

Remus Teodorescu He received the Dipl.Ing. degree in electrical engineering from Polytechnical University of Bucharest, Romania in 1989, and PhD.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. He 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 systems.

Josep M. Guerrero received the B.S. degree in telecommunications engineering, the M.S. degree in electronics engineering, and the Ph.D. degree in power electronics, in 1997, 2000, and 2003, from the Technical University of Catalonia, Barcelona, Spain. He is an Associate Professor at the same university, where he teaches courses on digital signal processing, control theory, and renewable energy systems. Since 2011, he has been a Full Professor on MicroGrids at the Department of Energy Technology, Aalborg University. His research interests include distributed and hierarchical control of AC and DC MicroGrids. Dr. Guerrero is an Associate Editor of the IEEE TRANSACTIONS ON Industrial Electronics, the IEEE TRANSACTIONS ON POWER ELECTRONICS, and the IEEE Industrial Electronics Magazine. He is the Guest Editor-in-Chief of the IEEE TRANSACTIONS ON POWER ELECTRONICS for

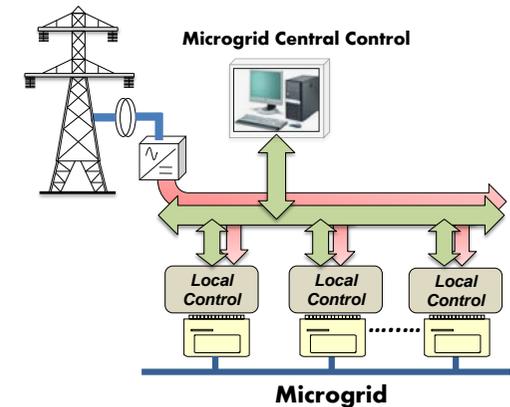
the Special Issue: “Power Electronics for Microgrids”. Currently, he chairs the IEEE Industrial Electronics Society Technical Committee on Renewable Energy Systems.

Tamas Kerekes obtained his Electrical Engineer diploma in 2002 from Technical University of Cluj, Romania, with specialization in Electric Drives and Robots. He received his MSc and PhD degree in 2005 and 2009, at Aalborg University. Currently he is working as an Assistant Professor at the same Department. His main interest is on PV inverter modelling, control and topologies as well as modulation techniques with focus on transformerless PV inverter systems.

Juan C. Vasquez received the B.S. degree in Electronics Engineering from Autonoma University of Manizales, Colombia in 2004 where he has been teaching courses on digital circuits, servo systems and flexible manufacturing systems. He received the PhD degree from the Technical University of Catalonia, Barcelona, Spain in 2009, where he taught courses on renewable energy systems. Currently he is working as Assistant Professor at Aalborg University, Department of Energy Technology. His research interests include modelling, simulation, and power management applied to Distributed Generation in Microgrids.

Fee

4000 DKK for PhD students/Academics outside of Denmark and 1500 DKK for PhD students in Denmark, who is not from AAU. 6.000 DKK for the Industry. If you also take the course AC MicroGrids and SuperGrids in the spring, there will be a discount. The prices for both courses will then be 6000 DKK for PhD students Academics outside of Denmark and 2000 DKK for PhD students in Denmark, who is not from AAU. 9.000 DKK for the Industry. The fee includes coffee, lunch for all days and copy of slides and simulation models on a USB key.



DC Microgrids

Industrial/Ph.D. Course in DC Microgrids – in Theory and Practice

**June 21 – June 22
2012**



**Department of Energy Technology
Aalborg, Denmark**

Background of the course

DC distribution and transmission systems are a trend in future and present electrical networks.

The focus of this course is based on modeling, control and operation of DC MicroGrids, starting with stability analysis and control strategies, such as DC droop control, virtual impedances, and distributed and hierarchical control strategies.

In a DC MicroGrid, the control can be established with some similarity with the AC conventional grids. Three control levels can be used. The primary control consists of a resistive virtual output impedance loop, integrating the soft-start approach. The secondary control is based on an external common controller to restore the voltage deviation inside the DC-MicroGrid. The tertiary control regulates the current flow from/to an external DC distribution network that can be connected to other DC MicroGrids or to DC/AC converters connected to the grid or an AC-MicroGrid.

Further, control of DC-DC and AC-DC converters acting as DC Microgrids interfaces and bridges are evaluated. The course also shows examples of DC MicroGrids and its application in telecommunication systems or residential DC electrical distribution system and hybrid AC-DC MicroGrids increasing the reliability and reducing the losses produced by the large power lines.

This course also introduces the study of the hierarchical control of DC Microgrids. Primary and secondary control issues are introduced to control the DC voltage of the MicroGrid by using communication systems and distributed control.

No less than 60% of the course time will be spent in the lab

Keep yourselves updated at www.et.aau.dk

Course Program

Day 1, 08.30-16.30

- L1 DC Distribution Microgrids
- L2 Analysis and Control of Voltage Source Inverters for DC Microgrids
- L3 Droop Control and Virtual Impedance concept for DC Microgrids
- Lab I Design of Control Parameters for DC Microgrids
- Lab II Experimental Evaluation of a Stand-alone converter with DC Voltage Control
- Lab III Design of Hierarchical Control for DC Microgrids
- LabIV Experimental Evaluation of a DC Microgrid

Day 2, 08.30-16.30

- L4 Stability of DC Electrical Networks
- L5 Distributed Control of DC MicroGrids
- L6 Control of Multiterminal DC transmission systems
- LabV Design of Multiterminal DC control parameters
- Lab VI Experimental Evaluation of Multiterminal DC Transmission Systems

Lecturers

Remus Teodorescu, Professor, Aalborg University, Denmark, ret@et.aau.dk

Josep M. Guerrero, Professor, Aalborg University, Denmark, joz@et.aau.dk

Tamas Kerekes, Assistant Professor, Aalborg University, Denmark, tak@et.aau.dk

Juan C. Vasquez, Assistant Professor, Aalborg University, Denmark, juq@et.aau.dk

Course Location



**Aalborg University,
Department of Energy Technology
Pontoppidanstraede 101, Room 23
DK-9220 Aalborg East, Denmark**

Credits 2.0 ECTS

Prerequisites

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

Accommodation and Transport

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

Further information

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Registration

Please fill out the registration form available at:

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

Registrations close on **June 6, 2012**