DEVELOPMENT AND TESTING OF AN ACOUSTO-ULTRASONIC INSPECTION DEVICE FOR CONDITION MONITORING OF WIND TURBINE BLADES

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Summary.

In recent years the wind energy industry has grown rapidly (23% per annum) to the stage where a modern turbine blade exceeds the wing span of an Airbus A380, where offshore wind farms of 300MW are a reality, and where an 800MW total level of European power production 15 years ago has become a significant 10,000MW in 2010, with this rate of growth forecast to continue despite a general economic slowdown. One of the many challenges this industry has (and continues) to face concerns the polymer fiber composite material and structure utilized in the wind turbine blades. This large, complex, multi-layered structure must meet the requirements of greater size and quality demanded by the industry, whilst matching the harsher environments of offshore placement, and providing improvements in reliability and an upgraded life-cycle maintenance approach.

Non-destructive inspection technology is an important topic for this dynamic new industry. There is a need to understand the effect(s) of more advanced designs and manufacturing approaches, the prevalence and significance of production defects in material and structure, and the optimization of maintenance/inspection effort through monitoring. Described in this paper are the evaluation results from a European project (E4410 SESS) attempting to provide a flexible device based on surface mounted piezoelectric transducers which will detect and localize flaws and/or potential damage in the wind turbine blade using both an active and a passive approach. The target capability can be summarized as: early detection of critical damage. The development and prototype evaluation testing of this local monitoring system is described on sub-component and full-scale structures as well as an on-turbine installation.