Wind Turbine Measurement Technique—an Open Laboratory for Educational Purposes -

As part of the International Master of Science Programme in Wind Energy at the Technical University of Denmark (DTU), a complete interactive wind turbine measurement laboratory (WTMLAB) was developed. A 500 kW stall regulated wind turbine was instrumented with sensors for recording (i) turbine operational parameters, (ii) meteorological conditions, (iii) electrical quantities and (iv) mechanical loads. The data acquisition system was PC based, and it was combined with a MySQL® database for data management. The system enabled online access for real-time recordings, which were used both for demonstration purposes, for individual student exercises and for scientific investigations. The automatic data acquisition system furthermore enabled recording of extreme and fatigue loads together with a long-term event registration. Long-term registration of wind turbine loads resulted in a unique database of non-commercial time series, which would be available for practicing fatigue calculations and extreme load estimation in basic wind turbine courses.

Power quality analysis was carried out based on high-speed-sampled, three-phase voltage and current signals. The wide spectrum of sensors enabled a detailed study of the correlation between meteorological, mechanical and electrical quantities. Measurements were recorded with a PC placed at the wind turbine site at Risø. The PC could be remotely controlled from DTU, which gave the students the opportunity to work on an operating wind turbine. The WTMLAB was included in a new course entitled Wind Turbine Measurement Techniques.