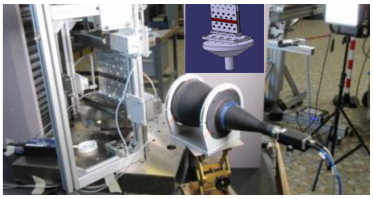
EikoTwin

Case Study

Buckling compression test on a joint specimen.
Characterization test of a joint test piece for lauching Ariane 6 in collaboration with Arianegroup.

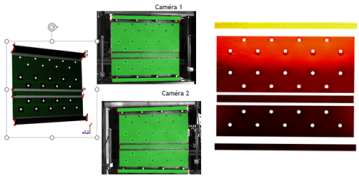
Context



The complexity and large size of the structures to be sent into orbit make it necessary to carry out strenght tests on small-scale structures. The test on a joining specimen is an example : its purpose is to reproduce the loading conditions between two stages of the launcher, so it is a multi-materal assembled structure that is fairly complex to model. **In order to reduce the number of tests actually performed, numerical models of the parts and tests to be performed are created and must be validated.**

The first objective of this trial is to compare the results obtained by image correlation with those predicted by the simulation in order to increase the degree of confidence attached to the simulations, with a view to reducing the number of real trials. the second objective is to use the measurement to control the boundary conditions of the simulation. The comparaison is made over several study areas and two image correlation systems.

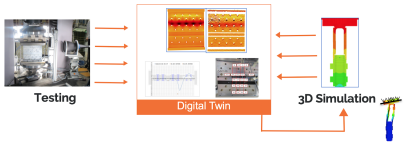
Solutions



In order to increase their confidence in their simulation, Arianegroup need to ensure that its numerical model has only a small deviation from the real part geometry. to do this, several sets of cameras are arranged in stereo and monovision to scan the entire part. Image correlation with EikoTwin-DIC allows the direct measurement of the shape deviation between the real part and the digital simulation though its unique working interface.

In contrast of their previous measuring tools, EikoTwin-DIC also allows the kinematics of the buckling tests to be captured and the results of displacement and deformation to be compared directly on the same mesh as used for simulation. in addition, the direct comparison function between simulated and meassured fields eliminates errors in the transfer of results. By displaying test and simulation data and the difference in results on the same interface, the confidence and optimization of the model is increased.

Results



The 3D reconstruction of the part using the camera system highlighted the importance of a small form deviation between reality and simulation for the validity of the result obtained via the digital model. Indeed, too large deviations between real and simulated geometries have a significant impact on the robustness and validity of the simulations. Whe have thus been able to update the latter in order to optimize their revelance.

EikoTwin-DIC also provides a direct comparison of measured and simulated displacement and deformation fields. Based on these results, the model can then be updated by adjusting its boundary conditions, so that it is always closer to the real test conditions. **We thus enable them, to increase their confidence in their simulation in order to optimize the number of tests performed in the future.**

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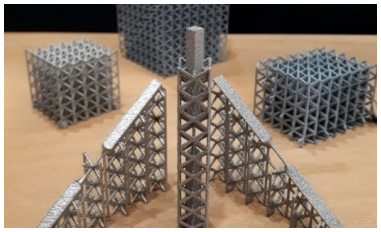
Case Study

Comparison between test and simulation with digital image correlation

Compression test on lattice structure with the IRT Saint - Exupéry.

Context

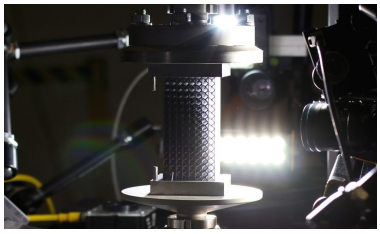


The technical research institute IRT Saint-Exupéry is leading the R&D project LASER (LAttice structures engines and launchRs) in partnership with major aeronautics and space manufacturers, based on the use of lattice structures. These structures, obtained by additive manufacturing, have a strong potential for mass reduction and optimisation of mechanical behaviour of aeronautical parts.

During this test a 5x5 mesh BCCZ specimen (centered cubic meshes and vertical beams) is subjective to a comprehensive loading between two plates. Partial discharges are carried out and the test is carried out until the specimen breaks.

The objective of DIC monitoring is to capture the complexity of the kinimatics, in particular the characteristic shear-band deformation mode.

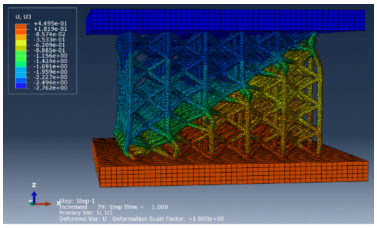
Solutions



In order to obtain this test monitoring, two pairs of cameras are set up to observe two perpendicular faces of the specimen. This arrangement is chosen to capture with certainty the appearance of shear bands on one of two observed size. A speckled texture is applied using an airbrush and two light sources are used in correspondence with the cameras.

Using our digital image correlation software Eiko Twin-DIC, the three dimensional kinematic behaviour of the beams visible on both observed sides is measured, for each set of images acquired. **This measurement is carried out using the same mesh size, which allows simulations to be directly compared with this measurement to ultimately improve predictions.**

Results



The results provided by EikoSim allowed IRT Saint-Exupéry to capture the test kinematics, in particular the appearance of shear bands and cracks before rupture. The result also highlitghed the discrepancies between the actual stress and the theoretical stress, in particular the lack of parallelism between the plates.

IRT Saint-Exupéry was also able to compare its numerical model with DIC measurements. The use of **EikoTwin - Digital Twin** software allowed the real boundary conditions to be injected into the digital model and the material parameters to be optimized in order to reproduce the deformation of the specimen during the test.

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