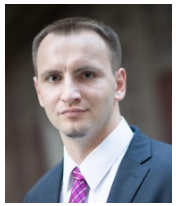
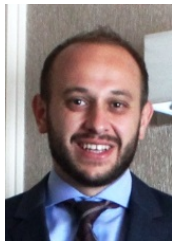
Remus Teodorescu

He received the Dipl. Ing. degree in electrical engineering from Polytechnical University of Bucharest, Romania in 1989, and a 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 professor. Since 2003, he is a visiting professor at Chalmers University of Technology, Gothenburg, Sweden. He has co-authored the book "***Grid Converters for Photovoltaic and Wind Power Systems***", ISBN-10: 0-470-05751-3 – Wiley and over 200 IEEE journals and conference papers. His areas of interests include: design and control of power converters for photovoltaics and wind power systems, grid integration with wind power, HVDC/FACTS based on MMC, SiC-based converters, storage systems for utility.



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. In 2012, he completed his Ph.D. at Aalborg University, Denmark with Ph.D. thesis: "Lithium-ion battery energy storage system for augmented wind power plants". He is working currently as an Associate Professor at Aalborg University. His area of research is in energy storage technologies for wind applications, battery testing, modelling, and lifetime analyses.

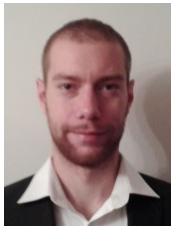


Daniel I. Stroe

He received the MSc degree in the field of wind power systems from the Department of Energy Technology, Aalborg University in 2010. In 2014, he received his Ph.D. degree in "lifetime modeling of lithium-ion batteries used in virtual power plant applications" from the Department of Energy Technology where he is currently working as an Assistant Professor. His main research interests are in the area of renewable energy systems, energy storage systems for stationary applications and battery testing and performance degradation modeling.

Erik Schaltz

He received the M.Sc. and Ph.D. degrees in electrical engineering from the Department of Energy Technology, Aalborg University, Aalborg, Denmark, in 2005 and 2010, respectively.
From 2009 to 2012, he has been an Assistant Professor in the same department where he is currently an Associate Professor and the head of the research programme in E-Mobility and Industrial Drives.
His research interests include a wide range of topics within the field of electro-mobility, e.g. power electronics, electric machines, batteries, ultracapacitors, fuel cells, battery management systems, electric and hybrid electric vehicle modelling, thermoelectric generators, reliability, and inductive power transfer systems.



Vaclav Knap

He received his Bc. from Czech Technical University in Prague, in Power Electrical Engineering, and MSc. from Aalborg University, Denmark in Electrical Power Systems and High Voltage Engineering. For one year he worked as a research assistant at Aalborg University in the field of Lithium-ion batteries, their lifetime modeling and utilization for grid applications. Nowadays, Václav pursues his Ph.D. in topic "Advanced management system for Lithium-Sulfur batteries" at the same university.

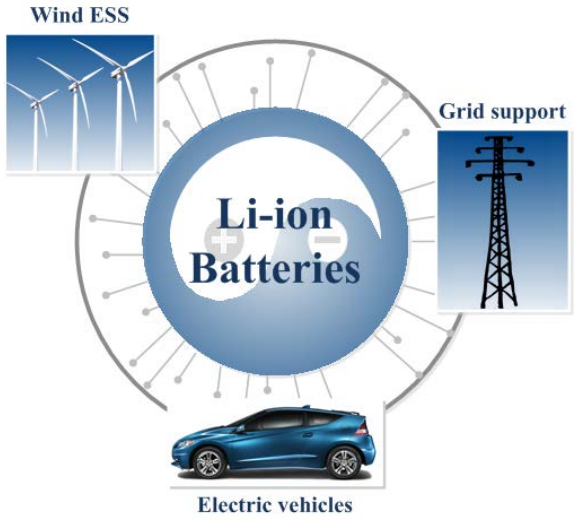
DEPARTMENT OF ENERGY TECHNOLOGY
AALBORG UNIVERSITY

INNOVATIONSNETVÆRKET
SMART ENERGY

VI Edition of Industrial/Ph.D. Course in

Storage Systems based on Li-Ion Batteries for Grid Support and Automotive Applications

24 – 27 October, 2017



www.et.aau.dk

Background of the course

The importance of the li-ion batteries is booming and after dominating portable electronics applications, they are entering into new sectors like grid support applications and propelling of the electric vehicles. The penetration of renewables in the power system is considered to significantly increase in near future; thus, batteries can play a crucial role in the reliable and cost efficient grid integration of intermittent energy sources. Besides, the grid support applications, li-ion batteries have begun to play a major role in the automotive market. The use of batteries in automotive applications is a promising option in order to replace the internal combustion engine cars with ideally, zero emissions vehicles (full electric vehicles), or with controlled emission vehicles (hybrid electric vehicles and plug-in hybrid electric vehicles).

The course starts with an overview of electrochemical battery storage technologies with special focus on the lithium-ion batteries. Moreover, the services that the energy storage can provide for grid applications will be discussed. This will be followed by a lecture about lithium-ion batteries fundamentals and Matlab exercise on optimal sizing of storage in different stationary applications.

The second part focuses on lithium-ion battery technology performance modeling. Lithium-ion batteries laboratory testing and electrical and thermal performance modeling will be presented. Simulation studies in Matlab will be performed, where course participants will develop their own performance model of the Li-ion battery.

During the third day lifetime degradation, ageing phenomena, lifetime testing and lifetime modeling of lithium-ion batteries will be covered. Moreover, lecture about emerging lithium based battery technologies will be provided.

The last day is devoted to automotive applications. Aspects related to li-ion battery management systems for vehicles will be covered together with methods of lithium-ion battery diagnostics and state estimation. Moreover, sizing and control of battery-powered vehicles will be addressed. The fourth day will be finished with the exercise on li-ion battery powered vehicle.

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

Registration

To register, you must create an account by filling out the form available at:

https://phd.moodle.aau.dk/login/index.php

You will be ready to register for course participation after you will receive an e-mail and confirm your registration.

Registrations close on **October 9, 2017**.

Course Program

Day 1: Battery Technologies and Grid Applications

08:30	Course Registration
09:00	Overview of Electrochemical Battery Technologies and Battery Power Converter Topologies
10:00	Coffee Break
10:30	Overview of Stationary Applications
12:00	Lunch
13:00	Li-ion Batteries: Fundamentals, Technology, and Performance
14:30	Coffee Break
15:00	Matlab Exercise: Sizing of Storage Systems in Different Stationary Applications

Day 2: Modeling of Li-ion Batteries

08:30	Li-ion Battery Testing
10:00	Coffee Break
10:30	Performance Modeling of the Li-ion Batteries
12:00	Lunch
13:00	Thermal Modeling of the Li-ion Batteries
14:30	Coffee Break
15:00	Matlab Exercise: Performance Modeling of a Li-ion Battery

Day 3: Lifetime of Li-ion batteries

08:30	Ageing phenomena and degradation of the Li-ion batteries
10:00	Coffee Break
10:30	Lifetime models of Li-ion batteries
12:00	Lunch
13:00	Battery Online Diagnostic and State Estimation
14:30	Coffee Break
15:00	Industrial Guest Lecture

Day 4: Automotive Applications

08:30	Emerging Lithium Based Battery Technologies
10:00	Coffee Break
10:30	Battery Management in Automotive Applications
12:00	Lunch
13:00	Modeling, Sizing and Control of Battery Powered Vehicles
14:30	Coffee Break
15:00	Matlab Exercise: Battery Powered Vehicles

Language: English

Credits: 4.0 ECTS

Course Location

Aalborg University
Department of Energy Technology
Pontoppidanstræde 111
DK-9220 Aalborg East Denmark

Organization

Further information

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

Hotel and Transport

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

Fee

The fee for the course is **8.000 DKK** for Industry, **6.000 DKK** for Ph.D. students/ Academics outside of Denmark, and **1.500 DKK** for Ph.D. students in Denmark.

The registration fee includes: coffee and lunch for all days, and the course materials.

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
- Maccor Battery Test Station
- Digatron Cell and Module Tester
- FuelCon Portable EIS Analyzer
- Industrial Ovens and Climatic Chambers
- Real Time Digital Simulator (RTDS)
- dSpace 32-Cell Battery Emulator
- NETZSCH Isothermal Calorimeter IBC 284