A New Smart Approach to Monitor Thickness Reduction in Metallic Structures

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ABSTRACT

Structural health monitoring methods based on the generation and detection of highly nonlinear solitary waves have emerged as a cost-effective technique for a variety of structures and materials. Outlier analysis is a statistic tool able to identify anomalies in data that diverge from a set of baseline data. In this paper the use of outlier analysis in terms of discordancy test and Mahalanobis squared distance was explored to enhance the damage detection capability based on the propagation and detection of highly nonlinear solitary waves. An experiment was performed to demonstrate the procedure. A thick steel plate was monitored with a solitary wave transducer placed above the plate, and damage was simulated in terms of a foreign object attached to the bottom of the plate. Three different masses located at an increasing distance from the transducer were considered. A few features were extracted from the experimental time waveforms, and then fed to a univariate and a multivariate analysis that compared the testing data to a set of baseline data. The experimental results show that the outlier analysis significantly enhances the ability to detect damage.