testing and other services.

In recognition of the training needs of the power industry, in 2011 APQRC established a modular Masters/Graduate Certificate program in power engineering that has seen strong growth and covers subjects which are highly relevant to the industry and which are taught by industry experts.

I invite outside organisations who are interested in developing links with APQRC to consider avenues which can be used to work collaboratively to ensure that APQRC has a viable future beyond the next three years and continues to deliver useful outcomes for the benefit of the wider community.

Power Electronics Course

The APQRC hosted a one-day course entitled Power Electronics in Distribution Systems (PEDS) which was delivered twice on the 4th and 5th of July. The course was attended by personnel from both Ausgrid and Endeavour Energy. This was the first course run by the Centre under the Australian Power Quality and Reliability Centre name.

The aim of the PEDS course was to provide distribution system engineers and technical staff with an overview of modern power electronics and power electronic systems in the context of distribution networks. The course was structured around two lectures and two practical sessions. The focus of the morning session was a review of power electronic devices and common topologies. Following on from the theoretical session, delegates were able to observe the performance of several common power conversion circuits at the University’s laboratory facilities.

The focus of the afternoon session was voltage source converters (VSC). The VSC is the basis of many other devices commonly found in power electronic systems in distribution networks including PV inverter systems and a range of power quality improvement devices such as active harmonic filters. A laboratory was held following the theoretical component and delegates were able to observe the performance of a single-phase SPWM inverter. A demonstration of a PhD research project rounded out the day.

APQRC Services

Consulting
- Investigation and resolution of power quality (PQ) problems
- PQ monitoring for compliance with standards and regulations including harmonic and flicker studies
- Connection agreements
- Harmonic and flicker allocation studies
- Voltage sag studies
- Interpretation of power quality standards
- Routine PQ monitoring
- PQ data analysis and reporting
- General power monitoring
- Distribution system reliability
- Transient and small-signal stability studies
  - Wind integration studies
  - Dynamic modelling and validation of power plants

Continuing Education
- Power quality short courses
- Renewable energy & distributed generation
- Solar PV generation
- Electrical drive systems

Testing
- World class laboratory facilities
- Equipment power quality immunity testing to national and international standards
- Equipment performance testing
The University of Wollongong
Power Quality and Renewable Energy Laboratory.

Featured Student
Kun Zhao
PhD Candidate

Project
Susceptibility of Low Voltage Equipment to Voltage Fluctuations.

Project Summary
Lamp flicker levels that arise as a result of voltage fluctuations can exceed limits set by appropriate standards. New lamp types such as compact fluorescent lamps are less sensitive to voltage fluctuations as their flicker characteristics are considerably different compared to those of the traditional incandescent lamp. These differences could support the relaxation of the present voltage fluctuation and flicker standards and hence the associated limits. The potential detrimental effects on electrical equipment which may be caused by relaxation of these limits must be investigated before any changes to the present standards take place.

This project investigates the sensitivity of equipment to voltage fluctuations. Three widely used pieces of equipment are investigated: rectifiers, induction motors and AC adjustable speed drives. The investigations will provide useful information to equipment manufacturers, electricity utilities, end-user customers and those involved in the development of relevant electromagnetic compatibility (EMC) standards.

Dynamic Dynamometer Upgraded
A key piece of research equipment operated by the APQRC is the 100 kW, 3000 rpm 1000 Nm 4-quadrant dynamic dynamometer located in the Power Quality and Renewable Energy Laboratory. This device allows study of motor and drive behavior under a range of controlled load conditions. First commissioned in the 1990s, many of the control and data acquisition systems were very dated by 2012.

4th year student Phil Melville was tasked with upgrading the control and data acquisition systems along with the graphical user interface (GUI) for the dynamometer as part of his thesis project. Phil has been very successful with his project and the dynamometer now boasts a modern SCADA based control system, a National Instruments NI CompactDAQ data acquisition system and a National Instruments Labview GUI.

The upgraded hardware and software provides a facility which is more reliable, robust and offers greater flexibility than was possible with the previous arrangement.

100 kW Dynamic Dynamometer

EECON 13 Wrap Up
Sean Elphick presented a well-received paper titled Emerging Power Quality Issues and Impacts of Domestic PV Systems at EECON 13, the EESA NSW chapter annual conference held in Sydney on 26th and 27th June 2013. Approximately 200 delegates from across transmission and distribution companies as well as consultants attended the conference. The conference focuses on current practical industry problems and solutions.

At this year’s conference there was a heavy focus on renewable and embedded generation and the challenges (and success stories) related to connecting these technologies to transmission and distribution networks. The need for ongoing practical industry based research into these areas is obvious and the University of Wollongong is well placed to assist industry in this respect.

Other highlights included discussion of electric vehicles and battery energy storage systems, their development and their implications for the networks of the future. A plenary session on nuclear energy (both fission and fusion) provided an insight into the state of the art for these energy sources.

Upcoming Events
7 – 8 November 2013: Renewable Energy and Distributed Generation Continuing Education Course.

Contact Us
Australian Power Quality & Reliability Centre
University of Wollongong
Phone: +61 (0)2 4221 4737
Fax: +61 (0)2 4221 3236
Web: www.elec.uow.edu.au/apqrc
E-mail: pqrc@uow.edu.au