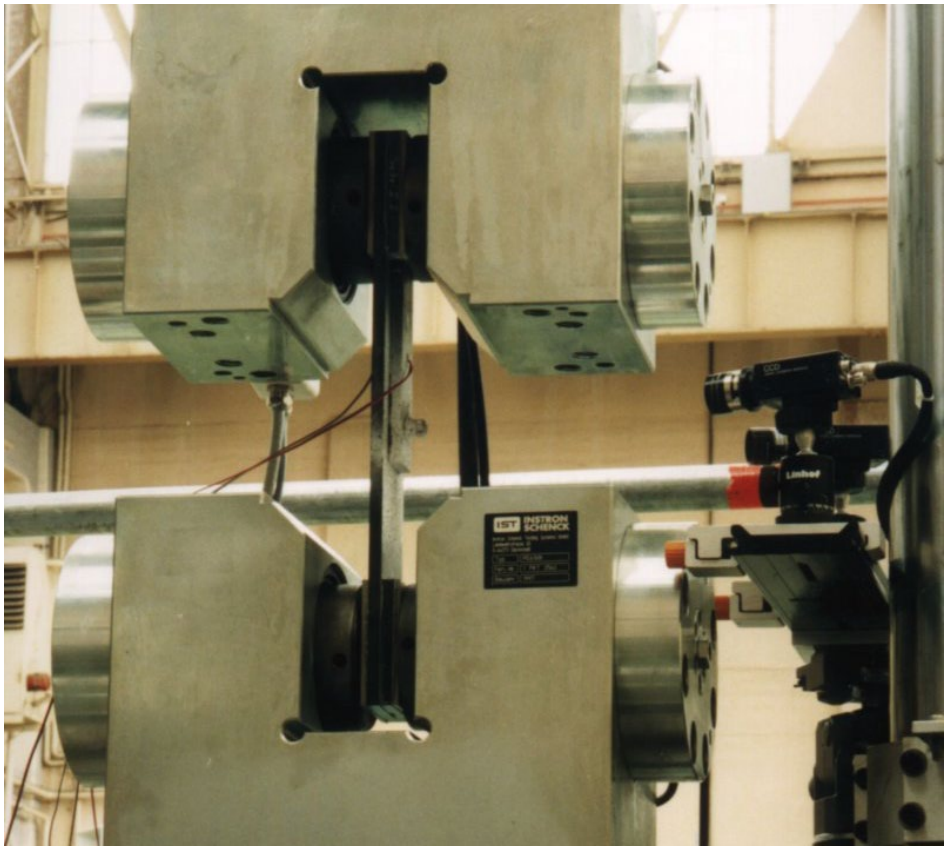
Material Testing: Numerical Simulation

Measurement of the Load Transfer from a bolt into a CFK panel

Measuring Systems: ARAMIS
Keywords: Bonded specimen, bolted

Verification of numerical models to predict the Load Transfer from a bolt into a CFK panel and the determination of the variance of the results.



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Material Testing / Numerical Simulation

Measurement of the Load Transfer from a bolt into a CFK panel

Measuring Systems: ARAMIS
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The aim of the experimental measuring is the verification of numerical models to predict the Load Transfer from a bolt into a CFK panel and the determination of the variance of the results.

Aim of the optical deformation measurement

The full field measurement of the deformations at joints made by bolts, in different settings and determination of the maximal deformation.

The ARAMIS raster method was preferred to the strain gauge strips as a full field measuring technique with graphical display of the measured results was needed to understand the behavior of the probe and get the maximum deformation as well as its distribution and development. In addition the simple preparation needed and the ease of use of the system allows to measure and evaluate many test samples to define the variance of the results.

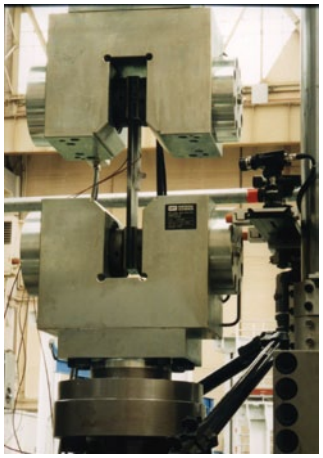

Fig. 1: ARAMIS measuring set up

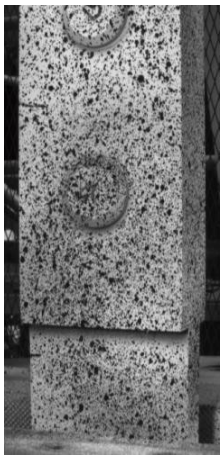

Fig. 2: Specimen with raster

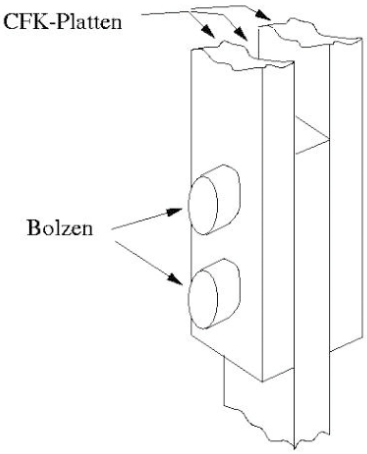

Fig. 3: Outline of the test object

Description of one of the test objects

Tensile test using a double bolt joint, with a symmetrical CFK panel setup, panel thickness 10 mm, steel bolt.

Experimental results

In the figure showing the strain in the tensile direction, the maximum tensile strain values spread out regularily on both sides of the upper bolt.
The values are in the order of 0.3 %. Under the bolt a compression area can be seen, with values up to -0.15 %.
On the side of the lower bolt, only half the tensile strain values are shown although the CFK panel has the same thickness. Under this bolt a compression area can be found with values almost twice as high as given in the vicinity of the upper bolt.

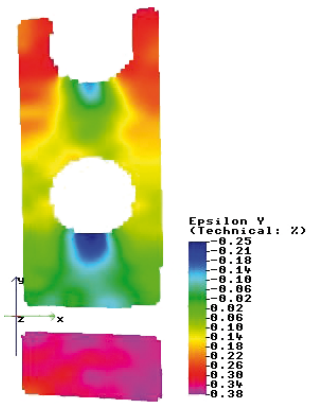

Fig. 4: Strain in tensile direction

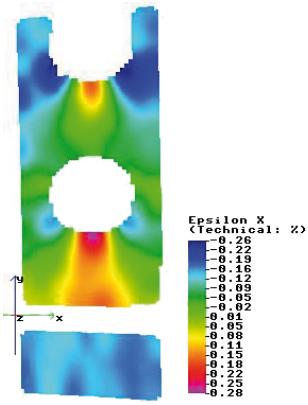

Fig. 5: Strain normal to tensile direction

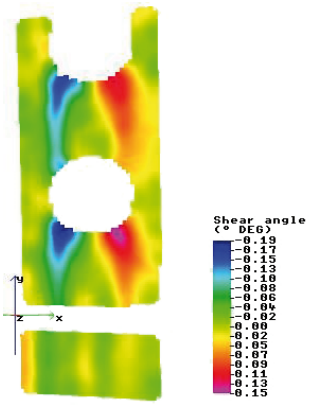

Fig. 6: Shearing

The resulting deformation and strain values were relatively symmetric to the tensile direction.

By courtesy of IMA Dresden, DaimlerChrysler Aerospace and DLR.