DAMAGE LOCALISATION IN DELAMINATED COMPOSITE PLATES USING A GAUSSIAN PROCESS APPROACH

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ABSTRACT

Detecting damage by inspection of mode shape curvature is an interesting approach, but its attraction diminished by the requirement to differentiate the examined mode shape [1]. Indeed, inaccuracies present in the mode shapes are compounded by the numerical differentiation process and, since these small inaccuracies are caused by noise in the data, the method is inapplicable for the vast majority of real situations. Very recently a new methodology based on Gaussian Process Regression, a technique usually used for pattern recognition and closely related to neural network approaches, has been proposed by the authors for detecting discontinuities in the smoothness of post-damage mode shapes in the case of beam-like structures, without directly calculating the curvature i.e. without differentiation [2]. A unique covariance function, which allows for a non-smooth point, has been developed based on the premise that simple optimisation of this point can be effective in detecting the damage location.

This paper presents an extension of this method for detecting and localising delamination in laminated composite plates, considering that the presence of a delamination causes a discontinuity in the smoothness of the mode shape functions on the boundary of the delamination area.

Using the finite-element method, the mode shapes of a multi-layered composite plate with a delamination have been calculated and the performance of the approach analysed for increasing amounts of noise. The encouraging results indicate that further development of the technique for non-destructive testing of composite 2D structures would be greatly valuable.

REFERENCES

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