

3D-VALIDATOR™

3D Characterisation of Composites

Carbon and glass-fibre reinforced composite components are comprised of multiple plies. During manufacture, plies can become wrinkled and distorted, and the orientation of the fibres they contain may be incorrect. This can lead to a reduction in structural performance. QinetiQ's 3D-VALIDATOR software allows these deviations from design to be detected, visualised and quantified.

3D-VALIDATOR

QinetiQ has developed a software package that measures the 3D orientation of plies and fibres in composite materials. 3D-VALIDATOR analyses full-waveform ultrasonic data to image out-of-plane ply wrinkling and fibre orientation, both of which affect structural performance. It can also be used to identify the stacking sequence of plies in a composite to confirm fabrication quality.

Ply Stacking Sequence

Correct ply stacking sequence is critical for designed performance to be realised. The large number of plies in many of today's thick composites leads to a high probability of an incorrect ply sequence. From an ultrasonic data-set, 3D-VALIDATOR can determine the stacking sequence in components having as few as 4 plies, to over 90 plies.

Out-of-Plane Ply Wrinkling

Cross-sections through the ultrasonic data (B-scans) can typically be used to identify ply wrinkling. Quantification and visualisation is made possible by using 3D-VALIDATOR. The software maps, on a ply-by-ply basis, the ply surface-heights. Wrinkles are clearly imaged and quantified.

General Waveform Analysis

3D-VALIDATOR has tools for general ultrasonic waveform analysis. Measurement gates, similar to those found on a conventional ultrasonic test set, allow the user freedom to generate amplitude and time-of-flight (thickness) maps from ultrasonic waveform data. Presentation of the results is available in A-Scan, B-Scan and C-scan forms, as well as 3D views of C-scan data.

Automation

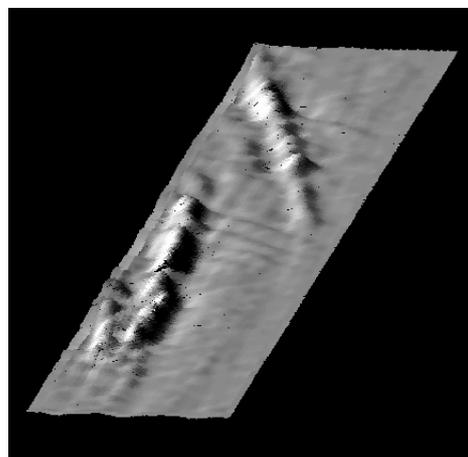
The tools available in 3D-VALIDATOR are highly automated, requiring only 'one-click' to achieve the analysis desired.

3D-VALIDATOR provides detection and 3D mapping of:

- Ply stacking sequence
- Out-of-plane ply wrinkling
- Fibre orientation

Compatibility

3D-VALIDATOR is compatible with Olympus Omniscan and ScanTech full-waveform data formats. Other full-waveform formats are available on request.



Surface profile of a wrinkled ply generated by 3D-VALIDATOR



Optical image of plies in a thick carbon-fibre component

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