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# Modeling of Frequency Dependent Characteristics in Power System Components and Sub-networks

*Jeewantha De Silva, Manitoba HVDC Research Centre, & Bjorn Gustavsen, SINTEF Energy Research, Norway*

**Introduction** Accurate wide-band frequency modeling of power system components and sub-networks is required in certain power system applications. Typical applications are high-frequency representation of power transformers and motors from frequency sweep measurements and wide-band representation of sub-networks, e.g. frequency-dependent network equivalents (FDNEs).

**Description** The terminal behavior of a component or a sub-network can be conveniently characterized by the admittance matrix or impedance matrix, which defines the relation between voltages and currents at the terminals as shown in Figure 1. Another way of characterizing the port behavior is by incident and reflected waves which are related via the S-parameter matrix, S (see Figure 2). This scattering characterization is often preferred in high-speed electronics modeling over the admittance formulation due to more accurate measurements at very high frequencies.

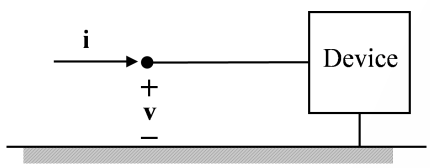


**Figure 1** *n*-port device with port voltages and currents

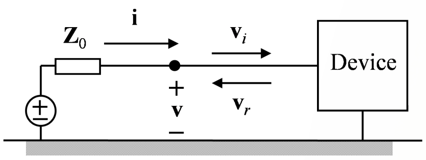


**Figure 2** *n*-port device with incident and reflected port waves

Implementation of the given admittance, impedance, and scattering parameters in emtp-type programs involves several steps. First, the parameters are approximated using rational functions using curve-fitting techniques such as Vector fitting. Finally this rational model is converted into an emtp typical Norton equivalent through a numerical convolution technique such as recursive convolution.

**Example: Simple Electrical Circuit** In the following we demonstrate the alternative model interfacing approaches for a small two-port electrical circuit (see Figure 3). First, we calculate the port characteristics defined by Y-, Z, and S-parameters. Then the three models are interfaced with PSCAD using frequency dependent network equivalent component. The simulation results by the three alternative approaches are compared with that obtained using a detailed representation of the original RLC circuit.

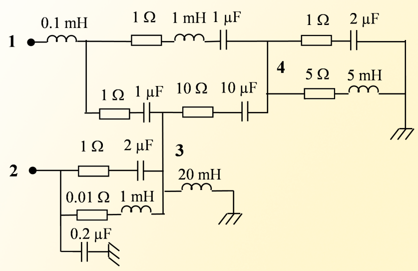


**Figure 3** Two-port circuit

*The responses are virtually identical since the frequency domain fitting errors are close to zero...*

From Figures 4, 5, and 6, it can be seen that each parameter is approximated with very good accuracy in frequency domain.

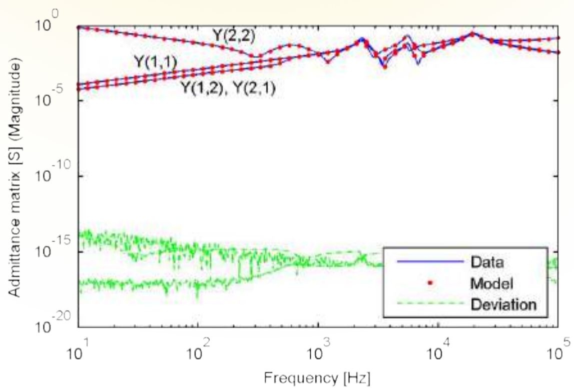


**Figure 4** Fitted Y-parameters (magnitude)

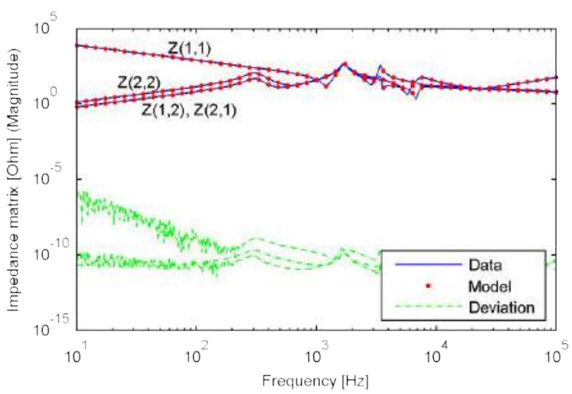


**Figure 5** Fitted Z-parameters (magnitude)

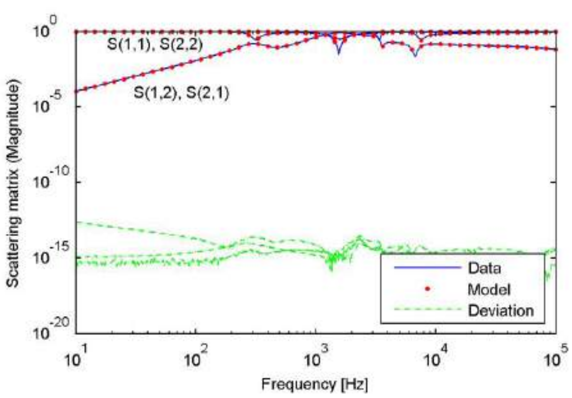


**Figure 6** Fitted S-parameters (magnitude)

A unit step voltage behind a 100 V resistor is applied to port #1 with port #2 open (see Figure 7). We simulate the (transient) current response at port #1 and the voltage response at port #2 with a Δt=10 μs time step length.

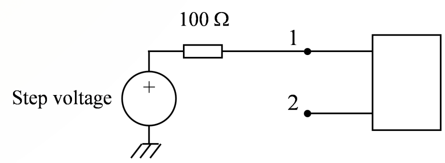


**Figure 7** Voltage excitation voltage at port #1

Figure 8 shows the simulated current response at port #1 when simulated via Y- Z- or S-parameters. As expected, the responses are virtually identical since the frequency domain fitting errors are close to zero. Figure 9 shows the simulated voltage at port #2 when simulated via Y- Z- or S-parameters.

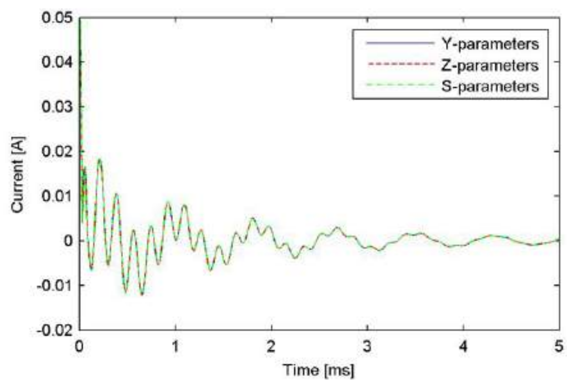


**Figure 8** Current response at port #1

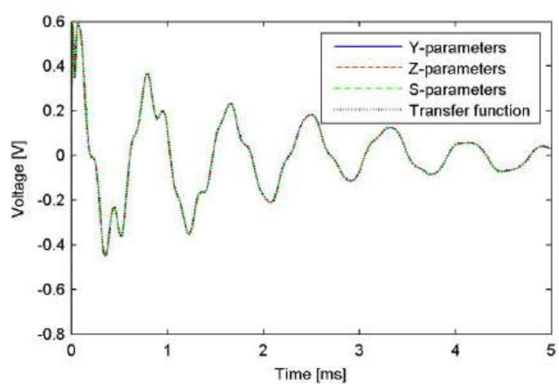


**Figure 9** Voltage response at port #2

**Example: Sub-network Modeling from Computed Admittance Parameters** The application example is a 345 kV, 27 bus system network. There are 22 transmission lines with maximum length up to 200 km and loads are represented using shunt elements at load buses (resisters, capacitors and inductors). The impedance response for the network as seen from bus number 100 was obtained by performing a frequency scan using the Harmonic impedance component. The frequencies were linearly distributed from 1 Hz up to 2 kHz in 20 Hz steps.

Next, the network as seen from bus 100 was replaced by a reduced order network equivalent. The network equivalent component is configured as shown in Figures 10 and 11. Note that the impedance data file from Harmonic impedance component is Harm.out.

The current sources were added at the terminals of the network equivalent in order to maintain the correct steady state power flow and voltages at each bus.

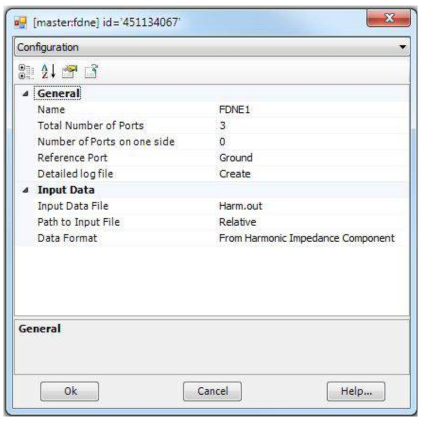


Figure 10 FDNE component parameters (I)

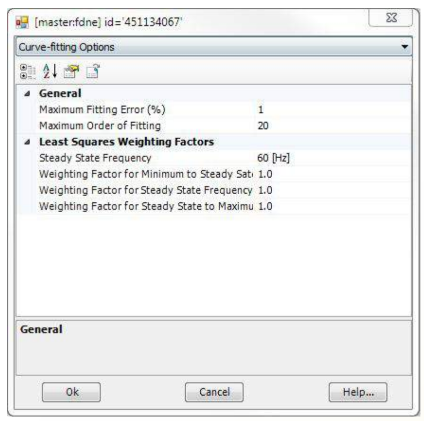


Figure 11 FDNE component parameters (II)

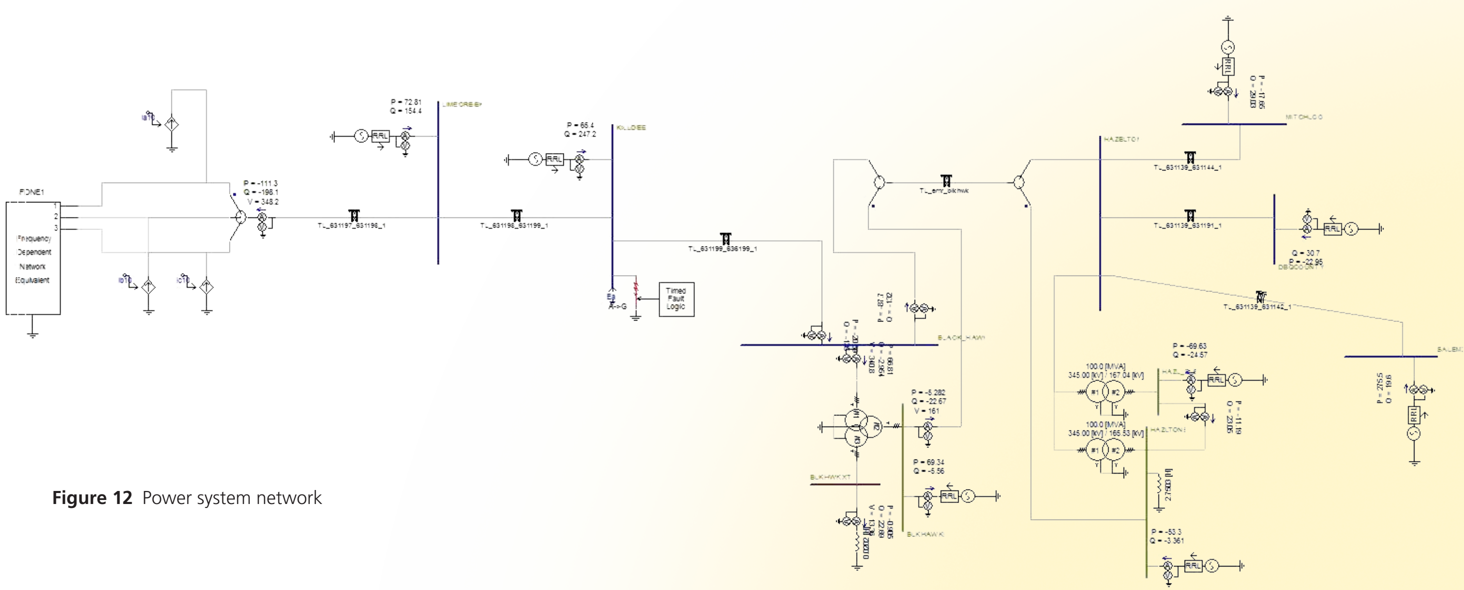

Figure 12 Power system network

Figure 13 shows the elements in the first column of actual and approximated admittance matrices as a function of frequency. The fitted elements are in a close agreement with the actual elements of the admittance matrix.

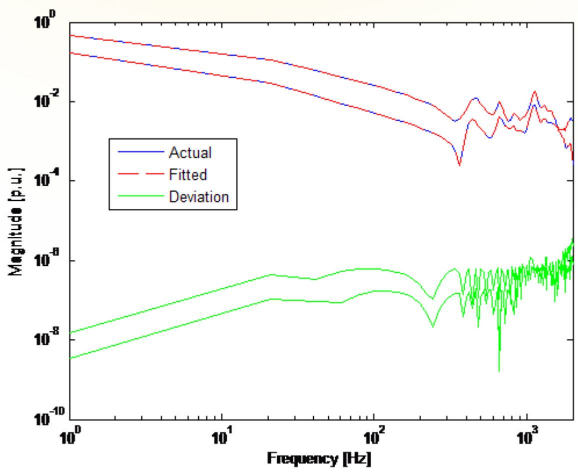


**Figure 13** Actual and fitted admittance matrices

A line to ground fault is applied at bus number 104 at t = 0.4 sec and the fault is clear after t = 0.11 sec. The fault current and voltage waveforms are shown in Figures 14 and 15. The simulation time step is 50 μs. The simulation results with network equivalent is in close agreement with that of the actual network.

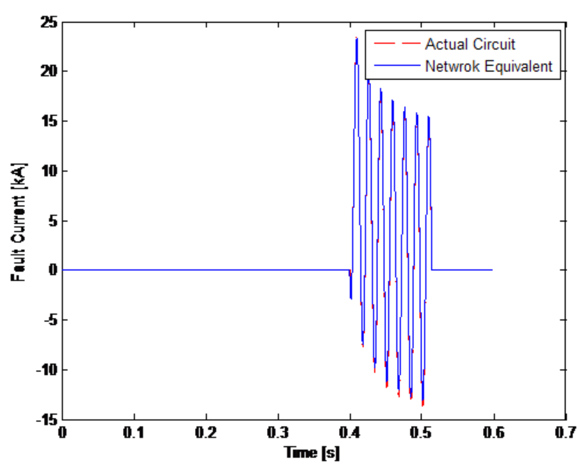


**Figure 14** Phase A fault current at bus 104

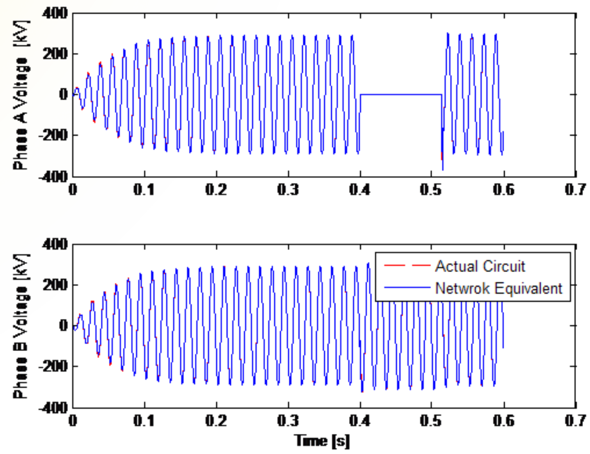


**Figure 15** Phase voltages at bus 104

**Reference**

"*Inclusion of Rational Models in an Electromagnetic Transients Program: Y-Parameters, Z-Parameters, S-Parameters, Transfer Functions,*" Gustavsen, B.; De Silva, H.M.J., Power Delivery, IEEE Transations on (Volume:28, Issue: 2 ), April 2013

# A New Transient Model of Air-Conditioner Compressor Single Phase Induction Motor Based on PSCAD™

*Yuan Liu, Vijay Vittal, & John Undrill, Arizona State University*

In some portion of the U.S. grid interconnection, fault induced delayed voltage recovery (FIDVR) phenomenon is found to be caused by the large-scale stalling of air-conditioner (A/C) compressor motors. This article describes an A/C compressor single phase induction motor (SPIM) model for use in an elecrotromagnetic transients (EMTs) simulation. This model is developed to analyze FIDVR and explain the cause of motor stalling.

Field testing results reveal that the A/C compressor stalling is closely related to the instant at which voltage dip occurs rather than the depth of voltage dip. This behavior has been validated by this model. The simulation results also reveal that the vulnerability of motor stalling is determined by the extent of negative electromagnetic torque rather than the magnitude of the mechanical torque.

The dynamics of the SPIM model are expressed by two parallel-connected Norton equivalent branches shown in Figure 1 to emulate the effects of stator main and auxiliary windings. The equivalent circuit of the proposed model is represented as an interface to the external electric network in the EMTs simulator.

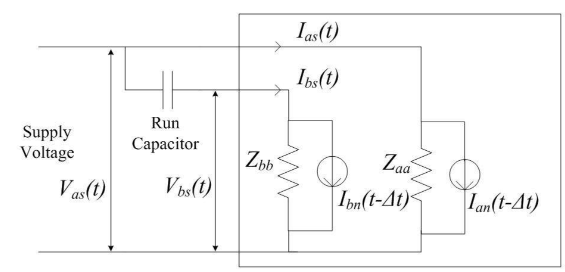


**Figure 1** Representation of the motor model

The electrical connection for testing the motor model is given by Figure 2. The motor model has an average mechanical load torque of 14 N-m. A sudden voltage dip to 60% of the nominal value is applied at around t=1 sec. Figures 3 and 4 depict the trajectories of electrical torque, load torque and motor speed when the voltage dips are applied at t=1.00 sec. (0 deg. phase) and t=1.0042 sec. (90 deg. phase) separately. It is observed that the motor stalls when the voltage sag occurs at 0 deg. phase and is caused by the first negative swing of electromagnetic torque after the sag instant.

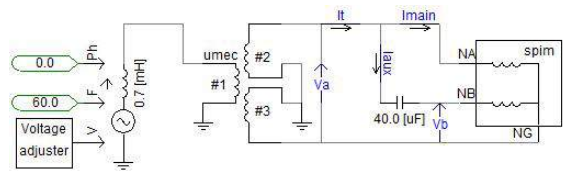


**Figure 2** Schematic for testing the model

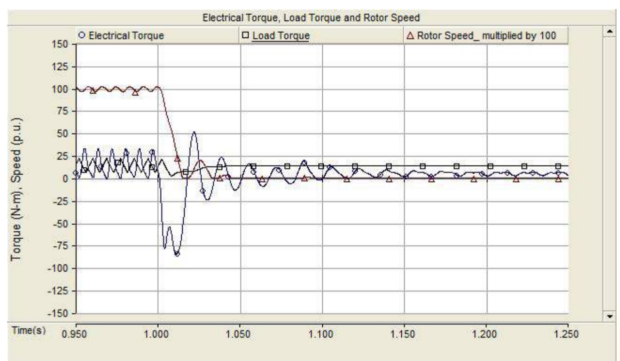


**Figure 3** Plot of electrical and load torques and motor speed when load torque is 14 N-m and fault is applied at 0 degree of voltage waveform

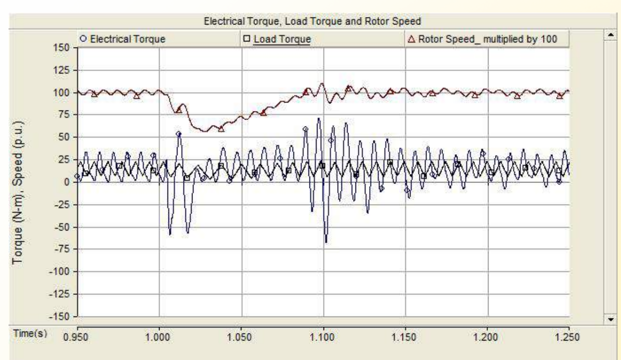


**Figure 4** Plot of electrical and load torques and motor speed when load torque is 14 N-m and fault is applied at 90 degree of voltage waveform

The application of this model is not just constrained in studying the FIDVR problem. This model is developed based on solving a series of non-linear differential equations using implicit integration method. It replicates the dynamic behaviors of real motor. The power quality issues with integrations of residential single phase motors can also be investigated using this model.

**Reference**

*"Transient model of air-conditioner compressor single phase induction motor,"* IEEE Trans. Power Syst., vol. 28, no. 4, pp. 4528-4536, Nov. 2013.

# Electric Network Interface (ENI) Breakthrough

*Craig Muller, Rajendra Singh, Bathiya Jayasekera, & Rohitha Jayasinghe, Manitoba HVDC Research Centre*

The PSCAD™ Development Group is always exploring new ways to expand and enhance our tools capabilities; one of these enhancements has been in the area of High Performance Computing (HPC). Over the last three years the group has achieved multiple milestones in this domain. The first core development was the integration of a new workspace and simulation sets that allows the user to develop coordinated runs in sets using the Xoreax Grid Engine (XGE). Last year a successful implementation of the Electric Network Interface (ENI) was demonstrated and developed to a commercial grade for deployment to end-users. ENI effectively enables a large system to be broken into independent, but interconnected sub-networks. This enables a large system to be broken into multiple projects, one per sub-network, so that each project can be dedicated to its own CPU and improve performance.

As the number of breaks increases, such as the 9 Terminal HVDC case, each terminal requires a dedicated CPU core to execute plus one for PSCAD itself. Most hardware does not have 10+ cores in a single machine (internally we have some single machines with 8, 12, 24 cores that have been used for testing). Our goal is to bring the application to common networked hardware (typically 4 cores/machine).

In order to improve overall performance, recent successes in non-blocking EMTDC allows the process to pick-up the values from its peer the moment the data becomes available rather than waiting to un-block. This means the next release of PSCAD will have the potential to use XGE for this feature without the need for specific configurations.

Recent developments in the group have created an even more advanced build of the software that is now capable of analyzing a single project network, computing suitable breakpoints, separately build individual EMTDC processes and launch those processes in concert to work together on a single project. This means the power of ENI can be deployed to an end-user with absolutely no changes required by the user. Essentially, a user is not required to learn how to break networks apart to support ENI; rather it will support the customer in their existing implementations. To the best of our knowledge this has never been done before in an offline Electromagnetics Transients tool, making us the first in the world to have this capability.

It is expected that this work will continue to ensure its functionality with control signal carriers, increasingly complex split patterns and performance mapping. Stay tuned for the next phase of the work, which will be to develop algorithmic methods to include intelligent optimization of the network splitting.

Please contact the technical support team at *pscad@support.com* for illustrative examples.

**Reference**

*10th International Conference on Power Systems Transients (IPST 2013),* 18th July – 21st July 2013, Vancouver, BC, Canada.

# Introducing MyCentre and the PSCAD™ Q&A Forum

*George Wai, Manitoba HVDC Research Centre*

MyCentre is a cloud-based service that provides MHRC customers with relevant information regarding their products in one central location. New MyCentre features include an online library, model management and centralized licensing for PSCAD, as well as an improved user interface with enhanced product support capabilities. Future work will focus on providing customers customizable solutions to meet their needs.

**Farewell PSCAD Discussion Forum** The PSCAD Discussion forum has been online and active since 2003. Earlier this year it was closed and replaced with the new, user-friendly PSCAD Q&A Forum, which is available through the MyCentre service.

Discussion forums served the purpose of providing a place for like-minded individuals to share ideas and grow their understanding through discussion. The new Q&A forum provides many added features and functionalities that were not available in its predecessor.

**The New PSCAD Q&A Forum** The power of a Q&A forum lies in the following conveniences:

- Post questions and tag them with keywords
- Fast and effective searching through keyword tags
- Offer up suggestions as possible solutions
- Vote on quality solutions, making it simple for future users to find the most likely solutions
- Gain points to be recognized as an expert in your field from users' votes on answers
- Images, video, and attachments are supported in posts

The new Q&A forum empowers users by providing a place to efficiently find quality solutions. Each solution submitted is subject to three levels of scrutiny:

1. **Voting** allows the users to decide the best solution. This is a form of crowd sourcing for validation.
2. **User points** allow other users to see how experienced the user is that provided the solution.
3. **Comments** allow fellow users to make comments on any solution, further aiding in the breath of each user's understanding.

The new Q&A forum is accessed through your MyCentre account. If you do not already have an account, please visit *https://mycentre.hvdc.ca* to register. If you need any assistance, contact our sales department at *sales@pscad.com*. Registration is simple and fast.

MyCentre and the new Q&A forum area are not just about offering online services and support: They create an accessible environment where you can connect with, share information and collaborate with others.

# COMING SOON: PSCAD™ v4.6

*Manitoba HVDC Research Centre*

MHRC, the developer of PSCAD, continuously monitors and improves its existing software products in order to meet the needs of its valued clients. MHRC is excited to announce that it will soon be releasing its newest minor update to the X4 product: v4.6.

PSCAD v4.6 includes many improvements, new enhancements, and expansions to existing features. Customer satisfaction and ease of use is of the upmost importance to MHRC, and user feedback is always welcome. To submit your feedback or ask for assistance, the support desk can be reached via email at *support@pscad.com*.

Below is a list of additions and improvements that are featured in the new v4.6 release:

**Electric Network Interface (ENI)** This new interface enables sub-networks in individual projects to be electrically connected to each other and simulated as one complete network. In essence, this provides a way to break large electric networks into sub-networks, interconnect them, and run each as a separate process on an individual processor core. Communication is accomplished through TCP/IP sockets. Minor alterations have been made to the transmission segment components to facilitate the interface, along with changes to the EMTDC communication interface with PSCAD.

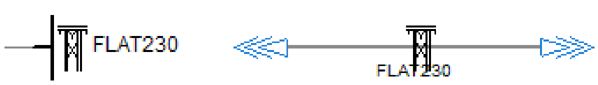


**Figure 1** Transmission Line Interface and Configuration Components

**Volley Launch/Root Control** Volley launch provides the ability to launch multiple EMTDC simulation runs in parallel (up to a maximum of 64), based on a single PSCAD case project. To set up a volley, a simulation must first be added to a simulation set. Once added, simply invoke the Simulation Options dialog and adjust the Volley Count option. For example, if you want to launch 7 simultaneous runs of a single project, then set the Volley Count to 7. When you next launch the simulation set, 7 instances of that simulation will be launched in parallel, utilizing all available processor cores.

**Transformer Magnetic Hysteresis** A core magnetic hysteresis algorithm has been added to all classical transformer components. The algorithm includes two unique hysteresis modeling techniques: The Basic (Loop Width) model and the Jiles-Atherton model. Each model is configured differently of course; the basic model being the simpler of the two.

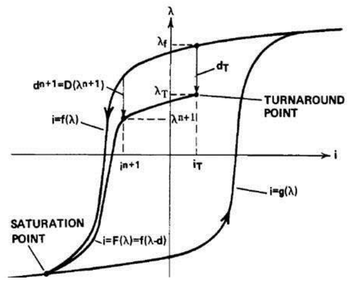


**Figure 2** Hysteresis Diagram

**Frequency-Dependent Network Equivalent Model (FDNE)** This component may be used to model the frequency-domain characteristics of an electrical circuit. In power systems, the FDNE model may represent a reduced-order network equivalent, a high frequency transformer model, short transmission lines, etc.

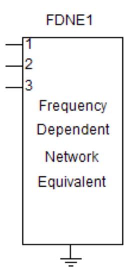


**Figure 3** The FDNE Component in PSCAD

**Frequency-Dependent Transfer Function Model (FDTF)** This component models a multi-port transfer function and may be utilized as part of any control system. The component transfer function is constructed based on state-space realization using ABCD parameters.

## *The FDNE model may represent a reduced-order network equivalent, a high frequency transformer model, short transmission lines…*

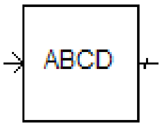


**Figure 4** The FDTE Component in PSCAD

**Comparator Tool** The schematic comparator tool allows for quick and convenient visual differentiation between module component definitions. By selecting two sources for comparison (from the ***Tools*** tab in the ribbon bar), users can click the compare button to perform a comparison of the two definitions.

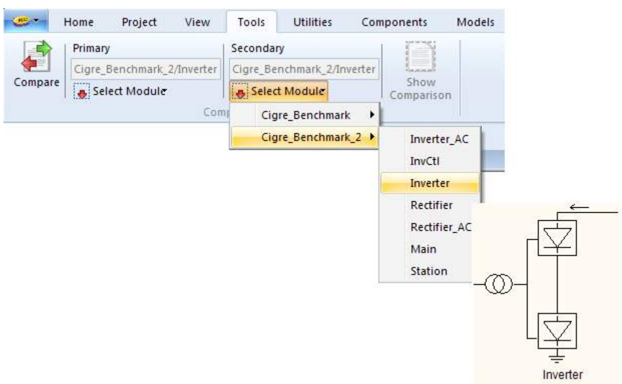


**Figure 5** Selecting a Primary and Secondary Source in PSCAD

The user will be presented with a visual display of the differences between the two modules. A results table will give users a text description of the differences, along with the values that were found to be different. Additionally, components with differences will be surrounded in color coded highlighting boxes on the schematic canvas of the primary source.

**Bird's Eye View Navigation Pane** This new pane provides an overview of the entire schematic or graphic canvas and indicates what is currently in view with a blue box. This tool is an important part of the collection of navigational tools in PSCAD, and is used to easily zoom and navigate. This pane is particularly helpful when working with very large projects.

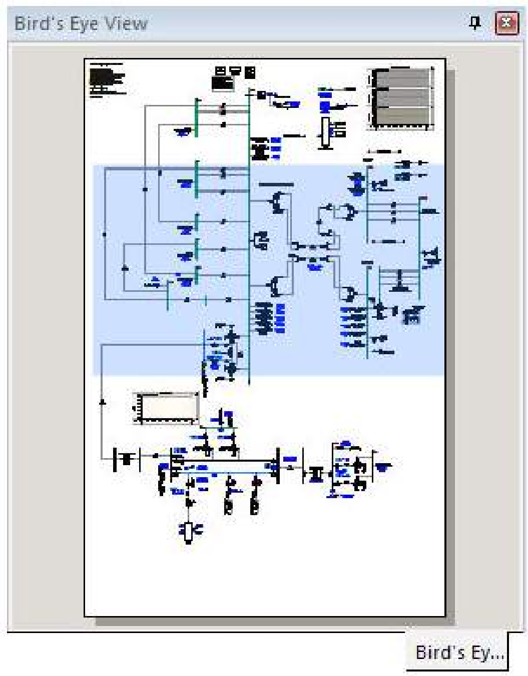


**Figure 6** The Bird's Eye View Pane in PSCAD

**Statistical Breaker Model** A statistical breaker component has been added to the master library. This component is meant to be used in the single-pole operation of a 3-phase breaker, in a statistically distributed manner.

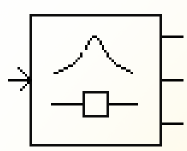

**Figure 7** The Statistical Breaker Component in PSCAD

**Multi-meter** The ability to measure RMS current has been added to the multi-meter component.

**MOD and MODULO Components** Both MOD and MODULO components have been added to the CSMF section of the master library.

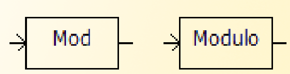


**Figure 8** The MOD and MODULO Components in PSCAD

**Synchronous Machine Neutral Connection** The synchronous machine has been extended to allow users access to the neutral connection point. Enabling the additional connection N is controlled via a new component input parameter.

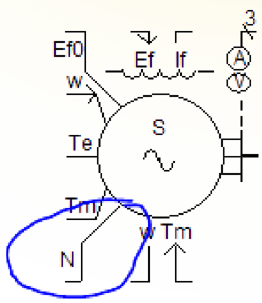


**Figure 9** The Synchronous Machine Component in PSCAD

**Single-Phase, 3-Winding UMEC Transformer (Replacement)** This new component (umec-xfmr-3w2) replaces the previous Single-Phase, 3-Winding UMEC Transformer component (umec-xfmr-3w). In the new component, winding leakage and copper losses may be specified individually, as opposed to a total value being evenly distributed amongst all windings.

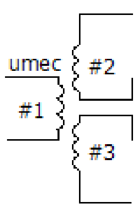


**Figure 10** The 1-Phase, 3-Winding UMEC Transformer Component in PSCAD

**Battery Model** A battery model has been added to the master library, based on both an electro-chemical and a tabulated data battery model. The battery is modeled using a general approach, in which an ideal controlled voltage source, in series with a resistance, is used.

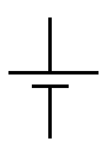

**Figure 11** The Battery Component in PSCAD

**12-Channel Decoder Enhanced to N-Channel** Formerly, the 12-channel decoder was of course limited 12 output channels. This component has been modified such that it can now possess an unlimited number (i.e. N-dimensional) of outputs.

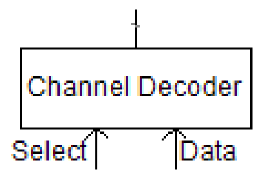


**Figure 12** The 12-Channel Decoder Component in PSCAD

**Multi-Mass Interface to Permanent Magnet Machine** An interface has been added to the permanent magnet machine from the multi-mass component.

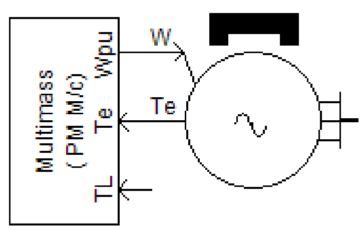


**Figure 13** The PM Machine Component with Multi-Mass Interface in PSCAD

**Machine Speed/Mechanical Torque Input** The DC and Permanent Magnet machines are now configured to accept either speed or mechanical torque input, similar to what is done in the synchronous and induction machines.

**External Input on Hard Limit Component** External limit connections have been added to the Hard Limit component.

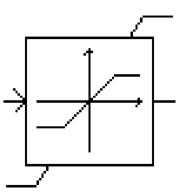

**Figure 14** The Hard Limit Component in PSCAD

*The battery is modeled using a general approach, in which an ideal controlled voltage source, in series with a resistance, is used…*

**Data Merge Component Now Supports Array Signals** It is now possible to merge array signals together, in addition to scalars.

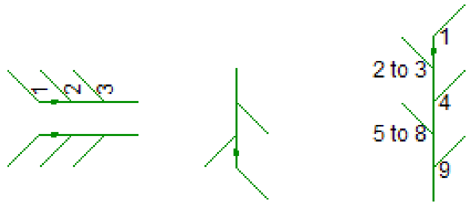


**Figure 15** The Data Merge Component in PSCAD

**Latch Mode Operation Added to Flip-Flop** The flip-flop component now supports latch mode operation, complete with optional enable signal.

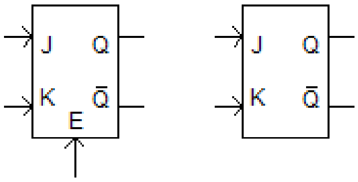


**Figure 16** The Flip-Flop Component in PSCAD

**Dynamic Data Tap Component** This component outputs a signal (scalar or array), based on the connection input for the starting index. The dimension of the output is defined in the parameters section. If the selection of starting index and output dimension refers to elements outside the input array, the component will warn and output zero (or .FALSE.) depending on the data type.

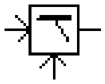

**Figure 17** The Dynamic Data Tap Component in PSCAD

**Change to Multiple Run File Naming Format** If the simulation rank number is 0, the current file naming behaviour is used. However, if the rank number is non-zero, the output filename is now formatted as `mrunout_##.out`, where ## is the 2-digit rank number.

**Maximum Number of Cables Increased** The maximum number of cables per right-of-way has been increased from 8 to 12. These changes affect the cable interface component and the Line Constants Program (LCP).

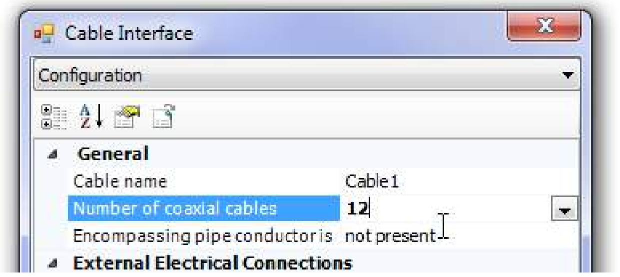


**Figure 18** Part of the Cable Interface Component Parameter Dialog in PSCAD

**Externally Connected Resistors on Cable Interface** An option has been provided to the cable interface component to allow users to automatically connect resistors externally to ground.

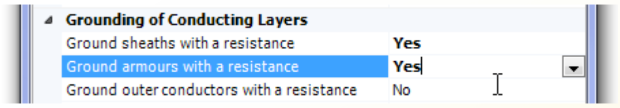


**Figure 19** Part of the Cable Interface Component Parameter Dialog in PSCAD

**Rank Number** This component outputs the rank number of a simulation that is part of a volley launch. Note that the rank number of non-volley simulation is 0. Combined with a look up table method, such as XY Transfer Function or XY Table, this component can be utilized to take different data for different runs in a volley launch simulation.


**Figure 20** The Rank Number Component in PSCAD

**Enable/Disable Output Channel Data Transfer** It is now possible to enable/disable individual output channel components. A new parameter has been added called 'Transfer Data?'. Selecting 'No' will disable any transfer of data between EMTDC and PSCAD, thereby stopping use of memory by that output channel during runtime.

# Manitoba Hydro International Ltd.

*Roberta Desserre, Manitoba Hydro International Ltd.*

**The Manitoba HVDC Research Centre became a division of Manitoba Hydro International Ltd. (MHI). Find here a description of our company as well as the products and services provided by each of the divisions.**

Manitoba
HYDRO INTERNATIONAL

**Manitoba Hydro International Ltd. (MHI)** MHI is a wholly owned subsidiary of Manitoba Hydro, one of the largest and longest standing energy utilities in Canada. MHI is comprised of five divisions, which were amalgamated in 2009. Each division delivers innovative, exceptional products and services in their area of expertise.

The divisions of MHI:

**MHI-MHRC: Manitoba HVDC Research Centre** MHRC is the world leader of power system simulation and applied engineering consulting services. Setting this division apart is its research focus for practical applications and continued collaboration with global partners. Initially exclusively a research organization focused on HVDC, today MHRC has grown, providing both products and services for AC and HVDC and the leading supplier of the electromagnetic transient software PSCAD™.

MANITOBA·HVDC
RESEARCH
CENTRE

**MHI-US: Manitoba Hydro International Utility Services** assists clients around the world in the efficient, effective, and sustainable delivery of electricity and natural gas. Leveraging its own utility's first-hand experience, MHIUS offers clients tangible solutions, sustainable results, and true value. MHIUS has provided utility and asset management, consulting, and training solutions to over 75 countries. For the past 29 years, MHIUS has established itself as an ethical, environmentally responsible provider of high-quality utility services.

Manitoba
HYDRO INTERNATIONAL

**MHI-WIRE: Worldwide Integrated Rating Enhancement Services** WIRE Services assists clients in achieving cost effective and energy efficient solutions for their power transmission line needs. WIRE was the first utility-based company to integrate LiDAR technology for power utility applications. LiDAR allows clients to use topographical data to simulate the effect of differing weather conditions on power lines in order to maximize the utilization of their current assets, or to perform cost effective upgrades to their system. Since 2001, WIRE has been providing a turnkey package to power utilities including new route surveys, transmission line modeling, vegetation management, thermal rating analysis, and upgrade engineering.

WIRE
SERVICES

**MHI-MHT: Manitoba Hydro Telecom** MHT is a facilities-based, carrier-class telecom service provider with a comprehensive network in rural Manitoba and the Winnipeg region. The network was originally designed to protect, monitor, and control the electric power system throughout Manitoba, and is now leveraged to connect customers with reliable access to broadband communication services. Comprised of thousands of kilometers of fiber optic cable, the network is equipped with next generation Ethernet technology, enabling Manitoba Hydro Telecom to provide organizations with scalable broadband capacity. MHT also offers colocation services in data centers as well as at Manitoba Hydro's Service Centers and radio towers. These services are combined to create high quality unique network solutions

Manitoba Hydro telecom
We connect...

**MHI-MS: Manitoba Hydro International Maintenance Services** MHIMS provides safe, efficient, and cost-effective electrical high voltage and natural gas services within Manitoba and throughout North America. Their areas of expertise include material procurement, maintenance, project design, and project and contract management, allowing MHIMS to offer their clients comprehensive solutions for maximizing energy efficiencies.

MHI
Maintenance Services

Additional Services available from MHI:

**HVTF - Insulation Engineering and Testing Services** HVTF services are available from MHI including robust quality assurance test programs for a wide variety of high voltage electrical equipment and materials in accordance with IEEE, ANSI, IEC, and CSA Standards. This independent, third party High Voltage Test Facility (HVTF) is located in Winnipeg, Manitoba, Canada near the geographical center of North America. The HVTF provides insulation engineering and testing services tailored to meet the specialized needs of electrical utilities, heavy industry, and academic research institutions. The facility is fully equipped with state-of-the-art testing equipment and highly trained technical staff capable of testing electrical apparatus rated up to and including 550 kVac and 500kVdc, such as instrument transformers, bushings, aerial lift devices and power transformers.

HVTF

For more information about Manitoba Hydro International Ltd. please see our website at *www.mhi.ca* or contact Roberta Desserre (*rdesserre@mhi.ca*).

# Resolving MyUpdater Issues

*Manitoba HVDC Research Centre*

This is a brief article to demonstrate the type of challenges to which we can find solutions on the recently rolled-out Q&A Forum. New solutions and tips are frequently posted to the PSCAD Q&A Forum (log in to *https://mycentre.hvdc.ca*, click on the "PSCAD Q&A" tab, and search for key terms in the "Search" field).

**Background** In order to run the PSCAD Free Edition, the user must download a software deployment utility called MyUpdater. The MyUpdater utility is used to install, uninstall, update, and launch PSCAD.

A small number of users have reported minor issues such as:

- The utility will not install
- The utility will not launch
- The utility will not display any products for installation
- Products will not install from the utility
- Products will not launch from the utility

There may be a number of reasons for these issues, most of which are related to settings and protection tools on a user's machine or network, such as proxies, firewalls and anti-virus tools.

**Troubleshooting** You may troubleshoot these issues using the Update Client Common Issues guide, available at: *updater.pscad.com/docs/CommonIssues.pdf*.

**Note** The above link is case sensitive.

**Assistance from our Support Desk** If you are still unable to resolve the problem, please send the following to *support@pscad.com*:

- A description of steps leading up to the problem
- Snapshots of error messages. If the error messages contain "Details", also send in this log information
- The MyUpdater utility log file, which will be saved as "UpdateClient_Msgs.txt"

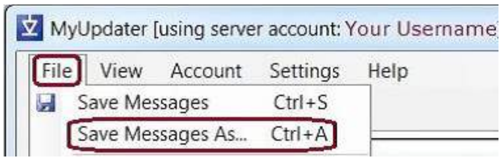


**Figure 1** Save as UpdateClient_Msgs.txt

**Note** This log file will only be available if MyUpdater is installed on your machine.

# E-TRAN Software Release Notice

*E-TRAN Development Team at Electranix Corporation*

Electranix is pleased to announce the release of E-TRAN v3.0!

New Features in E-TRAN version 3.0 include:

- Added PSCAD x4 support
- Added PSS/E v33 support
- Native writing and substitution of .pscx files
- Support for Intel v12 and GFortran Compilers
- Improved speed when translating cases

Please contact *E-TRAN@electranix.com* for more information and pricing.

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info@pscad.com

# Meet the Team!

*Manitoba HVDC Research Centre*

The Manitoba HVDC Research Centre (MHRC) prides itself on its excellent customer support and service. Our success is a direct result of our client focused efforts. We are committed to providing our clients with the best possible support to ensure optimum success with our products and services. Meet the Team will be a regularly published addition to the Pulse Newsletter to introduce our experienced team members. This publication features Dharshana Muthumuni and George Wai; just a few of the dynamic staff members we are fortunate to have at the MHRC.

**Dharshana Muthumuni,** Ph.D., P.Eng.
*Managing Director of Manitoba HVDC Research Centre, a division of Manitoba Hydro International.*

We are pleased to announce that Dr. Dharshana Muthumuni has been appointed the position of Managing Director for the Manitoba HVDC Research Centre.

Dharshana, formerly known in his role as Technical Director, has made many contributions to the company's growth and development during his 14 years with the organization. He has lead the technical team to solve challenging problems and has worked closely with equipment vendors to develop simulation models and techniques. In addition to his engineering study experience, Dharshana has been a key developer of the PSCAD simulation software tool and has conducted training workshops on a variety of power system topics.

Dharshana will be responsible for overseeing all aspects of the business including products, engineering consulting, research, and training services. Strategic partnerships and high level of customer service will continue to be his top priority.

**George Wai,** B.Sc., Electronic Engineering Technologist
*Software Support & Development Specialist*

George has been working closely with PSCAD since 2001. From 2006 to 2010 George was involved with the development of PSCAD as a Senior Software Developer at MHRC. In his current role as a Software Support & Development Specialist, George plays a vital role in reviewing all incoming PSCAD support, assisting users with problems, aiding in technical marketing of PSCAD, and helping shape the future direction of PSCAD through user feedback and experiences. George received his Bachelor of Science degree in 2001 from the University of Manitoba, where he specialized in Computer Science. George also became an accredited Electronic Engineering Technologist in 1995 after attending Red River College.

## Connect with Us!

Be sure to visit MHRC at the following industry events to see a demonstration of the latest release of PSCAD™:

August 27, 2014
**2014 CIGRE Paris Conference**
*http://www.cigre.org/*
Palais des Congres – Porte Maillot, Paris, France

September 22- 24, 2014
**2014 CIGRE Canada Conference**
*http://www.cigre.ca/*
International Center, Toronto, Ontario, Canada

September 25-26, 2014
**2014 PSCAD User Group Meeting**
*http://www.nayakcorp.com/PSCADUGM2014.htm*
Executive Conference Center, New York, NY, USA

## Upcoming Training

You are invited to join us for the following upcoming training sessions scheduled during 2014. Additional opportunities will be added periodically, please visit *www.pscad.com* for more information about course availability.

September 23-25, 2014
**Applications of PSCAD & Transient Studies**

October 22-23, 2014
**Applications of PSCAD in Power Systems including Switching & Lightning Transients for Insulation Coordination**

November 18-20, 2014
**HVDC Control & Project Management**

All training courses mentioned above are held at the Manitoba HVDC Research Centre, Winnipeg, Manitoba, Canada.

## Expanding Knowledge

The Manitoba HVDC Research Centre (MHRC) is committed to providing a variety of power system, PSCAD, and custom training courses to assist all clients in fulfilling their learning objectives, whether attendees are beginners or experts. The following courses are available, as well as custom training courses – please contact *training@pscad.com* for more information.

**Applications of PSCAD & Transient Studies | 3 Days**
Fundamentals applicable to the study of electromagnetic transients in electrical networks. A number of application areas such as AC transients, fault and protection, transformer saturation, wind power, FACTS, power quality, as well as other power system topics are discussed with practical examples and several case studies.

**HVDC Control & Project Management | 3-5 Days**
Fundamentals of HVDC transmission in electrical networks, including HVDC transmission system concepts, components, equipment and their characteristics and their controls. The concepts presented are reinforced with several PSCAD simulation workshops and case studies.

**Modeling & Applications of FACTS Devices | 3 Days**
Fundamentals of solid-state FACTS systems, system modeling, control system modeling, converter modeling, and system impact studies.

**Wind Power Modeling & Studies Using PSCAD | 3 Days**
Fundamentals of wind power and its integration into the electric grid. Several case studies are applied in detail to highlight practical situations encountered by engineers. Attendees are able to experiment with case studies in an interactive hands-on workshop environment using PSCAD simulation software.

**Transmission System Modeling in PSCAD - Recommendations & Applications | 3 Days**
Remove the uncertainty when modeling transmission systems by touching upon important mathematical concepts, including frequency and time-domain theory, practical selection of model types, explanation of important model parameters, and troubleshooting. Apply newly learned modeling skills to several real-world applications using PSCAD.

**Advanced Topics in PSCAD Simulation | 2-4 Days**
Custom, client-specific component design and assisting users with the analysis of specific simulation models. Topics may include HVDC/FACTS, distributed generation, machines, power quality and others. Attendees can request coverage of specific topics or phenomena of interest.

**Applications of PSCAD in Power Systems including Switching & Lightning Induced Transients for Insulation Coordination | 2 Days**
Covers the electromagnetic transient studies that are required to determine the insulation levels and ratings of sub-station equipment. Topics include: selection of surge arrester (ratings and position) to protect substation equipment from lightning and switching surges, development of the system model for switching frequency overvoltage studies and estimation of ‘failure rates, lightning overvoltage studies - representation of station equipment, line segments and towers for a lightning overvoltage study, circuit breaker TRV, and capacitor switching transients.

For more information visit *www.pscad.com* or contact *training@pscad.com*.

If you have an article or experience that you would like to share with the PSCAD community send in your article to *info@pscad.com* to have it featured in a future issue of the ***Pulse***.

*Pulse* is distributed free of charge and is posted electronically at *www.hvdc.ca* If you would like to receive a copy of *Pulse*, please send us an email to *info@hvdc.ca* Articles and submissions addressing the use of PSCAD™ in the real world are always welcome.


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