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# Anomalous Wave Propagation Imaging with Adjacent Wave Subtraction: Composite Wing Application

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Application of the laser ultrasonic wave propagation imaging to field structures is challenging because the structure-wave interaction generates complex wave patterns. We developed the anomalous wave propagation imaging method with adjacent wave subtraction to alleviate this problem in our previous work. It highlights the propagation of anomalous waves related to structural discontinuities, and suppresses incident waves without the need for pre-stored reference data. Based on this method, we proposed a wing test setup for automatic NDE, and applied it to a composite wing with manufacturing defect and then to another wing underwent bending and impact tests. The results enhanced the visibility of the anomalous waves related to the damages such as stringer tip debonding, skin-spar debonding, and invisible impact damage. Based on these anomalous waves, variable time window amplitude mapping was performed to show the location, size, and shape of the damage resemble to the actual damage. The presence of structural elements such as spars, stringers, ribs, lugs, inspection windows, and integrated sensors did not adversely affect the inspection process. The proposed automatic wing NDE test setup could be expanded in a whole hanger easily for the manufacturing quality or maintenance inspection process.

## Ключевые слова:

Laser ultrasonic propagation imaging system, composite aircraft wing, field-test, anomalous wave propagation imaging.

## Содержание.

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