

# Monitoring of Concrete Bases of Wind Turbines with Modern Inclinometers: Approaches and Experience

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## SUMMARY

Due to high investments within recent years, wind energy contributes significant parts of Germany's energy supply. Almost half of the existing wind turbines were built before 2003 and are within short time reaching their scheduled service life of 20 years. Besides the exploration of new suitable constructions sites, the maintenance of existing wind turbines is playing a major role. The last years showed that more and more problems arise around the link between steel tower and concrete foundation in turbines of several manufacturers. Dangerous defects in the concrete bases of wind turbines are known to be caused not only by external factors, such as temperature changes or fatigue of construction materials over the time, but often particularly by constructional defects or design failure. The valid standards and guidelines suggest specific measurement methods, descriptions and evaluations of existing cracks in the concrete base. The goal of the current research project at the Beuth University of Applied Sciences Berlin is to develop a new concept for an early identification of security-relevant defects within the fastening between tower and concrete base, in the form of a Condition-Monitoring-System (CMS). To apply existing techniques of a rapid alert system, specific algorithms have to be developed. Based on continuous measurements, these will allow a reliable and stable identification of significant deviations from the structure's "normal behavior". Extensive test measurements on selected structures with the newly developed methods, as well as classic, non-destructive testing, are used to verify the possibilities of the developed methods and algorithms. It is shown that the proposed technique can detect changes of the structural behavior of wind turbine foundations and can be used for early warning systems in condition monitoring.

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