DEPARTMENT OF ENERGY TECHNOLOGY
AALBORG UNIVERSITY

PhD Public Defence

Title:	Modular Uninterruptible Power Supply System
Location:	Pontoppidanstræde 101 room 23
Time:	Monday 10 October 2016 at 13.00
PhD defendant:	Chi Zhang
Supervisor:	Professor Josep M Guerrero
Moderator:	Associate Professor Sanjay K. Chaudhary
Opponents:	Associate Professor Tamas Kerekes, Dept. of Energy Technology, Aalborg University (Chairman) Professor Marco Liserre, Departmentof Power Electronics, Christian-Albrechts University of Kiel Associate Professor Ramon Blasco-Gimenez, Institute of Control and Industrial Informatics, Technical University of Valencia

All are welcome. The defence will be in English.

After the defence there will be an informal reception in Pontoppidanstræde 111 (coffee room).

DEPARTMENT OF ENERGY TECHNOLOGY
AALBORG UNIVERSITY

Abstract:

Online uninterruptible power supply systems (UPS) have been actively growing during the past decades due to the fast development of modern technologies. A great number of advanced electrical loads, e.g. communication facilities, academic laboratory equipment, etc, are constantly emerging in our everyday lives. That is why, power electronics interfaces, which can regulate the power quality and cooperate actively with the main grid, are becoming more and more significant in an online UPS system. However, the exiting product is lack of flexibility. Thus the objective of the project is to study power electronics converters control in a flexible modular online UPS system. Numbers of emerging potentials and challenges will be discussed.

First, different UPS architectures are reviewed and two modularized strategies are proposed by considering the drawbacks and main advantages. Based on the different architectures, variable control methods are discussed, especially the importance of how to parallel different modules in the system. The controls methodologies should follow the UPS product standard IEC 62040-3 in order to consider it into a real application, such as data center, hospital and IT loads integration scenarios. The basic behavior for the parallel modules is presented and it should be taken into account when designing the system.

According to the basic knowledge of modular system, advanced control architectures and their concepts are discussed and compared in detail. The control mechanism of the modules in the online UPS system is shown and simulation models were conducted in PLECS. On the other hand, other functionalities for a modular online UPS system such as active power filter, and UPQC are also investigated with presenting experimental results. Furthermore, mathematical model is proposed for a modular online UPS system, which emulates a real modular system and study its behavior in both steady and dynamic state. Experimental data was acquired to analysis the proposed system behavior together with the mathematic model. On the other hand, basic thermal analysis for the modular system was presented.

Based on what have been acquired in the lab, both the control methods and modular structure are applied to industrial product in the companies. Some basic analysis regarding product implementation together with some experimental results is discussed.