# Composite Plate Automatic Damage Isolation Based on Support Vector Machine Classification of Lamb Wave Signals

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## ABSTRACT

Artificial intelligence methods have been successfully used to solve complex problems in a wide variety of engineering fields. Support Vector Machine (SVM) is recognized as a reliable and efficient tool among current machine learning techniques, and is here adopted to automatize a Structural Health Monitoring (SHM) method aiming to detect and isolate the onset of damage. In a supervised learning approach, an experimental dataset is used to train the SVM algorithm so it would be able to predict the target structural integrity by means of new input data obtained during the inspection phase. A Lamb wave based effective monitoring uses the pitch-catch approach to generate the signals, and the SVM algorithm assesses the structures' integrity. The inspection is performed by means of an arrangement of piezoelectric transducers forming a circular array of eight sensors with a centered actuator, dividing the monitored area into eight regions. Damage presence causes waves scattering, which influences the amplitude of the measured signals, beyond its respective regular behavior. Discrete wavelet and Hilbert transform are applied to the raw signals in order to minimize noise and dispersion effects, and to propitiate clear damage indicators. Processed peak amplitudes from each of the eight signals are used as attributes axis for an eight-dimension SVM algorithm based on a Gaussian Radial Basis Function (RBF) kernel. Using a punctual mass placed on different positions inside the plate regions to simulate damage, a set of labeled measurements is obtained in order to train and test the SVM algorithm. Posterior experimental application of the classifier shows its effectiveness to automatically isolate the respective damaged region.

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