Body:

Motivation

When operating a wind turbine, damage of the rotor blade is a serious problem and has to be taken into account. The rotor blades are subject to varying dynamic loads during the whole lifespan which is planned to be at least 20 years. Even small damages of the blade can accumulate over time and lead to structurally relevant damage. Therefore, regular sight inspections are mandatory in many countries. However, these inspections cannot provide instant damage detection. Besides the safety risk of an undetected damage, the economic burden will grow rapidly if the damage increases, given the costs of repairing, replacing and downtime. A system that reliably detects defects in early stages can help to react fast and to avoid greater damage. Such a system will enable the wind turbine operator to provide higher operational safety and to minimize the economic burdens.

Challenges & Highlights

The essential goal of the project is to develop, combine and test global and local SHM methods for rotor blades of wind turbines. According to a multivariate procedure, different structure-mechanical and acoustic approaches, which are able to capture different indicator parameters, will be considered.

One part of the project investigates a new acoustic emission approach. While other approaches measure ultrasonic sound waves at the surface of the material with many sensors, we propose using the airborne sound in audible frequencies and only about three sensors. The higher risks of lightning damage with wired electrical sensors is avoided by using fiber optic microphones. Environmental noise can be handled with sophisticated signal processing, making the approach robust for operating under real-world conditions.

Potential applications & future issues

The aim of the project is to path the way to a rotor blade damage detection system, which reliably detects damage in early stages. A further goal is to extract useful information about the damage, e. g., its localization and an estimation of its relevance.

Project abstract:

A major design goal for wind turbines and its operation is to provide high efficiency. Unexpected rotor blade damage decreases the efficiency by causing downtimes and expenses for maintenance, repairing and replacement. Structural health monitoring (SHM) of the rotor blade helps to react fast and to minimize these burdens. The aim of the research project is to path the way for a new generation of structural health monitoring systems which reliably detect damages in early stages.

Project duration:
13.12.2018

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Members:
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Project manager:
Prof. Dr.-Ing. Jörn Ostermann

Project research areas:
Collective Intelligence

Project type:
BMWI