Remus Teodorescu

He received the Dipl. Ing. degree in electrical engineering from Polytechnical University of Bucharest, Romania in 1989, and Ph.D. degree in power electronics from University of Galati, Romania, in 1994. In 1998, he joined Aalborg University, Department of Energy Technology, power electronics section where he currently works as a professorHe has more than 200 papers published, 1 book ("***Grid Converters for Photovoltaic and Wind Power Systems***", ISBN-10: 0-470-05751-3 – Wiley) and 5 patents. He is a IEEE Fellow, Past Associate Editor for IEEE Transactions on Power Electronics Letters and chair of IEEE Danish joint IES/PELS/IAS chapter. He is the founder and coordinator of the Green Power Laboratory at Aalborg University focusing on the development and testing of grid converters for renewable energy systems. He is the coordinator of Vestas Power Program, involving 10 PhD students and guest professors in the areas of power electronics, power systems and energy storage. His areas of interests are: design and control of power converters used in photovoltaics and wind power systems, grid integration with wind power, medium-voltage converters, HVDC/FACTS, energy storage.

Dirk Uwe Sauer

He received a diploma degree in physics from University of Darmstadt and a PhD in electrochemistry from University of Ulm. From 1992 until 2003 he worked at the Fraunhofer Institute for Solar Energy Systems (ISE) in Freiburg, as scientist, project coordinator and finally head of the groups "Storage Systems" and "Off-grid Power Supply Systems". In 2003 he was appointed as a Junior professor for "Electrochemical Energy Conversion and Storage Systems" at RWTH Aachen University (2003) in the Faculty for Electrical Engineering and Information Technology and in 2009 he became Full Professor on the same subject also at RWTH Aachen University. The research focus is on storage systems in hybrid and full electric vehicles, energy storage in grids with a high penetration of renewable energies including economic analysis, ageing and lifetime prediction of batteries, modeling and diagnostics for batteries, as well as on hardware and methodology for impedance spectroscopy on batteries and fuel cells. The main technologies in focus are lithium-ion batteries, lead-acid batteries, supercaps, redox-flow batteries; concepts and consequences of a CO2-free energy supply.

Pedro Rodriguez

He received the M.Sc. and Ph.D. degrees in electrical engineering from the Technical University of Catalonia (UPC), Spain, in 1994 and 2004, respectively. He was a Postdoctoral Researcher at the Center for Power Electronics Systems (CPES), Virginia Tech, Blacksburg in 2005, and at the Department of Energy Technology, Aalborg University (AAU) in 2006. He joined the faculty of UPC as an Assistant Professor in 1990, where he became the Director of the research center on Renewable Electrical Energy Systems (SEER) in the Department of Electrical Engineering. He was also a Visiting Professor at the AAU from 2007 to 2011, acting as a co-supervisor of the Vestas Power Program. He still lectures Ph.D. courses at the AAU every year. From 2011, he is the Principal Research Scientist on Electrical Engineering and a member of the Scientific Director Board of Abengoa Research, although he is still joined to the UPC as a part time Professor. He has coauthored one book and more than 100 papers in technical journals and conference proceedings. He is the holder of seven licensed patents. His research interests include integration of distributed generation systems, smart grids, and design and control of power converters. Dr. Rodriguez is a senior member of the IEEE, a member of the administrate committee of the IEEE Industrial Electronics Society (IES), the general chair of IEEE-IES Gold and Student Activities, the vice-chair of the Sustainability and Renewable Energy Committee of the IEEE Industry Application Society and a member of the IEEE-IES Technical Committee on Renewable Energy Systems. He is an Associate Editor of the IEEE Transaction on Power Electronics.

Maciej Swierczynski

He received his B. Tech. degree from AGH University of Science and Technology, Poland in 2005 and M. Tech degree from AGH University of Science and Technology, Poland, Cracow in 2007 in Computer Engineering for Industrial Applications and from Aalborg University, Denmark in 2009 in Power Electronics and Drives.
From 2009 he pursues his Ph.D. at Aalborg University, Denmark. His area of research is in energy storage technologies for wind applications, battery testing, modelling, and lifetime analyses.

AALBORG UNIVERSITY

Department of ENERGY TECHNOLOGY E.T.

Industrial/Ph.D. Course in

Storage Systems based on Li-Ion Batteries for Stationary Applications

15 – 17 October, 2013

Department of Energy Technology
Aalborg University, Denmark

Background of the course

Despite environmental friendliness, the wind power grid integration at a large scale faces several limitations, mainly related to wind variability, forecast accuracy and grid requirements. Since the accuracy of wind forecast is limited, even when the effect is reduced by large scale aggregation, the use of energy storage (ES) can be an attractive solution. Moreover, the future plans concerning the increase of the share of wind power in the electrical grid point to a major challenge that wind power integration implies: the need of transforming the behaviour of WPP closer to the one of conventional power plants. Therefore, the future wind power plants are intended to function like conventional power plants, seen from the transmission system perspective by complying with grid codes and providing ancillary services. This is possible by integration of energy storage in the so called Virtual Power Plants (Wind Power Plants + Energy Storage).

Different storage technologies are available for integration of ES in the VPPs. Among the electrochemical battery solutions, the Lithium – Ion batteries represent promising candidates because of their advantages: high efficiency, quick response, low self-discharge rate, high voltage operation, high energy density, decreasing cost due to expanding electrical car industry etc.

The course starts with an overview of electrochemical battery storage technologies and of the grid support applications (services) that energy storage can provide to the power grid. Moreover, already existing applications of ES in PV plants and WP plants will be introduced.

The second part of the course is dedicated to the principles of electrochemistry, with focus on the Li-ion battery technology. The performances, ageing mechanisms and modelling of Li-ion batteries will be extensively discussed.

Since the feasibility of integrating ES in PV/WPPs is a key aspect, the last part of the course is dedicated to the life-time modelling of Li-ion batteries. During this part, aspects such as: impedance-based modelling, curve fitting and parameter extraction will be covered.

Keep yourself updated at **www.et.aau.dk**

Course Program

Day 1

08:30	Course Registration
09:00	Overview of Electrochemical Battery Technologies
10:00	Coffee Break
10:30	Overview of Stationary Applications
12:00	Lunch
13:00	Applications to PV Plants and to WP plants
14:30	Coffee Break
15:00	Matlab Exercise for Optimal Sizing of Storage in Different Applications

Day 2

08:30	Principles of Electrochemistry – Part I
10:00	Coffee Break
10:30	Principles of Electrochemistry – Part II
12:00	Lunch
13:00	Li-Ion Batteries, Technology, Performance, Ageing Mechanism and Modeling – Part I
14:30	Coffee Break
15:00	Li-Ion Batteries, Technology, Performance, Ageing Mechanism and Modeling – Part II

Day 3

08:30	Life Time Modeling
10:00	Coffee Break
10:30	Impedance-based Modeling
12:00	Lunch
13:00	Matlab Exercise on Curve Fitting and Parameter Extraction
14:30	Coffee Break
15:00	Lab visit
15:30	End of Course

Language

English

Credits 3.0 ECTS

Registration

To register, please fill out the Registration Form available at:

http://phdcourse.aau.dk/index.php?list=29586

Registrations close on **September 24, 2013**.

Course Location

Aalborg University

Department of Energy Technology
Pontoppidanstræde 101, Room 23
DK-9220 Aalborg East
Denmark

Organisation

Further information

Maciej Swierczynski
Assistant Professor
Aalborg University
Department of Energy Technology
Phone +45 9940 3348
Email: mas@et.aau.dk

Accommodation and Transport

For hotel, transport information and booking please check: www.et.aau.dk/phd/phd-courses

Fee

The fee for the course is **10.000 DKK** for Industry, **6.500 DKK** for PhD students/ Academics outside of Denmark, and **1.500 DKK** for PhD students in Denmark.

The registration fee include: coffee, lunch for all days, gala dinner, copy of slides and simulation models on a USB stick.

Prerequisites

In order to be able to perform the exercises, the course participants should bring their own notebook with MATLAB software pre-installed (in case that it is not possible, some computers will be available).

Lab facilities

- FuelCon Battery Test Station with EIS Analyser
- Portable EIS Analyzer
- Industrial Ovens
- Maccor 4000 Battery Test Facility
- Real Time Digital Simulator (RTDS)
- VRB Flow Battery