NEWS AND VIEWS FROM PSC

Specialist Consultants
to the Electricity Industry

PSC NEWS

Helping our clients power the world

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Fast modelling with Real-Time Simulation

The increasing penetration of renewables has led to a rapid rise in the amount of power electronics connected to the grid. Renewable energy sources like solar, wind, and tidal power all connect to the grid via inverters. Of course, all the positive changes enabled by power electronics do not come without risk. Since power electronics have closed loop control systems there is potential for resonance to be amplified – and with so many power electronics in the system converting and controlling the flow of electricity, the potential system impact of harmonic resonance has grown dramatically. Making sure all the power electronics on your system work together properly is more important than ever before.

So how do you get everything to play along? Ideally, you need to accurately model all of the equipment that is connected to the grid. A few years ago, this meant off-line computer simulations - modelling traditional generators using simulation time steps around 1 ms, and overall simulation run times in the tens of minutes to simulate a few seconds of real time. However, modelling the fast switching of inverter-connected generation requires simulation time steps around 10 us, and simulation run times of several hours to simulate a few seconds of real time.

While off-line simulation is still widely used in the industry, there is a growing recognition that very long simulation run times tend to make good engineering analysis very difficult.

In contrast, real-time simulation (RTS) allows for the timely investigation of the stability and transient responses of the power system and allows system operators to more reliably plan and mitigate the risks presented by the mass integration of new inverter connected energy sources.

There are two major platforms used widely around the world for performing Real Time Simulation:

1. Real Time Digital Simulator (RTDS) developed by RTDS Technologies Inc.
2. The suite of RTS platforms known as ePHASORSIM, HYPERSIM, eMEGASIM and eFPGASIM, developed by Opal-RT Technologies Inc.

Some of the major applications for RTS are:

1. Relay Testing
2. Hardware-in-the-Loop (HIL) testing
3. Software in the loop (SIL) testing
4. Microgrid and DER testing

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Fast modelling with Real-Time Simulation continued

Only real-time simulation allows you to test and analyze the impact of the real control systems that will be installed. As the power system continues to evolve, the speed and flexibility of simulation tools will become increasingly important. Power system operators should consider the value of real-time simulation to help them evaluate the impact of inverters on their rapidly developing networks.

PSC supports clients with RTS on both major platforms. RTS customers can turn to PSC to develop the power system models in OPAL-RT or RTDS, and perform HIL testing on these platforms. For customers seeking expertise developing models and testing controls in RTS, PSC supports both RTDS and OPAL-RT products.

Other areas you can benefit from RTS support include:

- Developing specifications for factory acceptance and commissioning tests of controls for Inverters, SVC's, and STATCOM's
- Modelling in RSCAD/Hypersim (including network modelling)
- Testing in RTDS/Hypersim
- Reviewing and validating factory acceptance and commissioning results
- Model validation between PSS/E (or PSLF or Powerfactory), PSCAD (or EMTP-RV), and RTDS/Hypersim.

CIGRE AUSTRALIA D2 PANEL

This year's CIGRE Australia D2 Panel Meeting was held in Hilton Darwin between 24 and 26 July. D2 focusses on the areas of Information Systems and Telecommunications for Electric Power Utilities and the panel meeting's aim is to foster information exchange among panel members, who consist of Telecommunication representatives from utilities in Australia and New Zealand.

Over 25 participants consisting of regular panel members and guest speakers from Cisco, Nokia and Telstra attended the panel meeting. This year's presentations and discussion topics included Internet of Things (IoT), Asset Lifecycle, Software Defined Network (SDN) and Cybersecurity in the context of power utilities.

Over the three days, there were 19 presentations, 2 discussion workshops and a technical tour of a Power and Water Corporation site on the last day. Overall the event was a success based from the feedback, and the participants benefited from the discussions and contributions by everyone.

The panel meeting was chaired by Victor Tan, the Convener of the panel, and PSC's Principal Network and Security Consultant. The event was sponsored by Power and Water Corporation and co-sponsored by PSC. The Convener would like to thank the sponsors and all participants for the insightful and productive discussions, and is looking forward to the next annual panel meeting.

Overview of new system strength requirements in Australia's National Electricity Market

Electricity System strength, traditionally provided by large rotating machines such as thermal and hydro generation units, helps the grid remain stable following a fault. With the pace of change in Australia's National Electricity Market, particularly the increasing penetration of asynchronous inverter connected generation – predominantly wind and solar – and retirements of large synchronous plant, concerns over reductions in system strength have been intensifying.

Under the National Electricity Rules, transmission utilities are required to maintain minimum levels of system strength. From 1 July 2018, new System Strength Impact Assessment Guidelines are in effect. These Guidelines reflect obligations on the Australian Energy Market Operator (AEMO), utilities, and (indirectly) market participants, to ensure that changes to the grid do not result in unacceptable reductions in system strength.

PSC has the tools and the people to carry out the suite of analysis required to identify and resolve system strength issues. Our Australian and global teams of PSCAD-fluent system studies experts are well placed to carry out the Preliminary and Full Assessment processes set out in the Guidelines. Whilst the Preliminary Assessment is a relatively straightforward process based around short-circuit ratio metrics, the Full Assessment requires electromagnetic transient simulation (typically using the PSCAD/EMTDC software package) to carry out a detailed analysis of the ability of proposed plant to operate under fault conditions.

PSC's experience at the intersection of the regulatory environment, technical capability, and the appropriate software tools means we are well placed to provide support and advice to utilities, generators, and system operators, in navigating the changing requirements.

It's all about the customer at CIGRE Canada 2018

Like its regional counterparts around the world, CIGRE Canada brings together key members of the electricity industry to tackle contemporary issues facing the electric power sector. The focus of CIGRE Canada 2018 turns, therefore, to the customer – whose needs and expectations are now at the center of what is arguably the most rapid transformation of the energy industry in over a century.

Amidst the rampant development of distributed energy resources and disruptive technologies remains the critical infrastructure of the electrical grid, which must maintain security and reliability while being adaptive to changing customer needs and expectations.

To address these challenges, CIGRE Canada hosts a series of panel sessions and presentations from industry professionals and researchers. As a Diamond Sponsor of CIGRE Canada 2018, PSC is sending several thought leaders to share their insights, which range from technical findings on the improvement of synchrophasor data quality, to strategic advice for grid operators interested in preparing their system for the future.

The CIGRE Canada Conference & Expo is the premiere CIGRE event in Canada.

~ HERE ARE A FEW CONFERENCE PROCEEDINGS YOU DON'T WANT TO MISS ~

TECHNICAL TOURS ▸ 1:00 - 5:00pm > Monday, October 15

Attendance is limited, but the lucky few will lock down a reservation to one of these fascinating tours presented by host companies TransAlta and AltaLink.

- **Horseshoe Hydro Plant**

  Participants will have the opportunity to visit the historic hydro facility at Horseshoe Falls on the Bow River. Commissioned in 1911, the original four generators are still providing power to the Alberta grid.

- **Crossings HVDC Converter Station**

  The WATL HVDC Link was the first DC Power link across the province of Alberta. Visitors will explore the Crossings Converter Station control building as well as the outdoor yards. This tour will include an introduction to the basics of HVDC and its role in the Alberta bulk electric system.

COCKTAIL RECEPTION & STUDENT POSTER SESSION ▸ 4:30 - 6:30pm > Tuesday, October 16

Break out from the first full day of CIGRE to enjoy a cocktail and revel in the academic work of some of the industry's sharpest young minds. The student poster session offers recent graduates the opportunity to present technical papers eligible for the Best Student Paper Award. This is an exciting opportunity for young professionals in the electricity industry and a great way to catch up on the latest academic research in the field of electrical power systems.

PSC's **Matin Rahmatian** will present his paper, "*Assessing Confidence Level in Synchrophasor-based Fault Location Results Using Goodness of Fit Metrics.*"

SPONSOR PANEL ▸ 8:00 - 9:00am > Wednesday, October 17

Thought provoking insights from CIGRE Canada's biggest industry sponsors, including Diamond Sponsor PSC. Panelists will tackle the critical challenges presented by rapid innovation in the electric power sector, including sharing success stories and offering advice on how to prepare for change. PSC's Marc Brunet-Watson, GM Power Networks, will offer his perspective on how to address areas the industry has fallen behind.

This marks the 5th consecutive year that PSC is a Diamond Sponsor of CIGRE Canada. As a leading specialist in power network design and management, HVDC, and operational technology, PSC is highly involved in CIGRE around the world.

During the Exhibitor Trade Show, October 16-17 > PSC will be at booth #10!

Come meet some of PSC's technical experts at PSC's booth and hear about the latest ways we're helping our clients prepare for the changing demands of electricity customers.

2018 PSC Scholarship awarded to Irene Anderson

2018 PSC Scholarship repicient Irene Anderson (pictured centre) alongside PSC Group CEO Alex Boyd (R) and Ranil de Silva (L)

PSC is pleased to continue its association with the University of Canterbury, School of Engineering and EPE Centre with the annual award of the PSC Scholarship.

The PSC Scholarship was established in 2004 as a co-operation between PSC and the Electric Power Engineering Centre (EPECentre) to promote and support the education of power engineers and the study of power engineering as a field of excellence in New Zealand. The scholarship is open to students in their 3rd professional year, who are focusing on power engineering subjects and have demonstrated excellence in their studies.

The successful candidate this year was selected from a very strong field of submissions and our congratulations go to Irene Anderson who has shown outstanding academic achievement combined with a strong focus on practical work experience. With a particular interest in power systems engineering, Irene has completed work assignments with Meridian Energy and Marlborough Lines. PSC's Group CEO Alex Boyd awarded the PSC Scholarship to Irene at the University of Canterbury in August.

PSC OPENS NEW CHRISTCHURCH OFFICE

PSC New Zealand has opened a new office in Christchurch. The office is located at 106 Coleridge Street in Sydenham which is a short drive from the Christchurch CBD. The new office can comfortably accommodate staff and has additional room for visiting PSC staff and clients. A successful social function to celebrate the office opening was held on the 9th August.

The office will house PSC's group of electrical and operational technology engineers in Christchurch and the Genassure team will also work from this office. Genassure provides specialist test engineering and data acquisition expertise for generator AVR and Governor testing. For more information, please contact PSC Asia Pacific's Sales Manager, Peter Brown at peter.brown@pscconsulting.com.

Simon Lister Celebrates 20 years of Excellent Service with PSC

PSC congratulates Simon Lister who has achieved a significant milestone in completing 20 years of excellent service with PSC. Simon has extensive experience in power station and substation automation and control systems. Over the past 20 years, this work has also included the specialist areas of RTU and PLC programming and HMI configuration.

Simon has worked on many projects for our clients including:

- Technical specification for a substation HMI replacement
- Design, programming and commissioning for a runback system for an HVDC interconnector in Australia
- New SCADA master station and RTU's for a rail network upgrade
- Revenue metering design and configuration for hydro power stations
- Field installation and detailed designs, implementation and testing for the upgrade of a generation control system

The PSC management team would like to thank Simon for his commitment and excellent service over the past 20 years, and a small social event was held to celebrate this important milestone.

Simon Lister (L) and PSC Co-founder Tony Armstrong

PSC STAFF CELEBRATE 10 YEARS OF EXCELLENT SERVICE WITH PSC

Recently two PSC staff celebrated 10 years of excellent service with PSC. The PSC management team congratulates Feiyu Lu and Tim Browne on reaching this important milestone – well done.

Feiyu Lu is a Power System and EMS Engineer based in the United States. He has extensive knowledge and experience with Energy Management Systems (EMS) and Market Systems, and worked with multiple major vendors. Feiyu has worked for numerous utility clients throughout the United States and Canada, to upgrade their EMS and applications that includes testing, configuration, modeling and ongoing system support.

Tim Browne is based in our Brisbane office and has held a range of engineering and management roles over the past 10 years. He originally joined PSC North America (as employee number 6) before transferring to PSC New Zealand and then PSC Australia. Tim's areas of technical expertise include power quality and harmonics, electromagnetic transients, and power system studies. A common theme in his work with PSC has been translating complexity into clear recommendations suitable for both technical and general audiences.

Feiyu Lu (L) pictured here with Alex Boyd (R), PSC Group CEO

Tim Browne (R) and Warwick Glendenning (L), MD Asia Pacific

PSC WELCOMES NEW STAFF

ROGER RILEY

PSC is pleased to welcome Roger Riley. As General Manager, Power Networks, Roger will be responsible for the management of PSC's Power Networks Business Units in Australia and New Zealand, including Electrical Engineering, HVDC, Transmission Line Engineering and Generator Testing. Roger has held a range of senior leadership roles within the power industry, most recently with AusNet Services. He also has management experience from Hill Michael Associates Consulting, Select Solutions and Transend Networks (now TasNetworks). Roger will be based in the PSC Melbourne office.

ROGER BEDELL

PSC is pleased to welcome Roger Bedell as a Senior Consultant to PSC North America based in Kirkland, Washington. He has over 30 years of global experience in power systems, software development, database modeling and EMS and DMS project delivery domestically and overseas. A Graduate of the Electric Utility Management Program at New Mexico State. He's third generation serving the Electric Utility Industry as his maternal grandfather and aunts worked for the public electric utility in Jackson, Michigan.

MEHRDAD CHAPARIHA

PSC North America welcomes Mehrdad Chapariha to the Power Networks team in Vancouver, B.C.! Mehrdad is a power systems specialist and an expert in systems studies including transients, dynamics, and steady-state analysis. He is also experienced in design and implementation of automation tools ranging from internal scripts to database management systems for power systems studies. Mehrdad has worked on power systems protection modeling and coordination studies for multiple North American and international utilities with Quanta Technology. As a postdoctoral fellow of the University of British Columbia, Mehrdad worked with the Manitoba HVDC Research Centre to design and implement a PSCAD model for 6- phase synchronous generators with advanced interface for modeling accuracy and numerical advantages.

ISO9001 Quality Audits - PSC Australia and New Zealand

PSC Australia and PSC New Zealand's quality management system is certified to the world's most widely recognised quality system standard, ISO9001:2015. Recently Telarc SAI Ltd (PSC's external auditor) completed quality review audits at a number of PSC's Australian and New Zealand offices. The audit results identified no non-conformances, no areas of concern and several opportunities for improvement.

The audit report summary confirmed a strong and stable system showing a very good level of ongoing maturity and stability. This is an excellent achievement and ensures PSC's continued quality certification. The audit results show PSC's continued commitment to the improvement of its quality management system and services to PSC's clients.

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