



# PE:Region Newsletter

## September 2018

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### Conference/Workshop Participation



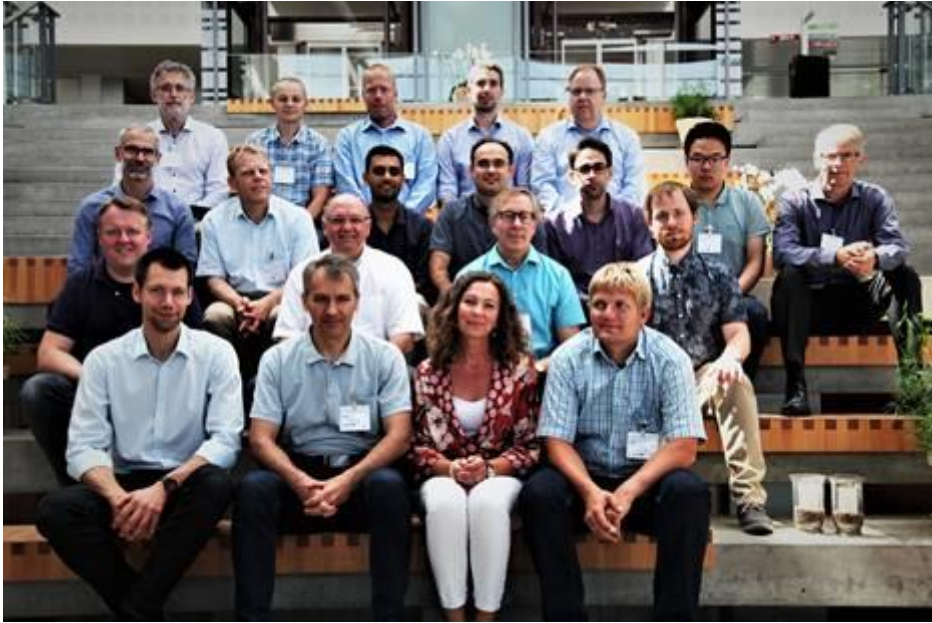
#### **Danish-German PE:Region Seminar**

**SDU Sonderborg - The Mads Clausen Institute**

**Wednesday 27 June 2018 at 11.30 - 15.00 at Alsion**

[Demonstrator Development for Intelligent Grid Integration, High Speed Drives and Battery Charging](#)

On 27 June, the PE:Region project conducted an open demonstrator workshop, where the status of the 3 project demonstrators were presented.



The demonstrators, that are all developed in close cooperation with industrial network partners, are:

- #1 - Intelligent grid integration of wind and sun (CAU)
- #2 - Energy efficient, reliable and compact high speed drive (CAU)
- #3 - High power onboard bidirectional battery charger (SDU)

All demonstrators are progressing as planned. - For further information on the demonstrator status please see below.

## **Danish-German PE:Region Seminar**

### **Danfoss Drives - Graasten**

**Tuesday 28 August 2018 at 9.30 - 15.30**

### **[Electrical Drives Technologies in Industrial and Mobile Applications](#)**

The seminar "Electrical Drives Technologies in Industrial and Mobile Applications" on 28 August was hosted at Danfoss Drives in Graasten. The number of participants had to be limited to 65 with focus on participants from industry.



The future trends in power electronics was described by invited speakers from a broad range of companies (Danfoss Silicon Power GmbH, Danfoss Power Solutions GmbH, MOTEG GmbH, Nord Drivesystems, Danfoss Drives and Linak) as well as the PE:Region partner universities CAU and SDU. Furthermore, Lappeenranta University of Technology (LUT) was represented by professor Dr. Sc. Olli Pyrhönen. We plan to strengthen the cooperation with LUT in the field of power electronics in close cooperation with industry.

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## Staff News



### Giorgo Kapino



As of 1 August 2018, Giorgio Kapino has been employed as a PhD student at SDU joining the PE:Region project. Giorgio will work on high speed drives with a strong focus on the hardware, topologies and alternatives to standard PWM.

Giorgio graduated as MSc in Engineering from SDU Odense with a focus on power electronics. During his studies he has been working on electronic power systems, machines and on modelling and control of power electronics. His master thesis was on grid connected voltage source converters. With this background he is perfectly prepared for this project.

## **Thomas Ebel**



On 15 August, SDU had the pleasure of welcoming Dr. Thomas Ebel as Head of SDU Electrical Engineering and CIE.

Thomas Ebel has years of experience from the electronics industry. He has worked at Siemens in Germany and Italy and is coming to SDU from a top position in the German company FTCAP GmbH where he has been the CEO since 2011 and thus also a well-known stakeholder of the PE:Region project.

In addition to a vast industrial experience, Thomas Ebel has an academic background as a researcher and teacher from the University of Münster (Westfälische Wilhelms-Universität Münster). Thomas Ebel has a strong, global network in power electronics and he is an experienced manager of R&D teams consisting of highly qualified researchers and engineers.

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## **Demonstrator Status**

### **Demonstrator #1: Increasing the renewable energy penetration by coordination of different voltage control devices**

Demonstrator #1 targets to increase the hosting capacity for renewable energy sources in the electrical distribution grid. In this context, the performance of different devices such as transformers with 'On Load Tap Changers' (OLTC), shunt capacitor banks and power electronics equipment (eg. smart transformer),

is investigated. Thereby, the centralized control of multiple devices by a ST is proposed as shown in Fig. 1. The aim is to demonstrate that the new structure increases the hosting capability of renewable energy sources. As it is demonstrated, the proposal achieves higher flexibility and prolongs the lifetime of OLTC and shunt capacitor banks.

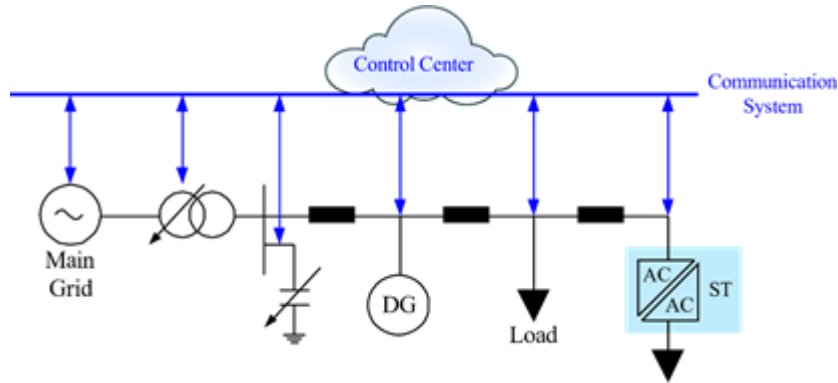


Fig.1: Distribution grid with a Smart Transformer (ST) and an advanced communication system.

The results of the work are disseminated by the following conference publications:

1. X. Gao, R. Zhu, G. De Carne and M. Liserre, "Comparison of voltage support services by means of STATCOM and smart transformer in medium voltage grid," 2018 13th IEEE Conference on Industrial Electronics and Applications (ICIEA), Wuhan, China, 2018
2. L. Camurca, F. Costa, X. Gao and M. Liserre, "Design of a Medium Voltage DC Fast charging Station with Voltage Regulation and Central Modular Multilevel Converter," 2018 30<sup>th</sup> ECCE, Portland, USA, 2018

Both publications analyzed the methods of voltage control implemented by power electronics devices. The results show that with more advanced power electronics devices, the voltage performance of the grid can be further improved, so that higher penetration of renewable energy can be achieved.

## Demonstrator #2: Controller design for energy efficient, reliable, and compact high speed drives

In the past weeks, the developed Model Predictive Control algorithms have been tested on the developed laboratory test setup. The 2-Level and 3-Level converter operation are showing promising results for low carrier ratios, which is important for the application of high-speed drives. The test was done with a 20kW PMSM, for the control a DSpace MicroLabBox (DS1202) is used.

In figure 2, a load step under nominal speed is shown. A detailed analysis of this research is presented at the upcoming IEEE Energy Conversion Congress & Exposition (ECCE 2018) in Portland, Oregon.

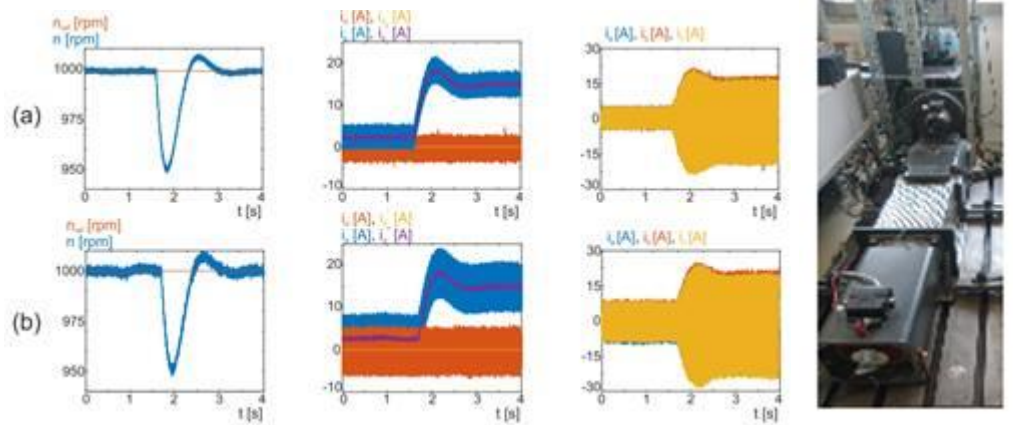


Figure 2: Schematic of 2-Level Voltage Source Converter with MPC: (a)  $i_{Bound} = 3A$ , (b)  $I_{Bound} = 6A$ , (c) *Figure of the experimental setup.*

The results of the work are disseminated by the following conference publication:

1. S. Walz, R. Lazar and M. Liserre, "Two-Step Model Predictive Control for High-Speed PMSM," 2018 IEEE Energy Conversion Congress and Exposition, Portland, 2018.

### Demonstrator #3: High power on-board bidirectional battery charger

Activities are progressing as planned.

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## Publications

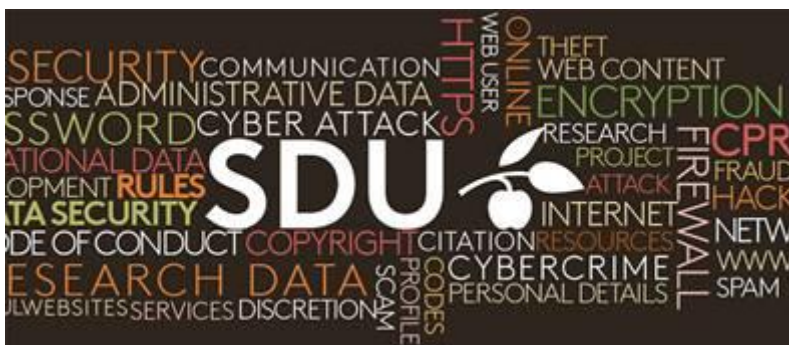


1. S. Pugliese, M. Andresen, R. A. Mastromauro, G. Buticchi, S. Stasi and M. Liserre, "A New Voltage Balancing Technique for a Three-Stage Modular Smart Transformer Interfacing a DC Multibus," in IEEE Transactions on Power Electronics.
2. Y. Ko, M. Andresen, G. Buticchi and M. Liserre, "Discontinuous Modulation Based Active Thermal Control of Power Electronic Modules in Wind Farms," in IEEE Transactions on Power Electronics.

3. M. Andresen, G. De Carne, M. Schloh and M. Liserre, "Active Thermal Control of Grid-Forming Converter Considering Load Sensitivity to Voltage," 2018 IEEE Energy Conversion Congress and Exposition, Portland, 2018.
4. V. Raveendran, M. Andresen and M. Liserre "Optimal Power Routing in Smart Transformer for Flexible Maintenance Scheduling," 2018 IEEE Energy Conversion Congress and Exposition, Portland, 2018.
5. Y. Ko, V. Raveendran, M. Andresen and M. Liserre "Discontinuous modulation based power routing for modular smart transformers," 2018 IEEE Energy Conversion Congress and Exposition, Portland, 2018.
6. V. Ferreira, M. Andresen, B. Cardoso and M. Liserre "Thermal Control Through Active Redundancy in the Low Voltage Stage of Smart Transformers," 2018 IEEE Energy Conversion Congress and Exposition, Portland, 2018.
7. T. Polom, M. Andresen, R. D. Lorenz and M. Liserre "Experimentally Extracting Multiple Spatial Thermal Models that Accurately Capture Slow and Fast Properties of Assembled Power Semiconductor Converter Systems," 2018 IEEE Energy Conversion Congress and Exposition, Portland, 2018.
8. V.k Raveendran, M. Andresen and M. Liserre "Reliability Oriented Control of DC/DC Converters For More Electric Aircraft," 27th IEEE International Symposium on Industrial Electronics, Cairns, Australia, 2018.

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## EU's General Data Protection Regulations



We are happy to have you on our list of subscribers of PE:Region news and events.

Due to EU's General Data Protection Regulations that entered into force on 25 May, we need to know if you still want to be part of this list which allows SDU and the PE:Region project to proceed your name and e-mail address in our IT systems in order to send you PE:Region newsletters and invitations.

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