

The next generation of robot simulation

Carbon fibre composite

The use of carbon fibre composite materials is spreading wider than its traditional automotive base, to aerospace and beyond. As a result, new, powerful methods of non-destructive inspection (NDI) or non-destructive testing (NDT) are required to ensure that materials have the necessary strength to perform effectively in their challenging roles. Applied Computing & Engineering Ltd (ac&e) is at the forefront of new developments in robot simulation software that ensures composite materials are safe.

Carbon fibre composite is an effective high strength, low weight material. It has been used in smaller aircraft for many years but not on larger passenger planes, until recently. The drive to reduce the cost of air travel, meet environmental responsibilities and cope with the rising cost of fuel has led the aircraft industry to demand lighter passenger aircraft with improved performance.

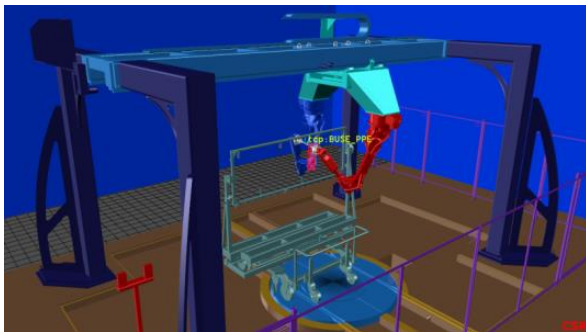
Carbon fibre composite is the obvious material of choice, but ensuring the production process is free from manufacturing defects in the material is a challenge – and not one that can be overcome by conventional techniques.

The porosity problem

The process of manufacturing carbon fiber composite (baking many layers of carbon fiber coated tape in an autoclave) hardens the material, but can lead to gaps or bubbles opening up between the tape layers leaving the structure vulnerable. Such imperfections determine the porosity of the material and can affect mechanical performance, which is why porosity values must typically be lower than 2.5%. Spotting bubbles and cracks in a black, opaque material, however, isn't easy.

Scanning at the limits

Ultrasound scanning, similar to methods used in pre-natal care, is used to determine porosity in carbon fiber materials. The size and shape of, for example, an aircraft panel demands new capabilities from the scanning software.



1 Flexible Methodology for NDT of Carbon Fibre Composite Structures Using Robotised Systems

Additionally, ultrasound scanning requires the use of water as a sound conducting medium meaning inspection of the part has to be fast, but at a suitably high resolution to pick up any flaws or anomalies.

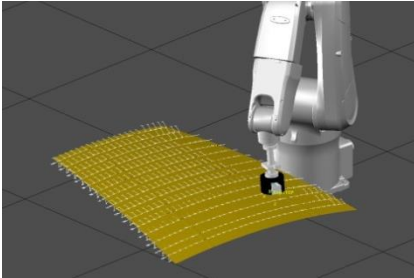
Manually operated devices can't deliver the required speed and accuracy, and the traditional choice of a Cartesian axes machine no longer offers the accuracy required for scanning more complex shapes like engine nacelles and structural stiffeners.

Computer simulation based robot off-line programming (OLP) methods have been available for some time but early OLP techniques were developed predominantly for automotive industry and are not suitable for programming NDI robots.

New software, new standards

To create simulation software suitable for passenger aircraft ac&e appreciated early that resolution of the scan would need to increase dramatically. At the same time the speed of the scan would need to increase to meet throughput requirements.

And since the scanned components are irregular shapes, ac&e understands that advanced collision anticipation and avoidance also had to be a key part of the software. The solution was to avoid contact with the subject of the scan.

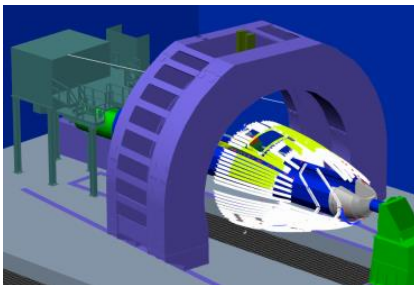


Typically, in robot programming, you 'teach' the robot to operate in simple planes. Where there is an obstacle there can be a collision causing costly damage to both robot and component. In contrast, ac&e's software automatically programs the robot to scan the structure without making contact with it. This allows complex structures, as well as flat panels, to be scanned without risk.

This new generation of automated scanning software does more than avoid collisions. It achieves the faster scan times at greater resolutions that the new carbon fiber composite applications require.

2 Clemessy NDT, France

Aerospace and beyond



3 Rivetting at Spirit

ac&e expects its new software system to find applications far beyond its current uses in automotive and aerospace manufacturing. "We expect this form of NDI software will appeal to the shipbuilding industry, particularly pleasure boats," says Yash Khandhia, ac&e Technical Director. "We also expect it to play a pioneering role in defence related manufacturing, for example in the construction of unmanned drones, which are extensively carbon fiber composite."

Yash Khandhia: "ac&e encounters different NDI requirements and procedures depending on who we are working with. Currently the basic minimum sizes of scanning for defects in composites are equivalent to 6mm x 6mm or a flat bottom hole with a 6mm diameter. However we are beginning to see projects where a 3mm diameter test is required. When this happens the number of points to be checked in areas such as aircraft wings will number in the hundreds of thousands. Our customized software automatically programs a robot for this level of inspection in a way unique in the industry."

ac&e



4 Spot welding at Nissan

Simulation software specialist ac&e has a reputation for delivering more from scanning robots. Its experts are enhancing robot off-line programming software and the results it delivers, in order to make NDI faster and more accurate than has previously been possible.

From its base on the Sci-Tech Daresbury Campus in North West England, ac&e works with leaders in robot manufacturing such as Fanuc, Motoman, Kuka, ABB, Adept and Natchi, to apply its technology to organisations across Europe. Nissan uses ac&e software at all its facilities and ac&e has been helping Airbus develop an NDI robot programming methodology for its factories in France and Spain.

Now its new software is helping manufacturers working with carbon fibre composite achieve the greater scanning accuracy they need.

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