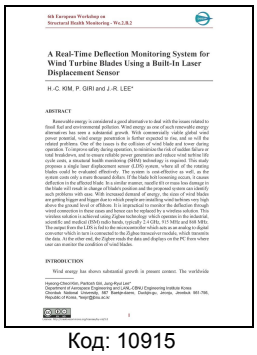

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A Real-Time Deflection Monitoring System for Wind Turbine Blades Using a Built-In Laser Displacement Sensor

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Renewable energy is considered a good alternative to deal with the issues related to fossil fuel and environmental pollution. Wind energy as one of such renewable energy alternatives has seen a substantial growth. With commercially viable global wind power potential, wind energy penetration is further expected to rise, and so will the related problems. One of the issues is the collision of wind blade and tower during operation. To improve safety during operation, to minimize the risk of sudden failure or total breakdown, and to ensure reliable power generation and reduce wind turbine life cycle costs, a structural health monitoring (SHM) technology is required. This study proposes a single laser displacement sensor (LDS) system, where all of the rotating blades could be evaluated effectively. The system is cost-effective as well, as the system costs only a mere thousand dollars. If the blade bolt loosening occurs, it causes deflection in the affected blade. In a similar manner, nacelle tilt or mass loss damage in the blade will result in change of blade's position and the proposed system can identify such problems with ease. With increased demand of energy, the sizes of wind blades are getting bigger and bigger due to which people are installing wind turbines very high above the ground level or offshore. It is impractical to monitor the deflection through wired connection in these cases and hence can be replaced by a wireless solution. This wireless solution is achieved using Zigbee technology which operates in the industrial, scientific and medical (ISM) radio bands, typically 2.4 GHz, 915 MHz and 868 MHz. The output from the LDS is fed to the microcontroller which acts as an analog to digital converter which in turn is connected to the Zigbee transceiver module, which transmits the data. At the other end, the Zigbee reads the data and displays on the PC from where user can monitor the condition of wind blades.

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Ключевые слова:

Содержание