Accepted Manuscript

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PII: S1359-8368(17)34371-8

DOI: 10.1016/j.compositesb.2018.02.028

Reference: JCOMB 5553

To appear in: *Composites Part B*

Received Date: 18 December 2017

Revised Date: 18 February 2018

Accepted Date: 27 February 2018

Please cite this article as: Saeedifar M, Najafabadi MA, Zarouchas D, Toudeshky HH, Jalalvand M, Clustering of interlaminar and intralaminar damages in laminated composites under indentation loading using Acoustic Emission, *Composites Part B* (2018), doi: 10.1016/j.compositesb.2018.02.028.

Clustering of Interlaminar and Intralaminar damages in Laminated Composites under Indentation Loading using Acoustic Emission

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Abstract

This study focuses on the clustering of the indentation-induced interlaminar and intralaminar damages in carbon/epoxy laminated composites using Acoustic Emission (AE) technique. Two quasi-isotropic specimens with layups of $[60/0/-60]_{4S}$ (is named dispersed specimen) and $[60_4/0_4/-60_4]_S$ (is named blocked specimen) were fabricated and subjected to a quasi-static indentation loading. The mechanical data, digital camera and ultrasonic C-scan images of the damaged specimens showed different damage evolution behaviors for the blocked and dispersed specimens. Then, the AE signals of the specimens were clustered for tracking the evolution behavior of different damage mechanisms. In order to select a reliable clustering method, the performance of six different clustering methods consisting of k-Means, Genetic k-Means, Fuzzy C-Means, Self-Organizing Map (SOM), Gaussian Mixture Model (GMM), and hierarchical model were compared. The results illustrated that hierarchical model has the best performance in clustering of AE signals. Finally, the evolution behavior of each damage mechanism was

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