

DUAL TOWER TWELVE-AXES SQUIRTER BASED C-SCAN SYSTEM

The emergence of strong and stiff reinforcements like carbon fiber along with advances in polymer research to produce highperformance resins as matrix materials have helped meet the challenges posed by the complex designs of modern aircraft. The large-scale use of advanced composites in current programs of development of military fighter aircraft, sonar domes in ships, small and big civil transport aircraft, helicopters, satellites, launch vehicles, and missiles all around the world is perhaps the most glowing example of the utilization potential of such composite materials. Glass Fiber Reinforced Polymer (GFRP), Carbon Fiber Reinforced Polymer

(CFRP), Kevlar, hybrid and composites are commonly used for aircraft structures and components. However, these materials are at risk of experiencing damage. There are different types of damages possible in a composite such as fatigue, resin-rich region, resin starvation region, delamination, inclusion, and dis-bond between composite and honeycomb/foam sandwich structure, and accidental impact damages.

As the stiffness of composite components is relatively lower, compared to metals, the size of structures has to be increased leading to thicker section inspections Also, the requirements for ultrasonic non-destructive evaluation of more critical structural aerospace components have become more demanding. Complex-shaped composites with thick honeycomb or low-density foam cores with integral bond lines present a particular challenge due to their high attenuation of ultrasound.

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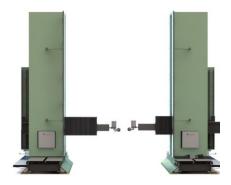
Ultrasonic squirter based scanning systems are widely accepted as a technique for detecting the voids, blisters, de-laminations, and debound in single and multi-laminate structures, parts with non-uniform thicknesses tapered parts, honeycomb structure components made from the same or different materials. Large robotic gantry ultrasonic systems are now in common use for production



Application Note 01

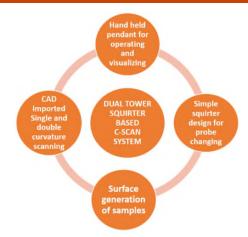
DAMAGE EVALUATION OF COMPOSITE SAMPLE USING SQUIRTER BASED ULTRASONIC SYSTEM – APPLICATION NOTE

inspection of aerospace components. The ultrasonic scanning system will be equipped to support through- transmission and pulse-echo operations using the squirter-based modified immersion mode for plane, single and double curvature structures.



12 axes C-Scan system

The Squirter Gantry system has two side-arms configurations and it is specially designed to perform ultrasonic raster scanning of complex composite and metallic structures. The system typically consists of a scanning aperture with an X-axis (length) operation range of 6,000 mm and a speed of 750 mm/s, a Y-axis (width) operational range of 3,000 mm and a speed of 300 mm/s and a Zaxis (height) operational range of 3,000 mm and a speed of 300 mm/s. The system employs rugged servo motors for motion requirements and had industrial standard safety interlocks.



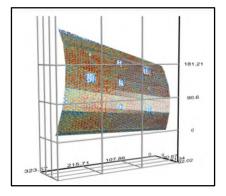
The system has capabilities to programmatically scan complex geometries and to import models from commercial software like AUTOCAD, CATIA, etc.. and software is linked to the ultrasonic data of inspecting components on an imported CAD model of that specific component. The easiness of loading the sample, simple squirter design to change the automatic probe. report generation, contour following algorithm, surface generation of the sample, speed of inspection, and reliability of results making are the key features of the system.

The data acquisition software consists of A-scan, B-scan and Amplitude, time of flight and thickness C-scan data acquisition with simultaneous pulse-echo and through transmission operation, Save and recall of ultrasound and motion parameters, 3D assisted scan plan generation, resume scan when scan get interrupted.



C-scan image of a GFRP sample with defects

The NDE 4.0 enabled control and acquisition software will be feature a DIGITAL TWIN MODULE which mimics the motion of the actual scanner. This digital twin can be used to load the path planning programs and avoid possible collisions and provide a virtual C-scan platform that communicates with the physical Cscan system. The analysis software consists of instant keyboard attenuation, scaling of the image, histogram graphing, comment making, filtering options for the most advanced inspection capabilities with an operatorfriendly user interface.



C-Scan image of a Honeycomb sample with defects



Application Note 01

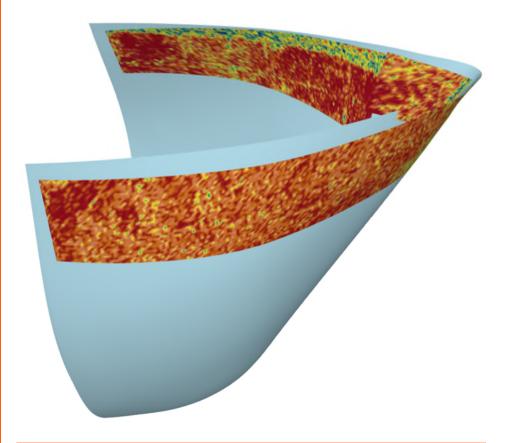
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Damage evaluation of composite sample using squirter based ultrasonic system -Application note

> A Dhvani Research Application Note

> > Chennai, INDIA





C-scan image with overlaymodel of a SONAR dome

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