EikoTwin

Case Study

GROUPE RENAULT | cetim

Large-scale monitoring of automotive parts production

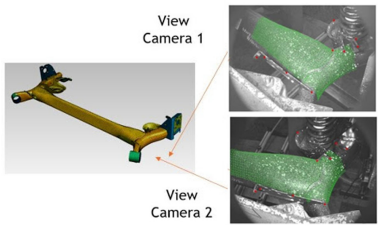
Vehicle axle production follow-up test in collaboration with Renault and CETIM for fatigue dimensioning.

Context

Renault is a major car manufacturer in France. In order to dimension and to guarantee the fatigue resistance of its most critical parts, Renault must ensure that the numerical simulation reproduces experimental behaviour as closely as possible. A stress sequence, resulting from tests carried out upstream on the track, is extracted and reproduced on a test bench. It consists of a representative cyclic loading of the actual use of an axle (turns, passages on heterogeneous terrain, presence of paving stones, etc.).

The goal of the instrumentation of this bench with digital image correlation systems is to view as much of the axle as possible and check that it is capable to withstand a predefined number of representative load cycles, and thus increase the level of confidence attached to the simulations.

Solutions

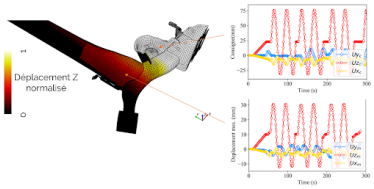


In order to give access to this vital information during the solicitation tests in multiaxial axle fatigue, a camera pair is arranged around the test monitor the test and capture the kinematics.

Despite the large, rigid body movements of the workpiece, EikoTwin-DIC captures the entire of the kinematics associated with driving over "bad pavement". The measurement being express directly on the finite element mesh of part, the comparison with simulated displacement fields is immediate for the considered fatigue stress.

EikoTwin allows to compare numerical solicitations with real cycles extracted from the preliminary tests. EikoTwin also allows to check the validity of the part dimensioning for the fatigue resistance during realistic stresses and to validate the relevance of their simulation model.

Results



The result provided by EikoSim allowed for an immediate comparison of the measured and simulated fields on the instrumented area and to highlight the deviation between the measured and simulated values due to the idealized boundary conditions of the simulation.

Digital image correlation makes it possible to obtain a very large kinematic richness. EikoTwin DIC measured the equivalent of the results of 1300 displacement sensors (corresponding to the nodes of the measuring mesh) recording the movement of the part over 1200 instants, over a single uninterrupted test run. The measured displacements were then re-injected as boundary conditions into the finite element model to improve the predictability of the simulation for this fatigue dimensioning.

Pierre Bole
Head of Sales

+33 (0)6 69 67 16 75
pierre.bole@eikosim.com

EikoTwin

www.eikosim.com

EikoSim

EikoSim
13 rue Saint-Honoré
78000 Versailles
FRANCE

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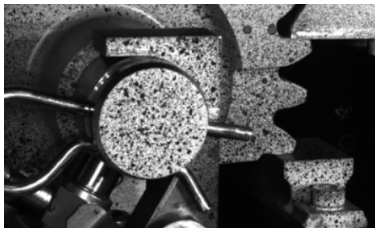
Case Study

MCE5 BEYOND STANDARDS SmartMeca Solutions

Test kinematics validation

Certification test on high-performance gearwheel with MCE-5 and MECATEST

Context

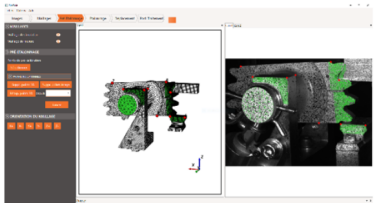


MCE-5 is developing high-performance mechanical parts, in particular for the propulsion, helping to make vehicles more fuel-efficent, more economical and environmentally friendly. In order to guarantee the conformity of its products, MCE-5 must estimate the uncertainty in the fidelity of its test devices with the revelance of the measurement obtained with their certification loads, and thus of the relevance of the measurement obtained with their conventional sensors.

In this test, a high performance gear is subjected to cycles of step loading. The wheel is free to rotate on its axis, and a movement is applied to the upper insert in contact with the third tooth of the wheel is in contact with the lower plate and the force is measured at the lower key.

The objective of DIC monitoring is to quantify the test kinematics in order to ensure that the application complies with the certification specifications. On the other hand, MCE-5 wishes to capitalize on the comparison between the simulation and the measurements obtained by DIC.

Solutions

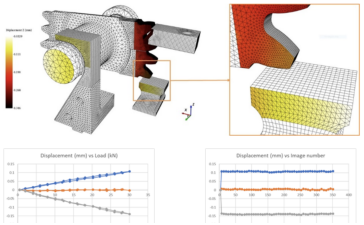


In order to obtain this test monitoring by DIC, a pair of cameras is set in place to observe the areas of interest of the study : the teeth of the wheel, the pad stop and bottom, and the wheel axle.

The digital image correlation software EikoTwin-DIC compare the images for each loading stage, and calculate and display the displacements and deformations on the measurement mesh for each step of solicitation.

EikoTwin-DIC allowed MCE-5 to measure the displacement at any point in the zone of measurement for each loading step, and thus evaluate the test performance in relation to the desired behaviour.

Results



The results provided by EikoSim allowed MCE-5 to verify the conformity of the test set-up with the certification specifications, proving that the load and unload travel paths are the same, and that the position at minimum and maximum load during cyclic loading are constant.

In addition, MCE-5 was able to validate the numerical model and thus be able to use it in the future in its validation and certification processes for its parts.

Pierre Bole
Head of Sales

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pierre.bole@eikosim.com

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