Structural Health Monitoring of Wind Turbine Blades*

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ABSTRACT

As electric utility wind turbines increase in size, and correspondingly, increase in initial capital investment cost, there is an increasing need to monitor the health of the structure. Acquiring an early indication of structural or mechanical problems allows operators to better plan for maintenance, possibly operate the machine in a de-rated condition rather than taking the unit off-line, or in the case of an emergency, shut the machine down to avoid further damage. This paper describes several promising structural health monitoring (SHM) techniques that were recently exercised during a fatigue test of a 9 meter glass-epoxy and carbon-epoxy wind turbine blade. The SHM systems were implemented by teams from NASA Kennedy Space Center, Purdue University and Virginia Tech. A commercial off-the-shelf acoustic emission (AE) NDT system gathered blade AE data throughout the test. At a fatigue load cycle rate around 1.2 Hertz, and after more than 4,000,000 fatigue cycles, the blade was diagnostically and visibly failing at the out-board blade spar-cap termination point at 4.5 meters. For safety reasons, the test was stopped just before the blade completely failed. This paper provides an overview of the SHM and NDT system setups and some current test results.

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