

Non-contact inspection method of composite panels using MEMS-microphones

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Composite panels are commonly inspected using the ultrasonic C-scan inspection method. This requires that the panel is either submerged in water or that a squirter technique is applied. The objective of this research is to develop a non-contact inspection method using extremely low-cost MEMS microphones. Having non-contact receivers would allow flexibility with geometries. The use of large linear or even areal arrays of microphones would provide a very rapid inspection approach. Our initial prototype array contains 128 MEMS-microphones with a small pitch. It is suitable for attachment onto a robotic arm. To introduce low frequency Lamb waves into the composite panel, one or just a few piezo elements are attached to the panel. One piezo element is capable in covering 3 to 4 m². The Lamb waves interact with defects and radiate into the air, where the complete wavefield is registered by the microphone array. Subsequently various data processing schemes are applied to yield a similar image as a conventional C-scan. The inspection approach will be illustrated on measured data from various composite panels. The processed experimental data shows that the spatial resolution is comparable to conventional C-scans. The smallest artificial defects, mimicking delaminations, that currently can be detected are in the order of 5 mm.