DC Components and Grid (DCC+G)

List of Publications, Conferences and Workshops

Name	Planned/actual Dates	Type	Type of audience	Countries addressed	Partner responsible /involved
Intelec 2012, Phoenix, 2012	Sep, 30 – Oct, 04 2012	Presentation in the Conference	Industry	International	Emerson Network Power
ECPE Workshop, Kassel, Germany	March, 2013	Presentation at the Workshop	Academia and Industry	EU	Philips Research
Vermogens Elektronica Workshop	June 2013	Lecture in workshop	Manufacturing Industry	NL	TU/e, Philips Research
EPE 2013, Lille, France	Sep 2013	Paper presentation in International Conference	Academia and Industry	International, mostly EU	TU/e, Philips Research, Siemens
Darnell's Power Forum, Dallas, USA	Sep 2013	Presentation in a Conference	Industry	International	Emerson Network Power
Intelec 2013, Hamburg	Oct 2013	Presentation	Industry	International	Emerson Network Power
European Nanoelectronics Forum 2013, Barcelona, Spain	Nov 2013	Poster-Presentation	Industry, Academia	International, mostly EU	Infineon
ETG-Kongress 2013, Berlin, Germany	Nov 2013	Paper Presentation	Industry	International, mostly EU	Fraunhofer IISB, Philips Research, Siemens
CIGRE DC Congress, TU Delft, Delft, the Netherlands	Jan 2014	Presentation	Industry	EU	Philips Research
VICOR webinars	Feb 2014	Presentation	Industry	EU	Fraunhofer IISB
ISGT 2014, Washington DC, USA	Feb 2014	Paper presentation in International Conference	Academia and Industry	International	TU/e, Philips Research, Siemens
CleanTech Forum 2014, San Francisco, USA	Mar 2014	Presentation	Industry	International	SolCalor
DC Safety workshop by the German Standartization Body DKE	Apr 2014	Presentation	Industry (standardization experts)	EU	Philips Research
Hannover Messe 2014	Apr 2014	Presentation	Industry	International,	SolCalor

Name	Planned/actual Dates	Type	Type of audience	Countries addressed	Partner responsible /involved
				mostly EU	
EPE 2014, Lappeenranta, Finland	Sep 2014	Paper presentation in International Conference	Academia and Industry	International, mostly EU	TU/e, Philips Research, Infineon, Siemens

Publications
Presented papers:

1) Rykov, K., Duarte, J.L., Boeke, U., Wendt, M., and Weiss, R., (2013). **Voltage Stability Assessment in Semi-Autonomous DC-Grids with Multiple Power Modules**. Proceedings paper : *Proceedings of the 15th European Conference on Power Electronics and Applications (EPE 2013), 3-5 September 2013, Lille, Fr*, (*pp. 1-10*). IEEE;

Abstract

Basic concepts with respect to stable operation of semi-autonomous low-voltage DC-grids are discussed. Design considerations on the output impedances of power electronic converters are analyzed in order to avoid resonance issues within a DC-grid. With calculated or measured converter output impedances, potential resonance problems due to background harmonics between aggregated power modules and the DC-grid can be forecasted. Simulation results are included for verification of the proposed ideas.

Link

http://dcgrid.tue.nl/files/

2) Rykov, K., Duarte, J.L., Szpek, M., Olsson, J., Zeltner, S., and Ott L. (2013). **"Converter Impedance Characterization for Stability Analysis of Low-Voltage DC-Grids,"** *Proceedings of the IEEE PES Conference on Innovative Smart Grid Technologies, February 19-22, 2014, Washington, DC, USA.* (pp. 1-10). IEEE;

Abstract

The paper discusses aspects of modelling and operation of low-voltage DC-grids with aggregated power and load modules in terms of small-signal stability. Multiple power modules connected to the common DC-bus potentially may become a reason of voltage instabilities due to background harmonics interactions. Unfortunately, in a practical grid implementation, usually the internal structure of the converters including control algorithms and parameters is not fully known for the users. A technique of experimental impedance

identification, applied to each module and which consequently enables for the relatively simple and effective analysis of the aggregated system is described.

Link

http://dcgrid.tue.nl/files/

3) Ott, L., Boeke, U., Weiss, R., (2013). **"Energieeffiziente Gleichstromnetze für kommerziell genutzte Gebäude (Energy Efficient DC-Grids for Commercial Buildings)",** *ETG-Kongress 2013, November 5-6, 2013, Berlin, Germany;*

Abstract

Modern and highly efficient power electronic devices enable the immediate supply of almost all electric power consumers in commercial buildings, e. g. lighting, IT-equipment and speed-controlled drives, out of locally available regenerative energy sources such as photovoltaic and micro-CHP units using a DC grid. The reduced number of DC/AC and AC/DC conversions holds a potential for electric energy savings and the reduction of passive and active electronic components. Another advantage compared to a conventional AC supply arises from the possibility to halve the conductor cross-sections. That is a cost advantage and it saves on the limited copper resources. Yet, the missing voltage zero-crossing of DC makes special demands on circuit breakers and protection equipment to extinguish electric arcs in suited ways.

Link

http://dcgrid.tue.nl/files/

4) R. Weiss, U. Boeke, W. Maurer, S. Zeltner. **"Energieeffiziente Gleichstromverteilung in kommerziell genutzten Gebäuden mit intelligenter Kopplung zum Niederspannungsnetz"**

Abstract

The joint undertaking "Direct Current Components and Grid" (DCC+G) takes on the strategic challenge to reduce energy consumption and thus the reduction of CO2 emission caused by commercially used buildings through research in the fields of Direct Current distribution at a voltage level of ±380 V. The major energy consumers in commercially used buildings, ready for the „net-zero-energy" goal of the European Union, are heat pumps for heating, ventilation systems, air conditioning units, cooling units (HVAC), lighting systems and information technology. All these components and subsystems have in common, that the most efficient versions would benefit from a direct current supply. Additionally the local producers of electric energy like photovoltaic systems usually generate DC-current. A Direct Current distribution grid within buildings would avoid the repeating conversion from DC to AC and vice versa and therefore reduce conversion losses. Important components of a direct current

distribution grid are central, smart, high efficient, bidirectional rectifiers replacing the large number of small, less efficient rectifiers used today. Such large central rectifiers units could additionally be used to actively improve the power quality of the smart local AC distribution grid. One major part of the described activities is to show energy savings of about 5% of electrical energy with a 2-phase direct cur-rent distribution grid using a voltage level of ±380V.

Link

http://dcgrid.tue.nl/files/Gleichstromverteilung_Siemens_VDE_v7_p.pdf

5) U. Boeke, M. Wendt: **"LED Beleuchtung mit Gleichstromnetzen",** *Tagungsband der VDI Konferenz "Innovative Beleuchtung mit LED 2012"*, *VDI Bericht 2162, ISBN 978-3-18-0921624*

Abstract

Direct current (DC) electricity grids will contribute to more efficient electricity generation, distribution and application in buildings. New DC power grid systems in Europe must compete with state-of-the-art 400 V 3-phase AC grids. For this the authors have roposed a 2-phase ±380 V DC power grid system. Low power loads like LED lamps and luminaires shall be supplied with 1-phase 380 V DC in future. People without access to a public grid will use more and more solar powered island grids. These island grids are 12 V or 24 V DC grids due to the used energy storage components. Efficient LED lighting solutions are already available and described.

Link

http://dcgrid.tue.nl/files/

Submitted papers

1) K. Rykov, J. Duarte, E.A. Lomonova, A. Mauder, L. Ott, **"Modelling of Aggregated Operation of Power Modules in Low-Voltage DC-Grids"** *16th European Conference on Power Electronics and Applications (EPE 2014), 26-28 August 2014, Lappeenranta, Finland*.

Abstract

The paper discusses aspects of modelling and operation of low-voltage DC-grids with aggregated power and load modules in terms of small-signal stability. Multiple power modules connected to the common DC-bus potentially may become a reason of voltage instabilities due to background harmonics interactions. Unfortunately, in a practical grid implementation, usually the internal structure of the converters including control algorithms and parameters is not fully known for the users. A technique of experimental impedance identification, applied to each module and which consequently enables for the relatively simple and effective analysis of the aggregated system, is described.

Link

to be updated

Rejected papers

No

Contributions to conferences (abstracts, etc)

1) ENIAC Joint Undertaking, Project profile **"DCC+G DC components and grid"** http://dcgrid.tue.nl/files/ENIAC-DCC+G_project_profile.pdf

2) ENP and Vicor have presented 400VDC Small Scale Demo System**: DC Microgrid for Telecom and Datacom Applications Using Existing Technologies and Components**. *Intelec 2012 in Phoenix*, http://www.intelec.org/intelec2012/.

3) E. Waffenschmidt, U. Boeke: Low Voltage DC Grids. Presentation at the ECPE Workshop **"Power Electronics in the Electrical Network,"** *Kassel, Germany, 12/13. March 2013*. http://dcgrid.tue.nl/files/Waffenschmidt-Low%20Voltage%20DC%20Grids-ECPE_2013.pdf

4) Lecture in the workshop "Power Electronics Event" organized by "FHI Industriele Elektronica" in Eindhoven, the Netherlands, on June 18th, 2013, with title: "DC Power Grids for Energy Efficient Buildings", by U. Boeke, M. Wendt, Philips Research; J. Duarte, K. Rykov, TU/e; E. Waffenschmidt, Cologne University of Applied Science; http://dcc-g.eu/

5) Participation in *Darnell's Fifth-Annual International Forum on DC Power and Micro Grids, Dallas, Texas, September, 9-13, 2013* with the **presentation about DCC+G Project Overview** by Emerson Network Power; http://greenbuildingpower.darnell.com/sched.php

6) Presentation on **"Performance of 400VDC distribution at short circuits and arcing"** *at Intelec 2013 in Hamburg, October 13-17* by Emerson Network Power; http://conference.vde.com/intelec/Program/Seiten/default.aspx

7) Poster-presentation of the **DCC+G project** *at the European Nanoelectronics Forum 2013, organized on Nov 27/28 in Barcelona by Eniac/Catrene* by Infineon Technologies AG. http://www.eniac.eu/web/forum2013/index.php

8) U. Boeke: Presentation **Direct Current Components +Grid European R&D Project Low Voltage DC Power Grids**, *CIGRE DC Congress, Delft January 30th 2014,* http://www.aanmelder.nl/cigredccongres

9) Presentation **"380V DC in Commercial Buildings and Offices"** by Bernd Wunder (Fraunhofer IISB) *at the VICOR webinar given on February, 13, 2014* http://dcgrid.tue.nl/Publications.html

10) Jan van Diessen (Solcalor B.V.): Presentation of the **DCC+G** at *the Cleantech Forum 2014, San Francisco, USA, March 11-13.* http://events.cleantech.com/sanfrancisco/

11) SRB Energy/Solcalor B.V.: participation at the *Hannover Messe 2014, Hannover, Germany, 7-11 April, 2014*, promoting the **DCC+G project within the framework of the Holland High Tech House**.

http://www.hannovermesse.de/

International articles

1) U. Boeke, R. Weiss, P. Meckler, L. Ott. “Gleichstromnetze für kommerziell genutzte Gebäude, Magazine Elektrotechnik“, August 2013, http://www.elektroniknet.de/power/leistungswandler/artikel/100935