IEEE Industrial Electronics Magazine, founder and the chairman of the technical committee on Renewable Energy Systems, co-chairman of the International Symposium on Industrial Electronics (ISIE 2010), IES vice-president responsible of the publications. He has received the IES 2009 Early Career Award, the IES 2011 Anthony J. Horrifeck Service Award and the 2011 Industrial Electronics Magazine best paper award. He is senior member of IES AdCom. He has been elevated to the IEEE fellow grade in 2013. In 2014, he received “The Dr. Bimal Bose Energy Systems Awards” and was amongst the highly cited researchers, “The world’s most influential scientific minds”, by Thomson Reuters. He was also involved with managerial responsibilities in the Center of Reliable Power Electronics (CORPE) at Aalborg University.

Constantine D. Vournas is currently a professor in the Electrical Energy Systems Laboratory, School of Electrical and Computer Engineering, NTUA. He has published more than 150 papers in international journals and conferences and has co-authored the book “Voltage Stability of Electric Power Systems”. He is an active member of several IEEE and CIGRE task forces and co-author of many CIGRE reports. Prof. Vournas organized the 4th Bulk Power System Dynamics and Control Symposium with the theme of “Restructuring” (1998) and served as the chairman of the International Institute for Research and Education in Power System Dynamics (IREP). He was a member of the organizing committee of Athens Power Tech (1993) which initiated a series of Power Tech Conferences that later became the main IEEE Power Conference in Europe. He is currently the secretary of the Power System Dynamic Performance committee (PSDP) of IEEE/PES and also chair of the Dynamic Security Assessment Working Group of the same committee.

Giampaolo Buticchi is a post-doctoral researcher at the chair of power electronics of Kiel university. Over 70 technical papers (22 of them in international peer-reviewed ISI journals, like IEEE Transactions or IET) are published by him. In 2014 he received the “Alexander Von Humboldt” fellowship for post-doctoral researchers. He also won the “Best Paper Award” of International Symposium on Linear Drives for Industry Applications (LDIA 2013). Currently, he is involved in several international projects and is the teacher/co-teacher of different modules in Kiel university.
**Description of the course**

The increasing connection of renewables and new loads is challenging the distribution grids. The Smart Transformer (ST), a power electronics-based transformer, can provide ancillary services to the distribution grids to support the grid management, in addition to the voltage adaptation. The Smart Transformer is a natural connection point for hybrid (AC and DC) grids both at MV and LV levels.

The course starts with an introduction of the basic concepts of power systems and smart grids. The Smart Transformer is defined and the topologies and controllers are explored. Current challenges in hybrid grids are presented and proposed solutions are described. New services enabled with the Smart Transformer technology, for instance load identification in LV grids and voltage support in MV grids, are explained in the last part of the course.

This course consists of two main parts, lectures (50%) and lab experiences (50%). The lab participants not only will learn about the modeling and control of Smart Transformer, but they will test the new control possibilities through lab experiences. The proposed lab tests will be performed in a ST-fed microgrid by means of Control-Hardware-In-Loop (CHIL) and Power-Hardware-In-Loop (PHIL) evaluation. Since the lab vacancies are quite limited, it is also possible to register only for the theoretical part.

**Further information**

For more information about the administration and registration please contact:

**Ms.Cristina Terasa**
EEK, SH - Competence Centre Renewable Energies and Climate Protection Schleswig-Holstein
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For more information about the course contents please contact:

**Mr. Shahab Asadollah**
Kiel University, Chair of power electronics
Kaiserstraße 2, 24143, Kiel, Germany
Phone +49 431 880-6106, E-mail: shah@uni-kiel.de

**Location**

Lectures: Building D, Room: Aquarium,
Laboratory: Building B, Lab of Power Electronics,
Faculty of Engineering at Kiel University,
Kaiserstraße 2, 24143, Kiel, Germany.

**Language**

English

**Prerequisites**

Control and power electronics basics are recommended for the lectures and exercises.

**Literature**


**Course program:**

**Feb 22, 2017, 08.30-17.30**

Lec.0 Course introduction
Lec.1 Basics of power systems and smart grids
Lec.2 Active/reactive power, frequency and voltage regulation
Lec.3 Power system stability issues
Lec.4 Smart Transformer definition, control and communication
Lec.5 Smart Transformer topologies: an overview on architectures and power converters stages
Lab.1 Intro of PSCAD, RTDS and microgrid setup

**Feb 23, 2017, 08.30-17.30**

Lec.6 Control of the Smart Transformer
Lec.7 Synchronization issues in microgrids
Lec.8 Parallel converters and microgrids control
Lec.9 DC/DC converters for DC microgrids management
Lab.2 DC challenges in LV grids, control of ST, ST-fed microgrids, DAB and QAB technologies

**Feb 24, 2017, 08.30-17.30**

Lec.10 LV Grid identification
Lec.11 Voltage/frequency control of LV Grid
Lec.12 MV grid voltage regulation
Lec.13 ST ancillary services for MV grid
Lab.3 Reverse power flow limitation experiment in microgrid, PHIL: Stability analysis, on-line load identification and ST voltage support in MV grid.

Program may be subject to amendment

**Lecturers**

**Prof. Marco Liserre**, Kiel University, Germany
**Prof. Constantine D. Vournas**, National Technical University of Athens, Greece
**Dr. Giampaolo Buticchi**, Kiel University, Germany

Marco Liserre is the head of the chair of power electronics at the Kiel university. He has published more than 230 technical papers (80 of them in international peer-reviewed journals and magazines), and three chapters of a book (Grid Converters for Photovoltaic and Wind Power Systems, ISBN-10: 0-470-05751-3 – IEEE-Wiley, also translated in Chinese). He has been associate professor at Bari Polytechnic (Italy) and professor in reliable power electronics at Aalborg university (Denmark). He is associate editor of many IEEE journals. He has been founder and editor-in-chief of the