NDT Services from TWI

Immersion and Rapid Large Area Ultrasonic Mapping

Description

Typically in large area mapping, a probe is traversed across the component's surface in a raster pattern. A plan-view map is generated showing the positions of any flaws lying in planes parallel to the surface such as laminations. The map that is produced is termed a C-scan. However, in modern computerised systems the full waveform is captured. This means that it is possible to carry out off-line analysis in which other scan types can be displayed:

- A-scan (amplitude v. time of flight) for any given probe position.
- B-scan, which is a cross-sectional view showing the position of any flaws.
- D-scan, which is also a cross-sectional view at right angles to the B-scan view.

The computer collects and stores all the data. Thus data analysis can continue whist the NDT system continues to be used to carry out further scans and to collect new data.

Area scanning systems can be divided between those that operate with contact scanning using a thin couplant layer and those that utilise immersion tanks. TWI has two systems falling into each of these categories.

Contact scanning

NDT Solution's RapidScan2 system is portable and capable of generating high resolution B (through thickness slice) and C (plan view) Scans in a fraction of the time required by existing techniques. Utilising a novel wheel probe containing an ultrasonic array of up to 128 elements, RapidScan2 can be used for manual scanning or can be integrated into automated systems. Applications include composites inspection and plate or corrosion mapping among others.

The DSL Andscan system has a unique manually manipulated R-θ scanner arm. In this, the scanner base incorporates encoders that register the position and orientation of the probe head. However, if the probe is held stationary and the scanner base is moved, this movement is also registered. Thus, by first scanning the complete area that can be covered within the limits of the arm for one base position and then moving the base to new locations, a large area can be fully mapped.

Immersion scanning

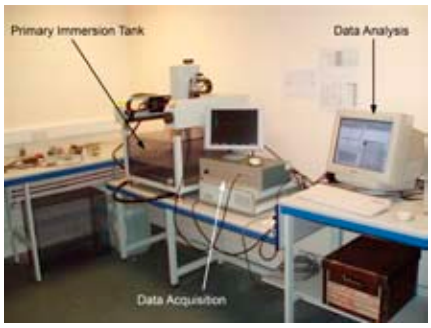
TWI has two immersion systems (one in the Cambridge laboratories and the other in South Wales) in which the component to be inspected is immersed in a water tank. The ultrasonic probe is manipulated by a motion controller. Immersion testing offers the following advantages compared with the contact method:

- Water coupling eliminates the variability associated with contact coupling.
- High frequencies, up to 100MHz can be used. Higher frequencies give reduced ultrasonic beam width and much higher resolution. Flaws as small as 0.2mm are readily resolved.
- Focused beams can be generated either by using a phased array or with concave contoured single element transducers.
- Inspection of complex geometries.

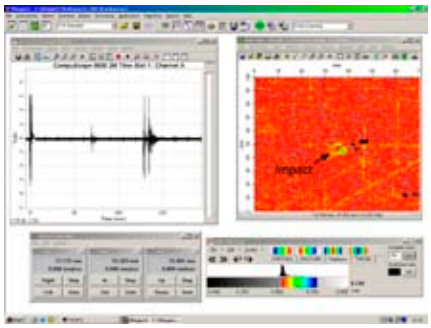
The Cambridge based system (shown above right) has very high frequency capability (100MHz), enabling extremely fine focusing. The pulser/receiver operates under the control of Utex Winspect software. This collects the entire waveform and enables the data to be presented in a variety of views

The Andscan R-Θ scanning arm

RapidScan2 wheel probe



The primary tank, data acquisition and analysis systems



A-Scan (right) and C-Scan (left) outputs from a scan of carbon fibre reinforced plastic aircraft wing component

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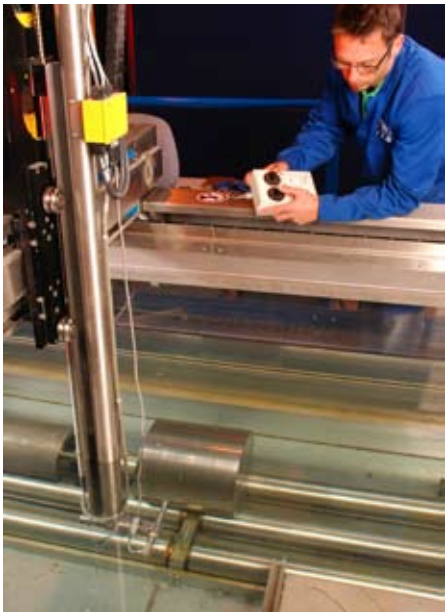
(plan, cross-section, etc.). The probe manipulator has 4 degrees of freedom.

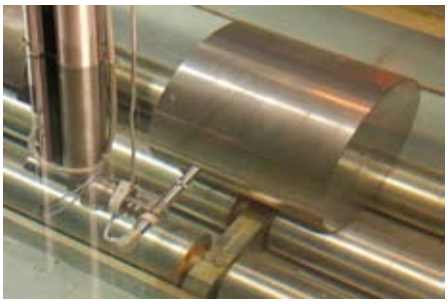
The illustration on the previous page shows the output for an aircraft wing component made from a carbon fibre reinforced plastic tested at the onset of impact damage (A-scan on the right and C-scan on the left).

The photographs on the right show the Ultrasonic Sciences immersion system in South Wales. This has a number of alternative manipulation devices.

- A 750mm diameter turntable enabling discs to be inspected.
- A billet table allowing the rotation of tubular rolls.
- A 5-axis manipulator for manoeuvring the probe head.

It is being used here to inspect a cylindrical metal billet to detect embedded inclusions. The close-up shows the transducer mounted in the 5-axis manipulator. The tank can accommodate components that are up to 2.5m x 1.5m.





Ultrasonic Sciences immersion UT system being used to inspect a cylindrical metal billet to detect embedded inclusions

Selected clients and applications

TWI uses its scanning systems to inspect high added value components for Industrial Member companies. Examples are: -

- Detection of hardening flaws in gear castings for Bosch Rexroth.
- Inspection of electron beam welded rotors for Goodrich.
- Testing carbon fibre reinforced plastic tubes for Hunting Engineering. (This was a challenging application of ultrasound because of the attenuative nature of the matrix.)
- Inspection of adhesive bonds in an aluminium alloy for Thomson Training.
- NDT of friction stir welds for a range of clients.

For more information on the services offered in this leaflet, contact:

NDT Technology Group

TWI Ltd, Granta Park, Great Abington, Cambridge, CB21 6AL, UK
Tel: +44 (0)1223 899000 Fax: +44 (0)1223 892588

TWI Technology Centre (Wales) Ltd, ECM^2,
Hoel Cefn Gwrgan, Margam, Port Talbot, SA13 2EZ, UK
Tel: +44 (0)1639 873100 Fax: +44 (0)1639 864679

E-mail: ndt@twi.co.uk
Website: www.twi.co.uk

TWI WORLD CENTRE FOR MATERIALS JOINING TECHNOLOGY

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