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Impact Damage Detection for Composite Material Typical of Wind Turbine Blades Using Novelty Detection

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Offshore wind turbines are gaining a leading role in the electric energy market. The wind turbine blade plays a vital role in the lifetime operation of the turbine. Key challenges such as robust Structural Health Monitoring (SHM) of the blades is crucial for the economic and structural efficiency of the new generation of wind energy. In this study intelligent fault diagnosis methods are adopted such as novelty detection techniques. The methods used are a statistical outlier analysis which allows a diagnosis of deviation from normality, an Auto-Associative Neural Network (AANN) and an Artificial Neural Network (ANN) classification technique. Vibration responses combined with a novelty approach provide a robust statistical method for low-level structural damage detection. It will be shown that a neural network is a powerful tool, offering on-line and real time damage prediction and classification. This paper is adopting vibration data such as FRFs by exploiting multilayer neural networks and outlier detection. The outcomes of these approaches are demonstrated for a blade composite structure subject to gradually increased levels of impact damage.

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Ключевые слова:

Содержание

Abstract
Introduction
Artificial Neural Networks
Principal component analysis (PCA)
Auto-associative Neural Networks and singular value decomposition (SVD)
Multivariate data outlier analysis
The composite experimental plate and data extraction
Feature selection for novelty detection
Novelty detection results
Damage detection using artificial Neural Networks via reduced data dimension
Discussion and conclusion
Acknowledgements