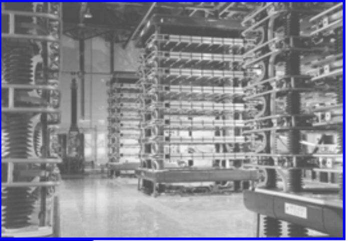
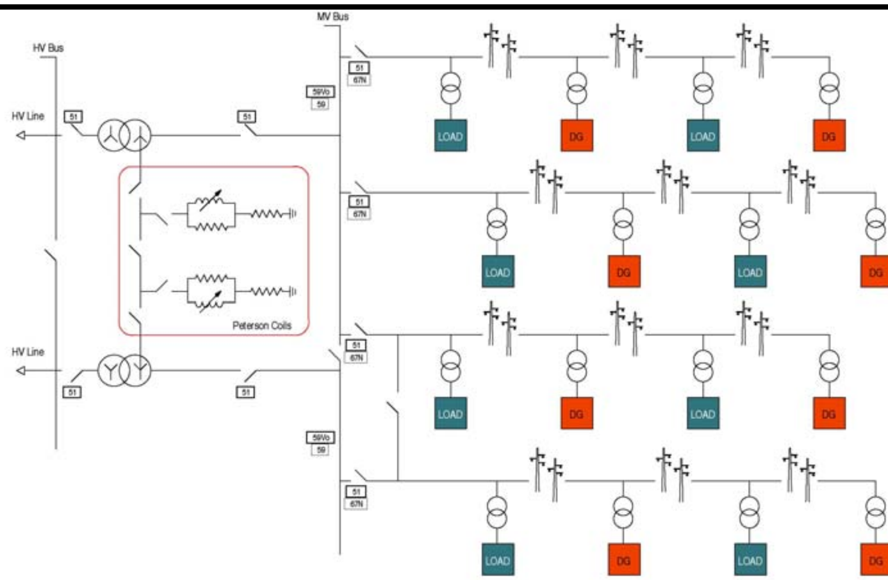


RTDS NEWS

Summer 2009

Real time digital simulation for the power industry

Enel
ENERGY IN TUNE WITH YOU.



Smart Grid and DG Investigation

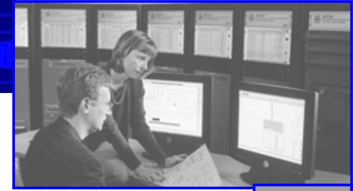
ENEL Distribuzione's research lab in Milan, Italy is using the RTDS® Simulator to study interactions between their distribution network and the new types of devices that are being connected to it.

According to ENEL, Distributed Generation (DG) represents a possible development model for modern electrical systems to evolve toward Smart Grids in which integrated resource management allows for their ideal utilization. However the introduction of DG devices, such as photovoltaics and wind energy, into the distribution system presents unique challenges since the network, as well as its protection and control, was originally designed to conform to passive unidirectional power flow from the HV to the MV network. The performance of the existing protection and control as well as suggested changes must be evaluated under these new conditions. The RTDS Simulator is the ideal tool for these investigations since the actual protection and control equipment can be connected to the real time simulation of the network in which the new DG devices are included.

Researchers from ENEL, in collaboration with the Italian research organization CESI, created several RTDS models which represented typical HV/MV substations in ENEL's network. In one example shown above, several MV feeder lines distribute power to loads connected at points along the lines. Several different types of DG sources were also connected to the feeders at various points. Some of the DG sources included static converters with PWM switching and were modeled using small timestep subnetworks. The effect of the different DG power sources on the network and its protection and control equipment were studied.

In addition to the standard power system components such as feeder lines, transformers, loads etc., the model shown here also included a detailed representation of the Peterson coils connected to the MV side of the substation transformers' neutral connections. A Peterson coil is a variable inductor that is adjusted so that it forms a resonance with the shunt capacitance presented by the network. The result is that very little fault current flows for earth faults. As system conditions change, a controller adjusts the Peterson coil's inductance to stay in tune with the shunt capacitance. During the ENEL study the electrical components of the Peterson coil were modeled on the RTDS Simulator but the control was done by physical controllers connected to the simulator. Phase voltage, injection current and zero sequence voltage signals were sent in real time to the controller from the simulation and the controller provided the coil position increase/decrease signal using analogue and digital I/O. In fact the behaviour of two different types of Peterson coil controllers were tested under new system conditions.

RTDS Technologies



More detailed information regarding this work can be found in the technical paper - "Smart Grids: Preliminary MV Network Model Using Real Time Digital Simulator and Real Devices in a Closed Loop Control" by P. Paulon, R. Calone, C. Noce, G. Scrosati, L. Delli Carpini, G. Sapienza (ENEL) and E. De Berardinis (CESI) presented at the 20th International Conference on Electricity Distribution, Prague, June 2009.

Florida State University Pushes for Development of GTFPGA

Researchers from the Center for Advanced Power Systems (CAPS) at Florida State University (FSU) strongly encouraged the development of the GTFPGA so they would have more freedom to implement FPGA based models and high level communication protocols for use with the RTDS Simulator. The GTFPGA is based on the ML507 Evaluation Platform from Xilinx and it includes a Virtex 5 FPGA. The card connects to a GPC card through a fiber optic link in the same manner as the GTNET and GTIO cards. Data can be exchanged between the GTFPGA and the GPC card as well as between the GTFPGA and the outside world. In addition to the fiber optic port that connects to the GPC card, the GTFPGA also includes various other hardware links that can be used to connect to external devices (USB, RS-232, RJ-45, PCI/e, etc.).

The power of the Virtex 5 and the physical interfaces available on the card make it possible for CAPS researchers to implement existing, or create new, high level protocol connections to the RTDS Simulator. Previously all communication protocols were created by RTDS Technologies. With the GTFPGA the user now has the freedom and flexibility to implement other protocols.

CAPS is also interested in using the GTFPGA to develop specialized power system models to interface with the main network simulation running on the RTDS Simulator. Not only does the Virtex 5 offer cutting edge FPGA functionality, but it also includes an embedded RISC processor that can be used when creating models.

In addition to the hardware, a piece of RTDS IP (RTDS_InterfaceModule) is required. When included in a FPGA design, it will allow the ML507 board to communicate with a GPC card and pass data in both directions. This interface module takes very few resources so almost the entire FPGA capability remains available for the user's application.

GTWIF - Increased Communication Speed, More Nodes, …

The GTWIF card replaces the functionality of both the WIF and the IRC cards. The biggest benefit of the GTWIF results from the increased backplane communication speed for all GPC racks. The communication speed has doubled which in many cases can significantly reduce the simulation timestep. The increased backplane speed permits the network solution to process 66 nodes per rack, up from 54.

Each GTWIF has six optical fiber ports for IRC communication (the same number as the existing IRC card) to allow full interconnection of 7 rack simulators. Development is also nearly complete on the IRC Switch which will allow direct communication between as many as 60 simulator racks.

The GTWIF can run at the standard backplane communication rate in racks that include 3PC's or RPC's. IRC version 3 cards can also be run in racks with the GTWIF card to allow interconnection to WIF/IRC based racks. For simulators with three or more racks, the GTWIF utilizes the current GBH.

UPCOMING EVENTS

IEEE/PES General Meeting
Hospitality Suite July 27-29, 2009 in Calgary, Canada

RTDS Introductory Training Course
August 24- 28, 2009 in Winnipeg, Canada

APAP
Exhibition Oct. 18-24, 2009 on Jeju Island, South Korea

IEEE PES T&D Asia-Pacific
Exhibition October 26-30, 2009 in Seoul, South Korea

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