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Lamb Wave-based BVID Imaging for a Curved Composite Sandwich Panel

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Composite sandwich structures, consisting of a low density core sandwiched between two laminated facesheets, have been widely used in various aerospace structures. A new Lamb wave-based imaging condition, which will be referred to as the inverse energy imaging criterion, is proposed in this paper to resolve the situations where the incident wave energy weakly penetrates into the damaged area on the top facesheet region. Current imaging conditions by analyzing wavefield reconstructed from laser Doppler vibrometer (LDV) scanning have been proven to be adequate for imaging damage in layered composite laminates. In this research, those current imaging conditions were found to be less effective in the composite foam structures for barely visible impact damage (BVID). A piezoelectric wafer was used to excite Lamb waves into the structure and a LDV was used to scan the potential damaged areas in the front facesheet of the panel. A few sites of BVID in a curved composite sandwich foam aileron were inspected using various wavefield analysis methods and the damage images were compared with C-scan images. The results show that the proposed imaging condition performs better when the incident waves have difficulty penetrating into the damaged region.

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