

**Damage Detection in a Real Complex Structure with a Guided Wave SHM Sparse Array System—Performance and Artefact Suppression**

T. CLARKE and P. CAWLEY

**ABSTRACT**

A sparse array SHM system based on guided waves was applied to the door of a commercial shipping container. The door comprised a corrugated steel panel approximately 2.4 m by 2.4 m surrounded by a box beam frame and testing was performed in a non-laboratory environment. A sparse array with 9 transducers was attached to the structure and signals from the undamaged structure were recorded at periodic intervals over a three week period and the resulting signal database was used for temperature compensation of subsequent signals. Defects in the form of holes with 5mm and 10mm diameter were introduced to the structure and signals from all transducer combinations were recorded for each condition. These signals were then used in imaging algorithms and localization of the holes was possible, but the signal-to-noise ratio in the images for the 5mm diameter hole was low. The source of the noise in the images was investigated and based on this study a method to enhance defect localization was proposed.

**INTRODUCTION**

Structural health monitoring of complex structures is an increasingly important topic particularly for aerospace applications, but also in the oil and gas, nuclear and shipping industries. Techniques based on sparse arrays of sensors which generate and receive guided waves are among the more promising candidates [1-5]. Guided waves propagate over large distances and certain modes have the ability to penetrate through a variety of structural features leading to a relatively small number of sensors being able to cover the structure.

In structures containing high densities of structural elements, the time-resonance obtained can often be complex to be directly interpreted due to the large number of overlapping reflections. In this case, the Baseline Subtraction technique becomes attractive [1,5]. In this method a reference signal from the structure is subtracted from a signal which has been acquired during the initial stages of operation of the structure. This eliminates the need for interpretations of the complex raw time signal and any defects will be clearly seen provided the amplitude of the residual signal obtained after subtraction of the baseline is sufficiently low.

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**Ключевые слова:**

## Содержание.

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