Loop Technology

FibreEYE

State of the art system for in-process deposition inspection

FibreEYE utilises a high speed camera to verify the deposition integrity of glass or carbon fibre tows or fabrics into a mould tool. In an Advanced Fibre Placement (AFP) scenario the system is mounted alongside or in line with the deposition head and continuously monitors for features such as gaps, overlaps, twists and bridging. In a fabric draping situation the system is mounted on the fabric gripper or on a secondary robot and can be used to verify fibre volume fraction and edge location.

Logged defects are stored in a manufacturing database along with their location and defining characteristics. Information can be sent to a projector to indicate the feature location to an operator.

PROFILING TECHNOLOGY
Rapid generation of surface information with minimal data dropout at fast scan speeds.

REAL TIME ANALYSIS AND DISPLAY
Flexibility to distribute complex measurements and analysis operations over multiple processors and servers for faster results and feedback.

IMAGE NORMALISATION
Algorithms compensate for offset scans to rescale and realign generated surface profiles in real time.

How does it work?

The inspection system is deployed on an appropriate motion stage which is used to scan the unit over the surface to be inspected.

The system operates by using triangulation techniques to generate a detailed 3D profile of the component surface. Proprietary algorithms then normalise the profile to compensate for geometric misalignment before analysing the data looking for surface anomalies. Each anomaly type effectively has a signature that the algorithms look for amongst the surface information.

When an anomaly is discovered it is classified according to its type and details related to its location and extent are generated. Anomalies that exceed configurable thresholds are written to a defect database for traceability and future analysis.

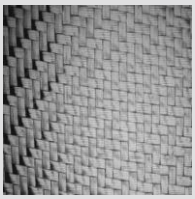
Feature Detection

The system is designed to detect surface anomalies including:

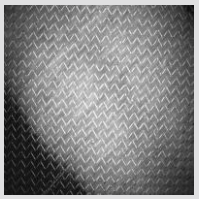
- ✓ Gaps
- ✓ Overlaps
- ✓ Twists
- ✓ Bridging
- ✓ Fibre orientation
- ✓ Fibre volume
- ✓ Fibre thickness
- ✓ Edge location
- ✓ Fuzzballs
- ✓ Foreign object detection

These features can potentially span more than one scan width. Adjacent scans are analysed and features spanning more than one scan are concatenated into a single anomaly.

Fibre orientation



Defect



Triangulation Technology

The use of triangulation technology coupled with an optimised light source and optics enables rapid generation of surface information with minimal data drop out. This helps simplify the pre-processing required by the analysis algorithms which in turn enables fast scan speeds and inline analysis. Commonly available commercial scanners suffer with excessive data dropout as a result of material characteristics, an effect that seems to get worse as scan speeds get higher. By maintaining control over the lighting and optics we are able to optimise them for monitoring composite materials.

Thickness Measurement

FibreEYE allows for intelligent fibre density analysis throughout the lay-up process.

Real Time Result Analysis and Display

The FibreEYE system features a distributable process architecture allowing complex measurement and analysis operations to be distributed over multiple processors and/or servers for faster results and feedback, meaning less labour time and easier access.

Image Normalisation

If the imaging system isn't scanned perfectly along the system scan axis, internal normalisation algorithms detect this and automatically rescale and realign the generated surface profile in real time to accurately reflect the nature of the scanned part.

Pose Compensation

In an AFP environment the primary focus of the deposition head is in laying the material into the mould. This can result in levels of pitch and yaw that would move the deposition region beyond the field of view of the verification system. To compensate for this the system can be supplied with two additional highly dynamic servo stages to steer the module such that the area of interest remains in view.

Technical Specification

Profile capture at 800FPS. Typical application speeds:

Path speed	Resolution in direction of travel	Scan resolution	Height resolution
1000mm/s	1.25mm	55µm	27µm
500mm/s	0.63mm	55µm	27µm
250mm/s	0.32mm	55µm	27µm
100mm/s	0.13mm	55µm	27µm

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