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Real time ultrasonic imaging of aerospace composites

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Summary

Ultrasonic inspection techniques have a proven record of applications during manufacturing and maintenance of metallic and composite aircraft structures. Traditional ultrasonic inspection techniques use a point-by-point scanning method to acquire a full-field image. This scanning method is slow and inadequate in satisfying modern manufacturing and maintenance time line requirements. The next generation of ultrasonic inspection eliminates the need for point-by-point scanning using an imaging array that is capable of displaying thousands of points to create a full-field image in real-time.

In this study, a next generation dual-channel ultrasonic imaging system is used for real-time three-dimensional evaluation of small composite aerospace structures with programmed damage present. The system's pulser uses a piezoelectric transducer to insonify the structure and the system's receiver consists of two integrated data acquisition channels that are utilized for concurrent in-plane and in-depth real-time evaluation of structures. The first channel uses an ultrasonic imaging array to create a large real-time planar (X-Y plane) image of the structure while another acquisition channel analyzes in-depth (Z-axis) ultrasonic scans displaying data in an A-scan format.

The images acquired with the ultrasonic system are then compared to images obtained using flash thermography. Flash thermography is capable of fast, full-field images by measuring the material heat transfer response to thermal excitation. Flash thermography has gained acceptance as an inspection technique in the manufacturing and maintenance of aerospace composites the last couple of years and provides a good benchmark to compare the next generation ultrasonic imaging system results.

keywords: Nondestructive Evaluation, Ultrasonic, Imaging, Thermography, Composite, Full-Field

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