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A Comprehensive Survey on Fault Detection in Wind Turbine Blades Using Non-Destructive Testing and Machine Learning Techniques

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Abstract: Wind turbines play a crucial role in renewable energy generation, but their performance and longevity are significantly affected by the condition of their blades. Faults such as cracks, erosion, and other structural damage can reduce efficiency, increase maintenance costs, and potentially lead to catastrophic failures. Traditional inspection methods, often involving manual inspections and ground-based observations, can be time- consuming, costly, and occasionally dangerous. This study investigates advanced techniques for wind turbine blade fault detection by combining non-destructive testing methods and machine learning algorithms. We utilize vibration-based sensors, acoustic emissions, and thermographic imaging to capture data from the blades, which is then analyzed using signal processing techniques and convolutional neural networks (CNNs) to identify and classify potential faults

Keywords: Wind Turbine, Convolutional Neural Network, Pre-processing, Blade, Fault, Machine Learning, Deep Learning

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