



DEPARTMENT OF ENERGY TECHNOLOGY
AALBORG UNIVERSITY

PhD Public Defence

Title: Methods of Monitoring and Reliability Improvement of Wind Turbine Converters

Location: Pontoppidanstræde 111, auditorium

Time: Thursday 16 May at 13.00

PhD defendant: Bjørn Rannestad

Supervisor: Professor Stig Munk-Nielsen

Moderator: Associate Professor Szymon Michal Beczkowski

Opponents: Associate Professor Deszo Sera, Dept. of Energy Technology, Aalborg University (Chairman)
Dr. Suresh Perinpanayagam, Cranfield University, United Kingdom
Senior Specialist Lars Helle, Vestas, Denmark

All are welcome. The defence will be in English.



Abstract:

Condition monitoring systems for several of the mechanical and structural components of wind turbines are commercially available, but condition monitoring of the electronic components are not yet commercialized.

Bringing converter monitoring from the R&D laboratories to field wind turbine converters is a major contribution of the work performed in relation to this PhD thesis. A converter monitoring system named Converter Monitoring Unit (CMU) was designed and installed in a multi Mega Watt test wind turbine. Reference data (calibration data) were generated, based on field data alone. The temperature related parameters Virtual Temperature (T_v), Relative Virtual Temperature (T_{vr}) and Relative Virtual Temperature Difference (ΔT_{vr}) were calculated based on reference data generated, and a full year of power module monitoring was shown with consistent results.

Inductive coupling between measurement circuitries and current carrying conductors distort the sampled signals, and several compensation strategies were proposed.

In addition, a novel statistical method of estimating IGBT switching transition time (t^{tr}), and a novel discontinuous interleaved modulation scheme was proposed. The latter drastically reduces diode switching losses. The methods presented are important steps in bringing cost-effective converter monitoring solutions into the field.