Ultrasonic flaw detection of large-scale wind turbine blades

Wu et al. [148] discussed the vision-based approach to detect large-scale structures such as turbine blades, and the structural displacement can be extracted by ...

Ultrasonic contact pulse-echo immersion testing with moving water container has been selected for inspection of wind turbine blades, because this type of the inspection can be performed having ...

The wind energy sector is experiencing rapid growth, marked by the expansion of wind farms and the development of large-scale turbines. However, conventional manual methods for wind turbine operations and maintenance are struggling to keep pace with this development, encountering challenges related to quality, efficiency, and safety. In response, ...

The operational height of large-scale wind turbine blades often exceeds 90 m, while their lengths range from 50 to 80 m. ... There are now two categories of wind turbine surface flaw detection ...

As a kind of large-scale composite structure and a key part of wind turbine, the wind turbine blade bears the main force in the process of wind power generation. Therefore, it is of great significance to carry out health testing in their life cycle. The ultrasonic nondestructive test has been applied to the wind turbine blade defect detection ...

Components of an Ultrasonic Flaw Detector. An ultrasonic flaw detector consists of several key components that work together to detect internal flaws. These components include: Transducer: The transducer generates ultrasonic waves that penetrate the material being tested. It also receives the echoes or reflected waves from the material"s ...

The wind turbine blade is the core component of the wind turbine. However, wind turbine blades will suffer fatigue and internal crack defects, which seriously affect the safety service performance ...

Portable, powerful wind turbine, tower, and blade nondestructive inspection solutions. Learn how our technology helps save you time and reduce your cost. ... Learn more about our EPOCH 6LT ultrasonic flaw detector; Read our application note, "Laminar Cracking in Fiberglass" Learn more about our composite inspection solutions; View our video ...

Wind turbine blades are critical components in wind energy generation, and blade health management is a challenging issue for the operation and maintenance of wind turbines. In this paper, an adaptive method is developed to identify blade damages based on the microphone array and compressive beamforming, and global and remote health assessment ...

are difficult to analyze and to evaluate. In this work, ultrasonic guided waves excited by the PZT wafers array are pro-posed to detect the onset of icing on a full-scale wind turbine blade.

Blade bearings, as the critical parts of wind turbines, are used to pitch blades for optimized outputs or to stop wind turbines for protection if wind speeds are greater than a cut-out speed. In order to pitch blades, blade bearings are driven by electric systems or hydraulic equipment [[4], [5], [6]], as shown in Fig. 1 .

The objective of this study was to adapt ultrasonic and radiographic techniques for the inspection of wind turbine blades and to compare the obtained results.

An automatic positioning system has been designed in this paper to record the moving coordinates and the target distance in real time and concludes that the system possesses high accuracy and magnificent meanings in practical engineering. Ultrasonic testing technology has been used essentially in non-destructive testing of wind turbine blades. However, it is fact ...

The wave propagates along the structure of the blade and passes through or interacts with the defects (such as delamination, debonding, and crack) to make the wave change in the propagation process.

This paper proposes a refined and multi-scale detection method for large-scale wind turbine blades by combining image stitching algorithm and deep learning network. ... Automatic ultrasonic flaw ...

Wind energy utilization is a significant approach toward a sustainable society, and it has received extensive attention over the past decades [[1], [2], [3], [4]].Additionally, wind power generation calls for high efficiency and reliability, which are affected by the health conditions of wind turbines [[5], [6], [7]].With the rapid evolution of sensors, the operating ...

Wind turbine (WT) is a typical mechatronics system. It consists of numerous mechanical and electrical components including the blades, rotor, gearbox, shaft, generator, bearings, pitch and yaw system, and tower [2], [10].Among these components, blades are regarded as one of the most critical components [11], [12] cause the efficiency of WT ...

1980 [5]. In general, a wind turbine converts the kinetic energy of wind into electrical energy [6, 7]. As mentioned by Jha [7], a wind turbine is designed for producing industrially useful amounts of energy with eco-friendly effects, compared to other energy resources. However, the operation and maintenance costs of a wind turbine cannot be ...

The objective of this study is review of different NDT techniques, which are used, or could be used for non-destructive testing of wind turbine blades, taking into account the complicated ...

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Abstract For wind turbine operation and maintenance, wind turbine blade surface defect detection is a very important and challenging problem, as wind turbine blade surface defects seriously affect the efficiency and safety of the wind turbine. The performance of traditional methods depends heavily on the correlation between the

At present, the application of blade detection based on ultrasonic phased array is only for the detection of the bonding surface of the main blade beam, and various defects in key parts such as ...

Ultrasonic phased array can be used to inspect wind blades with low-frequency probes (0.5 and 1 MHz). The 1.5 mm resolution enables the detection and accurate sizing of small flaws.

At present, in addition to the overview of various detection methods of wind turbine blades, there is a lack of comprehensive classifications and overviews of the main damage types, damage ...

Ultrasonic testing technology has been used essentially in non-destructive testing of wind turbine blades. However, it is fact that the ultrasonic flaw detection method has inefficiently employed ...

The largest wind turbines use blades as long as 107 m for offshore sites (Onshore turbine capaciti, 2021) and rotor diameter as long as 170 m for onshore sites (How Long Are Wind Turbin, 2021), the stresses should be kept as small as possible not only in the blades but also on the nacelle, tower and foundation. Blade materials are typically fiber-reinforced ...