

June 2013

Multi-Module Converter Models

Power-Hardware-in-the-Loop at NTUA

RTDS User's Group Meeting

## IPST 2013

This year's International Conference on Power System Transients (IPST) will be held July 18-20, 2013 at the University of British Columbia in beautiful Vancouver, Canada. RTDS Technologies is a Main Level Sponsor of this event, which focuses on the exchange of information regarding EMTP-type power system transients.

IPST is the only conference that highlights electromagnetic transient simulation, which has garnered the support of RTDS for many years. It features a session on real time simulation, which is a very good fit for the RTDS Simulator. Other topics include non-real time computer simulations and field measurements as related to EMTP.

For more information about IPST, please contact [steph@rtds.com](mailto:steph@rtds.com) or go to <http://www.ipst2013.com/>



## Multi-Module Converters - MMC Model



The latest MMC valve development from RTDS Technologies is an FPGA based component that is fully integrated into the small timestep sub-network. It provides valuable modeling flexibility with detailed representation of up to 512 submodules per valve which is more than 3000 submodules in one HVDC station! The model is used for detailed control development and factory

acceptance testing where a physical connection to external firing pulse controls as Hardware-In-the-Loop (HIL) is required. The FPGA-based model supports various faults, including internal faults, for in-depth controller testing. A maximum of two optical fibers are used per valve to bring in the firing pulse signals and send out the individual capacitor voltages, the valve currents, etc.

The FPGA hardware can also be used to act as the controller for the MMC valve model, which can help in the understanding of the control and operation of an MMC scheme before the customer's physical controls are connected. Manufacturers in both Europe and Asia are now using the new models and have successfully connected their physical controls to the valve model, using full firing pulse control for each level.

In addition to the FPGA based MMC model, two other models exist for modeling MMC schemes. The first is called CHAINV5 and uses the same algorithm as the FPGA based model above to test physical firing pulse controls. CHAINV5 runs on either a PB5 or GPC processor card and can support 40/50 levels in the full/half bridge configurations. The second model is called MMC5 and it is designed to test the higher level control strategy (no firing pulses). MMC5 has an ideal capacitor voltage balancing algorithm and uses the number of deblocked submodules and the number of positively or negatively inserted submodules as its input. More than 600 levels per valve (1200 per phase) can be represented with MMC5.



## Power-Hardware-in-the-Loop simulation for Distributed Generation at the National Technical University of Athens

### Guest Article

Power-Hardware-in-the-loop (PHIL) simulation allows the connection of an actual power device or system to a power system model which is simulated on dedicated real-time hardware, allowing testing under realistic conditions. The simulated system can be changed easily and quickly without the need for hardware adaptations. Therefore, various experiments can be performed repeatedly and conveniently.

The RTDS Simulator has been successfully used for performing PHIL experiments in a wide range of applications, including the testing electric ship motors and motor drives even at the MW range. PHIL simulation is a relatively novel tool in studying the integration of Distributed Energy Resources (DER) in the transmission and distribution grids. Photovoltaic panels, wind turbines, electric vehicles or whole microgrids can be connected to simulated active networks containing various simulated DER devices. PHIL simulation has been successfully used in these fields and is expected to gain high interest in other fields in the future.

A PHIL simulation environment focusing on distributed generation and microgrids was developed at the National Technical University of Athens (NTUA). The hardware part comprises a low voltage microgrid with photovoltaic panels and a small wind turbine as primary power sources interfaced to the AC bus via fast-acting DC/AC PWM inverters. A battery bank is also interfaced to the AC bus via a bi-directional PWM voltage source converter. Several PHIL experiments have been performed, where medium and low voltage active networks with photovoltaic, wind generation, and a D-STATCOM are simulated in the RTDS. In addition, an irradiation sensor provides input to the PV models in the RTDS Simulator in order to achieve realistic conditions. Slow dynamic (actual irradiation variations) and fast dynamic experiments (voltage dips and faults in the RTDS simulation) allow thorough examination of the hardware device, as well as its impact on the simulated network. Further tests are planned, focusing on voltage and frequency support provided by distributed generation.

*If you are interested in contributing to the RTDS News, please contact Steph at [steph@rtds.com](mailto:steph@rtds.com). We would love to hear from you!*

### UGM Summary

The 2nd biennial RTDS User's Group Meeting was held May 7-9, 2013 at Florida State University's Center for Advanced Power Systems in Tallahassee, Florida. The Meeting was a great success, bringing together users of RTDS simulation technology from around the world. From all accounts, the meeting was intellectually stimulating and served to foster valuable connections within the RTDS community. Presentations on 16 different RTDS-related topics were given over the 3 day span of the Meeting. We look forward to hosting another in 2015!

If you would like further information regarding the presentations given at the User's Group Meeting, please contact Steph at [steph@rtds.com](mailto:steph@rtds.com)

### RTDS Training Courses

We are currently accepting registrations for the following courses:

**RTDS IEC-61850  
ADVANCED SIMULATOR  
TRAINING**

September 9-13, 2013 in  
Winnipeg, CANADA

**INTRODUCTORY RTDS  
SIMULATOR TRAINING**

October 21-25, 2013 in  
Winnipeg, CANADA

Email [steph@rtds.com](mailto:steph@rtds.com) for  
more details.

### Upcoming Events

**Actual Trends in  
Development of Power  
System Protection and  
Automation**

Yekaterinburg, RUSSIA  
June 3—7, 2013

**PAC World Dublin**

Dublin, IRELAND  
June 24—27, 2013  
Booth 11

**IPST 2013**

Vancouver, CANADA  
July 17—20, 2013



### RTDS is on Facebook!

Check out our Facebook page where you will find our regular feature "Model Monday" as well as other information on what we're up to!

Congratulations to Poland, Qatar and Thailand for being the latest countries to purchase RTDS Simulator equipment. We now have simulators in 36 countries worldwide!

