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PROCEEDINGS

Damage Detection in CFRP Composite Joints using Acoustic Emission Analysis

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ABSTRACT

This research advances the field by focusing on the damage assessment of adhesively bonded joints using AE, with limited prior studies in this specific area. Through the preparation of CFRP specimens and subsequent tensile loading tests, AE signals were captured and analyzed. The study employed wavelet decomposition for noise reduction and Short-Time Fourier Transform (STFT) for signal analysis, facilitating the identification of damage-related frequencies and amplitudes. Hierarchical clustering was applied to categorize AE signals into distinct damage behaviors, utilizing a divisive approach that avoids local minima and offers unique results at each iteration. The method's effectiveness was validated through the calculation of the cophenetic correlation coefficient (CCC), with a cosine distance metric yielding the highest CCC values, indicating a strong correlation between hierarchical clustering structures and actual data distances. Optimal clustering was determined through silhouette score and Davies-Bouldin index, establishing three as the optimal number of damage categories. This research not only highlights the utility of AE in monitoring damage in composite joints but also demonstrates the effectiveness of hierarchical clustering and signal processing techniques in classifying distinct damage mechanisms, providing a foundation for further investigation into preventive measures against catastrophic failures in composite structures.

KEYWORDS

Composites joint; acoustic emission; damage clustering

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