Concepts for an early identification of security-relevant defects in concrete bases of wind turbines in terms of Condition Monitoring Systems

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Abstract

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 and descriptions and evaluations of existing cracks in the concrete base. In recent years, the research results of the participating universities of this international research project pointed out the possibilities and limits of the applied methods.

The goal of this cooperative research project is to pool the existing expertise of the project partners and 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 were carried out to verify the possibilities of the developed methods and algorithms. It was demonstrated 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.

Keywords: Condition-Monitoring-System, Wind Turbines, Foundation, Inclinometer, Statistical Analysis