



**UNIVERSITÉ
DE GENÈVE**

**INSTITUT DES SCIENCES
DE L'ENVIRONNEMENT**

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CYCLE DE FORMATION ÉNERGIE – ENVIRONNEMENT

SÉMINAIRE 2014-2015

Le défi de l'intégration des ressources renouvelables distribuées dans les réseaux électriques

SÉMINAIRE EN FRANÇAIS

Mario PAOLONE

Laboratoire de Systèmes Electriques Distribués, EPFL

jeudi 23 octobre 2014 à 17h.15

Auditoire D 185 - Bâtiment D - Uni Battelle

7, route de Drize, 1227 Carouge

PROGRAMME DES PROCHAINES CONFÉRENCES :

Jeudi 13 novembre 2014 à 17h15

« *Analyse coût/bénéfice du stockage d'énergie en France à horizon 2030* »

Laurent Fournié, Artelys

Jeudi 27 novembre 2014 à 17h15

« *Stations de Transfert d'Energie par Pompage* »

Claude Crampes, Toulouse School of Economics

Jeudi 11 décembre 2014 à 17h15

« *Grid integration of renewables: Dispatching and exploitation of virtual power plants* »

Karl Werlen, Misurio AG

L'orateur

Mario Paolone received the M.Sc. (with honors) and the Ph.D. in electrical engineering from the University of Bologna, Italy in 1998 and 2002, respectively. In 2005, he was appointed assistant professor in power systems at the University of Bologna where he was with the Power Systems laboratory until 2011. In 2010, he received Associate Professor eligibility from the Politecnico di Milano, Italy. Currently, he is Associate Professor at the Swiss Federal Institute of Technology, Lausanne, Switzerland, where he accepted the EOS Holding Chair of the Distributed Electrical Systems laboratory. He is secretary and member of several IEEE and Cigré Working Groups. He was co-chairperson of the Technical Committee of the 9th edition of the International Conference of Power Systems Transients (IPST 2009). In 2013, he was the recipient of the IEEE EMC Society Technical Achievement Award. He is the Editor-in-Chief of the Elsevier journal Sustainable Energy, Grids and Networks. His research interests are in power systems with particular reference to real-time monitoring and operation, power system protections, power systems dynamics and power system transients. Mario Paolone is author or coauthor of over 170 scientific papers published in reviewed journals and international conferences.

La conférence

The classic approach to the control of medium and low voltage electrical distribution networks involves a combination of both frequency and voltage controls at different time scales. With the increased penetration of stochastic renewable resources, distributed generation and demand response, it shows severe limitations both in the optimal/safe operation of these networks as well as in aggregating the network resources for upper-layer power systems. To overcome this difficulty, new methods in the monitoring operation and control need to be defined and suitably validated.

In this context, the seminar first discusses the latest monitoring methodologies that have been developed to *estimate the state* of electrical distribution networks in *real-time*. Then, the seminar illustrates a radically-different control philosophy, which enables low and medium voltage distribution networks as well as their resources to directly communicate with each other in order to define explicit real-time setpoints for active/reactive power absorptions or injections. This control method adopts the concept of *explicit control of power flows and voltage*, combined with a *recursive abstraction framework*. The method is composable, i.e. subsystems can be aggregated into abstract models that hide most of their internal complexity. Application examples are illustrated in the seminar as validation case studies