DEPARTMENT OF ENERGY TECHNOLOGY
AALBORG UNIVERSITY

PhD Public Defence

Title: Model Predictive Control of Multilevel Power Electronic Converters: Design, Optimization and Performance Evaluation

Location: Pontoppidanstræde 101, room 1.001

Time: Friday 24 January at 13.00

PhD defendant: Mateja Novak

Supervisor: Associate Professor Tomislav Dragicevic

Moderator: Associate Professor Pooya Davari

Opponents: Associate Professor Amjad Anvari-Moghaddam, Dept. of Energy Technology, Aalborg University (Chairman)
Associate Professor Sergio Vazquez, University of Seville, Spain
Dr. Alessandra Parisio, University of Manchester, UK

All are welcome. The defence will be in English.

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Abstract:

Finite set model predictive control (FS-MPC) algorithm comes from the family of non-linear algorithms and it is characterized by a straightforward design and a fast transient response. Multiple control objectives can simply be implemented in the cost function, which defines the desired behavior of the converter. FS-MPC algorithm is an attractive alternative for multilevel converters, which due to higher number of devices and sources, require the implementation of additional control objectives. It is demonstrated that FS-MPC algorithm can not only be used to achieve a fast transient response and good reference tracking abilities, but is also able to extend the life-time of the three level neutral point clamped (NPC) converter.

Although many applications of the FS-MPC algorithm were proposed in power electronics, the algorithm has not yet fully reached the level of maturity observed for the linear controllers. For FS-MPC algorithm applications in power electronics, well defined design procedures and tools for assessing the performance and the stability are missing.

The contributions of this Ph.D. project are aiming to remove the limitations of FS-MPC algorithm, show advantages of implementation on multilevel converters and propose tools that can validate and optimize its performance. Thus, it is anticipated that these findings can bring FS-MPC algorithm one step closer to more power electronics industrial implementations in the near future.