MatchID
Metrology beyond colors

iX Cameras

SIEMENS
Ingenuity for life

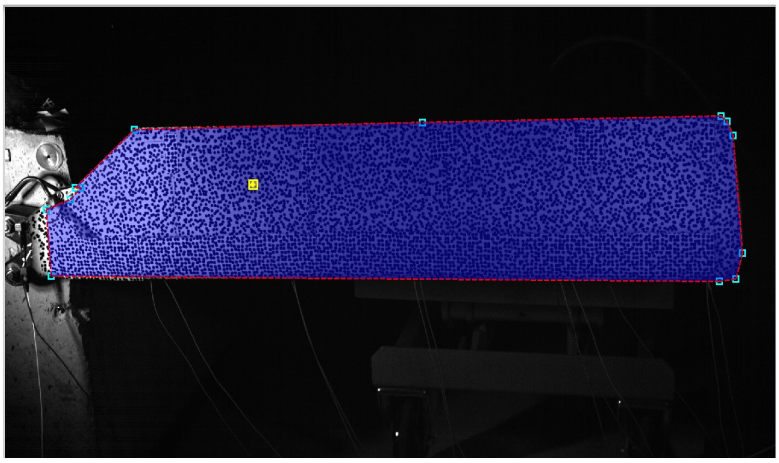
Application

Vibration Analysis: High-speed stereo DIC on a helicopter blade

Case Description

A helicopter blade was vibrated by a shaker with a sine sweep signal and imaged via 2 iX high–speed cameras. For benchmark purposes, accelerometers were simultaneously attached and Simcenter SCADAS system was invoked to impose perfect synchronization between the accelerometers and the recorded images.

An optimized DIC analysis was obtained using MatchID Stereo Correlation. Frequency response functions (FRF) could then seamlessly be extracted via a direct integration between Simcenter Testlab and MatchID. Finally, the corresponding operational deflection shapes were determined. An excellent agreement between traditional sensor data and DIC results could be retrieved.



Experimental Setup

- ✓ **Cameras:** 2 x i-SPEED 727. 8512FPS @ 2072x1536
- ✓ **Validation:** Accelerometers and Simcenter SCADAS
- ✓ **Acquisition Speed:** 1600 Hz

Analysis

- ✓ **Type:** Stereo DIC with optimized settings
- ✓ **Vibration:** Modal parameters identified with Simcenter Polymax
- ✓ **Mode Shapes:** Deflection shape determination with MatchID ODS Module

Results

- ✓ **Stereo DIC:** Time resolved displacements results
- ✓ **Natural frequencies:** structural resonances and damping
- ✓ **Operational Deflection Shapes** : 3D deformation at the identified natural frequencies

- ✓ Achieving **optimum spatial and temporal resolution**
- ✓ Very **low noise floor** thanks to high-performant iX Cameras
- ✓ Seamless coupling with **Simcenter Testlab**
- ✓ **Combined** usage of classical sensors and innovative optical data

Why MatchID

+32 (0) 9 223 64 41 ■ info@matchid.eu ■ www.matchid.eu

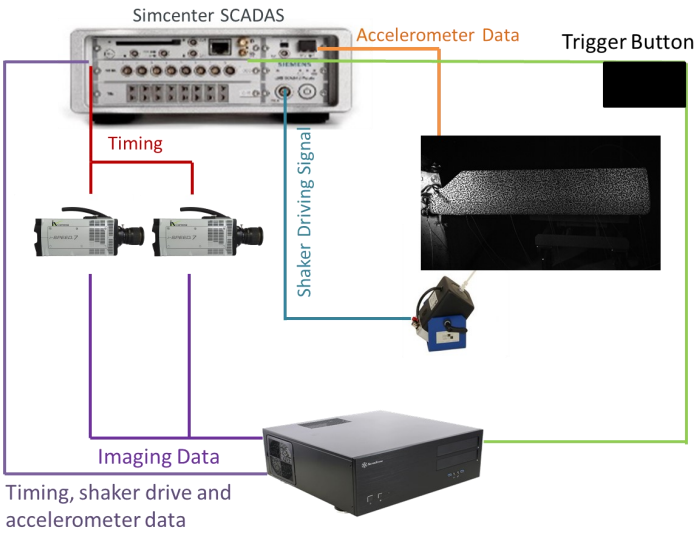
Image Acquisition

The image acquisition is performed through a Stereo DIC setup consisting of 2 high-speed cameras.

The measurements are made simultaneously with accelerometers using a Simcenter SCADAS system.

The timing of the cameras are governed by Simcenter SCADAS. A manual trigger button starts the data acquisition, shaker and imaging clock simultaneously, making sure the clock of all devices are synchronized.

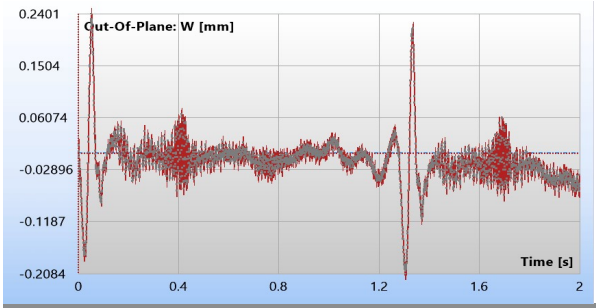
The iX cameras yield a very low noise floor enabling the displacement measurements with DIC even at high frequencies.



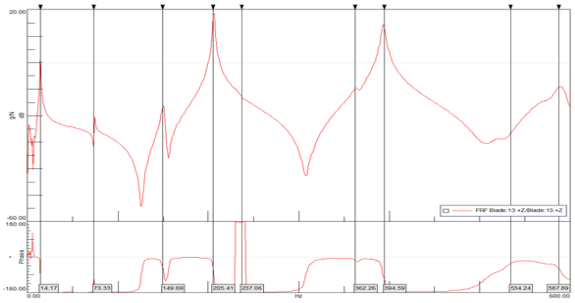
Usage of iX 727 High-Speed cameras for DIC measurements

Mode Shape Frequency Detection

A clear advantage of DIC is that it simultaneously yields the time history of many data channels as the blade geometry. Within the MatchID platform, the deformation data can be seamlessly exported to Simcenter Testlab, where Simcenter Polymax allows a dedicated frequency response function analysis to identify the natural frequencies. The DIC FRF results are benchmarked with accelerometer results within the same environment.



Out-of-plane deformation time signal calculated using MatchID DIC software.



Frequency response functions as extracted from Simcenter Polymax.

Operational Deflection Shapes

The phase-time information of each point is then used to extract various mode shapes at frequencies determined via Simcenter Polymax. The mode shapes are reconstructed using the MatchID ODS module. .

Excellent agreement was retrieved between classical sensor measurements and optical DIC data. DIC has the advantage, however, that it is wireless, does not add mass to the structure and moreover generates data in many data points. Accordingly, DIC can be considered as a valid alternative for classical sensor measurements. Moreover, our approach allows the combined use of both techniques guaranteeing the most profound insights in your test structure.