University Research

Case Study | Composites Research

As a highly prestigious university with nearly 35,000 students and 8,500 staff, this University has an income of over £500 million a year, of which £100 million is from research grants. One of the areas of research is composite materials and material qualification.

The Challenge

Material qualification forms a large part of the testing conducted by the university's composite material research lab. When investigating new materials, mechanical properties are measured by conducting many tests, including tensile, compression, shear, and other unique tests to give a complete data set.

One of the tests conducted is open hole tension or compression, where a standard coupon has a hole machined in its center. Holes in composite materials are very important as it allows for the testing of structural parts to occur in an environment that is closer to 'real life' conditions.

The hole creates a stress concentration and, as seen in finite element (FE) analysis, produces a non-uniform strain pattern throughout the specimen. The university was using standard extensometers that are not designed to determine how strain was distributed through specimens. This limited the tests they were able to perform to comparing failures at a time or extension and this, in turn, made it difficult to supply usable comparison data for their materials.

The lab manager wanted a strain measurement solution that would show how strain was distributed through specimens as it would be when running a finite element analysis. He had seen the use of digital image correlation (DIC) in research papers, allowing strain over the entire specimen surface to be measured. But he had doubts; he didn't understand how it worked, thought it would be very expensive and would require additional staff and training to run and analyze the tests, and, that it would require new equipment.

The Solution

After joining one of Instron's webinars focused on an introduction to DIC where a new software package, DIC Replay, was demonstrated, it was clear to the lab manager that DIC was on obtainable solution; he would be able to utilize the results and the software looked very easy to set up and use.

Per their request, we visited the University to assess their current set up and to give them a more detailed

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demonstration of the DIC software. We explained that because they already use an AVE, it wasn't necessary for them to purchase a new one, which in turn, was a huge cost savings for the department. Their current AVE was sufficient to collect the images required for their testing and only a software upgrade was required to run DIC Replay.

The Results

After installation, the lab manager found it easy to collect data to be used with DIC Replay and results could be seen very quickly after the test. They are now able to view a complete strain map of the specimen's surface, clearly indicating how the strain concentrates around the hole and ultimately where it fails. This has allowed the university to investigate changes in fiber lay-up and materials and compare strains at failure. Additionally, they now use virtual extensometers and strain gauges, which are included in DIC Replay as standard, to obtain strain measurements similar to traditional techniques, but allowing position and gauge lengths to be selected and amended after the test.