



OPAL-RT's 10th International Conference on Real-Time Simulation

November 13 – 16, 2018

Le Karé, Paris, France



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Le réseau de transport d'électricité





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Floor plans



Floor plans

OPAL-RT's 10th International Conference on Real-Time Simulation November 13 – 16, 2018



Agenda



TUESDAY, SEPTEMBER 13th

VISITS (GROUP 1)		KARÉ
9:00 AM		Bus Departure
10:00 AM - 11:30 AM		RTE's Laboratory Visit
12:00 AM	—	Return Karé
VISITS (GROUP 2)		KARÉ
VISITS (GROUP 2) 13:00 PM		KARÉ Bus Departure
VISITS (GROUP 2) 13:00 PM 2:00 PM - 3:30 PM		KARÉ Bus Departure RTE's Laboratory Visit

WEDNESDAY, SEPTEMBER 14th

REGISTRATION AND BREAKF	AST	LEGO LEVEL		
9:00 AM - 10:00 AM	_	REGISTRATION		
10:00 AM - 10:30 AM		BREAKFAST		
TRAININGS		LEGO LEVEL		
10:30 AM - 12:30 PM	—	RT-LAB HYPERSIM Technical user group Technical user g	group	
12:30 PM - 1:30 PM	—	LUNCH		
1:30 PM - 3:30 PM	—	eHS ePHASORSIM Technical user group Technical user g	group	
3:30 AM - 4:00 PM	_	BREAK		
REGISTRATION		LEGO LEVEL		
3:30 AM - 5:30 PM	—	REGISTRATION		
WELCOME COCKTAIL		SCENO LEVEL		
6:30 PM - 9:30 PM	—			
		Evening sponsored by detransport		
	T	DRESS CODE: FORMAL ATTIRE		





THURSDAY, SEPTEMBER 15th

BREAKFAST		RESTO LEVEL		
8:30 AM - 9:30 AM		Breakfast Sponsored by Le réseau de transport		
PRESENTATIONS		SCENO LEVEL		
9:30 AM - 10:00 AM	—	WELCOME TO RT18!		
10:00 AM - 10:25 AM	—	An Insight on the Value of Real-Time Simulation to Accelerate Time-to-market by Dr. Luís Miguel Costa, General Electric, France		
10:25 AM - 11:00 AM	—	eFPGASIM, The New Era of Fast Simulation by Yahia Bouzid, OPAL-RT		
11:00 AM - 11:30 AM	_	BREAK Sponsored by triphase		
11:30 AM - 11:55 AM		Challenges for the Power Sector in the 21 st Century by Nuno Souza Silva, R&D Nester, Portugal		
11:55 AM - 12:30 PM	-	Power System HIL Simulation with HYPERSIM Real-Time Solution by François Tempez, OPAL-RT		
12:30 PM - 1:30 PM	—	LUNCH Sponsored by Rec Le réseau de transport d'électricité		
TECHNICAL PRESENTATIONS		ROOM: VILLE MARIE	ROOM: ST-ANTOINE	
		TRACK 1: POWER SYSTEM SIMULATION	TRACK 3: MICROGRID & CYBERSECURITY	
1:00 PM - 2:00 PM	_	Heterogeneous Real-Time Simulation Platform - The ONS experience by Henildo Medeiros de Barros, Operador Nacional do Sistema Elétrico, Brazil	Modeling and Real-Time Simulation of Micro-Grid System Components using RT-LAB Platform by Sidahmed Khiat, Ecole Nationale Polytechnique d'Oran, Algeria	
2:00 PM - 2:30 PM	-	Real-Time Cooperative Simulation Between RTDS and HYPERSIM. Test Results for the IEEE 39 Bus System by João José Rodrigues de Oliveira, Operador Nacional do Sistema Elétrico, Brazil	Energy Load Flow Optimisation in the Smart Grid (EOSG): Analysis using Real Time Simulation in the COMPASS Environment by Dominik Hilbrich, TU Dortmund, Germany	
2:30 PM - 3:00 PM	_	Investigation and Modelling of Fast Frequency Phenomena in the GB Transmission System Dr. Peter Imris and Prof. Gareth Taylor, Brunel University London, UK	Cyber Threat Assessment and Mitigation for Control Systems by Lloyd Wihl, SCALABLE Network Technologies, USA	
3:00 PM - 3:30 PM	_	Modeling and Real Time Simulation of Micro-Grids for Algerian Scenarios by Mounir Khiat, Ecole Nationale Polytechnique d'Oran, Algeria	Smart Grid Resilience Assessment - using multi- domain real-time platform by Felipe Castro, OFFIS, Germany	
3:30 PM - 4:00 PM	_	BREAK Sponsored by		
		TRACK 2: POWER SYSTEM SIMULATION	TRACK 4: REAL-TIME SIMULATION FOR POWER QUALITY CHALLENGES	
4:00 PM - 4:30 PM	-	Reactive Power Optimization by the Optimal Location of a Compensation System using RT-LAB Platform: Application to Southwest Algerian grid by Abdelkader Chaker, Ecole Nationale Polytechnique d'Oran, Algeria	The Quality of the Voltage and Current Signals by Dr. Djafar Ould Abdeslam and Bushra Canaan, Université de Haute Alsace, France	
4:30 PM - 5:00 PM	_	Task Separation for Parallel Real-Time Simulation by Boris Bruned, RTE, France	Voltage and Frequency Support in Low Voltage Distribution Networks by a Highspeed Flywheel Energy Storage System (FESS) by Shahab Karrari, Karlsruhe Institute of Technology, Germany	
GALA DINNER		CRUISE ON THE SEINE, QUAL DE BERCY, PARIS		
6:30 PM - 7:30 PM	_	Bus Departure from Le Karé to Quai de Bercy		
8:00 PM - 12:00 AM	—	GALA DINNER DRESS CODE: FORMAL ATTIRE	Evening sponsored by: WINSTRUMENTS	
12:00 AM - 1:00 AM	_	Bus Departure from Quai de Bercy to Le Karé		

FRIDAY, NOVEMBER 16th



Real-Time Hardware-in-the-Loop (HIL) Simulation Approaches ".

by Mike Mekkanen, University of Vaasa, Finland

Real-time Simulation based HIL Testing – Theory

and Practice by Georg Lauss, Austrian Institute of

BREAKFAST

8:30 AM - 9:30 AM

2:00 PM - 2:30 PM

RESTO LEVEL

Breakfast Sponsored by MATIONAL

PRESENTATIONS		SCENO LEVEL		
9:30 AM - 9:50 AM		Welcome		
9:50 AM - 10:25 AM	—	Towards a Decarbonised Energy System – An Insight on Challenges and Opportunities for Real-Time Simulation by Dr. Olivier Despouys, RTE, France		
10:25 AM - 10:55 AM		How to Validate an Autonomous Car? by Hervé Pollart, OPAL-RT INCLUDING SPECIAL PRESENTATION: Testing in Automotive isn't Changing. It Already has by Daniel Riedelbauch, National Instruments GmbH, Germany		
10:55 AM - 11:25 AM	—	BREAK Sponsored by		
11:25 AM - 11:50 AM		Current and Future state of Cybersecurity in the Electric Power Industry and How Modeling & Simulation is a Must by Dr. Aaron Fansler, Ampex, USA		
11:50 AM - 12:30 PM	—	The Importance of Real-Time Simulators in Developing More-Electric Aircraft (MEA) and Modern Space Systems by Thomas Kirk, OPAL-RT		
12:30 PM - 13:30 PM	—	LUNCH Sponsored by INSTRUMENTS		
TECHNICAL PRESENTATIONS		SCENO LEVEL	LEGO LEVEL	
		TRACK 5: CONTROL CHALLENGES AND NEW ALTERNATIVES	TRACK 7: HIL & SIL APPLICATIONS	
1:30 PM - 2:00 PM		Power Electronics Control Over the Network	"Conventional and Lightweight IEDs Testing based IEC 61850	

Technology, Austria 2:30 PM - 3:00 PM New Concept for UAS Academy by Shay Hardware in the Loop Testing of an IED Prototype for Davidzon, IAI - Malat Technologies Division, HVDC Systems Protection by Dr. William R. Leon-Garcia, SuperGrid Institute, France Israel 3:00 PM - 3:30 PM The Importance of Power Hardware in the High-Sensitivity Stator Fault Protection for Synchronous Loop by Dr. Jeroen Van den Keybus, Triphase, Generators: Software-in-the-loop Validation Belgium by Prof. Adriano Peres de Morais, Universidade Federal de Santa Maria, Brazil

by Dr. Jeroen Van den Keybus, Triphase,

Open Source Control of DC Microgrid by Nady

Kheirallah, Technical University of Munich,

3:30 PM - 4:00 PM BREAK Draw of passport prize

Belgium

Germany

		TRACK 6: MMC FOR HVDC APPLICATIONS	TRACK 8: FUTURE OF REAL-TIME SIMULATION IN EDUCATION AND RESEARCH
4:00 PM - 4:30 PM	_	PHIL Testing of a Novel MMC Control Method by Ahmed Islam Zama, SuperGrid Institute, France	Is Real-Time Digital Simulation Education ready for the Classroom? An Australian perspective by Dr. Georgios Konstantinou, University of New South Wales, Australia
4:30 PM - 5:00 PM	3	Control Design of MMC prototype based on OP 5600 Real Time Simulation and eMEGASIM by Prof. Xavier Guillaud and Dr. Mohamed Moez Belhaouane, L2EP, France	Power Systems Laboratory of the KIOS Research and Innovation Center of Excellence by Dr. Lenos Hadjidemetriou, University of Cyprus, Cyprus
5:00 PM - 5:30 PM		Investigation of Future Multiterminal DC Grids with MMC Testbench by Fisnik Loku and Markus Kaiser, RWTH Aachen University, Germany	HIL Real-Time Simulation for Worldwide-Networks by Michel Guenat, Puissance Plus, France

Diamond sponsors



Critical technology trends in ADAS, EV, and V2X are bringing with them new test challenges and pressures beyond the here and now. The quickly evolving technology landscape increases the pressure to any test schedule and requirements. Work with National Instruments to overcome the pressure of rapidly changing test requirements using an open and easily upgradable platform that is designed for test system flexibility. **www.ni.com**

Le réseau de transport d'électricité

With nearly 105,000 km of lines, RTE's grid is the biggest in Europe. 46.2% of extra-high voltage lines (400,000 and 225,000 volts) transmit electricity over long distances and to 60 cross-border connections with the neighbouring countries. The lines at 150,000, 90,000 and 63,000 volts are designed for regional sub-transmission. **www.rte-france.com**

HIGHLIGHTED PRODUCT:

A dedicated team to support your HVDC projects:

— RTE and the Real-time laboratory provide services in power systems with a focus on HVDC and FACTS.
 We offer comprehensive services to meet the needs of the ever-changing power industry. With its team of experts coming from multiple backgrounds and specialized in Power Electronics,
 — RTE tackles a wide variety of challenges in Power Systems.



Gold sponsors



Wherever methods based on experience and innovation are put into action, where customers have high expectations regarding materials and technology and where European know-how blends with global structures, you will find Egston. **www.egstonpower.com**

HIGHLIGHTED PRODUCT:

Austrian-based EGSTON Power Electronics offers a revolutionary power electronic test bench based on P-HIL technology (Power – Hardware in the Loop). Our unique COMPISO system offers a high voltage bandwidth of 5 kHz at 440 VRMS which can generate harmonics of up to 15 kHz with a power range of 100kW up to 2 MW. Based on a modular design, the COMPISO P-HIL System offers full flexibility and can be used as an AC source/sink, DC source/sink, smart grid, aerospace grid, PV-panel, battery or electrical machine emulator.





We are one of the worldwide leading manufacturers for analogue linear transistor amplifiers, AC/DC current and voltage power supplies for industrial measurement and testing systems.

Our services extend from single amplifiers for AC and DC mains simulation to complex completely computer controlled testing and measurement systems. Based on our 4-quadrant linear power amplifiers we are able to simulate all supply voltages from DC to several hundred kHz with power up to the megawatt range. **www.spitzenberger.de**

HIGHLIGHTED PRODUCT:

The APS 4-quadrant power amplifier is a universal source for both voltage and current applications with a power capability between 1kVA and 60kVA per phase.

— The adjustable and desired output current is automatically regulated and stabilized according to the user's preferences, the only limitation is the amplifier's performance characteristic.

— The main APS benefits are a very high peak load ability, adjustable low internal resistance, fast slew rate as well as low harmonic distortion.

— It's bandwidth is from DC to 10kHz (large signal) up to 50kHz (small signal), overload monitoring allows long and short term overload possibilities.

— The sink operation mode and the adjustable voltage and current limitation is the base for flexible applications. The high-speed optical interface is ideal for PHIL applications.





HIGHLIGHTED PRODUCT:

Triphase introduces PMSiC: a new, high-performance power converter based on SiC mosfet technology. Its high bandwidth, high efficiency, modular architecture and deep integration with real-time simulators make PMSiC an ideal solution for high-fidelity test setups and Power Hardware In the Loop (PHIL) simulations. PMSiC addresses the needs of high bandwidth and low latency applications that can be used in a wide variety of configurations and setups.



Silver sponsors



Doble offers a comprehensive and extensive scope of diagnostic products and services to test and maintain transformers, bushings, protective relays, circuit breakers, rotating machines and more. With more than 400 employees and 5500 customers, offices in eleven countries, and 55 million points of test data for more than 1 million different electric apparatus, Doble is dedicated to helping the global power industry overcome its challenges, no matter how big or how small. **www.doble.com**

HIGHLIGHTED PRODUCT:

Doble F6350e and F6300e amplifiers can be used with real time simulator to test protections. F6350e amplifier offers 6 voltage outputs and 6 enhanced current outputs, up to 35A, and F6300e amplifier offers 12 enhanced current outputs. It is possible to configure up to 16 external amplifiers for 192 simultaneous sources.

Chroma



Chroma supplies precision power conversion test instruments, automated systems and turnkey solutions to suit a variety of applications, ranging from research and development to design verification for various market demands such as: power electronics, renewable energy, electric vehicle, avionics, etc. Chroma products are trusted by the world's leading research labs to provide consistent, reliable and accurate measurements. With offices located worldwide, Chroma is renowned for its commitment to excellence in product, service and innovation. **www.chromaeu.com**

HIGHLIGHTED PRODUCT:

The 61800 series regenerative grid simulator with maximum output power rating up to 300kVA, is a full 4 quadrant, full regenerative, low distortion AC power supply with advanced amplifier feature specifically designed for PHIL application. The 61800 series has further extended its test application capability by including optional items such as Regenerative AC load and 800VLN XHV functions designed for UPS, PCS, OBC (V2H/V2G), PV Inverter and micro grid related applications.

imperix



Imperix is a Swiss company developing high-end control equipment and prototyping hardware for power electronics, drives, smart grids and related topics. Its products are designed to enable cutting-edge innovation in corporate and academic environments. They are especially valued for their ability to accelerate the implementation of laboratoryscale power converters and facilitate the derivation of high quality experimental results. **www.imperix.ch**

HIGHLIGHTED PRODUCT:

The microgrid bundle is a multi-purpose test bench for power electronics. It is able to support both HIL simulation and low-voltage experimentation with an easy-to-use reconfigurable hardware.





With an original position combining Production and Service R&D, expertise in the fields of power electronics, analog, measurement, digital and programming, Puissance+ has been affirming itself for more than 20 years as a reference in the fields of: design of electronic equipment, energy conversion, instrumentation in power electronics, and integration of emulation systems.

Its industrial know-how is exercised within the framework of the business of critical systems and services. Its equipment are integrated into: production bench, on ground and embedded test equipment, system integration benches, testing laboratories, and tools for testing and maintenance. **www.puissanceplus.com**

HIGHLIGHTED PRODUCT:

Three-phase power amplifier 4 quadrants AC+DC 3 x 7kVA.

- High electrical performance to test or simulate all kinds of generators or loads with high dynamics, very low distortion over a wide frequency band and a wide bandwidth.

- Linear technology allows a quick and easy integration for "Real time" or "Hardware In the Loop" applications in combination with Opal-RT simulators.



Based in Culver City, California, SCALABLE provides network design, modeling and analysis tools, cyber training systems and engineering support services to commercial enterprises, government and defense agencies, research organizations and educational institutions around the world.

SCALABLE solutions integrate simulated virtual network models with physical hardware and applications, allowing users to reduce the time, cost and risks of developing, testing and deploying large, sophisticated wired and wireless networks and new communications equipment, and train personnel on cyber defense. More information on the company is available at **web.scalable-networks.com**

HIGHLIGHTED PRODUCT:

EXata is a comprehensive suite of tools for emulating large wired and wireless networks. It uses network emulation and simulation to predict the behavior and performance of networks to improve their design, operation, and management. EXata includes a system-in-the-loop emulation interface which enables the seamless integration of live hardware and applications with the virtual network models for effective operational testing and the assessment of networks as to their resiliency to cyber threats. Our cyber behavior models provide a vulnerability analysis framework with configurable cyber-physical attack and defense models. SCALABLE's solutions determine effectiveness and cyber resiliency of networked communications environments and enable system lifecycle management and operator training.



Bronze sponsors

AMPEX

Ampex Data Systems Corporation, a wholly owned subsidiary of Delta Information Systems, Inc., is the market leader in delivering visual intelligence and data security in rugged environments. Ampex is a small business based in the Silicon Valley that specializes in cost-effective data recording, on-board storage, cybersecurity, data management, machine learning and other associated technologies. **www.ampex.com**

GRIDEX^w fmtp



FMTP Power provides products, training and consulting that increases control over the Smart Grid IEC 61850 networks and thereby profitability for the power industry. **www.fmtppower.com**

HIGHLIGHTED PRODUCT:

Through our new product GridEx®, Power network owners and Service companies have access to a cyber secure test and audit tool for commissioning and maintenance activities.

GridEx[®] is a Smart grid portable multimeter. It is designed to make from large amounts of complex IT data an easy to understand information available to the power engineers in their power electrical language. It creates readable information, powerful suggestions and status informative reports.

As non-PC, dedicated and non-injecting products can also be used safely on "live" substations to monitor, audit and analyze the networks with full cyber security. Often used for troubleshooting and maintenance, they are not only minimizing the risk of blackouts and interruptions, but also reduce the cost of maintenance by up to 70%. Incidents and alarms are mitigated and managed before serious problems and costs occur.



R&D NESTER is an energy research centre belonging to the Portuguese Transmission System Operator REN. The main areas of activity are Power Systems Simulation, Renewable Energy Management, Smart Grid Technologies, Energy Markets and Economics, Power Systems Planning and Operation. **www.rdnester.com**

HIGHLIGHTED PRODUCT:

R&D NESTER owns and operates a real-time power systems simulation laboratory, ideal to leverage R&D NESTERs core competences through state-of-the-art technologies, enabling HIL simulation and testing of both power systems and communication networks, either in a stand-alone mode or by performing co-simulation.



GE Power is a world leader in power generation with deep domain expertise to help customers deliver electricity from a wide spectrum of fuel sources. We are transforming the electricity industry with the digital power plant, the world's largest and most efficient gas turbine, full balance of plant, upgrade and service solutions as well as our data-leveraging software. Our innovative technologies and digital offerings help make power more affordable, reliable, accessible and sustainable. Grid Solutions is part of GE Power.

For more information, visit the company's website at **www.gepower.com**. Follow GE Power on Twitter @GE_Power and on LinkedIn at GE Power.