*ePHASOR*sim

Real-Time Transient Stability Simulator

The Ultimate Solution for Large-Scale Power System Simulations

OPAL-RT
TECHNOLOGIES

e*PHASOR*sim Fundamental-Frequency Real-Time Power Grid Simulator

*ePHASOR*sim simulates electro-mechanical transient stability phenomenon of very large power grids with thousands of buses, generators, transformers, transmission lines, loads and controllers. It uses a fundamental frequency solver optimized to compute rms values of voltages, currents, active and reactive power in real time, with a typical time step of 10 milliseconds.

*ePHASOR*sim is ideal when implementing training simulators for transmission system operators, and developing and testing the performance of local protection and control systems, as well as complex global power system controls implemented in SCADA software.

In such applications, the simulator receives commands and computes the new steady conditions and dynamic behaviour of the simulated power grid in real time. Voltages, currents, power, breaker status and critical control signals can be monitored in real-life applications. Different system disturbances such as faults, line and load switching, and generator tripping can be simulated to analyze the effects of protection and complex control systems installed on each station.

Typical Applications

- Operator training simulator for transmission systems using balanced positive-sequence network models
- Operator training simulator for distribution systems using unbalanced phase-by-phase nework models (2012-Q4)
- Test and optimization of machine control on system stability (voltage regulators, speed regulators, power system stabilizers)
- Testing of interaction between FACTS and HVDC transmission systems on system stability of interconnected systems using fundamental-frequency simulation before making detailed EMT simulations (2012-Q4)
- Testing global control systems implemented on SCADA systems using PMU measurements for voltage and power control
- Testing local control systems such as transformer tap changers, capacitor switching, over-current protection and re-closers, load shedding, load restoration and their interaction with global control systems
- Educational and research works
- Study the dynamic security assessment of large-scale power grids

e*PHASOR*sim

OP5600 Chassis
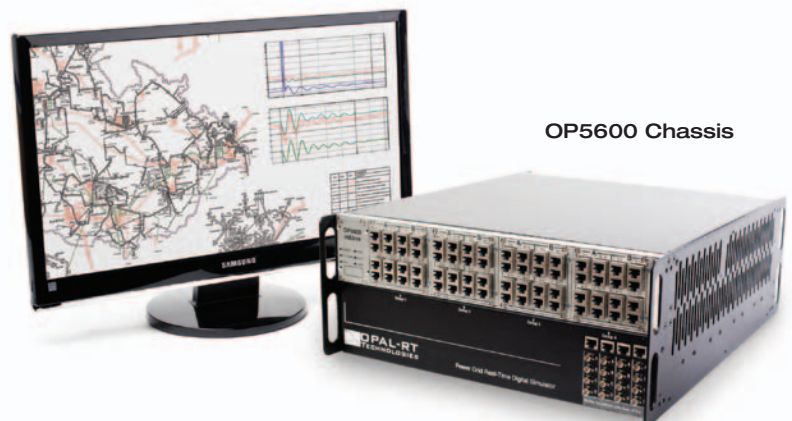
User Benefits

Simulation of Power Systems in Real Time

- Simulate power grids with up to 20,000 buses
- Simulate thousands of generators, tranmission lines, cables, loads and transformers
- Simulate detailed HVDC, FACTS and SVC systems and their controllers with large grid simulation
- Simulate synchronous generator with power system stabilizer, excitation system, turbine-governor and various voltage- and machine-speed regulators
- Simulate several types of events and actions such as balanced and unbalanced faults, line trips, open connector conditions, generator outages, load shedding and restoration, loss of excitation, reclosing and more
- Simulate tap changer and AVR adjustments, capacitor and inductor bank controllers and other typical protections
- Perform load flow analysis and islanding check
- Simulate systems with more than 100,000 buses with parallel processing (2012-Q4)

Open and Scalable Hardware Platform

- Integrated with the OP5600 chassis equipped with one FPGA, several I/O channels and up to 12 Intel processor cores
- Several OP5600 and OP7000 systems can be interfaced to simulate very large systems, if needed
- Interfaced with control and protection relay equipment using standard analog and digital I/O
- Interfaced with modern communication protocols such as IEC61850 and DNP3 (2012-Q3)

## Intuitive Test Automation Platform

- Perform test automation using Python scripts and TestStand software
- Use ScopeView oscilloscope to record, analyze and display results during or after simulation
- Interfaced with TestDrive and LabView user interface to implement realistic control panels with gauges, dial scopes and other virtual instruments
- Modify parameters while the simulator is running

The Best Third-Party Connectivity and Integration

- Interfaced with Simulink, SimPowerSystems and SimScape to enable users to develop their own load, control and protection models
- Interfaced with user-made models in C code or other programming languages to perform software-in-the-loop simulation and testing
- Interface with the Excel™ data base and with PTI PSS/e to import the network data files (will also be interfaced with other data bases used by popular distribution analysis software)
- Interfaced with e*MEGA*sim and Hypersim models with time steps as low as 10 microseconds for combined phasor-mode and EMT simulation (2012-Q4)

A very large transmission system simulated with e*PHASOR*sim
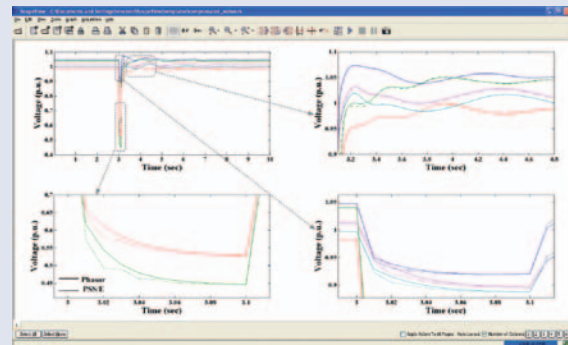
Effect of a three-phase-to-ground fault on a generator bus

from imagination to real-time

About OPAL-RT

Founded in 1997, OPAL-RT Technologies is a world-leading developer of open real-time digital simulators and hardware-in-the-loop testing equipment for electrical, electromechanical and power electronics systems.

OPAL-RT's unique technological approach integrates parallel, distributed computing with commercial-off-the-shelf technologies.

OPAL-RT's simulators are used by engineers and researchers at leading manufacturers, utilities, universities and research centers around the world.

Our customers perform rapid control prototyping, system integration, and hardware-in-the-loop testing of electric drives, electronic controllers and power distribution networks in a variety of industries including automotive, aerospace, electric ships, power generation, rail, and industrial manufacturing.

OPAL-RT helps projects to move from imagination to real-time.

OPAL-RT Technologies Inc.
1751 Richardson, Suite 2525
Montréal, Québec, Canada
H3K 1G6
Phone: 514-935-2323
Toll free: 1-877-935-2323
Fax: 514-935-4994

U.S.A.
OPAL-RT Corporation
26 Summit Street, Brighton
MI 48116, USA
Phone: (734) 418-2961
Fax: (866) 462-5120

Middle East - Japan
OPAL-RT Technologies Inc.
Berytech Technological Pole,
Beirut 1107 2240 – Lebanon
Phone: +961 168-0469

Europe
OPAL-RT Europe S.A.
1, rue traversière
94150 RUNGIS
France
Phone: +33 1 41 73 40 80
Fax: +33 1 41 73 08 49

India
Opal-RT Technologies India Pvt. Ltd.
648/A, 2nd Floor
100 Ft Road, Binnamangala
Indiranagar, 2nd Stage
Bangalore - 560 038, India
Phone: +91.80.6572.6326
Fax: +91.80.4152.5049

China - South East Asia
OPAL-RT Technologies Inc.
Phone: +66-83-279-6667
China : 86-136-9914-8768

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