

# EMTP-RV

ElectroMagnetic Transients Program

**3 days training**  
**Dubrovnik - CROATIA**  
**27 - 29 April 2009**



## SIMULATION & ANALYSIS OF POWER SYSTEM TRANSIENTS WITH EMTP-RV

**In cooperation with**  
University of Zagreb



University of Sarajevo



**EMTP-RV is developed by DCG**

(Hydro Quebec, American Electric Power, CEATI International, CRIEPI, Electricité de France, EPRI, Hydro One Networks, US Bureau of Reclamation, WAPA)

**EMTP-RV is distributed in Europe by POWERSYS**  
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TRAINING DUBROVNIK, CROATIA - APRIL, 27 - 29 2009

## SIMULATION & ANALYSIS OF POWER SYSTEM TRANSIENTS WITH EMTP-RV

### Objectives:

The objectives of the course is to give a good hands-on experience on the simulation and analysis of Power System Transients.

The course will cover the following topics:

- ▶ Theoretical backgrounds to the simulation transients
- ▶ Equipment Modelling and Applications
- ▶ Insulation Coordination issues
- ▶ Practical Power System Studies

### Intended Audience:

This course is intended for :  
People who deal with transient studies:

- Users of software

Also people who **subcontract transients studies** and wish to understand and see how usefull simulation can be for them  
- Be able to check some simulation results.

- ▶ Professionals from Power Transmission, Distribution and Production companies,
- ▶ Telecommunication companies,
- ▶ Professional engineers,
- ▶ Consultants
- ▶ Post-graduated students.

### Instructors:

Sébastien DENNETIERE  
**Electricité de France, France**

Stephan PACK  
**Graz University of Technology, Austria**

Tarik SADOVIC  
**Sadovic Consultant, France**

Salih SADOVIC  
**Sadovic Consultant, France**

Ivo UGLESIC  
**University of Zagreb, Croatia**

Alain XEMARD  
**Electricité de France, France**

Mario PAOLONE  
**University of Bologna, Italy**

### Course duration and location:

3 days from Monday 27 to Wednesday 29 of April 2009.

>> The course will be held in DUBROVNIK, CROATIA at the RIXOS LIBERTAS DUBROVNIK hotel.

>> An EMTP-RV **user group meeting** will be held at the RIXOS LIBERTAS DUBROVNIK hotel on **April 30**.

This Meeting will include end-user simulation studies presentations, an opportunity to discuss simulation topics, and future EMTP-RV requirements with the developers and end-users.

Dubrovnik is a medieval city on the Croatian side of the Adriatic coastline and a treasure - trove of cultural - historical monuments that where created throughout its thousand-year existence.

### Information and registration:

#### SADOVIC CONSULTANT

13 rue de l'Abreuvoir  
92100 - BOULOGNE BILLANCOURT  
FRANCE  
Tel. : +33. 1.41.31.23.34  
Fax.: +33. 1.40.85.16.58  
email: [sigma@sadovic.com](mailto:sigma@sadovic.com)

>> Download the registration form

>> Registration:

SADOVIC CONSULTANT will aknowledge the registration by email after the reception of the **Registration Form** filled in any part.

The organization wil send an invoice to each registered participant, after the reception of the payment.

**Course Fees: 1300 euros**

The course fees include lectures, documentation, coffee breaks and lunches.

**Preferential rates could be granted to students.**

#### Accomodation:

Special rates have been negociated with RIXOS LIBERTAS DUBROVNIK hotel.

To book a room please use the reference "EMTP" and contact:

Maro Kulas ([Maro.Kulas@rixos.com](mailto:Maro.Kulas@rixos.com))  
Conference & Incentive Manager  
RIXOS LIBERTAS DUBROVNIK  
[www.rixos.com](http://www.rixos.com)  
Liechtensteinov put 3  
20000 DUBROVNIK - CROATIA

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## SIMULATION & ANALYSIS OF POWER SYSTEM TRANSIENTS WITH EMTP- RV

### Instructors

#### Sébastien DENNETIERE

Electricité de France, France

Sébastien Denetière graduated from École Supérieure d'Electricité (Supélec) in France in 2002. He received the M.A.Sc. degree from École Polytechnique de Montréal in 2003. From 2002 to 2004 he worked at IREQ (Hydro-Québec) on research and development activities related to the simulation and analysis of electromagnetic transients. In October 2004 he joined the research center of EDF where his interests are currently in the field of **insulation coordination and power system simulations**.

#### Course contents :

##### Theoretical background on simulation of transients in power systems with EMTP-RV :

- Typical cases of transient studies,
- Computational methods : load flow, steady state, frequency scan, and time-domain simulations,
- Fundamental notions on transients in power systems,
- How to use EMTPWorks (graphical user interface of EMTP-RV)

##### Transformers and transients phenomena :

- Basic modelling requirements, which model for which type of study,
- Study of energization of power transformers, harmonic temporary overvoltages, controlled switching

#### Stephan PACK

Graz University of Technology, Austria

Stephan Pack was born in Graz in Austria and studied Electrical Power Engineering at the Graz University of Technology. Since 1985 he is working with the Institute of High Voltage Engineering and System Management. He is also involved in the work of the Test Laboratory at this University.

In 1997 he became an associate professor in the field of high voltage engineering and is nowadays the vice head of the Institute. Additionally he is the head of the group "**high voltage techniques**" and therefore his work is related to the field of high voltage engineering, high voltage tests, insulation coordination, transients, numerical calculations, lightning and grounding.

For many years he has been member of the national standard organization for lightning, he has been active in a WG in IEC and National Delegate for Austria in CIGRE for **System Technical Performance**.

#### Course contents :

##### Insulation coordination study in a mixed overhead-cable network configuration :

- Investigation of a 110 kV network with EMTP-RV,
- Analysis according insulation coordination rules,
- Study of several different network configurations and switching states within a mixture of overhead lines and cable sections,
- Analysis of transient lightning overvoltage trends and peak values as well as the transient stress at various network nodes.

#### Salih SADOVIC

SADOVIC Consultant, France

Salih Sadovic is University professor and international consultant. His research interests include **overvoltages and insulation coordination, power systems analysis, numerical field computations and computer applications in power engineering**. He is a member of IEEE, SEE and CIGRE.

#### Tarik SADOVIC

SADOVIC Consultant, France

Tarik Sadovic is research and development engineer at Sadovic Consultant, France. He is doctor student at TU Graz. His fields of interest cover: **electromagnetic transients, computer control and measurement, real time remote measurement of the fast electromagnetic transients, overvoltages and insulation coordination**.

#### Course contents :

##### Transmission line lightning performance :

Basic definitions. Number of strokes collected by OHL. Shielding failures and back flashovers. Critical currents. EMTP modeling for OHL lightning performance calculations: stroke distributions, tower footing resistance, line insulation, tower model, power frequency voltage, corona. How to improve line lightning performance? Line surge arresters. Case study.

##### HV substation lightning overvoltages insulation coordination :

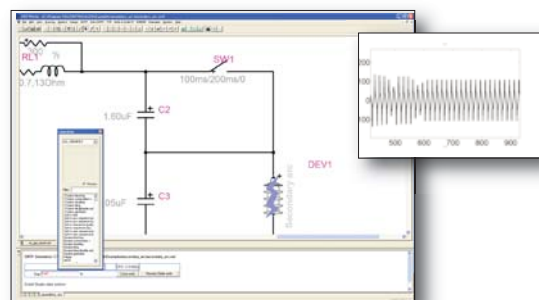
Basic principles of HV substation insulation coordination. Substation equipment EMTP modeling: surge arresters, power and measuring transformers, breakers, switches, post insulators, bus bars.. Designing incoming overvoltage surge. IEEE and IEC recommended insulation coordination procedures. Cable connected HV substations. Gas insulated substations. Case study.

##### Switching overvoltages :

Transmission line switching overvoltages. Phase to ground and phase to phase overvoltages. EMTP modeling: source side, line models, surge arresters, closing resistor, statistical switch,.. Line closing and re-closing overvoltages. Fault overvoltages. Risk of failure calculation. Case study.

##### EMTP insulation coordination user interfaces :

Automatic creation of 'net' files. Running EMTP in loop. Automatic creation of line, arrester and cable models. Running EMTP statistical studies. Automatic calculations of insulation risk of failures.



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## SIMULATION & ANALYSIS OF POWER SYSTEM TRANSIENTS WITH EMTP-RV

Ivo UGLEŠIĆ

University of Zagreb, Croatia

Ivo Uglesic is a Professor at the Faculty of Electrical Engineering and Computing of Zagreb University, Croatia. He lectures for the graduate and postgraduate courses: High Voltage Engineering, Transients and Electromagnetic Compatibility, Overvoltage Protection and Electric Railways. He is the author of numerous scientific and professional papers and of numerous studies and technical solutions that have been implemented in practice. Currently he is a member of the CIGRE WG 4.301 dealing with insulation coordination and a member of the technical committee of the IPST. In 2008 he chaired International CIGRE Colloquium on line arresters and in 2007 gave a tutorial at the CIGRE Symposium of Transient phenomena in large electric power systems.

### Course contents :

- Data and models of substations elements for simulations of overvoltages in a high-voltage switchgear,
- Determining the rating of surge arresters (rated voltage, discharge class, nominal current...),
- Protective zone of surge arresters,
- Energy stresses of surge arresters with regard to lightning and switching overvoltages,
- Transient recovery voltage of circuit breaker clearing short line fault,
- Examples and computer simulations.

Alain XEMARD

Electricité de France, France

Alain Xémard graduated from the National Institute of Applied Sciences in Lyon, France, with an engineering degree in electrical engineering in 1985.

He received a doctor from the Ecole Centrale de Lyon.

He has been working at the Research Division of EDF since 1992. His research interests include **insulation coordination, and development of tools for electromagnetic transient calculation.**

He was convener of the IEC 28.04 in charge of the preparation of the IEC 60071.4 and is a member of the IPST steering committee.

He is presently convener of the CIGRE C4 301 (**Insulation coordination**).

### Course contents :

- Studies on the protection of underground cables against Fast Front and Slow Front over-voltages,
- Studies of safety related to the coupling between OHL and telecommunication lines.

Mario PAOLONE

University of Bologna, Italy

Mario Paolone was born in Campobasso, Italy, in 1973. He received the electrical engineering (Hons.) and Ph.D. degrees from the University of Bologna, Bologna, Italy, in 1998 and 2002, respectively. Currently, he is assistant professor with the Power Systems Group at the University of Bologna. His research interests are power system transients, with particular reference to LEMP interaction with electrical networks, power systems dynamics, power system protection, and distributed generation.

Dr. Paolone is a member of the IEEE Working Group on Lightning Performance of distribution lines and of the joint CIGRE-CIRED Working Group "Protection of MV and LV networks against Lightning". Secretary of the Cigrè Working Group C4.501 "Numerical Electromagnetic Analysis and Its Application to Surge Phenomena" from October 2007 and Co-chairperson of the Technical Program Committee of the IPST 2009 - International Conference on Power System Transients that will be held in Kyoto, Japan in June 2009.

### Course contents :

- Power quality issues of distribution systems with particular reference to lightning-originated problems: theory relevant to the mechanism of formation of lightning-induced voltages, fundamental aspects for the development of transmission line coupling equations, the LIOV-EMTP-RV code for the calculation of lightning-induced voltages in overhead distribution lines, lightning performance of overhead distribution lines and relevant insulation coordination.
- Power Quality problems in distribution networks: voltage sag definitions, calculation due to faults in radial and non-radial networks, effect of unbalanced faults, calculation due to starting of induction motors, application examples using the EMTP-RV. Harmonic analysis by means of the EMTP-RV, network frequency response, solution of the harmonic steady state and its use for the harmonic analysis, application examples.

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(Hydro Quebec, American Electric Power, CEATI International, CRIEPI, Electricité de France, EPRI, Hydro One Networks, US Bureau of Reclamation, WAPA)

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